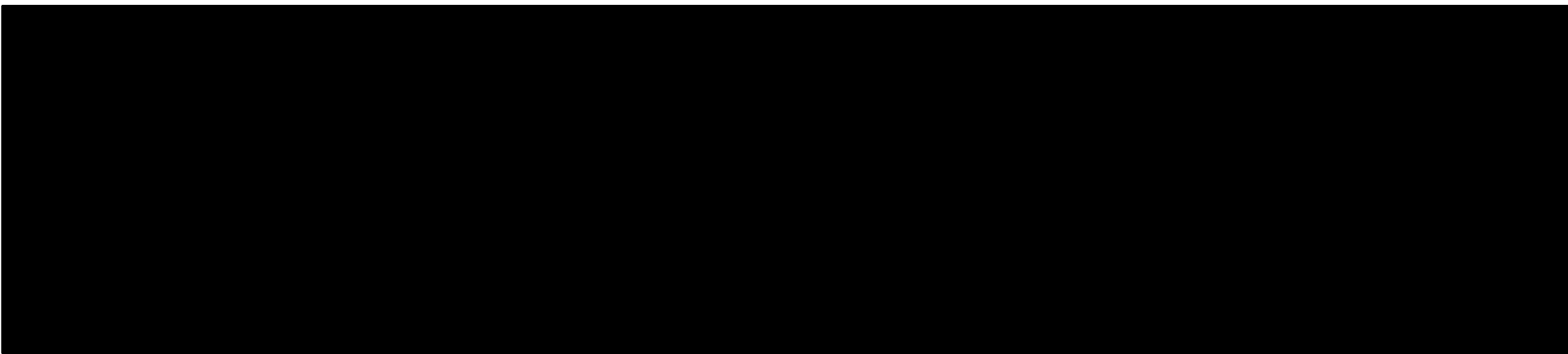


# ***PCI1410 GHK/GGU/PGE***

## ***PC Card Controllers***

# *Data Manual*



# ***PCI1410 PC Card Controllers Data Manual***

Literature Number: SCPS045C  
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Printed on Recycled Paper

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# 1 Introduction

## 1.1 Description

The TI™ PCI1410 is a high-performance PCI-to-PC Card controller that supports a single PC Card socket compliant with the *1997 PC Card Standard*. The PCI1410 provides features that make it the best choice for bridging between PCI and PC Cards in both notebook and desktop computers. The *1997 PC Card Standard* retains the 16-bit PC Card specification defined in *PCI Local Bus Specification* and defines the new 32-bit PC Card, CardBus, capable of full 32-bit data transfers at 33 MHz. The PCI1410 supports both 16-bit and CardBus PC Cards, powered at 5 V or 3.3 V, as required.

The PCI1410 is compliant with the *PCI Local Bus Specification*, and its PCI interface can act as either a PCI master device or a PCI slave device. The PCI bus mastering is initiated during 16-bit PC Card DMA transfers or CardBus PC Card bridging transactions. The PCI1410 is also compliant with the latest *PCI Bus Power Management Interface Specification* and *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges*.

All card signals are internally buffered to allow hot insertion and removal without external buffering. The PCI1410 is register compatible with the Intel™ 82365SL-DF and 82365SL ExCA controllers. The PCI1410 internal data path logic allows the host to access 8-, 16-, and 32-bit cards using full 32-bit PCI cycles for maximum performance. Independent buffering and a pipeline architecture provide an unsurpassed performance level with sustained bursting. The PCI1410 can also be programmed to accept fast posted writes to improve system-bus utilization.

Multiple system-interrupt signaling options are provided, including: parallel PCI, parallel ISA, serialized ISA, and serialized PCI. Furthermore, general-purpose inputs and outputs are provided for the board designer to implement sideband functions. Many other features designed into the PCI1410, such as socket activity light-emitting diode (LED) outputs, are discussed in detail throughout the design specification.

An advanced complementary metal-oxide semiconductor (CMOS) process achieves low system power consumption while operating at PCI clock rates up to 33 MHz. Several low-power modes enable the host power management system to further reduce power consumption.

## 1.2 Features

The PCI1410 supports the following features:

- Ability to wake from D3<sub>hot</sub> and D3<sub>cold</sub>
- Fully compatible with the Intel 430TX (Mobile Triton II) chipset
- A 144-terminal low-profile QFP (PGE), 144-terminal MicroStar BGA™ ball grid array (GGU) package, or 209-terminal MicroStar BGA™ (GHK) package
- 3.3-V core logic with universal PCI interfaces compatible with 3.3-V and 5-V PCI signaling environments
- Mix-and-match 5-V/3.3-V 16-bit PC Cards and 3.3-V CardBus Cards
- Single PC Card or CardBus slot with hot insertion and removal
- Burst transfers to maximize data throughput on the PCI bus and the CardBus bus
- Parallel PCI interrupts, parallel ISA IRQ and parallel PCI interrupts, serial ISA IRQ with parallel PCI interrupts, and serial ISA IRQ and PCI interrupts

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MicroStar BGA is a trademark of Texas Instruments.

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Other trademarks are the property of their respective owners.

- Serial EEPROM interface for loading subsystem ID and subsystem vendor ID
- Pipelined architecture allows greater than 130-Mbps sustained throughput from CardBus to PCI and from PCI to CardBus
- Interface to parallel single-slot PC Card power interface switches like the TI TPS2211
- Up to five general-purpose I/Os
- Programmable output select for  $\overline{\text{CLKRUN}}$
- Five PCI memory windows and two I/O windows available to the 16-bit PC Card socket
- Two I/O windows and two memory windows available to the CardBus socket
- Exchangeable card architecture (ExCA) compatible registers are mapped in memory and I/O space
- Intel 82365SL-DF and 82365SL register compatible
- Distributed DMA (DDMA) and PC/PCI DMA
- 16-Bit DMA on the PC Card socket
- Ring indicate,  $\overline{\text{SUSPEND}}$ , PCI  $\overline{\text{CLKRUN}}$ , and CardBus  $\overline{\text{CCLKRUN}}$
- Socket activity LED pins
- PCI bus lock ( $\overline{\text{LOCK}}$ )
- Advanced submicron, low-power CMOS technology
- Internal ring oscillator

### 1.3 Related Documents

- *Advanced Configuration and Power Interface (ACPI) Specification* (Revision 2.0)
- *PCI Bus Power Management Interface Specification* (Revision 1.1)
- *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges* (Revision 0.6)
- *PCI Local Bus Specification* (Revision 2.2)
- *PCI Mobile Design Guide* (Revision 1.0)
- *PCI14xx Implementation Guide for D3 Wake-Up*
- *1997 PC Card Standard*
- *PC 98*
- *PC 99*
- *Serialized IRQ Support for PCI Systems* (Revision 6)

### 1.4 Ordering Information

| ORDERING NUMBER | NAME               | VOLTAGE                  | PACKAGE                                                     |
|-----------------|--------------------|--------------------------|-------------------------------------------------------------|
| PCI1410         | PC Card Controller | 3.3-V, 5-V tolerant I/Os | 144-terminal LQFP<br>144-terminal PBGA<br>209-terminal PBGA |

## 2 Terminal Descriptions

The PCI1410 is packaged in either a 144-terminal GGU MicroStar BGA or a 144-terminal PGE package. It is also packaged in a 209-terminal GHK MicroStar BGA that is pin compatible with the TI PCI4410. The PCI4410 is a single-socket CardBus bridge with integrated OHCI link. Figure 2–1 is a PGE-package terminal diagram showing PCI-to-CardBus signal names, and Figure 2–2 is a PGE-package terminal diagram showing PCI-to-PC Card signal names. Figure 2–3 and Figure 2–4 are terminal diagrams for the GGU and GHK packages, respectively.

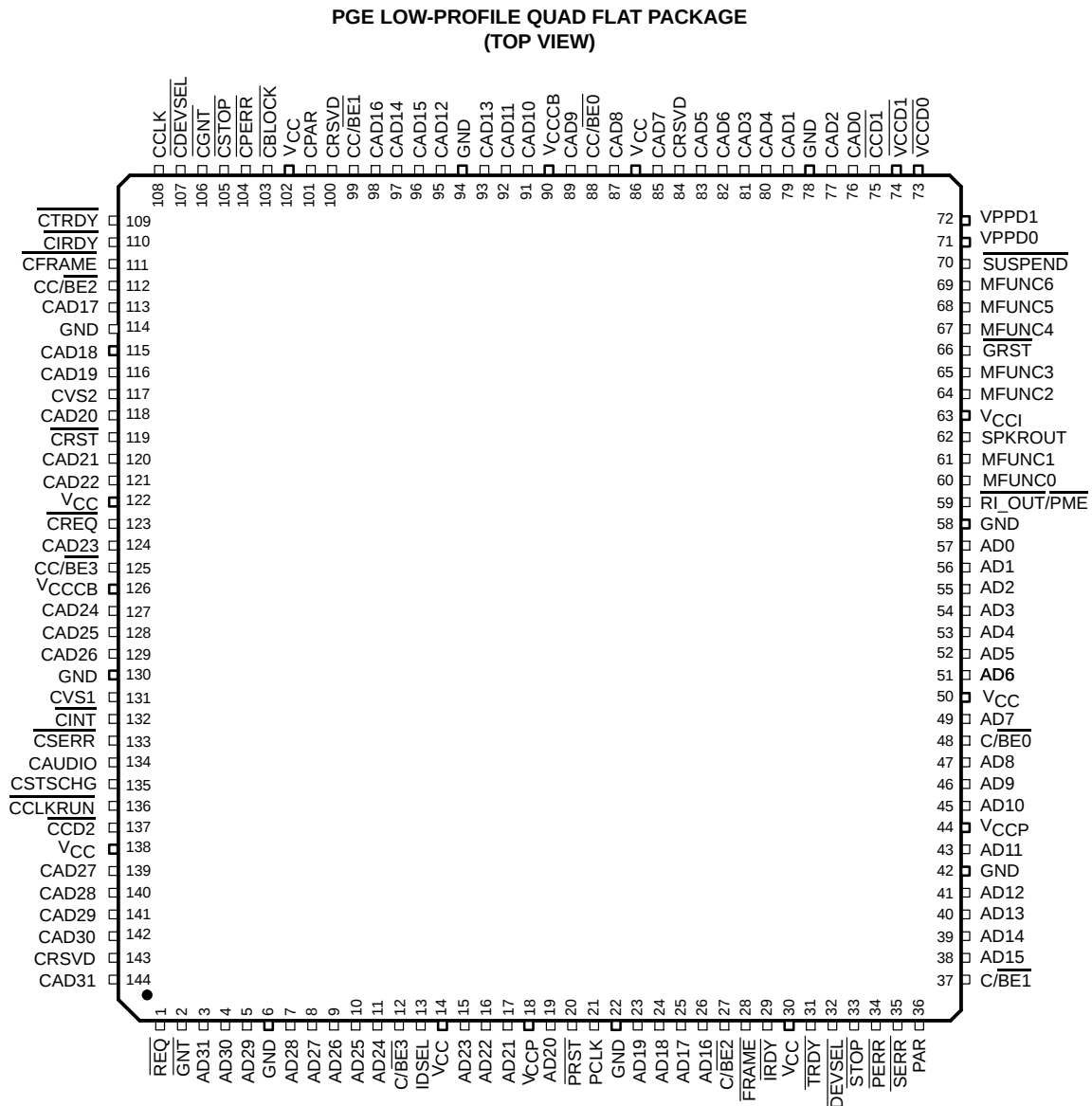
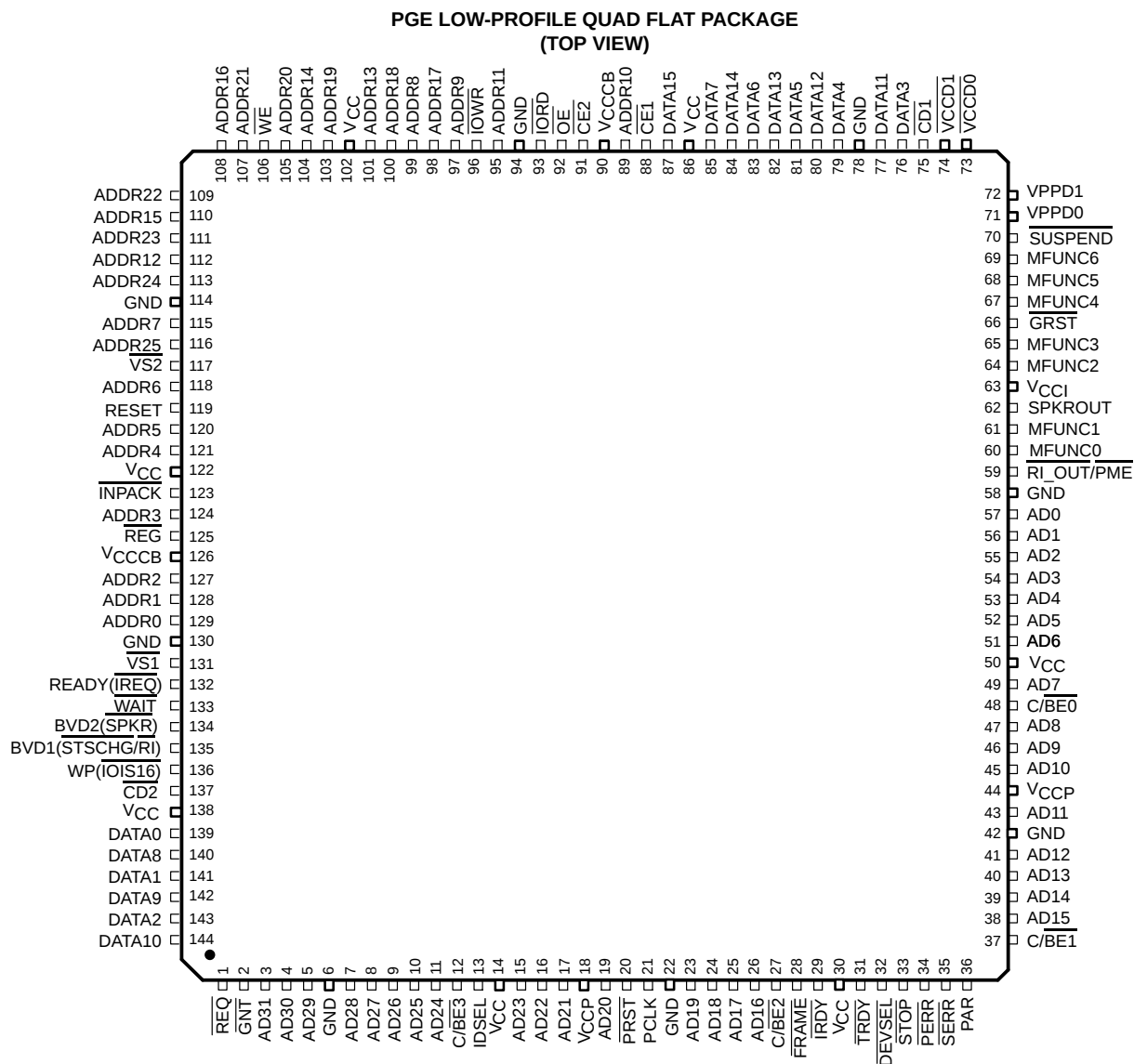
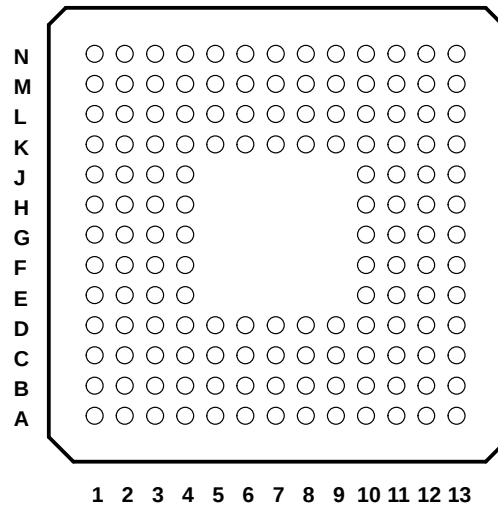


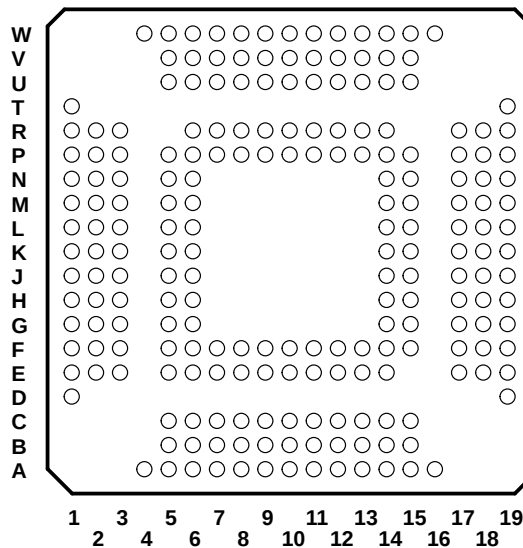
Figure 2–1. PCI-to-CardBus Terminal Diagram



**Figure 2–2. PCI-to-PC Card (16-Bit) Terminal Diagram**



**Figure 2-3. GGU Package Terminal Diagram**



**Figure 2-4. GHK Package Terminal Diagram**

Table 2-1 shows the terminal assignments for the 144-terminal GGU CardBus and 16-bit PC Card signal names. Table 2-2 shows the terminal assignments for the 144-terminal PGE CardBus and 16-bit PC Card signal names. Table 2-3 shows the terminal assignments for the 209-terminal GHK CardBus and 16-bit PC Card signal names. Table 2-4 shows the CardBus PC Card signal names sorted alphabetically to the GGU/PGE/GHK terminal numbers. Table 2-5 shows the 16-bit PC Card signal names sorted alphabetically to the GGU/PGE/GHK terminal numbers.

**Table 2–1. CardBus and 16-Bit PC Card Signal Names by GGU Terminal Number**

| TERM.<br>NO. | SIGNAL NAME |                     | TERM.<br>NO. | SIGNAL NAME |                 | TERM.<br>NO. | SIGNAL NAME |        | TERM.<br>NO. | SIGNAL NAME    |                |
|--------------|-------------|---------------------|--------------|-------------|-----------------|--------------|-------------|--------|--------------|----------------|----------------|
|              | CARD<br>BUS | 16-BIT              |              | CARD<br>BUS | 16-BIT          |              | CARD<br>BUS | 16-BIT |              | CARD<br>BUS    | 16-BIT         |
| A1           | REQ         | REQ                 | C11          | CGNT        | WE              | G10          | CAD11       | OE     | L4           | GND            | GND            |
| A2           | CRSVD       | DATA2               | C12          | CSTOP       | ADDR20          | G11          | CAD10       | CE2    | L5           | AD9            | AD9            |
| A3           | CAD28       | DATA8               | C13          | CPERR       | ADDR14          | G12          | CAD9        | ADDR10 | L6           | VCC            | VCC            |
| A4           | CCD2        | CD2                 | D1           | AD27        | AD27            | G13          | VCCCB       | VCCCB  | L7           | AD2            | AD2            |
| A5           | CSERR       | WAIT                | D2           | AD28        | AD28            | H1           | PCLK        | PCLK   | L8           | RI_OUT/<br>PME | RI_OUT/<br>PME |
| A6           | CAD26       | ADDR0               | D3           | GND         | GND             | H2           | GND         | GND    | L9           | VCCI           | VCCI           |
| A7           | VCCCB       | VCCCB               | D4           | AD29        | AD29            | H3           | AD19        | AD19   | L10          | MFUNC4         | MFUNC4         |
| A8           | CAD23       | ADDR3               | D5           | CCLKRUN     | WP<br>(IOIS16)  | H4           | AD18        | AD18   | L11          | SUSPEND        | SUSPEND        |
| A9           | CAD21       | ADDR5               | D6           | CINT        | READY<br>(IREQ) | H10          | CAD7        | DATA7  | L12          | CCD1           | CD1            |
| A10          | CAD19       | ADDR25              | D7           | CAD25       | ADDR1           | H11          | VCC         | VCC    | L13          | CAD0           | DATA3          |
| A11          | CC/BE2      | ADDR12              | D8           | CAD22       | ADDR4           | H12          | CAD8        | DATA15 | M1           | SERR           | SERR           |
| A12          | CIRDY       | ADDR15              | D9           | CVS2        | VS2             | H13          | CC/BE0      | CE1    | M2           | PAR            | PAR            |
| A13          | CTRDY       | ADDR22              | D10          | CAD17       | ADDR24          | J1           | AD17        | AD17   | M3           | AD14           | AD14           |
| B1           | GNT         | GNT                 | D11          | CBLOCK      | ADDR19          | J2           | AD16        | AD16   | M4           | AD11           | AD11           |
| B2           | CAD31       | DATA10              | D12          | VCC         | VCC             | J3           | C/BE2       | C/BE2  | M5           | AD8            | AD8            |
| B3           | CAD29       | DATA1               | D13          | CPAR        | ADDR13          | J4           | FRAME       | FRAME  | M6           | AD6            | AD6            |
| B4           | VCC         | VCC                 | E1           | C/BE3       | C/BE3           | J10          | CAD3        | DATA5  | M7           | AD4            | AD4            |
| B5           | CAUDIO      | BVD2<br>(SPKR)      | E2           | AD24        | AD24            | J11          | CAD6        | DATA13 | M8           | GND            | GND            |
| B6           | GND         | GND                 | E3           | AD25        | AD25            | J12          | CAD5        | DATA6  | M9           | SPKROUT        | SPKROUT        |
| B7           | CC/BE3      | REG                 | E4           | AD26        | AD26            | J13          | CRSVD       | DATA14 | M10          | GRST           | GRST           |
| B8           | CREQ        | INPACK              | E10          | CRSVD       | ADDR18          | K1           | IRDY        | IRDY   | M11          | MFUNC6         | MFUNC6         |
| B9           | CRST        | RESET               | E11          | CC/BE1      | ADDR8           | K2           | VCC         | VCC    | M12          | VPPD1          | VPPD1          |
| B10          | CAD18       | ADDR7               | E12          | CAD16       | ADDR17          | K3           | TRDY        | TRDY   | M13          | VCCD1          | VCCD1          |
| B11          | CFRAME      | ADDR23              | E13          | CAD14       | ADDR9           | K4           | AD12        | AD12   | N1           | C/BE1          | C/BE1          |
| B12          | CCLK        | ADDR16              | F1           | AD22        | AD22            | K5           | AD10        | AD10   | N2           | AD15           | AD15           |
| B13          | CDEVSEL     | ADDR21              | F2           | AD23        | AD23            | K6           | AD7         | AD7    | N3           | AD13           | AD13           |
| C1           | AD30        | AD30                | F3           | VCC         | VCC             | K7           | AD1         | AD1    | N4           | VCCP           | VCCP           |
| C2           | AD31        | AD31                | F4           | IDSEL       | IDSEL           | K8           | MFUNC0      | MFUNC0 | N5           | C/BE0          | C/BE0          |
| C3           | CAD30       | DATA9               | F10          | CAD15       | IOWR            | K9           | MFUNC2      | MFUNC2 | N6           | AD5            | AD5            |
| C4           | CAD27       | DATA0               | F11          | CAD12       | ADDR11          | K10          | CAD2        | DATA11 | N7           | AD3            | AD3            |
| C5           | CSTSCHG     | BVD1<br>(STSCHG/RI) | F12          | GND         | GND             | K11          | GND         | GND    | N8           | AD0            | AD0            |
| C6           | CVS1        | VS1                 | F13          | CAD13       | IORD            | K12          | CAD1        | DATA4  | N9           | MFUNC1         | MFUNC1         |
| C7           | CAD24       | ADDR2               | G1           | VCCP        | VCCP            | K13          | CAD4        | DATA12 | N10          | MFUNC3         | MFUNC3         |
| C8           | VCC         | VCC                 | G2           | AD21        | AD21            | L1           | DEVSEL      | DEVSEL | N11          | MFUNC5         | MFUNC5         |
| C9           | CAD20       | ADDR6               | G3           | AD20        | AD20            | L2           | STOP        | STOP   | N12          | VPPD0          | VPPD0          |
| C10          | GND         | GND                 | G4           | PRST        | PRST            | L3           | PERR        | PERR   | N13          | VCCD0          | VCCD0          |

**Table 2–2. CardBus and 16-Bit PC Card Signal Names by PGE Terminal Number**

| TERM.<br>NO. | SIGNAL NAME |        | TERM.<br>NO. | SIGNAL NAME    |                | TERM.<br>NO. | SIGNAL NAME |        | TERM.<br>NO. | SIGNAL NAME |                     |
|--------------|-------------|--------|--------------|----------------|----------------|--------------|-------------|--------|--------------|-------------|---------------------|
|              | CARD<br>BUS | 16-BIT |              | CARD<br>BUS    | 16-BIT         |              | CARD<br>BUS | 16-BIT |              | CARD<br>BUS | 16-BIT              |
| 1            | REQ         | REQ    | 37           | C/BE1          | C/BE1          | 73           | VCCD0       | VCCD0  | 109          | CTRDY       | ADDR22              |
| 2            | GNT         | GNT    | 38           | AD15           | AD15           | 74           | VCCD1       | VCCD1  | 110          | CIRDY       | ADDR15              |
| 3            | AD31        | AD31   | 39           | AD14           | AD14           | 75           | CCD1        | CD1    | 111          | CFRAME      | ADDR23              |
| 4            | AD30        | AD30   | 40           | AD13           | AD13           | 76           | CAD0        | DATA3  | 112          | CC/BE2      | ADDR12              |
| 5            | AD29        | AD29   | 41           | AD12           | AD12           | 77           | CAD2        | DATA11 | 113          | CAD17       | ADDR24              |
| 6            | GND         | GND    | 42           | GND            | GND            | 78           | GND         | GND    | 114          | GND         | GND                 |
| 7            | AD28        | AD28   | 43           | AD11           | AD11           | 79           | CAD1        | DATA4  | 115          | CAD18       | ADDR7               |
| 8            | AD27        | AD27   | 44           | VCCP           | VCCP           | 80           | CAD4        | DATA12 | 116          | CAD19       | ADDR25              |
| 9            | AD26        | AD26   | 45           | AD10           | AD10           | 81           | CAD3        | DATA5  | 117          | CVS2        | VS2                 |
| 10           | AD25        | AD25   | 46           | AD9            | AD9            | 82           | CAD6        | DATA13 | 118          | CAD20       | ADDR6               |
| 11           | AD24        | AD24   | 47           | AD8            | AD8            | 83           | CAD5        | DATA6  | 119          | CRST        | RESET               |
| 12           | C/BE3       | C/BE3  | 48           | C/BE0          | C/BE0          | 84           | CRSVD       | DATA14 | 120          | CAD21       | ADDR5               |
| 13           | IDSEL       | IDSEL  | 49           | AD7            | AD7            | 85           | CAD7        | DATA7  | 121          | CAD22       | ADDR4               |
| 14           | VCC         | VCC    | 50           | VCC            | VCC            | 86           | VCC         | VCC    | 122          | VCC         | VCC                 |
| 15           | AD23        | AD23   | 51           | AD6            | AD6            | 87           | CAD8        | DATA15 | 123          | CREQ        | INPACK              |
| 16           | AD22        | AD22   | 52           | AD5            | AD5            | 88           | CC/BE0      | CE1    | 124          | CAD23       | ADDR3               |
| 17           | AD21        | AD21   | 53           | AD4            | AD4            | 89           | CAD9        | ADDR10 | 125          | CC/BE3      | REG                 |
| 18           | VCCP        | VCCP   | 54           | AD3            | AD3            | 90           | VCCCB       | VCCCB  | 126          | VCCCB       | VCCCB               |
| 19           | AD20        | AD20   | 55           | AD2            | AD2            | 91           | CAD10       | CE2    | 127          | CAD24       | ADDR2               |
| 20           | PRST        | PRST   | 56           | AD1            | AD1            | 92           | CAD11       | OE     | 128          | CAD25       | ADDR1               |
| 21           | PCLK        | PCLK   | 57           | AD0            | AD0            | 93           | CAD13       | IORD   | 129          | CAD26       | ADDR0               |
| 22           | GND         | GND    | 58           | GND            | GND            | 94           | GND         | GND    | 130          | GND         | GND                 |
| 23           | AD19        | AD19   | 59           | RI_OUT/<br>PME | RI_OUT/<br>PME | 95           | CAD12       | ADDR11 | 131          | CVS1        | VS1                 |
| 24           | AD18        | AD18   | 60           | MFUNC0         | MFUNC0         | 96           | CAD15       | IOWR   | 132          | CINT        | READY<br>(IREQ)     |
| 25           | AD17        | AD17   | 61           | MFUNC1         | MFUNC1         | 97           | CAD14       | ADDR9  | 133          | CSERR       | WAIT                |
| 26           | AD16        | AD16   | 62           | SPKROUT        | SPKROUT        | 98           | CAD16       | ADDR17 | 134          | CAUDIO      | BVD2<br>(SPKR)      |
| 27           | C/BE2       | C/BE2  | 63           | VCCI           | VCCI           | 99           | CC/BE1      | ADDR8  | 135          | CSTSCHG     | BVD1<br>(STSCHG/RI) |
| 28           | FRAME       | FRAME  | 64           | MFUNC2         | MFUNC2         | 100          | CRSVD       | ADDR18 | 136          | CCLKRUN     | WP (IOIS16)         |
| 29           | IRDY        | IRDY   | 65           | MFUNC3         | MFUNC3         | 101          | CPAR        | ADDR13 | 137          | CCD2        | CD2                 |
| 30           | VCC         | VCC    | 66           | GRST           | GRST           | 102          | VCC         | VCC    | 138          | VCC         | VCC                 |
| 31           | TRDY        | TRDY   | 67           | MFUNC4         | MFUNC4         | 103          | CBLOCK      | ADDR19 | 139          | CAD27       | DATA0               |
| 32           | DEVSEL      | DEVSEL | 68           | MFUNC5         | MFUNC5         | 104          | CPERR       | ADDR14 | 140          | CAD28       | DATA8               |
| 33           | STOP        | STOP   | 69           | MFUNC6         | MFUNC6         | 105          | CSTOP       | ADDR20 | 141          | CAD29       | DATA1               |
| 34           | PERR        | PERR   | 70           | SUSPEND        | SUSPEND        | 106          | CGNT        | WE     | 142          | CAD30       | DATA9               |
| 35           | SERR        | SERR   | 71           | VPPD0          | VPPD0          | 107          | CDEVSEL     | ADDR21 | 143          | CRSVD       | DATA2               |
| 36           | PAR         | PAR    | 72           | VPPD1          | VPPD1          | 108          | CCLK        | ADDR16 | 144          | CAD31       | DATA10              |

**Table 2–3. CardBus and 16-Bit PC Card Signal Names by GHK Terminal Number**

| TERM.<br>NO. | SIGNAL NAME        |                            | TERM.<br>NO. | SIGNAL NAME          |                           | TERM.<br>NO. | SIGNAL NAME        |                    |
|--------------|--------------------|----------------------------|--------------|----------------------|---------------------------|--------------|--------------------|--------------------|
|              | CARDBUS            | 16-BIT                     |              | CARDBUS              | 16-BIT                    |              | CARDBUS            | 16-BIT             |
| A4           | NC                 | NC                         | E9           | CAD29                | DATA1                     | H17          | CAD11              | $\overline{OE}$    |
| A5           | NC                 | NC                         | E10          | CSTSCHG              | BVD1(STSCHG/RI)           | H18          | CAD10              | $\overline{CE2}$   |
| A6           | NC                 | NC                         | E11          | GND                  | GND                       | H19          | VCCCB              | VCCCB              |
| A7           | NC                 | NC                         | E12          | $\overline{CREQ}$    | $\overline{INPACK}$       | J1           | AD31               | AD31               |
| A8           | CAD30              | DATA9                      | E13          | CVS2                 | $\overline{VS2}$          | J2           | AD30               | AD30               |
| A9           | $\overline{CCD2}$  | $\overline{CD2}$           | E14          | $\overline{CFRAME}$  | ADDR23                    | J3           | AD29               | AD29               |
| A10          | $\overline{CINT}$  | READY( $\overline{IREQ}$ ) | E17          | $\overline{CDEVSEL}$ | ADDR21                    | J5           | GND                | GND                |
| A11          | CAD24              | ADDR2                      | E18          | $\overline{CSTOP}$   | ADDR20                    | J6           | AD28               | AD28               |
| A12          | VCCCB              | VCCCB                      | E19          | $\overline{CBLOCK}$  | ADDR19                    | J14          | CC/BE0             | $\overline{CE1}$   |
| A13          | VCC                | VCC                        | F1           | NC                   | NC                        | J15          | CAD9               | ADDR10             |
| A14          | CAD20              | ADDR6                      | F2           | NC                   | NC                        | J17          | CAD8               | DATA15             |
| A15          | GND                | GND                        | F3           | NC                   | NC                        | J18          | VCC                | VCC                |
| A16          | $\overline{CTRDY}$ | ADDR22                     | F5           | NC                   | NC                        | J19          | CAD7               | DATA7              |
| B5           | NC                 | NC                         | F6           | NC                   | NC                        | K1           | AD27               | AD27               |
| B6           | NC                 | NC                         | F7           | NC                   | NC                        | K2           | AD26               | AD26               |
| B7           | NC                 | NC                         | F8           | NC                   | NC                        | K3           | AD25               | AD25               |
| B8           | CRSVD              | DATA2                      | F9           | CAD28                | DATA8                     | K5           | AD24               | AD24               |
| B9           | VCC                | VCC                        | F10          | $\overline{CCLKRUN}$ | WP( $\overline{IOIS16}$ ) | K6           | C/BE3              | $\overline{C/BE3}$ |
| B10          | $\overline{CSERR}$ | $\overline{WAIT}$          | F11          | CVS1                 | $\overline{VS1}$          | K14          | CRSVD              | DATA14             |
| B11          | CAD25              | ADDR1                      | F12          | $\overline{CRST}$    | RESET                     | K15          | CAD5               | DATA6              |
| B12          | CC/BE3             | $\overline{REG}$           | F13          | CC/BE2               | ADDR12                    | K17          | CAD6               | DATA13             |
| B13          | CAD22              | ADDR4                      | F14          | $\overline{CPERR}$   | ADDR14                    | K18          | CAD3               | DATA5              |
| B14          | CAD19              | ADDR25                     | F15          | $\overline{CGNT}$    | $\overline{WE}$           | K19          | CAD4               | DATA12             |
| B15          | CAD17              | ADDR24                     | F17          | VCC                  | VCC                       | L1           | IDSEL              | IDSEL              |
| C5           | NC                 | NC                         | F18          | CRSVD                | ADDR18                    | L2           | VCC                | VCC                |
| C6           | NC                 | NC                         | F19          | CC/BE1               | ADDR8                     | L3           | AD23               | AD23               |
| C7           | NC                 | NC                         | G1           | NC                   | NC                        | L5           | AD21               | AD21               |
| C8           | CAD31              | DATA10                     | G2           | NC                   | NC                        | L6           | AD22               | AD22               |
| C9           | CAD27              | DATA0                      | G3           | NC                   | NC                        | L14          | CAD1               | DATA4              |
| C10          | CAUDIO             | BVD2( $\overline{SPKR}$ )  | G5           | NC                   | NC                        | L15          | GND                | GND                |
| C11          | CAD26              | ADDR0                      | G6           | NC                   | NC                        | L17          | CAD2               | DATA11             |
| C12          | CAD23              | ADDR3                      | G14          | CAD16                | ADDR17                    | L18          | CAD0               | DATA3              |
| C13          | CAD21              | ADDR5                      | G15          | CPAR                 | ADDR13                    | L19          | $\overline{CCD1}$  | $\overline{CD1}$   |
| C14          | CAD18              | ADDR7                      | G17          | CAD14                | ADDR9                     | M1           | VCCP               | VCCP               |
| C15          | $\overline{CIRDY}$ | ADDR15                     | G18          | CAD15                | $\overline{IOWR}$         | M2           | AD20               | AD20               |
| D1           | NC                 | NC                         | G19          | CAD12                | ADDR11                    | M3           | $\overline{PRST}$  | $\overline{PRST}$  |
| D19          | CCLK               | ADDR16                     | H1           | $\overline{GNT}$     | $\overline{GNT}$          | M5           | GND                | GND                |
| E1           | NC                 | NC                         | H2           | $\overline{REQ}$     | $\overline{REQ}$          | M6           | PCLK               | PCLK               |
| E2           | NC                 | NC                         | H3           | NC                   | NC                        | M14          | NC                 | NC                 |
| E3           | NC                 | NC                         | H5           | NC                   | NC                        | M15          | NC                 | NC                 |
| E6           | NC                 | NC                         | H6           | NC                   | NC                        | M17          | NC                 | NC                 |
| E7           | NC                 | NC                         | H14          | CAD13                | $\overline{IORD}$         | M18          | $\overline{VCCD0}$ | $\overline{VCCD0}$ |
| E8           | NC                 | NC                         | H15          | GND                  | GND                       | M19          | $\overline{VCCD1}$ | $\overline{VCCD1}$ |

**Table 2–3. CardBus and 16-Bit PC Card Signal Names by GHK Terminal Number (Continued)**

| TERM.<br>NO. | SIGNAL NAME                     |                                 | TERM.<br>NO. | SIGNAL NAME               |                           | TERM.<br>NO. | SIGNAL NAME                 |                             |
|--------------|---------------------------------|---------------------------------|--------------|---------------------------|---------------------------|--------------|-----------------------------|-----------------------------|
|              | CARDBUS                         | 16-BIT                          |              | CARDBUS                   | 16-BIT                    |              | CARDBUS                     | 16-BIT                      |
| N1           | AD19                            | AD19                            | R1           | $\overline{\text{TRDY}}$  | $\overline{\text{TRDY}}$  | U15          | NC                          | NC                          |
| N2           | AD18                            | AD18                            | R2           | $\overline{\text{STOP}}$  | $\overline{\text{STOP}}$  | V5           | AD12                        | AD12                        |
| N3           | AD17                            | AD17                            | R3           | $\overline{\text{SERR}}$  | $\overline{\text{SERR}}$  | V6           | VCCP                        | VCCP                        |
| N5           | $\overline{\text{IRDY}}$        | $\overline{\text{IRDY}}$        | R6           | AD14                      | AD14                      | V7           | AD7                         | AD7                         |
| N6           | AD16                            | AD16                            | R7           | AD10                      | AD10                      | V8           | AD4                         | AD4                         |
| N14          | NC                              | NC                              | R8           | AD6                       | AD6                       | V9           | AD1                         | AD1                         |
| N15          | NC                              | NC                              | R9           | GND                       | GND                       | V10          | MFUNC1                      | MFUNC1                      |
| N17          | NC                              | NC                              | R10          | VCCI                      | VCCI                      | V11          | $\overline{\text{GRST}}$    | $\overline{\text{GRST}}$    |
| N18          | NC                              | NC                              | R11          | MFUNC6                    | MFUNC6                    | V12          | VPPD0                       | VPPD0                       |
| N19          | NC                              | NC                              | R12          | NC                        | NC                        | V13          | NC                          | NC                          |
| P1           | $\overline{\text{C/BE2}}$       | $\overline{\text{C/BE2}}$       | R13          | NC                        | NC                        | V14          | NC                          | NC                          |
| P2           | $\overline{\text{FRAME}}$       | $\overline{\text{FRAME}}$       | R14          | NC                        | NC                        | V15          | NC                          | NC                          |
| P3           | VCC                             | VCC                             | R17          | NC                        | NC                        | W4           | $\overline{\text{C/BE1}}$   | $\overline{\text{C/BE1}}$   |
| P5           | $\overline{\text{PERR}}$        | $\overline{\text{PERR}}$        | R18          | NC                        | NC                        | W5           | GND                         | GND                         |
| P6           | $\overline{\text{DEVSEL}}$      | $\overline{\text{DEVSEL}}$      | R19          | NC                        | NC                        | W6           | AD9                         | AD9                         |
| P7           | AD13                            | AD13                            | T1           | PAR                       | PAR                       | W7           | VCC                         | VCC                         |
| P8           | AD8                             | AD8                             | T19          | NC                        | NC                        | W8           | AD3                         | AD3                         |
| P9           | $\overline{\text{RI\_OUT/PME}}$ | $\overline{\text{RI\_OUT/PME}}$ | U5           | AD15                      | AD15                      | W9           | AD2                         | AD2                         |
| P10          | MFUNC2                          | MFUNC2                          | U6           | AD11                      | AD11                      | W10          | MFUNC0                      | MFUNC0                      |
| P11          | MFUNC5                          | MFUNC5                          | U7           | $\overline{\text{C/BE0}}$ | $\overline{\text{C/BE0}}$ | W11          | MFUNC3                      | MFUNC3                      |
| P12          | NC                              | NC                              | U8           | AD5                       | AD5                       | W12          | $\overline{\text{SUSPEND}}$ | $\overline{\text{SUSPEND}}$ |
| P13          | NC                              | NC                              | U9           | AD0                       | AD0                       | W13          | NC                          | NC                          |
| P14          | NC                              | NC                              | U10          | SPKROUT                   | SPKROUT                   | W14          | NC                          | NC                          |
| P15          | NC                              | NC                              | U11          | MFUNC4                    | MFUNC4                    | W15          | NC                          | NC                          |
| P17          | NC                              | NC                              | U12          | VPPD1                     | VPPD1                     | W16          | NC                          | NC                          |
| P18          | NC                              | NC                              | U13          | NC                        | NC                        |              |                             |                             |
| P19          | NC                              | NC                              | U14          | NC                        | NC                        |              |                             |                             |

**Table 2–4. CardBus PC Card Signal Names Sorted Alphabetically to GGU/PGE/GHK Terminal Number**

| SIGNAL NAME | TERM. NO. |     |     | SIGNAL NAME | TERM. NO. |     |     | SIGNAL NAME | TERM. NO. |     |     |
|-------------|-----------|-----|-----|-------------|-----------|-----|-----|-------------|-----------|-----|-----|
|             | GGU       | PGE | GHK |             | GGU       | PGE | GHK |             | GGU       | PGE | GHK |
| AD0         | N8        | 57  | U9  | CAD11       | G10       | 92  | H17 | CRST        | B9        | 119 | F12 |
| AD1         | K7        | 56  | V9  | CAD12       | F11       | 95  | G19 | CRSVD       | A2        | 143 | B8  |
| AD2         | L7        | 55  | W9  | CAD13       | F13       | 93  | H14 | CRSVD       | E10       | 100 | F18 |
| AD3         | N7        | 54  | W8  | CAD14       | E13       | 97  | G17 | CRSVD       | J13       | 84  | K14 |
| AD4         | M7        | 53  | V8  | CAD15       | F10       | 96  | G18 | CSERR       | A5        | 133 | B10 |
| AD5         | N6        | 52  | U8  | CAD16       | E12       | 98  | G14 | CSTOP       | C12       | 105 | E18 |
| AD6         | M6        | 51  | R8  | CAD17       | D10       | 113 | B15 | CSTSCHG     | C5        | 135 | E10 |
| AD7         | K6        | 49  | V7  | CAD18       | B10       | 115 | C14 | CTRDY       | A13       | 109 | A16 |
| AD8         | M5        | 47  | P8  | CAD19       | A10       | 116 | B14 | CVS1        | C6        | 131 | F11 |
| AD9         | L5        | 46  | W6  | CAD20       | C9        | 118 | A14 | CVS2        | D9        | 117 | E13 |
| AD10        | K5        | 45  | R7  | CAD21       | A9        | 120 | C13 | DEVSEL      | L1        | 32  | P6  |
| AD11        | M4        | 43  | U6  | CAD22       | D8        | 121 | B13 | FRAME       | J4        | 28  | P2  |
| AD12        | K4        | 41  | V5  | CAD23       | A8        | 124 | C12 | GND         | D3        | 6   | A15 |
| AD13        | N3        | 40  | P7  | CAD24       | C7        | 127 | A11 | GND         | H2        | 22  | E11 |
| AD14        | M3        | 39  | R6  | CAD25       | D7        | 128 | B11 | GND         | L4        | 42  | H15 |
| AD15        | N2        | 38  | U5  | CAD26       | A6        | 129 | C11 | GND         | M8        | 58  | J5  |
| AD16        | J2        | 26  | N6  | CAD27       | C4        | 139 | C9  | GND         | K11       | 78  | L15 |
| AD17        | J1        | 25  | N3  | CAD28       | A3        | 140 | F9  | GND         | F12       | 94  | M5  |
| AD18        | H4        | 24  | N2  | CAD29       | B3        | 141 | E9  | GND         | C10       | 114 | R9  |
| AD19        | H3        | 23  | N1  | CAD30       | C3        | 142 | A8  | GND         | B6        | 130 | W5  |
| AD20        | G3        | 19  | M2  | CAD31       | B2        | 144 | C8  | GNT         | B1        | 2   | H1  |
| AD21        | G2        | 17  | L5  | CAUDIO      | B5        | 134 | C10 | GRST        | M10       | 66  | V11 |
| AD22        | F1        | 16  | L6  | C/BE0       | N5        | 48  | U7  | IDSEL       | F4        | 13  | L1  |
| AD23        | F2        | 15  | L3  | C/BE1       | N1        | 37  | W4  | IRDY        | K1        | 29  | N5  |
| AD24        | E2        | 11  | K5  | C/BE2       | J3        | 27  | P1  | MFUNC0      | K8        | 60  | W10 |
| AD25        | E3        | 10  | K3  | C/BE3       | E1        | 12  | K6  | MFUNC1      | N9        | 61  | V10 |
| AD26        | E4        | 9   | K2  | CBLOCK      | D11       | 103 | E19 | MFUNC2      | K9        | 64  | P10 |
| AD27        | D1        | 8   | K1  | CC/BE0      | H13       | 88  | J14 | MFUNC3      | N10       | 65  | W11 |
| AD28        | D2        | 7   | J6  | CC/BE1      | E11       | 99  | F19 | MFUNC4      | L10       | 67  | U11 |
| AD29        | D4        | 5   | J3  | CC/BE2      | A11       | 112 | F13 | MFUNC5      | N11       | 68  | P11 |
| AD30        | C1        | 4   | J2  | CC/BE3      | B7        | 125 | B12 | MFUNC6      | M11       | 69  | R11 |
| AD31        | C2        | 3   | J1  | CCD1        | L12       | 75  | L19 | PAR         | M2        | 36  | T1  |
| CAD0        | L13       | 76  | L18 | CCD2        | A4        | 137 | A9  | PCLK        | H1        | 21  | M6  |
| CAD1        | K12       | 79  | L14 | CCLK        | B12       | 108 | D19 | PERR        | L3        | 34  | P5  |
| CAD2        | K10       | 77  | L17 | CCLKRUN     | D5        | 136 | F10 | PRST        | G4        | 20  | M3  |
| CAD3        | J10       | 81  | K18 | CDEVSEL     | B13       | 107 | E17 | REQ         | A1        | 1   | H2  |
| CAD4        | K13       | 80  | K19 | CFRAME      | B11       | 111 | E14 | RI_OUT/PME  | L8        | 59  | P9  |
| CAD5        | J12       | 83  | K15 | CGNT        | C11       | 106 | F15 | SERR        | M1        | 35  | R3  |
| CAD6        | J11       | 82  | K17 | CINT        | D6        | 132 | A10 | SPKROUT     | M9        | 62  | U10 |
| CAD7        | H10       | 85  | J19 | CIRDY       | A12       | 110 | C15 | STOP        | L2        | 33  | R2  |
| CAD8        | H12       | 87  | J17 | CPAR        | D13       | 101 | G15 | SUSPEND     | L11       | 70  | W12 |
| CAD9        | G12       | 89  | J15 | CPERR       | C13       | 104 | F14 | TRDY        | K3        | 31  | R1  |
| CAD10       | G11       | 91  | H18 | CREQ        | B8        | 123 | E12 | VCC         | F3        | 14  | A13 |

**Table 2–4. CardBus PC Card Signal Names Sorted Alphabetically to GGU/PGE/GHK  
Terminal Number (Continued)**

| SIGNAL NAME     | TERM. NO. |     |     | SIGNAL NAME       | TERM. NO. |     |     | SIGNAL NAME       | TERM. NO. |     |     |
|-----------------|-----------|-----|-----|-------------------|-----------|-----|-----|-------------------|-----------|-----|-----|
|                 | GGU       | PGE | GHK |                   | GGU       | PGE | GHK |                   | GGU       | PGE | GHK |
| V <sub>CC</sub> | K2        | 30  | B9  | V <sub>CC</sub>   | B4        | 138 | W7  | V <sub>CCI</sub>  | L9        | 63  | R10 |
| V <sub>CC</sub> | L6        | 50  | F17 | V <sub>CCCB</sub> | G13       | 90  | A12 | V <sub>CCP</sub>  | G1        | 18  | M1  |
| V <sub>CC</sub> | H11       | 86  | J18 | V <sub>CCCB</sub> | A7        | 126 | H19 | V <sub>CCP</sub>  | N4        | 44  | V6  |
| V <sub>CC</sub> | D12       | 102 | L2  | V <sub>CCD0</sub> | N13       | 73  | M18 | V <sub>PPD0</sub> | N12       | 71  | V12 |
| V <sub>CC</sub> | C8        | 122 | P3  | V <sub>CCD1</sub> | M13       | 74  | M19 | V <sub>PPD1</sub> | M12       | 72  | U12 |

**Table 2–5. 16-Bit PC Card Signal Names Sorted Alphabetically to GGU/PGE/GHK Terminal Number**

| SIGNAL NAME | TERM. NO. |     |     | SIGNAL NAME                          | TERM. NO. |     |     | SIGNAL NAME                       | TERM. NO. |     |     |
|-------------|-----------|-----|-----|--------------------------------------|-----------|-----|-----|-----------------------------------|-----------|-----|-----|
|             | GGU       | PGE | GHK |                                      | GGU       | PGE | GHK |                                   | GGU       | PGE | GHK |
| AD0         | N8        | 57  | U9  | ADDR11                               | F11       | 95  | G19 | GND                               | D3        | 6   | A15 |
| AD1         | K7        | 56  | V9  | ADDR12                               | A11       | 112 | F13 | GND                               | H2        | 22  | E11 |
| AD2         | L7        | 55  | W9  | ADDR13                               | D13       | 101 | G15 | GND                               | L4        | 42  | H15 |
| AD3         | N7        | 54  | W8  | ADDR14                               | C13       | 104 | F14 | GND                               | M8        | 58  | J5  |
| AD4         | M7        | 53  | V8  | ADDR15                               | A12       | 110 | C15 | GND                               | K11       | 78  | L15 |
| AD5         | N6        | 52  | U8  | ADDR16                               | B12       | 108 | D19 | GND                               | F12       | 94  | M5  |
| AD6         | M6        | 51  | R8  | ADDR17                               | E12       | 98  | G14 | GND                               | C10       | 114 | R9  |
| AD7         | K6        | 49  | V7  | ADDR18                               | E10       | 100 | F18 | GND                               | B6        | 130 | W5  |
| AD8         | M5        | 47  | P8  | ADDR19                               | D11       | 103 | E19 | $\overline{\text{GNT}}$           | B1        | 2   | H1  |
| AD9         | L5        | 46  | W6  | ADDR20                               | C12       | 105 | E18 | $\overline{\text{GRST}}$          | M10       | 66  | V11 |
| AD10        | K5        | 45  | R7  | ADDR21                               | B13       | 107 | E17 | IDSEL                             | F4        | 13  | L1  |
| AD11        | M4        | 43  | U6  | ADDR22                               | A13       | 109 | A16 | $\overline{\text{INPACK}}$        | B8        | 123 | E12 |
| AD12        | K4        | 41  | V5  | ADDR23                               | B11       | 111 | E14 | $\overline{\text{IORD}}$          | F13       | 93  | H14 |
| AD13        | N3        | 40  | P7  | ADDR24                               | D10       | 113 | B15 | $\overline{\text{IOWR}}$          | F10       | 96  | G18 |
| AD14        | M3        | 39  | R6  | ADDR25                               | A10       | 116 | B14 | $\overline{\text{IRDY}}$          | K1        | 29  | N5  |
| AD15        | N2        | 38  | U5  | BVD1( $\overline{\text{STSCHG/R}}$ ) | C5        | 135 | E10 | MFUNC0                            | K8        | 60  | W10 |
| AD16        | J2        | 26  | N6  | BVD2( $\overline{\text{SPKR}}$ )     | B5        | 134 | C10 | MFUNC1                            | N9        | 61  | V10 |
| AD17        | J1        | 25  | N3  | $\overline{\text{C/BE0}}$            | N5        | 48  | U7  | MFUNC2                            | K9        | 64  | P10 |
| AD18        | H4        | 24  | N2  | $\overline{\text{C/BE1}}$            | N1        | 37  | W4  | MFUNC3                            | N10       | 65  | W11 |
| AD19        | H3        | 23  | N1  | $\overline{\text{C/BE2}}$            | J3        | 27  | P1  | MFUNC4                            | L10       | 67  | U11 |
| AD20        | G3        | 19  | M2  | $\overline{\text{C/BE3}}$            | E1        | 12  | K6  | MFUNC5                            | N11       | 68  | P11 |
| AD21        | G2        | 17  | L5  | $\overline{\text{CD1}}$              | L12       | 75  | L19 | MFUNC6                            | M11       | 69  | R11 |
| AD22        | F1        | 16  | L6  | $\overline{\text{CD2}}$              | A4        | 137 | A9  | $\overline{\text{OE}}$            | G10       | 92  | H17 |
| AD23        | F2        | 15  | L3  | $\overline{\text{CE1}}$              | H13       | 88  | J14 | PAR                               | M2        | 36  | T1  |
| AD24        | E2        | 11  | K5  | $\overline{\text{CE2}}$              | G11       | 91  | H18 | PCLK                              | H1        | 21  | M6  |
| AD25        | E3        | 10  | K3  | DATA0                                | C4        | 139 | C9  | $\overline{\text{PERR}}$          | L3        | 34  | P5  |
| AD26        | E4        | 9   | K2  | DATA1                                | B3        | 141 | E9  | $\overline{\text{PRST}}$          | G4        | 20  | M3  |
| AD27        | D1        | 8   | K1  | DATA2                                | A2        | 143 | B8  | READY( $\overline{\text{IREQ}}$ ) | D6        | 132 | A10 |
| AD28        | D2        | 7   | J6  | DATA3                                | L13       | 76  | L18 | $\overline{\text{REG}}$           | B7        | 125 | B12 |
| AD29        | D4        | 5   | J3  | DATA4                                | K12       | 79  | L14 | $\overline{\text{REQ}}$           | A1        | 1   | H2  |
| AD30        | C1        | 4   | J2  | DATA5                                | J10       | 81  | K18 | RESET                             | B9        | 119 | F12 |
| AD31        | C2        | 3   | J1  | DATA6                                | J12       | 83  | K15 | $\overline{\text{RI\_OUT/PME}}$   | L8        | 59  | P9  |
| ADDR0       | A6        | 129 | C11 | DATA7                                | H10       | 85  | J19 | $\overline{\text{SERR}}$          | M1        | 35  | R3  |
| ADDR1       | D7        | 128 | B11 | DATA8                                | A3        | 140 | F9  | SPKROUT                           | M9        | 62  | U10 |
| ADDR2       | C7        | 127 | A11 | DATA9                                | C3        | 142 | A8  | $\overline{\text{STOP}}$          | L2        | 33  | R2  |
| ADDR3       | A8        | 124 | C12 | DATA10                               | B2        | 144 | C8  | $\overline{\text{SUSPEND}}$       | L11       | 70  | W12 |
| ADDR4       | D8        | 121 | B13 | DATA11                               | K10       | 77  | L17 | $\overline{\text{TRDY}}$          | K3        | 31  | R1  |
| ADDR5       | A9        | 120 | C13 | DATA12                               | K13       | 80  | K19 | VCC                               | F3        | 14  | A13 |
| ADDR6       | C9        | 118 | A14 | DATA13                               | J11       | 82  | K17 | VCC                               | K2        | 30  | B9  |
| ADDR7       | B10       | 115 | C14 | DATA14                               | J13       | 84  | K14 | VCC                               | L6        | 50  | F17 |
| ADDR8       | E11       | 99  | F19 | DATA15                               | H12       | 87  | J17 | VCC                               | H11       | 86  | J18 |
| ADDR9       | E13       | 97  | G17 | $\overline{\text{DEVSEL}}$           | L1        | 32  | P6  | VCC                               | D12       | 102 | L2  |
| ADDR10      | G12       | 89  | J15 | $\overline{\text{FRAME}}$            | J4        | 28  | P2  | VCC                               | C8        | 122 | P3  |

**Table 2–5. 16-Bit PC Card Signal Names Sorted Alphabetically to GGU/PGE/GHK  
Terminal Number (Continued)**

| SIGNAL NAME        | TERM. NO. |     |     | SIGNAL NAME       | TERM. NO. |     |     | SIGNAL NAME       | TERM. NO. |     |     |
|--------------------|-----------|-----|-----|-------------------|-----------|-----|-----|-------------------|-----------|-----|-----|
|                    | GGU       | PGE | GHK |                   | GGU       | PGE | GHK |                   | GGU       | PGE | GHK |
| V <sub>CC</sub>    | B4        | 138 | W7  | V <sub>CCI</sub>  | L9        | 63  | R10 | $\overline{VS1}$  | C6        | 131 | F11 |
| V <sub>CCCB</sub>  | G13       | 90  | A12 | V <sub>CCP</sub>  | G1        | 18  | M1  | $\overline{VS2}$  | D9        | 117 | E13 |
| $\overline{VCCCB}$ | A7        | 126 | H19 | V <sub>CCP</sub>  | N4        | 44  | V6  | $\overline{WAIT}$ | A5        | 133 | B10 |
| $\overline{VCCD0}$ | N13       | 73  | M18 | V <sub>PPD0</sub> | N12       | 71  | V12 | $\overline{WE}$   | C11       | 106 | F15 |
| $\overline{VCCD1}$ | M13       | 74  | M19 | V <sub>PPD1</sub> | M12       | 72  | U12 | WP(IOIS16)        | D5        | 136 | F10 |

The terminals are grouped in tables by functionality (see Table 2–6 through Table 2–16), such as PCI system function and power-supply function. The terminal numbers are also listed for convenient reference.

**Table 2–6. Power Supply Terminals**

| TERMINAL          |                                   |                                 |                                    | DESCRIPTION                                                                            |
|-------------------|-----------------------------------|---------------------------------|------------------------------------|----------------------------------------------------------------------------------------|
| NAME              | NUMBER                            |                                 |                                    |                                                                                        |
|                   | GGU                               | PGE                             | GHK                                |                                                                                        |
| GND               | B6, C10, D3, F12, H2, K11, L4, M8 | 6, 22, 42, 58, 78, 94, 114, 130 | A15, E11, H15, J5, L15, M5, R9, W5 | Device ground terminals                                                                |
| V <sub>CC</sub>   | B4, C8, D12, F3, H11, K2, L6      | 14, 30, 50, 86, 102, 122, 138   | A13, B9, F17, J18, L2, P3, W7      | Power supply terminal for core logic (3.3 V)                                           |
| V <sub>CCCB</sub> | A7, G13                           | 90, 126                         | A12, H19                           | Clamp voltage for PC Card interface. Matches card signaling environment, 5 V or 3.3 V. |
| V <sub>CCI</sub>  | L9                                | 63                              | R10                                | Clamp voltage for interrupt subsystem interface and miscellaneous I/O, 5 V or 3.3 V    |
| V <sub>CCP</sub>  | G1, N4                            | 18, 44                          | M1, V6                             | Clamp voltage for PCI signaling, 5 V or 3.3 V                                          |

**Table 2–7. PC Card Power Switch Terminals**

| TERMINAL                     |            |          |            | I/O | DESCRIPTION                                                                   |
|------------------------------|------------|----------|------------|-----|-------------------------------------------------------------------------------|
| NAME                         | NUMBER     |          |            |     |                                                                               |
|                              | GGU        | PGE      | GHK        |     |                                                                               |
| <u>VCCD0</u><br><u>VCCD1</u> | N13<br>M13 | 73<br>74 | M18<br>M19 | O   | Logic controls to the TPS2211 PC Card power interface switch to control AVCC. |
| VPPD0<br>VPPD1               | N12<br>M12 | 71<br>72 | V12<br>U12 | O   | Logic controls to the TPS2211 PC Card power interface switch to control AVPP. |

**Table 2–8. PCI System Terminals**

| TERMINAL                 |        |     |     | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------|--------|-----|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                     | NUMBER |     |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                          | GGU    | PGE | GHK |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| $\overline{\text{GRST}}$ | M10    | 66  | V11 | I   | <p>Global reset. When the global reset is asserted, the <math>\overline{\text{GRST}}</math> signal causes the <math>\overline{\text{PCI1410}}</math> to place all output buffers in a high-impedance state and reset all internal registers. When <math>\overline{\text{GRST}}</math> is asserted, the device is completely in its default state. For systems that require wake-up from D3, <math>\overline{\text{GRST}}</math> will normally be asserted only during initial boot. <math>\overline{\text{PRST}}</math> should be used following initial boot so that PME context is retained when transitioning from D3 to D0. For systems that do not require wake-up from D3, <math>\overline{\text{GRST}}</math> should be tied to <math>\overline{\text{PRST}}</math>.</p> <p>When the <math>\overline{\text{SUSPEND}}</math> mode is enabled, the device is protected from the <math>\overline{\text{GRST}}</math>, and the internal registers are preserved. All outputs are placed in a high-impedance state.</p> |
| PCLK                     | H1     | 21  | M6  | I   | <p>PCI bus clock. PCLK provides timing for all transactions on the PCI bus. All PCI signals are sampled at the rising edge of PCLK.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| $\overline{\text{PRST}}$ | G4     | 20  | M3  | I   | <p>PCI reset. When the PCI bus reset is asserted, <math>\overline{\text{PRST}}</math> causes the <math>\overline{\text{PCI1410}}</math> to place all output buffers in a high-impedance state and reset internal registers. When <math>\overline{\text{PRST}}</math> is asserted, the device is completely nonfunctional. After <math>\overline{\text{PRST}}</math> is deasserted, the <math>\overline{\text{PCI1410}}</math> is in a default state.</p> <p>When the <math>\overline{\text{SUSPEND}}</math> mode is enabled, the device is protected from the <math>\overline{\text{PRST}}</math>, and the internal registers are preserved. All outputs are placed in a high-impedance state.</p>                                                                                                                                                                                                                                                                                                                        |

Table 2–9. PCI Address and Data Terminals

| TERMINAL                                                                             |                      |                      |                      | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                                                                                 | NUMBER               |                      |                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                      | GGU                  | PGE                  | GHK                  |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD31                                                                                 | C2                   | 3                    | J1                   | I/O | PCI address/data bus. These signals make up the multiplexed PCI address and data bus on the primary interface. During the address phase of a primary bus PCI cycle, AD31–AD0 contain a 32-bit address or other destination information. During the data phase, AD31–AD0 contain data.                                                                                                                                                                                                                                                                                                                  |
| AD30                                                                                 | C1                   | 4                    | J2                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD29                                                                                 | D4                   | 5                    | J3                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD28                                                                                 | D2                   | 7                    | J6                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD27                                                                                 | D1                   | 8                    | K1                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD26                                                                                 | E4                   | 9                    | K2                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD25                                                                                 | E3                   | 10                   | K3                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD24                                                                                 | E2                   | 11                   | K5                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD23                                                                                 | F2                   | 15                   | L3                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD22                                                                                 | F1                   | 16                   | L6                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD21                                                                                 | G2                   | 17                   | L5                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD20                                                                                 | G3                   | 19                   | M2                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD19                                                                                 | H3                   | 23                   | N1                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD18                                                                                 | H4                   | 24                   | N2                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD17                                                                                 | J1                   | 25                   | N3                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD16                                                                                 | J2                   | 26                   | N6                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD15                                                                                 | N2                   | 38                   | U5                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD14                                                                                 | M3                   | 39                   | R6                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD13                                                                                 | N3                   | 40                   | P7                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD12                                                                                 | K4                   | 41                   | V5                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD11                                                                                 | M4                   | 43                   | U6                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD10                                                                                 | K5                   | 45                   | R7                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD9                                                                                  | L5                   | 46                   | W6                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD8                                                                                  | M5                   | 47                   | P8                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD7                                                                                  | K6                   | 49                   | V7                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD6                                                                                  | M6                   | 51                   | R8                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD5                                                                                  | N6                   | 52                   | U8                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD4                                                                                  | M7                   | 53                   | V8                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD3                                                                                  | N7                   | 54                   | W8                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD2                                                                                  | L7                   | 55                   | W9                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD1                                                                                  | K7                   | 56                   | V9                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| AD0                                                                                  | N8                   | 57                   | U9                   |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| $\overline{C/BE3}$<br>$\overline{C/BE2}$<br>$\overline{C/BE1}$<br>$\overline{C/BE0}$ | E1<br>J3<br>N1<br>N5 | 12<br>27<br>37<br>48 | K6<br>P1<br>W4<br>U7 | I/O | PCI bus commands and byte enables. These signals are multiplexed on the same PCI terminals. During the address phase of a primary bus PCI cycle, $\overline{C/BE3}$ – $\overline{C/BE0}$ define the bus command. During the data phase, this 4-bit bus is used as byte enables. The byte enables determine which byte paths of the full 32-bit data bus carry meaningful data. $\overline{C/BE0}$ applies to byte 0 ( $\overline{AD7}$ –AD0), $\overline{C/BE1}$ applies to byte 1 (AD15–AD8), $\overline{C/BE2}$ applies to byte 2 (AD23–AD16), and $\overline{C/BE3}$ applies to byte 3 (AD31–AD24). |
| PAR                                                                                  | M2                   | 36                   | T1                   | I/O | PCI bus parity. In all PCI bus read and write cycles, the PCI1410 calculates even parity across the AD31–AD0 and $\overline{C/BE3}$ – $\overline{C/BE0}$ buses. As an initiator during PCI cycles, the PCI1410 outputs this parity indicator with a one-PCLK delay. As a target during PCI cycles, the calculated parity is compared to the initiator parity indicator. A compare error results in the assertion of a parity error ( $\overline{PERR}$ ).                                                                                                                                              |

**Table 2–10. PCI Interface Control Terminals**

| TERMINAL                   |        |     |     | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|--------|-----|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                       | NUMBER |     |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                            | GGU    | PGE | GHK |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| $\overline{\text{DEVSEL}}$ | L1     | 32  | P6  | I/O | PCI device select. The PCI1410 asserts $\overline{\text{DEVSEL}}$ to claim a PCI cycle as the target device. As a PCI initiator on the bus, the PCI1410 monitors $\overline{\text{DEVSEL}}$ until a target responds. If no target responds before timeout occurs, then the PCI1410 terminates the cycle with an initiator abort.                                                                                                                                    |
| $\overline{\text{FRAME}}$  | J4     | 28  | P2  | I/O | PCI cycle frame. $\overline{\text{FRAME}}$ is driven by the initiator of a bus cycle. $\overline{\text{FRAME}}$ is asserted to indicate that a bus transaction is beginning, and data transfers continue while this signal is asserted. When $\overline{\text{FRAME}}$ is deasserted, the PCI bus transaction is in the final data phase.                                                                                                                           |
| $\overline{\text{GNT}}$    | B1     | 2   | H1  | I   | PCI bus grant. $\overline{\text{GNT}}$ is driven by the PCI bus arbiter to grant the PCI1410 access to the PCI bus after the current data transaction has completed. $\overline{\text{GNT}}$ may or may not follow a PCI bus request, depending on the PCI bus parking algorithm.                                                                                                                                                                                   |
| IDSEL                      | F4     | 13  | L1  | I   | Initialization device select. IDSEL selects the PCI1410 during configuration space accesses. IDSEL can be connected to one of the upper 24 PCI address lines on the PCI bus.                                                                                                                                                                                                                                                                                        |
| $\overline{\text{IRDY}}$   | K1     | 29  | N5  | I/O | PCI initiator ready. $\overline{\text{IRDY}}$ indicates the ability of the PCI bus initiator to complete the current data phase of the transaction. A data phase is completed on a rising edge of PCLK where both $\overline{\text{IRDY}}$ and $\overline{\text{TRDY}}$ are asserted. Until $\overline{\text{IRDY}}$ and $\overline{\text{TRDY}}$ are both sampled asserted, wait states are inserted.                                                              |
| $\overline{\text{PERR}}$   | L3     | 34  | P5  | I/O | PCI parity error indicator. $\overline{\text{PERR}}$ is driven by a PCI device to indicate that calculated parity does not match PAR when $\overline{\text{PERR}}$ is enabled through bit 6 of the command register (offset 04h, see Section 4.4).                                                                                                                                                                                                                  |
| $\overline{\text{REQ}}$    | A1     | 1   | H2  | O   | PCI bus request. $\overline{\text{REQ}}$ is asserted by the PCI1410 to request access to the PCI bus as an initiator.                                                                                                                                                                                                                                                                                                                                               |
| $\overline{\text{SERR}}$   | M1     | 35  | R3  | O   | PCI system error. $\overline{\text{SERR}}$ is an output that is pulsed from the PCI1410 when enabled through bit 8 of the command register (offset 04h, see Section 4.4) indicating a system error has occurred. The PCI1410 need not be the target of the PCI cycle to assert this signal. When $\overline{\text{SERR}}$ is enabled in the command register, this signal also pulses, indicating that an address parity error has occurred on a CardBus interface. |
| $\overline{\text{STOP}}$   | L2     | 33  | R2  | I/O | PCI cycle stop signal. $\overline{\text{STOP}}$ is driven by a PCI target to request the initiator to stop the current PCI bus transaction. $\overline{\text{STOP}}$ is used for target disconnects and is commonly asserted by target devices that do not support burst data transfers.                                                                                                                                                                            |
| $\overline{\text{TRDY}}$   | K3     | 31  | R1  | I/O | PCI target ready. $\overline{\text{TRDY}}$ indicates the ability of the primary bus target to complete the current data phase of the transaction. A data phase is completed on a rising edge of PCLK when both $\overline{\text{IRDY}}$ and $\overline{\text{TRDY}}$ are asserted. Until both $\overline{\text{IRDY}}$ and $\overline{\text{TRDY}}$ are asserted, wait states are inserted.                                                                         |

**Table 2–11. Multifunction and Miscellaneous Terminals**

| TERMINAL                        |        |     |     | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|--------|-----|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                            | NUMBER |     |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                 | GGU    | PGE | GHK |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| MFUNC0                          | K8     | 60  | W10 | I/O | Multifunction terminal 0. MFUNC0 can be configured as parallel PCI interrupt $\overline{\text{INTA}}$ , GPIO, GPO0, socket activity LED output, ZV switching outputs, CardBus audio PWM, $\overline{\text{GPE}}$ , or a parallel IRQ. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| MFUNC1                          | N9     | 61  | V10 | I/O | Multifunction terminal 1. MFUNC1 can be configured as GPI1, GPO1, socket activity LED output, ZV switching outputs, CardBus audio PWM, $\overline{\text{GPE}}$ , or a parallel IRQ. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.<br><br>Serial data (SDA). When $\overline{\text{VCCD0}}$ and $\overline{\text{VCCD1}}$ are high after a PCI reset, the MFUNC1 terminal provides the SDA signaling for the serial bus interface. The two-terminal serial interface loads the subsystem identification and other register defaults from an EEPROM after a PCI reset. See Section 3.6.1, <i>Serial Bus Interface Implementation</i> , for details on other serial bus applications.                                                               |
| MFUNC2                          | K9     | 64  | P10 | I/O | Multifunction terminal 2. MFUNC2 can be configured as PC/PCI DMA request, GPI2, GPO2, socket activity LED output, ZV switching outputs, CardBus audio PWM, $\overline{\text{GPE}}$ , $\overline{\text{RI\_OUT}}$ , or a parallel IRQ. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| MFUNC3                          | N10    | 65  | W11 | I/O | Multifunction terminal 3. MFUNC3 can be configured as a parallel IRQ or the serialized interrupt signal IRQSER. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| MFUNC4                          | L10    | 67  | U11 | I/O | Multifunction terminal 4. MFUNC4 can be configured as PCI $\overline{\text{LOCK}}$ , GPI3, GPO3, socket activity LED output, ZV switching outputs, CardBus audio PWM, $\overline{\text{GPE}}$ , $\overline{\text{RI\_OUT}}$ , or a parallel IRQ. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.<br><br>Serial clock (SCL). When $\overline{\text{VCCD0}}$ and $\overline{\text{VCCD1}}$ are high after a PCI reset, the MFUNC4 terminal provides the SCL signaling for the serial bus interface. The two-terminal serial interface loads the subsystem identification and other register defaults from an EEPROM after a PCI reset. See Section 3.6.1, <i>Serial Bus Interface Implementation</i> , for details on other serial bus applications. |
| MFUNC5                          | N11    | 68  | P11 | I/O | Multifunction terminal 5. MFUNC5 can be configured as PC/PCI DMA grant, GPI4, GPO4, socket activity LED output, ZV switching outputs, CardBus audio PWM, $\overline{\text{GPE}}$ , or a parallel IRQ. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| MFUNC6                          | M11    | 69  | R11 | I/O | Multifunction terminal 6. MFUNC6 can be configured as a PCI $\overline{\text{CLKRUN}}$ or a parallel IRQ. See Section 4.30, <i>Multifunction Routing Register</i> , for configuration details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| $\overline{\text{RI\_OUT/PME}}$ | L8     | 59  | P9  | O   | Ring indicate out and power management event output. Terminal provides an output for ring-indicate or PME signals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| SPKROUT                         | M9     | 62  | U10 | O   | Speaker output. SPKROUT is the output to the host system that can carry $\overline{\text{SPKR}}$ or CAUDIO through the PCI1410 from the PC Card interface. SPKROUT is driven as the exclusive-OR combination of card $\overline{\text{SPKR}}$ //CAUDIO inputs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| $\overline{\text{SUSPEND}}$     | L11    | 70  | W12 | I   | Suspend. $\overline{\text{SUSPEND}}$ protects the internal registers from clearing when the $\overline{\text{GRST}}$ or $\overline{\text{PRST}}$ signal is asserted. See Section 3.8.4, <i>Suspend Mode</i> , for details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Table 2–12. 16-Bit PC Card Address and Data Terminals**

| TERMINAL |        |     |     | I/O | DESCRIPTION                                                                        |
|----------|--------|-----|-----|-----|------------------------------------------------------------------------------------|
| NAME     | NUMBER |     |     |     |                                                                                    |
|          | GGU    | PGE | GHK |     |                                                                                    |
| ADDR25   | A10    | 116 | B14 | O   | PC Card address. 16-bit PC Card address lines. ADDR25 is the most significant bit. |
| ADDR24   | D10    | 113 | B15 |     |                                                                                    |
| ADDR23   | B11    | 111 | E14 |     |                                                                                    |
| ADDR22   | A13    | 109 | A16 |     |                                                                                    |
| ADDR21   | B13    | 107 | E17 |     |                                                                                    |
| ADDR20   | C12    | 105 | E18 |     |                                                                                    |
| ADDR19   | D11    | 103 | E19 |     |                                                                                    |
| ADDR18   | E10    | 100 | F18 |     |                                                                                    |
| ADDR17   | E12    | 98  | G14 |     |                                                                                    |
| ADDR16   | B12    | 108 | D19 |     |                                                                                    |
| ADDR15   | A12    | 110 | C15 |     |                                                                                    |
| ADDR14   | C13    | 104 | F14 |     |                                                                                    |
| ADDR13   | D13    | 101 | G15 |     |                                                                                    |
| ADDR12   | A11    | 112 | F13 |     |                                                                                    |
| ADDR11   | F11    | 95  | G19 |     |                                                                                    |
| ADDR10   | G12    | 89  | J15 |     |                                                                                    |
| ADDR9    | E13    | 97  | G17 |     |                                                                                    |
| ADDR8    | E11    | 99  | F19 |     |                                                                                    |
| ADDR7    | B10    | 115 | C14 |     |                                                                                    |
| ADDR6    | C9     | 118 | A14 |     |                                                                                    |
| ADDR5    | A9     | 120 | C13 |     |                                                                                    |
| ADDR4    | D8     | 121 | B13 |     |                                                                                    |
| ADDR3    | A8     | 124 | C12 |     |                                                                                    |
| ADDR2    | C7     | 127 | A11 |     |                                                                                    |
| ADDR1    | D7     | 128 | B11 |     |                                                                                    |
| ADDR0    | A6     | 129 | C11 |     |                                                                                    |
| DATA15   | H12    | 87  | J17 | I/O | PC Card data. 16-bit PC Card data lines. DATA15 is the most significant bit.       |
| DATA14   | J13    | 84  | K14 |     |                                                                                    |
| DATA13   | J11    | 82  | K17 |     |                                                                                    |
| DATA12   | K13    | 80  | K19 |     |                                                                                    |
| DATA11   | K10    | 77  | L17 |     |                                                                                    |
| DATA10   | B2     | 144 | C8  |     |                                                                                    |
| DATA9    | C3     | 142 | A8  |     |                                                                                    |
| DATA8    | A3     | 140 | F9  |     |                                                                                    |
| DATA7    | H10    | 85  | J19 |     |                                                                                    |
| DATA6    | J12    | 83  | K15 |     |                                                                                    |
| DATA5    | J10    | 81  | K18 |     |                                                                                    |
| DATA4    | K12    | 79  | L14 |     |                                                                                    |
| DATA3    | L13    | 76  | L18 |     |                                                                                    |
| DATA2    | A2     | 143 | B8  |     |                                                                                    |
| DATA1    | B3     | 141 | E9  |     |                                                                                    |
| DATA0    | C4     | 139 | C9  |     |                                                                                    |

**Table 2–13. 16-Bit PC Card Interface Control Terminals**

| TERMINAL                                                                        |            |           |            | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------|------------|-----------|------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                                                                            | NUMBER     |           |            |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                                                 | GGU        | PGE       | GHK        |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| $\overline{\text{BVD1}}$<br>( $\overline{\text{STSCHG}}/\overline{\text{RI}}$ ) | C5         | 135       | E10        | I   | Battery voltage detect 1. BVD1 is generated by 16-bit memory PC Cards that include batteries. BVD1 is used with BVD2 as an indication of the condition of the batteries on a memory PC Card. Both BVD1 and BVD2 are high when the battery is good. When BVD2 is low and BVD1 is high, the battery is weak and should be replaced. When BVD1 is low, the battery is no longer serviceable and the data in the memory PC Card is lost. See Section 5.6, <i>ExCA Card Status-Change-Interrupt Configuration Register</i> , for enable bits. See Section 5.5, <i>ExCA Card Status-Change Register</i> , and Section 5.2, <i>ExCA Interface Status Register</i> , for the status bits for this signal.<br><br>Status change. $\overline{\text{STSCHG}}$ is used to alert the system to a change in the READY, write protect, or battery voltage dead condition of a 16-bit I/O PC Card.<br><br>Ring indicate. $\overline{\text{RI}}$ is used by 16-bit modem cards to indicate a ring detection.                                                                                                                                                                          |
| $\overline{\text{BVD2}}$<br>( $\overline{\text{SPKR}}$ )                        | B5         | 134       | C10        | I   | Battery voltage detect 2. BVD2 is generated by 16-bit memory PC Cards that include batteries. BVD2 is used with BVD1 as an indication of the condition of the batteries on a memory PC Card. Both BVD1 and BVD2 are high when the battery is good. When BVD2 is low and BVD1 is high, the battery is weak and should be replaced. When BVD1 is low, the battery is no longer serviceable and the data in the memory PC Card is lost. See Section 5.6, <i>ExCA Card Status-Change-Interrupt Configuration Register</i> , for enable bits. See Section 5.5, <i>ExCA Card Status-Change Register</i> , and Section 5.2, <i>ExCA Interface Status Register</i> , for the status bits for this signal.<br><br>Speaker. $\overline{\text{SPKR}}$ is an optional binary audio signal available only when the card and socket have been configured for the 16-bit I/O interface. The audio signals from cards A and B are combined by the PCI1410 and are output on SPKROUT.<br><br>DMA request. BVD2 can be used as the DMA request signal during DMA operations to a 16-bit PC Card that supports DMA. The PC Card asserts BVD2 to indicate a request for a DMA operation. |
| $\overline{\text{CD1}}$<br>$\overline{\text{CD2}}$                              | L12<br>A4  | 75<br>137 | L19<br>A9  | I   | Card detect 1 and card detect 2. $\overline{\text{CD1}}$ and $\overline{\text{CD2}}$ are internally connected to ground on the PC Card. When a PC Card is inserted into a socket, $\overline{\text{CD1}}$ and $\overline{\text{CD2}}$ are pulled low. For signal status, see Section 5.2, <i>ExCA Interface Status Register</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| $\overline{\text{CE1}}$<br>$\overline{\text{CE2}}$                              | H13<br>G11 | 88<br>91  | J14<br>H18 | O   | Card enable 1 and card enable 2. $\overline{\text{CE1}}$ and $\overline{\text{CE2}}$ enable even- and odd-numbered address bytes. $\overline{\text{CE1}}$ enables even-numbered address bytes, and $\overline{\text{CE2}}$ enables odd-numbered address bytes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| $\overline{\text{INPACK}}$                                                      | B8         | 123       | E12        | I   | Input acknowledge. $\overline{\text{INPACK}}$ is asserted by the PC Card when it can respond to an I/O read cycle at the current address.<br><br>DMA request. $\overline{\text{INPACK}}$ can be used as the DMA request signal during DMA operations from a 16-bit PC Card that supports DMA. If it is used as a strobe, then the PC Card asserts this signal to indicate a request for a DMA operation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| $\overline{\text{IORD}}$                                                        | F13        | 93        | H14        | O   | I/O read. $\overline{\text{IORD}}$ is asserted by the PCI1410 to enable 16-bit I/O PC Card data output during host I/O read cycles.<br><br>DMA write. $\overline{\text{IORD}}$ is used as the DMA write strobe during DMA operations from a 16-bit PC Card that supports DMA. The PCI1410 asserts $\overline{\text{IORD}}$ during DMA transfers from the PC Card to host memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| $\overline{\text{IOWR}}$                                                        | F10        | 96        | G18        | O   | I/O write. $\overline{\text{IOWR}}$ is driven low by the PCI1410 to strobe write data into 16-bit I/O PC Cards during host I/O write cycles.<br><br>DMA read. $\overline{\text{IOWR}}$ is used as the DMA write strobe during DMA operations from a 16-bit PC Card that supports DMA. The PCI1410 asserts $\overline{\text{IOWR}}$ during transfers from host memory to the PC Card.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| $\overline{\text{OE}}$                                                          | G10        | 92        | H17        | O   | Output enable. $\overline{\text{OE}}$ is driven low by the PCI1410 to enable 16-bit memory PC Card data output during host memory read cycles.<br><br>DMA terminal count. $\overline{\text{OE}}$ is used as terminal count (TC) during DMA operations to a 16-bit PC Card that supports DMA. The PCI1410 asserts $\overline{\text{OE}}$ to indicate TC for a DMA write operation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

**Table 2–13. 16-Bit PC Card Interface Control Terminals (Continued)**

| TERMINAL                                           |          |            |            | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|----------|------------|------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                                               | NUMBER   |            |            |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                    | GGU      | PGE        | GHK        |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| READY<br>(IREQ)                                    | D6       | 132        | A10        | I   | Ready. The ready function is provided by READY when the 16-bit PC Card and the host socket are configured for the memory-only interface. READY is driven low by the 16-bit memory PC Cards to indicate that the memory card circuits are busy processing a previous write command. READY is driven high when the 16-bit memory PC Card is ready to accept a new data transfer command.<br><br>Interrupt request. $\overline{\text{IREQ}}$ is asserted by a 16-bit I/O PC Card to indicate to the host that a device on the 16-bit I/O PC Card requires service by the host software. IREQ is high (deasserted) when no interrupt is requested.                                                                                                                                                                                                                                                                    |
| $\overline{\text{REG}}$                            | B7       | 125        | B12        | O   | Attribute memory select. $\overline{\text{REG}}$ remains high for all common memory accesses. When $\overline{\text{REG}}$ is asserted, access is limited to attribute memory ( $\overline{\text{OE}}$ or $\overline{\text{WE}}$ active) and to the I/O space ( $\overline{\text{IORD}}$ or $\overline{\text{IOWR}}$ active). Attribute memory is a separately accessed section of card memory and is generally used to record card capacity and other configuration and attribute information.<br><br>DMA acknowledge. $\overline{\text{REG}}$ is used as a DMA acknowledge ( $\overline{\text{DACK}}$ ) during DMA operations to a 16-bit PC Card that supports DMA. The PCI1410 asserts $\overline{\text{REG}}$ to indicate a DMA operation. $\overline{\text{REG}}$ is used in conjunction with the DMA read ( $\overline{\text{IOWR}}$ ) or DMA write ( $\overline{\text{IORD}}$ ) strobes to transfer data. |
| RESET                                              | B9       | 119        | F12        | O   | PC Card reset. RESET forces a hard reset to a 16-bit PC Card.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| $\overline{\text{VS1}}$<br>$\overline{\text{VS2}}$ | C6<br>D9 | 131<br>117 | F11<br>E13 | I/O | Voltage sense 1 and voltage sense 2. $\overline{\text{VS1}}$ and $\overline{\text{VS2}}$ , when used in conjunction with each other, determine the operating voltage of the PC Card.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| $\overline{\text{WAIT}}$                           | A5       | 133        | B10        | I   | Bus cycle wait. $\overline{\text{WAIT}}$ is driven by a 16-bit PC Card to extend the completion of the memory or I/O cycle in progress.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| $\overline{\text{WE}}$                             | C11      | 106        | F15        | O   | Write enable. $\overline{\text{WE}}$ is used to strobe memory write data into 16-bit memory PC Cards. $\overline{\text{WE}}$ is also used for memory PC Cards that employ programmable memory technologies.<br><br>DMA terminal count. $\overline{\text{WE}}$ is used as $\overline{\text{TC}}$ during DMA operations to a 16-bit PC Card that supports DMA. The PCI1410 asserts $\overline{\text{WE}}$ to indicate $\overline{\text{TC}}$ for a DMA read operation.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| $\overline{\text{WP}}$<br>(IOIS16)                 | D5       | 136        | F10        | I   | Write protect. WP applies to 16-bit memory PC Cards. WP reflects the status of the write-protect switch on 16-bit memory PC Cards. For 16-bit I/O cards, WP is used for the 16-bit port (IOIS16) function.<br><br>I/O is 16 bits. $\overline{\text{IOIS16}}$ applies to 16-bit I/O PC Cards. $\overline{\text{IOIS16}}$ is asserted by the 16-bit PC Card when the address on the bus corresponds to an address to which the 16-bit PC Card responds, and the I/O port that is addressed is capable of 16-bit accesses.<br><br>DMA request. WP can be used as the DMA request signal during DMA operations to a 16-bit PC Card that supports DMA. If used, then the PC Card asserts WP to indicate a request for a DMA operation.                                                                                                                                                                                 |

**Table 2–14. CardBus PC Card Interface System Terminals**

| TERMINAL |        |     |     | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------|--------|-----|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME     | NUMBER |     |     |     |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|          | GGU    | PGE | GHK |     |                                                                                                                                                                                                                                                                                                                                                                                                                              |
| CCLK     | B12    | 108 | D19 | O   | CardBus clock. CCLK provides synchronous timing for all transactions on the CardBus interface. All signals except CRST, CCLKRUN, CINT, CSTSCHG, CAUDIO, CCD2, CCD1, CVS2, and CVS1 are sampled on the rising edge of CCLK, and all timing parameters are defined with the rising edge of this signal. CCLK operates at the PCI bus clock frequency, but it can be stopped in the low state or slowed down for power savings. |
| CCLKRUN  | D5     | 136 | F10 | I/O | CardBus clock run. CCLKRUN is used by a CardBus PC Card to request an increase in the CCLK frequency, and by the PCI1410 to indicate that the CCLK frequency is going to be decreased.                                                                                                                                                                                                                                       |
| CRST     | B9     | 119 | F12 | O   | CardBus reset. CRST brings CardBus PC Card-specific registers, sequencers, and signals to a known state. When CRST is asserted, all CardBus PC Card signals are placed in a high-impedance state, and the PCI1410 drives these signals to a valid logic level. Assertion can be asynchronous to CCLK, but deassertion must be synchronous to CCLK.                                                                           |

**Table 2–15. CardBus PC Card Address and Data Terminals**

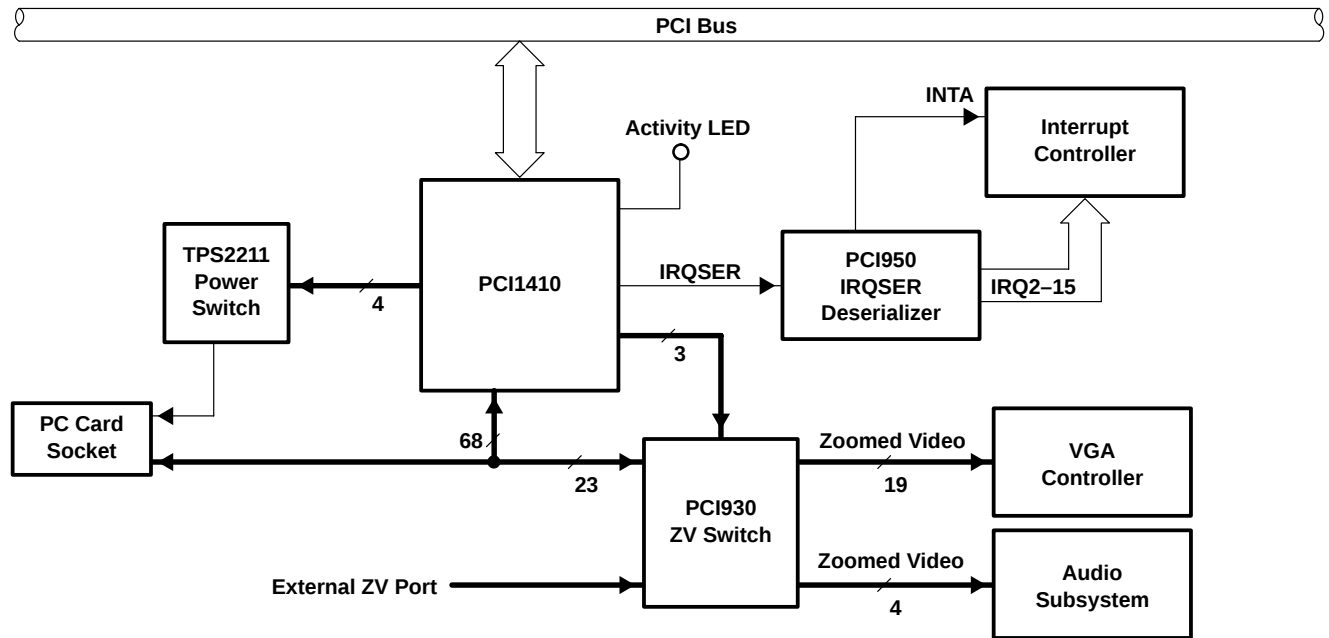
| TERMINAL                                                                 |                         |                        |                          | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------|-------------------------|------------------------|--------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                                                                     | NUMBER                  |                        |                          |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                          | GGU                     | PGE                    | GHK                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD31                                                                    | B2                      | 144                    | C8                       | I/O | CardBus address and data. These signals make up the multiplexed CardBus address and data bus on the CardBus interface. During the address phase of a CardBus cycle, CAD31–CAD0 contain a 32-bit address. During the data phase of a CardBus cycle, CAD31–CAD0 contain data. CAD31 is the most significant bit.                                                                                                                                                                                                                                                                                |
| CAD30                                                                    | C3                      | 142                    | A8                       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD29                                                                    | B3                      | 141                    | E9                       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD28                                                                    | A3                      | 140                    | F9                       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD27                                                                    | C4                      | 139                    | C9                       |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD26                                                                    | A6                      | 129                    | C11                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD25                                                                    | D7                      | 128                    | B11                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD24                                                                    | C7                      | 127                    | A11                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD23                                                                    | A8                      | 124                    | C12                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD22                                                                    | D8                      | 121                    | B13                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD21                                                                    | A9                      | 120                    | C13                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD20                                                                    | C9                      | 118                    | A14                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD19                                                                    | A10                     | 116                    | B14                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD18                                                                    | B10                     | 115                    | C14                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD17                                                                    | D10                     | 113                    | B15                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD16                                                                    | E12                     | 98                     | G14                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD15                                                                    | F10                     | 96                     | G18                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD14                                                                    | E13                     | 97                     | G17                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD13                                                                    | F13                     | 93                     | H14                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD12                                                                    | F11                     | 95                     | G19                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD11                                                                    | G10                     | 92                     | H17                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD10                                                                    | G11                     | 91                     | H18                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD9                                                                     | G12                     | 89                     | J15                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD8                                                                     | H12                     | 87                     | J17                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD7                                                                     | H10                     | 85                     | J19                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD6                                                                     | J11                     | 82                     | K17                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD5                                                                     | J12                     | 83                     | K15                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD4                                                                     | K13                     | 80                     | K19                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD3                                                                     | J10                     | 81                     | K18                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD2                                                                     | K10                     | 77                     | L17                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD1                                                                     | K12                     | 79                     | L14                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CAD0                                                                     | L13                     | 76                     | L18                      |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CC/ <u>BE</u> 3<br>CC/ <u>BE</u> 2<br>CC/ <u>BE</u> 1<br>CC/ <u>BE</u> 0 | B7<br>A11<br>E11<br>H13 | 125<br>112<br>99<br>88 | B12<br>F13<br>F19<br>J14 | I/O | CardBus bus commands and byte enables. CC/ <u>BE</u> 3–CC/ <u>BE</u> 0 are multiplexed on the same CardBus terminals. During the address phase of a CardBus cycle, CC/ <u>BE</u> 3–CC/ <u>BE</u> 0 define the bus command. During the data phase, this 4-bit bus is used as byte enables. The byte enables determine which byte paths of the full 32-bit data bus carry meaningful data. CC/ <u>BE</u> 0 applies to byte 0 (CAD7–CAD0), CC/ <u>BE</u> 1 applies to byte 1 (CAD15–CAD8), CC/ <u>BE</u> 2 applies to byte 2 (CAD23–CAD16), and CC/ <u>BE</u> 3 applies to byte 3 (CAD31–CAD24). |
| CPAR                                                                     | D13                     | 101                    | G15                      | I/O | CardBus parity. In all CardBus read and write cycles, the PCI1410 calculates even parity across the CAD and CC/ <u>BE</u> buses. As an initiator during CardBus cycles, the PCI1410 outputs CPAR with a one-CCLK delay. As a target during CardBus cycles, the calculated parity is compared to the initiator's parity indicator; a compare error results in a parity error assertion.                                                                                                                                                                                                        |

**Table 2–16. CardBus PC Card Interface Control Terminals**

| TERMINAL                                             |           |            |            | I/O | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------|-----------|------------|------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME                                                 | NUMBER    |            |            |     |                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                      | GGU       | PGE        | GHK        |     |                                                                                                                                                                                                                                                                                                                                                                                                                |
| CAUDIO                                               | B5        | 134        | C10        | I   | CardBus audio. CAUDIO is a digital input signal from a PC Card to the system speaker. The PCI1410 supports the binary audio mode and outputs a binary signal from the card to SPKROUT.                                                                                                                                                                                                                         |
| $\overline{\text{CBLOCK}}$                           | D11       | 103        | E19        | I/O | CardBus lock. $\overline{\text{CBLOCK}}$ is used to gain exclusive access to a target.                                                                                                                                                                                                                                                                                                                         |
| $\overline{\text{CCD1}}$<br>$\overline{\text{CCD2}}$ | L12<br>A4 | 75<br>137  | L19<br>A9  | I   | CardBus detect 1 and CardBus detect 2. $\overline{\text{CCD1}}$ and $\overline{\text{CCD2}}$ are used in conjunction with CVS1 and CVS2 to identify card insertion and interrogate cards to determine the operating voltage and card type.                                                                                                                                                                     |
| $\overline{\text{CDEVSEL}}$                          | B13       | 107        | E17        | I/O | CardBus device select. The PCI1410 asserts $\overline{\text{CDEVSEL}}$ to claim a CardBus cycle as the target device. As a CardBus initiator on the bus, the PCI1410 monitors $\overline{\text{CDEVSEL}}$ until a target responds. If no target responds before timeout occurs, then the PCI1410 terminates the cycle with an initiator abort.                                                                 |
| $\overline{\text{CFRAME}}$                           | B11       | 111        | E14        | I/O | CardBus cycle frame. $\overline{\text{CFRAME}}$ is driven by the initiator of a CardBus bus cycle. $\overline{\text{CFRAME}}$ is asserted to indicate that a bus transaction is beginning, and data transfers continue while this signal is asserted. When $\overline{\text{CFRAME}}$ is deasserted, the CardBus bus transaction is in the final data phase.                                                   |
| $\overline{\text{CGNT}}$                             | C11       | 106        | F15        | O   | CardBus bus grant. $\overline{\text{CGNT}}$ is driven by the PCI1410 to grant a CardBus PC Card access to the CardBus bus after the current data transaction has been completed.                                                                                                                                                                                                                               |
| $\overline{\text{CINT}}$                             | D6        | 132        | A10        | I   | CardBus interrupt. $\overline{\text{CINT}}$ is asserted low by a CardBus PC Card to request interrupt servicing from the host.                                                                                                                                                                                                                                                                                 |
| $\overline{\text{CIRDY}}$                            | A12       | 110        | C15        | I/O | CardBus initiator ready. $\overline{\text{CIRDY}}$ indicates the ability of the CardBus initiator to complete the current data phase of the transaction. A data phase is completed on a rising edge of CCLK when both $\overline{\text{CIRDY}}$ and $\overline{\text{CTRDY}}$ are asserted. Until $\overline{\text{CIRDY}}$ and $\overline{\text{CTRDY}}$ are both sampled asserted, wait states are inserted. |
| $\overline{\text{CPERR}}$                            | C13       | 104        | F14        | I/O | CardBus parity error. $\overline{\text{CPERR}}$ reports parity errors during CardBus transactions, except during special cycles. It is driven low by a target two clocks following that data when a parity error is detected.                                                                                                                                                                                  |
| $\overline{\text{CREQ}}$                             | B8        | 123        | E12        | I   | CardBus request. $\overline{\text{CREQ}}$ indicates to the arbiter that the CardBus PC Card desires use of the CardBus bus as an initiator.                                                                                                                                                                                                                                                                    |
| $\overline{\text{CSERR}}$                            | A5        | 133        | B10        | I   | CardBus system error. $\overline{\text{CSERR}}$ reports address parity errors and other system errors that could lead to catastrophic results. $\overline{\text{CSERR}}$ is driven by the card synchronous to CCLK. The PCI1410 can report $\overline{\text{CSERR}}$ to the system by assertion of $\overline{\text{SERR}}$ on the PCI interface.                                                              |
| $\overline{\text{CSTOP}}$                            | C12       | 105        | E18        | I/O | CardBus stop. $\overline{\text{CSTOP}}$ is driven by a CardBus target to request the initiator to stop the current CardBus transaction. $\overline{\text{CSTOP}}$ is used for target disconnects, and is commonly asserted by target devices that do not support burst data transfers.                                                                                                                         |
| CSTSCHG                                              | C5        | 135        | E10        | I   | CardBus status change. CSTSCHG alerts the system to a change in the card status, and is used as a wake-up mechanism.                                                                                                                                                                                                                                                                                           |
| $\overline{\text{CTRDY}}$                            | A13       | 109        | A16        | I/O | CardBus target ready. $\overline{\text{CTRDY}}$ indicates the ability of the CardBus target ability to complete the current data phase of the transaction. A data phase is completed on a rising edge of CCLK, when both $\overline{\text{CIRDY}}$ and $\overline{\text{CTRDY}}$ are asserted; until this time, wait states are inserted.                                                                      |
| CVS1<br>CVS2                                         | C6<br>D9  | 131<br>117 | F11<br>E13 | I/O | CardBus voltage sense 1 and CardBus voltage sense 2. CVS1 and CVS2 are used in conjunction with $\overline{\text{CCD1}}$ and $\overline{\text{CCD2}}$ to identify card insertion and interrogate cards to determine the operating voltage and card type.                                                                                                                                                       |

### 3 Feature/Protocol Descriptions

The following sections give an overview of the PCI1410. Figure 3–1 shows a simplified block diagram of the PCI1410. The PCI interface includes all address/data and control signals for PCI protocol. The interrupt interface includes terminals for parallel PCI, parallel ISA, and serialized PCI and ISA signaling. Miscellaneous system interface terminals include multifunction terminals: SUSPEND, RI\_OUT/PME (power management control signal), and SPKROUT.



NOTE: The PC Card interface is 68 terminals for CardBus and 16-bit PC Cards. In ZV mode 23 terminals are used for routing the ZV signals to the VGA controller and audio subsystem.

Figure 3–1. PCI1410 Simplified Block Diagram

#### 3.1 Power Supply Sequencing

The PCI1410 contains 3.3-V I/O buffers with 5-V tolerance requiring a core power supply and clamp voltages. The core power supply is always 3.3 V. The clamp voltages can be either 3.3 V or 5 V, depending on the interface. The following power-up and power-down sequences are recommended.

The power-up sequence is:

1. Apply 3.3-V power to the core.
2. Assert  $\overline{\text{GRST}}$  to the device to disable the outputs during power up. Output drivers must be powered up in the high-impedance state to prevent high current levels through the clamp diodes to the 5-V supply.
3. Apply the clamp voltage.

The power-down sequence is:

1. Use  $\overline{\text{GRST}}$  to switch outputs to a high-impedance state.
2. Remove the clamp voltage.
3. Remove the 3.3-V power from the core.

## 3.2 I/O Characteristics

Figure 3–2 shows a 3-state bidirectional buffer. Section 8.2, *Recommended Operating Conditions*, provides the electrical characteristics of the inputs and outputs.

**NOTE:** The PCI1410 meets the ac specifications of the *1997 PC Card Standard* and *PCI Local Bus Specification*.

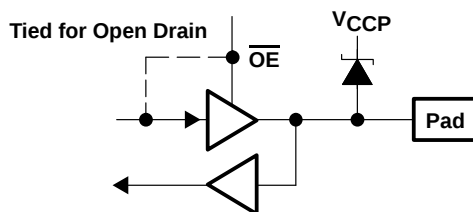


Figure 3–2. 3-State Bidirectional Buffer

**NOTE:** Unused pins (input or I/O) must be held high or low to prevent them from floating.

## 3.3 Clamping Voltages

The clamping voltages are set to match whatever external environment the PCI1410 will be interfaced with: 3.3 V or 5 V. The I/O sites can be pulled through a clamping diode to a voltage rail that protects the core from external signals. The core power supply is always 3.3 V and is independent of the clamping voltages. For example, PCI signaling can be either 3.3 V or 5 V, and the PCI1410 must reliably accommodate both voltage levels. This is accomplished by using a 3.3-V I/O buffer that is 5-V tolerant, with the applicable clamping voltage applied. If a system designer desires a 5-V PCI bus, then  $V_{CCP}$  can be connected to a 5-V power supply.

The PCI1410 requires three separate clamping voltages because it supports a wide range of features. The three voltages are listed and defined in Section 8.2, *Recommended Operating Conditions*.

## 3.4 Peripheral Component Interconnect (PCI) Interface

The PCI1410 is fully compliant with the *PCI Local Bus Specification*. The PCI1410 provides all required signals for PCI master or slave operation, and may operate in either a 5-V or 3.3-V signaling environment by connecting the  $V_{CCP}$  terminals to the desired voltage level. In addition to the mandatory PCI signals, the PCI1410 provides the optional interrupt signal  $\overline{INTA}$ .

### 3.4.1 PCI Bus Lock ( $\overline{LOCK}$ )

The bus-locking protocol defined in the *PCI Local Bus Specification* is not highly recommended, but is provided on the PCI1410 as an additional compatibility feature. The PCI  $\overline{LOCK}$  signal can be routed to the MFUNC4 terminal via the multifunction routing register. See Section 4.30, *Multifunction Routing Register*, for details. Note that the use of  $\overline{LOCK}$  is only supported by PCI-to-CardBus bridges in the downstream direction (away from the processor).

PCI  $\overline{LOCK}$  indicates an atomic operation that may require multiple transactions to complete. When  $\overline{LOCK}$  is asserted, nonexclusive transactions can proceed to an address that is not currently locked. A grant to start a transaction on the PCI bus does not guarantee control of  $\overline{LOCK}$ ; control of  $\overline{LOCK}$  is obtained under its own protocol. It is possible for different initiators to use the PCI bus while a single master retains ownership of  $\overline{LOCK}$ . Note that the CardBus signal for this protocol is  $\overline{CBLOCK}$  to avoid confusion with the bus clock.

An agent may need to do an exclusive operation because a critical access to memory might be broken into several transactions, but the master wants exclusive rights to a region of memory. The granularity of the lock is defined by PCI to be 16 bytes, aligned. The  $\overline{LOCK}$  protocol defined by the *PCI Local Bus Specification* allows a resource lock without interfering with nonexclusive real-time data transfer, such as video.

The PCI bus arbiter may be designed to support only complete bus locks using the  $\overline{LOCK}$  protocol. In this scenario, the arbiter will not grant the bus to any other agent (other than the  $\overline{LOCK}$  master) while  $\overline{LOCK}$  is asserted. A complete

bus lock may have a significant impact on the performance of the video. The arbiter that supports complete bus lock must grant the bus to the cache to perform a writeback due to a snoop to a modified line when a locked operation is in progress.

The PCI1410 supports all  $\overline{\text{LOCK}}$  protocol associated with PCI-to-PCI bridges, as also defined for PCI-to-CardBus bridges. This includes disabling write posting while a locked operation is in progress, which can solve a potential deadlock when using devices such as PCI-to-PCI bridges. The potential deadlock can occur if a CardBus target supports delayed transactions and blocks access to the target until it completes a delayed read. This target characteristic is prohibited by the *PCI Local Bus Specification*, and the issue is resolved by the PCI master using  $\overline{\text{LOCK}}$ .

### 3.4.2 Loading Subsystem Identification

The subsystem vendor ID register (see Section 4.26) and subsystem ID register (see Section 4.27) make up a doubleword of PCI configuration space located at offset 40h for functions 0 and 1. This doubleword register is used for system and option card (mobile dock) identification purposes and is required by some operating systems. Implementation of this unique identifier register is a *PC 99* requirement.

The PCI1410 offers two mechanisms to load a read-only value into the subsystem registers. The first mechanism relies upon the system BIOS providing the subsystem ID value. The default access mode to the subsystem registers is read-only, but can be made read/write by setting bit 5 (SUBSYSRW) in the system control register (see Section 4.29) at PCI offset 80h. Once this bit is set, the BIOS can write a subsystem identification value into the registers at PCI offset 40h. The BIOS must clear the SUBSYSRW bit such that the subsystem vendor ID register and subsystem ID register are limited to read-only access. This approach saves the added cost of implementing the serial electrically erasable programmable ROM (EEPROM).

In some conditions, such as in a docking environment, the subsystem vendor ID register and subsystem ID register must be loaded with a unique identifier via a serial EEPROM. The PCI1410 loads the data from the serial EEPROM after a reset of the primary bus. Note that the  $\overline{\text{SUSPEND}}$  input gates the PCI reset from the entire PCI1410 core, including the serial bus state machine (see Section 3.8.4, *Suspend Mode*, for details on using  $\overline{\text{SUSPEND}}$ ).

The PCI1410 provides a two-line serial bus host controller that can interface to a serial EEPROM. See Section 3.6, *Serial Bus Interface*, for details on the two-wire serial bus controller and applications.

## 3.5 PC Card Applications

This section describes the PC Card interfaces of the PCI1410:

- Card insertion/removal and recognition
- P<sup>2</sup>C power-switch interface
- Zoomed video support
- Speaker and audio applications
- LED socket activity indicators
- PC Card-16 DMA support
- PC Card controller programming model
- CardBus socket registers

### 3.5.1 PC Card Insertion/Removal and Recognition

The *1997 PC Card Standard* addresses the card-detection and recognition process through an interrogation procedure that the socket must initiate on card insertion into a cold, nonpowered socket. Through this interrogation, card voltage requirements and interface (16-bit versus CardBus) are determined.

The scheme uses the card detect and voltage sense signals. The configuration of these four terminals identifies the card type and voltage requirements of the PC Card interface. The encoding scheme is defined in the *1997 PC Card Standard* and in Table 3–1.

**Table 3–1. PC Card Card-Detect and Voltage-Sense Connections**

| $\overline{CD2}/\overline{CCD2}$ | $\overline{CD1}/\overline{CCD1}$ | $\overline{VS2}/\overline{CVS2}$ | $\overline{VS1}/\overline{CVS1}$ | KEY      | INTERFACE       | VOLTAGE                 |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------|-----------------|-------------------------|
| Ground                           | Ground                           | Open                             | Open                             | 5 V      | 16-bit PC Card  | 5 V                     |
| Ground                           | Ground                           | Open                             | Ground                           | 5 V      | 16-bit PC Card  | 5 V and 3.3 V           |
| Ground                           | Ground                           | Ground                           | Ground                           | 5 V      | 16-bit PC Card  | 5 V, 3.3 V, and X.X V   |
| Ground                           | Ground                           | Open                             | Ground                           | LV       | 16-bit PC Card  | 3.3 V                   |
| Ground                           | Connect to CVS1                  | Open                             | Connect to $\overline{CCD1}$     | LV       | CardBus PC Card | 3.3 V                   |
| Ground                           | Ground                           | Ground                           | Ground                           | LV       | 16-bit PC Card  | 3.3 V and X.X V         |
| Connect to CVS2                  | Ground                           | Connect to $\overline{CCD2}$     | Ground                           | LV       | CardBus PC Card | 3.3 V and X.X V         |
| Connect to CVS1                  | Ground                           | Ground                           | Connect to $\overline{CCD2}$     | LV       | CardBus PC Card | 3.3 V, X.X V, and Y.Y V |
| Ground                           | Ground                           | Ground                           | Open                             | LV       | 16-bit PC Card  | Y.Y V                   |
| Connect to CVS2                  | Ground                           | Connect to $\overline{CCD2}$     | Open                             | LV       | CardBus PC Card | Y.Y V                   |
| Ground                           | Connect to CVS2                  | Connect to $\overline{CCD1}$     | Open                             | LV       | CardBus PC Card | X.X V and Y.Y V         |
| Connect to CVS1                  | Ground                           | Open                             | Connect to $\overline{CCD2}$     | LV       | CardBus PC Card | Y.Y V                   |
| Ground                           | Connect to CVS1                  | Ground                           | Connect to $\overline{CCD1}$     | Reserved |                 |                         |
| Ground                           | Connect to CVS2                  | Connect to $\overline{CCD1}$     | Ground                           | Reserved |                 |                         |

### 3.5.2 P<sup>2</sup>C Power-Switch Interface (TPS2211)

The PCI1410 provides a P<sup>2</sup>C (PCMCIA peripheral control) interface for control of the PC Card power switch. The  $\overline{VCCD}$  and VPPD terminals are used with the TI TPS2211 single slot PC Card power interface switch to provide power switch support. Figure 3–3 shows terminal assignments for the TPS2211. Figure 3–4 illustrates a typical application, where the PCI1410 represents the PC Card controller.

|                    |   |    |       |
|--------------------|---|----|-------|
| $\overline{VCCD0}$ | 1 | 16 | SHDN  |
| $\overline{VCCD1}$ | 2 | 15 | VPPD0 |
| 3.3V               | 3 | 14 | VPPD1 |
| 3.3V               | 4 | 13 | AVCC  |
| 5V                 | 5 | 12 | AVCC  |
| 5V                 | 6 | 11 | AVCC  |
| GND                | 7 | 10 | AVPP  |
| $\overline{OC}$    | 8 | 9  | 12V   |

**Figure 3–3. TPS2211 Terminal Assignments**

The PCI1410 also includes support for the Maxim™ 1602 single-channel CardBus and PCMCIA power-switching network. Application of this power switch would be similar to the TPS2211.

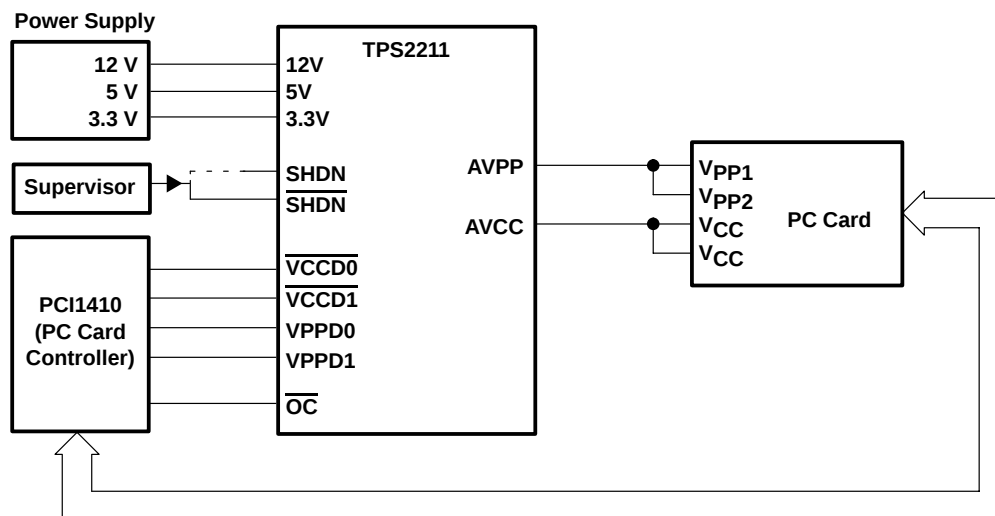


Figure 3-4. TPS2211 Typical Application

### 3.5.3 Zoomed Video Support

The PCI1410 allows for the implementation of zoomed video for PC Cards. Zoomed video is supported by setting bit 6 (ZVENABLE) in the card control register (see Section 4.32) on a per-socket function basis. Setting this bit puts PC Card 16 address lines ADDR25–ADDR4 of the PC Card interface in the high-impedance state. These lines can then transfer video and audio data directly to the appropriate controller. Card address lines ADDR3–ADDR0 can still access PC Card CIS registers for PC Card configuration. Figure 3-5 illustrates a PCI1410 ZV implementation.

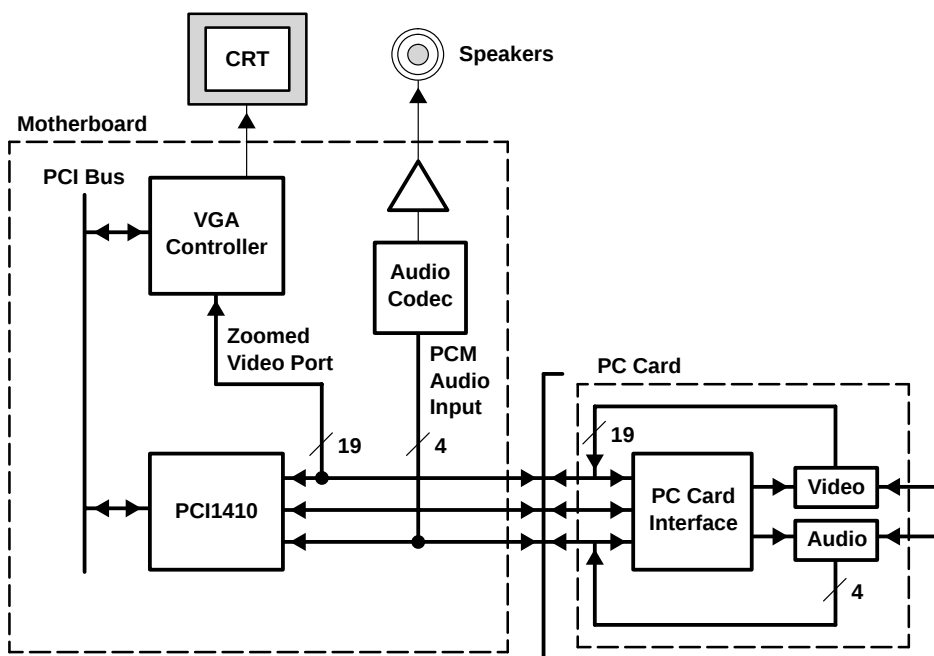
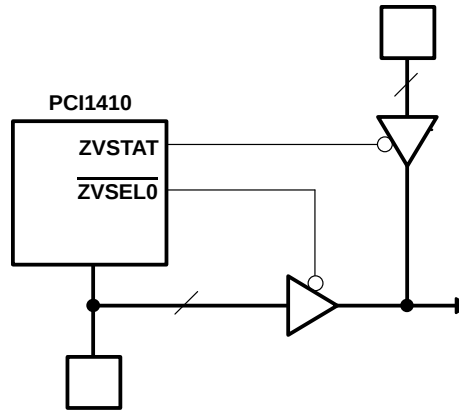


Figure 3-5. Zoomed Video Implementation Using PCI1410

Not shown in Figure 3-5 is the multiplexing scheme used to route a socket ZV source or an external ZV source to the graphics controller. A typical external source might be provided from a high-speed serial bus like IEEE 1394. The PCI1410 provides ZVSTAT and  $\overline{\text{ZVSEL0}}$  signals on the multifunction terminals to switch external bus drivers. Figure 3-6 shows an implementation for switching between two ZV streams using external logic.



**Figure 3–6. Zoomed Video Switching Application**

Figure 3–6 illustrates an implementation using standard three-state bus drivers with active-low output enables.  $\overline{\text{ZVSEL0}}$  is an active-low output indicating that the socket ZV mode is enabled. ZVSTAT is an active-high output indicating that the PCI1410 socket is enabled for ZV mode. The implementation shown in Figure 3–6 can be used if PC Card ZV is prioritized over other sources.

### 3.5.4 Ultra Zoomed Video

Ultra zoomed video is an enhancement to the PCI1410 DMA engine and is intended to improve the 16-bit bandwidth for MPEG I and MPEG II decoder PC Cards. This enhancement allows the PCI1410 to fetch 32 bits of data from memory versus the 11XX/12XX 16-bit fetch capability. This enhancement allows a higher sustained throughput to the 16-bit PC Card because the PCI1410 prefetches an extra 16 bits (32 bits total) during each PCI read transaction. If the PCI bus becomes busy, then the PCI1410 has an extra 16 bits of data to perform back-to-back 16-bit transactions to the PC Card before having to fetch more data. This feature is built into the DMA engine and software is not required to enable this enhancement.

**NOTE:** The 11XX and 12XX series CardBus controllers have enough 16-bit bandwidth to support MPEG II PC Card decoders, but it was decided to improve the bandwidth even more in the 14XX series CardBus controllers.

### 3.5.5 Internal Ring Oscillator

The internal ring oscillator provides an internal clock option for the PCI1410 so that the PCI clock is not required in order for the PCI1410 to power down a socket or interrogate a PC Card. This internal oscillator operates nominally at 16 kHz and can be enabled by setting bit 27 (P2CCLK) of the system control register (offset 80h, see Section 4.29) to 1. This function is disabled by default.

### 3.5.6 Integrated Pullup Resistors For PC Card Interface

The 1997 PC Card Standard requires pullup resistors on various terminals to support both CardBus and 16-bit card configurations. Unlike the PCI1210/1211 which required external pullup resistors, the PCI1410 has integrated all of these pullup resistors.

| SIGNAL NAME                                       | PIN NUMBER |     |     |
|---------------------------------------------------|------------|-----|-----|
|                                                   | GGU        | PGE | GHK |
| ADDR14/ $\overline{\text{CPERR}}$                 | C13        | 104 | F14 |
| READY/ $\overline{\text{CINT}}$                   | D6         | 132 | A10 |
| ADDR15/ $\overline{\text{CIRDY}}$                 | A12        | 110 | C15 |
| $\overline{\text{CD1}}/\overline{\text{CCD1}}$    | L12        | 75  | L19 |
| $\overline{\text{VS1}}/\overline{\text{CVS1}}$    | C6         | 131 | F11 |
| ADDR19/ $\overline{\text{CBLOCK}}$                | D11        | 103 | E19 |
| ADDR20/ $\overline{\text{CSTOP}}$                 | C12        | 105 | E18 |
| ADDR21/ $\overline{\text{CDEVSEL}}$               | B13        | 107 | E17 |
| ADDR22/ $\overline{\text{CTRDY}}$                 | A13        | 109 | A16 |
| $\overline{\text{VS2}}/\overline{\text{CVS2}}$    | D9         | 117 | E13 |
| RESET/ $\overline{\text{CRST}}$                   | B9         | 119 | F12 |
| $\overline{\text{WAIT}}/\overline{\text{CSERR}}$  | A5         | 133 | B10 |
| $\overline{\text{INPACK}}/\overline{\text{CREQ}}$ | B8         | 123 | E12 |
| BVD2( $\overline{\text{SPKR}}$ )/CAUDIO           | B5         | 134 | C10 |
| BVD1( $\overline{\text{STSCHG}}$ )/CSTSCHG        | C5         | 135 | E10 |
| $\overline{\text{CD2}}/\overline{\text{CCD2}}$    | A4         | 137 | A9  |

### 3.5.7 SPKROUT and CAUDPWM Usage

SPKROUT carries the digital audio signal from the PC Card to the system. When a 16-bit PC Card is configured for I/O mode, the BVD2 terminal becomes SPKR. This terminal is also used in CardBus binary audio applications, and is referred to as CAUDIO. SPKR passes a TTL level digital audio signal to the PCI1410. The CardBus CAUDIO signal also can pass a single-amplitude binary waveform. The binary audio signal from the PC Card socket is used in the PCI1410 to produce SPKROUT. This output is enabled by bit 1 (SPKROUTEN) in the card control register (see Section 4.32).

Older controllers support CAUDIO in binary or PWM mode but use the same terminal (SPKROUT). Some audio chips may not support both modes on one terminal and may have a separate terminal for binary and PWM. The PCI1410 implementation includes a signal for PWM, CAUDPWM, which can be routed to an MFUNC terminal. Bit 2 (AUD2MUX) located in the card control register is programmed to route a CardBus CAUDIO PWM terminal to CAUDPWM. See Section 4.30, *Multifunction Routing Register*, for details on configuring the MFUNC terminals.

Figure 3–7 illustrates a sample application using SPKROUT and CAUDPWM.

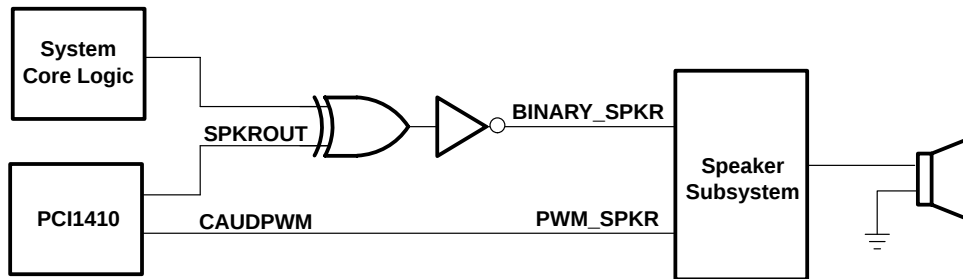


Figure 3-7. Sample Application of SPKROUT and CAUDPWM

### 3.5.8 LED Socket Activity Indicators

The socket activity LEDs are provided to indicate when a PC Card is being accessed. The LED\_SKT signal can be routed to the multifunction terminals. When configured for LED output, this terminal outputs an active high signal to indicate socket activity. See Section 4.30, *Multifunction Routing Register*, for details on configuring the multifunction terminals.

The LED signal is active high and is driven in pulses of 64-ms duration. When the LED is not being driven high, it is driven to a low state. Either of the two circuits shown in Figure 3-8 can be implemented to provide LED signaling and it is left for the board designer to implement the circuit that best fits the application.

The LED activity signals are valid when a card is inserted, powered, and not in reset. For PC Card-16, the LED activity signal is pulsed when  $\overline{\text{READY}}/\overline{\text{IREQ}}$  is low. For CardBus cards, the LED activity signal is pulsed if  $\overline{\text{CFRAME}}$ ,  $\overline{\text{CIRDY}}$ , or  $\overline{\text{CREQ}}$  is active.

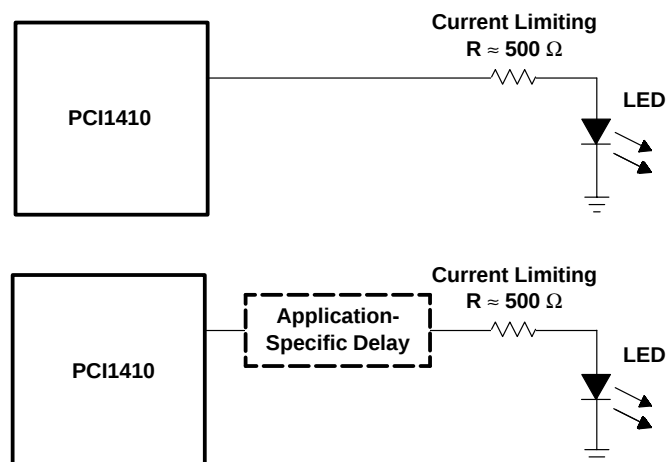


Figure 3-8. Two Sample LED Circuits

As indicated, the LED signals are driven for a period of 64 ms by a counter circuit. To avoid the possibility of the LED appearing to be stuck when the PCI clock is stopped, the LED signaling is cut off when the  $\overline{\text{SUSPEND}}$  signal is asserted, when the PCI clock is to be stopped during the clock run protocol, or when in the D2 or D1 power state.

If any additional socket activity occurs during this counter cycle, then the counter is reset and the LED signal remains driven. If socket activity is frequent (at least once every 64 ms), then the LED signal remains driven.

### 3.5.9 PC Card-16 Distributed DMA Support

The PCI1410 supports a distributed DMA slave engine for 16-bit PC Card DMA support. The distributed DMA (DDMA) slave register set provides the programmability necessary for the slave DDMA engine. Table 3-2 provides the DDMA register configuration.

Two socket-function-dependent PCI configuration header registers that are critical for DDMA are the socket DMA register 0 (offset 94h, see Section 4.35) and the socket DMA register 1 (offset 98h, see Section 4.36). Distributed DMA is enabled through socket DMA register 0 and the contents of this register configure the PC Card-16 terminal ( $\overline{\text{SPKR}}$ ,  $\overline{\text{IOIS16}}$ , or  $\overline{\text{INPACK}}$ ) which is used for the DMA request signal,  $\overline{\text{DREQ}}$ . The base address of the DDMA slave registers and the transfer size (bytes or words) are programmed through the socket DMA register 1. Refer to the programming model and register descriptions (see Section 7 for details).

**Table 3–2. Distributed DMA Registers**

| TYPE | REGISTER NAME |          |                 |          | DDMA<br>BASE ADDRESS<br>OFFSET |
|------|---------------|----------|-----------------|----------|--------------------------------|
| R    | Reserved      | Page     | Current address |          | 00h                            |
| W    |               |          | Base address    |          |                                |
| R    | Reserved      | Reserved | Current count   |          | 04h                            |
| W    |               |          | Base count      |          |                                |
| R    | N/A           | Reserved | N/A             | Status   | 08h                            |
| W    | Mode          |          | Request         | Command  |                                |
| R    | Multichannel  | Reserved | N/A             | Reserved | 0Ch                            |
| W    | Mask          |          | Master clear    |          |                                |

The DDMA registers contain control and status information consistent with the 8237 DMA controller; however, the register locations are reordered and expanded in some cases. While the DDMA register definitions are identical to those in the 8237 DMA controller, some register bits defined in the 8237 DMA controller do not apply to distributed DMA in a PCI environment. In such cases, the PCI1410 implements these obsolete register bits as read-only, nonfunctional bits. The reserved registers shown in Table 3–2 are implemented as read-only and return 0s when read. Write transactions to reserved registers have no effect.

The DDMA transfer is prefaced by several configuration steps that are specific to the PC Card and must be completed after the PC Card is inserted and interrogated. These steps include setting the proper  $\overline{\text{DREQ}}$  signal assignment, setting the data transfer width, and mapping and enabling the DDMA register set. As discussed above, this is done through socket DMA register 0 and socket DMA register 1. The DMA register set is then programmed similarly to an 8237 controller, and the PCI1410 awaits a  $\overline{\text{DREQ}}$  assertion from the PC Card requesting a DMA transfer.

DMA writes transfer data from the PC Card-to-PCI memory addresses. The PCI1410 accepts data 8 or 16 bits at a time, depending on the programmed data width, and then requests access to the PCI bus by asserting its  $\overline{\text{REQ}}$  signal. Once the PCI bus is granted in an idle state, the PCI1410 initiates a PCI memory write command to the current memory address and transfers the data in a single data phase. After terminating the PCI cycle, the PCI1410 accepts the next byte(s) from the PC Card until the transfer count expires.

DMA reads transfer data from PCI memory addresses to the PC Card application. Upon the assertion of  $\overline{\text{DREQ}}$ , the PCI1410 asserts  $\overline{\text{REQ}}$  to acquire the PCI bus. Once the bus is granted in an idle state, the PCI1410 initiates a PCI memory read operation to the current memory address and accepts 8 or 16 bits of data, depending on the programmed data width. After terminating the PCI cycle, the data is passed onto the PC Card. After terminating the PC Card cycle, the PCI1410 requests access to the PCI bus again until the transfer count has expired.

The PCI1410 target interface acts normally during this procedure and accepts I/O reads and writes to the DDMA registers. While a DDMA transfer is in progress and the host resets the DMA channel, the PCI1410 asserts TC and ends the PC Card cycle(s). TC is indicated in the DDMA status register (DDMA offset 08h, see Section 7.5). At the PC Card interface, the PCI1410 supports demand mode transfers. The PCI1410 asserts DACK during the transfer unless  $\overline{\text{DREQ}}$  is deasserted before TC. TC is mapped to the  $\overline{\text{OE}}$  PC Card terminal for DMA write operations and is mapped to the  $\overline{\text{WE}}$  PC Card terminal for DMA read operations. The DACK signal is mapped to the PC Card  $\overline{\text{REG}}$  signal in all transfers, and the  $\overline{\text{DREQ}}$  terminal is routed to one of three options which is programmed through socket DMA register 0.

### 3.5.10 PC Card-16 PC/PCI DMA

Some chip sets provide a way for legacy I/O devices to do DMA transfers on the PCI bus. In the PC/PCI DMA protocol, the PCI1410 acts as a PCI target device to certain DMA related I/O addresses. The PCI1410  $\overline{\text{PCREQ}}$  and  $\overline{\text{PCGNT}}$  signals are provided as a point-to-point connection to a chipset supporting PC/PCI DMA. The  $\overline{\text{PCREQ}}$  and  $\overline{\text{PCGNT}}$  signals may be routed to the MFUNC2 and MFUNC5 terminals, respectively. See Section 4.30, *Multifunction Routing Register*, for details on configuring the multifunction terminals.

Under the PC/PCI protocol, a PCI DMA slave device (such as the PCI1410) requests a DMA transfer on a particular channel using a serialized protocol on  $\overline{\text{PCREQ}}$ . The I/O DMA bus master arbitrates for the PCI bus and grants the channel through a serialized protocol on  $\overline{\text{PCGNT}}$  when it is ready for the transfer. The I/O cycle and memory cycles are then presented on the PCI bus, which performs the DMA transfers similarly to legacy DMA master devices.

PC/PCI DMA is enabled for each PC Card-16 slot by setting bit 19 (CDREQEN) in the respective system control register (see Section 4.29). On power up this bit is reset and the card PC/PCI DMA is disabled. Bit 3 (CDMA\_EN) of the system control register is a global enable for PC/PCI DMA, and is set at power up and never cleared if the PC/PCI DMA mechanism is implemented. The desired DMA channel for each PC Card-16 slot must be configured through bits 18–16 (CDMACHAN field) in the system control register. The channels are configured as indicated in Table 3–3.

**Table 3–3. PC/PCI Channel Assignments**

| SYSTEM CONTROL REGISTER |        |        | DMA CHANNEL | CHANNEL TRANSFER DATA WIDTH |
|-------------------------|--------|--------|-------------|-----------------------------|
| BIT 18                  | BIT 17 | BIT 16 |             |                             |
| 0                       | 0      | 0      | Channel 0   | 8-bit DMA transfers         |
| 0                       | 0      | 1      | Channel 1   | 8-bit DMA transfers         |
| 0                       | 1      | 0      | Channel 2   | 8-bit DMA transfers         |
| 0                       | 1      | 1      | Channel 3   | 8-bit DMA transfers         |
| 1                       | 0      | 0      | Channel 4   | Not used                    |
| 1                       | 0      | 1      | Channel 5   | 16-bit DMA transfers        |
| 1                       | 1      | 0      | Channel 6   | 16-bit DMA transfers        |
| 1                       | 1      | 1      | Channel 7   | 16-bit DMA transfers        |

As in distributed DMA, the PC Card terminal mapped to  $\overline{\text{DREQ}}$  must be configured through socket DMA register 0 (offset 94h, see Section 4.35). The data transfer width is a function of channel number and the DDMA slave registers are not used. When a  $\overline{\text{DREQ}}$  is received from a PC Card and the channel has been granted, the PCI1410 decodes the I/O addresses listed in Table 3–4 and performs actions dependent upon the address.

**Table 3–4. I/O Addresses Used for PC/PCI DMA**

| DMA I/O ADDRESS | DMA CYCLE TYPE | TERMINAL COUNT | PCI CYCLE TYPE |
|-----------------|----------------|----------------|----------------|
| 00h             | Normal         | 0              | I/O read/write |
| 04h             | Normal TC      | 1              | I/O read/write |
| C0h             | Verify         | 0              | I/O read       |
| C4h             | Verify TC      | 1              | I/O read       |

When the PC/PCI DMA is used as a PC Card-16 DMA mechanism, it may not provide the performance levels of DDMA; however, the design of a PCI target implementing PC/PCI DMA is considerably less complex. No bus master state machine is required to support PC/PCI DMA, since the DMA control is centralized in the chipset. This DMA scheme is often referred to as centralized DMA for this reason.

### 3.5.11 CardBus Socket Registers

The PCI1410 contains all registers for compatibility with the latest *1997 PC Card Standard*. These registers exist as the CardBus socket registers and are listed in Table 3–5.

**Table 3–5. CardBus Socket Registers**

| REGISTER NAME           | OFFSET |
|-------------------------|--------|
| Socket event            | 00h    |
| Socket mask             | 04h    |
| Socket present state    | 08h    |
| Socket force event      | 0Ch    |
| Socket control          | 10h    |
| Reserved                | 14h    |
| Reserved                | 18h    |
| Reserved                | 1Ch    |
| Socket power management | 20h    |

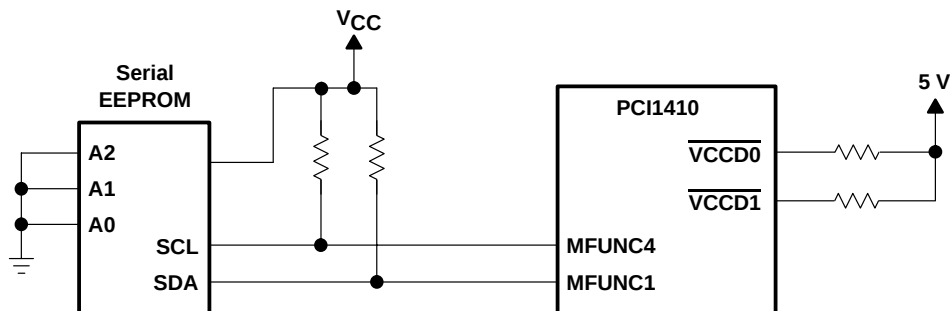
## 3.6 Serial Bus Interface

The PCI1410 provides a serial bus interface to load subsystem identification and select register defaults through a serial EEPROM and to provide a PC Card power switch interface alternative to P<sup>2</sup>C. See Section 3.5.2, *P<sup>2</sup>C Power-Switch Interface (TPS2211)*, for details. The PCI1410 serial bus interface is compatible with various I<sup>2</sup>C and SMBus components.

### 3.6.1 Serial Bus Interface Implementation

To enable the serial interface, a pullup resistor must be implemented on the  $\overline{\text{VCCD0}}$  and  $\overline{\text{VCCD1}}$  terminals and the appropriate pullup resistors must be implemented on the SDA and SCL signals, that is, the MFUNC1 and MFUNC4 terminals. When the interface is detected, bit 3 (SBDETECT) in the serial bus control and status register (offset B3h, see Section 4.50) is set. The SBDETECT bit is cleared by a writeback of 1.

The PCI1410 implements a two-pin serial interface with one clock signal (SCL) and one data signal (SDA). When pullup resistors are provided on the  $\overline{\text{VCCD0}}$  and  $\overline{\text{VCCD1}}$  terminals, the SCL signal is mapped to the MFUNC4 terminal and the SDA signal is mapped to the MFUNC1 terminal. The PCI1410 drives SCL at nearly 100 kHz during data transfers, which is the maximum specified frequency for standard mode I<sup>2</sup>C. The serial EEPROM must be located at address A0h. Figure 3–9 illustrates an example application implementing the two-wire serial bus.



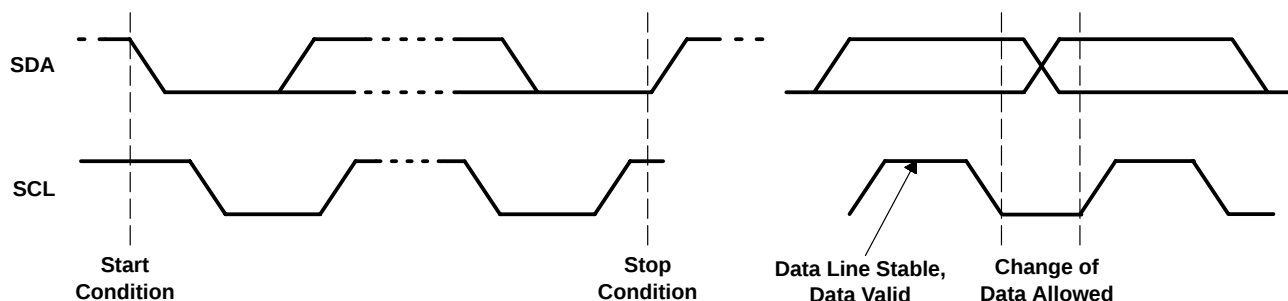
**Figure 3–9. Serial EEPROM Application**

Some serial device applications may include PC Card power switches, ZV source switches, card ejectors, or other devices that may enhance the user's PC Card experience. The serial EEPROM device and PC Card power switches are discussed in the sections that follow.

### 3.6.2 Serial Bus Interface Protocol

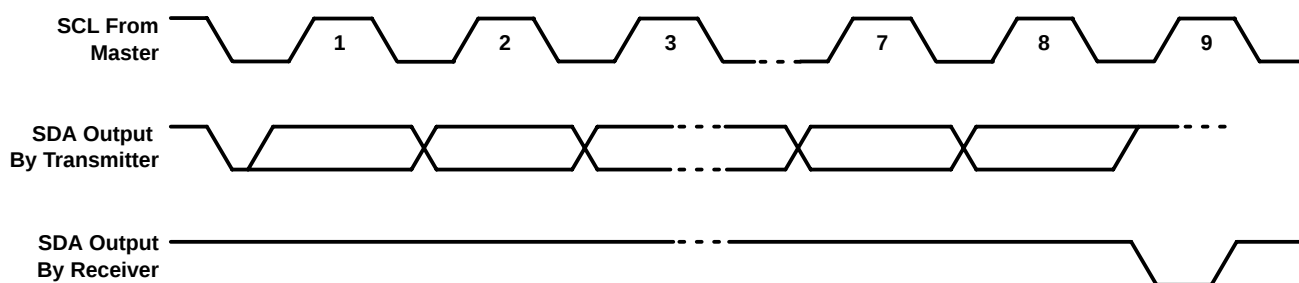
The SCL and SDA signals are bidirectional, open-drain signals and require pullup resistors as shown in Figure 3–9. The PCI1410 supports up to 100 Kb/s data transfer rate and is compatible with standard mode I<sup>2</sup>C using 7-bit addressing.

All data transfers are initiated by the serial bus master. The beginning of a data transfer is indicated by a start condition, which is signalled when the SDA line transitions to a low state while SCL is in the high state, as illustrated in Figure 3–10. The end of a requested data transfer is indicated by a stop condition, which is signalled by a low-to-high transition of SDA while SCL is in the high state, as shown in Figure 3–10. Data on SDA must remain stable during the high state of the SCL signal, as changes on the SDA signal during the high state of SCL are interpreted as control signals, that is, a start or a stop condition.



**Figure 3–10. Serial Bus Start/Stop Conditions and Bit Transfers**

Data is transferred serially in 8-bit bytes. The number of bytes that may be transmitted during a data transfer is unlimited; however, each byte must be completed with an acknowledge bit. An acknowledge (ACK) is indicated by the receiver pulling the SDA signal low so that it remains low during the high state of the SCL signal. Figure 3–11 illustrates the acknowledge protocol.

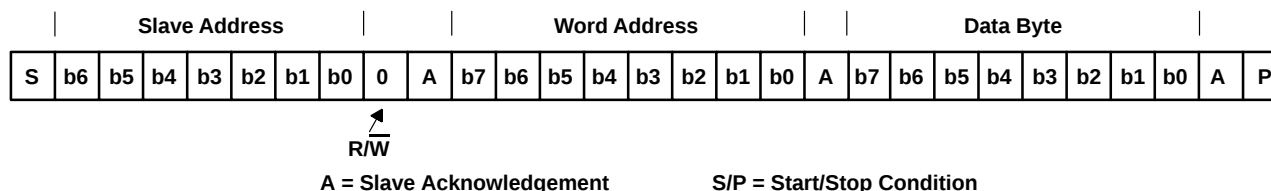


**Figure 3–11. Serial Bus Protocol Acknowledge**

The PCI1410 is a serial bus master; all other devices connected to the serial bus external to the PCI1410 are slave devices. As the bus master, the PCI1410 drives the SCL clock at nearly 100 kHz during bus cycles and places SCL in a high-impedance state (zero frequency) during idle states.

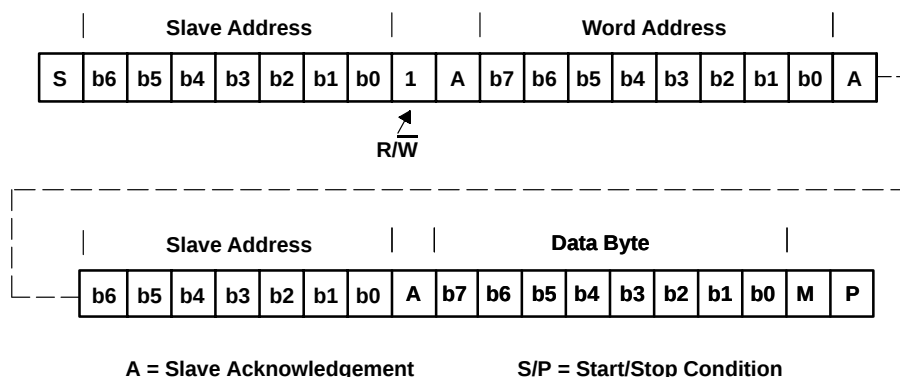
Typically, the PCI1410 masters byte reads and byte writes under software control. Doubleword reads are performed by the serial EEPROM initialization circuitry upon a PCI reset and may not be generated under software control. See Section 3.6.3, *Serial Bus EEPROM Application*, for details on how the PCI1410 automatically loads the subsystem identification and other register defaults through a serial bus EEPROM.

Figure 3–12 illustrates a byte write. The PCI1410 issues a start condition and sends the 7-bit slave device address and the command bit zero. A 0 in the  $R/\overline{W}$  command bit indicates that the data transfer is a write. The slave device acknowledges if it recognizes the address. If there is no acknowledgment received by the PCI1410, then bit 6 is set in the serial bus control and status register (offset B3h, see Section 4.50). The word address byte is then sent by the PCI1410 and another slave acknowledgment is expected. Then the PCI1410 delivers the data byte MSB first and expects a final acknowledgment before issuing the stop condition.



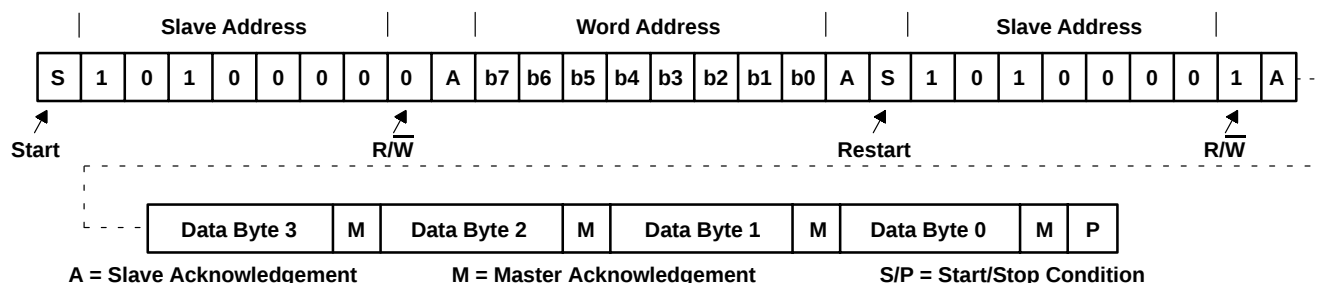
**Figure 3-12. Serial Bus Protocol – Byte Write**

Figure 3-13 illustrates a byte read. The read protocol is very similar to the write protocol except the  $R/\overline{W}$  command bit must be set to 1 to indicate a read-data transfer. In addition, the PCI1410 master must acknowledge reception of the read bytes from the slave transmitter. The slave transmitter drives the SDA signal during read data transfers. The SCL signal remains driven by the PCI1410 master.



**Figure 3-13. Serial Bus Protocol – Byte Read**

Figure 3-14 illustrates EEPROM interface doubleword data collection protocol.



**Figure 3-14. EEPROM Interface Doubleword Data Collection**

### 3.6.3 Serial Bus EEPROM Application

When the PCI bus is reset and the serial bus interface is detected, the PCI1410 attempts to read the subsystem identification and other register defaults from a serial EEPROM. The registers and corresponding bits that may be loaded with defaults through the EEPROM are provided in Table 3-6.

**Table 3-6. Registers and Bits Loadable Through Serial EEPROM**

| OFFSET<br>REFERENCE | PCI OFFSET | REGISTER                                               | BITS LOADED FROM EEPROM           |
|---------------------|------------|--------------------------------------------------------|-----------------------------------|
| 01h                 | 40h        | Subsystem vendor ID, subsystem ID                      | 31-0                              |
| 02h                 | 80h        | System control                                         | 31-30, 27, 26, 24, 15, 14, 6-3, 1 |
| 03h                 | 8Ch        | Multifunction routing                                  | 27-0                              |
| 04h                 | 90h        | Retry status, card control, device control, diagnostic | 31, 28-24, 22, 19-16, 15, 7, 6    |

Figure 3–15 details the EEPROM data format. This format must be followed for the PCI1410 to properly load initializations from a serial EEPROM. Any undefined condition results in a terminated load and sets the ROM\_ERR bit (bit 0) in the serial bus control and status register (offset B3h, see Section 4.50).

Slave Address = 1010 000

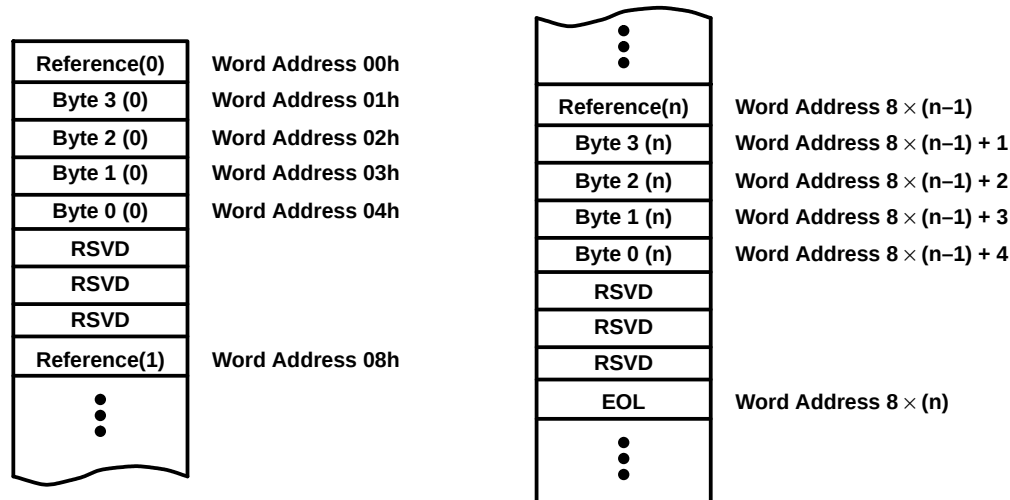


Figure 3–15. EEPROM Data Format

The byte at the EEPROM word address 00h must either contain a valid offset reference, as listed in Table 3–6, or an end-of-list (EOL) indicator. The EOL indicator is a byte value of FFh, and indicates the end of the data to load from the EEPROM. Only doubleword registers are loaded from the EEPROM, and all bit fields must be considered when programming the EEPROM.

The serial EEPROM is addressed at slave address 1010 000b by the PCI1410. All hardware address bits for the EEPROM should be tied to the appropriate level to achieve this address. The serial EEPROM chip in the sample application circuit (Figure 3–9) assumes the 1010b high address nibble. The lower three address bits are terminal inputs to the chip, and the sample application shows these terminal inputs tied to GND.

When a valid offset reference is read, four bytes are read from the EEPROM, MSB first, as illustrated in Figure 3–14. The address autoincrements after every byte transfer according to the doubleword read protocol. Note that the word addresses align with the data format illustrated in Figure 3–15. The PCI1410 continues to load data from the serial EEPROM until an end-of-list indicator is read. Three reserved bytes are stuffed to maintain eight-byte data structures.

Note, the eight-byte data structure is important to provide correct addressing per the doubleword read format shown in Figure 3–14. In addition, the reference offsets must be loaded in the EEPROM in sequential order, that is 01h, 02h, 03h, 04h. If the offsets are not sequential, then the registers will be loaded incorrectly.

3.6.4 Accessing Serial Bus Devices Through Software

The PCI1410 provides a programming mechanism to control serial bus devices through software. The programming is accomplished through a doubleword of PCI configuration space at offset B0h. Table 3–7 lists the registers used to program a serial bus device through software.

Table 3–7. PCI1410 Registers Used to Program Serial Bus Devices

| PCI OFFSET | REGISTER NAME                 | DESCRIPTION                                                                                                                                                               |
|------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B0h        | Serial bus data               | Contains the data byte to send on write commands or the received data byte on read commands                                                                               |
| B1h        | Serial bus index              | The content of this register is sent as the word address on byte writes or reads. This register is not used in the quick command protocol.                                |
| B2h        | Serial bus slave address      | Write transactions to this register initiate a serial bus transaction. The slave device address and the R/W command selector are programmed through this register.        |
| B3h        | Serial bus control and status | Read data valid, general busy, and general error status are communicated through this register. In addition, the protocol select bit is programmed through this register. |

To write a byte, the serial bus data register must be programmed with the data, the serial bus index register must be programmed with the byte address, and the serial bus slave address register must be programmed with the 7-bit slave address (SLAVADDR field) and bit 0 (RWCMD) must be reset.

On byte reads, the byte address is programmed into the serial bus index register, the serial bus slave address register must be programmed with the 7-bit slave address (SLAVADDR field) and bit 0 (RWCMD) must be set, and bit 5 (REQBUSY) in the serial bus control and status register (see Section 4.50) must be polled until clear. Then the contents of the serial bus data register are valid read data from the serial bus interface.

### **3.7 Programmable Interrupt Subsystem**

Interrupts provide a way for I/O devices to let the microprocessor know that they require servicing. The dynamic nature of PC Cards and the abundance of PC Card I/O applications require substantial interrupt support from the PCI1410. The PCI1410 provides several interrupt signaling schemes to accommodate the needs of a variety of platforms. The different mechanisms for dealing with interrupts in this device are based on various specifications and industry standards. The ExCA register set provides interrupt control for some 16-bit PC Card functions, and the CardBus socket register set provides interrupt control for the CardBus PC Card functions. The PCI1410 is, therefore, backward compatible with existing interrupt control register definitions, and new registers have been defined where required.

The PCI1410 detects PC Card interrupts and events at the PC Card interface and notifies the host controller using one of several interrupt signaling protocols. To simplify the discussion of interrupts in the PCI1410, PC Card interrupts are classified as either card status change (CSC) or as functional interrupts.

The method by which any type of PCI1410 interrupt is communicated to the host interrupt controller varies from system to system. The PCI1410 offers system designers the choice of using parallel PCI interrupt signaling, parallel ISA-type IRQ interrupt signaling, or the IRQSER serialized ISA and/or PCI interrupt protocol. It is possible to use the parallel PCI interrupts in combination with either parallel IRQs or serialized IRQs, as detailed in the sections that follow. All interrupt signalling is provided through the seven multifunction terminals, MFUNC0–MFUNC6.

#### **3.7.1 PC Card Functional and Card Status Change Interrupts**

PC Card functional interrupts are defined as requests from a PC Card application for interrupt service and are indicated by asserting specially-defined signals on the PC Card interface. Functional interrupts are generated by 16-bit I/O PC Cards and by CardBus PC Cards.

Card status change (CSC)-type interrupts are defined as events at the PC Card interface that are detected by the PCI1410 and may warrant notification of host card and socket services software for service. CSC events include both card insertion and removal from PC Card sockets, as well as transitions of certain PC Card signals.

Table 3–8 summarizes the sources of PC Card interrupts and the type of card associated with them. CSC and functional interrupt sources are dependent on the type of card inserted in the PC Card socket. The three types of cards that can be inserted into any PC Card socket are:

- 16-bit memory card
- 16-bit I/O card
- CardBus cards

**Table 3–8. Interrupt Mask and Flag Registers**

| CARD TYPE           | EVENT                           | MASK                              | FLAG                               |
|---------------------|---------------------------------|-----------------------------------|------------------------------------|
| 16-bit memory       | Battery conditions (BVD1, BVD2) | ExCA offset 05h/805h bits 1 and 0 | ExCA offset 04h/804h bits 1 and 0  |
|                     | Wait states (READY)             | ExCA offset 05h/805h bit 2        | ExCA offset 04h/804h bit 2         |
| 16-bit I/O          | Change in card status (STSCHG)  | ExCA offset 05h/805h bit 0        | ExCA offset 04h/804h bit 0         |
|                     | Interrupt request (IREQ)        | Always enabled                    | PCI configuration offset 91h bit 0 |
| All 16-bit PC Cards | Power cycle complete            | ExCA offset 05h/805h bit 3        | ExCA offset 04h/804h bit 3         |
| CardBus             | Change in card status (CSTSCHG) | Socket mask bit 0                 | Socket event bit 0                 |
|                     | Interrupt request (CINT)        | Always enabled                    | PCI configuration offset 91h bit 0 |
|                     | Power cycle complete            | Socket mask bit 3                 | Socket event bit 3                 |
|                     | Card insertion or removal       | Socket mask bits 2 and 1          | Socket event bits 2 and 1          |

Functional interrupt events are valid only for 16-bit I/O and CardBus cards; that is, the functional interrupts are not valid for 16-bit memory cards. Furthermore, card insertion and removal-type CSC interrupts are independent of the card type. Table 3–9 describes the PC Card interrupt events.

**Table 3–9. PC Card Interrupt Events and Description**

| CARD TYPE     | EVENT                           | TYPE       | SIGNAL                                                                                         | DESCRIPTION                                                                                                                                                                                 |
|---------------|---------------------------------|------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16-bit memory | Battery conditions (BVD1, BVD2) | CSC        | $\overline{\text{BVD1}}(\overline{\text{STSCHG}})//\overline{\text{CSTSCHG}}$                  | A transition on BVD1 indicates a change in the PC Card battery conditions.                                                                                                                  |
|               |                                 |            | $\overline{\text{BVD2}}(\overline{\text{SPKR}})//\overline{\text{CAUDIO}}$                     | A transition on BVD2 indicates a change in the PC Card battery conditions.                                                                                                                  |
|               | Wait states (READY)             | CSC        | $\overline{\text{READY}}(\overline{\text{IREQ}})//\overline{\text{CINT}}$                      | A transition on READY indicates a change in the ability of the memory PC Card to accept or provide data.                                                                                    |
| 16-bit I/O    | Change in card status (STSCHG)  | CSC        | $\overline{\text{BVD1}}(\overline{\text{STSCHG}})//\overline{\text{CSTSCHG}}$                  | The assertion of $\overline{\text{STSCHG}}$ indicates a status change on the PC Card.                                                                                                       |
|               | Interrupt request (IREQ)        | Functional | $\overline{\text{READY}}(\overline{\text{IREQ}})//\overline{\text{CINT}}$                      | The assertion of $\overline{\text{IREQ}}$ indicates an interrupt request from the PC Card.                                                                                                  |
| CardBus       | Change in card status (CSTSCHG) | CSC        | $\overline{\text{BVD1}}(\overline{\text{STSCHG}})//\overline{\text{CSTSCHG}}$                  | The assertion of $\overline{\text{CSTSCHG}}$ indicates a status change on the PC Card.                                                                                                      |
|               | Interrupt request (CINT)        | Functional | $\overline{\text{READY}}(\overline{\text{IREQ}})//\overline{\text{CINT}}$                      | The assertion of $\overline{\text{CINT}}$ indicates an interrupt request from the PC Card.                                                                                                  |
| All PC Cards  | Card insertion or removal       | CSC        | $\overline{\text{CD1}}//\overline{\text{CCD1}}, \overline{\text{CD2}}//\overline{\text{CCD2}}$ | A transition on either $\overline{\text{CD1}}//\overline{\text{CCD1}}$ or $\overline{\text{CD2}}//\overline{\text{CCD2}}$ indicates an insertion or removal of a 16-bit or CardBus PC Card. |
|               | Power cycle complete            | CSC        | N/A                                                                                            | An interrupt is generated when a PC Card power-up cycle has completed.                                                                                                                      |

The naming convention for PC Card signals describes the function for 16-bit memory, I/O cards, and CardBus. For example,  $\overline{\text{READY}}(\overline{\text{IREQ}})//\overline{\text{CINT}}$  includes  $\overline{\text{READY}}$  for 16-bit memory cards,  $\overline{\text{IREQ}}$  for 16-bit I/O cards, and  $\overline{\text{CINT}}$  for CardBus cards. The 16-bit memory card signal name is first, with the I/O card signal name second, enclosed in parentheses. The CardBus signal name follows after a double slash (/).

The *1997 PC Card Standard* describes the power-up sequence that must be followed by the PCI1410 when an insertion event occurs and the host requests that the socket  $V_{CC}$  and  $V_{PP}$  be powered. Upon completion of this power-up sequence, the PCI1410 interrupt scheme can be used to notify the host system (see Table 3–9), denoted by the power cycle complete event. This interrupt source is considered a PCI1410 internal event because it depends on the completion of applying power to the socket rather than on a signal change at the PC Card interface.

### 3.7.2 Interrupt Masks and Flags

Host software may individually mask (or disable) most of the potential interrupt sources listed in Table 3–9 by setting the appropriate bits in the PCI1410. By individually masking the interrupt sources listed, software can control those events that cause a PCI1410 interrupt. Host software has some control over the system interrupt the PCI1410 asserts by programming the appropriate routing registers. The PCI1410 allows host software to route PC Card CSC and PC Card functional interrupts to separate system interrupts. Interrupt routing somewhat specific to the interrupt signaling method used is discussed in more detail in the following sections.

When an interrupt is signaled by the PCI1410, the interrupt service routine must determine which of the events listed in Table 3–8 caused the interrupt. Internal registers in the PCI1410 provide flags that report the source of an interrupt. By reading these status bits, the interrupt service routine can determine the action to be taken.

Table 3–8 details the registers and bits associated with masking and reporting potential interrupts. All interrupts can be masked except the functional PC Card interrupts, and an interrupt status flag is available for all types of interrupts.

Notice that there is not a mask bit to stop the PCI1410 from passing PC Card functional interrupts through to the appropriate interrupt scheme. These interrupts are not valid until the card is properly powered, and there should never be a card interrupt that does not require service after proper initialization.

Table 3–8 lists the various methods of clearing the interrupt flag bits. The flag bits in the ExCA registers (16-bit PC Card-related interrupt flags) can be cleared using two different methods. One method is an explicit write of 1 to the flag bit to clear and the other is by reading the flag bit register. The selection of flag bit clearing is made by bit 2 (IFCMODE) in the ExCA global control register (see Section 5.20), located at ExCA offset 1Eh/81Eh, and defaults to the *flag cleared on read* method.

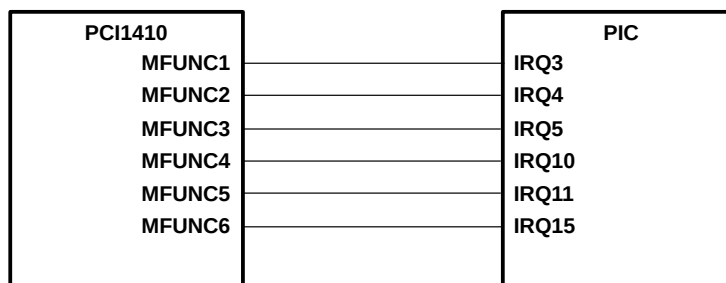
The CardBus-related interrupt flags can be cleared by an explicit write of 1 to the interrupt flag in the socket force event register (see Section 6.4). Although some of the functionality is shared between the CardBus registers and the ExCA registers, software should not program the chip through both register sets when a CardBus card is functioning.

### 3.7.3 Using Parallel IRQ Interrupts

The seven multifunction terminals, MFUNC6–MFUNC0, implemented in the PCI1410 may be routed to obtain a subset of the ISA IRQs. The IRQ choices provide ultimate flexibility in PC Card host interruptions. To use the parallel ISA type IRQ interrupt signaling, software must program the device control register (offset 92h, see Section 4.33), located at PCI offset 92h, to select the parallel IRQ signaling scheme. See Section 4.30, *Multifunction Routing Register*, for details on configuring the multifunction terminals.

A system using parallel IRQs requires (at a minimum) one PCI terminal,  $\overline{INTA}$ , to signal CSC events. This requirement is dictated by certain card and socket services software. The  $\overline{INTA}$  requirement calls for routing the MFUNC0 terminal for  $\overline{INTA}$  signaling. This leaves (at a maximum) six different IRQs to support legacy 16-bit PC Card functions.

As an example, suppose the six IRQs used by legacy PC Card applications are IRQ3, IRQ4, IRQ5, IRQ10, IRQ11, and IRQ15. The multifunction routing register must be programmed to a value of 0FBA 5432h. This value routes the MFUNC0 terminal to  $\overline{INTA}$  signaling and routes the remaining terminals as illustrated in Figure 3–16. Not shown is that  $\overline{INTA}$  must also be routed to the programmable interrupt controller (PIC), or to some circuitry that provides parallel PCI interrupts to the host.



**Figure 3–16. IRQ Implementation**

Power-on software is responsible for programming the multifunction routing register to reflect the IRQ configuration of a system implementing the PCI1410. See Section 4.30, *Multifunction Routing Register*, for details on configuring the multifunction terminals.

The parallel ISA type IRQ signaling from the MFUNC6–MFUNC0 terminals is compatible with those input directly into the 8259 PIC. The parallel IRQ option is provided for system designs that require legacy ISA IRQs. Design constraints may demand more MFUNC6–MFUNC0 IRQ terminals than the PCI1410 makes available.

### 3.7.4 Using Parallel PCI Interrupts

Parallel PCI interrupts are available when exclusively in parallel PCI interrupt mode, parallel ISA IRQ signaling mode, and when only IRQs are serialized with the IRQSER protocol. The socket function interrupts are routed to  $\overline{\text{INTA}}$  (MFUNC0).

### 3.7.5 Using Serialized IRQSER Interrupts

The serialized interrupt protocol implemented in the PCI1410 uses a single terminal to communicate all interrupt status information to the host controller. The protocol defines a serial packet consisting of a start cycle, multiple interrupt indication cycles, and a stop cycle. All data in the packet is synchronous with the PCI clock. The packet data describes 16 parallel ISA IRQ signals and the optional 4 PCI interrupts  $\overline{\text{INTA}}$ ,  $\overline{\text{INTB}}$ ,  $\overline{\text{INTC}}$ , and  $\overline{\text{INTD}}$ . For details on the IRQSER protocol refer to the document *Serialized IRQ Support for PCI Systems*.

### 3.7.6 SMI Support in the PCI1410

The PCI1410 provides a mechanism for interrupting the system when power changes have been made to the PC Card socket interfaces. The interrupt mechanism is designed to fit into a system maintenance interrupt (SMI) scheme. SMI interrupts are generated by the PCI1410, when enabled, after a write cycle to either the socket control register (see Section 6.5) of the CardBus register set or the ExCA power control register (ExCA offset 02h, see Section 5.3) causes a power cycle change sequence sent on the power switch interface.

The SMI control is programmed through three bits in the system control register (offset 80h, see Section 4.29). These bits are SMIRROUTE (bit 26), SMISTATUS (bit 25), and SMIENB (bit 24). Table 3–10 describes the SMI control bits function.

**Table 3–10. SMI Control**

| BIT NAME  | FUNCTION                                                                                                            |
|-----------|---------------------------------------------------------------------------------------------------------------------|
| SMIRROUTE | This shared bit controls whether the SMI interrupts are sent as a CSC interrupt or as IRQ2.                         |
| SMISTATUS | This socket-dependent bit is set when an SMI interrupt is pending. This status flag is cleared by writing back a 1. |
| SMIENB    | When set, SMI interrupt generation is enabled.                                                                      |

If CSC SMI interrupts are selected, then the SMI interrupt is sent as the CSC. The CSC interrupt can be either level or edge mode, depending upon the CSCMODE bit (bit 1) in the ExCA global control register (ExCA offset 1Eh, see Section 5.20).

If IRQ2 is selected by SMIRROUTE, then the IRQSER signaling protocol supports SMI signaling in the IRQ2 IRQ/Data slot. In a parallel ISA IRQ system, the support for an active low IRQ2 is provided only if IRQ2 is routed to either MFUNC1, MFUNC3, or MFUNC6 through the multifunction routing register (offset 8Ch, see Section 4.30).

## 3.8 Power Management Overview

In addition to the low-power CMOS technology process used for the PCI1410, various features are designed into the device to allow implementation of popular power-saving techniques. These features and techniques are discussed in this section.

### 3.8.1 Clock Run Protocol

The PCI  $\overline{\text{CLKRUN}}$  feature is the primary method of power management on the PCI interface of the PCI1410.  $\overline{\text{CLKRUN}}$  signalling is provided through the MFUNC6 terminal. Since some chip sets do not implement  $\overline{\text{CLKRUN}}$ , this is not always available to the system designer, and alternate power-saving features are provided. For details on the  $\overline{\text{CLKRUN}}$  protocol see the *PCI Mobile Design Guide*.

The PCI1410 does not permit the central resource to stop the PCI clock under any of the following conditions:

- Bit 1 (KEEPCLK) in the system control register (offset 80h, see Section 4.29) is set.
- The PC Card-16 resource manager is busy.
- The PCI1410 CardBus master state machine is busy. A cycle may be in progress on CardBus.
- The PCI1410 master is busy. There may be posted data from CardBus to PCI in the PCI1410.
- Interrupts are pending.
- The CardBus CCLK for either socket has not been stopped by the PCI1410  $\overline{\text{CCLKRUN}}$  manager.

The PCI1410 restarts the PCI clock using the  $\overline{\text{CLKRUN}}$  protocol under any of the following conditions:

- A PC Card-16 IREQ or a CardBus  $\overline{\text{CINT}}$  has been asserted.
- A CardBus CBWAKE (CSTSCHG) or PC Card-16  $\overline{\text{STSCHG/RI}}$  event occurs.
- A CardBus attempts to start the CCLK using  $\overline{\text{CCLKRUN}}$ .
- A CardBus card arbitrates for the CardBus bus using  $\overline{\text{CREQ}}$ .
- A 16-bit DMA PC Card asserts  $\overline{\text{DREQ}}$ .

### 3.8.2 CardBus PC Card Power Management

The PCI1410 implements its own card power management engine that can turn off the CCLK to a socket when there is no activity to the CardBus PC Card. The PCI clock-run protocol is followed on the CardBus  $\overline{\text{CCLKRUN}}$  interface to control this clock management.

### 3.8.3 16-Bit PC Card Power Management

The COE bit (bit 7) of the ExCA power control register (ExCA offset 02h, see Section 5.3) and PWRDWN bit (bit 0) of the ExCA global control register (ExCA offset 1Eh, see Section 5.20) are provided for 16-bit PC Card power management. The COE bit places the card interface in a high-impedance state to save power. The power savings when using this feature are minimal. The COE bit will reset the PC Card when used, and the PWRDWN bit will not. Furthermore, the PWRDWN bit is an automatic COE, that is, the PWRDWN performs the COE function when there is no card activity.

**NOTE:** The 16-bit PC Card must implement the proper pullup resistors for the COE and PWRDWN modes.

### 3.8.4 Suspend Mode

The  $\overline{\text{SUSPEND}}$  signal, provided for backward compatibility, gates the  $\overline{\text{PRST}}$  (PCI reset) signal and the  $\overline{\text{GRST}}$  (global reset) signal from the PCI1410. Besides gating  $\overline{\text{PRST}}$  and  $\overline{\text{GRST}}$ ,  $\overline{\text{SUSPEND}}$  also gates PCLK inside the PCI1410 in order to minimize power consumption.

Gating PCLK does not create any issues with respect to the power switch interface in the PCI1410. This is because the PCI1410 does not depend on the PCI clock to clock the power switch interface. There are two methods to clock the power switch interface in the PCI1410:

- Use an external clock to the PCI1410 PCLK terminal
- Use the internal oscillator

It should also be noted that asynchronous signals, such as card status change interrupts and  $\overline{\text{RI\_OUT}}$ , can be passed to the host system without a PCI clock. However, if card status change interrupts are routed over the serial interrupt stream, then the PCI clock will have to be restarted in order to pass the interrupt, because neither the internal oscillator nor an external clock is routed to the serial interrupt state machine. Figure 3–17 is a logic diagram.

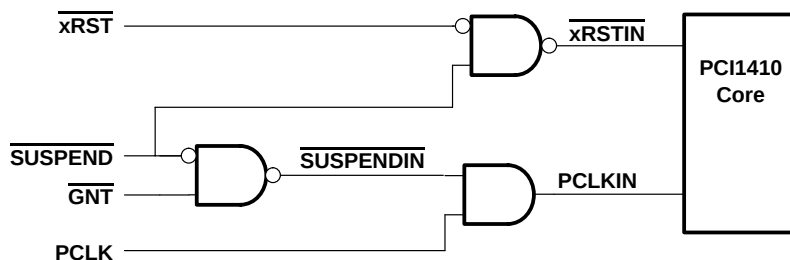


Figure 3–17. Suspend Logic Diagram

Figure 3–18 is a signal diagram of the suspend function.

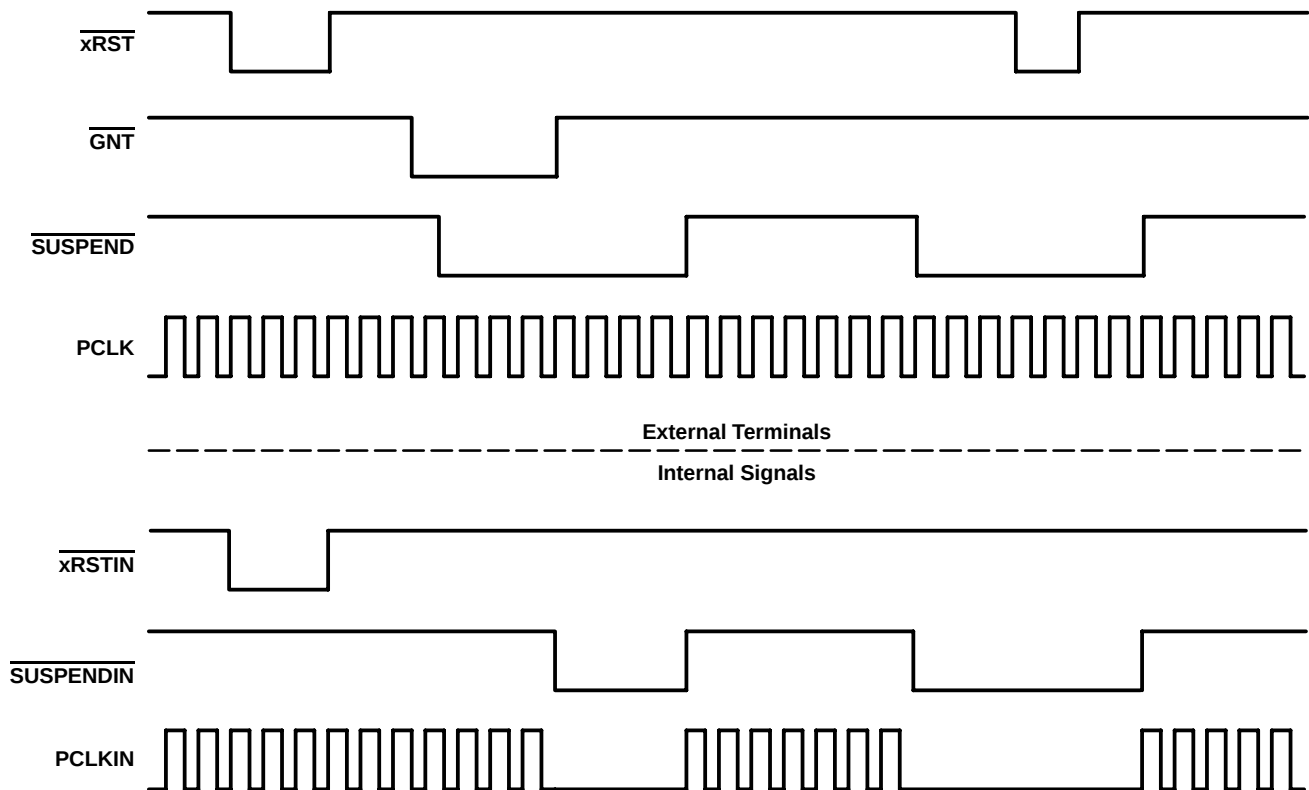


Figure 3–18. Signal Diagram of Suspend Function

### 3.8.5 Requirements for Suspend Mode

The suspend mode prevents the clearing of all register contents on the assertion of reset ( $\overline{\text{PRST}}$  or  $\overline{\text{GRST}}$ ) which would require the reconfiguration of the PCI1410 by software. Asserting the  $\overline{\text{SUSPEND}}$  signal places the controller PCI outputs in a high impedance state and gates the PCLK signal internally to the controller unless a PCI transaction is currently in process ( $\overline{\text{GNT}}$  is asserted). It is important that the PCI bus not be parked on the PCI1410 when  $\overline{\text{SUSPEND}}$  is asserted because the outputs are in a high-impedance state.

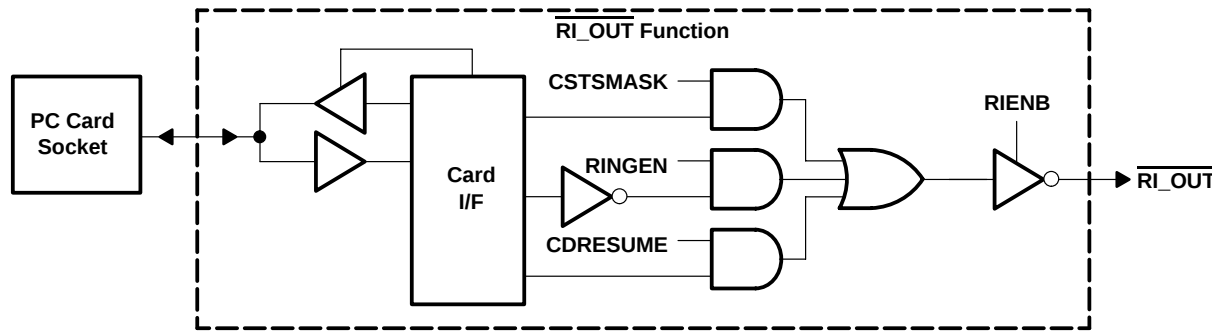
The GPIOs, MFUNC signals, and  $\overline{\text{RI\_OUT}}$  signals are all active during  $\overline{\text{SUSPEND}}$ , unless they are disabled in the appropriate PCI1410 registers.

### 3.8.6 Ring Indicate

The  $\overline{\text{RI\_OUT}}$  output is an important feature in power management, allowing a system to go into a suspended mode and wake up on modem rings and other card events. TI-designed flexibility permits this signal to fit wide platform requirements.  $\overline{\text{RI\_OUT}}$  on the PCI1410 can be asserted under any of the following conditions:

- A 16-bit PC Card modem in a powered socket asserts  $\overline{\text{RI}}$  to indicate to the system the presence of an incoming call.
- A powered down CardBus card asserts CSTSCHG (CBWAKE) requesting system and interface wake-up.
- A powered CardBus card asserts CSTSCHG from the insertion/removal of cards or change in battery voltage levels.

Figure 3–19 shows various enable bits for the PCI1410  $\overline{\text{RI\_OUT}}$  function; however, it does not show the masking of CSC events. See Table 3–8 for a detailed description of CSC interrupt masks and flags.



**Figure 3-19.  $\overline{\text{RI\_OUT}}$  Functional Diagram**

$\overline{\text{RI}}$  from the 16-bit PC Card interface is masked by bit 7 (RINGEN) in the ExCA interrupt and general control register (ExCA offset 03h, see Section 5.4). This is programmed on a per-socket basis and is only applicable when a 16-bit card is powered in the socket.

The CBWAKE signaling to  $\overline{\text{RI\_OUT}}$  is enabled through the same mask as the CSC event for CSTSCHG. The mask bit (bit 0, CSTSMASK) is programmed through the socket mask register (CardBus offset 04h, see Section 6.2) in the CardBus socket registers.

### 3.8.7 PCI Power Management

The *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges* establishes the infrastructure required to let the operating system control the power of PCI functions. This is done by defining a standard PCI interface and operations to manage the power of PCI functions on the bus. The PCI bus and the PCI functions can be assigned one of four software-visible power management states that result in varying levels of power savings.

The four power management states of PCI functions are:

- D0 – Fully-on state
- D1 and D2 – Intermediate states
- D3 – Off state

Similarly, bus power states of the PCI bus are B0–B3. The bus power states B0–B3 are derived from the device power state of the originating bridge device.

For the operating system (OS) to power manage the device power states on the PCI bus, the PCI function should support four power management operations. These operations are:

- Capabilities reporting
- Power status reporting
- Setting the power state
- System wake up

The OS identifies the capabilities of the PCI function by traversing the new capabilities list. The presence of capabilities in addition to the standard PCI capabilities is indicated by a 1 in bit 4 (CAPLIST) of the status register (offset 06h, see Section 4.5).

The capabilities pointer provides access to the first item in the linked list of capabilities. For the PCI1410, a CardBus bridge with PCI configuration space header type 2, the capabilities pointer is mapped to an offset of 14h. The first byte of each capability register block is required to be a unique ID of that capability. PCI power management has been assigned an ID of 01h. The next byte is a pointer to the next pointer item in the list of capabilities. If there are no more items in the list, then the next item pointer should be set to 0. The registers following the next item pointer are specific to the capabilities of their corresponding power management functions. The PCI power management capability implements the register block outlined in Table 3-11.

**Table 3–11. Power Management Registers**

| REGISTER NAME                 |                                 |                                 |               | OFFSET |
|-------------------------------|---------------------------------|---------------------------------|---------------|--------|
| Power management capabilities |                                 | Next-item pointer               | Capability ID | A0h    |
| PM data                       | PMCSR bridge support extensions | Power management control/status |               | A4h    |

The power management capabilities register (offset A2h, see Section 4.39) provides information on the capabilities of the function related to power management. The power management control/status register (offset A4h, see Section 4.40) enables control of power management states and enables/monitors power management events. The data register is an optional register that can provide dynamic data.

For more information on PCI power management, see the *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges*.

### 3.8.8 CardBus Bridge Power Management

The *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges* was approved by PCMCIA in December of 1997. This specification follows the device and bus state definitions provided in the *PCI Bus Power Management Interface Specification* published by the PCI Special Interest Group (SIG). The main issue addressed in the *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges* is wake-up from D3<sub>hot</sub> or D3<sub>cold</sub> without losing wake-up context (also called  $\overline{\text{PME}}$  context).

The specific issues addressed by the *PCI Bus Power Management Interface Specification for PCI to CardBus Bridges* for D3 wake up are as follows:

- Preservation of device context: The specification states that a reset must occur when transitioning from D3 to D0. Some method to preserve wake-up context must be implemented so that the reset does not clear the  $\overline{\text{PME}}$  context registers.
- Power source in D3<sub>cold</sub> if wake-up support is required from this state.

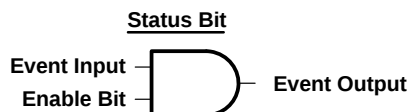
The Texas Instruments PCI1410 addresses these D3 wake-up issues in the following manner:

- Two resets are provided to handle preservation of  $\overline{\text{PME}}$  context bits:
  - Global reset ( $\overline{\text{GRST}}$ ) is used only on the initial boot up of the system after power up. It places the PCI1410 in its default state and requires BIOS to configure the device before becoming fully functional.
  - PCI reset ( $\overline{\text{PRST}}$ ) now has dual functionality based on whether  $\overline{\text{PME}}$  is enabled or not. If  $\overline{\text{PME}}$  is enabled, then  $\overline{\text{PME}}$  context is preserved. If  $\overline{\text{PME}}$  is not enabled, then  $\overline{\text{PRST}}$  acts the same as a normal PCI reset. Please see the master list of  $\overline{\text{PME}}$  context bits in Section 3.8.10.
- Power source in D3<sub>cold</sub> if wake-up support is required from this state. Since  $V_{CC}$  is removed in D3<sub>cold</sub>, an auxiliary power source must be supplied to the PCI1410  $V_{CC}$  pins. Consult the *PCI14xx Implementation Guide for D3 Wake-Up* or the *PCI Power Management Interface Specification for PCI to CardBus Bridges* for further information.

### 3.8.9 ACPI Support

The *Advanced Configuration and Power Interface (ACPI) Specification* provides a mechanism that allows unique pieces of hardware to be described to the ACPI driver. The PCI1410 offers a generic interface that is compliant with ACPI design rules.

Two doublewords of general-purpose ACPI programming bits reside in PCI1410 PCI configuration space at offset A8h. The programming model is broken into status and control functions. In compliance with ACPI, the top level event status and enable bits reside in general-purpose event status (offset A8h, see Section 4.43) and general-purpose event enable (offset AAh, see Section 4.44) registers. The status and enable bits are implemented as defined by ACPI and illustrated in Figure 3–20.



**Figure 3–20. Block Diagram of a Status/Enable Cell**

The status and enable bits generate an event that allows the ACPI driver to call a control method associated with the pending status bit. The control method can then control the hardware by manipulating the hardware control bits or by investigating child status bits and calling their respective control methods. A hierarchical implementation would be somewhat limiting, however, as upstream devices would have to remain in some level of power state to report events.

For more information of ACPI, see the *Advanced Configuration and Power Interface (ACPI) Specification*.

### 3.8.10 Master List of $\overline{\text{PME}}$ Context Bits and Global Reset Only Bits

If the  $\overline{\text{PME}}$  enable bit (bit 8) of the power management control/status register (PCI offset A4h, see Section 4.40) is asserted, then the assertion of  $\overline{\text{PRST}}$  will not clear the following  $\overline{\text{PME}}$  context bits. If the  $\overline{\text{PME}}$  enable bit is not asserted, then the  $\overline{\text{PME}}$  context bits are cleared with  $\overline{\text{PRST}}$ . The  $\overline{\text{PME}}$  context bits are:

- Bridge control register (PCI offset 3Eh, see Section 4.25): bit 6
- Power management capabilities register (PCI offset A2h, see Section 4.39): bit 15
- Power management control/status register (PCI offset A4h, see Section 4.40): bits 15, 8
- ExCA power control register (ExCA offset 802h, see Section 5.3): bits 4, 3, 1, 0
- ExCA interrupt and general control (ExCA offset 803h, see Section 5.4): bits 6, 5
- ExCA card status-change-interrupt configuration register (ExCA offset 805h, see Section 5.6): bits 3–0
- CardBus socket event register (CardBus offset 00h, see Section 6.1): bits 3–0
- CardBus socket mask register (CardBus offset 04h, see Section 6.2): bits 3–0
- CardBus socket present state register (CardBus offset 08h, see Section 6.3): bits 13–10, 7, 5–0
- CardBus socket control register (CardBus offset 10h, see Section 6.5): bits 6–4, 2–0

Global reset will place all registers in their default state regardless of the state of the  $\overline{\text{PME}}$  enable bit. The  $\overline{\text{GRST}}$  signal is gated only by the  $\overline{\text{SUSPEND}}$  signal. This means that assertion of  $\overline{\text{SUSPEND}}$  blocks the  $\overline{\text{GRST}}$  signal internally, thus preserving all register contents. The registers cleared by  $\overline{\text{GRST}}$  are:

- Subsystem vendor ID (PCI offset 40h, see Section 4.26): bits 15–0
- Subsystem ID (PCI offset 42h, see Section 4.27): bits 15–0
- PC Card 16-bit legacy mode base address register (PCI offset 44h): bits 31–1
- System control register (PCI offset 80h, see Section 4.29): bits 31, 30, 27, 26, 24–14, 7–0
- Multifunction routing register (PCI offset 8Ch, see Section 4.30): bits 27–0
- Retry status register (PCI offset 90h, see Section 4.31): bits 7, 6, 3, 1
- Card control register (PCI offset 91h, see Section 4.32): bits 7–5, 2–0
- Device control register (PCI offset 92h, see Section 4.33): bits 7–5, 3–0
- Diagnostic register (PCI offset 93h, see Section 4.34): bits 7–0
- Socket DMA register 0 (PCI offset 94h, see Section 4.35): bits 1–0
- Socket DMA register 1 (PCI offset 98h, see Section 4.36): bits 15–4, 2–0
- General-purpose event enable register (PCI offset AAh, see Section 4.44): bits 15, 11, 8, 4–0
- General-purpose output (PCI offset AEh, see Section 4.46): bits 4–0
- Serial bus data (PCI offset B0h, see Section 4.47): bits 7–0
- Serial bus index (PCI offset B1h, see Section 4.48): bits 7–0
- Serial bus slave address register (PCI offset B2h, see Section 4.49): bits 7–0
- Serial bus control and status register (PCI offset B3h, see Section 4.50): bits 7, 2
- ExCA identification and revision register (ExCA offset 00h, see Section 5.1): bits 7–0
- ExCA card status change register (ExCA offset 804h, see Section 5.5): bits 3–0
- ExCA global control register (ExCA offset 1Eh, see Section 5.20): bits 3–0

## 4 PC Card Controller Programming Model

This section describes the PCI1410 PCI configuration registers that make up the 256-byte PCI configuration header for each PCI1410 function. As noted, some bits are global in nature and are accessed only through function 0.

### 4.1 PCI Configuration Registers

The configuration header is compliant with the *PCI Local Bus Specification* as a CardBus bridge header and is *PC 99* compliant as well. Table 4–1 shows the PCI configuration header, which includes both the predefined portion of the configuration space and the user-definable registers.

**Table 4–1. PCI Configuration Registers**

| REGISTER NAME                               |                                                           |                                 |                    | OFFSET  |
|---------------------------------------------|-----------------------------------------------------------|---------------------------------|--------------------|---------|
| Device ID                                   |                                                           | Vendor ID                       |                    | 00h     |
| Status                                      |                                                           | Command                         |                    | 04h     |
| PCI class code                              |                                                           |                                 | Revision ID        | 08h     |
| BIST                                        | Header type                                               | Latency timer                   | Cache line size    | 0Ch     |
| CardBus socket/ExCA base-address            |                                                           |                                 |                    | 10h     |
| Secondary status                            |                                                           | Reserved                        | Capability pointer | 14h     |
| CardBus latency timer                       | Subordinate bus number                                    | CardBus bus number              | PCI bus number     | 18h     |
| Memory base register 0                      |                                                           |                                 |                    | 1Ch     |
| Memory limit register 0                     |                                                           |                                 |                    | 20h     |
| Memory base register 1                      |                                                           |                                 |                    | 24h     |
| Memory limit register 1                     |                                                           |                                 |                    | 28h     |
| I/O base register 0                         |                                                           |                                 |                    | 2Ch     |
| I/O limit register 0                        |                                                           |                                 |                    | 30h     |
| I/O base register 1                         |                                                           |                                 |                    | 34h     |
| I/O limit register 1                        |                                                           |                                 |                    | 38h     |
| Bridge control                              |                                                           | Interrupt pin                   | Interrupt line     | 3Ch     |
| Subsystem ID                                |                                                           | Subsystem vendor ID             |                    | 40h     |
| PC Card 16-bit I/F legacy-mode base address |                                                           |                                 |                    | 44h     |
| Reserved                                    |                                                           |                                 |                    | 48h–7Ch |
| System control                              |                                                           |                                 |                    | 80h     |
| Reserved                                    |                                                           |                                 |                    | 84h–88h |
| Multifunction routing                       |                                                           |                                 |                    | 8Ch     |
| Diagnostic                                  | Device control                                            | Card control                    | Retry status       | 90h     |
| Socket DMA register 0                       |                                                           |                                 |                    | 94h     |
| Socket DMA register 1                       |                                                           |                                 |                    | 98h     |
| Reserved                                    |                                                           |                                 |                    | 9Ch     |
| Power management capabilities               |                                                           | Next-item pointer               | Capability ID      | A0h     |
| Power management data                       | Power management control/status bridge support extensions | Power management control/status |                    | A4h     |
| General-purpose event enable                |                                                           | General-purpose event status    |                    | A8h     |
| General-purpose output                      |                                                           | General-purpose input           |                    | ACH     |
| Serial bus control and status               | Serial bus slave address                                  | Serial bus index                | Serial bus data    | B0h     |
| Reserved                                    |                                                           |                                 |                    | B4h–FCh |

A bit description table, typically included when a register contains bits of more than one type or purpose, indicates bit field names, a detailed field description, and field access tags, which appear in the type column of the bit description table. Table 4–2 describes the field access tags.

**Table 4–2. Bit Field Access Tag Descriptions**

| ACCESS TAG | NAME   | MEANING                                                           |
|------------|--------|-------------------------------------------------------------------|
| R          | Read   | Field may be read by software. <sup>†</sup>                       |
| W          | Write  | Field may be written by software to any value.                    |
| S          | Set    | Field may be set by a write of 1. Writes of 0 have no effect.     |
| C          | Clear  | Field may be cleared by a write of 1. Writes of 0 have no effect. |
| U          | Update | Field may be autonomously updated by the PCI1410.                 |

<sup>†</sup> A bit may display either of two types of behavior when read. After having been read it can maintain the value it had previously, or the read process can cause it to be reset to 0.

## 4.2 Vendor ID Register

This 16-bit register contains a value allocated by the PCI Special Interest Group (SIG) and identifies the manufacturer of the PCI device. The vendor ID assigned to TI is 104Ch.

| Bit     | 15        | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-----------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Name    | Vendor ID |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| Type    | R         | R  | R  | R  | R  | R  | R | R | R | R | R | R | R | R | R | R |
| Default | 0         | 0  | 0  | 1  | 0  | 0  | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |

Register: **Vendor ID**  
 Offset: 00h  
 Type: Read-only  
 Default: 104Ch

## 4.3 Device ID Register

This 16-bit register contains a value assigned to the PCI1410 by TI. The device identification for the PCI1410 is AC50h.

| Bit     | 15        | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-----------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Name    | Device ID |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| Type    | R         | R  | R  | R  | R  | R  | R | R | R | R | R | R | R | R | R | R |
| Default | 1         | 0  | 1  | 0  | 1  | 1  | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |

Register: **Device ID**  
 Offset: 02h  
 Type: Read-only  
 Default: AC50h

## 4.4 Command Register

The command register provides control over the PCI1410 interface to the PCI bus. All bit functions adhere to the definitions in *PCI Local Bus Specification*. See Table 4–3 for the complete description of the register contents.

| Bit     | 15      | 14 | 13 | 12 | 11 | 10 | 9 | 8   | 7 | 6   | 5   | 4 | 3 | 2   | 1   | 0   |
|---------|---------|----|----|----|----|----|---|-----|---|-----|-----|---|---|-----|-----|-----|
| Name    | Command |    |    |    |    |    |   |     |   |     |     |   |   |     |     |     |
| Type    | R       | R  | R  | R  | R  | R  | R | R/W | R | R/W | R/W | R | R | R/W | R/W | R/W |
| Default | 0       | 0  | 0  | 0  | 0  | 0  | 0 | 0   | 0 | 0   | 0   | 0 | 0 | 0   | 0   | 0   |

Register: **Command**  
Offset: 04h  
Type: Read-only, Read/Write  
Default: 0000h

**Table 4–3. Command Register**

| BIT   | SIGNAL  | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                      |
|-------|---------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15–10 | RSVD    | R    | Reserved. Bits 15–10 return 0s when read.                                                                                                                                                                                                                                                                                                                                     |
| 9     | FBB_EN  | R    | Fast back-to-back enable. The PCI1410 does not generate fast back-to-back transactions; therefore, bit 9 returns 0 when read.                                                                                                                                                                                                                                                 |
| 8     | SERR_EN | R/W  | System error ( <u>SERR</u> ) enable. Bit 8 controls the enable for the <u>SERR</u> driver on the PCI interface. <u>SERR</u> can be asserted after detecting an address parity error on the PCI bus. Both bits 8 and 6 must be set for the PCI1410 to report address parity errors.<br>0 = Disable <u>SERR</u> output driver (default)<br>1 = Enable <u>SERR</u> output driver |
| 7     | STEP_EN | R    | Address/data stepping control. The PCI1410 does not support address/data stepping; therefore, bit 7 is hardwired to 0.                                                                                                                                                                                                                                                        |
| 6     | PERR_EN | R/W  | Parity error response enable. Bit 6 controls the response of the PCI1410 to parity errors through <u>PERR</u> . Data parity errors are indicated by asserting <u>PERR</u> , whereas address parity errors are indicated by asserting <u>SERR</u> .<br>0 = PCI1410 ignores detected parity error (default)<br>1 = PCI1410 responds to detected parity errors                   |
| 5     | VGA_EN  | R/W  | VGA palette snoop. When bit 5 is set to 1, palette snooping is enabled (that is, the PCI1410 does not respond to palette register writes and snoops the data). When bit 5 is 0, the PCI1410 treats all palette accesses like all other accesses.                                                                                                                              |
| 4     | MWI_EN  | R    | Memory write and invalidate enable. Bit 4 controls whether a PCI initiator device can generate memory write and invalidate commands. The PCI1410 controller does not support memory write and invalidate commands, it uses memory write commands instead; therefore, this bit is hardwired to 0.                                                                              |
| 3     | SPECIAL | R    | Special cycles. Bit 3 controls whether or not a PCI device ignores PCI special cycles. The PCI1410 does not respond to special cycle operations; therefore, this bit is hardwired to 0.                                                                                                                                                                                       |
| 2     | MAST_EN | R/W  | Bus master control. Bit 2 controls whether or not the PCI1410 can act as a PCI bus initiator (master). The PCI1410 can take control of the PCI bus only when this bit is set.<br>0 = Disables the ability of the PCI1410 to generate PCI bus accesses (default)<br>1 = Enables the ability of the PCI1410 to generate PCI bus accesses                                        |
| 1     | MEM_EN  | R/W  | Memory space enable. Bit 1 controls whether or not the PCI1410 can claim cycles in PCI memory space.<br>0 = Disables the PCI1410 from responding to memory space accesses (default)<br>1 = Enables the PCI1410 to respond to memory space accesses                                                                                                                            |
| 0     | IO_EN   | R/W  | I/O space control. Bit 0 controls whether or not the PCI1410 can claim cycles in PCI I/O space.<br>0 = Disables the PCI1410 from responding to I/O space accesses (default)<br>1 = Enables the PCI1410 to respond to I/O space accesses                                                                                                                                       |

## 4.5 Status Register

The status register provides device information to the host system. Bits in this register may be read normally. A bit in the status register is reset when a 1 is written to that bit location; a 0 written to a bit location has no effect. All bit functions adhere to the definitions in the *PCI Local Bus Specification*. PCI bus status is shown through each function. See Table 4–4 for a complete description of the register contents.

| Bit     | 15     | 14  | 13  | 12  | 11  | 10 | 9 | 8   | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|--------|-----|-----|-----|-----|----|---|-----|---|---|---|---|---|---|---|---|
| Name    | Status |     |     |     |     |    |   |     |   |   |   |   |   |   |   |   |
| Type    | R/C    | R/C | R/C | R/C | R/C | R  | R | R/C | R | R | R | R | R | R | R | R |
| Default | 0      | 0   | 0   | 0   | 0   | 0  | 1 | 0   | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

Register: **Status**  
 Offset: 06h  
 Type: Read-only, Read/Clear  
 Default: 0210h

**Table 4–4. Status Register**

| BIT  | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                        |
|------|-----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15   | PAR_ERR   | R/C  | Detected parity error. Bit 15 is set when a parity error is detected (either address or data).                                                                                                                                                                                                                                                                                                                  |
| 14   | SYS_ERR   | R/C  | Signaled system error. Bit 14 is set when <b>SERR</b> is enabled and the PCI1410 signals a system error to the host.                                                                                                                                                                                                                                                                                            |
| 13   | MABORT    | R/C  | Received master abort. Bit 13 is set when a cycle initiated by the PCI1410 on the PCI bus has been terminated by a master abort.                                                                                                                                                                                                                                                                                |
| 12   | TABT_REC  | R/C  | Received target abort. Bit 12 is set when a cycle initiated by the PCI1410 on the PCI bus was terminated by a target abort.                                                                                                                                                                                                                                                                                     |
| 11   | TABT_SIG  | R/C  | Signaled target abort. Bit 11 is set by the PCI1410 when it terminates a transaction on the PCI bus with a target abort.                                                                                                                                                                                                                                                                                        |
| 10–9 | PCI_SPEED | R    | DEVSEL timing. These bits encode the timing of <b>DEVSEL</b> and are hardwired 01b, indicating that the PCI1410 asserts <b>PCI_SPEED</b> at a medium speed on nonconfiguration cycle accesses.                                                                                                                                                                                                                  |
| 8    | DATAPAR   | R/C  | Data parity error detected.<br>0 = The conditions for setting bit 8 have not been met.<br>1 = A data parity error occurred, and the following conditions were met:<br>a. <b>PERR</b> was asserted by any PCI device including the PCI1410.<br>b. The PCI1410 was the bus master during the data parity error.<br>c. The parity error response bit is set in the command register (offset 04h, see Section 4.4). |
| 7    | FBB_CAP   | R    | Fast back-to-back capable. The PCI1410 cannot accept fast back-to-back transactions; therefore, bit 7 is hardwired to 0.                                                                                                                                                                                                                                                                                        |
| 6    | UDF       | R    | User-definable feature support. The PCI1410 does not support the user-definable features; therefore, bit 6 is hardwired to 0.                                                                                                                                                                                                                                                                                   |
| 5    | 66MHZ     | R    | 66-MHz capable. The PCI1410 operates at a maximum PCLK frequency of 33 MHz; therefore, bit 5 is hardwired to 0.                                                                                                                                                                                                                                                                                                 |
| 4    | CAPLIST   | R    | Capabilities list. Bit 4 returns 1 when read. This bit indicates that capabilities in addition to standard PCI capabilities are implemented. The linked list of PCI power management capabilities is implemented in this function.                                                                                                                                                                              |
| 3–0  | RSVD      | R    | Reserved. Bits 3–0 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                         |

## 4.6 Revision ID Register

The revision ID register indicates the silicon revision of the PCI1410.

| Bit     | 7           | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------|---|---|---|---|---|---|---|
| Name    | Revision ID |   |   |   |   |   |   |   |
| Type    | R           | R | R | R | R | R | R | R |
| Default | 0           | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Register: **Revision ID**  
Offset: 08h  
Type: Read-only  
Default: 01h

## 4.7 PCI Class Code Register

The class code register recognizes the PCI1410 as a bridge device (06h) and CardBus bridge device (07h) with a 00h programming interface.

| Bit     | 23             | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15       | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7                     | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|----------------|----|----|----|----|----|----|----|----------|----|----|----|----|----|---|---|-----------------------|---|---|---|---|---|---|---|
| Name    | PCI class code |    |    |    |    |    |    |    |          |    |    |    |    |    |   |   |                       |   |   |   |   |   |   |   |
|         | Base class     |    |    |    |    |    |    |    | Subclass |    |    |    |    |    |   |   | Programming interface |   |   |   |   |   |   |   |
| Type    | R              | R  | R  | R  | R  | R  | R  | R  | R        | R  | R  | R  | R  | R  | R | R | R                     | R | R | R | R | R | R | R |
| Default | 0              | 0  | 0  | 0  | 0  | 1  | 1  | 0  | 0        | 0  | 0  | 0  | 0  | 1  | 1 | 1 | 0                     | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **PCI class code**  
Offset: 09h  
Type: Read-only  
Default: 06 0700h

## 4.8 Cache Line Size Register

The cache line size register is programmed by host software to indicate the system cache line size.

| Bit     | 7               | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-----------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Cache line size |     |     |     |     |     |     |     |
| Type    | R/W             | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Cache line size**  
Offset: 0Ch  
Type: Read/Write  
Default: 00h

## 4.9 Latency Timer Register

The latency timer register specifies the latency timer for the PCI1410 in units of PCI clock cycles. When the PCI1410 is a PCI bus initiator and asserts FRAME, the latency timer begins counting from zero. If the latency timer expires before the PCI1410 transaction has terminated, then the PCI1410 terminates the transaction when its GNT is deasserted.

| Bit     | 7             | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|---------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Latency timer |     |     |     |     |     |     |     |
| Type    | R/W           | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0             | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Latency timer**  
Offset: 0Dh  
Type: Read/Write  
Default: 00h

## 4.10 Header Type Register

This register returns 02h when read, indicating that the PCI1410 configuration spaces adhere to the CardBus bridge PCI header. The CardBus bridge PCI header ranges from PCI register 0 to 7Fh, and 80h–FFh are user-definable extension registers.

| Bit     | 7           | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------|---|---|---|---|---|---|---|
| Name    | Header type |   |   |   |   |   |   |   |
| Type    | R           | R | R | R | R | R | R | R |
| Default | 0           | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

Register: **Header type**  
Offset: 0Eh  
Type: Read-only  
Default: 02h

## 4.11 BIST Register

Because the PCI1410 does not support a built-in self-test (BIST), this register returns the value of 00h when read.

| Bit     | 7    | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|------|---|---|---|---|---|---|---|
| Name    | BIST |   |   |   |   |   |   |   |
| Type    | R    | R | R | R | R | R | R | R |
| Default | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **BIST**  
Offset: 0Fh  
Type: Read-only  
Default: 00h

## 4.12 CardBus Socket/ExCA Base-Address Register

The CardBus socket/ExCA base-address register is programmed with a base address referencing the CardBus socket registers and the memory-mapped ExCA register set. Bits 31–12 are read/write and allow the base address to be located anywhere in the 32-bit PCI memory address space on a 4-Kbyte boundary. Bits 11–0 are read-only, returning 0s when read. When software writes all 1s to this register, the value read back is FFFF F000h, indicating that at least 4K bytes of memory address space are required. The CardBus registers start at offset 000h, and the memory-mapped ExCA registers begin at offset 800h.

| Bit     | 31                               | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | CardBus socket/ExCA base-address |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                              | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 15                               | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | CardBus socket/ExCA base-address |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                              | R/W | R/W | R/W | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   |
| Default | 0                                | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **CardBus socket/ExCA base-address**  
 Offset: 10h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

## 4.13 Capability Pointer Register

The capability pointer register provides a pointer into the PCI configuration header where the PCI power management register block resides. PCI header doublewords at A0h and A4h provide the power management (PM) registers. The socket has its own capability pointer register. This register returns A0h when read.

| Bit     | 7                  | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|--------------------|---|---|---|---|---|---|---|
| Name    | Capability pointer |   |   |   |   |   |   |   |
| Type    | R                  | R | R | R | R | R | R | R |
| Default | 1                  | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

Register: **Capability pointer**  
 Offset: 14h  
 Type: Read-only  
 Default: A0h

## 4.14 Secondary Status Register

The secondary status register is compatible with the PCI-to-PCI bridge secondary status register and indicates CardBus-related device information to the host system. This register is very similar to the PCI status register (offset 06h); status bits are cleared by writing a 1. See Table 4–5 for a complete description of the register contents.

| Bit     | 15               | 14  | 13  | 12  | 11  | 10 | 9 | 8   | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|------------------|-----|-----|-----|-----|----|---|-----|---|---|---|---|---|---|---|---|
| Name    | Secondary status |     |     |     |     |    |   |     |   |   |   |   |   |   |   |   |
| Type    | R/C              | R/C | R/C | R/C | R/C | R  | R | R/C | R | R | R | R | R | R | R | R |
| Default | 0                | 0   | 0   | 0   | 0   | 0  | 1 | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **Secondary status**  
 Offset: 16h  
 Type: Read-only, Read/Clear  
 Default: 0200h

**Table 4–5. Secondary Status Register**

| BITS | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                          |
|------|-----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15   | CBPARITY  | R/C  | Detected parity error. Bit 15 is set when a CardBus parity error is detected (either address or data).                                                                                                                                                                                                                                                            |
| 14   | CBSERR    | R/C  | Signaled system error. Bit 14 is set when CSERR is signaled by a CardBus card. The PCI1410 does not assert CSERR.                                                                                                                                                                                                                                                 |
| 13   | CBMABORT  | R/C  | Received master abort. Bit 13 is set when a cycle initiated by the PCI1410 on the CardBus bus has been terminated by a master abort.                                                                                                                                                                                                                              |
| 12   | REC_CBTA  | R/C  | Received target abort. Bit 12 is set when a cycle initiated by the PCI1410 on the CardBus bus is terminated by a target abort.                                                                                                                                                                                                                                    |
| 11   | SIG_CBTA  | R/C  | Signaled target abort. Bit 11 is set by the PCI1410 when it terminates a transaction on the CardBus bus with a target abort.                                                                                                                                                                                                                                      |
| 10–9 | CB_SPEED  | R    | CDEVSEL timing. These bits encode the timing of CDEVSEL and are hardwired 01b, indicating that the PCI1410 asserts CB_SPEED at a medium speed.                                                                                                                                                                                                                    |
| 8    | CB_DPAR   | R/C  | CardBus data parity error detected.<br>0 = The conditions for setting bit 8 have not been met.<br>1 = A data parity error occurred and the following conditions were met:<br>a. CPERR was asserted on the CardBus interface.<br>b. The PCI1410 was the bus master during the data parity error.<br>c. The parity error response bit is set in the bridge control. |
| 7    | CBFBB_CAP | R    | Fast back-to-back capable. The PCI1410 cannot accept fast back-to-back transactions; therefore, bit 7 is hardwired to 0.                                                                                                                                                                                                                                          |
| 6    | CB_UDF    | R    | User-definable feature support. The PCI1410 does not support the user-definable features; therefore, bit 6 is hardwired to 0.                                                                                                                                                                                                                                     |
| 5    | CB66MHZ   | R    | 66-MHz capable. The PCI1410 CardBus interface operates at a maximum CCLK frequency of 33 MHz; therefore, bit 5 is hardwired to 0.                                                                                                                                                                                                                                 |
| 4–0  | RSVD      | R    | Reserved. Bits 4–0 return 0s when read.                                                                                                                                                                                                                                                                                                                           |

## 4.15 PCI Bus Number Register

This register is programmed by the host system to indicate the bus number of the PCI bus to which the PCI1410 is connected. The PCI1410 uses this register in conjunction with the CardBus bus number and subordinate bus number registers to determine when to forward PCI configuration cycles to its secondary buses.

| Bit     | 7              | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|----------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | PCI bus number |     |     |     |     |     |     |     |
| Type    | R/W            | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0              | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **PCI bus number**  
Offset: 18h  
Type: Read/Write  
Default: 00h

## 4.16 CardBus Bus Number Register

This register is programmed by the host system to indicate the bus number of the CardBus bus to which the PCI1410 is connected. The PCI1410 uses this register in conjunction with the PCI bus number and subordinate bus number registers to determine when to forward PCI configuration cycles to its secondary buses.

| Bit     | 7                  | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|--------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | CardBus bus number |     |     |     |     |     |     |     |
| Type    | R/W                | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                  | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **CardBus bus number**  
Offset: 19h  
Type: Read/Write  
Default: 00h

## 4.17 Subordinate Bus Number Register

This register is programmed by the host system to indicate the highest-numbered bus below the CardBus bus. The PCI1410 uses this register in conjunction with the PCI bus number and CardBus bus number registers to determine when to forward PCI configuration cycles to its secondary buses.

| Bit     | 7                      | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Subordinate bus number |     |     |     |     |     |     |     |
| Type    | R/W                    | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Subordinate bus number**  
Offset: 1Ah  
Type: Read/Write  
Default: 00h

## 4.18 CardBus Latency Timer Register

This register is programmed by the host system to specify the latency timer for the PCI1410 CardBus interface in units of CCLK cycles. When the PCI1410 is a CardBus initiator and asserts CFRAME, the CardBus latency timer begins counting. If the latency timer expires before the PCI1410 transaction has terminated, then the PCI1410 terminates the transaction at the end of the next data phase. A recommended minimum value for this register is 20h, which allows most transactions to be completed.

| Bit     | 7                     | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-----------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | CardBus latency timer |     |     |     |     |     |     |     |
| Type    | R/W                   | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                     | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **CardBus latency timer**  
 Offset: 1Bh  
 Type: Read/Write  
 Default: 00h

## 4.19 Memory Base Registers 0, 1

The memory base registers indicate the lower address of a PCI memory address range. These registers are used by the PCI1410 to determine when to forward a memory transaction to the CardBus bus and when to forward a CardBus cycle to PCI. Bits 31–12 of these registers are read/write and allow the memory base to be located anywhere in the 32-bit PCI memory space on 4-Kbyte boundaries. Bits 11–0 are read-only and always return 0s. Write transactions to these bits have no effect. Bits 8 and 9 of the bridge control register (offset 3Eh, see Section 4.25) specify whether memory windows 0 and 1 are prefetchable or nonprefetchable. The memory base register or the memory limit register must be nonzero for the PCI1410 to claim any memory transactions through the CardBus memory windows (that is, these windows are not enabled by default to pass the first 4K bytes of memory to CardBus).

| Bit     | 31                         | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | Memory base registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                        | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                          | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 15                         | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | Memory base registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                        | R/W | R/W | R/W | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   |
| Default | 0                          | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Memory base register 0**  
 Offset: 1Ch  
 Register: **Memory base register 1**  
 Offset: 24h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

## 4.20 Memory Limit Registers 0, 1

The memory limit registers indicate the upper address of a PCI memory address range. These registers are used by the PCI1410 to determine when to forward a memory transaction to the CardBus bus and when to forward a CardBus cycle to PCI. Bits 31–12 of these registers are read/write and allow the memory base to be located anywhere in the 32-bit PCI memory space on 4-Kbyte boundaries. Bits 11–0 are read-only and always return 0s. Write transactions to these bits have no effect. Bits 8 and 9 of the bridge control register specify whether memory windows 0 and 1 are prefetchable or nonprefetchable. The memory base register or the memory limit register must be nonzero for the PCI1410 to claim any memory transactions through CardBus memory windows (that is, these windows are not enabled by default to pass the first 4K bytes of memory to CardBus).

| Bit     | 31                          | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | Memory limit registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                         | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 15                          | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | Memory limit registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                         | R/W | R/W | R/W | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   |
| Default | 0                           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Memory limit registers 0, 1**  
 Offset: 20h, 28h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

## 4.21 I/O Base Registers 0, 1

The I/O base registers indicate the lower address of a PCI I/O address range. These registers are used by the PCI1410 to determine when to forward an I/O transaction to the CardBus bus and when to forward a CardBus cycle to the PCI bus. The lower 16 bits of these registers locate the bottom of the I/O window within a 64-Kbyte page, and the upper 16 bits (31–16) are a page register which locates this 64-Kbyte page in 32-bit PCI I/O address space. Bits 31–2 are read/write. Bits 1 and 0 are read-only and always return 0s, forcing the I/O window to be aligned on a natural doubleword boundary.

**NOTE:** Either the I/O base or the I/O limit register must be nonzero to enable any I/O transactions.

| Bit     | 31                      | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | I/O base registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                     | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                       | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 15                      | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | I/O base registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                     | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R   | R   |
| Default | 0                       | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **I/O base registers 0, 1**  
 Offset: 2Ch, 34h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

## 4.22 I/O Limit Registers 0, 1

The I/O limit registers indicate the upper address of a PCI I/O address range. These registers are used by the PCI1410 to determine when to forward an I/O transaction to the CardBus bus and when to forward a CardBus cycle to PCI. The lower 16 bits of these registers locate the top of the I/O window within a 64-Kbyte page, and the upper 16 bits are a page register that locates this 64-Kbyte page in 32-bit PCI I/O address space. Bits 15–2 are read/write and allow the I/O limit address to be located anywhere in the 64-Kbyte page (indicated by bits 31–16 of the appropriate I/O base) on doubleword boundaries.

Bits 31–16 are read-only and always return 0s when read. The page is set in the I/O base register. Bits 1 and 0 are read-only and always return 0s, forcing I/O windows to be aligned on a natural doubleword boundary. Write transactions to read-only bits have no effect. The PCI1410 assumes that the lower 2 bits of the limit address are 1s.

**NOTE:** The I/O base or the I/O limit register must be nonzero to enable an I/O transaction.

| Bit     | 31                       | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17 | 16 |
|---------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| Name    | I/O limit registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| Type    | R                        | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R  | R  |
| Default | 0                        | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0  |
| Bit     | 15                       | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1  | 0  |
| Name    | I/O limit registers 0, 1 |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| Type    | R/W                      | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R  | R  |
| Default | 0                        | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0  |

Register: **I/O limit registers 0, 1**  
Offset: 30h, 38h  
Type: Read-only, Read/Write  
Default: 0000 0000h

## 4.23 Interrupt Line Register

The interrupt line register communicates interrupt line routing information.

| Bit     | 7              | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|----------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Interrupt line |     |     |     |     |     |     |     |
| Type    | R/W            | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 1              | 1   | 1   | 1   | 1   | 1   | 1   | 1   |

Register: **Interrupt line**  
Offset: 3Ch  
Type: Read/Write  
Default: FFh

## 4.24 Interrupt Pin Register

The value read from the interrupt pin register is function dependent and depends on the interrupt signaling mode, selected through bits 2–1 (INTMODE field) of the device control register (offset 92h, see Section 4.33). The PCI1410 defaults to serialized PCI and ISA interrupt mode.

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------|---|---|---|---|---|---|---|
| Name    | Interrupt pin |   |   |   |   |   |   |   |
| Type    | R             | R | R | R | R | R | R | R |
| Default | 0             | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Register: **Interrupt pin**  
Offset: 3Dh  
Type: Read-only  
Default: 01h

## 4.25 Bridge Control Register

The bridge control register provides control over various PCI1410 bridging functions. See Table 4–6 for a complete description of the register contents.

| Bit     | 15             | 14 | 13 | 12 | 11 | 10  | 9   | 8   | 7   | 6   | 5   | 4 | 3   | 2   | 1   | 0   |
|---------|----------------|----|----|----|----|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|
| Name    | Bridge control |    |    |    |    |     |     |     |     |     |     |   |     |     |     |     |
| Type    | R              | R  | R  | R  | R  | R/W | R/W | R/W | R/W | R/W | R/W | R | R/W | R/W | R/W | R/W |
| Default | 0              | 0  | 0  | 0  | 0  | 0   | 1   | 1   | 0   | 1   | 0   | 0 | 0   | 0   | 0   | 0   |

Register: **Bridge control**  
Offset: 3Eh  
Type: Read-only, Read/Write  
Default: 0340h

**Table 4–6. Bridge Control Register**

| BIT   | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                              |
|-------|-----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15–11 | RSVD      | R    | Reserved. Bits 15–11 return 0s when read.                                                                                                                                                                                                                                                                                                             |
| 10    | POSTEN    | R/W  | Write posting enable. Enables write posting to and from the CardBus sockets. Write posting enables posting of write data on burst cycles. Operating with write posting disabled inhibits performance on burst cycles. Note that burst write data can be posted, but various write transactions may not.                                               |
| 9     | PREFETCH1 | R/W  | Memory window 1 type. Bit 9 specifies whether or not memory window 1 is prefetchable. This bit is socket dependent. Bit 9 is encoded as:<br>0 = Memory window 1 is nonprefetchable.<br>1 = Memory window 1 is prefetchable (default).                                                                                                                 |
| 8     | PREFETCH0 | R/W  | Memory window 0 type. Bit 8 specifies whether or not memory window 0 is prefetchable. This bit is encoded as:<br>0 = Memory window 0 is nonprefetchable.<br>1 = Memory window 0 is prefetchable (default).                                                                                                                                            |
| 7     | INTR      | R/W  | PCI interrupt – IREQ routing enable. Bit 7 selects whether PC Card functional interrupts are routed to PCI interrupts or to the IRQ specified in the ExCA registers.<br>0 = Functional interrupts routed to PCI interrupts (default)<br>1 = Functional interrupts routed by ExCAs                                                                     |
| 6     | CRST      | R/W  | CardBus reset. When bit 6 is set, $\overline{\text{CRST}}$ is asserted on the CardBus interface. $\overline{\text{CRST}}$ can also be asserted by passing a $\overline{\text{PRST}}$ assertion to CardBus.<br>0 = $\overline{\text{CRST}}$ deasserted<br>1 = $\overline{\text{CRST}}$ asserted (default)                                              |
| 5     | MABTMODE  | R/W  | Master abort mode. Bit 5 controls how the PCI1410 responds to a master abort when the PCI1410 is an initiator on the CardBus interface.<br>0 = Master aborts not reported (default)<br>1 = Signal target abort on PCI and $\overline{\text{SERR}}$ (if enabled)                                                                                       |
| 4     | RSVD      | R    | Reserved. Bit 4 returns 0 when read.                                                                                                                                                                                                                                                                                                                  |
| 3     | VGAEN     | R/W  | VGA enable. Bit 3 affects how the PCI1410 responds to VGA addresses. When this bit is set, accesses to VGA addresses are forwarded.                                                                                                                                                                                                                   |
| 2     | ISAEN     | R/W  | ISA mode enable. Bit 2 affects how the PCI1410 passes I/O cycles within the 64-Kbyte ISA range. This bit is not common between sockets. When this bit is set, the PCI1410 does not forward the last 768 bytes of each 1K I/O range to CardBus.                                                                                                        |
| 1     | CSERREN   | R/W  | $\overline{\text{CSERR}}$ enable. Bit 1 controls the response of the PCI1410 to $\overline{\text{CSERR}}$ signals on the CardBus bus. This bit is common between the two sockets.<br>0 = $\overline{\text{CSERR}}$ is not forwarded to PCI $\overline{\text{SERR}}$ .<br>1 = $\overline{\text{CSERR}}$ is forwarded to PCI $\overline{\text{SERR}}$ . |
| 0     | CPERREN   | R/W  | CardBus parity error response enable. Bit 0 controls the response of the PCI1410 to CardBus parity errors. This bit is common between the two sockets.<br>0 = CardBus parity errors are ignored.<br>1 = CardBus parity errors are reported using $\overline{\text{CPERR}}$ .                                                                          |

## 4.26 Subsystem Vendor ID Register

The subsystem vendor ID register is used for system and option-card identification purposes and may be required for certain operating systems. This register is read-only or read/write, depending on the setting of bit 5 (SUBSYSRW) in the system control register (offset 80h, see Section 4.29).

| Bit     | 15                  | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Name    | Subsystem vendor ID |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| Type    | R                   | R  | R  | R  | R  | R  | R | R | R | R | R | R | R | R | R | R |
| Default | 0                   | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **Subsystem vendor ID**  
Offset: 40h  
Type: Read-only (Read/Write if enabled by SUBSYSRW)  
Default: 0000h

## 4.27 Subsystem ID Register

The subsystem ID register is used for system and option-card identification purposes and may be required for certain operating systems. This register is read-only or read/write, depending on the setting of bit 5 (SUBSYSRW) in the system control register (offset 80h, see Section 4.29).

| Bit     | 15           | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|--------------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Name    | Subsystem ID |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| Type    | R            | R  | R  | R  | R  | R  | R | R | R | R | R | R | R | R | R | R |
| Default | 0            | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **Subsystem ID**  
Offset: 42h  
Type: Read-only (Read/Write if enabled by SUBSYSRW)  
Default: 0000h

## 4.28 PC Card 16-bit I/F Legacy-Mode Base-Address Register

The PCI1410 supports the index/data scheme of accessing the ExCA registers, which is mapped by this register. An address written to this register is the address for the index register and the address + 1 is the data address. Using this access method, applications requiring index/data ExCA access can be supported. The base address can be mapped anywhere in 32-bit I/O space on a word boundary; hence, bit 0 is read-only, returning 1 when read. See Section 5, *ExCA Compatibility Registers*, for register offsets.

| Bit     | 31                                          | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|---------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | PC Card 16-bit I/F legacy-mode base address |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                                         | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 15                                          | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | PC Card 16-bit I/F legacy-mode base address |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                                         | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R   |
| Default | 0                                           | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   |

Register: **PC Card 16-bit I/F legacy-mode base address**  
Offset: 44h  
Type: Read-only, Read/Write  
Default: 0000 0001h

## 4.29 System Control Register

System-level initializations are performed through programming this doubleword register. See Table 4–7 for a complete description of the register contents.

| Bit     | 31             | 30  | 29 | 28 | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|----------------|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | System control |     |    |    |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W            | R/W | R  | R  | R/W | R/W | R/C | R/W | R   | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0              | 0   | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | 0   |
| Bit     | 15             | 14  | 13 | 12 | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | System control |     |    |    |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W            | R/W | R  | R  | R   | R   | R   | R   | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 1              | 0   | 0  | 1  | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 0   | 0   |

Register: **System control**  
 Type: Read-only, Read/Write, Read/Clear  
 Offset: 80h  
 Default: 0044 9060h

**Table 4–7. System Control Register**

| BITS  | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------|-----------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–30 | SER_STEP  | R/W  | Serialized PCI interrupt routing step. Bits 31 and 30 configure the serialized PCI interrupt stream signaling and accomplish an even distribution of interrupts signaled on the four PCI interrupt slots. Bits 31 and 30 are encoded as follows:<br>00 = <u>INTA</u> signaled in <u>INTA</u> IRQSER slots<br>01 = <u>INTA</u> signaled in <u>INTB</u> IRQSER slots<br>10 = <u>INTA</u> signaled in <u>INTC</u> IRQSER slots<br>11 = <u>INTA</u> signaled in <u>INTD</u> IRQSER slots |
| 29–28 | RSVD      | R    | Reserved. Bits 29 and 28 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 27    | OSEN      | R/W  | Internal oscillator enable.<br>0 = Internal oscillator disabled (default)<br>1 = Internal oscillator enabled.                                                                                                                                                                                                                                                                                                                                                                        |
| 26    | SMIRROUTE | R/W  | SMI interrupt routing. Bit 26 selects whether IRQ2 or CSC is signaled when a write occurs to power a PC Card socket.<br>0 = PC Card power change interrupts routed to IRQ2 (default)<br>1 = A CSC interrupt is generated on PC Card power changes.                                                                                                                                                                                                                                   |
| 25    | SMISTATUS | R/C  | SMI interrupt status. This bit is set when bit 24 (SMIENB) is set and a write occurs to set the socket power. Writing a 1 to bit 25 clears the status.<br>0 = SMI interrupt signaled (default)<br>1 = SMI interrupt not signaled                                                                                                                                                                                                                                                     |
| 24    | SMIENB    | R/W  | SMI interrupt mode enable. When bit 24 is set and a write to the socket power control occurs, the SMI interrupt signaling is enabled and generates an interrupt. This bit is shared and defaults to 0 (disabled).                                                                                                                                                                                                                                                                    |
| 23    | RSVD      | R    | Reserved. Bit 23 returns 0 when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 22    | CBRSVD    | R/W  | CardBus reserved terminals signaling. When a CardBus card is inserted and bit 22 is set, the RSVD CardBus terminals are driven low. When this bit is 0, these signals are placed in a high-impedance state.<br>0 = Place CardBus RSVD in a high-impedance state<br>1 = Drive Cardbus RSVD low (default)                                                                                                                                                                              |
| 21    | VCCPROT   | R/W  | V <sub>CC</sub> protection enable.<br>0 = V <sub>CC</sub> protection enabled for 16-bit cards (default)<br>1 = V <sub>CC</sub> protection disabled for 16-bit cards                                                                                                                                                                                                                                                                                                                  |
| 20    | REDUCEZV  | R/W  | Reduced zoomed video enable. When this bit is enabled, pins ADDR25–ADDR22 of the card interface for PC Card-16 cards are placed in the high-impedance state. This bit should not be set for normal ZV operation. This bit is encoded as:<br>0 = Reduced zoomed video disabled (default)<br>1 = Reduced zoomed video enabled                                                                                                                                                          |
| 19    | CDREQEN   | R/W  | PC/PCI DMA card enable. When bit 19 is set, the PCI1410 allows 16-bit PC Cards to request PC/PCI DMA using the <u>DREQ</u> signaling. <u>DREQ</u> is selected through the socket DMA register (offset 94h, see Section 4.35).<br>0 = Ignore <u>DREQ</u> signaling from PC Cards (default)<br>1 = Signal DMA request on <u>DREQ</u>                                                                                                                                                   |
| 18–16 | CDMACHAN  | R/W  | PC/PCI DMA channel assignment. Bits 18–16 are encoded as:<br>0–3 = 8-bit DMA channels<br>4 = Not used (default)<br>5–7 = 16-bit DMA channels                                                                                                                                                                                                                                                                                                                                         |
| 15    | MRBURSTDN | R/W  | Memory read burst enable downstream. When bit 15 is set, memory read transactions are allowed to burst downstream.<br>0 = Downstream memory read burst is disabled.<br>1 = Downstream memory read burst is enabled (default).                                                                                                                                                                                                                                                        |
| 14    | MRBURSTUP | R/W  | Memory read burst enable upstream. When bit 14 is set, the PCI1410 allows memory read transactions to burst upstream.<br>0 = Upstream memory read burst is disabled (default).<br>1 = Upstream memory read burst is enabled.                                                                                                                                                                                                                                                         |

**Table 4–7. System Control Register (Continued)**

| BITS | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                    |
|------|-------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13   | SOCACTIVE   | R    | Socket activity status. When set, bit 13 indicates access has been performed to or from a PC card and is cleared upon read of this status bit.<br>0 = No socket activity (default)<br>1 = Socket activity                                                                                                                                                                   |
| 12   | RSVD        | R    | Reserved. Bit 12 returns 1 when read.                                                                                                                                                                                                                                                                                                                                       |
| 11   | PWRSTREAM   | R    | Power stream in progress status bit. When set, bit 11 indicates that a power stream to the power switch is in progress and a powering change has been requested. This bit is cleared when the power stream is complete.<br>0 = Power stream is complete and delay has expired.<br>1 = Power stream is in progress.                                                          |
| 10   | DELAYUP     | R    | Power-up delay in progress status. When set, bit 9 indicates that a power-up stream has been sent to the power switch and proper power may not yet be stable. This bit is cleared when the power-up delay has expired.                                                                                                                                                      |
| 9    | DELAYDOWN   | R    | Power-down delay in progress status. When set, bit 10 indicates that a power-down stream has been sent to the power switch and proper power may not yet be stable. This bit is cleared when the power-down delay has expired.                                                                                                                                               |
| 8    | INTERROGATE | R    | Interrogation in progress. When set, bit 8 indicates an interrogation is in progress and clears when interrogation completes. This bit is socket dependent.<br>0 = Interrogation not in progress (default)<br>1 = Interrogation in progress                                                                                                                                 |
| 7    | AUTOPWRSWEN | R/W  | Auto power switch enable.<br>0 = Bit 5 (AUTOPWRSWEN) in ExCA power control register (ExCA offset 02h, see Section 5.3) is disabled (default).<br>1 = Bit 5 (AUTOPWRSWEN) in ExCA power control register (ExCA offset 02h, see Section 5.3) is enabled.                                                                                                                      |
| 6    | PWRSAVINGS  | R/W  | Power savings mode enable. When this bit is set, if a CB card is inserted, idle, and without a CB clock, then the applicable CB state machine will not be clocked.                                                                                                                                                                                                          |
| 5    | SUBSYSRW    | R/W  | Subsystem ID (see Section 4.27), subsystem vendor ID (see Section 4.26), ExCA identification and revision (see Section 5.1) registers read/write enable.<br>0 = Subsystem ID, subsystem vendor ID, ExCA identification and revision registers are read/write.<br>1 = Subsystem ID, subsystem vendor ID, ExCA identification and revision registers are read-only (default). |
| 4    | CB_DPAR     | R/W  | CardBus data parity <u>SERR</u> signaling enable<br>0 = CardBus data parity not signaled on <u>PCI SERR</u><br>1 = CardBus data parity signaled on <u>PCI SERR</u>                                                                                                                                                                                                          |
| 3    | CDMA_EN     | R/W  | PC/PCI DMA enable. Bit 3 enables PC/PCI DMA when set if MFUNC0–MFUNC6 are configured for centralized DMA.<br>0 = Centralized DMA disabled (default)<br>1 = Centralized DMA enabled                                                                                                                                                                                          |
| 2    | ExCAPower   | R/W  | ExCA power control bit. Enabled by selecting the 82365SL mode.<br>0 = Enables 3.3 V<br>1 = Enables 5 V                                                                                                                                                                                                                                                                      |
| 1    | KEEPCLK     | R/W  | Keep clock. This bit works with <u>PCI</u> and <u>CB CLKRUN</u> protocols.<br>0 = Allows normal functioning of both <u>CLKRUN</u> protocols (default)<br>1 = Does not allow CB clock or PCI clock to be stopped using the <u>CLKRUN</u> protocols                                                                                                                           |
| 0    | RIMUX       | R/W  | <u>RI_OUT/PME</u> multiplex enable.<br>0 = <u>RI_OUT</u> and <u>PME</u> are both routed to the <u>RI_OUT/PME</u> terminal. If both are enabled at the same time, then <u>RI_OUT</u> has precedence over <u>PME</u> .<br>1 = Only <u>PME</u> is routed to the <u>RI_OUT/PME</u> terminal.                                                                                    |

## 4.30 Multifunction Routing Register

The multifunction routing register is used to configure the MFUNC0–MFUNC6 terminals. These terminals may be configured for various functions. All multifunction terminals default to the general-purpose input configuration. This register is intended to be programmed once at power-on initialization. The default value for this register may also be loaded through a serial bus EEPROM. See Table 4–8 for a complete description of the register contents.

| Bit     | 31                    | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19  | 18  | 17  | 16  |
|---------|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name    | Multifunction routing |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R                     | R   | R   | R   | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 15                    | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | Multifunction routing |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Type    | R/W                   | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Multifunction routing**  
Offset: 8Ch  
Type: Read-only, Read/Write  
Default: 0000 0000h

**Table 4–8. Multifunction Routing Register**

| BIT   | SIGNAL | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–28 | RSVD   | R    | Bits 31–28 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 27–24 | MFUNC6 | R/W  | Multifunction terminal 6 configuration. These bits control the internal signal mapped to the MFUNC6 terminal as follows:<br>0000 = RSVD      0100 = IRQ4      1000 = IRQ8      1100 = IRQ12<br>0001 = CLKRUN    0101 = IRQ5      1001 = IRQ9      1101 = IRQ13<br>0010 = IRQ2      0110 = IRQ6      1010 = IRQ10     1110 = IRQ14<br>0011 = IRQ3      0111 = IRQ7      1011 = IRQ11     1111 = IRQ15                                                                                                                                                                                                               |
| 23–20 | MFUNC5 | R/W  | Multifunction terminal 5 configuration. These bits control the internal signal mapped to the MFUNC5 terminal as follows:<br>0000 = GPI4      0100 = IRQ4      1000 = CAUDPWM    1100 = LED_SKT<br>0001 = GPO4      0101 = RSVD      1001 = IRQ9      1101 = LED_SKT<br>0010 = PCGNT     0110 = ZVSTAT    1010 = IRQ10     1110 = GPE<br>0011 = IRQ3      0111 = ZVSEL0    1011 = IRQ11     1111 = IRQ15                                                                                                                                                                                                            |
| 19–16 | MFUNC4 | R/W  | Multifunction terminal 4 configuration. These bits control the internal signal mapped to the MFUNC4 terminal as follows:<br>NOTE: When the serial bus mode is implemented by pulling up the $\overline{\text{VCCD0}}$ and $\overline{\text{VCCD1}}$ terminals, the MFUNC4 terminal provides the SCL signaling.<br>0000 = GPI3      0100 = IRQ4      1000 = CAUDPWM    1100 = $\overline{\text{RI\_OUT}}$<br>0001 = GPO3      0101 = IRQ5      1001 = IRQ9      1101 = LED_SKT<br>0010 = LOCK PCI   0110 = ZVSTAT    1010 = IRQ10     1110 = GPE<br>0011 = IRQ3      0111 = ZVSEL0    1011 = IRQ11     1111 = IRQ15 |
| 15–12 | MFUNC3 | R/W  | Multifunction terminal 3 configuration. These bits control the internal signal mapped to the MFUNC3 terminal as follows:<br>0000 = RSVD      0100 = IRQ4      1000 = IRQ8      1100 = IRQ12<br>0001 = IRQSER    0101 = IRQ5      1001 = IRQ9      1101 = IRQ13<br>0010 = IRQ2      0110 = IRQ6      1010 = IRQ10     1110 = IRQ14<br>0011 = IRQ3      0111 = IRQ7      1011 = IRQ11     1111 = IRQ15                                                                                                                                                                                                               |
| 11–8  | MFUNC2 | R/W  | Multifunction terminal 2 configuration. These bits control the internal signal mapped to the MFUNC2 terminal as follows:<br>0000 = GPI2      0100 = IRQ4      1000 = CAUDPWM    1100 = $\overline{\text{RI\_OUT}}$<br>0001 = GPO2      0101 = IRQ5      1001 = IRQ9      1101 = RSVD<br>0010 = PCREQ     0110 = ZVSTAT    1010 = IRQ10     1110 = GPE<br>0011 = IRQ3      0111 = ZVSEL0    1011 = IRQ11     1111 = IRQ7                                                                                                                                                                                            |

**Table 4–8. Multifunction Routing Register (Continued)**

| BITS        | SIGNAL        | TYPE           | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
|-------------|---------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|----------------|----------------|-------------|-------------|-------------|--------------|-------------|---------------|--------------|------------|-------------|---------------|--------------|--------------|
| 7–4         | MFUNC1        | R/W            | <p>Multifunction terminal 1 configuration. These bits control the internal signal mapped to the MFUNC1 terminal as follows:</p> <p>NOTE: When the serial bus mode is implemented by pulling up the <math>\overline{VCCD0}</math> and <math>\overline{VCCD1}</math> terminals, the MFUNC1 terminal provides the SDA signaling.</p> <table> <tr> <td>0000 = GPI1</td><td>0100 = IRQ4</td><td>1000 = CAUDPWM</td><td>1100 = LED_SKT</td></tr> <tr> <td>0001 = GPO1</td><td>0101 = IRQ5</td><td>1001 = IRQ9</td><td>1101 = IRQ13</td></tr> <tr> <td>0010 = RSVD</td><td>0110 = ZVSTAT</td><td>1010 = IRQ10</td><td>1110 = GPE</td></tr> <tr> <td>0011 = IRQ3</td><td>0111 = ZVSEL0</td><td>1011 = IRQ11</td><td>1111 = IRQ15</td></tr> </table> | 0000 = GPI1 | 0100 = IRQ4 | 1000 = CAUDPWM | 1100 = LED_SKT | 0001 = GPO1 | 0101 = IRQ5 | 1001 = IRQ9 | 1101 = IRQ13 | 0010 = RSVD | 0110 = ZVSTAT | 1010 = IRQ10 | 1110 = GPE | 0011 = IRQ3 | 0111 = ZVSEL0 | 1011 = IRQ11 | 1111 = IRQ15 |
| 0000 = GPI1 | 0100 = IRQ4   | 1000 = CAUDPWM | 1100 = LED_SKT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 0001 = GPO1 | 0101 = IRQ5   | 1001 = IRQ9    | 1101 = IRQ13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 0010 = RSVD | 0110 = ZVSTAT | 1010 = IRQ10   | 1110 = GPE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 0011 = IRQ3 | 0111 = ZVSEL0 | 1011 = IRQ11   | 1111 = IRQ15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 3–0         | MFUNC0        | R/W            | <p>Multifunction terminal 0 configuration. These bits control the internal signal mapped to the MFUNC0 terminal as follows:</p> <table> <tr> <td>0000 = GPIO</td><td>0100 = IRQ4</td><td>1000 = CAUDPWM</td><td>1100 = LED_SKT</td></tr> <tr> <td>0001 = GPO0</td><td>0101 = IRQ5</td><td>1001 = IRQ9</td><td>1101 = IRQ13</td></tr> <tr> <td>0010 = INTA</td><td>0110 = ZVSTAT</td><td>1010 = IRQ10</td><td>1110 = GPE</td></tr> <tr> <td>0011 = IRQ3</td><td>0111 = ZVSEL0</td><td>1011 = IRQ11</td><td>1111 = IRQ15</td></tr> </table>                                                                                                                                                                                                   | 0000 = GPIO | 0100 = IRQ4 | 1000 = CAUDPWM | 1100 = LED_SKT | 0001 = GPO0 | 0101 = IRQ5 | 1001 = IRQ9 | 1101 = IRQ13 | 0010 = INTA | 0110 = ZVSTAT | 1010 = IRQ10 | 1110 = GPE | 0011 = IRQ3 | 0111 = ZVSEL0 | 1011 = IRQ11 | 1111 = IRQ15 |
| 0000 = GPIO | 0100 = IRQ4   | 1000 = CAUDPWM | 1100 = LED_SKT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 0001 = GPO0 | 0101 = IRQ5   | 1001 = IRQ9    | 1101 = IRQ13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 0010 = INTA | 0110 = ZVSTAT | 1010 = IRQ10   | 1110 = GPE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |
| 0011 = IRQ3 | 0111 = ZVSEL0 | 1011 = IRQ11   | 1111 = IRQ15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |             |                |                |             |             |             |              |             |               |              |            |             |               |              |              |

### 4.31 Retry Status Register

The retry status register enables the retry timeout counters and displays the retry expiration status. The flags are set when the PCI1410 retries a PCI or CardBus master request and the master does not return within  $2^{15}$  PCI clock cycles. The flags are cleared by writing a 1 to the bit. These bits are expected to be incorporated into the PCI command, PCI status, and bridge control registers by the PCI SIG. See Table 4–9 for a complete description of the register contents.

| Bit     | 7            | 6   | 5 | 4 | 3   | 2 | 1   | 0 |
|---------|--------------|-----|---|---|-----|---|-----|---|
| Name    | Retry status |     |   |   |     |   |     |   |
| Type    | R/W          | R/W | R | R | R/C | R | R/C | R |
| Default | 1            | 1   | 0 | 0 | 0   | 0 | 0   | 0 |

Register: **Retry status**  
Offset: 90h  
Type: Read-only, Read/Write, Read/Clear  
Default: C0h

**Table 4–9. Retry Status Register**

| BITS | SIGNAL   | TYPE | FUNCTION                                                                                                                                                    |
|------|----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7    | PCIRETRY | R/W  | <p>PCI retry timeout counter enable. Bit 7 is encoded:</p> <p>0 = PCI retry counter disabled</p> <p>1 = PCI retry counter enabled (default)</p>             |
| 6    | CBRETRY  | R/W  | <p>CardBus retry timeout counter enable. Bit 6 is encoded:</p> <p>0 = CardBus retry counter disabled</p> <p>1 = CardBus retry counter enabled (default)</p> |
| 5–4  | RSVD     | R    | Reserved. Bits 5 and 4 return 0s when read.                                                                                                                 |
| 3    | TEXP_CB  | R/C  | <p>CardBus target retry expired. Write a 1 to clear bit 3.</p> <p>0 = Inactive (default)</p> <p>1 = Retry has expired.</p>                                  |
| 2    | RSVD     | R    | Reserved. Bit 2 returns 0 when read.                                                                                                                        |
| 1    | TEXP_PCI | R/C  | <p>PCI target retry expired. Write a 1 to clear bit 1.</p> <p>0 = Inactive (default)</p> <p>1 = Retry has expired.</p>                                      |
| 0    | RSVD     | R    | Reserved. Bit 0 returns 0 when read.                                                                                                                        |

## 4.32 Card Control Register

The card control register is provided for PCI1130 compatibility.  $\overline{\text{RI\_OUT}}$  is enabled through this register. See Table 4–10 for a complete description of the register contents.

| Bit     | 7            | 6   | 5   | 4 | 3 | 2   | 1   | 0   |
|---------|--------------|-----|-----|---|---|-----|-----|-----|
| Name    | Card control |     |     |   |   |     |     |     |
| Type    | R/W          | R/W | R/W | R | R | R/W | R/W | R/C |
| Default | 0            | 0   | 0   | 0 | 0 | 0   | 0   | 0   |

Register: **Card control**  
 Offset: 91h  
 Type: Read-only, Read/Write, Read/Clear  
 Default: 00h

**Table 4–10. Card Control Register**

| BIT | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                         |
|-----|-------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | RIENB       | R/W  | Ring indicate output enable.<br>0 = Disables any routing of $\overline{\text{RI\_OUT}}$ signal (default).<br>1 = Enables $\overline{\text{RI\_OUT}}$ signal for routing to the $\overline{\text{RI\_OUT}}$ /PME terminal, when bit 0 (RIMUX) in the system control register (see Section 4.29) is set to 0, and for routing to MFUNC2 or MFUNC4. |
| 6   | ZVENABLE    | R/W  | Compatibility ZV mode enable. When set, the PC Card socket interface ZV terminals enter a high-impedance state. This bit defaults to 0.                                                                                                                                                                                                          |
| 5   | No function | R/W  | This bit has no assigned function.                                                                                                                                                                                                                                                                                                               |
| 4–3 | RSVD        | R    | Reserved. Bits 4 and 3 return 0 when read.                                                                                                                                                                                                                                                                                                       |
| 2   | AUD2MUX     | R/W  | CardBus audio-to-IRQMUX. When set, the CAUDIO CardBus signal is routed to the corresponding multifunction terminal which may be configured for CAUDPWM.                                                                                                                                                                                          |
| 1   | SPKROUTEN   | R/W  | Speaker out enable. When bit 1 is set, $\overline{\text{SPKR}}$ on the PC Card is enabled and is routed to SPKROUT. The SPKROUT terminal drives data only when the socket SPKROUTEN bit is set. This bit is encoded as:<br>0 = $\overline{\text{SPKR}}$ to SPKROUT not enabled (default)<br>1 = $\overline{\text{SPKR}}$ to SPKROUT enabled      |
| 0   | IFG         | R/C  | Interrupt flag. Bit 0 is the interrupt flag for 16-bit I/O PC Cards and for CardBus cards. Bit 0 is set when a functional interrupt is signaled from a PC Card interface. Write back a 1 to clear this bit.<br>0 = No PC Card functional interrupt detected (default).<br>1 = PC Card functional interrupt detected.                             |

### 4.33 Device Control Register

The device control register is provided for PCI1130 compatibility. The interrupt mode select and the socket-capable force bits are programmed through this register. See Table 4–11 for a complete description of the register contents.

| Bit     | 7              | 6   | 5   | 4 | 3   | 2   | 1   | 0   |
|---------|----------------|-----|-----|---|-----|-----|-----|-----|
| Name    | Device control |     |     |   |     |     |     |     |
| Type    | R/W            | R/W | R/W | R | R/W | R/W | R/W | R/W |
| Default | 0              | 1   | 1   | 0 | 0   | 1   | 1   | 0   |

Register: **Device control**  
 Offset: 92h  
 Type: Read-only, Read/Write  
 Default: 66h

**Table 4–11. Device Control Register**

| BIT | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                          |
|-----|-------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | SKTPWR_LOCK | R/W  | Socket power lock bit. When this bit is set to 1, software will not be able to power down the PC Card socket while in D3. This may be necessary to support wake on LAN or RING if the operating system is programmed to power down a socket when the CardBus controller is placed in the D3 state.                                |
| 6   | 3VCAPABLE   | R/W  | 3-V socket capable force<br>0 = Not 3-V capable<br>1 = 3-V capable (default)                                                                                                                                                                                                                                                      |
| 5   | IO16V2      | R/W  | Diagnostic bit. This bit defaults to 1.                                                                                                                                                                                                                                                                                           |
| 4   | RSVD        | R    | Reserved. Bit 4 returns 0 when read.                                                                                                                                                                                                                                                                                              |
| 3   | TEST        | R/W  | TI test. Only a 0 should be written to bit 3.                                                                                                                                                                                                                                                                                     |
| 2–1 | INTMODE     | R/W  | Interrupt signaling mode. Bits 2 and 1 select the interrupt signaling mode. The interrupt signaling mode bits are encoded:<br>00 = Parallel PCI interrupts only<br>01 = Parallel IRQ and parallel PCI interrupts<br>10 = IRQ serialized interrupts and parallel PCI interrupt<br>11 = IRQ and PCI serialized interrupts (default) |
| 0   | RSVD        | R/W  | Reserved. Bit 0 is reserved for test purposes. Only 0 should be written to this bit.                                                                                                                                                                                                                                              |

## 4.34 Diagnostic Register

The diagnostic register is provided for internal TI test purposes. It is a read/write register, but only 0s should be written to it. See Table 4–12 for a complete description of the register contents.

| Bit     | 7          | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Diagnostic |     |     |     |     |     |     |     |
| Type    | R/W        | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0          | 0   | 1   | 0   | 0   | 0   | 0   | 1   |

Register: **Diagnostic**  
 Offset: 93h  
 Type: Read/Write  
 Default: 21h

**Table 4–12. Diagnostic Register**

| BIT | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                               |
|-----|----------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | TRUE_VAL | R/W  | This bit defaults to 0. This bit is encoded as:<br>0 = Reads true values in PCI vendor ID and PCI device ID registers (default)<br>1 = Reads all 1s in the PCI vendor ID and PCI device ID registers                                                                   |
| 6   | RSVD     | R/W  | Reserved. Bit 6 returns 0 when read.                                                                                                                                                                                                                                   |
| 5   | CSC      | R/W  | CSC interrupt routing control<br>0 = CSC interrupts routed to PCI if ExCA 803 (see Section 5.4) bit 4 = 1<br>1 = CSC interrupts routed to PCI if ExCA 805 (see Section 5.6) bits 7–4 = 0000b (default)<br>In this case, the setting of ExCA 803 bit 4 is a don't care. |
| 4   | DIAG4    | R/W  | Diagnostic RETRY_DIS. Delayed transaction disable.                                                                                                                                                                                                                     |
| 3   | DIAG3    | R/W  | Diagnostic RETRY_EXT. Extends the latency from 16 to 64.                                                                                                                                                                                                               |
| 2   | DIAG2    | R/W  | Diagnostic DISCARD_TIM_SEL_CB. Set = $2^{10}$ , reset = $2^{15}$ .                                                                                                                                                                                                     |
| 1   | DIAG1    | R/W  | Diagnostic DISCARD_TIM_SEL_PCI. Set = $2^{10}$ , reset = $2^{15}$ .                                                                                                                                                                                                    |
| 0   | ASYNCINT | R/W  | Asynchronous interrupt enable.<br>0 = CSC interrupt is not generated asynchronously<br>1 = CSC interrupt is generated asynchronously (default)                                                                                                                         |

## 4.35 Socket DMA Register 0

The socket DMA register 0 provides control over the PC Card DMA request ( $\overline{\text{DREQ}}$ ) signaling. See Table 4–13 for a complete description of the register contents.

| Bit     | 31                    | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17  | 16  |
|---------|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|
| Name    | Socket DMA register 0 |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |
| Type    | R                     | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R   | R   |
| Default | 0                     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   |
| Bit     | 15                    | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1   | 0   |
| Name    | Socket DMA register 0 |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |
| Type    | R                     | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R/W | R/W |
| Default | 0                     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   |

Register: **Socket DMA register 0**  
 Offset: 94h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

**Table 4–13. Socket DMA Register 0**

| BITS | SIGNAL  | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------|---------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–2 | RSVD    | R    | Reserved. Bits 31–2 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1–0  | DREQPIN | R/W  | DMA request ( $\overline{\text{DREQ}}$ ). Bits 1 and 0 indicate which pin on the 16-bit PC Card interface acts as $\overline{\text{DREQ}}$ during DMA transfers. This field is encoded as:<br>00 = Socket not configured for DMA (default).<br>01 = $\overline{\text{DREQ}}$ uses $\overline{\text{SPKR}}$ .<br>10 = $\overline{\text{DREQ}}$ uses $\overline{\text{IOIS16}}$ .<br>11 = $\overline{\text{DREQ}}$ uses $\overline{\text{INPACK}}$ . |

## 4.36 Socket DMA Register 1

The socket DMA register 1 provides control over the distributed DMA (DDMA) registers and the PCI portion of DMA transfers. The DMA base address locates the DDMA registers in a 16-byte region within the first 64K bytes of PCI I/O address space. See Table 4–14 for a complete description of the register contents.

**NOTE:**32-bit transfers are not supported; the maximum transfer possible for 16-bit PC Cards is 16 bits.

| Bit     | 31                    | 30  | 29  | 28  | 27  | 26  | 25  | 24  | 23  | 22  | 21  | 20  | 19 | 18  | 17  | 16  |
|---------|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|
| Name    | Socket DMA register 1 |     |     |     |     |     |     |     |     |     |     |     |    |     |     |     |
| Type    | R                     | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R   | R  | R   | R   | R   |
| Default | 0                     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0   | 0   | 0   |
| Bit     | 15                    | 14  | 13  | 12  | 11  | 10  | 9   | 8   | 7   | 6   | 5   | 4   | 3  | 2   | 1   | 0   |
| Name    | Socket DMA register 1 |     |     |     |     |     |     |     |     |     |     |     |    |     |     |     |
| Type    | R/W                   | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R  | R/W | R/W | R/W |
| Default | 0                     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0  | 0   | 0   | 0   |

Register: **Socket DMA register 1**  
Offset: 98h  
Type: Read-only, Read/Write  
Default: 0000 0000h

**Table 4–14. Socket DMA Register 1**

| BITS  | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                   |
|-------|----------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–16 | RSVD     | R    | Reserved. Bits 31–16 return 0s when read.                                                                                                                                                                                                                                                                                                                                                  |
| 15–4  | DMABASE  | R/W  | DMA base address. Locates the socket's DMA registers in PCI I/O space. This field represents a 16-bit PCI I/O address. The upper 16 bits of the address are hardwired to 0, forcing this window to within the lower 64K bytes of I/O address space. The lower 4 bits are hardwired to 0 and are included in the address decode. Thus, the window is aligned to a natural 16-byte boundary. |
| 3     | EXTMODE  | R    | Extended addressing. This feature is not supported by the PCI4410 and always returns a 0.                                                                                                                                                                                                                                                                                                  |
| 2–1   | XFERSIZE | R/W  | Transfer size. Bits 2 and 1 specify the width of the DMA transfer on the PC Card interface and are encoded as:<br>00 = Transfers are 8 bits (default).<br>01 = Transfers are 16 bits.<br>10 = Reserved<br>11 = Reserved                                                                                                                                                                    |
| 0     | DDMAEN   | R/W  | DDMA registers decode enable. Enables the decoding of the distributed DMA registers based on the value of bits 15–4 (DMABASE field).<br>0 = Disabled (default)<br>1 = Enabled                                                                                                                                                                                                              |

## 4.37 Capability ID Register

The capability ID register identifies the linked list item as the register for PCI power management. The register returns 01h when read, which is the unique ID assigned by the PCI SIG for the PCI location of the capabilities pointer and the value.

| Bit     | 7             | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|---------------|---|---|---|---|---|---|---|
| Name    | Capability ID |   |   |   |   |   |   |   |
| Type    | R             | R | R | R | R | R | R | R |
| Default | 0             | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Register: **Capability ID**  
Offset: A0h  
Type: Read-only  
Default: 01h

## 4.38 Next-Item Pointer Register

The next-item pointer register indicates the next item in the linked list of the PCI power management capabilities. Because the PCI1410 functions include only one capabilities item, this register returns 0s when read.

| Bit     | 7                 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------------|---|---|---|---|---|---|---|
| Name    | Next-item pointer |   |   |   |   |   |   |   |
| Type    | R                 | R | R | R | R | R | R | R |
| Default | 0                 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **Next-item pointer**  
Offset: A1h  
Type: Read-only  
Default: 00h

## 4.39 Power Management Capabilities Register

This register contains information on the capabilities of the PC Card function related to power management. Both PCI1410 CardBus bridge functions support D0, D1, D2, and D3 power states. See Table 4–15 for a complete description of the register contents.

| Bit     | 15                            | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------------------------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Name    | Power management capabilities |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| Type    | R/W                           | R  | R  | R  | R  | R  | R | R | R | R | R | R | R | R | R | R |
| Default | 1                             | 1  | 1  | 1  | 1  | 1  | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |

Register: **Power management capabilities**

Offset: A2h

Type: Read/Write, Read-only

Default: FE21h

**Table 4–15. Power Management Capabilities Register**

| BIT   | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------|-------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15    | PME_Support | R/W  | <p>PME support. This 5-bit field indicates the power states from which the PCI1410 device functions may assert <math>\overline{\text{PME}}</math>. A 0 (zero) for any bit indicates that the function cannot assert the <math>\overline{\text{PME}}</math> signal while in that power state. These five bits return 11111b when read. Each of these bits is described below:</p> <p>Bit 15 defaults to the value 1 indicating that the <math>\overline{\text{PME}}</math> signal can be asserted from the D3<sub>cold</sub> state. This bit is R/W because wake-up support from D3<sub>cold</sub> is contingent on the system providing an auxiliary power source to the V<sub>CC</sub> terminals. If the system designer chooses not to provide an auxiliary power source to the V<sub>CC</sub> terminals for D3<sub>cold</sub> wake-up support, then BIOS should write a 0 to this bit.</p> <p>Bit 14 contains the value 1, indicating that the <math>\overline{\text{PME}}</math> signal can be asserted from D3<sub>hot</sub> state.</p> <p>Bit 13 contains the value 1, indicating that the <math>\overline{\text{PME}}</math> signal can be asserted from D2 state.</p> <p>Bit 12 contains the value 1, indicating that the <math>\overline{\text{PME}}</math> signal can be asserted from D1 state.</p> <p>Bit 11 contains the value 1, indicating that the <math>\overline{\text{PME}}</math> signal can be asserted from the D0 state.</p> |
| 14–11 | PME_Support | R    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 10    | D2_Support  | R    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 9     | D1_Support  | R    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 8–6   | RSVD        | R    | Reserved. Bits 8–6 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 5     | DSI         | R    | Device-specific initialization. Bit 5 returns 1 when read, indicating that the CardBus controller function requires special initialization (beyond the standard PCI configuration header) before the generic class device driver is able to use it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 4     | AUX_PWR     | R    | Auxiliary power source. Bit 4 is meaningful only if bit 15 (PME_Support, D3 <sub>cold</sub> ) is set. When bit 4 is set, it indicates that support for $\overline{\text{PME}}$ in D3 <sub>cold</sub> requires auxiliary power supplied by the system by way of a proprietary delivery vehicle. When bit 4 is 0, it indicates that the function supplies its own auxiliary power source.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 3     | PMECLK      | R    | $\overline{\text{PME}}$ clock. Bit 3 returns 0 when read, indicating that no host bus clock is required for the PCI1410 to generate $\overline{\text{PME}}$ .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 2–0   | VERSION     | R    | Version. Bits 2–0 return 001b when read, indicating that there are four bytes of general-purpose power management (PM) registers as described in the <i>PCI Bus Power Management Interface Specification</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 4.40 Power Management Control/Status Register

The power management control/status register determines and changes the current power state of the PCI1410 CardBus function. The contents of this register are not affected by the internally-generated reset caused by the transition from D3<sub>hot</sub> to D0 state. All PCI, ExCA, and CardBus registers are reset as a result of a D3<sub>hot</sub> to D0 state transition. TI-specific registers, PCI power management registers, and the legacy base address register are not reset. See Table 4–16 for a complete description of the register contents.

| Bit     | 15                              | 14 | 13 | 12 | 11 | 10 | 9 | 8   | 7 | 6 | 5 | 4 | 3 | 2 | 1   | 0   |
|---------|---------------------------------|----|----|----|----|----|---|-----|---|---|---|---|---|---|-----|-----|
| Name    | Power management control/status |    |    |    |    |    |   |     |   |   |   |   |   |   |     |     |
| Type    | R/C                             | R  | R  | R  | R  | R  | R | R/W | R | R | R | R | R | R | R/W | R/W |
| Default | 0                               | 0  | 0  | 0  | 0  | 0  | 0 | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 0   | 0   |

Register: **Power management control/status**  
 Offset: A4h  
 Type: Read-only, Read/Write, Read/Write to Clear  
 Default: 0000h

**Table 4–16. Power Management Control/Status Register**

| BITS  | SIGNAL          | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                         |
|-------|-----------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15    | PMESTAT         | R/C  | $\overline{\text{PME}}$ status. Bit 15 is set when the CardBus function would normally assert $\overline{\text{PME}}$ , independent of the state of bit 8 (PME_EN). Bit 15 is cleared by a write back of 1, and this also clears the $\overline{\text{PME}}$ signal if PME was asserted by this function. Writing a 0 to this bit has no effect. |
| 14–13 | DATASCALE       | R    | Data scale. This 2-bit field returns 0s when read. The CardBus function does not return any dynamic data as indicated by bit 4 (DYN_DATA_PME_EN).                                                                                                                                                                                                |
| 12–9  | DATASEL         | R    | Data select. This 4-bit field returns 0s when read. The CardBus function does not return any dynamic data as indicated by bit 4 (DYN_DATA_PME_EN).                                                                                                                                                                                               |
| 8     | PME_EN          | R/W  | $\overline{\text{PME}}$ enable. Bit 8 enables the function to assert $\overline{\text{PME}}$ . If this bit is cleared, then assertion of $\overline{\text{PME}}$ is disabled.                                                                                                                                                                    |
| 7–5   | RSVD            | R    | Reserved. Bits 7–5 return 0s when read.                                                                                                                                                                                                                                                                                                          |
| 4     | DYN_DATA_PME_EN | R    | Dynamic data $\overline{\text{PME}}$ enable. Bit 4 returns 0 when read since the CardBus function does not report dynamic data.                                                                                                                                                                                                                  |
| 3–2   | RSVD            | R    | Reserved. Bits 3–2 return 0s when read.                                                                                                                                                                                                                                                                                                          |
| 1–0   | PWR_STATE       | R/W  | Power state. This 2-bit field is used both to determine the current power state of a function and to set the function into a new power state. This field is encoded as:<br>00 = D0<br>01 = D1<br>10 = D2<br>11 = D3 <sub>hot</sub>                                                                                                               |

## 4.41 Power Management Control/Status Bridge Support Extensions Register

The power management control/status register bridge support extensions support PCI bridge specific functionality. See Table 4–17 for a complete description of the register contents.

| Bit     | 7                                                         | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-----------------------------------------------------------|---|---|---|---|---|---|---|
| Name    | Power management control/status bridge support extensions |   |   |   |   |   |   |   |
| Type    | R                                                         | R | R | R | R | R | R | R |
| Default | 1                                                         | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **Power management control/status bridge support extensions**

Offset: A6h

Type: Read-only

Default: C0h

**Table 4–17. Power Management Control/Status Bridge Support Extensions Register**

| BIT | SIGNAL  | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----|---------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | BPCC_EN | R    | BPCC_Enable. Bus power/clock control enable. This bit returns 1 when read.<br>This bit is encoded as:<br>0 = Bus power/clock control is disabled.<br>1 = Bus power/clock control is enabled (default).<br>A 0 indicates that the bus power/clock control policies defined in the <i>PCI Bus Power Management Interface Specification</i> are disabled. When the bus power/clock control enable mechanism is disabled, the bridge power management control/status register power state field (see Section 4.40, bits 1–0) cannot be used by the system software to control the power or the clock of the bridge secondary bus. A 1 indicates that the bus power/clock control mechanism is enabled. |
| 6   | B2_B3   | R    | B2/B3 support for D3 <sub>hot</sub> . The state of this bit determines the action that is to occur as a direct result of programming the function to D3 <sub>hot</sub> . This bit is only meaningful if bit 7 (BPCC_EN) is a 1. This bit is encoded as:<br>0 = When the bridge is programmed to D3 <sub>hot</sub> , its secondary bus will have its power removed (B3).<br>1 = When the bridge function is programmed to D3 <sub>hot</sub> , its secondary bus PCI clock will be stopped (B2). (Default)                                                                                                                                                                                           |
| 5–0 | RSVD    | R    | Reserved. Bits 5–0 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## 4.42 Power Management Data Register

The power management data register returns 0s when read, since the CardBus functions do not report dynamic data.

| Bit     | 7                     | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-----------------------|---|---|---|---|---|---|---|
| Name    | Power management data |   |   |   |   |   |   |   |
| Type    | R                     | R | R | R | R | R | R | R |
| Default | 0                     | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **Power management data**

Offset: A7h

Type: Read-only

Default: 00h

## 4.43 General-Purpose Event Status Register

The general-purpose event status register contains status bits that are set when events occur that are controlled by the general-purpose control register. The bits in this register and the corresponding  $\overline{GPE}$  are cleared by writing a 1 to the corresponding bit location. The status bits in this register do not depend upon the state of a corresponding bit in the general-purpose enable register. See Table 4–18 for a complete description of the register contents.

| Bit     | 15                           | 14 | 13 | 12 | 11  | 10 | 9 | 8   | 7 | 6 | 5 | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------------|----|----|----|-----|----|---|-----|---|---|---|-----|-----|-----|-----|-----|
| Name    | General-purpose event status |    |    |    |     |    |   |     |   |   |   |     |     |     |     |     |
| Type    | R/C                          | R  | R  | R  | R/C | R  | R | R/C | R | R | R | R/C | R/C | R/C | R/C | R/C |
| Default | 0                            | 0  | 0  | 0  | 0   | 0  | 0 | 0   | 0 | 0 | 0 | 0   | 0   | 0   | 0   | 0   |

Register: **General-purpose event status**  
 Offset: A8h  
 Type: Read-only, Read/Write to Clear  
 Default: 0000h

**Table 4–18. General-Purpose Event Status Register**

| BIT   | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                      |
|-------|-----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15    | ZV_STS    | R/C  | PC card ZV status. Bit 15 is set on a change in status of bit 6 (ZVENABLE) in the card control register (offset 91h, see Section 4.32).                                       |
| 14–12 | RSVD      | R    | Reserved. Bits 14–12 return 0s when read.                                                                                                                                     |
| 11    | PWR_STS   | R/C  | Power change status. Bit 11 is set when software has changed the power state of the socket. A change in either $V_{CC}$ or $V_{PP}$ for the socket causes this bit to be set. |
| 10–9  | RSVD      | R    | Reserved. Bits 10 and 9 return 0s when read.                                                                                                                                  |
| 8     | VPP12_STS | R/C  | 12-Volt $V_{PP}$ request status. Bit 8 is set when software has changed the requested $V_{PP}$ level to or from 12 Volts for the PC Card socket.                              |
| 7–5   | RSVD      | R    | Reserved. Bits 7–5 return 0s when read.                                                                                                                                       |
| 4     | GP4_STS   | R/C  | GPI4 status. Bit 4 is set on a change in status of the MFUNC5 terminal input level.                                                                                           |
| 3     | GP3_STS   | R/C  | GPI3 status. Bit 3 is set on a change in status of the MFUNC4 terminal input level.                                                                                           |
| 2     | GP2_STS   | R/C  | GPI2 status. Bit 2 is set on a change in status of the MFUNC2 terminal input level.                                                                                           |
| 1     | GP1_STS   | R/C  | GPI1 status. Bit 1 is set on a change in status of the MFUNC1 terminal input level.                                                                                           |
| 0     | GP0_STS   | R/C  | GPI0 status. Bit 0 is set on a change in status of the MFUNC0 terminal input level.                                                                                           |

## 4.44 General-Purpose Event Enable Register

The general-purpose event enable register contains bits that are set to enable a  $\overline{\text{GPE}}$  signal. The  $\overline{\text{GPE}}$  signal is driven until the corresponding status bit is cleared and the event is serviced. The  $\overline{\text{GPE}}$  can only be signaled if one of the multifunction terminals, MFUNC6–MFUNC0, is configured for  $\overline{\text{GPE}}$  signaling. See Table 4–19 for a complete description of the register contents.

| Bit     | 15                           | 14 | 13 | 12 | 11  | 10 | 9 | 8   | 7 | 6 | 5 | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------------|----|----|----|-----|----|---|-----|---|---|---|-----|-----|-----|-----|-----|
| Name    | General-purpose event enable |    |    |    |     |    |   |     |   |   |   |     |     |     |     |     |
| Type    | R/W                          | R  | R  | R  | R/W | R  | R | R/W | R | R | R | R/W | R/W | R/W | R/W | R/W |
| Default | 0                            | 0  | 0  | 0  | 0   | 0  | 0 | 0   | 0 | 0 | 0 | 0   | 0   | 0   | 0   | 0   |

Register: **General-purpose event enable**  
Offset: AAh  
Type: Read-only, Read/Write  
Default: 0000h

**Table 4–19. General-Purpose Event Enable Register**

| BIT   | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                |
|-------|----------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15    | ZV_EN    | R/W  | PC card socket ZV enable. When bit 15 is set, a $\overline{\text{GPE}}$ is signaled on a change in status of bit 6 (ZVENABLE) in the card control register (offset 91h, see Section 4.32).              |
| 14–12 | RSVD     | R    | Reserved. Bits 14–12 return 0s when read.                                                                                                                                                               |
| 11    | PWR_EN   | R/W  | Power change enable. When bit 11 is set, a $\overline{\text{GPE}}$ is signaled when software has changed the power state of the socket.                                                                 |
| 10–9  | RSVD     | R    | Reserved. Bits 10 and 9 return 0s when read.                                                                                                                                                            |
| 8     | VPP12_EN | R/W  | 12 Volt V <sub>PP</sub> request enable. When bit 8 is set, a $\overline{\text{GPE}}$ is signaled when software has changed the requested V <sub>PP</sub> level to or from 12 Volts for the card socket. |
| 7–5   | RSVD     | R    | Reserved. Bits 7–5 return 0s when read.                                                                                                                                                                 |
| 4     | GP4_EN   | R/W  | GPI4 enable. When bit 4 is set, a $\overline{\text{GPE}}$ is signaled when there has been a change in status of the MFUNC5 terminal input level if configured as GPI4.                                  |
| 3     | GP3_EN   | R/W  | GPI3 enable. When bit 3 is set, a $\overline{\text{GPE}}$ is signaled when there has been a change in status of the MFUNC4 terminal input level if configured as GPI3.                                  |
| 2     | GP2_EN   | R/W  | GPI2 enable. When bit 2 is set, a $\overline{\text{GPE}}$ is signaled when there has been a change in status of the MFUNC2 terminal input if configured as GPI2.                                        |
| 1     | GP1_EN   | R/W  | GPI1 enable. When bit 1 is set, a $\overline{\text{GPE}}$ is signaled when there has been a change in status of the MFUNC1 terminal input if configured as GPI1.                                        |
| 0     | GP0_EN   | R/W  | GPI0 enable. When bit 0 is set, a $\overline{\text{GPE}}$ is signaled when there has been a change in status of the MFUNC0 terminal input if configured as GPI0.                                        |

## 4.45 General-Purpose Input Register

The general-purpose input register provides the logical value of the data input from the GPI terminals, MFUNC5, MFUNC4, and MFUNC2–MFUNC0. See Table 4–20 for a complete description of the register contents.

| Bit     | 15                    | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-----------------------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Name    | General-purpose input |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
| Type    | R                     | R  | R  | R  | R  | R  | R | R | R | R | R | R | R | R | R | R |
| Default | 0                     | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | X | X | X | X | X |

Register: **General-purpose input**

Offset: ACh

Type: Read-only

Default: 00XXh

**Table 4–20. General-Purpose Input Register**

| BIT  | SIGNAL    | TYPE | FUNCTION                                                                                                          |
|------|-----------|------|-------------------------------------------------------------------------------------------------------------------|
| 15–5 | RSVD      | R    | Reserved. Bits 15–5 return 0s when read.                                                                          |
| 4    | GPI4_DATA | R    | GPI4 data bit. The value read from bit 4 represents the logical value of the data input from the MFUNC5 terminal. |
| 3    | GPI3_DATA | R    | GPI3 data bit. The value read from bit 3 represents the logical value of the data input from the MFUNC4 terminal. |
| 2    | GPI2_DATA | R    | GPI2 data bit. The value read from bit 2 represents the logical value of the data input from the MFUNC2 terminal. |
| 1    | GPI1_DATA | R    | GPI1 data bit. The value read from bit 1 represents the logical value of the data input from the MFUNC1 terminal. |
| 0    | GPI0_DATA | R    | GPI0 data bit. The value read from bit 0 represents the logical value of the data input from the MFUNC0 terminal. |

## 4.46 General-Purpose Output Register

The general-purpose output register is used for control of the general-purpose outputs. See Table 4–21 for a complete description of the register contents.

| Bit     | 15                     | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------|----|----|----|----|----|---|---|---|---|---|-----|-----|-----|-----|-----|
| Name    | General-purpose output |    |    |    |    |    |   |   |   |   |   |     |     |     |     |     |
| Type    | R                      | R  | R  | R  | R  | R  | R | R | R | R | R | R/W | R/W | R/W | R/W | R/W |
| Default | 0                      | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0   | 0   | 0   | 0   | 0   |

Register: **General-purpose output**  
Offset: AEh  
Type: Read-only, Read/Write  
Default: 0000h

**Table 4–21. General-Purpose Output Register**

| BIT  | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                      |
|------|-----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15–5 | RSVD      | R    | Reserved. Bits 15–5 return 0s when read.                                                                                                                                                      |
| 4    | GPO4_DATA | R/W  | GPO4 data bit. The value written to bit 4 represents the logical value of the data driven to the MFUNC5 terminal if configured as GPO4. Read transactions return the last data value written. |
| 3    | GPO3_DATA | R/W  | GPO3 data bit. The value written to bit 3 represents the logical value of the data driven to the MFUNC4 terminal if configured as GPO3. Read transactions return the last data value written. |
| 2    | GPO2_DATA | R/W  | GPO2 data bit. The value written to bit 2 represents the logical value of the data driven to the MFUNC2 terminal if configured as GPO2. Read transactions return the last data value written. |
| 1    | GPO1_DATA | R/W  | GPO1 data bit. The value written to bit 1 represents the logical value of the data driven to the MFUNC1 terminal if configured as GPO1. Read transactions return the last data value written. |
| 0    | GPO0_DATA | R/W  | GPO0 data bit. The value written to bit 0 represents the logical value of the data driven to the MFUNC0 terminal if configured as GPO0. Read transactions return the last data value written. |

## 4.47 Serial Bus Data Register

The serial bus data register is for programmable serial bus byte reads and writes. This register represents the data when generating cycles on the serial bus interface. See Table 4–22 for a complete description of the register contents.

| Bit     | 7               | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-----------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Serial bus data |     |     |     |     |     |     |     |
| Type    | R/W             | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Serial bus data**  
Offset: B0h  
Type: Read/Write  
Default: 00h

**Table 4–22. Serial Bus Data Register**

| BIT | SIGNAL | TYPE | FUNCTION                                                                                                                                                                                                                                                                                               |
|-----|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–0 | SBDATA | R/W  | Serial bus data. This bit field represents the data byte in a read or write transaction on the serial interface. On reads, the REQBUSY bit (bit 5) in the serial bus control and status register (offset B3h, see Section 4.50) must be polled to verify that the contents of this register are valid. |

## 4.48 Serial Bus Index Register

The serial bus index register is for programmable serial bus byte reads and writes. This register represents the byte address when generating cycles on the serial bus interface. See Table 4–23 for a complete description of the register contents.

| Bit     | 7                | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Serial bus index |     |     |     |     |     |     |     |
| Type    | R/W              | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Serial bus index**  
 Offset: B1h  
 Type: Read/Write  
 Default: 00h

**Table 4–23. Serial Bus Index Register**

| BITS | SIGNAL  | TYPE | FUNCTION                                                                                                             |
|------|---------|------|----------------------------------------------------------------------------------------------------------------------|
| 7–0  | SBINDEX | R/W  | Serial bus index. This bit field represents the byte address in a read or write transaction on the serial interface. |

## 4.49 Serial Bus Slave Address Register

The serial bus slave address register is for programmable serial bus byte read and write transactions. See Table 4–24 for a complete description of the register contents.

| Bit     | 7                        | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|--------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | Serial bus slave address |     |     |     |     |     |     |     |
| Type    | R/W                      | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                        | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **Serial bus slave address**  
 Offset: B2h  
 Type: Read/Write  
 Default: 00h

**Table 4–24. Serial Bus Slave Address Register**

| BITS | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                          |
|------|----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–1  | SLAVADDR | R/W  | Serial bus slave address. This bit field represents the slave address of a read or write transaction on the serial interface.                                                                                                                                     |
| 0    | RWCMD    | R/W  | Read/write command. Bit 0 indicates the read/write command bit presented to the serial bus on byte read and write accesses<br>0 = A byte write access is requested to the serial bus interface<br>1 = A byte read access is requested to the serial bus interface |

## 4.50 Serial Bus Control and Status Register

The serial bus control and status register communicates serial bus status information and selects the quick command protocol. Bit 5 (REQBUSY) in this register must be polled during serial bus byte reads to indicate when data is valid in the serial bus data register. See Table 4–25 for a complete description of the register contents.

| Bit     | 7                             | 6 | 5 | 4 | 3   | 2   | 1   | 0   |
|---------|-------------------------------|---|---|---|-----|-----|-----|-----|
| Name    | Serial bus control and status |   |   |   |     |     |     |     |
| Type    | R/W                           | R | R | R | R/C | R/W | R/C | R/C |
| Default | 0                             | 0 | 0 | 0 | 0   | 0   | 0   | 0   |

Register: **Serial bus control and status**  
Offset: B3h  
Type: Read-only, Read/Write, Read/Clear  
Default: 00h

**Table 4–25. Serial Bus Control and Status Register**

| BIT | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----|----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | PROT_SEL | R/W  | Protocol select. When bit 7 is set, the send byte protocol is used on write requests and the receive byte protocol is used on read commands. The word address byte (SBINDEX) in the serial bus index register (see Section 4.48) is not output by the PCI1410 when bit 7 is set.                                                                                                                                                                                                                                            |
| 6   | RSVD     | R    | Reserved. Bit 6 returns 0 when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5   | REQBUSY  | R    | Requested serial bus access busy. Bit 5 indicates that a requested serial bus access (byte read or write) is in progress. A request is made, and bit 5 is set, by writing to the serial bus slave address register (see Section 4.49). Bit 5 must be polled on reads from the serial bus interface. After the byte read access has been requested, the read data is valid in the serial bus data register.                                                                                                                  |
| 4   | ROMBUSY  | R    | Serial EEPROM busy status. Bit 4 indicates the status of the PCI1410 serial EEPROM circuitry. Bit 4 is set during the loading of the subsystem ID and other default values from the serial bus EEPROM.<br>0 = Serial EEPROM circuitry is not busy<br>1 = Serial EEPROM circuitry is busy                                                                                                                                                                                                                                    |
| 3   | SBDETECT | R/C  | Serial bus detect. Bit 3 is set when the serial bus interface is detected through pullup resistors on the $\overline{\text{VCCD0}}$ and $\overline{\text{VCCD1}}$ terminals after reset. If bit 3 is cleared, then the MFUNC4 and MFUNC1 terminals can be used for alternate functions such as general-purpose inputs and outputs.<br>0 = Serial bus interface not detected<br>1 = Serial bus interface detected                                                                                                            |
| 2   | SBTEST   | R/W  | Serial bus test. When bit 2 is set, the serial bus clock frequency is increased for test purposes.<br>0 = Serial bus clock at normal operating frequency, $\approx 100$ kHz (default)<br>1 = Serial bus clock frequency increased for test purposes                                                                                                                                                                                                                                                                         |
| 1   | REQ_ERR  | R/C  | Requested serial bus access error. Bit 1 indicates when a data error occurs on the serial interface during a requested cycle and may be set due to a missing acknowledge. Bit 1 is cleared by a write back of 1.<br>0 = No error detected during user requested byte read or write cycle<br>1 = Data error detected during user requested byte read or write cycle                                                                                                                                                          |
| 0   | ROM_ERR  | R/C  | EEPROM data error status. Bit 0 indicates when a data error occurs on the serial bus interface during the auto-load from the serial bus EEPROM and may be set due to a missing acknowledge. Bit 0 is also set on invalid EEPROM data formats. See Section 3.6.1, <i>Serial Bus Interface Implementation</i> , for details on EEPROM data format. Bit 0 is cleared by a write back of 1.<br>0 = No error detected during auto-load from serial bus EEPROM<br>1 = Data error detected during auto-load from serial bus EEPROM |



## 5 ExCA Compatibility Registers

The ExCA registers implemented in the PCI1410 are register-compatible with the Intel 82365SL–DF PCMCIA controller. ExCA registers are identified by an offset value that is compatible with the legacy I/O index/data scheme used on the Intel 82365 ISA controller. The ExCA registers are accessed through this scheme by writing the register offset value into the index register (I/O base) and reading or writing the data register (I/O base + 1). The I/O base address used in the index/data scheme is programmed in the PC Card 16-bit I/F legacy mode base address register (offset 44h, see Section 4.28). The offsets from this base address run contiguous from 00h to 3Fh for the socket. See Figure 5–1 for an ExCA I/O mapping illustration.

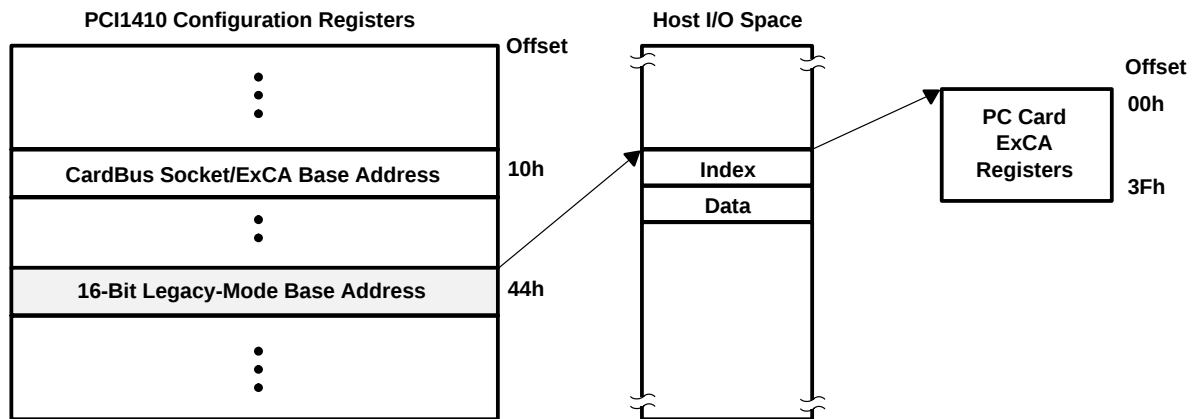


Figure 5–1. ExCA Register Access Through I/O

The TI PCI1410 also provides a memory-mapped alias of the ExCA registers by directly mapping them into PCI memory space. They are located through the CardBus socket/ExCA base address register (offset 10h, see Section 4.12) at memory offset 800h. See Figure 5–2 for an ExCA memory mapping illustration. This illustration also identifies the CardBus socket register mapping, which is mapped into the same 4K window at memory offset 0h.

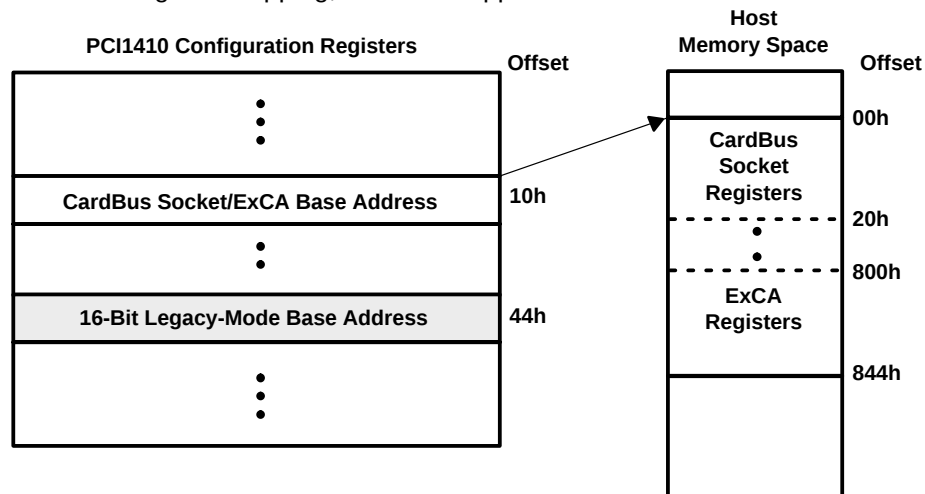


Figure 5–2. ExCA Register Access Through Memory

The interrupt registers in the ExCA register set, as defined by the 82365SL–DL specification, control such card functions as reset, type, interrupt routing, and interrupt enables. Special attention must be paid to the interrupt routing registers and the host interrupt signaling method selected for the PCI1410 to ensure that all possible PCI1410 interrupts can potentially be routed to the programmable interrupt controller. The ExCA registers that are critical to the interrupt signaling are the ExCA interrupt and general control register (ExCA offset 03h, see Section 5.4) and the ExCA card status-change-interrupt configuration register (ExCA offset 05h, see Section 5.6).

Access to I/O mapped 16-bit PC cards is available to the host system via two ExCA I/O windows. These are regions of host I/O address space into which the card I/O space is mapped. These windows are defined by start, end, and offset addresses programmed in the ExCA registers described in this section. I/O windows have byte granularity.

Access to memory mapped 16-bit PC Cards is available to the host system via five ExCA memory windows. These are regions of host memory space into which the card memory space is mapped. These windows are defined by start, end, and offset addresses programmed in the ExCA registers described in this section. Table 5–1 identifies each ExCA register and its respective ExCA offset. Memory windows have 4K-byte granularity.

**Table 5–1. ExCA Registers and Offsets**

| ExCA REGISTER NAME                         | PCI MEMORY ADDRESS<br>OFFSET (HEX) | ExCA OFFSET<br>(HEX) |
|--------------------------------------------|------------------------------------|----------------------|
| Identification and revision                | 800                                | 00                   |
| Interface status                           | 801                                | 01                   |
| Power control                              | 802                                | 02                   |
| Interrupt and general control              | 803                                | 03                   |
| Card status-change                         | 804                                | 04                   |
| Card status-change-interrupt configuration | 805                                | 05                   |
| Address window enable                      | 806                                | 06                   |
| I / O window control                       | 807                                | 07                   |
| I / O window 0 start-address low-byte      | 808                                | 08                   |
| I / O window 0 start-address high-byte     | 809                                | 09                   |
| I / O window 0 end-address low-byte        | 80A                                | 0A                   |
| I / O window 0 end-address high-byte       | 80B                                | 0B                   |
| I / O window 1 start-address low-byte      | 80C                                | 0C                   |
| I / O window 1 start-address high-byte     | 80D                                | 0D                   |
| I / O window 1 end-address low-byte        | 80E                                | 0E                   |
| I / O window 1 end-address high-byte       | 80F                                | 0F                   |
| Memory window 0 start-address low-byte     | 810                                | 10                   |
| Memory window 0 start-address high-byte    | 811                                | 11                   |
| Memory window 0 end-address low-byte       | 812                                | 12                   |
| Memory window 0 end-address high-byte      | 813                                | 13                   |
| Memory window 0 offset-address low-byte    | 814                                | 14                   |
| Memory window 0 offset-address high-byte   | 815                                | 15                   |
| Card detect and general control            | 816                                | 16                   |
| Reserved                                   | 817                                | 17                   |
| Memory window 1 start-address low-byte     | 818                                | 18                   |
| Memory window 1 start-address high-byte    | 819                                | 19                   |
| Memory window 1 end-address low-byte       | 81A                                | 1A                   |
| Memory window 1 end-address high-byte      | 81B                                | 1B                   |
| Memory window 1 offset-address low-byte    | 81C                                | 1C                   |
| Memory window 1 offset-address high-byte   | 81D                                | 1D                   |

**Table 5–1. ExCA Registers and Offsets (Continued)**

| ExCA REGISTER NAME                       | PCI MEMORY ADDRESS<br>OFFSET (HEX) | ExCA OFFSET<br>(HEX) |
|------------------------------------------|------------------------------------|----------------------|
| Global control                           | 81E                                | 1E                   |
| Reserved                                 | 81F                                | 1F                   |
| Memory window 2 start-address low-byte   | 820                                | 20                   |
| Memory window 2 start-address high-byte  | 821                                | 21                   |
| Memory window 2 end-address low-byte     | 822                                | 22                   |
| Memory window 2 end-address high-byte    | 823                                | 23                   |
| Memory window 2 offset-address low-byte  | 824                                | 24                   |
| Memory window 2 offset-address high-byte | 825                                | 25                   |
| Reserved                                 | 826                                | 26                   |
| Reserved                                 | 827                                | 27                   |
| Memory window 3 start-address low-byte   | 828                                | 28                   |
| Memory window 3 start-address high-byte  | 829                                | 29                   |
| Memory window 3 end-address low-byte     | 82A                                | 2A                   |
| Memory window 3 end-address high-byte    | 82B                                | 2B                   |
| Memory window 3 offset-address low-byte  | 82C                                | 2C                   |
| Memory window 3 offset-address high-byte | 82D                                | 2D                   |
| Reserved                                 | 82E                                | 2E                   |
| Reserved                                 | 82F                                | 2F                   |
| Memory window 4 start-address low-byte   | 830                                | 30                   |
| Memory window 4 start-address high-byte  | 831                                | 31                   |
| Memory window 4 end-address low-byte     | 832                                | 32                   |
| Memory window 4 end-address high-byte    | 833                                | 33                   |
| Memory window 4 offset-address low-byte  | 834                                | 34                   |
| Memory window 4 offset-address high-byte | 835                                | 35                   |
| I/O window 0 offset-address low-byte     | 836                                | 36                   |
| I/O window 0 offset-address high-byte    | 837                                | 37                   |
| I/O window 1 offset-address low-byte     | 838                                | 38                   |
| I/O window 1 offset-address high-byte    | 839                                | 39                   |
| Reserved                                 | 83A                                | 3A                   |
| Reserved                                 | 83B                                | 3B                   |
| Reserved                                 | 83C                                | 3C                   |
| Reserved                                 | 83D                                | 3D                   |
| Reserved                                 | 83E                                | 3E                   |
| Reserved                                 | 83F                                | 3F                   |
| Memory window 0 page                     | 840                                | –                    |
| Memory window 1 page                     | 841                                | –                    |
| Memory window 2 page                     | 842                                | –                    |
| Memory window 3 page                     | 843                                | –                    |
| Memory window 4 page                     | 844                                | –                    |

## 5.1 ExCA Identification and Revision Register

The ExCA identification and revision register provides host software with information on 16-bit PC Card support and Intel 82365SL-DF compatibility. This register is read-only or read/write, depending on the setting of bit 5 (SUBSYSRW) in the system control register (see Section 4.29). See Table 5–2 for a complete description of the register contents.

| Bit     | 7                                | 6 | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|----------------------------------|---|-----|-----|-----|-----|-----|-----|
| Name    | ExCA identification and revision |   |     |     |     |     |     |     |
| Type    | R                                | R | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 1                                | 0 | 0   | 0   | 0   | 1   | 0   | 0   |

Register: **ExCA identification and revision**  
 Offset: CardBus socket address + 800h; ExCA offset 00h  
 Type: Read-only, Read/Write  
 Default: 84h

**Table 5–2. ExCA Identification and Revision Register**

| BITS | SIGNAL | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                  |
|------|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–6  | IFTYPE | R    | Interface type. These bits, which are hardwired as 10b, identify the 16-bit PC Card support provided by the PCI1410. The PCI1410 supports both I/O and memory 16-bit PC cards.                                                                                                                                            |
| 5–4  | RSVD   | R/W  | Reserved. Bits 5 and 4 can be used for Intel 82365SL-DF emulation.                                                                                                                                                                                                                                                        |
| 3–0  | 365REV | R/W  | Intel 82365SL-DF revision. This field stores the Intel 82365SL-DF revision supported by the PCI1410. Host software can read this field to determine compatibility to the Intel 82365SL-DF register set. Writing 0010b to this field puts the controller in 82365SL mode. This field defaults to 0100b upon PCI1410 reset. |

## 5.2 ExCA Interface Status Register

The ExCA interface status register provides information on the current status of the PC Card interface. An X in the default bit value indicates that the value of the bit after reset depends on the state of the PC Card interface. See Table 5–3 for a complete description of the register contents.

| Bit     | 7                     | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-----------------------|---|---|---|---|---|---|---|
| Name    | ExCA interface status |   |   |   |   |   |   |   |
| Type    | R                     | R | R | R | R | R | R | R |
| Default | 0                     | 0 | X | X | X | X | X | X |

Register: **ExCA interface status**  
Offset: CardBus socket address + 801h; ExCA offset 01h  
Type: Read-only  
Default: 00XX XXXXb

**Table 5–3. ExCA Interface Status Register**

| BIT | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----|----------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | RSVD     | R    | Reserved. Bit 7 returns 0 when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 6   | CARDPWR  | R    | Card Power. Bit 6 indicates the current power status of the PC Card socket. This bit reflects how the ExCA power control register (ExCA offset 02h, see Section 5.3) is programmed. Bit 6 is encoded as:<br>0 = $V_{CC}$ and $V_{PP}$ to the socket turned off (default)<br>1 = $V_{CC}$ and $V_{PP}$ to the socket turned on                                                                                                                                                                                                                                                                             |
| 5   | READY    | R    | Ready. Bit 5 indicates the current status of the READY signal at the PC Card interface.<br>0 = PC Card not ready for data transfer<br>1 = PC Card ready for data transfer                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 4   | CARDWP   | R    | Card write protect. Bit 4 indicates the current status of WP at the PC Card interface. This signal reports to the PCI1410 whether or not the memory card is write protected. Furthermore, write protection for an entire PCI1410 16-bit memory window is available by setting the appropriate bit in the ExCA memory window offset-address high-byte register (see Section 5.18).<br>0 = WP is 0. PC Card is read/write.<br>1 = WP is 1. PC Card is read-only.                                                                                                                                            |
| 3   | CDETECT2 | R    | Card detect 2. Bit 3 indicates the status of $\overline{CD2}$ at the PC Card interface. Software may use this and bit 2 (CDETECT1) to determine if a PC Card is fully seated in the socket.<br>0 = $\overline{CD2}$ is 1. No PC Card is inserted.<br>1 = $\overline{CD2}$ is 0. PC Card is at least partially inserted.                                                                                                                                                                                                                                                                                   |
| 2   | CDETECT1 | R    | Card detect 1. Bit 2 indicates the status of $\overline{CD1}$ at the PC Card interface. Software may use this and bit 3 (CDETECT2) to determine if a PC Card is fully seated in the socket.<br>0 = $\overline{CD1}$ is 1. No PC Card is inserted.<br>1 = $\overline{CD1}$ is 0. PC Card is at least partially inserted.                                                                                                                                                                                                                                                                                   |
| 1–0 | BVDSTAT  | R    | Battery voltage detect. When a 16-bit memory card is inserted, the field indicates the status of the battery voltage detect signals (BVD1, BVD2) at the PC Card interface, where bit 1 reflects the BVD2 status and bit 0 reflects BVD1.<br>00 = Battery dead<br>01 = Battery dead<br>10 = Battery low; warning<br>11 = Battery good<br><br>When a 16-bit I/O card is inserted, this field indicates the status of $\overline{SPKR}$ (bit 1) and $\overline{STSCHG}$ (bit 0) at the PC Card interface. In this case, the two bits in this field directly reflect the current state of these card outputs. |

### 5.3 ExCA Power Control Register

The ExCA power control register provides PC Card power control. Bit 7 (COE) of this register controls the 16-bit output enables on the socket interface, and can be used for power management in 16-bit PC Card applications. See Table 5–4 and Table 5–5 for a complete description of the register contents.

| Bit     | 7                  | 6 | 5 | 4   | 3   | 2 | 1   | 0   |
|---------|--------------------|---|---|-----|-----|---|-----|-----|
| Name    | ExCA power control |   |   |     |     |   |     |     |
| Type    | R/W                | R | R | R/W | R/W | R | R/W | R/W |
| Default | 0                  | 0 | 0 | 0   | 0   | 0 | 0   | 0   |

Register: **ExCA power control**  
Offset: CardBus socket address + 802h; ExCA offset 02h  
Type: Read-only, Read/Write  
Default: 00h

**Table 5–4. ExCA Power Control Register 82365SL Support**

| BIT | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                              |
|-----|-------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | COE         | R/W  | Card output enable. Bit 7 controls the state of all of the 16-bit outputs on the PCI1410. This bit is encoded as:<br>0 = 16-bit PC Card outputs disabled (default)<br>1 = 16-bit PC Card outputs enabled                                                                                              |
| 6   | RSVD        | R    | Reserved. Bit 6 returns 0 when read.                                                                                                                                                                                                                                                                  |
| 5   | AUTOPWRSWEN | R/W  | Auto power switch enable. This bit is enabled by bit 7 of the system control register (offset 80h, see Section 4.29).<br>0 = Automatic socket power switching based on card detects is disabled.<br>1 = Automatic socket power switching based on card detects is enabled.                            |
| 4   | CAPWREN     | R/W  | PC Card power enable.<br>0 = $V_{CC} = V_{PP1} = V_{PP2}$ = No connection<br>1 = $V_{CC}$ is enabled and controlled by bit 2 (ExCAPower) of the system control register (offset 80h, see Section 4.29), $V_{PP1}$ and $V_{PP2}$ are controlled according to bits 1–0 (EXCAVPP field).                 |
| 3–2 | RSVD        | R    | Reserved. Bits 3 and 2 return 0s when read.                                                                                                                                                                                                                                                           |
| 1–0 | EXCAVPP     | R/W  | PC Card $V_{PP}$ power control. Bits 1 and 0 are used to request changes to card $V_{PP}$ . The PCI1410 ignores this field unless $V_{CC}$ to the socket is enabled (that is, 5 V or 3.3 V). This field is encoded as:<br>00 = No connection (default)<br>01 = $V_{CC}$<br>10 = 12 V<br>11 = Reserved |

**Table 5–5. ExCA Power Control Register 82365SL-DF Support**

| BIT | SIGNAL  | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                          |
|-----|---------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | COE     | R/W  | Card output enable. Bit 7 controls the state of all of the 16-bit outputs on the PCI1410. This bit is encoded as:<br>0 = 16-bit PC Card outputs disabled (default)<br>1 = 16-bit PC Card outputs enabled                                                                                                                          |
| 6–5 | RSVD    | R    | Reserved. Bits 6 and 5 return 0s when read.                                                                                                                                                                                                                                                                                       |
| 4–3 | EXCAVCC | R/W  | V <sub>CC</sub> . Bits 4 and 3 are used to request changes to card V <sub>CC</sub> . This field is encoded as:<br>00 = 0 V (default)<br>01 = 0 V reserved<br>10 = 5 V<br>11 = 3.3 V                                                                                                                                               |
| 2   | RSVD    | R    | Reserved. Bit 2 returns 0 when read.                                                                                                                                                                                                                                                                                              |
| 1–0 | EXCAVPP | R/W  | PC Card V <sub>pp</sub> power control. Bits 1 and 0 are used to request changes to card V <sub>pp</sub> . The PCI1410 ignores this field unless V <sub>CC</sub> to the socket is enabled (that is, 5 V or 3.3 V). This field is encoded as:<br>00 = No connection (default)<br>01 = V <sub>CC</sub><br>10 = 12 V<br>11 = Reserved |

## 5.4 ExCA Interrupt and General Control Register

The ExCA interrupt and general control register controls interrupt routing for I/O interrupts, as well as other critical 16-bit PC Card functions. See Table 5–6 for a complete description of the register contents.

| Bit     | 7                                  | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA interrupt and general control |     |     |     |     |     |     |     |
| Type    | R/W                                | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                  | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA interrupt and general control**  
Offset: CardBus socket address + 803h; ExCA offset 03h  
Type: Read/Write  
Default: 00h

**Table 5–6. ExCA Interrupt and General Control Register**

| BIT | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|-----------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | RINGEN    | R/W  | Card ring indicate enable. Bit 7 enables the ring indicate function of BVD1/ $\overline{RI}$ . This bit is encoded as:<br>0 = Ring indicate disabled (default)<br>1 = Ring indicate enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 6   | RESET     | R/W  | Card reset. Bit 6 controls the 16-bit PC Card RESET, and allows host software to force a card reset. Bit 6 affects 16-bit cards only. This bit is encoded as:<br>0 = RESET signal asserted (default)<br>1 = RESET signal deasserted                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 5   | CARDTYPE  | R/W  | Card type. Bit 5 indicates the PC Card type. This bit is encoded as:<br>0 = Memory PC Card installed (default)<br>1 = I/O PC Card installed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 4   | CSCROUTE  | R/W  | PCI interrupt CSC routing enable bit. When bit 4 is set (high), the card status change interrupts are routed to PCI interrupts. When low, the card status change interrupts are routed using bits 7–4 (CSCSELECT field) in the ExCA card status change interrupt configuration register (ExCA offset 05h, see Section 5.6). This bit is encoded as:<br>0 = CSC interrupts are routed by ExCA registers (default).<br>1 = CSC interrupts are routed to PCI interrupts.                                                                                                                                                                                                                            |
| 3–0 | INTSELECT | R/W  | Card interrupt select for I/O PC Card functional interrupts. Bits 3–0 select the interrupt routing for I/O PC Card functional interrupts. This field is encoded as:<br>0000 = No interrupt routing (default). CSC interrupts routed to PCI interrupts. This bit setting is ORed with bit 4 (CSCROUTE) for backwards compatibility.<br>0001 = IRQ1 enabled<br>0010 = SMI enabled<br>0011 = IRQ3 enabled<br>0100 = IRQ4 enabled<br>0101 = IRQ5 enabled<br>0100 = IRQ6 enabled<br>0111 = IRQ7 enabled<br>1000 = IRQ8 enabled<br>1001 = IRQ9 enabled<br>1010 = IRQ10 enabled<br>1011 = IRQ11 enabled<br>1100 = IRQ12 enabled<br>1101 = IRQ13 enabled<br>1110 = IRQ14 enabled<br>1111 = IRQ15 enabled |

## 5.5 ExCA Card Status-Change Register

The ExCA card status-change register controls interrupt routing for I/O interrupts as well as other critical 16-bit PC Card functions. The register enables these interrupt sources to generate an interrupt to the host. When the interrupt source is disabled, the corresponding bit in this register always reads 0. When an interrupt source is enabled, the corresponding bit in this register is set to indicate that the interrupt source is active. After generating the interrupt to the host, the interrupt service routine must read this register to determine the source of the interrupt. The interrupt service routine is responsible for resetting the bits in this register as well. Resetting a bit is accomplished by one of two methods: a read of this register or an explicit writeback of 1 to the status bit. The choice of these two methods is based on bit 2 (interrupt flag clear mode select) in the ExCA global control register (see Section 5.20). See Table 5–7 for a complete description of the register contents.

| Bit     | 7                       | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------------------|---|---|---|---|---|---|---|
| Name    | ExCA card status-change |   |   |   |   |   |   |   |
| Type    | R                       | R | R | R | R | R | R | R |
| Default | 0                       | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **ExCA card status-change**  
Offset: CardBus socket address + 804h; ExCA offset 04h  
Type: Read-only  
Default: 00h

**Table 5–7. ExCA Card Status-Change Register**

| BIT | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----|-------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–4 | RSVD        | R    | Reserved. Bits 7–4 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                     |
| 3   | CDCHANGE    | R    | Card detect change. Bit 3 indicates whether a change on $\overline{CD1}$ or $\overline{CD2}$ occurred at the PC Card interface. This bit is encoded as:<br>0 = No change detected on either $\overline{CD1}$ or $\overline{CD2}$<br>1 = Change detected on either $\overline{CD1}$ or $\overline{CD2}$                                                                                                                                      |
| 2   | READYCHANGE | R    | Ready change. When a 16-bit memory is installed in the socket, bit 2 includes whether the source of a PCI1410 interrupt was due to a change on READY at the PC Card interface, indicating that the PC Card is now ready to accept new data. This bit is encoded as:<br>0 = No low-to-high transition detected on READY (default)<br>1 = Detected low-to-high transition on READY<br>When a 16-bit I/O card is installed, bit 2 is always 0. |
| 1   | BATWARN     | R    | Battery warning change. When a 16-bit memory card is installed in the socket, bit 1 indicates whether the source of a PCI1410 interrupt was due to a battery-low warning condition. This bit is encoded as:<br>0 = No battery warning condition (default)<br>1 = Detected battery warning condition<br>When a 16-bit I/O card is installed, bit 1 is always 0.                                                                              |
| 0   | BATDEAD     | R    | Battery dead or status change. When a 16-bit memory card is installed in the socket, bit 0 indicates whether the source of a PCI1410 interrupt was due to a battery dead condition. This bit is encoded as:<br>0 = $\overline{STSCHG}$ deasserted (default)<br>1 = $\overline{STSCHG}$ asserted<br>Ring indicate. When the PCI1410 is configured for ring indicate operation, bit 0 indicates the status of $\overline{RI}$ .               |

## 5.6 ExCA Card Status-Change-Interrupt Configuration Register

The ExCA card status-change-interrupt configuration register controls interrupt routing for card status-change interrupts, as well as masking CSC interrupt sources. See Table 5–8 for a complete description of the register contents.

| Bit     | 7                                          | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|--------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA status-change-interrupt configuration |     |     |     |     |     |     |     |
| Type    | R/W                                        | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                          | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA card status-change-interrupt configuration**  
Offset: CardBus socket address + 805h; ExCA offset 05h  
Type: Read/Write  
Default: 00h

**Table 5–8. ExCA Card Status-Change-Interrupt Configuration Register**

| BIT                                   | SIGNAL               | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
|---------------------------------------|----------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------|---------------------|---------------------|--------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|
| 7–4                                   | CSCSELECT            | R/W  | <p>Interrupt select for card status change. Bits 7–4 select the interrupt routing for card status change interrupts.</p> <p>0000 = CSC interrupts routed to PCI interrupts if bit 5 (CSC) of the diagnostic register (offset 93h, see Section 4.34) is set to 1. In this case bit 4 (CSCROUTE) of the ExCA interrupt and general control register (ExCA offset 03h, see Section 5.4) is a don't care . This is the default setting.</p> <p>0000 = No ISA interrupt routing if bit 5 (CSC) of the diagnostic register (offset 93h, see Section 4.34) is set to 0. In this case, CSC interrupts are routed to PCI interrupts by setting bit 4 (CSCROUTE) of the ExCA interrupt and general control register to 1 (see Section 5.4).</p> <p>This field is encoded as:</p> <table><tr><td>0000 = No interrupt routing (default)</td><td>1000 = IRQ8 enabled</td></tr><tr><td>0001 = IRQ1 enabled</td><td>1001 = IRQ9 enabled</td></tr><tr><td>0010 = SMI enabled</td><td>1010 = IRQ10 enabled</td></tr><tr><td>0011 = IRQ3 enabled</td><td>1011 = IRQ11 enabled</td></tr><tr><td>0100 = IRQ4 enabled</td><td>1100 = IRQ12 enabled</td></tr><tr><td>0101 = IRQ5 enabled</td><td>1101 = IRQ13 enabled</td></tr><tr><td>0110 = IRQ6 enabled</td><td>1110 = IRQ14 enabled</td></tr><tr><td>0111 = IRQ7 enabled</td><td>1111 = IRQ15 enabled</td></tr></table> | 0000 = No interrupt routing (default) | 1000 = IRQ8 enabled | 0001 = IRQ1 enabled | 1001 = IRQ9 enabled | 0010 = SMI enabled | 1010 = IRQ10 enabled | 0011 = IRQ3 enabled | 1011 = IRQ11 enabled | 0100 = IRQ4 enabled | 1100 = IRQ12 enabled | 0101 = IRQ5 enabled | 1101 = IRQ13 enabled | 0110 = IRQ6 enabled | 1110 = IRQ14 enabled | 0111 = IRQ7 enabled | 1111 = IRQ15 enabled |
| 0000 = No interrupt routing (default) | 1000 = IRQ8 enabled  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0001 = IRQ1 enabled                   | 1001 = IRQ9 enabled  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0010 = SMI enabled                    | 1010 = IRQ10 enabled |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0011 = IRQ3 enabled                   | 1011 = IRQ11 enabled |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0100 = IRQ4 enabled                   | 1100 = IRQ12 enabled |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0101 = IRQ5 enabled                   | 1101 = IRQ13 enabled |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0110 = IRQ6 enabled                   | 1110 = IRQ14 enabled |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0111 = IRQ7 enabled                   | 1111 = IRQ15 enabled |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 3                                     | CDEN                 | R/W  | <p>Card detect enable. Bit 3 enables interrupts on <math>\overline{CD1}</math> or <math>\overline{CD2}</math> changes. This bit is encoded as:</p> <p>0 = Disables interrupts on <math>\overline{CD1}</math> or <math>\overline{CD2}</math> line changes (default)</p> <p>1 = Enables interrupts on <math>\overline{CD1}</math> or <math>\overline{CD2}</math> line changes</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 2                                     | READYEN              | R/W  | <p>Ready enable. Bit 2 enables/disables a low-to-high transition on PC Card READY to generate a host interrupt. This interrupt source is considered a card status change. This bit is encoded as:</p> <p>0 = Disables host interrupt generation (default)</p> <p>1 = Enables host interrupt generation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 1                                     | BATWARNEN            | R/W  | <p>Battery warning enable. Bit 1 enables/disables a battery warning condition to generate a CSC interrupt. This bit is encoded as:</p> <p>0 = Disables host interrupt generation (default)</p> <p>1 = Enables host interrupt generation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |
| 0                                     | BATDEADEN            | R/W  | <p>Battery dead enable. Bit 0 enables/disables a battery dead condition on a memory PC Card or assertion of the STSCHG I/O PC Card signal to generate a CSC interrupt.</p> <p>0 = Disables host interrupt generation (default)</p> <p>1 = Enables host interrupt generation</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                       |                     |                     |                     |                    |                      |                     |                      |                     |                      |                     |                      |                     |                      |                     |                      |

## 5.7 ExCA Address Window Enable Register

The ExCA address window enable register enables/disables the memory and I/O windows to the 16-bit PC Card. By default, all windows to the card are disabled. The PCI1410 does not acknowledge PCI memory or I/O cycles to the card if the corresponding enable bit in this register is 0, regardless of the programming of the memory or I/O window start/end/offset address registers. See Table 5–9 for a complete description of the register contents.

| Bit     | 7                          | 6   | 5 | 4   | 3   | 2   | 1   | 0   |
|---------|----------------------------|-----|---|-----|-----|-----|-----|-----|
| Name    | ExCA address window enable |     |   |     |     |     |     |     |
| Type    | R/W                        | R/W | R | R/W | R/W | R/W | R/W | R/W |
| Default | 0                          | 0   | 0 | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA address window enable**  
Offset: CardBus socket address + 806h; ExCA offset 06h  
Type: Read-only, Read/Write  
Default: 00h

**Table 5–9. ExCA Address Window Enable Register**

| BIT | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                         |
|-----|-----------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | IOWIN1EN  | R/W  | I/O window 1 enable. Bit 7 enables/disables I/O window 1 for the PC Card. This bit is encoded as:<br>0 = I/O window 1 disabled (default)<br>1 = I/O window 1 enabled             |
| 6   | IOWIN0EN  | R/W  | I/O window 0 enable. Bit 6 enables/disables I/O window 0 for the PC Card. This bit is encoded as:<br>0 = I/O window 0 disabled (default)<br>1 = I/O window 0 enabled             |
| 5   | RSVD      | R    | Reserved. Bit 5 returns 0 when read.                                                                                                                                             |
| 4   | MEMWIN4EN | R/W  | Memory window 4 enable. Bit 4 enables/disables memory window 4 for the PC Card. This bit is encoded as:<br>0 = Memory window 4 disabled (default)<br>1 = Memory window 4 enabled |
| 3   | MEMWIN3EN | R/W  | Memory window 3 enable. Bit 3 enables/disables memory window 3 for the PC Card. This bit is encoded as:<br>0 = Memory window 3 disabled (default)<br>1 = Memory window 3 enabled |
| 2   | MEMWIN2EN | R/W  | Memory window 2 enable. Bit 2 enables/disables memory window 2 for the PC Card. This bit is encoded as:<br>0 = Memory window 2 disabled (default)<br>1 = Memory window 2 enabled |
| 1   | MEMWIN1EN | R/W  | Memory window 1 enable. Bit 1 enables/disables memory window 1 for the PC Card. This bit is encoded as:<br>0 = Memory window 1 disabled (default)<br>1 = Memory window 1 enabled |
| 0   | MEMWIN0EN | R/W  | Memory window 0 enable. Bit 0 enables/disables memory window 0 for the PC Card. This bit is encoded as:<br>0 = Memory window 0 disabled (default)<br>1 = Memory window 0 enabled |

## 5.8 ExCA I/O Window Control Register

The ExCA I/O window control register contains parameters related to I/O window sizing and cycle timing. See Table 5–10 for a complete description of the register contents.

| Bit     | 7                       | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA I/O window control |     |     |     |     |     |     |     |
| Type    | R/W                     | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                       | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA I/O window control**  
Offset: CardBus socket address + 807h; ExCA offset 07h  
Type: Read/Write  
Default: 00h

**Table 5–10. ExCA I/O Window Control Register**

| BIT | SIGNAL     | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                 |
|-----|------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | WAITSTATE1 | R/W  | I/O window 1 wait state. Bit 7 controls the I/O window 1 wait state for 16-bit I/O accesses. Bit 7 has no effect on 8-bit accesses. This wait-state timing emulates the ISA wait state used by the Intel 82365SL-DF. This bit is encoded as:<br>0 = 16-bit cycles have standard length (default).<br>1 = 16-bit cycles are extended by one equivalent ISA wait state.    |
| 6   | ZEROWS1    | R/W  | I/O window 1 zero wait state. Bit 6 controls the I/O window 1 wait state for 8-bit I/O accesses. Bit 6 has no effect on 16-bit accesses. This wait-state timing emulates the ISA wait state used by the Intel 82365SL-DF. This bit is encoded as:<br>0 = 8-bit cycles have standard length (default).<br>1 = 8-bit cycles are reduced to equivalent of three ISA cycles. |
| 5   | IOSIS16W1  | R/W  | I/O window 1 <u>IOIS16</u> source. Bit 5 controls the I/O window 1 automatic data sizing feature that uses <u>IOIS16</u> from the PC Card to determine the data width of the I/O data transfer. This bit is encoded as:<br>0 = Window data width determined by <u>DATASIZE1</u> , bit 4 (default).<br>1 = Window data width determined by <u>IOIS16</u> .                |
| 4   | DATASIZE1  | R/W  | I/O window 1 data size. Bit 4 controls the I/O window 1 data size. Bit 4 is ignored if bit 5 (IOSIS16W1) is set. This bit is encoded as:<br>0 = Window data width is 8 bits (default).<br>1 = Window data width is 16 bits.                                                                                                                                              |
| 3   | WAITSTATE0 | R/W  | I/O window 0 wait state. Bit 3 controls the I/O window 0 wait state for 16-bit I/O accesses. Bit 3 has no effect on 8-bit accesses. This wait-state timing emulates the ISA wait state used by the Intel 82365SL-DF. This bit is encoded as:<br>0 = 16-bit cycles have standard length (default).<br>1 = 16-bit cycles are extended by one equivalent ISA wait state.    |
| 2   | ZEROWS0    | R/W  | I/O window 0 zero wait state. Bit 2 controls the I/O window 0 wait state for 8-bit I/O accesses. Bit 2 has no effect on 16-bit accesses. This wait-state timing emulates the ISA wait state used by the Intel 82365SL-DF. This bit is encoded as:<br>0 = 8-bit cycles have standard length (default).<br>1 = 8-bit cycles are reduced to equivalent of three ISA cycles. |
| 1   | IOSIS16W0  | R/W  | I/O window 0 <u>IOIS16</u> source. Bit 1 controls the I/O window 0 automatic data sizing feature that uses <u>IOIS16</u> from the PC Card to determine the data width of the I/O data transfer. This bit is encoded as:<br>0 = Window data width is determined by <u>DATASIZE0</u> , bit 0 (default).<br>1 = Window data width is determined by <u>IOIS16</u> .          |
| 0   | DATASIZE0  | R/W  | I/O window 0 data size. Bit 0 controls the I/O window 0 data size. Bit 0 is ignored if bit 1 (IOSIS16W0) is set. This bit is encoded as:<br>0 = Window data width is 8 bits (default).<br>1 = Window data width is 16 bits.                                                                                                                                              |

## 5.9 ExCA I/O Windows 0 and 1 Start-Address Low-Byte Registers

These registers contain the low byte of the 16-bit I/O window start address for I/O windows 0 and 1. The 8 bits of these registers correspond to the lower 8 bits of the start address.

| Bit     | 7                                               | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA I/O windows 0 and 1 start-address low-byte |     |     |     |     |     |     |     |
| Type    | R/W                                             | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                               | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA I/O window 0 start-address low-byte**

Offset: CardBus socket address + 808h; ExCA offset 08h

Register: **ExCA I/O window 1 start-address low-byte**

Offset: CardBus socket address + 80Ch; ExCA offset 0Ch

Type: Read/Write

Default: 00h

## 5.10 ExCA I/O Windows 0 and 1 Start-Address High-Byte Registers

These registers contain the high byte of the 16-bit I/O window start address for I/O windows 0 and 1. The 8 bits of these registers correspond to the upper 8 bits of the start address.

| Bit     | 7                                                | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|--------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA I/O windows 0 and 1 start-address high-byte |     |     |     |     |     |     |     |
| Type    | R/W                                              | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                                | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA I/O window 0 start-address high-byte**

Offset: CardBus socket address + 809h; ExCA offset 09h

Register: **ExCA I/O window 1 start-address high-byte**

Offset: CardBus socket address + 80Dh; ExCA offset 0Dh

Type: Read/write

Default: 00h

## 5.11 ExCA I/O Windows 0 and 1 End-Address Low-Byte Registers

These registers contain the low byte of the 16-bit I/O window end address for I/O windows 0 and 1. The 8 bits of these registers correspond to the lower 8 bits of the end address.

| Bit            | 7                                             | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|----------------|-----------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| <b>Name</b>    | ExCA I/O windows 0 and 1 end-address low-byte |     |     |     |     |     |     |     |
| <b>Type</b>    | R/W                                           | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| <b>Default</b> | 0                                             | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA I/O window 0 end-address low-byte**  
 Offset: CardBus socket address + 80Ah; ExCA offset 0Ah  
 Register: **ExCA I/O window 1 end-address low-byte**  
 Offset: CardBus socket address + 80Eh; ExCA offset 0Eh  
 Type: Read/Write  
 Default: 00h

## 5.12 ExCA I/O Windows 0 and 1 End-Address High-Byte Registers

These registers contain the high byte of the 16-bit I/O window end address for I/O windows 0 and 1. The 8 bits of these registers correspond to the upper 8 bits of the end address.

| Bit            | 7                                              | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|----------------|------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| <b>Name</b>    | ExCA I/O windows 0 and 1 end-address high-byte |     |     |     |     |     |     |     |
| <b>Type</b>    | R/W                                            | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| <b>Default</b> | 0                                              | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA I/O window 0 end-address high-byte**  
 Offset: CardBus socket address + 80Bh; ExCA offset 0Bh  
 Register: **ExCA I/O window 1 end-address high-byte**  
 Offset: CardBus socket address + 80Fh; ExCA offset 0Fh  
 Type: Read/write  
 Default: 00h

### 5.13 ExCA Memory Windows 0–4 Start-Address Low-Byte Registers

These registers contain the low byte of the 16-bit memory window start address for memory windows 0, 1, 2, 3, and 4. The 8 bits of these registers correspond to bits A19–A12 of the start address.

| Bit     | 7                                              | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 start-address low-byte |     |     |     |     |     |     |     |
| Type    | R/W                                            | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                              | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 start-address low-byte**

Offset: CardBus socket address + 810h; ExCA offset 10h

Register: **ExCA memory window 1 start-address low-byte**

Offset: CardBus socket address + 818h; ExCA offset 18h

Register: **ExCA memory window 2 start-address low-byte**

Offset: CardBus socket address + 820h; ExCA offset 20h

Register: **ExCA memory window 3 start-address low-byte**

Offset: CardBus socket address + 828h; ExCA offset 28h

Register: **ExCA memory window 4 start-address low-byte**

Offset: CardBus socket address + 830h; ExCA offset 30h

Type: Read/Write

Default: 00h

## 5.14 ExCA Memory Windows 0–4 Start-Address High-Byte Registers

These registers contain the high nibble of the 16-bit memory window start address for memory windows 0, 1, 2, 3, and 4. The lower 4 bits of these registers correspond to bits A23–A20 of the start address. In addition, the memory window data width and wait states are set in this register. See Table 5–11 for a complete description of the register contents.

| Bit     | 7                                               | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 start-address high byte |     |     |     |     |     |     |     |
| Type    | R/W                                             | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                               | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 start-address high-byte**

Offset: CardBus socket address + 811h; ExCA offset 11h

Register: **ExCA memory window 1 start-address high-byte**

Offset: CardBus socket address + 819h; ExCA offset 19h

Register: **ExCA memory window 2 start-address high-byte**

Offset: CardBus socket address + 821h; ExCA offset 21h

Register: **ExCA memory window 3 start-address high-byte**

Offset: CardBus socket address + 829h; ExCA offset 29h

Register: **ExCA memory window 4 start-address high-byte**

Offset: CardBus socket address + 831h; ExCA offset 31h

Type: Read/Write

Default: 00h

**Table 5–11. ExCA Memory Windows 0–4 Start-Address High-Byte Registers**

| BIT | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                       |
|-----|----------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | DATASIZE | R/W  | Data size. Bit 7 controls the memory window data width. This bit is encoded as:<br>0 = Window data width is 8 bits (default).<br>1 = Window data width is 16 bits.                                                                                                                                                                                                                             |
| 6   | ZEROWAIT | R/W  | Zero wait state. Bit 6 controls the memory window wait state for 8- and 16-bit accesses. This wait-state timing emulates the ISA wait state used by the Intel 82365SL-DF. This bit is encoded as:<br>0 = 8- and 16-bit cycles have standard length (default).<br>1 = 8-bit cycles are reduced to equivalent of three ISA cycles.<br>16-bit cycles are reduced to equivalent of two ISA cycles. |
| 5–4 | SCRATCH  | R/W  | Scratch pad bits. Bits 5 and 4 have no effect on memory window operation.                                                                                                                                                                                                                                                                                                                      |
| 3–0 | STAHN    | R/W  | Start-address high nibble. Bits 3–0 represent the upper address bits A23–A20 of the memory window start address.                                                                                                                                                                                                                                                                               |

## 5.15 ExCA Memory Windows 0–4 End-Address Low-Byte Registers

These registers contain the low byte of the 16-bit memory window end address for memory windows 0, 1, 2, 3, and 4. The 8 bits of these registers correspond to bits A19–A12 of the end address.

| Bit     | 7                                            | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|----------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 end-address low-byte |     |     |     |     |     |     |     |
| Type    | R/W                                          | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                            | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 end-address low-byte**  
Offset: CardBus socket address + 812h; ExCA offset 12h  
Register: **ExCA memory window 1 end-address low-byte**  
Offset: CardBus socket address + 81Ah; ExCA offset 1Ah  
Register: **ExCA memory window 2 end-address low-byte**  
Offset: CardBus socket address + 822h; ExCA offset 22h  
Register: **ExCA memory window 3 end-address low-byte**  
Offset: CardBus socket address + 82Ah; ExCA offset 2Ah  
Register: **ExCA memory window 4 end-address low-byte**  
Offset: CardBus socket address + 832h; ExCA offset 32h  
Type: Read/Write  
Default: 00h

## 5.16 ExCA Memory Windows 0–4 End-Address High-Byte Registers

These registers contain the high nibble of the 16-bit memory window end address for memory windows 0, 1, 2, 3, and 4. The lower 4 bits of these registers correspond to bits A23–A20 of the end address. In addition, the memory window wait states are set in this register. See Table 5–12 for a complete description of the register contents.

| Bit     | 7                                             | 6   | 5 | 4 | 3   | 2   | 1   | 0   |
|---------|-----------------------------------------------|-----|---|---|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 end-address high-byte |     |   |   |     |     |     |     |
| Type    | R/W                                           | R/W | R | R | R/W | R/W | R/W | R/W |
| Default | 0                                             | 0   | 0 | 0 | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 end-address high-byte**

Offset: CardBus socket address + 813h; ExCA offset 13h

Register: **ExCA memory window 1 end-address high-byte**

Offset: CardBus socket address + 81Bh; ExCA offset 1Bh

Register: **ExCA memory window 2 end-address high-byte**

Offset: CardBus socket address + 823h; ExCA offset 23h

Register: **ExCA memory window 3 end-address high-byte**

Offset: CardBus socket address + 82Bh; ExCA offset 2Bh

Register: **ExCA memory window 4 end-address high-byte**

Offset: CardBus socket address + 833h; ExCA offset 33h

Type: Read-only, Read/Write

Default: 00h

**Table 5–12. ExCA Memory Windows 0–4 End-Address High-Byte Registers**

| BIT | SIGNAL | TYPE | FUNCTION                                                                                                                                                                                         |
|-----|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–6 | MEMWS  | R/W  | Wait state. Bits 7 and 6 specify the number of equivalent ISA wait states to be added to 16-bit memory accesses. The number of wait states added is equal to the binary value of these two bits. |
| 5–4 | RSVD   | R    | Reserved. Bits 5 and 4 return 0s when read.                                                                                                                                                      |
| 3–0 | ENDHN  | R/W  | End-address high nibble. Bits 3–0 represent the upper address bits A23–A20 of the memory window end address.                                                                                     |

## 5.17 ExCA Memory Windows 0–4 Offset-Address Low-Byte Registers

These registers contain the low byte of the 16-bit memory window offset address for memory windows 0, 1, 2, 3, and 4. The 8 bits of these registers correspond to bits A19–A12 of the offset address.

| Bit     | 7                                               | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 offset-address low-byte |     |     |     |     |     |     |     |
| Type    | R/W                                             | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                               | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 offset-address low-byte**

Offset: CardBus socket address + 814h; ExCA offset 14h

Register: **ExCA memory window 1 offset-address low-byte**

Offset: CardBus socket address + 81Ch; ExCA offset 1Ch

Register: **ExCA memory window 2 offset-address low-byte**

Offset: CardBus socket address + 824h; ExCA offset 24h

Register: **ExCA memory window 3 offset-address low-byte**

Offset: CardBus socket address + 82Ch; ExCA offset 2Ch

Register: **ExCA memory window 4 offset-address low-byte**

Offset: CardBus socket address + 834h; ExCA offset 34h

Type: Read/Write

Default: 00h

## 5.18 ExCA Memory Windows 0–4 Offset-Address High-Byte Registers

These registers contain the high 6 bits of the 16-bit memory window offset address for memory windows 0, 1, 2, 3, and 4. The lower 6 bits of these registers correspond to bits A25–A20 of the offset address. In addition, the write protection and common/attribute memory configurations are set in this register. See Table 5–13 for a complete description of the register contents.

| Bit     | 7                                                | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|--------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 offset-address high-byte |     |     |     |     |     |     |     |
| Type    | R/W                                              | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                                | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 offset-address high-byte**

Offset: CardBus socket address + 815h; ExCA offset 15h

Register: **ExCA memory window 1 offset-address high-byte**

Offset: CardBus socket address + 81Dh; ExCA offset 1Dh

Register: **ExCA memory window 2 offset-address high-byte**

Offset: CardBus socket address + 825h; ExCA offset 25h

Register: **ExCA memory window 3 offset-address high-byte**

Offset: CardBus socket address + 82Dh; ExCA offset 2Dh

Register: **ExCA memory window 4 offset-address high-byte**

Offset: CardBus socket address + 835h; ExCA offset 35h

Type: Read/Write

Default: 00h

**Table 5–13. ExCA Memory Windows 0–4 Offset-Address High-Byte Registers**

| BIT | SIGNAL | TYPE | FUNCTION                                                                                                                                                                                                                        |
|-----|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | WINWP  | R/W  | Write protect. Bit 7 specifies whether write operations to this memory window are enabled. This bit is encoded as:<br>0 = Write operations are allowed (default).<br>1 = Write operations are not allowed.                      |
| 6   | REG    | R/W  | Bit 6 specifies whether this memory window is mapped to card attribute or common memory. This bit is encoded as:<br>0 = Memory window is mapped to common memory (default).<br>1 = Memory window is mapped to attribute memory. |
| 5–0 | OFFHB  | R/W  | Offset-address high byte. Bits 5–0 represent the upper address bits A25–A20 of the memory window offset address.                                                                                                                |

## 5.19 ExCA Card Detect and General Control Register

The ExCA card detect and general control register controls how the ExCA registers for the socket respond to card removal, as well as reports the status of  $\overline{VS1}$  and  $\overline{VS2}$  at the PC Card interface. See Table 5–14 for a complete description of the register contents.

| Bit     | 7                                        | 6 | 5   | 4   | 3 | 2 | 1   | 0 |
|---------|------------------------------------------|---|-----|-----|---|---|-----|---|
| Name    | ExCA I/O card detect and general control |   |     |     |   |   |     |   |
| Type    | R                                        | R | R/W | R/W | R | R | R/W | R |
| Default | X                                        | X | 0   | 0   | 0 | 0 | 0   | 0 |

Register: **ExCA card detect and general control**  
Offset: CardBus socket address + 816h; ExCA offset 16h  
Type: Read-only, Read/Write  
Default: XX00 0000b

**Table 5–14. ExCA Card Detect and General Control Register**

| BIT | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----|-----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7   | VS2STAT   | R    | $\overline{VS2}$ state. Bit 7 reports the current state of $\overline{VS2}$ at the PC Card interface and, therefore, does not have a default value.<br>0 = $\overline{VS2}$ low<br>1 = $\overline{VS2}$ high                                                                                                                                                                                                                                                                                                      |
| 6   | VS1STAT   | R    | $\overline{VS1}$ state. Bit 6 reports the current state of $\overline{VS1}$ at the PC Card interface and, therefore, does not have a default value.<br>0 = $\overline{VS1}$ low<br>1 = $\overline{VS1}$ high                                                                                                                                                                                                                                                                                                      |
| 5   | SWCSC     | R/W  | Software card detect interrupt. If bit 3 (CDEN) in the ExCA card status-change-interrupt configuration register is set (ExCA offset 05h, see Section 5.6), then writing a 1 to bit 5 causes a card-detect card-status-change interrupt for the associated card socket. If bit 3 (CDEN) in the ExCA card status-change-interrupt configuration register is cleared to 0 (see Section 5.6), then writing a 1 to bit 5 has no effect. A read operation of this bit always returns 0.                                 |
| 4   | CDRESUME  | R/W  | Card detect resume enable. If bit 4 is set to 1, then once a card detect change has been detected on $\overline{CD1}$ and $\overline{CD2}$ inputs, $\overline{RI\_OUT}$ goes from high to low. $\overline{RI\_OUT}$ remains low until bit 0 (card status change) in the ExCA card status-change register is cleared (ExCA offset 04h, see Section 5.5). If this bit is a 0, then the card detect resume functionality is disabled.<br>0 = Card detect resume disabled (default)<br>1 = Card detect resume enabled |
| 3–2 | RSVD      | R    | Reserved. Bits 3 and 2 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1   | REGCONFIG | R/W  | Register configuration on card removal. Bit 1 controls how the ExCA registers for the socket react to a card removal event. This bit is encoded as:<br>0 = No change to ExCA registers on card removal (default)<br>1 = Reset ExCA registers on card removal                                                                                                                                                                                                                                                      |
| 0   | RSVD      | R    | Reserved. Bit 0 returns 0 when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## 5.20 ExCA Global Control Register

The ExCA global control register controls the PC Card socket. The host interrupt mode bits in this register are retained for Intel 82365SL-DF compatibility. See Table 5–15 for a complete description of the register contents.

| Bit     | 7                   | 6 | 5 | 4   | 3   | 2   | 1   | 0   |
|---------|---------------------|---|---|-----|-----|-----|-----|-----|
| Name    | ExCA global control |   |   |     |     |     |     |     |
| Type    | R                   | R | R | R/W | R/W | R/W | R/W | R/W |
| Default | 0                   | 0 | 0 | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA global control**  
Offset: CardBus socket address + 81Eh; ExCA offset 1Eh  
Type: Read-only, Read/Write  
Default: 00h

**Table 5–15. ExCA Global Control Register**

| BIT | SIGNAL      | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|-------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–5 | RSVD        | R    | Reserved. Bits 7–5 return 0s when read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 4   | No function | R/W  | This bit has no assigned function.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3   | INTMODE     | R/W  | Level/edge interrupt mode select. Bit 3 selects the signaling mode for the PCI1410 host interrupt. This bit is encoded as:<br>0 = Host interrupt is edge mode (default).<br>1 = Host interrupt is level mode.                                                                                                                                                                                                                                                                                                                                                    |
| 2   | IFCMODE     | R/W  | Interrupt flag clear mode select. Bit 2 selects the interrupt flag clear mechanism for the flags in the ExCA card status change register (ExCA offset 04h, see Section 5.5). This bit is encoded as:<br>0 = Interrupt flags are cleared by read of CSC register (default).<br>1 = Interrupt flags are cleared by explicit writeback of 1.                                                                                                                                                                                                                        |
| 1   | CSCMODE     | R/W  | Card status change level/edge mode select. Bit 1 selects the signaling mode for the PCI1410 host interrupt for card status changes. This bit is encoded as:<br>0 = Host interrupt is edge mode (default).<br>1 = Host interrupt is level mode.                                                                                                                                                                                                                                                                                                                   |
| 0   | PWRDWN      | R/W  | Power-down mode select. When bit 0 is set to 1, the PCI1410 is in power-down mode. In power-down mode, the PCI1410 card outputs are high impedance until an active cycle is executed on the card interface. Following an active cycle, the outputs are again high impedance. The PCI1410 still receives DMA requests, functional interrupts, and/or card status change interrupts; however, an actual card access is required to wake up the interface. This bit is encoded as:<br>0 = Power-down mode is disabled (default).<br>1 = Power-down mode is enabled. |

## 5.21 ExCA I/O Windows 0 and 1 Offset-Address Low-Byte Registers

These registers contain the low byte of the 16-bit I/O window offset address for I/O windows 0 and 1. The 8 bits of these registers correspond to the lower 8 bits of the offset address, and bit 0 is always 0.

| Bit     | 7                                                | 6   | 5   | 4   | 3   | 2   | 1   | 0 |
|---------|--------------------------------------------------|-----|-----|-----|-----|-----|-----|---|
| Name    | ExCA I/O windows 0 and 1 offset-address low-byte |     |     |     |     |     |     |   |
| Type    | R/W                                              | R/W | R/W | R/W | R/W | R/W | R/W | R |
| Default | 0                                                | 0   | 0   | 0   | 0   | 0   | 0   | 0 |

Register: **ExCA I/O window 0 offset-address low-byte**

Offset: CardBus socket address + 836h; ExCA offset 36h

Register: **ExCA I/O window 1 offset-address low-byte**

Offset: CardBus socket address + 838h; ExCA offset 38h

Type: Read-only, Read/Write

Default: 00h

## 5.22 ExCA I/O Windows 0 and 1 Offset-Address High-Byte Registers

These registers contain the high byte of the 16-bit I/O window offset address for I/O windows 0 and 1. The 8 bits of these registers correspond to the upper 8 bits of the offset address.

| Bit     | 7                                                 | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|---------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA I/O windows 0 and 1 offset-address high-byte |     |     |     |     |     |     |     |
| Type    | R/W                                               | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                                 | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA I/O window 0 offset-address high-byte**

Offset: CardBus socket address + 837h; ExCA offset 37h

Register: **ExCA I/O window 1 offset-address high-byte**

Offset: CardBus socket address + 839h; ExCA offset 39h

Type: Read/Write

Default: 00h

## 5.23 ExCA Memory Windows 0–4 Page Register

The upper 8 bits of a 4-byte PCI memory address are compared to the contents of this register when decoding addresses for 16-bit memory windows. Each window has its own page register, all of which default to 00h. By programming this register to a nonzero value, host software can locate 16-bit memory windows in any 1 of 256 16-Mbyte regions in the 4G-byte PCI address space. These registers are only accessible when the ExCA registers are memory mapped, that is, these registers cannot be accessed using the index/data I/O scheme.

| Bit     | 7                            | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | ExCA memory windows 0–4 page |     |     |     |     |     |     |     |
| Type    | R/W                          | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                            | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **ExCA memory window 0 page**

Offset: CardBus socket address + 840h

Register: **ExCA memory window 1 page**

Offset: CardBus socket address + 841h

Register: **ExCA memory window 2 page**

Offset: CardBus socket address + 842h

Register: **ExCA memory window 3 page**

Offset: CardBus socket address + 843h

Register: **ExCA memory window 4 page**

Offset: CardBus socket address + 844h

Type: Read/Write

Default: 00h

## 6 CardBus Socket Registers

The *1997 PC Card Standard* requires a CardBus socket controller to provide five 32-bit registers that report and control socket-specific functions. The PCI1410 provides the CardBus socket/ExCA base address register (offset 10h, see Section 4.12) to locate these CardBus socket registers in PCI memory address space (see Figure 6–1). Table 6–1 gives the location of the socket registers in relation to the CardBus socket/ExCA base address.

The PCI1410 implements an additional register at offset 20h that provides power management control for the socket.

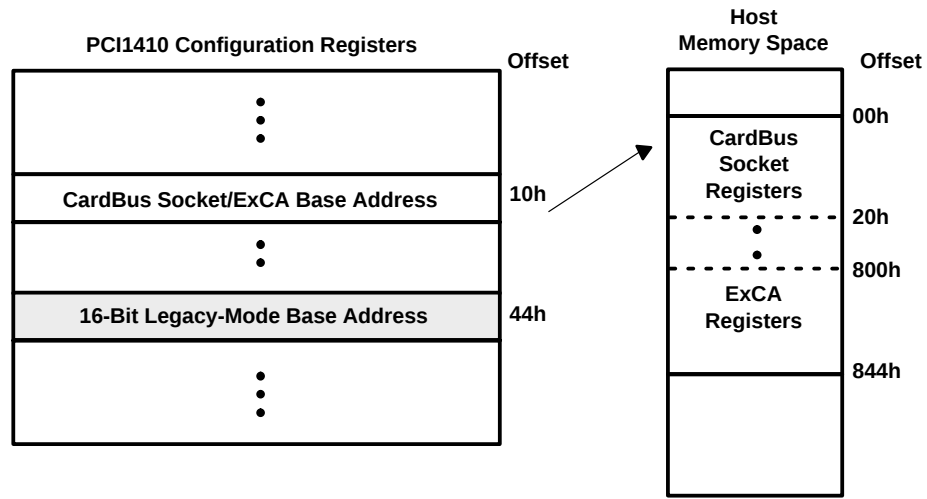


Figure 6–1. Accessing CardBus Socket Registers Through PCI Memory

Table 6–1. CardBus Socket Registers

| REGISTER NAME           | OFFSET |
|-------------------------|--------|
| Socket event            | 00h    |
| Socket mask             | 04h    |
| Socket present state    | 08h    |
| Socket force event      | 0Ch    |
| Socket control          | 10h    |
| Reserved                | 14h    |
| Reserved                | 18h    |
| Reserved                | 1Ch    |
| Socket power management | 20h    |

## 6.1 Socket Event Register

The socket event register indicates a change in socket status has occurred. These bits do not indicate what the change is, only that one has occurred. Software must read the socket present state register (CardBus offset 08h, see Section 6.3) for current status. Bits 31–4 of this register are reserved and return 0 when read. The following discussion describes bits 3–0. Each bit can be cleared by writing a 1 to that bit. The bits can be set to a 1 by software by writing a 1 to the corresponding bit in the socket force event register (see Section 6.4). All bits are cleared by PCI reset. They can be immediately set again if, when coming out of PC Card reset, the bridge finds the status unchanged (that is, CSTSCHG reasserted or card detect is still true). Software must clear this register before enabling interrupts. If it is not cleared when interrupts are enabled, then an interrupt is generated (but not masked) based on any bit that is set. See Table 6–2 for a complete description of the register contents.

| Bit     | 31           | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19  | 18  | 17  | 16  |
|---------|--------------|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| Name    | Socket event |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |
| Type    | R            | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R   | R   | R   | R   |
| Default | 0            | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   |
| Bit     | 15           | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3   | 2   | 1   | 0   |
| Name    | Socket event |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |
| Type    | R            | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R/C | R/C | R/C | R/C |
| Default | 0            | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   |

Register: **Socket event**  
Offset: CardBus socket address + 00h  
Type: Read-only, Read/Write to Clear  
Default: 0000 0000h

**Table 6–2. Socket Event Register**

| BITS | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                    |
|------|-----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–4 | RSVD      | R    | Reserved. Bits 31–4 return 0s when read.                                                                                                                                                                                                                                                                    |
| 3    | PWREVENT  | R/C  | Power cycle. Bit 3 is set when the PCI1410 detects that bit 3 (PWRCYCLE) in the socket present state register (CardBus offset 08h, see Section 6.3) has changed state. This bit is cleared by writing a 1.                                                                                                  |
| 2    | CD2EVENT  | R/C  | $\overline{\text{CCD2}}$ . Bit 2 is set when the PCI1410 detects that bit 2 (CDETECT2) in the socket present state register (CardBus offset 08h, see Section 6.3) has changed state. This bit is cleared by writing a 1.                                                                                    |
| 1    | CD1EVENT  | R/C  | $\overline{\text{CCD1}}$ . Bit 3 is set when the PCI1410 detects that bit 1 (CDETECT1) in the socket present state register (CardBus offset 08h, see Section 6.3) has changed state. This bit is cleared by writing a 1.                                                                                    |
| 0    | CSTSEVENT | R/C  | CSTSCHG. Bit 0 is set when bit 0 (CARDSTS) in the socket present state register (CardBus offset 08h, see Section 6.3) has changed state. For CardBus cards, bit 0 is set on the rising edge of CSTSCHG. For 16-bit PC Cards, bit 0 is set on both transitions of CSTSCHG. This bit is reset by writing a 1. |

## 6.2 Socket Mask Register

The socket mask register allows software to control the CardBus card events that generate a status change interrupt. The state of these mask bits does not prevent the corresponding bits from reacting in the socket event register (CardBus offset 00h, see Section 6.1). See Table 6–3 for a complete description of the register contents.

| Bit     | 31          | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19  | 18  | 17  | 16  |
|---------|-------------|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| Name    | Socket mask |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |
| Type    | R           | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R   | R   | R   | R   |
| Default | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   |
| Bit     | 15          | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3   | 2   | 1   | 0   |
| Name    | Socket mask |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |
| Type    | R           | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R/W | R/W | R/W | R/W |
| Default | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   |

Register: **Socket mask**  
Type: Read-only, Read/Write  
Offset: CardBus socket address + 04h  
Default: 0000 0000h

**Table 6–3. Socket Mask Register**

| BIT  | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                      |
|------|----------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–4 | RSVD     | R    | Reserved. Bits 31–4 return 0s when read.                                                                                                                                                                                                                                                                                                                      |
| 3    | PWRMASK  | R/W  | Power cycle. Bit 3 masks bit 3 (PWRCYCLE) in the socket present state register (CardBus offset 08h, see Section 6.3) from causing a status change interrupt.<br>0 = PWRCYCLE event does not cause CSC interrupt (default).<br>1 = PWRCYCLE event causes CSC interrupt.                                                                                        |
| 2–1  | CDMASK   | R/W  | Card detect mask. Bits 2 and 1 mask bits 1 and 2 (CDETECT1 and CDETECT2) in the socket present state register (CardBus offset 08h, see Section 6.3) from causing a CSC interrupt.<br>00 = Insertion/removal does not cause CSC interrupt (default).<br>01 = Reserved (undefined)<br>10 = Reserved (undefined)<br>11 = Insertion/removal causes CSC interrupt. |
| 0    | CSTSMASK | R/W  | CSTSCHG mask. Bit 0 masks bit 0 (CARDSTS) in the socket present state register (CardBus offset 08h, see Section 6.3) from causing a CSC interrupt.<br>0 = CARDSTS event does not cause CSC interrupt (default).<br>1 = CARDSTS event causes CSC interrupt.                                                                                                    |

## 6.3 Socket Present State Register

The socket present state register reports information about the socket interface. Write transactions to the socket force event register (CardBus offset 0Ch, see Section 6.4) are reflected here, as well as general socket interface status. Information about PC Card  $V_{CC}$  support and card type is only updated at each insertion. Also note that the PCI1410 uses  $\overline{CCD1}$  and  $\overline{CCD2}$  during card identification, and changes on these signals during this operation are not reflected in this register. See Table 6–4 for a complete description of the register contents.

| Bit     | 31                   | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|---------|----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Name    | Socket present state |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Type    | R                    | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  |
| Default | 0                    | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Bit     | 15                   | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| Name    | Socket present state |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Type    | R                    | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  |
| Default | 0                    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | X  | 0  | 0  | 0  | X  | X  | X  |

Register: **Socket present state**  
Offset: CardBus socket address + 08h  
Type: Read-only  
Default: 3000 00XXh

**Table 6–4. Socket Present State Register**

| BITS  | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                 |
|-------|-----------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31    | YVSOCKET  | R    | YV socket. Bit 31 indicates whether or not the socket can supply $V_{CC} = Y.Y$ V to PC Cards. The PCI1410 does not support Y.Y-V $V_{CC}$ ; therefore, this bit is always reset unless overridden by the socket force event register (CardBus offset 0Ch, see Section 6.4). This bit is hardwired to 0. |
| 30    | XVSOCKET  | R    | XV socket. Bit 30 indicates whether or not the socket can supply $V_{CC} = X.X$ V to PC Cards. The PCI1410 does not support X.X-V $V_{CC}$ ; therefore, this bit is always reset unless overridden by the socket force event register (CardBus offset 0Ch, see Section 6.4). This bit is hardwired to 0. |
| 29    | 3VSOCKET  | R    | 3-V socket. Bit 29 indicates whether or not the socket can supply $V_{CC} = 3.3$ V to PC Cards. The PCI1410 does support 3.3-V $V_{CC}$ ; therefore, this bit is always set unless overridden by the socket force event register (CardBus offset 0Ch, see Section 6.4).                                  |
| 28    | 5VSOCKET  | R    | 5-V socket. Bit 28 indicates whether or not the socket can supply $V_{CC} = 5$ V to PC Cards. The PCI1410 does support 5-V $V_{CC}$ ; therefore, this bit is always set unless overridden by the socket force event register (CardBus offset 0Ch, see Section 6.4).                                      |
| 27–14 | RSVD      | R    | Reserved. Bits 27–14 return 0s when read.                                                                                                                                                                                                                                                                |
| 13    | YVCARD    | R    | YV card. Bit 13 indicates whether or not the PC Card inserted in the socket supports $V_{CC} = Y.Y$ V.                                                                                                                                                                                                   |
| 12    | XVCARD    | R    | XV card. Bit 12 indicates whether or not the PC Card inserted in the socket supports $V_{CC} = X.X$ V.                                                                                                                                                                                                   |
| 11    | 3VCARD    | R    | 3-V card. Bit 11 indicates whether or not the PC Card inserted in the socket supports $V_{CC} = 3.3$ V.                                                                                                                                                                                                  |
| 10    | 5VCARD    | R    | 5-V card. Bit 10 indicates whether or not the PC Card inserted in the socket supports $V_{CC} = 5$ V.                                                                                                                                                                                                    |
| 9     | BADVCCREQ | R    | Bad $V_{CC}$ request. Bit 9 indicates that the host software has requested that the socket be powered at an invalid voltage.<br>0 = Normal operation (default)<br>1 = Invalid $V_{CC}$ request by host software                                                                                          |
| 8     | DATALOST  | R    | Data lost. Bit 8 indicates that a PC Card removal event may have caused lost data because the cycle did not terminate properly or because write data still resides in the PCI1410.<br>0 = Normal operation (default)<br>1 = Potential data loss due to card removal                                      |
| 7     | NOTACARD  | R    | Not a card. Bit 7 indicates that an unrecognizable PC Card has been inserted in the socket. This bit is not updated until a valid PC Card is inserted into the socket.<br>0 = Normal operation (default)<br>1 = Unrecognizable PC Card detected                                                          |

**Table 6–4. Socket Present State Register (Continued)**

| BIT | SIGNAL    | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                 |
|-----|-----------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6   | IREQCINT  | R    | READY( $\overline{\text{IREQ}}$ )/ $\overline{\text{CINT}}$ . Bit 6 indicates the current status of READY( $\overline{\text{IREQ}}$ )/ $\overline{\text{CINT}}$ at the PC Card interface.<br>0 = READY( $\overline{\text{IREQ}}$ )/ $\overline{\text{CINT}}$ low<br>1 = READY( $\overline{\text{IREQ}}$ )/ $\overline{\text{CINT}}$ high |
| 5   | CBCARD    | R    | CardBus card detected. Bit 5 indicates that a CardBus PC Card is inserted in the socket. This bit is not updated until another card interrogation sequence occurs (card insertion).                                                                                                                                                      |
| 4   | 16BITCARD | R    | 16-bit card detected. Bit 4 indicates that a 16-bit PC Card is inserted in the socket. This bit is not updated until another card interrogation sequence occurs (card insertion).                                                                                                                                                        |
| 3   | PWRCYCLE  | R    | Power cycle. Bit 3 indicates the status of each card powering request. This bit is encoded as:<br>0 = Socket powered down (default)<br>1 = Socket powered up                                                                                                                                                                             |
| 2   | CDETECT2  | R    | $\overline{\text{CCD2}}$ . Bit 2 reflects the current status of $\overline{\text{CCD2}}$ at the PC Card interface. Changes to this signal during card interrogation are not reflected here.<br>0 = $\overline{\text{CCD2}}$ low (PC Card may be present)<br>1 = $\overline{\text{CCD2}}$ high (PC Card not present)                      |
| 1   | CDETECT1  | R    | $\overline{\text{CCD1}}$ . Bit 1 reflects the current status of $\overline{\text{CCD1}}$ at the PC Card interface. Changes to this signal during card interrogation are not reflected here.<br>0 = $\overline{\text{CCD1}}$ low (PC Card may be present)<br>1 = $\overline{\text{CCD1}}$ high (PC Card not present)                      |
| 0   | CARDSTS   | R    | CSTSCHG. Bit 0 reflects the current status of CSTSCHG at the PC Card interface.<br>0 = CSTSCHG low<br>1 = CSTSCHG high                                                                                                                                                                                                                   |

## 6.4 Socket Force Event Register

The socket force event register is used to force changes to the socket event register (see Section 6.1) and the socket present state register (see Section 6.3). Bit 14 (CVSTEST) in this register must be written when forcing changes that require card interrogation. See Table 6–5 for a complete description of the register contents.

| Bit     | 31                 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|---------|--------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Name    | Socket force event |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Type    | R                  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  |
| Default | 0                  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Bit     | 15                 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
| Name    | Socket force event |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Type    | R                  | W  | W  | W  | W  | W  | W  | W  | W  | R  | W  | W  | W  | W  | W  | W  |
| Default | 0                  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

Register: **Socket force event**  
 Type: Read-only, Write-only  
 Offset: CardBus socket address + 0Ch  
 Default: 0000 0000h

**Table 6–5. Socket Force Event Register**

| BIT   | SIGNAL     | TYPE | FUNCTION                                                                                                                                                                                                                                                                      |
|-------|------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–15 | RSVD       | R    | Reserved. Bits 31–15 return 0s when read.                                                                                                                                                                                                                                     |
| 14    | CVSTEST    | W    | Card VS test. When bit 14 is set, the PCI1410 re-interrogates the PC Card, updates the socket present state register (CardBus offset 08h, see Section 6.3), and enables the socket control register (CardBus offset 10h, see Section 6.5).                                    |
| 13    | FYVCARD    | W    | Force YV card. Write transactions to bit 13 cause bit 13 (YVCARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3). When set, this bit disables the socket control register (CardBus offset 10h, see Section 6.5).                    |
| 12    | FXVCARD    | W    | Force XV card. Write transactions to bit 12 cause bit 12 (XVCARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3). When set, this bit disables the socket control register (CardBus offset 10h, see Section 6.5).                    |
| 11    | F3VCARD    | W    | Force 3-V card. Write transactions to bit 11 cause bit 11 (3VCARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3). When set, this bit disables the socket control register (CardBus offset 10h, see Section 6.5).                   |
| 10    | F5VCARD    | W    | Force 5-V card. Write transactions to bit 10 cause bit 10 (5VCARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3). When set, this bit disables the socket control register (CardBus offset 10h, see Section 6.5).                   |
| 9     | FBADVCCREQ | W    | Force bad $V_{CC}$ request. Changes to bit 9 (BADVCCREQ) in the socket present state register (CardBus offset 08h, see Section 6.3) can be made by writing to bit 9.                                                                                                          |
| 8     | FDATALOST  | W    | Force data lost. Write transactions to bit 8 cause bit 8 (DATALOST) in the socket present state register to be written (CardBus offset 08h, see Section 6.3).                                                                                                                 |
| 7     | FNOTACARD  | W    | Force not a card. Write transactions to bit 7 cause bit 7 (NOTACARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3).                                                                                                                |
| 6     | RSVD       | R    | Reserved. Bit 6 returns 0 when read.                                                                                                                                                                                                                                          |
| 5     | FCBCARD    | W    | Force CardBus card. Write transactions to bit 5 cause bit 5 (CBCARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3).                                                                                                                |
| 4     | F16BITCARD | W    | Force 16-bit card. Write transactions to bit 4 cause bit 4 (16BITCARD) in the socket present state register to be written (CardBus offset 08h, see Section 6.3).                                                                                                              |
| 3     | FPWRCYCLE  | W    | Force power cycle. Write transactions to bit 3 cause bit 3 (PWREVENT) in the socket event register to be written (CardBus offset 00h, see Section 6.1), and bit 3 (PWRCYCLE) in the socket present state register is unaffected (CardBus offset 08h, see Section 6.3).        |
| 2     | FCDETECT2  | W    | Force $\overline{CCD2}$ . Write transactions to bit 2 cause bit 2 (CD2EVENT) in the socket event register to be written (CardBus offset 00h, see Section 6.1), and bit 2 (CDETECT2) in the socket present state register is unaffected (CardBus offset 08h, see Section 6.3). |
| 1     | FCDETECT1  | W    | Force $\overline{CCD1}$ . Write transactions to bit 1 cause bit 1 (CD1EVENT) in the socket event register to be written (CardBus offset 00h, see Section 6.1), and bit 1 (CDETECT1) in the socket present state register is unaffected (CardBus offset 08h, see Section 6.3). |
| 0     | FCARDSTS   | W    | Force CSTSCHG. Write transactions to bit 0 cause bit 0 (CSTSEVENT) in the socket event register to be written (CardBus offset 00h, see Section 6.1), and bit 0 (CARDSTS) in the socket present state register is unaffected (CardBus offset 08h, see Section 6.3).            |

## 6.5 Socket Control Register

The socket control register provides control of the voltages applied to the socket and instructions for CB  $\overline{\text{CLKRUN}}$  protocol. The PCI1410 ensures that the socket is powered up only at acceptable voltages when a CardBus card is inserted. See Table 6–6 for a complete description of the register contents.

| Bit     | 31             | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23  | 22  | 21  | 20  | 19 | 18  | 17  | 16  |
|---------|----------------|----|----|----|----|----|----|----|-----|-----|-----|-----|----|-----|-----|-----|
| Name    | Socket control |    |    |    |    |    |    |    |     |     |     |     |    |     |     |     |
| Type    | R              | R  | R  | R  | R  | R  | R  | R  | R   | R   | R   | R   | R  | R   | R   | R   |
| Default | 0              | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   | 0  | 0   | 0   | 0   |
| Bit     | 15             | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7   | 6   | 5   | 4   | 3  | 2   | 1   | 0   |
| Name    | Socket control |    |    |    |    |    |    |    |     |     |     |     |    |     |     |     |
| Type    | R              | R  | R  | R  | R  | R  | R  | R  | R/W | R/W | R/W | R/W | R  | R/W | R/W | R/W |
| Default | 0              | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   | 0  | 0   | 0   | 0   |

Register: **Socket control**  
 Offset: CardBus socket address + 10h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

**Table 6–6. Socket Control Register**

| BITS | SIGNAL  | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                              |
|------|---------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–8 | RSVD    | R    | Reserved. Bits 31–8 return 0s when read.                                                                                                                                                                                                                                                                                                                                                              |
| 7    | STOPCLK | R/W  | CB $\overline{\text{CLKRUN}}$ protocol instructions.<br>0 = CB $\overline{\text{CLKRUN}}$ protocol can only attempt to stop/slow the CB clock if the socket is idle and the PCI $\overline{\text{CLKRUN}}$ protocol is preparing to stop/slow the PCI bus clock.<br>1 = CB $\overline{\text{CLKRUN}}$ protocol can attempt to stop/slow the CB clock if the socket is idle.                           |
| 6–4  | VCCCTRL | R/W  | V <sub>CC</sub> control. Bits 6–4 request card V <sub>CC</sub> changes.<br>000 = Request power off (default)      100 = Request V <sub>CC</sub> = X.X V<br>001 = Reserved                              101 = Request V <sub>CC</sub> = Y.Y V<br>010 = Request V <sub>CC</sub> = 5 V                  110 = Reserved<br>011 = Request V <sub>CC</sub> = 3.3 V                111 = Reserved            |
| 3    | RSVD    | R    | Reserved. Bit 3 returns 0 when read.                                                                                                                                                                                                                                                                                                                                                                  |
| 2–0  | VPPCTRL | R/W  | V <sub>pp</sub> control. Bits 2–0 request card V <sub>pp</sub> changes.<br>000 = Request power off (default)      100 = Request V <sub>pp</sub> = X.X V<br>001 = Request V <sub>pp</sub> = 12 V                  101 = Request V <sub>pp</sub> = Y.Y V<br>010 = Request V <sub>pp</sub> = 5 V                   110 = Reserved<br>011 = Request V <sub>pp</sub> = 3.3 V                111 = Reserved |

## 6.6 Socket Power Management Register

This register provides power management control over the socket through a mechanism for slowing or stopping the clock on the card interface when the card is idle. See Table 6–7 for a complete description of the register contents.

| Bit     | 31                      | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16  |
|---------|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Name    | Socket power management |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Type    | R                       | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R/W |
| Default | 0                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| Bit     | 15                      | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0   |
| Name    | Socket power management |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Type    | R                       | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R  | R/W |
| Default | 0                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   |

Register: **Socket power management**  
 Offset: CardBus socket address + 20h  
 Type: Read-only, Read/Write  
 Default: 0000 0000h

**Table 6–7. Socket Power Management Register**

| BIT   | SIGNAL     | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                              |
|-------|------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31–26 | RSVD       | R    | Reserved. Bits 31–26 return 0s when read.                                                                                                                                                                                                                                                                                             |
| 25    | SKTACCES   | R    | Socket access status. This bit provides information on when a socket access has occurred. This bit is cleared by a read access.<br>0 = A PC card access has not occurred (default).<br>1 = A PC card access has occurred.                                                                                                             |
| 24    | SKTMODE    | R    | Socket mode status. This bit provides clock mode information.<br>0 = Clock is operating normally.<br>1 = Clock frequency has changed.                                                                                                                                                                                                 |
| 23–17 | RSVD       | R    | Reserved. Bits 23–17 return 0s when read.                                                                                                                                                                                                                                                                                             |
| 16    | CLKCTRLLEN | R/W  | CardBus clock control enable. When bit 16 is set, bit 0 (CLKCTRL) is enabled.<br>0 = Clock control is disabled (default).<br>1 = Clock control is enabled.                                                                                                                                                                            |
| 15–1  | RSVD       | R    | Reserved. Bits 15–1 return 0s when read.                                                                                                                                                                                                                                                                                              |
| 0     | CLKCTRL    | R/W  | CardBus clock control. This bit determines whether the CB <u>CLKRUN</u> protocol stops or slows the CB clock during idle states. <u>Bit 16 (CLKCTRLLEN)</u> enables this bit.<br>0 = Allows CB <u>CLKRUN</u> protocol to stop the CB clock (default).<br>1 = Allows CB <u>CLKRUN</u> protocol to slow the CB clock by a factor of 16. |



## 7 Distributed DMA (DDMA) Registers

The DMA base address, programmable in PCI configuration space as bits 15–4 of socket DMA register 1 (offset 98h, see Section 4.36), points to a 16-byte region in PCI I/O space where the DDMA registers reside. The names and locations of these registers are summarized in Table 7–1. These PCI1410 register definitions are identical in function to, but different in location from, those of the 8237 DMA controller. The similarity between the register models retains some level of compatibility with legacy DMA and simplifies the translation required by the master DMA device when it forwards legacy DMA writes to DMA channels.

While the DMA register definitions are identical to those in the 8237 of the same name, some register bits defined in the 8237 do not apply to distributed DMA in a PCI environment. In such cases, the PCI1410 implements these obsolete register bits as read-only nonfunctional bits. The reserved registers shown in Table 7–1 are implemented as read-only and return 0s when read. Write transactions to reserved registers have no effect.

**Table 7–1. Distributed DMA Registers**

| REGISTER NAME |          |                 |          | DDMA BASE ADDRESS OFFSET |
|---------------|----------|-----------------|----------|--------------------------|
| Reserved      | Page     | Current address |          | 00h                      |
|               |          | Base address    |          |                          |
| Reserved      | Reserved | Current count   |          | 04h                      |
|               |          | Base count      |          |                          |
| N/A           | Reserved | N/A             | Status   | 08h                      |
| Mode          |          | Request         | Command  |                          |
| Multichannel  | Reserved | N/A             | Reserved | 0Ch                      |
| Mask          |          | Master clear    |          |                          |

### 7.1 DDMA Current Address/Base-Address Register

The DDMA current address/base address register sets the starting (base) memory address of a DDMA transfer. Read transactions from this register indicate the current memory address of a direct memory transfer.

For the 8-bit DDMA transfer mode, the current address register contents are presented on AD15–AD0 of the PCI bus during the address phase. Bits 7–0 of the DDMA page register (see Section 7.2) are presented on AD23–AD16 of the PCI bus during the address phase.

For the 16-bit DDMA transfer mode, the current address register contents are presented on AD16–AD1 of the PCI bus during the address phase, and AD0 is driven to logic 0. Bits 7–1 of the DDMA page register (see Section 7.2) are presented on AD23–AD17 of the PCI bus during the address phase, and bit 0 is ignored.

| Bit     | 15                                | 14  | 13  | 12  | 11  | 10  | 9   | 8   |
|---------|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | DDMA current address/base-address |     |     |     |     |     |     |     |
| Type    | R/W                               | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                 | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 7                                 | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | DDMA current address/base-address |     |     |     |     |     |     |     |
| Type    | R/W                               | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                                 | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **DDMA current address/base-address**  
 Offset: DDMA base address + 00h  
 Type: Read/Write  
 Default: 0000h

## 7.2 DDMA Page Register

The DDMA page register sets the upper byte of the address of a DDMA transfer. Details of the address represented by this register are explained in Section 7.1, *DDMA Current Address/Base Address Register*.

| Bit     | 7         | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
|---------|-----------|-----|-----|-----|-----|-----|-----|-----|
| Name    | DDMA page |     |     |     |     |     |     |     |
| Type    | R/W       | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0         | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **DDMA page**  
 Offset: DDMA base address + 02h  
 Type: Read/Write  
 Default: 00h

## 7.3 DDMA Current Count/Base Count Register

The DDMA current count/base count register sets the total transfer count, in bytes, of a direct memory transfer. Read transactions to this register indicate the current count of a direct memory transfer. In the 8-bit transfer mode, the count is decremented by 1 after each transfer, and the count is decremented by 2 after each transfer in the 16-bit transfer mode.

| Bit     | 15                            | 14  | 13  | 12  | 11  | 10  | 9   | 8   |
|---------|-------------------------------|-----|-----|-----|-----|-----|-----|-----|
| Name    | DDMA current count/base count |     |     |     |     |     |     |     |
| Type    | R/W                           | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                             | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| Bit     | 7                             | 6   | 5   | 4   | 3   | 2   | 1   | 0   |
| Name    | DDMA current count/base count |     |     |     |     |     |     |     |
| Type    | R/W                           | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| Default | 0                             | 0   | 0   | 0   | 0   | 0   | 0   | 0   |

Register: **DDMA current count/base count**  
 Offset: DDMA base address + 04h  
 Type: Read/Write  
 Default: 0000h

## 7.4 DDMA Command Register

The DDMA command register enables and disables the DDMA controller. Bit 2 (DMAEN) defaults to 0 enabling the DDMA controller. All other bits are reserved. See Table 7–2 for a complete description of the register contents.

| Bit     | 7            | 6 | 5 | 4 | 3 | 2   | 1 | 0 |
|---------|--------------|---|---|---|---|-----|---|---|
| Name    | DDMA command |   |   |   |   |     |   |   |
| Type    | R            | R | R | R | R | R/W | R | R |
| Default | 0            | 0 | 0 | 0 | 0 | 0   | 0 | 0 |

Register: **DDMA command**  
 Offset: DDMA base address + 08h  
 Type: Read-only, Read/Write  
 Default: 00h

**Table 7–2. DDMA Command Register**

| BIT | SIGNAL | TYPE | FUNCTION                                                                                                                                                                                                           |
|-----|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–3 | RSVD   | R    | Reserved. Bits 7–3 return 0s when read.                                                                                                                                                                            |
| 2   | DMAEN  | R/W  | DDMA controller enable. Bit 2 enables and disables the distributed DMA slave controller in the PCI1410 and defaults to the enabled state.<br>0 = DDMA controller enabled (default)<br>1 = DDMA controller disabled |
| 1–0 | RSVD   | R    | Reserved. Bits 1 and 0 return 0s when read.                                                                                                                                                                        |

## 7.5 DDMA Status Register

The DDMA status register indicates the terminal count and DMA request ( $\overline{\text{DREQ}}$ ) status. See Table 7–3 for a complete description of the register contents.

| Bit     | 7           | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------|---|---|---|---|---|---|---|
| Name    | DDMA status |   |   |   |   |   |   |   |
| Type    | R           | R | R | R | R | R | R | R |
| Default | 0           | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **DDMA status**  
 Offset: DDMA base address + 08h  
 Type: Read-only  
 Default: 00h

**Table 7–3. DDMA Status Register**

| BIT | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----|----------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–4 | DREQSTAT | R    | Channel request. In the 8237, bits 7–4 indicate the status of $\overline{\text{DREQ}}$ of each DMA channel. In the PCI1410, these bits indicate the $\overline{\text{DREQ}}$ status of the single socket being serviced by this register. All four bits are set when the PC Card asserts $\overline{\text{DREQ}}$ and are reset when $\overline{\text{DREQ}}$ is deasserted. The status of bit 0 (MASKBIT) in the DDMA multichannel/mask register (see Section 7.9) has no effect on these bits. |
| 3–0 | TC       | R    | Channel terminal count. The 8237 uses bits 3–0 to indicate the TC status of each of its four DMA channels. In the PCI1410, these bits report information about a single DMA channel; therefore, all four of these register bits indicate the TC status of the single socket being serviced by this register. All four bits are set when the TC is reached by the DMA channel. These bits are reset when read or the DMA channel is reset.                                                        |

## 7.6 DDMA Request Register

The DDMA request register requests a DDMA transfer through software. Any write to this register enables software requests, and this register is to be used in block mode only.

| Bit     | 7            | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|--------------|---|---|---|---|---|---|---|
| Name    | DDMA request |   |   |   |   |   |   |   |
| Type    | W            | W | W | W | W | W | W | W |
| Default | 0            | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **DDMA request**  
Offset: DDMA base address + 09h  
Type: Write-only  
Default: 00h

## 7.7 DDMA Mode Register

The DDMA mode register sets the DDMA transfer mode. See Table 7–4 for a complete description of the register contents.

| Bit     | 7         | 6   | 5   | 4   | 3   | 2   | 1 | 0 |
|---------|-----------|-----|-----|-----|-----|-----|---|---|
| Name    | DDMA mode |     |     |     |     |     |   |   |
| Type    | R/W       | R/W | R/W | R/W | R/W | R/W | R | R |
| Default | 0         | 0   | 0   | 0   | 0   | 0   | 0 | 0 |

Register: **DDMA mode**  
Offset: DDMA base address + 0Bh  
Type: Read-only, Read/Write  
Default: 00h

**Table 7–4. DDMA Mode Register**

| BIT | SIGNAL   | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                 |
|-----|----------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–6 | DMAMODE  | R/W  | Mode select. The PCI1410 uses bits 7 and 6 to determine the transfer mode.<br>00 = Demand mode select (default)<br>01 = Single mode select<br>10 = Block mode select<br>11 = Reserved                                                                                                                                                                                                    |
| 5   | INCDEC   | R/W  | Address increment/decrement. The PCI1410 uses bit 5 to select the memory address in the DDMA current address/base address register to increment or decrement after each data transfer. This is in accordance with the 8237 use of this register bit and is encoded as follows:<br>0 = Addresses increment (default).<br>1 = Addresses decrement.                                         |
| 4   | AUTOINIT | R/W  | Auto initialization<br>0 = Auto initialization disabled (default)<br>1 = Auto initialization enabled                                                                                                                                                                                                                                                                                     |
| 3–2 | XFERTYPE | R/W  | Transfer type. Bits 3 and 2 select the type of direct memory transfer to be performed. A memory write transfer moves data from the PCI1410 PC Card interface to memory and a memory read transfer moves data from memory to the PCI1410 PC Card interface. The field is encoded as:<br>00 = No transfer selected (default)<br>01 = Write transfer<br>10 = Read transfer<br>11 = Reserved |
| 1–0 | RSVD     | R    | Reserved. Bits 1 and 0 return 0s when read.                                                                                                                                                                                                                                                                                                                                              |

## 7.8 DDMA Master Clear Register

The DDMA master clear register resets the DDMA controller and all DDMA registers.

| Bit     | 7                 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---------|-------------------|---|---|---|---|---|---|---|
| Name    | DDMA master clear |   |   |   |   |   |   |   |
| Type    | W                 | W | W | W | W | W | W | W |
| Default | 0                 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Register: **DDMA master clear**  
 Offset: DDMA base address + 0Dh  
 Type: Write-only  
 Default: 00h

## 7.9 DDMA Multichannel/Mask Register

The PCI1410 uses only the least significant bit of this register to mask the PC Card DMA channel. The PCI1410 sets the mask bit when the PC Card is removed. Host software is responsible for either resetting the socket's DMA controller or enabling the mask bit. See Table 7–5 for a complete description of the register contents.

| Bit     | 7                      | 6 | 5 | 4 | 3 | 2 | 1 | 0   |
|---------|------------------------|---|---|---|---|---|---|-----|
| Name    | DDMA multichannel/mask |   |   |   |   |   |   |     |
| Type    | R                      | R | R | R | R | R | R | R/W |
| Default | 0                      | 0 | 0 | 0 | 0 | 0 | 0 | 0   |

Register: **DDMA multichannel/mask**  
 Offset: DDMA base address + 0Fh  
 Type: Read-only  
 Default: 00h

**Table 7–5. DDMA Multichannel/Mask Register**

| BIT | SIGNAL  | TYPE | FUNCTION                                                                                                                                                                                                                                                                                                                     |
|-----|---------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7–1 | RSVD    | R    | Reserved. Bits 7–1 return 0s when read.                                                                                                                                                                                                                                                                                      |
| 0   | MASKBIT | R/W  | Mask select. Bit 0 masks incoming <u>DREQ</u> signals from the <u>PC Card</u> . When set, the socket ignores DMA requests from the card. When cleared (or reset), incoming <u>DREQ</u> assertions are serviced normally.<br>0 = DDMA service provided on card <u>DREQ</u><br>1 = Socket <u>DREQ</u> signal ignored (default) |



## 8 Electrical Characteristics

### 8.1 Absolute Maximum Ratings Over Operating Temperature Ranges<sup>†</sup>

|                                                                             |                             |
|-----------------------------------------------------------------------------|-----------------------------|
| Supply voltage range, $V_{CC}$                                              | –0.5 V to 4.6 V             |
| Clamping voltage range, $V_{CCP}$ , $V_{CCCB}$ , $V_{CCI}$                  | –0.5 V to 6 V               |
| Input voltage range, $V_I$ : PCI                                            | –0.5 V to $V_{CCP} + 0.5$ V |
| Card                                                                        | –0.5 to $V_{CCCB} + 0.5$ V  |
| Miscellaneous                                                               | –0.5 to $V_{CCI} + 0.5$ V   |
| Fail safe                                                                   | –0.5 V to $V_{CC} + 0.5$ V  |
| Output voltage range, $V_O$ : PCI                                           | –0.5 V to $V_{CC} + 0.5$ V  |
| Card                                                                        | –0.5 to $V_{CC} + 0.5$ V    |
| Miscellaneous                                                               | –0.5 to $V_{CC} + 0.5$ V    |
| Fail safe                                                                   | –0.5 V to $V_{CC} + 0.5$ V  |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)  | $\pm 20$ mA                 |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 2) | $\pm 20$ mA                 |
| Storage temperature range, $T_{stg}$                                        | –65°C to 150°C              |
| Virtual junction temperature, $T_J$                                         | 150°C                       |

<sup>†</sup> Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. Applies for external input and bidirectional buffers.  $V_I > V_{CC}$  does not apply to fail-safe terminals. PCI terminals are measured with respect to  $V_{CCP}$  instead of  $V_{CC}$ . PC Card terminals are measured with respect to  $V_{CCCB}$ . Miscellaneous signals are measured with respect to  $V_{CCI}$ . The limit specified applies for a dc condition.
  2. Applies for external output and bidirectional buffers.  $V_O > V_{CC}$  does not apply to fail-safe terminals. PCI terminals are measured with respect to  $V_{CCP}$  instead of  $V_{CC}$ . PC Card terminals are measured with respect to  $V_{CCCB}$ . Miscellaneous signals are measured with respect to  $V_{CCI}$ . The limit specified applies for a dc condition.

## 8.2 Recommended Operating Conditions (see Note 3)

|                              |                                                            |                                                       | OPERATION | MIN                     | NOM | MAX                     | UNIT |
|------------------------------|------------------------------------------------------------|-------------------------------------------------------|-----------|-------------------------|-----|-------------------------|------|
| V <sub>CC</sub>              | Core voltage                                               | Commercial                                            | 3.3 V     | 3                       | 3.3 | 3.6                     | V    |
| V <sub>CCP</sub>             | PCI I/O clamp voltage                                      | Commercial                                            | 3.3 V     | 3                       | 3.3 | 3.6                     | V    |
|                              |                                                            |                                                       | 5 V       | 4.75                    | 5   | 5.25                    |      |
| V <sub>CCCB</sub>            | PC Card I/O clamp voltage                                  | Commercial                                            | 3.3 V     | 3                       | 3.3 | 3.6                     | V    |
|                              |                                                            |                                                       | 5 V       | 4.75                    | 5   | 5.25                    |      |
| V <sub>CCI</sub>             | Miscellaneous I/O clamp voltage                            | Commercial                                            | 3.3 V     | 3                       | 3.3 | 3.6                     | V    |
|                              |                                                            |                                                       | 5 V       | 4.75                    | 5   | 5.25                    |      |
| V <sub>IH</sub> <sup>†</sup> | High-level input voltage                                   | PCI                                                   | 3.3 V     | 0.5 V <sub>CCP</sub>    |     | V <sub>CCP</sub>        | V    |
|                              |                                                            |                                                       | 5 V       | 2                       |     | V <sub>CCP</sub>        |      |
|                              | PC Card                                                    |                                                       | 3.3 V     | 0.475 V <sub>CCCB</sub> |     | V <sub>CCCB</sub>       |      |
|                              |                                                            |                                                       | 5 V       | 2.4                     |     | V <sub>CCCB</sub>       |      |
|                              | Miscellaneous <sup>‡</sup>                                 |                                                       |           | 2                       |     | V <sub>CCI</sub>        |      |
|                              | Fail safe <sup>§</sup>                                     |                                                       |           | 2                       |     | V <sub>CC</sub>         |      |
| V <sub>IL</sub> <sup>†</sup> | Low-level input voltage                                    | PCI                                                   | 3.3 V     | 0                       |     | 0.3 V <sub>CCP</sub>    | V    |
|                              |                                                            |                                                       | 5 V       | 0                       |     | 0.8                     |      |
|                              | PC Card                                                    |                                                       | 3.3 V     | 0                       |     | 0.325 V <sub>CCCB</sub> |      |
|                              |                                                            |                                                       | 5 V       | 0                       |     | 0.8                     |      |
|                              | Miscellaneous <sup>‡</sup>                                 |                                                       |           | 0                       |     | 0.8                     |      |
|                              | Fail safe <sup>§</sup>                                     |                                                       |           | 0                       |     | 0.8                     |      |
| V <sub>I</sub>               | Input voltage                                              | PCI                                                   |           | 0                       |     | V <sub>CCP</sub>        | V    |
|                              |                                                            |                                                       |           | 0                       |     | V <sub>CCCB</sub>       |      |
|                              |                                                            | Miscellaneous <sup>‡</sup>                            |           | 0                       |     | V <sub>CCI</sub>        |      |
|                              |                                                            |                                                       |           | 0                       |     | V <sub>CC</sub>         |      |
| V <sub>O</sub> <sup>¶</sup>  | Output voltage                                             | PCI                                                   |           | 0                       |     | V <sub>CC</sub>         | V    |
|                              |                                                            | PC Card                                               |           | 0                       |     | V <sub>CC</sub>         |      |
|                              |                                                            | Miscellaneous <sup>‡</sup>                            |           | 0                       |     | V <sub>CC</sub>         |      |
|                              |                                                            | Fail safe <sup>§</sup>                                |           | 0                       |     | V <sub>CC</sub>         |      |
| t <sub>t</sub>               | Input transition time (t <sub>r</sub> and t <sub>f</sub> ) | PCI and PC Card                                       |           | 1                       |     | 4                       | ns   |
|                              |                                                            | Miscellaneous <sup>‡</sup> and fail safe <sup>§</sup> |           | 0                       |     | 6                       |      |
| T <sub>A</sub>               | Operating ambient temperature range                        |                                                       |           | 0                       | 25  | 70                      | °C   |
| T <sub>J</sub> <sup>#</sup>  | Virtual junction temperature                               |                                                       |           | 0                       | 25  | 115                     | °C   |

<sup>†</sup> Applies to external inputs and bidirectional buffers without hysteresis

<sup>‡</sup> Miscellaneous terminals are 70, 62, 59, 60, 61, 64, 65, 67, 68, and 69 for the PGE packaged device; L11, M9, L8, K8, N9, K9, N10, L10, N11, and M11 for the GGU packaged device; and W12, U10, P9, W10, V10, P10, W11, U11, P11, and R11 for the GHK packaged device (SUSPEND, SPKROUT, RI\_OUT, multifunction terminals (MFUNC0–MFUNC6), and power switch control pins).

<sup>§</sup> Fail-safe terminals are 75, 117, 131, and 137 for the PGE packaged device; L12, D9, C6, and A4 for the GGU packaged device; and L19, E13, F11, and A9 for the GHK packaged device (card detect and voltage sense pins).

<sup>¶</sup> Applies to external output buffers

<sup>#</sup> These junction temperatures reflect simulation conditions. The customer is responsible for verifying junction temperature.

☆CD terminals are 75 and 137 for the PGE packaged device; L12 and A4 for the GGU packaged device; and L19 and A9 for the GHK packaged device.

NOTE 3: Unused terminals (input or I/O) must be held high or low to prevent them from floating.

### 8.3 Electrical Characteristics Over Recommended Operating Conditions (unless otherwise noted)

| PARAMETER                                                            | TERMINALS                  | OPERATION | TEST CONDITIONS                               | MIN                | MAX | UNIT |
|----------------------------------------------------------------------|----------------------------|-----------|-----------------------------------------------|--------------------|-----|------|
| V <sub>OH</sub> High-level output voltage (see Note 4)               | PCI and Misc1§             | 3.3 V     | I <sub>OH</sub> = −0.5 mA                     | 0.9V <sub>CC</sub> |     | V    |
|                                                                      |                            | 5 V       | I <sub>OH</sub> = −2 mA                       | 2.4                |     |      |
|                                                                      | PC Card                    | 3.3 V     | I <sub>OH</sub> = −0.15 mA                    | 0.9V <sub>CC</sub> |     |      |
|                                                                      |                            | 5 V       | I <sub>OH</sub> = −0.15 mA                    | 2.4                |     |      |
|                                                                      | Misc2¶                     |           | I <sub>OH</sub> = −12 mA                      | 2.1                |     |      |
|                                                                      | Misc3#                     |           | I <sub>OH</sub> = −4 mA                       | 2.1                |     |      |
| V <sub>OL</sub> Low-level output voltage                             | PCI and Misc1§             | 3.3 V     | I <sub>OL</sub> = 1.5 mA                      | 0.1V <sub>CC</sub> |     | V    |
|                                                                      |                            | 5 V       | I <sub>OL</sub> = 6 mA                        | 0.55               |     |      |
|                                                                      | PC Card                    | 3.3 V     | I <sub>OL</sub> = 0.7 mA                      | 0.1V <sub>CC</sub> |     |      |
|                                                                      |                            | 5 V       | I <sub>OL</sub> = 0.7 mA                      | 0.55               |     |      |
|                                                                      | Misc2¶                     |           | I <sub>OL</sub> = 12 mA                       | 0.5                |     |      |
|                                                                      | Misc3#                     |           | I <sub>OL</sub> = 4 mA                        | 0.5                |     |      |
| I <sub>OZL</sub> 3-state output, high-impedance state output current | Output terminals           | 3.6 V     | V <sub>I</sub> = V <sub>CC</sub>              |                    | −1  | μA   |
|                                                                      |                            | 5.25 V    | V <sub>I</sub> = V <sub>CC</sub>              |                    | −1  |      |
| I <sub>OZH</sub> 3-state output, high-impedance state output current | Output terminals           | 3.6 V     | V <sub>I</sub> = V <sub>CC</sub> <sup>†</sup> |                    | 10  | μA   |
|                                                                      |                            | 5.25 V    | V <sub>I</sub> = V <sub>CC</sub> <sup>†</sup> |                    | 25  |      |
| I <sub>IL</sub> Low-level input current                              | Input terminals            |           | V <sub>I</sub> = GND                          |                    | −1  | μA   |
|                                                                      | I/O terminals              |           | V <sub>I</sub> = GND                          |                    | −10 |      |
| I <sub>IH</sub> High-level input current                             | Input terminals            | 3.6 V     | V <sub>I</sub> = V <sub>CC</sub> <sup>‡</sup> |                    | 10  | μA   |
|                                                                      |                            | 5.25 V    | V <sub>I</sub> = V <sub>CC</sub> <sup>‡</sup> |                    | 20  |      |
|                                                                      | I/O terminals              | 3.6 V     | V <sub>I</sub> = V <sub>CC</sub> <sup>‡</sup> |                    | 10  |      |
|                                                                      |                            | 5.25 V    | V <sub>I</sub> = V <sub>CC</sub> <sup>‡</sup> |                    | 25  |      |
|                                                                      | Fail-safe terminals        | 3.6 V     | V <sub>I</sub> = V <sub>CC</sub>              |                    | 10  |      |
|                                                                      | V <sub>CCD</sub> terminals | 3.6 V     | V <sub>I</sub> = V <sub>CC</sub>              |                    | 300 |      |

<sup>†</sup> For PCI terminals, V<sub>I</sub> = V<sub>CCP</sub>. For PC Card terminals, V<sub>I</sub> = V<sub>CCCB</sub>. For miscellaneous terminals, V<sub>I</sub> = V<sub>CCI</sub>

<sup>‡</sup> For I/O terminals, input leakage (I<sub>IL</sub> and I<sub>IH</sub>) includes I<sub>OZ</sub> leakage of the disabled output.

§ Misc1 includes MFUNC6(69), MFUNC5(68), MFUNC4(67), MFUNC3(65), and MFUNC2(64) for the PGE packaged device; M11, N11, L10, N10, and K9 for the GGU packaged device; and R11, P11, U11, W11, and P10 for the GHK packaged device.

¶ Misc2 includes MFUNC1(61), MFUNC0(60), and SERR(35) for the PGE packaged device; N9, K8, and M1 for the GGU packaged device; and V10, W10, and R3 for the GHK packaged device..

# Misc3 includes SPKROUT(62) and RI\_OUT(59) for the PGE packaged device; M9 and L8 for the GGU packaged device; and U10 and P9 for the GHK packaged device.

|| V<sub>CCD</sub> pins include V<sub>CCD0</sub>(73) and V<sub>CCD1</sub>(74).

## 8.4 PCI Clock/Reset Timing Requirements Over Recommended Ranges of Supply Voltage and Operating Free-Air Temperature

| PARAMETER           |                                                      | ALTERNATE SYMBOL | TEST CONDITIONS | MIN | MAX | UNIT    |
|---------------------|------------------------------------------------------|------------------|-----------------|-----|-----|---------|
| $t_c$               | Cycle time, PCLK                                     | $t_{cyc}$        |                 | 30  |     | ns      |
| $t_{WH}$            | Pulse duration (width), PCLK high                    | $t_{high}$       |                 | 11  |     | ns      |
| $t_{WL}$            | Pulse duration (width), PCLK low                     | $t_{low}$        |                 | 11  |     | ns      |
| $\Delta V/\Delta t$ | Slew rate, PCLK                                      | $t_r, t_f$       |                 | 1   | 4   | V/ns    |
| $t_w$               | Pulse duration (width), RSTIN                        | $t_{rst}$        |                 | 1   |     | ms      |
| $t_{su}$            | Setup time, PCLK active at end of $\overline{RSTIN}$ | $t_{rst-clk}$    |                 | 100 |     | $\mu s$ |

## 8.5 PCI Timing Requirements Over Recommended Ranges of Supply Voltage and Operating Free-Air Temperature

This data sheet uses the following conventions to describe time (  $t$  ) intervals. The format is  $t_A$ , where *subscript A* indicates the type of dynamic parameter being represented. The following are used:  $t_{pd}$  = propagation delay time,  $t_d$  = delay time,  $t_{su}$  = setup time, and  $t_h$  = hold time.

| PARAMETER |                                    |                                                             | ALTERNATE SYMBOL | TEST CONDITIONS                       | MIN | MAX | UNIT |
|-----------|------------------------------------|-------------------------------------------------------------|------------------|---------------------------------------|-----|-----|------|
| $t_{pd}$  | Propagation delay time, See Note 4 | PCLK-to-shared signal valid delay time                      | $t_{val}$        | $C_L = 50 \text{ pF}$ ,<br>See Note 4 | 2   | 11  | ns   |
|           |                                    | PCLK-to-shared signal invalid delay time                    | $t_{inv}$        |                                       | 2   |     |      |
| $t_d$     | Delay time, $t_{en}$               | Enable time, high impedance-to-active delay time from PCLK  | $t_{on}$         |                                       | 2   |     | ns   |
|           | Delay time, $t_{dis}$              | Disable time, active-to-high impedance delay time from PCLK | $t_{off}$        |                                       |     | 28  | ns   |
| $t_{su}$  | Setup time before PCLK valid       |                                                             | $t_{su}$         |                                       | 7   |     | ns   |
| $t_h$     | Hold time after PCLK high          |                                                             | $t_h$            |                                       | 0   |     | ns   |

NOTE 4: PCI shared signals are AD31–AD0, C/BE3–C/BE0, FRAME, TRDY, IRDY, STOP, IDSEL, DEVSEL, and PAR.

## 8.6 PC Card Cycle Timing

The PC Card cycle timing is controlled by the wait-state bits in the Intel 82365SL-DF compatible memory and I/O window registers. The PC Card cycle generator uses the PCI clock to generate the correct card address setup and hold times and the PC Card command active (low) interval. This allows the cycle generator to output PC Card cycles that are as close to the Intel 82365SL-DF timing as possible while always slightly exceeding the Intel 82365SL-DF values. This ensures compatibility with existing software and maximizes throughput.

The PC Card address setup and hold times are a function of the wait-state bits. Table 8–1 shows address setup time in PCLK cycles and nanoseconds for I/O and memory cycles. Table 8–2 and Table 8–3 show command active time in PCLK cycles and nanoseconds for I/O and memory cycles. Table 8–4 shows address hold time in PCLK cycles and nanoseconds for I/O and memory cycles.

**Table 8–1. PC Card Address Setup Time,  $t_{su(A)}$ , 8-Bit and 16-Bit PCI Cycles**

| WAIT-STATE BITS |     |   |  | TS1 – 0 = 01 (PCLK/ns) |
|-----------------|-----|---|--|------------------------|
| I/O             |     |   |  | 3/90                   |
| Memory          | WS1 | 0 |  | 2/60                   |
| Memory          | WS1 | 1 |  | 4/120                  |

**Table 8–2. PC Card Command Active Cycle Time,  $t_{c(A)}$ , 8-Bit PCI Cycles**

| WAIT-STATE BITS |    |     | TS1 – 0 = 01<br>(PCLK/ns) |
|-----------------|----|-----|---------------------------|
|                 | WS | ZWS |                           |
| I/O             | 0  | 0   | 19/570                    |
|                 | 1  | X   | 23/690                    |
|                 | 0  | 1   | 7/210                     |
| Memory          | 00 | 0   | 19/570                    |
|                 | 01 | X   | 23/690                    |
|                 | 10 | X   | 23/690                    |
|                 | 11 | X   | 23/690                    |
|                 | 00 | 1   | 7/210                     |

**Table 8–3. PC Card Command Active Cycle Time,  $t_{c(A)}$ , 16-Bit PCI Cycles**

| WAIT-STATE BITS |    |     | TS1 – 0 = 01<br>(PCLK/ns) |
|-----------------|----|-----|---------------------------|
|                 | WS | ZWS |                           |
| I/O             | 0  | 0   | 7/210                     |
|                 | 1  | X   | 11/330                    |
|                 | 0  | 1   | N/A                       |
| Memory          | 00 | 0   | 9/270                     |
|                 | 01 | X   | 13/390                    |
|                 | 10 | X   | 17/510                    |
|                 | 11 | X   | 23/630                    |
|                 | 00 | 1   | 5/150                     |

**Table 8–4. PC Card Address Hold Time,  $t_{h(A)}$ , 8-Bit and 16-Bit PCI Cycles**

| WAIT-STATE BITS |     |   | TS1 – 0 = 01<br>(PCLK/ns) |
|-----------------|-----|---|---------------------------|
|                 | WS1 |   |                           |
| I/O             |     |   | 2/60                      |
| Memory          | WS1 | 0 | 2/60                      |
| Memory          | WS1 | 1 | 3/90                      |

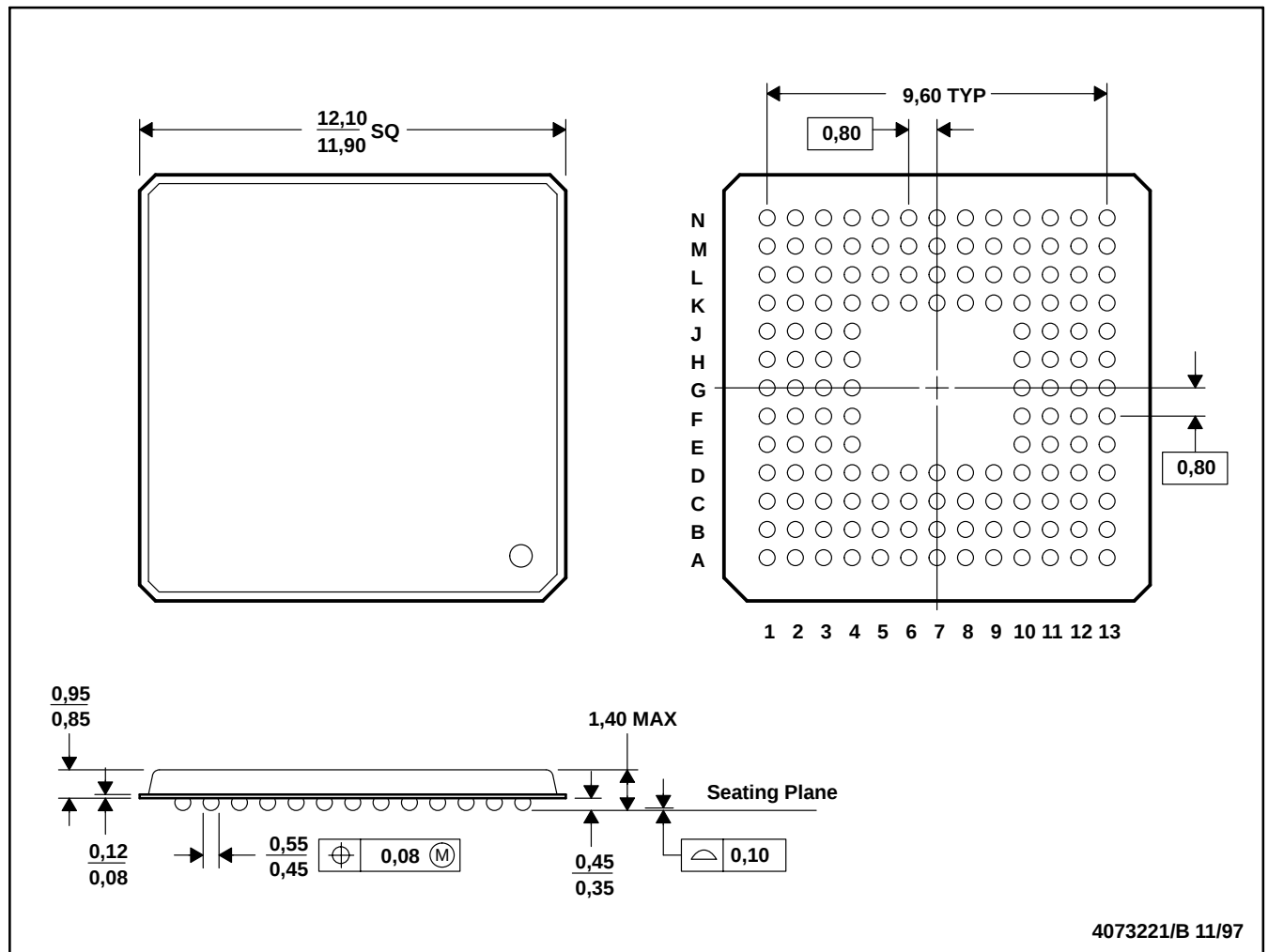


## 9 Mechanical Information

The PCI1410 is packaged in either a 144-ball GGU MicroStar BGA or a 144-pin PGE package. It is also packaged in a 209-ball GHK MicroStar BGA that is pin compatible with the TI PCI4410. The PCI4410 is a single-socket CardBus bridge with an integrated OHCI link. The following shows the mechanical dimensions for the GGU, GHK, and PDV packages.

### GGU (S-PBGA-N144)

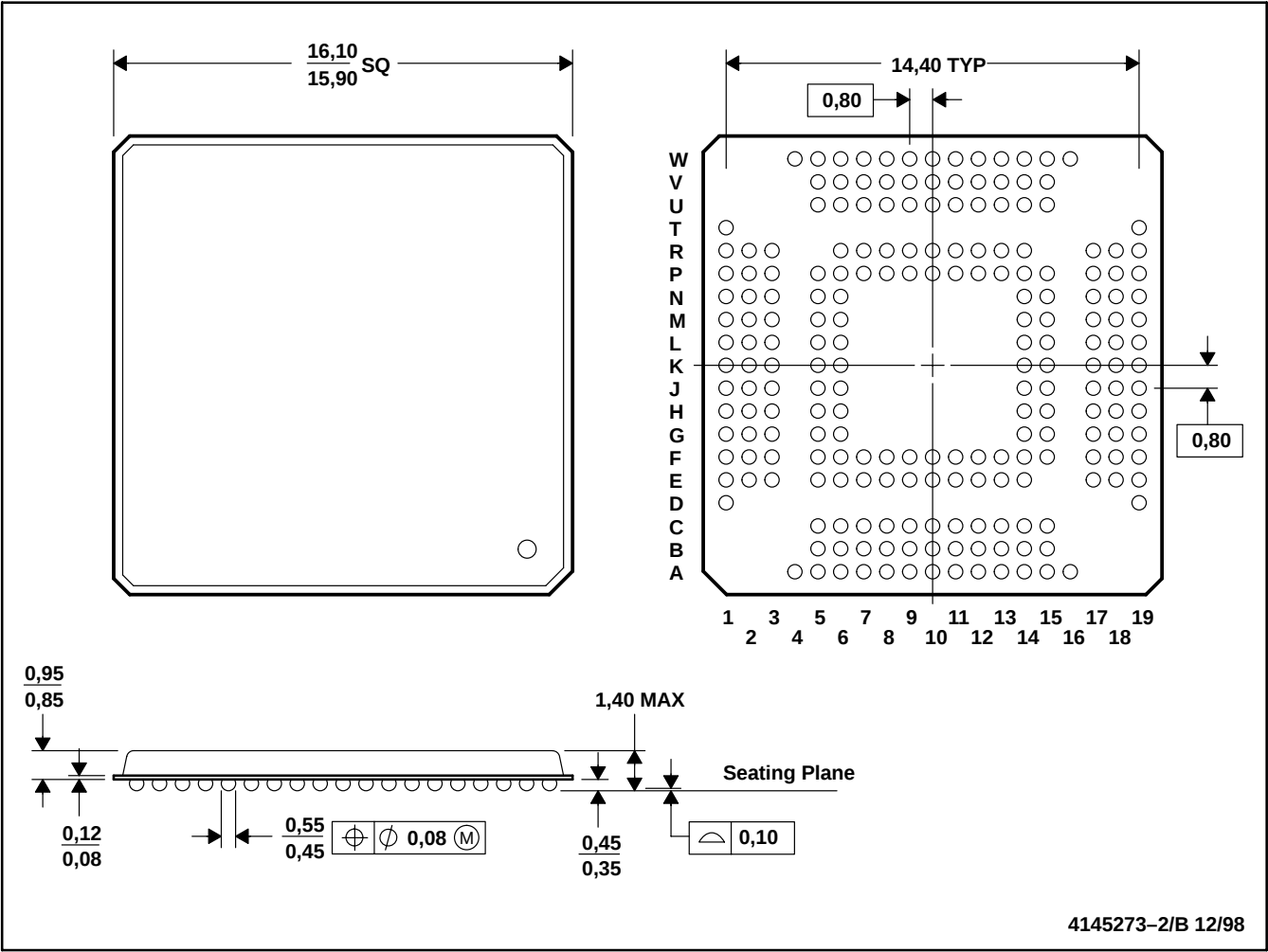
### PLASTIC BALL GRID ARRAY



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. MicroStar BGA configuration

GHK (S-PBGA-N209)

PLASTIC BALL GRID ARRAY



- NOTES: A. All linear dimensions are in millimeters.  
B. This drawing is subject to change without notice.  
C. MicroStar BGA configuration.

PGE (S-PQFP-G144)

PLASTIC QUAD FLATPACK

