



Data Book

AU6366

**USB 2.0 Single-LUN for
Multiple Flash Card Reader
Controller**

Technical Reference Manual

Product Specification

Preliminary Release

Revision 0.91W

Confidential

Sep 2005



Data sheet status

| | |
|---------------------------|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |

Revision History

| Date | Revision | Description |
|----------|----------|--|
| Jun 2005 | 0.01W | Preliminary Release |
| Sep 2005 | 0.9W | Preliminary Release Moved "3.0 Power Switch Feature" to "5.6 Power Switch Feature" |
| Sep 2005 | 0.91W | Preliminary Release Change "USB 2.0 Multi LUN Flash Card Reader Controller" to "USB 2.0 Single-LUN for Multiple Flash Card Reader Controller" |



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Contact Information:

Web site: <http://www.alcormicro.com/>

Taiwan

Alcor Micro Corp.
4F, No 200 Kang Chien Rd., Nei Hu,
Taipei, Taiwan, R.O.C.
Phone: 886-2-8751-1984
Fax: 886-2-2659-7723

Santa Clara Office

2901 Tasman Drive, Suite 206
Santa Clara, CA 95054
USA
Phone: (408) 845-9300
Fax: (408) 845-9086

Los Angeles Office

9070 Rancho Park Court
Rancho Cucamonga, CA.91730
USA
Phone: (909) 483-9900
Fax: (909) 944-0464



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1.0 Introduction

1.1 Description

This AU6366 is a highly integrated single chip for USB all-in-one storage card reader controller. It supports USB2.0 high-speed transmission to most of the popular storage media interface in one chip, such as CF, MD, SMC, SD, MMC, Memory Stick (MS, MS Pro, MS Duo) and XD.

The AU6366 supports USB2.0 high-speed specification and USB Storage Class V1.0 specification. It can read digital contents stored on memory card designed to cover a wide area of applications such as digital cameras, PDAs, MP3 players and smart phones...etc. With the AU6366, users can transfer digital data between flash memory card and PC or these electronic devices.

Especially, AU6366 is designed with the high performance characteristic in flash card I/O speed in 48pin package. Manufacturers can easily design their all-in-one flash card reader in a smallest dimension.

1.2 Features

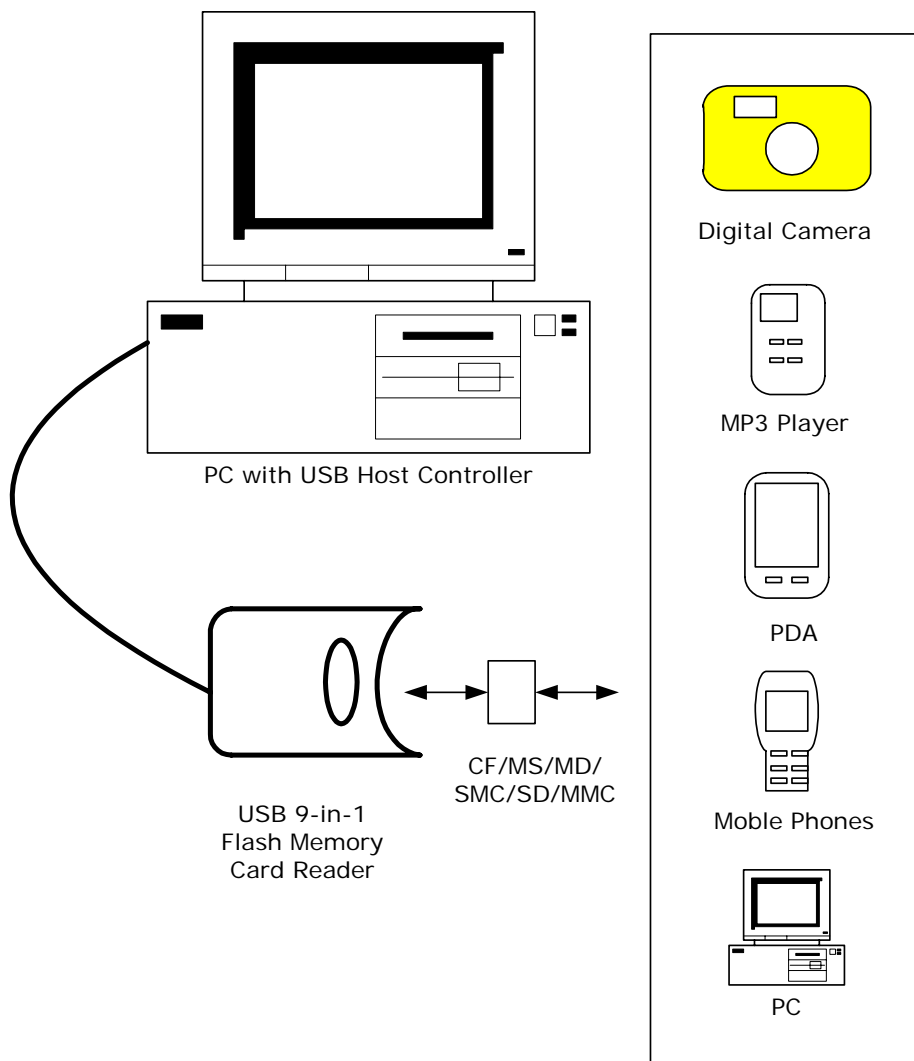
- Support USB V2.0 specification and USB Device Class Definition for Mass Storage, Bulk-Transport V1.0
- Support CF/MD/SD/MMC/MS/MS_Pro/MS_Duo/xD/SMC compatible flash card in 48 pin package
- Support the latest flash card specification: CF 3.0 (16-bit IDE mode), SD1.1 (HS-SD), MMC4.0 (8-bit), MSPro parallel mode (4-bit), xD 1.2
- Alcor speed-up engine integrated for data transmission performance enhancement
- Work with default driver from Windows ME/2000/XP and Mac OS X; Windows 98/2000(SP1/SP2) and Mac OS 9 are supported by vendor driver from Alcor.
- Ping-pong FIFO implementation for concurrent bus operation
- Support multiple sectors transfer optimize performance
- Support Dynamic Icon Utility
- Support LED for bus operating indication
- Power switch integrated to reduce production BOM cost
- 30MHz 8051 CPU



2.0 Application Block Diagram

Following is the application diagram of a typical card reader product with AU6366. By connecting the card reader to a desktop or notebook PC through USB bus, AU6366 is implemented as a bus-powered, high speed USB card reader, which can be used as a bridge for data transfer between Desktop PC and Notebook PC.

2.1 Block Diagram





3.0 Pin Assignment

The AU6366 is packed in 48pin-LQFP-form factor. The following figure shows signal name for each pin and the table in the following page describes each pin in detail.

Figure 3.1 Pin Assignment Diagram

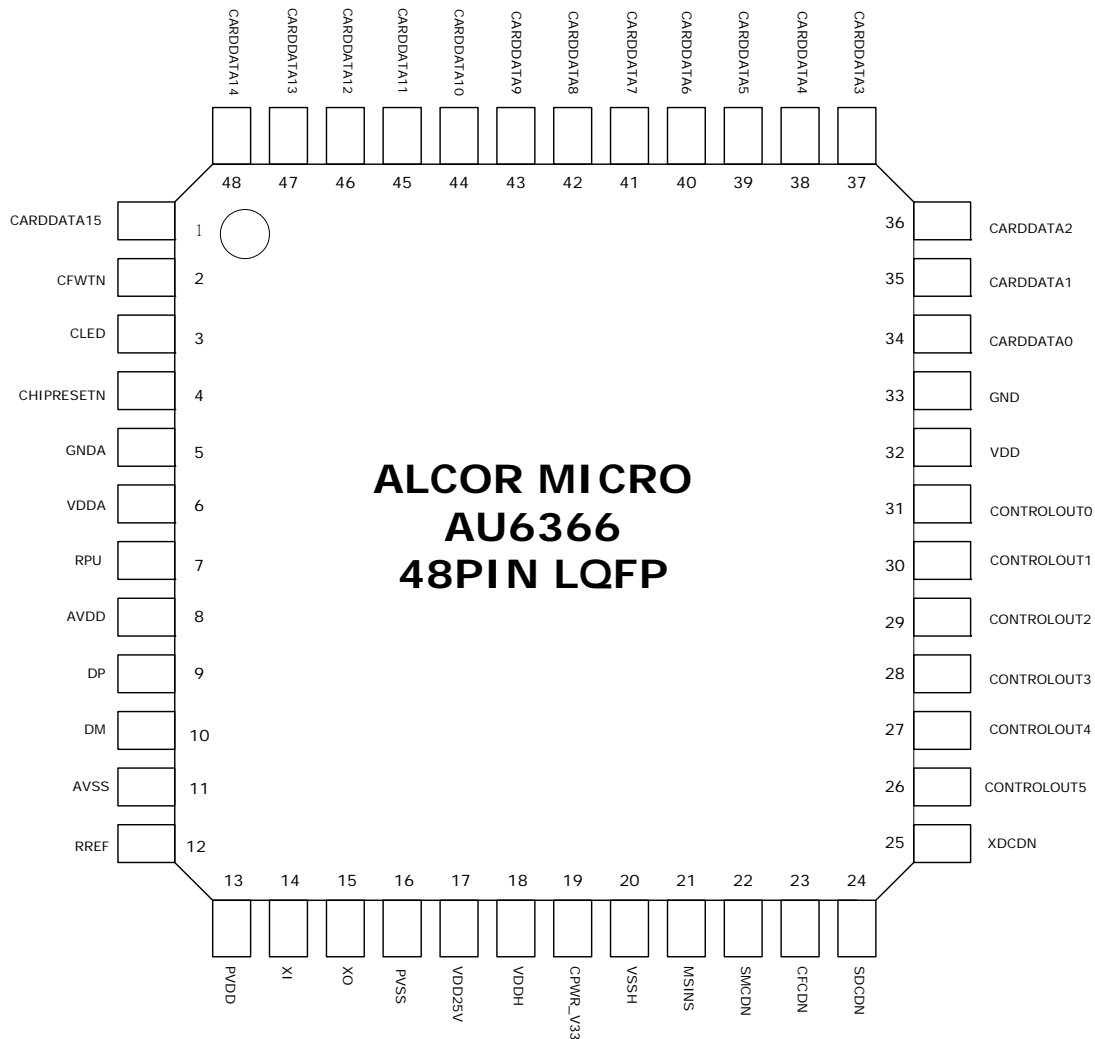




Table 3.1 Pin Descriptions

| Pin # | Pin Name | I/O | Description |
|-------|-------------|-----|---|
| 1 | CARDDATA15 | I/O | CF Data15/xD Data7 |
| 2 | CFWTN | I | CF WAITN |
| 3 | CLED | O | Card Operating LED |
| 4 | CHIPRESETN | I | Chip Reset, Pull up with RC |
| 5 | GNDA | | PLL Ground |
| 6 | VDDA | I | PLL VDD 2.5V |
| 7 | RPU | I | Connected with an 1.5k pull up resistor to 3.3 VDD |
| 8 | AVDD | I | Analog Power 3.3V |
| 9 | DP | I/O | DP |
| 10 | DM | I/O | DM |
| 11 | AVSS | | Analog Ground |
| 12 | RREF | I | Connected an 1k resistor to GND for impedance match |
| 13 | PVDD | I | OSC Power 3.3V |
| 14 | XI | I | 12 MHz crystal input. |
| 15 | XO | O | 12 MHz crystal output. |
| 16 | PVSS | | OSC Ground |
| 17 | VDD25V | O | Core Power 2.5V |
| 18 | VDDH | I | 3.3V for IO pad |
| 19 | CPWR_V33 | O | Card Power 3.3V |
| 20 | VSSH | | Power Ground |
| 21 | MSINS | I | MS INS |
| 22 | SMCDN | I | SMC Card Detect |
| 23 | CFCDN | I | CF Card Detect |
| 24 | SDCDN | I | SD Card Detect |
| 25 | XDCDN | I | xD Card Detect |
| 26 | CONTROLOUT5 | O | CFRESETN and SMWRN/XDWRN |
| 27 | CONTROLOUT4 | O | CFWRN and SMRDN/XDRDN |
| 28 | CONTROLOUT3 | O | CFRDN and XDCEN/SMCEN |
| 29 | CONTROLOUT2 | O | CFAD2 and SMALE/XDALE |
| 30 | CONTROLOUT1 | O | CFAD1, MSCLK and SMCLE/XDCLE |
| 31 | CONTROLOUT0 | O | CFAD0, SDCLK and MSBS |
| 32 | VDD | I | Core power 2.5V |
| 33 | GND | | Core Ground |
| 34 | CARDDATA0 | I/O | CFDATA0, MSDATA0, and SDCMD |
| 35 | CARDDATA1 | I/O | CFDATA1, MSDATA1, XDWP, and SMWPN |
| 36 | CARDDATA2 | I/O | CFDATA2, MSDATA2, and SDWP |
| 37 | CARDDATA3 | I/O | CFDATA3, MSDATA3, SMRBN, and XDRBN |
| 38 | CARDDATA4 | I/O | CFDATA4 and SDDATA0 |



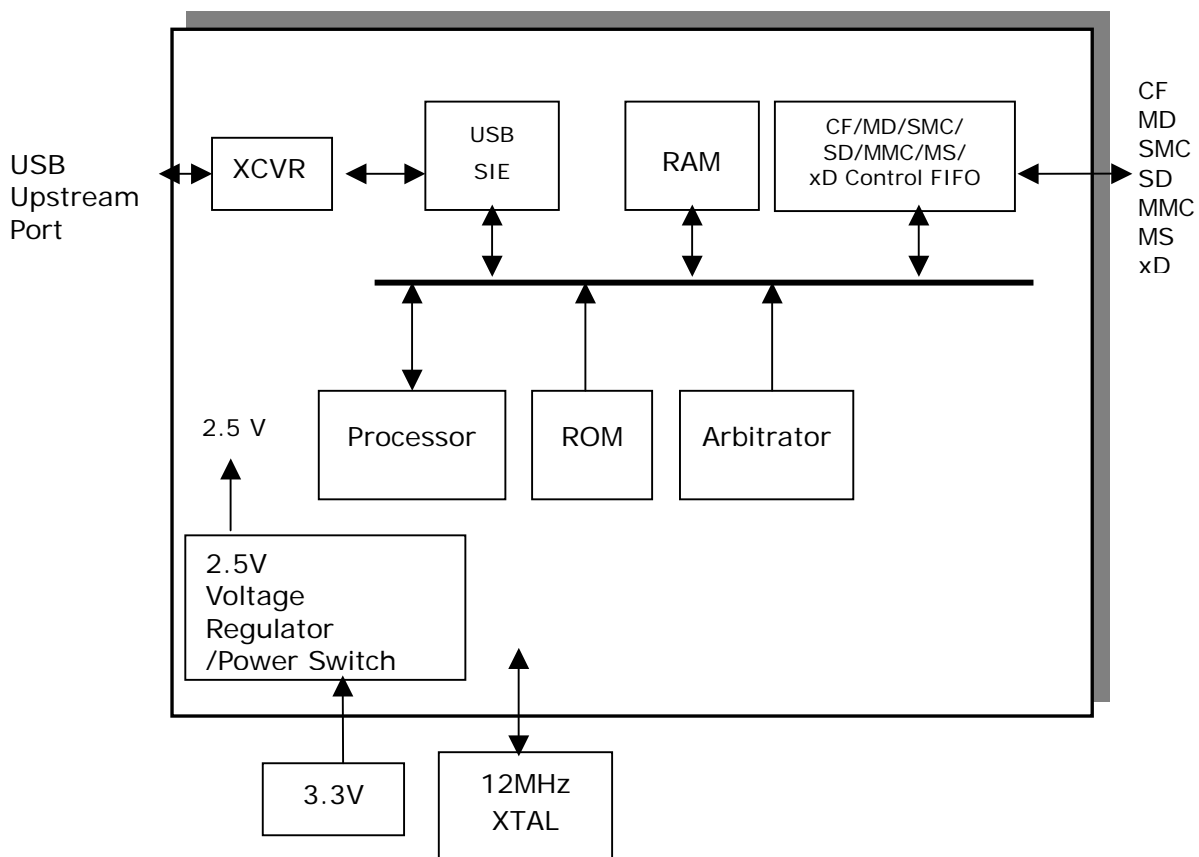
| | | | |
|----|------------|-----|-------------------------------|
| 39 | CARDDATA5 | I/O | CFDATA5 and SDDATA1 |
| 40 | CARDDATA6 | I/O | CFDATA6 and SDDATA2 |
| 41 | CARDDATA7 | I/O | CFDATA7 and SDDATA3 |
| 42 | CARDDATA8 | I/O | CFDATA8,XDDATA0, and SDDATA4 |
| 43 | CARDDATA9 | I/O | CFDATA9,XDDATA1, and SDDATA5 |
| 44 | CARDDATA10 | I/O | CFDATA10,XDDATA2, and SDDATA6 |
| 45 | CARDDATA11 | I/O | CFDATA11,XDDATA3, and SDDATA7 |
| 46 | CARDDATA12 | I/O | CFDATA12 and XDDATA4 |
| 47 | CARDDATA13 | I/O | CFDADA13 and XDDATA5 |
| 48 | CARDDATA14 | I/O | CFDATA14 and XDDATA6 |



4.0 System Architecture and Reference Design

4.1 AU6366 Block Diagram

Figure 4.1 AU6366 Block Diagram





5.0 Electrical Characteristics

5.1 Absolute Maximum Ratings

Table 5.1 Absolute Maximum Ratings

| SYMBOL | PARAMETER | RATING | UNITS |
|-----------|---------------------|----------------------|-------------|
| V_{CC} | Power Supply | -0.3 to $V_{CC}+0.3$ | V |
| V_{IN} | Input Voltage | -0.3 to 3.6 | V |
| V_{OUT} | Output Voltage | -0.3 to $V_{CC}+0.3$ | V |
| T_{STG} | Storage Temperature | -40 to 150 | $^{\circ}C$ |

5.2 Recommended Operating Conditions

Table 5.2 Recommended Operating Conditions

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS |
|-----------|-----------------------|------|-----|------|-------------|
| V_{CC} | Power Supply | 3.0 | 3.3 | 3.6 | V |
| V_{DD} | Digital Supply | 2.25 | 2.5 | 2.75 | V |
| V_{IN} | Input Voltage | 0 | 3.3 | 5.2 | V |
| T_{OPR} | Operating Temperature | 0 | 25 | 125 | $^{\circ}C$ |

5.3 Leakage Current and Capacitance

Table 5.3 General DC Characteristics

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------|-----------------------------------|-------------------------|-----|---------|-----|----------|
| I_{IN} | Input current | no pull-up or pull-down | -10 | ± 1 | 10 | μA |
| I_{OZ} | Tri-state leakage current | | -10 | ± 1 | 10 | μA |
| C_{IN} | Input capacitance | Pad Limit | | 2.8 | | ρF |
| C_{OUT} | Output capacitance | Pad Limit | | 2.8 | | ρF |
| C_{BID} | Bi-directional buffer capacitance | Pad Limit | | 2.8 | | ρF |



5.4 DC Electrical Characteristics of 3.3V I/O Cells

Table 5.4 DC Electrical Characteristics of 3.3V I/O Cells

| SYMBOL | PARAMETER | CONDITIONS | Limits | | | UNIT |
|----------|----------------------------------|---------------------------------|--------|---------|-----|-----------|
| | | | MIN | TYP | MAX | |
| V_{CC} | Power supply | 3.3V I/O | 3.0 | 3.3 | 3.6 | V |
| V_{il} | Input low voltage | LVTTTL | | | 0.8 | V |
| V_{ih} | Input high voltage | | 2.0 | | | V |
| V_{ol} | Output low voltage | $ I_{ol} = 2 \sim 16\text{mA}$ | | | 0.4 | V |
| V_{oh} | Output high voltage | $ I_{oh} = 2 \sim 16\text{mA}$ | 2.4 | | | V |
| R_{pu} | Input pull-up resistance | PU=high, PD=low | 40 | 75 | 190 | $K\Omega$ |
| R_{pd} | Input pull-down resistance | PU=low, PD=high | 40 | 75 | 190 | $K\Omega$ |
| I_{in} | Input leakage current | $V_{in} = V_{CC}$ or 0 | -10 | ± 1 | 10 | μA |
| I_{oz} | Tri-state output leakage current | | -10 | ± 1 | 10 | μA |



5.5 USB Transceiver Characteristics

Table 5.5 Electrical characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|------|------|------|---------|
| AVCC | Analog supply voltage | | 3.0 | 3.3 | 3.6 | V |
| VCC | Digital supply voltage | | 2.25 | 2.5 | 2.75 | V |
| I _{CC} | Operating supply current | High speed operating at 480 MHz | | | 73 | mA |
| I _{CC(susp)} | Suspend supply current | In suspend mode, current with 1.5k Ω pull-up resistor on pin RPU disconnected | | | 120 | μ A |

Table 5.6 Static characteristic : Digital pin

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|------------|---------|------|------|------|
| Input levels | | | | | | |
| V _{IL} | Low-level input voltage | | | | 0.8 | V |
| V _{IH} | High-level input voltage | | 2.0 | | | V |
| Output levels | | | | | | |
| V _{OL} | Low-level output voltage | | | | 0.2 | V |
| V _{OH} | High-level output voltage | | VCC-0.2 | | | V |

AVCC=3.0V~3.6V ; VCC=2.25V~2.75V ; Temp=0 $^{\circ}$ C~115 $^{\circ}$ C



Table 5.7 Static characteristic : Analog I/O pins (DP/DM)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------------|---|--|------|------|------|----------|
| USB2.0 Transceiver (HS) | | | | | | |
| Input Levels (differential receiver) | | | | | | |
| V_{HSDIFF} | High speed differential input sensitivity | $ V_{I(DP)} - V_{I(DM)} $ measured at the connection as application circuit | 300 | | | mV |
| V_{HSCM} | High speed data signaling common mode voltage range | | -50 | | 500 | mV |
| V_{HSSQ} | High speed squelch detection threshold | Squelch detected | | | 100 | mV |
| | | No squelch detected | 150 | | | mV |
| V_{HSDSC} | High speed disconnection detection threshold | Disconnection detected | 625 | | | mV |
| | | Disconnection not detected | | | 525 | mV |
| Output Levels | | | | | | |
| V_{HSOI} | High speed idle level output voltage(differential) | | -10 | | 10 | mV |
| V_{HSOL} | High speed low level output voltage(differential) | | -10 | | 10 | mV |
| V_{HSOH} | High speed high level output voltage(differential) | | -360 | | 400 | mV |
| V_{CHIRPJ} | Chirp-J output voltage (differential) | | 700 | | 1100 | mV |
| V_{CHIRPK} | Chirp-K output voltage (differential) | | -900 | | -500 | mV |
| Resistance | | | | | | |
| R_{DRV} | Driver output impedance | Equivalent resistance used as internal chip only | 3 | 6 | 9 | Ω |
| | | Overall resistance including external resistor | 40.5 | 45 | 49.5 | |
| Termination | | | | | | |
| V_{TERM} | Termination voltage for pull-up resistor on pin RPU | | 3.0 | | 3.6 | V |
| USB1.1 Transceiver (FS/LS) | | | | | | |
| Input Levels (differential receiver) | | | | | | |
| V_{DI} | Differential input sensitivity | $ V_{I(DP)} - V_{I(DM)} $ | 0.2 | | | V |
| V_{CM} | Differential common mode voltage | | 0.8 | | 2.5 | V |
| Input Levels (single-ended receivers) | | | | | | |



| | | | | | | |
|---------------|---------------------------------|--|-----|--|-----|---|
| V_{SE} | Single ended receiver threshold | | 0.8 | | 2.0 | V |
| Output levels | | | | | | |
| V_{OL} | Low-level output voltage | | 0 | | 0.3 | V |
| V_{OH} | High-level output voltage | | 2.8 | | 3.6 | V |

AVCC=3.0V~3.6V ; VCC=2.25V~2.75V ; Temp=0°C~115°C

Table 5.8 Dynamic characteristic : Analog I/O pins (DP/DM)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------|--|---|------|------|------|------|
| Driver Characteristics | | | | | | |
| High-Speed Mode | | | | | | |
| t_{HSR} | High-speed differential rise time | | 500 | | | ps |
| t_{HSF} | High-speed differential fall time | | 500 | | | ps |
| Full-Speed Mode | | | | | | |
| t_{FR} | Rise time | CL=50pF ; 10 to 90% of $ V_{OH}-V_{OL} $; | 4 | | 20 | ns |
| t_{FF} | Fall time | CL=50pF ; 90 to 10% of $ V_{OH}-V_{OL} $; | 4 | | 20 | ns |
| t_{FRMA} | Differential rise/fall time matching (t_{FR} / t_{FF}) | Excluding the first transition from idle mode | 90 | | 110 | % |
| V_{CRS} | Output signal crossover voltage | Excluding the first transition from idle mode | 1.3 | | 2.0 | V |
| Low-Speed Mode | | | | | | |
| t_{LR} | Rise time | CL=200pF-600pF ; 10 to 90% of $ V_{OH}-V_{OL} $; | 75 | | 300 | ns |
| t_{LF} | Fall time | CL=200pF-600pF ; 90 to 10% of $ V_{OH}-V_{OL} $; | 75 | | 300 | ns |
| t_{LRMA} | Differential rise/fall time matching (t_{LR} / t_{LF}) | Excluding the first transition from idle mode | 80 | | 125 | % |
| V_{CRS} | Output signal crossover voltage | Excluding the first transition from idle mode | 1.3 | | 2.0 | V |
| V_{OH} | High-level output voltage | | 2.8 | | 3.6 | V |



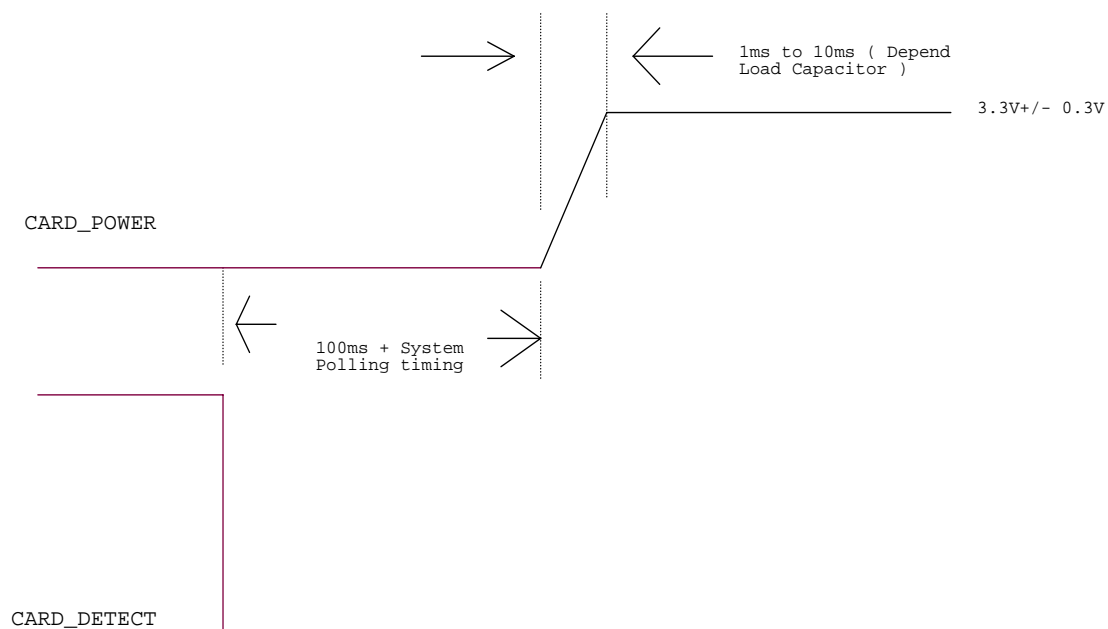
5.6 Power Switch Feature

AU6366 integrates a 3.3V to 2.5V voltage regulator and power switch to replace all MOS chips for flash card power supply.

Card Power Output Current Range

- For MS/SD
 - ◆ MAX: 100mA
- For XD/SMC
 - ◆ MAX: 70mA
- For CF
 - ◆ MAX: 250mA
- Card power output voltage range
 - ◆ MS/XD/SD/SMC/CF: $3.3V \pm 0.3V$
- AU6366 will turn off all of Card Power in suspend mode

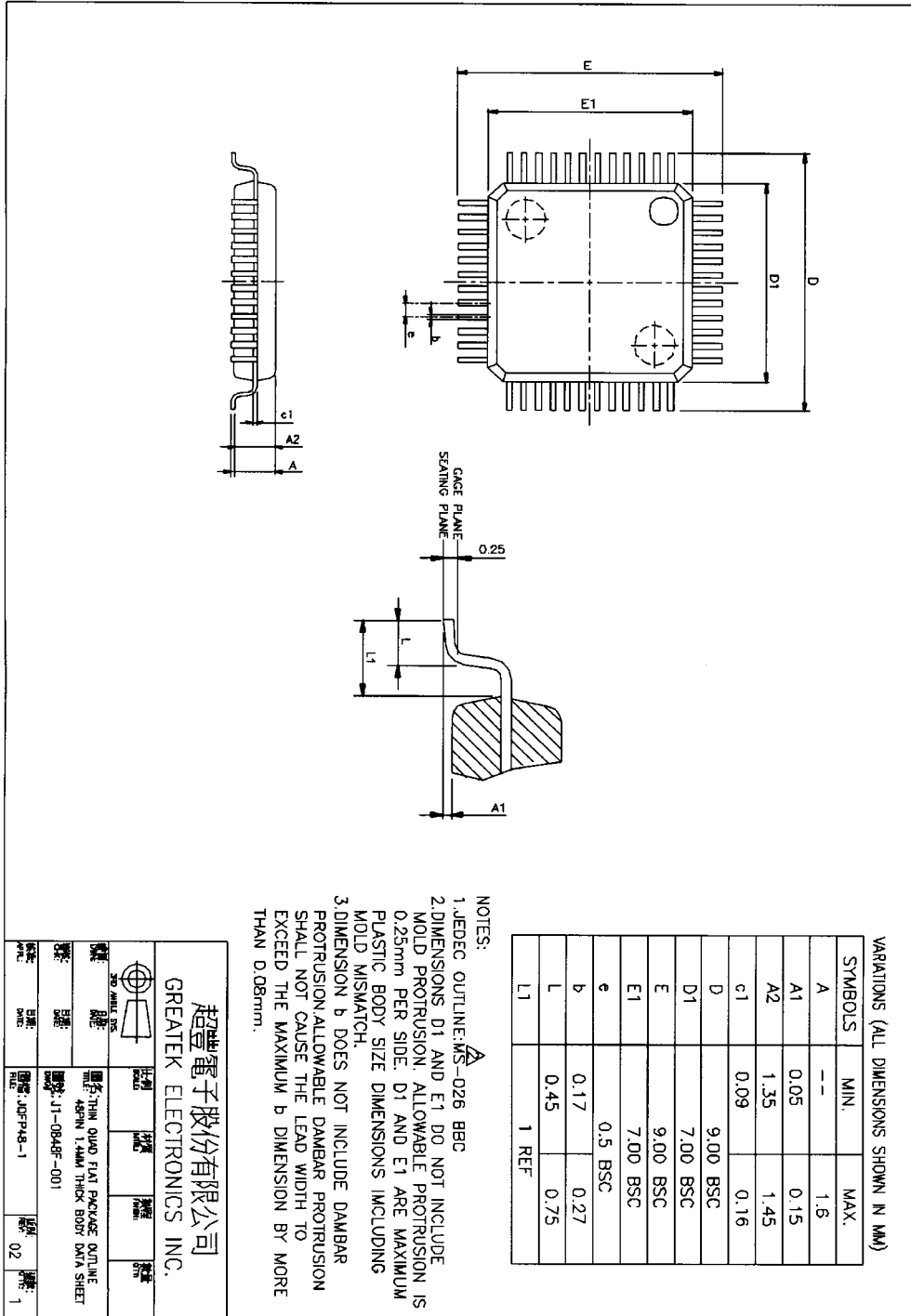
Figure 5.1 Card Detect Power-on Timing





6.0 Mechanical Information

Figure 6.1 Mechanical Information Diagram





7.0 Abbreviations

This chapter lists and defines terms and abbreviations used throughout this specification.

| | |
|-------------|-------------------------------------|
| SIE | Serial Interface Engine |
| CF | Compact Flash |
| MD | Micro Drive |
| SMC | SmartMedia Card |
| MS | Memory Stick |
| SD | Secure Digital |
| MMC | Multimedia Card |
| UTMI | USB Transceiver Macrocell Interface |

**【MEMO】**

About Alcor Micro, Corp

Alcor Micro, Corp. designs, develops and markets highly integrated and advanced peripheral semiconductor, and software driver solutions for the personal computer and consumer electronics markets worldwide. We specialize in USB solutions and focus on emerging technology such as USB and IEEE 1394. The company offers a range of semiconductors including controllers for USB hub, integrated keyboard/USB hub and USB Flash memory card reader...etc. Alcor Micro, Corp. is based in Taipei, Taiwan, with sales offices in Taipei, Japan, Korea and California.

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