

**F81232****F81232****USB to UART Chip**

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**Release Date: August, 2008**  
**Version: V0.10P**

**F81232 Datasheet Revision History**

| Version | Date      | Page | Revision History    |
|---------|-----------|------|---------------------|
| V0.10P  | 2008/8/25 | -    | Preliminary Version |
|         |           |      |                     |
|         |           |      |                     |
|         |           |      |                     |
|         |           |      |                     |

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## 1. General Description

The F81232 is a highly-integrated USB to UART bridge controller providing a simple solution for updating RS-232 design to USB using a minimum of components. A programmable generator is provided to select baud rate from 1200 to 115.2kbps.

In USB interface function, The F81232 communications with host by full-speed USB interface (12Mb/s). It supports 4 suits endpoint, one control endpoint( endpoint zero) is for bus enumeration, one output endpoint is for UART transmit data and two input endpoint is transmit UART data and status to host.

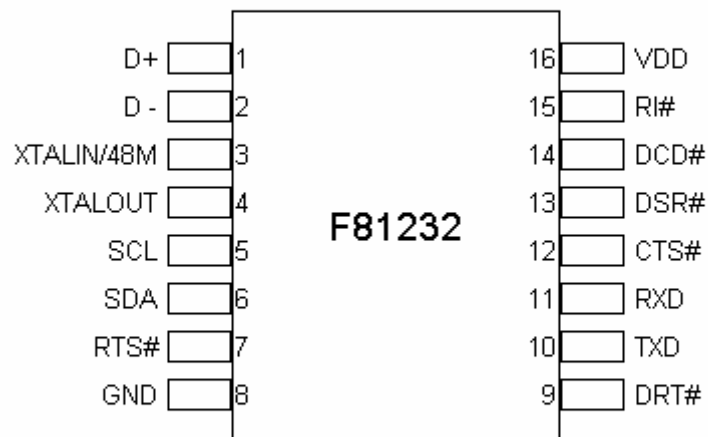
In I2C interface function, The F81232 builds 256 bytes SRAM to save from I2C flash/ROM information for USB bus enumeration. The I2C flash/ROM contains IdVendor/ IdProduct/ BcdDevice/ Manufacturer string / IProduct string / iSerialNumber string information.

In power function, The F81232 supports remote-wakeup function for USB interface, when PC system into S3 state. The F81232 receive UART data to asserted USB interface to wakeup PC system.

## 2. Feature List

- Full compliance with the USB specification Rev 1.1.
- Support RS-232 serial interface.
- Install as a standard COM port.
- Support baud rate from 1200 to 115.2kbps.
- Support remote-wakeup and power management
- Single chip USB to serial communication.
- Power by 3.3V and package in 16SSOP.

### 3. Pin Configuration



### 4. Pin Description

OD<sub>12\_5v</sub> - Open-drain output pin with 12 mA sink 5v tolerance capability.

IOD<sub>12st\_5v</sub> - TTL level bi-directional pin with schmitt trigger and with 12 mA sink 5v tolerance capability.

O<sub>12</sub> - output pin with 12 mA driving/sink capability.

IN<sub>st\_5v</sub> - TTL level input pin with schmitt trigger 5v tolerance.

IN<sub>t</sub> - TTL level input pin.

AIO - USB PAD compatible USB 1.1 spec( internal resistor 28ohm~44ohm)

AIO<sub>1.5k</sub> - USB PAD compatible USB 1.1 spec( internal resistor 28ohm~44ohm),and internal pull high 1.5kohm

P - Power.

| Pin No | Pin Name   | Type                   | PWR | Description  |
|--------|------------|------------------------|-----|--|
| 1      | D+         | AIO <sub>1.5k</sub>    | VDD | D+, different data bus conforming to USB standard. internal pull high 1.5k |
| 2      | D-         | AIO                    | VDD | D-, different data bus conforming to USB standard.                         |
| 3      | XTALIN/48M | IN <sub>t</sub>        | VDD | 12MHz/48Mhz clock input.   |
| 4      | XTALOUT    | O <sub>12</sub>        | VDD | 12 MHz clock output.   |
| 5      | SCL        | OD <sub>12_4.7k</sub>  | VDD | I2C serial clock internal pull high 4.7k                                   |
| 6      | SDA        | OD <sub>12_4.7k</sub>  | VDD | I2C serial data internal pull high 4.7k                                    |
| 7      | RTS#       | O <sub>12</sub>        | VDD | Serial port (request to send)  |
| 8      | GND        | P                      | GND | GND  |
| 9      | DTR#       | I/O <sub>12st_5v</sub> | VDD | Serial port(data terminal ready)   |
| 10     | TXD        | O <sub>12</sub>        | VDD | Serial port(transmitted data )   |
| 11     | RXD        | IN <sub>ts_5v</sub>    | VDD | Serial port(received data)   |
| 12     | CTS#       | IN <sub>ts_5v</sub>    | VDD | Serial port(clear to send)   |
| 13     | DSR#       | IN <sub>ts_5v</sub>    | VDD | Serial port(data set ready)  |
| 14     | DCD#       | IN <sub>ts_5v</sub>    | VDD | Serial port(data carrier detect)   |
| 15     | RI#        | IN <sub>ts_5v</sub>    | VDD | Serial port(ring indicator)  |
| 16     | VDD        | P                      | VDD | Power supply input 3.3v  |

## 5. Functional Description

### 5.1 USB function

The F81232 communications with host by full-speed USB interface (12Mb/s). It supports 4 suits endpoint, one control endpoint( endpoint zero) is for bus enumeration, one output endpoint is for UART transmit data and two input endpoint is transmit UART data and status to host.

Endpoint zero is special significance in USB system. It is a control endpoint, and is required by every device. Only control endpoint accept special setup token that the host transfer command to device.

During enumeration, host requests GET\_DESCRIPTOR to device and device return information (over in endpoint zero) as what device driver top load. The F81232 get descriptor information from I2C flash/ROM, the F81232 returns default description to Host. If I2C flash/ROM does not connect with F81232, the below table is about F81232 default descriptor.

| offset | Field   | size | Value |
|--------|---------|------|-------|
| 0      | BLength | 1    | 0x12  |

|    |                   |   |        |
|----|-------------------|---|--------|
| 1  | bDescriptor Type  | 1 | 0x01   |
| 2  | BcdUSB            | 2 | 0x0101 |
| 4  | bDeviceClass      | 1 | 0x00   |
| 5  | bDeviceSubClass   | 1 | 0x00   |
| 6  | bDeviceProtocol   | 1 | 0x00   |
| 7  | bMaxPacketSize    | 1 | 0x10   |
| 8  | IdVendor          | 2 | 0x1934 |
| 10 | IdProduct         | 2 | 0x0706 |
| 12 | BcdDevice         | 2 | 0x0001 |
| 14 | Manufacturer      | 1 | 0x01   |
| 15 | IProduct          | 1 | 0x02   |
| 16 | iSerialNumber     | 1 | 0x03   |
| 17 | bNumConfiguration | 1 | 0x01   |

Table 5-1 Device Descriptor

| offset | Field               | size | Value  |
|--------|---------------------|------|--------|
| 0      | BLength             | 1    | 0x09   |
| 1      | bDescriptor Type    | 1    | 0x02   |
| 2      | wTotalLength        | 2    | 0x0027 |
| 4      | bNumInterface       | 1    | 0x01   |
| 5      | bConfigurationValue | 1    | 0x01   |
| 6      | iConfiguration      | 1    | 0x00   |
| 7      | BmAttributes        | 1    | 0xa0   |
| 8      | MaxPower            | 1    | 0x32   |

Table 5-2 Configuration Descriptor

| offset | Field              | size | Value |
|--------|--------------------|------|-------|
| 0      | BLength            | 1    | 0x09  |
| 1      | bDescriptor Type   | 1    | 0x04  |
| 2      | wInterfaceNumber   | 1    | 0x00  |
| 3      | bAlternateSetting  | 1    | 0x00  |
| 4      | bNumEndpoints      | 1    | 0x03  |
| 5      | bInterfaceClass    | 1    | 0x00  |
| 6      | bInterfaceSubClass | 1    | 0x00  |
| 7      | bInterfaceProtocol | 1    | 0x00  |
| 8      | IInterface         | 1    | 0x00  |

Table 5-3 Interface Descriptor

| offset | Field            | size | Value  |
|--------|------------------|------|--------|
| 0      | BLength          | 1    | 0x07   |
| 1      | bDescriptor Type | 1    | 0x05   |
| 2      | bEndpointAddress | 1    | 0x81   |
| 3      | BmAttributes     | 1    | 0x03   |
| 4      | wMaxPacketSize   | 2    | 0x0010 |
| 6      | BInterval        | 1    | 0x0a   |

Table 5-4 In Endpoint Descriptor

| offset | Field            | size | Value |
|--------|------------------|------|-------|
| 0      | BLength          | 1    | 0x07  |
| 1      | bDescriptor Type | 1    | 0x05  |

|   |                  |   |        |
|---|------------------|---|--------|
| 2 | bEndpointAddress | 1 | 0x82   |
| 3 | BmAttributes     | 1 | 0x02   |
| 4 | wMaxPacketSize   | 2 | 0x0010 |
| 6 | BInterval        | 1 | 0x00   |

Table 5-5 In Endpoint Descriptor

| offset | Field            | size | Value  |
|--------|------------------|------|--------|
| 0      | BLength          | 1    | 0x07   |
| 1      | bDescriptor Type | 1    | 0x05   |
| 2      | bEndpointAddress | 1    | 0x01   |
| 3      | BmAttributes     | 1    | 0x02   |
| 4      | wMaxPacketSize   | 2    | 0x0010 |
| 6      | BInterval        | 1    | 0x00   |

Table 5-6 Out Endpoint Descriptor

The string table 1 is about manufacturer information, its contents are "FINTEK", the string table 2 is about Product information, its contents is "USB to UART Bridge. The string table 3 is about serial number information, its contents is "88635600168801".

In power function, The F81232 supports remote-wakeup function for USB interface, when PC system into S3 state. The F81232 receive any UART data and ring. The F81232 is asserted USB interface to wakeup PC system.

## 5.2 UART function

The F81232 provides 1 suit UART through USB interface. UART includes 16-bytes send/ 64 bytes receive FIFO, a programmable baud rate generator, complete modem control capability and an interrupt system.

## 5.3 Wakeup function

The F81232 Supports wakeup system function, The F81232 detect idle state on USB bus for more than 3.0ms, it is into suspend state. In Suspend state, the F81232 receive any UART data and ring. It asserted USB interface.



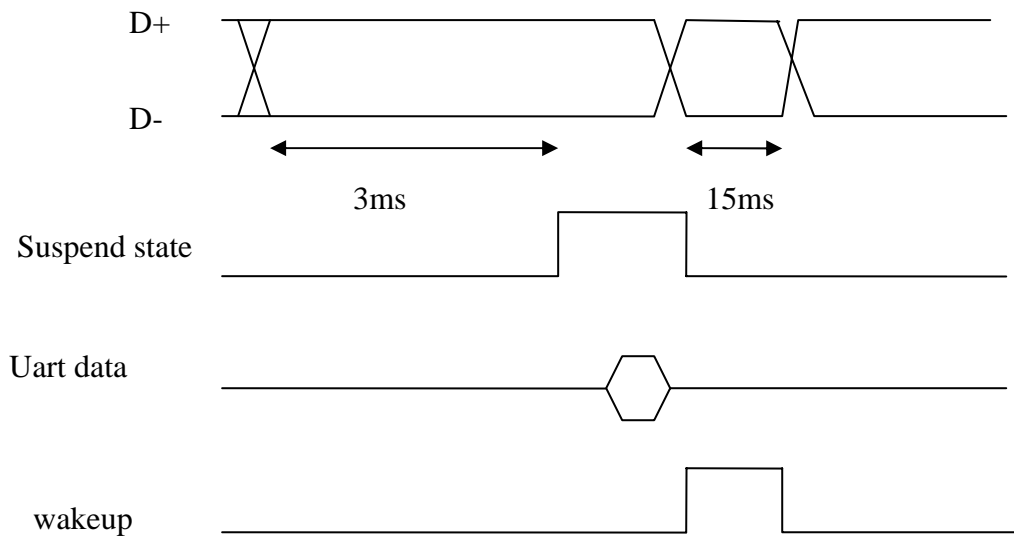


Figure 5-1 USB remote wakeup

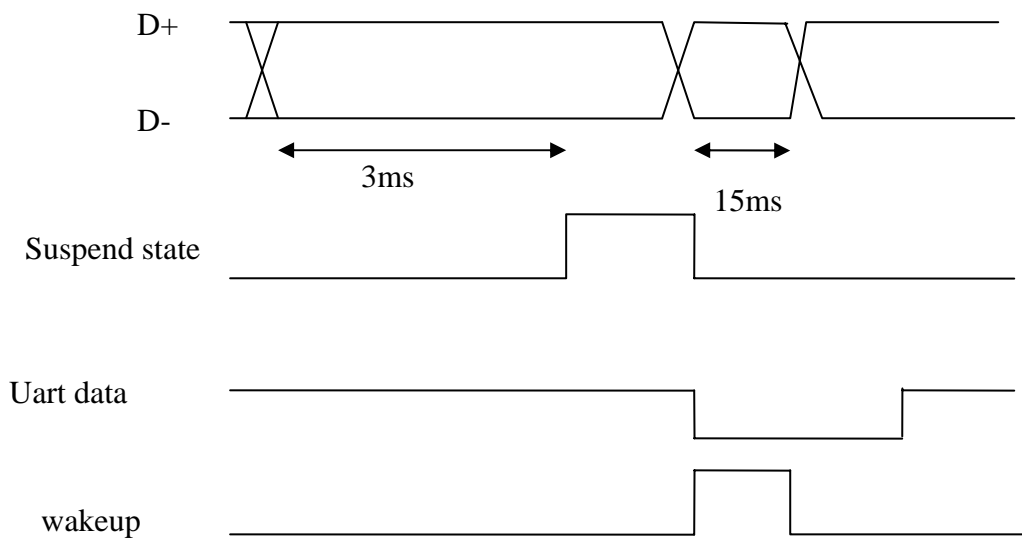


Figure 5-2 USB remote wakeup

## 5.4 I2C interface function

The F81232 Supports 1 suit I2C interface to get USB description information and builds 256 bytes RAM to save vendor USB description information. When power is ready, I2C function start to load USB description into 256 bytes RAM, and expect host requests GET\_DESCRIPTOR to F81232 which returns vendor USB description, if i2c flash/ROM connect with F81232. The contents of I2C flash /ROM format is below table.

|  |                             |                          |
|--|-----------------------------|--------------------------|
| 0x0  | Security code               | 0x55                     |
| 0x1  | Security code               | 0xaa                     |
| 0x2  | IdVendor length             | 0x02                     |
| 0x3  | IdVendor low byte           | IdVendor low byte        |
| 0x4  | IdVendor low byte           | IdVendor high byte       |
| 0x5  | IdProduct length            | 0x02                     |
| 0x6  | IdProduct low byte          | IdProduct low byte       |
| 0x7  | IdProduct low byte          | IdProduct high byte      |
| 0x8  | Endpoint 1 polling time     | Define by vendor content |
| 0x9  | BcdDevice length            | 0x02                     |
| 0xa  | BcdDevice low byte          | BcdDevice low byte       |
| 0xb  | BcdDevice high byte         | BcdDevice high byte      |
| 0xc  | Manufacturer string length  | Define by vendor content |
| 0xd+ Manufacturer string length                              | Manufacturer string content | Define by vendor content |
| 0xd+ Manufacturer string length + 1                          | IProduct string length      | Define by vendor content |
| 0xd+ Manufacturer string length + IProduct string length + 1 | IProduct string content     | Define by vendor content |
| 0xd+ Manufacturer string length + IProduct string length + 2 | ISerialNumber string length | Define by vendor content |
| 0xd+ Manufacturer string length + IProduct string length + 2 | IProduct string length      | Define by vendor content |

Table 5-7 I2C flash/ROM USB description format

## 6. Electrical Characteristics Request

### Absolute Maximum Ratings

| PARAMETER             | RATING          | UNIT |
|-----------------------|-----------------|------|
| Power Supply Voltage  | -0.3 to 3       | V    |
| Input Voltage         | -0.3 to VDD+0.3 | V    |
| Operating Temperature | 0 to 70         | ° C  |
| Storage Temperature   | -55 to 150      | ° C  |

**Table 6-1:** Electrical characteristics table

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.

### DC Characteristics

( $T_A = 0^\circ \text{C}$  to  $70^\circ \text{C}$ ,  $V_{DD} = 3.3\text{V} \pm 10\%$ ,  $V_{SS} = 0\text{V}$ )

| Parameter            | Conditions | MIN | TYP | MAX | Unit |
|----------------------|------------|-----|-----|-----|------|
| Supply Voltage range | VDD        | 3.0 | 3.3 | 3.6 | V    |

**Table 6-2:** Operating Voltage table

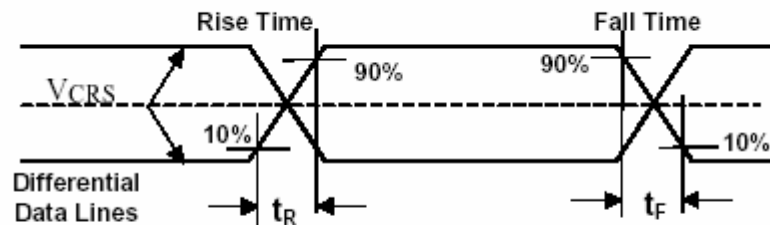
| PARAMETER  | SYM. | MIN | TYP | MAX. | UNIT | CONDITIONS |
|--|------|-----|-----|------|------|------------|
| <b>I/O<sub>12st_5v</sub> - TTL level and schmitt trigger bi-directional pin with 12 mA source-sink 5v tolerance capability(3.3V)</b> |      |     |     |      |      |            |
| Input Low Voltage  | VIL  |     |     | 0.8  | V    |            |
| Input High Voltage   | VIH  | 2.0 |     |      | V    |            |
| Hysteresis   |      |     | 0.5 |      | V    |            |
| Output Low Current   | IOL  |     | 12  |      | mA   | 0.4V       |
| Output high Current  | IOL  |     | 12  |      | mA   | 2.4V       |
| Input High Leakage   | ILIH | -1  |     | 1    | μA   |            |
| Input Low Leakage  | ILIL | -1  |     | 1    | μA   |            |
| <b>OD<sub>12_4.7k</sub> – Open-drain output pin with 12mA source-sink capability(3.3V), pull high 4.7k</b>                           |      |     |     |      |      |            |
| Output Low Current   | IOL  |     | 12  |      | mA   | 0.4V       |
| <b>O<sub>12</sub> – Output pin with 12mA source-sink capability(3.3V)</b>  |      |     |     |      |      |            |
| Output Low Current   | IOL  |     | 12  |      | mA   | 0.4V       |
| Output HIGH Current  | IOH  |     | 12  |      | mA   | 2.4V       |
| <b>IN<sub>t</sub> – TTL level input pin</b>  |      |     |     |      |      |            |
| Input Low Threshold Voltage  | VIL  |     |     | 0.8  | V    |            |
| Input High Threshold Voltage   | VIH  | 2.0 |     |      | V    |            |

|  |      |     |     |     |               |  |
|--|------|-----|-----|-----|---------------|--|
| Input High Leakage   | ILIH |     |     | +1  | $\mu\text{A}$ |  |
| Input Low Leakage  | ILIL | -1  |     |     | $\mu\text{A}$ |  |
| <b>IN<sub>ts_5v</sub> – TTL level input pin and schmitt trigger, 5 tolerance</b> |      |     |     |     |               |  |
| Input Low Threshold Voltage  | VIL  |     |     | 0.8 | V             |  |
| Input High Threshold Voltage   | VIH  | 2.0 |     |     | V             |  |
| Hysteresis   |      |     | 0.5 |     | V             |  |
| Input High Leakage   | ILIH |     |     | +1  | $\mu\text{A}$ |  |
| Input Low Leakage  | ILIL | -1  |     |     | $\mu\text{A}$ |  |

**Table 6-3: PAD DC table**

## USB Interface

| Parameter                                | Symbol     | Min. | Max.   | Units    |
|--|------------|------|--------|----------|
| Rise Time                                | $T_{FR}$   | 4    | 20     | Ns       |
| Fall Time                                | $T_{FF}$   | 4    | 20     | Ns       |
| Differential Rise and Fall Time Matching | $T_{FRFM}$ | 90   | 111.11 | %        |
| Driver Output Resistance                 | $Z_{DRV}$  | 28   | 44     | $\Omega$ |

**USB AC table**

**USB timing**

| Jitter Source                           | Full-speed      |             |                   |             |
|---|-----------------|-------------|-------------------|-------------|
|   | Next Transition |             | Paired Transition |             |
|   | Each (ns)       | Total (ns)  | Each (ns)         | Total (ns)  |
| Source Driver Jitter                    | 2.0             | 2.0         | 1.0               | 1.0         |
| Source Frequency Tolerance (worst-case) | 0.21/bit        | 1.5         | 0.21/bit          | 3.0         |
| <b>Source Jitter Total</b>              |                 | <b>3.5</b>  |                   | <b>4.0</b>  |
| Hub Jitter                              | 3.0             | 15.0        | 1.0               | 5.0         |
| <b>Jitter Specification</b>             |                 | <b>18.5</b> |                   | <b>9.0</b>  |
| Destination Frequency Tolerance         | 0.21/bit        | 1.5         | 0.21/bit          | 3.0         |
| <b>Receiver Jitter Budget</b>           |                 | <b>20.0</b> |                   | <b>12.0</b> |

USB Jitter

## 7. Ordering Information

| Part Number | Package Type                | Production Flow          |
|-------------|-----------------------------|--------------------------|
| F81232R     | 16 pin SSOP (Green Package) | Commercial, 0°C to +70°C |