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## Ultra Fast USB 2.0 Multi-Format, SD/MMC, and MS Flash Media Controllers

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### Highlights

The Microchip USB224x is a USB 2.0 compliant, Hi-Speed bulk only<sup>1</sup> mass storage class peripheral controller intended for reading and writing to popular flash media from the xD-Picture Card™ (xD)<sup>2</sup>, Memory Stick® (MS), Secure Digital (SD), and MultiMedia-Card™ (MMC) families.

The USB224x is a fully integrated, single chip solution capable of ultra high performance operation. Average sustained transfer rates exceeding 35 MB/s are possible if the media and host can support those rates. The USB2244/44i includes provisions to read/write secure media formats.

### General Features

- Low pin count 36-pin QFN (6x6 mm) RoHS compliant package
- USB2240/40i/41/41i
  - Targeted for applications in which single or "combo" media sockets are used
- Hardware-controlled data flow architecture for all self-mapped media
- Pipelined hardware support for access to non-self-mapped media
- Order number with "I" denote the products that support the industrial temperature range of -40°C to 85°C
- Support included for secure media format on a licensed, customized basis
  - USB2244/44i: SD Secure

### Hardware Features

- Single chip flash media controller with
  - USB2240/40i/41/41i: multiplexed interface for use with "combo" card sockets
  - USB2244/44i: SD/MMC flash media reader/writer
- MMC Streaming Mode support
- Extended configuration options
  - xD player mode operation
  - Socket switch polarities, etc.

- Media Activity LED
- On board 24 MHz crystal driver circuit
- Optional external 24 MHz clock input<sup>3</sup>
- Internal card power FET
  - 200 mA
  - "Fold-back" short circuit protection
- 8051 8-bit microprocessor
  - 60 MHz - single cycle execution
  - 64 KB ROM | 14 KB RAM
- Supports a single external 3.3 V supply source; internal regulators provide 1.8 V internal core voltage for additional bill of materials and power savings
- Optimized pinout improves signal routing which eases implementation for improved signal integrity

### Flash Media Specification Compliance

- Secure Digital 2.0
  - HS-SD, SDHC
  - TransFlash™ and reduced form factor media
- MultiMediaCard 4.2
  - 1/4/8-bit MMC
- Memory Stick Formats
  - MS 1.43, Pro 1.02, Duo 1.10
  - Pro-HG Duo 1.01
    - MS, MS Duo, HS-MS, MS Pro-HG, MS Pro
- xD-Picture Card 1.2

### Software Features

- Customizable vendor specific data
- Optimized for low latency interrupt handling
- Reduced memory footprint

### Applications

- Flash media card reader/writers
- Desktop and mobile PCs
- Printers
- Consumer A/V and media players/viewers
- Compatible with
  - Microsoft® Vista™ and Vista ReadyBoost™
  - Windows® XP, ME, 2K SP4
  - Apple Mac OSx®
  - Linux Mass Storage Class Drivers

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1. Bulk only is not applicable to USB2240/40i/41/41i.  
2. xD-Picture Card is not applicable to USB2241/41i.

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3. Only applicable to USB2240/40i/41/41i.

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## 1.0 INTRODUCTION

The Microchip USB224x is a flash media card reader solution fully compliant with the USB 2.0 specification. All required resistors on the USB ports are integrated into the device. This includes all series termination resistors on D+ and D- pins and all required pull-down and pull-up resistors. The over-current sense inputs for the downstream facing ports have internal pull-up resistors.

### 1.1 Hardware Features

- Single chip flash media controller in low pin count 36-pin QFN, RoHS compliant package
- Commercial temperature products support 0°C to +70°C: USB2240/41 and USB2244
- Industrial temperature products support -40°C to +85°C: USB2240I/41I and USB2244I
- 8051 8-bit microprocessor
  - 60 MHz - single cycle execution
  - 64 KB ROM | 14 KB RAM
- Supports a single external 3.3 V supply source; internal regulators provide 1.8 V internal core voltage for additional bill of materials and power savings

#### Compliance with the following flash media card specifications:

- Secure Digital 2.0
  - HS-SD and SDHC
  - TransFlash™ and reduced form factor media
- MultiMediaCard 4.2
  - 1/4/8 bit MMC
- Memory Stick 1.43
- Memory Stick Pro Format 1.02
- Memory Stick Pro-HG Duo Format 1.01
  - Memory Stick, MS Duo, HS-MS, MS Pro-HG, MS Pro
- Memory Stick Duo 1.10
- xD-Picture Card 1.2

### 1.2 Software Features

- If the OEM is using an external EEPROM, the following features are available:
  - Customizable vendor, product, language, and device ID's
  - 12-hex digits maximum for the serial number string
  - 28-character manufacturer ID and product strings for the flash media reader/writer
  - LED blink interval or duration

# USB224X

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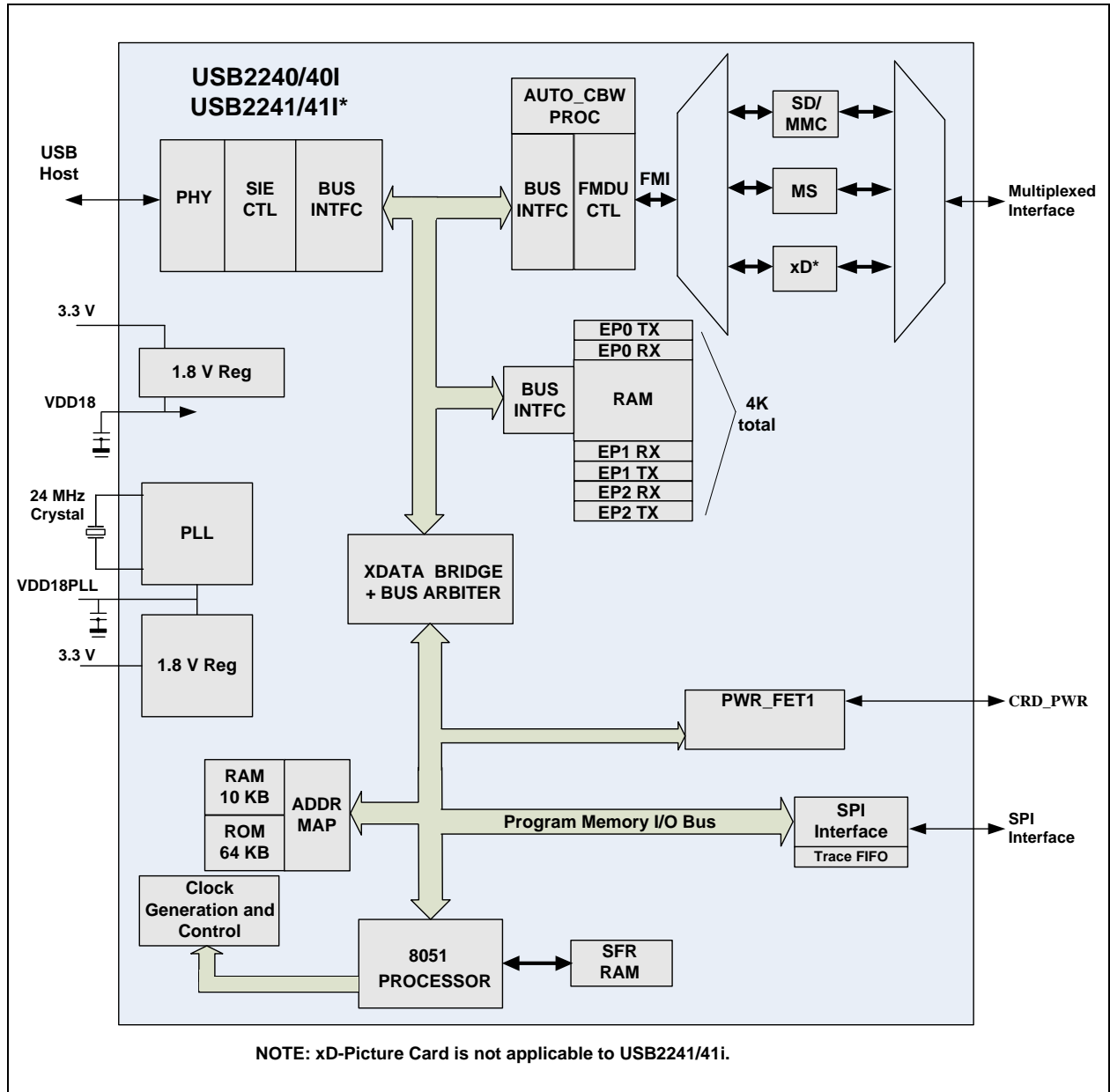
## 2.0 ACRONYMS

|               |   |
|---------------|---|
| <b>ATA:</b>   | Advanced Technology Attachment                |
| <b>FET:</b>   | Field Effect Transistor                       |
| <b>LUN:</b>   | Logical Unit Number                           |
| <b>MMC:</b>   | MultiMediaCard                                |
| <b>MSC:</b>   | Memory Stick Controller <sup>1</sup>          |
| <b>PLL:</b>   | Phase-Locked Loop                             |
| <b>QFN:</b>   | Quad Flat No leads                            |
| <b>RoHS:</b>  | Restriction of Hazardous Substances Directive |
| <b>RXD:</b>   | Received eXchange Data                        |
| <b>SDC:</b>   | Secure Digital Controller                     |
| <b>SIE:</b>   | Serial Interface Engine                       |
| <b>TXD:</b>   | Transmit eXchange Data                        |
| <b>UART:</b>  | Universal Asynchronous Receiver-Transmitter   |
| <b>UCHAR:</b> | Unsigned Character                            |
| <b>UINT:</b>  | Unsigned Integer                              |

1. Not applicable to USB2244/44i.

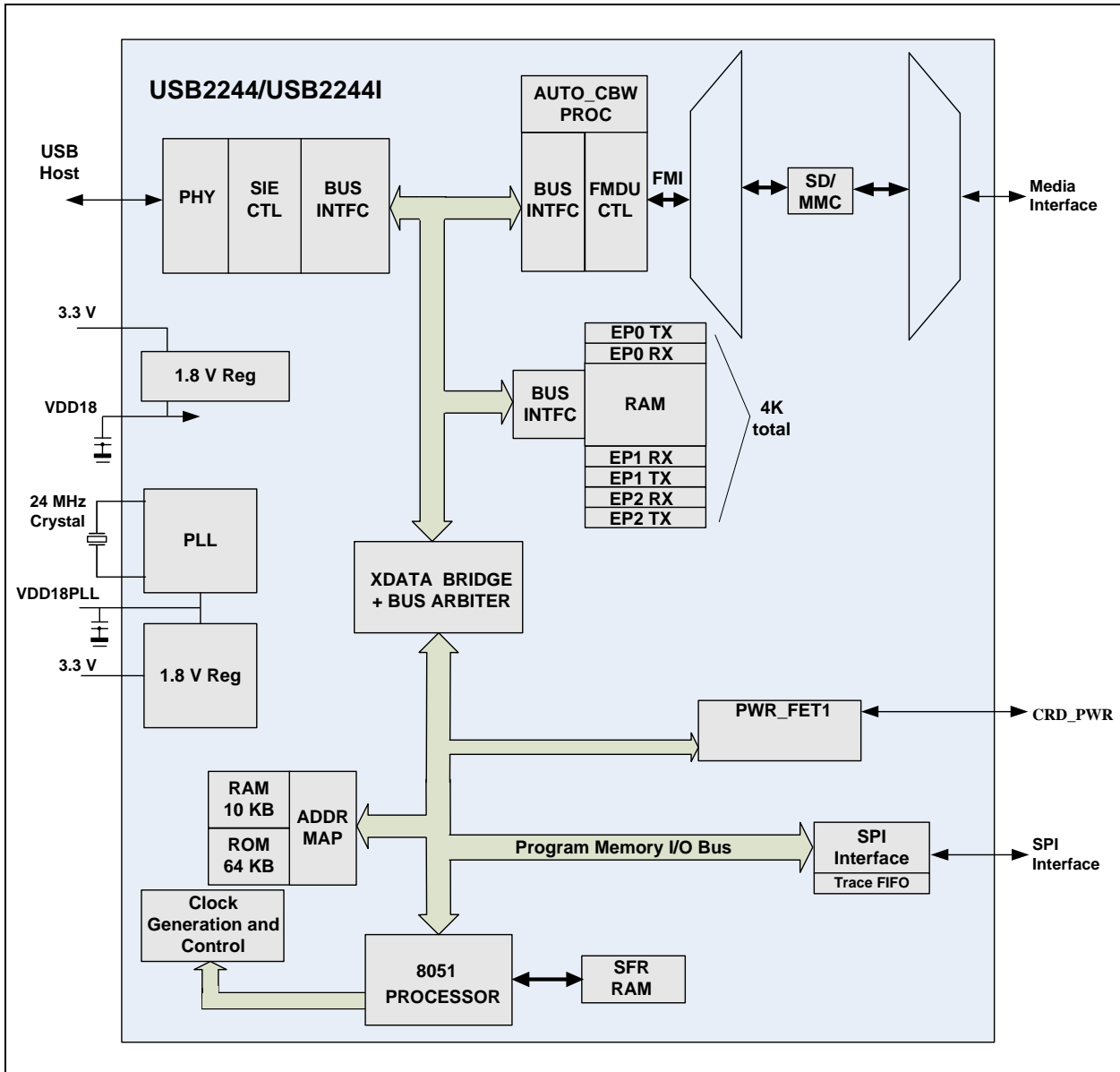
## 3.0 BLOCK DIAGRAMS

FIGURE 3-1: USB2240/40I/41/41I BLOCK DIAGRAM



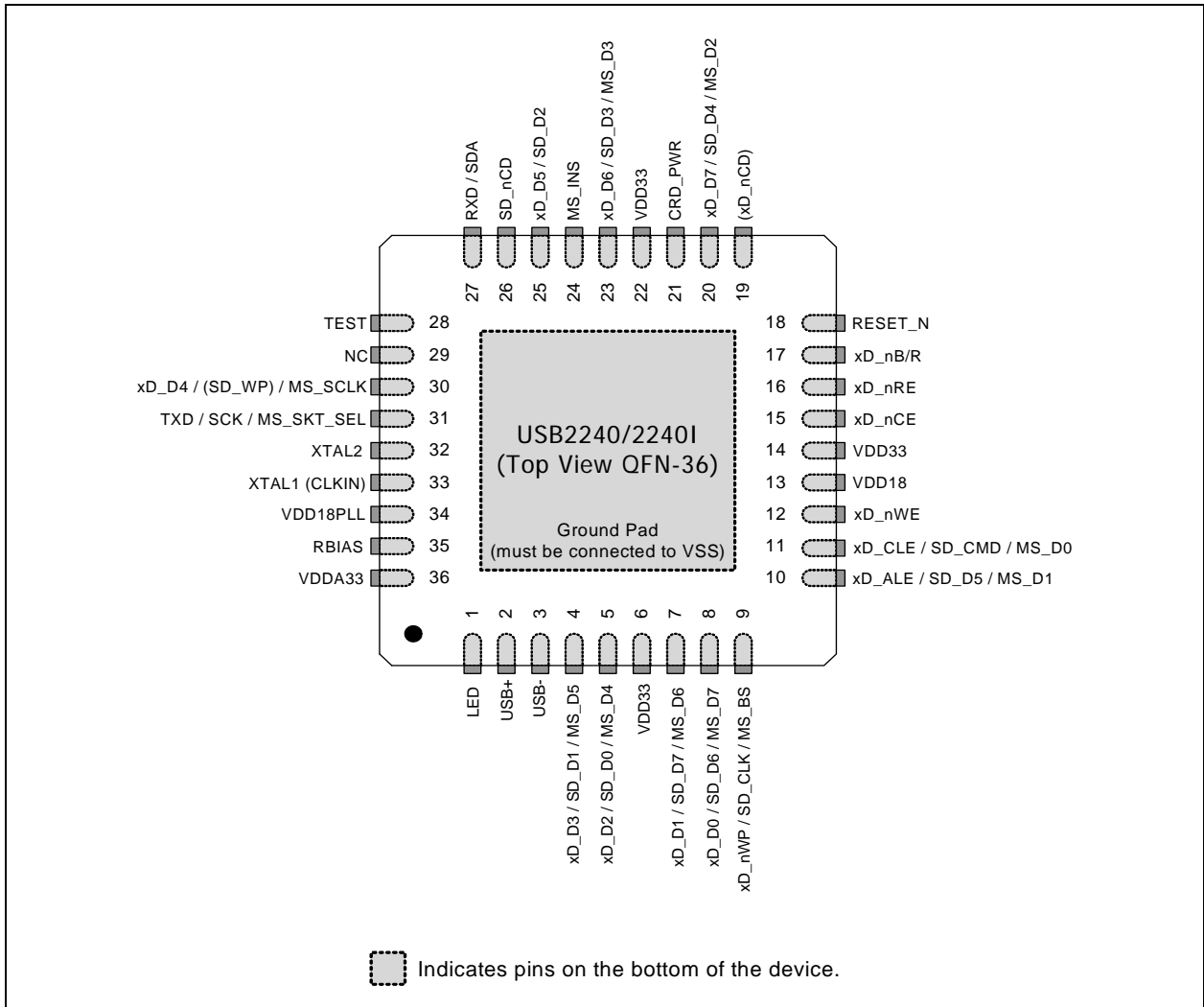
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FIGURE 3-2: USB2244/44I BLOCK DIAGRAM



## 4.0 PIN CONFIGURATIONS

FIGURE 4-1: USB2240/USB2240I 36-PIN QFN DIAGRAM



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FIGURE 4-2: USB2241/USB2241I 36-PIN QFN DIAGRAM

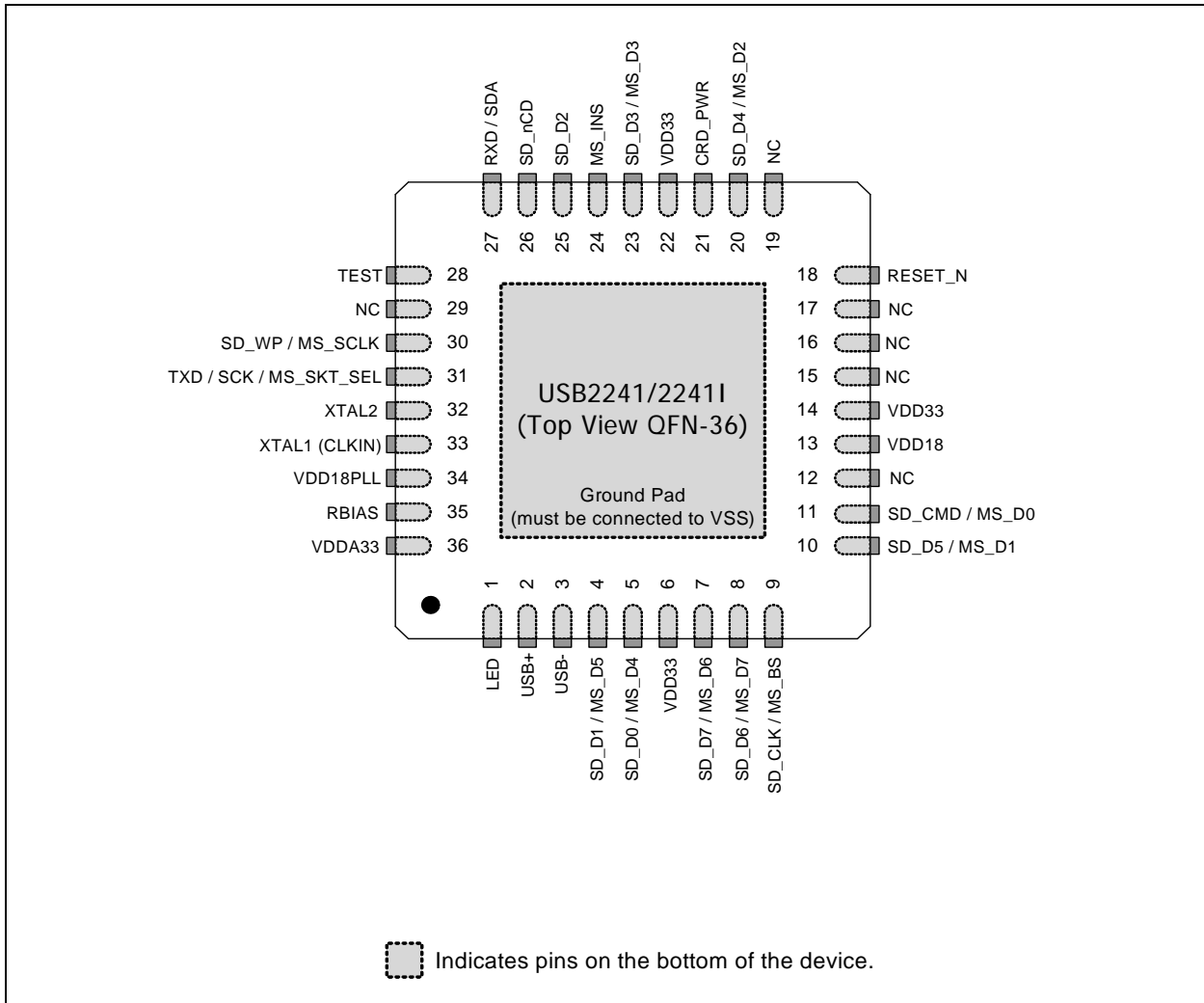
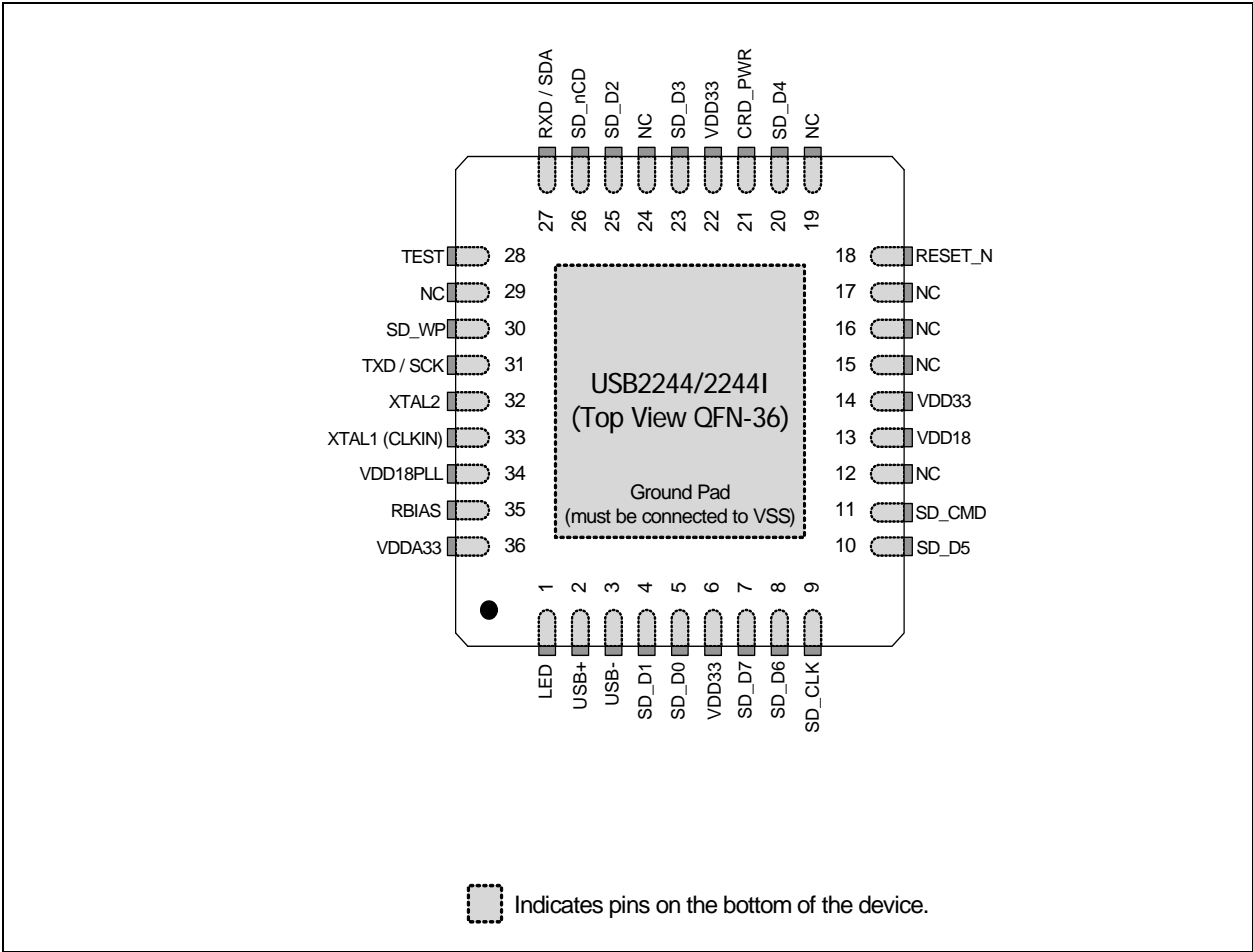




FIGURE 4-3: USB2244/USB2244I 36-PIN QFN DIAGRAM



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## 5.0 PIN TABLES

TABLE 5-1: USB2240/2240I 36-PIN QFN PACKAGE

| <b>xD/SD/MS INTERFACE (18 PINS)</b> |                              |                               |                              |
|-------------------------------------|------------------------------|-------------------------------|------------------------------|
| xD_D3 /<br>SD_D1 /<br>MS_D5         | xD_D2 /<br>SD_D0 /<br>MS_D4  | xD_D1 /<br>SD_D7 /<br>MS_D6   | xD_D0 /<br>SD_D6 /<br>MS_D7  |
| xD_nWP /<br>SD_CLK /<br>MS_BS       | xD_ALE /<br>SD_D5 /<br>MS_D1 | xD_CLE /<br>SD_CMD /<br>MS_D0 | xD_D7 /<br>SD_D4 /<br>MS_D2  |
| xD_D6 /<br>SD_D3 /<br>MS_D3         | xD_D5 / SD_D2                | xD_nRE                        | xD_nWE                       |
| xD_D4 /<br>SD_WP /<br>MS_SCLK       | xD_nB/R                      | xD_nCE                        | MS_INS                       |
| xD_nCD                              | SD_nCD                       |                               |                              |
| <b>USB INTERFACE (5 PINS)</b>       |                              |                               |                              |
| USB+                                | USB-                         | XTAL1 (CLKIN)                 | XTAL2                        |
| RBIAS                               |                              |                               |                              |
| <b>MISC (7 Pins)</b>                |                              |                               |                              |
| LED                                 | RXD /<br>SDA                 | NC                            | TXD /<br>SCK /<br>MS_SKT_SEL |
| CRD_PWR                             | TEST                         | RESET_N                       |                              |
| <b>DIGITAL, POWER (6 PINS)</b>      |                              |                               |                              |
| (3) VDD33                           | VDDA33                       | VDD18                         | VDD18PLL                     |
| <b>TOTAL 36</b>                     |                              |                               |                              |

**TABLE 5-2: USB2241/2241I 36-PIN QFN PACKAGE**

| <b>SD/MS INTERFACE (14 PINS)</b> |                  |                    |                              |
|----------------------------------|------------------|--------------------|------------------------------|
| SD_D1 /<br>MS_D5                 | SD_D0 /<br>MS_D4 | SD_D7 /<br>MS_D6   | SD_D6 /<br>MS_D7             |
| SD_CLK /<br>MS_BS                | SD_D5 /<br>MS_D1 | SD_CMD /<br>MS_D0  | SD_D4 /<br>MS_D2             |
| SD_D3 /<br>MS_D3                 | SD_D2            | SD_WP /<br>MS_SCLK | MS_INS                       |
| NC                               | SD_nCD           |                    |                              |
| <b>USB INTERFACE (5 PINS)</b>    |                  |                    |                              |
| USB+                             | USB-             | XTAL1 (CLKIN)      | XTAL2                        |
| RBIAS                            |                  |                    |                              |
| <b>MISC (11 Pins)</b>            |                  |                    |                              |
| LED                              | RXD /<br>SDA     | NC                 | TXD /<br>SCK /<br>MS_SKT_SEL |
| CRD_PWR                          | TEST             | RESET_N            | (4) NC                       |
| <b>DIGITAL, POWER (6 PINS)</b>   |                  |                    |                              |
| (3) VDD33                        | VDDA33           | VDD18              | VDD18PLL                     |
| <b>TOTAL 36</b>                  |                  |                    |                              |

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**TABLE 5-3: USB2244/2244I 36-PIN QFN PACKAGE**

| <b>SD/MMC INTERFACE (12 Pins)</b> |           |               |           |
|-----------------------------------|-----------|---------------|-----------|
| SD_D0                             | SD_D1     | SD_D2         | SD_D3     |
| SD_D4                             | SD_D5     | SD_D6         | SD_D7     |
| SD_CLK                            | SD_CMD    | SD_WP         | SD_nCD    |
| <b>USB INTERFACE (5 PINS)</b>     |           |               |           |
| USB+                              | USB-      | XTAL1 (CLKIN) | XTAL2     |
| RBIAS                             |           |               |           |
| <b>MISC (13 PINS)</b>             |           |               |           |
| LED                               | RXD / SDA | NC            | TXD / SCK |
| CRD_PWR                           | NC        | NC            | (4) NC    |
| TEST                              | RESET_N   |               |           |
| <b>DIGITAL, POWER (6 PINS)</b>    |           |               |           |
| (3)VDD33                          | VDDA33    | VDD18         | VDD18PLL  |
| <b>TOTAL 36</b>                   |           |               |           |

## 6.0 PIN DESCRIPTIONS

This section provides a detailed description of each signal. The signals are arranged in functional groups according to their associated interface. The pin descriptions are applied when using the internal default firmware and can be referenced in [Section 7.0, "Pin Configurations," on page 18](#). Please reference [Section 2.0, "Acronyms," on page 4](#) for a list of the acronyms used.

The “n” symbol in the signal name indicates that the active, or asserted, state occurs when the signal is at a low voltage level. When “n” is not present in the signal name, the signal is asserted at the high voltage level.

The terms assertion and negation are used exclusively. This is done to avoid confusion when working with a mixture of “active low” and “active high” signals. The term assert, or assertion, indicates that a signal is active, independent of whether that level is represented by a high or low voltage. The term negate, or negation, indicates that a signal is inactive.

### 6.1 USB224x 36-Pin QFN Pin Descriptions

**TABLE 6-1: USB224X 36-PIN QFN PIN DESCRIPTIONS**

| Symbol   | USB2240/40I                              | USB2241/41I | USB2244/44I | Buffer Type | Description  |
|--|--|-------------|-------------|-------------|--|
| <b>xD-PICTURE CARD (xD) INTERFACE (APPLIES ONLY TO USB2240/USB2240I)</b> |  |             |             |             |  |
| xD_D[7:0]  | 20<br>23<br>25<br>30<br>4<br>5<br>7<br>8 |             |             | I/O12PD     | xD Data<br><br>These bi-directional data signals have weak internal pull-down resistors.   |
| xD_nWP   | 9  |             |             | O12PD       | xD Write Protect<br><br>This pin is an active low write protect signal for the xD device and has a weak pull-down resistor that is permanently enabled.  |
| xD_ALE   | 10                                       |             |             | O12PD       | xD Address Strobe<br><br>This pin is an active high Address Latch Enable signal for the xD device and has a weak pull-down resistor that is permanently enabled.   |
| xD_CLE   | 11                                       |             |             | O12PD       | xD Command Strobe<br><br>This pin is an active high Command Latch Enable signal for the xD device and has a weak pull-down resistor that is permanently enabled.   |
| xD_nRE   | 16                                       |             |             | O12PU       | xD Read Enable<br><br>This pin is an active low read strobe signal for the xD device.<br><br>When using the internal FET, this pin has a weak internal pull-up resistor that is tied to the output of the internal power FET.<br><br>If an external FET is used (Internal FET is disabled), then the internal pull-up is not available (external pull-ups must be used). |

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TABLE 6-1: USB224X 36-PIN QFN PIN DESCRIPTIONS (CONTINUED)

| Symbol                             | USB2240/40I                              | USB2241/41I | USB2244/44I | Buffer Type | Description  |
|------------------------------------|--|-------------|-------------|-------------|--|
| xD_nWE                             | 12                                       |             |             | O12PU       | <p>xD Write Enable</p> <p>This pin is an active low write strobe signal for the xD device.</p> <p>When using the internal FET, this pin has a weak internal pull-up resistor that is tied to the output of the internal power FET.</p> <p>If an external FET is used (Internal FET is disabled), then the internal pull-up is not available (external pull-ups must be used).</p>  |
| xD_nB/R                            | 17                                       |             |             | IPU         | <p>xD Busy or Data Ready</p> <p>This pin is connected to the BSY/RDY pin of the xD device.</p> <p>When using the internal FET, this pin has a weak internal pull-up resistor that is tied to the output of the internal power FET.</p> <p>If an external FET is used (Internal FET is disabled), then the internal pull-up is not available (external pull-ups must be used).</p>  |
| xD_nCD                             | 19                                       |             |             | I/O12       | <p>xD Card Detection</p> <p>This is designated by the default firmware as the xD-Picture card detection pin.</p> <p><b>Note:</b> This pin can be left unconnected if the socket is not used.</p>   |
| xD_nCE                             | 15                                       |             |             | O12PU       | <p>xD Chip Enable</p> <p>This pin is the active low chip enable signal to the xD device.</p> <p>When using the internal FET, this pin has a weak internal pull-up resistor that is tied to the output of the internal power FET.</p> <p>If an external FET is used (Internal FET is disabled), then the internal pull-up is not available (external pull-ups must be used).</p>  |
| <b>MEMORY STICK (MS) INTERFACE</b> |  |             |             |             |  |
| MS_D[7:0]                          | 8<br>7<br>4<br>5<br>23<br>20<br>10<br>11 |             |             | I/O12PD     | <p>MS System Data In/Out</p> <p>These pins are the bi-directional data signals for the MS device. MS_D0, MS_D2, and MS_D3 have weak pull-down resistors.</p> <p>In serial mode, the most significant bit (MSB) of each byte is transmitted first by either MSC or MS device on MS_D0.</p> <p>In parallel mode, MS_D1 has a pull-down resistor, otherwise it is disabled.</p> <p>In 4- or 8-bit parallel mode, there is a weak pull-down resistor on all MS_D7 - 0 signals.</p> |

**TABLE 6-1: USB224X 36-PIN QFN PIN DESCRIPTIONS (CONTINUED)**

| Symbol  | USB2240/40I                              | USB2241/41I                              | USB2244/44I | Buffer Type | Description   |
|---|--|--|-------------|-------------|---|
| MS_BS   | 9  |  |             | O12         | MS Bus State<br>This pin is connected to the bus state (BS) pin of the MS device. It is used to control the bus states 0, 1, 2 and 3 (BS0, BS1, BS2 and BS3) of the MS device.      |
| MS_SCLK   | 30                                       |  |             | O12         | MS System CLK<br>This pin is an output clock signal to the MS device. The clock frequency is software configurable.   |
| MS_INS  | 24                                       |  |             | IPU         | MS Card Insertion<br>This is designated by the default firmware as the Memory Stick card detection pin.<br><b>Note:</b> This pin can be left unconnected if the socket is not used. |
| <b>SECURE DIGITAL (SD) / MULTIMEDIACARD (MMC) INTERFACE</b> |  |  |             |             |   |
| SD_D[7:0]   | 7<br>8<br>10<br>20<br>23<br>25<br>4<br>5 | 7<br>8<br>10<br>20<br>23<br>25<br>4<br>5 |             | I/O12PU     | SD Data<br>The pins are bi-directional data signals SD_D0 - SD_D7 and have weak pull-up resistors.  |
| SD_CLK  | 9  | 9  |             | O12         | SD Clock<br>This is an output clock signal to SD/MMC device. The clock frequency is software configurable.  |
| SD_CMD  | 11                                       | 11                                       |             | I/O12PU     | SD Command<br>This is a bi-directional signal that connects to the CMD signal of the SD/MMC device and has a weak internal pull-up resistor.  |
| SD_WP   |  |  |             |             | SD Write Protect Detection  |
| SD_nCD  |  |  |             |             | SD Card Detect  |
| <b>USB INTERFACE</b>  |  |  |             |             |   |
| USB+<br>USB-  | 2<br>3                                   |  |             | I/O-U       | USB Bus Data<br>These pins connect to the USB bus data signals.   |
| RBIAS   | 35                                       |  |             | I-R         | USB Transceiver Bias<br>A 12.0 k $\Omega$ , $\pm$ 1.0% resistor is attached from VSS to this pin in order to set the transceiver's internal bias currents.                          |
| XTAL1 (CLKIN)   | 33                                       |  |             | ICLKx       | 24 MHz Crystal (External clock input)<br>This pin can be connected to one terminal of the crystal or can be connected to an external 24 MHz clock when a crystal is not used.       |
| XTAL2   | 32                                       |  |             | OCLKx       | 24 MHz Crystal<br>This is the other terminal of the crystal, or it is left open when an external clock source is used to drive XTAL1(CLKIN).  |
| VDDA33  | 36                                       |  |             |             | 3.3 V Analog Power  |

# USB224X

**TABLE 6-1: USB224X 36-PIN QFN PIN DESCRIPTIONS (CONTINUED)**

| Symbol                 | USB2240/40I   | USB2241/41I          | USB2244/44I          | Buffer Type | Description  |
|------------------------|---------------|----------------------|----------------------|-------------|--|
| VDD18PLL               | 34            |                      |                      |             | 1.8 V PLL Power<br><br>+1.8 V Filtered analog power for internal PLL. This pin must have a 1.0 $\mu$ F $\pm$ 20% (ESR < 0.1 $\Omega$ ) capacitor to VSS. |
| <b>MISC</b>            |               |                      |                      |             |  |
| LED                    | 1             |                      |                      | I/O12       | LED: Can be used as an LED output.   |
| RXD /                  |               |                      |                      | I           | RXD: This signal can be used as input to the RXD of UART in the device. Custom firmware is required to activate this function.                           |
| SDA                    |               |                      |                      | I/O12       | SDA: This is the data pin when used with an external serial EEPROM.  |
| TXD /                  | 31            |                      |                      | O12         | TXD: This signal can be used as an output TXD of UART in the device. Custom firmware is required to activate this function.                              |
| SCK /                  |               |                      |                      | O12         | SCK: This is the clock output when used with an external EEPROM.   |
| MS_SKT_SEL             |               |                      |                      | I           | MS_SKT_SEL: On the positive edge of RESET_N, this pin is sampled to determined the Memory Stick socket size.<br><br>1 = 8-bit<br>0 = 4-bit               |
| CRD_PWR                | 21            |                      |                      | I/O200      | CRD_PWR: Card power drive of 3.3 V at either 100 mA or 200 mA.   |
| RESET_N                | 18            |                      |                      | IS          | RESET Input: This active low signal is used by the system to reset the chip. The active low pulse should be at least 1 $\mu$ s wide.                     |
| TEST                   | 28            |                      |                      | I           | TEST Input: Tie this pin to ground for normal operation.   |
| NC                     |               | 12<br>15<br>16<br>17 | 12<br>15<br>16<br>17 |             | No Connect. No trace or signal should be routed/attached to these pins.  |
| <b>DIGITAL / POWER</b> |               |                      |                      |             |  |
| VDD18                  | 13            |                      |                      |             | +1.8 V core power. This pin must have a 1.0 $\mu$ F $\pm$ 20% (ESR < 0.1 $\Omega$ ) capacitor to VSS.  |
| VDD33                  | 6<br>14<br>22 |                      |                      |             | 3.3 V Power and Regulator Input  |
| VSS                    | ePad          |                      |                      |             | Ground Pad/ePad: the package slug is the only VSS for the device and must be tied to ground with an array of 3x3 vias.                                   |



## 6.2 Buffer Type Descriptions

**TABLE 6-2: BUFFER TYPE DESCRIPTIONS**

| Buffer  | Description   |
|---------|---|
| I       | Input   |
| IPU     | Input with internal weak pull-up resistor   |
| IS      | Input with Schmitt trigger  |
| I/O12   | Input/output buffer with 12 mA sink and 12 mA source  |
| I/O200  | Input/Output buffer 12 mA with FET disabled, 100/200 mA source only when the FET is enabled   |
| I/O12PD | Input/output buffer with 12 mA sink and 12 mA source with an internal weak pull-down resistor |
| I/O12PU | Input/output buffer with 12 mA sink and 12 mA source with a pull-up resistor                  |
| O12     | Output buffer with 12 mA source   |
| O12PU   | Output buffer with 12 mA sink and 12 mA source, with a pull-up resistor                       |
| O12PD   | Output buffer with 12 mA sink and 12 mA source, with a pull-down resistor                     |
| ICLKx   | XTAL clock input  |
| OCLKx   | XTAL clock output   |
| I/O-U   | Analog input/output as defined in the USB 2.0 Specification                                   |
| I-R     | RBIAS   |

**Note:** The DC characteristics are outlined in [Section 9.3, on page 32](#).

# USB224X

## 7.0 PIN CONFIGURATIONS

### 7.1 Card Reader

The Microchip USB224x is fully compliant with the following flash media card reader specifications:

- Secure Digital 2.0
  - HS-SD and SDHC
  - TransFlash™ and reduced form factor media
- MultiMediaCard 4.2
  - 1/4/8 bit MMC
- Memory Stick 1.43
- Memory Stick Pro Format 1.02
- Memory Stick Pro-HG Duo Format 1.01
  - Memory Stick, MS Duo, HS-MS, MS Pro-HG, MS Pro
- Memory Stick Duo 1.10
- xD-Picture Card 1.2

### 7.2 System Configurations

#### 7.2.1 EEPROM

The USB224x can be configured via a 2-wire (I<sup>2</sup>C) EEPROM (512x8) flash device containing the options for the USB224x. If an external configuration device does not exist the internal default values will be used. If one of the external devices is used for configuration, the OEM can update the values through the USB interface. The device will then “attach” to the upstream USB host.

The USBDM tool set is available in the USB224x/USB225x Card Reader software release package. To download the software package from Microchip's website, please visit:

<http://www.microchip.com/SWLibraryWeb/product.aspx?product=OBJ Card Reader>

to go to the [OBJ Card Reader Software Download Agreement](#). Review the license, and if you agree, check the "I agree" box and then select “Confirm”. You will then be able to download the USB224x/USB225x Card reader combo release package zip file containing the USBDM tool set. Please note that the following applies to the system values and descriptions when used:

- N/A = Not applicable to this part
- Reserved = For internal use

#### 7.2.2 EEPROM DATA DESCRIPTOR

**TABLE 7-1: INTERNAL FLASH MEDIA CONTROLLER CONFIGURATIONS**

| Address | Register Name   | Description                                    | Internal Default Value                            |
|---------|-----------------|--|---|
| 00h     | USB_SER_LEN     | USB Serial String Descriptor Length            | 1Ah   |
| 01h     | USB_SER_TYP     | USB Serial String Descriptor Type              | 03h   |
| 02h-19h | USB_SER_NUM     | USB Serial Number                              | "000000225001"<br>(See <a href="#">Note 7-1</a> ) |
| 1Ah-1Bh | USB_VID         | USB Vendor Identifier                          | 0424  |
| 1Ch-1Dh | USB_PID         | USB Product Identifier                         | 2240  |
| 1Eh     | USB_LANG_LEN    | USB Language String Descriptor Length          | 04h   |
| 1Fh     | USB_LANG_TYP    | USB Language String Descriptor Type            | 03h   |
| 20h     | USB_LANG_ID_LSB | USB Language Identifier Least Significant Byte | 09h<br>(See <a href="#">Note 7-2</a> )            |

**TABLE 7-1: INTERNAL FLASH MEDIA CONTROLLER CONFIGURATIONS (CONTINUED)**

| Address   | Register Name   | Description                                   | Internal Default Value                                       |
|-----------|-----------------|---|--|
| 21h       | USB_LANG_ID_MSB | USB Language Identifier Most Significant Byte | 04h<br>(See <a href="#">Note 7-2</a> )                       |
| 22h       | USB_MFR_STR_LEN | USB Manufacturer String Descriptor Length     | 10h  |
| 23h       | USB_MFR_STR_TYP | USB Manufacturer String Descriptor Type       | 03h  |
| 24h-31h   | USB_MFR_STR     | USB Manufacturer String                       | "Generic"<br>(See <a href="#">Note 7-1</a> )                 |
| 32h-5Dh   | Reserved        | -   | 00h  |
| 5Eh       | USB_PRD_STR_LEN | USB Product String Descriptor Length          | 24h  |
| 5Fh       | USB_PRD_STR_TYP | USB Product String Descriptor Type            | 03h  |
| 60h-99h   | USB_PRD_STR     | USB Product String                            | "Ultra Fast Media Reader"<br>(See <a href="#">Note 7-1</a> ) |
| 9Ah       | USB_BM_ATT      | USB BmAttribute                               | 80h  |
| 9Bh       | USB_MAX_PWR     | USB Max Power                                 | 30h (96 mA)  |
| 9Ch       | ATT_LB          | Attribute Lo byte                             | 40h (Reverse SD_WP only)                                     |
| 9Dh       | ATT_HLB         | Attribute Hi Lo byte                          | 00h  |
| 9Eh       | ATT_LHB         | Attribute Lo Hi byte                          | 00h  |
| 9Fh       | ATT_HB          | Attribute Hi byte                             | 00h  |
| A0h       | MS_PWR_LB       | Memory Stick Device Power Lo byte             | 08h  |
| A1h       | MS_PWR_HB       | Memory Stick Device Power Hi byte             | 00h  |
| A2h       | Reserved        | -   | 80h  |
| A3h       | Reserved        | -   | 00h  |
| A4h       | xD_PWR_LB       | xD-Picture Card Device Power Lo byte          | 00h  |
| A5h       | xD_PWR_HB       | xD-Picture Card Device Power Hi byte          | 08h  |
| A6h       | SD_PWR_LB       | Secure Digital Device Power Lo byte           | 00h  |
| A7h       | SD_PWR_HB       | Secure Digital Device Power Hi byte           | 80h  |
| A8h       | LED_BLK_INT     | LED Blink Interval                            | 02h  |
| A9h       | LED_BLK_DUR     | LED Blink After Access                        | 28h  |
| AAh - B0h | DEV0_ID_STR     | Device 0 Identifier String                    | "COMBO"  |
| B1h - B7h | DEV1_ID_STR     | Device 1 Identifier String                    | "MS"   |
| B8h - BEh | DEV2_ID_STR     | Device 2 Identifier String                    | "SM"<br>(See <a href="#">Note 7-3</a> )                      |
| BFh - C5h | DEV3_ID_STR     | Device 3 Identifier String                    | "SD/MMC"   |
| C6h - CDh | INQ_VEN_STR     | Inquiry Vendor String                         | "Generic"  |
| CEh-D2h   | INQ_PRD_STR     | Inquiry Product String                        | 2240   |
| D3h       | DYN_NUM_LUN     | Dynamic Number of LUNs                        | FFh  |
| D4h - D7h | DEV_LUN_MAP     | Device to LUN Mapping                         | FFh, FFh, FFh, FFh   |
| D8h - DAh | Reserved        | -   | 00h, 03h, 07h  |
| DBh - DDh | Reserved        | -   | 5Ch, 56h, 97h  |

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**TABLE 7-1: INTERNAL FLASH MEDIA CONTROLLER CONFIGURATIONS (CONTINUED)**

| Address | Register Name  | Description                    | Internal Default Value |
|---------|----------------|--------------------------------|------------------------|
| DEh-FBh | Not Applicable | -                              | 00h                    |
| FCh-FFh | NVSTORE_SIG    | Non-Volatile Storage Signature | "ATA2"                 |

**Note 7-1** This value is a UNICODE UTF-16LE encoded string value that meets the USB 2.0 specification (Revision 2.0, 2000). Values in double quotations without this note are ASCII values.

**Note 7-2** For a list of the most current 16-bit language ID's defined by the USB-IF, please visit <http://www.unicode.org> or consult *The Unicode Standard, Worldwide Character Encoding*, (Version 4.0), The Unicode Consortium, Addison-Wesley Publishing Company, Reading, Massachusetts.

**Note 7-3** The "SM" value will be overridden with "xD" once an xD-Picture Card has been identified.

## 7.2.3 EEPROM DATA DESCRIPTOR REGISTER DESCRIPTIONS

### 7.2.3.1 00h: USB Serial String Descriptor Length

| Byte | Name        | Description   |
|------|-------------|---|
| 0    | USB_SER_LEN | USB serial string descriptor length as defined by Section 9.6.7 "String" of the USB 2.0 Specification (Revision 2.0, 2000). This field is the "bLength" which describes the size of the string descriptor (in bytes). |

### 7.2.3.2 01h: USB Serial String Descriptor Type

| Byte | Name        | Description   |
|------|-------------|---|
| 1    | USB_SER_TYP | USB serial string descriptor type as defined by Section 9.6.7 "String" of the USB 2.0 Specification (Revision 2.0, 2000). This field is the "bDescriptorType" which is a constant value associated with a string descriptor type. |

### 7.2.3.3 02h-19h: USB Serial Number Option

| Byte | Name        | Description  |
|------|-------------|--|
| 25:2 | USB_SER_NUM | Maximum string length is 12 hex digits. Must be unique to each device. |

### 7.2.3.4 1Ah-1Bh: USB Vendor ID Option

| Byte | Name    | Description   |
|------|---------|---|
| 1:0  | USB_VID | This ID is unique for every vendor. The vendor ID is assigned by the USB Implementer's Forum. |

### 7.2.3.5 1Ch-1Dh: USB Product ID Option

| Byte | Name    | Description  |
|------|---------|--|
| 1:0  | USB_PID | This ID is unique for every product. The product ID is assigned by the vendor. |

### 7.2.3.6 1Eh: USB Language Identifier Descriptor Length

| Byte | Name         | Description  |
|------|--------------|--|
| 0    | USB_LANG_LEN | USB language ID string descriptor length as defined by Section 9.6.7 "String" of the USB 2.0 Specification (Revision 2.0, 2000). This field is the "bLength" which describes the size of the string descriptor (in bytes). |

## 7.2.3.7 1Fh: USB Language Identifier Descriptor Type

| Byte | Name         | Description  |
|------|--------------|--|
| 1    | USB_LANG_TYP | USB language ID string descriptor type as defined by Section 9.6.7 “String” of the USB 2.0 Specification (Revision 2.0, 2000). This field is the “bDescriptorType” which is a constant value associated with a string descriptor type. |

## 7.2.3.8 20h: USB Language Identifier Least Significant Byte

| Byte | Name            | Description   |
|------|-----------------|---|
| 2    | USB_LANG_ID_LSB | English language code = ‘0409’. See <a href="#">Note 7-2</a> to reference additional language ID’s defined by the USB-IF. |

## 7.2.3.9 21h: USB Language Identifier Most Significant Byte

| Byte | Name            | Description   |
|------|-----------------|---|
| 3    | USB_LANG_ID_MSB | English language code = ‘0409’. See <a href="#">Note 7-2</a> to reference additional language ID’s defined by the USB-IF. |

## 7.2.3.10 22h: USB Manufacturer String Descriptor Length

| Byte | Name            | Description   |
|------|-----------------|---|
| 0    | USB_MFR_STR_LEN | USB manufacturer string descriptor length as defined by Section 9.6.7 “String” of the USB 2.0 Specification (Revision 2.0, 2000). This field is the “bLength” which describes the size of the string descriptor (in bytes). |

## 7.2.3.11 23h: USB Manufacturer String Descriptor Type

| Byte | Name            | Description   |
|------|-----------------|---|
| 1    | USB_MFR_STR_TYP | USB manufacturer string descriptor type as defined by Section 9.6.7 “String” of the USB 2.0 Specification (Revision 2.0, 2000). This field is the “bDescriptorType” which is a constant value associated with a string descriptor type. |

## 7.2.3.12 24h-31h: USB Manufacturer String Option

| Byte | Name        | Description                                 |
|------|-------------|---|
| 15:2 | USB_MFR_STR | The maximum string length is 29 characters. |

## 7.2.3.13 32h-5Dh: Reserved

| Byte  | Name     | Description |
|-------|----------|-------------|
| 59:16 | Reserved | Reserved.   |

## 7.2.3.14 5Eh: USB Product String Descriptor Length

| Byte | Name            | Description   |
|------|-----------------|---|
| 0    | USB_PRD_STR_LEN | USB product string descriptor length as defined by Section 9.6.7 “String” of the USB 2.0 Specification (Revision 2.0, 2000). This field is the “bLength” which describes the size of the string descriptor (in bytes). Maximum string length is 29 characters |

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## 7.2.3.15 5Fh: USB Product String Descriptor Type

| Byte | Name            | Description  |
|------|-----------------|--|
| 1    | USB_PRD_STR_TYP | USB product string descriptor type as defined by Section 9.6.7 “String” of the USB 2.0 Specification (Revision 2.0, 2000). This field is the “bDescriptorType” which is a constant value associated with a string descriptor type. |

## 7.2.3.16 60h-99h: USB Product String Option

| Byte | Name        | Description   |
|------|-------------|---|
| 59:2 | USB_PRD_STR | This string will be used during the USB enumeration process in the Windows® operating system. Maximum string length is 29 characters. |

## 7.2.3.17 9Ah: USB BmAttribute (1 byte)

| Bit | Name       | Description   |
|-----|------------|---|
| 7:0 | USB_BM_ATT | <p>Self- or Bus-Power: Selects between self- and bus-powered operation.</p> <p>The hub is either self-powered (draws less than 2 mA of upstream bus power) or bus-powered (limited to a 100 mA maximum of upstream power prior to being configured by the host controller).</p> <p>When configured as a bus-powered device, the Microchip device consumes less than 100 mA of current prior to being configured. After configuration, the bus-powered Microchip device (along with all associated device circuitry, any embedded devices if part of a compound device, and 100 mA per externally available downstream port) must consume no more than 500 mA of upstream VBUS current. The current consumption is system dependent, and the OEM must ensure that the USB 2.0 Specification is not violated.</p> <p>When configured as a self-powered device, &lt;1 mA of upstream VBUS current is consumed and all ports are available, with each port being capable of sourcing 500 mA of current.</p> <p><b>80 = Bus-powered operation (default)</b><br/>C0 = Self-powered operation<br/>A0 = Bus-powered operation with remote wake-up<br/>E0 = Self-powered operation with remote wake-up</p> |

## 7.2.3.18 9Bh: USB MaxPower (1 byte)

| Bit | Name        | Description   |
|-----|-------------|---|
| 7:0 | USB_MAX_PWR | USB Max Power per the USB 2.0 Specification. Do NOT set this value greater than 100 mA. |

## 7.2.3.19 9Ch-9Fh: Attribute Byte Descriptions

| Byte | Byte Name | Bit | Description   |
|------|-----------|-----|---|
| 0    | ATT_LB    | 3:0 | Always reads '0'.   |
|      |           | 4   | Inquire Manufacturer and Product ID Strings<br>'1' - Use the Inquiry Manufacturer and Product ID Strings.<br>'0' (default) - Use the USB Descriptor Manufacturer and Product ID Strings.  |
|      |           | 5   | Always reads '0'.   |
|      |           | 6   | Reverse SD Card Write Protect Sense<br>'1' (default) - SD cards will be write protected when SW_nWP is high, and writable when SW_nWP is low.<br>'0' - SD cards will be write protected when SW_nWP is low, and writable when SW_nWP is high. |
|      |           | 7   | Reserved.   |
| 1    | ATT_HLB   | 3:0 | Always reads '0'.   |
|      |           | 4   | Activity LED True Polarity<br>'1' - Activity LED to Low True.<br>'0' (default) - Activity LED polarity to High True.  |
|      |           | 5   | Common Media Insert / Media Activity LED<br>'1' - The activity LED will function as a common media inserted/media access LED.<br>'0' (default) - The activity LED will remain in its idle state until media is accessed.                      |
|      |           | 6   | Always reads '0'.   |
|      |           | 7   | Reserved.   |
| 2    | ATT_LHB   | 0   | Attach on Card Insert / Detach on Card Removal<br>'1' - Attach on Insert is enabled.<br>'0' (default) - Attach on Insert is disabled.   |
|      |           | 1   | Always reads '0'.   |
|      |           | 2   | Enable Device Power Configuration<br>'1' - Custom Device Power Configuration stored in the NVSTORE is used.<br>'0' (default) - Default Device Power Configuration is used.  |
|      |           | 7:3 | Always reads '0'.   |
| 3    | ATT_HB    | 6:0 | Always reads '0'.   |
|      |           | 7   | xD Player Mode  |

## 7.2.4 A0H-A7H: DEVICE POWER CONFIGURATION

The USB224x has one internal FET which can be utilized for card power. This section describes the default internal configuration. The settings are stored in NVSTORE and provide the following features:

1. A card can be powered by an external FET or by an internal FET.
2. The power limit can be set to 100 mA or 200 mA (Default) for the internal FET.

Each media uses two bytes to store its device power configuration. Bit 3 selects between internal or external card power FET options. For internal FET card power control, bits 0 through 2 are used to set the power limit. The "Device Power Configuration" bits are ignored unless the "Enable Device Power Configuration" bit is set. See [Section 7.2.3.19, "9Ch-9Fh: Attribute Byte Descriptions," on page 23.](#)

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## 7.2.4.1 A0h-A1h: Memory Stick Device Power Configuration

| FET | Type                     | Bits | Bit Type    | Description   |
|-----|--------------------------|------|-------------|---|
| 0   | FET Lo Byte<br>MS_PWR_LB | 3:0  | Low Nibble  | 0000b Disabled  |
| 1   |                          | 7:4  | High Nibble |   |
| 2   | FET Hi Byte<br>MS_PWR_HB | 3:0  | Low Nibble  | 0000b Disabled<br>0001b External FET enabled<br>1000b Internal FET with 100 mA power limit<br><b>1010b Internal FET with 200 mA power limit</b> |
| 3   |                          |      |             | 7:4   |

## 7.2.4.2 A2h-A3h: Not Applicable

| Byte | Name           | Description     |
|------|----------------|-----------------|
| 1:0  | Not Applicable | Not applicable. |

## 7.2.4.3 A4h-A5h: xD-Picture Card Device Power Configuration

When applicable, the "SM" value will be overridden with "xD" once an xD-Picture Card has been identified.

| FET | Type                     | Bits | Bit Type    | Description   |
|-----|--------------------------|------|-------------|---|
| 0   | FET Lo Byte<br>xD_PWR_LB | 3:0  | Low Nibble  | 0000b Disabled  |
| 1   |                          | 7:4  | High Nibble |   |
| 2   | FET Hi Byte<br>xD_PWR_HB | 3:0  | Low Nibble  | 0000b Disabled<br>0001b External FET enabled<br>1000b Internal FET with 100 mA power limit<br><b>1010b Internal FET with 200 mA power limit</b> |
| 3   |                          |      |             | 7:4   |

## 7.2.4.4 A6h-A7h: Secure Digital Device Power Configuration

| FET | Type                     | Bits | Bit Type    | Description   |
|-----|--------------------------|------|-------------|---|
| 0   | FET Lo Byte<br>SD_PWR_LB | 3:0  | Low Nibble  | 0000b Disabled  |
| 1   |                          | 7:4  | High Nibble |   |
| 2   | FET Hi Byte<br>SD_PWR_HB | 3:0  | Low Nibble  | 0000b Disabled<br>0001b External FET enabled<br>1000b Internal FET with 100 mA power limit<br><b>1010b Internal FET with 200 mA power limit</b> |
| 3   |                          |      |             | 7:4   |

## 7.2.4.5 A8h: LED Blink Interval

| Byte | Name        | Description  |
|------|-------------|--|
| 0    | LED_BLK_INT | The blink rate is programmable in 50 ms intervals. The high bit (7) indicates an idle state:<br><br>'0' - Off<br>'1' - On<br><br>The remaining bits (6:0) are used to determine the blink interval up to a max of 128 x 50 ms. |



## 7.2.4.6 A9h: LED Blink Duration

| Byte | Name        | Description  |
|------|-------------|--|
| 1    | LED_BLK_DUR | LED Blink After Access. This byte is used to designate the number of seconds that the LED will continue to blink after a drive access. Setting this byte to "05" will cause the LED to blink for 5 seconds after a drive access. |

## 7.2.5 DEVICE ID STRINGS

These bytes are used to specify the LUN descriptor returned by the device. These bytes are used in combination with the device to LUN mapping bytes in applications where the OEM wishes to reorder and rename the LUNs. If multiple devices are mapped to the same LUN (a COMBO LUN), then the CLUN#\_ID\_STR will be used to name the COMBO LUN instead of the individual device strings. When applicable, the "SM" value will be overridden with xD once an xD-Picture Card has been identified.

### 7.2.5.1 AAh-B0h: Device 0 Identifier String

| Byte | Name        | Description     |
|------|-------------|-----------------|
| 6:0  | DEV0_ID_STR | Not applicable. |

### 7.2.5.2 B1h-B7h: Device 1 Identifier String

| Byte | Name        | Description  |
|------|-------------|--|
| 6:0  | DEV1_ID_STR | This ID string is associated with the Memory Stick device. |

### 7.2.5.3 B8h-BEh: Device 2 Identifier String

| Byte | Name        | Description   |
|------|-------------|---|
| 6:0  | DEV2_ID_STR | This ID string is associated with the xD-Picture Card device. |

### 7.2.5.4 BFh-C5h: Device 3 Identifier String

| Byte | Name        | Description   |
|------|-------------|---|
| 6:0  | DEV3_ID_STR | This ID string is associated with the Secure Digital / MultiMediaCard device. |

### 7.2.5.5 C6h-CDh: Inquiry Vendor String

| Byte | Name        | Description   |
|------|-------------|---|
| 7:0  | INQ_VEN_STR | If bit 4 of the 1st attribute byte is set, the device will use these strings in response to a USB inquiry command, instead of the USB descriptor manufacturer and product ID strings. |

### 7.2.5.6 CEh-D2h: Inquiry Product String

| Byte | Name        | Description   |
|------|-------------|---|
| 4:0  | INQ_PRD_STR | If bit 4 of the 1st attribute byte is set, the device will use these strings in response to a USB inquiry command, instead of the USB descriptor manufacturer and product ID strings. |

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## 7.2.5.7 D3h: Dynamic Number of LUNs

| Bit | Name        | Description   |
|-----|-------------|---|
| 7:0 | DYN_NUM_LUN | <p>These bytes are used to specify the number of LUNs the device exposes to the host. These bytes are also used for icon sharing by assigning more than one LUN to a single icon. This is used in applications where the device utilizes a combo socket and the OEM wishes to have only a single icon displayed for one or more interfaces.</p> <p>If this field is set to "FF", the program assumes that you are using the default value and icons will be configured per the default configuration.</p> |

## 7.2.5.8 D4h-D7h: Device to LUN Mapping

| Byte | Name        | Description  |
|------|-------------|--|
| 3:0  | DEV_LUN_MAP | <p>These registers map a device controller (SD/MMC, SM, and MS) to a Logical Unit Number (LUN). The device reports the mapped LUNs to the USB host in the USB descriptor during enumeration. The icon installer associates custom icons with the LUNs specified in these fields.</p> <p>Setting a register to "FF" indicates that the device is not mapped. Setting all of the DEV_LUN_MAP registers for all devices to "FF" forces the use of the default mapping configuration. Not all configurations are valid. Valid configurations depend on the hardware, packaging, and OEM board layout. The number of unique LUNs mapped must match the value in the <a href="#">Section 7.2.5.7, "D3h: Dynamic Number of LUNs," on page 26</a>.</p> |

## 7.2.5.9 D8h-FBh: Not Applicable

| Byte | Name           | Description     |
|------|----------------|-----------------|
| 35:0 | Not Applicable | Not Applicable. |

## 7.2.5.10 FCh-FFh: Non-Volatile Storage Signature

| Byte | Name        | Description  |
|------|-------------|--|
| 3:0  | NVSTORE_SIG | This signature is used to verify the validity of the data in the first 256 bytes of the configuration area. The signature must be set to 'ATA2' for USB224x. |

## 7.3 Default Configuration Option

The Microchip device can be configured via its internal default configuration. Please see [Section 7.2.2, "EEPROM Data Descriptor"](#) for specific details on how to enable default configuration. Please refer to [Table 7-1](#) for the internal default values that are loaded when this option is selected.

### 7.3.1 EXTERNAL HARDWARE RESET\_N

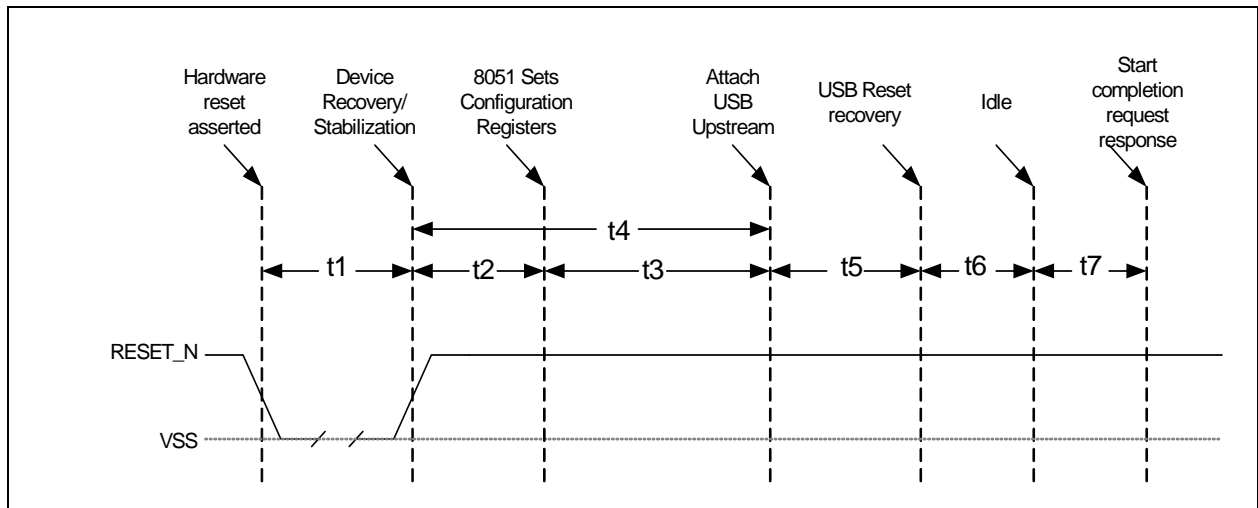
A valid hardware reset is defined as assertion of RESET\_N for a minimum of 1  $\mu$ s after all power supplies are within operating range. While reset is asserted, the device (and its associated external circuitry) consumes less than 500  $\mu$ A of current from the upstream USB power source.

Assertion of RESET\_N (external pin) causes the following:

1. The PHY is disabled and the differential pair will be in a high-impedance state.
2. All transactions immediately terminate; no states are saved.
3. All internal registers return to the default state.
4. The external crystal oscillator is halted.
5. The PLL is halted.
6. The processor is reset.
7. All media interfaces are reset.

## 7.3.1.1 RESET\_N for EEPROM Configuration

**FIGURE 7-1: RESET\_N TIMING FOR EEPROM MODE**



**TABLE 7-2: RESET\_N TIMING FOR EEPROM MODE**

| Name | Description                                     | MIN | TYP       | MAX | Units |
|------|---|-----|-----------|-----|-------|
| t1   | RESET_N asserted                                | 1   |           |     | μsec  |
| t2   | Device recovery/stabilization                   |     |           | 500 | μsec  |
| t3   | 8051 programs device configuration              |     | 20        | 50  | msec  |
| t4   | USB attach                                      |     |           | 100 | msec  |
| t5   | Host acknowledges attach and signals USB reset  | 100 |           |     | msec  |
| t6   | USB idle  |     | Undefined |     | msec  |
| t7   | Ready to handle requests (with or without data) |     |           | 5   | msec  |

**Note:** All power supplies must have reached the operating levels mandated in [Section 9.0, "DC Parameters," on page 31](#), prior to (or coincident with) the assertion of RESET\_N.

## 7.3.2 USB BUS RESET

In response to the upstream port signaling a reset to the device, the device does the following:

1. Sets default address to '0'.
2. Sets configuration to: Unconfigured.
3. All transactions are stopped.
4. Processor reinitializes and restarts.
5. All media interfaces are disabled.

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## 8.0 PIN RESET STATES

FIGURE 8-1: PIN RESET STATES

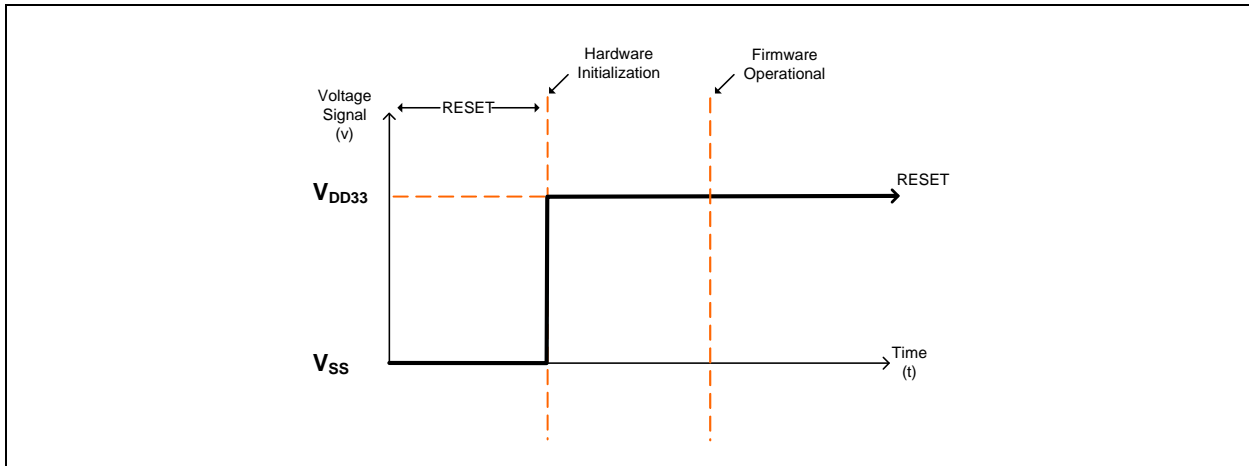


TABLE 8-1: LEGEND FOR PIN RESET STATES TABLE

| Symbol | Description   |
|--------|---|
| 0      | Output driven low   |
| 1      | Output driven high  |
| IP     | Input enabled   |
| PU     | Hardware enables pull-up  |
| PD     | Hardware enables pull-down  |
| --     | Hardware disables function  |
| Z      | Hardware disables pad. Both output driver and input buffers are disabled. |

### 8.1 USB2240/40I/41/41I Pin Reset States

TABLE 8-2: USB2240/40I/41/41I 36-PIN RESET STATES

| Pin | Pin Name                | Reset State |              |       |
|-----|-------------------------|-------------|--------------|-------|
|     |                         | Function    | Input/Output | PU/PD |
| 8   | xD_D0 / SD_D6 / MS_D7   | none        | z            | --    |
| 7   | xD_D1 / SD_D7 / MS_D6   | none        | z            | --    |
| 5   | xD_D2 / SD_D0 / MS_D4   | none        | z            | --    |
| 4   | xD_D3 / SD_D1 / MS_D5   | none        | z            | --    |
| 30  | xD_D4 / SD_WP / MS_SCLK | SD_WP       | 0            | --    |
| 25  | xD_D5 / SD_D2           | none        | z            | --    |
| 26  | SD_nCD                  | none        | IP           | pu    |
| 24  | MS_INS                  | none        | IP           | pu    |

**TABLE 8-2: USB2240/40I/41/41I 36-PIN RESET STATES (CONTINUED)**

| Pin | Pin Name                | Reset State |                  |       |
|-----|-------------------------|-------------|------------------|-------|
|     |                         | Function    | Input/<br>Output | PU/PD |
| 23  | xD_D6 / SD_D3 / MS_D3   | none        | z                | --    |
| 20  | xD_D7 / SD_D4 / MS_D2   | none        | z                | --    |
| 9   | xD_nWP / SD_CLK / MS_BS | none        | z                | --    |
| 10  | xD_ALE / SD_D5 / MS_D1  | none        | z                | --    |
| 11  | xD_CLE / SD_CMD / MS_D0 | none        | z                | --    |
| 19  | xD_nCD                  | none        | IP               | pu    |
| 1   | LED                     | none        | 0                | --    |
| 16  | xD_nRE                  | none        | z                | --    |
| 27  | RXD / SDA               | none        | 0                | --    |
| 29  |                         | none        | 0                | --    |
| 31  | TXD / SCK / MS_SKT_SEL  | none        | 0                | --    |
| 21  | CRD_PWR                 | none        | z                | --    |
| 28  | TEST                    | TEST        | IP               | --    |
| 18  | RESET_N                 | RESET_N     | IP               | --    |
| 12  | xD_nWE                  | none        | z                | --    |
| 17  | xD_nB/R                 | none        | z                | --    |
| 15  | xD_nCE                  | none        | z                | --    |
| 2   | USB+                    | USB+        | z                | --    |
| 3   | USB-                    | USB-        | z                | --    |

**Note:** xD signals only apply to USB2240/USB2240I.

# USB224X

## 8.2 USB2244/44I Pin Reset States

TABLE 8-3: USB2244/USB2244I 36-PIN RESET STATES

| Pin   | Pin Name      | Reset State |                  |           | Post-Reset State<br>SD Mode |        |           |       |
|-------|---------------|-------------|------------------|-----------|-----------------------------|--------|-----------|-------|
|       |               | Function    | Input/<br>Output | PU/<br>PD | Function                    | Output | PU/<br>PD | Input |
| 8     | SD_D6         | none        | z                | --        | SD_D6                       | hw     | pu        | yes   |
| 7     | SD_D7         | none        | z                | --        | SD_D7                       | hw     | pu        | yes   |
| 5     | SD_D0         | none        | z                | --        | SD_D0                       | hw     | pu        | yes   |
| 4     | SD_D1         | none        | z                | --        | SD_D1                       | hw     | pu        | yes   |
| 30    | SD_WP         | SD_WP       | 0                | --        | SD_WP                       | (fw)   | (fw)      | (fw)  |
| 25    | SD_D2         | none        | z                | --        | SD_D2                       | hw     | pu        | yes   |
| 23    | SD_D3         | none        | z                | --        | SD_D3                       | hw     | pu        | yes   |
| 20    | SD_D4         | none        | z                | --        | SD_D4                       | hw     | pu        | yes   |
| 9     | SD_CLK        | none        | z                | --        | SD_CLK                      | hw     | --        | yes   |
| 10    | SD_D5         | none        | z                | --        | SD_D5                       | hw     | pu        | yes   |
| 11    | SD_CMD        | none        | z                | --        | SD_CMD                      | hw     | pu        | yes   |
| 19    |               | none        | IP               | pu        |                             |        |           |       |
| 26    | SD_nCD        | none        | IP               | pu        |                             |        |           |       |
| 24    |               | none        | IP               | pu        |                             |        |           |       |
| 27    | RXD / SDA     | none        | 0                | --        | RXD                         | z      | pu        | yes   |
| 29    |               | none        | 0                | --        |                             |        |           |       |
| 31    | TXD / SCK     | none        | 0                | --        | TXD                         | hw     | --        | --    |
| 21    | CRD_PWR       | none        | z                | --        | PWR                         | VDD    | --        | --    |
| 28    | TEST          | TEST        | IP               | --        |                             |        |           |       |
| 18    | RESET_N       | RESET_N     | IP               | --        |                             |        |           |       |
| 1     | LED           | none        | 0                | --        |                             |        |           |       |
| 17:15 | NC            | none        | z                | --        | none                        | z      | --        | --    |
| 12    | NC            | none        | z                | --        | none                        | z      | --        | --    |
| 2     | USB+          | USB+        | z                | --        |                             |        |           |       |
| 3     | USB-          | USB-        | z                | --        |                             |        |           |       |
| 35    | RBIAS         |             |                  |           |                             |        |           |       |
| 33    | XTAL1 (CLKIN) |             |                  |           |                             |        |           |       |
| 32    | XTAL2         |             |                  |           |                             |        |           |       |

## 9.0 DC PARAMETERS

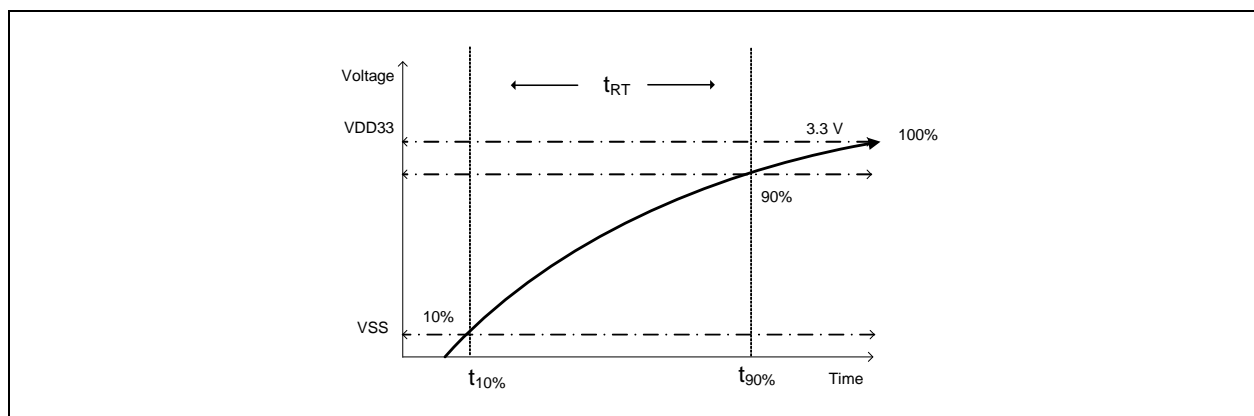
### 9.1 Maximum Ratings

| Parameter                     | Symbol     | MIN  | MAX   | Units | Comments  |
|-------------------------------|------------|------|---|-------|---|
| Storage Temperature           | $T_A$      | -55  | 150   | °C    |   |
| Lead Temperature              |            |      |   | °C    | Please refer to JEDEC specification J-STD-020D.   |
| 3.3 V supply voltage          | $V_{DD33}$ | -0.5 | 4.0   | V     |   |
| Voltage on USB+ and USB- pins |            | -0.5 | $(3.3 \text{ V supply voltage} + 2) \leq 6$ | V     |   |
| Voltage on CRD_PWR            |            | -0.5 | $V_{DD33} + 0.3$                            | V     | When internal power FET operation of this pin is enabled, this pin may be simultaneously shorted to ground or any voltage up to 3.63 V indefinitely, without damage to the device as long as $V_{DD33}$ and $V_{DDA33}$ are less than 3.63 V and $T_A$ is less than 70°C. |
| Voltage on any signal pin     |            | -0.5 | $V_{DD33} + 0.3$                            | V     |   |
| Voltage on XTAL1              |            | -0.5 | 3.6   | V     |   |
| Voltage on XTAL2              |            | -0.5 | $V_{DD18} + 0.3$                            | V     |   |

**Note 9-1** Stresses above the specified parameters may cause permanent damage to the device. This is a stress rating only and functional operation of the device at any condition above those indicated in the operation sections of this specification is not implied.

**Note 9-2** When powering this device from laboratory or system power supplies, it is important that the absolute maximum ratings not be exceeded or device failure can result. Some power supplies exhibit voltage spikes on their outputs when the AC power is switched on or off. In addition, voltage transients on the AC power line may appear on the DC output. When this possibility exists, it is suggested that a clamp circuit be used.

**FIGURE 9-1: SUPPLY RISE TIME MODEL**



# USB224X

## 9.2 Operating Conditions

| Parameter                     | Symbol     | MIN  | MAX        | Units | Comments  |
|-------------------------------|------------|------|------------|-------|---|
| Commercial Part               | $T_A$      | 0    | 70         | °C    | Operating Temperature   |
| Industrial Part               | $T_A$      | -40  | 85         | °C    | Ambient temperature in still air.   |
| 3.3 V supply voltage          | $V_{DD33}$ | 3.0  | 3.6        | V     | (Note 9-3)  |
| 3.3 V supply rise time        | $t_{RT}$   | 0    | 400        | μs    |   |
| Voltage on USB+ and USB- pins |            | -0.3 | 5.5        | V     | If any 3.3 V supply voltage drops below 3.0 V, then the MAX becomes:<br>$(3.3 \text{ V supply voltage}) + 0.5 \leq 5.5$ |
| Voltage on any signal pin     |            | -0.3 | $V_{DD33}$ | V     |   |
| Voltage on XTAL1              |            | -0.3 | $V_{DD33}$ | V     |   |
| Voltage on XTAL2              |            | -0.3 | $V_{DD18}$ | V     |   |

**Note 9-3** A 3.3 V regulator with an output tolerance of 1% must be used if the output of the internal power FETs must support a 5% tolerance.

## 9.3 DC Electrical Characteristics

| Parameter                            | Symbol     | MIN | TYP | MAX | Units | Comments                          |
|--------------------------------------|------------|-----|-----|-----|-------|-----------------------------------|
| <b>I, IPU, IPD Type Input Buffer</b> |            |     |     |     |       |                                   |
| Low Input Level                      | $V_{ILI}$  |     |     | 0.8 | V     | TTL Levels                        |
| High Input Level                     | $V_{IHI}$  | 2.0 |     |     | V     |                                   |
| Pull Down                            | PD         |     | 72  |     | μA    |                                   |
| Pull Up                              | PU         |     | 58  |     | μA    |                                   |
| <b>IS Type Input Buffer</b>          |            |     |     |     |       |                                   |
| Low Input Level                      | $V_{ILI}$  |     |     | 0.8 | V     | TTL Levels                        |
| High Input Level                     | $V_{IHI}$  | 2.0 |     |     | V     |                                   |
| Hysteresis                           | $V_{HYSI}$ |     | 420 |     | mV    |                                   |
| <b>ICLK Input Buffer</b>             |            |     |     |     |       |                                   |
| Low Input Level                      | $V_{ILCK}$ |     |     | 0.5 | V     |                                   |
| High Input Level                     | $V_{IHCK}$ | 1.4 |     |     | V     |                                   |
| Input Leakage                        | $I_{IL}$   | -10 |     | +10 | μA    | $V_{IN} = 0 \text{ to } V_{DD33}$ |
| <b>Input Leakage</b>                 |            |     |     |     |       |                                   |
| (All I and IS buffers)               |            |     |     |     |       |                                   |
| Low Input Leakage                    | $I_{IL}$   | -10 |     | +10 | μA    | $V_{IN} = 0$                      |
| High Input Leakage                   | $I_{IH}$   | -10 |     | +10 | μA    | $V_{IN} = V_{DD33}$               |



| Parameter                                       | Symbol       | MIN              | TYP | MAX | Units         | Comments  |
|---|--------------|------------------|-----|-----|---------------|---|
| <b>O12 Type Buffer</b>                          |              |                  |     |     |               |   |
| Low Output Level                                | $V_{OL}$     |                  |     | 0.4 | V             | $I_{OL} = 12 \text{ mA @ } V_{DD33} = 3.3 \text{ V}$  |
| High Output Level                               | $V_{OH}$     | $V_{DD33} - 0.4$ |     |     | V             | $I_{OH} = -12 \text{ mA @ } V_{DD33} = 3.3 \text{ V}$ |
| Output Leakage                                  | $I_{OL}$     | -10              |     | +10 | $\mu\text{A}$ | $V_{IN} = 0 \text{ to } V_{DD33}$<br>(Note 9-4)       |
| <b>I/O12, I/O12PU &amp; I/O12PD Type Buffer</b> |              |                  |     |     |               |   |
| Low Output Level                                | $V_{OL}$     |                  |     | 0.4 | V             | $I_{OL} = 12 \text{ mA @ } V_{DD33} = 3.3 \text{ V}$  |
| High Output Level                               | $V_{OH}$     | $V_{DD33} - 0.4$ |     |     | V             | $I_{OH} = -12 \text{ mA @ } V_{DD33} = 3.3 \text{ V}$ |
| Output Leakage                                  | $I_{OL}$     | -10              |     | +10 | $\mu\text{A}$ | $V_{IN} = 0 \text{ to } V_{DD33}$<br>(Note 9-4)       |
| Pull Down                                       | PD           |                  | 72  |     | $\mu\text{A}$ |   |
| Pull Up   | PU           |                  | 58  |     | $\mu\text{A}$ |   |
| <b>IO-U</b><br>(Note 9-5)                       |              |                  |     |     |               |   |
| <b>I-R</b><br>(Note 9-6)                        |              |                  |     |     |               |   |
| <b>I/O200 Integrated Power FET for CRD_PWR</b>  |              |                  |     |     |               |   |
| High Output Current Mode                        | $I_{OUT}$    | 200              |     |     | mA            | $V_{dropFET} = 0.46 \text{ V}$                        |
| Low Output Current Mode<br>(Note 9-7)           | $I_{OUT}$    | 100              |     |     | mA            | $V_{dropFET} = 0.23 \text{ V}$                        |
| On Resistance<br>(Note 9-7)                     | $R_{DS(on)}$ |                  |     | 2.1 | $\Omega$      | $I_{FET} = 70 \text{ mA}$                             |
| Output Voltage Rise Time                        | $t_{DSON}$   |                  |     | 800 | $\mu\text{s}$ | $C_{LOAD} = 10 \mu\text{F}$                           |
| Supply Current Unconfigured                     | $I_{CCINIT}$ |                  | 80  | 90  | mA            |   |
| Supply Current Active                           |              |                  |     |     |               |   |
| Full Speed                                      | $I_{CC}$     |                  | 110 | 140 | mA            |   |
| High Speed                                      | $I_{CC}$     |                  | 135 | 165 | mA            |   |
| Supply Current Suspend                          | $I_{CSBY}$   |                  | 350 | 700 | $\mu\text{A}$ |   |
| Industrial Temperature Suspend                  | $I_{CSBYI}$  |                  | 350 | 900 | $\mu\text{A}$ |   |

# USB224X

- Note 9-4** Output leakage is measured with the current pins in high impedance.
- Note 9-5** See The USB 2.0 Specification, Chapter 7, for USB DC electrical characteristics
- Note 9-6** RBIAS is a 3.3 V tolerant analog pin.
- Note 9-7** Output current range is controlled by program software, software disables FET during short circuit condition.
- Note 9-8** The assignment of each Integrated Card Power FET to a designated Card Connector is controlled by both firmware and the specific board implementation.
- Note 9-9** The 3.3 V supply should be at least at 75% of its operating condition before the 1.8 V supply is allowed to ramp up.

## 9.4 Capacitance

$T_A = 25^\circ\text{C}$ ;  $f_c = 1\text{ MHz}$ ;  $V_{DD}$ ,  $V_{DDP} = 1.8\text{ V}$

**TABLE 9-1: PIN CAPACITANCE**

| Parameter               | Symbol     | Limits |     |     | Unit | Test Condition  |
|-------------------------|------------|--------|-----|-----|------|---|
|                         |            | MIN    | TYP | MAX |      |   |
| Clock Input Capacitance | $C_{XTAL}$ |        |     | 2   | pF   | All pins (except USB pins and pins under test) are tied to AC ground. |
| Input Capacitance       | $C_{IN}$   |        |     | 10  | pF   |   |
| Output Capacitance      | $C_{OUT}$  |        |     | 20  | pF   |   |

## 9.5 Package Thermal Specification

**TABLE 9-2: 36-PIN QFN PACKAGE THERMAL PARAMETERS**

| Parameter                  | Velocity (Meters/Sec) | Symbol        | Value | Unit               |
|----------------------------|-----------------------|---------------|-------|--------------------|
| Thermal Resistance         | 0                     | $\Theta_{JA}$ | 33.2  | $^\circ\text{C/W}$ |
|                            | 1                     |               | 29    |                    |
|                            | 2                     |               | 26    |                    |
| Junction-to-Top-of-Package | 0                     | $\Psi_{JT}$   | 2.6   | $^\circ\text{C/W}$ |
|                            | 1                     |               | 2.6   |                    |
|                            | 2                     |               | 2.6   |                    |

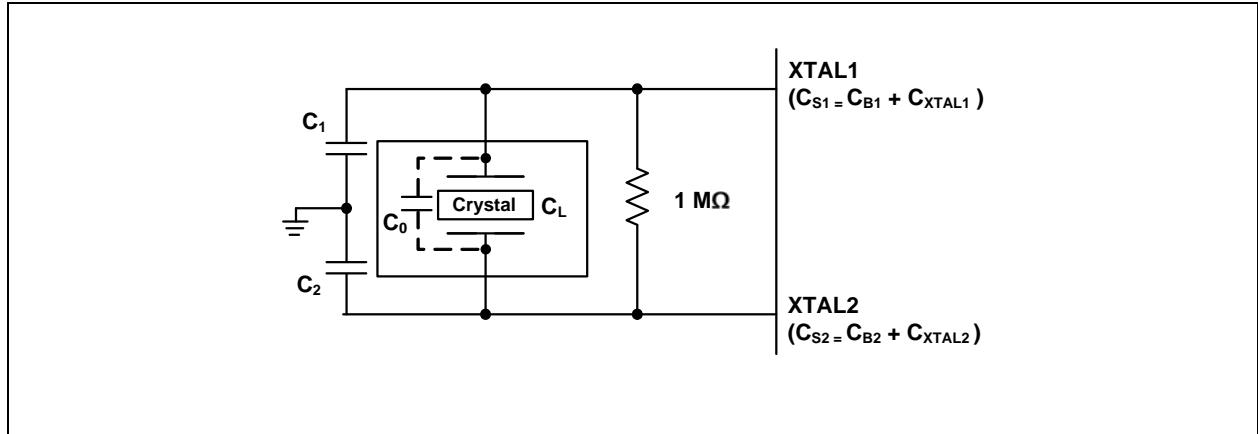
- Note 9-10** Thermal parameters are measured or estimated for devices with the exposed pad soldered to thermal vias in a multilayer 2S2P PCB per JESD51. Thermal resistance is measured from the die to the ambient air.

## 10.0 AC SPECIFICATIONS

### 10.1 Oscillator/Crystal

Parallel Resonant, Fundamental Mode, 24 MHz ± 350 ppm.

**FIGURE 10-1: TYPICAL CRYSTAL CIRCUIT**



**TABLE 10-1: CRYSTAL CIRCUIT LEGEND**

| SYMBOL         | DESCRIPTION                            | IN ACCORDANCE WITH  |
|----------------|--|---|
| $C_0$          | Crystal shunt capacitance              | Crystal manufacturer's specification (See <a href="#">Note 10-1</a> )                           |
| $C_L$          | Crystal load capacitance               |   |
| $C_B$          | Total board or trace capacitance       | OEM board design  |
| $C_S$          | Stray capacitance                      | MCHP IC and OEM board design  |
| $C_{XTAL}$     | XTAL pin input capacitance             | MCHP IC   |
| $C_1$<br>$C_2$ | Load capacitors installed on OEM board | Calculated values based on Figure 10-2, "Capacitance Formulas" (See <a href="#">Note 10-2</a> ) |

**FIGURE 10-2: CAPACITANCE FORMULAS**

$$C_1 = 2 \times (C_L - C_0) - C_{S1}$$

$$C_2 = 2 \times (C_L - C_0) - C_{S2}$$

**Note 10-1**  $C_0$  is usually included (subtracted by the crystal manufacturer) in the specification for  $C_L$  and should be set to '0' for use in the calculation of the capacitance formulas in Figure 10-2, "Capacitance Formulas". However, the OEM PCB itself may present a parasitic capacitance between XTAL1 and XTAL2. For an accurate calculation of  $C_1$  and  $C_2$ , take the parasitic capacitance between traces XTAL1 and XTAL2 into account.

**Note 10-2** Each of these capacitance values is typically approximately 18 pF.

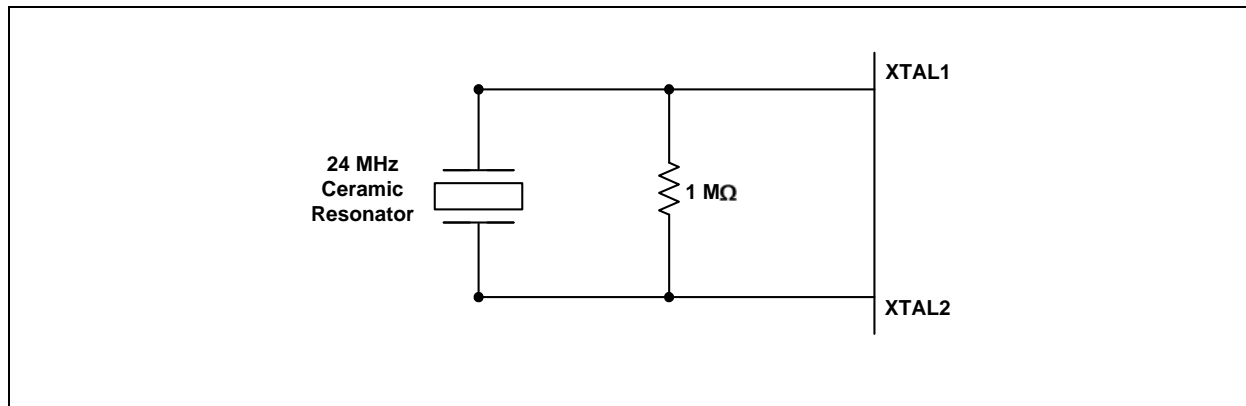
# USB224X

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## 10.2 Ceramic Resonator

24 MHz  $\pm$  350 ppm

FIGURE 10-3: CERAMIC RESONATOR USAGE WITH MCHP IC



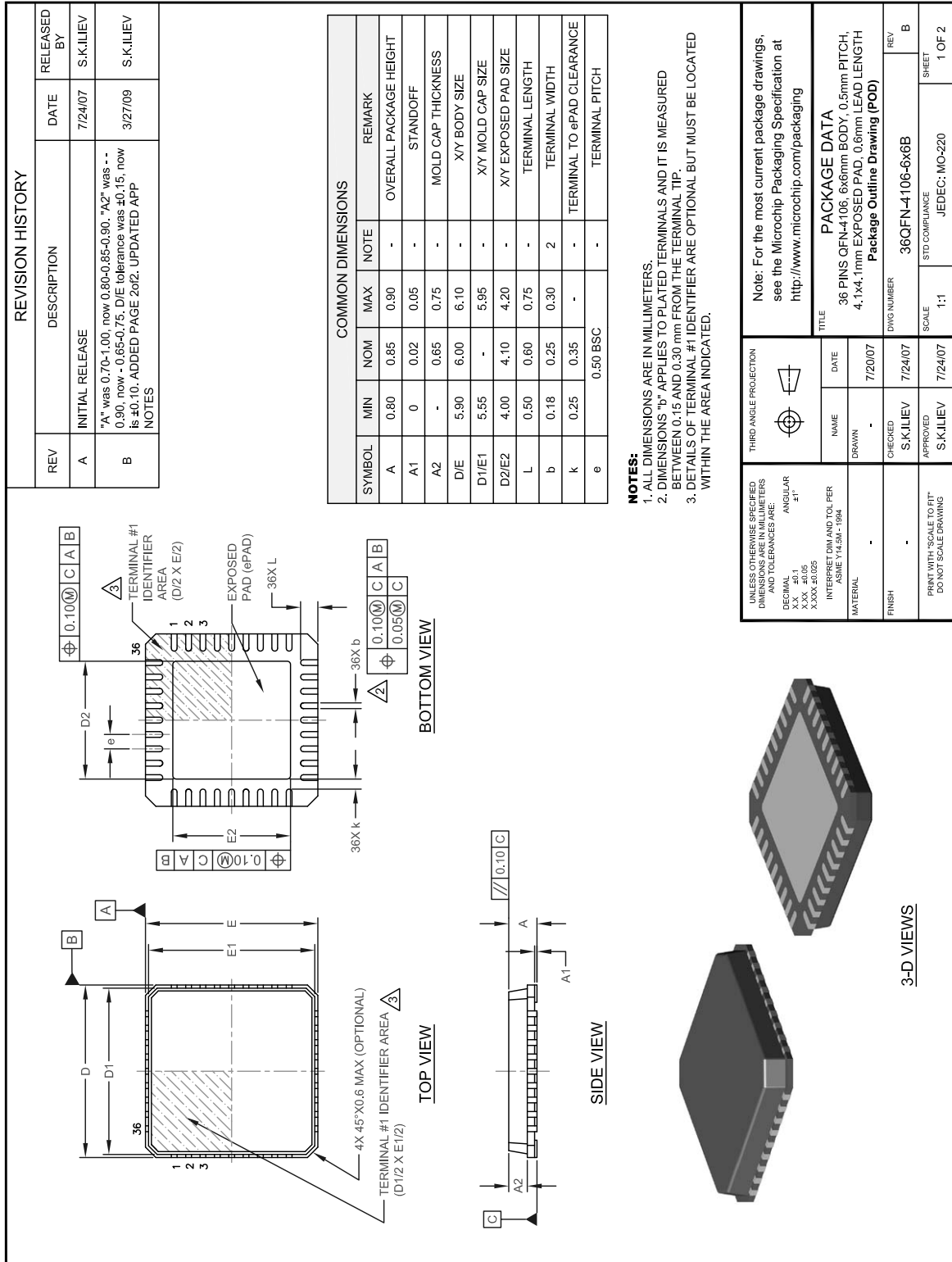
## 10.3 External Clock

50% Duty cycle  $\pm$  10%, 24 MHz  $\pm$  350 ppm, Jitter < 100 ps rms.

The external clock is recommended to conform to the signaling level designated in the JESD76-2 specification on 1.8 V CMOS Logic. XTAL2 should be treated as a no connect or drive only a CMOS-like buffer.

## 11.0 PACKAGE OUTLINE

TABLE 11-1: USB224X 36-QFN, 6X6 MM BODY, 0.5 MM PITCH



# USB224X

TABLE 11-1: USB224X 36-QFN, 6X6 MM BODY, 0.5 MM PITCH (CONTINUED)

**PCB LAND PATTERN**

SEE DETAIL "A" FOR PERIMETER PAD AND SOLDER MASK

SEE DETAIL "B" FOR CENTER PAD DESIGN (EXPOSED SOLDERABLE COPPER AREA)

SEE DETAIL "A" FOR STENCIL REFERENCE PAD

SEE DETAIL "B" FOR CENTER PAD STENCIL OPENINGS

**REVISION HISTORY**

| REV | DESCRIPTION  | DATE    | RELEASED BY |
|-----|--|---------|-------------|
| B   | "A" was 0.70-1.00, now 0.80-0.85-0.90. "A2" was -- 0.90, now -- 0.65-0.75. D/E tolerance was ±0.15, now is ±0.10. ADDED PAGE 2of2. UPDATED APP NOTES | 3/27/09 | S.K.ILIEV   |

**LAND PATTERN DIMENSIONS**

| SYMBOL       | MIN  | NOM  | MAX  |
|--------------|------|------|------|
| GD/GE        | 4.70 | -    | 4.75 |
| GDs/GEs      | 4.80 | -    | -    |
| D2/E2'       | -    | 4.10 | 4.10 |
| Pad: X       | -    | 0.28 | 0.28 |
| Stencilt: Xs | -    | 0.23 | 0.25 |
| Pad: Y       | -    | 0.90 | 0.90 |
| Stencilt: Ys | -    | 0.82 | 0.84 |
| e            | -    | 0.50 | -    |

**STENCIL**

**STENCIL OPENING - PERIMETER LANDS**

**DETAIL "A"**

OPTION 1 (NON-PLUGGED THERMAL VIAS)

OPTION 2 (PLUGGED THERMAL VIAS)

Thermal Vias: Ø0.30mm, 5x5 Matrix @ 0.50mm Pitch

Stencil Openings: 0.82x0.82mm (MAX) 4x4 Matrix

Thermal Vias: Ø0.30mm, 5x5 Matrix @ 0.50mm Pitch

Stencil Openings: 0.82x0.82mm (MAX) 4x4 Matrix

**THERMAL VIAS and STENCIL OPENING - CENTER PAD**

**DETAIL "B"**

Thermal Vias: Ø0.30mm, 5x5 Matrix @ 0.50mm Pitch

Stencil Openings: 0.82x0.82mm (MAX) 4x4 Matrix

**SMT APPLICATION NOTES**

1. THE USER MAY MODIFY THE PCB LAND PATTERN DIMENSIONS BASED ON THEIR EXPERIENCE AND/OR PROCESS CAPABILITY.
2. THE LAND PATTERN CORRESPONDING TO THE PACKAGE EXPOSED PAD (IN THE CENTER) CAN BE LARGER, AND WITH DIFFERENT SHAPE THAN THE EXPOSED PAD ON THE PACKAGE. HOWEVER, THE SOLDERABLE AREA, AS DEFINED BY THE SOLDER MASK (SMD), OR NON-SOLDER MASK DEFINED (NSMD), SHOULD BE AS SHOWN FOR THE BEST THERMAL & ELECTRICAL PERFORMANCE.
3. MAXIMUM THERMAL AND ELECTRICAL PERFORMANCE IS ACHIEVED WHEN AN ARRAY OF SOLID VIAS IS INCORPORATED IN THE CENTER LAND PATTERN (See Options 1 & 2).
4. THE VIAS SHOULD BE AT 0.8 TO 1.2MM PITCH WITH 0.30 TO 0.40MM DIAMETER, AND 1 OZ COPPER VIA BARREL PLATING.
5. NON SOLDER MASK DEFINED (NSMD) PAD DESIGN IS RECOMMENDED FOR PERIMETER LANDS.
6. A LASER-CUT STAINLESS STEEL STENCIL IS RECOMMENDED WITH ELECTRO POLISHED TRAPEZOIDAL WALLS. THE RECOMMENDED STENCIL THICKNESS IS 0.125 mm FOR PITCHES 0.4 and 0.5 mm.
7. RECOMMENDED STENCIL AREA & ASPECT RATIOS ARE 0.66 & 1.5 (MIN) RESPECTIVELY.
8. RECOMMENDED STENCIL APERTURES ARE AS SHOWN.
9. IT IS RECOMMENDED TO USE "NO-CLEAN" TYPE 3 SOLDER PASTE.
10. THE REFLOW PROFILE DEPENDS ON THE EXACT SOLDER PASTE USED AND THE GIVEN BOARD DETAILS, SUCH AS GEOMETRY, COMPONENTS ETC.

**UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS AND TOLERANCES ARE:**

DECIMAL ±0.1

X.X ±0.05

X.XX ±0.025

X.XXX ±0.025

INTERPRET DIM AND TOL PER ASME Y14.5M - 1994

MATERIAL -

FINISH -

**THIRD ANGLE PROJECTION**

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS AND TOLERANCES ARE:

DECIMAL ±0.1

X.X ±0.05

X.XX ±0.025

X.XXX ±0.025

INTERPRET DIM AND TOL PER ASME Y14.5M - 1994

MATERIAL -

FINISH -

**PRINT WITH "SCALE TO FIT" DO NOT SCALE DRAWING**

SCALE 1:1

STANDARD COMPLIANCE JEDEC: MO-220

SHEET 2 OF 2

**PACKAGE DATA**

36 PINS QFN-4106, 6x6mm BODY, 0.5mm PITCH, 4.1x4.1mm EXPOSED PAD, 0.6mm LEAD LENGTH

**Application Notes**

DWG NUMBER 36QFN-4106-6x6B

REV B

**Note:** For the most current package drawings, see the Microchip Packaging Specification at <http://www.microchip.com/packaging>

## APPENDIX A: DATA SHEET REVISION HISTORY

**TABLE A-1: REVISION HISTORY**

| REVISION               | SECTION/FIGURE/ENTRY  | CORRECTION  |
|------------------------|---|---|
| DS00001979A (07-13-15) | Replaces previous SMSC version Rev. 2.1 (02-07-13)<br>GPIOs and SDIO support removed<br>USB2242 removed   |   |
| Rev. 2.1<br>(02-07-13) | Document co-branded: Microchip logo added to cover; company disclaimer modified.<br><br>Added the following to the ordering information: "Please contact your SMSC sales representative for additional documentation related to this product such as application notes, anomaly sheets, and design guidelines." |   |
| Rev 2.1<br>(12-22-10)  | Chapter 3, Figure 3.1, 3.2, and 3.3   | Upgraded to put the mux for the multiplexed interface inside the part, put in a SPI interface for outside access to the Program Memory I/O bus. |
| Rev 2.1<br>(11-23-10)  | Chapter 6, Table 6.1  | Removed " It may not be used to drive any external circuitry other than the crystal circuit" from the XTAL2 description.                        |
| Rev. 2.1<br>(10-21-10) | Chapter 11, Table 11.3  | Changed the active level from L to H for GPIO6.   |

# USB224X

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To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

| <b>PART NO.</b>  | <b>[X]</b>  | <b>-</b>       | <b>XXX</b>                         | <b>-</b>                      | <b>[X]</b> | <b>-</b> | <b>[X]</b> |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
|--|---|----------------|------------------------------------|-------------------------------|------------|----------|------------|----------------|---|--|--|--|--|--|--|---------------------------|-------|---|------------------------------------|--|--|--|--|--|---|---|-----------------------------|--|--|--|--|-----------------|------|---|------------|--|--|--|--|------------------------------|-------|---|---------------------------|--|--|--|--|--|----|---|------------------------------|--|--|--|--|
| <b>Device</b>  | <b>Temperature Range</b>                                | <b>Package</b> | <b>Internal Microchip Code</b>     | <b>Tape &amp; Reel Option</b> |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
| <table border="1"> <tr> <td><b>Device:</b></td> <td colspan="7">USB2240, USB2240I, USB2241, USB2241I, USB2244, USB2244I</td> </tr> <tr> <td><b>Temperature Range:</b></td> <td>Blank</td> <td>=</td> <td colspan="5">0°C to +70°C (Extended Commercial)</td> </tr> <tr> <td></td> <td>I</td> <td>=</td> <td colspan="5">-40°C to +85°C (Industrial)</td> </tr> <tr> <td><b>Package:</b></td> <td>AEZG</td> <td>=</td> <td colspan="5">36-pin QFN</td> </tr> <tr> <td><b>Tape and Reel Option:</b></td> <td>Blank</td> <td>=</td> <td colspan="5">Standard packaging (tray)</td> </tr> <tr> <td></td> <td>TR</td> <td>=</td> <td colspan="5">Tape and Reel <sup>(1)</sup></td> </tr> </table>   |   |                |                                    |                               |            |          |            | <b>Device:</b> | USB2240, USB2240I, USB2241, USB2241I, USB2244, USB2244I |  |  |  |  |  |  | <b>Temperature Range:</b> | Blank | = | 0°C to +70°C (Extended Commercial) |  |  |  |  |  | I | = | -40°C to +85°C (Industrial) |  |  |  |  | <b>Package:</b> | AEZG | = | 36-pin QFN |  |  |  |  | <b>Tape and Reel Option:</b> | Blank | = | Standard packaging (tray) |  |  |  |  |  | TR | = | Tape and Reel <sup>(1)</sup> |  |  |  |  |
| <b>Device:</b>   | USB2240, USB2240I, USB2241, USB2241I, USB2244, USB2244I |                |                                    |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
| <b>Temperature Range:</b>  | Blank   | =              | 0°C to +70°C (Extended Commercial) |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
|  | I   | =              | -40°C to +85°C (Industrial)        |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
| <b>Package:</b>  | AEZG  | =              | 36-pin QFN                         |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
| <b>Tape and Reel Option:</b>   | Blank   | =              | Standard packaging (tray)          |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
|  | TR  | =              | Tape and Reel <sup>(1)</sup>       |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
| <p><b>Note 1:</b> Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option. Reel size is 3,000.</p>   |   |                |                                    |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |
| <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>a) <b>USB2240-AEZG-06</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tray</li> <li>b) <b>USB2240-AEZG-05</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tray</li> <li>c) <b>USB2241-AEZG-06</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tray</li> <li>d) <b>USB2241-AEZG-05</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tray</li> <li>e) <b>USB2244-AEZG-06</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tray</li> <li>f) <b>USB2244-AEZG-06-CA1</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tray</li> <li>g) <b>USB2240I-AEZG-06</b> 36-pin QFN RoHS Compliant pkg, Industrial Temp, Tray</li> <li>h) <b>USB2241I-AEZG-06</b> 36-pin QFN RoHS Compliant pkg, Industrial Temp, Tray</li> <li>i) <b>USB2241I-AEZG-06</b> 36-pin QFN RoHS Compliant pkg, Industrial Temp, Tray</li> <li>j) <b>USB2240-AEZG-06-TR</b> 36-pin QFN RoHS Compliant pkg, Commercial Temp, Tape &amp; Reel</li> <li>k) <b>USB2244I-AEZG-06-TR</b> 36-pin QFN RoHS Compliant pkg, Industrial Temp, Tape &amp; Reel</li> </ul> |   |                |                                    |                               |            |          |            |                |   |  |  |  |  |  |  |                           |       |   |                                    |  |  |  |  |  |   |   |                             |  |  |  |  |                 |      |   |            |  |  |  |  |                              |       |   |                           |  |  |  |  |  |    |   |                              |  |  |  |  |

# USB224X

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