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DOCUMENT DESCRIPTION

Schematic Checklist for the USB2244, 36-pin QFN Package

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Document Number	Revision
SC571236	A

Schematic Checklist for USB2244

Information Particular for the 36-pin QFN Package

USB Upstream Interface Port 0:

1. USB+ (pin 2), this pin is the USB Upstream channel positive data pin. This pin should be connected directly to pin 3 (D+) on a standard 4-pin, upstream USB connector (Type “B”).

2. USB- (pin 3), this pin is the USB Upstream channel negative data pin. This pin should be connected directly to pin 2 (D-) on a standard 4-pin, upstream USB connector (Type “B”).

3. Typical applications will connect pin 4 (Ground) on a standard 4-pin, upstream USB connector (Type “B”) directly to digital ground.

4. Pin 1 (VBUS) on the Upstream USB connector can be configured in one of two ways. In Bus-Powered Mode, pin 1 draws +5V power (VBUS) from the Host side and typically powers a +3.3V regulator to power the system. In Self-Powered Mode, pin 1 (VBUS) simply acts as a sensory circuit in order to alert the Hub that a Host is connected.

5. The two metal shield connections on the USB connector should be connected directly to a suitable chassis ground plane.

Secure Digital 2.0 Interface Connections:

1. SD_D[7..0] pins 7, 8, 10, 20, 23, 25, 4 & 5 are bi-directional data signals for the Secure Digital interface. These pins have weak internal pull-up terminations.

2. Series terminations may be required on the SD_D[7..0] lines in order to better match the impedance of the internal drivers of the USB2244. This may or may not help to resolve any signal integrity or radiated EMI issues encountered on the bus.

3. SD_CLK pin 9 is an output clock signal to the SD/MMC device. The clock frequency is software configurable.

4. SD_CMD pin 11 is a bi-directional signal that connects to the CMD signal of the SD/MMC device. This pin has a weak internal pull-up termination.

5. SD_WP pin 30 indicates to the USB2244 that the SD card cannot be written to. Typically, this pin is connected to one side of a two pin switch mechanism within the SD connector. The input / output / polarity / pull-up / pull-down characteristics of this pin are firmware controlled. Custom firmware is required to activate this feature.

6. Designers Note: SD Card Write-Protect notch…. The user can designate most full-size SD cards as read-only by use of a sliding tab that covers a notch in the card. (The miniSD and microSD formats do not support a write protection notch.)

7. SD_nCD pin 26 indicates to the USB2244 that the SD card is present in the SD connector. Typically, this pin is connected to one side of a two pin switch mechanism within the SD connector. The input / output / polarity / pull-up / pull-down characteristics of this pin are firmware controlled. Custom firmware is required to activate this feature.

8. CRD_PWR pin 21 this pin powers the SD device with +3.3V with either 100 mA or 200 mA of power.

9. Secure Digital 2.0 bus speed with the USB2244 is 25 Mbyte/s.

Secure Digital 2.0 Connector Pin-outs

There are (3) Form Factors for Secure Digital connectors:

A. Standard: 32.0×24.0×2.1 mm (1.260×0.945×0.083 in)
B. Mini: 21.5×20.0×1.4 mm (0.846×0.787×0.055 in)
C. Micro: 15.0×11.0×1.0 mm (0.591×0.433×0.039 in)

Micro SD Connector					
Four Bit Secure Digital Bus Mode					
USB2244 Pin	**Micro SD Pin**	**Name**	**I/O**	**Logic**	**Description**
25	1	DAT2	I/O	Push-Pull	SD Serial Data 2
23	2	DAT3	I/O	Push-Pull	SD Serial Data 3
11	3	CMD	I/O	Push-Pull, Open Drain	Command, Response
21	4	VDD	Power		Power
9	5	CLK	I	Push-Pull	Serial Clock
	6	VSS	Power		Ground
5	7	DAT0	I/O	Push-Pull	SD Serial Data 0
4	8	DAT1	I/O	Push-Pull	SD Serial Data 1

Mini SD Connector					
Four Bit Secure Digital Bus Mode					
USB2244 Pin	**Mini SD Pin**	**Name**	**I/O**	**Logic**	**Description**
25	9	DAT2	I/O	Push-Pull	SD Serial Data 2
23	1	DAT3	I/O	Push-Pull	SD Serial Data 3
11	2	CMD	I/O	Push-Pull, Open Drain	Command, Response
21	4	VDD	Power		Power
9	5	CLK	I	Push-Pull	Serial Clock
	6	VSS	Power		Ground
5	7	DAT0	I/O	Push-Pull	SD Serial Data 0
4	8	DAT1	I/O	Push-Pull	SD Serial Data 1
	3	VSS	Power		Ground

SD Connector					
Four Bit Secure Digital Bus Mode					
USB2244 Pin	**SD Pin**	**Name**	**I/O**	**Logic**	**Description**
25	9	DAT2	I/O	Push-Pull	SD Serial Data 2
23	1	DAT3	I/O	Push-Pull	SD Serial Data 3
11	2	CMD	I/O	Push-Pull, Open Drain	Command, Response
21	4	VDD	Power		Power
9	5	CLK	I	Push-Pull	Serial Clock
	6	VSS	Power		Ground
5	7	DAT0	I/O	Push-Pull	SD Serial Data 0
4	8	DAT1	I/O	Push-Pull	SD Serial Data 1
	3	VSS	Power		Ground

MMC MultiMediaCard 4.2 Connector Pin-Outs

MMC Connector					
Eight Bit MMC Bus Mode					
USB2244 Pin	**MMC Pin**	**Name**	**I/O**	**Logic**	**Description**
25	9	DAT2	I/O	Push-Pull	SD Serial Data 2
23	1	DAT3	I/O	Push-Pull	SD Serial Data 3
11	2	CMD	I/O	Push-Pull, Open Drain	Command, Response
21	4	VDD	Power		Power
9	5	CLK	I	Push-Pull	Serial Clock
	6	VSS	Power		Ground
5	7	DAT0	I/O	Push-Pull	SD Serial Data 0
4	8	DAT1	I/O	Push-Pull	SD Serial Data 1
	3	VSS	Power		Ground
20	10	DAT4	I/O	Push-Pull	SD Serial Data 4
10	11	DAT5	I/O	Push-Pull	SD Serial Data 5
8	12	DAT6	I/O	Push-Pull	SD Serial Data 6
7	13	DAT7	I/O	Push-Pull	SD Serial Data 7

+3.3V Power Supply Connections:

1. The digital supply (VDD33) pins on the USB2244 QFN are 6, 14 & 22. They require a connection to +3.3V.

2. Each VDD33 power pin should have one .01 µF (or smaller) capacitor to decouple the USB2244. The capacitor size should be SMD_0603 or smaller.

3. The analog supply (VDDA33) pin on the USB2244 QFN is 36. This pin requires a connection to +3.3V through a ferrite bead. Be sure to place bulk capacitance on each side of the ferrite bead.

4. The VDDA33 pin should have one .01 µF (or smaller) capacitor to decouple the USB2244. The capacitor size should be SMD_0603 or smaller.

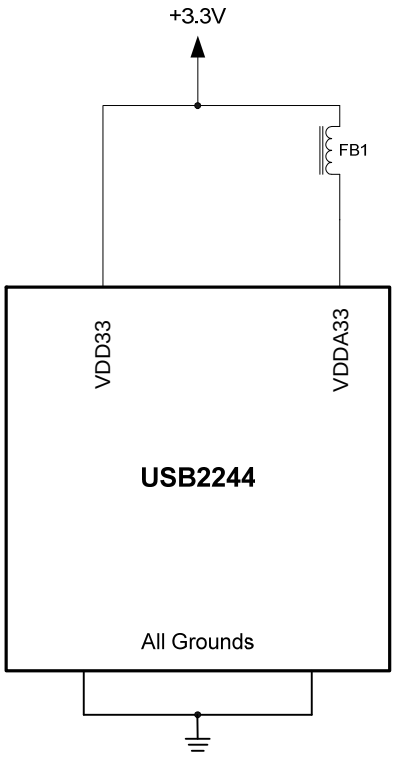


Figure 1 - +3.3V Power Supply Connections

VDD18:

1. VDD18 (pin 13), this pin provides bypassing for the +1.8V core regulator. The pin requires a 0.01 μF decoupling/bypass capacitor. The capacitor should be located as close as possible to pin 13 without using vias. In addition, pin 13 requires a bulk capacitor placed as close as possible to pin 13. The bulk capacitor must have a value of at least 1.0 μF, and have an ESR (equivalent series resistance) of no more than 0.1 Ω. Microchip recommends a very low ESR ceramic capacitor for design stability. Other values, tolerances & characteristics are not recommended.

Caution: Even though both are +1.8V levels, **Do Not Connect** VDD18 to VDD18PLL.

Caution: This +1.8V supply is for internal logic only and USB2244 use only. **Do Not** power other external circuits or devices with this supply.

VDD18PLL:

1. VDD18PLL (pin 34), this pin provides bypassing for the second +1.8V regulator. The pin requires a 0.01 μF decoupling/bypass capacitor. The capacitor should be located as close as possible to pin 34 without using vias. In addition, pin 34 requires a bulk capacitor placed as close as possible to pin 34. The bulk capacitor must have a value of at least 1.0 μF, and have an ESR (equivalent series resistance) of no more than 0.1 Ω. Microchip recommends a very low ESR ceramic capacitor for design stability. Other values, tolerances & characteristics are not recommended.

Caution: Even though both are +1.2V levels, **Do Not Connect** VDD18PLL to VDD18.

Caution: This +1.8V supply is for internal logic only and USB2244 use only. **Do Not** power other external circuits or devices with this supply.

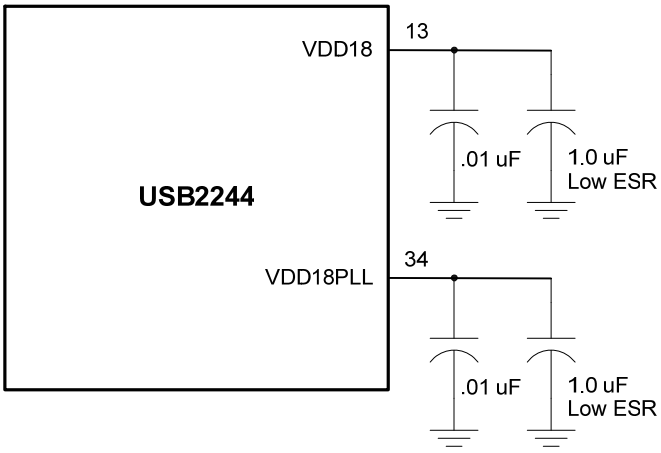


Figure 2 - USB2244 +1.8V Power Connections

Ground Connections:

1. All grounds, the digital ground pins (GND), the core ground pins (GND_CORE) and the analog ground pins (VSS_A) on the USB2244 QFN, are all connected internally to the exposed die paddle ground (VSS). The EDP Ground pad on the underside of the USB2244 must be connected directly to a solid, contiguous digital ground plane.

2. On the PCB, we recommend one Digital Ground. We do not recommend running separate ground planes for any of our USB products.

Crystal Connections:

1. A 24.000 MHz crystal must be used with the USB2244 QFN. For exact specifications and tolerances refer to the latest revision USB2244 data sheet.

2. XTAL1(CLKIN) (pin 33) on the USB2244 QFN is the clock circuit input. This pin requires a 15 – 33 ρF capacitor to digital ground. One side of the crystal connects to this pin.

3. XTAL2 (pin 32) on the USB2244 QFN is the clock circuit output. This pin requires a matching 15 – 33 ρF capacitor to ground and the other side of the crystal.

4. Since every system design is unique, the capacitor values are system dependant. The PCB design, the crystal selected, the layout and the type of caps selected all contribute to the characteristics of this circuit. Once the board is complete and operational, it is up to the system engineer to analyze this circuit in a lab environment. The system engineer should verify the frequency, the stability and the voltage level of the circuit to guarantee that the circuit meets all design criteria as put forth in the data sheet.

5. For proper operation, an additional 1.0M Ω resistor needs to be added to the crystal circuit. This resistor needs to be placed in parallel with the crystal.

EEPROM Interface:

1. Enhanced OEM configuration options can be loaded into the USB2244 via the use of an optional external serial I^2C EEPROM. Otherwise, the USB2244 will use it's default register values.

2. SCK (pin 31) on the USB2244 QFN connects to the external I^2C EEPROM's serial clock pin.

3. SDA (pin 27) on the USB2244 QFN connects to the external I^2C EEPROM's serial data pin.

4. Be sure to select a 2-wire style 4K I^2C EEPROM that is organized for 512 x 8-bit operation.

5. The hub will read the external EEPROM for configuration data and then attach to the upstream USB host. The hub does not have the capacity to write to the external EEPROM.

RBIAS Resistor:

1. RBIAS (pin 35) on the USB2244 QFN should connect to digital ground through a 12.0K Ω resistor with a tolerance of 1.0%. This pin is used to set-up critical bias currents for the embedded USB Physical device.

Required External Pull-ups/Pull-downs:

1. SCK (pin 31) requires a 10.0K ohm pull-up resistor (VDD33) in order to guarantee proper operation in I^2C mode.

2. SDA (pin 27) requires a 10.0K ohm pull-up resistor (VDD33) in order to guarantee proper operation in I^2C mode.

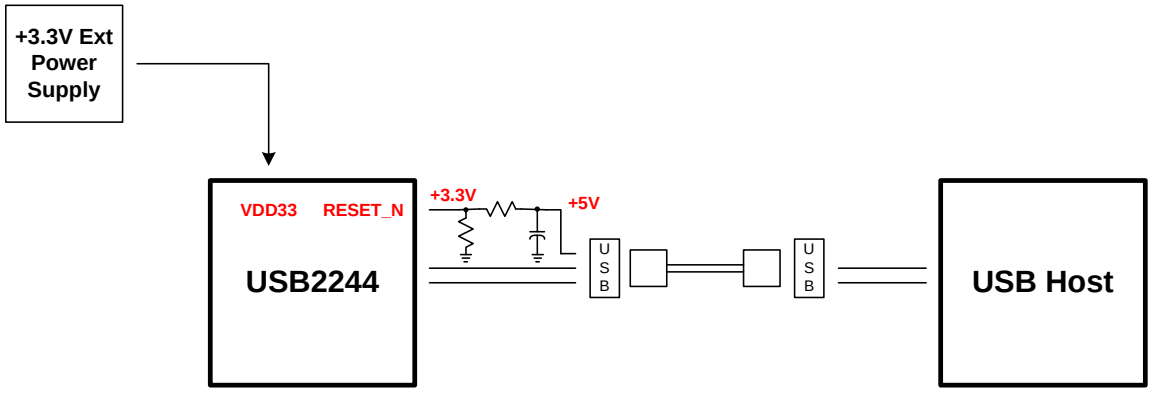
Possible RESET_N Configurations:

Possible RESET_N pin (pin 18) connections are dictated by the hardware configuration of the USB link and application requirments. Possible designs are “Hard Reset”, “Self-Powered Mode”, “Self-Powered Permanently Attached Mode” and “Bus-Powered Mode”. These four possible configurations are depicted below.

Hard RESET_N

1. RESET_N (pin 18), is an active-low reset input. This signal resets all logic and registers within the USB2244. A hardware reset (RESET_N assertion) is required following power-up. Please refer to the latest copy of the USB2244 data sheet for reset timing requirements. Microchip does not recommend the use of an RC circuit for this required pin reset. A reset generator / voltage monitor is one option to provide a proper reset. Better yet, for increased design flexibility, a controllable reset (GPIO, dedicated reset output) should be considered. In this case, Microchip recommends a push-pull type output (not an open-drain type) for the monotonic reset to ensure a sharp rise time transition from low-to-high.

Self-Powered Mode:

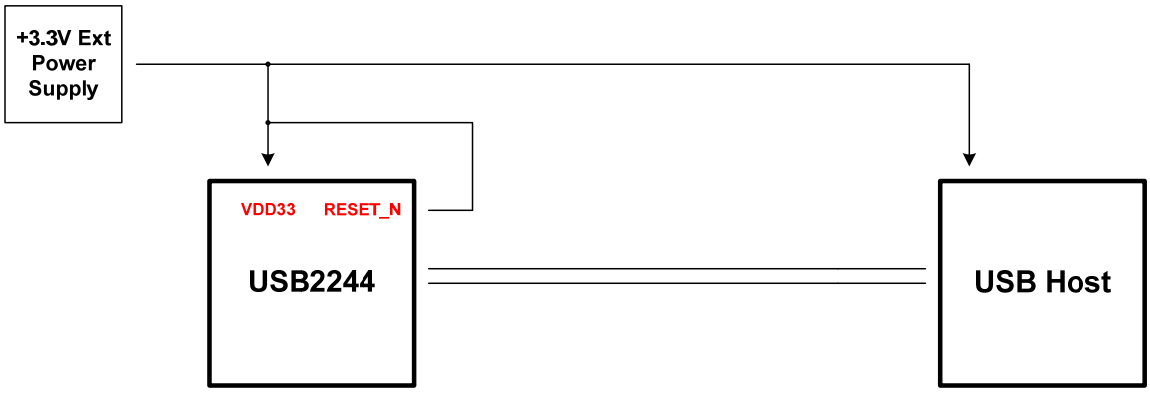


1. In this application, the RESET_N pin (pin 18) is driven by a voltage divider circuit that drops the +5V VBUS voltage to +3.3V.

2. For the voltage divider, a series 100K ohm resistor with a 100K ohm resistor to digital ground is recommended.

3. A 1.0 uF capacitor is also recommended on pin 1 (VBUS) of the USB connector.

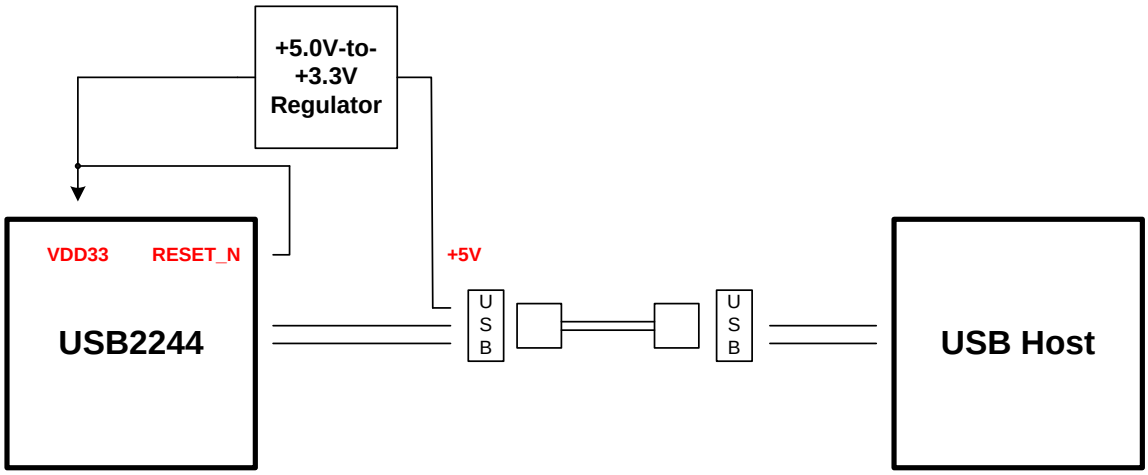
Self-Powered Permanently Attached Mode:



1. In this application, the RESET_N pin (pin 18) is driven by the same power rail that powers both the USB2244 and the USB Host.

2. A series resistor (820 ohms to 10K ohms) may be used on the RESET_N pin in order to improve susceptibility characteristics.

Bus-Powered Mode:



1. Typical Bus-Powered applications will connect pin 1 (VBUS) on a standard 4-pin, upstream USB connector (Type “B”) directly to a 2000 mA ferrite bead. This ferrite bead will in turn feed a LDO +5.0V-to-+3.3V voltage regulator to power the USB2244.

2. We recommend no bulk capacitance be placed on pin 1 (VBUS) of the USB connector in Bus-Powered applications. On the voltage regulator side of the ferrite bead, we recommend limiting the bulk capacitance to 4.7 uF. This should satisfy the 10.0 uF total capacitance to limit in-rush current as required by the USB-IF specification.

3. RESET_N (pin 18), this pin detects the state of the supplied upstream power. This pin must be tied to VDD33 when operating in Bus-Powered mode.

4. A series resistor (820 ohms to 10K ohms) may be used on the VBUS_DET pin in order to improve susceptibility characteristics.

Miscellaneous:

1. TEST (pin 28), this pin must be tied directly to digital ground in order to ensure proper operation.

2. RXD (pin 27), this pin is the input pin for the RXD signal of the internal UART of the USB2244. Custom firmware is required to activate this feature.

3. TXD (pin 31), this pin is the output pin for the TXD signal of the internal UART of the USB2244. Custom firmware is required to activate this feature.

4. There are (7) No-Connect pins on the USB2244; to ensure proper operation, these pins must be left as No-Connect. These are pins 12, 15, 16, 17, 19, 24 and 29 on the USB2244.

5. Incorporate a large SMD resistor (SMD_1210) to connect the USB chassis ground to the digital ground. This will allow some flexibility at EMI testing for different grounding options. Leave the resistor out, the two grounds are separate. Short them together with a zero ohm resistor. Short them together with a cap or a ferrite bead for best performance.

6. Be sure to incorporate enough bulk capacitors (4.7 - 22μF caps) for each power plane.

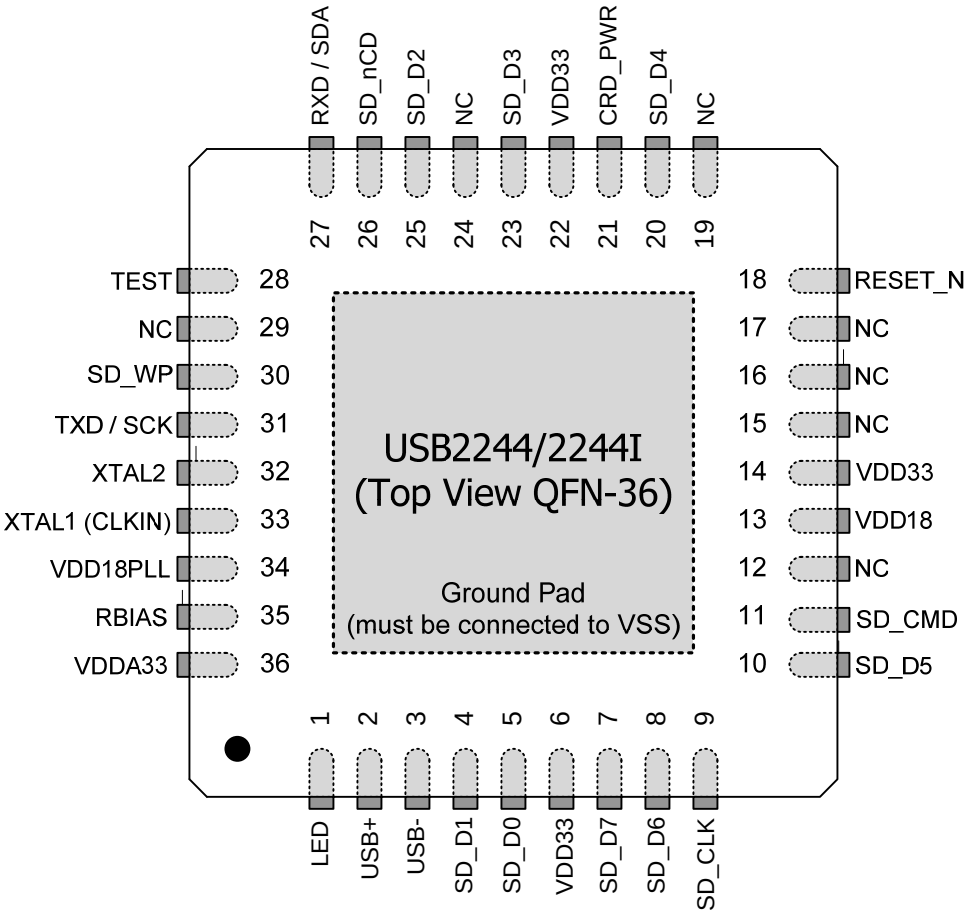
USB2244 QFN QuickCheck Pinout Table:

Use the following table to check the USB2244 QFN shape in your schematic.

USB2244 QFN			
Pin No.	**Pin Name**	**Pin No.**	**Pin Name**
1	LED	19	NC
2	USB+	20	SD_D4
3	USB-	21	CRD_PWR
4	SD_D1	22	VDD33
5	SD_DO	23	SD_D3
6	VDD33	24	NC
7	SD_D7	25	SD_D2
8	SD_D6	26	SD_nCD
9	SD_CLK	27	RXD / SDA
10	SD_D5	28	TEST
11	SD_CMD	29	NC
12	NC	30	SD_WP
13	VDD18	31	TXD / SCK
14	VDD33	32	XTAL2
15	NC	33	XTAL1(CLKIN)
16	NC	34	VDD18PLL
17	NC	35	RBIAS
18	RESET_N	36	VDDA33
37		**EDP Ground Connection Exposed Die Paddle Ground Pad on Bottom of Package**	

Notes:

USB2244 QFN Package Drawing:



Indicates pins on the bottom of the device.

Reference Material:

1. Microchip USB2244 Data Sheet; check web site for latest revision.
2. Microchip USB2240 CEB Schematic, Assembly EVB-USB2240-IND; check web site for latest revision.
3. Microchip USB2240 CEB PCB, Assembly EVB-USB2240-IND; order PCB from web site.
4. Microchip USB2240 CEB PCB Bill of Materials, Assembly EVB-USB2240-IND; check web site for latest revision.
5. CEB stands for Customer Evaluation Board.
6. Microchip USB2244 Reference Design, check web site for latest revision.
7. Microchip Reference Designs are schematics only; there are no associated PCBs.