



### Description

The [XR22417](#) is a USB 2.0 7-port hub using Multiple Transaction Translators (MTT) for highest possible bandwidth capability. The upstream USB interface has an integrated USB 2.0 PHY and device controller that is compliant with both hi-speed (480 Mbps) and full-speed (12 Mbps). The downstream PHY supports hi-speed, full-speed and low-speed (1.5 Mbps) on each of the 7 downstream ports. Individual port activity and overall hub activity indicators provide status outputs to control external LEDs for each port. An external EEPROM may be used with the XR22417 to change selected USB descriptors including the USB vendor and product IDs, the number of downstream ports and device serial number. Overcurrent protection and power control for each downstream port is available in the LQFP-64 package. The XR22417 operates from a single 5V power input. Internal regulators provide a 3.3V output which may be connected to VCC33 power input pins. In turn a second internal regulator provides a 1.8V output from the 3.3V input. This 1.8V output may be connected to VCC18 power input pins.

### FEATURES

- USB 2.0 compliant interface
- Multiple transaction translators (MTT)
- Regulated +3.3V output power
- Individual port and hub activity LED indicators
- Individual power enables (LQFP-64)
- Individual overcurrent sensing (LQFP-64)
- Single 5V power input
- Single 12 MHz Crystal

### APPLICATIONS

- USB port expansion
- Docking stations
- POS terminals
- Test instrumentation
- Factory automation and process controls
- Industrial applications

### Typical Application

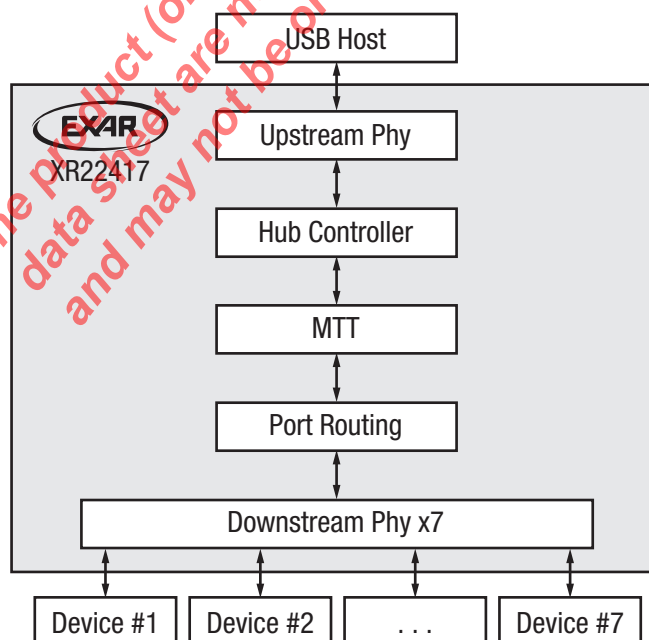


Figure 1. Typical Application

## Absolute Maximum Ratings

Stresses beyond the limits listed below may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

|                                                       |                |
|-------------------------------------------------------|----------------|
| VCC5 supply voltage .....                             | -0.5V to 6.0V  |
| VCC33 supply voltage .....                            | -0.5V to 4.0V  |
| VCC18 supply voltage .....                            | -0.5V to 2.5V  |
| Input voltage<br>(all pins except USBD+, USBD-) ..... | -0.3V to 4.0V  |
| Input voltage (USBD+ and USBD-) .....                 | -0.3V to 5.75V |
| Junction temperature .....                            | 125°C          |

## Operating Conditions

|                                   |                |
|-----------------------------------|----------------|
| Operating temperature range ..... | 0°C to 70°C    |
| VCC5 supply voltage .....         | 4.4V to 5.5V   |
| VCC33 supply voltage .....        | 3.0V to 3.6V   |
| VCC18 supply voltage .....        | 1.62V to 1.98V |

## Electrical Characteristics

Unless otherwise noted:  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ , VCC5 = 4.4V to 5.5V.

| Symbol                              | Conditions          |                                   |                               | Min | Typ | Max | Units |
|-------------------------------------|---------------------|-----------------------------------|-------------------------------|-----|-----|-----|-------|
|                                     | Upstream Port Speed | Number of Active Downstream Ports | Downstream Ports Device Speed |     |     |     |       |
| Power Consumption DC Supply Current |                     |                                   |                               |     |     |     |       |
| I <sub>CC</sub>                     | High Speed          | Suspend                           |                               |     | 0.6 | 2.5 | mA    |
|                                     |                     | None                              |                               |     | 53  |     | mA    |
|                                     |                     | 1                                 | 1x Full Speed                 |     | 63  |     | mA    |
|                                     |                     |                                   | 1x High Speed                 |     | 71  |     | mA    |
|                                     |                     | 2                                 | 2x Full Speed                 |     | 67  |     | mA    |
|                                     |                     |                                   | 1x Full Speed, 1x High Speed  |     | 76  |     | mA    |
|                                     |                     |                                   | 2x High Speed                 |     | 87  |     | mA    |
|                                     |                     | 7                                 | 7x Full Speed                 |     | 71  |     | mA    |
|                                     |                     |                                   | 7x High Speed                 |     | 167 |     | mA    |
|                                     | Full Speed          | Suspend                           |                               |     | 0.6 | 2.5 | mA    |
|                                     |                     | None                              |                               |     | 38  |     | mA    |
|                                     |                     | 1                                 | 1x Full Speed                 |     | 45  |     | mA    |
|                                     |                     | 7                                 | 7x Full Speed                 |     | 78  |     | mA    |

## Electrical Characteristics (Continued)

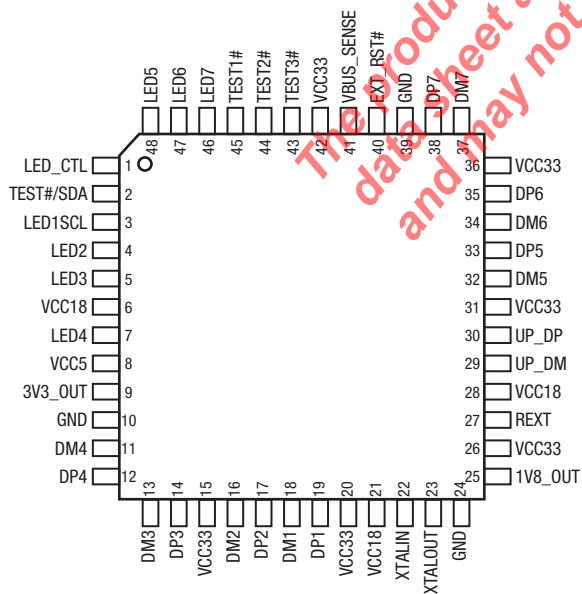
Unless otherwise noted:  $T_A = 0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ ,  $V_{CC5} = 4.4\text{V}$  to  $5.5\text{V}$ .

| Symbol                      | Parameter                  | Conditions              | Min  | Typ | Max      | Units         |
|-----------------------------|----------------------------|-------------------------|------|-----|----------|---------------|
| Non-USB I/O Pins            |                            |                         |      |     |          |               |
| $V_{IL}$                    | Input low voltage          |                         | -0.3 |     | 0.8      | V             |
| $V_{IH}$                    | Input high voltage         |                         | 2.0  |     | 5.5      | V             |
| $V_{OL}$                    | Output low voltage         | $I_{OL} = 4\text{ mA}$  |      |     | 0.4      | V             |
| $V_{OH}$                    | Output high voltage        | $I_{OH} = -4\text{ mA}$ | 2.4  |     |          | V             |
| $I_{IL}$                    | Input low leakage current  |                         |      |     | $\pm 10$ | $\mu\text{A}$ |
| $I_{IH}$                    | Input high leakage current |                         |      |     | $\pm 10$ | $\mu\text{A}$ |
| $C_{IN}$                    | Input pin capacitance      |                         |      |     | 5        | pF            |
| USB I/O Pins <sup>(1)</sup> |                            |                         |      |     |          |               |
| 3.3V Regulated Power Output |                            |                         |      |     |          |               |
| 3V3_OUT                     | Output voltage             | Max load current 100 mA | 3.0  | 3.3 | 3.6      | V             |

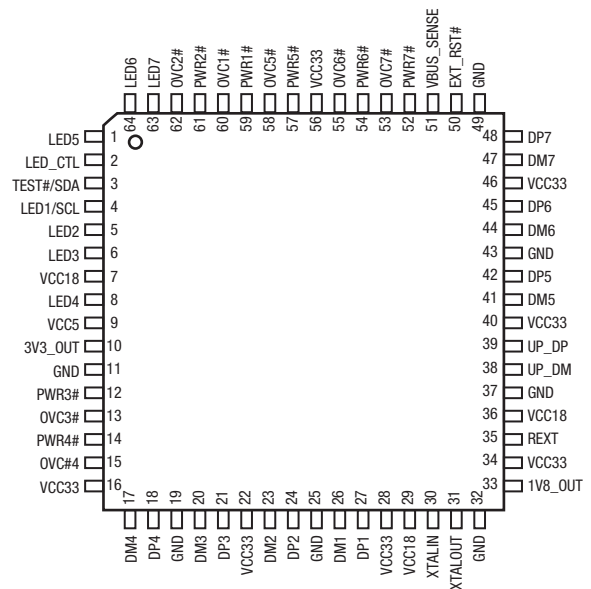
### NOTE:

1. See USB 2.0 Specification for USB I/O pins DC Electrical Characteristics.

## Pin Configuration, Top View



48-Pin LQFP



64-Pin LQFP

## Pin Functions

| LQFP-48<br>Pin Number | LQFP-64<br>Pin Number | Pin Name  | Type   | Description                                                                                                                                 |
|-----------------------|-----------------------|-----------|--------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 48                    | 1                     | LED5      | O      | Port 5 LED indicator. May be used in conjunction with LED_CTL pin.                                                                          |
| 1                     | 2                     | LED_CTL   | O      | LED hub active indicator. May be used in conjunction with port status LEDs.                                                                 |
| 2                     | 3                     | TEST#/SDA | I/O OD | Test mode enable. Active low and I <sup>2</sup> C serial data. Leave unconnected for normal device operation if no external EEPROM is used. |
| 3                     | 4                     | LED1/SCL  | I/O OD | Port 1 LED indicator and I <sup>2</sup> C serial clock. May be used in conjunction with LED_CTL pin.                                        |
| 4                     | 5                     | LED2      | O      | Port 2 LED indicator. May be used in conjunction with LED_CTL pin.                                                                          |
| 5                     | 6                     | LED3      | O      | Port 3 LED indicator. May be used in conjunction with LED_CTL pin.                                                                          |
| 6                     | 7                     | VCC18     | PWR    | 1.8V power input.                                                                                                                           |
| 7                     | 8                     | LED4      | O      | Port 4 LED indicator. May be used in conjunction with LED_CTL pin.                                                                          |
| 8                     | 9                     | VCC5      | PWR    | 5V power input.                                                                                                                             |
| 9                     | 10                    | 3V3_OUT   | PWR    | 3.3V power output from internal 5V to 3.3V regulator. Must be decoupled with minimum of 10 $\mu$ F.                                         |
| 10                    | 11                    | GND       | PWR    | Ground.                                                                                                                                     |
| -                     | 12                    | PWR3#     | OD     | Power enable for port 3 downstream device, active low. Asserted if OVC3# input is asserted or device is not configured.                     |
| -                     | 13                    | OVC3#     | I      | Downstream port 3 over current indicator, active low.                                                                                       |
| -                     | 14                    | PWR4#     | OD     | Power enable for port 4 downstream device, active low. Asserted if OVC4# input is asserted or device is not configured.                     |
| -                     | 15                    | OVC4#     | I      | Downstream port 4 overcurrent indicator, active low.                                                                                        |
| 15                    | 16                    | VCC33     | PWR    | 3.3V power input.                                                                                                                           |
| 11                    | 17                    | DM4       | I/O    | Downstream port 4 USB <sup>D</sup> - data.                                                                                                  |
| 12                    | 18                    | DP4       | I/O    | Downstream port 4 USB <sup>D</sup> + data.                                                                                                  |
| -                     | 19                    | GND       | PWR    | Ground.                                                                                                                                     |
| 13                    | 20                    | DM3       | I/O    | Downstream port 3 USB <sup>D</sup> - data.                                                                                                  |
| 14                    | 21                    | DP3       | I/O    | Downstream port 3 USB <sup>D</sup> + data.                                                                                                  |
| -                     | 22                    | VCC33     | PWR    | 3.3V power input.                                                                                                                           |
| 16                    | 23                    | DM2       | I/O    | Downstream port 2 USB <sup>D</sup> - data.                                                                                                  |
| 17                    | 24                    | DP2       | I/O    | Downstream port 2 USB <sup>D</sup> + data.                                                                                                  |
| -                     | 25                    | GND       | PWR    | Ground.                                                                                                                                     |
| 18                    | 26                    | DM1       | I/O    | Downstream port 1 USB <sup>D</sup> - data.                                                                                                  |
| 19                    | 27                    | DP1       | I/O    | Downstream port 1 USB <sup>D</sup> + data.                                                                                                  |
| 20                    | 28                    | VCC33     | PWR    | 3.3V power input.                                                                                                                           |
| 21                    | 29                    | VCC18     | PWR    | 1.8V power input.                                                                                                                           |
| 22                    | 30                    | XTALIN    | I      | 12 MHz $\pm$ 50 ppm crystal input with load capacitance rating of 16-20 pF.                                                                 |
| 23                    | 31                    | XTALOUT   | O      | 12 MHz crystal feedback output.                                                                                                             |

**NOTE:**

Type: I = Input, O = Output, I/O = Input/Output, PWR = Power, OD = Open-Drain.

## Pin Functions (Continued)

| LQFP-48<br>Pin Number | LQFP-64<br>Pin Number | Pin Name   | Type | Description                                                                                                                                                                                                                         |
|-----------------------|-----------------------|------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24                    | 32                    | GND        | PWR  | Ground.                                                                                                                                                                                                                             |
| 25                    | 33                    | 1V8_OUT    | PWR  | 1.8V power output from internal 3.3V to 1.8V regulator. Must be decoupled with minimum of 10 $\mu$ F.                                                                                                                               |
| 26                    | 34                    | VCC33      | PWR  | 3.3V power input.                                                                                                                                                                                                                   |
| 27                    | 35                    | REXT       | I    | External bias resistor. Connect 2.7k $\Omega$ 1% resistor from this pin to GND.                                                                                                                                                     |
| 28                    | 36                    | VCC18      | PWR  | 1.8V power input.                                                                                                                                                                                                                   |
| -                     | 37                    | GND        | PWR  | Ground.                                                                                                                                                                                                                             |
| 29                    | 38                    | UP_DM      | I/O  | Upstream port USB D <sup>-</sup> data.                                                                                                                                                                                              |
| 30                    | 39                    | UP_DP      | I/O  | Upstream port USB D <sup>+</sup> data.                                                                                                                                                                                              |
| 31                    | 40                    | VCC33      | PWR  | 3.3V power input.                                                                                                                                                                                                                   |
| 32                    | 41                    | DM5        | I/O  | Downstream port 5 USB D <sup>-</sup> data.                                                                                                                                                                                          |
| 33                    | 42                    | DP5        | I/O  | Downstream port 5 USB D <sup>+</sup> data.                                                                                                                                                                                          |
| -                     | 43                    | GND        | PWR  | Ground.                                                                                                                                                                                                                             |
| 34                    | 44                    | DM6        | I/O  | Downstream port 6 USB D <sup>-</sup> data.                                                                                                                                                                                          |
| 35                    | 45                    | DP6        | I/O  | Downstream port 6 USB D <sup>+</sup> data.                                                                                                                                                                                          |
| 36                    | 46                    | VCC33      | PWR  | 3.3V power input.                                                                                                                                                                                                                   |
| 37                    | 47                    | DM7        | I/O  | Downstream port 7 USB D <sup>-</sup> data.                                                                                                                                                                                          |
| 38                    | 48                    | DP7        | I/O  | Downstream port 7 USB D <sup>+</sup> data.                                                                                                                                                                                          |
| 39                    | 49                    | GND        | PWR  | Ground.                                                                                                                                                                                                                             |
| 40                    | 50                    | EXT_RST#   | I    | External reset input, active low. Must be asserted for a minimum of 10 $\mu$ S. This pin requires an external pull-up resistor to 3.3V.                                                                                             |
| 41                    | 51                    | VBUS_SENSE | I    | Active high, indicates connection to USB host. Must connect to VBUS power input from USB host through a series 10k $\Omega$ resistor. A 100k $\Omega$ pull-down resistor and 100nF shunt capacitance are also required on this pin. |
| -                     | 52                    | PWR7#      | OD   | Power enable for port 7 downstream device, active low. Asserted if OVC7# input is asserted or device is not configured.                                                                                                             |
| -                     | 53                    | OVC7#      | I    | Downstream port 7 over current indicator, active low.                                                                                                                                                                               |
| -                     | 54                    | PWR6#      | OD   | Power enable for port 6 downstream device, active low. Asserted if OVC6# input is asserted or device is not configured.                                                                                                             |
| -                     | 55                    | OVC6#      | I    | Downstream port 6 over current indicator, active low.                                                                                                                                                                               |
| 42                    | 56                    | VCC33      | PWR  | 3.3V power input.                                                                                                                                                                                                                   |
| -                     | 57                    | PWR5#      | OD   | Power enable for port 5 downstream device. Asserted if OVC5# input is asserted or device is not configured.                                                                                                                         |

## NOTE:

Type: I = Input, O = Output, I/O = Input/Output, PWR = Power, OD = Open-Drain.

## Pin Functions (Continued)

| LQFP-48<br>Pin Number | LQFP-64<br>Pin Number | Pin Name | Type | Description                                                                                                 |
|-----------------------|-----------------------|----------|------|-------------------------------------------------------------------------------------------------------------|
| -                     | 58                    | OVC5#    | I    | Downstream port 5 over current indicator, active low.                                                       |
| -                     | 59                    | PWR1#    | OD   | Power enable for port 1 downstream device. Asserted if OVC1# input is asserted or device is not configured. |
| -                     | 60                    | OVC1#    | I    | Downstream port 1 over current indicator, active low.                                                       |
| -                     | 61                    | PWR2#    | OD   | Power enable for port 2 downstream device, active low.                                                      |
| -                     | 62                    | OVC2#    | I    | Downstream port 2 over current indicator, active low.                                                       |
| 43                    | -                     | TEST1#   | I    | Test input. Use pull-up resistor to 3.3V for normal operation.                                              |
| 44                    | -                     | TEST2#   | O    | Test output. Leave unconnected.                                                                             |
| 45                    | -                     | TEST3#   | I    | Test input. Use pull-up resistor to 3.3V for normal operation.                                              |
| 46                    | 63                    | LED7     | O    | Port 7 LED Indicator. May be used in conjunction with LED_CTL pin.                                          |
| 47                    | 64                    | LED6     | O    | Port 6 LED Indicator. May be used in conjunction with LED_CTL pin.                                          |

**NOTE:**

Type: I = Input, O = Output, I/O = Input/Output, PWR = Power, OD = Open-Drain.

The product (or products) mentioned in this data sheet are no longer being manufactured and may not be ordered (OBS)

## Functional Block Diagram

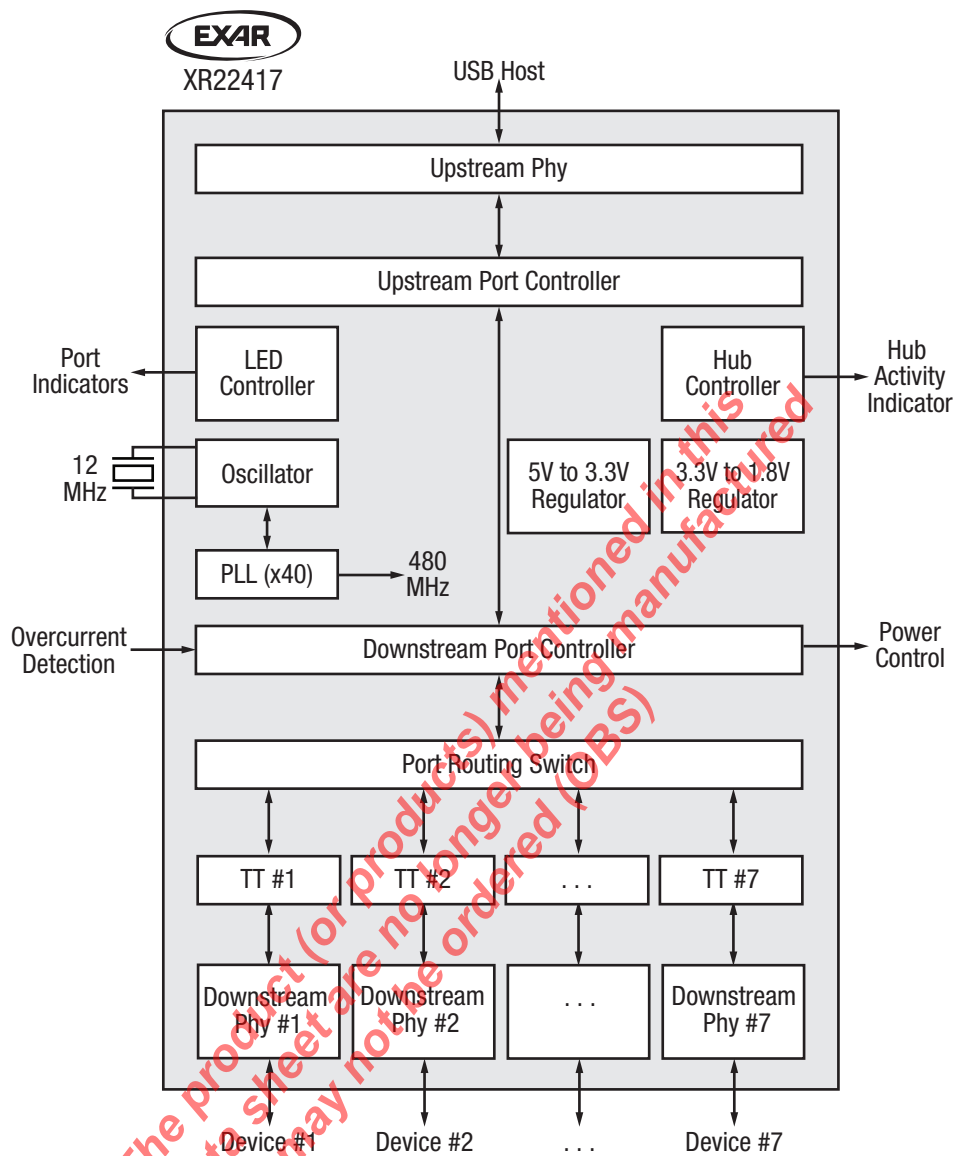


Figure 2. Functional Block Diagram

## Applications Information

### Functional Description

The XR22417 hub has a multiple transaction translator architecture that provides one Transaction Translator (TT) for each of the downstream USB ports. The transaction translators allow the USB 2.0 hub to take incoming high speed packets from the USB host on the upstream port and translate these commands, if necessary to full or low speed devices on any of the 7 downstream ports. The MTT architecture allows for higher bandwidth as the 7 individual ports are not constrained by a shared resource.

### USB Interface

The hub function of the XR22417 supports one configuration and supports all USB endpoints:

- Control endpoint
- Interrupt-in and interrupt-out endpoints
- Bulk-in and bulk-out endpoints
- Isochronous-in and isochronous-out endpoints

The XR22417 may be placed into a low power or suspended state by the USB host. The XR22417 hub may only be utilized in self-powered mode. Each of the downstream ports may draw up to 500mA.

Operating the XR22417 in bus powered mode violates the USB specification, as the device reports as self-powered in USB descriptors. A bus powered hub must provide 100mA on each downstream port but a 7-port hub cannot since it can only draw 500mA maximum from the USB host.

### USB Vendor ID

Exar's USB vendor ID is 0x04E2.

### USB Product ID

Exar's USB hub product ID is 0x0417.

### Device Reset

The XR22417 has both an automatic power-up reset and an external hardware pin reset. Strapping options selected by tying pins to logic '0' or logic '1' states are sampled at either reset and the resulting hardware configuration selected by the strapping is then set. Refer to [Tables 2](#) and [Table 3](#).

The product (products) mentioned in this data sheet are no longer being manufactured and may not be ordered (OBS)



## Applications Information (Continued)

### External EEPROM

An external I<sup>2</sup>C EEPROM may be used with the XR22417 to configure USB device descriptors, the number of downstream ports, a device serial number, and downstream non-removable devices. The contents of the EEPROM are described in Table 1. In order for contents of the EEPROM to be used by the XR22417, both the EEPROM check values at address 0x00, 0x01 and the checksum at address 0x1F must be correct. If either field is incorrect, the EEPROM contents will be ignored and the device will use the default descriptor values. Note that using the EEPROM requires the use of serial numbers. By USB specification, if the hub is serialized, each individual device must be guaranteed to have a unique serial number.

Table 1: EEPROM Contents

| Address      | Content              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x00         | 0x40                 | EEPROM check value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0x01         | 0x1A                 | EEPROM check value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0x02         | Vendor ID, LSB       | idVendor field LSB of device descriptor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0x03         | Vendor ID, MSB       | idVendor field MSB of device descriptor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0x04         | Product ID, LSB      | idProduct field LSB of device descriptor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0x05         | Product ID, MSB      | idProduct field MSB of device descriptor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0x06         | Device Release, LSB  | bcdDevice field LSB of device descriptor in binary coded decimal format.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0x07         | Device Release, MSB  | bcdDevice field MSB of device descriptor in binary coded decimal format.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 0x08 to 0x17 | Device Serial Number | ASCII alpha-numeric serial number with maximum length 16 characters. First character of serial number string in location 0x08.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 0x18         | Serial Number Length | Length of device serial number.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 0x19         | 0x00                 | Reserved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0x1A         | Downstream Ports     | Number of downstream ports in the bNbrPorts field of the hub descriptor. EEPROM value will take precedence over any strapping options from <a href="#">Table 2</a> and <a href="#">Table 3</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 0x1B         | 0x00                 | Reserved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0x1C         | Device Removable     | Device removable field of hub descriptor. Bit n = '0' indicates a removable device, or bit n = '1' indicates a non-removable device for port n, (n = port 1 - 7). Bit 0 is reserved. EEPROM value will take precedence over any strapping options from <a href="#">Table 2</a> and <a href="#">Table 3</a> .                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 0x1D         | 0x00                 | Reserved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0x1E         | Device Attributes    | <p>Bit 0: port indicators support, bit 7 of <i>wHubCharacteristics</i> field of hub descriptor - 0: port indicators are not supported on its downstream facing ports and PORT_ INDICATOR request has no effect. 1: port indicators are supported on its downstream facing ports and PORT_ INDICATOR request controls the indicators.</p> <p>Bit 1: identifies a compound device, bit 2 of <i>wHubCharacteristics</i> field of hub descriptor - 0: hub is not part of a compound device. 1: hub is part of a compound device.</p> <p>Bit 2: maximum current requirements of the hub controller electronics, <i>bHubContrCurrent</i> field of hub descriptor - 0: 200 mA. 1: 500 mA.</p> <p>Bit 3 to 7, reserved, must be 0's.</p> |
| 0x1F         | Checksum             | Bitwise checksum of EEPROM values from address 0x00 to 0x1E.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## Applications Information (Continued)

### Configurations for Reduced Downstream Ports

The number of usable downstream ports of the XR22417 may be configured using an external EEPROM. Additionally, the number of usable downstream ports may be reduced from 7 down to a minimum of 4 by strapping options on the device, shown in Table 2. Both the EEPROM values and the strapping options will change the bNbrPorts field of the hub descriptor reported to the USB host. LED pins for unusable downstream ports are disabled.

Table 2: Strapping Options for Reducing Usable Downstream Ports

| Usable Downstream Ports | LED7      | LED6      |
|-------------------------|-----------|-----------|
| 4, 3, 2, 1              | Logic '0' | Logic '0' |
| 5, 4, 3, 2, 1           | Normal    | Logic '0' |
| 6, 5, 4, 3, 2, 1        | Logic '0' | Normal    |
| 7, 6, 5, 4, 3, 2, 1     | Normal    | Normal    |

### Configurations for Non-Removable Devices

Non-removable devices are reported in the device removable field of the hub descriptor. They can be identified by strapping options. LED pins for non-removable downstream ports are disabled.

Table 3: Strapping Options for Configuring Non-Removable Downstream Ports

| Non-Removable Downstream Ports | LED4      | LED3      | LED2      |
|--------------------------------|-----------|-----------|-----------|
| None                           | Normal    | Normal    | Normal    |
| 2                              | Normal    | Normal    | Logic '0' |
| 3, 2                           | Normal    | Logic '0' | Normal    |
| 3, 2, 1                        | Normal    | Logic '0' | Logic '0' |
| 4, 3, 2, 1                     | Logic '0' | Normal    | Normal    |
| 5, 4, 3, 2, 1                  | Logic '0' | Normal    | Logic '0' |
| 6, 5, 4, 3, 2, 1               | Logic '0' | Logic '0' | Normal    |
| 7, 6, 5, 4, 3, 2, 1            | Logic '0' | Logic '0' | Logic '0' |

## Applications Information (Continued)

### Port Status Indicators

Seven port indicator (LED1 - LED7) pins, provide status of downstream devices. Ports using LED indicators may configure status LEDs in a number of configurations in conjunction with the LED\_CTL pin. Per the USB 2.0 spec, amber and green LEDs are used to indicate port status automatically controlled by the USB hub. When the hub is suspended or not yet configured the LEDs must be off, solid green indicates normal operation, and amber or flashing green and/or amber indicate various error conditions as defined in the specification. The TEST#/SDA and LED1/SCL pins may also be connected to an external EEPROM.

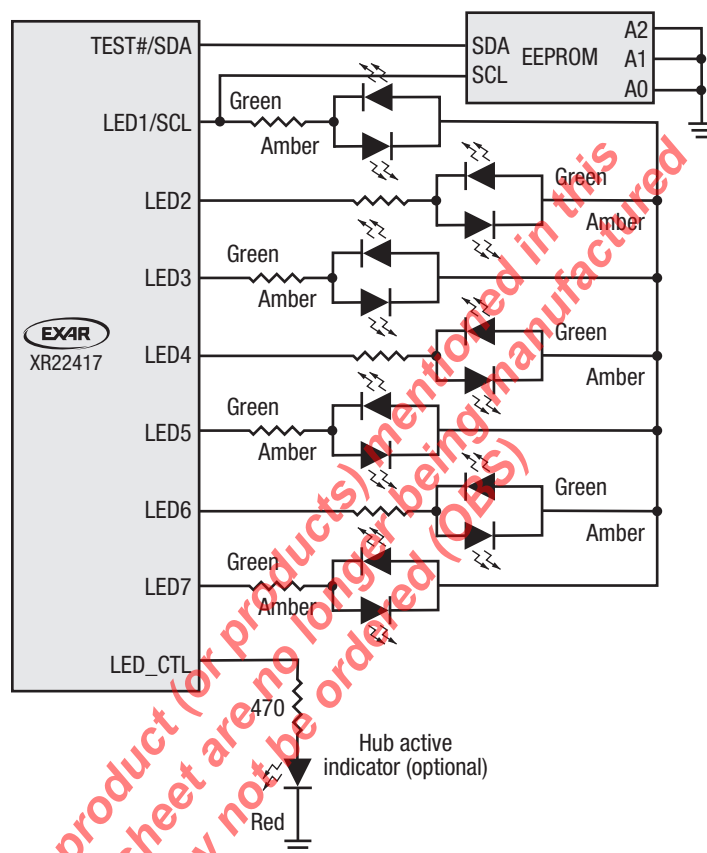


Figure 3. Port and Hub Status Indicators

TEST#/SDA

SDA EEPROM

A2

A1

A0

Green

Amber

LED1/SCL

LED2

LED3

LED4

Green

Amber

LED5

Green

Amber

LED6

LED7

LED\_CTL

EXAR

XR22417

470

Hub active indicator (optional)

Red

(or products) mentioned in this  
are no longer being manufactured

### Figure 4. Port Indicators Example

## Applications Information (Continued)

### Power Control and Overcurrent Protection

In the LQFP-64 package, the XR22417 OVCn# pins monitor overcurrent conditions for each port and individual PWRn# pins enable power to devices connected to each downstream port. Figure 5 depicts downstream ports 1-4 using individual power and overcurrent protection.

#### NOTE:

Ports 5-7 are unused in this example. If used can duplicate the monitor and control using the XRP2528.

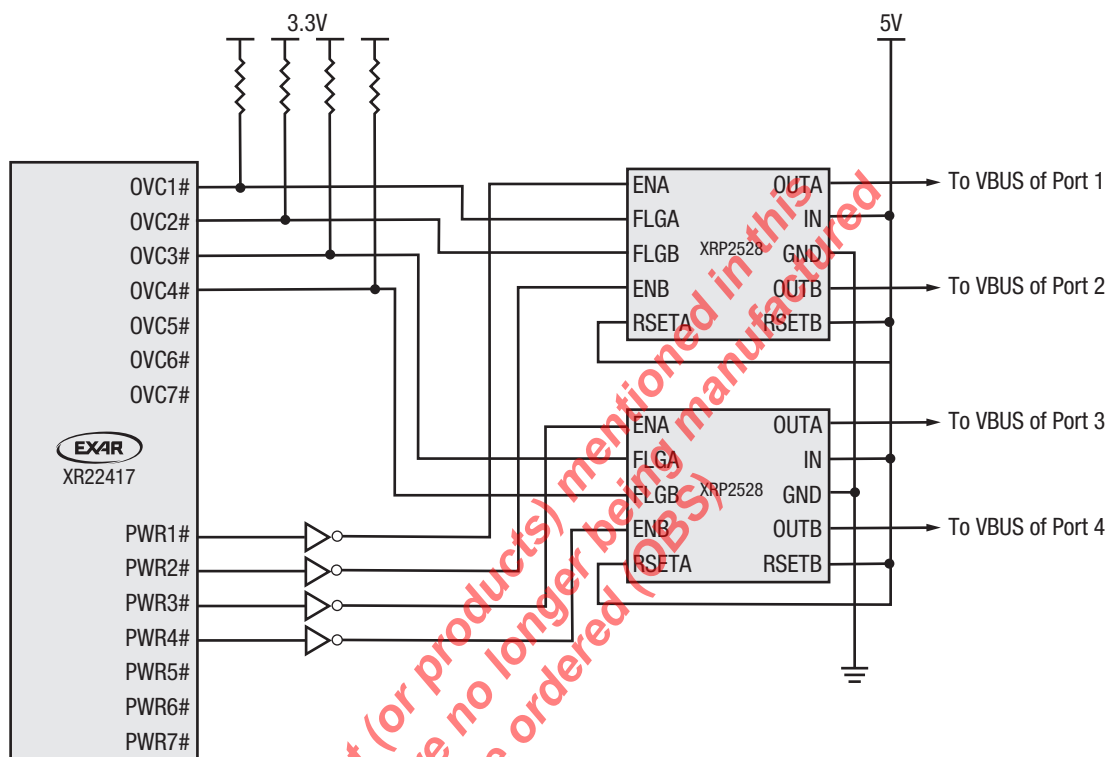


Figure 5. LQFP-64 Individual Power Control and Overcurrent Mode

### USB Hub Drivers

All operating systems provide a native USB hub device driver for the XR22417 device to operate. No other device drivers are necessary for the XR22417.

### Regulated 3.3V Power Output

The XR22417 internal voltage regulator provides 3.3 VDC output power from 5V input, which can be utilized by other circuitry. Refer to Electrical Characteristics on page 2 for maximum power capability.

## Applications Information (Continued)

### External Crystal

A 12 MHz  $\pm$  50 PPM fundamental frequency external crystal must be connected between the XTALIN and XTALOUT pins of the XR22417 device. The crystal should have a rated load capacitance of 16-20pF. However, note that both the load capacitors and feedback resistance are internal to the XR22417 device as shown.

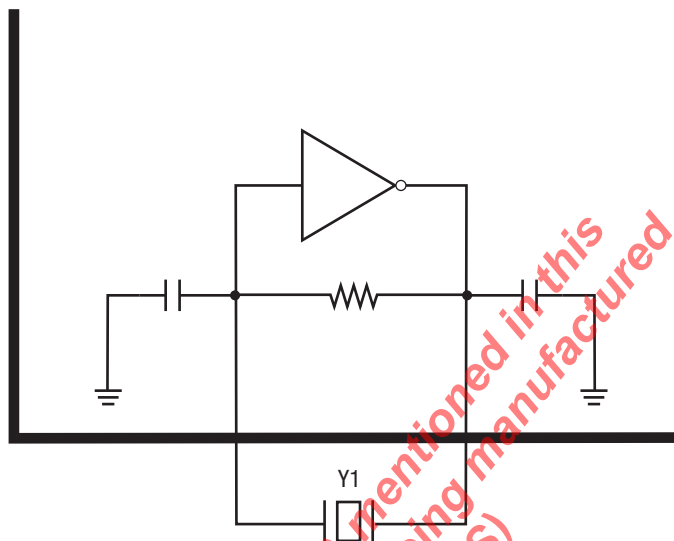
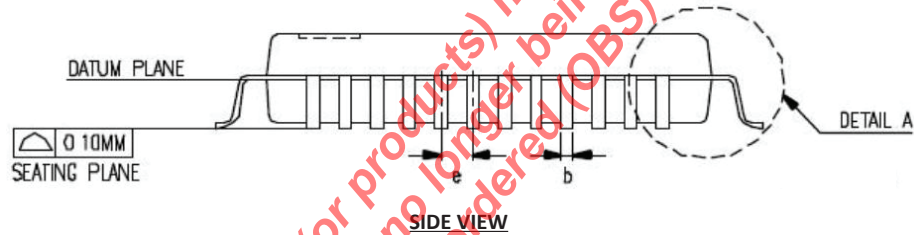
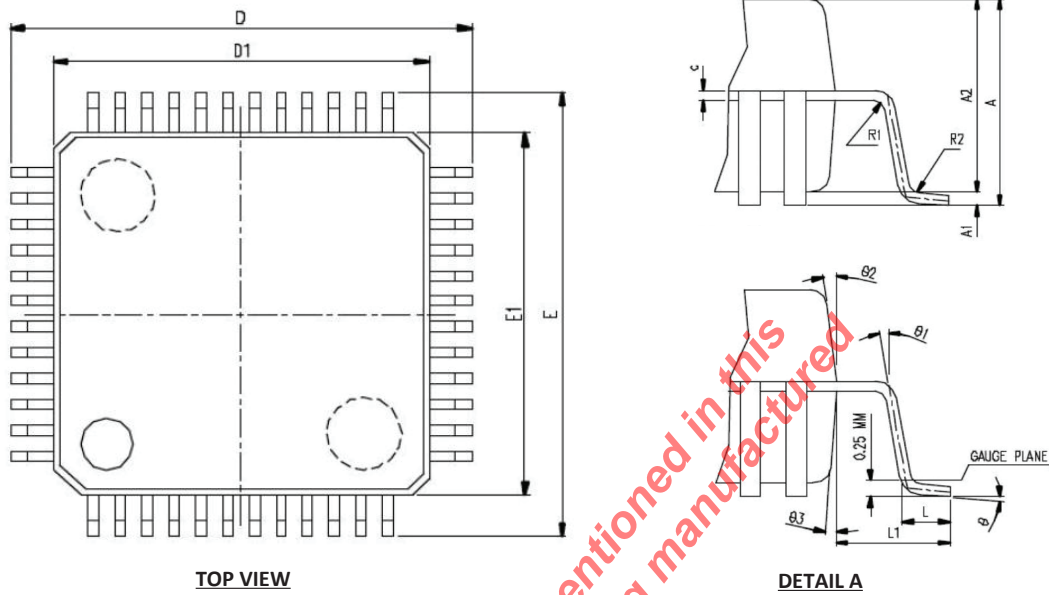


Figure 6. Typical Oscillator Connections

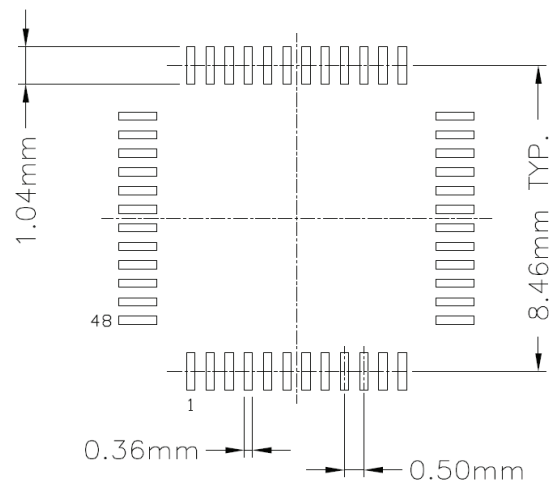
## Package Description

### LQFP-48



| SYMBOL | DIMENSION IN MM |       |      |
|--------|-----------------|-------|------|
|        | MIN.            | NOM.  | MAX. |
| A      |                 |       | 1.60 |
| A1     | 0.05            |       | 0.15 |
| A2     | 1.35            | 1.40  | 1.45 |
| b      | 0.17            | 0.22  | 0.27 |
| c      | 0.09            |       | 0.20 |
| e      | 0.50            | BASIC |      |
| D      | 9.00            | BASIC |      |
| D1     | 7.00            | BASIC |      |
| E      | 9.00            | BASIC |      |
| E1     | 7.00            | BASIC |      |
| L      | 0.45            | 0.60  | 0.75 |
| L1     |                 | 1.00  | REF. |
| R1     | 0.08            |       |      |
| R2     | 0.08            |       | 0.20 |
| θ      | 0°              | 3.5°  | 7°   |
| θ1     | 0°              |       |      |
| θ2     | 11°             | 12°   | 13°  |
| θ3     | 11°             | 12°   | 13°  |

**TERMINAL DIMENSION**



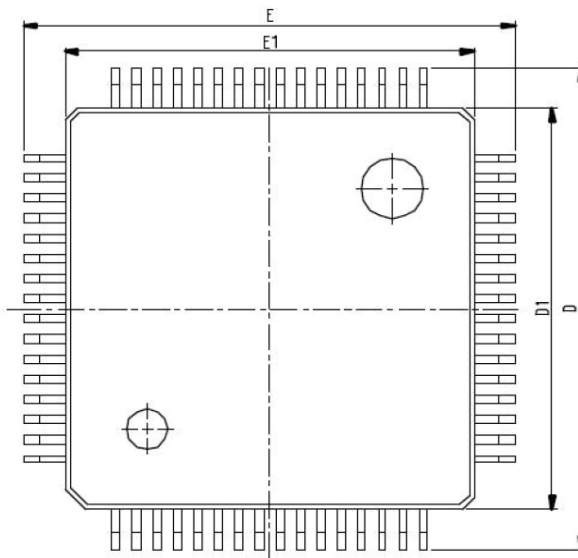
**TYPICAL RECOMMENDED LAND PATTERN**

- Control dimensions are in Millimeters
- Jedec MS 026

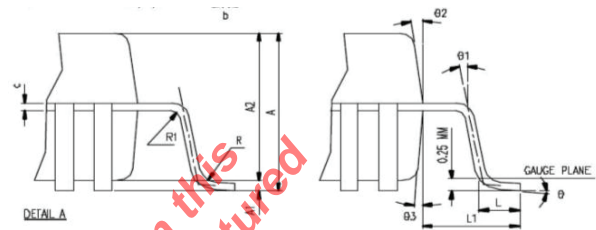
Drawing No. : POD - 00000096  
Revision: A

## Package Description (Continued)

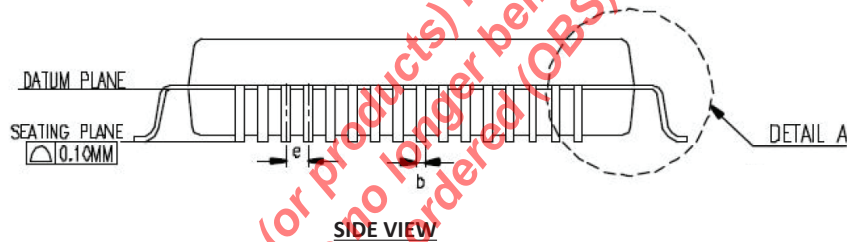
## LQFP-64



TOP VIEW



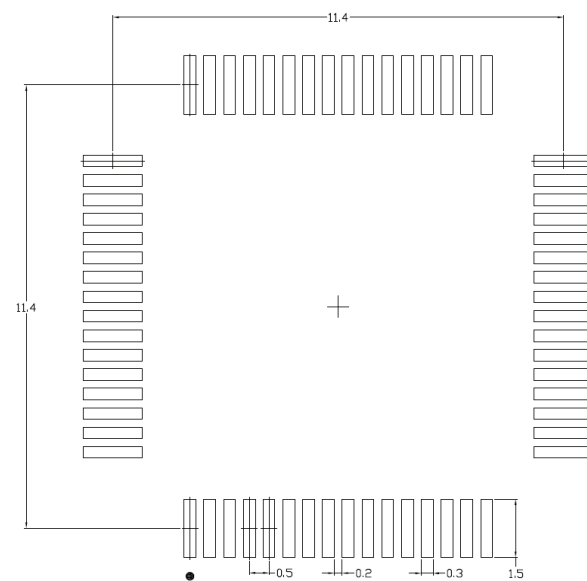
DETAIL A



SIDE VIEW

| SYMBOL | DIMENSION IN MM |      |      | DIMENSION IN INCH |       |       |
|--------|-----------------|------|------|-------------------|-------|-------|
|        | MIN.            | NOM. | MAX. | MIN.              | NOM.  | MAX.  |
| A      |                 |      | 1.80 |                   |       | 0.063 |
| A1     | 0.05            |      | 0.15 | 0.002             |       | 0.006 |
| A2     | 1.35            | 1.40 | 1.45 | 0.053             | 0.055 | 0.057 |
| b      | 0.17            | 0.20 | 0.23 | 0.007             | 0.008 | 0.009 |
| c      | 0.09            |      | 0.16 | 0.004             |       | 0.006 |
| e      | 0.50 BASIC      |      |      | 0.020 BASIC       |       |       |
| D      | 12.00 BASIC     |      |      | 0.472 BASIC       |       |       |
| D1     | 10.00 BASIC     |      |      | 0.394 BASIC       |       |       |
| E      | 12.00 BASIC     |      |      | 0.472 BASIC       |       |       |
| E1     | 10.00 BASIC     |      |      | 0.394 BASIC       |       |       |
| L      | 0.45            | 0.60 | 0.75 | 0.018             | 0.024 | 0.030 |
| L1     | 1.00 REF.       |      |      | 0.039 REF.        |       |       |
| R1     | 0.08            |      |      | 0.003             |       |       |
| R      | 0.08            |      | 0.20 | 0.003             |       | 0.008 |
| θ      | 0               | 3.5  | 7    | 0                 | 3.5   | 7     |
| θ1     | 0               |      |      | 0                 |       |       |
| θ2     | 11              | 12   | 13   | 11                | 12    | 13    |
| θ3     | 11              | 12   | 13   | 11                | 12    | 13    |
| JEDEC  | MS-026 (BCD)    |      |      |                   |       |       |

TERMINAL DIMENSION



TYPICAL RECOMMENDED LAND PATTERN

Drawing No. : POD - 00000092  
Revision: A

1. Control dimensions are in Millimeters
2. Dimensions and tolerance per Jedec MS-026



Ordering Information<sup>(1)</sup>

| Part Number     | Operating Temperature Range  | Lead-Free          | Package     | Packaging Method |
|-----------------|------------------------------|--------------------|-------------|------------------|
| XR22417CV48-F   | 0°C to 70°C                  | Yes <sup>(2)</sup> | 48-pin LQFP | Tray             |
| XR22417CV48TR-F |                              |                    |             | Reel             |
| XR22417CV64-F   |                              |                    | 64-pin LQFP | Tray             |
| XR22417CV48EVB  | Evaluation board for LQFP-48 |                    |             |                  |
| XR22417CV64EVB  | Evaluation board for LQFP-64 |                    |             |                  |

## NOTE:

1. Refer to [www.exar.com/XR22417](http://www.exar.com/XR22417) for most up-to-date Ordering Information.
2. Visit [www.exar.com](http://www.exar.com) for additional information on Environmental Rating.

## Revision History

| Revision | Date     | Description     |
|----------|----------|-----------------|
| 1A       | Aug 2016 | Initial Release |

The product (or products) mentioned in this data sheet are no longer being manufactured and may not be ordered (OBS)


[www.exar.com](http://www.exar.com)

48760 Kato Road  
Fremont, CA 94538  
USA

Tel.: +1 (510) 668-7000  
Fax: +1 (510) 668-7001  
Email: [uarttechsupport@exar.com](mailto:uarttechsupport@exar.com)

Exar Corporation reserves the right to make changes to the products contained in this publication in order to improve design, performance or reliability. Exar Corporation conveys no license under any patent or other right and makes no representation that the circuits are free of patent infringement. While the information in this publication has been carefully checked, no responsibility, however, is assumed for inaccuracies.

Exar Corporation does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless Exar Corporation receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of Exar Corporation is adequately protected under the circumstances.

Reproduction, in part or whole, without the prior written consent of Exar Corporation is prohibited. Exar, XR and the XR logo are registered trademarks of Exar Corporation. All other trademarks are the property of their respective owners.