

## TI USB 1.1/USB 2.0 Hub FAQs

Julie Nirchi

CCI Consumer Computer Interface

### 1. What is the recommended reset timing for the hubs?

Texas Instruments recommends a minimum of 100  $\mu$ s to a maximum of 1 ms of reset timing. If the hub is held in reset for a longer period of time, it can fail to respond promptly to USB host signaling and not complete enumeration. This is typically an issue with embedded system applications.

### 2. Is it imperative to have series resistors on a differential pair?

Yes. Per USB 2.0 specification, the differential impedance must be 90- $\Omega$  differential or 45- $\Omega$  single-ended. Having series resistors between 22  $\Omega$  to 33  $\Omega$  along with internal resistance of the device ensures that the impedance matches this specification.

### 3. Can the TSTPLL and TSTMODE pins be left open?

No. Because these are input pins, if unused, they have to be terminated by connecting them to ground.

### 4. If the TPS20xx is not used, can the OVRCUR and PWRON pins be left open?

PWRON pins are outputs and can be left open. OVRCUR pins are active-low inputs and must always be tied high. If not, the hub floats these pins low and goes into a suspend state.

### 5. Must the SUSPEND pin be terminated?

No. The SUSPEND pin is an output and must be left open if unused.

### 6. Is it necessary to have additional ESD protection circuitry on differential pair?

Although it is not required to have additional ESD protection on the USB differential pairs, depending on the application and the amount of ESD sensitive circuits in the design, users may want to implement them. It is still important to ensure that the impedance requirement on the differential pair meets the USB 2.0 specification even with the additional ESD circuit.

### 7. What are the conditions for the hub to go into SUSPEND state?

Per USB specification, any USB device can start to enter SUSPEND after 3 ms of bus inactivity, but they must be in the SUSPEND state by 10 ms of bus inactivity and consuming only 2.5-mA supply current from the bus.

A USB device or hub cannot initiate a SUSPEND state; it can only occur after at least 3 ms of bus inactivity. If the USB hub reset timing is inaccurate or if the host does not load the hub class driver correctly, the hub goes into the SUSPEND state and shows up as an "Unknown device" in the device manager.

### 8. What is the recommended crystal for TI USB hubs?

Texas Instruments (TI) has used and tested the Fox Electronics HC49U family of crystals. Although the recommendation is to use a 30-ppm crystal, it is acceptable to use a 50-ppm crystal with a load capacitance of 20 pF.

### 9. How are the values for the load capacitance and the resistor calculated for XTAL pins?

The formula to approximate the value of load capacitors used is:

$$C_L = ((C_1 \times C_2) / (C_1 + C_2)) + C_{\text{stray}}$$

$C_{\text{stray}}$  is the stray capacitance in the circuit, typically 2 pF to 5 pF. If the oscillation frequency is high, the capacitor values must be increased to lower the frequency. If the frequency is low, the capacitor values must be decreased, thus raising the oscillation frequency. When  $C_L = 20$  pF,  $C_1$  and  $C_2$  are approximately 27 pF to 33 pF each, depending on the amount of stray capacitance. A series resistor on the XTAL pin is used to limit the output of the inverter so that the crystal is not overdriven. The minimum value recommended depends on the crystal characteristics. Note that overdriving of the crystal can be observed on the oscillator output signal. The recommended way to optimize RX2 is to first choose  $C_1$  and  $C_2$  values as explained earlier and connect a potentiometer in place of RX2. Its initial setting must be set to be approximately equal to  $C_2$  capacitive reactance, and then adjusted, if required, until an acceptable output and crystal drive level are found.

Windows is a trademark of Microsoft Corporation.

**10. What is the jitter requirement for the 48-MHz signal (pin 27) for the TUSB2046B?**

The clock must meet the USB 2.0 full-speed jitter specification as outlined in Table 7-9 of the full-speed specification (available at <http://www.usb.org/developers/docs/>). The source jitter tolerance TDJ1 has to be between -3.5 ns (min) to 3.5 ns (max). TDJ2 has to be between -4 ns to 4 ns.

**11. Can the unused downstream ports be left open?**

No. The differential pair on unused downstream ports must be tied together and pulled down to ground so that they are in a single-ended zero state.

**12. Does TI provide any utility to program an EEPROM for USB hubs?**

No. TI does not have any utility for programming the EEPROM on USB hubs.

**13. Does TI provide drivers for using its hub on non- Windows™ operating systems?**

No, TI does not provide drivers for non-Windows (including Windows CE) operating systems.

**14. Why is it recommended to use power management devices such as TPS20xx along with TI hubs?**

External power-management devices, such as the TPS20xx, provide the ability to control the 5-V power source switching (on/off) to the downstream ports and to detect an overcurrent condition from the downstream ports individually or ganged.

Outputs from external power devices provide overcurrent inputs to the TUSB20xx OVRCUR terminals in case of an overcurrent condition. The corresponding PWRON terminals are disabled by the TUSB20xx. In the ganged mode, all PWRON signals transition simultaneously, and any OVRCUR input can be used. In the nonganged mode, the PWRON outputs and OVRCUR inputs operate on a per-port basis.

**15. Do we have pullup on DP0 or DM0, and what is the difference between the two implementations?**

According to the USB specification, you must connect a pullup resistor of 1.5 kΩ on D+ for a full-speed device or on D- for a low-speed device.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Transportation and Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2011, Texas Instruments Incorporated