TI USB 1.1/USB 2.0 Hub FAQs

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

   Texas Instruments recommends a minimum of 100 μs 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-Ω differential or 45-Ω single-ended. Having series resistors between 22 Ω to 33 Ω 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:

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

   C_{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 C1 and C2 values as explained earlier and connect a potentiometer in place of RX2. Its initial setting must be set to be approximately equal to C2 capacitive reactance, and then adjusted, if required, until an acceptable output and crystal drive level are found.

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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.

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