

Design Advisory: guidelines on VBUS design for xCORE-200 USB devices

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1 Background

A small number of customers have experienced problems when using xCORE-200 USB devices with long USB cables (>1.5m). In rare cases, inductive effects can cause the failure of the xCORE-200 USB device.

This document describes the recommended protection circuitry to alleviate this risk, and provides best practice design guidelines for the USB VBUS connection at the board level when implementing a USB *device* (as opposed to a *host* or *OTG*).

2 Bus-Powered Designs

XMOS recommends that the xCORE-200 USB_VBUS is not connected if the device is wholly powered by USB. A typical schematic is shown in the diagram below.

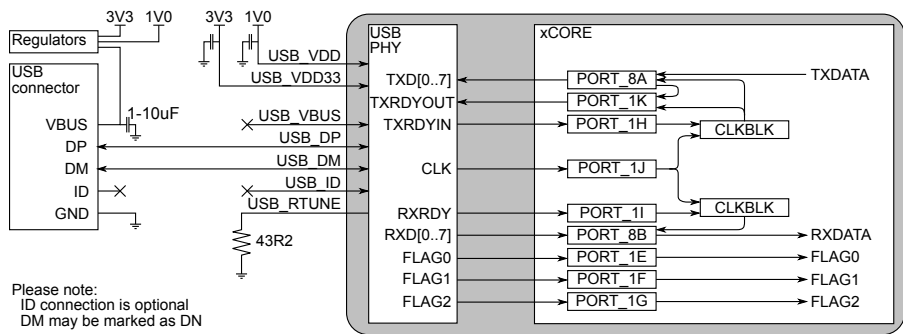


Figure 1:
Bus-powered
USB design

3 Self-Powered Designs

For a self-powered design, the xCORE-200 must be able to detect the presence of VBUS on the USB connector (so the device can disconnect its pull-up resistors from

D+/D- to ensure the device does not have any voltage on the D+/D- pins when VBUS is not present). This requires USB_VBUS to be connected to the VBUS pin of the USB connector as is shown in the diagram below.

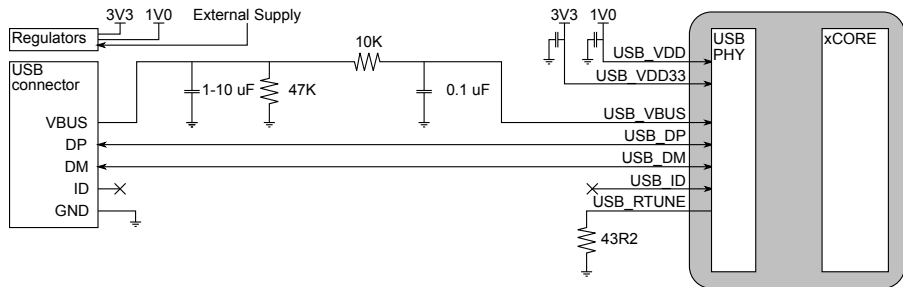


Figure 2:
Self-powered
USB design

When connecting a USB cable to the device it is possible an overvoltage transient will be present on VBUS due to the inductance of the USB cable combined with the required input capacitor on VBUS. XMOS recommends that the circuit shown above is used to ensure that the transient does not damage the device. The 10k series resistor and 0.1 uF capacitor ensure that any input transient is filtered and does not reach the device. The 47k resistor to ground is a bleeder resistor to discharge the input capacitor when VBUS is not present. The 1-10uF input capacitor is required as part of the USB specification. A typical value would be 2.2uF to ensure the 1uF minimum requirement is met even under voltage bias conditions.

In any case, extra components (such as a ferrite bead and diodes) may be required for EMC compliance and ESD protection. Different wiring is required for USB-host and USB-OTG.

4 XMOS Part Numbers

XMOS xCORE-200 parts covered by these guidelines have part numbers prefixed in the following way:

- ▶ XU- : USB
- ▶ XE- : USB and gigabit Ethernet

Customers should always refer to the device datasheet for the most up to date system level design and integration recommendations.



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