TN00007

Connecting a USB power switch to the LPC18xx / LPC43xx

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Document information

Info	Content
Keywords	LPC18xx, LPC43xx, USB power switch
Abstract	This technical note shows how to connect a USB power switch to the LPC18xx/LPC43xx

Revision history

Rev	Date	Description
1	20130115	Initial version.

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1. Introduction

The USB host controllers in the LPC18xx and LPC43xx family of microcontrollers have signals that control the VBUS drive pin and detect and act on an over-current condition when connected to a USB device. This document outlines design issues that should be considered when connecting these signals to an integrated power switch.

2. Block diagram

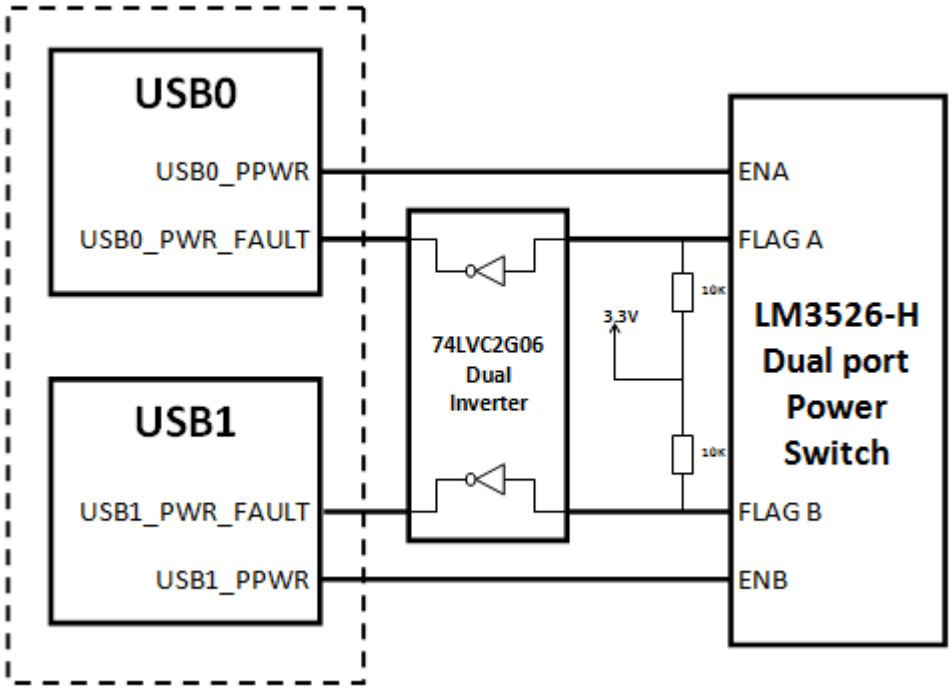

Fig 1. Block diagram

This is the recommended way to connect these two signals to an integrated current-limiting power switch. The LM3526-H part shown in this block diagram is used on most development boards that hold this part, but the dual inverter is not included on these boards.

If you decide to use the USBx_PWR_FAULT signal in combination with the power switch in this diagram then the inverter must be included.

3. The signals

The USBx_PPWR signal is the VBUS drive signal used by the USB host controller to control power to USB devices on the bus. This signal should be pulled low to disable the power switch at reset. The signal has an opposite polarity compared to the same signals used on other NXP LPC parts.

The input signal USBx_PWR_FAULT tells the host controller that an over-current condition exists on the external power switch. This signal is active HIGH. When the signal becomes active it causes the Over-current Active bit (bit 4) in the Port Status and Control register (PORTSC) to be set. A hardware interrupt is issued if the Port Change Interrupt Enable bit (bit 2) in the USBINTR register is set. In the interrupt handler the controller should be shut down.

4. The power switch

The block diagram shows a TI LM3526-H Dual port USB power switch which is what is used on the majority of development boards that hold the LPC18xx microcontroller.

The ENABLE_x inputs are active high that directly matches the active HIGH output of the USBx_PPWR output signals on the microcontroller which enables a direct connection.

However, as with most power switches available in the market today, the over-current (FLAG x) outputs are active LOW whereas the USBx_PWR_FAULT inputs on the microcontroller expect an active HIGH signal. Therefore an inverter is required with this power switch when using these inputs.

NOTE: when the part is not detecting an over-current condition its FLAG x outputs are open-drain, so it is important to use pull-ups on these pins.

5. An alternative approach

If there is a desire to eliminate the inverter component from the design an alternative solution exists where GPIO pins are used in place of the USBx_PWR_FAULT pins. In this design the FLAG x outputs on the power switch are tied directly to GPIO inputs on the microcontroller. These GPIO pins are configured to generate an interrupt on a falling edge. This handler for this interrupt would then take the action to shut down the controller.

This alternative approach would require changes being made to the USB host drivers.

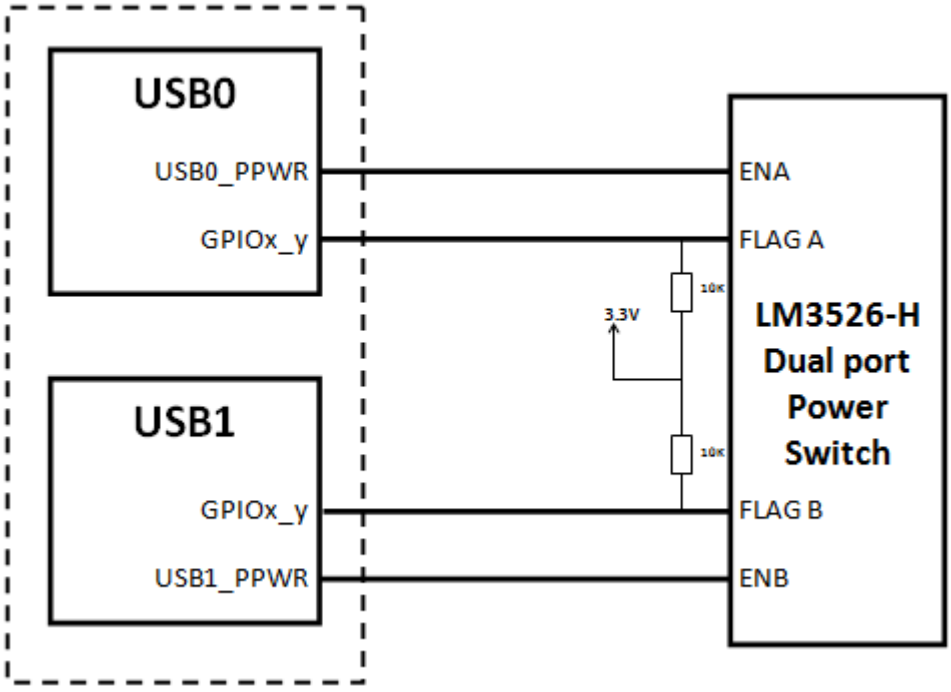

Fig 2. Alternative block diagram

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