AN11309

Connecting a High Speed USB PHY via ULPI

Rev. 1 — 7 January 2013 Application note

Document information

Info	Content
Keywords	USB PHY, ULPI, LPC18xx, LPC43xx
Abstract	This application note describes how to connect a high speed USB PHY via ULPI.

Revision history

Rev	Date	Description
1	20130107	Initial version.

Contact information

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1. Introduction

Some parts in the LPC18xx and LPC43xx families of microcontrollers have two USB controllers on board. Both controllers are capable of running at high speed but only one of them has an integrated high speed PHY connected to it. The other controller has an integrated full speed PHY. But this other controller also has a ULPI interface option which allows it to be connected to an external high speed PHY which means two simultaneous high speed USB interfaces, running in either host or device mode, are possible with this family of microcontrollers.

This app note includes the schematic for a circuit that connects an external high speed USB PHY to a LPC43xx microcontroller in a LBGA256 package, and software that configures the USB controller to use the ULPI interface and configures the pins of this interface that connect to the external PHY.

2. Block diagram

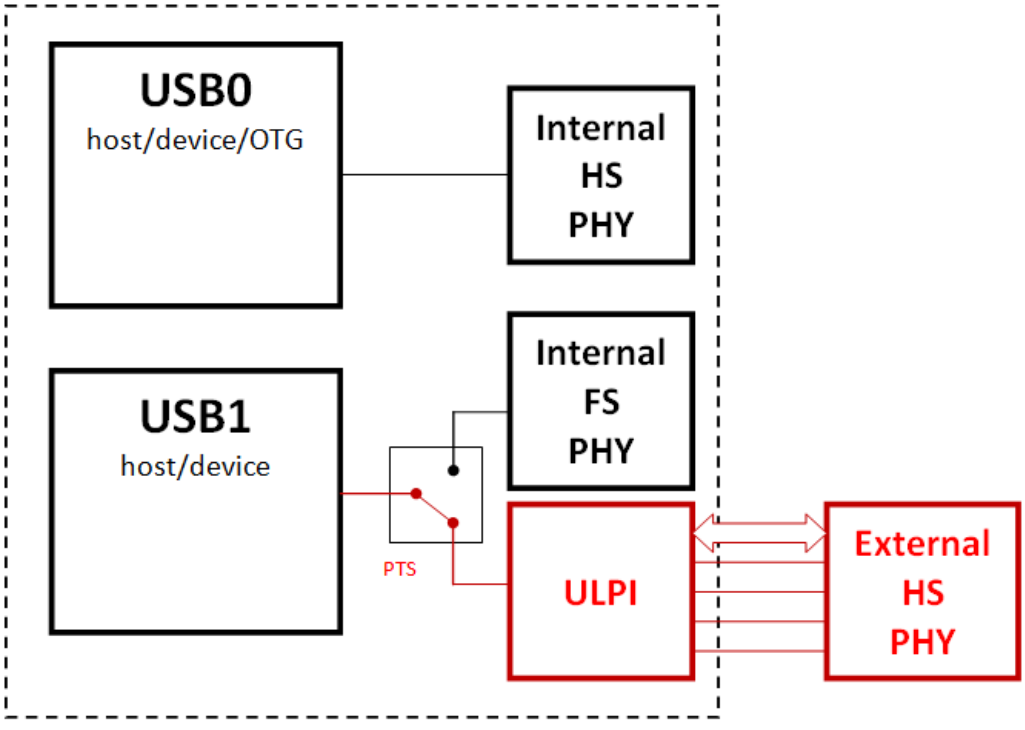

Fig 1. Block diagram

3. Parallel Transceiver Select (PTS)

USB1 includes a switch that selects between an internal full speed PHY and a ULPI interface which can be connected to an external high speed PHY.

The control of this switch is located in the 2 MSBs of the Port Status and Control register (PORTSC1) in the USB1 controller. Setting the most significant (0x80000000) will select the ULPI interface.

Bit 24 (PFSC) in the PORTSC1 register must be clear. This will prevent the port from forcing a full speed connection.

4. ULPI / PHY interface

The interface between the ULPI and the external USB PHY consists of 8 data lines 3 control lines and a clock line. These 12 signals are available on two sets of pins on higher pin count packages.

The external USB PHY requires other signals in addition to these, like chip select and reset, which can be tied off or connected to other GPIO signals on the microcontroller.

Sheet 8 of the included schematic shows a working example of a circuit that implements this interface.

5. Configuring the microcontroller

The software included with this app note is a uVision based USB example program that implements a mass storage class device through the external high speed USB PHY.

The file usbd_msc\usbd_config.h includes two definitions that must be set as shown below to include the code that enables the ULPI interface.

```
/*************************************************************
******

 ** USB defines

*************************************************************
*****/

#define CURR_USB_PORT    LPC_USB1_BASE

#define USB1_ULPI_PHY   1
```

To configure and enable the ULPI interface through USB1 you must:

1. Disable the USB1 clock
2. Select which of the two sets of pins you want to use for the ULPI interface and then setup the pinmux accordingly
3. Select the ULPI interface (see Parallel Transceiver Select above)
4. Set the PFSC bit in the PORTSC1_D register to enable high speed operation

All the code that configures and enables the ULPI interface is located in the function SetUsb1ClockPinmux() in usbd_msc\usbd_msc.c.

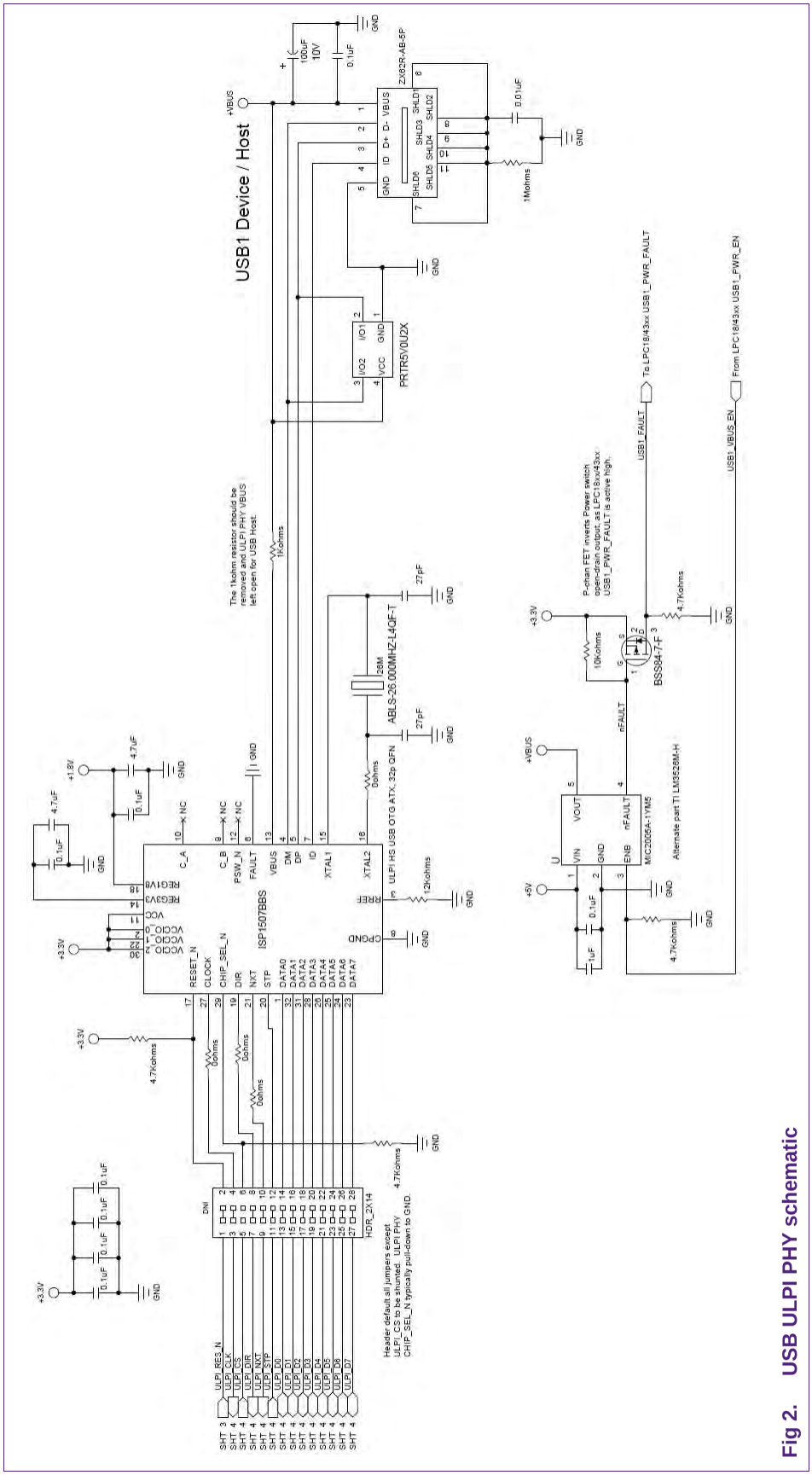

Fig 2. USB ULPI PHY schematic

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Date of release: 7 January 2013
Document identifier: AN11309