

# TI81XX PSP USB Driver User Guide



## TI81XX USB Driver User Guide

Linux PSP

### IMPORTANT

TI81XX refers to TI816X, TI814X and TI813X.

## Introduction

The TI81XX USBSS consists of two instance of mentor usb controller (**musb controller**). Each controller supports USB2.0 standards supporting HS/FS/LS speed. Each musb controller uses CPPI4.1 (Communication programming port interface 4.1 compliance) based DMA controller to transfer of data to/from between the external memory and endpoint FIFO. There are 15 Tx/Rx endpoints for each controller and each Tx/Rx endpoint uses dedicated Tx/Rx CPPI4.1 DMA channel for transfer of data. The endpoint-0 used for control transfer. For more information please refer to Technical reference manual at here <sup>[1]</sup>

## References

The USB2.0 specification standard at USB 2.0 spec <sup>[2]</sup>

- refer corresponding TI81XX Technical Reference Manual at here <sup>[1]</sup>
- refer approved usb class specification documents here <sup>[3]</sup>

## Acronyms & Definitions

### USB Driver: Acronyms

Acronym	Definition
USB	Universal Serial Bus
OTG	On The Go
HS/FS/LS	Highspeed/Fullspeed/LowSpeed
UAC	USB Audio Class
UVC	USB Video Class
HID	Human Interface Devices
CDC	Communication Device Class
RNDIS	Remote Network Device Interface Specification
DTM	Driver Test Manager
CPPI	Communication programming port interface
USBSS	USB subsystem

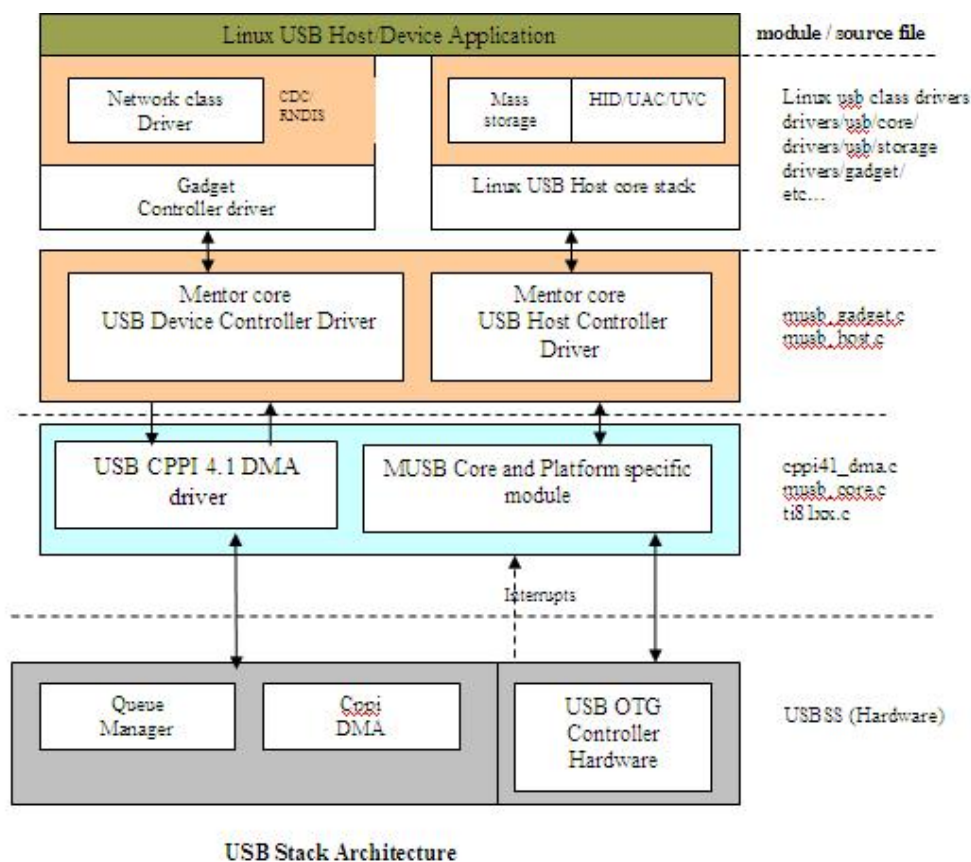
## Software Architecture

### Mentor graphics usb otg controller driver (or MUSB driver)

The MUSB driver is implemented on top of Mentor controller IP which supports all the speeds (High, Full and Low). TI81XX USBOTG subsystem uses CPPI 4.1 DMA for all the transfers. The musb driver conforms to linux usb framework support both in PIO/DMA mode of operation. The musb host controller driver (HCD) binds the controller hardware and linux usb core stack. The musb device/gadget controller driver binds the controller hardware and specific gadget driver (filestorage, cdc/rndis etc).

### Linux USB Stack Architecture

As shown in the figure, linux usb stack is an layered architecture, musb controller being the lowest layer, the musb host/device controller driver binds the musb controller hardware to linux usb stack frame work. The CPPI4.1 DMA controller driver is responsible for transmission/reception of packets over the musb endpoints.



## Features

- The Mentor USB driver can be built as module or built-in to kernel
- Support both PIO and DMA mode (The DMA mode not applicable for control endpoint)
- Support two instances musb controller in host mode (both usb0 and usb1 controller in host mode).
- Support USB gadget/device mode only (In this gadget only mode, only USB0 controller can be configured as Gadget and USB1 cannot be configured as gadget mode)
- Dual role support : Concurrent usage of one port as USB host and other port as USB device (refer USB Userguide for details)

## USB Host Features (TI816X/TI814X/TI813X)

Host Mode Feature	TI816x PG1.X	TI816x PG2.X	TI814x	TI813x
HUB class support	No <sup>[4]</sup>	Yes	Yes	Yes
Human Interface Class (HID) <sup>[5]</sup>	Yes	Yes	Yes	Yes
Mass Storage Class (MSC) <sup>[6]</sup>	Yes	Yes	Yes	Yes
USB Video Class (UVC) <sup>[7]</sup>	Yes	Yes	Yes	Yes
USB Audio Class (UAC) <sup>[8]</sup>	Yes	Yes	Yes	Yes
USB CDC Host <sup>[9]</sup>	Yes	Yes	Yes	No

## USB Gadget Features (TI816X/TI814X/TI813X)

Gadget Mode Feature	TI816x	TI814x	TI813x
Mass Storage Class (MSC) <sup>[10]</sup>	Yes	Yes	Yes
USB Networking - RNDIS <sup>[11]</sup>	Yes	Yes	Yes
USB Networking - CDC <sup>[11]</sup>	Yes	Yes	Yes

## Dual mode features (TI816X/TI814X/TI813X)

In dual mode feature, each port (usb0 or usb1) can be configured as host or device mode. Based on the USB\_ID pin on connector or cable type, the musb controller can take the role of host (if USB\_ID is grounded) and device (if USB\_ID is open).

Dual Mode Feature	TI816x	TI814x	TI813x
USB0 as host, USB1 as gadget <sup>[12]</sup>	Yes	Yes	Yes
USB0 as gadget, USB1 as host <sup>[12]</sup>	Yes	Yes	Yes
USB0 as host, USB1 as host <sup>[12]</sup>	Yes	Yes	Yes

Note: This feature not supported for TI814X PG1.x silicon version (refer known issues at release notes)

## Connector type details

**Note:** To support dual mode, the usb ports on board should have mini/micro-AB connector in order to connect both host cable (mini/micro-A to A receptacle) or device cable (mini/micro-B to standard A cable). The host only port will have standard host A-receptacle (or mini/micro-A receptacle) and device only port will have standard-B connector (or mini/micro-B connector).

## OTG support (TI816X/TI814X/TI813X)

	TI816x	TI814x	TI813x
OTG support	No	No	No

## Configuration

The Mentor USB driver can be built as module or built into kernel. For more information refer to linux-usb configuration Page <sup>[13]</sup>

## USB Host Configuration

### Host Mass storage class

For USB Host MSC configuration refer to Mass Storage Class (MSC) <sup>[14]</sup>

### Host HID class

For USB HID configuration refer to Human Interface Class (HID) <sup>[15]</sup>

### Host Audio class

For USB Host Audio configuration refer to USB Audio Class (UAC) <sup>[16]</sup>

### Host Video class

For USB Host Video configuration USB Video Class (UVC) <sup>[7]</sup>

### Host CDC class

refer to CDC-Host configuration at USB CDC Host <sup>[9]</sup>

## USB Device Configuration

### Device CDC/RNDIS class

- For USB gadget RNDIS configuration refer to USB Networking - RNDIS <sup>[17]</sup>
- For USB gadget CDC configuration refer to USB Networking - CDC <sup>[18]</sup>

### Device Mass storage class

For USB gadget Mass storage FSG configuration refer to Mass Storage Class (MSC) <sup>[10]</sup>

## Dual mode Configuration

In dual mode configuration, user has option to configure one port as host and other as device and vice versa. For more info, refer to USB0 as host, USB1 as gadget <sup>[12]</sup>

## References

- [1] <http://www.ti.com>
- [2] [http://www.usb.org/developers/docs/usb\\_20\\_101111.zip](http://www.usb.org/developers/docs/usb_20_101111.zip)
- [3] [http://www.usb.org/developers/devclass\\_docs#approved](http://www.usb.org/developers/devclass_docs#approved)
- [4] [http://processors.wiki.ti.com/index.php/DM81xx\\_AM38XX\\_USB-User-Guide#Hardware\\_Limitation\\_.28Not\\_supported\\_feature.29\\_DM816X](http://processors.wiki.ti.com/index.php/DM81xx_AM38XX_USB-User-Guide#Hardware_Limitation_.28Not_supported_feature.29_DM816X)
- [5] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB\\_HID\\_Class](http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB_HID_Class)
- [6] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#Mass\\_Storage\\_Driver](http://processors.wiki.ti.com/index.php/Usbgeneralpage#Mass_Storage_Driver)
- [7] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB\\_Video](http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB_Video)
- [8] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB\\_Audio](http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB_Audio)
- [9] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB\\_CDC-HOST](http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB_CDC-HOST)
- [10] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#Mass\\_Storage\\_Gadget](http://processors.wiki.ti.com/index.php/Usbgeneralpage#Mass_Storage_Gadget)
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- [12] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#One\\_port\\_as\\_host\\_and\\_other\\_port\\_as\\_Gadget\\_.28for\\_DM81XX.29](http://processors.wiki.ti.com/index.php/Usbgeneralpage#One_port_as_host_and_other_port_as_Gadget_.28for_DM81XX.29)
- [13] <http://processors.wiki.ti.com/index.php/Usbgeneralpage>
- [14] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#Mass\\_Storage\\_Driver](http://processors.wiki.ti.com/index.php/Usbgeneralpage#Mass_Storage_Driver)
- [15] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB\\_HID\\_Class](http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB_HID_Class)
- [16] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB\\_Audio](http://processors.wiki.ti.com/index.php/Usbgeneralpage#USB_Audio)
- [17] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#CDC.2FRNDIS\\_gadget](http://processors.wiki.ti.com/index.php/Usbgeneralpage#CDC.2FRNDIS_gadget)
- [18] [http://processors.wiki.ti.com/index.php/Usbgeneralpage#CDC.2FRNDIS\\_gadget](http://processors.wiki.ti.com/index.php/Usbgeneralpage#CDC.2FRNDIS_gadget)

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