

Application Note

Implementing Hyperstone NAND flash USB Controllers with USB Type-C Connector

Contents

1 Overview	3
2 Introduction	3
2.1 A brief history of USB interface and its adoption	3
2.2 USB Type-C connector	3
3 Hyperstone USB controllers with a USB Type-C connector	4
3.1 USB2.0 Controller U8 with USB Type-C connector	5
3.2 USB3.1 Controller U9 with USB Type-C connector	5
4 Conclusion	5

Hyperstone

1 Overview

USB Type-C connector specifications were released in July 2014. There is a compelling list of reasons to make it a likely success in the next few months, with its initial major introduction on Apple MacBook. There is a simple way to implement Hyperstone USB controllers on a board with a USB Type-C connector. It enables integrators to quickly adapt to the market.

2 Introduction

2.1 A brief history of USB interface and its adoption

USB development begins in the early 1990 with the USB implementers Forum comprised of industry leaders like Intel, Microsoft, Compaq, Apple, HP, LSI, ... In 1994, Intel releases the first USB 1.0 host, which will be used as a reference for all other device developments (for example during USB-IF Compliance Workshops). However, it is only in 1998 when Apple decided to replace its legacy ports with USB 1.1 ports on its iMac G3 that the USB interface took off. It was the trigger for its exponential success.

Many generations later, USB interface went from a 12Mb/s for a USB1.1 interface, to 5Gb/s for USB 3.1 Gen1 (SuperSpeed) or 10Gb/s for USB3.1 Gen2. A number of new connectors were also adopted along the way, with different form factors to adapt to USB specifications, to differentiate host or device side, and to accommodate thinner designs.

2.2 USB Type-C connector

In July 2014, the specifications for the new USB Type-C connector were released.

It has major advantages over its predecessors:

- About the size of a 5-pin micro USB device connector
- Orientation-agnostic (no wrong way to connect it)
- Can be used for power, data and video
- Supports 100 Watts (compared with 2.5 Watts on previous ones, just enough for a phone/tablet)
 - Bi-directional power delivery (any device in a connection is either the power source or the charging device or both)



Artist renderings courtesy of Foxconn.
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Its adoption was relatively slow, but the history repeats itself. In 2016, Apple has released its latest ultra-thin MacBook with only 2 connectors: a **USB 3.1 Type-C** and a headphone jack! Their legendary MagSafe power connector was removed. The laptop can now be powered from a terminal with USB Type-C connector for example.

It is only a matter of time before this USB Type-C connector replaces all other connectors on all new products. The transition though will require a number of gadgets to adapt legacy connectors to USB Type-C unless the design already includes the USB Type-C connector.

For a device, it is easy to adapt the board design to use this connector.

The following chapter will describe how-to.

3 Hyperstone USB controllers with a USB Type-C connector

Hyperstone USB flash controllers can be implemented on a board with a USB Type-C connector. The following USB Type-C plug diagram is extracted from the USB Type-C Cable and Connector Specification Release 1.2 (March 25, 2016).

A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
GND	RX2+	RX2-	VBUS	SBU1	D-	D+	CC	VBUS	TX1-	TX1+	GND
GND	TX2+	TX2-	VBUS	VCONN			SBU2	VBUS	RX1-	RX1+	GND
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12

Figure 1 : USB Full-Featured Type-C Plug interface (Front View)

On the receptacle interface (generally pictured), D+ and D- are also connected respectively to B6 and B7, and CC2 is on B5.

Before USB Type-C connectors, host and device roles were determined by the type of connector:

- std-A for hosts
- std-B or micro-B for device
- micro-AB for dual role (ID-pin tells if it's a host or device)

For USB Type-C, the same connector is used for host and device. The type of device is determined by a pull-up or pull-down resistor connected to the CC pin (Connection Channel pin).

3.1 USB2.0 Controller U8 with USB Type-C connector

To implement U8 as a high speed device with Type-C connectivity, the only things required are:

- Route USB D+/D- from the PHY to respectively A6 & A7
- Connect USB VBus and GND to all VBUS and GND pins on the receptacle
- Leave the ID pin on the PHY floating
- Connect a pull-down resistor (Rd) with nominal value 5.1kOhm to A5 (CC in Figure 1)

3.2 USB3.1 Controller U9 with USB Type-C connector

To implement U9 as a high speed device with Type-C connectivity, the only things required are:

- Route USB D+/D- from the PHY to respectively A6 & A7 (D+ and D- in Figure 1)
- Route RX+/RX- to pins B11 and B10 (RX1+ and RX1- in Figure 1)
- Route TX+/TX- to pins A2 and A3 (TX1+ and TX1- in Figure 1)
- Connect USB VBus and GND to all VBUS and GND pins on the receptacle
- Leave the ID pin on the PHY floating
- Connect a pull-down resistor (Rd) with nominal value 5.1kOhm to A5 (CC in Figure 1)

4 Conclusion

The process to implement Hyperstone USB NAND Flash controllers with a USB Type-C connector is straight forward. It only requires an additional pull-down resistor so that the device is recognized as a USB device.

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