PI5USB30213A Application Information

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1 Introduction

Diodes PI5USB30213A is a dual differential-channel bi-directional Mux/Demux switch with plug-in detector for USB3.1 Gen1 (5.0 Gbps) Type-C connector.

The device includes:

1) The Plug-in Detector for Type-C connector (CC Sensing)
   a) Supports DFP/UFP/DRP/Try.SRC DRP/Try.SNK. DRP
2) Integrated 2:1 USB3.1 Gen1 Mux/DeMux
   a) Auto-configure ports orientation through CC sensing
3) Integrated VCONN switch to power active cables

The device implements CC pins for port attachment, detachment, cable orientation, role detection and Type-C Current Mode control. The device supports host mode, device mode and dual role mode ports with automatic configuration based on the voltage levels detected on CC pins. The device supports both pin and I^2C control mode. I^2C control mode allows higher flexibility for port control and communications.

Packaging: 24-contact TQFN (2mmx4mm)

2 The Role of PI5USB30213A in USB3.1 Gen1 Type-C Application

USB Type-C connectors support flipping and swapping. Type-C Connector specification defined the new pin "CC" to resolve port roles and cable orientation to establish power routing and data bus routing. Please see Figure 1 below for an USB Type-C implementation with USB3 switch.

PI5USB30213A Type-C port controller detects and control CC1/2 pin and configure its integrated 2:1 USB3.1 Gen1 Mux/DeMux automatically to establish USB3.1 Gen1 data bus.

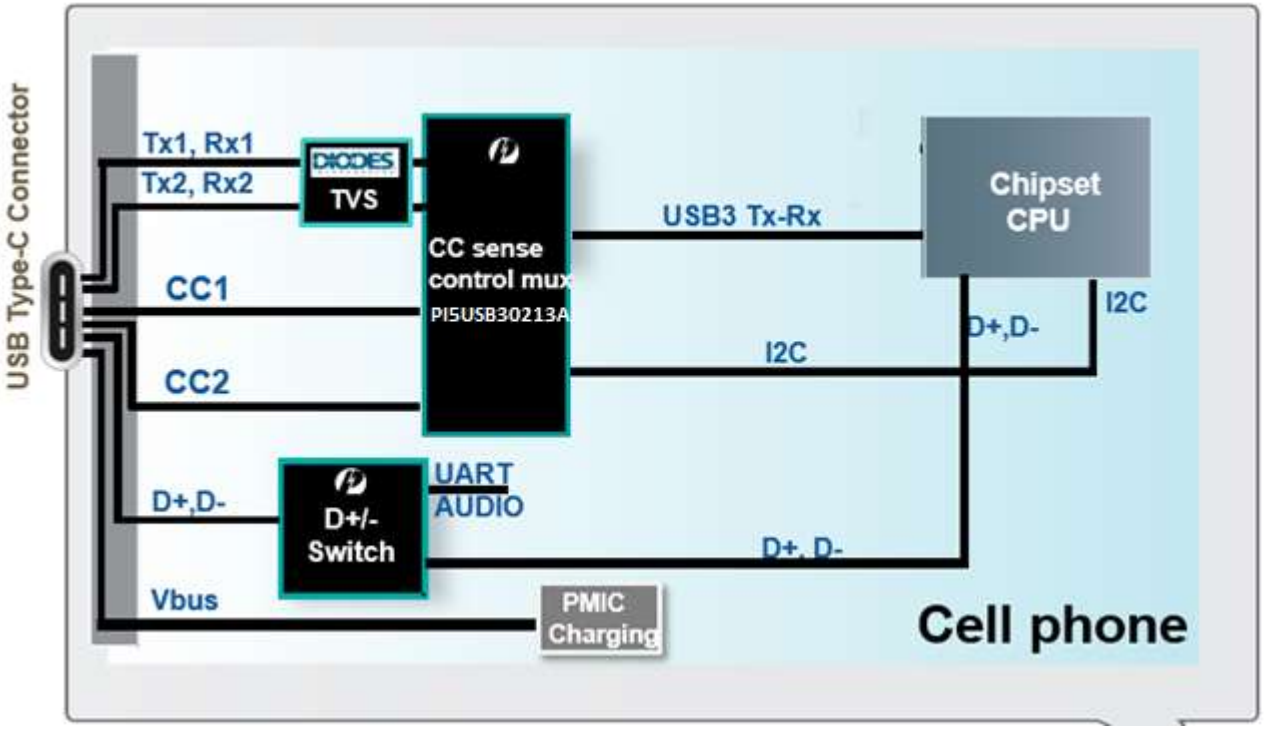


Figure 1: USB Type-C implementation with PI5USB30213A.

2.1 Type-C Port Channel Budget

In Type-C applications, Host & device channel loss budget is defined as 6.5dB @ 5Gbps by USB3.1 specification. (See below table from a slide presented at USB-IF Development Day)

PCB routing estimates

	Type-A Port		Type-C Port	
	Baseline	Best case	Baseline	Best case
SS Gen 1 5Gbps Insertion Loss Budget	10 dB	10 dB	6.5 dB	6.5 dB
Gen 1	10"	10"	5.5"	7"
Gen 1 + DP 1.2 discrete MUX			4.0"	5.5"
Gen 1 + DP 1.2 integrated MUX**			5.5"	7"

Table 1: USB3.1 Type-A Port vs Type-C Port channel loss budget

(1) If total channel loss from SOC to end connector, including PI5USB30213A, is less than 6.5dB→ use PI5USB30213A

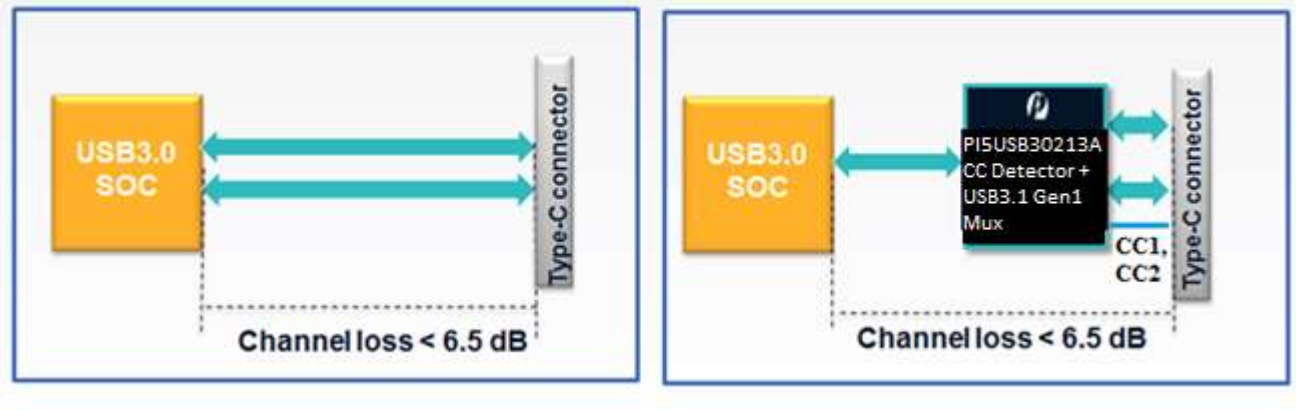


Figure 2: USB3.1 Type-C application needs passive Mux if total channel loss from SOC to end connector is less than 6.5dB.

(2) If total channel loss from SOC to end connector is more than 6.5dB
→ Active MUX or Re-driver is needed to increase signal integrity

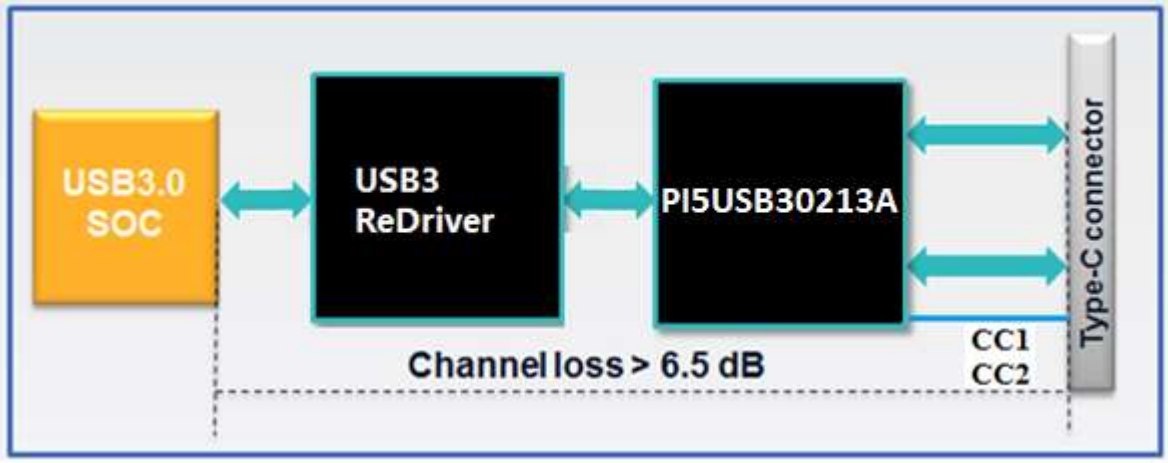


Figure 3: USB3.1 Type-C application needs active Mux if total channel Loss from SOC to end connector is more than 6.5dB.

2.2 VCONN

In non USB Power Delivery (USB-PD) application,
a) VCONN support is a must in USB3 Source/DRP to power active cable per USB Type-C spec
b) VCONN support is not needed in USB3 UFP
c) VCONN support is optional in USB2 Type-C application

The VCONN source requirement is below:

Table 4-3 USB Type-C Source Port's VCONN Requirements Summary

D+/D−	SSTX/SSRX	> 3 A	VCONN Requirements
No	No	No	Not required to source VCONN
Yes	No	No	Not required to source VCONN
Yes	Yes	No	Required to source 1 W. VCONN power may be removed after the source has read the cable's eMarker and has determined that it is not an active cable.
No	No	Yes	Required to source 1 W. VCONN power may be removed after the source has read the cable's eMarker and has determined the cable's current carrying capacity.
Yes	No	Yes	Required to source 1 W. VCONN power may be removed after the source has read the cable's eMarker and has determined the cable's current carrying capacity.
Yes	Yes	Yes	Required to source 1 W. VCONN power may be removed after the source has read the cable's eMarker and has determined the cable's current carrying capacity and that it is not an active cable.

Table 4-3 VCONN Source Characteristics

	Minimum	Maximum	Notes
Voltage	4.75 V	5.5 V	Ports that support VCONN-powered accessories are allowed to supply at a lower minimum of 2.7 V when operating in the PoweredAccessory state.
Power	1.0 W		Source may latch-off VCONN if excessive power is drawn beyond the specified inrush and mode wattage.
Bulk Capacitance	10 µF	220 µF	The VCONN source shall disconnect the bulk capacitance from the receptacle when VCONN is powered off.

Figure 4: VCONN Source requirement. Reprinted from USB Type-C Connector Spec 1.1 and 1.2.

2.3 USB3 SoC VBUS detection in DRP/UFP Mode

Per Type-C spec recommendation, USB3.1 SuperSpeed shall hold off VBUS detection to the device controller until PI5USB30213A has reported host/DFP attachment (PI5USB30213A in "Attached.SNK" state) via I2C. Otherwise, it may connect as USB2.0 when attached to a legacy host or hub's DFP

3 Settings of PI5USB30213A

The Type-C port role of PI5USB30213A can be controlled via two modes – pin control and I2C control. ADDR pin is used to select the desired mode. If ADDR pin is set to either high or low, I2C control is active. SDA/OUT1 and SCL/OUT2 are used for I2C transaction. ADDR is also used to set the I2C address. If ADDR pin is floating, pin control mode is active.

*Please use "I^2C Transport" API to communicate with PI5USB30213A if needed.

ADDR pin	I^2C address format	I^2C address
ADDR=GND	7-bit addressing	0x0D
	8-bit address	Write:0x1A; Read:0x1B
ADDR=VDD	7-bit addressing	0x2D
	8-bit address	Write:0x5A; Read:0x5B
ADDR=FLOAT	Pin control mode	

Table 2: I2C Slave Address Setting

3.1 Port Role Setting via Pin Control Mode

These modes are available: default current host/DFP only mode, device/UFP only mode and default current Try.SNK DRP mode. The PORT pin is used to configure the role of Type-C Port in pin control mode. Please refer to the table below for the settings.

Port setting	PORT
Device (SNK)	GND
Dual-role port (DRP) with Try.SNK	No Connection
Host (SRC)	VDD

Table 3: Port Setting

3.2 Port Role Setting via I2C Control Mode

Please refer to Byte 2 of I2C Register Description in the Diodes datasheet for the settings of port role.

0x02	Control	Bit 7 = Powersaving 0 = Enable/Active state 1 = Disable and low power state In Disable and low power state, all outputs of PI5USB30213A, with the exception of CC1 and CC2 pins, are in High-Z State. CC1 and CC2 pins are pulled low with resistor Rd. Bits [6] = Dual role 2 Try.SRC or Try.SNK setting 0 = Enable Try.SRC supported 1 = Enable Try.SNC supported Bits [5] = Accessory Detection in Device Mode 0 = Disable 1 = Enable Bits [4:3] = Charging current mode System can set the charging current mode when port is a host or dual role acting as host. These bits are ignored when port is a device or dual role acting as device. 00 = Default current mode 01 = Medium current mode (1.5A) 10 = High current mode (3A) Bits [2:1] = Port setting System can set the role of the port. 00 = Device (SNK) 01 = Host (SRC) 10 = Dual Role (DRP) 11 = Dual Role 2 (DRP) where Try.SRC or Try.SNC is supported Bit 0 = Interrupt Mask INTB pin is used to acknowledge system if there is any interrupt events triggered. When this bit is set to 0, INTB pin is pulled low when an interrupt event occur. When this bit is set to 1, INTB pin ignores all interrupt and remain High-Z. 0 = Do not mask interrupt 1 = Mask interrupt	00h Upon first enable, Bits [2:1] are initialized according to PORT pin setting as follows: PORT pin initial settins / Bits [2:1] GND / 00 VDD / 01 Float / 10 Note: This initialization only happens once when ENB is first time pulled low after PI5USB30213A is powered on.. Bits [2:1] can be changed by I^2C command afterwards.	R/W

Table 4: Port Setting Register

4 Processor Communication via I2C

Please note that PI5USB30213A does not have offset byte*. All registers must be read or written sequentially from 0x01. For example, in order to read address 0x04, PI5USB30213A I^2C registers must be read sequentially from 0x01, 0x02, 0x03 to 0x04. In order to write address 0x02, it must be written sequentially from 0x01 to 0x02.

Processor shall use following procedure to process PI5USB30213A interrupt request:

1. INTB asserted LOW, indicating Type-C port status change.
2. Processor first masks PI5USB30213A interrupt by writing a '1' to Bit0 of Control Register(0x02). INTB returned Hi.
3. Processor then read Register(0x01), Control Register (0x02), Interrupt Register(0x03) and CC Status Register(0x04). Interrupt Register(0x03) indicates if an attach or detach event was detected. All interrupt flags in Interrupt Register will be cleared after the I2C read action. CC Status Register(0x04) is used to determine plugin details and charging profile. Processor can configure the power and USB channels according to information in CC Status Register.
4. Processor unmask PI5USB30213A interrupt by writing a '0' to Bit 0 of Address 0x02 before ending the interrupt service routine.

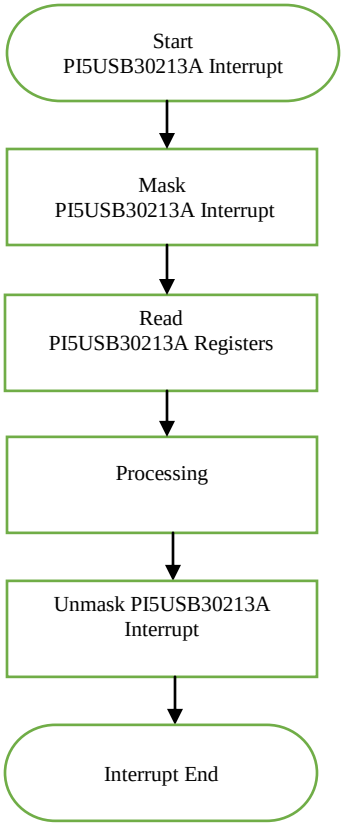


Figure 5: Suggested Flow of Processor Communication with PI5USB30213A via I^2C Control Mode

4.1 I2C Configuration Sequence

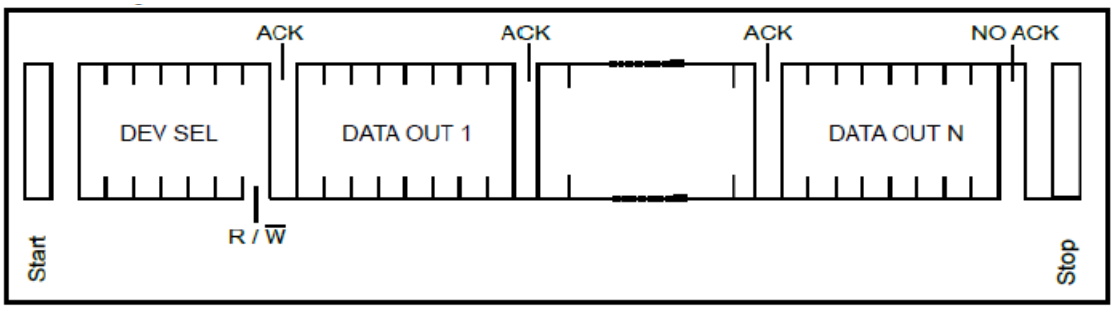


Figure 6: READ Sequence Diagram

Figure 7 below shows one example for read sequence at ADDR=GND and Data Reg [1:4]=08,04,01,06.

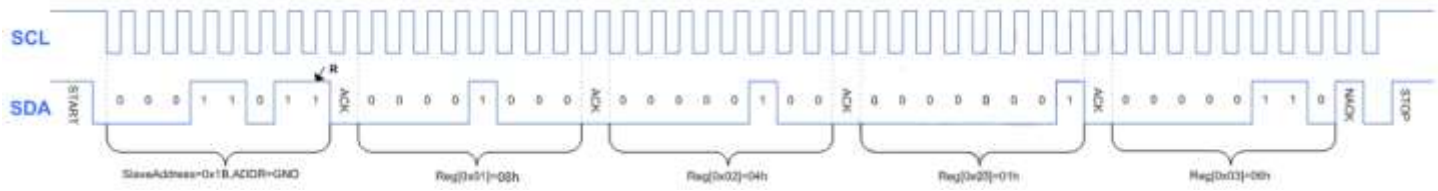


Figure 7: I²C Read Sequence Sample

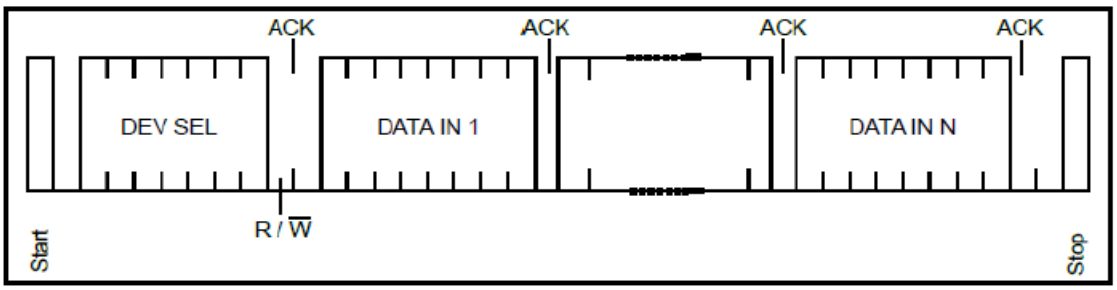


Figure 8: WRITE Sequence Diagram

Figure 9 below shows one example for write sequence at ADDR=GND and Data Reg [1:2]=08,05.

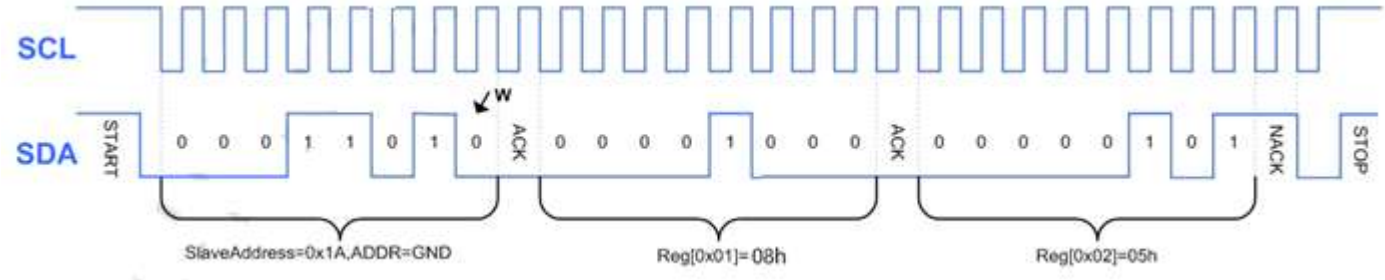


Figure 9: I²C WRITE Sequence Sample

4.2 Power-up Sequence in I2C Control Mode with ENB tied to ground

The power-up sequence for the PI5USB30213A with ENB tied to ground is as following:

1. When system is powered off and PI5USB30213A has no VDD, CC1 and CC2 are pulled low by PI5USB30213A and the port acts as a UFP/Sink.
2. System powered on and supply VDD to PI5USB30213A. PI5USB30213A is reset by POR.
3. PI5USB30213A in I2C control mode is initialized according to PORT pin setting upon first enable.
4. System first set bit 0 of byte2 to '1' to make sure INTB pin is High.
5. System can change PI5USB30213A to desired mode by writing byte2 according to "Port Setting Register" in section 3.2.
   E.g. Write Reg[0x02]=46h to set the port to Try.SNK DRP default current mode.
6. PI5USB30213A monitors CC pins and VBUS for attachment and detachment.

4.3 Power-down and Power-up through ENB pin

The power-down sequence for the PI5USB30213A using ENB is as following:

1. Pull high ENB to disable PI5USB30213A.
2. PI5USB30213A I2C is still accessible and the system should read PI5USB30213A I2C as usual to clean the interrupt (if any).
3. The device is in disabled state and will pull low CC1 and CC2 and the port acts as a UFP/Sink.
4. User can re-enable the part by pull low ENB pin.

4.4 Power-down and Power-up via Powersaving bit in I2C Control Mode

When ENB is low, user can put PI5USB30213A into low power state via I2C as following:

1. Write Reg[0x02]=81h to put the part in powersaving mode.
2. Read PI5USB30213A I2C to clear byte3 and byte4.
3. The device will also pull low CC1 and CC2 and the port acts as a UFP/Sink.
4 User can re-enable the part by writing desired mode to byte2 according to "Port Setting Register" in section 2.2.
E.g. Write Reg[0x02]=46h to set the port to Try.SNK DRP default current mode.

4.5 I2C Register Quick Reference Table

Reg[0x02]	PI5USB30213A Operating Mode	CC1/2 voltage when unattached	ID pin
00h	Sink/UFP; No accessory support	GND	"H"
01h	Sink/UFP; No accessory support; Mask Interrupt		
02h	Source/DFP; Default USB Power	VDD	"L" when UFP is attached
03h	Source/DFP; Default USB Power; Mask Interrupt		
04h	DRP; Default USB Power	Toggle between VDD and GND	
05h	DRP; Default USB Power; Mask Interrupt		
06h	Try.SRC DRP; Default USB Power	Toggle between VDD and GND	
07h	Try.SRC DRP; Default USB Power; Mask Interrupt		
0Ah	Source/DFP; 1.5A Type-C Current Mode	VDD	
0Bh	Source/DFP; 1.5A Type-C Current Mode; Mask Interrupt		
0Ch	DRP; 1.5A Type-C Current Mode	Toggle between VDD and GND	
0Dh	DRP; 1.5A Type-C Current Mode; Mask Interrupt		
0Eh	Try.SRC DRP; 1.5A Type-C Current Mode	Toggle between VDD and GND	
0Fh	Try.SRC DRP; 1.5A Type-C Current Mode; Mask Interrupt		
12h	Source/DFP; 3A Type-C Current Mode	VDD	
13h	Source/DFP; 3A Type-C Current Mode; Mask Interrupt		
14h	DRP; 3A Type-C Current Mode	Toggle between VDD and	

15h	DRP; 3A Type-C Current Mode; Mask Interrupt	GND	
16h	Try.SRC DRP; 3A Type-C Current Mode	Toggle between VDD and GND	
17h	Try.SRC DRP; 3A Type-C Current Mode; Mask Interrupt		
46h	Try.SNK DRP; Default USB Power	Toggle between VDD and GND	
47h	Try.SNK DRP; Default USB Power; Mask Interrupt		
4Eh	Try.SNK DRP; 1.5A Type-C Current Mode	Toggle between VDD and GND	
4Fh	Try.SNK DRP; 1.5A Type-C Current Mode; Mask Interrupt		
56h	Try.SNK DRP; 3A Type-C Current Mode	Toggle between VDD and GND	
57h	Try.SNK DRP; 3A Type-C Current Mode; Mask Interrupt		
20h	Sink/UFP; Support accessory	Toggle between VDD and GND	"H"
21h	Sink/UFP; Support accessory; Mask Interrupt		

Table 5: Control Register (Reg[0x02]) Quick Reference Table

Reg[0x03]	PI5USB30213A Attach/Detach Event and VCONN switch status
00h	No attach or detect event occurred since last I^2C read.
01h	Attach event occurred since last I^2C read.
02h	Detach event occurred since last I^2C read.
04h	Fault is occurring for VCONN switch detector. If not use VCONN, please ignore it.
08h	OTP event, VCONN Over-temperature protection detected. If not use VCONN, please ignore it.
20h	OVP event, VCONN Over-voltage protection detected. If not use VCONN, please ignore it.
40h	OCP event, VCONN Over-current protection detected. If not use VCONN, please ignore it.
80h	Fault condition recovery.

Table 6: Interrupt Register (Reg[0x03]) Quick Reference Table

Reg[0x04]	Type-C Port Status	Plug Position	CC1 Voltage	CC2 Voltage	ID
00h	Unattached; The port shall not drive VBUS.	-	-	-	H
04h	Attached.SRC state but the connected CC pin is shorted to GND.	-	-	-	L
05h	Attached to a Sink/UFP; The port shall drive VBUS.	CC1	Default Host: 0.41V 1.5A Host: 0.92V 3A Host: 1.7V	VCONN voltage	L
06h	Attached to a Sink/UFP; The port shall drive VBUS.	CC2	VCONN voltage	Default Host: 0.41V 1.5A Host: 0.92V 3A Host: 1.7V	L
0Fh	Attached to an audio accessory. *4	Accessory	0.08V	0.08V	H
13h	Attached to a debug accessory. *4	Accessory	0.4V	0.4V	H
8Fh	Attached to a charge-through audio accessory	Accessory	0.08V	0.08V	H
93h	Attached to a debug accessory with VBUS detected. *4	Accessory	0.4V	0.4V	H
A8h	Attached to a Host; CC pin is detached. Check cable connection. *1	-	-	-	H
A9h	Attached to a Host; *1	CC1	0.4V	-	H

AAh	Attached to a Host; *1	CC2	-	0.4V	H
C8h	Attached to a Host; CC pin is detached. Check cable connection. *2	-	-	-	H
C9h	Attached to a Host; *2	CC1	0.92V	-	H
CAh	Attached to a Host; *2	CC2	-	0.92V	H
E8h	Attached to a Host; CC pin is detached. Check cable connection. *3	-	-	-	H
E9h	Attached to a Host; *3	CC1	1.7V	-	H
EAh	Attached to a Host; *3	CC2	-	1.7V	H

Table 7: CC Status (Reg[0x04]) Quick Reference Table

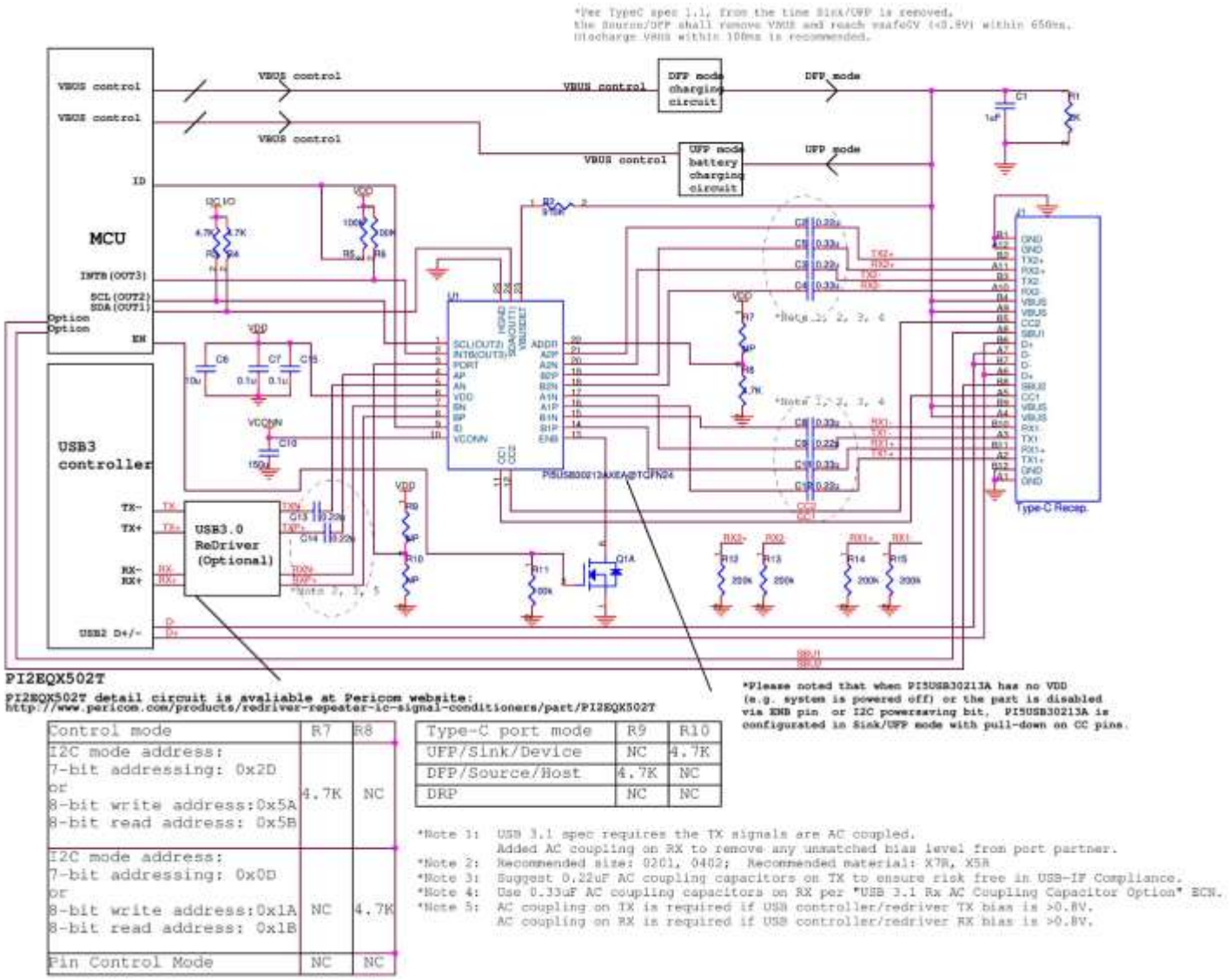
Note
*1: The port shall draw no more than the default USB power from VBUS.
*2: The port shall draw no more than 1.5A from VBUS.
*3: The port shall draw no more than 3A from VBUS.
*4: According to Type-C spec 1.1, the port shall not drive VBUS.
*5: The port shall not sink more than 500mA from VBUS.

5. Typical Application Circuit

5.1 DRP in I2C Mode

Figure 10 shows a typical DRP mode Type-C configuration. Please noted that when PI5USB30213A: has no power (e.g. the system is powered off) or the part is disabled via ENB pin or I2C powersaving bit, PI5USB30213A is configured automatically in Sink/UFP mode with pull-low on CC pins.

Per USB Type-C specification, VCONN source requires 10uF-220uF bulk capacitance.
Per USB Type-C specification, system should discharge VBUS to <0.8V within 650ms after sink is detached.



Control mode	R7	R8
I2C mode address: 7-bit addressing: 0x2D or 8-bit write address:0x5A 8-bit read address: 0x5B	4.7K	NC
I2C mode address: 7-bit addressing: 0x0D or 8-bit write address:0x1A 8-bit read address: 0x1B	NC	4.7K
Pin Control Mode	NC	NC

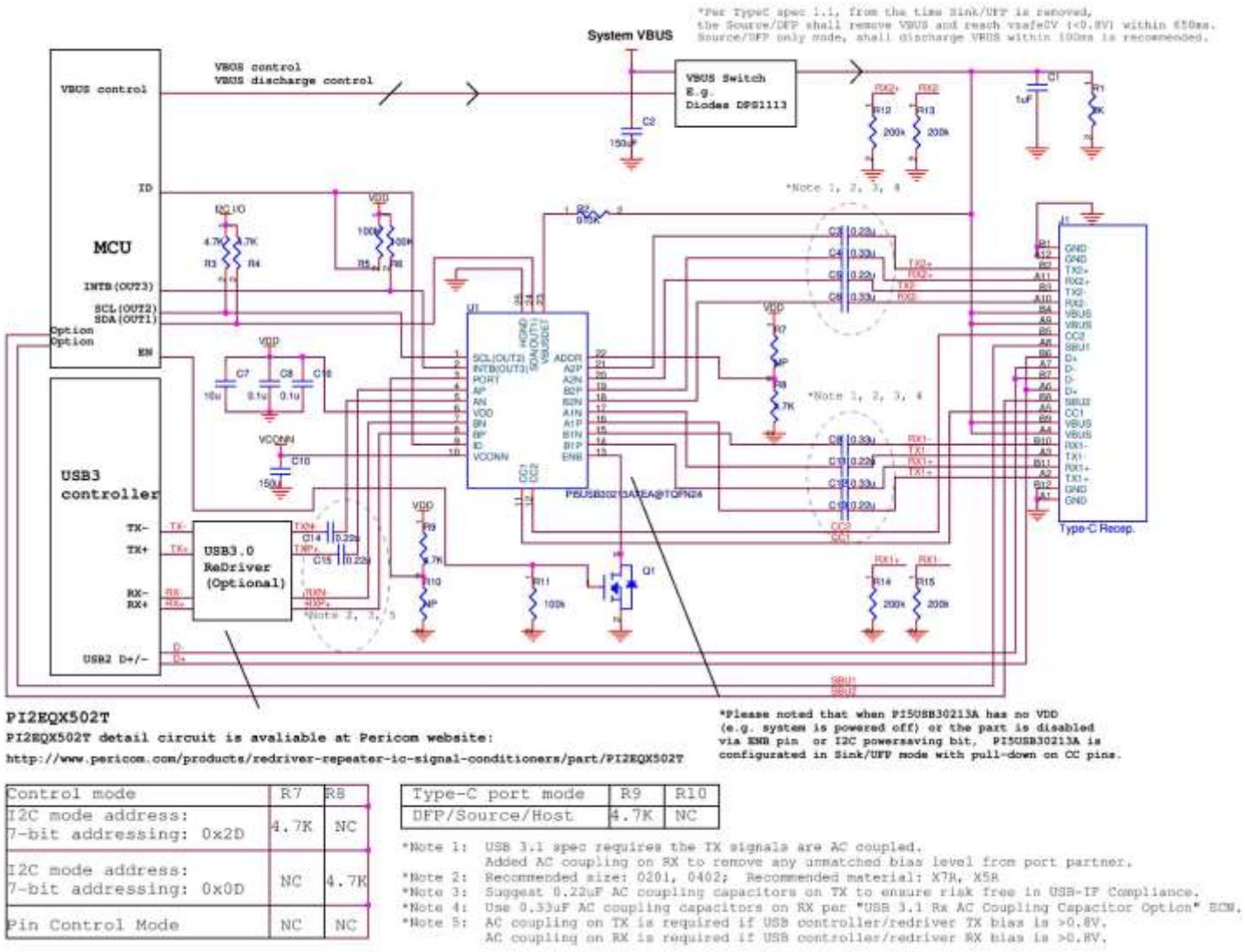
Type-C port mode	R9	R10
UFP/Sink/Device	NC	4.7K
DFP/Source/Host	4.7K	NC
DRP	NC	NC

Figure 10: Typical Application Circuit of PI5USB30213A DRP I²C Mode

5.2 DFP Mode

5.2.1 DFP in I2C Mode

Figure 11 shows a typical Source/DFP mode Type-C configuration.
Per USB Type-C specification, system should discharge VBUS to <0.8V within 650ms after sink is detached. In Source/DFP only mode, shall discharge VBUS within 100ms.



Control mode	R7	R8
I2C mode address: 7-bit addressing: 0x2D	4.7K	NC
I2C mode address: 7-bit addressing: 0x0D	NC	4.7K
Pin Control Mode	NC	NC

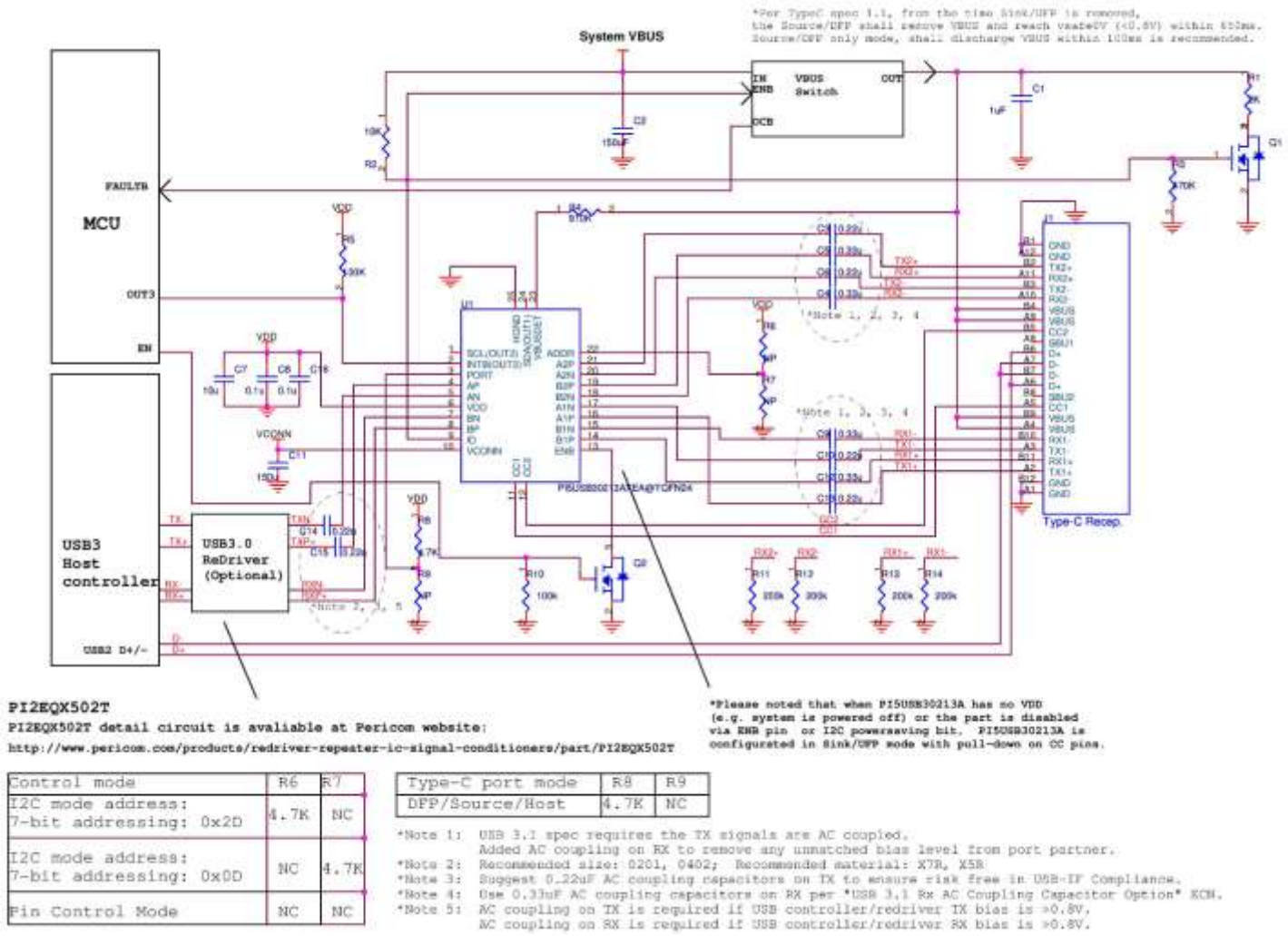
Type-C port mode	R9	R10
DFP/Source/Host	4.7K	NC

*Note 1: USB 3.1 spec requires the TX signals are AC coupled.
Added AC coupling on RX to remove any unmatched bias level from port partner.
*Note 2: Recommended size: 0201, 0402; Recommended material: X7R, X5R
*Note 3: Suggest 0.22uF AC coupling capacitors on TX to ensure risk free in USB-IF Compliance.
*Note 4: Use 0.33uF AC coupling capacitors on RX per "USB 3.1 Rx AC Coupling Capacitor Option" ECN.
*Note 5: AC coupling on TX is required if USB controller/redriver TX bias is >0.8V.
AC coupling on RX is required if USB controller/redriver RX bias is >0.8V.

Figure 11: Typical Application Circuit of PI5USB30213A DFP I²C Mode

5.2.2 DFP (Default Current) in Pin Control Mode

Figure 12 shows a Source/DFP default current mode Type-C configuration. In Source/DFP only mode, shall discharge VBUS within 100ms.



Control mode	R6	R7
I2C mode address: 7-bit addressing: 0x2D	4.7K	NC
I2C mode address: 7-bit addressing: 0x0D	NC	4.7K
Pin Control Mode	NC	NC

Type-C port mode	R8	R9
DFP/Source/Host	4.7K	NC

*Note 1: USB 3.1 spec requires the TX signals are AC coupled.
Added AC coupling on RX to remove any unmatched bias level from port partner.
*Note 2: Recommended size: 0201, 0402; Recommended material: X7R, X5R
*Note 3: Suggest 0.22uF AC coupling capacitors on TX to ensure risk free in USB-IF Compliance.
*Note 4: Use 0.33uF AC coupling capacitors on RX per "USB 3.1 Rx AC Coupling Capacitor Option" KCN.
*Note 5: AC coupling on TX is required if USB controller/redriver TX bias is >0.8V,
AC coupling on RX is required if USB controller/redriver RX bias is >0.8V.

Figure 12: Typical Application Circuit of PI5USB30213A DFP Pin Control Mode

5.2.3 DFP Mode Design Note and Waveform

Please note that when PI5USB30213A has no power (e.g. the system is powered off) or the part is disabled via ENB pin or I2C Powersaving bit, PI5USB30213A is configured automatically in Sink/UFP mode with pull-low on CC pins.

A 150uF is used to meet USB2 DFP bulk capacitance requirement (minimum 120uF).

Per USB Type-C specification, VCONN source requires 10uF-220uF bulk capacitance. The USB Type-C specification also has VBUS turn-on and turn-off timing requirement. Please refer to the USB Type-C specification for details.

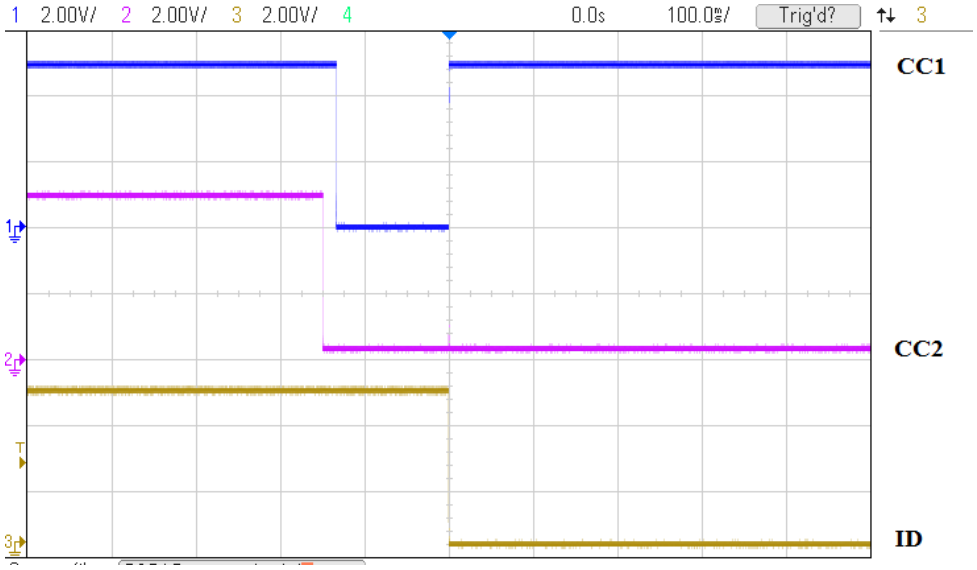


Figure 13: Application Waveform for DFP Mode. ID pin is pulled low after a sink/UFP is attached to the port.

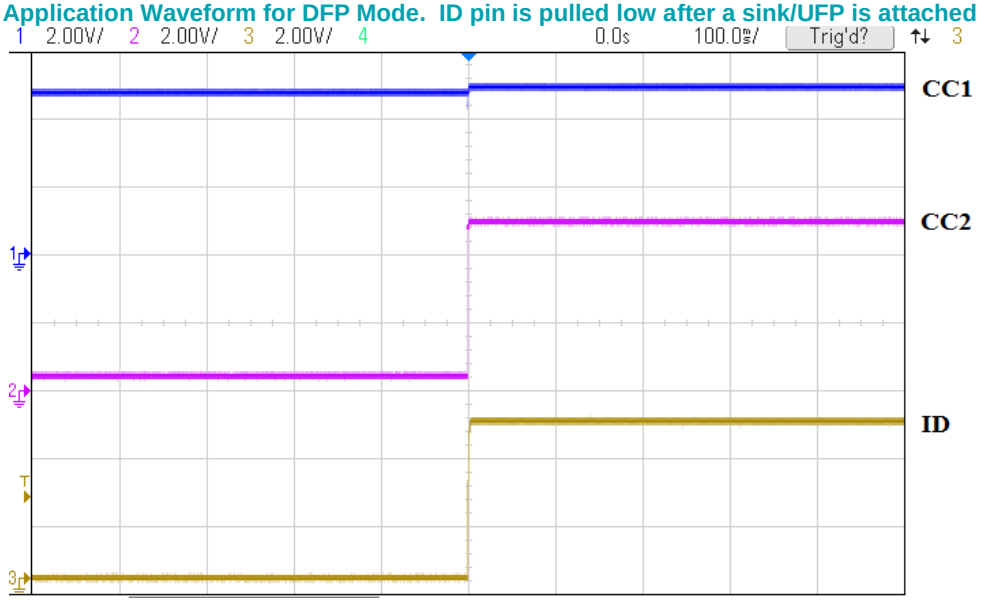


Figure 14: Application Waveform for DFP mode. Once device is detached, ID pin returns high.

5.3 Battery-Powered UFP Mode

Figure 15 shows a typical Battery-Powered UFP mode Type-C configuration.

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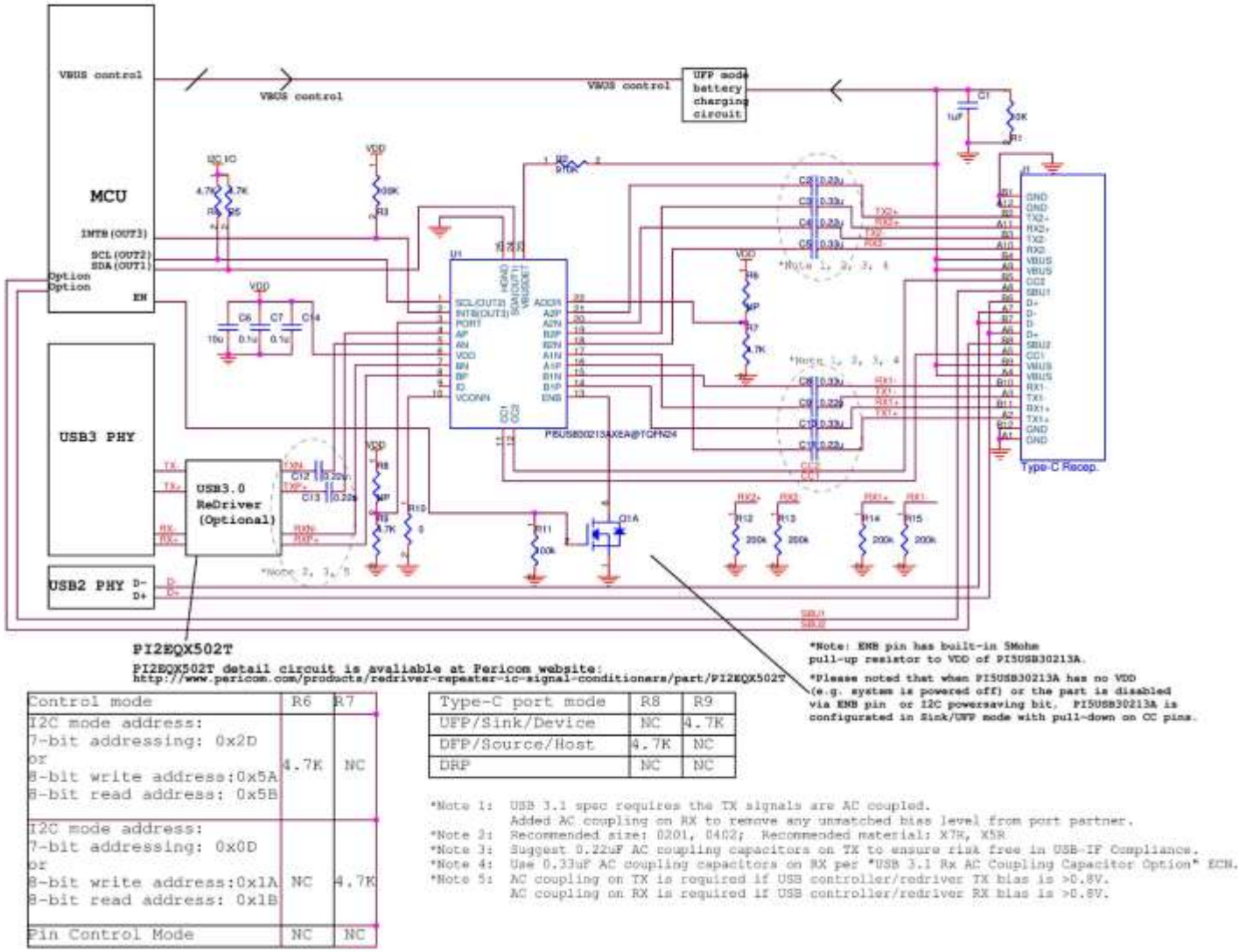

Control mode	R6	R7
I2C mode address: 7-bit addressing: 0x2D or 8-bit write address:0x5A 8-bit read address: 0x5B	4.7K	NC
I2C mode address: 7-bit addressing: 0x0D or 8-bit write address:0x1A 8-bit read address: 0x1B	NC	4.7K
Pin Control Mode	NC	NC

Type-C port mode	R8	R9
UFP/Sink/Device	NC	4.7K
DFP/Source/Host	4.7K	NC
DRP	NC	NC

*Note 1: USB 3.1 spec requires the TX signals are AC coupled.
Added AC coupling on RX to remove any unmatched bias level from port partner.
*Note 3: Recommended size: 0201, 0402; Recommended material: X7R, X5R
*Note 3: Suggest 0.22uF AC coupling capacitors on TX to ensure risk free in USB-IF Compliance.
*Note 4: Use 0.33uF AC coupling capacitors on RX per "USB 3.1 Rx AC Coupling Capacitor Option" ECN.
*Note 5: AC coupling on TX is required if USB controller/redriver TX bias is >0.8V.
AC coupling on RX is required if USB controller/redriver RX bias is >0.8V.

Figure 15: Typical Application Circuit of PI5USB30213A Battery-Powered UFP I²C Mode

6 Layout Recommendation

6.1 Power Decoupling Capacitor Recommendation

At least 1pc 4.7uF and 1pc 0.1uF decoupling capacitors are recommended for VDD of PI5USB30213A. Each decoupling capacitor should be connected to PCB power plane via shortest path. VDD and GND pins should be shorted to PCB power planes via shortest paths.

At least 1uF decoupling capacitor is recommended at VBUS.

6.2 Layout Example

Typical application Layout suggestion

- Use 6/7/6 mils for trace-space-trace for the micro-strip lines (the traces on top and bottom layers) for 90ohm differential impedance.
- Use 6/5/6 mils for trace-space-trace for the strip-lines (the traces inside layers) for 90ohm differential impedance.
- Use FR4.
- Using standard 4 to 8 layers stack-up with 0.062 inch thick PCB.
- For micro-strip lines, using ½ OZ Cu plated is ok.
- For strip-lines in 6 plus players, using 1 OZ Cu is better.
- The trace length miss-matching shall be less than 5 mils for the "+" and "–" traces in the same pairs
- More pair-to-pair spacing for minimal crosstalk

Target differential Zo of 90ohm ±15%

The PCB layout recommended:

- Use 0.1uf in size of 0402 for all the Vdd (any power pins) pins of the IC device, as close to the Vdd pins as possible, within 2-3mm if feasible.
- Use dedicated Vdd and GND planes for to minimize the jitters coupled between channel trough power sources

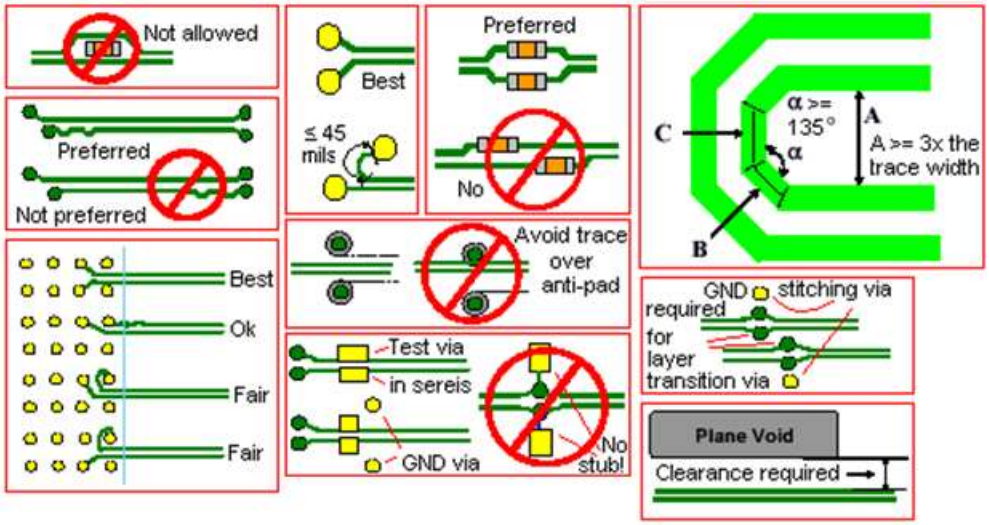

Figure 16: The Layout Guidance for the trace routings

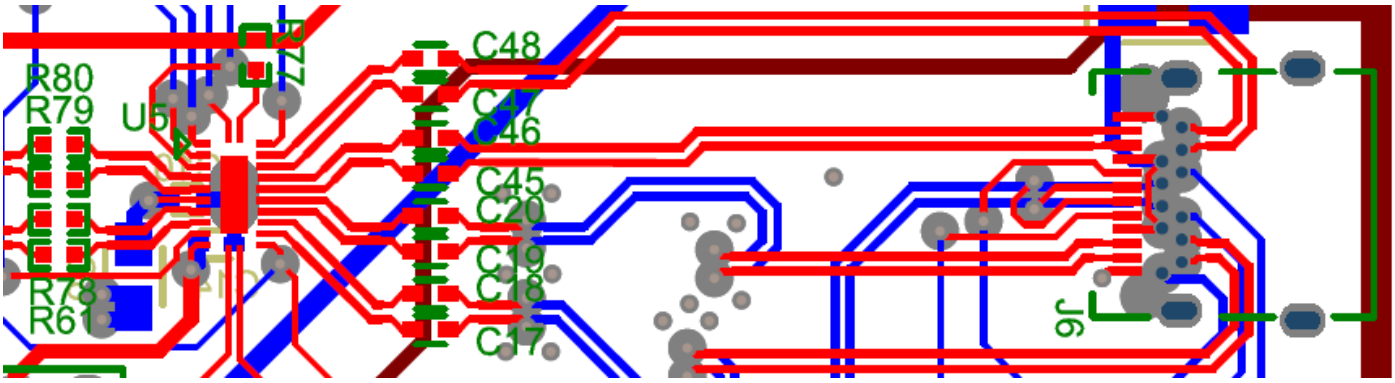

Figure 17: PI5USB30213A Layout Example

7 Firmware Example

```
bool vconn_flag = FALSE; //Global Variable for VCONN function flag.
char i2c_read_buf[4]={0x00,0x00,0x00,0x00};
char i2c_write_buf[2]={0x00,0x00};

void PI5USB30213A_INTN_handler (void)
{
        char vconn_status = 0x00;  //Variable for VCONN switch status;
        char int_status = 0x00;                 //Interrupt status;
        char cc_status =0x00;
        char port_status=0x00;
        char control_status;

        pi5usb30213A_i2c_read(pi5usb30213A_slaveAddr, i2c_read_buf, 4);
 //Read PI5USB30213A registers when Interrupt occurred

        control_status=i2c_read_buf[1];

        if(vconn_flag)
//if vconn_flag is TRUE, means VCONN connected to 5V power supply, and PI5USB30213A will control the vconn switch and monitor switch status.
        {
                vconn_status = i2c_read_buf[2];
                if(vconn_status&0x80)     printf("PI5USB30213A recover from fault condition.\n");
                if(vconn_status&0x44)     printf("PI5USB30213A OCP event, VCONN Over-current protection detected. If not use VCONN, please ignore it.\n");
                if(vconn_status&0x24)     printf("PI5USB30213A OVP event, VCONN Over-voltage protection detected. If not use VCONN, please ignore it.\n");
                if(vconn_status&0x0C)     printf("PI5USB30213A OTP event, VCONN Over-temperature protection detected. If not use VCONN, please ignore it.\n");
                if(vconn_status&0x04)     printf("PI5USB30213A Fault is occurring for VCONN switch detector. If not use VCONN, please ignore it.\n");

        }

        int_status = i2c_read_buf[2];
        if(int_status&0x02)
        {
                printf("Unpluged.\n");
                switch_off_VBUS_PWR();          //CPU switch off the VBUS power supply when port unpluged
        }
        if(int_status&0x01)         printf("Plug in.\n");

        cc_status = i2c_read_buf[3];
        if(cc_status&0x01)          printf("CC1 connected.\n");

        if(cc_status&0x02)          printf("CC2 connected.\n");

        port_status = (i2c_read_buf[3]>>2)&0x07;
        if((cc_status&0x01)|(cc_status&0x02))
        {
                switch(port_status)
                {
                case 1:
                        printf("Device plug in.\n");
                        switch_on_VBUS_PWR(); //CPU switch on the VBUS power supply when UFP/Device plug in
```

```
                        break;
                case 2:
                        printf("Host plug in.\n");
                        break;
                case 3:
                        printf("Audio Adapter Accessory plug in.\n");
                        break;
                case 4:
                        printf("Debug Accessory plug in.\n");
                        break;
                default:
                        break;
                }
        }
        if(i2c_read_buf[3]==0x04)                       //special process for PI5USB30213
                {
                        i2c_write_buf[1]=0x01;
                        pi5usb30213A_i2c_write(pi5usb30213A_slaveAddr,i2c_write_buf,2);
                        delay(30);
                        i2c_write_buf[1]=control_status;
                        pi5usb30213A_i2c_write(pi5usb30213A_slaveAddr,i2c_write_buf,2);
                        delay(10);
                }
}

void Initial_prog(void)
{
        vconn_flag = TRUE; //If vconn connected to 5V power supply, vconn_flag set to TRUE.
        set_ENB_low();    //Enable the PI5USB30213A when ENB pin by GPIO control
        i2c_write_buf[1]=0x01;   //Support DRP/DFP/Try.SNK DRP/Try.SRC DRP mode
        //i2c_write_buf[1]=0x05;  //Support UFP mode
        pi5usb30213A_i2c_write(pi5usb30213A_slaveAddr,i2c_write_buf,2);
        delay(30);
        i2c_write_buf[1]=0x04;     //Support DRP mode with default current mode
        //i2c_write_buf[1]=0x46;  //Support Try.SNK DRP mode
        pi5usb30213A_i2c_write(pi5usb30213A_slaveAddr,i2c_write_buf,2);

}
```

Revision History

Revision	Date	Description
1.0	20 July, 2017	1. Initial release.
1.1	7 Sept., 2017	1. Updated application schematics.
1.2	26 Oct., 2017	1. Updated application schematics to Rev. 1.2.
1.3	25 Jan., 2018	1. Updated Figure 1.
1.4	8 Feb., 2018	This Doc. 1. Updated Figure 2, 3, 7, 9.