Application Note

TUSB521-Q1 and TUSB1021-Q1 Schematic Checklist

Ryan Kitto

ABSTRACT

The TUSB521-Q1 and TUSB1021-Q1 are linear redrivers with 1:2 DeMUX or 2:1 MUX function for USB Type-C® applications at rates of 5Gbps and 10Gbps respectively. The TUSB521-Q1 and TUSB1021-Q1 is intended to reside between a Host and a USB Type-C® receptacle or between a USB device and a USB Type-C® receptacle. This schematic checklist provides a brief explanation of each device pin and the recommended configuration of the device pin for default operation. Use this information to check the connectivity for each TUSB521-Q1 or TUSB1021-Q1 on a system schematic.

This document aids the design at the system level for general applications. This document should not be the only resource used. In addition to this list, customers are advised to use the information in the TUSB521-Q1 or TUSB1021-Q1 data sheet, TUSB521Q1-EVM or TUSB1021Q1-EVM User's Guide and associated documents to gain a full understanding of device functionality. Project collateral discussed in this application note can be downloaded from the this link.

Table of Contents

Trademarks

USB Type-C® is a registered trademark of USB Implementers Forum.
All trademarks are the property of their respective owners.

1 TUSB521-Q1, TUSB1021-Q1 Schematic Checklist

Table 1-1. Schematic Checklist

Pin Name	Pin Number(s)	Pin Description	Recommendation
Power Pins			
VCC	12, 20, 38	3.3 V Positive Power Supply	Parallel array of one 10 µF and three 0.1µF capacitors to GND.
GND	PAD	Ground	Connected to Ground.
Configuration Pins			
EQ0	3	This pin along with EQ1 sets the USB receiver equalizer gain for RX1 and RX2. If not used, this pin can be left unconnected.	Pull down to GND with a 20kΩ pull-down resistor in combination with EQ1 settings to set RX1 and RX2 ports to EQ setting #1. Refer to Table 7-3 in the data sheet for additional configurations. To avoid over equalizing data start at the lowest settings and increase until described eye is achieved.
EQ1	6	This pin along with EQ0 sets the USB receiver equalizer gain for RX1 and RX2. If not used, this pin can be left unconnected.	Pull down to GND with a 1kΩ pull-down resistor in combination with EQ0 settings to set RX1 and RX2 ports to EQ setting #1 . Refer to Table 7-3 in the data sheet for additional configurations. To avoid over equalizing data start at the lowest settings and increase until the desired eye is achieved.
SSEQ0/A0	30	Along with SSEQ1, sets the USB receiver equalizer gain for SSTXP/N receiver. When I2C_EN ≠ '0', this pin also sets the I2C address. If I2C_EN = “F”, then this pin must be set to “F” or “0”.	Pull down to GND with a 20kΩ pull-down resistor in combination with SSEQ1 settings to set the SSTX port to EQ setting #1. Refer to Table 7-3 in the data sheet for additional configurations. To avoid over equalizing data start at the lowest settings and increase until described eye is achieved.
SSEQ1	35	Along with SSEQ0, sets the USB receiver equalizer gain for SSTXP/N receiver.	Pull down to GND with a 1kΩ pull-down resistor in combination with SSEQ1 settings to set the SSTX port to EQ setting #1. Refer to Table 7-3 in the data sheet for additional configurations. To avoid over equalizing data start at the lowest settings and increase until described eye is achieved.
A1	27	When I2C_EN ≠ '0', this pin also sets the TUSB521-Q1 I2C address.	Can be connected to GND using a 1kΩ pull-down resistor. Table 7-5 can be used to determine a different address if one is needed.
FLIP/SCL	13	When I2C_EN = ’0’, this is Flip control pin, When I2C_EN != "0", this pin is I2C clock. When used for I2C clock, pullup to I2C controller's VCC I2C supply.	If I2C_EN = 0, then this pin should be connected to a PD/CC controller, to help determine what is the orientation of the USB-C connection. If I2C_EN != 0, this should be connected to the SCL pin of an I2C configuration, with a pullup to the VCC of the I2C controller's supply.
CTL0/SDA	14	When I2C_EN = '0', this is a USB3.2 control pin, When I2C_EN != "0", this pin is I2C data. When used for I2C clock, pullup to I2C controller's VCC I2C supply.	If I2C_EN = 0, then this pin should be connected to pulled up to high to enable USB, or driven externally to enable when needed.. If I2C_EN != 0, this should be connected to the SDA pin of an I2C configuration, with a pullup to the VCC of the I2C controller's supply.
I2C_EN	9	I2C Programming Mode or GPIO Programming Select. I2C is only disabled when this pin is ‘0’.	If I2C is not being used, this pin can be connected to GND using a 1kΩ pull-down resistor. If I2C is being used, this pin should be left floating or pulled up to VCC with a 1kΩ pull-up resistor to enable I2C at 1.8V or 3.3V.
EN	21	Device Enable. For normal operation, pull this pin up to 3.3V through a 10k to 50kΩ resistor.	To enable this device, this pin should be pulled up to 3.3V with a 10k to 50kΩ pull-up resistor.
USB Data Lines			
TX1P	1	Differential positive output. Connect to the Type-C receptacle's TX1p pin through an external ac-coupling capacitor.	Connect to the USB3.2 TX1/2 P/N terminals of a USB Type-C receptacle with 220nF AC coupling capacitors, and a 1-2Ω resistor for ESD protection. These pins allow polarity swapping.
TX1N	2	Differential negative output. Connect to the Type-C receptacle's TX1n pin through an external ac-coupling capacitor	
TX2P	11	Differential positive output. Connect to the Type-C receptacle's TX2p pin through an external ac-coupling capacitor.	
TX2N	10	Differential negative output. Connect to the Type-C receptacle's TX2n pin through an external ac-coupling capacitor	

Table 1-1. Schematic Checklist (continued)

Pin Name	Pin Number(s)	Pin Description	Recommendation
RX1P	4	Differential positive input. Connect to the Type-C receptacle's RX1p pin through an external ac-coupling capacitor.	Connect to the USB3.2 RX1/2 P/N terminals of a USB Type-C receptacle with 330nF AC coupling capacitors, and a 1-2Ω resistor for ESD protection. These pins allow polarity swapping.
RX1N	5	Differential negative input. Connect to the Type-C receptacle's RX1n pin through an external ac-coupling capacitor	
RX2P	8	Differential positive input. Connect to the Type-C receptacle's RX2p pin through an external ac-coupling capacitor.	
RX2N	7	Differential negative input. Connect to the Type-C receptacle's RX2p pin through an external ac-coupling capacitor.	
SSTXp	40	Differential positive input. Connect to the USB3.2 Host/Device transmitter through an external ac-coupling capacitor.	Connect to the USB3.2 RX1/2 P/N terminals of a USB Type-C receptacle with 330nF AC coupling capacitors, and a 1-2Ω resistor for ESD protection. These pins allow polarity swapping.
SSTXn	39	Differential negative input. Connect to the USB3.2 Host/Device transmitter through an external ac-coupling capacitor.	
SSRXp	37	Differential positive output. Connect to the USB3.2 Host/Device receiver through an external ac-coupling capacitor.	Connect to the USB3.2 TX1/2 P/N terminals of a USB Type-C receptacle with 220nF AC coupling capacitors, and a 1-2Ω resistor for ESD protection. These pins allow polarity swapping.
SSRXn	36	Differential negative output. Connect to the USB3.2 Host/Device receiver through an external ac-coupling capacitor.	
Misc. Pins			
RSVD	32, 31, 29, 28, 26, 25, 23, 22, 16, 17, 18, 19	Reserved. Leave unconnected	Leave unconnected/floating.
NC	33	No connect pin. Leave open.	Leave unconnected/floating.
TEST1	15	Test. Leave unconnected or pulldown to GND.	Leave floating or pulled down directly to GND.
TEST2	24	Test2. Connect directly to GND or pulldown with a 100k or less resistor.	Connect directly to GND.
TEST3	34	Test pin. Leave unconnected.	Leave unconnected/floating.

2 References

- Texas Instruments, *TUSB521-Q1 Automotive USB Type-C® 5 Gbps Linear Redriver MUX and DeMUX,* data sheet.
- Texas Instruments, *TUSB521Q1-EVM Users Guide.*
- Texas Instruments, *Strengthening the USB Type-C signal chain through redrivers* .

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265