

# TUSB1064RNQ EVM

The TUSB1064 device is a USB Type-C / VESA DisplayPort™, Alternate Mode, redriving switch which supports data rates up to 10 Gbps for an Upstream facing port (device). This guide describes how to bring up the EVM, and includes schematics that can be used as a reference design for Alternate Mode implementations of the system with the TUSB1064 device.

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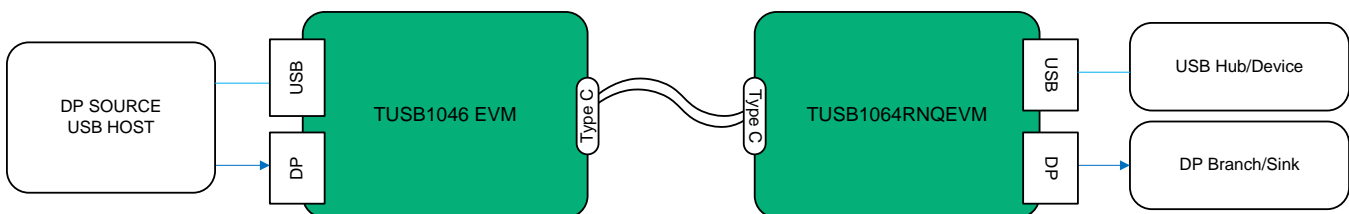
## 1 Introduction

The TUSB1064RNQEVM (see [Figure 1](#)) can be used with an Alternate Mode Type-C Source such as the TUSB1046EVM and/or USB, or the DisplayPort, Type-C Host system, to evaluate the Type-C implementation. [Figure 2](#) shows a typical test setup.



**Figure 1. TUSB1064RNQEVM Board**

The EVM comes with a legacy Type-A USB receptacle to connect to a USB hub/device, and a DisplayPort receptacle to connect to the DisplayPort Sink. The TUSB1064RNQEVM uses the TPS65983 device from TI for CC pin control and I2C or pin-strap mode to configure the device.



**Figure 2. Test Board Setup**

## 2 TUSB1064RNQEV Configuration

This section provides the configuration options available in the TUSB1064RNQEV.

### 2.1 TUSB1064RNQEV Default Configuration

Table 1 lists the headers provided for configuration of the TUSB1064 by default. The configuration settings may need to be optimized depending on the amount of loss of each channel in the system. The EVM is configured to I2C mode by default. If GPIO configuration is desired, the JMP7 (I2C\_EN) shunt must be changed to shunt pins 2 – 3 (GND).

**Table 1. TUSB1064 Configuration Pins**

Reference Designator	Jumper Control	Configuration
JMP1	Downstream EQ1	Shunt on pins 1 – 2 (GND)
JMP2	Downstream EQ0	Shunt on pins 2 – 3 (PU)
JMP3	Upstream SSEQ1	Shunt on pins 1 – 2 (GND)
JMP4	Upstream SSEQ0	Shunt on pins 2 – 3 (PU)
JMP5	DP EQ1	Shunt on pins 1 – 2 (GND)
JMP6	DP EQ0	Shunt on pins 2 – 3 (PU)
JMP7	I2C_EN	Shunt on pins 1 – 2 (PU)
J1	FLIP	Shunt on pins 2 – 3 (GND)
J2	CTL0	Shunt on pins 1 – 2 (PU)
J3	CTL1	Shunt on pins 1 – 2 (PU)
J4	EN	Shunt on pins 1 – 2 (PU)

### 2.2 TUSB1064 Equalization Control

Equalization (EQ) can be controlled using I2C or pin-strapping. Each of the TUSB1064 receiver lanes has individual controls for receiver equalization. Table 2 and Table 3 list the gain values for each available combination of Downstream, Upstream, and DisplayPort configurations.

**Table 2. Configuration Pin Level Definitions**

Level	Settings
0	Option 1: Tie 1-K $\Omega$ 5% to GND.
	Option 2: Tie directly to GND.
R	Tie 20-K $\Omega$ 5% to GND.
F	Float (leave pin open)
1	Option 1: Tie 1-K $\Omega$ 5% to VCC.
	Option 2: Tie directly to VCC.

**Table 3. USB 3.1 EQ Settings**

USB 3.1 Downstream Facing Port			USB 3.1 Upstream Facing Port		
EQ1 Pin Level	EQ0 Pin Level	EQ Gain at 5 GHz (dB)	SSEQ1 Pin Level	SSEQ0 Pin Level	EQ Gain at 5 GHz (dB)
0	0	0	0	0	0
0	R	1	0	R	1
0	F	2	0	F	2
0	1	3	0	1	3
R	0	4	R	0	4
R	R	5	R	R	5
R	F	6	R	F	6
R	1	7	R	1	7

**Table 3. USB 3.1 EQ Settings (continued)**

USB 3.1 Downstream Facing Port			USB 3.1 Upstream Facing Port		
EQ1 Pin Level	EQ0 Pin Level	EQ Gain at 5 GHz (dB)	SSEQ1 Pin Level	SSEQ0 Pin Level	EQ Gain at 5 GHz (dB)
F	0	8	F	0	8
F	R	9	F	R	9
F	F	10	F	F	10
F	1	11	F	1	11
1	0	12	1	0	12
1	R	13	1	R	13
1	F	14	1	F	14
1	1	15	1	1	15

**Table 4. DisplayPort EQ Settings**

All DisplayPort Lanes		
DPEQ1 Pin Level	DPEQ0 Pin Level	EQ Gain at 5 GHz (dB)
0	0	0
0	R	1
0	F	2
0	1	3
R	0	4
R	R	5
R	F	6
R	1	7
F	0	8
F	R	9
F	F	10
F	1	11
1	0	12
1	R	13
1	F	14
1	1	15

### 2.3 Power

The EVM is designed to operate off of the VBUS, from a USB host, connected through a USB Type-C (P2). 5-V external power does not need to be applied through J8, unless standalone operation is desired. If testing the DisplayPort only, or if bypassing VBUS power, the EVM must be powered through J8 (5-V, 1-A input).

### 3 TUSB1064RNQEVM Schematics

Figure 3, Figure 4, Figure 5, and Figure 6 show the TUSB1064RNQEVM schematics.

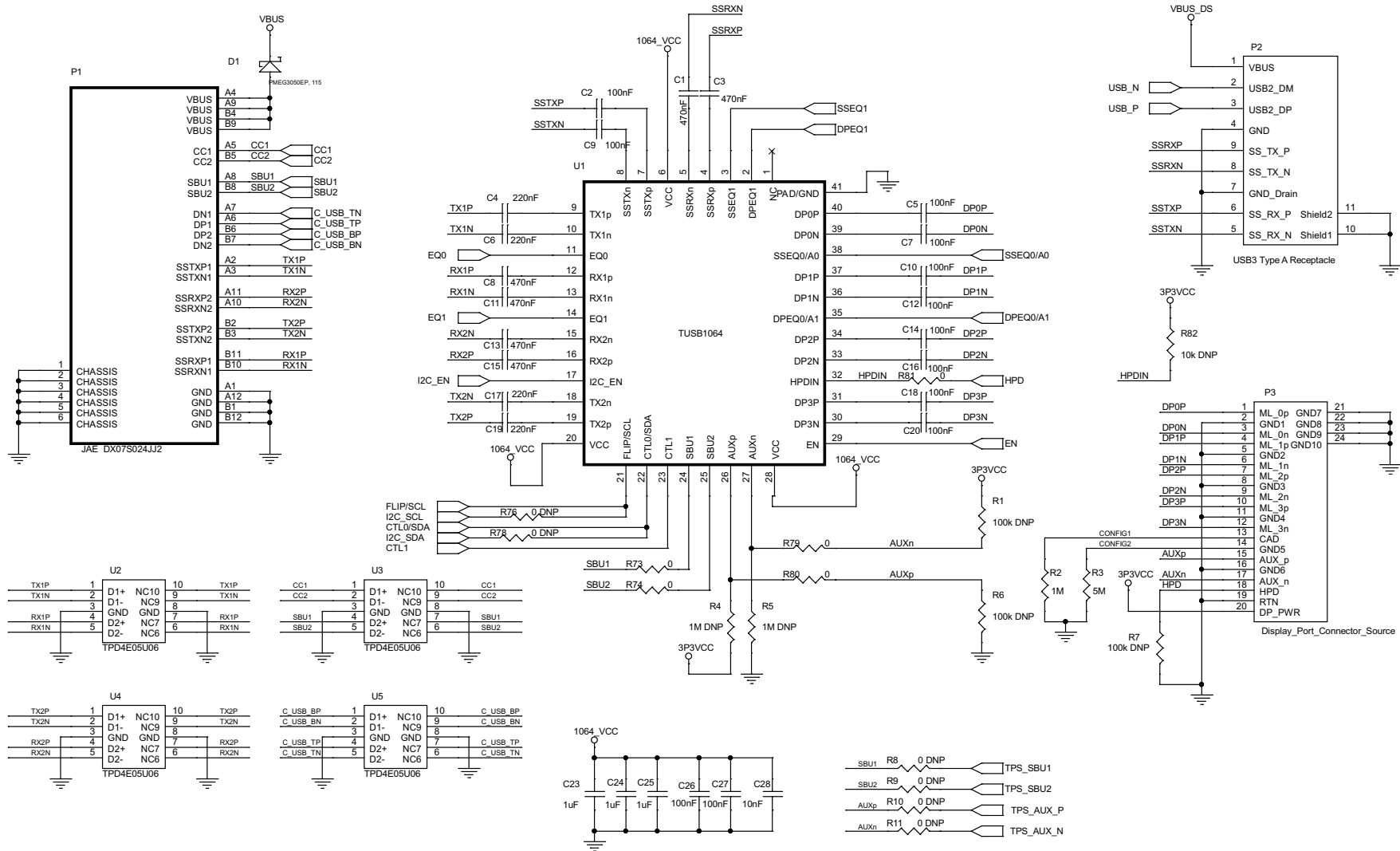
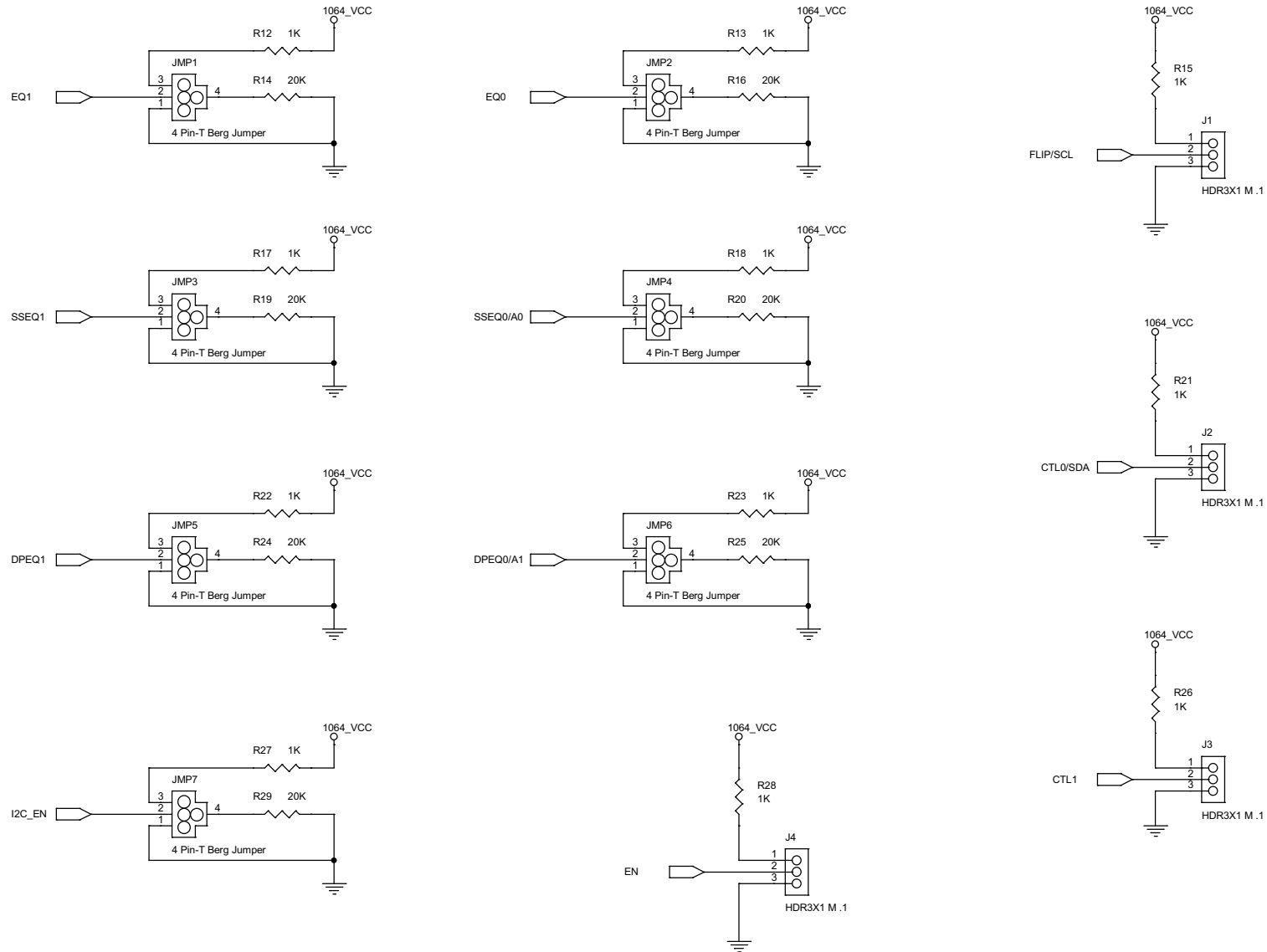
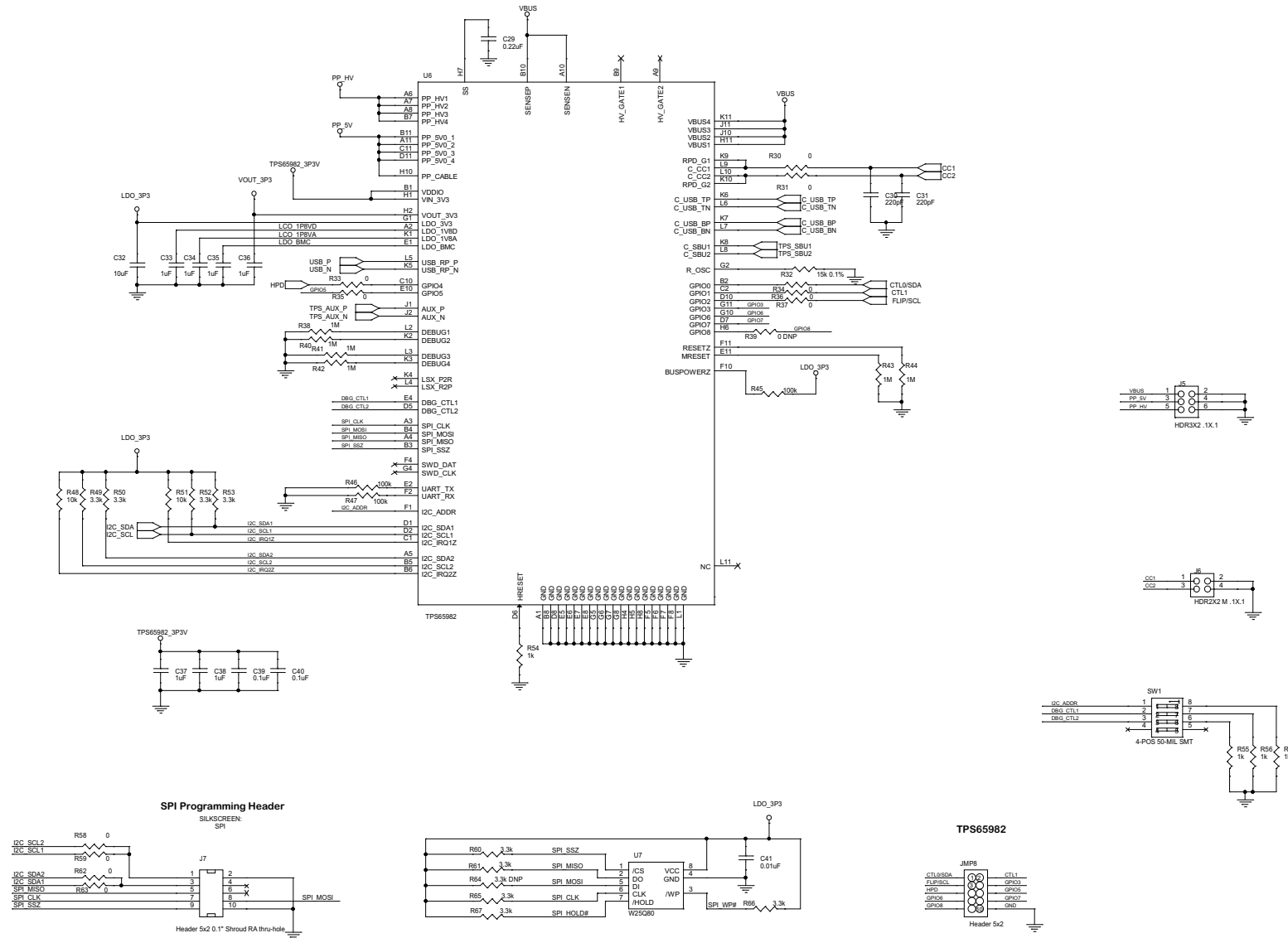


Figure 3. TUSB1064RNQEVM Schematics (1/4)



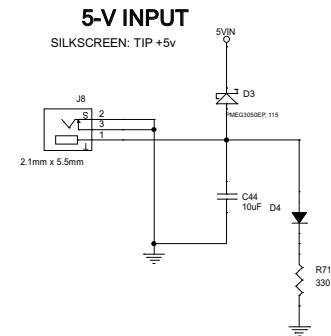
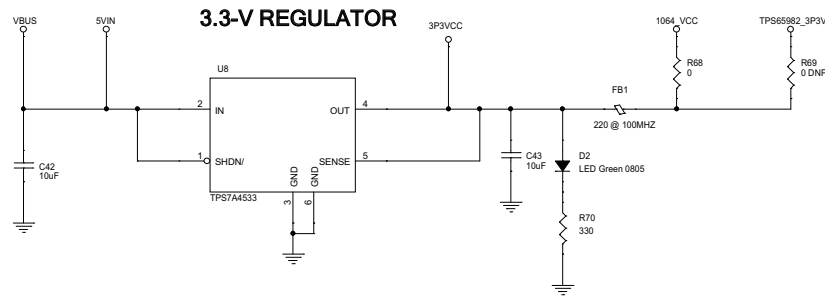
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Figure 4. TUSB1064RNQEVM Schematics (2/4)

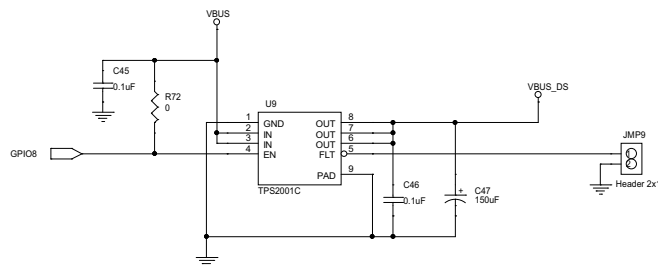


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Figure 5. TUSB1064RNQEVMSchematics (3/4)



DOWNSTREAM PORT POWER SWITCH



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Figure 6. TUSB1064RNQEVM Schematics (4/4)

4 Bill of Materials

Table 5 lists the TUSB1064RNQEVM bill of materials (BOM).



Table 5. BOM

Item	Quantity	Reference	Part	Footprint	Manufacturer	Part Number	Description
1	6	C1, C3, C8, C11, C13, C15	470 nF	c0201	Murata	GRM033R60J474KE90D	Capacitor ceramic, 0.47 $\mu$ F, 6.3 V, X5R, 0201
2	10	C2, C5, C7, C9, C10, C12, C14, C16, C18, C20	100 nF	c0201	Murata	GRM033R61A104KE15D	Capacitor ceramic, 0.1 $\mu$ F, 10 V, X5R, 0201
3	4	C4, C6, C17, C19	220 nF	c0201	Murata	GRM033R60G224ME15D	Capacitor ceramic, 0.22 $\mu$ F, 4 V, X5R, 0201
4	9	C23, C24, C25, C33, C34, C35, C36, C37, C38	1 $\mu$ F	c0402	Murata	GRM155R60J105ME19D	Capacitor ceramic, 1 $\mu$ F, 6.3 V, X5R, 0402
5	2	C26, C27	100 nF	c0402	Murata	GRM155R61A104KA01D	Capacitor ceramic, 0.1 $\mu$ F, 10 V, X5R, 0402
6	1	C28	10 nF	c0402	Murata	GRM155R71C103KA01D	Capacitor ceramic, 10000 pF, 16 V, X7R, 0402
7	1	C29	0.22 $\mu$ F	c0402	Murata	GRM152R61A224KE19D	Capacitor ceramic, 0.22 $\mu$ F, 10 V, X5R, 0402
8	2	C30, C31	220 pF	c0402	Murata	GRM1555C1H221JA01D	Capacitor ceramic, 220 pF, 50 V, C0G/NP0, 0402
9	1	C32	10 $\mu$ F	c0603	Murata	GRM188R61C106MA73D	GRM188R61C106MA73D
10	4	C39, C40, C45, C46	0.1 $\mu$ F	c0402	Murata	GRM155R61A104KA01D	Capacitor ceramic, 0.1 $\mu$ F, 10 V, X5R, 0402
11	1	C41	0.01 $\mu$ F	c0402	Murata	GRM155R71C103KA01D	GRM155R71C103KA01D
12	3	C42, C43, C44	10 $\mu$ F	c1206	Murata	GRM319R61E106KA12D	Capacitor ceramic, 10 $\mu$ F, 25 V, X5R, 1206
13	1	C47	150 $\mu$ F, DNI	7343	Murata	GRM31CR60J157ME11L	Capacitor ceramic, 150 $\mu$ F, 6.3 V, X5R, 1206
14	1	D1	SCHOTTKY	diode_smb	NXP	PMEG3050EP, 115	DIODE SCHOTTKY 30 V, 5 A, SOD128
15	2	D2, D4	LED green 0805	805	Lumex	LTST-C170KGKT	LED green clear, 0805, SMD
16	1	D3	SCHOTTKY	DO-214AA	Nexperia	PMEG3050EP, 115	DIODE SCHOTTKY, 30 V, 5 A, SOD128
17	1	FB1	220 at 100 MHz	fb_0603	MuRata	BLM18EG221SN1D	FERRITE BEAD, 220 $\Omega$ , 0603, 1LN
18	7	JMP1, JMP2, JMP3, JMP4, JMP5, JMP6, JMP7	4 pin-T Berg jumper	berg2x3tee	AMP	68000-103HLF	BERGSTIK II .100" SR STRAIGHT
	7	JMP1, JMP2, JMP3, JMP4, JMP5, JMP6, JMP7	4 pin-T Berg jumper	berg2x3tee	AMP	68000-101HLF	BERGSTIK II .100" SR STRAIGHT
19	1	JMP8	Header 5 x 2	HDR_THVT_2x5_100	FCI	68021-210HLF	Connector Header, 10 POS., 100 R/A, 15AU

**Table 5. BOM (continued)**

Item	Quantity	Reference	Part	Footprint	Manufacturer	Part Number	Description
20	1	JMP9	Header 2 x 1	HDR_THVT_1x2_100	Amphenol FCI	77311-118-02LF	Connector Header, 2 POS, VERT, T/H
21	4	J1, J2, J3, J4	Header 3 x 1	M .1 HDR_THVT_1x3_100_M	3M	961103-6404-AR	Connector Header, VERT, SGL, 3POS, GOLD
22	1	J5	Header 3 x 2 .1 x .1	HDR_THVT_2x3_100_M	Harwin	M20-9980345	DIL vertical PC tail pin header
23	1	J6	Header 2 x 2 M .1 x .1	HDR_THVT_2x2_100	Amphenol FCI	67997-404HLF	Connector header, 4 POS., 100 STR TIN
24	1	J7	Header 5 x 2 0.1" Shroud RA thru-hole	HDR_THRT_2X5_100	Amphenol FCI	67997-410HLF	Connector header, 10 POS., 100 STR TIN
25	1	J8	2.1 mm x 5.5 mm	PJ-202AH	CUI Inc.	PJ-202AH	Connector power jack, 2 x 5.5 mm, KINKED PIN
26	1	P1	JAE DX07B024JJ2	USB-C_SMRT_DX07B024JJ2	JAE	DX07B024JJ2	Connector Receptacle, USB 3.1, TYPE-C, BRD EDGE
27	1	P2	USB3 Type-A Receptacle	USB3_TYPEA	TE Connectivity	1932258-1	Connector Receptacle, USB 3.0 STD-A, BLUE
28	1	P3	Display_Port_Connector_Source	CON_DP_SD-47272-001	Molex Inc	472720001	Connector Receptacle, 20 POS., UDI, R/A, SMD
29	3	R1, R6, R7	100 k DNP	r0402	Panasonic Electronic Components	ERJ-2GEJ104X	ERJ-2GEJ104X
30	7	R2, R38, R40, R41, R42, R43, R44	1 M	r0402	Panasonic Electronic Components	ERJ-2GEJ105X	Resistor, SMD 1M $\Omega$ 5% 1/10W 0402
31	1	R3	5 M	r0402	Ohmite	HVC0402T5004JET	Resistor, SMD 5M $\Omega$ 5% 1/20W 0402
32	2	R4, R5	1 M DNP	r0402	Panasonic Electronic Components	ERJ-2GEJ105X	Resistor, SMD 1M $\Omega$ 5% 1/10W 0402
33	7	R8, R9, R10, R11, R39, R76, R78	0 DNP	r0402	Panasonic Electronic Components	ERJ-2GE0R00X	Resistor, SMD 0 $\Omega$ JUMPER 1/10W 0402
34	15	R12, R13, R15, R17, R18, R21, R22, R23, R26, R27, R28, R54, R55, R56, R57	1 k	r0402	Panasonic Electronic Components	ERJ-2GEJ102X	Resistor, SMD 1K $\Omega$ 5% 1/10W 0402
35	7	R14, R16, R19, R20, R24, R25, R29	20 K	r0402	Panasonic Electronic Components	ERJ-2GEJ203X	Resistor, SMD 20K $\Omega$ 5% 1/10W 0402
36	2	R30, R31	0	r0201	Panasonic Electronic Components	ERJ-1GN0R00C	Resistor, SMD 0 $\Omega$ JUMPER 1/20W 0201
37	1	R32	15 k 0.1%	r0402	Panasonic Electronic Components	ERA-2AEB153X	Resistor, SMD 15K $\Omega$ 0.1% 1/16W 0402

Table 5. BOM (continued)

Item	Quantity	Reference	Part	Footprint	Manufacturer	Part Number	Description
38	7	R33, R35, R73, R74, R79, R80, R81	0	r0402	Panasonic Electronic Components	ERJ-2GE0R00X	Resistor, SMD 0 Ω JUMPER 1/10W 0402
39	8	R34, R36, R37, R58, R59, R62, R63, R72	0	r0402	Panasonic Electronic Components	ERJ-2GE0R00X	Resistor, SMD 0 Ω JUMPER 1/10W 0402
40	3	R45, R46, R47	100 k	r0402	Panasonic Electronic Components	ERJ-2GEJ104X	Resistor, SMD 100K Ω 5% 1/10W 0402
41	2	R48, R51	10 k	r0402	Panasonic Electronic Components	ERJ-2GEJ103X	Resistor, SMD 10K Ω 5% 1/10W 0402
42	9	R49, R50, R52, R53, R60, R61, R65, R66, R67	3.3 k	r0402	Panasonic Electronic Components	ERJ-2GEJ332X	Resistor, SMD 3.3K Ω 5% 1/10W 0402
43	1	R64	3.3 k DNP	r0402	Panasonic Electronic Components	ERJ-2GEJ332X	Resistor, SMD 3.3K Ω 5% 1/10W 0402
44	1	R68	0	r1206	Panasonic Electronic Components	ERJ-8GEY0R00V	Resistor, SMD 0 Ω JUMPER 1/4W 1206
45	1	R69	0 DNP	r1206	Panasonic Electronic Components	ERJ-8GEY0R00V	Resistor, SMD 0 Ω JUMPER 1/4W 1206
46	2	R70, R71	330	r0402	Panasonic Electronic Components	ERJ-2GEJ331X	Resistor, SMD 330 Ω 5% 1/10W 0402
49	1	R82	10 k DNP	r0402	Panasonic Electronic Components	ERJ-2GEJ103X	Resistor, SMD 10K Ω 5% 1/10W 0402
50	1	SW1	4-POS. 50-MIL SMT	sw_smvt_dip_4pos_8	C&K (ITT-CANNON)	TDA04H0SB1R	Switch slide dip, SPST, 25 MA, 24 V
51	1	U1	TUSB1064RNQ	RNQ0040A	Texas Instruments	TUSB1064	Provided by TI
52	4	U2, U3, U4, U5	TPD4E05U06	DQA	Texas Instruments	TPD4E05U06DQAR	TVS DIODE, 5.5VWM, 14VC, 10SON
53	1	U6	TPS65983	ZQZ_BGA_96	Texas Instruments	TPS65983ACZQZR	IC, PD, CTRLR, USB, TYPE-C, 96BGA
54	1	U7	W25Q80	SOIC_8_197x157_50	WINBOND	W25Q80DVSNIG	IC, FLASH, 8 mbit, 104 MHz, 8SOIC
55	1	U8	TPS7A4533	DCQ_PDSO_6	Texas Instruments	TPS7A4533DCQR	IC, REG, LINEAR, 3.3 V, 1.5 A, SOT223-6
56	1	U9	TPS2001C	DGN_PDSO_8	Texas Instruments	TPS2001CDGN	IC, PWR, SW, USB, 2.87 A, 1CH, 8MSOP
57	1	Label	"HSDC025-002"			Any	Sticket text: HSDC025-002 Rev A

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