![Texas Instruments logo]

TUSB564RNQ EVM

The TUSB564 is a USB Type-C / VESA DP Alt Mode re-driving switch supporting USB data rates up to 5Gbps for a Type-C Upstream Facing Port (UFP). This guide describes how to bring up the EVM and includes schematics that can be used as reference design for the Alternate mode implementations of the system with the TUSB564 device.

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Figure 1. TUSB564RNQEVM

The TUSB564RNQEVM can be used with an Alternate Mode Type-C Source such as the TUSB1046EVM and/or USB or DisplayPort Type-C Host system to evaluate the Type C implementation. Figure 2 is a typical test set-up.
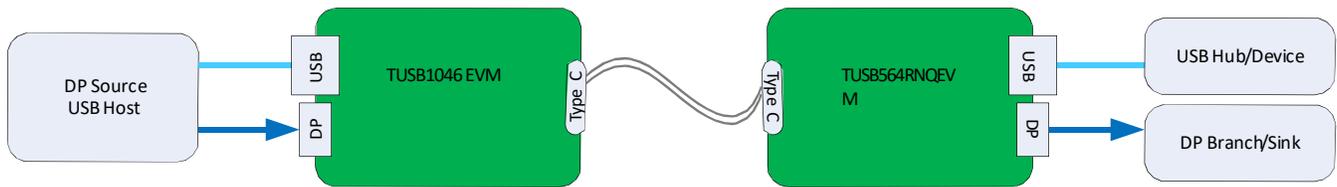

Figure 2. Test Board Setup

The EVM comes with a legacy Type A USB receptacle to connect to a USB hub/device and a DisplayPort receptacle to connect to DisplayPort Sink. The TUSB564RNQEVM uses the Texas Instruments TPS65986 for Type-C PD control and to configure the TUSB564.

2 TUSB564RNQEVM Configuration

This section provides the configuration options available in the TUSB564RNQEVM.

2.1 TUSB564RNQEVM Default Configuration

The following headers are provided for TUSB564 configuration by default, configuration settings may need to be optimized depending on the amount of loss of each channel in the system. The EVM is configured to GPIO mode by default, if I2C configuration is desired, JMP7 (I2C_EN) shunt must be changed to shunt pins 2-3(VCC).

Reference Designator	JMP Control	Configuration
JMP1	Downstream EQ1	SHUNT on pin 2-4 (R – 20k to GND)
JMP2	Downstream EQ0	SHUNT on pin 2-4 (R – 20k to GND)
JMP3	Upstream SSEQ1	SHUNT on pin 2-4 (R – 20k to GND)
JMP4	Upstream SSEQ0	SHUNT on pin 2-4 (R – 20k to GND)
JMP5	DP EQ1	SHUNT on pin 2-4 (R – 20k to GND)
JMP6	DP EQ0	SHUNT on pin 2-4 (R – 20k to GND)
JMP7	I2C_EN	SHUNT on pin 1-2 (GND)
J1	FLIP	No SHUNT
J2	CTL0	No SHUNT
J3	CTL1	No SHUNT
J4	EN	SHUNT on pin 1-2 (PU)

Table 1. TUSB564 Configuration Pins

2.2   TUSB564 EQ Control

Equalization can be controlled via I2C or pin-strapping. Each of the TUSB564 receiver lanes has individual controls for receiver equalization. The tables below detail the gain values for each available combination for Downstream, Upstream and all DisplayPort configurations.

LEVEL	SETTINGS
0	Option 1: Tie 1KΩ 5% to GND. Option 2: Tie directly to GND.
R	Tie 20K Ω 5% to GND.
F	Float (Leave pin open)
1	Option 1: Tie 1K Ω 5% to VCC. Option 2: Tie directly to VCC.

Table 2. Config Pin Level Definitions

USB3.1 Downstream Facing Ports			USB3.1 Upstream Facing Port		
EQ1 Pin Level	EQ0 Pin Level	EQ Gain @2.5GHz (dB)	SSEQ1 Pin Level	SSEQ0 Pin Level	EQ Gain @2.5GHz (dB)
0	0	-2.4	0	0	-0.9
0	R	-1.3	0	R	0.2
0	F	-0.4	0	F	1.2
0	1	0.7	0	1	2.2
R	0	1.5	R	0	3.1
R	R	2.5	R	R	4.0
R	F	3.2	R	F	4.8
R	1	4.0	R	1	5.6
F	0	4.8	F	0	6.3
F	R	5.5	F	R	7.0
F	F	6.0	F	F	7.5
F	1	6.6	F	1	8.1
1	0	7.1	1	0	8.5
1	R	7.6	1	R	9.1
1	F	8.0	1	F	9.5
1	1	8.5	1	1	9.9

Table 3. USB 3.1 EQ Settings

All DisplayPort Lanes		
DPEQ1 Pin Level	DPEQ0 Pin Level	EQ Gain @5GHz (dB)
0	0	-0.3
0	R	1.6
0	F	3.0
0	1	4.4
R	0	5.4
R	R	6.5
R	F	7.3
R	1	8.1
F	0	8.9
F	R	9.5
F	F	10.0
F	1	10.6
1	0	11.0
1	R	11.4
1	F	11.8
1	1	12.1

Table 4. DisplayPort EQ Settings

2.3   Power

The EVM is designed to operate off of the VBUS from a USB host connected via USB Type C (P2). No 5V external power to be applied via J8 unless standalone operation is desired.

If testing DisplayPort only, or if by-passing VBUS power, the EVM must be powered via J8 (5V, 1A input).

3   TUSB564RNQEVM Schematics
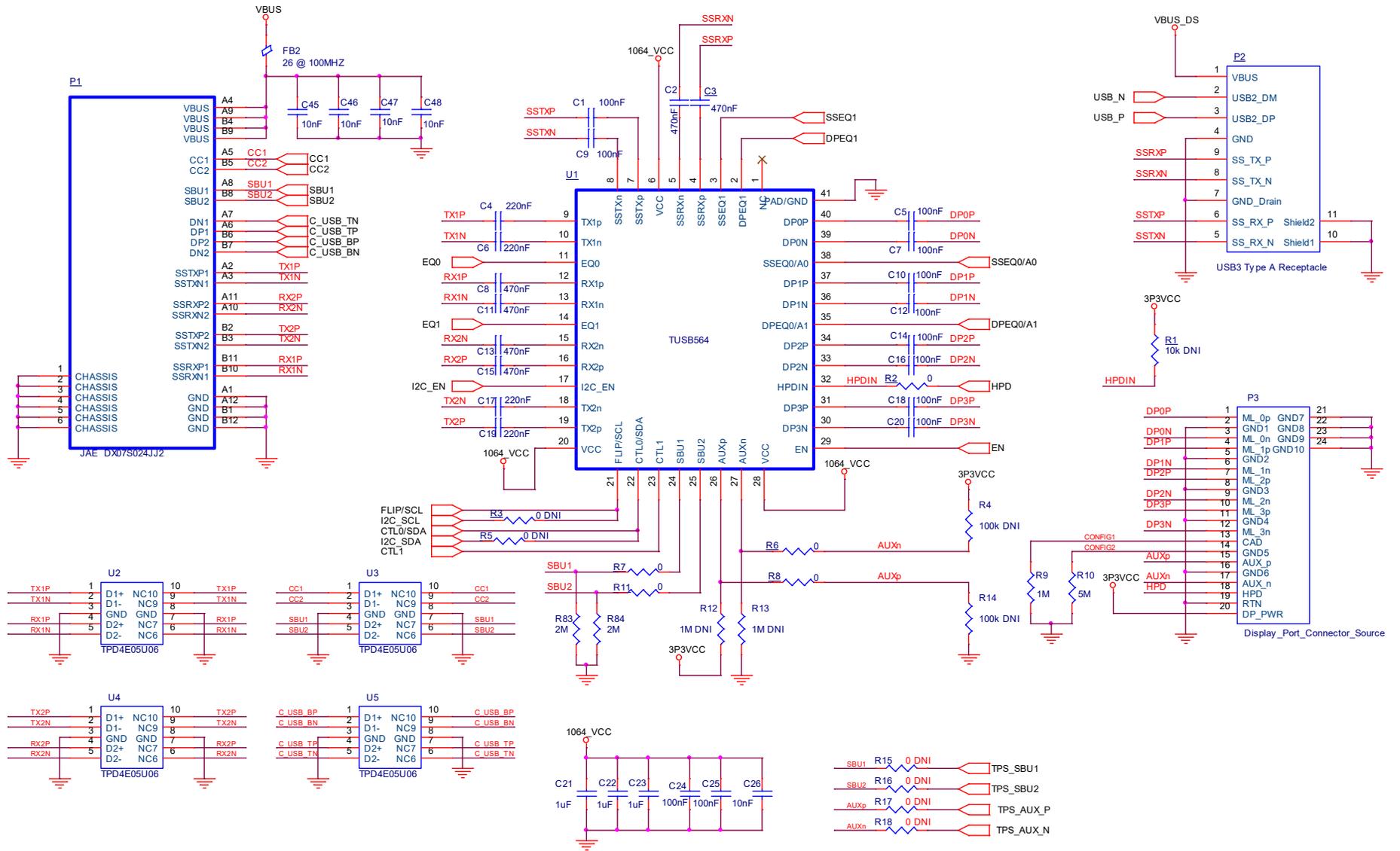


Figure 3. TUSB564RNQ EVM Main
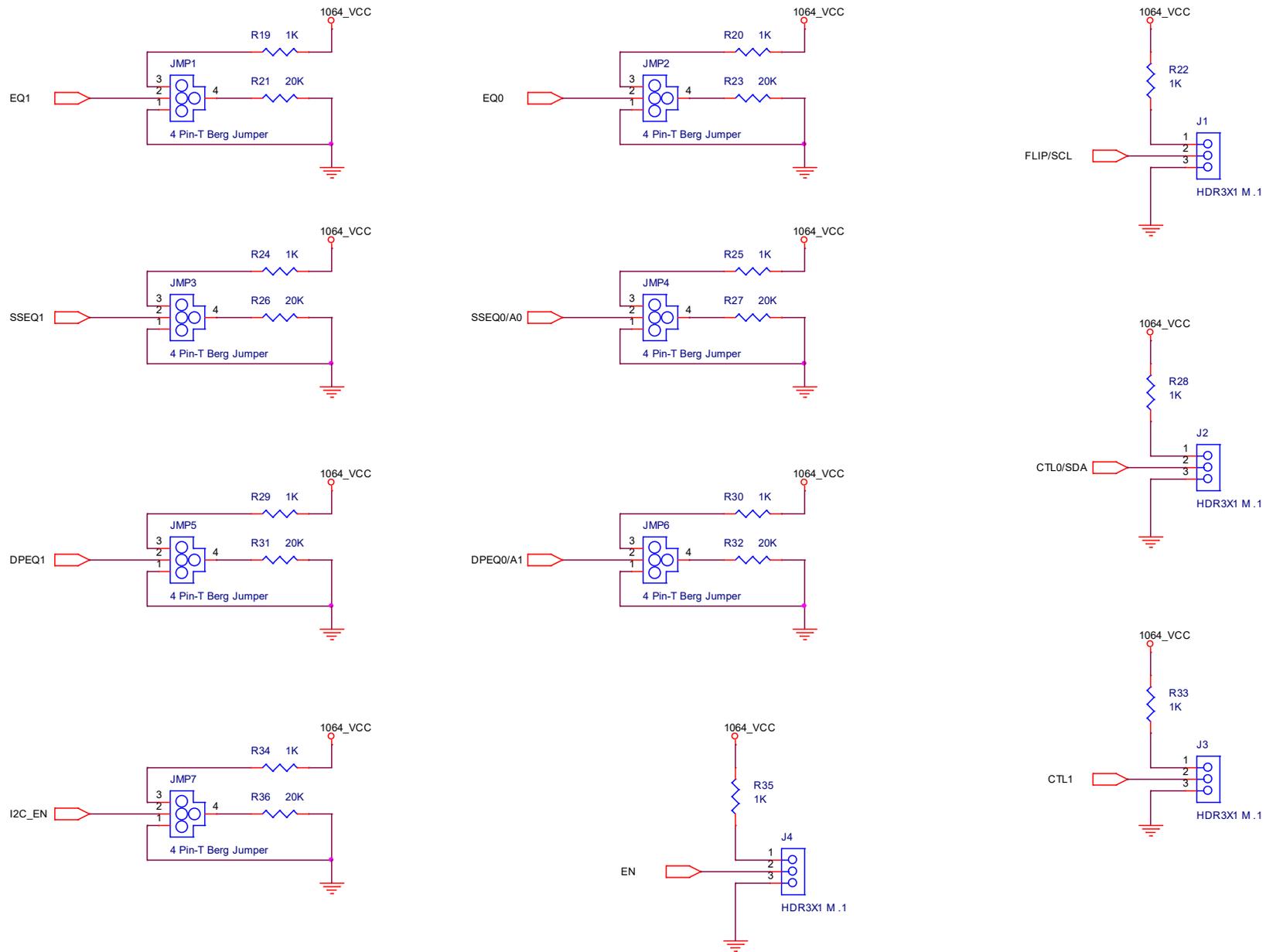
Figure 4. TUSB564RNQ EVM Config Pins

Figure 5. TPS65986

3.3V REGULATOR

SYS_PWR

U8

IN 2
OUT 4
SHDN/ 1
SENSE 5
GND 3
GND 6

TPS7A4533

C40
22uF

3P3VCC

C41
10uF

D2
LED Green

R77
330

FB1
26 @ 100MHZ

1064_VCC

R75
0

TPS65986_3P3V

R76
0

VDDIO

R85
0

R86
0 DNI

LDO_3P3

5V INPUT

SYS_PWR

+5V / Max 3A Input

J8

2
3
1

2.1mm x 5.5mm

D1
PMEG3050EP, 115

C42
10uF

D4

R78
330
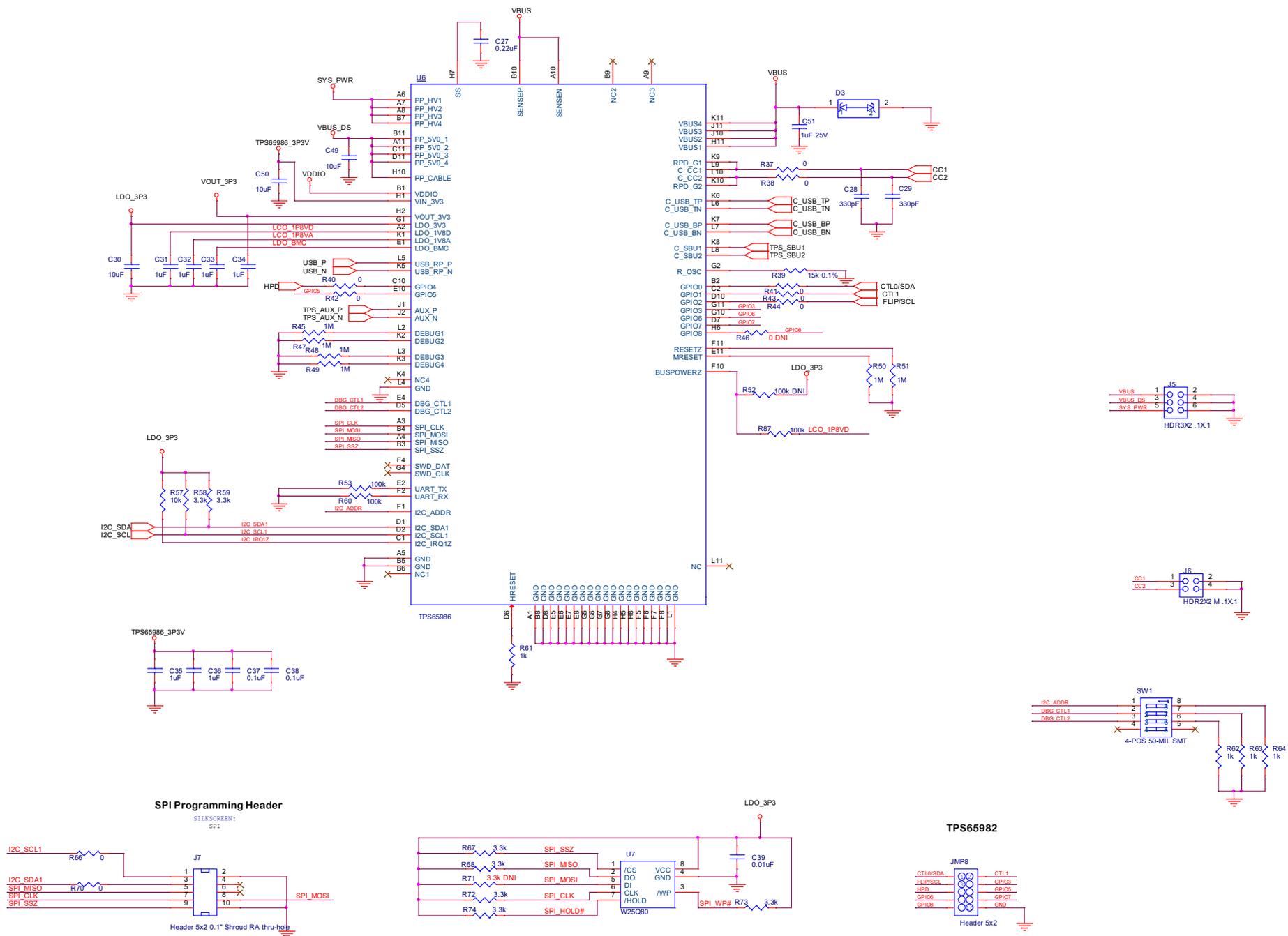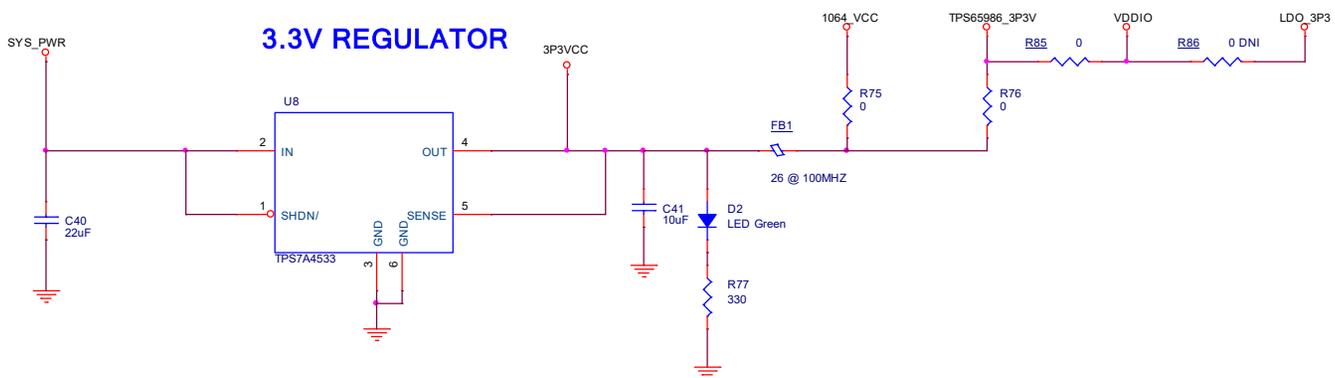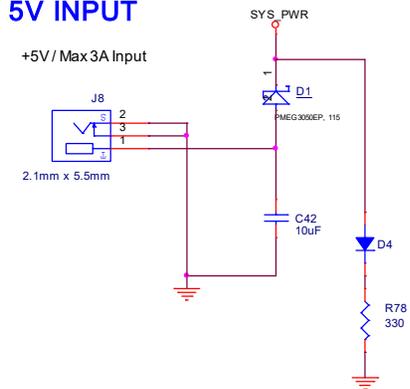
DOWNSTREAM PORT/PP_5V POWER SWITCH

VBUS

R82
0 DNI

SYS_PWR

C44
10uF

U9

TPS7A4501

IN 2
OUT 4
SHDN/ 1
ADJ 5
GND 3
GND 6

R80
3.9K

R81
1.2K

VBUS_DS

C43
10uF

R79
0 DNI

VBUS
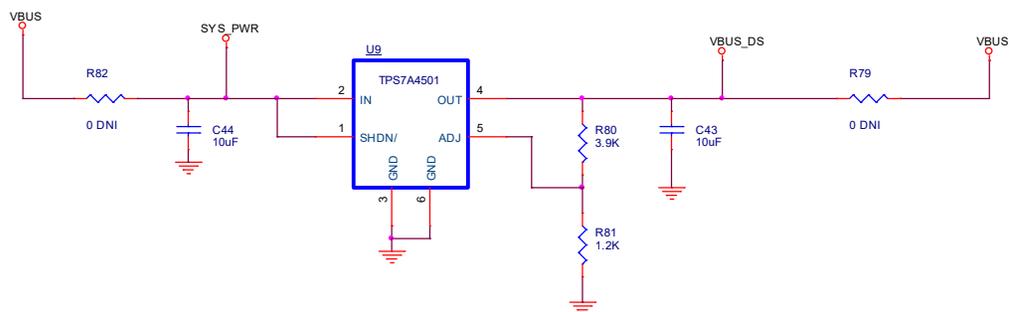
Figure 6. TUSB564RNQ EVM Power

4. Bill of Materials

| Item	Quantity	Reference	Part	Footprint	Manufacturer	Manufacture Part Number	Description
1	10	C1,C5,C7,C9,C10,C12,C14,C16,C18,C20	100nF	c0201	Murata	GRM033R61A104KE15D	CAP CER 0.1UF 10V X5R 0201
2	6	C2,C3,C8,C11,C13,C15	470nF	c0201	Murata	GRM033R60J474KE90D	CAP CER 0.47UF 6.3V X5R 0201
3	4	C4,C6,C17,C19	220nF	c0201	Murata	GRM033R60G224ME15D	CAP CER 0.22UF 4V X5R 0201
4	9	C21,C22,C23,C31,C32,C33,C34,C35,C36	1uF	c0402	Murata	GRM155R60J105ME19D	CAP CER 1UF 6.3V X5R 0402
5	2	C24,C25	100nF	c0402	Murata	GRM155R61A104KA01D	CAP CER 0.1UF 10V X5R 0402
6	5	C26,C45,C46,C47,C48	10nF	c0402	Murata	GRM155R71C103KA01D	CAP CER 10000PF 16V X7R 0402
7	1	C27	0.22uF	c0402	Murata	GRM152R61A224KE19D	CAP CER 0.22UF 10V X5R 0402
8	2	C28,C29	330pF	c0402	Murata	GRM1555C1E331JA01D	CAP CER 330PF 25V C0G/NP0 0402
9	5	C30,C43,C44,C49,C50	10uF	c0603	Murata	GRM188R61E106MA73D	CAP CER 10UF 25V X5R 0603
10	2	C37,C38	0.1uF	c0402	Murata	GRM155R61A104KA01D	CAP CER 0.1UF 10V X5R 0402
11	1	C39	0.01uF	c0402	Murata	GRM155R71C103KA01D	CAP CER 10000PF 16V X7R 0402
12	1	C40	22uF	c1206	Murata	GRT31CR61E226ME01L	CAP CER 22UF 25V X5R 1206
13	2	C41,C42	10uF	c1206	Murata	GRM319R61E106KA12D	CAP CER 10UF 25V X5R 1206
14	1	C51	1uF 25V	c0603	Murata	GRM185R61E105KA12D	CAP CER 1UF 25V X5R 0603
15	1	D1	SCHOTTKY	DO-214AA	NXP	PMEG3050EP,115	DIODE SCHOTTKY 30V 5A SOD128
16	1	D2	LED Green	805	Lumex	LTST-C170KGKT	LED GREEN CLEAR 0805 SMD
17	1	D3	TPD1E10B06	DPY0001AA	Texas Instruments	TPD1E10B06DPYR	Schottky
18	1	D4	LED Green 0805	805	Lumex	LTST-C170KGKT	LED GREEN CLEAR 0805 SMD
19	2	FB1,FB2	26 @ 100MHZ	603	Murata	BLM18SG260TN1D	ERRITE BEAD 26 OHM 0603 1LN
20	7	JMP1A,JMP2A,JMP3A,JMP4A,JMP5A, JMP6A,JMP7A	4 Pin-T Berg Jumper	BERGSTIK II .100" SR STRAIGHT	AMP	68000-103HLF,	3 Positions Header Connector 0.100" (2.54mm) Through Hole Gold or Gold, GXT™
21	7	JMP1B,JMP2B,JMP3B,JMP4B,JMP5B, JMP6b,JMP7B		BERGSTIK II .100" SR STRAIGHT	AMP	68000-101HLF	1 Positions Header Connector 0.100" (2.54mm) Through Hole Gold or Gold, GXT™
22	1	JMP8	Header 5x2	HDR_THVT_2x5_100	FCI	68021-210HLF	CONN HEADER 10POS .100 R/A 15AU
23	4	J1,J2,J3,J4	HDR3X1 M .1	HDR_THVT_1x3_100_M	3M	961103-6404-AR	CONN HEADER VERT SGL 3POS GOLD
24	1	J5	HDR3X2 .1X.1	HDR_THVT_2x3_100_M	Harwin	M20-9980345	DIL VERTICAL PC TAIL PIN HEADER
25	1	J6	HDR2X2 M .1X.1	HDR_THVT_2x2_100	Amphenol FCI	67997-404HLF	CONN HEADER 4POS .100 STR TIN
26	1	J7	Header 5x2 0.1" Shroud RA thru-hole	HDR_THRT_2X5_100	Amphenol FCI	67997-410HLF	CONN HEADER 10POS .100 STR TIN
27	1	J8	2.1mm x 5.5mm	PJ-202AH	CUI Inc.	PJ-202AH	CONN PWR JACK 2X5.5MM KINKED PIN
28	2	LB1,LB2	THD-47-478-10	rectangle	Brady	THD-47-478-10	LB1 = "HSDC025A-001", LB2 = "TUSB564RNQEVM"
29	1	P1	JAE DX07S024JJ2	USB-C_SMRT_DX07S024JJ2	JAE	DX07B024JJ2	CONN RCPT USB3.1 TYPEC BRD EDGE

30	1	P2	USB3 Type A Receptacle	USB3_TYPEA	AMP	GSB4111312HR	USB3.1 Type-A Connector
31	1	P3	Display_Port_Connector_Source	CON_DP_SD-47272-001	Molex Inc	472720001	CONN RCPT 20POS UDI R/A SMD
32	0	R1	10k DNI	r0402	Panasonic Electronic Components	ERJ-2GEJ103X	RES SMD 10K OHM 5% 1/10W 0402
33	11	R2,R6,R7,R8,R11,R41,R43,R44,R66,R70,R85	0	r0402	Panasonic Electronic Components	ERJ-2GE0R00X	RES SMD 0 OHM JUMPER 1/10W 0402
34	0	R3,R5,R15,R16,R17,R18,R46,R86	0 DNI	r0402	Panasonic Electronic Components	ERJ-2GE0R00X	RES SMD 0 OHM JUMPER 1/10W 0402
35	0	R4,R14,R52	100k DNI	r0402	Panasonic Electronic Components	ERJ-2GEJ104X	RES SMD 100K OHM 5% 1/10W 0402
36	7	R9,R45,R47,R48,R49,R50,R51	1M	r0402	Panasonic Electronic Components	ERJ-2GEJ105X	RES SMD 1M OHM 5% 1/10W 0402
37	1	R10	5M	r0402	Ohmite	HVC0402T5004JET	RES SMD 5M OHM 5% 1/20W 0402
38	0	R12,R13	1M DNI	r0402	Panasonic Electronic Components	ERJ-2GEJ105X	RES SMD 1M OHM 5% 1/10W 0402
39	15	R19,R20,R22,R24,R25,R28,R29,R30,R33,R34,R35,R61,R62,R63,R64	1k	r0402	Panasonic Electronic Components	ERJ-2GEJ102X	RES SMD 1K OHM 5% 1/10W 0402
40	7	R21,R23,R26,R27,R31,R32,R36	20K	r0402	Panasonic Electronic Components	ERJ-2RKF2001X	RES SMD 20K OHM 1% 1/10W 0402
41	2	R37,R38	0	r0201	Panasonic Electronic Components	ERJ-1GN0R00C	RES SMD 0 OHM JUMPER 1/20W 0201
42	1	R39	15k 0.1%	r0402	Panasonic Electronic Components	ERA-2AEB153X	RES SMD 15K OHM 0.1% 1/16W 0402
43	2	R40,R42	0	r0402	Panasonic Electronic Components	ERJ-2GE0R00X	RES SMD 0 OHM JUMPER 1/10W 0402
44	3	R53,R60,R87	100k	r0402	Panasonic Electronic Components	ERJ-2GEJ104X	RES SMD 100K OHM 5% 1/10W 0402
45	1	R57	10k	r0402	Panasonic Electronic Components	ERJ-2GEJ103X	RES SMD 10K OHM 5% 1/10W 0402
46	7	R58,R59,R67,R68,R72,R73,R74	3.3k	r0402	Panasonic Electronic Components	ERJ-2GEJ332X	RES SMD 3.3K OHM 5% 1/10W 0402
47	0	R71	3.3k DNI	r0402	Panasonic Electronic Components	ERJ-2GEJ332X	RES SMD 3.3K OHM 5% 1/10W 0402
48	2	R75,R76	0	r1206	Panasonic Electronic Components	ERJ-8GEY0R00V	RES SMD 0 OHM JUMPER 1/4W 1206
49	2	R77,R78	330	r0402	Panasonic Electronic Components	ERJ-2GEJ331X	RES SMD 330 OHM 5% 1/10W 0402

50	0	R79,R82	0 DNI	r0805	Panasonic Electronic Components	ERJ-6GEY0R00V	RES SMD 0 OHM JUMPER 1/8W 0805
51	1	R80	3.9K	r0402	Panasonic Electronic Components	ERA-2AEB392X	RES SMD 3.9K OHM 0.1% 1/16W 0402
52	1	R81	1.2K	r0402	Panasonic Electronic Components	ERA-2AEB122X	RES SMD 1.2K OHM 0.1% 1/16W 0402
53	2	R83,R84	2M	r0402	Panasonic Electronic Components	ERJ-2GEJ205X	RES SMD 2M OHM 5% 1/10W 0402
54	4	SCRW1,SCRW2,SCRW3,SCRW4	NY PMS 440 005 PH	screw	B&F Fastener	NY PMS 440 005 PH	40x.5 inch nylon
55	8	SHNT1,SHNT2,SHNT3,SHNT4,SHNT5,SHNT6,SHNT7,SHNT8	QPC02SXGN-RC	0.1	Sullins Connector Solutions	QPC02SXGN-RC	CONN JUMPER SHORTING .100" GOLD
56	4	STDOFF1,STDOFF2,STDOFF3,STDOFF4	1902E	Standoff	Keystone	1902E	1 inch nylon
57	1	SW1	4-POS 50-MIL SMT	sw_smvt_dip_4pos_8	C&K(ITT-CANNON)	TDA04H0SB1R	SWITCH SLIDE DIP SPST 25MA 24V
58	1	U1	TUSB564	RNQ0040A	Texas Instruments	TUSB564RNQ	
59	4	U2,U3,U4,U5	TPD4E05U06	DQA	Texas Instruments	TPD4E05U06DQAR	TVS DIODE 5.5VWM 14VC 10SON
60	1	U6	TPS65986	ZQZ_BGA_96	Texas Instruments	TPS65986ABZQZR	IC PD CTLR USB TYPE-C 96BGA
61	1	U7	W25Q80	SOIC_8_197x157_50	WINBOND	W25Q80DVSNIG	IC FLASH 8MBIT 104MHZ 8SOIC
62	1	U8	TPS7A4533	DCQ_PDSO_6	Texas Instruments	TPS7A4533DCQR	IC REG LINEAR 3.3V 1.5A SOT223-6
63	1	U9	TPS7A4501	DCQ_PDSO_6	Texas Instruments	TPS7A4501DCQT	IC REG LINEAR ADJ SOT223-6