TUSB1046 USB Type-C™ Enabler EVM

The TUSB1046 USB Type-C™ Alternate Mode re-driving switch supports data rates up to 10 Gbps for a downstream facing port (host). This user's guide describes how to use the EVM and includes schematics that can be used as a reference design for the alternate mode implementations of the host system with the TUSB1046 device.

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1 TUSB1046EVM-SRC

Figure 1 illustrates the EVM board.

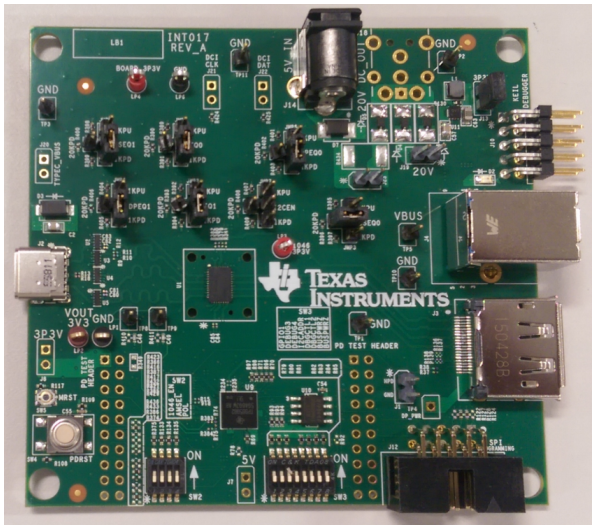


Figure 1. TUSB1046 EVM

The TUSB1046EVM-SRC can be used with a legacy DP Source or USB Host system to evaluate the USB Type-C implementation. Figure 2 is a typical test setup.

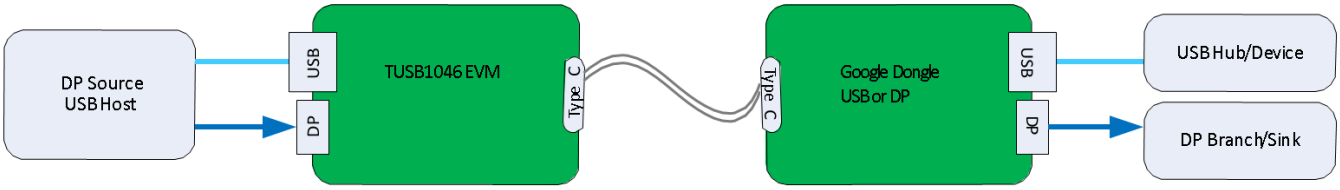


Figure 2. Test Board Setup

The EVM comes with a legacy Type B USB receptacle to connect to USB host systems and a DisplayPort receptacle to connect to DisplayPort-capable source. The TUSB1046 EVM uses the Texas Instruments TPS65982 (http://www.ti.com/product/TPS65982) controller for power delivery and CC pin control.

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2 TUSB1046EVM Configuration

This section provides the configuration options available in the TUSB1046EVM.

2.1 TUSB1046 EVM Default EQ Configuration

The headers in Table 1 are provided for TUSB1046 EQ configuration by default, configuration settings may need to be optimized depending on the amount of loss of each channel in the system.

Table 1. TUSB1046 Configuration Pins

Reference Designator	JMP Control	Configuration
JMP1	Downstream EQ0	No connect
JMP2	Downstream EQ1	Shunt on pin 2–4 (20-kΩ pulldown)
JMP3	Upstream SSEQ0	Shunt on pin 2–1 (1-kΩ pullup)
JMP4	Upstream SSEQ1	Shunt on pin 2–4 (20-kΩ pulldown)
JMP5	DP EQ0	Shunt on pin 2–4 (20-kΩ pulldown)
JMP6	DP EQ1	Shunt on pin 2–4 (20-kΩ pulldown)

2.2 TUSB1046 EQ Control

Each of the TUSB1046 receiver lanes has individual controls for receiver equalization. Table 2, Table 3, and Table 4 detail the gain values for each available combination for downstream, upstream, and all DisplayPort configurations.

Table 2. Configuration Pin-Level Definitions

Level	Settings
0	Option 1: Tie 1 kΩ 5% to GND Option 2: Tie directly to GND
R	Tie 20 kΩ, 5% to GND
F	Float (leave pin open)
1	Option 1: Tie 1 kΩ 5% to VCC Option 2: Tie directly to VCC

Table 3. USB 3.1 EQ Settings

USB3.1 Downstream Facing Ports			USB3.1 Upstream Facing Port		
EQ1 Pin Level	EQ0 Pin Level	EQ Gain @ 5 GHz (dB)	SSEQ1 Pin Level	SSEQ0 Pin Level	EQ Gain @ 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
F	0	8	F	0	8
F	R	9	F	R	9
F	F	10	F	F	10
F	1	11	F	1	11

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Table 3. USB 3.1 EQ Settings (continued)

USB3.1 Downstream Facing Ports			USB3.1 Upstream Facing Port		
EQ1 Pin Level	EQ0 Pin Level	EQ Gain @ 5 GHz (dB)	SSEQ1 Pin Level	SSEQ0 Pin Level	EQ Gain @ 5 GHz (dB)
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 @ 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

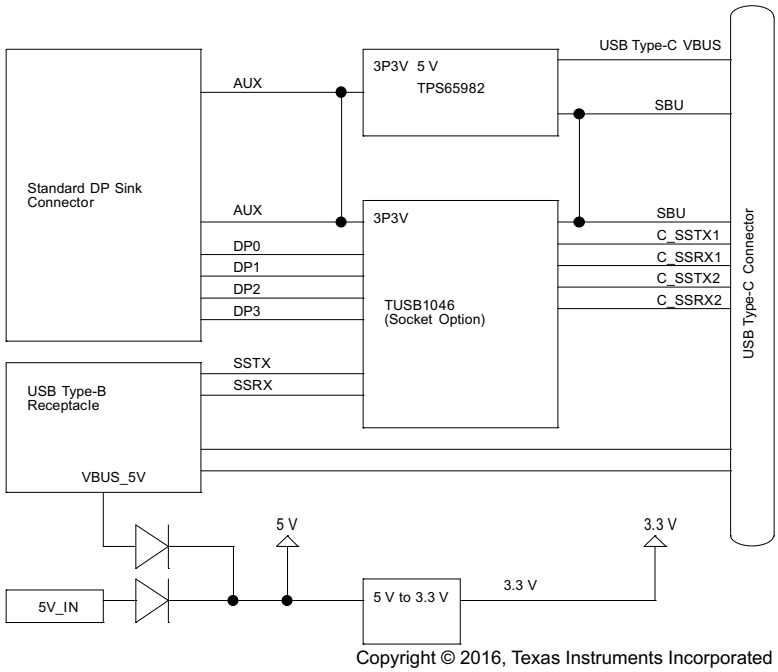
The EVM is designed to operate off of the VBUS from a USB host connected via USB Type B, J4. No external power is to be applied via J14 unless standalone operation is desired.

If testing the DisplayPort only, or if bypassing VBUS power, the EVM must be powered via J14 (5-V, 1-A input).

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3 TUSB1046EVM Schematics

Figure 3 displays the block diagram of the EVM.

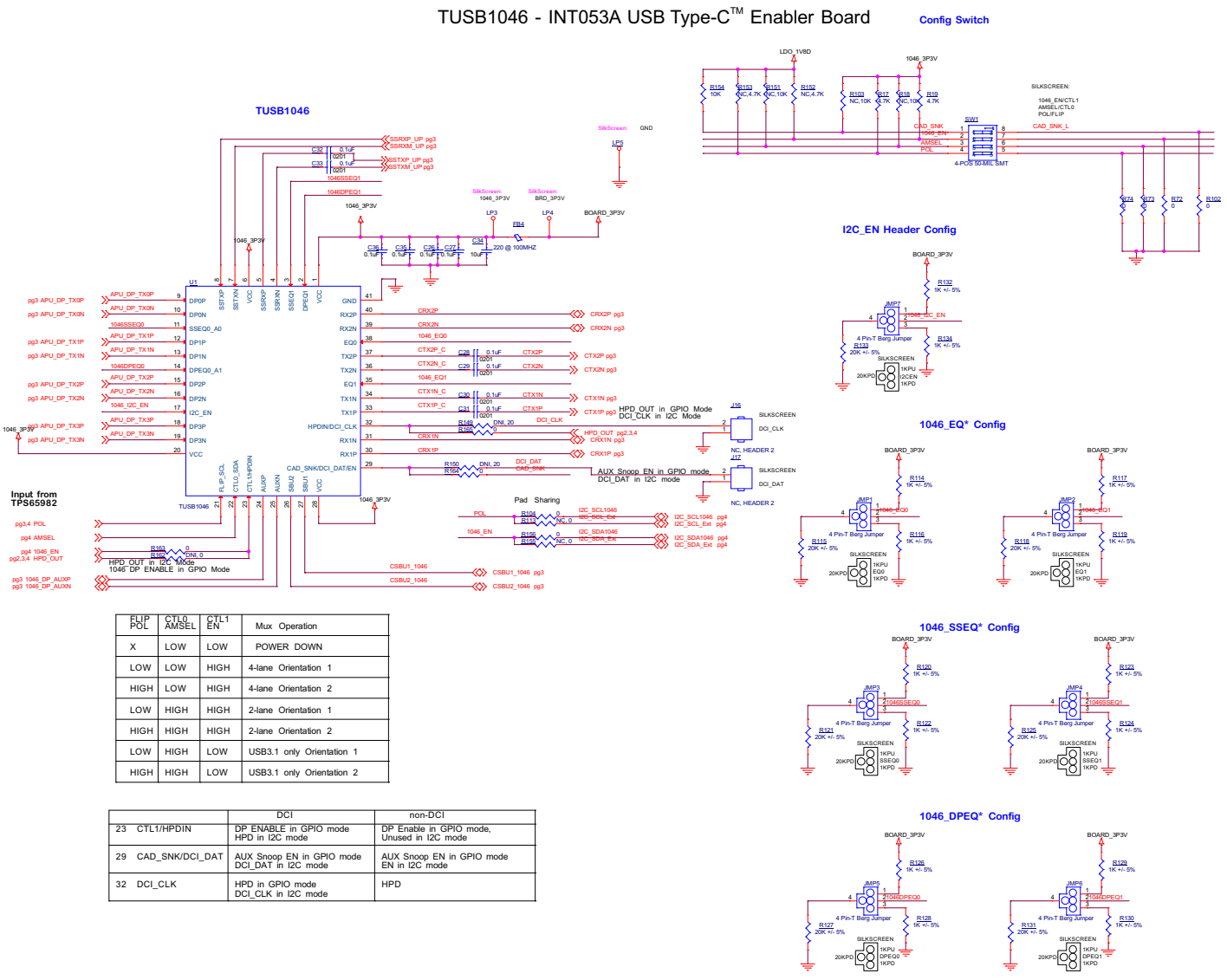


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Figure 3. TUSB1046EVM Block Diagram

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Figure 4 through Figure 7 show the EVM schematics.

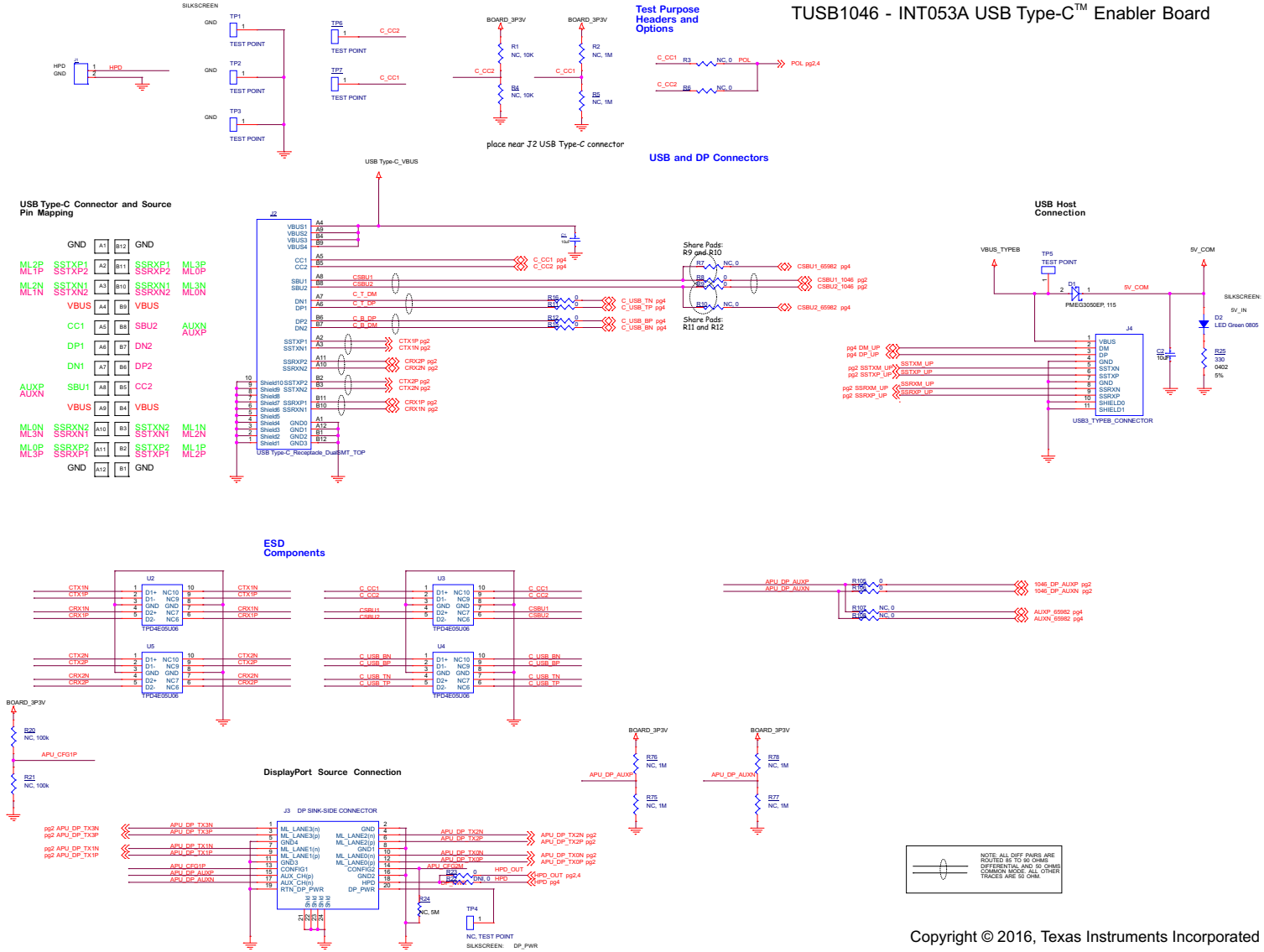


FLIP POL	CTL0 AMSEL	CTL1 EN	Mux Operation
X	LOW	LOW	POWER DOWN
LOW	LOW	HIGH	4-lane Orientation 1
HIGH	LOW	HIGH	4-lane Orientation 2
LOW	HIGH	HIGH	2-lane Orientation 1
HIGH	HIGH	HIGH	2-lane Orientation 2
LOW	HIGH	LOW	USB3.1 only Orientation 1
HIGH	HIGH	LOW	USB3.1 only Orientation 2

	DCI	non-DCI
23 CTL1/HPDIN	DP ENABLE in GPIO mode HPD in I2C mode	DP Enable in GPIO mode, Unused in I2C mode
29 CAD_SNK/DCI_DAT	AUX Snoop EN in GPIO mode DCI_DAT in I2C mode	AUX Snoop EN in GPIO mode EN in I2C mode
32 DCI_CLK	HPD in GPIO mode DCI_CLK in I2C mode	HPD

Figure 4. TUSB1046EVM Schematics (1 of 4)

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Figure 5. TUSB1046EVM Schematics (2 of 4)

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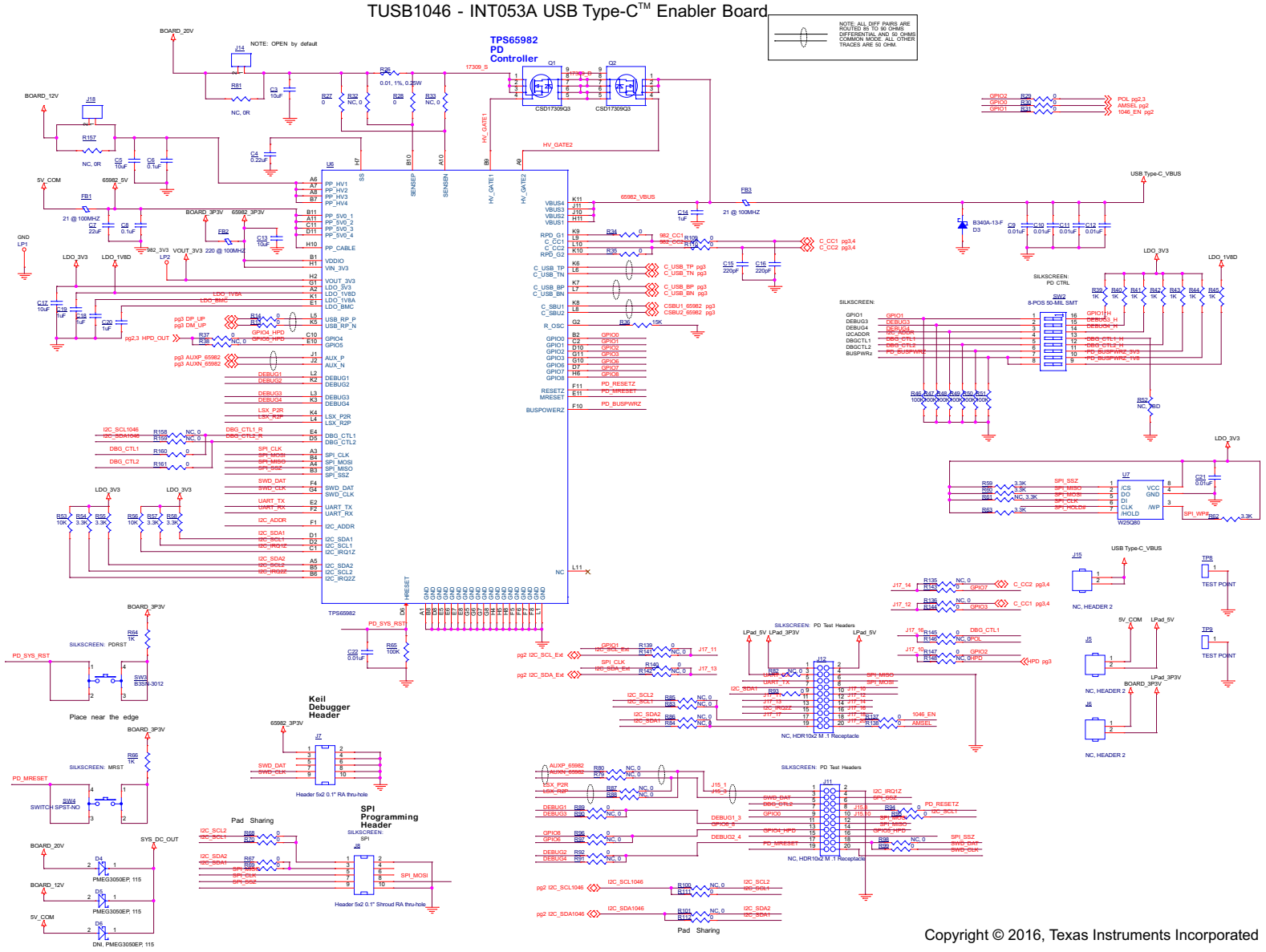
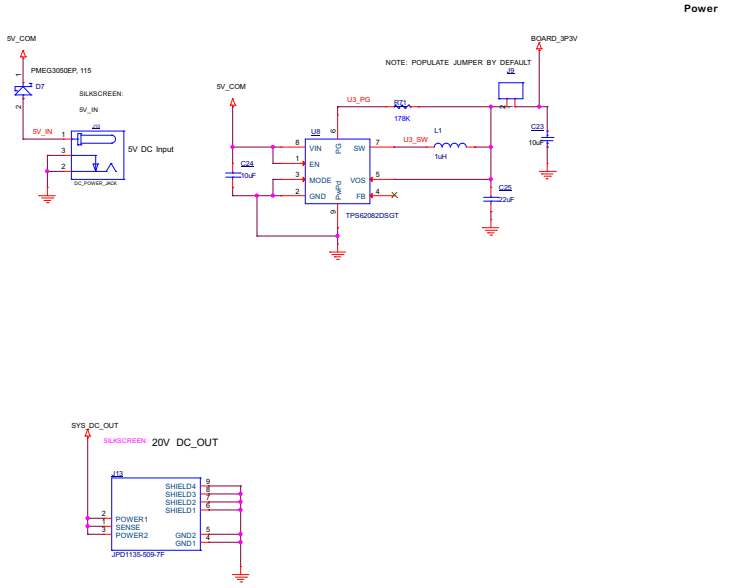


Figure 6. TUSB1046EVM Schematics (3 of 4)

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Figure 7. TUSB1046EVM Schematics (4 of 4)

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4 Bill of Materials

Table 5 lists the TUSB1046EVM bill of materials (BOM).

Table 5. TUSB1046 EVM Bill of Materials

Item	Qty	Reference	Part	Manufacturer	Manufacturer Part Number	PCB Footprint
1	9	C1,C2,C3,C5,C13,C17,C23,C24,C34	10uF	Murata	GRM188R61C106MA73D	603
2	1	C4	0.22uF	Murata	GRM152R61A224KE19D	402
3	12	C6,C8,C26,C27,C28,C29,C30,C31,C32,C33,C35,C36	0.1uF	Murata	GRM155R61A104KA01D	402
4	2	C7,C25	22uF	Murata	GRM188R60J226MEA0D	603
5	6	C9,C10,C11,C12,C21,C22	0.01uF	Murata	GRM155R71C103KA01D	402
6	4	C14,C18,C19,C20	1uF	Murata	GRM155R60J105ME19D	402
7	2	C15,C16	220pF	Murata	GRM1555C1H221JA01D	402
8	5	D1,D4,D5,D6,D7	SCHOTTKY	NXP	PMEG3050EP,115	SOD-128
9	1	D2	LED Green 0805	Lumex	SML-LX0805GC-TR	805
10	1	D3	B340A-13-F	Diodes Inc	B340A-13-F	
11	2	FB1,FB3	21 @ 100MHZ	Taiyo Yuden	FBMJ2125HM210NT	
12	2	FB2,FB4	220 @ 100MHZ	MuRata	BLM18EG221SN1D	
13	7	JMP1,JMP2,JMP3,JMP4,JMP5,JMP6,JMP7	4 Pin-T Berg Jumper			berg2x3tee
14	4	J1,J9,J14,J18	CON02	FCI	68001-402HLF	HDR_THVT_1X2_100_M
15	1	J2	TypeC_Receptacle_DualSMT_TOP	Foxconn	UT12113-11601-7H	USB_TYPEC_UT1211
16	1	J3	DP SINK-SIDE CONNECTOR	Molex Inc	472720001	con_DP_SD-47272-001
17	1	J4	USB3_TYPEB_CONNECTOR	Amphenol Commercial Products	GSB4211311WEU	usb3_typeb_ak4aa009
18	5	J5,J6,J15,J16,J17	NC, HEADER 2	Omron Electronics Inc-EMC Div	XG8T-0231	berg1x2
19	1	J7	Header 5x2 0.1" RA thru-hole	FCI	68021-210HLF	HDR_THRT_68020
20	1	J8	Header 5x2 0.1" Shroud RA thru-hole	3M	20210-5002HB	HDR_THRT_2X5_100
21	1	J10	DC_PWR_JACK	CUI Inc.	PJ-202AH	pj-202ah
22	2	J11,J12	NC, HDR10x2 M .1 Receptacle	Sullins	PPPC102LFBN-RC	HDR_THVT_2x10_100_F
23	1	J13	JPD1135-509-7F	Foxconn	JPD1135-509-7F	Jack_THRT_JPD1135
24	2	LP1,LP5	LP	Keystone Electronics	5011	THM Test Point
25	3	LP2,LP3,LP4,		Keystone Electronics	5010	THM Test Point
26	1	L1	1uH	Taiyo Yuden	NR3015T1R0N	IND_NR3015
27	2	Q1,Q2	MOS_P_4D_3S	Texas Instruments	CSD17309Q3	Q3_SON-8
28	2	R1,R4	NC, 10K	Panasonic Electronic Components	ERJ-2GEJ103X	402
29	6	R2,R5,R75,R76,R77,R78	NC, 1M	Panasonic Electronic Components	ERJ-2GEJ105X	402
30	34	R3,R6,R7,R10,R32,R33,R38,R79,R80,R82,R83,R84,R85,R86,R87,R88,R90,R91,R97,R98,R100,R101,R107,R108,R113,R135,R136,R141,R142,R146,R148,R155,R158,R159	NC, 0	Panasonic Electronic Components	ERJ-2GE0R00X	402

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Table 5. TUSB1046 EVM Bill of Materials (continued)

Item	Qty	Reference	Part	Manufacturer	Manufacturer Part Number	PCB Footprint
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32	2	R17,R19	4.7K	Panasonic Electronic Components	ERJ-2GEJ472X	402
33	3	R18,R103,R151	NC,10K	Panasonic Electronic Components	ERJ-2GEJ103X	402
34	2	R20,R21	NC, 100k	Panasonic Electronic Components	ERJ-2GEJ104X	402
35	2	R22,R162	DNI, 0	Panasonic Electronic Components	ERJ-1GN0R00C	201
36	1	R24	NC, 1M	Panasonic Electronic Components	ERJ-1GEF1004C	201
37	1	R25	330	Panasonic Electronic Components	ERJ-2GEJ331X	402
38	1	R26	0.01, 1%, 0.25W	Panasonic Electronic Components	ERJ-6BWFR010V	805
39	1	R36	15K	Panasonic Electronic Components	ERJ-2RKF1502X	402
40	9	R39,R40,R41,R42,R43,R44,R45,R64,R66	1K	Panasonic Electronic Components	ERJ-2GEJ102X	402
41	7	R46,R47,R48,R49,R50,R51,R65	100K	Panasonic Electronic Components	ERJ-2GEJ104X	402
42	1	R52	NC, 100	Panasonic Electronic Components	ERJ-2GEJ101X	402
43	3	R53,R56,R154	10K	Panasonic Electronic Components	ERJ-2GEJ103X	402
44	8	R54,R55,R57,R58,R59,R60,R62,R63	3.3K	Panasonic Electronic Components	ERJ-2GEJ332X	402
45	1	R61	NC, 3.3K	Panasonic Electronic Components	ERJ-2GEJ332X	402
46	1	R71	178K	Panasonic Electronic Components	ERJ-3EKF1783V	603
47	2	R81,R157	NC, 0R	Vishay Dale	RCL12250000Z0EG	2512
48	14	R114,R116,R117,R119,R120,R122,R123,R124,R126,R128,R129,R130,R132,R134	1K +/- 5%	Panasonic Electronic Components	ERJ-2GEJ102X	402
49	7	R115,R118,R121,R125,R127,R131,R133	20K +/- 5%	Panasonic Electronic Components	ERJ-2GEJ203X	402
50	2	R149,R150	DNI, 20	Panasonic Electronic Components	ERJ-2GEJ200X	402
51	2	R152,R153	NC,4.7K	Panasonic Electronic Components	ERJ-2GEJ472X	402
52	1	SW1	4-POS 50-MIL SMT	C&K(ITT-CANNON)	TDA04H0SB1R	sw_smvt_dip_4pos_8
53	1	SW2	8-POS 50-MIL SMT	C&K(ITT-CANNON)	TDA08H0SB1R	SW_SMVT_SPST_TDA08
54	1	SW3	Pushbutton Switch	Omron Electronics Inc-EMC Div	B3SN-3012P	switch_b3sn
55	1	SW4	SWITCH SPST-NO	C&K Components	KMT221G HF LFS	kmt2_switch
56	8	TP1,TP2,TP3,TP5,TP6,TP7,TP8,TP9	TEST POINT	Samtec	HTSW-101-07-G-S	berg1x1
57	1	TP4	NC, TEST POINT	Keystone Electronics	1035	berg1x1
58	1	U1	TUSB1046	Texas Instruments	TUSB1046	
59	4	U2,U3,U4,U5	TPD4E05U06	Texas Instruments	TPD4E05U06	DQA
60	1	U6	TPS65982	Texas Instruments	TPS65982	ZQZ_BGA_96
61	1	U7	W25Q80	WINBOND	W25Q80DVSNIG	SOIC_8_197x157_50
62	1	U8	TPS62082DSGT	Texas Instruments	TPS62082DSGT	dsg

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