

EVM User's Guide: TUSB564Q1-EVM

TUSB564-Q1 USB Type-C Evaluation Module



Description

The TUSB564Q1-EVM can be used with an alternate mode, USB Type-C® source such as the TUSB546EVM or USB, or the DisplayPort™, Type-C Host system to evaluate the Type-C implementation. The EVM comes with a legacy Type-A USB receptacle to connect to a USB hub or device, and a DisplayPort receptacle to connect to the DisplayPort sink. The TUSB564Q1-EVM uses the TPS65987 PD controller for CC pin control and to configure the device in I2C or pin-strap mode.

Get Started

1. Order the EVM
2. Configure the board headers to fit your application.
3. Use the EVM and associated design files to evaluate the TUSB564-Q1.
4. For issues, reach out to us directly on the TI E2E forum.

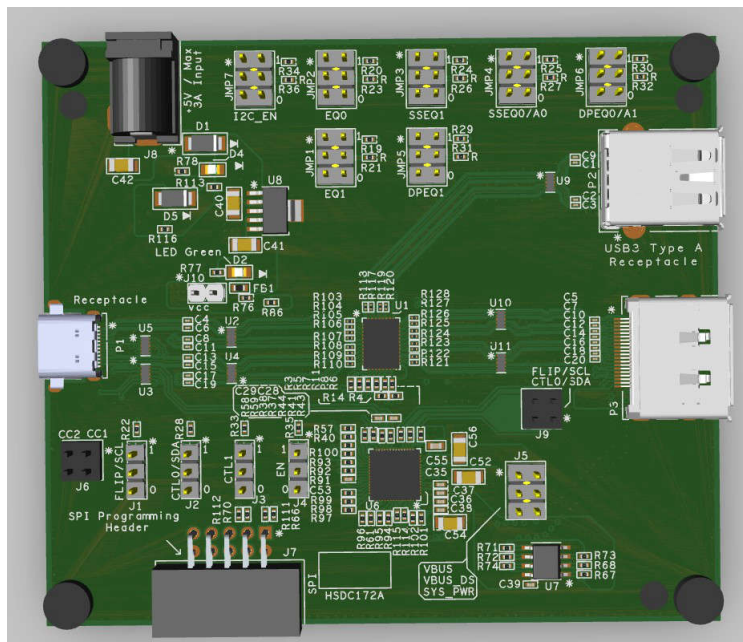
Features

- USB Type-C crosspoint switch supporting
 - USB 3.1 Gen 1 + 2 DP 1.4 lanes

- 4 DP 1.4 lanes
- USB 3.1 Gen 1 up to 5Gbps
- DisplayPort 1.4 up to 8.1 Gbps (HBR3)
- VESA DisplayPort alt mode UFP_D redriving crosspoint switch supporting pin assignments C, D, and E
- Ultra-low-power architecture
- Linear redriver with up to 12dB equalization
- Transparent to DisplayPort link training
- Automatic LFPS de-emphasis control to meet USB 3.1 certification requirements
- Configuration through GPIO or I2C
- Hot-plug capable
- Automotive grade 2 temperature range: –40°C to 105°C (TUSB564-Q1)
- 5mm × 7mm, 0.5mm pitch WQFN package

Applications

- [PC and notebooks](#)
- [TV](#)
- [Gaming](#)
- [Home theater and entertainment](#)
- [Smart phones](#)
- [Tablets](#)
- [Automotive infotainment](#)



1 Evaluation Module Overview

1.1 Introduction

The TUSB564-Q1 device is a USB Type-C/VESA DisplayPort, alternate mode, redriving switch, which supports data rates up to 5Gbps for an upstream facing port (device).

This EVM user's 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 TUSB564-Q1 device.

1.2 Kit Contents

The TUSB564Q1-EVM includes:

- The TUSB564-Q1 device
- (1) USB-A receptacle that connects to a USB device
- (1) DisplayPort receptacle that connects to a DisplayPort-capable sink
- (1) Standard 5V barrel jack receptacle
- Headers for configuring various TUSB564-Q1 features

1.3 Specification

Figure 1-1 shows the power and data path of the TUSB564Q1-EVM.

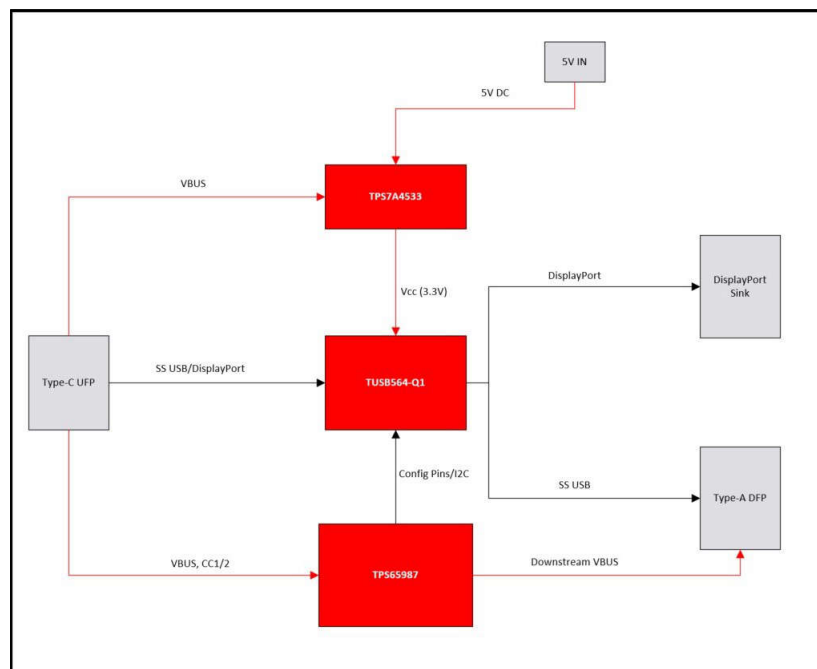


Figure 1-1. Block Diagram

1.4 Device Information

The TUSB564-Q1 is a VESA USB Type-C alt mode redriving switch supporting USB 3.1 data rates up to 5Gbps and DisplayPort 1.4 up to 8.1Gbps for upstream facing port (sink). The device is used for UFP_D pin assignments C, D, and E from the VESA DisplayPort alt mode on USB Type-C standard.

2 Hardware

2.1 Setup

Table 2-1 lists the headers provided for the configuration of the TUSB564 by default. The configuration settings 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, then the JMP7 (I2C_EN) shunt must be changed.

Table 2-1. TUSB564-Q1 EVM Configuration Pins

Designator	Jumper Control	Default Configuration
JMP1	Downstream EQ1	Shunt on pin 3 - 4 (R)
JMP2	Downstream EQ0	Shunt on pin 3 - 4 (R)
JMP3	Upstream SSEQ1	Shunt on pin 3 - 4 (R)
JMP4	Upstream SSEQ0	Shunt on pin 3 - 4 (R)
JMP5	DP EQ1	Shunt on pin 5 - 6 (0)
JMP6	DP EQ0	Shunt on pin 1 - 2 (1)
JMP7	I2C_EN	Shunt on pin 5 - 6 (0)
J1	FLIP	No Shunt
J2	CTL0	No Shunt
J3	CTL1	No Shunt
J4	EN	Shunt on pin 1 - 2 (VCC)
J5	POWER	VBUS → VBUS_DS
J10	VCC	Shunt

2.2 TUSB564-Q1 Equalization Control

Equalization (EQ) can be controlled using I2C or pin-strapping. Each of the TUSB564-Q1 receiver lanes has individual controls for receiver equalization (see Configuration Pin-Level Definitions). Table 2-3 and Table 2-4 list the gain values of each available combination of downstream, upstream, and DisplayPort configurations.

Table 2-2. Configuration Pin-Level Definitions

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

Table 2-3. USB 3.1 Equalization Settings

EQ Setting #	USB 3.1 Upstream Facing Ports			USB 3.1 Downstream Facing Ports		
	EQ1	EQ0	EQ Gain at 2.5GHz (dB)	SSEQ1	SSEQ0	EQ Gain at 2.5GHz (dB)
0	0	0	-0.9	0	0	-2.4
1	0	R	0.2	0	R	-1.3
2	0	F	1.2	0	F	-0.4
3	0	1	2.2	0	1	0.7
4	R	0	3.1	R	0	1.5
5	R	R	4.0	R	R	2.5
6	R	F	4.8	R	F	3.2
7	R	1	5.6	R	1	4.0
8	F	0	6.3	F	0	4.8
9	F	R	7.0	F	R	5.5
10	F	F	7.5	F	F	6.0
11	F	1	8.1	F	1	6.6
12	1	0	8.5	1	0	7.1
13	1	R	9.1	1	R	7.6
14	1	F	9.5	1	F	8.0
15	1	1	9.9	1	1	8.5

Table 2-4. DisplayPort Equalization Settings

Equalization Setting #	DPEQ1	DPEQ0	EQ Gain at 4.05GHz (dB)
0	0	0	-0.3
1	0	R	1.6
2	0	F	3.0
3	0	1	4.4
4	R	0	5.4
5	R	R	6.5
6	R	F	7.3
7	R	1	8.1
8	F	0	8.9
9	F	R	9.5
10	F	F	10.0
11	F	1	10.6
12	1	0	11.0
13	1	R	11.4
14	1	F	11.8
15	1	1	12.1

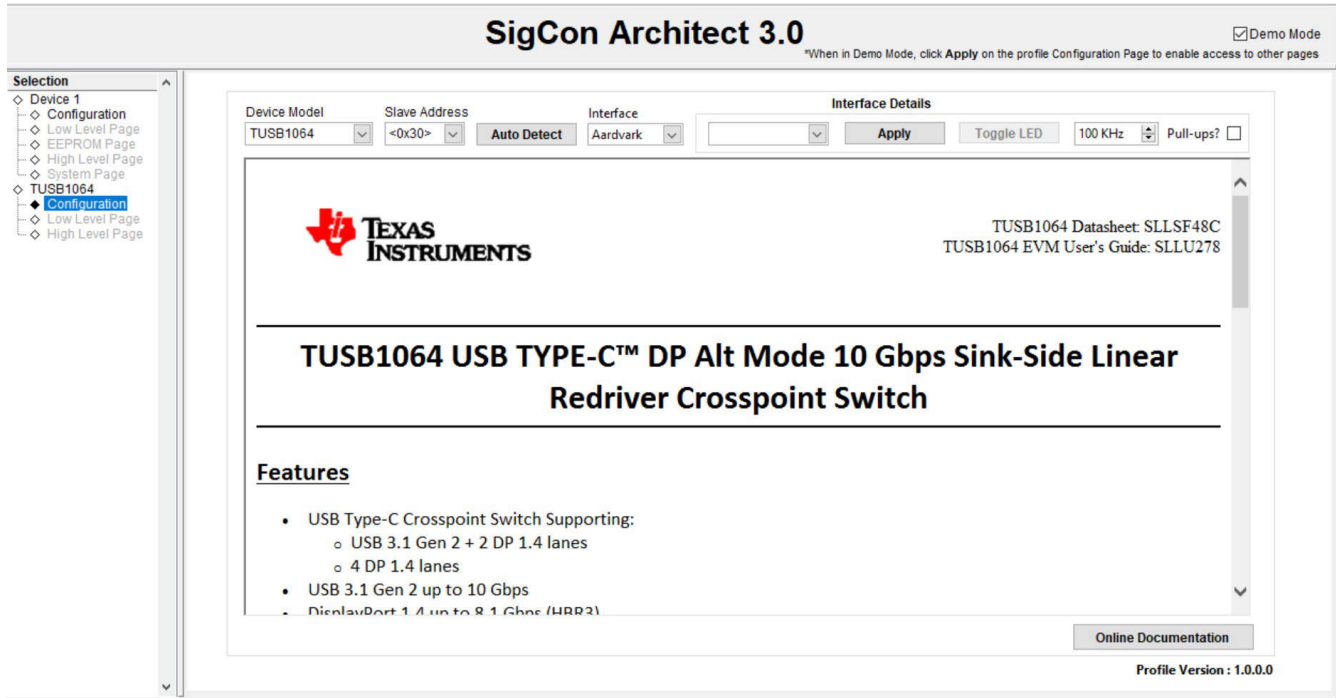
3 Software

3.1 Firmware Description

The TUSB564-Q1 EVM uses the TPS65987 power delivery (PD) controller to manage the Type-C VBUS, handle configuration channel negotiation, and to set the CTL0/CTL1/FLIP pins on the TUSB564-Q1. The TPS65987 can be configured by loading firmware through the SPI programming header located on the side of the EVM. This evaluation module comes with pre-loaded firmware however, if a certain behavior is desired, custom firmware can be loaded to the PD controller as well. For details on creating a custom firmware file, see the [TPS6598X-CONFIG page](#) on TI.com.

3.2 GUI Installation

For information regarding the TUSB564Q1-EVM GUI, contact TI through the [E2E forum](#).



The screenshot displays the SigCon Architect 3.0 software interface. The main window is titled "SigCon Architect 3.0" and includes a "Demo Mode" checkbox in the top right corner. A note below the title bar states: "When in Demo Mode, click Apply on the profile Configuration Page to enable access to other pages".

On the left side, there is a "Selection" tree with the following items: Device 1, Configuration, Low Level Page, EEPROM Page, High Level Page, System Page, TUSB1064, Configuration (highlighted), Low Level Page, and High Level Page.

The main configuration area is divided into several sections:

- Device Model:** TUSB1064
- Slave Address:** <0x30>
- Interface:** Aardvark
- Interface Details:** Includes an "Apply" button, "Toggle LED", "100 KHz" frequency setting, and a "Pull-ups?" checkbox.

The central content area displays the Texas Instruments logo and the following text:

TUSB1064 Datasheet: SLLSF48C
TUSB1064 EVM User's Guide: SLLU278

TUSB1064 USB TYPE-C™ DP Alt Mode 10 Gbps Sink-Side Linear Redriver Crosspoint Switch

Features

- USB Type-C Crosspoint Switch Supporting:
 - USB 3.1 Gen 2 + 2 DP 1.4 lanes
 - 4 DP 1.4 lanes
- USB 3.1 Gen 2 up to 10 Gbps
- DisplayPort 1.4 up to 8.1 Gbps (HBR3)

At the bottom right of the main content area, there is an "Online Documentation" button and a "Profile Version : 1.0.0.0" label.

4 Hardware Design Files

4.1 Schematics

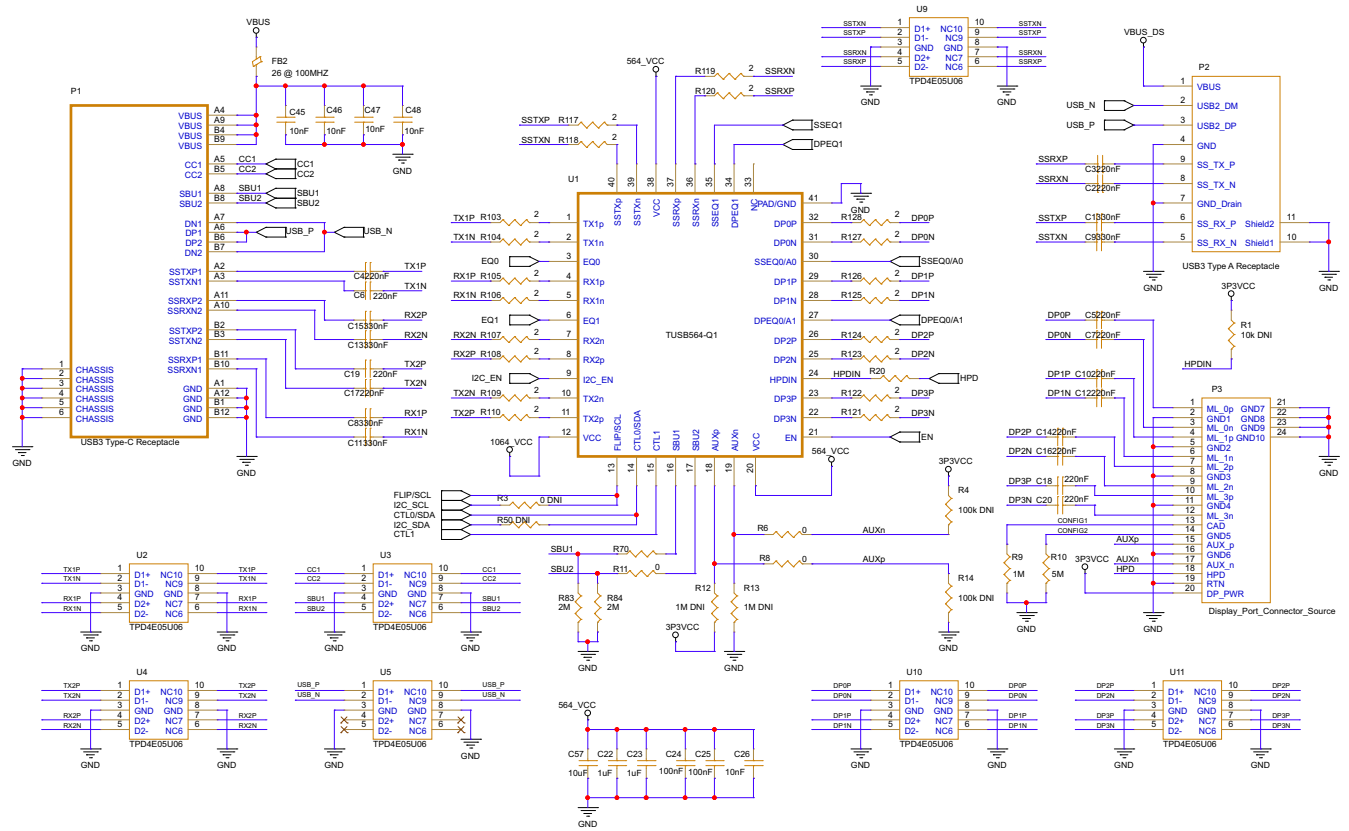


Figure 4-1. TUSB564-Q1 EVM Schematic (Page 1)

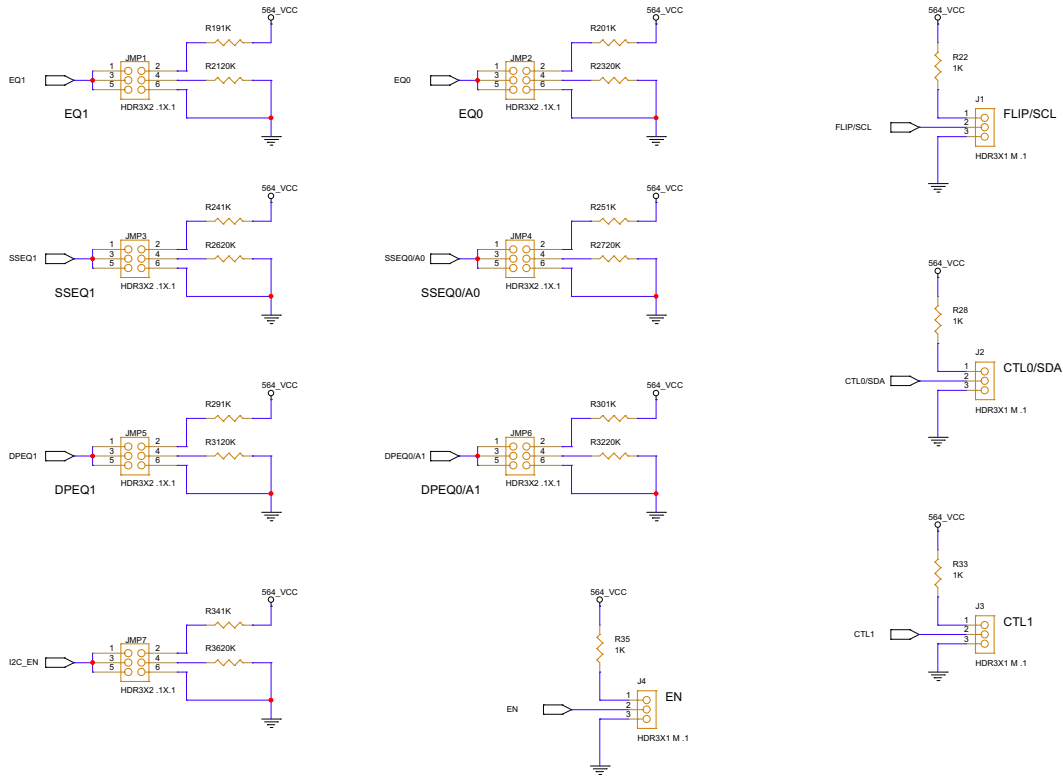


Figure 4-2. TUSB564-Q1 EVM Schematic (Page 2)

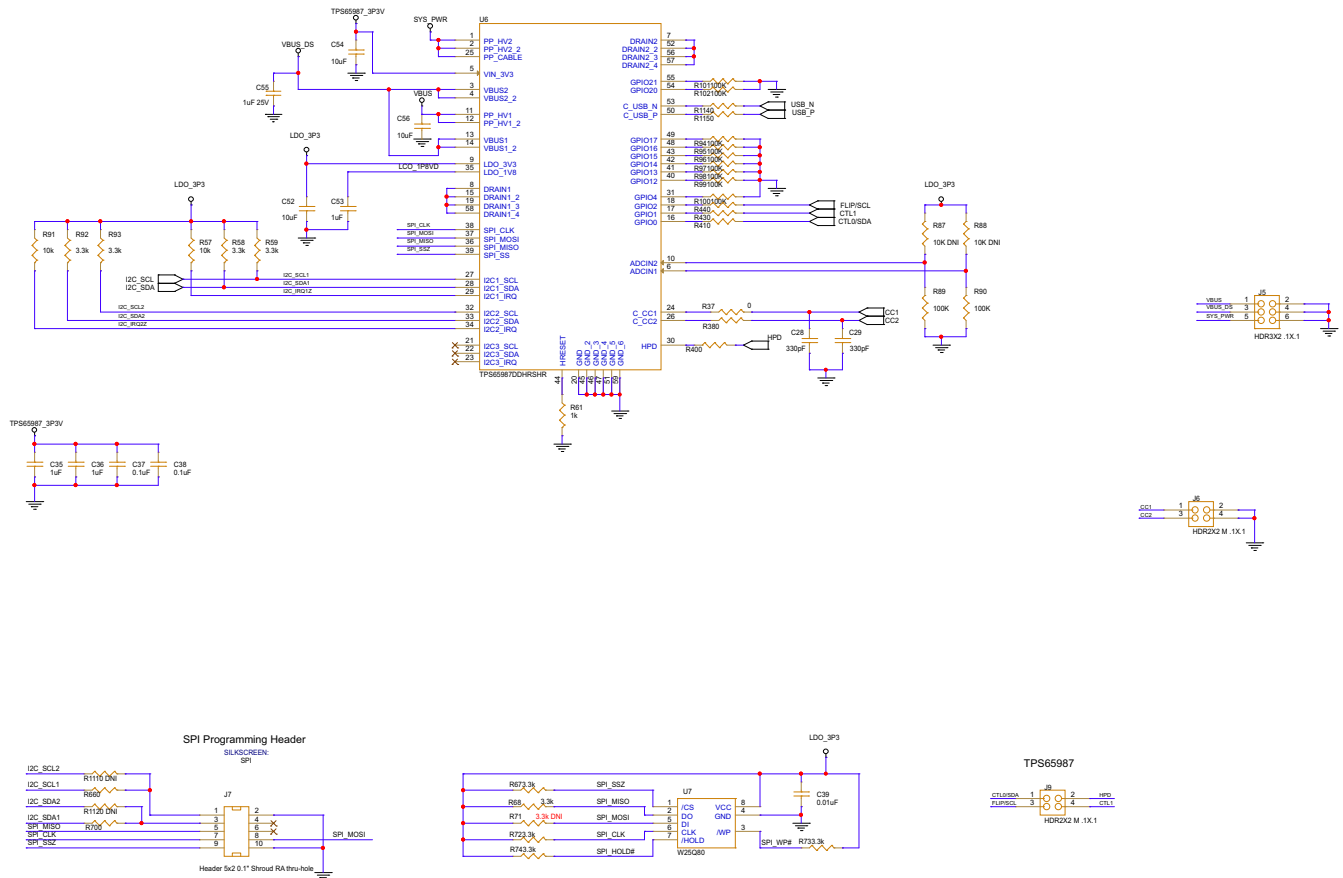


Figure 4-3. TUSB564-Q1 EVM Schematic (Page 3)

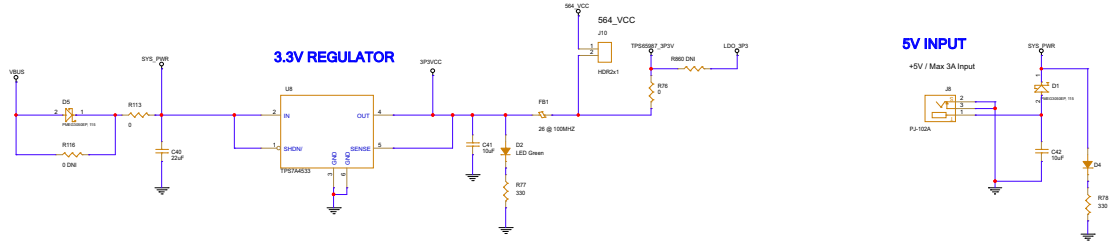


Figure 4-4. TUSB564-Q1 EVM Schematic (Page 4)

4.2 PCB Layouts

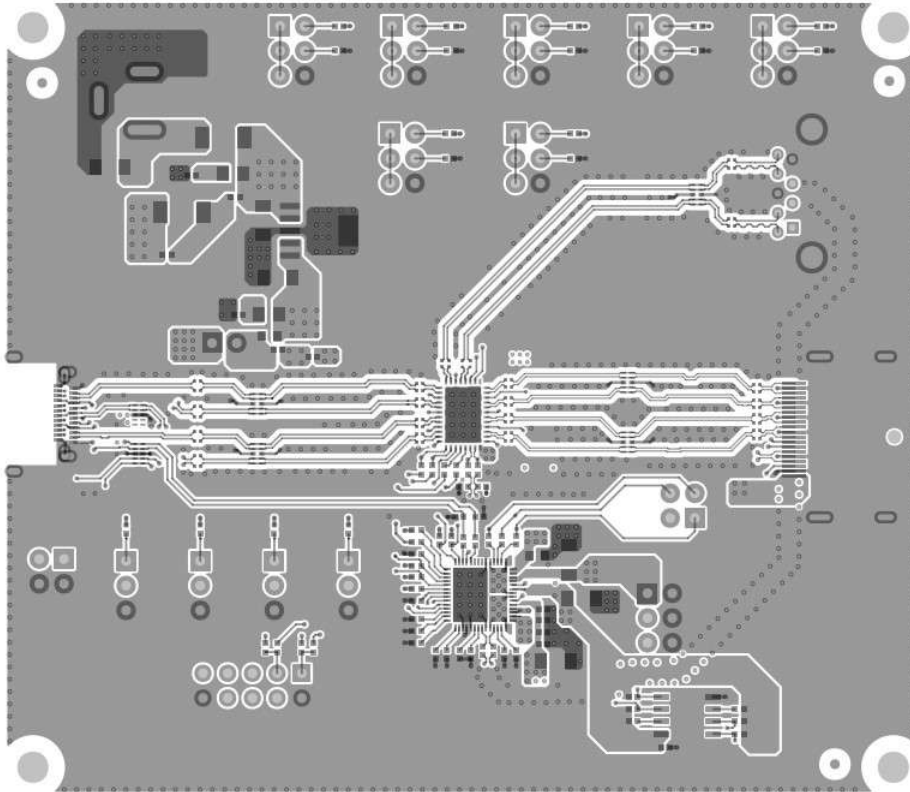


Figure 4-5. TUSB564-Q1 EVM PCB Layer 1 (Top)

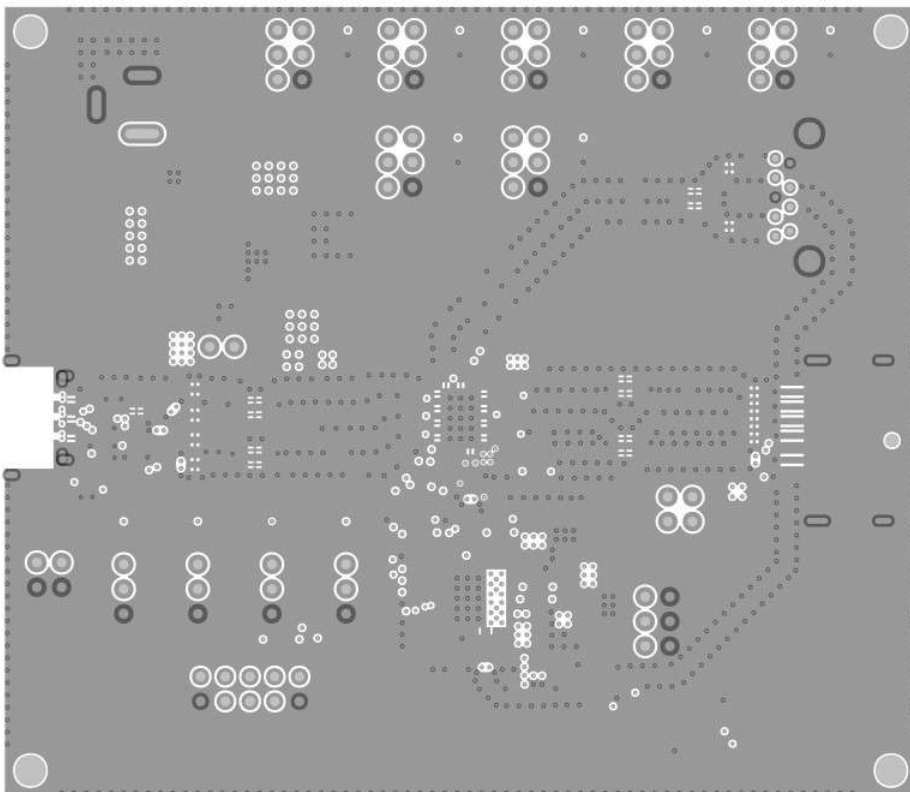


Figure 4-6. TUSB564-Q1 EVM PCB Layer 2 (GND)

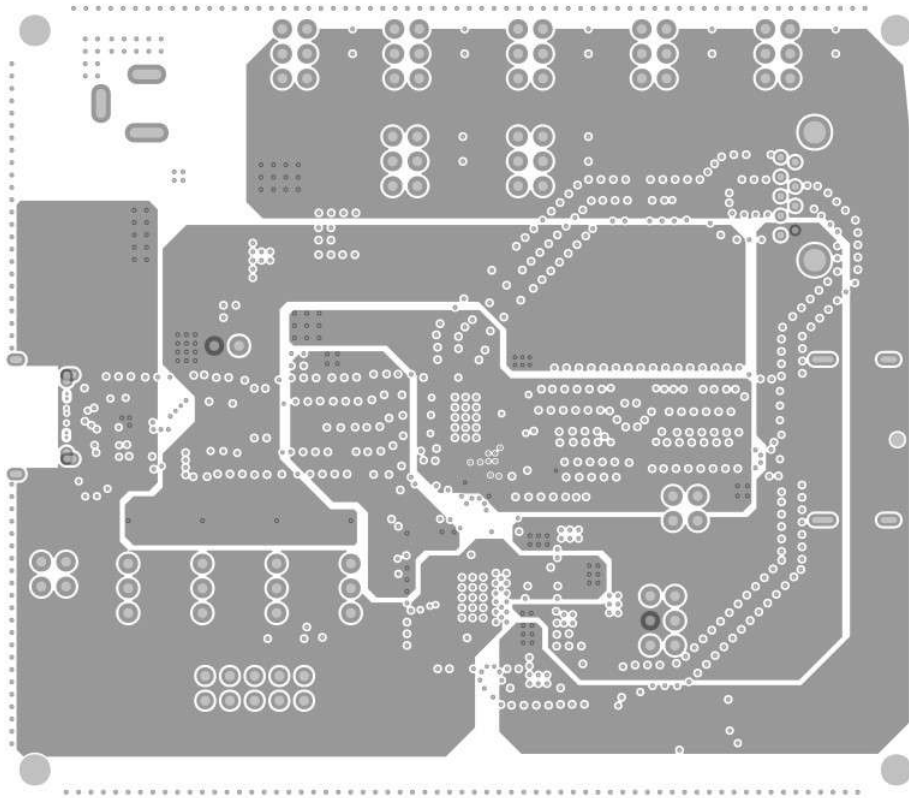


Figure 4-7. TUSB564-Q1 EVM PCB Layer 3 (Power)

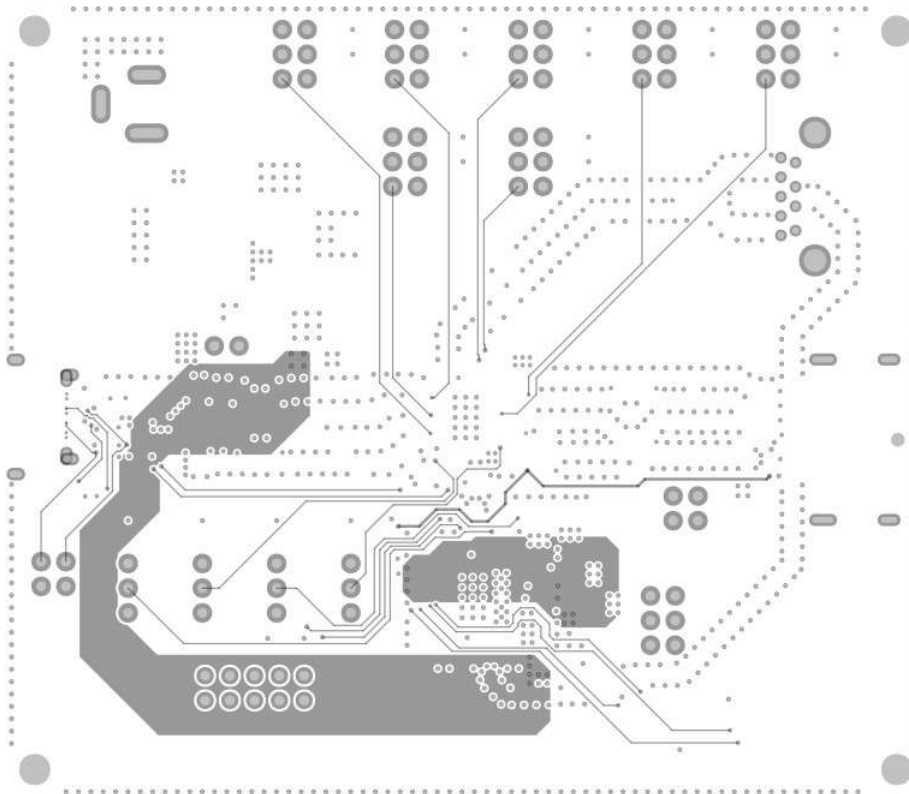


Figure 4-8. TUSB564-Q1 EVM PCB Layer 4 (Signal)

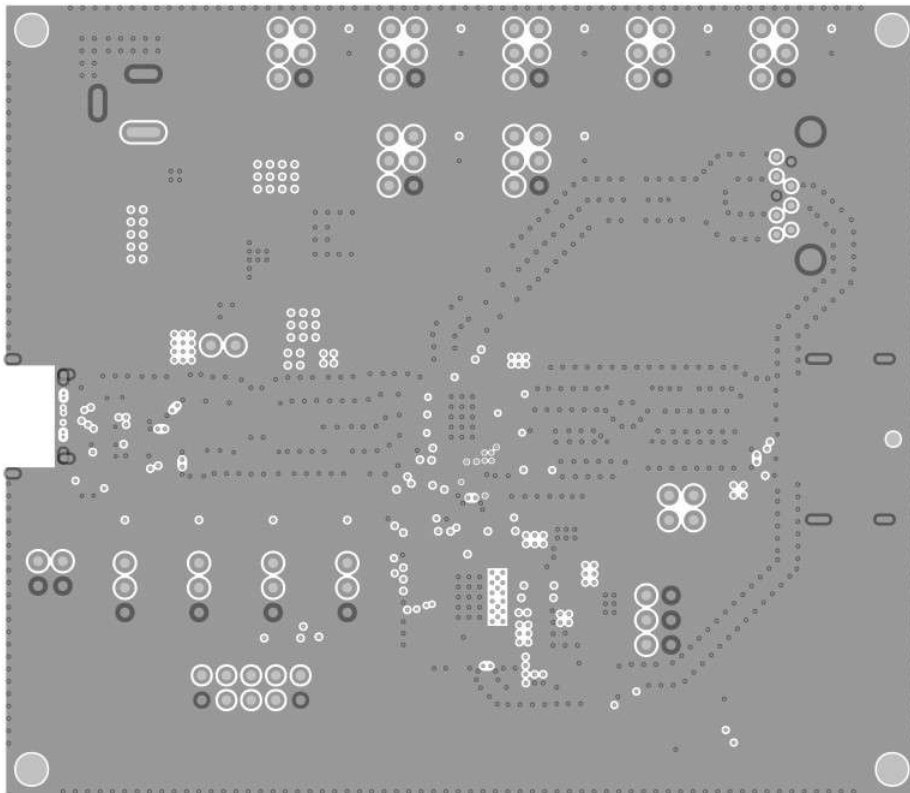


Figure 4-9. TUSB564-Q1 EVM PCB Layer 5 (GND)

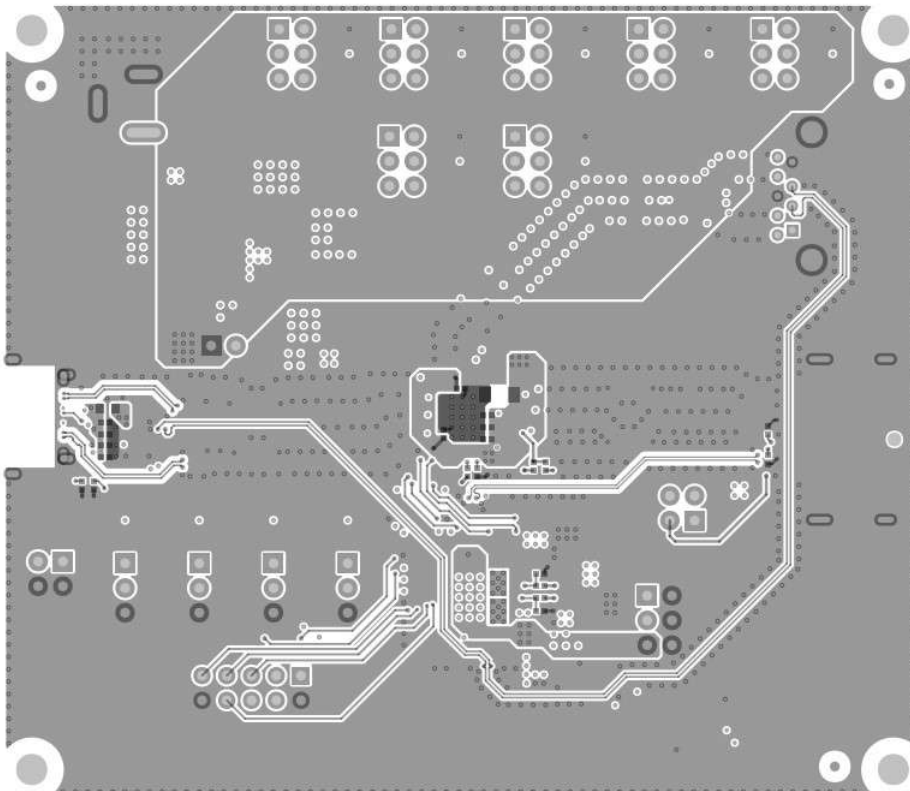


Figure 4-10. TUSB564-Q1 EVM PCB Layer 6 (Bottom)

4.3 Bill of Materials (BOM)

Table 4-1. Bill of Materials

Designator	Quantity	Part	Description	Part Number	PCB Footprint	Manufacturer
C1,C8,C9,C11,C13,C15	6	330nF	CAP CER 0.33UF 25V X5R 0201	CL03A334KA3NRNC	CAP_0201	Samsung Electro-Mechanics
C2,C3,C4,C5,C6,C7,C10,C12,C14,C16,C17,C18,C19,C20	14	220nF	CAP CER 0.22UF 25V X5R 0201	GRM033R61E224KE01D	CAP_0201	Murata
C22,C23,C35,C36,C53	5	1uF	CAP CER 1UF 6.3V X5R 0402	GRM155C81C105KE15D	CAP_0402	Murata
C24,C25	2	100nF	CAP CER 0.1UF 10V X5R 0402	GCM155R71A104KA55D	CAP_0402	Murata
C26,C45,C46,C47,C48	5	10nF	CAP CER 10000PF 16V X7R 0402	GRM155R71C103KA01D	CAP_0402	Murata
C28,C29	2	330pF	CAP CER 330PF 25V C0G/NP0 0402	GRM1555C1E331JA01D	CAP_0402	Murata
C37,C38	2	0.1uF	CAP CER 0.1UF 10V X5R 0402	CL05B104KP5NNNC	CAP_0402	Samsung
C39	1	0.01uF	CAP CER 10000PF 16V X7R 0402	GRM155R71C103KA01D	CAP_0402	Murata
C40	1	22uF	CAP CER 22UF 25V X5R 1206	GRT31CC71E226ME13K	CAP_1206	Murata
C41,C42,C52,C54,C56,C57	6	10uF	CAP CER 10UF 25V X5R 1206	GRM31CR71E106KA12L	CAP_1206	Murata
C55	1	1uF 25V	CAP CER 1UF 25V X7R 0603	0603B105K250XD	CAP_0603	Aillen
D1,D5	2	SCHOTTKY	DIODE SCHOTTKY 30V 5A SOD128	PMEG3050EP,115	DIO_SOD-128	NXP
D2	1	LED Green	LED GREEN CLEAR 0805 SMD	VFHL1112H-4B13C-TR	LED_0805	Stanley Electric
D4	1	LED Green 0805	LED GREEN CLEAR 0805 SMD	VFHL1112H-4B13C-TR	LED_0805	Stanley Electric
FB1,FB2	2	26 @ 100MHZ	FERRITE BEAD 26 OHM 0603 1LN	BLM18SG260TN1D	FB_0603	Murata
JMP1,JMP2,JMP3,JMP4,JMP5,J5,JMP6,JMP7	8	HDR3X2 .1X.1	DIL VERTICAL PC TAIL PIN HEADER	M20-9980345	HDR_THVT_2X3_254_871	Harwin
J1,J2,J3,J4	4	HDR3X1 M .1	CONN HEADER VERT 3POS 2.54MM	TSW-103-07-G-S	hdr_thvt_1x3_254_871	Samtec
J6,J9	2	HDR2X2 M .1X.1	CONN HEADER 4POS .100 STR TIN	67997-404HLF	HDR_THVT_2X2_254_871	Amphenol FCI
J7	1	Header 5x2 0.1" Shroud RA thru-hole	CONN HEADER 10POS .100 STR TIN	30310-5002HB	CON_SHRD_THRT_30310-5002HB	3M
J8	1	PJ-102A	CONN PWR JACK 2X5.5MM SOLDER	PJ-102A	JACK_THRT_PJ-202AH	CUI Inc.
J10	1	HDR2x1	CONN HEADER VERT 2POS 2.54MM	9-146280-0-02	HDR_THVT_1X2_254_1097	TE Connectivity
LB2	1	THD-47-478-10	LB2 = "TUSB564RNQEVN"	THD-47-478-10	rectangle	Brady
PCB1	1	HSDC172	PCB	HSDC172 PCB	n/a	Any
P1	1	USB3 Type-C Receptacle	USB TYPE C SOCKET, MID MOUNT, BL	KUSBX-MM-CS1-B30TR	USB-C_SMRT_KUSBX-MM-CS1-B30TR	Kycon

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Part	Description	Part Number	PCB Footprint	Manufacturer
P2	1	USB3 Type A Receptacle	USB3.1 Type-A Connector	GSB4111312HR	USB-A_THRT_GSB4111312HR	Amphenol ICC
P3	1	Display_Port_Connector_Source	CONN RCPT 20POS UDI R/A SMD	0472720001	DP_SMRT_472720001	Molex Inc
R1,R87,R88	3	10K DNI	RES SMD 10K OHM 5% 1/10W 0402	ERJ-2GEJ103X	RES_0402	Panasonic Electronic Components
R2,R6,R7,R8,R11,R37,R38,R41,R43,R44,R66,R70,R76,R113,R114,R115	16	0	RES SMD 0 OHM JUMPER 1/10W 0402	ERJ-2GE0R00X	RES_0402	Panasonic Electronic Components
R3,R5,R86,R111,R112,R116	6	0 DNI	RES SMD 0 OHM JUMPER 1/10W 0402	ERJ-2GE0R00X	RES_0402	Panasonic Electronic Components
R4,R14	2	100k DNI	RES SMD 100K OHM 5% 1/10W 0402	ERJ-2GEJ104X	RES_0402	Panasonic Electronic Components
R9	1	1M	RES SMD 1M OHM 5% 1/10W 0402	ERJ-2GEJ105X	RES_0402	Panasonic Electronic Components
R10	1	5M	RES SMD 5M OHM 5% 1/20W 0402	HVC0402T5004JET	RES_0402	Ohmite
R12,R13	2	1M DNI	RES SMD 1M OHM 5% 1/10W 0402	ERJ-2GEJ105X	RES_0402	Panasonic Electronic Components
R19,R20,R22,R24,R25,R28,R29,R30,R33,R34,R35,R61	12	1k	RES SMD 1K OHM 5% 1/10W 0402	ERJ-2GEJ102X	RES_0402	Panasonic Electronic Components
R21,R23,R26,R27,R31,R32,R36	7	20K	RES SMD 20K OHM 1% 1/10W 0402	ERJ-2RKF2002X	RES_0402	Panasonic Electronic Components
R40	1	0	RES SMD 0 OHM JUMPER 1/10W 0402	ERJ-2GE0R00X	RES_0402	Panasonic Electronic Components
R57,R91	2	10k	RES SMD 10K OHM 5% 1/10W 0402	ERJ-2GEJ103X	RES_0402	Panasonic Electronic Components
R58,R59,R67,R68,R72,R73,R74,R92,R93	9	3.3k	RES SMD 3.3K OHM 5% 1/10W 0402	ERJ-2GEJ332X	RES_0402	Panasonic Electronic Components
R71	1	3.3k DNI	RES SMD 3.3K OHM 5% 1/10W 0402	ERJ-2GEJ332X	RES_0402	Panasonic Electronic Components
R77,R78	2	330	RES SMD 330 OHM 5% 1/10W 0402	ERJ-2GEJ331X	RES_0402	Panasonic Electronic Components
R83,R84	2	2M	RES SMD 2M OHM 5% 1/10W 0402	ERJ-2GEJ205X	RES_0402	Panasonic Electronic Components
R89,R90,R94,R95,R96,R97,R98,R99,R100,R101,R102	11	100K	RES SMD 100K OHM 5% 1/10W 0402	ERJ-2GEJ104X	RES_0402	Panasonic Electronic Components

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Part	Description	Part Number	PCB Footprint	Manufacturer
R103,R104,R105,R106,R107,R108,R109,R110,R117,R118,R119,R120,R121,R122,R123,R124,R125,R126,R127,R128	20	2	RES SMD 2 OHM 5% 1/20W 0201	ERJ-1GNJ2R0C	RES_0201	Panasonic Electronic Components
SCRW1,SCRW2,SCRW3,SCRW4	4	NY PMS 440 005 PH	40x.5 inch nylon	NY PMS 440 0050 PH	screw	B&F Fastener
SHNT1,SHNT2,SHNT3,SHNT4,SHNT5,SHNT6,SHNT7,SHNT8	8	60900213421	JUMPER W/TEST PNT 1X2PINS 2.54MM	60900213421	N/A	Würth Elektronik
STDOFF1,STDOFF2,STDOFF3,STDOFF4	4	1902E	1 inch nylon	1902E	Standoff	Keystone
U1	1	TUSB564-Q1	REDRIVER	TUSB564-Q1	RGF0040FBA_370x570	Texas Instruments
U2,U3,U4,U5,U9,U10,U11	7	TPD4E05U06	TVS DIODE 5.5VWM 14VC 10SON	TPD4E05U06DQAR	DQA0010AA_00	Texas Instruments
U6	1	TPS65987DDHRSHR	IC PD CTRL USB TYPE-C	TPS65987DDHRSHR	RSH0056BA_MPAD	Texas Instruments
U7	1	W25Q80	IC FLASH 8MBIT 104MHZ 8SOIC	W25Q80DVSNIQ	SOIC_8_390X490_127	WINBOND
U8	1	TPS7A4533	IC REG LINEAR 3.3V 1.5A SOT223-6	TPS7A4533DCQR	DCQ0006AA_00	Texas Instruments

5 Additional Information

5.1 Trademarks

DisplayPort™ is a trademark of Video Electronics Standards Association.

USB Type-C® is a registered trademark of USB Implementers Forum.

All trademarks are the property of their respective owners.

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・イ

ンスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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- 4 *EVM Use Restrictions and Warnings:*
 - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
 - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
 - 4.3 *Safety-Related Warnings and Restrictions:*
 - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
 - 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
 - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
 5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
 6. *Disclaimers:*
 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
 - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
 7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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