

EVM User's Guide: TPS25762DQ1EVM

TPS25762-Q1 Evaluation Module



Description

The TPS25762DQ1EVM is designed to evaluate the TPS25762-Q1 for USB Type-C® and Power Delivery (PD) applications. This EVM supports single port PD charging and comes with three other variants: single port charging with DisplayPort™ over USB-C® (DP Alt Mode) (TPS25763Q1EVM), dual ports charging only (TPS25772DQ1EVM), and dual ports charging + USB 2.0 (TPS25772Q1EVM-CD-150). The EVM integrates a TIVA microcontroller, enabling online debugging and online EEPROM updates.

Device configuration settings are selected through an intuitive Application Customization Tool in the form of a graphical user interface (TPS257XX-Q1-GUI), reducing much of the complexity associated with competitive USB-PD designs.

Get Started

1. Read this TPS25762Q1EVM user's guide (this document).
2. Start development with the Graphical User Interface (TPS257XX-Q1-GUI).

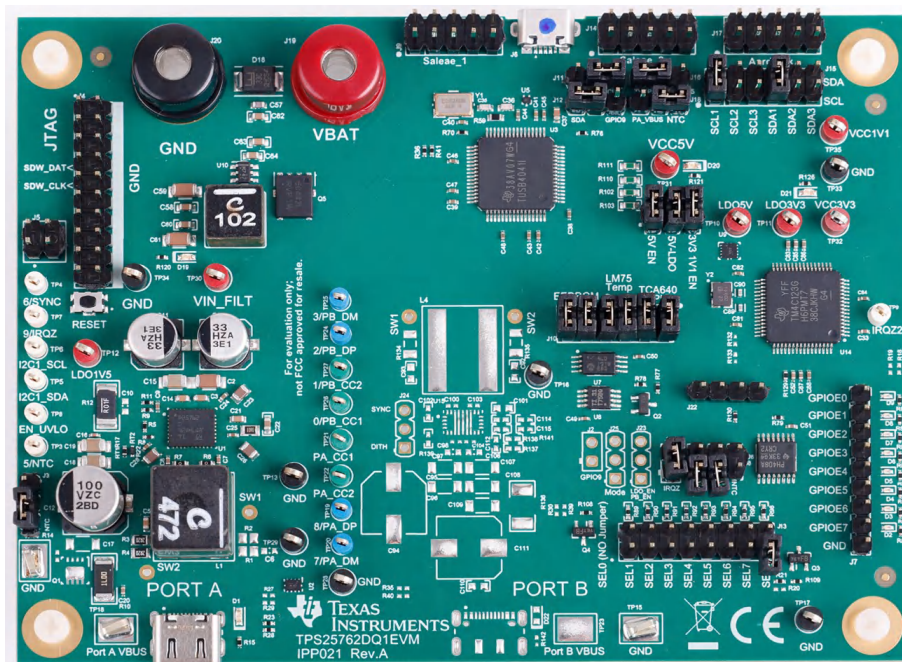
3. Refer to the [TPS25762-Q1 data sheet](#) or [E2E](#) for questions and support.

Features

- TPS25762-Q1: USB-IF certification with PPS, TID: 9509
- Charging up to 65W on Port A
- Easy-to-use GUI with preconfigured firmware to configure device
- VBUS and CCx test points for Type-C port to monitor PD traffic
- MCU for EEPROM programming and system telemetry
- Jumper configuration of all system configurable pins

Applications

- [Automotive USB charge](#)
- [Automotive media hub](#)
- [Automotive head unit](#)
- [Automotive rear seat entertainment](#)



1 Evaluation Module Overview

1.1 Introduction

The TPS25762-Q1 is a USB PD controller that has a 65W capable buck boost converter.

The EVM is customizable through the (TPS257XX-Q1-GUI.). Additionally, the EVM is equipped with Aardvark connector to I2C interfaces and USB Micro-B interface and USB2ANY interface for debugging and development.

This user's guide describes how the TPS25762DQ1EVM can be used to test PD functions. This document includes descriptions of how to use the EVM, contents, schematics, printed circuit board (PCB) layouts, and bill of materials (BOM). Throughout this document the terms evaluation board, evaluation module, and EVM are synonymous with the TPS25762DQ1EVM.

1.2 Kit Contents

The EVM kit contains the (1) TPS25762DQ1EVM.

1.3 Specification

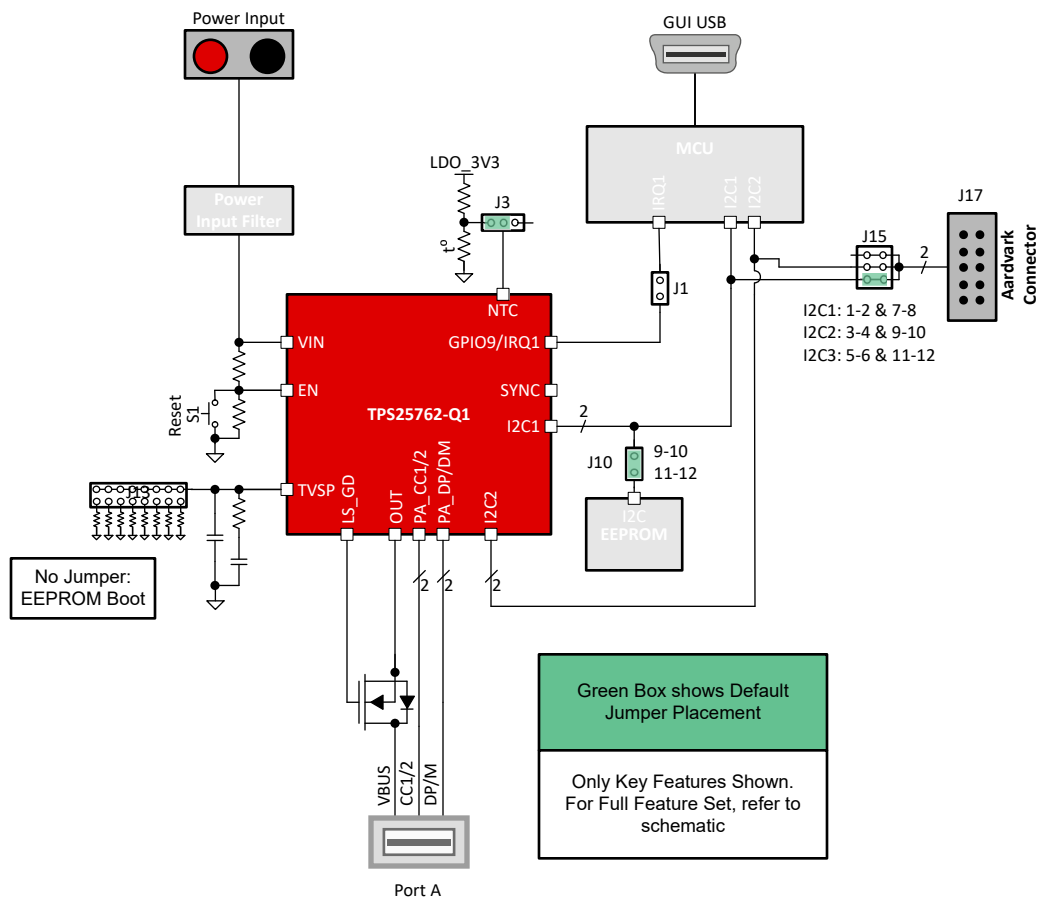


Figure 1-1. Top Level Block Diagram

1.4 Device Information

The TPS25762-Q1 is a single port Type-C controller that has a 65W capable buck boost converter for Port A.

The TPS25762-Q1 implements intelligent System Power Management (SPM) to maximize delivered USB power while protecting the system from automotive battery transient and over-temperature conditions.

2 Hardware

2.1 Connections

Use the following connections to operate EVM successfully:

- Connect 5.5V to 18V DC power supply to the power input banana connectors.
- Connect Micro Type-B USB connector to PC to use GUI to program EEPROM.
- Aardvark Connector to program EEPROM.
- Port A Type-C connector are provided to connect to power delivery or Type-C sink devices or test equipment.

Table 2-1. TPS25762DQ1 EVM Configuration for Basic Operation

Jumper	Connection	Description
J1	Jumper installed	IRQ1 Connected to USB MCU used by GUI
J3	Jumper installed between pins 1-2	NTC pin of the TPS25762-Q1 connected to the EVM PTC
J10	Jumpers installed between pins 9-10 and 11-12	PCB EEPROM connected to the TPS25762-Q1
J13	Jumper not installed	TPS25762-Q1 configured to boot from EEPROM1
J15	Jumpers installed between pins 1-2 and 7-8	I2C1 connected to the Aardvark connector (J17)

2.2 Setup

Items Required for Operation

- [TPS25762-Q1 Automotive USB Type-C® Power Delivery Controller with Buck-Boost Regulator](#) data sheet
- [TPS257XX-Q1-GUI](#)
- 5.5V to 18V DC power supply
- Passive USB Type-C e-marker cable
- UFP emulator for Port A
- USB Type-A to USB Micro-B cable
- Notebook with USB 2.0 capabilities

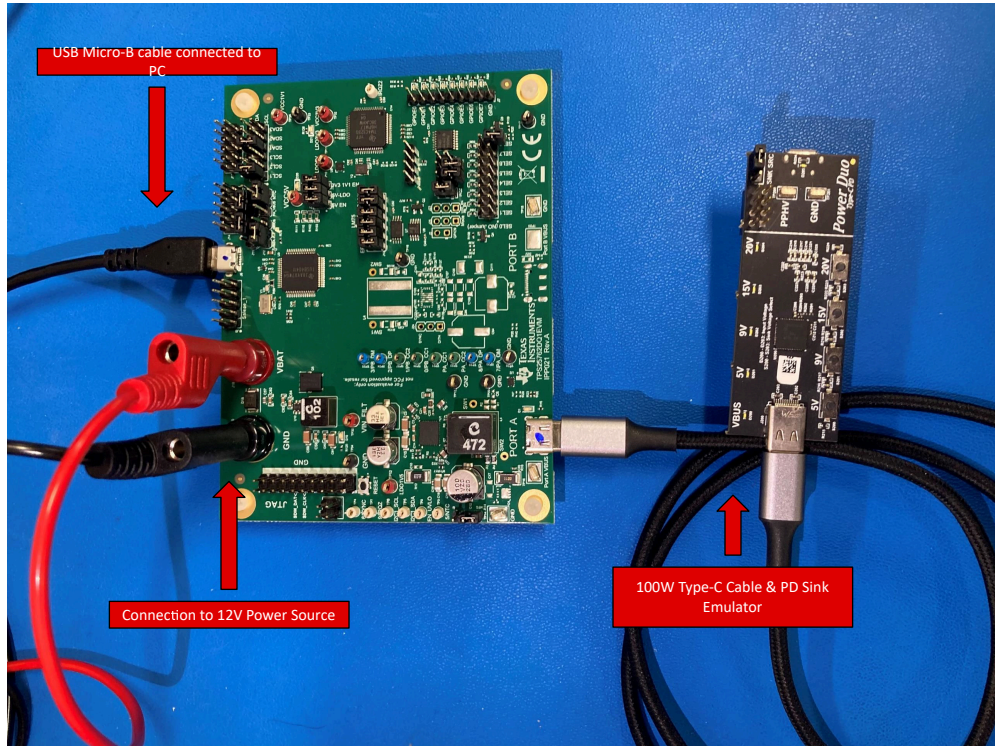


Figure 2-1. EVM Setup

2.3 Header Information

J17 Aardvark Connector

This connector is configured to allow the Total Phase Aardvark to connect directly to the EVM. One or more I2C bus can be connected to the Aardvark connector by connecting jumpers on J15. When making this connection, both the SCL1/2/3 and SDA1/2/3 must be selected by installing the jumper.

- I2C1 is connected to the I2C controller of the TPS25762-Q1
- I2C2 connects to I2C2 of the TPS25762-Q1 (dependent on EVM configuration) and the TIVA MCU
- I2C3 connects to the TIVA MCU

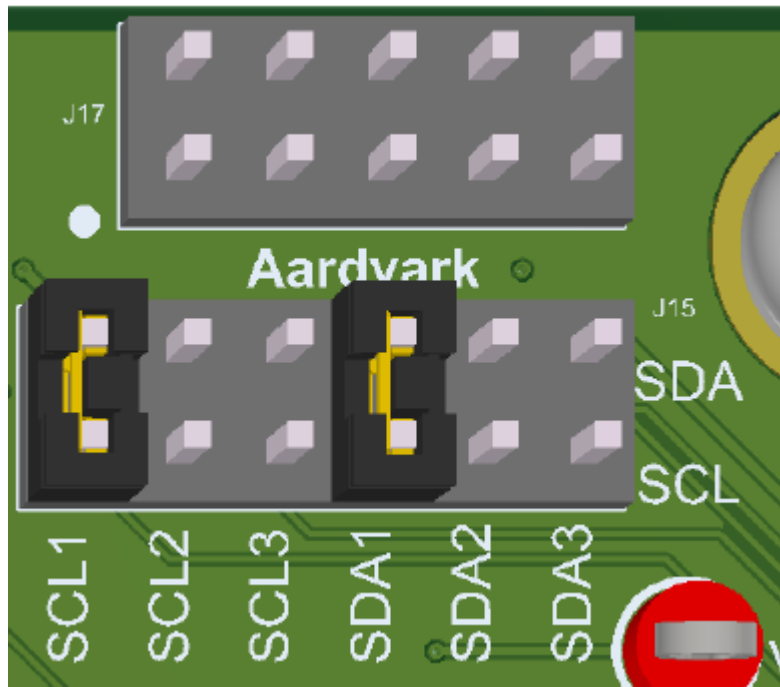


Figure 2-2. J17 Aardvark Connector

Table 2-2. J17 Aardvark Connector and J15 I2C Selection Jumper

Pin Number	Pin or Jumper		Description
1	J15	1:2	I2C_SCL1
		3:4	I2C_SCL2
		5:6	I2C_SCL3
2	GND		Ground Reference
3	J15	7:8	I2C_SDA1
		9:10	I2C_SDA2
		11:12	I2C_SDA3
4	Aard1_5V		5V Supply from the Aardvark connection. Not used on the EVN, but present for potential use in debug
5	No Connection		
6	Aard1_5V		5V Supply from the Aardvark connection. Not used on the EVN, but present for potential use in debug
7	No Connection		
8	No Connection		
9	No Connection		
10	GND		Ground Reference

J9 and J14 Debug Headers

These headers are included to allow the EVM to connect a debug digitizer with a range of 10V.

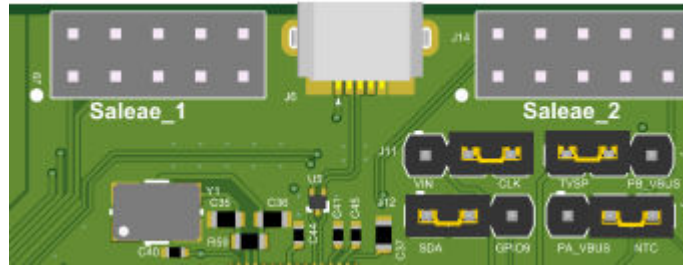


Figure 2-3. Debug Headers

Table 2-3. J9 and J14 Debug Headers

Pin	J9	Description		J14	Description		
1	PA_CC1	Observe Port A CC1		PA_D_P	Observe Port A D_P		
2	PA_CC2	Observe Port A CC2		PA_D_N	Observe Port A D_N		
3	0.4*PA_VBUS	Observe Port A VBUS scaled to 40% of full scape to fit 10V input range of the digitizer		PB_D_P	Observe Port B D_P		
4	PB_CC1	Observe Port B CC1		PB_D_N	Observe Port B D_N		
5	GND			GND	Ground reference		
6	GND			GND	Ground reference		
7	PB_CC2	Observe Port B CC2		NTC or 0.4*PA_VBUS	J18	1:2	Observe Port A VBUS scaled to 40% of full scape to fit 10V input range of the digitizer
						2:3	Observe NTC pin of TPS25762-Q1
8	0.4*PB_VBUS	Observe Port B VBUS scaled to 40% of full scape to fit 10V input range of the digitizer		TVSP or 0.4*PB_VBUS	J16	1:2	Observe TVSP pin of TPS25762-Q1
						2:3	No connection
9	I2C1:SCL1 or VIN/2	J11	1:2	Observe input voltage scaled to 50% to fit input range of the digitizer	VIN_FILT/2	Observe Vin input filter voltage scaled to 50% to fit input range of the digitizer	
			2:3				
10	I2C_SDA1 or GPIO_9	J12	1:2	Observe I2C_SDA1	GPIO_9	Observe GPIO_9	
			2:3				

2.4 Jumper Information

J13 TVSP Jumper

This jumper selects the bootmode and I2C address for the TPS25762-Q1.

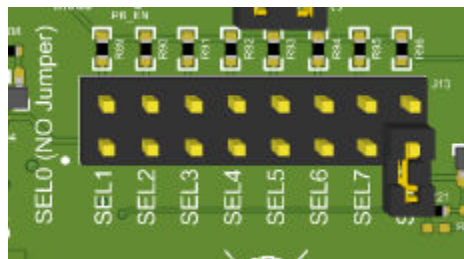


Figure 2-4. J13 TVSP Jumper

See [TPS25762-Q1 Automotive USB Type-C® Power Delivery Controller with Buck-Boost Regulator](#) data sheet for more information.

J21 Power Supply Control

This jumper is used to disable or select power supplies for the board.



Figure 2-5. J21 Power Supply Control

Table 2-4. Power Supply Control

Pins	Label	Description
1-2	5V EN	Enable buck regulator to generate VCC5V
3-4	5V-LDO	Connect LDO_5V to VCC5V
5-6	3V3 1V1EN	Enable the LDO to generate VCC3V3 and VCC1V1 for Hub and MCU

J10 I2C Connection Jumper

This jumper block expands the I2C1 connections of TPS25762-Q1 and can connect to GPIO expander, I2C temperature sensor and EEPROM. Since I2C bus can support multiple targets, TI recommends to connect all pins.

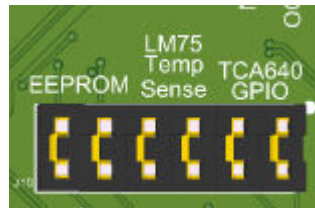


Figure 2-6. J10 I2C Connection Jumper

Table 2-5. J10 I2C Connection Jumper

Pins	Label	Description
1-2 and 3-4	TCA640 GPIO	Connect the I2C1 bus of the TPS25762-Q1 to the TCA640 GPIO expander
4-5 and 7-8	LM75 Temp Sense	Connect the I2C1 bus of the TPS25762-Q1 to LM75 temperature sensor
9-10 and 10-11	EEPROM	Connect the I2C1 bus of the TPS25762-Q1 to the TCA640 EEPROM

J3 NTC Selection Jumper

The J3 header is used to verify the Thermal Foldback function. The NTC pin actually detects the voltage of external NTC circuit and can be connected to thermistor (NTC or PTC) divider or NTC_VAR. NTC_VAR is the output of TPL0102, which is a I2C digital potentiometer. The divider footprints allows the use of either PTC or NTC resistors to match what is used in the system represented. This combinations is used to test the thermal foldback function. The thermistor assembled on the EVM is positive temperature coefficient (PTC).



Figure 2-7. J3 NTC Selection Jumper

Table 2-6. J3 NTC Selection Jumper

Pins	Label	Description
1-2	NTC	Connect NTC resistor to TPS25762-Q1 NTC pin
2-3	NTC VAR	Connect the digital pot to the NTC pin

J8 TMP75B-Q1 Alert Connection Jumper

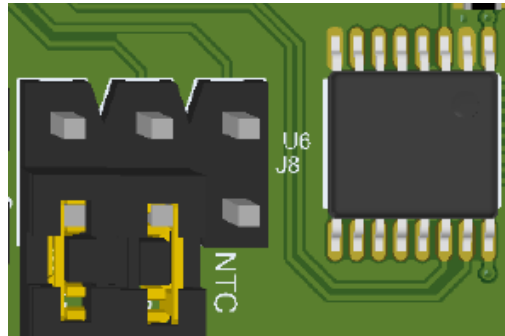


Figure 2-8. J8 TMP75B-Q1 Alert Connection Jumper

Table 2-7. J8 TMP75B-Q1 Alert Connection Jumper

Pins	Label	Description
1-2	IRQ	Connect the active low output of the TMP75B-Q1 pin to the IRQ pin (GPIO9 of the TPS25762-Q1)
3-4	NTC	Connect the active low output of the alert pin of the TMP75B-Q1 to the NTC pin of the TPS25762-Q1
5-6	NTC	Connect the inverted (active high) output of the alert pin of the TMP75B-Q1 to the NTC pin of the TPS25762-Q1

2.5 Push Buttons

The TPS25762-Q1 can be reset using using the RESET momentary button.

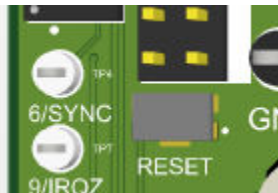


Figure 2-9. Reset Button

3 Software

3.1 Software Description

The TPS25762-Q1 device is configured using the [TPS257XX-Q1-GUI](#). The [TPS257XX-Q1-GUI Configuration Guide](#) describes the features of the GUI and the process to program the resulting configuration into the EEPROM connected to the TPS25762-Q1. See the [TPS257XX-Q1-GUI Configuration Guide](#) for more information.

4 Hardware Design Files

4.1 Schematics

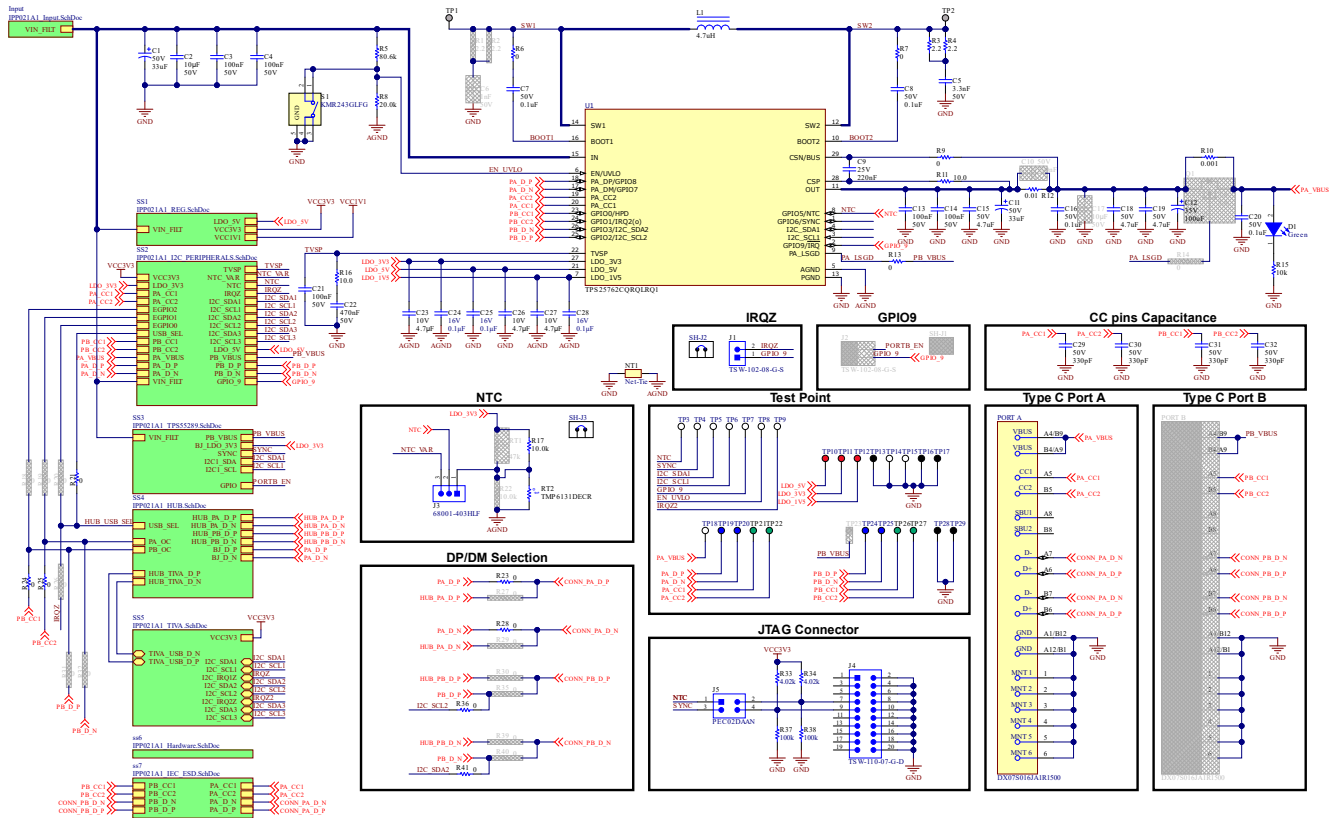


Figure 4-1. Top Level Schematic

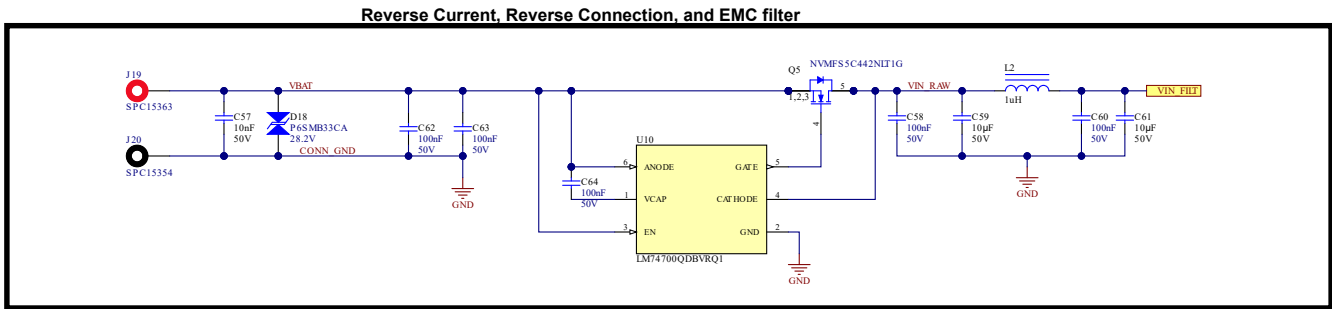


Figure 4-2. Input Filter

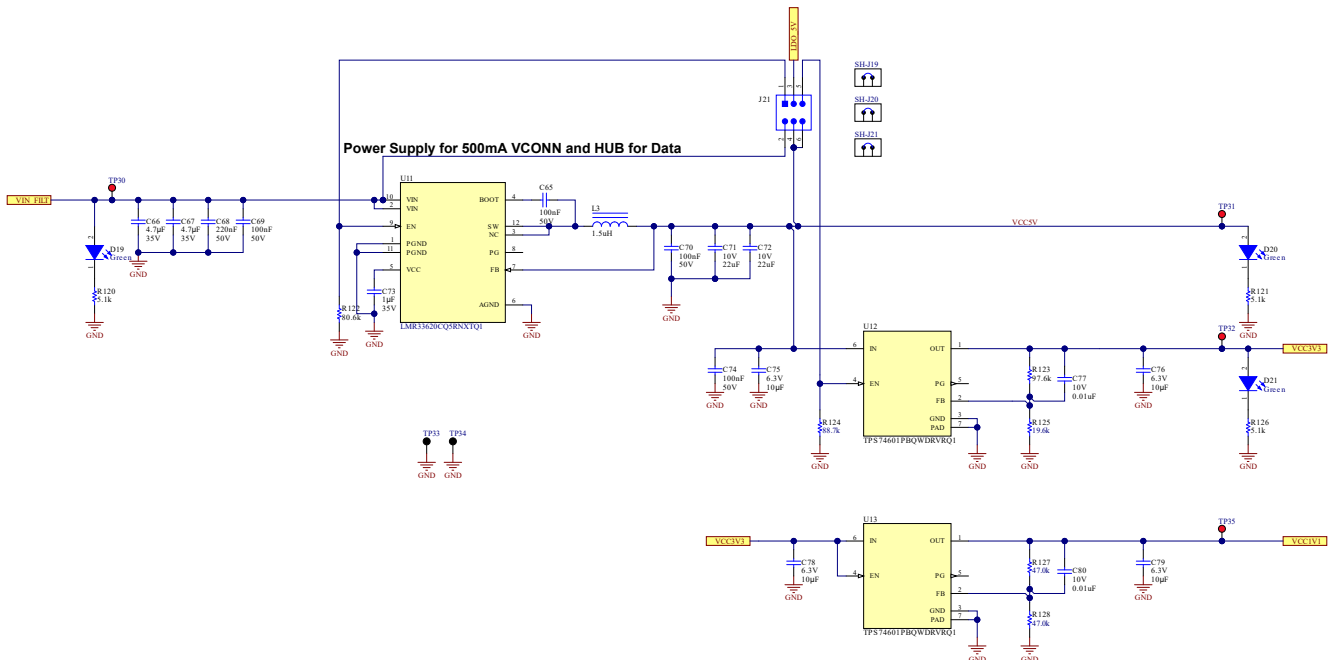


Figure 4-3. Power Regulators

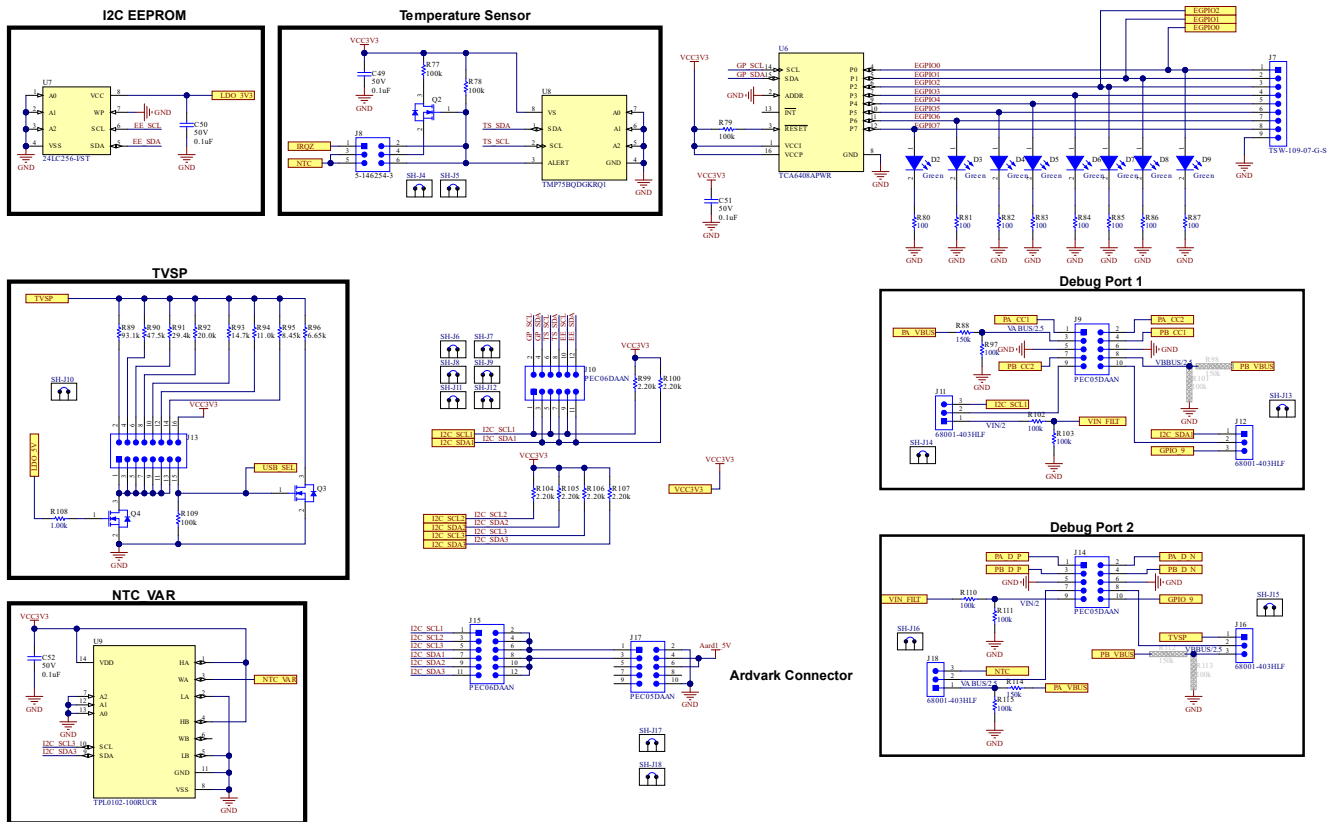


Figure 4-4. Device Support Peripherals

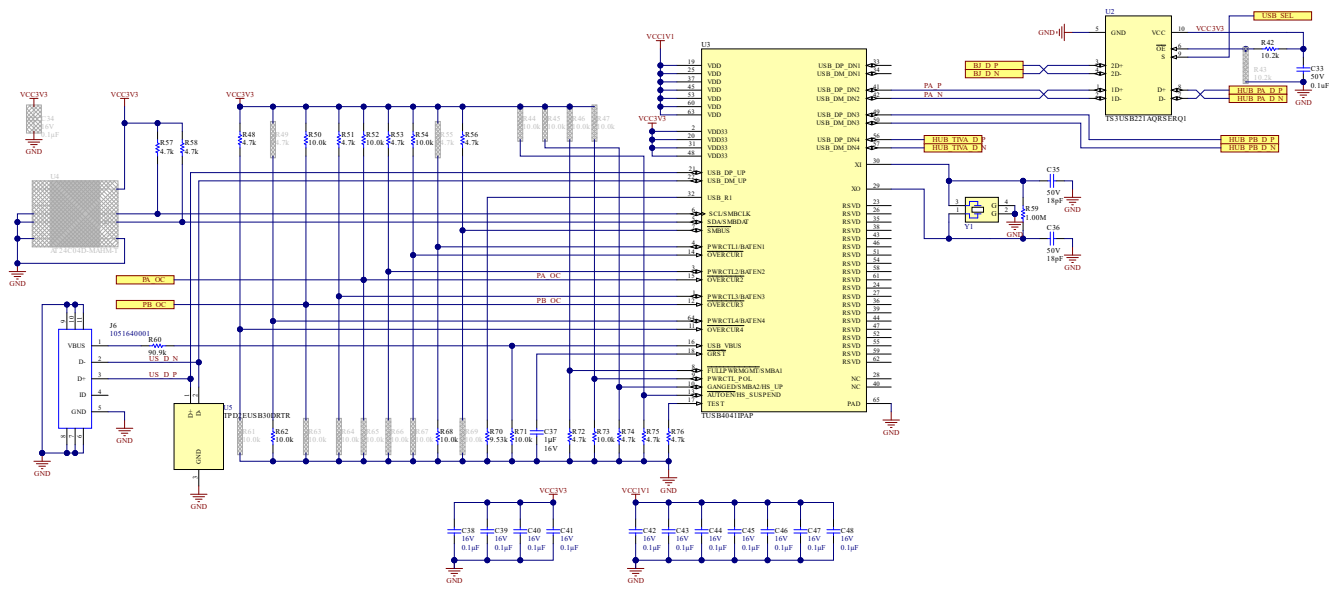


Figure 4-5. USB2.0 HUB

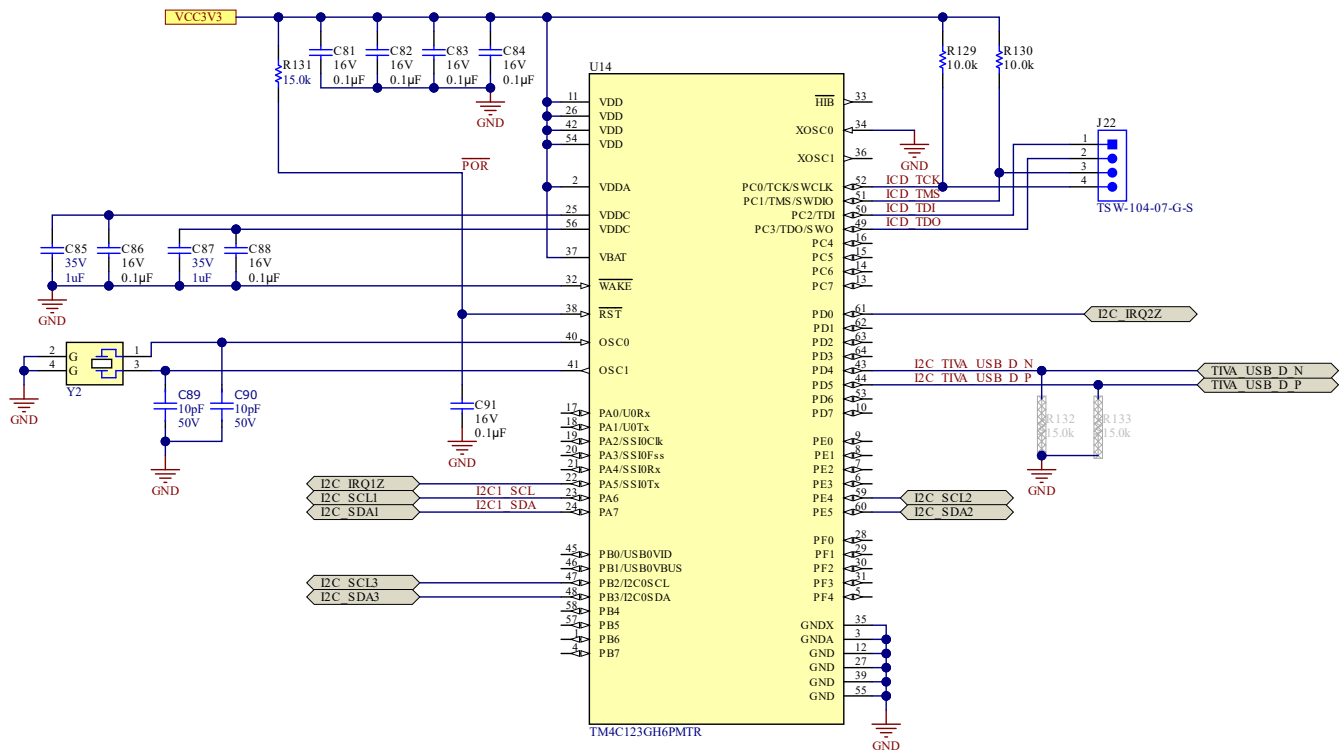


Figure 4-6. USB to I2C MCU

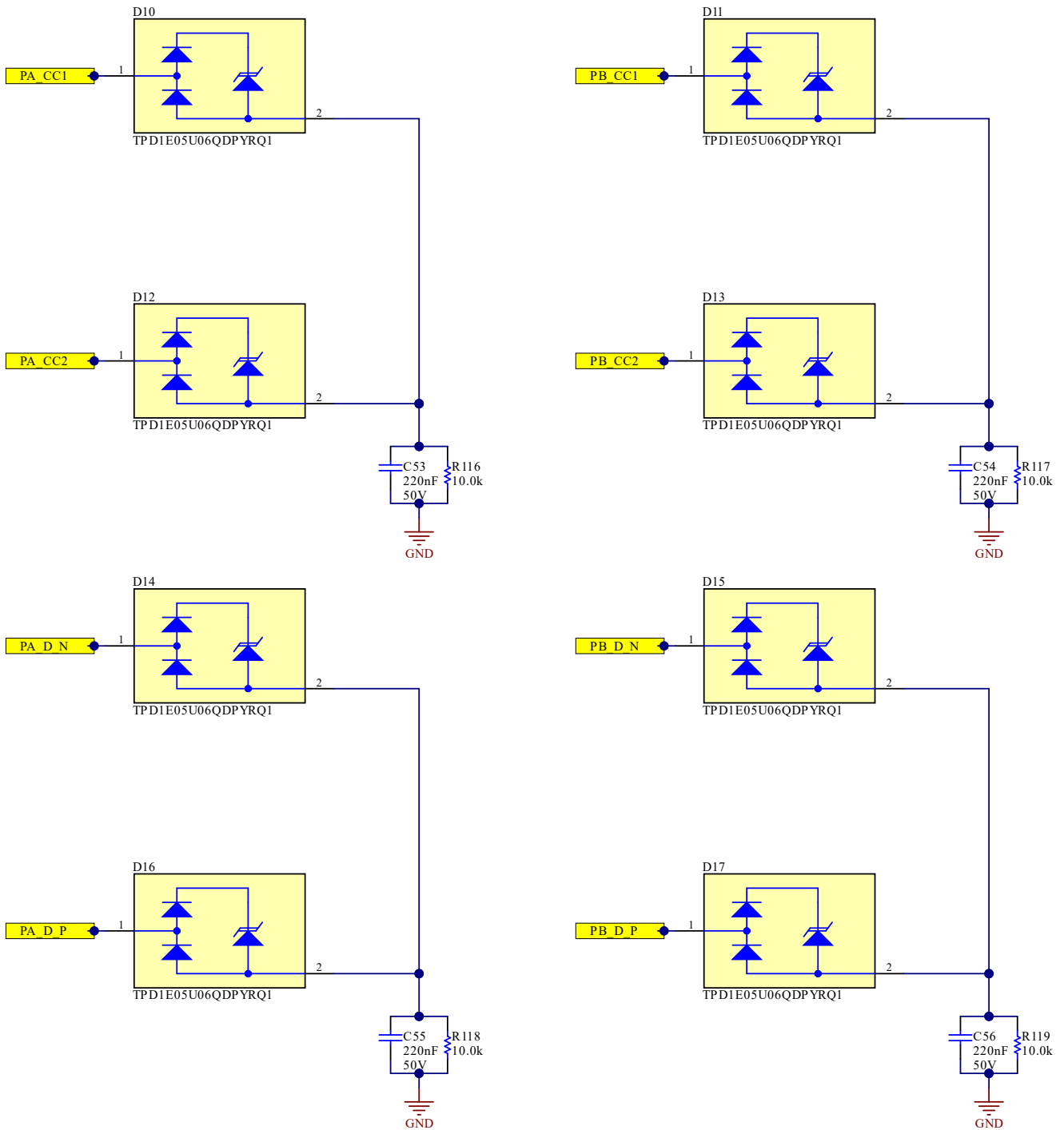


Figure 4-7. IEC ESD Devices

4.2 PCB Layouts

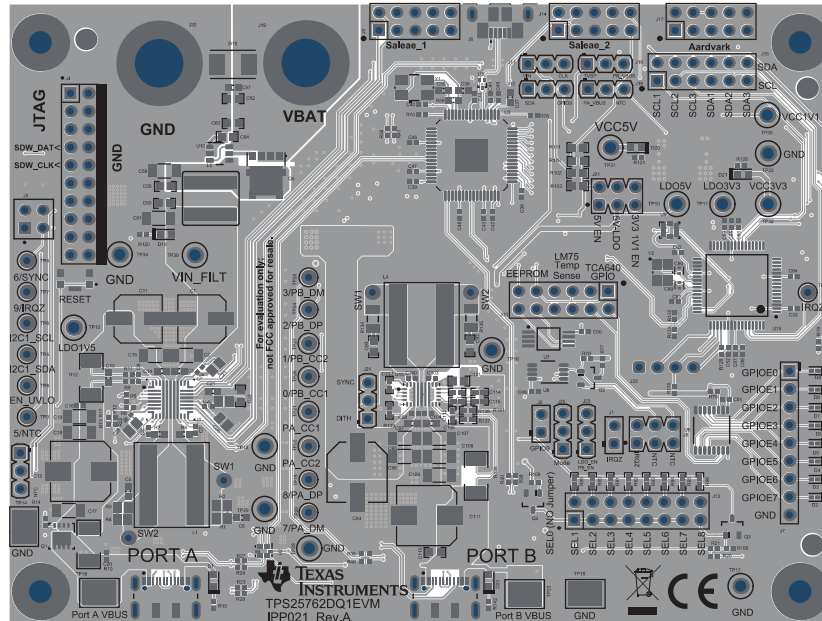


Figure 4-8. TPS25762Q1 EVM Top Composite

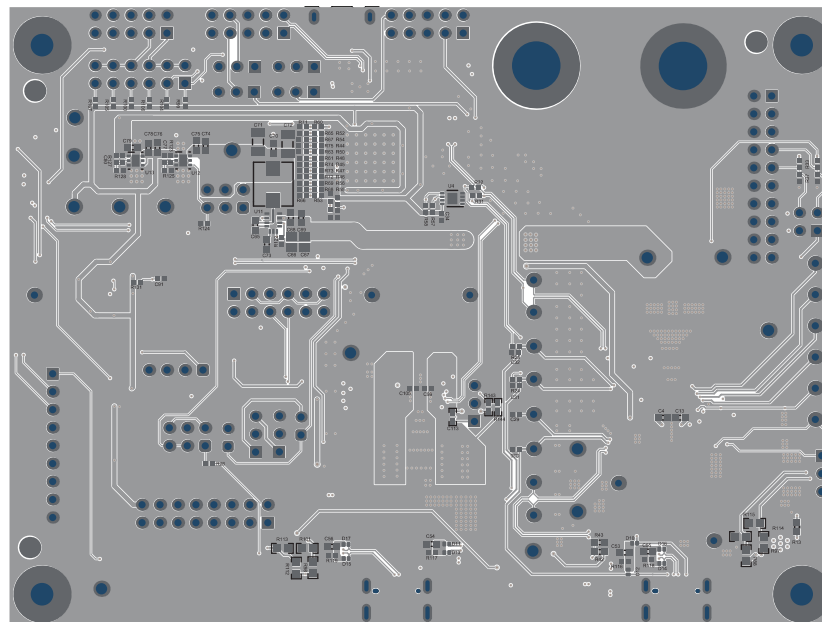


Figure 4-9. TPS25762Q1EVM Bottom Composite

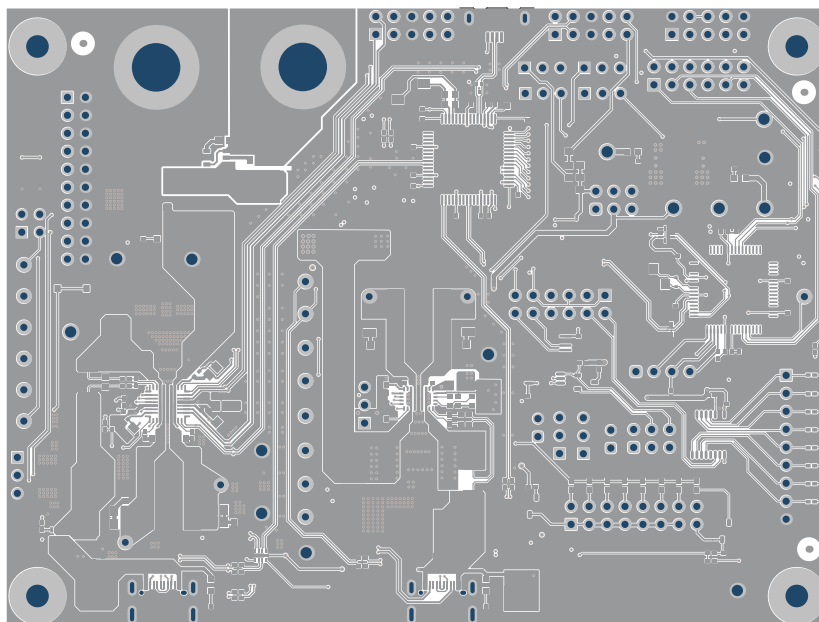


Figure 4-10. TPS25762Q1EVM Top Component (1)

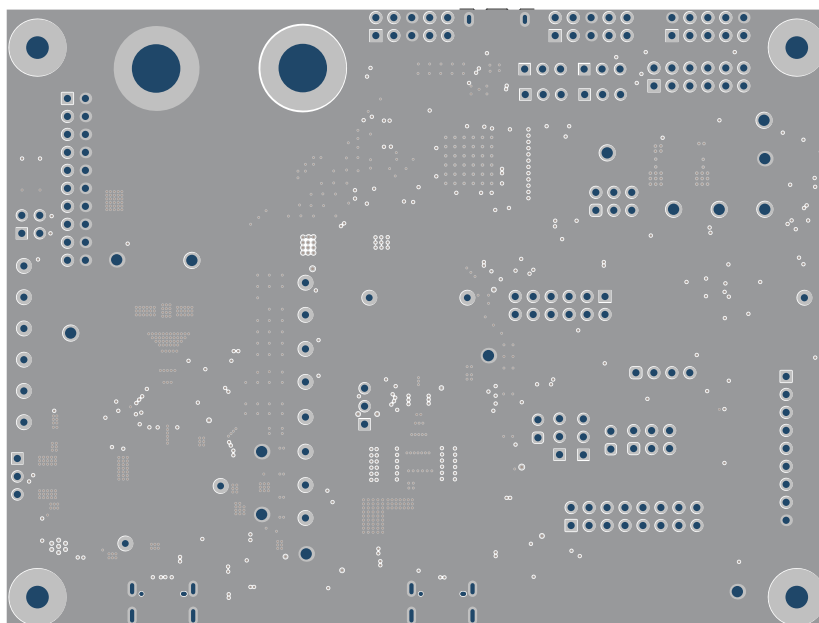


Figure 4-11. TPS25762Q1EVM Signal1 (2)

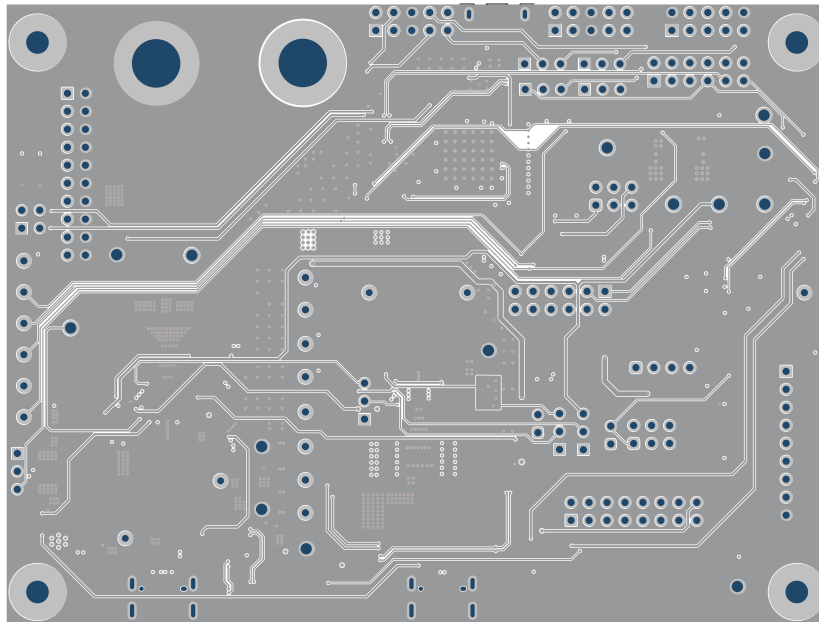


Figure 4-12. TPS25762Q1EVM Signal2 (3)

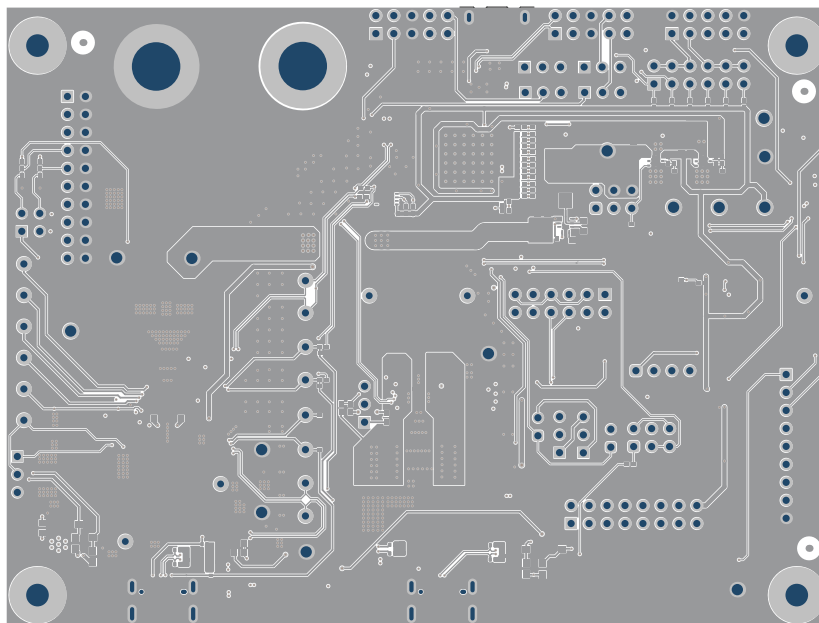


Figure 4-13. TPS25762Q1EVM Bottom Component (4)

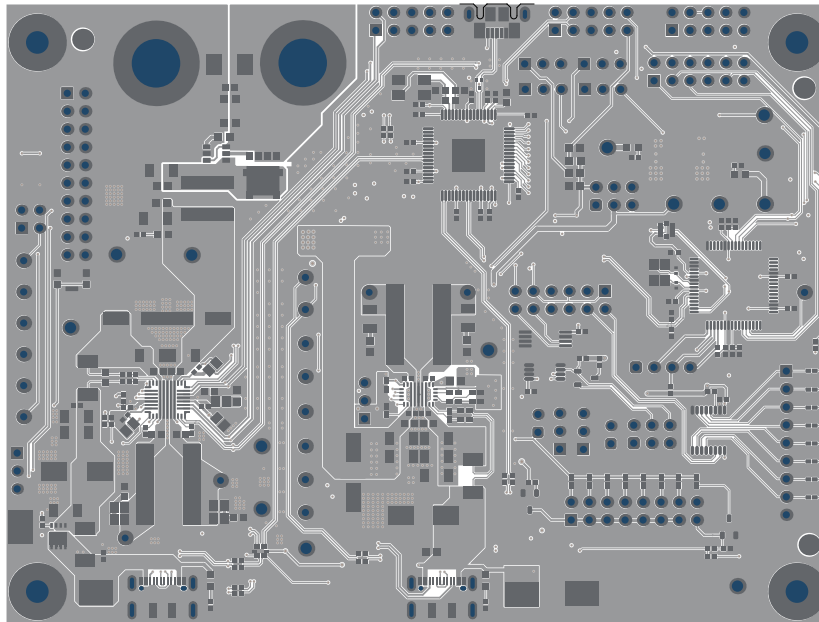


Figure 4-14. TPS25762Q1EVM Top Solder Mask

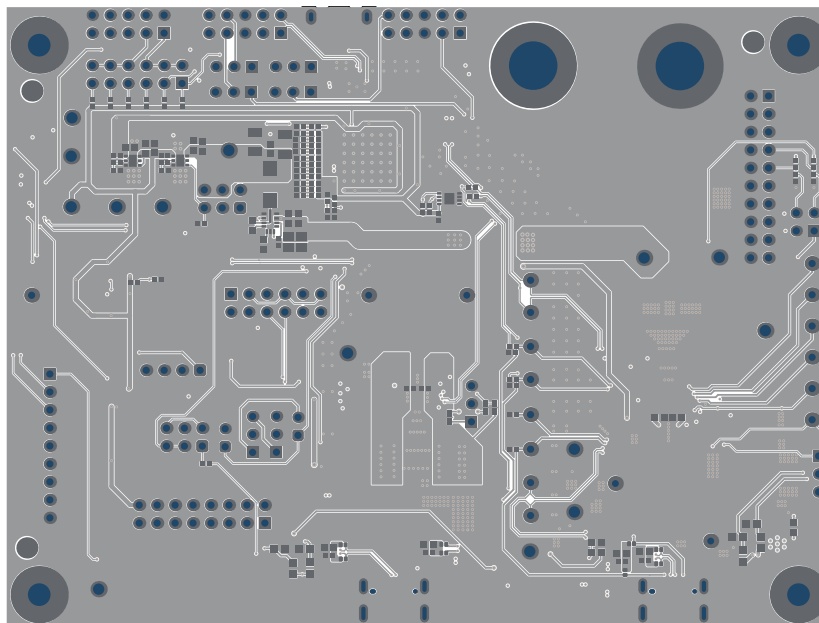


Figure 4-15. TPS25762Q1EVM Bottom Solder Mask

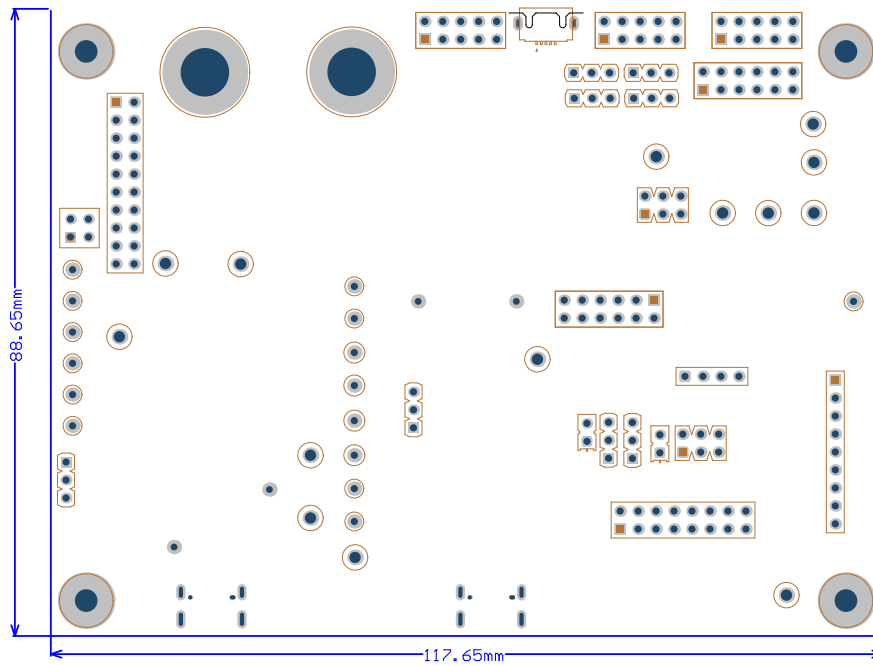


Figure 4-16. TPS25762Q1EVM Board Dimensions

4.3 Bill of Materials (BOM)

Table 4-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		IPP021	Any
C1, C11	2	33uF	CAP, Polymer Hybrid, 33uF, 50V, +/- 20%, 40 ohm, 6.3x7.7 SMD	6.3x7.7	EEH-ZA1H330XP	Panasonic
C2, C59, C61	3	10uF	CAP, CERM, 10uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	CGA5L1X7R1H106K160AC	TDK
C3, C4, C13, C14, C21, C65, C69, C70, C74	9	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	CGA3E2X7R1H104K080AA	TDK
C5	1	3300pF	CAP, CERM, 3300pF, 50V, +/- 10%, X7R, 0603	603	8.85012E+11	Wurth Elektronik
C7, C8, C16, C20, C33, C49, C50, C51, C52	9	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	CGA2B3X7R1H104K050BB	TDK
C9	1	0.22uF	CAP, CERM, 0.22uF, 25V, +/- 20%, X5R, 0402	402	C1005X5R1E224M050BC	TDK
C12	1	100uF	CAP, Polymer Hybrid, 100uF, 35V, +/- 20%, 27 mohm, 8x10 SMD	8x10	EEH-ZC1V101P	Panasonic
C15, C18, C19	3	4.7uF	CAP, CERM, 4.7uF, 50V, +/- 10%, X7R, 1206	1206	C3216X7R1H475K160AC	TDK
C22	1	0.47uF	CAP, CERM, 0.47uF, 50V, +/- 10%, X7R, 0603	603	C1608X7R1H474K080AC	TDK
C23, C26, C27	3	4.7uF	CAP, CERM, 4.7uF, 10V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	805	CGA4J3X7R1A475K125AB	TDK
C24, C25, C28, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C81, C82, C83, C84, C86, C88, C91	21	0.1uF	CAP, CERM, 0.1uF, 16V, +/- 5%, X7R, AEC-Q200 Grade 1, 0402	402	GCM155R71C104JA55D	MuRata
C29, C30, C31, C32	4	330pF	CAP, CERM, 330pF, 50V, +/- 10%, X7R, 0402	402	GRM155R71H331KA01D	MuRata
C35, C36	2	18pF	CAP, CERM, 18pF, 50V, +/- 5%, C0G/NP0, 0603	603	GRM1885C1H180JA01D	MuRata
C37	1	1uF	CAP, CERM, 1uF, 16V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	EMK107B7105KAHT	Taiyo Yuden
C53, C54, C55, C56, C68	5	0.22uF	CAP, CERM, 0.22uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCJ188R71H224KA01D	MuRata
C57	1	0.01uF	CAP, CERM, 0.01uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCM188R71H103KA37D	MuRata
C58, C60, C62, C63, C64	5	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	C0603C104K5RACAUTO	Kemet
C66, C67	2	4.7uF	CAP, CERM, 4.7uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	805	CGA4J1X7R1V475K125AC	TDK

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C71, C72	2	22uF	CAP, CERM, 22uF, 10V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	GCM31CR71A226KE02L	MuRata
C73	1	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	CGA3E1X7R1V105K080AC	TDK
C75, C76, C78, C79	4	10uF	CAP, CERM, 10uF, 6.3V,+/- 20%, X7R, 0603	603	CL10B106MQ8NRNC	Samsung Electro-Mechanics
C77, C80	2	0.01uF	CAP, CERM, 0.01uF, 10V, +/- 10%, X5R, 0402	402	GRM155R61A103KA01D	MuRata
C85, C87	2	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X5R, 0402	402	C1005X5R1V105K050BC	TDK
C89, C90	2	10pF	Cap Ceramic 10pF 50V NP0 0.5pF Pad SMD 0402 +150°C Automotive T/R	402	CGA2B2NP01H100D050BA	TDK Corporation
D1, D19, D20, D21	4	Green	LED, Green, SMD	LED_0603	150060GS75000	Würth Elektronik
D2, D3, D4, D5, D6, D7, D8, D9	8	Green	LED, Green, SMD	402	APHHS1005CGCK	Kingbright
D10, D11, D12, D13, D14, D15, D16, D17	8		Automotive 1-Channel Ultra-Low-Capacitance IEC ESD Protection Diode, DPY0002A (X1SON-2)	DPY0002A	TPD1E05U06QDPYRQ1	Texas Instruments
D18	1	28.2V	Diode, TVS, Bi, 22V, 35.5 Vc, AEC-Q101, SMC	SMB	P6SMB33CA	Littelfuse
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1	1		Header, 2.54mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	TSW-102-08-G-S	Samtec
J3, J11, J12, J16, J18	5		Header, 2.54mm, 3x1, Tin, TH	Header, 2.54mm, 3x1, TH	68001-403HLF	FCI
J4	1		Header, 100mil, 10x2, Gold, TH	10x2 Header	TSW-110-07-G-D	Samtec
J5	1		Header, 100mil, 2x2, Tin, TH	Header, 2x2, 2.54mm, TH	PEC02DAAN	Sullins Connector Solutions
J6	1		Receptacle, USB 2.0, Micro B, 5 Position, R/A, SMT	Receptacle, USB 2.0, Micro B, 5 Pos, 0.65mm Pitch, R/A, SMT	1051640001	Molex
J7	1		Header, 100mil, 9x1, Gold, TH	9x1 Header	TSW-109-07-G-S	Samtec
J8, J21	2		Header, 100mil, 3x2, Tin, TH	Header, 100mil, 3x2, TH	5-146254-3	TE Connectivity
J9, J14, J17	3		Header, 100mil, 5x2, Tin, TH	Header, 5x2, 100mil, Tin	PEC05DAAN	Sullins Connector Solutions
J10, J15	2		Header, 100mil, 6x2, Tin, TH	Header, 6x2, 100mil, Tin	PEC06DAAN	Sullins Connector Solutions
J13	1		Header, 100mil, 8x2, Gold, TH	8x2 Header	TSW-108-07-G-D	Samtec
J19	1		BANANA JACK, SOLDER LUG, RED, TH	Red Insulated Banana Jack	SPC15363	Tenma

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
J20	1		BANANA JACK, SOLDER LUG, BLACK, TH	Black Insulated Banana Jack	SPC15354	Tenma
J22	1		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07-G-S	Samtec
L1	1	4.7uH	Inductor, Shielded, Composite, 4.7uH, 24A, 0.01 ohm, SMD	Inductor, 11.3x10x10mm	XAL1010-472MEB	Coilcraft
L2	1	1uH	Inductor, Shielded, Composite, 1uH, 25A, 0.00255 ohm, SMD	7.2x7x7.5mm	XAL7070-102MEB	Coilcraft
L3	1	1.5uH	Inductor, Shielded, Ferrite, 1.5uH, 6A, 0.025 ohm, SMD	Inductor, 5.7x2.8x5.2mm	SRP5030T-1R5M	Bourns
PORT A	1		CONN RCP USB2.0 TYP C 24P SMD RA	Receptacle, USB 2.0 Type C, R/A, SMT	DX07S016JA1R1500	JAE Electronics
Q2	1	60V	MOSFET, N-CH, 60V, 0.115A, AEC-Q101, SOT-23	SOT-23	2N7002Q-7-F	Diodes Inc.
Q3, Q4	2	60V	MOSFET, N-CH, 60V, 0.24A, SOT-23	SOT-23	2N7002E-T1-E3	Vishay-Siliconix
Q5	1	40V	MOSFET, N-CH, 40V, 27A, AEC-Q101, DFN5 5x6mm	DFN5 5x6mm	NVMFS5C442NLT1G	ON Semiconductor
R3, R4	2	2.2	RES, 2.2, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	805	ERJ-6GEYJ2R2V	Panasonic
R5, R122	2	80.6k	RES, 80.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040280K6FKED	Vishay-Dale
R6, R7, R13	3	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	RMCF0603ZT0R00	Stackpole Electronics Inc
R8	1	20.0k	RES, 20.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040220K0FKED	Vishay-Dale
R9, R21, R23, R24, R25, R28, R36, R41	8	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0ED	Vishay-Dale
R10	1	0.001	RES, 0.001, 1%, 1 W, 2010	2010	PMR50HZPFV1L00	Rohm
R11	1	10	RES, 10.0, 1%, 0.063 W, 0402	402	CRCW040210R0FKED	Vishay-Dale
R12	1	0.01	RES, 0.01, 1%, 1 W, 2010	2010	WSL2010R0100FEA18	Vishay-Dale
R15	1	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ103X	Panasonic
R16	1	10	RES, 10.0, 1%, 0.25 W, 0805	805	RNCP0805FTD10R0	Stackpole Electronics Inc
R17, R50, R52, R54, R62, R68, R71, R73, R116, R117, R118, R119, R129, R130	14	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	AC0402FR-0710KL	Yageo America
R33, R34	2	4.02k	RES, 4.02 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04024K02FKED	Vishay-Dale
R37, R38, R77, R78, R79, R109	6	100k	RES, 100 k, 1%, 0.0625 W, AEC-Q200 Grade 0, 0402	402	AC0402FR-07100KL	Yageo America

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R42	1	10.2k	RES, 10.2 k, 1%, 0.1 W, 0603	603	RC0603FR-0710K2L	Yageo
R48, R51, R53, R56, R57, R58, R72, R74, R75, R76	10	4.7k	RES, 4.7 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04024K70JNED	Vishay-Dale
R59	1	1.00Meg	RES, 1.00M, 1%, 0.1W, AEC-Q200 Grade 0, 0603	603	CRCW06031M00FKEA	Vishay-Dale
R60	1	90.9k	RES, 90.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040290K9FKED	Vishay-Dale
R70	1	9.53k	RES, 9.53 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04029K53FKED	Vishay-Dale
R80, R81, R82, R83, R84, R85, R86, R87	8	100	RES, 100, 1%, 0.063 W, 0402	402	MCR01MZPF1000	Rohm
R88, R114	2	150k	RES, 150 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW0603150KFKEA	Vishay-Dale
R89	1	93.1k	RES, 93.1 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040293K1FKED	Vishay-Dale
R90	1	47.5k	RES, 47.5 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040247K5FKED	Vishay-Dale
R91	1	29.4k	RES, 29.4 k, 1%, 0.063 W, 0402	402	CRCW040229K4FKED	Vishay-Dale
R92	1	20.0k	RES, 20.0 k, 1%, 0.063 W, 0402	402	CRCW040220K0FKED	Vishay-Dale
R93	1	14.7k	RES, 14.7 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040214K7FKED	Vishay-Dale
R94	1	11.0k	RES, 11.0 k, 1%, 0.063 W, 0402	402	CRCW040211K0FKED	Vishay-Dale
R95	1	8.45k	RES, 8.45 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04028K45FKED	Vishay-Dale
R96	1	6.65k	RES, 6.65 k, 1%, 0.063 W, 0402	402	CRCW04026K65FKED	Vishay-Dale
R97, R102, R103, R110, R111, R115	6	100k	RES, 100 k, 0.1%, 0.1 W, AEC-Q200 Grade 1, 0603	603	TNPW0603100KBEEA	Vishay-Dale
R99, R100, R104, R105, R106, R107	6	2.20k	RES, 2.20 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	RMCF0402FT2K20	Stackpole Electronics Inc
R108	1	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	402	MCR01MZPF1001	Rohm
R120, R121, R126	3	5.1k	RES, 5.1 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04025K10JNED	Vishay-Dale
R123	1	97.6k	RES, 97.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040297K6FKED	Vishay-Dale
R124	1	88.7k	RES, 88.7 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040288K7FKED	Vishay-Dale
R125	1	19.6k	RES, 19.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040219K6FKED	Vishay-Dale

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R127, R128	2	47.0k	RES, 47.0 k, 1%, 0.0625 W, 0402	402	RC0402FR-0747KL	Yageo America
R131	1	15.0k	RES, 15.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040215K0FKED	Vishay-Dale
RT2	1		Thermistor, DEC0002A (X1SON-2)	DEC0002A	TMP6131DECR	Texas Instruments
S1	1		Switch, SPST-NO, Off-Mom, 0.01A, 32 VDC, SMD	4.2x2.8mm	KMR243GLFG	C&K Components
SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10, SH-J11, SH-J12, SH-J13, SH-J14, SH-J15, SH-J16, SH-J17, SH-J18, SH-J19, SH-J20, SH-J21	20	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP3, TP4, TP5, TP6, TP7, TP8, TP9	7		Test Point, Miniature, White, TH	White Miniature Test point	5002	Keystone
TP10, TP11, TP12, TP30, TP31, TP32, TP35	7		Test Point, Compact, Red, TH	Red Compact Test point	5005	Keystone
TP13, TP16, TP17, TP28, TP29, TP33, TP34	7		Test Point, Compact, Black, TH	Black Compact Test point	5006	Keystone
TP14, TP15, TP18	3		Test Point, Compact, SMT	Test point_Keystone_Compact	5016	Keystone
TP19, TP20, TP24, TP25	4		Test Point, Miniature, Blue, TH	Blue Miniature Test point	5117	Keystone
TP21, TP22, TP26, TP27	4		Test Point, Miniature, Green, TH	Green Miniature Test point	5116	Keystone
U1	1		Automotive Dual USB Type-C Power Delivery Controller with Buck-Boost Regulator	VQFN-HR29	TPS25762CQRQLRQ1	Texas Instruments
U2	1		Automotive Catalog ESD Protected, High-Speed USB 2.0 (480Mbps) 1:2 Multiplexer / Demultiplexer Switch, 16 ohm RON, 2.5 to 3.3V, -40 to 125 degC, 10-Pin UQFN (RSE), Green (RoHS & no Sb/Br)	RSE0010A	TS3USB221AQRSERQ1	Texas Instruments
U3	1		Four-Port High-Speed 480Mbps USB 2.0 Hub, PAP0064K (HTQFP-64)	PAP0064K	TUSB4041IPAP	Texas Instruments
U5	1		ESD Solution for Super-Speed (6Gbps) USB 3.0 Interface, 2 Channels, -40 to +85 degC, 3-pin SOT (DRT), Green (Rohs & No Sb/Br)	DRT0003A	TPD2EUSB30DRTR	Texas Instruments

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
U6	1		Low-Voltage 8-Bit I2C and SMBus I/O Expander, 1.65 to 5.5V, -40 to 85 degC, 16-pin TSSOP (PW), Green (RoHS & no Sb/Br)	PW0016A	TCA6408APWR	Texas Instruments
U7	1		256K I2C CMOS Serial EEPROM, TSSOP-8	TSSOP-8	24LC256-I/ST	Microchip
U8	1		Automotive Grade, 1.4V-Capable Temperature Sensor with I2C/SMBus Interface in LM75 Pinout, DGK0008A (VSSOP-8)	DGK0008A	TMP75BQDGKRQ1	Texas Instruments
U9	1		256-Taps Dual-Channel Digital Potentiometer With I2C Interface and Nonvolatile Memory, RUC0014A (X2QFN-14)	RUC0014A	TPL0102-100RUCR	Texas Instruments
U10	1		Low Iq Always ON Smart Diode Controller, DBV0006A (SOT-23-6)	DBV0006A	LM74700QDBVRQ1	Texas Instruments
U11	1		Automotive 3.8V to 36V 2A Synchronous Step-Down Voltage Regulator, RNX0012B (VQFN-HR-12)	RNX0012B	LMR33620CQ5RNXTQ1	Texas Instruments
U12, U13	2		1A LDO With Power-Good, DRV0006A (WSON-6)	DRV0006A	TPS74601PBQWDRVRQ1	Texas Instruments
U14	1		Tiva C Series Microcontroller, 256 KB Flash, 32 KB SRAM, 12 Bit, 12 Channels, -40 to 105 degC, 64-Pin LQFP (PM), Green (RoHS & no Sb/Br), Tape and Reel	PM0064A	TM4C123GH6PMTR	Texas Instruments
Y1	1		Crystal, 24MHz, 30ppm, 20pF, SMD	5x3.2mm	ECS-240-20-30B-AEN-TR	ECS Inc.
Y2	1		Crystal, 16MHz, 8pF, SMD	3.2x0.75x2.5mm	NX3225GA-16.000M-STD-CRG-1	NDK
C6	0	1000pF	CAP, CERM, 1000pF, 50V, +/- 10%, X7R, 0603	603	GRM188R71H102KA01D	MuRata
C10	0	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	CGA3E2X7R1H104K080AA	TDK
C17, C95, C96, C107, C108, C109	0	10uF	CAP, CERM, 10uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	CGA5L1X7R1H106K160AC	TDK
C34	0	0.1uF	CAP, CERM, 0.1uF, 16V, +/- 5%, X7R, AEC-Q200 Grade 1, 0402	402	GCM155R71C104JA55D	MuRata
C92, C93	0	2200pF	CAP, CERM, 2200pF, 50V, +/- 10%, X7R, 0603	603	GRM188R71H222KA01D	MuRata
C94	0	68uF	CAP, Aluminum Polymer, 68uF, 50V, +/- 20%, 0.03 ohm, AEC-Q200 Grade 2, D8xL10.2mm SMD	D8xL10.2mm	EEH-ZA1H680P	Panasonic
C97, C106, C110	0	1uF	CAP, CERM, 1uF, 50V, +/- 20%, X5R, AEC-Q200 Grade 3, 0603	603	GRT188R61H105ME13D	MuRata
C98, C99	0	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 20%, X7R, 0402	402	GRM155R71H104ME14D	MuRata

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C100, C102, C103, C104, C105, C112	0	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	CGA2B3X7R1H104K050BB	TDK
C101	0	4.7uF	CAP, CERM, 4.7uF, 16V, +/- 10%, X5R, AEC-Q200 Grade 3, 0603	603	GRT188R61C475KE13D	MuRata
C111	0	100uF	CAP, Polymer Hybrid, 100uF, 35V, +/- 20%, 27 mohm, 8x10 SMD	8x10	EEH-ZC1V101P	Panasonic
C113	0	0.01uF	CAP, CERM, 0.01uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	CGA2B3X7R1H103K050BB	TDK
C114	0	100pF	CAP, CERM, 100pF, 50V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0402	402	CGA2B2C0G1H101J050BA	TDK
C115	0	4700pF	CAP, CERM, 4700pF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	CGA2B2X7R1H472K050BA	TDK
D22	0	Green	LED, Green, SMD	LED_0603	150060GS75000	Würth Elektronik
J2	0		Header, 2.54mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	TSW-102-08-G-S	Samtec
J23, J24, J25	0		Header, 2.54mm, 3x1, Tin, TH	Header, 2.54mm, 3x1, TH	68001-403HLF	FCI
L4	0	4.7uH	Inductor, Shielded, Composite, 4.7uH, 24A, 0.01 ohm, SMD	Inductor, 11.3x10x10mm	XAL1010-472MEB	Coilcraft
PORT B	0		CONN RCP USB2.0 TYP C 24P SMD RA	Receptacle, USB 2.0 Type C, R/A, SMT	DX07S016JA1R1500	JAE Electronics
Q1	0	30V	MOSFET, N-CH, 30V, 60A, DQG0008A (VSON-CLIP-8)	DQG0008A	CSD17575Q3	Texas Instruments
R1, R2	0	2.2	RES, 2.2, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	805	ERJ-6GEYJ2R2V	Panasonic
R14	0	0	RES, 0, 5%, 0.063 W, 0402	402	RC0402JR-070RL	Yageo America
R18, R19, R20, R26, R27, R29, R30, R31, R32, R35, R39, R40	0	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0ED	Vishay-Dale
R22, R44, R45, R46, R47, R61, R63, R64, R65, R66, R67, R69	0	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	AC0402FR-0710KL	Yageo America
R43	0	10.2k	RES, 10.2 k, 1%, 0.1 W, 0603	603	RC0603FR-0710K2L	Yageo
R49, R55	0	4.7k	RES, 4.7 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04024K70JNED	Vishay-Dale
R98, R112	0	150k	RES, 150 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	603	CRCW0603150KFKEA	Vishay-Dale
R101, R113	0	100k	RES, 100 k, 0.1%, 0.1 W, AEC-Q200 Grade 1, 0603	603	TNPW0603100KBEEA	Vishay-Dale
R132, R133	0	15.0k	RES, 15.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040215K0FKED	Vishay-Dale

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R134, R135	0	2.2	RES, 2.20, 1%, 0.25 W, AEC-Q200 Grade 0, 1206	1206	ERJ-8RQF2R2V	Panasonic
R136	0	0.01	RES, 0.01, 1%, 1 W, 2010	2010	WSL2010R0100FEA18	Vishay-Dale
R137, R138	0	10	RES, 10.0, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040210R0FKED	Vishay-Dale
R139	0	49.9k	RES, 49.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040249K9FKED	Vishay-Dale
R140	0	150k	RES, 150 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402150KFKED	Vishay-Dale
R141	0	27.4k	RES, 27.4 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040227K4FKED	Vishay-Dale
R142	0	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ103X	Panasonic
R143	0	115k	RES, 115 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402115KFKED	Vishay-Dale
R144	0	147k	RES, 147 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402147KFKED	Vishay-Dale
RT1	0	47k	Thermistor NTC, 47k ohm, 5%, 0402	402	NCP15WL473J03RC	MuRata
SH-J1, SH-J22, SH-J23	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP23	0		Test Point, Compact, SMT	Test point_Keystone_Compact	5016	Keystone
U4	0		EEPROM 4KBIT 1MHZ,8UDFN	UDFN-8	AT24C04D-MAHM-T	Atmel
U15	0		36V, 8A Buck-boost Converter with I2C Interface	VQFN21	TPS55289QWRYQRQ1	Texas Instruments

5 Additional Information

5.1 Trademarks

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6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (August 2024) to Revision A (September 2024)	Page
• Updated release status from private to public.....	1
• Updated GPN to complete number TMP75B-Q1 in Table 2-7	5

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