EVM User's Guide: TPS25763Q1EVM

TPS25763-Q1 Evaluation Module

Description

The TPS25763Q1EVM is designed to evaluate the TPS25763-Q1 for USB Type-C® and Power Delivery (PD) applications. This EVM supports single port PD charging with DisplayPort™ over USB-C® (DP Alt Mode) and comes with three other variants: single port charging only (TPS25762DQ1EVM), dual ports charging only (TPS25772DQ1EVM), and dual ports charging and 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

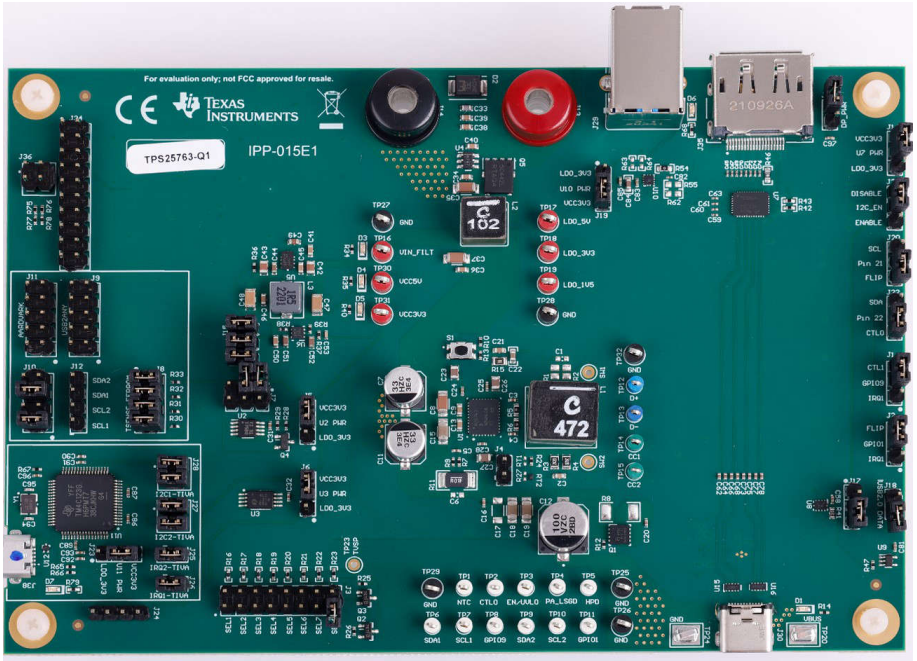
1. Read the TPS25763Q1EVM user's guide (this document).
2. Start development with the Graphical User Interface (TPS257XX-Q1-GUI).
3. Refer to the TPS25763-Q1 data sheet or E2E for questions and support.

Features

- Charging up to 65W
- Easy-to-use GUI with pre-configured firmware to configure device
- VBUS and CCx test points for Type-C port to monitor PD traffic
- MCU for EEPROM programming and system telemetry
- USB1064 USB Type-C DP Alt Mode 10Gbps redriver crosspoint switch
- Jumper configuration of all system configurable pins

Applications

- Automotive USB charging
- Automotive media hub
- Automotive head unit
- Automotive rear seat entertainment



1 Evaluation Module Overview

1.1 Introduction

The TPS25763-Q1 is a USB PD controller that has a 65W capable buck boost converter. The TPS25763-Q1 can interface with TUSB1064 as demonstrated with the TPS25763Q1EVM for DP alt mode sink side functionality.

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 TPS25763Q1EVM can be used to test PD functions as well as USB data and DP alt mode. 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 TPS25763Q1EVM.

1.2 Kit Contents

The EVM kit contains (1) TPS25763Q1EVM.

1.3 Specification

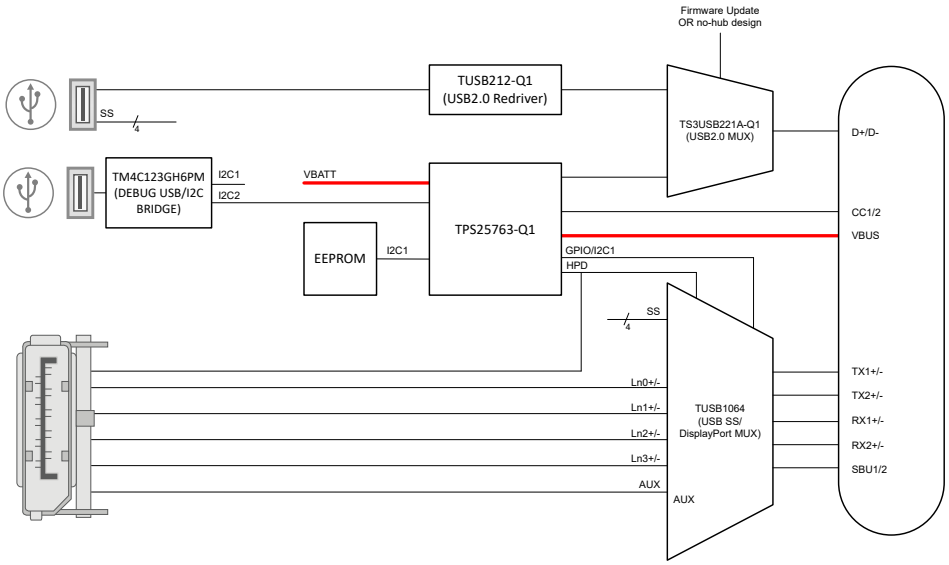


Figure 1-1. EVM Block Diagram

1.4 Device Information

The TPS25763-Q1 is a fully integrated USB Type-C Power Delivery (PD) design with integrated buck-boost converter and DP alt mode for automotive single USB port applications.

The TPS25763-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 EVM Connections

Connections to achieve EVM operation

- 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.
- Connect DisplayPort connector J35 to DP capable monitor.
- Connect USB3.0 connector J29 to PC USB3.0 (or greater) port.
- Interface to Aardvark connector to program EEPROM.
- Type-C connector is provided to connect to Power Delivery or Type-C sink devices or test equipment.

Table 2-1. TPS25763Q1 EVM Configuration for Basic Operation

Jumper	Connection	Description
J1	Jumper installed	IRQ1 connected to USB MCU used by GUI
J28	Install all rows	Connects MCU to I2C1 bus
J27	Install all rows	Connects MCU to I2C2 bus
J10	Install rows 2, 4 (pins 1:2, 5:6)	Connects Aardvark I2C to I2C1 bus
J3	Not installed	TPS25763-Q1 boots from EEPROM
J4	Installed	TPS25763-Q1 NTC pin connected to external PTC/resistor divider
J8	Install rows 3, 4 (pins 5:6, 7:8)	EEPROM connected to I2C1 bus
J23, J5, J6, J19, J16	VCC3V3	Peripheral circuits powered by external LDO
J17	Connect pins 2:3	U8 T3USB221A-Q1 MUX powered by external LDO
J15	Install all rows	Enables external LDOs, TPS25763-Q1 LDO_5V powered from external LDO (VCC5V)
J41	Installed	DP_PWR connected to VCC3V3
J21	Pins 2:3 (DISABLE)	Disables TUSB1064 I2C function. Controlled by TPS25763-Q1 GPIO
J20	Pins 1:2 (FLIP)	Connects TUSB1064 pin 21 to TPS25763-Q1 GPIO FLIP output
J22	Pins 1:2 (CTL0)	Connects TUSB1064 pin 22 to TPS25763-Q1 GPIO CLT0 output
J1	Pins 2:3 (CTL1)	Configures TPS25763-Q1 GPIO9 as CTL1 signal to TUSB1064
J2	Pins 2:3 (FLIP)	Configures TPS25763-Q1 GPIO1 as FLIP signal to TUSB1064

2.2 Setup

Items Required for Operation:

- TPS25763-Q1 Automotive Single USB Type-C Alternate Mode Power Delivery Controller with Buck-Boost Regulator data sheet
- TPS25763Q1EVM
- TPS257XX-Q1-GUI
- 5.5V to 18V, +70W DC power supply
- USB 3.x USB-C cable
- DisplayPort to DisplayPort cable
- USB Type-A to USB micro-B cable
- Notebook with USB 2.0 capabilities
- DisplayPort capable monitor

2.3 Header Information

J11 & J9 I2C Connectors

These connectors are configured to allow the Total Phase Aardvark or USB2ANY to connect directly to the EVM. One or more I2C bus can be connected to these connectors by connecting jumpers on J10. When making this connection, both the SCL1/2 and SDA1/2 must be selected by installing the jumper.

- I2C1 is connected to the I2C controller of TPS25763-Q1 and the TIVA MCU
- I2C2 is connected to I2C2 of the TPS25763-Q1 (dependent on EVM configuration) and the TIVA MCU

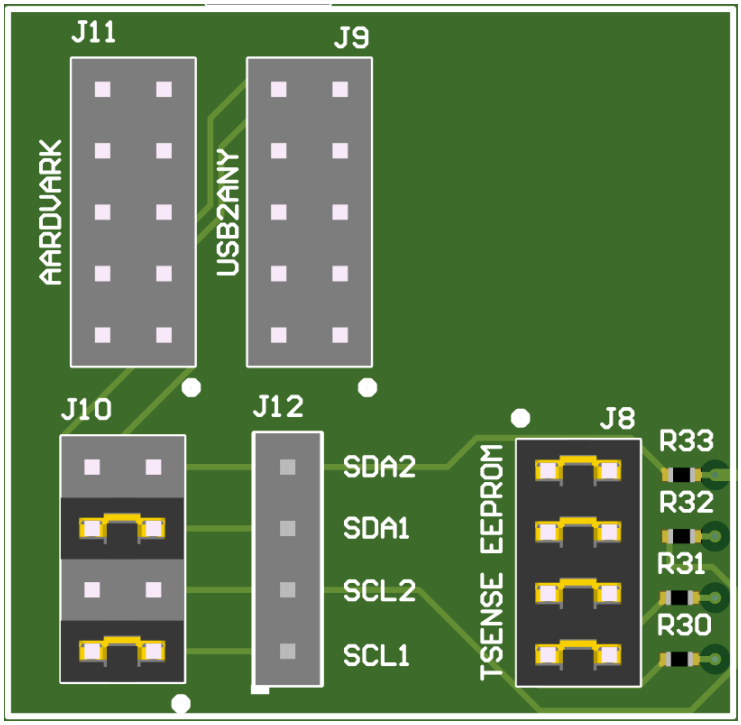


Figure 2-1. J11 Aardvark Connector, J9 USB2ANY Connector

Table 2-2. J11 Aardvark Connector

Pin Number	Pin/Jumper			Description
1	J10	1:2	I2C_SCL1	Select between the 2 possible I2C connections on the EVM. I2C1 is connected to the I2C controller of TPS25763-Q1. I2C2 is connected to the I2C target of TPS25763-Q1 (dependent on EVM configuration).
		3:4	I2C_SCL2	
2	GND			Ground reference.
3	J10	5:6	I2C_SDA1	Select between the 2 possible I2C connections on the EVM. I2C1 is connected to the I2C controller of TPS25763-Q1. I2C2 is connected to the I2C target of TPS25763-Q1 (dependent on EVM configuration).
		7:8	I2C_SDA2	
4	Aard1_5V			5V supply from the Aardvark connection. Not used on the EVM, but present for potential use in debug.
5	No Connection			
6	Aard1_5V			5V supply from the Aardvark connection. Not used on the EVM, but present for potential use in debug.
7	No connection			
8	No connection			
9	No connection			
10	GND			Ground reference.

Table 2-3. J9 USB2ANY Connector

Pin Number	Pin/Jumper			Description
1	No connection			
2	No connection			
3	No connection			
4	No connection			
5	No connection			
6	GND			
7	No connection			
8	No connection			
9	J10	1:2	I2C_SCL1	Select between the 2 possible I2C connections on the EVM. I2C1 is connected to the I2C controller of TPS25763-Q1. I2C2 is connected to the I2C target of TPS25763-Q1 (dependent on EVM configuration).
		3:4	I2C_SCL2	
10	J10	5:6	I2C_SDA1	Select between the 2 possible I2C connections on the EVM. I2C1 is connected to the I2C controller of TPS25763-Q1. I2C2 is connected to the I2C target of TPS25763-Q1 (dependent on EVM configuration).
		7:8	I2C_SDA2	

2.4 Jumper Information

J3 TVSP Jumper

This jumper selects the boot mode and I2C address for TPS25763-Q1.

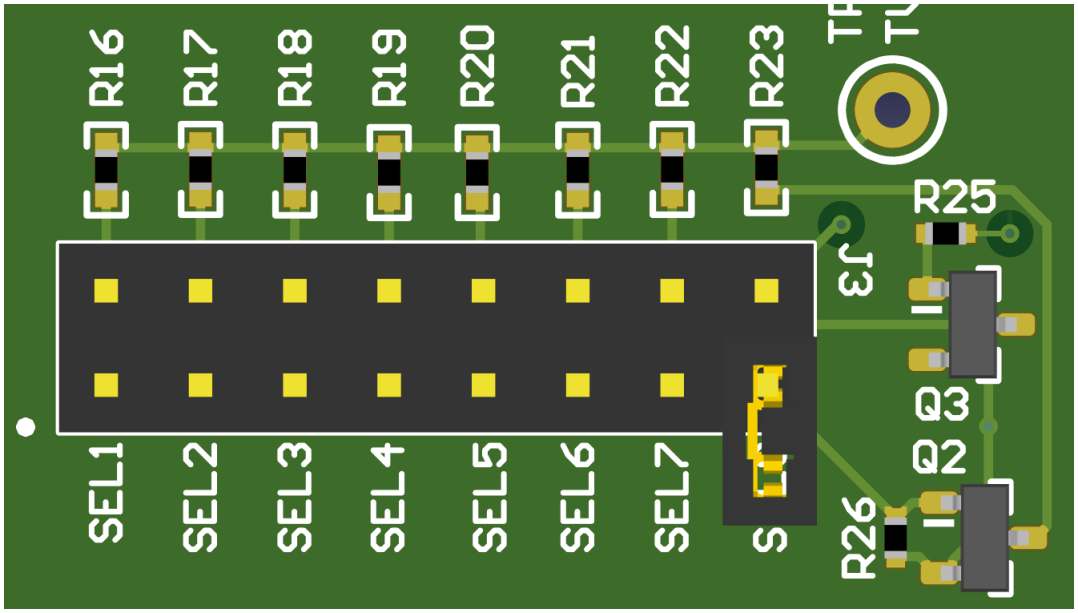


Figure 2-2. J3 TVSP Jumper

See the R_{TVSP} *Configuration Settings* table in the TPS25763-Q1 Automotive Single USB Type-C Alternate Mode Power Delivery Controller with Buck-Boost Regulator data sheet for selection description.

Table 2-4. TVSP Selection

Pins	Name	Description
Open	SEL0	EEPROM boot. I2C address 0x22. 3.3V logic
1:2	SEL1	MCU boot. I2C address 0x23. 3.3V logic
3:4	SEL2	EEPROM boot. I2C address 0x22. 1.8V logic
5:6	SEL3	MCU boot. I2C address 0x23. 1.8V logic
7:8	SEL4	EEPROM boot. I2C address 0x23. 3.3V logic
9:10	SEL5	MCU boot. I2C address 0x22. 3.3V logic
11:12	SEL6	EEPROM boot. I2C address 0x23. 1.8V logic
13:14	SEL7	MCU boot. I2C address 0x22. 1.8V logic
15:16	SEL8	Firmware update mode

J15 Power Supply Control

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

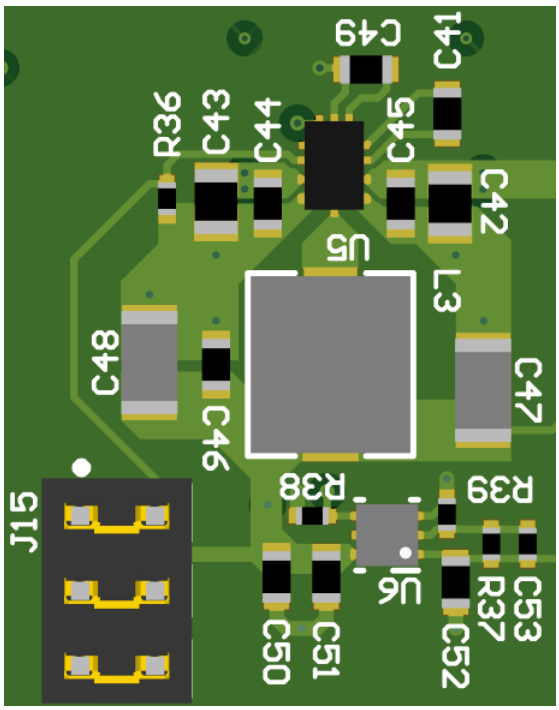


Figure 2-3. J15 Power Supply Control

Table 2-5. J15 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 MCU

J8 I2C Connection Jumper

This jumper block expands the I2C1 connections of TPS2573DQ1. The jumper can connect to the I2C temperature sensor and EEPROM. Since I2C bus can support multiple targets, TI recommends to connect all pins.

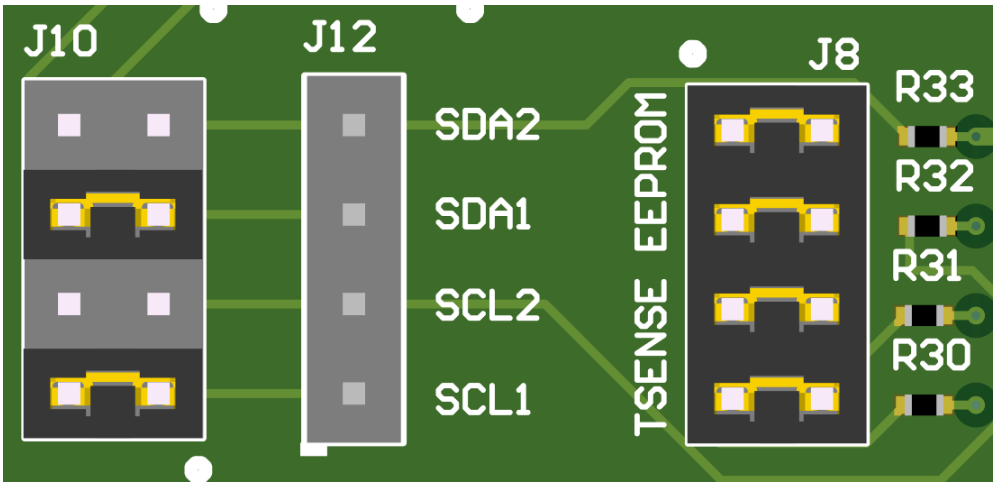


Figure 2-4. J8 I2C Connection Jumper

Table 2-6. J8 I2C Connection Jumper

Pins	Label	Description
1-2 and 3-4	LM75 Temp Sense	Connect the I2C1 bus of TPS25763-Q1 to LM75 temperature sensor
4-5 and 7-8	EEPROM	Connect the I2C1 bus of TPS25763-Q1 to the on board EEPROM

J4 NTC Selection Jumper

The J4 header is used to verify the Thermal Foldback function. The NTC pin detects the voltage of an external NTC circuit. The pin can be connected to a thermistor (NTC or PTC) divider or users can directly apply an external voltage to NTC contact pin without any jumper. The thermistor assembled on the EVM is positive temperature coefficient (PTC).

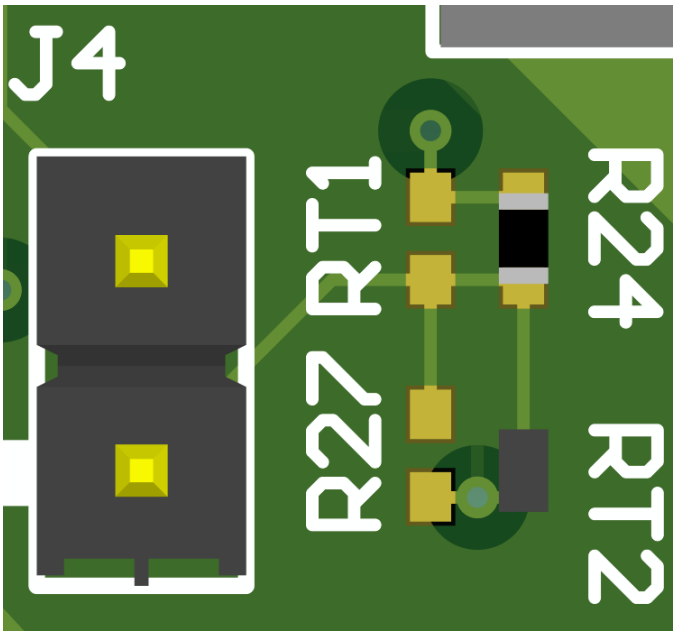


Figure 2-5. J4 NTC Selection Jumper

Table 2-7. J4 NTC Selection Jumper

Pins	Label	Description
1:2	PTC divider	Connect PTC resistor divider to TPS25763-Q1 NTC pin
Open	Open	Connect a DC voltage supply to NTC pin to emulate temperature change

J7 TMP75B-Q1 Alert Connection Jumper

The J7 jumper can be used to test the function of an I2C controlled temperature sensor in place of the NTC/PTC/ resistor divider circuit. The temperature feedback is available via I2C or the ALERT signal can directly be connected to the TPS2673-Q1 NTC pin.

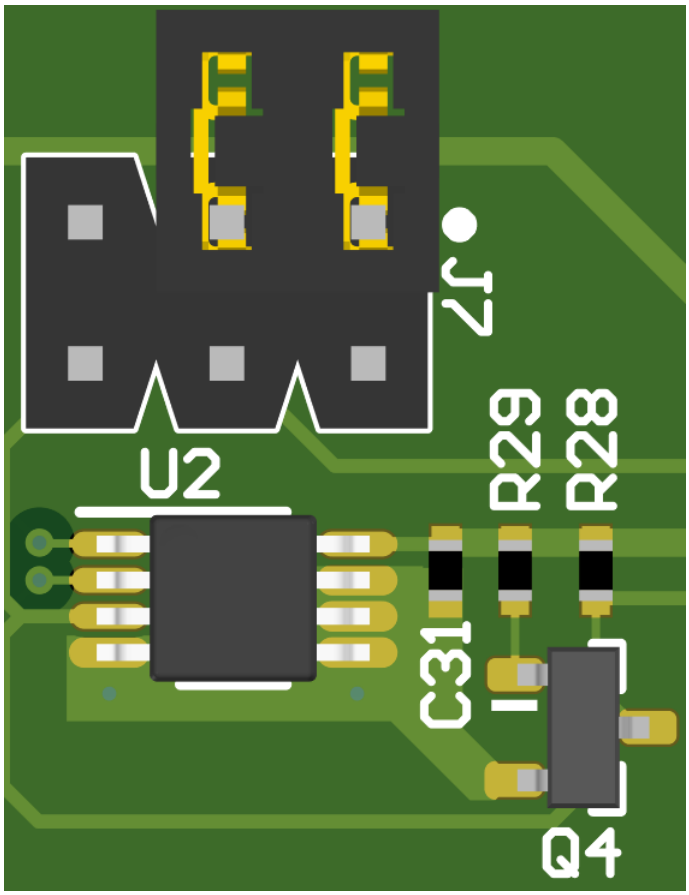


Figure 2-6. J7 TMP75B-Q1 Alert Connection Jumper

Table 2-8. J7 TMP75B-Q1 Alert Connection Jumper

Pins	Description
1:2	Connect the active low output of TMP75B-Q1 pin to the IRQ1 pin (GPIO9 of TPS25763-Q1)
3:4	Connect the inverted (active high) output of the Alert pin of TMP75B-Q1 to the NTC pin of TPS25763-Q1
5:6	Connect the active low output of the Alert pin of TMP75B-Q1 to the NTC pin of TPS25763-Q1

J23, J5, J6, J19, J16, J17 Power Selection Jumpers

Controls whether a given peripheral circuit is powered by VCC3V3 (external LDO) or LDO_3V3 (internal LDO of TPS25763-Q1). This allows users to evaluate whether the system requires an external 3.3V supply. Additionally, a better efficiency measurement of TPS25763-Q1 can be made by removing all Power Selection jumpers.

J21, J20, J22, J1, J2 DisplayPort MUX Configuration Jumpers

Dictates whether TUSB1064 is controlled by TPS25763-Q1 via GPIO signals or I2C commands. The MUX I2C feature is enabled or disabled, then the appropriate signal routing can be made between the MUX and PD controller. If the MUX I2C feature is disabled, then expect the remaining jumpers to be set for GPIO control. Similarly, if the MUX I2C feature is enabled, then expect the remaining jumpers to be set for I2C control.

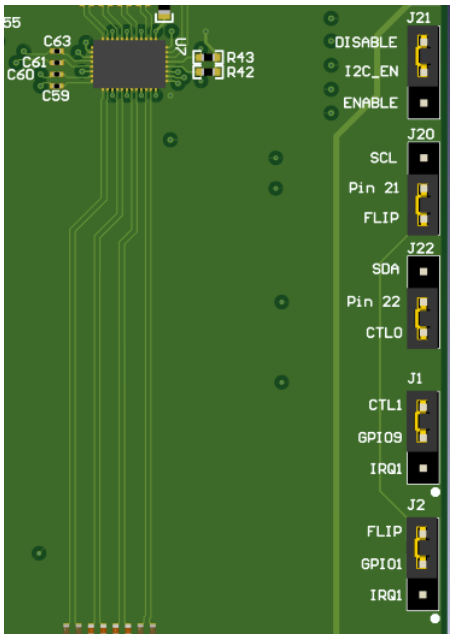


Figure 2-7. DisplayPort MUX Configuration Jumpers

Table 2-9. DisplayPort MUX Configuration Jumpers

Jumper	Label	Description
J21	DISABLE	Disable I2C control
	ENABLE	Enable I2C control
J20	SCL	MUX pin 21 connected to I2C1 clock signal
	FLIP	MUX pin 21 connected to FLIP IO signal
J22	SDA	MUX pin 22 connected to I2C1 data signal
	CTL0	MUX pin 22 connected to CTL0 IO signal
J1	CTL1	TPS25763-Q1 GPIO9 configured as CTL1 signal
	IRQ1	TPS25763-Q1 GPIO9 configured as IRQ1 signal
J2	FLIP	TPS25763-Q1 GPIO1 configured as FLIP signal
	IRQ1	TPS25763-Q1 GPIO1 configured as IRQ2 signal.

J18 !USB2.0 Data Jumper

Install if USB2.0 data is not required for the system (charge only). This does not impact DisplayPort over USB-C functionality. Installing this jumper causes D+/D- from the Type-C connector to route to TPS25763-Q1 via TS3USB221A-Q1, enabling legacy charging algorithms such as BC1.2.

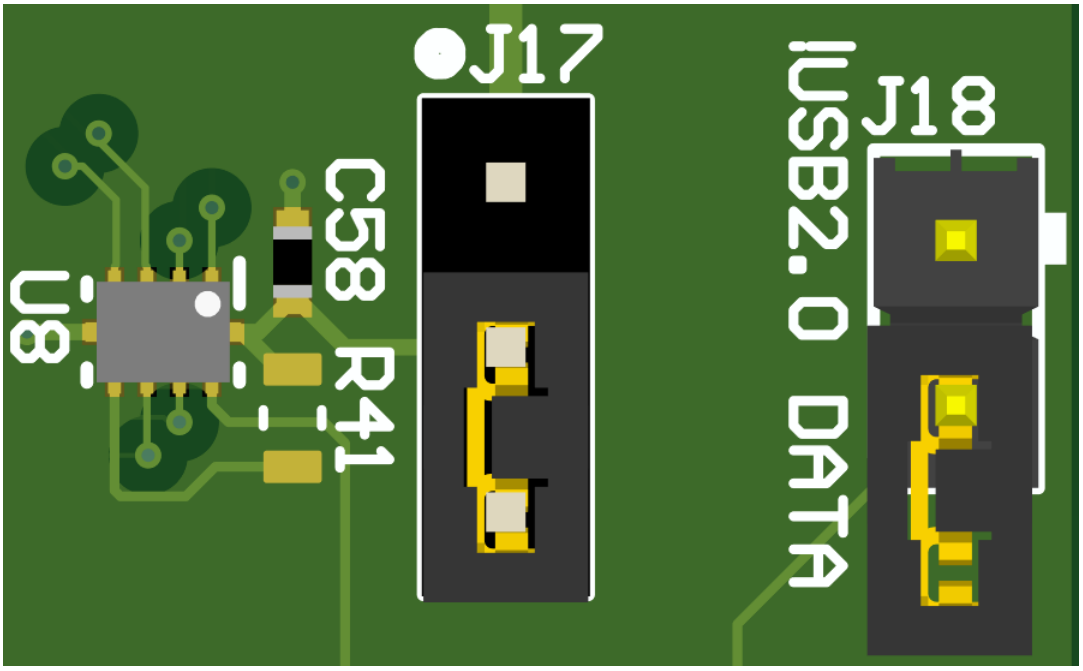


Figure 2-8. !USB2.0 Data Jumper

Pins	Description
1:2	USB2.0 data is not passed through to an upstream port. D+/D- from the Type-C receptacle are routed to TPS25763-Q1 for legacy charge handshake capability.
Open	USB2.0 data is passed through to upstream port J29. Legacy charge compatibility is unavailable unless implemented in the upstream port.

3 Software

3.1 Software Description

The TPS25763-Q1 device is configured using TPS257XX-Q1-GUI graphical user interface. 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 TPS25763-Q1.

4 Additional Information

4.1 Known Hardware or Software Limitations

USB 2.0 MUX Disabled

TS3USB221A-Q1 USB 2.0 data MUX /OE pin is misconfigured. This prevents legacy charge handshakes and firmware updates over the Type-C port from working as intended. To fix this, short the bottom pad of R41 (/OE) to the top pad of C58 (GND).

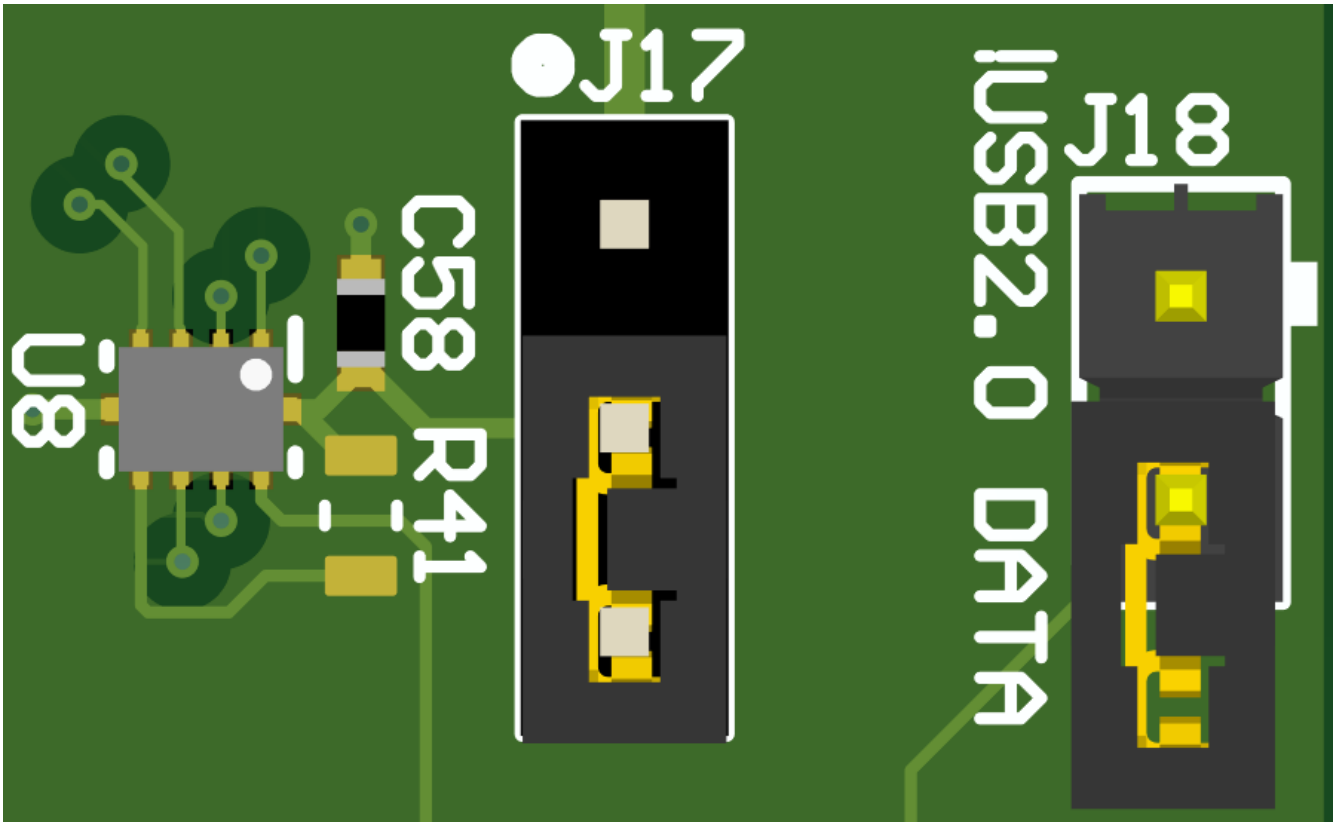


Figure 4-1. TS3USB221A-Q1 /OE Input Correction

Dual Role Power (DRP) Circuit

When configured as a DRP system, a 100Ω resistor must be placed in parallel with the NFET load switch between CSN/OUT and the Type-C receptacle. The required resistance is 100Ω with ±5% tolerance and 0.25W rating. This resistor can be installed by the user as R8 on the EVM.

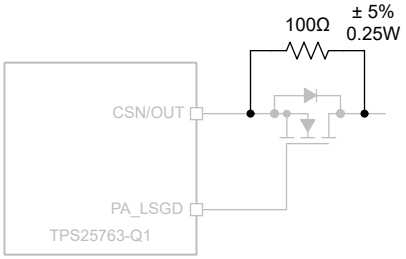


Figure 4-2. DRP Simplified Bypass Resistor Circuit

J2 IRQ2 Silk Screen Error

The silk screen label for pin 1 of J2 is mislabeled and reads IRQ2.

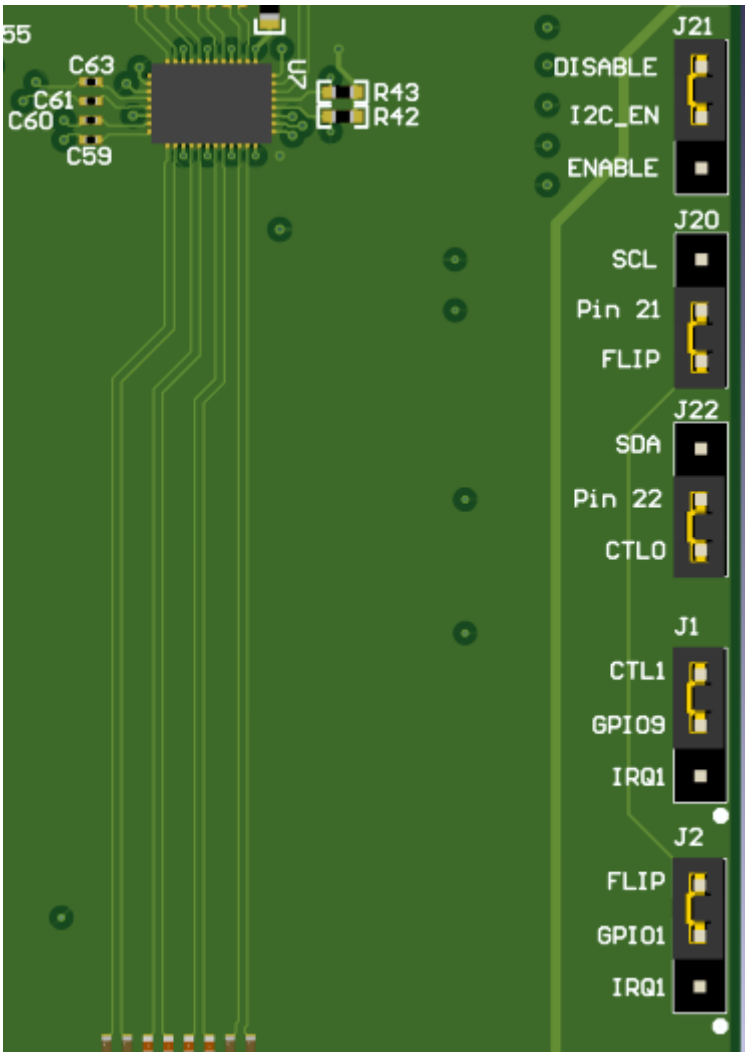


Figure 4-3. J2 IRQ2 Silk Screen Error

J8 Silk Screen Error

The silk screen label for EEPROM and TSENSE are reversed. Onboard EEPROM I2C1 pullups are rows 3 and 4 (pins 5-6 and 7-8), TMP75B-Q1 I2C1 pullups are rows 1 and 2 (pins 1-2 and 3-4).

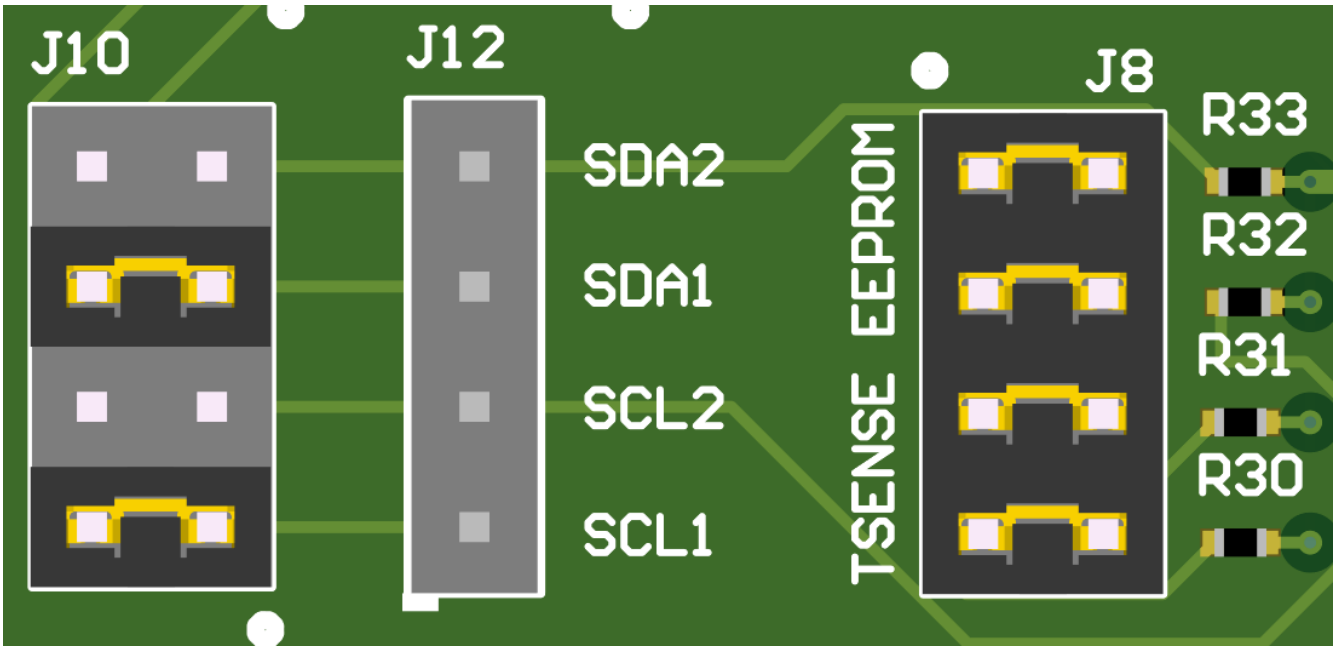


Figure 4-4. J8 Silk Screen Error

5 Hardware Design Files

5.1 Schematics

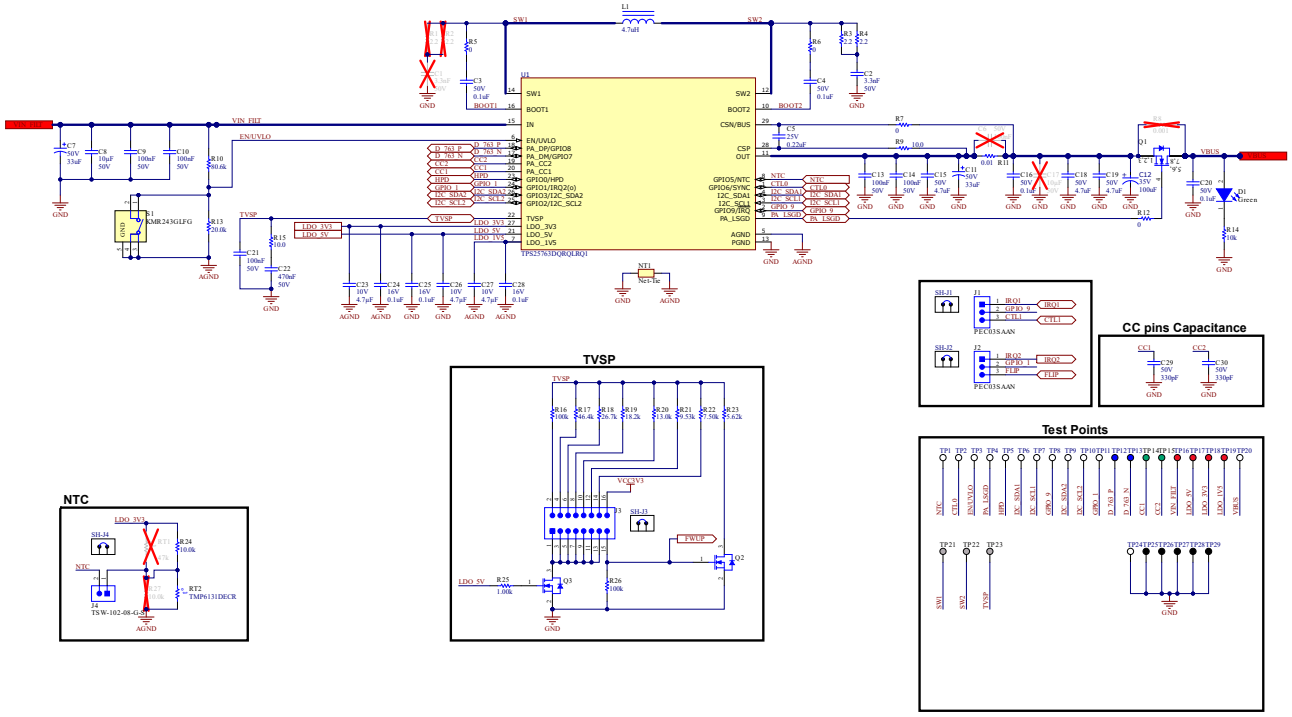


Figure 5-1. Primary TPS25763-Q1 Schematic

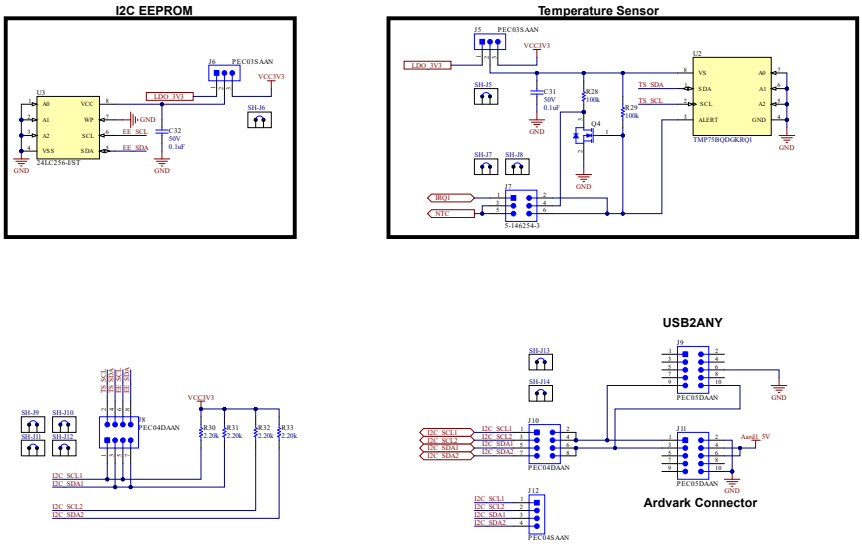


Figure 5-2. I2C Peripherals

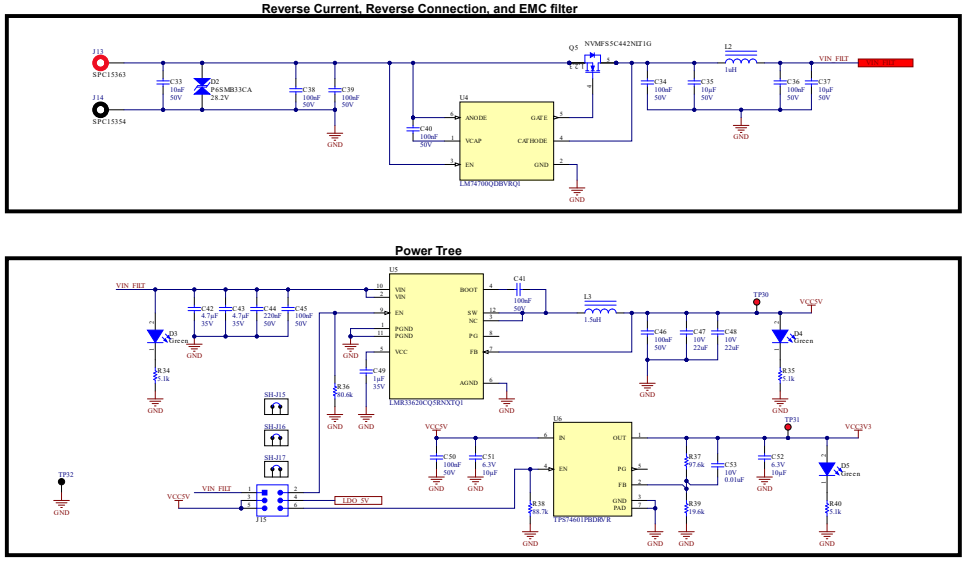


Figure 5-3. Input Filter and Power Tree

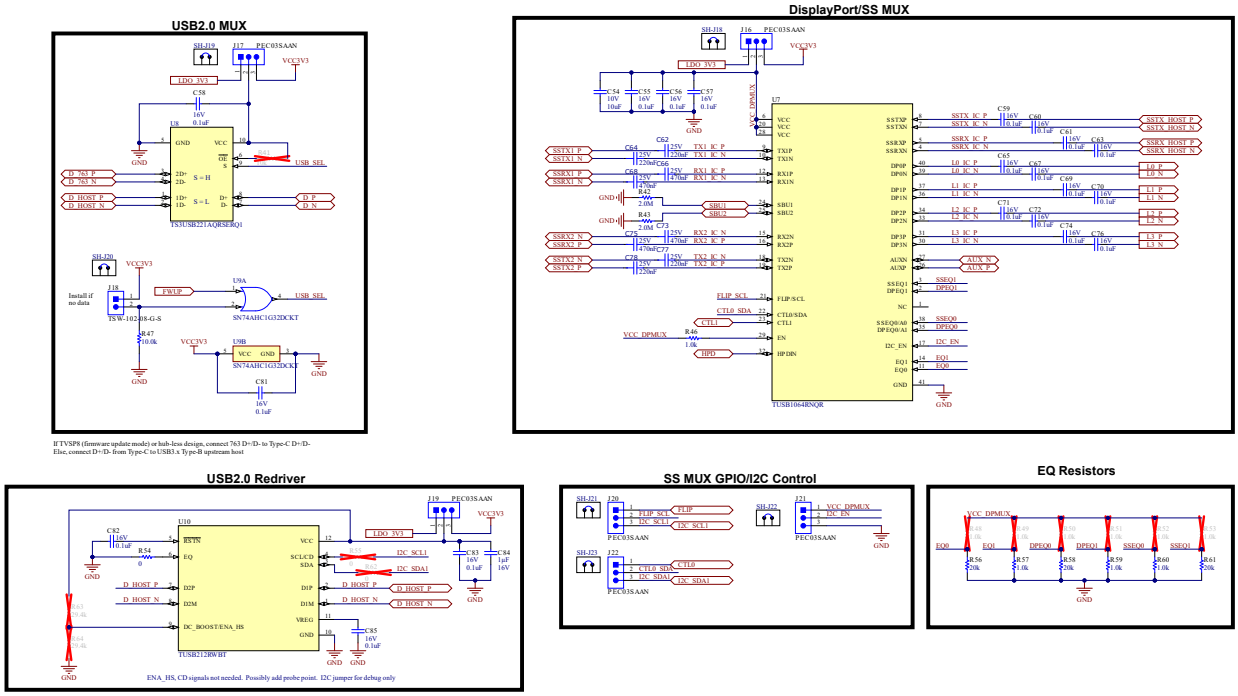


Figure 5-4. Data, Display Port MUX

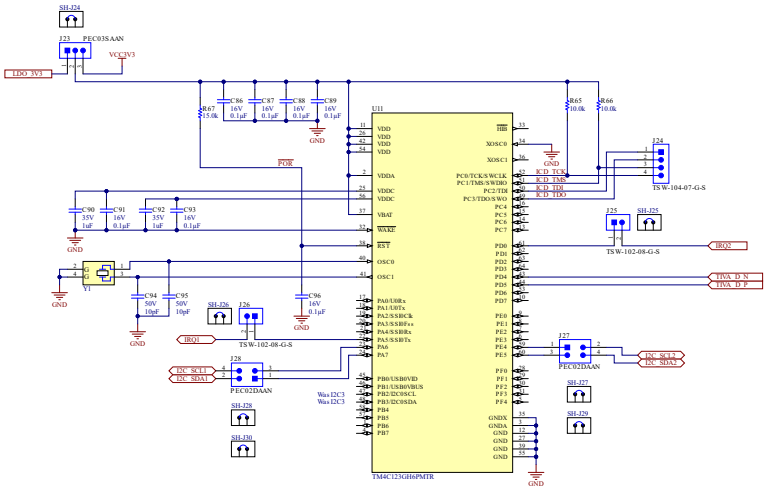


Figure 5-5. TIVA MCU

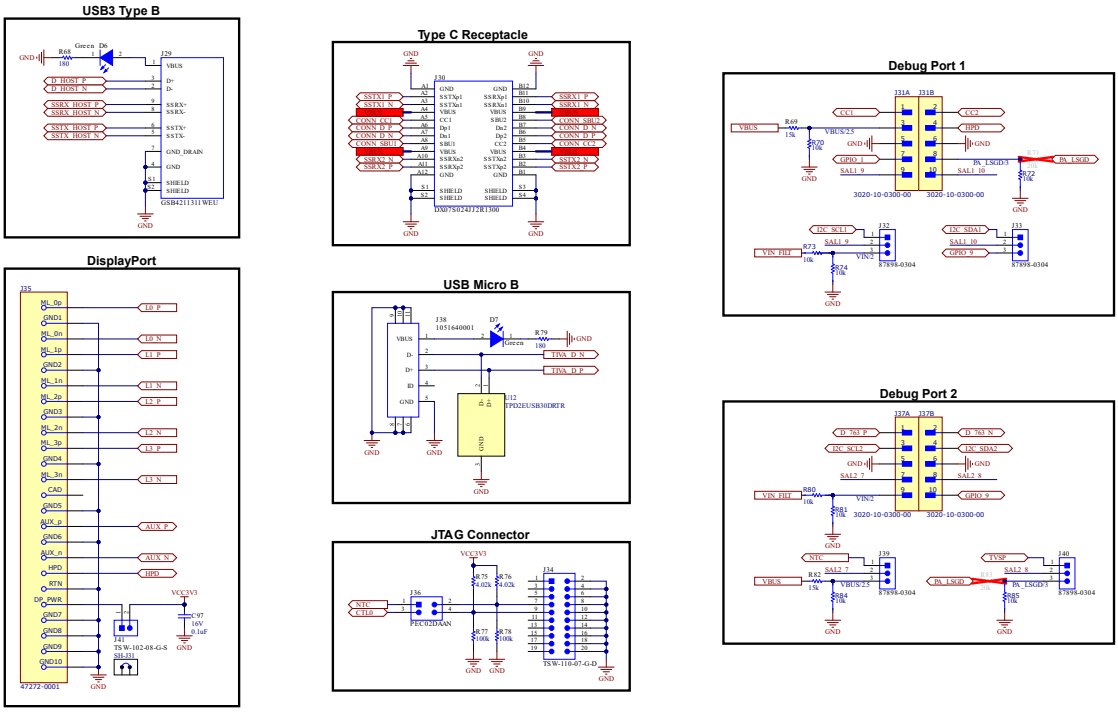


Figure 5-6. External Connectors

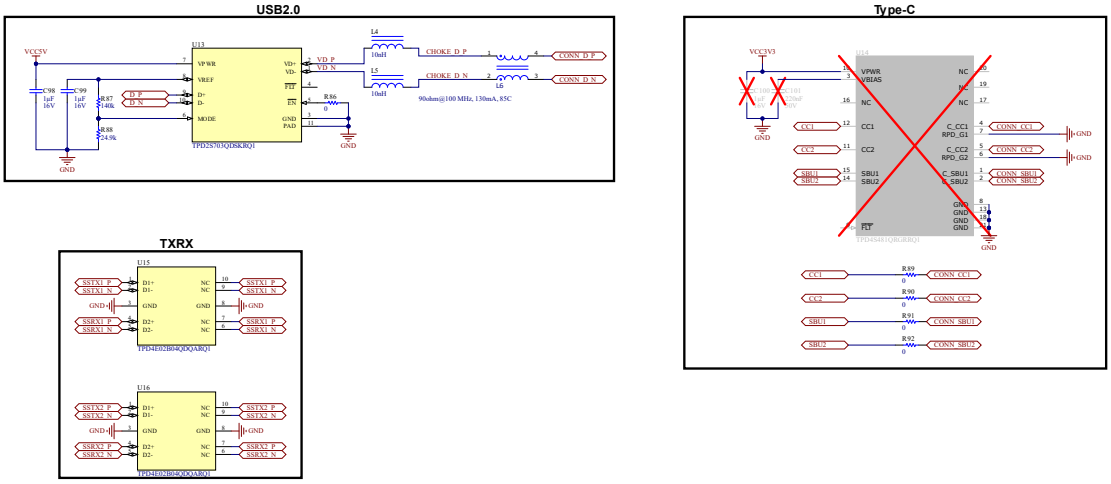


Figure 5-7. ESD Protection

5.2 PCB Layouts

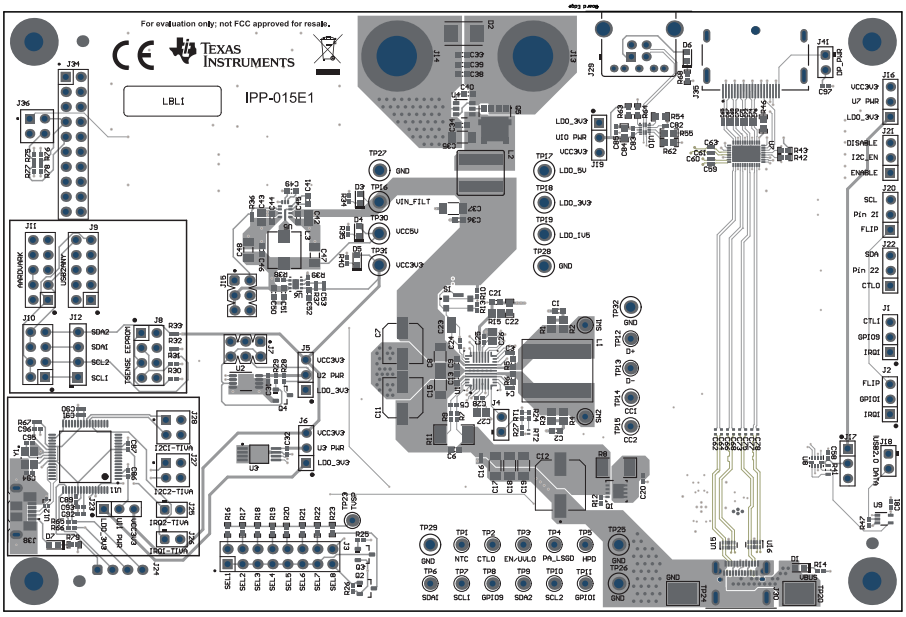


Figure 5-8. Top Composite View

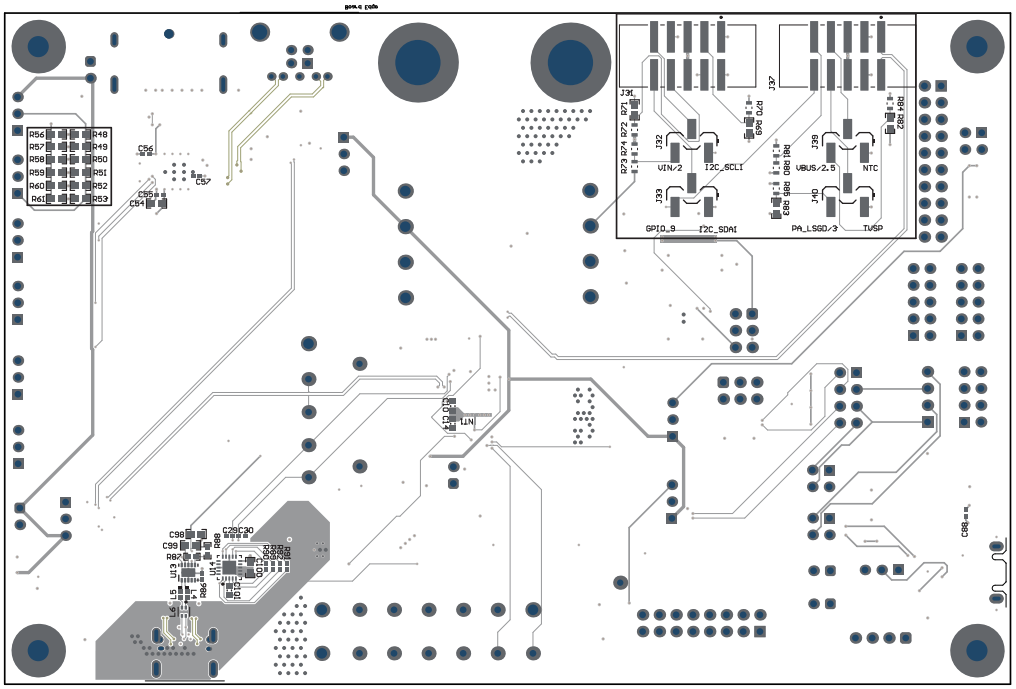


Figure 5-9. Bottom Composite View

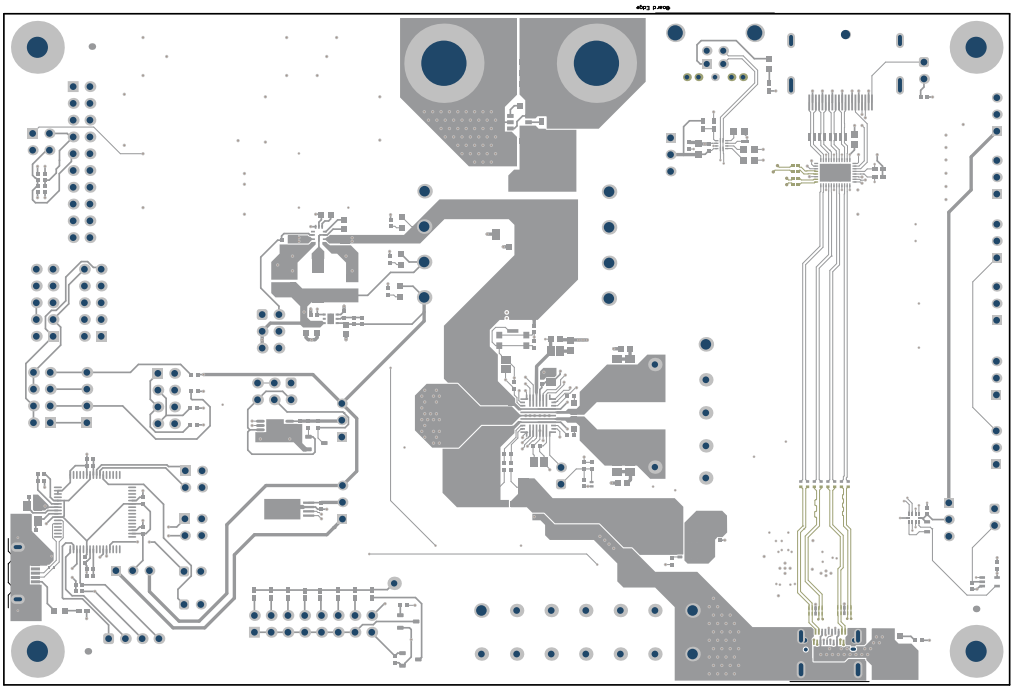


Figure 5-10. Top Layer (1)

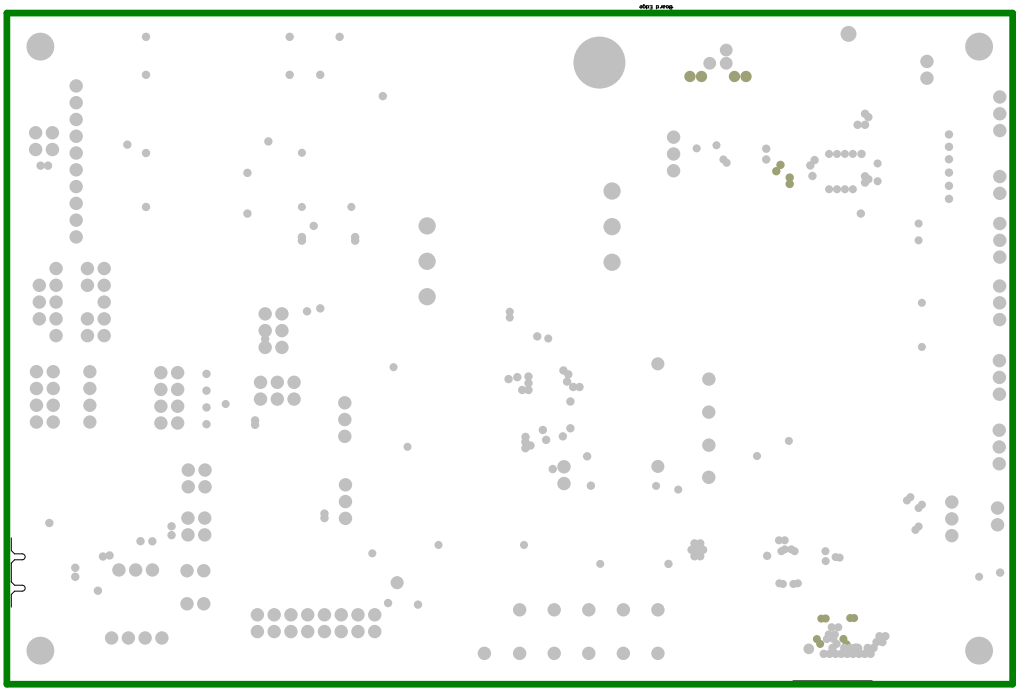


Figure 5-11. GND1 Layer (2)

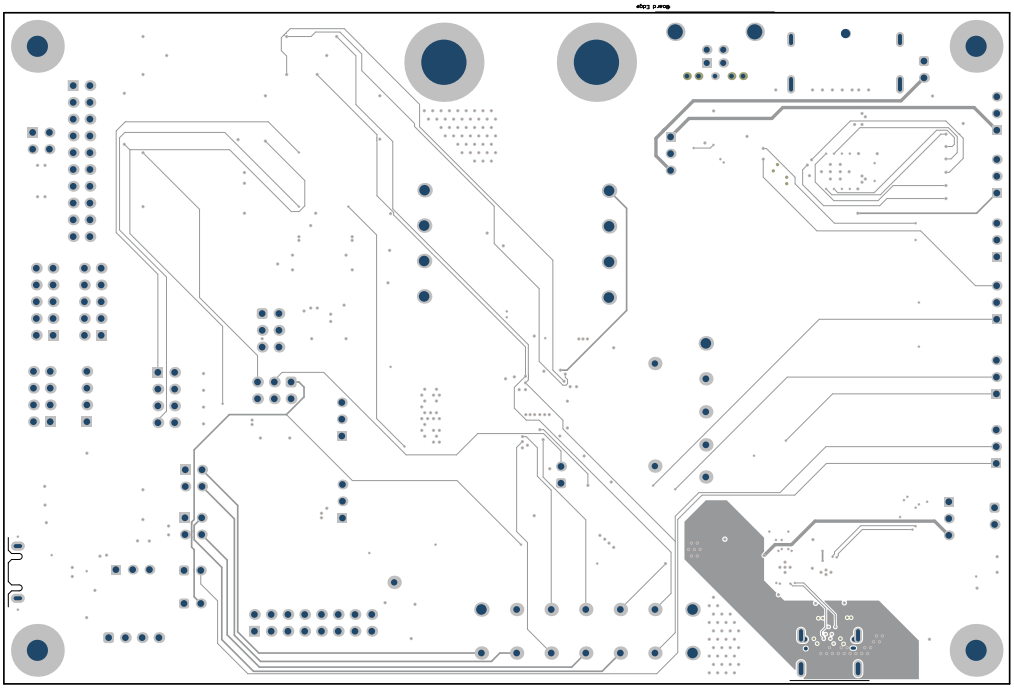


Figure 5-12. Low Speed/Power1 Layer (3)

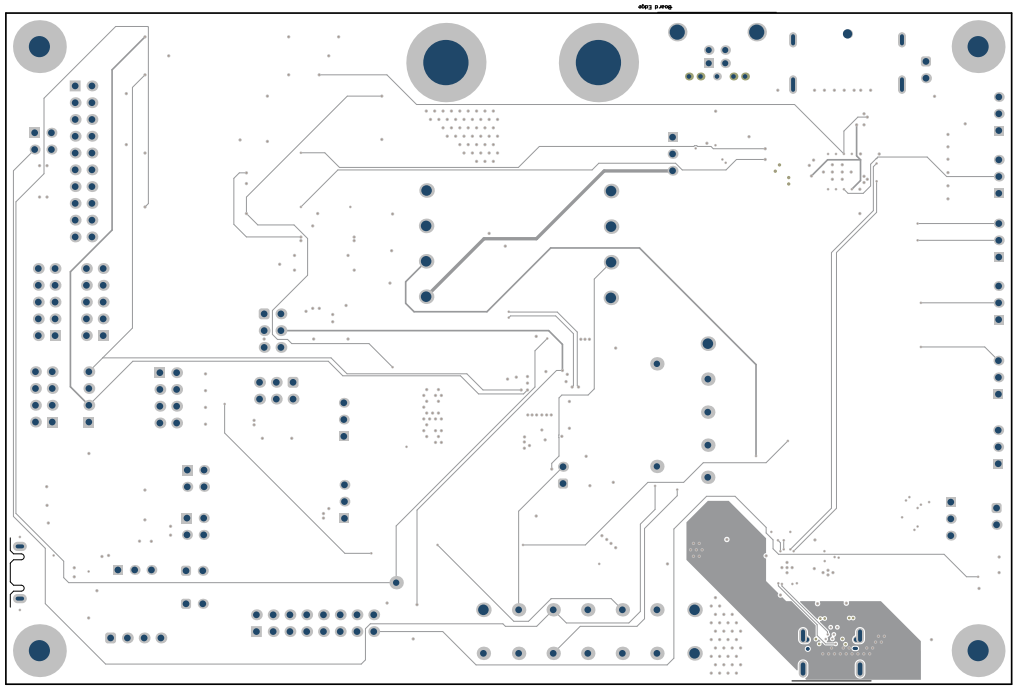


Figure 5-13. Low Speed/Power2 Layer (4)

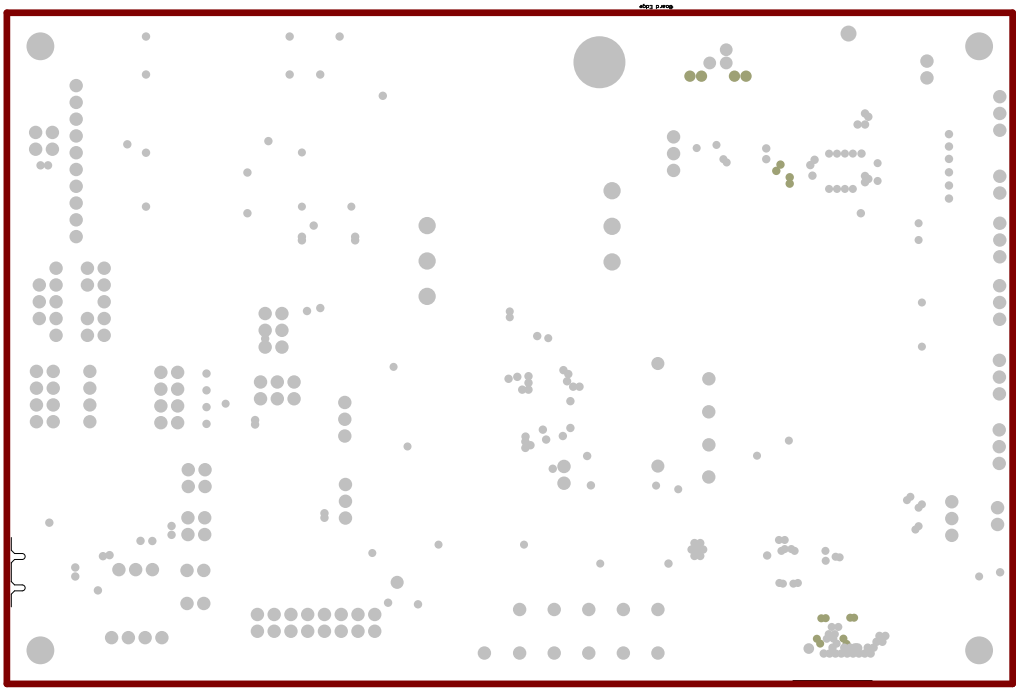


Figure 5-14. GND2 Layer (5)

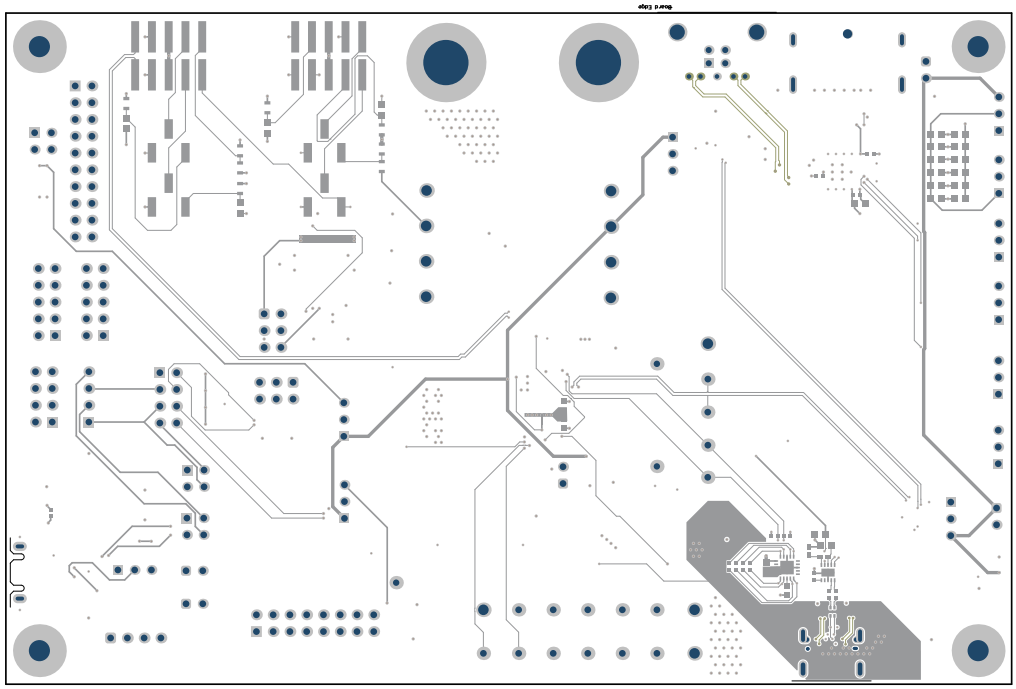


Figure 5-15. Bottom Layer (6)

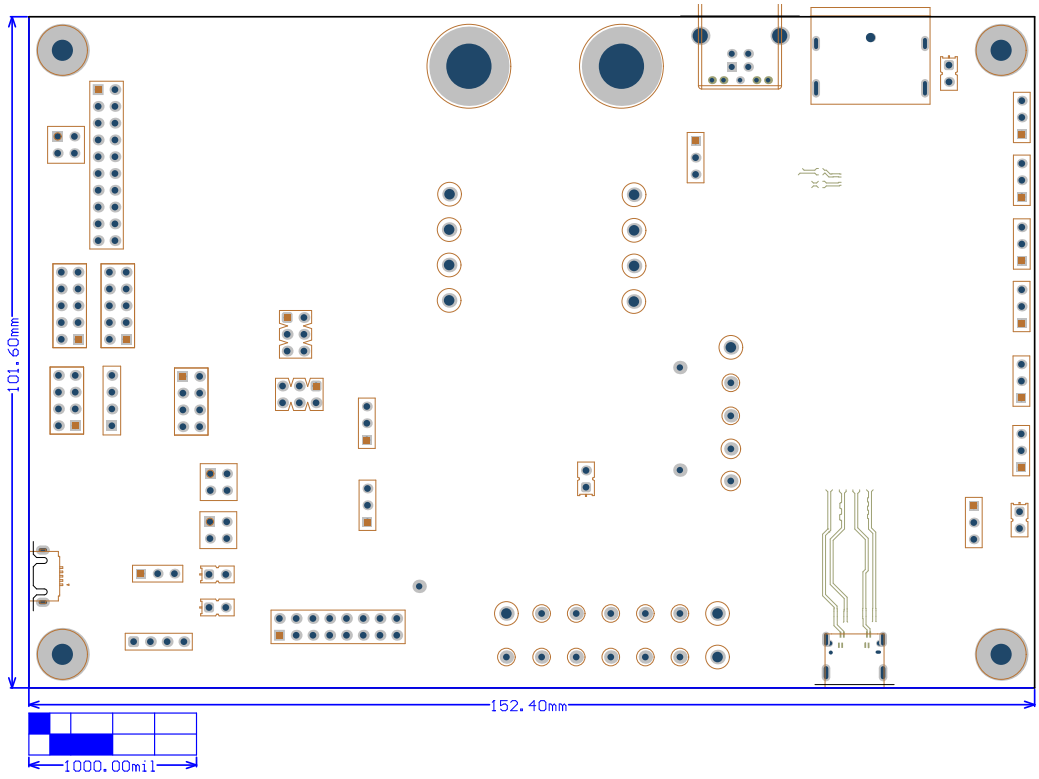


Figure 5-16. TPS25763Q1EVM Board Dimensions

5.3 Bill of Materials (BOM)

Table 5-1 lists the bill of materials of TPS25763Q1EVM.

Table 5-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C2	1	3300pF	CAP, CERM, 3300pF, 50V,+/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik
C3, C4, C16, C20, C31, C32	6	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7R1H104K050BB	TDK
C5	1	0.22uF	CAP, CERM, 0.22uF, 25V, +/- 20%, X5R, 0402	0402	C1005X5R1E224M050BC	TDK
C7, C11	2	33uF	CAP, Polymer Hybrid, 33uF, 50V, +/- 20%, 40 ohm, 6.3x7.7 SMD	6.3x7.7	EEHZC1H330XP	Panasonic
C8, C35, C37	3	10uF	CAP, CERM, 10µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	CGA5L1X7R1H106K160AC	TDK
C9, C10, C13, C14, C21, C41, C45, C46, C50	9	0.1uF	CAP, CERM, 0.1uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H104K080AA	TDK
C12	1	100µF	100µF 35V Aluminum - Polymer Capacitors Radial, Can - SMD 27mOhm 4000 Hrs @ 125°C	SMT_ECAP_8MM3_8MM3	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	0603	C1608X7R1H474K080AC	TDK
C23, C26, C27	3	4.7uF	CAP, CERM, 4.7µF, 10V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	CGA4J3X7R1A475K125AB	TDK
C24, C25, C28, C55, C56, C57, C58, C81, C83, C85, C97	11	0.1uF	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0402	0402	0402YC104KAT2A	AVX
C29, C30	2	330pF	CAP, CERM, 330pF, 50V, +/- 10%, X7R, 0402	0402	GRM155R71H331KA01D	MuRata
C33	1	0.01uF	CAP, CERM, 0.01uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71H103KA37D	MuRata
C34, C36, C38, C39, C40	5	0.1uF	CAP, CERM, 0.1µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	06035C104KAZ2A	AVX
C42, C43	2	4.7uF	CAP, CERM, 4.7uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	CGA4J1X7R1V475K125AC	TDK
C44	1	0.22uF	CAP, CERM, 0.22µF, 50V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCJ188R71H224KA01D	MuRata
C47, C48	2	22uF	CAP, CERM, 22uF, 10V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	GCM31CR71A226KE02L	MuRata
C49	1	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1V105K080AC	TDK
C51, C52	2	10uF	CAP, CERM, 10µF, 6.3V,+/- 20%, X7R, 0603	0603	CL10B106MQ8NRNC	Samsung Electro-Mechanics
C53	1	0.01uF	CAP, CERM, 0.01uF, 10V, +/- 10%, X5R, 0402	0402	GRM155R61A103KA01D	MuRata

Table 5-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C54	1	10uF	CAP, CERM, 10uF, 10V, +/- 10%, X6S, 0603	0603	C1608X6S1A106M080AC	TDK
C59, C60, C61, C63, C65, C67, C69, C70, C71, C72, C74, C76, C82	13	0.1uF	CAP, CERM, 0.1uF, 16V,+/- 10%, X7R, 0201	0201	GRM033Z71C104KE14D	MuRata
C62, C64, C77, C78	4	220nF	Cap Ceramic 220nF 25V X7R 10% Pad SMD 0402 +125°C Automotive T/R	0402	CGA2B3X7R1E224K050BB	TDK Corporation
C66, C68, C73, C75	4	470nF	Cap Ceramic 0.47uF 25V X5R 10% Pad SMD 0402 Soft Termination 85°C T/R	0402	C1005X5R1E474K050BE	TDK
C84, C98, C99	3	1uF	CAP, CERM, 1µF, 16V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71C105KA64J	MuRata
C86, C87, C88, C89, C91, C93, C96	7	0.1uF	CAP, CERM, 0.1µF, 16V,+/- 5%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71C104JA55D	MuRata
C90, C92	2	1uF	CAP, CERM, 1uF, 35V, +/- 10%, X5R, 0402	0402	C1005X5R1V105K050BC	TDK
C94, C95	2	10pF	CAP, CERM, 10pF, 50V, +/- 5%, C0G/NP0, 0402	0402	500R07S100JV4T	Johanson Technology
D1, D3, D4, D5, D6, D7	6	Green	LED, Green, SMD	LED_0603	150060GS75000	Wurth Elektronik
D2	1	28.2V	Diode, TVS, Bi, 22V, 35.5Vc, 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, J2, J5, J6, J16, J17, J19, J20, J21, J22, J23	11		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions
J3	1		Header, 100mil, 8x2, Gold, TH	8x2 Header	TSW-108-07-G-D	Samtec
J4, J18, J25, J26, J41	5		Header, 2.54mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	TSW-102-08-G-S	Samtec
J7, J15	2		Header, 100mil, 3x2, Tin, TH	Header, 100mil, 3x2, TH	5-146254-3	TE Connectivity
J8, J10	2		Header, 100mil, 4x2, Tin, TH	Header, 4x2, 100mil, Tin	PEC04DAAN	Sullins Connector Solutions
J9, J11	2		Header, 100mil, 5x2, Tin, TH	Header, 5x2, 100mil, Tin	PEC05DAAN	Sullins Connector Solutions
J12	1		Header, 100mil, 4x1, Tin, TH	Header, 4x1, 100mil, TH	PEC04SAAN	Sullins Connector Solutions
J13	1		BANANA JACK, SOLDER LUG, RED, TH	Red Insulated Banana Jack	SPC15363	Tenma
J14	1		BANANA JACK, SOLDER LUG, BLACK, TH	Black Insulated Banana Jack	SPC15354	Tenma
J24	1		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07-G-S	Samtec

Table 5-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
J27, J28, J36	3		Header, 100mil, 2x2, Tin, TH	Header, 2x2, 2.54mm, TH	PEC02DAAN	Sullins Connector Solutions
J29	1		Connector, Receptacle, USB 3.1 Type B, R/A, TH	Connector, Receptacle, USB 3.1 Type B, R/A, TH	GSB4211311WEU	Amphenol Canada
J30	1		Receptacle, USB 3.1 Type C, R/A, Gold, SMT	Receptacle, USB 3.1 Type C, R/A, SMT	DX07S024JJ2R1300	JAE Electronics
J31, J37	2		Connector Header Surface Mount 10 position 0.100" (2.54mm)	CONN_SMT_HDR10	3020-10-0300-00	CNC Tech
J32, J33, J39, J40	4		Header, 2.54mm, 3x1, Gold, SMT	Header, 2.54mm, 3x1, SMT	87898-0304	Molex
J34	1		Header, 100mil, 10x2, Gold, TH	10x2 Header	TSW-110-07-G-D	Samtec
J35	1		HDMI™pri, DisplayPort and DVI Connectors .5MM RA SMT RCPT	CONN_HDMI_14MM39_17MM79	47272-0001	Molex
J38	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
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
L4, L5	2	10nH	Inductor, Multilayer, Air Core, 10nH, 0.3A, 0.26 ohm, SMD	0402 polarized	LQG15HS10NJ02D	MuRata
L6	1		2 Line Common Mode Choke Surface Mount 90Ohms at 100MHz 130mA DCR 2.5Ohm	SMT_1MM25_1MM00	EXC24CH900U	Panasonic
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
Q1	1	30V	MOSFET, N-CH, 30V, 60A, DQG0008A (VSON-CLIP-8)	DQG0008A	CSD17575Q3	Texas Instruments
Q2, Q3	2	60V	MOSFET, N-CH, 60V, 0.24A, SOT-23	SOT-23	2N7002E-T1-E3	Vishay-Siliconix
Q4	1	60V	MOSFET, N-CH, 60V, 0.115A, AEC-Q101, SOT-23	SOT-23	2N7002Q-7-F	Diodes Inc.
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	0805	ERJ-6GEYJ2R2V	Panasonic
R5, R6	2	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R7, R86, R89, R90, R91, R92	6	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0ED	Vishay-Dale
R9	1	10	RES, 10.0, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210R0FKED	Vishay-Dale

Table 5-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R10, R36	2	80.6k	RES, 80.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040280K6FKED	Vishay-Dale
R11	1	0.01	RES, 0.01, 1%, 1 W, 2010	2010	WSL2010R0100FEA18	Vishay-Dale
R12	1	0	RES, 0, 5%, 0.063 W, 0402	0402	RC0402JR-070RL	Yageo America
R13	1	20.0k	RES, 20.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040220K0FKED	Vishay-Dale
R14	1	10k	RES, 10 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ103X	Panasonic
R15	1	10	RES, 10.0, 1%, 0.25 W, 0805	0805	RNCP0805FTD10R0	Stackpole Electronics Inc
R16	1	100k	RES, 100 k, 1%, 0.0625 W, 0402	0402	RC0402FR-07100KL	Yageo America
R17	1	46.4k	RES, 46.4 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040246K4FKED	Vishay-Dale
R18	1	26.7k	RES, 26.7 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040226K7FKED	Vishay-Dale
R19	1	18.2k	RES, 18.2 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040218K2FKED	Vishay-Dale
R20	1	13.0k	RES, 13.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040213K0FKED	Vishay-Dale
R21	1	9.53k	RES, 9.53 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04029K53FKED	Vishay-Dale
R22	1	7.50k	RES, 7.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04027K50FKED	Vishay-Dale
R23	1	5.62k	RES, 5.62 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04025K62FKED	Vishay-Dale
R24, R47, R65, R66	4	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	AC0402FR-0710KL	Yageo America
R25	1	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	0402	MCR01MZPF1001	Rohm
R26, R28, R29, R77, R78	5	100k	RES, 100 k, 1%, 0.0625 W, AEC-Q200 Grade 0, 0402	0402	AC0402FR-07100KL	Yageo America
R30, R31, R32, R33	4	2.20k	RES, 2.20 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT2K20	Stackpole Electronics Inc
R34, R35, R40	3	5.1k	RES, 5.1 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04025K10JNED	Vishay-Dale
R37	1	97.6k	RES, 97.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040297K6FKED	Vishay-Dale
R38	1	88.7k	RES, 88.7 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040288K7FKED	Vishay-Dale
R39	1	19.6k	RES, 19.6 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040219K6FKED	Vishay-Dale
R42, R43	2	2.0Meg	RES, 2.0M, 5%, 0.063W, AEC-Q200 Grade 0, 0402	0402	CRCW04022M00JNED	Vishay-Dale
R46, R57, R59, R60	4	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K00JNEA	Vishay-Dale
R54	1	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R56, R58, R61	3	20k	RES, 20 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060320K0JNEA	Vishay-Dale
R67	1	15.0k	RES, 15.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040215K0FKED	Vishay-Dale
R68, R79	2	180	RES, 180, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402180RJNED	Vishay-Dale
R69, R82	2	15k	RES, 15 k, 5%, 0.1 W, 0603	0603	RC0603JR-0715KL	Yageo
R70, R72, R73, R74, R80, R81, R84, R85	8	10k	10 kOhms ±5% 0.1W, 1/10W Chip Resistor 0603 (1608 Metric) Thick Film	0603	CRCW060310K0JNEBC	Vishay
R75, R76	2	4.02k	RES, 4.02 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04024K02FKED	Vishay-Dale

Table 5-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R87	1	140k	RES, 140 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF1403X	Panasonic
R88	1	24.9k	RES, 24.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040224K9FKED	Vishay-Dale
RT2	1		Thermistor, DEC0002A (X1SON-2)	DEC0002A	TMP6131DECR	Texas Instruments
S1	1		Switch, SPST-NO, Off-Mom, 0.01A, 32VDC, SMD	4.2x2.8mm	KMR243GLFG	C&K Components
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11	11		Test Point, Miniature, White, TH	White Miniature Test point	5002	Keystone Electronics
TP12, TP13	2		Test Point, Miniature, Blue, TH	Blue Miniature Test point	5117	Keystone
TP14, TP15	2		Test Point, Miniature, Green, TH	Green Miniature Test point	5116	Keystone
TP16, TP17, TP18, TP19, TP30, TP31	6		Test Point, Compact, Red, TH	Red Compact Test point	5005	Keystone Electronics
TP20, TP24	2		Test Point, Compact, SMT	oint_Keystone_Compact	5016	Keystone Electronics
TP25, TP26, TP27, TP28, TP29, TP32	6		Test Point, Compact, Black, TH	Black Compact Test point	5006	Keystone Electronics
U1	1		Automotive Dual USB Type-C Power Delivery Controller with Buck-Boost Regulator	VQFN-HR29	TPS25763DQRQLRQ1	Texas Instruments
U2	1		Automotive Grade, 1.4V-Capable Temperature Sensor with I2C/SMBus Interface in LM75 Pinout, DGK0008A (VSSOP-8)	DGK0008A	TMP75BQDGKRQ1	Texas Instruments
U3	1		256K I2C CMOS Serial EEPROM, TSSOP-8	TSSOP-8	24LC256-I/ST	Microchip
U4	1		Low Iq Always ON Smart Diode Controller, DBV0006A (SOT-23-6)	DBV0006A	LM74700QDBVRQ1	Texas Instruments
U5	1		Automotive 3.8V to 36V 2A Synchronous Step-Down Voltage Regulator, RNX0012B (VQFN-HR-12)	RNX0012B	LMR33620CQ5RNXTQ1	Texas Instruments
U6	1		1A LDO With Power-Good, DRV0006A (WSON-6)	DRV0006A	TPS74601PBDRVR	Texas Instruments
U7	1		USB Type-C(TM) DP Alt Mode 10Gbps Linear Redriver Crosspoint Switch for Sink Side, RNQ0040A (WQFN-40)	RNQ0040A	TUSB1064RNQR	Texas Instruments
U8	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
U9	1		Single 2-Input Positive-OR Gate, DCK0005A, SMALL T&R	DCK0005A	SN74AHC1G32DCKT	Texas Instruments
U10	1		USB 2.0 High Speed Signal Conditioner, RWB0012A (X2QFN-12)	RWB0012A	TUSB212RWBT	Texas Instruments
U11	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

Table 5-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
U12	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
U13	1		Automotive USB 2-Ch Date Line Short-to-Battery, Short-to-VBUS, and IEC ESD protection, DSK0010A (WSON-10)	DSK0010A	TPD2S703QDSKRQ1	Texas Instruments
U15, U16	2		Automotive 4-Channel ESD Protection Diode for USB Type-C and HDMI 2.0, DQA0010A (USON-10)	DQA0010A	TPD4E02B04QDQARQ1	Texas Instruments
Y1	1		Crystal, 16MHz, 8pF, SMD	3.2x0.75x2.5mm	NX3225GA-16.000M-STD-CRG-1	NDK

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
• Added dual role power (DRP) circuit details	11

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