TPD3S713Q1EVM-103 User's Guide

This user's guide describes the evaluation module (EVM) for TPD3S713-Q1(TPD3S713Q1EVM-103). This document contains the EVM schematics, EVM configuration, bill of materials (BOM), board layout drawing and assembly drawing.

Contents

List of Figures

List of Tables

Trademarks

1 Introduction

The TPD3S713Q1EVM-103 allows reference circuit evaluation of TI's TPD3S713-Q1 which is a single-chip solution for short-to-battery, short-circuit, and ESD protection for high speed data and power lines in automotive USB hub, head unit, telematics, and media interface applications.

1.1 Features

The EVM supports the following features:

- TPD3S713-Q1 built-in IEC 61000-4-2 ESD protection on DP_IN and DM_IN pins
- Linear USB cable voltage droop compensation
- The TPD3S713-Q1 is fully AEC Q100 qualified
- Built-in short to battery protection and notification on VBUS, DP_IN and DM_IN

1.2 Applications

The EVM can be used in the following applications:

- Automotive infotainment system
- Automotive USB charging port
- Navigation Module

2 Test Setup and Results

Figure 1 shows the EVM board . Connect J1 to the 13.5-V power supply. Connect USB Type-A device to Type A receptacle port.

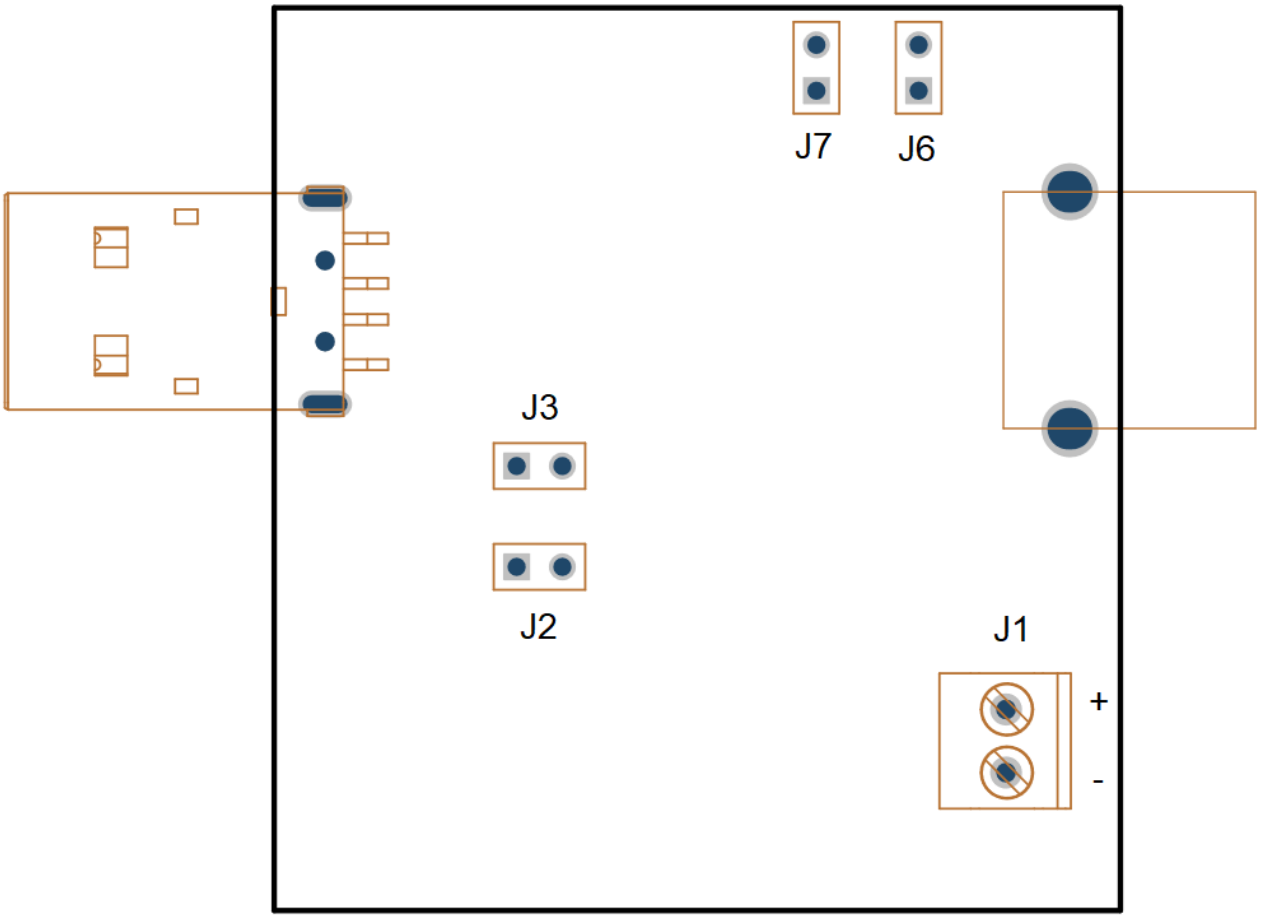

Figure 1. EVM Setup for Charging USB Type-A Device

2.1

Table 1 lists the TPD3S713Q1EVM-103 connector functionality, Table 2 describes the test point availability and Table 3 describes the jumper functionality.

Table 1. Connector Functionality

Connector	Label	Description
J5	J5	Downstream facing USB 2.0 connector. Connect to the USB 2.0 slave for data pass through from J4. USB output power is also provided to the slave.

Table 1. Connector Functionality (continued)

Connector	Label	Description
J4	J4	Upstream facing USB 2.0 connector. Connect to the USB 2.0 host for data pass through to J5. USB input power can also be provided by the host when the J3 shunt is installed.
J1	J1	Automotive input voltage range connector. Connect to a 7 V–18 V, 1.5-A voltage source according to the polarity marked on the EVM.
D2 (RED)	D2	TPD3S713-Q1 FAULT output is triggered
D6 (GREEN)	D6	TPD3S713-Q1 output powered

Table 2. Test Points

Test Point	Color	Label	Description
TP1	SM-L	VDC	TPD3S713-Q1 power switch input from DC-DC converter
TP2	SM-L	CS	Loop injection point
TP3,TP4,TP5,TP6	SM-L	GND	GND Test point
TP8	SM-L	FAULT	TPD3S713-Q1 FAULT pin test point
TP9	SM-L	VIN	TPD3S713-Q1 VIN pin test point
TP10	SM-L	OUT	TPD3S713-Q1 VBUS pin test point
TP11	SM-L	IMON	TPD3S713-Q1 IMON pin test point

Table 3. Jumpers

Jumper	Label	Description
J2	J2	Install to power TPD3S713-Q1 with a DC/DC
J3	J3	USB host furnished input voltage. Install to power TPD3S713-Q1 with a USB host.
J6	J6	Logic-level control input for choosing the current limit resistor and current limit threshold. When ILIM_SEL = High, ILIM_HI resistor is valid; When ILIM_SEL = Low, ILIM_LO resistor is valid.
J7	J7	Logic-level control input for turning the power and signal switches on or off. When EN is low, the device is disabled, and the signal and power switches are OFF.

3 Board Layout

Figure 2 and Figure 3 show the top and bottom assembly. Figure 4 to Figure 7 show the layout of the EVM.

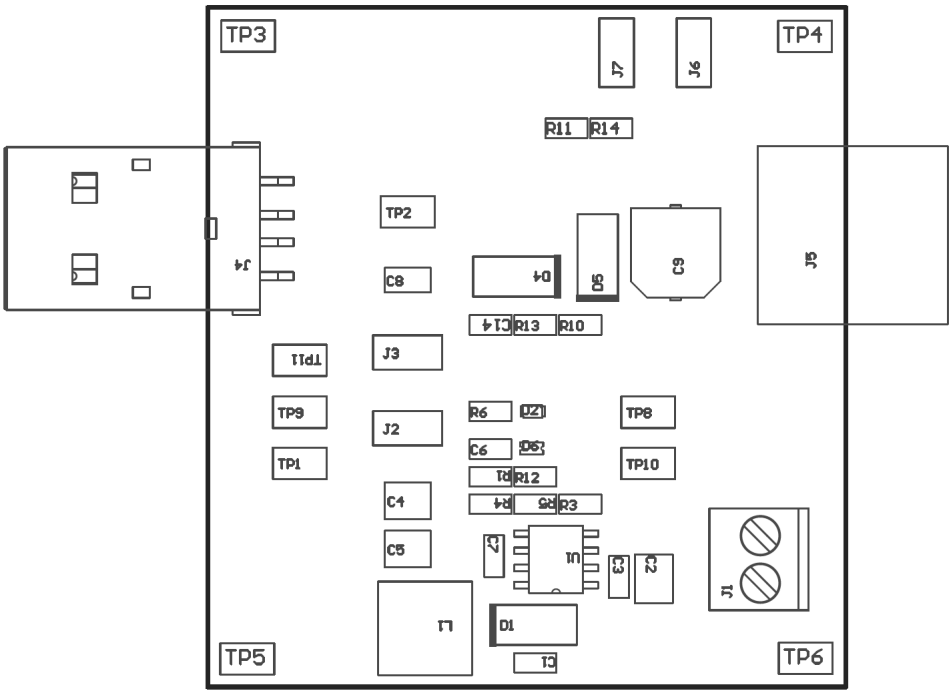

Figure 2. Top Side Assembly

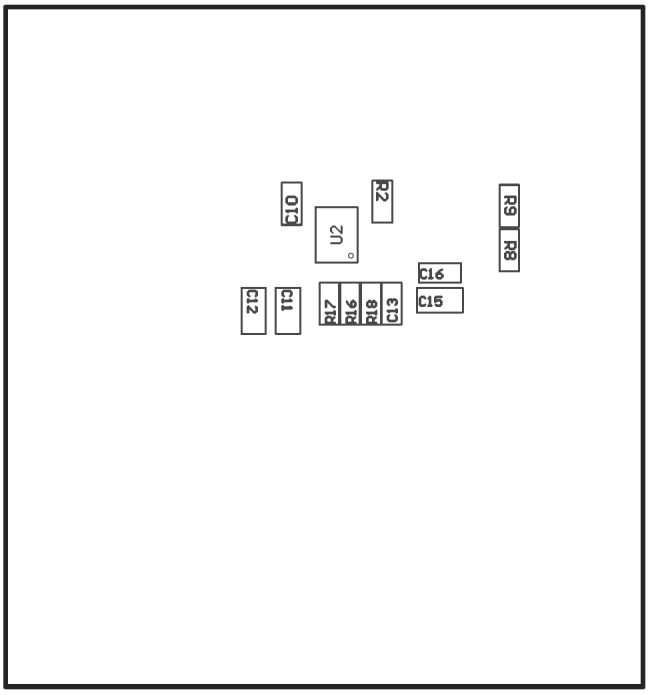

Figure 3. Bottom Side Assembly

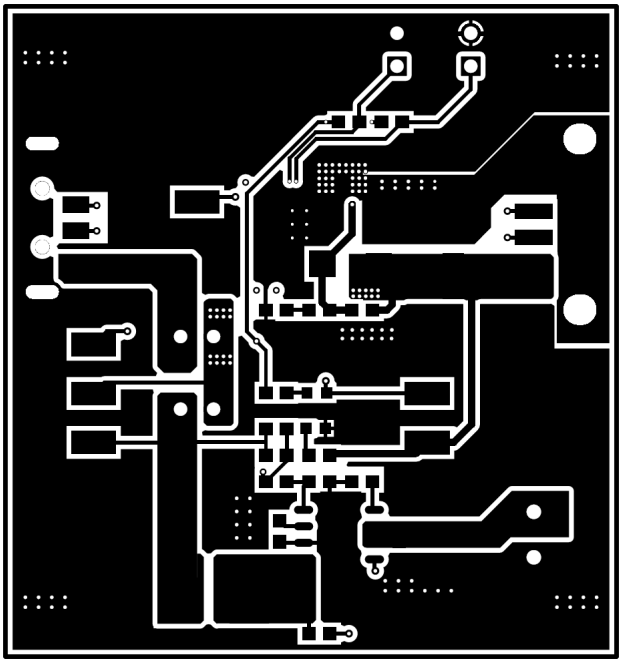

Figure 4. Top Layer Layout

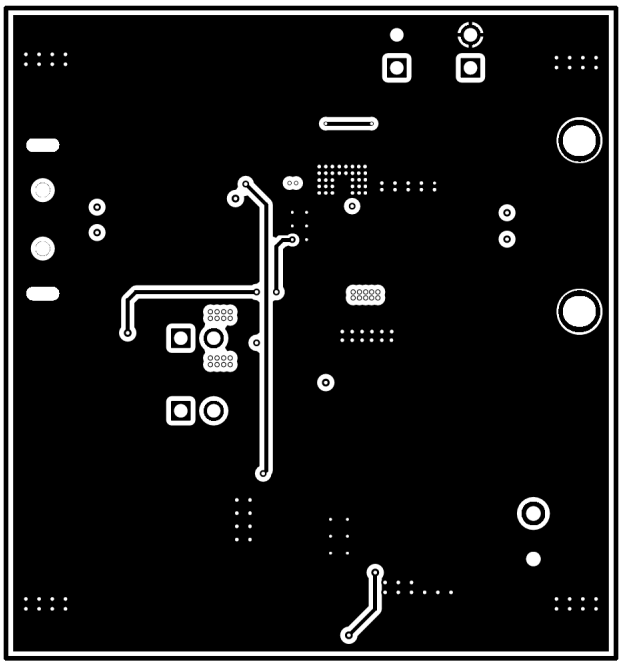

Figure 5. Middle Layer 1 Layout

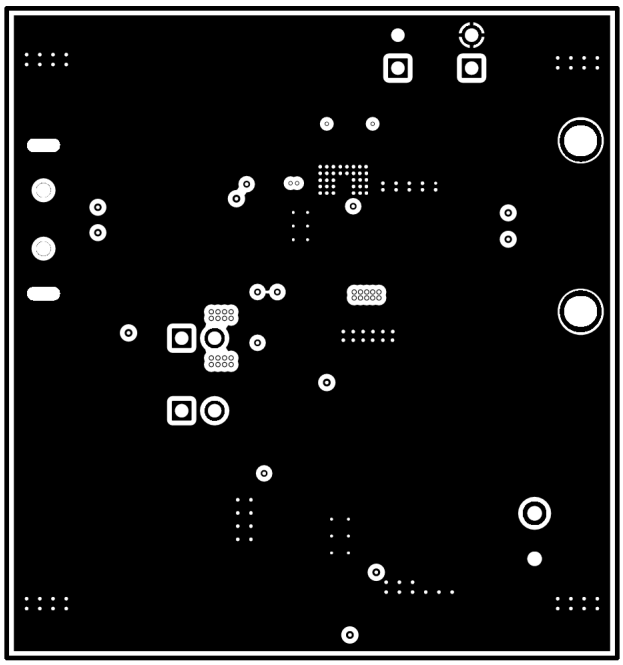

Figure 6. Middle Layer 2 Layout

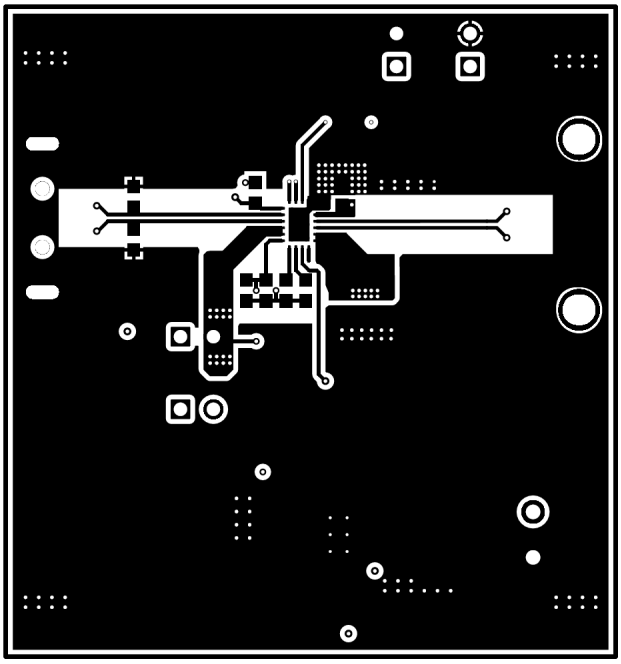

Figure 7. Bottom Layer Layout

4 Schematic and Bill of Materials

4.1 Schematic

Figure 8 show the TPD3S713Q1EVM-103 schematic

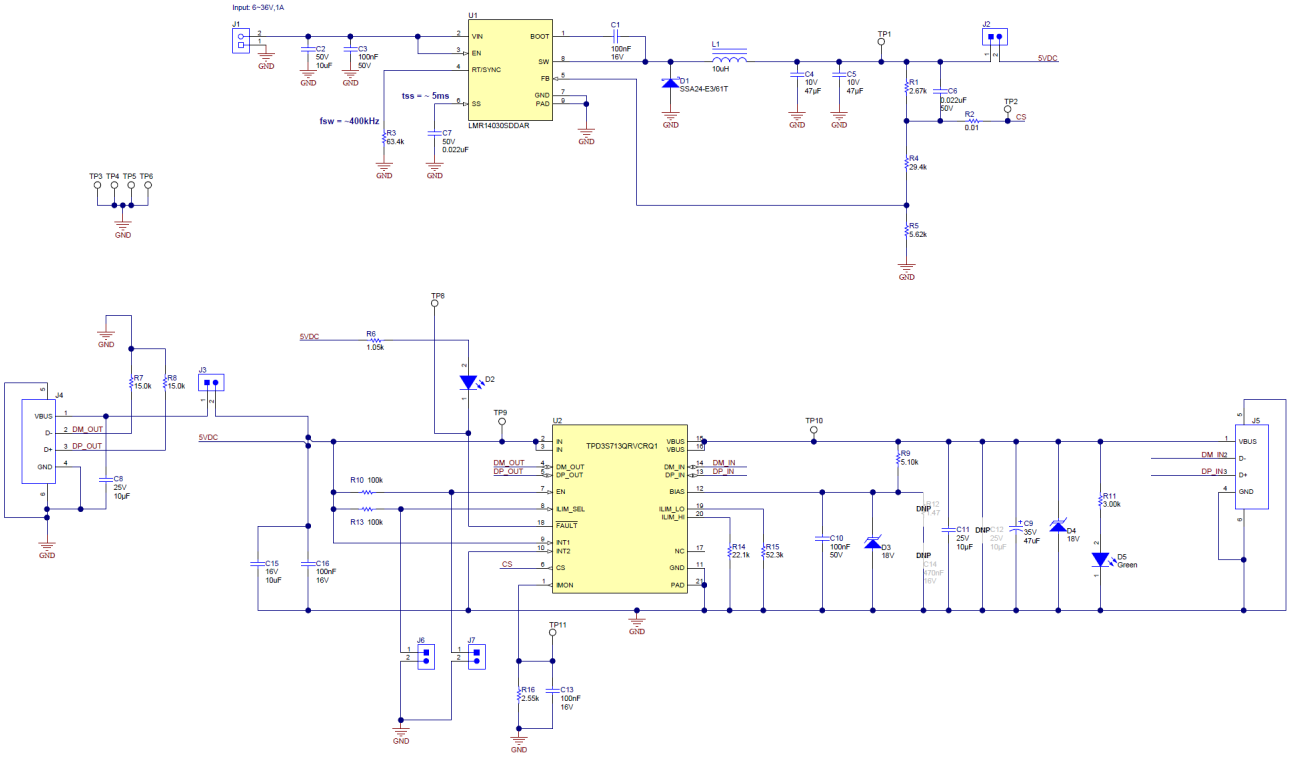

Figure 8. TPD3S713Q1EVM-103 Schematic

4.2 Bill of Materials

Table 4 lists the EVM bill of materials.

Table 4. TPD3S713Q1EVM-103 Bill of Materials(1)

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB	1		Printed Circuit Board		PSIL103	Any	-	-
C1, C13, C16	3	0.1uF	CAP, CERM, 0.1 µF, 16 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	0603YC104K4T4A	AVX		
C2	1	10uF	CAP, CERM, 10 µF, 50 V, +/- 10%, X5R, 1210	1210	C3225X5R1H106K 250AB	TDK		
C3,C10	2	0.1uF	CAP, CERM, 0.1 µF, 50 V, +/- 20%, X7R, 0603	0603	06035C104JAT2A	AVX		
C4, C5	2	47uF	CAP, CERM, 47 µF, 16 V, +/- 20%, X5R, 1210	1210	LMK325B7476MM -PR	Taiyo Yuden		
C6, C7	2	0.022 uF	CAP, CERM, 0.022 µF, 50V, +/- 10%, X7R, 0603	0603	GRM188R71H223 KA01D	MuRata		
C8	1	10uF	CAP, CERM, 10 µF, 25 V,+/- 10%, X7R, 1206	1206	C3216X7R1E106K 160AB	TDK		
C9	1	47uF	CAP, AL, 47 uF, 35 V, +/- 20%, 1 ohm, SMD	F55	EMVY350ADA470 MF55G	Chemi-Con		
C15	1	10uF	CAP, CERM, 10 uF, 16 V, +/- 10%, X7R, 1206	1206	C3216X7R1C106K 160AC	TDK		
D1	1	40V	Diode, Schottky, 40 V, 2 A, SMA	SMA	SSA24-E3/61T	Vishay-Semiconductor		

(1) Unless otherwise noted in the *Alternate Part Number* or *Alternate Manufacturer* columns, all parts may be substituted with equivalents.

Table 4. TPD3S713Q1EVM-103 Bill of Materials[(1)] (continued)

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
D2	1	Red	LED, Super Red, SMD	LED_0603	150060SS75000	Wurth Elektronik		
D3,D4	2	18V	Diode, TVS, Uni, 18 V, 29.2 Vc, 400 W, 13.7 A, AEC-Q101, SMA	SMA	SZ1SMA18AT3G	Littelfuse		
D5	1	Green	LED, Green, SMD	LED_0603	150060GS75000	Wurth Elektronik		
J1	1		Terminal Block, 5.08 mm, 2x1, TH	2POS Terminal Block	1715721	Phoenix Contact		
J2, J3, J6, J7	4		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions		
J4	1		Connector, Plug, USB Type A, R/A, Top Mount SMT	USB 2.0, SMT Plug, 18.65x4.5x12mm	931	'Keystone		
J5	1		Connector, Receptacle, USB TYPE A, R/A, Top Mount SMT	USB TYPE A CONNECTOR RECEPTACLE 4POS SMD	896-43-004-00-000000	Mill-Max		
L1	1	10uH	Inductor, Unshielded Drum Core, Ferrite, 10 uH, 2.5 A, 0.055 ohm, TH	D6 x 8.5mm	7447462100	Wurth Elektronik		
R1	1	2.67k	RES, 2.67 k, 1%, 0.1 W, 0603	0603	RC0603FR-072K67L	Yageo		
R2	1	0.01	RES, 0.01, 1%, 0.1 W, 0603	0603	WSL0603R0100FEA	Vishay-Dale		
R3	1	63.4k	RES, 63.4 k, 1%, 0.1 W, 0603	0603	CRCW060363K4FKEA	Vishay-Dale		
R4	1	29.4k	RES, 29.4 k, 1%, 0.1 W, 0603	0603	CRCW060329K4FKEA	Vishay-Dale		
R5	1	5.62k	RES, 5.62 k, 1%, 0.1 W, 0603	0603	CRCW06035K62FKEA	Vishay-Dale		
R6	1	1.05K	RES, 1.05 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K05FKEA	Vishay-Dale		
R7,R8	2	15k	RES, 15 k, 5%, 0.1 W, 0603	0603	CRCW060315K0JNEA	Vishay-Dale		
R9	1	5.1k	RES, 5.1 k, 5%, 0.1 W, 0603	0603	CRCW06035K10JNEA	Vishay-Dale		
R10,R13	4	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	RC0603FR-07100KL	Yageo America		
R11	1	3.0k	RES, 3.0 k, 5%, 0.1 W, 0603	0603	CRCW06033K00JNEA	Vishay-Dale		
R14	1	22.1k	RES, 22.1 k, 1%, 0.1 W, 0603	0603	CRCW060322K1FKEA	Vishay-Dale		
R15	1	52.3K	RES, 52.3k, 1%, 0.1 W, 0603	0603	RC0603FR-0752K3L	Yageo		
R16	1	2.55k	RES, 2.55 k, 1%, 0.1 W, 0603	0603	CRCW06032K55FKEA	Vishay-Dale		
SH-J1, SH-J2	2	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
TP1, TP2, TP8, TP9, TP10, TP11	9	SMT	Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone		
TP3, TP4, TP5, TP6	4		Test Point, Compact, SMT	Testpoint_Keystone_Compact	5016	Keystone		
U1	1		SIMPLE SWITCHER 40 V 3.5 A, 2.2 MHz Step-Down Converter with 40 uA IQ, DDA0008E	DDA0008E	LMR14030SDDAR	Texas Instruments	LMR14030SDDA	Texas Instruments
U2	1		Automotive USB 2.0 Interface Protection with Adjustable Current Limit and Short-to-VBATT Protection, RVC0020A (WQFN-20)	RVC0020A	TPD3S713QRVCRQ1	Texas Instruments	TPD3S713QRVCRQ1	Texas Instruments
C12	0	10uF	CAP, CERM, 10 µF, 25 V,+/- 10%, X7R, 1206	1206	C3216X7R1E106K160AB	TDK		
C14	0	0.47uF	CAP, CERM, 0.47 uF, 16 V, +/- 10%, X7R, 0603	0603	GRM188R71C474KA88D	MuRata		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265