TPS22953/54 5.7-V, 5-A, 14-mΩ On-Resistance Load Switch

The TPS22953EVM and TPS22954EVM evaluation modules (EVM) allow the user to connect power to and control the TPS22953 and TPS22954 5.7-V, 5-A, 14-mΩ On-Resistance Load Switches. Table 1 summarizes the available EVMs and Package Options; refer to the device datasheet SLVSCT5 for more details.

Table 1. Device and Package Configurations

EVM Orderable	Device	Device Package	Default UVLO/PG	Maximum Voltage	Maximum Continuous Current	Quick Output Discharge
TPS22953EVM	U1	TPS22953DSQ	4.5V	5.7V	5A	No
	U2	TPS22953DQC	3.0V	5.7V	5A	No
TPS22954EVM	U1	TPS22954DSQ	4.5V	5.7V	5A	Yes
	U2	TPS22954DQC	3.0V	5.7V	5A	Yes

Contents

1 Introduction

The TPS22953EVM and TPS22954EVM evaluation modules (EVM) allow the user to connect power to and control the both package versions of the TPS22953 and TPS22954 5.7-V, 5-A, 14-mΩ On-Resistance Load Switches. This allows for easy evaluation of ON Resistance, Adjustable Slew Rate, Adjustable Under Voltage Lockout (UVLO), and Adjustable Voltage Supervisor with Power Good (PG) output.

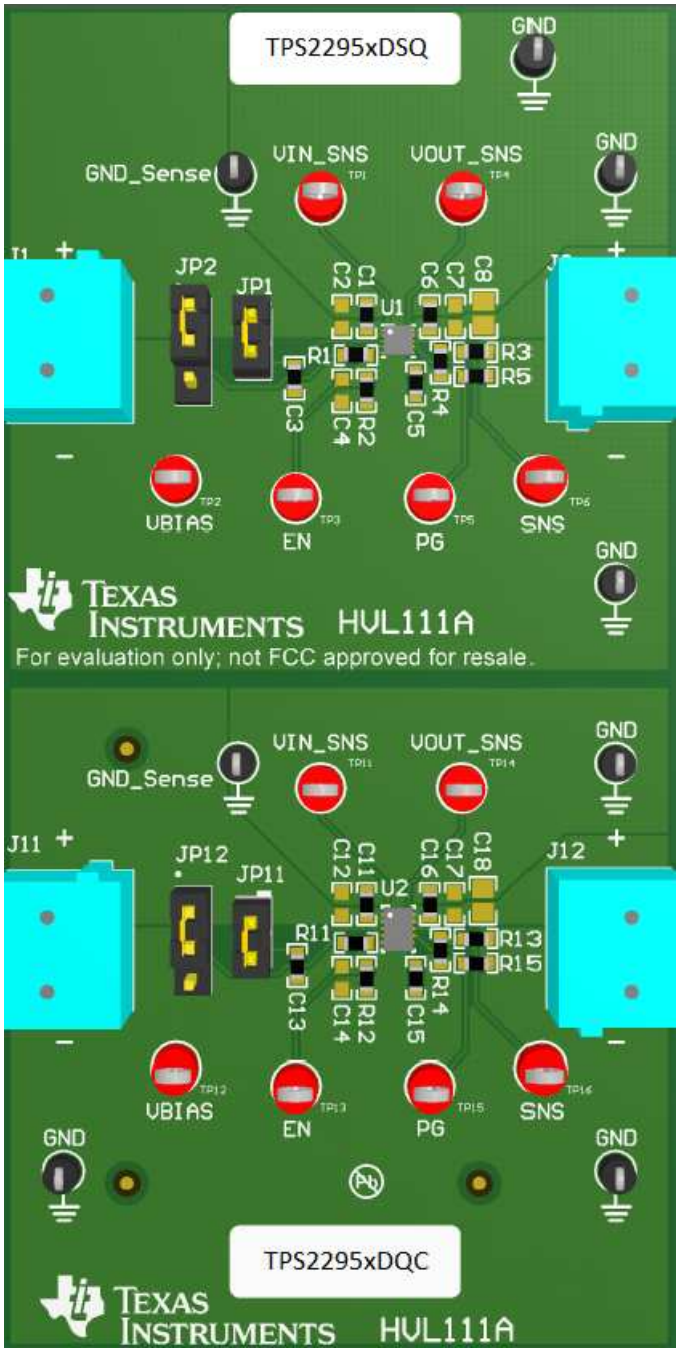

Figure 1. 3D Rendering of EVM

1.1 Typical Applications

- Solid State Drives (SSDs)
- Embedded/Industrial PC
- Ultrabook™/Notebooks
- Desktops
- Servers
- Telecom Systems

1.2 Features

- VBIAS voltage range: 2.5 V to 5.7 V
- VIN input voltage range: 0.7 V to 5.7 V
- External capacitor for adjustable rise time
- External resistors for adjustable under voltage lockout
- External resistors for adjustable voltage supervisor with PG output
- High current connection terminals available for 5A maximum continuous switch current operation
- Test Point Connections to VIN, VOUT, VBIAS, EN, SNS, and PG pins
- SENSE connections for accurate measurement of VIN and VOUT voltages used for Voltage Drop and ON Resistance Calculations

2 Electrical Performance

Refer to the datasheet SLVSCJ7 for detailed electrical characteristics of the TPS22953 and TPS22954.

3 Schematic

The Schematic for the TPS22953 and TPS22954 EVMs is shown in Figure 2.

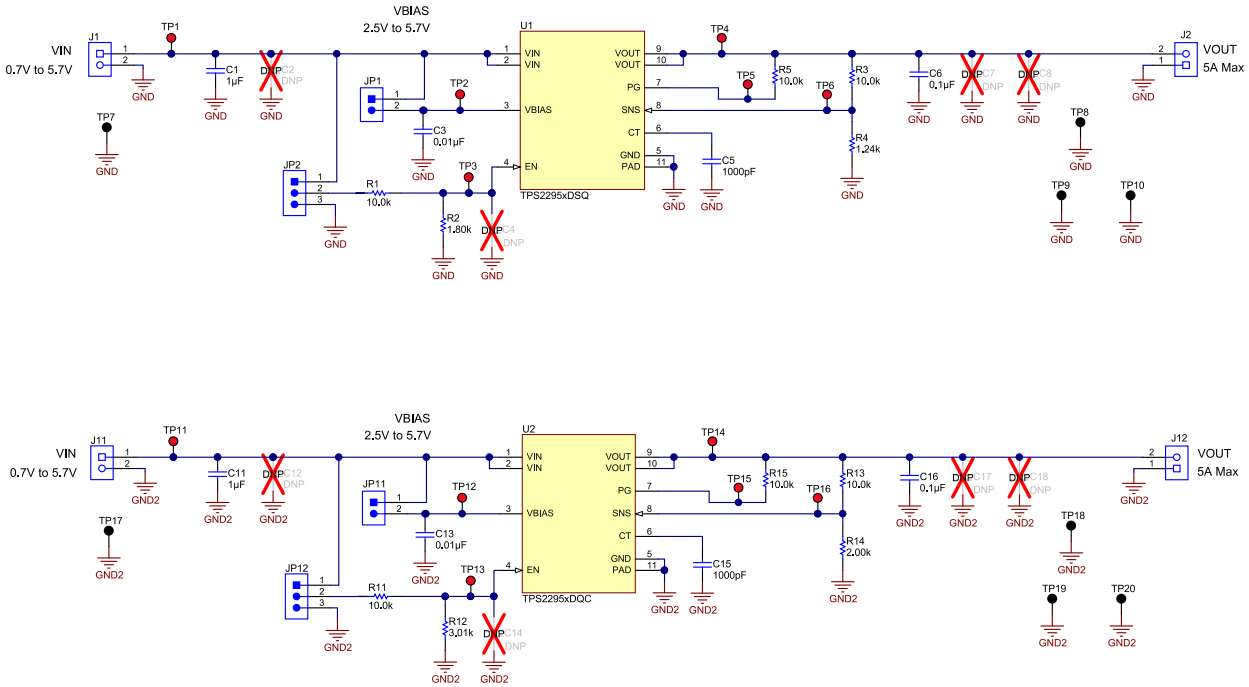

Figure 2. Schematic

4 EVM Connections

This section describes the connectors, jumpers, and test points on the EVM.

4.1 J1/J11 – VIN Power Connections

These are the high current input connections from the power supply. Connect the positive lead to the top (+) thermal and the negative lead to the bottom (–) terminal.

4.2 J2/J12 – VOUT Power Connections

These are the high current output connections for loading the EVM. Connect the positive lead of the load to the top (+) terminal and the GND of the load to the bottom (–) terminal.

4.3 JP1/JP11 – VBIAS Power

These jumpers connect VBIAS to the respective VIN voltage source. VBIAS must be maintained between 2.5 V–5.7 V for proper operation on the TPS22953 and TPS22954 devices. If testing conditions involve taking the VIN voltage below 2.5V, remove the shunt across JP1/JP11 and connect VBIAS voltage at TP2/TP12.

4.4 JP2/JP12 – EN Control

These three pin jumpers connect the EN sense resistors either to VIN or to GND. This allow for quickly enabling/disabling the device after power is present.

4.5 TP1/TP11 – VIN Sense

These connects provide and low current path to the input pins of the device for accurate voltage measurements. These sense connections should be used when measuring the voltage drop from VIN to VOUT which is used to calculate the ON resistance. In cases where there is a large load current, it is recommended configure the power supply to use sense connections. Connect the positive sense lead to the VIN sense point to overcome voltage drop in cabling.

4.6 TP4/TP14 – VOUT Sense

These connects provide and low current path to the output pins of the device for accurate voltage measurements. These sense connections should be used when measuring the voltage drop from VIN to VOUT which is used to calculate the ON resistance.

4.7 TP7/TP17 – GND_Sense

These test points provide a low current path to the GND pad of the device for accurate GND measurements. In cases where there is a large load current, it is recommended configure the power supply to use sense connections. Connect the negative sense lead to the GND_sense point to overcome voltage drop in cabling.

4.8 TP3/TP13 – EN

These test points are used to monitor the EN pin voltage used for UVLO. These test points can also be used to drive the EN pin independently when JP2/JP12 is removed.

4.9 TP6/TP16 – SNS

These test points are used to monitor the SNS pin voltage.

4.10 TP5/TP15 – PG

These test points are used to monitor the PG pin voltage which is tied to VOUT through at 10kΩ resistor.

4.11 TP8/TP9/TP10/TP18/TP19/TP20 – GND

These are the GND connection points to the EVM.

4.12 List of Connections

The EVM Connections are summarized in Table 2.

Table 2. EVM Connection Points

Connection	Name	Description
J1, J11	VIN	DC input to VIN
J2, J12	VOUT	Load connection for VOU
JP1, JP11	VBIAS Power	Connects VBIAS to VIN
JP2, JP12	EN Control	Connects EN resistors to VIN or GND
TP1, TP11	VIN Sense	Sense connection to VIN
TP2, TP12	VBIAS	VBIAS connection
TP3, TP13	EN	EN connection
TP4, TP14	VOUT Sense	Sense connection to VOUT
TP5, TP15	PG	PG connection
TP6, TP16	SNS	SNS connection
TP7, TP17	GND Sense	Sense connection to device GND
TP8, TP9, TP10, TP18, TP19, TP20	GND	Connection to board ground

5 Test Setup

This section will describe how to take key parameter measurements on the EVM.

5.1 RON Test Procedure

1. Setup the EVM per Figure 3.
2. Set SOURCE1 level to 5.0 V.
3. Turn on SOURCE1.
4. Record the voltage reading from METER1 as well as the input current reading from SOURCE1.
5. Turn SOURCE1 off.
6. Calculate the Resistance of the switch by dividing the voltage reading from METER1 by the current reading from SOURCE1.

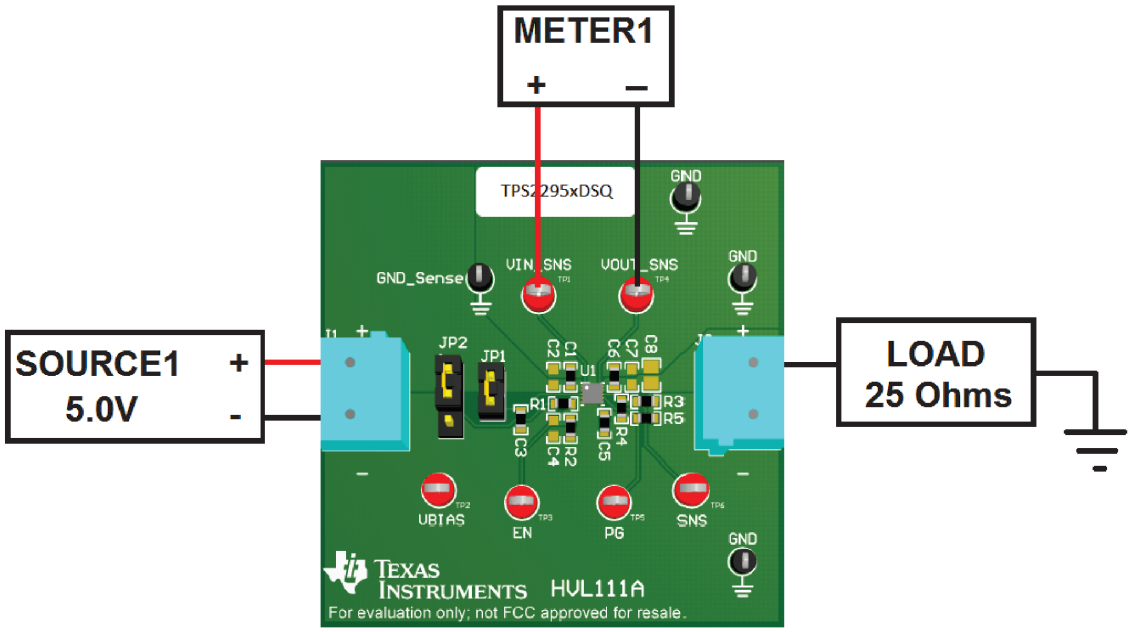

Figure 3. RON Test Setup

5.2 AC Parameter Test Procedure (tR, tON, tF, tOFF, tD)

1. A detailed description of tR, tON, tF, tOFF, and tD are listed in the TPS22953/54 Datasheet under the Switching Characteristics Section.
2. The rise time (tR) is selected by the CT capacitor value on each switch channel. The EVM is shipped with a default CT value of 1 nF.
3. Set up the EVM per Figure 4.
4. Set SOURCE1 level to 5.0 V.
5. Set Signal Generator output to 0–2 Vpp, 10–100 Hz, and 25% duty cycle.
6. Turn SOURCE1 on.
7. Enable the Signal Generator output.
8. Rise time (tR), turn-on time (tON), and delay time (tD) can be observed with a Oscilloscope sync the scope trigger on the rising edge of the on signal..
9. Fall time (tF) and turn-of time (tOFF) can be observed from the oscilloscope by charging the scope triggering to sync with the falling edge of the ON signal.
10. Turn SOURCE1 off and disable the signal generator output.

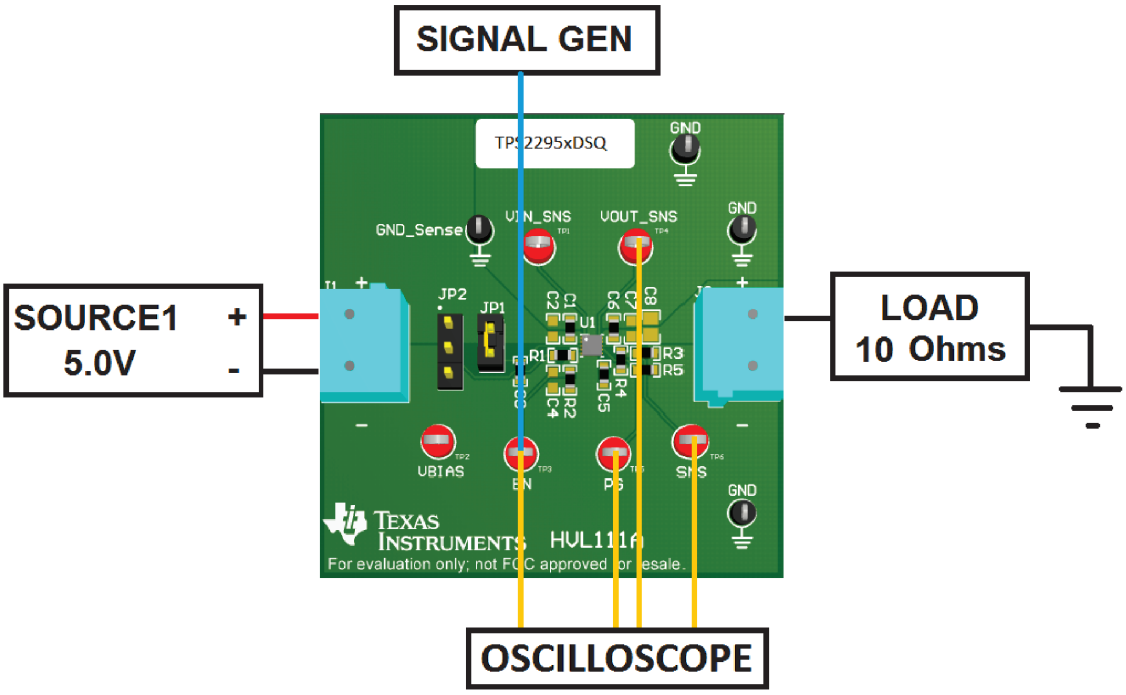

Figure 4. AC Parameter Test Setup

6 Board Assembly and Layout

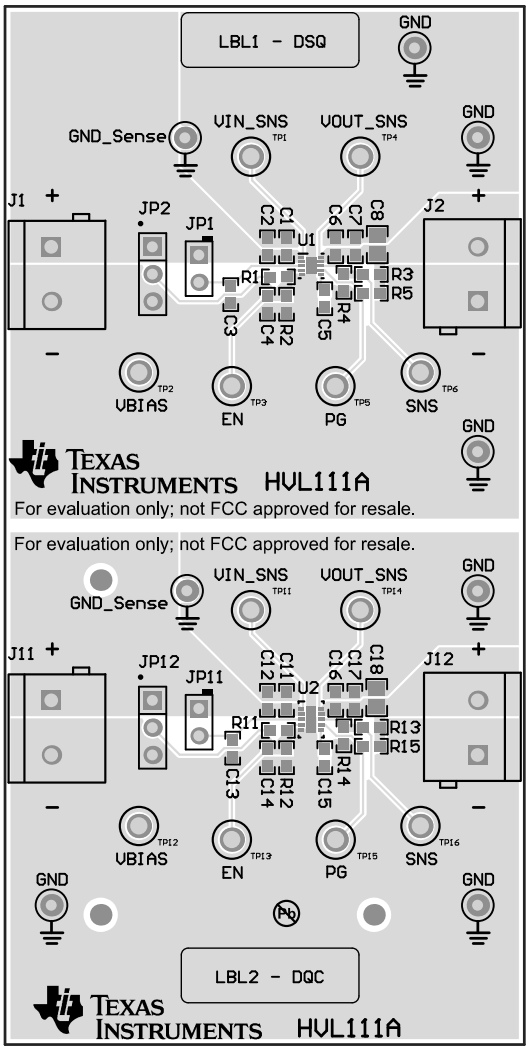

Figure 5. Top Side

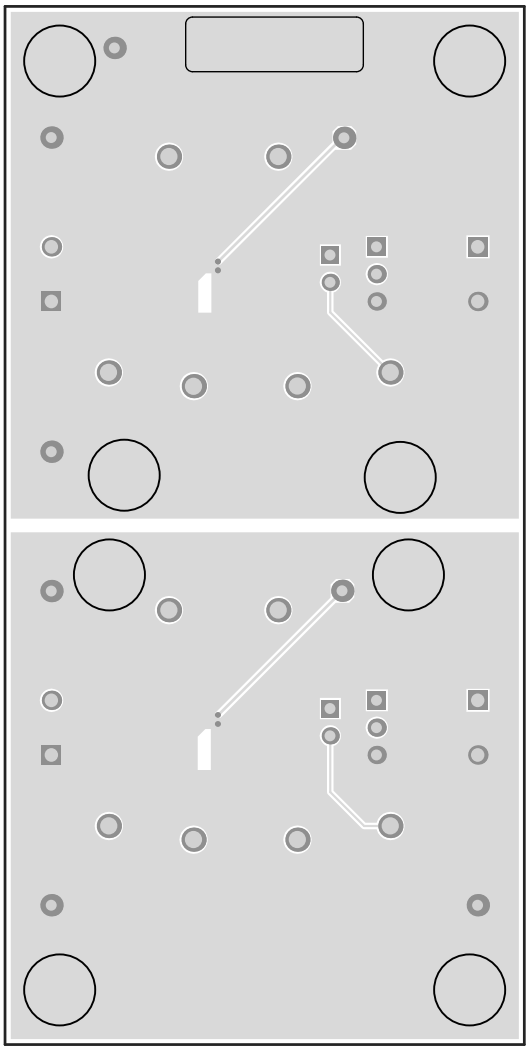

Figure 6. Bottom Side

7 TPS22953EVM Bill of Materials

This section contains details on the bill of materials for the TPS22953EVM. Unpopulated items have a quantity of 0.

Table 3. PS22953EVM Bill of Materials

Designator	Qty	Description	Package Reference	Part Number	Manufacturer
C1, C11	2	CAP, CERM, 1 µF, 16 V, ±10%, X5R, 0603	0603	C1608X5R1C105K	TDK
C3, C13	2	CAP, CERM, 0.01 µF, 50 V, ±5%, X7R, 0603	0603	C0603C103J5RACTU	Kemet
C5, C15	2	CAP, CERM, 1000 pF, 50 V, ±10%, X7R, 0603	0603	C0603C102K5RACTU	Kemet
C6, C16	2	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	0603	C1608X7R1E104K	TDK
J1, J2, J11, J12	4	TERMINAL BLOCK 5.08MM VERT 2POS, TH	TERM_BLK, 2pos, 5.08mm	ED120/2DS	On-Shore Technology
JP1, JP11	2	Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07-G-S-240	Samtec
JP2, JP12	2	Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
R1, R3, R11, R13	4	RES, 10.0 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD0710KL	Yageo America
R2	1	RES, 1.80 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD071K8L	Yageo America
R4	1	RES, 1.24 k, 0.1%, 0.1 W, 0603	0603	RG1608P-1241-B-T5	Susumu Co Ltd
R5, R15	2	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
R12	1	RES, 3.01 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD073K01L	Yageo America
R14	1	RES, 2.00 k, 0.1%, 0.063 W, 0603	0603	CPF0603B2K0E	TE Connectivity
SH-JP1, SH-JP2, SH-JP11, SH-JP12	4	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP11, TP12, TP13, TP14, TP15, TP16	12	Test Point, Compact, Red, TH	Red Compact Testpoint	5005	Keystone
TP7, TP8, TP9, TP10, TP17, TP18, TP19, TP20	8	Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
U1	1	5.7V, 5A, 14mΩ On-Resistance Load Switch	DSQ0010A	TPS22953DSQR	Texas Instruments
U2	1	5.7V, 5A, 14mΩ On-Resistance Load Switch	DQC0010A	TPS22953DQCR	Texas Instruments
C2, C12	0	CAP, CERM, 1 µF, 16 V, ±10%, X5R, 0603	0603	C1608X5R1C105K	TDK
C4, C14	0	CAP, CERM, 0.1 µF, 16 V, ±10%, X7R, 0603	0603	C1608X7R1C104K	TDK
C7, C17	0	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	0603	C1608X7R1E104K	TDK
C8, C18	0	CAP, CERM, 10 µF, 16 V, ±10%, X6S, 0805	0805	C2012X6S1C106MT	TDK

8 TPS22954EVM Bill of Materials

This section contains details on the bill of materials for the TPS22954EVM. Unpopulated items have a quantity of 0.

Table 4. TPS22954EVM Bill of Materials

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C1, C11	2	CAP, CERM, 1 µF, 16 V, ±10%, X5R, 0603	0603	C1608X5R1C105K	TDK
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C5, C15	2	CAP, CERM, 1000 pF, 50 V, ±10%, X7R, 0603	0603	C0603C102K5RACTU	Kemet
C6, C16	2	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	0603	C1608X7R1E104K	TDK
J1, J2, J11, J12	4	TERMINAL BLOCK 5.08MM VERT 2POS, TH	TERM_BLK, 2pos, 5.08mm	ED120/2DS	On-Shore Technology
JP1, JP11	2	Header, 100mil, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	HMTSW-102-07-G-S-240	Samtec
JP2, JP12	2	Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
R1, R3, R11, R13	4	RES, 10.0 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD0710KL	Yageo America
R2	1	RES, 1.80 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD071K8L	Yageo America
R4	1	RES, 1.24 k, 0.1%, 0.1 W, 0603	0603	RG1608P-1241-B-T5	Susumu Co Ltd
R5, R15	2	RES, 10.0 k, 1%, 0.1 W, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
R12	1	RES, 3.01 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD073K01L	Yageo America
R14	1	RES, 2.00 k, 0.1%, 0.063 W, 0603	0603	CPF0603B2K0E	TE Connectivity
SH-JP1, SH-JP2, SH-JP11, SH-JP12	4	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP11, TP12, TP13, TP14, TP15, TP16	12	Test Point, Compact, Red, TH	Red Compact Testpoint	5005	Keystone
TP7, TP8, TP9, TP10, TP17, TP18, TP19, TP20	8	Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
U1	1	5.7V, 5A, 14mΩ On-Resistance Load Switch	DSQ0010A	TPS22954DSQR	Texas Instruments
U2	1	5.7V, 5A, 14mΩ On-Resistance Load Switch	DQC0010A	TPS22954DQCR	Texas Instruments
C2, C12	0	CAP, CERM, 1 µF, 16 V, ±10%, X5R, 0603	0603	C1608X5R1C105K	TDK
C4, C14	0	CAP, CERM, 0.1 µF, 16 V, ±10%, X7R, 0603	0603	C1608X7R1C104K	TDK
C7, C17	0	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	0603	C1608X7R1E104K	TDK
C8, C18	0	CAP, CERM, 10 µF, 16 V, ±10%, X6S, 0805	0805	C2012X6S1C106MT	TDK

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