# TPS22975 Load Switch Evaluation Module

The TPS22975EVM evaluation module (EVM) features both the TPS22975 and TPS22975N. The evaluation module allows the user to connect power to and control the 8-pin DSG package load switch. Parameters such as the on-resistance, rise time, and output pull-down resistance can be easily and accurately evaluated. Table 1 lists a short description of the TPS22975 load switch performance specifications; for additional details on load switch performance, application notes, and the datasheet, see www.ti.com/loadswitch.

**Table 1. TPS22975 Rise Time, Output Current Rating, Enable, and Output Discharge Characteristics**

| EVM | Device | Rise Time Typical (µs) | $V_{IN}$ (V) | Maximum Continuous Current (A) | Enable (ON Pin) | Quick Output Discharge |
|---|---|---|---|---|---|---|
| HVL148 | TPS22975 | Adjustable | 0.6 to 5.7 | 6 | Active High | Y |
| | TPS22975N | Adjustable | 0.6 to 5.7 | 6 | Active High | N |

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# 1 Introduction

## 1.1 Description

The TPS22975EVM is a two-layer PCB containing the TPS22975 and TPS22975N load switch devices. The VIN and VOUT connections to the device and the PCB layout routing are capable of handling high continuous currents and provide a low-resistance pathway into and out of the device under test. Test point connections allow the EVM user to control the device with user-defined test conditions and make accurate $R_{ON}$ measurements.

## 1.2 Features

This EVM has the following features:

- $V_{IN}$ input voltage range: 0.6 V to 5.7 V
- Access to the VIN, VOUT, CT, QOD, GND, and ON pins of the TPS22975 load switch device
- Onboard $C_{IN}$, $C_{OUT}$, and CT capacitors
- 6-A maximum continuous current operation

# 2 Electrical Performance

Refer to the data sheet SLVSDD0 for detailed electrical characteristics of the TPS22975.

# 3 Schematic

Figure 1 illustrates the EVM schematic.

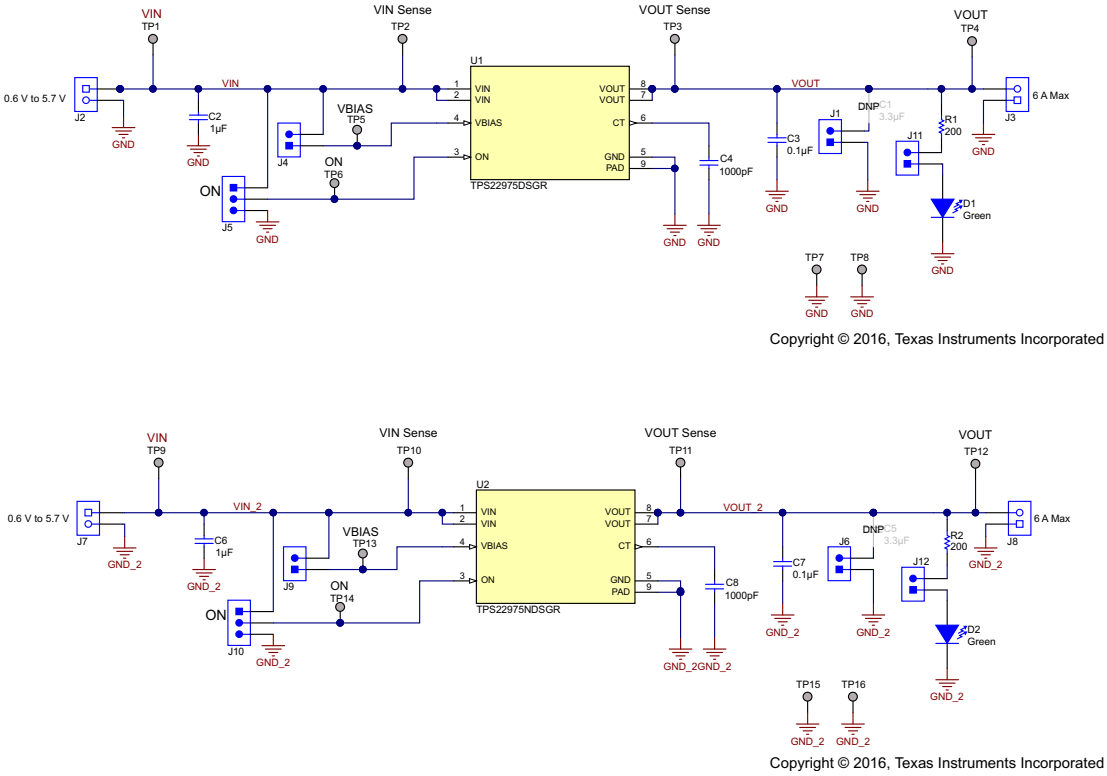



**Figure 1. TPS22975EVM Schematic**

## 4 Layout

Figure 2 and Figure 3 show the PCB layout images.

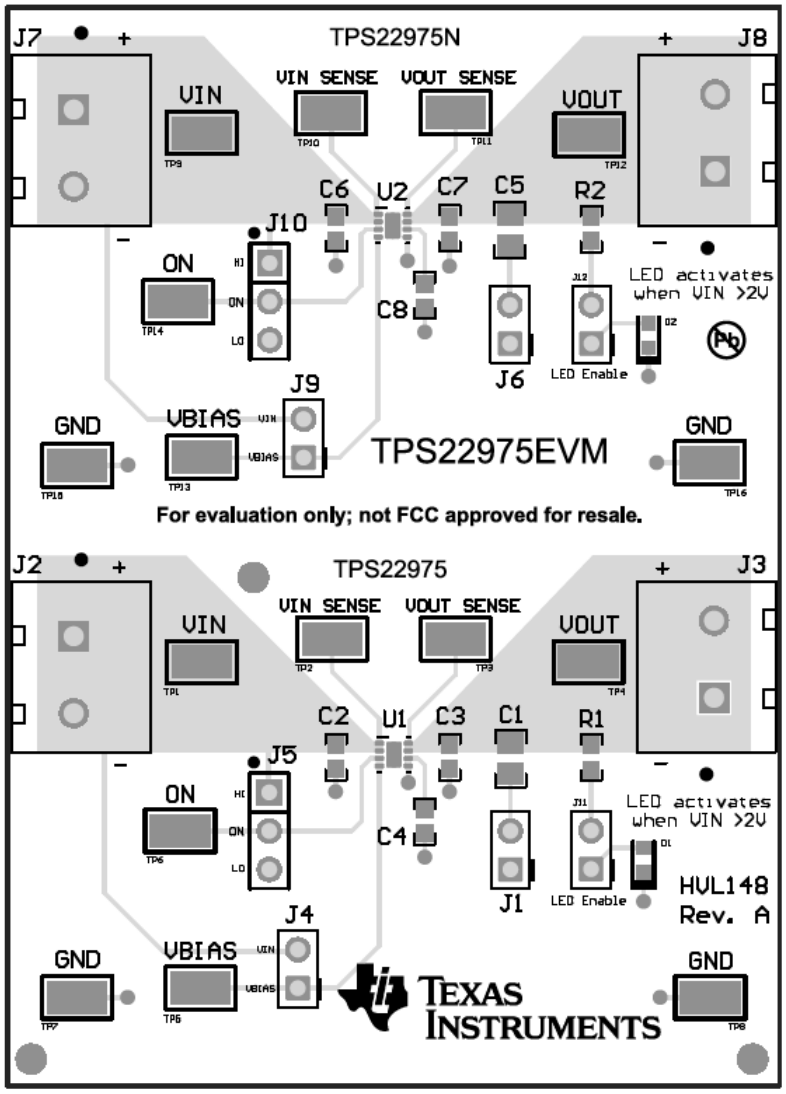



**Figure 2. TPS22975EVM Top Layer**

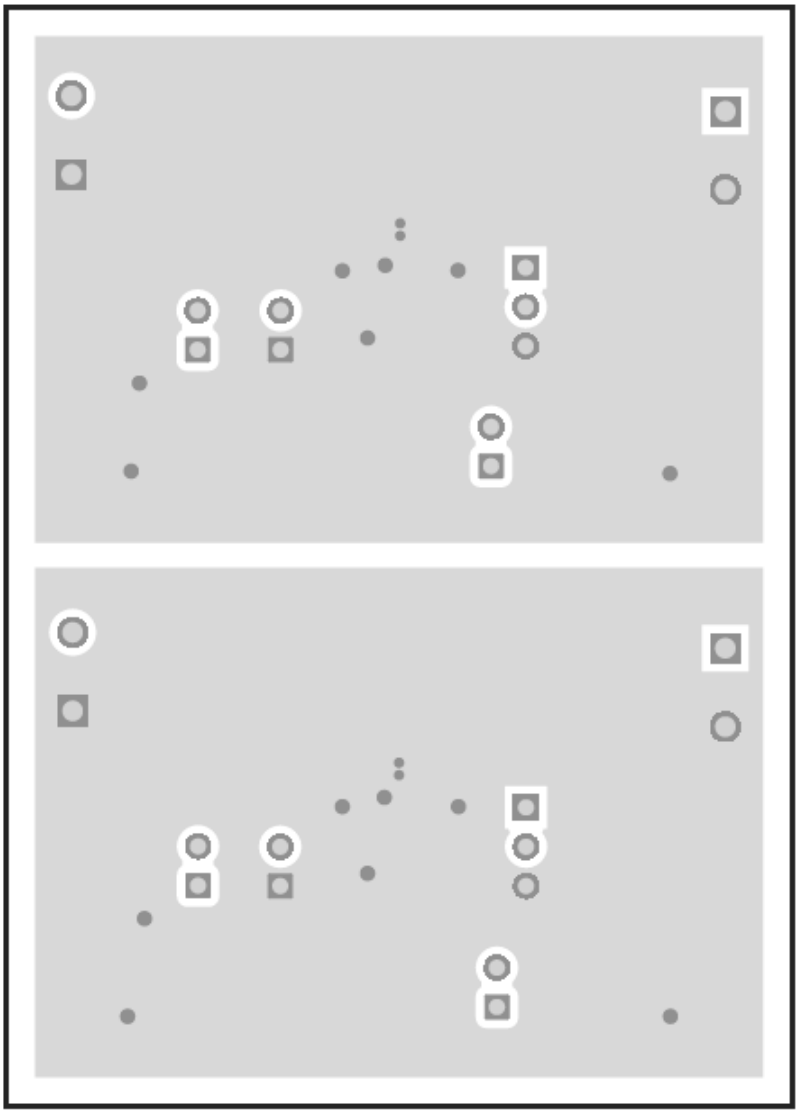


**Figure 3. TPS22975EVM Bottom Layer**

## *4.1 Setup (TPS22975 and TPS22975N)*

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up, and use the EVM.

### 4.1.1 J2, TP1 - J7, TP9—Input Connections

These are the connections for the leads from the input source. Connect the positive lead to the + terminal (VIN) and the negative lead to the – terminal (GND).

### 4.1.2 J3, TP4 - J8, TP12—Output Connection

These are the connections for the output of the EVM. Connect the positive lead to the + terminal (VOUT) and the negative lead to the – terminal (GND).

### 4.1.3 J5, TP6 - J10, TP14—ON

This is the enable input for the device. A shorting jumper must be installed on J5/J10 in either the high or low position. The TPS22975 is active high, and ON must not be left floating. An external enable source can be applied to the EVM by removing the shunt and connecting a signal to TP6/TP14. Refer to the datasheet for proper ON and OFF voltage level settings. A switching signal may also be used and connected at this point.

### 4.1.4 TP2/TP10 - VIN Sense, TP3/TP11—VOUT Sense

These two connections are used when very accurate measurements of the input or output are required. Make $R_{ON}$ measurements using these sense connections when measuring the voltage drop from VIN to VOUT.

### 4.1.5 TP5, J4 - TP13, J9—BIAS

This is the VBIAS input for the device. A shorting jumper can be connected across J4/J9 to connect VIN to VBIAS. An external source can be applied to VBIAS by removing the jumper and connecting a supply to TP5/TP13. See the TPS22975 data sheet (SLVSDD0) for proper VBIAS voltage level settings.

### 4.1.6 J1 - J6—Output capacitor (Optional)

A shorting jumper can be placed across J1/J6 to enable the use of optional output capacitor C1/C5 (not provided).

### 4.1.7 J11 - J12—LED Enable

A shorting jumper can be placed across J11/J12 to enable the LED indicator. The LED only functions when $V_{OUT}$ is greater than 2 V. It is recommended to disable the LED when making measurements.

### 4.1.8 TP7, TP8 - TP14, TP16—GND

These are connections to GND.

## 5 Operation

Connect the VIN power supply to the J2/J7 terminal (VIN). Connect the negative lead of the power supply to TP7/TP14 (GND). The input voltage range of the TPS22975EVM is 0.6 V to 5.7 V.

External output loads can be applied to the switch by using the J3/J8 terminal (VOUT). The TPS22975EVM is rated for a maximum continuous current of 6 A. When the ON pin is asserted high, the output of the TPS22975 is enabled.

# 6 Test Configurations

## 6.1 On-Resistance ($R_{ON}$) Test Setup

Figure 4 shows the typical setup for measuring on-resistance. Connect the desired VBIAS to the the VBIAS test point. It is recommended that VBIAS is greater than VIN for best on-resistance performance. The voltage drop across the switch is measured using the sense connections, and this can be divided by the load current to calculate the $R_{ON}$ resistance.

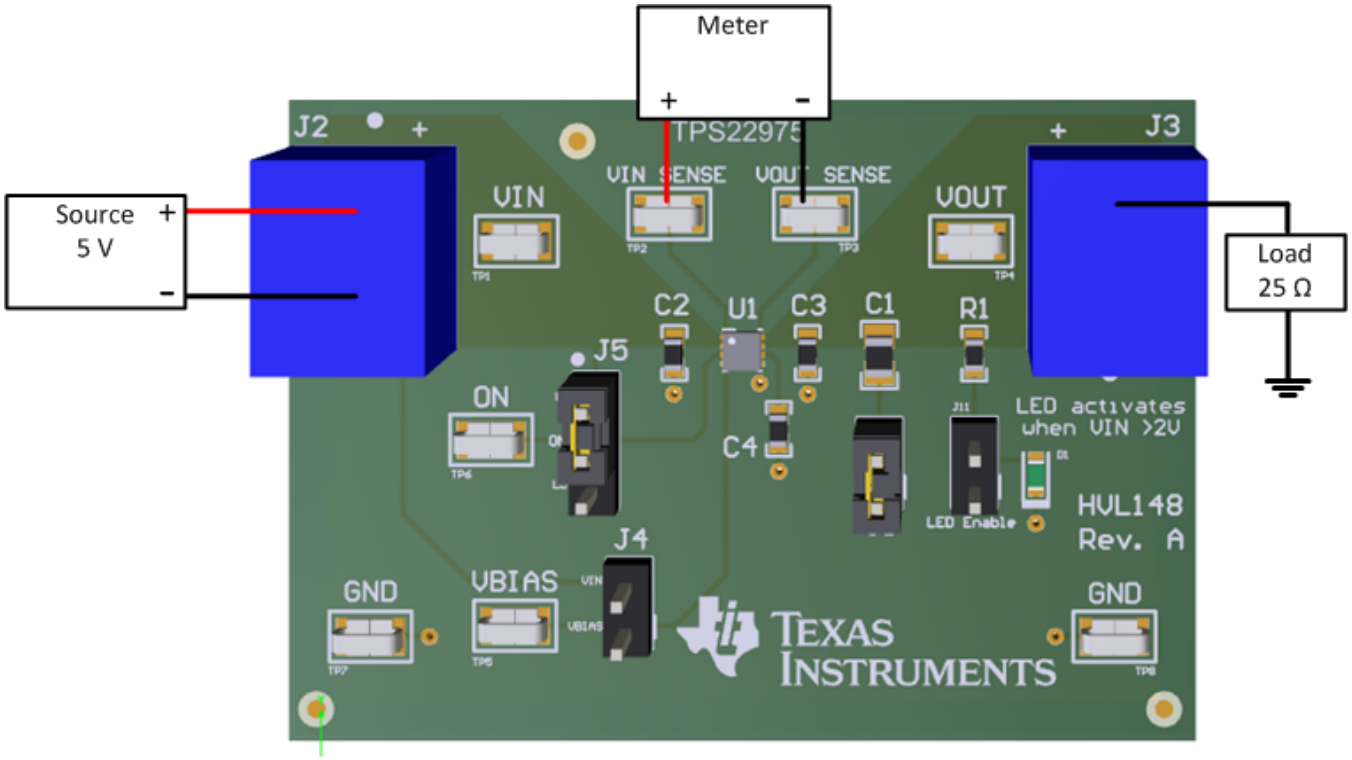



**Figure 4. $R_{ON}$ Test Setup**

## 6.2 Rise Time Test Setup

Figure 5 shows the test setup for measuring the rise time of the TPS22975. Apply a square wave to the ON pin of the switch using a function generator and apply a voltage to the VIN terminal using a power supply. Observe the waveform at VOUT Sense (TP3/TP11) with an oscilloscope to measure the slew rate and rise time of the switch with a given input voltage. To vary the output voltage rise time, change the default 1000-pF CT capacitor (C4/C8). For more information on the rise time variance with CT capacitor value, refer to the TPS22975 data sheet (SLVSDD0).

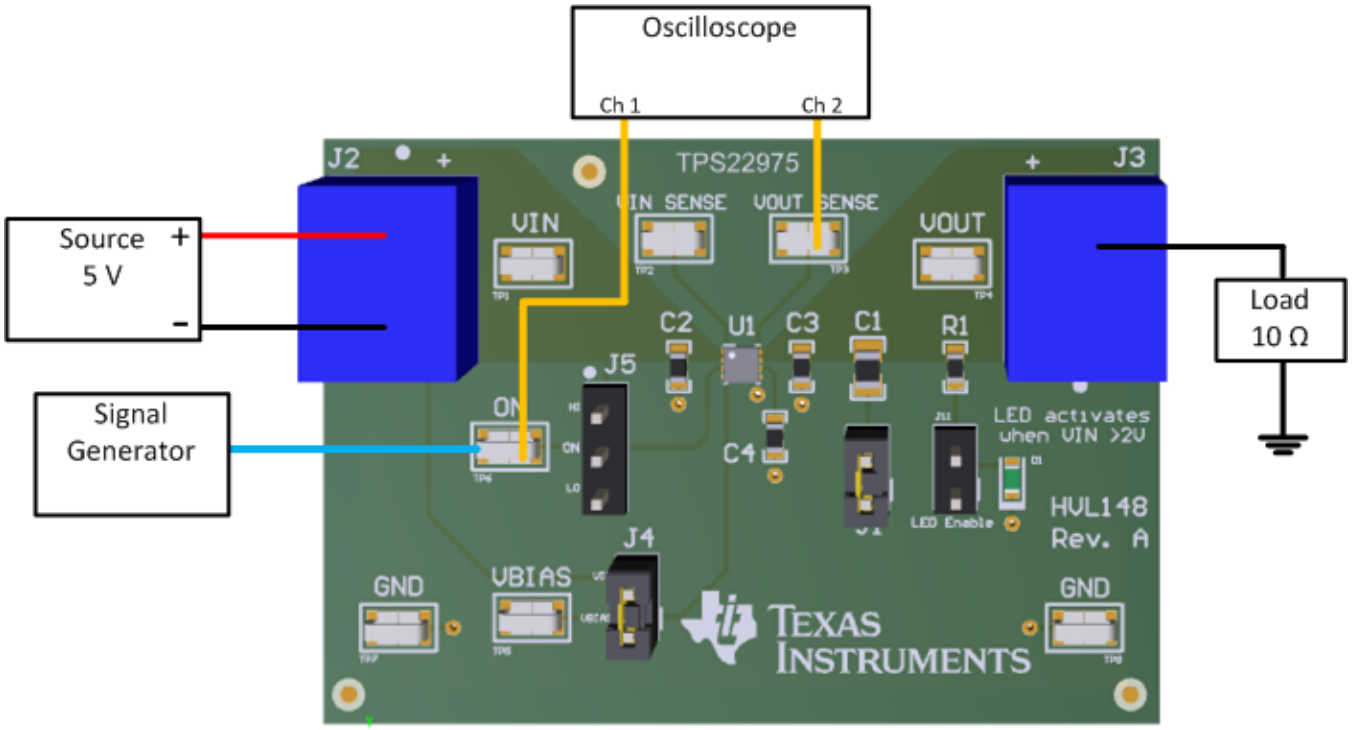
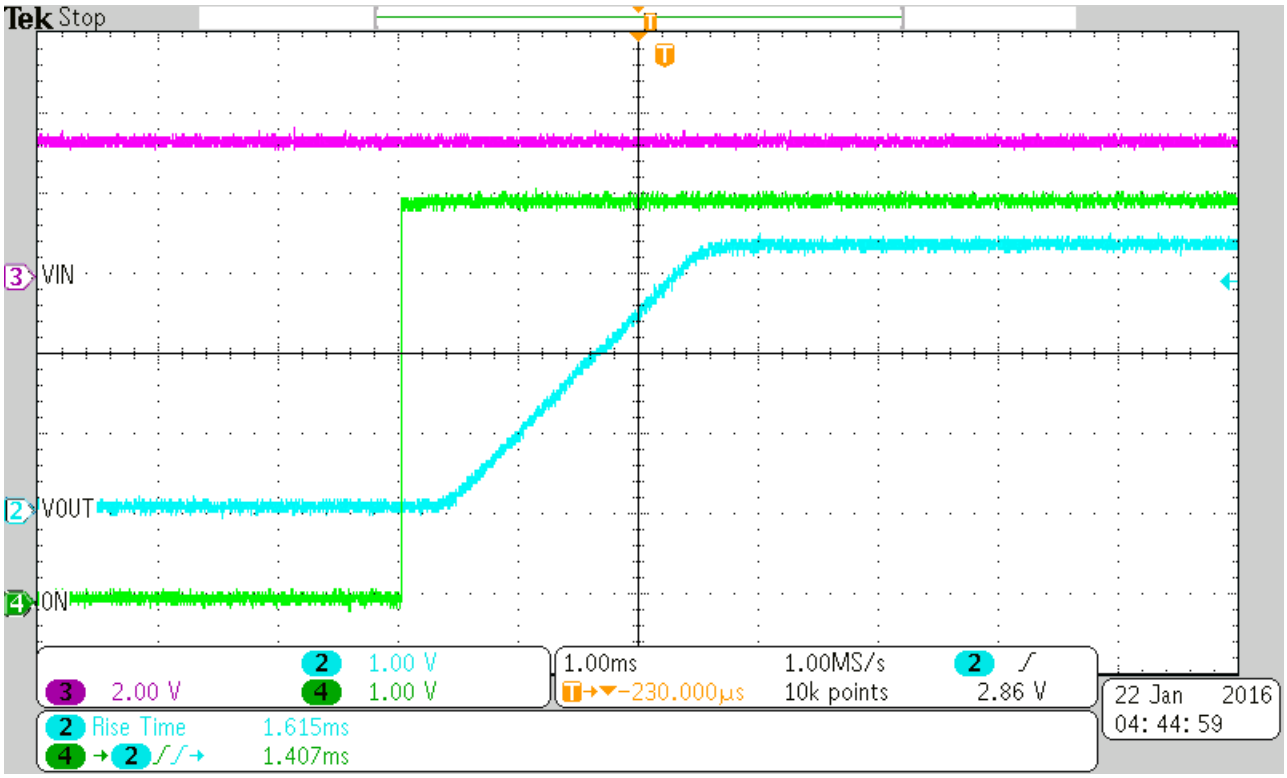



**Figure 5. Rise Time Test Setup**

### 6.3 $V_{OUT}$ Rise Time Example

Figure 6 shows an example of a rise time measurement taken on the TPS22975EVM.




$V_{IN}$ = 3.3 V, CT = 1000 pF, $R_L$ = 10 Ω

**Figure 6. TPS22975 $V_{OUT}$ $t_R$ Example**

# 7 Bill of Materials (BOM)

Table 2 lists the EVM BOM.

**Table 2. Bill of Materials TPS22975EVM**

| Qty | Designator | Value | Description | Package Reference | Manufacturer | Part Number |
|---|---|---|---|---|---|---|
| 1 | !PCB | | Printed Circuit Board | | Any | HVL148 |
| 2 | C1, C5 | DNP | DNP | 0805 | Any | N/A |
| 2 | C2, C6 | 1uF | CAP, CERM, 1 µF, 16 V, ± 10%, X5R, 0603 | 0603 | Murata | GRM185R61C105KE44D |
| 1 | C3, C7 | 0.1uF | CAP, CERM, 0.1 µF, 25 V, ± 5%, X7R, 0603 | 0603 | AVX | 06033C104JAT2A |
| 2 | C4, C8 | 1000pF | CAP, CERM, 1000 pF, 16 V, ± 10%, X7R, 0603 | 0603 | Murata | GRM188R71C102KA01D |
| 6 | J1, J4, J6, J9, J11, J12 | 2x1 | Header, 100 mil, 2x1, Tin, TH | Header, 2.54 mm, 2x1, TH | Sullins | PEC02SAAN |
| 4 | J2, J3, J7, J8 | 2x1 | Terminal Block, 2x1, 5.08 mm, TH | TERM_BLK, 2pos, 5.08 mm | On-Shore Technology | OSTTA024163 |
| 2 | J5, J10 | 3x1 | Header, 100 mil, 3x1, Tin, TH | 3x1 Header | Sullins | PEC03SAAN |
| 2 | SH-J1, SH-J2 | 2x1 | Shunt, 100 mil, Gold plated, Black | Shunt | 3M, Alternate: Samtec | 969102-0000-DA, Alternate: SNT-100-BK-G |
| 16 | TP1, TP2, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16 | | Test Point, Miniature, SMT | Test Point, Miniature, SMT | Keystone | 5019 |
| 1 | U1 | | 5.7-V, 6-A, 16-mΩ On-Resistance Load Switch, DSG | DSG0008B | Texas Instruments | TPS22975DSG |
| 1 | U2 | | 5.7-V, 6-A, 16-mΩ On-Resistance Load Switch, DSG | DSG0008B | Texas Instruments | TPS22975NDSG |
| 0 | FID1, FID2, FID3 | | Fiducial mark. There is nothing to buy or mount. | Fiducial | N/A | N/A |

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

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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