TPS22960EVM Dual Channel Load Switch IC

The TPS22960EVM evaluation module (EVM) allows the user to connect power to and control the 8pin µQFN package load switch. Parameters such as On State resistance, Slew Rate and Discharge properties can be easily evaluated. Table 1 lists a short description of the load switch performance specifications, refer to the data sheet SLVS914 for more details.

Table 1. TPS22960 Slew Rate, Output Current Rating, Enable, and Output Discharge Options

EVM	Device	Slew Rate at 3.3V Typical	VIN (V)	Max. Continuous Current	Enable (ON Pin)	Quick Output Discharge
HVL059	TPS22960	75 µs with SR = low 660 µs with SR = high	3.3	500mA	Active High	Yes

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1 Description

The TPS22960 is a small low-rON dual load switch with controlled turn on. The devices contain two P-channel MOSFETs that can operate over an input voltage range of 1.62 V to 5.5 V. Each switch is controlled by an on/off input (ON1 and ON2), which is capable of interfacing directly with low-voltage control signals. The TPS22960 has an internal 85-Ω load resistor for output quick discharge when switch is turned Off.

1.1 Typical Applications

- Battery Powered Equipment
- Portable Industrial Equipment
- Portable Medical Equipment
- Portable Media Players
- Smart phones / Tablets
- Digital Cameras
- GPS Devices

1.2 Features

- EVM Allows Access to the Input, Output and Control Pins of the TPS22960 Dual Load Switch Device
- Adjustable Slew Rate Selection Made Through the SR pin of the Device Using an EVM jumper
- Output Loading Resistors, a 33Ω, 1W and 1/8W 0805 Mounting Pads per Each Channel
- VIN Input Voltage Range: 1.62V to 5.5V
- 500mA Max Continuous Current Per Channel

2 Electrical Performance

Refer to the datasheet SLVS194A for detailed electrical characteristics.

Operation

2.1 Equipment

- **Voltage Sources:**
  - DC supply will be used.
    - DC Supply capable of 10V, 5A.
- **Multi Meters:**
  - Multi Meter for measuring voltage in the 100mV volt range.
- **Output Load:**
  - Variable load connected to VOUT, observe power rating.
- **Oscilloscope:**
  - 4 Channel 100 MHz.
- **Recommended Wire Gauge:** 18 AWG

2.2 Setup

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

2.2.1 J1/J6/J8 – Input Connections

This is the connection for the leads from the input source. Connect the positive lead to VIN1 J1, and VIN2 J8, and the negative lead connection to GND J6.

2.2.2 J2/J5/J7 – Output Connections

This is the connection for the output of the EVM. Connect the positive connection of the load to VOUT1 J2, and VOUT2 J7, and the negative connection to GND J5.

2.2.3 JP1/JP6 – ON1 and ON2

This is the enable input for the device. A shorting jumper must be installed on JP1 and JP6 in either the High or Low Position. The TPS22960 is active High. 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 TP1 and or TP2. Refer to the datasheet for proper ON and OFF voltage level settings. A switching signal may also be used and connected at these points.

2.2.4 J3/J10 – VIN1/VIN2 Sense, J4/J9 - VOUT1/VOUT2 Sense

These two connections are used when very accurate measurements of the input or output voltage are required. rON measurements should be made using these sense connections when measuring the voltage drop from VIN to VOUT and then calculating the resistance.

2.2.5 JP5/JP14 –JP4/JP13 Input Capacitors

During normal operation a shorting jumper is placed on JP5 and JP14 this connects C4 and C8 capacitors from the input of the device to ground. JP4 and C3, JP13 and C7 may be used to connect a user selected capacitor value from the input of the device to ground. Refer to the Applications Section of the Datasheet for additional information on selecting the input capacitors.

2.2.6 JP2/JP11– JP3/JP12 Output Capacitors

During normal operation a shorting jumper is placed on JP2 and JP11, this connects C1 and C5 capacitor from the output of the device to ground. JP3 and C2, JP12 and C6 may be used to connect a user selected capacitor value from the output of the device to ground. Refer to the Applications Section of the Datasheet for additional information on selecting the output capacitors.

2.2.7 JP7/JP15 – JP8/JP16 Output Resistors

During normal operation no shorting jumper is placed on JP7, JP15, JP8, or JP16. A shorting jumper may be used on JP7 to connect R1, and JP15 to connect R3 a 33Ω load resistor from the outputs of the device to ground. JP7 and JP14 may be used to connect R2 and R4 load resistors from the outputs to ground. R1 and R3 are sized for 2512 1W power rated resistors, ROUT4 and ROUT7 are sized for 0805 1/8W power rated resistors.

2.2.8 JP10 – SR

This is the slew rate control for the device. A shorting jumper installed on JP10 in the High position translates into a 660µS rise time on the output of VOUT1 and VOUT2. Placing the shorting jumper into the Low position translates into a 75µS rise time on the outputs.

2.2.9 JP9 – SR Power Source

This jumper selects the power source for SR input. Place a shorting jumper in the desired position for power to come from VIN1 or VIN2.

3 Operation

Connect the positive input of the power supply to VIN1 at J1 and VIN2 at J8; connect the negative lead of the power supply to GND at J6. The input voltage range of the TPS22960EVM is 1.62V to 5.5V.

External output loads can be applied to each switch by connecting between J2 VOUT1 and J5 GND, and J7 VOUT2 and J5 GND. The TPS22960EVM is rated for a maximum continuous current of 500mA. Configure JP1 and JP6 as required. JP1 and JP6 must be installed for proper operation. When the ON pin is asserted the TPS22960 device will control the slew rate of VOUT1 and VOUT2. The slew rate of the device is selected by the state of the SR device pin using JP10.

4 Test Configurations

4.1 On State Resistance (r_{ON}) Test Setup

Figure 1 shows a typical setup for measuring On State Resistance. The voltage drop across the switch is measured using the sense connections then divided by the current into the load yielding the r_{ON} resistance.

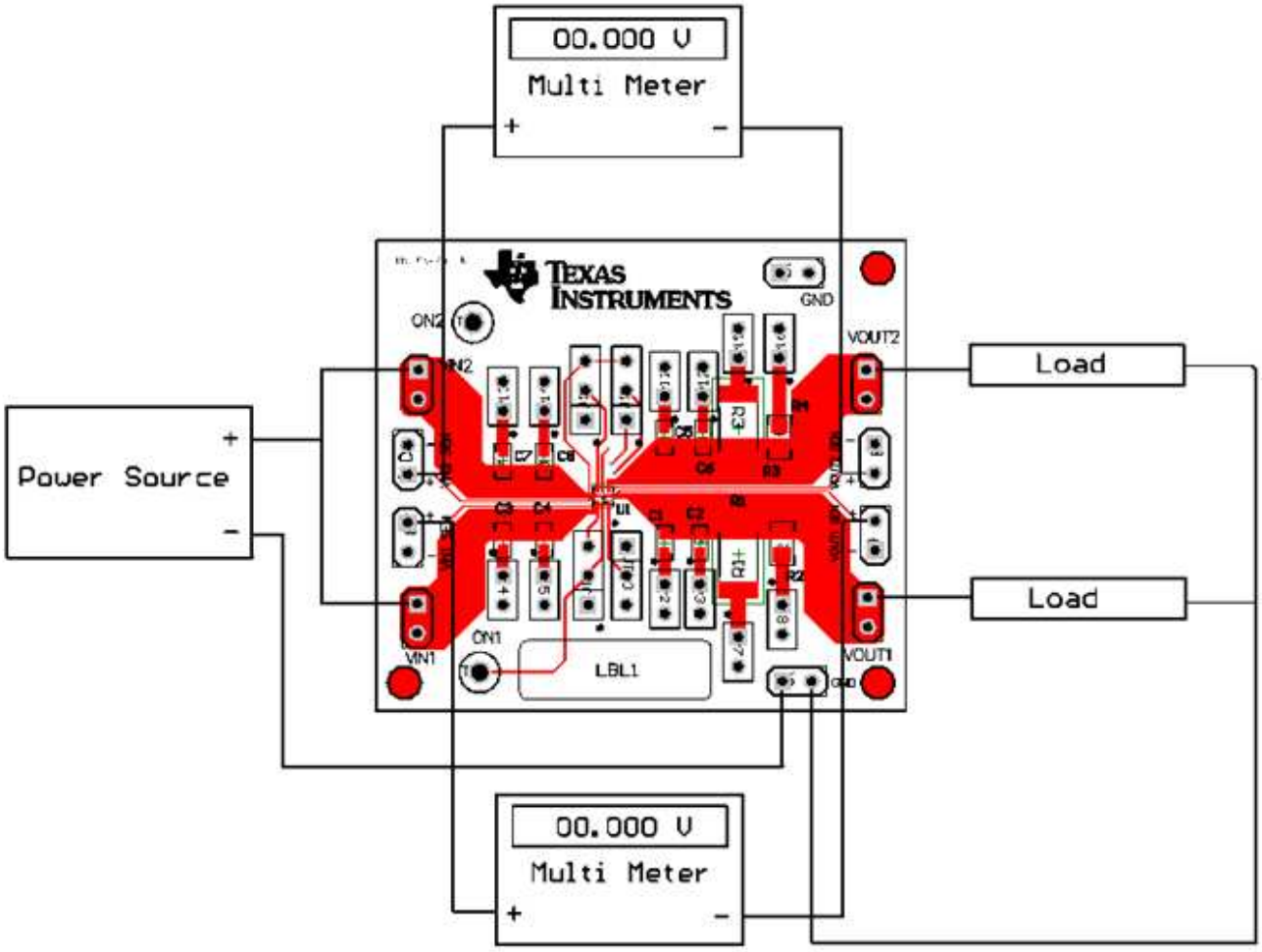


Figure 1. r_{ON} Setup

4.2 Slew Rate Test Setup

Figure 2 shows a test setup for measuring the Slew Rate of the Load Switch. Controlling the ON pins of the switch with a signal source and then measuring the outputs with a scope shows the switches ability to avoid inrush current.

4.3 VOUT Slew Rate Examples

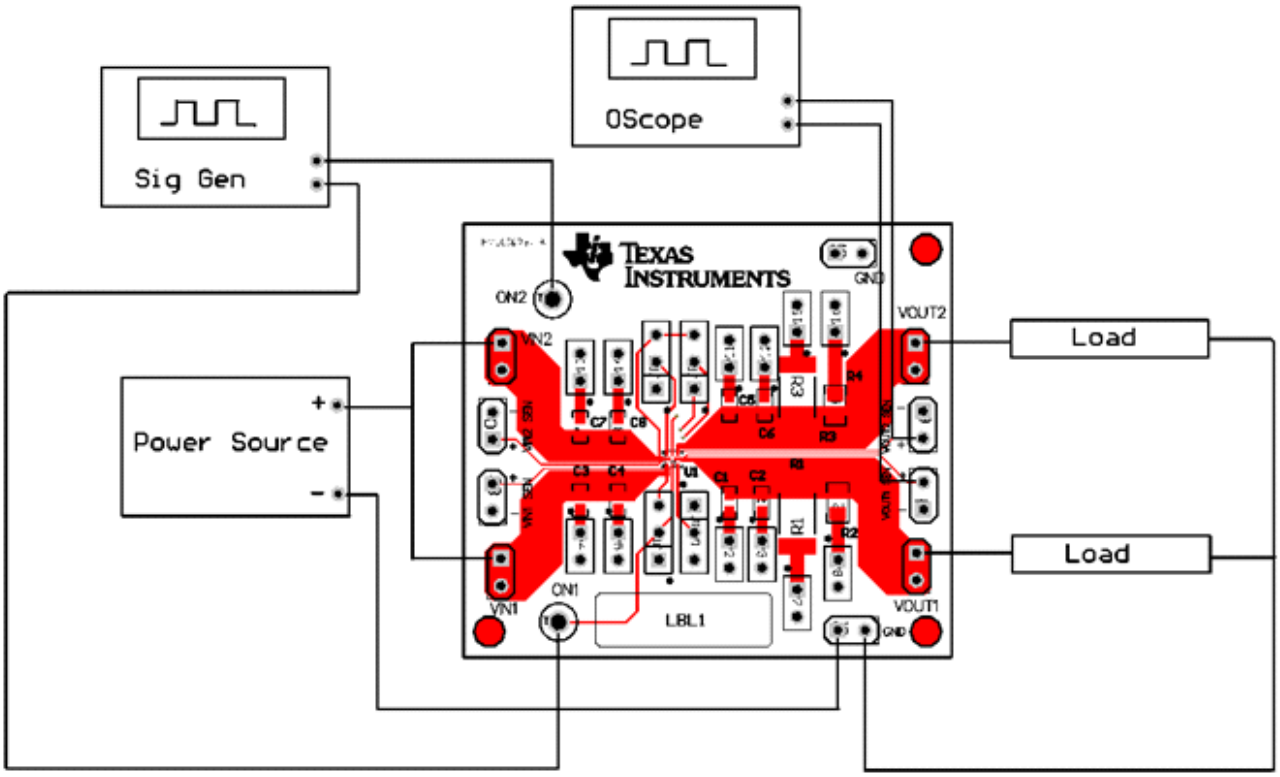


Figure 2. Slew Rate Setup

4.4 VOUT Slew Rate Examples

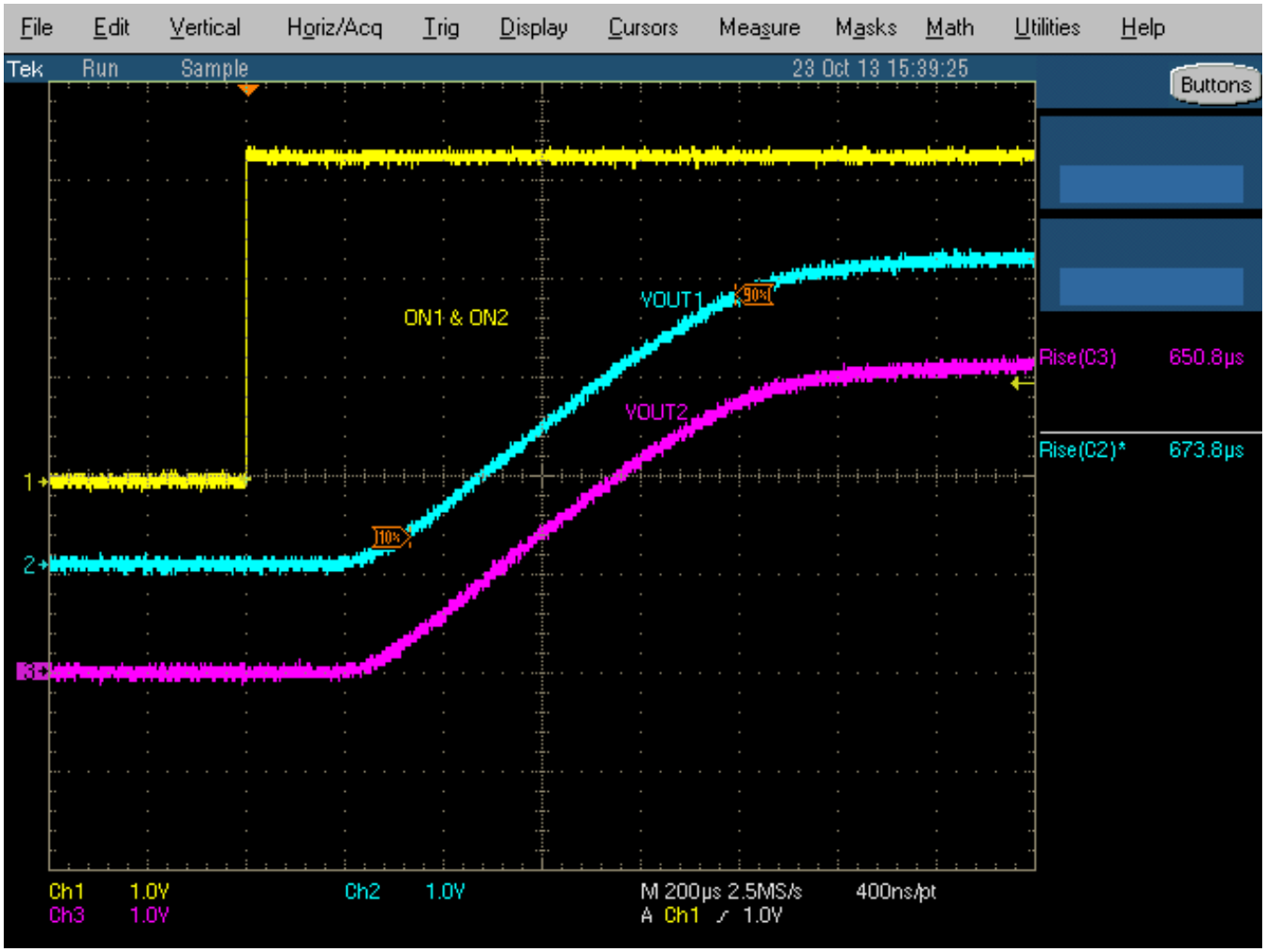


Figure 3. TPS22960 SR=high TRISE Example

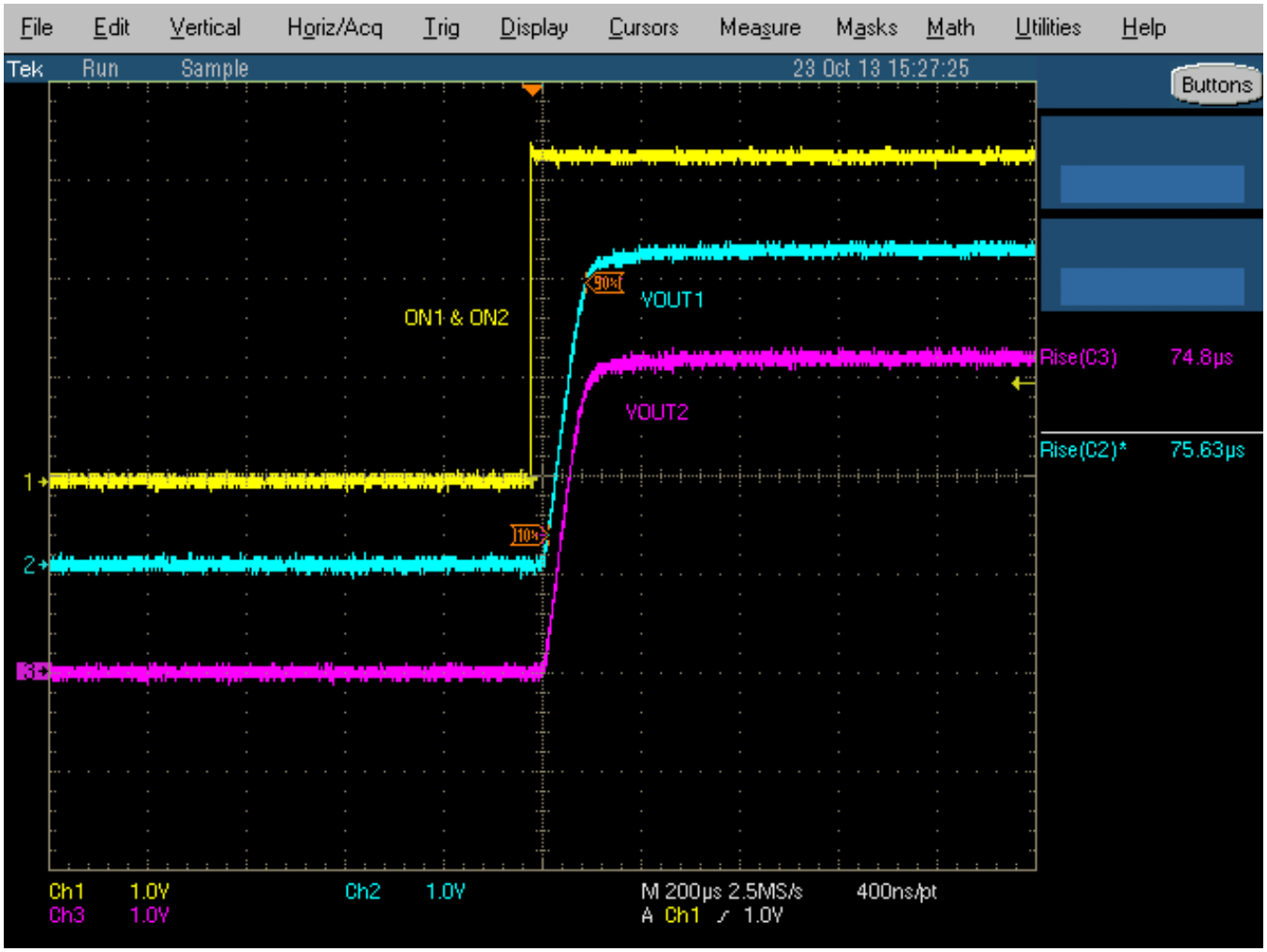


Figure 4. TPS22960 SR=low TRISE Example

5 Layout

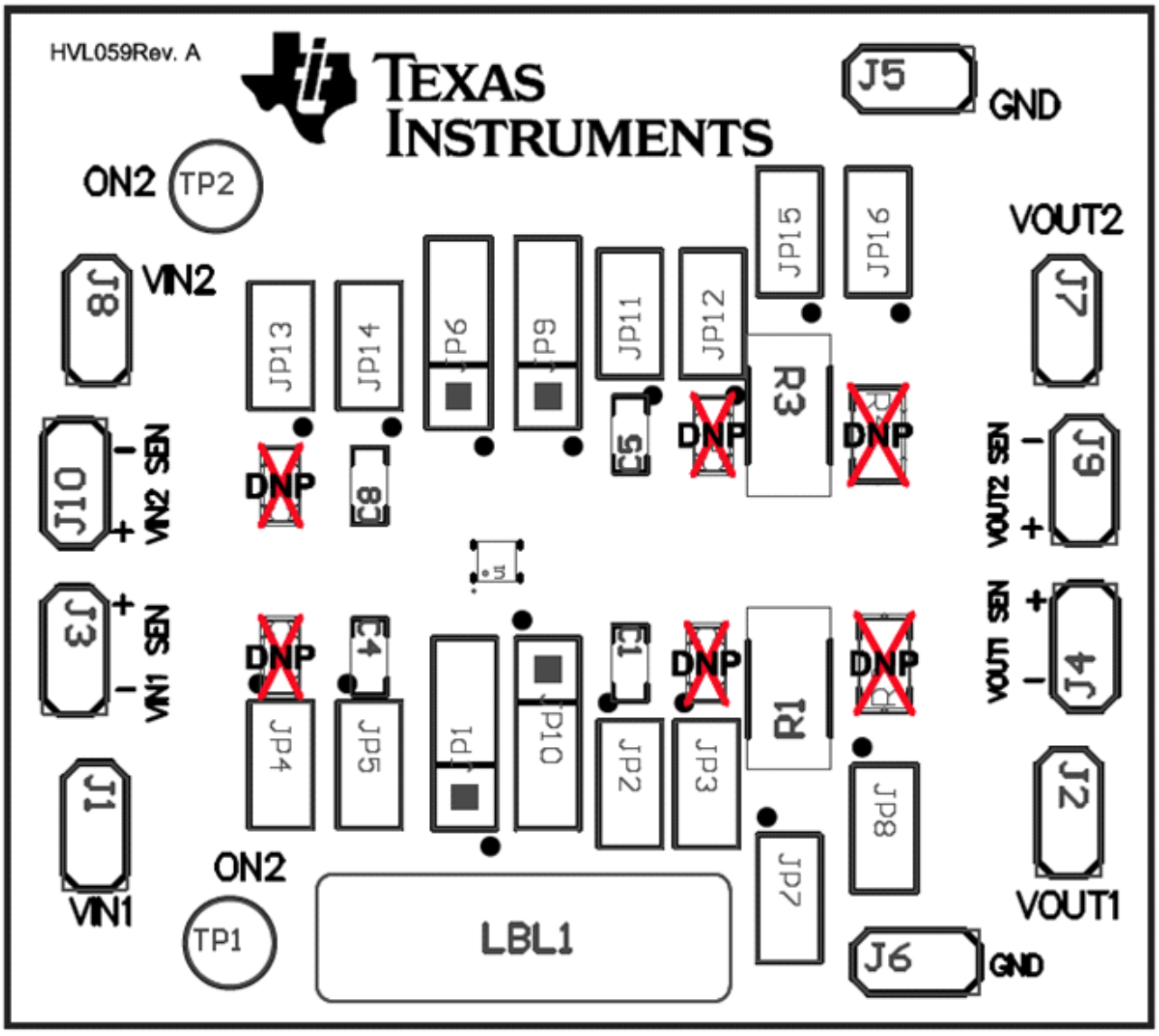


Figure 5. Top Assembly

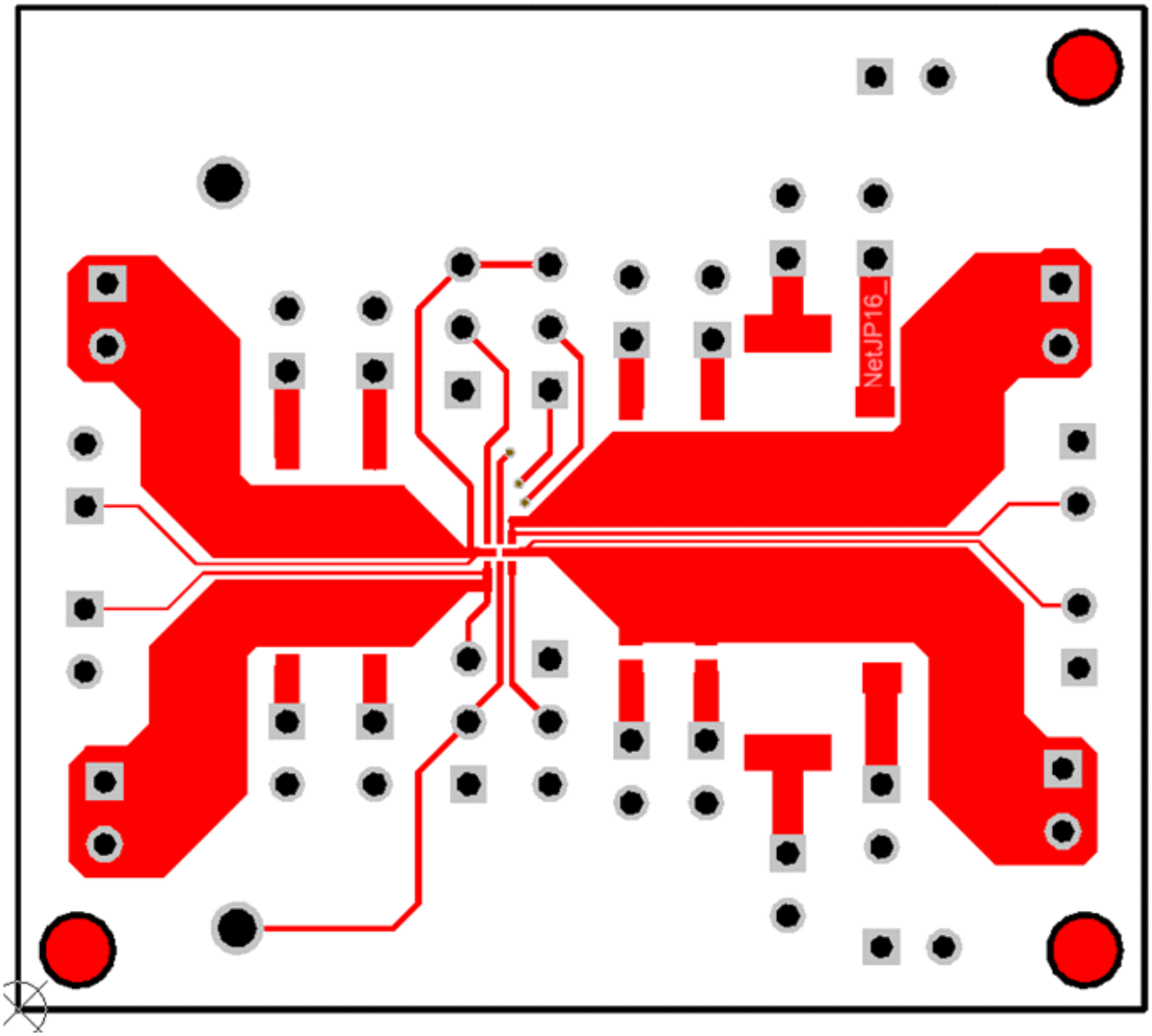


Figure 6. Top Side

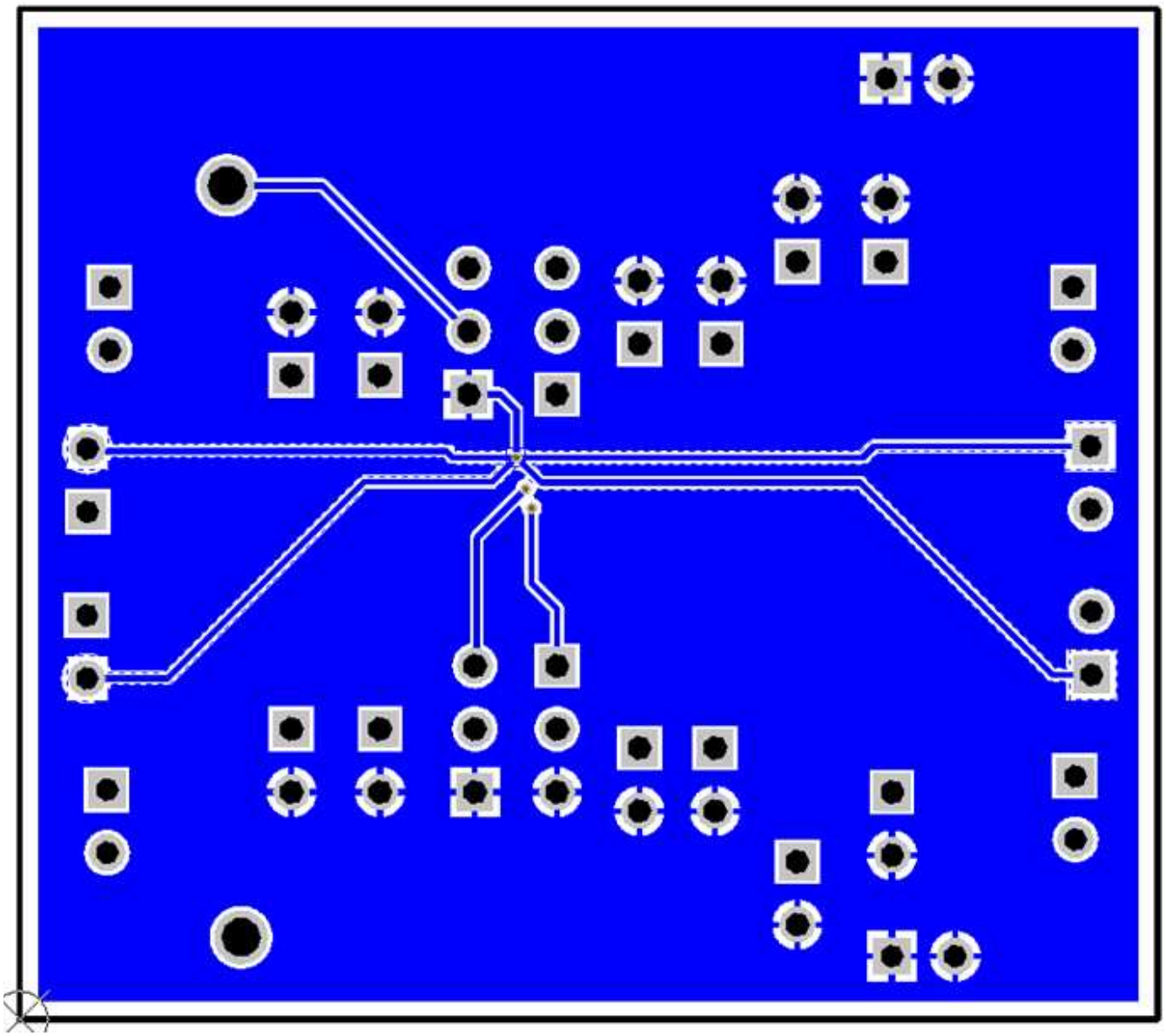
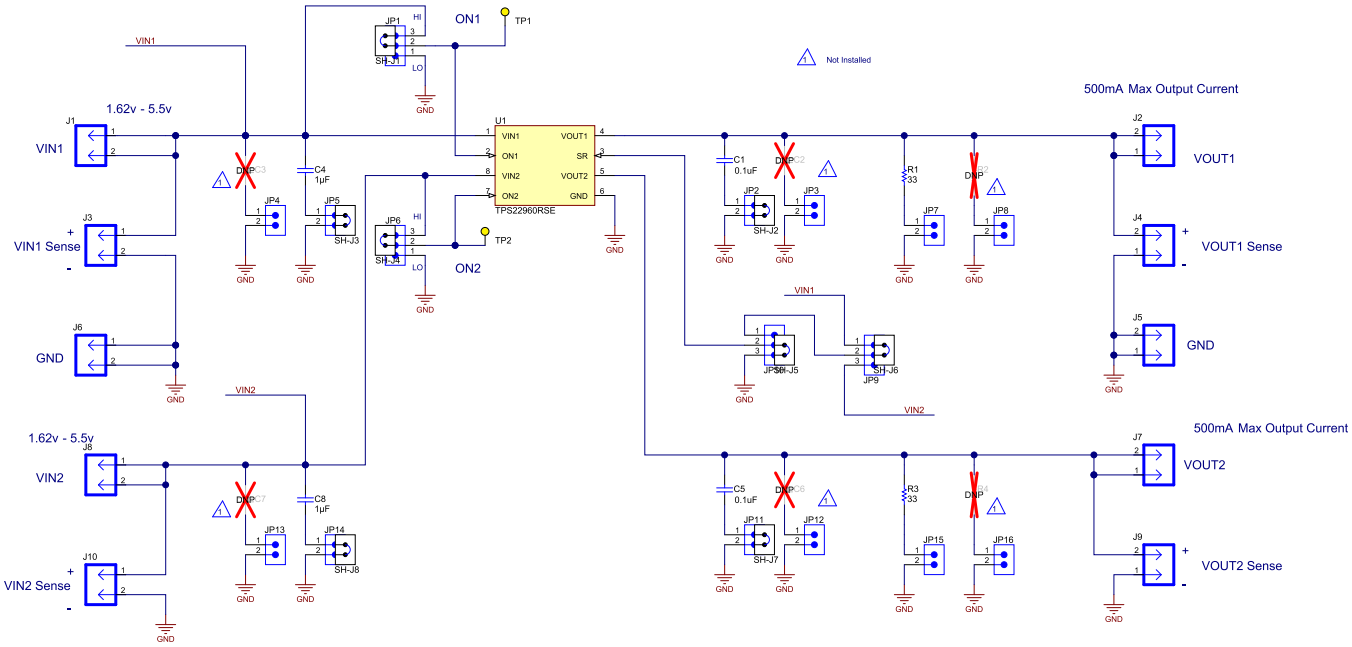


Figure 7. Bottom Side

6 Schematic



7 Bill of Materials

Designator	Quantity	Description	Manufacturer	PartNumber
C1, C5	2	CAP, CERM, 0.1uF, 100V, +/-10%, X7R, 0603	MuRata	GRM188R72A104KA35D
C2, C3, C6, C7	4	Capacitor, Ceramic, Low Inductance, vvV, [temp], [tol]	MuRata	GRM188R72A104KA35D
C4, C8	2	CAP, CERM, 1uF, 25V, +/-10%, X7R, 0603	MuRata	GRM188R71E105KA12D
J1, J2, J3, J4, J5, J6, J7, J8, J9, J10	10	Header, Male 2-pin, 100mil spacing,	Sullins	PEC02SAAN
JP1, JP6, JP9, JP10	4	Header, 100mil, 3x1, Tin plated, TH	Sullins Connector Solutions	PEC03SAAN
JP2, JP3, JP4, JP5, JP7, JP8, JP11, JP12, JP13, JP14, JP15, JP16	12	Header, 100mil, 2x1, Tin plated, TH	Sullins Connector Solutions	PEC02SAAN
R1, R3	2	RES, 33 ohm, 5%, 1W, 2512	Panasonic	ERJ-1TYJ102U
R2, R4	2	RES, 0805, RES, 0805	Vishay-Dale	CRCW08051K00FKEA
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8	8	Shunt, 100mil, Gold plated, Black	3M	969102-0000-DA
TP1, TP2	2	Test Point, Multipurpose, Yellow, TH	Keystone	5014
U1	1	LOW INPUT VOLTAGE, DUAL LOAD SWITCH WITH CONTROLLED TURN-ON, RSE0008A	Texas Instruments	TPS22960RSE

Revision History

Changes from Original (November 2013) to A Revision	Page
• Updated EVM part number.	1

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

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