Current-Sense MOSFET Evaluation Board

FEATURES

- Facilitates Evaluation of Vishay Siliconix Current Sensing Power MOSFETs Available in Three Different Packages
- Jumper Isolation to Select The Device Under Test
- Simple Two Resistor External Circuit for Each Variety

ORDERING INFORMATION

- SiDB766760

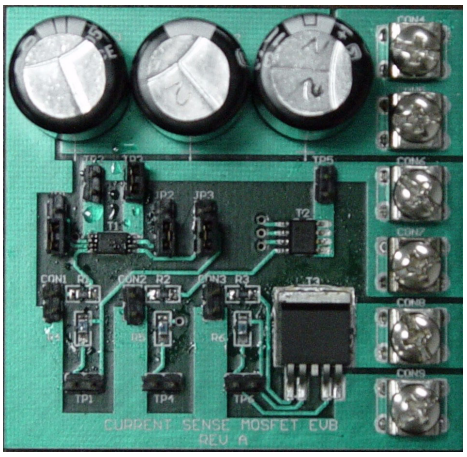


FIGURE 1. EVB Assembly

DESCRIPTION

This evaluation board (EVB) is loaded with the following Vishay Siliconix current sensing MOSFETs: SUM60N08-07C, (5-pin D^2PAK), Si4730EY (single SO-8), and Si6862DQ (dual TSSOP–8). Figure 1 shows the PC board assembly. A simple electrical set-up allows users to evaluate the effect of these parameters and operating condition variations:

a. R_{SENSE}, current sense resistor
b. V_{GS}, gate-source voltage
c. I_{DS}, drain current
d. T_A, ambient temperature

A basic demo set-up consisting of four connection configuration variations allows users to compare the current sensing capability of each package (Figures 2, 3, 4, and 5, pages 4 and 5).

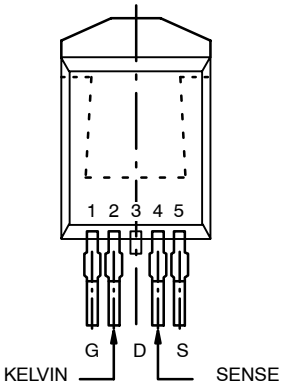
Using this EVB, users can devise various design experiments to study device behavior patterns and characterize various parameters for current sensing MOSFETs. Users can also connect the current sense signal directly into the external circuit to prototype the controller.

The electrical schematic diagram for the PC board is shown in Appendix (A). The bill of material (BOM) for the PC board is given in Appendix (B) and the board layout details are given in Appendix (C).

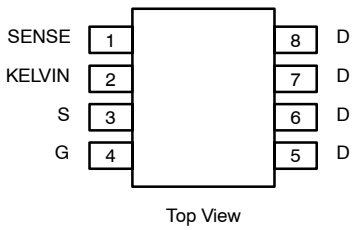
The demonstration board layout is available in Gerber file format. Please contact your Vishay Siliconix sales representative or distributor for a copy.

PIN CONFIGURATIONS

D^2PAK-5

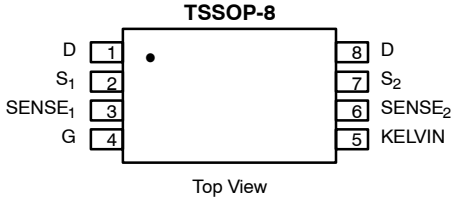


SO-8



Top View

TSSOP-8



Top View

TEST SET-UP

Evaluation of SUM60N08-07C in 5-pin D²PAK Package

Figure 2 (page 4) shows the electrical connection details. Please observe the polarity of each connection.

1. Connect the main power supply, Vcc, between CON4 and CON9, +ve to CON4 and –ve to CON9.
2. Connect the +ve of the electronic load to CON5 and –ve to CON6.
3. Connect an external jumper between CON7 and CON8.
4. Connect the +ve of auxiliary power supply, V_{GS}, to CON3, pin 1 and –ve to CON3, pin 2.
5. Connect the +ve of voltmeter, V_S, to the monitoring test port, TP6, pin 1 and –ve to TP6, pin 2.
6. Remove all other jumper shunts (JP1, JP2, JP3, TP2, TP3, and TP5).

Evaluation of Si4730EY MOSFET in SO-8 Package

Figure 3 (page 4) shows the electrical connection details. Please observe the polarity of each connection.

1. Connect the main power supply, Vcc, between CON4 and CON9, +ve to CON4 and –ve to CON9.
2. Connect the +ve of the electronic load to CON5 and –ve to CON6.
3. Connect the +ve of auxiliary power supply, V_{GS}, to CON2, pin 1 and –ve to CON2, pin 2.
4. Connect the +ve of voltmeter, V_S, to the monitoring test port, TP4, pin 1 and –ve to TP4, pin 2.
5. Place a jumper shunt to short pins 1 and 2 on TP5. Remove all other jumper shunts (JP1, JP2, JP3, TP2, TP3) and the external jumper.

Evaluation of Si6862DQ Dual MOSFET in TSSOP-8 Package

Channel 1 MOSFET Terminated On Pins 1, 2, 3 and 4

Figure 4 (page 5) shows the electrical connection details. Please observe the polarity of each connection.

1. Connect the main power supply, V_{CC}, between CON4 and CON9, +ve to CON4 and –ve to CON9.
2. Connect the +ve of the electronic load to CON5 and –ve to CON6.
3. Connect the +ve of auxiliary power supply, V_{GS}, to CON1, pin 1 and –ve to CON1, pin 2.
4. Connect the +ve of voltmeter, V_S, to the monitoring test port, TP1, pin1 and –ve to TP1, pin 2.
5. Place a jumper shunt to short pins 1 and 2 on TP2.
6. Place a jumper shunt on JP1, to short pins 1 and 2.
7. Place a jumper shunt on JP2, to short pins 1 and 2.
8. Place a jumper shunt on JP3, to short pins 1 and 2.
9. Remove the jumper shunts on TP3 and TP5 and the external jumper.

Channel 2 MOSFET Terminated On Pins 5, 6, 7 and 8:

Figure 5 (page 5) shows the electrical connection details. Please observe the polarity of each connection.

1. Connect the main power supply, Vcc, between CON4 and CON9, +ve to CON4 and –ve to CON9.
2. Connect the +ve of the electronic load to CON5 and –ve to CON6.
3. Connect the +ve of auxiliary power supply, V_{GS}, to CON1, pin 1 and –ve to CON1, pin 2.
4. Connect the +ve of voltmeter, V_S, to the monitoring test port, TP1, pin 1 and –ve to TP1, pin 2.
5. Place a jumper shunt to short pins 1 and 2 on TP3.
6. Place a jumper shunt on JP1, to short pins 2 and 3.
7. Place a jumper shunt on JP2, to short pins 2 and 3.
8. Place a jumper shunt on JP3, to short pins 2 and 3.
9. Remove the jumper shunts on TP2 and TP5 and the external jumper.

CIRCUIT OPERATION

Select the appropriate set-up for the device under testing (DUT) and complete the electrical connection.

1. Connect the main power supply, auxiliary power supply and electronic load to 115-V_{AC} mains input.
2. Adjust the output voltage of main supply to provide Vcc = 12 V_{DC}.
3. Select the constant current mode for the electronic load and adjust the load current to 0 A.
4. Turn on the load. Adjust the output of auxiliary power supply to provide V_{GS} = 10 V_{DC} or 5.0 V_{DC} as the case may be.
5. Adjust the load current, which is drain current, I_D, in steps of 1 A up to the device rating or 15 A maximum and measure the current sense signal voltage, V_S.
6. Record the MOSFET current, I_D, and sense voltage, V_S. See Table 1 on page 3.
7. Compute the current sense ratio, r, from V_S and I_{DS}:

$I_{DS} = r \times (V_S / R_{SENSE})$

Where
I_{DS} = Drain-source current
r = Current-sensing ratio
V_S = Current sense voltage

SUMMARY

The current sensing MOSFET EVB facilitates basic testing as well as parametric study of current sensing MOSFETs. The current sense signal can easily be sent to other circuits being tested to study control behavior.

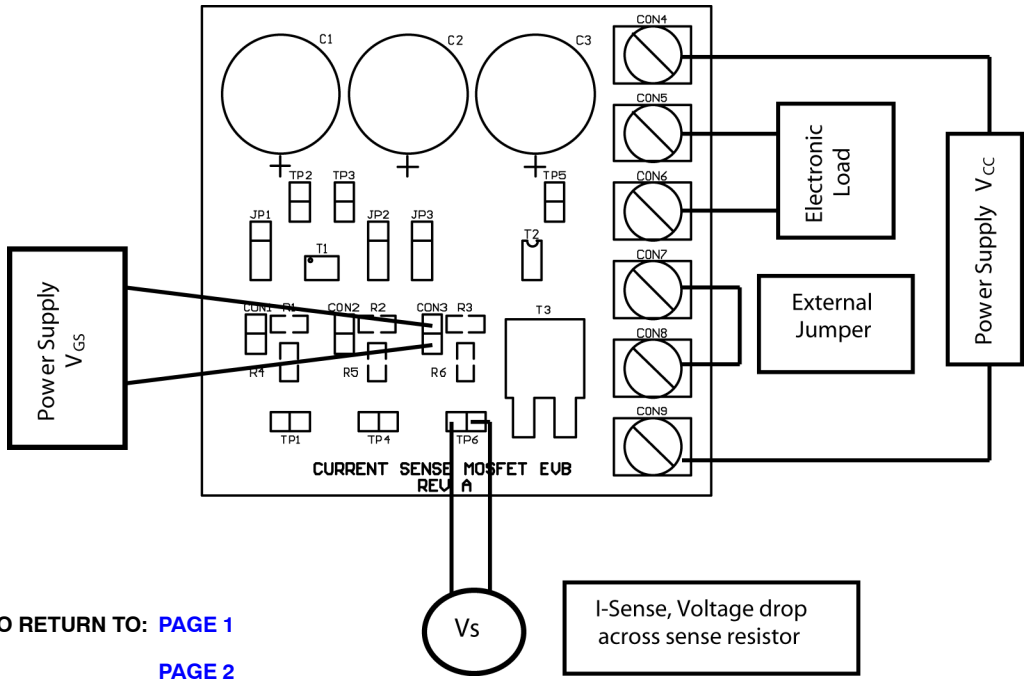
TABLE 1: REPRESENTATIVE READINGS AND COMPUTATIONS										
SUM60N08-07C Kelvin-to-Ground			Si4730EY				Si6862EY TSSOP-8			
D^2PAK (5 Pin)			SO-8				Channel 1		Channel 2	
V_{DS}	12 V_{DC}		V_{DS}	12 V_{DC}		V_{DS}	12 V_{DC}		12 V_{DC}	
V_{GS}	10 V_{DC}		V_{GS}	10 V_{DC}		V_{GS}	5 V_{DC}		5 V_{DC}	
Data Sheet Value of **r**	2470		Data Sheet Value of **r**	540		Data Sheet Value of **r**	200		600	
R_{SENSE} = 1 Ω			R_{SENSE} = 1.1 Ω				R_{SENSE} = 1 Ω		R_{SENSE} = 1 Ω	
I_{DS} (ADC)	V_S (mV)	r	I_{DS} (ADC)	V_S (mV)	r	I_{DS} (ADC)	V_S (mV)	r	V_S (mV)	r
1	0.410	2439	1	1.522	597	1	5.590	179	1.559	641
2	0.845	2367	2	3.079	591	2	11.210	178	3.140	637
3	1.267	2368	3	4.618	591	3	16.790	179	4.734	634
4	1.691	2365	4	6.185	588	4	22.300	179	6.370	628
5	2.117	2362	5	7.768	585	5	27.800	180	8.090	618
6	2.534	2368	6	9.363	583	6	32.700	183	9.880	607
7	2.936	2362	7	11.190	569	7	38.500	182	11.250	622
8	3.386	2363	8	12.790	569					
9	3.805	2365	9	14.580	561					
10	4.231	2364	10	17.400	522					
11	4.653	2364	11	19.200	521					
12	5.076	2364	12	20.800	524					
13	5.493	2367								
14	5.905	2371								
15	6.323	2372								
	Average	2371		Average	567		Average	180	Average	627

NOTES:

1 **r** = current sense ratio

2 Table 1 contains representative readings and computations obtained during testing of the EVB. The average values are in line with the datasheet specifications.

TEST SET-UP



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PAGE 2

FIGURE 2. Test Set-Up for D²PAK Package — Board Marking T3

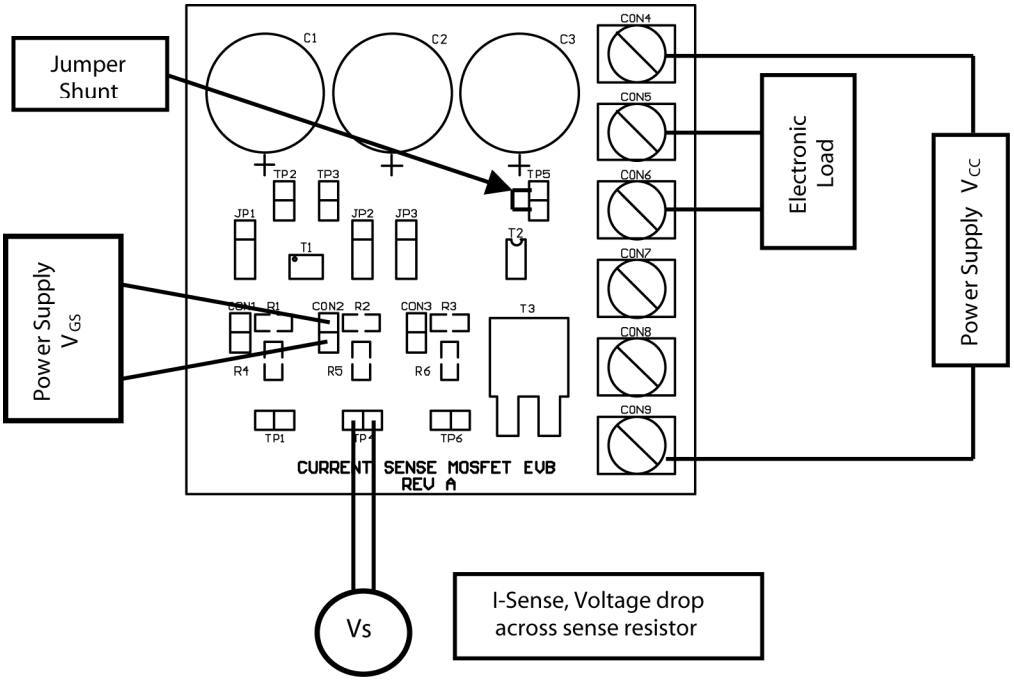

FIGURE 3. Test Set-Up for SO-8 Package — Board Marking T2

TEST SET-UP (CONT'D)

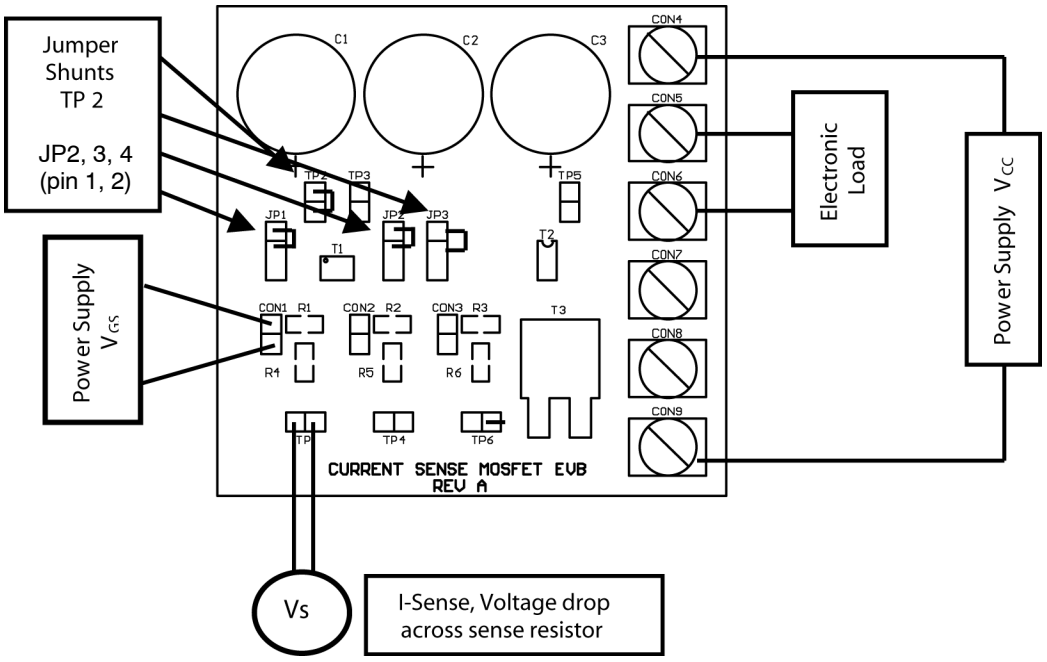

FIGURE 4. Test Set-Up for TSSOP-8 Package — Channel 2 — Board Marking T1

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PAGE 2

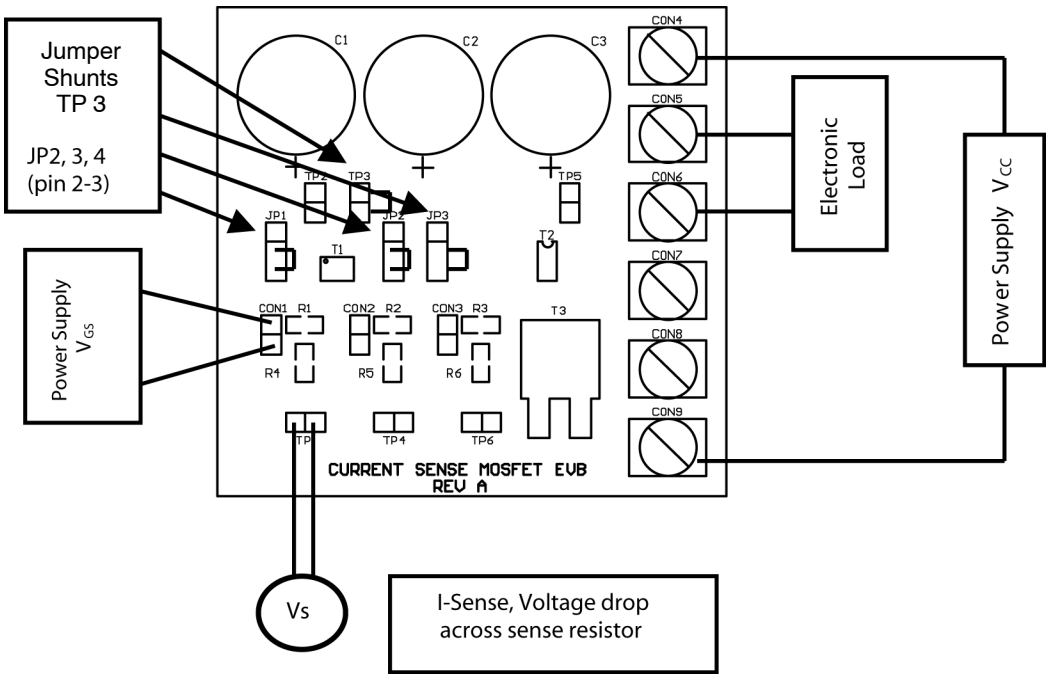
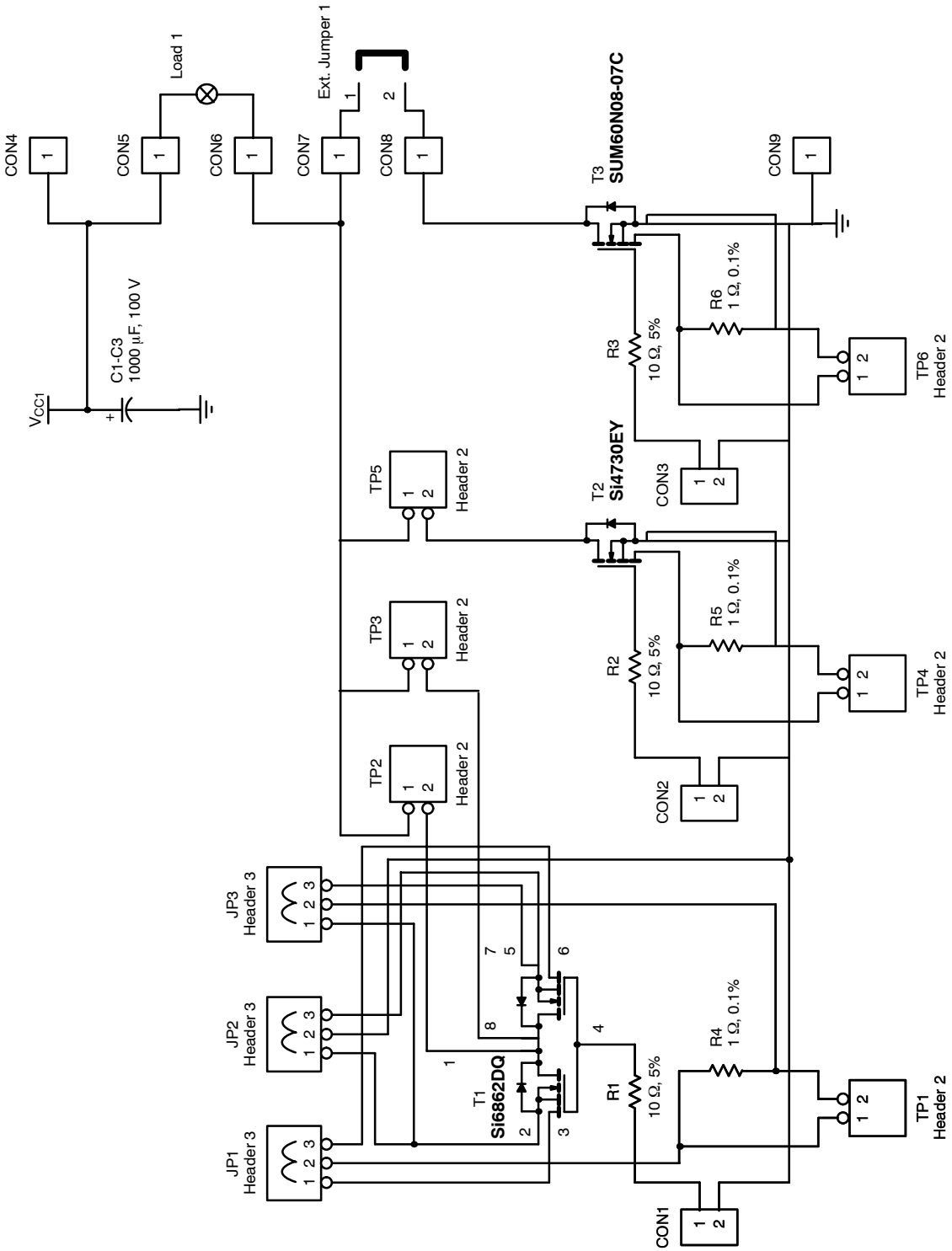


FIGURE 5. Test Set-Up for TSSOP-8 Package — Channel 1 — Board Marking T1

APPENDIX A: SCHEMATIC DIAGRAM



Click Here to Return to Page 1

APPENDIX B: BILL OF MATERIALS

Item	Qty	Designator	Description	Footprint	Vendor Part #	Manufacturer
1	3	R1, R2, R3	10-Ω Resistor, 5%	805	CRCW0805, 10 Ω, 5%	Vishay Dale
2	3	R4, R5, R6	1-Ω Resistor 1%	805	CRCW0805, 1 Ω, 1%	Vishay Dale
3	3	C1, C2, C3	330-μF/100-V Electrolytic Capacitor	RB-0.2/0.4		
4	1	T1	Si6862DQ Current Sensing MOSFET	TSSOP-8 Dual	Si6862DQ	Vishay Siliconix
5	1	T2	Si4730EY Current Sensing MOSFET	SO-8	Si4730EY	Vishay Siliconix
6	1	T3	SUM60N08-07C Current Sensing MOSFET	D^2PAK (5 pin)	SUM60N08-07C	Vishay Siliconix
7	6	CON1 to CON3, TP1 to TP6	2-Pin Connector	SIP-2	92834-02-36-ND	Digi-Key
8	6	CON4 to CON9	Terminal Connector	LOADCON	7693-ND	Digi-Key
9	3	JP1 to JP3	3-Pin Connector	SIP-3	92834-03-36-ND	Digi-Key
10	4	JMP Shunt	jumper shunts		A26228-ND	Digi-Key
11	1	PCB	Evaluation PCB		NWTSM1	Vishay Siliconix

CLICK HERE TO RETURN TO: PAGE 1

APPENDIX C: LAYOUT

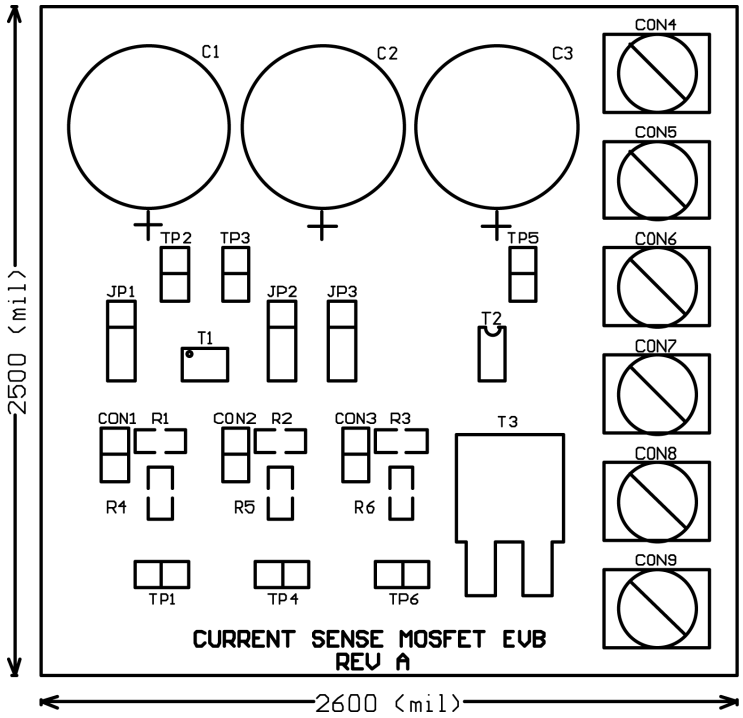


FIGURE 6. Silk Screen Layer

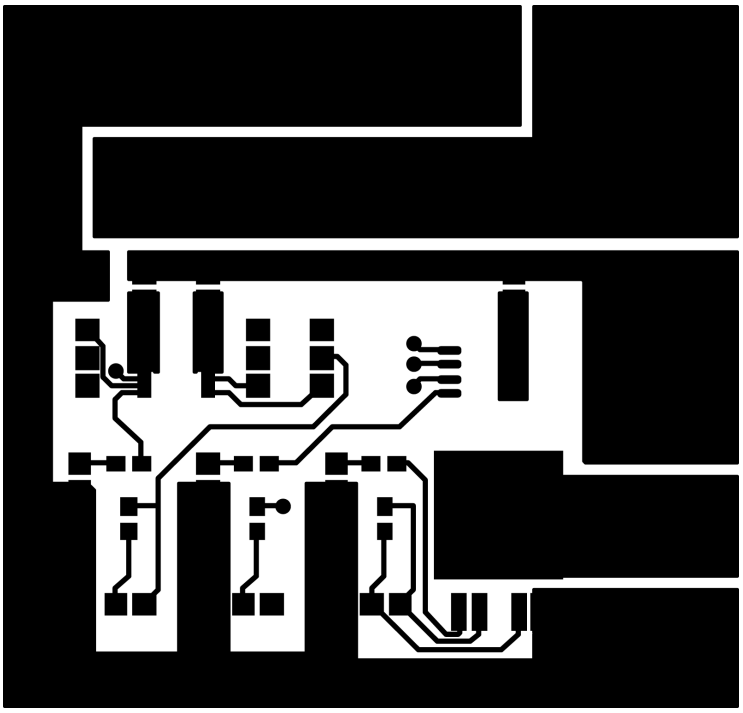


FIGURE 7. Top Copper Layer

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APPENDIX C: LAYOUT (CONT'D)

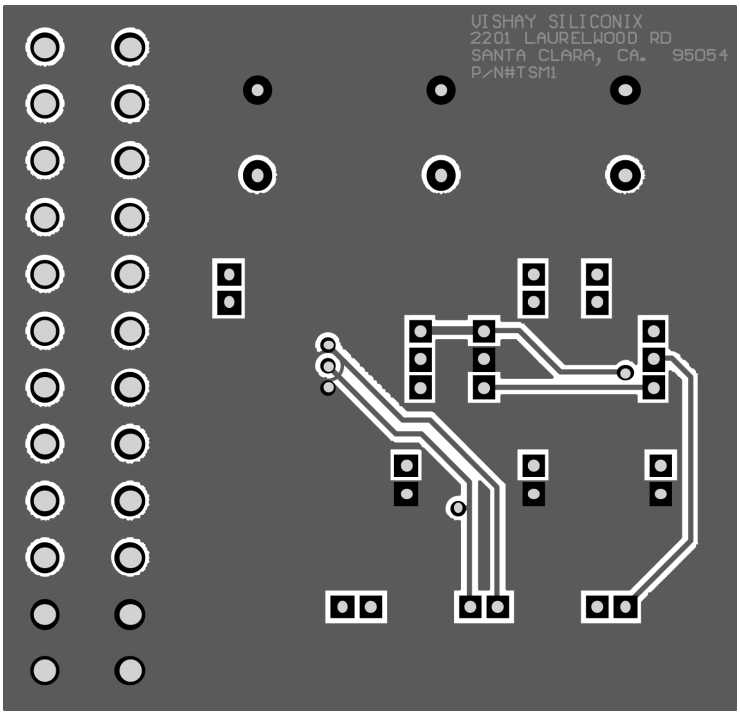

FIGURE 8. Bottom Copper Layer

CLICK HERE TO RETURN TO: PAGE 1

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