User's Manual

ISL70592SEHEVAL1Z

User's Manual: Evaluation Board

High Reliability

Rev.0.00 Sep 2018

1. Overview

The Renesas ISL70592SEH IC is a radiation hardened 1mA precision constant current source designed for thermistor and other resistive sensor excitation applications. Its two-terminal floating type topology allows the load to be connected at the high side (+V pin), low side (-V pin), or both the high and low sides of the current source. It is specifically designed to operate in the harsh environment of space.

The ISL70592SEHEVAL1Z evaluation board provides a quick and easy method for evaluating the ISL70592SEH 1mA current source. A thorough knowledge of the ISL70592SEH's operation is required to use this evaluation board properly. Refer to the ISL70592SEH datasheet for information about the device's function and performance.

1.1 Key Features

- Convenient test points and connections for test equipment
- Jumpers to select between a short (0Ω resistor), 100Ω resistor, or 1kΩ resistor at either the input side or output side, or at both sides of the current source
- Banana jacks for:
  - Power
  - Ground
  - Connecting external load or circuitry between VS and VP and/or between VM and GND (as an external sensor and signal conditioning circuit such as instrumentation amplifier)

1.2 Specifications

The evaluation board is configured and optimized for the following conditions:

- V_S = 3V to 40V
- Board temperature: +25°C

1.3 Ordering Information

Part Number	Description
ISL70592SEHEVAL1Z	ISL70592SEHEVAL1Z evaluation board

1.4 Related Literature

For a full list of related documents, visit our website:

- ISL70592SEH product page

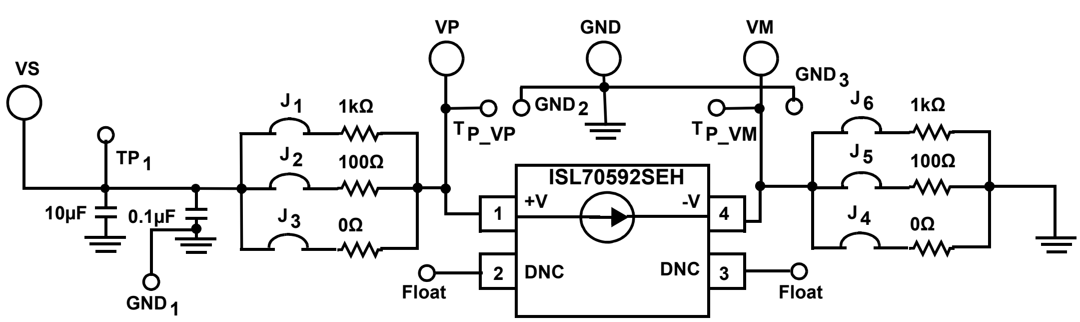


Figure 1. ISL70592SEHEVAL1Z Block Diagram

2. Functional Description

Figure 1 on page 2 shows the ISL70592SEHEVAL1Z evaluation board block diagram. A picture of the ISL70592SEHEVAL1Z is shown in Figure 3 on page 6. The ISL70592SEHF/PROTO 4 Ld flatpack IC is soldered onto the ISL70592SEHEVAL1Z. It is located in the lower center of the board and is designated as U1.

The current source outputs a constant current of 1mA to the circuit that is connected in series with the IC. It is designed to operate over a compliance range of +3V to +40V (+35V under ion beam) and a temperature range of -55°C to +125°C.

The ISL70592SEHEVAL1Z is a simple platform to demonstrate the features and evaluate the performance of the ISL70592SEH current source. The board provides easy access to the pins of the ISL70592SEH device and convenient connectors/test points for connecting test equipment. For more information, refer to the schematic (Figure 4 on page 7), top layer silkscreen (Figure 7 on page 9), and "Bill of Materials" on page 8.

Figures 8 through 17 show performance data taken using the ISL70592SEHEVAL1Z and basic lab equipment.

The user guide explains how to configure and use the ISL70592SEHEVAL1Z to evaluate the ISL70592SEH current source.

2.1 Basic Layout

Refer to Figure 3 on page 6 for a picture of the or the ISL70592SEHEVAL1Z. The basic layout of the ISL70592SEHEVAL1Z is as follows:

The ISL70592SEHF/PROTO current source IC (U1) is located in the lower center of the board. The ISL70592SEHEVAL1Z's Pin 1 dot shows how the IC should be oriented onto the evaluation board. The IC Pin 1 indicator triangle must be aligned with the evaluation board Pin 1 dot indicator. The IC is soldered onto the evaluation board.

The banana jack labeled VS at the left side of the board provides power to the IC. A DC voltage source of 3V to 40V must be connected between VS and the GND banana jack to power the part. Use test points TP_1 (VS), GND_1, GND_2, and GND_3 to measure the VS voltage.

The banana jack labeled VP at the upper left corner of the board provides access to the +V input of the current source. External circuitry can be connected to the +V of the current source by removing jumpers J_1, J_2, and J_3 and connecting the circuitry between the VS banana jack and the VP banana jack.

The banana jack labeled VM at the upper right corner of the board provides access to the -V output of the current source. External circuitry can be connected to the -V of the current source by removing jumpers J_4, J_5, and J_6 and connecting the circuitry between the VM banana jack and the ground of the system.

The board is populated with two sets of resistors.

- R_1 (0Ω resistor), R_2 (100Ω resistor), and R_3 (1kΩ resistor) are connected between the VS banana jack and the +V input of the current source. Populate J_1 to connect R_1, J_2 to connect R_2, and J_3 to connect R_3.
- R_4 (0Ω resistor), R_5 (100Ω resistor), and R_6 (1kΩ resistor) are connected between the -V output of the current source and ground (GND). Populate J_4 to connect R_4, J_5 to connect R_5, and J_6 to connect R_6.

The board schematic (Figure 4 on page 7) shows the reference designators of the jumpers, resistors, and connectors associated with each I/O.

2.1.1 Power Supply

The ISL70592SEH IC requires a DC power supply in the range of 3.0V to 40V.

The power supply is connected at banana jacks VS and GND. The power supply should be capable of delivering >10mA of current.

The ISL70592SEH current source has a wide compliance voltage range from 3V to 40V in terrestrial applications and 3V to 35V in the space applications.

A minimum voltage of at least 3V must be maintained across the current source for proper functionality. If the voltage across the current source drops below 3V, the current drops significantly and the part no longer functions properly.

2.1.2 High-Side Load, Low-Side Load, and Dual-Side Load Operation

The ISL70592SEH device is a two-terminal completely floating current source. All current entering the +V pin exits the -V pin. This allows for the circuit loading to be applied at the positive side (+V), the negative side (-V), or at both the +V and -V sides of the current source.

The floating topology allows the current source to be used in a variety of applications that require loads to be connected as a high-side load, low-side load, or dual-side load.

The resistors R_1, R_2, R_3, R_4, R_5, and R_6 as well as their associated jumpers J_1, J_2, J_3, J_4, J_5, and J_6 can be configured to demonstrate high-side load, low-side load, or dual-side load.

2.1.2.1 High-Side Load

Connect the current source to a negative power supply or ground on the negative voltage lead (-V). Connect the load between the positive voltage lead (+V) of the current source and a positive power supply.

2.1.2.2 Low-Side Load

Connect the current source directly to a positive power supply on the positive voltage lead (+V). Connect the load to the negative voltage lead (-V) and to either a negative power supply or to ground.

2.1.2.3 Dual-Side Load

Connect the current source's first load to the positive voltage lead (+V) and positive power supply. Connect the second load to the negative voltage lead (-V) and to either a negative power supply or to ground.

2.1.3 Connecting Multiple Current Sources in Parallel for Higher Drive Current

You can parallel multiple current sources together to build a current source with higher current capability. The current into the circuit load from paralleled current sources is equal to the summation of the current from each current source. For example, two ISL70592SEHEVAL1Z boards connected in parallel supply 2mA of current to the circuit. Three ISL70592SEHEVAL1Z boards in parallel provide 3mA of current. The number of current sources you can connect in parallel is theoretically unlimited as long as the circuit loading maintains at least 3V across the +V and -V terminals of the ISL70592SEH ICs.

2.2 Quick Start Guide

2.2.1 Required Equipment

The following equipment is needed to operate the board:

- One 3V to 20V DC power supply capable of delivering 100mA
- One ammeter (Keithley 2000 multimeter or equivalent)
- Two voltmeters (Keithley 2000 multimeter or equivalent)

2.2.2 Using the Board

(1) Configure the board as shown in Figure 2 on page 5.

(2) Set the DC supply to 10V. Turn the DC power supply ON. The current in the ammeter should read approximately 0.99940mA.

(3) Adjust the DC supply voltage to 5V. The current in the ammeter should read in the range of 0.9980mA to 1.004mA with a typical value of approximately 1.0009mA.

(4) Adjust the DC supply voltage to 15V. The current in the ammeter should read in the range of 0.9980mA to 1.004mA with a typical value of approximately 1.0009mA.

(5) Turn the DC supply OFF. Remove the jumpers from J_3 and J_4. Put the jumpers on J_1 and J_6. Set the DC supply to 5V. The current in the ammeter should read in the range of 0.9980mA to 1.004mA with a typical value of approximately 1.0009mA.The V_1 voltage should read approximately 4.01V, and the V_2 voltage should read in the range of 0.988V to 1.024V with a typical value of approximately 1.013V.

(6) Set the DC supply to 10V. The current in the ammeter should read in the range of 0.9980mA to 1.004mA with a typical value of approximately 1.0009mA.The V_1 voltage should read approximately 9.03V, and the V_2 voltage should read in the range of 0.988V to 1.024V with a typical value of approximately 1.013V.

(7) Turn the DC supply OFF. Remove the jumpers from J_1 and J_6. Place jumpers on J_2 and J_5. Set the DC supply to 10V. The current in the ammeter should read in the range of 0.9980mA to 1.004mA with a typical value of approximately 1.0009mA. The V_1 voltage should read approximately 9.93V, and the V_2 voltage should read in the range of 98.8mV to 111.7mV with a typical value of approximately 110.9mV.

(8) Set the DC supply to 15V. The current in the ammeter should read in the range of 0.9980mA to 1.004mA with a typical value of approximately 1.0009mA. The V_2 voltage should read in the range of 98.8mV to 111.7mV with a typical value of approximately 110.9mV.

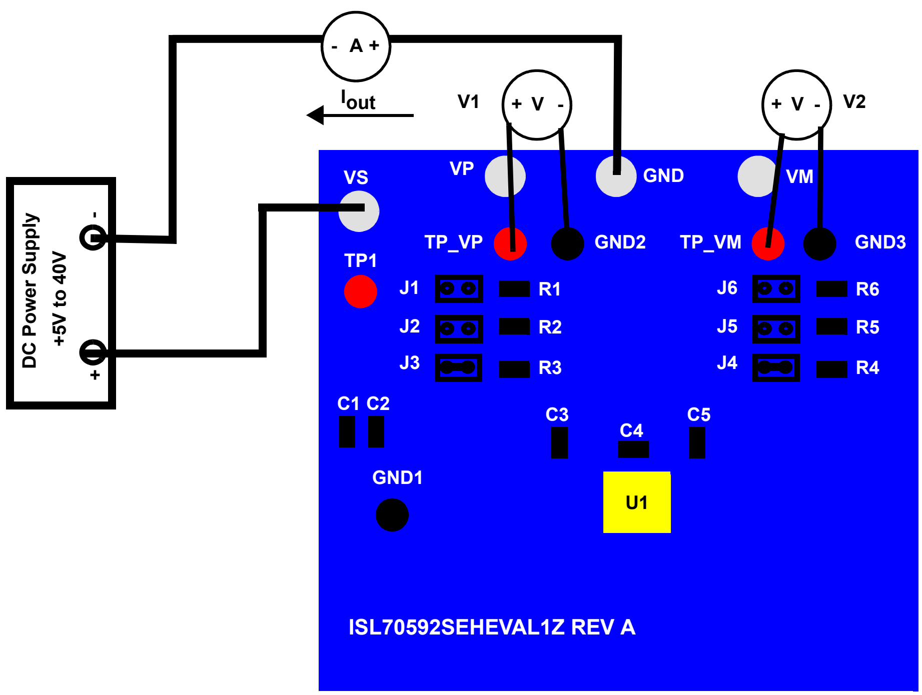


Figure 2. Basic Evaluation Test Setup Block Diagram

3. PCB Layout Guidelines

3.1 ISL70592SEHEVAL1Z Evaluation Board

Figure 3. ISL70592SEHEVAL1Z Evaluation Board

3.2 ISL70592SEHEVAL1Z Circuit Schematic

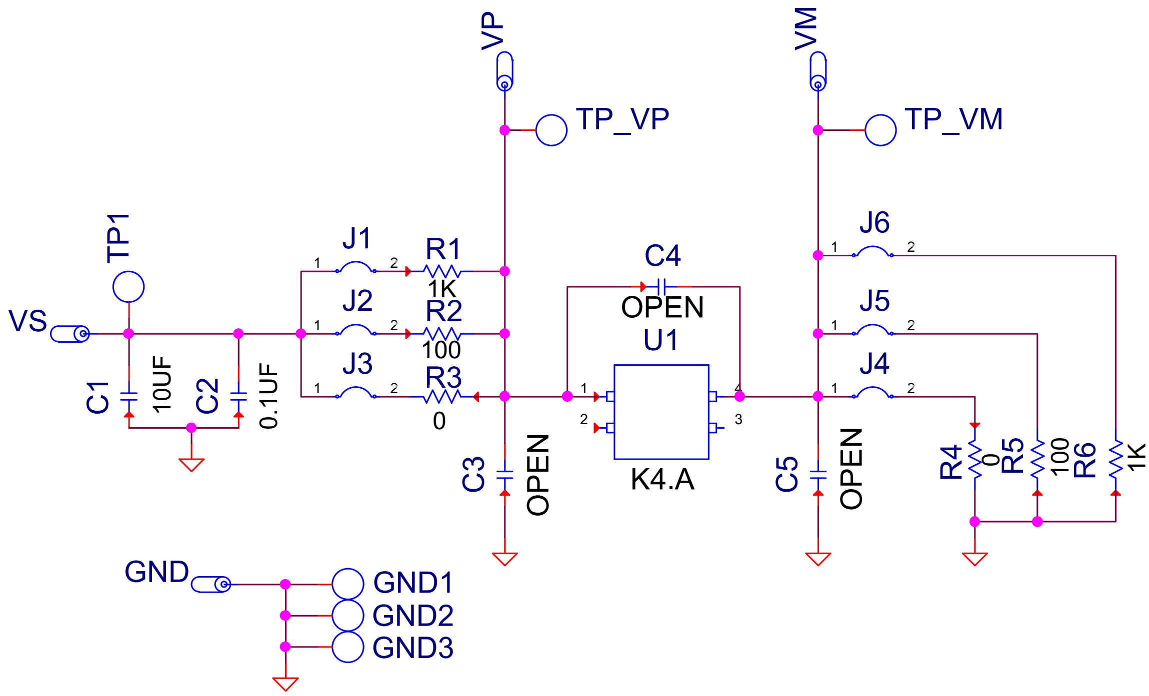


Figure 4. Schematic

3.3 Bill of Materials

Qty	Reference Designator	Description	Mfr	Manufacturer Part Number
1	-	PWB-PCB, ISL70592SEHEVAL1Z, REVA, RoHS	Imagineering Inc	ISL70592SEHEVAL1ZREVA PCB
1	C1	CAP, SMD, 0805, 10µF, 25V, 10%, X5R, RoHS	TDK	C2012X5R1E106K
1	C2	CAP, SMD, 0805, 0.1µF, 50V, 10%, X7R, RoHS	Kemet	C0805C104K5RACTU
0	C3, C4, C5	CAP, SMD, 0805, DNP-PLACE HOLDER, RoHS		
3	TP1, TP_VP, TP_VM	CONN - MINI TEST PT, VERTICAL, RED, RoHS	Keystone	5000
3	GND1, GND2, GND3	CONN - MINI TEST PT, VERTICAL, BLK, RoHS	Keystone	5001
4	VM, VP, VS, GND	CONN-JACK, MINI BANANA, 0.175 PLUG, NICKEL/BRASS, RoHS	Keystone	575-4
6	J1, J2, J3, J4, J5, J6	CONN-HEADER,1x2, BRKAWY 1X36, 2.54mm, RoHS	Berg/FCI	68000-236HLF
1	U1	IC-RAD HARD, 100µA CURRENT SOURCE, 4P, KCW, RoHS	Renesas	ISL70592SEHF/PROTO
2	R3, R4	RES,SMD,0805,0Ω, 1/8W, TF, RoHS	Yageo	RC0805JR-070RL
2	R2, R5	RES, SMD, 0805, 100Ω, 1/8W, 1%, TF, RoHS,	Venkel	CR0805-8W-1000FT
2	R1, R6	RES, SMD, 0805, 1k, 1/8W, 1%, TF, RoHS	Venkel	CR0805-8W-1001FT
4	Bottom four corners	BUMPONS, 0.44inW x 0.20inH, DOMETOP, BLACK	3M	SJ-5003SPBL
1	Place assy in bag	BAG, STATIC, 5X8, ZIPLOC, RoHS	Renesas	212403-013
1	Affix to back of PCB	LABEL-DATE CODE_LINE 1: YRWK/REV#, LINE 2: BOM NAME	Renesas	LABEL-DATE CODE

3.4 Board Layout

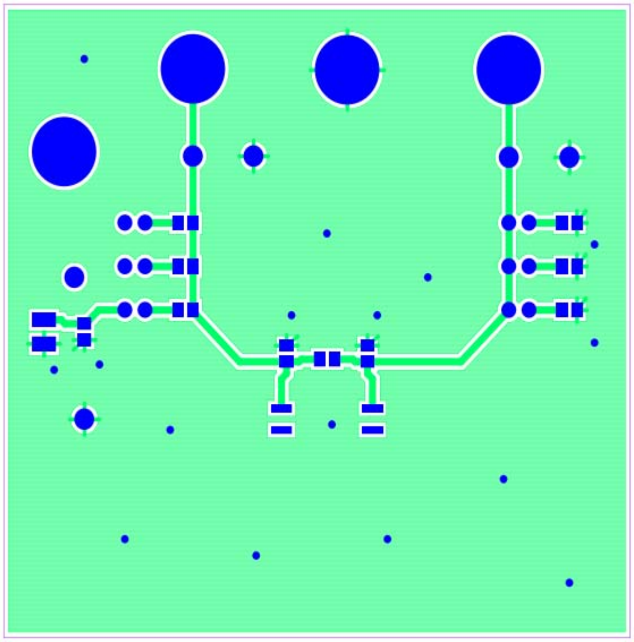


Figure 5. Top Layer

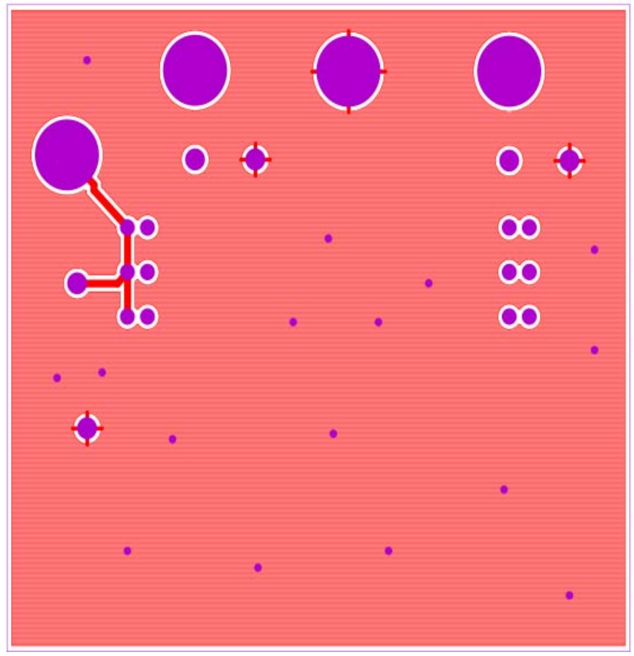


Figure 6. Bottom Layer

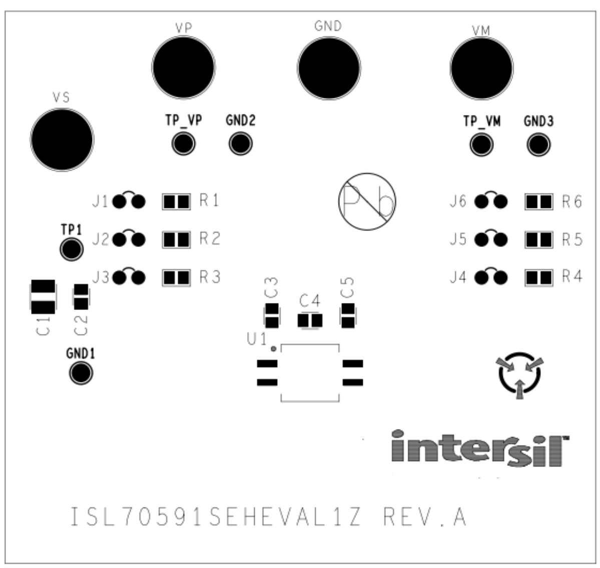


Figure 7. Top Layer Silk Screen

4. Typical Performance Curves

Unless otherwise noted: +V = 20V, T_A = +25°C

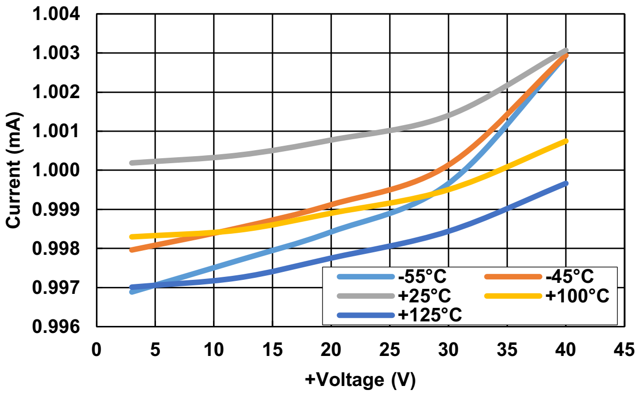


Figure 8. Output Current vs Voltage vs Temperature

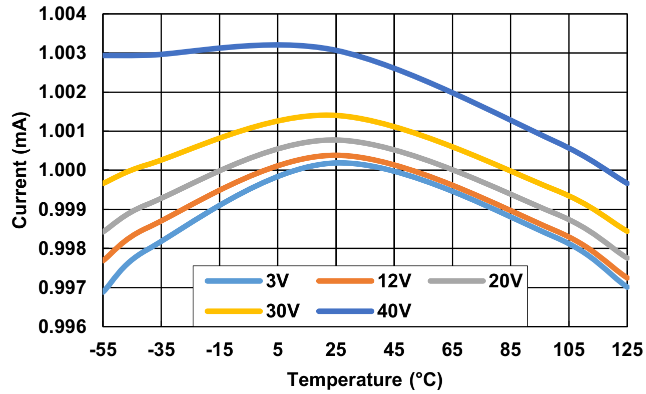


Figure 9. Output Current vs Temperature vs Voltage

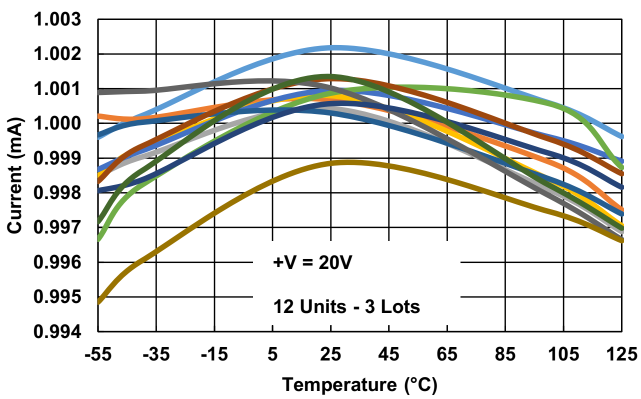
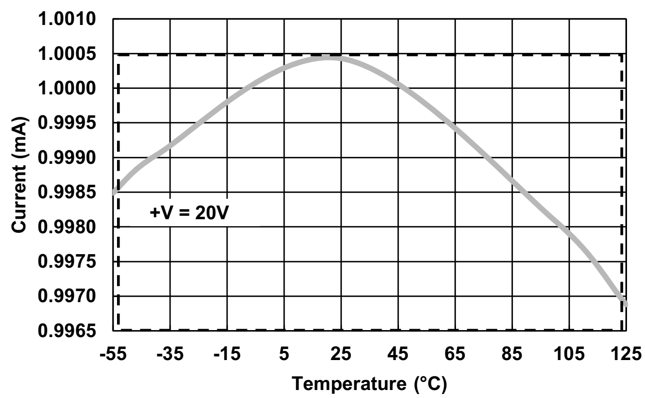


Figure 10. Output Current vs Temperature vs (12 units - 3 lots)



1.00043mA - 0.99688mA/180°C = 0.00355mA/180°C = 19.7nA/°C
[19.7nA/°C/1mA] x 10^6 = 19.7ppm/°C

Figure 11. Temperature Coefficient at +V = 20V

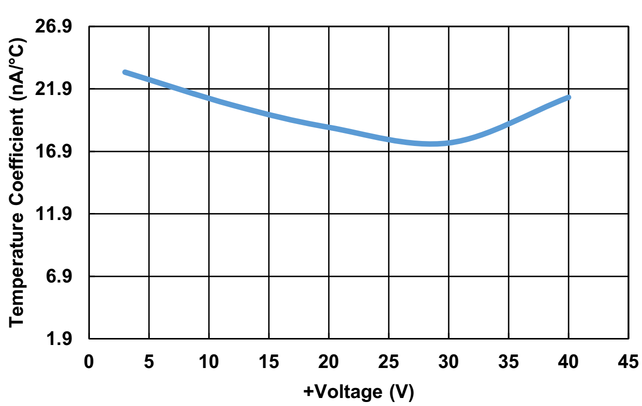


Figure 12. Output Current Temperature Coefficient vs Voltage

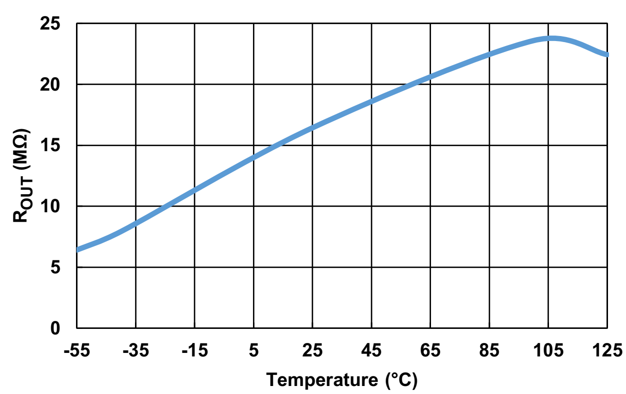


Figure 13. Output Impedance (R_{OUT}) vs Temperature

Unless otherwise noted: +V = 20V, T_A = +25°C

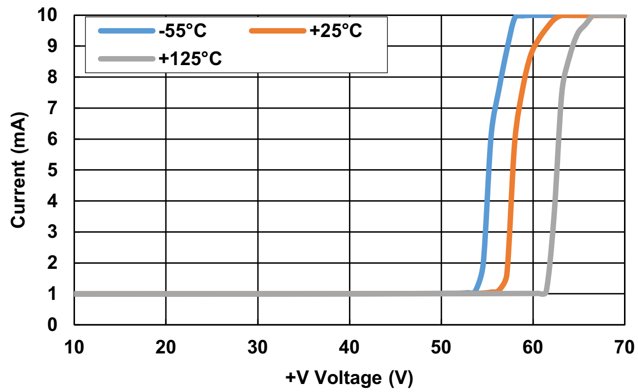


Figure 14. +V Breakdown Voltage

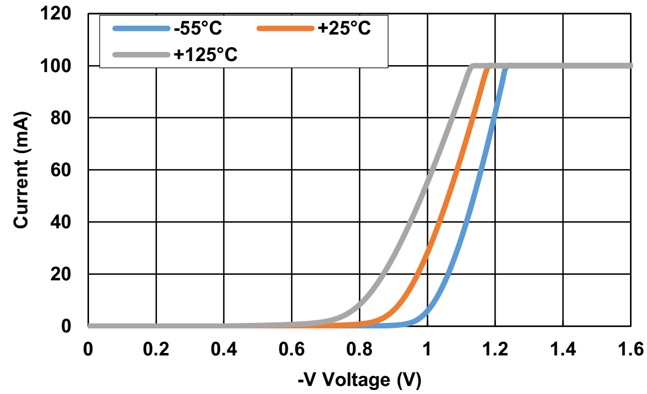


Figure 15. Reverse (-V) Breakdown Voltage

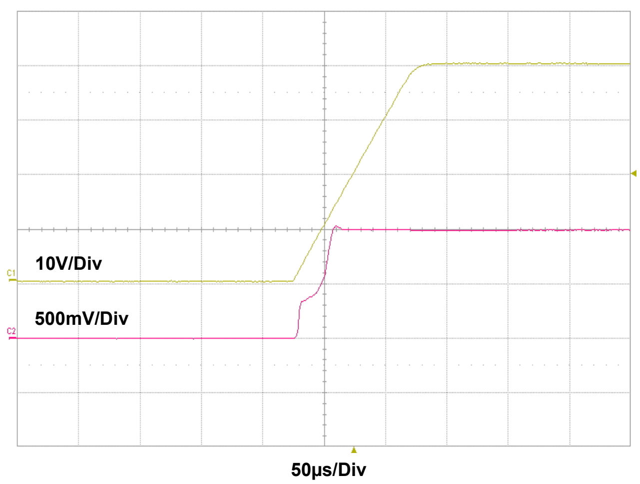


Figure 16. Turn-on Time Plot (40V/100µs Ramp)

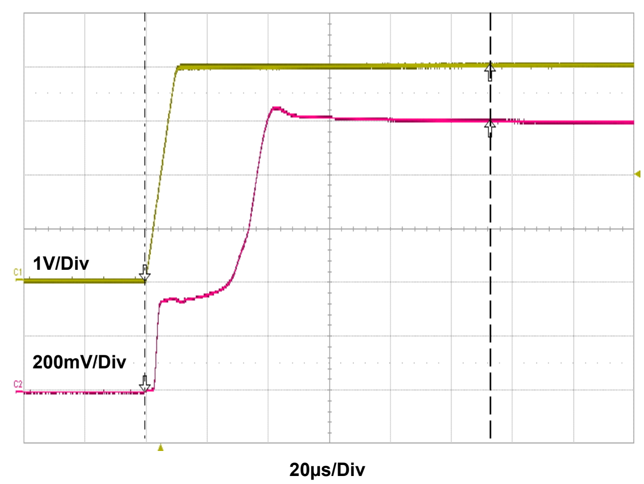


Figure 17. Turn-on Time Plot (4V/10µs Ramp)

5. Revision History

Rev.	Date	Description
0.00	Sep 5, 2018	Initial release

Notice

RENESAS

SALES OFFICES

Renesas Electronics Corporation

http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

California Eastern Laboratories, Inc.
4590 Patrick Henry Drive, Santa Clara, California 95054-1817, U.S.A.
Tel: +1-408-919-2500, Fax: +1-408-988-0279

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338

Colophon 7.1

ISL70592SEHEVAL1Z