

ISL70227MHEVAL1Z

ISL70227SRH Evaluation Board

AN1669

Rev.0.00

September 23, 2011

Introduction

The ISL70227MHEVAL1Z evaluation board is designed to evaluate the performance of the rad hard ISL70227SRH 36V Precision Low Power Operational Amplifier. The ISL70227SRH can operate from a dual supply with a 4.5V to 36V supply range. The ISL70227SRH features very low power, low offset voltage and low temperature drift, making it ideal for applications for precision instrumentation, current sensing and power supply, and industrial process controls.

Reference Documents

- ISL70227SRH Data Sheet, [FN7925](#)

Evaluation Board Key Features

- Wide Supply Operation: 4.5V to 36V
- Single-Ended or Differential Input Operation
- External VREF Input
- Banana Jack Connectors for Power Supply and VREF Inputs
- BNC Connectors for Op Amp Input and Output Terminals
- Convenient PCB Pads for Op Amp Input/Output Impedance Loading

Power Supplies

External power connections are made through the +V, -V, VREF and Ground connections on the evaluation board. For single supply operation, the -V and Ground pins are tied together to the power supply negative terminal. For split supplies, +V and -V terminals connect to their respective power supply terminals. De-coupling capacitors C2, C3, C4 and C6 connect to their respective supplies through R11 and R15 resistors. These resistors are 100Ω but can be changed by the user to provide additional power supply filtering, or to reduce the voltage rate-of-rise to less than ±1V/μs. Two additional capacitors, C5 and C7, are connected close to the part to filter out high frequency noise. Anti-reverse diode D1 protects the circuit in the momentary case of accidentally reversing the power supplies to the evaluation board. The VREF pin can be connected to ground to establish a ground referenced input for split supply operation, or can be externally set to any reference level for single supply operation.

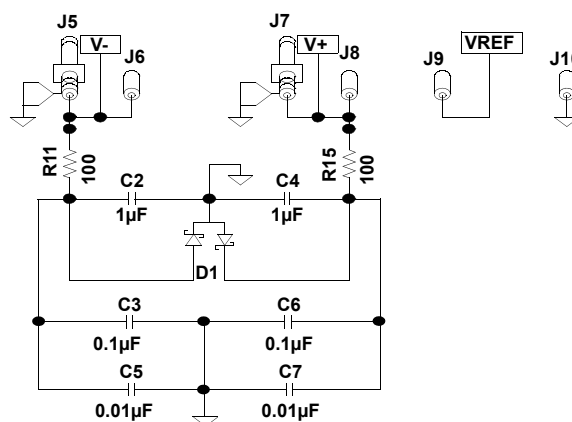


FIGURE 1. POWER SUPPLY CIRCUIT

Amplifier Configuration

A simplified schematic of the evaluation board is shown in Figure 2. The input stage with the components supplied is shown in Figure 3, with a closed loop gain of 10V/V. The differential amplifier gain is expressed in Equation 1:

$$V_{OUT} = (V_{IN+} - V_{IN-}) \cdot (R_F / R_{IN}) + V_{REF} \quad (EQ. 1)$$

For single-ended input with an inverting gain $G = -10V/V$, the $IN+$ input is grounded and the signal is supplied to the $IN-$ input. $VREF$ can be connected to a reference voltage between the $V+$ and $V-$ supply rails. For non-inverting operation with $G = 11V/V$, the $IN-$ input is grounded and the signal is supplied to the $IN+$ input. The non-inverting gain is strongly dependent on any resistance from $IN-$ to GND. For good gain accuracy, a 0Ω resistor should be installed on the empty R5 pad. The $VREF$ pin must be connected to ground to establish a ground referenced input for dual supply operation, or can be externally set to any reference level for single supply operation. $VREF$ should not be left floating.

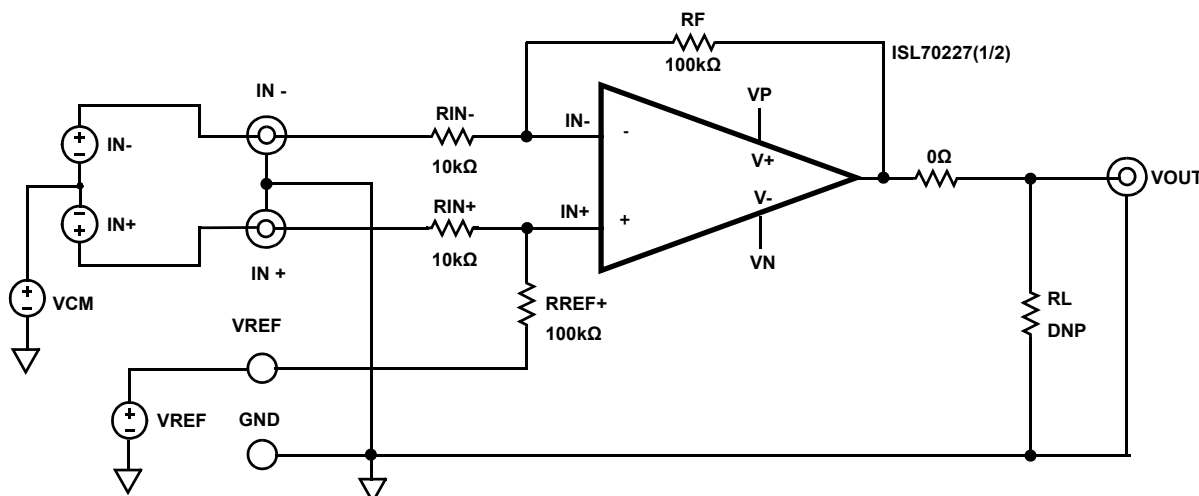


FIGURE 2. BASIC AMPLIFIER CONFIGURATION

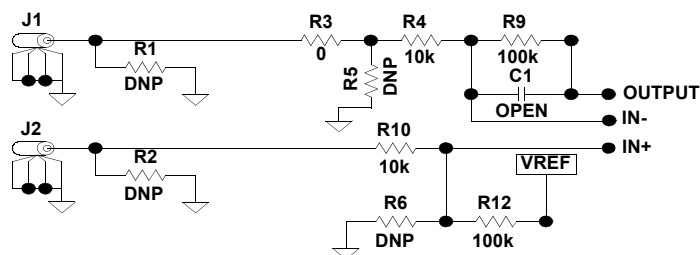


FIGURE 3. INPUT STAGE (1/2)

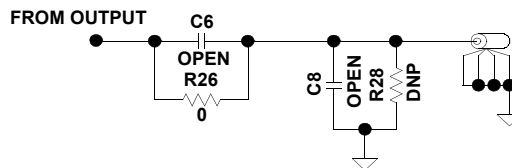


FIGURE 4. OUTPUT STAGE (1/2)

User-selectable Options

Component pads are included to enable a variety of user-selectable circuits to be added to the amplifier VREF, inputs, outputs, and the amplifier feedback loops.

A voltage divider (Figure 3, R6 and R12) can be added to establish a power supply-tracking common mode reference using the VREF input. The input stages (see Figure 3) have additional resistor and/or capacitor pads that may be used to add voltage divider networks or feedback networks for adding input attenuation, or to establish input DC offsets through the VREF pin. The output stages (see Figure 4) have additional resistor and capacitor placements for loading.

NOTE: Operational amplifiers are sensitive to output capacitance and may oscillate. In the event of oscillation, reduce output capacitance by using shorter cables, or add a resistor in series with the output.

TABLE 1. ISL70227MHEVAL1Z COMPONENTS PARTS LIST

DEVICE #	DESCRIPTION	COMMENTS
C2, C4	CAP, SMD, 1210, 1 μ F, 50V, 10%, X7R, ROHS	Power Supply Decoupling
C3, C6	CAP, SMD, 0805, 0.1 μ F, 50V, 10%, X7R, ROHS	Power Supply Decoupling
C5, C7	CAP, SMD, 0603, 0.01 μ F, 50V, 10%, X7R, ROHS	Power Supply Decoupling
C1, C8-C12	CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS	User selectable capacitors - not populated
D1	DIODE-RECTIFIER, SMD, SOD-123, 2P, 40V, 0.5A, ROHS	Reverse Power Protection
U1	ISL70227SRHM, DUAL OP-AMP, 10 Ld. FLATPAK	
R1, R2, R5-R8, R14, R20, R23, R24,	RESISTOR, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER	User selectable resistors - not populated
R3, R20-R22	RES, SMD, 0603, 0 Ω , 1/10W, TF, ROHS	Zero ohm resistors
R4, R10, R17, R18	RES, SMD, 0603, 10k, 1/10W, 1%, TF, ROHS	Gain resistors
R10, R12, R13, R16	RES, SMD, 0603, 100k, 1/10W, 1%, TF, ROHS	Gain resistors

FIGURE 5. ISL70227MHEVAL1Z TOP VIEW



Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
 2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
 3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
 4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
 5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
 6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
 7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
 8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
 9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
 10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
 11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
- (Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

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

Renesas Electronics America Inc.
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

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, Fax: +44-1628-651-804

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