ISL70617SEHEV1Z

Evaluation Board User Guide

UG061
Rev 0.00
November 19, 2015

Description

The ISL70617SEHEV1Z evaluation board is designed to assess the performance of the ISL70617SEH differential input, differential output, precision instrumentation amplifier (in-amp). With separate supply rails for the input and output stages and gain ranging from 0.1 to 10,000, this in-amp is ideal for a wide variety of applications. The gain accuracy is limited only by the matching of the gain resistors and the output is capable of driving rail-to-rail.

Specifications

The boards are designed to operate under the following conditions.

- Power supply range:
  - Input: 8V (±4V) to 36V (±18V)
  - Output: 3V (±1.5V) to 36V (±18V)
- Common-mode Input voltage range: V_{EE} + 3V to V_{CC} - 3V
- Differential input voltage range: ±3V (Note 1)
- Output voltage range: ±3V (Note 1)
- Operating temperature range: -55°C to +125°C

NOTE:

1. The input and output voltage range may also be limited by the power supply voltages.

Key Features

- Separate input and output supplies allow signals riding on a high common-mode voltage to be level shifted to a low voltage device.
- Banana jack connectors for simple power supply connections.
- Multiple connectors to easily access V_{IN} and V_{OUT}

Reference Documents

- ISL70617SEH Datasheet

Ordering Information

ORDERING NUMBER	OUTPUT	TYPE
ISL70617SEHEV1Z	Differential	Evaluation Board

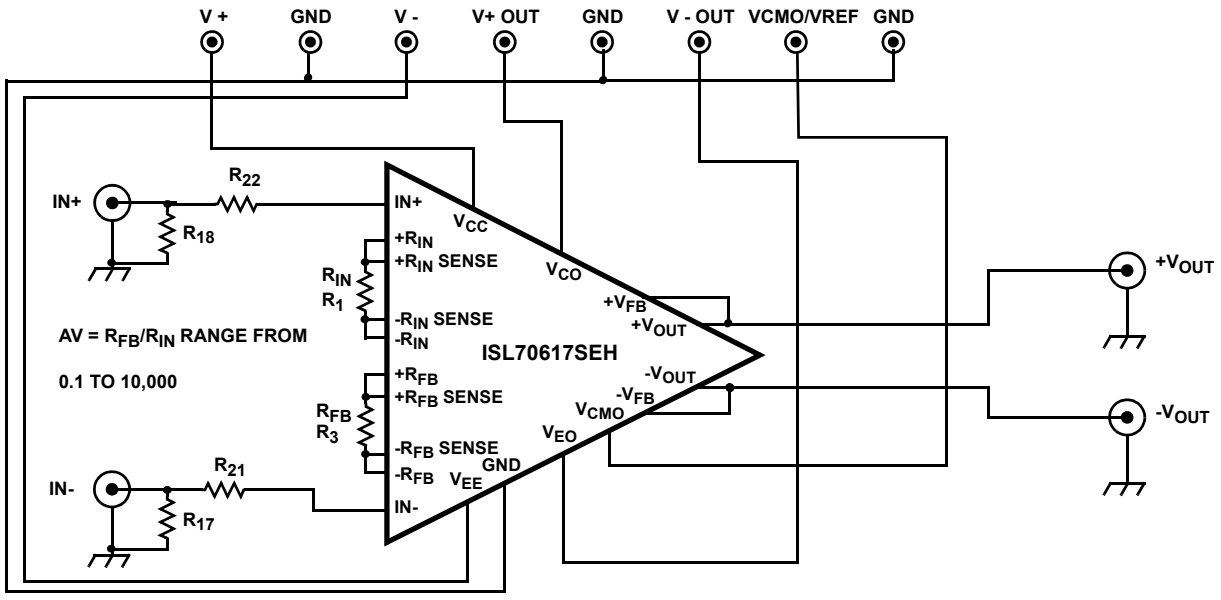

FIGURE 1. ISL70617SEH EVALUATION BOARD BLOCK DIAGRAM

Functional Description

The schematic of the evaluation board is shown on Figure 10. The ISL70617SEHEV1Z contains the ISL70617SEH in-amp (U1), supply decoupling capacitors (C_1-C_{12}, C_{15}-C_{17}), optional filter capacitors (C_{13}, C_{14}, C_{18}-C_{21}), feedback gain resistor (R_1), input gain resistor (R_3) and numerous filter, load and selection resistors. Component values are listed in the BOM page 7.

Power Supplies

External power supplies are connected via the banana jack plugs (J1-J8). Each plug is labeled to identify the corresponding supply, ground, or reference voltage. The in-amp has two distinct sets of power supplies; one on the input stage and one on the output stage. The input and output supplies can be connected together externally or powered separately. Using the separate supply feature enables input signals riding on a high common-mode voltage to be level shifted to a low voltage device such as an Analog-to-Digital Converter (ADC). The operating voltage range is ±4V to ±36V for V_{CC}/V_{EE} and ±1.5V to ±36V on V_{CO}/V_{EO}. For split supply operation, the common-mode voltage (V_{CMO}) can be connected externally to ground.

The supply voltage on the input stage must be 3V above the maximum and 3V below the minimum input signal voltage. Note that while the output stage is rail-to-rail, the feedback returns to the input stage, which is not rail-to-rail. Therefore, the input power supply must be 3V above and below the maximum and minimum output signal as well. For more information, reference "Setting the Power Supply Voltages" section in the ISL70617SEH datasheet.

Inputs and Outputs

The input and output pins have BNC connectors (J9-J12) as well as two pin headers (J13, J16) to allow the use of differential probes. When testing the output voltage of the device under load, it is recommended to attach the load to the BNC connector and monitor the voltage from the differential probe.

The ISL70617SEHEV1Z includes the option for an anti-aliasing filter on the output comprised of a 100Ω resistor (R_7, R_8) and 3300pF capacitor (C_{14}, C_{18}). The filter is recommended when connecting the output directly to an ADC. When using the in-amp in a gain less than 1, it is possible to add a low pass filter before the input to compensate for the gain peaking at the limits of the gain bandwidth product. Resistor locations (R_{21}, R_{22}) and capacitors locations (C_{19}, C_{20}) can be used for this input filter.

Amplifier Configuration

The ISL70617SEH evaluation board schematic is in a closed loop gain of 1 in the default configuration. To change the gain, simply replace the R_3 input resistor and/or the R_1 feedback resistor. The in-amp gain is calculated with the Equation 1:

$$A_V = \frac{R_1}{R_3} \quad \text{(EQ. 1)}$$

R_1 and R_3 also limit the maximum signal size at the input and output due to the amplifier architecture. Table 1 shows the signal limits for the boards at the preset resistor values. For more information, refer to the "Setting the Feedback Gain R_{FB}" and "Setting the Input Gain R_{IN}" section in the ISL70617SEH datasheet.

Figures 2 through 9 show several of the key performance curves generated from the ISL70617SEHEV1Z.

TABLE 1. RECOMMENDED INPUT AND OUTPUT VOLTAGE LIMITS FOR A GIVEN SET OF GAIN RESISTORS

R_{IN} (Ω)	R_{FB} (kΩ)	GAIN	MAX RECOMMENDED V_{IN} (V)	Max Recommended V_{OUT} (V)
30.1k	30.1	1	±2.0	±2.0
3.01k	30.1	10	±0.20	±2.0
301	30.1	100	±0.020	±2.0
301k	30.1	0.1	±20	±2.0

Device Performance

The following plots show the performance of the in-amp that can be expected on the evaluation board. V_{CC} = V_{CO} = 15V, V_{EE} = V_{EO} = -15V, V_{CMO} = 0V unless otherwise specified.

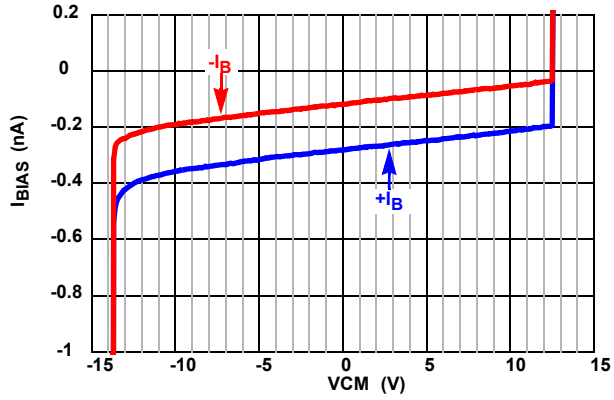

FIGURE 2. I_B vs INPUT COMMON-MODE VOLTAGE (±15V)

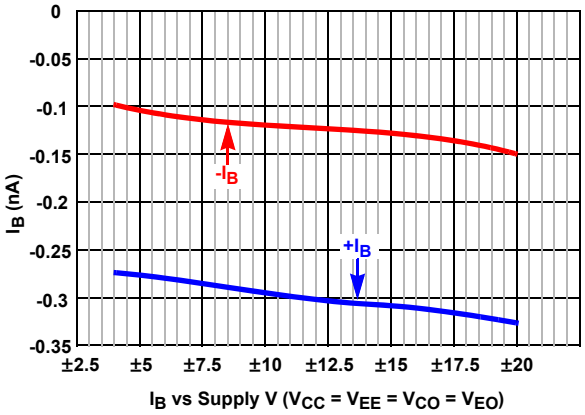

FIGURE 3. I_B vs SUPPLY VOLTAGE (V_{CC} - V_{EE})

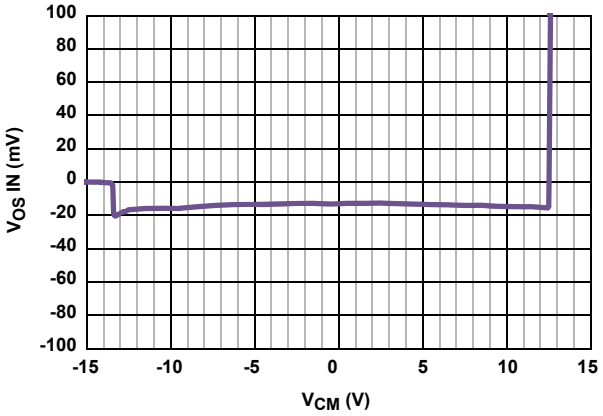

FIGURE 4. V_{OS}IN vs INPUT COMMON-MODE VOLTAGE

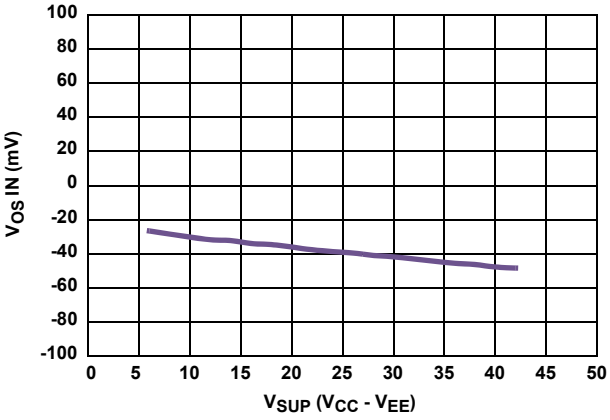

FIGURE 5. V_{OS}IN vs SUPPLY VOLTAGE (V_{CC} - V_{EE})

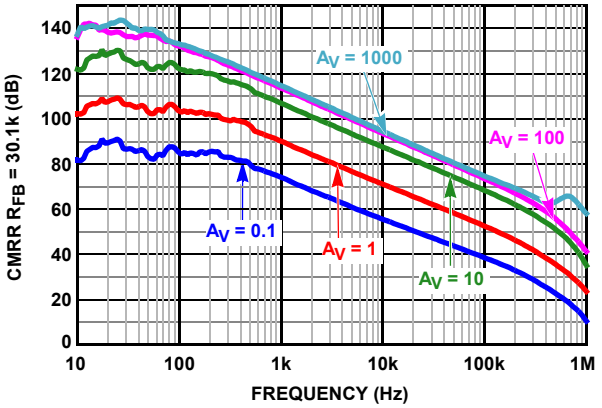

FIGURE 6. CMRR (RTI) R_F = 30.1k

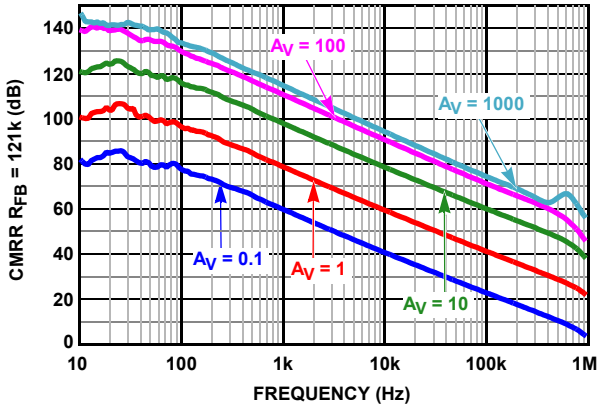

FIGURE 7. CMRR (RTI) R_F = 121k

Device Performance

The following plots show the performance of the in-amp that can be expected on the evaluation board. $V_{CC} = V_{CO} = 15V$, $V_{EE} = V_{EO} = -15V$, $V_{CMO} = 0V$ unless otherwise specified.

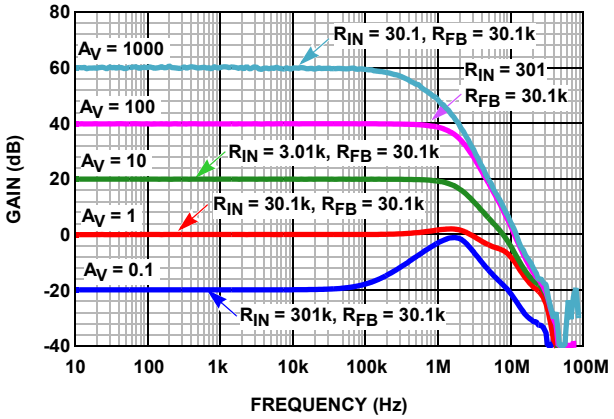

FIGURE 8. CLOSED LOOP GAIN (R_{FB} = 30.1k) vs FREQUENCY

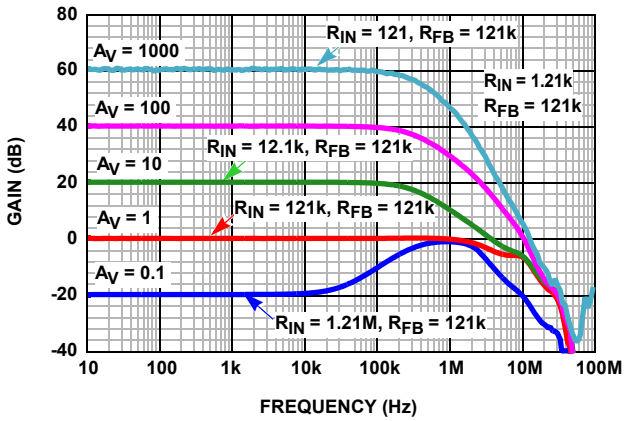

FIGURE 9. CLOSED LOOP GAIN (R_{FB} = 121k) vs FREQUENCY

ISL70617SEHEV1Z Schematic

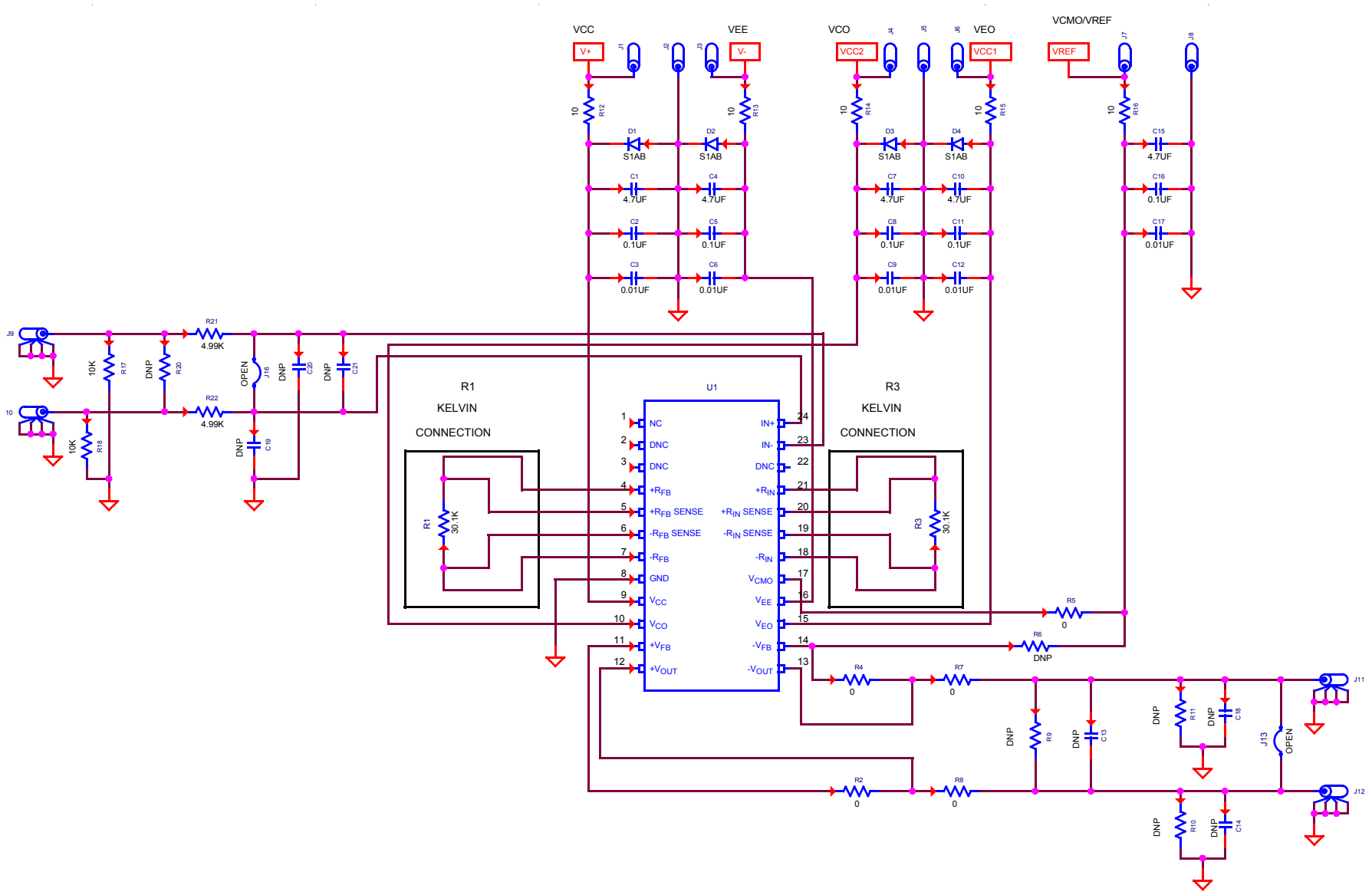

FIGURE 10. ISL70617SEHEV1Z SCHEMATIC

In-Amp Evaluation Board Layout

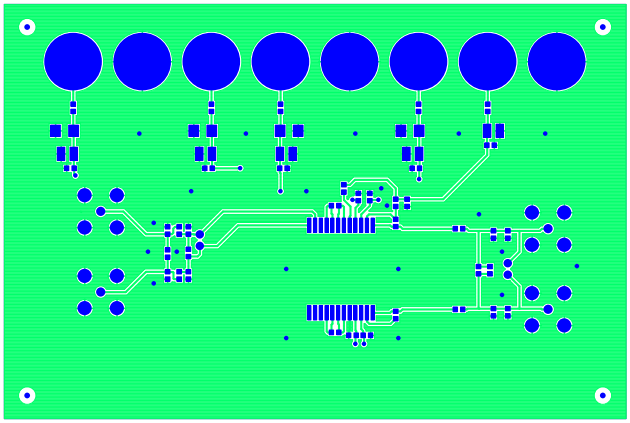

FIGURE 11. TOP LAYER

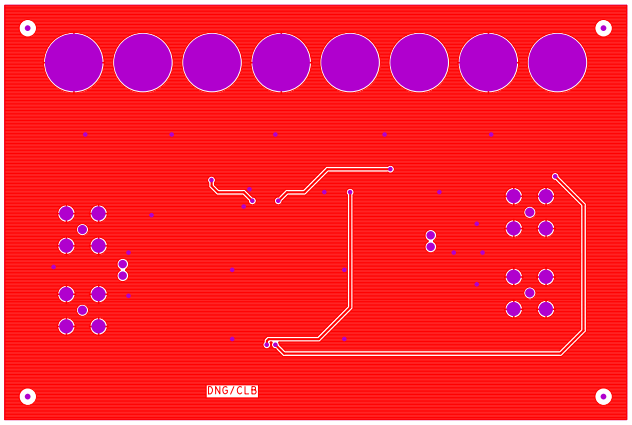

FIGURE 12. BOTTOM LAYER (VIEWED FROM BOTTOM)

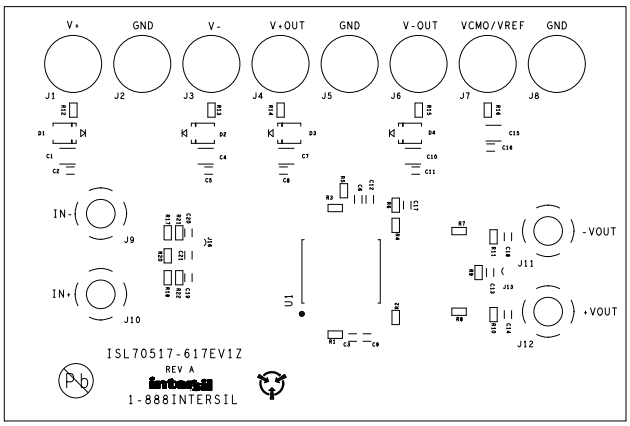

FIGURE 13. TOP SILKSCREEN

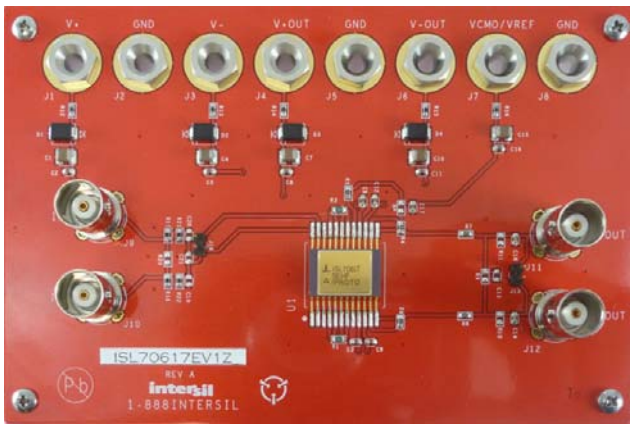

FIGURE 14. ISL70617SEHEV1Z EVALUATION BOARD

BILL OF MATERIALS

MANUFACTURER PART NUMBER	QTY	UNITS	REFERENCE DESIGNATOR	DESCRIPTION	MANUFACTURER
ISL70517-617EV1ZREVAPCB	1	ea.	SEE LABEL-RENAME BOARD	PWB-PCB,ISL70517-617EV1Z, REVA, ROHS	IMAGINEERING INC
GRM39X7R103K050	5	ea.	C3, C6, C9, C12, C17	CAP, SMD, 0603, 0.01µF, 50V, 10%, X7R, ROHS	MURATA
06035C104KAT2A	5	ea.	C2, C5, C8, C11, C16	CAP, SMD, 0603, 0.1µF, 50V, 10%, X7R, ROHS	AVX
	0	ea.	C13, C14, C18, C19, C20, C21	CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS	
GRM32ER71H475KA88L	5	ea.	C1, C4, C7, C10, C15	CAP, SMD, 1210, 4.7µF, 50V, 10%, X7R, ROHS	MURATA
108-0740-001	8	ea.	J1-J8	CONN-JACK, BANANA-SS-SDRLESS, VERTICAL, 0.53Length, ROHS	JOHNSON COMPONENTS
31-5329-52RFX	4	ea.	J9-J12	CONN-BNC, RECEPTACLE, TH, 4 POST, 50Ω, GOLDCONTACT, ROHS	AMPHENOL
69190-202HLF	2	ea.	J13, J16	CONN-HEADER, 1X2, RETENTIVE, 2.54mm, 0.230X 0.120, ROHS	BERG/FCI
S1AB-13-F	4	ea.	D1-D4	DIODE-RECTIFIER, SMD, 4.5X3.9mm, 50V, 1A, ROHS	DIODES INC.
ISL70617SEHF/PROTO	1	ea.	U1	IC-RH INSTRUMENTATION AMP, 24P, FLATPACK, ROHS	INTERSIL
ERA-3AEB3012V	2	ea.	R1, R3	RES, SMD, 0603, 30.1k, 1/10W, 0.1%, 25ppm, ROHS	PANASONIC
	0	ea.	R6, R9, R10, R11, R20	RESISTOR, SMD, 0603, 0.1%, MF, DNP-PLACE HOLDER	
RK73H1JT10R0F	5	ea.	R12, R13, R14, R15, R16	RES,SMD, 0603, 10Ω, 1/10W, 1%, TF, ROHS	KOA
CR0603-10W-000T	5	ea.	R2, R4, R5, R7, R8	RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS	VENKEL
CR0603-10W-1002FT	2	ea.	R17, R18	RES,SMD, 0603, 10k, 1/10W, 1%, TF, ROHS	VENKEL
ERJ-3EKF4991V	2	ea.	R21, R22	RES, SMD, 0603, 4.99k, 1/10W, 1%, TF, ROHS	PANASONIC
PMSSS 440 0025 PH	4	ea.	Four corners	SCREW,4-40X1/4in, PHILLIPS, PANHEAD, STAINLESS, ROHS	BUILDING FASTENERS
2204	4	ea.	Four corners	STANDOFF,4-40X3/4in, F/F, HEX, ALUMINUM, 0.25 OD, ROHS	KEYSTONE
S-2261	1	ea.	Place assy in bag	BAG, STATIC, 4X6, ZIPLOC, ROHS	ULINE
LABEL-DATE CODE	1	ea.	AFFIX TO BACK OF PCB	LABEL-DATE CODE_LINE 1: YRWK/REV#, LINE 2: BOM NAME	INTERSIL
	1	ea.	AFFIX LABEL “EAR CONTROL” TOP SIDE PCB.	LABEL, GENERIC	
LABEL-RENAME BOARD	1	ea.	RENAME PCB TO: ISL70617SEHEV1Z	LABEL, TO RENAME BOARD	INTERSIL

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