ISL70517SEHEV1Z

Evaluation Board User Guide

UG060
Rev 0.00
November 6, 2015

Description

The ISL70517SEHEV1Z evaluation board is designed to assess the performance of the ISL70517SEH differential input, single-ended 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: ±2.6V (Note 1)
- Output voltage range: ±2.6V (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

- ISL70517SEH Datasheet

Ordering Information

ORDERING NUMBER	OUTPUT	TYPE
ISL70517SEHEV1Z	Single-Ended	Evaluation Board

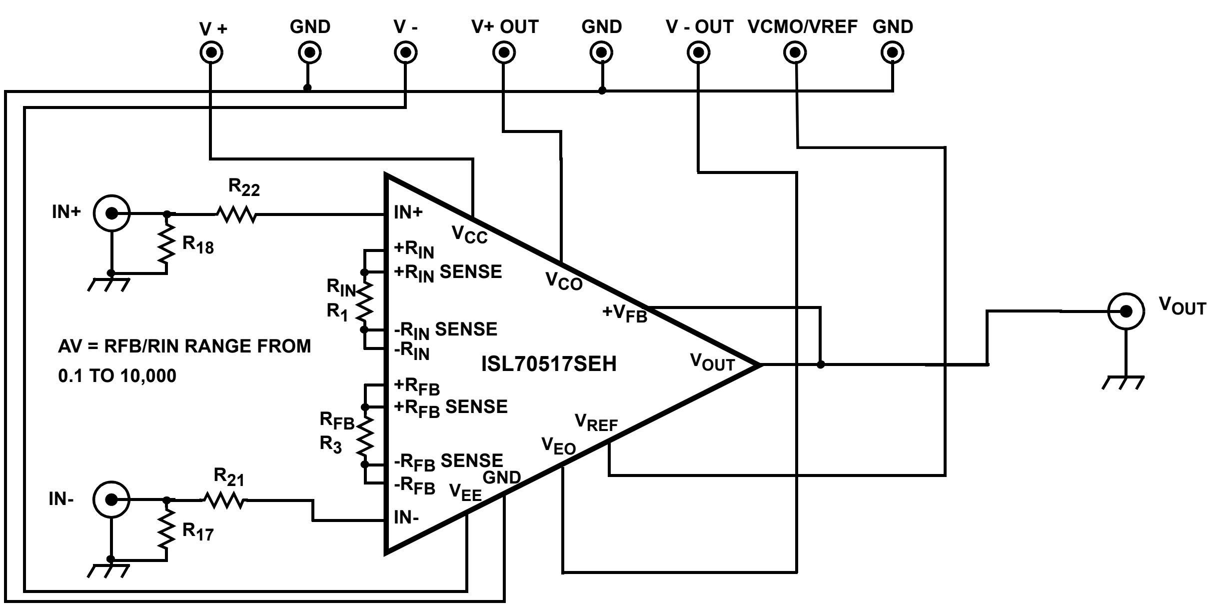

FIGURE 1. ISL70517SEH EVALUATION BOARD BLOCK DIAGRAM

Functional Description

The schematic of the evaluation board is shown on page 4. The ISL70517SEHEV1Z contains the ISL70517SEH 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 in "Appendix A" on page 6.

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 reference voltage (V_{REF}) 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" of the ISL70517SEH 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 ISL70517SEHEV1Z includes the option for an anti-aliasing filter on the output comprised of a 100Ω resistor (R_8) and 3300pF capacitor (C_{14}). 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 ISL70517SEH 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 following simple formula:

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

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 "Setting the Feedback Gain R_{FB}" and "Setting the Input Gain R_{IN}" of the ISL70517SEH datasheet.

Figures 2 through 7 show several of the key performance curves generated from the ISL70517SEHEV1Z.

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_{REF} = 0V unless otherwise specified.

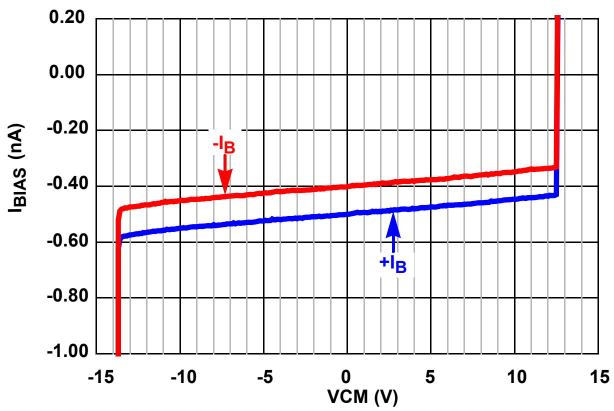

FIGURE 2. I_B vs INPUT COMMON-MODE VOLTAGE (±15V)

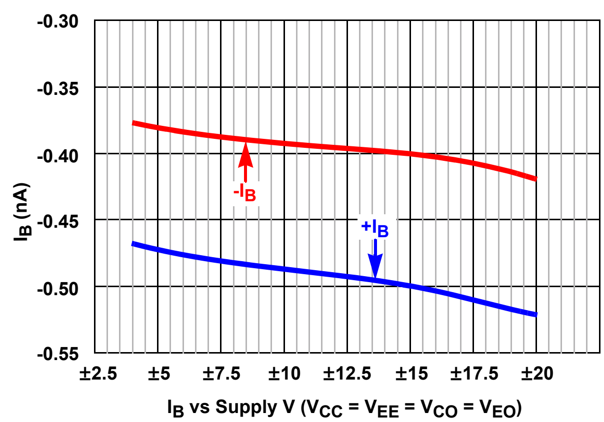

FIGURE 3. I_B vs SUPPLY VOLTAGE (V_{CC} - V_{EE})

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_{REF} = 0V unless otherwise specified. **(Continued)**

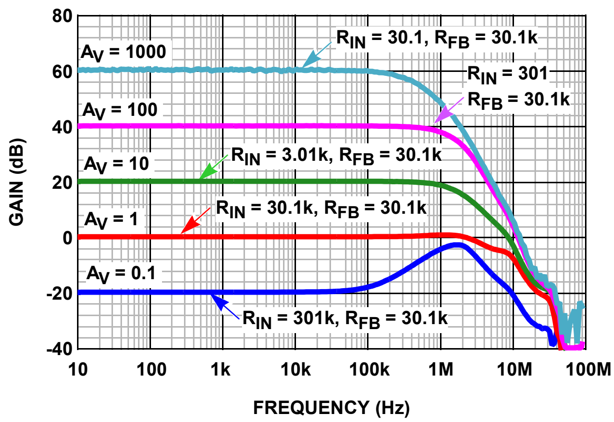

FIGURE 4. CLOSED LOOP GAIN (R_{FB} = 30.1k) vs FREQUENCY)

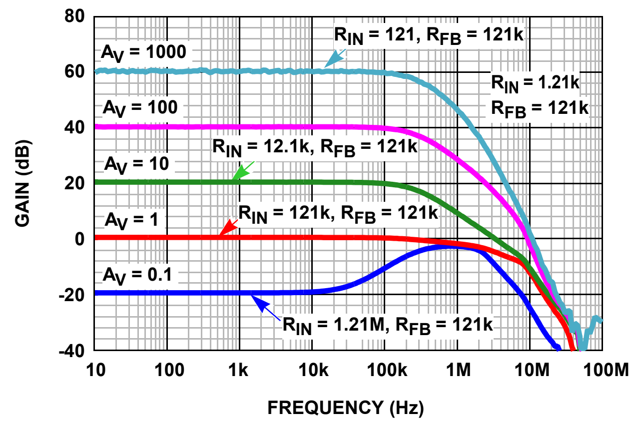

FIGURE 5. CLOSED LOOP GAIN (R_{FB} = 121k) vs FREQUENCY

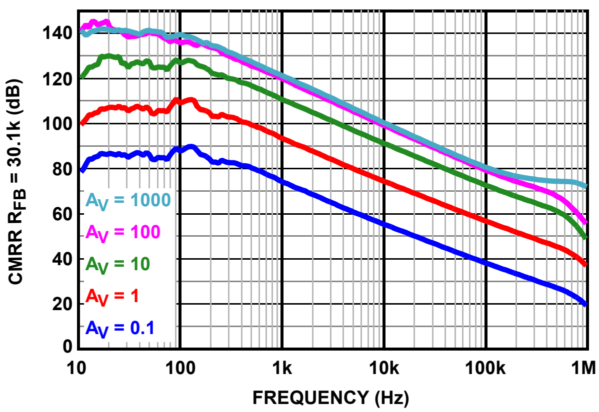

FIGURE 6. CMRR (RTI) R_F = 30.1k

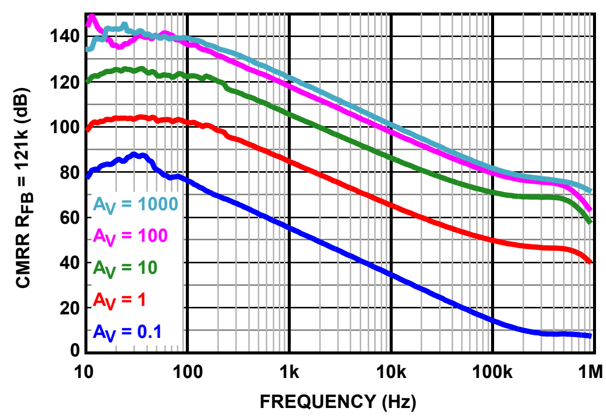

FIGURE 7. CMRR (RTI) R_F = 121k

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

ISL70517SEHEV1Z Schematic

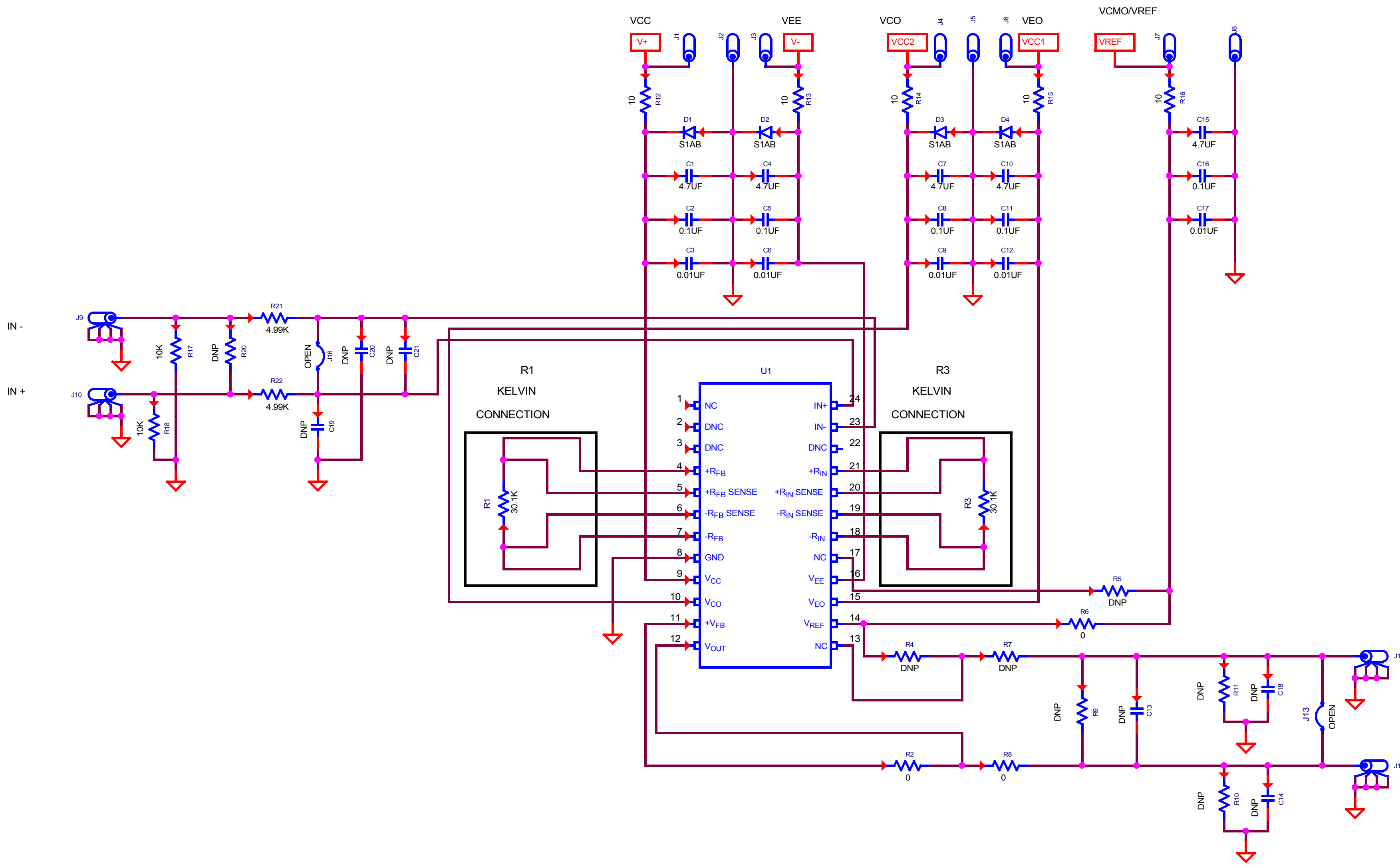

FIGURE 8. ISL70517SEHEV1Z SCHEMATIC

In-Amp Evaluation Board Layout

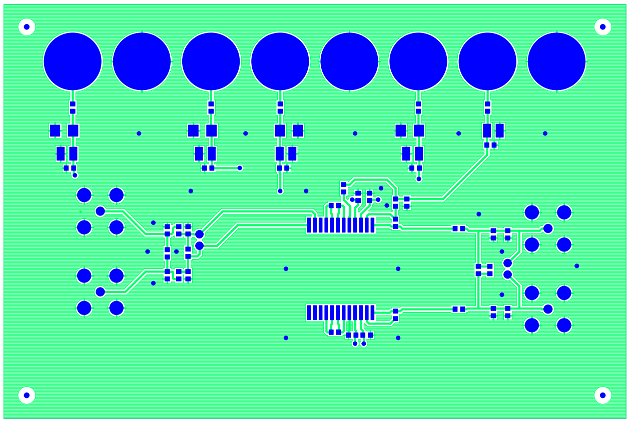

FIGURE 9. TOP LAYER

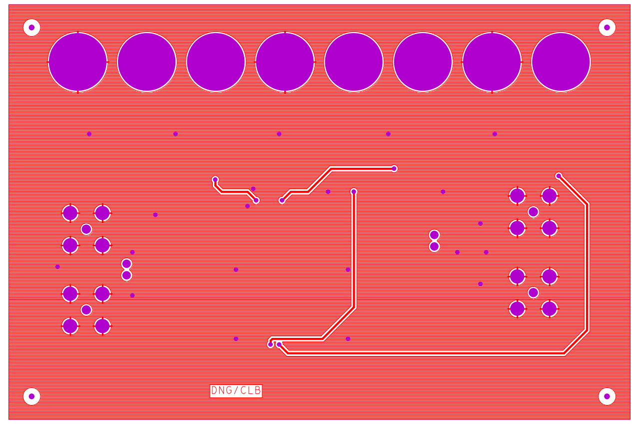

FIGURE 10. BOTTOM LAYER (VIEWED FROM BOTTOM)

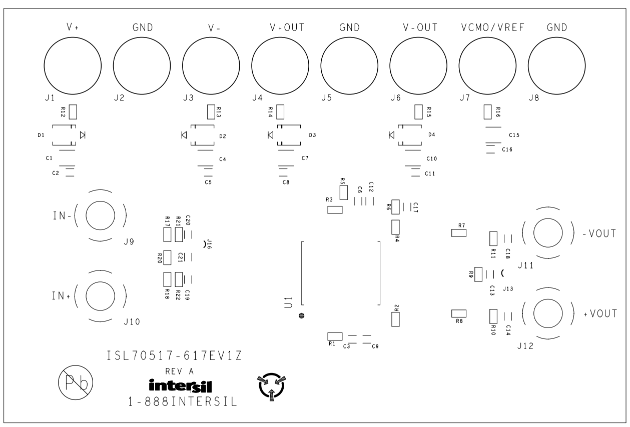

FIGURE 11. TOP SILKSCREEN

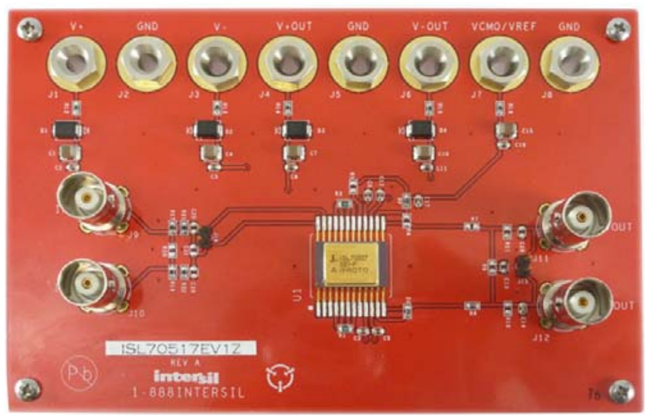

FIGURE 12. ISL70517SEHEV1Z EVALUATION BOARD

Appendix A

TABLE 2. BILL OF MATERIALS

PART NUMBER	REFERENCE DESIGNATOR	QTY	VALUE	TOL. (%)	VOLTAGE RATING (V)	POWER RATING	PKG TYPE	JEDEC TYPE	MANUFACTURER	DESCRIPTION
C1210X7R500-475KNE	C1, C4, C7, C10, C15	5	4.7µF	10	50		1210	CAP_1210	VENKLE CORP	CERAMIC CHIP CAP
H1045-00104-50V10	C2, C5, C8, C11, C16	5	0.1µF	10	50		0603	CAP_0603	GENERIC	MULTILAYER CAP
H1045-00103-50V10	C3, C6, C9, C12, C17	5	0.01µF	10	50		0603	CAP_0603	GENERIC	MULTILAYER CAP
H1045-OPEN	C13, C18-C21	0	DNP				0603	CAP_0603	GENERIC	DO NOT POPULATE
H1045-00332-50V10	C14	0	DNP	10	50		0603	CAP_0603	GENERIC	DO NOT POPULATE
S1AB	D1-D4	4					SMD	DIO_SMB	GENERIC	1A 50V GENERIC DIODE
108-0740-001	J1-J8	8					CONN	BAN-JACK	JOHNSON-COMPONENTS	STANDARD TYPE BANANA JACK
31-5329-52RFX	J9-J12	4					CONN	CON_BNC_31_5329_52RFX	AMPHENOL	GOLD PLATED 50 OHM PCB MOUNT RECEPTACLE
JUMPER2_100	J13, J16	2	OPEN				THOLE	JUMPER-1	GENERIC	TWO PIN JUMPER
H2505-03012-1/16WR1	R1, R3	2	30.1k	0.1		1/16W	0603	RES_0603	GENERIC	THICK FILM CHIP RESISTOR
H2511-00R00-1/16W	R2, R6, R8	3	0			1/16W	0603	RES_0603	GENERIC	THICK FILM CHIP RESISTOR
H2505-DNP-DNP-1	R4, R5, R7, R9-R11, R20	0	DNP				0603	RES_0603	GENERIC	DO NOT POPULATE
H2511-00100-1/16W1	R12-R16	5	10	1		1/16W	0603	RES_0603	GENERIC	THICK FILM CHIP RESISTOR
H2511-01002-1/16W1	R17, R18	2	10k	1		1/16W	0603	RES_0603	GENERIC	THICK FILM CHIP RESISTOR
H2511-04991-1/16W1	R21, R22	2	4.99k	1		1/16W	0603	RES_0603	GENERIC	THICK FILM CHIP RESISTOR
ISL70517SEHF/PROTO	U1	1					24PF	CDPF24_K24_A	INTERSIL	24 PIN CERAMIC FLATPACK (CDFP) PACKAGE K24.A

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

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