

ISL28617VYXXEV1Z User's Guide

Introduction

The ISL28617VYXXEV1Z evaluation board is designed to assess the ISL28617 instrumentation amplifier's (in-amp) performance with Bulk Metal® Foil resistors from Vishay Precision Group. With a differential input voltage range up to $\pm 34V$, a supply voltage range of $8V (\pm 4V)$ to $40V (\pm 20V)$ and gain ranging from 0.1 to 10,000, this precision in-amp is ideal for a wide variety of applications. It features differential inputs and outputs, and can drive the output rail-to-rail. The gain accuracy is limited only by the matching of the gain resistors. Reference: Vishay Precision Group's foil resistors at <http://www.vishaypg.com/ppg?63209>.

The FRSM series Bulk Metal® Foil ultra-high precision resistors have a tolerance of 0.01% and a temperature coefficient (TCR) of 0.2 ppm/°C, giving exceptional gain accuracy that is ideal for high end applications. The foil resistors are capable of achieving tighter absolute and ratio tolerances than any other technology. The real value of foil resistors is their unmatched stability through temperature excursions, load life and extraordinary thermal and environmental stresses, resulting in far more stable gain ratios. Another important feature of the Bulk Metal® Foil technology is the lowest current noise of any resistor technology (< -40 dB). The combination of foil resistors' low current noise and the exceptional low-noise performance of the ISL28617 amplifier make this the perfect solution for noise critical precision applications.

The board is configured for ease of use, but allows for more complex variations to fit the user's need. The evaluation board includes test points (V_{CC} , V_{EE} , and GND) for the power supply inputs, and is configured for operation from split supplies between $\pm 4V$ to $\pm 20V$. There are two pairs of test points for the differential input and output as well (V_{IN+} , V_{IN-} , V_{OUT+} , and V_{OUT-}). The board is available in three different gain configurations: 0.25, 10 and 100. Ordering information is shown in Table 3.

Reference Documents

- ISL28617 Data sheet, [FN6562](#)
- FRSM Vishay Foil Resistor Data sheet, Document Number: 63209

Power Supplies

External power connections are made to the positive supply rail (TP1), the negative supply rail (TP9), and ground (TP4) for split supply operation. The operating voltage range is $\pm 4V$ to $\pm 20V$. The in-amp has two distinct sets of power supplies; one on the input stage and one on the output stage. For the evaluation board, the output stage supplies are tied to the input stage supplies, and the common mode voltage is tied to ground. The supply voltage on the input stage must be 3V above and below the maximum and minimum input signal voltage, respectively. 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. Table 2 provides suggested

supply voltages for the three standard boards. For more information, reference "Setting the Power Supply Voltages" on page 13 of the ISL28617 data sheet.

If the user wants to control the output supplies separately, the R3 and R5 resistors must be removed, and the V_{CO} (TP2) and V_{EO} (TP6) test points are used for the positive output supply and negative output supply respectively (reference evaluation board schematic in Figure 4). Single supply operation requires removing R7 and attaching the desired common mode voltage to the V_{REF} (TP10) test point. 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 rail-to-rail output stage can be powered from the same supplies as the ADC while preserving the in-amp's maximum input dynamic range. Once again, the positive input power supply must be 3V above the maximum output signal, and the negative input power supply must be 3V below the minimum output signal.

Amplifier Configuration

The ISL28617 evaluation board schematic is shown in Figure 4 with a closed loop gain of 10 and split supply operation with input and output supplies tied together. Other gain options are 0.25 and 100, with the required resistor and capacitor changes listed in Table 1. The in-amp gain is controlled through R1 and R2, the feedback and input resistors, with the following simple formula:

$$A_V = \frac{R_1}{R_2} \quad (\text{EQ. 1})$$

R1 and R2 also limit the maximum signal size at the input and output due to the amplifier architecture. Table 2 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} " on page 13 of the ISL28617 data sheet.

The evaluation board allows the user to add an optional low pass RC filter to the signal path. R8, R9, and C6 create a filter on the output of the in-amp, while R10, R11, and C7 create a filter on the input. The gain of 0.25 board option includes a filter on the input to avoid gain peaking at the limits of the gain bandwidth product.

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TABLE 1. COMPONENTS PARTS LIST

| DEVICE # | VALUE | DESCRIPTION |
|------------|----------------|--|
| C1-C5 | 0.01 μ F | Decoupling Capacitors |
| C6 | Open | Optional Output Filter Capacitor |
| C7 | Open | Optional Input Filter Capacitor |
| | 1.2pF | Input Filter Capacitor ($G = 0.25$) |
| D1, D2 | S1A | Reverse Power Protection |
| R1 | 30k Ω | Feedback Gain Resistor ($G = 0.25$) |
| | 120k Ω | Feedback Gain Resistor ($G = 10, 100$) |
| R2 | 120k Ω | Input Gain Resistor ($G = 0.25$) |
| | 12k Ω | Input Gain Resistor ($G = 10$) |
| | 1.2k Ω | Input Gain Resistor ($G = 100$) |
| R3, R5, R7 | 0 Ω | User Selectable Resistors |
| R8, R9 | 0 Ω | Optional Output Filter Resistors |
| R10, R11 | 0 Ω | Optional Input Filter Resistors |
| | 49.9k Ω | Input Filter Resistors ($G = 0.25$) |
| R4, R6 | 1M Ω | Ground Input for Stability |
| U1 | ISL28617 | TSSOP 24-Pin Package |

TABLE 2. SUGGESTED INPUT VOLTAGE AND POWER SUPPLY LIMITS

| GAIN | SUGGESTED V_{IN} LIMIT | OVERLOAD V_{IN} LIMIT | SUGGESTED SUPPLY VOLTAGE |
|------|--------------------------|-------------------------|--------------------------|
| 0.25 | $\pm 10V$ | $\pm 12V$ | $\pm 15V$ |
| 10 | $\pm 1V$ | $\pm 1.2V$ | $\pm 15V$ |
| 100 | $\pm 0.1V$ | $\pm 0.12V$ | $\pm 15V$ |

TABLE 3. ORDERING INFORMATION

| BOARD PART NUMBER | GAIN | TYPE |
|-------------------|------|------------|
| ISL28617VY25EV1Z | 0.25 | Eval Board |
| ISL28617VY10EV1Z | 10 | Eval Board |
| ISL28617VY100EV1Z | 100 | Eval Board |

ISL28617VYXXEV1Z Evaluation Board Layout

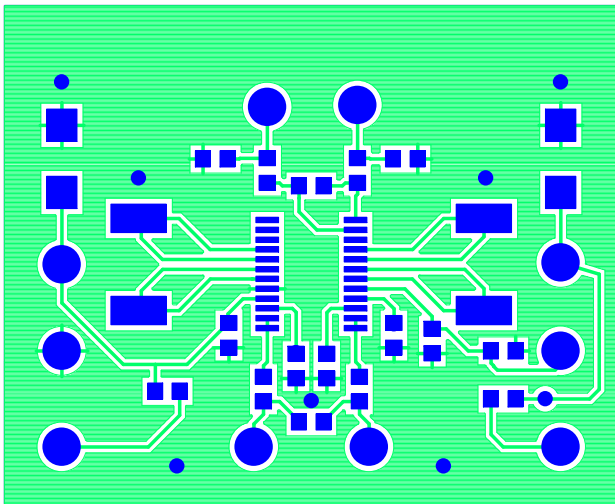


FIGURE 1. TOP LAYER

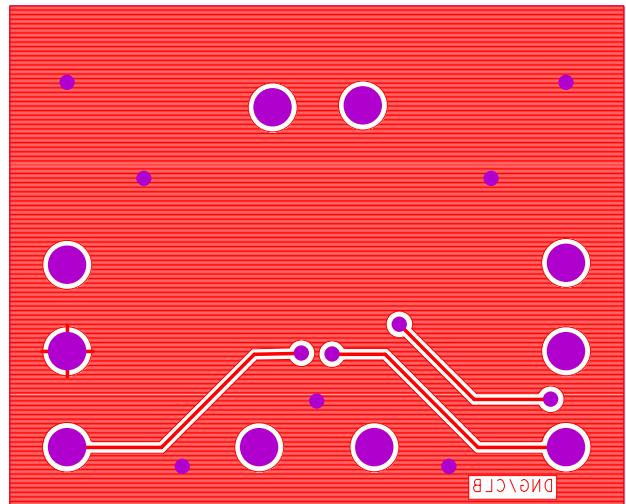


FIGURE 2. BOTTOM LAYER

ISL28617VYXXEV1Z Evaluation Board Layout (Continued)

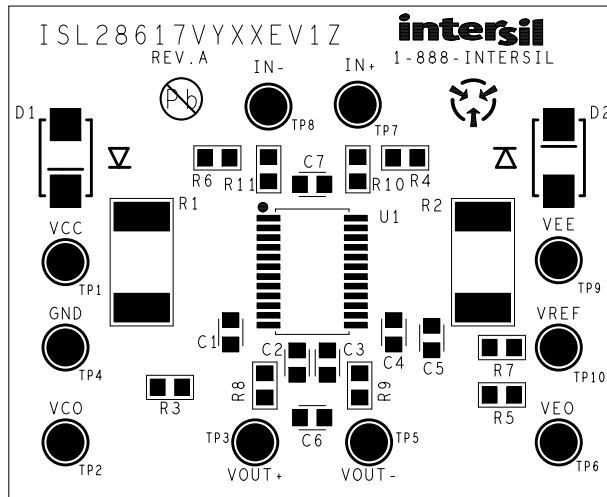


FIGURE 3. ASSEMBLY DRAWING

ISL28617VYXXEV1Z Schematic

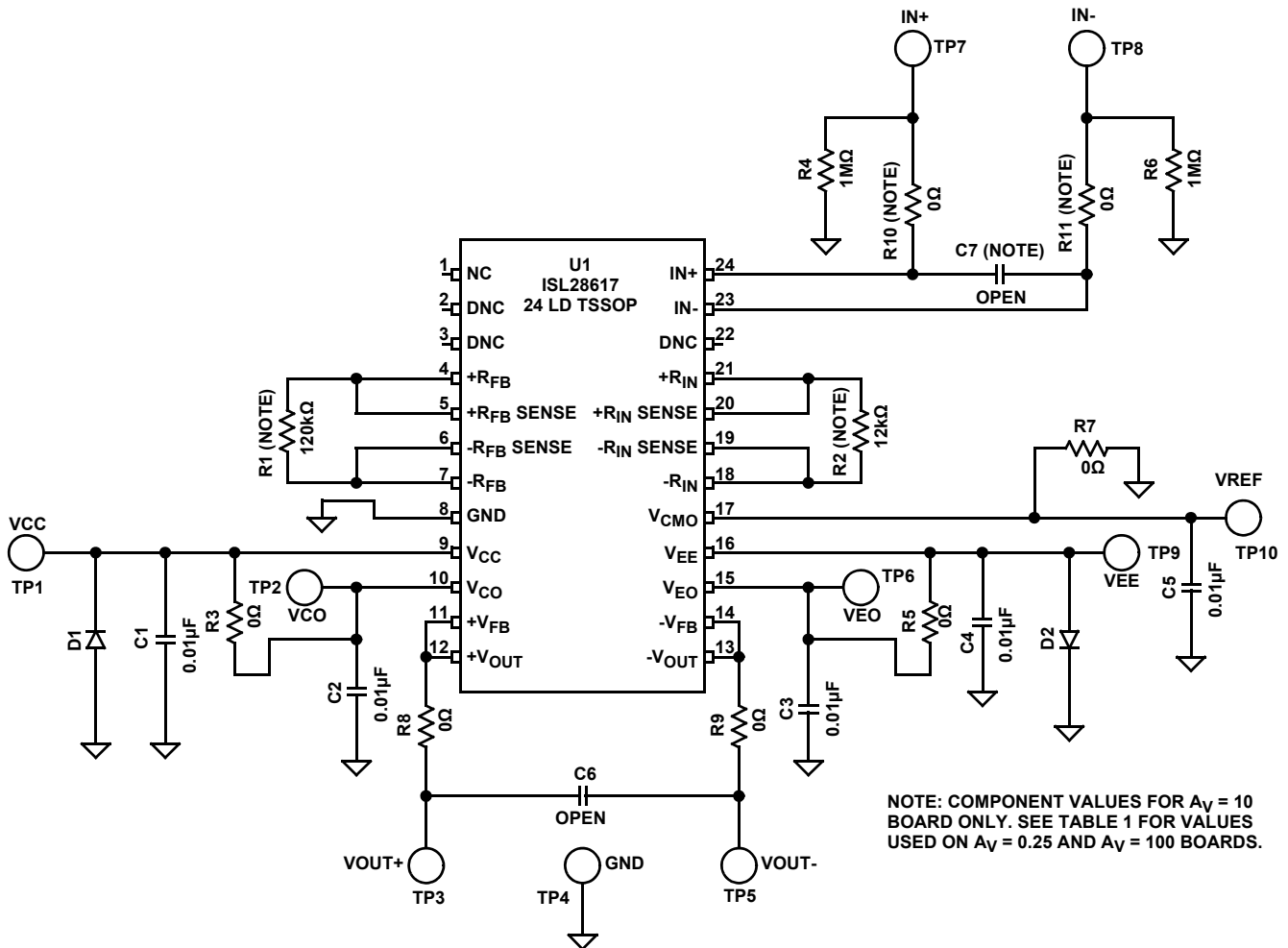


FIGURE 4. ISL28617VY10EV1Z ($A_V = 10$) EVALUATION BOARD SCHEMATIC

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TABLE 4. BILL OF MATERIALS FOR A_v = 10 BOARD (ISL28617VY10EV1Z)

| PART # | REF DES | QTY | DESCRIPTION | MANUFACTURER |
|-----------------|----------------|-----|---|--------------|
| GRM39X7R103K050 | C1-C5 | 5 | CAP, SMD, 0603, 0.01μF, 50V, 10%, X7R, ROHS | Murata |
| DNP | C6, C7 | 0 | DO NOT POPULATE | |
| 5000 | TP1, TP9 | 2 | CONN-MINI TEST POINT, VERTICAL, RED, ROHS | Keystone |
| 5001 | TP4 | 1 | CONN-MINI TEST POINT, VERTICAL, BLK, ROHS | Keystone |
| 5002 | TP7, TP8 | 2 | CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS | Keystone |
| 5004 | TP3, TP5 | 2 | CONN-MINI TEST POINT, VERTICAL, YEL, ROHS | Keystone |
| S1A | D1, D2 | 2 | DIODE-RECTIFIER, SMD, 2P, SMA, 50V, 1A, 1.4W, ROHS | Fairchild |
| ISL28617FVZ | U1 | 1 | IC-40V R/R OUTPUT ADC DRIVER, 24P, TSSOP, 4X5, ROHS | Intersil |
| ERJ-3GEYOR00V | R3, R5, R7-R11 | 7 | RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS | Panasonic |
| ERJ-3EKF1004V | R4, R6 | 2 | RES, SMD, 0603, 1M, 1/10W, 1%, TF, ROHS | Panasonic |
| Y4027120K000B9W | R1 | 1 | RES-Z1 PRECISION, SMD, 2515, 120k, 3/4W, 0.1%, FOIL, ROHS | Vishay |
| Y402712K0000B9W | R2 | 1 | RES-Z1 PRECISION, SMD, 2515, 12k, 3/4W, 0.1%, FOIL, ROHS | Vishay |
| DNP | TP2, TP6, TP10 | 0 | DO NOT POPULATE | |

Intersil Corporation reserves the right to make changes in circuit design, software and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that the Application Note or Technical Brief is current before proceeding.

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