

ISL28006 Evaluation Board User's Guide

Introduction

The ISL28006 evaluation board is a design platform containing all the circuitry needed to characterize critical performance parameters of the ISL28006 in either a high side or low-side current sense application. The ISL28006 is available in fixed 100V/V, 50V/V, 20V/V and adjustable gains.

Reference Documents

- ISL28006 Data Sheet, [FN6548](#)

Evaluation Board Schematic

The ISL2800XEVAL1Z evaluation board is configured with either the ISL28006-100, ISL28006-50, ISL28006-20 or the ISL28006-ADJ device (adjustable gain via external resistors R₁₁ and R₁₄). Note: When using the adjustable part, V-REF (J₁) needs to be grounded. J₁₃ is provided to enable accurate voltage measurements across the sense resistor R₃.

Figure 1 shows the basic application circuit and optional protection components for the fixed gain parts. Figure 2 shows the basic application circuit and optional protection components for the adjustable gain part. Figure 3 shows the complete schematic for the ISL2800XEVAL1Z evaluation board.

Components shown in red in both Figures 1 and 2 are optional transient protection and not required for clean environments. Note: The evaluation board comes equipped with the transient protection devices.

Optional Transient Protection

For applications where the load and the power source are permanently connected, transient protection is not required and only an external current sense resistor (R₃) is needed.

For applications where fast transients can generate voltage spikes that can overdrive the amplifier input and drive the output of the amplifier into the rails, a long overload recovery time will result. Common mode capacitors C₇, C₉ and differential capacitor C₈ are used to filter the common mode and differential voltage spikes.

For switching applications or where fast transients are caused by hot plugging the source or load, external protection components may be needed. The external

current limiting resistor (R₆) in Figure 1 will limit the peak current through the internal ESD diodes to <20mA. This condition can occur in applications that experience high levels of in-rush current causing high peak voltages that can damage the internal ESD diodes of the ISL28006. If the current limiting resistor is required, it needs to be placed on the RS- input (R₆). Placing it on the RS+ input side (R₇) will result in a much larger error voltage due to the ISL28006 taking its supply current from the sense current in high-side applications.

For example:

Current limiting resistor R₆ with a value of 100Ω will provide protection for a 2V transient with the maximum of 20mA flowing through the input while adding only an additional 13μV (worst case over-temperature) of V_{OS} as shown in Equation 1. Note: Worst case over-temperature input bias current on the RS- input is 130nA.

$$R_6 \times I_{RS-} = 100\Omega \times 130\text{nA} = 13\mu\text{V} \quad (\text{EQ. 1})$$

Current limiting resistor R₇ with value of 100Ω will provide the same transient protection, but with an error voltage of 800μV. Note: Worst case over-temperature input bias current on the RS+ input is 8μA as shown in Equation 2.

$$R_7 \times I_{RS+} = 100\Omega \times 8\mu\text{A} = 800\mu\text{V} \quad (\text{EQ. 2})$$

R₇ is a carry-over from our characterization board and was used to measure input bias current. The evaluation board is populated with a zero ohm resistor for R₇.

Power Supplies

External power connections are made through the VS+ and Ground connections on the evaluation board. Capacitors C₂ and C₄ perform two duties, de-coupling the supplies and filtering of the power supply noise with R₁₅. Anti-reverse diodes D₁ and D₃ protect the circuit in the case of accidental polarity reversal of the supply. Resistor R₁₂ is used to connect ground to the fixed gain parts.

ISL2800XEVAL1Z and BOM

Figure 4 shows the top view of the ISL2800XEVAL1Z evaluation board. The evaluation board Bill of Materials is given in Table 2.

Application Note 1532

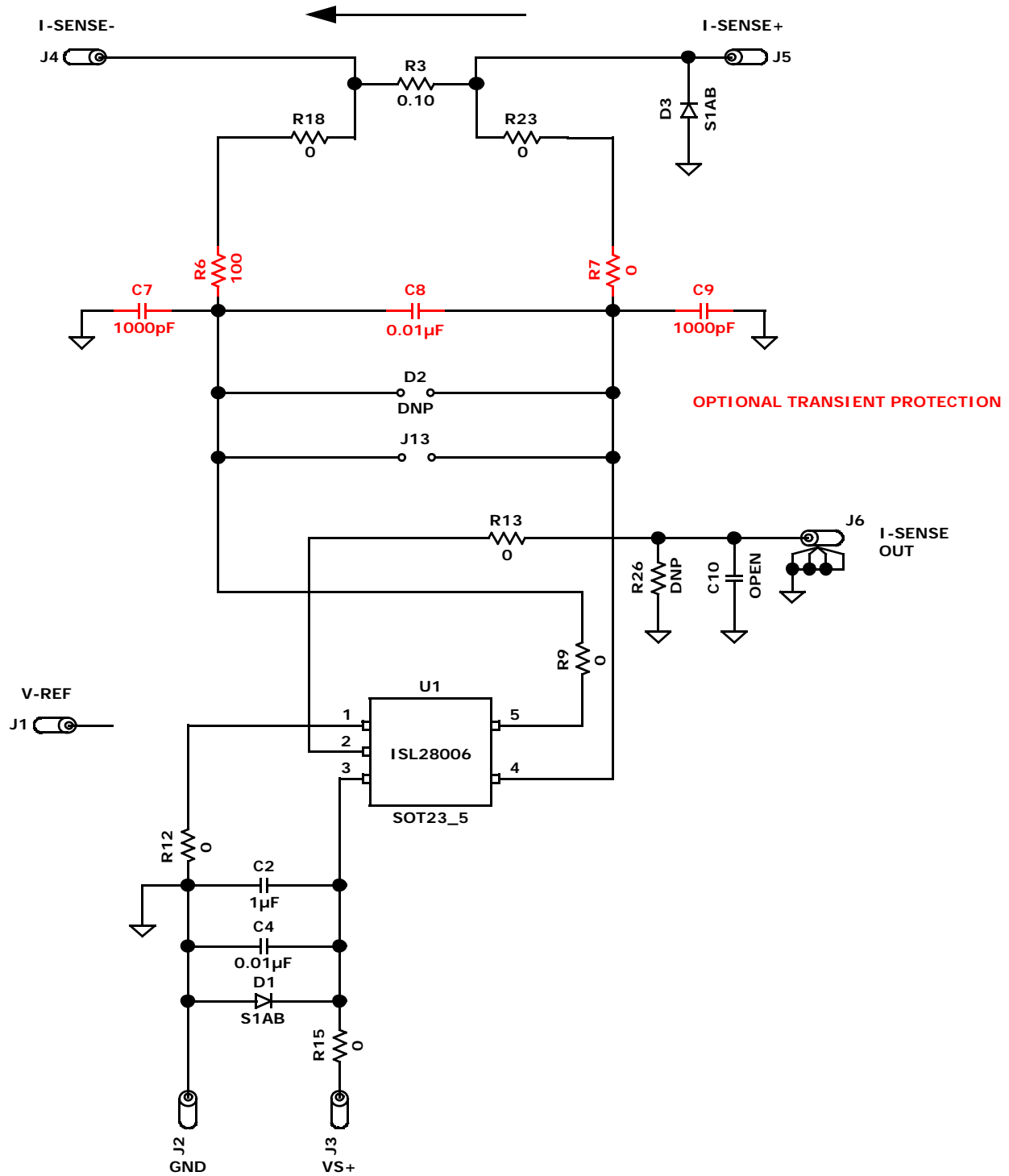


FIGURE 1. SIMPLIFIED ISL2800XEVAL1Z SCHEMATIC DIAGRAM FOR FIXED GAIN PARTS

Application Note 1532

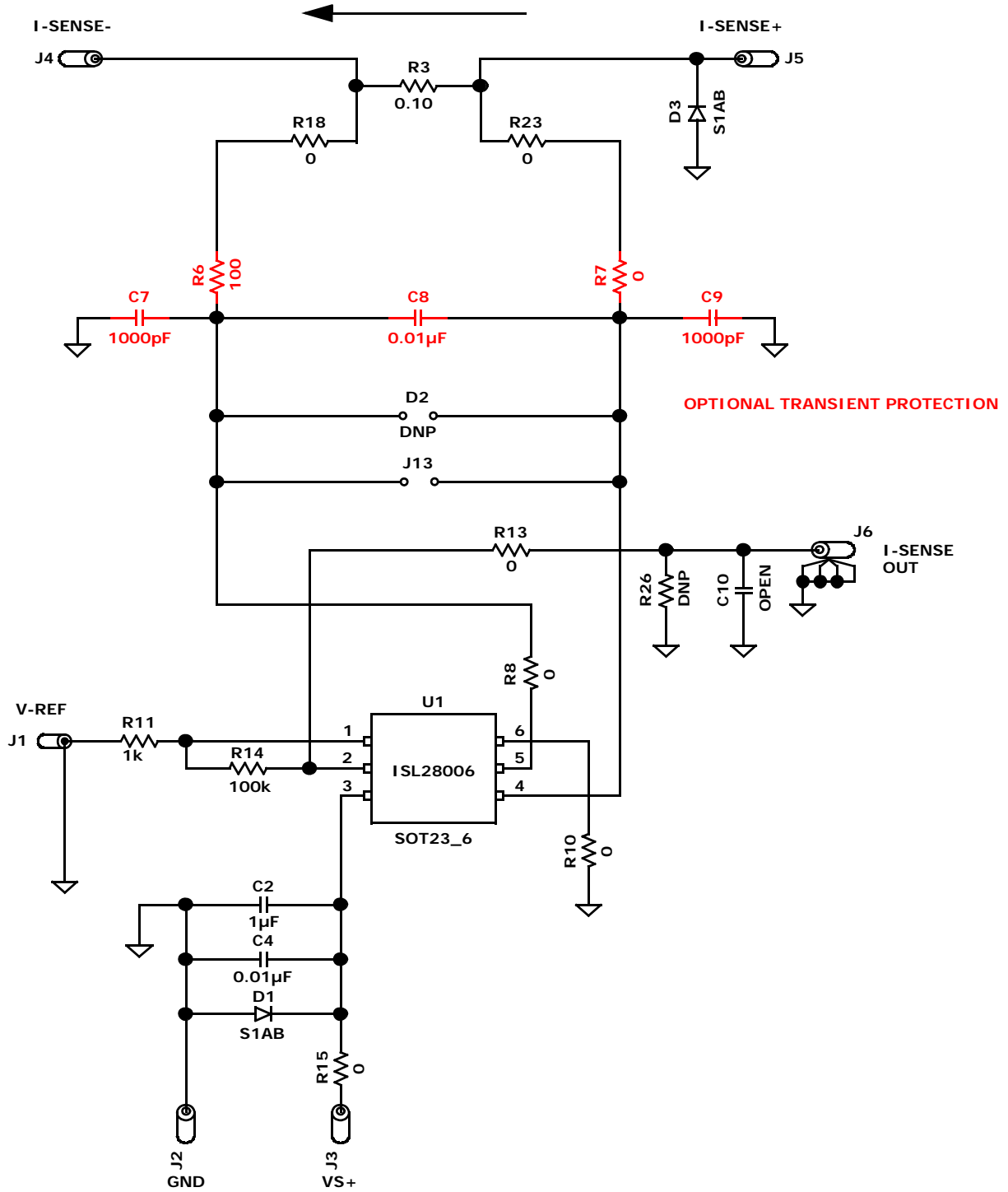


FIGURE 2. SIMPLIFIED ISL2800XEVAL1Z SCHEMATIC DIAGRAM FOR ADJUSTABLE GAIN PARTS

Application Note 1532

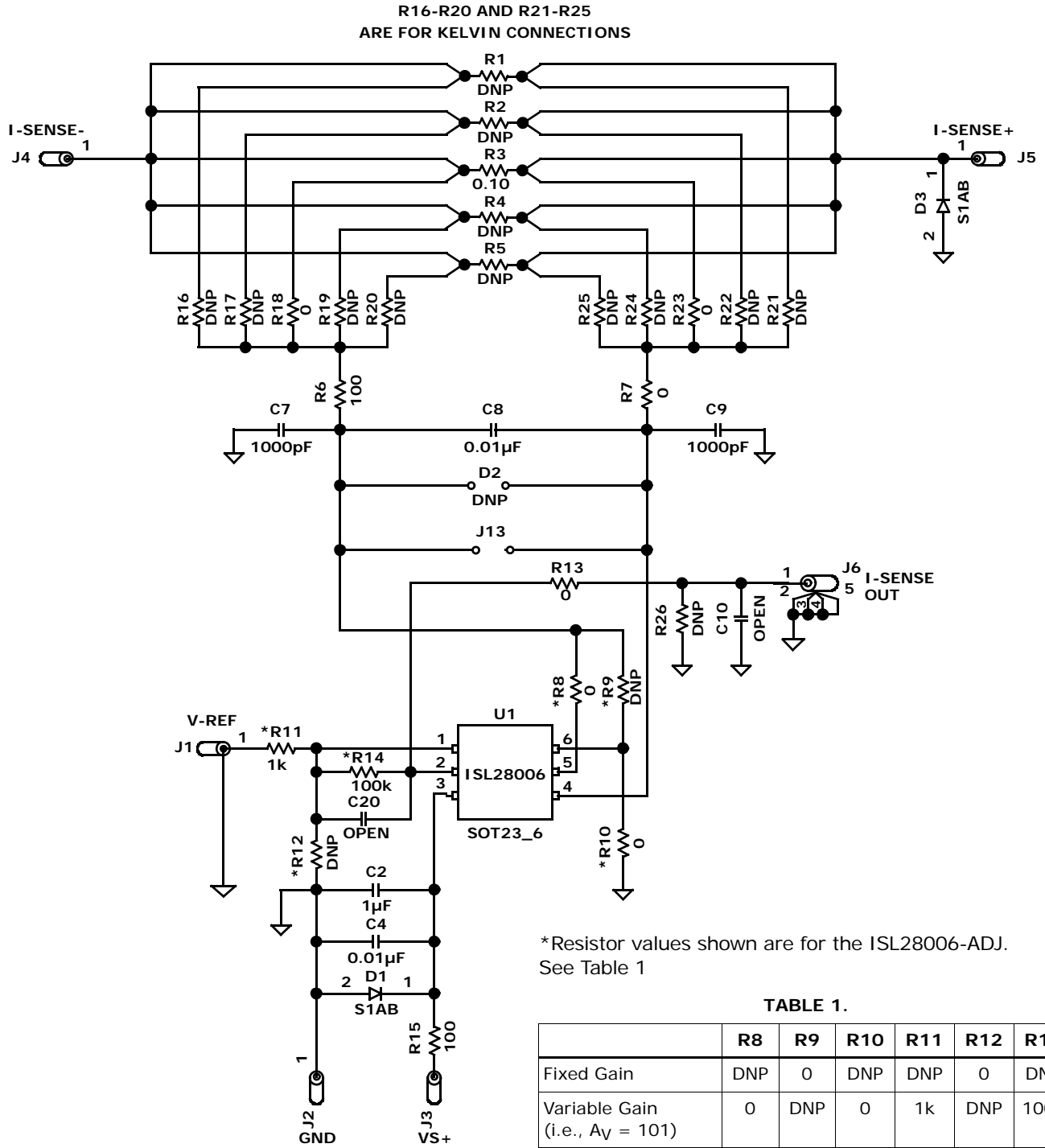


FIGURE 3. ISL2800XEVAL1Z SCHEMATIC DIAGRAM

Application Note 1532

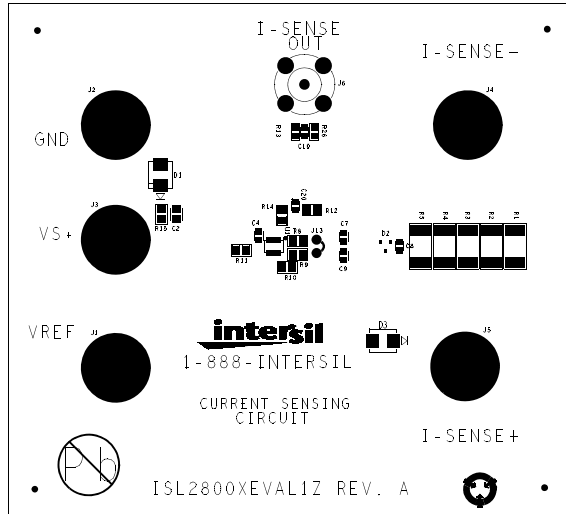


FIGURE 4. ISL2800XEVAL1Z TOP VIEW

TABLE 2. ISL2800XEVAL1Z COMPONENTS PARTS LIST

| DEVICE # | DESCRIPTION | COMMENTS |
|--|---|--|
| C2 | CAP, SMD, 0805, 1 μ F, 50V, 20%, X7R, ROHS | Power Supply Decoupling and Input Filter |
| C4, C8 | CAP, SMD, 0603, 0.01 μ F, 50V, 10%, X7R, ROHS | Power Supply Decoupling/Input Filter and Differential Current Sense Filter |
| C7, C9 | CAP, SMD, 0603, 1000pF, 50V, 10%, X7R, ROHS | Common Mode Current Sense Filter |
| C10, C20 | CAP, SMD, 0603, DNP-Place Holder, ROHS | User Selectable Capacitors - Not Populated |
| D1, D3 | Diode-Rectifier, SMD, S1AB, 50V, ROHS | Reverse Power Protection |
| U1 (ISL28006-100EVAL1Z) | ISL28006FH100Z-T7, SOT-23, ROHS | |
| U1 (ISL28006-50EVAL1Z) | ISL28006FH50Z-T7, SOT-23, ROHS | |
| U1 (ISL28006-20EVAL1Z) | ISL28006FH20Z-T7, SOT-23, ROHS | |
| U1 (ISL28006-ADJEVAL1Z) | ISL28006FHADJZ-T7-T7, SOT-23, ROHS | |
| R16, R17, R19, R20, R21, R22, R24, R25 | Resistor, SMD, 0603, MF, DNP-Place Holder | User Selectable Kelvin Connection - Not Populated |
| R26 | Resistor, SMD, 0603, MF, DNP-Place Holder | User Selectable Output Load Resistor - Not Populated |
| R3 | Resistor, SMD, 2512, 0.1 Ω , 1W, 1%, TF, ROHS | SENSE resistor |
| R1, R2, R4, R5 | Resistor, SMD, 2512, DNP-Place Holder | User Selectable SENSE Resistors - Not Populated |
| R6, R7, R13, R18, R23 | Resistor, SMD, 0603, 0 Ω , 1/10W, TF, ROHS | Zero Ohm User Selectable Resistors |
| R15 | Resistor, SMD, 0603, 100 Ω , 1/10W, TF, ROHS | Current Limiting Resistors |
| R11 | Resistor, SMD, 0603, 1k Ω , 1/10W, 1%, TF, ROHS (Variable Gain) RES, SMD, 0603, DNP-Place Holder (Fixed Gain) | Gain and Other User Selectable Resistors |
| R14 | Resistor, SMD, 0603, 100k Ω , 1/10W, 1%, TF, ROHS (Variable Gain) RES, SMD, 0603, DNP-Place Holder (Fixed Gain) | Gain and Other User Selectable Resistors |
| R8, R10 | Resistor, SMD, 0603, 0 Ω , 1/10W, 1%, TF, ROHS (Variable Gain) Resistor, SMD, 0603, DNP-Place Holder (Fixed Gain) | Gain and Other User Selectable Resistors |
| R9, R12 | Resistor, SMD, 0603, DNP-Place Holder (Variable Gain) Resistor, SMD, 0603, 0 Ω , 1/10W, 1%, TF, ROHS (Fixed Gain) | Gain and Other User Selectable Resistors |

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