



MAX9937 Evaluation Kit

General Description

The MAX9937 evaluation kit (EV kit) is an assembled and tested PCB used to evaluate the MAX9937 automotive grade current-sense amplifier, designed for unidirectional high-side current-sense applications. The EV kit can be used to demonstrate the applicability of the MAX9937 to withstand automotive transients, such as load-dump protection, reverse-battery protection, and filtering for EMI.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	1 μ F \pm 10%, 50V X7R ceramic capacitor (1206) Murata GRM31MR71H105KA TDK C3216X7R1H105K
C2, C4	0	Not installed, capacitors (0603)
C3	1	0.01 μ F \pm 10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H103K TDK C1608X7R1H103K
R1	1	0.05 Ω \pm 1%, 0.5W current-sense resistor (1206) IRC LRC-LR1206LF-01-R050-F
R2	1	20k Ω \pm 1% resistor (0603)
R3, R4	2	1k Ω \pm 1% resistor (1206)
U1	1	Automotive grade current-sense amplifier (5 SC70) Maxim MAX9937AXK+
—	1	PCB: MAX9937 Evaluation Kit+

Component Suppliers

SUPPLIER	PHONE	WEBSITE
IRC, Inc.	361-992-7900	www.irctt.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: Indicate that you are using the MAX9937 when contacting these component suppliers.

Features

- ◆ Reverse-Battery and Load-Dump Protection
-20V to +40V
- ◆ +4V to +28V Input Common-Mode Range
- ◆ +2.7V to +5.5V Supply Range
- ◆ Flexible EMI Filtering
- ◆ Lead(Pb)-Free and RoHS Compliant
- ◆ Fully Assembled and Tested

Ordering Information

PART	TYPE
MAX9937EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- 12V, 2A power supply (VBAT)
- 5V power supply (VCC)
- Electronic load capable of sinking 2A
- Digital voltmeter (DVM)

Procedure

The MAX9937 EV kit is fully assembled and tested. Follow the steps below to verify board operation.

Caution: Do not turn on power supplies until all connections are completed.

- 1) Set the input power supply to 12V and connect the positive terminal to the VBAT pad. Connect the ground of the power supply to the GND pad.
- 2) Set the VCC power supply to 5V and connect the positive terminal to the VCC pad. Connect the ground of the VCC supply to the GND pad.
- 3) Set the electronic load to sink 2A.
- 4) Connect the electronic load's positive terminal to the LOAD pad. Connect the load's ground to the GND pad.
- 5) Connect the DVM across the VOUT pad and the GND pad.
- 6) Turn on the 5V power supply.

Evaluates: MAX9937

MAX9937 Evaluation Kit

- 7) Turn on the 12V power supply.
- 8) Adjust the electronic load current (I_{LOAD}) between 0A and 2A and verify that V_{OUT} is proportional to V_{SENSE} according to the following equation:

$$V_{OUT} = V_{SENSE} \times \frac{R2}{R3}$$

where $V_{SENSE} = I_{LOAD} \times R1$.

__Detailed Description of Hardware

The MAX9937 EV kit evaluates the MAX9937 unidirectional high-side current-sense amplifier, which features a 4V to 28V input common-mode voltage range that is independent of supply voltage ($VCC = 2.7V$ to $5.5V$). The MAX9937 monitors the current through a current-sense resistor by converting the sense voltage to a voltage output (V_{OUT}). Gain is set by the ratio of an output resistor ($R2$) and an input resistor ($R3$). High-side current monitoring with the MAX9937 does not interfere with the ground path of the load, making it useful for a variety of automotive battery/ECU monitoring applications.

The MAX9937 EV kit produces an output voltage (V_{OUT}) given by the following equations:

$$V_{SENSE} = I_{LOAD} \times R_{SENSE}$$

$$V_{OUT} = V_{SENSE} \times \frac{R2}{R3}$$

where I_{LOAD} is the current load applied to the device and R_{SENSE} is the current-sense resistor $R1$ (e.g., $I_{LOAD} = 2A$, $R_{SENSE} = 0.05\Omega$, $R2 = 20k\Omega$, $R3 = 1k\Omega$, and $V_{OUT} = 2V$).

Overvoltage Protection

The MAX9937 EV kit provides a $1k\Omega$ resistor at each of the RSP and RSN inputs to demonstrate the reverse-battery and load-dump protection capabilities of the MAX9937 IC. The normal operating V_{RSP} and V_{RSN} range is 4V to 28V, but the robust input ESD structure allows the input common-mode voltages to exceed this range for short periods of time.

Short-duration overvoltages on the battery line (V_{BAT} to $LOAD$) are isolated from the RSP and RSN pins of the MAX9937 by the use of input resistors $R3$ and $R4$. The input ESD clamp structure is designed so the device can withstand short-duration ($< 1s$) overvoltages up to 40V when using resistors $R3$ and $R4$ of 500Ω or greater. The circuit can also withstand a reverse-battery voltage of $-20V$. During reverse-battery conditions, size $R3$ and $R4$ input resistors to withstand their expected power dissipations. Refer to the *Input Common-Mode Voltages > 28V and < 0V* section in the MAX9937 IC data sheet for a more detailed description.

EMI Filtering

The MAX9937 EV kit provides two uninstalled capacitor pads ($C2$ and $C4$), which the user can populate to improve performance in the presence of input common-mode voltage and input differential-voltage transients. Refer to the *Flexible EMI Filtering* section in the MAX9937 IC data sheet for a more detailed description.

MAX9937 Evaluation Kit

Evaluates: MAX9937

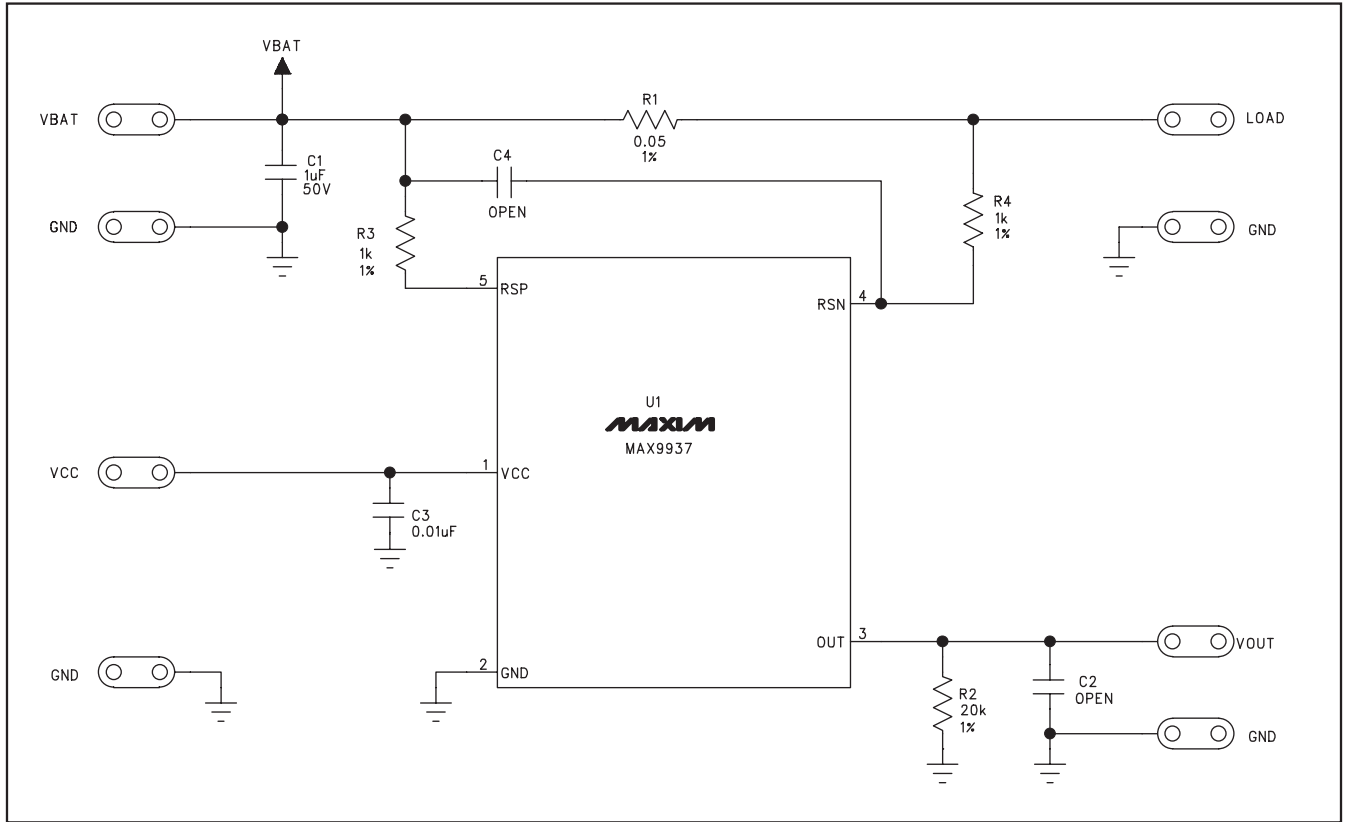


Figure 1. MAX9937 EV Kit Schematic

MAX9937 Evaluation Kit

Evaluates: MAX9937

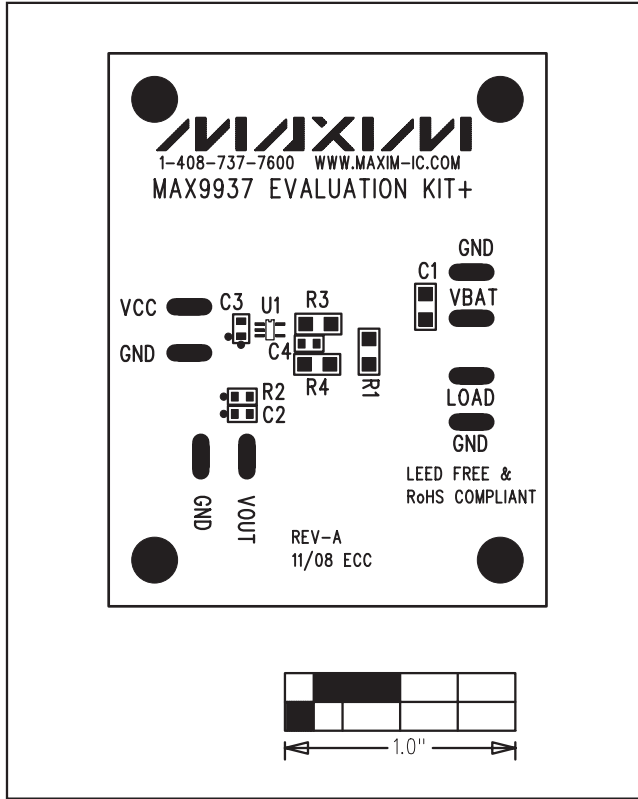


Figure 2. MAX9937 EV Kit Component Placement Guide—Component Side

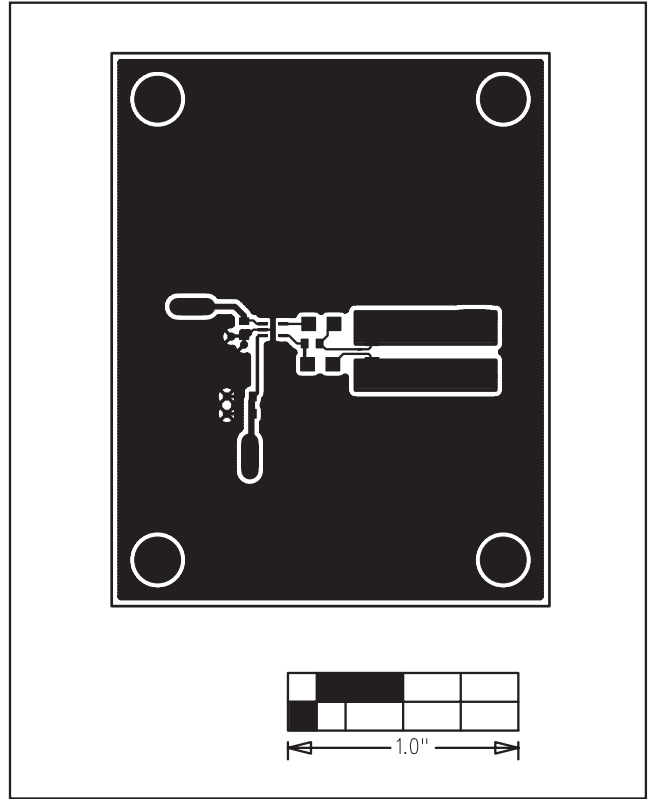


Figure 3. MAX9937 EV Kit Component PCB Layout—Component Side

MAX9937 Evaluation Kit

Evaluates: MAX9937

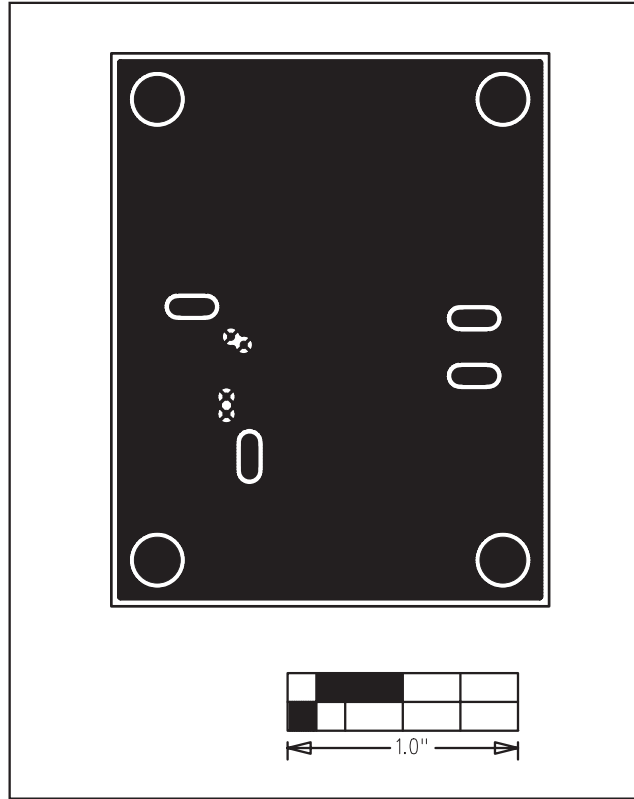


Figure 4. MAX9937 EV Kit PCB Layout—Solder Side

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