

# MAXIM

## MAX1972 Evaluation Kit

### General Description

The MAX1972 evaluation kit (EV kit) is a fully assembled and tested circuit board that evaluates the MAX1970 family of dual step-down regulators. The circuit operates from an input voltage of 2.6V to 5.5V, and delivers a minimum of 750mA on each output. The output voltages are programmable from 0.8V to  $V_{IN}$  using external feedback resistors, or they can be preset to 3.3V or 1.8V for output 1, and 2.5V or 1.5V for output 2. The board has a MAX1972 installed, but it can also be used to evaluate the MAX1970 and the MAX1971. The MAX1971 features a reset input (RSI), while the MAX1970/MAX1972 feature a power-fail output (PFO).

### Selector Guide

PART	POR DELAY TIME (TYP)	RSI	PFO	FREQUENCY
MAX1970EEE	16.6ms	No	Yes	1.4MHz
MAX1971EEE	175ms	Yes	No	0.7MHz
MAX1972EEE	175ms	No	Yes	1.4MHz

### Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata	770-436-1300	www.murata.com
Sumida	847-956-0666	www.sumida.com
Taiyo-Yuden	408-573-4150	www.taiyo-yuden.com

### Features

- ◆ Current-Mode, 1.4MHz Fixed-Frequency PWM Operation
- ◆ Dual-Output 180° Out-of-Phase Operation Reduces Input Ripple Current
- ◆  $\pm 1\%$  Output Accuracy Over Load, Line, and Temperature Ranges
- ◆ 750mA Guaranteed Output Current
- ◆ 2.6V to 5.5V Input
- ◆ Power-On Reset Output ( $\overline{\text{POR}}$ )
- ◆ Power-Fail Output (MAX1970 and MAX1972)
- ◆ Power-On Reset Input (MAX1971)
- ◆ Ultra-Compact Design with Small External Components
- ◆ Outputs Adjustable from 0.8V to  $V_{IN}$
- ◆ 1.8V/3.3V and 1.5V/2.5V Preset
- ◆ All Ceramic Capacitor Application
- ◆ Soft-Start Reduces Inrush Current
- ◆ Fully Assembled and Tested

### Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX1972EVKIT	-40°C to +85°C	16 QSOP

**Note:** To evaluate the MAX1970 or MAX1971, request free samples of these parts with the MAX1972EVKIT.

### Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	10 $\mu$ F $\pm 20\%$ , 6.3V X5R ceramic capacitor (1206) Taiyo-Yuden JMK316BJ106ML
C2, C3	2	0.1 $\mu$ F $\pm 10\%$ , 16V X7R ceramic capacitors (0603) Taiyo-Yuden EMK107BJ104KA
C4, C7	2	620pF $\pm 10\%$ , 50V X7R ceramic capacitors (0603) Murata GRM39X7R621K050AD
C5, C6	2	10 $\mu$ F $\pm 20\%$ , 4V X5R ceramic capacitors (0805) Taiyo-Yuden AMK212BJ106MG
JU1, JU2, JU3	3	3-pin headers

DESIGNATION	QTY	DESCRIPTION
L1, L2	2	4.7 $\mu$ H $\pm 30\%$ , 0.9A, 80m $\Omega$ inductors Sumida CDRH3D16-4R7
R1	1	10 $\Omega$ $\pm 5\%$ resistor (0603)
R2, R3	2	100k $\Omega$ $\pm 5\%$ resistors (0603)
R4	1	82k $\Omega$ $\pm 5\%$ resistor (0603)
R5, R8	2	0 $\Omega$ resistors (0603)
R6, R9, R10	0	Not installed
R7	1	39k $\Omega$ $\pm 5\%$ resistor (0603)
U1	1	MAX1972EEE (16-pin QSOP)
None	3	Shunts
None	1	MAX1972EVKIT PC board
None	1	MAX1970/MAX1971/MAX1972 data sheet

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## Quick Start

The MAX1972 EV kit is a fully assembled and tested surface-mount board. Follow the steps below to verify board operation. **Do not turn on the power supply until all connections are completed:**

- 1) Connect a voltmeter and load from OUT1 to GND, and another voltmeter and load from OUT2 to GND.
- 2) Verify the JU1 shunt is across pins 1 and 2.
- 3) Connect the input supply (preset to 2.6V to 5.5V) to the pads marked IN and GND.
- 4) Configure JU2 and JU3 for desired output voltages (see Table 1 and Table 2).
- 5) Turn on the power supply and verify the output voltages.

## Detailed Description

### Jumper Selection

#### EN Function

JU1 is used to enable shutdown mode (see Table 3). For normal device operation, connect the JU1 shunt between pins 1 and 2. To place the part in shutdown mode, connect the JU1 shunt between pins 2 and 3. This turns off both outputs and reduces the input supply current to approximately 1 $\mu$ A.

#### Preset Output Voltages

Each output can be set to one of two preset voltages. This is done by using JU2 and JU3. See Table 1 and Table 2 for the output voltages and corresponding jumper settings.

The installed compensation resistors (R4 and R7) are selected for  $V_{OUT1} = 3.3V$  and  $V_{OUT2} = 1.5V$ . For best performance, these need to be changed for different output voltages. Refer to the MAX1970/MAX1971/MAX1972 data sheet for details on selecting compensation components.

**Table 1. JU2 Functions**

SHUNT LOCATION	FBSEL1 PIN	OUT1
1, 2	V <sub>CC</sub>	3.3V
2, 3	GND	1.8V
None	Not Connected	Adjustable 0.8V to V <sub>IN</sub>

**Table 2. JU3 Functions**

SHUNT LOCATION	FBSEL2 PIN	OUT2
1, 2	V <sub>CC</sub>	2.5V
2, 3	GND	1.5V
None	Not Connected	Adjustable 1.2V to V <sub>IN</sub>

**Table 3. JU1 Functions**

SHUNT LOCATION	FBSEL3 PIN	OUT3
1, 2	V <sub>CC</sub>	Enabled
2, 3	GND	Shutdown

### Adjusting the Output Voltage

In addition to two preset output voltages, OUT1 can be set to any voltage between 0.8V and V<sub>IN</sub>, and OUT2 can be set to any voltage between 1.2V and V<sub>IN</sub>. For output voltages greater than 3.3V, change the output capacitors (C5 and C6) to higher-voltage-rated capacitors such as Taiyo-Yuden JMK316BJ106ML (10 $\mu$ F, 6.3V).

Use the following procedure to set the voltage of OUT1 from 1.2V to V<sub>IN</sub>:

- 1) Remove the shunt from JU2.
- 2) Remove R5.
- 3) Select a resistor value for R6 from 10k $\Omega$  to 30k $\Omega$ .
- 4) Calculate a resistor value for R5 from:

$$R5 = R6 \times \left( \frac{V_{OUT1}}{1.2} - 1 \right)$$

- 5) Install the selected resistors R5 and R6.

Use the following procedure to set the voltage of OUT2 from 1.2V to V<sub>IN</sub>:

- 1) Remove the shunt from JU3.
- 2) Remove R8.
- 3) Select a resistor value for R9 from 10k $\Omega$  to 30k $\Omega$ .
- 4) Calculate a resistor value for R8 from:

$$R8 = R9 \times \left( \frac{V_{OUT2}}{1.2} - 1 \right)$$

- 5) Install the selected resistors R8 and R9.

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If  $V_{OUT2} > 1.2V$ , then  $V_{OUT1}$  can be set to a voltage as low as 0.8V. Use the following procedure to set  $V_{OUT1}$ :

- 1) Remove the shunt from JU2.
- 2) Remove R6 (if installed).
- 3) Remove R5.
- 4) Make sure that  $V_{OUT2}$  is set to a value greater than 1.2V (either using a voltage preset or a resistor-divider).
- 5) Select R5 and R10 so the current is about 100 $\mu$ A flowing through R5 and R10:

$$I_{R5} = I_{R10} = \frac{(V_{OUT2} - 1.2V)}{R10} \text{ (approximately equal to } 100\mu\text{A)}$$

- 6) Calculate a resistor value for R5 from:

$$R5 = R10 \times \frac{(1.2V - V_{OUT1})}{(V_{OUT2} - 1.2V)}$$

- 7) Install the selected resistors R5 and R10.

The installed compensation resistors (R4 and R7) are selected for  $V_{OUT1} = 3.3V$  and  $V_{OUT2} = 1.5V$ . For best performance, these need to be changed for different output voltages. Refer to the MAX1970/MAX1971/MAX1972 data sheet for details on selecting compensation components.

## Evaluating Power-On Reset (POR)

POR is an output that provides a delayed signal after the outputs reach 92% of their regulated voltages after startup. Refer to the MAX1970/MAX1971/MAX1972 data sheet for details of this feature. A  $\overline{\text{POR}}$  pad is provided on the evaluation kit so that this feature can be tested.

## Evaluating Power-Fail Output (MAX1970/MAX1972)

Power-fail output (PFO) is a feature of the MAX1970 and MAX1972. PFO is an output that is typically used to indicate that the IC's input voltage has dropped below 3.94V. Refer to the MAX1970/MAX1971/MAX1972 data sheet for details of this feature.

**Note:** The RSI/PFO pad is used for RSI when the MAX1971 is installed. With the MAX1970 or MAX1972 installed, the RSI/PFO pad is used for PFO.

## Evaluating the MAX1970 or MAX1971

Although the MAX1972 evaluation kit is assembled with the MAX1972, it can also be used to evaluate the MAX1970 and the MAX1971. Free samples of these parts can be obtained from Maxim. To evaluate the MAX1970/MAX1971, first carefully remove the MAX1972, and replace it with the MAX1970 or MAX1971. For the MAX1971 only, remove R3. Use Figure 2 to locate these pads.

Since the MAX1971 operates at 700kHz, external components may need to be optimized. Refer to the MAX1970/MAX1971/MAX1972 data sheet for details on selecting these components.

## Evaluating Reset Input (MAX1971)

Reset input (RSI) is an input available only on the MAX1971. To evaluate the MAX1971, first follow the procedure given in the *Evaluating the MAX1970 or MAX1971* section. This input is normally held low. A positive pulse on the RSI/PFO pad causes the  $\overline{\text{POR}}$  function to reset.

**Note:** The RSI/PFO pad is used for RSI when the MAX1971 is installed. With the MAX1970 or MAX1972 installed, the RSI/PFO pad is used for PFO.

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Evaluates: MAX1970/MAX1971/MAX1972

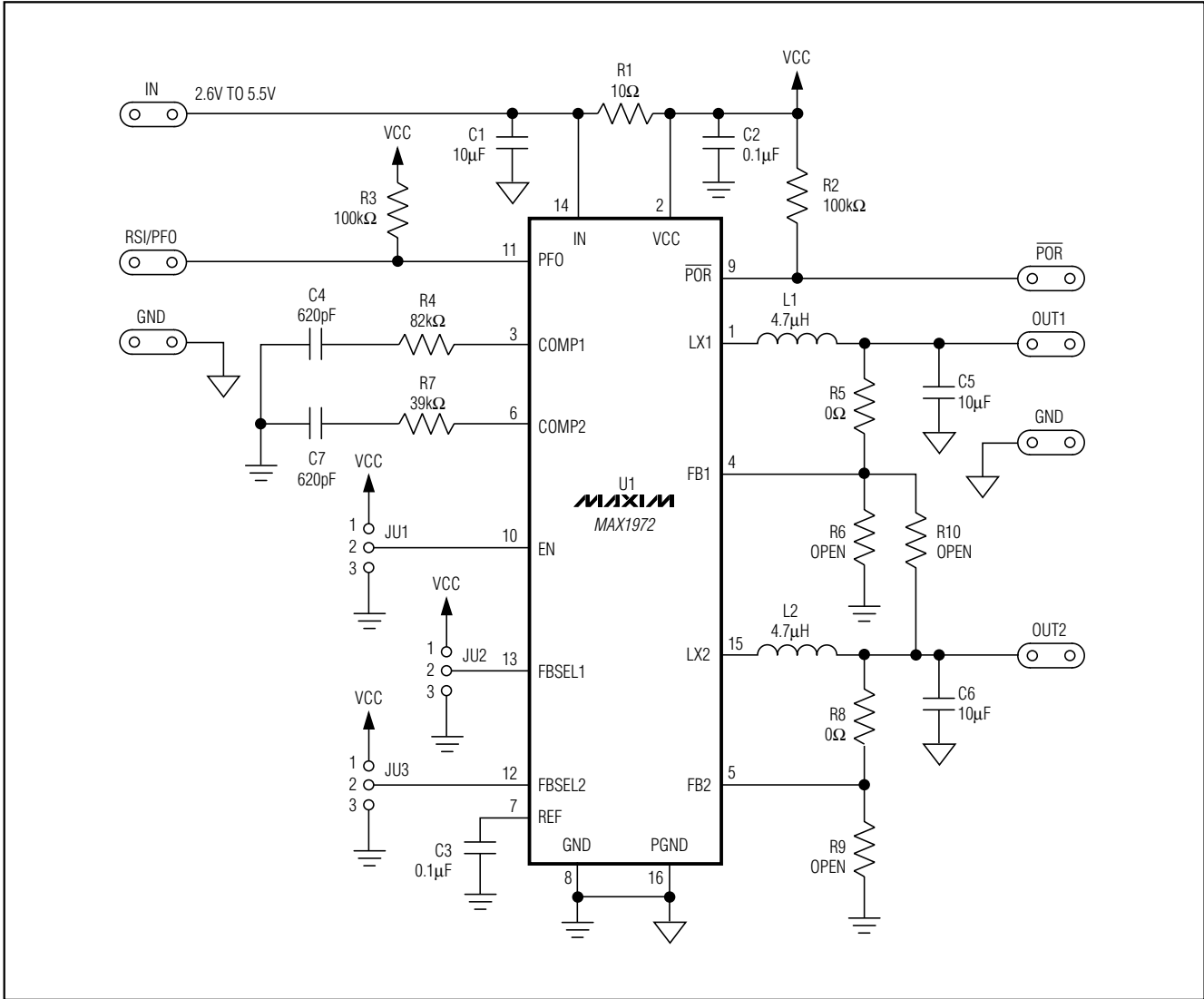


Figure 1. MAX1972 EV Kit Schematic

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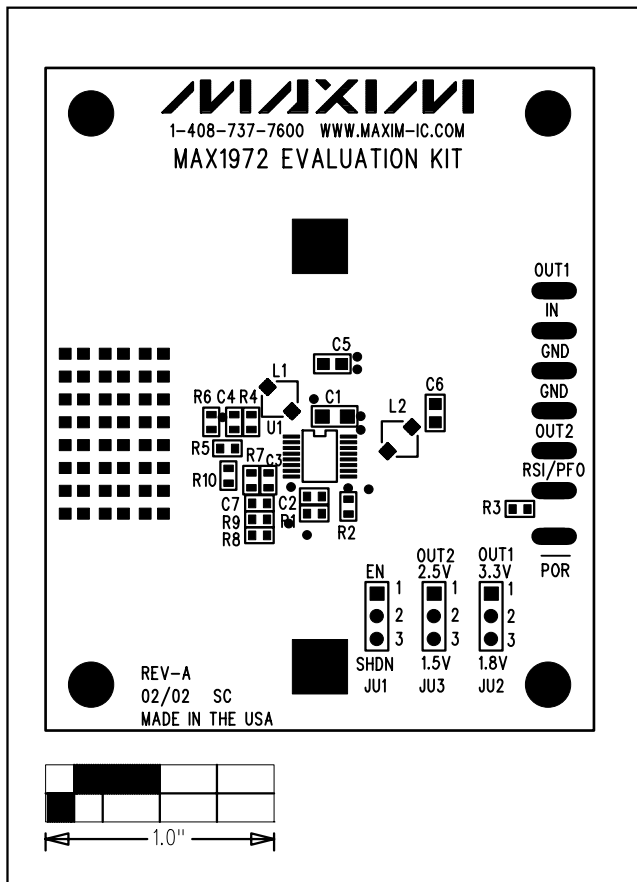


Figure 2. MAX1972 EV Kit Component Placement Guide—Component Side

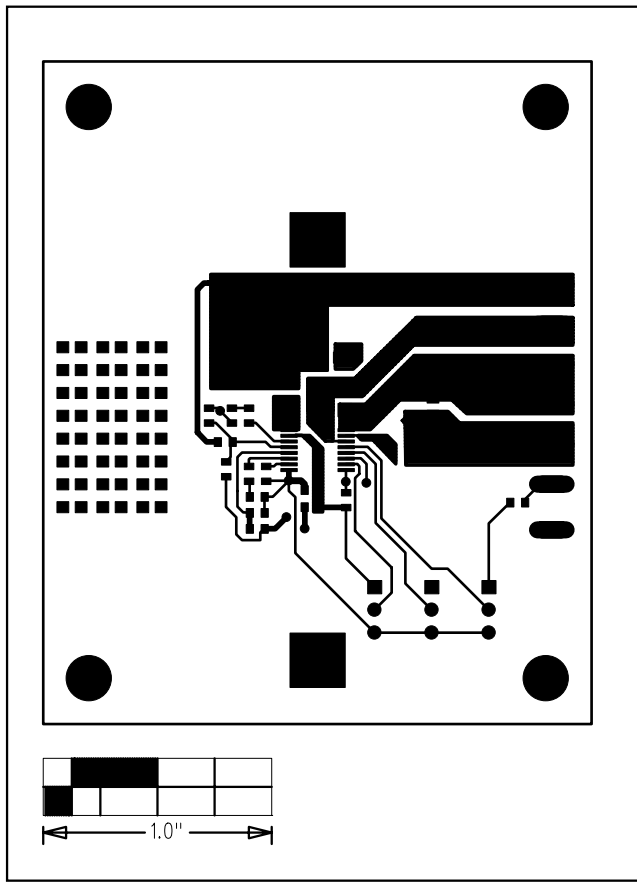


Figure 3. MAX1972 EV Kit PC Board Layout—Component Side

Evaluates: MAX1970/MAX1971/MAX1972

# MAX1972 Evaluation Kit

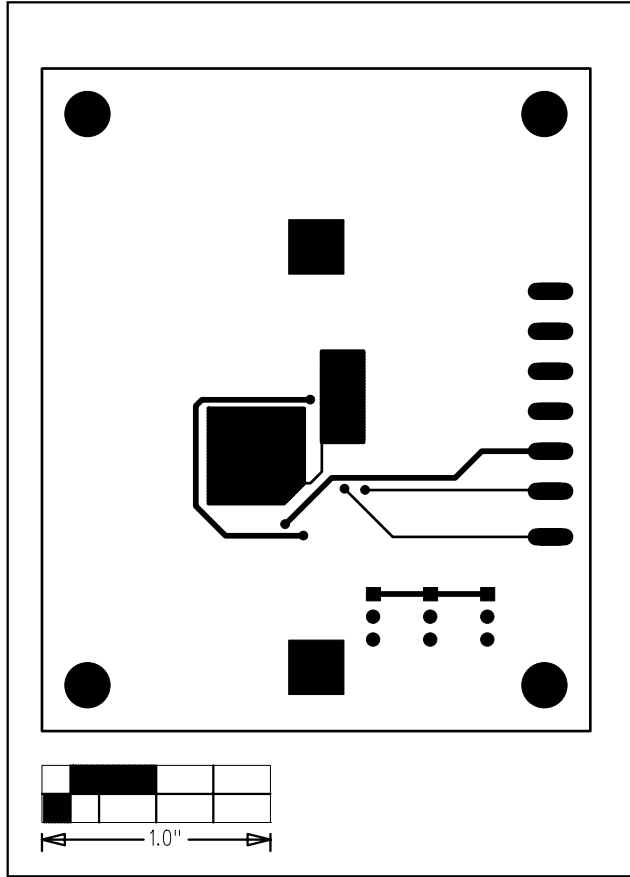


Figure 4. MAX1972 EV Kit PC Board Layout—Solder Side

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