



# MAX4029 Evaluation Kit

Evaluates: MAX4029

## General Description

The MAX4029 evaluation kit (EV kit) is a fully assembled and tested surface-mount circuit board that contains the MAX4029, which is a four-channel, 2:1, voltage-feedback multiplexer-amplifier with input clamps and a fixed gain of +2V/V (6dB). Channel 1 inputs are clamped to the video sync tip of their input signals, while the remaining inputs can be clamped to either the video sync tip of their respective input signals or the key clamp voltage. The latter is referred to as key clamp. The EV kit operates from a single +5V power supply.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	0.01 $\mu$ F $\pm$ 10%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H103K
C2, C4–C11	9	0.1 $\mu$ F $\pm$ 10%, 25V X7R ceramic capacitors (0603) TDK C1608X7R1E104K
C3	1	4.7 $\mu$ F $\pm$ 10%, 6.3V X5R ceramic capacitor (0603) Murata GRM188R60J475K
R1–R12	12	75.0 $\Omega$ $\pm$ 1% resistors (1206) Panasonic ERJ-8ENF75R0V
R13	1	2.2k $\Omega$ $\pm$ 5% resistor (0603)
R14	1	10k $\Omega$ potentiometer 19 turn, 3/8in
INPUT1A, INPUT1B, INPUT2A, INPUT2B, INPUT3A, INPUT3B, INPUT4A, INPUT4B, OUTPUT1–OUTPUT4	12	75 $\Omega$ BNC PC board-mount jack connectors
JU1–JU5	5	3-pin headers
None	5	Shunts
None	1	MAX4029 PC board
U1	1	MAX4029EUP (20-pin TSSOP)

## Features

- ◆ Single +5V Operation
- ◆ Composite, S-Video, Component, or RGB Primaries
- ◆ Independently Selectable Sync-Tip or Key-Clamp Inputs
- ◆ Adjustable Key-Clamp Voltage
- ◆ Standard 75 $\Omega$  Input/Output Termination
- ◆ Surface-Mount Components
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX4029EVKIT	0°C to 70°C	20 TSSOP

## Quick Start

### Recommended Equipment

- +5VDC power supply
- Color camera (e.g., Hitachi KPC551) or DVD player
- Oscilloscope

The MAX4029 EV kit is fully assembled and tested. Follow these steps to verify board operation. **Do not turn on the power supply until all connections are completed:**

- 1) Verify that a shunt is installed across pins 1 and 2 of jumper JU1 (EV kit on).
- 2) Verify that a shunt is installed across pins 1 and 2 of jumper JU2 (channel A selected).
- 3) Verify that a shunt is installed across pins 2 and 3 of jumper JU3 (input 2A is key clamped).
- 4) Connect the color camera's Y/C OUT to the EV kit as follows:
  - The yellow cable (LUMA) to the INPUT1A BNC connector on the EV kit.
  - The white cable (CHROMA) to the INPUT2A BNC connector on the EV kit.
- 5) Set the lens switch of the color camera to video mode and connect the power cord to an appropriate AC power source.

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## Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
Murata	770-436-1300	770-436-3030	www.murata.com
Panasonic	714-373-7366	714-737-7323	www.panasonic.com
TDK	847-803-6100	847-390-4405	www.component.tdk.com

**Note:** Indicate that you are using the MAX4029 EV kit when contacting these suppliers.

- Connect the positive terminal of the DC power supply to the VCC pad on the EV kit. Connect the ground terminal of the DC power supply to the GND pad.
- Turn on the DC power supply, and turn on the color camera's power switch.
- Verify that OUTPUT1 of the EV kit has a luma signal with a sync tip using the oscilloscope.
- Verify that OUTPUT2 of the EV kit has a chroma signal with a color burst using the oscilloscope.

### Detailed Description

The MAX4029 EV kit is a fully assembled and tested surface-mount circuit board that contains the MAX4029, which is a four-channel, 2:1, voltage-feedback multiplexer-amplifier with input clamps and a fixed gain of +2V/V (6dB). Channel 1 inputs (1A and 1B) are clamped to the video sync tip of their respective input signals. The remaining inputs can be clamped to either the video sync tip of their respective input signals (INPUT\_A or INPUT\_B) or the key-clamp voltage as described below. The latter clamp method is referred to as a key clamp.

The key-clamp voltage is adjustable between 0.9V to 1.6V by varying R<sub>KEYREF</sub> from 12.2kΩ to 2.2kΩ, respectively. R<sub>KEYREF</sub> is the total resistance (R13 and R14) from pin 6 to GND.

All the video input and output channels on the MAX4029 EV kit are terminated at 75Ω impedance. All the video input channels are AC coupled. AC-coupling the video input signal allows the EV kit to operate from a single +5V power supply without compromising the video quality.

## Applications Information

### Sync Tip and Key Clamps

The MAX4029 has AC-coupled inputs, with either a sync tip or key clamps, to provide bias for the video signal. Channel 1 of the MAX4029 always has a sync-tip clamp at the input, while the remaining channels are selectable as either sync tip or key clamps to accommodate the various video waveforms (see the *Clamp/Key-Clamp Settings for Video Formats* section).

The value of the sync-tip clamp voltage is set internally for the lowest value consistent with linear operation and cannot be adjusted. The key-clamp voltage is adjustable to compensate for variations in the voltage between component video inputs such as linear RGB, YPbPr, and Y-C, by varying R<sub>KEYREF</sub>. The key-clamp voltage can be calculated from Figure 1 or the following equation:

$$V_{\text{Key-Clamp}} = 0.40 + 2000 / [(5000 \times R_{\text{KEYREF}}) / (5000 + R_{\text{KEYREF}})]$$

In order for these clamps (sync tip or key) to work properly, the input must be coupled with a 0.1μF capacitor (typ) having low leakage (2μA max). Without proper coupling, the clamp voltage will change during the Horizontal line time causing the black level to vary, changing the image brightness from left to right on the display. In addition to the capacitor, a low resistance (<75Ω) is required on the source side to return the capacitor to ground. The clamps used here are active devices with the coupling capacitor serving two functions: first, as a charge reservoir to maintain the clamp voltage, and second, as the compensation capacitor for the clamp itself. If an input is not used, it must be terminated to avoid causing oscillations that could couple to another input.

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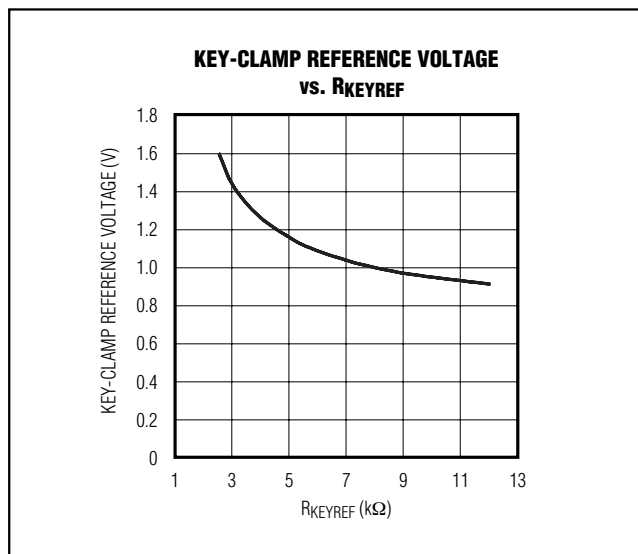


Figure 1. Key-Clamp Voltage vs. R<sub>KEYREF</sub>

In general, a sync tip clamp is used for composite video (Cvbs), gamma-corrected primaries (R'G'B'), and the luma signal (Y') in S-Video. A key clamp is preferred for component color difference signals (Pb & Pr), linear primaries (RGB in PCs), and chroma (C) in S-Video. The rule is to sync-tip clamp a signal if sync is present and key clamp all others. Several examples are given in the *Clamp/Key-Clamp Settings for Video Formats* section.

### Clamp/Key-Clamp Settings for Video Formats

Table 1 provides the clamp settings for the MAX4029 to interface with various video formats.

Table 1. MAX4029 Clamp Settings for Video Formats

INPUT	FORMAT	CLAMP/KEY
1	Cvbs1	Clamp
2	Cvbs2	Clamp
3	Cvbs3	Clamp
4	Cvbs4	Clamp

INPUT	FORMAT	CLAMP/KEY
1	Gs	Clamp
2	R	Key
3	B	Key
4	Cvbs	Clamp

Gs, B, R has sync only on green.

INPUT	FORMAT	CLAMP/KEY
1	H-Sync	Clamp
2	G	Key
3	B	Key
4	R	Key

R, G, B has sync on none.

INPUT	FORMAT	CLAMP/KEY
1	Y	Clamp
2	Pr	Key
3	Pb	Key
4	Cvbs	Clamp

INPUT	FORMAT	CLAMP/KEY
1	Y	Clamp
2	C	Key
3	Cvbs	Clamp
4	Cvbs	Clamp

INPUT	FORMAT	CLAMP/KEY
1	Cvbs	Clamp
2	G'	Clamp
3	B'	Clamp
4	R'	Clamp

R', G', B' has sync on all.

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## Jumper Selection

### Disable Mode ( $\overline{DISABLE}$ )

The MAX4029 EV kit features an option to disable all the video outputs on the EV kit. Jumper JU1 selects the disable mode for the MAX4029. Table 2 lists the selectable jumper options.

**Table 2. JU1 Jumper Selection**

SHUNT POSITION	$\overline{DISABLE}$ PIN	EV KIT FUNCTION
1-2	High	Enabled
2-3	Low	Disabled
None	<b>Connected to external logic</b>	$\overline{DISABLE}$ driven by external logic; disable is active low

### Channel Select Input ( $A/\overline{B}$ )

The MAX4029 EV kit features an option to select between channels A or B inputs. Jumper JU2 selects the desired input channels for the MAX4029. Table 3 lists the selectable jumper options.

**Table 3. JU2 Jumper Selection**

SHUNT POSITION	$A/\overline{B}$ PIN	CHANNEL SELECTED
1-2	High	A
2-3	Low	B
None	<b>Connected to external logic</b>	$A/\overline{B}$ driven by external logic

### Clamp/Key Clamp Selection for Channel 2 ( $\overline{CLAMP/KEY\_2}$ )

The MAX4029 EV kit features an option to select between clamp or key clamp for channel 2. Jumper JU3 selects between clamp/key-clamp settings. Table 4 lists the selectable jumper options.

**Table 4. JU3 Jumper Selection**

SHUNT POSITION	$\overline{CLAMP/KEY\_2}$	CHANNEL 2 CLAMP FUNCTION
1-2	High	Clamp
2-3	Low	Key clamp
None	<b>Connected to external logic</b>	$\overline{CLAMP/KEY\_2}$ driven by external logic

### Clamp/Key Clamp Selection for Channel 3 ( $\overline{CLAMP/KEY\_3}$ )

The MAX4029 EV kit features an option to select between clamp or key clamp for channel 3. Jumper JU4 selects between clamp/key-clamp settings. Table 5 lists the selectable jumper options.

**Table 5. JU4 Jumper Selection**

SHUNT POSITION	$\overline{CLAMP/KEY\_3}$	CHANNEL 3 CLAMP FUNCTION
1-2	High	Clamp
2-3	Low	Key clamp
None	<b>Connected to external logic</b>	$\overline{CLAMP/KEY\_3}$ driven by external logic

### Clamp/Key Clamp Selection for Channel 4 ( $\overline{CLAMP/KEY\_4}$ )

The MAX4029 EV kit features an option to select between clamp or key clamp for channel 4. Jumper JU5 selects between clamp/key-clamp settings. Table 6 lists the selectable jumper options.

**Table 6. JU5 Jumper Selection**

SHUNT POSITION	$\overline{CLAMP/KEY\_4}$	CHANNEL 4 CLAMP FUNCTION
1-2	High	Clamp
2-3	Low	Key clamp
None	<b>Connected to external logic</b>	$\overline{CLAMP/KEY\_4}$ driven by external logic

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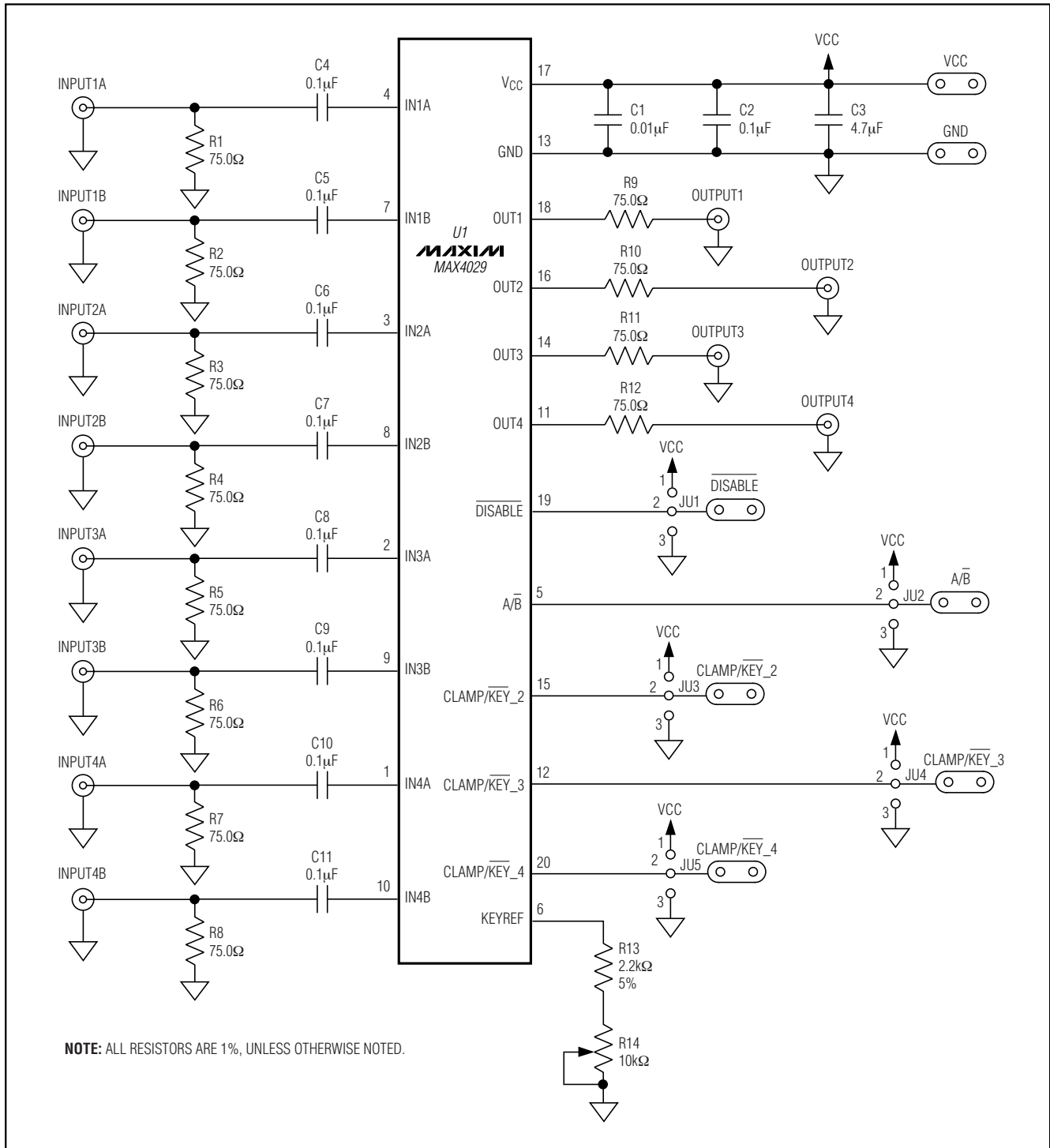


Figure 2. MAX4029 EV Kit Schematic

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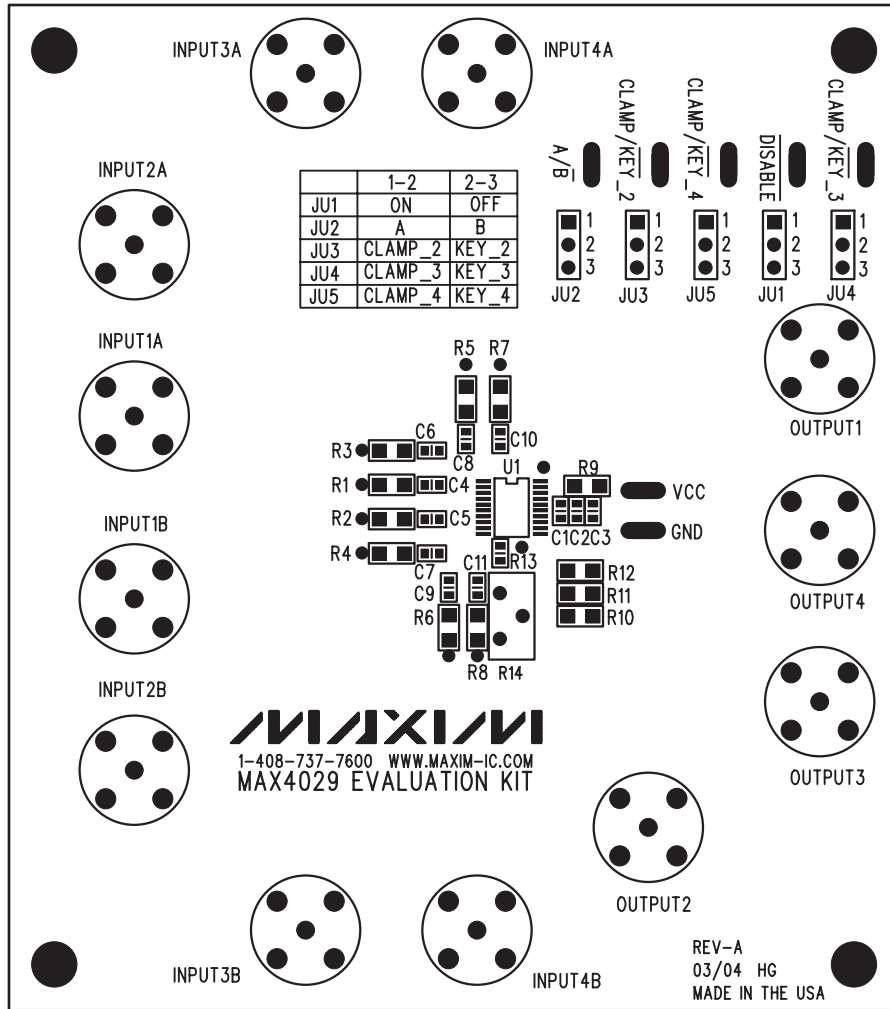


Figure 3. MAX4029 EV Kit Component Placement Guide—Component Side

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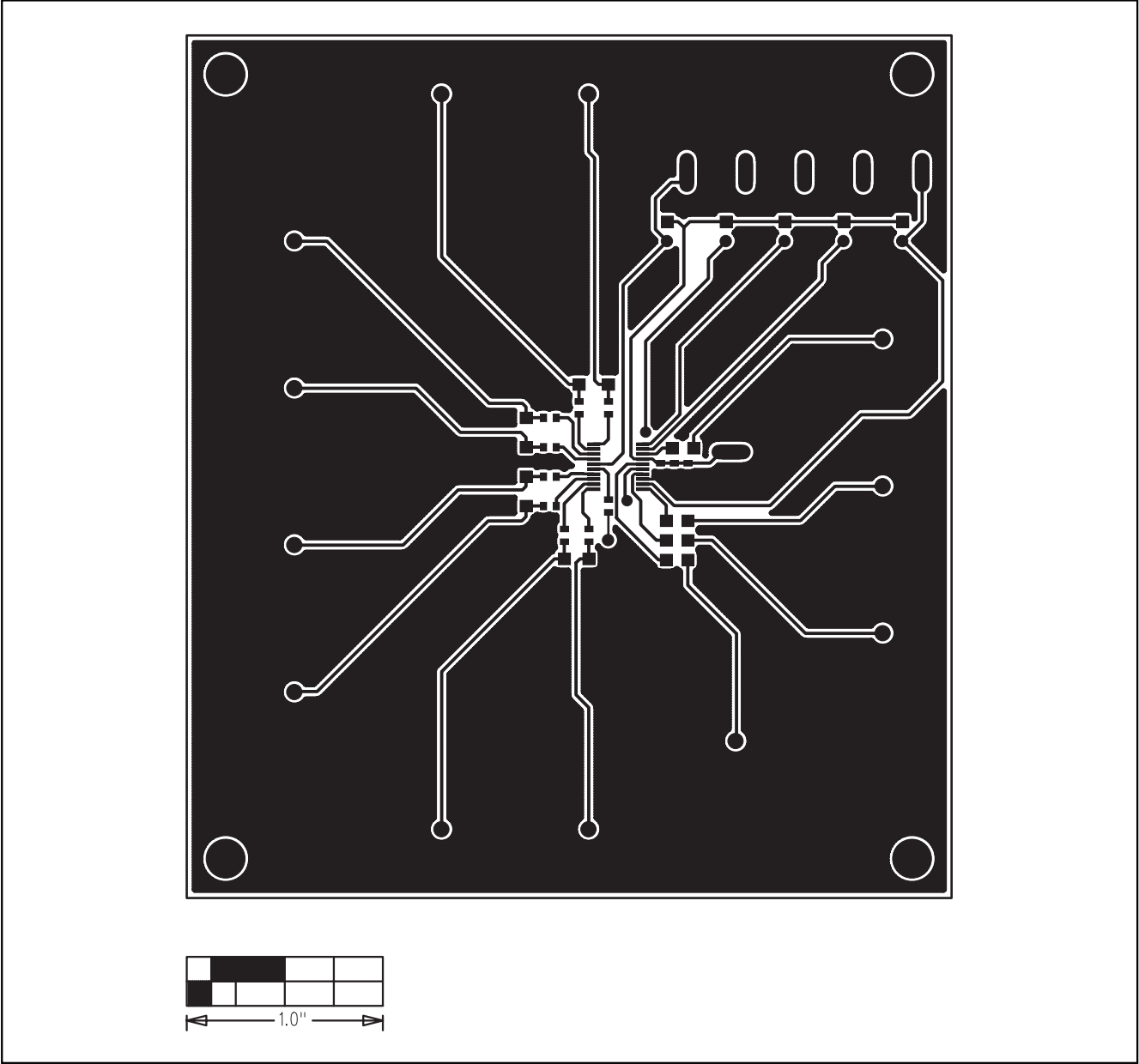


Figure 4. MAX4029 EV Kit PC Board Layout—Component Side

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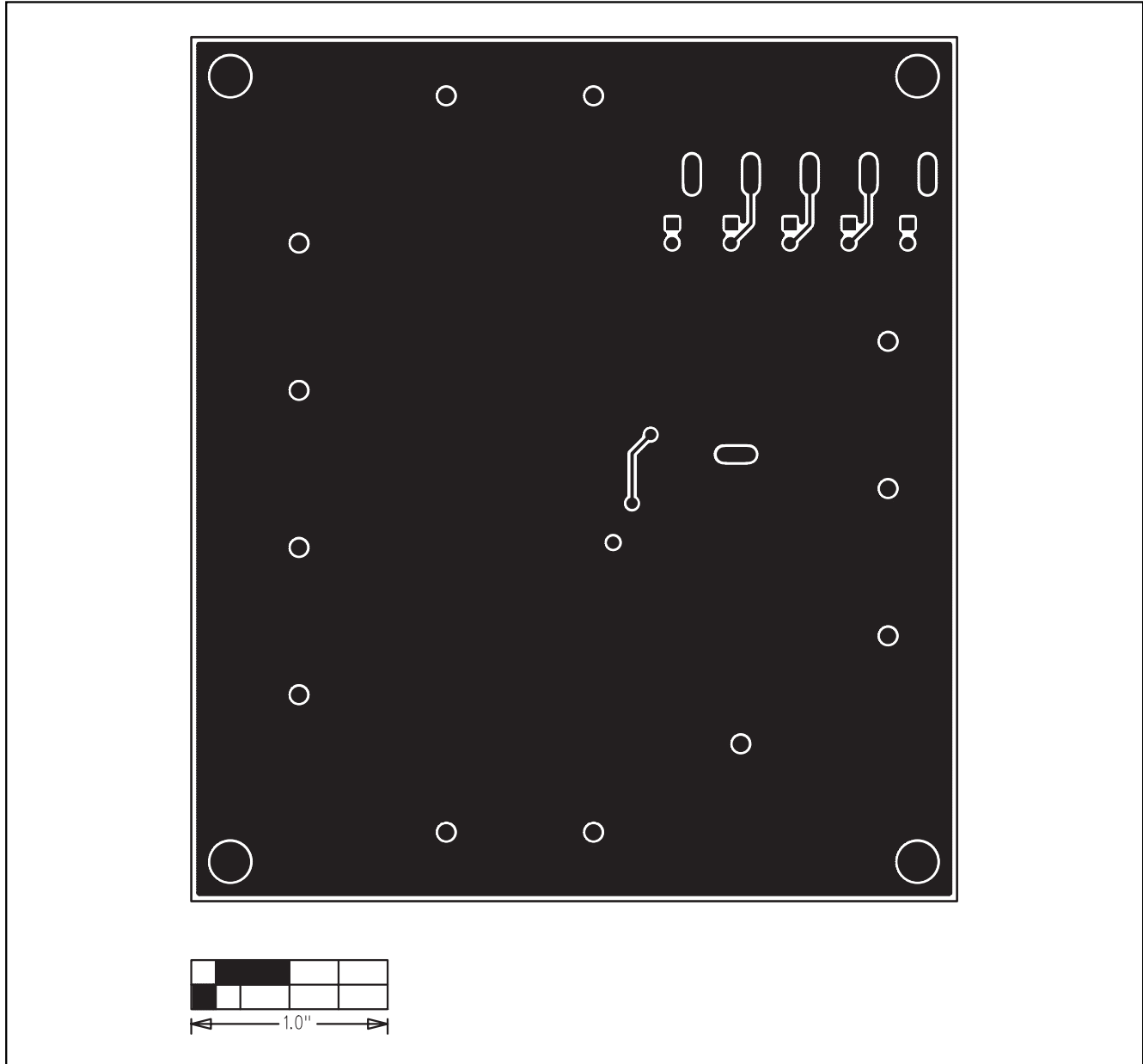


Figure 5. MAX4029 EV Kit PC Board Layout—Solder Side

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