



# MAX15050 Evaluation Kit

**Evaluates: MAX15050**

## General Description

The MAX15050 evaluation kit (EV kit) provides a proven design to evaluate the MAX15050 high-efficiency, 4A, step-down regulator with integrated switches. The EV kit is preset for 1.8V output at load currents up to 4A from a 2.9V to 5.5V input supply. The IC features a 1MHz fixed switching frequency, which allows the EV kit to achieve an all-ceramic capacitor design and fast transient responses.

The EV kit PCB comes with a MAX15050EWE+ installed.

## Features

- ◆ Operates from 2.9V to 5.5V Input Supply
- ◆ All-Ceramic Capacitor Design
- ◆ 1MHz Switching Frequency
- ◆ Output Voltage Range from 0.6V to (0.9 x V<sub>IN</sub>)
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested

## Ordering Information

| PART           | TYPE   |
|----------------|--------|
| MAX15050EVKIT+ | EV Kit |

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

## Component List

| DESIGNATION | QTY | DESCRIPTION   |
|-------------|-----|---|
| C1, C4      | 2   | 22 $\mu$ F $\pm$ 10%, 10V X7R ceramic capacitors (1206)<br>Murata GRM31CR71A226K                        |
| C2, C6      | 2   | 0.1 $\mu$ F $\pm$ 10%, 50V X7R ceramic capacitors (0603)<br>Murata GRM188R71H104K<br>TDK C1608X7R1H104K |
| C3          | 0   | Not installed, capacitor (0805)   |
| C5          | 0   | Not Installed, capacitor (1206)   |
| C7          | 1   | 820pF $\pm$ 10%, 50V X7R ceramic capacitor (0603)<br>Murata GRM188R71H821K                              |
| C8          | 1   | 33pF $\pm$ 5%, 50V C0G ceramic capacitor (0603)<br>Murata GRM1885C1H330J                                |
| C9          | 1   | 680pF $\pm$ 10%, 50V X7R ceramic capacitor (0603)<br>Murata GRM188R71H681K                              |
| C10         | 1   | 2.2 $\mu$ F $\pm$ 10%, 10V X7R ceramic capacitor (0603)<br>Murata GRM188R71A225K                        |

| DESIGNATION | QTY | DESCRIPTION  |
|-------------|-----|--|
| C11         | 1   | 0.033 $\mu$ F $\pm$ 10%, 25V X7R ceramic capacitor (0603)<br>Murata GRM188R71E333K |
| C12         | 0   | Not installed, capacitor (0603)  |
| JU1         | 1   | 2-pin header   |
| L1          | 1   | 0.47 $\mu$ H, 16A inductor<br>Würth 744312047                                      |
| R1          | 1   | 8.06k $\Omega$ $\pm$ 1% resistor (0603)  |
| R2          | 1   | 4.02k $\Omega$ $\pm$ 1% resistor (0603)  |
| R3          | 1   | 6.19k $\Omega$ $\pm$ 1% resistor (0603)  |
| R4          | 1   | 20k $\Omega$ $\pm$ 5% resistor (0603)  |
| R5          | 1   | 48.7 $\Omega$ $\pm$ 1% resistor (0603)   |
| R6          | 1   | 100k $\Omega$ $\pm$ 5% resistor (0603)   |
| R8          | 0   | Not installed, resistor (0603)   |
| U1          | 1   | Synchronous buck regulator (16 WLP)<br>Maxim MAX15050EWE+                          |
| —           | 1   | Shunt  |
| —           | 1   | PCB: MAX15050 EVALUATION KIT+  |

## Component Suppliers

| SUPPLIER                               | PHONE        | WEBSITE                     |
|--|--------------|-----------------------------|
| Murata Electronics North America, Inc. | 770-436-1300 | www.murata-northamerica.com |
| TDK Corp.                              | 847-803-6100 | www.component.tdk.com       |
| Würth Elektronik GmbH & Co. KG         | 201-785-8800 | www.we-online.com           |

**Note:** Indicate that you are using the MAX15050 when contacting these component suppliers.



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## Quick Start

### Recommended Equipment

- MAX15050 EV kit
- 5V, 4A DC power supply
- Load capable of 4A
- Digital voltmeter

### Procedure

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

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

- 1) Connect the positive terminal of the 5V supply to the IN pad and the negative terminal to the nearest GND pad.
- 2) Connect the positive terminal of the 4A load to the OUT pad and the negative terminal to the nearest GND pad.
- 3) Connect the digital voltmeter across the OUT pad and the nearest GND pad.
- 4) Verify that a shunt is not installed on jumper JU1.
- 5) Turn on the DC power supply.
- 6) Enable the load.
- 7) Verify that the voltmeter displays 1.8V.

## Detailed Description of Hardware

The MAX15050 EV kit provides a proven design to evaluate the MAX15050 high-efficiency, 4A, step-down regulator with integrated switches. The applications include server, point-of-load, ASIC/CPU/DSP, base stations, telecom and networking, and RAID control power supplies. The EV kit is preset for 1.8V output at load currents up to 4A from a 2.9V to 5.5V input supply. The IC features a 1MHz fixed switching frequency, which allows the EV kit to achieve an all-ceramic capacitor design and fast transient responses.

### Reference Input and Soft-Start (REFIN/SS)

The IC utilizes an adjustable soft-start function to limit inrush current during startup. The soft-start time is adjusted by C11, the external capacitor from REFIN/SS to GND. By default, C11 is 0.033 $\mu$ F, which gives a soft-start time of approximately 2.5ms. To adjust the soft-start time, determine C11 using the following equation:

$$C11 = (8\mu\text{A} \times t_{\text{SS}})/0.6\text{V}$$

where  $t_{\text{SS}}$  is the required soft-start time in seconds and C11 is in farads. C11 should be a 1nF (min) capacitor between REFIN/SS and GND.

When no external reference is applied at REFIN/SS, the device uses the internal 0.6V reference.

### Setting Output Voltage

The EV kit can be adjusted from 0.6V to  $(0.9 \times V_{\text{IN}})$  by changing the values of R1 and R2. To determine the value of the resistor-divider, first select R1 between 2k $\Omega$  to 10k $\Omega$ , then use the following equation to calculate R2:

$$R2 = (V_{\text{FB}} \times R1)/(V_{\text{OUT}} - V_{\text{FB}})$$

where  $V_{\text{FB}}$  is equal to the reference voltage at REFIN/SS and  $V_{\text{OUT}}$  is the output. If no external reference is applied at REFIN/SS, the internal reference is automatically selected and  $V_{\text{FB}}$  becomes 0.6V. In this case, R2 is not needed for  $V_{\text{OUT}} = 0.6\text{V}$ .

When R2 is changed, compensation components C7, C8, C9, R3, and R5 must be recalculated to ensure loop stability (refer to the *Compensation Design* section in the MAX15050/MAX15051 IC data sheet).

### Regulator Enable (EN)

To shut down the converter, install a shunt on jumper JU1. For normal operation, remove the shunt from JU1. See Table 1 to configure JU1.

### Power Good (PWRGD)

PWRGD is an open-drain output that goes high impedance when  $V_{\text{FB}}$  is above  $92.5\% \times V_{\text{REFIN/SS}}$  and  $V_{\text{REFIN/SS}}$  is above 0.54V. PWRGD becomes low when  $V_{\text{FB}}$  is below 90% of  $V_{\text{REFIN/SS}}$  for at least 48 clock cycles or  $V_{\text{REFIN/SS}}$  is below 0.54V. PWRGD also becomes low during shutdown. On the EV kit, the PWRGD PCB pad is pulled up to VDD through resistor R4. Use the GND PCB pad as a ground reference for this signal.

**Table 1. Regulator Enable (EN) Jumper JU1 Description**

| SHUNT POSITION | DESCRIPTION      |
|----------------|------------------|
| Installed      | Disables the IC  |
| Not installed* | Normal operation |

\*Default position.

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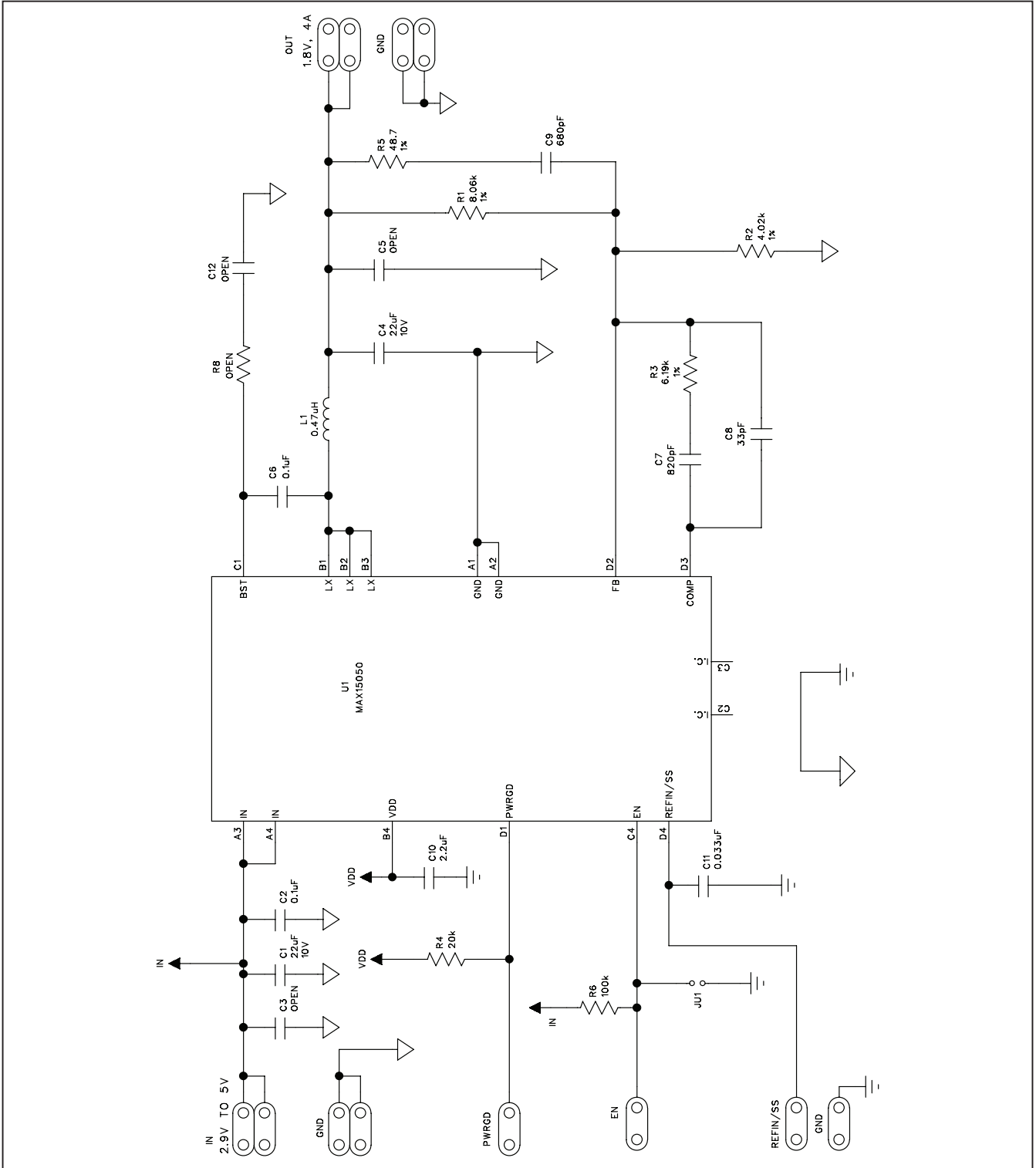


Figure 1. MAX15050 EV Kit Schematic

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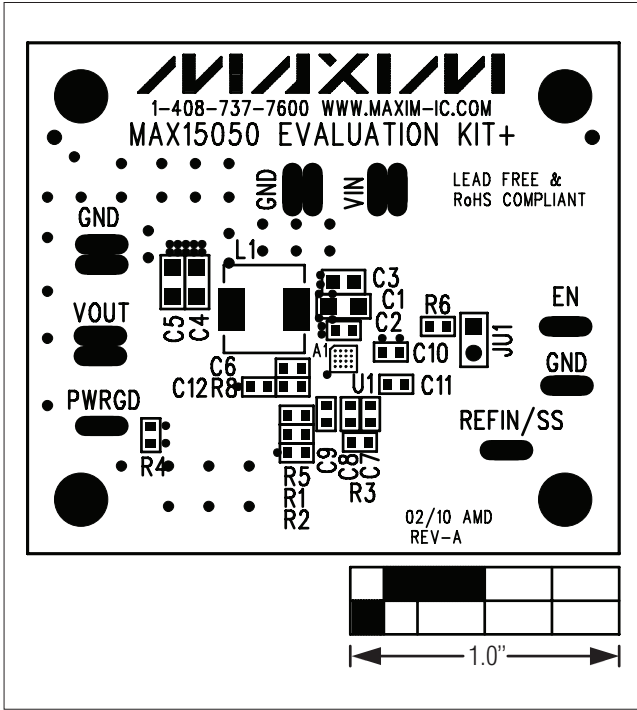


Figure 2. MAX15050 EV Kit Component Placement Guide—Component Side

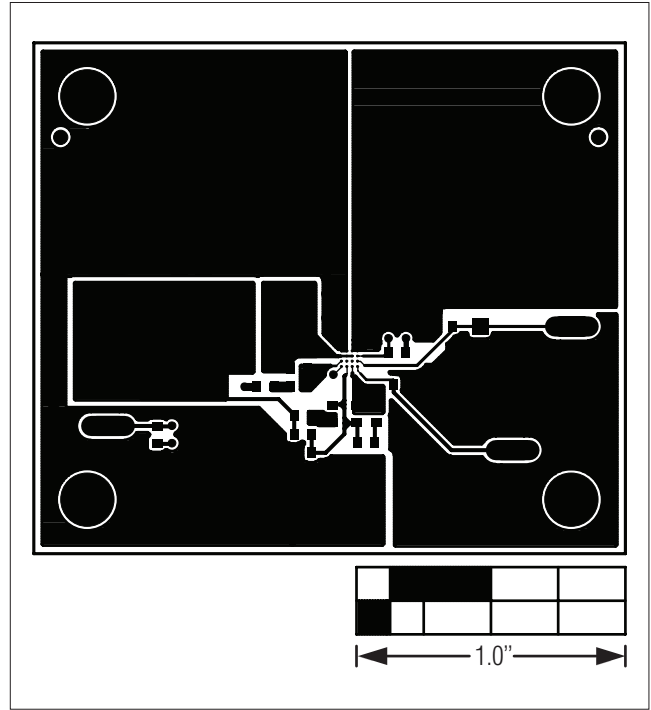


Figure 3. MAX15050 EV Kit Component PCB Layout—Component Side

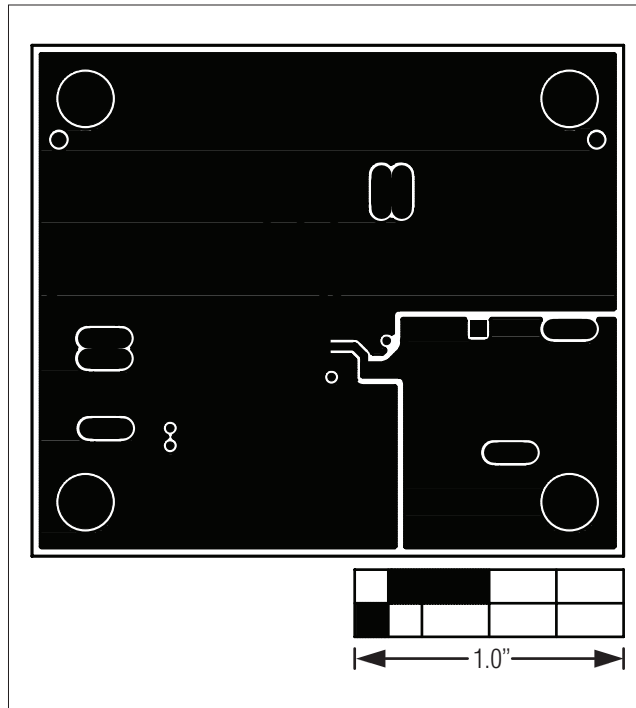


Figure 4. MAX15050 EV Kit PCB Layout—Inner Layer 2

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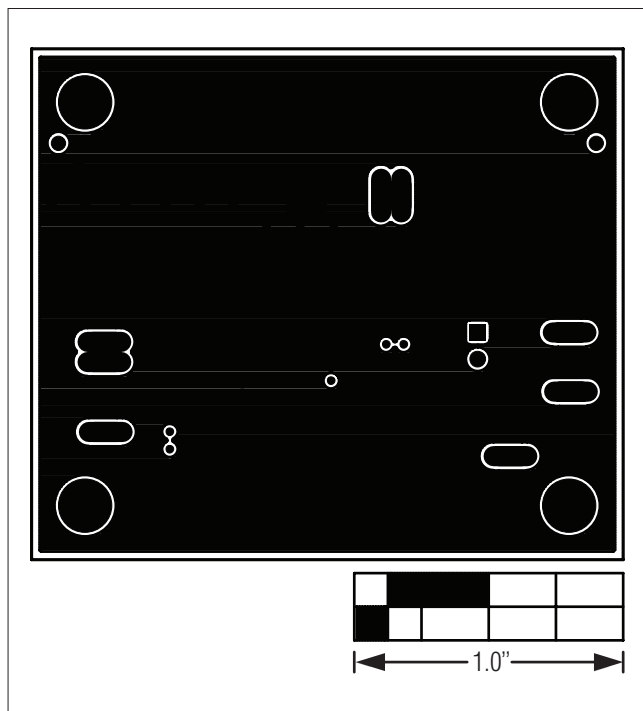


Figure 5. MAX15050 EV Kit PCB Layout—Inner Layer 3

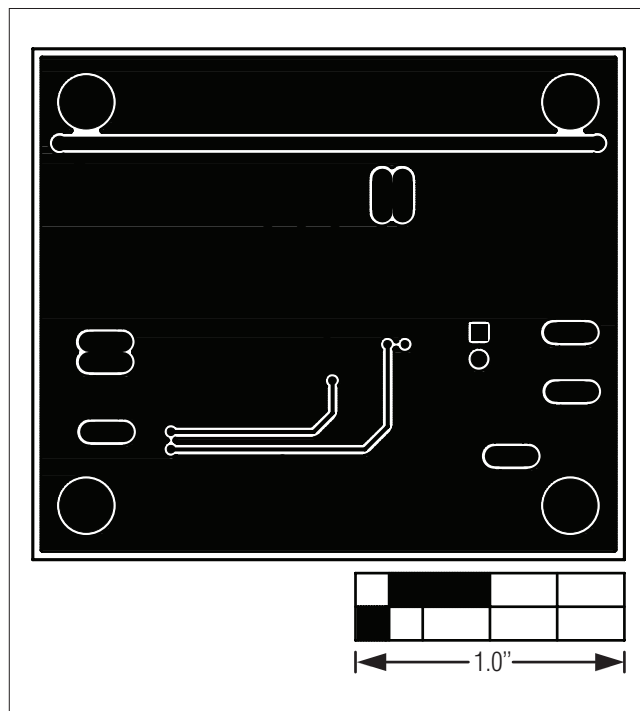


Figure 6. MAX15050 EV Kit PCB Layout—Solder Side

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## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION     | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0               | 5/10          | Initial release | —             |

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