

## MAX17506EVKITBE# Evaluation Kit

## Evaluates: MAX17506 5V Output-Voltage Application

### General Description

The MAX17506EVKITBE# (EV kit) provides a proven design to evaluate the MAX17506 high-voltage, high-efficiency, synchronous step-down DC-DC converter. The EV kit is preset for a 5V output at load currents up to 5A and features a 450kHz switching frequency for optimum efficiency and component size. The EV kit features adjustable-input, undervoltage-lockout, adjustable soft-start, open-drain  $\overline{\text{RESET}}$  signal, and external clock synchronization. The EV kit also provides a good layout example, which is optimized for conducted, radiated EMI and thermal performance. For more details about the IC benefits and features, refer to the MAX17506 data sheet.

### Features

- Operates From a 6.5V to 60V Input Supply
- 5V Output Voltage
- Up to 5A Output Current
- 450kHz Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Adjustable Soft-Start Time
- MODE Pin to Select Among PWM, PFM, or DCM Modes
- Open-Drain  $\overline{\text{RESET}}$  Output
- External Clock Synchronization
- Overcurrent and Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested
- Complies with CISPR22(EN55022) Class B Conducted and Radiated Emissions

### Quick Start

#### Recommended Equipment

- MAX17506EVKITBE#
- 6.5V to 60V, 10A DC input power supply
- Load capable of sinking 5A
- Digital voltmeter (DVM)

#### Equipment Setup and Test 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) Set the power supply at a voltage between 6V and 60V. Disable the power supply.
- 2) Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the nearest PGND PCB pad. Connect the positive terminal of the 5A load to the VOUT PCB pad and the negative terminal to the nearest PGND PCB pad.
- 3) Connect the DVM across the VOUT PCB pad and the nearest PGND PCB pad.
- 4) Verify that the shunt is installed across pins 1-2 on jumper JU1 (see [Table 1](#) for details).
- 5) Select the shunt position on JU2 according to the intended mode of operation (see [Table 2](#) for details).
- 6) Turn on the DC power supply.
- 7) Enable the load.
- 8) Verify that the DVM displays 5V.

[Ordering Information](#) appears at end of data sheet.

## Detailed Description

The MAX17506EVKITBE# provides a proven design to evaluate the MAX17506 high-voltage, high-efficiency, synchronous step-down DC-DC converter. The EV kit is preset for a 5V output from a 6.5V to 60V input at load currents up to 5A and features a 450kHz switching frequency for optimum efficiency and component size.

The EV kit includes an EN/UVLO PCB pad and JU1 to enable the output at a desired input voltage. The SYNC PCB pad allows an external clock to synchronize the device. JU2 allows the selection of a particular mode of operation based on light-load performance requirements. An additional RESET PCB pad is available for monitoring when the converter output is in regulation.

### Soft-Start Input (SS)

The EV kit offers an adjustable soft-start function to limit inrush current during startup. The soft-start time is adjusted by the value of external soft start capacitor C7, connected between SS and SGND. The selected output capacitance (C<sub>SEL</sub>) and the output voltage (V<sub>OUT</sub>) determine the minimum value of C7, as shown by the following equation:

$$C7 \geq 28 \times 10^{-6} \times C_{SEL} \times V_{OUT}$$

The soft-start time (t<sub>SS</sub>) is related to C7 by the following equation:

$$t_{SS} = C7 / (5.55 \times 10^{-6})$$

For example, to program a 2.2ms soft-start time, C7 should be 12nF.

## Enable/Undervoltage-Lockout (EN/UVLO) Programming

The MAX17506 offers an Enable and adjustable input undervoltage lockout feature. In this EV kit, for normal operation, leave EN/UVLO jumper (JU1) open. When JU1 is left open, the MAX17506 is enabled when the input voltage rises above 6.4V. To disable MAX17506, install a jumper across pins 2-3 on JU1. See [Table 1](#) for JU1 settings. The EN/UVLO PCB pad on the EV kit supports external enable/disable control of the device. Leave JU1 open when external enable/disable control is desired. A potential divider formed by R1 and R2 sets the input voltage (V<sub>INU</sub>) above which the converter is enabled when JU1 is left open.

Choose R1 to be 3.32MΩ max, and then calculate R2 as follows:

$$R_2 = \frac{R_1 \times 1.215}{(V_{INU} - 1.215)}$$

where,

V<sub>INU</sub> is the voltage at which the device is required to turn on.

R1 and R2 are in kΩ.

For more details about setting the undervoltage lockout level, refer to the MAX17506 data sheet.

### Mode Selection (MODE/SYNC)

The EV Kit provides a jumper (JU2) that allows the MAX17506 to operate in PWM, PFM, and DCM modes. Refer to MAX17506 data sheet for more details on the modes of operation.

[Table 2](#) shows the Mode Selection (JU2) settings that can be used to configure the desired mode of operation.

**Table 1. Converter EN/UVLO Jumper (JU1) Settings**

| SHUNT POSITION | EN/UVLO PIN  | MAX17506 OUTPUT   |
|----------------|--|---|
| 1-2*           | Connected to VIN   | Enabled   |
| Not installed  | Connected to the center node of resistor-divider R1 and R2 | Enabled, UVLO level set through the R1 and R2 resistors |
| 2-3            | Connected to SGND  | Disabled  |

\*Default position.

**Table 2. Mode Selection (JU2) Settings**

| SHUNT POSITION | MODE PIN          | MAX17506 MODE         |
|----------------|-------------------|-----------------------|
| Not installed* | Unconnected       | PFM mode of operation |
| 1-2            | Connected to SGND | PWM mode of operation |
| 2-3            | Connected to VCC  | DCM mode of operation |

\*Default position.

**External Clock Synchronization  
(MODE/SYNC)**

The EV kit provides MODE/SYNC PCB pad, to synchronize the MAX17506 to an optional external clock. Leave jumper JU2 open when external clock signals are applied. In the presence of a valid external clock for synchronization, the MAX17506 operates in PWM mode only. For more details about external clock synchronization, refer to the MAX17506 data sheet.

**Active-Low, Open-Drain Reset Output  
(RESET)**

The EV kit provides a  $\overline{\text{RESET}}$  PCB pad to monitor the status of the converter.  $\overline{\text{RESET}}$  goes high when  $V_{\text{OUT}}$  rises above 95% (typ) of its nominal regulated voltage.  $\overline{\text{RESET}}$  goes low when  $V_{\text{OUT}}$  falls below 92% (typ) of its nominal regulated voltage.

**Hot Plug-In and Long Input Cables**

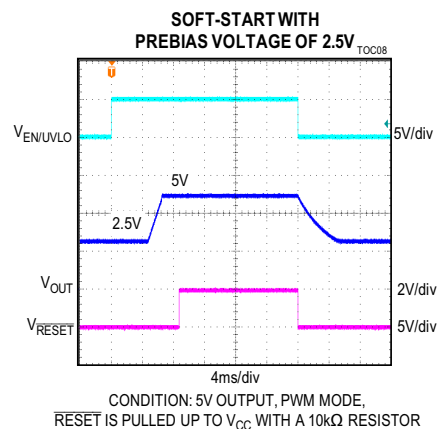
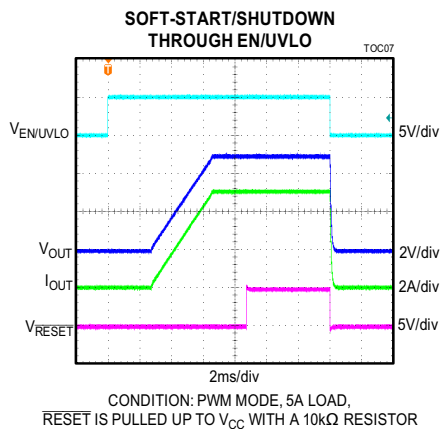
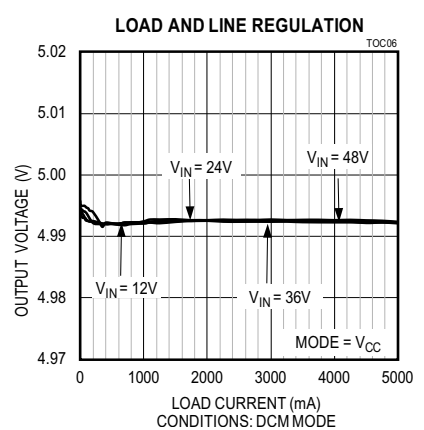
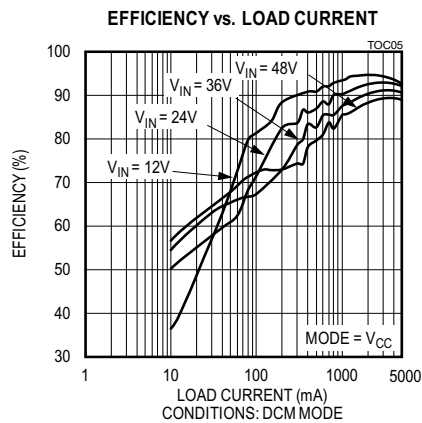
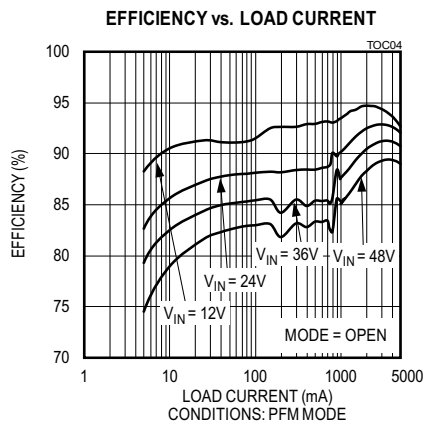
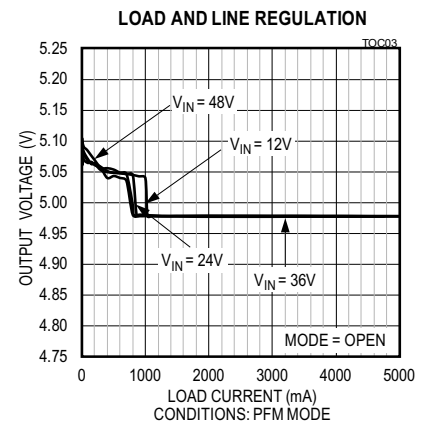
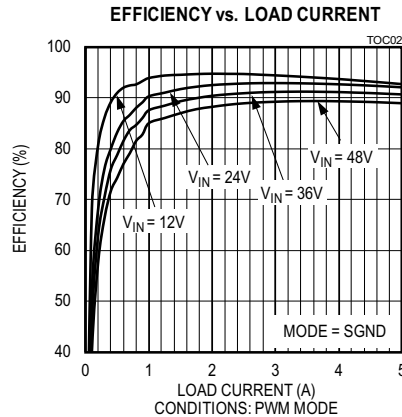
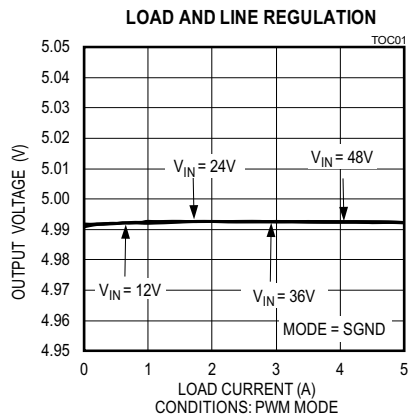
The MAX17506EVKITBE# PCB layout provides an optional electrolytic capacitor ( $\text{CIN7} = 47\mu\text{F}/80\text{V}$ ). This capacitor limits the peak voltage at the input of the MAX17506 when the DC input source is “hot-plugged” to the EV kit input terminals with long input cables. The equivalent series resistance (ESR) of the electrolytic capacitor dampens the oscillations caused by interaction of the inductance of the long input cables, and the ceramic capacitors at the buck converter input.

**Electromagnetic Interference (EMI)**

Compliance to conducted emissions (CE) standards requires an EMI filter at the input of a switching power converter. The EMI filter attenuates high-frequency currents drawn by the switching power converter, and limits the noise injected back into the input power source.

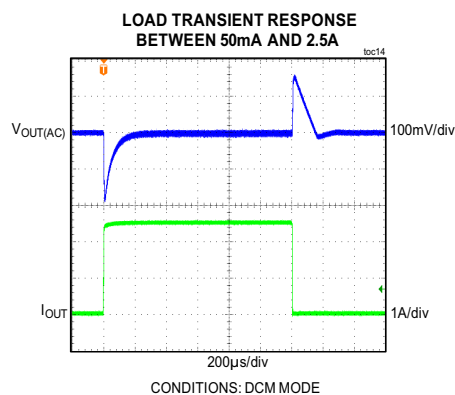
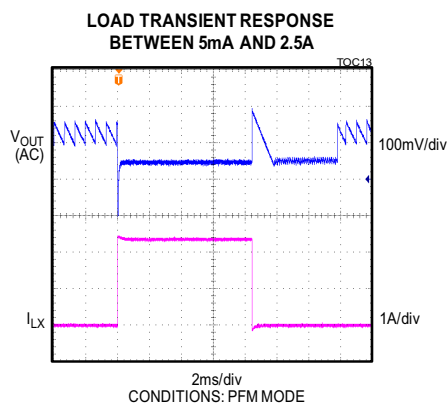
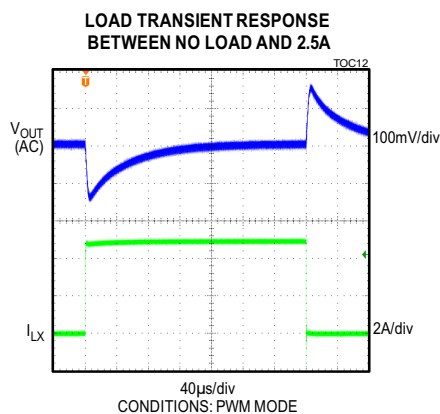
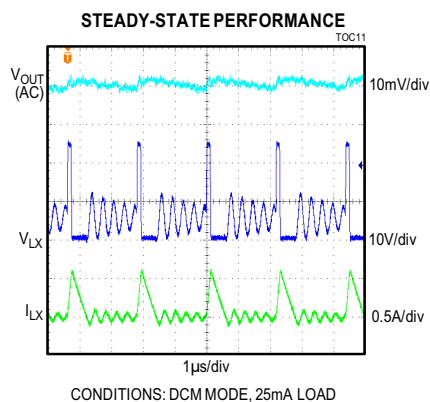
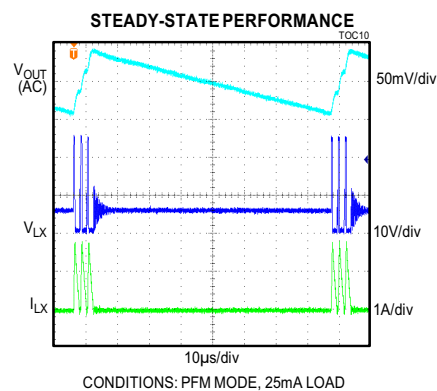
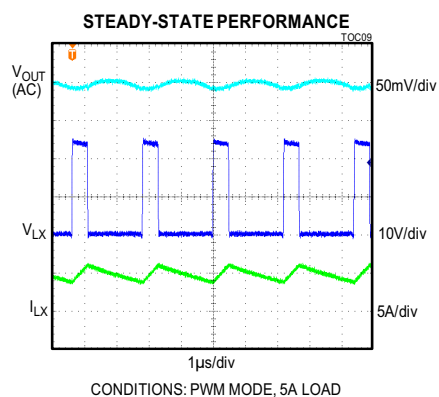
The MAX17506EVKITBE# has designated footprints on the EV Kit for placement of EMI filter components. Use of these filter components results in lower conducted emissions, below CISPR22 Class B limits. Cut open the trace at L2 before installing conducted EMI filter components. The MAX17506EVKITBE# PCB layout is also designed to limit radiated emissions from switching nodes of the power converter, resulting in radiated emissions below CISPR22 Class B limits.

## EV Kit Performance Report

(V<sub>IN</sub> = 24V, V<sub>OUT</sub> = 5V, I<sub>OUT</sub> = 5A, f<sub>SW</sub> = 450kHz, T<sub>A</sub> = +25°C, unless otherwise noted.)

**EV Kit Performance Report (continued)**

( $V_{IN} = 24V$ ,  $V_{OUT} = 5V$ ,  $I_{OUT} = 5A$ ,  $f_{SW} = 450kHz$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

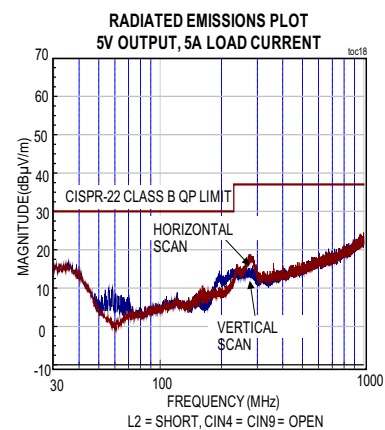
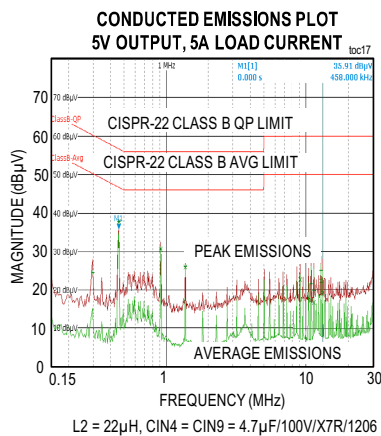
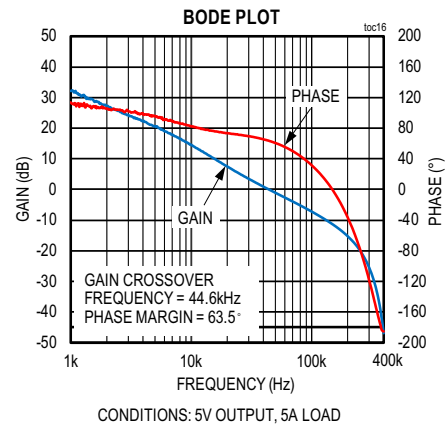
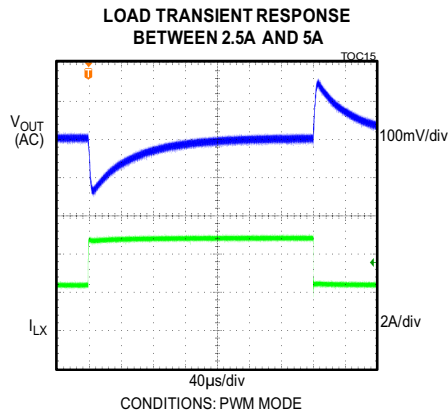


# MAX17506EVKITBE# Evaluation Kit

Evaluates: MAX17506  
5V Output-Voltage Application

## EV Kit Performance Report (continued)

( $V_{IN} = 24V$ ,  $V_{OUT} = 5V$ ,  $I_{OUT} = 5A$ ,  $f_{SW} = 450kHz$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.)



## Component Suppliers

| SUPPLIER        | WEBSITE  |
|-----------------|--|
| Coilcraft, Inc. | <a href="http://www.coilcraft.com">www.coilcraft.com</a> |
| TDK Corp.       | <a href="http://www.tdk.com">www.tdk.com</a>             |
| Murata Americas | <a href="http://www.murata.com">www.murata.com</a>       |
| Panasonic Corp. | <a href="http://www.panasonic.com">www.panasonic.com</a> |
| Vishay          | <a href="http://www.vishay.com">www.vishay.com</a>       |
| Taiyo Yuden     | <a href="http://www.ty-top.com">www.ty-top.com</a>       |

**Note:** Indicate that you are using the MAX17506 when contacting these component suppliers.

## Ordering Information

| PART             | TYPE   |
|------------------|--------|
| MAX17506EVKITBE# | EV Kit |

#Denotes RoHS compliant.

# MAX17506EVKITBE# Evaluation Kit

Evaluates: MAX17506  
5V Output-Voltage Application

## MAX17506EVKITBE# Bill of Materials

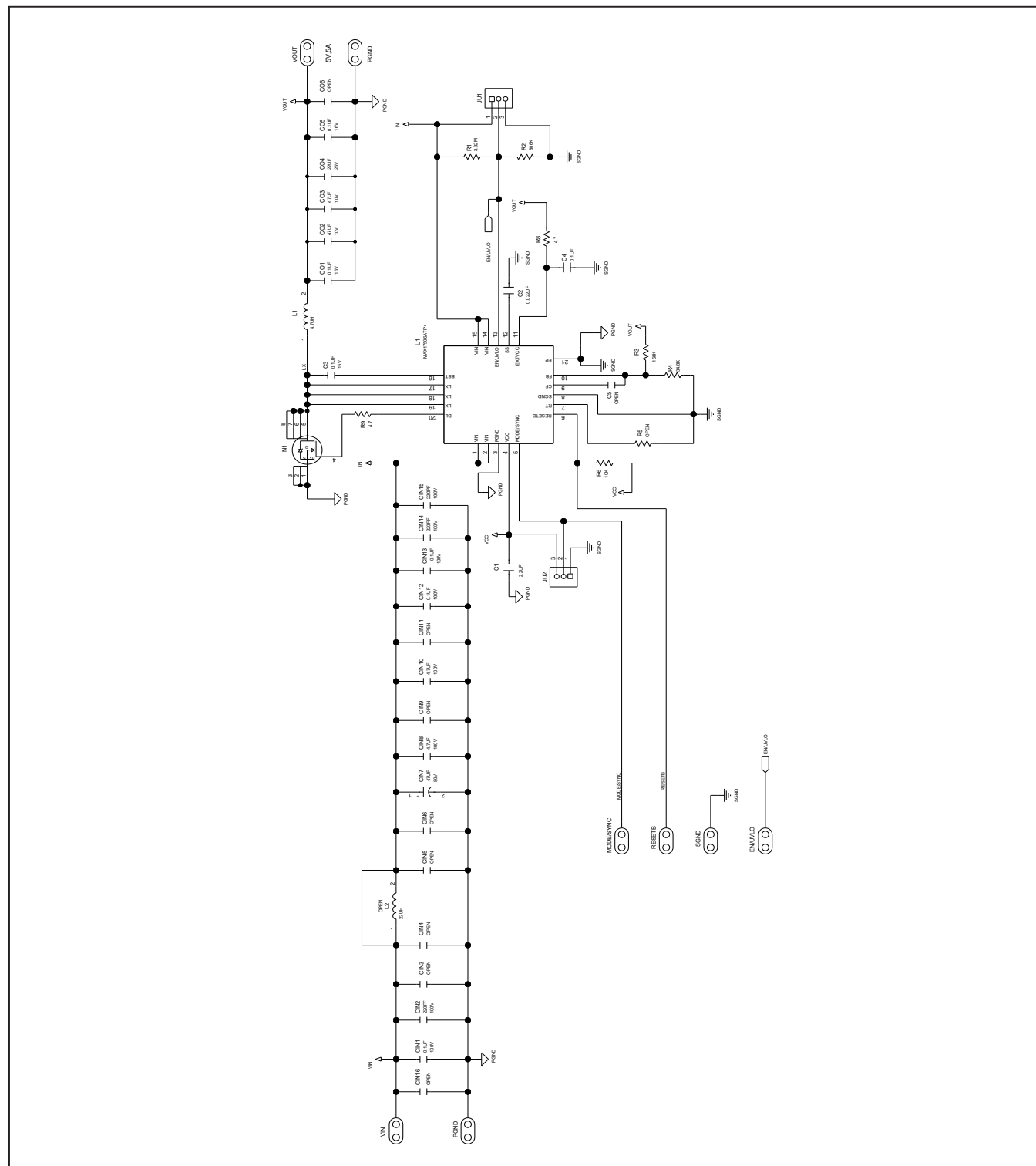
| S.No | DESIGNATOR              | DESCRIPTION   | QUANTITY | MANUFACTURER PART NUMBER         |
|------|-------------------------|---|----------|----------------------------------|
| 1    | C1                      | 2.2 $\mu$ F, 10%, 10V, X7R, Ceramic capacitor (0603)                                | 1        | MURATA GRM188R71A225KE15         |
| 2    | C2                      | 0.022 $\mu$ F, 10%, 50V, X7R, Ceramic capacitor (0402)                              | 1        | MURATA GCM155R71H223KA55         |
| 3    | C3, C4, CO1, CO5        | 0.1 $\mu$ F, 10%, 16V, X7R, Ceramic capacitor (0402)                                | 4        | TAIYO YUDEN EMK105B7104KV-F      |
| 4    | CIN1, CIN12, CIN13      | 0.1 $\mu$ F, 10%, 100V, X7R, Ceramic capacitor (0603)                               | 3        | TAIYO YUDEN HMK107B7104KA-T      |
| 5    | CIN2, CIN14, CIN15      | 220pF, 5%, 100V, COG, Ceramic capacitor (0603)                                      | 3        | TDK C1608C0G2A221J080AA          |
| 6    | CIN7                    | ALUMINUM-ELECTROLYTIC; 47UF; 80V;<br>TOL = 20%; MODEL=EEV SERIES                    | 1        | PANASONIC EEE-FK1K470P           |
| 7    | CIN8, CIN10             | 4.7 $\mu$ F, 10%, 100V, X7R, Ceramic capacitor (1206)                               | 2        | MURATA GRM31CZ72A475KE11         |
| 8    | CO2, CO3                | 47 $\mu$ F, 10%, 10V, X7R, Ceramic capacitor (1210)                                 | 2        | MURATA GRM32ER71A476KE15         |
| 9    | CO4                     | 22 $\mu$ F, 10%, 25V, X7R, Ceramic capacitor (1210)                                 | 1        | MURATA GRM32ER71E226ME15         |
| 10   | L1                      | INDUCTOR, 4.7 $\mu$ H, 17.4A (8mm x 8mm)  | 1        | COILCRAFT XAL8080-472ME          |
| 11   | N1                      | N-CHANNEL 80V MOSFET (3.3mm x 3.3mm)  | 1        | VISHAY SILICONIX SIS468DN-T1-GE3 |
| 12   | R1                      | RES+, 3.32M $\Omega$ , 1% (0603)  | 1        | VISHAY DALE CRCW04023M32FK       |
| 13   | R2                      | RES+, 806K $\Omega$ , 1% (0603)   | 1        | PANASONIC ERJ-3EKF8063           |
| 14   | R3                      | RES+, 158K $\Omega$ , 1% (0402)   | 1        | PANASONIC ERJ-2RKF1583           |
| 15   | R4                      | RES+, 34.8K $\Omega$ , 1% (0402)  | 1        | VISHAY DALE CRCW040234K8FK       |
| 16   | R6                      | RES+, 10K $\Omega$ , 1% (0402)  | 1        | PANASONIC ERJ-2RKF1002Y          |
| 17   | R8, R9                  | RES+, 4.7 $\Omega$ , 1% (0402)  | 2        | VISHAY CRCW04024R70FK            |
| 18   | U1                      | HIGH-EFFICIENCY; SYNCHRONOUS<br>STEP-DOWN DC-DC CONVERTER;<br>(TQFN20-EP 5mm x 5mm) | 1        | MAX17506ATP+                     |
| 19   | JU1, JU2                | 3-pin header (36-pin header 0.1" centers )  | 2        | Sullins: PEC03SAAN               |
| 20   | —                       | Shunts  | 2        | SULLINS STC02SYAN                |
| 21   | MH1-MH4                 | MACHINE SCREW; SLOTTED  | 4        | EAGLE PLASTIC DEVICES P440.375   |
| 22   | MH1-MH4                 | HEX STANDOFF #4-40 NYLON 3/8"   | 4        | KEYSTONE ELECTRONICS 1902B       |
| 23   | CIN4 , CIN9             | OPTIONAL: 4.7 $\mu$ F, 10%, 100V, X7R,<br>Ceramic capacitor (1206)                  | 2        | MURATA GRM31CZ72A475KE11         |
| 24   | L2                      | OPTIONAL: INDUCTOR,<br>22 $\mu$ H, 3.4A (5mm x 5mm)                                 | 1        | COILCRAFT XAL5050-223ME          |
| 25   | CIN3, CIN5, CIN6, CIN11 | OPEN: Capacitor (1206)  | 0        |                                  |
| 26   | CIN16                   | OPEN: Capacitor (0603)  | 0        |                                  |
| 27   | C5                      | OPEN: Capacitor (0402)  | 0        |                                  |
| 28   | CO6                     | OPEN: Capacitor (0402)  | 0        |                                  |
| 29   | R5                      | OPEN: Resistor (0402)   | 0        |                                  |

| DEFAULT JUMPER TABLE |                |
|----------------------|----------------|
| JUMPER               | SHUNT POSITION |
| JU1                  | 1–2            |
| JU2                  | 1              |

# MAX17506EVKITBE# Evaluation Kit

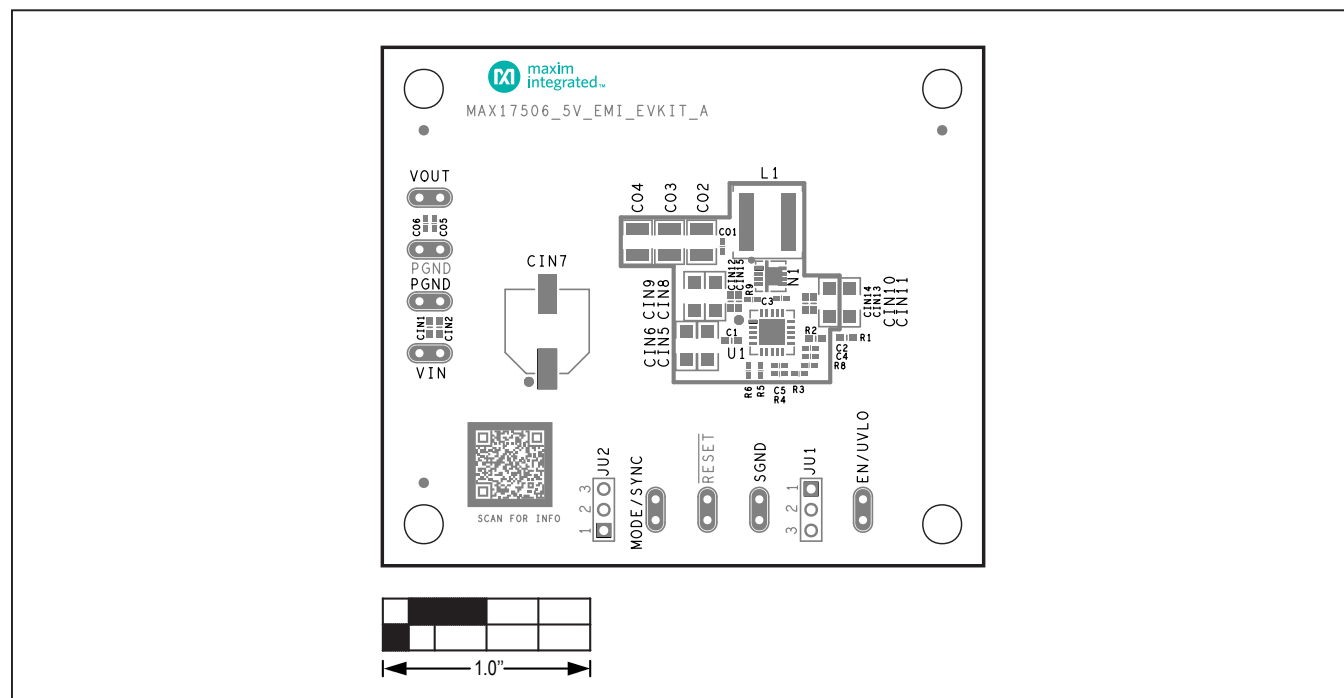
Evaluates: MAX17506  
5V Output-Voltage Application

## MAX17506EVKITBE# Schematic

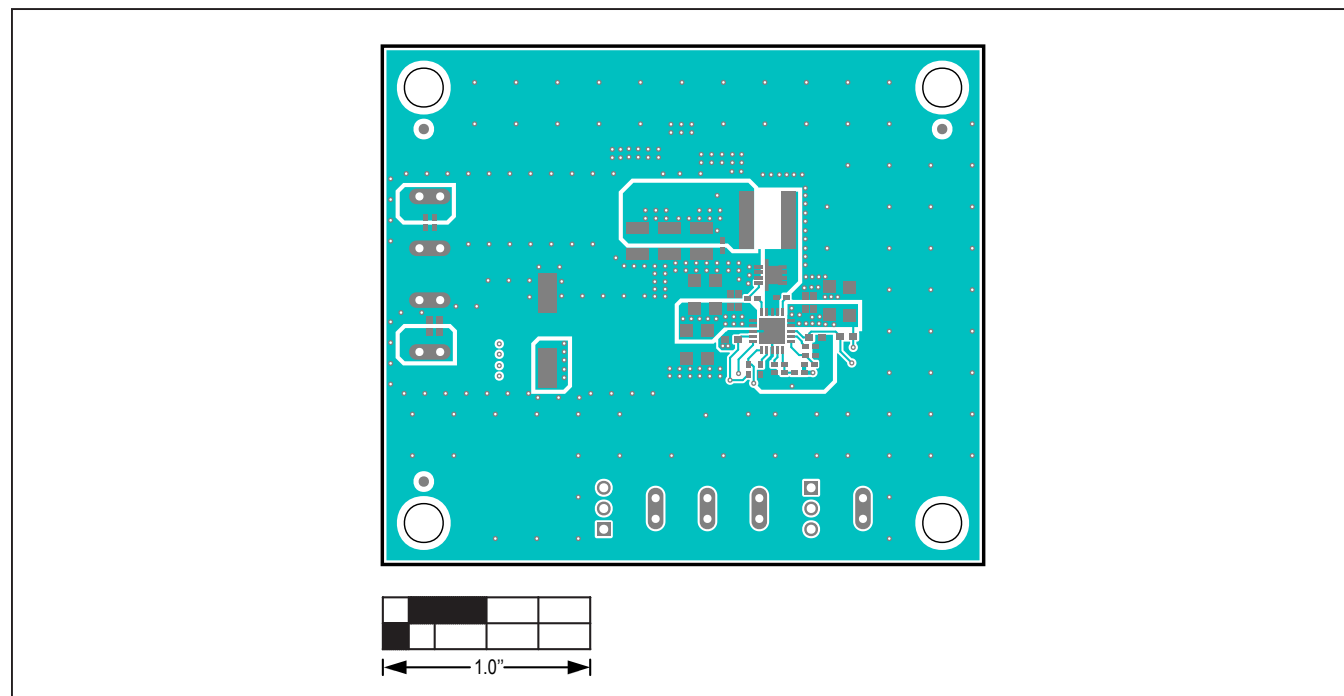




## MAX17506EVKITBE# PCB Layout Diagrams

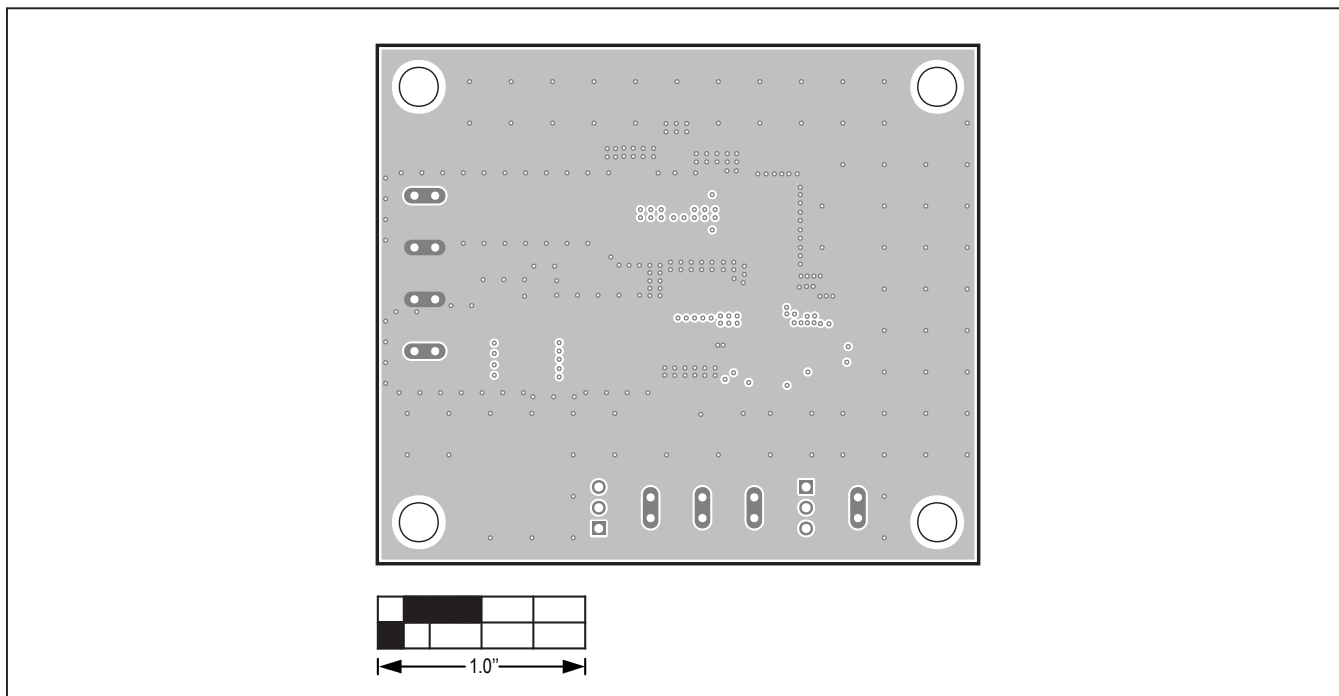


MAX17506EVKITBE# PCB Layout—Top Silkscreen

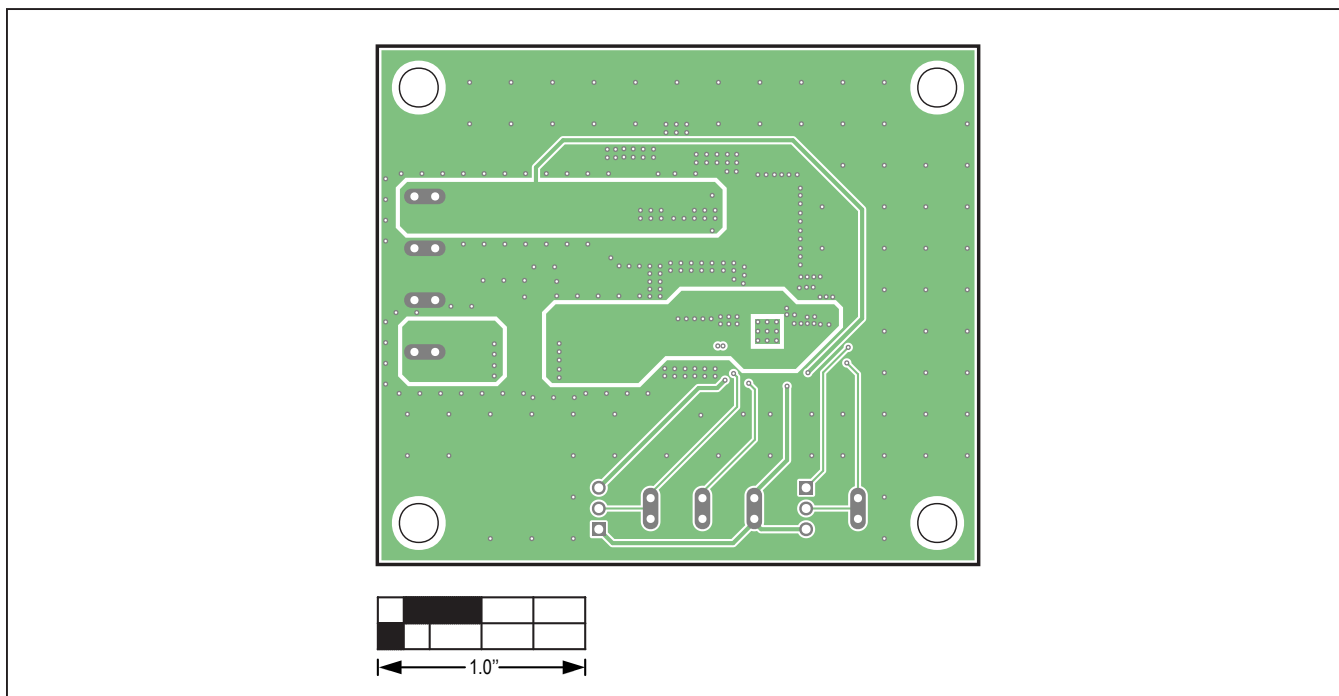


MAX17506EVKITBE# PCB Layout—Top Layer

## MAX17506EVKITBE# PCB Layout Diagrams (continued)

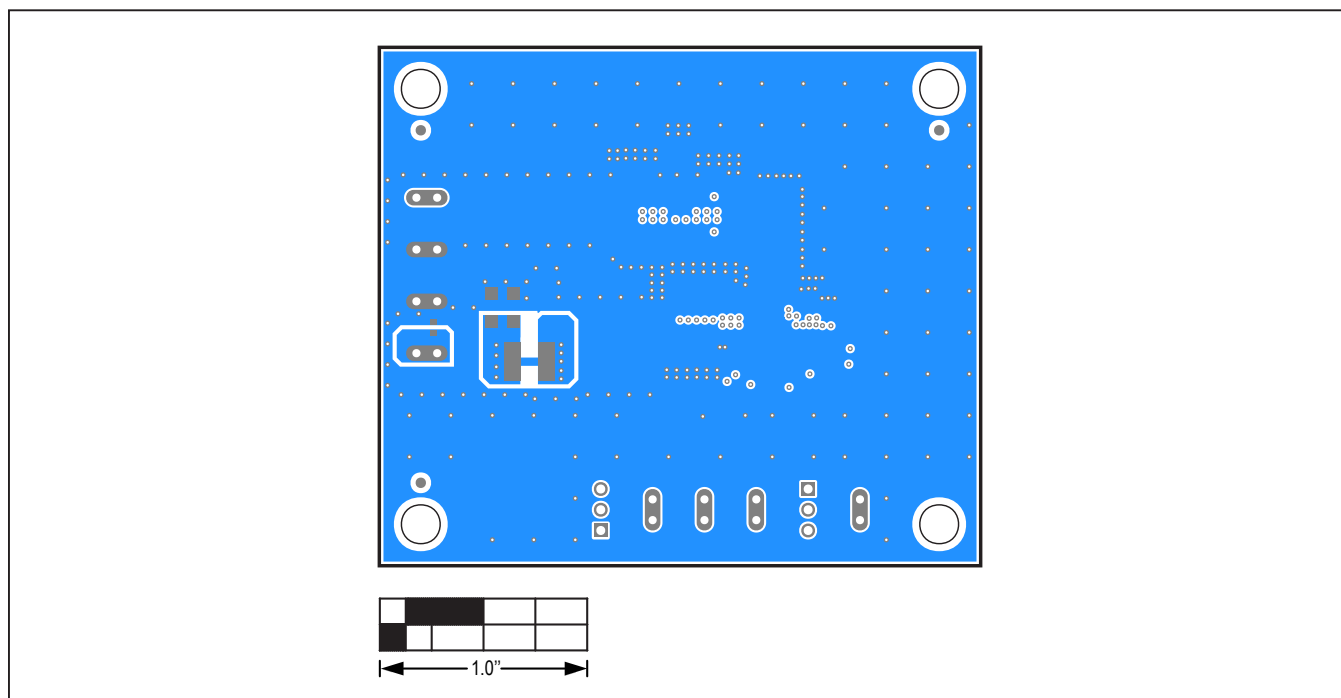


MAX17506EVKITBE# PCB Layout—Layer 2 Ground

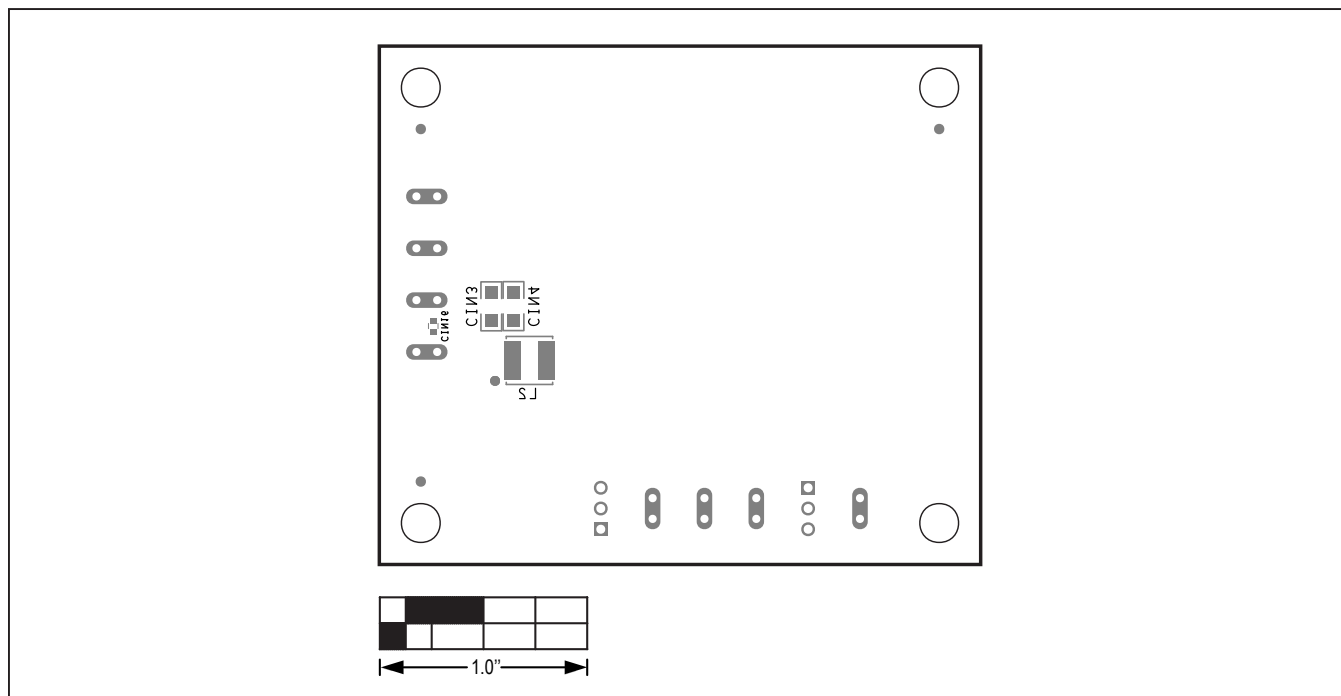


MAX17506EVKITBE# PCB Layout—Layer 3 Power

## MAX17506EVKITBE# PCB Layout Diagrams (continued)



MAX17506EVKITBE# PCB Layout—Bottom Layer



MAX17506EVKITBE# PCB Layout—Bottom Silkscreen

## Revision History

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION     | PAGES<br>CHANGED |
|--------------------|------------------|-----------------|------------------|
| 0                  | 8/19             | Initial release | —                |

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at <https://www.maximintegrated.com/en/storefront/storefront.html>.

*Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time.*

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Maxim Integrated:

MAX17506EVKITBE#