Click here for production status of specific part numbers.

MAX17501GTEVKITE# Evaluation Kit

Evaluates: MAX17501 in TDFN Package

General Description

The MAX17501GTEVKITE# provides a proven design to evaluate the MAX17501G high-efficiency, high-voltage, synchronous step-down DC-DC converter in a TDFN package. The EV kit generates 5V at load currents up to 500mA from a 6.5V to 60V input supply. The EV kit features a 600kHz fixed switching frequency for optimum efficiency and component size. The EV kit features a forced-PWM control scheme that provides constant switching-frequency operation at all load and line conditions. 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 MAX17501 data sheet.

Features

- Operates from a 6.5V to 60V Input Supply
- Programmed 5V Output Voltage, 500mA Load Current
- 600kHz Switching Frequency
- Enable/UVLO Input
- Resistor-Programmable UVLO Threshold
- Open-Drain $\overline{\text{RESET}}$ Output
- Overcurrent and Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested
- Complies with CISPR22(EN55022) Class B Conducted and Radiated Emissions

***Ordering Information* appears at end of data sheet.**

Quick Start

Recommended Equipment

- MAX17501GTEVKITE#
- 6.5V to 60V, 1A DC input power supply
- Load capable of sinking 500mA
- Digital voltmeter (DVM)
- Function generator

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 6.5V 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 500mA 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) Turn on the DC power supply.
5) Enable the load.
6) Verify that the DVM displays 5V.

To turn-on/off the part through the EN/UVLO, follow the steps below:

1) Remove resistors R1 and R2.
2) Connect the power supply to the EV kit and turn on the power supply. Set the power supply at a voltage between 6.5V and 60V.
3) Connect the function generator output to the EN/UVLO PCB pad.
4) EN/UVLO rising threshold is 1.24V and falling threshold is 1.11V.Make sure that the voltage-high and voltage-low levels of the function generator output are greater than 1.24V and less than 1.11V, respectively.
5) While powering down the EV kits, first disconnect the function generator output from the EN/UVLO PCB pad and then turn off the DC power supply.

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Detailed Description of Hardware

The MAX17501GTEVKITE# provides a proven design to evaluate the MAX17501G high-efficiency, high-voltage, synchronous step-down DC-DC converter. The EV kit generates 5V at load currents up to 500mA from a 6.5V to 60V input supply. The EV kit features a 600kHz fixed switching frequency for optimum efficiency and component size. The EV kit features a forced-PWM control scheme that provides constant switching-frequency operation at all load and line conditions.

The EV kit includes an EN/UVLO PCB pad to enable control of the converter output. An additional $\overline{\text{RESET}}$ PCB pad is available for monitoring the open-drain logic output.

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 (C10), connected between SS and SGND. To adjust the soft-start time, determine C10 using the following formula:

$$C10 = 5.55 \times t_{SS}$$

where t_{SS} is the required soft-start time in milliseconds and C10 is in nanofarads.

Enable/Undervoltage-Lockout (EN/UVLO) Programming

The MAX17501 offers an Enable and adjustable input undervoltage lockout feature. In this EV kit, for normal operation, leave the EN/UVLO jumper (JU1) open. When JU1 is left open, the MAX17501 is enabled when the input voltage rises above 6.4V. To disable the MAX17501, 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 (VINU) above which the converter is enabled when JU1 is left open.

Choose R1 to be 3.3MΩ (max), and then calculate R2 as follows:

$$R_2 = \frac{R_1 \times 1.218}{(V_{INU} - 1.218)}$$

where, V_{INU} is the voltage at which the device is required to turn on, and R1 and R2 are in kΩ.

For more details about setting the undervoltage-lockout Level, refer to the MAX17501 data sheet.

Active-Low, Open-Drain Reset Output ($\overline{\text{RESET}}$)

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

Hot Plug-In and Long Input Cables

The MAX17501GTEVKITE# PCB layout provides an optional electrolytic capacitor (CIN4 = 33µF/80V). This capacitor limits the peak voltage at the input of the MAX17501 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.

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

JUMPER	SHUNT POSITION	EN/UVLO PIN	MAX17501 OUTPUT
JU1	1-2*	Connected to VIN	Enabled
	Not installed	Connected to the center node of resistor-divider R1 and R2	Programmed to startup at desired input voltage level set by R1 and R2
	2-3	Connected to GND	Disabled

**Default position.*

Electromagnetic Interference (EMI)

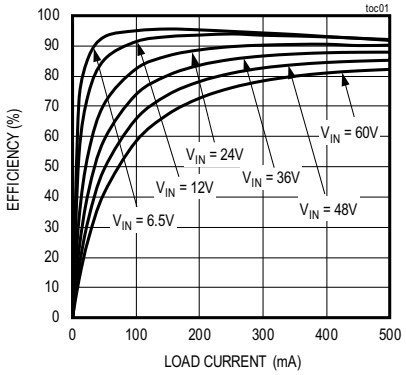
Compliance to conducted emissions (CE) standards requires an EMI filter at the input of a switching power converter. The EMI filter attenuates high-frequency currents drawn by the switching power converter and limits the noise injected back into the input power source.

The MAX17501GTEVKITE# PCB has designated footprints on the bottom side for placement of EMI filter components. Use of these filter components results in lower conducted emissions below CISPR22 Class B limits. Remove the 0Ω resistor which is placed on the L1 footprint before installing conducted EMI filter components. The MAX17501GTEVKITE# EV kit 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

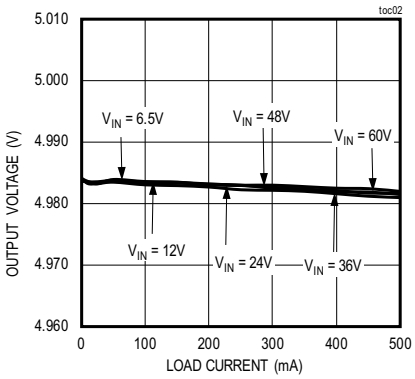
(V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 500mA, T_A = +25°C, All voltages are referenced to GND, unless otherwise noted.)

EFFICIENCY vs. LOAD CURRENT



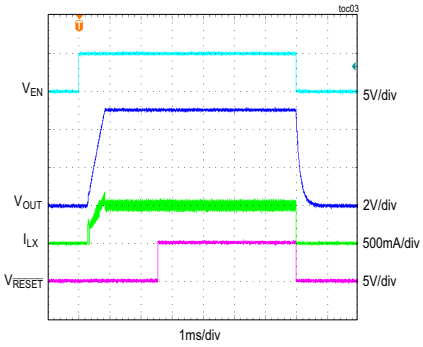
CONDITIONS: f_{SW} = 600kHz

LOAD AND LINE REGULATION



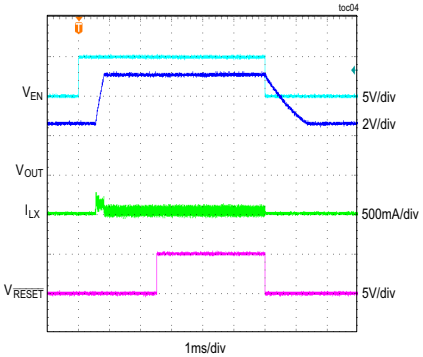
CONDITIONS: f_{SW} = 600kHz

SOFT-START/SHUTDOWN THROUGH EN/UVLO



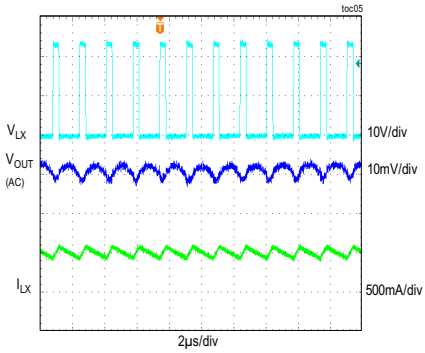
CONDITIONS: 500mA LOAD CURRENT

SOFT-START WITH 2.5V PREBIAS VOLTAGE



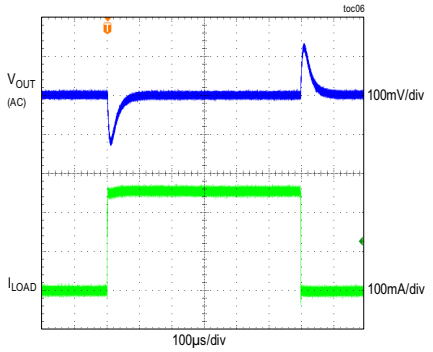
CONDITIONS: 10mA LOAD CURRENT

STEADY-STATE PERFORMANCE



CONDITIONS: 500mA LOAD CURRENT

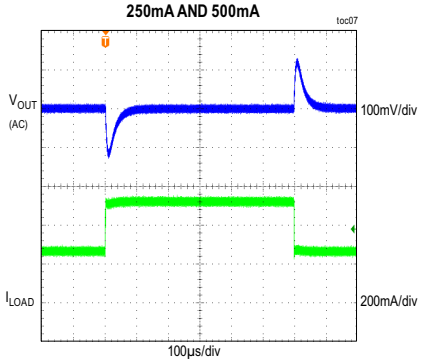
LOAD TRANSIENT RESPONSE BETWEEN 0mA AND 250mA



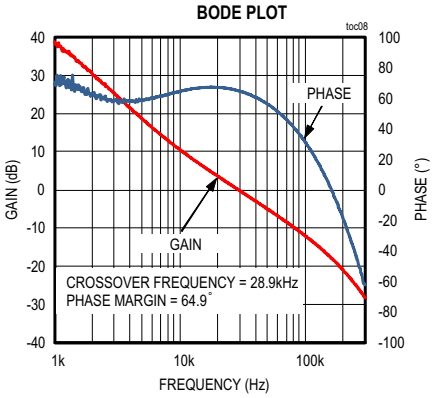
EV Kit Performance Report (continued)

(V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 500mA, T_A = +25°C, All voltages are referenced to GND, unless otherwise noted.)

LOAD TRANSIENT RESPONSE BETWEEN 250mA AND 500mA

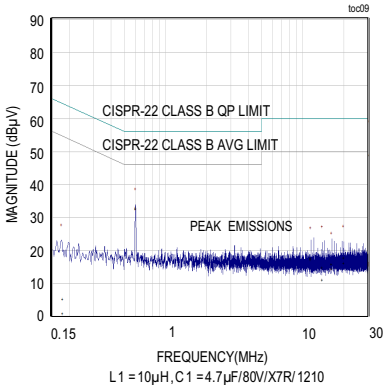


BODE PLOT



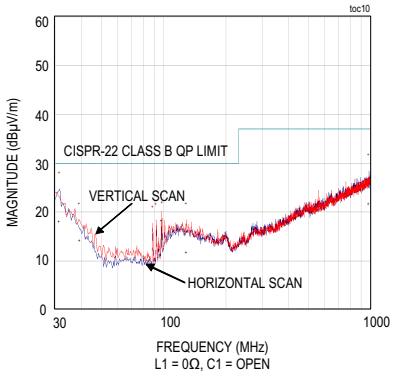
CONDITIONS: 5V OUTPUT, 500mA LOAD CURRENT

CONDUCTED EMISSIONS PLOT 5V OUTPUT, 500mA LOAD CURRENT



L1 = 10µH, C1 = 4.7µF/80V/X7R/1210

RADIATED EMISSIONS PLOT 5V OUTPUT, 500mA LOAD CURRENT



L1 = 0Ω, C1 = OPEN

Component Suppliers

SUPPLIER	WEBSITE
Coilcraft, Inc.	www.coilcraft.com
Murata Americas	www.murata.com
Panasonic Corp.	www.panasonic.com
TDK Corp.	www.component.tdk.com
SullinsCorp	www.sullinscorp.com
AVX	www.avx.com
Taiyo Yuden	www.ty-top.com

Note: *Indicate that you are using the MAX17501 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX17501GTEVKITE#	EV Kit

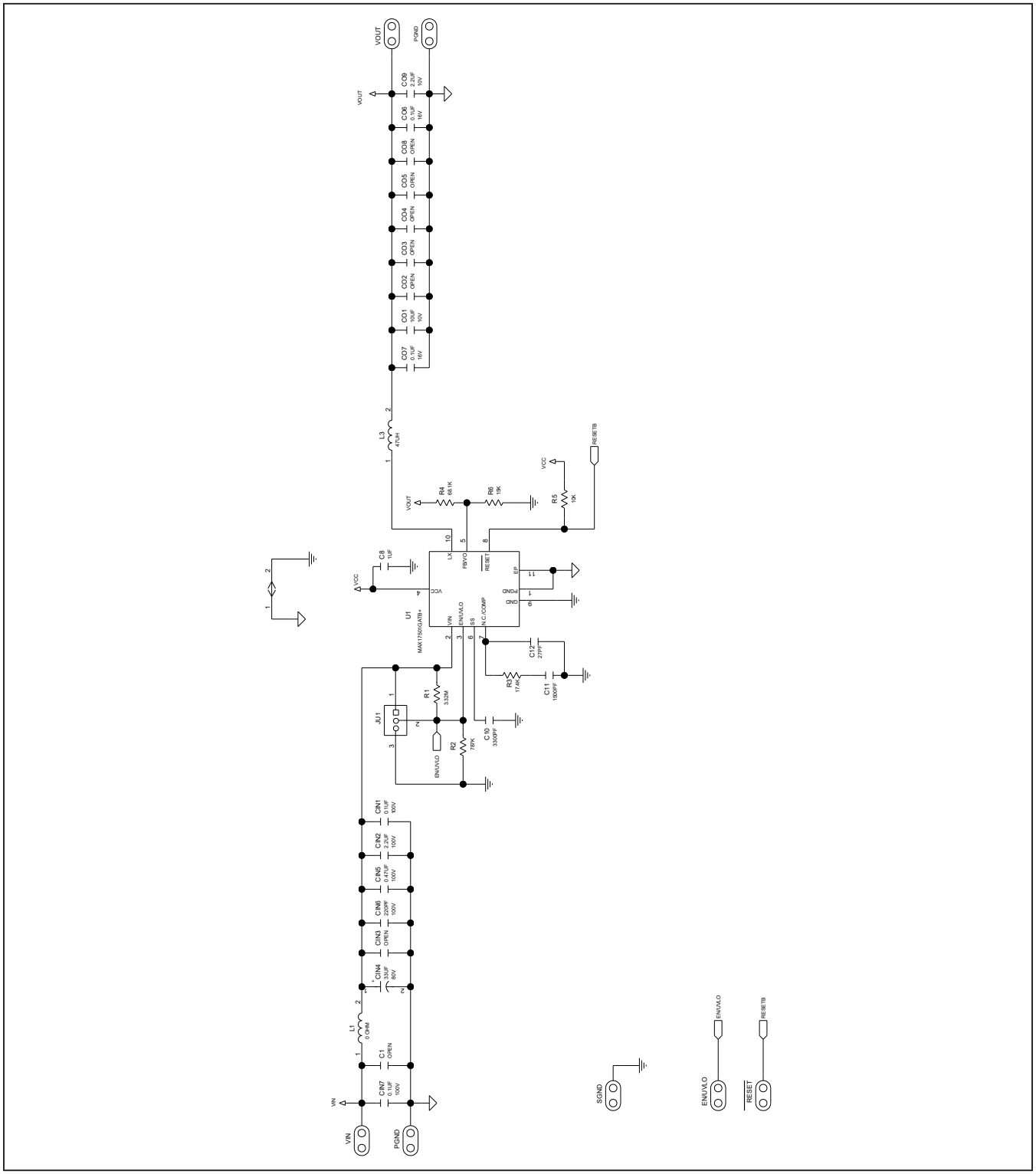
#Denotes RoHS compliance.

MAX17501GTEVKITE# Bill of Materials

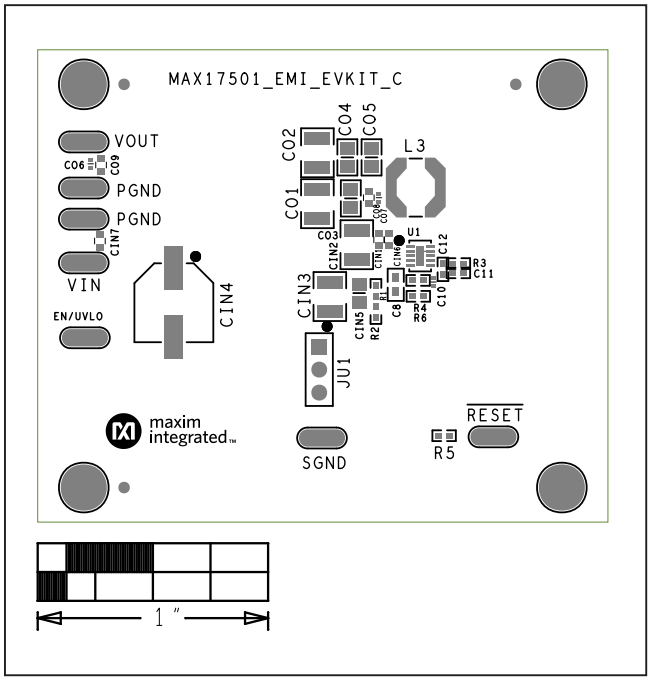
S.No	DESIGNATOR	DESCRIPTION	QUANTITY	MANUFACTURER PART NUMBER
1	CIN1, CIN7	0.1µF, 10%, 100V, X7R, Ceramic capacitor (0603)	2	TAIYO YUDEN HMK107B7104KA-T
2	CIN2	2.2µF, 10%, 100V, X7R, Ceramic capacitor (1210)	1	MURATA GRM32ER72A225KA35
3	CIN4	ALUMINUM-ELECTROLYTIC; 33UF; 80V; TOL=20%; MODEL=FK SERIES	1	PANASONIC EEE-FK1K330P
4	CIN5	0.47µF, 10%, 100V, X7R, Ceramic capacitor (0805)	1	MURATA GRM21BR72A474KA73
5	CIN6	220pF, 5%, 100V, COG, Ceramic capacitor (0603)	1	TDK C1608C0G2A221J080AA
6	C8	1µF, 10%, 25V, X7R, Ceramic capacitor (0603)	1	TDK C1608X7R1E105K080AE
7	C10	3300pF, 2%, 50V, COG, Ceramic capacitor (0402)	1	MURATA GRM1555C1H332GE01
8	C11	1500pF, 2%, 50V, COG, Ceramic capacitor (0402)	1	MURATA GRM1555C1H152JA01
9	C12	27pF, 5%, 50V, X7R, Ceramic capacitor (0402)	1	TAIYO YUDEN TMK042CG270JC-W
10	CO1	10µF, 10%, 10V, X7R, Ceramic capacitor (1210)	1	TAIYO YUDEN LMK325B7106KN-T
11	CO6, CO7	0.1µF, 10%, 16V, X7R, Ceramic capacitor (0402)	2	TAIYO YUDEN EMK105B7104KV-F
12	CO9	2.2µF, 10%, 10V, X7R, Ceramic capacitor (0603)	1	MURATA GRM188R71A225KE15
13	L1	RES+, 0Ω OHM, 1W, (0805)	1	VISHAY CRCW08050000Z0EAHP
14	L3	INDUCTOR, 47µH, 1.2A (6mm x 6mm)	1	COILCRAFT LPS6235-473ML
15	R1	RES+, 3.32MΩ, 1% (0402)	1	VISHAY DALE CRCW04023M32FK
16	R2	RES+, 787KΩ, 1% (0402)	1	VISHAY DALE CRCW0402787KFK
17	R3	RES+, 17.4KΩ, 1% (0402)	1	PANASONIC ERA-2AEB1742X
18	R4	RES+, 68.1KΩ, 1% (0402)	1	VISHAY DALE CRCW040268K1FK
19	R5	RES+, 10KΩ, 1% (0402)	1	VISHAY DALE CRCW040210K0FK
20	R6	RES+, 15KΩ, 1% (0402)	1	VISHAY DALE CRCW040215K0FK
21	U1	ULTRA-SMALL; HIGH-EFFICIENCY; SYNCHRONOUS STEP-DOWN DC-DC CONVERTER; (TDFN10-EP 3mm x 2mm)	1	MAX17501GATB+
22	JU1	3-pin header (36-pin header 0.1” centers)	1	Sullins: PEC03SAAN
23	-	Shunts	1	SULLINS STC02SYAN
24	MH1-MH4	MACHINE SCREW; SLOTTED	4	EAGLE PLASTIC DEVICES P440.375
25	MH1-MH4	HEX STANDOFF #4-40 NYLON 3/8"	4	KEYSTONE ELECTRONICS 1902B
26	C1	OPTIONAL: 4.7µF, 10%, 80V, X7R, Ceramic capacitor (1210)	1	MURATA GRM32ER71K475KE14
27	L1	OPTIONAL: INDUCTOR, 10µH, 0.75A (2.95mm x 2.95mm)	1	COILCRAFT LPS3015-103MR
28	CIN3, CO2	OPEN: Capacitor (1210)	0	
29	CO3, CO4, CO5	OPEN: Capacitor (0805)	0	
30	CO8	OPEN: Capacitor (0603)	0	

DEFAULT JUMPER TABLE	
JUMPER	**SHUNT POSITION**
JU1	1- 2

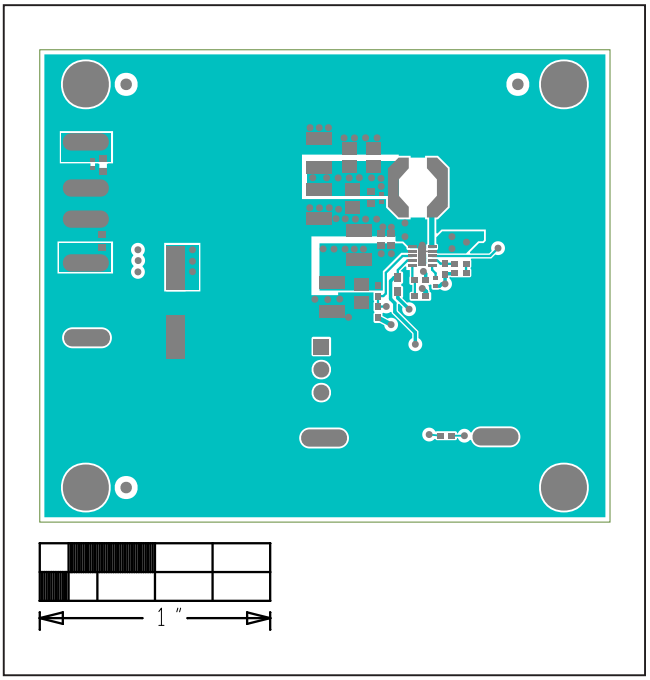
MAX17501GTEVKITE# Schematic



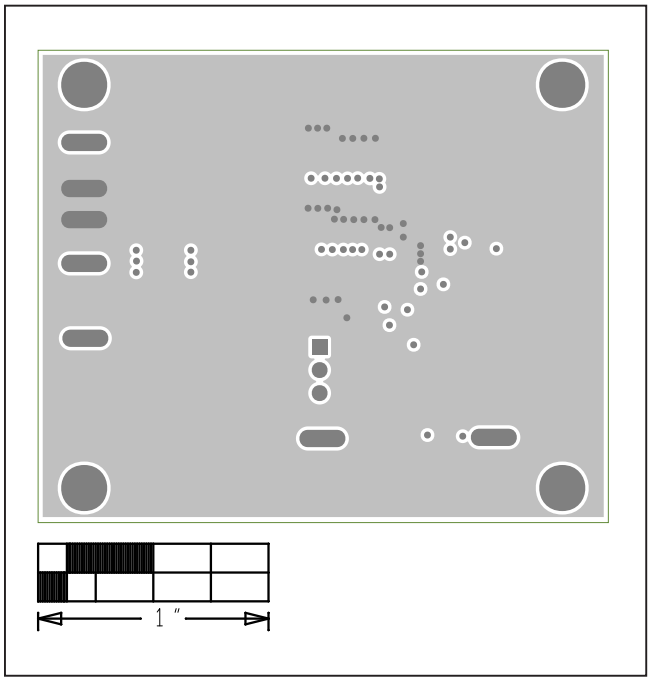
MAX17501GTEVKITE# PCB Layout



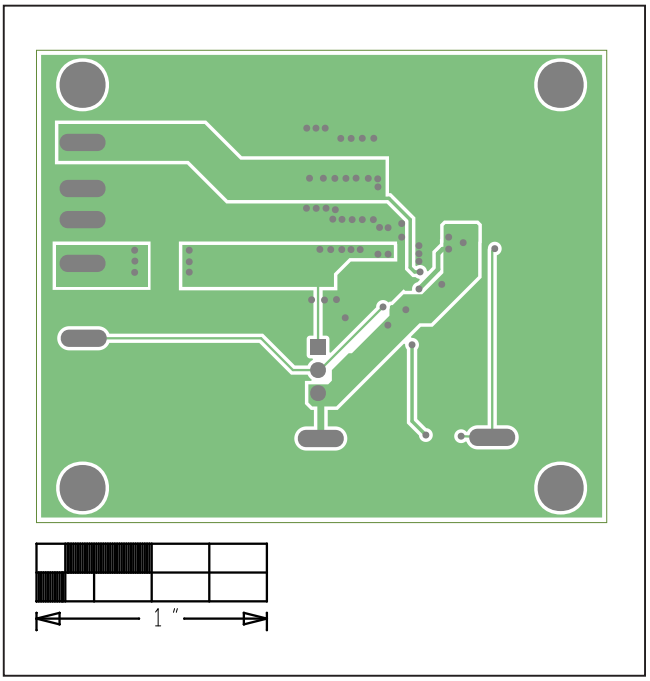
MAX17501GTEVKITE# PCB Layout—Top Silkscreen



MAX17501GTEVKITE# PCB Layout—Top Layer

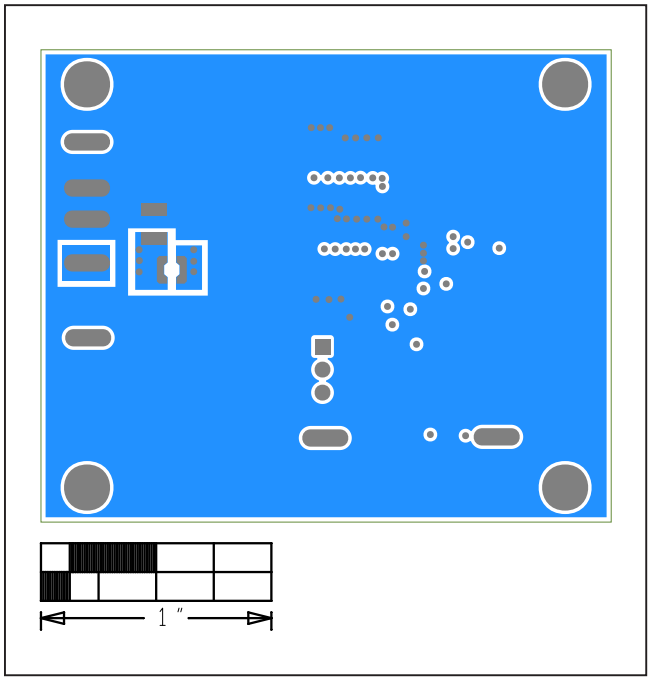


MAX17501GTEVKITE# PCB Layout—Layer 2

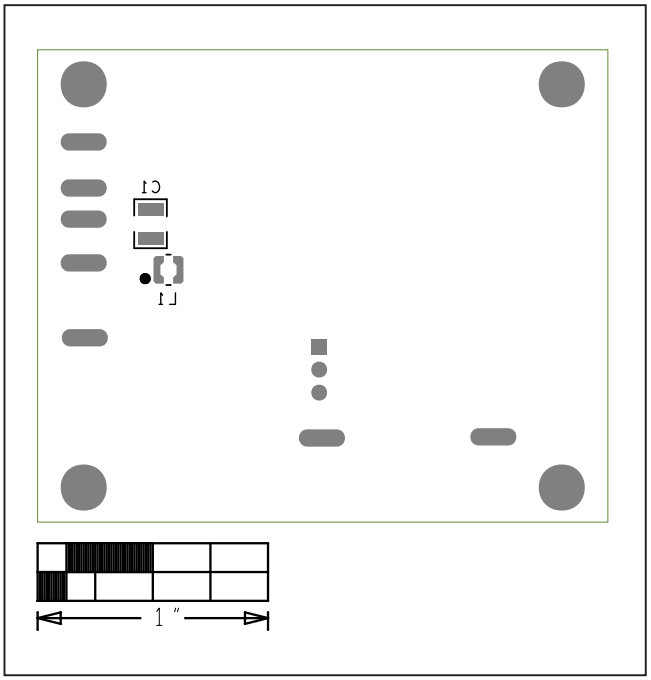


MAX17501GTEVKITE# PCB Layout—Layer 3

MAX17501GTEVKITE# PCB Layout (Continued)



MAX17501GTEVKITE# PCB Layout—Bottom Layer



MAX17501GTEVKITE# PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/19	Initial release	—
1	9/19	Updated title on all pages	1–10

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