Click here for production status of specific part numbers.

MAX17574EVKITBE# Evaluation Kit

Evaluates: MAX17574 5V Output-Voltage Application

General Description

The MAX17574EVKITBE# evaluation kit (EV kit) provides a proven design to evaluate the MAX17574 high-voltage, high-efficiency, synchronous step-down DC-DC converter. The EV kit is preset for 5V output at load currents up to 3A and features a 500kHz 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 MAX17574 IC data sheet.

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

Features

- Operates from a 6.5V to 60V Input Supply
- Programmed 5V Output Voltage, 3A Load Current
- 500kHz Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Adjustable Soft-Start Time
- MODE/SYNC 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

319-100434; Rev 0; 8/19

maxim integrated™

Quick Start

Recommended Equipment

- MAX17574EVKITBE#
- 6.5V to 60V, 5A DC input power supply
- Load capable of sinking 3A
- 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 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 3A 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 shunts are installed across pins 1-2 on jumper JU1 (see Table 1 for details).
5) Select the shunt position on jumper 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.

Detailed Description

The MAX17574EVKITBE# provides a proven design to evaluate the MAX17574 high-voltage, high-efficiency, synchronous step-down DC-DC converter. The EV kit is preset for 5V output from 6.5V to 60V input at load currents up to 3A and features a 500kHz switching frequency for optimum efficiency and component size.

The EV kit includes an EN/UVLO PCB pad and jumper JU1 to enable the output at a desired input voltage. The SYNC PCB pad allows an external clock to synchronize the device. Jumper JU2 allows the selection of a particular MODE/SYNC of operation based on light-load performance requirements. An additional $\overline{\text{RESET}}$ PCB pad is available for monitoring whether 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 the soft-start capacitor (C10) connected between SS and SGND. The selected output capacitance (C_{SEL}) and the output voltage (V_{OUT}) determine the minimum value of C10, as shown by the following equation:

$$C10 \geq 28 \times 10^{-6} \times C_{SEL} \times V_{OUT}$$

The soft-start time (t_{SS}) is related to C10 by the following equation:

$$t_{SS} = C10/(5.55 \times 10^{-6})$$

For example, to program a 1ms soft-start time, C10 should be 5.6nF.

Enable/Undervoltage-Lockout (EN/UVLO) Programming

The MAX17574 offers an Enable and adjustable input undervoltage lockout feature. For normal operation in this EV kit, leave the EN/UVLO jumper (JU1) open. When JU1 is left open, the MAX17574 is enabled when the input voltage rises above 6.4V. To disable MAX17574, 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_{INU}) 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_{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 MAX17574 data sheet.

Mode Selection (MODE/SYNC)

The EV kit provides a jumper (JU2) that allows the MAX17574 to operate in PWM, PFM, and DCM modes. Refer to the MAX17574 data sheet for more details about the modes of operation. Table 2 shows the Mode Selection (JU2) settings that can be used to configure the desired mode of operation.

External Clock Synchronization (MODE/SYNC)

The EV kit provides a MODE/SYNC PCB pad to synchronize the MAX17574 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 MAX17574 operates in PWM mode only. For more details about external clock synchronization, refer to the MAX17574 data sheet.

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

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

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

SHUNT POSITION	EN/UVLO PIN	MAX17574_ 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 Jumper (JU2) Settings

SHUNT POSITION	MODE/SYNC PIN	MAX17574_ MODE
Not installed	Unconnected	PFM mode of operation
2-3*	Connected to SGND	PWM mode of operation
1-2	Connected to VCC	DCM mode of operation

**Default position.*

Hot Plug-In and Long Input Cables

The MAX17574EVKITBE# PCB layout provides an optional electrolytic capacitor (CIN4 = 47µF/80V). This capacitor limits the peak voltage at the input of the MAX17574C 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.

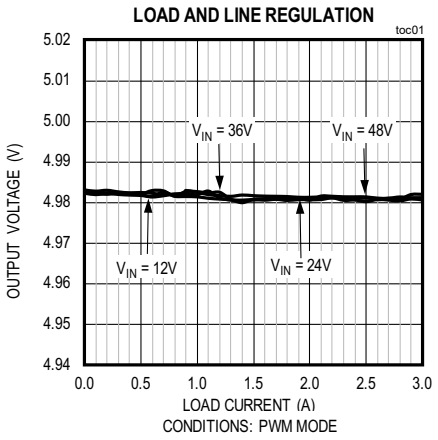
Electromagnetic Interference (EMI)

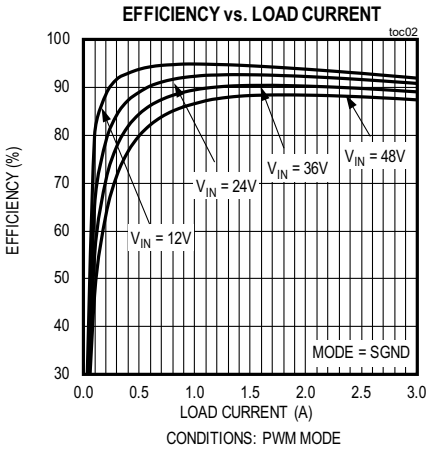
Compliance to conducted emissions (CE) standards requires an electromagnetic interference (EMI) filter at the input of a switching power converter. The EMI filter attenuates high-frequency currents drawn by the switching power converter and limits the noise injected back into the input power source.

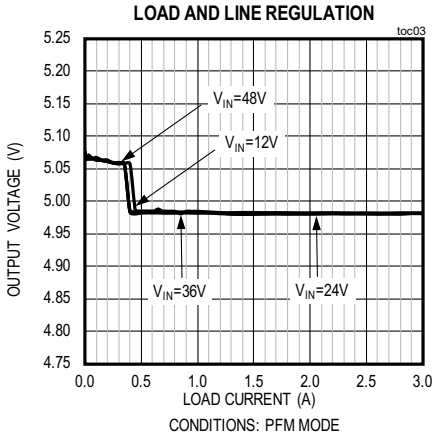
The MAX17574EVKITBE# has designated footprints on the EV kit for placement of EMI filter components. Use of these filter components results in lower conducted emissions below CISPR22 Class B limits. Cut open the trace at L1 before installing conducted EMI filter components. The MAX17574EVKITBE# PCB layout is also designed to limit radiated emissions from switching nodes of the power converter resulting in radiated emissions below CISPR22 Class B limits.

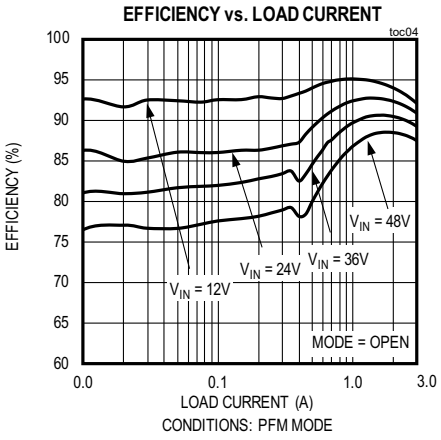
EV Kit Performance Report

(V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 500kHz, unless otherwise noted.)





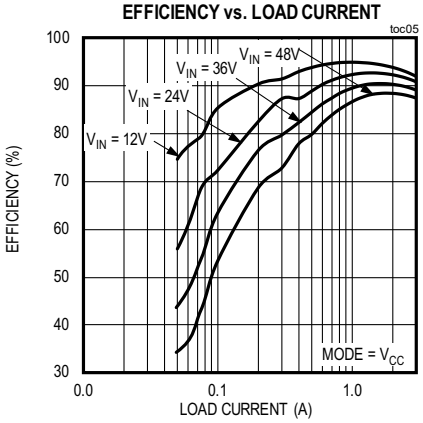




EV Kit Performance Report (continued)

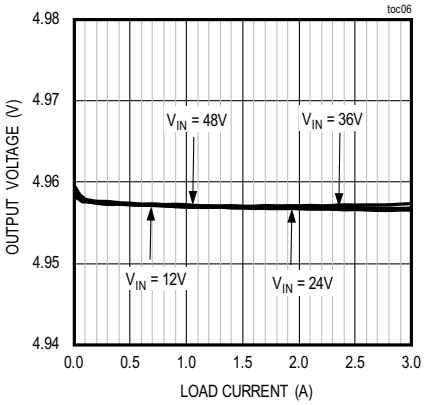
(V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 500kHz, unless otherwise noted.)

EFFICIENCY vs. LOAD CURRENT



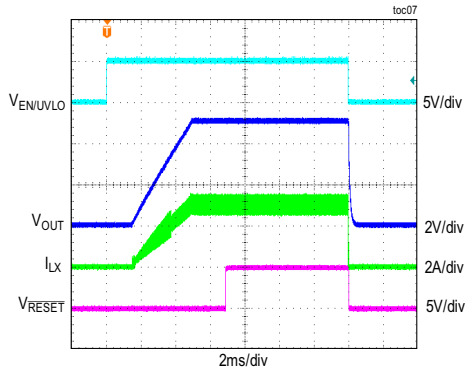
CONDITIONS: DCM MODE

LOAD AND LINE REGULATION



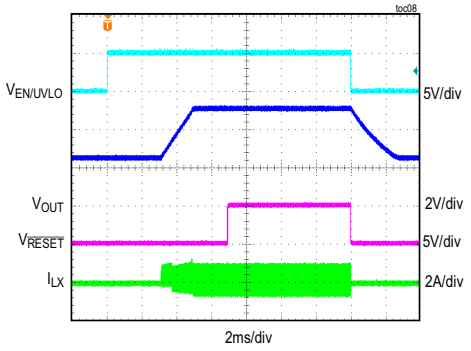
CONDITIONS: DCM MODE

SOFT-START/SHUTDOWN THROUGH EN/UVLO



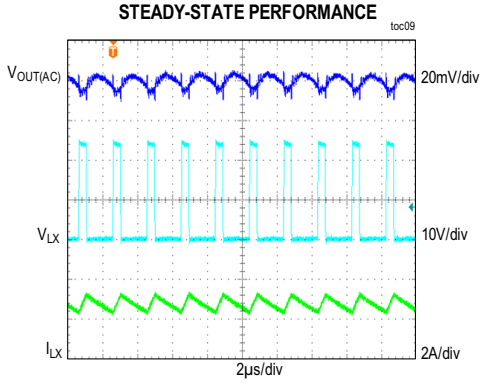
CONDITIONS: PWM MODE, R_{LOAD} = 1.66Ω

SOFT-START WITH PREBIAS VOLTAGE OF 2.5V



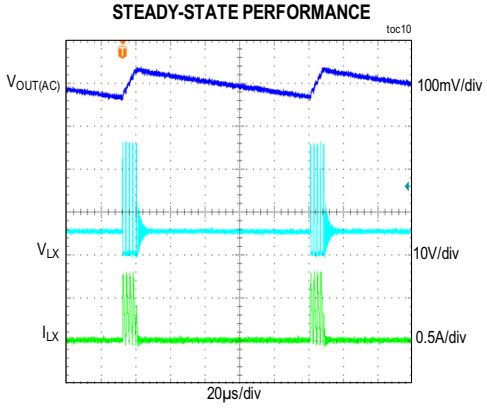
CONDITIONS: PWM MODE, R_{LOAD} = 166Ω

STEADY-STATE PERFORMANCE



CONDITIONS: PWM MODE, 3A LOAD

STEADY-STATE PERFORMANCE

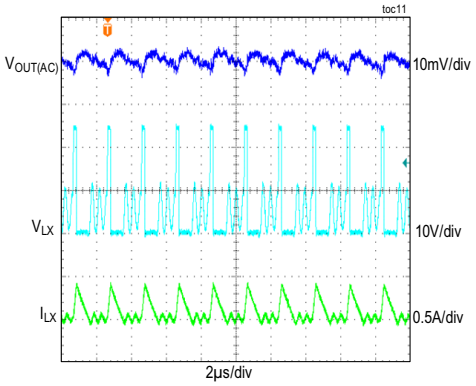


CONDITIONS: PFM MODE, 25mA LOAD

EV Kit Performance Report (continued)

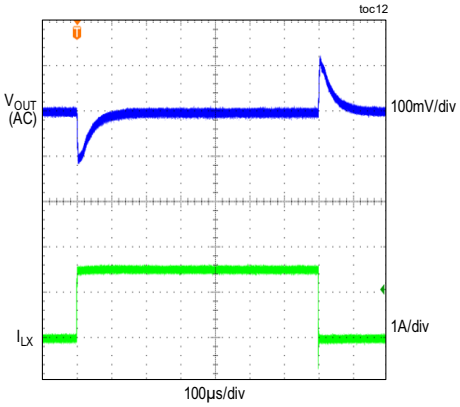
(V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 500kHz, unless otherwise noted.)

STEADY-STATE PERFORMANCE



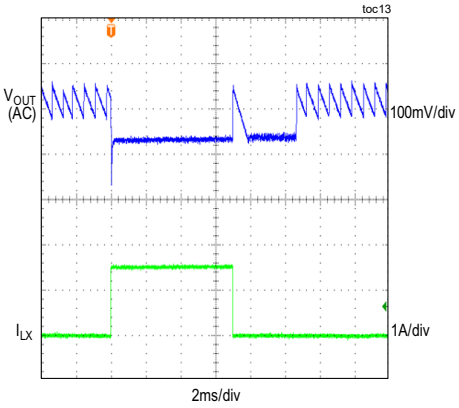
CONDITIONS: DCM MODE, 75mA LOAD

LOAD TRANSIENT RESPONSE BETWEEN 0A AND 1.5A



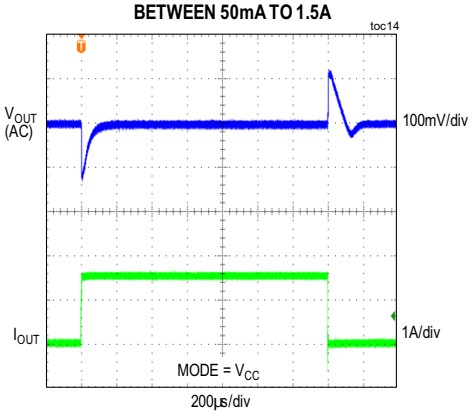
CONDITIONS: PWM MODE

LOAD TRANSIENT RESPONSE BETWEEN 5mA TO 1.5A



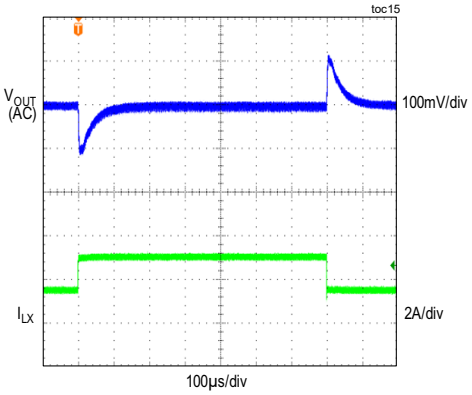
CONDITIONS: PFM MODE

LOAD TRANSIENT RESPONSE BETWEEN 50mA TO 1.5A



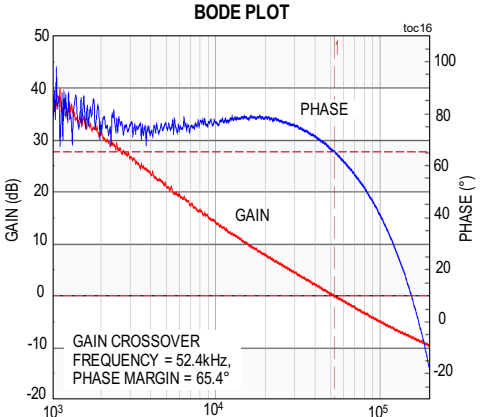
CONDITIONS: DCM MODE

LOAD TRANSIENT RESPONSE BETWEEN 1.5A TO 3A



CONDITIONS: PWM MODE

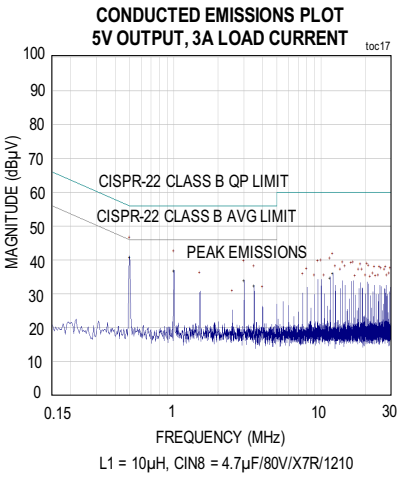
BODE PLOT

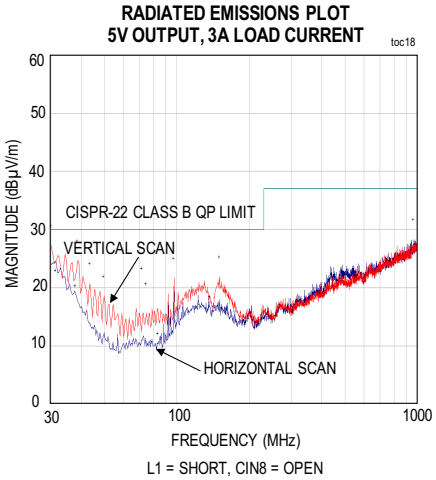


CONDITIONS: 5V OUTPUT, 3A LOAD CURRENT

EV Kit Performance Report (continued)

(V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 500kHz, unless otherwise noted.)





Component Suppliers

SUPPLIER	WEBSITE
Coilcraft, Inc.	www.coilcraft.com
Vishay Dale	www.vishay.com
Murata Americas	www.murata.com
Panasonic Corp.	www.panasonic.com
Taiyo Yuden	www.t-yuden.com
TDK Corp.	www.tdk.com
AVX corporation	www.avx.com

Note: *Indicate that you are using the MAX17574 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX17574EVKITBE#	EV Kit

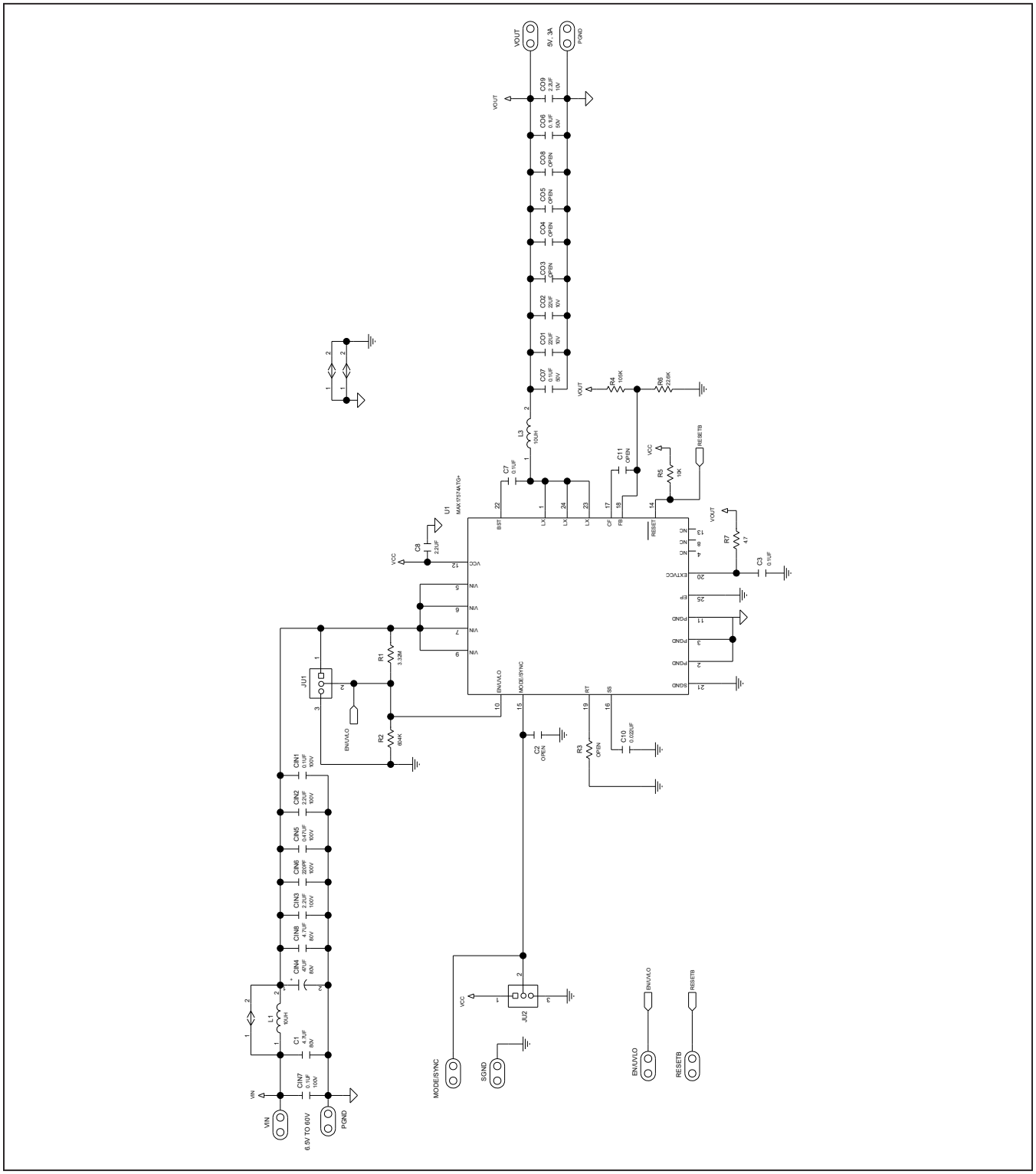
+Denotes a lead(Pb)-free/RoHS-compliant package.

MAX17574EVKITBE# EV Kit Bill of Materials

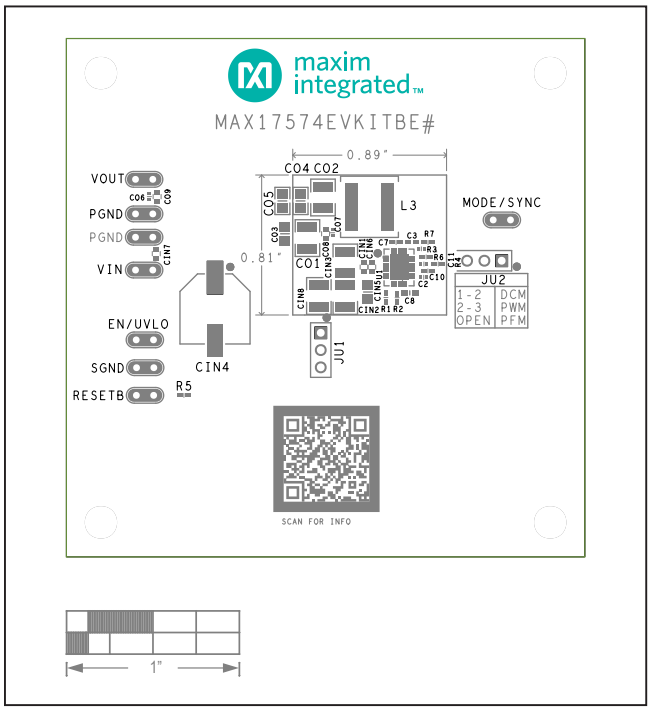
S. No	Designator	Description	Quantity	Manufacturer Part Number
1	C1	4.7µF, 10%, 80V, X7R, Ceramic capacitor (1210)	1	MURATA GRM32ER71K475KE14
2	CIN1, CIN7	0.1µF, 10%, 100V, X7R, Ceramic capacitor (0603)	2	TAIYO YUDEN HMK107B7104KA-T
3	CIN2, CIN3	2.2µF, 10%, 100V, X7R, Ceramic capacitor (1210)	2	TDK CGA6N3X7R2A225K230
4	CIN4	ALUMINUM-ELECTROLYTIC; 47UF; 80V; TOL=20%; MODEL=EEV SERIES	1	PANASONIC EEE-FK1K470P
5	CIN5	0.47µF, 10%, 100V, X7R, Ceramic capacitor (0805)	1	AVX 08051C474K4T2A
6	CIN6	220pF, 5%, 100V, COG, Ceramic capacitor (0603)	1	TDK C1608C0G2A221J080AA
7	C3, CO6, CO7	0.1µF, 10%, 50V, X7R, Ceramic capacitor (0402)	3	MURATA GCM155R71H104KE02
8	C7	0.1µF, 10%, 16V, X7R, Ceramic capacitor (0402)	1	MURTA GCM155R71C104KA55D
9	C8, CO9	2.2µF, 10%, 10V, X7R, Ceramic capacitor (0603)	2	MURATA GRM188R71A225KE15
10	C10	22000pF, 20%, 25V, COG, Ceramic capacitor (0402)	1	TAIYO YUDEN TMK105B7223MVHF
11	CO1, CO2	22µF, 10%, 10V, X7R, Ceramic capacitor (1210)	2	MURATA GCM32ER71A226KE12L
12	L3	INDUCTOR, 10µH, 8.7A (8mm x 8mm)	1	COILCRAFT XAL8080-103ME
13	R1	RES+, 3.32MΩ, 1% (0402)	1	VISHAY DALE CRCW04023M32FK
14	R2	RES+, 604KΩ, 1% (0402)	1	PANASONIC ERJ-2RKF6043X
15	R4	RES+, 105KΩ, 1% (0402)	1	VISHAY DALE CRCW0402105KFK
16	R5	RES+, 10KΩ, 1% (0402)	1	VISHAY DALE CRCW040210K0FK
17	R6	RES+, 22.6KΩ, 1% (0402)	1	VISHAY DALE CRCW040222K6FK
18	R7	RES+, 4.7Ω, 1% (0402)	1	VISHAY DALE CRCW04024R70FK
19	U1	HIGH-EFFICIENCY SYNCHRONOUS STEP-DOWN DC-DC CONVERTER WITH INTERNAL COMPENSATION (TQFN24-EP 4mm x 5mm)	1	MAX17574ATG+
20	JU1-JU2	3-pin header (36-pin header 0.1” centers)	2	Sullins: PEC03SAAN
21	-	Shunts	2	SULLINS STC02SYAN
22	MH1-MH4	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	4	KEYSTONE 9032
23	CIN8	OPTIONAL: 4.7µF, 10%, 80V, X7R, Ceramic capacitor (1210)	1	MURATA GRM32ER71K475KE14
24	L1	OPTIONAL: INDUCTOR, 10µH, 3.1A (4mm x 4mm)	1	COILCRAFT XAL4040-103ME
25	C2, C11	OPEN: Capacitor (0402)	0	
26	CO3, CO4, CO5	OPEN: Capacitor (0805)	0	
27	CO8	OPEN: Capacitor (0603)	0	
28	R3	OPEN: Resistor (0402)	0	

DEFAULT JUMPER TABLE	
JUMPER	**SHUNT POSITION**
JU1	OPEN
JU2	2-3

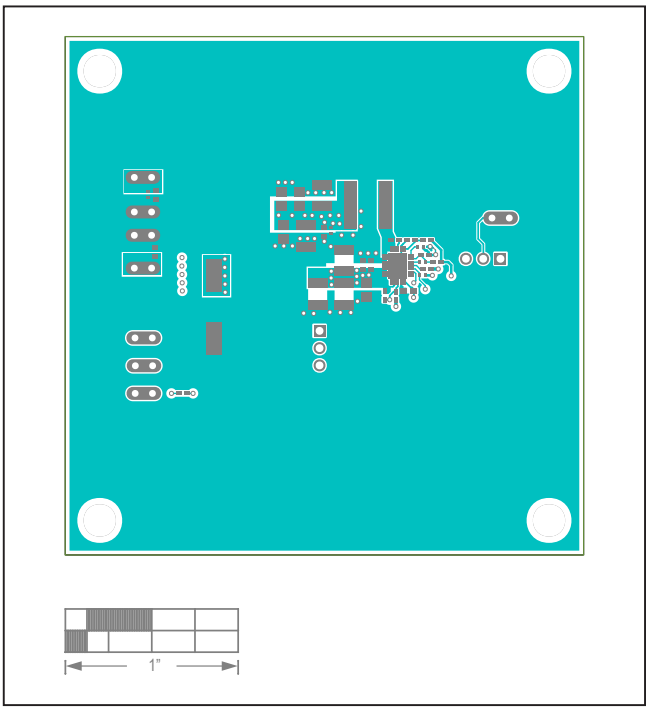
MAX17574EVKITBE# EV Kit Schematic



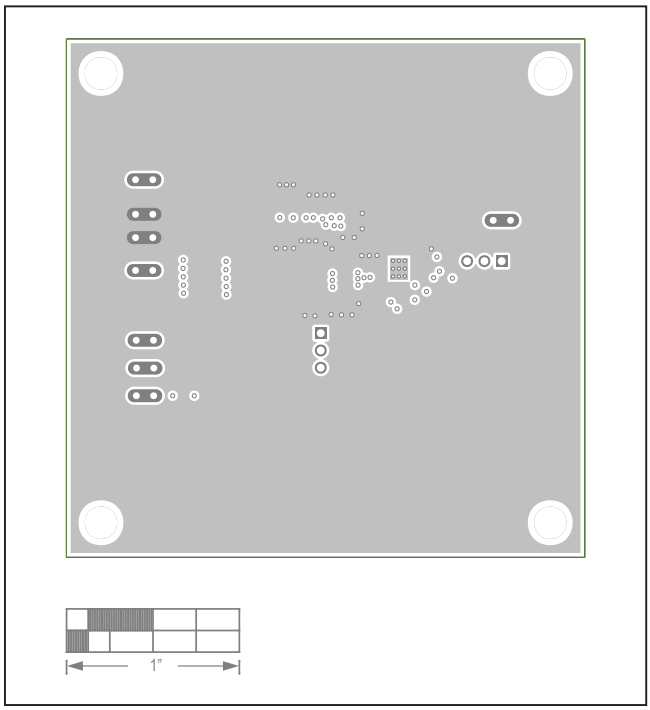
MAX17574EVKITBE# EV Kit PCB Layout



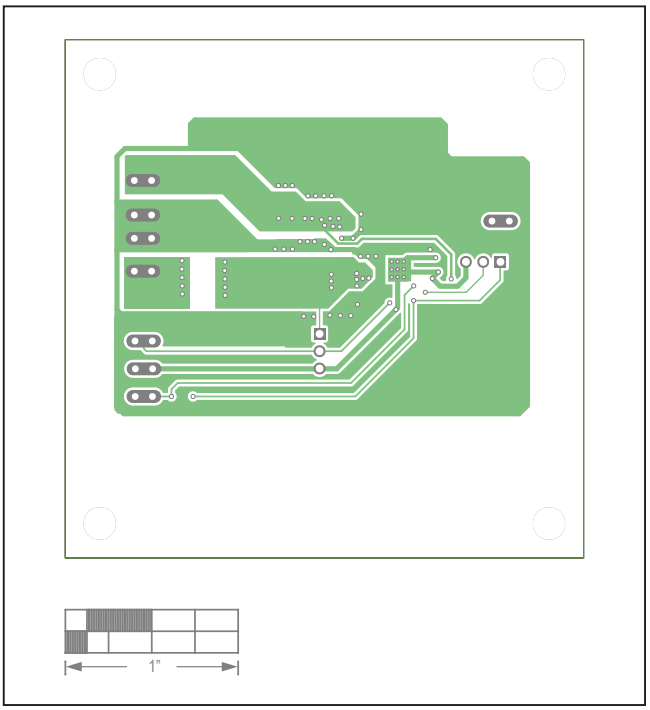
MAX17574EVKITBE# EV Kit—Top Silkscreen



MAX17574EVKITBE# EV Kit—Top Layer

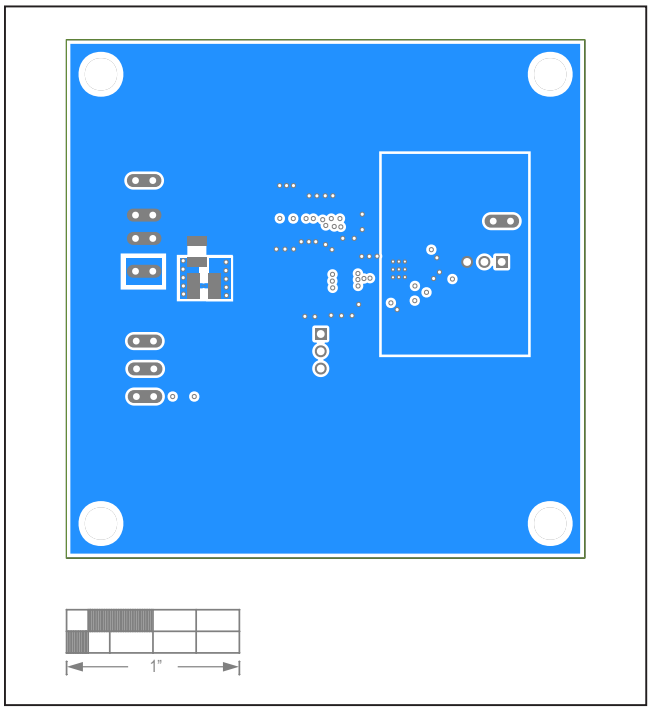


MAX17574EVKITBE# EV Kit—Layer 2

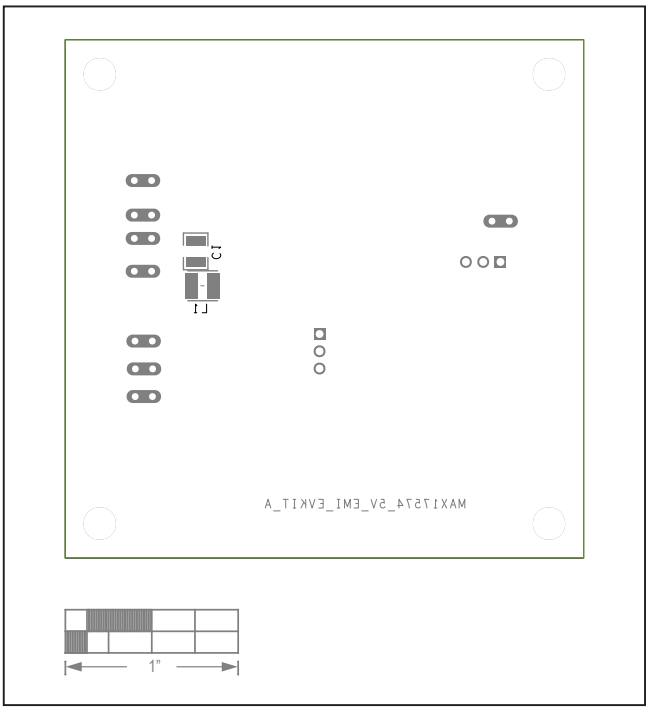


MAX17574EVKITBE# EV Kit—Layer 3

MAX17574EVKITBE# EV Kit PCB Layout (continued)



MAX17574EVKITBE# EV Kit—Bottom Layer



MAX17574EVKITBE# EV Kit—Bottom Silkscreen