Click here for production status of specific part numbers.

MAX17662BEVKITB# Evaluation Kit

Evaluates: MAX17662 in 5V Output-Voltage Application

General Description

The MAX17662BEVKITB# evaluation kit (EV kit) provides a proven design to evaluate the MAX17662B high-efficiency, synchronous step-down DC-DC converter. The EV kit provides 5V/2A at the output from a 6.5V to 36V input supply. The switching frequency of the EV kit is preset to 500kHz for optimum efficiency and component size. The EV kit features adjustable input undervoltage lockout, adjustable soft-start, open-drain $\overline{\text{RESET}}$ signal. 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 MAX17662B data sheet.

Features

- Operates from a 6.5V to 36V Input Supply
- 5V Output Voltage
- Delivers Up to 2A Output Current
- 500kHz Switching Frequency
- Enable/Undervoltage Lockout Input, Resistor-Programmable UVLO Threshold
- Adjustable Soft-Start Time
- Open-Drain $\overline{\text{RESET}}$ Output
- Overcurrent and Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested
- Compliance with CISPR22(EN55022) Class B Conducted and Radiated Emissions

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

Quick Start

Recommended Equipment

- MAX17662BEVKITB#
- 6.5V to 36V, 2A DC-input power supply
- Load capable of sinking 2A
- One 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 36V. Then, 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 2A 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 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.
9) Verify that the DVM displays at $\overline{\text{RESET}}$ PCB pad is 1.8V.

319-100429; Rev 1; 9/19

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Detailed Description

The MAX17662BEVKITB# EV kit is designed to deliver load current up to 2A at 5V output voltage from a 6.5V to 36V input supply. The switching frequency of the EV kit is configured at 500 kHz by leaving the RT resistor open.

The EV kit includes an EN/UVLO PCB pad and jumper JU1 to enable the output at a desired minimum input voltage. Jumper JU2 allows the selection of the mode 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 the startup. The soft-start time is adjusted by the value of C3, the external capacitor connected between SS and SGND. The selected output capacitance (C_{SEL}) and the output voltage (V_{OUT}) determine the minimum value of C3, as shown by the following equation:

$$C3 \geq 28 \times 10^{-6} \times C_{SEL} \times V_{OUT}$$

The soft-start time (t_{SS}) is related to the soft-start capacitor C3 by the following equation:

$$t_{SS} = \frac{C3}{\left(8.325 \times 10^{-6}\right)}$$

For example, to program a 0.82ms soft-start time, C3 should be 6800pF.

Enable/Undervoltage-Lockout (EN/UVLO) Programming

The MAX17662B offers an enable and an adjustable input undervoltage lockout feature. In this EV kit, for normal operation, leave EN/UVLO jumper (JU1) open. When JU1 is left open, the MAX17662B is enabled when the input voltage rises above 6.3V. To disable MAX17662B, 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 jumper 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, then calculate R2 as follows:

$$R2 = \frac{R1 \times 1.25}{(V_{INU} - 1.25)}$$

where,

V_{INU} is the voltage at which the device is required to turn on.

R1 and R2 are in kΩ,

For more details about setting the input undervoltage lockout level, refer to the MAX17662B data sheet.

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

SHUNT POSITION	EN/UVLO PIN	MAX17662B OUTPUT
1-2	Connected to V_{IN}	Always enabled
Not installed*	Connected to the center node of resistor-divider R1 and R2	Enabled, UVLO level is set by the resistor-divider between V_{IN} and SGND
2-3	Connected to SGND	Disabled

**Default position.*

Mode Selection (MODE)

The EV kit provides a jumper (JU2) that allows the MAX17662B to operate in PWM and DCM modes. The EV kit also provides a MODE PCB pad to monitor MODE pin voltage of the converter in desired mode of operation. Refer to the MAX17662B 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.

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 V_{OUT} rises above 95% (typ) of its nominal regulated voltage. $\overline{RESET}$ goes low when V_{OUT} falls below 92% (typ) of its nominal regulated voltage.

Hot Plug-In and Long Input Cables

The MAX17662BEVKITB# PCB layout provides an optional electrolytic capacitor (C6 = 47µF/50V). This capacitor limits the peak voltage at the input of the MAX17662B 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 MAX17662BEVKITB# 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 on L2 before installing conducted EMI filter components. The MAX17662BEVKITB# 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.

Table 2. Mode Selection (JU2) Settings

SHUNT POSITION	MODE PIN	MAX17662B OUTPUT
1-2	Connected to V_{CC}	DCM mode of operation
2-3*	Connected to SGND	PWM mode of operation

**Default position.*

Component Suppliers

SUPPLIER	WEBSITE
Coilcraft	www.coilcraft.com
Murata Americas	www.murata.com
Panasonic	www.panasonic.com
Vishay Dale	www.vishay.com
TDK Corp.	www.tdk.com
SullinsCorp	www.sullinscorp.com
Taiyo yuden	www.ty-top.com

Note: *Indicate that you are using the MAX17662B when contacting these component suppliers.*

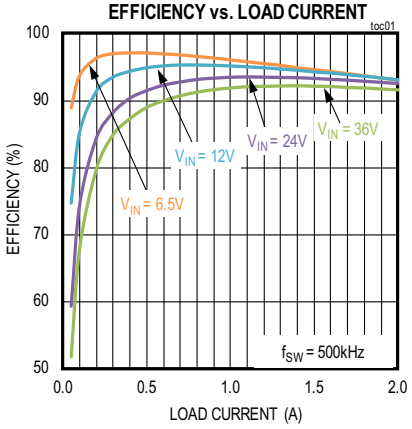
Ordering Information

PART	TYPE
MAX17662BEVKITB#	EV KIT

MAX17662BEVKITB# EV Kit Performance Report

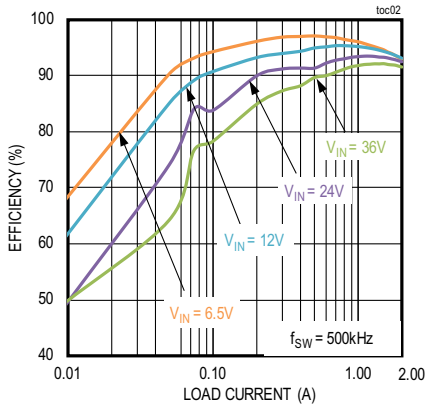
(V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 2A, f_{SW} = 500kHz, T_A = +25ºC, unless otherwise noted.)

EFFICIENCY vs. LOAD CURRENT



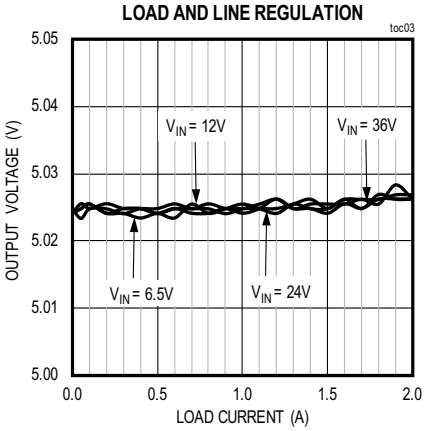
CONDITIONS: PWM MODE

EFFICIENCY vs. LOAD CURRENT



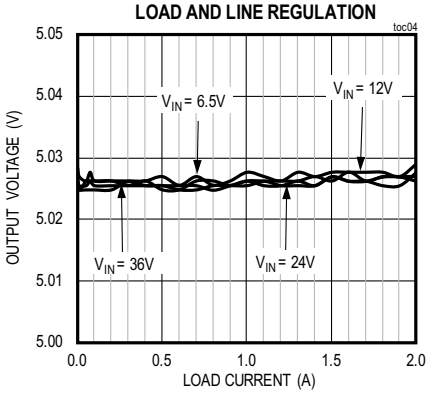
CONDITIONS: DCM MODE

LOAD AND LINE REGULATION



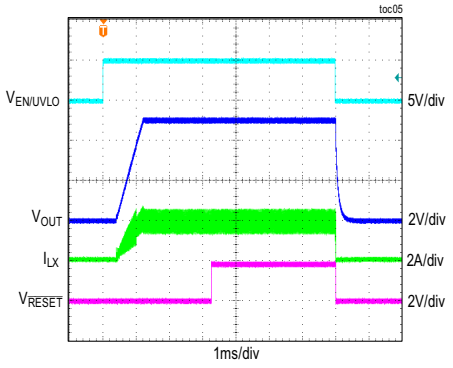
CONDITIONS: PWM MODE

LOAD AND LINE REGULATION



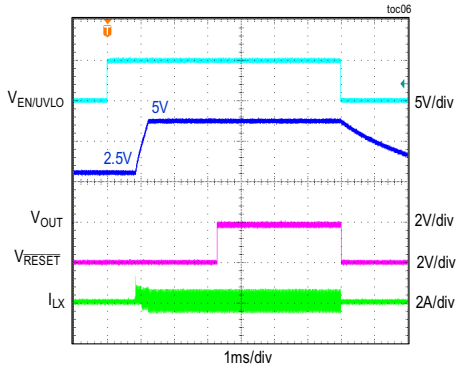
CONDITIONS: DCM MODE

SOFT-START/SHUTDOWN THROUGH EN/UVLO



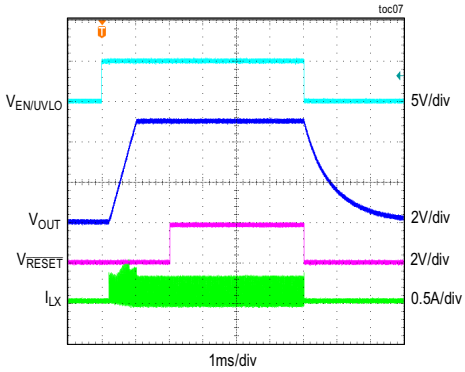
CONDITIONS: PWM MODE, R_{LOAD} = 2.5Ω

SOFT-START WITH PREBIAS VOLTAGE OF 2.5V



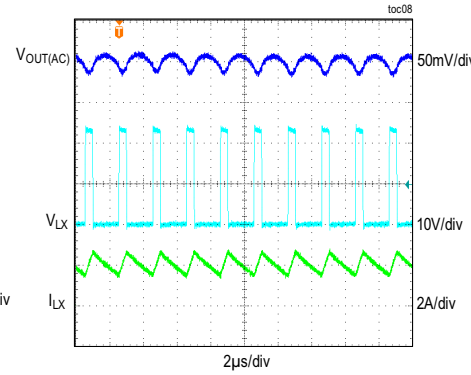
CONDITIONS: PWM MODE, R_{LOAD} = 250Ω

SOFT-START/SHUTDOWN THROUGH EN/UVLO



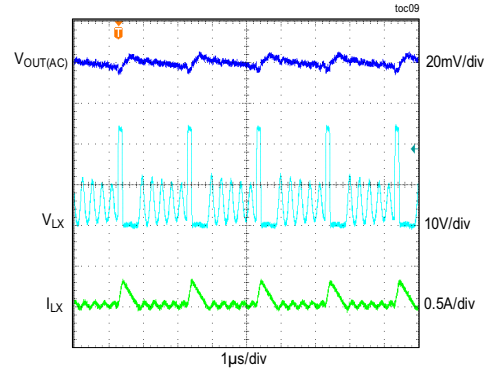
CONDITIONS: DCM MODE, R_{LOAD} = 250Ω

STEADY-STATE PERFORMANCE



CONDITIONS: PWM MODE, 2A LOAD

STEADY-STATE PERFORMANCE

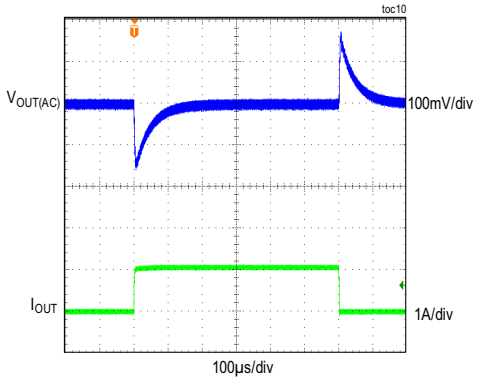


CONDITIONS: DCM MODE, 20mA LOAD

MAX17662BEVKITB# EV Kit Performance Report (continued)

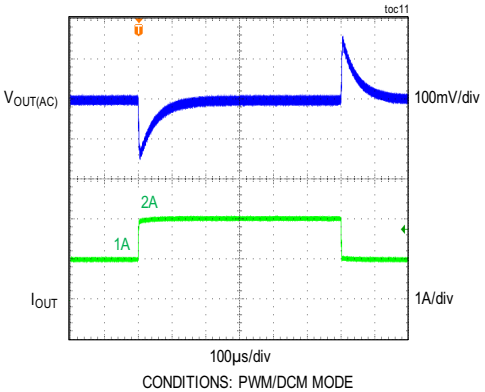
(V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 2A, f_{SW} = 500kHz, T_A = +25ºC, unless otherwise noted.)

LOAD TRANSIENT BETWEEN 0A AND 1A



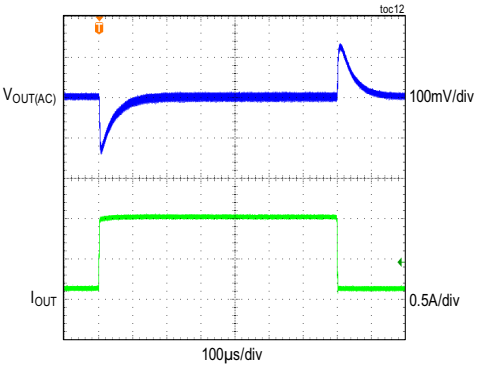
CONDITIONS: PWM MODE

LOAD TRANSIENT BETWEEN 1A AND 2A



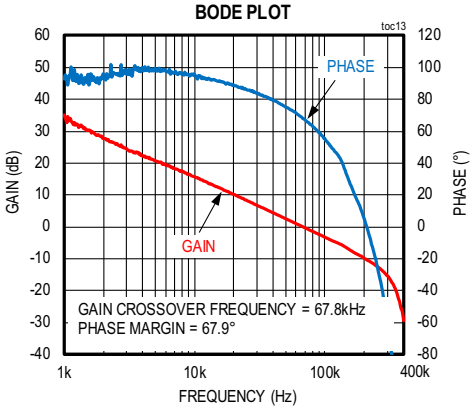
CONDITIONS: PWM/DCM MODE

LOAD TRANSIENT BETWEEN 100mA AND 1A



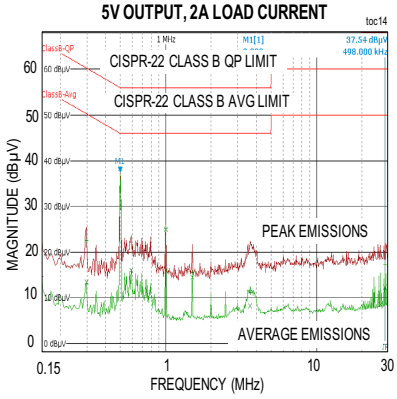
CONDITIONS: 5V OUTPUT, DCM MODE,
C4 = 47µF/10V/X7R/1210, R3 = 182kΩ, R4 = 24.9kΩ

BODE PLOT



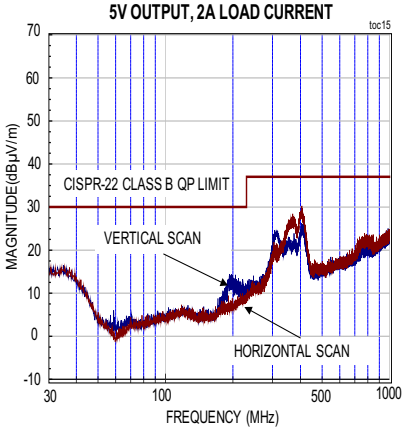
CONDITIONS: 5V OUTPUT, 2A LOAD

CONDUCTED EMISSIONS PLOT
5V OUTPUT, 2A LOAD CURRENT



L2 = 10µH, C13 = C14 = 4.7µF/ 50V/X7R/1206

RADIATED EMISSIONS PLOT
5V OUTPUT, 2A LOAD CURRENT



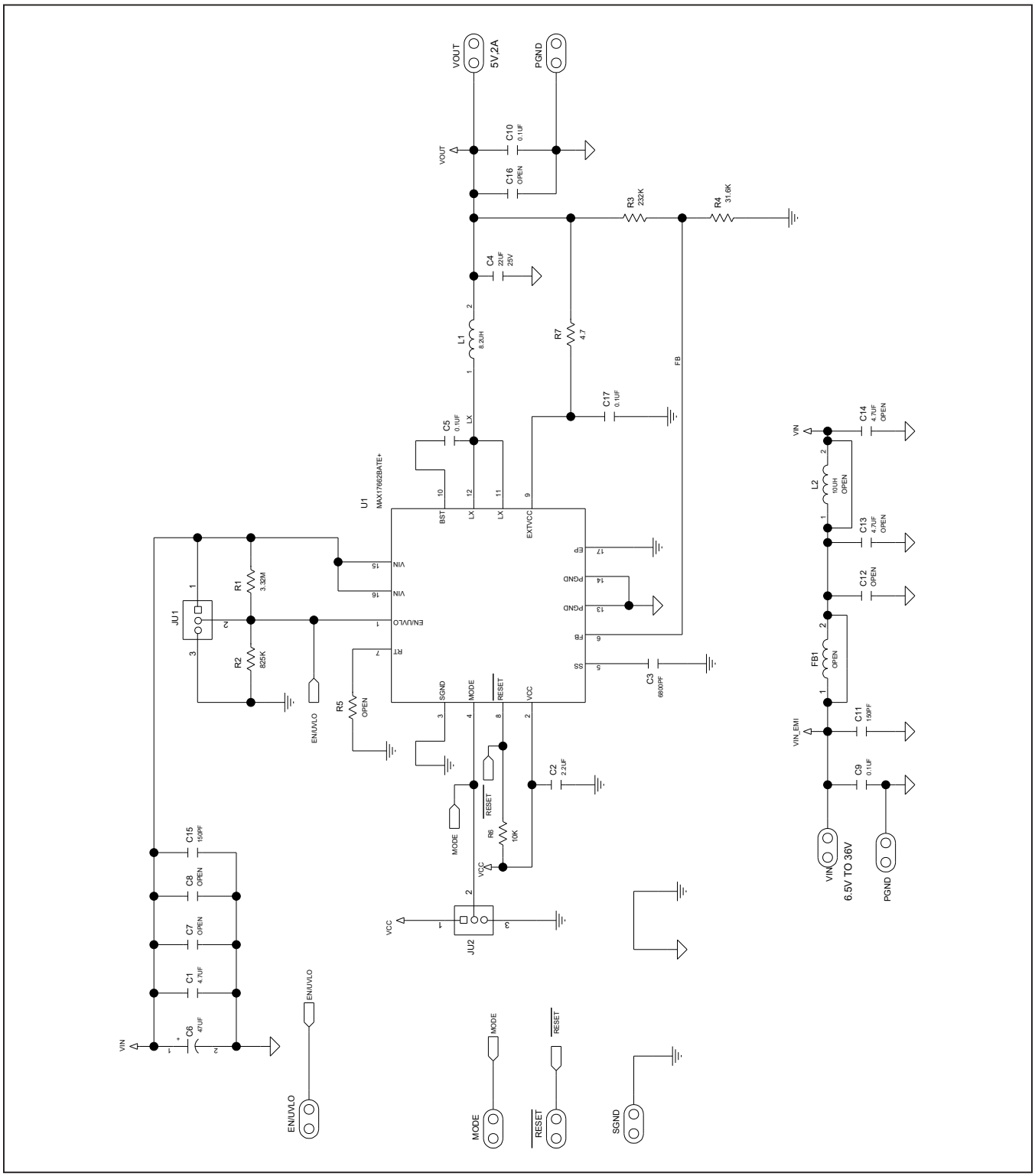
L2 = SHORT, C13 = C14 = OPEN

MAX17662BEVKITB# Bill of Materials

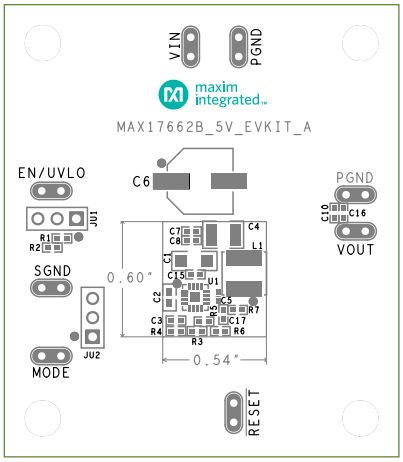
S. No	Designator	Description	Quantity	Manufacturer Part Number
1	C1	4.7µF, 10%, 50V, X7R, Ceramic capacitor (1206)	1	MURATA GRM31CR71H475KA12
2	C2	2.2µF, 10%, 10V, X7R, Ceramic capacitor (0603)	1	MURATA GRM188R71A225KE15
3	C3	6800pF, 10%, 50V, X7R, Ceramic capacitor (0402)	1	MURATA GCM155R71H682KA55
4	C4	22µF, 10%, 25V, X7R, Ceramic capacitor (1210)	1	MURATA GRM32ER71E226ME15
5	C5, C10, C17	0.1µF, 10%, 16V, X7R, Ceramic capacitor (0402)	3	TAIYO YUDEN EMK105B7104KV
6	C6	ALUMINUM-ELECTROLYTIC; 47UF; 50V; TOL=20%; MODEL=EEV SERIES	1	PANASONIC EEE-TG1H470UP
7	C9	0.1µF, 10%, 50V, X7R, Ceramic capacitor (0402)	1	TDK C1005X7R1H104K050BE
8	C11, C15	150pF, 5%, 100V, COG, Ceramic capacitor (0402)	2	TDK C1005C0G2A151J050BA
9	L1	INDUCTOR, 8.2µH, 4.5A (5mm x 5mm)	1	COILCRAFT XAL5050-822ME
10	R1	RES+, 3.32MΩ, 1% (0402)	1	VISHAY DALE CRCW04023M32FK
11	R2	RES+, 825KΩ, 1% (0402)	1	VISHAY DALE CRCW0402825KFK
12	R3	RES+, 232KΩ, 1% (0402)	1	VISHAY DALE CRCW0402232KFK
13	R4	RES+, 31.6KΩ, 1% (0402)	1	VISHAY DALE CRCW040231K6FK
14	R6	RES+, 10KΩ, 1% (0402)	1	VISHAY DALE CRCW040210K0FK
15	R7	RES+, 4.7Ω, 1% (0402)	1	VISHAY DALE CRCW04024R70FK
16	U1	HIGH-EFFICIENCY SYNCHRONOUS STEP-DOWN DC-DC CONVERTER WITH INTERNAL COMPENSATION (TQFN16-EP 3mm x 3mm)	1	MAX17662BATE+
17	JU1-JU2	3-pin header (36-pin header 0.1” centers)	2	Sullins: PEC03SAAN
18	-	Shunts	2	SULLINS STC02SYAN
19	MH1-MH4	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	4	KEYSTONE 9032
20	C13, C14	OPTIONAL: 4.7µF, 10%, 50V, X7R, Ceramic capacitor (1206)	2	MURATA GRM31CR71H475KA12
21	L2	OPTIONAL: INDUCTOR, 10µH, 3.1A (4mm x 4mm)	1	COILCRAFT XAL4040-103ME
22	FB1	OPEN: Ferrite Bead (0805)	0	
23	C7, C8, C12, C16	OPEN: Capacitor (0402)	0	
24	R5	OPEN: Resistor (0402)	0	

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

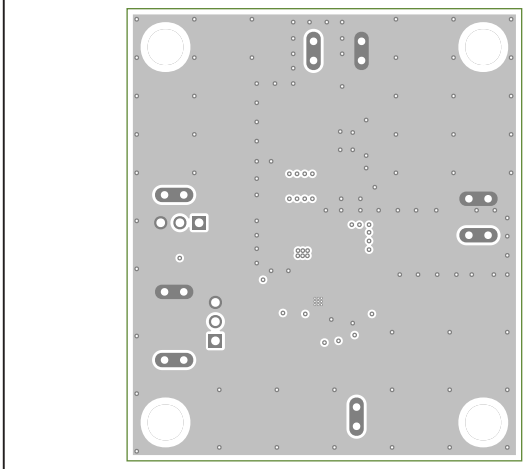
MAX17662BEVKITB# Schematic



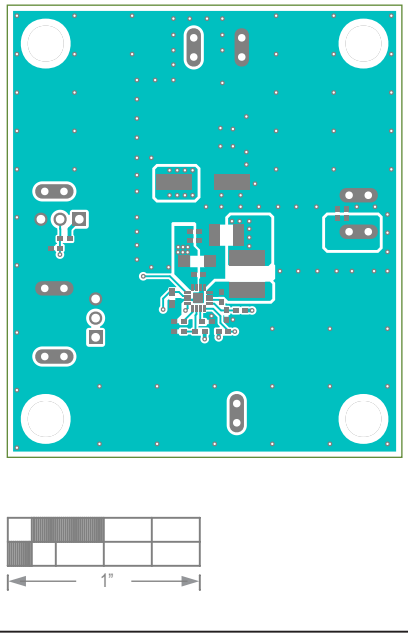
MAX17662BEVKITB# PCB Layout Diagrams



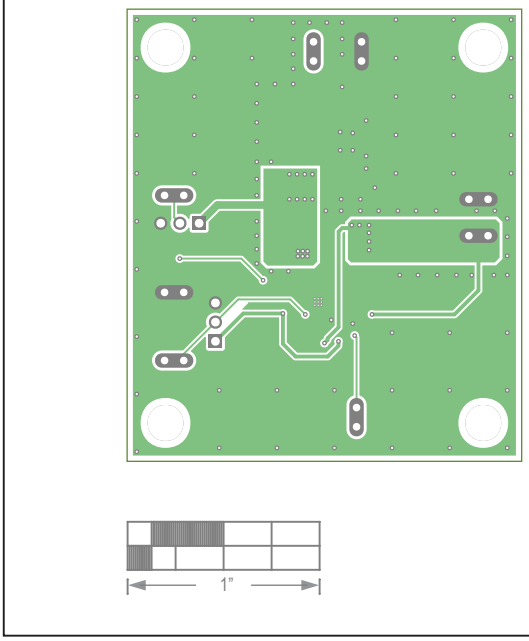
MAX17662BEVKITB# —Top Silkscreen



MAX17662BEVKITB# —Layer 2

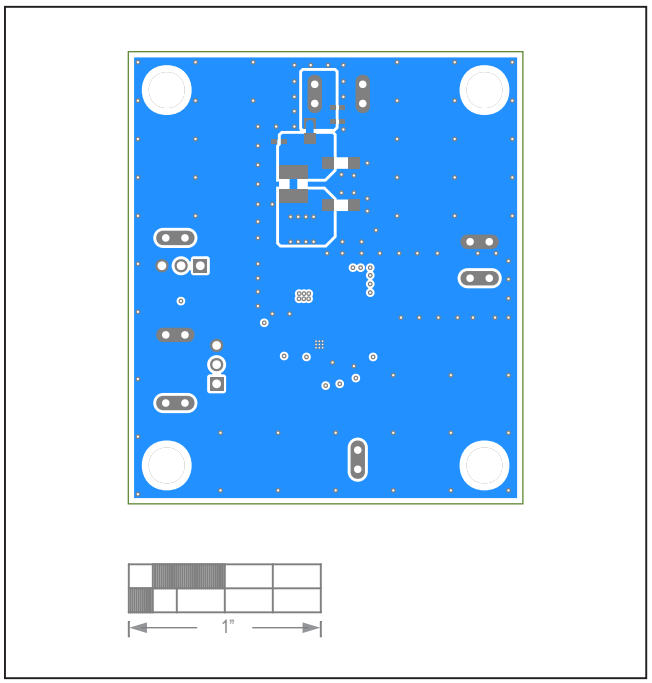


MAX17662BEVKITB# —Top Layer

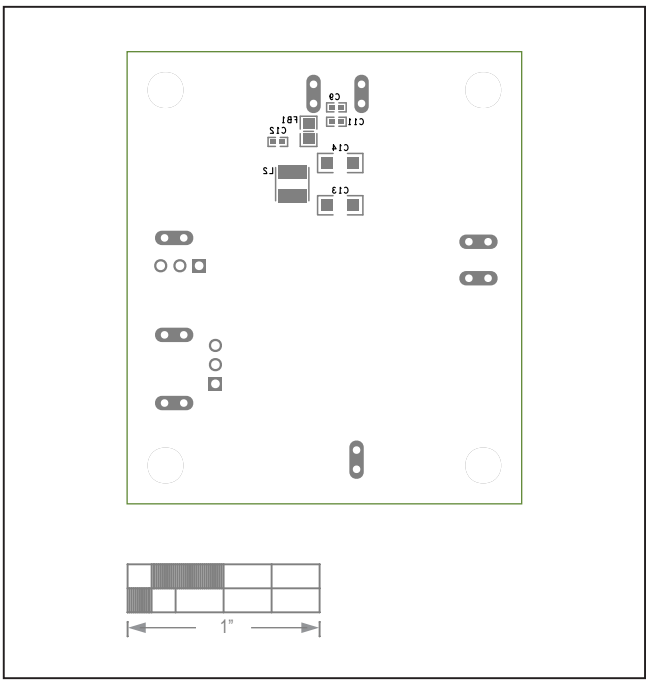


MAX17662BEVKITB# —Layer 3

MAX17662BEVKITB# PCB Layout Diagrams (continued)



MAX17662BEVKITB# —Bottom Layer



MAX17662BEVKITB# —Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/19	Initial release	—
1	9/19	Updated title	1–10

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

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