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Evaluates: MAX17645 in 5V Output Voltage Application

MAX17645BEVKITB#/ MAX17645DEVKITB# Evaluation Kits

General Description

The MAX17645BEVKITB# and MAX17645DEVKITB# evaluation kits (EV kits) provide proven 5V designs to evaluate the performance of MAX17645B and MAX17645D high-efficiency, high-voltage, synchronous step-down DC-DC converters. The MAX17645BEVKITB# EV kit operates in constant frequency PWM (pulse-width modulation) mode at all loads and the MAX17645DEVKITB# EV kit operates in PFM (pulse-frequency modulation) mode at light loads to improve efficiency.

The EV kits are configured to demonstrate the optimum performance and component sizes for MAX17645B/ MAX17645D converter. The EV kits support a wide operating input range of 7V to 36V and are configured for 5V output. The EV kits deliver up to 1A at a switching frequency of 650kHz.

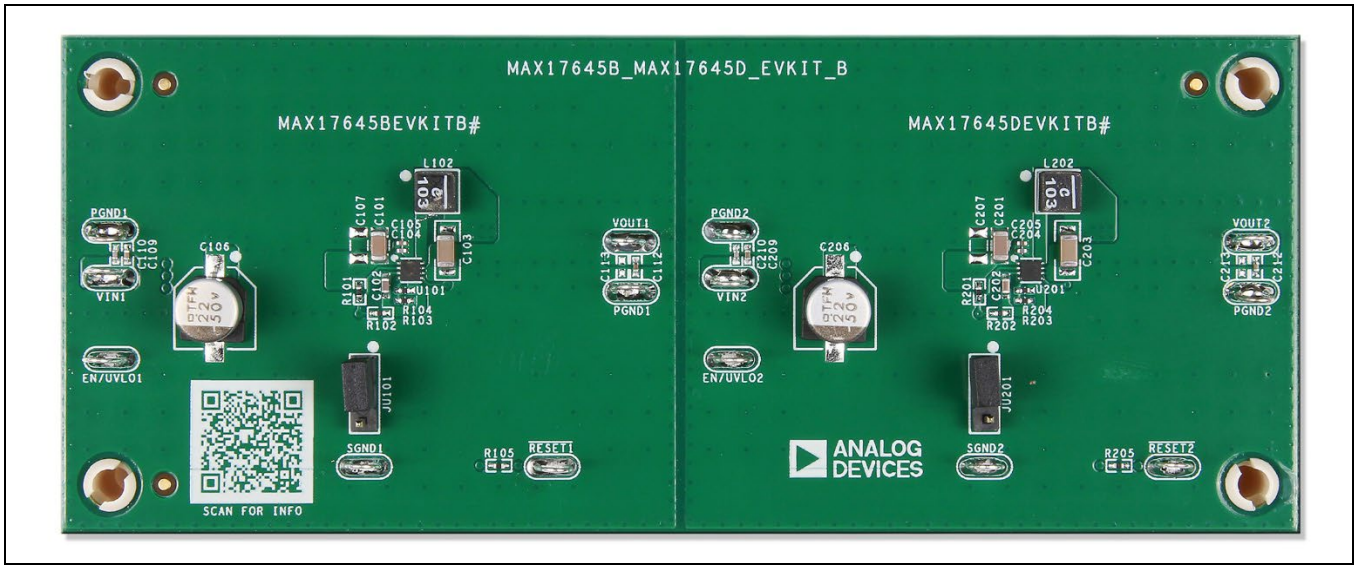
The features of the EV kits include adjustable input undervoltage lockout, fixed internal soft-start, and open-drain $\overline{\text{RESET}}$ signal for output voltage status monitoring. The EV kits also provide a good layout example, which is optimized for conducted, radiated EMI, and thermal performance. For more details about the IC benefits and features, refer to the MAX17645 IC data sheet.

Features

- Wide 7V to 36V Input Range
- Up to 1A Load Current
- 650kHz Fixed Switching Frequency
- High Peak Efficiency of 91.1% (V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0.6A)
- EN/UVLO for On/Off Control and Programmable Input Undervoltage Lockout
- Fixed 3.15ms (typ) Soft-Start Time
- Open-Drain $\overline{\text{RESET}}$ Output
- Overcurrent and Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested
- Complies with CISPR32 (EN55032) Class B Conducted and Radiated Emissions

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

MAX17645BEVKITB#/MAX17645DEVKITB# Top View



319-100892; Rev 1; 06/22

ANALOG DEVICES

Quick Start

Configuration Diagram

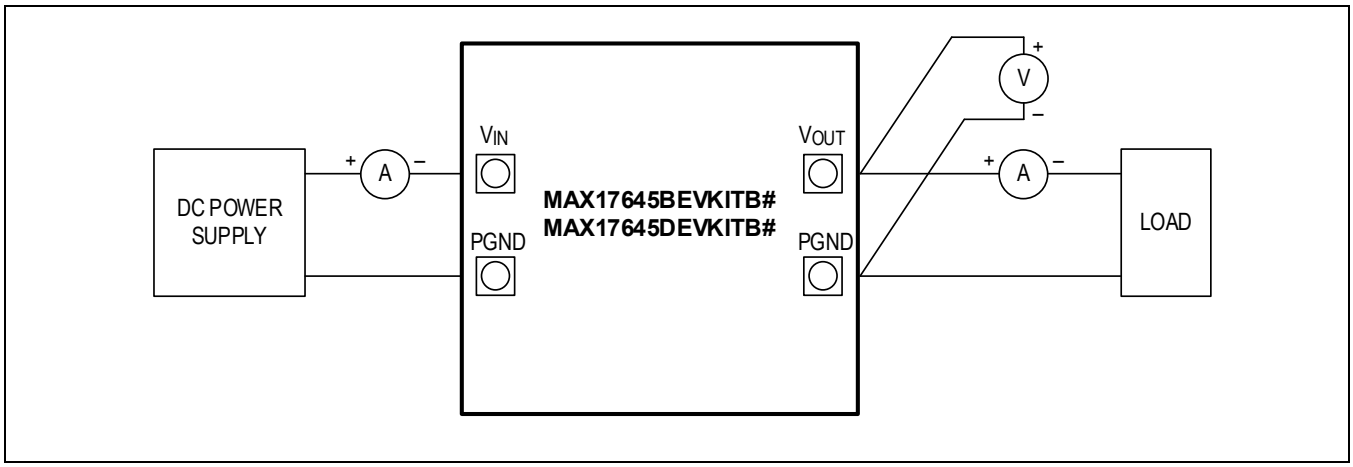


Figure 1. MAX17645BEVKITB#/MAX17645DEVKITB# EV kits Setup Diagram

Required Equipment

- MAX17645BEVKITB#/MAX17645BEVKITB# EV kits
- 7V to 36V, 1A power supply
- Loads capable of sinking 1A at 5V
- Digital voltmeter (DVM)

Equipment Setup and Test Procedure

The EV kits are fully assembled and tested. Use the following steps to verify and test individual board operation.

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

1. Disable the power supply and set the input power supply at a voltage between 7V to 36V.
2. Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the nearest PGND PCB pad of the EV kit under evaluation. Connect the positive terminal of the 1A load to the VOUT PCB pad and the negative terminal to the nearest PGND PCB pad of the EV kit.
3. Connect the DVM across the VOUT PCB pad and the nearest PGND PCB pad.
4. Verify that no shunts are installed on jumpers (JU101, JU201). See *Table 1* for details.
5. Turn on the input power supply.
6. Enable the load.
7. Verify that the digital voltmeter displays 5V across the output terminals.

Detailed Description

The MAX17645BEVKITB# and MAX17645DEVKITB# EV kits are designed to demonstrate the salient features of the MAX17645B and MAX17645D high-efficiency, high-voltage, synchronous step-down DC-DC converters in 5V application. The MAX17645B and the MAX17645D application circuits are electrically isolated from each other and hosted on the same PCB. Each of these circuits can be evaluated by powering them from their respective input pins.

The EV kits include EN/UVLO PCB pads and jumpers (JU101, JU201) to enable the output at the desired input voltage. An additional $\overline{RESET}$ PCB pad is available for monitoring the status of the output.

Enable/Undervoltage Lockout (EN/UVLO) Programming

The MAX17645B and MAX17645D offer an Enable and adjustable input undervoltage lockout feature. To enable the converters always, install a shunt across pin 1-2 on respective jumpers (JU101, JU201). To disable the converters, install a shunt across pin 2-3 on respective jumpers (JU101, JU201). A potential divider formed by resistors R_{UVL_TOP} (R101, R201) and R_{UVL_BOT} (R102, R202) sets the input voltage (V_{INU}) above which the converter is enabled when jumpers (JU101, JU201) are left open. See *Table 1* for jumper (JU101, JU201) settings. In these EV kits, when the respective jumpers (JU101, JU201) are left open, the MAX17645B and MAX17645D are enabled when the input voltage rises above 6.85V (typ).

Choose R_{UVL_TOP} to be 3.32MΩ (max) and then calculate R_{UVL_BOT} as follows:

$$R_{UVL\_BOT} = \frac{R_{UVL\_TOP} \times V_{ENR}}{(V_{INU} - V_{ENR})}$$

where V_{INU} is the voltage at which the device is required to turn on, V_{ENR} is the EN/UVLO rising threshold (1.215V, typ) and R_{UVL_BOT} is in Ω. For more details about setting the undervoltage lockout level, refer to the MAX17645 IC data sheet.

The EN/UVLO PCB pads on the EV kits support external Enable/Disable control of the device. Leave jumpers (JU101, JU201) open when external Enable/Disable control is desired. If the EN/UVLO pin is driven from an external signal source, it is recommended that a series resistance of a minimum of 1kΩ is placed between the signal source output and the EN/UVLO pin to reduce voltage ringing on the line.

Table 1. Converter EN/UVLO Jumper (JU101, JU201) Settings

SHUNT POSITION	EN/UVLO PIN	OUTPUT
1-2	Connected to VIN	Enabled
2-3	Connected to SGND	Disabled
Not installed*	Connected to center node of respective resistive divider (R101 and R102, R201 and R202)	Programmed to startup at desired input voltage level

**Default position*

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

The EV kits provide $\overline{RESET}$ PCB pads to monitor the status of the converters. The $\overline{RESET}$ is an open drain signal and is pulled up to the V_{CC} of the respective IC on these EV kits. $\overline{RESET}$ goes high (V_{CC}) when VOUT rises above 95.5% (typ) of its nominal regulated output voltage. $\overline{RESET}$ goes low when VOUT falls below 92% (typ) of its nominal regulated voltage.

Hot Plug-in and Long Input Cables

The MAX17645BEVKITB# and MAX17645DEVKITB# EV kits come with an installed optional electrolytic capacitor (C106, C206 = 22µF/50V). These capacitors limit the peak voltage at the input of the converters 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 the interaction of the inductance of the long input cables and the ceramic capacitors at the buck converter input.

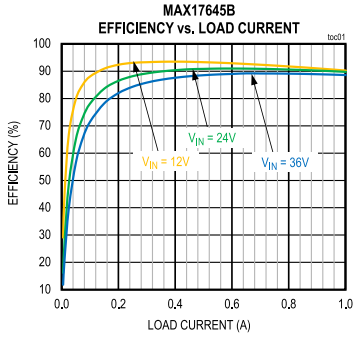
Electromagnetic Interference

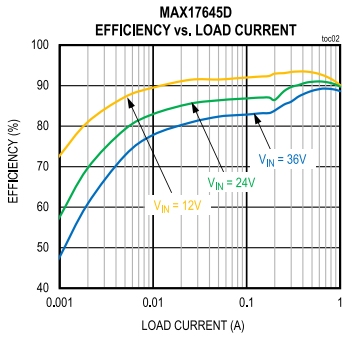
Compliance to conducted emission (CE) standards requires an electromagnetic interference (EMI) filter at the input of a switching power converter. The EMI filter attenuates high-frequency currents drawn by the switching power converter and limits the noise injected back into the input power source.

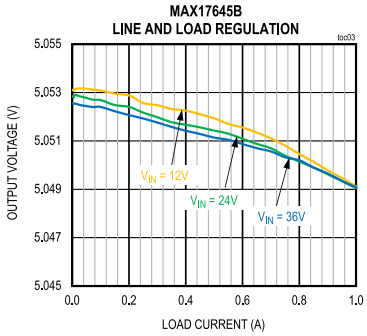
The MAX17645BEVKITB# and MAX17645DEVKITB# PCBs have designated footprints for the placement of conducted EMI filter components as per the optional bill of material (BOM). The use of these filter components results in lower conducted EMI below CISPR32 Class B limits. Cut open the trace at L101 and L201 before installing conducted EMI filter components. The PCB layouts are also designated to limit radiated emissions from switching nodes of the power converter resulting in radiated emissions below CISPR32 Class B limits.

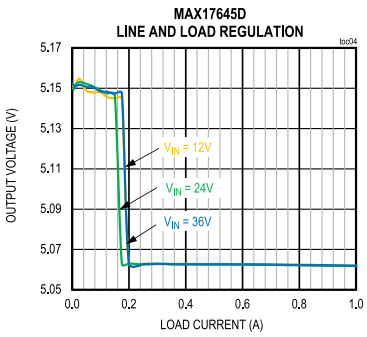
MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits Performance Report

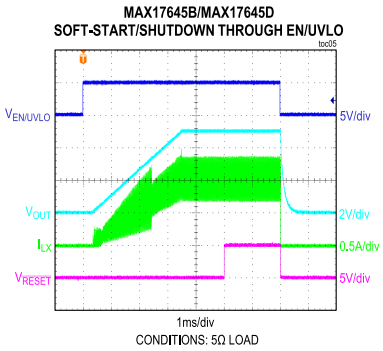
(V_{IN1} = V_{IN2} = 24V, V_{OUT1} = V_{OUT2} = 5V, T_A = +25°C, unless otherwise noted)

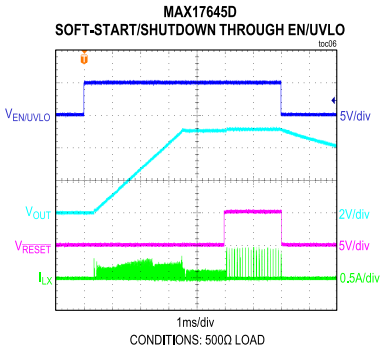






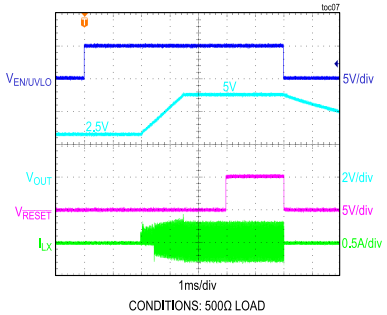






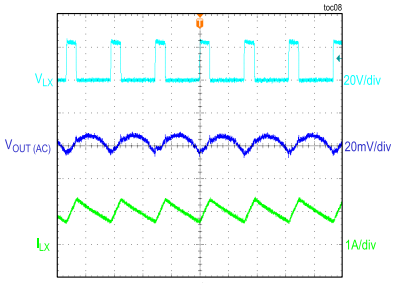
(V_{IN1} = V_{IN2} = 24V, V_{OUT1} = V_{OUT2} = 5V, T_A = +25°C, unless otherwise noted)

MAX17645B
SOFT-START WITH PREBIAS OF VOLTAGE 2.5V



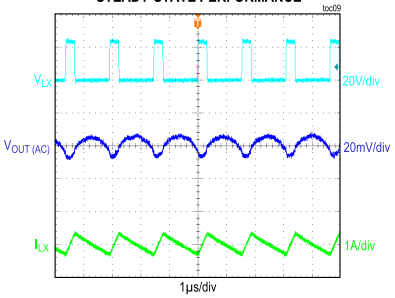
CONDITIONS: 500Ω LOAD

MAX17645B/MAX17645D
STEADY-STATE PERFORMANCE



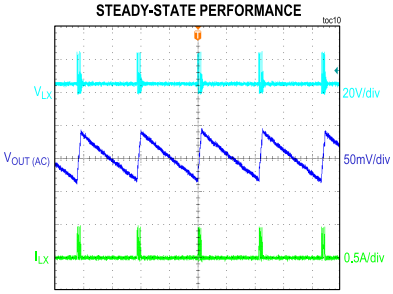
CONDITIONS: 1A LOAD

MAX17645B
STEADY-STATE PERFORMANCE



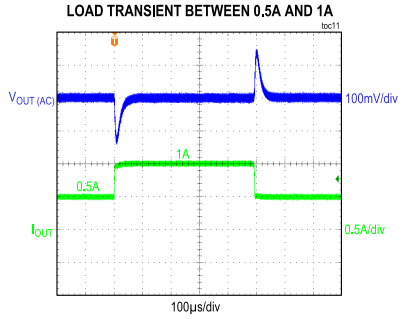
CONDITIONS: NO LOAD

MAX17645D
STEADY-STATE PERFORMANCE

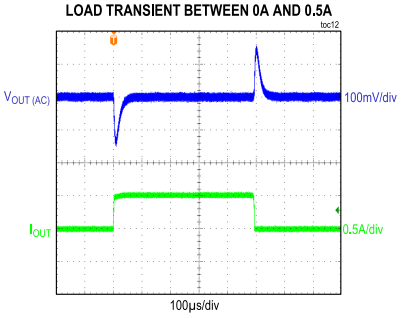


CONDITIONS: 10mA LOAD

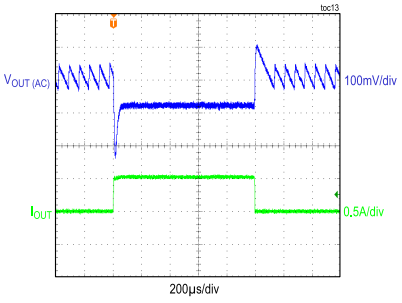
MAX17645B/MAX17645D
LOAD TRANSIENT BETWEEN 0.5A AND 1A



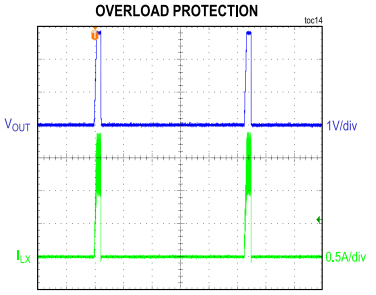
MAX17645B
LOAD TRANSIENT BETWEEN 0A AND 0.5A



MAX17645D
LOAD TRANSIENT BETWEEN 0.01A AND 0.5A

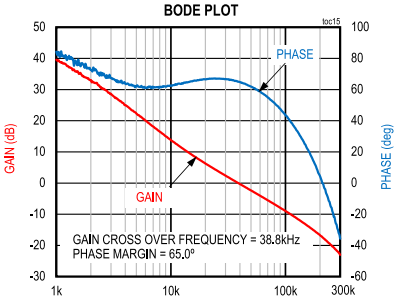


MAX17645B/MAX17645D
OVERLOAD PROTECTION



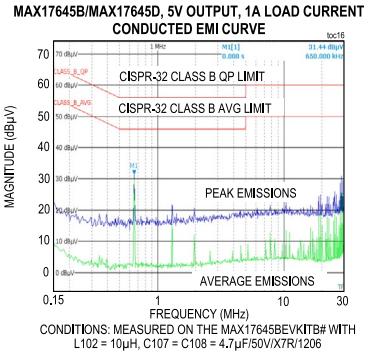
CONDITIONS: R_LOAD = 2.1Ω

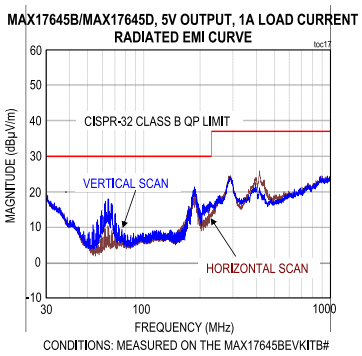
MAX17645B/MAX17645D
BODE PLOT



CONDITIONS: 1A LOAD

(V_{IN1} = V_{IN2} = 24V, V_{OUT1} = V_{OUT2} = 5V, T_A = +25°C, unless otherwise noted)





Ordering Information

PART	TYPE
MAX17645BEVKITB#	EV Kit
MAX17645DEVKITB#	EV Kit

#Denotes RoHS compliance.

Component Suppliers

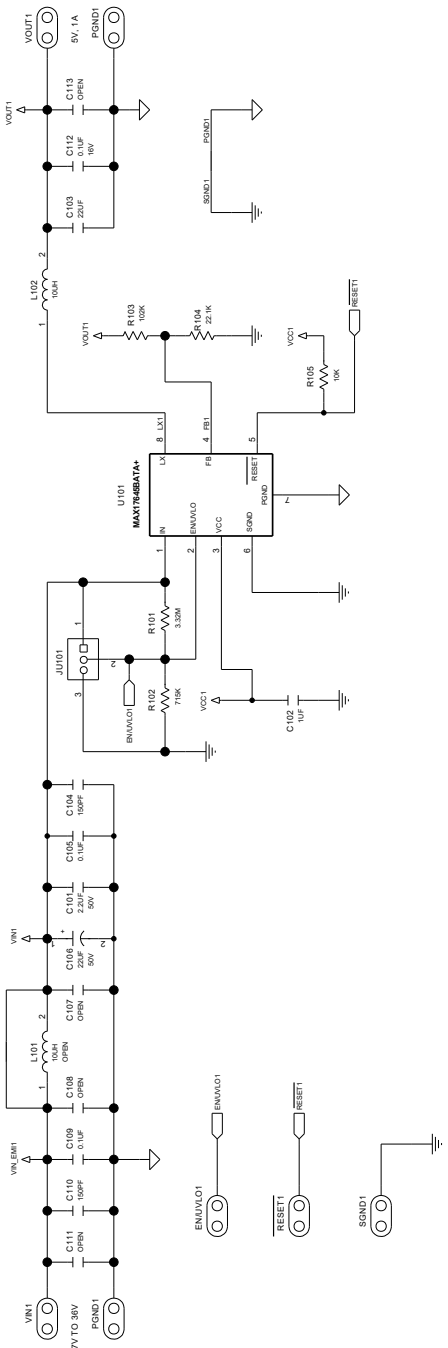
SUPPLIER	WEBSITE
Murata Americas	www.murata.com
TDK Corp	www.tdk.com
Vishay	www.vishay.com
Panasonic	www.panasonic.com
Coilcraft	www.coilcraft.com
Taiyo yuden	www.ty-top.com
SullinsCorp	www.sullinscorp.com

Note: *Indicate that you are using the MAX17645B/MAX17645D when contacting these component suppliers.*

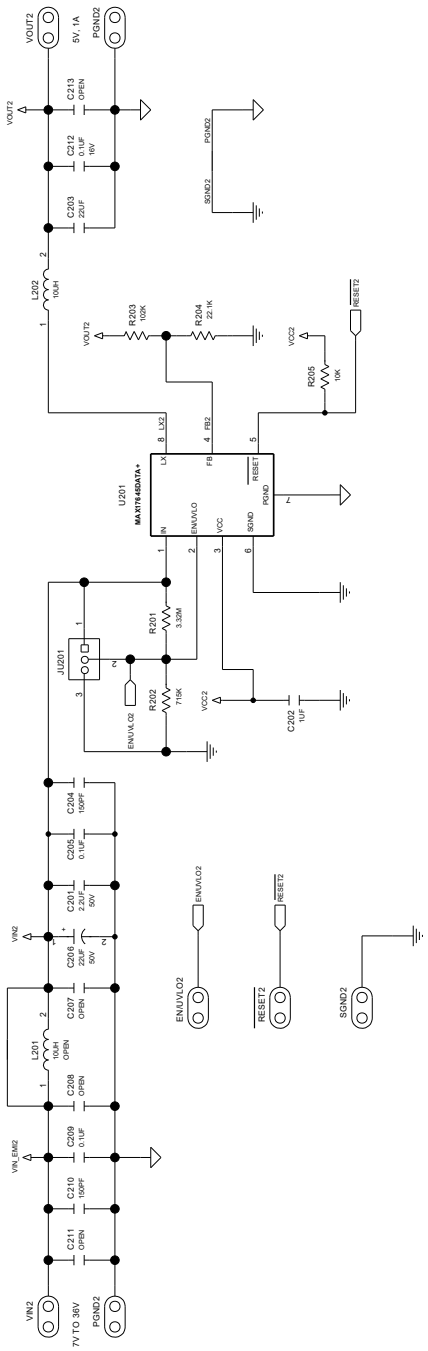
MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits Bill of Materials

Sl. No.	DESIGNATOR	DESCRIPTION	QTY	PART NUMBER
1	C101, C201	2.2µF, 10%, 50V, X7R, Ceramic capacitor (1206)	2	TDK C3216X7R1H225K160AE
2	C102, C202	1µF, 10%, 16V, X7R, Ceramic capacitor (0603)	2	TDK C1608X7R1C105K080AC
3	C103, C203	22µF, 20%, 16V, X7R, Ceramic capacitor (1206)	2	MURATA GRM31CZ71C226ME15
4	C104, C110, C204, C210	150pF, 5%, 100V, COG, Ceramic capacitor (0402)	4	TDK C1005C0G2A151J050BA
5	C105, C109, C205, C209	0.1µF, 10%, 50V, X7R, Ceramic capacitor (0402)	4	TDK C1005X7R1H104K050BE
6	C106, C206	22µF, 20%, 50V, Electrolytic capacitor	2	PANASONIC EEE-TG1H220P
7	C112, C212	0.1µF, 10%, 16V, X7R, Ceramic capacitor (0402)	2	TAIYO YUDEN EMK105B7104KV
8	L102, L202	INDUCTOR, 10µH; 20%; 2.8A (4mm x 4mm)	2	COILCRAFT XGL4040-103ME
9	R101, R201	3.32MΩ ±1%, 1/16W, resistor (0402)	2	VISHAY DALE CRCW04023M32FK
10	R102, R202	715kΩ ±1%, 1/10W, resistor (0402)	2	PANASONIC ERJ-2RKF7153
11	R103, R203	102kΩ ±1%, 1/16W, resistor (0402)	2	VISHAY DALE CRCW0402102KFK
12	R104, R204	22.1kΩ ±1%, 1/16W, resistor (0402)	2	VISHAY DALE CRCW040222K1FK
13	R105, R205	10kΩ ±1%, 1/16W, resistor (0402)	2	YAGEO RC0402FR-0710KL
14	U101	High-efficiency; Synchronous step-down DC-DC Converter (8 TDFN 2mm x 2mm)	1	ANALOG DEVICES MAX17645BATA+
15	U201	High-efficiency; Synchronous step-down DC-DC Converter (8 TDFN 2mm x 2mm)	1	ANALOG DEVICES MAX17645DATA+
16	JU101, JU201	3-pin header	2	SULLINS PEC03SAAN
17		Shunts	2	SULLINS NPB02SVAN-RC
18	C107, C108, C207, C208	OPEN: Capacitor (1206)	0	MURATA GRM31CR71H475KA12
19	C111, C113, C211, C213	OPEN: Capacitor (0402)	0	
20	L101, L201	OPEN: Inductor (4mm x 4mm)	0	COILCRAFT XGL4040-103ME

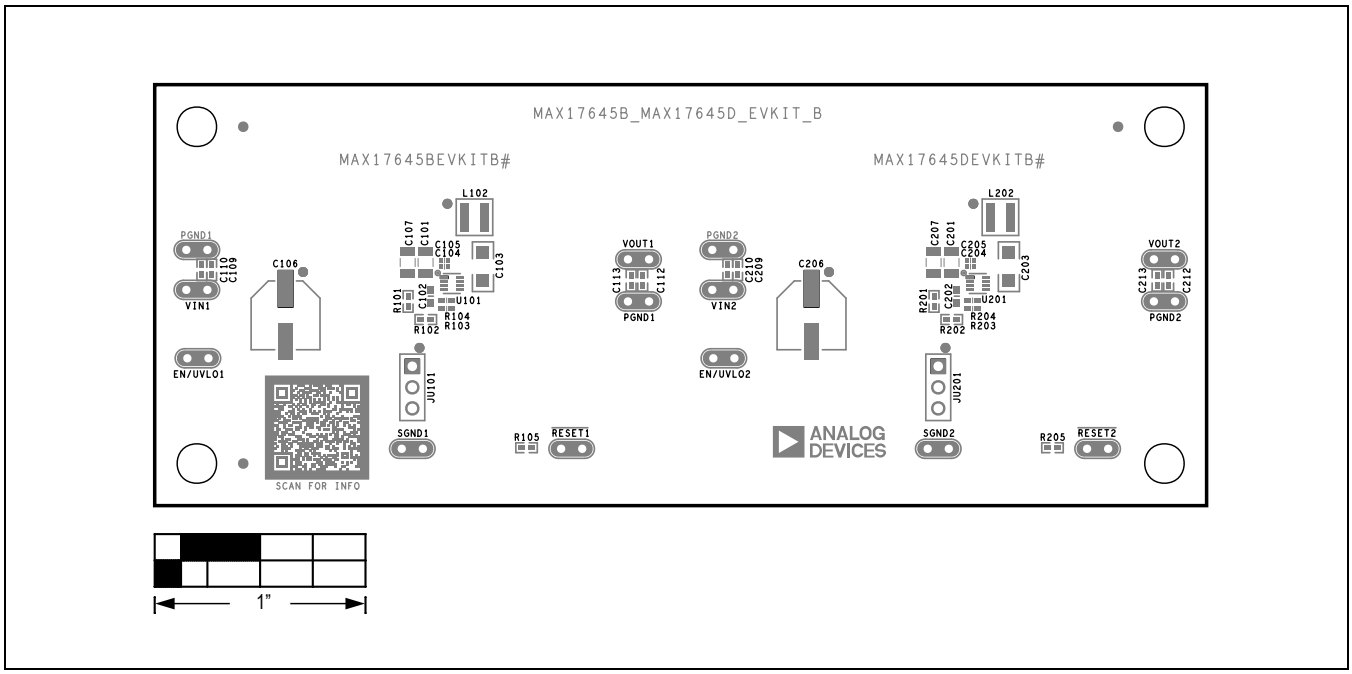
MAX17645BEVKITB# EV Kit Schematic Diagram



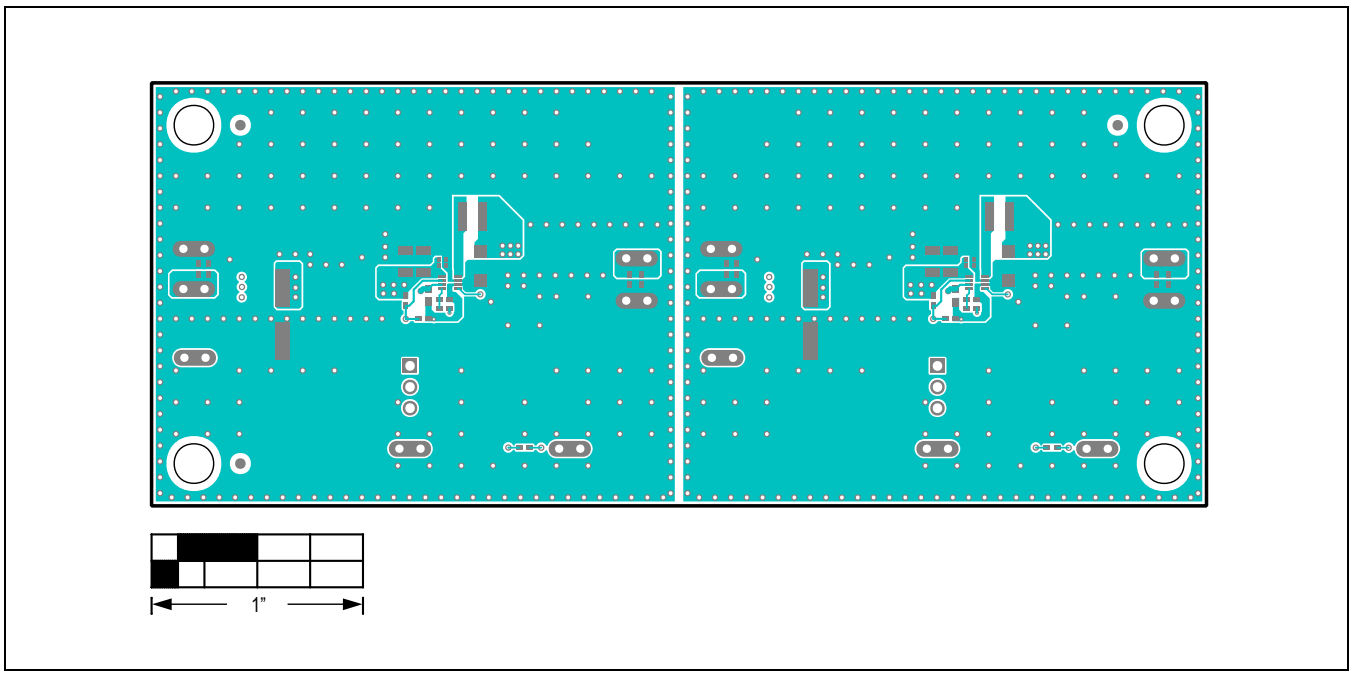
MAX17645DEVKITB# EV Kit Schematic Diagram



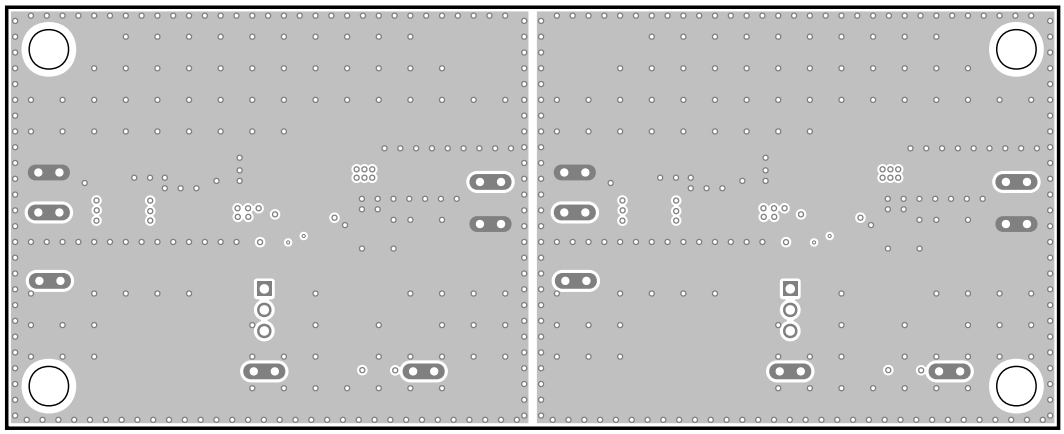
MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits PCB Layout Diagrams



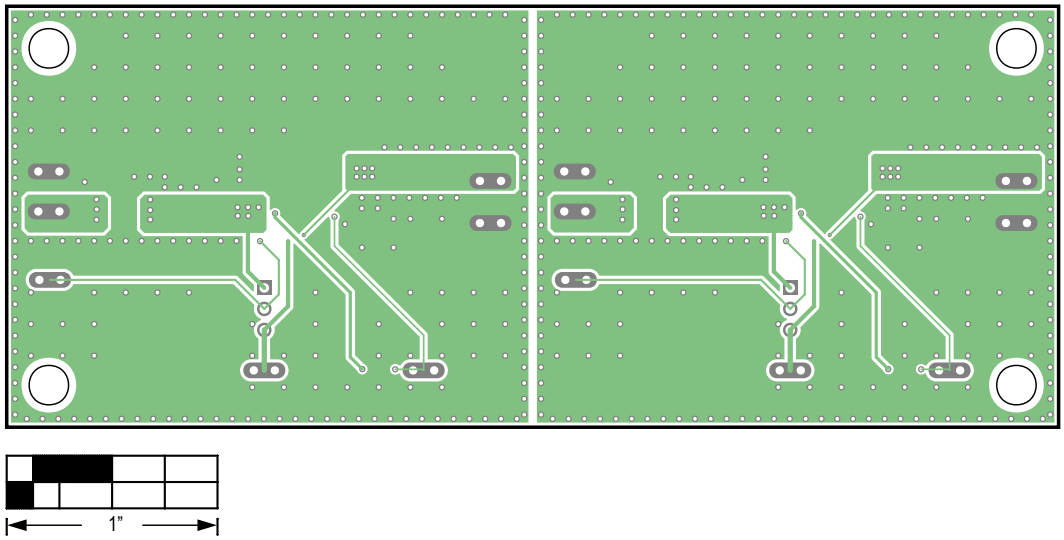
MAX17645BEVKITB#/MAX17645DEVKITB# EV kits Component Placement Guide—Top Silkscreen



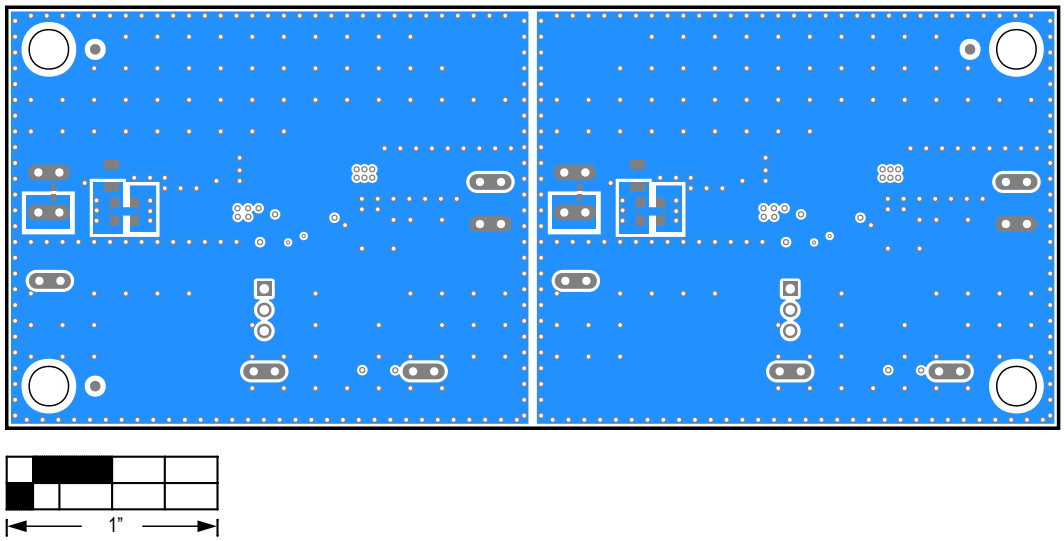
MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits PCB Layout—Top Layer



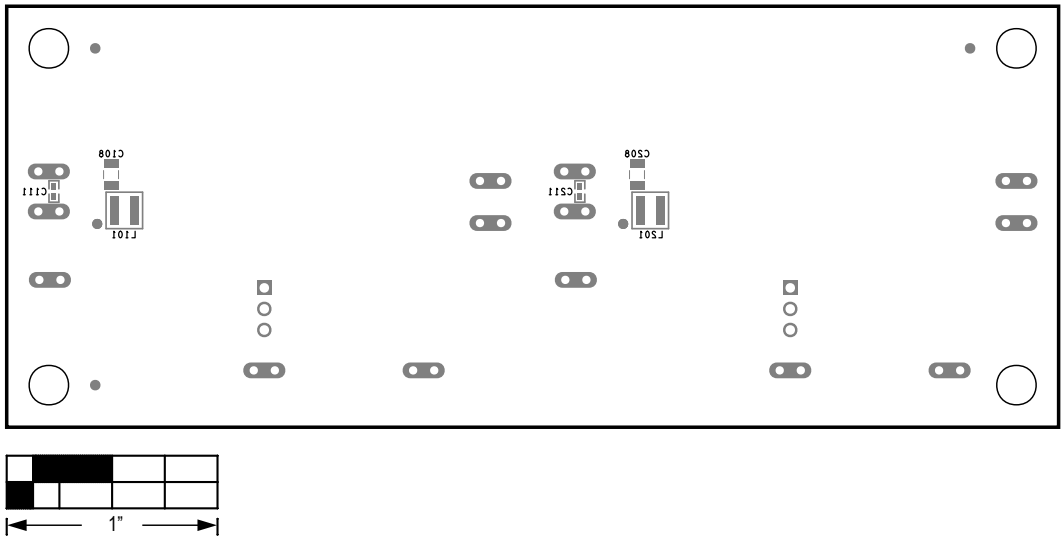
MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits PCB Layout—Layer 2



MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits PCB Layout—Layer 3



MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits PCB Layout—Bottom Layer



MAX17645BEVKITB#/MAX17645DEVKITB# EV Kits Component Placement Guide—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	03/22	Initial release	—
1	06/22	Updated datasheet title	1-12