MAX17640A/MAX17640B/ MAX17640C Evaluation Kits

Evaluate: MAX17640 Converters in Application

General Description

The MAX17640A/MAX17640B/MAX17640C evaluation kits (EV kits) provide proven designs to evaluate the performance of the MAX17640A/MAX17640B/MAX17640C high-voltage, high-efficiency, synchronous step-down DC-DC converters. The MAX17640A converter operates over a 5V to 48V input range and can deliver up to 400mA at a fixed 3.3V output. The MAX17640B converter operates over a 7V to 60V input range and can deliver up to 400mA at a fixed 5V output. The MAX17640C converter operates over a 15V to 60V input range and can deliver up to 400mA at an adjustable 12V output.

The EV kits feature an adjustable input undervoltage-lockout, open-drain $\overline{\text{RESET}}$, overcurrent protection, selectable mode of operation, and thermal shutdown. Refer to the MAX17640 converter data sheet for a complete description of the part that should be read in conjunction with this data sheet before operating these EV kits.

Features

- Operates up to 60V Input Supply
- Fixed 5V, Fixed 3.3V, and Adjustable 12V Application Circuits
- Up to 400mA Load Current
- 500kHz Fixed Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Selectable PWM and PFM Modes of Operation
- 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.**

Quick Start

Required Equipment

- One 60V, 400mA DC power supply
- Digital multimeters (DMM)
- Load resistors capable of sinking up to 400mA (8.25Ω for MAX17640A, 12.5Ω for MAX17640B, and 30Ω for MAX17640C)

Equipment Setup and Procedure

The EV kits are fully assembled and tested. Follow the steps to verify and test individual converter operation:

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

1) Disable the power supply and set the input power supply at a valid input voltage.
2) Connect the positive terminal and negative terminal of the power supply to the VIN pad and its adjacent PGND pad of the converter under evaluation.
3) Connect the positive terminal of the 400mA (max) load to the VOUT pad and the negative terminal to the nearest PGND pad of the corresponding converter.
4) Connect the DMM across the VOUT pad and the nearest PGND pad.
5) Verify that the shunts are not installed across pins on jumper JU101 for MAX17640A, JU201 for MAX17640B and, JU301 for MAX17640C. See Table 1 for details.
6) Turn on the input power supply.
7) Verify that the DMMs display the expected terminal voltages with respect to GND.

319-100682; Rev 1; 3/21

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Detailed Description

The MAX17640A/MAX17640B/MAX17640C EV kits are designed to demonstrate the salient features of the MAX17640A/MAX17640B/MAX17640C high-voltage, high-efficiency, synchronous step-down DC-DC converters. The EV kits consist of typical application circuits of three different converters. Each of these circuits is electrically isolated from each other and hosted on the same PCB. Each of these converters can be evaluated for their performance under different operating conditions by powering them from their respective input pins.

Enable/Undervoltage Lockout (EN/UVLO) Programming

The EV kits offer an adjustable input undervoltage-lockout level feature for the converters. For the MAX17640A when jumper JU101 is left open, the converter is enabled when the input voltage rises above 5V. To disable the MAX17640A, install a shunt across pins 2-3 on jumper JU101. For the the MAX17640B when jumper JU201 is left open, the converter is enabled when the input voltage rises above 7V. To disable the MAX17640B, install a shunt across pins 2-3 on jumper JU201. For the MAX17640C when jumper JU301 is left open, the converter is enabled when the input voltage rises above 15V. To disable the MAX17640C, install a shunt across pins 2-3 on jumper JU301. See Table 1 for jumper settings. Refer to the *Setting the Input Undervoltage-Lockout Level* section in the MAX17640 datasheet for more details.

If the EN/UVLO pin is driven from an external signal source, it is recommended that a minimum 1kΩ series resistance is placed is placed between the signal source output and the EN/UVLO pin to reduce voltage ringing on the line.

MODE Selection

The MAX17640A/MAX17640B/MAX17640C converters support PWM and PFM modes of operation. In the EV kits, leave the jumpers (JU102 for MAX17640A, JU202 for MAX17640B and JU302 for MAX17640C) open for operating the modules in PFM mode at light load. Install shunts across positions 1-2 to configure the modules in PWM mode. See Table 2 for jumper settings. Refer to the *Mode Selection (MODE)* section in the MAX17640 data sheet for more details.

Adjusting Output Voltage

The MAX17640C supports a 0.9V to (0.89 x V_{IN})V adjustable output voltage. Output Voltage in the MAX17640C EV kit is preset to 12V. Output voltage can be programmed using the feedback-resistive divider (R304 and R305) from VOUT and GND. For programming the output to a different voltage, refer to the *Adjusting the Output Voltage* section in the MAX17640 datasheet for more details.

Input Capacitor Selection

The input capacitors C106 for the MAX17640A, C206 for the MAX17640B, and C306 for the MAX17640C, serve to reduce current peaks drawn from the input power supply and reduce switching frequency ripple at the input. Refer to the *Input Capacitor* section in the MAX17640 datasheet to choose input capacitance. Input capacitor is chosen to be 1µF/100V for the MAX17640A/MAX17640B/MAX17640C EV kits.

Table 1. EN/UVLO Jumper Description (JU101, JU201, and JU301)

SHUNT POSITION	EN/UVLO PIN	OUTPUT
Not installed*	Connected to the center nodes of the respective resistor-dividers (R101 and R102 for 3.3V application circuit; R201 and R202 for 5V application circuit; R301 and R302 for 12V application circuit)	Programmed to startup at desired input-voltage level
1–2	Connected to VIN	Enabled
2–3	Connected to GND	Disabled

**Default position*

Table 2. MODE Jumper Description (JU102, JU202, and JU302)

SHUNT POSITION	EN/UVLO PIN	OUTPUT
Not installed*	Unconnected	PFM mode of operation
1-2	Connected to GND	PWM mode of operation

**Default position*

Output Capacitor Selection

X7R ceramic capacitors are preferred due to their stability over temperature in industrial applications. The required output capacitor (C109, C209) for the MAX17640A and MAX17640B is 22µF/6.3V. The required Output Capacitor (C309) for the MAX17640C is 22µF/16V. Refer to the *Output Capacitor* section in the MAX17640 datasheet for more details.

Hot Plug-In and Long Input Cables

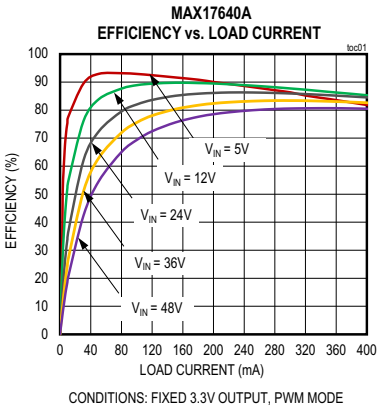
The EV kits provide optional electrolytic capacitors 22µF/100V (C103 for the MAX17640A, C203 for the MAX17640B, and C303 for the MAX17640C) to dampen input voltage peaks and oscillations that may arise during hot-plug-in and/or due to long input cables. These capacitors limit the peak voltage at the input of the DC-DC converters when the EV kits are powered directly from a precharged capacitive source or an industrial backplane PCB. Long input cables, between the input power source and the EV kit circuit, can cause input-voltage oscillations due to the inductance of the cables. The equivalent series resistance (ESR) of the electrolytic capacitor helps damp out the oscillations caused by long input cables.

Electromagnetic Interference (EMI)

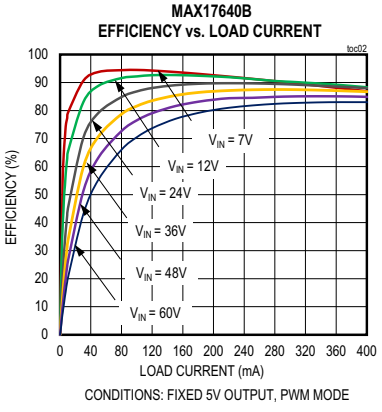
Compliance to conducted emissions (CE) standards requires an EMI filter at the input of a switching power converter. The EMI filter attenuates high-frequency currents drawn by the switching power converter and limits the noise injected back into the input power source.

Use of EMI filter components as shown in the EV kit schematic results in lower conducted emissions, below CISPR32 Class B limits. Manufacturer part numbers of the EMI filter components are listed as optional BOM. The EV kits' PCB layout are also designed to limit radiated emissions from switching nodes of the power converter, resulting in radiated emissions below CISPR32 Class B limits. Further, capacitors placed near the input of the board help in attenuating high-frequency noise.

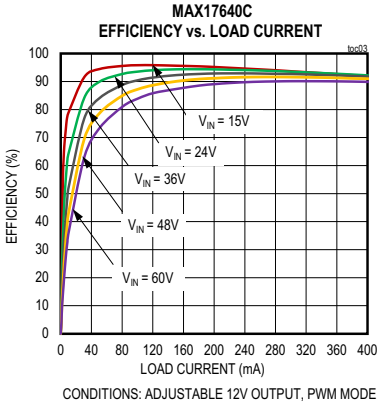
MAX17640A/MAX17640B/MAX17640C EV Kits Performance Report



CONDITIONS: FIXED 3.3V OUTPUT, PWM MODE



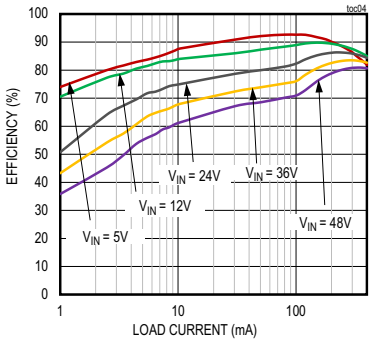
CONDITIONS: FIXED 5V OUTPUT, PWM MODE



CONDITIONS: ADJUSTABLE 12V OUTPUT, PWM MODE

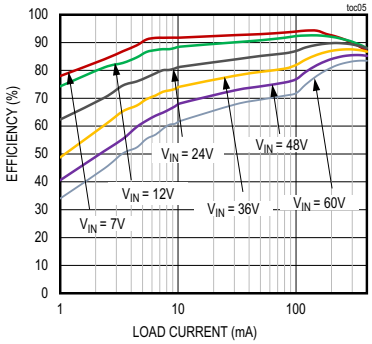
MAX17640A/MAX17640B/MAX17640C EV Kits Performance Report (continued)

MAX17640A
EFFICIENCY vs. LOAD CURRENT



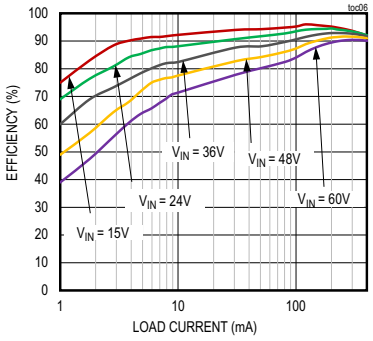
CONDITIONS: FIXED 3.3V OUTPUT, PFM MODE

MAX17640B
EFFICIENCY vs. LOAD CURRENT



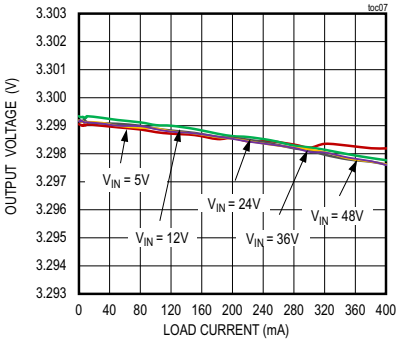
CONDITIONS: FIXED 5V OUTPUT, PFM MODE

MAX17640C
EFFICIENCY vs. LOAD CURRENT



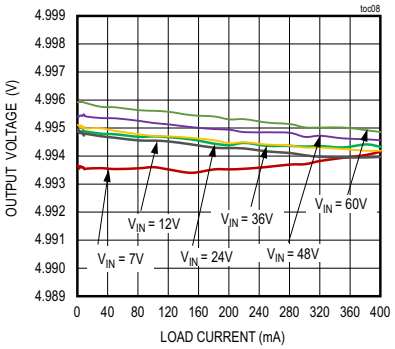
CONDITIONS: ADJUSTABLE 12V OUTPUT, PFM MODE

MAX17640A
OUTPUT VOLTAGE vs. LOAD CURRENT



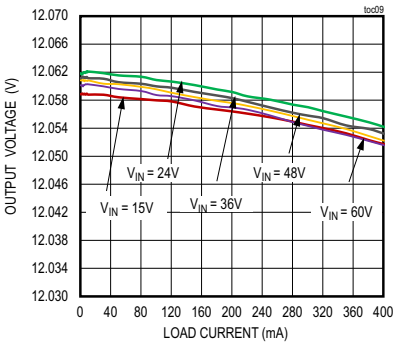
CONDITIONS: FIXED 3.3V OUTPUT, PWM MODE

MAX17640B
OUTPUT VOLTAGE vs. LOAD CURRENT



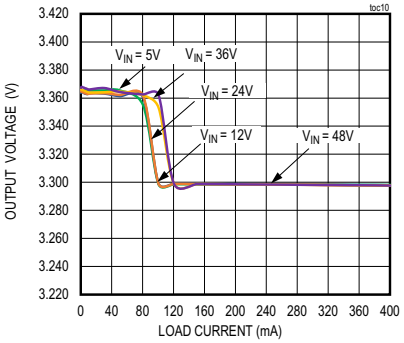
CONDITIONS: FIXED 5V OUTPUT, PWM MODE

MAX17640C
OUTPUT VOLTAGE vs. LOAD CURRENT



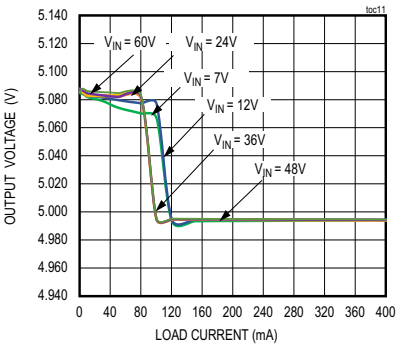
CONDITIONS: ADJUSTABLE 12V OUTPUT, PWM MODE

MAX17640A
OUTPUT VOLTAGE vs. LOAD CURRENT



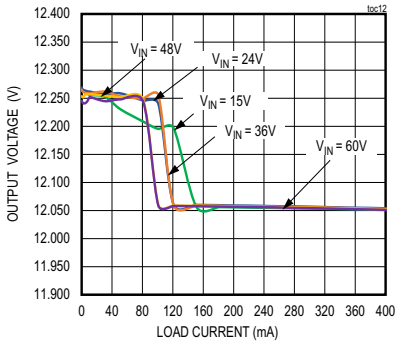
CONDITIONS: FIXED 3.3V OUTPUT, PFM MODE

MAX17640B
OUTPUT VOLTAGE vs. LOAD CURRENT



CONDITIONS: FIXED 5V OUTPUT, PFM MODE

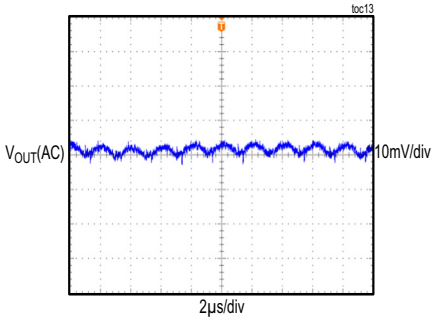
MAX17640C
OUTPUT VOLTAGE vs. LOAD CURRENT



CONDITIONS: ADJUSTABLE 12V OUTPUT, PFM MODE

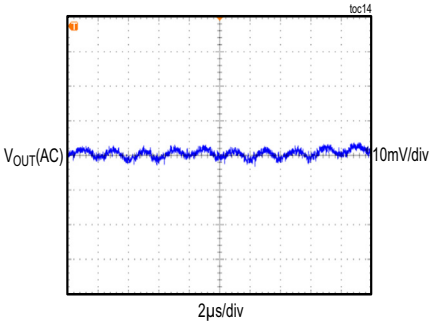
MAX17640A/MAX17640B/MAX17640C EV Kits Performance Report (continued)

MAX17640A
OUTPUT VOLTAGE RIPPLE



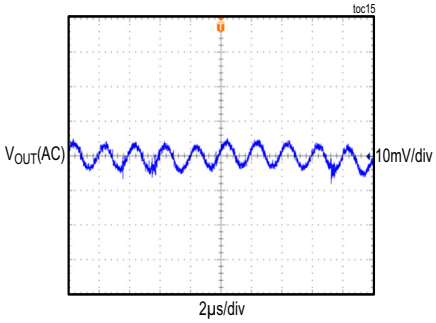
CONDITIONS: FIXED 3.3V OUTPUT,
400mA LOAD, PWM MODE

MAX17640B
OUTPUT VOLTAGE RIPPLE



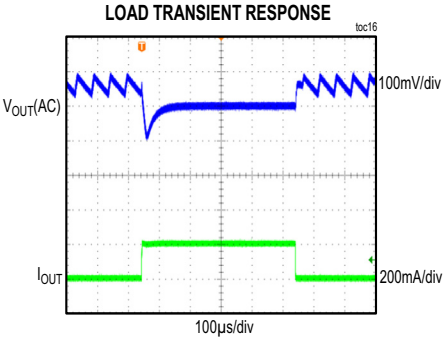
CONDITIONS: FIXED 5V OUTPUT,
400mA LOAD, PWM MODE

MAX17640C
OUTPUT VOLTAGE RIPPLE



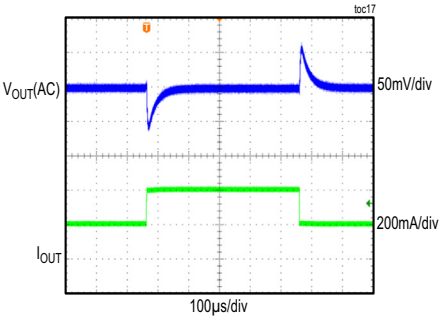
CONDITIONS: ADJUSTABLE 12V OUTPUT
400mA LOAD, PWM MODE

MAX17640A
LOAD TRANSIENT RESPONSE



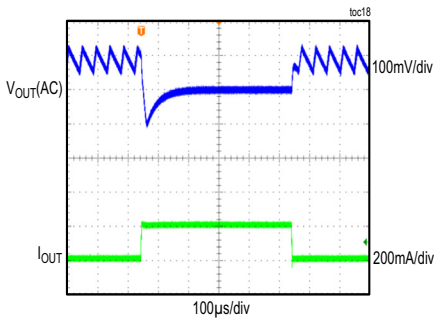
CONDITIONS: PFM MODE, FIXED 3.3V OUTPUT
LOAD STEP BETWEEN 5mA to 200mA

MAX17640A
LOAD TRANSIENT RESPONSE



CONDITIONS: PWM MODE, FIXED 3.3V OUTPUT
LOAD STEP BETWEEN 200mA to 400mA

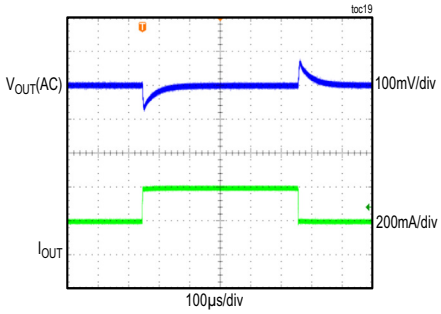
MAX17640B
LOAD TRANSIENT RESPONSE



CONDITIONS: PFM MODE, FIXED 5V OUTPUT
LOAD STEP BETWEEN 5mA to 200mA

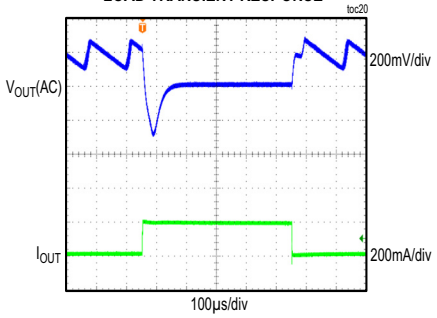
MAX17640A/MAX17640B/MAX17640C EV Kits Performance Report (continued)

MAX17640B
LOAD TRANSIENT RESPONSE



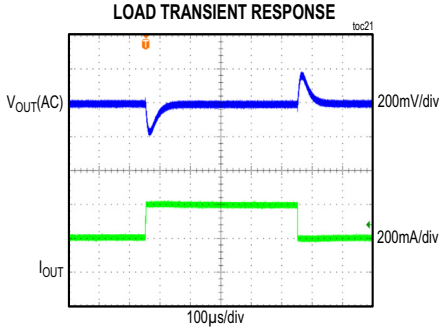
CONDITIONS: PWM MODE, FIXED 5V OUTPUT
LOAD STEP BETWEEN 200mA to 400mA

MAX17640C
LOAD TRANSIENT RESPONSE



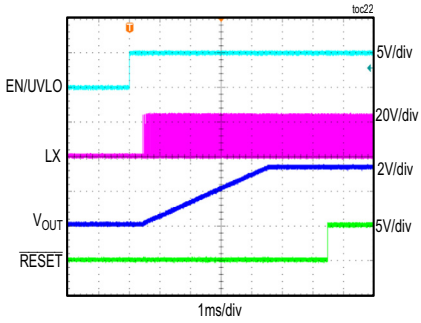
CONDITIONS: PFM MODE, ADJUSTABLE 12V OUTPUT
LOAD STEP BETWEEN 5mA to 200mA

MAX17640C
LOAD TRANSIENT RESPONSE



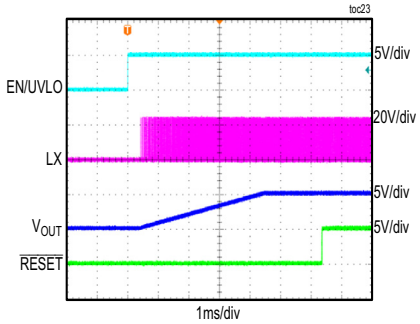
CONDITIONS: PWM MODE, ADJUSTABLE 12V OUTPUT
LOAD STEP BETWEEN 200mA to 400mA

MAX17640A
STARTUP THROUGH ENABLE



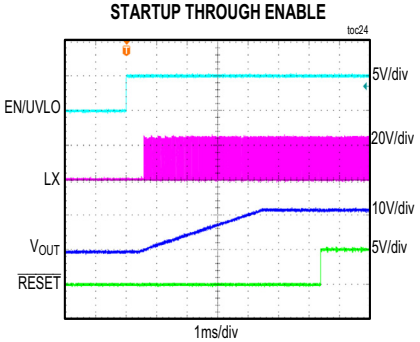
CONDITIONS: FIXED 3.3V OUTPUT,
400mA LOAD, PWM MODE

MAX17640B
STARTUP THROUGH ENABLE



CONDITIONS: FIXED 5V OUTPUT,
400mA LOAD, PWM MODE

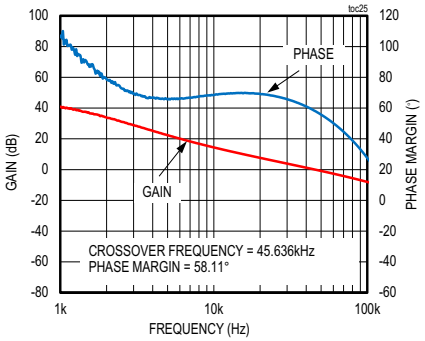
MAX17640C
STARTUP THROUGH ENABLE



CONDITIONS: ADJUSTBALE 12V OUTPUT,
400mA LOAD, PWM MODE

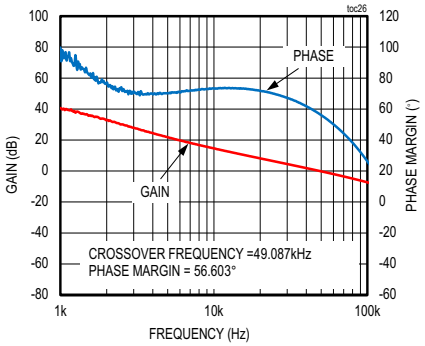
MAX17640A/MAX17640B/MAX17640C EV Kits Performance Report (continued)

**MAX17640A
BODE PLOT**



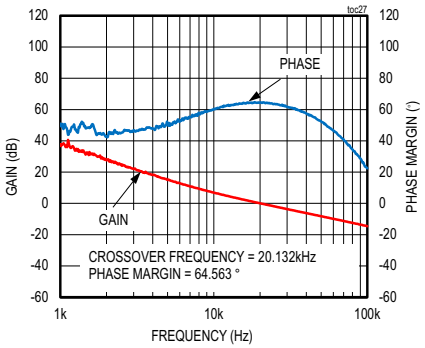
CONDITIONS: FIXED 3.3V OUTPUT, 400mA LOAD, PWM MODE

**MAX17640B
BODE PLOT**



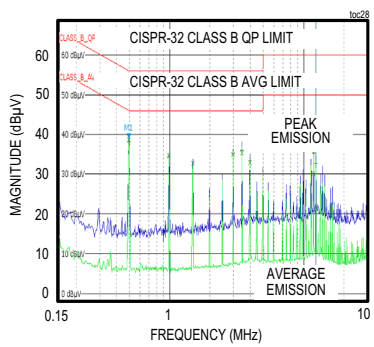
CONDITIONS: FIXED 5V OUTPUT, 400mA LOAD, PWM MODE

**MAX17640C
BODE PLOT**



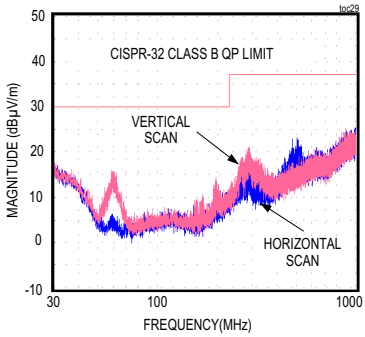
CONDITIONS: ADJUSTABLE 12V OUTPUT, 400mA LOAD, PWM MODE

**MAX17640B
CONDUCTED EMISSIONS PLOT**



CONDITIONS : V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0.4A
MEASURED ON THE MAX17640BEVKIT# WITH
L201 = 22µH, C202 = C204 = 1µF/100V/X7R/1206

**MAX17640B
RADIATED EMISSIONS PLOT**



CONDITIONS : V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0.4A
MEASURED ON THE MAX17640BEVKIT#

Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Panasonic Corp	www.panasonic.com
Taiyo Yuden	www.yuden.co.jp
TDK	www.tdk.com
Vishay	www.vishay.com
Wurth Elektronik	www.we-online.com

Note: *Indicate that you are using the MAX17640 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX17640AEVKIT#	EV Kit
MAX17640BEVKIT#	EV Kit
MAX17640C12EVKIT#	EV Kit

#Denotes RoHS compliance.

MAX17640A EV Kit Bill of Materials

MAX17640A 3.3V Application Circuit

ITEM	QTY	DESIGNATION	DESCRIPTION	MANUFACTURER PART NUMBER
1	2	C101, C107	0.1µF±10%, 100V, X7R Ceramic Capacitor (0603)	TAIYO YUDEN HMK107B7104KA
2	1	C103	22µF±20%, 100V, Aluminum Electrolytic capacitor	PANASONIC EEE-FK2A220P
3	1	C105	220pF±5%, 100V, C0G Ceramic Capacitor (0603)	TDK C1608C0G2A221J080AA
4	1	C106	1µF±10%, 100V, X7R Ceramic Capacitor (1206)	TAIYO YUDEN HMK316B7105KLH
5	1	C108	1µF±10%, 16V, X7R Ceramic Capacitor (0603)	TAIYO YUDEN EMK107B7105KA
6	1	C109	22µF±10%, 6.3V, X7R Ceramic Capacitor (1206)	MURATA GRM31CR70J226KE19
7	1	C111	0.1µF±10%, 16V, X7R Ceramic Capacitor (0402)	TAIYO YUDEN EMK105B7104KV-F
8	1	L102	INDUCTOR, 47µH, 1A	WURTH 74404054470
9	1	R101	1.1MΩ±1% resistor (0402)	VISHAY DALE CRCW04021M10FK
10	1	R102	3.32MΩ±1% resistor (0402)	VISHAY DALE CRCW04023M32FK
11	1	R103	10kΩ±1% resistor (0402)	VISHAY DALE CRCW040210K0FK
12	1	U1	MAX17640A, Integrated Step-down Converter	MAXIM MAX17640AATA+
13	1	L101	Package Outline 2mmx1.9mm inductor	
14	2	C102, C104	Package Outline 1206 capacitor	
15	1	C110	Package Outline 0805 capacitor	

MAX17640B EV Kit Bill of Materials

MAX17640B 5V Application Circuit

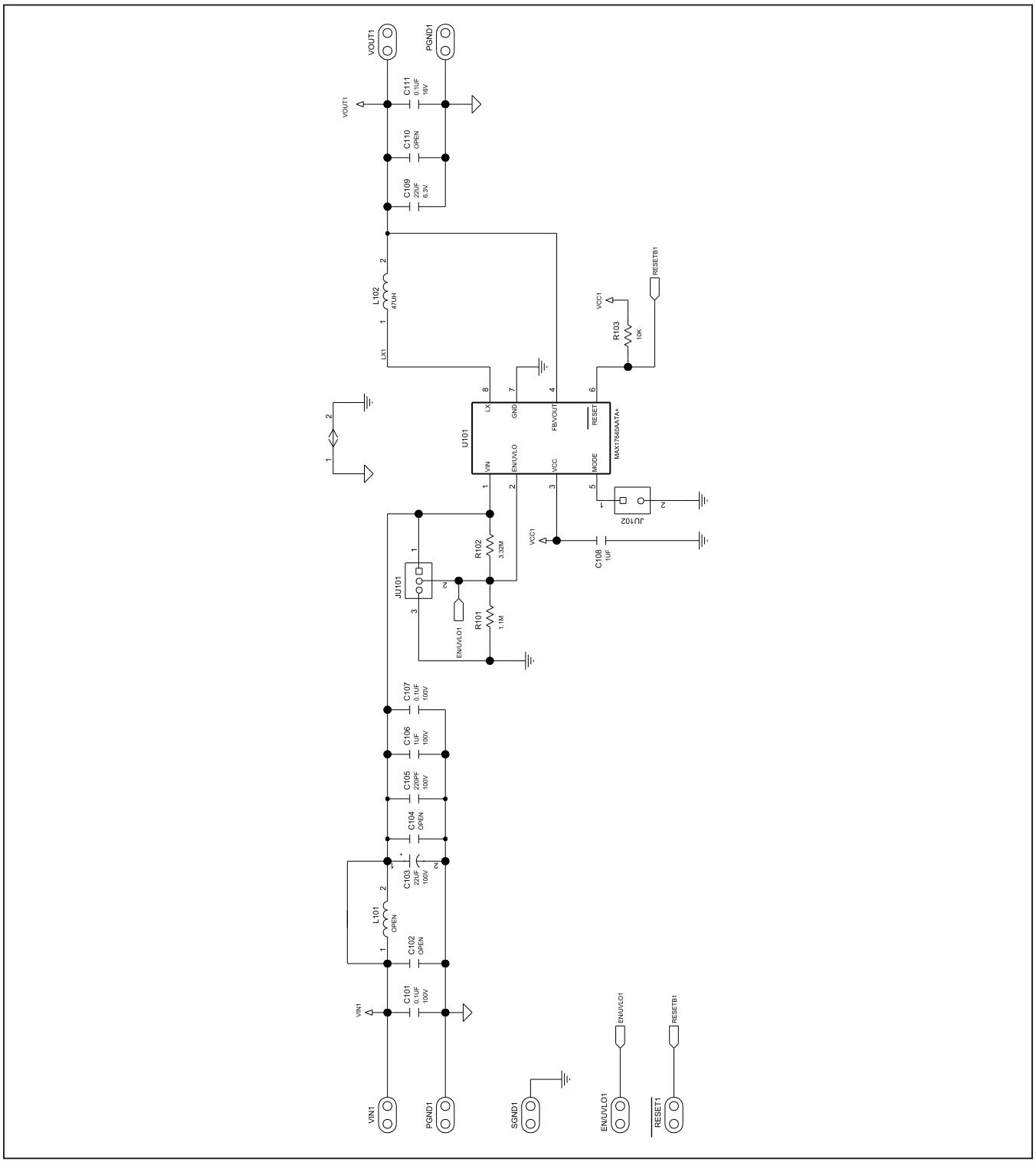
ITEM	QTY	DESIGNATION	DESCRIPTION	MANUFACTURER PART NUMBER
1	2	C201, C207	0.1µF±10%, 100V, X7R Ceramic Capacitor (0603)	TAIYO YUDEN HMK107B7104KA
2	1	C203	22µF±20%, 100V, Aluminum Electrolytic capacitor	PANASONIC EEE-FK2A220P
3	1	C205	220pF±5%, 100V, C0G Ceramic Capacitor (0603)	TDK C1608C0G2A221J080AA
4	1	C206	1µF±10%, 100V, X7R Ceramic Capacitor (1206)	TAIYO YUDEN HMK316B7105KLH
5	1	C208	1µF±10%, 16V, X7R Ceramic Capacitor (0603)	TAIYO YUDEN EMK107B7105KA
6	1	C209	22µF±10%, 6.3V, X7R Ceramic Capacitor (1206)	MURATA GRM31CR70J226KE19
7	1	C211	0.1µF±10%, 16V, X7R Ceramic Capacitor (0402)	TAIYO YUDEN EMK105B7104KV-F
8	1	L202	INDUCTOR, 68µH, 0.8A	WURTH 74404054680
9	1	R201	715kΩ±1% resistor (0402)	VISHAY DALE CRCW0402715KFK
10	1	R202	3.32MΩ±1% resistor (0402)	VISHAY DALE CRCW04023M32FK
11	1	R203	10kΩ±1% resistor (0402)	VISHAY DALE CRCW040210K0FK
12	1	U1	MAX17640B, Integrated Step-down Converter	MAXIM MAX17640BATA+
13	1	L201	OPTIONAL: 22µH±20%, 390mA Shielded Wirewound Inductor	COILCRAFT XPL2010-223ML
14	2	C202, C204	OPTIONAL: 1µF±10%, 100V, X7R Ceramic Capacitor (1206)	TAIYO YUDEN HMK316B7105KLH
15	1	C210	Package Outline 0805 capacitor	

MAX17640C EV Kit Bill of Materials

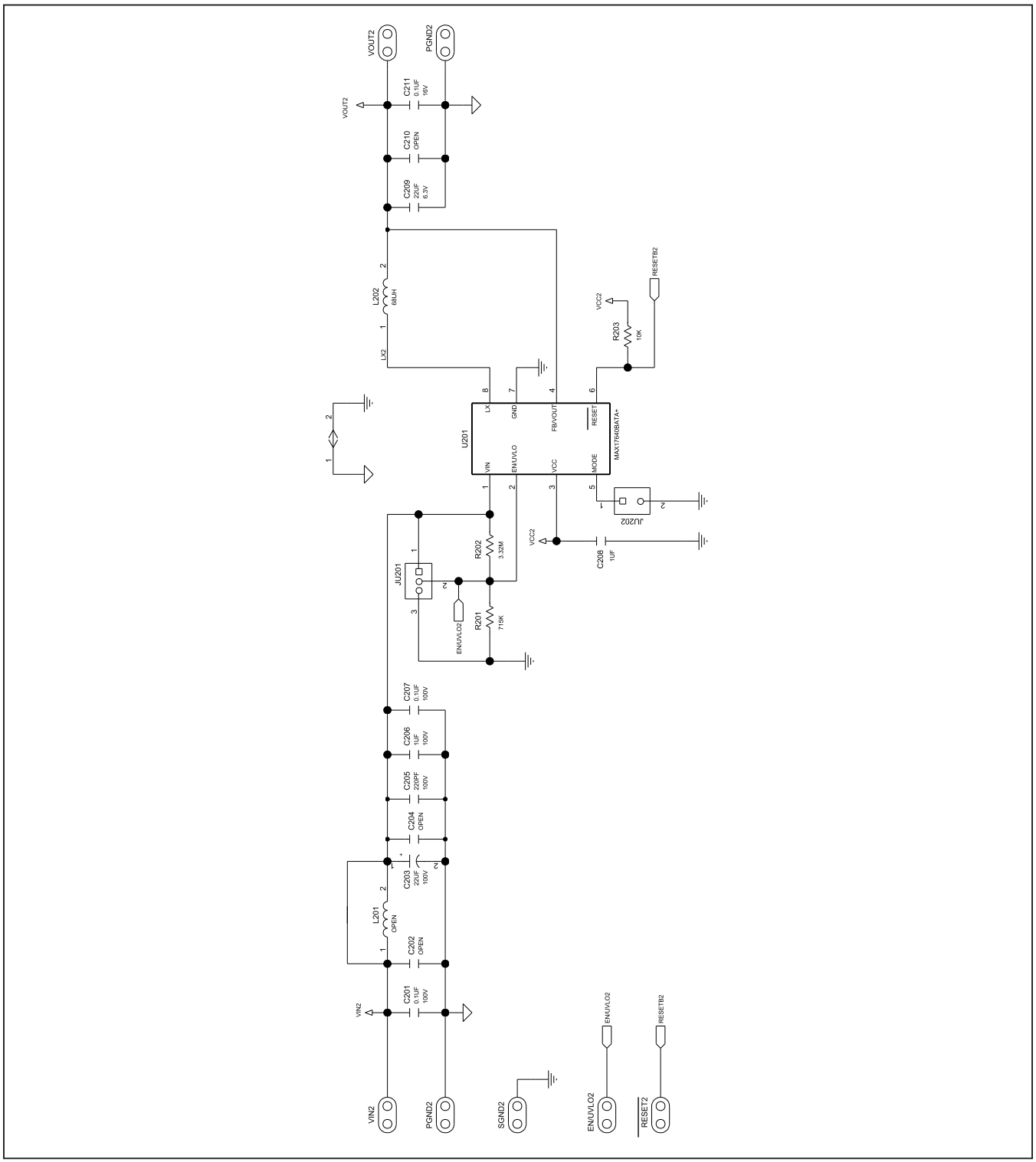
MAX17640C 12V Application Circuit

ITEM	QTY	DESIGNATION	DESCRIPTION	MANUFACTURER PART NUMBER
1	2	C301, C307	0.1µF±10%, 100V, X7R Ceramic Capacitor (0603)	TAIYO YUDEN HMK107B7104KA
2	1	C303	22µF±20%, 100V, Aluminum Electrolytic capacitor	PANASONIC EEE-FK2A220P
3	1	C305	220pF±5%, 100V, C0G Ceramic Capacitor (0603)	TDK C1608C0G2A221J080AA
4	1	C306	1µF±10%, 100V, X7R Ceramic Capacitor (1206)	TAIYO YUDEN HMK316B7105KLH
5	1	C308	1µF±10%, 16V, X7R Ceramic Capacitor (0603)	TAIYO YUDEN EMK107B7105KA
6	1	C309	22µF±10%, 16V, X7R Ceramic Capacitor (1210)	MURATA GRM32ER71C226KEA8
7	1	C311	0.1µF±10%, 16V, X7R Ceramic Capacitor (0402)	TAIYO YUDEN EMK105B7104KV-F
8	1	L302	INDUCTOR, 150µH, 0.6A	WURTH 74404054151
9	1	R301	301kΩ±1% resistor (0402)	VISHAY DALE CRCW0402301KFK
10	1	R302	3.32MΩ±1% resistor (0402)	VISHAY DALE CRCW04023M32FK
11	1	R303	10kΩ±1% resistor (0402)	VISHAY DALE CRCW040210K0FK
12	1	R304	499kΩ±1% resistor (0402)	VISHAY DALE CRCW0402499KFK
13	1	R305	40.2kΩ±1% resistor (0402)	VISHAY DALE CRCW040240K2FK
14	1	U1	MAX17640C, Integrated Step-down Converter	MAXIM MAX17640CATA+
15	1	L301	Package Outline 2mmx1.9mm inductor	
16	2	C302, C304	Package Outline 1206 Capacitor	
17	1	C310	Package Outline 0805 Capacitor	

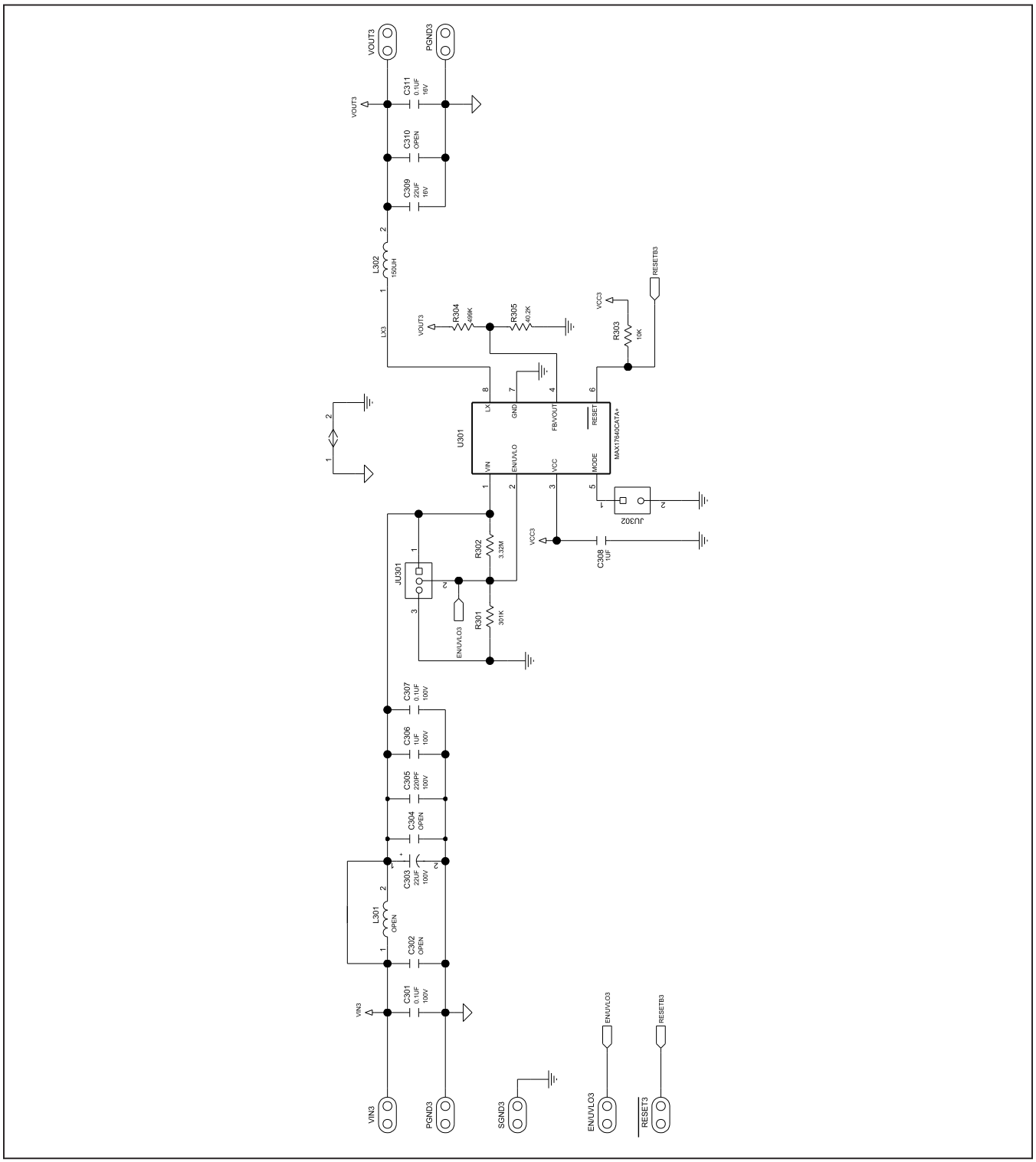
MAX17640A EV Kit Schematic Diagram



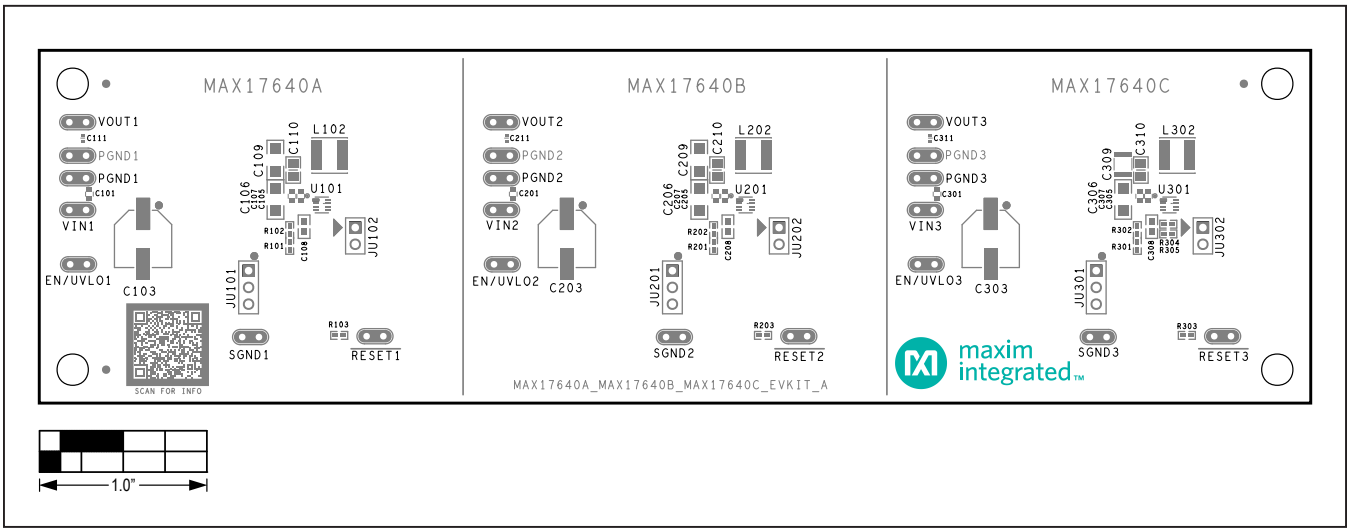
MAX17640B EV Kit Schematic Diagram



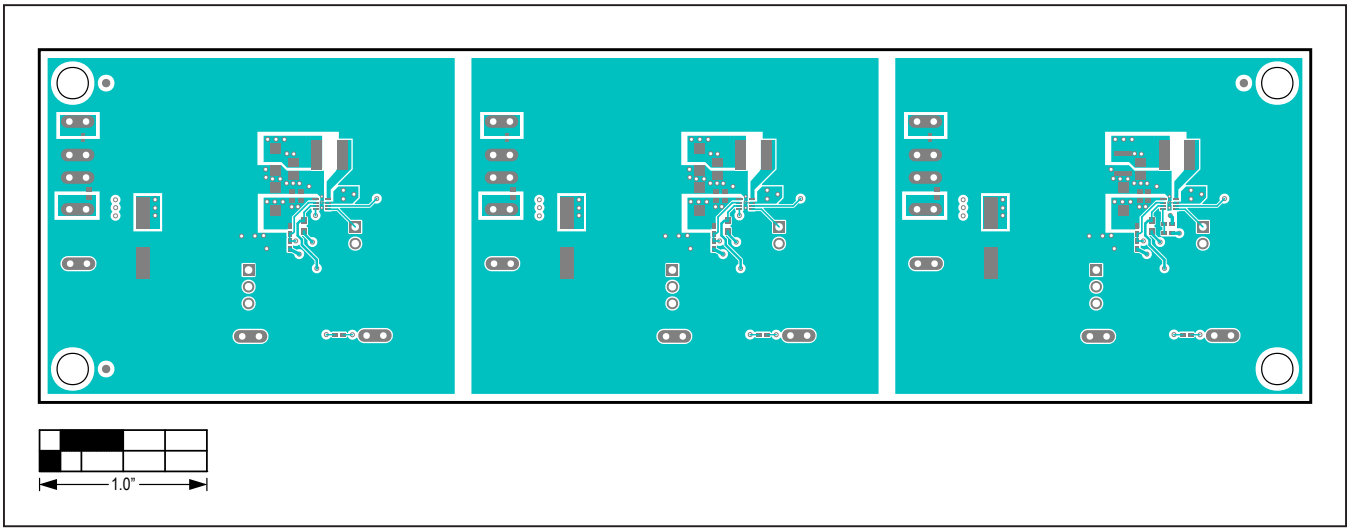
MAX17640C EV Kit Schematic Diagram



MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagrams

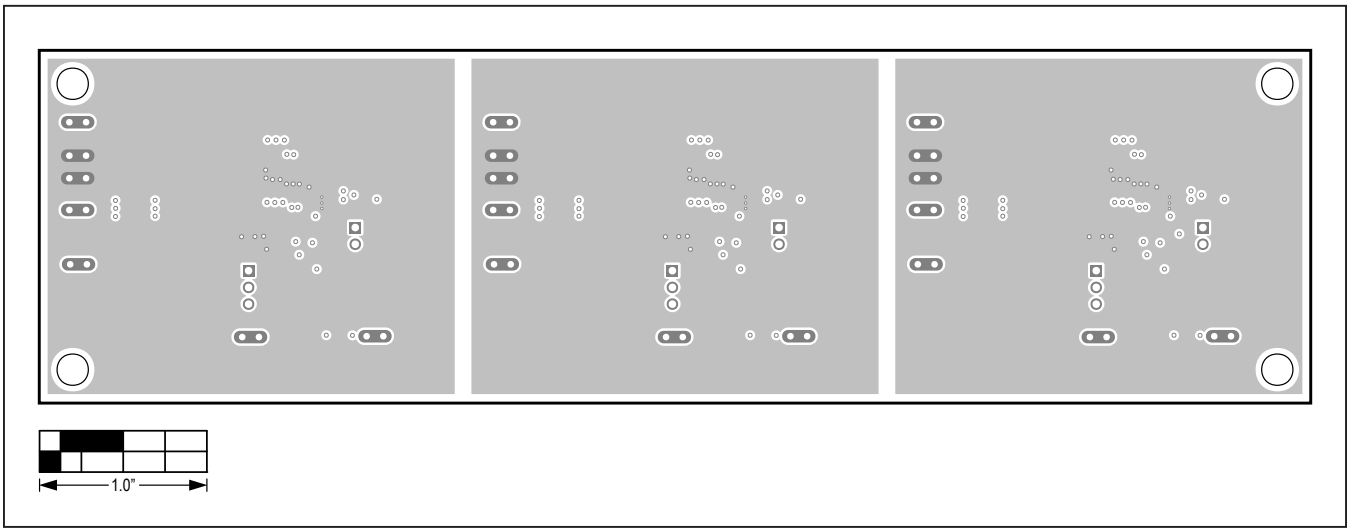


MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagram—Top Silkscreen

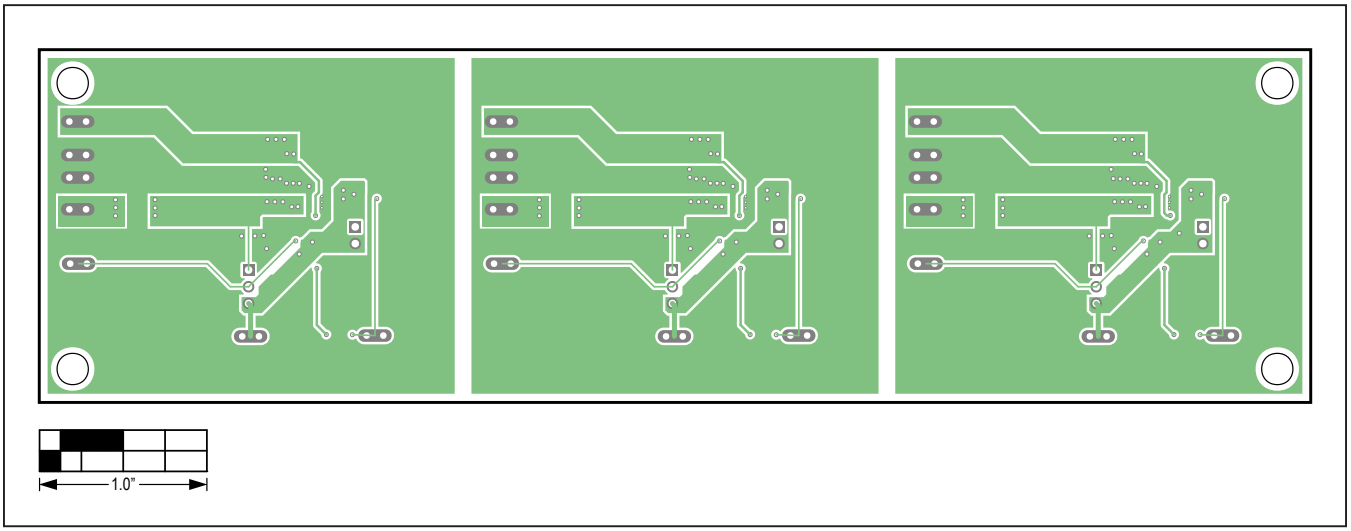


MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagram—Top Layer

MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagrams (continued)

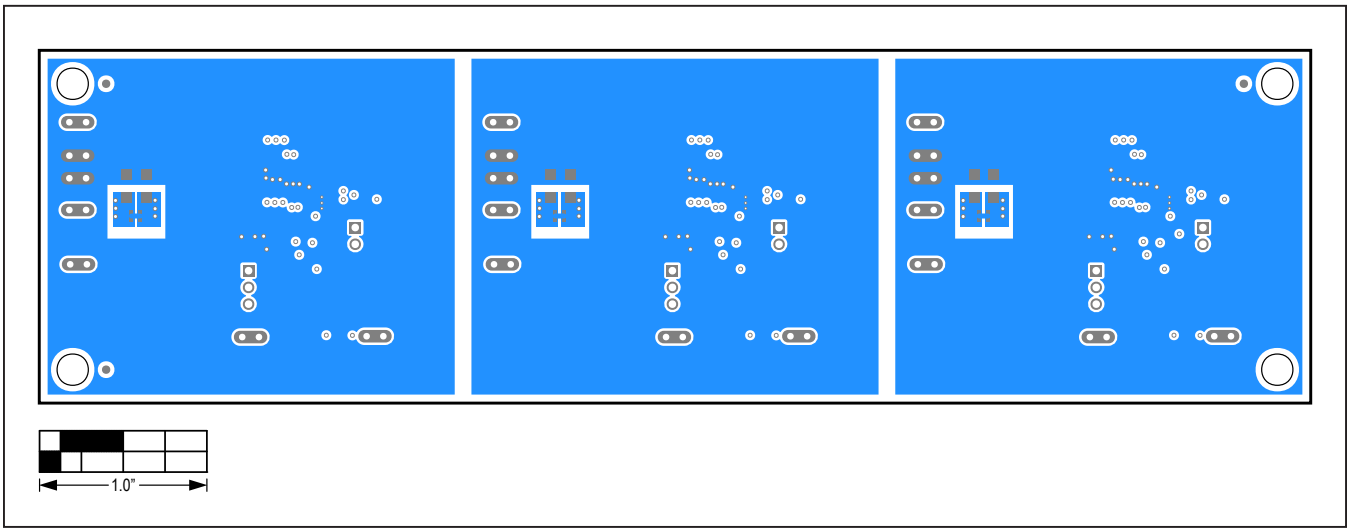


MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagram—Layer 2

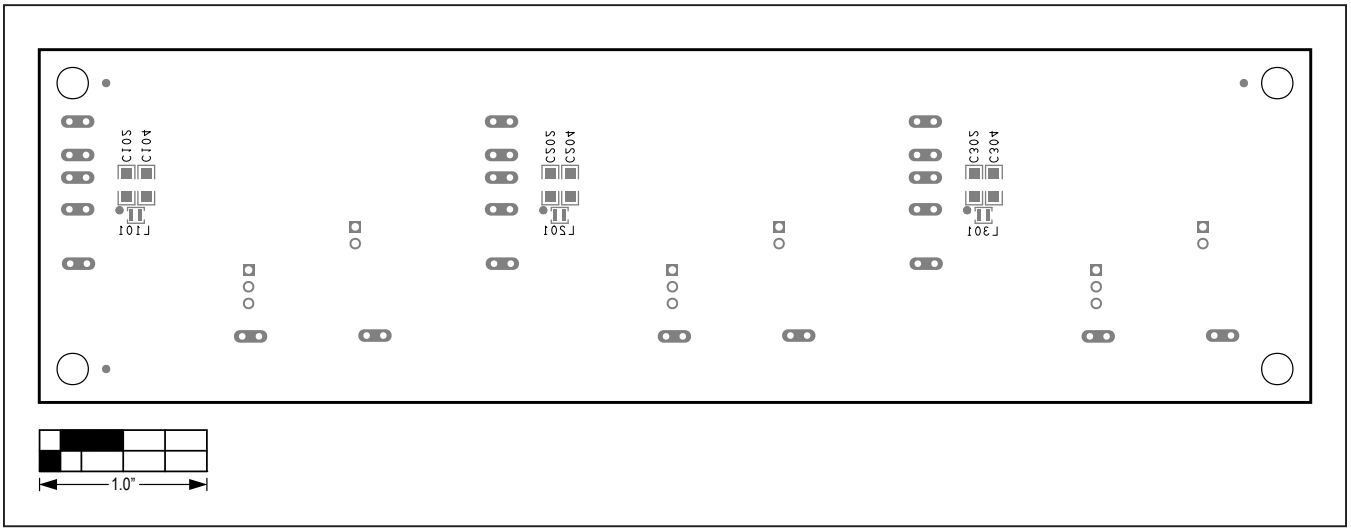


MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagram—Layer 3

MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagrams (continued)



MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagram—Bottom Layer



MAX17640A/MAX17640B/MAX17640C EV Kits PCB Layout Diagram—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/21	Release for Market Intro	—
1	3/21	Updated Part numbers in EV kit title	1–17

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