MAX17643 Evaluation Kit

Evaluates: MAX17643 in 5V and 3.3V Output-Voltage Applications

General Description

The MAX17643 evaluation kit (EV kit) provides a proven 5V and 3.3V designs to evaluate the MAX17643 high-voltage, high-efficiency, synchronous step-down DC-DC converter. The 3.3V application circuit operates over a 6V to 60V input-voltage range at 500kHz. The 5V application circuit operates over a 7.5V to 60V input-voltage range at 500kHz.

Each application circuit on the EV kit features an adjustable input undervoltage-lockout, adjustable soft-start, open-drain $\overline{\text{RESET}}$ signal, and external frequency synchronization. The *MAX17643 converter data sheet* provides a complete description of the part that should be read in conjunction with this data sheet before operating the EV kit.

Features

- Operates up to 60V Input Supply
- 5V and 3.3V Application Circuits
- Up to 2A Load Current
- 500kHz Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Programmed 1ms Soft-Start Time
- Open-Drain $\overline{\text{RESET}}$ Output
- External Frequency Synchronization
- Overcurrent and Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested

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

Quick Start

Required Equipment

- One 60V, 2A DC power supply
- Digital multimeters (DMM)
- Load resistors capable of sinking up to 2A. (1.65Ω for 3.3V application circuit and 2.5Ω for 5V application circuit)

Equipment Setup and Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify and test individual application circuits:

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 application circuit under evaluation.
3) Connect the positive terminal of the 2A load to the VOUT pad and the negative terminal to the nearest PGND pad of the corresponding application circuit.
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 3.3V application circuit and JU201 for 5V application circuit. See Table 1 for details.
6) Turn on the input-power supply.
7) Verify that the DMMs display expected terminal voltages with respect to PGND.

319-100665; Rev 0; 12/20

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Detailed Description

The MAX17643 EV kit is designed to demonstrate the salient features of MAX17643 high-voltage, high efficiency, synchronous step-down DC-DC converter in 5V and 3.3V applications. The EV kit consists of typical application circuits for 5V and 3.3V. Each of these circuits are electrically isolated from each other and hosted on the same PCB. Each of these circuits can be evaluated for its performance under different operating conditions by powering them from their respective input pins.

Setting Switching Frequency

The switching frequency of the MAX17643 can be programmed from 400kHz to 2.2MHz by using a resistor connected from the RT/SYNC pin to GND. Resistors R104 in the 3.3V application circuit and R204 in the 5V application circuit programs the desired switching frequencies. When no resistor is used, the frequency is programmed to 490kHz. To optimize performance and component size in the EV kit, 500kHz switching frequency has been chosen for 3.3V and 5V application circuits. Use the *Switching Frequency* section of the *MAX17643 data sheet* to choose different values of resistors for programming the required switching frequency.

Soft-Start Capacitor Selection

The EV kit offers an adjustable soft-start function to limit inrush current during startup. The soft-start time is adjusted by changing the value of capacitor C111 for a 3.3V application circuit and C211 for a 5V application circuit. In this EV kit, the default soft-start time is set to 1ms, which is achieved by using a 5600pF soft-start capacitor for both 3.3V and 5V application circuits. To program a different soft-start time, refer to the *MAX17643 data sheet* to calculate the soft-start capacitor value.

Enable/Undervoltage Lockout (EN/UVLO) Programming

The 5V and 3.3V application circuits offer an adjustable input undervoltage-lockout level. For the 3.3V application circuit, when jumper JU101 is left open, the MAX17643 is enabled when the input voltage rises above 5.5V. To disable the MAX17643, install shunt JU101 across pins 2–3. For the 5V application circuit, when jumper JU201 is left open, the MAX17643 is enabled when the input voltage rises above 7V. To disable the MAX17643, install shunt across pins 2–3 on jumper JU201. See Table 1 for jumper settings. Refer to the *Setting the Undervoltage Lockout Level* section in the *MAX17643 data sheet* for more details.

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.

Adjusting Output Voltage

The MAX17643 supports a 0.9V to (0.9 x V_{IN}) V adjustable output voltage. MAX17643 EV kit consists of two application circuits configured to 3.3V output and 5V output. In the 3.3V application circuit, the output voltage is programmed using the resistor divider R106 and R107 and in the 5V application circuit, the output voltage is programmed using the resistor divider R206 and R207. Refer to the *Adjusting Output Voltage* section in the *MAX17643 data sheet* for more details.

Input Capacitor Selection

The input capacitors C105 for the 3.3V application circuit and C205 for the 5V application circuit, serve to reduce current peaks drawn from the input-power supply and reduce the switching frequency ripple at the input. Refer to the *Input Capacitor Selection* section in the *MAX17643 data sheet* to choose input capacitance. The input capacitor is chosen to be 4.7µF/100V in both the 3.3V and 5V application circuits.

Output Capacitor Selection

X7R ceramic capacitors are preferred due to their stability over the temperature in industrial applications. For the 3.3V application circuit, the required output capacitor (C113) is 47µF/10V and for the 5V application circuit, the required output capacitor (C213) is 22µF/16V. Refer to the *Output capacitor selection* section in the *MAX17643 data sheet* for more details.

Table 1. Step-Down Converter (EN/UVLO) Description (JU101 and JU201)

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)	Programmed to startup at desired input-voltage level
1–2	Connected to V_{IN}	Enabled
2–3	Connected to GND	Disabled

**Default Position*

Linear Regulator (V_{CC} and EXTVCC)

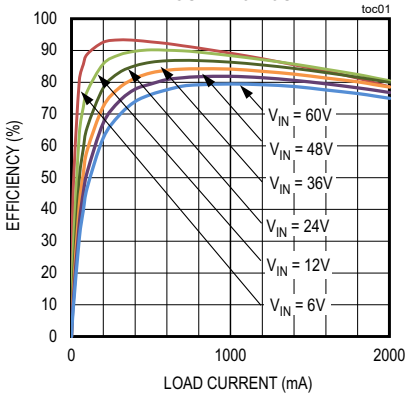
Powering V_{CC} from EXTVCC increases the efficiency of the module at higher input voltages. If the applied EXTVCC voltage is greater than 4.7V (typ), internal V_{CC} is powered from EXTVCC. If EXTVCC is lower than 4.7V (typ), internal V_{CC} is powered from V_{IN}. EXTVCC is connected to GND in the 3.3V application circuit and to OUT in the 5V application circuit.

Hot Plug-In and Long input cables

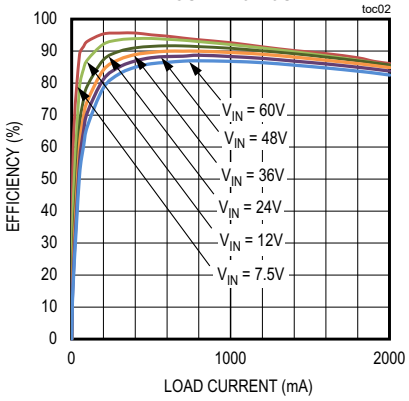
The MAX17643 EV kit provides optional electrolytic capacitors (C104 in 3.3V application circuit and C204 in 5V application circuit, 33µF/100V) to dampen input-voltage peaks and oscillations that can arise during hot-plug-in and/or due to long input cables. These capacitors limit the peak voltage at the input of the DC-DC converters when the EV kit is powered directly from a precharged capacitive source or an industrial backplane PCB. Long input cables between an 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.

MAX17643 EV Kit Performance Reports

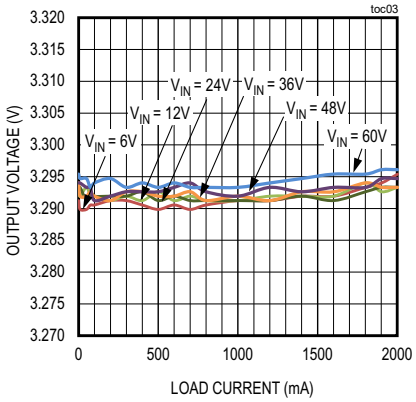
3.3V OUTPUT
EFFICIENCY vs. LOAD CURRENT
FIGURE 1 CIRCUIT



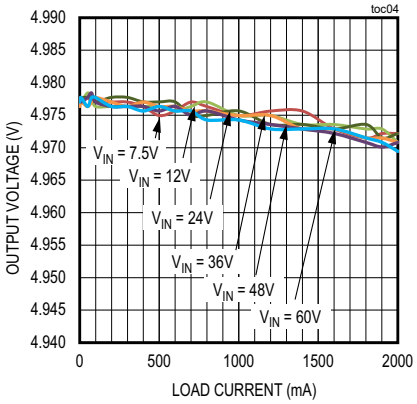
5V OUTPUT
EFFICIENCY vs. LOAD CURRENT
FIGURE 2 CIRCUIT



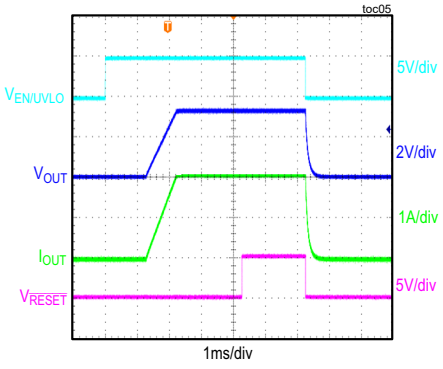
3.3V OUTPUT
OUTPUT VOLTAGE vs. LOAD CURRENT
FIGURE 1 CIRCUIT



5V OUTPUT
OUTPUT VOLTAGE vs. LOAD CURRENT
FIGURE 2 CIRCUIT

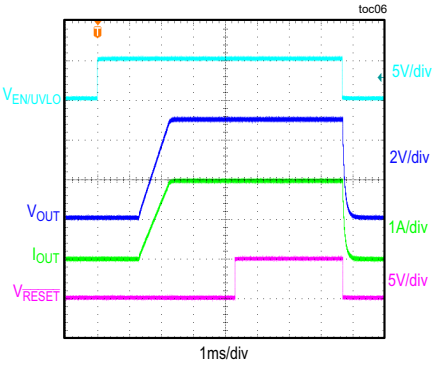


STARTUP/SHUTDOWN THROUGH EN/UVLO
1.65Ω RESISTIVE LOAD
FIGURE 1 CIRCUIT



CONDITION: $\overline{RESET}$ IS PULLED UP TO V_{CC} WITH A 10kΩ RESISTOR

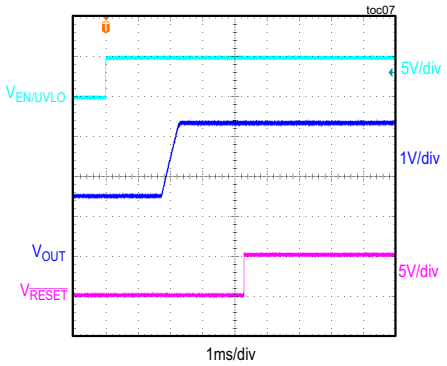
STARTUP/SHUTDOWN THROUGH EN/UVLO
2.5Ω RESISTIVE LOAD
FIGURE 2 CIRCUIT



CONDITION: $\overline{RESET}$ IS PULLED UP TO V_{CC} WITH A 10kΩ RESISTOR

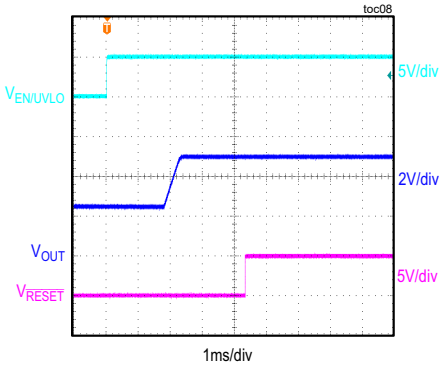
MAX17643 EV Kit Performance Reports (continued)

SOFT-START WITH 1.5V PREBIAS
3.3V OUTPUT
FIGURE 1 CIRCUIT



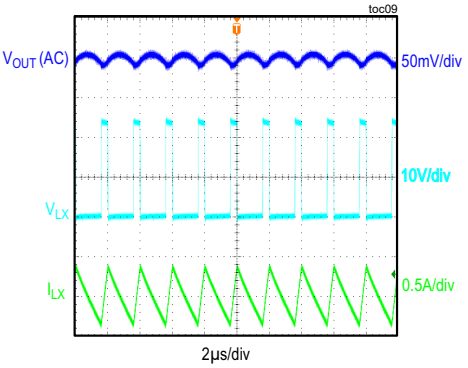
CONDITION: $\overline{RESET}$ IS PULLED UP TO V_{CC} WITH A 10kΩ RESISTOR

SOFT-START WITH 2.5V PREBIAS
5V OUTPUT
FIGURE 2 CIRCUIT

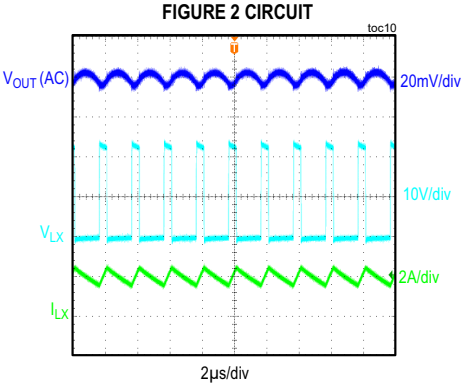


CONDITION: $\overline{RESET}$ IS PULLED UP TO V_{CC} WITH A 10kΩ RESISTOR

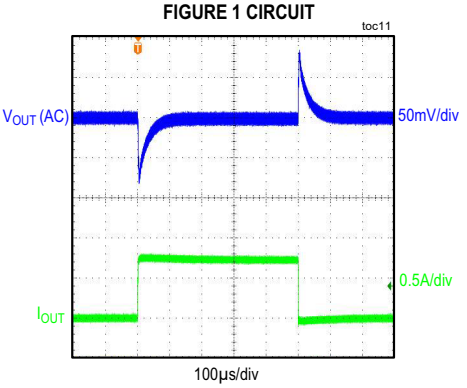
STEADY-STATE SWITCHING WAVEFORMS
5V OUTPUT, NO LOAD
FIGURE 2 CIRCUIT



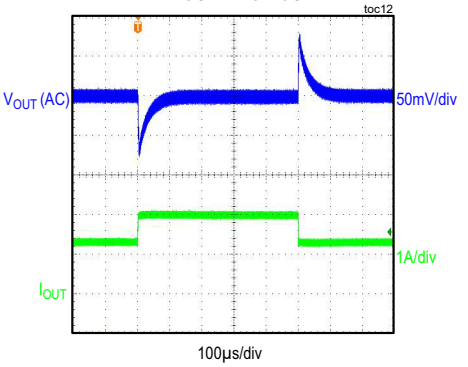
STEADY-STATE SWITCHING WAVEFORMS
5V OUTPUT, 2A LOAD CURRENT
FIGURE 2 CIRCUIT



3.3V OUTPUT
LOAD CURRENT STEPPED FROM NO LOAD TO 0.75A
FIGURE 1 CIRCUIT

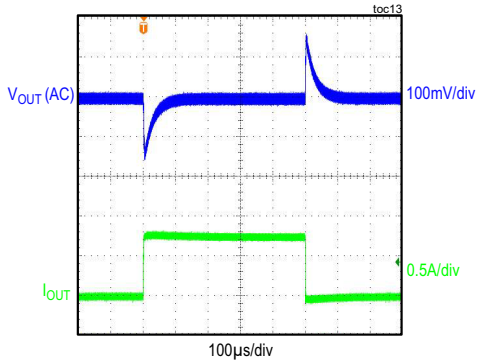


3.3V OUTPUT
LOAD CURRENT STEPPED FROM 1.25A TO 2A
FIGURE 1 CIRCUIT

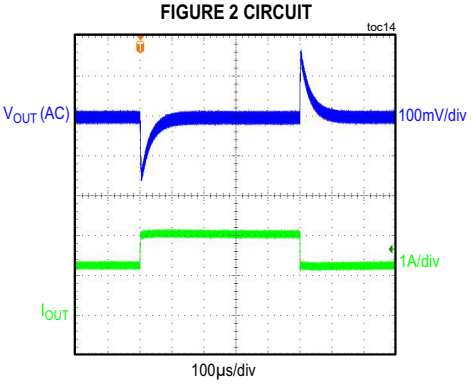


MAX17643 EV Kit Performance Reports (continued)

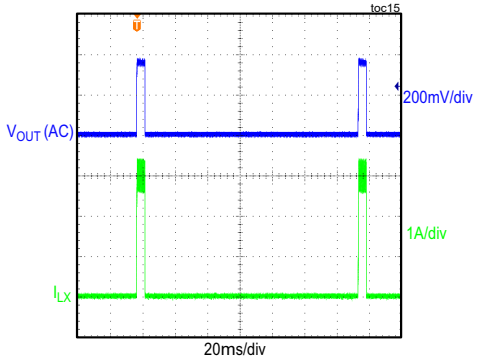
5V OUTPUT
LOAD CURRENT STEPPED FROM NO LOAD TO 0.75A
FIGURE 2 CIRCUIT



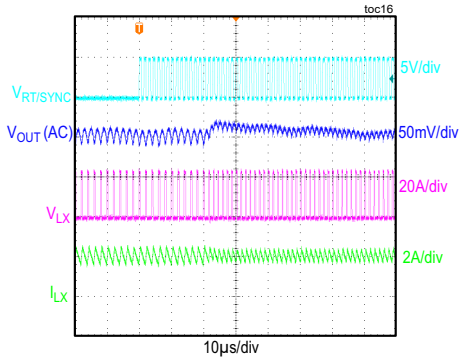
5V OUTPUT
LOAD CURRENT STEPPED FROM 1.25A TO 2A
FIGURE 2 CIRCUIT



OVERLOAD PROTECTION
5V OUTPUT
FIGURE 2 CIRCUIT

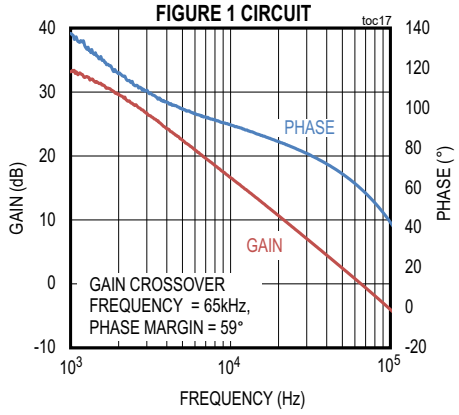


EXTERNAL-CLOCK SYNCHRONIZATION
FIGURE 2 CIRCUIT

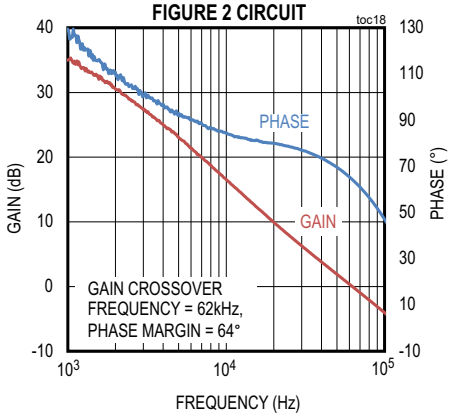


CONDITIONS: 5V OUTPUT, 2A LOAD CURRENT, f_{SW} = 500kHz, EXTERNAL-CLOCK FREQUENCY = 700kHz

BODE PLOT, 3.3V OUTPUT
1.65Ω RESISTIVE LOAD
FIGURE 1 CIRCUIT



BODE PLOT, 5V OUTPUT
2.5Ω RESISTIVE LOAD
FIGURE 2 CIRCUIT



Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Panasonic Corp	www.panasonic.com
Coilcraft, Inc.	www.coilcraft.com
Vishay	www.vishay.com
KEMET	www.kemet.com
TDK	www.tdk.com
Yageo	www.yageo.com

Note: *Indicate that you are using the MAX17643 when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX17643EVKIT#	EV Kit

#Denotes RoHS compliance.

MAX17643 EV Kit Bill of Materials

MAX17643 3.3V Application Circuit

ITEM	QTY	REF DES	MFG PART #	MANUFACTURER	DESCRIPTION
1	2	C101, C106	GRM188R72A104KA35	MURATA	0.1UF ± 10%, 100V, X7R, Ceramic Capacitor (0603)
2	1	C104	EEE-FK1K330P	PANASONIC	33UF ± 20%, 80V, Aluminium-Electrolytic Capacitor
3	1	C105	GRM31CZ72A475KE11	MURATA	4.7UF ± 10%, 100V, X7R, Ceramic Capacitor (1206)
4	1	C107	C1608C0G2A221J080AA	TDK	220pF ± 5%, 100V, C0G, Ceramic Capacitor (0603)
5	1	C108	C0402C101K5GAC	KEMET	100pF ± 10%, 50V, C0G, Ceramic Capacitor (0402)
6	1	C109	GCM1555C1H470JA16	MURATA	47pF ± 5%, 50V, C0G, Ceramic Capacitor (0402)
7	1	C110	GRM188R71A225KE15	MURATA	2.2UF ± 10%, 10V, X7R, Ceramic Capacitor (0603)
8	1	C111	GRM1555C1H562GE01	MURATA	5600pF ± 2%, 50V, C0G, Ceramic Capacitor (0402)
9	2	C112, C115	GRM155R71C104KA88	MURATA	0.1UF ± 10%, 16V, X7R, Ceramic Capacitor (0402)
10	1	C113	GRM32ER71A476KE15	MURATA	47UF ± 10%, 10V, X7R, Ceramic Capacitor (1210)
11	1	D101	BAT54WS-E3-08	VISHAY	Diode, PIV=30V, SOD-323
12	1	JU101	PBC03SAAN	SULLINS	3 pin header
13	1	L102	XAL5050-682ME	COILCRAFT	6.8UH ± 20%, 6.4A, Inductor
14	1	R101	CRCW0402953KFKEDC	VISHAY	953K ± 1% resistor (0402)
15	1	R102	CRCW04023M32FK	VISHAY DALE	3.32M ± 1% resistor (0402)
16	1	R103	ERJ-2RKF1001	PANASONIC	1k ± 1% resistor (0402)
17	1	R104	CRCW040240K2FK	VISHAY DALE	40.2k ± 1% resistor (0402)
18	1	R105	CRCW040210K0FK	VISHAY DALE	10k ± 1% resistor (0402)
19	1	R106	ERA-2AEB5232	PANASONIC	52.3k ± 1% resistor (0402)
20	1	R107	RT0402BRD0719K6L	YAGEO	19.6k ± 1% resistor (0402)
21	1	U101	MAX17643	MAXIM	Buck Converter, MAX17643 IC
22	1	C102	N/A	N/A	OPEN
23	1	L101	N/A	N/A	OPEN
24	1	C103	N/A	N/A	OPEN
25	1	C114	N/A	N/A	OPEN

MAX17643 EV Kit Bill of Materials (continued)

MAX17643 5V Application Circuit

ITEM	QTY	REF DES	MFG PART #	MANUFACTURER	DESCRIPTION
1	2	C201, C206	GRM188R72A104KA35	MURATA	0.1UF ± 10%, 100V, X7R, Ceramic Capacitor (0603)
2	1	C204	EEE-FK1K330P	PANASONIC	33UF ± 20%, 80V, Aluminium-Electrolytic Capacitor
3	1	C205	GRM31CZ72A475KE11	MURATA	4.7UF ± 10%, 100V, X7R, Ceramic Capacitor (1206)
4	1	C207	C1608C0G2A221J080AA	TDK	220pF ± 5%, 100V, C0G, Ceramic Capacitor (0603)
5	1	C208	C0402C101K5GAC	KEMET	100pF ± 10%, 50V, C0G, Ceramic Capacitor (0402)
6	1	C209	GCM1555C1H470JA16	MURATA	47pF ± 5%, 50V, C0G, Ceramic Capacitor (0402)
7	1	C210	GRM188R71A225KE15	MURATA	2.2UF ± 10%, 10V, X7R, Ceramic Capacitor (0603)
8	1	C211	GRM1555C1H562GE01	MURATA	5600pF ± 2%, 50V, C0G, Ceramic Capacitor (0402)
9	3	C212, C215, C216	GRM155R71C104KA88	MURATA	0.1UF ± 10%, 16V, X7R, Ceramic Capacitor (0402)
10	1	C213	GRM32ER71C226KEA8	MURATA	22UF ± 10%, 16V, X7R, Ceramic Capacitor (1210)
11	1	D201	BAT54WS-E3-08	VISHAY	Diode, PIV=30V, SOD-323
12	1	JU201	PBC03SAAN	SULLINS	3 pin header
13	1	L202	XAL5050-103ME	COILCRAFT	10UH ± 20%, 4.9A, Inductor
14	1	R201	ERJ-2RKF6983	PANASONIC	698K ± 1% resistor (0402)
15	1	R202	CRCW04023M32FK	VISHAY DALE	3.32M ± 1% resistor (0402)
16	1	R203	ERJ-2RKF1001	PANASONIC	1k ± 1% resistor (0402)
17	1	R204	CRCW040240K2FK	VISHAY DALE	40.2k ± 1% resistor (0402)
18	1	R205	CRCW040210K0FK	VISHAY DALE	10k ± 1% resistor (0402)
19	1	R206	RC0402FR-07105KL	YAGEO	105k ± 1% resistor (0402)
20	1	R207	CRCW040223K2FK	VISHAY	23.2k ± 1% resistor (0402)
21	1	R208	CRCW04024R70FK	VISHAY DALE	4.7 ± 1% resistor (0402)
22	1	U201	MAX17643	MAXIM	Buck Converter, MAX17643 IC
23	1	C202	N/A	N/A	OPEN
24	1	L201	N/A	N/A	OPEN
25	1	C203	N/A	N/A	OPEN
26	1	C214	N/A	N/A	OPEN

MAX17643 EV Kit Schematic Diagrams

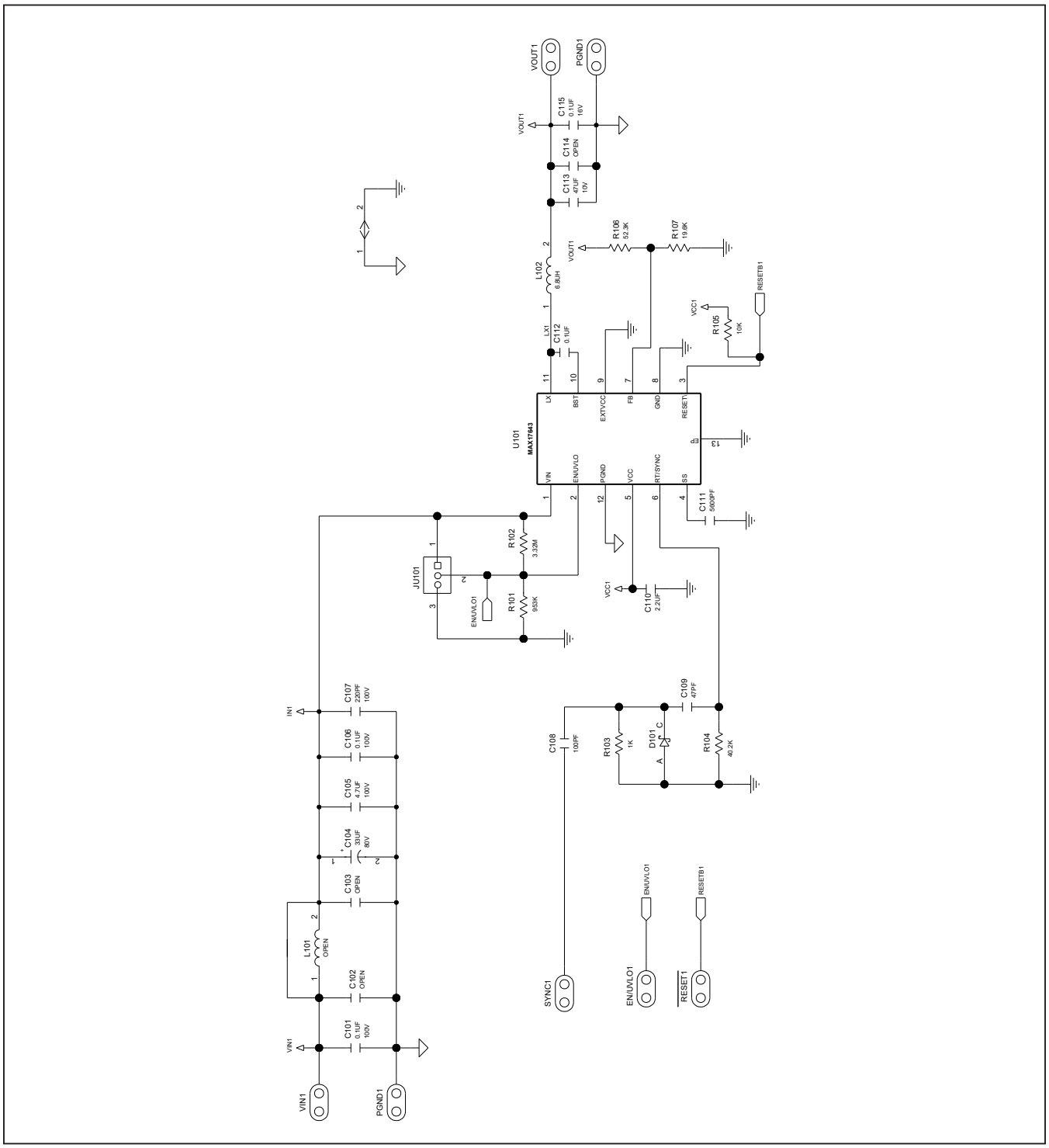


Figure 1. 3.3V Application Circuit Schematic Diagram

MAX17643 EV Kit Schematic Diagrams (continued)

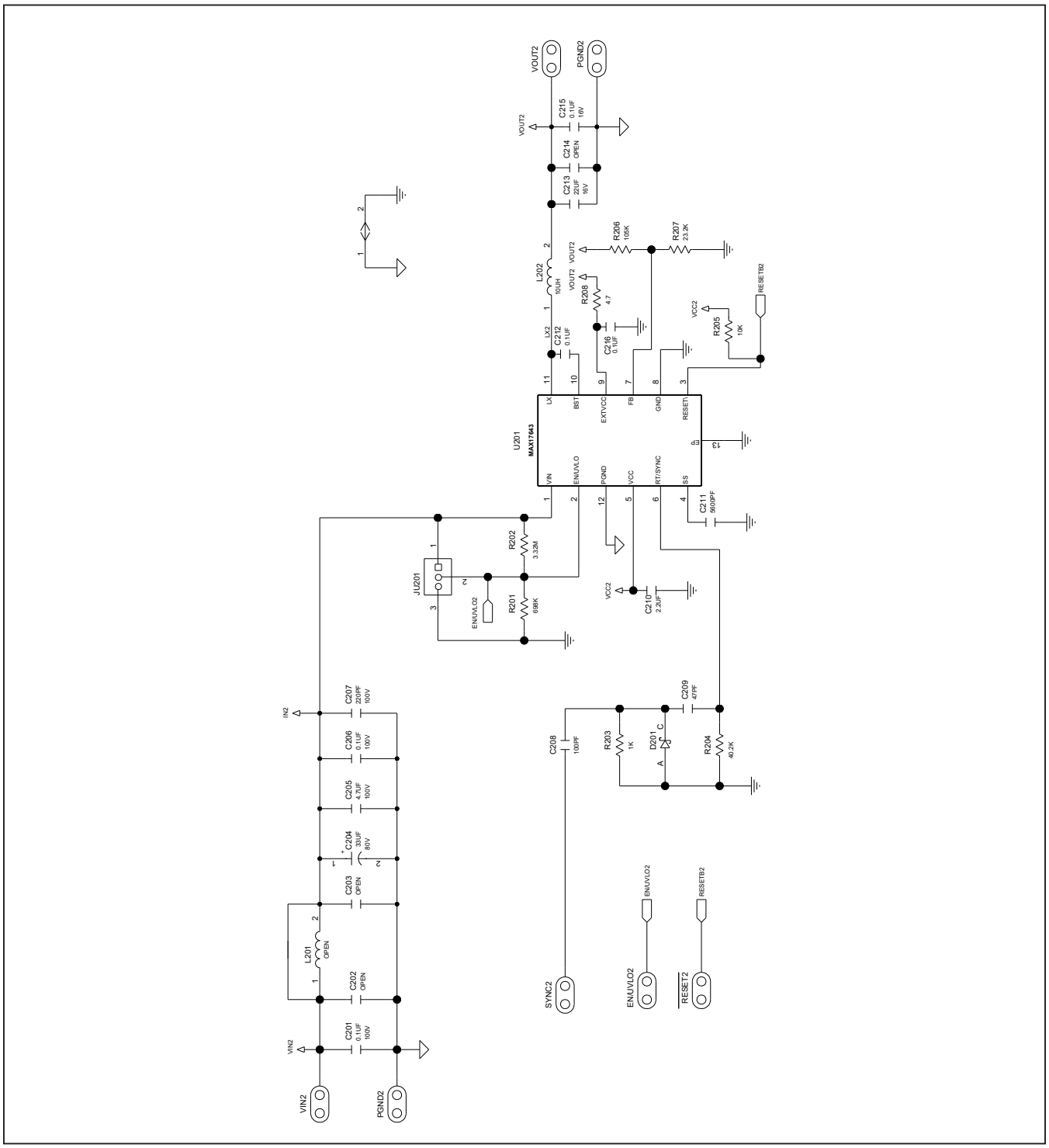
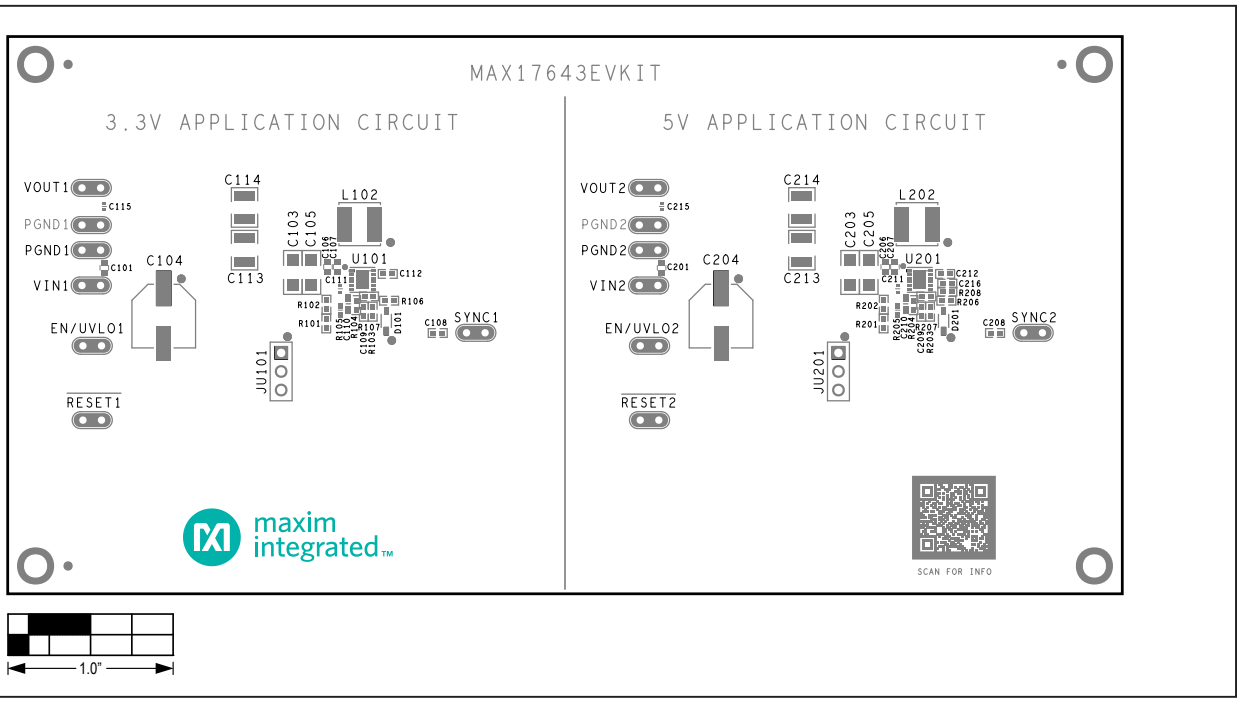
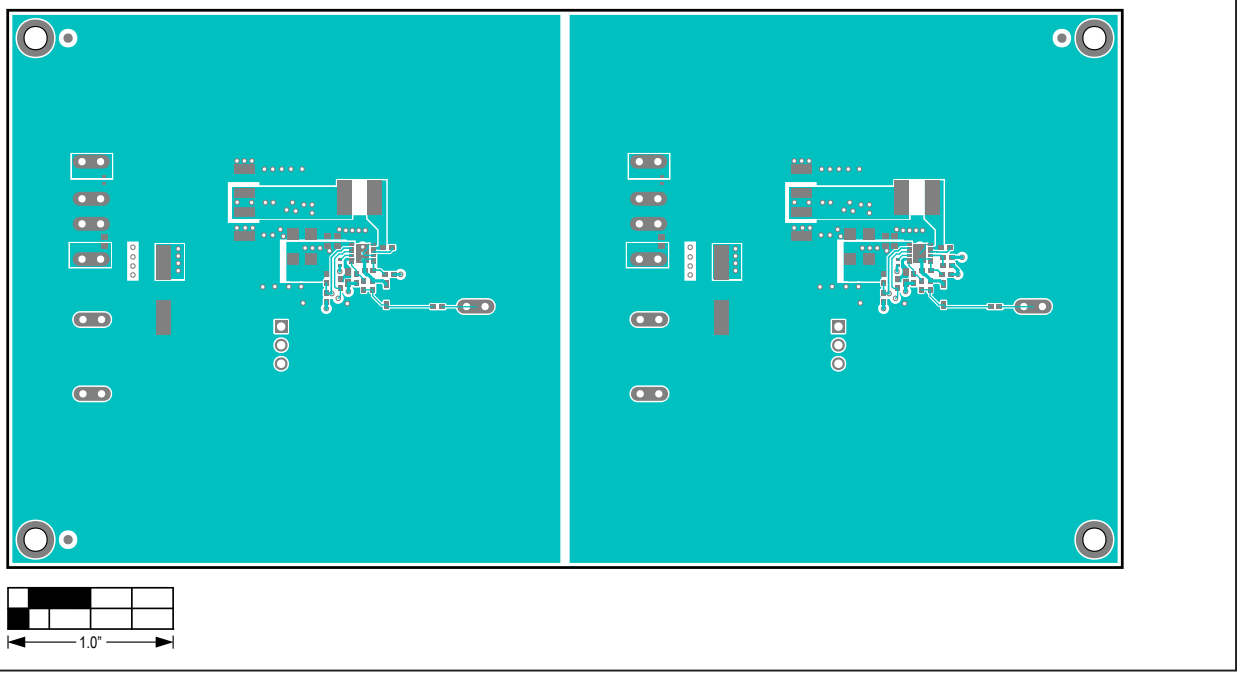


Figure 2. 5V Application Circuit Schematic Diagram

MAX17643 EV Kit PCB Layout Diagrams

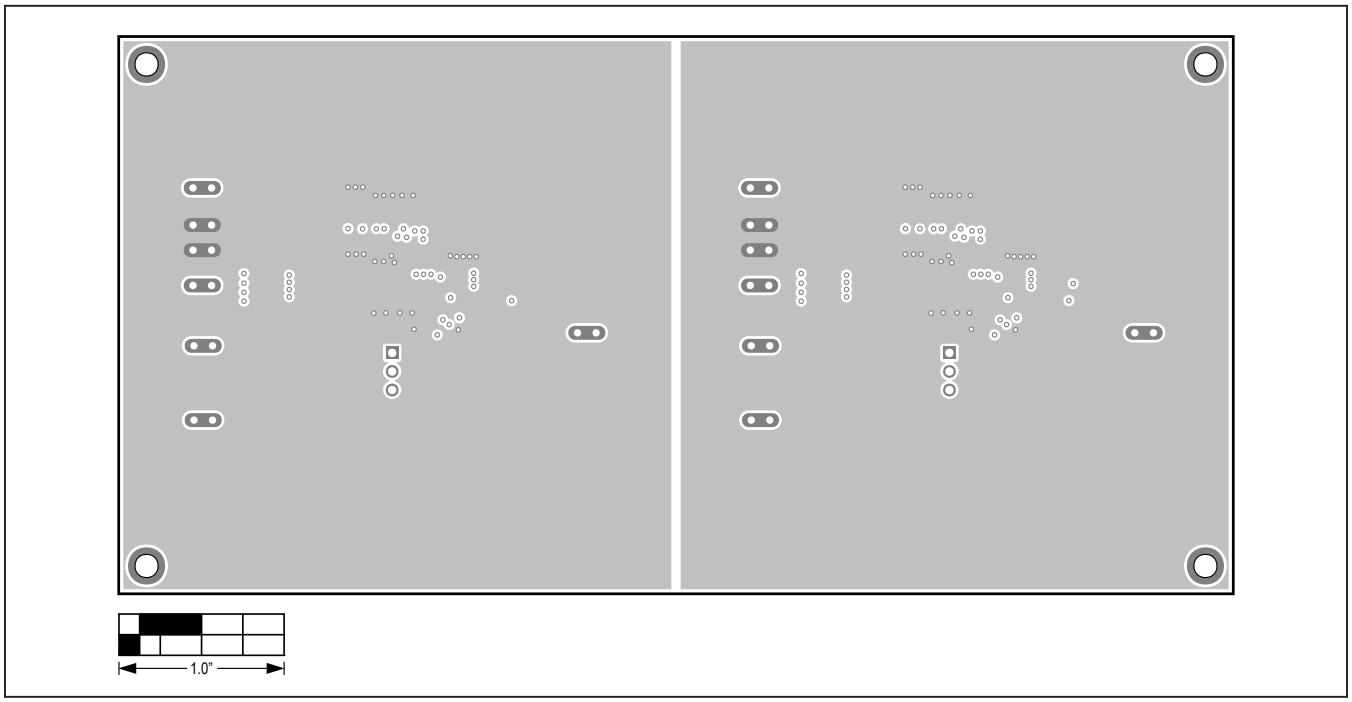


MAX17643 EV Kit PCB Layout Diagrams—Top Silkscreen

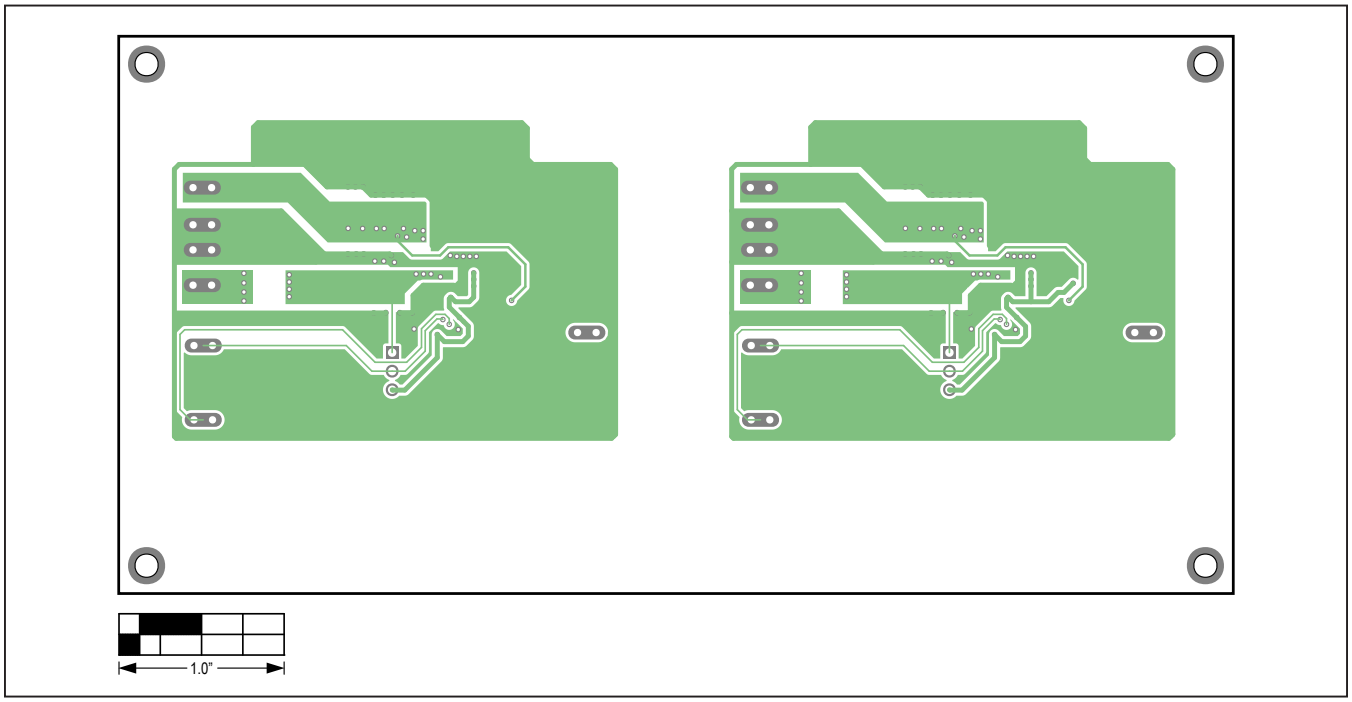


MAX17643 EV Kit PCB Layout Diagrams—Top Layer

MAX17643 EV Kit PCB Layout Diagrams (continued)

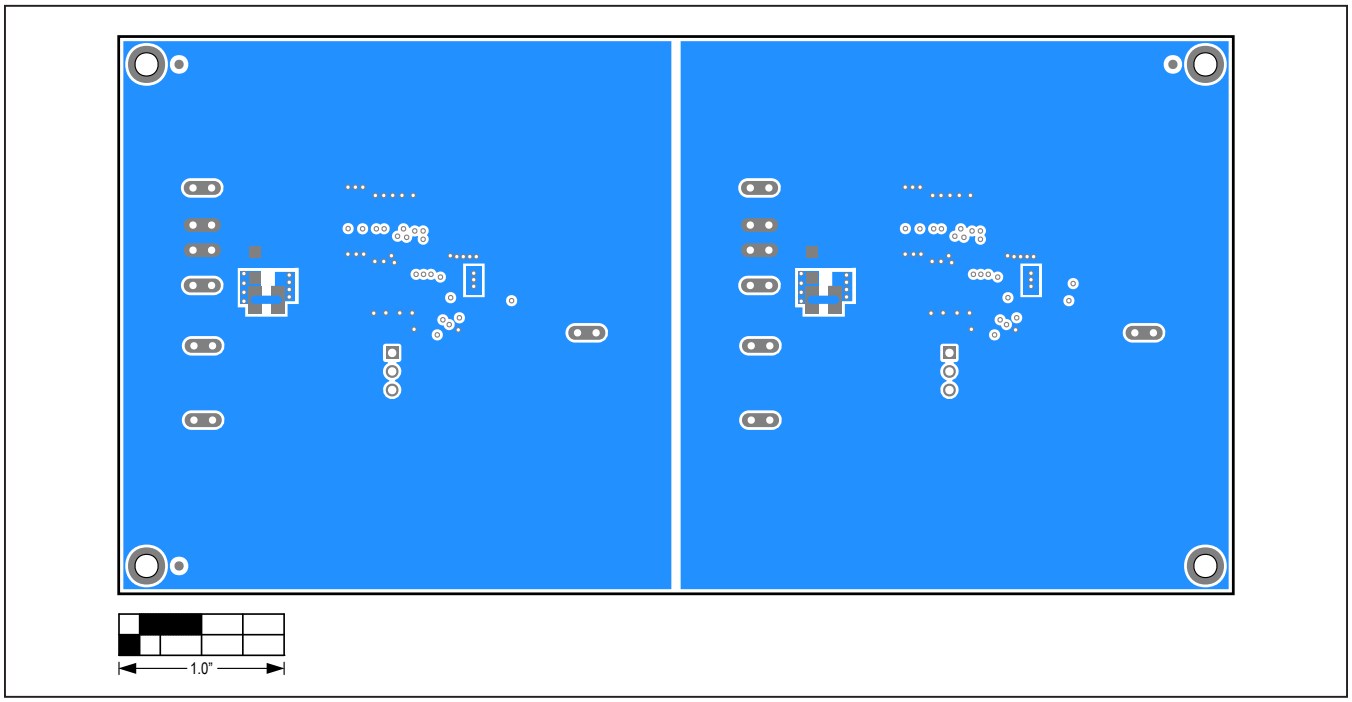


MAX17643 EV Kit PCB Layout Diagrams—Layer 2

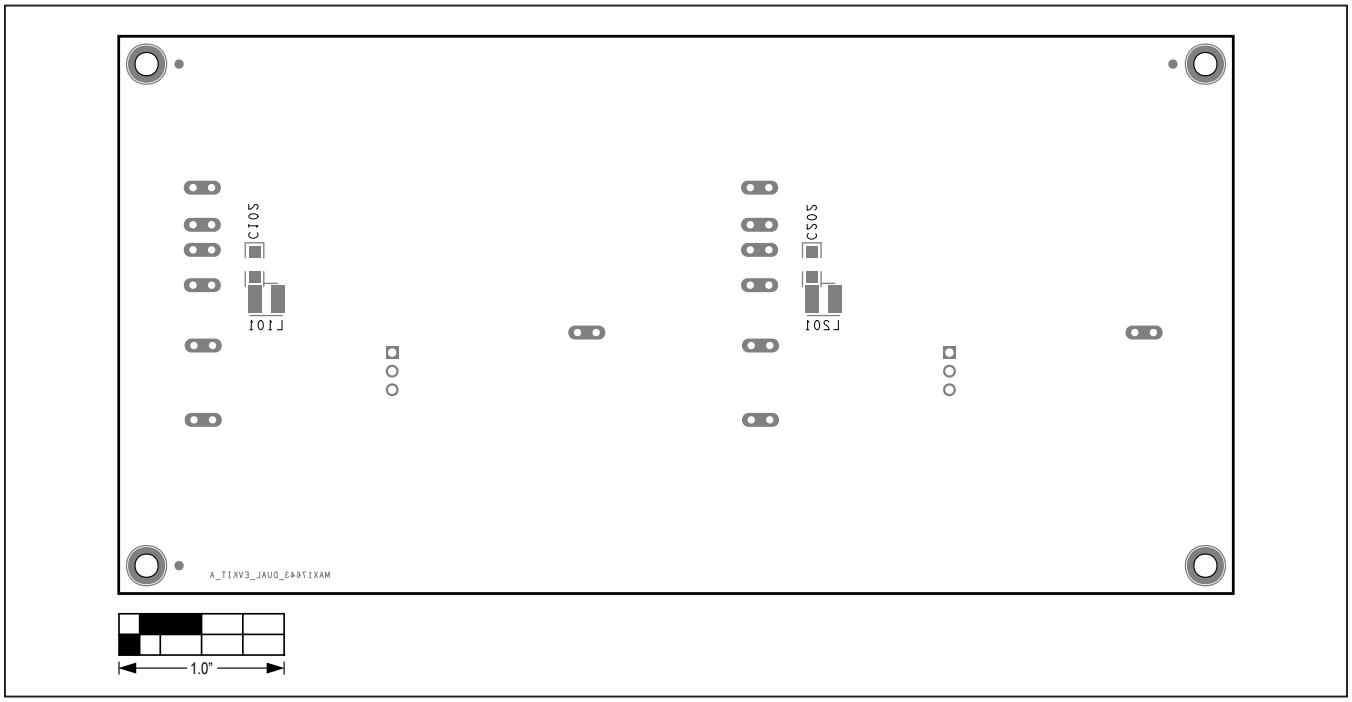


MAX17643 EV Kit PCB Layout Diagrams—Layer 3

MAX17643 EV Kit PCB Layout Diagrams (continued)



MAX17643 EV Kit PCB Layout Diagrams—Bottom Layer



MAX17643 EV Kit PCB Layout Diagrams—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/20	Release for Market Intro	—