Click here for production status of specific part numbers.

MAX17687 Evaluation Kit

Evaluates: MAX17687 for Isolated +12V Output Configuration

General Description

The MAX17687EVKITA# evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the performance of the MAX17687 high-efficiency, iso-buck DC-DC Converter. The EV kit operates over a wide input-voltage range of 16V to 60V and uses primary-side feedback to regulate the output voltage. The EV kit has isolated output, programmed to +12V at 750mA, with 10% output voltage regulation.

The EV kit comes installed with the MAX17687 in a 20-pin (4mm x 4mm) TDFN package.

Features

- 16V to 60V Input Voltage Range
- +12V, 750mA Continuous Current
- EN/UVLO Input
- 200kHz Switching Frequency
- Overcurrent Protection
- No Optocoupler
- Delivers up to 10W Output Power
- Overtemperature Protection
- Proven PCB layout
- Complies with CISPR22(EN55022) Class B Conducted and Radiated Emissions

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

Quick Start

Recommended Equipment

- One 15V - 60V DC, 1A Power Supply
- One resistive load 750mA sink capacity
- Two Digital Multimeters (DMM)

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

Procedure

The EV kit comes with the default secondary output programmed to +12V.

1) Verify that JU2 is open
2) Set the power supply output to 24V. Disable the power supply
3) Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the nearest PGND PCB pad. Connect a 750mA resistive load across the VOUT PCB pad and the GND0 PCB pad.
4) Connect a DMM configured in voltmeter mode across the VOUT PCB pad and the nearest GND0 PCB pad.
5) Connect a DMM configured in voltmeter mode across the VPRI PCB pad and the nearest PGND PCB pad.
6) Enable the input power supply.
7) Verify that the primary voltage is at +8V with respect to PGND.
8) Verify that output voltage is at +12V (with allowable tolerance of 10%) with respect to GND0.
9) If required, vary the input voltage from 16V to 60V, and the load current from 0mA to 750mA and verify that output voltage is at +12V (with allowable tolerance of 10%).

319-100287; Rev 0; 12/18

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Detailed Description

The MAX17687EVKITA# evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the performance of the MAX17687 high-efficiency, iso-buck, DC-DC converter designed to provide an isolated power up to 10W. The EV kit generates +12V, 750mA voltages from a 16V to 60V input supply. The EV kit features a forced-PWM control scheme that provides constant switching-frequency of 200 kHz operation at all load and line conditions.

The EV Kit includes an EN/UVLO PCB pad to monitor and program the EN/UVLO pin of the MAX17687. The VPRI PCB pad helps measure the regulated primary output voltage (V_{PRI}). An additional $\overline{RESET}$ PCB pad is available for monitoring the health of primary output voltage (V_{PRI}). $\overline{RESET}$ pulls low if FB voltage drops below 92%(typ) of its set value and $\overline{RESET}$ goes high impedance 1024 clock cycles after FB voltage rises above 95% of its set value. The programmable soft-start feature allows users to reduce the input inrush current.

The iso-buck is a synchronous-buck-converter-based topology, useful for generating isolated outputs at low power level without using an opto-coupler. The detailed procedure for setting the soft-start time, EN/UVLO divider, primary output voltage (V_{PRI}) selection, adjusting the primary output voltage, primary inductance selection, turns-ratio selection, output capacitor selection, output diode selection and external loop compensation are given in MAX17687 IC data sheet.

Electro-Magnetic 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 Figure 1 results in lower conducted emissions, below CISPR22 Class B limits. The MAX17687 EV kit 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.

Hot-Plug-In and Long Input Cables

The MAX17687 EV kit PCB provides an electrolytic capacitor (C8, 47µF/100V) to dampen input voltage peaks and oscillations that can arise during hot-plug-in and/or due to long input cables. This capacitor limits the peak voltage at the input of the MAX17687 IC, when the EV kit is powered directly from a precharged capacitive source or an industrial backplane PCB. Long input cables, between 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. Further, capacitor C9 (0.1µF/100V), placed near the input of the board, helps in attenuating high frequency noise.

Enable Control (JU2)

The EN/UVLO pin on the device serves as an on/off control while also allowing the user to program the input undervoltage lockout (UVLO) threshold. Jumper JU2 configures the EV kit's output for turn-on/turn-off control. Install a shunt across jumper JU2 pins 2-3 to disable VOUT. See Table 1 for proper JU2 jumper configurations.

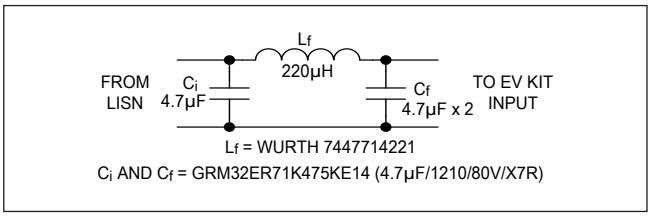


Figure 1. Conducted Emissions Filter

Table 1. Enable Control (EN/UVLO) (JU2) Jumper Settings

SHUNT POSITION	EN/UVLO PIN	V_{OUT} OUTPUT
JU2		
1-2	Connected to V_{IN}	Always Enabled
2-3	Connected to GND	Always Disabled
Open*	Connected to midpoint of R2, R3 resistor-divider	Enabled at V_{IN} ≥ 15V

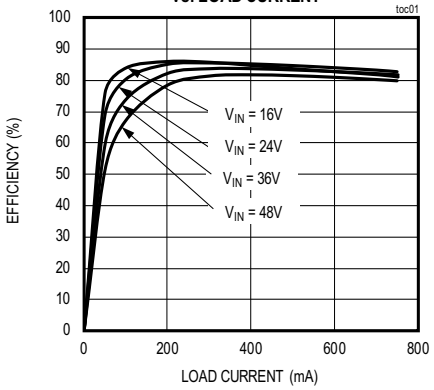
**Default position.*

Note 1: *The secondary output diodes D1 is rated to carry short-circuit current only for few hundredths of a millisecond and is not rated to carry the continuous short-circuit current.*

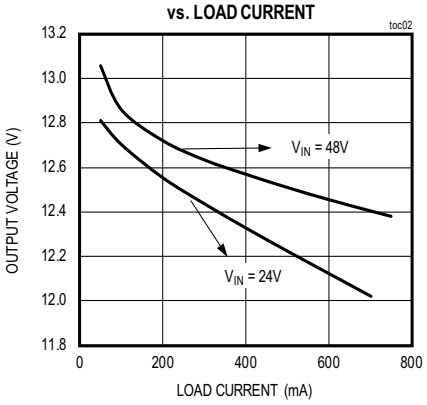
Note 2: *The iso-buck converter typically needs 10% minimum load to regulate the output voltage. In this design when the +12V rail is healthy, D2 sinks the minimum load current required to regulate the output voltages within ±10% regulation.*

EV Kit Performance Report

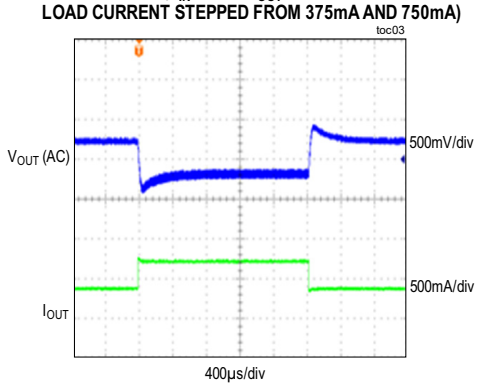
EFFICIENCY vs. LOAD CURRENT



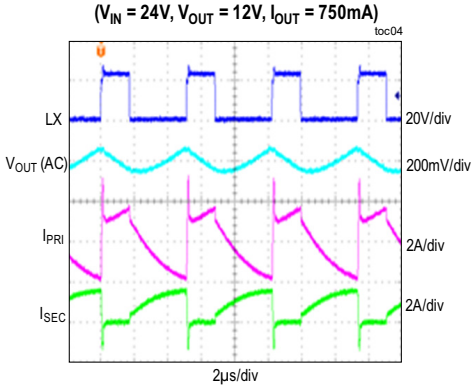
OUTPUT VOLTAGE vs. LOAD CURRENT



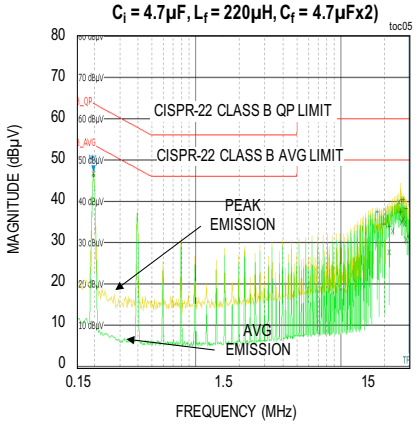
LOAD TRANSIENT RESPONSE (V_{IN} = 24V, V_{OUT} = 12V, LOAD CURRENT STEPPED FROM 375mA AND 750mA)



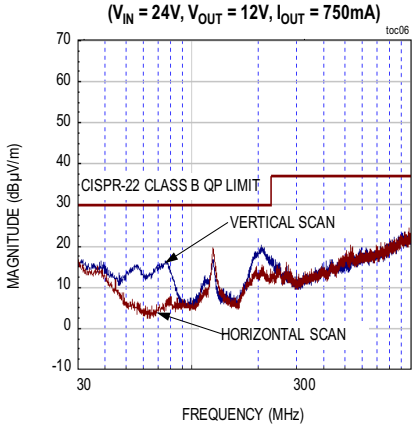
FULL LOAD SWITCHING WAVEFORMS (V_{IN} = 24V, V_{OUT} = 12V, I_{OUT} = 750mA)



CONDUCTED EMISSION PLOT (V_{IN} = 24V, V_{OUT} = 12V, I_{OUT} = 750mA C_i = 4.7µF, L_f = 220µH, C_f = 4.7µFx2)



RADIATED EMISSION PLOT (V_{IN} = 24V, V_{OUT} = 12V, I_{OUT} = 750mA)



Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murataamericas.com
Panasonic Corp.	www.panasonic.com
TDK Corp	www.component.tdk.com
KEMET Corp.	www.kemet.com
ON Semiconductor	www.onsemi.com
Taiwan Semiconductor	www.taiwansemi.com
Vishay Intertechnology	www.vishay.com
Wurth Electronik	www.we-online.com

Note: *Indicate that you are using the MAX17687 when contacting these component suppliers.*

Ordering Information

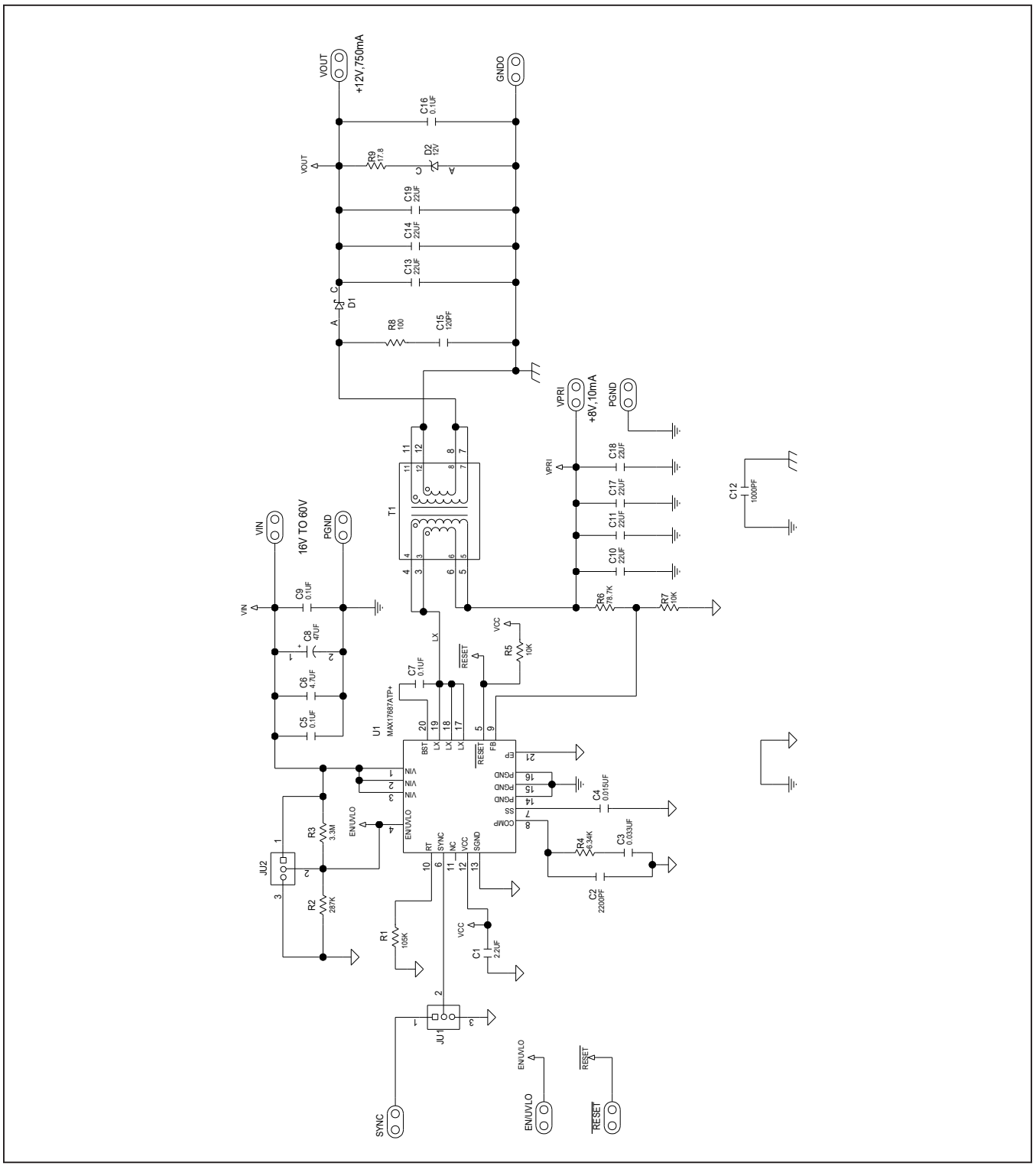
PART	TYPE
MAX17687EVKITA#	EVKIT

#Denotes RoHS compliant.

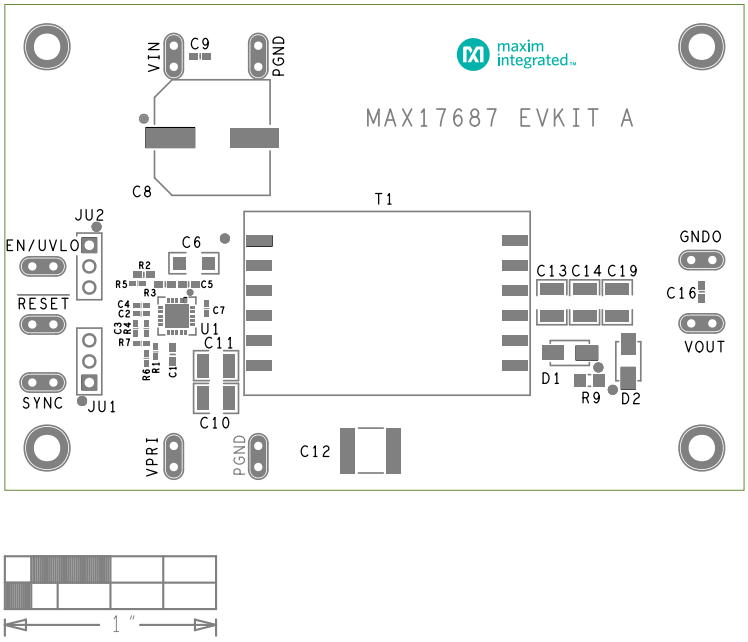
MAX17687EVKITA# EV Kit Bill of Materials

Sl. No	DESIGNATION	QTY	DESCRIPTION	MFG PART #1	MFG PART #2
1	C1	1	2.2UF±10%; 10V, X7R Ceramic Capacitor (0603)	Murata GRM188R71A225KE15	TDK C1608X7R1A225K080AC
2	C2	1	2200PF±10%; 50V, X7R Ceramic Capacitor (0402)	Murata GCM155R71H222KA37	TDK C1005X7R1H222K050BA
3	C3	1	0.033UF±10%; 25V, X7R Ceramic Capacitor (0402)	Murata GCM155R71E333KA55	
4	C4	1	0.015UF±10%; 25V, X7R Ceramic Capacitor (0402)	Murata GCM155R71E153KA55	
5	C5, C9, C16	3	0.1UF±10%; 100V, X7R Ceramic Capacitor (0603)	Murata GCJ188R72A104KA01	
6	C6	1	4.7UF±10%; 100V, X7R Ceramic Capacitor (1206)	Murata GRM31CZ72A475KE11	
7	C7	1	0.1UF±10%; 16V, X7R Ceramic Capacitor (0402)	Murata GCM155R71C104KA55	
8	C8	1	47UF±20%; 100V, Aluminium electrolytic capacitor	Panasonic EEV-TG2A470Q	
9	C10, C11, C13, C14, C17-C19	7	22UF±10%; 25V, X7R Ceramic Capacitor (1210)	Murata GRM32ER71E226KE15	
10	C12	1	1000PF±10%; 4000V, X7R Ceramic Capacitor (2220)	Vishay Vitramon HV2220Y102KXVATHV	
11	C15	1	120PF±5%; 200V, C0G Ceramic Capacitor (0805)	Kemet C0805C121J2GAC	
12	D1	1	Diode 200V / 3A, SMA	Taiwan Semicondoctor SK320A R3G	
13	D2	1	Zener Diode, 12V, SMA	On Semiconductor 1SMA5927BT3G	
15	JU1, JU2	2	3 Pin Connector Male	Sullins PEC03SAAN	
16	MECH1-MECH4	4	STANDOFF; FEMALE-THREADED; HEX; M2.5; 12MM; BRASS	Keysone 24384	
17	R1	1	105KΩ±1% Resistor (0402)	Vishay Dale CRCW0402105KFK	
18	R2	1	287KΩ±1% Resistor (0603)	Vishay Dale CRCW0603287KFK	
19	R3	1	3.3MΩ±1% Resistor (0603)	Vishay Dale CRCW06033M30FK	
20	R4	1	6.34KΩ±1% Resistor (0402)	Vishay Dale CRCW04026K34FK	
21	R5, R7	2	10KΩ±1% Resistor (0402)	Vishay Dale CRCW040210K0FK	Yageo Phicomp RC0402FR-0710KL
22	R6	1	78.7KΩ±1% Resistor (0402)	Vishay Dale CRCW040278K7FK	
23	R8	1	100Ω±5% Resistor (1210)	Vishay Dale CRCW1210100RJNEAHP	
24	R9	1	17.8Ω±1% Resistor (0805)	Vishay Dale CRCW080517R8FK	Panasonic ERJ-6ENF17R8V
25	SCREW1-SCREW4	4	M2.5 Screws	Keystone 29300	
26	SU1, SU2	2	Shunt Connectors	SULLINS ELECTRONICS CORP. STC02SYAN	
27	T1	1	EVKIT PART-TRANSFORMER; SMT; 1.67:1	WURTH ELECTRONICS INC 750343160	
28	U1	1	MAX17687 20pin TQFN 4mm x 4mm	Maxim Integrated MAX17687ATP+	

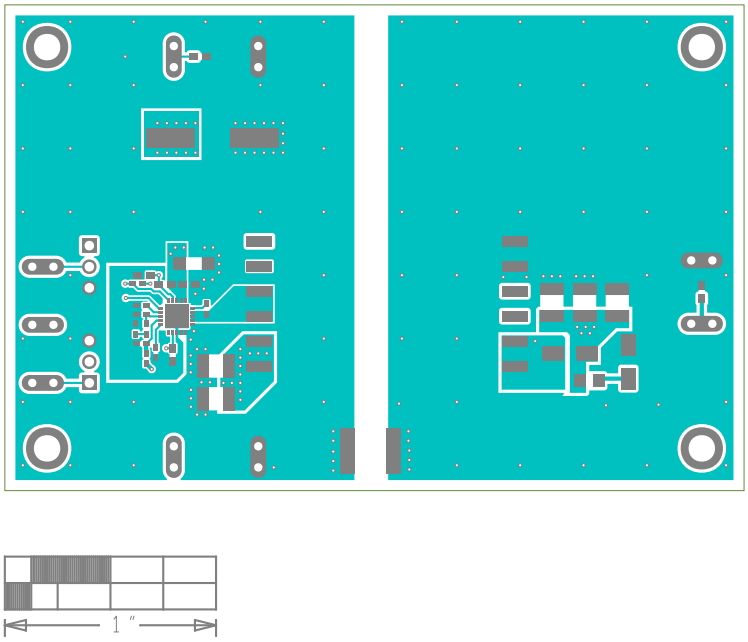
MAX17687EVKITA# EV Kit Schematics



MAX17687EVKITA# EV Kit PCB Layout Diagrams

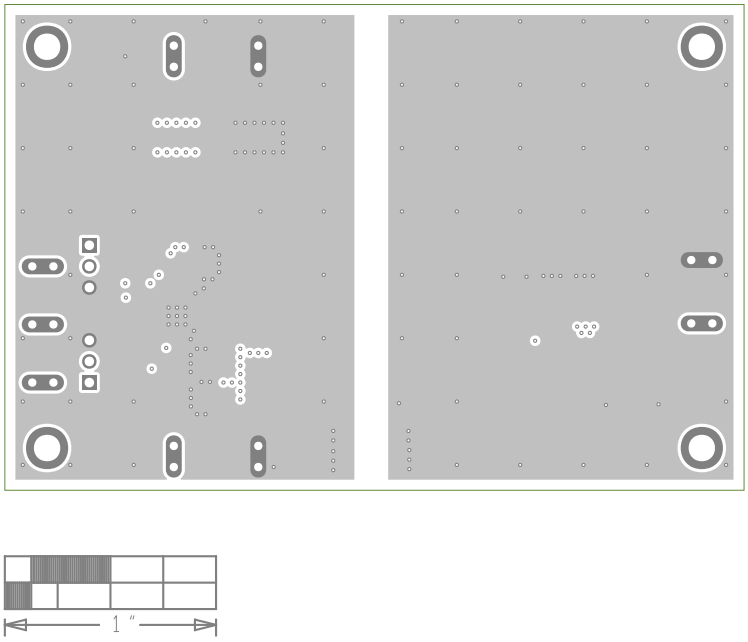


MAX17687EVKITA# EV Kit—Top Silkscreen

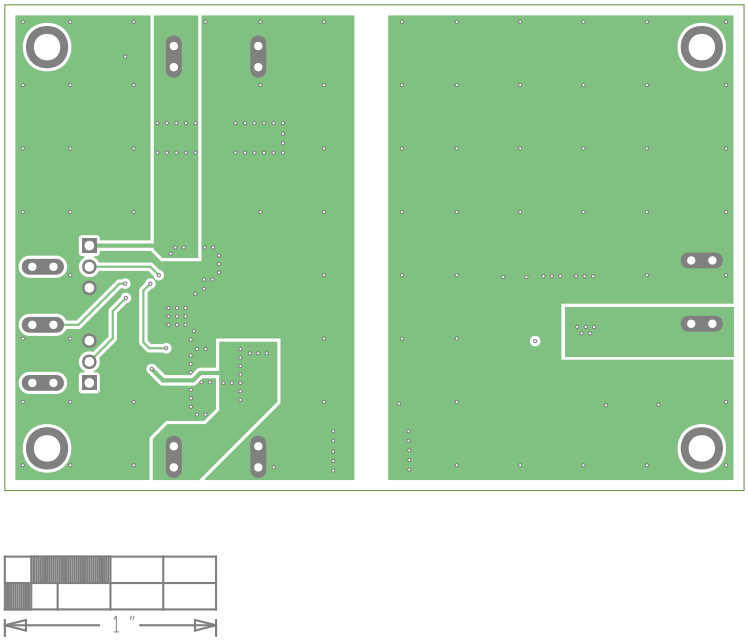


MAX17687EVKITA# EV Kit—Top View

MAX17687EVKITA# EV Kit PCB Layout Diagrams (continued)

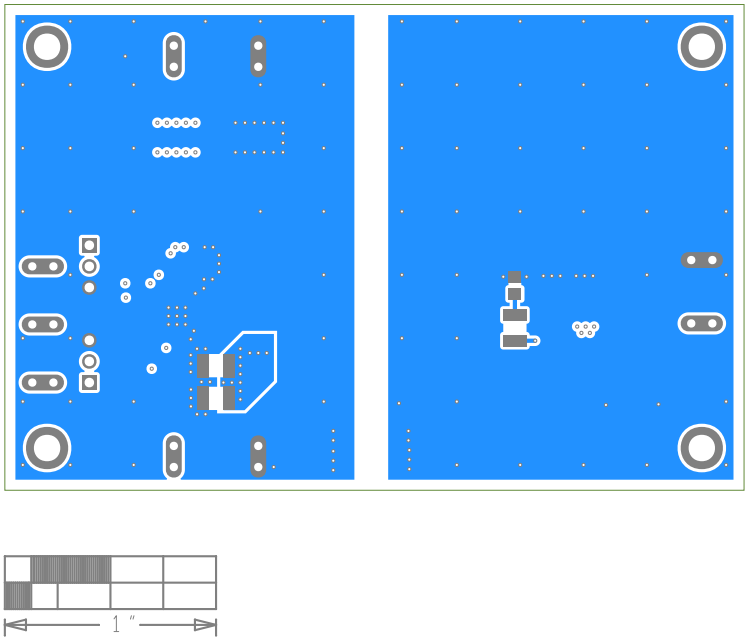


MAX17687EVKITA# EV Kit—Level 2 SGND

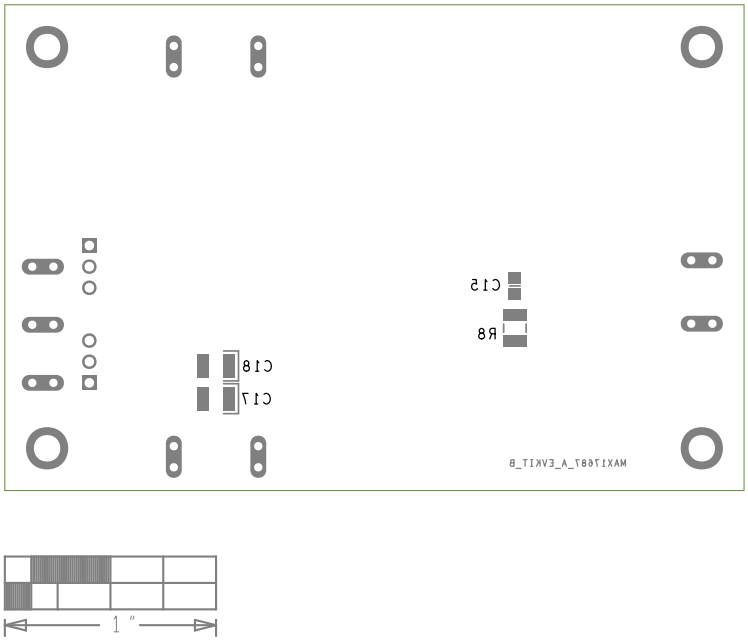


MAX17687EVKITA# EV Kit—Level 3 SGND

MAX17687EVKITA# EV Kit PCB Layout Diagrams (continued)



MAX17687EVKITA# EV Kit—Bottom View



MAX17687EVKITA# EV Kit—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/18	Initial release	—

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

