MAX17783CEVKITB# Evaluation Kit

Evaluates: MAX17783C in 5V Output-Voltage Application

General Description

The MAX17783CEVKITB# evaluation kit (EV kit) provides a proven design to evaluate the MAX17783C high-efficiency, high-voltage, Himalaya step-down DC-DC converter. The EV kit generates 5V output at load currents up to 2.5A from a 6.5V to 60V 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, and external clock synchronization. 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 the MAX17783C IC data sheet.

Features

- Operates from a 6.5V to 60V Input Supply
- 5V Output Voltage
- Delivers Up to 2.5A Output Current
- 500kHz Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Adjustable Soft-Start Time
- External Clock Synchronization
- 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

Recommended Equipment

- MAX17783CEVKITB#
- 6.5V to 60V, 3A DC input power supply
- Load capable of sinking 2.5A
- 2 digital voltmeters (DVM)

Equipment Setup and Test Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation.

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

1) Set the power supply at a voltage between 6.5V and 60V. 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 2.5A load to the VOUT PCB pad and the negative terminal to the nearest PGND PCB pad.
3) Connect one DVM across the VOUT PCB pad and the nearest PGND PCB pad.
4) Verify that shunts are not installed across the pins on jumper JU1 (see Table 1 for details).
5) Turn on the DC power supply.
6) Enable the load.
7) Ensure that input voltage to be 6.5V or higher, with which EN/UVLO voltage is more than EN/UVLO rising threshold.
8) Verify that the DVM displays 5V.
9) Connect the other DVM across the $\overline{\text{RESET}}$ pad and GND. Verify that the DVM displays 5V.
10) The power supply voltage can be set at any voltage between 6.5V and 60V.
11) Reduce the input voltage to 5V which is below the EN/UVLO falling threshold.
12) Verify that the DVM across the VOUT PCB pad and the nearest PGND PCB pad displays 0V.
13) Verify that the DVM across the $\overline{\text{RESET}}$ pad and the nearest GND pad displays 0V.
14) Disable the input power supply.

319-100566; Rev 1; 3/21

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Detailed Description

The MAX17783CEVKITB# provides a proven design to evaluate the MAX17783C high-efficiency, high-voltage, Himalaya step-down DC-DC converter. The EV kit generates 5V output at load currents up to 2.5A from a 6.5V to 60V input supply. The EV kit features a 500kHz switching frequency for optimum efficiency and component size. The EV kit includes an EN/UVLO PCB pad and JU1 to enable the output at a desired input voltage or enable the converter through an external enable signal on the EN/UVLO PCB pad. The RT/SYNC PCB pad allows application of an external clock to synchronize the device. 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 startup. The soft-start time is adjusted by the value of external soft-start capacitor (C11) connected between SS and GND pins. The selected output capacitance (C_{SEL}) and the output voltage (V_{OUT}) determine the minimum required soft-start capacitor as follows:

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

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

$$t_{SS} = \frac{C_{SS}}{5.55 \times 10^{-6}}$$

For example, to program a 1ms soft-start time, a 5600pF capacitor should be connected from the SS pin to GND.

Enable/Undervoltage-Lockout (EN/UVLO) Programming

The MAX17783C offers an Enable and adjustable input undervoltage lockout feature. In this EV kit, for normal operation, leave the EN/UVLO jumper (JU1) open. When JU1 is left open, the MAX17783C is enabled when the input voltage rises above 6.4V. To disable the MAX17783C, install a jumper across pins 1–2 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 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), and then calculate R2 as follows:

$$R2 = \frac{1.218 \times R1}{(V_{INU} - 1.218)}$$

where, V_{INU} is the voltage at which the device is required to turn on. For more details about setting the undervoltage lockout level, refer to the *MAX17783C data sheet*.

External Clock Synchronization (RT/SYNC)

The EV kit provides a RT/SYNC PCB pad to synchronize the MAX17783C to an optional external clock. For more details about external clock synchronization, refer to the *MAX17783C data sheet*.

Active-Low, Open-Drain Reset Output ($\overline{\text{RESET}}$)

The EV kit provides a $\overline{\text{RESET}}$ PCB pad to monitor the status of the converter. $\overline{\text{RESET}}$ goes high 1024 switching cycles after V_{OUT} rises above 95% (typ) of its nominal regulated output voltage. $\overline{\text{RESET}}$ goes low when V_{OUT} falls below 92% (typ) of its nominal regulated voltage.

Hot Plug-In and Long Input Cables

The MAX17783CEVKITB# PCB layout provides an optional electrolytic capacitor (C6 = 33µF/100V). This capacitor limits the peak voltage at the input of the MAX17783C when the DC input source is “Hot-Plugged” to the EV kit input terminals with 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 MAX17783CEVKITB# PCB has designated footprints for the placement of conducted EMI filter components as per the optional Bill of Material (BoM). Use of these filter components results in lower conducted EMI, below CISPR32 Class B limits. Cut open the trace at L2 before installing conducted EMI filter components. The MAX17783CEVKITB# PCB layout is also designed to limit radiated emissions from switching nodes of the power converter resulting in radiated emissions below CISPR32 Class B limits.

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

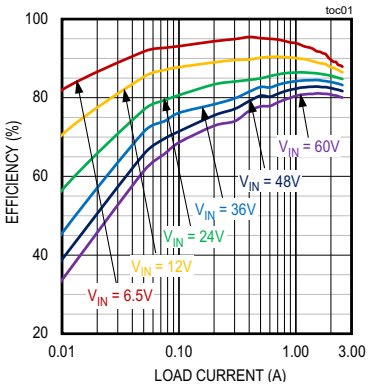
SHUNT POSITION	EN/UVLO PIN	OUTPUT
Not installed*	Connected to the center node of resistor-divider R1 and R2	Enabled, UVLO level is set by the resistor-divider between IN and GND
1–2	Connected to GND	Disabled

**Default position.*

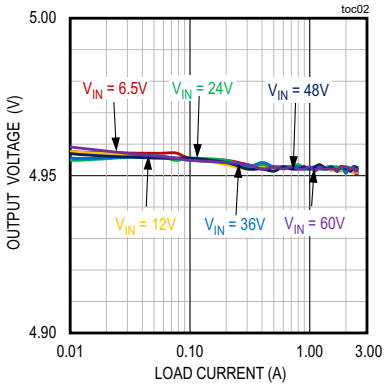
MAX17783CEVKITB# EV KIT Performance Report

(V_{IN} = 24V, unless otherwise noted.)

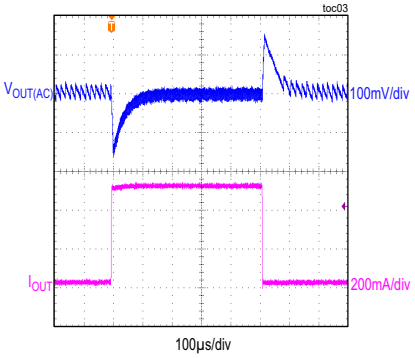
EFFICIENCY vs. LOAD CURRENT



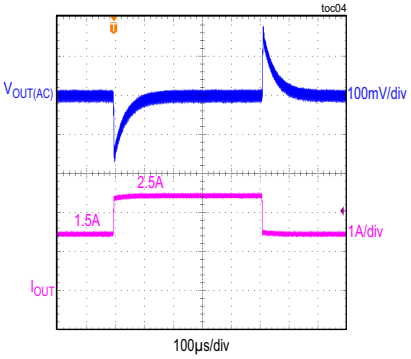
LOAD AND LINE REGULATION



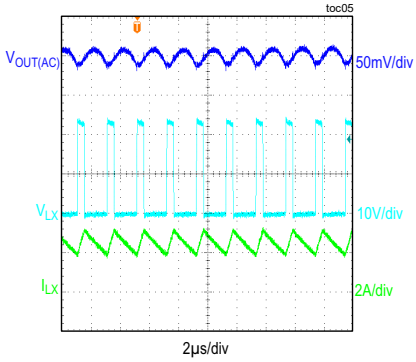
LOAD TRANSIENT BETWEEN 25mA AND 0.5A



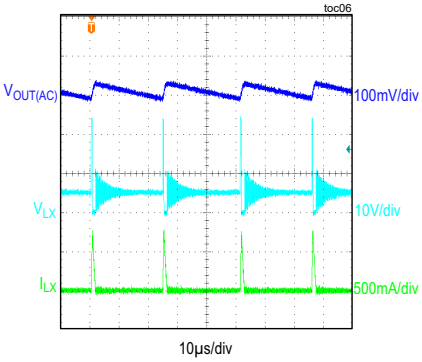
LOAD TRANSIENT BETWEEN 1.5A AND 2.5A



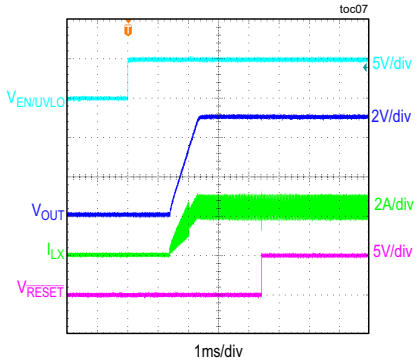
STEADY-STATE AT 2.5A LOAD



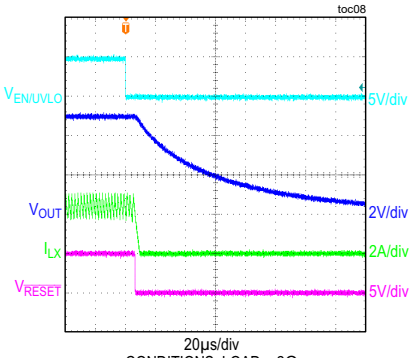
STEADY-STATE AT 25mA LOAD



STARTUP THROUGH EN/UVLO



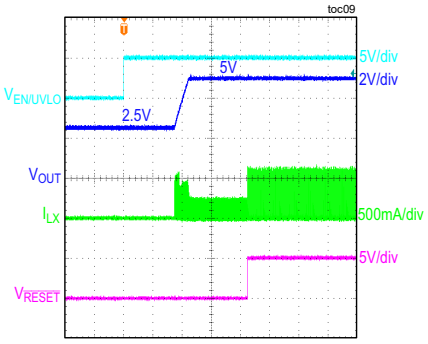
SHUTDOWN THROUGH EN/UVLO



MAX17783CEVKITB# EV KIT Performance Report (continued)

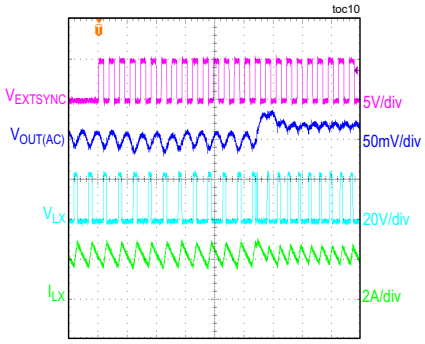
(V_{IN} = 24V, unless otherwise noted.)

STARTUP WITH PREBIAS VOLTAGE OF 2.5V



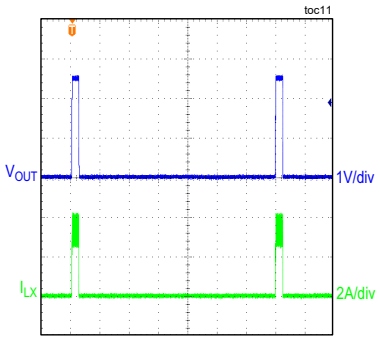
CONDITIONS: LOAD = 200Ω

EXTERNAL CLOCK SYNCHRONIZATION WITH 700kHz



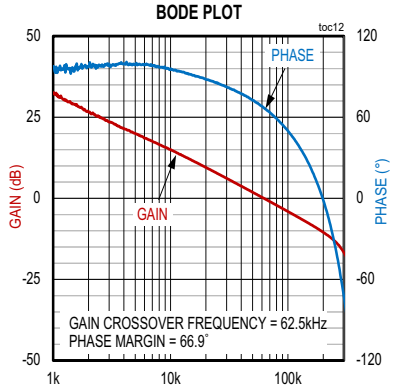
CONDITIONS: LOAD = 2Ω

OVERLOAD PROTECTION



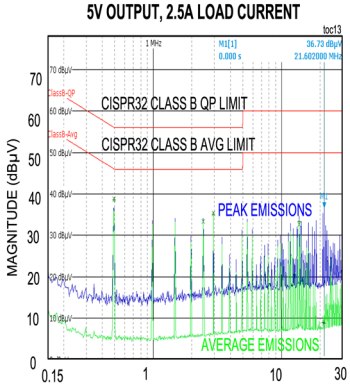
CONDITIONS: LOAD = 1Ω

BODE PLOT



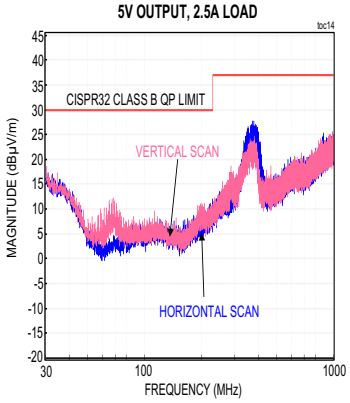
CONDITIONS: LOAD = 2Ω

CONDUCTED EMISSIONS PLOT 5V OUTPUT, 2.5A LOAD CURRENT



L2 = 15µH, C4 = C5 = 4.7µF/100V/X7R/1206

RADIATED EMISSIONS PLOT 5V OUTPUT, 2.5A LOAD



Component Suppliers

SUPPLIER	WEBSITE
Coilcraft, Inc.	www.coilcraft.com
Murata Americas	www.murataamericas.com
Panasonic Corp.	www.panasonic.com
SullinsCorp	www.sullinscorp.com
Diodes Incorporated	www.diodes.com
Onsemi	www.onsemi.com
TDK Corp.	www.tdk.com

Note: *Indicate that you are using the MAX17783C when contacting these component suppliers.*

Ordering Information

PART	TYPE
MAX17783CEVKITB#	EV Kit

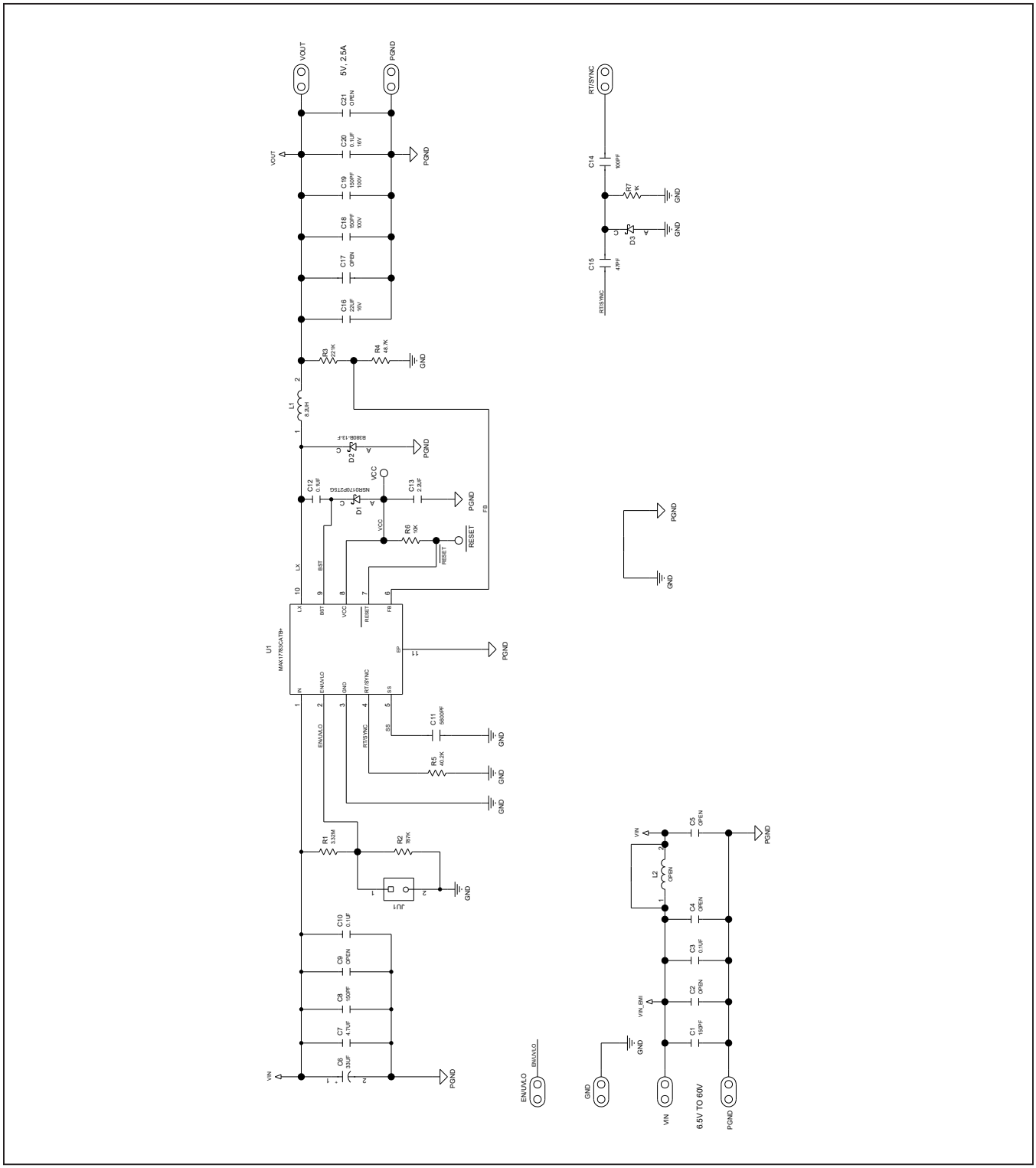
#Denotes RoHS compliance.

MAX17783C EV Kit Bill of Materials

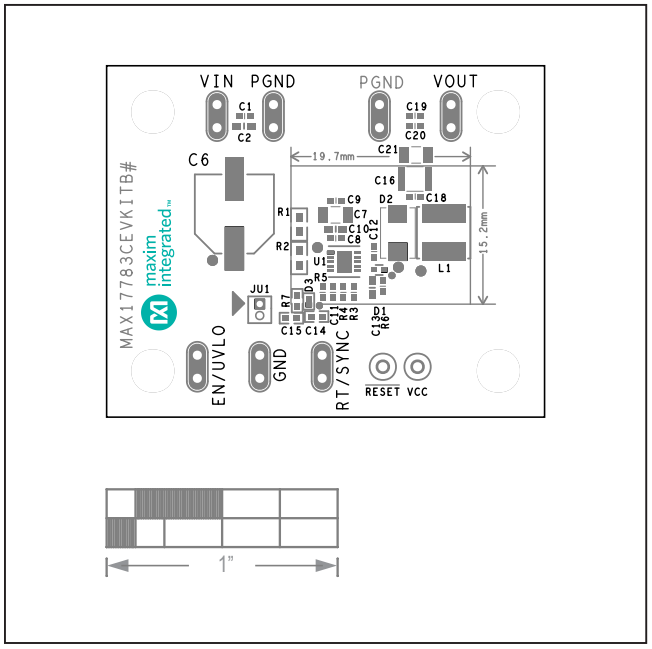
S.No	DESIGNATOR	DESCRIPTION	QUANTITY	MANUFACTURER PART NUMBER
1	C1, C8, C18, C19	150pF, 5%, 100V, COG,Ceramic capacitor (0402)	4	TDK C1005C0G2A151J050BA
2	C3, C10	0.1µF, 10%, 100V, X7R,Ceramic capacitor (0603)	2	MURATA GRM188R72A104KA35
3	C6	33uF, 20%, 80V, Electrolytic capacitor	1	PANASONIC EEE-FK1K330P
4	C7	4.7µF, 10%, 100V, X7R,Ceramic capacitor (1206)	1	MURATA GRM31CZ72A475KE11
5	C11	5600pF, 10%, 25V, X7R,Ceramic capacitor (0402)	1	MURATA GRM155R71E562KA01
6	C12, C20	0.1µF, 10%, 16V, X7R,Ceramic capacitor (0402)	2	MURATA GRM155R71C104KA88
7	C13	2.2µF, 10%, 10V, X7R,Ceramic capacitor (0603)	1	MURATA GRM188R71A225KE15
8	C14	100pF,10%,50V,X7R,0402,Ceramic capacitor(0402)	1	MURATA GRM1555C1H101JA01D
9	C15	47pF,10%,50V,X7R,0402,Ceramic capacitor(0402)	1	MURATA GRM1555C1H470JA01
10	C16	22µF, 10%, 16V, X7R,Ceramic capacitor (1210)	1	MURATA GRM32ER71C226KEA8
11	D1	70V, 0.07A, Schottky Barrier Diode, SMT (SOD-923)	1	ON SEMICONDUCTOR NSR0170P2T5G
12	D2	80V, 3A, Schottky Barrier Rectifier, SMT (SMB)	1	DIODES INCORPORATED B380B-13-F
13	D3	20V, 0.5A, Schottky Barrier Diode, SMT (DSN2)	1	ON SEMICONDUCTOR NSR05F20NXT5G
14	L1	INDUCTOR, 8.2µH, 4.5A (5.5mm X 5.5mm)	1	COILCRAFT XAL5050-822ME
15	R1	3.32MΩ, ±1%, 1/10W, Resistor (0603)	1	
16	R2	787kΩ, ±1%, 1/10W, Resistor (0603)	1	
17	R3	221kΩ, ±1%, 1/16W, Resistor (0402)	1	
18	R4	48.7kΩ, ±1%, 1/16W, Resistor (0402)	1	
19	R5	40.2kΩ, ±1%, 1/16W, Resistor (0402)	1	
20	R6	10kΩ, ±1%, 1/16W, Resistor (0402)	1	
21	R7	1kΩ, ±1%, 1/16W, Resistor (0402)	1	
22	U1	Asynchronous Buck Converter, MAX17783C, 10 TDFN (3mm x 3mm)	1	MAXIM MAX17783CATB+
23	JU1	Connector Header Through Hole 2 position 0.050" (1.27mm)	1	SULLINS GRPB021VWVN-RC
24	SU1	Jumper Socket (1.27mm)	1	HARWIN M50-2030005
25	C4, C5	OPTIONAL: 4.7µF, 10%, 100V, X7R,Ceramic capacitor (1206)	2	MURATA GRM31CZ72A475KE11
26	L2	OPTIONAL: INDUCTOR, 15µH, 2.2A (4mm x 4mm)	1	COILCRAFT XAL4040-153ME
27	C2	OPEN: Capacitor (0603)	0	N/A
28	C9, C17	OPEN: Capacitor (0402)	0	N/A
29	C21	OPEN: Capacitor (1206)	0	N/A

DEFAULT JUMPER TABLE	
Jumper	Shunt Position
JU1	Not Installed

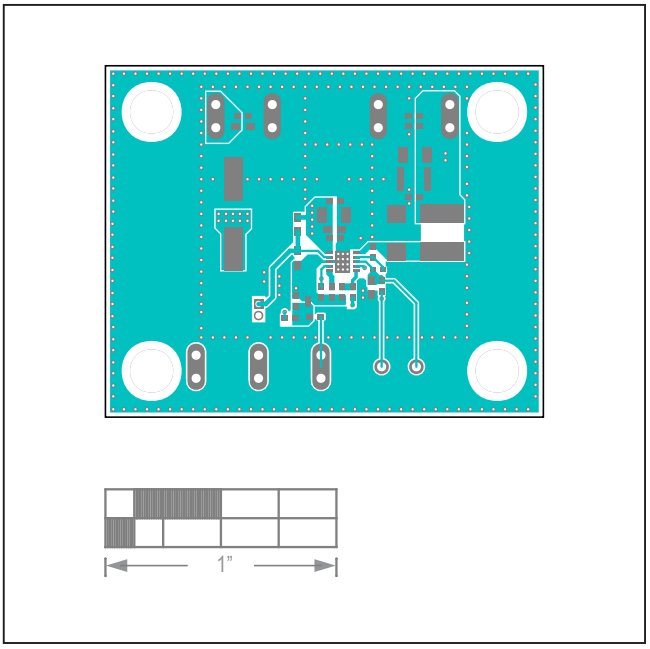
MAX17783C EV Kit Schematic Diagram



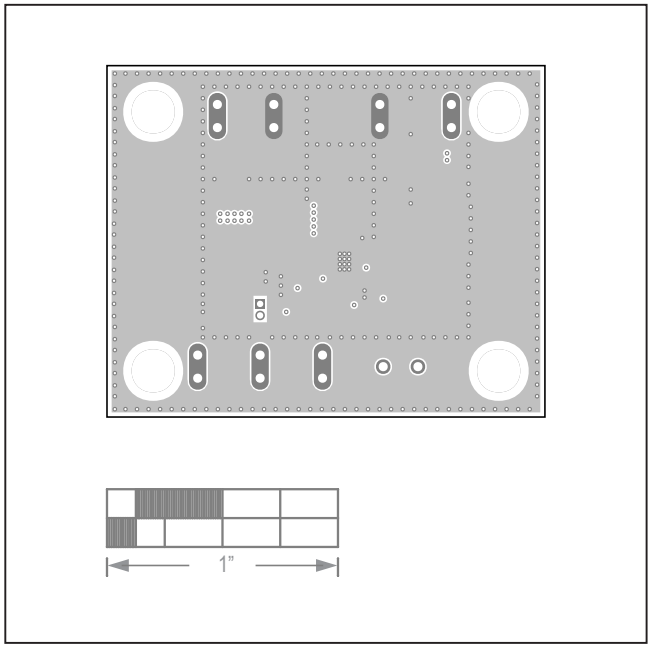
MAX17783C EV Kit PCB Layout Diagrams



MAX17783C EV Kit—Top Silkscreen

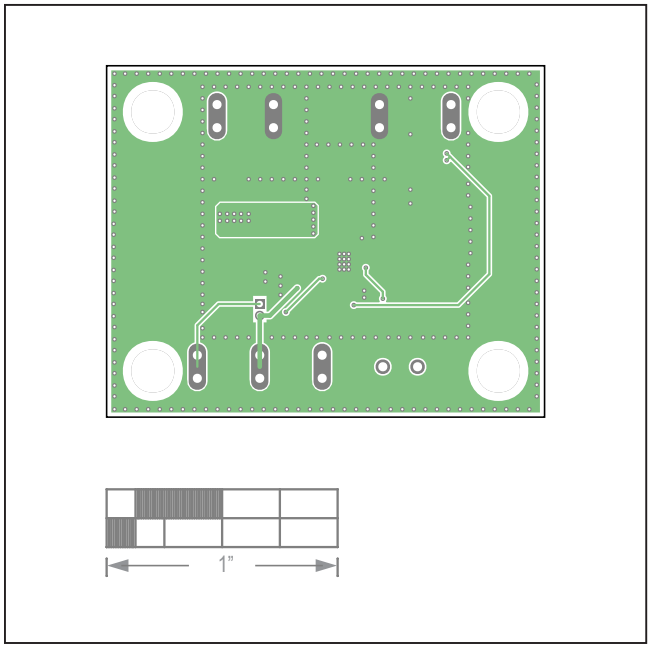


MAX17783C EV Kit—Top Layer

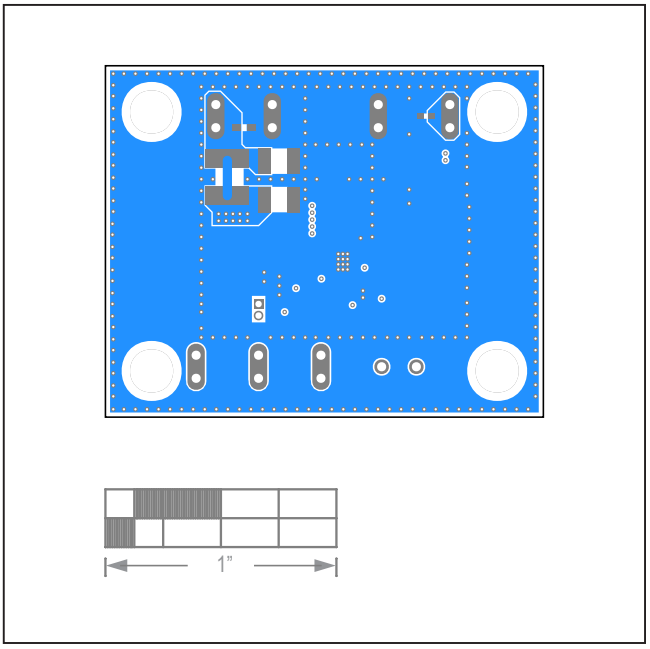


MAX17783C EV Kit—Layer 2_GND

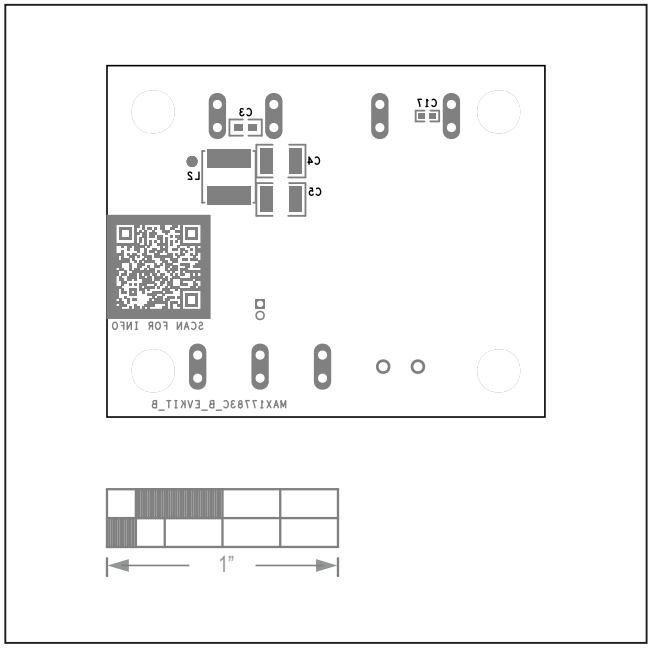
MAX17783C EV Kit PCB Layout Diagrams (continued)



MAX17783C EV Kit—Layer 3_GND



MAX17783C EV Kit—Bottom Layer



MAX17783C EV Kit—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/20	Initial release	—
1	3/21	Updated the *General Description*, *Enable/Undervoltage-Lockout (EN/UVLO) Programming*, *Electromagnetic Interference (EMI)* and *Component Suppliers* sections, and Table 1; replaced TOC09; added TOC14	1–2, 4–9