MAX17761 5V Output Evaluation Kit

Evaluates: MAX17761 in 5V Output-Voltage Application

General Description

The MAX17761 5V output EV kit is a proven design to evaluate the MAX17761 high-efficiency, high-voltage, synchronous step-down DC-DC converter in a TDFN package. The EV kit generates 5V at load currents up to 1A from a 6.5V to 76V input supply. The EV kit features a 400kHz switching frequency for optimum efficiency and component size. The EV kit features adjustable input undervoltage lockout, adjustable soft-start, adjustable switching frequency, adjustable current limit, open-drain $\overline{\text{RESET}}$ signal and external frequency synchronization.

Features

- Operates from a 6.5V to 76V Input Supply
- 5V Output Voltage
- Up to 1A Output Current
- 400kHz Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Adjustable Soft-Start Time
- MODE/ILIM Pin to Select Among PWM or PFM Modes and 1.6A or 1.14A current limits
- Auxiliary Bootstrap LDO to improve efficiency
- Open-Drain RESET Output
- External Frequency Synchronization
- Overcurrent and Overtemperature Protection
- Proven PCB Layout
- Fully Assembled and Tested

Quick Start

Recommended Equipment

- MAX17761 5V output EV kit
- 6.5V to 76V, 2A DC input power supply
- Load capable of sinking 1A
- Digital voltmeter (DVM)

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on power supply until all connections are completed.**

1) Set the power supply at a voltage between 6.5V and 76V. 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 1A load to the VOUT PCB pad and the negative terminal to the nearest PGND PCB pad.
3) Connect the DVM across the VOUT PCB pad and the nearest PGND PCB pad.
4) Verify that shunts are installed across pins 1-2 on jumper JU1, JU2, and JU3 (see Table 3 for details).
5) Turn on the DC power supply.
6) Enable the load.
7) Verify that the DVM displays 5V.

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

319-100053; Rev 1; 2/18

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Detailed Description

The MAX17761 5V Output EV kit provides a proven design to evaluate the MAX17761 high-efficiency, high-voltage, synchronous step-down DC-DC converter. The EV kit generates 5V at load currents up to 1A from a 6.5V to 76V input supply. The EV kit features a 400kHz 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. The RT/SYNC PCB pad and JU3 allow an external clock to synchronize the device. An additional $\overline{\text{RESET}}$ PCB pad is available for monitoring when the converter output is in regulation.

Soft-Start Input (SS)

The device implements adjustable soft-start operation to reduce inrush current. A capacitor connected from the SS pin to SGND programs the soft-start time for the corresponding output voltage. The selected output capacitance (C_{SEL}) and the output voltage (V_{OUT}) determine the minimum required soft-start capacitor as follows:

$$C_{SS} \geq 30 \times 10^{-6} \times C_{SEL} \times V_{OUT}$$

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

$$t_{SS} = \frac{C_{SS}}{6.25 \times 10^{-6}}$$

For example, to program a 5.3ms soft-start time, a 33nF capacitor should be connected from the SS pin to SGND. The minimum possible soft-start time is 5ms.

Regulator Enable/Undervoltage-Lockout Level (EN/UVLO)

The device offers an adjustable input undervoltage-lockout level. For always on operation, no shunt should be installed across JU1. To disable the output, install a shunt across pins 2-3 on JU1 and the EN/UVLO pin is pulled to GND. See Table 3 for JU1 settings.

Set the voltage at which each converter turns on with a resistive voltage-divider connected from VIN to SGND. Connect the center node of the divider to EN/UVLO pin.

Choose R1 as follows:

$$R1 \leq (110000 \times V_{INU})$$

Where V_{INU} is the input voltage at which the MAX17761 is required to turn ON and R1 is in Ω. Calculate the value of R2 as follows:

$$R2 = \frac{1.215 \times R1}{(V_{INU} - 1.215 + (2.5\mu A \times R1))}$$

Current Limit and Mode of Operation Selection

The following table lists the values of the resistor R5 to program PWM or PFM modes of operation and 1.6A or 1.14A peak current limits.

Table 1. R_{ILIM} Resistor vs. Modes of Operation and Peak Current Limit

R5 (kΩ)	MODE OF OPERATION	PEAK CURRENT LIMIT (A)
OPEN	PFM	1.6
422	PFM	1.14
243	PWM	1.6
121	PWM	1.14

The mode of operation cannot be changed on-the-fly after power-up.

Switching Frequency Selection and External Frequency synchronization

The RT/SYNC pin programs the switching frequency of the converter. The resistor R7 sets the switching frequency of the part at any one of four discrete frequencies—200kHz, 300kHz, 400kHz, and 600kHz. The following table gives the resistor values.

The internal oscillator of the MAX17761 can be synchronized to an external clock signal on the RT/SYNC pin. A shunt should be placed across the jumper JU3 for this purpose. The external synchronization clock frequency must be between 1.15 x f_{SW} and 1.4 x f_{SW}, where f_{SW} is the frequency programmed by R7.

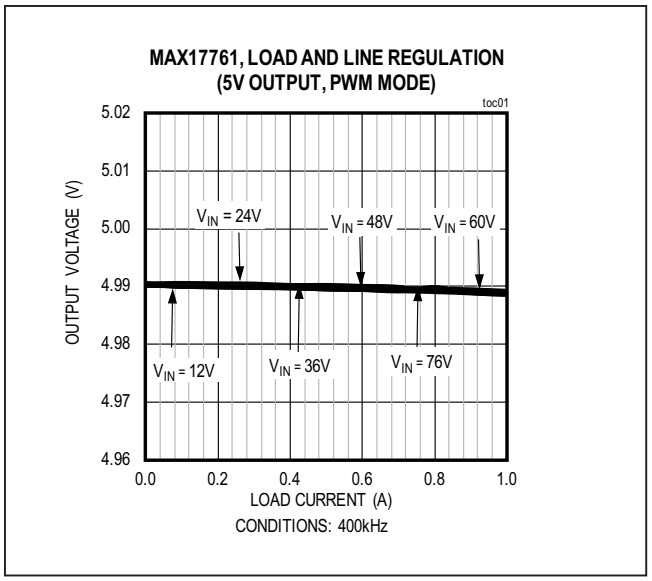
Table 2. Switching Frequency vs. RT Resistor

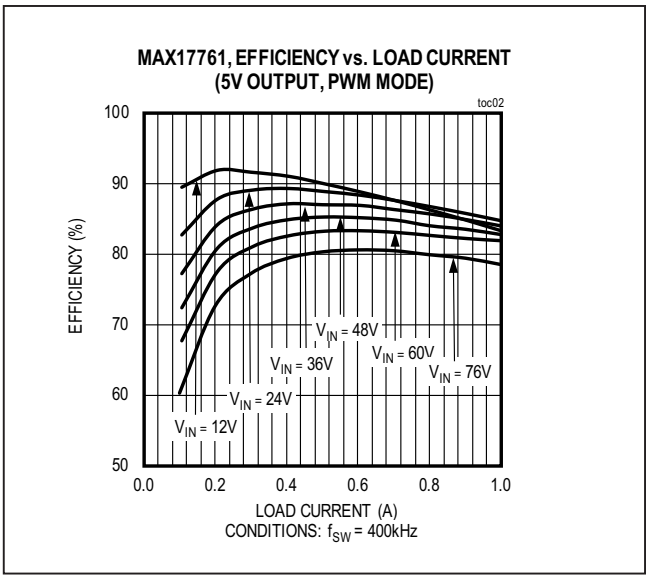
SWITCHING FREQUENCY (kHz)	R7 (kΩ)
200	210
300	140
400	105
600	69.8

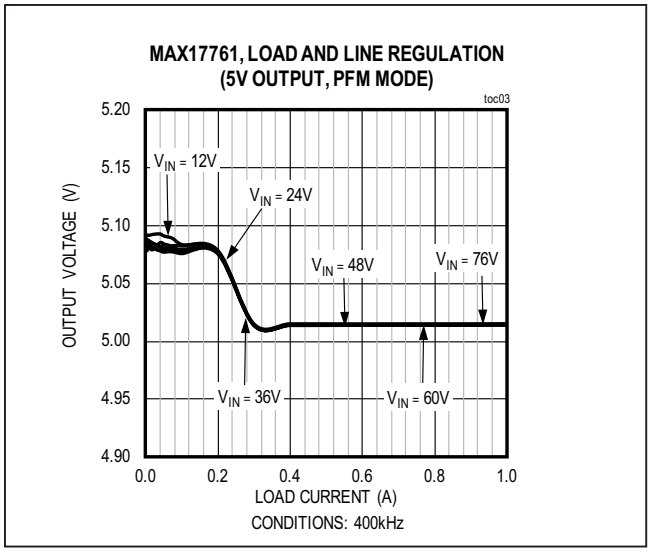
Table 3. Regulator Enable (EN/UVLO) Description (JU1)

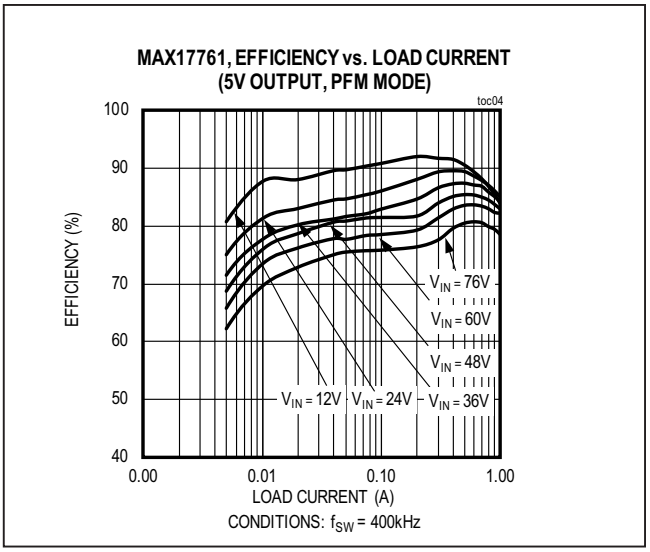
SHUNT POSITION	EN/UVLO PIN	MAX17761 OUTPUT
Not Installed	Floating	Always ON
1-2	Connected to the center node of resistor-divider R1 and R2	Enabled, UVLO level set through the R1 and R2 resistors
2-3	Connected to SGND	Disabled

MAX17761 EV Kit Performance Report



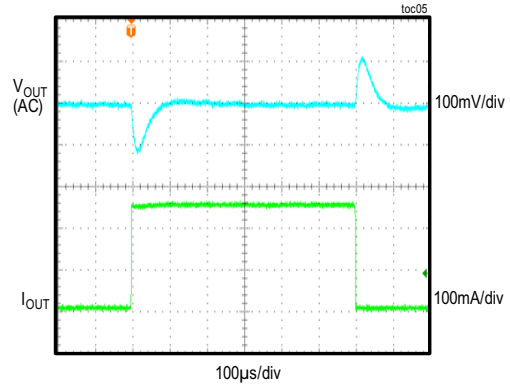




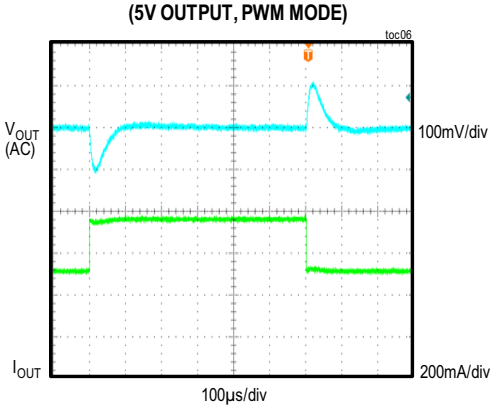


MAX17761 EV Kit Performance Report (continued)

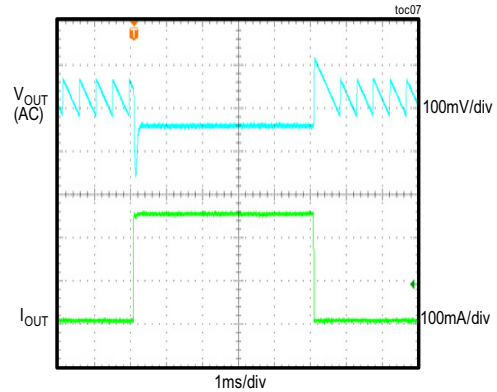
MAX17761, LOAD CURRENT STEPPED FROM 0A TO 0.25A
(5V OUTPUT, PWM MODE)



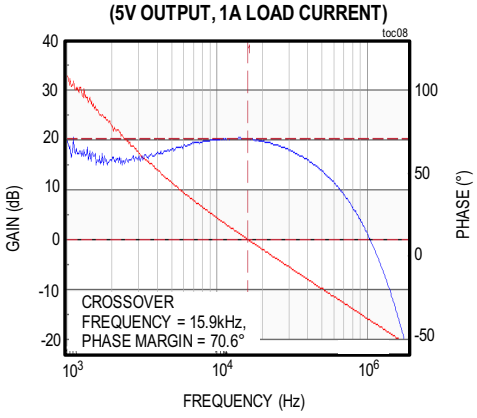
MAX17761, LOAD CURRENT STEPPED FROM 0.5A TO 0.75A
(5V OUTPUT, PWM MODE)



MAX17761, LOAD CURRENT STEPPED FROM 0A TO 0.25A
(5V OUTPUT, PFM MODE)



MAX17761, BODE PLOT
(5V OUTPUT, 1A LOAD CURRENT)



CONDITIONS: 400kHz, 24V Input

MAX17761 EV Kit Bill of Materials

No.	Description	Quantity	Designator	Part Number
1	0.1uF 10%, 100V ,X7R,Ceramic capacitor (0603)	1	C1	MURATA GRM188R72A104KA35, TDK CC0603KRX7R0BB104
2	2.2uF 10%, 100V ,X7R,Ceramic capacitor (1210)	1	C2	MURATA GRM32ER72A225KA35, TDK CGA6N3X7R2A225K230
3	22uF 20%,100V, Electrolytic capacitor	1	C3	PANASONIC EEE-TG2A220UP
4	1uF 10%, 6.3V ,X7R,Ceramic capacitor (0603)	1	C4	MURATA GRM188R70J105KA01, SAMSUNG ELECTRONICS CL10B105KQ8NNNC
5	47pF,5%,25V,COG, Ceramic capacitor(0402)	1	C5	MURATA GRM1555C1E470JA01
6	33nF, 10%, 25V, X7R, Ceramic capacitor(0402)	1	C6	MURATA GRM155R71E333KA88
7	0.1uF,10%,50V, X7R,Ceramic capacitor (0402)	1	C7	MURATA GRM155R71H104KE14
8	22uF,10%,10V, X7R,Ceramic capacitor (1210)	1	C8	MURATA GRM32ER71A226K
9	4700pF,10%,50V, X7R,Ceramic capacitor (0402)	1	C9	MURATA GRM155R71H472KA01
10	3-pin header (36-pin header 0.1” centers)	1	JU1	Sullins: PEC03SAAN
11	2-pin header (36-pin header 0.1” centers)	2	JU2,JU3	Sullins: PEC02SAAN
12	INDUCTOR, 33 uH,1.45A	1	L1	WURTH 74404064330
13	649k ohm ±1%,1/10W, resistor (0603)	1	R1	Any
14	127k ohm ±1%,1/10W, resistor (0603)	1	R2	Any
15	95.3k ohm ±1%,1/16W, resistor (0402)	1	R3	Any
16	18.2k ohm ±1%,1/16W, resistor (0402)	1	R4	Any
17	Not installed, OPEN (0402)	0	R5	Any
18	10k ohm ±1%,1/10W, resistor (0402)	1	R6	Any
19	105k ohm ±1%, 1/16W, resistor (0402)	1	R7	Any
20	4.7ohm ±1%, 1/16W, resistor (0402)	1	R8	Any
21	16.9k ohm ±1%, 1/10W, resistor (0402)	1	R9	Any
22	Buck Converter MAX17761ATC+	1	U1	MAX17761ATC+
23	Shunts (JU1, JU2, JU3)	3	-	Sullins: STC02SYAN

Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Panasonic Corp.	www.panasonic.com
Samsung Electronics	www.samsung.com
Sullins Corp.	www.sullinscorp.com
TDK Corp.	www.tdk.com
Wurth Electronics	www.we-online.com

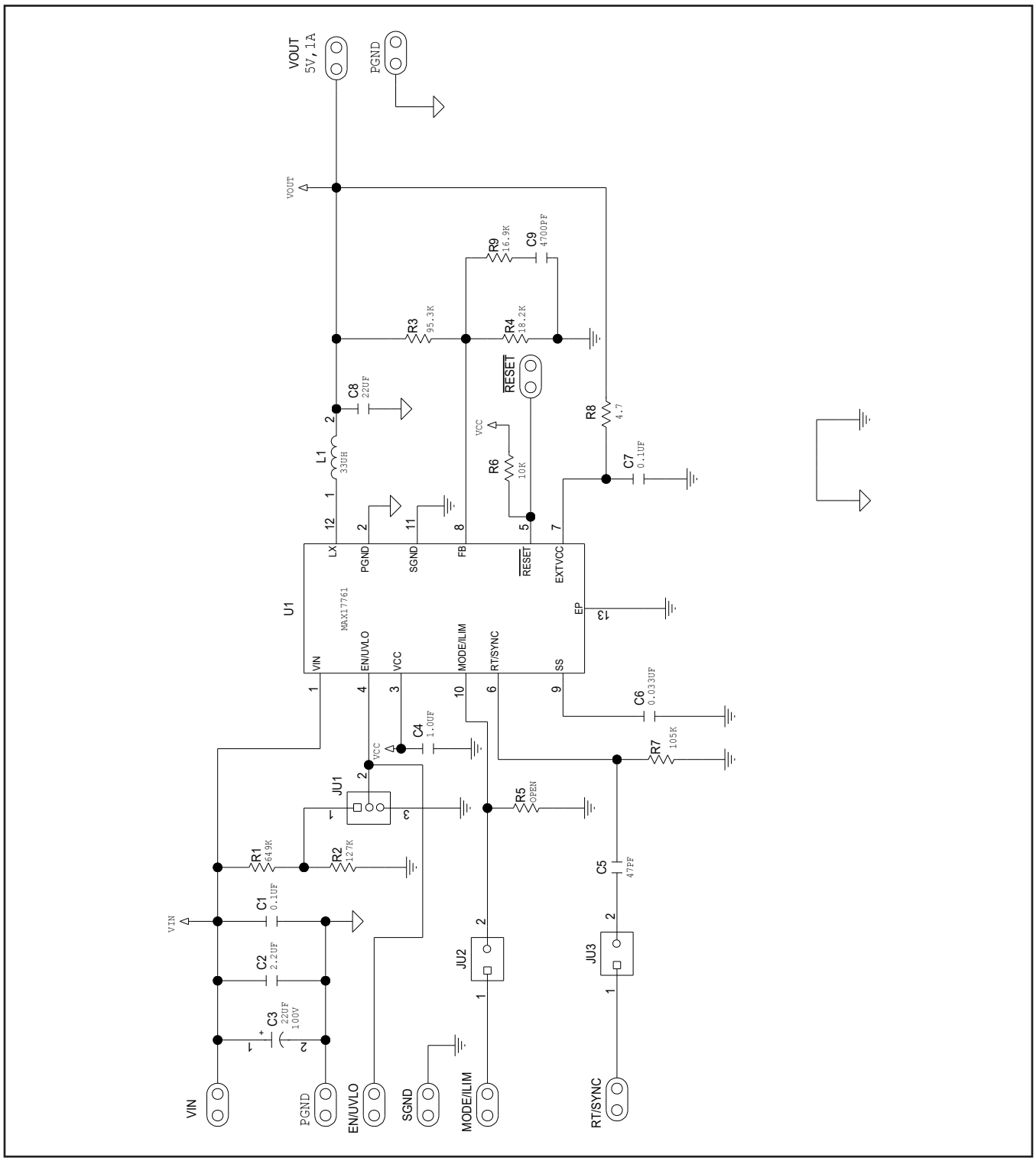
Note: *Indicate that you are using the MAX17761 when contacting these component suppliers.*

Ordering Information

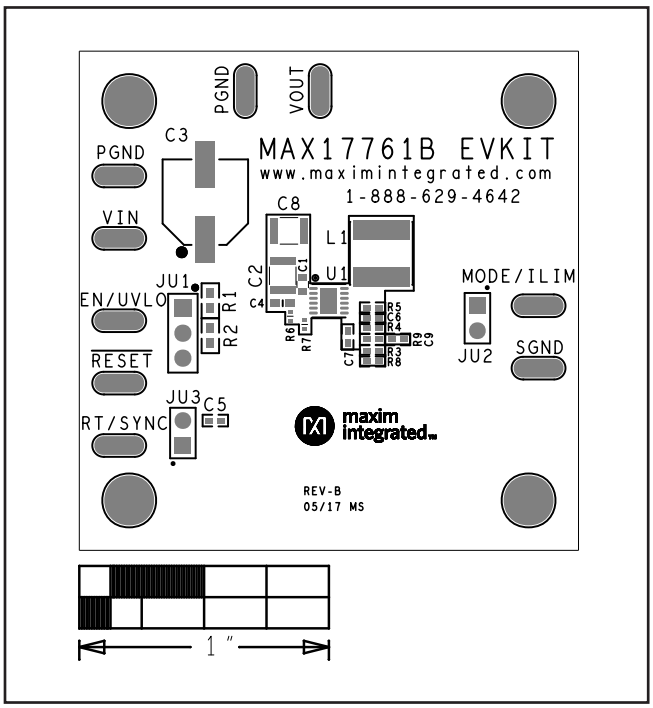
PART	TYPE
MAX17761EVKITB#	EV Kit

#Denotes RoHS compliant.

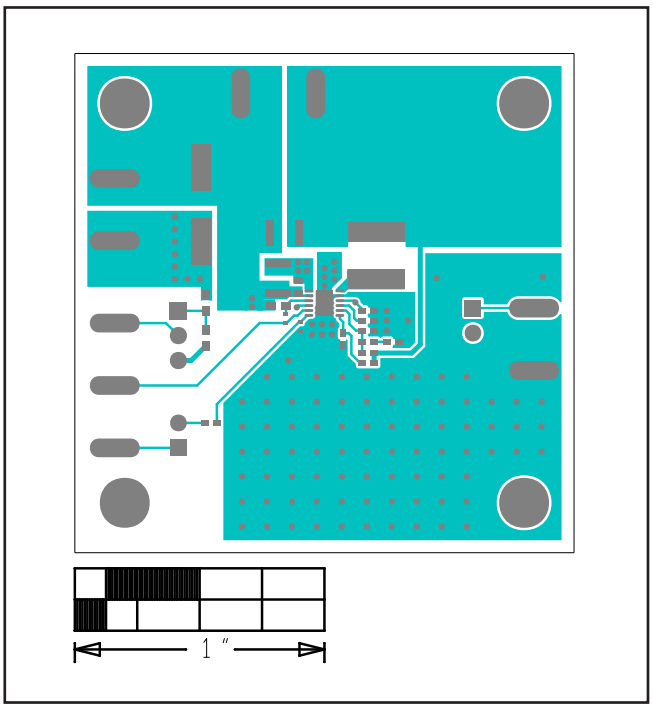
MAX17761 EV Kit Schematic



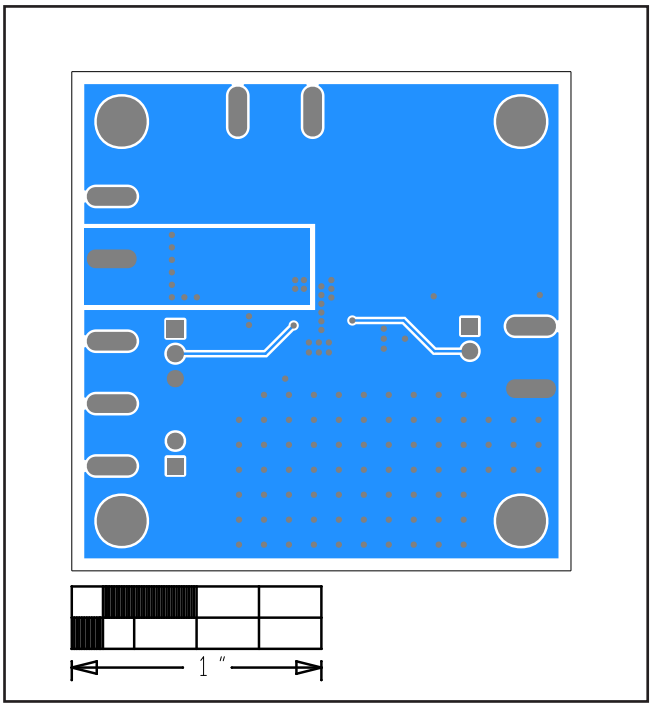
MAX17761 EV Kit PCB Layout



MAX17761 EV Kit PCB 5V Output Top Silkscreen



MAX17761 EV Kit PCB 5V Output Top Layer



MAX17761 EV Kit PCB 5V Output Bottom Layer