Click here for production status of specific part numbers.

MAX17613AEVKIT# Evaluation Kit

Evaluates: MAX17613A - 4.5V to 60V, 3A Current-Limiter with OV, UV and Reverse Protection

General Description

The MAX17613AEVKIT# evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the MAX17613A 4.5V to 60V, 3A, overvoltage (OV), undervoltage (UV) protector with forward current limit and reverse current block in a 20-pin TQFN-EP package. The EV kit can be configured to demonstrate adjustable overvoltage, undervoltage, three current-limit types (Autoretry, Continuous, and Latchoff) with different current-limit thresholds (from 0.15A to 3A). For more details about the IC benefits and features, refer to the MAX17613 IC data sheet.

Features

- 4.5V to 40V Operating Voltage Range (Remove the TVS Diode to Extend the Operating Voltage Range up to 60V)
- Features a 40V TVS Diode (D1) across the Input and Schottky Diode across the Output Terminals
- Evaluates Undervoltage-Lockout (UVLO), Overvoltage-Lockout (OVLO), Three Current Limit Types, and Current-Limit Threshold
- UVLO Programmed to 4.5V
- OVLO Programmed to 36V
- Jumper-Configurable Current Limit
- Jumper-Configurable Current Limit Type
- Programmable Startup Blanking Time
- Features Fault Indication Signals ($\overline{UVOV}$, $\overline{FLAG}$)
- Proven PCB Layout
- Fully Assembled and Tested

Quick Start

Recommended Equipment

- MAX17613AEVKIT#
- 60V, 5A DC power supply
- 4 Multimeters
- Adjustable load (0A to 3.5A)
- USB-A male to USB-B male cable or 5V DC power supply

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 power supply until all connections are complete.

1) Verify that all jumpers are in their default positions.
2) Connect the USB cable to J1 from a computer or connect a 5V DC power supply to TP3.
3) Verify that LED1 is on.
4) Verify the JU6 jumper is installed.
5) Set the 60V DC power supply to 5V and connect to IN (J2). Verify that OUT (J3/TP8) is 5V.

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

319-100349; Rev 0; 4/19

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6) Gradually increase the DC power-supply voltage to observe that the device enters lockout mode by verifying the OUT voltage (TP8) begins drooping and fault signal $\overline{UVOV}$ (TP4) goes low (to approximately 0V) when input reaches approximately 36V.
7) Gradually decrease the DC power-supply voltage to observe that the device exits lockout mode by verifying the OUT voltage (TP8) is recovered close to the input voltage level and the fault signal $\overline{UVOV}$ (TP4) goes high (approximately 5V) when the input voltage reaches approximately 34.8V.
8) Set the DC power-supply voltage to 24V and connect the adjustable load between OUT and GND terminals and a multimeter in series to measure the current. Gradually increase the load current and verify that the OUT goes down and $\overline{FLAG}$ goes low when the load current increases above 0.3A.
9) The jumper JU1 can be configured to change the current limit as shown in Table 1. Verify various current-limit operations by repeating step 8.

CAUTION: The negative input test should be performed by applying negative input voltage (VIN) across input terminals at J2 only when the output capacitors connected at the OUT terminals are fully discharged and 5V BUS at J1 is not supplied.

Detailed Description

The EV kit circuit can be configured to evaluate user-defined UVLO and OVLO thresholds using resistor-dividers. The overcurrent threshold is determined by external resistors connected to the SETI pin and is configurable through jumper JU1. Using jumper JU4, the EV kit circuit can be configured to evaluate Autoretry, Continuous, and Latchoff current limit types. LED1 on the EV kit indicates availability of logic power for annunciation signals ($\overline{UVOV}$ and $\overline{FLAG}$) and EN. Device offers a programmable startup blanking time that enables charging of large capacitances on the output during startup and when recovering from a fault condition. Connecting a capacitor from the TSTART pin to GND programs the startup blanking time. The EV kit can be configured to enable or disable the IC operation using Jumper JU5. The EV kit provides on-board output capacitors to enable a demonstration of the MAX17613A protection features. For more details about the IC benefits and features, refer to the MAX17613 IC data sheet.

Input Power Supply

The EV kit is powered by a user-supplied 4.5V to 60V power supply connected between input connector (J2) terminals.

Setting the Current-Limit Threshold

The EV kit features a jumper (JU1) to select the current-limit threshold. Install a jumper as shown in Table 1 to change the current-limit threshold. The current limit can be programmed between 0.15A to 3A. The current limit (I_{LIM}) is programmed by the resistor R_{SETI} connected at the SETI pin. Use the following equation to calculate the current-limit setting resistor:

$$R_{SETI} = \frac{4500}{I_{LIM}}$$

where, I_{LIM} is the desired current limit in mA and R_{SETI} is in kΩ.

Do not use R_{SETI} smaller than 1.5kΩ.

Current-Limit Type Selection

The EV kit features a jumper (JU4) to select different current limit type responses (see Table 2). For more details about each current limit type, refer to the MAX17613 IC data sheet.

Table 1. Current-Limit Threshold Jumper (JU1) Settings

SHUNT POSITION	CURRENT-LIMIT THRESHOLD
1–2	Adjustable using the resistor pot
3–4*	0.3A
5–6	1.5A
7–8	3A

**Default Position*

Table 2. Current-Limit Type Selection (JU4)

SHUNT POSITION	CURRENT-LIMIT TYPE
1–2	Latchoff
2–3	Continuous
Not Installed*	Autoretry

**Default Position*

Enable

Connect a USB-A male connector from the computer to the USB-B female connector, J1, or an external 5V supply to TP3 and GND. This provides 5V to V_{BUS} and to the EN pin (JU5 connects V_{BUS} to EN by default). Choose the (JU5) setting to enable or disable operation of the MAX17613A (see Table 3). Driving the EN pin high or low makes the device enable or disable, respectively.

Undervoltage-Lockout / Overvoltage-Lockout (UVLO/OVLO) Programming

The UVLO threshold for input voltage is set through the R11, R12 resistive divider. Use the following equation to calculate the value of R12 for a required undervoltage threshold level:

$$R12 = \frac{R11}{\left(\frac{V_{UVLO}}{V_{REF}} - 1\right)}$$

where,

R11 = Can be chosen as 2.2MΩ

V_{REF} = 1.5V (typ)

V_{UVLO} = Required undervoltage protection threshold

The OVLO threshold for input voltage is set through the R9, R10 resistive divider. Use the following equation to calculate the value of R10 for a required overvoltage threshold level:

$$R10 = \frac{R9}{\left(\frac{V_{OVLO}}{V_{REF}} - 1\right)}$$

where,

R9 is chosen between 450kΩ and 500kΩ

V_{REF} = 1.5V (typ)

V_{OVLO} = Required overvoltage protection threshold

Startup Blanking Time Programming (TSTART)

Connecting a capacitor from the TSTART pin to GND programs the startup blanking time. The below equation ensures proper value of C_{TSTART} when connected at the TSTART pin for successful startup of the board especially when OUT is connected to a large capacitance.

$$C_{TSTART} \geq \frac{3.33 \times C_{OUT(MAX)} \times V_{IN(MAX)}}{I_{LIM}}$$

The startup time (t_{TSTART}) is related to the startup capacitor by the following equation:

$$t_{TSTART} = 300 \times C_{TSTART}$$

where,

C_{TSTART} = TSTART pin capacitance in nF

$C_{OUT(MAX)}$ = Maximum output capacitance in µF

$V_{IN(MAX)}$ = Maximum input voltage in V

I_{LIM} = Programmed current limit in mA

t_{TSTART} = Startup blanking time in µs

Output-Load Capacitor

Use JU6 to connect the OUT pins to the OUT test point (TP8) and output connector J3 (see Table 4). Use jumper JU7 to connect output to 470µF capacitor (see Table 5).

Table 3. Enable Jumper (JU5) Settings

SHUNT POSITION	DESCRIPTION	MAX17613A OUTPUT
1–2*	EN Connected to V_{BUS}	ON
Not Installed	EN pin Unconnected	ON
2–3	EN Connected to GND	OFF

**Default Position*

Table 4. Output Jumper (JU6) Settings

SHUNT POSITION	DESCRIPTION
Installed*	OUT is connected to TP8 and J3
Not Installed	OUT is not connected TP8 and J3

**Default Position*

Table 5. Output Load Capacitor (JU7) Settings

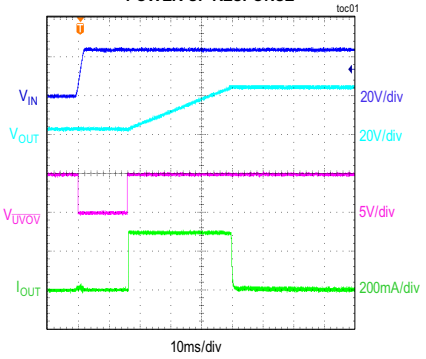
SHUNT POSITION	DESCRIPTION
Installed	OUT is connected to C4 and C7
Not Installed*	OUT is not connected to C4 and C7

**Default Position*

MAX17613AEVKIT# EV Kit Performance Report

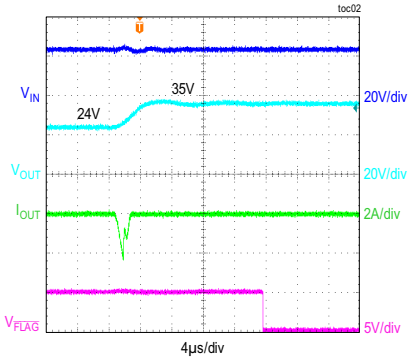
(C_{IN} = 0.47µF, C_{OUT} = 4.7µF, V_{IN} = 24V, T_A = +25°C. Autoretry mode, unless otherwise noted.)

POWER-UP RESPONSE

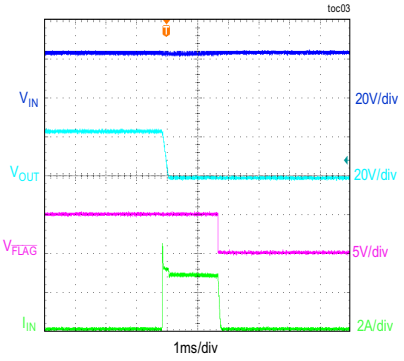


CONDITIONS: C_{OUT} = 470µF, I_{LIMIT} = 0.3A, MODE = AUTORETRY

REVERSE-BLOCKING RESPONSE



THERMAL SHUTDOWN DUE TO OUTPUT SHORT CIRCUIT

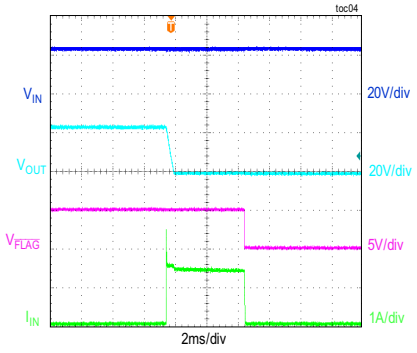


CONDITIONS: I_{LIMIT} = 3A, MODE = AUTORETRY

MAX17613AEVKIT# EV Kit Performance Report (continued)

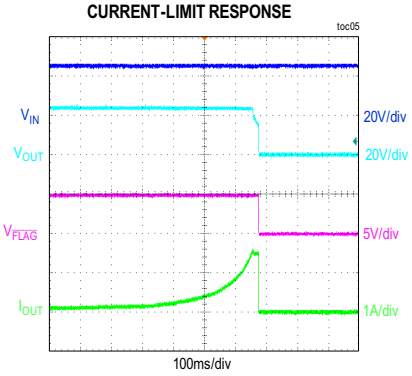
(C_{IN} = 0.47µF, C_{OUT} = 4.7µF, V_{IN} = 24V, T_A = +25°C. Autoretry mode, unless otherwise noted.)

OUTPUT SHORT-CIRCUIT RESPONSE



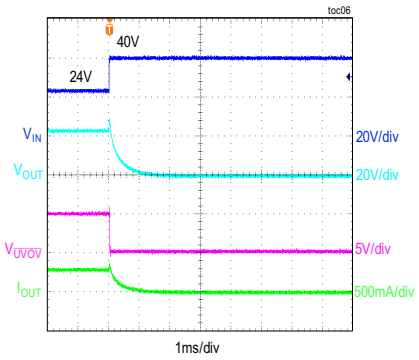
CONDITIONS: I_{LIMIT} = 1.5A, AUTORETRY MODE

CURRENT-LIMIT RESPONSE



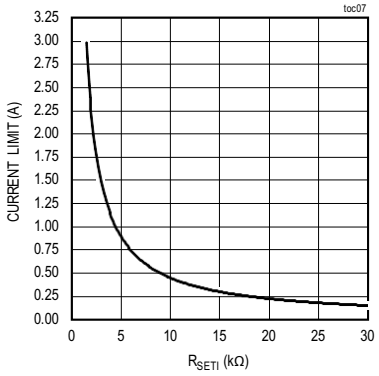
CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 1.5A,
SHORT ON OUT WITH CONTROLLED OUT CURRENT SLEW RATE

INPUT OVERVOLTAGE FAULT RESPONSE

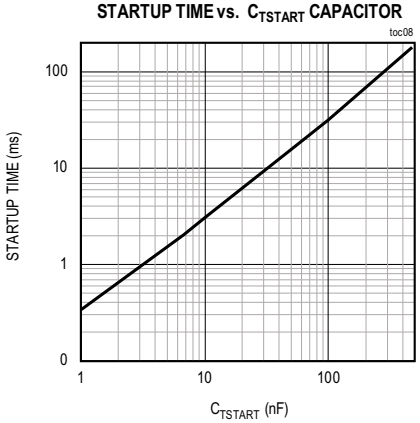


CONDITIONS: I_{LIMIT} = 3A, AUTORETRY MODE, R_{LOAD} = 80Ω

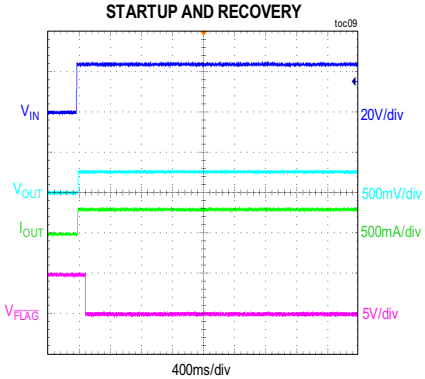
CURRENT LIMIT vs. R_{SETI}



STARTUP TIME vs. C_{TSTART} CAPACITOR

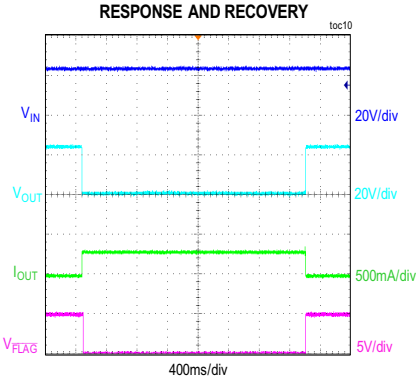


OVER CURRENT FAULT DURING STARTUP AND RECOVERY



CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 0.3A, R_{OUT} = 0.9Ω,
CONTINUOUS MODE

OVERCURRENT FAULT RESPONSE AND RECOVERY

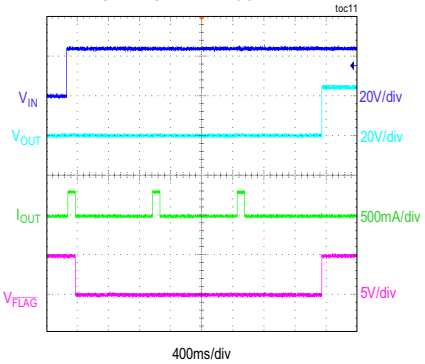


CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 0.3A, R_{OUT} = 0.9Ω,
CONTINUOUS MODE

MAX17613AEVKIT# EV Kit Performance Report (continued)

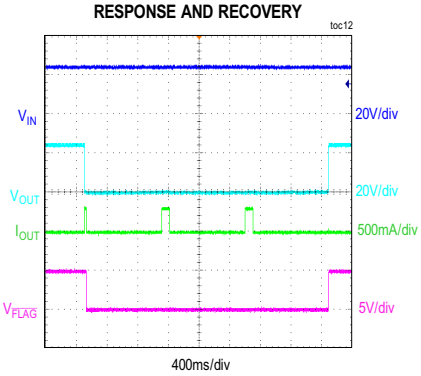
(C_{IN} = 0.47µF, C_{OUT} = 4.7µF, V_{IN} = 24V, T_A = +25°C. Autoretry mode, unless otherwise noted.)

OVERCURRENT FAULT DURING STARTUP AND RECOVERY



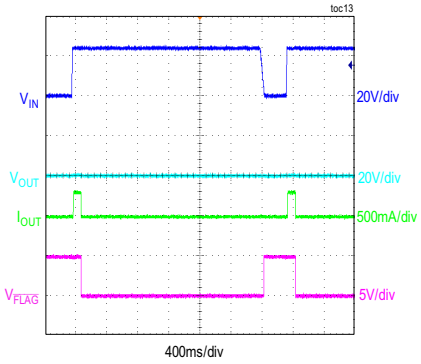
CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 0.3A, AUTORETRY MODE

OVERCURRENT FAULT RESPONSE AND RECOVERY



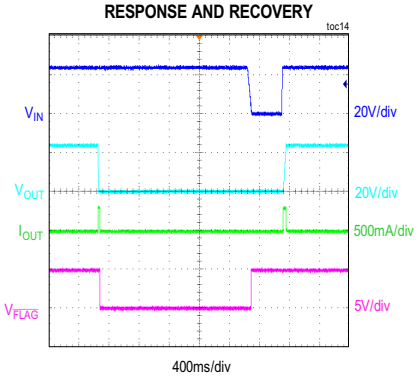
CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 0.3A, AUTORETRY MODE

OVERCURRENT FAULT DURING STARTUP AND RECOVERY



CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 0.3A, LATCHOFF MODE

OVERCURRENT FAULT RESPONSE AND RECOVERY



CONDITIONS: V_{IN} = 24V, I_{LIMIT} = 0.3A, LATCHOFF MODE

Component Suppliers

SUPPLIER	WEBSITE
Bourns, Inc	www.bourns.com
Murata Americas	www.murata.com
Panasonic Corp.	www.panasonic.com
Little fuse	www.littelfuse.com
TE connectivity	www.te.com
SULLINS	www.sullinscorp.com
LUMEX	www.lumex.com
KEYSTONE	www.keyelco.com
Amphenol	www.amphenol.com
DIODES INCORPORATED	www.diodes.com

Note: *Indicate that you are using the MAX17613A when contacting these component suppliers.*

Ordering Information

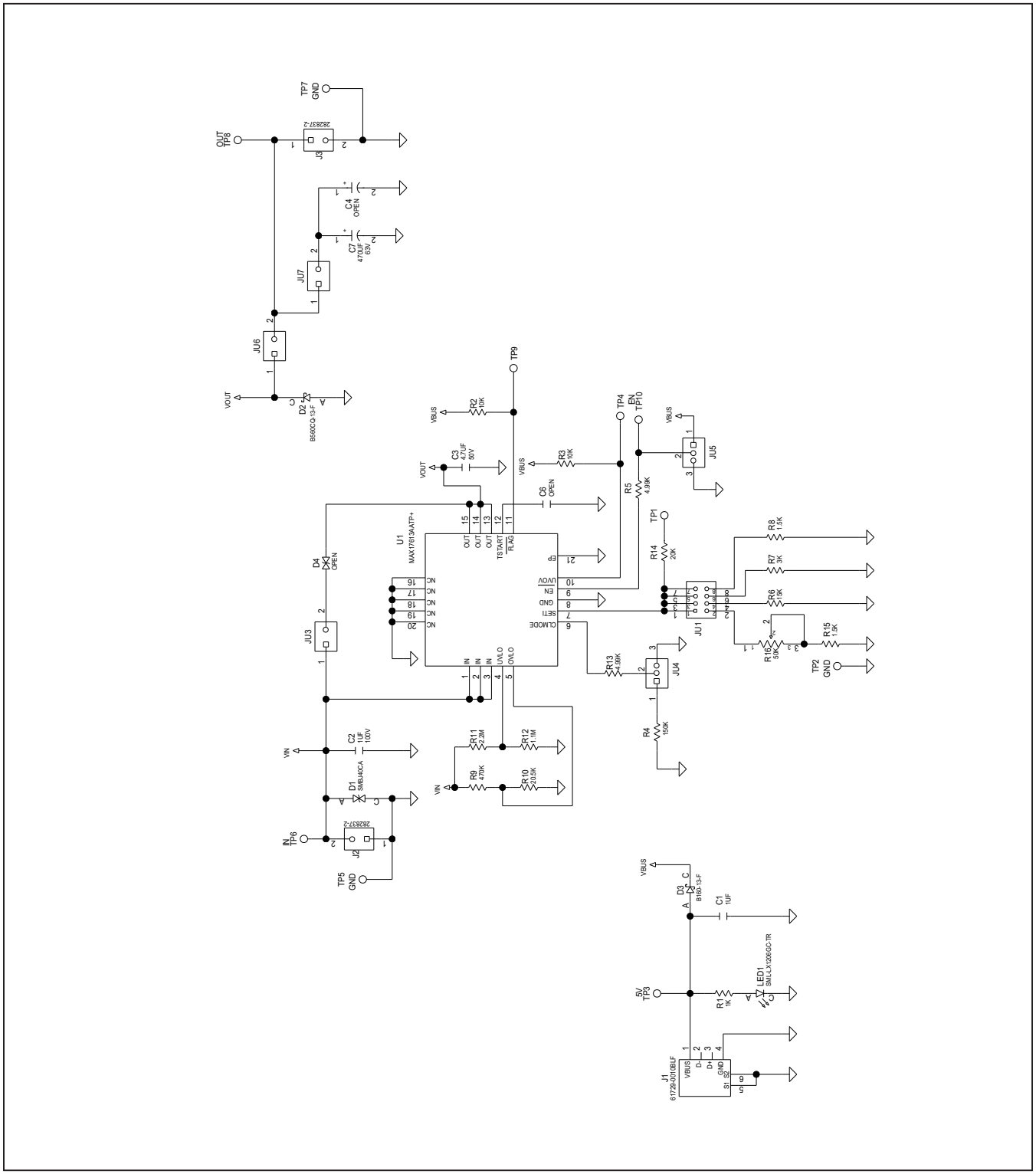
PART	TYPE
MAX17613AEVKIT#	EV Kit

MAX17613AEVKIT# EV Kit Bill of Materials

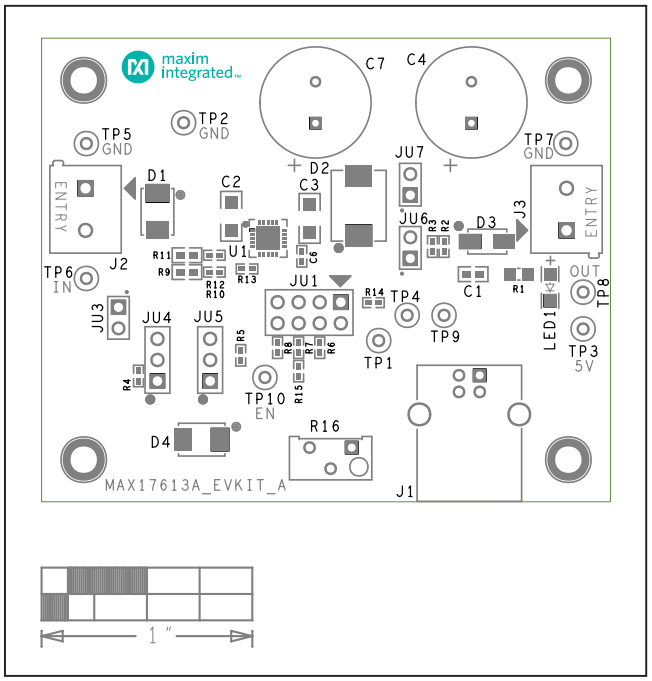
S.No	Designator	Description	Quantity	Manufacturer Part Number
1	C1	1µF, SMT Capacitor-X7R/25V (0603)	1	Murata GRM188R71E105KA12
2	C2	1µF, SMT Capacitor-X7R/100V (1206)	1	Murata GRM31CR72A105KA01
3	C3	4.7µF, SMT Capacitor-X7R/50V (1206)	1	Murata GRJ31CR71H475KE11L
4	C7	470µF, PTH Aluminum Capacitor-63V	1	Panasonic EEUFR1J471B
5	D1	40V,600W, TVS Diode (DO-214AA)	1	Littlefuse SMBJ40CA
6	D2	60V, 5A, Diode (DO-214AB)	1	DIODES INCORPORATED B560CQ-13-F
7	D3	Power Schottky Diode, 60V, 1A (SMA)	1	DIODES INCORPORATED B160-13-f
8	LED1	2.2V, 20mA, LED (1206)	1	Lumex SML-LX1206GC-TR
9	R1	1kΩ, SMT Resistor 1% 100PPM (0805)	1	
10	R2, R3	10kΩ, SMT Resistor 1% 100PPM (0402)	2	
11	R4	150kΩ, SMT Resistor 1% 100PPM (0402)	1	
12	R5, R13	4.99kΩ, SMT Resistor 1% 100PPM (0402)	2	
13	R6	15kΩ, SMT Resistor 1% 100PPM (0402)	1	
14	R7	3kΩ, SMT Resistor 1% 100PPM (0402)	1	
15	R8	1.5kΩ, SMT Resistor 1% 100PPM (0402)	1	
16	R9	470kΩ, SMT Resistor 1% 100PPM (0603)	1	
17	R10	20.5kΩ, SMT Resistor 1% 100PPM (0402)	1	
18	R11	2.2MΩ, SMT Resistor 1% 100PPM (0603)	1	
19	R12	1.1MΩ, SMT Resistor 1% 100PPM (0402)	1	
20	R14	20kΩ, SMT Resistor 1% 100PPM (0402)	1	
21	R15	1.5kΩ, SMT Resistor 1% 100PPM (0402)	1	
22	R16	50kΩ, 0.5W, Trimmer Potentiometers 10% , 100PPM	1	BOURNS 3296W-503LF-ND
23	U1	4.5V to 60V, 3A Current-Limiter with OV, UV and Reverse Protection	1	MAXIM MAX17613AATP+T
24	TP1, TP2, TP4, TP5, TP7, TP9	Black Test Point	6	KEYSTONE 5001
25	TP3, TP6, TP8	Red Test Point	3	KEYSTONE 5000
26	SU1, SU3-SU7	Shunt Connector, Black Closed Top	6	SULLINS STC02SYAN
27	J1	USB B connector	1	Amphenol 61729-0010BLF
28	J2, J3	2-Pin Green PC Terminal Block	2	TE Connectivity 282837-2
29	JU1	2x4 Dual-Row Header	1	SULLINS PBC04DAAN
30	JU3, JU6, JU7	2-Pin Single-Row Header	3	SULLINS PEC02SAAN
31	JU4, JU5	3-Pin Single-Row Header	2	SULLINS PEC03SAAN
32	C6	OPEN, SMT Capacitor (0603)	0	
33	C4	OPEN, Capacitor, 470µF, 12.5mm Dia (PTH)	0	
34	D4	OPEN, 40V,600W, TVS Diode (DO-214AA)	0	

Default Jumper Table	
Jumper	**Shunt Position**
JU1	3-4 short
JU3	Open
JU4	Open
JU5	1-2 short
JU6	short
JU7	Open

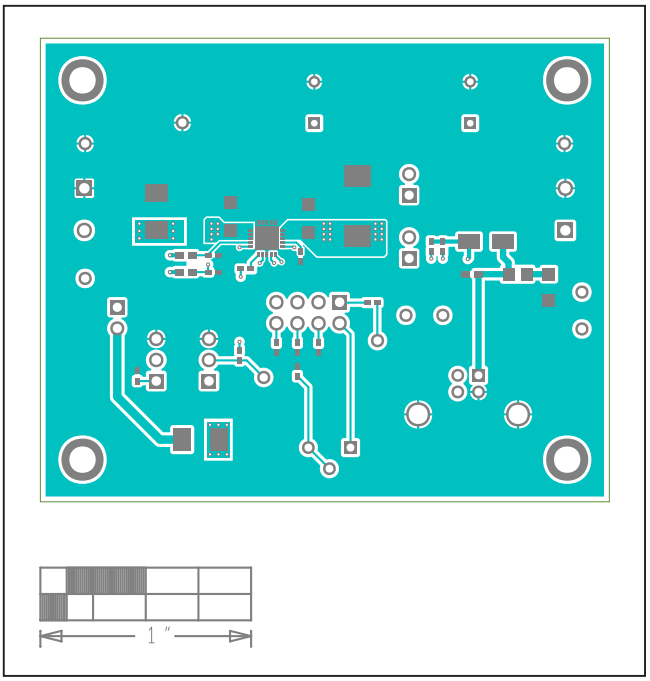
MAX17613AEVKIT# EV Kit Schematic



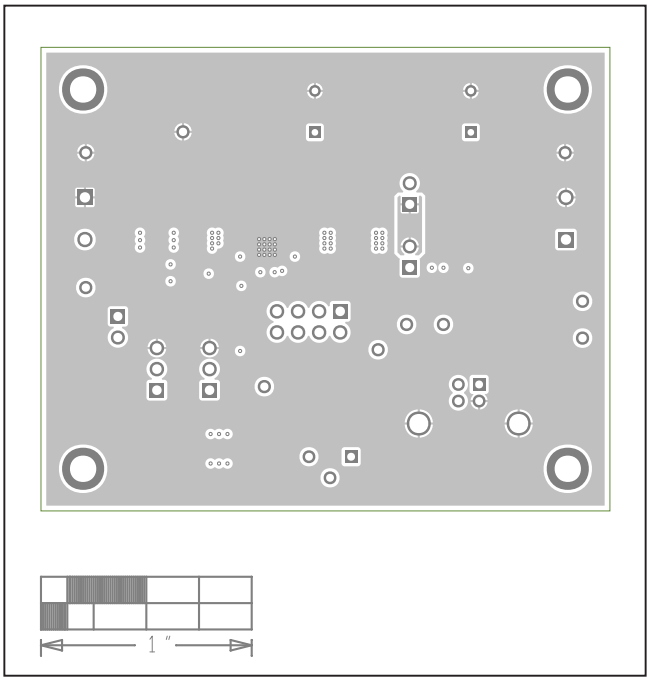
MAX17613AEVKIT# EV Kit PCB Layout



MAX17613AEVKIT# EV Kit—Top Silkscreen

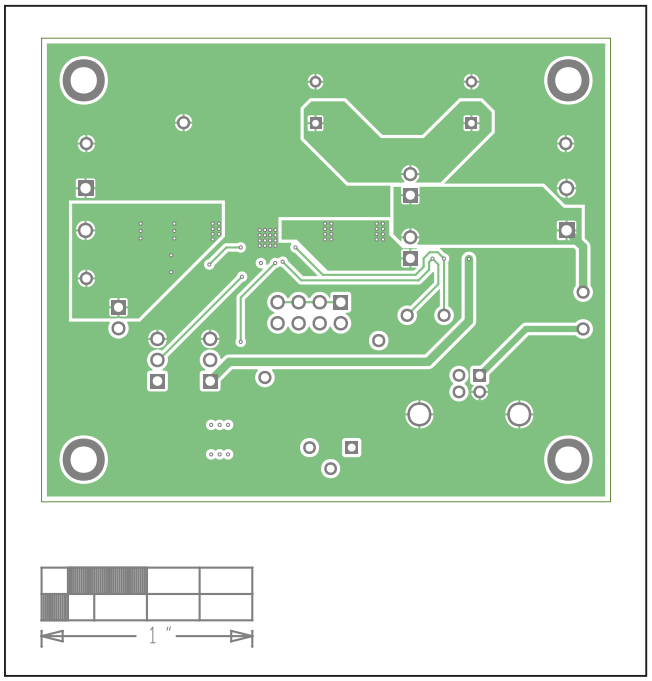


MAX17613AEVKIT# EV Kit—Top Layer

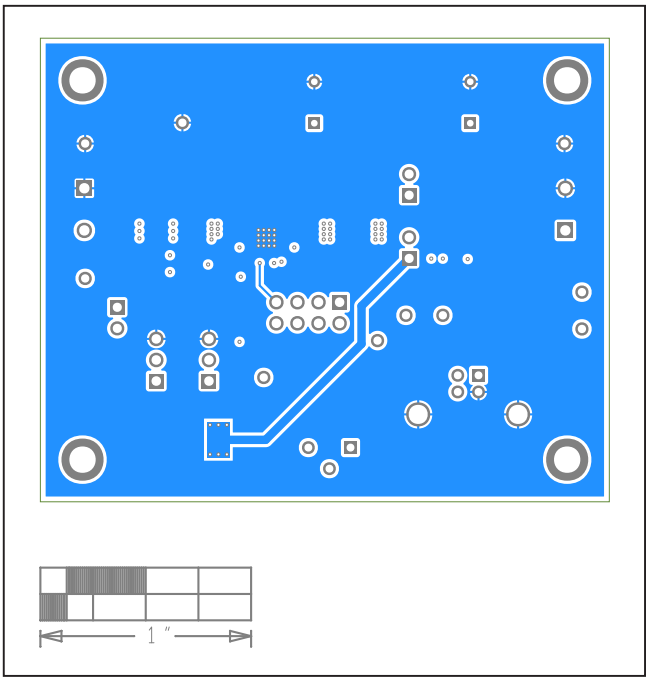


MAX17613AEVKIT# EV Kit—Layer 2

MAX17613AEVKIT# EV Kit PCB Layout (continued)



MAX17613AEVKIT# EV Kit—Layer 3



MAX17613AEVKIT# EV Kit—Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/19	Initial release	—

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