

## MAX25610B Evaluation Kit

Evaluates: MAX25610B

### General Description

The MAX25610B evaluation kit (EV kit) provides a proven design to evaluate the MAX25610B automotive high-voltage, high-brightness LED (HB LED) controller. The EV kit is set up for buck configuration and operates from a 5V to 18V DC supply voltage. The EV kit is configured to deliver up to 3A to one string of LEDs. The total voltage of the string can vary from 3V to 6V. The anode of the LED string should go to LEDBK+ terminal and the cathode to the LEDEXTBK- terminal for external sensing and LEDBK- for internal sensing.

### Benefits and Features

- 5V to 18V Input Voltage Range
- Demonstrates Analog Dimming Control, Digital Dimming Control
- Demonstrates External and Internal Current Sensing
- Demonstrates LED Short and Open Protection
- Proven PCB Layout
- Fully Assembled and Tested

[Ordering Information](#) appears at end of data sheet.

### Quick Start

#### Required Equipment

- MAX25610B EV kit
- 12V, 5A DC power supply
- One LED rated at least 3A
- Oscilloscope with a current probe

#### 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 made.**

- 1) Verify that all jumpers are in their default positions, as shown in [Table 1](#).
- 2) Connect the positive terminal of the 12V supply to the VIN\_BK PCB pad and the negative terminal to the GND\_BK PCB pad.
- 3) Connect the LED string across the LEDBK+ and LEDEXTBK- PCB pads for external sensing. For internal sensing connect the LED string between LEDBK+ and LEDBK- PCB pads. The Anode of the LED string should go to the LEDBK+ PCB pad and Cathode of the LED string to LEDEXTBK- PCB pad for external sensing and LEDBK- PCB pad for internal sensing.
- 4) Clip the current probe on the wire connected to the LED string.
- 5) Turn on the DC power supply.
- 6) Verify that the LEDs turn on.
- 7) Verify that the oscilloscope displays approximately 3A.

### Detailed Description

The MAX25610B evaluation kit (EV kit) provides a proven design to evaluate the MAX25610B automotive high-voltage, high-brightness LED (HB LED) controller. The EV kit is set up for buck configuration and operates from a 5V to 18V DC supply voltage. The EV kit is configured to deliver up to 3A to one string of LEDs. The total voltage of the string can vary from 3V to 6V. The anode of the LED string should go to LEDBK+ terminal and the cathode to the LEDEXTBK- terminal for external sensing and LEDBK- for internal sensing.

#### Analog Dimming Control (REFI)

When J3 is closed, the LED current is set by external current sensing. The equation to set the LED current is

$$I_{LED} = \frac{V_{REFI} - 200mV}{6.67 \times R_{LED}}$$

In the case of the EV kit,  $I_{LED}$  is set to 3A.

When J3 is open, the LED current is set by internal current sensing. The equation to set the LED current is  $I_{LED} = 13125/R_{REFI}$ .

### PWM Dimming

The EV kit demonstrates the PWM dimming feature of the MAX25610 using either an external PWM signal, or a DC voltage at the PWMDIM pin.

#### Analog-to-PWM dimming:

Keep J5 open and J8 closed as described in [Table 1](#) and remove the 0.1µF C28 capacitor. PWM dimming duty cycle is set by the voltage at PWMDIM between 0.2V (0% duty) and 3V (100% duty). Alternatively, drive the PWMDIM test point with an external DC source. PWMDIM voltages above 3V set the dimming duty cycle to 100%.

#### External PWM dimming:

Keep J5 open and J8 open. Install the 0.1µF C28 capacitor (installed by default). Connect an external PWM signal to the PWMDIM test point. Vary the duty cycle to increase or decrease the intensity of the HB LED string. The PWMDIM input of the device has a 2V (max) rising threshold and a 0.4V (min) falling threshold, and is compatible with 3.3V and 5V logic-level signals.

**Table 1. MAX25610B EV Kit Jumper Descriptions**

JUMPER	SHUNT POSITION	DESCRIPTION
J3	Closed*	For external current sense. The voltage on REFI pin is adjusted from 0.2v to 1.2v to set the LED current as per the equation below: $I_{LED} = (V_{REFI} - 0.2) / 6.67 \times R_{LED}$
	Open	For internal current sense. The potentiometer R24 is adjusted for setting the LED current as per the equation below: $I_{LED} = 13125 / R_{REFI}$
J5	1-2	Connects PWMDIM pin to GND and no switching.
	2-3*	Connects PWMDIM pin to VCC (Internal 5V) for 100% duty.
	Open	Connect an external clock source to do PWM dimming with J5 Open. With J8 Closed, the potentiometer R36 is adjusted to set the dc voltage on PWMDIM pin to do analog PWM dimming. The capacitor C28 needs to be removed to do analog PWM Dimming. Check the IC datasheet to see how the PWM frequency can be set.
J6	1-2*	External Sense
	2-3	Internal Sense
J8	Open*	For external PWM dimming
	Closed	For analog PWM dimming

## Current Sensing

### External current sensing:

Keep J3 closed and J6 closed in 1-2 position as described in [Table 1](#) and adjust the potentiometer R24 to set the LED current. Connect the LED string between LEDBK+ and LEDEXTBK-. The anode of LEDs should go to LEDBK+ and cathode to LEDEXTBK-.

### Internal current sensing:

Keep J3 open and J6 closed in 2-3 position as described in [Table 1](#) and adjust the potentiometer R24 to set the LED current. Connect the LED string between LEDBK+

and LEDBK-. The anode of LEDs should go to LEDBK+ and cathode to LEDBK-.

## Faults

### Open and Short LEDs:

The fault pin is pulled low if the IC detects an open or short fault condition in the LEDs, or if there is an overtemperature condition. The fault pin is an open-drain output and is active low.

## Ordering Information

PART	TYPE
MAX25610BEVKIT#	EV Kit

#Denotes RoHS compliance.

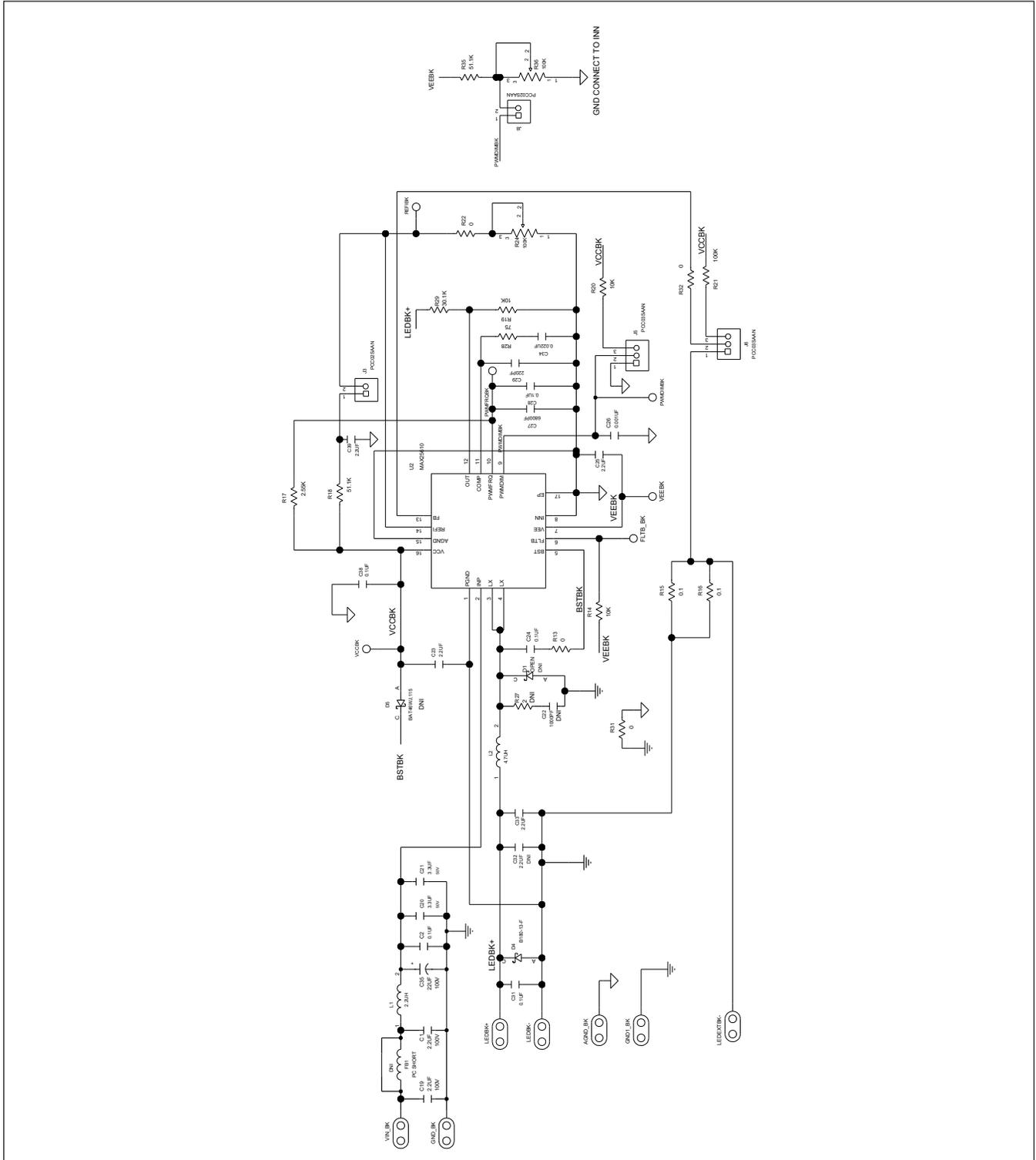
MAX25610B EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	AGND_BK, GND1_BK, GND_BK, LEDBK+, LEDBK-, LEDEXTBK-, VIN_BK	-	7	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL;SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
2	C1, C19	-	2	GRM32ER72A225KA35; CGA6N3X7R2A225K230AB; CC1210KX7R0BB225; HMK325B7225KM	MURATA;TDK; YAGEO; TAIYO YUDEN	2.2UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 2.2UF;100V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R	
3	C2, C24	-	2	CC0603KRX7R0BB104; GRM188R72A104KA35; GCJ188R72A104KA01; HMK107B7104KA; 06031C104KAT2A	YAGEO;MURATA; MURATA; TAIYO YUDEN; AVX	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
4	C20, C21	-	2	C1210X335K5RACAUTO	KEMET	3.3UF	CAPACITOR; SMT (1210); CERAMIC; 3.3UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; AUTO	
5	C23, C25, C39	-	3	C1608X5R1E225K; TMK107ABJ225KA; TMK107BJ225KA; GRM188R61E225KA12	TDK;TAIYO YUDEN; TAIYO YUDEN; MURATA	2.2UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 2.2UF; 25V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R	
6	C26	-	1	GRM1885C1E102JA01	MURATA	0.001UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.001UF; 25V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=COG	
7	C27	-	1	C0603C682K5RAC; CL10B682KB85FN	KEMET;SAMSUNG	6800PF	CAPACITOR; SMT; 0603; CERAMIC;6800pF; 50V; 10%; X7R; -55degC to + 125degC; +/-15% from -55degC to +125degC	
8	C28, C38	-	2	C1608X8R1E104K080AA	TDK	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 25V; TOL=10%; TG=-55 DEGC TO +150 DEGC; TC=X8R	
9	C29	-	1	ECH-U1C221JX5	PANASONIC	220PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 220PF; 50V; TOL=5%; MODEL=PPS; TG=-55 DEGC TO +85 DEGC; TC=+/-	
10	C31	-	1	GCJ188R71H104KA12; GCM188R71H104K; CGA3E2X7R1H104K080AA	MURATA;MURATA; TDK	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; AUTO	
11	C33	-	1	C2012X7R1H225K125AC; CGA4J3X7R1H225K125AB; CGA4J3X7R1H225K125AE	TDK;TDK;TDK	2.2UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 2.2UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
12	C34	-	1	C0603C223K5RAC; GRM188R71H223K; C1608X7R1H223K080AA; GCJ188R71H223KA01	KEMET;MURATA; TDK;MURATA	0.022UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.022UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
13	C35	-	1	EEE-TG2A220UP	PANASONIC	22UF	CAPACITOR; SMT (CASE_F); ALUMINUM-ELECTROLYTIC; 22UF; 100V; TOL=20%; MODEL=TG SERIES; TG=-40 DEGC TO +125 DEGC	
14	D4	-	1	B180-13-F	DIODES INCORPORATED	B180-13-F	DIODE; SCH; SCHOTTKY BARRIER RECTIFIER; SMA; PIV=80V; IF=1A	
15	FB1	-	1	HF70ACB322513	TDK	52	INDUCTOR; SMT (1210); FERRITE-BEAD;52; TOL=+/-25%; 0.4A; -40 DEGC TO +125 DEGC	PC SHORT
16	FLT_BK, PWMDIMBK, PWMFRQBK, REFIBK, VCCBK, VEEBK	-	6	5007	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
17	J3, J8	-	2	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
18	J5, J6	-	2	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	
19	L1	-	1	XAL4020-222ME	COILCRAFT	2.2UH	INDUCTOR; SMT; COMPOSITE CORE; 2.2UH; TOL=+/-20%; 4A	
20	L2	-	1	MSS1278T-472ML	COILCRAFT	4.7UH	INDUCTOR; SMT; FERRITE BOBBIN CORE; 4.7UH; TOL=+/-0.2; 6.2A; -40 DEGC TO +125 DEGC	

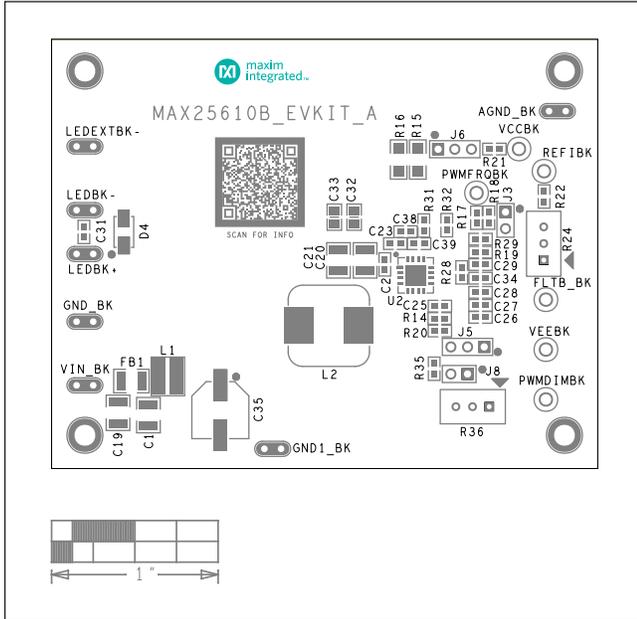
**MAX25610B EV Kit Bill of Materials (continued)**

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
21	R13, R22, R31, R32	-	4	CRCW06030000Z0	VISHAY DALE	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM	
22	R14, R19, R20	-	3	TNPW060310K0BE; RN731JTTD1002B	VISHAY DALE; KOA SPEER ELECTRONICS	10K	RESISTOR; 0603; 10K OHM; 0.1%; 25PPM; 0.1W; THICK FILM	
23	R15, R16	-	2	ERJ-8BWFR100	PANASONIC	0.1	RESISTOR; 1206; 0.1 OHM; 1%; 100PPM; 1W; THICK FILM	
24	R17	-	1	CRCW06032K55FK; ERJ-3EKF2551	VISHAY DALE; PANASONIC	2.55K	RESISTOR; 0603; 2.55K OHM; 1%; 100PPM; 0.1W; THICK FILM	
25	R18, R35	-	2	CRCW060351K1FK; ERJ-3EKF5112	VISHAY DALE; PANASONIC	51.1K	RESISTOR; 0603; 51.1K; 1%; 100PPM; 0.10W; THICK FILM	
26	R21	-	1	CRCW0603100KFK; RC0603FR-07100KL; RC0603FR-13100KL; ERJ-3EKF1003; AC0603FR-07100KL	VISHAY DALE;YAGEO; YAGEO;PANASONIC	100K	RESISTOR; 0603; 100K; 1%; 100PPM; 0.10W; THICK FILM	
27	R24, R36	-	2	3296W-1-104LF	BOURNS	100K	RESISTOR; THROUGH-HOLE-RADIAL LEAD; 100K OHM; 10%; 100PPM; 0.5W; MOLDER CERAMIC OVER METAL FILM	
28	R28	-	1	CRCW060375R0FK	VISHAY DALE	75	RESISTOR; 0603; 75 OHM; 1%; 100PPM; 0.10W; THICK FILM	
29	R29	-	1	CRCW06033012FK	VISHAY DALE	30.1K	RESISTOR; 0603; 30.1K; 1%; 100PPM; 0.10W; THICK FILM	
30	U2	-	1	MAX25610	MAXIM	MAX25610	EVKIT PART - IC; CONV; SYNCHRONOUS BUCK AND BUCK BOOST LED DRIVER/DC-DC CONVERTER; TQFN16-EP	
31	PCB	-	1	MAX25610B	MAXIM	PCB	PCB:MAX25610B	-
32	C22	DNP	0	C1206C102K5RAC	KEMET	1000PF	CAPACITOR; SMT (1206); CERAMIC CHIP; 1000PF; 50V; TOL=10%; MODEL=X7R; TG=-55 DEGC TO +125 DEGC; TC=+	
33	C32	DNP	0	C2012X7R1H225K125AC; CGA4J3X7R1H225K125AB; CGA4J3X7R1H225K125AE	TDK;TDK;TDK	2.2UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 2.2UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
34	D1	DNP	0	B380-13-F	DIODES INCORPORATED	B380-13-F	DIODE; SCH; SMC; PIV=80V; IF=3A	OPEN
35	D5	DNP	0	BAT46WJ	NXP	BAT46WJ,115	DIODE; SCH; SMT (SOD-323F); PIV=100V; IF=0.25A	
36	R27	DNP	0	CRCW12062R00FK	VISHAY DALE	2	RESISTOR, 1206, 20HMS, 1%, 100PPM, 0.25W, THICK FILM	
TOTAL			58					

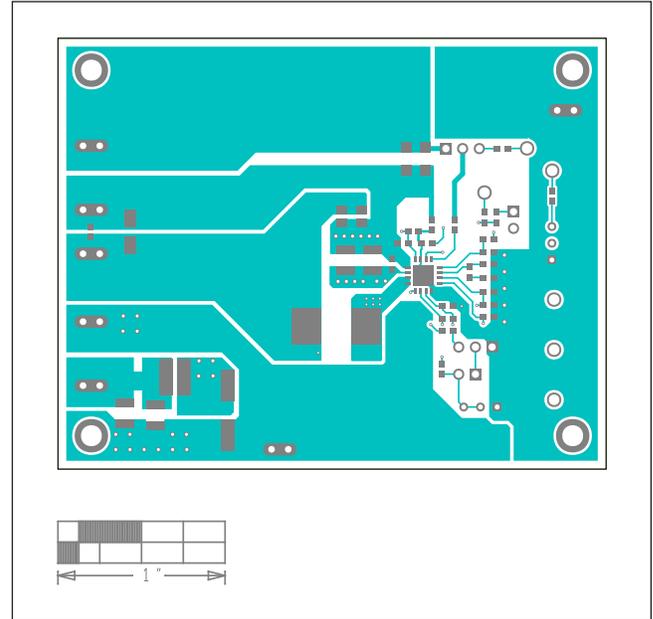
MAX25610B EV Kit Schematics



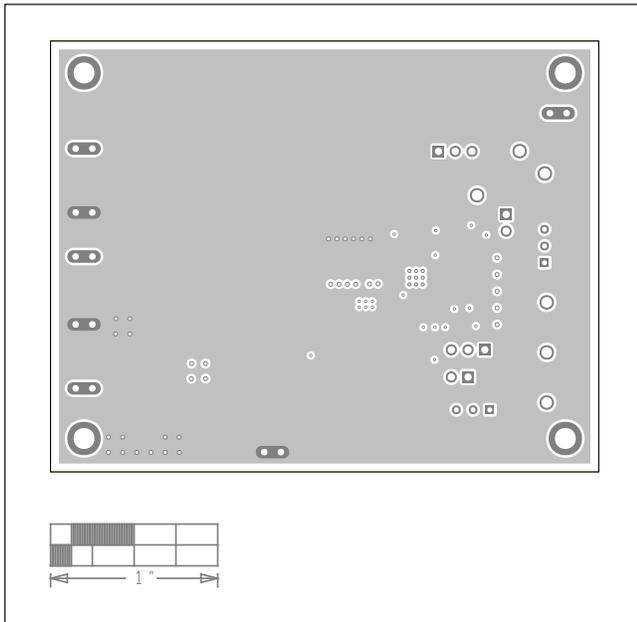
MAX25610B EV Kit PCB Layout Diagrams



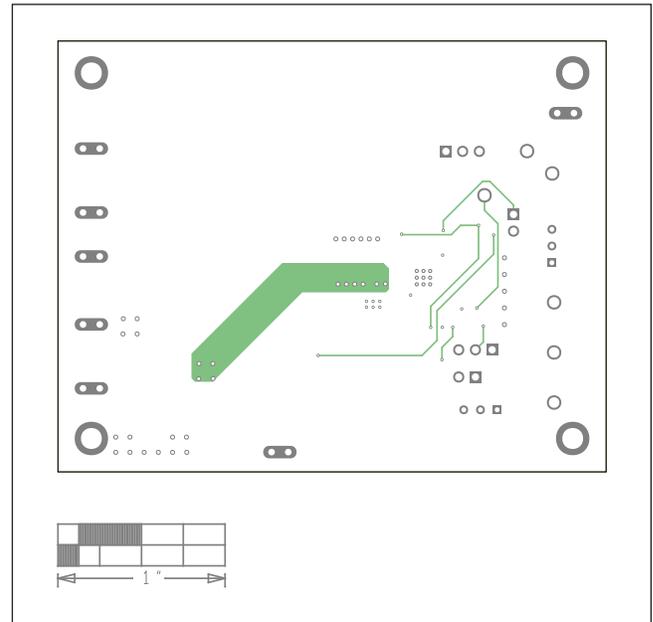
MAX25610B EV Kit Component Placement Guide—Top Silkscreen



MAX25610B EV Kit PCB Layout—Top View

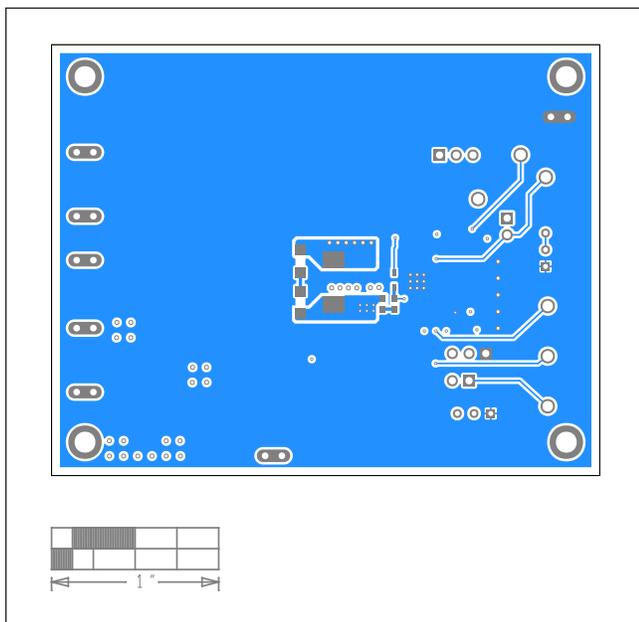


MAX25610B EV Kit PCB Layout—Internal2

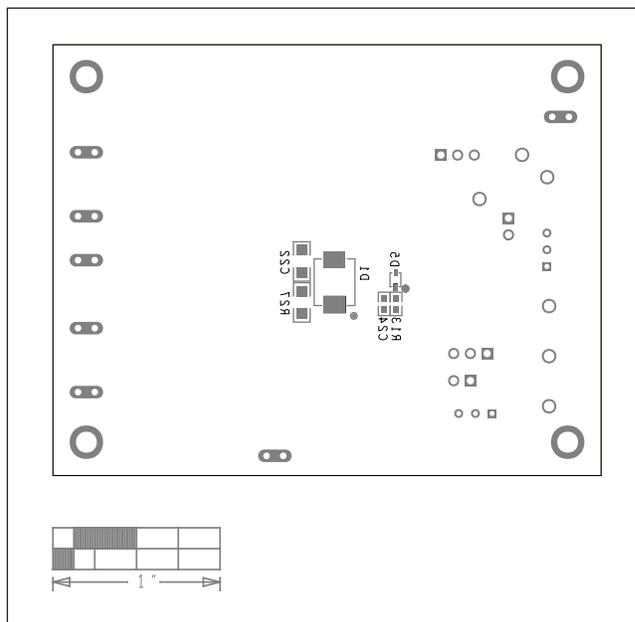


MAX25610B EV Kit PCB Layout—Internal3

MAX25610B EV Kit PCB Layout Diagrams (continued)



MAX25610B EV Kit PCB Layout—Bottom View



MAX25610B EV Kit Component Placement Guide—Bottom Silkscreen

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
1	9/19	Initial release, revised Manuscript	—

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