MAX25600 Evaluation Kit

Evaluates: MAX25600

General Description

The MAX25600 evaluation kit (EV kit) provides a proven design to evaluate the MAX25600 automotive high-voltage, high-brightness LED (HB LED) buck boost controller. The EV kit operates from 8V to 48V DC supply voltage. The EV kit is configured to deliver up to 1.5A to one string of one to fifteen LEDs. The total voltage of the string can vary from 3V to 60V. The anode of the LED string should go to LED+ terminal and the cathode to the LED- terminal.

Benefits and Features

- 8V to 48V Input Voltage Range
- Demonstrates Analog Dimming Control, Digital Dimming Control
- Demonstrates Input Current Limit
- Demonstrates LED Current Monitoring function
- 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

- MAX25600 EV kit
- 12V, 5A DC power supply
- A series-connected LED string rated at least 1.5A
- 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 the 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 VINP1 board PCB pad and the negative terminal to the GND1_board PCB pad.
3) Connect the LED string across the LED+ and LED- PCB pads on the EV kit. The Anode of the LED string should go to the LED+ PCB pad and Cathode of the LED string to LED- PCB pad.
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 1.5A.

PRELIMINARY

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Detailed Description

The MAX25600 evaluation kit (EV kit) provides a proven design to evaluate the MAX25600 automotive high-voltage, high-brightness LED (HB LED) buck boost controller. The EV kit operates from 8V to 48V DC supply voltage. The EV kit is configured to deliver up to 1.5A to one string of LEDs. The total voltage of the string can vary from 3V to 60V. The anode of the LED string should go to LED+ terminal and the cathode to the LED- terminal.

Analog Dimming Control (ICTRL)

When J2 is closed, the LED current is set by resistive divider from VCC. The equation to set the LED current is

$$I_{LED} = \frac{V_{ICTRL} - 200mV}{5 \times R9}$$

In the case of the EV kit, ILED is set to 1.5A. Use a screw driver on the potentiometer R21 to adjust the LED current.

PWM Dimming

The EV kit demonstrates the PWM dimming feature of the MAX25600 using either an external PWM signal, or a DC voltage at the PWMDIM pin.

External PWM dimming:

Keep J4 open and remove the 0.1uF C55 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.

Analog-to-PWM dimming:

Keep J4 open and keep the 0.1uF C55 (installed by default). The PWM dimming duty cycle is set by the voltage at PWMDIM between 0.2V (0% duty) and 3.2V (100% duty). Drive the PWMDIM test point with an external DC source. PWMDIM voltages above 3.2V set the dimming duty cycle to 100%.

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Table 1. MAX25600 EV Kit Jumper Descriptions

JUMPER	SHUNT POSITION	DESCRIPTION
J1	Closed	Short the PMOS PWM dimming switch.
	Open*	PWM Dimming done with the PMOS switch
J2	Closed	Uses the resistive divider from VCC and the potentiometer R21 to set the LED current.
	Open	Apply an external dc voltage between 0.2V to 1.2V for setting LED current.
J3	Open	Connect an external power supply for the IN pin of the IC using the IN_IC PAD.
	1-2*	Connects the IN input of the IC to the VIN power supply connected on VINP1 PAD.
	2-3	The IN and VCC inputs of the IC are shorted and should be driven with an external 5V supply.
J4	Open	Apply an external PWM clock source for PWM dimming or apply an external dc source between 0.2V to 3.2V for analog PWM dimming.
	1-2*	PWMDIM pin pulled to VCC for 100% duty.
	2-3	PWMDIM pin pulled to GND to turn OFF.

Current Monitor Output

The EV kit also demonstrates the current-monitor output feature of the buck boost controller. The MAX25600 includes a current monitor on the IOUTV pin. The IOUTV voltage is an analog voltage indication of the LED current when DIM is high. The voltage on the IOUTV pin is given by the following equation:

$$V_{IOUTV} = I_{LED} \times R_{CS\_LED} \times 5 + 0.2V$$

Input-Current Limit

The MAX25600 features circuitry that limits the input current during line dropouts. Refer to the IC datasheet for details on setting the input current limit.

External VCC input

The EV kit demonstrates operation of the buck boost controller with an external VCC input. In this case, the internal LDO is not used. Move the shunt to pins 2-3 on J3 (the IN and VCC pins of the buck controller are shorted together). Apply an external power supply between 4.6V and 5.5V on the IN_IC PCB pad to allow switching of the device.

Faults

Open and Short LEDs:

The IC detects the open and short fault conditions of the LEDs and the fault pin is pulled low. The fault pin also goes low when there is an overtemperature condition. The fault pin is an open-drain output and is active low.

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Ordering Information

PART	TYPE
MAX25600EVKIT#	EV Kit

#Denotes RoHS compliant.

MAX25600 EV Kit Bill of Materials

ITEM	QTY	REF DES	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	9	AGND, ICTRL, IN_IC, LED+, LED-, PGND, PGND1, PWMDIM, VINP1	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG
2	6	C1, C4, C20, C22, C24, C55	885012206071;CGJ3E2X7R1E104K080AA; C1608X7R1E104K080AA;C0603C104K3RAC; GRM188R71E104KA01;C1608X7R1E104K	WURTH ELECTRONICS INC;TDK; TDK;KEMET	0.1UF	CAPACITOR; SMT; 0603; CERAMIC; 0.1uF; 25V; 10%; X7R; -55degC to + 125degC; +/-15% from -55degC to +125degC
3	9	C2, C3, C6, C7, C9, C10, C12, C13, C15	CGA6M3X7S2A475K200AE; CGA6M3X7S2A475K200AB	TDK;TDK	4.7UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 4.7UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7S; AUTO
4	1	C5	CGA3E3X7S2A104K080AB	TDK	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7S
5	3	C8, C14, C21	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
6	1	C11	EEV-FK2A680Q	PANASONIC	68UF	CAPACITOR; SMT (CASE_H13); ALUMINUM-ELECTROLYTIC; 68UF; 100V; TOL=20%; MODEL=EEV SERIES
7	1	C17	C0603C471K1RAC; 06031C471KAT2A	KEMET;AVX	470PF	CAPACITOR; SMT; 0603; CERAMIC; 470pF; 100V; 10%; X7R; -55degC to + 125degC; +/-15% from -55degC to +125degC
8	1	C18	C0603X5R160-105KNP;EMK107BJ105KA; C1608X5R1C105K080AA;GRM188R61C105K; 0603YD105KAT2A;CL10A105KO8NNN	VENKEL LTD.;TAIYO YUDEN; TDK;MURATA;AVX;SAMSUNG ELECTRO-MECHANICS	1UF	CAPACITOR; SMT; 0603; CERAMIC; 1uF; 16V; 10%; X5R; -55degC to + 85degC; 0 +/-15% degC MAX.USE 20-0001u-63 FOR NEW DESIGN
9	1	C19	C1608C0G1E103J080AA	TDK	0.01UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.01UF; 25V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=C0G
10	1	C23	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
11	1	C25	C0603H102J1GAC	KEMET	1000PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 100V; TOL=5%; MODEL=HT SERIES; TG=-55 DEGC TO +200 DEGC; TC=C0G
12	1	C51	CGA3E2X8R1E104K080AE	TDK	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 25V; X8R; CERAMIC CHIP
13	4	D1, D2, D5, D6	1N4148W-7-F	DIODES INCORPORATED	1N4148W-7-F	DIODE; SWT; SMT (SOD-123); PIV=100V; IF=0.3A; -65 DEGC TO +150 DEGC
14	2	D7, D8	BAT46WJ	NXP	BAT46WJ,115	DIODE; SCH; SMT (SOD-323F); PIV=100V; IF=0.25A
15	1	FB1	HF70ACB322513	TDK	52	INDUCTOR; SMT (1210); FERRITE-BEAD; 52; TOL=+/-25%; 0.4A; -40 DEGC TO +125 DEGC
16	3	FLTB, IOUTV, VCC	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	2	J1, J2	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC
18	2	J3, J4	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC
19	1	L1	MSS1278-103ML	COILCRAFT	10UH	INDUCTOR; SMT; FERRITE CORE; 10UH; TOL=+/-20%; 5.7A
20	1	L2	MSS1278T-472ML	COILCRAFT	4.7UH	INDUCTOR; SMT; FERRITE BOBBIN CORE; 4.7UH; TOL=+/-0.2; 6.2A; -40 DEGC TO +125 DEGC
21	2	Q1, Q3	SQJA84EP-T1_GE3	VISHAY SILICONIX	SQJA84EP-T1_GE3	TRAN; AUTOMOTIVE N-CHANNEL MOSFET ; NCH; SO-8L; PD-(55W); I-(46A); V-(80V)
22	1	Q2	BUK9Y72-80E	NEXPERIA	BUK9Y72-80E	TRAN; N-CH LOGIC LEVEL MOSFET ; NCH; LFPAK; PD-(45W); I-(15A); V-(80V)
23	1	Q4	BUK9Y25-80E	NEXPERIA	BUK9Y25-80E	TRAN; N-CH LOGIC LEVEL MOSFET ; NCH; LFPAK; PD-(95W); I-(37A); V-(80V)
24	1	Q5	SI7415DN-T1-GE3	VISHAY SILICONIX	SI7415DN-T1-GE3	TRAN; P-CHANNEL 60-V (D-S) MOSFET; PCH; POWERPAK1212-8; PD-(3.8W); I-(-5.7A); V-(-60V)
25	10	R1, R3, R4, R6-R8, R13, R25, R27, R28	CRCW06030000Z0	VISHAY DALE	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM
26	2	R2, R12	CRCW06035R62FK	VISHAY DALE	5.62	RESISTOR; 0603; 5.62 OHM; 1%; 100PPM; 0.10W; THICK FILM
27	5	R5, R11, R17, R19, R20	301-10K-RC	XICON	10K	RESISTOR, 0603, 10K OHM, 5%, 200PPM, 1/16W, THICK FILM
28	1	R9	CSR1206FTR130	STACKPOLE ELECTRONICS INC	0.13	RESISTOR; 1206; 0.13 OHM; 1%; 100PPM; 0.5W; THICK FILM
29	1	R10	ERJ-3EKF5113	PANASONIC	511K	RESISTOR; 0603; 511K OHM; 1%; 100PPM; 0.1W; THICK FILM
30	1	R16	CRCW060354K9FK	VISHAY DALE	54.9K	RES; SMT (0603); 54.9K; 1%; +/-100PPM/DEGC; 0.1W
31	1	R18	288-0603-49.9K-RC	XICON	49.9K	RESISTOR, 0603, 49.9K OHM, 0.1%, 10PPM, 1/16W, THIN FILM
32	1	R21	3296W-1-103LF	BOURNS	10K	RESISTOR; THROUGH-HOLE-RADIAL LEAD; 3296 SERIES; 10K OHM; 10%; 100PPM; 0.5W; SQUARE TRIMMING POTENTIOMETER; 25 TURNS; MOLDER CERAMIC OVER METAL FILM
33	1	R22	CRCW0603560RFK	VISHAY DALE	560	RESISTOR, 0603, 560 OHM, 1%, 100PPM, 0.10W, THICK FILM
34	1	R23	RG1608P-101-B;ERA-3YEB101V	SUSUMU CO LTD.;PANASONIC	100	RESISTOR; 0603; 100 OHM; 0.1%; 25PPM; 0.1W; THICK FILM
35	1	R24	RCS060312R0FK	VISHAY DALE	12	RESISTOR; 0603; 12 OHM; 1%; 100PPM; 0.25W; THICK FILM
36	1	R26	CRCW060349R9FK	VISHAY DALE	49.9	RESISTOR; 0603; 49.9 OHM; 1%; 100PPM; 0.10W; THICK FILM
37	1	R55	CRCW08051R00FK	VISHAY DALE	1	RESISTOR; 0805; 1 OHM; 1%; 100PPM; 0.125W; THICK FILM
38	2	RN1, RN2	ERJ-8BWFR024	PANASONIC	0.024	RES; SMT (1206); 0.024; 1%; +/-150PPM/DEGC; 1W
39	2	RS1, RS2	TLM2BER012F	TE CONNECTIVITY	0.012	RES; SMT (1206); 0.012; 1%; +/-100PPM/DEGC; 0.5W;NOTE:PURCHASE DIRECT FROM THE MANUFACTURER
40	1	TP1	7007	KEYSTONE	7007	CONNECTOR; PANELMOUNT; BINDING POST; STRAIGHT THROUGH; 1PIN; BLACK
41	1	TP10	7006	KEYSTONE	7006	CONNECTOR; PANELMOUNT; BINDING POST; STRAIGHT THROUGH; 1PIN; RED
42	1	U1	MAX25600	MAXIM	MAX25600	EVKIT PART-IC; MAX25600; QFN28-EP; PACKAGE OUTLINE DRAWING: 21-100130; PACKAGE CODE: T2855+5C
43	1	PCB	MAX25600	MAXIM	PCB	PCB:MAX25600
TOTAL	91					

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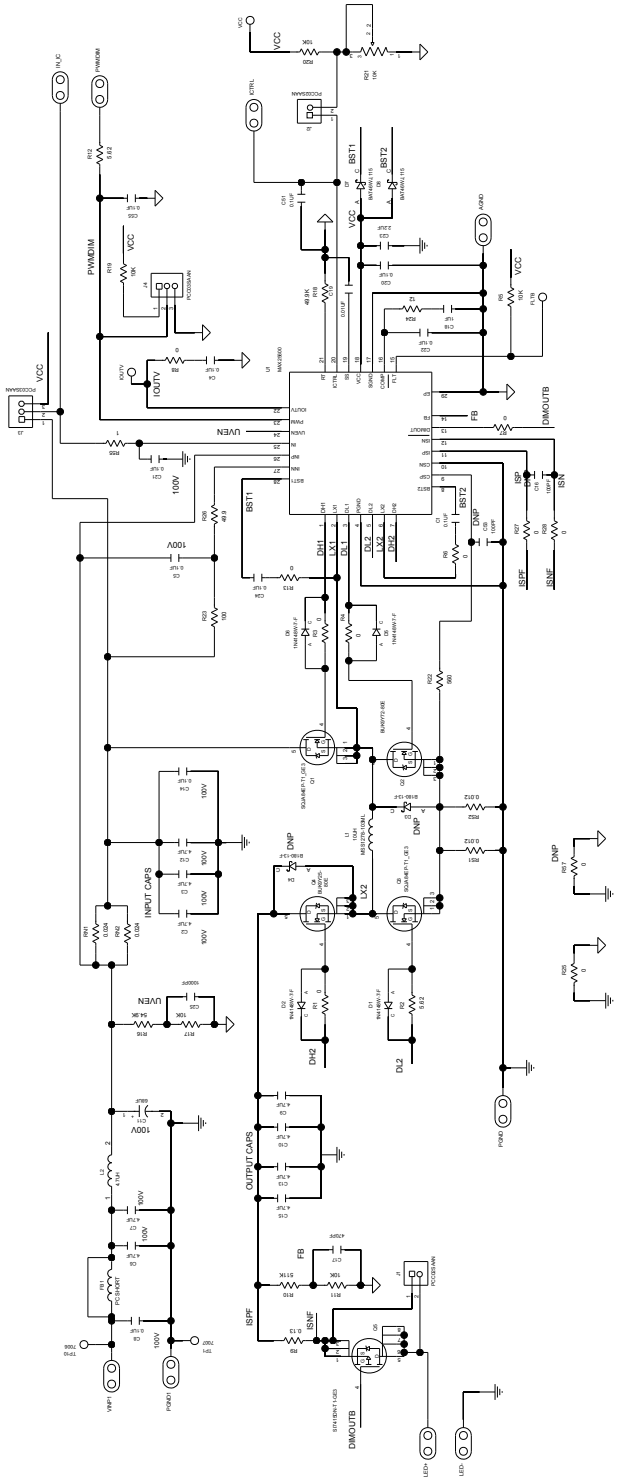
MAX25600 EV Kit Schematics



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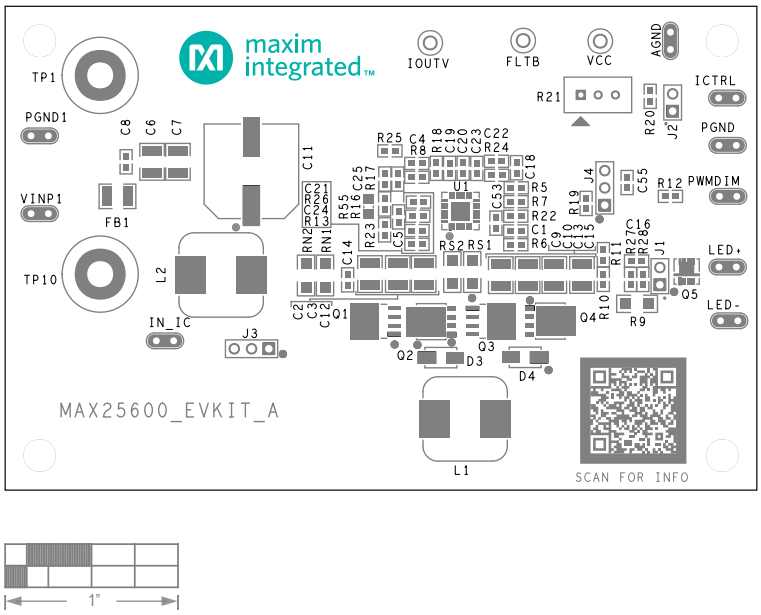
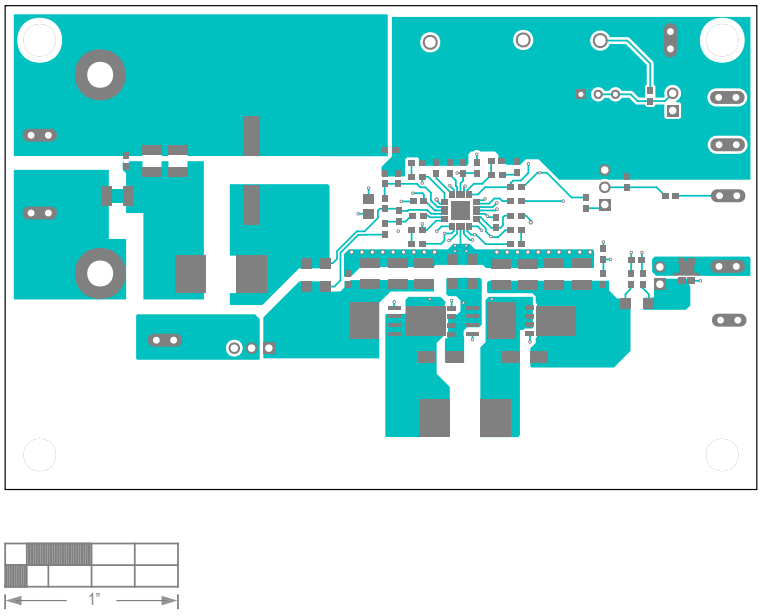
MAX25600 EV Kit PCB Layout Diagrams



MAX25600 EV Kit Component Placement Guide—Top Silkscreen



MAX25600 EV Kit PCB Layout—Top View

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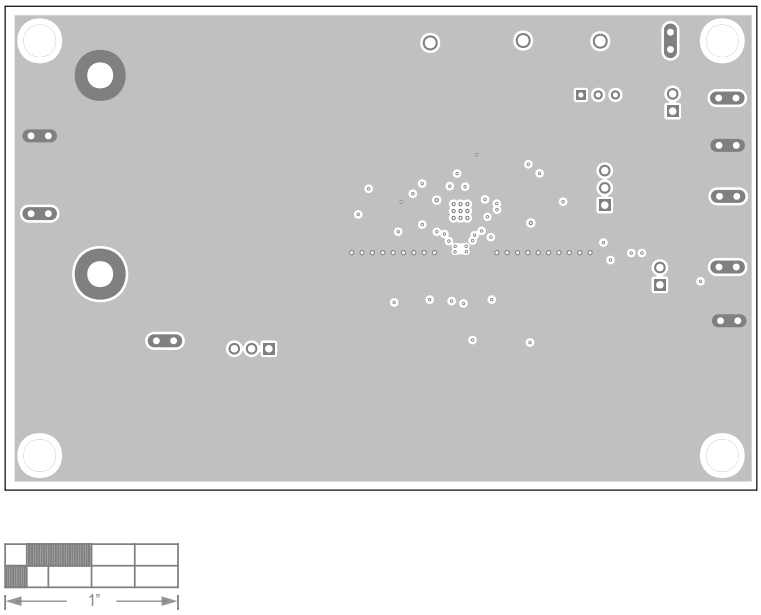
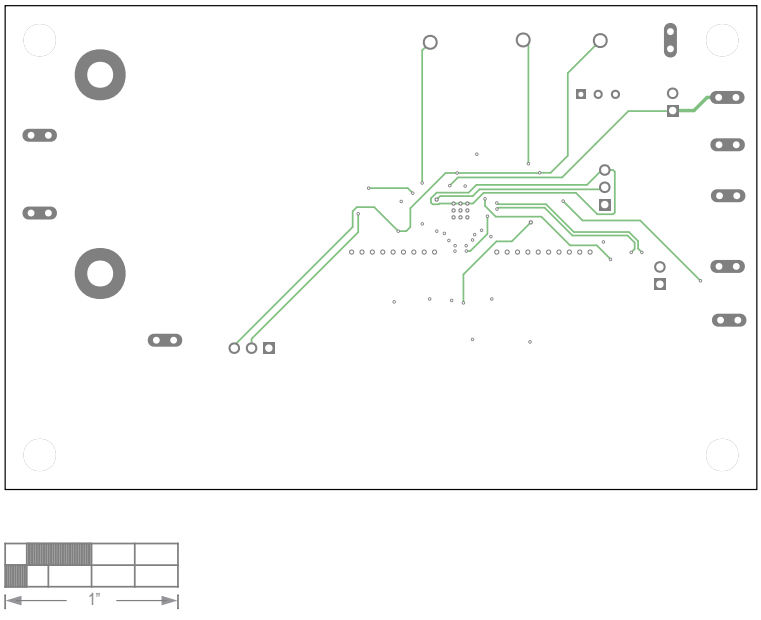
MAX25600 EV Kit PCB Layout Diagrams (continued)

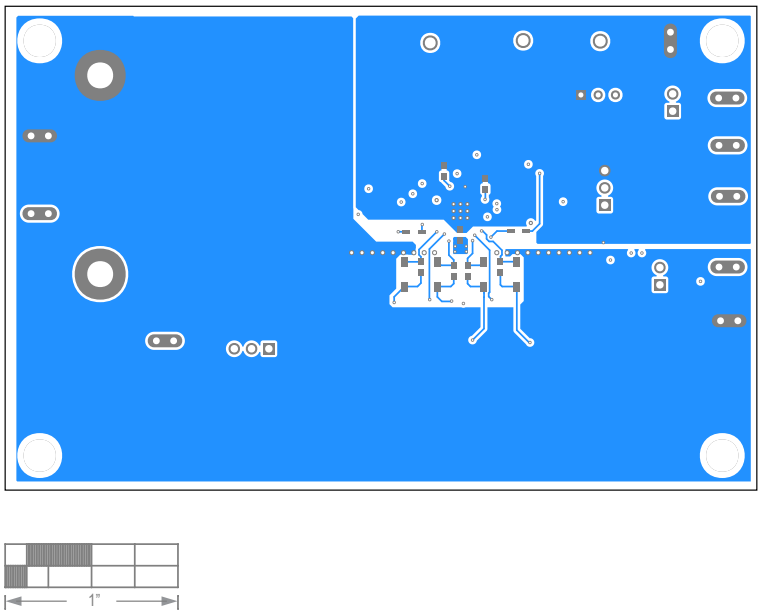


MAX25600 EV Kit PCB Layout—Internal2

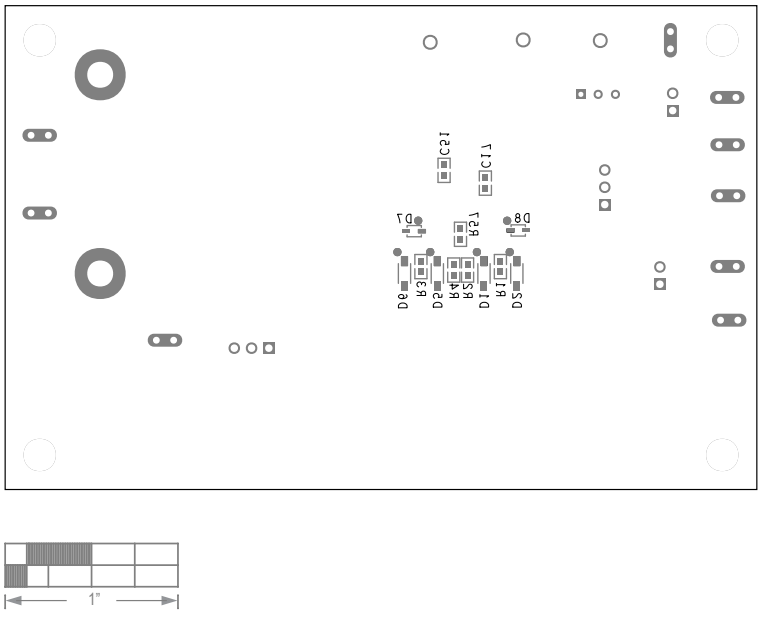


MAX25600 EV Kit PCB Layout—Internal3

MAX25600 EV Kit PCB Layout Diagrams (continued)



MAX25600 EV Kit PCB Layout—Bottom View



MAX25600 EV Kit Component Placement Guide—Bottom Silkscreen

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/19	Initial release	—

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

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