MAX16932 Evaluation Kit

Evaluates: MAX16932, MAX16933

General Description

The MAX16932 evaluation kit (EV kit) is a fully assembled and tested application circuit for the MAX16932 high-voltage, dual synchronous step-down controller. The EV kit is set up to provide 5V and 3.3V from an input voltage ranging from 3.5V to 36V. Each buck rail can deliver up to 5A load current. The EV kit's switching frequency is set at 2.2MHz for both buck converters. Various jumpers are provided to help evaluate features of the MAX16932 IC.

Benefits and Features

- Dual, Synchronous Step-Down Controllers Operate at 180° Out-of-Phase to Reduce Switching Noise
- 3.5V to 36V Wide Input Supply Range
- Buck Output Voltage: 5V and 3.3V Fixed or Adjustable Between 1V and 10V
- Current-Mode Controllers with Forced-PWM and Skip Modes
- Resistor-Programmable Frequency Between 1MHz and 2.2MHz
- Frequency Synchronization Input
- Independent Enable Inputs
- Voltage Monitoring PGOOD_ Outputs
- Fully Assembled and Tested

EV Kit Contents

- MAX16932 EV Kit Board

Quick Start

Recommended Equipment

- MAX16932 EV kit
- 3.5V to 36V, 15A power supply
- Two voltmeters
- Two electronic loads capable of sinking 5A each

Procedure

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

1) Verify that all jumpers are in their default configurations according to Table 1.
2) Connect the positive and negative terminals of the power supply to the VBATF and PGND test pads, respectively.
3) Connect the positive terminal of the first electronic load to the VOUT1 test pad. Connect the ground terminal of the electronic load to the corresponding PGND test pad.
4) Connect the positive terminal of the second electronic load to the VOUT2 test pad. Connect the ground terminal of the electronic load to the corresponding PGND test pad.
5) Set the power-supply voltage to 14V.
6) Turn on the power supply.
7) Enable the electronic loads.
8) Verify that VOUT1 is approximately 5V.
9) Verify that VOUT2 is approximately 3.3V.

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

19-6806; Rev 0; 9/13

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Table 1. Default Jumper Settings

JUMPER	DEFAULT SHUNT POSITION	FUNCTION
JU1, JU2	1-2	Buck outputs enabled.
JU6	1-2	Forced-PWM mode.
JU7	1-2	Switches to EXTVCC. Internal regulator disabled.
JU8, JU9	Installed	PGOOD_ pulls up to VBIAS when OUT_ is in regulation.

Detailed Description of Hardware

The MAX16932 EV kit, which evaluates the MAX16932 high-voltage, dual synchronous step-down controller, can supply up to two rails. The EV kit includes two current-mode buck outputs that are fixed to 5V and 3.3V, or programmable from 1V to 10V with external resistor-dividers. The current capability is 5A per rail. Both outputs are current limited and can be controlled independently through their respective enable inputs EN_.

Switching Frequency/ External Synchronization

The EV kit switching frequency can be adjusted from 1MHz to 2.2MHz by changing the FOSC resistor R136. The EV kit can also be synchronized to an external clock by connecting the external clock signal to the FSYNC test point. Refer to the *Switching Frequency/External Synchronization* section in the MAX16932 IC data sheet for more details.

Enable Control

The EV kit features jumper JU1 to independently control the enable input of VOUT1 and jumper JU2 to control the enable input of VOUT2. Connect the EN_ pin to VBAT (pins 1-2) to enable VOUT_. Connect the EN_ pin to ground (pins 2-3) to disable VOUT_. See Table 2.

Mode of Operation

The EV kit features jumper JU6 to configure the mode switch-control input (Table 3). Drive FSYNC high (pins 1-2 of JU6) to enable forced-PWM mode. Drive FSYNC low (pins 2-3 of JU6) to enable skip mode under light loads.

EXTVCC Switchover Comparator

The internal linear regulator can be bypassed by connecting an external supply (3.1V to 5.2V) or the output of one of the buck converters to EXTVCC. BIAS internally switches to EXTVCC and the internal linear regulator turns off. If V_{EXTVCC} drops below $V_{TH,EXTVCC}$ = 3.1V(min), the internal regulator enables and switches back to BIAS. See Table 4.

Table 2. Enable Control (JU1, JU2)

SHUNT POSITION	EN_ PIN	VOUT_
1-2*	Connected to VBAT	Enabled
2-3	Connected to PGND	Disabled

**Default configuration.*

Table 3. Mode of Operation (JU6)

SHUNT POSITION	FSYNC PIN	MODE
1-2*	Connected to BIAS	Forced-PWM mode
2-3	Connected to AGND	Skip mode

**Default configuration.*

Table 4. EXTVCC (JU7)

SHUNT POSITION	EXTVCC PIN	BIAS
1-2	Connected to VOUT1	Switches to EXTVCC. Internal regulator disabled.
1-3*	Connected to PGND	Internal regulator enabled.
1-4	Connected to VOUT2	Switches to EXTVCC. Internal regulator disabled.

**Default configuration.*

Buck Output Monitoring (PGOOD_)

The EV kit provides two power-good output test points (PGOOD1 and PGOOD2) to monitor the status of the two buck outputs (OUT1 and OUT2). Each PGOOD_ goes high (high impedance) when the corresponding regulator output voltage is in regulation. Each PGOOD_ goes low when the corresponding regulator output voltage drops below 15% (typ) or rises above 10% (typ) of its nominal regulated voltage. PGOOD_ asserts low during soft-start and in shutdown. PGOOD_ becomes high impedance when OUT_ is in regulation. To obtain a logic signal, pull up PGOOD_ to VBIAS by installing shunts on JU8 and JU9.

Setting the Output Voltage in Buck Converters

To externally adjust the output voltage OUT1 between 1V and 10V, remove R122 and install a 0Ω resistor on R121. Connect a resistive divider from the output OUT1 to FB1 to AGND. Place appropriate resistors in positions R58 and R119 and R120 according to the following equation:

$$R119 = R120\left[\left(\frac{V_{OUT1}}{V_{FB1}}\right) - 1\right]$$

where V_{FB1} = 1V (typ).

To externally adjust the output voltage OUT2 between 1V and 10V, remove R132 and install a 0Ω resistor on R133. Connect a resistive divider from the output OUT2 to FB2 to GND. Place appropriate resistors in positions R131 and R132 according to the following equation:

$$R131 = R132\left[\left(\frac{V_{OUT2}}{V_{FB2}}\right) - 1\right]$$

where V_{FB2} = 1V (typ).

Evaluating the MAX16933 on the MAX16932 EV Kit

The MAX16932 EV kit can be modified to operate the MAX16933. The MAX16933 operates at a switching frequency of 400kHz, which requires a change in the following components:

1) Replace U1 with the MAX16933 IC.
2) Replace R136 (R_{FOSC}) with 80.6kΩ to achieve 400kHz switching frequency.
3) Replace the buck inductors (L7, L8) with a 6.8µH 7A inductor.

Contact Technical Support at **www.maximintegrated.com/support** for any further questions.

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3, C75, C83	5	0.1µF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H104K
C4, C5, C100–C103, C105–C108, C111, C112, C119, C120	0	Not installed, ceramic capacitors (0603)
C76, C77, C84, C85	4	47µF ±20%, 16V X7R ceramic capacitor (2220) TDK CGA9N3X7R1C476M
C78, C86	2	4700pF ±10%, 50V X7R ceramic capacitors (0402) Murata GRM155R71H472K
C79	1	22pF ±5%, 50V C0G ceramic capacitor (0402) Murata GRM1555C1H220J
C81	1	6.8µF ±10%, 16V X7R ceramic capacitor (1206) TDK C3216X7R1C685K
C82	1	2.2µF ±10%, 10V X7R ceramic capacitor (0603) Murata GRM188R71A225K
C87	1	33pF ±5% 50V C0G ceramic capacitor (0402) Murata GRM1555C1H330J
C88	1	47µF, 50V aluminum electrolytic capacitor (E) Panasonic EEE-FK1H470P
C90–C93, C97, C116	6	4.7µF ±10%, 50V X7R ceramic capacitors (1210) Murata GCM32ER71H475KA55L
C117, C118	0	Not installed, ceramic capacitors (2220)
D20, D21	2	200mA, 30V diodes (SOT23) Fairchild BAT54
D22, D23	2	3A, 60V Schottky diodes (SMB) Diodes B360B-13-F
FSYNC	0	Not installed, test point
JU1, JU2, JU6	3	3-pin headers
JU7	1	4-pin header
JU8, JU9	2	2-pin headers
L7, L8	2	2.2µH, 12A power inductors Vishay IHLP4040DZER2R2M01
PGOOD1, PGOOD2	2	Test points
Q13–Q16	4	40V, 7.6A n-channel MOSFETs (8 SO) Fairchild FDS8449
R1, R2	2	1kΩ ±5% resistors (0603)
R113, R114, R115, R117, R118, R122, R125, R126, R127, R129, R130, R134, R162, R166	14	0Ω ±5% resistors (0603)
R116, R128	2	0.015Ω ±1%, 0.5W sense resistors (1206) Panasonic ERJ-8BWFR015V IRC LRF1206LF-01-R015-F
R119, R120, R121, R131, R132, R133, R146, R147, R161, R165	0	Not installed, resistors (0603)
R123	1	22.1kΩ ±1% resistor (0603)
R124	1	1Ω ±5% resistor (0603)

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R135	1	14kΩ ±1% resistor (0603)
R136	1	13.7kΩ ±1% resistor (0603)
R137	1	100kΩ ±1% resistor (0603)
R156, R157	2	51.1kΩ ±5% resistors (0603)

DESIGNATION	QTY	DESCRIPTION
U1	1	Automotive dual buck (28 TQFN-EP*) Maxim MAX16932ATIR/V+
—	6	Shunts
—	1	PCB: MAX16932 EVKIT

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Diodes, Inc.	805-446-4800	www.diodes.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
IRC, Inc.	361-992-7900	www.irctt.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Panasonic Corp.	800-344-2112	www.panasonic.com
TDK Corp.	847-803-6100	www.component.tdk.com
Vishay	402-563-6866	www.vishay.com

Note: *Indicate that you are using the MAX16932 when contacting these component suppliers.*

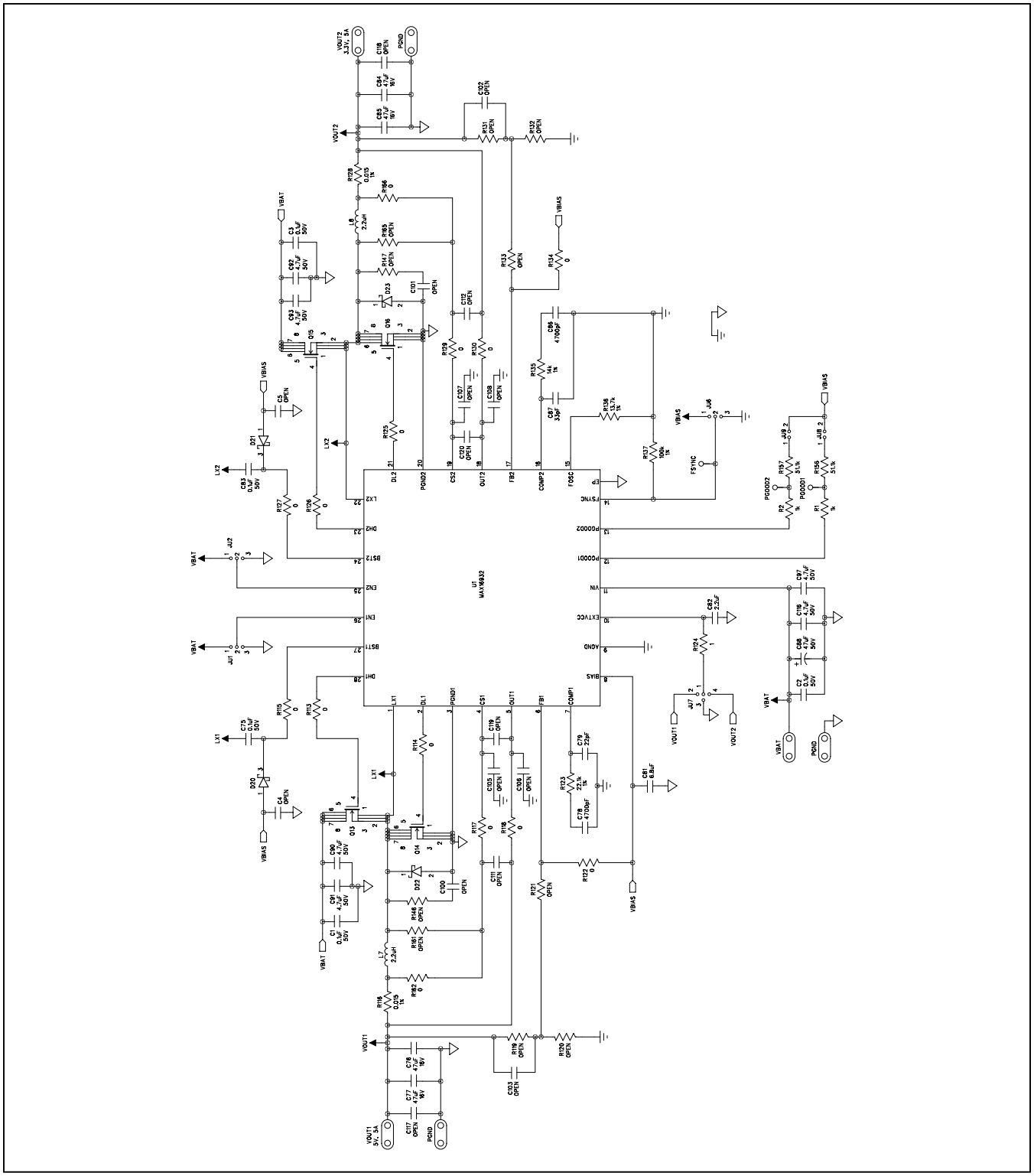

Figure 1. MAX16932 EV Kit Schematic

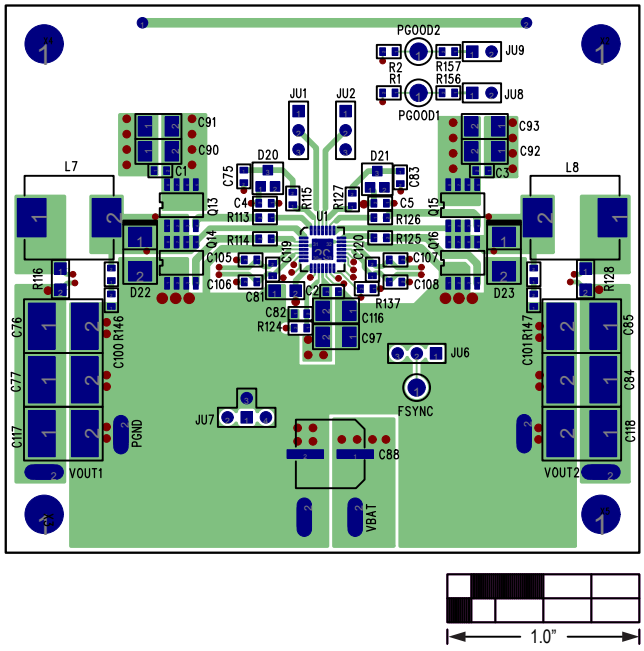

Figure 2. MAX16932 EV Kit Component Placement Guide—Component Side

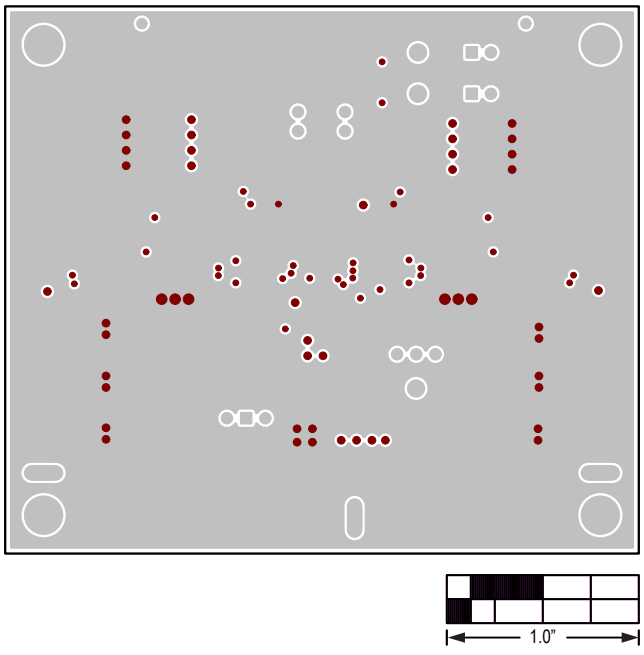

Figure 3. MAX16932 EV Kit PCB Layout—Component Side

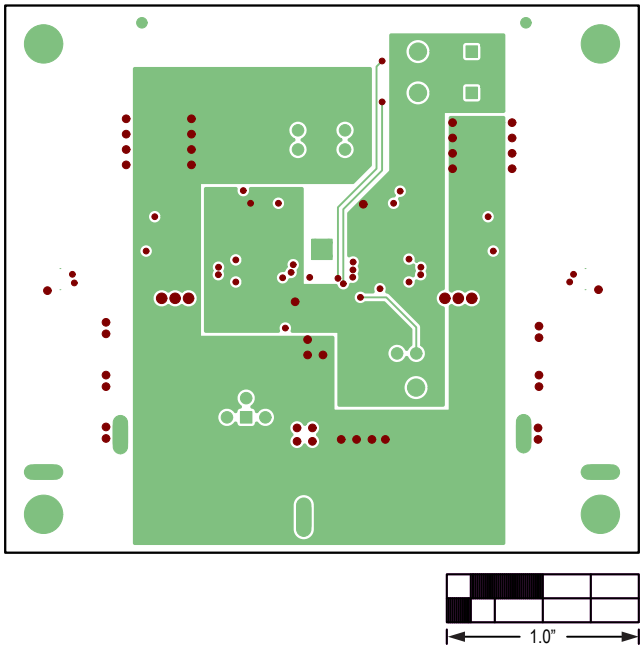

Figure 4. MAX16932 EV Kit PCB Layout—Layer 2

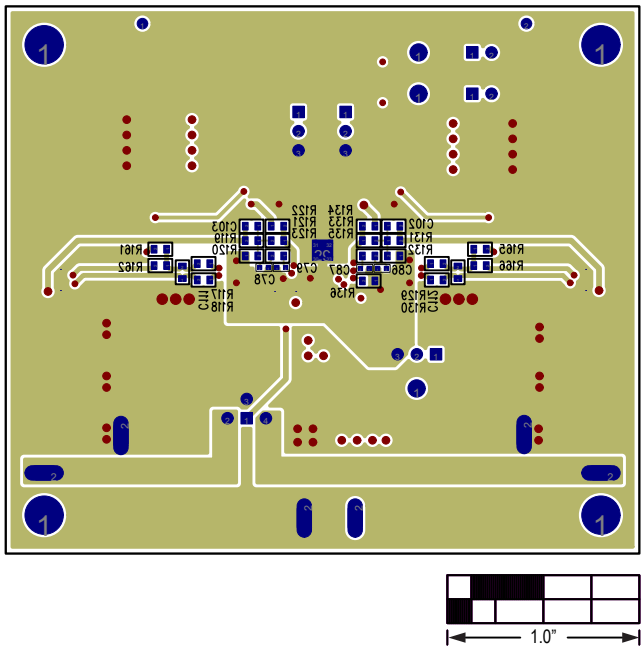

Figure 5. MAX16932 EV Kit PCB Layout—Layer 3

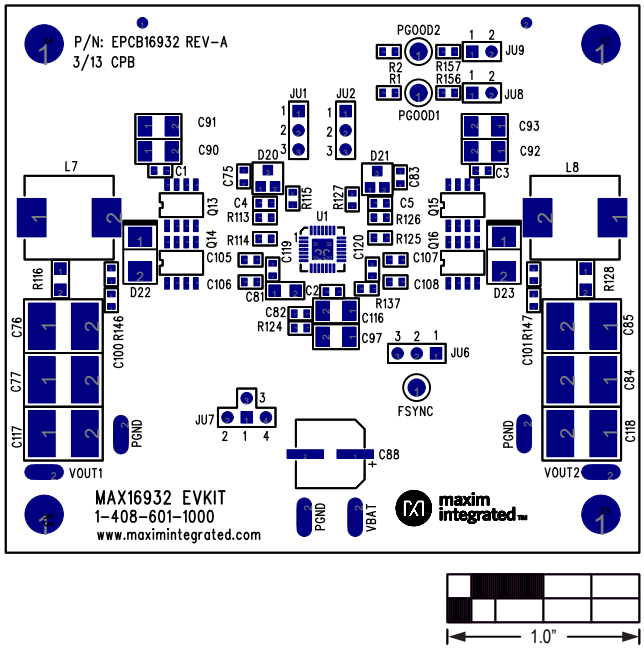

Figure 6. MAX16932 EV Kit PCB Layout—Solder Side

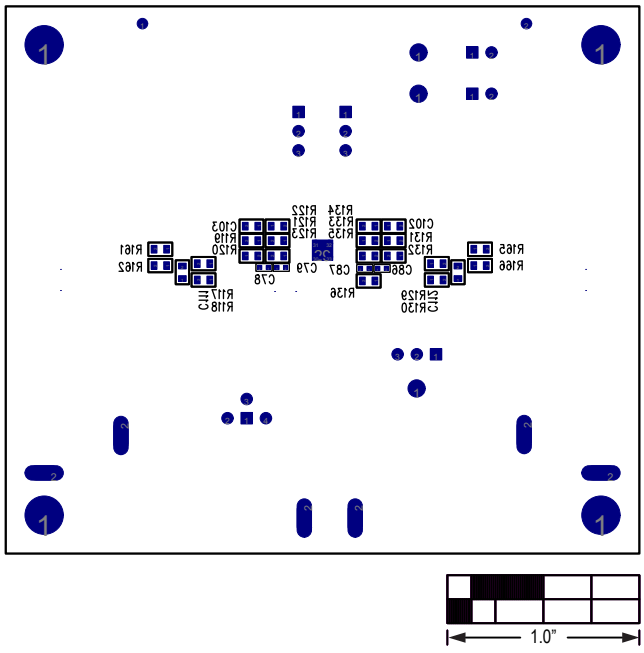

Figure 7. MAX16932 EV Kit Component Placement Guide—Solder Side

Ordering Information

PART	TYPE
MAX16932EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/13	Initial release	—

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