Click here to ask an associate for production status of specific part numbers.

Evaluates: MAX14916, MAX14916A

MAX14916 and MAX14916A Evaluation Kit

General Description

This evaluation kit provides a proven design to evaluate the MAX14916 and MAX14916A, eight-channel high-side switch with extended diagnostics. The EV kit includes the MAX14916 evaluation board and a graphical user interface (GUI) that provides communication from a PC to the target device through a USB port and the USB2GPIO# interface board. The USB2GPIO# board should be ordered separately. The MAX14916 EV kit comes with a MAX14916AFM+ in a 48-pin, 6mm x 6mm FC2QFN package, installed as U1. The EV kit can also be used to evaluate the MAX14916AAFM+. The user needs to order the MAX14916AAFM+ samples and replace U1.

The GUI is compatible with Windows® 10 for exercising the features of the MAX14916 IC. The EV kit connects the two adjacent channels of the MAX14916 together for quad high-output current operation. The EV kit software, however, gives access to the full register map, allowing individual control of the eight high-side switches. Refer to the MAX14915 EV kit to evaluate the octal output configuration. The software also retrieves all the diagnostic information from the MAX14916, including open-wire conditions, state of the output channels, multiple undervoltage alarms, global and per-channel overtemperature alarms, and other fault alarms.

The MAX14916 EV kit must be powered from an external +24V power supply and can consume more than 16A when fully loaded. The USB2GPIO# interface board is powered from the USB port.

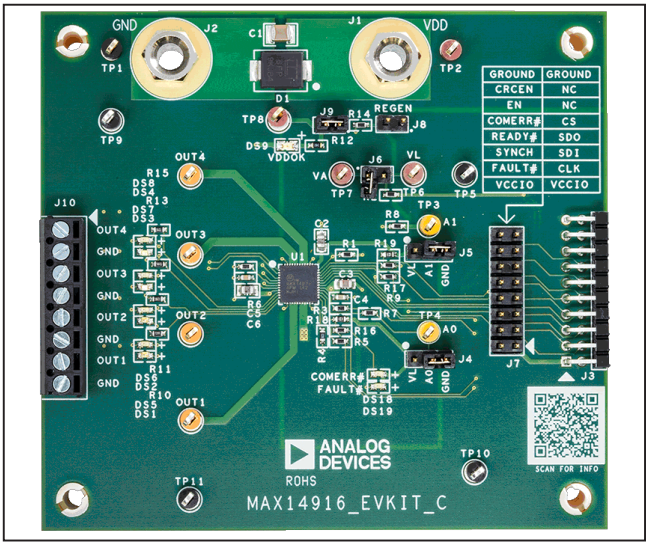
A single TVS diode on V_{DD} protects all output channels against ±1kV/42Ω IEC 61000-4-5 surge transients.

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

Features

- Current Limit in Quad-Channel Configuration
  - MAX14916: 2.78A (typ)
  - MAX14916A: 4A (typ)
- Robust Operation with Wide Range Of Input Voltages and Load Conditions
- $\overline{\text{VDDOK}}$ Indication
- LED Indication of Channels Status and Fault Conditions
- Fast Inductive Load Demagnetization
- Open-wire, Overload, Undervoltage, Overcurrent, Thermal Shutdown Fault Condition Indication
- Supports Watchdog and SYNCH Features
- Communication Error Indication
- Wide Logic Voltage Range
- Pin Addressable SPI Communication
- -40°C to +125°C Temperature Range
- Proven PCB Layout
- Fully Assembled and Tested
- Windows 10 Compatible Software

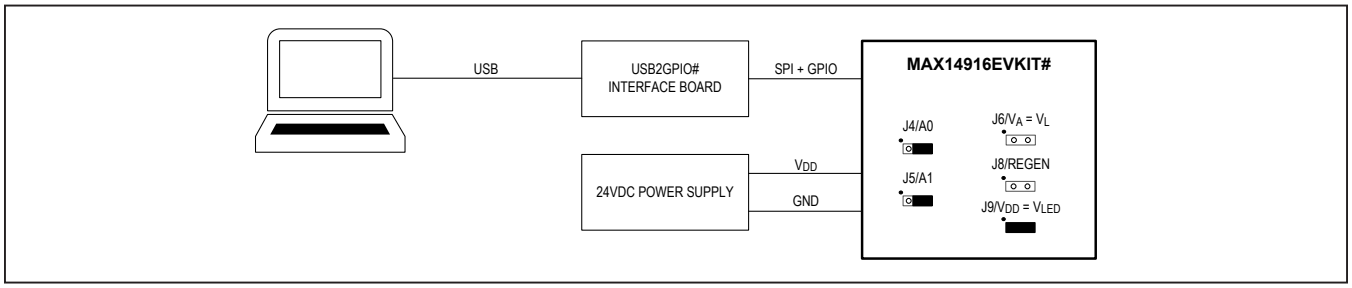
MAX14916 EV Kit Photo



Windows and Windows XP are registered trademarks and registered service marks of Microsoft Corporation.

319-100443; Rev 1; 7/23

System Block Diagram



MAX14916 EV Kit Files

FILE	DESCRIPTION
MAX14915_6_7EVKITSetupV1.14.exe	Application Program (GUI)

Quick Start

Required Equipment

- MAX14916 EV kit
- USB2GPIO interface board (must be ordered separately)
- +24V DC power supply
- PC with installed Windows 10 and a USB port
- USB-A to micro-USB cable (not included)

Note: *In the following section(s), software-related items are identified by bolding. Text in* ***bold*** *refers to items directly from the EV system software. Text in* ***bold and underline*** *refers to items from the Windows operating system.*

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Visit **HERE** and download the latest version of the EV kit software, MAX14915_6_7EVKITSetupV1.14.exe.
2) Install the EV kit software on your computer by running the MAX14915_6_7EVKITSetupV1.14.exe program inside the temporary folder. The program files are copied to your PC and icons are created in the Windows **Start | Programs** menu.
3) Verify that all jumpers are in their default positions (Table 1).
4) Power up the EV kit with +24V from an external power supply through J1 and J2 Banana Plugs.
5) Connect the evaluation kit to the USB2GPIO# and the USB2GPIO# board to a USB port of a PC. A micro-USB cable is not included and should be obtained locally.
6) Start the EV kit software by opening its icon in the **Start | Programs** menu. Select the MAX14916EVKIT button in the startup window. The EV kit software appears as shown in Figure 1. Verify that the lower-right status bar indicates the EV kit hardware is **Connected**. The GUI automatically detects EV kit is connected to the PC and enables serial communication. Any configuration change can be made on **Register Settings** tab.

The following steps are used to verify functionality of the MAX14916 or MAX14916A.

7) Select **Register Settings** tab and press the **Read All** button twice to clear the initially detected undervoltage global conditions in the GlobalErr register 0x09.
8) Enable the desirable diagnostics in registers 0x0A through 0x0F. For example, allowing STATUS LEDs and FAULT LEDs to be controlled autonomously by the internal logic, by disabling SLEDSet and FLEDSet bits in the Config1 register 0x0D[1:0] = 00b. Select register 0x0D in the **Register Map** table on the left and choose "**0: Disabled**" from the pull-down menu of the bit **Setting** column of the register description table on the right. The font color of the modified register is changed from black to red. Click **Write Modified** button to write a new configuration into the register.
9) Set all OUTPUT switches ON, by typing in 255 decimal number into SetOUT register 0x00. Note, the GUI accepts decimal, hex or binary numbers (e.g., 255, or 0xFF, or 0b11111111). The user can enable **Auto Write** button to allow auto write the changes instead of clicking **Write Modified** or **Write Selected** buttons, that allow individual command to be sent to the MAX14916 or MAX14916A.

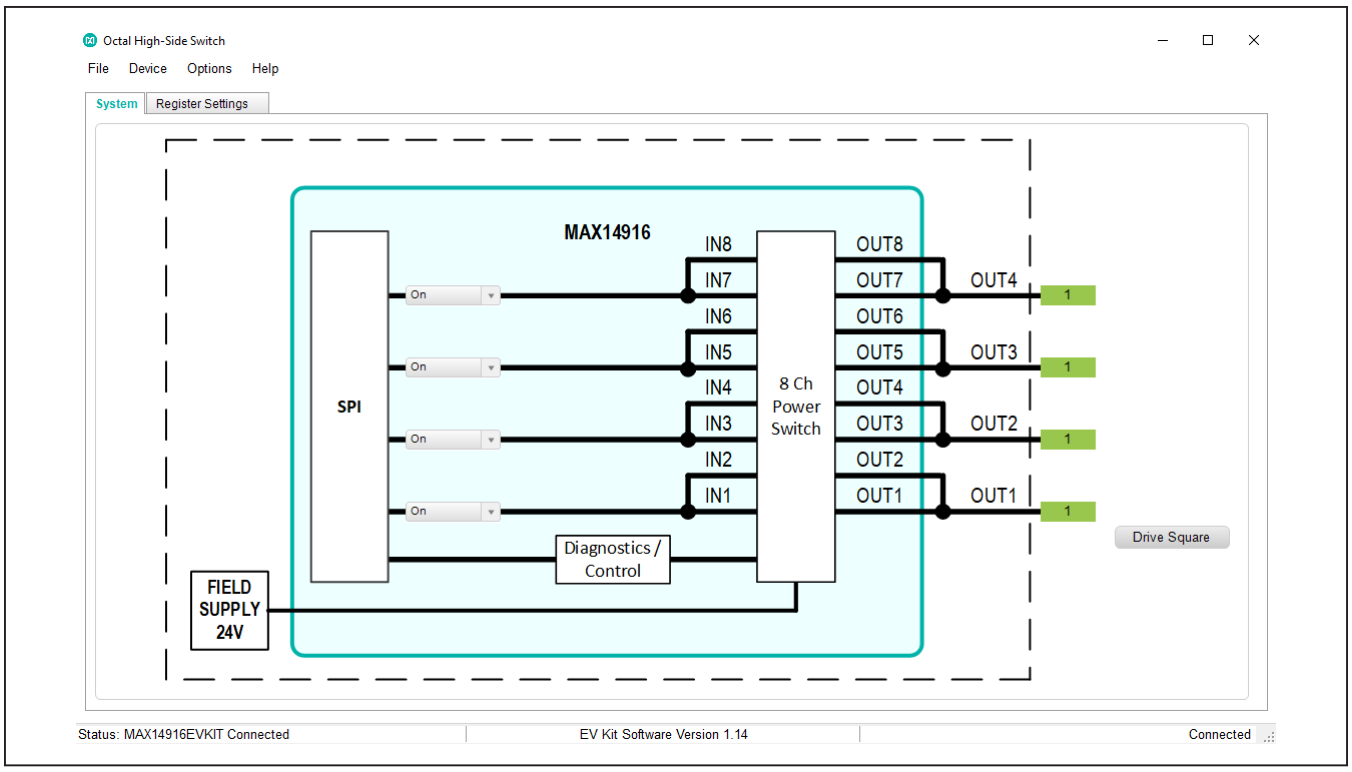


Figure 1. MAX14916 EV Kit GUI System Tab

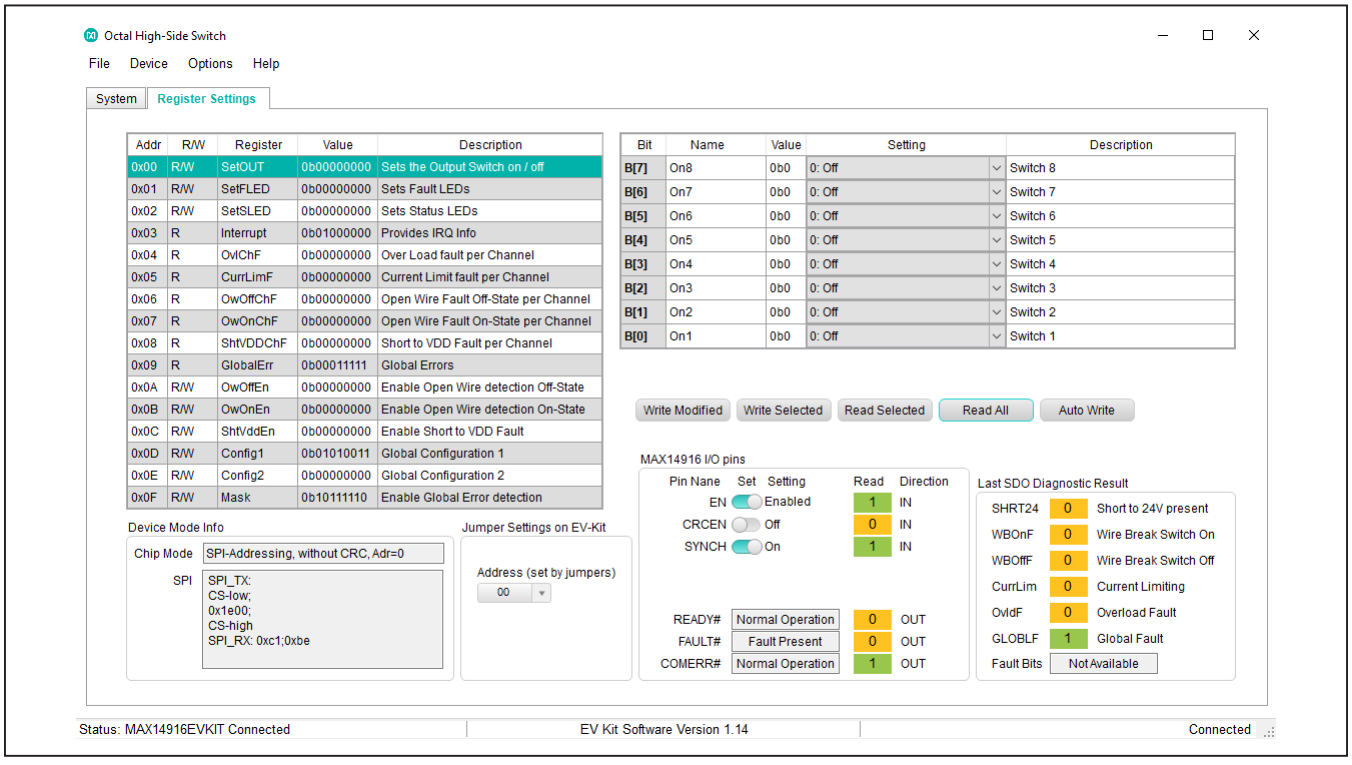


Figure 2. MAX14916 EV Kit GUI Register Settings Tab

Detailed Description of Hardware

The MAX14916 EV kit in conjunction with the USB2GPIO# adapter board provides easy-to-use and flexible solution for evaluation of the MAX14916 and MAX14916A, octal high-side switch for industrial applications. It allows SPI communication between the Windows compatible GUI installed on a PC, and the MAX14916/MAX14916A. The USB2GPIO# adapter board is a plug-and-play device that is powered from the USB port and does not require any additional configuration, refer to the USB2GPIO data sheet **HERE**. A USB driver for the USB2GPIO# board is installed automatically with the MAX14916 GUI.

The MAX14916EVKIT# can be used as a standalone board connected to the SPI bus using J3 and/or J7 headers, refer to the *MAX14916 EV Kit Schematic*. Up to four EV kits can share the same SPI bus by configuring the SPI address using J4 and J5 jumpers. For full configuration options, refer to Table 1.

Load for each channel should be connected to the J10 terminal block. Each channel (switch) can provide up to 2.4A (min) if the MAX14916 is installed, or up to 3A (min) if the MAX14916A is installed. The outputs can handle resistive, capacitive or inductive loads.

On-board diagnostics provide V_{DD} status through $\overline{VDDOK}$ LED (DS9), communication error via COMERR# LED (DS18) and the global fault condition via FAULT# LED (DS19). Per-channel output state and per-channel fault conditions are visible via LED matrix, DS1 through DS4, and DS5 through DS8, correspondently. Other diagnostics are provided through the SPI interface by reading the diagnostic registers 0x03 through 0x09.

Table 1. MAX14916 Board Shunt Positions & Settings

HEADER	SHUNT POSITION	DESCIPTION
J9	1-2*	V_{LED} supplied from V_{DD}.
	Open	Use an external V_{LED} source. Apply V_{LED} power between V_{LED} test point TP8 and GND (TP9).
J6	1-2	Select 3.3V logic level ($V_L = V_A$).
	Open*	Logic voltage (V_L) supplied from USB2GPIO board (3.3V). Use an external source between V_L (TP6) and GND (TP5) if another host controller is used.
J8	Open*	Internal 3.3V V_A regulator enabled.
	1-2	Internal V_A regulator disabled (REGEN = GND). Use an external V_A source between V_A test point (TP7) and GND (TP4).
J4	1-2	Set address bit A0 = 1.
	2-3*	Set address bit A0 = 0.
J5	1-2	Set address bit A1 = 1.
	2-3*	Set address bit A1 = 0.

**Default configuration*

Detailed Description of Software

The MAX14916 GUI provides access to all registers and allows full configuration and control of the MAX14916. There are two tabs available to control the EV kit. The **System** tab provides system-level control of the selected output pins, including static and dynamic control. The **Register Settings** tab provides per-channel and enhanced diagnostic configuration.

System Tab

The **System** tab allows driving the output pins by configuring each output either on, off, or selecting Square wave frequency from pull-down menu, as shown in Figure 3.

Click **Drive Pins** button on the right-side of the GUI to drive the outputs. The indicators connected to the OUT_ pins show the state of each output.

Connect the oscilloscope probe to OUT_ test points on the EV kit to see the output signal in real-time.

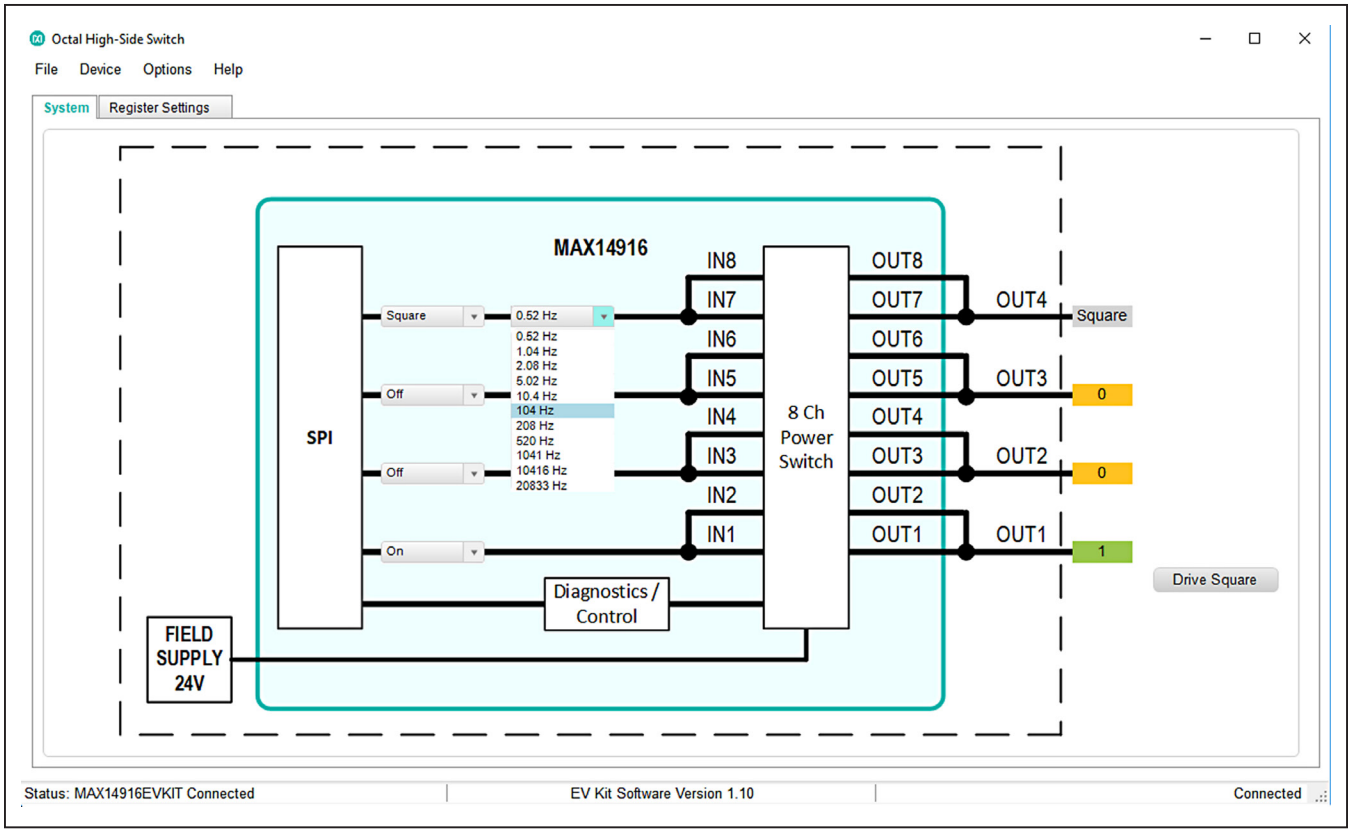


Figure 3. System Tab Output Configuration

Register Settings Tab

The **Register Settings** tab allows detailed configuration of the device to explore all the available features, refer to Figure 4. The full register map table of the MAX14916/MAX14916A is located on the left-side of the tab, and the bit-by-bit control and description table is located on the right side. When the register is selected in the register map table, the detailed description of each bit is shown on the right table. The register setting can be changed directly in the register map table by double-clicking on the **Value** cell. Each data entry should follow by the "Enter/Return" button on the keyboard. The **Value** cell accepts binary (0b), decimal or hex (0x) numbers. The modified register changes its color from black to red until the data will be actually written to the register. The data in the right table can be changed using drop down menus in the **Setting** cell for each bit individually. Both tables are synchronized that changes made in one table appear at both tables. There are several write and read options available through the corresponding control buttons located below the register bit-by-bit description table.

When the **Auto Write** button is selected, any data typed in, or selected through the **Setting** pull-down menu will be automatically written into the corresponding writable register. The button is renamed to **Stop Auto Write** and auto-write function can be canceled by clicking on this button second time.

When the **Auto Read** button is selected, the write function is disabled, and the GUI is constantly monitoring the status and fault conditions of the device. Clicking a second time on the button, which becomes **Stop Auto Read**, allows canceling this operation.

The **Read All** button performs a read operation of all registers after each click.

When the fault conditions occur, they set the bit(s) in the corresponding read-only registers 0x03 to 0x09. The fault condition should be carefully evaluated and removed externally (over/under voltage, overload, open-wire, etc.). It is recommended to read Interrupt (0x03) and Global Error (0x09) registers first to identify what kind of fault conditions happened, then read per-channel diagnostic registers 0x04 to 0x08 twice to make sure that condition is gone and to clear interrupts.

The **Write Selected** button allows to write to the selected register only, while the **Write Modified** button performs write operation to all modified registers after each click.

There is an I/O pins control box and diagnostic result box in the GUI. SDO diagnostic result is provided by the MAX14916 after each SPI write or read operation. The EN slider allows enabling or disabling OUTs, CRCEN slider enables or disables error-detecting code to be added to each SPI transaction and SYNCH slider allows manual synchronization of multiple devices.

User must match the A0 and A1 jumper position on the EV kit with the SPI address selected from the **Address** pulldown menu, located below the register map table. The default address is 00.

Each SPI transaction is displayed in the **Device Mode Info** box for user convenience.

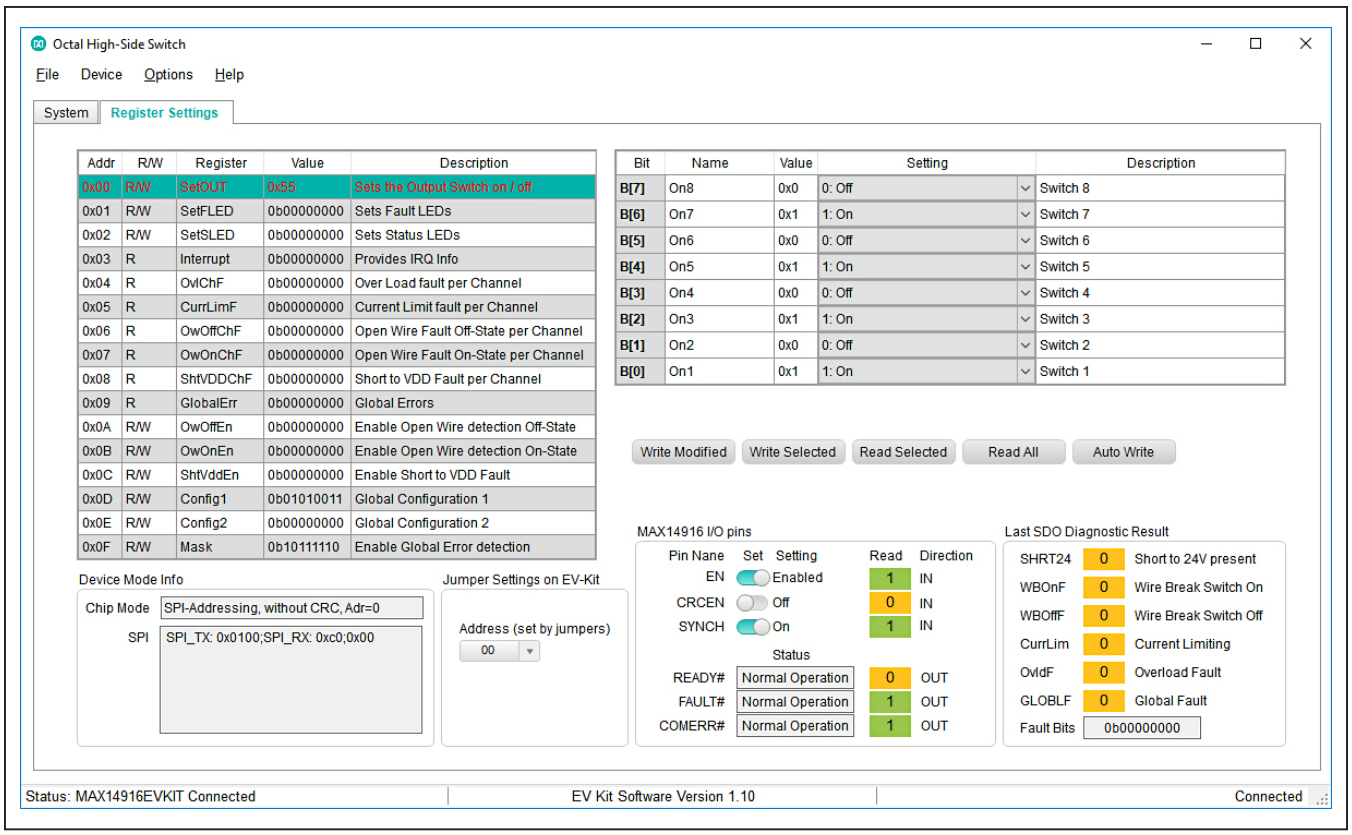


Figure 4. Register Settings Tab

Ordering Information

PART	TYPE
MAX14916EVKIT#	EV Kit
USB2GPIO#	EV Kit

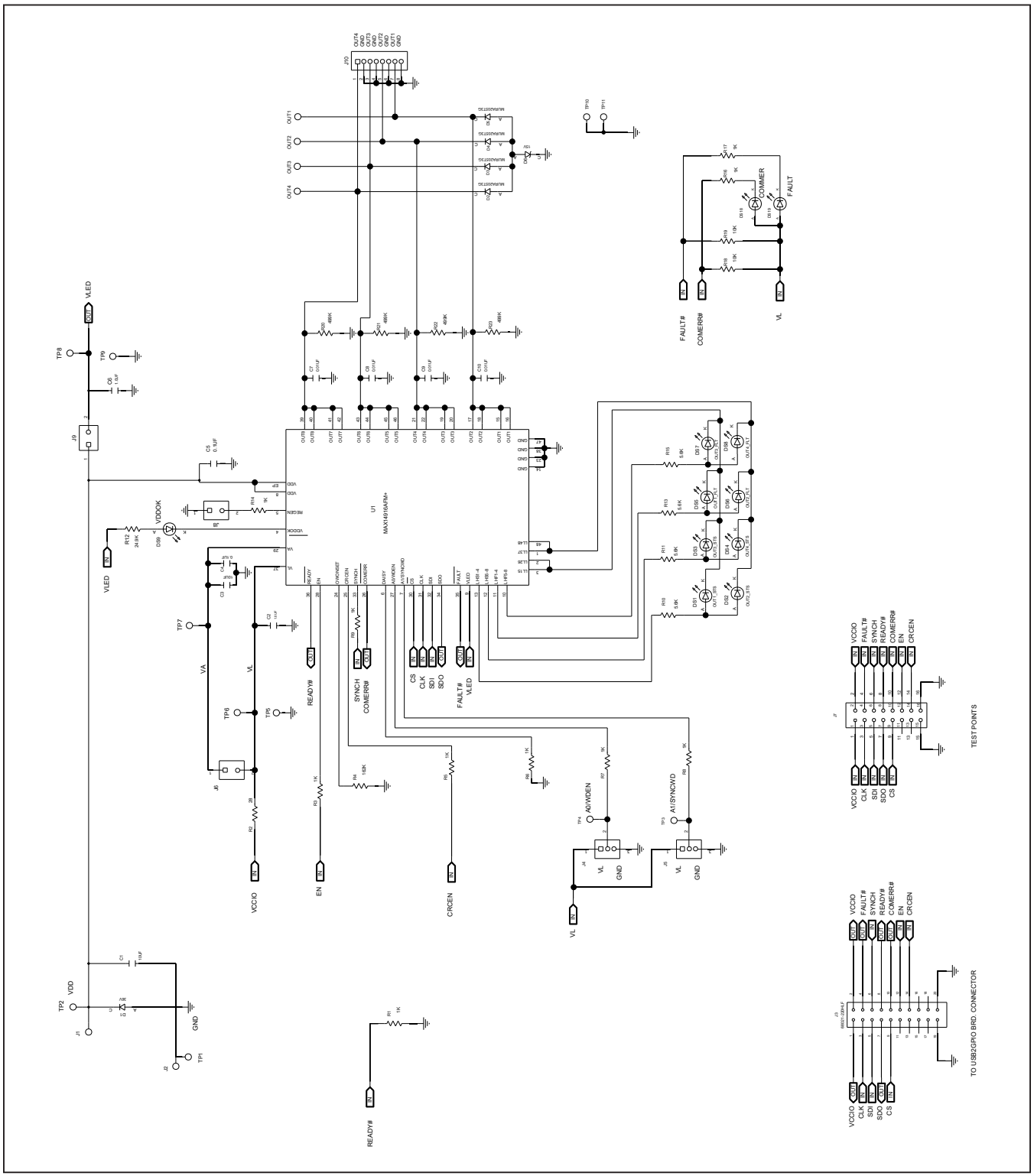
#Denotes RoHS compliance.

Note: MAX14916EVKIT# comes with MAX14916AFM+. In order to evaluate the MAX14916AAFM+, request samples separate to the EV kit.

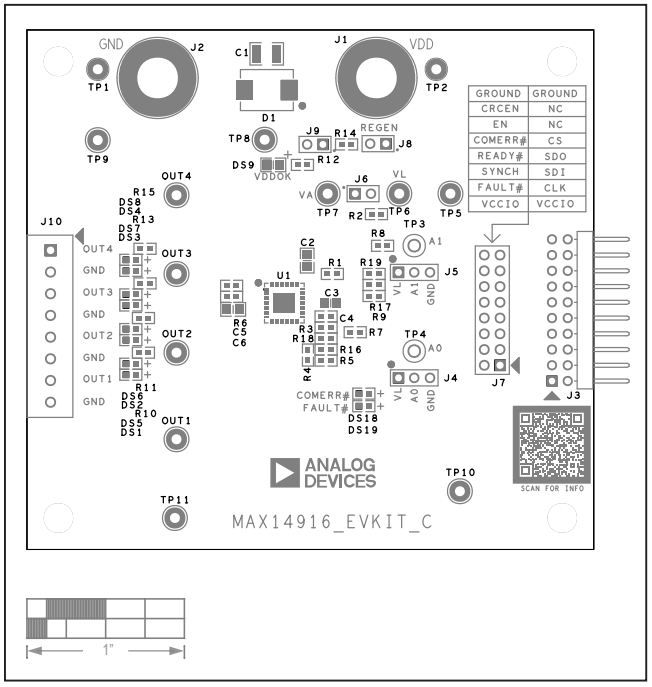
MAX14916 EV Kit Bill of Materials

ITEM	REF_DES	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1	1	GRM32EC72A106KE05	MURATA	10UF	CAP; SMT (1210); 10UF; 10%; 100V; X7S; CERAMIC	
2	C2, C6	2	GMK212B7105KG; GRM219R7YA105KA12	TAIYO YUDEN;MURATA	1.0UF	CAP; SMT (0805); 1.0UF; 10%; 35V; X7R; CERAMIC	
3	C3	1	CGA4J1X7S1C106K125; GCM21BC71C106KE35	TDK;MURATA	10UF	CAP; SMT (0805); 10UF; 10%; 16V; X7S; CERAMIC	
4	C4, C5	2	CC0603KRX7R0BB104; GRM188R72A104KA35; HMK107B7104KA; 06031C104KAT2A; GRM188R72A104K	YAGEO;MURATA;TAIYO YUDEN; AVX;MURATA	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 100V; X7R; CERAMIC	
5	C7-C10	4	CGA3EANP02A103J080AC	TDK	0.01UF	CAP; SMT (0603); 0.01UF; 5%; 100V; C0G; CERAMIC	
6	D1	1	SMCJ36A	LITTEL FUSE	36V	DIODE; TVS; SMC (DO-214AB); VRM=36V; IPP=25.9A	
7	D2-D5	4	MURA205T3G	ON SEMICONDUCTOR	MURA205T3G	DIODE; RECT; SMA (DO-214AC); PIV=50V; IF=2A	
8	D6	1	SM30T15AY	ST MICROELECTRONICS	15V	DIODE; TVS; SMC (DO-214AB); VRM=15V; IPP=140A	
9	DS1-DS4	4	LGL29K-G2J1-24-Z	OSRAM	LGL29K-G2J1-24-Z	DIODE; LED; SMARTLED; GREEN; SMT; PIV=1.7V; IF=0.02A	
10	DS5-DS8, DS18, DS19	6	LS L29K-G1J2-1-Z	OSRAM	LS L29K-G1J2-1-Z	DIODE; LED; SMART; RED; SMT (0603); PIV=1.8V; IF=0.02A; -40 DEGC TO +100 DEGC	
11	DS9	1	LTST-C171GKT	LITE-ON ELECTRONICS INC.	LTST-C171GKT	DIODE; LED; STANDARD; GREEN; SMT (0805); PIV=5.0V; IF=0.12A; -55 DEGC TO +85 DEGC	
12	J1, J2	2	3267	POMONA ELECTRONICS	3267	CONNECTOR; MALE; PANELMOUNT; STANDARD UNINSULATED BANANA JACK; STRAIGHT; 1PIN	
13	J3	1	68021-220HLF	AMPHENOL ICC	68021-220HLF	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BERGSTIK II BREAKAWAY HEADER; RIGHT ANGLE; 20PINS;	
14	J4, J5	2	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	
15	J6, J8, J9	3	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
16	J7	1	PBC08DAAN	SULLINS ELECTRONICS CORP.	PBC08DAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 16PINS; -65 DEGC TO +125 DEGC	
17	J10	1	OSTTE080104	ON-SHORE TECHNOLOGY INC.	OSTTE080104	CONNECTOR; MALE; THROUGH HOLE; TERMINAL BLOCKS-WIRE TO BOARD; STRAIGHT; 8PINS	
18	J11-J14	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
19	OUT1-OUT4	4	5013	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; ORANGE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
20	R1, R3, R5-R9, R14, R16, R17	10	CRCW06031K00FK; ERJ-3EKF1001; CR0603AFX-1001ELF; RMCF0603FT1K00	VISHAY;PANASONIC;BOURNS; STACKPOLE ELECTRONICS INC.	1K	RES; SMT (0603); 1K; 1%; +/-100PPM/DEGC; 0.1000W	
21	R2	1	ERJ-3EKF28R0	PANASONIC	28	RES; SMT (0603); 28; 1%; +/-100PPM/DEGC; 0.1000W	
22	R4	1	CRCW0603162KFK	VISHAY DALE	162K	RES; SMT (0603); 162K; 1%; +/-100PPM/DEGC; 0.1000W	
23	R10, R11, R13, R15	4	CRCW06035K60FK	VISHAY DALE	5.6K	RES; SMT (0603); 5.6K; 1%; +/-100PPM/DEGC; 0.1000W	
24	R12	1	CRCW060324K9FK; ERJ-3EKF2492	VISHAY DALE;PANASONIC	24.9K	RES; SMT (0603); 24.9K; 1%; +/-100PPM/DEGC; 0.1000W	
25	R18, R19	2	301-10K-RC	XICON	10K	RES; SMT (0603); 10K; 5%; +/-200PPM/DEGC; 0.0630W	
26	R20-R23	4	CRCW0603499KFK; ERJ-3EKF4993; RC0603FR-07499KL	VISHAY DALE;PANASONIC;YAGEO	499K	RES; SMT (0603); 499K; 1%; +/-100PPM/DEGC; 0.1000W	
27	SU1-SU5	5	S1100-B;SX1100-B; STC02SYAN	KYCON;KYCON;SULLINS ELECTRONICS CORP.	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED	
28	TP1, TP5, TP9-TP11	5	5011	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
29	TP2, TP6-TP8	4	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;	
30	TP3, TP4	2	5009	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
31	U1	1	MAX14916AFM+	MAXIM	MAX14916AFM+	IC; HSSWTCH; COMPACT INDUSTRIAL OCTAL 1A/QUAD 2A; HIGH-SIDE SWITCH WITH DIAGNOSTICS; FCQFN48-EP	
32	PCB	1	MAX14916	MAXIM	PCB	PCB:MAX14916	-
TOTAL		86					

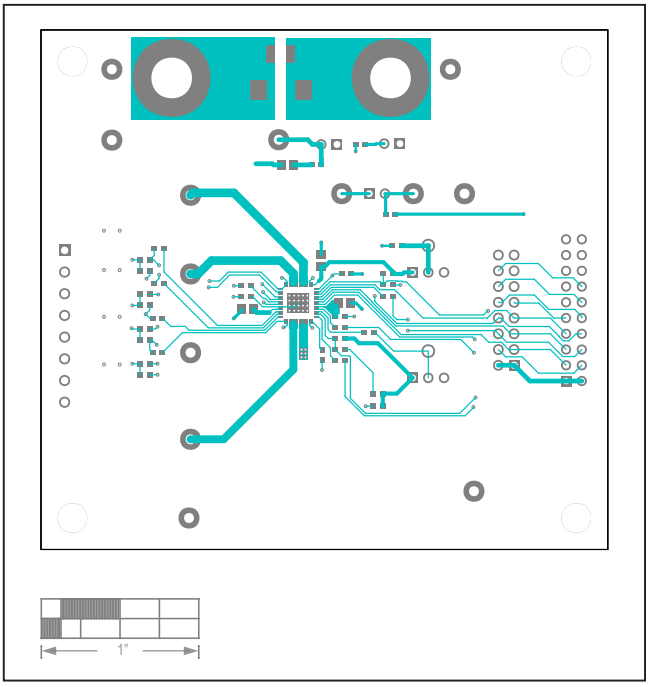
MAX14916 EV Kit Schematic



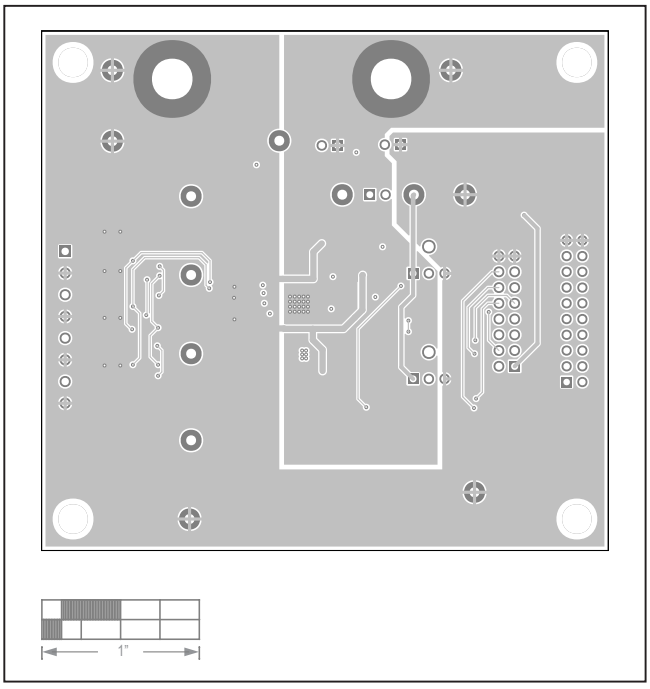
MAX14916 EV Kit PCB Layout Diagrams



MAX14916 EV Kit PCB Layout—Silk Top

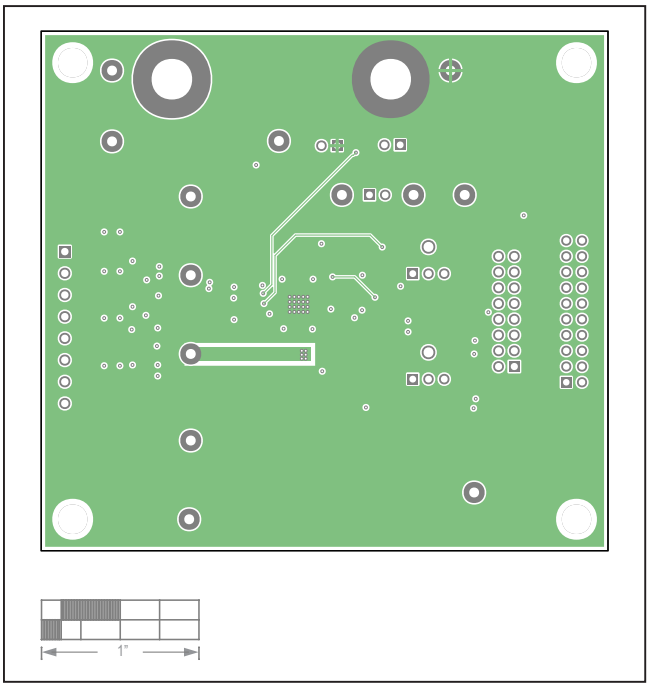


MAX14916 EV Kit PCB Layout—Top View

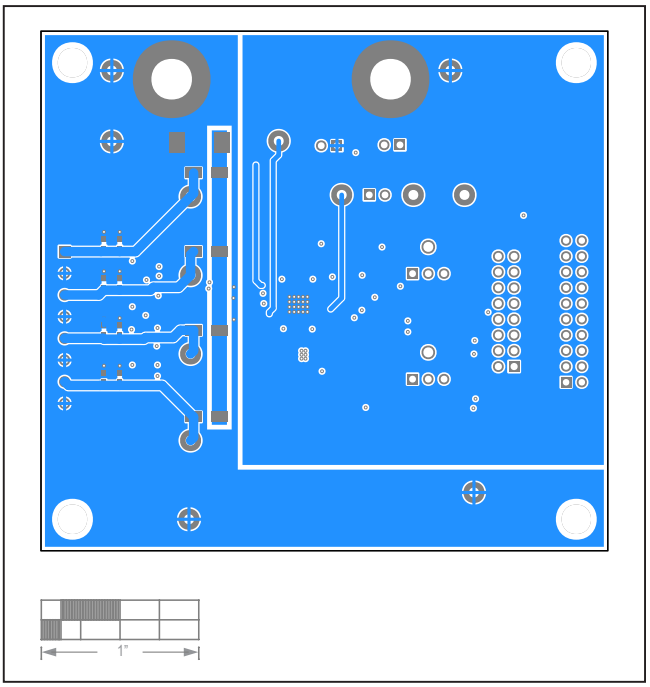


MAX14916 EV Kit PCB Layout—Internal 2

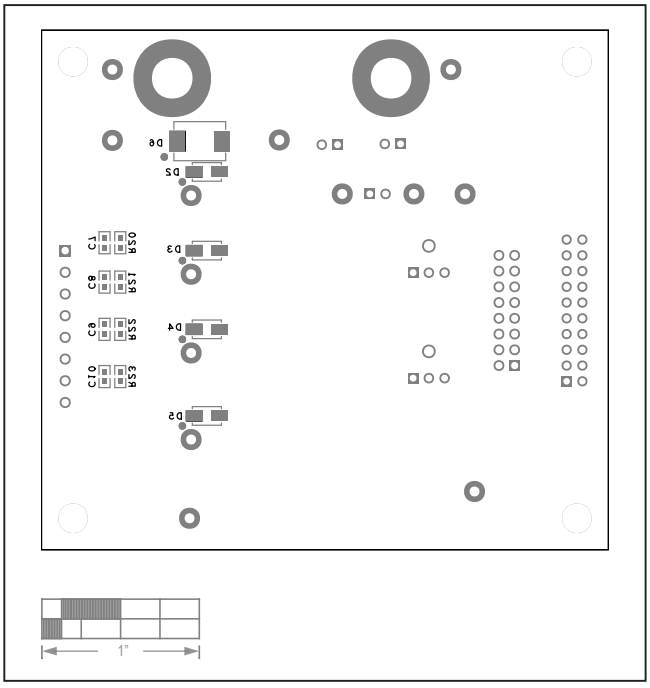
MAX14916 EV Kit PCB Layout Diagrams (continued)



MAX14916 EV Kit PCB Layout—Internal 3



MAX14916 EV Kit PCB Layout—Bottom View



MAX14916 EV Kit PCB Layout—Bottom Silkscreen