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

Evaluates: MAX14916

MAX14916PMB

General Description

The MAX14916PMB (peripheral module board) provides the hardware to evaluate the MAX14916 Octal 1A / Quad 2A industrial high-side switch with diagnostics. Refer to the MAX14916 IC data sheet for detailed information on the operation of the IC. The module takes advantage of the features in the MAX14916, which allow each channel to independently be toggled on and off and continuously monitored for faults. Note the module provides a subset of the MAX14916 features. For greater flexibility, refer to the MAX14916 evaluation kit.

The MAX14916PMB# has a 12-pin Pmod™-compatible connector for serial peripheral interface (SPI) communication. The peripheral module can be used in various ways; Analog Devices sells low-cost USB2PMB2# and USB2GPIO# adapter boards that use the Munich GUI software for SPI communication through a USB cable. This is not included with this board but is available from Analog Devices or one of its distributors. Alternatively, use any microcontroller or field programmable gate array (FPGA) with a 12-pin Pmod-compatible connector for SPI communication.

The PCB dimension is 62mm long x 22.6mm wide, with the width determined by the size of the DO terminal block.

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

Features

- Easy Evaluation of the MAX14916
- Internal Clamps for Fast Inductive Load Demagnetization
- Individual Channel Fault Detection
- Supports Load Currents of up to 2.4A per Channel
- Works with USB2PMB2# or USB2GPIO# Adapter and Munich GUI Software
- Fully Assembled and Tested
- Proven PCB Layout
- RoHS Compliant

Contents

- MAX14916PMB# with the MAX14916AFM+
- 24V DC (2.71A max.) power adapter

MAX14916PMB EV Kit Files

FILE	DESCRIPTION
Munich GUISetupV2.26.exe or later	Munich GUI software for use with the USB2PMB2# or USB2GPIO# adapter

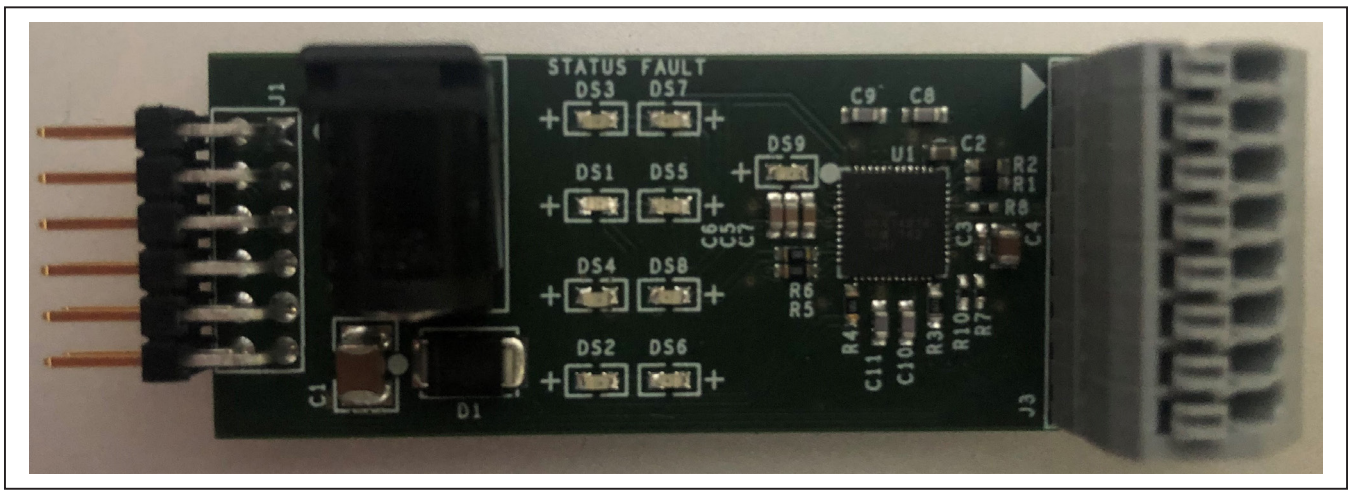


Figure 1. MAX14916PMB# Board Photo

Pmod is a registered trademark of Digilent Inc.

319-100958; Rev 0; 10/22

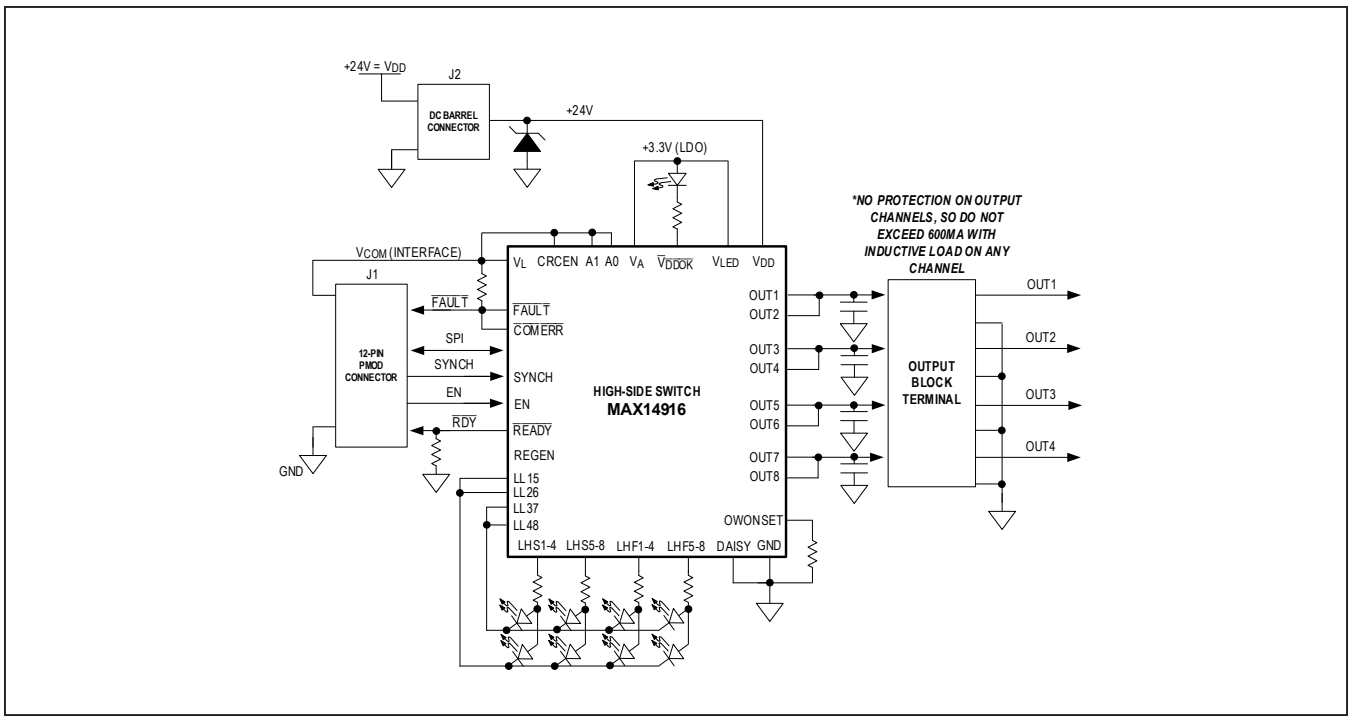


Figure 2. MAX14916PMB# Block Diagram

Quick Start

Required Equipment

- MAX14916PMB#
- 24V DC power adapter
- USB2PMB2# or USB2GPIO# adapter board
- Micro-USB cable
- MS Windows-10 PC with a spare USB port
- Munich GUI v2.26 or higher

Note: In the following sections, software-related items are identified in **bold**. Text in bold refers to items directly from the Munich GUI software. Text in **bold and underline** refers to items from the MS Windows operating system.

Procedure

The MAX14916PMB# board is fully assembled and tested. Follow these steps to verify the board operation. If the USB2PMB2# or USB2GPIO# adapter is used, download the software by following these steps to get started. In this description, the USB2PMB2# adapter is used.

1) Visit **www.maximintegrated.com** to download the latest version of the Munich GUI software, version 2.26 or later.
2) Save the software to a temporary folder. Double-click the .exe file to run the installer. A message box asking **Do you want to allow the following program to make changes to this computer?** appears. Click **Yes**.
3) The installer includes the drivers for the hardware and software. Follow the instructions on the installer, and once complete, click **Finish**.
4) The default location of the software is in the program files directory.
5) Connect the 24V DC power adapter to J2 of the MAX14916PMB# to power up the board. The $\overline{V_{DDOK}}$ LED (DS9 - green) turns on.
6) Connect the MAX14916PMB# Pmod connector J1 to the Pmod connector on the USB2PMB2#.
7) Connect the USB2PMB2# to the PC with the Micro-USB cable.

Windows is a registered trademark of Microsoft.

8) Once the hardware is ready to use, launch the Munich GUI software. The status bar in the GUI should display **Disconnected** in the bottom right corner. To configure the MAX14916PMB#, go to the **Device** tab, select **Industrial Digital**, then select the **MAX14916PMB**. (See Figure 3)
9) The GUI should automatically detect the USB-2PMB2# board serial number and show it in the **USB2PMB Adapter** dropdown menu. If no serial number is displayed, check the USB connection, and click **Scan Adapters**. Select the USB2PMB2# board serial number from the dropdown menu once it shows up.
10) Click **Connect**.
11) Connect CH1 (pin 7) and GND (pin 8) from the J3 connector to an oscilloscope or digital multimeter. The MAX14916PMB# is configured in HighImpedance mode (**High-Z**) by default after power-up. Using the CH1 dropdown menu, turn on CH1 by setting the signal type from the default **High-Z** to **Static High**. Observe that STATUS LED (DS2 - green) is turned on and the output on the oscilloscope or digital multimeter reads 24V.
12) Observe that when the output channel is turned on and is shorted to GND, the Status LED turns off and the Fault LED (DS6 - red) toggles on and off as the output detects an overcurrent or overload fault. The Munich GUI's Channel Faults box indicates the channel in fault condition by turning the corresponding channel's status bar to red.
13) Monitoring for open-wire detection (with channel output ON and/or OFF) can be enabled in the Monitoring Setup Window of the Munich GUI. Channel Output connected to V_{DD} monitoring can also be enabled in the same window. When a fault is enabled in this window and detected on the MAX14916PMB# board, it displays in the Munich GUI's **SPI Result Monitoring Window box** and the fault LED for the channel turns ON.

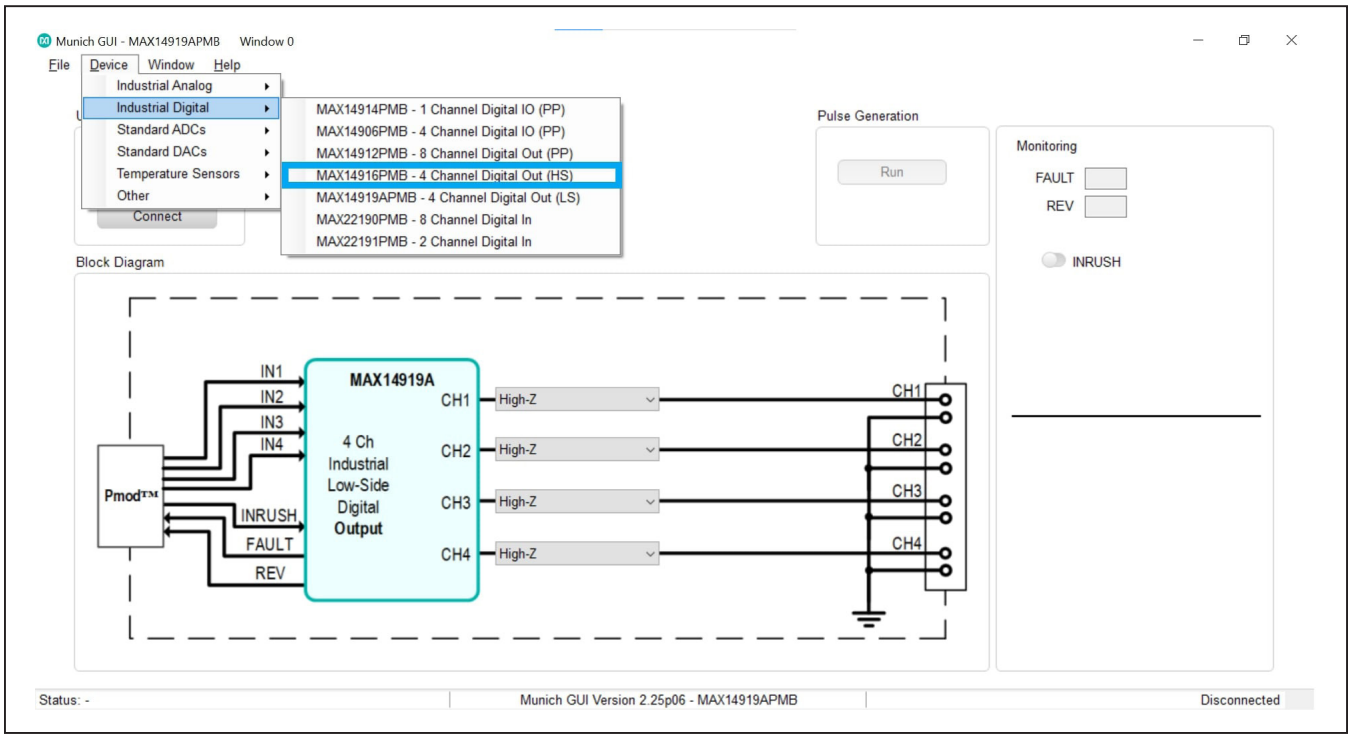


Figure 3. MAX14916PMB# Software (Munich GUI Device Menu)

Detailed Description of Hardware

The MAX14916 is a high-speed, Octal 1A / Quad 2A High-Side Switch with a maximum of 250mΩ on resistance. The MAX14916PMB# is configured to be operated as a Quad 2A High-Side Switch. Each channel's output can be toggled independently, and the IC provides channel diagnostics through an SPI-compatible interface. The MAX14916 is specified for operation with a field supply voltage of 24V typical and tolerant to 65V. The MAX14916PMB# comes with a standard 2.1mm barrel connector as the main sup-ply connector. A 24V (2.71A max) DC power adapter is included with the module for convenience. For ease of use, this module only supports a subset of the MAX14916 features. For greater flexibility, refer to the MAX14916 evaluation kit.

The MAX14916PMB# hardware provides everything needed to evaluate the MAX14916 using the Pmod interface. An optional USB2PMB2# or USB2GPIO# adapter can be used with the Munich GUI to provide the USB-to-SPI interface to communicate with the MAX14916. The adapter provides a 3.3V output from the USB interface providing a VL supply to the MAX14916.

The MAX14916PMB# does not feature galvanic isolation. To isolate the module, select the USB2GPIO# adapter board and use it with the USB2GPIOISO# isolation module. Both modules work seamlessly with the Munich GUI.

High-Side Switch Operation

The MAX14916 has eight high-side (HS) switch channels. The MAX14916PMB# connects two high-side switch channels in parallel to provide four output channels with a higher current delivery capability. The high-side switch current limit is 2.4A per channel when configured in this parallel orientation.

The high-side driver has 120mΩ (typ) on-resistance at 25ºC ambient temperature. For full details about the high-side switch characteristics, refer to the MAX14916 IC data sheet.

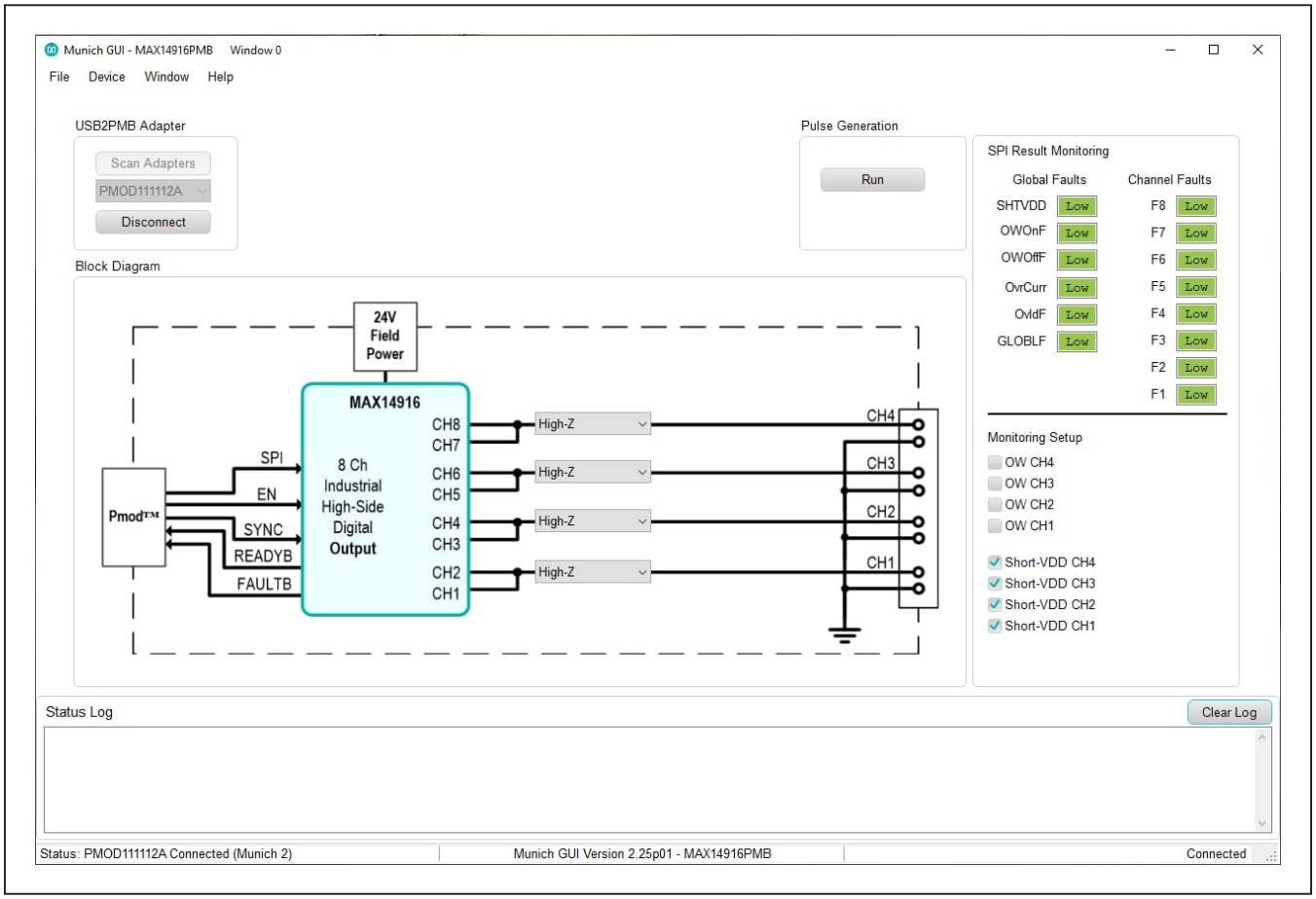


Figure 4. MAX14916PMB# Connected in Munich GUI (Short-VDD and Global Faults Enabled)

Pmod Style Connector

The MAX14916PMB# can plug directly into a Pmod-compatible port through J1. Note the pin definitions are determined by the USB2PMB2# or USB2GPIO# adapter, and to use this board with own host, configure the microcontroller or FPGA to match the MAX14916PMB# J1 pinout. For more information on the MAX14916 SPI interface and control, refer to the MAX14916 IC data sheet. See the MAX14916PMB schematic for the J1 pinout.

Power Supply

A 24V DC power adapter, SDI65-24-UDC-P5, with a maximum of 2.71A output current is included with the MAX14916PMB# and must be connected to J2 for normal operation. For a higher total load current on the output than the power adapter can provide, use own DC power supply. Note the MAX14916 is specified for operation with a supply voltage up to 36V and is tolerant to 65V. The barrel connector J2 is rated up to 5A maximum. Do not operate beyond these maximum ratings.

Light-Emitting Diodes (LEDs)

The MAX14916PMB# comes with a 4 x 2 LED matrix, providing four green LEDs indicating per-channel input or output status, and four red LEDs indicating per channel fault conditions. See Table 1 for a full list of each channel's corresponding status and fault LEDs. If a fault LED is turned on for a channel, the corresponding status LED is always turned off. This mitigates false information about the status of the affected channel.

Field supply (V_{DD}) diagnostic faults are provided through the $\overline{V_{DDOK}}$ LED (DS9 - green). The Munich GUI provides limited access to the diagnostic features of the MAX14916. To explore the full diagnostic capabilities of the MAX14916, refer to the MAX14916 evaluation kit.

Transient Immunity Protection

No external surge suppression is needed on OUT_ pins as they are protected against ±1kV surge pulses per IEC 61000-4-5. Connect a TVS diode between V_{DD} and GND to clamp positive surge pulses on the OUT_ and V_{DD} pins. The MAX14916PMB# outputs are protected against ±1kV surge transients with TVS diode D1, SMBJ36A, connected between V_{DD} and GND.

Addressable SPI

Figure 5. Digital Output Operation Mode Configuration

The MAX14916 supports addressable SPI, allowing direct communication with up to four MAX14916 devices. By default, the MAX14916PMB# is configured as address 00, with A1 = 0 and A0 = 0. It is possible to change the SPI address using the provided resistor footprints by connecting A1 and A0 to VL or GND using the pads provided at R10 and R11. Note that if the SPI address is changed from the default value, it no longer works with the provided Munich GUI software and the user must develop own software to support the new SPI address. For more information on SPI device address selection, refer to the MAX14916 IC data sheet.

Table 1. MAX14916PMB# LED Channel Assignments

CHANNEL NUMBER	STATUS LED (GREEN)	FAULT LED (RED)
1	DS2	DS6
2	DS4	DS8
3	DS1	DS5
4	DS3	DS7

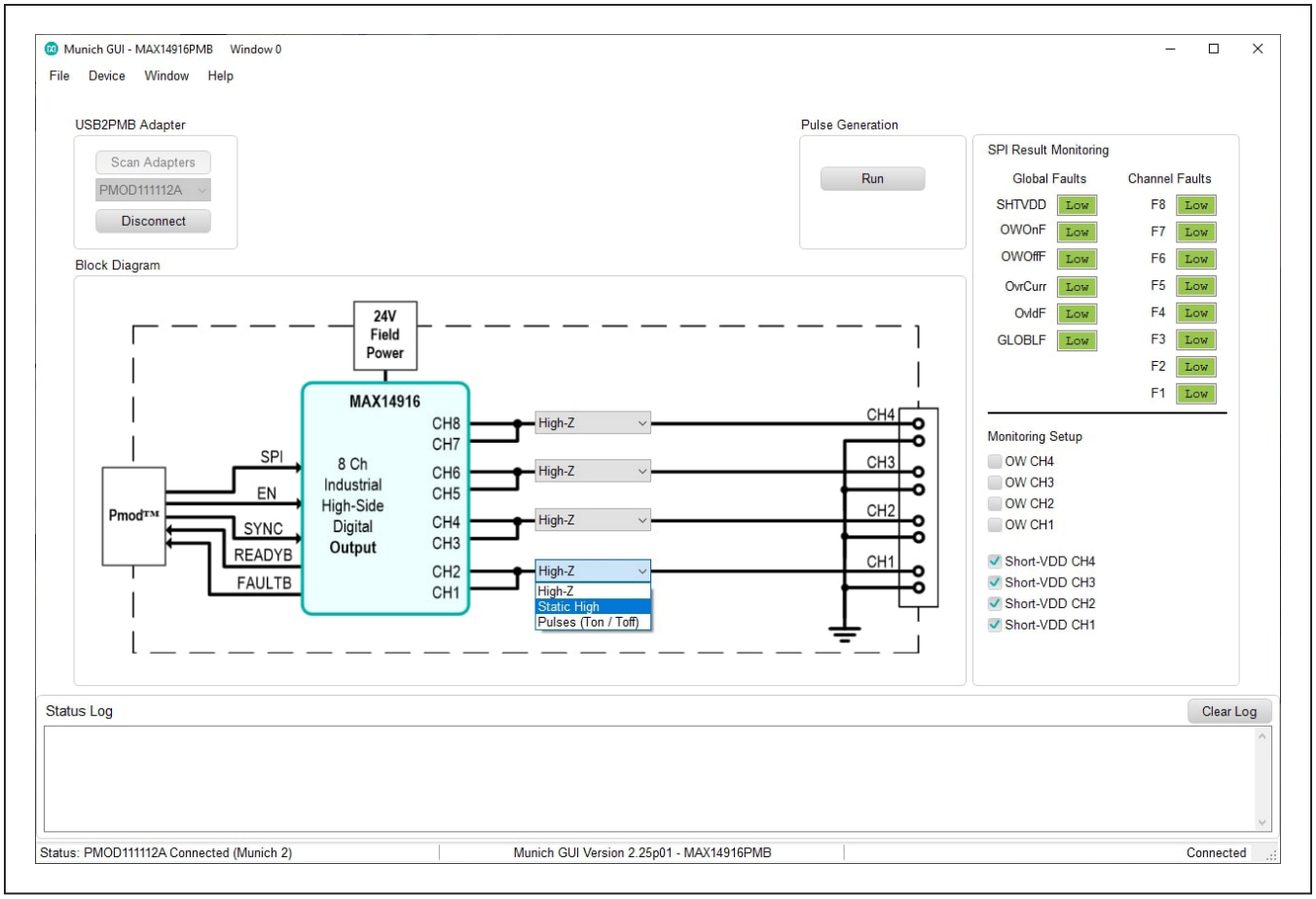


Figure 5. Digital Output Operation Mode Configuration

Detailed Description of Software

For easy development and testing, Analog Devices provides the Munich GUI to communicate with the MAX14916PMB#. The Munich GUI supports many different Pmod boards using low-cost USB adapters, USB2PMB2# or USB2GPIO#, also available from Analog Devices.

Connection to Hardware

The **Device** menu has options to select peripheral modules (see Figure 3). In this case, select

Industrial Digital, then select the **MAX14916PMB**. Use the **Scan Adapters** option to search for the USB2PMB2# or USB2GPIO# modules connected to the PC if the GUI does not automatically find the Pmod adapters. If the adapters are found, the serial number of the adapters are listed in the **USB2PMB Adapter** dropdown. Select the serial number of the adapter for the Munich GUI to communicate with. The software can only communicate to one module at a time. Select **Connect** and notice how the status changes from **Disconnected** to **Connected** in the lower-right area of the GUI. The **Short-V_{DD}** per channel monitoring is automatically enabled, and all **Global Faults** are **Low**, if the Munich GUI successfully communicates with the MAX14916PMB# (see Figure 4).

Pulse Mode

Drive a pulse signal for each output channel and configure its ON and OFF time by selecting **Pulses (Ton/Toff)** from the dropdown menu, as shown in Figure 7. To configure the ON and OFF time, first set up the **Ton** for each channel, and then adjust **Toff** only for one channel. The cycle is automatically equalized so that the pulse periods on all channels configured in pulse mode are the same. Different cycle lengths between different output channels are not supported, and the total time (Ton + Toff) should be less than 1000ms. Once the appropriate Ton and Toff values are entered, click the **Run** button to activate the pulse output.

High-Side Switch Operation

All channels of the MAX14916PMB# are configured in High-Impedance mode by default after power up. The CH1 to CH4 dropdown menus allow to configure all four high-side switch channels. The output channels can be driven to **High-Z**, **Static High**, or **Pulses (Ton/Toff)**, as shown in Figure 5. When configured to **Static High**, the channel switch is turned on, and the CH_ output is pulled to V_{DD}. The pulse mode is discussed in the *Pulse Mode* section.

Diagnostic Features

The MAX14916PMB# takes advantage of the built-in diagnostic features of the MAX14916 and provides basic fault monitoring using the Munich GUI. To explore the full diagnostic capabilities of the MAX14916, refer to the MAX14916 evaluation kit.

Six global faults are provided on SDO in each SPI cycle and are displayed in the **Monitoring** section in the Munich GUI, which include short-to-V_{DD} (**SHTVDD**), open-wire detection in on-state (**OWOnF**), open-wire detection in off-state (**OWOffF**), overcurrent limit (**OvrCurr**), channel overload (**OvldF**), and the global diagnostic (**GLOBLF**). The global fault bit (**GLOBLF**) is the logical OR of the ComErr, SupplyErr, and ThrmShutd bits in the Interrupt and GlobalErr registers. Also enable or disable per-channel open wire detection (**OW CH1** to **OW CH4**) and per-channel short-to-VDD monitoring (**Short-VDD CH1** to **Short-VDD CH4**), as shown in Figure 6. Refer to the MAX14916 IC data sheet for more details on the per-channel and global diag-nostics features.

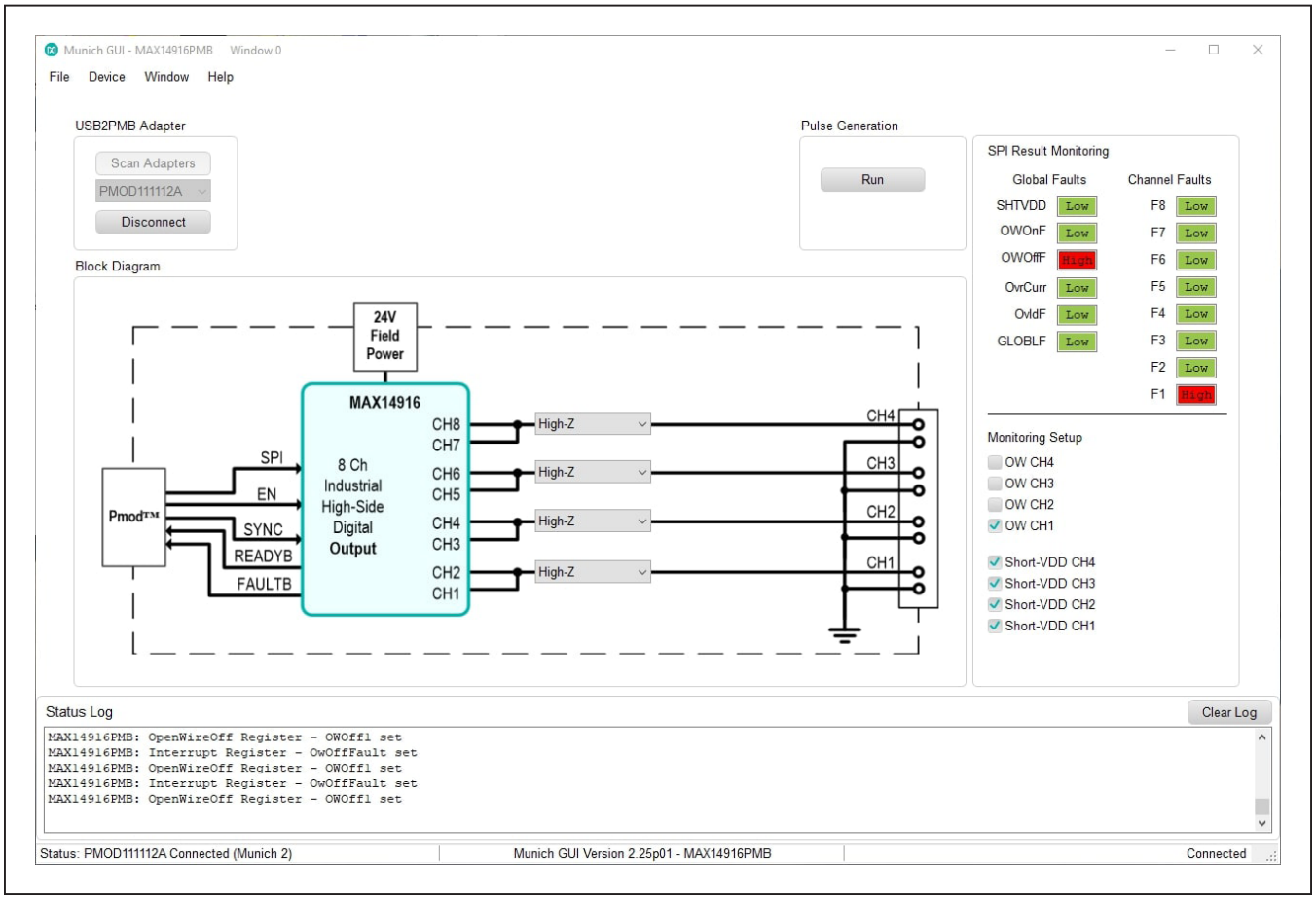


Figure 6. Diagnostic Features

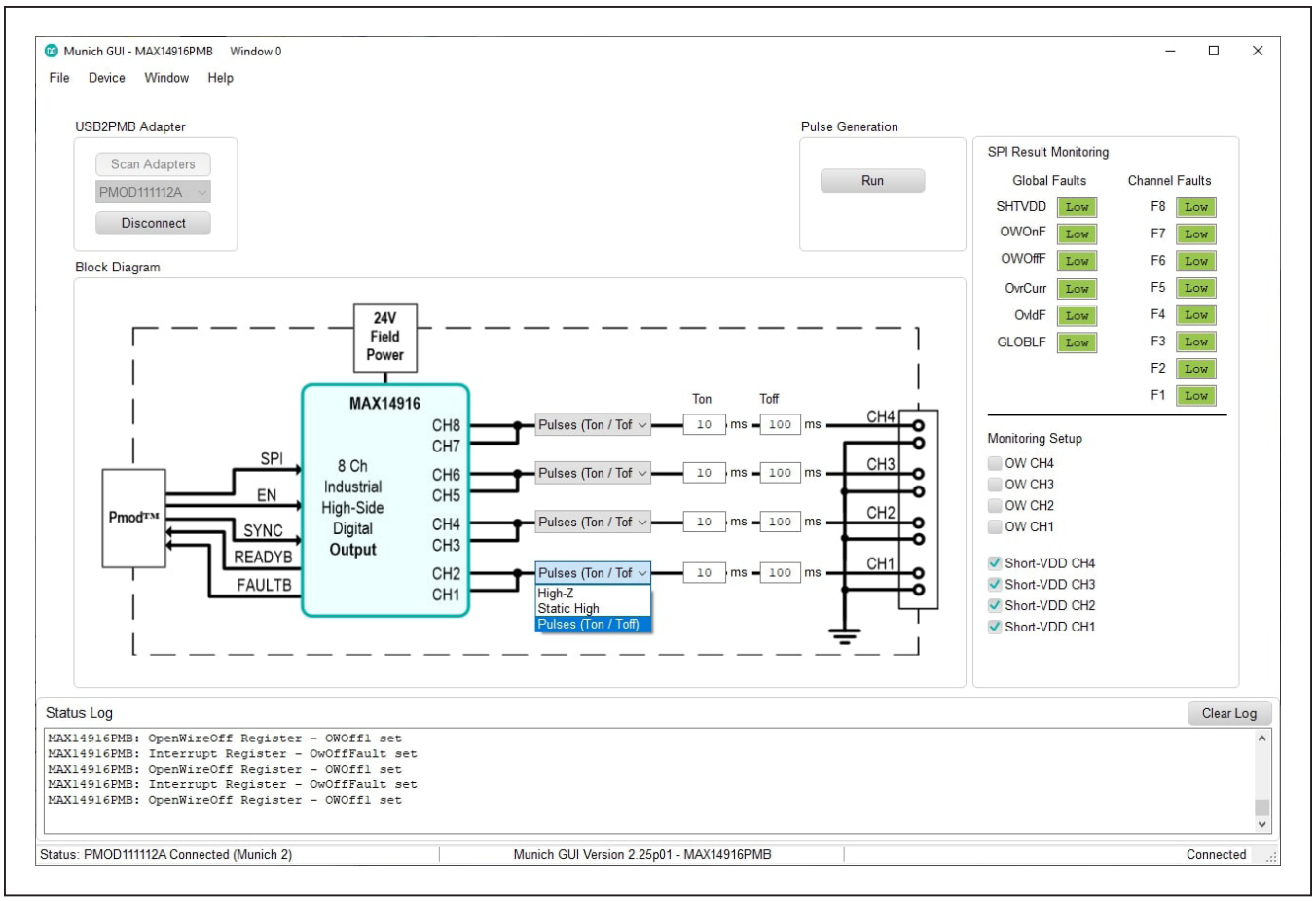


Figure 7. Pulse Generation

Ordering Information

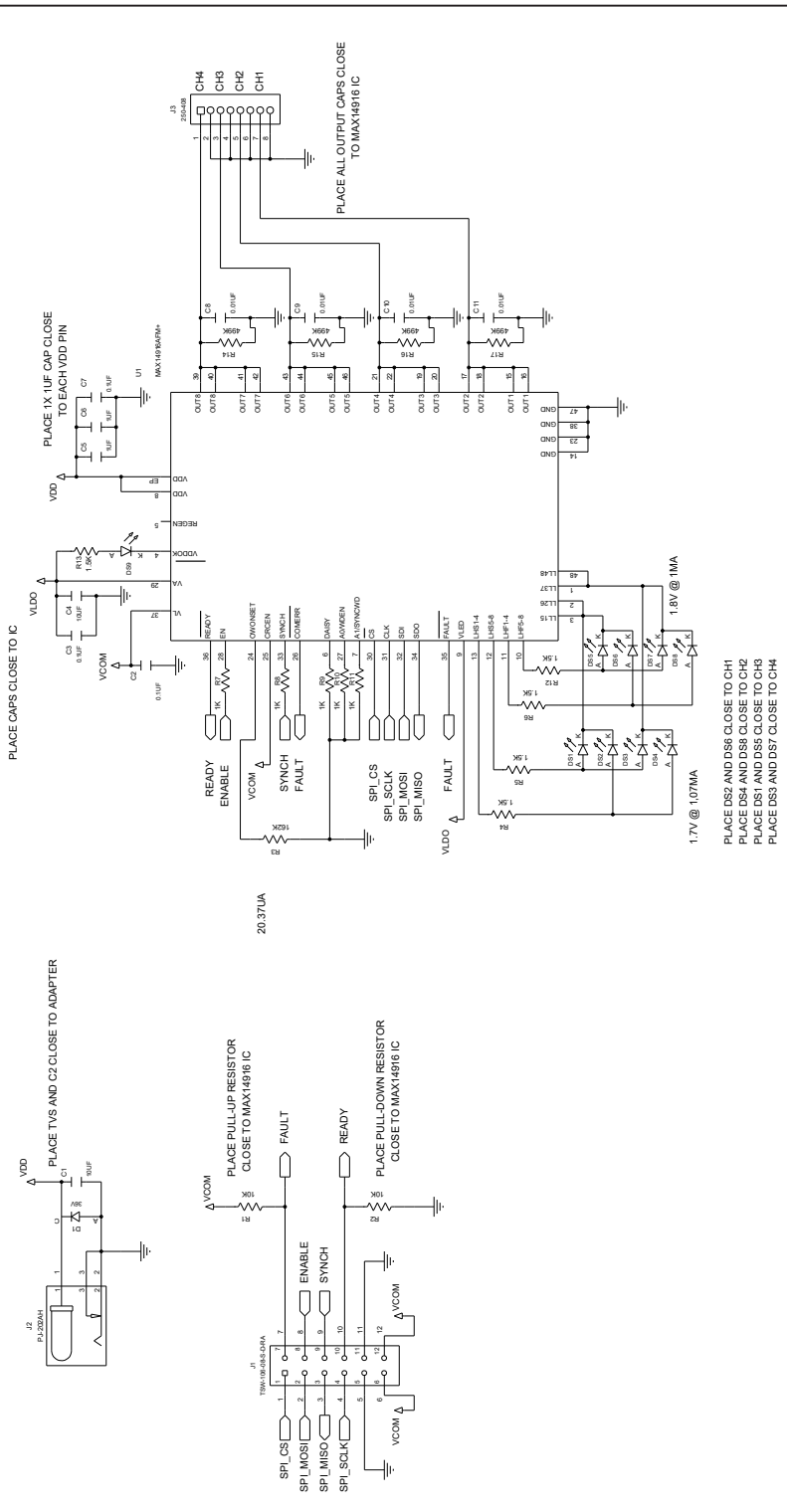
PART	TYPE
MAX14916PMB#	Peripheral Module

#Denotes RoHS compliance.

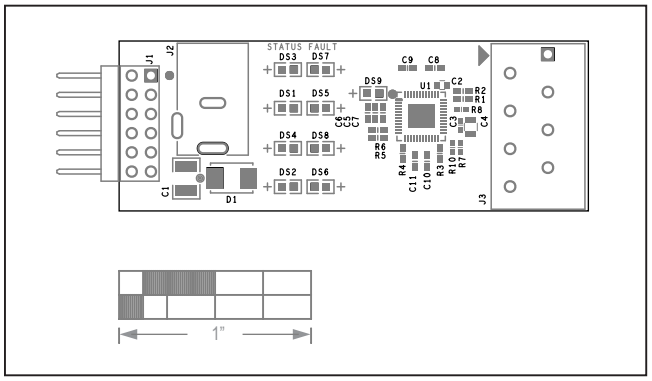
MAX14916PMB Bill of Materials

NOTE: DNI --> DO NOT INSTALL (PACKOUT); DNP --> DO NOT PROCURE						
ITEM	**REF_DES**	**QTY**	**MFG PART #**	**MANUFACTURER**	**VALUE**	**DESCRIPTION**
1	C1	1	C3225X7S1H106K250AB; CGA6P3X7S1H106K250AB; GCM32EC71H106K; CGA6P3X7S1H106K250AE	TDK;TDK;MURATA;TDK	10µF	CAP; SMT (1210); 10µF; 10%; 50V; X7S; CERAMIC
2	C2	1	GMK107B7104KAH	TAIYO YUDEN	0.1µF	CAP; SMT (0603); 0.1µF; 10%; 35V; X7R; CERAMIC
3	C3	1	GRM155R62A104KE14	MURATA	0.1µF	CAP; SMT (0402); 0.1µF; 10%; 100V; X5R; CERAMIC
4	C4	1	CGA4J1X7S1C106K125; GCM21BC71C106KE35	TDK;MURATA	10µF	CAP; SMT (0805); 10µF; 10%; 16V; X7S; CERAMIC
5	C5, C6	2	UMK107AB7105KA; CC0603KRX7R9BB105	TAIYO YUDEN;YAGEO	1µF	CAP; SMT (0603); 1µF; 10%; 50V; X7R; CERAMIC
6	C7	1	CC0603KRX7R0BB104; GRM188R72A104KA35; HMK107B7104KA; 06031C104KAT2A; GRM188R72A104K	YAGEO;MURATA;TAIYO YUDEN;AVX;MURATA	0.1µF	CAP; SMT (0603); 0.1µF; 10%; 100V; X7R; CERAMIC
7	C8-C11	4	CGA3EANP02A103J080AC	TDK	0.01µF	CAP; SMT (0603); 0.01µF; 5%; 100V; C0G; CERAMIC
8	D1	1	SMBJ36A-E3	VISHAY GENERAL SEMICONDUCTOR	36V	DIODE; TVS; SMB (DO-214AA); VRM = 36V; IPP = 10.3A
9	DS1-DS4, DS9	5	LGL29K-F2J1-24-Z	OSRAM	LGL29K-F2J1-24-Z	DIODE; LED; SMARTLED; GREEN; SMT; PIV = 1.7V; IF =0.02A
10	DS5-DS8	4	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	J1	1	TSW-106-08-S-D-RA	SAMTEC	TSW-106-08-S-D-RA	CONNECTOR; THROUGH HOLE; DOUBLE ROW; RIGHT ANGLE; 12 PINS;
12	J2	1	PJ-202AH	CUI INC.	PJ-202AH	CONNECTOR; MALE; THROUGH HOLE; DC POWER JACK; RIGHT ANGLE; 3PINS
13	J3	1	250-408	WAGO	250-408	CONNECTOR; FEMALE; THROUGH HOLE; COMPACT TERMINAL STRIP WITH PUSH BUTTON; STRAIGHT; 8 PINS
14	R1, R2	2	CRCW060310K0FK; ERJ-3EKF1002; AC0603FR-0710KL; RMCF0603FT10K0	VISHAY;PANASONIC; YAGEO;STACKPOLE	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W
15	R3	1	CRCW0603162KFK	VISHAY DALE	162K	RES; SMT (0603); 162K; 1%; +/-100PPM/DEGC; 0.1000W
16	R4-R6, R12, R13	5	CRCW06031K50FK	VISHAY DALE	1.5K	RES; SMT (0603); 1.5K; 1%; +/-100PPM/DEGC; 0.1000W
17	R7-R11	5	ERJ-2GEJ102	PANASONIC	1K	RES; SMT (0402); 1K; 5%; +/-200PPM/DEGC; 0.1000W
18	R14-R17	4	CRCW0603499KFK; ERJ-3EKF4993; RC0603FR-07499KL	VISHAY DALE;PANASONIC; YAGEO	499K	RES; SMT (0603); 499K; 1%; +/-100PPM/DEGC; 0.1000W
19	U1	1	MAX14916AFM+	MAXIM	MAX14916AFM+	IC; HSSWTCH; COMPACT INDUSTRIAL OCTAL 1A/QUAD 2A; HIGH-SIDE SWITCH WITH DIAGNOSTICS; FCQFN48-EP
20	PCB	1	MAX14916PMB	MAXIM	PCB	PCB:MAX14916PMB
TOTAL		**43**				

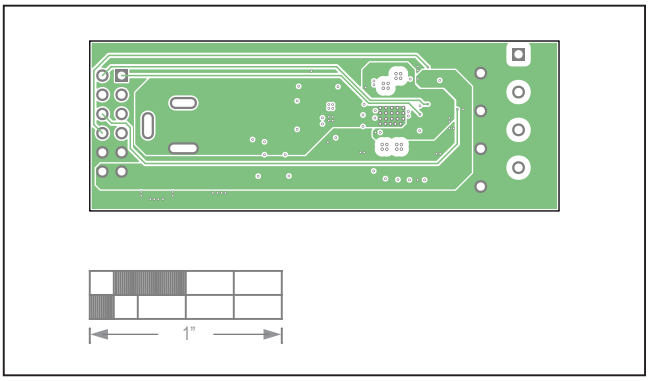
MAX14906PMB Schematic



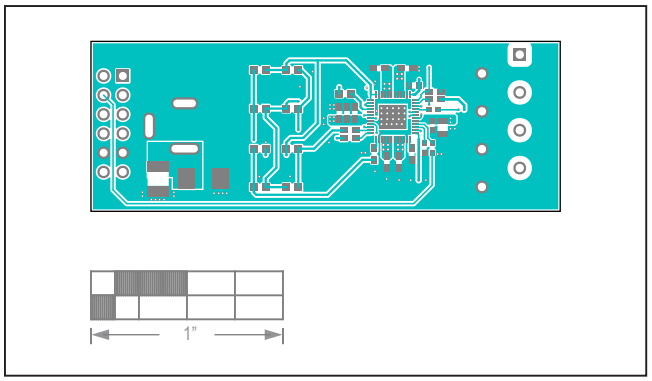
MAX14916PMB# PCB Layouts



MAX14916PMB—Silk Top



MAX14916PMB—Layer3



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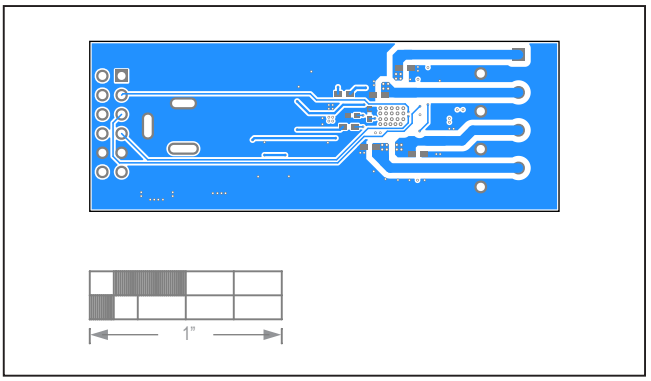

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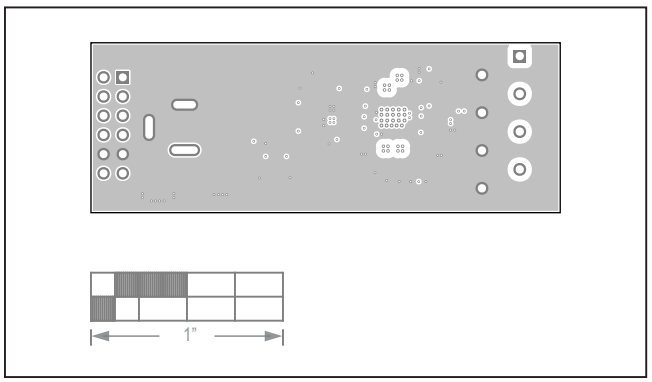

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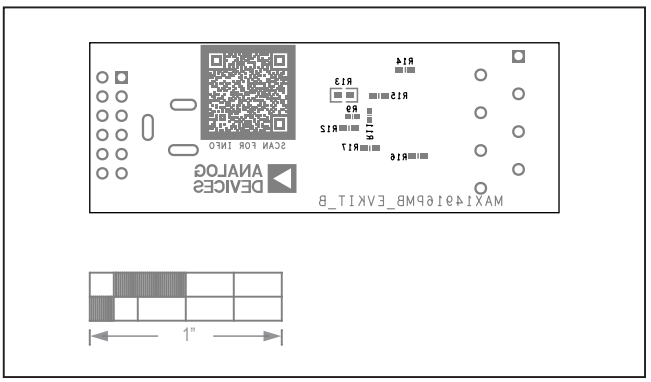

MAX14916PMB—Silk Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/22	Initial release	—