



# MAX16922 Evaluation Kit

## General Description

The MAX16922 evaluation kit (EV kit) is an assembled and tested circuit board that contains all the components necessary to evaluate the MAX16922 IC family. The MAX16922 is a dual-output, step-down DC-DC converter and dual low dropout (LDO) linear regulator. The EV kit is powered from a DC supply providing 6V to 18V and up to 3A. The EV kit is designed to withstand a load-dump condition up to 45V.

The EV kit is shipped with the MAX16922ATPE/V+ installed. This MAX16922 version is capable of delivering 5V at 1.2A from the first step-down DC-DC converter (DC-DC1) and 3.3V at up to 600mA from the second step-down DC-DC converter (DC-DC2). The first LDO linear regulator (LDO1) provides 2.5V and up to 300mA, while the second LDO linear regulator (LDO2) provides 1.8V and up to 300mA. The MAX16922 switching frequency is 2.2MHz and the two DC-DC converters switch 180° out of phase with respect to each other. The DC-DC2 can operate in PWM mode to prevent AM band interference or high-efficiency skip mode. The EV kit includes an enable input (EN) and a power-good reset output (RESET) to monitor the output voltages of the two DC-DC converters.

## Features

- ◆ 6V to 18V Input Supply Voltage Range
- ◆ Load-Dump Protection Circuit Withstands Input Transients Up to 45V
- ◆ 5V at 1.2A Output (OUT1 from DC-DC1)
- ◆ 3.3V at 600mA Output (OUT2 from DC-DC2)
- ◆ 2.5V at 300mA Output (OUT3 from LDO1)
- ◆ 1.8V at 300mA Output (OUT4 from LDO2)
- ◆ 180° Out-of-Phase Operation Reduces Input Capacitance
- ◆ 2.2MHz Switching Frequency
- ◆ Forced-PWM and Skip Mode Operation
- ◆ Enable Input (EN)
- ◆ Power-Good Reset Output (RESET)
- ◆ Evaluates the MAX16922 Family in a 20-Pin TQFN (5mm x 5mm x 0.8mm) Package
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TYPE
MAX16922EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	47µF ±20%, 50V aluminum electrolytic capacitor (Size E or 8mm x 6.2mm) Panasonic EEE-FK1H470P
C2, C3	2	0.047µF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H473K
C4	1	1µF ±10%, 10V X7R ceramic capacitor (0603) Murata GRM188R71A105K
C5-C10	6	4.7µF ±10%, 25V X7R ceramic capacitors (1206) Murata GRM31CR71E475K

DESIGNATION	QTY	DESCRIPTION
C11	1	0.1µF ±10%, 16V X7R ceramic capacitor (0402) Murata GRM155R71C104K
C12, C13	2	10µF ±10%, 10V X7R ceramic capacitors (1206) Murata GRM31CR71A106K
D1	1	40V, 1.1A Schottky diode (PowerDI-123) Diodes Inc. DFLS140 (Top Mark: F04)
D2	1	200V, 1A diode (SMA) Diodes Inc. ES1D (Top Mark: ES1D)
JU1, JU2	2	2-pin headers

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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
JU3, JU4	2	3-pin headers
L1	1	4.7 $\mu$ H, 2.0A inductor TDK LTF5022-4R7N2R0
L2	1	2.2 $\mu$ H, 1.32A inductor Coilcraft EPL2014-222MLB
PGND, VBAT	2	Uninsulated panel-mount banana jacks
R1	1	100k $\Omega$ $\pm$ 5% resistor (0402)

DESIGNATION	QTY	DESCRIPTION
R2, R3	2	20k $\Omega$ $\pm$ 5% resistors (0402)
U1	1	Dual step-down converter (20 TQFN-EP*) Maxim MAX16922ATPE/V+
—	4	Shunts
—	1	PCB: MAX16922 EVALUATION KIT+

\*EP = Exposed pad.

/V denotes an automotive qualified part.

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Coilcraft, Inc.	847-639-6400	www.coilcraft.com
Diodes Incorporated	805-446-4800	www.diodes.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

**Note:** Indicate that you are using the MAX16922 when contacting these component suppliers.

## Quick Start

### Required Equipment

- Adjustable 6V to 18V, 3A DC power supply
- Up to four electronic (e.g., HP6060B) or passive loads
- Voltmeter

### Procedure

The MAX16922 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 completed.**

- Verify that a shunt is installed on jumper JU1 (EV kit enabled).
- Verify that a shunt is installed on jumper JU2 (DC-DC2 on forced-PWM mode).

- Verify that a shunt is installed on pins 1-2 of jumper JU3 (LDO1 powered from OUT1).
- Verify that a shunt is installed on pins 2-3 of jumper JU4 (LDO2 powered from OUT2).
- Connect the electronic or passive loads to the desired outputs.
- Connect a 6V to 18V DC power supply to the VBAT and PGND binding posts; set the voltage to 12V.
- Turn on the power supply.
- Enable the electronic loads.
- Verify that OUT1 is 5V, OUT2 is 3.3V, OUT3 is 2.5V, and OUT4 is 1.8V.

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## Detailed Description of Hardware

The MAX16922 evaluation kit (EV kit) contains two step-down DC-DC converters and two low dropout (LDO) linear regulators. The EV kit is designed to operate from a DC power supply that provides 6V to 18V and at least 3A of current. The MAX16922's converter switching frequency is 2.2MHz. The DC-DC2 operates in either PWM mode or skip mode.

The DC-DC1 generates 5V and provides up to 1.2A of current. The DC-DC2 generates 3.3V and provides up to 600mA of current. The LDO1 generates 2.5V and provides up to 300mA of current. The LDO2 generates 1.8V and provides up to 300mA of current. For different output voltages, replace U1 with the desired IC in the MAX16922 IC family. Refer to the MAX16922 IC data sheet for a complete list of the available IC versions.

The DC-DC1 switching frequency is 2.2MHz and enters skip mode automatically under light loads to prevent an overvoltage condition from occurring at the output. The DC-DC2 switching-frequency mode is jumper selectable between forced-PWM mode and skip mode. The DC-DC converters switch 180° out of phase with respect to each other.

### Enable Input (EN)

The MAX16922 EV kit provides an enable input (EN) to enable or disable the MAX16922 DC-DC1 and DC-DC2. Since the LDO inputs are supplied by either DC-DC1 or DC-DC2, the LDO outputs are also controlled by the logic

level of the EN pin. When the EN pin is logic-high, all EV kit outputs are enabled. When the EN pin is logic-low, all EV kit outputs are disabled. The MAX16922 EN pin is an input logic pin that is active-high and TTL compatible (see Table 1).

### Power-Good Reset Output (RESET)

The MAX16922 EV kit provides a power-good reset output signal ( $\overline{\text{RESET}}$ ) to validate the outputs of the DC-DC1 and DC-DC2.  $\overline{\text{RESET}}$  is pulled up to OUT1 by resistor R2. The power-good reset output signal pulls low when either converter output drops below 90% of their nominal regulated voltages. The  $\overline{\text{RESET}}$  output signal is available on the RESET PCB pad.

### DC-DC2 Switching Frequency Mode (PWM)

The MAX16922 EV kit provides an option to select the switching frequency mode of the 600mA DC-DC converter (DC-DC2). The DC-DC2 switching frequency can be set to forced-PWM mode to prevent AM band interference or high-efficiency skip mode. When PWM is high, the DC-DC2 switching frequency is in PWM mode. When PWM is low, the DC-DC2 switching frequency is in skip mode (see Table 2).

### LDO1/LDO2 Input Supplies (PV3 and PV4)

The MAX16922 EV kit provides an option to select the input supplies for the two LDOs. The LDO1/LDO2 inputs are selectable between OUT1 and OUT2 (see Tables 3 and 4).

### Jumper Selection

#### Enable, EN (JU1)

The MAX16922 EV kit provides a jumper (JU1) to enable or disable the MAX16922 IC, thus reducing the supply current to the EV kit. To disable the MAX16922, remove the shunt from JU1. Table 1 lists the options to enable or disable the EV kit.

Table 1. Jumper JU1 Functions (EN)

SHUNT POSITION	EN PIN CONNECTED TO	MAX16922 EV KIT FUNCTION
Installed*	PV1	Enabled
Not installed	PGND (through resistor R1)	Disabled

\*Default position.

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## DC-DC2 Switching Frequency Mode, PWM (JU2)

The MAX16922 EV kit circuit features a jumper (JU2) to set the DC-DC2 switching frequency mode to PWM mode or skip mode. Table 2 lists the various JU2 jumper options for configuring DC-DC2's switching frequency mode.

## LDO1 Input Supply, PV3 (JU3)

The MAX16922 EV kit provides an option to select the LDO1 input supply. The LDO1 input supply is selectable between OUT1 and OUT2. Jumper JU3 selects the LDO1 input supply on the EV kit. Table 3 lists the selectable JU3 jumper options.

**Table 2. Jumper JU2 Functions (PWM)**

SHUNT POSITION	PWM PIN CONNECTED TO	DC-DC2 SWITCHING FREQUENCY MODE
Installed*	OUT1	PWM mode
Not installed	PGND (through resistor R3)	Skip mode

\*Default position.

**Table 3. Jumper JU3 Functions (PV3)**

SHUNT POSITION	PV3 PIN CONNECTED TO	LDO1 INPUT SUPPLY
1-2*	OUT1	DC-DC1 output
2-3	OUT2	DC-DC2 output
Not installed	Unconnected	None (LDO1 off)

\*Default position.

## LDO2 Input Supply, PV4 (JU4)

The MAX16922 EV kit provides an option to select the LDO2 input supply. The LDO2 input supply is selectable between OUT1 and OUT2. Jumper JU4 selects the LDO2 input supply on the EV kit. Table 4 lists the selectable JU4 jumper options.

## Other Output Voltages

The MAX16922 IC is available in different output-voltage versions. Refer to the MAX16922 IC data sheet for a complete list of the MAX16922 IC family.

The MAX16922 EV kit is designed to evaluate all the various voltage versions of the MAX16922. To evaluate other MAX16922 IC versions, replace U1 with the desired TQFN IC.

**Table 4. Jumper JU4 Functions (PV4)**

SHUNT POSITION	PV4 PIN CONNECTED TO	LDO2 INPUT SUPPLY
1-2	OUT1	DC-DC1 output
2-3*	OUT2	DC-DC2 output
Not installed	Unconnected	None (LDO2 off)

\*Default position.

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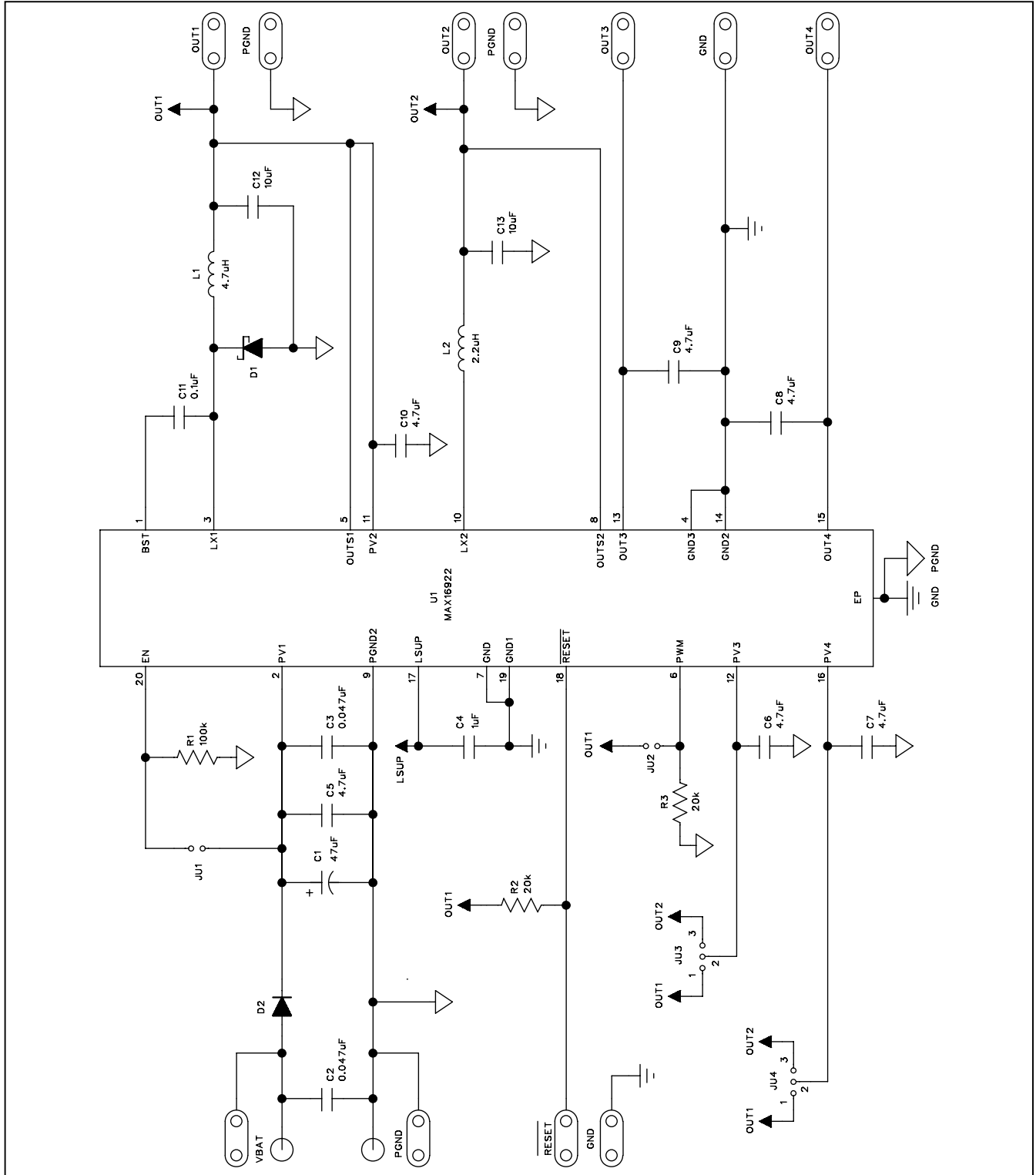


Figure 1. MAX16922 EV Kit Schematic

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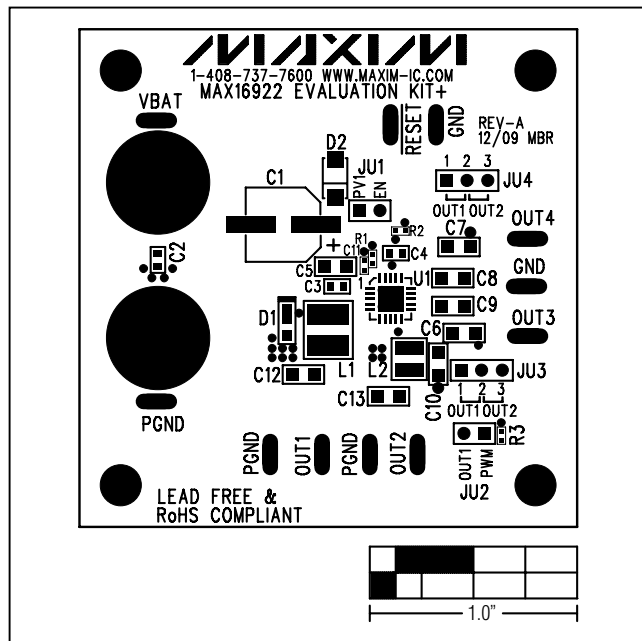


Figure 2. MAX16922 EV Kit Component Placement Guide—Component Side

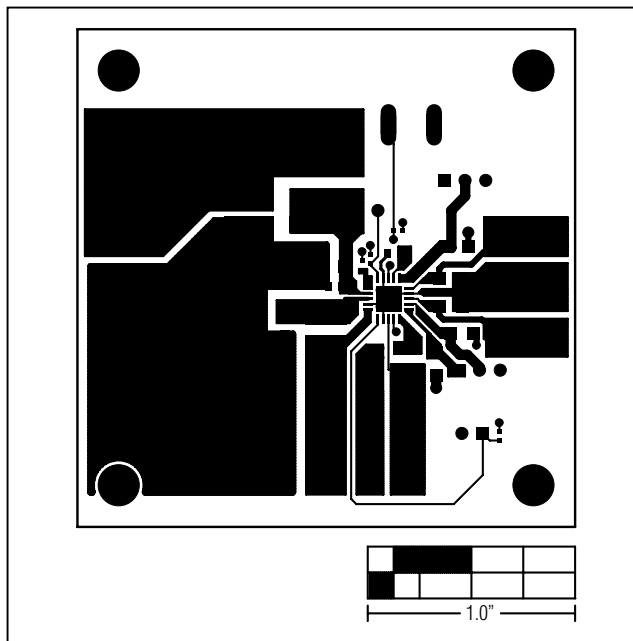


Figure 3. MAX16922 EV Kit PCB Layout—Component Side

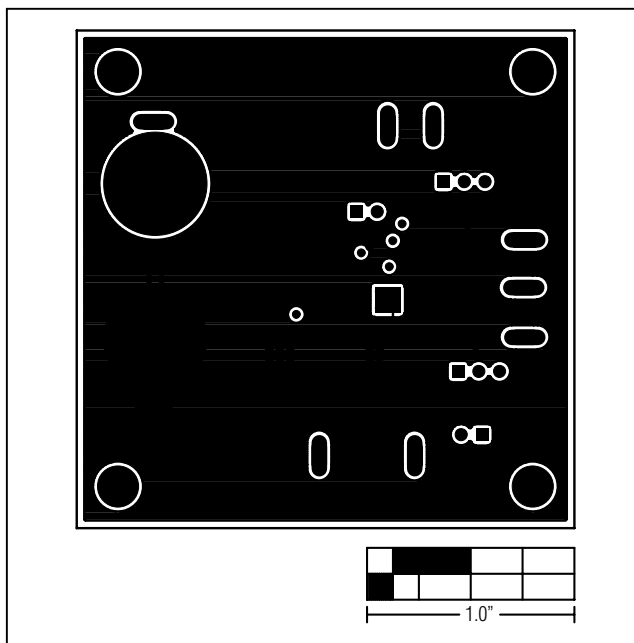


Figure 4. MAX16922 EV Kit PCB Layout—Layer 2 (GND)

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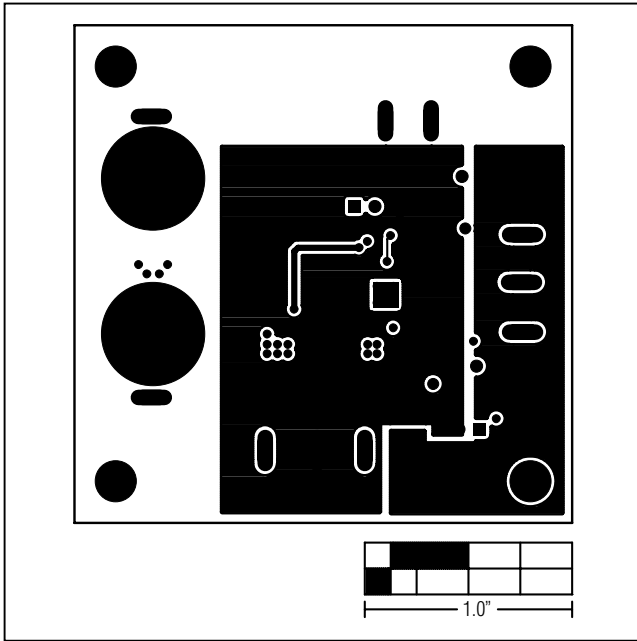


Figure 5. MAX16922 EV Kit PCB Layout—Layer 3 (PWR)

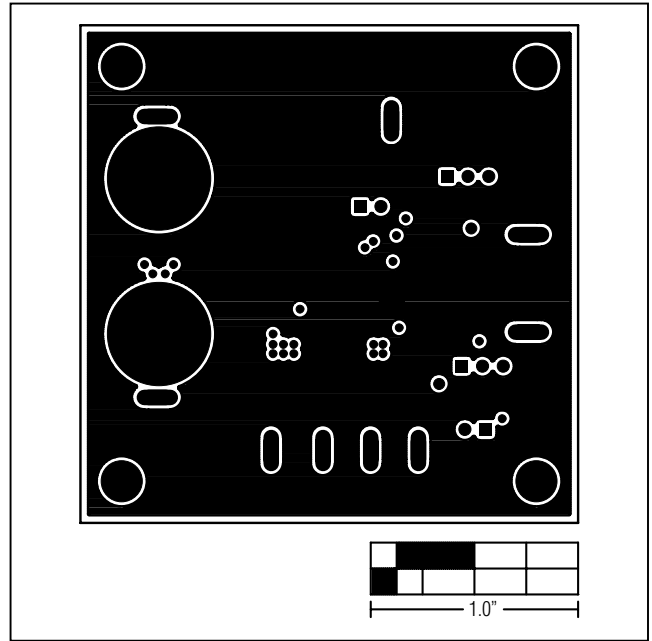


Figure 6. MAX16922 EV Kit PCB Layout—Solder Side

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