

# MAXIM

## MAX1932 Evaluation Kit

**Evaluates: MAX1932**

### General Description

The MAX1932 evaluation kit (EV kit) is a fully assembled and tested surface-mount printed circuit board (PCB). The EV kit contains a MAX1932 step-up switching regulator that includes an 8-bit DAC with an SPI™-compatible serial interface. The output of the step-up switching regulator is configured for a range of 40V to 90V and can provide up to 2mA. The EV kit is powered from a DC supply providing 4.5V to 5.5V. The EV kit can be reconfigured for an input voltage down to 3V.

The SPI-compatible serial interface can be connected to an IBM-compatible PC parallel port for evaluation. Windows® 95/98/2000-compatible software provides a user-friendly interface to demonstrate the features of the MAX1932 IC. The program is menu driven and offers a graphics interface with control buttons.

The MAX1932 EV kit features current-limit protection for the output. The MAX1932 thin QFN package and small external components permit the circuit area to be less than 0.6in x 0.9in.

SPI is a trademark of Motorola, Inc.

Windows is a registered trademark of Microsoft Corp.

### Features

- ◆ 4.5V to 5.5V Input Range
- ◆ Output Voltage Ranges from 40V to 90V
- ◆ Output Ranges are Adjustable with Resistors
- ◆ Overcurrent Protection
- ◆ SPI-Compatible Serial Interface
- ◆ Menu-Driven Software
- ◆ Windows 95/98/2000-Compatible Software
- ◆ Reconfigurable for Input Voltages Down to 3V (Refer to the MAX1932 IC Data Sheet)
- ◆ Surface-Mount Components
- ◆ Fully Assembled and Tested

### Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX1932EVKIT	0°C to +70°C*	12 Thin QFN (4mm x 4mm)
MAX1932EVKIT+	0°C to +70°C*	12 Thin QFN (4mm x 4mm)

\*This limited temperature range applies to the EV kit PCB only. The MAX1932 IC temperature range is -40°C to +85°C.

+Denotes a lead-free and RoHS-compliant EV kit.

### Component List

DESIGNATION	QTY	DESCRIPTION
C1, C6	2	1μF ±10%, 6.3V X5R ceramic capacitors (0603) TDK C1608X5R0J105K
C2	1	0.047μF ±10%, 100V X7R ceramic capacitor (0805) TDK C2012X7R2A473K
C3	1	0.1μF ±10%, 100V X7R ceramic capacitor (1206) TDK C3216X7R2A104K
C4	1	0.22μF ±10%, 10V X5R ceramic capacitor (0603) TDK C1608X5R1A224K
C7	1	0.1μF ±10%, 16V X7R ceramic capacitor (0603) TDK C1608X7R1C104K
D1	1	150mA, 100V Schottky barrier diode SOD123 Diodes Inc. BAT46W
D2, D3	2	200mA, 25V Schottky diodes SOT23 Fairchild BAT54C
J1	1	DB-25 male right-angle connector
J2	1	5-pin header
JU2, JU3, JU4	3	2-pin headers

DESIGNATION	QTY	DESCRIPTION
L1	1	100μH, 170mA inductor Sumida CMD4D13NP-101MC
N1	1	170mA, 100V N-channel MOSFET SOT23 Fairchild BSS123_NL
R1	1	806Ω ±1% resistor (0805)
R2	1	91kΩ ±5% resistor (0805)
R3, R9, R10	3	1MΩ ±5% resistors (0603)
R5	1	1MΩ ±1% resistor (0805)
R6	1	24.9kΩ ±1% resistor (0805)
R7	1	20kΩ ±5% resistor (0603)
R8	1	32.4kΩ ±1% resistor (0805)
R11	0	Not installed, resistor (0603)
U1	1	MAX1932ETC+ 12-pin Thin QFN (4mm x 4mm)
U2	1	MAX1841EUB+ 10-pin μMAX®
—	3	Shunts (JU2, JU3, JU4)
—	1	PCB: MAX1932 Evaluation Kit

μMAX is a registered trademark of Maxim Integrated Products, Inc.

# MAX1932 Evaluation Kit

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Diodes Inc.	805-446-4800	www.diodes.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Sumida USA	847-545-6700	www.sumida.com
TDK Corp.	847-803-6100	www.component.tdk.com

**Note:** Indicate that you are using the MAX1932 when contacting these component suppliers.

## Quick Start

### Required Equipment

The following equipment is required:

- MAX1932 EV kit
- 5V, 500mA DC power supply
- One voltmeter
- (Optional) Windows 95/98/2000 computer with a spare parallel (printer) port
- (Optional) 25-pin I/O extension cable

### Procedure with a Computer

The MAX1932 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.**

- 1) Install shunts on jumpers JU2, JU3, and JU4.
- 2) With the power off, connect the 5V DC power supply to the MAX1932 EV kit.
- 3) Connect the 25-pin I/O extension cable from the computer's parallel port to the MAX1932 EV kit board. The EV kit software uses a loopback connection to confirm that the correct port has been selected.
- 4) Install the evaluation software by running the INSTALL.EXE program on the floppy disk. The program files are copied and icons are created for them in the Windows Start menu.
- 5) Turn on the power supply. Verify that V<sub>OUT</sub> is approximately 40V.
- 6) Start the MAX1932 program by opening its icon in the Start menu.
- 7) Click on SPI 3-Wire Parallel Port Diagnostic (Figure 1).
- 8) Click on Bit-Banging Serial Interface.
- 9) Enter 0x01 into "Data bytes to be written" and click on Send Now (Figure 2).
- 10) Verify that the voltage at the V<sub>OUT</sub> pad is approximately 90V.

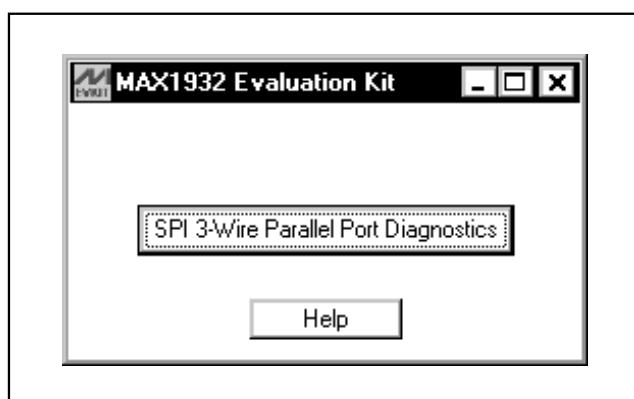


Figure 1. MAX1932 Evaluation Software's Main Window to Access the SPI 3-Wire Parallel Port Diagnostic Utility

- 11) Enter 0xFF into the "Data bytes to be written" box and click on Send Now.
- 12) Verify that the voltage at the V<sub>OUT</sub> pad is approximately 40V.
- 13) Header J2 is provided to monitor the parallel port pins supplying the CLK\_P, CS\_P, DIN\_P (5V signals), and loopback signal. The CS, SCLK, and DIN pads on the EV kit's bottom edge are V<sub>CC</sub> level-shifted signals from the MAX1841 translator. Both signal locations can be used for monitoring.

For instructions on selecting the feedback resistors for other output voltages, see the *Output Voltage Range* section.

### Procedure without a Computer

Do not turn on the power supply until all connections are completed:

- 1) Remove shunts on jumpers JU2, JU3, and JU4.
- 2) With the power off, connect the 5V DC power supply to the MAX1932 EV kit.
- 3) Turn on the power supply. Verify that V<sub>OUT</sub> is approximately 40V.

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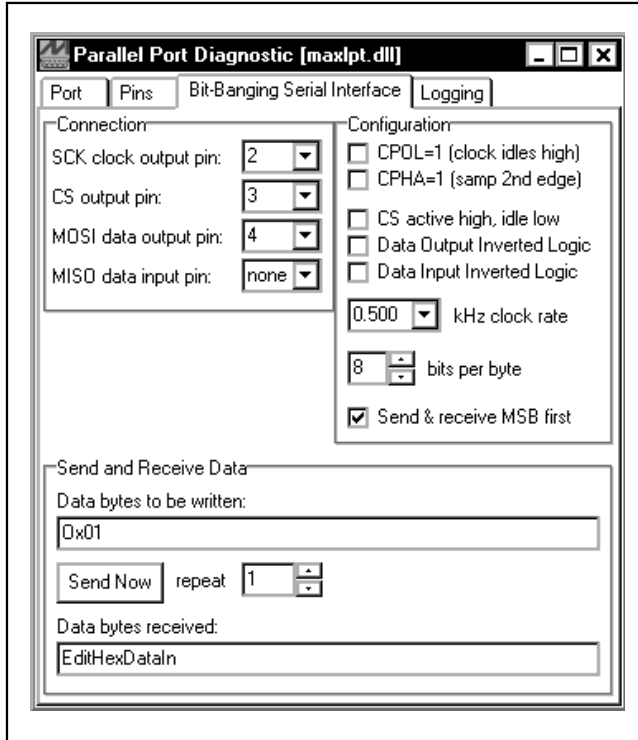


Figure 2. Parallel Port Diagnostic Window's Bit-Banging Serial Interface Tab

## Detailed Description

The MAX1932 EV kit contains a step-up switching regulator that includes an 8-bit DAC with an SPI-compatible serial interface. The output of the EV kit has two settings: the range voltage setting and a specific voltage setting within the range.

As configured, the step-up switching regulator can generate an output range of 40V to 90V and provide up to 2mA of current to the output with 4.75V input. The step-up switching-regulator output voltage can be reconfigured to ranges of 4.5V to 15V, 4.5V to 45V, and 20V to 60V with proper resistor selection (see the *Output Voltage Range* section).

The voltage setting within the range is set by the 8-bit DAC that receives input data from the SPI-compatible interface. The EV kit connects to a compatible PC parallel port and uses the port to control the EV kit. The EV kit's SPI signals are connected to a MAX1841 level translator (U2). The translator level shifts the computer's parallel port logic 5V signals to the EV kit's logic VCC voltage level chosen by the user. The translator can function with voltages down to 2.7V. The level

translator's parallel port side is powered by the parallel port's data pins 6, 7, 8, and 9, diodes D2/D3, and capacitor C6, which provides approximately 5V to the translator's input. The power supply connected to VCC provides power to the level translator's output. A 5-pin header (J2) is provided for monitoring the 5V CLK\_P, CS\_P, DIN\_P nonlevel-translated and loopback signals coming from the parallel port cable.

The EV kit can be reconfigured for stand-alone operation and connected to an external microcontroller for evaluation. PCB pads are provided for interfacing or monitoring the CS, SCLK, and DIN level-translated pins of the MAX1932 IC.

## Output Voltage Range

### Step-Up Switching Regulator Output Range

The MAX1932 EV kit's step-up switching regulator output range is set from 40V to 90V by feedback resistors R5, R6, and R8. To generate output voltage ranges other than 40V to 90V (4.5V to 15V, 4.5V to 45V, or 20V to 60V), select different external voltage-divider resistors (R5, R6, and R8). Refer to the *Output and DAC Adjustment Range* section in the MAX1932 data sheet for instruction on selecting resistors.

## Jumper Selection

### Stand-Alone Configuration

The MAX1932 EV kit features four jumpers (JU1–JU4) to reconfigure the EV kit for stand-alone operation mode or PC/software control mode. Tables 1 and 2 list the options for the desired evaluation mode. **Note:** All jumpers must be configured for only one mode at a time. A suitable voltage must be selected for stand-alone mode. Configure all jumpers for either stand-alone or PC/software control mode.

## Detailed Description of Software

The MAX1932 EV kit software's main window has a button to start the SPI 3-wire parallel port diagnostic utility used for bit-banging data into the MAX1932. Click on SPI 3-Wire Parallel Port Diagnostic to start the utility.

### SPI/3-Wire Diagnostic

The SPI/3-wire diagnostic screen allows you to send SPI or 3-wire commands, or manipulate the parallel port pins directly. Each of the 25 pins is represented by a checkbox. A checkmark means that the corresponding pin is at a logic-high level. Unused and grounded pins are gray.

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**Table 1. Stand-Alone Mode**

JUMPER	SHUNT	JUMPER FUNCTION	EV KIT MODE
JU1	Cut open	U2 level translator VCC pin isolated	U2 power disconnected
JU2	Not installed	U2 level translator SCLK signal isolated from EV kit	Stand-alone, external controller connected to SCLK pad
JU3	Not installed	U2 level translator $\overline{CS}$ signal isolated from EV kit	Stand-alone, external controller connected to $\overline{CS}$ pad
JU4	Not installed	U2 level translator DIN signal isolated from EV kit	Stand-alone, external controller connected to DIN pad

**Table 2. PC/Software Control Mode**

JUMPER	SHUNT	JUMPER FUNCTION	EV KIT MODE
JU1	Shorted	U2 level translator powered from VCC rail	U2 power connected
JU2	Installed	U2 level translator provides SCLK signal	PC/software control through parallel port
JU3	Installed	U2 level translator provides $\overline{CS}$ signal	PC/software control through parallel port
JU4	Installed	U2 level translator provides DIN signal	PC/software control through parallel port

The bit-banging SPI diagnostic utility transmits data using synchronous serial format (similar to Motorola's 68HC11 SPI interface). The SPI interface sends and receives data simultaneously on separate pins. Parallel port pin 2 drives the CLK\_P, pin 3 drives CS\_P, and pin 4 drives DIN\_P.

The data to be sent is 8-bit data represented by a two-digit hexadecimal DAC code. The DAC code ranges from 0x01 to 0xFF. The output is at the higher limit, 90V, when the DAC code is 0x01, and at the lower limit, 40V, when the DAC code is 0xFF. The DAC code is entered in the "Data bytes to be written" box and transmitted by clicking on Send Now.

### Troubleshooting

#### **Problem: Cannot find the MAX1932 EV kit parallel port connection.**

Ensure that the I/O extension cable is connected to a parallel port and not to a SCSI or other type of port. Verify that the supplied LPTCON.VXD is in the same directory as MAX1932.EXE. If a local printer driver is installed, temporarily disable it. The software does not work if the program icon is dragged onto the Windows desktop.

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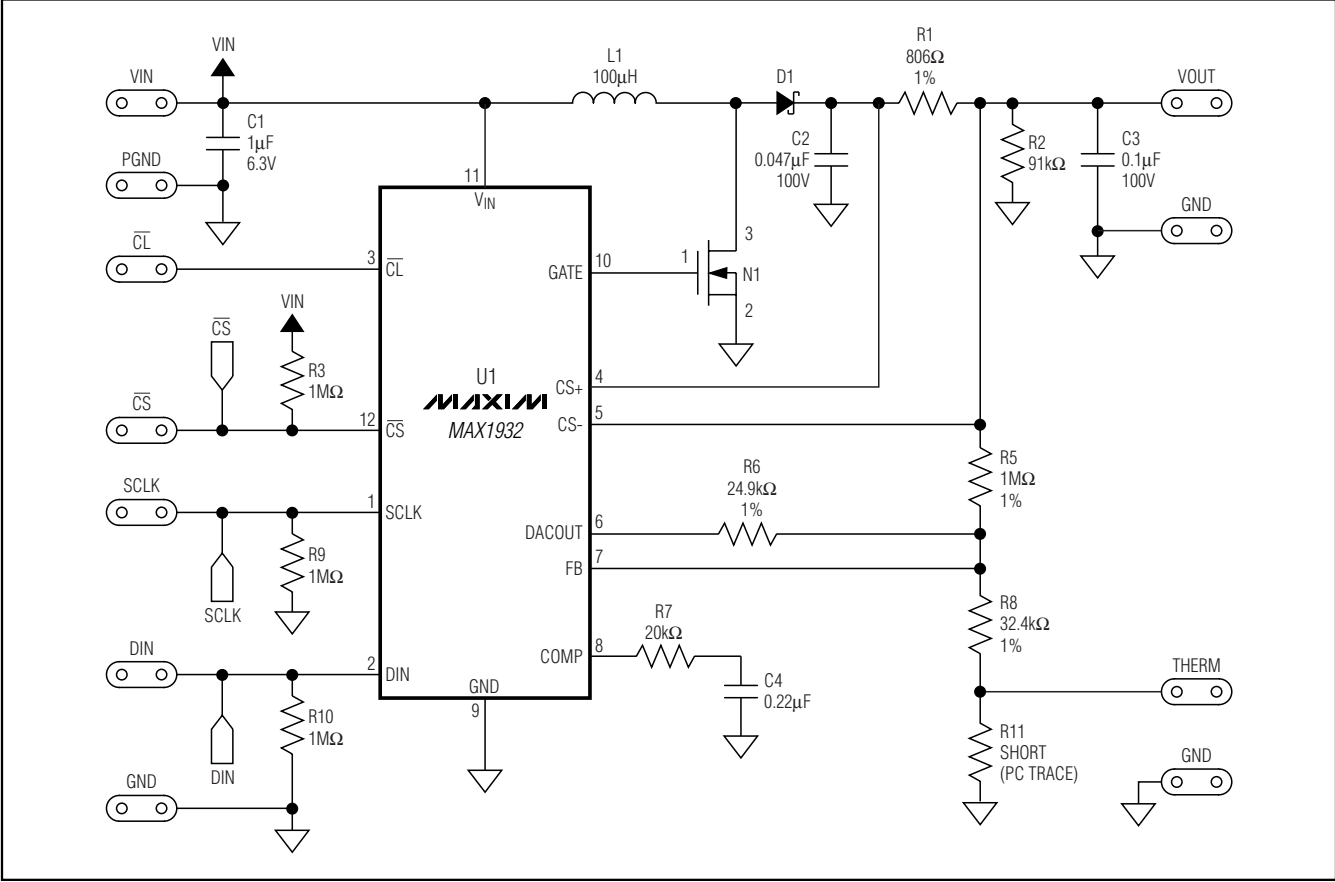


Figure 3a. MAX1932 EV Kit Schematic (Sheet 1 of 2)

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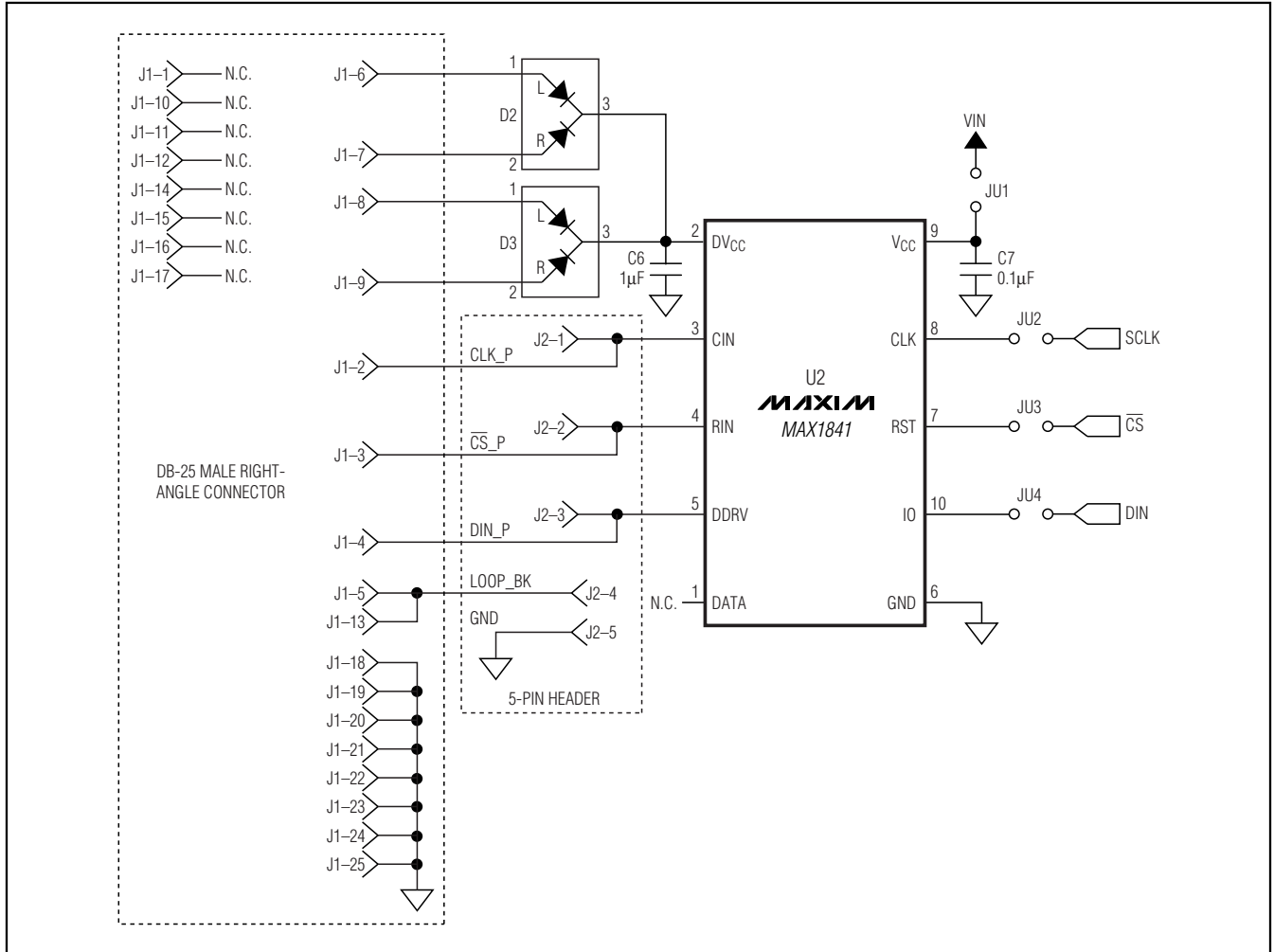


Figure 3b. MAX1932 EV Kit Schematic (Sheet 2 of 2)

# MAX1932 Evaluation Kit

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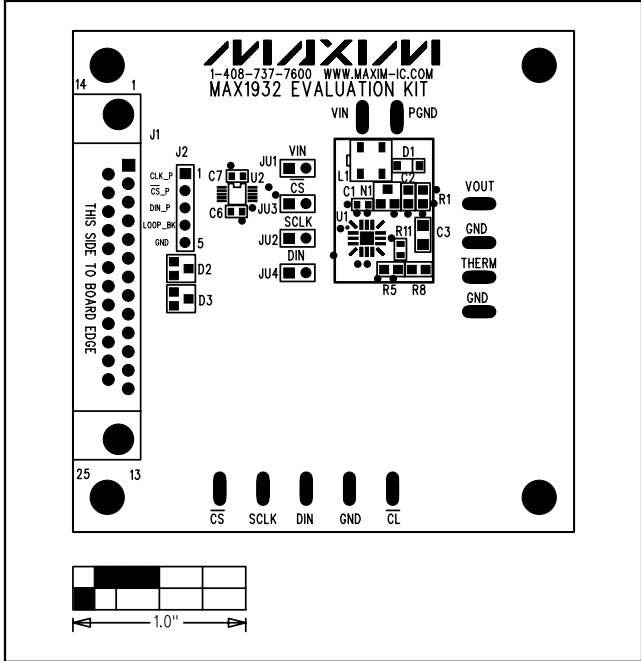


Figure 4. MAX1932 EV Kit Component Placement Guide—Component Side

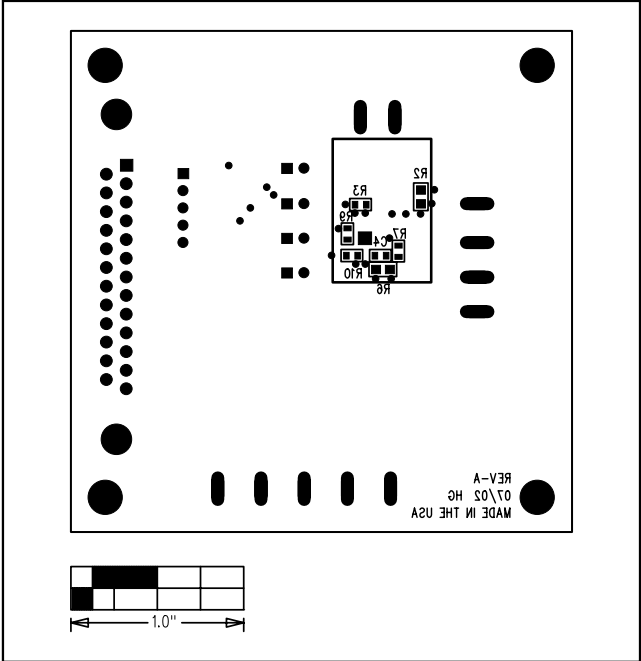


Figure 5. MAX1932 EV Kit Component Placement Guide—Solder Side

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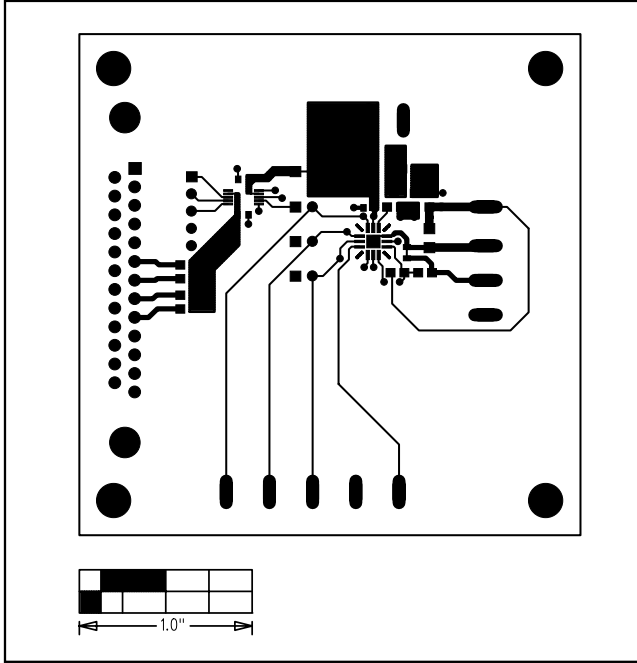


Figure 6. MAX1932 EV Kit PCB Layout—Component Side

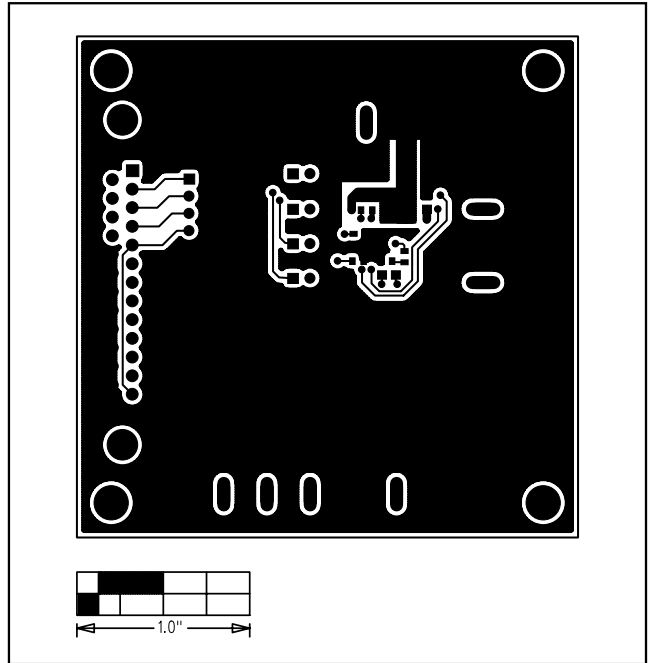


Figure 7. MAX1932 EV Kit PCB Layout—Solder Side

## Revision History

Pages changed at Rev 1: 1, 2, 3, 5, 6, 7

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