



MAX1586A Evaluation System/ MAX1586A Evaluation Kit

General Description

The MAX1586A evaluation system (EV system) consists of a MAX1586A evaluation kit (EV kit) and a companion Maxim system management bus (SMBus™) interface board.

The MAX1586A evaluation kit (EV kit) is a fully assembled and tested surface-mount circuit board that evaluates the MAX1586A power-management IC (PMIC). The IC is optimized for microprocessor-based applications. The MAX1586A integrates three high-performance synchronous step-down DC-DC power supplies, three low-dropout (LDO) regulators, a battery backup supply, and various power-management functions.

The Maxim SMBus interface board (MAXSMBUS) allows an IBM-compatible PC to use its parallel port to emulate an SMBus/I²C™-compatible 2-wire interface. Windows 98/2000/XP®-compatible software provides a professional interface to exercise the features of the MAX1586A. The program is menu driven and offers a graphical user interface (GUI) with control buttons and a status display.

The MAX1586AEVSYS includes both the EV kit and the MAXSMBUS interface board. Order the MAX1586A EVKIT if you already have an SMBus interface.

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Windows is a registered trademark of Microsoft Corp.

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Features

- ◆ 2.6V to 5.5V Single-Supply Operation
- ◆ Seven-Output Power Supply
 - 3.3V at 1.3A (VCC_I/O)
 - 2.5V at 900mA (VCC_MEM)
 - 0.7 to 1.475V at 500mA (VCC_CORE) Software Adjustable
 - 1.3V at 35mA (VCC_PLL)
 - 1.1V at 40mA (VCC_SRAM)
 - 0 to 3V at 35mA (VCC_USIM) Software-Adjustable
- ◆ Backup Battery Supply (30mA)
- ◆ 1MHz Switching Frequency
- ◆ On-Board Manual Reset Switch
- ◆ Optional On-Board Power-Sequencing Circuitry
- ◆ Power-OK Output
- ◆ SMBus/I²C-Compatible 2-Wire Serial Interface
- ◆ Easy-to-Use Menu-Driven Software
- ◆ Software-Controlled Core and USIM Voltage Adjustment
- ◆ Assembled and Tested
- ◆ Include Windows 98/2000/XP-Compatible Software
- ◆ Also Evaluate the MAX1586B

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Ordering Information

PART	TEMP RANGE	IC PACKAGE	SMBus INTERFACE TYPE
MAX1586AEVKIT	0°C to +70°C	48 QFN	Not included
MAX1586AEVSYS	0°C to +70°C	48 QFN	MAXSMBUS

Note: The MAX1586A EV kit software is provided with the MAX1586AEVKIT; however, the MAXSMBUS board is required to interface the EV kit to the computer when using the included software.

Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
Central Semiconductor	631-435-1110	631-435-1824	www.centrasemi.com
Sumida USA	847-545-6700	847-545-6720	www.sumida.com
TDK	847-803-6100	847-390-4405	www.component.tdk.com
TOKO America	847-297-0070	847-699-1194	www.tokoam.com

Note: Please indicate that you are using the MAX1586A when contacting these component suppliers.



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Component List

DESIGNATION	QTY	DESCRIPTION
C1–C6	0	Not installed (0603)
C7	0	Not installed (0805)
C8, C9, C10	0	Not installed (0402)
C11, C15, C16, C17, C29, C30, C33	7	10 μ F \pm 20%, 6.3V X5R ceramic capacitors (0805) TDK C2012X5R0J106M
C12, C13, C14, C31, C32	5	4.7 μ F \pm 20%, 6.3V X5R ceramic capacitors (0805) TDK C2012X5R0J475M
C18	1	1500pF \pm 10%, 50V X7R ceramic capacitor (0402) TDK C1005X7R1H152K
C19	1	0.1 μ F \pm 20%, 10V X5R ceramic capacitor (0402) TDK C1005X5R1A104M
C20	1	0.01 μ F \pm 20%, 25V X7R ceramic capacitor (0402) TDK C1005X7R1E103M
C21–C25	5	1.0 μ F \pm 20%, 10V X5R ceramic capacitors (0603) TDK C1608X5R1A105M
C26, C28	2	330pF \pm 5%, 50V C0G ceramic capacitors (0603) TDK C1608C0G1H331J

DESIGNATION	QTY	DESCRIPTION
C27	1	270pF \pm 5%, 50V C0G ceramic capacitor (0603) TDK C1608C0G1H271J
D1	1	Switching diode (SOT323) Central Semiconductor CMSD4448
J1	1	2 x 10 right-angle female receptacle
JU1–JU9	9	Jumpers, 3-pin headers
L1	1	3.3 μ H, 2.66A inductor TOKO A915AY-3R3M
L2	1	6.8 μ H, 1.51A inductor TOKO A915AY-6R8M
L3	1	10 μ H, 0.85A inductor Sumida CDRH2D18/HP-100 TOKO A960AW-100M
R1–R6, R14, R15	0	Not installed (0603)
R7–R13, R24, R25	0	Not installed (0402)
R16–R20	5	1M Ω \pm 5% resistors (0402)
R21, R22, R23	3	240k Ω \pm 1% resistors (0402)
SW1	1	Momentary pushbutton switch
U1	1	MAX1586AETM (QFN thin 48)
None	9	Shunts
None	1	MAX1586A PC board
None	1	Software disk (CD-ROM) "MAX1586A Evaluation Kit"

Quick Start

Recommended Equipment

- Computer running Windows 98, 2000, or XP
- Parallel printer port (this is a 25-pin socket on the back of the computer)
- Standard 25-pin, straight-through, male-to-female cable (printer extension cable) to connect the computer's parallel port to the Maxim SMBus interface board
- 9V/50mA DC power supply
- 4.5V/2A DC power supply
- 3.6V backup battery (optional)
- 8 voltmeters

Procedure

The MAX1586A EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Do not turn on the power supply until all connections are completed:**

- 1) Carefully connect the boards by aligning the 20-pin connector of the MAX1586A EV kit with the 20-pin header of the MAXSMBUS interface board. Gently press them together.
- 2) Ensure that a shunt is placed across pins 1 and 2 of jumpers JU1, JU2, JU3, JU4, JU5, JU6, and JU7.
- 3) Ensure that a shunt is placed across pins 2 and 3 of jumpers JU8 and JU9.
- 4) Connect a cable from the computer's parallel port to the SMBus interface board. Use a straight-through 25-pin female-to-male cable.

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- 5) Use the INSTALL.EXE program on the provided CD-ROM to copy the files and create icons in the Windows 98/2000/XP **Start** menu.

Do not turn on the power until all connections are made.

- 6) Connect the 9V power supply to the pads labeled POS9 and GND1 on the MAXSMBUS interface board.
- 7) Connect the 4.5V power supply to the pads labeled VIN and GND on the MAX1586A EV kit board.
- 8) Connect the optional backup battery to the pads labeled BKBT and GND.
- 9) Connect a voltmeter to the pads labeled VCC_I/O and GND.
- 10) Connect a voltmeter to the pads labeled VCC_MEM and GND.
- 11) Connect a voltmeter to the pads labeled VCC_CORE and GND.
- 12) Connect a voltmeter to the pad labeled VCC_PLL and the GND pad (located below the VCC_PLL pad).
- 13) Connect a voltmeter to the pads labeled VCC_SRAM and GND.
- 14) Connect a voltmeter to the pads labeled VCC_USIM and GND.
- 15) Connect a voltmeter to the pads labeled VCC_BATT and GND.
- 16) Connect a voltmeter to the pads labeled POK and GND.
- 17) Turn on the DC power supplies.
- 18) Verify the following voltages:
 - VCC_I/O = 3.3V
 - VCC_MEM = 2.5V
 - VCC_CORE = 1.3V
 - VCC_PLL = 1.3V
 - VCC_SRAM = 1.1V
 - VCC_BATT = 3.3V
 - VCC_USIM = 0V
- 19) Verify that POK is high.
- 20) Start the MAX1586A program by opening its icon in the **Start** menu.
- 21) Observe as the program automatically detects the address of the MAX1586A and starts the main program.

— Detailed Description of Software

User-Interface Panel

The user interface (Figure 1) is easy to operate; use the mouse or press the Tab key to navigate with the arrow keys. Each button corresponds to bits in the command and configuration bytes. By clicking on them, the correct SMBus write operation is generated to update the internal registers of the MAX1586A. The **Interface** box indicates the current **Device Address**, the **Data Sent/Received** (the MAX1586A EV kit software only sends) for the last read/write operation. This data is used to confirm proper device operation.

Note: Words in boldface are user-selectable features in the software.

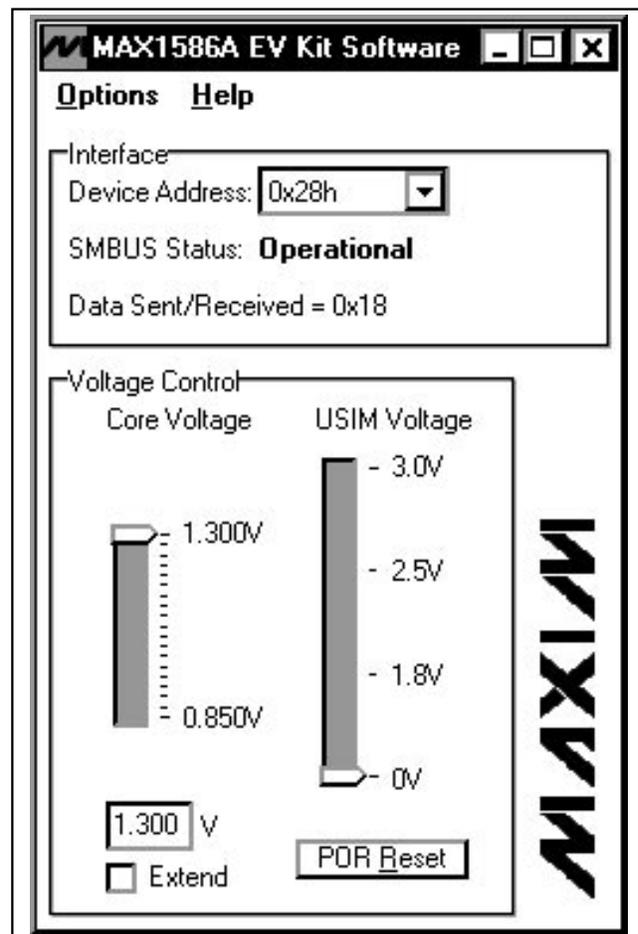


Figure 1. MAX1586A EV Kit Software Main Window

Evaluate: MAX1586A

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Core Voltage Control

The core voltage (VCC_CORE) can be adjusted in 25mV increments by adjusting the **Core Voltage** slider. Alternatively, a number can be entered in the box below the **Core Voltage** slider. If a number not divisible by 0.025 is entered, the software automatically rounds the number to the nearest 25mV increment and sends the appropriate data to the MAX1586A.

Check the **Extend** checkbox to increase the core voltage range to 0.7V to 1.475V.

USIM Voltage Control

The USIM voltage (VCC_USIM) can be adjusted to one of four preset voltages. Adjust the **USIM Voltage** slider to select the desired voltage.

Simple SMBus Commands

There are two methods for communicating with the MAX1586A: through the normal user-interface panel or

through the SMBus commands available by selecting the **2-Wire Interface Diagnostic** item from the **Options** pulldown menu. A display pops up that allows the SMBus protocols, such as Read Byte, Write Byte, and Send Byte, to be executed.

The SMBus dialog boxes accept numeric data in binary, decimal, or hexadecimal form. Hexadecimal numbers should be prefixed by \$ or 0x. Binary numbers must be exactly eight digits. See Figure 2 for an example of this tool.

Note: In places where the slave address asks for an 8-bit value, it must be the 7-bit slave address of the MAX1586A as determined by SRAD with the last bit set to 1 for a read operation or zero for a write. Refer to the MAX1586A data sheet for a complete list of registers and functions.

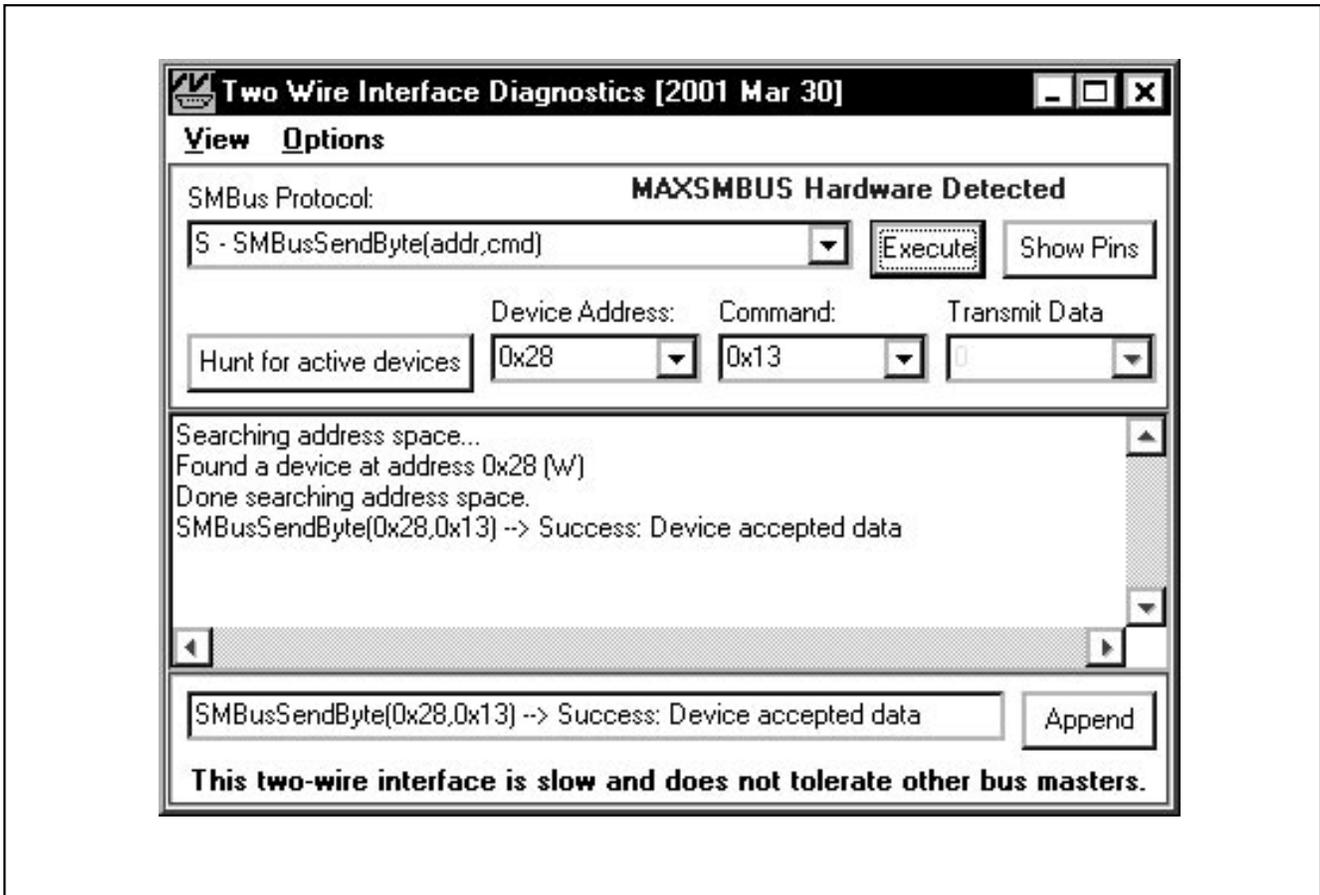


Figure 2. A Simple SMBusSendByte Operation Using the Included Two-Wire Interface Diagnostics. In this example, the software is writing data (0x13) to Device Address 0x28. The above data sequence sets the core voltage of the MAX1586A to 1.175V.

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Detailed Description of Hardware

The MAX1586A EV kit is a fully assembled and tested surface-mount circuit board that evaluates the MAX1586A PMIC. The MAX1586A integrates three high-performance, 1MHz, synchronous step-down DC-DC power supplies, three low-dropout regulators, and a battery backup supply.

The power outputs consist of a 3.3V at 1.3A I/O (VCC_I/O) step-down output, a 2.5V at 900mA memory (VCC_MEM) step-down output, a software-adjustable 0.7V to 1.475V at 500mA core (VCC_CORE) step-down output, a 1.3V at 35mA phase-locked loop (VCC_PLL) LDO, a 1.1V at 40mA SRAM (VCC_SRAM) LDO, and a software-adjustable 0 to 3.0V at 35mA (VCC_USIM) LDO. An additional 30mA backup battery (VCC_BATT) output is also available.

Power-management functions include a power-OK (POK) output, a manual reset input, multiple output-enable inputs, a sleep function, and a reset output. Activate the manual reset input by pressing the switch labeled SW1.

Power sequencing is also available through component placeholders R1–R6 and C1–C6. See the *Optional Power-Sequencing Circuitry* section in the document for more details.

Address Selection

Jumper JU9 sets the MAX1586A slave address. The default address is 0010 1000 (SRAD = GND). See Table 1 for a complete list of addresses.

Sleep Mode

Jumper JU7 controls the sleep function of the MAX1586A EV kit. Removing the shunt from JU7 allows the sleep function to be controlled by an external signal source connected to the $\overline{\text{SLP}}$ pad. See Table 2 for sleep shunt positions.

Table 1. Shunt Settings for SMBus Address (JU9)

SHUNT POSITION	MAX1586A ADDRESS PIN	MAX1586A ADDRESS	
		BINARY	HEXADECIMAL
1-2	VIN	0010 1010	0x2A
2-3*	GND	0010 1000	0x28

*Default Configuration: JU9 (2-3)

Table 2. Sleep Selection (JU7)

SHUNT POSITION	DESCRIPTION
1-2*	I/O and MEM DC-DC converters enabled.
2-3	I/O and MEM DC-DC converters disabled. I/O and MEM sleep LDOs enabled.
Not installed	$\overline{\text{SLP}}$ function controlled by an external signal source.

*Default Configuration: JU7 (1-2)

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Table 3. Output Enable (JU1–JU6)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1 (ON1)	1-2*	VCC_I/O output enabled.
	2-3	VCC_I/O output disabled.
	Not installed	ON1 controlled by an external signal source.
JU2 (ON2)	1-2*	VCC_MEM output enabled.
	2-3	VCC_MEM output disabled.
	Not installed	ON2 controlled by an external signal source.
JU3 (ON3)	1-2*	VCC_CORE output enabled.
	2-3	VCC_CORE output disabled.
	Not installed	ON3 controlled by an external signal source.
JU4 (ON4)	1-2*	VCC_PLL output enabled.
	2-3	VCC_PLL output disabled.
	Not installed	ON4 controlled by an external signal source.
JU5 (ON5)	1-2*	VCC_SRAM output enabled.
	2-3	VCC_SRAM output disabled.
	Not installed	ON5 controlled by an external signal source.
JU6 (ON6)	1-2*	VCC_USIM output enabled.
	2-3	VCC_USIM output disabled.
	Not installed	ON6 controlled by an external signal source.

*Default Configuration: JU1 (1-2), JU2 (1-2), JU3 (1-2), JU4 (1-2), JU5 (1-2), JU6 (1-2)

Output Enables

Jumpers JU1–JU6 control the on/off state of the MAX1586A EV kit VCC_I/O, VCC_MEM, VCC_CORE, VCC_PLL, VCC_SRAM, and VCC_USIM outputs. Removing the shunt allows the output enable function to be controlled by an external signal source. See Table 3 for output enable shunt positions.

Table 4. Pulse-Skipping Mode Selection (JU8)

SHUNT POSITION	DESCRIPTION
1-2	VCC_CORE pulse-skipping mode disabled (forced PWM).
2-3*	VCC_CORE pulse-skipping mode enabled.

*Default Configuration: JU8 (2-3)

Pulse-Skipping Mode

Jumper JU8 controls the pulse-skipping mode of the VCC_CORE output. See Table 4 for pulse-skipping mode shunt positions.

Adjusting the I/O Voltage

The VCC_I/O (I/O) output voltage can be adjusted from its default value of 3.3V. Cut the trace at R12 and install a 0Ω resistor at R24 to set the I/O voltage to 3.0V. To set the I/O voltage to an alternative value, cut the trace at R12 and install resistors at R10 and R12. Use the equation below to calculate resistor values:

$$R_{10} = R_{12} \times \left(\frac{V_{CC_I/O}}{V_{FB1}} - 1 \right)$$

where:

R₁₂ = 100kΩ

VCC_I/O = desired I/O voltage

V_{FB1} = 1.25V

Adjusting the MEM Voltage

The VCC_MEM (MEM) output voltage can be adjusted from its default value of 2.5V. Cut the trace at R13 and install a 0Ω resistor at R18 to set the MEM voltage to 1.8V. To set the MEM voltage to an alternative value, cut the trace at R13 and install resistors at R11 and R13. Use the equation below to calculate resistor values:

$$R_{11} = R_{13} \times \left(\frac{V_{CC_MEM}}{V_{FB2}} - 1 \right)$$

where:

R₁₃ = 100kΩ

VCC_MEM = desired MEM voltage

V_{FB2} = 1.25V

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Low-Battery Detection

The MAX1586A is capable of monitoring the main battery input voltage and activating outputs when the voltage falls below a given threshold. The default EV kit configuration triggers the low-battery output when the input voltage falls below 3.6V. The dead-battery output is triggered when the input voltage falls below 3.2V. Monitor the outputs at the $\overline{\text{LBO}}$ and $\overline{\text{DBO}}$ pads.

To alter the EV kit defaults, cut the trace at R7 and R8 and install resistors at locations R7, R8, and R9. Use the following equations to calculate resistor values:

$$R_8 = \left(\frac{\text{DBI}}{\text{LBI}} \times \frac{V_{\text{inL}}}{V_{\text{inD}}} - 1 \right) \times R_9$$

$$R_7 = R_9 \times \left(\frac{V_{\text{inL}}}{\text{LBI}} - 1 \right) - R_8$$

where:

LBI = 1.0V

DBI = 1.232V

V_{inL} = desired low-battery detection voltage

V_{inD} = desired dead-battery detection voltage

R_9 = 100k Ω

Note: The following conditions must be met.

$V_{\text{inL}} \geq \text{LBI}$ (1.0V)

$V_{\text{inD}} \geq \text{DBI}$ (1.232V)

Optional Power-Sequencing Circuitry

The MAX1586A EV kit provides extra pads to support power sequencing. The directions below describe the implementation of this feature.

- 1) Cut the trace at R1–R6.
- 2) To create an RC time delay:
Install resistors and capacitors at locations R1–R6 and C1–C6.
- 3) Ensure that shunts are installed across pins 1 and 2 of jumpers JU1–JU6.

Calculate component values using the equation below:

$$R_n = \frac{-t}{C_n \times \ln\left(1 - \frac{V_{\text{TH}}}{V_{\text{in}}}\right)}$$

where:

C_n = 0.1 μF

V_{TH} = 1.1V

V_{in} = battery input voltage

t = desired startup time

Using an Alternative SMBus Interface

The MAX1586A EV kit provides pads and pullup resistor placeholders that allow an alternative SMBus/I²C-compatible interface to be used. Connect the interface through the SCL, SDA, and GND pads. Install pullup resistors at positions R14 and R15 if required.

Evaluating the MAX1586B

To evaluate the MAX1586B, replace IC U1 with a MAX1586BETM.

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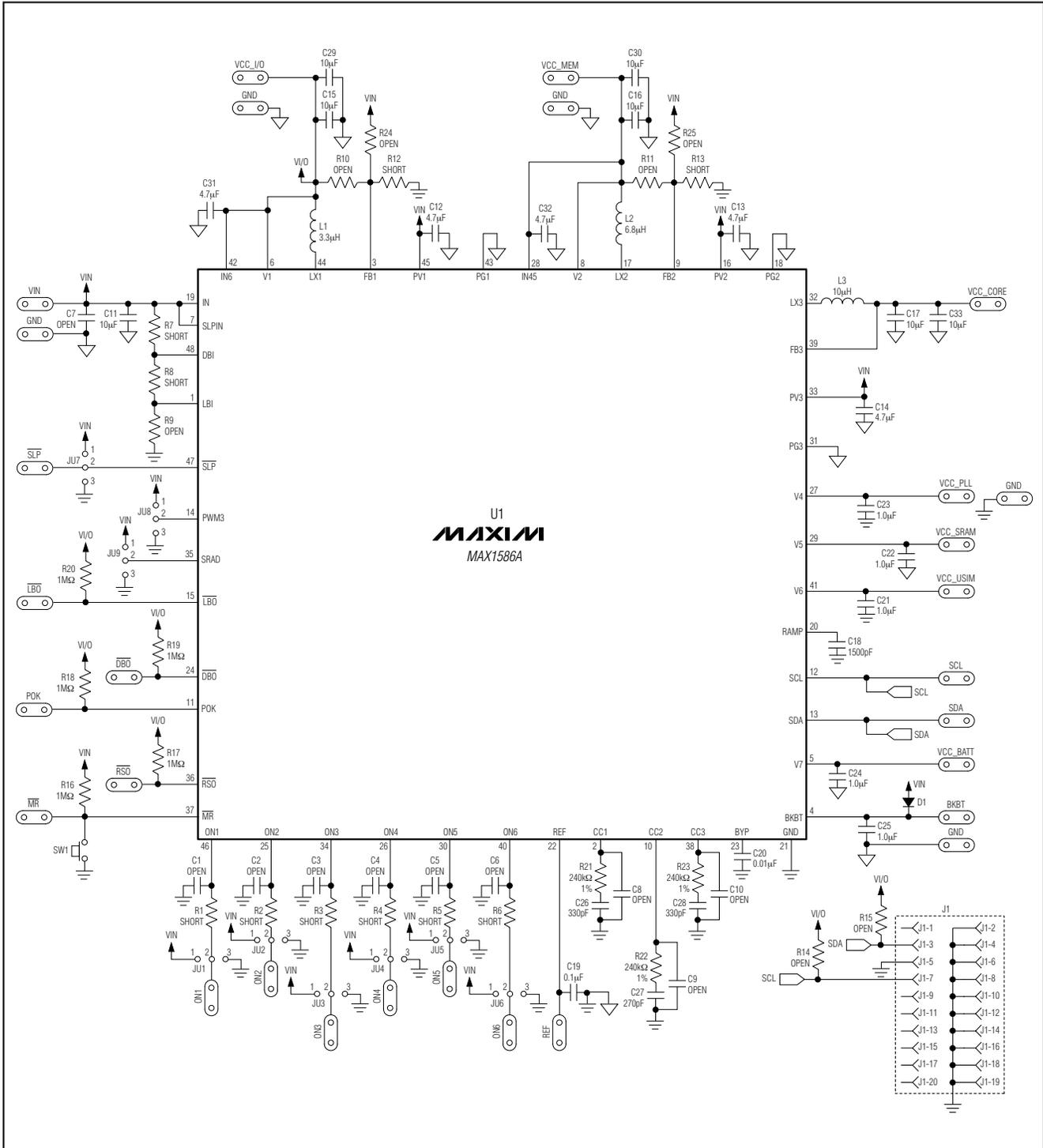


Figure 3. MAX1586A EV Kit Schematic

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Evaluate: MAX1586A

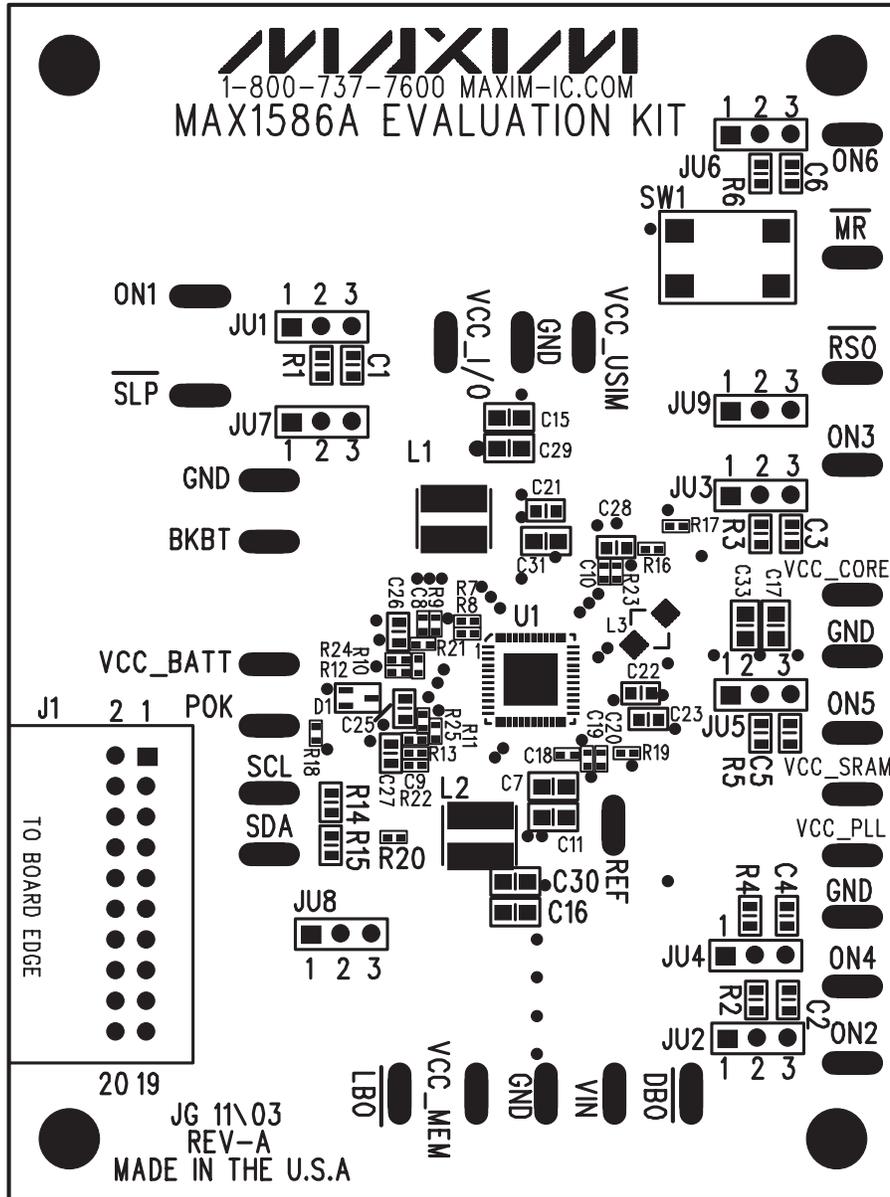


Figure 4. MAX1586A EV Kit Component Placement Guide—Component Side

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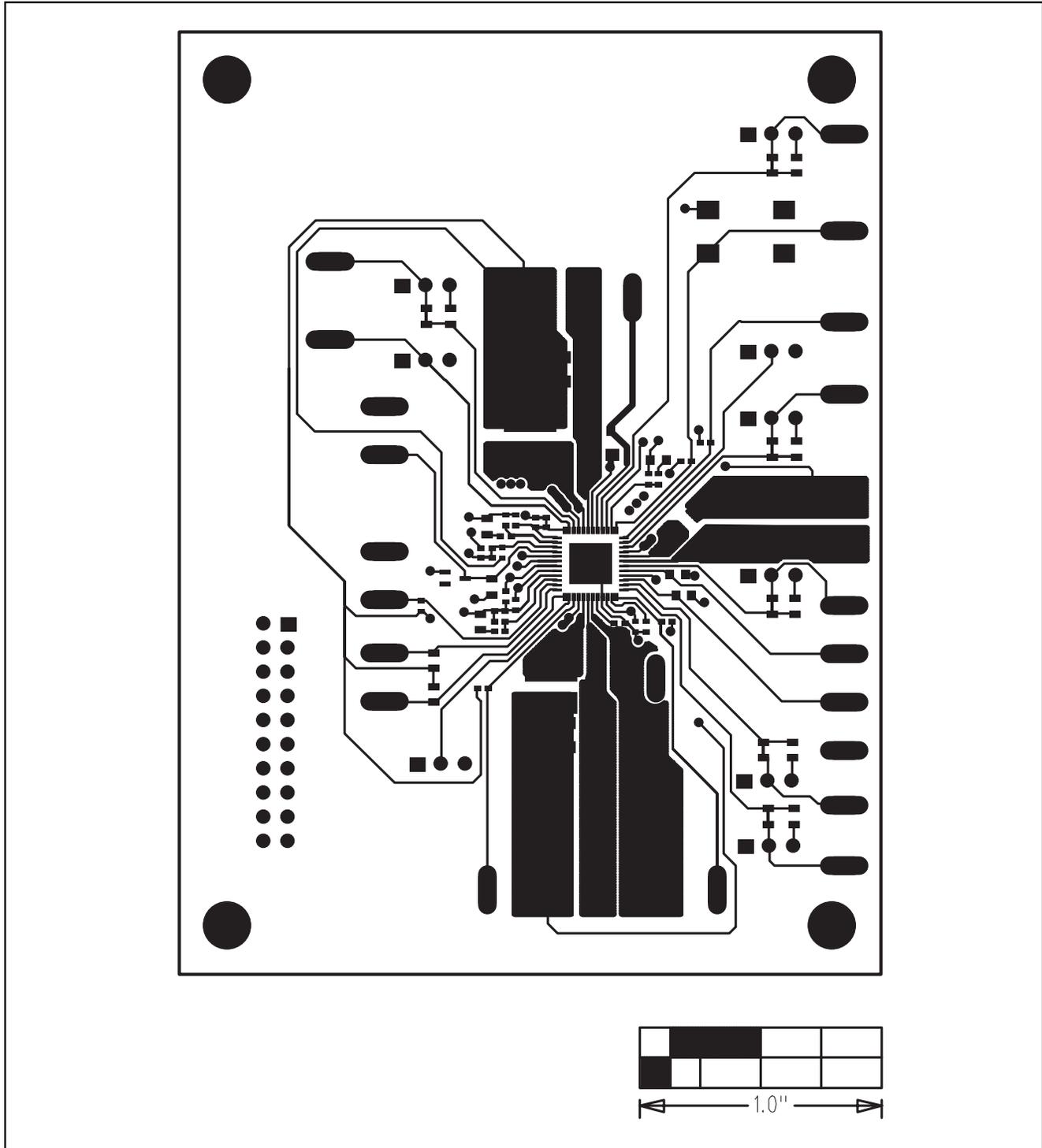


Figure 5. MAX1586A EV Kit PC Board Layout—Component Side

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Evaluate: MAX1586A

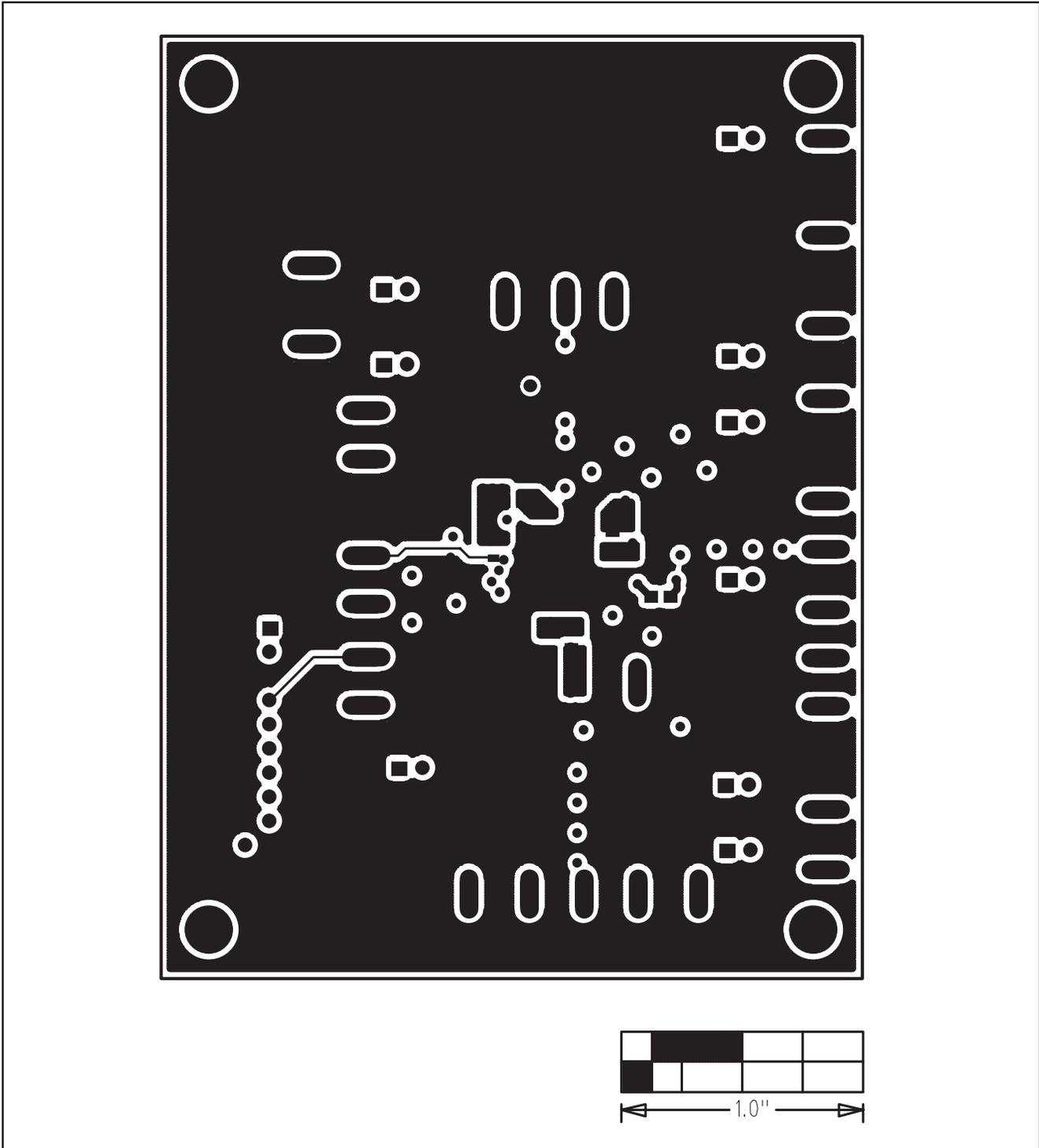


Figure 6. MAX1586A EV Kit PC Board Layout—Inner Layer 2

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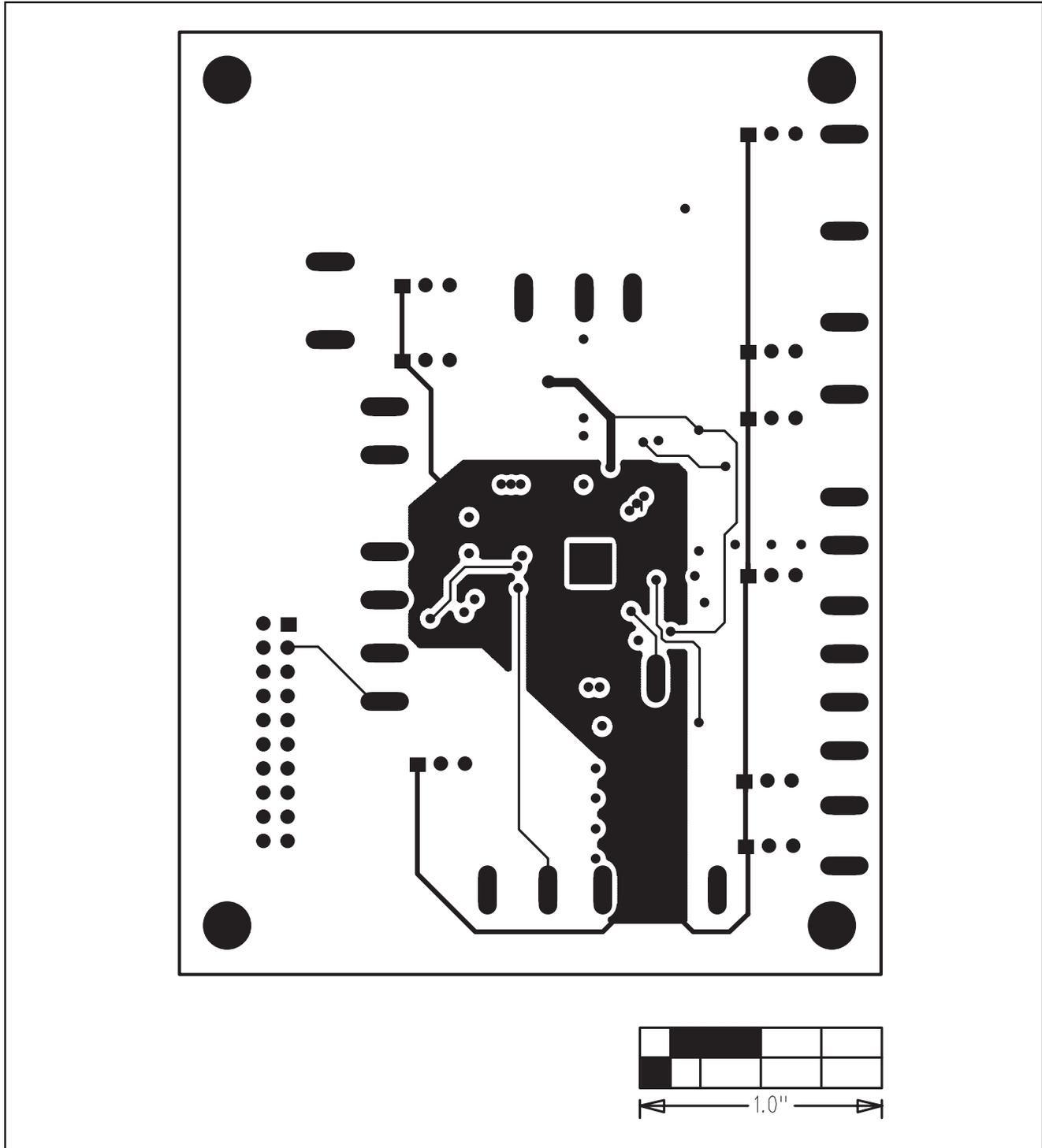


Figure 7. MAX1586A EV Kit PC Board Layout—Inner Layer 3

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Evaluate: MAX1586A

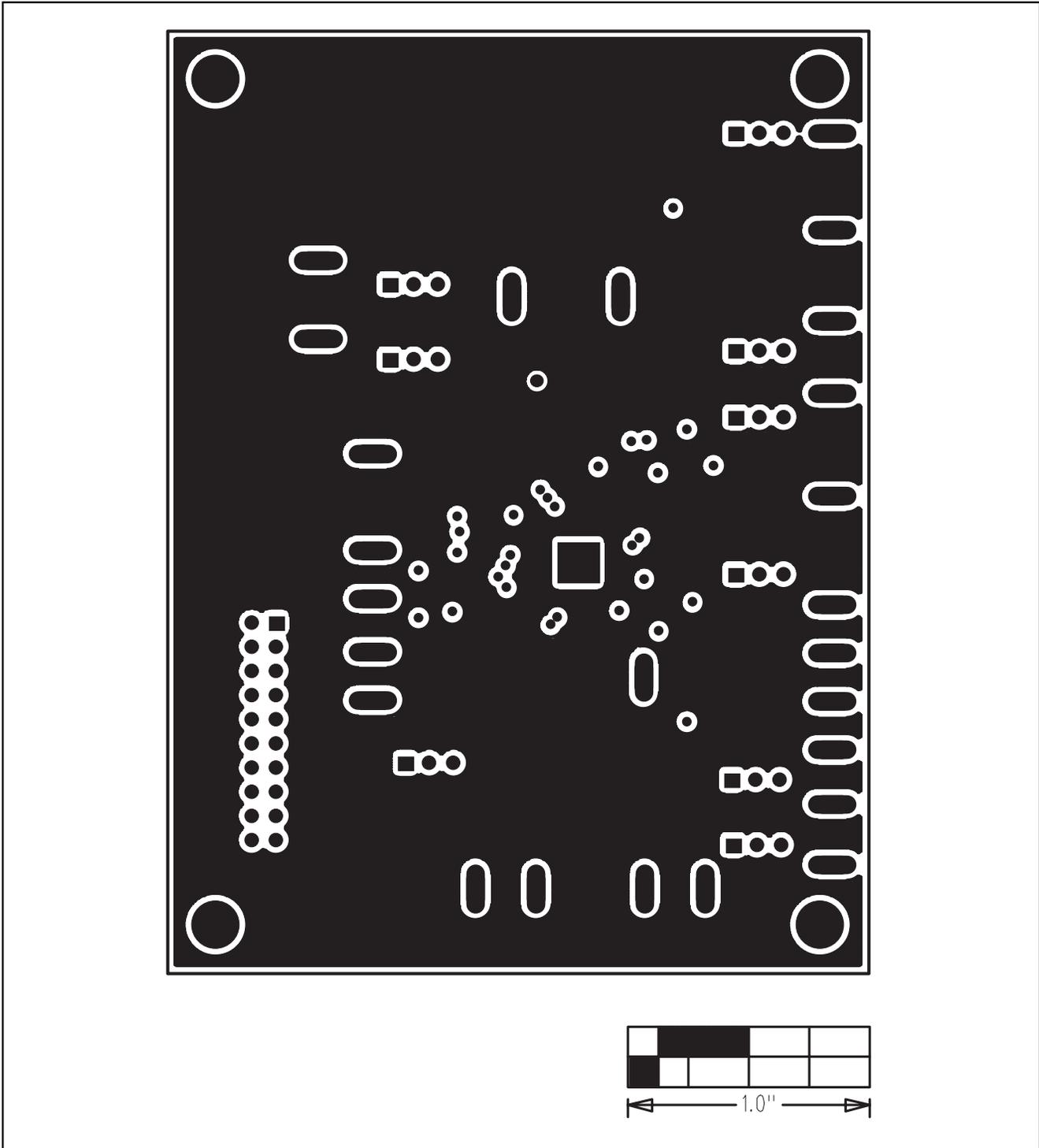


Figure 8. MAX1586A EV Kit PC Board Layout—Solder Side

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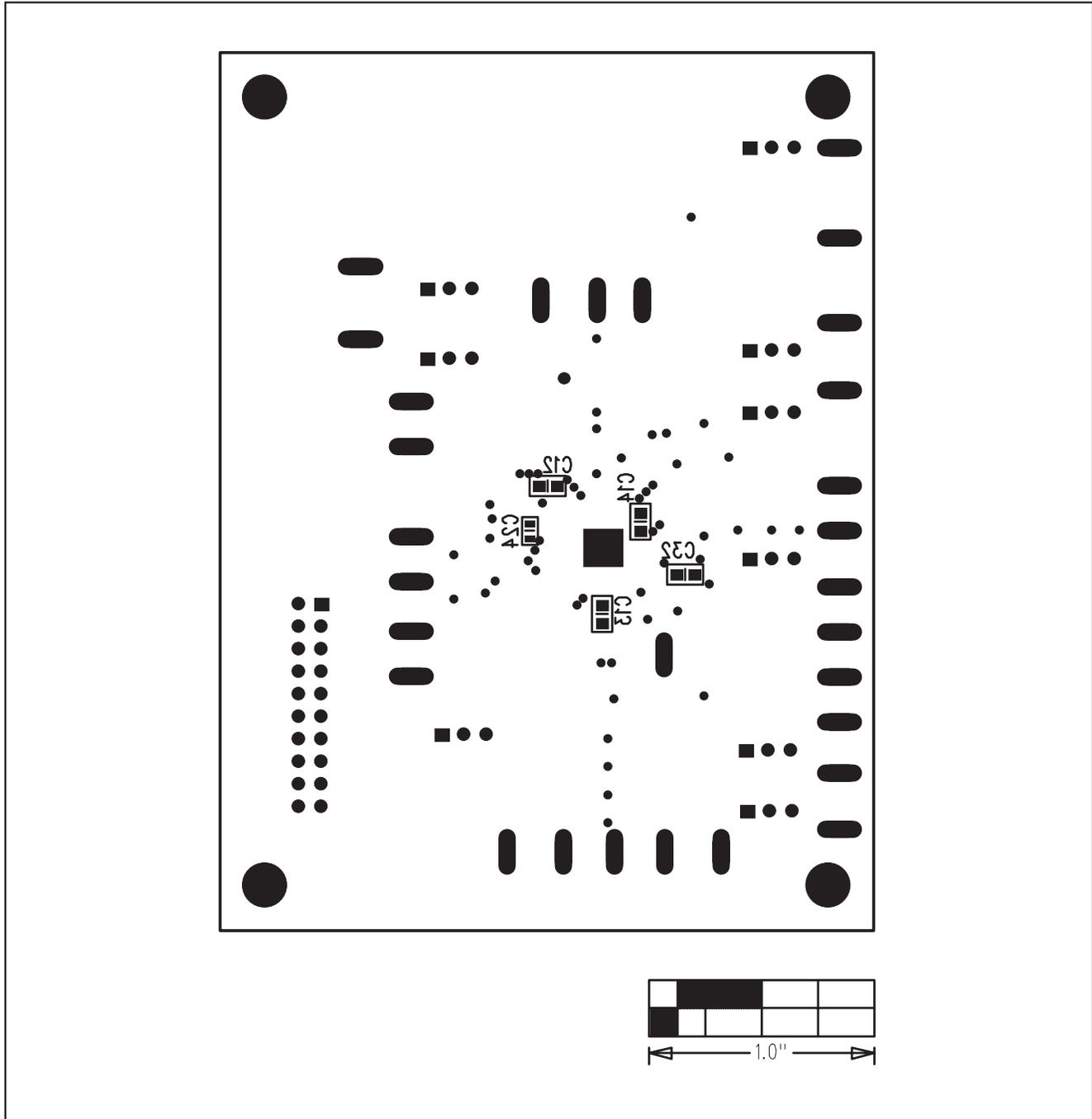


Figure 9. MAX1586A EV Kit Component Placement Guide—Solder Side

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