19-4918; Rev 0; 8/09

MAX9674 Evaluation Kit

Evaluates: MAX9672/MAX9673/MAX9674

General Description

The MAX9674 evaluation kit (EV kit) demonstrates the MAX9672/MAX9673/MAX9674 reference voltage generator for gamma correction in TFT-LCD panels, such as those found in high-resolution TVs and high-end monitors, or for general-purpose industrial reference voltage generation. The EV kit provides a total of 17 programmable 10-bit-resolution voltage outputs—16 gamma outputs and one VCOM output. Multiple-time programming (MTP) provides nonvolatile memory for gamma and VCOM values. VCOM is a common output voltage for driving an LCD backplane.

The EV kit includes Windows® 2000, Windows XP®-, and Windows Vista®-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX9674. The EV kit comes with the MAX9674ETI+ installed. Contact the factory for free samples of the pin-compatible MAX9673ETI+ and MAX9672ETI+, which are 14- and 12-channel versions, respectively.

Features

- **MAX9672/MAX9673/MAX9674-Compatible EV Kit**
- **Windows 2000, Windows XP-, and Windows Vista (32-Bit)-Compatible Software**
- **16 Channels of Programmable Gamma**
- **10-Bit Resolution**
- **On-Board Microcontroller to Generate I²C Commands**
- **USB-PC Connection (Cable Included)**
- **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX9674EVKIT+	EV Kit

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1–C8, C13–C16, C22, C48, C49, C50	0	Not installed, ceramic capacitors (0603)
C9, C12, C18, C19, C23, C25, C27–C30, C32, C33, C34, C40, C41, C42, C44	17	0.1µF ±10%, 25V X5R ceramic capacitors (0603) Murata GRM188R6E104K
C10, C11, C20, C21, C24	5	10µF ±10%, 25V X5R ceramic capacitors (1206) Taiyo Yuden MK316BJ106KL
C17, C26, C45, C47	4	10µF ±10%, 16V X5R ceramic capacitors (0805) KEMET 0805C106K4PACTU
C31, C43, C46	3	1µF ±10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C35, C36	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C37	1	0.033µF ±10%, 25V X7R ceramic capacitor (0603) TDK C1608X7R1E333K
C38, C39	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
D1	1	Green LED (0603)
FB1	0	Not installed, ferrite bead—shorted by PC trace (0603)
H1	1	2 x 20-pin header
JU1–JU4	4	3-pin header
P1	1	USB type-B right-angle PC-mount receptacle
R1–R16, R45	17	0Ω ±5% resistors (0603)
R17–R25, R28, R30–R35, R46	0	Not installed, resistors (0603)
R26, R27, R39, R41, R42	5	2.2kΩ ±5% resistors (0603)

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R29	1	1kΩ ±5% resistor (0603)
R36, R37	2	27Ω ±5% resistors (0603)
R38	1	1.5kΩ ±5% resistor (0603)
R40	1	10kΩ ±5% resistor (0603)
R43	1	220Ω ±5% resistor (0603)
R44	0	Not installed, resistor (0402)
U1	1	Reference voltage generator (28 TQFN EP*) Maxim MAX9674ETI+
U2	1	Microcontroller (68 QFN-EP* Maxim MAXQ2000-RAX+
U3	1	93C46 type 3-wire EEPROM (8 SO)
U4	1	UART-to-USB converter (32 TQFP)
U5	1	3.3V LDO regulator (5 SC70) Maxim MAX8511EXK33+
U6	1	2.5V LDO regulator (5 SC70) Maxim MAX8511EXK25+
U7	1	Level translator (8 TDFN-EP*) Maxim MAX3394EETA+
Y1	1	16MHz crystal (HCM49) Hong Kong X'tals SSM16000N1HK188F0-0
Y2	1	6MHz crystal (HCM49) Hong Kong X'tals SSL60000N1HK188F0-0
—	4	Shunts
—	1	USB high-speed A-to-B cable, 6ft
—	1	PCB: MAX9674 EVALUATION KIT+

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
KEMET Corp.	864-963-6300	www.kemet.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: *Indicate that you are using the MAX9674 when contacting these component suppliers.*

MAX9674 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX9674.EXE	Application program
FTD2XX.INF	USB driver file
UNINST.INI	Uninstalls the EV kit software
USB_Driver_Help.PDF	USB driver installation help file

Quick Start

Required Equipment

- MAX9674 EV kit (USB cable included)
- User-supplied Windows 2000, Windows XP, or Windows Vista PC with a spare USB port
- 9V to 20V, 100mA DC power supply
- Digital voltmeter (DVM)

Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

Procedure

The MAX9674 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on power supplies until all connections are made.**

1) Visit **www.maxim-ic.com/evkitsoftware** to download the latest version of the EV kit software, 9674Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
2) Install the EV kit software on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied and icons are created in the Windows **Start | Programs** menu.
3) Connect the USB cable from the PC to the EV kit board. A **New Hardware Found** window pops up when installing the USB driver for the first time. If a window is not seen that is similar to the one described above after 30s, remove the USB cable from the board and reconnect. Administrator privileges are required to install the USB device driver on Windows.
4) Follow the directions of the **Add New Hardware Wizard** to install the USB device driver. Choose the **Search for the best driver for your device** option. Specify the location of the device driver to be **C:\Program Files\MAX9674** (default installation directory) using the **Browse** button. During device driver installation, Windows may show a warning message indicating that the device driver Maxim uses does not contain a digital signature. This is not an error condition and it is safe to proceed with installation. Refer to the USB_Driver_Help.PDF document included with the software for additional information.
5) Verify that jumpers JU1–JU4 are in their default position, as shown in Table 1.
6) Set the power supply to 15V and disable the power-supply output.
7) Connect the power supply's positive terminal to the AVDD PCB pad and the negative terminal to the AGND PCB pad.
8) Start the MAX9674 EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.
9) Measure the actual voltage for AVDD on the AVDD PCB pad.
10) Enter the voltage in the **REF** edit box within the **Reference Voltage (V)** group box.
11) Measure any of the outputs (DAC channels or VCOM) on H1 and verify that the value measured is approximately the corresponding voltage value displayed in the MAX9674 EV kit software.

Table 1. MAX9674 EV Kit Jumper Description

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Connects the MAX9674 to the on-board +3.3V supply
	2-3	Connects the MAX9674 to user-supplied 3.3V to 3.6V supply
JU2	1-2*	Connects pin A0 of the MAX9674 to DVDD (write address = 0xEA; read address = 0xEB)
	2-3	Connects pin A0 of the MAX9674 to GND (write address = 0xE8; read address = 0xE9)
JU3	1-2*	Connects the VDD_AMP pin of the MAX9674 to AVDD
	2-3	Connects the VDD_AMP pin of the MAX9674 to user-supplied AVDD
JU4	1-2*	Connects the REF pin of the MAX9674 to AVDD
	2-3	Connects the REF pin of the MAX9674 to user-supplied REF

**Default position.*

Detailed Description of Software

The main window of the MAX9674 EV kit software (Figure 1) displays the register values and output voltages for all DAC channels. Other features include DAC and MTP output selection, register addressing mode, part selection, saving, and loading register values.

Part Selection

If the MAX9673 or MAX9672 IC is installed, it is important to check the corresponding radio button from the **Part Selection** group box.

Setting Reference Voltage

Before changing the value of the **REF** edit box, see the *Reference Voltage* section.

Changing Register Values

Register values for the DAC channels and VCOM channel can be set in three different ways. First, a user can move the scrollbars and monitor the register values, as well as the expected output voltages, in the corresponding edit boxes. Second, a user can type in register values directly to the **Reg Value** edit boxes. Third, a user can type into the **Output (V)** edit boxes, which the software calculates and displays the closest register and corresponding voltage values for the user.

When a register value is changed, the text color for the corresponding edit boxes changes to red. A user should synchronize the GUI fields with the actual device registers by pressing either the **Load** button or the **Load All Values To Registers** button.

The **Register Addressing Mode** group box is used to decide the type of I²C write commands to use. Selecting the **Burst** radio button enables the **Load All Values To Registers** button and selecting the **Single** radio button enables the **Load** button for each channel. However, the **Load All Values To Registers** button will not update the VCOM channel.

The **Load All Reg Values From File** button is used to load all the register values and reference voltages from a text file. The **Save All Reg Values To File** button is used to save all the register values and reference voltages on the current GUI to a text file.

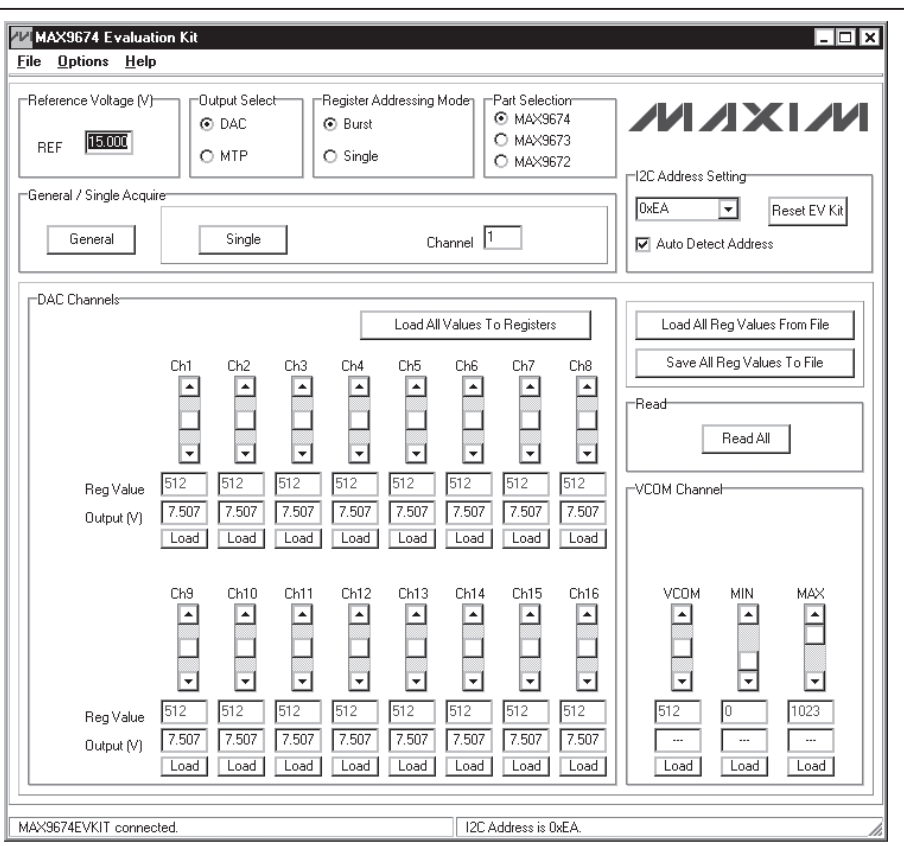

Figure 1. MAX9674 EV Kit Software Main Window

Loading MTP Values

The **General / Single Acquire** group box is used to update DAC channels and VCOM with values that are stored in MTP. The **General** button updates all the DAC channels and VCOM-to-MTP values. The **Single** button updates the channel corresponding to the **Channel** edit box (1–16 = DAC channels 1–16 and 17 = VCOM channel).

I²C Address Setting

If the **Auto Detect Address** checkbox is checked, the software automatically detects the I²C device address of the MAX9674. The MAX9674's I²C slave address is displayed in the status bar of the software window and the address drop-down list. Uncheck the **Auto Detect Address** checkbox to manually select an address in the drop-down list. The software probes the designated address and displays the address appropriately. If an acknowledgement is not received from the EV kit, a pop up window is opened and the user is prompted to properly set jumper JU2 on the EV kit.

Press the **Reset EV Kit** button to reestablish connection to the PC. The GUI synchronizes with the current DAC register values of the MAX9674.

Advanced User Interface

A serial interface can be used by advanced users by selecting **Options | Interface (Advanced Users)** from the menu bar.

An **Advanced User Interface** window pops up with the **2-wire interface** tab selected, which allows the SMBus™/I²C-compatible protocols, such as read word and write word, to be executed. The only SMBus/I²C-compatible protocols used by the MAX9674 are:

- **2 - SMBusWriteWord(addr,cmd,data16)**
- **5 - SMBusReadWord(addr, cmd) -> data16**

The combo and edit boxes accept numeric data in hexadecimal and should be prefixed by 0x. See Figure 2 for an example of this tool.

In this example, the software is writing to device address 1110101 (r/w) binary, and register address 0x00.

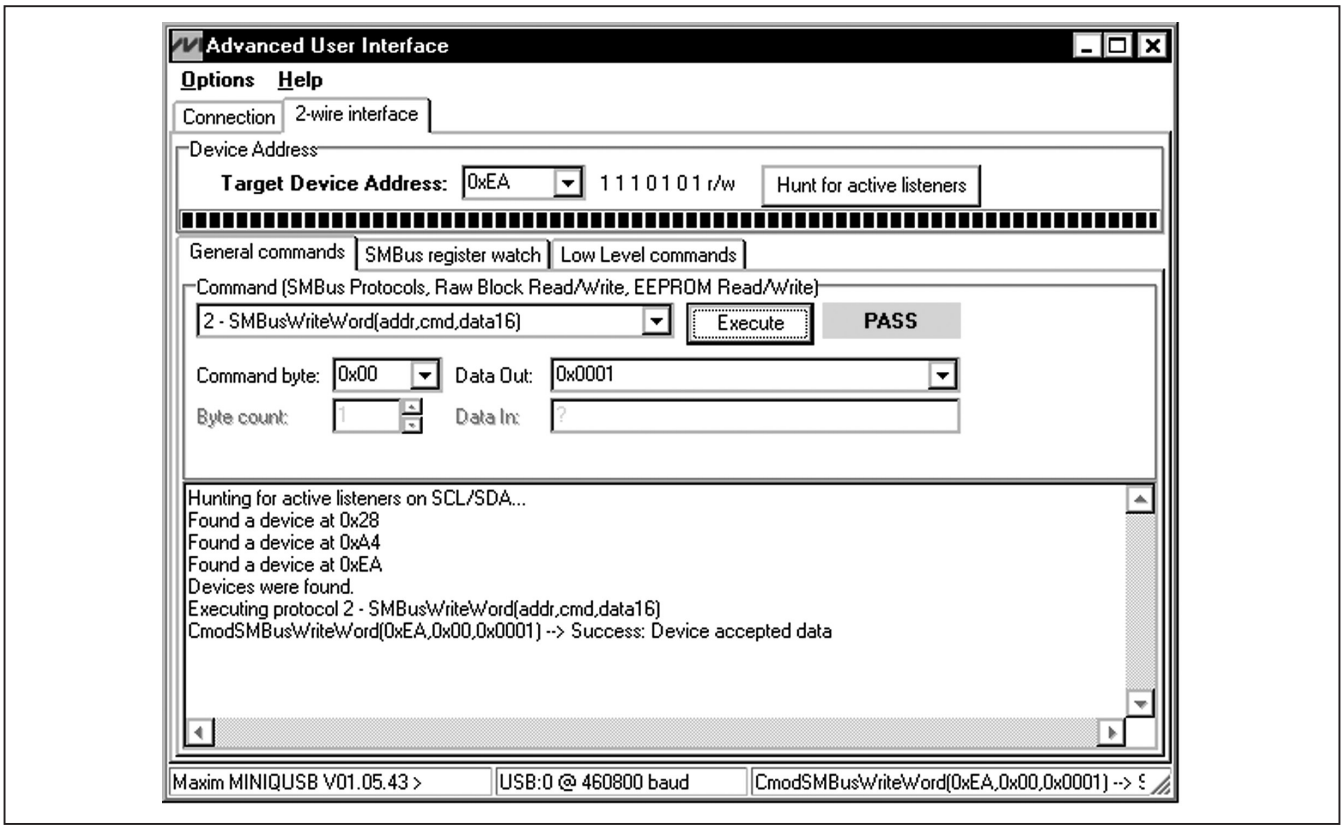

Figure 2. Example of SMBusWriteWord Operation Using the Advanced User Interface

SMBus is a trademark of Intel Corp.

Detailed Description of Hardware

The MAX9674 EV kit demonstrates the MAX9674 reference voltage generator for gamma correction in TFT-LCD panels, such as those found in high-resolution TVs and high-end monitors, or for general-purpose industrial reference voltage generation. The EV kit provides a total of 17 programmable 10-bit-resolution voltage outputs—16 gamma outputs and one VCOM output. MTP provides nonvolatile memory for gamma and VCOM values. VCOM is a common output voltage for driving an LCD backplane.

All outputs are available at header H1 (see Table 2 for configuration).

Output Description

Header H1 on the MAX9674 EV kit provides access to all outputs. Optional 0603 resistors are shorted with a 0Ω resistor between the MAX9674 outputs and the EV kit's H1 output header. See Table 2 for a description of header H1's outputs.

Digital Supply

Jumper JU1 connects the MAX9674 IC's digital supply pin (DVDD) to the EV kit's on-board +3.3V supply, regulated from USB's VBUS, or to a user-supplied power supply connected to the VDIG PCB pad.

If a user-supplied I²C interface is used, the user-supplied DVDD can be set within the IC's entire DVDD input range of 3.3V to 3.6V. See the *User-Supplied I²C Interface* section for more information on using a user-supplied I²C interface. See Table 3 for jumper JU1 configuration.

Table 2. Output Description

EV KIT OUTPUT	H1 PIN	SERIES RESISTOR	DESCRIPTION	RANGE	
				MIN (V)	MAX (V)
GMA1	1	R1	Gamma output	0	AVDD
GMA2	3	R2	Gamma output	0	AVDD
GMA3	5	R3	Gamma output	0	AVDD
GMA4	7	R4	Gamma output	0	AVDD
GMA5	9	R5	Gamma output	0	AVDD
GMA6	11	R6	Gamma output	0	AVDD
GMA7	13	R7	Gamma output	0	AVDD
GMA8	15	R8	Gamma output	0	AVDD
VCOM	17	N/A	LCD backplane common voltage	0	AVDD
GMA9	19	R9	Gamma output	0	AVDD
GMA10	21	R10	Gamma output	0	AVDD
GMA11	23	R11	Gamma output	0	AVDD
GMA12	25	R12	Gamma output	0	AVDD
GMA13*	27	R13	Gamma output	0	AVDD
GMA14*	29	R14	Gamma output	0	AVDD
GMA15**	31	R15	Gamma output	0	AVDD
GMA16**	33	R16	Gamma output	0	AVDD

**Not connected for the MAX9672.*

***Not connected for the MAX9672/MAX9673.*

Table 3. Digital Supply (JU1)

SHUNT POSITION	DVDD PIN CONNECTED TO
1-2*	On-board +3.3V
2-3	DVDD external supply

**Default position.*

Table 4. Device Address Setting (JU2)

SHUNT POSITION	A0 PIN CONNECTED TO	DEVICE ADDRESS	
		WRITE	READ
1-2*	DVDD	0xEA	0xEB
2-3	GND	0xE8	0xE9

**Default position.*

Table 5. AVDD_AMP (JU3)

SHUNT POSITION	AVDD_AMP PIN CONNECTED TO
1-2*	AVDD
2-3	AVDD_AMP external supply

**Default position.*

Device Address Setting

Jumper JU2 sets the MAX9674 device address by connecting the MAX9674's A0 pin to DVDD or GND. See Table 4 for jumper JU2 configuration.

External Supply for AVDD amplifier

Jumper JU3 sets the power supply for the AVDD amplifier by connecting the AVDD_AMP pin to AVDD or to an external power supply applied to the VDD_AMP PCB pad. See Table 5 for jumper JU3 configuration.

Reference Voltage

Jumper JU4 sets the reference voltage of the MAX9674 by connecting the REF pin to AVDD or an external reference supply. See Table 6 for jumper JU4 configuration. Depending on the shunt position of JU4, the actual reference voltages **MUST** be measured with a voltmeter and typed into the **REF** edit box for the calculated DAC output voltages shown in the **DAC Channels** and **VCOM Channel** group boxes to be correct.

Table 6. REF (JU4)

SHUNT POSITION	REF CONNECTED TO
1-2*	AVDD
2-3	REF external supply

**Default position.*

User-Supplied I²C Interface

To use the MAX9674 EV kit with a user-supplied I²C interface, perform the following steps:

1) Verify that the user-supplied interface logic levels meet the MAX9674 minimum input-high voltage requirement of 0.7 x DVDD and maximum input-low voltage requirement of 0.3 x DVDD.
2) Place the jumper JU1 shunt on pins 2-3.
3) Place the jumper JU2 shunt to set the desired device address.
4) Connect the positive terminal of a 9V to 20V DC power supply to the AVDD PCB pad and the negative terminal to the nearby AGND PCB pad.
5) Connect the I²C interface's positive digital supply (3.3V to 3.6V) to the VDIG PCB pad and the interface's ground to the nearby DGND PCB pad.
6) Connect the user-supplied I²C interface signals to the SDA and SCL EV kit PCB pads.

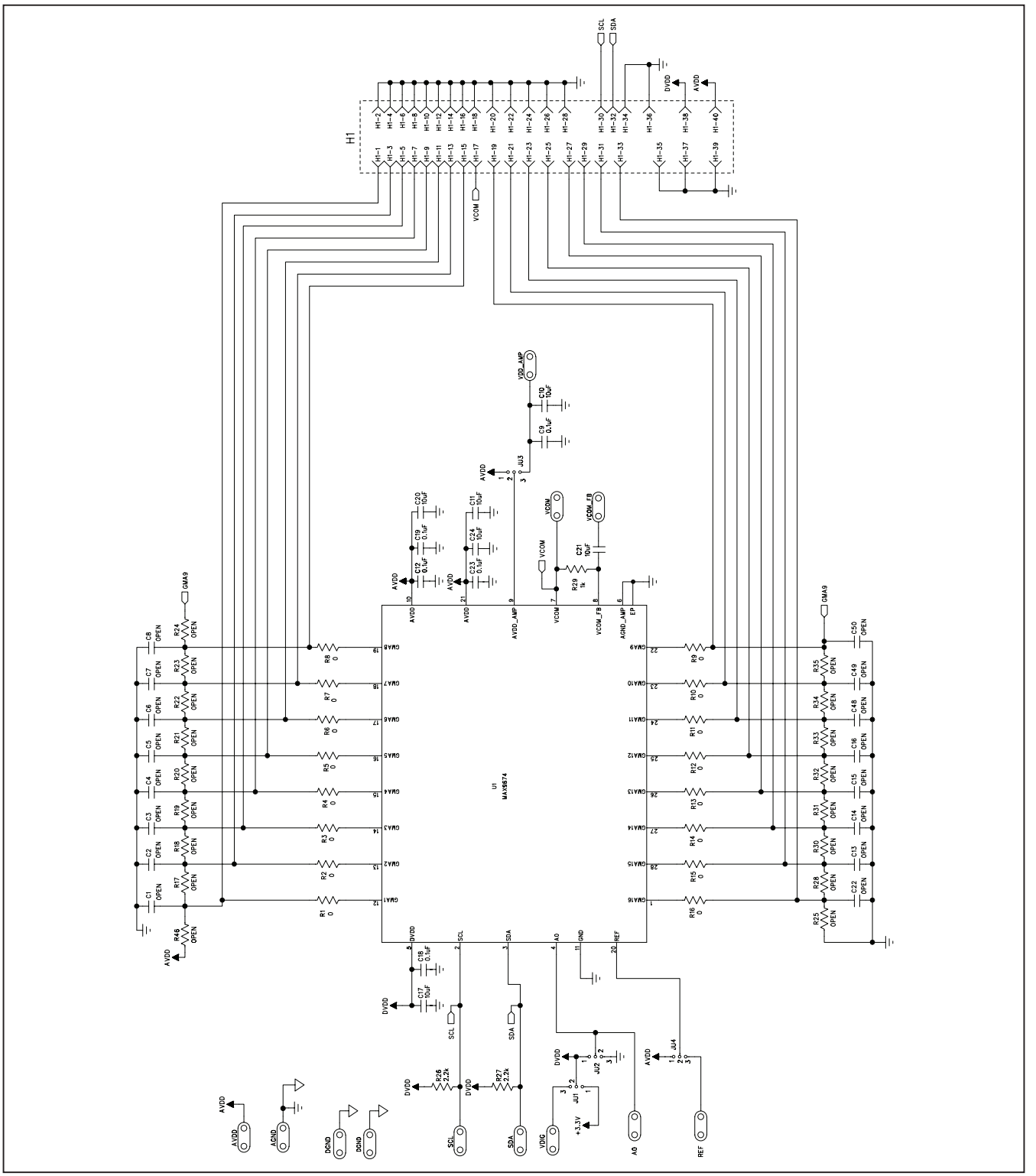

Figure 3a. MAX9674 EV Kit Schematic (Sheet 1 of 2)

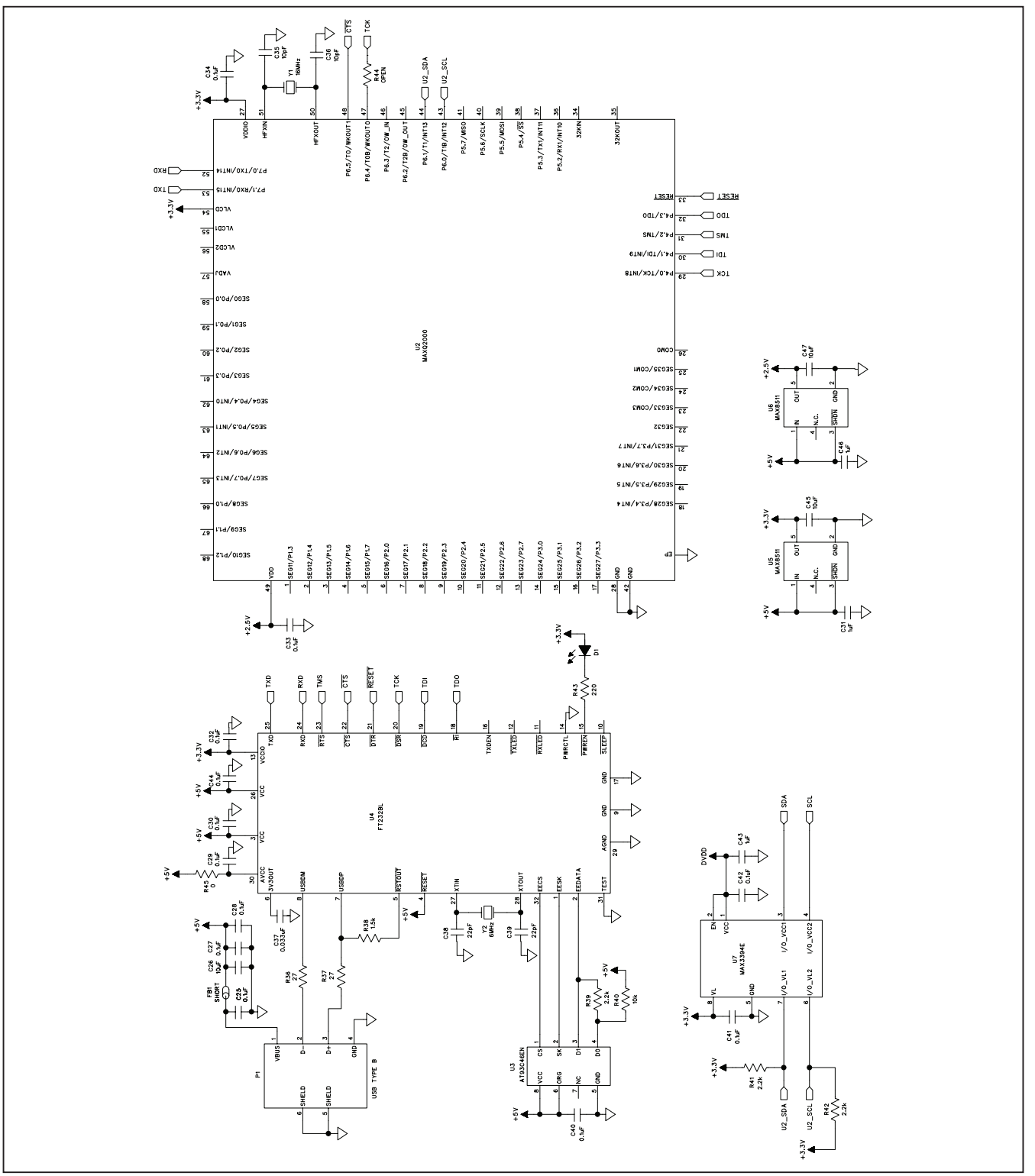

Figure 3b. MAX9674 EV Kit Schematic (Sheet 2 of 2)

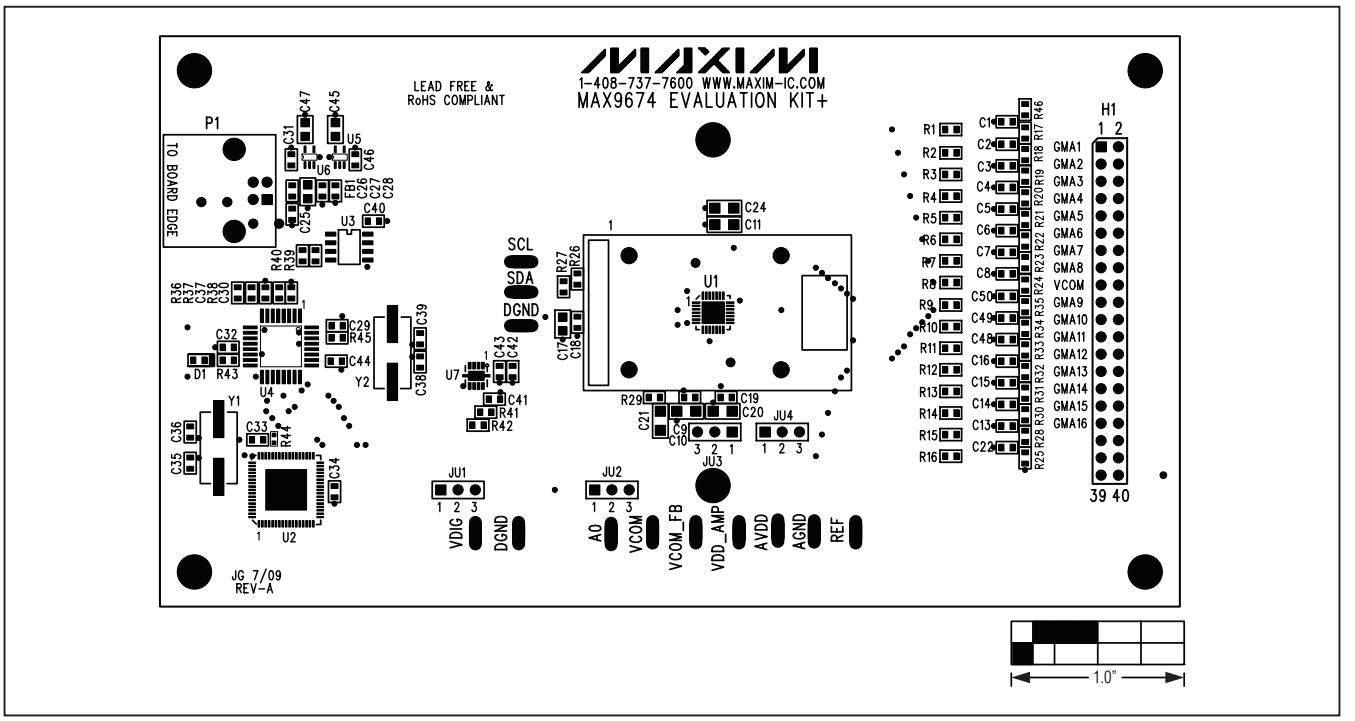

Figure 4. MAX9674 EV Kit Component Placement Guide—Component Side

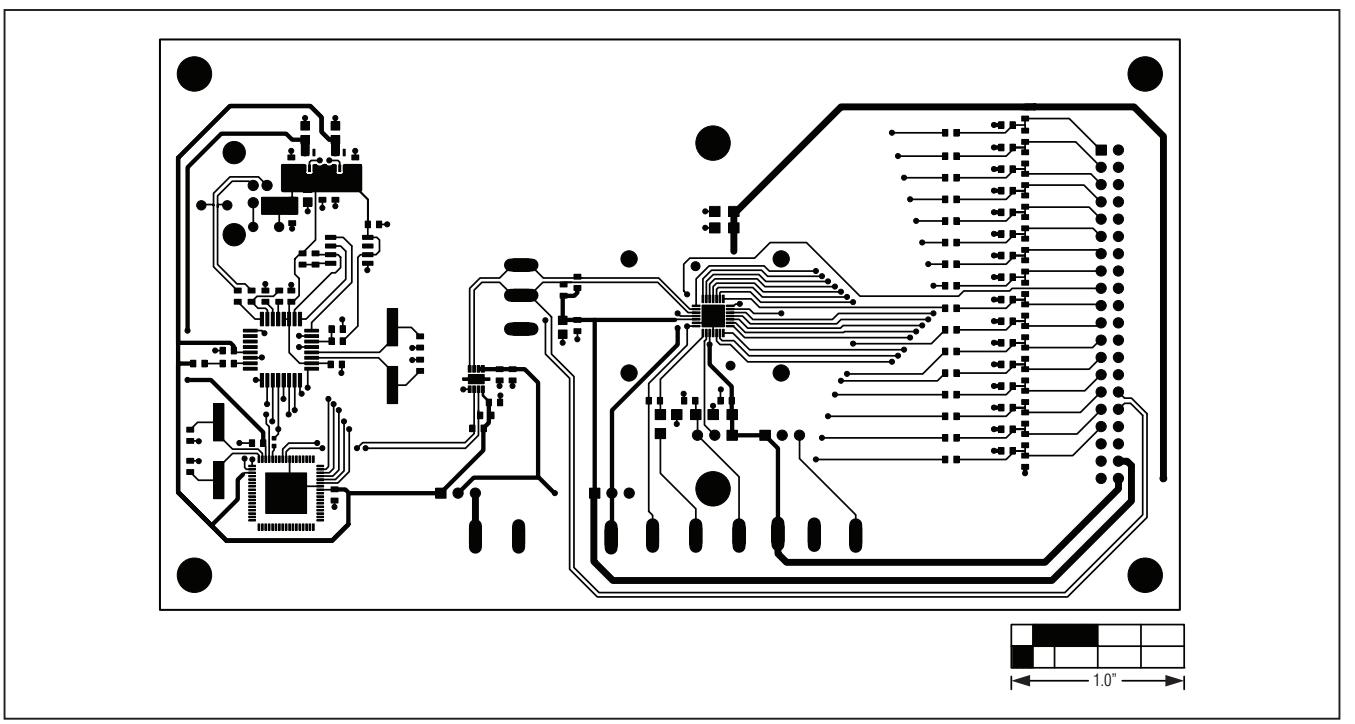

Figure 5. MAX9674 EV Kit PCB Layout—Component Side

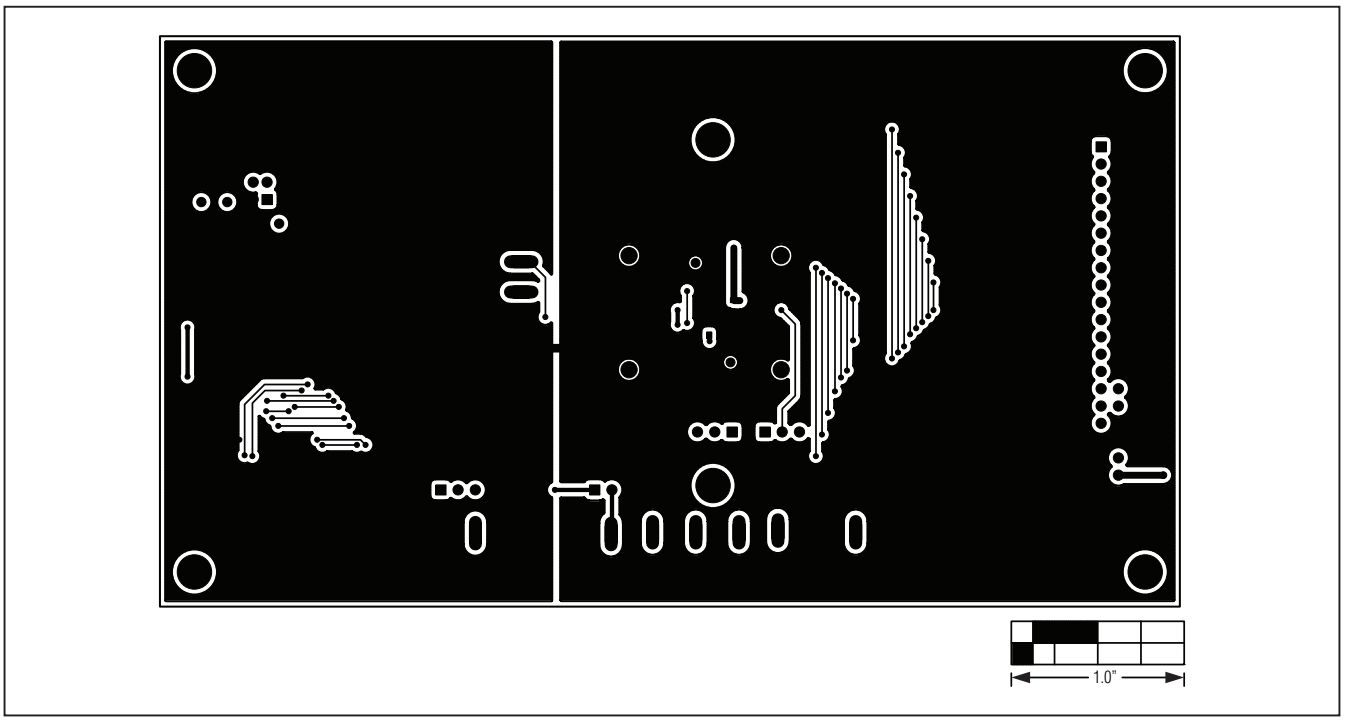

Figure 6. MAX9674 EV Kit PCB Layout—Solder Side

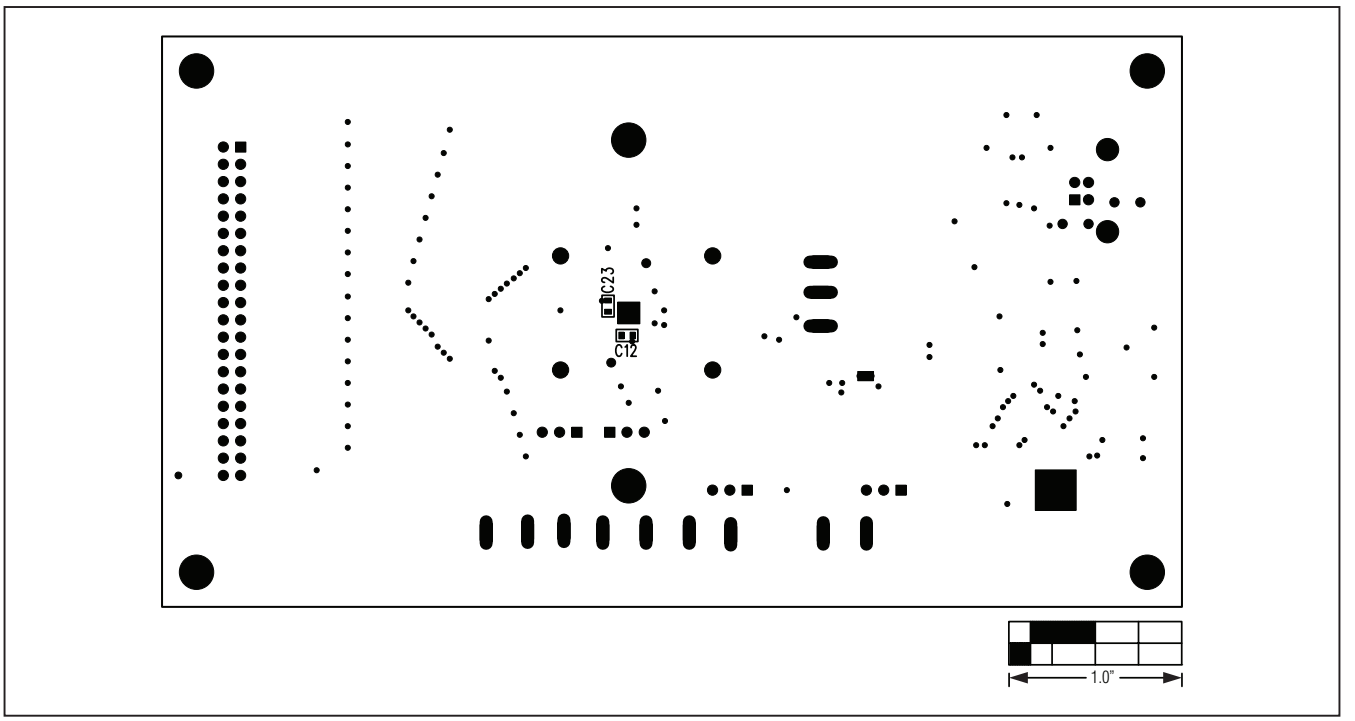

Figure 7. MAX9674 EV Kit Component Placement Guide—Solder Side