MAX5715A Evaluation Kit

Evaluates: MAX5713/MAX5714/ MAX5715A/MAX5715B

General Description

The MAX5715A evaluation kit (EV kit) demonstrates the MAX5715A 12-bit, 4-channel, low-power DAC with internal reference and buffered voltage output. The device is in a 14-pin TSSOP package. The EV kit provides controls to change the DAC's outputs, power operations, and references.

The EV kit includes a USB-to-SPI interface circuit. The EV kit features Windows XP®-, Windows Vista®-, and Windows® 7-compatible software that provides a simple graphical user interface (GUI) for exercising the device's features.

The EV kit comes with the MAX5715AAUD+ installed, which is the 12-bit SPI version. Contact the factory for samples of the pin-compatible MAX5715BAUD+ (12-bit), MAX5714AUD+ (10-bit), and MAX5713AUD+ (8-bit) devices.

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

Features

- Wide Input Supply Range: 2.7V to 5.5V
- Rail-to-Rail Buffered Output with 0.3Ω Output Impedance
- High Precision with ±1 LSB INL (max)
- Precision 10ppm (Max) Selectable Internal References: 2.048V, 2.500V, or 4.096V
- Independent Voltage for Digital I/Os: 1.8V to 5.0V
- Demonstrates 4.5µs Settling Time of Buffered Output
- Eliminates Level Shifters
- Supports User-Supplied External Reference Up to 5.0V
- Supports Entire Family of 12-/10-/8-Bit DACs
- Windows XP-, Windows Vista-, and Windows 7-Compatible Software
- USB-Powered (Cable Included)
- Proven PCB Layout
- Fully Assembled and Tested

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	10µF ±10%, 6.3V X7R ceramic capacitor (0805) TDK C2012X7R0J106K
C2, C3, C5, C10, C17, C19, C20, C24, C26–C29, C36	13	0.1µF ±10%, 16V X5R ceramic capacitors (0603) Murata GRM188R61C104K
C4	1	100pF ±5%, 50V C0G ceramic capacitor (0603) Murata GQM1885C1H101J
C6–C9, C25	0	Not installed, ceramic capacitors (0603)
C11, C12	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C13, C15, C18	3	10µF ±10%, 16V X5R ceramic capacitors (0805) Murata GRM21BR61C106K
C14, C16, C30–C35	8	1µF ±10%, 16V X5R ceramic capacitors (0603) Murata GRM188R61C105K
C21	1	33000pF ±10%, 25V X7R ceramic capacitor (0603) TDK C1608X7R1E333K
C22, C23	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
D1	1	Green LED (0603)
FB1	0	Not installed, ferrite bead—short (PC trace) (0603)

19-6402; Rev 0; 11/12

maxim integrated™

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
H1	1	18-pin (2 x 9) header
H2	0	Not installed, 10-pin (5 x 2) JTAG header
JU1, JU2, JU9–JU11, JU13	6	3-pin headers
JU3, JU4	2	4-pin headers
JU5, JU6, JU12	3	2-pin headers
JU7, JU8	0	Not installed, 2-pin headers
OUTA–OUTD, REF	5	Red test points
R1, R2	2	4.7kΩ ±5% resistors (0603)
R3, R4	2	1MΩ ±5% resistors (0603)
R5, R18–R25	9	1.5kΩ ±5% resistors (0603)
R6, R7	2	27Ω ±5% resistors (0603)
R8	1	220Ω ±5% resistor (0603)
R9–R13, R16	0	Not installed, resistors (0402) R9–R13 are short (PC trace); R16 is open
R14, R15	0	Not installed, resistors (0603)
R17	1	0Ω ±5% resistor (0603)
U1	1	12-bit DAC (14 TSSOP) Maxim MAX5715AAUD+
U2	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U3	0	Not installed, 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	2.5V reference (8 SO) Maxim MAX6173AASA+
U8–U10	3	Level translators (10 µMAX®) Maxim MAX1840EUB+
USB1	1	USB type-B, right-angle PC-mount receptacle
Y1	1	16MHz crystal (HCM49) Hong Kong X'tals SSM16000N1HK188F0-0
Y2	1	6MHz crystal (HCM49) Hong Kong X'tals SSL60000N1HK188F0-0
—	1	USB high-speed A-to-B cable (6ft)
—	11	Shunts
—	1	PCB: MAX5715A EVALUATION KIT

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: *Indicate that you are using the MAX5715A when contacting these component suppliers.*

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

MAX5715A EV Kit Files

FILES	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5715A.EXE	Application program
CDM20600.EXE	Installs the USB device driver
UNINSTALL.EXE	Uninstalls the EV kit software
USB_Driver_Help_200.PDF	USB driver installation help file

Quick Start

Required Equipment

- MAX5715A EV kit (USB cable included)
- Windows XP, Windows Vista, or Windows 7 PC with a spare USB port
- 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 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Verify that jumpers JU1–JU6 and JU9–JU13 are in their default positions, as shown in Table 1.
2) Visit www.maximintegrated.com/evkitsoftware to download the latest version of the EV kit software, 5715ARxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
3) Install the EV kit software on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied to your PC and icons are created in the Windows **Start | Programs** menu. During software installation, some versions of Windows may show a warning message indicating that this software is from an unknown publisher. This is not an error condition and it is safe to proceed with installation. Administrator privileges are required to install the USB device driver on Windows.
4) Connect the USB cable from the PC to the EV kit board. A Windows message appears when connecting the EV kit board to the PC for the first time. Each version of Windows has a slightly different message. If you see a Windows message stating **ready to use**, then proceed to the next step. Otherwise, open the USB_Driver_Help_200.PDF document in the Windows **Start | Programs** menu to verify that the USB driver was installed successfully.
5) Start the EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.
6) From the upper-left corner of the software, select the **12-bit** radio button within the **Part Selection** group box.
7) Within the **DACs** tab in the **Data** edit box, enter 0xFFF and select the command **Write all CODE and LOAD regs** within the same row. Press the **Execute** button on the right.
8) Use the GNDS PCB pad for the negative terminal of the DVM and use the positive terminal to measure the voltage at the OUTA–OUTD test points. Verify that the voltages measured are 2.5V.

Detailed Description of Software

The MAX5715A EV kit software can evaluate all SPI interface MAX5715A family of devices. In addition to the interfaces, the software allows 12-/10-/8-bit DAC part selection. The main software window has two tabs, **DACs** and **Controls**. From the **DACs** tab sheet, the user can send a sequence of write commands to the four DACs, assert $\overline{CLR}$ and $\overline{LDAC}$, and load and save the write sequence. The **Controls** tab sheet (Figure 2) allows the user to change the **Power**, **Configuration**, and **Reference**.

Part Selection

Once the main window appears, in the upper-left corner of the software is a **Part Selection** group box. The user must select the appropriate radio button that corresponds to the installed Maxim IC DAC bits.

DAC Commands

Enter the desired **Data** on the left and select the appropriate **Command** from the drop-down list (Figure 1). Pressing the **Execute** button writes to the CODE and/or DAC registers and the **Script Status** changes from **Incomplete** to **Complete**. Refer to the MAX5713/MAX5714/MAX5715A IC data sheet for a list of possible commands. If a sequence of commands needs to be performed, adjust all **Data** edit boxes and **Commands** drop-down lists accordingly, and press the **Execute All** button. To reset the **Script Status** to **Incomplete**, press the **Reset Script** button.

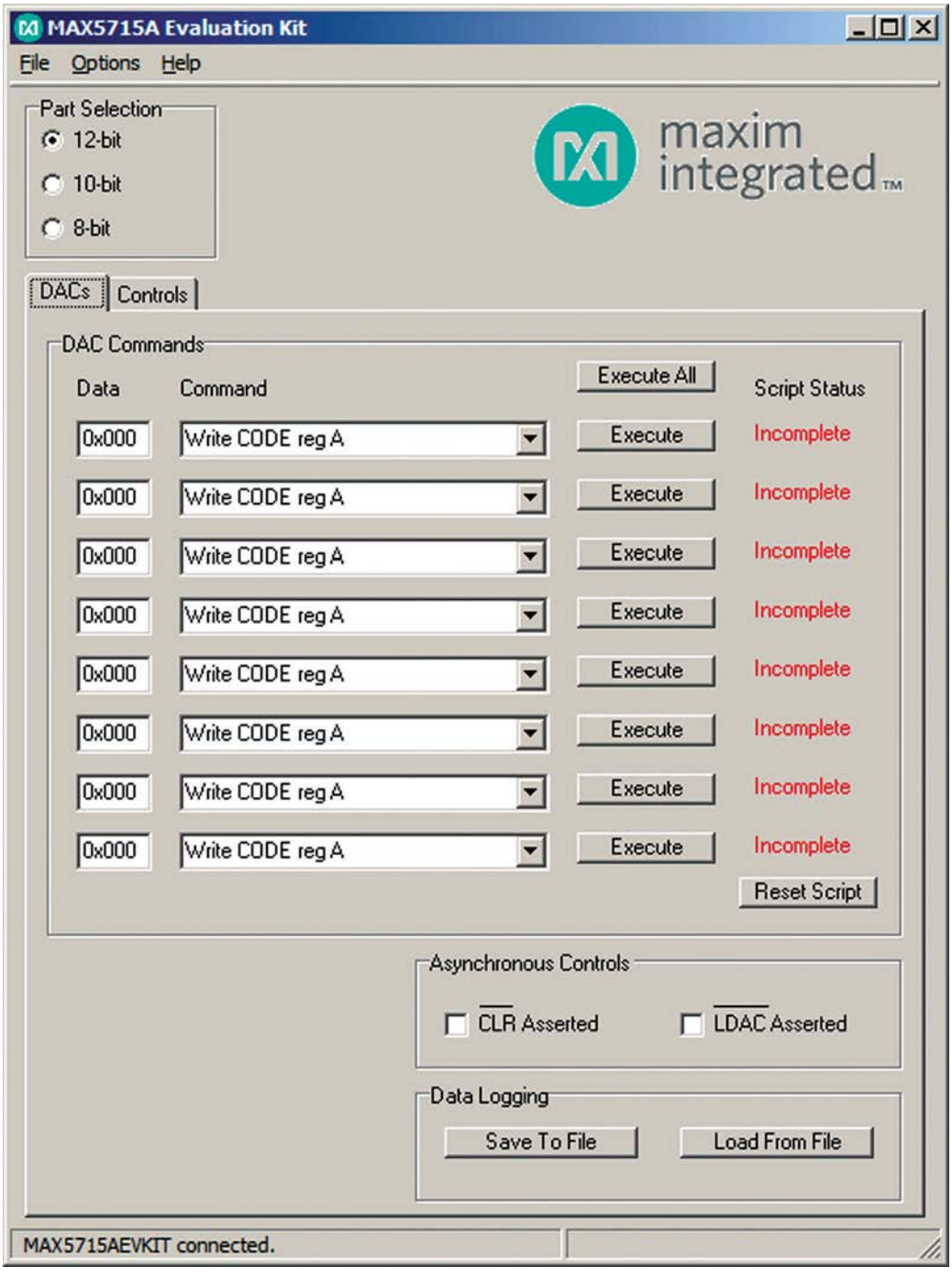

Figure 1. MAX5715A EV Kit Software Main Window (DACs Tab)

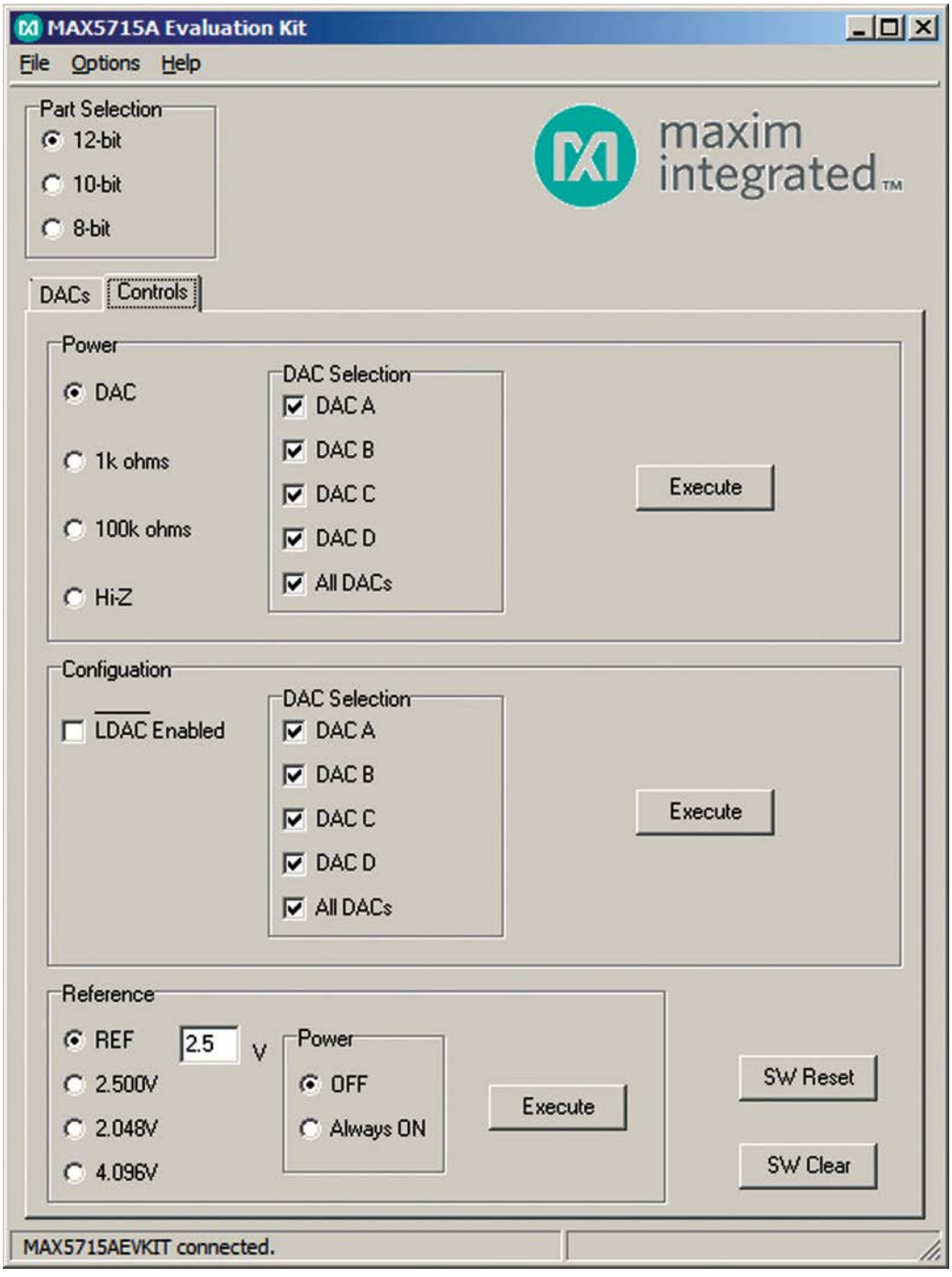

Figure 2. MAX5715A EV Kit Software Main Window (Controls Tab)

Data Logging

Using the **Save To File** button, the sequence of the commands can be saved into a text file. To recall the sequence, press the **Load From File** button and select the appropriate text file.

Asynchronous $\overline{CLR}$

In the **Asynchronous Controls** group box (Figure 1), a checked **$\overline{CLR}$ Asserted** checkbox drives the $\overline{CLR}$ pin of the device low, which clears the content of both CODE and DAC registers. An unchecked **$\overline{CLR}$ Asserted** checkbox drives the $\overline{CLR}$ pin of the device high, which allows the user to write new commands again.

Asynchronous $\overline{LDAC}$

A checked **$\overline{LDAC}$ Asserted** checkbox drives the $\overline{LDAC}$ pin of the device low, which allows writing to the CODE register to change the DAC's output. An unchecked **$\overline{LDAC}$ Asserted** checkbox drives the $\overline{LDAC}$ pin of the device high. To change the DAC outputs, the user must write to the CODE registers and then write to the DAC registers.

Power

The power command is selectable for individual DACs. When a DAC is selected, the channel is active. Other options include powering down with 1kΩ termination to GND, 100kΩ termination to GND, and high impedance. Once the appropriate selection is made, press the **Execute** button.

Configuration $\overline{LDAC}$

In the **Configuration** group box (Figure 2), the **$\overline{LDAC}$ Enabled** checkbox is selectable for individual DACs. When the DAC is selected, the channel allows the user to change the DAC's output by writing to the CODE register. Once the appropriate selection is made, press the **Execute** button.

Reference

The reference default configuration is set to external 2.5V using the on-board voltage reference IC (U7). A new external reference voltage can be entered into the **REF** edit box in the **Reference** group box, but the user must apply the same voltage at the board for proper operation. This does not change the part or board configuration, but allows the user to see what the device output voltages should be with a reference voltage. See the *User-Supplied Reference* section. Other reference options include 2.048V, 2.5V, and 4.096V through software commands. Make sure that the VDD supply is greater or equal to the voltage reference selected for proper operation. Once the appropriate selection is made, press the **Execute** button.

SW Reset

Press the **SW Reset** button to reset all CODE, DAC, and configuration registers to their default settings.

SW Clear

Press the **SW Clear** button to return all CODE and DAC registers to their default values.

Advanced User Interface

There are two methods for communicating with the device. The first is through the main window shown in Figure 1. The second is through the **Advanced User Interface** window shown in Figure 3. The **Advanced User Interface** window becomes available by selecting the **Options | Interface (Advanced User)** menu item and allows execution of serial commands manually.

Detailed Description of Hardware

The MAX5715A EV kit provides a proven layout for the MAX5715A. An on-board reference (MAX6173), USB interface circuitry, and jumpers to disconnect the on-board microcontroller are included on the EV kit.

User-Supplied Power Supply

The EV kit is powered completely from the USB port by default. To power the device with a user-supplied power supply, move the shunt on jumper JU10 to the 2-3 position and apply a 2.7V to 5.5V power supply at the VDD_EXT and the nearest GND PCB pads on the EV kit.

The on-board voltage reference (U7) is powered from the USB interface circuit when the shunt is installed in the 1-2 position on jumper JU13. To use the same external supply applied at the VDD_EXT PCB pad, move the shunt to the 2-3 position on JU13.

User-Supplied Reference

The on-board voltage reference (U7) generates a voltage reference of 2.5V. The user can apply a user-supplied voltage reference by moving the shunt on jumper JU11 to the 2-3 position and applying 2V to VDD at the adjacent REF_EXT PCB pad on the EV kit. As described in the *Reference* section, note that the value of the externally supplied reference should be written into the **REF** edit box

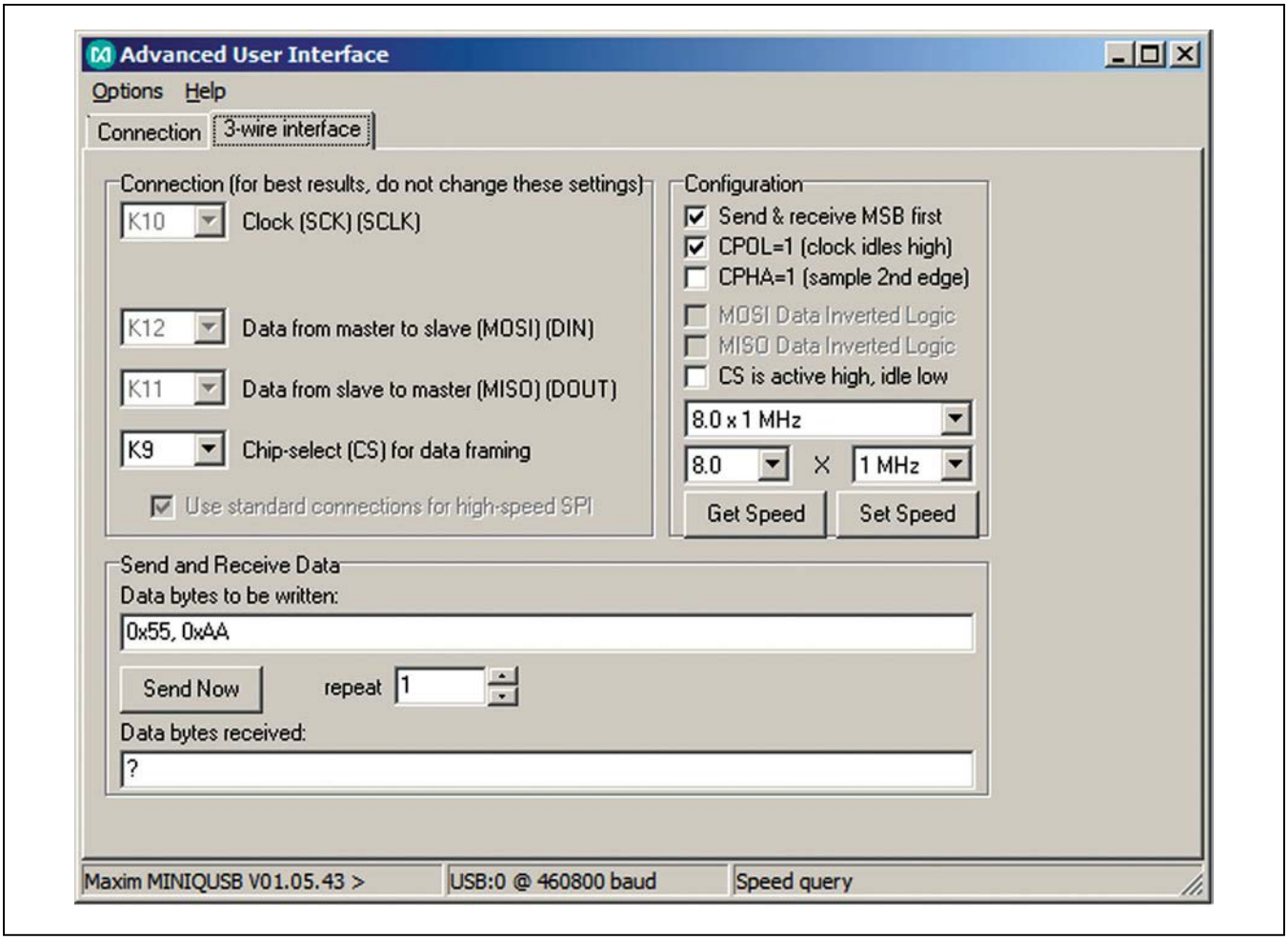

Figure 3. Advanced User Interface (3-Wire Interface Tab)

within the **Reference** group box of the GUI. Otherwise, the DAC output voltages shown in the GUI are incorrect.

User-Supplied SPI

To evaluate the EV kit with a user-supplied SPI bus, remove the shunts from jumpers JU1–JU4. Apply the user-supplied CSB signal to header pin H1-1, user-supplied SCLK signal to header pin H1-3, user-supplied DIN signal to header pin H1-5, and user-supplied $\overline{RDY}$ signal to header pin H1-7. Shunts must not be installed on jumpers JU7 and JU8. Connect the user-supplied SPI ground to header pins H1-2, H1-4, H1-6, or H1-8.

User-Supplied $\overline{LDAC}$ and $\overline{CLR}$

Remove the shunts from jumpers JU5 and JU6. Apply the user-supplied $\overline{LDAC}$ signal to header pin H1-17 and the user-supplied $\overline{CLR}$ signal to header pin H1-15. Connect the user-supplied signal ground to header pin H1-16 or H1-18.

Table 1. Jumper Settings (JU1–JU6, JU9–JU13)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Connects the CSB signal of the on-board microcontroller to the CSB pin of IC U1.
	2-3	Do not install.
	Not installed	User-supplied CSB. Apply appropriate signal at header pin H1-1.
JU2	1-2*	Connects the SCLK signal of the on-board microcontroller to the SCLK pin of IC U1.
	2-3	Do not install.
	Not installed	User-supplied SCLK. Apply appropriate signal at header pin H1-3.
JU3	1-2	Do not install.
	1-3*	Connects the DIN signal of the on-board microcontroller to the DIN pin of IC U1.
	1-4	Do not install.
	Not installed	User-supplied DIN. Apply appropriate signal at header pin H1-5.
JU4	1-2	Do not install.
	1-3*	Connects the $\overline{RDY}$ signal of the on-board microcontroller to the $\overline{RDY}$ pin of IC U1.
	1-4	Do not install.
	Not installed	User-supplied $\overline{RDY}$. Apply appropriate signal at header pin H1-7.
JU5	Installed*	Connects the $\overline{LDAC}$ signal of the on-board microcontroller to the $\overline{LDAC}$ pin of the IC U1.
	Not installed	User-supplied $\overline{LDAC}$ Apply appropriate signal at header pin H1-17.
JU6	Installed*	Connects the $\overline{CLR}$ signal of the on-board microcontroller to the $\overline{CLR}$ pin of IC U1.
	Not installed	User-supplied $\overline{CLR}$. Apply appropriate signal at header pin H1-15.
JU9	1-2*	Connects the VDDIO pin of IC U1 to the on-board +3.3V supply.
	2-3	Connects the VDDIO pin of the IC U1 to a user-supplied power supply between +1.7V and +5.5V (VDDIO_EXT).
JU10	1-2*	Connects the VDD pin of IC U1 to the on-board +3.3V supply.
	2-3	Connects the VDD pin of IC U1 to a user-supplied power supply between +2.5V and +5.5V (VDD_EXT).
JU11	1-2*	Connects the on-board voltage reference IC (U7) to the REF pin of IC U1.
	2-3	User-supplied REF. The user must apply a voltage reference at the REF_EXT PCB pad.
JU12	Installed*	Connects the additional bypass capacitor C36 on the REF pin of IC U1.
	Not installed	Disconnect the additional bypass capacitor C36 on the REF pin of IC U1.
JU13	1-2*	Powers the on-board voltage reference IC (U7) using the USB supply.
	2-3	Powers the on-board voltage reference IC (U7) using the user-supplied power supply.

**Default position.*

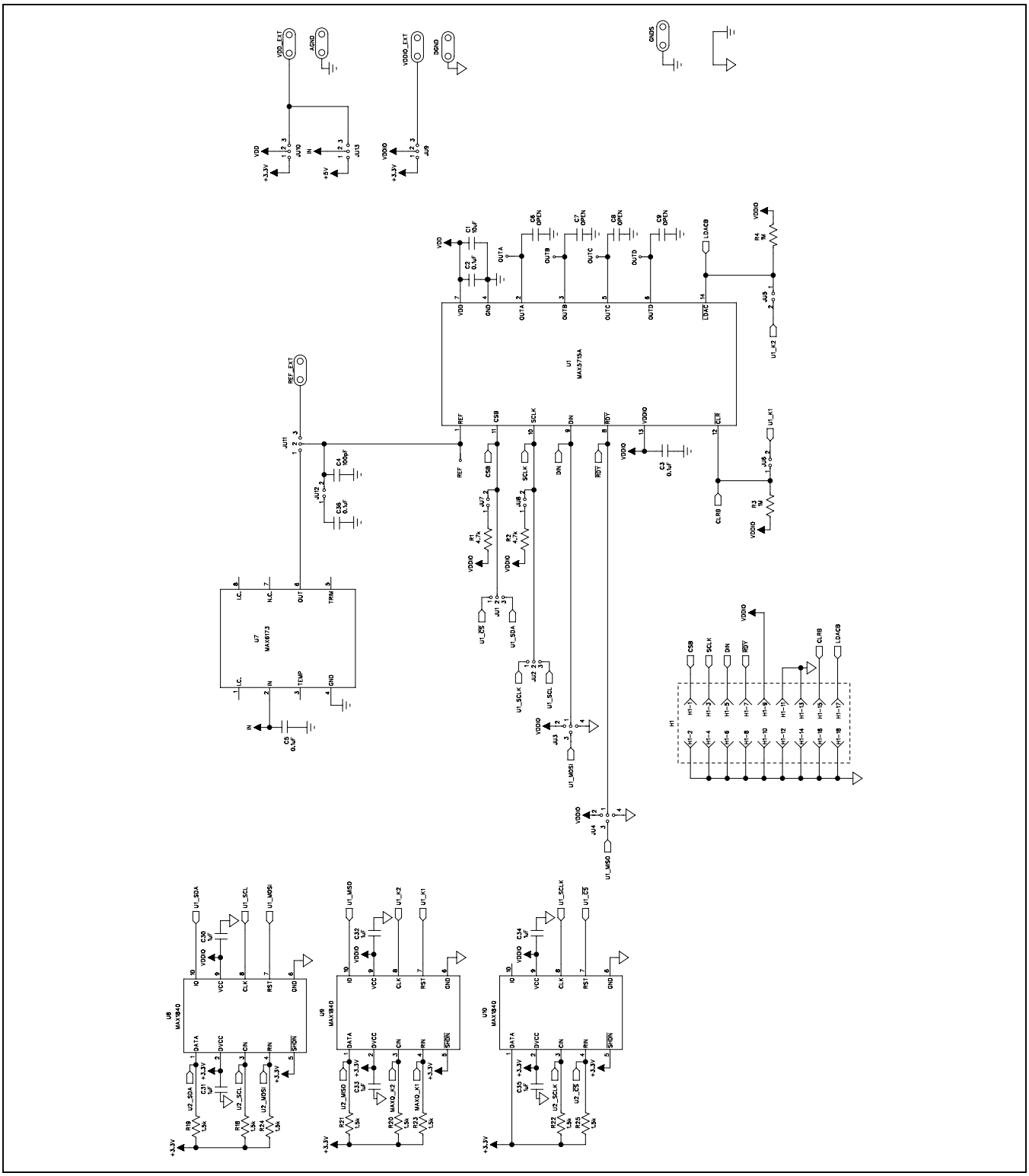

Figure 4a. MAX5715A EV Kit Schematic (Sheet 1 of 2)

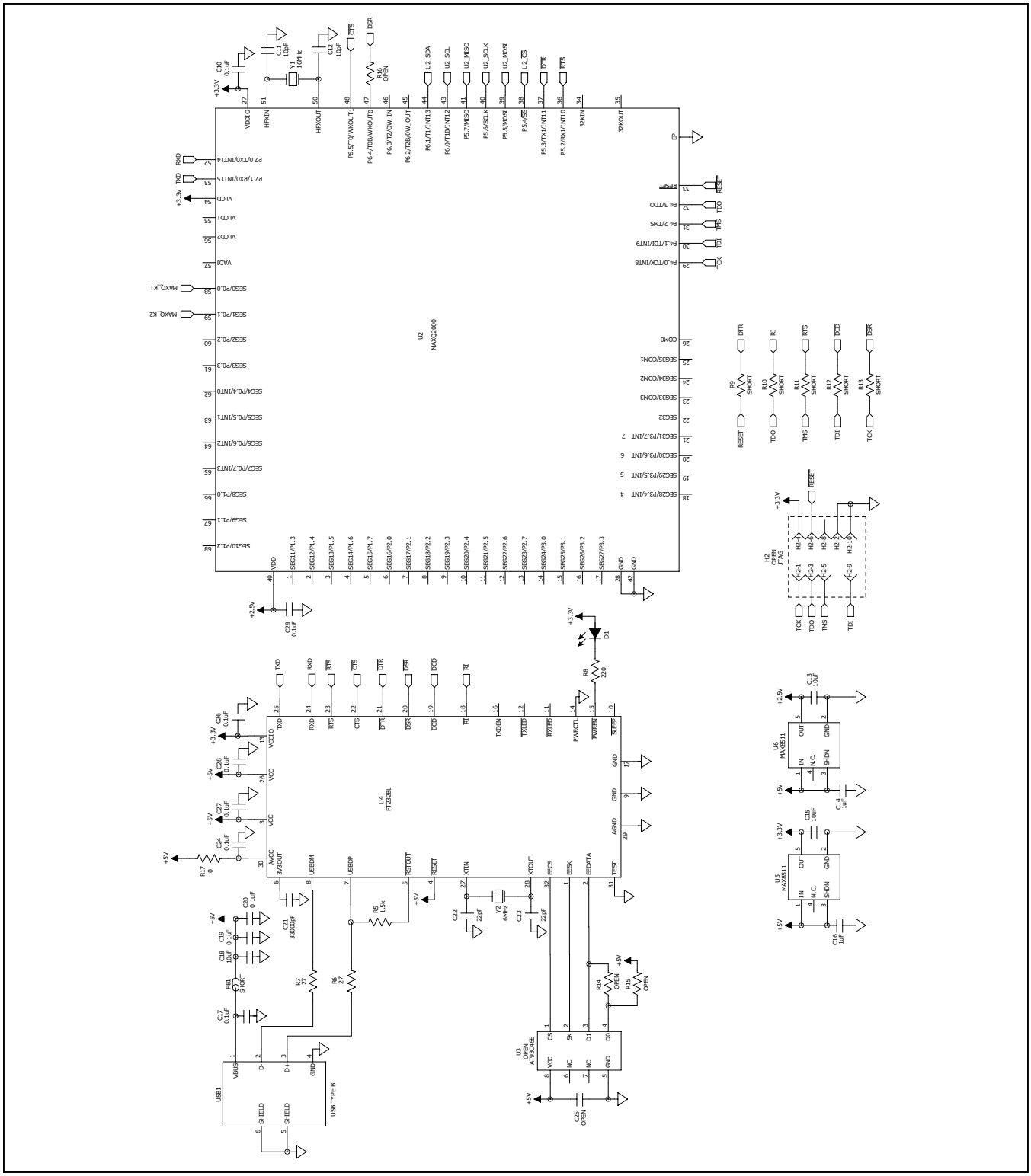

Figure 4b. MAX5715A EV Kit Schematic (Sheet 2 of 2)

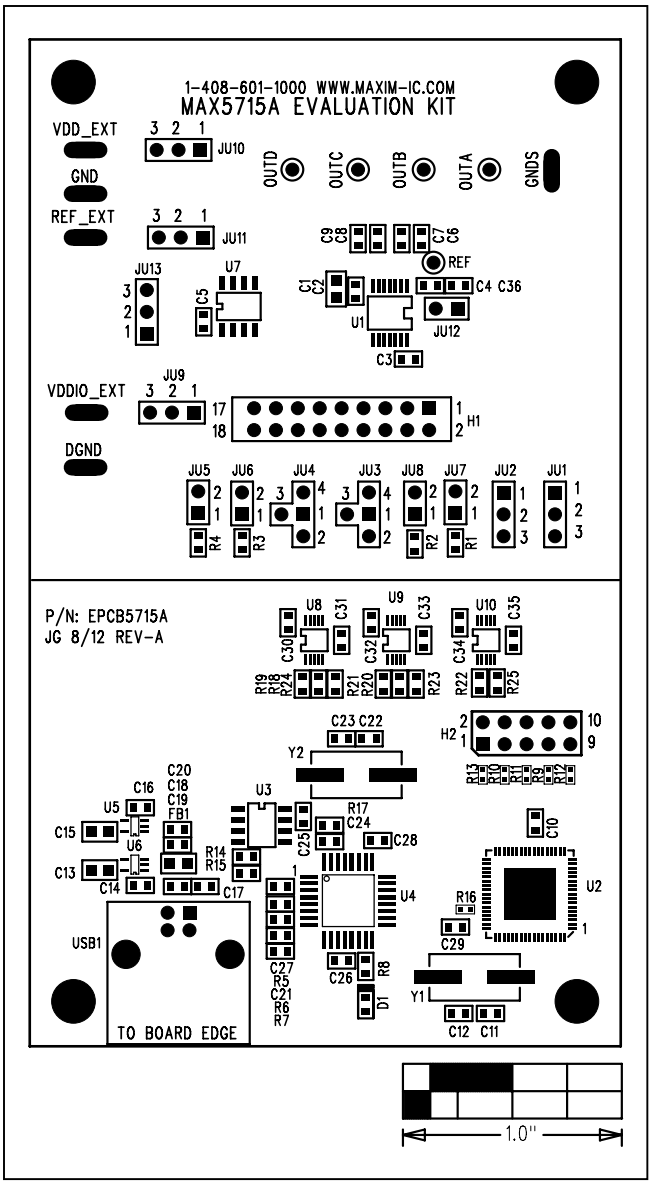

Figure 5. MAX5715A EV Kit Component Placement Guide—Component Side

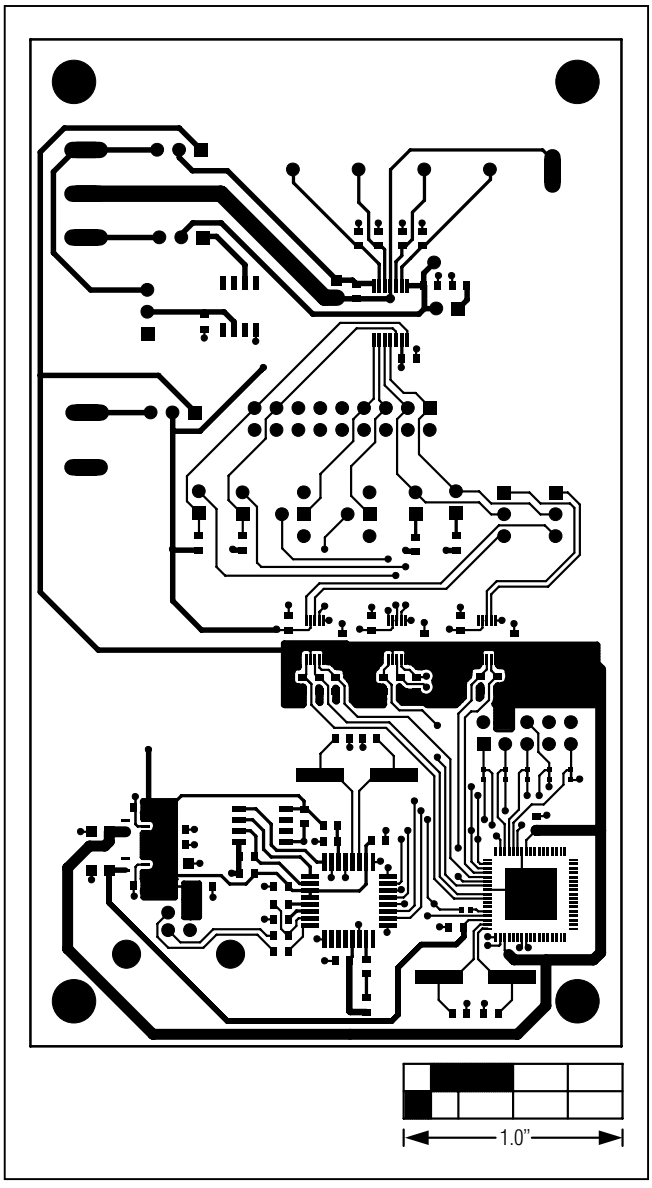

Figure 6. MAX5715A EV Kit PCB Layout—Component Side

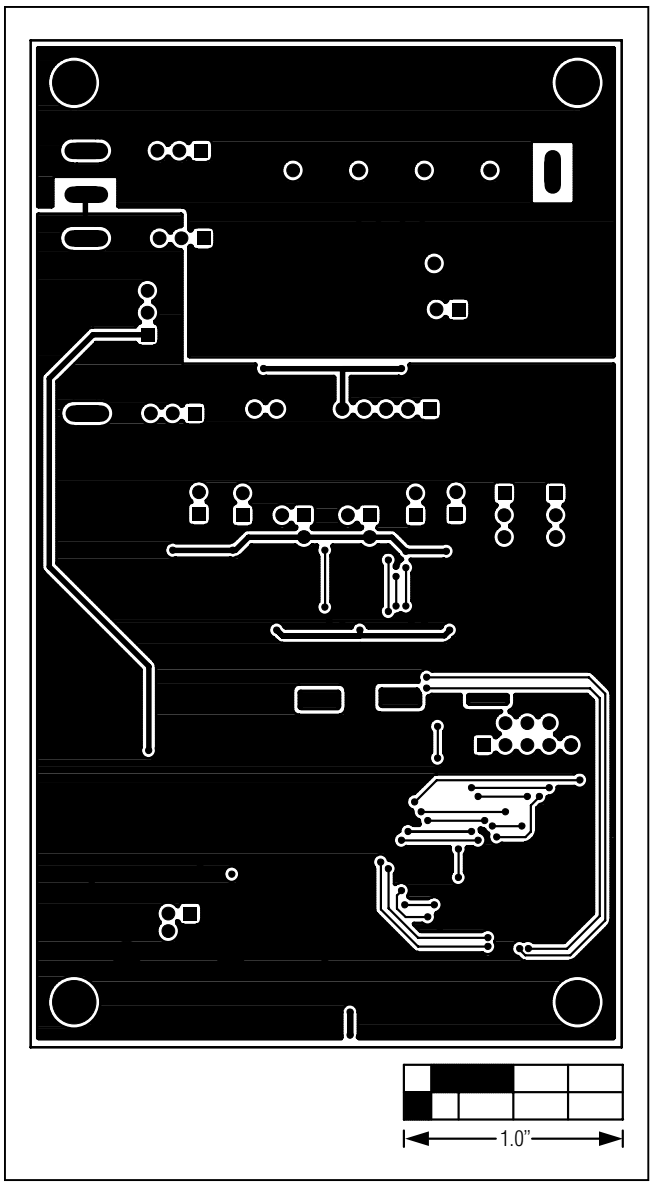

Figure 7. MAX5715A EV Kit PCB Layout—Solder Side

Ordering Information

PART	TYPE
MAX5715AEVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/12	Initial release	—

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time.

