

MAX5725A Evaluation Kit

Evaluates: MAX5723/MAX5724/ MAX5725A/MAX5725B

General Description

The MAX5725A evaluation kit (EV kit) demonstrates the MAX5725A 12-bit, 8-channel, low-power DAC with selectable internal references and buffered voltage output. The IC is in a 20-pin TSSOP package. The EV kit provides control to change the DAC's outputs, power operations, references, and watchdog time setting.

The IC features a watchdog function that can be enabled to monitor the I/O interface for activity and integrity.

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 IC's features.

The EV kit comes with the MAX5725AAUP+ installed, which is the 12-bit SPI version. Contact the factory for samples of the pin-compatible MAX5723AUP+ (8-bit), MAX5724AUP+ (10-bit), and MAX5725BAUP+ (12-bit) versions.

Ordering Information appears at end of data sheet.

Features

- ◆ **Wide Input Supply Range: 2.7V to 5.5V**
- ◆ **Independent Voltage for Digital I/O: 1.8V to 5.5V**
- ◆ **Demonstrates 4.4µs (typ) Settling Time of Buffered Output**
- ◆ **Precision Selectable Internal References Supporting 2.048V, 2.500V, and 4.096V**
- ◆ **Demonstrates User-Supplied External Reference**
- ◆ **Three Selectable Output Impedance (Termination) in Power-Down Mode**
 - ◇ 1kΩ, 100kΩ, or High Impedance
- ◆ **Power-Up Reset to Midscale or Zero**
- ◆ **Supports Entire Family of Octal SPI/I²C DACs**
- ◆ **Windows XP-, Windows Vista-, and Windows 7-Compatible Software**
- ◆ **USB-Powered (Cable Included)**
- ◆ **Demonstrates Configurable Interface Watchdog Timer**
- ◆ **Fully Assembled and Tested with Proven PCB Layout**

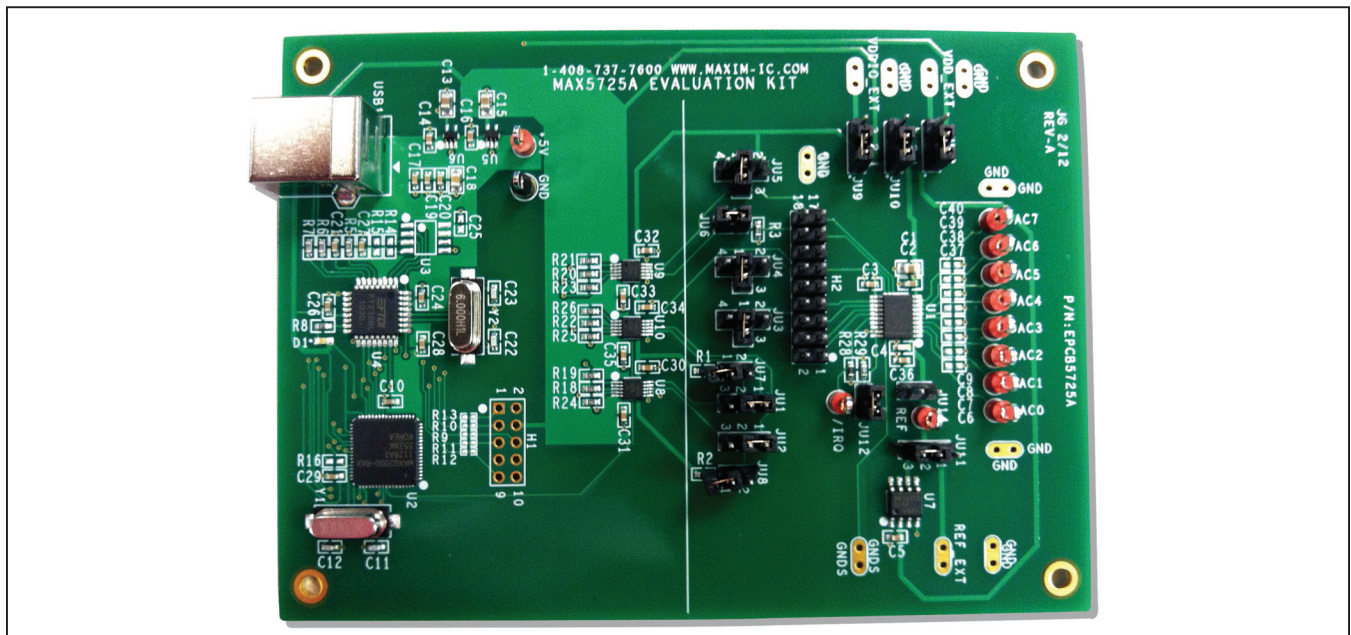


Figure 1. MAX5725A EV Kit

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Component List

DESIGNATION	QTY	DESCRIPTION
C1, C13, C15	3	10 μ F \pm 10%, 10V X7R ceramic capacitors (0805) Murata GRM21BR71A106K
C2, C3, C5, C10, C17, C19, C20, C24, C26–C29, C36	13	0.1 μ F \pm 10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C104K
C4	1	100pF \pm 5%, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H101J
C6–C9, C25, C37–C40	0	Not installed, ceramic capacitors (0603)
C11, C12	2	10pF \pm 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C14, C16, C30–C35	8	1 μ F \pm 10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C105K
C18	1	4.7 μ F \pm 10%, 10V X5R ceramic capacitor (0805) Murata GRM219R61A475K
C21	1	0.033 μ F \pm 10%, 25V X7R ceramic capacitor (0603) Murata GRM188R71E333K
C22, C23	2	22pF \pm 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
D1	1	Green LED (0603)
DAC0–DAC7, IRQ, REF, +5V	11	Red multipurpose test points
GND	1	Black multipurpose test point
H1	0	Not installed, 10-pin (2 x 5) header
H2	1	18-pin (2 x 9) header
JU1, JU2, JU9, JU10, JU11, JU13	6	3-pin headers
JU3, JU4, JU5	3	4-pin headers
JU6, JU7, JU8, JU12, JU14	5	2-pin headers

DESIGNATION	QTY	DESCRIPTION
R1, R2, R28	3	4.7k Ω \pm 5% resistors (0603)
R3	1	1M Ω \pm 5% resistor (0603)
R5, R18–R26	10	1.5k Ω \pm 5% resistors (0603)
R6, R7	2	27 Ω \pm 5% resistors (0603)
R8	1	220 Ω \pm 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)
R29	1	100k Ω \pm 5% resistor (0603)
U1	1	12-bit, 8-channel DAC (20 TSSOP) Maxim MAX5725AAUP+
U2	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U3	0	EEPROM (8 SO)
U4	1	UART-to-USB converter (32 LQFP)
U5	1	3.3V LDO regulator (5 SC70) Maxim MAX8511EXK33+
U6	1	2.5V LDO regulator (5 SC70) Maxim MAX8511EXK25+
U7	1	2.5V voltage reference (8 SO) Maxim MAX6173AASA+
U8, U9, U10	3	Level translators (10 μ MAX [®]) 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 SSL6000N1HK188F0-0
—	1	USB high-speed A-to-B cable (6 ft)
—	14	Shunts
—	1	PCB: MAX5725A EVALUATION KIT

*EP = Exposed pad.

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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

Note: Indicate that you are using the MAX5725A when contacting these component suppliers.

MAX5725A EV Kit Files

FILES	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5725A.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

- MAX5725A 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–JU14 are in their default positions, as shown in Table 1.
- 2) Visit www.maxim-ic.com/evkitsoftware to download the latest version of the EV kit software, 5725ARxx.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 2.

6) Within the **DACs** tab sheet, press the **EXECUTE** button with the **Quick DAC Output Voltage** group box.

7) Use the GNDS pad for the negative terminal of the DVM and use the positive terminal to measure the voltage at the DAC_ test points. Verify that the voltages measured are 1.25V.

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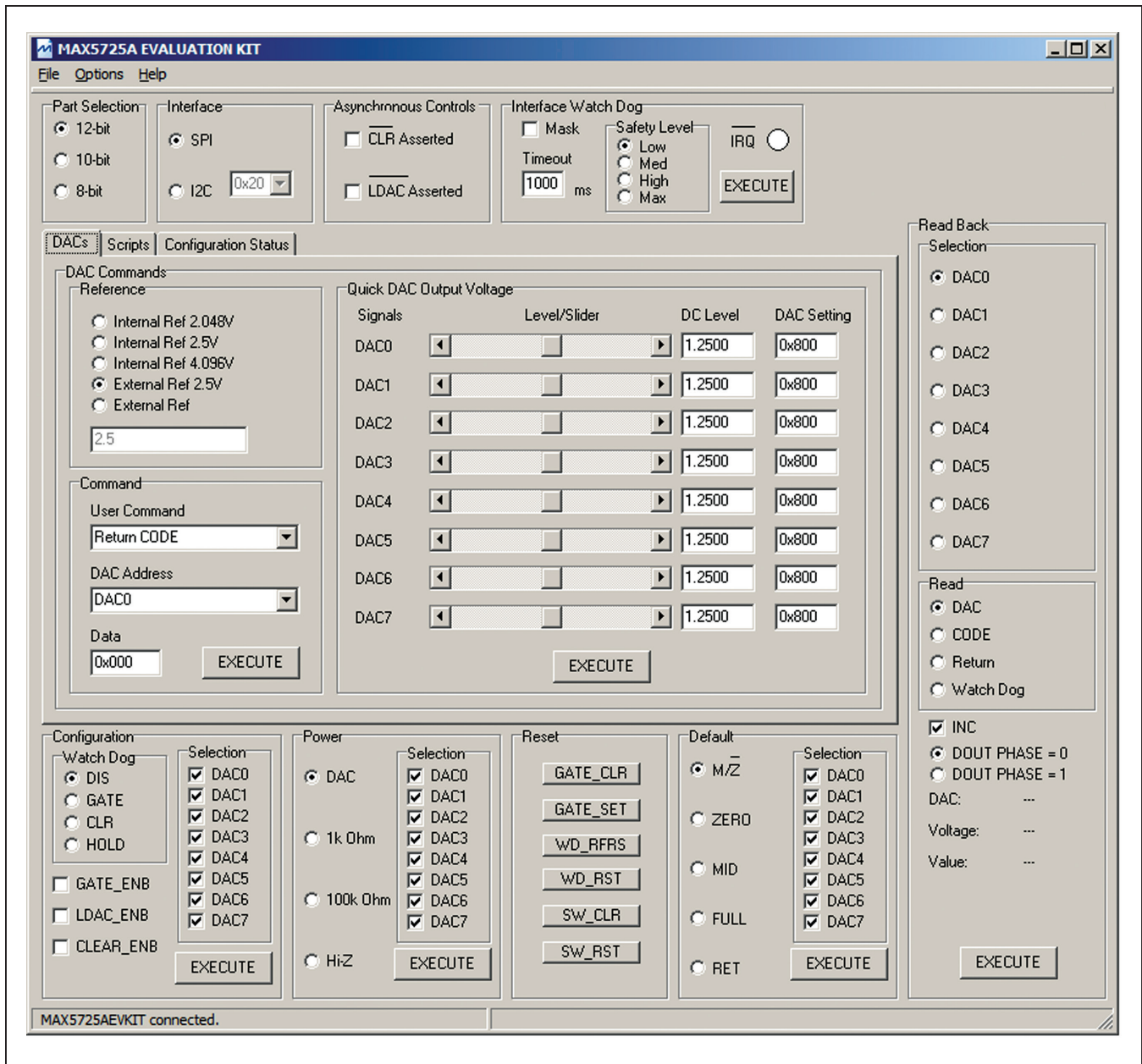


Figure 2. MAX5725A EV Kit Software Main Window (DACs Tab)

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MAX5725A/MAX5725B

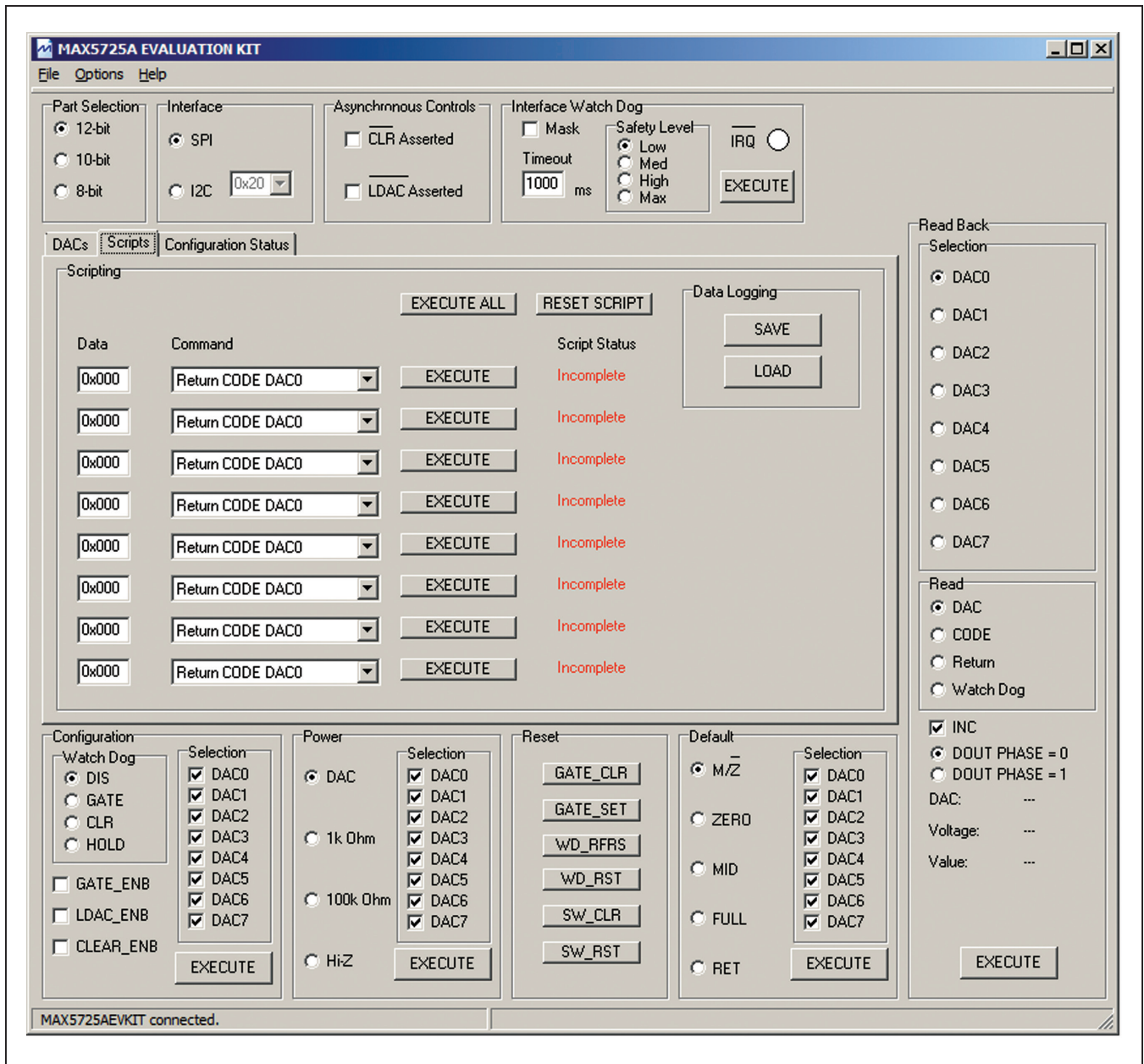


Figure 3. MAX5725A EV Kit Software Main Window (Scripts Tab)

MAX5725A Evaluation Kit

Evaluates: MAX5723/MAX5724/ MAX5725A/MAX5725B

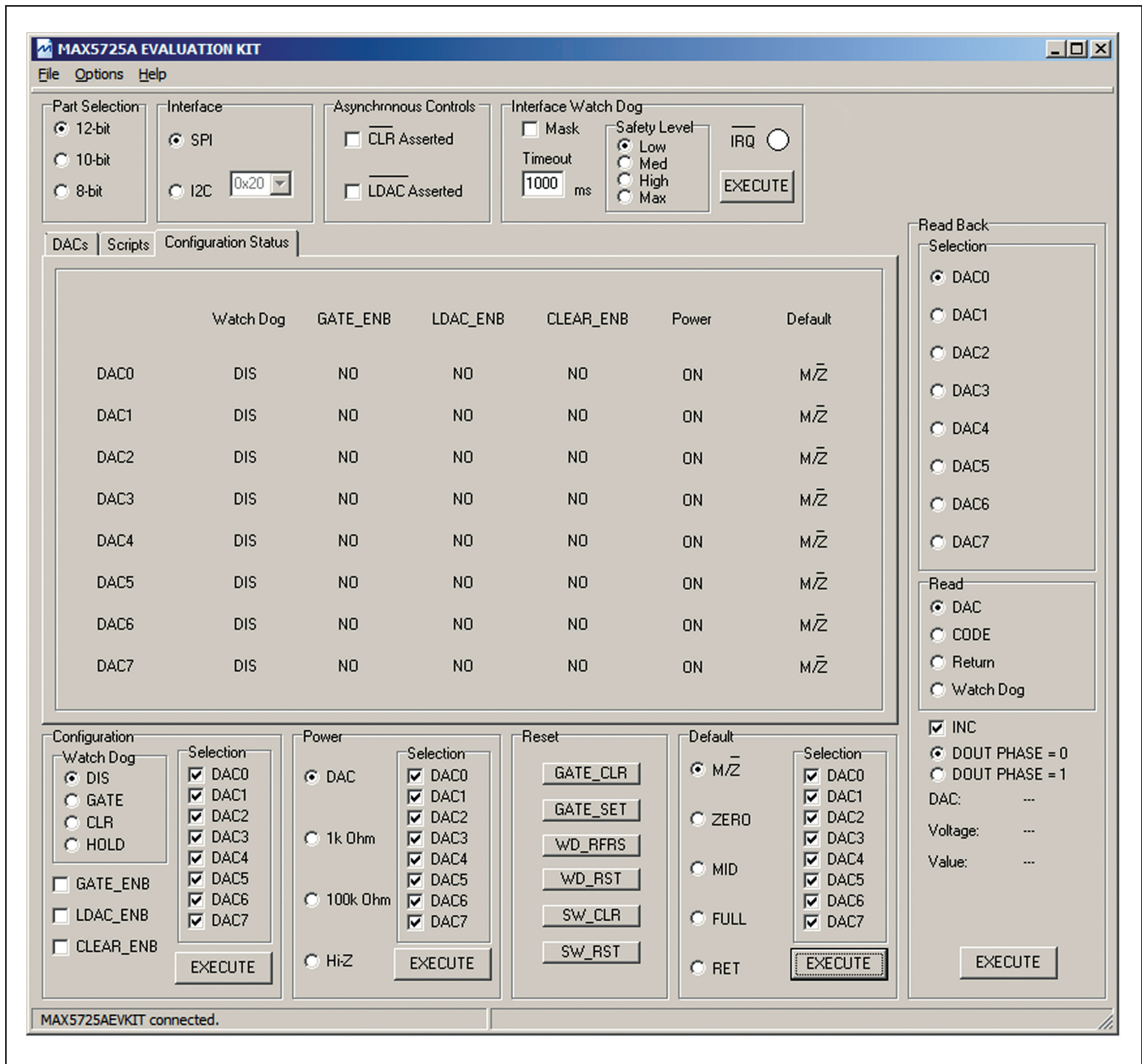


Figure 4. MAX5725A EV Kit Software Main Window (Configuration Status Tab)

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Detailed Description of Software

The MAX5725A EV kit software can evaluate the SPI interface MAX5725A family of 12-/10-/8-bit DACs. The main software window has three tabs: **DACs**, **Scripts**, and **Configuration Status**. Within the **DACs** tab sheet (Figure 2), the user can set the reference and DAC outputs. The **Scripts** tab sheet (Figure 3) allows the user to send a sequence of write commands to the eight DACs, and load and save the write sequence. The **Configuration Status** tab sheet (Figure 4) displays the configuration settings for each DAC. In addition, the software allows the user to adjust the configuration, power, reset, and default settings.

Demo Mode

The EV kit software enters the demo mode when the USB connection is not detected. When in demo mode, all communication to the EV kit is disabled; however, most of the software is functional. Demo mode allows the user to evaluate the software without hardware connectivity.

Part Selection

The user must select the appropriate radio button in the **Part Selection** group box that corresponds to the installed Maxim IC DAC bits.

SPI Interface

When the software first starts up, the **SPI** radio button is selected automatically. If the user selects the **I2C** radio button, then the software searches for a valid I2C address that is on the bus. If no address is found, the software returns to the **SPI** radio button selection.

The EV kit is capable of evaluating I2C parts by replacing U1. Once the I2C part is installed, refer to the *I2C Address* section in the MAX5825A EV kit data sheet.

Reference

The reference default configuration is set to 2.5V using the external voltage reference IC (U7). The external 2.5V reference can be connected between the EXT_REF pin and its corresponding ground. Select the **External Ref** radio button and type the reference voltage into the edit box. Removing the shunt from jumper JU11 allows internal reference options that include 2.048V, 2.5V, and 4.096V selection using the corresponding radio buttons. Make sure the VDD supply is greater or equal to the voltage reference selected for proper operation. When the EV kit uses the on-board 3.3V supply to power the IC, the **4.096V** radio button selection will not provide the 4.096V.

DAC Commands

Within the **DACs** tab sheet (Figure 2), the user can set the output of the DACs with two options. The first option is the **Quick DAC Output Voltage** group box that allows the user to write and load the CODE to all the DACs. Set

the desired output for each DAC using the corresponding slider and press the **EXECUTE** button. The second option is to write the return CODE, write the CODE, load the CODE, or write and load the CODE to the desired DAC using the drop-down lists and edit box within the **Command** group box. Press the **EXECUTE** button once all the settings are appropriately configured.

DAC Commands (Script)

Within the **Scripts** tab sheet (Figure 3), enter the desired **Data** on the left and choose the appropriate **Command** from the drop-down list. Pressing the **EXECUTE** button writes to the CODE and/or DAC registers and the **Script Status** changes from **Incomplete** to **Complete**. Refer to the MAX5725A IC data sheet for a list of possible commands. If a sequence of commands needs to be performed, adjust all **Data** edit boxes and **Command** drop-down lists accordingly, and press the **EXECUTE ALL** button. To reset the **Script Status** to **Incomplete**, press the **RESET SCRIPT** button.

Data Logging

Using the **SAVE** button, the sequence of commands can be saved into a text file format. To recall the sequence, press the **LOAD** button and select the appropriate text file.

Configuration Status

The **Configuration Status** tab sheet (Figure 4) displays the current status of the configuration, power, and default settings for each DAC.

Read Back

The EV kit reads back the return, CODE, DAC, and watchdog values. Check the **INC** checkbox to increment the address pointer and select the appropriate radio button to set the **DOUT PHASE** equal to 0 or 1 when reading back. Select the appropriate **Read** radio button and press the **EXECUTE** button in the **Read Back** group box.

Asynchronous $\overline{\text{CLR}}$

A checked **$\overline{\text{CLR}}$ Asserted** checkbox drives the $\overline{\text{CLR}}$ pin of the IC low, which clears the content of both CODE and DAC registers. Unchecking the **$\overline{\text{CLR}}$ Asserted** checkbox drives the $\overline{\text{CLR}}$ pin high and writing new commands is allowed again.

Asynchronous $\overline{\text{LDAC}}$

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

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Interface Watch Dog

Use the **Mask** checkbox, **Timeout** edit box, and **Safety Level** radio buttons to set the watchdog. The timeout time range that can be entered into the edit box is **1ms** to **4095ms**. The user must allow enough timeout time to send data to the DAC(s). It is recommended that the user set the timeout time to the maximum time of 4095ms, because the time Windows takes to communicate with the part may vary. In addition, configure the DAC output settings before pressing the **EXECUTE** button. The **IRQ** circle changes from white to red when the $\overline{\text{IRQ}}$ signal goes low. Refer to MAX5725A IC data sheet for detailed description.

Configuration

The configuration command includes the **Watch Dog** radio buttons and the **GATE_ENB**, **LDAC_ENB**, and **CLEAR_ENB** checkboxes for selected DAC(s). See the **Configuration Status** tab sheet to monitor the settings on each DAC. Refer to MAX5725A IC data sheet for detailed description.

Power

The power command is selectable for individual DACs. When a DAC is selected, the channel is active. Other options include powering down with 1k Ω termination

to GND, 100k Ω termination to GND, and high impedance. Once the appropriate selection is made, press the **EXECUTE** button.

Reset

The reset command allows the user to set or clear the gate, refresh or reset the watchdog timer, or issue a software reset or clear. Refer to MAX5725A IC data sheet for detailed description.

Default

The default command allows the user to set the default settings for individual DACs. Refer to MAX5725A IC data sheet for detailed description.

Advanced User Interface

There are two methods for communicating with the IC. The first is through the window shown in Figure 2. The second is through the **Advanced User Interface** window shown in Figure 4. The **Advanced User Interface** window becomes available by selecting the **Options I Interface (Advanced User)** menu item and allows execution of serial commands manually.

This interface is not recommended unless the user has to change individual bits in the interface.

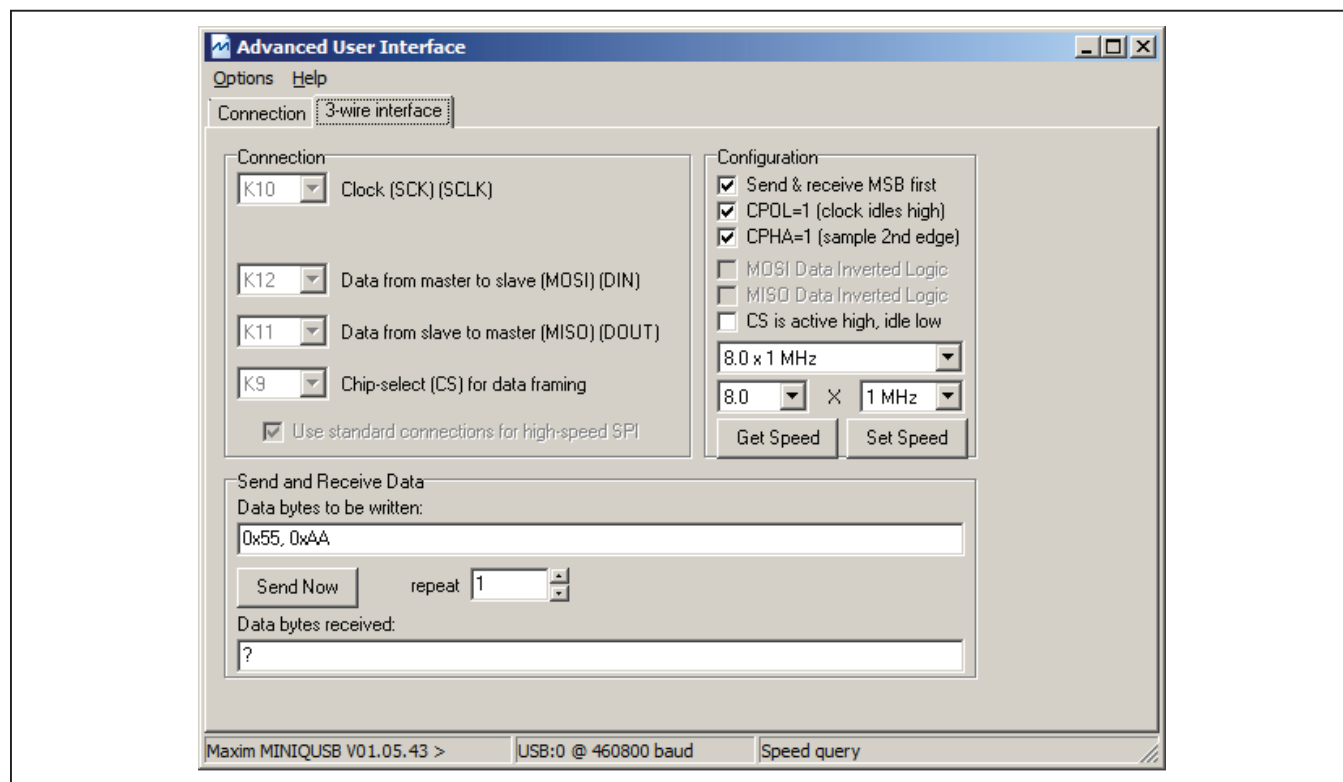


Figure 5. Advanced User Interface Window (3-Wire Interface Tab)

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Detailed Description of Hardware

The MAX5725A EV kit provides a proven layout for the MAX5725A IC. An on-board external 2.5V 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 IC 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 external 2.5V voltage reference (U7) is powered from the USB interface circuit when a 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 an external voltage reference by moving the shunt on jumper JU11 to the 2-3 position and applying 2V to VDD at the REF_EXT PCB pad on the EV kit. If the internal reference is selected, the REF pin becomes an output. In this case, JU11 should be removed.

User-Supplied SPI

To evaluate the EV kit with a user-supplied SPI bus, remove shunts from jumpers JU1–JU4. Apply the user-supplied \overline{CS} , SCLK, DIN, and DOUT signal to header pins H1-1, H1-3, H1-5, and H1-7, respectively. Connect the user-supplied SPI ground to header pins H1-2, H1-4, H1-6, and H1-8.

User-Supplied \overline{IRQ} , \overline{CLR} , and \overline{LDAC}

Remove the shunts from jumpers JU5 and JU6. Apply the user-supplied \overline{IRQ} , \overline{CLR} , and \overline{LDAC} to header pins H1-11, H1-15, and H1-17, respectively. Connect the user-supplied signal ground to header pins H1-12, H1-16, H1-18.

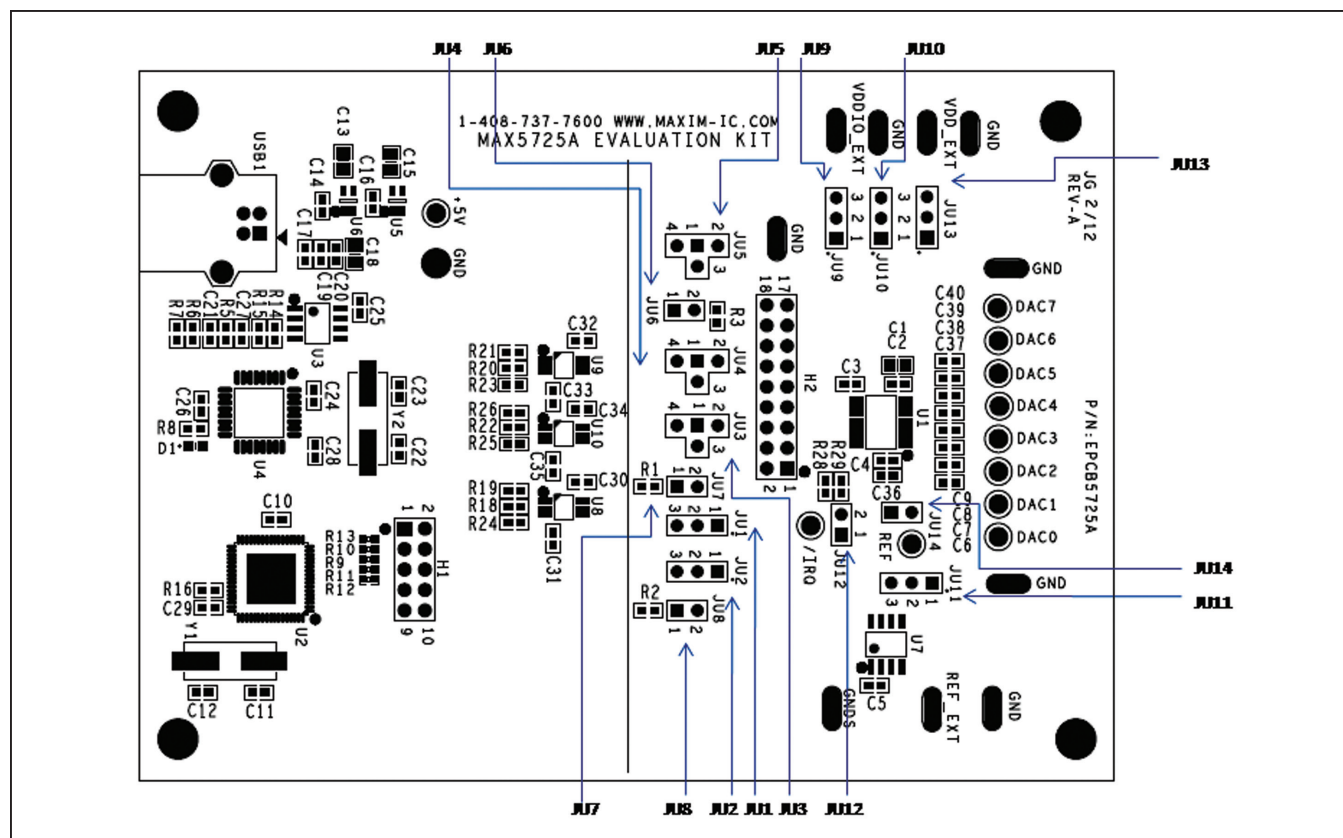


Figure 6. Jumper Callouts

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Table 1. Jumper Settings (JU1–JU14)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Connects the \overline{CS} signal of the on-board microcontroller to the \overline{CS} pin of IC U1.
	2-3	Do not install.
	Not installed	User-supplied \overline{CS} . Apply an appropriate signal at header pin H1-1.
JU2	1-2*	Connects the SCLK signal of the on-board microcontroller to the \overline{CS} pin of IC U1.
	2-3	Do not install.
	Not installed	User-supplied SCLK. Apply an 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.
JU4	1-2	Do not install.
	1-3*	Connects the DOUT signal of the on-board microcontroller to the DOUT pin of IC U1.
	1-4	Do not install.
JU5	1-2	Connects the \overline{LDAC} pin of IC U1 to VDDIO.
	1-3*	Connects the \overline{LDAC} signal of the on-board microcontroller to the \overline{LDAC} pin of IC U1.
	1-4	Connects the \overline{LDAC} pin of IC U1 to GND.
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 an appropriate signal at header pin H1-15.
JU7	Installed	Do not install.
	Not installed*	Disconnects pullup resistor R1 from the \overline{CS} pin of IC U1.
JU8	Installed	Do not install.
	Not installed*	Disconnects pullup resistor R2 from the SCLK pin of IC U1.
JU9	1-2*	Connects the VDDIO pin of IC U1 to the on-board 3.3V supply.
	2-3	Connects the VDDIO pin of 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 2.7V and 5.5V (VDD_EXT).
JU11	1-2	User-supplied REF. The user must apply a voltage reference at the REF_EXT PCB pad.
	2-3*	Connects the on-board voltage reference IC (U7) to the REF pin of IC U1.
JU12	Installed*	Connects the M/\overline{Z} pin of IC U1 to VDD.
	Not installed	Connects the M/\overline{Z} pin of IC U1 to 100k Ω pulldown resistor.
JU13	1-2*	Powers IC U7 using the USB supply.
	2-3	Powers IC U7 using the user-supplied power supply.
JU14	Installed*	Connects additional bypass capacitor C36 on the REF pin of IC U1.
	Not installed	Disconnect additional bypass capacitor C36 on the REF pin of IC U1.

*Default position.

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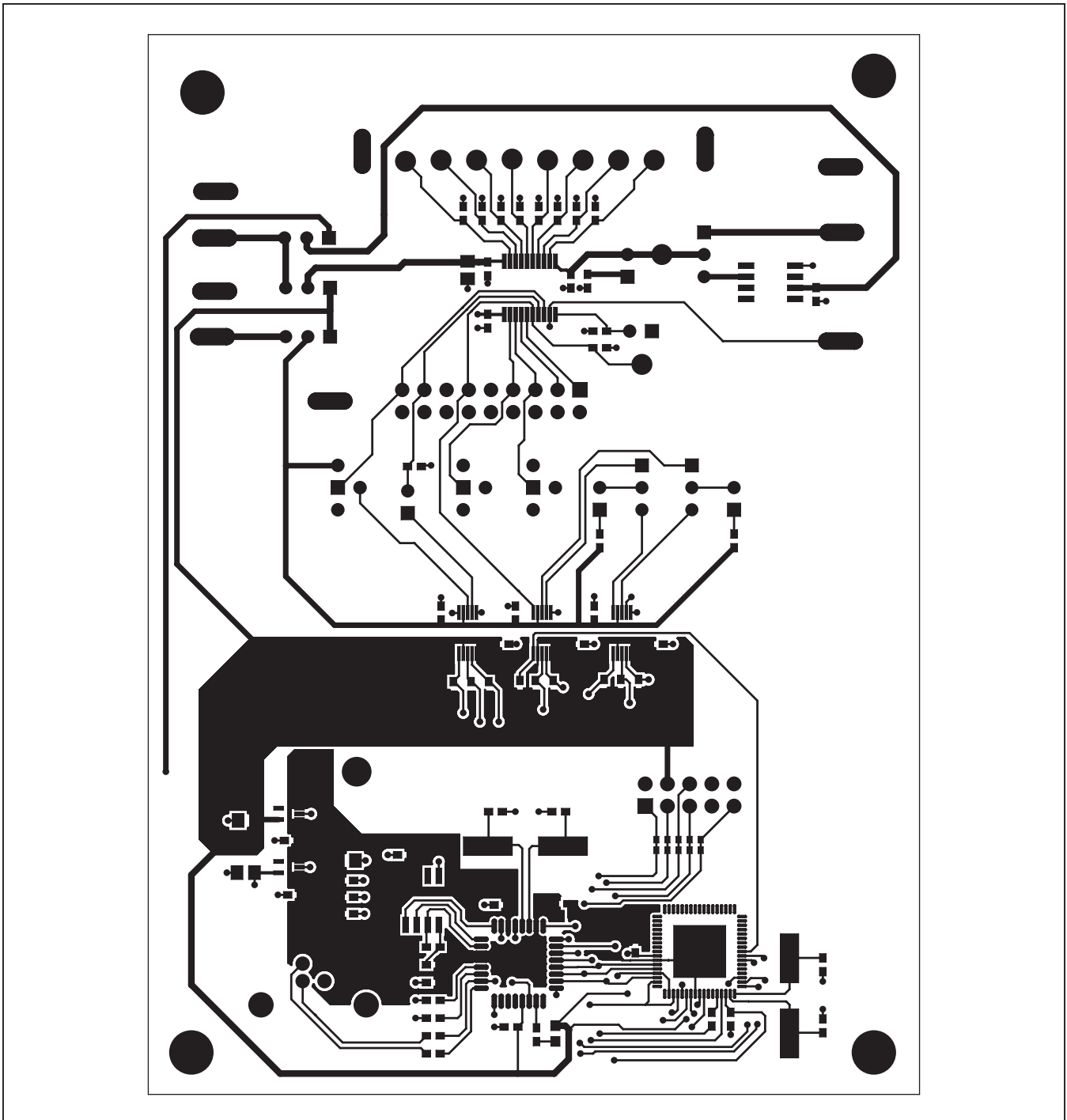


Figure 9. MAX5725A EV Kit PCB Layout—Component Side

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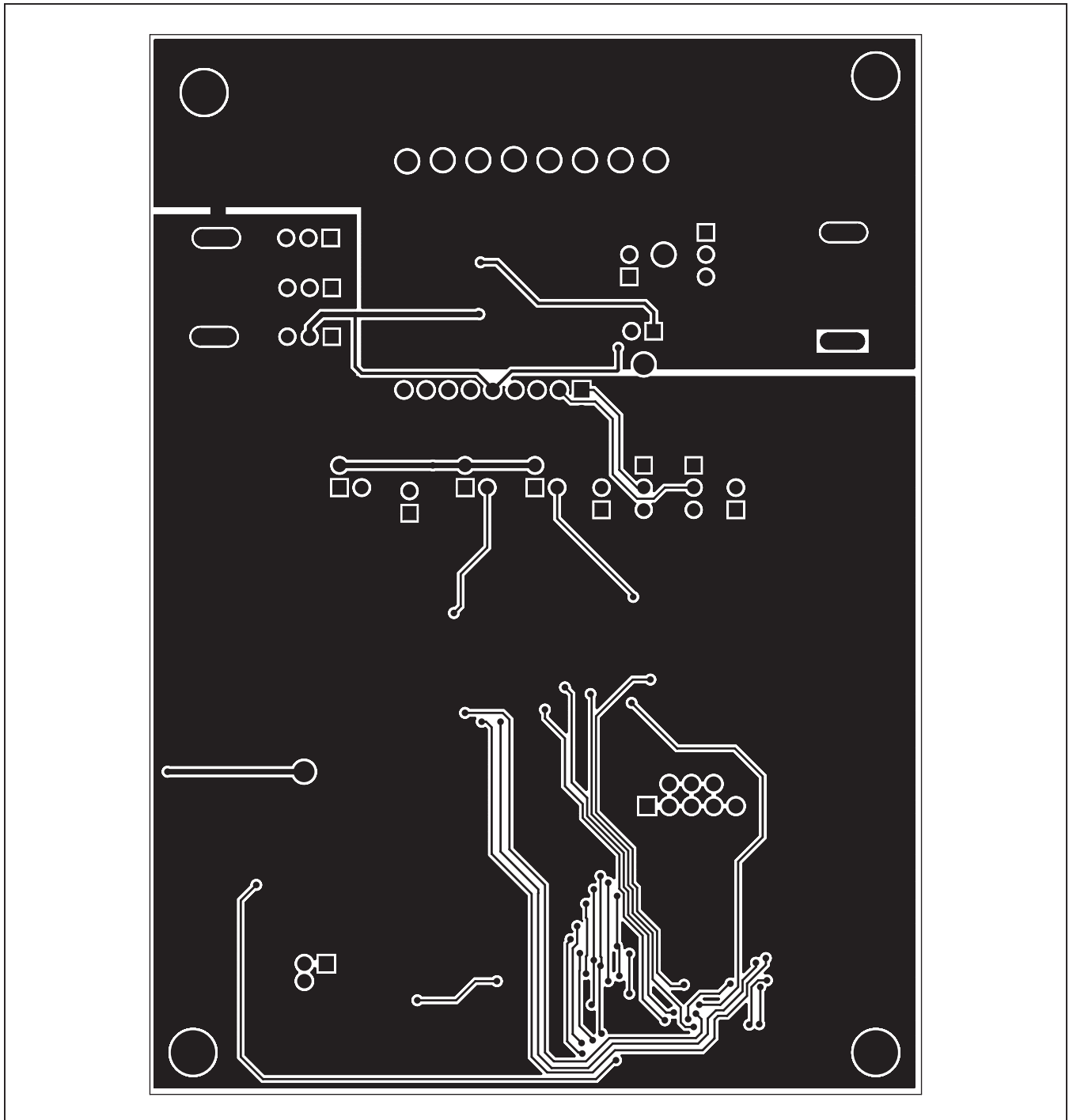


Figure 10. MAX5725A EV Kit PCB Layout—Solder Side

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Ordering Information

PART	TYPE
MAX5725AEVKIT#	EV Kit

#Denotes RoHS compliant.

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/12	Initial release	—

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

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