General Description

The MAX5X02 evaluation kit (EV kit) demonstrates the MAX5702 and MAX5802 12-bit, 2-channel, low-power DACs with internal reference and buffered voltage outputs. The EV kit provides controls to change the DAC outputs, power operations, and references.

The DAC ICs are controlled by an on-board MAXQ® microcontroller that provides two different selectable interface options: I2C and SPI. The EV kit features Windows XP®-, Windows Vista®-, and Windows® 7-compatible software that provides a simple graphical-user interface (GUI) for exercising the features of the ICs.

The EV kit comes with the MAX5702AAUB+ (SPI) and the MAX5802AAUB+ (I2C) installed. Contact the factory for samples of the pin-compatible MAX5700AUB+ (SPI, 8-bit), MAX5701AUB+ (SPI, 10-bit), MAX5702BAUB+ (SPI, 12-bit), MAX5800AUB+ (I2C, 8-bit), MAX5801AUB+ (I2C, 10-bit), MAX5802BAUB+ (I2C, 12-bit) versions.

Features

- 2.7V to 5.5V Wide Input Supply Range
- Demonstrates 4.5µs Settling Time of Buffered Output
- High Precision with ±1 LSB INL
- 1kΩ, 100kΩ, or High-Z Selectable Output Termination
- 2.048V, 2.500V, and 4.096V Precision 10ppm (max) Selectable Internal References
- Demonstrates User-Supplied External Reference
- Supports Entire Family of I2C and SPI 12-/10-/8-Bit DACs
- Windows XP-, Windows Vista-, and Windows 7-Compatible Software
- USB-Powered (Cable Included)
- Fully Assembled and Tested with Proven PCB Layout

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

Component List

DESIGNATION	QTY	DESCRIPTION
ADDR, CSB, DIN, SDA, SCL, SCLK, U1_REF, U1_CLR, U1_OUTA, U1_OUTB, U2_OUTA, U2_OUTB, U2_REF, U2_CLR, VDD, VDDIO	16	Red test points
AGND (x6), DGND (x2)	8	Black test points
C1, C6–C9, C19–C22, C24, C28, C32	12	1µF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C105K

DESIGNATION	QTY	DESCRIPTION
C2, C5, C12–C14, C18, C23, C25, C27, C29	10	0.1µF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C104K
C3, C11, C17, C30, C31	0	Not installed, ceramic capacitors (0603)
C4, C10	2	100pF ±5%, 50V C0G ceramic capacitors (0603) Murata GQM1885C1H101J
C15, C16	2	18pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H180J
H1	0	Not installed, 4-pin header
H2	0	Not installed, 10-pin (2 x 5) header
JU1, JU2, JU7–JU11	7	2-pin headers
JU3–JU6	4	3-pin headers
JU_ID0–JU_ID3	0	Not installed, 2-pin headers

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Windows, Windows XP, and Windows Vista are registered trademarks and registered service marks of Microsoft Corporation.

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
L1	1	Ferrite bead (0603) TDK MMZ1608R301A
R1, R2	2	4.7kΩ ±5% resistors (0603)
R3, R15, R16	3	1MΩ ±5% resistors (0603)
R4–R6	3	1.5kΩ ±5% resistors (0603)
R8	1	100Ω ±5% resistor (0603)
R9	1	10kΩ ±5% resistor (0603)
U1	1	12-bit 2-channel DAC (10 µMAX®) Maxim MAX5802AAUB+
U2	1	12-bit 2-channel DAC (10 µMAX) Maxim MAX5702AAUB+
U3	1	2.5 voltage reference (8 SO) Maxim MAX6071BAUT25+

DESIGNATION	QTY	DESCRIPTION
U4, U6	2	Level translators (10 µMAX) Maxim MAX1840EUB+
U5	0	ESD protector Not Installed (6 SOT23)
U7	1	3.3V LDO (5 SC70) Maxim MAX8511EXK33+
U8	1	Microcontroller (64 LQFP) Maxim MAXQ622G-0000+
USB1	1	Mini-USA type-B right-angle PC-mount receptacle
Y1	1	12MHz crystal (HCM49)
—	1	USB high-speed A-to-B cables, 6ft
—	11	Shunts
—	1	PCB: MAX5X02 EVKIT

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata Americas	800-241-6574	www.murataamericas.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: Indicate that you are using the MAX5X02 when contacting these suppliers.

MAX5X02 EV Kit Files

FILES	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5X02Vxx.EXE	Application program
USBConverterDLL.DLL	Application library
UNINSTALL.EXE	Uninstalls the EV kit software

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Quick Start

Required Equipment

- MAX5X02 EV kit (USB cable included)
- Windows XP, Windows Vista, or Windows 7 PC with a spare USB port
- Two digital voltmeters (DVMs)

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–JU11 are in their default position, as shown in Table 1.

2) Connect the positive terminal of DVM #1 to U2_OUTA and connect the negative terminal to nearest the AGND test point.

3) Connect the positive terminal of DVM #2 to U1_OUTA and connect the negative terminal to the nearest AGND test point.

4) Visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, MAX5X02GUISetupVxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.

5) 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.

6) Connect the USB cable from the PC to the EV kit board; the USB driver is installed automatically.

7) 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.

8) Within the **DACs** tab in the **Data** edit box, enter **0xFFF** and select the command **Write CODE and LOAD reg A** within the same row. Press the **Execute** button on the right.

9) Verify that DVM #1 measures 2.500V.

10) Select the **I2C** radio button in the **Interface** group box and the GUI automatically detects the I^2C address. See Figure 2.

11) Move jumper JU4 to the 1-2 position.

12) Press the **Execute** button on the same row again.

13) Verify that DVM #2 measures 2.500V.

Figure 1. MAX5X02 EV Kit Software Main Window (SPI)

Figure 2. MAX5X02 EV Kit Software Main Window (I²C)

Detailed Description of Software

The MAX5X02 EV kit software can evaluate all I^2C and SPI interface 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**. Within the **DACs** tab, the user can send a sequence of write commands to the two DACs, assert $\overline{CLR}$, and load and save the write sequence. The **Controls** tab (Figure 3) allows the user to change the power, configuration, and reference.

Part Selection

On the upper left corner is a **Part Selection** group box. The user must select the appropriate radio button that corresponds to the installed Maxim IC DAC resolution (number of bits).

Interface

The **Interface** group box allows the user to toggle between I^2C and SPI DAC parts. By default, the software is configured to communicate using the SPI interface first. Once the **I2C** radio button selection is made, the software automatically detects the correct I^2C address from the drop-down list and the user is allowed to communicate using the I^2C interface. See Table 2 for a list of the I^2C addresses.

DAC Commands

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 MAX5700/MAX5701/MAX5702 and MAX5800/MAX5801/MAX5802 IC data sheets for a list of possible commands. If a sequence of commands need 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.

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.

DAC Outputs (I^2C Only)

Press the **Read Back** button and the CODE and voltages of the DACs are displayed within the **DAC Outputs** group box.

Asynchronous $\overline{CLR}$

A checked $\overline{CLR}$ checkbox drives the $\overline{CLR}$ pin of the MAX5702 or MAX5802 low, which allows the changes to the CODE register to change the DAC outputs. Unchecking the $\overline{CLR}$ **Asserted** checkbox drives the $\overline{CLR}$ pin of the MAX5702 or MAX5802 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. A **Read Back** button is available for the I^2C interface.

Figure 3. MAX5X02 EV Kit Software Main Window (SPI Controls Tab)

Figure 4. MAX5X02 EV Kit Software Main Window (I2C Controls Tab)

Configuration $\overline{\text{LDAC}}$

The $\overline{\text{LDAC}}$ **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 2.5V using the on-board voltage-reference IC (U3). A new reference voltage can be entered into the **REF** edit box, but the user must apply the same voltage at the board for proper operation. Other reference options include 2.048V, 2.500V, and 4.096V through software commands. Make sure 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. A **Read Back** button is available for the I2C interface.

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, and the registers are cleared.

Multiple EV Kits

The software can communicate to multiple MAX5X02 EV kits connected to the USB ports of the PC. The status bar at the bottom of the GUI shows the number of boards that are connected. If all boards connected to the PC are not connected to the GUI, click the **Options | Connect** menu item and the status bar should be updated. Use the **Board Index** drop-down list to select the appropriate EV kit for communications.

Detailed Description of Hardware

The MAX5X02 EV kit provides a proven layout for the MAX5702 and the MAX5802. An on-board MAXQ622 microcontroller and jumpers to disconnect the on-board microcontroller are included on the EV kit.

Table 1. EV Kit Jumper Settings

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Installed*	Connects the SDA signal of the on-board microcontroller to the SDA pin of IC U1.
	Not installed	Disconnects the SDA signal of the on-board microcontroller to the SDA pin of IC U1.
JU2	Installed*	Connects SCL signal of in-board microcontroller to the SCL pin of IC U1.
	Not installed	Disconnects the SCL signal of the on-board microcontroller to the SCL pin of IC U1.
JU3	1-2*	Connects the ADDR pin of IC U1 to VDDIO to determine the I2C address (see Table 2).
	2-3	Connects the ADDR pin of IC U1 to DGND to determine the I2C address (see Table 2).
	Not installed	ADDR pin of IC U1 is not connected to determine the I2C address (see Table 2).
JU4	1-2	Connects on-board voltage reference IC (U3) to the REF pin of IC U1.
	2-3*	Connects on-board voltage reference IC (U3) to the REF pin of IC U2.
	Not installed	User-supplied REF. The user must apply a voltage reference at the U1_REF and/or U2_REF test point(s).
JU5	1-2*	Connects the VDDIO pins of IC U1 and U2 to the on-board 3.3V supply.
	2-3	Connects the VDDIO pins of IC U1 and U2 to the on-board 5V USB supply.
	Not installed	User-supplied VDDIO. The user must apply a voltage between 1.8V to 5.5V at the VDDIO test point.
JU6	1-2*	Connects the VDD pins of IC U1 and U2 to the on-board 3.3V supply
	2-3	Connects the VDD pins of IC U1 and U2 to the on-board 5V USB supply.
	Not installed	User-supplied VDD. The user must apply a voltage between 2.7V to 5.5V at the VDD test point.
JU7	Installed*	Connects the DIN signal of the on-board microcontroller to the DIN pin of IC U2.
	Not installed	Disconnects the DIN signal of the on-board microcontroller to the DIN pin of IC U2.

Table 1. EV Kit Jumper Settings (continued)

JUMPER	SHUNT POSITION	DESCRIPTION
JU8	Installed*	Connects the SCLK signal of the on-board microcontroller to the SCLK pin of IC U2.
	Not installed	Disconnects the SCLK signal of the on-board microcontroller to the SCLK pin of IC U2.
JU9	Installed*	Connects the CSB signal of the on-board microcontroller to the CSB pin of IC U2.
	Not installed	Disconnects the CSB signal of the on-board microcontroller to the CSB pin of IC U2.
JU10	Installed	Connects the $\overline{CLR}$ signal of the on-board microcontroller to the $\overline{CLR}$ pin of IC U1.
	Not installed*	Disconnects the $\overline{CLR}$ signal of the on-board microcontroller to the $\overline{CLR}$ pin of IC U1.
JU11	Installed*	Connects the $\overline{CLR}$ signal of the on-board microcontroller to the $\overline{CLR}$ pin of IC U2.
	Not installed	Disconnects the $\overline{CLR}$ signal of the on-board microcontroller to the $\overline{CLR}$ pin of IC U2.

*Default position.

I²C Address

The I²C address of the MAX5802 is determined by the shunt setting of jumper JU3. See Table 2 for all possible hexadecimal addresses.

User-Supplied Power Supply

The EV kit is powered completely from the USB port by default. To power the MAX5702 and MAX5802 with a user-supplied power supply, remove the shunt on jumper JU6 and apply a 2.7V to 5.5V power supply at the VDD test point and the nearest AGND test point on the EV kit.

A user-supplied VDDIO power supply can also be used by removing the shunt on jumper JU5 and applying 1.8V to 5.5V to the VDDIO test point and the nearest AGND test point on the EV kit.

User-Supplied Reference

The user can apply a user-supplied voltage reference by removing the shunt on jumper JU4 and applying 1.24V to VDD at the U1_REF and/or U2_REF test points on the EV kit.

User-Supplied SPI

To evaluate the EV kit with a user-supplied SPI bus, remove shunts from jumpers JU7–JU9. Apply the user-supplied SPI signals to the DIN, SCLK, and CSB test points and use the nearest DGND test point for the return ground on the EV kit.

Table 2. I²C Address Setting (JU3)

SHUNT POSITION (ADDR)	MAX5802 ADDRESS (hex)	
	WRITE	READ
1-2*	0x18	0x19
2-3	0x1C	0x1D
Not installed	0x1E	0x1F

*Default position.

User-Supplied I²C

To evaluate the EV kit with a user-supplied I²C bus, remove shunts from jumpers JU1–JU3. Apply the user-supplied I²C signals to the SCL and SDA test points and use the nearest DGND test point for the return ground on the EV kit. If pullup resistors are on the user-supplied interface, resistors R1 and R2 should be removed. Apply appropriate signal to the ADDR test point to determine the I²C address.

User-Supplied $\overline{CLR}$

A user-supplied $\overline{CLR}$ signal can be used by removing the shunts from jumper JU10 and/or JU11. Apply the user-supplied $\overline{CLR}$ signal to U1_$\overline{CLR}$ for the MAX5802 and/or U2_$\overline{CLR}$ for the MAX5702, and use the nearest DGND test point for the return ground on the EV kit.
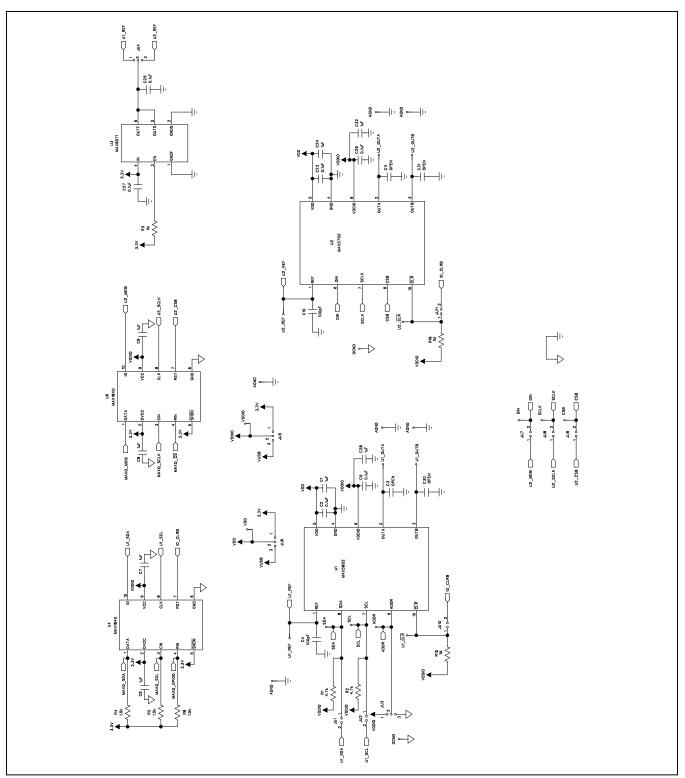
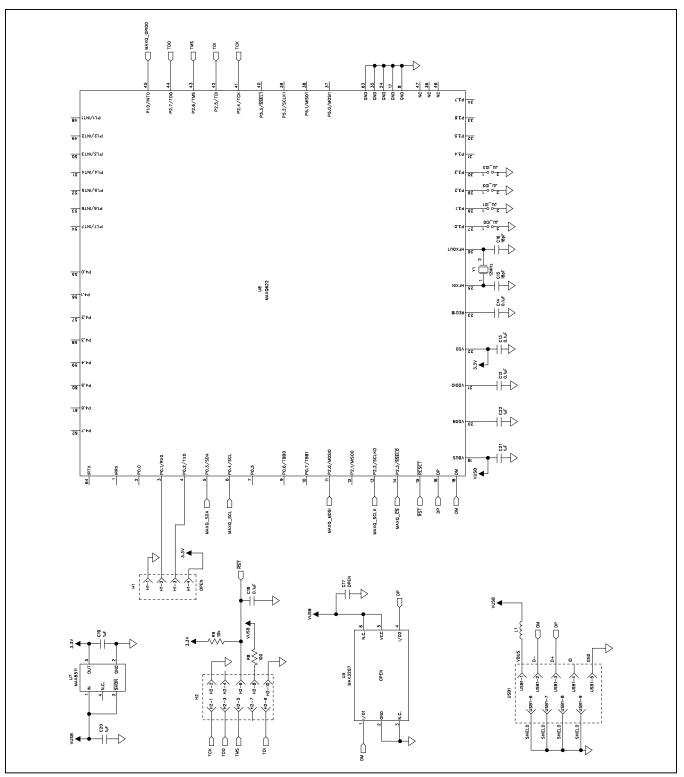*Figure 5a. MAX5X02 EV Kit Schematic (Sheet 1 of 2)*

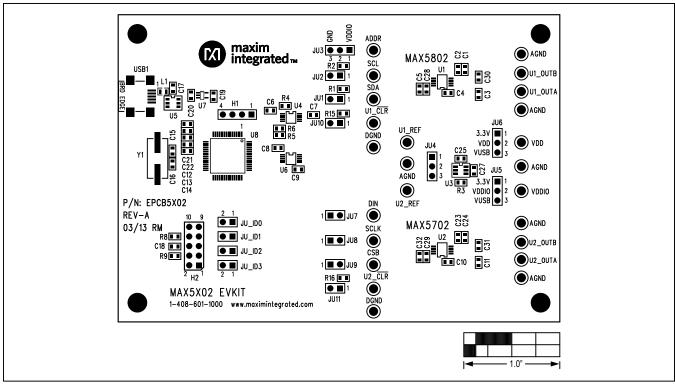*Figure 5b. MAX5X02 EV Kit Schematic (Sheet 2 of 2)*

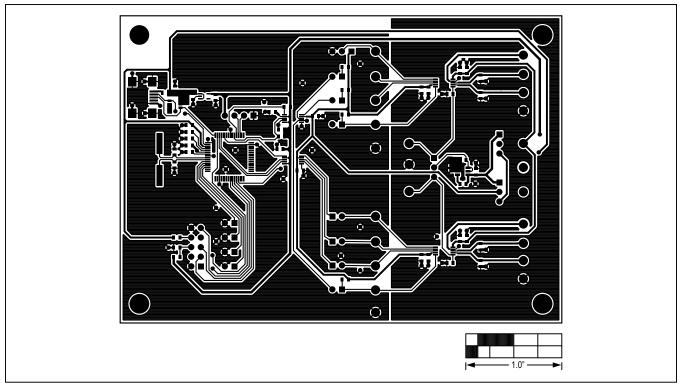Figure 6. MAX5X02 EV Kit Component Placement Guide—Component Side

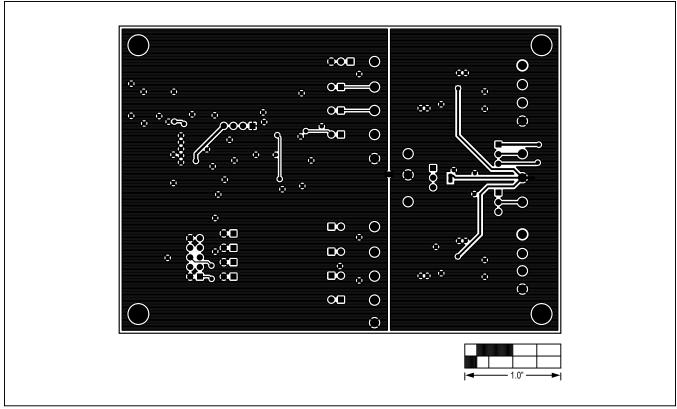Figure 7. MAX5X02 EV Kit PCB Layout—Component Side

Figure 8. MAX5X02 EV Kit PCB Layout—Solder Side

Ordering Information

PART	TYPE
MAX5X02EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/13	Initial release	—