

# MAX5214DACLite Evaluation Kit

## Evaluates: MAX5214

### General Description

The MAX5214DACLite evaluation kit (EV kit) enables evaluation of the MAX5214 single-channel, low-power, buffered-output, 3-wire SPI interface 14-bit DAC. The EV kit also includes Windows XP®, Windows Vista®, and Windows® 7-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the IC.

### Features

- ◆ **USB Powered, No Additional Supply Needed\* (Cable Not Included)**
- ◆ **3.3V Fixed VDD from On-Board LDO (MAX8510)**
- ◆ **3.000V On-Board Precise Voltage Reference (MAX6133)**
- ◆ **Direct USB Communication through the MAXQ622 Microcontroller**
- ◆ **Windows XP-, Windows Vista-, and Windows 7 (32-bit)-Compatible Software**
- ◆ **SPI Interface Terminals**
- ◆ **Proven PCB Layout**
- ◆ **Fully Assembled and Tested**

\*Since 14 bits is 16,383 levels, the LSB is 183 $\mu$ V. Depending on how clean the computer's USB power is, it may be necessary to provide clean analog power for the best accuracy.

[Ordering Information](#) appears at end of data sheet.

### Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C5, C6 C7, C9	6	1 $\mu$ F $\pm$ 10%, 10V X5R ceramic capacitors (0603) TDK C1608X5R1A105K
C3	1	10nF $\pm$ 10%, 50V X7R ceramic capacitor (0603) TDK CGA3E2X7R1H103K
C4, C8, C12, C13, C14	4	0.1 $\mu$ F $\pm$ 10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C104KA01J
C10, C11	2	18pF $\pm$ 5%, 50V C0G ceramic capacitors (0603) TDK C1608C0GH1180JT
FB1	1	Ferrite bead (0805) TDK MMZ20112Y601BT
J1	1	Mini-USB-B receptacle Mill-Max 897-43-005-00-100001
J2	0	Not installed, 10-pin (2 x 5) JTAG header, 0.1in centers

DESIGNATION	QTY	DESCRIPTION
J3	0	Not installed, 2-pin header, 0.1in centers
J4	0	Not installed, 1-pin header
J5, J7, J8	3	Turret terminal pin headers Mill-Max 2108-2-00-44-00-00-07-0
J6	0	Not installed, 4-pin header, 0.1in centers
J9	0	Not installed, RF-coaxial SMA connector Molex 733910060
R1, R2, R10	3	27 $\Omega$ $\pm$ 1% resistors (0603) YAGEO RC0603FR-0727RL
R3	1	1k $\Omega$ $\pm$ 1% resistor (0603) Panasonic ERJ-3EKF1001V
R4-R9	6	0 $\Omega$ $\pm$ 1% resistors (0603) YAGEO RC0603FR-070RL

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### Component List (continued)

DESIGNATION	QTY	DESCRIPTION
U1	1	14-bit DAC (8 $\mu$ MAX <sup>®</sup> ) Maxim MAX5214GUA+
U2	1	16-bit microcontroller with USB 2.0 interface (64 LQFP) Maxim MAXQ622G-0000+
U3	1	3.000V, 3ppm/°C, low-power voltage reference (8 $\mu$ MAX) Maxim MAX6133A30+

DESIGNATION	QTY	DESCRIPTION
U4	1	3.3V, ultra-low noise LDO linear regulator (5 SC70) Maxim MAX8510EXK33+
Y1	1	12MHz crystal oscillator (HC49US) Abracon Crystals ABLS-12.000MH-B4-T
—	1	PCB: MAX5214Lite Rev. A

### Component Suppliers

SUPPLIER	PHONE	WEBSITE
Abracon Corporation	945-546-8000	www.abracon.com
Mill-Max Mfg. Corp.	516-922-6000	www.mill-max.com
Molex	800-768-6539	www.molex.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Panasonic Corp.	800-344-2112	www.panasonic.com
TDK Corp.	847-803-6100	www.component.tdk.com
YAGEO Corporation	—	www.yageo.com

**Note:** Indicate that you are using the MAX5214 when contacting these component suppliers.

### Quick Start

#### Required Equipment

- MAX5214DACLite EV kit  
The EV kit board is a plug-n-play device that connects to the PC through a USB-A to Mini-B cable. The USB cable is not included, but is widely available from local stores.
- The EV kit is preloaded with the default firmware that communicates with the MAX5214DACLite evaluation software. Software can be installed and run on any Windows-based system.

**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:

- Visit [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware) to download the latest version of the EV kit software, 5214DACLiteRxx-LV.ZIP. Unzip the file and run the setup.exe program. Follow the instructions to install the evaluation software on your PC. The program files are copied and icons are created in the Windows **Start | Programs** menu.
- Connect the MAX5214DACLite to the PC through a USB cable. No additional driver is needed; Windows recognizes the new device as a human interface device (HID) and automatically finds and installs the appropriate driver for it. For more information, check the device properties in:  
**Device Manager\Human Interface Control\USB Input Device\Properties→USB\VID\_0B6A and PID\_1234**. See Figure 1.
- Run the MAX5214Lite.exe program. The application's GUI window appears, as shown in Figure 2.

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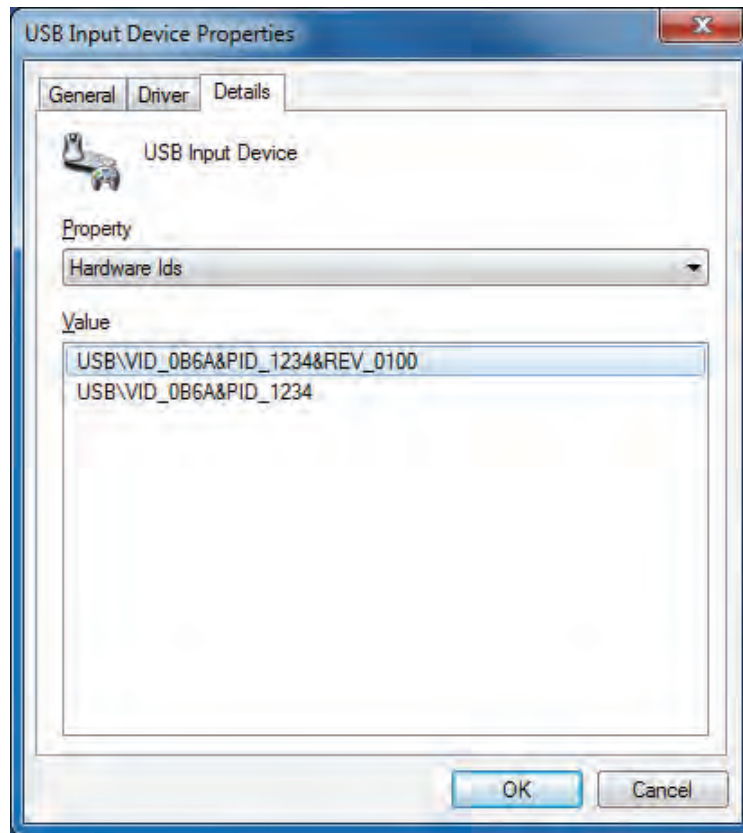


Figure 1. USB Input Device Properties

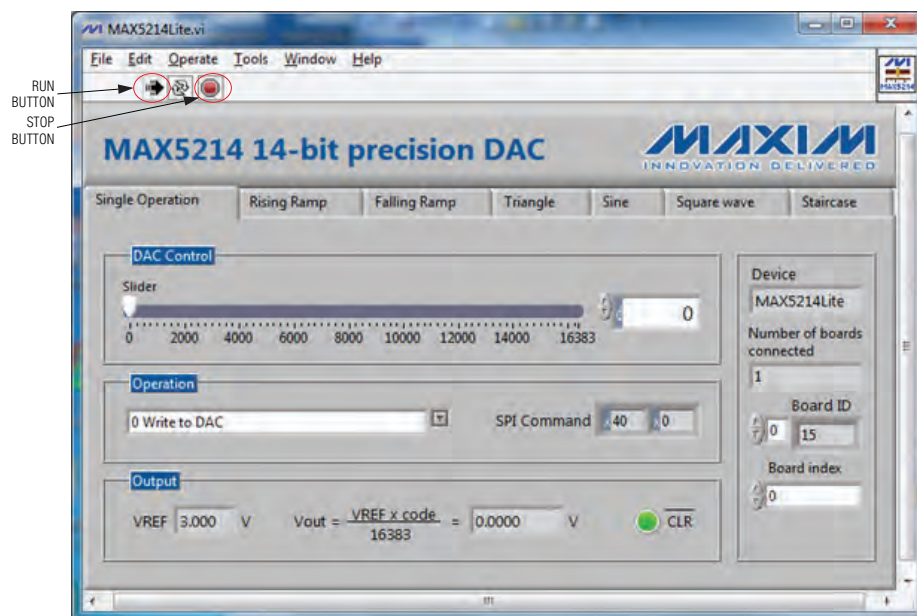


Figure 2. GUI Single Operation Tab

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### Detailed Description of Software

#### **Single Operation Tab**

The **Single Operation** tab (Figure 2) is active by default. The application checks all the boards with the USB VID/PID 0x0B6A/0x1234 that connected to the PC and indicates them on the right side of the GUI. Up to 16 boards can be connected to the system. Each board has its own unique board index even though the board ID could be the same. In order to communicate with a particular board, the **Board ID** index should match with the **Board Index** box (Figure 3).

Any possible operation can be evaluated on this tab sheet. For example, move the track bar slider to set the DAC output voltage. The **DAC Control** spin box reflects

the slider position with a decimal number. Connect a digital multimeter (DMM) to the J5 header (Figure 8) to measure the DAC output voltage.

The DAC output can also be set by selecting a decimal, hexadecimal, or an octal or binary value in the **DAC Control** spin box (Figure 4). The IC accepts codes from 0 to 16383 ( $2^{14}-1$ ) decimal or from 0 to 3FFF hex. The notation is displayed on the left side of the box.

In the **Rising Ramp**, **Falling Ramp**, **Triangle**, **Sine**, **Square wave**, or **Staircase** tab sheets give the DAC the ability to generate different waveforms with the selected parameters (see the sine-wave and staircase plots shown in Figures 5 and 6). There is a possible delay to start a new waveform until previous one finishes a full cycle when switching between tabs.

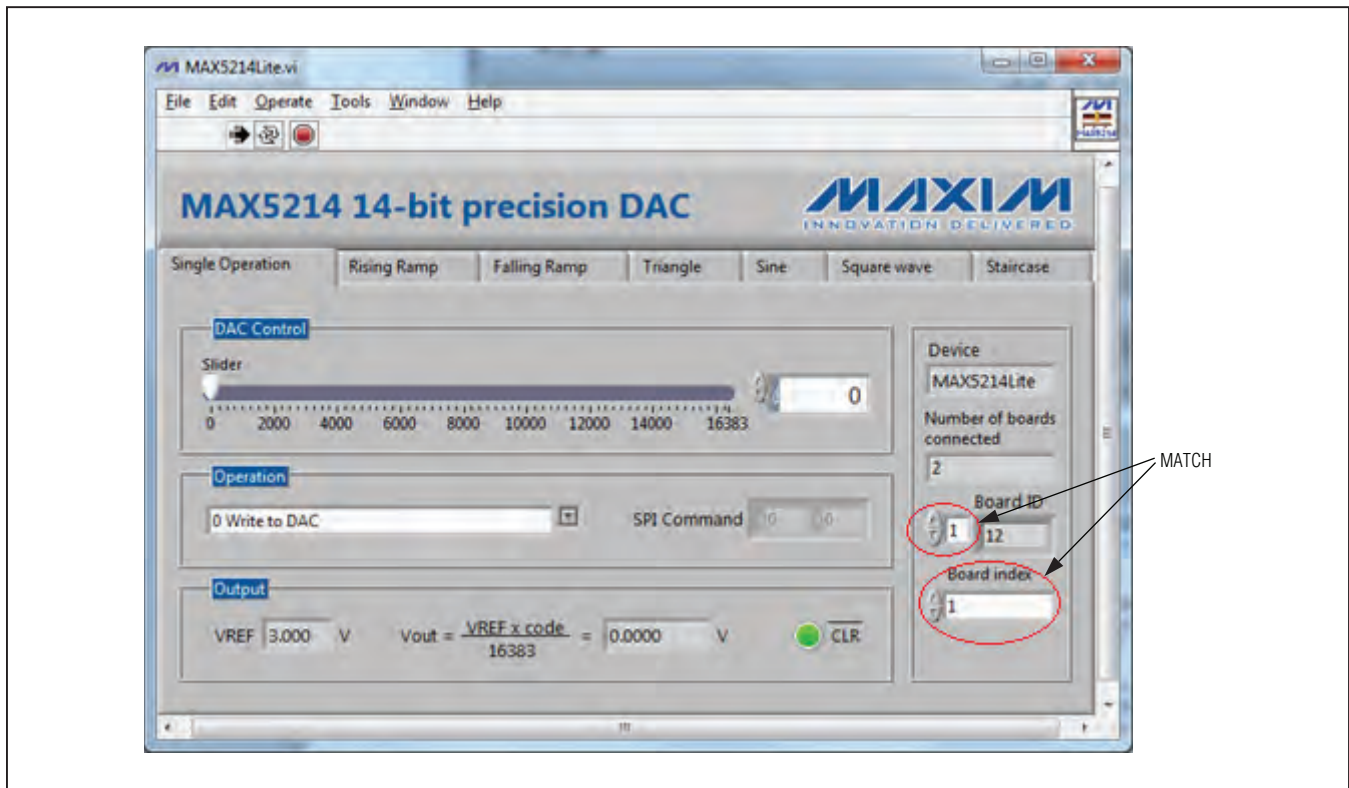


Figure 3. Select the Board Index in the System with Multiple Boards

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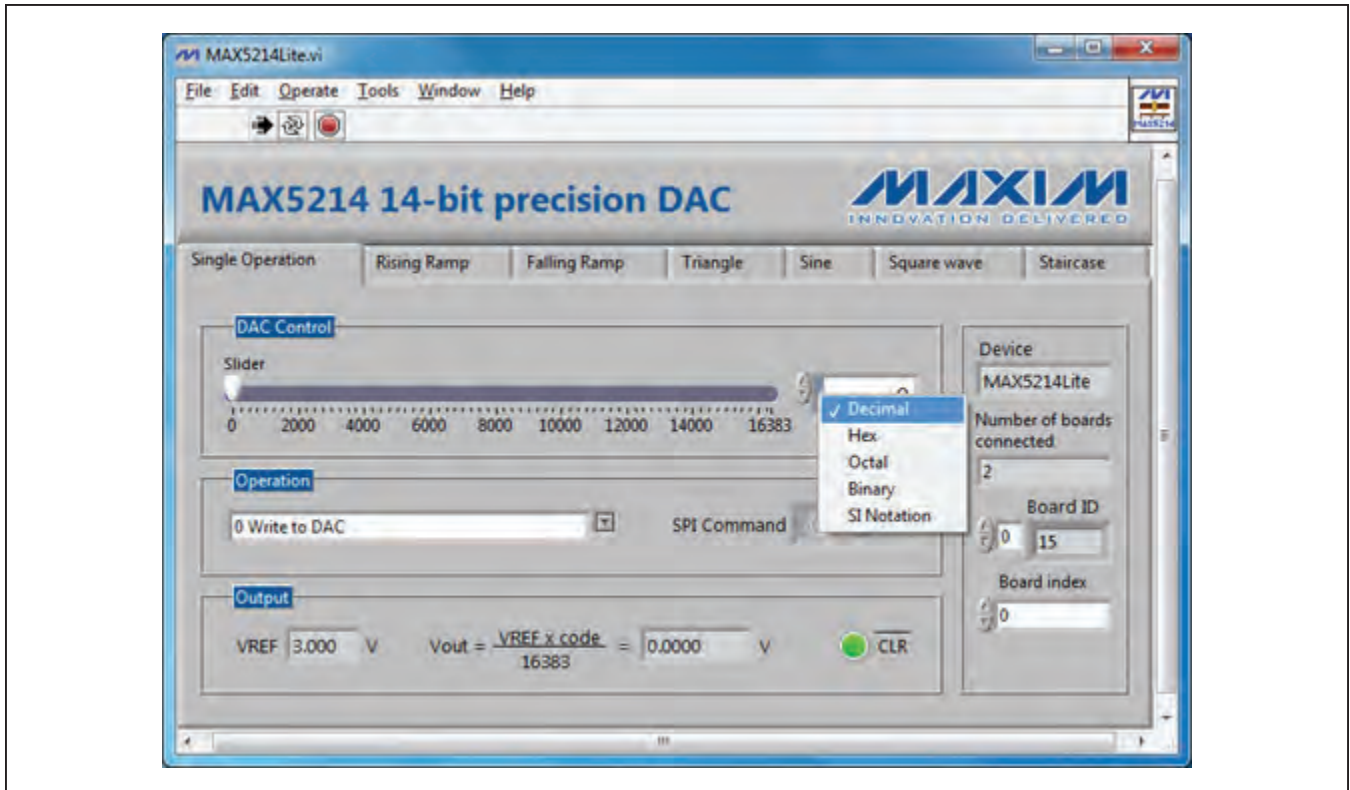


Figure 4. Notation Selection Dialog Box

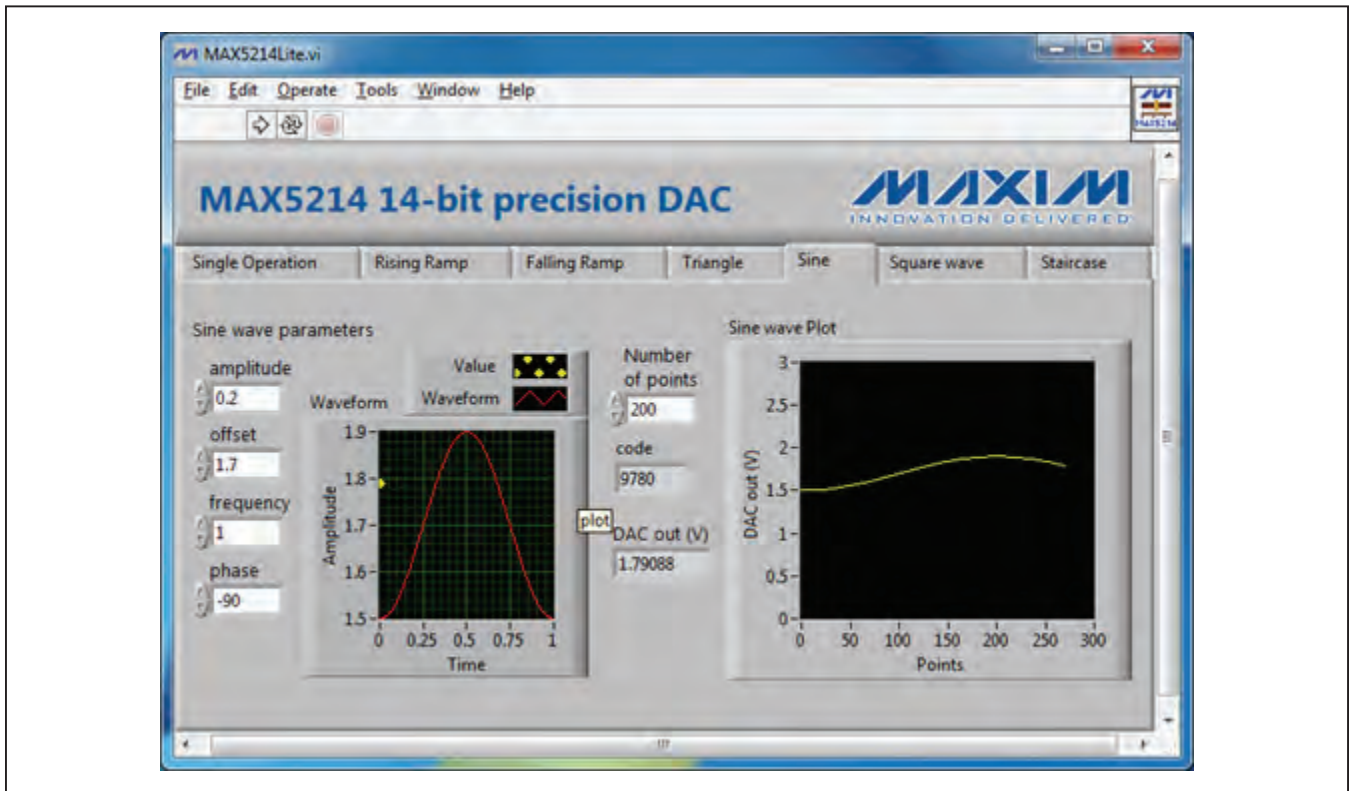


Figure 5. Sine-Wave Generator

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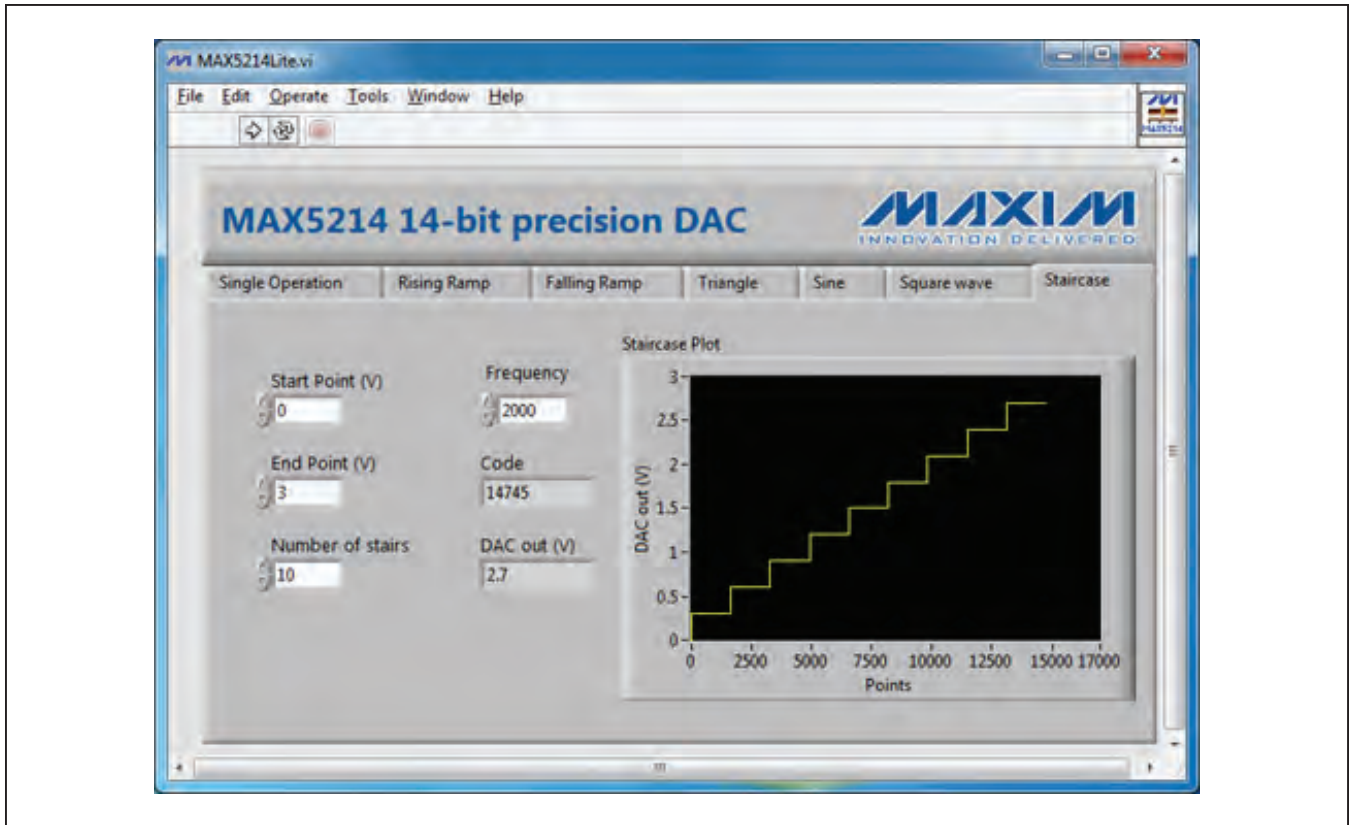


Figure 6. Staircase Plot

### Detailed Description of Hardware

The MAX5214Lite EV kit board is loaded with the MAX5214, Maxim's best-in-class, lowest power 14-bit DAC. The on-board MAX6133A30 device (U3) provides low noise, low-temperature drift of 3ppm/°C, and 3.000V precise voltage reference for the DAC. The MAX5214 device (U1) receives a command from the 16-bit MAXQ622 microcontroller (U2) through a 3-wire high-speed SPI bus. The U1 device can run at 50MHz clock frequency, but the SPI bus speed is limited to 6MHz on this board by the microcontroller. The U1, U2, and U3 devices are powered by the MAX8510 3.3V LDO, low-noise voltage regulator (U4), which gets power from the USB port. The U1 device can be evaluated at the fixed VDD level of 3.3V only. The above limitations are reflected by the suffix "Lite" in the name of the board. The EV kit block diagram is shown in Figure 7.

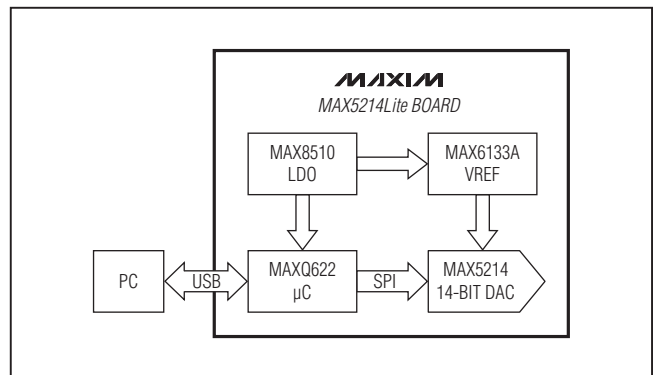


Figure 7. MAX5214Lite EV Kit Block Diagram

The evaluation software allows full access to the DAC's functions and features through the full-speed USB -2.0 bus and the U2 microcontroller. The microcontroller is preloaded with the firmware that communicates with the GUI.

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### MAX5214Lite Extended Features

The U1 device can be evaluated over the full voltage and SPI bus speed ranges with an external power supply and SPI host controller. To do so, the following board modifications must be made:

- 1) Totally disconnect the U1 and U3 devices from the rest of the board by removing resistors R4–R9 (see Figure 10 for component placement).
- 2) Connect the SPI lines, CSb, SCLK and DIN, and CLRb pins from J6 to the external host controller. Make sure that the input voltage ( $V_{IH}$ ) is within the spec limit and matches the AVDD level.
- 3) Apply external power from 2.7V to 5.5V between J3.2 (AVDD) and J8 (GND).
- 4) Send command to the DAC.

The microcontroller on the EV kit board can also be programmed with custom firmware through the J2 JTAG connector (see Table 1).

Table 1. JTAG Connector Description (J2)

PIN	LABEL	FUNCTION
1	TCK	Test clock
2	GND	Digital ground
3	TDO	Test data output
4	N.C.	No connect
5	TMS	Test mode select
6	RST	Reset
7	N.C.	No connect
8	+5V	+5V from the JTAG debug adapter
9	TDI	Test data input
10	GND	Digital ground

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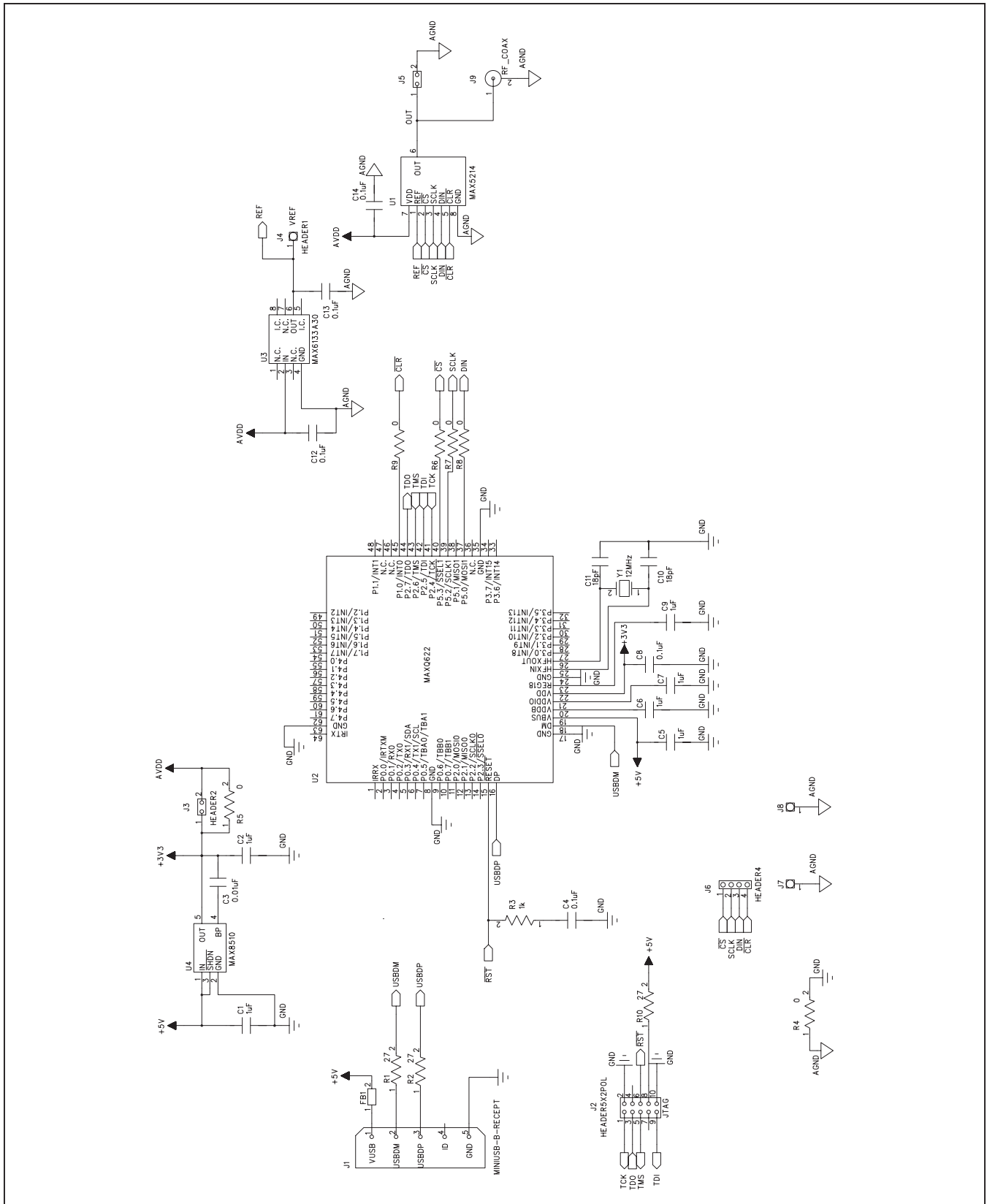


Figure 8. MAX5214DACLite EV Kit Schematic



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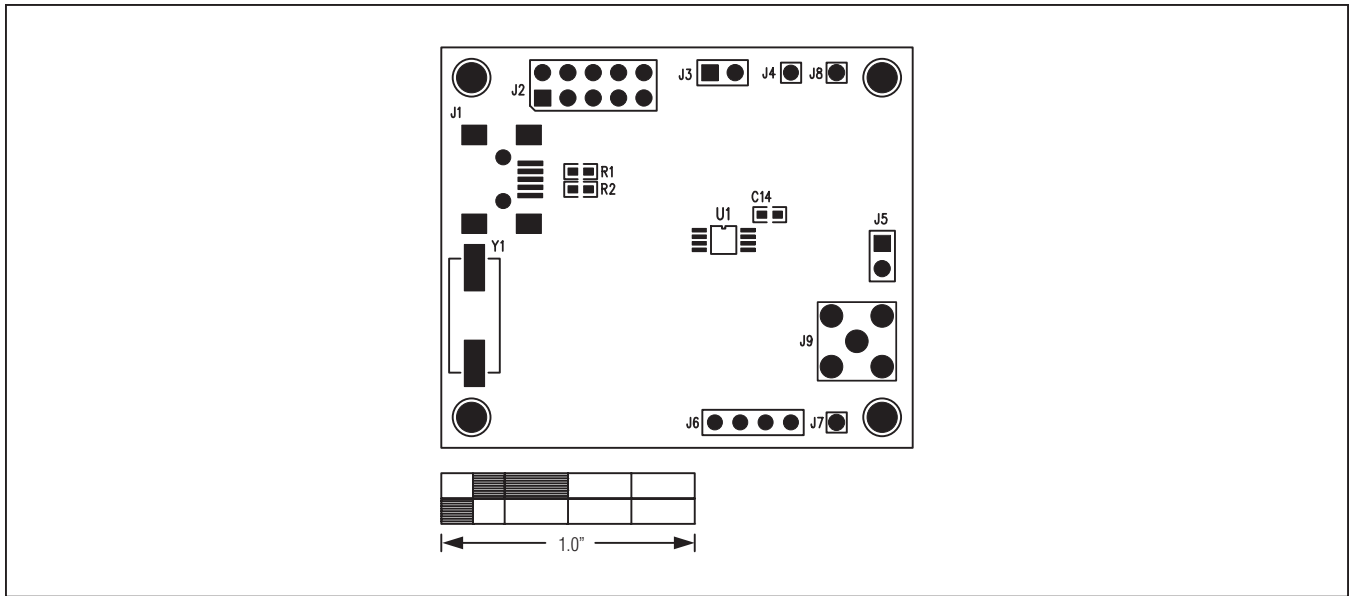


Figure 9. MAX5214DACLite EV Kit Component Placement Guide—Component Side (Top)

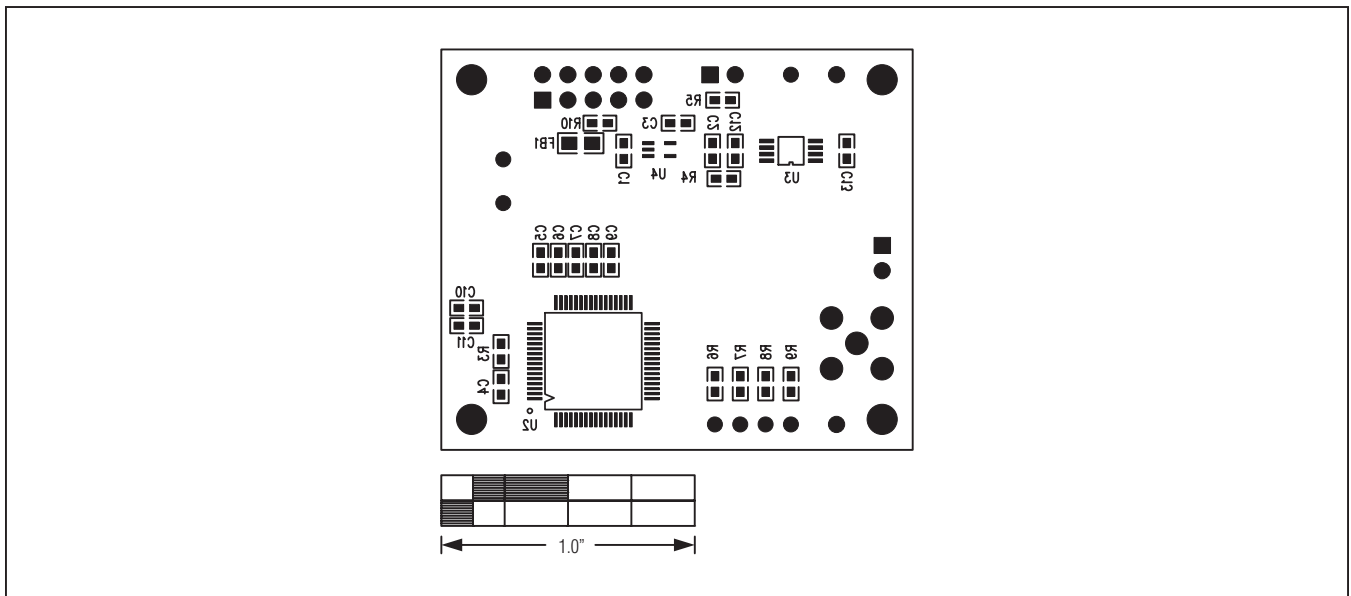


Figure 10. MAX5214DACLite EV Kit Component Placement Guide—Component Side (Bottom)

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### ***Ordering Information***

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<b>PART</b>	<b>TYPE</b>
MAX5214DACLITE#	EV Kit

#Denotes RoHS compliant.

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### Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	2/12	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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