

## Evaluates: MAX5214/MAX5216

#### **General Description**

The MAX5216 evaluation kit (EV kit) demonstrates the MAX5216 16-bit low-power, high-performance, buffered digital-to-analog converter (DAC). The EV kit includes Windows XP®-, Windows Vista®-, and Windows® 7-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX5216.

The EV kit comes with the MAX5216GUA+ installed. Contact the factory for samples of the pin-compatible MAX5214GUA+ (14-bit, low-power version).

#### **Features**

- Windows XP-, Windows Vista-, and Windows 7-Compatible Software
- Supports 14-Bit and 16-Bit DACs
- On-Board Microcontroller to Generate SPI™ Commands
- USB Powered (Cable Included)
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information appears at end of data sheet.

| Compo | nent List |
|-------|-----------|
|       |           |

| DESIGNATION            | QTY | DESCRIPTION  |
|------------------------|-----|--|
| C1, C3–C10,<br>C21–C24 | 13  | 0.1µF ±10%, 16V X7R ceramic<br>capacitors (0603)<br>Murata GRM188R71C104K      |
| C2, C13, C15           | 3   | 10μF ±10%, 16V X5R ceramic<br>capacitors (0805)<br>Murata GRM188R71C104K       |
| C11, C12               | 2   | 10pF ±5%, 50V C0G ceramic<br>capacitors (0603)<br>Murata GRM1885C1H100J        |
| C14, C16               | 2   | 1μF ±10%, 16V X5R ceramic<br>capacitors (0603)<br>TDK C1608X5R1C105K           |
| C17, C18               | 2   | 22pF ±5%, 50V C0G ceramic<br>capacitors (0603)<br>Murata GRM1885C1H220J        |
| C19                    | 1   | 10µF ±10%, 10V X7R ceramic<br>capacitor (0805)<br>Murata GRM21BR71A106K        |
| C20                    | 1   | 0.033µF ±10%, 16V X5R ceramic<br>capacitor (0603)<br>Taiyo Yuden EMK107BJ333KA |
| D1                     | 1   | Green LED (0603)   |
| H1                     | 0   | Not installed, 10-pin (2 x 5)<br>JTAG header                                   |

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| DESIGNATION | QTY | DESCRIPTION  |  |
|-------------|-----|--|--|
| H2          | 1   | 2-pin header                                       |  |
| H3          | 1   | 8-pin (2 x 4) header                               |  |
| JUA–JUE     | 0   | Not installed, 2-pin<br>headers—short (PC trace)   |  |
| JU1–JU6     | 6   | 3-pin headers                                      |  |
| L1          | 1   | Ferrite bead (0603)<br>TDK MMZ1608R301A            |  |
| P1          | 1   | USB type-B right-angle female receptacle           |  |
| R1          | 1   | $0\Omega \pm 5\%$ resistor (0603)                  |  |
| R2          | 1   | 220Ω ±5% resistor (0603)                           |  |
| R3          | 1   | 10kΩ ±5% resistor (0603)                           |  |
| R4          | 1   | 2.2kΩ ±5% resistor (0603)                          |  |
| R5          | 1   | 1.5k $\Omega$ ±5% resistor (0603)                  |  |
| R6, R7      | 2   | 27Ω ±5% resistors (0603)                           |  |
| R8          | 0   | Not installed, resistor (0603)                     |  |
| U1          | 1   | 16-bit DAC (8 μΜΑΧ®)<br>Maxim MAX5216GUA+          |  |
| U2          | 1   | Microcontroller (68 QFN-EP)<br>Maxim MAXQ2000-RAX+ |  |
| U3          | 1   | 93C46-type 3-wire EEPROM<br>(8 SO)                 |  |
| U4          | 1   | UART-to-USB converter<br>(32 TQFP)                 |  |
| U5          | 1   | LDO regulator (5 SC70)<br>Maxim MAX8511EXK33+      |  |

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

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#### **Component List (continued)**

| DESIGNATION | QTY | DESCRIPTION  |
|-------------|-----|--|
| U6          | 1   | LDO regulator (5 SC70)<br>Maxim MAX8511EXK25+                    |
| U7          | 1   | Voltage reference (8 µMAX)<br>Maxim MAX6133A25+                  |
| Y1          | 1   | 16MHz crystal (HCM49)<br>Hong Kong X'tals<br>SSM16000N1HK188F0-0 |
| Y2          | 1   | 6MHz crystal (HCM49)<br>Hong Kong X'tals<br>SSL60000N1HK188F0-0  |

| DESIGNATION | QTY | DESCRIPTION                          |
|-------------|-----|--------------------------------------|
| _           | 1   | USB high-speed A-to-B cables,<br>6ft |
| —           | 6   | Shunts                               |
| _           | 1   | PCB: MAX5216 EVALUATION<br>KIT+      |

#### **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 |
| 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 MAX5216 when contacting these component suppliers.

#### **MAX5216 EV Kit Files**

| FILES                   | DESCRIPTION                                |
|-------------------------|--|
| INSTALL.EXE             | Installs the EV kit files on your computer |
| MAX5216.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          |

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#### **Quick Start**

#### **Required Equipment**

- MAX5216 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 under-lined** 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 are in their default positions, as shown in Table 1.
- Visit <u>www.maxim-ic.com/evkitsoftware</u> to download the latest version of the EV kit software, 5216Rxx.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 <u>Start I Programs</u> 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 <u>ready to use</u>, then proceed to the next step. Otherwise, open the USB\_Driver\_Help\_200.PDF document in the Windows <u>Start I Programs</u> menu to verify that the USB driver was installed successfully.
- Start the EV kit software by opening its icon in the <u>Start I Programs</u> menu. The EV kit software (Figure 1) prompts the user to select the installed part on the the EV kit. Once selected, the EV kit software main window appears (Figure 2).
- Enter the desired code in the edit box and press the Enter button or move the scroll bar within the DAC group box.
- 7) Using the DVM, measure the voltage at H2-1 (the OUT pin of the DAC). Verify that the voltage is also displayed at the bottom of the main software window.

| JUMPER | SHUNT POSITION | DESCRIPTION  |
|--------|----------------|--|
|        | 1-2*           | Connects the VDD pin of the DAC to the on-board +3.3V supply.  |
| JUT    | 2-3            | Connects the VDD pin of the DAC to a user-supplied supply between +2.7V to +5.25V.                     |
|        | 1-2*           | Connects the $\overline{\text{CS}}$ pin of the DAC to the on-board microcontroller.                    |
| JU2    | 2-3            | Connects the $\overline{\text{CS}}$ pin of the DAC to a user-supplied $\overline{\text{CS}}$ signal.   |
|        | 1-2*           | Connects the SCLK pin of the DAC to the on-board microcontroller.                                      |
| 303    | 2-3            | Connects the SCLK pin of the DAC to a user-supplied SCLK signal.                                       |
| 11.1.4 | 1-2*           | Connects the DIN pin of the DAC to the on-board microcontroller.                                       |
| 304    | 2-3            | Connects the DIN pin of the DAC to a user-supplied DIN signal.   |
| 11.15  | 1-2*           | Connects the CLR pin of the DAC to the on-board microcontroller.                                       |
| 305    | 2-3            | Connects the $\overline{\text{CLR}}$ pin of the DAC to a user-supplied $\overline{\text{CLR}}$ signal. |
| 11.16  | 1-2*           | Connects the REF pin of the DAC to the voltage at VDD.   |
| 306    | 2-3            | Connects the REF pin of the DAC to the on-board MAX6133 voltage reference.                             |

#### Table 1. Jumper Descriptions (JU1–JU6)

\*Default position.



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#### **Detailed Description of Software**

The main window of the MAX5216 EV kit software displays the DAC code and output voltage. Other features include changing the operating modes and reference.

#### **16-Bit and 14-Bit Part Selection**

When the program first starts up, the user must select the correct part installed on the EV kit (Figure 1). Once the selection has been made, press the **Enter** button and the main software window appears (Figure 2).

#### **Operation**

Within the **Operation** group box, the user can select between **No Operation**, **Write**, and **Power Down**. Select the **Write** radio button when writing to the DAC. Select the **Power Down** radio button and the **Power Down Mode** group box appears (Figure 3).

#### **DAC Output**

The user can enter or scroll to the desired code within the **DAC** group box and press **Enter**. The DAC code and output voltage appear at the bottom of the software's main window.

| 4 Part Selectio                                      | n                   | - 0×           |
|--|---------------------|----------------|
| Please select the ir                                 | nstalled part on th | e MAX5216EVKI1 |
| <ul> <li>MAX5216 (16</li> <li>MAX5214 (14</li> </ul> | -bit)<br>-bit)      |                |
|  | Enter               |                |

Figure 1. MAX5216 EV Kit Part Selection Window

|      |              | 21P            |                     |                     |          |  |
|------|--------------|----------------|---------------------|---------------------|----------|--|
|      |              |                |                     |                     |          |  |
|      |              |                |                     |                     |          |  |
|      |              | Enter          | in the data below ( | or move the track b | oar<br>T |  |
|      | Allowed for  | mat: hex or de | ecimal 0x????       | Enter               | 1        |  |
|      | 0x0000       |                |                     |                     | 0xFFFF   |  |
|      | -ti-m        |                |                     |                     |          |  |
|      | ation        |                |                     |                     |          |  |
| 10 ° | lo Uperation |                |                     |                     |          |  |
| ⊙ v  | /rite        |                |                     |                     |          |  |
| LOF  | 'ower Down   |                |                     |                     |          |  |
| Ľ.   |              |                |                     |                     |          |  |
|      |              |                |                     |                     |          |  |
|      | Liode        | Voltage        |                     | . 133 IV I          |          |  |

Figure 2. MAX5216 EV Kit Software Main Window



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#### **Setting the Reference**

The reference is set to 3.3V by default. Uncheck the **Default REF** checkbox and enter the new reference voltage in the corresponding edit box. The user must apply the same voltage at the board for proper operation (see

the *Reference* section). The voltage entered in the edit box does not affect the operation of the part.

#### CLEAR ( $\overline{CLR}$ )

Press the CLEAR button to drive  $\overline{\text{CLR}}$  low and reset the DAC code to 0.

| DAC<br>Ente<br>Allowed format: hex or ( | er in the data below or move the track bar<br>decimal 0x???? Enter   |
|---|--|
| 0×0000                                  | 0xFFFF   |
| Operation                               | Power Down Mode  |
| O No Operation                          | <ul> <li>Normal Operation</li> </ul>   |
| O Write                                 | <ul> <li>Power Down: OUT is High Impedance</li> <li>Power Down: OUT is Tied to Ground Via 100k Ohms</li> </ul> |
| • Power Down                            | O Power Down: OUT is Tied to Ground Via 1k Ohms  |
| Code Voltage<br>OUT 0x???? ?.??V        | ✓ Default REF 3.3 V CLEAR CLOSE  |

Figure 3. MAX5216 EV Kit Software Main Window (Power-Down Mode)



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|--|--|
| Connection<br>K10 Clock (SCK) (SCLK)               | Configuration<br>✓ Send & receive MSB first<br>✓ CP0L=1 (clock idles high)<br>✓ CPHA=1 (sample 2nd edge) |
| K12 Data from master to slave (MOSI) (DIN)         | MOSI Data Inverted Logic   |
| K11 Data from slave to master (MISO) (DOUT)        | CS is active high, idle low  |
| K9 Chip-select (CS) for data framing               | 8.0 × 1 MHz •  |
| 🔽 Use standard connections for high-speed SPI      | Get Speed Set Speed  |
| Send and Receive Data<br>Data bytes to be written: |  |
| 0x55, 0xAA   |  |
| Send Now repeat 1                                  |  |
| Data butes received:                               |  |

Figure 4. Advanced SPI User Interface Window (3-Wire Interface Tab)

#### Advanced User Interface

A serial interface can be used by advanced users by clicking **Options I Interface (Advance Users)**. Click on the **3-wire interface** tab shown in Figure 4. Enter data into the **Data bytes to be written** edit box and press the **Send Now** button.

#### **Detailed Description of Hardware**

The MAX5216 EV kit provides a proven layout for the MAX5216 16-bit low-power, high-performance, buffered DAC. An on-board reference (MAX6133), USB-PC connection circuitry, and jumpers to disconnect the on-board microcontroller are included on the EV kit.

#### Reference

The EV kit default configuration is with the reference connected to VDD (see Table 1). To use the on-board external 2.5V reference (MAX6133), move the shunt on jumper JU6 to the 2-3 position and apply 2.7V to 12.6V between the REF\_SUP and GND PCB pads on the EV kit. Optionally, the shunt on JU6 can be removed and an external 2V to VDD reference applied at the REF loop on the EV kit.

#### User-Supplied SPI Interface and Power Supply

To use the EV kit with a user-supplied SPI interface, first move the shunts on jumpers JU1–JU5 to the 2-3 position. Next, apply a 2.7V to 5.25V power supply at the EXT\_VDD PCB pad on the EV kit. Lastly, connect the CS, SCLK, DIN, CLR, and GND signals to the corresponding pins of header H3.





Figure 5a. MAX5216 EV Kit Schematic (Sheet 1 of 2)





Figure 5b. MAX5216 EV Kit Schematic (Sheet 2 of 2)







Figure 6. MAX5216 EV Kit Component Placement Guide— Component Side

Figure 7. MAX5216 EV Kit PCB Layout—Component Side



Figure 8. MAX5216 EV Kit PCB Layout—Inner Layer 2







Figure 10. MAX5216 EV Kit PCB Layout—Solder Side

Figure 9. MAX5216 EV Kit PCB Layout—Inner Layer 3

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#### **Ordering Information**

| PART          | TYPE   |  |
|---------------|--------|--|
| MAX5216EVKIT+ | EV Kit |  |

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



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#### **Revision History**

| REVISION | REVISION | DESCRIPTION     | PAGES   |
|----------|----------|-----------------|---------|
| NUMBER   | DATE     |                 | CHANGED |
| 0        | 6/11     | Initial release |         |

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