

General Description

The MAX5258 evaluation kit (EV kit) provides a proven design to evaluate the MAX5258 low-power, 8-bit octal, digital-to-analog converter (DAC). The EV kit also includes Windows[®] 2000/XP- and Windows Vista[®]-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX5258.

The MAX5258 EV kit PCB comes with a MAX5258EE+ installed. This EV kit can also be used to evaluate the MAX5259EE+ low-power 8-bit octal DAC (2.7V to 3.6V). Contact the factory for free samples of the MAX5259EE+.

Features

- Windows 2000/XP- and Windows Vista (32-Bit)-Compatible Software
- ♦ Supports Standard SPI[™] Interface
- ♦ USB-PC Connection (Cable Included)
- USB Powered
- ♦ 16-Pin DAC Output Signal Header
- Proven PCB Layout
- ♦ Lead-Free and RoHS Compliant
- Fully Assembled and Tested

_Ordering Information

| PART | ТҮРЕ |
|---------------------------------------|--------|
| MAX5258EVKIT+ | EV Kit |
| Depates lead free and DeLIC compliant | |

+Denotes lead-free and RoHS compliant.

Component List

| | | 1 |
|---|-----|---|
| DESIGNATION | QTY | DESCRIPTION |
| C1, C3–C10, C17, C25, C27, C28, C29, C31, C32, C34, C35, C36, C37 | 20 | 0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K |
| C2, C13, C15, C26, C33 | 5 | 10μF ±20%, 6.3V X5R ceramic capacitors (0805) TDK C2012X5R0J106M |
| C11, C12 | 2 | 10pF ±5%, 50V C0G ceramic capacitors (0603) TDK C1608C0G1H100J |
| C14, C16 | 2 | 1μF ±20%, 6.3V X5R ceramic capacitors (0603) TDK C1608X5R0J105K TDK C1608X5R0J105M |
| C18, C19 | 2 | 22pF ±5%, 50V C0G ceramic capacitors (0603) TDK C1608C0G1H220J |
| C20 | 1 | 3300pF ±10%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H332K |
| C30 | 1 | 4.7µF ±20%, 16V X7R ceramic capacitor (1206) TDK C3216X7R1C475M |
| D1 | 1 | Green LED (0603) |
| FB1 | 1 | $0\Omega \pm 5\%$ resistor (0603) |

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DESIGNATION QTY DESCRIPTION H1 0 Not installed, 10-pin JTAG header H2 1 Dual-row (2 x 8) 16-pin header H3 1 Dual-row (2 x 5) 10-pin header JUA-JUE 0 Not installed JU1–JU5 5 3-pin headers JU6, JU7 2 4-pin headers USB type-B right-angle female Ρ1 1 receptacle R1 1 0Ω ±5% resistor (0603) R2 1 $220\Omega \pm 5\%$ resistor (0603) 1 R3 10kΩ ±5% resistor (0603) R4 1 2.2kΩ ±5% resistor (0603) R5 1 1.5kΩ ±5% resistor (0603) R6, R7 2 27Ω ±5% resistors (0603) R8-R15 8 $100k\Omega \pm 5\%$ resistors (0603) R16 0 Not installed, resistor (0402) Octal low-power DAC (16 QSOP) U1 1 Maxim MAX5258EEE+ Microcontroller (68 QFN-EP*) 112 1 Maxim MAXQ2000-RAX+ 93C46 type 3-wire EEPROM (8 SO) 1 U3 16-bit architecture

*EP = Exposed pad.

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Microsoft Corp.

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| | - | |
|-------------|-----|--|
| DESIGNATION | QTY | DESCRIPTION |
| U4 | 1 | UART-to-USB converter (32 TQFP) |
| U5 | 1 | 3.3V regulator (5 SC70) Maxim MAX8511EXK33+T (Top Mark: AEI) |
| U6 | 1 | 2.5V regulator (5 SC70) Maxim MAX8511EXK25+T (Top Mark: ADV) |
| U7 | 1 | +4.096V voltage reference (8 SO) Maxim MAX6126AASA41+ |
| U8, U9, U10 | 3 | Dual 1.8V to 5V level translators (8 SSOP) (Top Mark: CT2_) |
| Y1 | 1 | 16MHz crystal (HCM49) Hong Kong X'tals SSM1600000E18FAF |
| Y2 | 1 | 6MHz crystal (HCM49) Hong Kong X'tals SSL6000000E18FAF |
| | 7 | Shunts |
| _ | 1 | USB high-speed A-to-B cable, 6ft |
| _ | 1 | PCB: MAX5258 Evaluation Kit+ |

_Component List (continued)

*EP = Exposed pad.

Component Suppliers

| SUPPLIER | PHONE | WEBSITE |
|--------------------------|--------------|-------------------------|
| Hong Kong X'tals Ltd. | 852-35112388 | www.hongkongcrystal.com |
| TDK Corp. | 847-803-6100 | www.component.tdk.com |

Note: Indicate that you are using the MAX5258 or MAX5259 when contacting these component suppliers.

MAX5258 EV Kit Files

| FILE | DESCRIPTION |
|---------------------|--|
| INSTALL.EXE | Installs the EV kit files on your computer |
| MAX5258.EXE | Application program |
| FTD2XX.INF | USB device driver file |
| UNINST.INI | Uninstalls the EV kit software |
| USB_Driver_Help.PDF | USB driver installation help file |

Quick Start

Required Equipment

Before beginning, the following equipment is needed:

- MAX5258 EV kit (USB cable included)
- A user-supplied Windows 2000/XP- or Windows Vista-compatible PC with a spare USB port
- Two digital voltmeters (DVMs)
- USB powered. Use optional external power supply for enhanced performance.

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 MAX5258 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- Visit <u>www.maxim-ic.com/evkitsoftware</u> to download the latest version of the EV kit software, 5258Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
- Install the EV kit software on your computer by running the INSTALL.EXE program inside the temporary folder. The program files are copied and icons are created in the Windows <u>Start I Programs</u> menu.
- 3) Verify that all jumpers (JU1–JU7) are in their default positions, as shown in Table 1.
- 4) Connect the USB cable from the PC to the EV kit board. A <u>New Hardware Found</u> window pops up when installing the USB driver for the first time. If you do not see a window that is similar to the one described above after 30 seconds, remove the USB cable from the board and reconnect it. Administrator privileges are required to install the USB device driver on Windows.
- 5) Follow the directions of the <u>Add New Hardware</u> <u>Wizard</u> to install the USB device driver. Choose the <u>Search for the best driver for your device</u> option. Specify the location of the device driver to be <u>C:\Program Files\MAX5258</u> (default installation directory) using the <u>Browse</u> button. During device driver installation, Windows may show a warning message indicating that the device driver Maxim uses does not contain a digital signature. This is not an error condition and it is safe to proceed with installation. Refer to the USB_Driver_Help.PDF document included with the software for additional information.



- 6) Start the MAX5258 EV kit software by opening its icon in the <u>Start I Programs</u> menu. When the Part Selection window appears, click on the MAX5258 radio button and then press the Next button. The EV kit software main window appears, as shown in Figure 1.
- 7) To measure the OUTA voltage, connect the first DVM between H2-1 (OUTA) and H2-2 (GND).
- 8) To measure the OUTB voltage, connect the second DVM between H2-3 (OUTB) and H2-4 (GND).
- 9) Verify that the voltage on both DVMs is approximately 0V.

- 10) Enter **0x3F** into the **D7 D0 (Shift Register Data Bits)** edit box.
- 11) Press the Load All DACs button.
- 12) Verify that the voltage shown on both DVMs is approximately 1V.

_Detailed Description of Software

The main window of the evaluation software (shown in Figure 1) displays the voltages and codes for all DAC input and output registers. In addition, the main window has two tabs. The **Load DACs** tab sheet controls all of the DAC loading features of the MAX5258. The

| ile <u>O</u> pti | ions <u>H</u> e | lp | | | | | | |
|------------------|-----------------|-------------------|-----------|--------------|-----------------------------------|----------------|------------------------------|-------------------------|
| Load DAC | © Operat | ing Modes | | | | | | |
| | Enteri | n the data b | elow and | then press | the appropriate button | to load the (| corresponding DAC registers. | |
| | | | | D7· | D0 (Shift Register Da | ata Bits) | | |
| | | Allov | wed forma | it: hex or d | ecimal <mark>0x00</mark> i.e. 0x3 | 3F or 63 for (| DUT_ = 1V | |
| Shift to | Input Regi | ster | | | Load All DACs with s | ame data- | Shift to Input and Output R | egister |
| | CA | Load Input F | Register | | | | O DACIA Load Inp | out and Output Register |
| O DAI | СВ | for Solooted F | | | Load All DAC | s | O DAC B | for Selected DAC |
| O DAI | сс г | Selected L | AC | | | _ | | |
| | _{cd} L | Load Sel | ected DAI | | | | | ad Selected DAC |
| O DAI | CE | | | | Clear All DACs to Zer | 10 | O DACE | |
| O DAI | CF | | | | | _ | O DAC F | |
| | CG | | | | Clear All DAC | s | O DAC G | |
| O DAI | СН | | | | | | O DACH | |
| | | | | | | | | |
| | Input R | egister | Output | Register | | | | |
| | Code | Voltage | Code | Voltage | Shutdown Mode | DOUT Ph | ase Mode | Reset All Regist |
| OUTA | 0x00 | 0.000 | 0x00 | 0.000 | Normal | DOUT Tra | ansitions on Falling Edge | |
| OUTC | 0x00 | 0.000 | 0x00 | 0.000 | Normal Namal | Softwa | ve Load DAC command | Set Vref |
| | 0,00 | 0.000 | 0500 | 0.000 | Normal | Solution | s i coso prio command | |
| OUTE | 0x00 | 0.000 | 0x00 | 0.000 | Normal | | Software LDAC | 4.096 |
| OUTE | 0x00 | 0.000 | 0x00 | 0.000 | Normal | | | |
| OUTG | 0x00 | 0.000 | 0x00 | 0.000 | Normal | | | |
| | 0,00 | 0.000 | 0,00 | 0.000 | Normal | L] E | nable Hardware LDAC pin | 👖 <u>C</u> lose |

Figure 1. MAX5258 EV Kit Software Main Window (Load DACs Tab)

Operating Modes tab sheet (shown in Figure 2) controls all of the DAC modes of the MAX5258. The **Load Setting(s)** buttons must be pressed to write the corresponding mode settings to the DAC(s).

Software Reset

Press the **Reset All Registers** button to reset the MAX5258's registers and GUI to the power-on-reset (POR) state. This can be done at any time and is highly recommended after using the **Advanced User Interface** window (Figure 3).

| Load DAC | s Operati | ing Modes | | | | | /// |
|----------|---|---|--|--|--|---|---------------|
| Enter th | ie appropria | ate DAC sett | ings and ti | nen press th | e Load Setting(s) I | button | |
| [Powe | r Control | | | | | -DOUT Phase Mode Selection | |
| | Shutdown E | ACA | hecked = | Shutdown S | etting | DOUT Transitions on Falling Edge, Read on Rising Edge Mode 0 (Default) | e |
| | Shutdown E Shutdown E | ACD ACC U | nchecked | = Normal Se | etting | DOUT Transitions on Rising Edge, Read on Falling Edge O Mode 1 | e |
| | Shutdown E |)AC E | Load Sett | ing(s) to sele | cted DAC(s) | Load Setting(s) to selected DAC(s) | |
| | Shutdown E |)AC F | | Load Setting | (s) | | |
| | Shutdown E |)AC G | Chu | tdown All Dr | ACs | | |
| | Shutdown E |)AC H | Snu | | | | |
| | ihutdown [| DAC H | | | | | |
| | ihutdown E | OAC H egister | Output | Register | Shutdown Med | e DOUT Phase Mode Reset A | All Registers |
| | Shutdown E | OAC H egister Voltage 0.000 | Output Code 0x00 | Register Voltage 0.000 | Shutdown Mod | e DOUT Phase Mode Reset A DOUT Transitions on Falling Edge | All Registers |
| | Input R Code 0x00 0x00 | egister Voltage 0.000 0.000 | Output Code 0x00 0x00 | Register Voltage 0.000 0.000 | Shutdown Mod Normal Normal | e DOUT Phase Mode Reset A DOUT Transitions on Falling Edge | LII Registers |
| | Input R Code 0x00 0x00 0x00 | egister Voltage 0.000 0.000 0.000 | Output Code 0x00 0x00 0x00 | Register Voltage 0.000 0.000 0.000 | Shutdown Mod Normal Normal Normal | e DOUT Phase Mode Reset A DOUT Transitions on Falling Edge Software Load DAC command Set Vref | All Registers |
| | Input R Code 0x00 0x00 0x00 0x00 | egister Voltage 0.000 0.000 0.000 0.000 | Output Code 0x00 0x00 0x00 0x00 | Register Voltage 0.000 0.000 0.000 0.000 | Shutdown Mod Normal Normal Normal Normal | e DOUT Phase Mode Reset A DOUT Transitions on Falling Edge Software Load DAC command Set Vref Software LDAC // noc | All Registers |
| | Input R Code 0x00 0x00 0x00 0x00 0x00 0x00 | egister Voltage 0.000 0.000 0.000 0.000 0.000 0.000 | Output Code 0x00 0x00 0x00 0x00 0x00 0x00 | Register Voltage 0.000 0.000 0.000 0.000 0.000 | Shutdown Mod Normal Normal Normal Normal Normal | e DOUT Phase Mode Reset A DOUT Transitions on Falling Edge Software Load DAC command Set Vref Software LDAC 4.096 | All Registers |
| | Input R Code 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x | egister Voltage 0.000 0.000 0.000 0.000 0.000 0.000 0.000 | Output Code 0x00 0x00 0x00 0x00 0x00 0x00 0x00 | Register Voltage 0.000 0.000 0.000 0.000 0.000 0.000 0.000 | Shutdown Mod Normal Normal Normal Normal Normal Normal Normal | e DOUT Phase Mode Reset A DOUT Transitions on Falling Edge Software Load DAC command Set Vref Software LDAC 4.096 | All Registers |

Figure 2. MAX5258 EV Kit Software Main Window (Operating Modes Tab)

Advanced User Interface

A manual serial interface can be established by advanced users by selecting **Options I Interface (Advanced Users)** from the menu bar.

For SPI, click on the **3-wire interface** tab (shown in Figure 3). Enter data into the **Data bytes to be written:** edit box and press the **Send Now** button.

_Detailed Description of Hardware

The MAX5258 EV kit provides a proven layout for the MAX5258. An on-board analog output signal header (H2), an on-board digital input/output signal header (H3), and jumpers to disconnect the on-board micro-controller are all included on the EV kit.

| K9 Chip-select (CS) for data framing V Use standard connections for high-speed SPI Send and Receive Data Data bytes to be written: 0x55, 0xAA Send Now repeat 1 0 P Chip-select (CS) for data framing 8.0 X Image: Chip-select (CS) for data framing 8.0 X Send Now repeat 1 P Image: Chip-select (CS) for data framing 8.0 X Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing Image: Chip-select (CS) for data framing <td< th=""><th>Advanced User Interface Options Help Connection 3-wire interface Connection S-wire interface K10 Clock (SCK) (SCLK) K12 Data from master to slave (MOSI) (DIN) K11 Data from slave to master (MISO) (DOUT)</th><th>Configuration ✓ Send & receive MSB first □ CPOL=1 (clock idles high) □ CPHA=1 (sample 2nd edge) □ MOSI Data Inverted Logic □ MISO Data Inverted Logic □ CS is active high, idle low 8.0 × 1 MHz</th></td<> | Advanced User Interface Options Help Connection 3-wire interface Connection S-wire interface K10 Clock (SCK) (SCLK) K12 Data from master to slave (MOSI) (DIN) K11 Data from slave to master (MISO) (DOUT) | Configuration ✓ Send & receive MSB first □ CPOL=1 (clock idles high) □ CPHA=1 (sample 2nd edge) □ MOSI Data Inverted Logic □ MISO Data Inverted Logic □ CS is active high, idle low 8.0 × 1 MHz |
|--|--|--|
| Ox55, 0xAA Send Now repeat 1 Total bytes received: | K9 Image: Chip-select (CS) for data framing Image: Wight and Connections for high-speed SPI Send and Receive Data Data bytes to be written: | B.0 ▼ × 1 MHz ▼ Get Speed Set Speed |
| | 0x55, 0xAA Send Now repeat 1 2 | |

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

Evaluates: MAX5258/MAX5259

Reference

At power-up, the MAX5258 EV kit defaults to using the on-board 4.096V reference.

To use VDD as the reference, place a shunt on jumper JU7 in the 1-2 position. For off-board external references,

Table 1. MAX5258 EV Kit Jumper Descriptions (JU1–JU7)

| JUMPER | SHUNT POSITION | DESCRIPTION | | |
|--------|-------------------|--|--|--|
| 11 14 | 1-2* | MAX5258 CS signal connected to on-board microcontroller | | |
| 301 | 2-3 | MAX5258 $\overline{\text{CS}}$ signal connected to on-board header H3 | | |
| 1110 | 1-2* | MAX5258 SCLK signal connected to on-board microcontroller | | |
| 302 | 2-3 | MAX5258 SCLK signal connected to on-board header H3 | | |
| 11.12 | 1-2* | MAX5258 DIN signal connected to on-board microcontroller | | |
| 103 | 2-3 | MAX5258 DIN signal connected to on-board header H3 | | |
| 11.1.4 | 1-2* | MAX5258 DOUT signal connected to on-board microcontroller | | |
| 304 | 2-3 | MAX5258 DOUT signal connected to on-board header H3 | | |
| 11.15 | 1-2* | MAX5258 LDAC signal connected to on-board microcontroller | | |
| 105 | 1-3 | MAX5258 LDAC signal connected to on-board header H3 | | |
| | 1-2 | MAX5258 VDD is set to the on-board +3.3V supply post regulated from the USB port | | |
| JU6 | 1-3* | MAX5258 VDD is set to the on-board +5V supply powered directly from the USB port | | |
| | 1-4 | Connect an external 2.7V to 5.5V supply to the VDD pad | | |
| | 1-2 | MAX5258 REF pin is connected directly to VDD | | |
| JU7 | 1-3 | Connect an external reference voltage to the REF pad | | |
| | 1-4* | MAX5258 REF pin is connected to the on-board 4.096V reference | | |

connect a user-supplied reference voltage to REF and place a shunt on jumper JU7 in the 1-3 position. Type in the reference voltage value in the **Set Vref** edit box and press the **Set Vref** button. The MAX5258 EV kit software uses the value in the **Set Vref** edit box to calculate the input and output register voltage values. The **Set Vref** edit box value does not affect the register values.

User-Supplied SPI Interface

To use the MAX5258 EV kit with a user-supplied SPI interface, set the shunts as shown in Table 2. Then apply an external 2.7V to 5.5V power supply to VDD. Lastly, connect user-supplied CS, SCLK, DIN, DOUT, LDAC, and GND signals to the corresponding pins of header H3.

User-Supplied Power Supplies

Table 2. User-Supplied SPI InterfaceSettings

| JUMPER | SHUNT POSITION |
|---------|----------------|
| JU1–JU5 | 2-3 |
| JU6 | 1-4 |
| JU7 | 1-2 |

The MAX5258 EV kit is powered completely from the USB port by default. Place jumper JU6 in the 1-4 position and apply an external 2.7V to 5.5V power supply across the corresponding VDD and GND pads. Lastly, see the *Reference* section to choose the best reference option.

*Default position.



Figure 4a. MAX5258 EV Kit Schematic (Sheet 1 of 2)

Evaluates: MAX5258/MAX5259



Figure 4b. MAX5258 EV Kit Schematic (Sheet 2 of 2)



Figure 5. MAX5258 EV Kit Component Placement Guide—Component Side



Evaluates: MAX5258/MAX5259



Figure 7. MAX5258 EV Kit PCB Layout—Solder Side

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