Evaluation Board for the **AD5668** Octal, 16-Bit, Serial Voltage Output DAC

**FEATURES**
- Full-featured evaluation board for the **AD5668**
- On-board reference
- Various link options
- PC control in conjunction with Analog Devices, Inc.
- System development platform (SDP)
- PC software for control of DACs
- On-board ADC for voltage readback

**EVALUATION KIT CONTENTS**
- EVAL-AD5668SDCZ/EVAL-AD5668SDRZ evaluation board
- **AD5668** device
- CD including
  - Self-installing software that allows users to control the board and exercise all functions of the device
  - Electronic version of the **AD5668** data sheet
  - Electronic version of the **UG-155** user guide

**ADDITIONAL EQUIPMENT NEEDED**
- USB cable available in the **SDP-B** kit or the **SDP-S** kit

**GENERAL DESCRIPTION**

The Analog Devices **AD5668** evaluation boards, the **EVAL-AD5668SDCZ** and **EVAL-AD5668SDRZ**, are designed to help customers quickly prototype new **AD5668** circuits and reduce design time. The **AD5668** operates from a single 2.7 V to 5.5 V supply. The device incorporates an internal 1.25 V or 2.5 V on-board reference to give an output voltage span of 2.5 V or 5 V, respectively. The on-board reference is off at power-up allowing the use of an external reference; the **REF195** is used on this evaluation board. The device must be written to after power-up to turn on the internal reference.

Consult the **AD5668** data sheet, available from Analog Devices, in conjunction with this user guide when using the evaluation board.

The evaluation board interfaces to the USB port of a PC via the SDP. Software is available with the evaluation board, which allows the user to easily program the **AD5668**.

**FUNCTIONAL BLOCK DIAGRAM**

![Functional Block Diagram](image)

*Figure 1.*
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REVISION HISTORY

6/2016—Rev. 0 to Rev. A
Changed EVAL-AD5668EBRZ to EVAL-AD5668SDCZ and
EVAL-AD5668EBCZ to EVAL-AD5668SDRZ Throughout
Changes to Evaluation Kit Contents Section ................................................ 1
Added Additional Equipment Needed Section ............................................. 1
Changes to Table 3 .......................................................................................... 3
Changes to Installing the Software Section and Running the
  Software Section ......................................................................................... 4
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6/2010—Revision 0: Initial Version
POWER SUPPLIES

To power the AD5668 evaluation board, supply 5.5 V between the AVDD and AGND inputs for the analog supply, and supply 5 V between DVDD and DGND inputs for the digital supply. Refer to Table 1 for information on the power supply connectors.

Both AGND and DGND inputs are provided on the evaluation board. The AGND and DGND planes are connected at one location close to the AD5668. It is recommended not to connect AGND and DGND elsewhere in the system to avoid ground loop problems.

All supplies are decoupled to ground with 10 µF tantalum and 0.1 µF ceramic capacitors.

Table 1. Power Supply Connectors

<table>
<thead>
<tr>
<th>Connector No.</th>
<th>Voltage</th>
</tr>
</thead>
</table>
| J1            | Analog positive supply and ground, AVDD and AGND.  
For single-supply operation, supply 5.5 V. |
| J2            | Digital positive power supply, DVDD.  
For single-supply operation, supply 5 V. |

Table 2. Link Options Setup for SDP Control (Default)

<table>
<thead>
<tr>
<th>Link No.</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK1</td>
<td>A</td>
</tr>
<tr>
<td>LK2 to LK3</td>
<td>Inserted</td>
</tr>
<tr>
<td>LK4</td>
<td>Inserted</td>
</tr>
<tr>
<td>LK5</td>
<td>B</td>
</tr>
<tr>
<td>LK6</td>
<td>A</td>
</tr>
<tr>
<td>LK7</td>
<td>A</td>
</tr>
<tr>
<td>LK8</td>
<td>A</td>
</tr>
<tr>
<td>LK9 to LK14</td>
<td>Inserted</td>
</tr>
</tbody>
</table>

Table 3. Link Functions

<table>
<thead>
<tr>
<th>Link No.</th>
<th>Option</th>
</tr>
</thead>
</table>
| LK1      | This link selects the AVDD power supply source for the analog circuitry:  
Position A selects the J1 terminal block as the AVDD analog circuitry power supply source.  
Position B selects the DVDD source as the AVDD analog circuitry power supply source (see LK6). |
| LK2      | This link connects the VOUTG pin of the AD5668 to the input pin of the ADG738 demultiplexer, so the DAC output value can be monitored using the on-board AD7476 ADC. |
| LK3      | This link connects the VOUTH pin of the AD5668 to the input pin of the ADG738 demultiplexer, so the DAC output value can be monitored using the on-board AD7476 ADC. |
| LK4      | This link connects a 0.1 µF capacitor to AGND on the VREFIN/VREFOUT pin. It is recommended to connect this when using the internal reference. |
| LK5      | This link selects the reference source:  
Position A selects the internal reference as the reference source. The device must be written to via software to turn on the internal reference.  
Position B selects the on-board 5 V reference as the reference source. |
| LK6      | This link selects the 5 V power supply source for the digital circuitry:  
Position A selects V_IO on the evaluation board as the 5 V digital circuitry power supply source.  
Position B selects the J2 terminal block as the 5 V digital circuitry power supply source. |
| LK7      | This link selects the DAC voltage source:  
Position A selects the AVDD analog circuitry power supply source.  
Position B selects the on-board 5 V reference as the power supply source. |
| LK8      | This link sets the RESET pin on the ADG738:  
Position A allows normal operation of the switch.  
Position B resets the switch. |
| LK9 to LK14 | This link connects the VOUTA to VOUTF pins of the AD5668 to the input pins of ADG738 demultiplexer, so the DAC output value can be monitored using the on-board AD7476 ADC. |
EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The AD5668 evaluation kit includes self-installing software on the provided CD. The software is compatible with Windows® XP, Windows Vista (32 bits), and Windows 7 (32 bits).

To obtain drivers for 64-bit operating systems, download them from the AD5668 product page.

Install the software before connecting the SDP to the USB port of the PC. This ensures that the SDP is recognized when it connects to the PC. Follow these steps:

1. Start the Windows operating system and insert the provided CD. The installation software opens automatically. If it does not, run the setup.exe file from the CD.
2. After installation is completed, power-up the evaluation board as described in the Power Supplies section.
3. Plug the AD5668 evaluation board into the SDP, and plug the SDP into the PC using the USB cable available in the SDP-B kit or the SDP-S kit.
4. When the software detects the evaluation board, proceed through any dialog boxes that appear to finalize the installation.

RUNNING THE SOFTWARE

To run the program, do the following:

1. Click Start > All Programs > Analog Devices > AD5668 > AD5668 Evaluation Software. To uninstall the program, click Start > Control Panel > Add or Remove Programs > AD5668 Evaluation Software.
2. Determine if the SDP is connected to the USB port. If the SDP is not connected to the USB port when the software is launched, a connectivity error dialog box displays (see Figure 2). Connect the evaluation board to the USB port of the PC, wait a few seconds, click Rescan, and follow the instructions shown in the Hardware Select dialog box.
3. Determine if the SDP is connected to the evaluation board in use. If the SDP is not connected to the evaluation board, a dialog box appears, shown in Figure 3. Check the connection between the SDP and AD5668 evaluation boards and run the program again.
4. The main window of the AD5668 evaluation software then displays, as shown in Figure 4.
SOFTWARE OPERATION

Take the following steps to operate the software:

1. Click Start > All Programs > Analog Devices > AD5668 > AD5668 SDP Evaluation Software.
   For PC operating systems running Windows XP or older, click Start > Programs > Analog Devices > AD5668 > AD5668 SDP Evaluation Software.
   The AD5668 main window opens, as shown in Figure 4. The data programmed into the 32-bit input shift register is displayed. The user can select the command bits, the address bits, and the data bits by clicking the appropriate button under each area.

2. To select a command to program the device, select the appropriate option from the drop-down menu under Command Menu. For example, to program all DAC outputs with full scale, select Write to and Update DAC channel n and then click All DACs under Address Bits.

3. Under Data Bits, enter the data in decimal format in the Enter Value field. To execute, click Write to Part. Note that the user must click Write to Part to execute all writes to the device.

4. The voltage output on each DAC channel is monitored using the on-board ADC. To read the output voltage, click SAMPLE, under ADC.

5. To set up the power-down DAC bits, the clear code register bits, and the LDAC register bits, select the appropriate option from the drop-down menu under Command Menu and click Write to Part. The user can also set the register bits for the required mode of operation. Consult the AD5668 data sheet for details.

6. To set LDAC and CLR pins to high or low, click the corresponding check box under Hardware Pins. Because this command is executed immediately, there is no need to click Write to Part.

Figure 4. AD5668 Evaluation Board Main Window
Figure 5. Schematic of AD5668 Evaluation Circuitry
Figure 6. Schematic of SDP Connector
Figure 7. Component Placement Drawing

Figure 8. Component Side PCB Drawing
Figure 9. Solder Side PCB Drawing
## Ordering Information

### Bill of Materials

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Stock Code</th>
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<tbody>
<tr>
<td>1</td>
<td>U8</td>
<td>AD7476, 1 MSPS, 12-bit ADC in 6-lead SOT-23</td>
<td>Analog Devices, Inc.</td>
<td>AD7476BRTZ</td>
<td>AD7476BRTZ</td>
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<td>1</td>
<td>U7</td>
<td>ADG738, CMOS, low voltage, 3-wire, serially-controlled, matrix switch</td>
<td>Analog Devices, Inc.</td>
<td>ADG738BRUZ</td>
<td>ADG738BRUZ</td>
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<td>L1</td>
<td>Ferrite bead, 600 Ω at 100 MHz, 0603</td>
<td>Murata Electronics</td>
<td>BLM188D1025N1D</td>
<td>490-1024-1-ND</td>
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<td>9</td>
<td>LK2 to LK4, LK9 to LK14</td>
<td>Jumper blocks, 2-way, 2.54 mm pitch spacing, Shoring Block IN</td>
<td>Harwin</td>
<td>M20-9990246 and M7567-05</td>
<td>FEC 1022247 and 150-411</td>
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<td>Harwin</td>
<td>M20-9990345 and M7567-05</td>
<td>FEC 1022248 and 150-411</td>
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<td>Harwin</td>
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<td>SMB jacks, 50 Ω</td>
<td>TYCO</td>
<td>1-1337482-0</td>
<td>FEC1206013</td>
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<tr>
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<td>J3</td>
<td>120-way female connector</td>
<td>Hirose</td>
<td>FX8-120S-SV(21)</td>
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<td>U3</td>
<td>32 kΩ I²C serial EEPROM</td>
<td>Microchip</td>
<td>24LC32A-I/MS</td>
<td>FEC 1331330</td>
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<td>J1, J2</td>
<td>Terminal blocks, 2-way, 5 mm pitch</td>
<td>Camden</td>
<td>CTB5000/2</td>
<td>FEC 151789</td>
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<td>3</td>
<td>C2, C3, C9</td>
<td>Capacitors, Case A, 0.1 µF, 10 V, ±10%</td>
<td>AVX</td>
<td>TAJA106K010R</td>
<td>FEC 197-130</td>
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<tr>
<td>1</td>
<td>C7</td>
<td>Capacitor, 0603, 1 µF, 10 V, ±80%/−20%</td>
<td>Phycomp</td>
<td>2238 246 19863</td>
<td>FEC 318-8840</td>
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<td>SIL headers, 3-way, Shoring Block Position A</td>
<td>Harwin</td>
<td>M20-9990345 and M7567-05</td>
<td>FEC 512-047 and 150-411</td>
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<td>13</td>
<td>TP1 to TP12</td>
<td>Red test points</td>
<td>Vero</td>
<td>20-313137 (pack)</td>
<td>FEC 8731144</td>
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<td>Capacitors, 0603, 0.1 µF, ±10%</td>
<td>Murata</td>
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<td>R1 to R4</td>
<td>SMD resistors, 10 kΩ, 1%, 0603</td>
<td>Multicomp</td>
<td>MC 0.063W 0603 10K</td>
<td>FEC 933-0399</td>
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<tr>
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<td>R5</td>
<td>Resistor, 0603, 1.5 Ω, 5%</td>
<td>Multicomp</td>
<td>MC 0.063W 0603 5% 1R5</td>
<td>FEC 9331832</td>
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<td>U4, U5</td>
<td>Octal buffer/line drivers</td>
<td>Texas Instruments, Inc.</td>
<td>SN74HCT244PW</td>
<td>FEC 9591915</td>
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<td>U1</td>
<td>AD5668, octal 16-bit SPI voltage output denseDAC with 5 ppm/°C on-chip reference in LFCSFP</td>
<td>Analog Devices, Inc.</td>
<td>AD5668BCPZ-1</td>
<td>AD5668BCPZ-1</td>
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<tr>
<td>1</td>
<td>U2</td>
<td>AD5668, octal 16-bit SPI voltage output denseDAC with 5 ppm/°C on-chip reference in TSSOP, do not populate</td>
<td>Analog Devices, Inc.</td>
<td>AD5668BRUZ-2</td>
<td>Do not insert</td>
</tr>
<tr>
<td>1</td>
<td>U6</td>
<td>REF195, precision micropower, low dropout voltage reference</td>
<td>Analog Devices, Inc.</td>
<td>REF195ESZ</td>
<td>REF195ESZ</td>
</tr>
<tr>
<td>3</td>
<td>A to H</td>
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<td>Not applicable</td>
<td>Not applicable</td>
<td>Do not insert</td>
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<td>C11 to C18</td>
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<td>Not applicable</td>
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<td>SCREW1, SCREW2</td>
<td>Screw, cheese, nylon, M3X10, PK100</td>
<td>ALLTHREAD</td>
<td>119030010</td>
<td>FEC 7070597</td>
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<tr>
<td>1</td>
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<td>Nut/washer, nylon, M3, PK100</td>
<td>Duratool</td>
<td>1140030</td>
<td>FEC 7061857</td>
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I2C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).