

## Evaluation Board for **AD5663R/AD5667R** 16-Bit Dual-Channel Voltage Output DACs

### FEATURES

Full featured evaluation board for the **AD5663R** and **AD5667R**

Flexible configuration options

On-board references

PC control in conjunction with Analog Devices, Inc.

**EVAL-SDP-CB1Z** system demonstration platform (SDP)

### PACKAGE CONTENTS

**EVAL-AD5663R-SDZ/EVAL-AD5667R-SDZ** evaluation board

### GENERAL DESCRIPTION

This user guide details the operation of the evaluation board for the **AD5663R** and the **AD5667R**. These are 16-bit, dual-channel, voltage output digital-to-analog converters (DACs). The **AD5663R** uses a serial peripheral interface (SPI) for configuration and control, whereas the **AD5667R** uses an I<sup>2</sup>C interface.

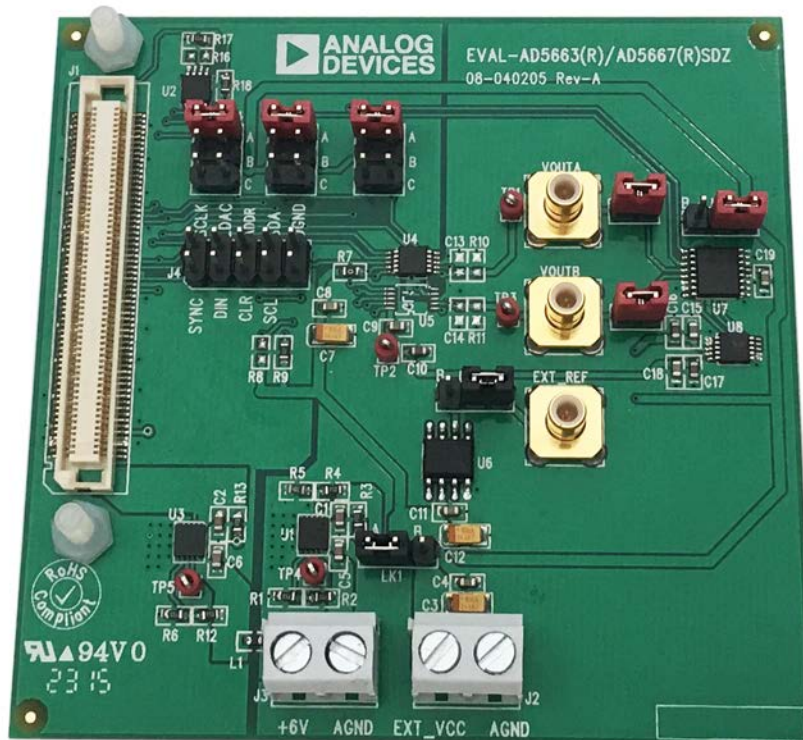
The evaluation board is designed to allow straightforward customer evaluation of the device using the hardware and software provided. The evaluation board can also be used to quickly create a prototype with the **AD5663R/AD5667R**, reducing design time. The **AD5663R/AD5667R** operate from a single 2.7 V to 5.5 V supply.

Full data on the **AD5663R/AD5667R** can be found in the appropriate data sheets available from Analog Devices and should be consulted 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 board.

This evaluation board requires the **EVAL-SDP-CB1Z** board (SDP-B controller board), which is available for order on the Analog Devices website at [www.analog.com](http://www.analog.com).

### **AD5663R/AD5667R** EVALUATION BOARD



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**REVISION HISTORY**

5/2016—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

The [EVAL-AD5663R-SDZ](#) and [EVAL-AD5667R-SDZ](#) evaluation board can be powered by the J3 or J2 connector. Supply the J3 connector with 6 V to 20 V and is regulated by the [ADP7102](#) low noise, complimentary metal-oxide semiconductor (CMOS) low dropout regulator (LDO). Alternatively, the J2 connector can provide power to the board, bypassing the LDOs, and is intended for use with well regulated, bench supplies. All supplies are decoupled to ground with 10  $\mu$ F tantalum and 0.1  $\mu$ F ceramic capacitors.

**Table 1. Power Supply Connectors**

Connector No.	Label	Voltage
J3, Pin 1	+6 V	Single 6 V power supply, used to generate the INT_VCC board supply
J3, Pin 2	AGND	Analog ground
J2, Pin 1	EXT_VCC	External V <sub>CC</sub>
J2, Pin 2	AGND	Analog ground

**Table 3. Link Functions**

Link Number	Function
LK1	This link selects the positive voltage source (VCC) for the board. Position A selects the output from the LDO <a href="#">ADP7102</a> as the voltage source for the board (supplied by 6 V). Position B selects the external voltage as the voltage source for the board.
LK2	This link selects the LDAC pin voltage source. Position A selects the voltage source from the SDP general-purpose input/output (GPIO). Position B selects the voltage source (VCC). Position C selects AGND.
LK3	This link selects the CLR pin voltage source. Position A selects the voltage source from the SDP GPIO. Position B selects the voltage source (VCC). Position C selects AGND.
LK4	This link selects the ADDR pin voltage source, which sets the [A1:A0] I <sup>2</sup> C address bits on the <a href="#">AD5667R</a> . Position A selects the voltage source from the SDP GPIO. Address bits depend on state of GPIO. Position B selects the voltage source (VCC), giving address bits of 00. Position C selects AGND, giving address bits of 11. This jumper can also be no connection, giving address bits of 10.
LK5	This link selects the reference voltage source. Position A allows use of the internal reference, or can also be used to apply an external reference after the internal reference is disabled. Position B connects the evaluation board reference to the DAC. This position must only be used after the internal reference is disabled.
LK6	This link connects the <a href="#">ADG728</a> switch and the <a href="#">AD7992</a> analog-to-digital converter (ADC) to V <sub>OUTA</sub> of the DAC. Inserted: connected. Removed: not connected.
LK7	This link connects the <a href="#">ADG728</a> switch and the <a href="#">AD7992</a> ADC to V <sub>OUTB</sub> of the DAC. Inserted: connected. Removed: not connected.
LK8	This link selects the RESET pin voltage level. Position A selects the voltage source VCC. Position B selects AGND.

### LINK OPTIONS

A number of link options are provided on the [EVAL-AD5663R-SDZ](#) and [EVAL-AD5667R-SDZ](#) board that must be set for the required operating conditions before using the board. Table 2 describes the positions of the links to control the evaluation board via the SDP board using a PC and external power supplies. The functions of these link options are described in detail in Table 3.

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

Link Number	Option
LK1	A
LK2	A
LK3	A
LK4	B
LK5	A
LK6	Inserted
LK7	Inserted
LK8	A



## BLOCK DIAGRAM AND DESCRIPTION

The EVAL-AD5663R-SDZ/EVAL-AD5667R-SDZ software is organized so that it appears similar to the functional block diagram shown in the data sheets. In this way, it is easy to correlate the functions on the board with the description in the data sheets. A full description of each block, register, and its settings is given in the AD5663R/AD5667R data sheets.

Some of the blocks and their functions are described here as they pertain to the evaluation board. The full screen block diagram is shown in Figure 4 and Table 4 describes the functionality of each block.

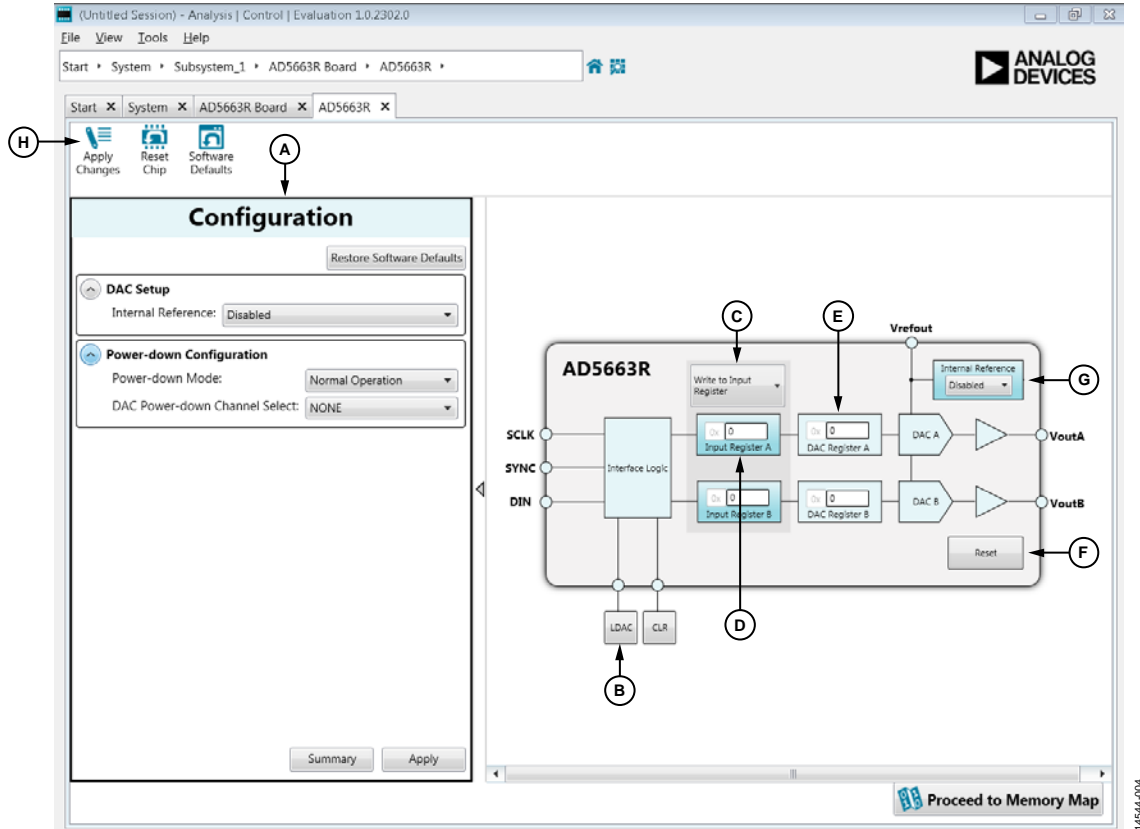


Figure 4. Block Diagram with Labels

Table 4. Block Diagram Functions

Label	Function
A	Configuration wizard: used to set the initial configuration for the board. From the <b>DAC Setup</b> drop-down menu, the internal reference can be enabled or disabled. The reference is disabled as default. From the <b>Power-Down Mode</b> drop-down menu, either channel can be configured as normal operation, powered down, or in a high impedance state. After setting up the initial configuration, click <b>Apply</b> and the values are applied. These settings can be modified at any stage while testing.
B	GPIO buttons: act as external GPIO pulses to the <b>LDAC</b> and <b>CLR</b> pins. The <b>LDAC</b> button pushes data from both input registers (D) to the DAC registers (E). The <b>CLR</b> button clears all data from input registers and DAC registers. These buttons are live, so there is no need to click <b>Apply Changes</b> (H).
C	<b>Command Option</b> drop-down menu: selects how the data being transferred to the device affects the input and DAC registers. After a data value is entered in either input register (see D), this menu determine if the data is transferred to the input register only, to the channel input register and channel DAC register (E), or to the channel input register and updates both DAC registers (E).
D	Input registers: 16-bit data word to be transferred to the device. Upon clicking the <b>Apply Changes</b> (H), this 16-bit data word is transferred to the device.
E	DAC registers: inaccessible registers, displays the value that is currently present in the DAC register on the device. The DAC registers can be updated by selecting the appropriate command option or by toggling <b>LDAC</b> (B).
F	Software reset: soft reset returns the board and software to default values. This button is live, so there is no need to click <b>Apply Changes</b> .
G	Internal reference: selecting enabled from this setting enables the on-chip reference for the board, if disabled is selected, an external reference must be applied.
H	<b>Apply Changes</b> : apply all modified values to the device.

## MEMORY MAP

All registers are fully accessible from the memory map tab; this allows registers to be edited at a bit level. The bits shaded in dark gray are read only bits and cannot be accessed from ACE; all other bits are toggled. **Apply Changes** is used to transfer data to the device. All changes here correspond to the block diagram;

for example, if the internal register bit is enabled, it shows as enabled on the block diagram. Any bits or registers that are in bold are modified values that have not been transferred to the board. After **Apply Changes** is clicked, the data is transferred to the board.

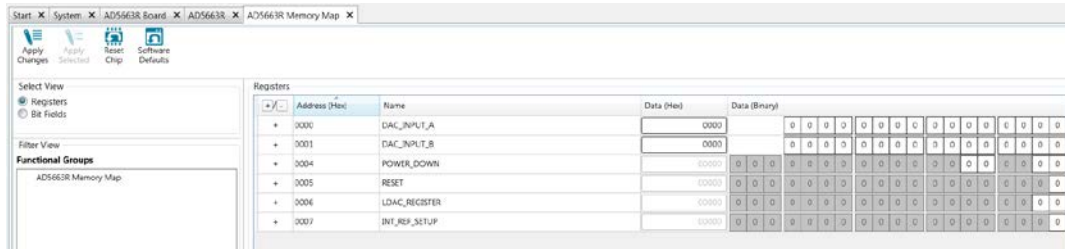


Figure 5. AD5663R Memory Map

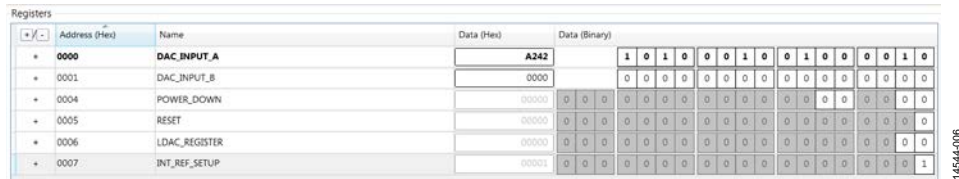
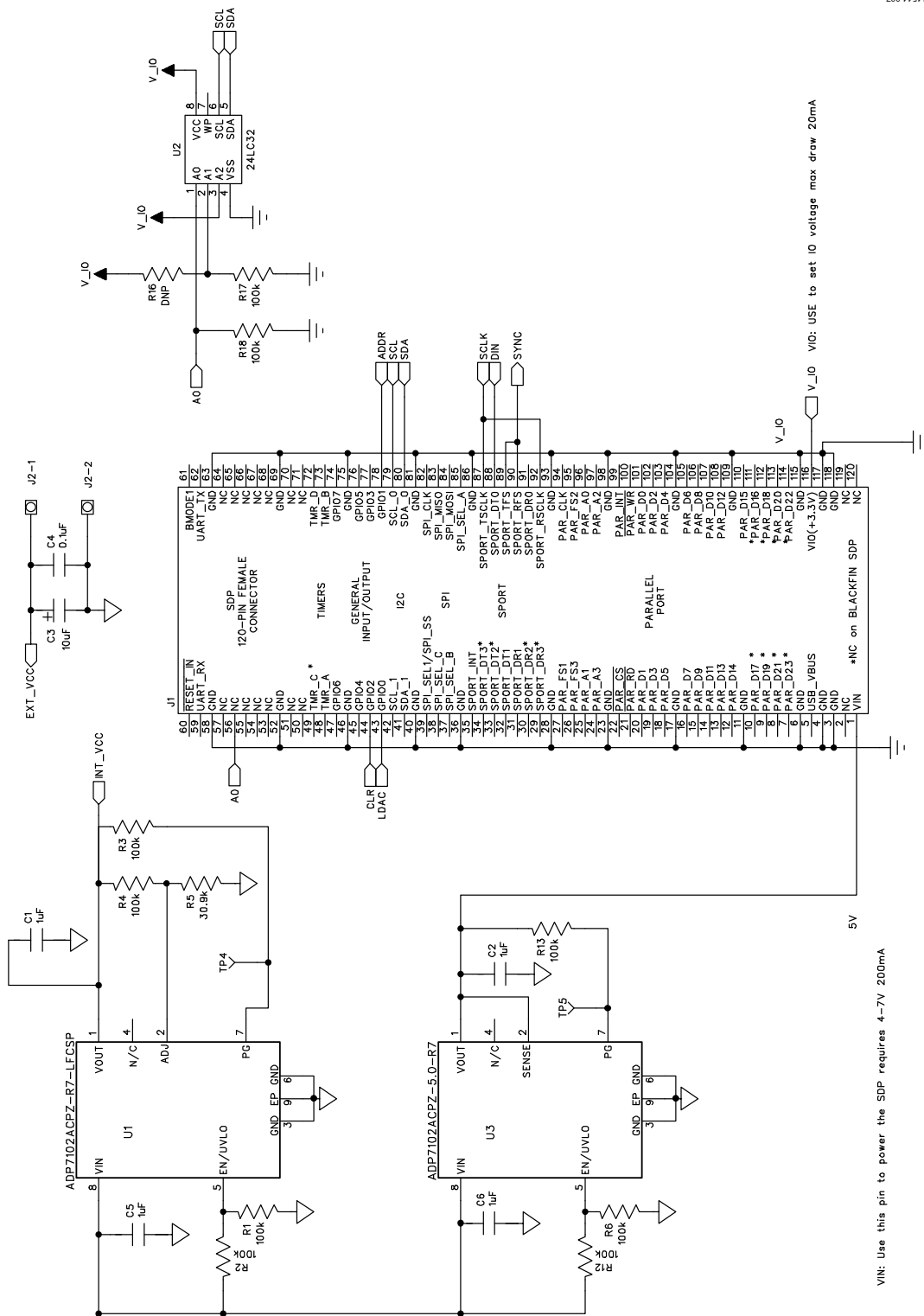


Figure 6. AD5663R Memory Map with Unapplied Changes in DAC\_INPUT\_A Register

EVALUATION BOARD SCHEMATICS



14544-007

Figure 7. Interface and Power Evaluation Board Schematics

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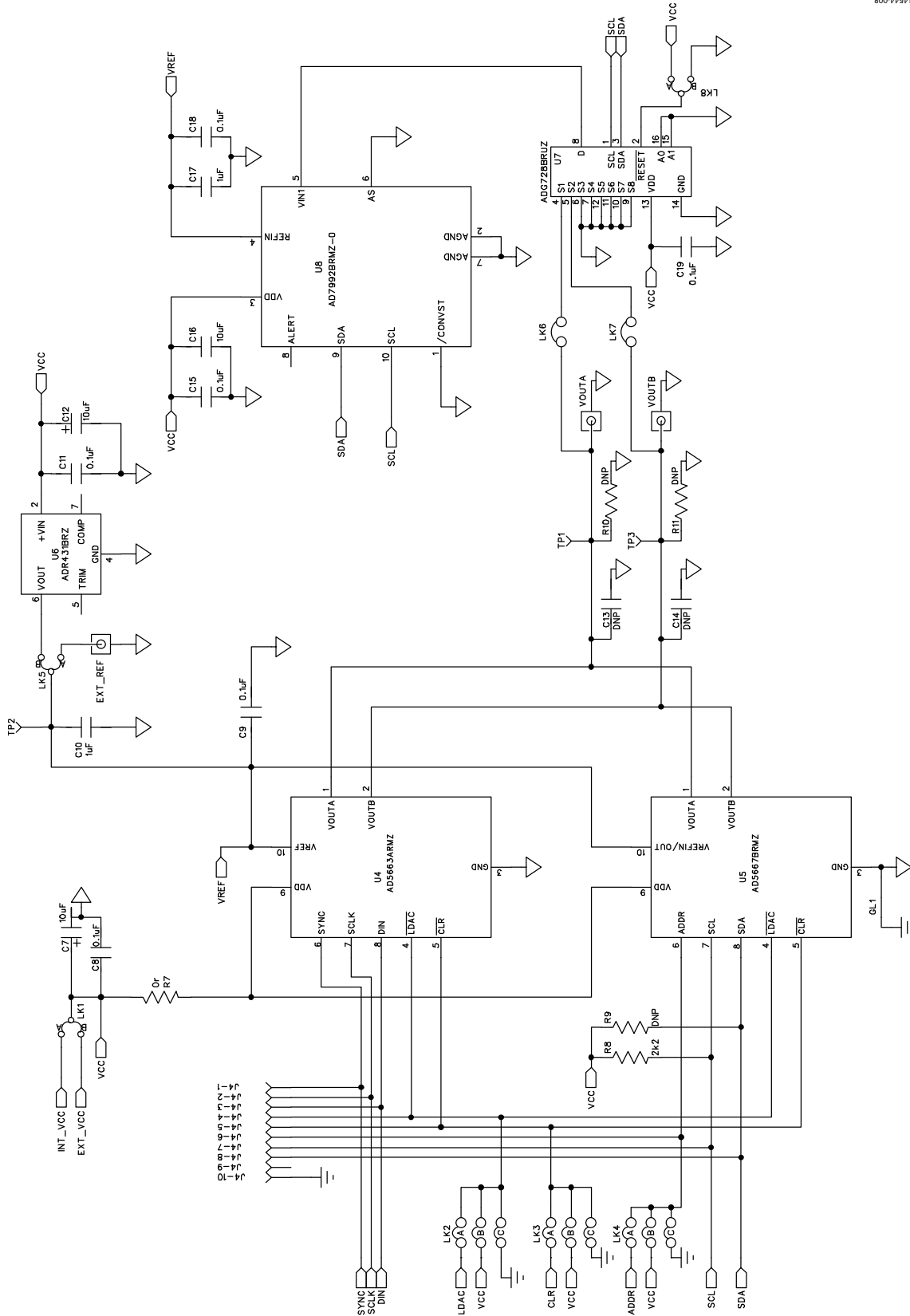


Figure 8. DAC Circuitry Evaluation Board Schematics



## ORDERING INFORMATION

### BILL OF MATERIALS

Table 5.

Reference Designator	Value	Part Description
C1	1 $\mu$ F	Capacitor, 1 $\mu$ F, 25 V, 0603
C2	1 $\mu$ F	Capacitor, 1 $\mu$ F, 25 V, 0603
C3	10 $\mu$ F	Capacitor, Case A, 10 $\mu$ F, 10 V
C4	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
C5	1 $\mu$ F	Capacitor, 1 $\mu$ F, 25 V, 0603
C6	1 $\mu$ F	Capacitor, 1 $\mu$ F, 25 V, 0603
C7	10 $\mu$ F	Capacitor, Case A, 10 $\mu$ F, 10 V
C8	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
C9	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
C10	1 $\mu$ F	Capacitor, 0603, 1 $\mu$ F, Y5V, 10 V
C11	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
C12	10 $\mu$ F	Capacitor, Case A, 10 $\mu$ F, 10 V
C13	Not placed	Not applicable
C14	Not placed	Not applicable
C15	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
C16	1 $\mu$ F	Capacitor, 0603, 1 $\mu$ F, Y5V, 10 V
C17	1 $\mu$ F	Capacitor, 0603, 1 $\mu$ F, Y5V, 10 V
C18	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
C19	0.1 $\mu$ F	50 V X7R multilayer ceramic capacitor
EXT_REF	Not applicable	Straight printed circuit board mount (PCB) SMB jack, 50 $\Omega$
GL1	Not applicable	Solder short
J1	Not applicable	120-way female connector, 0.6 mm pitch
J2	Not applicable	2-pin terminal block (5 mm pitch)
J3	Not applicable	2-pin terminal block (5 mm pitch)
J4	Not applicable	10-pin (2 $\times$ 5) 0.1" pitch SMT header
L1	600 $\Omega$ at 100 MHz	Ferrite bead
LK1	Not applicable	Jumper block using 3-Pin SIP header
LK2	Not applicable	6-pin (3 $\times$ 2) 0.1" header and shorting block
LK3	Not applicable	6-pin (3 $\times$ 2) 0.1" header and shorting block
LK4	Not applicable	6-pin (3 $\times$ 2) 0.1" header and shorting block
LK5	Not applicable	Jumper block using 3-pin SIP header
LK6	Not applicable	2-pin (0.1" pitch) header and shorting shunt
LK7	Not applicable	2-pin (0.1" pitch) header and shorting shunt
LK8	Not applicable	3-pin (0.1" pitch) header and shorting shunt
R1	100 k $\Omega$	SMD resistor
R2	100 k $\Omega$	SMD resistor
R3	100 k $\Omega$	SMD resistor
R4	100 k $\Omega$	SMD resistor
R5	30.9 k $\Omega$	SMD resistor
R6	100 k $\Omega$	SMD resistor
R7	0 $\Omega$	Resistor, 0603 1% 0R
R8	Not fitted	SMD resistor 0603
R9	2.2 k $\Omega$	SMD resistor, 0.063 W, 1%, 0603
R10	Not placed	SMD resistor 0603
R11	Not placed	SMD resistor 0603
R12	100 k $\Omega$	SMD resistor
R13	100 k $\Omega$	SMD resistor
R16	Not placed	SMD resistor
R17	100 k $\Omega$	SMD resistor

Reference Designator	Value	Part Description
R18	100 k $\Omega$	SMD resistor
TP1	Not applicable	Red test point
TP2	Not applicable	Red test point
TP3	Not applicable	Red test point
TP4	Not applicable	Red test point
TP5	Not applicable	Red test point
U1	ADP7102ACPZ-R7	Linear regulator adjustable, 20 V, 300 mA, ultralow noise, CMOS
U2	24LC32	32 kB I <sup>2</sup> C serial EEPROM
U3	ADP7102ACPZ-5.0-R7	LDO 5 V
U4	AD5663RBRMZ-5	Dual 16-bit <i>nano</i> DAC <sup>®</sup> with SPI interface; only placed on EVAL-AD5663R-SDZ
U5	AD5667RBRMZ-1	Dual 16-bit <i>nano</i> DAC with I <sup>2</sup> C interface; only placed on EVAL-AD5667R-SDZ
U6	ADR431BRZ	Ultralow noise XFET <sup>®</sup> voltage reference
U7	ADG728BRUZ	Serial controlled mux
U8	AD7992BRMZ-0	12-bit ADC
V <sub>OUTA</sub>	Not applicable	Straight PCB mount SMB jack, 50 $\Omega$
V <sub>OUTB</sub>	Not applicable	Straight PCB mount SMB jack, 50 $\Omega$

I<sup>2</sup>C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).



#### ESD Caution

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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