![ANALOG DEVICES]

EVAL-ADG2188EBZ User Guide
UG-915

Evaluation Board for I²C CMOS 8 × 8 Analog Switch Array with Dual/Single Supplies

FEATURES

Full-featured evaluation board for the ADG2188
Various link options
USB port
EVAL-ADG2188EBZ evaluation software for control of switches
Functions with or without a PC

EVALUATION KIT CONTENTS

EVAL-ADG2188EBZ evaluation board
EVAL-ADG2188EBZ evaluation software CD
USB cable

DOCUMENTS NEEDED

ADG2188 data sheet

SOFTWARE NEEDED

EVAL-ADG2188EBZ evaluation software CD

GENERAL DESCRIPTION

This user guide describes the evaluation board for the ADG2188 I²C CMOS 8 × 8 analog switch array with dual/single supplies. The array is bidirectional, and, as a result, the rows and columns can configure as either inputs or outputs. Any number of combinations can be active at one time.

The ADG2188 has a maximum difference of 15 V between the V_{DD} and V_{SS} inputs. Therefore, take care to not to exceed the maximum of 15 V difference when connecting the power supplies.

The evaluation board interfaces to the USB port of a PC. The evaluation software is available with the evaluation board that allows the user to easily program the ADG2188. The EVAL-ADG2188EBZ can also be used as a standalone board.

Complete specifications for the ADG2188 are available in the ADG2188 data sheet available from Analog Devices, Inc., and should be consulted in conjunction with this data sheet when using the evaluation board.

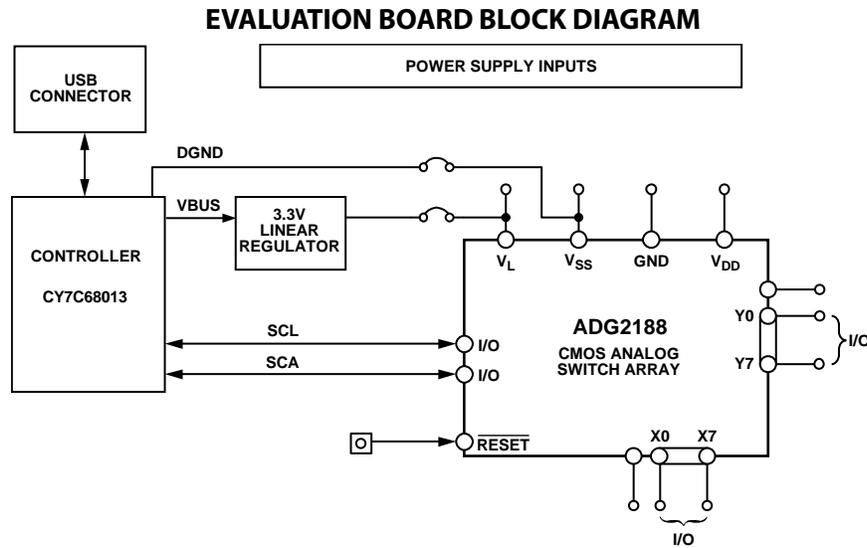## EVALUATION BOARD BLOCK DIAGRAM

Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The EVAL-ADG2188EBZ can operate with single and dual supplies. The ADG2188 is specified to operate in single-supply mode at 12 V ± 10% operation. It is also specified to operate at ±5 V dual supply. To apply these supplies to the evaluation board, adhere to the following guidelines:

- The V_L pin provides the digital supply for the ADG2188 and all digital circuitry on the board. This supply can be applied externally or the USB port can power the digital circuitry (Link 5 inserted). Note that in this case, the logic supply power is 3.3 V.

- The positive supply voltage (for example, 12 V) is applied between the AVDD and AGND inputs of the ADG2188 evaluation board. Note the maximum single supply the ADG2188 can handle is 15 V. In this case, the AVSS input must equal 0 V.

- The negative supply (for example, −5 V) is applied between the AVSS and AGND inputs for the negative supply (V_{SS}) of the ADG2188. Note that the maximum voltage between AVDD and AVSS is 15 V.

Both analog GND and digital GND inputs are provided on the board. The AGND and DGND planes are connected at one location on the evaluation board close to the ADG2188 It is recommended not to connect AGND and DGND elsewhere in the system to avoid ground loop problems.

Each supply is decoupled to the relevant ground plane with 10 μF and 0.1 μF capacitors. Each device supply pin is also decoupled with a 10 μF and 0.1 μF capacitor pair to the relevant ground plane.

LINK OPTIONS

There are a number of links and switch options on the evaluation board that must be set for the required operating setup before using the board. The functions of these link options are described in Table 1.

Table 1. Link Functions

Link No.	Function
LK1	This link chooses the first LSB bit of the chip address on the USB I²C interface. Note the I²C address must be set before the evaluation board software is launched.
	When inserted, the address bit is set to 0.
	When removed, the address bit is set to 1.
LK2	This link chooses the second LSB bit of the chip address on the USB I²C interface. Note the I²C must be set before the evaluation board software is launched.
	When inserted, the address bit is set to 0.
	When removed, the address bit is set to 1.
LK3	This link chooses the third LSB bit of the chip address on the USB I²C interface. Note the I²C address must be set before the evaluation board software is launched.
	When inserted, the address bit is set to 0.
	When removed, the address bit is set to 1.
LK4	This link selects whether the supply at V_{SS} is sourced from ground or from AVSS the input. If sourced from ground, the evaluation board becomes a single supply system.
	Position A: V_{SS} sourced from AVSS.
	Position B: V_{SS} is connected to ground. This implies single-supply operation of the ADG2188.
LK5	This link selects whether the logic supply power comes from the USB power (if connected to a PC) or from the user supplied V_L (if used as a standalone unit).
	When inserted, logic power supply comes from USB supply power, that is, 3.3 V.
	When removed, logic power supply comes from the user supplied V_L.

Setup for PC Control

The default setup for the EVAL-ADG2188EBZ is controlled by the PC via the USB port. The default link options are listed in Table 2.

Table 2. Default Link Options

Link No.	Option
LK1	Inserted; therefore, the LSB is 0.
LK2	Inserted; therefore, the second LSB is 0.
LK3	Inserted; therefore, the third LSB is 0.
LK4	Position A; therefore, the AVSS input supplies the power to the V_{SS} pin.
LK5	Inserted; therefore, logic power supply comes from USB power.

Setup for Control Without a PC

The EVAL-ADG2188EBZ can also be used as a standalone board. This option is designed for a PC without a USB port or for users to use the I²C interface within the system being evaluated. Table 3 lists the link options that must be set to operate the evaluation board without a PC.

Table 3. Link Options Setup for Control Without a PC

Link No.	Option
LK1, LK2, LK3	User configurable. Does not affect whether the board is connected to a PC or not.
LK4	Position A.
LK5	Removed.

SMB connectors are provided for the SDA and SCL inputs. Switches turn on and off via the I²C bus. The read/write procedures are provided in the ADG2188 data sheet and must be consulted when using this evaluation board in standalone mode.

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

The ADG2188 evaluation kit includes self installing EVAL-ADG2188EBZ evaluation software CD. Install the evaluation software before connecting the evaluation board to the USB port of the PC, ensuring the evaluation board is correctly recognized when connected to the PC.

SOFTWARE INSTALLATION

To install the software,

1. Insert the evaluation software CD into the PC. The installation software launches automatically. If it does not, use Windows Explorer to locate the file **setup.exe** on the CD. Double-click the **setup.exe** file to begin the installation procedure.

2. At the software installation prompt, select a destination directory. By default, the directory is **C:\Program Files\ Analog Devices\ADG2188**. After the directory is selected, the installation procedure copies the files into the relevant directories on the hard drive. The installation program creates a program group called **Analog Devices** with a subgroup called **ADG2188** in the **Start** menu of the taskbar.

3. After the installation of the evaluation software is complete, a welcome window displays for the installation of the **ADI PAD Drivers**. Click **Install** to install the drivers.

4. After installing the drivers, power up the ADG2188 evaluation board as described in the Power Supplies section and connect the board to the USB port of the PC using the supplied cable.

SOFTWARE OPERATION

To launch the software, click **Start** > **All Programs** > **Analog Devices** > **ADG2188** > **ADG2188 Evaluation Software**. The **Configuration** tab of the evaluation software displays as shown in Figure 2.
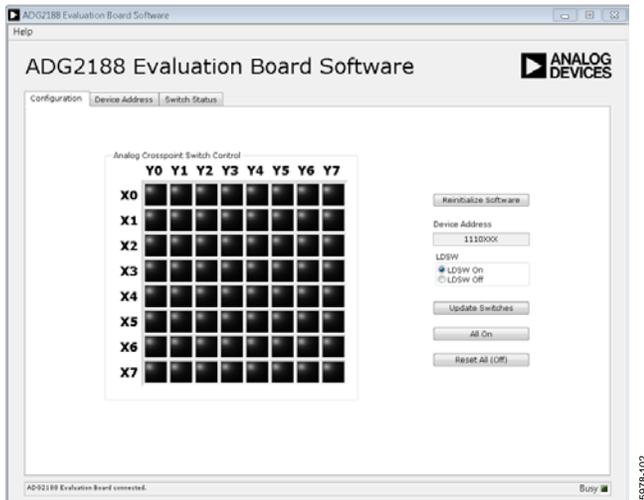

*Figure 2. **Configuration** Tab*

If the ADG2188 evaluation board is not connected to the USB port when the software is launched, a **Hardware Select** dialog box displays, seen in Figure 3. Connect the evaluation board to the USB port of the PC, wait for a few seconds, click **Rescan** and then click **Select**.

*Figure 3. **Hardware Select** Dialog Box*

Reinitialize Software

Click **Reinitialize Software** in the **Configuration** tab to reset the software to the default state. Reinitialize the software whenever the evaluation board is reconnected to the PC or if a new evaluation board isused.

Setting the I²C Address

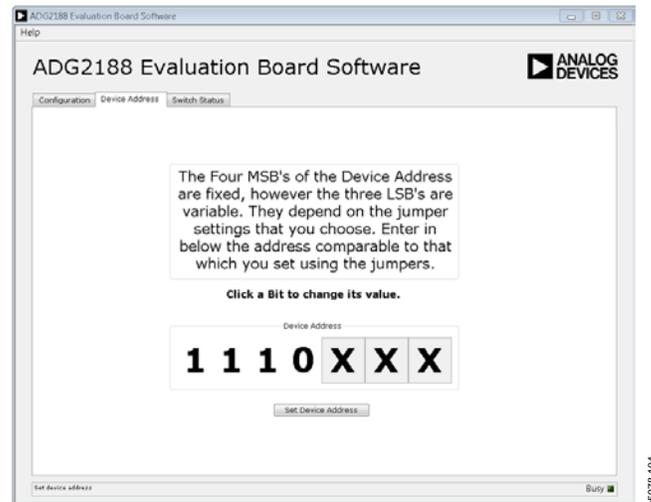The device address is set in the **Device Address** tab (shown in Figure 4).

*Figure 4. **Device Address** Tab*

Set the device address by clicking on the relevant bit. Click **Set Device Address** to update the device address in the software. Note the address set must correspond to the address set with the jumpers on the evaluation board and must be set before the evaluation board software begins to function.

LDSW (Load Switch)

If the load switch function in the **Configuration** tab is on, the switches can update simultaneously (for example, for RGB colors in video switching). Otherwise, if the load switch is off, the switch condition updates upon completion of each I²C write, that is, immediately upon clicking an LED button on the **Analog Crosspoint Switch Control** in the **Configuration** tab. The LED is green if the switch is on and is black if the switch is off.

If the load switch is on, clicking an LED in **Analog Crosspoint Switch Control** stores the switch status temporarily until **Update Switches** is clicked. When an LED is clicked, a red LED indicates the switch turns on and a dark green LED indicates that the switch turns off. All switches update simultaneously upon clicking **Update Switches**. The red LEDs turn green and the dark green LED turns black, indicating the switches are on and off, respectively.

Switch Status

To see what the status of the switch array is at any given time, click the **Switch Status** tab (shown in Figure 5). The green LED in the **Analog Crosspoint Switch Status** indicates that the switch is on and the black LED indicates the switch is off.
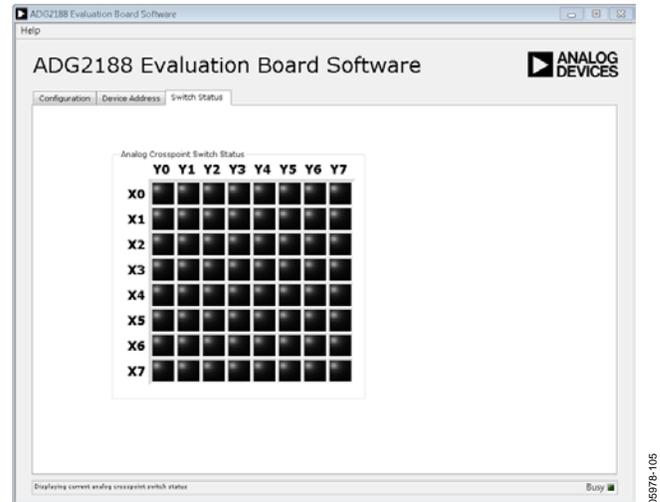

*Figure 5. **Switch Status** Tab*

RESET Function

There is a **RESET** button on the board that can reset the switch array. Alternatively, clicking **Reset All (Off)** in the **Configuration** tab of the software resets all switches.

All On Function

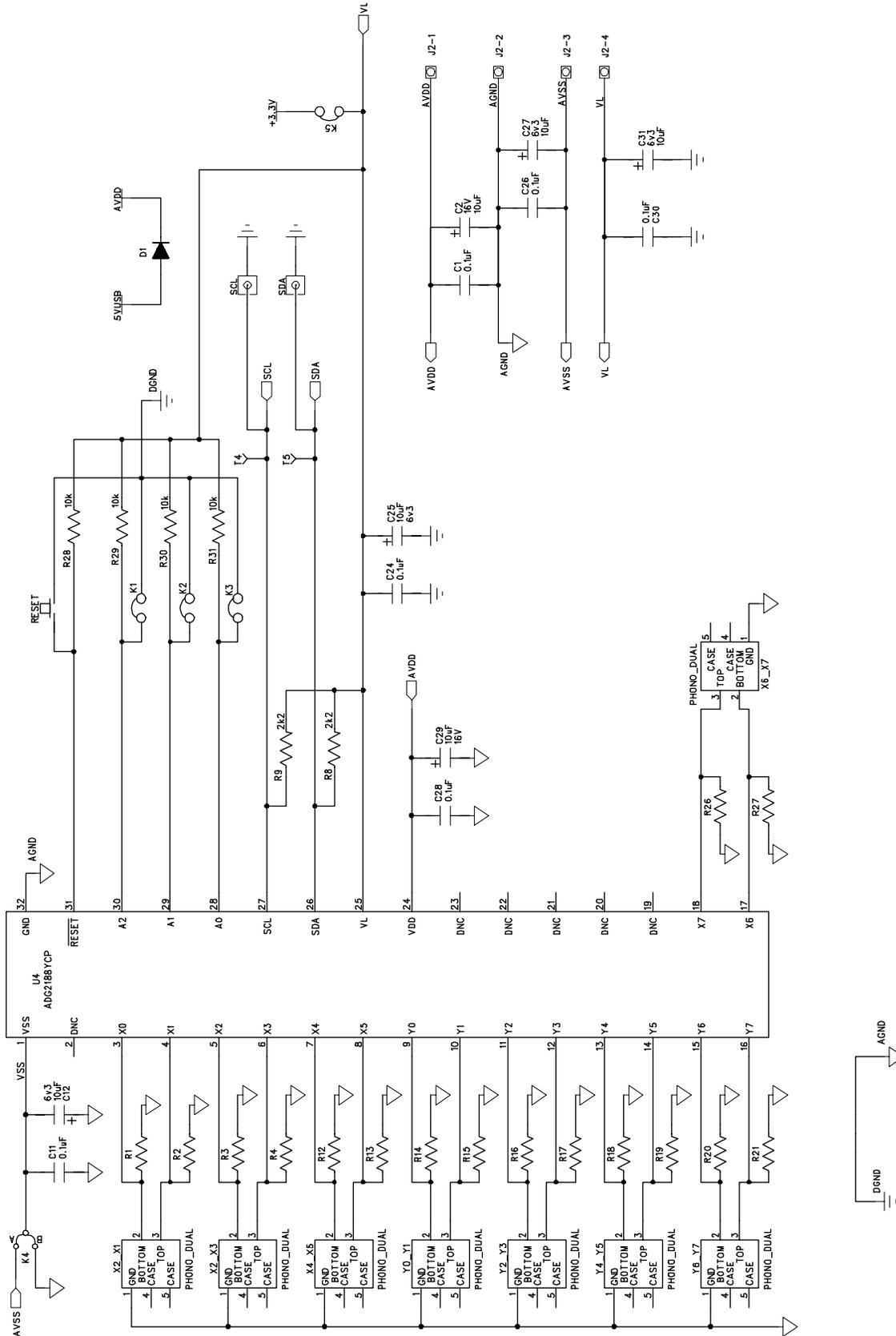Clicking **All On** button in the **Configuration** tab of the software turns on all the switches.

EVALUATION BOARD SCHEMATICS AND ARTWORK

Figure 6. Schematic of USB Controller Circuitry

Figure 7. Schematic of ADG2188 Circuitry

Figure 8. Component Placement Drawing

Figure 9. Component Side PCB Drawing
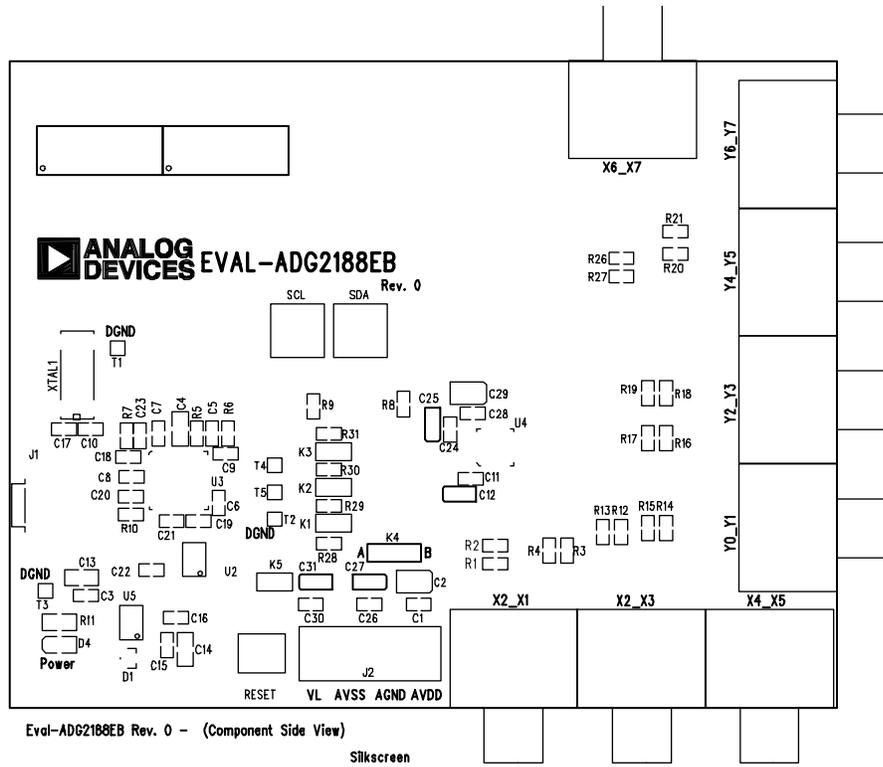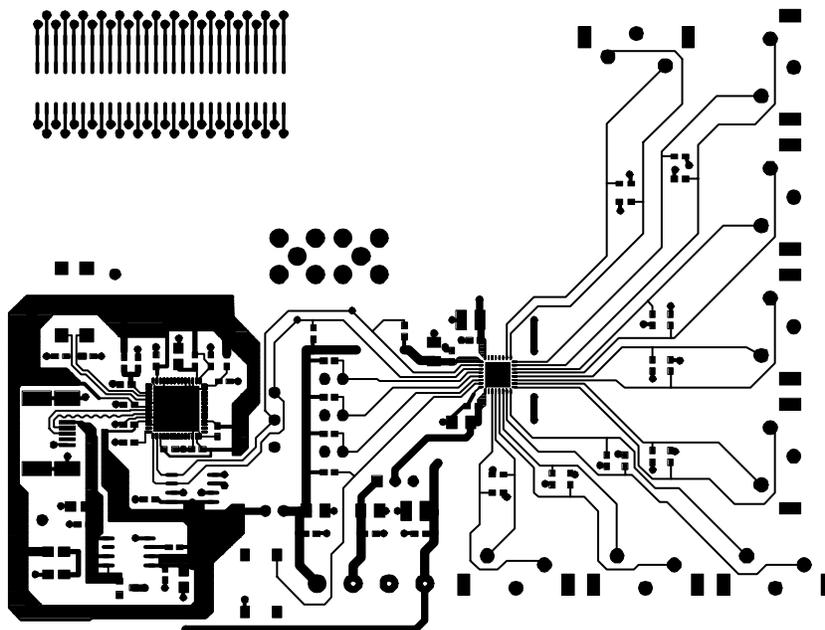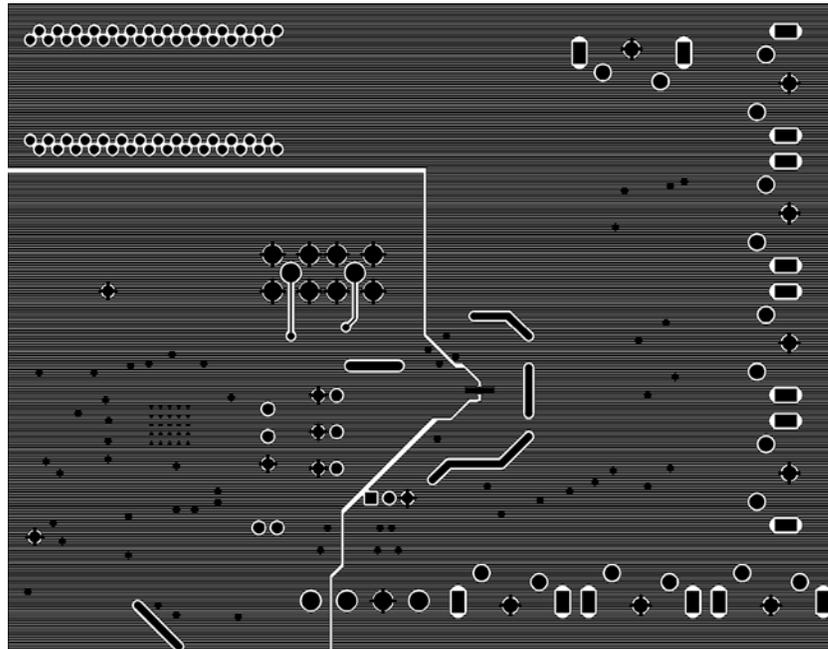
Eval—ADG2188EB Rev. 0 — (Component Side View)
Solder Side

Figure 10. Solder Side PCB Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Table 4. Component Listing

Qty.	Reference Designator	Description	Distributor	Part Number
19	C1, C3, C5 to C9, C11, C15, C16, C18 to C22, C24, C26, C28, C30	0.1 µF, 50 V, X7R SMD ceramic capacitors, 0603 package	FEC	FEC 499-675
2	C2, C29	10 µF, TAJ_B, 16 V, SMD tantalum capacitors	FEC	FEC 498-737
3	C4, C13, C14	10 µF, X5R ceramic capacitors, 0805 package	Digikey	490-1709-1-ND
4	C12, C25, C27, C31	10 µF, TAJ_A, 6.3 V, SMD tantalum capacitors	FEC	FEC 197-130
2	C10, C17	22 pF, 50 V, X7R SMD ceramic capacitors, 0603 package	FEC	FEC 722-005
1	C23	2.2 µF, 6.3 V, X5R SMD ceramic capacitors, 0603 package	Digikey	490-1552-1-ND
1	D1	Diode SOT23	FEC	FEC 304-9395
1	D4	LED, 0805 package	FEC	FEC 359-9681
1	J1	USB Mini-B connector	Digikey, Farnell	FEC 476-8309, WM2499CT-ND
4	J2	4-pin terminal block	FEC	FEC 151-787
5	K1 to K5	SIP-2P, 2-pin header and shorting shunts	FEC	FEC 511-705, FEC 150-411
16	R1 to R4, R12 to R21, R26, R27	SMD resistors, 0603 package	FEC	Not Inserted
2	R5, R6	75 Ω, SMD resistors, 0603 package	FEC	FEC 357-1269
1	R7	0 Ω, SMD resistor, 0603 package	FEC	FEC 772-227
2	R8, R9	2.2 kΩ, SMD resistors, 0603 package	FEC	FEC 911-276
1	R10	10 kΩ, SMD resistor, 0603 package	FEC	FEC 911-355
1	R11	1 kΩ, SMD resistor, 0603 package	FEC	FEC 911-239
4	R28 to R31	10 kΩ, SMD resistors, 0603 package	FEC	FEC 911-355
1	$\overline{RESET}$	Push button switch, sealed 6 mm x 8 mm	FEC	FEC177-807
5	T1 to T5	Test points	Not applicable	Do not insert
1	U4	8 × 8 analog switch array	Analog Devices	ADG2188YCP
1	U2	24LC64	Digikey	24LC64-I/SN-ND
1	U3	USB microcontroller	Cyprus	CY7C68013-56LFC
1	U5	3.3 V regulator	Analog Devices	ADP3303AR-3.3
2	SCL, SDA	50 Ω straight SMB jacks	FEC	FEC 365-1228
8	X2_X1, X2_X3, X4_X5, X6_X7, Y0_Y1, Y2_Y3, Y4_Y5, Y6_Y7	Sockets, phono, printed circuit board (PCB), gold, one pair	FEC	FEC 382-4834
1	XTAL1	24 MHz, CM309S, SMD crystal	FEC	FEC 569-872

NOTES

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS ($100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.

ANALOG DEVICES

www.analog.com