

Using the **EV-ADT7420ARDZ** with **ACE** and **SDP** Hardware

FEATURES

Fully featured evaluation board for the [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#) precision digital temperature sensors.

PC control in conjunction with the [ACE IDE](#)

EVALUATION KIT CONTENTS

EV-TEMPSENSE-ARDZ kit

[EVAL-ADT7420ARDZ](#) evaluation board

[EVAL-ADT7420MBZ](#) remote evaluation board

[EVAL-ADT7320MBZ](#) remote evaluation board

2 plastic screws and washers

6-way and 4-way ribbon cables

[EVAL-ADT7422MBZ](#) remote evaluation board, optional

EQUIPMENT NEEDED

Any of the following **SDP** hardware:

[EVAL-SDP-CS1Z \(SDP-S\)](#), [EVAL-SDP-CB1Z \(SDP-B\)](#), or

[EVAL-SDP-CK1Z \(SDP-K1\)](#) controller board.

(USB cables included)

PC or laptop running Windows® 10 operating system

DOCUMENTS NEEDED

[ADT7410](#) data sheet

[ADT7420](#) data sheet

[ADT7422](#) data sheet

[ADT7310](#) data sheet

[ADT7320](#) data sheet

SOFTWARE NEEDED

[Analysis, control, evaluation \(ACE\) software](#)

ONLINE RESOURCES

[Evaluation board schematics](#) and [bill of materials](#)

GENERAL DESCRIPTION

The [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#) are high accuracy digital temperature sensors offering breakthrough performance over a wide industrial temperature range. The devices contain an internal band gap reference, a temperature sensor, and a 16-bit ADC to monitor and digitize the temperature to 0.0078°C resolution. These devices are available in I²C or serial peripheral interface (SPI) versions.

Consult the [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#) data sheets in conjunction with this user guide when using the **EV-TEMPSENSE-ARDZ** with the [ACE](#) integrated development environment (IDE) and system development platform (SDP) hardware.

EV-TEMPSENSE-ARDZ FUNCTIONAL BLOCK DIAGRAM

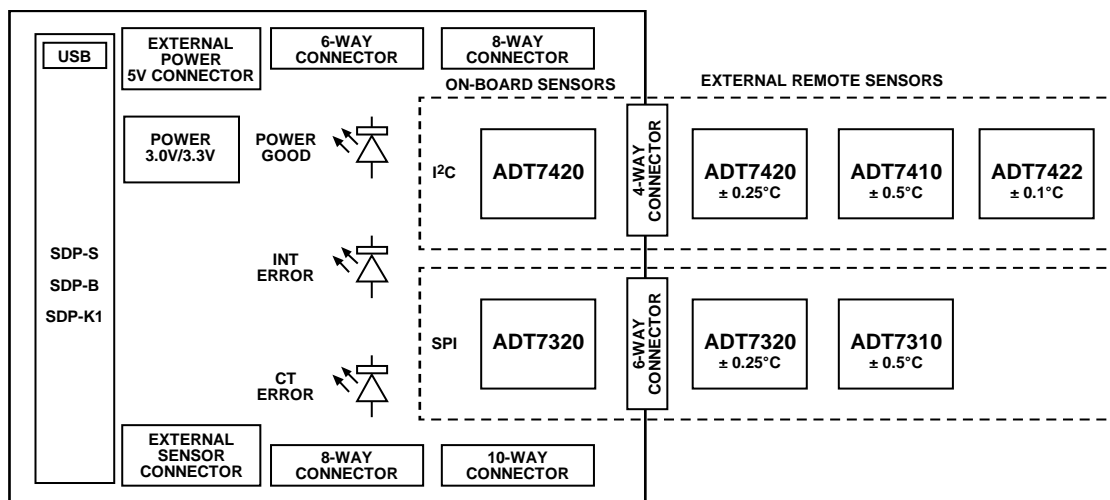


Figure 1.

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REVISION HISTORY

03/2020—Rev. 0 to Rev. A

Added ADT7422 and EVAL-ADT7422MBZ.....	Throughout.
Changes to Evaluation Kit Contents Section and Figure 1	1
Changes to Hardware Setup Section.....	3
Changes to Figure 8.....	5

10/2019—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

HARDWARE SETUP

Connect the SDP board ([SDP-S](#), [SDP-B](#), or [SDP-K1](#)) to the [EVAL-ADT7420ARDZ](#) (see Figure 2) development board via Connector P9.

Connect the 4-way ribbon cable to the external [EVAL-ADT7420MBZ](#) printed circuit board (PCB) (see Figure 3) at Connector P1. If available, the [EVAL-ADT7422MBZ](#) can be connected to P1 as an alternative.

Connect the 6-way ribbon cable to the external [EVAL-ADT7320MBZ](#) PCB (see Figure 4) at Connector P2.

See Figure 5 for a diagram showing the connected [EVAL-ADT7420MBZ](#) board and SDP board.

EVALUATION BOARD SCHEMATIC LOCATION

The evaluation board schematic diagrams are included with all the supporting documentation on the [EV-TEMPSENSE-ARDZ](#) product page.

POWER SUPPLIES

The [EVAL-ADT7420ARDZ](#) is powered by 5 V from the SDP board and this power supply is regulated to either 3.0 V or 3.3 V (voltages selected by JP1). The default power supply setting is 3.0 V. Alternatively, the [EVAL-ADT7420ARDZ](#) can be powered externally via P10, which is selected by changing the JP2 jumper to Position B.

The remote boards ([EVAL-ADT7420MBZ](#), [EVAL-ADT7422MBZ](#) and [EVAL-ADT7320MBZ](#)) are powered by the [EVAL-ADT7420ARDZ](#).

P1 and P2 connectors. See the schematic diagram on the [EV-TEMPSENSE-ARDZ](#) product page for more information.

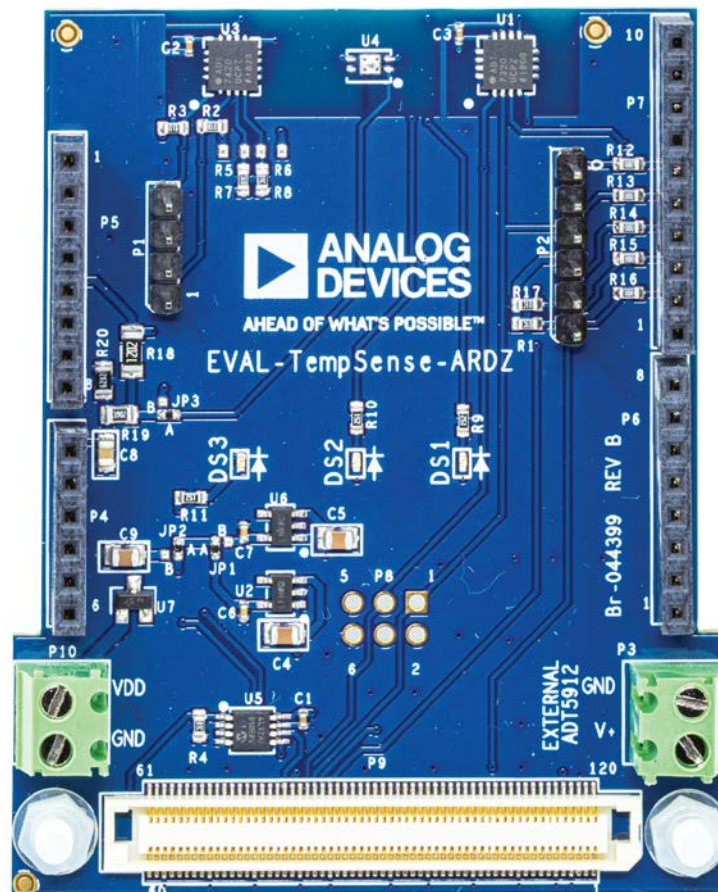
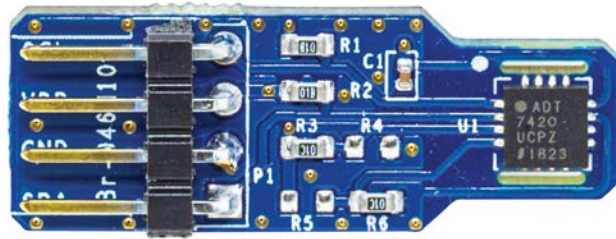
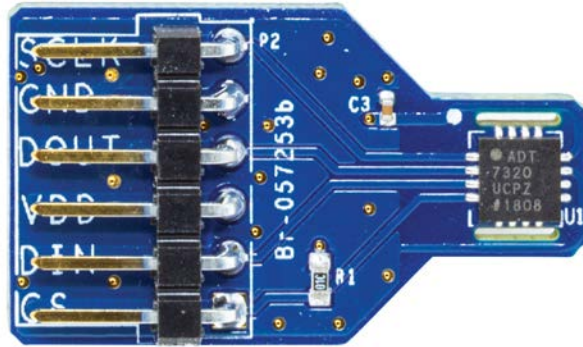


Figure 2. [EVAL-ADT7420ARDZ](#) Evaluation Board



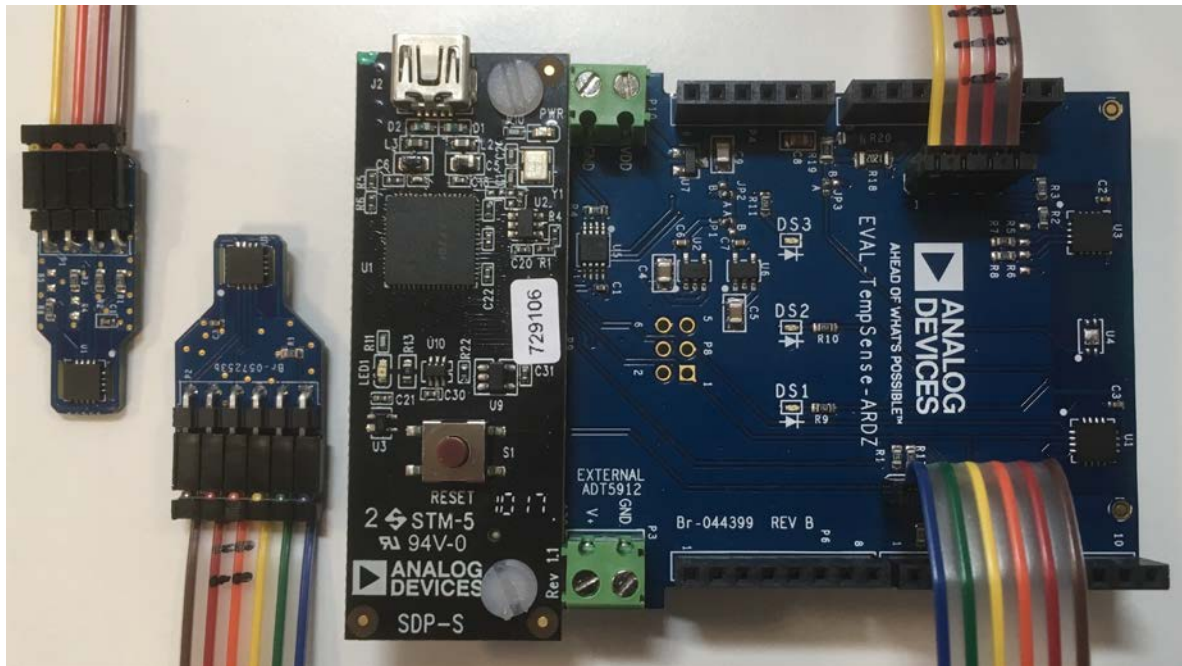
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Figure 3. EVAL-ADT7420MBZ Evaluation Board



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Figure 4. EVAL-ADT7320MBZ Evaluation Board



21755-105

Figure 5. Hardware Connected Diagram

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The [EVAL-ADT7420ARDZ](#), [EVAL-ADT7422MBZ](#), [EVAL-ADT7320MBZ](#), and [EVAL-ADT7420MBZ](#) boards use the Analog Devices, Inc., ACE software. ACE is a desktop software.

By default, the ACE installer installs the necessary SDP drivers for the SDP board and the Microsoft® .NET Framework 4 component. Install ACE before connecting the PC to the SDP board. The ACE software and full installation and operation instructions are found at www.analog.com/ACE.

When the [EVAL-ADT7420ARDZ](#) board hardware is connected to the PC with a USB cable, the corresponding plugin appears in the **Attached Hardware** section of the start-up window, as shown in Figure 7.

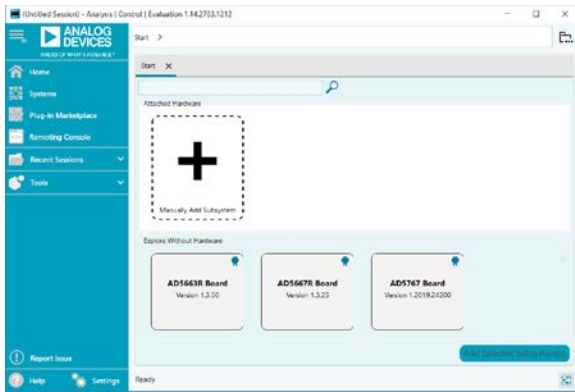


Figure 6. ACE Start-Up Window

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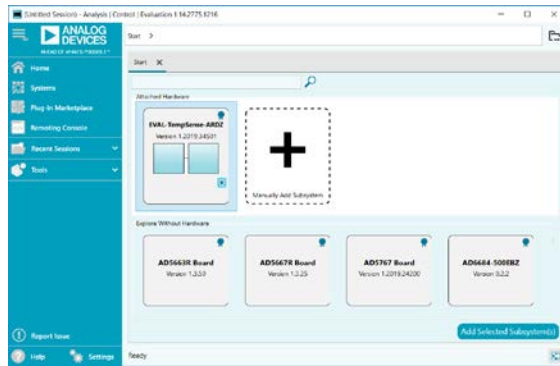


Figure 7. Hardware Connected

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INITIAL EVALUATION BOARD SETUP

To set up the [EVAL-ADT7420ARDZ](#), [EVAL-ADT7320MBZ](#), and [EVAL-ADT7420MBZ](#) or [EVAL-ADT7422MBZ](#) evaluation boards, complete the following steps:

1. Connect the [EVAL-ADT7420ARDZ](#) board to the SDP board as described in the Hardware Setup section and connect the SDP board to the computer USB port via a USB cable.
2. Power the [EVAL-ADT7420ARDZ](#) board as described in the Power Supplies section.
3. Run the ACE software. The [EV-TEMPSENSE-ARDZ](#) plugin appears in the **Attached Hardware** section of the **Start** tab (see Figure 7).
4. Double click the [EV-TEMPSENSE-ARDZ](#) plugin to open the functional block diagram shown in Figure 8.
5. Access the chip block diagram, which shows device functionality, by double clicking any of the evaluation board sensor chips (see Figure 9). This view is a simple representation of evaluation board functionality.

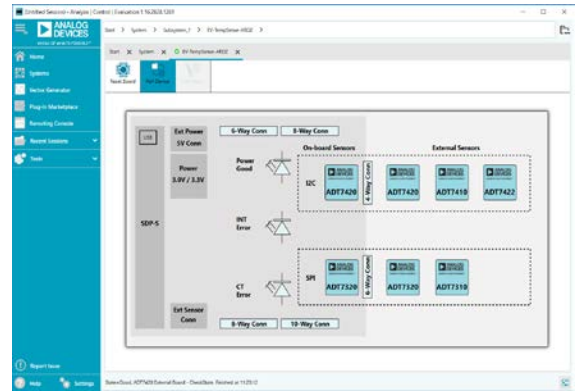


Figure 8. Evaluation Board View of the EV-TEMPSENSE-ARDZ

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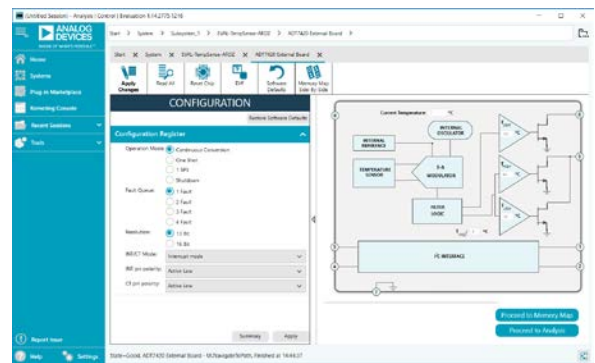


Figure 9. Chip Block Diagram View for the ADT7420

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ACE FUNCTIONAL BLOCK DIAGRAM

ACE is organized so that it appears similarly to the functional block diagrams shown in the [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#) data sheets. Matching the functional block diagrams between the [EV-TEMPSENSE-ARDZ](#) and devices in ACE makes it easy to correlate the functions on the [EVAL-ADT7420ARDZ](#) board with the data sheet descriptions of the corresponding [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#).

See the [ADT7410](#), [ADT7420](#), [ADT7310](#), and [ADT7320](#) data sheets for a full description of each block diagram, register and device settings, and how they pertain to the evaluation boards.

CONFIGURATION WINDOW

ACE allows the user to configure the components described in the following sections. Users can choose to configure the [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), or [ADT7320](#) board. For the purpose of this user guide, the [ADT7420](#) is used in the examples.

Operation Mode

In continuous conversion mode (default power-up mode), the [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), or [ADT7320](#) device (the user must choose one device) runs an automatic conversion sequence. During this sequence, a conversion takes 240 ms to complete and the device is continuously converting.

Fault Queue

Up to four faults are provided to prevent the INT and CT pins from falsely tripping when the device is used in a noisy temperature environment. The number of faults set in the queue must occur consecutively to set the INT and CT outputs.

Resolution

The [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#) are high accuracy digital temperature sensors that use a 16-bit ADC to monitor and digitize the temperature to a resolution of 0.0078°C. By default, the ADC resolution is set to 13 bits (0.0625°C). The temperature measurement result is stored in the 16-bit temperature value register.

INT Pin and CT Pin Functionality

The INT and CT pins have the following two undertemperature and overtemperature modes: comparator mode and interrupt mode. The interrupt mode is the default power-up overtemperature mode. When any register is read in interrupt mode, the INT pin and the CT pin return to the inactive status. When the temperature drops below or above the set temperatures (set by the user or default value) or is in comparator mode, the INT pin and the CT pin return to the inactive status.

INT Pin and CT Pin Polarity

The default setting is active low for both pins. These pins are connected to a resistor, and an LED is tied to the V_{DD} pin.

Functional Block Diagram

The temperature values for T_{CRIT}, T_{HIGH}, T_{LOW}, and T_{HYST}, the critical temperature thresholds described in the [ADT7410](#), [ADT7420](#), [ADT7422](#), [ADT7310](#), and [ADT7320](#) data sheets, can be entered directly into the value boxes in ACE (see Figure 10).

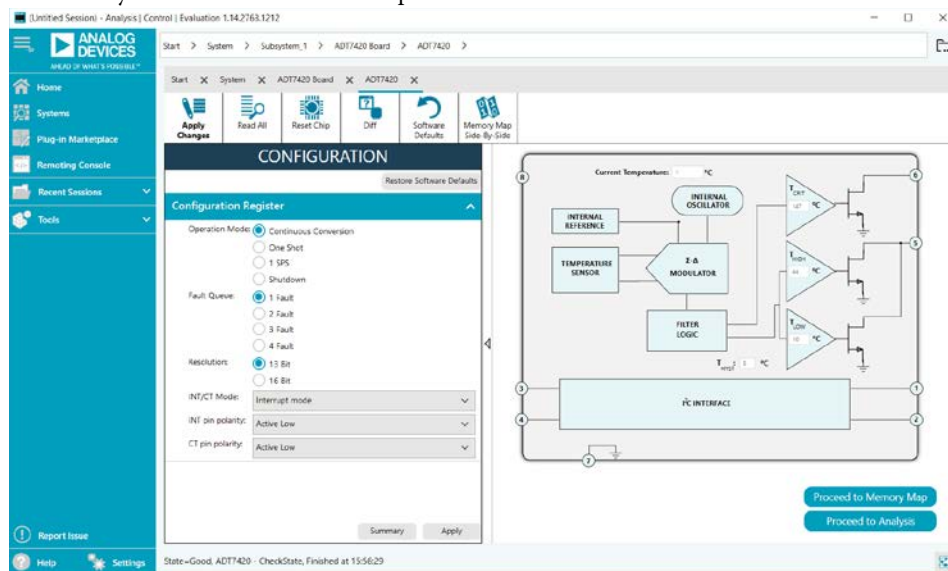


Figure 10. Chip Configuration Block Diagram for the [ADT7420](#)

MEMORY MAP

All registers are fully accessible from the ACE memory map tab (see Figure 11). This tab 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.

Clicking the **Apply Changes** button transfers data to the device. All changes to the registers correspond to the functional block

diagram shown in Figure 10. For example, if the internal register bit is enabled, this bit appears as enabled (set to 1 or 0) on the block diagram (see Figure 11). Any bolded bits or registers are modified values that have not been transferred to the device.

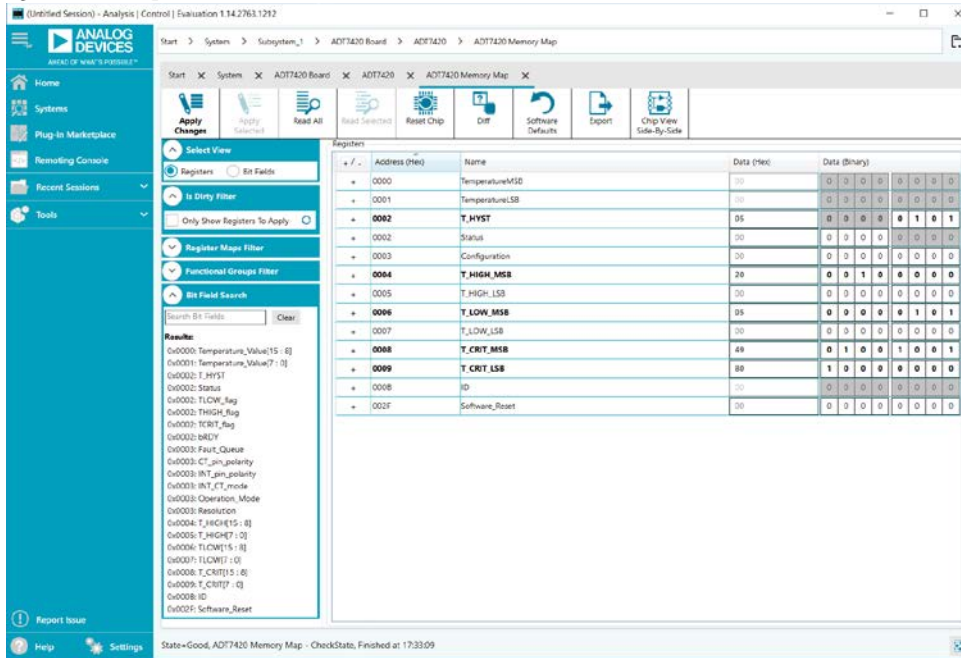


Figure 11. Memory Map Tab

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NOTES

I²C 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.

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 NON-INFRINGEMENT 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.