

ADS7823-28 EVM

User's Guide

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2004, Texas Instruments Incorporated

EVM IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation kit being sold by TI is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not considered by TI to be fit for commercial use. As such, the goods being provided may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product incorporating the goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this evaluation kit not meet the specifications indicated in the EVM User's Guide, the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Please be aware that the products received may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user is **not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein**.

Please read the EVM User's Guide and, specifically, the EVM Warnings and Restrictions notice in the EVM User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact the TI application engineer.

Persons handling the product must have electronics training and observe good laboratory practice standards.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 0-5 V and the output voltage range of 0-5 V

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 23°C. The EVM is designed to operate properly with certain components above 23°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Preface

Read This First

About This Manual

This user's guide describes the characteristics, operation, and use of the ADS7823-28 EVM. The ADS7823-28 is an evaluation module for use with the 12-bit single/octal channel, inter-integrated circuit (I²C) serial interface analog-to-digital converters ADS7823 and ADS7828. Both devices are located on a single printed wiring board. A complete circuit description as well as a schematic diagram and bill of materials are included.

How to Use This Manual

This document contains the following chapters:

Section 1 – EVM Overview

Section 2 – Analog Interface

Section 3 – Digital Interface

Section 4 – Power Supply Requirements

Section 5 – Board Setup and Operation

Section 6 – EVM BOM and Schematic

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

Trademarks

The I²C protocol is a form of synchronous, 2-wire serial communication developed by Phillips Semiconductors.

Related Documentation from Texas Instruments

To obtain a copy of any of the following Texas Instruments documents, call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580. When ordering, identify this booklet by the title and literature number. Updated documents can also be obtained through our website at www.ti.com.

Data Sheets:

ADS7823

ADS7828

5-6K Interface Board

DAP Signal Conditioning Boards

Literature Number:

SBAS180

SLAS181

SLAU104

SLAU105

Third Party Tools:

HPA449 Development Board

Vendor's Website:

www.SoftBaugh.com

Contents

1	EVM Overview	1-1
1.1	Features	1-2
2	Analog Interface	2-1
3	Digital Interface	3-1
4	Power Supplies	4-1
4.1	Reference Voltage	4-2
5	EVM Operation	5-1
5.1	Analog Input	5-2
5.2	Digital I/O	5-2
5.3	Address Selection	5-2
5.4	Jumper Defaults	5-3
6	EVM Bill of Materials and Schematic	6-1
6.1	Bill of Materials	6-2
6.2	EVM Schematic	6-3

Tables

5-1	Address Selection Options	5-2
5-2	Factory Jumper Defaults	5-3
6-1	EVM Bill of Materials	6-2

EVM Overview

The ADS7823 and ADS7828 are single-supply, low-power, 12-bit data acquisition devices that feature a serial I²C interface. The ADS7828 also features an 8-channel multiplexer. The analog-to-digital (A/D) converter contains a sample-and-hold amplifier and an internal asynchronous clock. The combination of an I²C serial, 2-wire interface and micropower consumption makes the ADS7823 and ADS7828 ideal for applications requiring the A/D converter to be close to the input source in remote locations and for applications requiring isolation. The EVM features one of each device (the ADS7823 and ADS7828) installed directly on the board.

Topic	Page
1.1 Features	1-2

1.1 Features

Full-featured evaluation board for the ADS7823 and ADS7828, single/octal channel analog-to-digital converters with I²C interface

Up to eight single-ended or four differential analog inputs

Built in reference with buffered output

I²C interface

Modular EVM form factor for use with a variety of Texas Instruments processors and interface boards



Analog Interface

For maximum flexibility, the ADS7823-28 EVM is designed for easy interfacing to multiple analog sources. Samtec part numbers SSW-110-22-F-D-VS-K and TSM-110-01-T-DV-P provide a convenient 10-pin dual row header/socket combination at J1. This header/socket provides access to the analog input pins of the ADC. Consult Samtec at www.samtec.com or call 1-800-SAMTEC-9 for a variety of mating connector options.

Pin Number	Signal	Description
J1.2	CH0	MUX input line 0 to ADS7828, AIN to ADS7823 via W4
J1.4	CH 1	MUX input line 1
J1.6	CH 2	MUX input line 2
J1.8	CH 3	MUX input line 3
J1.10	CH 4	MUX input line 4
J1.12	CH 5	MUX input line 5
J1.14	CH 6	MUX input line 6
J1.16	CH 7	MUX input line 7
J1.18	Unused	Pin is unused and should be left open for use with future amplifier and sensor input modules.
J1.20	REFIN	External reference source input (0 to V_{DD} MAX)
J1.1- J1.19 (odd)	AGND	Analog ground connections (except J1.15)
J1.15	VCOM Out	BufOut voltage available on this pin by appropriately setting W1

Digital Interface

The ADS7823-28 EVM is designed for easy interfacing to multiple control platforms. Samtec part numbers SSW-110-22-F-D-VS-K and TSM-110-01-T-DV-P provide a convenient 10-pin dual row header/socket combination at J2. This header/socket provides access to the digital control and serial data pins of the ADS7823 and ADS7828. Consult Samtec at www.samtec.com or 1-800-SAMTEC-9 for a variety of mating connector options.

Pin Number	Signal	Description
J2.1 – J2.19, J2.2, 6, 8, 12, 14	NC	No connections are associated with these pins. May be used in conjunction with GPIO source to control address settings of the ADS7823 and ADS7828 devices.
J2.16	SCL	Serial clock input to the ADC
J2.18	SDA	Serial data to/from the ADC
J2.4, 10, 18	DGND	Digital ground connections

Power Supplies

The ADS7823-28 EVM board requires +2.7 Vdc to 5.5 Vdc (3.3 V Nom) to power the ADC. While filters are provided for all power supply inputs, optimal performance of the EVM requires a clean, well-regulated power source. Positive 5-V and 3.3-V power is applied to J3 located on the bottom side of the printed circuit board when used in combination with the 5-6K interface or HPA449 development boards. Jumper W3 allows the user to choose 3.3-V operation (default) when a shunt is placed across pins 1-2. Moving the shunt to pins 2-3 allows 5-V operation.

If a variable digital supply voltage is desired, please completely remove the shunt jumper from W3. Apply a 100-mA current limited dc voltage of not more than 5.5 V to the test point TP5, referenced to GND (TP3).

Topic	Page
4.1 Reference Voltage	4-2

4.1 Reference Voltage

The ADS7823-28 can be configured to use the internal reference of the ADS7828 or an external reference source through jumper W1 (see the schematic for details). If an external reference is desired, the shunt jumper on W1 should cover pins 1-2. The external reference is supplied through J1 pin 20. The EVM is factory configured for use with the internal reference (W1 pin 2-3).

EVM Operation

Apply power to the EVM. For use in combination with one of the modular EVM interface boards, this is accomplished by simply plugging the ADS7823-28 into one of the serial positions (see the interface board schematics/documents for details). For stand alone use, apply power to TP4 (V_{DD}) referenced to TP3 (GND).

Topic	Page
5.1 Analog Input	5-2
5.2 Digital I/O	5-2
5.3 Address Selection	5-2
5.4 Jumper Defaults	5-3

5.1 Analog Input

The analog input source can be applied directly to J1 (top or bottom side) or through optional amplifier and signal conditioning modules. The ADS7823 accepts single-ended input in the range of 0-V_{ref} (5.5 V max). The analog input to the ADS7823 is shared with channel 0 of the ADS7828 device through J1 pin 2 and jumper W4.

For the ADS7828, the analog input level should not exceed 5 V_{p-p} (centered at 2.5 V) when configured for differential mode operation. The analog input range is from GND to +VREF (0 V – 5.5 V max) when configured as single ended inputs. Up to eight single-ended inputs can be applied to connector J2, pins 2-16 (even).

A maximum of four differential inputs may be applied to J2, using pins 2-4, 6-8, 10-12, and 14-16 as differential pair inputs. Single-ended and differential modes, as well as differential polarity, can be configured by writing to the ADC Gain/MUX register. Open W4 to remove the analog signal from the input of the ADS7823 when using differential mode signals.

5.2 Digital I/O

The digital control signals can be applied directly to J2 (top or bottom side). The ADS7823-28 EVM can also be connected directly to a DSP or micro controller interface board such as the 5-6K interface board or HPA449 development board. Consult the ADS7823 and ADS7828 product folders for a complete list of DSP interface cards, optional analog interface modules, and available application notes.

5.3 Address Selection

Jumper W2 provides a means to control the I²C address of the ADS7823 and ADS7828. W2 pins 1-2 and 3-4 control A0 and A1 respectively of the ADS7823. W2 pins 5-6 and 7-8 control A0 and A1 respectively of the ADS7828.

Table 5-1 describes the address selection options for both devices.

Table 5-1. Address Selection Options

W2	Controls	Jumper Functions / I ² C Address Restrictions
1-2	ADS7823 – A0	An open jumper places the address pin voltage at V _{DD} through a 10-kΩ pullup. Closing the jumper places the address pin at ground potential. Four possible address locations are available for each device. For proper operation of both devices simultaneously, each device must have a unique address.
3-4	ADS7823 – A1	
5-6	ADS7828 – A0	
7-8	ADS7828 – A1	

5.4 Jumper Defaults

Table 5-2 describes the factory jumper defaults as well as the functions the jumpers control.

Table 5-2. Factory Jumper Defaults

Jumper	Default Position	Function
W1	Open	Applies internal/common-mode output from/to J1. Default is neither applied.
W2	1-2 and 3-4 closed	Sets ADS7823 to address 00 and ADS7828 to address 11
W3	1-2	Applies 3.3 V or 5 V to V_{DD} when using an appropriate interface board. Default is 3.3 V.
W4	Closed	Applies AIN from J1.1 to ADS7823.

EVM Bill of Materials and Schematic

This chapter contains the bill of materials table and the schematic diagram.

Topic	Page
6.1 Bill of Materials	6-2
6.2 Schematic	6-3

6.1 Bill of Materials

Table 6-1 contains a complete bill of materials for the ADS7823-28 EVM.

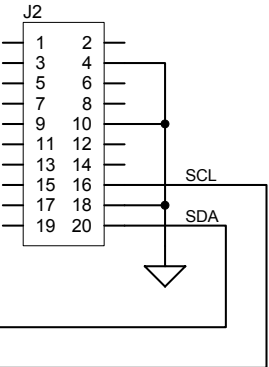
Table 6-1. EVM Bill of Materials

Designators	Description	Manufacturer	Mfg. Part Number
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12	Not installed		
C14, C19, C20, C23	1 μ F, 0805, ceramic	Panasonic	ECJ-2YB1H105K
C18	33 μ F, 16 V, aluminum, Size C	Cornell Dubilier	AVS106M16B12T
C13, C15, C17, C21	1 nF, 0805, ceramic, NPO, 50 V, 5%	PhyComp	0805CG102J9B200
C22	10- μ F tantalum		
FB1	SMT, EMI beads, Z = 47 Ω at 100 MHz	Fair-Rite	2743019447
J1, J2 (top side)	10-pin, dual row, SMT header (20 Pos.)	Samtec	TSM-110-01-T-DV-P
J1B, J2B (bottom side)	10-pin, dual row, SMT socket (20 Pos.)	Samtec	SSW-110-22-F-D-VS-K
J3 (bottom side)	5-pin, dual row, SMT socket (10 Pos.)	Samtec	SSW-105-22-F-D-VS-K
R1, R2, R3, R4, R5, R6, R7, R8	0 Ω , 0805, 0.1-W resistor	Yageo America	9C08052A0R00JLHFT
R10, R11, R12, R13, R14, R15	10 k Ω , 0805, 0.1-W resistor	Yageo America	9C08052A1002JLHFT
TP1, TP4	Red test point loop	Keystone	5000
TP2, TP3	Black test point loop	Keystone	5001
U1	ADS7828	Texas Instruments	ADS7828E
U2	ADS7823	Texas Instruments	ADS7823E
W1, W3	3-pin header	Samtec	TSW-103-07-L-S
W2	4-pin, dual row, TH header (8 Pos.)	Samtec	TSW-104-07-L-D
W4	2-pin header	Samtec	TSW-103-07-L-S

6.2 EVM Schematic

The schematic diagram is also provided for reference.

Revision History		
REV	ECN Number	Approved
A	Initial Release	TH



D

D

C

C

B

B

A

A



12500 TI Blvd. Dallas, Texas 75243

Title: ADS7823-28 EVM Schematic

Drawn By: Tom Hendrick

Engineer: Tom Hendrick

FILE: EDGE #6457911

SIZE: B

DATE: 16-Jun-2004

REV: A

SHEET: 1 OF: 1

