



ADuC8xx SIGMA DELTA EVALUATION BOARD REFERENCE GUIDE



MICROCONVERTER[®]
QUICKSTART[™] DEVELOPMENT SYSTEM

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(1) EVALUATION BOARD OVERVIEW

The ADuC8xx Sigma-Delta Evaluation board has the following features :

- 2 Layer PCB (4" X 5" Form Factor)
- 9V power supply/battery regulated to 5V on board
- 4 pin UART header to connect to RS232 Interface Cable
- 5 pin UART/ICE header to connect to external emulator board
- Example RTD Temperature Sensor Demonstration Circuit
- 32.768kHz Watch Crystal to drive the PLL clock
- AD780 2.5V External Reference Chip
- Reset/External Interrupt 0 Push Buttons
- Power on Reset circuit for ADuC816 and ADuC824 (not required for other parts)
- Power Indicator/General Purpose LEDs
- Access to all ADC inputs from external header. DAC output channel buffered to external header. All device Ports and Strobes are brought out to external header pins.
- Surface Mount and Through Hole General Purpose Prototype Area

THIS DOCUMENT REFERS TO THE MICROCONVERTER $\Sigma\Delta$ EVAL BOARD REV B

NOTES :

1. All references in this document to physical orientation of components on the board are made with respect to a component side view of the board with the battery connections appearing in the top left corner of the board.
2. The board is laid out to minimize coupling between the analog and digital sections of the board. To this end, the ground plane is split with the analog section on the left hand side and a digital plane on the right hand side of the board. The regulated 5V power supply is routed directly to the digital section and is filtered before being routed into the analog section of the board.
3. The ADuC8xx can be socketed on the board using a QFP carrier adaptor and corresponding surface mount feet available from Ironwood Electronics The part numbers are CA-QFE52SB-L-Z-T-01 and SF-QFE52SB-L-01 respectively.

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(2) EVALUATION BOARD FEATURES

Power Supply:

Users of the QuickStart Development System should power the evaluation board using the 9V power supply provided. Connect the 9V power supply to the 2.1mm input power socket (J6). The input connector is configured as 'CENTER NEGATIVE' i.e. GND on the center pin and +9V on the outer shield.

The 9V supply is regulated via a linear voltage regulator (U2). The 5V regulator output is used to drive the digital side of the board directly. The 5V supply is also filtered and then used to supply the analog side of the board.

When on, the green LED (D4) indicates that a valid 5V supply is being driven from the regulator circuit. All active components are decoupled with 0.1uF at device supply pins to ground.

Alternatively a 9V battery can be connected to the battery header P1.

UART/RS232 Interface:

The ADuC8xx (U1) TXD and RXD lines are connected to the RS232 Interface Cable via connector (J4). The Interface Cable generates the required level shifting to allow direct connection to a PC serial port. This interface will be the main channel of interactive comms on the board. Ensure that the cable supplied is connected to the board correctly i.e. DVDD is connected to DVDD and GND is connected to GND.

Emulation Interface:

Non intrusive single pin emulation is possible with the ADuC8xx via communications on the *EA* pin. The J5 connector allows the user to connect an emulator to the ADuC8xx evaluation board. While only the *EA* and GND connections need to be made the TXD, RXD and +9V connections are provided as added features.

The TXD and RXD can be connected so that the emulator can monitor communications on the users serial port. This allows the user to easily debug the serial port. From the IDE the user can send data to the hardware serial port to mimic an external device.

The +9V connection allows the user to power the evaluation board from the emulator itself. The 9V power supply should be connected to the emulator, which passes the 9V onto the evaluation board.

Crystal Circuit:

The board is fitted with a 32.768kHz watch crystal. This crystal is connected between the XTAL1 and XTAL2 pins. The ADuC8xx includes internal 12pF capacitors so external caps are not required.

External Reference (AD780)

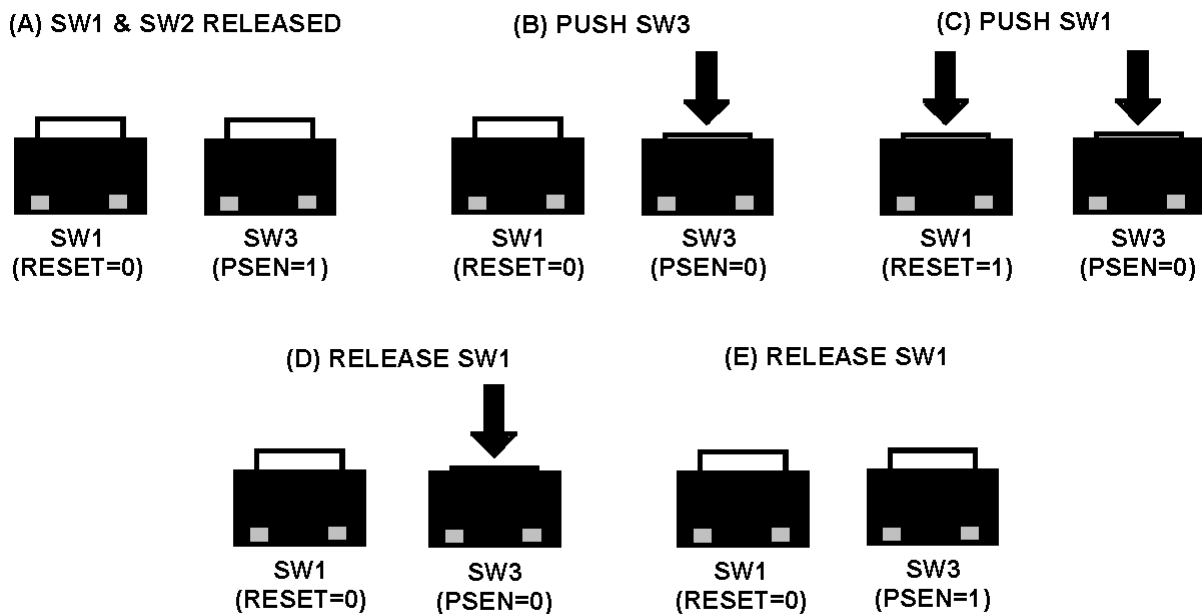
An external reference chip for use with the ADC is provided on the evaluation board. This allows the user to get improved ADC results from the ADuC8xx ADC. Using the WASP software on the QuickStart Development tools it is possible to compare ADC noise performance using the ADuC8xx internal reference and an external reference.

Reset/INT0 Push Buttons:

A **RESET push button** is provided to allow the user to manually reset the part. When inserted the RESET pin of the ADuC8xx will be pulled to DV_{DD} . Because the RESET pin on the ADuC8xx is Schmidt triggered internally there is no need to use an external Schmidt trigger on this pin.

When inserted the **INT0 push button** switch drives P3.2/INT0 low. This can be used to pull P3.2 low or more commonly to initiate an external interrupt 0.

To enter **serial download/debug** mode the user must pull the PSEN pin low while reset is toggled. On the evaluation board serial download mode can be easily initiated by holding down the serial download push button (SW3) while inserting and releasing the reset button (SW1) as illustrated below.



Entering Serial Download/DeBug Mode on the Evaluation Board.

Note: The ADuC816 and ADuC824 versions of the SD board have an external power on reset circuit implemented as shown in the schematic. Zero Ohm resistors bypass this circuit in the case of all of the other SD MicroConverter parts.

Power Indicator/General Purpose LEDs:

A green power LED (D4) is used to indicate that a sufficient supply is available on the board. A red general purpose LED (D5) is directly connected to P3.4 of the ADuC8xx. The CLR P3.4 instruction will turn the LED ON and the SETB P3.4 command will turn the LED off.

Analog I/O Connections:

The inputs to the primary ADC are filtered with a first order (RC) anti-aliasing filter. To evaluate the ADC noise performance of the ADuC8xx simply bias AIN2 to 2.5V (S1-7) and short AIN1 and AIN2 . Connecting (S1-1→ S1-5) and disconnecting (S1-6 and S1-7) allows the user to use the RTD demonstration circuit. The DAC output is buffered before being driven to an external pin header.

A general purpose buffer is also provided at J1. This buffer can be used to buffer the DAC output at pin 3, the PWM outputs or any other use that the user may have for it.⁷

A detailed pin out of this connector is given in section 4.

General Purpose prototype area

General Purpose prototype areas are provided at the top and the bottom of the evaluation board for adding external components as required in the users application. As can be seen from the layout AVDD, AGND, DVDD and DGND tracks are provided in this prototype area.

(3) DIP SWITCH LINK OPTIONS

S1-1 RTD EN

Function: Connects a current source at pin 3 of the ADuC834, through the RTD sensor and the reference resistor to AGND.

Use: *Slide S1-1 to the ON Position* to connect a current source at pin 3 to the RTD.
Slide S1-1 to the OFF Position to disconnect a current source at pin 3 from the RTD.

S1-2 RTD AIN1

Function: Connects the positive RTD terminal to AIN1.

Use : *Slide S1-2 to the ON position* to connect the positive RTD terminal to AIN1.
Slide S1-2 to the OFF position to disconnect the positive RTD terminal from AIN1.

S1-3 RTD AIN2

Function: Connects the negative RTD terminal to AIN2.

Use : *Slide S1-3 to the ON position* to connect the negative RTD terminal to AIN2.
Slide S1-3 to the OFF position to disconnect the negative RTD terminal from AIN2.

S1-4 RTD REFIN+

Function: Connects the positive RTD reference voltage to the REFIN+ pin of the ADuC834. To use the 2.5V external reference the following DIP switch options should also be used

- Connect REFIN- to ground via S1-5
- Disconnect REFIN+ from the 2.5V external reference via S1-6

Use: *Slide S1-6 to the ON Position* to connect REFIN+ to the 2.5V output of the AD780.
Slide S1-6 to the OFF Position to allow the RTD circuit reference voltage or any other reference voltage to REFIN+.

S1-5 RTD REFIN-

Function: Connects the REFIN- pin of the ADuC834 to AGND. This option should be used with either the RTD demo circuit or when connecting the 2.5V external reference to REFIN+

Use: *Slide S1-5 to the ON Position* to connect REFIN- to analog ground (use with RTD/AD780).
Slide S1-5 to the OFF Position if using an external differential reference to REFIN+ and REFIN-.

S1-6 2.5V REFIN+

Function: Connects the 2.5V external reference to the REFIN+ pin of the ADuC834. To use the 2.5V external reference the following DIP switch options should also be used

- Connect REFIN- to ground via S1-5
- Disconnect REFIN+ from the RTD circuit via S1-4

Use: *Slide S1-6 to the ON Position* to connect REFIN+ to the 2.5V output of the AD780.
Slide S1-6 to the OFF Position to allow the RTD circuit reference voltage or any other reference voltage to REFIN+.

S1-7 AIN2 BIAS

Function : Allows AIN2 to be biased to a 2.5V common mode voltage.

Use : *Slide S1-7 to the ON position* to bias AIN2 to 2.5V.

Slide s1-7 to the OFF position to remove the external bias voltage from AIN2.

S1-8 No Connect

Function : This link is already shorted

(4) EXTERNAL CONNECTORS:

J1 Analog I/O Connector

The analog I/O connector J1 provides external connections for all ADC inputs, reference inputs and DAC outputs. The pinout of the connector is shown below.

Pin #	Pin Name
J1-1	AV _{DD}
J1-2	AGND
J1-3	REFIN-
J1-4	REFIN+
J1-5	AIN1
J1-6	AIN2
J1-7	AIN3
J1-8	AIN4/DAC
J1-9	AIN5/IEXC2
J1-10	IEXC1/DAC
J1-11	DAC (BUF)
J1-12	BUF V-
J1-13	BUF V+
J1-14	BUF V _o

J2 (Port3 / Port2 / Port 0)

3 parallel ports (Port3, Port2 and Port0) are brought out to the connector J2 as well as P1.0 and P1.1. All these port pins are labeled on the silkscreen on the evaluation board.

J3 SPI/I²C Connector

J3 provides external connections for the SPI/I²C connector as described below.

Pin	Pin Name
J3-1	GND
J3-2	SS
J3-3	MISO
J3-4	MOSI/SDATA
J3-5	SCLOCK

J4 UART/RS232 Interface Connector

See “UART/RS232 Interface” in section 2.

J5 Emulation Connector

See “Emulation Interface” in section 2.

J6 Power Supply Connections

See “Power Supply” in section 2.

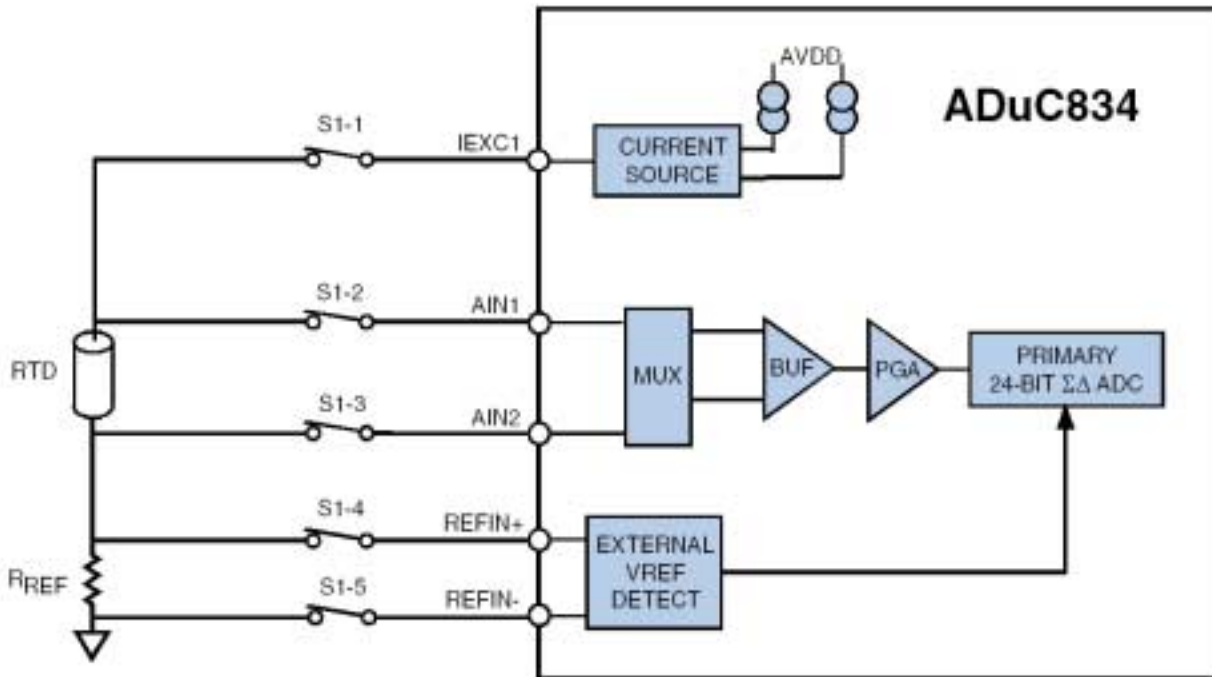
J7 Strobes

The ALE, PSEN and EA strobes are brought out to an external connector.

Pin	Function
J7-1	DGND
J7-2	ALE
J7-3	<i>PSEN</i>
J7-4	<i>EA</i>
J7-5	RESET

(5) RTD TEMPERATURE DEMONSTRATION CIRCUIT

As can be seen from examining the schematic an example RTD circuit is connected in a standard 4-wire configuration as shown in the figure below:



To use the RTD circuit the following links should be inserted.

- S1-1 Slide to the ON position
- S1-2 Slide to the ON position
- S1-3 Slide to the ON position
- S1-4 Slide to the ON position
- S1-5 Slide to the ON position
- S1-6 Slide to the OFF position
- S1-7 Slide to the OFF position

The RTD is excited by a current source from pin 3 of the ADuC8xx. In order for this current to excite the RTD S1-1 must be in the ON position. This DC excitation current generates a reference voltage across R4 which is fed to the ADC reference at REFIN+ and REFIN- through S1-4 and S1-5.

As described on page 35 of the ADuC834 datasheet the 0.1uF capacitors at REFIN+ and REFIN- will cause some dc error. Hence for optimum performance the two capacitors C17 and C18 should be removed while using the RTD demonstration.

The voltage across the RTD is fed into AIN1 and AIN2 via S1-2 and S1-3.

(6) ADUC8XX SIGMA DELTA EVALUATION BOARD PARTS LIST

Qty	Ref Des	Part Description	Load Y/N	Supplier	Cat No
1	U1	ADuC816BCP	ADuC816 ONLY	ADI	
		ADuC824BCP	ADuC824 ONLY	ADI	
		ADuC834BCP	ADuC834 ONLY	ADI	
		ADuC836BCP	ADuC836 ONLY	ADI	
		ADuC844BCP	ADuC844 ONLY	ADI	
		ADuC846BCP	ADuC846 ONLY	ADI	
1	U2	ZR78L05G, SOT223 200mA regulator	Y	Farnell	572-239
1	U3	AD780AR - 2.5V Voltage Reference	Y	ADI	
1	U4	OP284ES - Dual Single Supply Rail to Rail Op-amp	Y	ADI	
1	U5	ADM809RART	ADuC816/824 ONLY	ADI	
1	U6	ADuC816BS (Solder 2 pins only)	ADuC816 ONLY	ADI	
		ADuC824BS (Solder 2 pins only)	ADuC824 ONLY	ADI	
		ADuC834BS (Solder 2 pins only)	ADuC834 ONLY	ADI	
		ADuC836BS (Solder 2 pins only)	ADuC836 ONLY	ADI	
		ADuC844BS (Solder 2 pins only)	ADuC844 ONLY	ADI	
		ADuC846BS (Solder 2 pins only)	ADuC846 ONLY	ADI	
10	C5 C6 C9 C10 C11 C12 C13 C14 C15				
	C16	0.1uF SMD Multilayer Ceramic Cap, 0603 Case	Y	Farnell	317-287
5	C2 C3 C4 C7 C8	10uF 10V SMD Tantalum Cap, Taj-A Case	Y	Farnell	197-130
1	C1	Regulator Input Cap (not used)	N		
3	D1 D2 D3	PRLL4002 SMD Diode (SOD-87 case)	Y	Farnell	316-2734
1	D4	Green SMD LED (Power)	Y	Farnell	515-620
1	D5	Red SMD LED (Display)	Y	Farnell	515-607
2	R1 R7	0R 0.063W 1% SMD Resistor, 0603 case	Y	Farnell	772-227
2	R8 R11	0R 0.063W 1% SMD Resistor, 0603 case	ADuC834/836 ONLY	Farnell	772-227
1	R9	0R 0.063W 1% SMD Resistor, 0603 case	ADuC816/824 ONLY	Farnell	772-227
1	R3	1.5R 0.063W 5% SMD Resistor, 0603 case	Y	Farnell	758-267
2	R2 R13	560R 0.063W 1% SMD Resistor, 0603 case	Y	Farnell	911-203
4	R5 R6 R14 R15	1k 0.063W 1% SMD Resistor, 0603 case	Y	Farnell	911-239
2	R10 R12	1k 0.063W 1% SMD Resistor, 0603 case	ADuC816/824 ONLY	Farnell	911-239
1	R4	5.6k 0.063W 1% SMD Resistor, 0603 case	Y	Farnell	911-320
1	L1	Ferrite Bead (1206 case)	Y	Farnell	581-094
1	Y1	32.768kHz Crystal (85SMX package)	Y	Farnell	316-0312
1	Q1	BC856 PNP Transistor	ADuC816/824 ONLY	Farnell	506-266
1	RTD1	100R Class B 0805 RTD	Y	Enercorp	PCS 1.1503.1
3	SW1 SW2 SW3	Sealed 6mm SMD Push Button Switch	Y	Farnell	177-807
1	S1	Surface Mount Low Profile 8 way DIP Switch	Y	Farnell	566-718
1	P1	Pair of 9V Snap on Battery Connectors	Y	Farnell	723-988
1	J1	14 Pin Straight Single Row Surface Mount Header	Y	Samtec (Sable Electronics)	TSM-114-01-T-SV
1	J2	28 Pin Straight Single Row Surface Mount Header	Y	Samtec (Sable Electronics)	TSM-128-01-T-SV
1	J3	5 Pin Straight Single Row Surface Mount Header	Y	Samtec (Sable Electronics)	TSM-105-01-T-SV
1	J4	4 Pin 90° Single Row Surface Mount Header	Y	Samtec (Sable Electronics)	TSM-104-02-T-SH
1	J5	5 Pin 90° Single Row Thru Hole Header	N	Farnell	146-694
1	J5	2 Pin Straight Header with friction lock (EA & GND)	Y	Farnell	143-139
1	J3	5 Pin Straight Single Row Header	Y	Samtec (Sable Electronics)	TSM-105-01-T-SV
1	J6	PCB Mounted Socket (2mm Pin Diameter)	Y	Kycon (Sable Electronics)	KLD-SMT2-0202-A
1	J7	5 Pin Straight Single Row Thru Hole Header	N		
1	Each Corner	Stick on mounting feet	Y	Farnell	148-922