



FEATURES

- Resolution:** AD7792: 16-Bit
AD7793: 24-Bit
- Low Noise Programmable Gain Instrumentation-Amp**
- RMS noise: 80 nV (Gain = 64)**
- Bandgap Reference with 5ppm/ C Drift typ**
- Power**
 - Supply: 2.7 V to 5.25 V operation**
 - Normal: 400 μ A typ**
 - Power-down: 1 μ A max**
- Update Rate: 4 Hz to 500 Hz**
- Simultaneous 50 Hz/60 Hz Rejection**
- Internal Clock Oscillator**
- Programmable Current Sources (10 μ A/200 μ A/1 mA)**
- On-Chip Bias Voltage Generator**
- 100 nA Burnout Currents**
- Independent Interface Power Supply**
- 16-Lead TSSOP Package**

INTERFACE

- 3-wire serial**
- SPI[®], QSPI[™], MICROWIRE[™], and DSP compatible**
- Schmitt trigger on SCLK**

APPLICATIONS

- Thermocouple Measurements**
- RTD Measurements**
- Thermistor Measurements**

FUNCTIONAL BLOCK DIAGRAM

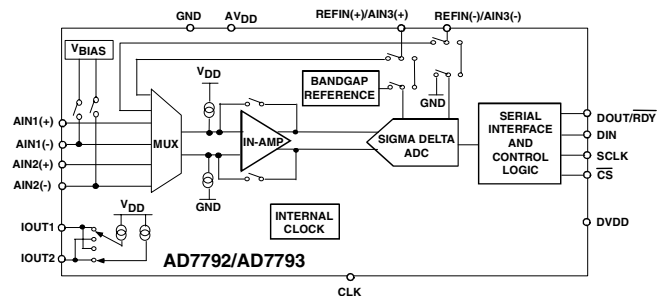


Figure 1.

GENERAL DESCRIPTION

The AD7792/AD7793 is a low power, complete analog front end for low frequency measurement applications. The AD7792/AD7793 contains a low noise 16/24-bit Σ - Δ ADC with three differential analog inputs. The on-chip low noise instrumentation amplifier means that signals of small amplitude can be interfaced directly to the ADC. With a gain setting of 64, the rms noise is 80 nV when the update rate equals 16.6 Hz.

The device contains a precision low noise, low drift internal bandgap reference for absolute measurements. An external reference can also be used if ratiometric measurements are required. On-chip programmable excitation current sources can be used to supply a constant current to RTDs and thermistors while the 100 nA burnout currents can be used to ensure that the sensors connected to the ADC are not burnt out. For thermocouple applications, the on-chip bias voltage generator steps up the common mode voltage from the thermocouple so that it is within the ADC's allowable range.

The device can be operated with the internal clock or, alternatively, an external clock can be used if synchronizing several devices. The output data rate from the part is software programmable and can be varied from 4 Hz to 500 Hz.

The part operates with a power supply from 2.7 V to 5.25 V. It consumes a current of 450 μ A maximum and is housed in a 16-lead TSSOP package.

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REVISION HISTORY

REV.PrF, June 2004: Initial Version

AD7792/AD7793—SPECIFICATIONS¹Table 1. ($V_{DD} = 2.7\text{ V to }5.25\text{ V}$; $DV_{DD} = 2.7\text{ V to }5.25\text{ V}$; $GND = 0\text{ V}$; all specifications T_{MIN} to T_{MAX} , unless otherwise noted.)

| Parameter | AD7792/AD7793B | Unit | Test Conditions/Comments |
|---|---|--|--|
| ADC CHANNEL SPECIFICATION | | | |
| Output Update Rate | 4 500 | Hz min nom Hz max nom | |
| ADC CHANNEL | | | |
| No Missing Codes ² | 24 16 | Bits min Bits min | $f_{ADC} \leq 125\text{ Hz}$. AD7793 |
| Resolution (pk – pk) | 16 19 16 | Bits p-p Bits p-p Bits p-p | Gain = 128, 16.6 Hz Update Rate, $V_{REF} = 2.5\text{V}$ Gain = 1, 16.6 Hz Update Rate, $V_{REF} = 2.5\text{V}$, AD7793 Gain = 1, 16.6 Hz Update Rate, $V_{REF} = 2.5\text{V}$, AD7792 |
| Output Noise and Update Rates | See Tables in ADC Description | | |
| Integral Nonlinearity | ± 15 ± 25 | ppm of FSR max ppm of FSR max | 3.5 ppm of FSR typ, Gain = 1 to 32 5 ppm of FSR typ, Gain = 64 and 128 |
| Offset Error ³ | ± 3 | μV typ | |
| Offset Error Drift vs. Temperature ⁴ | ± 10 | $\text{nV}/^\circ\text{C}$ typ | |
| Full-Scale Error ^{3,5} | ± 10 | μV typ | |
| Gain Drift vs. Temperature ⁴ | ± 0.5 ± 3 | $\text{ppm}/^\circ\text{C}$ typ $\text{ppm}/^\circ\text{C}$ typ | Gain = 1 or 2 Gain = 4 to 128 |
| Power Supply Rejection | 90 | dB min | 100 dB typ, $A_{IN} = FS/2$ |
| ANALOG INPUTS | | | |
| Differential Input Voltage Ranges | $\pm \text{REFIN}/\text{Gain}$ | V nom | $\text{REFIN} = \text{REFIN}(+) - \text{REFIN}(-)$ or Internal Reference, Gain = 1 to 128 |
| Absolute A_{IN} Voltage Limits ² | | | |
| Unbuffered Mode | GND – 30 mV $A_{VDD} + 30\text{ mV}$ | V min V max | Gain = 1 or 2 |
| Buffered Mode | GND + 100 mV $A_{VDD} - 100\text{ mV}$ | V min V max | Gain = 1 or 2 |
| In-Amp Enabled | GND + 300 mV $A_{VDD} - 1.1$ | V min V max | Gain = 4 to 128 |
| Common Mode Voltage | 0.5 | V min | Gain = 4 to 128 |
| Analog Input Current | | | |
| Buffered Mode or In-Amp Enabled | | | |
| Average Input Current ² | ± 200 | pA max | |
| Average Input Current Drift | ± 2 | $\text{pA}/^\circ\text{C}$ typ | |
| Unbuffered Mode | | | Gain = 1 or 2. Input current varies with input voltage. |
| Average Input Current | ± 400 | nA/V typ | |
| Average Input Current Drift | ± 50 | $\text{pA}/\text{V}/^\circ\text{C}$ typ | |
| Normal Mode Rejection ² | | | |
| Internal Clock | | | |
| @ 50 Hz, 60 Hz | 70 | dB min | 80 dB typ, $50 \pm 1\text{ Hz}$, $60 \pm 1\text{ Hz}$, $FS[3:0] = 1010^6$ |
| @ 50 Hz | 84 | dB min | 100 dB typ, $50 \pm 1\text{ Hz}$, $FS[3:0] = 1001^6$ |
| @ 60 Hz | 90 | dB min | 100 dB typ, $60 \pm 1\text{ Hz}$, $FS[3:0] = 1000^6$ |
| External Clock | | | |
| @ 50 Hz, 60 Hz | 80 | dB min | 90 dB typ, $50 \pm 1\text{ Hz}$, $60 \pm 1\text{ Hz}$, $FS[3:0] = 1010^6$ |
| @ 50 Hz | 94 | dB min | 100 dB typ, $50 \pm 1\text{ Hz}$, $FS[3:0] = 1001^6$ |
| @ 60 Hz | 90 | dB min | 100 dB typ, $60 \pm 1\text{ Hz}$, $FS[3:0] = 1000^6$ |
| Common Mode Rejection | | | $A_{IN} = +FS/2$ |
| @DC | 90 | dB min | 100 dB typ, $FS[3:0] = 1010^6$ |
| @ 50 Hz, 60 Hz ² | 100 | dB min | $50 \pm 1\text{ Hz}$, $60 \pm 1\text{ Hz}$, $FS[3:0] = 1010^6$ |

| Parameter | AD7792/AD7793B | Unit | Test Conditions/Comments | |
|---|---------------------------|-------------|---|--|
| @ 50 Hz, 60 Hz ² | 100 | dB min | 50 ± 1 Hz (FS[3:0] = 1001 ⁶), 60 ± 1 Hz (FS[3:0] = 1000 ⁶) | |
| REFERENCE | | | | |
| Internal Reference Initial Accuracy | 1.17 ± 0.01% | V min/max | Gain = 1, Update Rate = 16.6 Hz. Includes ADC Noise. REFIN = REFIN(+) – REFIN(-) | |
| Internal Reference Drift | 5 | ppm/°C typ | | |
| | 15 | ppm/°C max | | |
| Internal Reference Noise | 2 | µV RMS | | |
| External REFIN Voltage | 2.5 | V nom | | |
| Reference Voltage Range ² | 0.1 | V min | | |
| | V _{DD} | V max | | |
| Absolute REFIN Voltage Limits ² | GND – 30 mV | V min | | |
| | AV _{DD} + 30 mV | V max | | |
| Average Reference Input Current | 400 | nA/V typ | | |
| Average Reference Input Current Drift | ±0.03 | nA/V/°C typ | | |
| Normal Mode Rejection ² | Same as for Analog Inputs | | | |
| Common Mode Rejection | Same as for Analog Inputs | | | |
| EXCITATION CURRENT SOURCES (IEXC1 and IEXC2) | | | | |
| Output Current | 10/200/1000 | µA nom | Matching between IEXC1 and EXC2. V _{OUT} = 0 V AV _{DD} = 5 V ± 5%. Typically 1.25 ppm/V 10 µA or 200 µA Currents Selected 1 mA Currents Selected | |
| Initial Tolerance at 25°C | ±5 | % typ | | |
| Drift | 200 | ppm/°C typ | | |
| Initial Current Matching at 25°C | ±1 | % typ | | |
| Drift Matching | 20 | ppm/°C typ | | |
| Line Regulation (V _{DD}) | 2.1 | ppm/V max | | |
| Load Regulation | 0.3 | ppm/V typ | | |
| Output Compliance | AV _{DD} – 0.6 | V max | | |
| | AV _{DD} – 1 | V max | | |
| | GND – 30 mV | V min | | |
| TEMP SENSOR | | | | |
| Accuracy | TBD | °C typ | | |
| BIAS VOLTAGE GENERATOR | | | | |
| V _{BIAS} | AV _{DD} /2 | V nom | Dependent on the Capacitance on the AIN pin | |
| V _{BIAS} Generator Start-Up Time | TBD | ms/nF typ | | |
| INTERNAL/EXTERNAL CLOCK | | | | |
| Internal Clock | | | | |
| Frequency | 64 ± 2% | KHz nom | | |
| Duty Cycle | 50:50 | % typ | | |
| Drift | 0.01 | %/°C typ | | |
| External Clock | | | | |
| Frequency | 64 | KHz nom | | |
| Duty Cycle | 45:55 | % typ | | |
| LOGIC INPUTS | | | | |
| All Inputs Except SCLK, DIN and CLK ² | | | | |
| V _{INL} , Input Low Voltage | 0.8 | V max | DV _{DD} = 5 V | |
| | 0.4 | V max | DV _{DD} = 3 V | |
| V _{INH} , Input High Voltage | 2.0 | V min | DV _{DD} = 3 V or 5 V | |
| SCLK and DIN (Schmitt-Triggered Input) ² | | | | |
| V _T (+) | 1.4/2 | V min/V max | DV _{DD} = 5 V | |
| V _T (-) | 0.8/1.4 | V min/V max | DV _{DD} = 5 V | |
| V _T (+) – V _T (-) | 0.3/0.85 | V min/V max | DV _{DD} = 5 V | |

| Parameter | AD7792/AD7793B | Unit | Test Conditions/Comments |
|---|-------------------|-------------------|---|
| $V_{T(+)}$ | 0.9/2 | V min/V max | $DV_{DD} = 3\text{ V}$ |
| $V_{T(-)}$ | 0.4/1.1 | V min/V max | $DV_{DD} = 3\text{ V}$ |
| $V_{T(+)} - V_{T(-)}$ | 0.3/0.85 | V min/V max | $DV_{DD} = 3\text{ V}$ |
| CLK ² | | | |
| V_{INL} , Input Low Voltage | 0.8 | V max | $DV_{DD} = 5\text{ V}$ |
| V_{INL} , Input Low Voltage | 0.4 | V max | $DV_{DD} = 3\text{ V}$ |
| V_{INH} , Input High Voltage | 3.5 | V min | $DV_{DD} = 5\text{ V}$ |
| V_{INH} , Input High Voltage | 2.5 | V min | $DV_{DD} = 3\text{ V}$ |
| Input Currents | ± 1 | $\mu\text{A max}$ | $V_{IN} = DV_{DD}$ or GND |
| Input Capacitance | 10 | pF typ | All Digital Inputs |
| LOGIC OUTPUTS (Including CLK) | | | |
| V_{OH} , Output High Voltage ² | $DV_{DD} - 0.6$ | V min | $DV_{DD} = 3\text{ V}$, $I_{SOURCE} = 100\ \mu\text{A}$ |
| V_{OL} , Output Low Voltage ² | 0.4 | V max | $DV_{DD} = 3\text{ V}$, $I_{SINK} = 100\ \mu\text{A}$ |
| V_{OH} , Output High Voltage ² | 4 | V min | $DV_{DD} = 5\text{ V}$, $I_{SOURCE} = 200\ \mu\text{A}$ |
| V_{OL} , Output Low Voltage ² | 0.4 | V max | $DV_{DD} = 5\text{ V}$, $I_{SINK} = 1.6\text{ mA}$ ($DOUT/\overline{RDY}$)/800 μA (CLK) |
| Floating-State Leakage Current | ± 1 | $\mu\text{A max}$ | |
| Floating-State Output Capacitance | 10 | pF typ | |
| Data Output Coding | Offset Binary | | |
| SYSTEM CALIBRATION ² | | | |
| Full-Scale Calibration Limit | $1.05 \times FS$ | V max | |
| Zero-Scale Calibration Limit | $-1.05 \times FS$ | V min | |
| Input Span | $0.8 \times FS$ | V min | |
| | $2.1 \times FS$ | V max | |
| POWER REQUIREMENTS ⁷ | | | |
| Power Supply Voltage | | | |
| $AV_{DD} - GND$ | 2.7/5.25 | V min/max | |
| $DV_{DD} - GND$ | 2.7/5.25 | V min/max | |
| Power Supply Currents | | | |
| I_{DD} Current | 150 | $\mu\text{A max}$ | 125 $\mu\text{A typ}$, Unbuffered Mode, Ext. Reference |
| | 175 | $\mu\text{A max}$ | 150 $\mu\text{A typ}$, Buffered Mode, In-Amp Bypassed, Ext Ref |
| | 380 | $\mu\text{A max}$ | 330 $\mu\text{A typ}$, In-Amp used, Ext. Ref |
| | 450 | $\mu\text{A max}$ | 400 $\mu\text{A typ}$, In-Amp used, Int Ref |
| I_{DD} (Power-Down Mode) | 1 | $\mu\text{A max}$ | |

¹ Temperature Range -40°C to $+105^{\circ}\text{C}$.

² Specification is not production tested but is supported by characterization data at initial product release.

³ Following a self-calibration, this error will be in the order of the noise for the programmed gain and update rate selected. A system calibration will completely remove this error.

⁴ Recalibration at any temperature will remove these errors.

⁵ Full-scale error applies to both positive and negative full-scale and applies at the factory calibration conditions ($AV_{DD} = 4\text{ V}$).

⁶ FS[3:0] are the four bits used in the mode register to select the output word rate.

⁷ Digital inputs equal to DV_{DD} or GND.

TIMING CHARACTERISTICS^{4, 5}Table 2. ($A_{V_{DD}} = 2.7\text{ V to }5.25\text{ V}$; $DV_{DD} = 2.7\text{ V to }5.25\text{ V}$; $GND = 0\text{ V}$, Input Logic 0 = 0 V, Input Logic 1 = DV_{DD} , unless otherwise noted.)

| Parameter | Limit at T_{MIN}, T_{MAX} (B Version) | Unit | Conditions/Comments |
|-----------------|--|--------|--|
| t_3 | 100 | ns min | SCLK High Pulsewidth |
| t_4 | 100 | ns min | SCLK Low Pulsewidth |
| Read Operation | | | |
| t_1 | 0 | ns min | \overline{CS} Falling Edge to $DOUT/\overline{RDY}$ Active Time |
| | 60 | ns max | $DV_{DD} = 4.75\text{ V to }5.25\text{ V}$ |
| | 80 | ns max | $DV_{DD} = 2.7\text{ V to }3.6\text{ V}$ |
| t_2^6 | 0 | ns min | SCLK Active Edge to Data Valid Delay ⁷ |
| | 60 | ns max | $DV_{DD} = 4.75\text{ V to }5.25\text{ V}$ |
| | 80 | ns max | $DV_{DD} = 2.7\text{ V to }3.6\text{ V}$ |
| $t_5^{8,9}$ | 10 | ns min | Bus Relinquish Time after \overline{CS} Inactive Edge |
| | 80 | ns max | |
| t_6 | 100 | ns max | SCLK Inactive Edge to \overline{CS} Inactive Edge |
| t_7 | 10 | ns min | SCLK Inactive Edge to $DOUT/\overline{RDY}$ High |
| Write Operation | | | |
| t_8 | 0 | ns min | \overline{CS} Falling Edge to SCLK Active Edge Setup Time ⁷ |
| t_9 | 30 | ns min | Data Valid to SCLK Edge Setup Time |
| t_{10} | 25 | ns min | Data Valid to SCLK Edge Hold Time |
| t_{11} | 0 | ns min | \overline{CS} Rising Edge to SCLK Edge Hold Time |

⁴ Sample tested during initial release to ensure compliance. All input signals are specified with $t_r = t_f = 5\text{ ns}$ (10% to 90% of DV_{DD}) and timed from a voltage level of 1.6 V.

⁵ See Figure 3 and Figure 4.

⁶ These numbers are measured with the load circuit of Figure 2 and defined as the time required for the output to cross the V_{OL} or V_{OH} limits.

⁷ SCLK active edge is falling edge of SCLK.

⁸ These numbers are derived from the measured time taken by the data output to change 0.5 V when loaded with the circuit of Figure 2. The measured number is then extrapolated back to remove the effects of charging or discharging the 50 pF capacitor. This means that the times quoted in the timing characteristics are the true bus relinquish times of the part and, as such, are independent of external bus loading capacitances.

⁹ \overline{RDY} returns high after a read of the ADC. In single conversion mode and continuous conversion mode, the same data can be read again, if required, while \overline{RDY} is high, although care should be taken to ensure that subsequent reads do not occur close to the next output update. In continuous read mode, the digital word can be read only once.

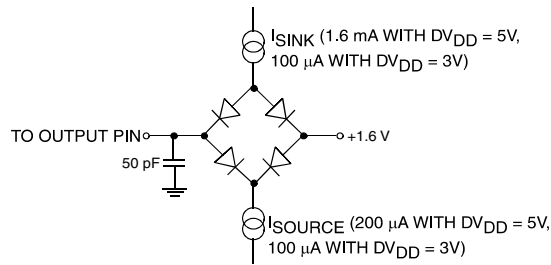


Figure 2. Load Circuit for Timing Characterization

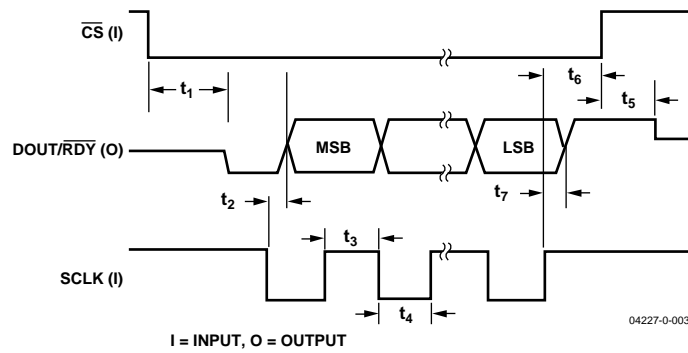


Figure 3. Read Cycle Timing Diagram

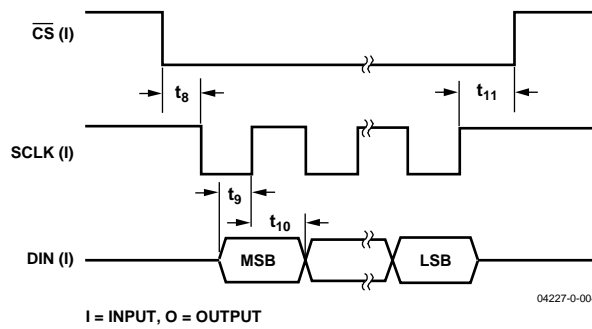


Figure 4. Write Cycle Timing Diagram

ABSOLUTE MAXIMUM RATINGS

Table 3. ($T_A = 25^\circ\text{C}$, unless otherwise noted.)

| Parameter | Rating |
|---------------------------------|---|
| AV_{DD} to GND | -0.3 V to +7 V |
| DV_{DD} to GND | -0.3 V to +7 V |
| Analog Input Voltage to GND | -0.3 V to $AV_{DD} + 0.3$ V |
| Reference Input Voltage to GND | -0.3 V to $AV_{DD} + 0.3$ V |
| Digital Input Voltage to GND | -0.3 V to $AV_{DD} + 0.3$ V |
| Digital Output Voltage to GND | -0.3 V to $AV_{DD} + 0.3$ V |
| AIN/Digital Input Current | 10 mA |
| Operating Temperature Range | -40°C to $+105^\circ\text{C}$ |
| Storage Temperature Range | -65°C to $+150^\circ\text{C}$ |
| Maximum Junction Temperature | 150°C |
| TSSOP | |
| θ_{JA} Thermal Impedance | 128°C/W |
| θ_{JC} Thermal Impedance | 14°C/W |
| Lead Temperature, Soldering | |
| Vapor Phase (60 sec) | 215°C |
| InfraRed (15 sec) | 220°C |

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

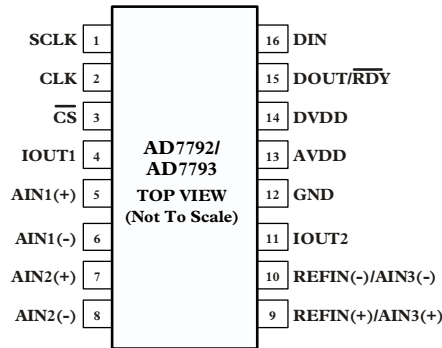


Figure 5. Pin Configuration

Table 4. Pin Function Descriptions

| Pin No. | Mnemonic | Function |
|---------|------------------|--|
| 1 | SCLK | Serial Clock Input for Data Transfers to and from the ADC. The SCLK has a Schmitt-triggered input, making the interface suitable for opto-isolated applications. The serial clock can be continuous with all data transmitted in a continuous train of pulses. Alternatively, it can be a noncontinuous clock with the information being transmitted to or from the ADC in smaller batches of data. |
| 2 | CLK | Clock In/Clock Out. The internal clock can be made available at this pin. Alternatively, the internal clock can be disabled and the ADC can be driven by an external clock. This allows several ADCs to be driven from a common clock, allowing simultaneous conversions to be performed. |
| 3 | \overline{CS} | Chip Select Input. This is an active low logic input used to select the ADC. \overline{CS} can be used to select the ADC in systems with more than one device on the serial bus or as a frame synchronization signal in communicating with the device. \overline{CS} can be hardwired low, allowing the ADC to operate in 3-wire mode with SCLK, DIN, and DOUT used to interface with the device. |
| 4 | IOUT1 | Output of Internal Excitation Current Source. The internal excitation current source can be made available at this pin. The excitation current source is programmable so that the current can be 10 μ A, 200 μ A or 1 mA. Either IEXC1 or IEXC2 can be switched to this output. |
| 5 | AIN1(+) | Analog Input. AIN1(+) is the positive terminal of the differential analog input pair AIN1(+)/AIN1(-). |
| 6 | AIN1(-) | Analog Input. AIN1(-) is the negative terminal of the differential analog input pair AIN1(+)/AIN1(-). |
| 7 | AIN2(+) | Analog Input. AIN2(+) is the positive terminal of the differential analog input pair AIN2(+)/AIN2(-). |
| 8 | AIN2(-) | Analog Input. AIN2(-) is the negative terminal of the differential analog input pair AIN2(+)/AIN2(-). |
| 9 | REFIN(+)/AIN3(+) | Positive Reference Input/Analog Input. An external reference can be applied between REFIN(+) and REFIN(-). REFIN(+) can lie anywhere between AV_{DD} and $GND + 0.1 V$. The nominal reference voltage (REFIN(+) – REFIN(-)) is 2.5 V, but the part functions with a reference from 0.1 V to AV_{DD} . Alternatively, this pin can function as AIN3(+) where AIN3(+) is the positive terminal of the differential analog input pair AIN3(+)/AIN3(-). |
| 10 | REFIN(-)/AIN3(-) | Negative Reference Input/Analog Input. REFIN(-) is the negative reference input for REFIN. This reference input can lie anywhere between GND and $AV_{DD} - 0.1 V$. This pin also functions as AIN3(-) which is the negative terminal of the differential analog input pair AIN3(+)/AIN3(-). |
| 11 | IOUT2 | Output of Internal Excitation Current Source. The internal excitation current source can be made available at this pin. The excitation current source is programmable so that the current can be 10 μ A, 200 μ A or 1 mA. Either IEXC1 or IEXC2 can be switched to this output. |
| 12 | GND | Ground Reference Point. |
| 13 | AV_{DD} | Supply Voltage, 2.7 V to 5.25 V. |
| 14 | DV_{DD} | Digital Interface Supply Voltage. The logic levels for the serial interface pins are related to this supply, which is between 2.7 V and 5.25 V. The DV_{DD} voltage is independent of the voltage on AV_{DD} so, AV_{DD} can equal 3V with |

| Pin No. | Mnemonic | Function |
|---------|------------------------|--|
| | | D V_{DD} at 5V or vice versa. |
| 15 | DOUT/ \overline{RDY} | <p>Serial Data Output/Data Ready Output. DOUT/\overline{RDY} serves a dual purpose . It functions as a serial data output pin to access the output shift register of the ADC. The output shift register can contain data from any of the on-chip data or control registers. In addition, DOUT/\overline{RDY} operates as a data ready pin, going low to indicate the completion of a conversion. If the data is not read after the conversion, the pin will go high before the next update occurs.</p> <p>The DOUT/\overline{RDY} falling edge can be used as an interrupt to a processor, indicating that valid data is available. With an external serial clock, the data can be read using the DOUT/\overline{RDY} pin. With \overline{CS} low, the data/control word information is placed on the DOUT/\overline{RDY} pin on the SCLK falling edge and is valid on the SCLK rising edge.</p> <p>The end of a conversion is also indicated by the \overline{RDY} bit in the status register. When \overline{CS} is high, the DOUT/\overline{RDY} pin is three-stated but the \overline{RDY} bit remains active.</p> |
| 16 | DIN | Serial Data Input to the Input Shift Register on the ADC. Data in this shift register is transferred to the control registers within the ADC, the register selection bits of the communications register identifying the appropriate register. |

TYPICAL PERFORMANCE CHARACTERISTICS

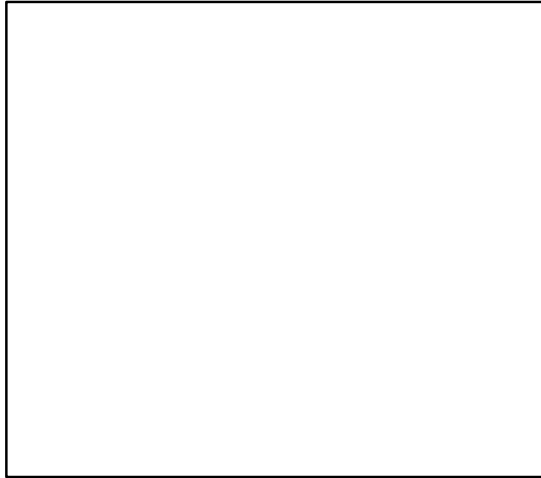


Figure 6.

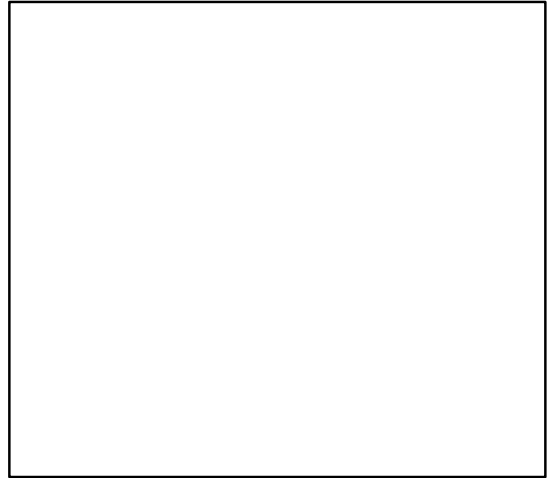


Figure 9.

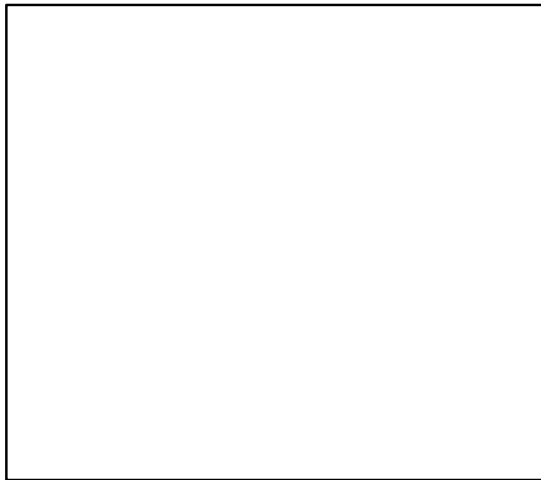


Figure 7.

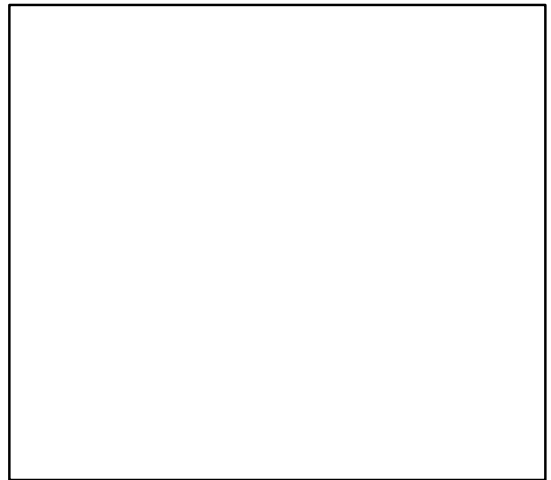


Figure 10.



Figure 8.



Figure 11.

ON-CHIP REGISTERS

The ADC is controlled and configured via a number of on-chip registers, which are described on the following pages. In the following descriptions, *set* implies a Logic 1 state and *cleared* implies a Logic 0 state, unless otherwise stated.

COMMUNICATIONS REGISTER (RS2, RS1, RS0 = 0, 0, 0)

The communications register is an 8-bit write-only register. All communications to the part must start with a write operation to the communications register. The data written to the communications register determines whether the next operation is a read or write operation, and to which register this operation takes place. For read or write operations, once the subsequent read or write operation to the selected register is complete, the interface returns to where it expects a write operation to the communications register. This is the default state of the interface and, on power-up or after a reset, the ADC is in this default state waiting for a write operation to the communications register. In situations where the interface sequence is lost, a write operation of at least 32 serial clock cycles with DIN high returns the ADC to this default state by resetting the entire part. Table 5 outlines the bit designations for the communications register. CR0 through CR7 indicate the bit location, CR denoting the bits are in the communications register. CR7 denotes the first bit of the data stream. The number in brackets indicates the power-on/reset default status of that bit.

| CR7 | CR6 | CR5 | CR4 | CR3 | CR2 | CR1 | CR0 |
|--------|--------|--------|--------|--------|----------|------|------|
| WEN(0) | R/W(0) | RS2(0) | RS1(0) | RS0(0) | CREAD(0) | 0(0) | 0(0) |

Table 5. Communications Register Bit Designations

| Bit Location | Bit Name | Description |
|--------------|----------|--|
| CR7 | WEN | Write Enable Bit. A 0 must be written to this bit so that the write to the communications register actually occurs. If a 1 is the first bit written, the part will not clock on to subsequent bits in the register. It will stay at this bit location until a 0 is written to this bit. Once a 0 is written to the WEN bit, the next seven bits will be loaded to the communications register. |
| CR6 | R/W | A 0 in this bit location indicates that the next operation will be a write to a specified register. A 1 in this position indicates that the next operation will be a read from the designated register. |
| CR5–CR3 | RS2–RS0 | Register Address Bits. These address bits are used to select which of the ADC's registers are being selected during this serial interface communication. See Table 6. |
| CR2 | CREAD | Continuous Read of the Data Register. When this bit is set to 1 (and the data register is selected), the serial interface is configured so that the data register can be continuously read, i.e., the contents of the data register are placed on the DOUT pin automatically when the SCLK pulses are applied. The communications register does not have to be written to for data reads. To enable continuous read mode, the instruction 01011100 must be written to the communications register. To exit the continuous read mode, the instruction 01011000 must be written to the communications register while the RDY pin is low. While in continuous read mode, the ADC monitors activity on the DIN line so that it can receive the instruction to exit continuous read mode. Additionally, a reset will occur if 32 consecutive 1s are seen on DIN. Therefore, DIN should be held low in continuous read mode until an instruction is to be written to the device. |
| CR1–CR0 | 0 | These bits must be programmed to logic 0 for correct operation. |

Table 6. Register Selection

| RS2 | RS1 | RS0 | Register | Register Size |
|-----|-----|-----|--|---------------------------------|
| 0 | 0 | 0 | Communications Register during a Write Operation | 8-Bit |
| 0 | 0 | 0 | Status Register during a Read Operation | 8-Bit |
| 0 | 0 | 1 | Mode Register | 16-Bit |
| 0 | 1 | 0 | Configuration Register | 16-Bit |
| 0 | 1 | 1 | Data Register | 16 / 24-Bit |
| 1 | 0 | 0 | ID Register | 8-Bit |
| 1 | 0 | 1 | IO Register | 8-Bit |
| 1 | 1 | 0 | Offset Register | 16-Bit (AD7792)/24-Bit (AD7793) |
| 1 | 1 | 1 | Full-Scale Register | 16-Bit (AD7792)/24-Bit (AD7793) |

STATUS REGISTER (RS2, RS1, RS0 = 0, 0, 0; POWER-ON/RESET = 0x80 (AD7792) / 0x88 (AD7793))

The status register is an 8-bit read-only register. To access the ADC status register, the user must write to the communications register, select the next operation to be a read, and load bits RS2, RS1 and RS0 with 0. Table 7 outlines the bit designations for the status register. SR0 through SR7 indicate the bit locations, SR denoting the bits are in the status register. SR7 denotes the first bit of the data stream. The number in brackets indicates the power-on/reset default status of that bit.

| SR7 | SR6 | SR5 | SR4 | SR3 | SR2 | SR1 | SR0 |
|--------|--------|------|------|-----|--------|--------|--------|
| RDY(1) | ERR(0) | 0(0) | 0(0) | 0/1 | CH2(0) | CH1(0) | CH0(0) |

Table 7. Status Register Bit Designations

| Bit Location | Bit Name | Description |
|--------------|----------|---|
| SR7 | RDY | Ready bit for ADC. <i>Cleared</i> when data is written to the ADC data register. The RDY bit is <i>set</i> automatically after the ADC data register has been read or a period of time before the data register is updated with a new conversion result to indicate to the user not to read the conversion data. It is <i>also set</i> when the part is placed in power-down mode. The end of a conversion is indicated by the DOUT/RDY pin also. This pin can be used as an alternative to the status register for monitoring the ADC for conversion data. |
| SR6 | ERR | ADC Error Bit. This bit is written to at the same time as the RDY bit. <i>Set</i> to indicate that the result written to the ADC data register has been clamped to all 0s or all 1s. Error sources include overrange, underrange. <i>Cleared</i> by a write operation to start a conversion. |
| SR5-SR4 | 0 | These bits are automatically <i>cleared</i> . |
| SR3 | 0/1 | This bit is automatically <i>cleared</i> on the AD7792 and is automatically <i>set</i> on the AD7793. |
| SR2-SR0 | CH2-CH0 | These bits indicate which channel is being converted by the ADC. |

MODE REGISTER (RS2, RS1, RS0 = 0, 0, 1; POWER-ON/RESET = 0x000A)

The mode register is a 16-bit register from which data can be read or to which data can be written. This register is used to select the operating mode, update rate and clock source. Table 8 outlines the bit designations for the mode register. MR0 through MR15 indicate the bit locations, MR denoting the bits are in the mode register. MR15 denotes the first bit of the data stream. The number in brackets indicates the power-on/reset default status of that bit. Any write to the setup register resets the modulator and filter and sets the RDY bit.

| MR15 | MR14 | MR13 | MR12 | MR11 | MR10 | MR9 | MR8 |
|---------|---------|--------|------|--------|--------|--------|--------|
| MD2(0) | MD1(0) | MD0(0) | 0(0) | 0(0) | 0(0) | 0(0) | 0(0) |
| MR7 | MR6 | MR5 | MR4 | MR3 | MR2 | MR1 | MR0 |
| CLK1(0) | CLK0(0) | 0(0) | 0(0) | FS3(1) | FS2(0) | FS1(1) | FS0(0) |

Table 8. Mode Register Bit Designations

| Bit Location | Bit Name | Description |
|--|-----------|---|
| MR15-MR13 | MD2-MD0 | Mode Select Bits. These bits select the operational mode of the AD7792/AD7793 (See Table 9). |
| MR12-MR8 | 0 | These bits must be programmed with a Logic 0 for correct operation. |
| MR7-MR6 | CLK1-CLK0 | These bits are used to select the clock source for the AD7792/AD7793. Either on on-chip 64 kHz clock can be used or an external clock can be used. The ability to override use an external clock is useful as it allows several AD7792/AD7793 devices to be synchronised. Also, 50 Hz/60 Hz is improved when an accurate external clock drives the AD7792/AD7793. |
| | | CLK1 CLK0 ADC Clock Source |
| | | 0 0 Internal 64 kHz Clock, Internal Clock is not available at the CLK pin |
| | | 0 1 Internal 64 kHz Clock. This clock is made available at the CLK pin |
| | | 1 0 External 64 kHz Clock used. An External clock gives better 50 Hz/60 Hz rejection. The external clock can have a 45:55 duty cycle. |
| 1 1 External Clock used. This external clock is divided by 2 within the AD7792/AD7793. This allows the user to supply a clock which has a duty cycle worse than a 45:55 duty cycle to the AD7792/AD7793, for example, a 128 kHz clock. | | |
| MR5-MR4 | 0 | These bits must be programmed with a Logic 0 for correct operation. |

| Bit Location | Bit Name | Description |
|--------------|----------|--|
| MR3-MR0 | FS3-FS0 | Filter Update Rate Select Bits (see Table 10). |

Table 9. Operating Modes

| MD2 | MD1 | MD0 | Mode |
|-----|-----|-----|--|
| 0 | 0 | 0 | <p>Continuous Conversion Mode (Default).</p> <p>In continuous conversion mode, the ADC continuously performs conversions and places the result in the data register. RDY goes low when a conversion is complete. The user can read these conversions by placing the device in continuous read mode whereby the conversions are automatically placed on the DOUT line when SCLK pulses are applied. Alternatively, the user can instruct the ADC to output the conversion by writing to the communications register. After power-on, a channel change or a write to the Mode, Configuration or IO Registers, the first conversion is available after a period $2/f_{ADC}$ while subsequent conversions are available at a frequency of f_{ADC}.</p> |
| 0 | 0 | 1 | <p>Single Conversion Mode.</p> <p>In single conversion mode, the ADC is placed in power-down mode when conversions are not being performed. When single conversion mode is selected, the ADC powers up and performs a single conversion, which occurs after a period $2/f_{ADC}$. The conversion result is placed in the data register, RDY goes low, and the ADC returns to power-down mode. The conversion remains in the data register and RDY remains active (low) until the data is read or another conversion is performed.</p> |
| 0 | 1 | 0 | <p>Idle Mode.</p> <p>In Idle Mode, the ADC Filter and Modulator are held in a reset state although the modulator clocks are still provided</p> |
| 0 | 1 | 1 | <p>Power-Down Mode.</p> <p>In power down mode, all the AD7792/AD7793 circuitry is powered down including the current sources, burnout currents, bias voltage generator and CLKOUT circuitry.</p> |
| 1 | 0 | 0 | <p>Internal Zero-Scale Calibration.</p> <p>An internal short is automatically connected to the enabled channel. A calibration takes 2 conversion cycles to complete. RDY goes high when the calibration is initiated and returns low when the calibration is complete. The ADC is placed in idle mode following a calibration. The measured offset coefficient is placed in the offset register of the selected channel.</p> |
| 1 | 0 | 1 | <p>Internal Full-Scale Calibration.</p> <p>The fullscale input voltage is automatically connected to the selected analog input for this calibration. The full-scale error of the AD7792/AD7793 is calibrated at a gain of 1 using the internal reference in the factory. When a channel is operated with a gain of 1 and the internal reference is selected, this factory-calibrated value is loaded into the full-scale register when a full-scale calibration is initiated. When the gain equals 1 and the external reference is selected, a calibration takes 2 conversion cycles to complete. Internal full-scale calibrations cannot be performed when the gain equals 128. With this gain setting, a system full-scale calibration can be performed. For other gains, 4 conversion cycles are required to perform the fullscale calibration. RDY goes high when the calibration is initiated and returns low when the calibration is complete. The ADC is placed in idle mode following a calibration. The measured fullscale coefficient is placed in the fullscale register of the selected channel. A fullscale calibration is required each time the gain of a channel is changed.</p> |
| 1 | 1 | 0 | <p>System Offset Calibration.</p> <p>User should connect the system zero-scale input to the .channel input pins as selected by the CH2-CH0 bits. A system offset calibration takes 2 conversion cycles to complete. RDY goes high when the calibration is initiated and returns low when the calibration is complete. The ADC is placed in idle mode following a calibration. The measured offset coefficient is placed in the offset register of the selected channel.</p> |
| 1 | 1 | 1 | <p>System Full-Scale Calibration.</p> <p>User should connect the system full-scale input to the .channel input pins as selected by the CH2-CH0 bits. A calibration takes 2 conversion cycles to complete.. RDY goes high when the calibration is initiated and returns low when the calibration is complete. The ADC is placed in idle mode following a calibration. The measured fullscale coefficient is placed in the fullscale register of the selected channel. A fullscale calibration is required each time the gain of a channel is changed.</p> |

Table 10. Update Rates Available

| FS3 | FS2 | FS1 | FS0 | f _{ADC} (Hz) | T _{settle} (ms) | Rejection@ 50 Hz / 60 Hz (Internal Clock) |
|----------|----------|----------|----------|-----------------------|--------------------------|---|
| 0 | 0 | 0 | 0 | x | x | |
| 0 | 0 | 0 | 1 | 500 | 5 | |
| 0 | 0 | 1 | 0 | 250 | 8 | |
| 0 | 0 | 1 | 1 | 125 | 16 | |
| 0 | 1 | 0 | 0 | 62.5 | 32 | |
| 0 | 1 | 0 | 1 | 50 | 40 | |
| 0 | 1 | 1 | 0 | 41.6 | 48 | |
| 0 | 1 | 1 | 1 | 33.3 | 60 | |
| 1 | 0 | 0 | 0 | 19.6 | 101 | 90 dB (60 Hz only) |
| 1 | 0 | 0 | 1 | 16.6 | 120 | 84 dB (50 Hz only) |
| 1 | 0 | 1 | 0 | 16.6 | 120 | 70 dB (50 Hz and 60 Hz) |
| 1 | 0 | 1 | 1 | 12.5 | 160 | 67 dB (50 Hz and 60 Hz) |
| 1 | 1 | 0 | 0 | 10 | 200 | 69 dB (50 Hz and 60 Hz) |
| 1 | 1 | 0 | 1 | 8.33 | 240 | 73 dB (50 Hz and 60 Hz) |
| 1 | 1 | 1 | 0 | 6.25 | 320 | 74 dB (50 Hz and 60 Hz) |
| 1 | 1 | 1 | 1 | 4.17 | 480 | 79 dB (50 Hz and 60 Hz) |

CONFIGURATION REGISTER (RS2, RS1, RS0 = 0, 1, 0; POWER-ON/RESET = 0x0710)

The configuration register is a 16-bit register from which data can be read or to which data can be written. This register is used to configure the ADC for unipolar or bipolar mode, enable or disable the buffer, enable or disable the burnout currents, select the gain and select the analog input channel. Table 11 outlines the bit designations for the filter register. CON0 through CON15 indicate the bit locations, CON denoting the bits are in the configuration register. CON15 denotes the first bit of the data stream. The number in brackets indicates the power-on/reset default status of that bit.

| CON15 | CON14 | CON13 | CON12 | CON11 | CON10 | CON9 | CON8 |
|-----------|-----------|-------|------------------|-------|--------|--------|--------|
| VBIAS1(0) | VBIAS0(0) | BO(0) | U/ \bar{B} (0) | 0(0) | G2(1) | G1(1) | G0(1) |
| CON7 | CON6 | CON5 | CON4 | CON3 | CON2 | CON1 | CON0 |
| REFSEL(0) | 0(0) | 0(0) | BUF(1) | 0(0) | CH2(0) | CH1(0) | CH0(0) |

Table 11. Configuration Register Bit Designations

| Bit Location | Bit Name | Description | | | | | | | | | | | | | | | |
|--------------|---------------|---|--------|--------|--------------|---|---|---------------------------------|---|---|-----------------------------------|---|---|-----------------------------------|---|---|----------|
| CON15–CON14 | VBIAS1-VBIAS0 | Bias Voltage Enable. The bias voltage generator applies a bias voltage of VDD/2 to the selected negative analog input terminals. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>VBIAS1</th> <th>VBIAS0</th> <th>Bias Voltage</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Bias Voltage Generator Disabled</td> </tr> <tr> <td>0</td> <td>1</td> <td>Bias Voltage connected to AIN1(-)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Bias Voltage connected to AIN2(-)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Reserved</td> </tr> </tbody> </table> | VBIAS1 | VBIAS0 | Bias Voltage | 0 | 0 | Bias Voltage Generator Disabled | 0 | 1 | Bias Voltage connected to AIN1(-) | 1 | 0 | Bias Voltage connected to AIN2(-) | 1 | 1 | Reserved |
| VBIAS1 | VBIAS0 | Bias Voltage | | | | | | | | | | | | | | | |
| 0 | 0 | Bias Voltage Generator Disabled | | | | | | | | | | | | | | | |
| 0 | 1 | Bias Voltage connected to AIN1(-) | | | | | | | | | | | | | | | |
| 1 | 0 | Bias Voltage connected to AIN2(-) | | | | | | | | | | | | | | | |
| 1 | 1 | Reserved | | | | | | | | | | | | | | | |
| CON13 | BO | Burnout Current Enable Bit. When this bit is set to 1 by the user, the 100 nA current sources in the signal path are enabled. When BO = 0, the burnout currents are disabled. The burnout currents can be enabled only when the buffer or In-Amp is active. | | | | | | | | | | | | | | | |
| CON12 | U/ \bar{B} | Unipolar/Bipolar Bit. Set by user to enable unipolar coding, i.e., zero differential input will result in 0x000000 output and a full-scale differential input will result in 0xFFFF output. Cleared by the user to enable bipolar coding. Negative full-scale differential input will result in an output code of 0x000000, zero differential input will result in an output code of 0x800000, and a positive full-scale differential input will result in an output code of 0xFFFF. | | | | | | | | | | | | | | | |
| CON11 | 0 | This bit must be programmed with a Logic 0 for correct operation. | | | | | | | | | | | | | | | |
| CON10–CON8 | G2–G0 | Gain Select Bits. | | | | | | | | | | | | | | | |

| Bit Location | Bit Name | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|--|---|---------------------|---|-----|---------|----------------------------------|---|---|---|---------------------|-------|---|---|---|---------------------|--------|---|---|---|-------------------|--------|---|---|---|-------------------|----------|---|---|---|----------|----------|---|---|---|----------|-----------|---|---|---|-------------|---|---|---|---|-------------|---|--------|------------------|---|--|---|-----------------------------|
| CON7 | REFSEL | <p>Written by the user to select the ADC input range as follows</p> <table border="1"> <thead> <tr> <th>G2</th> <th>G1</th> <th>G0</th> <th>Gain</th> <th>ADC Input Range (2.5V Reference)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1 (In-Amp not used)</td> <td>2.5 V</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>2 (In-Amp not used)</td> <td>1.25 V</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>4</td> <td>625 mV</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>8</td> <td>312.5 mV</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>16</td> <td>156.2 mV</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>32</td> <td>78.125 mV</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>64</td> <td>39.06 mV</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>128</td> <td>19.53 mV</td> </tr> </tbody> </table> <p>Reference Select Bit. The reference source for the ADC is selected using this bit.</p> <table border="1"> <thead> <tr> <th>REFSEL</th> <th>Reference Source</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>External Reference applied between REFIN(+) and REFIN(-)</td> </tr> <tr> <td>1</td> <td>Internal Reference Selected</td> </tr> </tbody> </table> | G2 | G1 | G0 | Gain | ADC Input Range (2.5V Reference) | 0 | 0 | 0 | 1 (In-Amp not used) | 2.5 V | 0 | 0 | 1 | 2 (In-Amp not used) | 1.25 V | 0 | 1 | 0 | 4 | 625 mV | 0 | 1 | 1 | 8 | 312.5 mV | 1 | 0 | 0 | 16 | 156.2 mV | 1 | 0 | 1 | 32 | 78.125 mV | 1 | 1 | 0 | 64 | 39.06 mV | 1 | 1 | 1 | 128 | 19.53 mV | REFSEL | Reference Source | 0 | External Reference applied between REFIN(+) and REFIN(-) | 1 | Internal Reference Selected |
| G2 | G1 | G0 | Gain | ADC Input Range (2.5V Reference) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 1 (In-Amp not used) | 2.5 V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 2 (In-Amp not used) | 1.25 V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | 4 | 625 mV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | 8 | 312.5 mV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 16 | 156.2 mV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | 32 | 78.125 mV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | 64 | 39.06 mV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 128 | 19.53 mV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REFSEL | Reference Source | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | External Reference applied between REFIN(+) and REFIN(-) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Internal Reference Selected | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CON6 - CON5 CON4 | 0 BUF | <p>These bits must be programmed with a Logic 0 for correct operation.</p> <p>Configures the ADC for buffered or unbuffered mode of operation. If <i>cleared</i>, the ADC operates in unbuffered mode, lowering the power consumption of the device. If <i>set</i>, the ADC operates in buffered mode, allowing the user to place source impedances on the front end without contributing gain errors to the system.</p> <p>The buffer can be disabled when the gain equals 1 or 2. For higher gains, the buffer is automatically enabled.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CON3 CON2-CON0 | 0 CH2-CH0 | <p>This bit must be programmed with a Logic 0 for correct operation.</p> <p>Channel Select bits.</p> <p>Written by the user to select the active analog input channel to the ADC.</p> <table border="1"> <thead> <tr> <th>CH2</th> <th>CH1</th> <th>CH0</th> <th>Channel</th> <th>Calibration Pair</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>AIN1(+) – AIN1(-)</td> <td>0</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>AIN2(+) – AIN2(-)</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>AIN3(+) – AIN3(-)</td> <td>2</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>AIN1(-) – AIN1(-)</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Reserved</td> <td></td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Reserved</td> <td></td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Temp Sensor</td> <td>Automatically Selects Gain = 1 and Internal Reference</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>VDD Monitor</td> <td>Automatically Selects Gain = 1/6 and 1.17 V Reference</td> </tr> </tbody> </table> | CH2 | CH1 | CH0 | Channel | Calibration Pair | 0 | 0 | 0 | AIN1(+) – AIN1(-) | 0 | 0 | 0 | 1 | AIN2(+) – AIN2(-) | 1 | 0 | 1 | 0 | AIN3(+) – AIN3(-) | 2 | 0 | 1 | 1 | AIN1(-) – AIN1(-) | 0 | 1 | 0 | 0 | Reserved | | 1 | 0 | 1 | Reserved | | 1 | 1 | 0 | Temp Sensor | Automatically Selects Gain = 1 and Internal Reference | 1 | 1 | 1 | VDD Monitor | Automatically Selects Gain = 1/6 and 1.17 V Reference | | | | | | |
| CH2 | CH1 | CH0 | Channel | Calibration Pair | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | AIN1(+) – AIN1(-) | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | AIN2(+) – AIN2(-) | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | AIN3(+) – AIN3(-) | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | AIN1(-) – AIN1(-) | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | Temp Sensor | Automatically Selects Gain = 1 and Internal Reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | VDD Monitor | Automatically Selects Gain = 1/6 and 1.17 V Reference | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

DATA REGISTER (RS2, RS1, RS0 = 0, 1, 1; POWER-ON/RESET = 0x0000(00))

The conversion result from the ADC is stored in this data register. This is a read-only register. On completion of a read operation from this register, the RDY bit/pin is set.

ID REGISTER (RS2, RS1, RS0 = 1, 0, 0; POWER-ON/RESET = 0xXA (AD7792) / 0xB (AD7793))

The Identification Number for the AD7792/AD7793 is stored in the ID register. This is a read-only register.

IO REGISTER (RS2, RS1, RS0 = 1, 0, 1; POWER-ON/RESET = 0x00)

The I/O register is an 8-bit register from which data can be read or to which data can be written. This register is used to enable the excitation currents and select the value of the excitation currents. Table 12 outlines the bit designations for the IO register. IO0 through IO7 indicate the bit locations, IO denoting the bits are in the IO register. IO7 denotes the first bit of the data stream. The number in brackets indicates the power-on/reset default status of that bit.

| | | | | | | | |
|------------|------------|------------|------------|-------------|-------------|------------|------------|
| IO7 | IO6 | IO5 | IO4 | IO3 | IO2 | IO1 | IO0 |
| 0(0) | 0(0) | 0(0) | 0(0) | IEXCDIR1(0) | IEXCDIR0(0) | IEXCEN1(0) | IEXCEN0(0) |

Table 12 Filter Register Bit Designations

| Bit Location | Bit Name | Description | | | | | | | | | | | | | | | |
|--------------------|----------------------------|--|----------|----------|--------------------------|---|---|--|---|---|--|---|---|--|---|---|--|
| IO7-IO4 IO3-IO2 | 0 IEXCDIR1– IEXCDIR0 | These bits must be programmed with a Logic 0 for correct operation. Direction of Current Sources Select bits. | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>IEXCDIR1</th> <th>IEXCDIR0</th> <th>Current Source Direction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Current Source IEXC1 connected to pin IOUT1, Current Source IEXC2 connected to pin IOUT2</td> </tr> <tr> <td>0</td> <td>1</td> <td>Current Source IEXC1 connected to pin IOUT2, Current Source IEXC2 connected to pin IOUT1</td> </tr> <tr> <td>1</td> <td>0</td> <td>Both Current Sources connected to pin IOUT1. Permitted when the current sources are set to 10 uA or 200 uA only.</td> </tr> <tr> <td>1</td> <td>1</td> <td>Both Current Sources connected to pin IOUT2. Permitted when the current sources are set to 10 uA or 200 uA only.</td> </tr> </tbody> </table> | IEXCDIR1 | IEXCDIR0 | Current Source Direction | 0 | 0 | Current Source IEXC1 connected to pin IOUT1, Current Source IEXC2 connected to pin IOUT2 | 0 | 1 | Current Source IEXC1 connected to pin IOUT2, Current Source IEXC2 connected to pin IOUT1 | 1 | 0 | Both Current Sources connected to pin IOUT1. Permitted when the current sources are set to 10 uA or 200 uA only. | 1 | 1 | Both Current Sources connected to pin IOUT2. Permitted when the current sources are set to 10 uA or 200 uA only. |
| IEXCDIR1 | IEXCDIR0 | Current Source Direction | | | | | | | | | | | | | | | |
| 0 | 0 | Current Source IEXC1 connected to pin IOUT1, Current Source IEXC2 connected to pin IOUT2 | | | | | | | | | | | | | | | |
| 0 | 1 | Current Source IEXC1 connected to pin IOUT2, Current Source IEXC2 connected to pin IOUT1 | | | | | | | | | | | | | | | |
| 1 | 0 | Both Current Sources connected to pin IOUT1. Permitted when the current sources are set to 10 uA or 200 uA only. | | | | | | | | | | | | | | | |
| 1 | 1 | Both Current Sources connected to pin IOUT2. Permitted when the current sources are set to 10 uA or 200 uA only. | | | | | | | | | | | | | | | |
| IO1-IO0 | IEXCEN1– IEXCEN0 | Direction of Current Sources Select bits. | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>IEXCEN1</th> <th>IEXCEN0</th> <th>Current Source Value</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Excitation Currents Disabled</td> </tr> <tr> <td>0</td> <td>1</td> <td>10 uA</td> </tr> <tr> <td>1</td> <td>0</td> <td>200 uA</td> </tr> <tr> <td>1</td> <td>1</td> <td>1 mA</td> </tr> </tbody> </table> | IEXCEN1 | IEXCEN0 | Current Source Value | 0 | 0 | Excitation Currents Disabled | 0 | 1 | 10 uA | 1 | 0 | 200 uA | 1 | 1 | 1 mA |
| IEXCEN1 | IEXCEN0 | Current Source Value | | | | | | | | | | | | | | | |
| 0 | 0 | Excitation Currents Disabled | | | | | | | | | | | | | | | |
| 0 | 1 | 10 uA | | | | | | | | | | | | | | | |
| 1 | 0 | 200 uA | | | | | | | | | | | | | | | |
| 1 | 1 | 1 mA | | | | | | | | | | | | | | | |

OFFSET REGISTER (RS2, RS1, RS0 = 1, 1, 0; POWER-ON/RESET = 0x8000(AD7792)/ 0x800000(AD7793))

Each analog input channel has a dedicated offset register that holds the offset calibration coefficient for the channel. This register is 16 bits wide on the AD7792 and 24 bits wide on the AD7793 and, its power-on/reset value is 8000(00) hex. The offset register is used in conjunction with its associated full-scale register to form a register pair. The power-on-reset value is automatically overwritten if an internal or system zero-scale calibration is initiated by the user. The offset register is a read/write register. However, the AD7792/AD7793 must be in idle mode or power down mode when writing to the offset register.

FULL-SCALE REGISTER (RS2, RS1, RS0 = 1, 1, 1; POWER-ON/RESET = 0x5XX5(AD7792)/ 0x5XXXX5(AD7793))

The full-scale registers is a 16-bit register on the AD7792 and a 24-bit register on the AD7793. The full-scale register holds the full-scale calibration coefficient for the ADC. The AD7792/AD7793 has 3 full-scale registers, each channel having a dedicated full-scale register. The full-scale registers are read/write registers, However, when writing to the full-scale registers, the ADC must be placed in power down mode or idle mode. These registers are configured on power-on with factory-calibrated internal full-scale calibration coefficients, the factory calibration being performed with the gain set to 1 and using the internal reference. Therefore, every device will have different default coefficients. These default values are used when the device is operated with a gain of 1 and when the internal reference is selected. For other gains or when the external reference is used at a gain of 1, these default coefficients will be automatically overwritten if an internal or system full-scale calibration is initiated by the user. A full-scale calibration should be performed when the gain is changed.

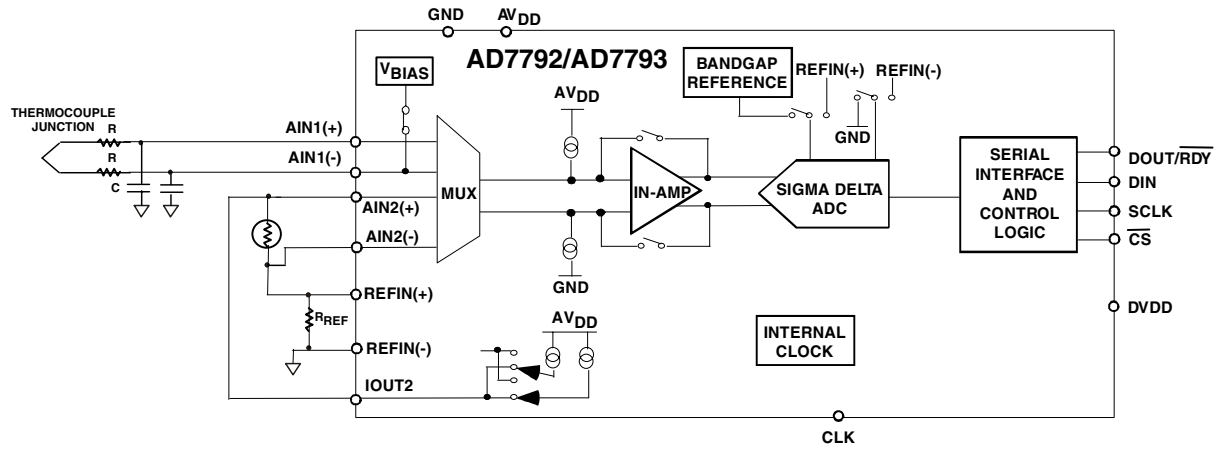


Figure 12. Thermocouple Application using the AD7792/AD7793

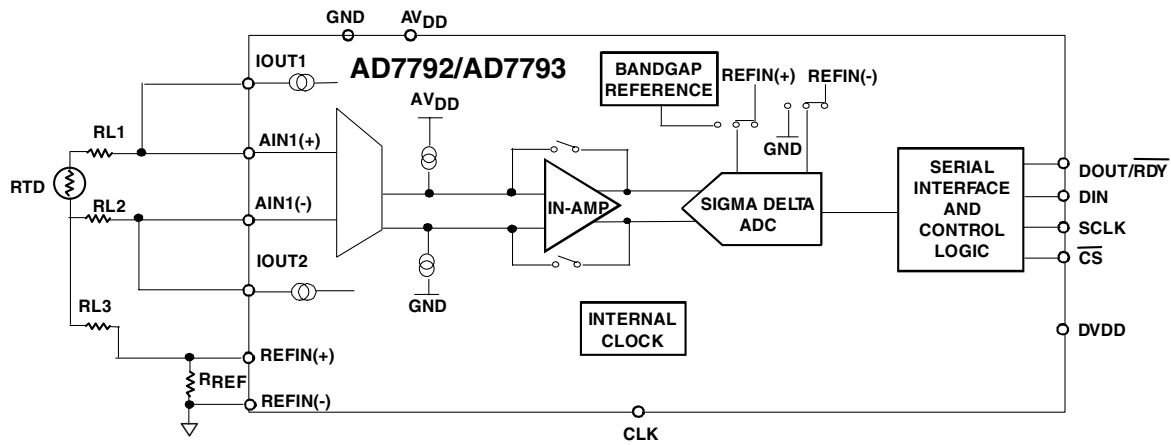


Figure 13. RTD Application using the AD7792/AD7793