

**1.1 Scope.**

This specification covers the detail requirements for a monolithic CMOS 10-bit sampling analog-to-digital converter with parallel (AD7580) and byte (AD7579) output formats.

**1.2 Part Number.**

The complete part number per Table 1 of this specification is as follows:

Device	Part Number
-1	AD7579S(X)/883B
-2	AD7580S(X)/883B

**1.2.3 Case Outline.**

See Appendix 1 of General Specification ADI-M-1000: package outline:

(X)	Package	Description
Q	Q-24	24-Pin Cerdip
E	E-28A	28-Pin LCC

**1.3 Absolute Maximum Ratings.** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

$V_{DD}$ to AGND	-0.3 V to +7 V
$V_{DD}$ to DGND	-0.3 V to +7 V
AGND to DGND	-0.3 V, $V_{DD} + 0.3$ V
$V_{IN(+)}A$ , $V_{IN(+)}B$ to AGND (Figure 6)	-0.3 V, $V_{DD} + 0.3$ V
$V_{IN(-)}A$ , $V_{IN(-)}B$ to AGND (Figure 6)	-0.3 V, $V_{DD} + 0.3$ V
$V_{IN(+)}A$ , to AGND (Figure 7)	-0.6 V, $2 V_{DD} + 0.6$ V
$V_{IN(-)}A$ , AGND (Figure 7)	-0.6 V, $2 V_{DD} + 0.6$ V
$V_{IN(+)}A$ , to AGND (Figure 8)	$-V_{REF} - 0.6$ V, $2 V_{DD} - V_{REF} + 0.6$ V
$V_{IN(-)}A$ , AGND (Figure 8)	$-V_{REF} - 0.6$ V, $2 V_{DD} - V_{REF} + 0.6$ V
Digital Input Voltage to DGND	-0.3 V, $V_{DD} + 0.3$ V
Digital Output Voltage to DGND	-0.3 V, $V_{DD} + 0.3$ V
CLK Input Voltage to DGND	-0.3 V, $V_{DD} + 0.3$ V
$V_{REF}$ to AGND	-0.3 V, $V_{DD}$
Power Dissipation (to $+75^\circ\text{C}$ )	450 mW
Derates above $+75^\circ\text{C}$	6 mW/ $^\circ\text{C}$
Operating Temperature Range	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
Storage Temperature	$-65^\circ\text{C}$ to $+150^\circ\text{C}$
Lead Temperature (Soldering 10 sec)	$+300^\circ\text{C}$

**1.5 Thermal Characteristics.**

Thermal Resistance  $\theta_{JC} = 35^\circ\text{C}/\text{W}$  for Q-24 and E-28A  
 $\theta_{JA} = 120^\circ\text{C}/\text{W}$  for Q-24 and E-28A

# AD7579/AD7580 — SPECIFICATIONS

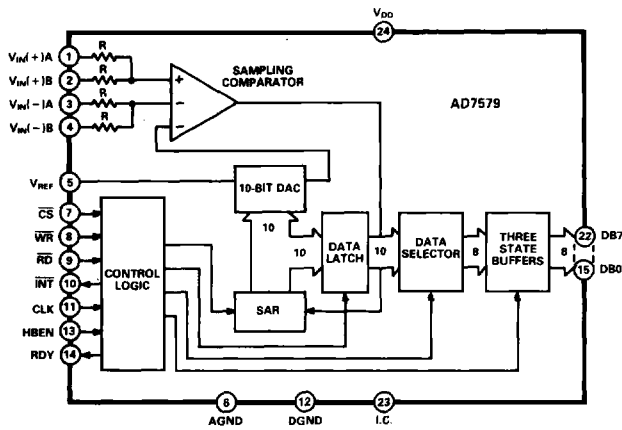
Table 1.

Test	Symbol	Device	Design Limit $T_{min}-T_{max}$	Sub Group 1	Sub Group 2, 3	Sub Group 4	Test Condition <sup>1</sup>	Units
Resolution	RES	-1, 2,	10				Minimum Resolution for Which No Missing Codes Are Guaranteed	Bits
Integral Nonlinearity	INL	-1, 2	1	1	1			±LSB max
Differential Nonlinearity	DNL	-1, 2	0.9	0.9	0.9			±LSB max
Full-Scale Error	FSE	-1, 2	5	5	5			±LSB max
Zero Code Error	ZCE	-1, 2	2	2	2		Figure 6	±LSB max
Power Supply Rejection	PSR	-1, 2	0.5					±LSB max
Zero Code Error	ZCE	-1, 2	3	3	3		Figure 7 or Figure 8	±LSB max
Conversion Time	$t_{CONV}$	-1, 2	16.9	16.9	16.9			µs min
			18.5	18.5	18.5			µs max
Clock Range		-1, 2	250					kHz min
			2.5					MHz max
Signal-to-Noise Ratio	SNR	-1, 2	55	55	55			dB min
Total Harmonic Distortion	THD	-1, 2	-58	-58	-58			dB max
Attenuator Input Resistance		-1, 2	5	5	5			kΩ min
			15	15	15			kΩ max
Comparator Input Resistance		-1, 2	10	10	10		Figure 6	MΩ min
Reference Input Current	$I_{REF}$	-1, 2	1.5	1.5	1.5			mA max
Digital Input Low Voltage	$V_{IL}$	-1, 2	0.8	0.8	0.8			V max
Digital Input High Voltage	$V_{IH}$	-1, 2	2.4	2.4	2.4			V min
Input Current	$I_{IN}$	-1, 2	10	10	10		$V_{IN} = 0 \text{ V or } V_{DD}$	±µA max
Input Capacitance	$C_{IN}$	-1, 2	10					pF max
Digital Output Low Voltage	$V_{OL}$	-1, 2	0.4	0.4	0.4		$I_{SINK} = 1.6 \text{ mA}$	V max
Digital Output High Voltage	$V_{OH}$	-1, 2	4.0	4.0	4.0		$I_{SOURCE} = 400 \text{ µA}$	V min
Floating State Leakage Current	$I_{OUT}$	-1, 2	10	10	10		$V_{OUT} = 0 \text{ to } V_{DD}$	±µA max
Floating State Output Capacitance	$C_{OUT}$	-1, 2	10					pF max
Supply Current from $V_{DD}$	$I_{DD}$	-1, 2	10	10	10			mA max

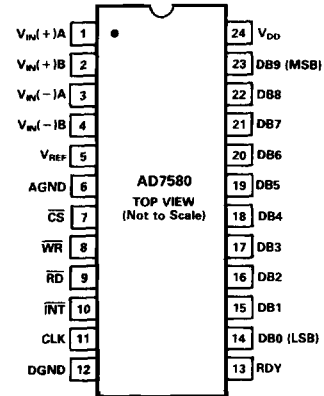
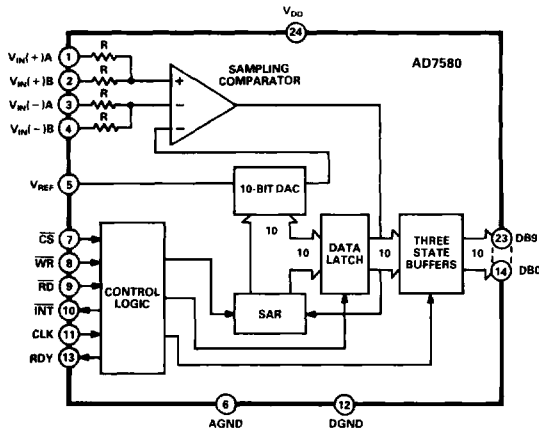
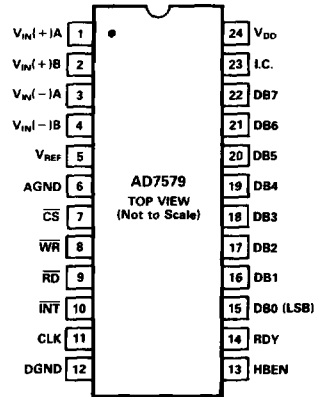
NOTE

<sup>1</sup> $V_{DD} = +5 \text{ V} \pm 5\%$ ,  $V_{REF} = +2.5 \text{ V}$ ,  $AGND = DGND = 0 \text{ V}$ ,  $f_{CLK} = 2.5 \text{ MHz}$ .

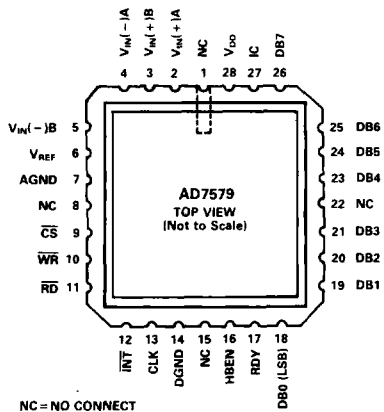
## 3.2.1 Functional Block Diagram and Terminal Assignments.



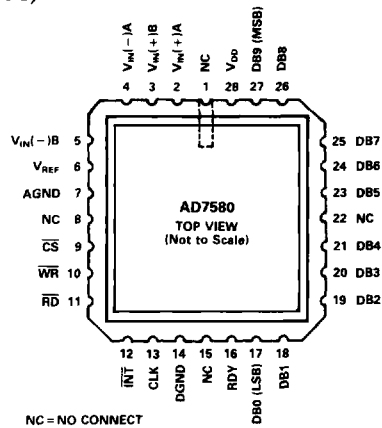
**Q Package (DIP)**



**E Package (LCC)**



NC = NO CONNECT



NC = NO CONNECT

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## 3.2.4 Microcircuit Technology Group.

This microcircuit is covered by Technology Group (81).

## AD7579/AD7580 TIMING<sup>1</sup>

Test	Symbol <sup>2, 3, 4</sup>	Device	Design Limit T <sub>min</sub> to T <sub>max</sub>	Units
CS to WR Setup Time	t <sub>1</sub>	-1, 2	0	ns min
WR Pulse Width	t <sub>2</sub>	-1, 2	50	ns min
CS to WR Hold Time	t <sub>3</sub>	-1, 2	0	ns min
WD to INT Propagation Delay	t <sub>4</sub>	-1, 2	120	ns max
CS to RD Setup Time	t <sub>5</sub>	-1, 2	0	ns min
RD Pulse Width	t <sub>6</sub>	-1, 2	t <sub>12</sub>	ns min
CS to RD Hold Time	t <sub>7</sub>	-1, 2	0	ns min
HBEN to RD Setup Time	t <sub>8</sub>	-1, 2	30	ns min
HBEN to RD Hold Time	t <sub>9</sub>	-1, 2	10	ns min
RDY Access Time	t <sub>10</sub>	-1, 2	150	ns min
RD to INT Propagation Delay	t <sub>11</sub>	-1, 2	120	ns max
Data Access Time After RD	t <sub>12</sub>	-1, 2	150	ns max
Data Hold Time, RDY Hold Time	t <sub>13</sub>	-1, 2	10	ns min
			90	ns max

### NOTES

<sup>1</sup>Timing specifications are sample tested at +25°C to ensure compliance. All input control signals are specified with tr = tf = 20 ns (10% to 90% of +5 V) and timed from a voltage level of 1.6 V.

<sup>2</sup>t<sub>2</sub>, t<sub>10</sub>, t<sub>11</sub> and t<sub>12</sub> are measured with the load circuits of Figures 3 and 5 and are defined as the time required for an output to cross 0.8 V or 2.4 V.

<sup>3</sup>t<sub>13</sub> is defined as the time required for the data lines to change 0.5 V when loaded with the circuits of Figure 4.

<sup>4</sup>INT and RDY are open-drain outputs and need 3 kΩ external pull-up resistors for operation.

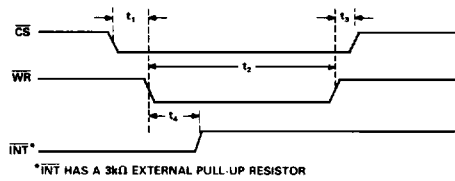


Figure 1. AD7579/AD7580 Start Cycle Timing

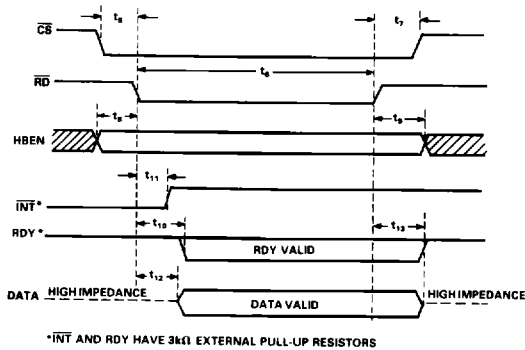


Figure 2. AD7579/AD7580 Read Cycle Timing

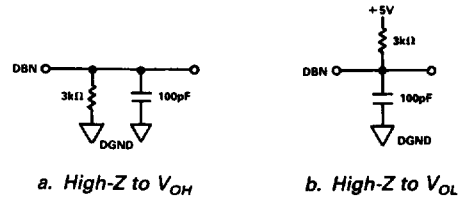


Figure 3. Load Circuits for Access Time Tests (t<sub>12</sub>)

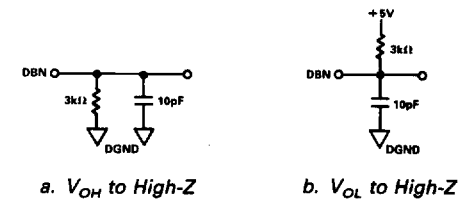


Figure 4. Load Circuits for Output Float Delay (t<sub>13</sub>)

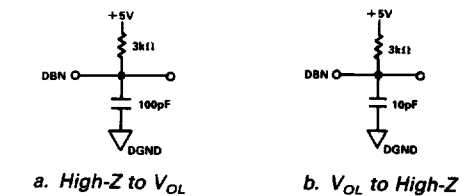


Figure 5. Load Circuits for INT Propagation Delays

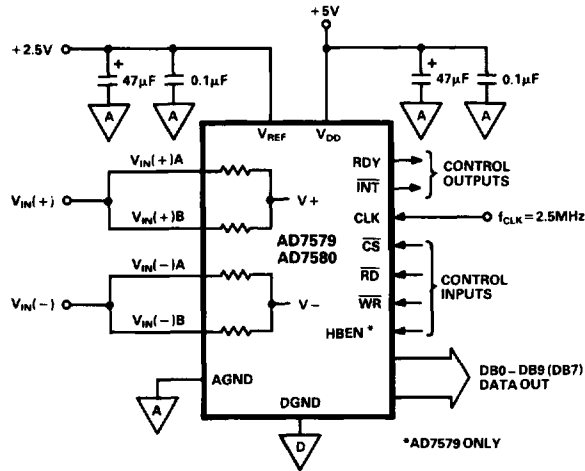
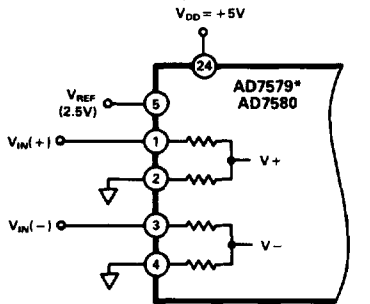


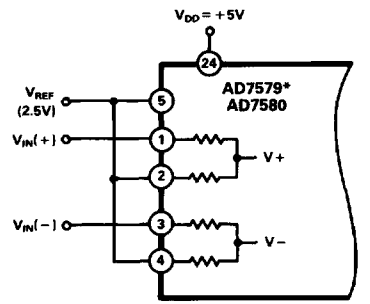
Figure 6. Unipolar 2.5 V Operational Diagram



\*DECOUPLING CIRCUITRY AND CONTROL CIRCUITRY AS IN FIGURE 10

$V_{IN(+)} - V_{IN(-)}$	OUTPUT CODE
0V	00 0000 0000
0.00488V	00 0000 0001
2.500V	10 0000 0000
4.99512V	11 1111 1111

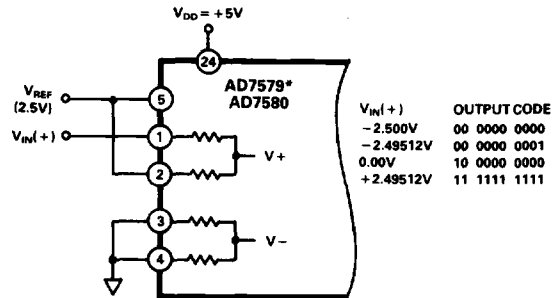
Figure 7. 5 V Span with 0 to 10 V CMR



\*DECOUPLING CIRCUITRY AND CONTROL CIRCUITRY AS IN FIGURE 10

$V_{IN(+)} - V_{IN(-)}$	OUTPUT CODE
0V	00 0000 0000
0.00488V	00 0000 0001
2.500V	10 0000 0000
4.99512V	11 1111 1111

Figure 8. 5 V Span with -2.5 V to +7.5 V CMR



\*DECOUPLING CIRCUITRY AND CONTROL CIRCUITRY AS IN FIGURE 10

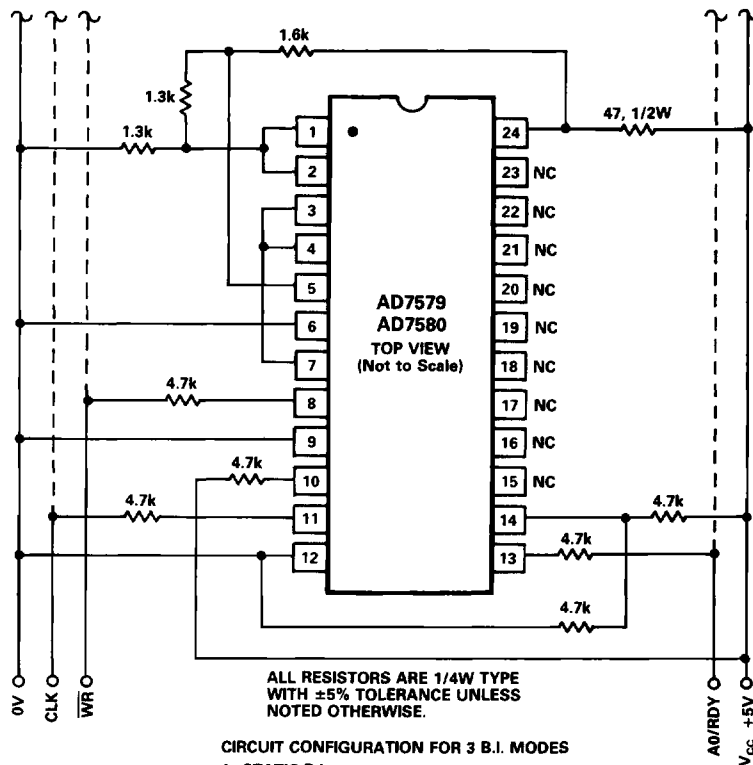
$V_{IN(+)}$	OUTPUT CODE
-2.500V	00 0000 0000
-2.49512V	00 0000 0001
0.00V	10 0000 0000
+2.49512V	11 1111 1111

Figure 9. Single-Ended Bipolar Operation, -2.5V to +2.5 V

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## 4.2.1 Life Test Burn-In Circuit.

Steady state life test is per MIL-STD-883 Method 1005. Burn-in is per MIL-STD-883 Method 1015 test condition (B).



AD7579/AD7580 signals applied to  $V_{CC}$ , CLK  $\overline{WR}$ , A0/RDY.

### 1. Static Burn-In

SEQ	$V_{CC}$	CLK	$\overline{WR}$	A0/RDY
Power-Up	V	0 V	0 V	0 V
Burn-In	5 V	0 V	5 V	0 V

### 2. Static Burn-In with Initialization

SEQ	$V_{CC}$	CLK	$\overline{WR}$	A0/RDY
Power-Up	5 V	0 V	0 V	0 V
Start Conversions	5 V	SQR-Wave FREQ = 20 kHz	0 V	0 V
Min of 16 CLK-Periods		$V_{LO} = 0 V$ $V_{HI} = V_{CC}$		
	5 V	SQR-Wave	$V_{CC}$	0 V
Convert Min of 64 CLK Periods	5 V	SQR-Wave	$V_{CC}$	0 V
Burn-In	5 V	0 V	$V_{CC}$	0 V

### 3. Dynamic Burn-In

SEQ	V <sub>CC</sub>	CLK	WR	A0/RDY
Power-Up	5 V	0 V	0 V	0 VC
Burn-In	5 V	SQR-Wave FREQ = 20 kHz V <sub>LO</sub> = 0 V V <sub>HI</sub> = V <sub>CC</sub>	SQR-Wave FREQ = 20/128 kHz V <sub>LO</sub> = 0 V V <sub>HI</sub> = V <sub>CC</sub>	SQR-Wave FREQ = 20/256 kHz V <sub>LO</sub> = 0 V V <sub>HI</sub> = V <sub>CC</sub>

**NOTES**

WR signal = CLK divided by 128, TRIG on rising edge of CLK.  
A0/RDY signal = CLK divided by 256 TRIG on rising edge of CLK.

### 6.0 Differential Applications.

Figure 10 shows the AD7579/AD7580 connected in the standard unipolar mode. Figure 11 and Table 2 show the ideal input/output transfer characteristics and the input/output code table, respectively. Code transitions occur between successive integer LSB values (i.e., 1/2 LSB, 3/2 LSBs, etc.). The output code is straight binary with 1 LSB = FS/1024 = 2.5/1024 V = 2.4 mV. The input voltage span is 2.5 V and the common mode range is 0 V to +5 V, when V<sub>DD</sub> = 5 V. This means that the lowest voltage which can be tolerated at any of the analog inputs is 0 V, and the highest voltage which can be tolerated is +5 V.

Figures 7 and 8 show the input attenuators on the AD7579/AD7580 configured to change the basic range of the device. A 5 V range can be configured by grounding one end of each attenuator and applying the

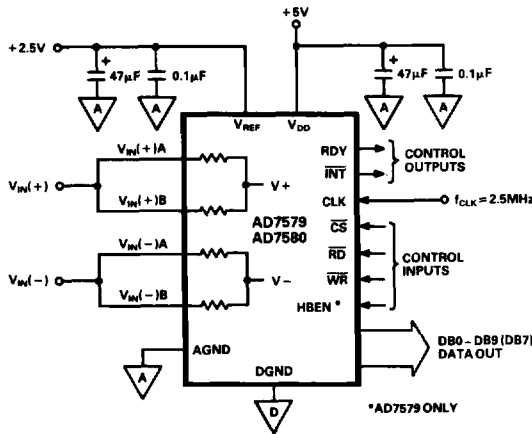


Figure 10. Unipolar 2.5 V Operational Diagram

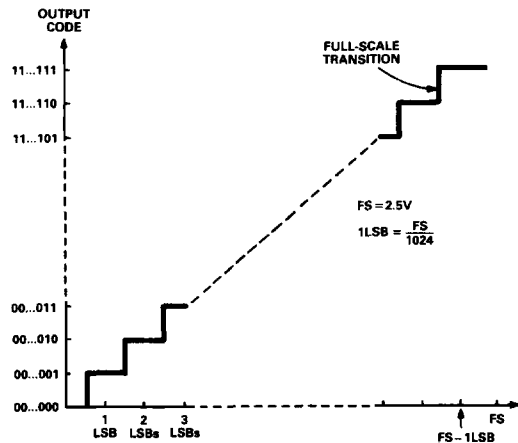


Figure 11. Ideal Input/Output Transfer Characteristics

Table 2. Input/Output Code Table for Figure 10

Differential Analog Input, Volts	Digital Output DB9 DB0
+ 0.000	00 0000 0000
+ 0.00244	00 0000 0001
+ 1.24756	01 1111 1111
+ 1.25	10 0000 0000
+ 1.25244	10 0000 0001
+ 2.49512	11 1111 1110
+ 2.49756	11 1111 1111

# AD7579/AD7580

differential input to the other ends. This is shown in Figure 7. The span is 5 V and the common mode range is 0 to +10 V. In Figure 8, one end of each attenuator is tied to  $V_{REF}$  (2.5 V), and this allows each of the other legs to go to -2.5 V without causing the comparator input to go negative. Assuming  $V_{REF}$  is 2.5 V, the span of this circuit is 5 V and the common mode range is -2.5 V to +7.5 V. Note that reducing  $V_{DD}$  below 5 volts causes a corresponding reduction in CMR. See Specifications page for full details.

## 6.1 Single-Ended Applications.

In many cases, users of the AD7579/AD7580 will want to measure single-ended input voltages (i.e., ground referred signals). The circuits of Figures 6, 7 and 8 can be easily adapted to accept such signals. If  $V_{IN(-)}$  in Figure 6 is tied to AGND, then the analog input range is 0 V to +2.5 V. By connecting  $V_{IN(-)}$  of Figure 7 to AGND, the analog input range becomes 0 V to +5 V. Figure 8 can be modified as in Figure 9 to accept input voltages in the range -2.5 V to +2.5 V. Each of these circuits are special cases of the differential input circuits and are achieved by making the negative input to the internal comparator equal to AGND.