

## COMPLETE LOW-POWER 12-BIT DAC

### FEATURES

- Low cost
- Complete
- Low power
- DAC80 compatibility
- Reliable

### DESCRIPTION

The DAC9356 is a unique, low-cost, 12-bit DAC packaged in a 24 pin double DIP. As supplied, the unit provides an output of  $\pm 10$  volts at 5mA; 25 $\mu$ S settling time for a full scale change; and  $\pm 30$ ppm/ $^{\circ}$ C gain drift. The addition of an external resistor permits  $\pm 5$  volt output with no loss in current capability — other ranges can be provided in OEM quantities. Matched CMOS current switches provide the lowest static power consumption of available technologies, while the  $\pm 20\%$  supply tolerance is a significant advantage over similar devices which may demand  $\pm 3\%$  or better. Outstanding features of the DAC9356 are:

**Completeness** — No external components are required for a 12-bit D-A conversion function. The DAC9356 includes the switches, temperature compensated reference, precision ladder network and output amplifier in the same package. Nothing else is needed.

**Low Power Consumption** — 175mW at  $\pm 15$  volts. Accumulated power, power supply size and expense, and system heat removal are significantly reduced — and no +5 volt logic supply is required.

**Pin-Out Similarity with DAC80** — For  $\pm 10$  volt output, the DAC9356 replaces the DAC80. DAC9356 is similar to other more expensive, higher power units as well.



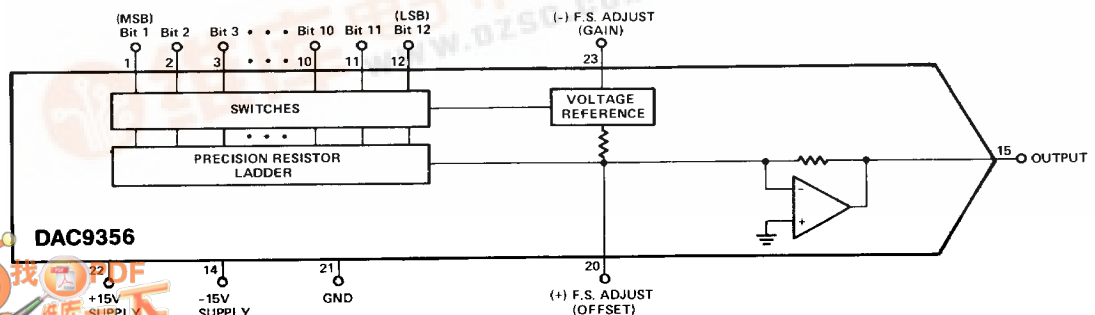
**Reliability Plus** — Packaged in a unique enclosure which has undergone extensive environmental testing during its development, the DAC9356 is continuously monitored during all assembly and test operations by our quality control organization.

Reliability is enhanced by batch-processed, precision laser-trimmed resistor networks fabricated in our own facility. Similar to monolithic circuits, the networks are processed and functionally trimmed to assure consistent performance. Networks are glass passivated to assure reliability under adverse environmental conditions.

Because of its low cost, low power, completeness and reliability, the DAC9356 is your best choice for systems which employ several DACs. With the advantages of large supply tolerance and lack of external components or adjustments, the DAC9356 is the most cost-effective converter product available.

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### FUNCTIONAL DIAGRAM



# SPECIFICATIONS

(Typical @ +25°C and nominal power supplies unless otherwise noted)

<b>MODEL</b>	<b>DAC9356</b>
<b>DIGITAL INPUT</b>	
Resolution	12-Bits
Coding	Complementary Offset Binary
Logic Compatibility <sup>1</sup>	CMOS 2.0V threshold (nominal)
Input Current	$V_{IH} > 3.0V$ (min), $V_{IL} < 0.8V$ (max) $\pm 1\mu A$ (max): $0.4V > V_{LOGIC} > 3.0V$
<b>ANALOG OUTPUT<sup>2</sup></b>	
Voltage @ Current <sup>3</sup>	$\pm 10$ Volts @ $\pm 5mA$
Impedance	$< 0.1\Omega$
Initial Accuracy <sup>4</sup>	$\pm 0.1\%$ F.S.R.
Protection	Continuous Short Circuit to Ground
<b>REFERENCE</b>	Internal; Temp. Compensated

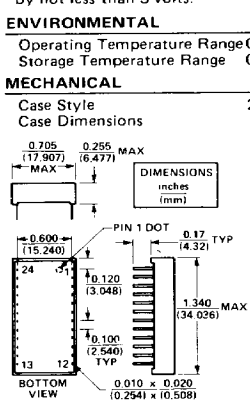
<b>STATIC PERFORMANCE</b>	
Integral Linearity (best straight line)	$\pm 0.02\%$ (max)
Differential Linearity	$\pm \frac{1}{2}$ LSB (typ), $\pm 1$ LSB (max)
<b>DYNAMIC PERFORMANCE</b>	
Settling Time, 10V Change to $\pm 0.02\%$ F.S.R.	25 $\mu$ Sec
Slew Rate	0.6V/ $\mu$ sec
<b>STABILITY</b>	
Gain	$\pm 30ppm/^\circ C$ F.S.R.
Offset	$\pm 10ppm/^\circ C$ F.S.R.
Differential Linearity	$\pm 5ppm/^\circ C$ F.S.R.

<b>POWER REQUIREMENTS*</b>	
Positive Supply Voltage	+11.5 to +18 volts (max)
+15V Supply Current	2.5mA (typ), 3.5mA (max)
Negative Supply Voltage	-11.5 to -18 volts (max)
-15V Supply Current	11mA (typ), 15.0mA (max)
Rejection Ratio	0.05%/ (typ), 0.08%/ (max)

\* Supply voltage must exceed maximum converter output voltage by not less than 3 volts.

<b>ENVIRONMENTAL</b>	
Operating Temperature Range	0°C to +70°C
Storage Temperature Range	0°C to +85°C
<b>MECHANICAL</b>	
Case Style	24 pin double-DIP
Case Dimensions	

Operating Temperature Range 0°C to +70°C  
Storage Temperature Range 0°C to +85°C

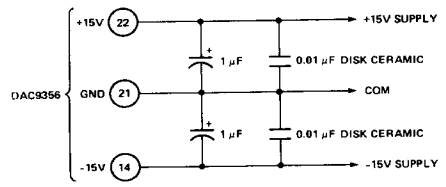


PIN	FUNCTION	PIN	FUNCTION
1	BIT-1 (MSB)	24	N.C.
2	BIT-2	23	(-) F.S. ADJ
3	BIT-3	22	+15VDC
4	BIT-4	21	GND
5	BIT-5	20	(+) F.S. ADJ
6	BIT-6	19	N.C.
7	BIT-7	18	N.C.
8	BIT-8	17	N.C.
9	BIT-9	16	N.C.
10	BIT-10	15	OUTPUT
11	BIT-11	14	-15VDC
12	BIT-12 (LSB)	13	N.C.

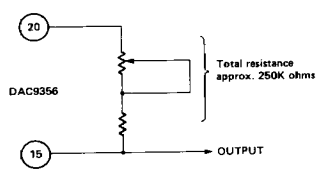
- NOTES:
- Logic input should not exceed +15 volts or be below -0.3V.
  - Full Scale range and offset voltage externally adjustable. See APPLICATIONS INFORMATION.
  - Can be supplied in unipolar ranges for OEM quantities. Consult factory.
  - Can be adjusted to  $\pm 0.02\%$  F.S.R. or better. See OPTIONAL ADJUSTMENT CIRCUITS.

# APPLICATIONS INFORMATION

## OPTIONAL BYPASS CIRCUIT

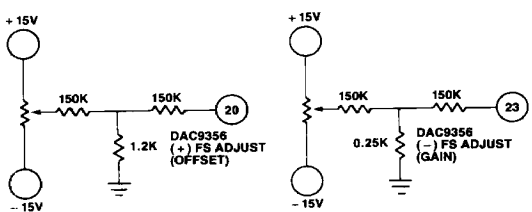


## OPTIONAL\* $\pm 5$ VOLT (OUTPUT) CONNECTION



\* TC of external resistors must be between 0 and +50ppm/°C to maintain drift performance.

## OPTIONAL ADJUSTMENT CIRCUITS



## CALIBRATION PROCEDURES

- Apply 000 ... 000 input code and set +F.S. ADJUST potentiometer for +F.S. -1 LSB output.
- Apply 111 ... 111 input code and set -F.S. ADJUST potentiometer for -F.S. output.

## TRANSFER CHARACTERISTICS

Complementary Offset Binary Input Code	Analog Output	
	Weighting	Voltage
MSB 2 3 4 5 6 7 8 9 10 11 LSB		
1 1 1 1 1 1 1 1 1 1 1 1	-F.S.	-10.000V
1 0 0 0 0 0 0 0 0 0 0 0	-1 LSB	-0.0048V
0 1 1 1 1 1 1 1 1 1 1 1	Zero	+0.000V
0 0 0 0 0 0 0 0 0 0 0 0	+F.S. -1 LSB	+9.9951V

**CAUTION:** ESD (Electro-Static Discharge) sensitive device. Permanent damage may occur when unconnected devices are subjected to high energy electrostatic fields. Unless otherwise noted, the voltage at any digital input should never exceed the supply voltage by more than 0.5 volts or go below -0.5 volts.

# ORDERING INFORMATION

MODEL	DESCRIPTION
DAC9356	Complete 12-Bit D/A Converter

Specifications subject to change without notice.