

# DAC9349

## Complete 12-Bit CMOS DAC

### FEATURES

- 12-Bit Binary or 3-Decade BCD Coding
- $\pm 2.5V$ ,  $\pm 5V$ ,  $\pm 10V$ , 0 to  $-5V$ , 0 to  $-10V$  Output Ranges
- Complete
- Low Power
- Low Cost
- Reliable



### DESCRIPTION

The DAC9349 is a versatile, economically-priced complete 12-Bit D/A converter intended for use in fixed reference applications. The unit combines CMOS switches, precision laser-trimmed ladder, internal precision reference and gain-selectable output amplifier in a unique, low-cost 24-pin double DIP<sup>1</sup>. An external fixed reference of  $-10V \pm 10\%$  may be used for ratiometric applications. Features of the DAC9349 include:

**Choice of Coding** — Units can be supplied in either 12-Bit binary (– 12 models) or 3 decade BCD coding (– 3D models).

**Pin Selectable Output Ranges** — External pin jumpers provide unipolar output ranges of 0 to  $-5V$  or 0 to  $-10V$  (binary models), or  $\pm 2.5V$ ,  $\pm 5V$  and  $\pm 10V$  for (offset binary coded) bipolar outputs.

**Completeness** — No additional external components are required for a 12-Bit D/A conversion.

<sup>1</sup> U.S. Patent Pending

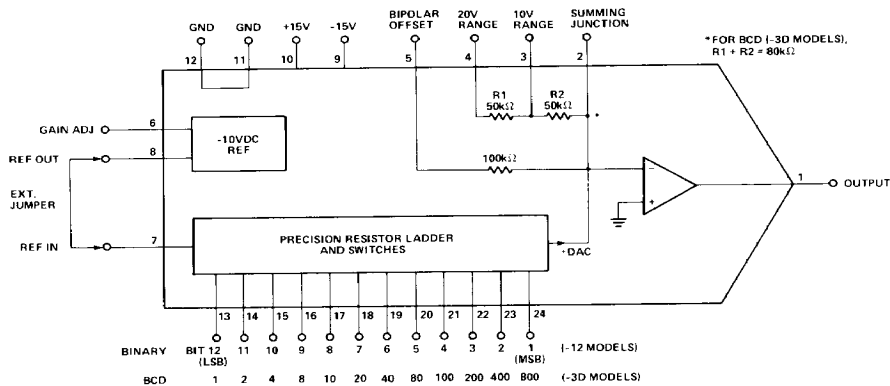
**Good Dynamic Performance** — Reduced settling time and higher slew rate compared to many 12-Bit converters.

**Reliability** — Like other converters in the commercial product line, the DAC9349 is offered in a unique package which has undergone the same extensive environmental testing to assure its reliability.

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.

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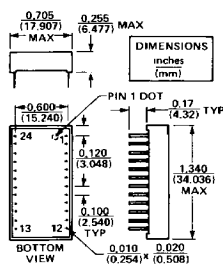
### FUNCTIONAL DIAGRAM



# SPECIFICATIONS

(Typical @ 25°C Using Internal Reference and  $V_{DD} = \pm 15V$  unless noted)

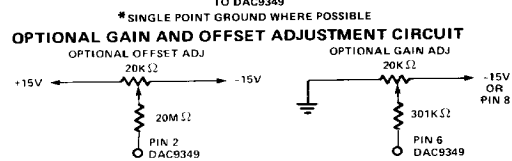
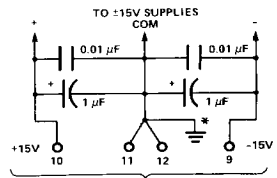
<b>MODEL</b>	<b>DAC9349</b>
<b>TYPE</b>	Fixed Reference, Voltage Out
<b>DIGITAL INPUT</b>	
Resolution	12 Bits
Coding	Binary: 3 DEC. BCD
Unipolar	Offset Binary
Bipolar	$V_{IL} = -1.0V$ max
Logic Levels (Threshold)	$V_{IH} = 3.5V$ min
<b>ANALOG OUTPUT</b>	
Scale Factor <sup>1</sup>	0.1% F.S.R. max
Initial Offset <sup>1</sup>	
Unipolar	$\pm 0.2\%$ F.S.R. max
Bipolar	$\pm 0.1\%$ F.S.R. max
Voltage Range <sup>2</sup>	
Unipolar	0 to -5V, 0 to -10V
Bipolar	$\pm 2.5V$ , $\pm 5V$ , $\pm 10V$
Current Compliance	$\pm 10mA$ typ $\pm 5mA$ min
Output Impedance	0.1 $\Omega$ max
<b>REFERENCE</b>	
Internal <sup>3</sup>	-10VDC
External (D.C. Only)	-10VDC $\pm 10\%$ @ 1mA
<b>STATIC PERFORMANCE</b>	
Linearity	$\pm 1/2$ LSB max
Differential Linearity	1 LSB max
<b>DYNAMIC PERFORMANCE</b>	
Settling Time (worst case)	15 $\mu s$ max
Slew Rate	1V/ $\mu s$
<b>STABILITY</b>	
(Over Specified Temperature Range)	
Linearity	5ppm/ $^{\circ}C$ max
Differential Linearity	2ppm/ $^{\circ}C$ max
Transfer Characteristics <sup>4</sup>	30ppm/ $^{\circ}C$ max
<b>POWER SUPPLY</b>	
Requirements	+15V @ 5mA typ 10mA max -15V @ 15mA typ 20mA max
Rejection Ratio	0.005%/max
<b>TEMPERATURE</b>	
Operating	0°C to +70°C
Storage	0°C to +85°C
<b>MECHANICAL</b>	
Case Style	24-pin Double-DIP
Case Dimensions	



PIN NO.	FUNCTION	PIN NO.	FUNCTION	
			BINARY	BCD
1	OUTPUT	24	BIT 1 (MSB)	800
2	SUMMING JCT	23	BIT 2	400
3	10V RANGE	22	BIT 3	200
4	20V RANGE	21	BIT 4	100
5	BIPOLAR OFFSET	20	BIT 5	80
6	GAIN ADJ	19	BIT 6	40
7	REF IN	18	BIT 7	20
8	REF OUT	17	BIT 8	10
9	-15V	16	BIT 9	8
10	+15V	15	BIT 10	4
11	GND	14	BIT 11	2
12	GND	13	BIT 12 (LSB)	1

- NOTES:
- 1 Or 10mV max, whichever is greater. Externally adjustable (see Figure 3).
  - 2 The -3D models have a 3-decade BCD format with a unipolar FS output range of 0 to -9.99V.
  - 3 For specified overall performance, external loading of the reference output (Pin 8) must not exceed 1.0mA.
  - 4 Total effect of linearity, offset and gain temperature coefficients on the transfer characteristic of the unit.

# APPLICATIONS INFORMATION



## CALIBRATION PROCEDURE (for optional external Gain & Offset adjustment)

- Unipolar operation:
1. Apply a 0 0 0 ... 0 input code and set the OFFSET ADJ pot for 0V out.
  2. Apply a 1 1 1 ... 1 input code and set the GAIN ADJ pot for -(F.S. - 1LSB).
- Bipolar operation:
1. Apply a 0 0 0 ... 0 input code and set the OFFSET ADJ pot for a +F.S. output.
  2. Apply a 1 1 1 ... 1 input code and set the GAIN ADJ pot for -(F.S. - 1LSB).
- BCD Unipolar operation:
1. Apply a 0 0 0 ... 0 input code and set the OFFSET ADJ pot for 0V out.
  2. Apply 1001 1001 1001 input and set the GAIN ADJ pot for -9.990V.

## TRANSFER CHARACTERISTICS

Unipolar Operation		Bipolar Operation	
Digital Input	Analog Output	Digital Input	Analog Output
1 1 1 ... 1	-(F.S. - 1 LSB)	1 1 1 ... 1	-(F.S. - 1 LSB)
1 0 0 ... 0	-F.S./2	1 0 0 ... 0	0V
0 0 0 ... 0	0V	0 0 0 ... 0	+F.S.

BCD Unipolar Operation

Digital Input	Analog Output
1001 1001 1001	-9.99
0101 0000 0000	-5.00
0000 0000 0000	0V

## OUTPUT RANGE SCALING\*\*

Output Voltage Range	Jumper These Pins	Connect Pin 5 to Pin	Coding
0 to -5V	1 & 3, 2 & 4	11	Binary
0 to -10V	1 & 3	11	
0 to -9.99V	1 & 4	*	
$\pm 2.5V$	1 & 3	7	Offset Binary
$\pm 5V$	1 & 3	7	
$\pm 10V$	1 & 4	7	

\* No Connection on BCD (-3D) Models.  
 \*\* Pin 7 must be connected to either the internal reference (Pin 8) or to an external -10VDC reference source.

**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
DAC9349-12	Complete, 12-Bit Binary DAC
DAC9349-3D	Complete, 3-Decade BCD DAC

Specifications subject to change without notice.