

## 16-Bit Binary & 4-Decade BCD DACs

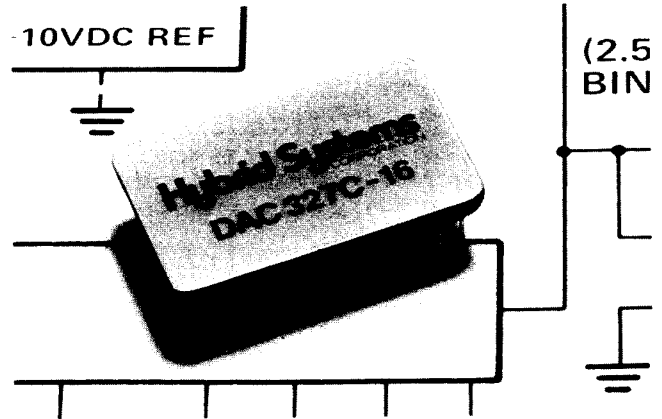
### FEATURES

- Very Low Cost
- Wide Operating Temperature Range . . . -25°C to +85°C
- Complete With Resistor Ladder, Switches, Gain Trimmed Output Amplifier . . . Internal and External Reference Models
- 50μS Settling Time
- 24-Pin Metal Hermetic Package

### DESCRIPTION

DAC327 is a standout value in the marketplace today. For operation over the -25°C to +85°C temperature range, both 16-bit binary and 4-decade BCD models offer unequaled price and performance. And even against competitive units offering only 0°C to +70°C operation, DAC327 models are most often lower in cost and higher in performance.

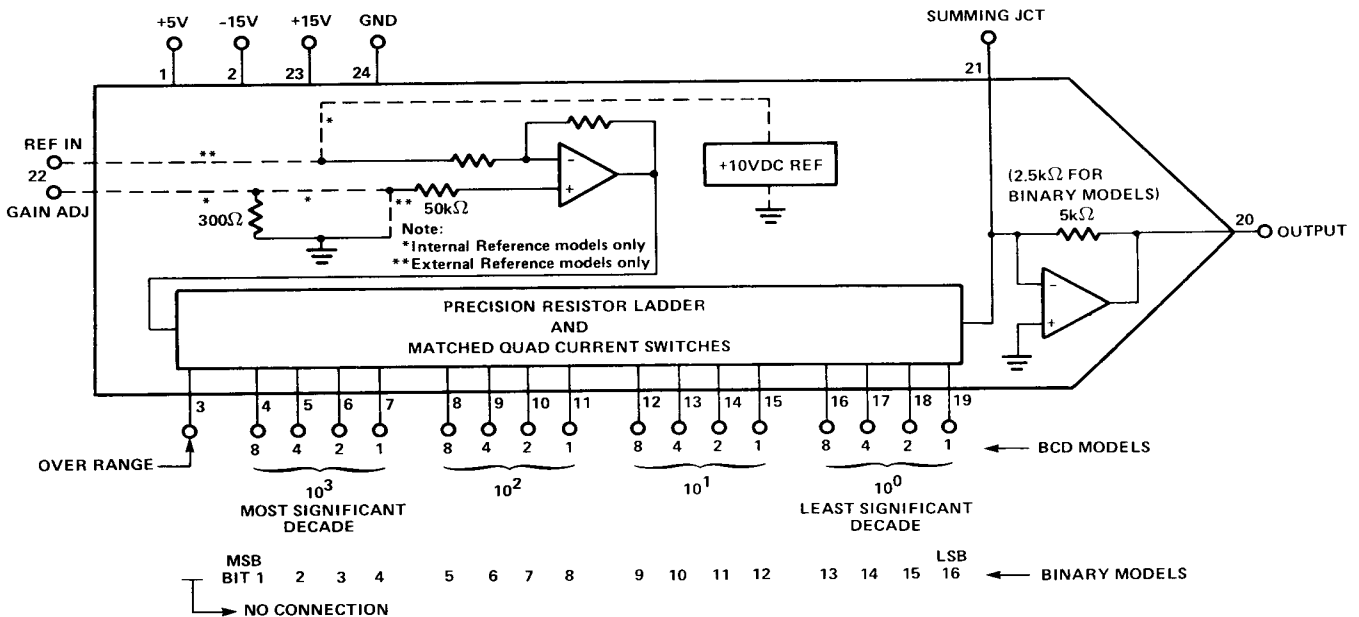
The DAC327 Series provides all digital-to-analog converter (DAC) functions in one package. All models come with a precision thin-film resistor ladder network, switches, and gain-trimmed output amplifier. Standard models have internal low drift references and can be ordered without the reference (-ER versions) for external reference applications. All models feature a 0 to +10V output range. In addition, BCD models (-4D option) can be overranged as a minimum to a full scale output of +12.000V. DAC327 models operate from standard ±15V and +5V power supplies.



Analog outputs are short-circuit proof. Settling time for a full scale 10V step change to ±0.003% F.S.R. is 100μS and 50μS for a 0.6mV change. Linearity is typically ±0.003% F.S.R. for binary models and ±0.005% F.S.R. for BCD models. Initially trimmed to ±10mV, offset may be externally adjusted if desired; models with built-in references can also be full scale adjusted by means of an external potentiometer.

Every DAC327 model is housed in a quality 24-pin metal DIP that is hermetically sealed. Units processed to MIL-STD-883, Class B requirements can also be supplied (consult factory).

### FUNCTIONAL DIAGRAM



# SPECIFICATIONS

(Typical @ +25°C using a +10VDC reference and nominal supplies unless otherwise noted)

<b>MODEL</b>	<b>DAC327</b>
<b>TYPE</b>	
-16 Models	16-bit Binary, Voltage Output
-4D Models	4-decade BCD, Voltage Output

## DIGITAL INPUT

Resolution	16 bits
-16 Models	4 decade plus overrange <sup>1</sup>
-4D Models	
Coding	
-16 Models	Complementary Binary
-4D Models	Complementary BCD
Logic Levels	
Logic "1"	+2.0 to +5.0V @ 0.1mA (max)
Logic "0"	-2.0 to +0.8V @ 2mA (max)
Logic Compatibility	TTL/DTL

## ANALOG OUTPUT

Scale Factor (Gain) <sup>2</sup>	±0.1% F.S.R. (max)
Initial Offset <sup>2</sup>	±10mV (max)
Voltage Range <sup>3</sup>	
-16 Models	0 to +10V
-4D Models <sup>1</sup>	0 to +9,999V, (+11,99V)
Current Output	5mA (min)
Output Impedance	0.1 ohm (max)

## REFERENCE

-ER Models	External Reference, +10V ±0.2V
Other Models	Internal, +10.0V

## STATIC PERFORMANCE

Linearity	
-16 Models	±0.003% F.S.R., typ; ±0.005% F.S.R., max
-4D Models	±0.005% F.S.R., typ; ±0.01% F.S.R., max
Differential Linearity	
-16 Models	2 LSB (max)
-4D Models	1 LSB (max)

## DYNAMIC PERFORMANCE

Slew Rate	0.5V/μS
Settling Time to ±0.003% F.S.R.	
For 10V Step	100μS
For 0.6mV Step	50μS

## STABILITY

Differential Linearity	±5ppm/°C F.S.R., typ; ±10ppm/°C F.S.R., max
Scale Factor (Gain)	±20ppm/°C F.S.R., typ;
Offset	±2ppm/°C F.S.R., max

## POWER SUPPLY REQUIREMENTS

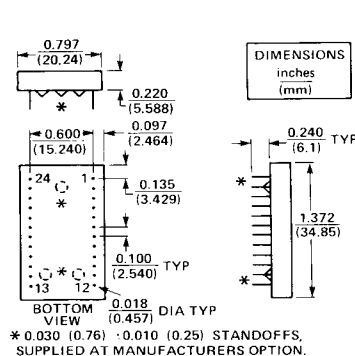
+15V -ER Models only	+14.4V to +19.0V @ 5mA
+15V Other Models	+14.4V to +19.0V @ 15mA
-15V All Models	-14.4V to -19.0V @ 30mA
+5V -16 Models only	+4.75V to +5.25V @ 30mA
+5V Other Models	+4.75V to +5.25V @ 50mA
Rejection Ratio (each supply)	0.001%/%

## TEMPERATURE RANGE

Operating	-25°C to +85°C
Storage	-65°C to +150°C

## MECHANICAL

Case Style Metal, 24-pin DIP style package  
Case Envelope Dimensions (max unless otherwise noted)



4D MODELS			
PIN	FUNCTION	PIN	FUNCTION
1	+5V	24	GND
2	-15V	23	+15V
3	OVERRRANGE	22	GAIN ADJ.*
4	BIT 8(DD)	21	SUMMING JCT
5	BIT 4(DD)	20	OUTPUT
6	BIT 2(DD)	19	BIT 1
7	BIT 1(DD)	18	BIT 2
8	BIT 8(DD)	17	BIT 4
9	BIT 4(DD)	16	BIT 8
10	BIT 2(DD)	15	BIT 10
11	BIT 1(DD)	14	BIT 20
12	BIT 8(DD)	13	BIT 40

16 MODELS			
PIN	FUNCTION	PIN	FUNCTION
1	+5V	24	GND
2	-15V	23	+15V
3	N/C	22	GAIN ADJ.*
4	BIT 1 (MSB)	21	SUMMING JCT
5	BIT 2	20	OUTPUT
6	BIT 3	19	BIT 16 (LSB)
7	BIT 4	18	BIT 15
8	BIT 5	17	BIT 14
9	BIT 6	16	BIT 13
10	BIT 7	15	BIT 12
11	BIT 8	14	BIT 11
12	BIT 9	13	BIT 10

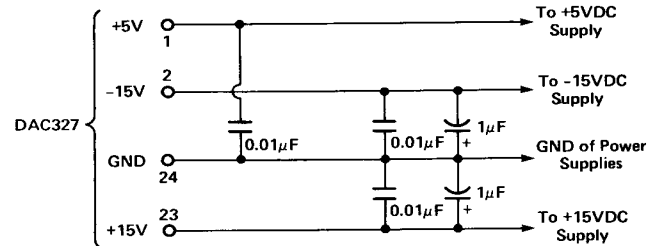
\* For ER Models, pin 22 is EXTERNAL REFERENCE input.

## NOTES:

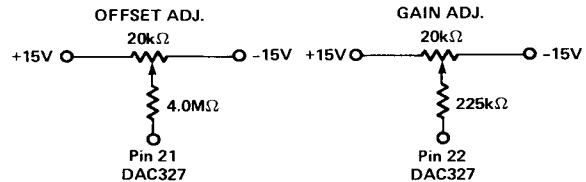
- With the +15V supply at +14.4V (minimum input) the user has the choice of +9.999V to +12.000V as full scale. Higher values are possible by increasing the +15V supply; at +19.0V (maximum input) the range of output can go to +16.000V.
- Initial gain and offset errors can be externally adjusted to zero. See OPTIONAL OFFSET AND GAIN ADJ. CIRCUITS under APPLICATIONS INFORMATION.
- Bipolar operation requires the use of a Sign Bit amplifier such as Hybrid Systems' Model A901.

# APPLICATIONS INFORMATION

## RECOMMENDED POWER SUPPLY BYPASS CIRCUIT



## OPTIONAL OFFSET AND GAIN ADJ. CIRCUITS



Note: -ER Models can not be gain adjusted.

- Apply a "1" logic level to all digital input pins and set the OFFSET ADJ. potentiometer for an output of +0.000V.
- Apply the digital input code for full scale (see TRANSFER CHARACTERISTICS) and set the GAIN ADJ. potentiometer for the equivalent output voltage.

## TRANSFER CHARACTERISTICS

BINARY CODED DECIMAL, -4D MODELS						
Complementary BCD Input Code					Analog Output <sup>2</sup>	
O.R. <sup>1</sup> BIT	M.S.D. 8 4 2 1	N.M.S.D. 8 4 2 1	N.L.S.D. 8 4 2 1	L.S.D. 8 4 2 1	Weighting	Voltage
0	1 0 0 1	1 1 1 1	1 1 1 1	1 1 1 1	Max. O.R. F.S. <sup>1</sup>	+16.000V
0	1 1 0 1	1 1 1 1	1 1 1 1	1 1 1 1	Min. O.R. F.S. <sup>1</sup>	+12.000V
1	0 1 1 1	0 1 1 0	0 1 1 0	0 1 1 0	F.S. <sup>1</sup>	+ 9.999V
1	1 0 1 0	1 1 1 1	1 1 1 1	1 1 1 1	F.S./2	+ 5.000V
1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	Zero	+ 0.000V

16-BIT BINARY, -16 MODELS								
Complementary Binary Input Code					Analog Output			
O.R. <sup>1</sup> BIT	MSB 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16					LSB	Weighting	Voltage
N/C	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0	0	0	0	F.S. -1 LSB	+9.99985V
N/C	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	1	1	1	1	F.S./2	+5.00000V
N/C	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	1	1	1	0	+1 LSB	+0.00015V
N/C	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	1	1	1	1	Zero	+0.00000V

- Notes: 1. O.R. = OVERRANGE, pin 3  
2. See note 1 under SPECIFICATIONS

# ORDERING INFORMATION

MODEL	DESCRIPTION
DAC327C-16	16-Bit Binary, Internal Reference
DAC327C-4D	4-Decade BCD, Internal Reference
DAC327C-16-ER	16-Bit Binary, External Reference
DAC327C-4D-ER	4-Decade BCD, External Reference

All standard DAC327 models are commercially processed. For MIL-STD-883, Class B processing, consult factory.

Specifications subject to change without notice.

# Hybrid Systems

CORPORATION

Crosby Drive  
Bedford, MA 01730 U.S.A.  
TWX: 710-326-7584 Tel. 617/275-1570

DIGITAL-TO-ANALOG CONVERTERS