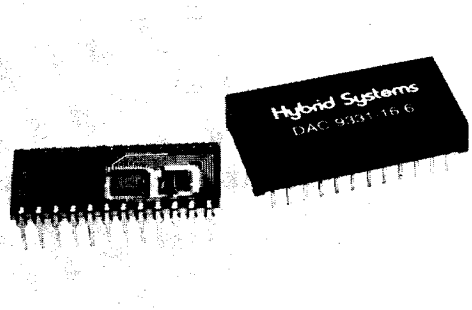
Sipex Corporation
SIGNAL PROCESSING EXCELLENCE

DAC9331-16 Series

14, 15, and 16-Bit Linearity, Latched MDAC's

FEATURES

- **Up to 16-Bit Linearity**
- **Two Chip Construction**
- **Input Registers**
- **Low Power**
- **Ceramic 24-Pin DIP**
- **2 and 4-quadrant Multiplication**
- **Single-Supply Operation**
- **Low-Cost**



DESCRIPTION

The DAC9331-16 Series are true 16-Bit D/A converters manufactured with advanced proprietary monolithic devices and proven performance packaging technique. A single, unique monolithic chip contains switches, storage registers and other electronics for high resolution and low linearity error. A second, passive chip provides all the needed resistors for these multiplying D/A's. Input storage registers are in two 8-Bit segments with independent latching — a system that is compatible with microprocessor data bus interfaces. It's a truly "byte-sized" D/A input system. Combining 2- and 4-quadrant multiplying capability, TTL/DTL and CMOS compatibility; low power consumption (less than 60 mW) and operation from a single supply, the DAC9331-16 Series offers exceptional performance/cost ratio. Outstanding features include:

True 16-Bit Linearity — 16-Bit (0.0008%) linearity with 16-Bit resolution is now a reality. No other microcircuit converter does better. 14- and 15-Bit linearity versions available at lower cost.

Low Power — CMOS proprietary monolithic devices[1] in a unique circuit configuration[1] yield the lowest power of any 16-Bit converter available.

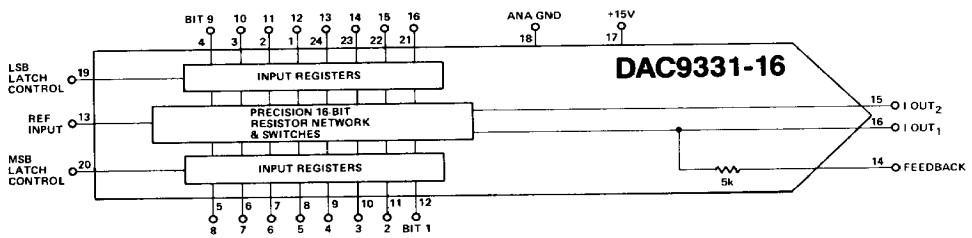
Two-Chip Construction — An advanced monolithic device, combined with our own resistor networks are all that's needed in this converter. Automatic wirebonding makes the most consistently superior assembly available.

Input Storage Registers — Designed as two 8-Bit segments, the input registers provide data storage when latched, or "transparent" registers when unlatched. Data conversion can now be performed continuously *or* from stored data — "byte-sized" input segments provide compatibility with most data bus lines.

Reliability — A proven performer, the DAC9331-16 is packaged in a 24-pin ceramic double DIP for the utmost in reliability. Combined with our proprietary monolithic switches and automatic wirebonding, we've made the DAC9331-16 Series the most reliable industrial converter to date. Reliability is further enhanced by batch-processed, precision laser-trimmed resistor networks fabricated in our own facility. Networks are functionally trimmed and glass passivated to assure reliability under adverse environmental conditions.

Advanced designs, proven processes and continuous monitoring during all production operations by our quality control organization are combined with rigorous AQL screening to provide the most dependable, low cost D/A converter possible.

FUNCTIONAL DIAGRAM

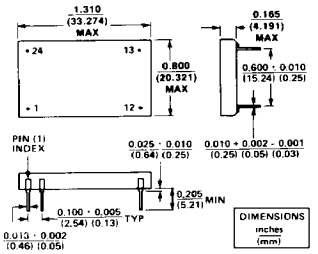


SPECIFICATIONS

(Typical @ +25° C and nominal power supply, V_{REF} = +10V, unipolar unless otherwise noted)

MODEL	DAC9331-16 -6 -5 -4		
TYPE	Multiplying, Latched Inputs		
DIGITAL INPUT			
Resolution	16-Bits		
2-Quad, Unipolar Coding	Binary		
4-Quad, Bipolar Coding	Offset Binary		
Logic Compatibility[1]	DTL, TTL, CMOS		
Input Leakage Current	±1μA (max): 0.4V>V_{LOGIC}>3.2V		
Strobe Width	250nS (min)		
Data Set-up Time[2]	500nS (min)		
REFERENCE INPUT			
Voltage Range	±25V (max)		
Input Impedance	5KΩ		
ANALOG OUTPUT			
Gain Accuracy[3]	0.1%		
Offset (unipolar)[4]	50μV (max)		
Small Signal 3dB Bandwidth	1 MHz		
Output Capacitance C_{out_1}	90pF		
Output Capacitance C_{out_2}	70pF		
STATIC PERFORMANCE			
Integral Linearity (max)	±0.001%	±0.002%	±0.003%
Differential Linearity (max)	±0.0015%	±0.003%	±0.006%
Monotonicity Guaranteed	16 bits	15 bits	14 bits
DYNAMIC PERFORMANCE			
Major Code Transition Settling to 0.01% F.S.R. (strobed)	2μS		
Reference Feedthrough Error (Vref=20Vpp @ 10kHz)	2mVp-p		
STABILITY[3] (Over Specified Temp. Range)			
Scale Factor[5]	2ppm/°C F.S.R. (typ), 6ppm/°C (max) 6ppm/°C (max)		
Linearity	0.5ppm/°C F.S.R. (max)		
Differential Linearity	0.5ppm/°C F.S.R. (max)		
Linearity Over Time[5]	3ppm F.S.R./1000 hrs.		
POWER SUPPLY(V_{DD})			
Voltage Range @ Current	+15V (nom); +11.5V to +15.5V @ 1.5mA		
Rejection Ratio (14V-16V)	±0.002%/% (max)		
Power Dissipation (inputs at GND, V_{ref}=0)	60mW (max)		
TEMPERATURE RANGE			
Operating	0°C to +70°C		
Storage	-55°C to +85°C		
MECHANICAL			
Case Style	24-pin double-DIP		
Case Dimensions			

PIN	FUNCTION	PIN	FUNCTION
1	BIT 12	24	BIT 13
2	BIT 11	23	BIT 14
3	BIT 10	22	BIT 15
4	BIT 9	21	BIT 16
5	BIT 8	20	MSB LATCH
6	BIT 7	19	LSB LATCH
7	BIT 6	18	ANA GND
8	BIT 5	17	+15V
9	BIT 4	16	I OUT 1
10	BIT 3	15	I OUT 2
11	BIT 2	14	$R_{FEEDBACK}$
12	BIT 1	13	REF IN

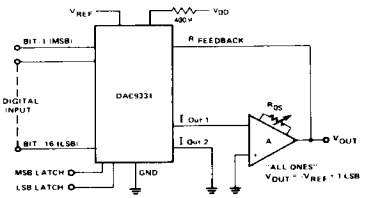


NOTES:

1. V_{IH}=2.4V (min); V_{IL}=0.8V (max) Inputs not to exceed -0.5V to +V_{DD}.
2. Time data must be stable before Strobe goes to "0".
3. Using internal feedback resistor.
4. Using the internal $R_{feedback}$ with nulled external amplifier in a constant 25°C ambient. (Offset doubles every 10°C).
5. The DAC9331-16 Series is designed to be used only in those applications where the current output is virtual ground; i.e., the summing junction of an op amp in the inverting mode. The internal feedback resistor (R Feedback) must be used to achieve temperature tracking. See APPLICATIONS INFORMATION for recommended circuit configurations.
6. For further information on long term drift refer to HS 9377 Application Notes.

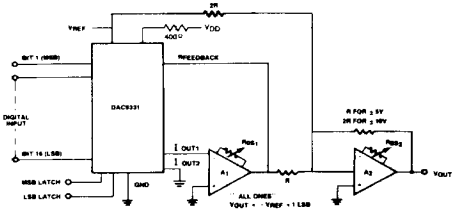
APPLICATIONS INFORMATION

UNIPOLAR OPERATION (2-Quadrant Multiplication)



NOTE: To maintain specified DAC9331 linearity, the external amplifier (A) must be zeroed. Apply an ALL "ZEROS" digital input and adjust R_{OS} for V_{OUT} = 0 ±1mV.

BIPOLAR OPERATION (4-Quadrant Multiplication)



NOTE: To maintain specified DAC9331 linearity, external amplifiers (A_1 and A_2) must be zeroed. With a digital input of 10...0 and V_{REF} set to zero:
a) Set R_{OS1} for V_{01} = 0
b) Set R_{OS2} for V_{OUT} = 0
c) Set V_{REF} to +10V and adjust R_B for V_{OUT} to be 0 Volts.

UNIPOLAR OPERATION
Transfer Characteristics

BINARY INPUT	ANALOG OUTPUT
11...111	$-V_{REF}(1-2^{-N})$
100...001	$-V_{REF}(½ + 2^{-N})$
100...000	$-\frac{V_{REF}}{2}$
011...111	$-V_{REF}(½ - 2^{-N})$
000...001	$-V_{REF}(2^{-N})$
000...000	0

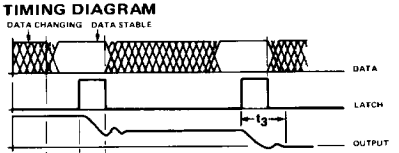
BIPOLAR OPERATION
Transfer Characteristics

OFFSET BINARY INPUT	ANALOG OUTPUT
111...111	$-V_{REF}(1-2^{-(N-1)})$
100...001	$-V_{REF}(2^{-(N-1)})$
100...000	0
011...111	$V_{REF}(2^{-(N-1)})$
000...001	$V_{REF}(1-2^{-(N-1)})$
000...000	V_{REF}

STROBE LOGIC

Strobe	Function
0	data latched (held)
1	data changing (transfer)

TIMING DIAGRAM



t_1 = DATA SETUP TIME <500ns
t_2 = STROBE WIDTH <250ns
t_3 = SETTLING TIME 2μSEC TYP

PRECAUTIONARY NOTES:

In order to realize the ultimate resolution which this unit is capable of delivering, several precautions must be taken.

1. Amplifiers must be balanced so the summing junction is as close to zero volts as can be achieved. Usually less than 100μV.
2. Amplifiers must have a large enough open loop gain to be consistent with the required linearity. To obtain optimum performance this should be in excess of 10^5V/V or 100dB.
3. All grounds should be of low resistance.
4. Reference should be as high as possible to minimize errors due to offset at outputs.
5. To maintain accuracy over temperature amplifiers should have low bias current and offset voltage temperature coefficients.

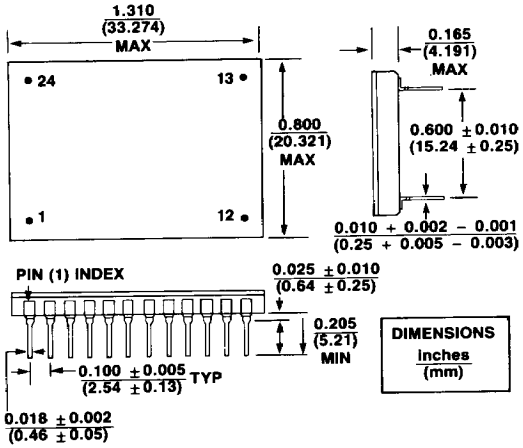
ORDERING INFORMATION

MODEL NUMBER	DESCRIPTION
DAC9331-16-4	14-BIT Linearity MDAC
DAC9331-16-5	15-BIT Linearity MDAC
DAC9331-16-6	16-BIT Linearity MDAC

CAUTION: ESD (Electro-Static Discharge) sensitive device. Permanent damage may occur when unconnected devices are subjected to high energy electro-static 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.

Specifications subject to change without notice.

BULLETIN DAC9331-16 SERIES/4-88/Printed in U.S.A.



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