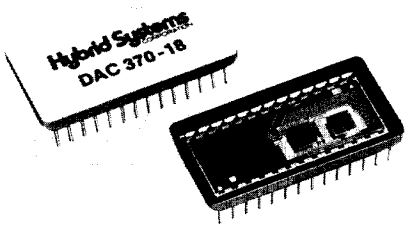
Sipex Corporation
SIGNAL PROCESSING EXCELLENCE

DAC370-18

18-BIT STORAGE REGISTER, MDAC

FEATURES

- True 16-bit (0.0008%) linearity
- Two chip construction
- Input registers
- Low power
- Hermetic 28-pin DIP
- 2- and 4-quadrant multiplication
- Single-supply operation
- Available with MIL-STD-883 screening and testing



DESCRIPTION

The DAC370-18 is a true 16-bit linear D/A converter manufactured with the most advanced proprietary monolithic devices[1] and proven 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 resistors needed for this multiplying D/A. Input storage registers are in two 8- and one 2-bit segments with independent latching — a system that is compatible with most microprocessor data bus interfaces. Combining 2-and 4-quadrant multiplying capability, TTL/DTL and CMOS compatibility, low power consumption and operation from a single supply, the DAC370-18 offers exceptional performance/cost ratio.

Outstanding features include:

True 16-Bit Linearity — 16-bit (0.0008%) linearity with 18-bit resolution is now a reality. No other microcircuit converter does better.

Low Power — CMOS proprietary monolithic devices in a unique circuit configuration yield extremely low power (60 mW max).

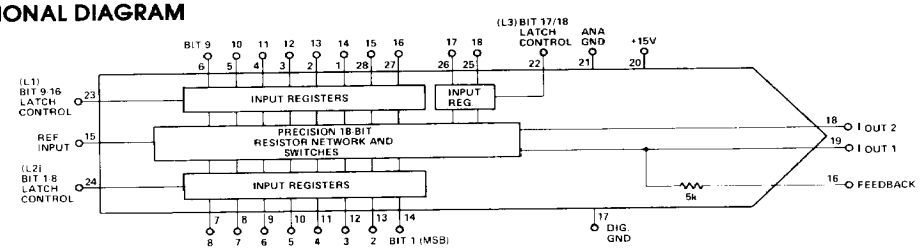
Two-Chip Construction — The most advanced monolithic device, combined with our own resistor network is all that is needed in this converter. Fully automatic wire-bonding makes the most consistently superior assembly available.

Input Storage Registers — Designed as two 8-bit and one 2-bit segments, the input registers provide data storage when latched, but are "transparent" when unlatched. Data conversion can now be performed continuously **or** from stored data.

Reliability — Our 28-pin hermetically-sealed package offers the utmost in reliability microelectronic converter products. Combined with our proprietary monolithic device and automatic wirebonding, we've made the DAC370-18 the most reliable high resolution device 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. DAC370-18 converters are available fully screened and tested to MIL-STD-883C.

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 reliable converter possible.

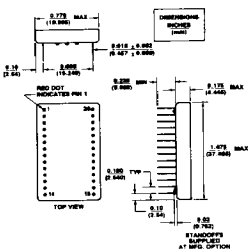
FUNCTIONAL DIAGRAM



SPECIFICATIONS

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

MODEL	DAC370-18
TYPE	Multiplying, latched inputs
DIGITAL INPUT	
Resolution	18 bits
2-Quad. Unipolar Coding	Binary
4-Quad. Bipolar Coding	Offset binary
Logic Compatibility	DTL, TTL, CMOS V_{IH} > 2.4V min V_{IL} < 0.8V max
Input Leakage Current	±1μA max, 0.4V > V_{LOGIC} > 3.2V
Strobe Width	250 ns min
Data Set-Up Time[1]	500 ns min
REFERENCE INPUT	
Voltage Range	±25V max
Input Impedance	5K
ANALOG OUTPUT	
Gain Accuracy[2]	0.1% typ, 0.2% max
Offset[3] (Unipolar)	50μV max
Small Signal 3 dB Bandwidth	1 MHz
Output Capacitance C_{OUT1}	90 pF
C_{OUT2}	70 pF
STATIC PERFORMANCE	
Integral Linearity (best straight line)	±0.0008% typ, ±0.0015% max
Differential Linearity (monotonic to 16-Bits)	±0.0004% typ, ±0.0015% max
DYNAMIC PERFORMANCE	
Major Code Transition Settling to 0.01% FSR (strobed)	2μs
Reference Feedthrough Error (V_{REF} = 20 Vpp @ 10 kHz)	2 mVp-p
STABILITY[3,5] (Over Specified Temp. Range)	
Scale Factor[4]	2 ppm/°C FSR typ, 6 ppm/°C max
Linearity	1 ppm/°C FSR max
Differential Linearity	1 ppm/°C FSR max
Linearity	±0.0115% max @ +125°C ±0.0095% max @ −55°C
Differential Linearity	±0.0115% max @ +125°C ±0.0095% max @ −55°C
POWER SUPPLY (V_{DD})	
Voltage Range @ Current	+15V nom, +11.5V to +15.5V @ 1.5 mA
Rejection Ratio (14.0V-16.0V)	0.002%/% max
Power Dissipation (inputs @ GND, V_{REF} = 0)	60 mW max
TEMPERATURE RANGE	
Operating — B Option	−55°C to +125°C
Operating — C Option	0°C to +85°C
Storage	−65°C to +150°C
MECHANICAL	
Case Style	28-pin double-DIP metal
Case Dimensions	



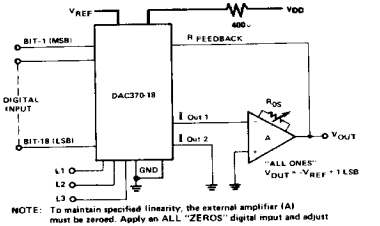
PIN	FUNCTION	PIN	FUNCTION
1	BIT 14	28	BIT 15
2	BIT 13	27	BIT 16
3	BIT 12	26	BIT 17
4	BIT 11	25	BIT 18
5	BIT 10	24	2^{-1}–2^{-8} LATCH
6	BIT 9	23	2^{-9}–2^{-16} LATCH
7	BIT 8	22	2^{-17}, 2^{-18} LATCH
8	BIT 7	21	ANA GND
9	BIT 6	20	+15V
10	BIT 5	19	$I_{out\ 1}$
11	BIT 4	18	$I_{out\ 2}$
12	BIT 3	17	DIG GND
13	BIT 2	16	FEEDBACK
14	BIT 1	15	REF INPUT

NOTES:

1. Time data must be stable before Strobe goes to "1".
2. Using internal feedback resistor.
3. Using the internal $R_{feedback}$ with nulled external amplifier in a constant 25°C ambient. (Offset doubles every 10°C.)
4. The DAC370-18 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.
5. For further information on long term drift, refer to HS 377 Application Notes, page 140.

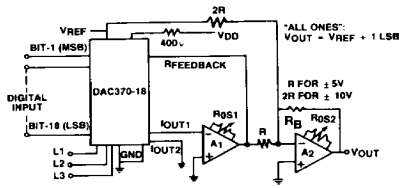
APPLICATIONS INFORMATION

UNIPOLAR OPERATION (2-Quadrant Multiplication)



NOTE: To maintain specified 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 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_{O1} = 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
111...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

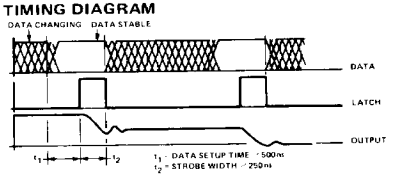
BIPOLAR OPERATION
Transfer Characteristics

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



PRECAUTIONARY NOTE:
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 100 dB.
(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.
(6) For optimum performance refer to APPLICATIONS INFORMATION in front of catalog.
(7) Tie unused inputs to ground.
(8) Do not apply digital inputs before V_{DD} supply.
(9) Unused inputs must be grounded.

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 NUMBER	DESCRIPTION
DAC370B-18	18-Bit MDAC, +15V Operation, MIL
DAC370C-18	18-Bit MDAC, +15V Operation, COMM

Specifications subject to change without notice.