FEATURES

- Complete ..... Includes Reference and Op Amp
- Compact ..... Single 18-Pin DIP Package
- Bipolar Output ..... (±10V) Sign-Magnitude Coding
- DAC-03 – Unipolar Only ..... +5V or +10V
- Monotonicity Guaranteed
- Nonlinearity ..... ±1 LSB
- Fast ..... 2.0μs Settling Time
- Stable ..... Full-Scale Tempco 60ppm/°C
- Low Power Consumption ..... 300mW Max
- TTL, CMOS Compatible Inputs
- Available in Die Form

ORDERING INFORMATION †

MONOTONICITY BITS	PACKAGE: 18-PIN CERDIP COMMERCIAL TEMP	
10	DAC02ACX	DAC03ADX
8	DAC02CCX	DAC03CDX
7	DAC02DDX	–

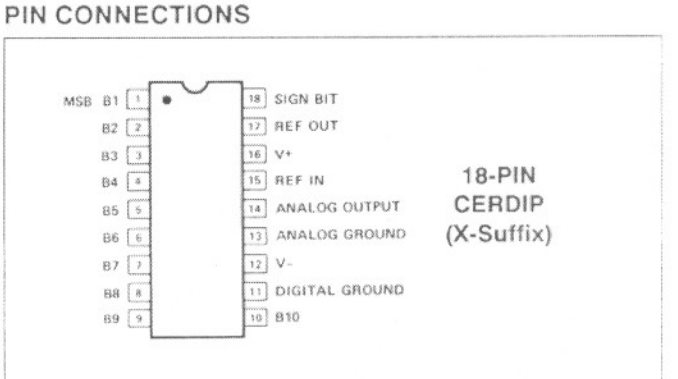
† Burn-in is available on commercial and industrial temperature range parts in CerDIP, plastic DIP, and TO-can packages. For ordering information, see 1990/91 Data Book, Section 2.

GENERAL DESCRIPTION

The DAC-02 is a complete 10-bit plus sign D/A converter on a single monolithic chip. All elements of a complete sign-magnitude DAC are included; precision voltage reference, current steering logic, current sources, R-2R resistor network, logic-controlled polarity switch, and high speed internally-compensated output op amp. Monotonicity guaranteed over the entire temperature range is achieved using an untrimmed diffused R-2R resistor network. The buffered reference input is capable of tracking over a wide range of voltages, increasing application flexibility. The wide power supply range, low power consumption, wide logic input compatibility and sign-magnitude coding assures utility in a wide range of applications including CRT displays, data acquisition systems, A/D converters, servo positioning controls, and audio digitizing/reconstruction systems.

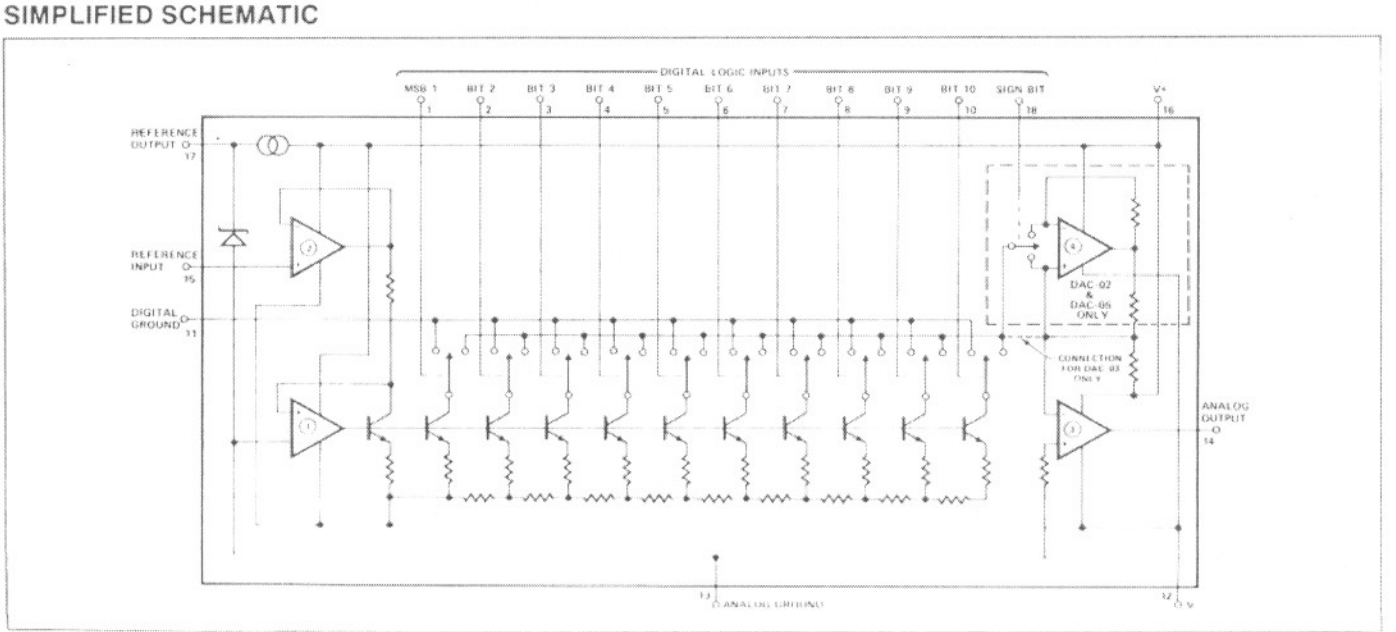
The DAC-03 is similar in construction to the DAC-02 except for a unipolar only output. This device is intended for low cost, limited temperature range applications, with the same general specifications as its premium counterparts.

PIN CONNECTIONS



18-PIN CERDIP (X-Suffix)

SIMPLIFIED SCHEMATIC



ELECTRICAL CHARACTERISTICS at $V_S = \pm15V$, $0 \le T_A \le +70°C$ for DAC-02, $T_A = +25°C$ for DAC-03, unless otherwise noted.

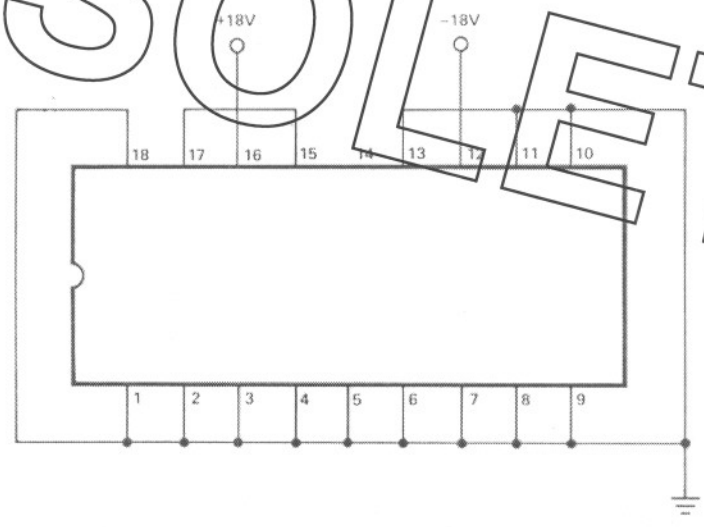
Continued

PARAMETER	SYMBOL	CONDITIONS	DAC-02	DAC-03	MIN	TYP	MAX	UNITS
Positive Supply Current	I_+	SB High. All other logic inputs low.	AC/CC		–	+7	+10	mA
			DD	ALL	–	+7	+11.6	
Negative Supply Current	I_-	SB High. All other logic inputs low.	AC/CC		–	–9	–10	mA
			DD		–	–9	–11.6	
				ALL	–	–10	–11.6	
Power Supply Sensitivity	P_{SS}	$V_S = \pm12$ to $\pm18V$	AC/CC		–	±0.015	±0.05	% V_{FS}/V
			DD	ALL	–	±0.015	±0.1	
Power Dissipation	P_d	$I_{OUT} = 0$	AC/CC		–	225	300	mW
			DD	ALL	–	225	350	
Output Drive Current	I_O	Guaranteed by V_{FR} test	ALL	ALL	–	–	5	mA

NOTES:
1. Reference output terminal connected directly to reference input terminal, R_L = 2kΩ for 10V devices, R_L = 1kΩ for 5V devices, all logic inputs ≥ 2.0V.
2. Zero-scale symmetry is the change in the output voltage produced by switching the sign-bit with all logic bits low ($V_{ZS+} - V_{ZS-}$).
3. Full-scale bipolar symmetry is the magnitude of the difference between V_{FR+} and $|V_{FR-}|$.
4. Guaranteed by design.
5. Tested with Best Straight Line method.

OBSOLETE

BURN-IN CURCUIT



NOTE : PINS 14, 15, & 17 MUST NOT BE CONNECTED TO A COMMON BUS BETWEEN DEVICES.

ABSOLUTE MAXIMUM RATINGS

Operating Temperature Range ..... 0°C to +70°C
Storage Temperature Range ..... −65°C to +150°C
V+ Supply to Analog Ground ..... 0 to +18V
V− Supply to Analog Ground ..... 0 to −18V
Analog Ground to Digital Ground ..... 0 to ±0.5V
Logic Inputs to Digital Ground ..... −5V to (V+ −0.7V)
Internal Reference Output Current 300µA
Reference Input Voltage ..... 0 to +10V
Lead Temperature (Soldering, 60 sec) ..... 300°C
Output Short-Circuit Duration ..... Indefinite
(Short circuit may be to ground or either supply.)

PACKAGE TYPE	Θ_{JA} (Note 1)	Θ_{JC}	UNITS
18-Pin Hermetic DIP (X)	79	11	°C/W

NOTE:
1. Θ_{JA} is specified for worst case mounting conditions, i.e., Θ_{JA} is specified for device in socket for CerDIP package.

OUTPUT VOLTAGE RANGE SELECTION TABLE

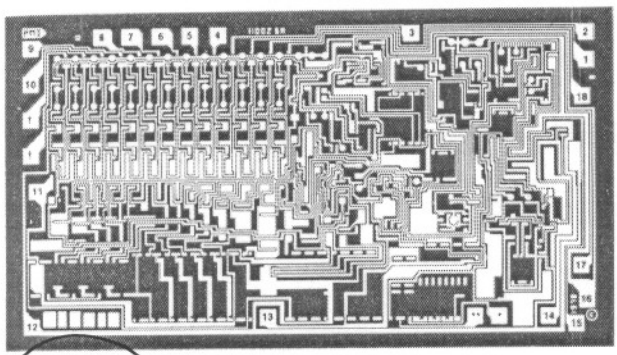
PRODUCT	OUTPUT VOLTAGE RANGE	ADD AS SUFFIX TO PART NO.
DAC02	±10V	1
DAC03	0 to +10V	1
DAC03	0 to +5V	2

OBSOLETE

ELECTRICAL CHARACTERISTICS at $V_S = \pm15V$, $0 \le T_A \le +70°C$ for DAC-02, $T_A = +25°C$ for DAC-03, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	DAC-02	DAC-03	MIN	TYP	MAX	UNITS
Monotonicity			AC	AD	10	–	–	Bits
			CC	CD	8	–	–	
			DD		7	–	–	
Nonlinearity	NL	(Note 5)	AC	AD	–	–	±0.1	% FS
			CC	CD	–	–	±0.2	
			DD		–	–	±0.4	
Full-Scale Tempco	T_C	INT REF	AC/CC		–	–	±60	ppm/°C
				AD	–	±60	–	
			DD		–	–	±150	
		EXT REF	ALL		–	±30	–	ppm/°C
				ALL	–	±40	–	
Settling Time	t_S	to 1/2 LSB, 10V Step (Note 4)	ALL	ALL	–	2	–	µs
Full Range Output Voltage (Note 1)	V_{FR}	V_{FR+} (SB High)	ALL		+10	–	+11.5	V
		V_{FR-} (SB Low)	ALL		−11.5	–	−10	
		DAC-03 +10V		ALL	+10	–	+11.5	
		+5V		ALL	+5.00	–	+5.75	
Zero-Scale Offset	V_{ZS}	SB High. All other logic inputs low. $T_A = +25°C$		ALL	–	±1	±10	mV
			ALL		–	±5	±10	
		T_A = Min or Max	ALL		–	±2	±10	mV
Zero-Scale Symmetry	V_{ZSS}	(Note 2)	AC/CC		–	±1	±5	mV
			DD	N/A	–	±1	±10	
Full Range Bipolar Symmetry	V_{FRS}	$V_{FR+} - \lvert V_{FR-} \rvert$ (Note 3)	AC/CC	N/A	–	±30	±60	mV
			DD		–	±30	±80	
Reference Input Bias Current	I_B		ALL	ALL	–	100	–	nA
Reference Input Impedance	Z_{IN}		ALL	ALL	–	200	–	MΩ
Reference Input Slew Rate	SR		ALL	ALL	–	2	–	V/µs
Reference Output Voltage	V_{REF}		ALL	ALL	–	6.7	–	V
Logic Input Current	I_{IN}	Each Input −5V to (V+ −0.7)V	ALL	ALL	–	±1	±10	µA
Logic Input 0	V_{INL}		ALL	ALL	–	–	0.8	V
Logic Input 1	I_{INH}		ALL	ALL	2	–	–	

DICE CHARACTERISTICS



DIE SIZE 0.162 x 0.090 inch, 14,580 sq. mils
(4.114 x 2.286 mm, 9,405 sq. mm)

1. BIT 1-MSB
2. BIT 2
3. BIT 3
4. BIT 4
5. BIT 5
6. BIT 6
7. BIT 7
8. BIT 8
9. BIT 9
10. BIT 10
11. DIGITAL GROUND
12. V–
13. ANALOG GROUND
14. ANALOG OUTPUT
15. REF IN
16. V+
17. REF OUT
18. SIGN BIT

For additional DICE ordering information, refer to 1990/91 Data Book, Section 2.

NOTE:
Voltage output range programmable by connecting *(10V) to analog output for 10 volt range. Jumps from **(5V) to analog output for 5 volt range. †Bits 11 & 12 (not normally used)

OBSOLETE

WAFER TEST LIMITS at V_S = ±15V, T_A = +25°C and +10V full-scale output, unless otherwise noted.

PARAMETER	CONDITIONS	DAC-02-N LIMIT	DAC-02-G LIMIT	UNITS
Resolution (Bits 11 and 12 Not Normally Used)	Bipolar Output Unipolar Output	13 12	13 12	Bits MAX
Monotonicity		9	8	Bits MIN
Nonlinearity		±0.1	±0.2	% FS MAX
Zero-Scale Offset	Sign Bit High, All Other Inputs Low	±10	±10	mV MAX
Zero-Scale Symmetry	±10V Full-Scale	±5	±5	mV MAX
Full-Scale Bipolar Symmetry	±10V Full-Scale	±60	±60	mV MAX
Power Supply Rejection	V_S = ±12V to ±18V	0.05	0.05	$\%V_{FS}/V$ MAX
Power Dissipation	I_{OUT} = 0	300	300	mW MAX
Logic Input "0"		0.8	0.8	V MAX
Logic Input "1"		2	2	V MIN
Full Range Output Voltage	Sign-Bit High or Low	±11.5 ±10	±11.5 ±10	V MAX V MIN

NOTE:
Electrical tests are performed at wafer probe to the limits shown. Due to variations in assembly methods and normal yield loss, yield after packaging is not guaranteed for standard product dice. Consult factory to negotiate specifications based on dice lot qualifications through sample lot assembly and testing.

TYPICAL ELECTRICAL CHARACTERISTICS at V_S = ±15V and +10V full-scale output, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	DAC-02-N TYPICAL	DAC-02-G TYPICAL	UNITS
Full-Scale Tempco	TVC_{FS}	Internal Reference	60	60	ppm/°C
Setting Time (T_A = +25°C)	t_s	To ±1/2 LSB 10 Volt Step	2	2	µs
Logic Input Current	I_{IN}	T_A = +25°C	1	1	µA

NOTE:
When ordering DICE in this series, use DAC-02 numbers and grades above.

ORDERING INFORMATION

DICE PART NUMBERING SYSTEM

Device Type and Model Number

Electrical Grade
N = Top
G = Middle
GR = Lowest

Temperature-Tested Die Option (125°C)

Visual Criteria
A = MIL-STD-883, Method 2010, Test Condition A
B = MIL-STD-883, Method 2010, Test Condition B

Backing Suffix
C = Plain
CG = Gold Backed

DAC-08 N T B C

All PMI dice are available with either plain backing or, for a 50% adder plus a $500 lot charge, a 1-micron-thick eutectic-bonded gold backing.

Many PMI devices are available with min/max wafer probe limits for dice tested at +125°C. See specific data sheet.

Data sheets give specific available grades for each PMI device.

Device types listed under packaged products. Select model number from product listings.

OBSOLETE