# PM-7548

CMOS 8-BIT μP COMPATIBLE
12-BIT D/A CONVERTER

Precision Monolithics Inc.

## FEATURES

- 8-Bit Bus Compatible 12-Bit DAC
- Versatile Microprocessor Interface with Selectable Data Input Format and Data Override
- Faster Interface Timing
- High Accuracy: Low ±1/2 LSB INL Error Over Temperature and ±1 LSB Gain Error
- Superior Power Supply Rejection from +5V to +15V ..... 0.001%/% Max
- Low Feedthrough Error and Digital Charge Injection
- Data Inputs Designed with ESD Protective Circuitry
- Narrow (0.3") DIP Packages Suitable for Auto-Insertion
- Superior Direct Replacement for AD7548
- Full Four Quadrant Multiplication

## APPLICATIONS

- Process Control
- Programmable Amplifiers
- Digitally Controlled Power Supplies
- Digitally Controlled Attenuators
- Digitally Controlled Filters

## ORDERING INFORMATION†

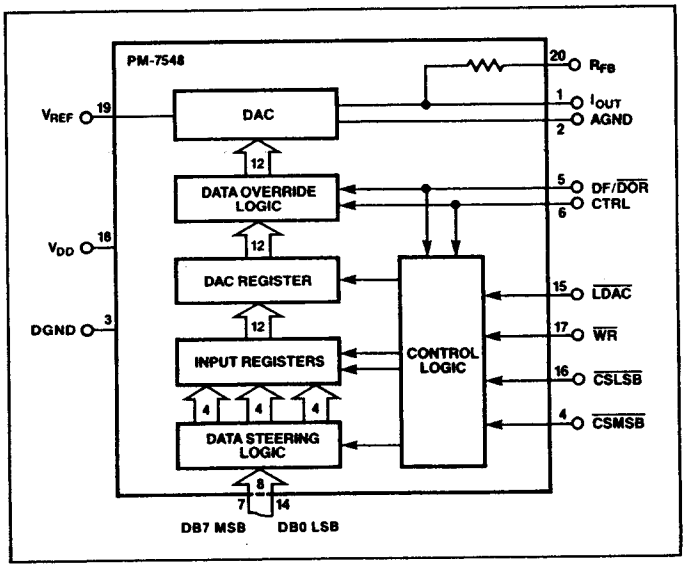
| | | PACKAGE: 20-PIN** | | |
|---|---|---|---|---|
| GAIN ERROR | NON-LINEARITY | MILITARY* TEMPERATURE −55°C TO +125°C | INDUSTRIAL TEMPERATURE −25°C TO +85°C | COMMERCIAL TEMPERATURE 0°C TO +70°C |
| ±1LSB | ±1/2LSB | PM7548AR | PM7548ER | PM7548GP |
| ±2LSB | ±1/2LSB | PM7548BR | PM7548FR | PM7548HP |
| ±2LSB | ±1/2LSB | PM7548BRC/883 | — | PM7548HPC |

* For devices processed in total compliance to MIL-STD-883, add /883 after part number. Consult factory for 883 data sheet.

**Package Designation: R Suffix = Hermetic DIP, RC Suffix = Leadless Chip Carrier, P Suffix = Plastic DIP, PC = Plastic Leadless Chip Carrier

† All commercial and industrial temperature range parts are available with burn-in. For ordering information see 1986 Data Book, Section 2.

## FUNCTIONAL BLOCK DIAGRAM




## CROSS REFERENCE

| PMI | ADI | TEMPERATURE RANGE |
|---|---|---|
| PM7548AR<br>PM7548BR | AD7548TD<br>AD7548SD | MILITARY |
| PM7548ER<br>PM7548FR | AD7548BQ<br>AD7548AQ | INDUSTRIAL |
| PM7548GP<br>PM7548HP | AD7548KN<br>AD7548JN | COMMERCIAL |

## GENERAL DESCRIPTION

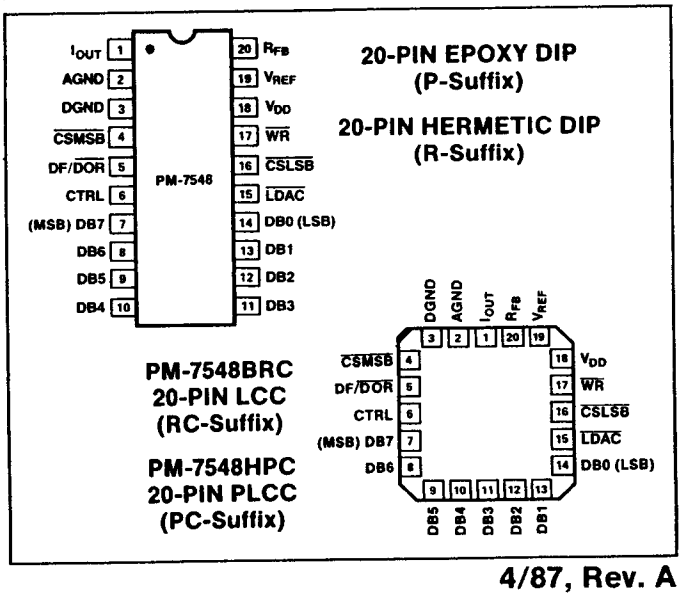
The PM-7548 is a 12-bit resolution, current output, CMOS D/A converter with a microprocessor interface for 8-bit busses. Its improved accuracy and inputs designed with ESD protection circuitry make it a superior pin-compatible replacement to the industry standard 7548. These performance improvements permit the upgrading of existing designs with greater accuracy and ruggedness. Tighter linearity and gain error specifications may permit a reduced circuit parts count through the elimination of trimming components. The PM-7548 is available in standard plastic and CERDIP packages that are compatible with auto-insertion equipment.

The PM-7548's versatile interface allows data to be loaded into an output register in two bytes. The PM-7548 can accept data right or left justified, least or most significant byte first, under microprocessor control. Faster interface timing minimizes microprocessor wait states.

Analog output updating and the loading of new data into the input registers may be coincident or separated in time by use of the $\overline{\text{LDAC}}$ control input. This allows user control of data update and analog output update timing.

Data override control allows full-scale or zero-scale analog outputs without altering the contents of the DAC registers. This permits the user to perform circuit calibration without the need to load calibration data into the DAC registers.

## PIN CONNECTIONS




4/87, Rev. A

## ABSOLUTE MAXIMUM RATINGS ($T_A$ = +25°C, unless otherwise noted.)

$V_{DD}$ (to GND) ..... +17V
$V_{REF}$ (to GND) ..... ±25V
$V_{RFB}$ (to GND) ..... ±25V
Digital Input Voltage Range ..... −0.3V to $V_{DD}$
Output Voltage (Pin 1, Pin 2) ..... −0.3V to $V_{DD}$
Power Dissipation (Any Package) ..... 450mW
Derate Above +75°C ..... 6mW/°C
Operating Temperature Range
AR/BR/BRC Versions ..... −55°C to +125°C
ER/FR Versions ..... −25°C to +85°C
GP/HP/HPC Versions ..... 0°C to +70°C
Dice Junction Temperature ..... +150°C
Storage Temperature ..... −65°C to +150°C
Lead Temperature (Soldering, 60 sec) ..... 300°C

**CAUTION:**

1. Do not apply voltages higher than $V_{DD}$ or less than GND potential on any terminal except $V_{REF}$ (Pin 17) and $R_{FB}$ (Pin 18).
2. The digital control inputs are zener protected, however, permanent damage may occur on unprotected units from high-energy electrostatic fields. Keep units in conductive foam at all times until ready to use.
3. Use proper anti-static handling procedures.
4. Absolute Maximum Ratings apply to both packaged devices and dice. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device.

## ELECTRICAL CHARACTERISTICS at $V_{DD}$ = +5V, +12V, or +15V; $V_{REF}$ = +10V; $V_{OUT}$ = $V_{AGND}$ = $V_{DGND}$ = 0V; $T_A$ = −55°C to +125°C for PM-7548AR/BR/BRC, $T_A$ = −25°C to +85°C for PM-7548ER/FR, and $T_A$ = 0°C to +70°C for PM-7548GP/HP/HPC, unless otherwise noted.

| PARAMETER | SYMBOL | CONDITIONS | PM-7548 MIN | PM-7548 TYP | PM-7548 MAX | UNITS |
|---|---|---|---|---|---|---|
| **STATIC ACCURACY** | | | | | | |
| Resolution | N | | 12 | — | — | Bits |
| Integral Nonlinearity (Note 1) | INL | | — | — | 1/2 | LSB |
| Differential Nonlinearity (Note 2) | DNL | PM-7548A/E/G | — | — | 1/2 | LSB |
| | | PM-7548B/F/H | — | — | 1 | |
| Gain Error (Note 3) | $G_{FSE}$ | $T_A$ = +25°C | | | | LSB |
| | | PM-7548A/E/G | — | — | 1 | |
| | | PM-7548B/F/H | — | — | 2 | |
| | | $T_A$ = Full Temperature Range | | | | |
| | | PM-7548A/E/G | — | — | 2 | |
| | | PM-7548B/F/H | — | — | 3 | |
| Gain Temperature Coefficient (Note 6) | $TCG_{FS}$ | | — | ±1 | ±5 | ppm/°C |
| Power Supply Rejection Ratio | PSRR | $T_A$ = +25°C | — | — | ±0.001 | %/% |
| | | $T_A$ = Full Temperature Range | — | — | ±0.002 | |
| Output Leakage Current (Notes 4, 5) | $I_{LKG}$ | $T_A$ = +25°C | — | ±0.5 | ±5 | nA |
| | | $T_A$ = Full Temperature Range | | | | |
| | | PM-7548A/B | — | ±12 | ±100 | |
| | | PM-7548E/F/G/H | — | — | ±25 | |
| Feedthrough Error (Note 6) | FT | $V_{REF}$ = $20V_{p-p}$ at $f$ = 10kHz All digital inputs LOW | — | — | 5 | $mV_{p-p}$ |
| Zero Scale Error (Notes 12, 13) | $I_{ZSE}$ | $T_A$ = +25°C | — | 0.002 | — | LSB |
| | | $T_A$ = Full Temperature Range | | | | |
| | | PM-7548A/B | — | 0.07 | — | |
| | | PM-7548E/F/G/H | — | 0.01 | — | |
| Input Resistance (Note 9) | $R_{IN}$ | | 7 | 11 | 15 | kΩ |
| **AC PERFORMANCE** | | | | | | |
| Output Current Settling-Time (Notes 6, 7, 8) | $t_s$ | $T_A$ = +25°C | — | — | 1 | μs |
| Digital to Analog Glitch Energy (Notes 6, 11) | Q | $V_{REF}$ = 0V $I_{OUT}$ Load = 100Ω $C_{Ext}$ = 13pF DAC register loaded alternately with all 0s and all 1s | — | — | 200 | nVs |