

ULTRA-LOW POWER 12-BIT IC DACs

FEATURES

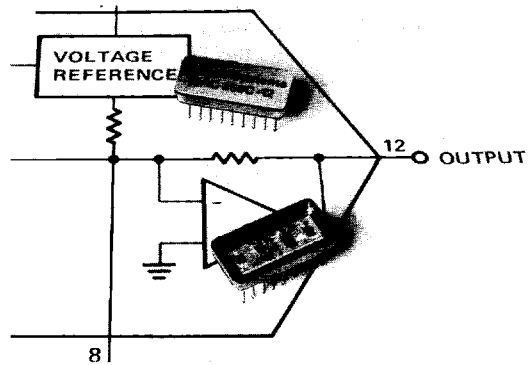
- Low power: 75mW versions
- -55°C to +125°C operation
- MIL-STD-883 or commercial processing
- Internal reference and output amplifier
- Hermetic 18-pin package

DESCRIPTION

Only DAC356 Series 12-bit digital-to-analog converters (DACs) offer minimum power consumption of available low cost DACs with internal references and output amplifiers. DAC356LP-12 operates switches, ladder network, internal reference and output amplifier on just 75mW typical, 90mW maximum. Each DAC is hermetically sealed in a compact 18-pin, single DIP width package.

Low power operation is accomplished using matched CMOS current switches. All models are factory trimmed to $\pm 0.1\%$ of full scale range (FSR) and may be further adjusted to an accuracy of $\pm 0.02\%$ or better (see APPLICATIONS INFORMATION).

The DAC356 Series uses complementary offset binary coding and delivers an output of $\pm 10V$ @5mA (consult factory for other ranges). Input logic is DTL, TTL, and CMOS compatible. Settling time for 1 LSB change to $\pm 0.02\%$ FSR is $5\mu s$; a full scale change settles in $50\mu s$. Gain drift is $\pm 30\text{ppm}/^\circ\text{C}$ FSR. Operation is from ± 13 to ± 18 volt power supplies

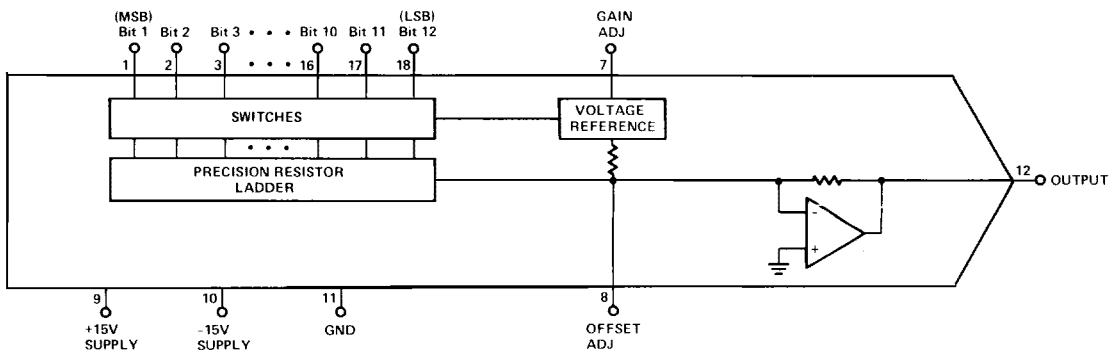


($\pm 15V$ nominal). The DAC356 is an ultra low power version of the DAC346 and DAC347.

DAC356 Series models are of particular advantage in systems that incorporate large numbers of DACs...where the accumulated power consumption can be significant. DAC356 Series allows minimum power supply size and expense. Related heat removal requirements are also diminished. And DAC356 Series' wide tolerance on power supply voltages (versus $\pm 3\%$ tolerance usual for higher power drain units) further eases supply needs. In systems applications of large or small DAC quantities, DAC356 Series' units offer increased reliability and wider operating temperature range.

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FUNCTIONAL DIAGRAM



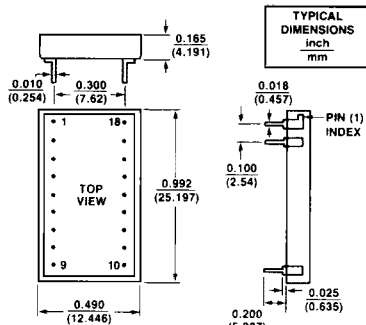
SPECIFICATIONS

(Typical @ +25°C and nominal supplies unless otherwise noted)

| | |
|----------------------------------|--|
| SERIES | DAC356 |
| TYPE | Fixed Ref, Volt Output |
| DIGITAL INPUT | |
| Resolution | 12-Bits |
| Coding | Complementary Offset Binary |
| Logic Compatibility ¹ | $V_{IH} = 2.4V$ min, $V_{IL} = 0.8V$ max |
| Input Current | $\pm 1\mu A$ max |
| ANALOG OUTPUT² | |
| Voltage @ Current | ± 10 Volts @ $\pm 5mA$ |
| Impedance | 0.1 Ω |
| Initial Accuracy ³ | $\pm 0.1\%$ F.S.R. |
| Output Protection | Short Circuit to GND (Continuous) |
| REFERENCE | Internal |
| STATIC PERFORMANCE | |
| Integral Linearity | $\pm 0.012\%$ F.S.R. max |
| Differential Linearity | $\pm \frac{1}{2}$ LSB typ, ± 1 LSB max |
| End Point Accuracy | $\pm 0.1\%$ max |
| DYNAMIC PERFORMANCE | |
| Settling Time for 1 LSB | |
| Change to $\pm 0.02\%$ F.S.R. | 5 μS |
| Settling Time for Full Scale | |
| Change to $\pm 0.02\%$ F.S.R. | 50 μS |
| STABILITY | |
| Gain | $\pm 30ppm/^{\circ}C$ F.S.R. (max) |
| Offset | $\pm 10ppm/^{\circ}C$ F.S.R. (max) |
| Differential Linearity | $\pm 5ppm/^{\circ}C$ F.S.R. (max) |
| POWER REQUIREMENTS | |
| +15V Supply Voltage | +13 to +16 Volts |
| +15V Supply Current | 2.5mA, typ; 3.0mA, max |
| -15V Supply Voltage | -13 to -16 Volts |
| -15V Supply Current | 2.5 mA, typ; 3.0mA, max |
| Rejection Ratio | 0.002%/ %max |
| TEMPERATURE RANGE | |
| Operating | -55°C to +125°C B Version 0°C to 70°C C Version |
| MECHANICAL | |

Case Style

Metal



Pin 1 is marked by a dot on the top of the package.

Pin Assignments

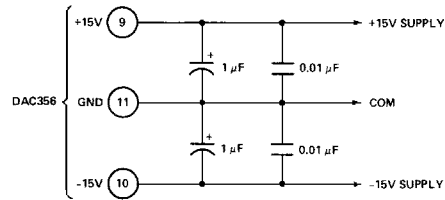
| PIN | FUNCTION | PIN | FUNCTION |
|-----|-------------|-----|--------------|
| 1 | BIT 1 (MSB) | 18 | BIT 12 (LSB) |
| 2 | BIT 2 | 17 | BIT 11 |
| 3 | BIT 3 | 16 | BIT 10 |
| 4 | BIT 4 | 15 | BIT 9 |
| 5 | BIT 5 | 14 | BIT 8 |
| 6 | BIT 6 | 13 | BIT 7 |
| 7 | GAIN ADJ | 12 | OUTPUT |
| 8 | OFFSET ADJ | 11 | GND |
| 9 | +15V | 10 | -15V |

NOTES:

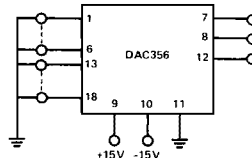
- Logic input should not exceed +15.0V or be below -0.3V.
- Full scale range and offset voltage are externally adjustable. See APPLICATIONS INFORMATION.
- Can be adjusted to $\pm 0.02\%$ F.S.R. or better. See OPTIONAL OFFSET AND GAIN ADJUSTMENTS in APPLICATIONS INFORMATION.

APPLICATIONS INFORMATION

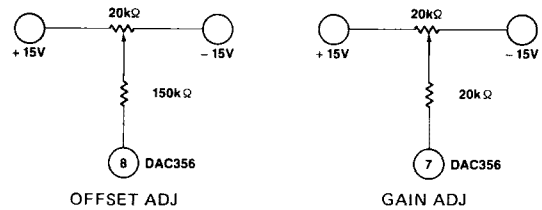
RECOMMENDED POWER SUPPLY BYPASS CIRCUIT



RECOMMENDED BURN-IN CIRCUIT (Standard for MIL-STD-883 models)



OPTIONAL OFFSET AND GAIN ADJUSTMENT CIRCUITS



Quick Calibration Procedure

- Apply a 0 1 1 ... 1 1 1 input code and set the OFFSET ADJ pot for zero output.
- Apply a 1 1 1 ... 1 1 1 input code and set the GAIN ADJ pot for -F.S. output.

TRANSFER CHARACTERISTICS

| Complementary Offset Binary Input Code | | | | | | | | | | | | Analog Output | |
|--|---|---|---|---|---|---|---|---|----|----|-----|---------------|----------|
| MSB | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | LSB | Weighting | Voltage |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | -F.S. | -10.000V |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 LSB | -0.0048V |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | ZERO | +0.000V |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | +F.S. -1LSB | +9.9952V |

CAUTION: ESD (Electro-Static Discharge) sensitive device. Permanent damage may occur when unconnected devices are subjected to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Protective foam should be discharged to the destination socket before devices are removed. Devices should be handled at static safe workstations only. Unused digital inputs must be grounded or tied to the logic supply voltage. Unless otherwise noted, the supply voltage at any digital input should never exceed the supply voltage by more than 0.5 volts or go below -0.5 volts. If this condition cannot be maintained, limit input current on digital inputs by using series resistors or contact Hybrid Systems for technical assistance.

ORDERING INFORMATION

| MODEL | DESCRIPTION |
|--------------|--------------------------------|
| DAC356LPC-12 | Comm, Ultra-Low Power, 12-Bits |
| DAC356LPB-12 | MIL, Ultra-Low Power, 12-Bits |

↑ C models are commercially processed.
B models are processed to MIL-STD-883 Rev. C, Level B

Specifications subject to change without notice.