**FEATURES**

- Complete 18-Bit DAC Including an Internal Reference and an Output Amplifier
- Input Latches Assist in Microprocessor Interface
- Low Nonlinearity:
  - ±1/2 LSB 18-Bit Differential
  - ±1/2 LSB 18-Bit Integral
- 18-Bit Monotonicity
- Low Power: 600 mW Typ
- High Stability Over Time and Temperature

**DESCRIPTION**

The SP9380 is a complete voltage output DAC offering 18-bit resolution (1 part in 262,144) and true 18-bit accuracy in a component size hybrid package. The SP9380 comes complete with input latches, an internal reference and a very low noise output amplifier. The analog output ranges are pin programmable for 0 to +5V, 0 to +10V, ±5V and ±10V.

Using decoding techniques and ultrastable resistor technology, the SP9380 exhibits typical nonlinearities of ±0.5 LSB (differential and integral) and high stability over time and temperature. The power dissipation is 600mW typical.

The device is available for either commercial (0°C to +70°C) or military (−55°C to +125°C) applications in a 32-pin triple DIP.
### SPECIFICATIONS
(Typical @25°C and rated supplies.)

<table>
<thead>
<tr>
<th>MODEL</th>
<th>SP9380-18</th>
<th>SP9380-16</th>
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</thead>
<tbody>
<tr>
<td>RESOLUTION</td>
<td>18-Bits</td>
<td></td>
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</table>

#### DIGITAL INPUTS
- **Unipolar Coding**: Binary
- **Bipolar Coding**: Offset Binary
- **Logic**: TTL CMOS
- **Compatibility**
- **Input Leakage Current**
  - ±1.0μA
- **Data Setup**
  - 150 nsec
- **Latch Width**
  - 170 nsec
- **Data Hold**
  - 100 nsec

#### ACCURACY
- **Differential Nonlinearity**
  - ±0.0002% FSR typ.
  - ±0.0004% FSR max.
- **Integral Nonlinearity**
  - ±0.0002% FSR typ.
  - ±0.0004% FSR max.
- **Monotonicity**
  - 18-Bits
  - 16-Bits

#### INITIAL ERRORS
- **Gain**: ±0.01% typ. ±0.10% max
- **Offset**
  - Unipolar: ±0.01% typ. ±0.05% max
  - Bipolar: ±0.01% typ. ±0.05% max

#### STABILITY (ppm/°C)
- **Differential Nonlinearity**: ±0.1 typ. 0.4 max
- **Integral Nonlinearity**: ±0.2 typ. ±0.4 max
- **Gain**: ±3 typ. ±7 max
- **Offset**
  - Unipolar: ±0.1 typ. ±0.5 max
  - Bipolar: ±1 typ. ±4 max

#### STABILITY LONG TERM
- **Differential Linearity**: 16ppm/168hrs. @25°C
  - 1ppm/1000hrs. @25°C
- **Gain**: 15ppm/1000hrs. @25°C
- **Offset**: 15ppm/1000hrs. @25°C
- **WARM-UP TIME**: 10 minutes

#### DYNAMIC PERFORMANCE
- **Analog Settling Time (1/2 LSB)**
  - 10 Volt Step: 30μsec
  - 20 Volt Step: 50μsec
  - LSB Change: 8μsec
  - Slew Rate: 2V/μsec
- **Major Carry Transition Settling to 0.006% FSR Strobbed**: 10μS

#### REFERENCE
- **Voltage**: +10V (internal)
- **Drift**: 5ppm/°C
- **Stability**: 1 mV/year

#### ANALOG OUTPUT
- **Voltage**: ±5V, ±10V, ±5V, ±10V
- **Noise (Wideband)**
  - 0.0004% FSR p-p

Continued on next page.
SPECIFICATION (Continued)

POWER SUPPLY REQUIREMENTS

+15V DC (±5%) 30mA max
-15V DC (±5%) 20mA max
Power Dissipation 600mW
Supply Rejection ±0.0001%/°C

TEMPERATURE RANGE

Operating -55 to +125°C
Storage -65 to +150°C
PACKAGE 32 Pin Metal

NOTES: 1. Digital input must not exceed supply voltage or go below 0.5V. 2. VIL 0.4, VH L 3.2.
3. Time that data must be stable before latch control goes to 0. 4. Time that data must be stable after latch control goes to 0.
5. Integral Linearity, for this product, is measured as the arithmetic mean value of the magnitudes of the greatest positive deviation and the greatest negative deviation from the theoretical value for any given input combination.

PACKAGE OUTLINE

PIN DESIGNATIONS

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>REF OUT</td>
<td>32</td>
<td>ANA GND</td>
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<tr>
<td>2</td>
<td>GAIN ADJUST</td>
<td>31</td>
<td>OUTPUT</td>
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<tr>
<td>3</td>
<td>+15V</td>
<td>30</td>
<td>SUMMING JUNCTION</td>
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<tr>
<td>4</td>
<td>-15V</td>
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<td>5</td>
<td>DIG GND</td>
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<td>10V SPAN</td>
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<td>6</td>
<td>LEN</td>
<td>27</td>
<td>BIPOLAR OFFSET</td>
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<td>7</td>
<td>HEN</td>
<td>26</td>
<td>REF IN</td>
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<tr>
<td>8</td>
<td>DBO (LSB)</td>
<td>25</td>
<td>DB17 (MSB)</td>
</tr>
<tr>
<td>9</td>
<td>DB1</td>
<td>24</td>
<td>DB16</td>
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<tr>
<td>10</td>
<td>DB2</td>
<td>23</td>
<td>DB15</td>
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<td>DB3</td>
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<td>DB14</td>
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<tr>
<td>16</td>
<td>DB8</td>
<td>17</td>
<td>DB9</td>
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</table>

OPERATING INSTRUCTIONS

POWER SUPPLY AND GROUNDING CONSIDERATIONS

Clearly, the management of IR drops, power supply noise, thermal stability and environmental noise become critical issues when designing an 18-bit system.

To optimize the absolute accuracy of a high resolution system, the following rules of thumb have to be followed:

1. Selection of low noise operation power supplies.
2. Proper decoupling of the supplies at the DAC using 10μF ceramic disk capacitor.
3. Usage of the “hot node” grounding technique.
4. “Kelvin-sensed-output” connection of the DAC to the load.

Consult factory for application information.

ORDERING INFORMATION

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<tr>
<th>MODEL</th>
<th>RANGE</th>
<th>SCREENING</th>
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<tr>
<td>SP9380C-18</td>
<td>0 Cto70</td>
<td>–</td>
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<td>SP9380C-16</td>
<td>0 Cto70</td>
<td>–</td>
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<tr>
<td>SP9380B-18</td>
<td>-55 to +125 C</td>
<td>MIL-STD-883C</td>
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