LM160/LM360
High Speed Differential Comparator

General Description
The LM160/LM360 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the µA760/µA760C, for which it is a pin-for-pin replacement. The device has been optimized for greater speed, input impedance and fan-out, and lower input offset voltage. Typically delay varies only 3 ns for overdrive variations of 5 mV to 400 mV.
Complementary outputs having minimum skew are provided. Applications involve high speed analog to digital convertors and zero-crossing detectors in disk file systems.

Features
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- High input impedance
- Low speed variation with overdrive variation
- Fan-out of 4
- Low input offset voltage
- Series 74 TTL compatible

Connection Diagrams

Metal Can Package

Dual-In-Line Package

Order Number LM160H/883 (Note 1)
See NS Package Number H08C

Order Number LM360M, LM360MX or LM360N
See NS Package Number M08A or N08E

Note 1: Also available in SMD# 5962-8767401
### Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

- **Positive Supply Voltage**: +8V
- **Negative Supply Voltage**: −8V
- **Peak Output Current**: 20 mA
- **Differential Input Voltage**: ±5V
- **Input Voltage**: $V^+ \geq V_{IN} \geq V^-$
- **ESD Tolerance** (Note 9): 1600V
- **Operating Temperature Range**:
  - **LM160**: −55˚C to +125˚C
  - **LM360**: 0˚C to +70˚C
- **Storage Temperature Range**: −65˚C to +150˚C
- **Lead Temperature** (Soldering, 10 sec.): 260˚C
- **Soldering Information**:
  - **Dual-In-Line Package**: Soldering (10 seconds) 260˚C
  - **Small Outline Package**: Vapor Phase (60 seconds) 215˚C
  - **Infrared (15 seconds)**: 220˚C
- **See AN-450 “Surface Mounting Methods and Their Effect on Product Reliability” for other methods of soldering surface mount devices.**

### Electrical Characteristics

$$(T_{MIN} \leq T_A \leq T_{MAX})$$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Conditions</td>
<td>Supply Voltage $V_{CC^+}$</td>
<td>4.5</td>
<td>5</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Supply Voltage $V_{CC^-}$</td>
<td>−4.5</td>
<td>−5</td>
<td>−6.5</td>
<td>V</td>
</tr>
<tr>
<td>Input Offset Voltage</td>
<td>$R_S \leq 200\Omega$</td>
<td>2</td>
<td>5</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Input Offset Current</td>
<td>0.5</td>
<td>3</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>5</td>
<td>20</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Resistance (Either Output)</td>
<td>$V_{OUT} = V_{OH}$</td>
<td>100</td>
<td>Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time</td>
<td>$T_A = 25˚C, V_S = \pm 5V$ (Notes 2, 7)</td>
<td>13</td>
<td>25</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$T_A = 25˚C, V_S = \pm 5V$ (Notes 3, 7)</td>
<td>12</td>
<td>20</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$T_A = 25˚C, V_S = \pm 5V$ (Notes 4, 7)</td>
<td>14</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response Time Difference between Outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(t_{pd} of +V_{IN1}) - (t_{pd} of −V_{IN2})$</td>
<td>$T_A = 25˚C$ (Notes 2, 7)</td>
<td>2</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(t_{pd} of +V_{IN2}) - (t_{pd} of −V_{IN1})$</td>
<td>$T_A = 25˚C$ (Notes 2, 7)</td>
<td>2</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(t_{pd} of +V_{IN1}) - (t_{pd} of +V_{IN2})$</td>
<td>$T_A = 25˚C$ (Notes 2, 7)</td>
<td>2</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$(t_{pd} of −V_{IN1}) - (t_{pd} of −V_{IN2})$</td>
<td>$T_A = 25˚C$ (Notes 2, 7)</td>
<td>2</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Resistance</td>
<td>$f = 1 MHz$</td>
<td>17</td>
<td>kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>$f = 1 MHz$</td>
<td>3</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Temperature Coefficient of Input Offset Voltage</td>
<td>$R_S = 50\Omega$</td>
<td>8</td>
<td>µV/˚C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Temperature Coefficient of Input Offset Current</td>
<td>7</td>
<td>nA/˚C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Mode Input Voltage Range</td>
<td>$V_S = \pm 6.5V$</td>
<td>±4</td>
<td>±4.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Differential Input Voltage Range</td>
<td>±5</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output High Voltage (Either Output)</td>
<td>$I_{OUT} = −320\mu A, V_S = \pm 4.5V$</td>
<td>2.4</td>
<td>3</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Output Low Voltage (Either Output)</td>
<td>$I_{SINK} = 6.4\ mA$</td>
<td>0.25</td>
<td>0.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Positive Supply Current</td>
<td>$V_S = \pm 6.5V$</td>
<td>18</td>
<td>32</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Negative Supply Current</td>
<td>$V_S = \pm 6.5V$</td>
<td>−9</td>
<td>−16</td>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>

**Note 2:** Response time measured from the 50% point of a 30 mVp-p 10 MHz sinusoidal input to the 50% point of the output.

**Note 3:** Response time measured from the 50% point of a 2 Vp-p 10 MHz sinusoidal input to the 50% point of the output.
Electrical Characteristics (Continued)

Note 4: Response time measured from the start of a 100 mV input step with 5 mV overdrive to the time when the output crosses the logic threshold.

Note 5: Typical thermal impedances are as follows:

- Cavity DIP (J): θJA 135˚C/W
- Header (H): θJA 165˚C/W (Still Air)
- Molded DIP (N): θJA 130˚C/W
- θJC 25˚C/W

Note 6: The device may be damaged if used beyond the maximum ratings.

Note 7: Measurements are made in AC Test Circuit, Fanout = 1


Note 9: Human body model, 1.5 kΩ in series with 100 pF.

Typical Performance Characteristics

Offset Voltage

Input Current vs Ambient Temperature

Input Characteristics

Supply Current vs Ambient Temperature

Propagation Delay vs Ambient Temperature

Delay of Output 1 With Respect to Output 2 vs Ambient Temperature

Common-Mode Pulse Response
AC Test Circuit

\[ V_{IN} = \pm 50 \text{ mV} \quad \text{FANOUT}=1 \quad \text{FANOUT}=4 \]
\[ V^+ = +5V \quad R=2.4k \quad R=630\Omega \]
\[ V^- = -5V \quad C=15 \text{ pF} \quad C=30 \text{ pF} \]
Physical Dimensions inches (millimeters) unless otherwise noted

Metal Can Package (H)
Order Number LM160H/883
NS Package Number H08C

Molded Dual-In-Line Package (M)
Order Number LM360M or LM360MX
NS Package Number M08A
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