

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 $\mu A760/\mu A760C$, 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 converters and zero-crossing detectors in disk file systems.

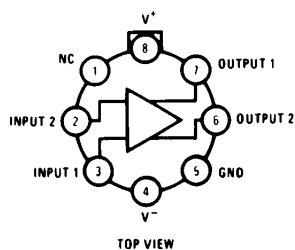
Features

- Guaranteed high speed
- 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

20 ns max

Connection Diagrams

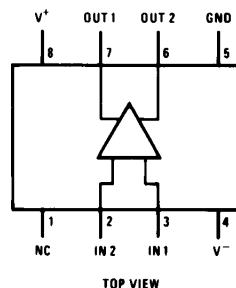
Metal Can Package



TL/H/5707-4

Order Number LM160H/883* or LM360H
See NS Package Number H08C

Dual-In-Line Package

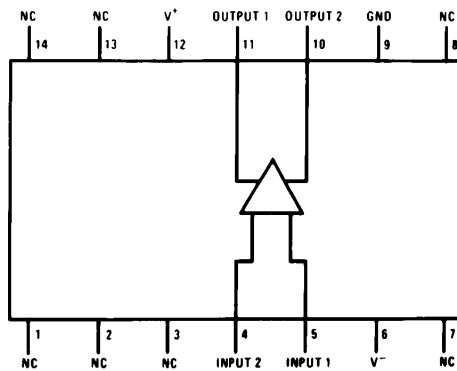


TOP VIEW

TL/H/5707-5

Order Number LM160J/883*,
LM360M or LM360N
See NS Package Number J08A, M08A or N08E

Dual-In-Package



TOP VIEW

TL/H/5707-6

Order Number LM160J-14/883*
See NS Package Number J14A

*Also available in SMD # 5962-8767401

Absolute Maximum Ratings (Note 5)

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

(Note 7)

| | |
|----------------------------|----------------------------|
| 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 8) | 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 ($T_{MIN} \leq T_A \leq T_{MAX}$)

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|------|------|------|------------------|
| Operating Conditions | | | | | |
| Supply Voltage V_{CC}^+ | | 4.5 | 5 | 6.5 | V |
| Supply Voltage V_{CC}^- | | −4.5 | −5 | −6.5 | V |
| Input Offset Voltage | $R_S \leq 200\Omega$ | | 2 | 5 | mV |
| Input Offset Current | | | 0.5 | 3 | μA |
| Input Bias Current | | | 5 | 20 | μA |
| Output Resistance (Either Output) | $V_{OUT} = V_{OH}$ | | 100 | | Ω |
| Response Time | $T_A = 25^\circ C, V_S = \pm 5V$ (Notes 1, 6) | | 13 | 25 | ns |
| | $T_A = 25^\circ C, V_S = \pm 5V$ (Notes 2, 6) | | 12 | 20 | ns |
| | $T_A = 25^\circ C, V_S = \pm 5V$ (Notes 3, 6) | | 14 | | ns |
| Response Time Difference between Outputs | | | | | |
| $(t_{pd} \text{ of } +V_{IN1}) - (t_{pd} \text{ of } -V_{IN2})$ | $T_A = 25^\circ C$ (Notes 1, 6) | | 2 | | ns |
| $(t_{pd} \text{ of } +V_{IN2}) - (t_{pd} \text{ of } -V_{IN1})$ | $T_A = 25^\circ C$ (Notes 1, 6) | | 2 | | ns |
| $(t_{pd} \text{ of } +V_{IN1}) - (t_{pd} \text{ of } +V_{IN2})$ | $T_A = 25^\circ C$ (Notes 1, 6) | | 2 | | ns |
| $(t_{pd} \text{ of } -V_{IN1}) - (t_{pd} \text{ of } -V_{IN2})$ | $T_A = 25^\circ C$ (Notes 1, 6) | | 2 | | ns |
| Input Resistance | $f = 1 \text{ MHz}$ | | 17 | | k Ω |
| Input Capacitance | $f = 1 \text{ MHz}$ | | 3 | | pF |
| Average Temperature Coefficient of Input Offset Voltage | $R_S = 50\Omega$ | | 8 | | $\mu V/^\circ C$ |
| Average Temperature Coefficient of Input Offset Current | | | 7 | | nA/°C |
| Common Mode Input Voltage Range | $V_S = \pm 6.5V$ | ±4 | ±4.5 | | V |
| Differential Input Voltage Range | | ±5 | | | V |
| Output High Voltage (Either Output) | $I_{OUT} = -320 \mu A, V_S = \pm 4.5V$ | 2.4 | 3 | | V |
| Output Low Voltage (Either Output) | $I_{SINK} = 6.4 \text{ mA}$ | | 0.25 | 0.4 | V |
| Positive Supply Current | $V_S = \pm 6.5V$ | | 18 | 32 | mA |
| Negative Supply Current | $V_S = \pm 6.5V$ | | −9 | −16 | mA |

Note 1: Response time measured from the 50% point of a 30 mVp-p 10 MHz sinusoidal input to the 50% point of the output.

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

Note 3: 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 4: Typical thermal impedances are as follows:

| | | | | | | |
|-----------------|---------------|---------|------------|---------------|---------|-----------------------|
| Cavity DIP (J): | θ_{JA} | 135°C/W | Header (H) | θ_{JA} | 165°C/W | (Still Air) |
| Molded DIP (N): | θ_{JA} | 130°C/W | | | 67°C/W | (400 LF/min Air Flow) |
| | | | | θ_{JC} | 25°C/W | |

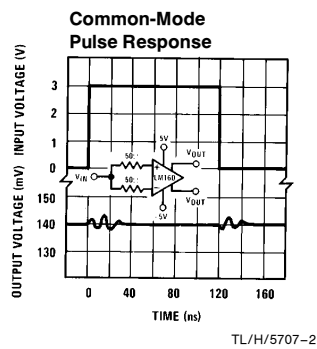
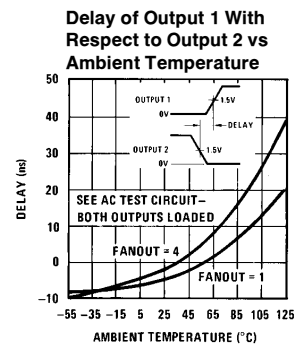
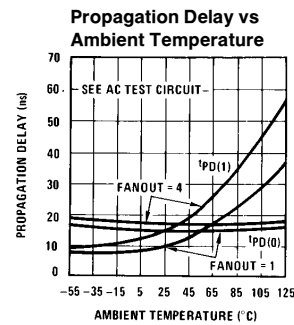
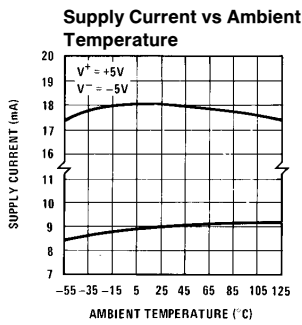
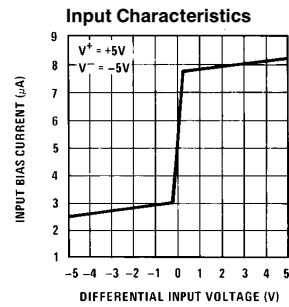
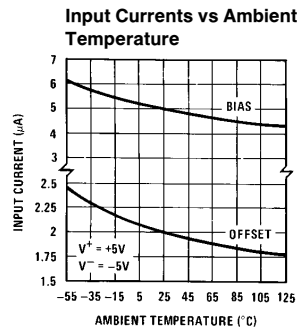
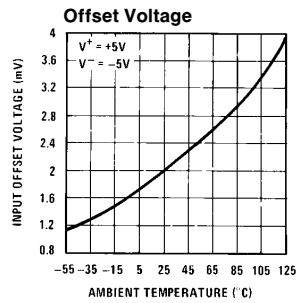
Note 5: The device may be damaged if used beyond the maximum ratings.

Note 6: Measurements are made in AC Test Circuit, Fanout = 1

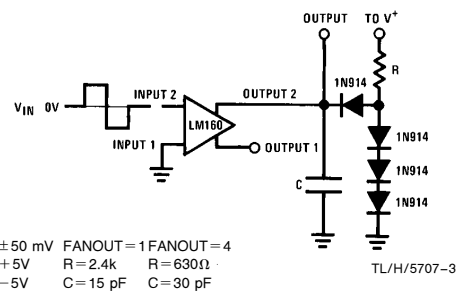
Note 7: Refer to RETS 160X for LM160H, LM160J-14 and LM160J military specifications.

Note 8: Human body model, 1.5 k Ω in series with 100 pF.

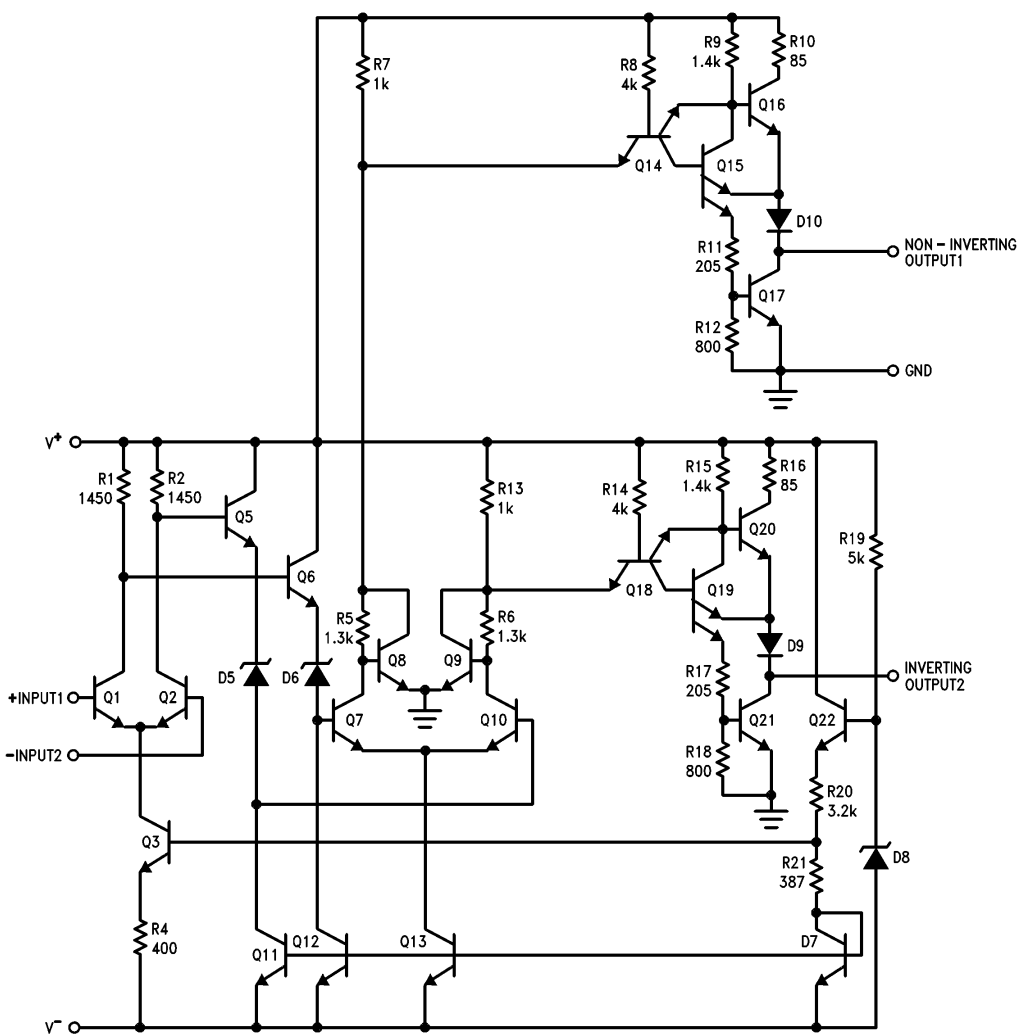
Typical Performance Characteristics



AC Test Circuit

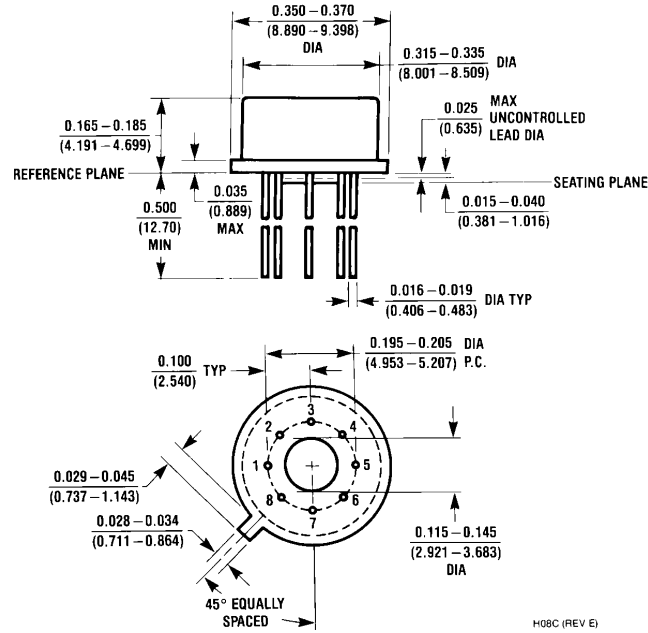


Schematic Diagram

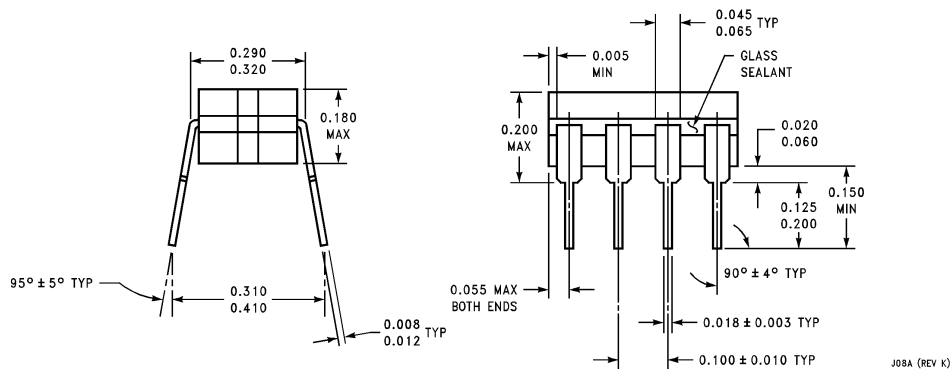
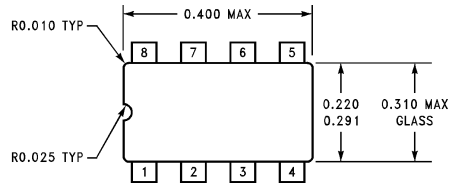


TL/H/5707-1

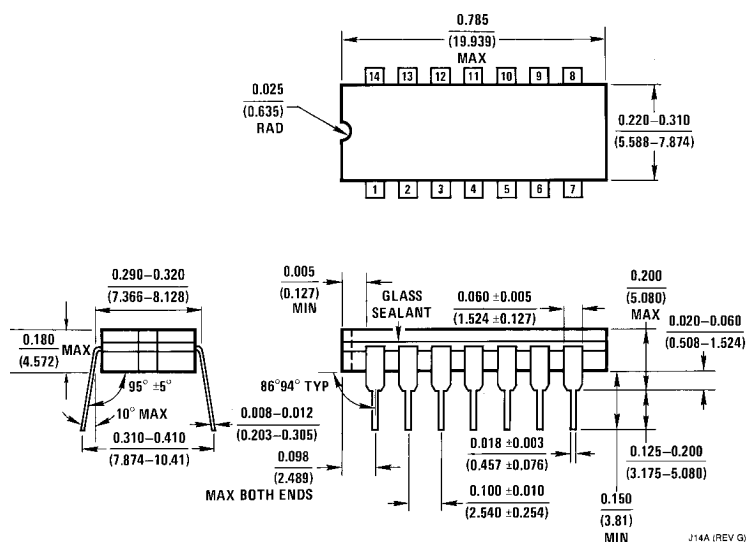
Physical Dimensions inches (millimeters)



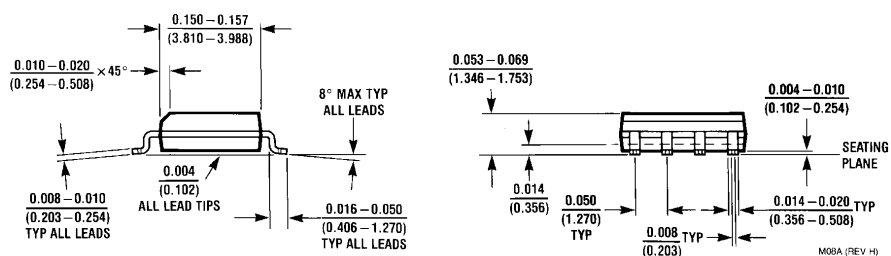
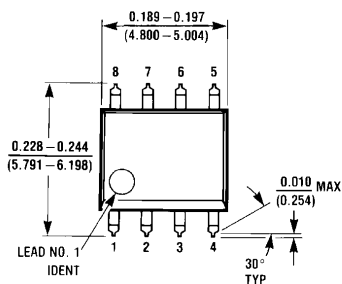
Metal Can Package (H)
Order Number LM160H/883 or LM360H
NS Package Number H08C



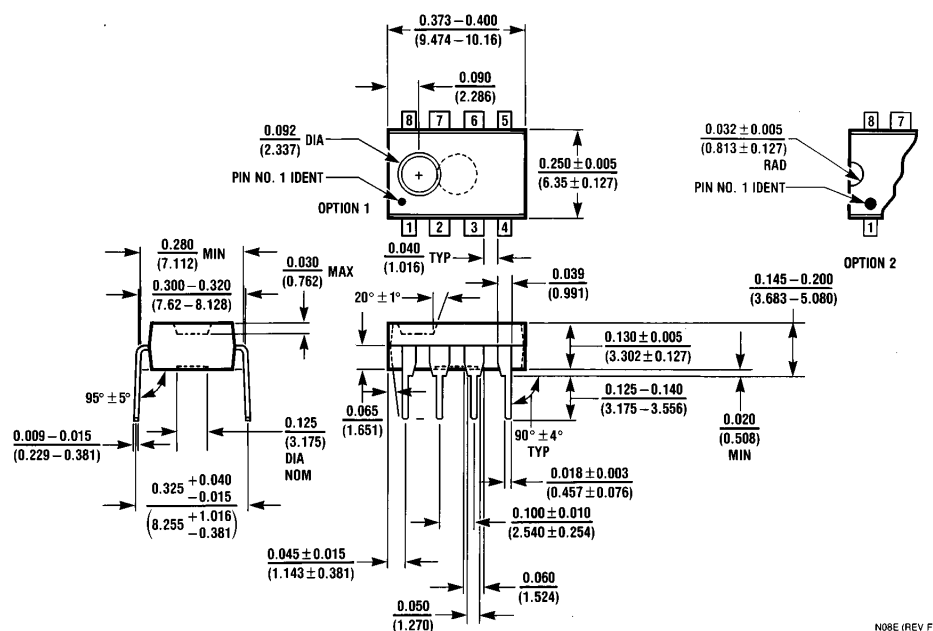
Dual In-Line Package (J)
Order Number LM160J/883
NS Package Number J08A

Physical Dimensions inches (millimeters) (Continued)

Ceramic Dual-In-Line Package (J)
Order Number LM160J-14/883
NS Package Number J14A



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

Physical Dimensions inches (millimeters) (Continued)

Molded Dual-In-Line Package (N)
Order Number LM360N
NS Package Number N08E

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