

LM161/LM261/LM361

High Speed Differential Comparators

General Description

The LM161/LM261/LM361 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the SE529/NE529 for which it is a pin-for-pin replacement. The device has been optimized for greater speed performance and lower input offset voltage. Typically delay varies only 3 ns for over-drive variations of 5 mV to 500 mV. It may be operated from op amp supplies ($\pm 15V$).

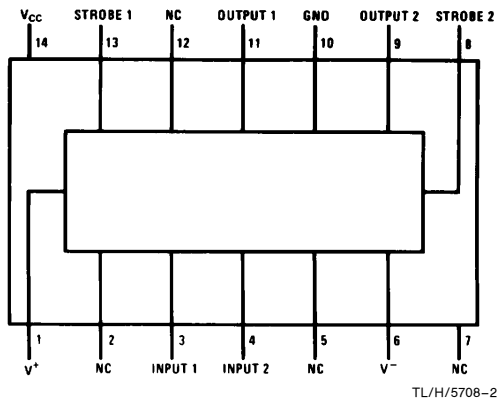
Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

Features

- Independent strobes
- Guaranteed high speed 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies $\pm 15V$
- Low speed variation with overdrive variation
- Low input offset voltage
- Versatile supply voltage range

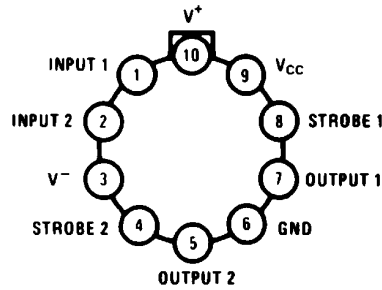
Connection Diagrams

Dual-In-Line Package



TL/H/5708-2

Metal Can Package



TL/H/5708-3

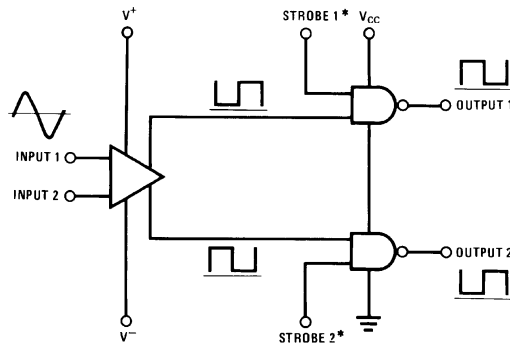
Order Number LM161H/883*, or LM361H
See NS Package Number H10C

Top View

Order Number LM161J, LM161J/883*,
LM361M or LM361N
See NS Package Number J14A, M14A or N14A

*Also available per SMD #5962-8757203

Logic Diagram



*Output is low when current is drawn from strobe pin.

TL/H/5708-4

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications. (Note 4)

| | |
|------------------------------------|---|
| Positive Supply Voltage, V^+ | +16V |
| Negative Supply Voltage, V^- | -16V |
| Gate Supply Voltage, V_{CC} | +7V |
| Output Voltage | +7V |
| Differential Input Voltage | $\pm 5V$ |
| Input Common Mode Voltage | $\pm 6V$ |
| Power Dissipation | 600 mW |
| Storage Temperature Range | -65°C to +150°C |
| Operating Temperature Range | T_{MIN} T_{MAX} |
| LM161 | -55°C to +125°C |
| LM261 | -25°C to +85°C |
| LM361 | 0°C to +70°C |
| Lead Temp. (Soldering, 10 seconds) | 260°C |
| For Any Device Lead Below V^- | 0.3V |

Operating Conditions

| | Min | Typ | Max |
|--------------------------|-------|-----|-------|
| Supply Voltage V^+ | | | |
| LM161/LM261 | 5V | | 15V |
| LM361 | 5V | | 15V |
| Supply Voltage V^- | | | |
| LM161/LM261 | -6V | | -15V |
| LM361 | -6V | | -15V |
| Supply Voltage V_{CC} | | | |
| LM161/LM261 | 4.5V | 5V | 5.5V |
| LM361 | 4.75V | 5V | 5.25V |
| ESD Tolerance (Note 5) | | | 1600V |
| 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 ($V^+ = +10V$, $V_{CC} = +5V$, $V^- = -10V$, $T_{MIN} \leq T_A \leq T_{MAX}$, unless noted)

| Parameter | Conditions | Limits | | | | | | Units |
|--|--|-------------|-----|------|-------|-----|------|--------------------|
| | | LM161/LM261 | | | LM361 | | | |
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | | | 1 | 3 | | 1 | 5 | mV |
| Input Bias Current | $T_A = 25^\circ C$ | | 5 | 20 | | 10 | 30 | μA μA |
| Input Offset Current | $T_A = 25^\circ C$ | | 2 | 3 | | 2 | 5 | μA μA |
| Voltage Gain | $T_A = 25^\circ C$ | | 3 | | | 3 | | V/mV |
| Input Resistance | $T_A = 25^\circ C$, $f = 1$ kHz | | 20 | | | 20 | | k Ω |
| Logical "1" Output Voltage | $V_{CC} = 4.75V$, $I_{SOURCE} = -0.5$ mA | 2.4 | 3.3 | | 2.4 | 3.3 | | V |
| Logical "0" Output Voltage | $V_{CC} = 4.75V$, $I_{SINK} = 6.4$ mA | | | 0.4 | | | 0.4 | V |
| Strobe Input "1" Current (Output Enabled) | $V_{CC} = 5.25V$, $V_{STROBE} = 2.4V$ | | | 200 | | | 200 | μA |
| Strobe Input "0" Current (Output Disabled) | $V_{CC} = 5.25V$, $V_{STROBE} = 0.4V$ | | | -1.6 | | | -1.6 | mA |
| Strobe Input "0" Voltage | $V_{CC} = 4.75V$ | | | 0.8 | | | 0.8 | V |
| Strobe Input "1" Voltage | $V_{CC} = 4.75V$ | 2 | | | 2 | | | V |
| Output Short Circuit Current | $V_{CC} = 5.25V$, $V_{OUT} = 0V$ | -18 | | -55 | -18 | | -55 | mA |

Electrical Characteristics (Continued)

($V^+ = +10V$, $V_{CC} = +5V$, $V^- = -10V$, $T_{MIN} \leq T_A \leq T_{MAX}$, unless noted)

| Parameter | Conditions | Limits | | | | | | Units |
|--|---|-------------|-----|-----|-------|-----|-----|-------|
| | | LM161/LM261 | | | LM361 | | | |
| | | Min | Typ | Max | Min | Typ | Max | |
| Supply Current I^+ | $V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $-55^\circ C \leq T_A \leq 125^\circ C$ | | | 4.5 | | | | mA |
| Supply Current I^+ | $V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $0^\circ C \leq T_A \leq 70^\circ C$ | | | | | 5 | | mA |
| Supply Current I^- | $V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $-55^\circ C \leq T_A \leq 125^\circ C$ | | | 10 | | | | mA |
| Supply Current I^- | $V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $0^\circ C \leq T_A \leq 70^\circ C$ | | | | | 10 | | mA |
| Supply Current I_{CC} | $V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $-55^\circ C \leq T_A \leq 125^\circ C$ | | | 18 | | | | mA |
| Supply Current I_{CC} | $V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $0^\circ C \leq T_A \leq 70^\circ C$ | | | | | 20 | | mA |
| Transient Response | $V_{IN} = 50$ mV overdrive (Note 3) | | | | | | | |
| Propagation Delay Time ($t_{pd(0)}$) | $T_A = 25^\circ C$ | | 14 | 20 | | 14 | 20 | ns |
| Propagation Delay Time ($t_{pd(1)}$) | $T_A = 25^\circ C$ | | 14 | 20 | | 14 | 20 | ns |
| Delay Between Output A and B | $T_A = 25^\circ C$ | | 2 | 5 | | 2 | 5 | ns |
| Strobe Delay Time ($t_{pd(0)}$) | $T_A = 25^\circ C$ | | 8 | | | 8 | | ns |
| Strobe Delay Time ($t_{pd(1)}$) | $T_A = 25^\circ C$ | | 8 | | | 8 | | ns |

Note 1: The device may be damaged by use beyond the maximum ratings.

Note 2: Typical thermal impedances are as follows:

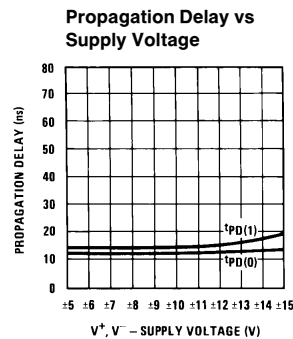
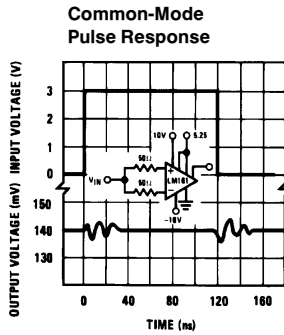
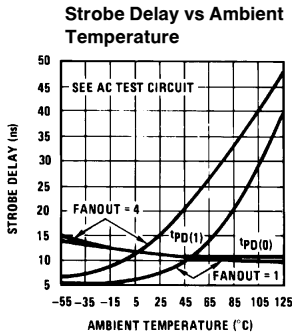
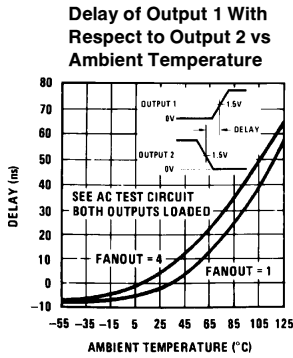
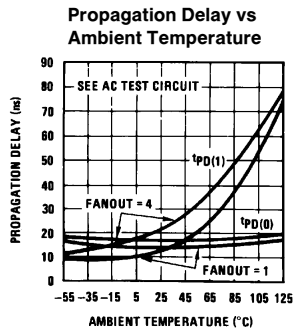
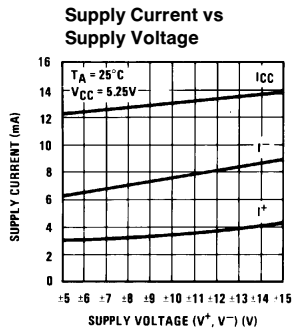
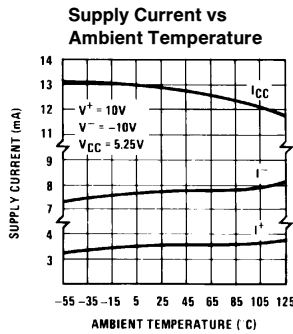
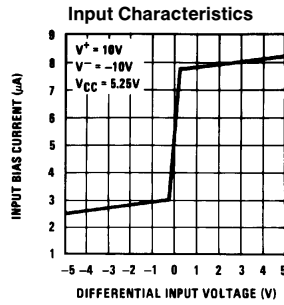
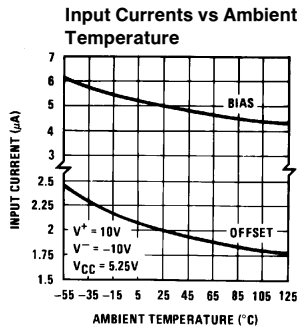
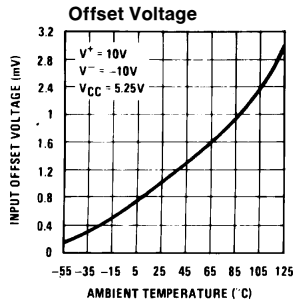
| | H Package | J Package | N Package |
|---------------|--|-----------|-----------|
| θ_{JA} | 165°C/W (Still Air) 67°C/W (400 LF/Min Air Flow) | 112°C/W | 105°C/W |
| θ_{JC} | 25°C/W | | |

Note 3: Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

Note 4: Refer to RETS161X for LM161H and LM161J military specifications.

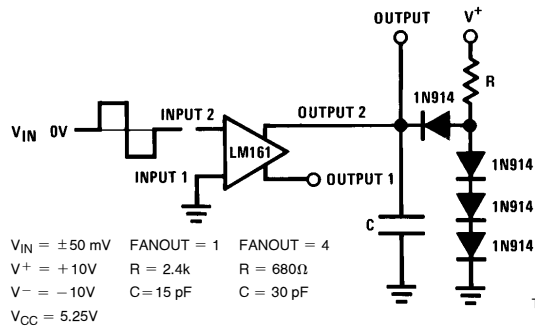
Note 5: Human body model, 1.5 k Ω in series with 100 pF.

Typical Performance Characteristics



TL/H/5708-7

AC Test Circuit

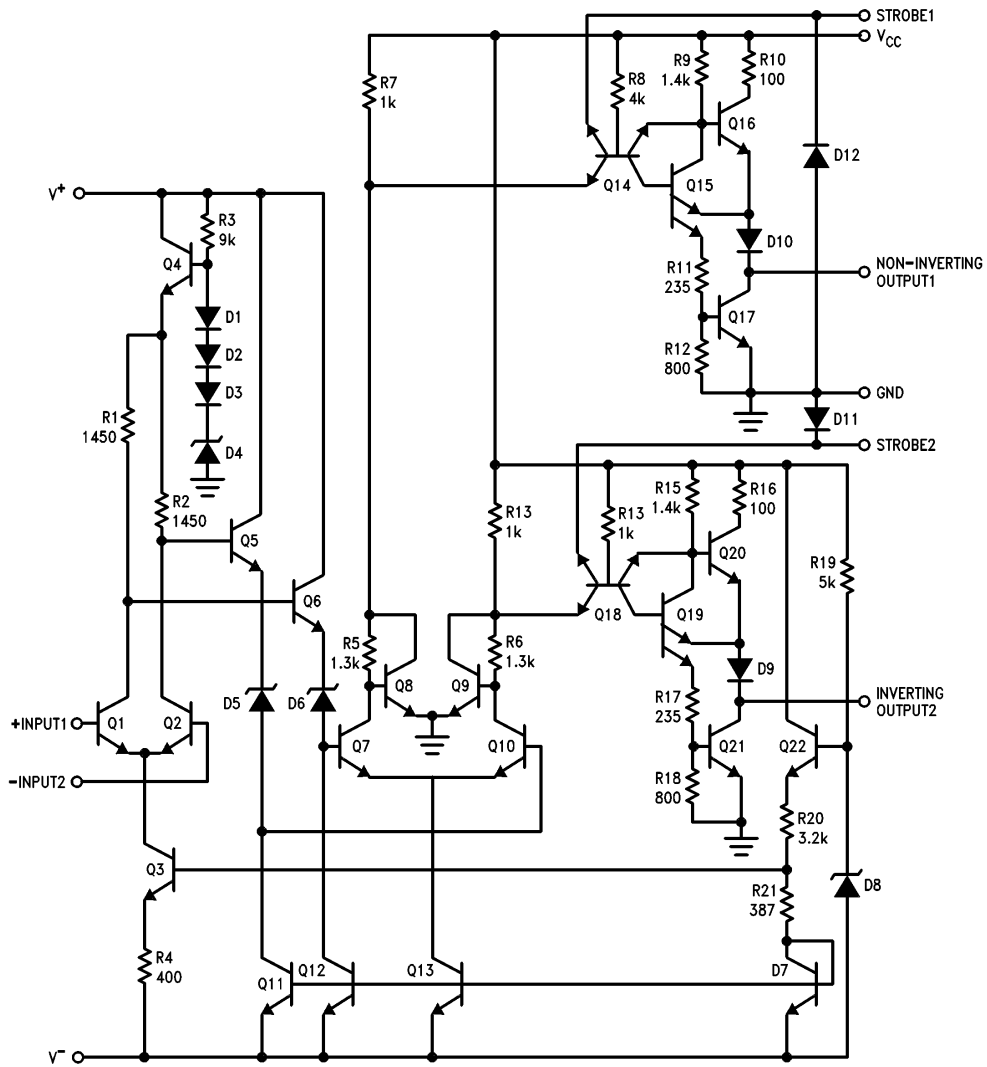


TL/H/5708-5

TL/H/5708-6

Schematic Diagram

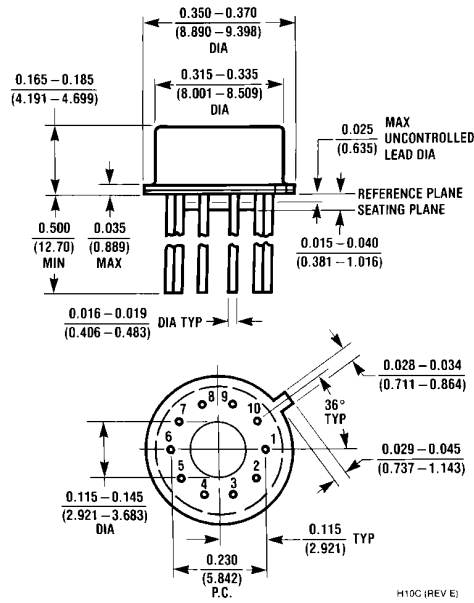
LM161



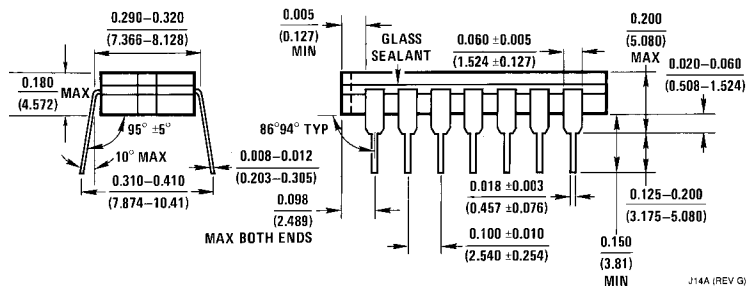
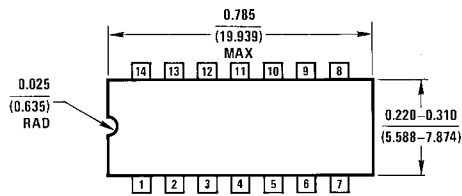
R10, R16: 85
R11, R17: 205

TL/H/5708-1

Physical Dimensions inches (millimeters)

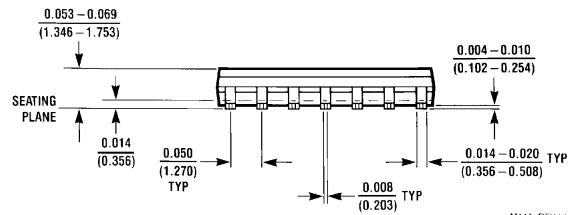
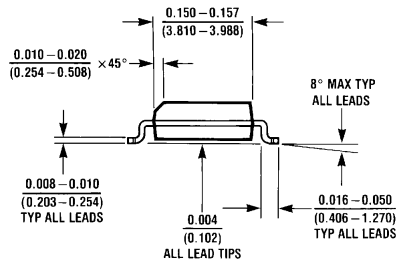
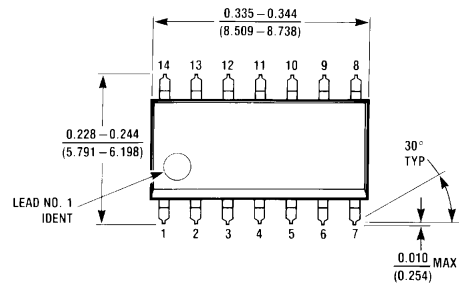


Metal Can Package (H)
 Order Number LM161H/883, or LM361H
 NS Package Number H10C



Ceramic Dual-In-Line Package (J)
 Order Number LM161J, LM161J/883
 NS Package Number J14A

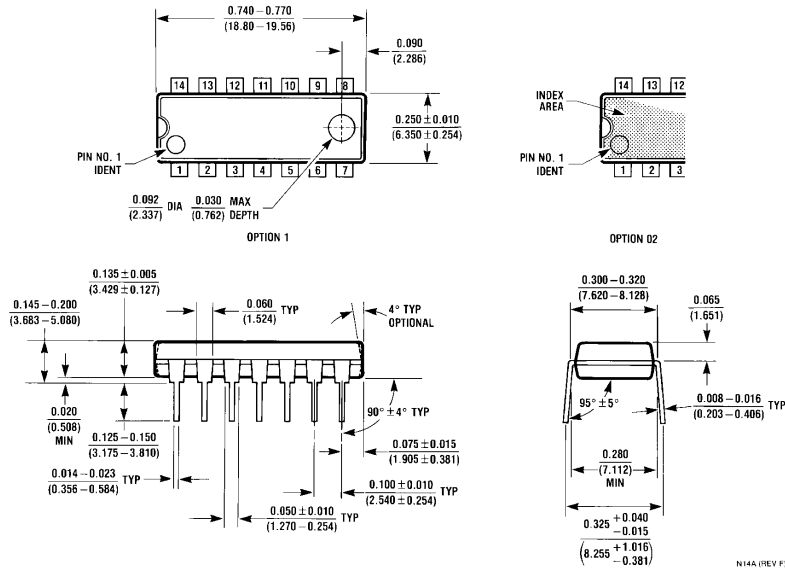
Physical Dimensions inches (millimeters) (Continued)



Order Number LM361M
NS Package Number M14A

M14A (REV H)

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number LM361N
NS Package Number N14A

N14A (REV F)

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