

# 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 ( $\pm 15V$ ).

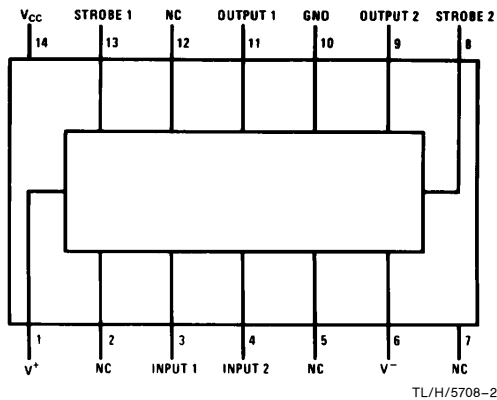
Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

### Features

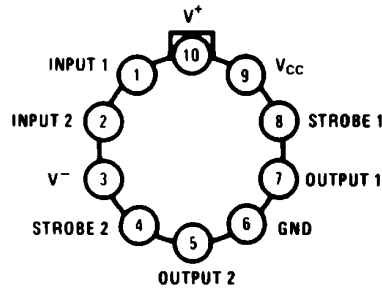
- Independent strobes
- Guaranteed high speed 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies  $\pm 15V$
- Low speed variation with overdrive variation
- Low input offset voltage
- Versatile supply voltage range

### Connection Diagrams

Dual-In-Line Package



Metal Can Package



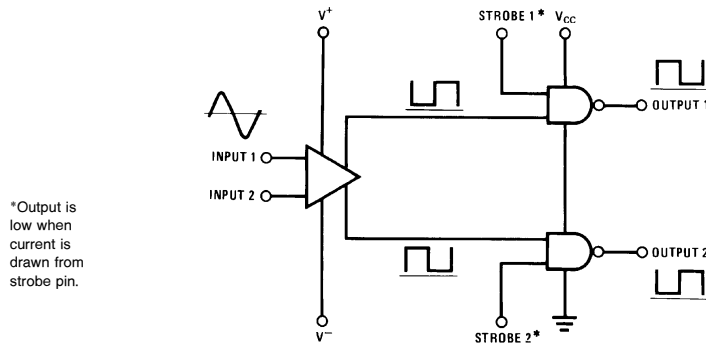
Order Number LM161H/883\*, or LM361H  
See NS Package Number H10C

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



## 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	<b>T<sub>MIN</sub></b> <b>T<sub>MAX</sub></b>
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	$\mu A$ $\mu A$
Input Offset Current	$T_A = 25^\circ C$		2	3		2	5	$\mu A$ $\mu A$
Voltage Gain	$T_A = 25^\circ C$		3			3		V/mV
Input Resistance	$T_A = 25^\circ C$ , $f = 1$ kHz		20			20		k $\Omega$
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	$\mu A$
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:

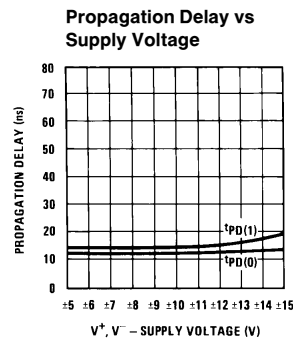
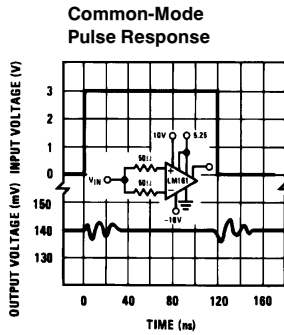
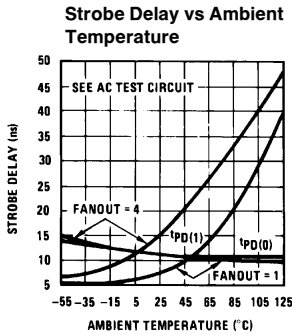
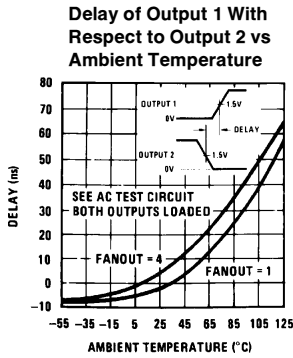
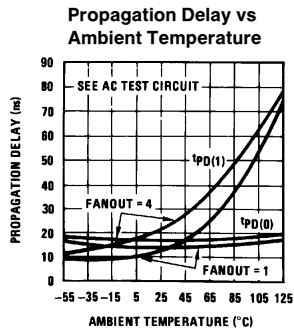
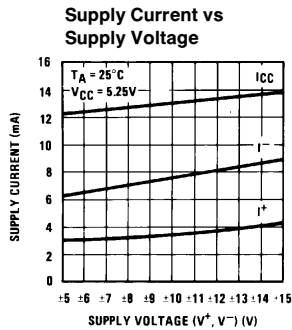
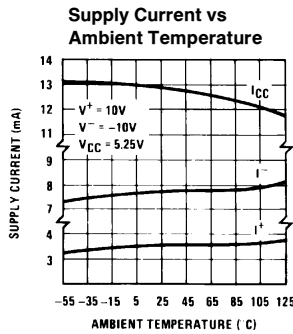
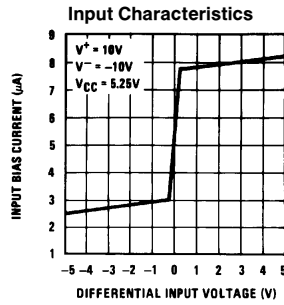
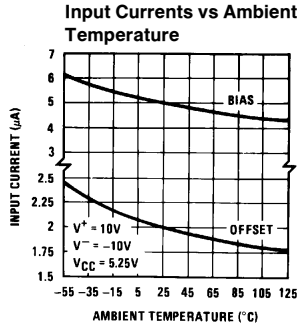
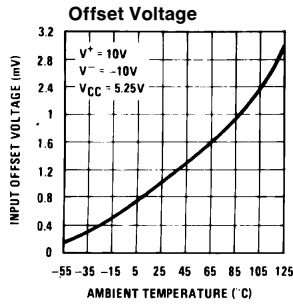
	H Package	J Package	N Package
$\theta_{JA}$	165°C/W (Still Air) 67°C/W (400 LF/Min Air Flow)	112°C/W	105°C/W
$\theta_{JC}$	25°C/W		

**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.

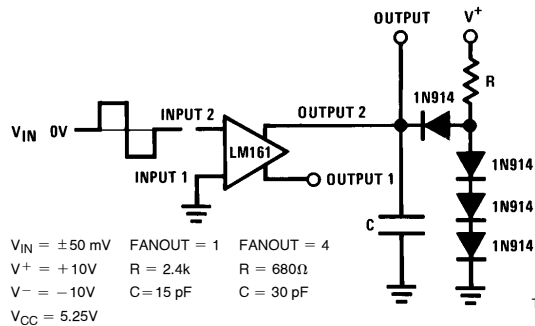
**Note 5:** Human body model, 1.5 k $\Omega$  in series with 100 pF.

# Typical Performance Characteristics



TL/H/5708-7

## AC Test Circuit

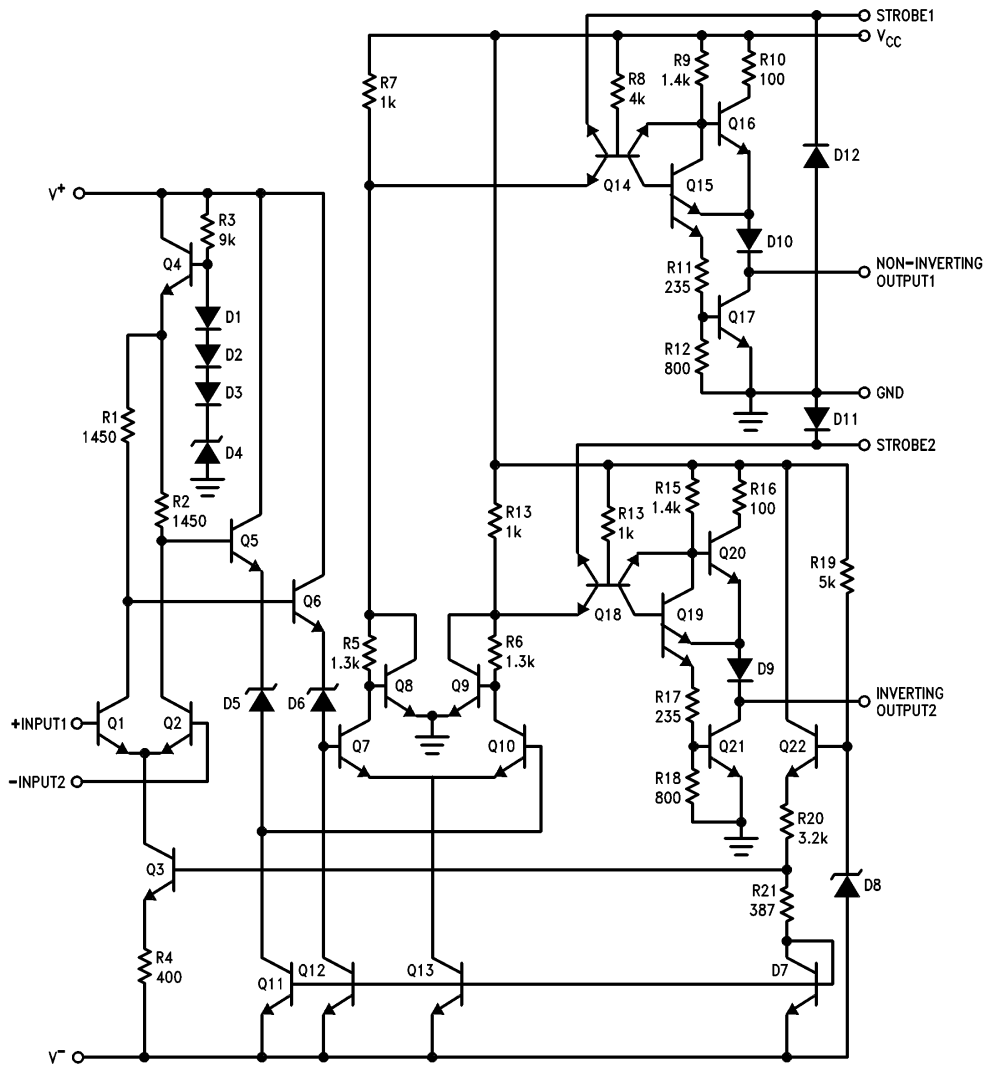


TL/H/5708-5

TL/H/5708-6

# Schematic Diagram

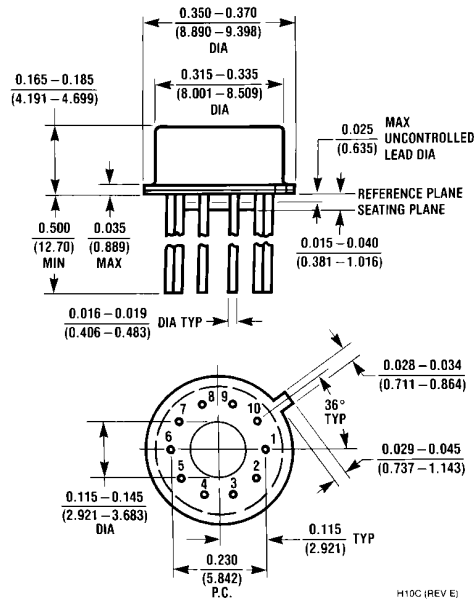
LM161



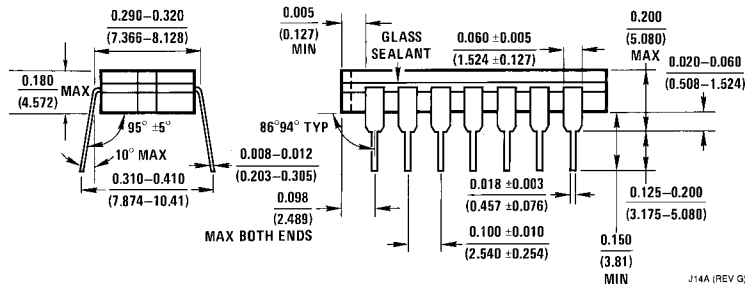
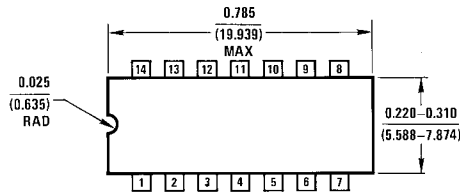
R10, R16: 85  
R11, R17: 205

TL/H/5708-1

**Physical Dimensions** inches (millimeters)

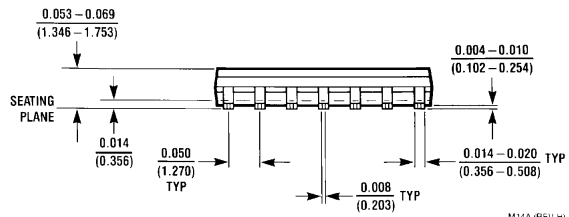
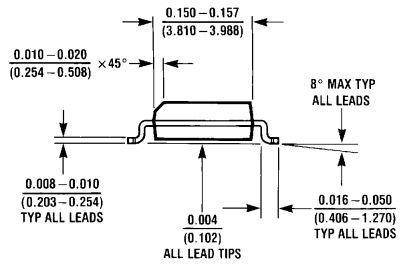
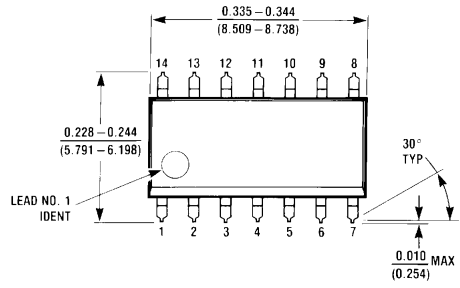


**Metal Can Package (H)**  
**Order Number LM161H/883, or LM361H**  
**NS Package Number H10C**



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

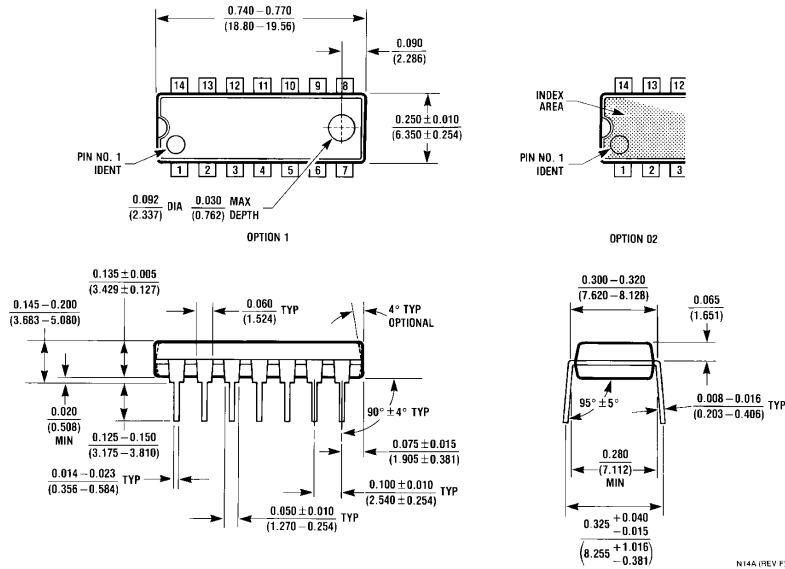
**Physical Dimensions** inches (millimeters) (Continued)



M14A (REV H)

**Order Number LM361M**  
**NS Package Number M14A**

**Physical Dimensions** inches (millimeters) (Continued)



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

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