

## LM161, LM261, LM361

### *High Speed Differential Comparators*

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.

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### **Rochester Electronics Manufactured Components**

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

### **Quality Overview**

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
  - Class Q Military
  - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)
  - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

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*The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.*

LM161/LM261/LM361



NATL SEMICOND (LINEAR)

T-73-53

# 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 ( $\pm 15V$ ).

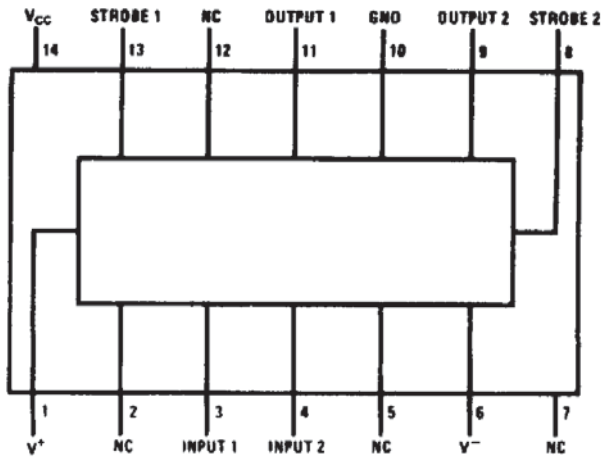
Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

## 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

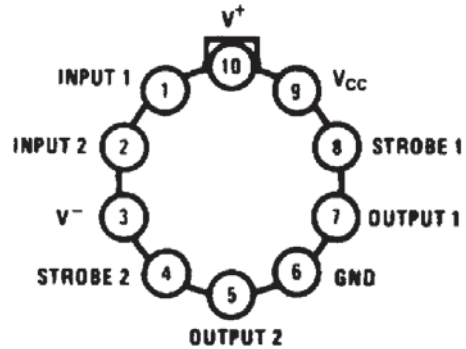
## Connection Diagrams

Dual-In-Line Package



TL/H/5708-2

Metal Can Package



TL/H/5708-3

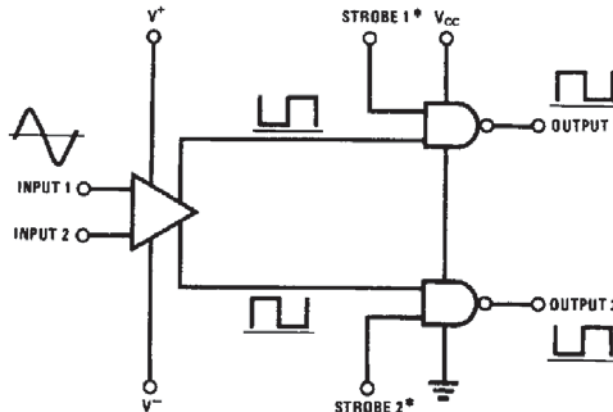
Order Number LM161H, LM161H/883\*,  
LM261H or LM361H  
See NS Package Number H10C

Top View

Order Number LM161J, LM161J/883\*, LM361J,  
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	$\mu A$ $\mu A$
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)

NATL SEMICON (LINEAR)

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

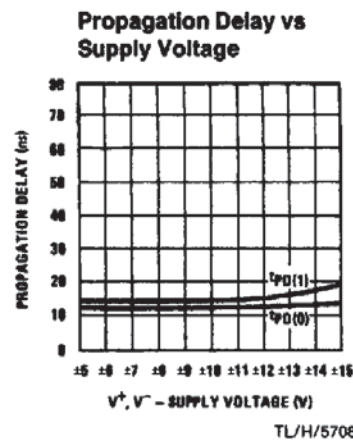
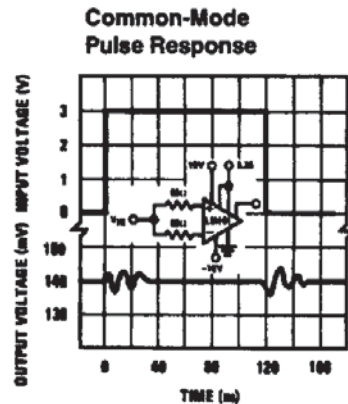
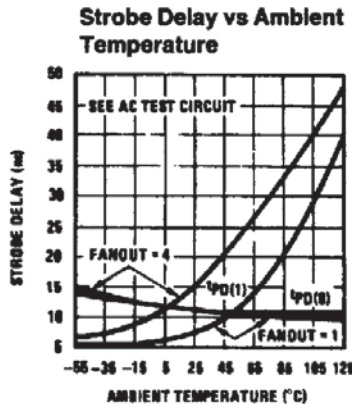
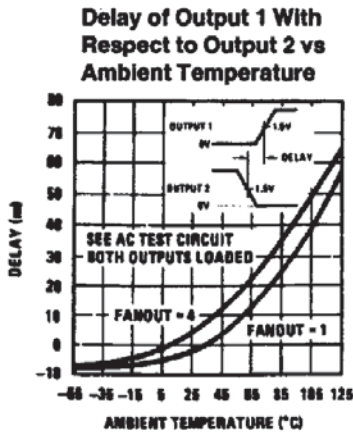
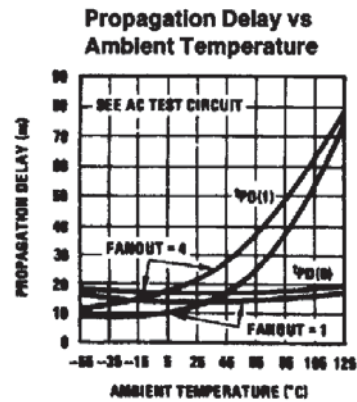
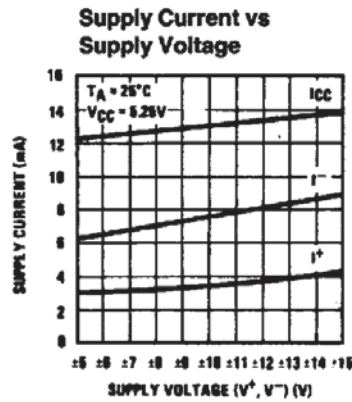
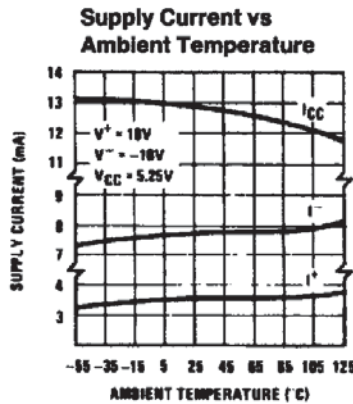
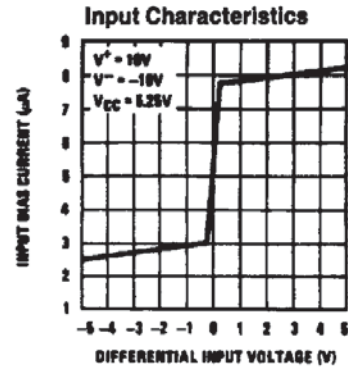
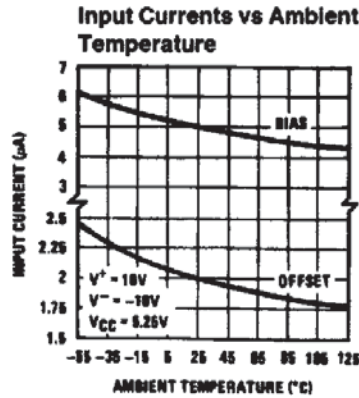
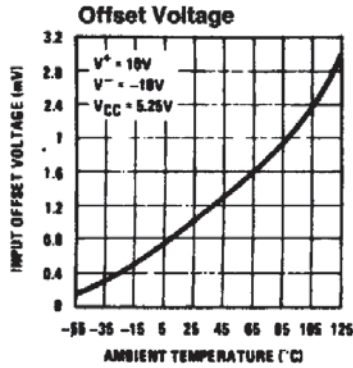
Parameter	Conditions	Limits						Units
		LM161/LM261			LM361			
		Min	Typ	Max	Min	Typ	Max	
Supply Current $I^+$	$V^+ = 10V, V^- = -10V,$ $V_{CC} = 5.25V,$ $-55^\circ C \leq T_A \leq 125^\circ C$			4.5				mA
Supply Current $I^+$	$V^+ = 10V, V^- = -10V,$ $V_{CC} = 5.25V,$ $0^\circ C \leq T_A \leq 70^\circ C$						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	$V_{IN} = 50 \text{ mV overdrive}$ (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:

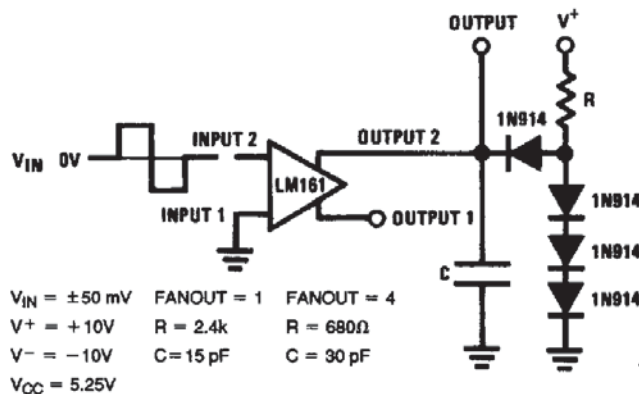
	H Package	J Package	N Package
$\theta_{JA}$	165°C/W (Still Air) 67°C/W (400 LF/Min Air Flow)	112°C/W	105°C/W
$\theta_{JC}$	25°C/W		

**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



AC Test Circuit



TL/H/5708-5

TL/H/5708-7

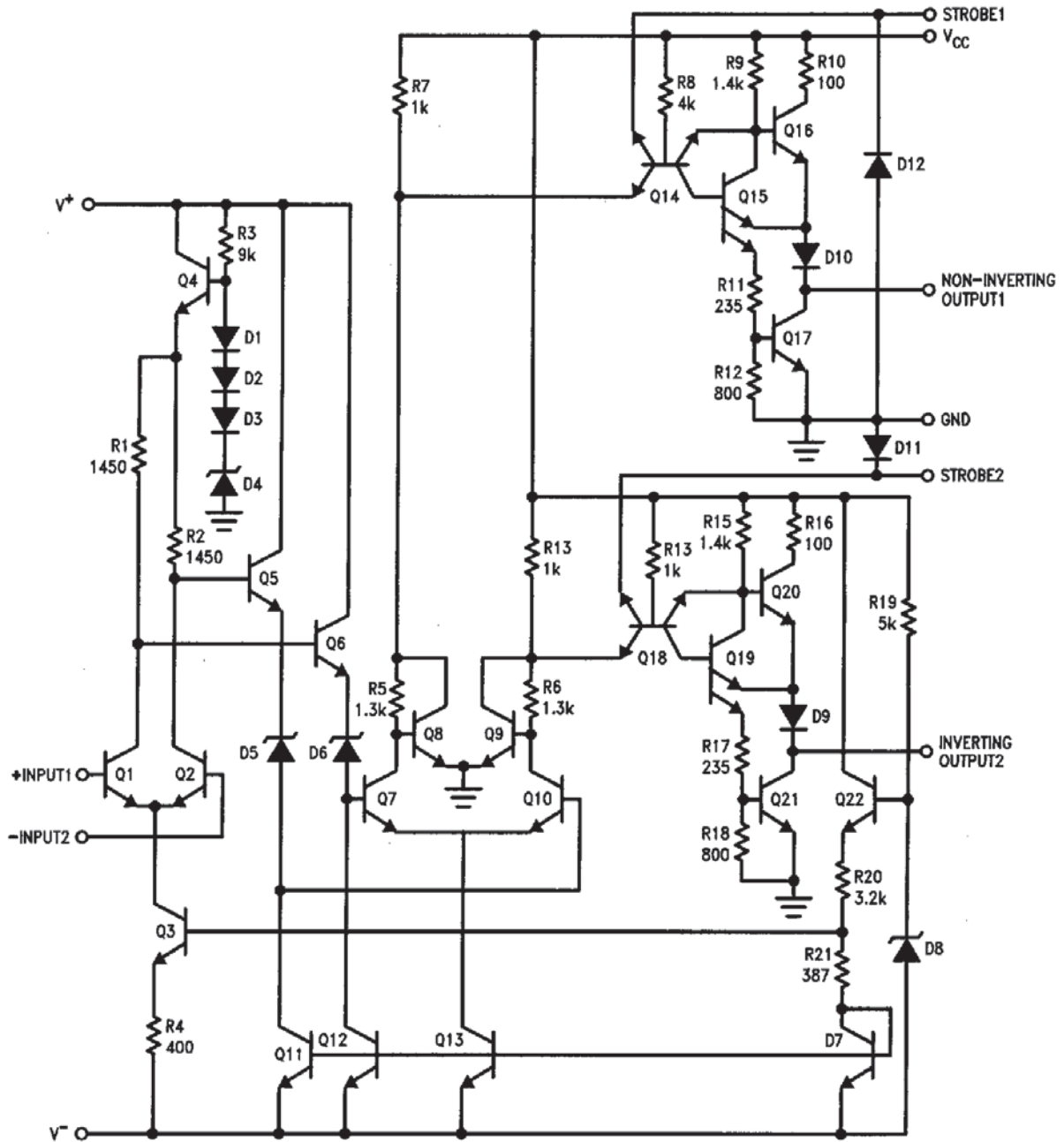
TL/H/5708-6

LM161/LM261/LM361

NATL SEMICOND (LINEAR)

LM161

Schematic Diagram



R10, R16: 85  
R11, R17: 205

TL/H/5708-1