

LM161/LM261/LM361

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 ( $\pm 15V$ ).

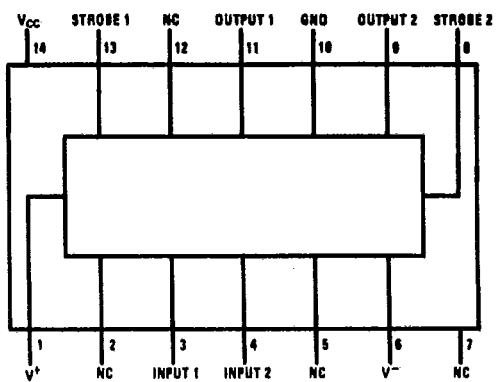
Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

## 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

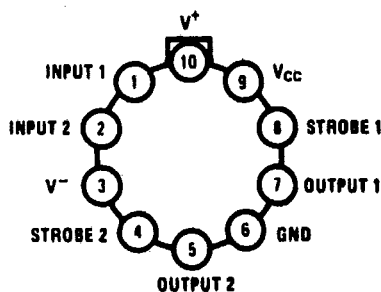
## Connection Diagrams

Dual-In-Line Package



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Metal Can Package



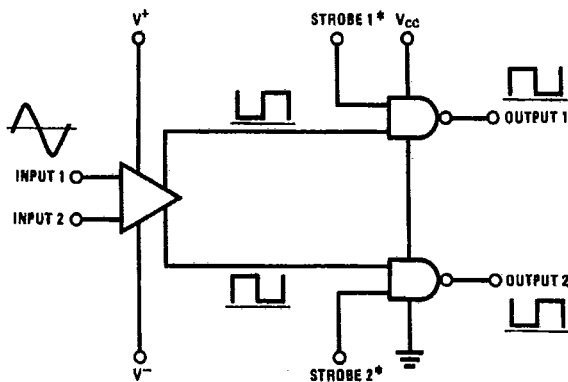
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Order Number LM161H, LM261H or LM361H  
See NS Package H10C

Top View

Order Number LM161J, LM261J, LM361J,  
LM361M or LM361N  
See NS Package Number J14A, M14A or N14A

## Logic Diagram



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**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 <sub>CC</sub>	+7V
Output Voltage	+7V
Differential Input Voltage	±5V
Input Common Mode Voltage	±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 <sub>CC</sub>			
LM161/LM261	4.5V	5V	5.5V
LM361	4.75V	5V	5.25V

ESD rating to be determined.  
 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<sub>CC</sub> = +5V, V- = -10V, T<sub>MIN</sub> ≤ T<sub>A</sub> ≤ T<sub>MAX</sub>, 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 <sub>A</sub> = 25°C		5	20		10	30	μA μA
Input Offset Current	T <sub>A</sub> = 25°C		2	3		2	5	μA μA
Voltage Gain	T <sub>A</sub> = 25°C		3			3		V/mV
Input Resistance	T <sub>A</sub> = 25°C, f = 1 kHz		20			20		kΩ
Logical "1" Output Voltage	V <sub>CC</sub> = 4.75V, I <sub>SOURCE</sub> = -0.5 mA	2.4	3.3		2.4	3.3		V
Logical "0" Output Voltage	V <sub>CC</sub> = 4.75V, I <sub>SINK</sub> = 6.4 mA			0.4			0.4	V
Strobe Input "1" Current (Output Enabled)	V <sub>CC</sub> = 5.25V, V <sub>STROBE</sub> = 2.4V			200			200	μA
Strobe Input "0" Current (Output Disabled)	V <sub>CC</sub> = 5.25V, V <sub>STROBE</sub> = 0.4V			-1.6			-1.6	mA
Strobe Input "0" Voltage	V <sub>CC</sub> = 4.75V			0.8			0.8	V
Strobe Input "1" Voltage	V <sub>CC</sub> = 4.75V	2			2			V
Output Short Circuit Current	V <sub>CC</sub> = 5.25V, V <sub>OUT</sub> = 0V	-18		-55	-18		-55	mA

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**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.

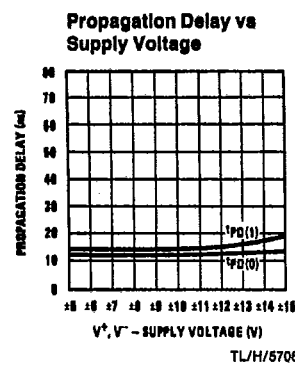
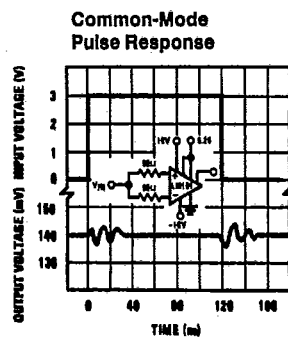
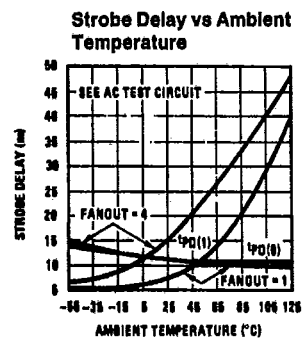
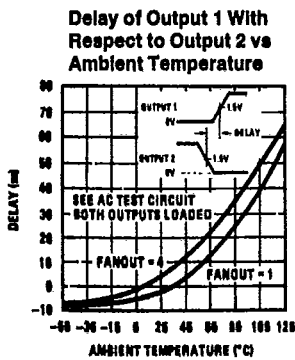
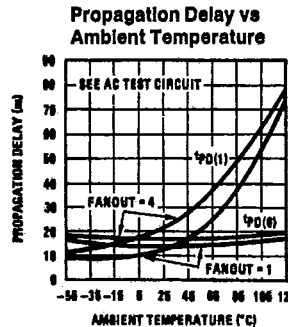
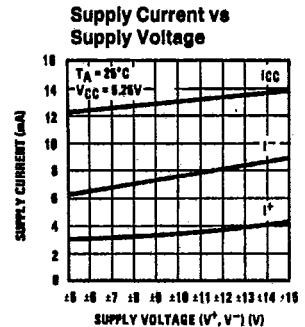
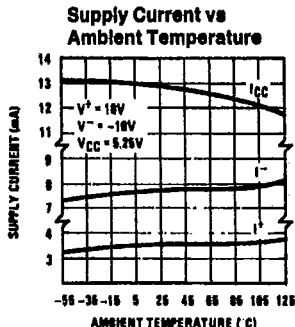
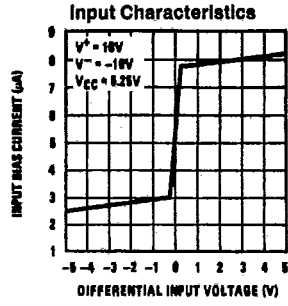
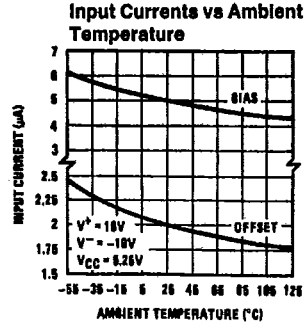
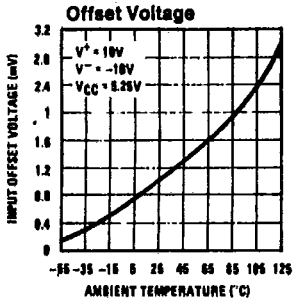
Note 2: Typical thermal impedances are as follows:

	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		

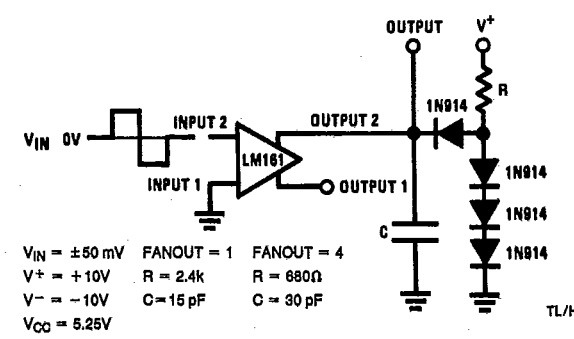
Note 3: Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

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

Typical Performance Characteristics



AC Test Circuit



TL/H/5708-6

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