



May 1999

LM161/LM261/LM361 High Speed Differential Comparators

General Description

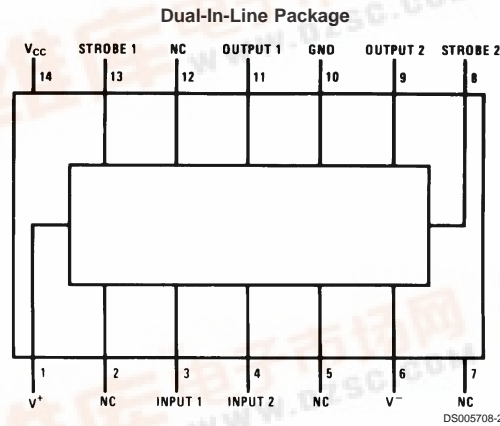
The LM161/LM261/LM361 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the SE529/NE529 for which it is a pin-for-pin replacement. The device has been optimized for greater speed performance and lower input offset voltage. Typically 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

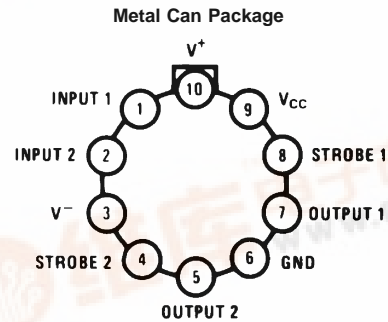
- Independent strobes
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies: $\pm 15V$
- Low speed variation with overdrive variation
- Low input offset voltage
- Versatile supply voltage range

Connection Diagrams



Top View
Order Number LM161J
LM361M or LM361N
See NS Package Number M14A or N14A

Note 1: Also available per SMD #5962-8757203

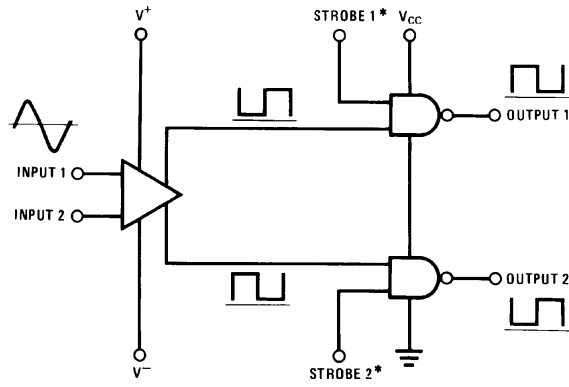


Order Number LM161H/883 (Note 1), or LM361H
See NS Package Number H10C

LM161/LM261/LM361 High Speed Differential Comparators



Logic Diagram



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

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Absolute Maximum Ratings (Note 2)

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

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 6)			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
Input Offset Current	$T_A = 25^\circ C$		2	3		2	5	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
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

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^-	$V^+ = 10V$, $V^- = -10V$, $V_{CC} = 5.25V$, $0^\circ C \leq T_A \leq 70^\circ C$						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 4)							
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 2: The device may be damaged by use beyond the maximum ratings.

Note 3: 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		

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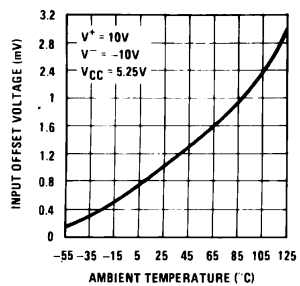
Note 4: Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

Note 5: Refer to RETS161X for LM161H and LM161J military specifications.

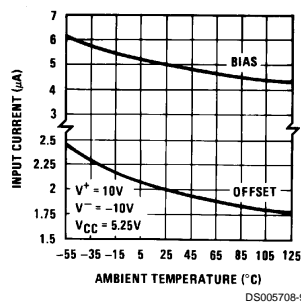
Note 6: Human body model, 1.5 k Ω in series with 100 pF.

Typical Performance Characteristics

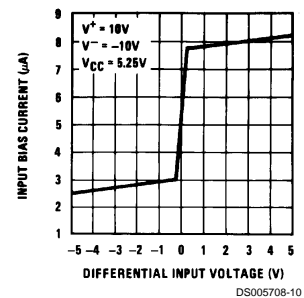
Offset Voltage



Input Currents vs Ambient Temperature

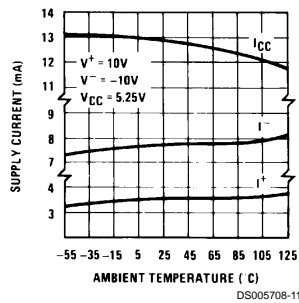


Input Characteristics

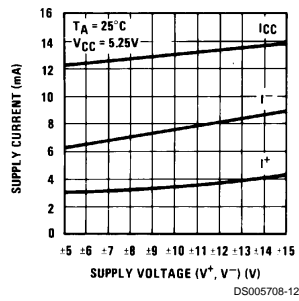


Typical Performance Characteristics (Continued)

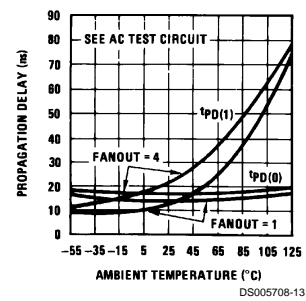
Supply Current vs Ambient Temperature



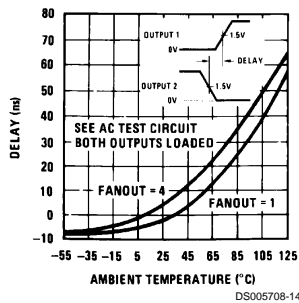
Supply Current vs Supply Voltage



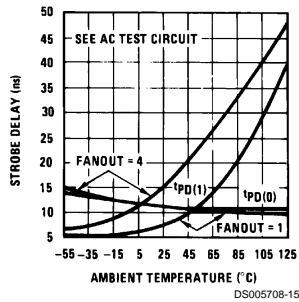
Propagation Delay vs Ambient Temperature



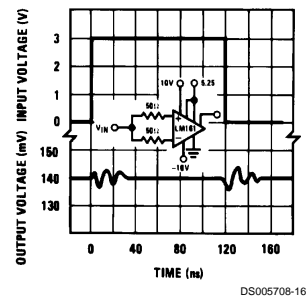
Delay of Output 1 With Respect to Output 2 vs Ambient Temperature



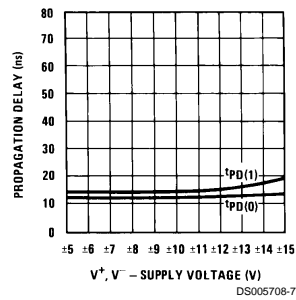
Strobe Delay vs Ambient Temperature



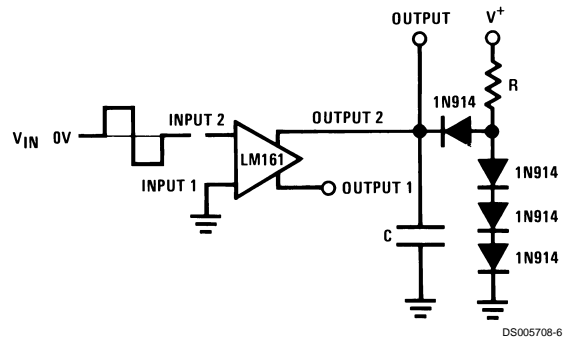
Common-Mode Pulse Response



Propagation Delay vs Supply Voltage

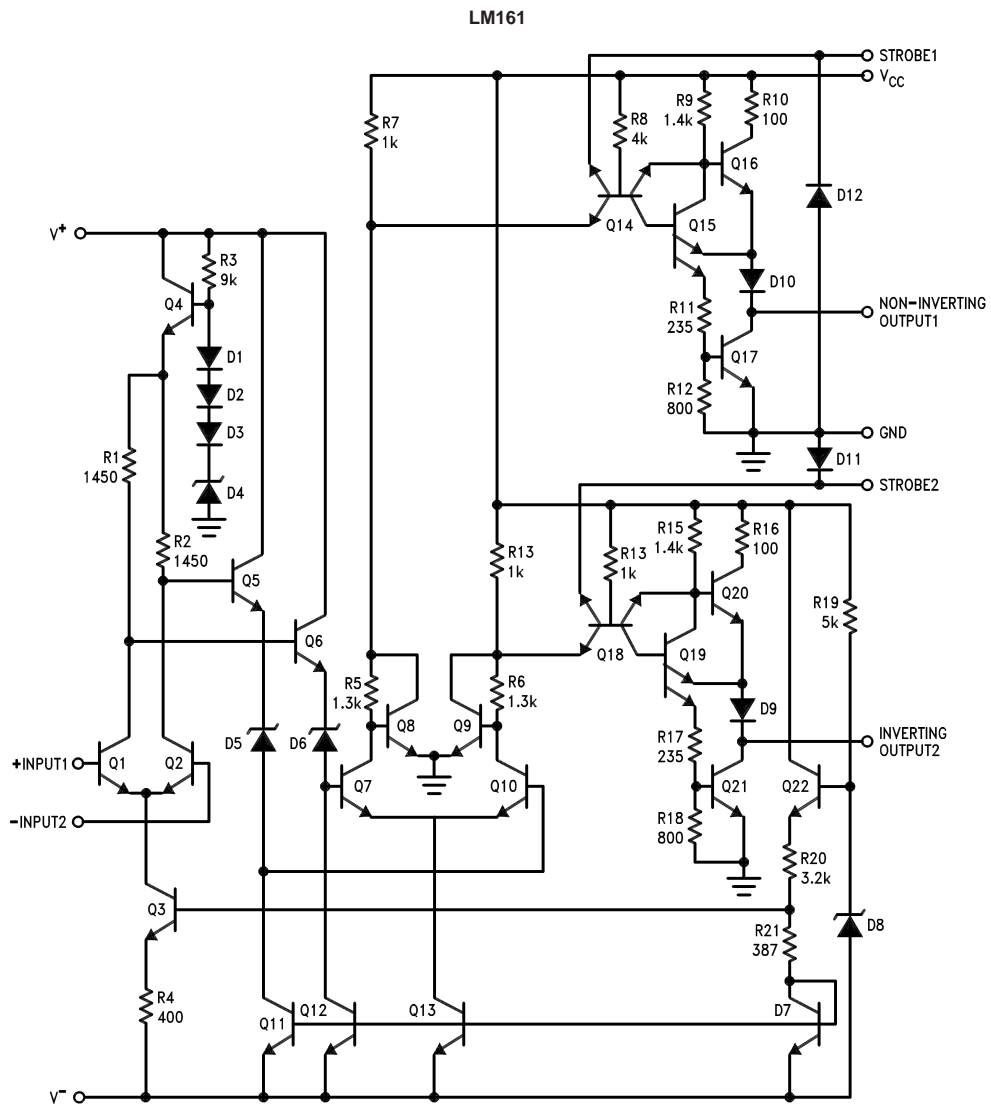


AC Test Circuit



$V_{IN} = \pm 50 \text{ mV}$ FANOUT = 1 FANOUT = 4
 $V^+ = +10\text{V}$ $R = 2.4\text{k}$ $R = 680\Omega$
 $V^- = -10\text{V}$ $C = 15 \text{ pF}$ $C = 30 \text{ pF}$
 $V_{CC} = 5.25\text{V}$

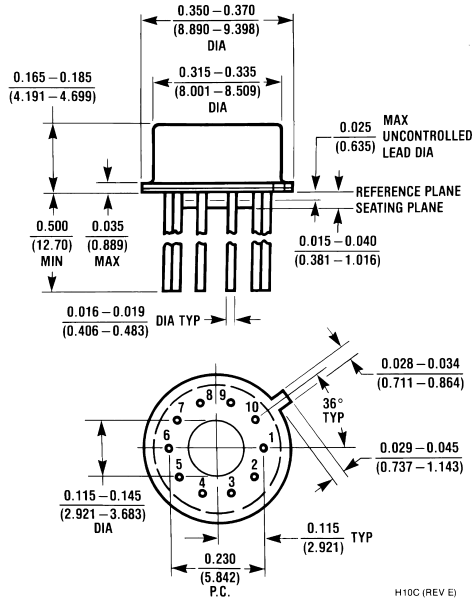
Schematic Diagram



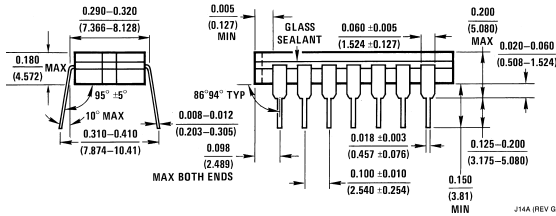
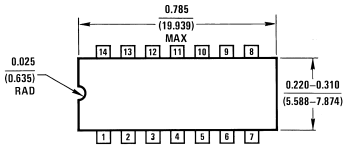
R10, R16: 85
R11, R17: 205

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Physical Dimensions inches (millimeters) unless otherwise noted

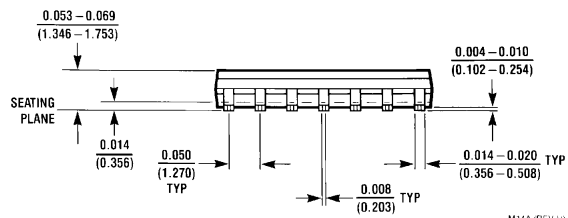
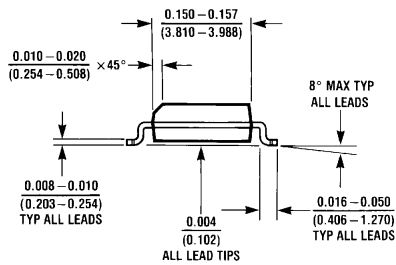
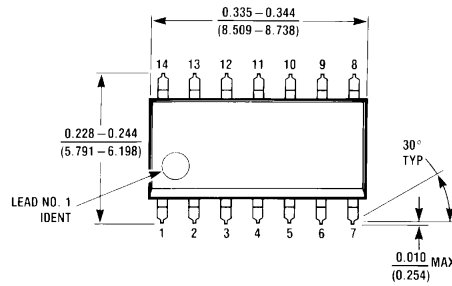


Metal Can Package (H)
Order Number LM161H/883, or LM361H
NS Package Number H10C



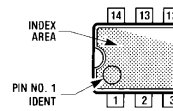
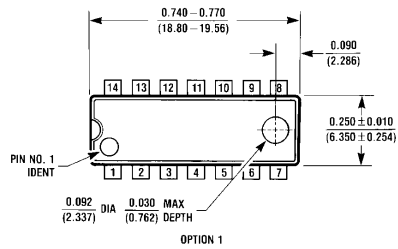
Ceramic Dual-In-Line Package (J)
Order Number LM161J
NS Package Number J14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

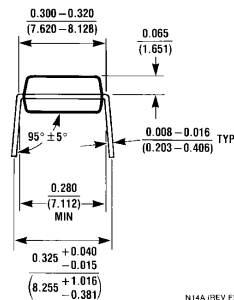
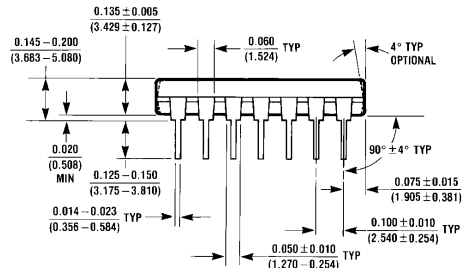


M14A (REV H)

**Order Number LM361M
NS Package Number M14A**



OPTION 02



N14A (REV F)

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

Notes

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