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LM161/LM361 High Speed Differential Comparators

General Description

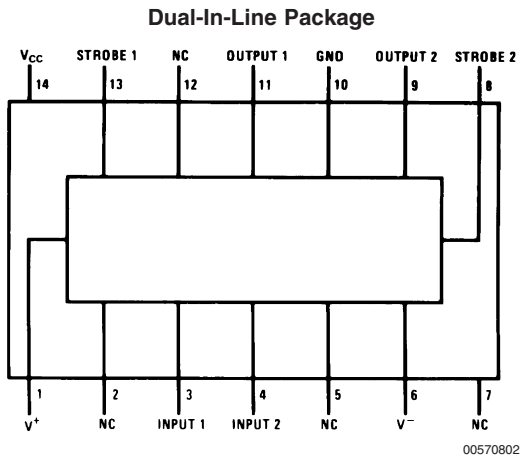
The LM161/LM361 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the SE529/NE529 for which it is a pin-for-pin replacement. The device has been optimized for greater speed performance and lower input offset voltage. Typically delay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

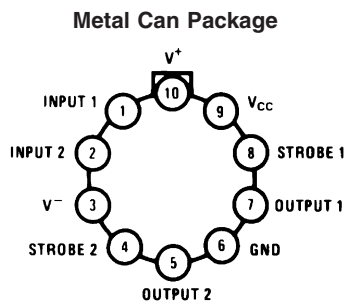
- Independent strobes
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies: $\pm 15V$
- Low speed variation with overdrive variation
- Low input offset voltage
- Versatile supply voltage range

Connection Diagrams



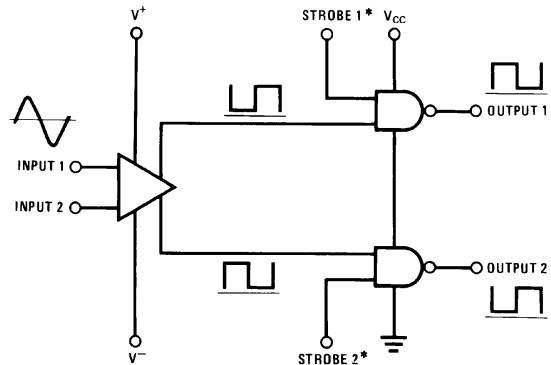
Top View

Order Number LM361M, LM361MX or LM361N
See NS Package Number M14A or N14A



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

Logic Diagram



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

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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.

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
	-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

LM361	Min	Typ	Max
Supply Voltage V^-	5V		15V
LM161	-6V		-15V
LM361	-6V		-15V
Supply Voltage V_{CC}			
LM161	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.

Operating Conditions

	Min	Typ	Max
Supply Voltage V^+			
LM161	5V		15V

Electrical Characteristics

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

Parameter	Conditions	Limits						Units
		LM161			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

Electrical Characteristics (Continued)(V⁺ = +10V, V_{CC} = +5V, V⁻ = -10V, T_{MIN} ≤ T_A ≤ T_{MAX}, unless noted)

Parameter	Conditions	Limits						Units
		LM161			LM361			
		Min	Typ	Max	Min	Typ	Max	
Supply Current I ⁺	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, 0°C≤T _A ≤70°C						5	mA
Supply Current I ⁻	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, -55°C≤T _A ≤125°C			10				mA
Supply Current I ⁻	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, 0°C≤T _A ≤70°C						10	mA
Supply Current I _{CC}	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, -55°C≤T _A ≤125°C			18				mA
Supply Current I _{CC}	V ⁺ =10V, V ⁻ =-10V, V _{CC} =5.25V, 0°C≤T _A ≤70°C						20	mA
Transient Response	V _{IN} = 50 mV overdrive (Note 3)							
Propagation Delay Time (t _{pd(0)})	T _A =25°C		14	20		14	20	ns
Propagation Delay Time (t _{pd(1)})	T _A =25°C		14	20		14	20	ns
Delay Between Output A and B	T _A =25°C		2	5		2	5	ns
Strobe Delay Time (t _{pd(0)})	T _A =25°C		8			8		ns
Strobe Delay Time (t _{pd(1)})	T _A =25°C		8			8		ns

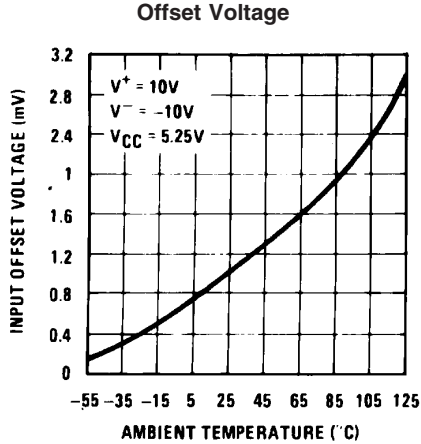
Note 1: The device may be damaged by use beyond the maximum ratings.**Note 2:** Typical thermal impedances are as follows:

	<u>H Package</u>	<u>J Package</u>	<u>N Package</u>
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		

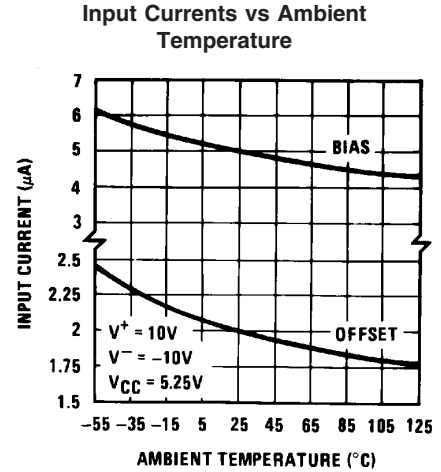
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Note 3: Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.**Note 4:** Refer to RETS161X for LM161H and LM161J military specifications.**Note 5:** Human body model, 1.5 kΩ in series with 100 pF.

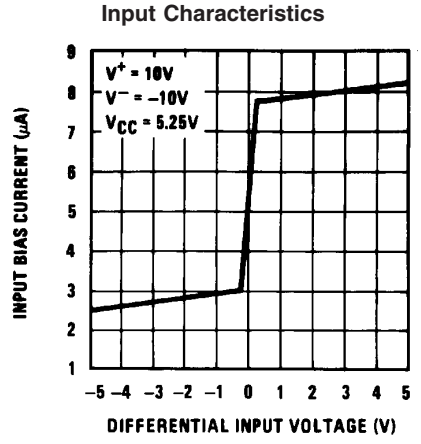
Typical Performance Characteristics



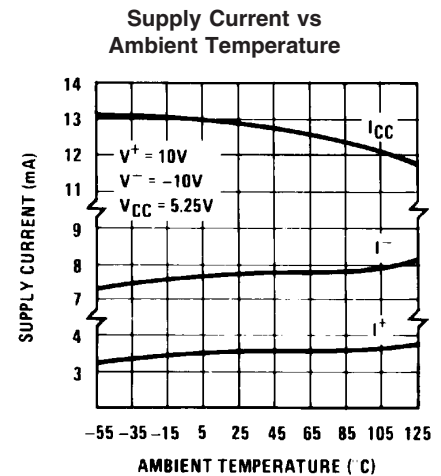
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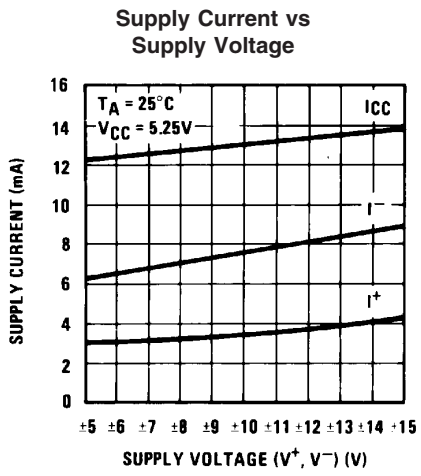
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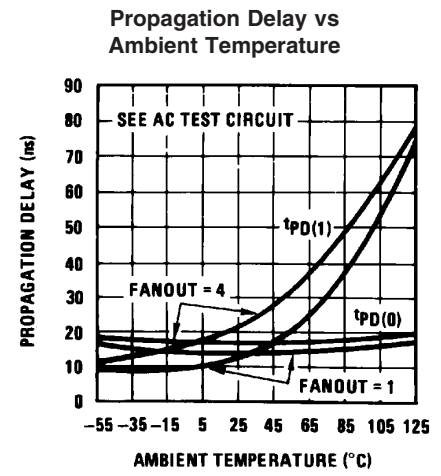
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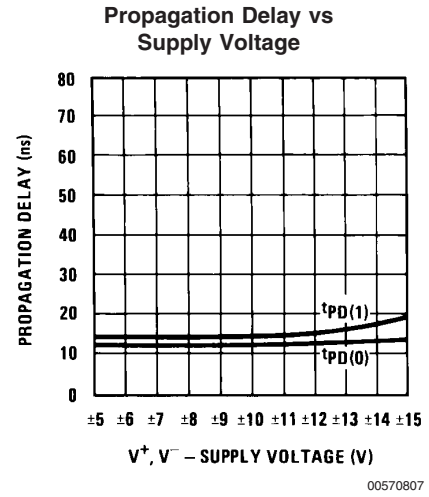
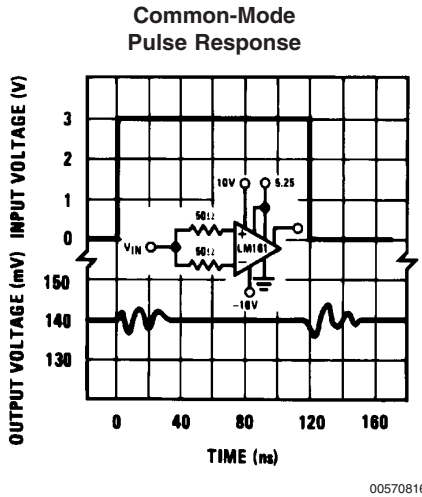
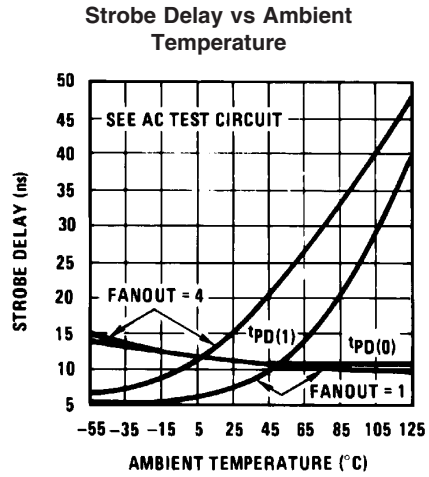
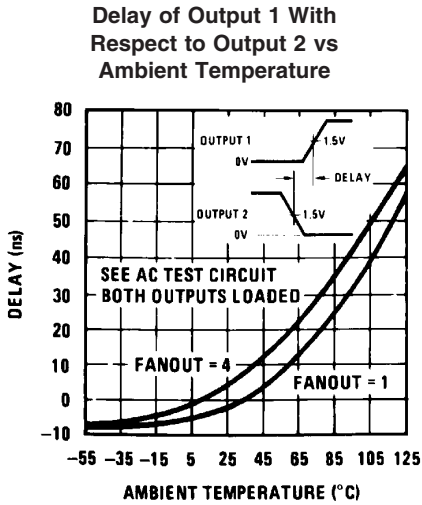


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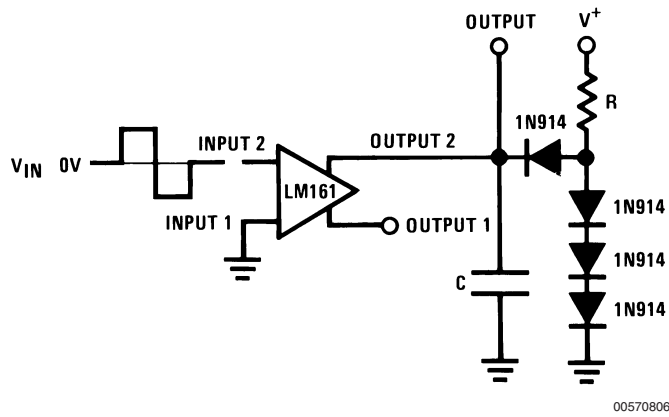


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Typical Performance Characteristics (Continued)

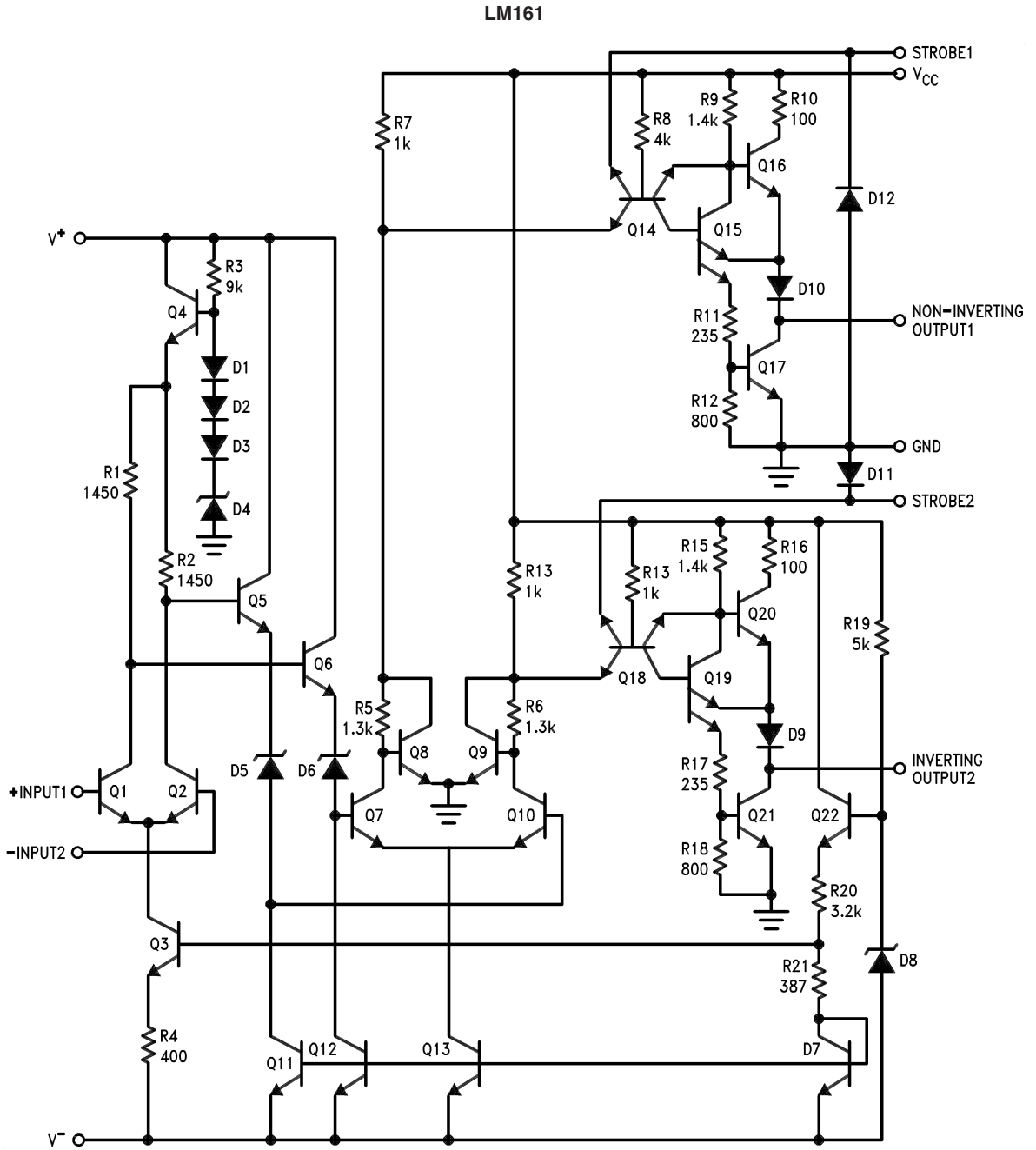


AC Test Circuit



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

Schematic Diagram

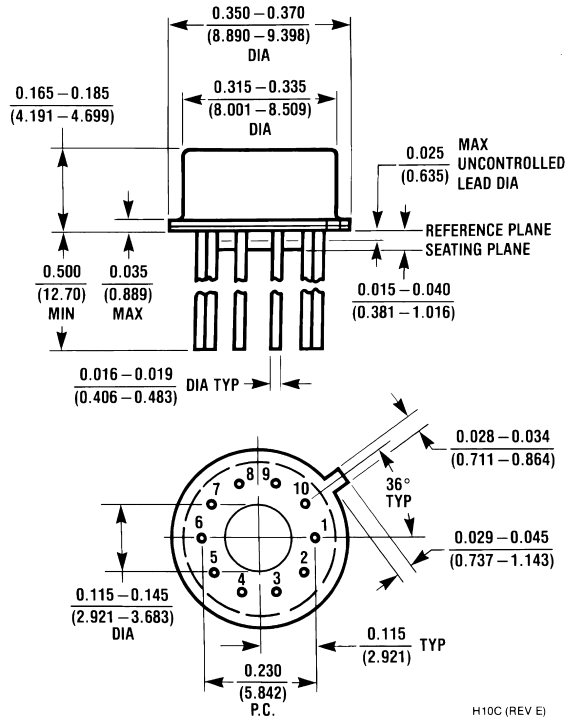


R10, R16: 85
 R11, R17: 205

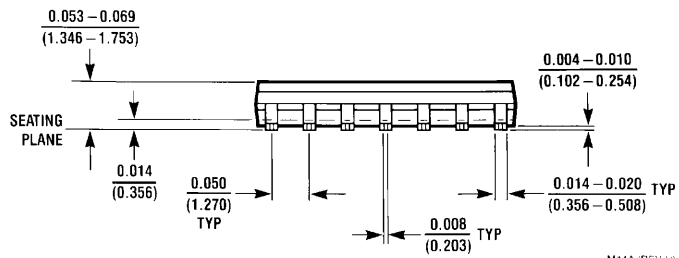
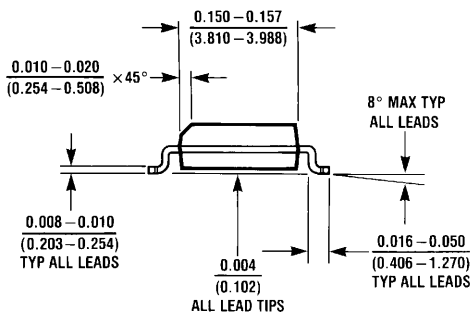
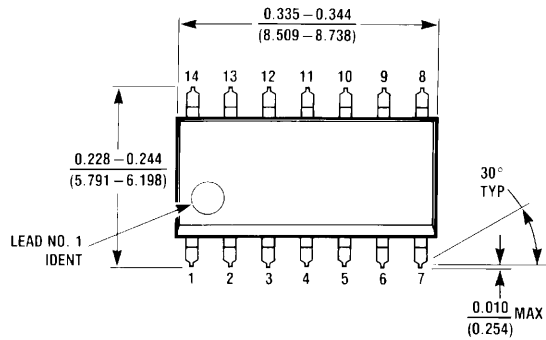
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Physical Dimensions inches (millimeters)

unless otherwise noted

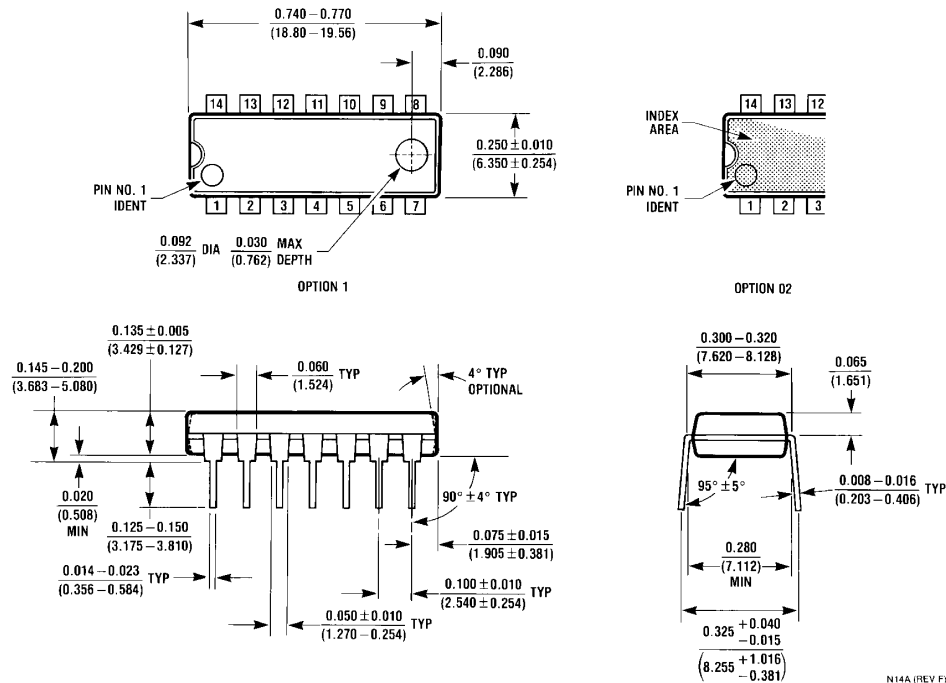


Metal Can Package (H)
Order Number LM161H/883, or LM361H
NS Package Number H10C



Order Number LM361M or LM361MX
NS Package Number M14A

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



N14A (REV F)

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