National Semiconductor

August 2000

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 (±15V).

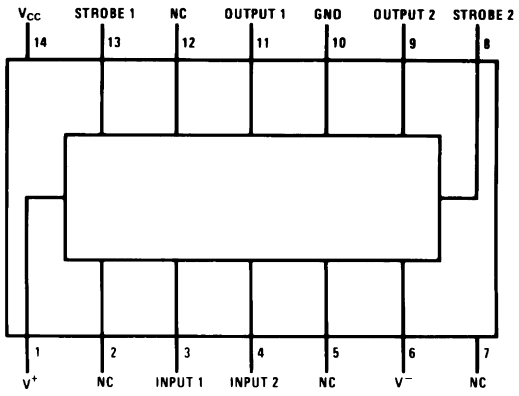
Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

Features

- Independent strobes
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies: ±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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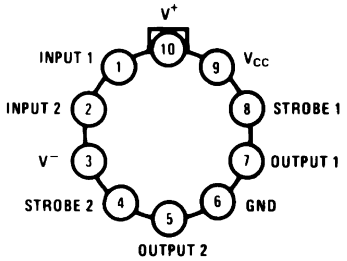
Top View
Order Number LM361M, LM361MX or LM361N
See NS Package Number M14A or N14A

Metal Can Package



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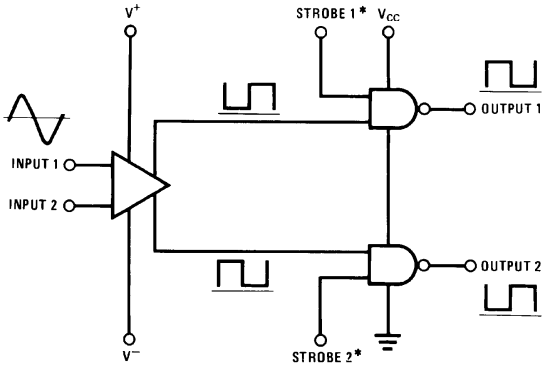
Order Number LM161H/883 or LM361H
See NS Package Number H10C

Logic Diagram



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

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	±5V
Input Common Mode Voltage	±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

	Min	Typ	Max
LM361	5V		15V
Supply Voltage V^-			
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, $T_{MIN} \le T_A \le T_{MAX}$, 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˚C		5			10		µA
				20			30	µA
Input Offset Current	T_A=25˚C		2			2		µA
				3			5	µA
Voltage Gain	T_A=25˚C		3			3		V/mV
Input Resistance	T_A=25˚C, f=1 kHz		20			20		kΩ
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˚C≤T_A≤125˚C			4.5				mA

Electrical Characteristics (Continued)

(V^+ = +10V, V_{CC} = +5V, V^- = −10V, $T_{MIN} \le T_A \le T_{MAX}$, 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:

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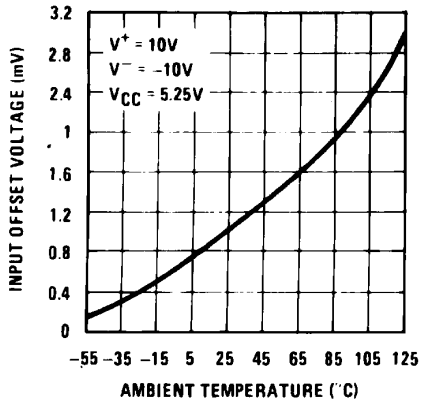
Note 3: Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

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

Offset Voltage



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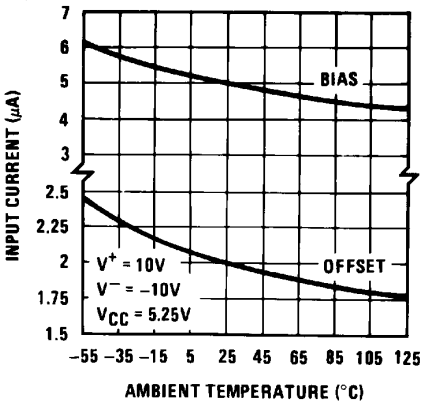
Input Currents vs Ambient Temperature



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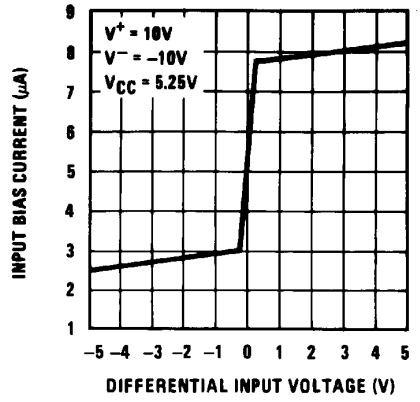
Input Characteristics



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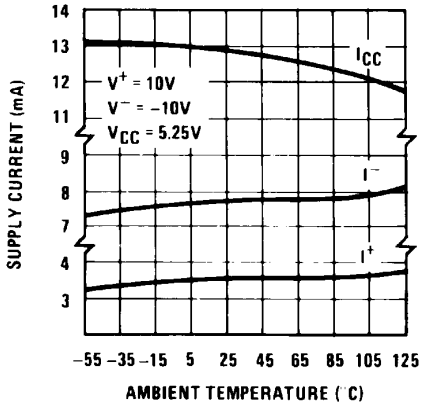
Supply Current vs Ambient Temperature



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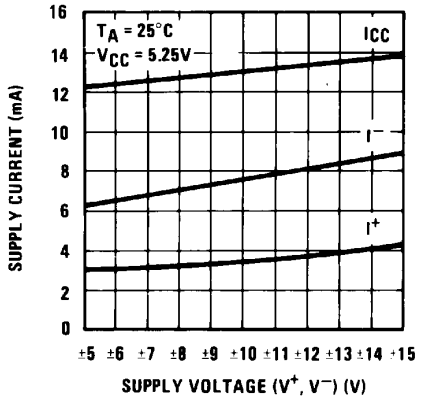
Supply Current vs Supply Voltage



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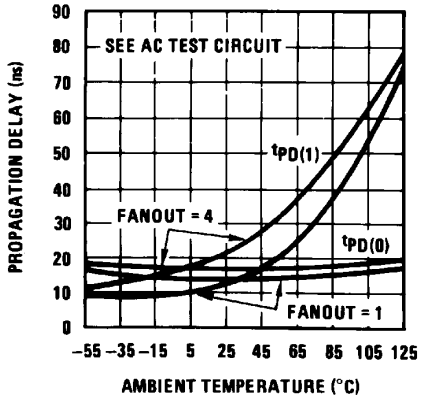
Propagation Delay vs Ambient Temperature



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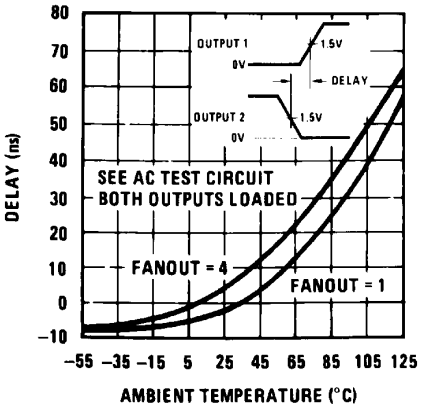
Typical Performance Characteristics (Continued)

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



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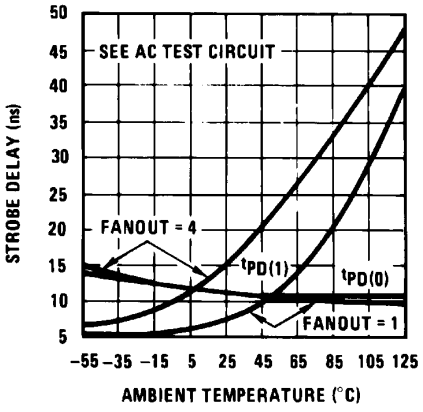
Strobe Delay vs Ambient Temperature



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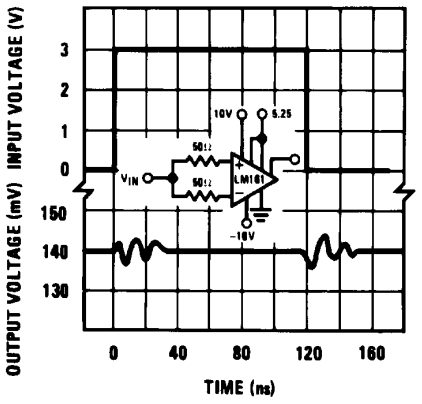
Common-Mode Pulse Response



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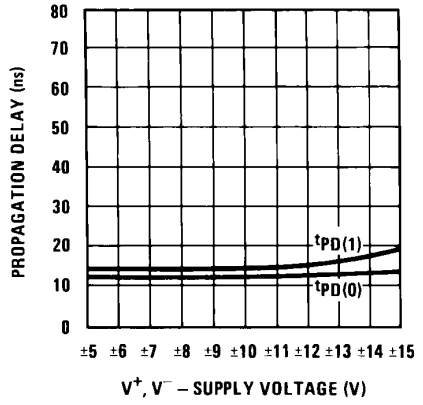
Propagation Delay vs Supply Voltage



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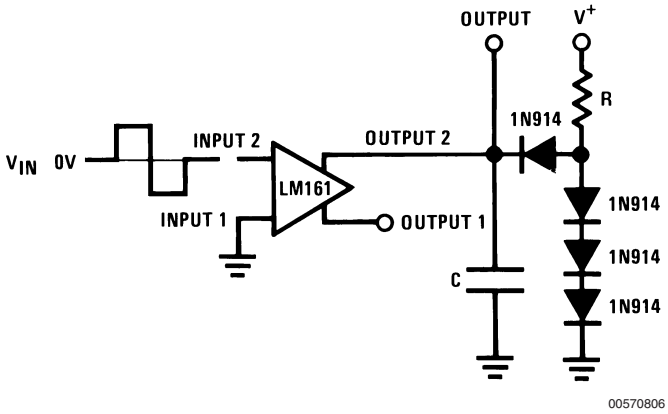
AC Test Circuit



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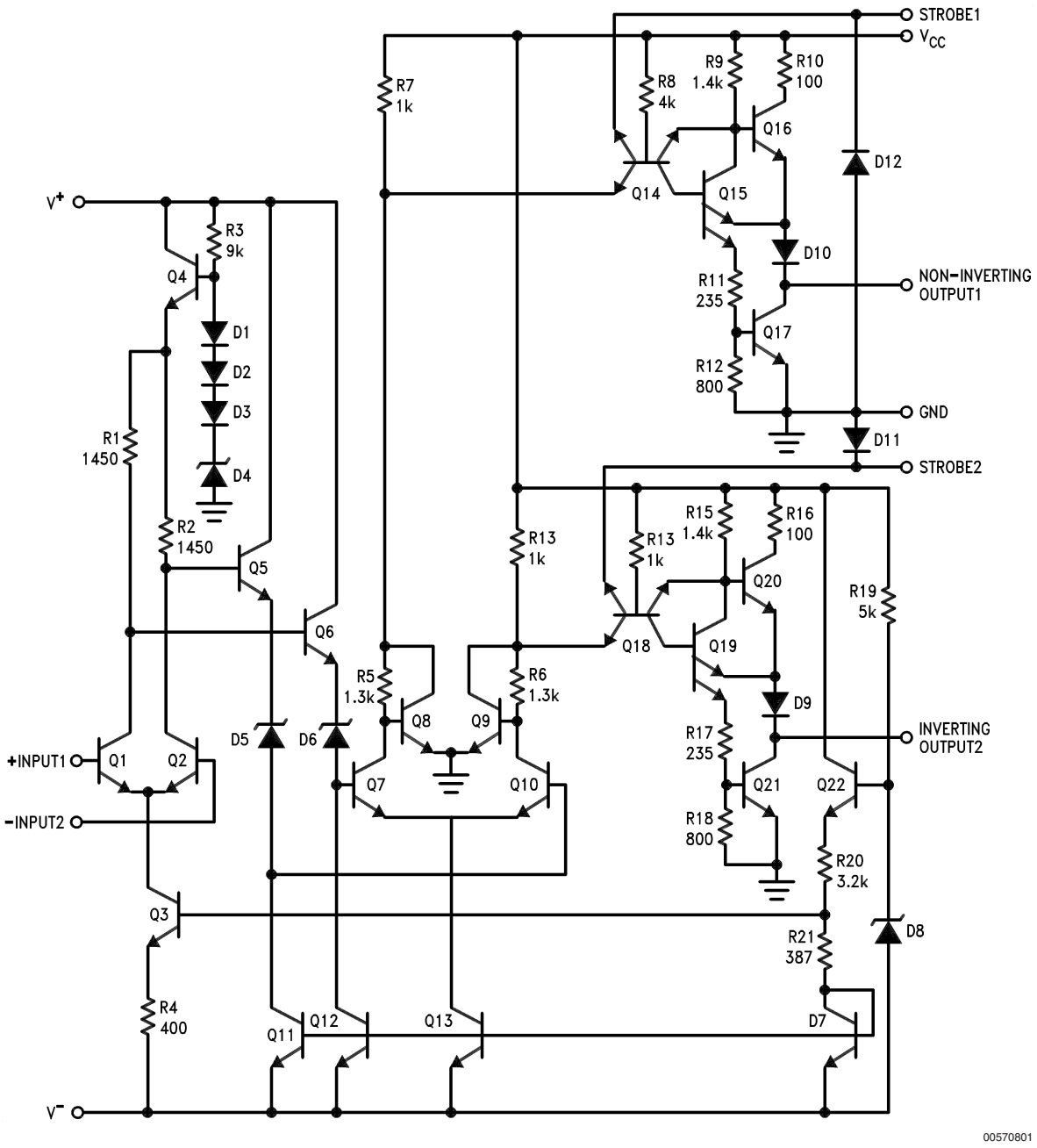
V_{IN} = ±50 mV FANOUT = 1 FANOUT = 4 V^- = –10V C=15 pF C = 30 pF
V^+ = +10V R = 2.4k R = 680Ω V_{CC} = 5.25V

Schematic Diagram

LM161

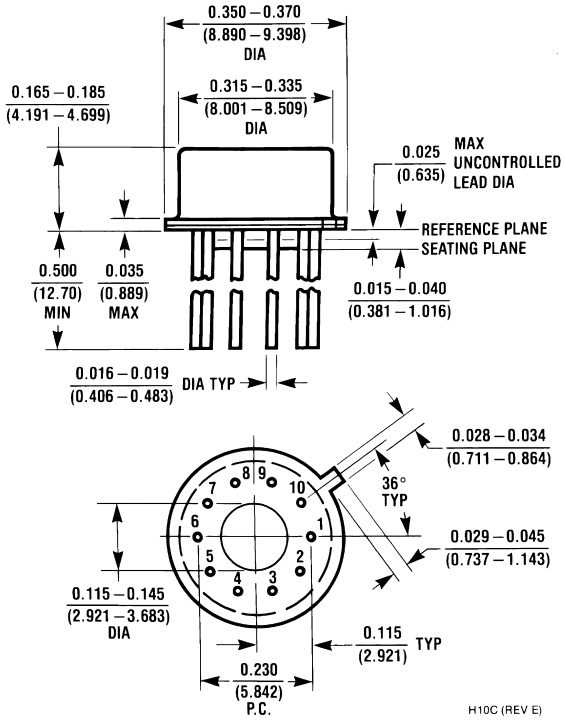


R10, R16: 85

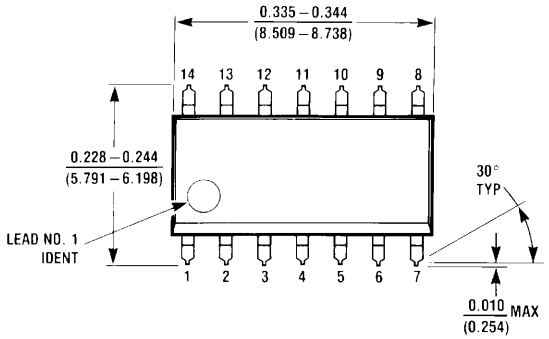
R11, R17: 205

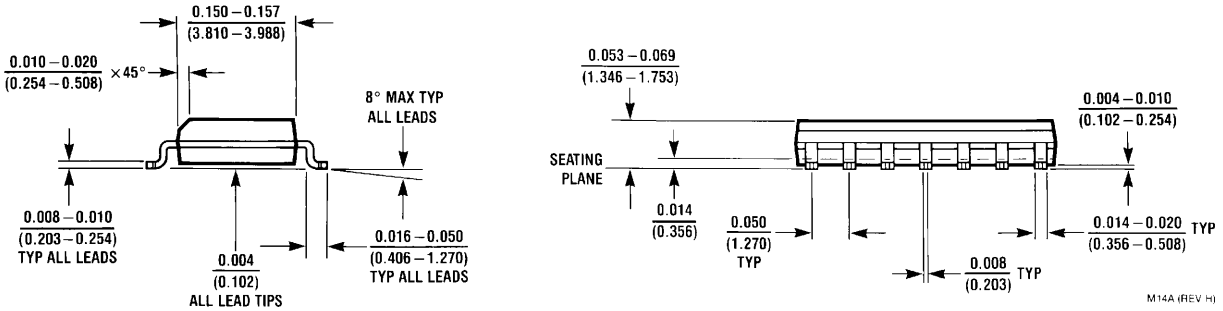
Physical Dimensions inches (millimeters)

unless otherwise noted



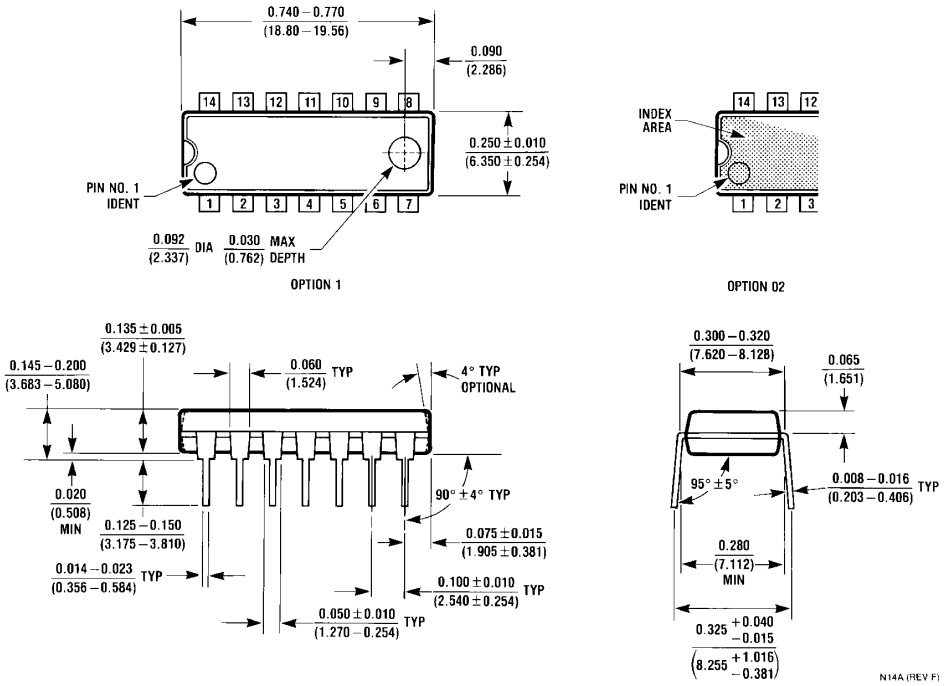
Metal Can Package (H)
Order Number LM161H/883, or LM361H
NS Package Number H10C





Order Number LM361M or LM361MX
NS Package Number M14A

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



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

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