National Semiconductor

December 1994

LM160/LM360 High Speed Differential Comparator

General Description

The LM160/LM360 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the μA760/μA760C, for which it is a pin-for-pin replacement. The device has been optimized for greater speed, input impedance and fan-out, and lower input offset voltage. Typically delay varies only 3 ns for overdrive variations of 5 mV to 400 mV.

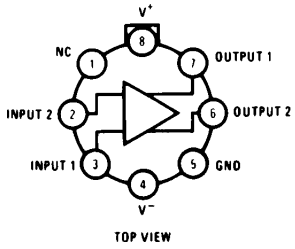
Complementary outputs having minimum skew are provided. Applications involve high speed analog to digital convertors and zero-crossing detectors in disk file systems.

Features

- Guaranteed high speed 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- High input impedance
- Low speed variation with overdrive variation
- Fan-out of 4
- Low input offset voltage
- Series 74 TTL compatible

Connection Diagrams

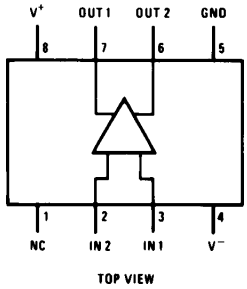
Metal Can Package



TL/H/5707–4

Order Number LM160H/883* or LM360H
See NS Package Number H08C

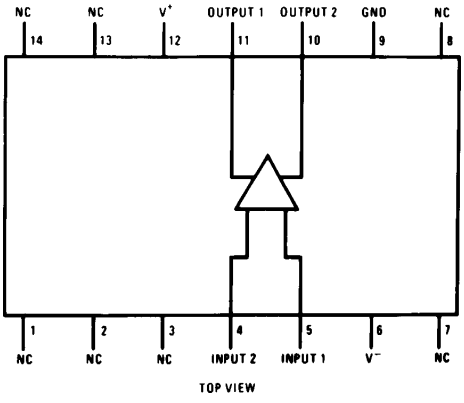
Dual-In-Line Package



TL/H/5707–5

Order Number LM160J/883*,
LM360M or LM360N
See NS Package Number J08A, M08A or N08E

Dual-In-Package



TL/H/5707–6

Order Number LM160J-14/883*
See NS Package Number J14A

*Also available in SMD# 5962-8767401

Absolute Maximum Ratings (Note 5)

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

(Note 7)

Positive Supply Voltage	+8V
Negative Supply Voltage	−8V
Peak Output Current	20 mA
Differential Input Voltage	±5V
Input Voltage	$V^+ \geq V_{IN} \geq V^-$
ESD Tolerance (Note 8)	1600V

Operating Temperature Range	
LM160	−55°C to +125°C
LM360	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C
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 ($T_{MIN} \leq T_A \leq T_{MAX}$)

Parameter	Conditions	Min	Typ	Max	Units
Operating Conditions					
Supply Voltage V_{CC}^+		4.5	5	6.5	V
Supply Voltage V_{CC}^-		−4.5	−5	−6.5	V
Input Offset Voltage	$R_S \leq 200\Omega$		2	5	mV
Input Offset Current			0.5	3	μA
Input Bias Current			5	20	μA
Output Resistance (Either Output)	$V_{OUT} = V_{OH}$		100		Ω
Response Time	$T_A = 25°C$, $V_S = \pm 5V$ (Notes 1, 6)		13	25	ns
	$T_A = 25°C$, $V_S = \pm 5V$ (Notes 2, 6)		12	20	ns
	$T_A = 25°C$, $V_S = \pm 5V$ (Notes 3, 6)		14		ns
Response Time Difference between Outputs					
(t_{pd} of $+V_{IN1}$) − (t_{pd} of $-V_{IN2}$)	$T_A = 25°C$ (Notes 1, 6)		2		ns
(t_{pd} of $+V_{IN2}$) − (t_{pd} of $-V_{IN\,1}$)	$T_A = 25°C$ (Notes 1, 6)		2		ns
(t_{pd} of $+V_{IN1}$) − (t_{pd} of $+V_{IN2}$)	$T_A = 25°C$ (Notes 1, 6)		2		ns
(t_{pd} of $-V_{IN1}$) − (t_{pd} of $-V_{IN2}$)	$T_A = 25°C$ (Notes 1, 6)		2		ns
Input Resistance	f = 1 MHz		17		kΩ
Input Capacitance	f = 1 MHz		3		pF
Average Temperature Coefficient of Input Offset Voltage	$R_S = 50\Omega$		8		μV/°C
Average Temperature Coefficient of Input Offset Current			7		nA/°C
Common Mode Input Voltage Range	$V_S = \pm 6.5V$	±4	±4.5		V
Differential Input Voltage Range		±5			V
Output High Voltage (Either Output)	$I_{OUT} = -320\ \mu A$, $V_S = \pm 4.5V$	2.4	3		V
Output Low Voltage (Either Output)	$I_{SINK} = 6.4$ mA		0.25	0.4	V
Positive Supply Current	$V_S = \pm 6.5V$		18	32	mA
Negative Supply Current	$V_S = \pm 6.5V$		−9	−16	mA

Note 1: Response time measured from the 50% point of a 30 mVp-p 10 MHz sinusoidal input to the 50% point of the output.

Note 2: Response time measured from the 50% point of a 2 Vp-p 10 MHz sinusoidal input to the 50% point of the output.

Note 3: Response time measured from the start of a 100 mV input step with 5 mV overdrive to the time when the output crosses the logic threshold.

Note 4: Typical thermal impedances are as follows:

Cavity DIP (J):	θ_{jA}	135°C/W	Header (H)	θ_{jA}	165°C/W	(Still Air)
					67°C/W	(400 LF/min Air Flow)
Molded DIP (N):	θ_{jA}	130°C/W		θ_{jC}	25°C/W	

Note 5: The device may be damaged if used beyond the maximum ratings.

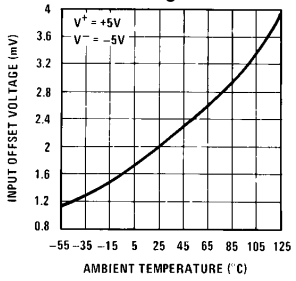
Note 6: Measurements are made in AC Test Circuit, Fanout = 1

Note 7: Refer to RETS 160X for LM160H, LM160J-14 and LM160J military specifications.

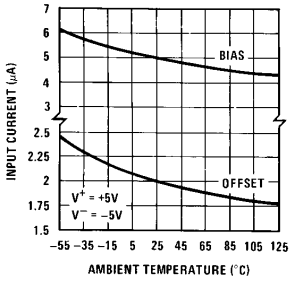
Note 8: Human body model, 1.5 kΩ in series with 100 pF.

Typical Performance Characteristics

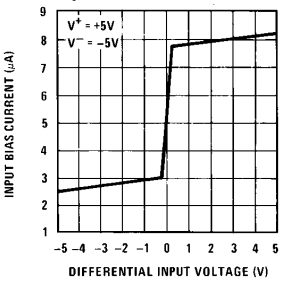
Offset Voltage



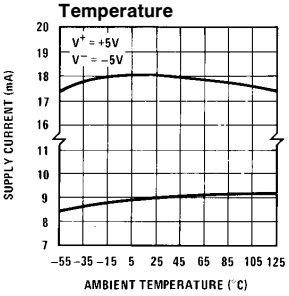
Input Currents vs Ambient Temperature



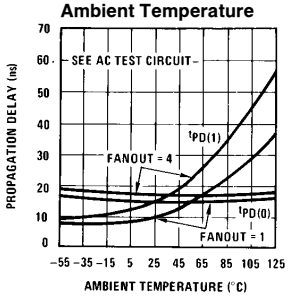
Input Characteristics



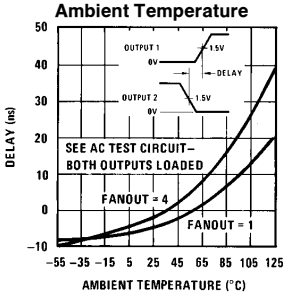
Supply Current vs Ambient Temperature



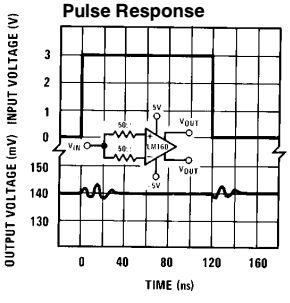
Propagation Delay vs Ambient Temperature



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



Common-Mode Pulse Response



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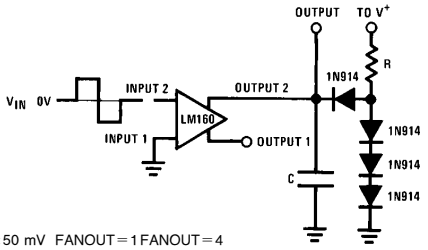
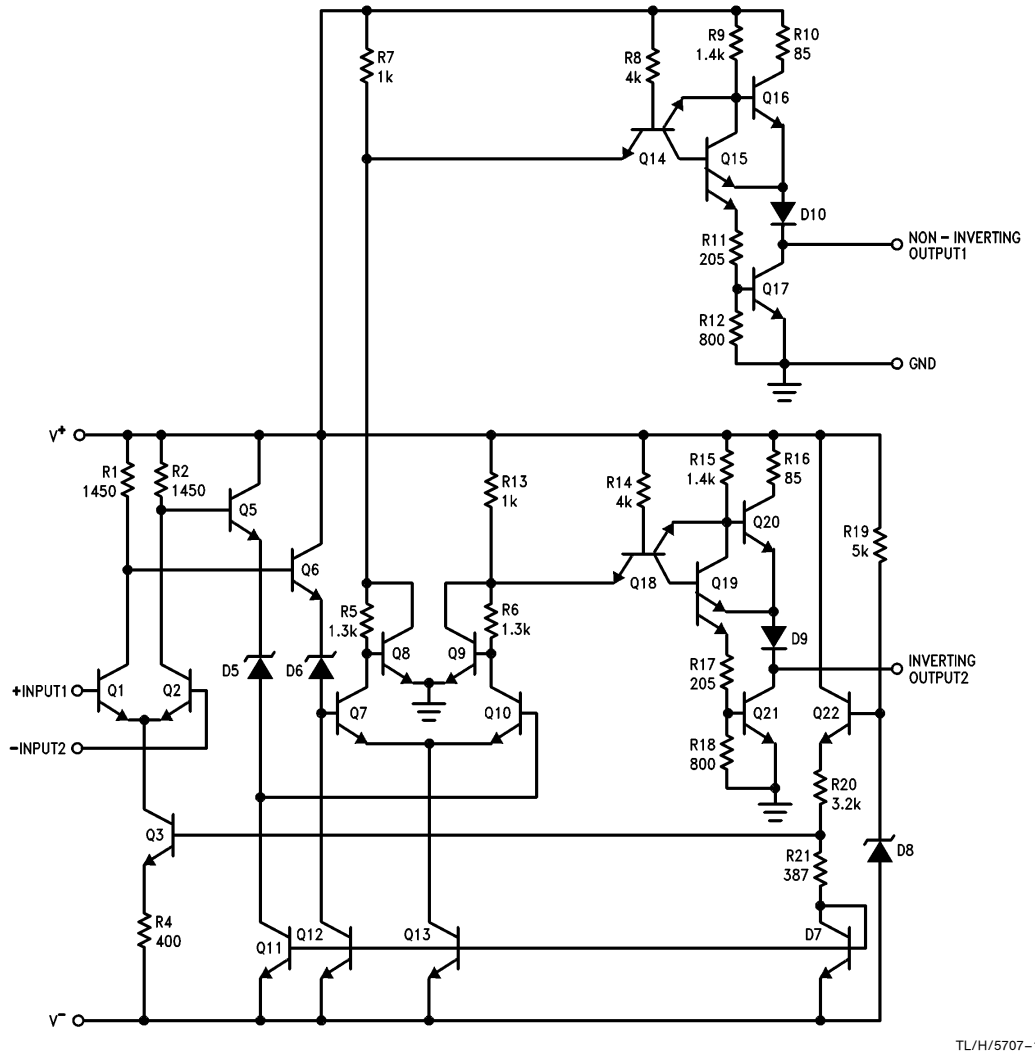
AC Test Circuit



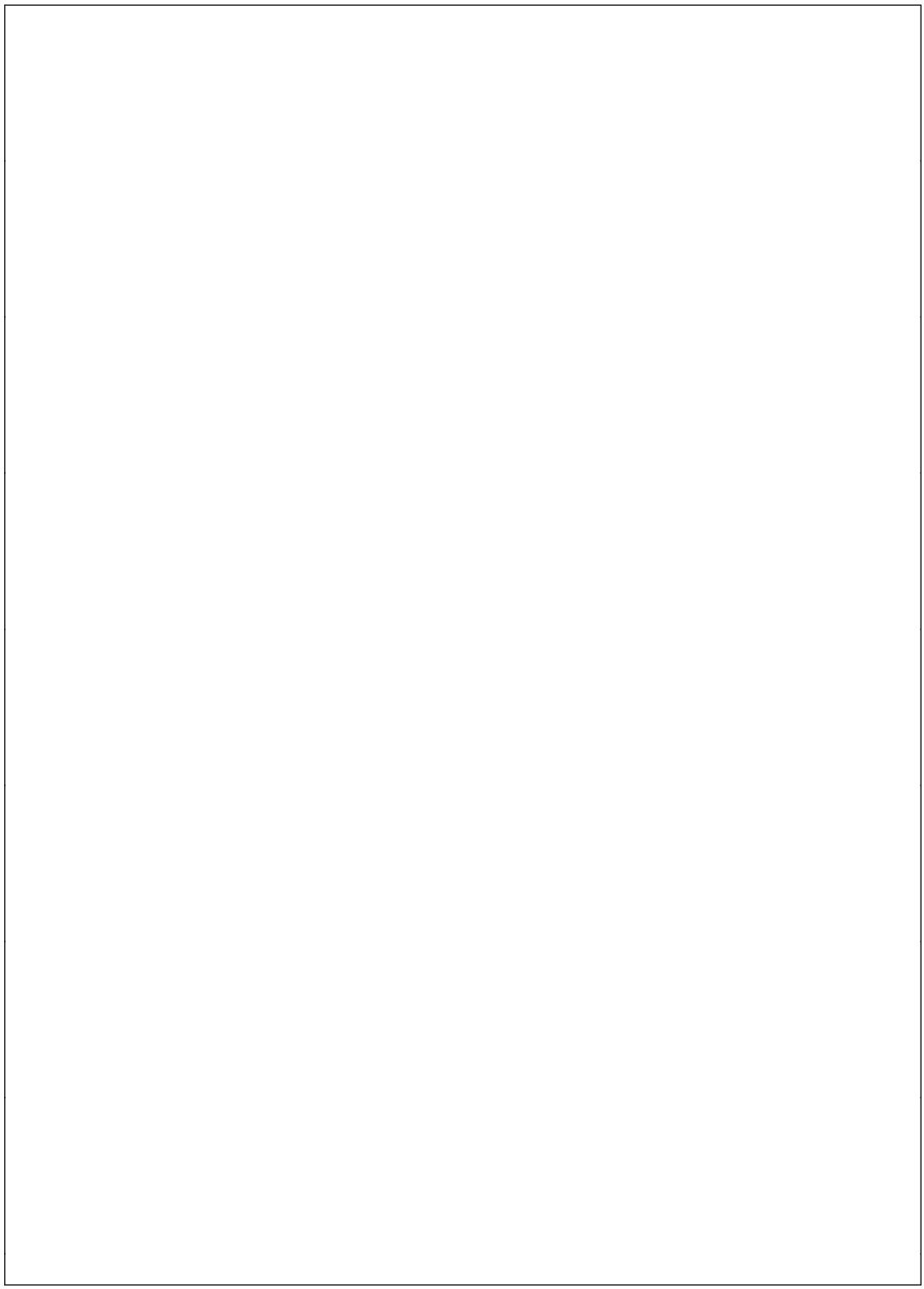
V_{IN} = ±50 mV FANOUT = 1 FANOUT = 4
V^+ = +5V R = 2.4k R = 630Ω
V^- = −5V C = 15 pF C = 30 pF

TL/H/5707–3

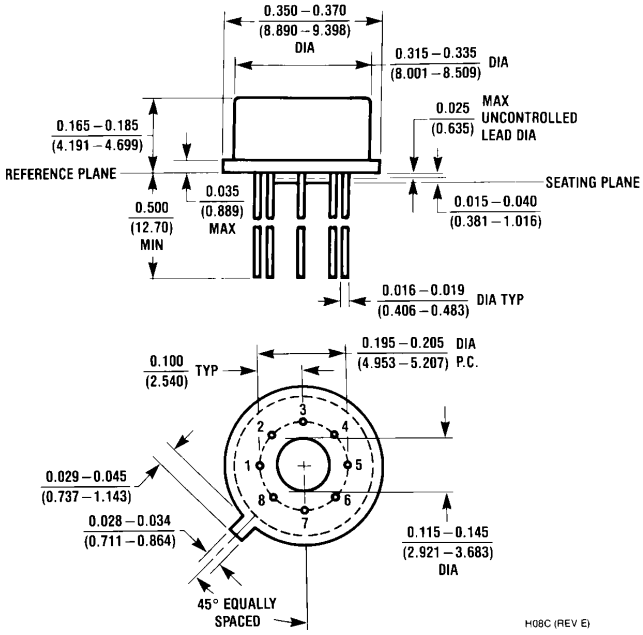
Schematic Diagram



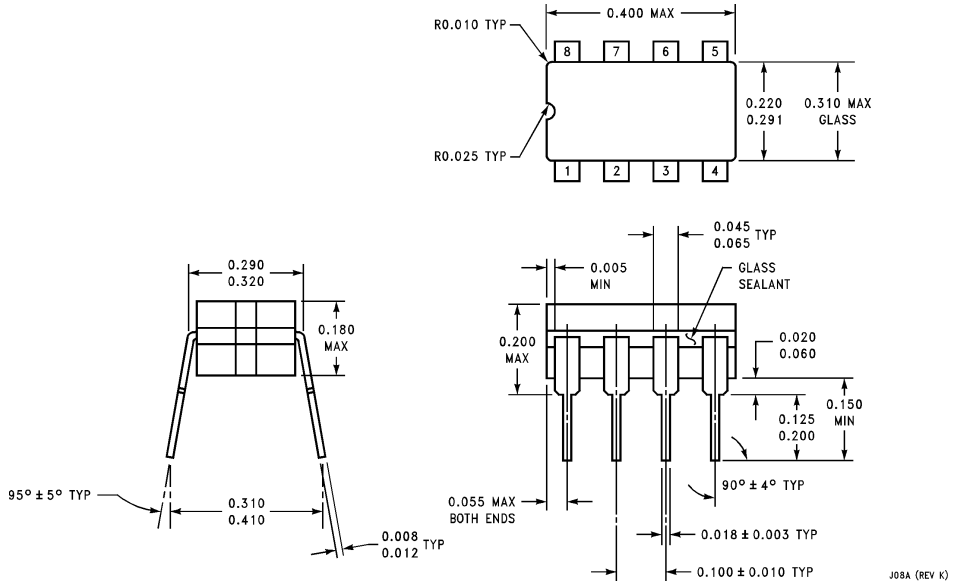
TL/H/5707–1



Physical Dimensions inches (millimeters)

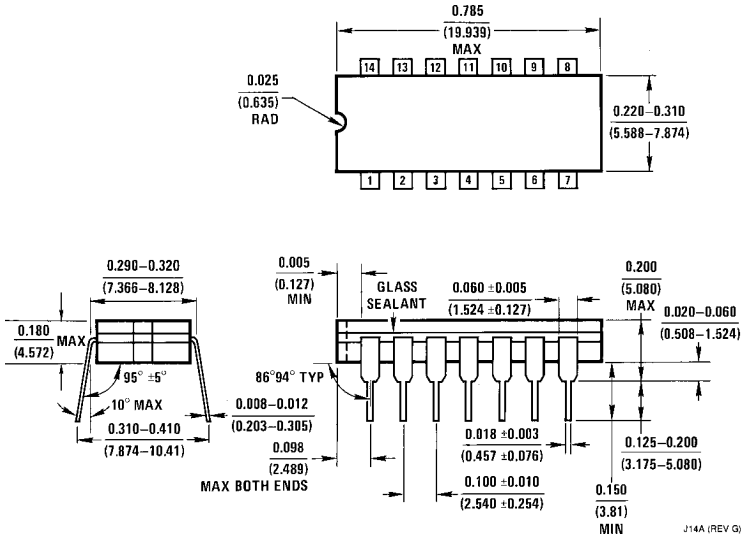


Metal Can Package (H)
Order Number LM160H/883 or LM360H
NS Package Number H08C

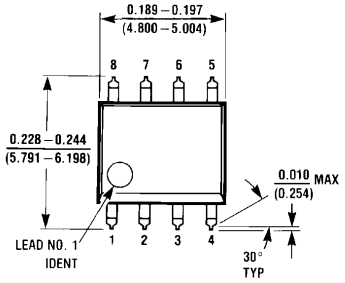


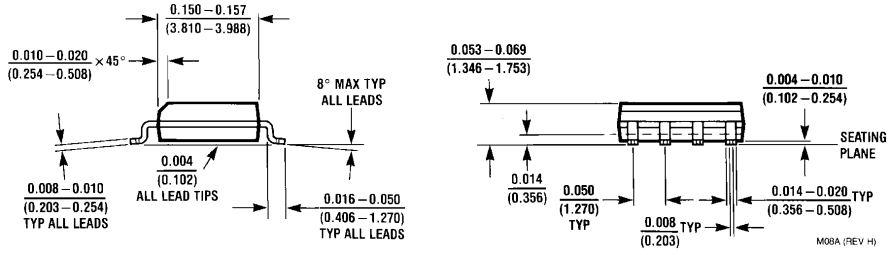
Dual In-Line Package (J)
Order Number LM160J/883
NS Package Number J08A

Physical Dimensions inches (millimeters) (Continued)



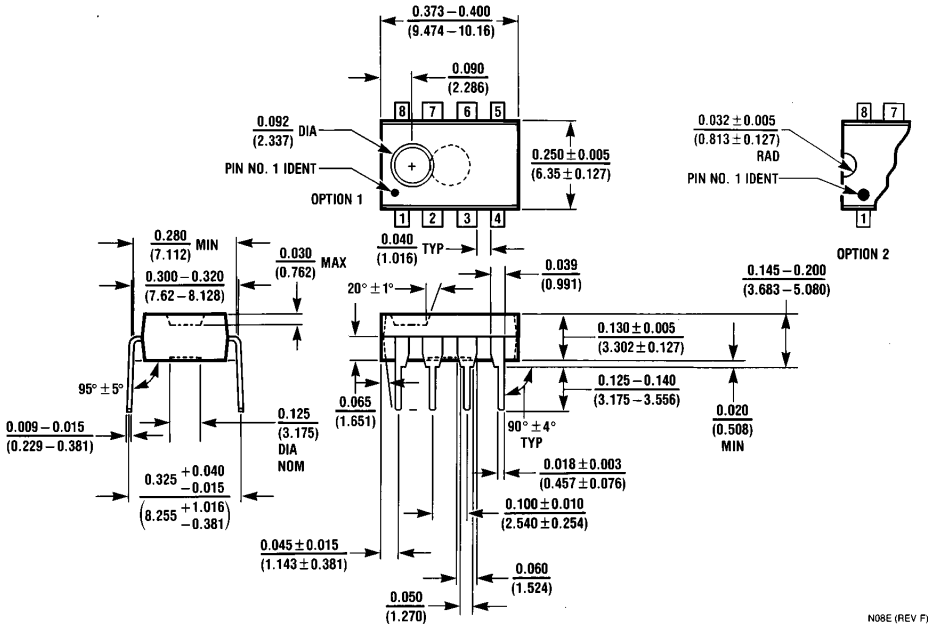
Ceramic Dual-In-Line Package (J)
Order Number LM160J-14/883
NS Package Number J14A





Molded Dual-In-Line Package (M)
Order Number LM360M
NS Package Number M08A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number LM360N
NS Package Number N08E

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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