

## LM160/LM360 High Speed Differential Comparator

### General Description

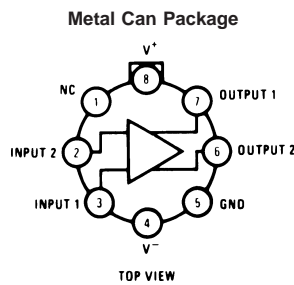
The LM160/LM360 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the  $\mu$ A760/ $\mu$ A760C, for which it is a pin-for-pin replacement. The device has been optimized for greater speed, input impedance and fan-out, and lower input 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

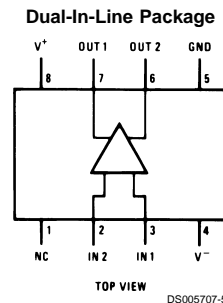
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- High input impedance
- Low speed variation with overdrive variation
- Fan-out of 4
- Low input offset voltage
- Series 74 TTL compatible

### Connection Diagrams



Order Number LM160H/883 (Note 1) or LM360H  
See NS Package Number H08C

Note 1: Also available in SMD# 5962-8767401



Order Number LM360M or LM360N  
See NS Package Number M08A or N08E

## Absolute Maximum Ratings (Notes 6, 8)

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

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 9)	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					
	$T_A = 25^\circ\text{C}, V_S = \pm 5\text{V}$ (Notes 2, 7)		13	25	ns
	$T_A = 25^\circ\text{C}, V_S = \pm 5\text{V}$ (Notes 3, 7)		12	20	ns
	$T_A = 25^\circ\text{C}, V_S = \pm 5\text{V}$ (Notes 4, 7)		14		ns
Response Time Difference between Outputs					
$(t_{pd} \text{ of } +V_{IN1}) - (t_{pd} \text{ of } -V_{IN2})$	$T_A = 25^\circ\text{C}$ (Notes 2, 7)		2		ns
$(t_{pd} \text{ of } +V_{IN2}) - (t_{pd} \text{ of } -V_{IN1})$	$T_A = 25^\circ\text{C}$ (Notes 2, 7)		2		ns
$(t_{pd} \text{ of } +V_{IN1}) - (t_{pd} \text{ of } +V_{IN2})$	$T_A = 25^\circ\text{C}$ (Notes 2, 7)		2		ns
$(t_{pd} \text{ of } -V_{IN1}) - (t_{pd} \text{ of } -V_{IN2})$	$T_A = 25^\circ\text{C}$ (Notes 2, 7)		2		ns
Input Resistance	$f = 1 \text{ MHz}$		17		kΩ
Input Capacitance	$f = 1 \text{ MHz}$		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	$V_S = \pm 6.5\text{V}$	±4	±4.5		V
Differential Input Voltage Range		±5			V
Output High Voltage (Either Output)	$I_{OUT} = -320 \mu\text{A}, V_S = \pm 4.5\text{V}$	2.4	3		V
Output Low Voltage (Either Output)	$I_{SINK} = 6.4 \text{ mA}$		0.25	0.4	V
Positive Supply Current	$V_S = \pm 6.5\text{V}$		18	32	mA
Negative Supply Current	$V_S = \pm 6.5\text{V}$		-9	-16	mA

**Note 2:** Response time measured from the 50% point of a 30 mVp-p 10 MHz sinusoidal input to the 50% point of the output.

**Note 3:** Response time measured from the 50% point of a 2 Vp-p 10 MHz sinusoidal input to the 50% point of the output.

**Note 4:** 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 5:** Typical thermal impedances are as follows:

Cavity DIP (J):	$\theta_{JA}$	135°C/W	Header (H)	$\theta_{JA}$	165°C/W	(Still Air)
Molded DIP (N):	$\theta_{JA}$	130°C/W		$\theta_{JC}$	67°C/W	(400 LF/min Air Flow)
					25°C/W	

**Note 6:** The device may be damaged if used beyond the maximum ratings.

**Note 7:** Measurements are made in AC Test Circuit, Fanout = 1

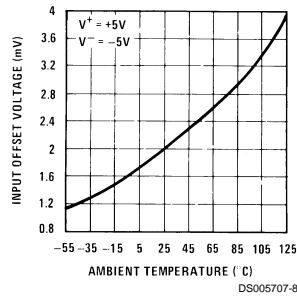
**Note 8:** Refer to RETS 160X for LM160H, LM160J-14 and LM160J military specifications.

## Electrical Characteristics (Continued)

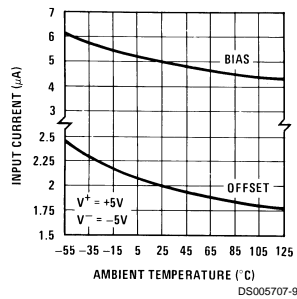
Note 9: Human body model, 1.5 k $\Omega$  in series with 100 pF.

### Typical Performance Characteristics

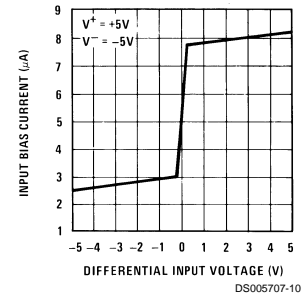
Offset Voltage



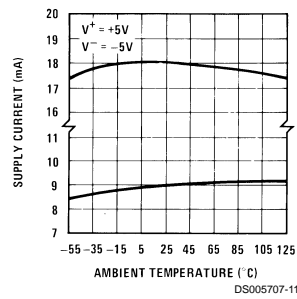
Input Current vs Ambient Temperature



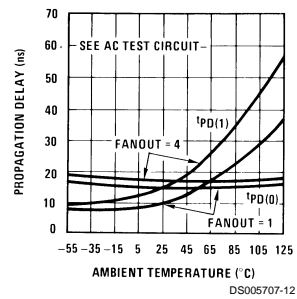
Input Characteristics



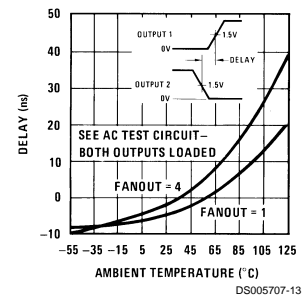
Supply Current vs Ambient Temperature



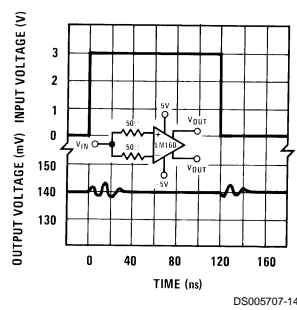
Propagation Delay vs Ambient Temperature



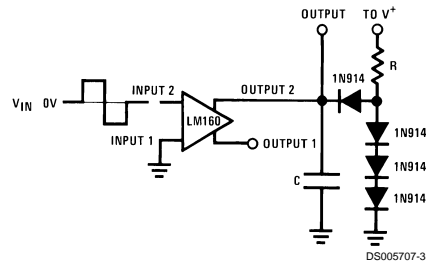
Delay of Output 1 With Respect to Output 2 vs Ambient Temperature



Common-Mode Pulse Response

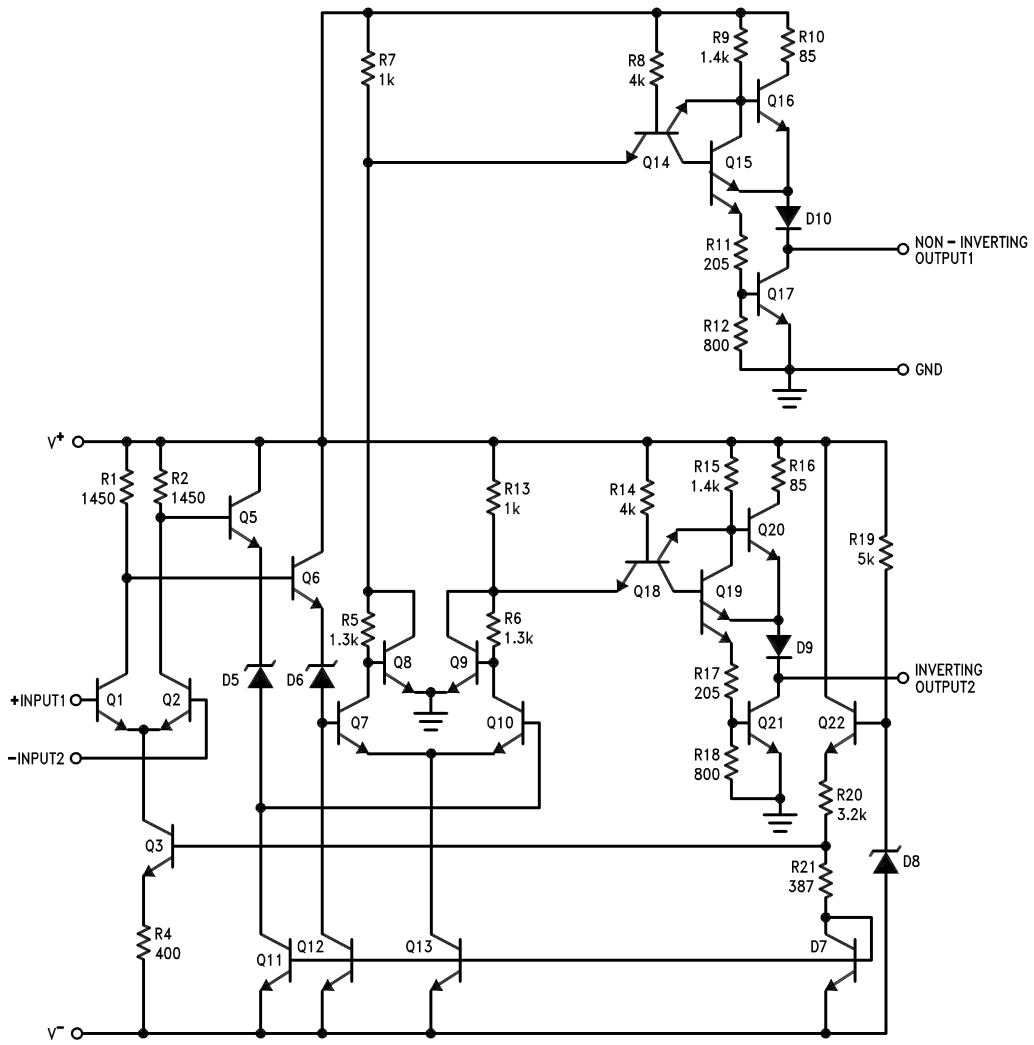


## AC Test Circuit



$V_{IN} = \pm 50 \text{ mV}$     FANOUT=1    FANOUT=4  
 $V^+ = +5\text{V}$      $R = 2.4\text{k}$      $R = 630\Omega$   
 $V^- = -5\text{V}$      $C = 15 \text{ pF}$      $C = 30 \text{ pF}$

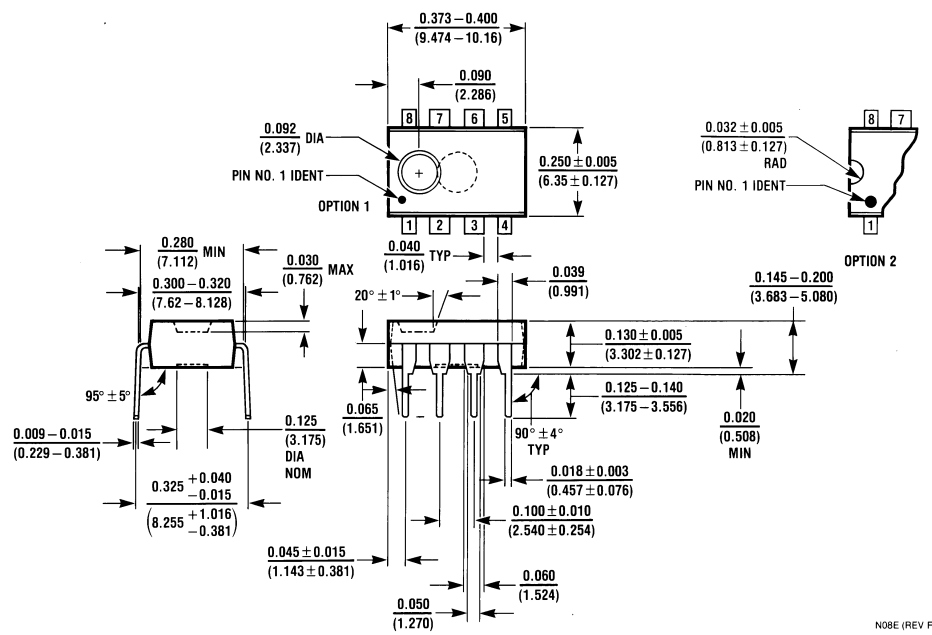
# Schematic Diagram



DS005707-1



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



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

NO8E (REV F)

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