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National Semiconductor

August 2000

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.

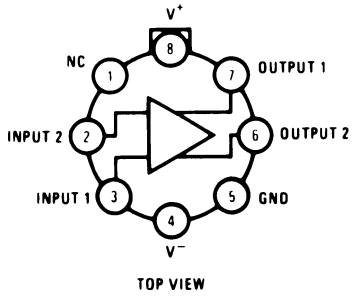
Complementary outputs having minimum skew are provided. Applications involve high speed analog to digital convertors and zero-crossing detectors in disk file systems.

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



TOP VIEW

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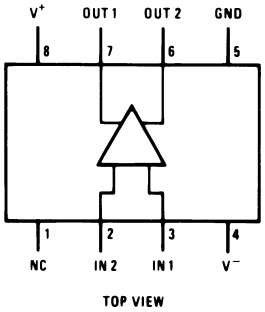
Order Number LM160H/883 (Note 1)
See NS Package Number H08C

Dual-In-Line Package



TOP VIEW

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Order Number LM360M, LM360MX or LM360N
See NS Package Number M08A or N08E

Note 1: Also available in SMD# 5962-8767401

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	$T_A = 25˚C$, $V_S = \pm5V$ (Notes 2, 7)		13	25	ns
	$T_A = 25˚C$, $V_S = \pm5V$ (Notes 3, 7)		12	20	ns
	$T_A = 25˚C$, $V_S = \pm5V$ (Notes 4, 7)		14		ns
Response Time Difference between Outputs					
(t_{pd} of $+V_{IN1}$) − (t_{pd} of $-V_{IN2}$)	$T_A = 25˚C$ (Notes 2, 7)		2		ns
(t_{pd} of $+V_{IN2}$) − (t_{pd} of $-V_{IN1}$)	$T_A = 25˚C$ (Notes 2, 7)		2		ns
(t_{pd} of $+V_{IN1}$) − (t_{pd} of $+V_{IN2}$)	$T_A = 25˚C$ (Notes 2, 7)		2		ns
(t_{pd} of $-V_{IN1}$) − (t_{pd} of $-V_{IN2}$)	$T_A = 25˚C$ (Notes 2, 7)		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	$V_S = \pm6.5V$	±4	±4.5		V
Differential Input Voltage Range		±5			V
Output High Voltage (Either Output)	$I_{OUT} = -320$ µA, $V_S = \pm4.5V$	2.4	3		V
Output Low Voltage (Either Output)	$I_{SINK} = 6.4$ mA		0.25	0.4	V
Positive Supply Current	$V_S = \pm6.5V$		18	32	mA
Negative Supply Current	$V_S = \pm6.5V$		−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.

Electrical Characteristics (Continued)

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

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

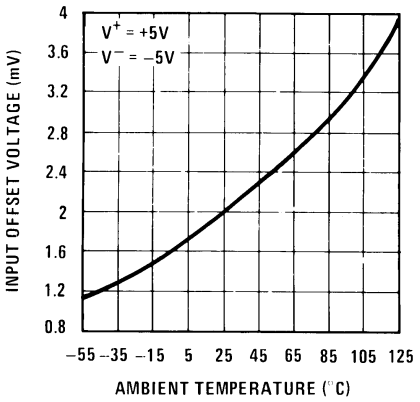
Note 7: Measurements are made in AC Test Circuit, Fanout = 1

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

Note 9: Human body model, 1.5 kΩ in series with 100 pF.

Typical Performance Characteristics

Offset Voltage



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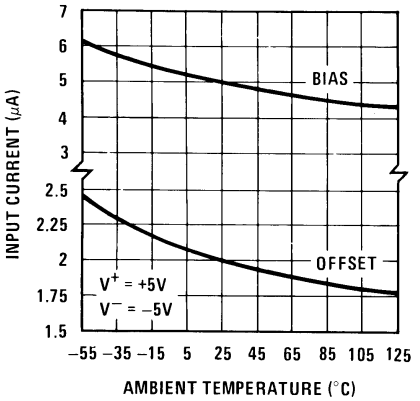
Input Current vs Ambient Temperature



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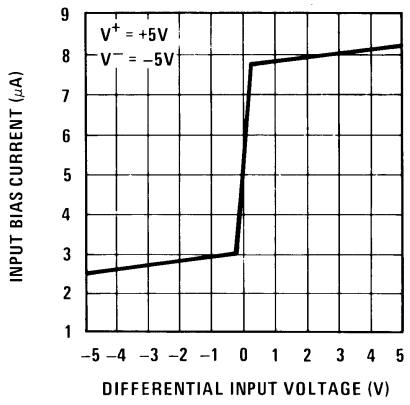
Input Characteristics



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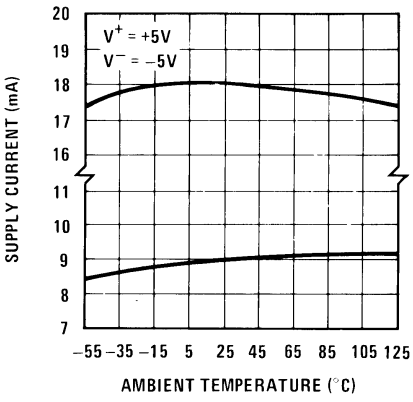
Supply Current vs Ambient Temperature



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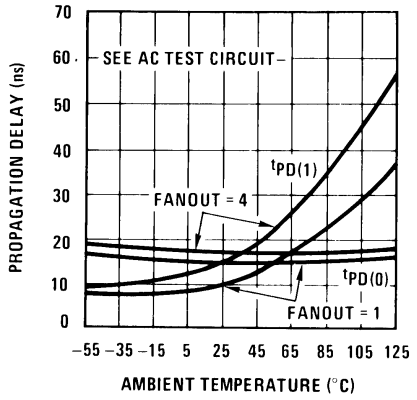
Typical Performance Characteristics (Continued)

Propagation Delay vs Ambient Temperature



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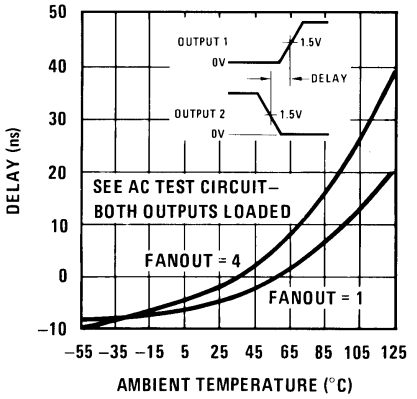
Delay of Output 1 With Respect to Output 2 vs Ambient Temperature



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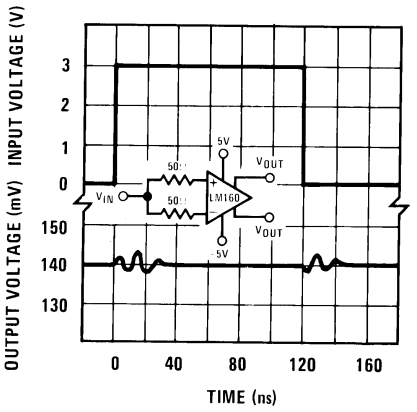
Common-Mode Pulse Response



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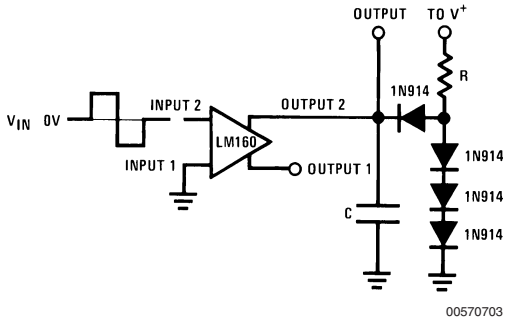
AC Test Circuit



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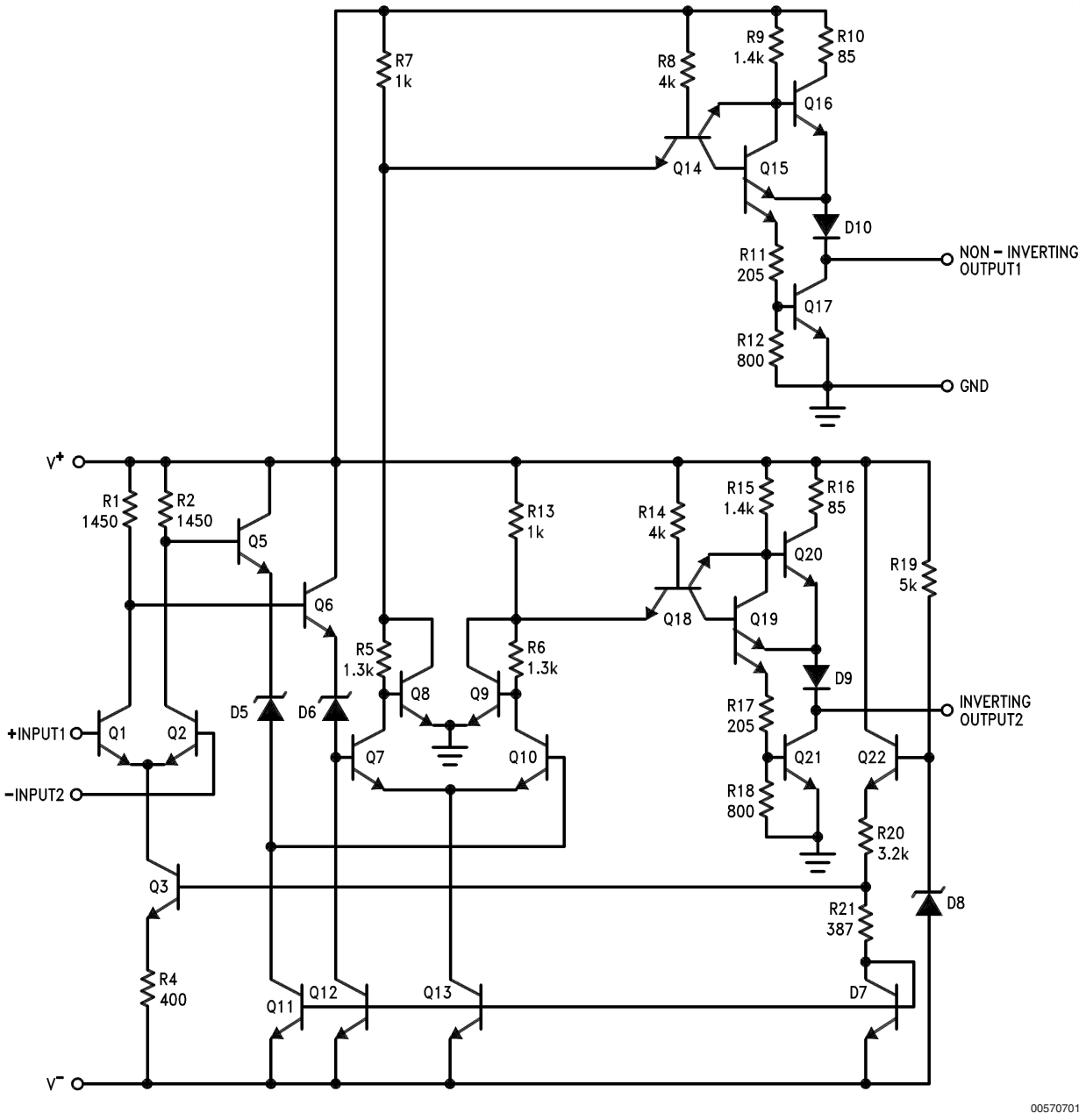
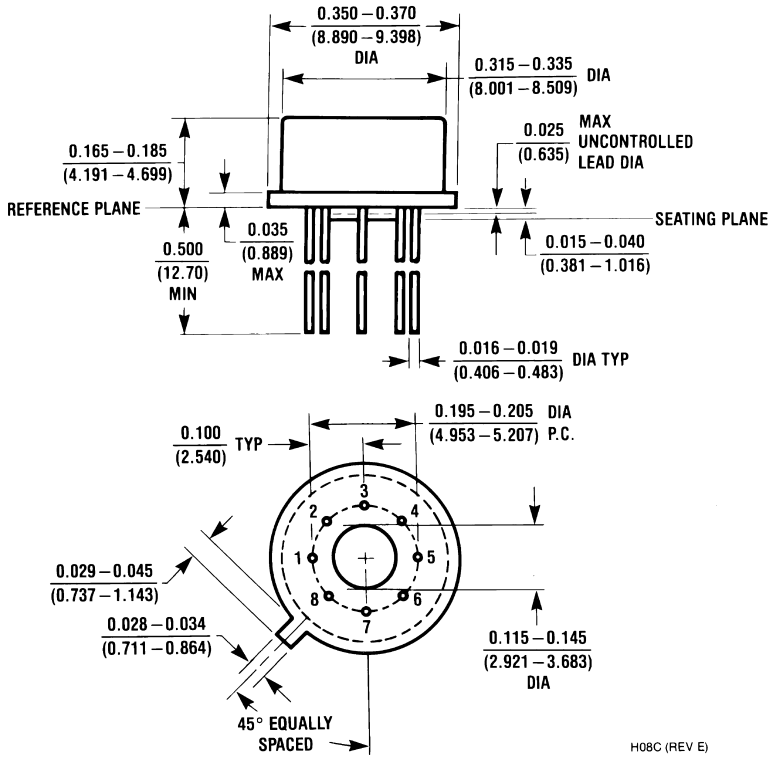
V_{IN}=±50 mV	FANOUT=1	FANOUT=4
V^+=+5V	R=2.4k	R=630Ω
V^-=–5V	C=15 pF	C=30 pF

Schematic Diagram



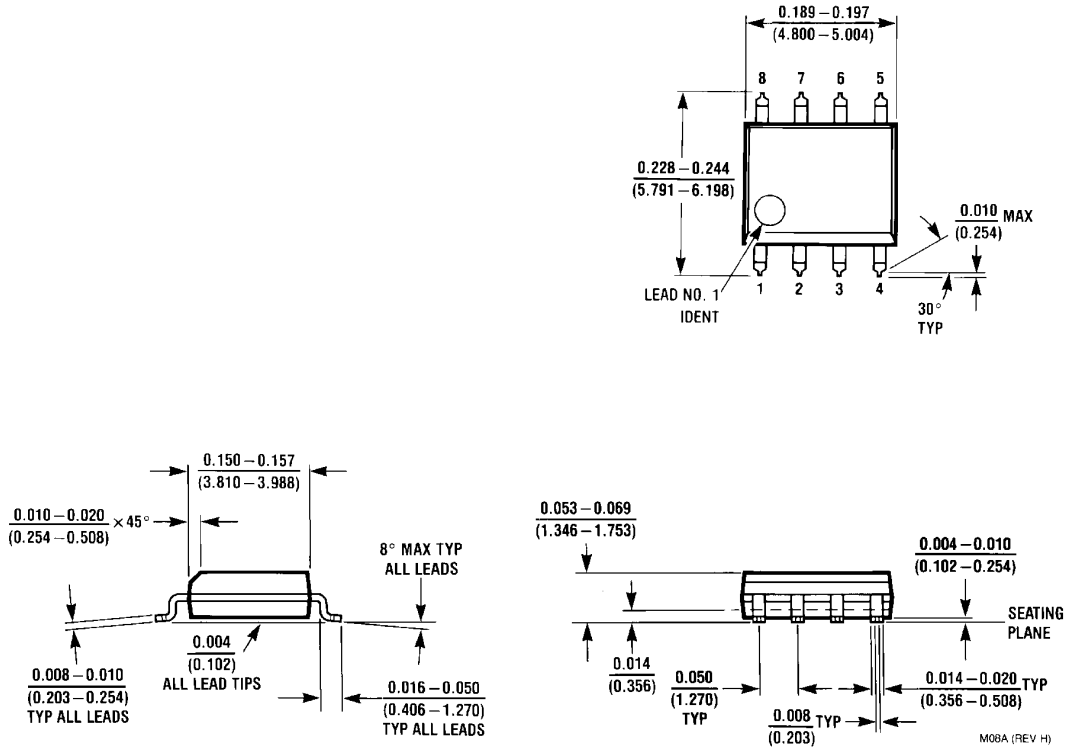
Physical Dimensions inches (millimeters)

unless otherwise noted



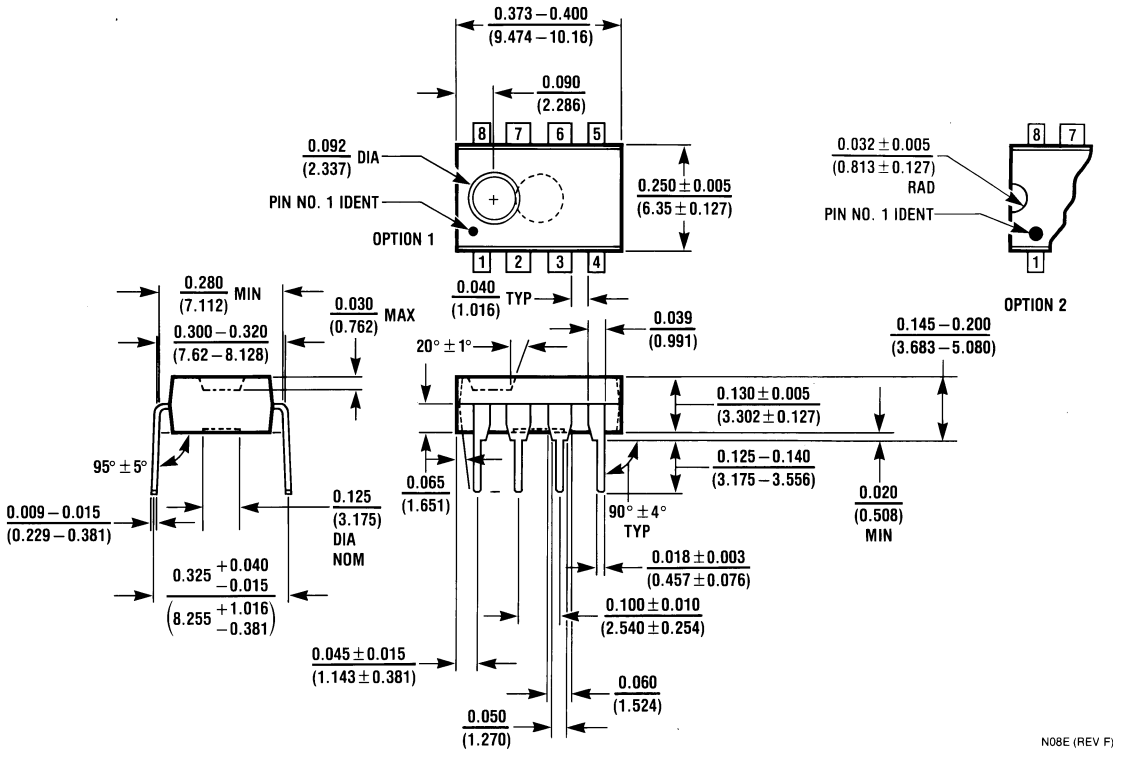
Metal Can Package (H)
Order Number LM160H/883
NS Package Number H08C

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



Molded Dual-In-Line Package (M)
Order Number LM360M or LM360MX
NS Package Number M08A

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



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

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