National Semiconductor

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LM760
High Speed Differential Comparator

General Description

The LM760 is a differential voltage comparator offering considerable speed improvement over the LM710 family and operates from symmetric supplies of ±4.5V to ±6.5V. The LM760 can be used in high speed analog-to-digital conversion systems and as a zero crossing detector in disc file and tape amplifiers. The LM760 output features balanced rise and fall times for minimum skew and close matching between the complementary outputs. The outputs are TTL compatible with a minimum sink capability of two gate loads.

Features

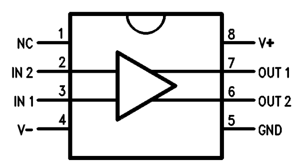
- Guaranteed high speed— 25 ns response time
- Guaranteed delay matching on both outputs
- Complementary TTL compatible outputs
- High sensitivity
- Standard supply voltages

Applications

- High speed A-to-D
- Peak or zero detector

Connection Diagram

8-Lead DIP



TL/H/10067–3

Top View

Ordering Information

Temperature Range Commercial 0°C to +70°C	Package Type	NSC Package Drawing
LM760CN	8-lead Plastic DIP	N08E

Absolute Maximum Ratings

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

Storage Temperature Range	
Metal Can and Ceramic DIP	−65°C to +175°C
Molded DIP	−65°C to +150°C
Operating Temperature Range	
Military (LM760)	−55°C to +125°C
Commercial (LM760C)	0°C to +70°C
Lead Temperature	
Metal Can and Ceramic DIP (Soldering, 60 sec.)	300°C
Molded DIP (Soldering, 10 sec.)	265°C
Positive Supply Voltage	+8.0V
Negative Supply Voltage	−8.0V
Peak Output Current	10 mA
Differential Input Voltage	±5.0V
Input Voltage	$V^+ \geq V_I \geq V^-$
ESD Susceptibility	TBD

LM760
Electrical Characteristics

$V_{CC} = \pm 4.5V$ to $\pm 6.5V$, $T_A = -55°C$ to $+125°C$, $T_A = 25°C$ for typical figures, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IO}	Input Offset Voltage	$R_S \leq 200\Omega$		1.0	6.0	mV
I_{IO}	Input Offset Current			0.5	7.5	μA
I_{IB}	Input Bias Current			8.0	60	μA
R_O	Output Resistance (Either Output)	$V_O = V_{OH}$		100		Ω
t_{PD}	Response Time	$T_A = 25°C$ (Note 3)		18	30	ns
		$T_A = 25°C$ (Note 4)			25	
		(Note 5)		16		
Δt_{PD}	Response Time Difference between Outputs (Note 1) $(t_{PD}$ of $+V_{I1}) - (t_{PD}$ of $-V_{I2})$	$T_A = 25°C$			5.0	ns
	$(t_{PD}$ of $+V_{I2}) - (t_{PD}$ of $-V_{I1})$	$T_A = 25°C$			5.0	
	$(t_{PD}$ of $+V_{I1}) - (t_{PD}$ of $+V_{I2})$	$T_A = 25°C$			7.5	
	$(t_{PD}$ of $-V_{I1}) - (t_{PD}$ of $-V_{I2})$	$T_A = 25°C$			7.5	
R_I	Input Resistance	f = 1.0 MHz		12		kΩ
C_I	Input Capacitance	f = 1.0 MHz		8.0		pF
$\Delta V_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Voltage	$R_S = 50\Omega$, $T_A = -55°C$ to $+125°C$		3.0		μV/°C
$\Delta I_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Current	$T_A = +25°C$ to $+125°C$		2.0		nA/°C
		$T_A = +25°C$ to $-55°C$		7.0		
V_{IR}	Input Voltage Range	$V_{CC} = \pm 6.5V$	±4.0	±4.5		V
V_{IDR}	Differential Input Voltage Range			±5.0		V
V_{OH}	Output Voltage HIGH (Either Output)	$0\ mA \leq I_{OH} \leq 5.0\ mA$, $V_{CC} = +5.0V$	2.4	3.2		V
		$I_{OH} = 80\ \mu A$, $V_{CC} = \pm 4.5V$	2.4	3.0		
V_{OL}	Output Voltage LOW (Either Output)	$I_{OL} = 3.2\ mA$		0.25	0.4	V
I^+	Positive Supply Current	$V_{CC} = \pm 6.5V$		18	32	mA
I^-	Negative Supply Current	$V_{CC} = \pm 6.5V$		9.0	16	mA

LM760C
Electrical Characteristics

$V_{CC} = \pm 4.5V$ to $\pm 6.5V$, $T_A = 0°C$ to $+70°C$, $T_A = 25°C$ for typical figures, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IO}	Input Offset Voltage	$R_S \leq 200\Omega$		1.0	6.0	mV
I_{IO}	Input Offset Current			0.5	7.5	µA
I_{IB}	Input Bias Current			8.0	60	µA
R_O	Output Resistance (Either Output)	$V_O = V_{OH}$		100		Ω
t_{PD}	Response Time	$T_A = 25°C$ (Note 3)		18	30	ns
		$T_A = 25°C$ (Note 4)			25	
		(Note 5)		16		
Δt_{PD}	Response Time Difference between Outputs (Note 1) (t_{PD} of $+V_{I1}$) − (t_{PD} of $-V_{I2}$)	$T_A = 25°C$			5.0	ns
	(t_{PD} of $+V_{I2}$) − (t_{PD} of $-V_{I1}$)	$T_A = 25°C$			5.0	
	(t_{PD} of $+V_{I1}$) − (t_{PD} of $+V_{I2}$)	$T_A = 25°C$			10	
	(t_{PD} of $-V_{I1}$) − (t_{PD} of $-V_{I2}$)	$T_A = 25°C$			10	
R_I	Input Resistance	f = 1.0 MHz		12		kΩ
C_I	Input Capacitance	f = 1.0 MHz		8.0		pF
$\Delta V_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Voltage	$R_S = 50\Omega$, $T_A = 0°C$ to $+70°C$		3.0		µV/°C
$\Delta I_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Current	$T_A = +25°C$ to $+70°C$		5.0		nA/°C
		$T_A = +25°C$ to $0°C$		10		
V_{IR}	Input Voltage Range	$V_{CC} = \pm 6.5V$	±4.0	±4.5		V
V_{IDR}	Differential Input Voltage Range			±5.0		V
V_{OH}	Output Voltage HIGH (Either Output)	0 mA ≤ I_{OH} ≤ 5.0 mA $V_{CC} = +5.0V$	2.4	3.2		V
		$I_{OH} = 80$ µA, $V_{CC} = \pm 4.5V$	2.5	3.0		
V_{OL}	Output Voltage LOW (Either Output)	$I_{OL} = 3.2$ mA		0.25	0.4	V
I^+	Positive Supply Current	$V_{CC} = \pm 6.5V$		18	34	mA
I^-	Negative Supply Current	$V_{CC} = \pm 6.5V$		9.0	16	mA

Note 1: $T_{J\ Max} = 150°C$.

Note 2: Ratings apply to ambient temperature at 25°C.

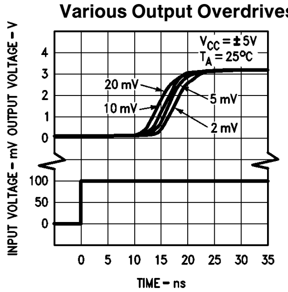
Note 3: Response time measured from the 50% point of a 30 mV_{P-P} 10 MHz sinusoidal input to the 50% point of the output.

Note 4: Response time measured from the 50% point of a 2.0 V_{P-P} 10 MHz sinusoidal input to the 50% point of the output.

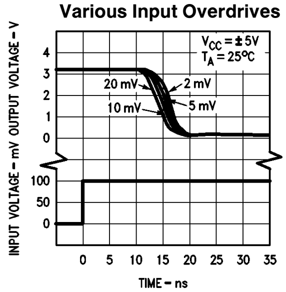
Note 5: Response time measured from the start of a 100 mV input step with 5.0 mV overdrive to the time when the output crosses the logic threshold.

Typical Performance Characteristics

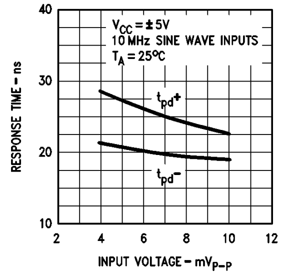
Response Time for Various Output Overdrives



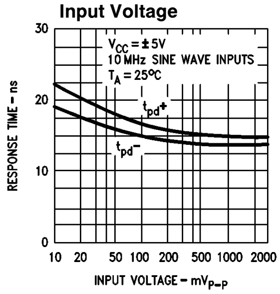
Response Time for Various Input Overdrives



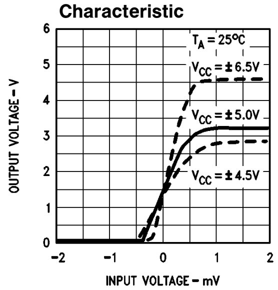
Response Time vs Input Voltage



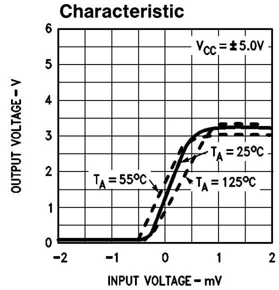
Response Time vs Input Voltage



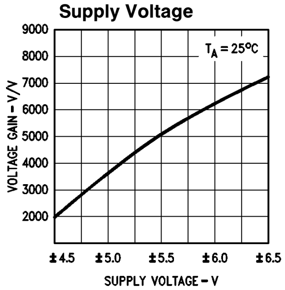
Voltage Transfer Characteristic



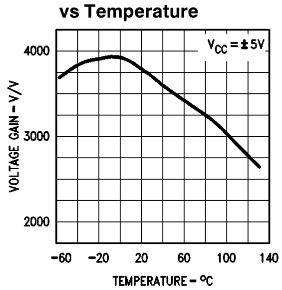
Voltage Transfer Characteristic



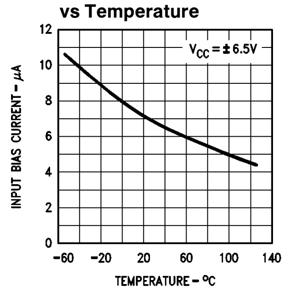
Voltage Gain vs Supply Voltage



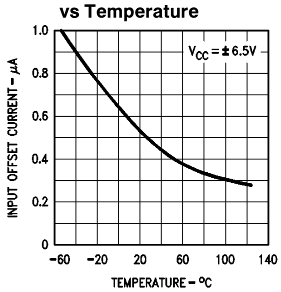
Voltage Gain vs Temperature



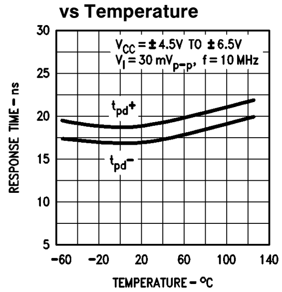
Input Bias Current vs Temperature



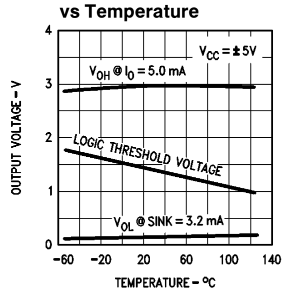
Input Offset Current vs Temperature



Response Time vs Temperature



Output Voltage Levels vs Temperature



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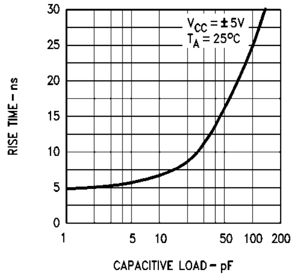
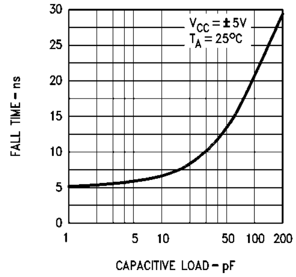
Typical Performance Characteristics (Continued)

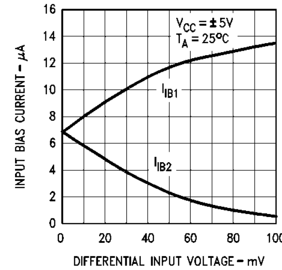
Rise Time vs Capacitive Load



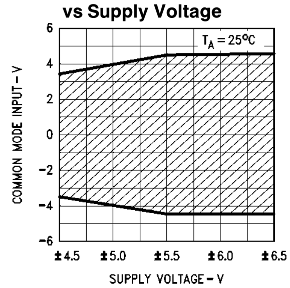
Fall Time vs Capacitive Load



Input Bias Current vs Differential Input Voltage



Common Mode Range vs Supply Voltage



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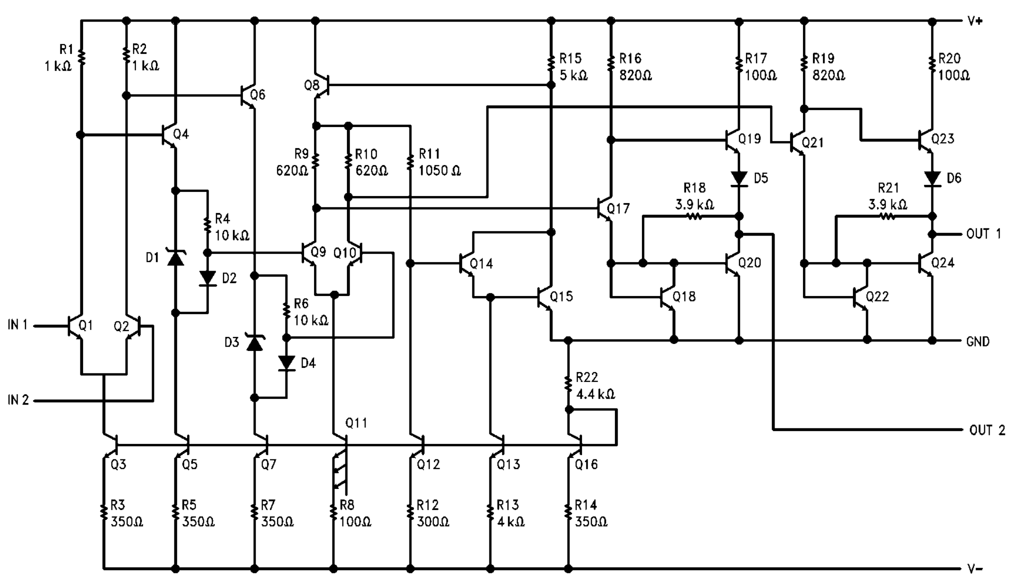
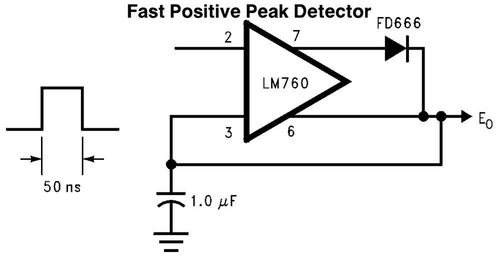
Equivalent Circuit



TL/H/10067–4

Typical Applications (Note 1)

Fast Positive Peak Detector



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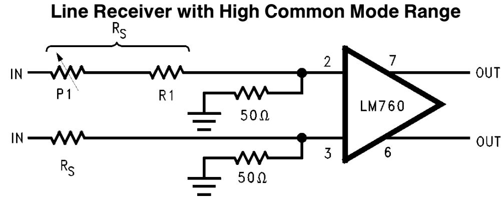
Line Receiver with High Common Mode Range



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Common mode range $= \pm 4 \times \frac{R_S}{50}$ V

Differential Input Sensitivity $= 5 \times \frac{R_S}{50}$ mV

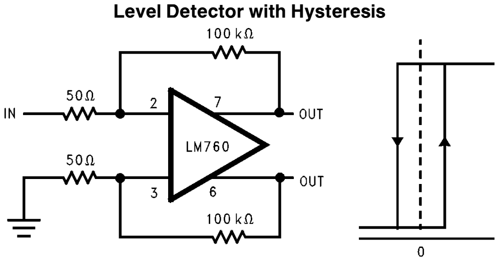
P_1 must be adjusted for optimum common mode rejection.

For $R_S = 200\Omega$:

Common mode range $= \pm 16V$

Sensitivity $=$ 20 mV

Level Detector with Hysteresis



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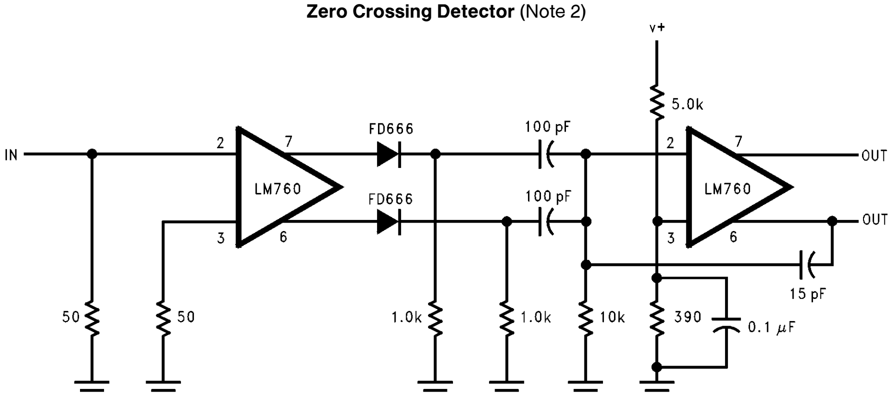
Zero Crossing Detector (Note 2)



TL/H/10067–9

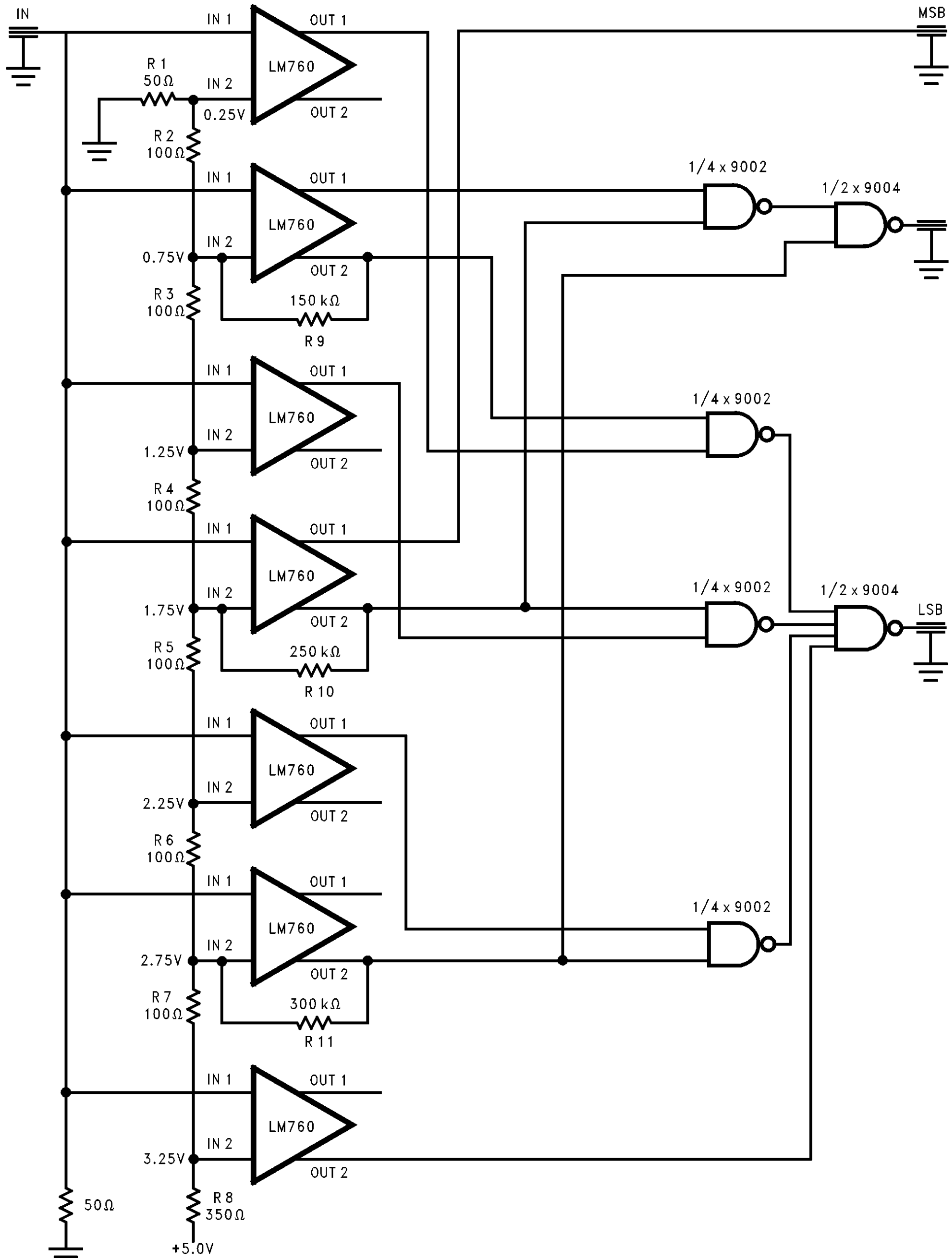
Total delay $=$ 30 ns
Input Frequency $=$ 300 Hz to 3.0 MHz
Minimum input voltage $=$ 20 mV_{P-P}

Note 1: Lead numbers shown are for Metal Package only.

Note 2: All resistor values in ohms.

Typical Applications (Note 1) (Continued)

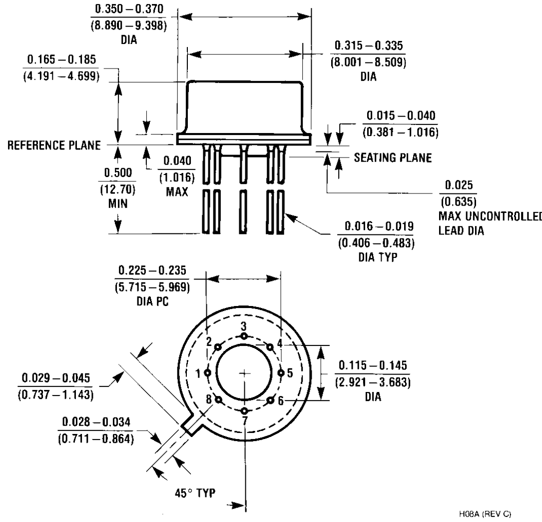
High Speed 3-Bit A/D Converter



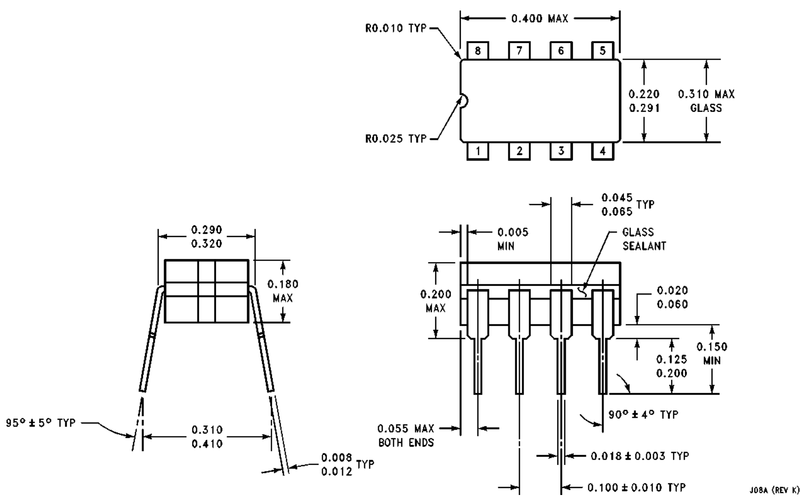
TL/H/10067–11

Input voltage range = 3.5V
Typical conversion speed = 30 ns

Physical Dimensions inches (millimeters)

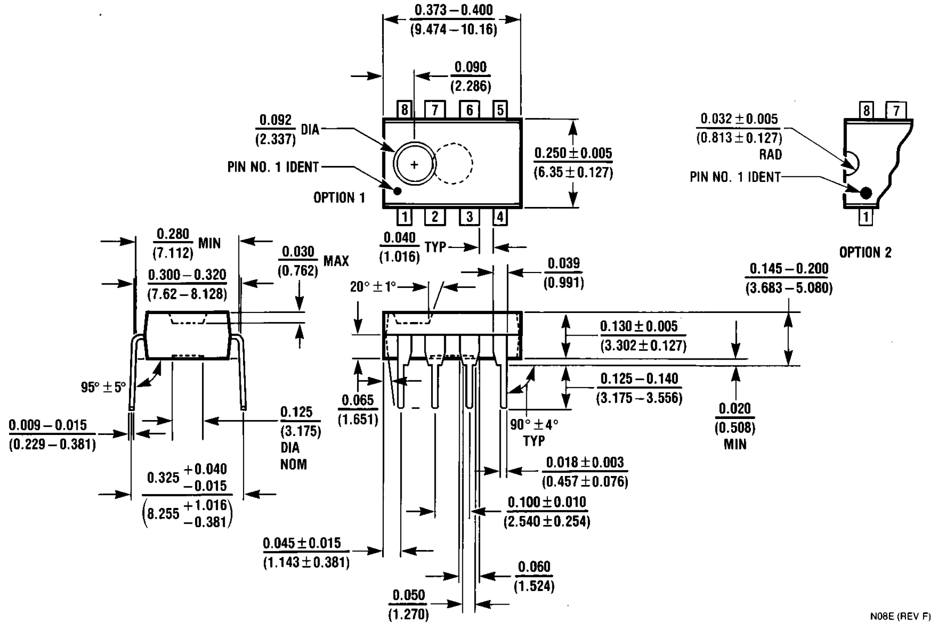


8-Lead Metal Can Package (H)
Order Number LM760CH or LM760H
NS Package Number H08A



8-Lead Ceramic Dual-In-Line Package (J)
Order Number LM760CJ or LM760J
NS Package Number J08A

Physical Dimensions inches (millimeters) (Continued)



8-Pin Molded Dual-In-Line Package (N)
Order Number LM760CN
NS Package Number N08E

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National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408