

## 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  $\pm 4.5\text{V}$  to  $\pm 6.5\text{V}$ . 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.

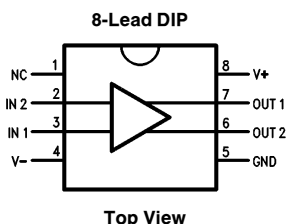
### Features

- 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



TL/H/10067-3

### 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  $\pm 6.5V$ ,  $T_A = -55^\circ C$  to  $+125^\circ C$ ,  $T_A = 25^\circ C$  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	$\mu A$
$I_{IB}$	Input Bias Current			8.0	60	$\mu A$
$R_O$	Output Resistance (Either Output)	$V_O = V_{OH}$		100		$\Omega$
$t_{PD}$	Response Time	$T_A = 25^\circ C$ (Note 3)		18	30	ns
		$T_A = 25^\circ C$ (Note 4)			25	
		(Note 5)		16		
$\Delta t_{PD}$	Response Time Difference between Outputs (Note 1) ( $t_{PD}$ of $+V_{I1}$ ) – ( $t_{PD}$ of $-V_{I2}$ )	$T_A = 25^\circ C$			5.0	ns
		$T_A = 25^\circ C$			5.0	
		$T_A = 25^\circ C$			7.5	
		$T_A = 25^\circ C$			7.5	
$R_I$	Input Resistance	$f = 1.0$ MHz		12		k $\Omega$
$C_I$	Input Capacitance	$f = 1.0$ MHz		8.0		pF
$\Delta V_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Voltage	$R_S = 50\Omega$ , $T_A = -55^\circ C$ to $+125^\circ C$		3.0		$\mu V/^\circ C$
$\Delta I_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Current	$T_A = +25^\circ C$ to $+125^\circ C$		2.0		nA/ $^\circ C$
		$T_A = +25^\circ C$ to $-55^\circ C$		7.0		
$V_{IR}$	Input Voltage Range	$V_{CC} = \pm 6.5V$	$\pm 4.0$	$\pm 4.5$		V
$V_{IDR}$	Differential Input Voltage Range			$\pm 5.0$		V
$V_{OH}$	Output Voltage HIGH (Either Output)	$0\text{ mA} \leq I_{OH} \leq 5.0\text{ mA}$ $V_{CC} = +5.0V$	2.4	3.2		V
		$I_{OH} = 80\text{ }\mu A$ , $V_{CC} = \pm 4.5V$	2.4	3.0		
$V_{OL}$	Output Voltage LOW (Either Output)	$I_{OL} = 3.2\text{ mA}$		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  $\pm 6.5V$ ,  $T_A = 0^\circ C$  to  $+70^\circ C$ ,  $T_A = 25^\circ C$  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	$\mu A$
$I_{IB}$	Input Bias Current			8.0	60	$\mu A$
$R_O$	Output Resistance (Either Output)	$V_O = V_{OH}$		100		$\Omega$
$t_{PD}$	Response Time	$T_A = 25^\circ C$ (Note 3)		18	30	ns
		$T_A = 25^\circ C$ (Note 4)			25	
		(Note 5)		16		
$\Delta t_{PD}$	Response Time Difference between Outputs (Note 1) ( $t_{PD}$ of $+V_{I1}$ ) – ( $t_{PD}$ of $-V_{I2}$ )	$T_A = 25^\circ C$			5.0	ns
		$T_A = 25^\circ C$			5.0	
		$T_A = 25^\circ C$			10	
		$T_A = 25^\circ C$			10	
$R_I$	Input Resistance	$f = 1.0$ MHz		12		$k\Omega$
$C_I$	Input Capacitance	$f = 1.0$ MHz		8.0		pF
$\Delta V_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Voltage	$R_S = 50\Omega$ , $T_A = 0^\circ C$ to $+70^\circ C$		3.0		$\mu V/^\circ C$
$\Delta I_{IO}/\Delta T$	Average Temperature Coefficient of Input Offset Current	$T_A = +25^\circ C$ to $+70^\circ C$		5.0		nA/ $^\circ C$
		$T_A = +25^\circ C$ to $0^\circ C$		10		
$V_{IR}$	Input Voltage Range	$V_{CC} = \pm 6.5V$	$\pm 4.0$	$\pm 4.5$		V
$V_{IDR}$	Differential Input Voltage Range			$\pm 5.0$		V
$V_{OH}$	Output Voltage HIGH (Either Output)	$0\text{ mA} \leq I_{OH} \leq 5.0\text{ mA}$ $V_{CC} = +5.0V$	2.4	3.2		V
		$I_{OH} = 80\text{ }\mu A$ , $V_{CC} = \pm 4.5V$	2.5	3.0		
$V_{OL}$	Output Voltage LOW (Either Output)	$I_{OL} = 3.2\text{ mA}$		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:**  $T_{J\text{ Max}} = 150^\circ C$ .

**Note 2:** Ratings apply to ambient temperature at  $25^\circ C$ .

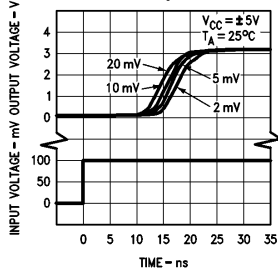
**Note 3:** Response time measured from the 50% point of a 30 mV<sub>P-P</sub> 10 MHz sinusoidal input to the 50% point of the output.

**Note 4:** Response time measured from the 50% point of a 2.0 V<sub>P-P</sub> 10 MHz sinusoidal input to the 50% point of the output.

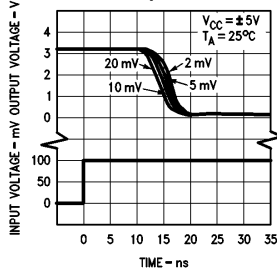
**Note 5:** Response time measured from the start of a 100 mV input step with 5.0 mV overdrive to the time when the output crosses the logic threshold.

## Typical Performance Characteristics

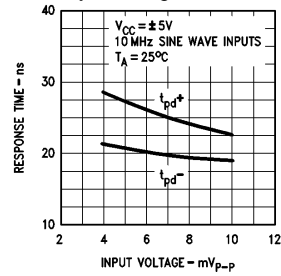
**Response Time for Various Output Overdrives**



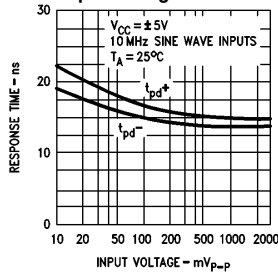
**Response Time for Various Input Overdrives**



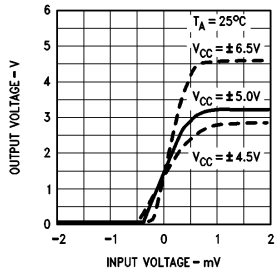
**Response Time vs Input Voltage**



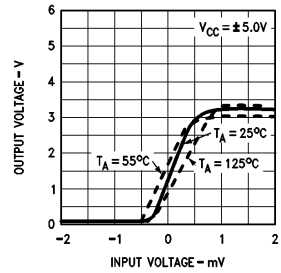
**Response Time vs Input Voltage**



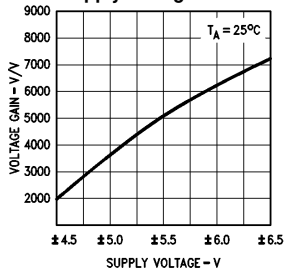
**Voltage Transfer Characteristic**



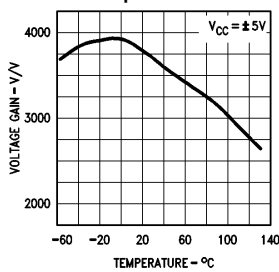
**Voltage Transfer Characteristic**



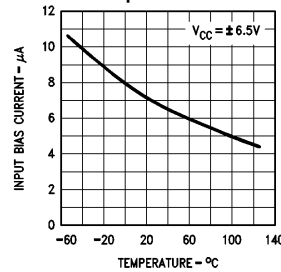
**Voltage Gain vs Supply Voltage**



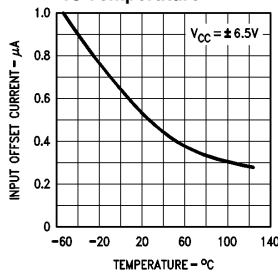
**Voltage Gain vs Temperature**



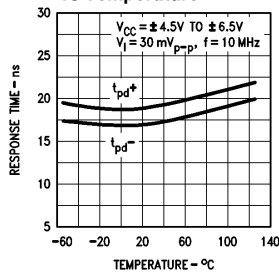
**Input Bias Current vs Temperature**



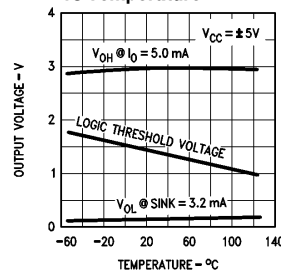
**Input Offset Current vs Temperature**



**Response Time vs Temperature**

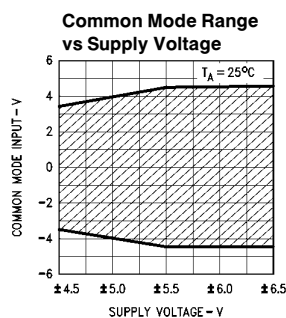
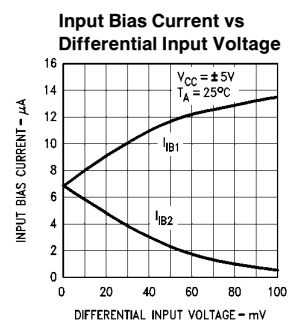
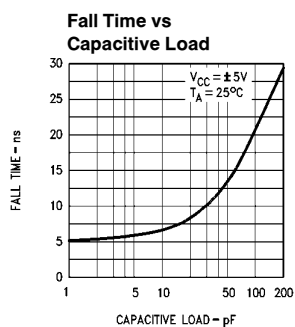
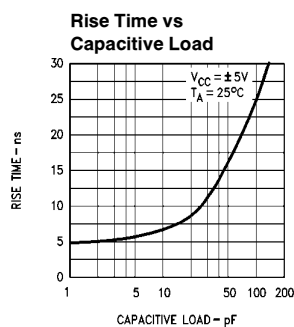


**Output Voltage Levels vs Temperature**



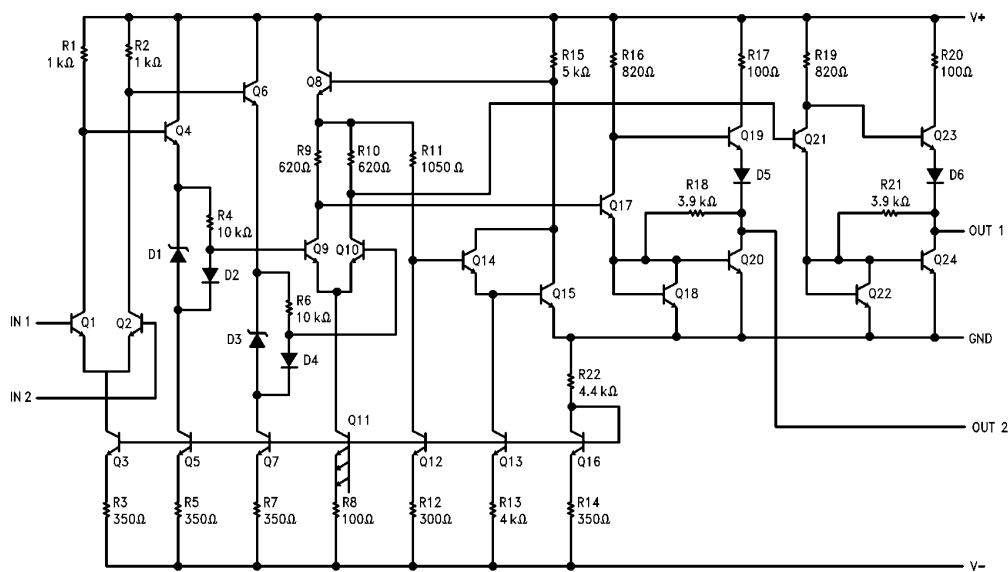
TL/H/10067-5

## Typical Performance Characteristics (Continued)



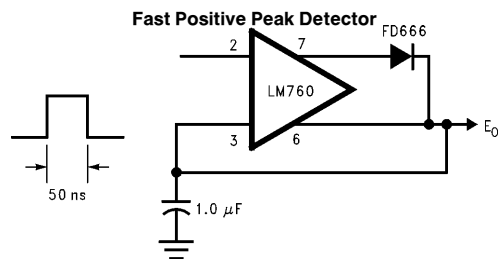
TL/H/10067-6

## Equivalent Circuit

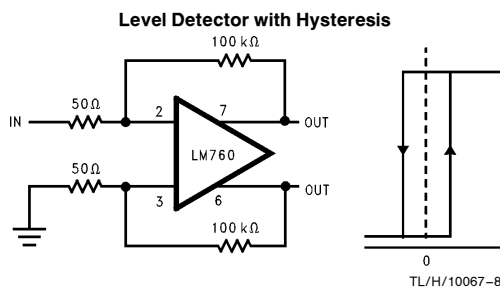


TL/H/10067-4

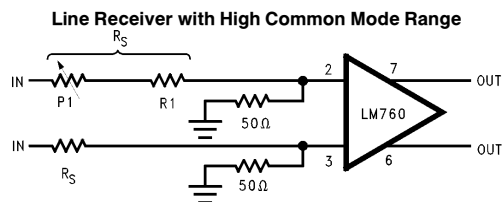
## Typical Applications (Note 1)



TL/H/10067-7



TL/H/10067-8



TL/H/10067-10

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

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

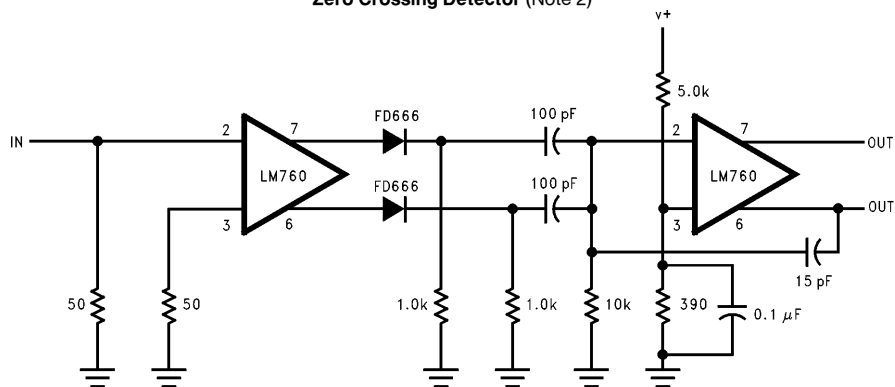
$P_1$  must be adjusted for optimum common mode rejection.

For  $R_S = 200 \Omega$ :

Common mode range =  $\pm 16 \text{ V}$

Sensitivity = 20 mV

## Zero Crossing Detector (Note 2)



TL/H/10067-9

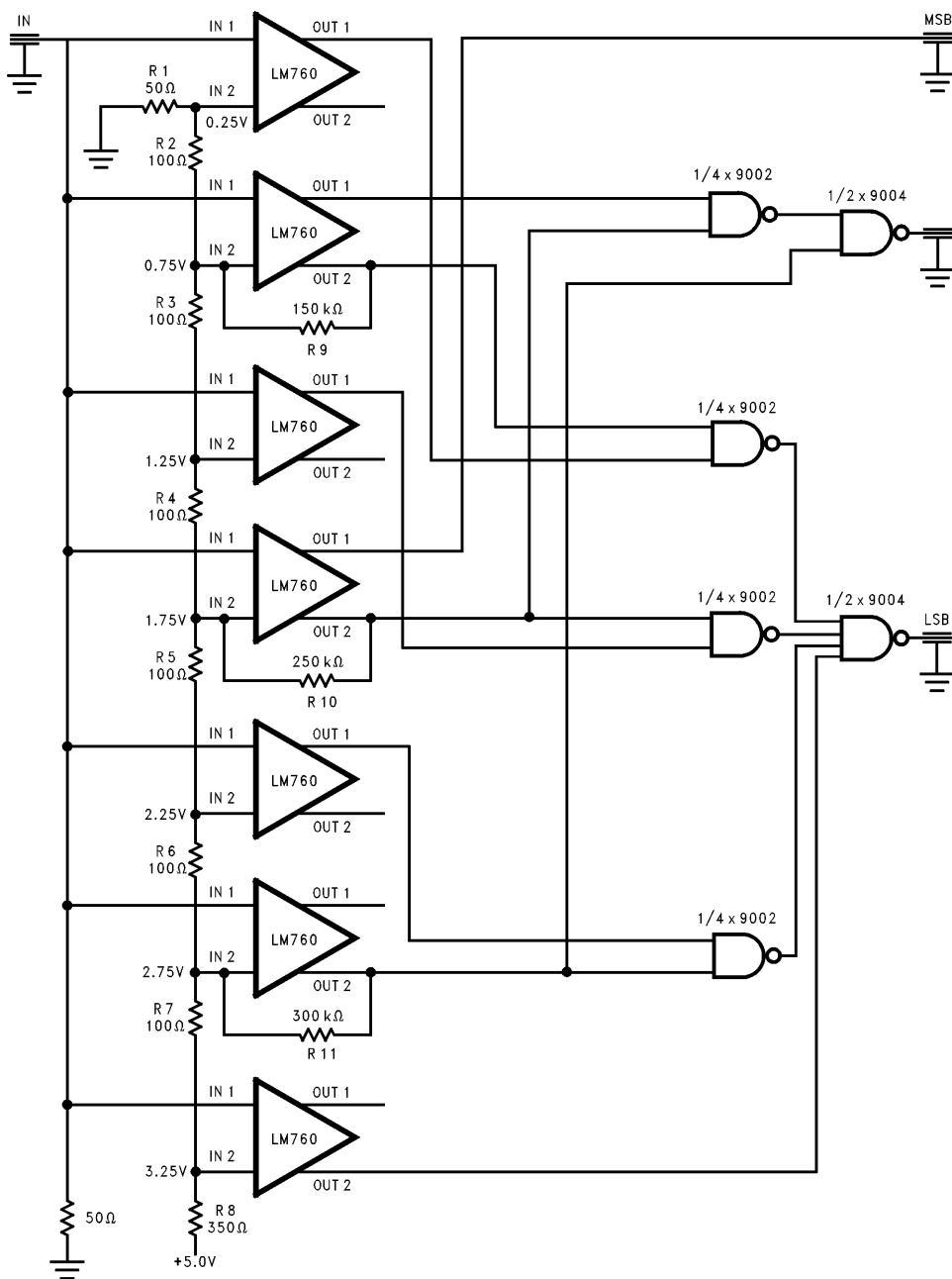
Total delay = 30 ns  
Input Frequency = 300 Hz to 3.0 MHz  
Minimum input voltage = 20 mV<sub>P-P</sub>

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

**Note 2:** All resistor values in ohms.

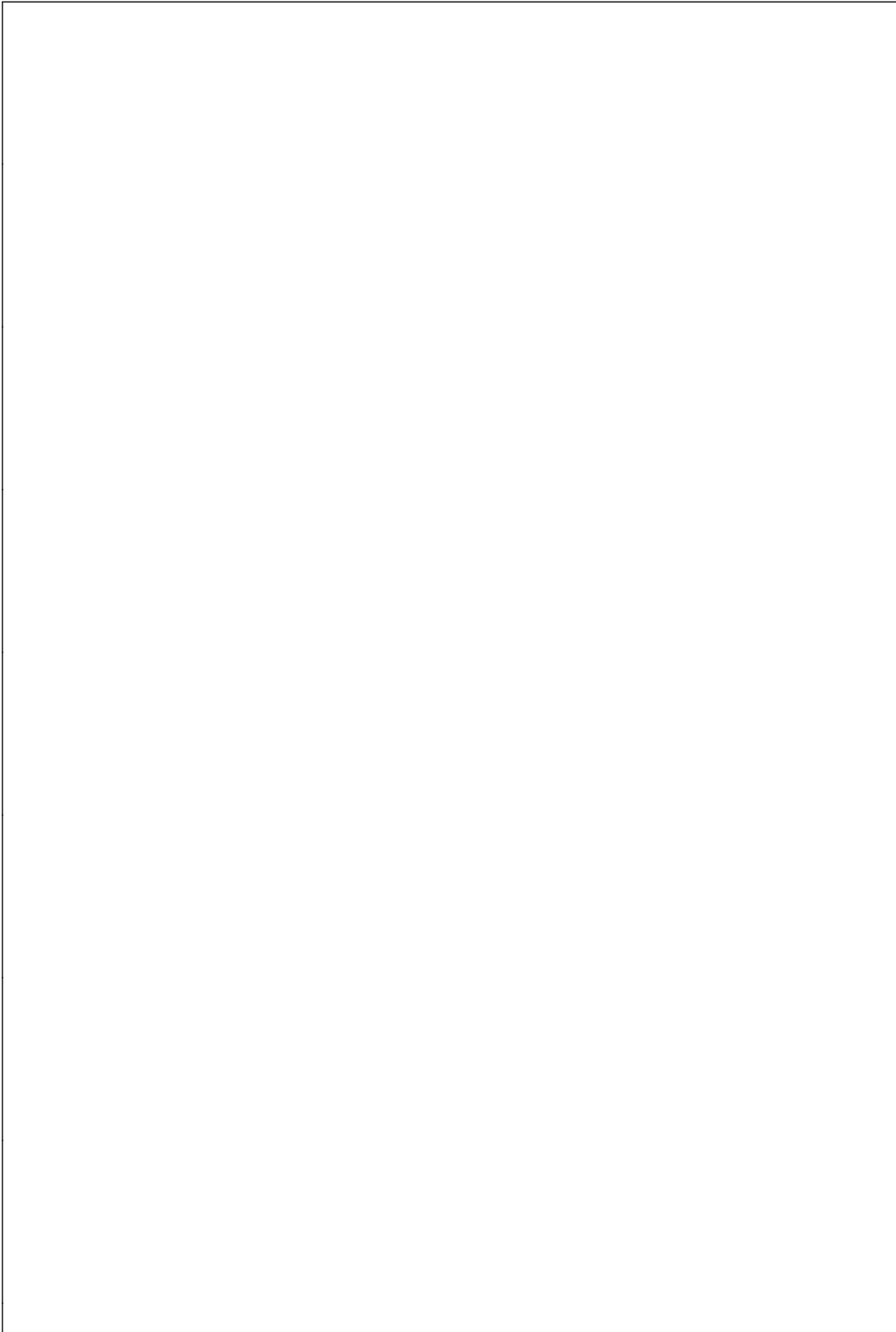
## Typical Applications (Note 1) (Continued)

High Speed 3-Bit A/D Converter



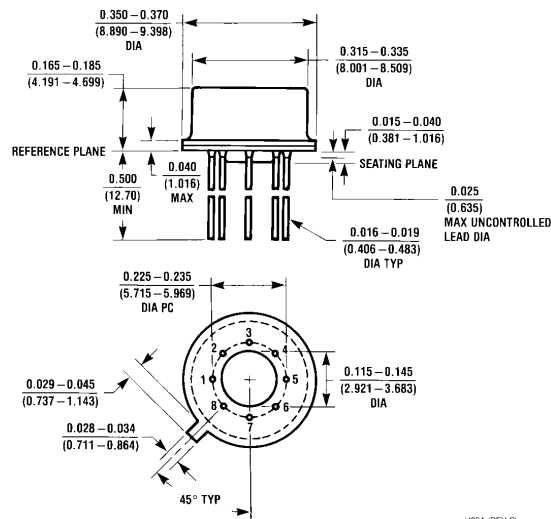
Input voltage range = 3.5V  
Typical conversion speed = 30 ns

TL/H/10067-11



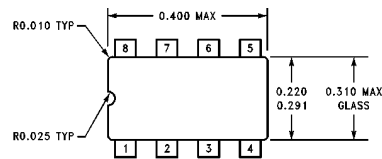


## Physical Dimensions inches (millimeters)



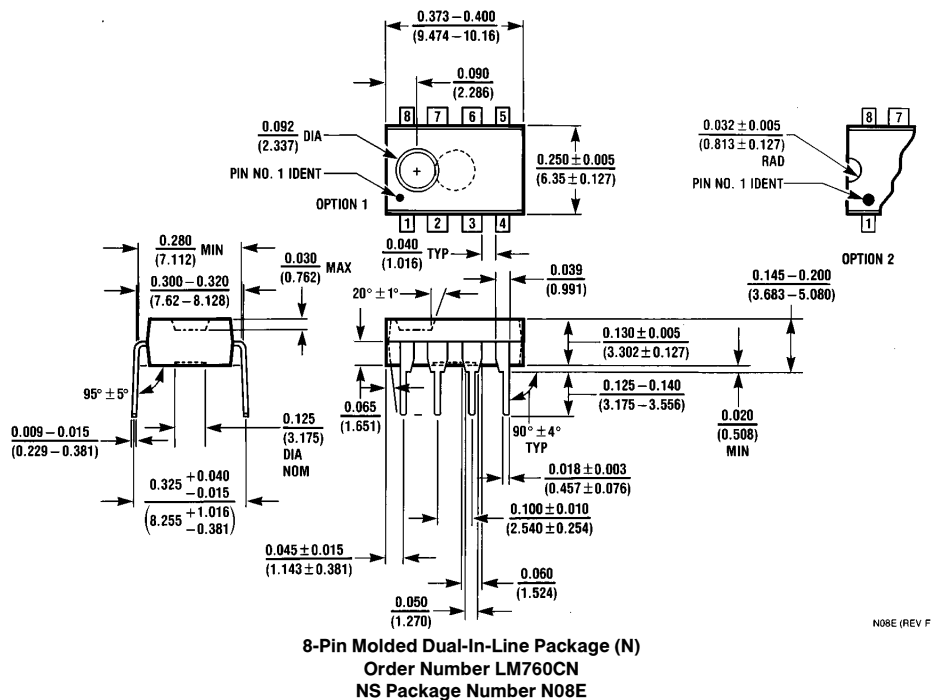
H08A (REV C)

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



J08A (REV K)

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

**Physical Dimensions** inches (millimeters) (Continued)

N08E (REV F)

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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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