



NATL SEMICON (LINEAR)

T-73-53

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 $\pm 4.5V$ to $\pm 6.5V$. 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.

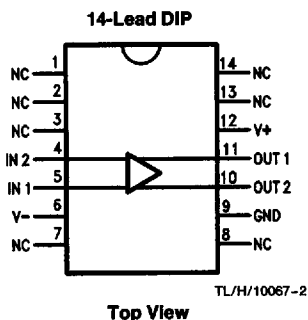
Features

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

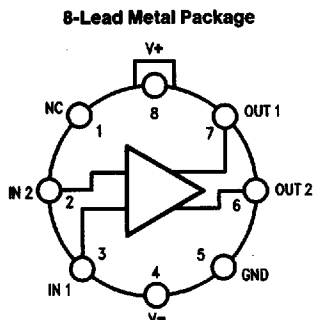
Applications

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

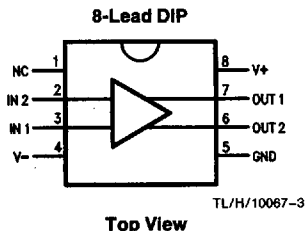
Connection Diagrams



Top View



Top View



Top View

Ordering Information

Temperature Range		Package Type	NSC Package Drawing
Military -55°C to +125°C	Commercial 0°C to +70°C		
LM760J-14	LM760CJ-14	14-lead Ceramic DIP	J14A
LM760J	LM760CJ	8-lead Ceramic DIP	J08A
LM760H	LM760CH	8-lead Metal Can	H08A
	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

NATL SEMICOND (LINEAR)

Internal Power Dissipation (Notes 1, 2)	
8L-Metal Can	1.00W
14L-Ceramic DIP	1.36W
8L-Ceramic DIP	1.30W
Positive Supply Voltage	+8.0V
Negative Supply Voltage	-8.0V
Peak Output Current	10 mA
Differential Input Voltage	±5.0V
Input Voltage	$V^+ \geq V_1 \geq V^-$
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	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	$T_A = 25^\circ C$ (Note 3)		18	30	ns
		$T_A = 25^\circ C$ (Note 4)			25	
		(Note 5)		16		
Δt_{PD}	Response Time Difference between Outputs (Note 1) (t_{PD} of $+V_{I1}$) - (t_{PD} of $-V_{I2}$)	$T_A = 25^\circ C$			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 Ω
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	$V_{CC} = \pm 6.5V$	± 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
		$I_{OH} = 80$ μA , $V_{CC} = \pm 4.5V$	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

NATL SEMICOND (LINEAR)

LM760

LM760C

Electrical Characteristics

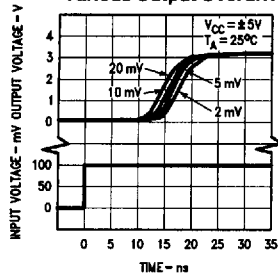
 $V_{CC} = \pm 4.5V$ to $\pm 6.5V$, $T_A = 0^\circ C$ to $+70^\circ C$, $T_A = 25^\circ C$ for typical figures, unless otherwise specified

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	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	$T_A = 25^\circ C$ (Note 3)		18	30	ns
		$T_A = 25^\circ C$ (Note 4)			25	
		(Note 5)		16		
Δt_{PD}	Response Time Difference between Outputs (Note 1) (t_{PD} of $+V_{I1}$) - (t_{PD} of $-V_{I2}$)	$T_A = 25^\circ C$			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 Ω
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	$V_{CC} = \pm 6.5V$	± 4.0	± 4.5		V
V_{IDR}	Differential Input Voltage Range			± 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
		$I_{OH} = 80\ \mu A$, $V_{CC} = \pm 4.5V$	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

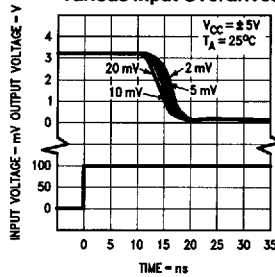
Note 1: $T_{J\text{ Max}} = 175^\circ C$.**Note 2:** Ratings apply to ambient temperature at $25^\circ C$. Above this temperature, derate the 8L-Metal Can at $6.7\text{ mW}/^\circ C$, the 14L-Ceramic DIP at $9.1\text{ mW}/^\circ C$, and the 8L-Ceramic DIP at $8.7\text{ mW}/^\circ C$.**Note 3:** Response 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

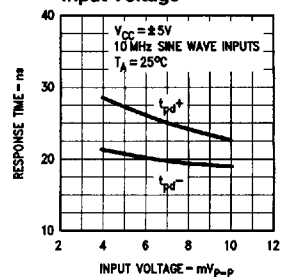
Response Time for Various Output Overdrives



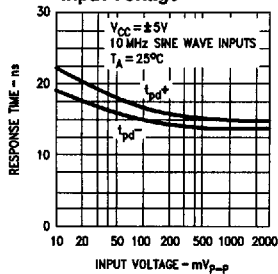
Response Time for Various Input Overdrives



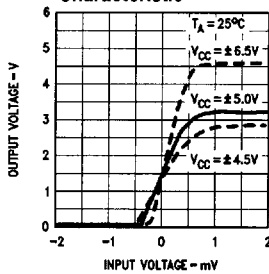
Response Time vs Input Voltage



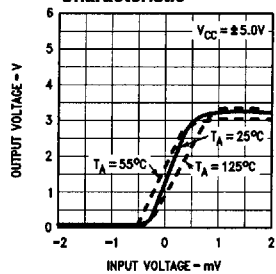
Response Time vs Input Voltage



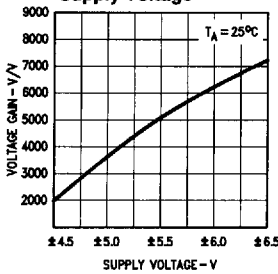
Voltage Transfer Characteristic



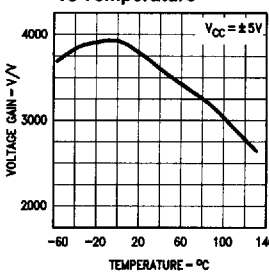
Voltage Transfer Characteristic



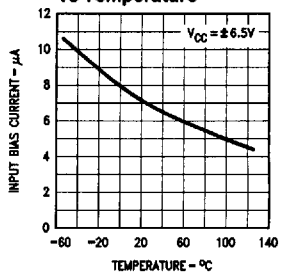
Voltage Gain vs Supply Voltage



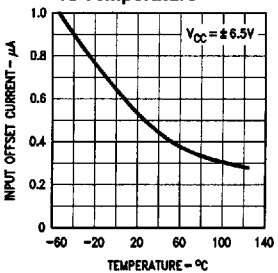
Voltage Gain vs Temperature



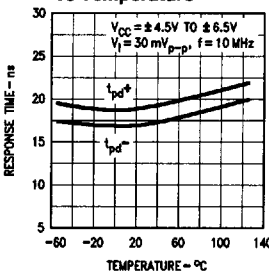
Input Bias Current vs Temperature



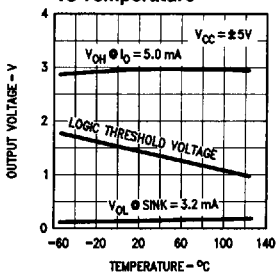
Input Offset Current vs Temperature



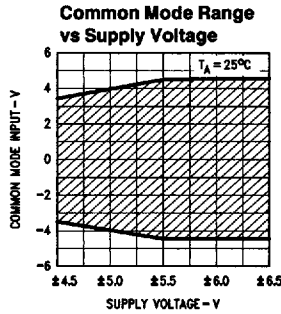
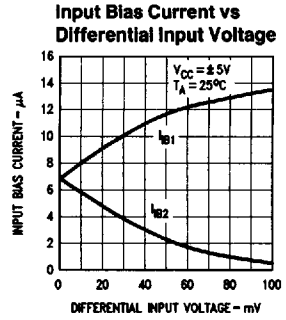
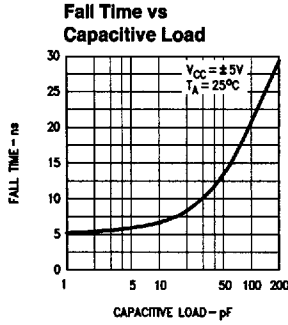
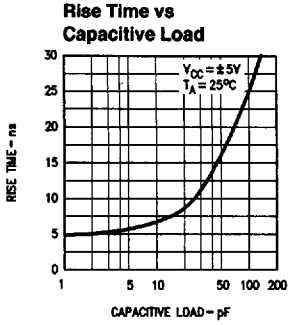
Response Time vs Temperature



Output Voltage Levels vs Temperature

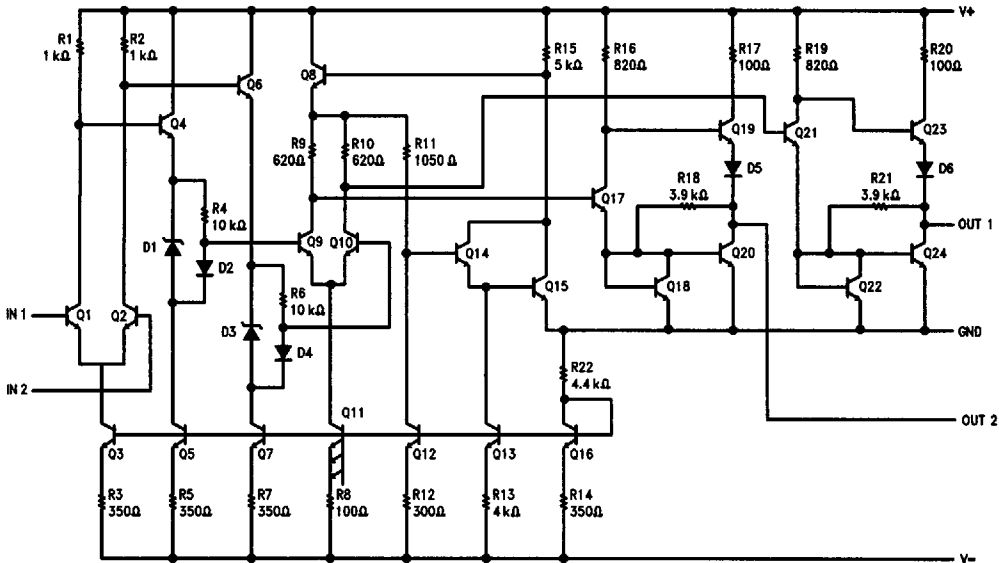


Typical Performance Characteristics (Continued)



TL/H/10067-6

Equivalent Circuit



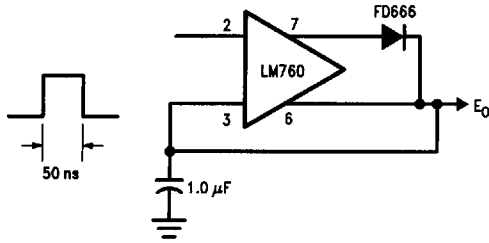
TL/H/10067-4

NATL SEMICOND (LINEAR)

Typical Applications (Note 1)

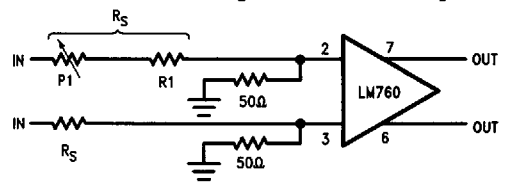
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Fast Positive Peak Detector



TL/H/10067-7

Line Receiver with High Common Mode Range



TL/H/10067-10

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

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

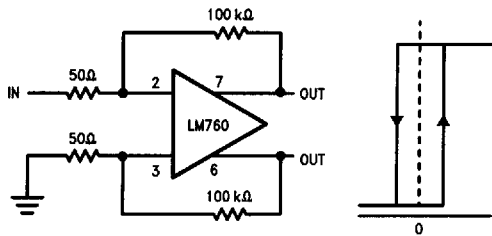
P₁ must be adjusted for optimum common mode rejection.

For R_S = 200Ω:

Common mode range = ±16V

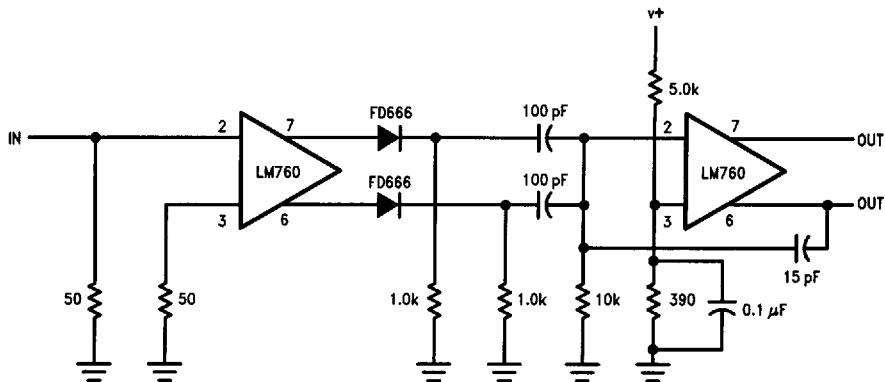
Sensitivity = 20 mV

Level Detector with Hysteresis



TL/H/10067-8

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}

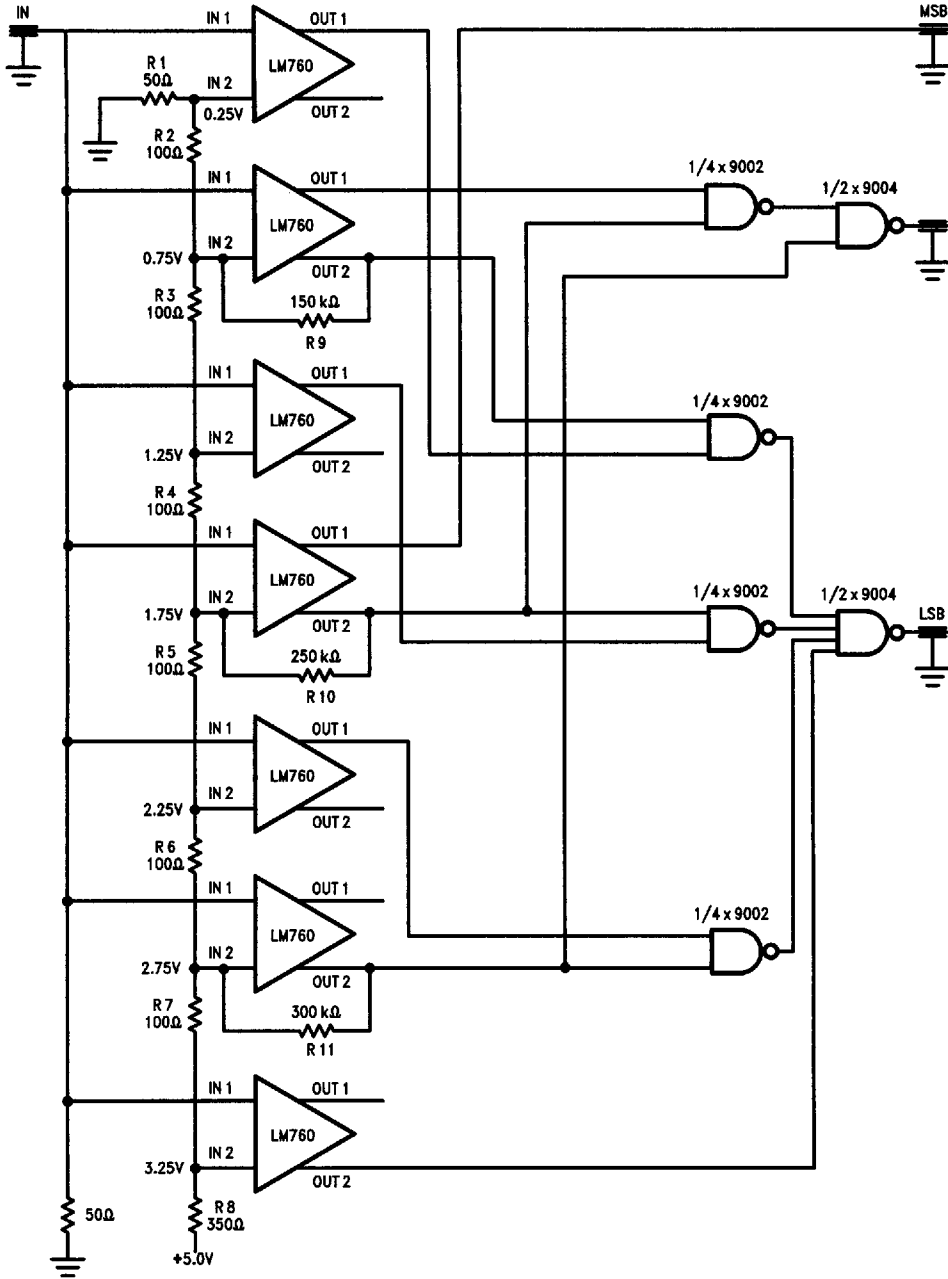
Note 1: Lead numbers shown are for Metal Package only.

Note 2: All resistor values in ohms.

Typical Applications (Note 1) (Continued)

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High Speed 3-Bit A/D Converter



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

TL/H/10087-11