



## LH2111/LH2311 Dual Voltage Comparators

### General Description

The LH2111 series of dual voltage comparators are two LM111 type comparators in a single hermetic package. Featuring all the same performance characteristics of the single, these duals offer in addition closer thermal tracking, lower weight, reduced insertion cost and smaller size than two singles. For additional information see the LM111 data sheet and National's Linear Application Handbook.

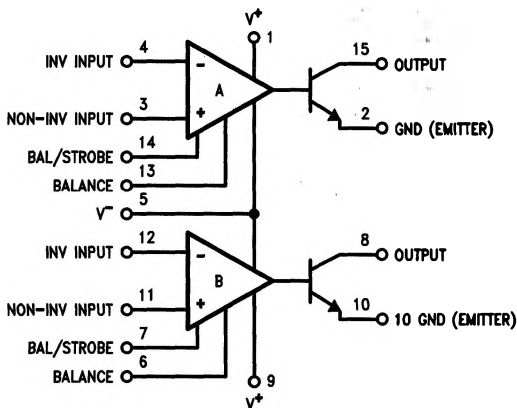
The LH2111 is specified for operation over the  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  military temperature range. The LH2311 is specified for operation over the  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  temperature range.

### Features

- Wide operating supply range
- Low input currents
- High sensitivity
- Wide differential input range
- High output drive

$\pm 15\text{V}$  to a  
single  $+5\text{V}$   
6 nA  
10  $\mu\text{V}$   
 $\pm 30\text{V}$   
50 mA, 50V

### Connection Diagram



Order Number LH2111D, LH2111D/883 or LH2311D  
See NS Package Number D16C

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## Absolute Maximum Ratings

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

Total Supply Voltage ( $V^+ - V^-$ )	36V
Output to Negative Supply Voltage ( $V_{OUT} - V^-$ )	50V
Ground to Negative Supply Voltage ( $GND - V^-$ )	30V
Differential Input Voltage	$\pm 30V$

Input Voltage (Note 1)	$\pm 15V$
Power Dissipation (Note 2)	500 mW
Output Short Circuit Duration	10 sec
Operating Temperature Range LH2111	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
LH2311	$0^\circ\text{C}$ to $+70^\circ\text{C}$
Storage Temperature Range	$-65^\circ\text{C}$ to $+150^\circ\text{C}$
Lead Temperature (Soldering, 10 sec)	$300^\circ\text{C}$

## Electrical Characteristics Each Side (Note 3)

Parameter	Conditions	Limits		Units
		LH2111	LH2311	
Input Offset Voltage (Note 4)	$T_A = 25^\circ\text{C}$ , $R_S \leq 50k$	3.0	7.5	mV Max
Input Offset Current (Note 4)	$T_A = 25^\circ\text{C}$	10	50	nA Max
Input Bias Current	$T_A = 25^\circ\text{C}$	100	250	nA Max
Voltage Gain	$T_A = 25^\circ\text{C}$	200	200	V/mV Typ
Response Time (Note 5)	$T_A = 25^\circ\text{C}$	200	200	ns Typ
Saturation Voltage	$V_{IN} \leq -5\text{ mV}$ , $I_{OUT} = 50\text{ mA}$ $T_A = 25^\circ\text{C}$	1.5	1.5	V Max
Strobe On Current	$T_A = 25^\circ\text{C}$	3.0	3.0	mA Typ
Output Leakage Current	$V_{IN} \geq 5\text{ mV}$ , $V_{OUT} = 35V$ $T_A = 25^\circ\text{C}$	10	50	nA Max
Input Offset Voltage (Note 4)	$R_S \leq 50k$	4.0	10	mV Max
Input Offset Current (Note 4)		20	70	nA Max
Input Bias Current		150	300	nA Max
Input Voltage Range		$\pm 14$	$\pm 14$	V Typ
Saturation Voltage	$V^+ \geq 4.5V$ , $V^- = 0$ $V_{IN} \leq -5\text{ mV}$ , $I_{SINK} \leq 8\text{ mA}$	0.4	0.4	V Max
Positive Supply Current	$T_A = 25^\circ\text{C}$	6.0	7.5	mA Max
Negative Supply Current	$T_A = 25^\circ\text{C}$	5.0	5.0	mA Max

**Note 1:** This rating applies for  $\pm 15V$  supplies. The positive input voltage limit is 30V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30V below the positive supply, whichever is less.

**Note 2:** The maximum junction temperature is  $150^\circ\text{C}$ . For operating at elevated temperatures, devices in the flat package, the derating is based on a thermal resistance of  $185^\circ\text{C/W}$  when mounted on a  $1/16$ -inch-thick epoxy glass board with 0.03-inch-wide, 2 ounce copper conductor. The thermal resistance of the dual-in-line package is  $100^\circ\text{C/W}$ , junction to ambient.

**Note 3:** These specifications apply for  $V_S = \pm 15V$  and  $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$  for the LH2111, and  $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$  for the LH2311, unless otherwise stated. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single 5V supply up to  $\pm 15V$  supplies. For the LH2311,  $V_{IN} = \pm 10\text{ mV}$ .

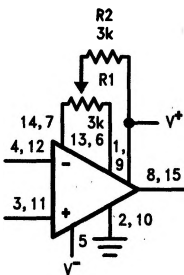
**Note 4:** The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with a 1 mA load. Thus, these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

**Note 5:** The response time specified is for a 100 mV input step with 5 mV overdrive.

**Note 6:** RETS2111X for the LH2111D and LH2111F military specifications.

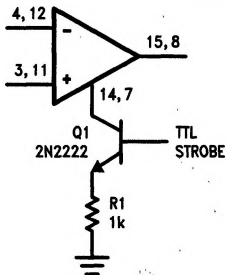
## Auxiliary Circuits

### Offset Balancing



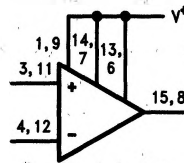
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### Strobing



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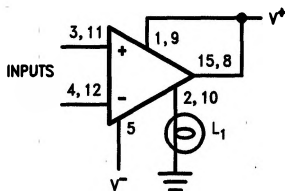
### Increasing Input Stage Current\*



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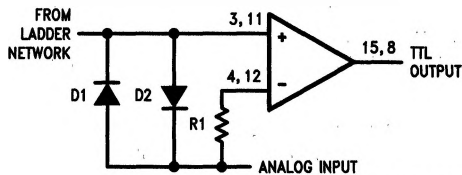
\*Increases typical common mode slew from 7.0 V/ $\mu$ s to 18 V/ $\mu$ s

### Driving Ground-Referred Load



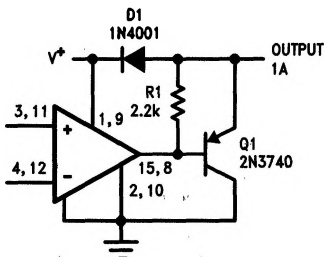
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### Using Clamp Diodes to Improve Responses



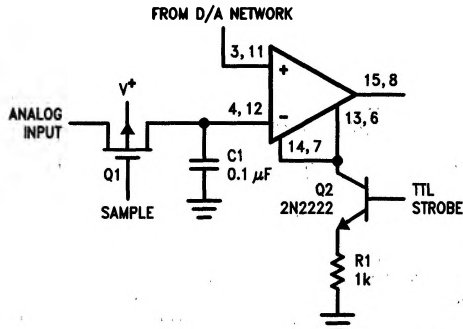
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### Comparator and Solenoid Driver



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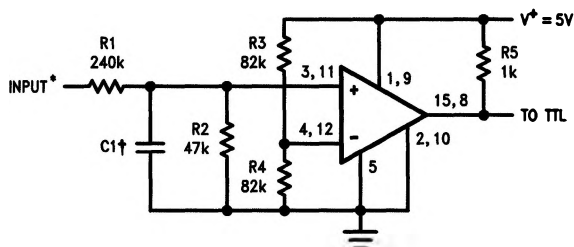
### Strobing off Both Input\* and Output Stages



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\*Typical input current is 50 pA with inputs strobed off

### TTL Interface with High Level Logic



\*Values shown are for a 0V to 30V logic swing and a 15V threshold.

†May be added to control speed and reduce susceptibility to noise spikes.

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