

August 1992



National Semiconductor

LH2111/LH2311

Dual Voltage Comparators

General Description

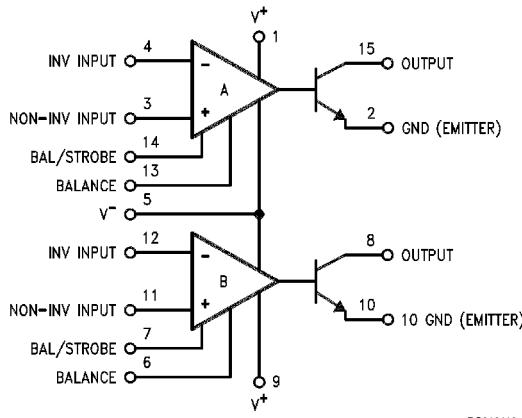
The LH2111 series of dual voltage comparators are two LM111 type comparators in a single hermetic package. Featuring all the same performance characteristics of the single, these duals offer in addition closer thermal tracking, lower weight, reduced insertion cost and smaller size than two singles. For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

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

Features

- Wide operating supply range $\pm 15\text{V}$ to a single $+5\text{V}$
- Low input currents 6 nA
- High sensitivity $10\text{ }\mu\text{V}$
- Wide differential input range $\pm 30\text{V}$
- High output drive $50\text{ mA}, 50\text{V}$

Connection Diagram



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

Absolute Maximum Ratings (Note *NO
TARGET FOR FNXref NS0050*)

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 | Input Voltage (Note 1) | $\pm 15V$ |
| Output to Negative Supply Voltage ($V_{OUT} - V^-$) | 50V | Power Dissipation (Note 2) | 500 mW |
| Ground to Negative Supply Voltage (GND - V^-) | 30V | Output Short Circuit Duration | 10 sec |
| Differential Input Voltage | $\pm 30V$ | Operating Temperature Range LH2111 | $-55^{\circ}C$ to $+125^{\circ}C$ |
| | | LH2311 | $0^{\circ}C$ to $+70^{\circ}C$ |

Electrical Characteristics (Note 3)

Each Side

| Parameter | Conditions | Limits | | Units |
|-------------------------------|---|----------|----------|----------|
| | | LH2111 | LH2311 | |
| Input Offset Voltage (Note 4) | $T_A = 25^{\circ}C, R_S \leq 50k$ | 3.0 | 7.5 | mV Max |
| Input Offset Current (Note 4) | $T_A = 25^{\circ}C$ | 10 | 50 | nA Max |
| Input Bias Current | $T_A = 25^{\circ}C$ | 100 | 250 | nA Max |
| Voltage Gain | $T_A = 25^{\circ}C$ | 200 | 200 | V/mV Typ |
| Response Time (Note 5) | $T_A = 25^{\circ}C$ | 200 | 200 | ns Typ |
| Saturation Voltage | $V_{IN} \leq -5$ mV, $I_{OUT} = 50$ mA $T_A = 25^{\circ}C$ | 1.5 | 1.5 | V Max |
| Strobe On Current | $T_A = 25^{\circ}C$ | 3.0 | 3.0 | mA Typ |
| Output Leakage Current | $V_{IN} \geq 5$ mV, $V_{OUT} = 35V$ $T_A = 25^{\circ}C$ | 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 | | ± 14 | ± 14 | V Typ |
| Saturation Voltage | $V^+ \geq 4.5V, V^- = 0$ $V_{IN} \leq -5$ mV, $I_{SINK} \leq 8$ mA | 0.4 | 0.4 | V Max |
| Positive Supply Current | $T_A = 25^{\circ}C$ | 6.0 | 7.5 | mA Max |
| Negative Supply Current | $T_A = 25^{\circ}C$ | 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 $150^{\circ}C$. For operating at elevated temperatures, devices in the flat package, the derating is based on a thermal resistance of $185^{\circ}C/W$ 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 $100^{\circ}C/W$, junction to ambient.

Note 3: These specifications apply for $V_S = \pm 15V$ and $-55^{\circ}C \leq T_A \leq 125^{\circ}C$ for the LH2111, and $0^{\circ}C \leq T_A \leq 70^{\circ}C$ 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, $V_{IN} = \pm 10$ mV.

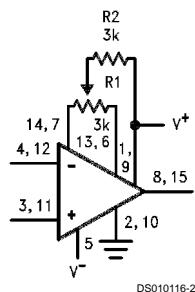
Note 4: The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with a 1 mA load. Thus, these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

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

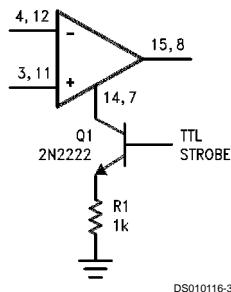
Note 6: RETS2111X for the LH2111D and LH2111F military specifications.

Auxiliary Circuits

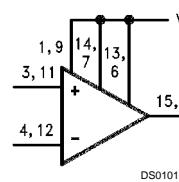
Offset Balancing



Strobing

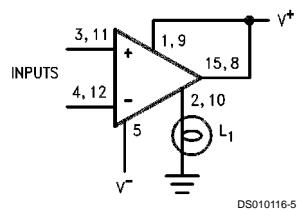


Increasing Input Stage Current*

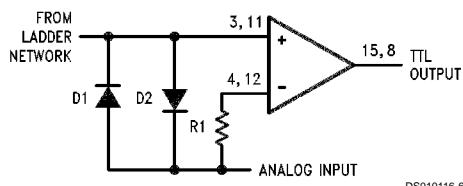


*Increases typical common mode slew from 7.0 V/μs to 18 V/μs

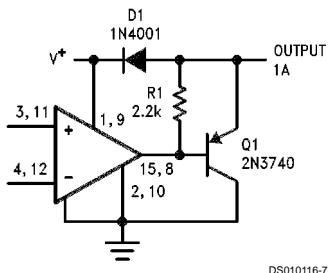
Driving Ground-Referenced Load



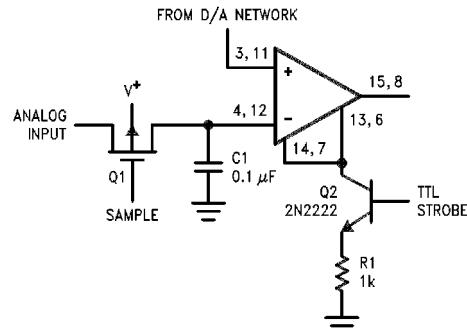
Using Clamp Diodes to Improve Responses



Comparator and Solenoid Driver



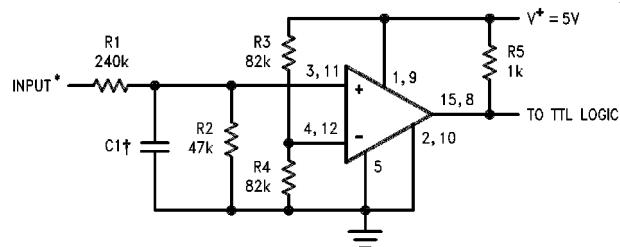
Strobing off Both Input* and Output Stages



*Typical input current is 50 pA with inputs strobed off

Auxiliary Circuits (Continued)

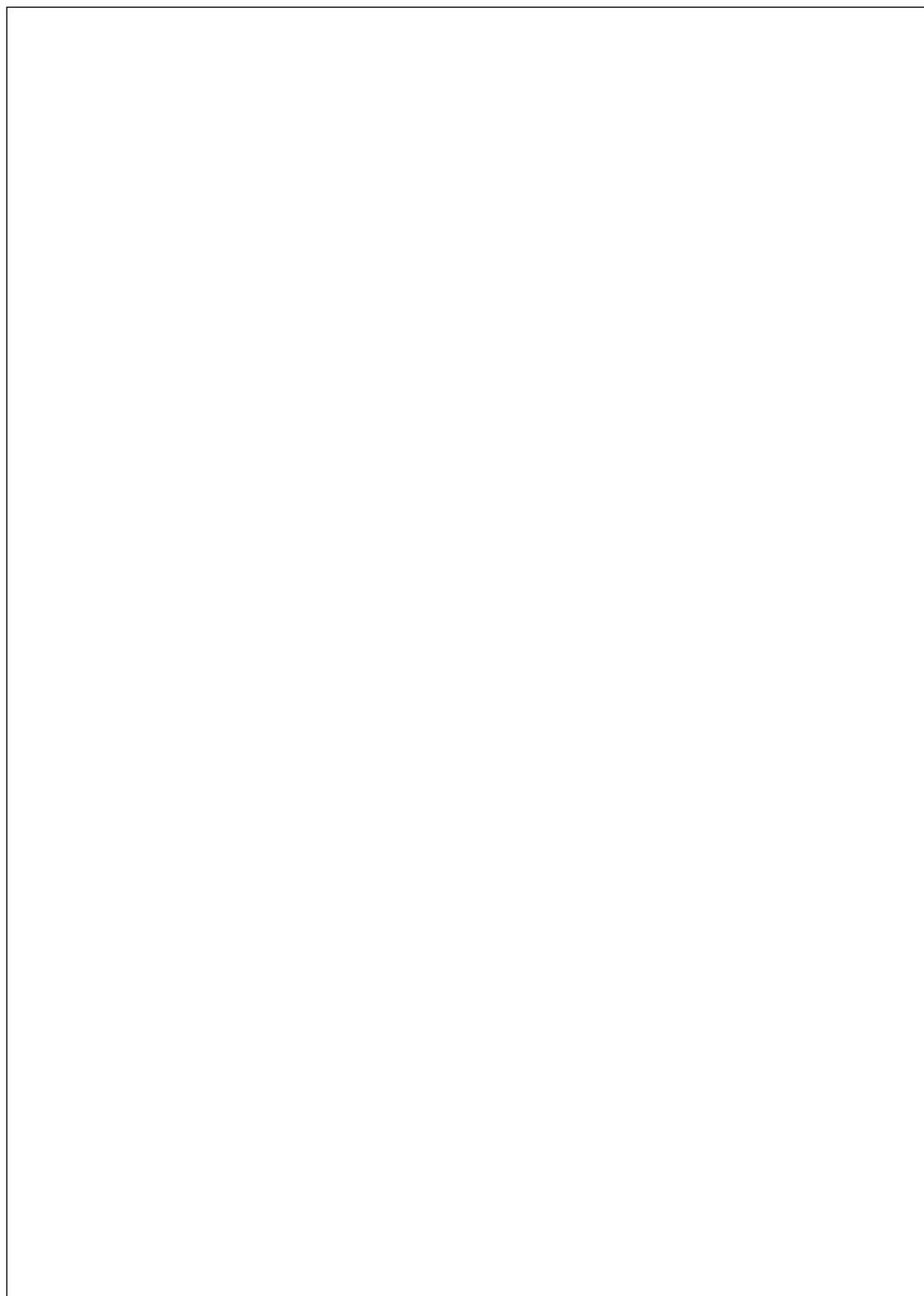
TTL Interface with High Level Logic



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

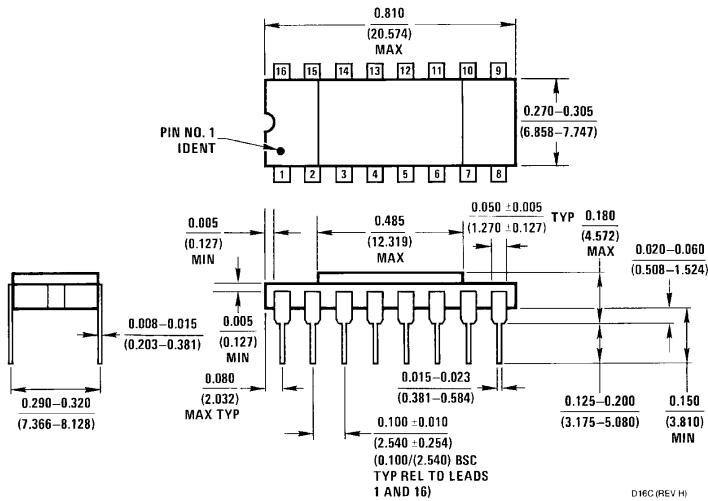
†May be added to control speed and reduce susceptibility to noise spikes.

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Physical Dimensions inches (millimeters)**LIFE SUPPORT POLICY**

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