

## LM6511 180 ns 3V Comparator

### General Description

The LM6511 voltage comparator is ideal for analog-digital interface circuitry when only a +3V or +3.3V supply is available. The open-collector output permits signal compatibility with a wide variety of digital families: +5V CMOS, +3V CMOS, TTL and so on. Supply voltage may range from 2.7V to 36V between supply voltage leads. The LM6511 operates with little power consumption ( $P_{diss} < 9.45 \text{ mW}$  at  $V^+ = +2.7\text{V}$  and  $V^- = 0\text{V}$ ).

This voltage comparator offers many features that are available in traditional sub-microsecond comparators: output sync strobe, inputs and output may be isolated from system ground, and wire-ORing. Also, the LM6511 uses the industry-standard, single comparator pinout configuration.

### Features

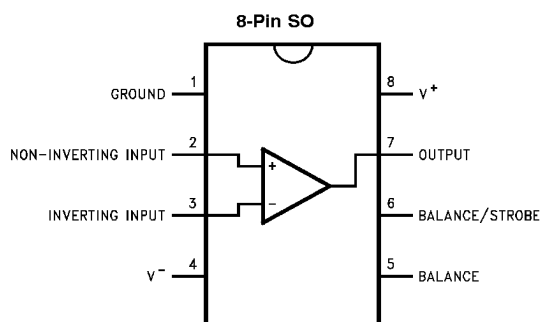
(Typical unless otherwise noted)

- Operates at +2.7V, +3V, +3.3V, +5V
- Low Power consumption  $< 9.45 \text{ mW}$  @  $V^+ = 2.7\text{V}$  (max)
- Fast Response Time of 180 ns

### Applications

- Portable Equipment
- Cellular Phones
- Digital Level Shifting

### Connection Diagram



DS011888-1

### Ordering Information

| Package             | Industrial Temperature Range<br>-40°C to +85°C | NSC Package<br>Drawing |
|---------------------|------------------------------------------------|------------------------|
| 8-Pin Small Outline | LM6511IM                                       | M08A                   |

## Absolute Maximum Ratings (Note 1)

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

|                                   |                 |
|-----------------------------------|-----------------|
| Supply Voltage                    | −0.3 to +36V    |
| Output to Negative Supply Voltage | 50V             |
| Ground to Negative Supply Voltage | 30V             |
| Differential Input Voltage        | ±30V            |
| Input Voltage                     | (Note 2)        |
| Storage Temperature Range         | −65°C to +150°C |
| Soldering Information:            |                 |
| SO Package                        |                 |
| (Vapor Phase in 60 sec)           | 215°C           |
| SO Package (Infrared in 15 sec)   | 220°C           |

|                               |        |
|-------------------------------|--------|
| Power Dissipation             | 500 mW |
| Output Short Circuit Duration | 10s    |
| Junction Temperature          | 150°C  |
| ESD Rating                    |        |
| (C = +100 pF, R = 1.5 kΩ)     | 300V   |

## Operating Ratings (Note 1)

|                                       |                                |
|---------------------------------------|--------------------------------|
| Supply Voltage                        | 2.5V to 30V                    |
| Temperature Range                     | −40°C ≤ T <sub>J</sub> ≤ +85°C |
| Thermal Resistance (θ <sub>JA</sub> ) |                                |
| SO Package                            | 170°C/W                        |

## DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T<sub>J</sub> = 25°C. **Boldface** limits apply at the temperature extremes. V<sup>+</sup> = 2.7V, V<sup>−</sup> = 0V, 50Ω ≤ R<sub>L</sub> ≤ 50kΩ, and I<sub>L</sub> = 1.0 mA unless otherwise specified

| Symbol              | Parameter                   | Conditions                                                                     | Typical | LM6511I               | Units (Limits) |
|---------------------|-----------------------------|--------------------------------------------------------------------------------|---------|-----------------------|----------------|
|                     |                             |                                                                                |         | Limit                 |                |
| V <sub>OS</sub>     | Offset Voltage              | R <sub>S</sub> ≤ 50 kΩ<br>(Note 3)                                             | 1.5     | 5<br><b>8</b>         | mV<br>max      |
| I <sub>B</sub>      | Input Bias Current          |                                                                                | 38      | 130<br><b>200</b>     | nA<br>max      |
| I <sub>OS</sub>     | Input Offset Current        | R <sub>S</sub> ≤ 50 kΩ<br>(Note 3)                                             | 1.5     | 20<br><b>50</b>       |                |
| I <sub>S</sub>      | Positive Supply Current     |                                                                                | 2.7     | 3.5<br><b>5</b>       | mA<br>max      |
|                     | Negative Supply Current     |                                                                                | 1.5     | 2.0<br><b>2.5</b>     |                |
| V <sub>SAT</sub>    | Saturation Voltage          | V <sub>IN</sub> ≤ 10 mV<br>I <sub>SINK</sub> = 8 mA                            | 0.23    | 0.4<br><b>0.4</b>     | V<br>max       |
| A <sub>V</sub>      | Large Signal Voltage Gain   | ΔV <sub>OUT</sub> = 2V                                                         | 40      |                       | V/mV           |
| CMRR                | Common Mode Rejection Ratio |                                                                                | 72      |                       | dB             |
| I <sub>STROBE</sub> | Strobe ON Current           | (Note 5)                                                                       | 2.0     | 5.0                   | mA max         |
| V <sub>IN</sub>     | Input Voltage Range         |                                                                                |         | 0.50                  | V min          |
|                     |                             |                                                                                |         | V <sup>+</sup> − 1.25 | V max          |
|                     | Output Leakage Current      | V <sub>IN</sub> ≥ 10 mV, V <sub>OUT</sub> = 35V,<br>I <sub>STROBE</sub> = 3 mA | 0.2     |                       | nA<br>max      |

## AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T<sub>J</sub> = 25°C. **Boldface** limits apply at the temperature extremes. V<sup>+</sup> = 2.7V, V<sup>−</sup> = 0V, 50Ω ≤ R<sub>L</sub> ≤ 50kΩ, and I<sub>L</sub> = 1.0 mA unless otherwise specified

| Symbol         | Parameter     | Conditions | Typical | LM6511I | Units (Limits) |
|----------------|---------------|------------|---------|---------|----------------|
|                |               |            |         | Limit   |                |
| T <sub>R</sub> | Response Time | (Note 4)   | 180     |         | ns             |

**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating ratings indicate conditions the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

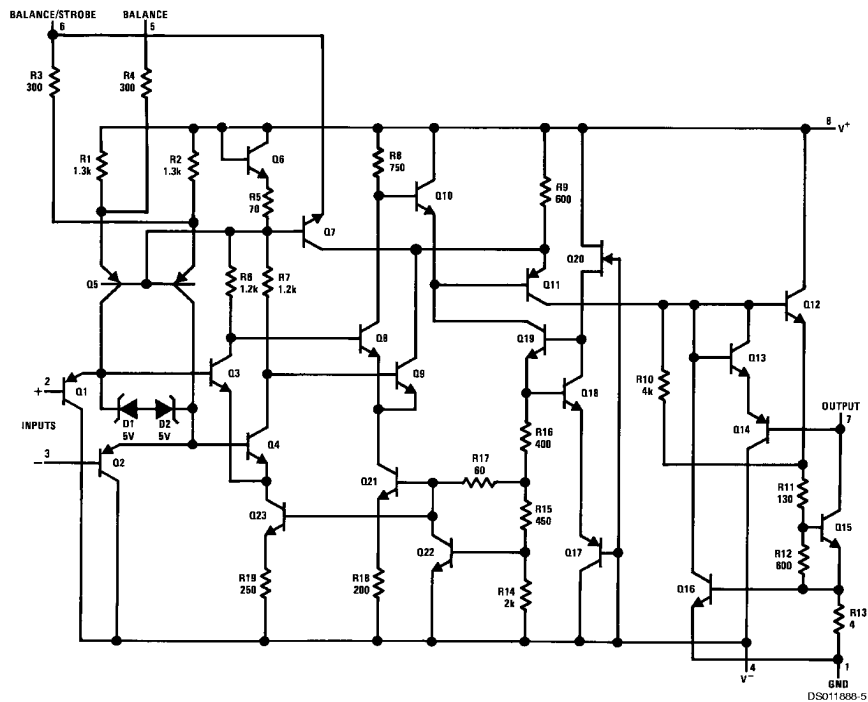
**Note 2:** The positive input voltage limit is 30V above the negative supply voltage. The negative input voltage limit is equal to the negative supply voltage or 30V below the positive supply voltage, whichever is less.

**Note 3:** The offset voltage and offset current limits are the maximum values required to drive the output within a volt of either supply with a 1 mA load. Therefore, these parameters define an error band and take into account the worst-case effects of voltage gain and input impedance.

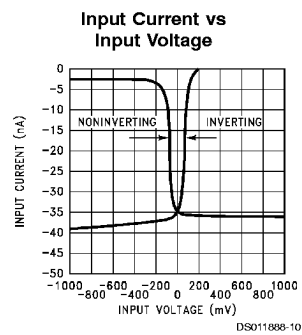
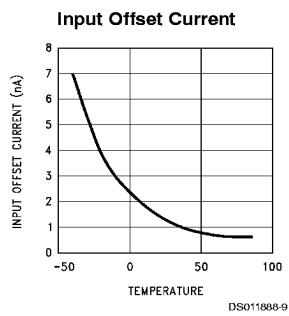
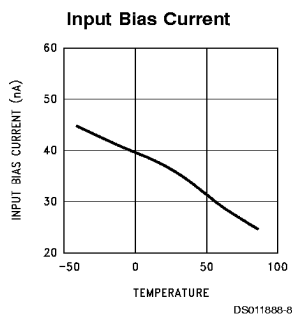
**Note 4:** This specification is for a 100 mV input step with a 25 mV overdrive.

**Note 5:** This specification gives the range of current which must be drawn from the strobe pin to ensure the output is properly disabled. Do not short the strobe pin to ground; it should be current driven at 3 mA to 5 mA.

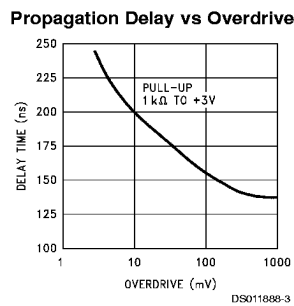
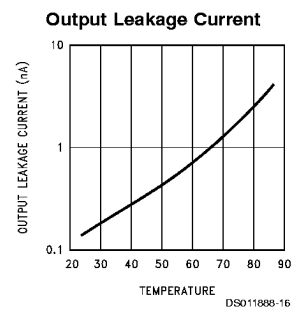
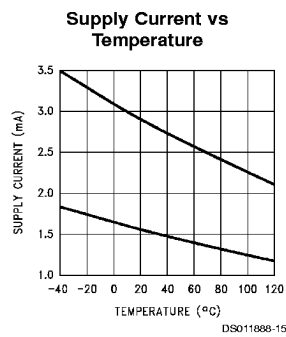
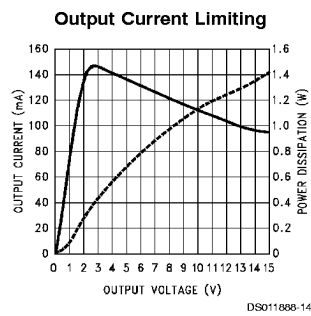
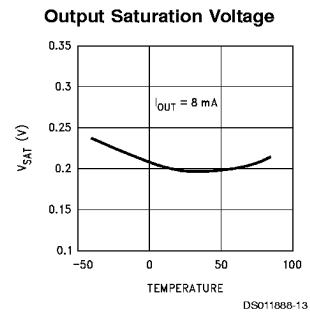
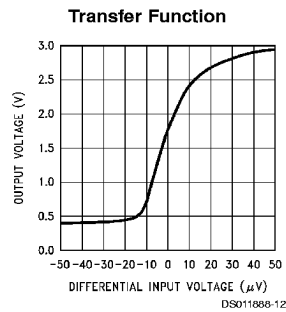
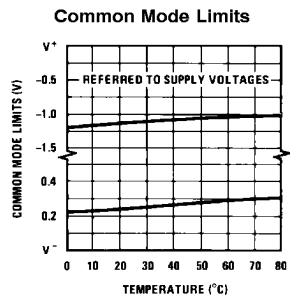
## Schematic Diagram



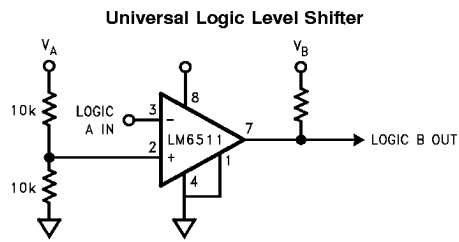
## LM6511 Typical Performance Characteristics $V_S = 3V$ unless otherwise noted



## LM6511 Typical Performance Characteristics $V_S = 3V$ unless otherwise noted (Continued)



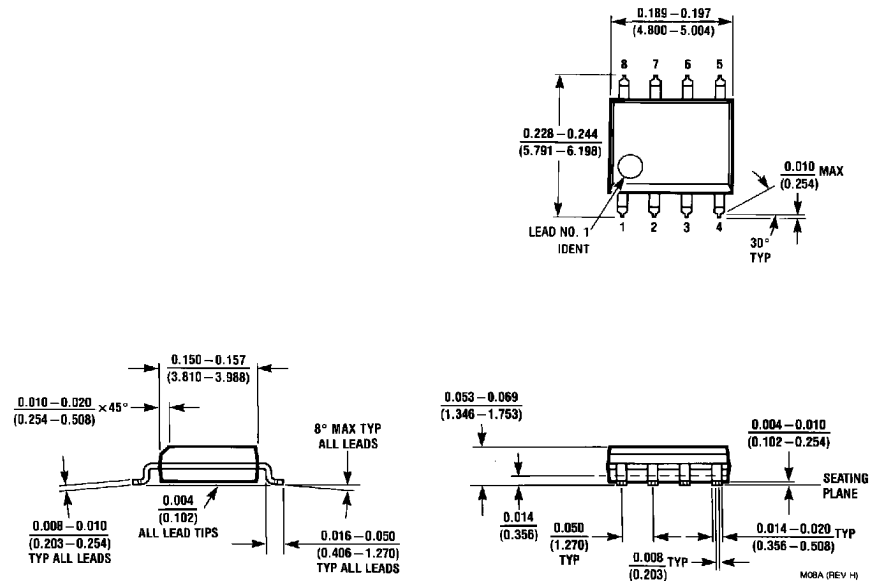
## Typical Application



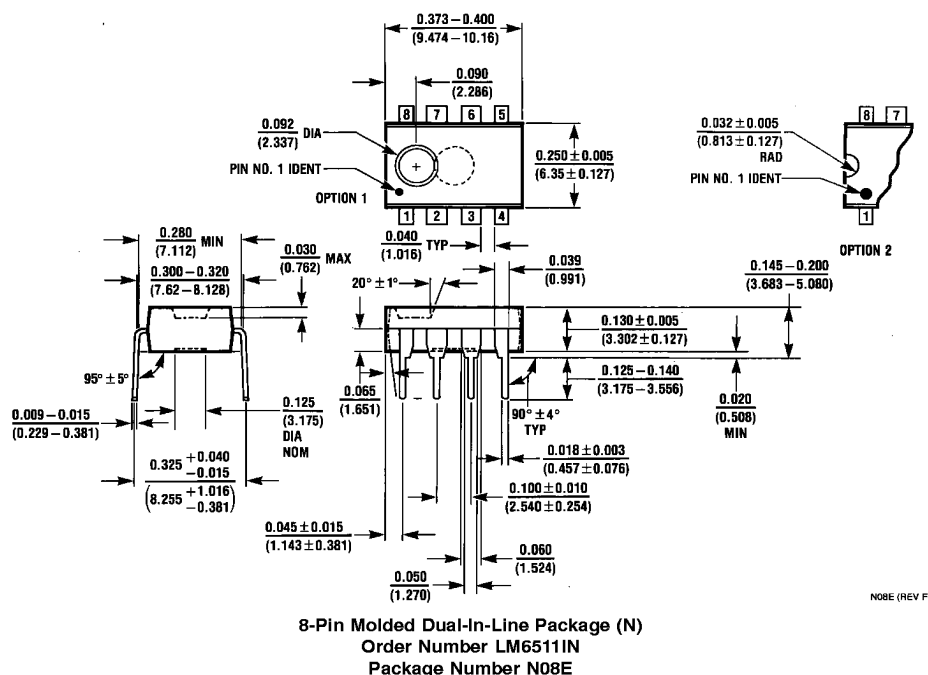
DS011888-4

**Notes:** Because of the very wide operating and output voltage range, the LM6511 may be used to shift logic levels from 3V to TTL or CMOS to the other way around. By biasing the input to  $\frac{1}{2}$  of the input logic supply ( $V_A$ ), this assures that this input remains within the input voltage range. The pull-up resistor should go to the output logic supply ( $V_B$ ).

**Physical Dimensions** inches (millimeters) unless otherwise noted



**8-Pin Small Outline Package (M)**  
**Order Number LM6511IM**  
**Package Number M08A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

N08E (REV F)

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