# LM311

## Single Comparator

### Features

- Low input bias current : 250nA (Max)
- Low input offset current : 50nA (Max)
- Differential Input Voltage : ±30V
- Power supply voltage : single 5.0V supply to ±15V.
- Offset voltage null capability.
- Strobe capability.

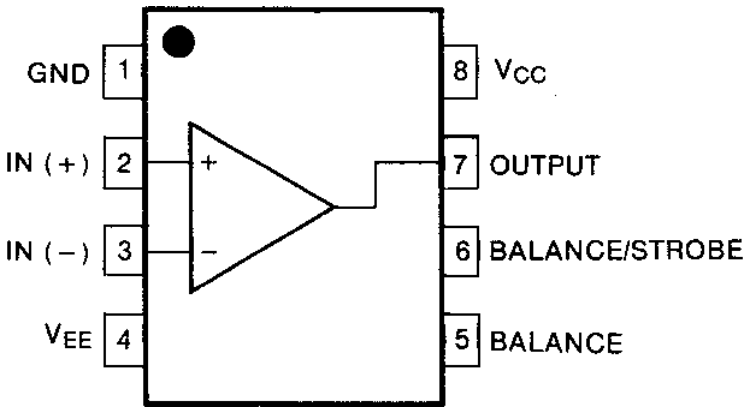
### Description

The LM311 series is a monolithic, low input current voltage comparator. The device is also designed to operate from dual or single supply voltage.

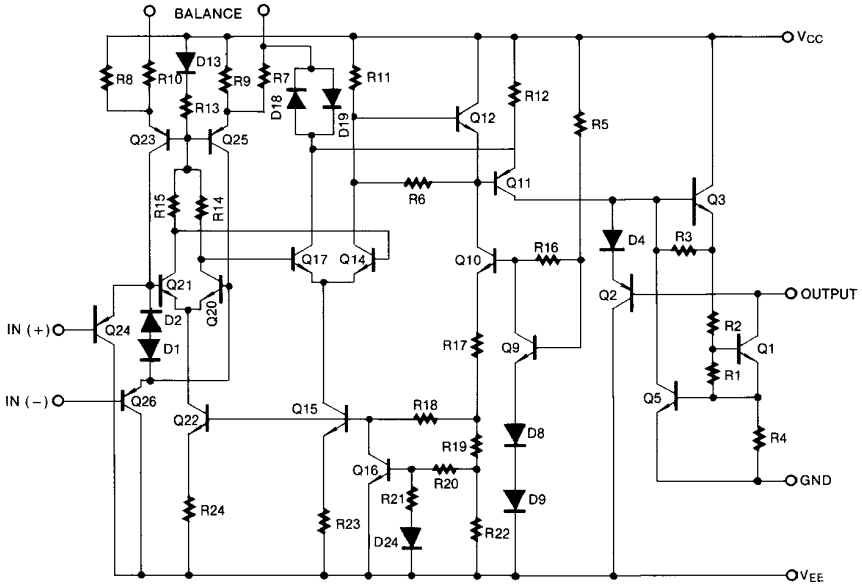
**8-DIP**


**8-SOP**


### Internal Block Diagram



## Schematic Diagram




## Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Total Supply Voltage | $V_{CC}$ | 36 | V |
| Output to Negative Supply Voltage LM311 | $V_O$ - $V_{EE}$ | 40 | V |
| Ground to Negative voltage | $V_{EE}$ | -30 | V |
| Differential Input Voltage | $V_{I(DIFF)}$ | 30 | V |
| Input Voltage | $V_I$ | ±15 | V |
| Output Short Circuit Duration | - | 10 | sec |
| Power Dissipation | $P_D$ | 500 | mW |
| Operating Temperature Range | $T_{OPR}$ | 0 ~ +70 | °C |
| Storage Temperature Range | $T_{STG}$ | - 65 ~ +150 | °C |

## Electrical Characteristics

($V_{CC}$ = 15V, $T_A$ = 25°C, unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $R_S \leq 50K\Omega$ | | - | 1.0 | 7.5 | mV |
| | | | Note 1 | - | - | 10 | |
| Input Offset Current | $I_{IO}$ | | | - | 6 | 50 | nA |
| | | | Note 1 | - | - | 70 | |
| Input Bias Current | $I_{BIAS}$ | | | - | 100 | 250 | nA |
| | | | Note 1 | - | - | 300 | |
| Voltage Gain | $G_V$ | - | | 40 | 200 | - | V/mV |
| Response Time | $T_{RES}$ | | Note 2 | - | 200 | - | ns |
| Saturation Voltage | $V_{SAT}$ | $I_O$ =50mA, $V_I \leq$ -10mV | | - | 0.75 | 1.5 | V |
| | | $V_{CC} \geq$ 4.5V, $V_{EE}$ =0V<br>$I_O$ =8mA, $V_I \leq$ -10mV, | Note 1 | - | 0.23 | 0.4 | |
| Strobe “ON” Current | $I_{STR(ON)}$ | - | | - | 3 | - | mA |
| Output Leakage Current | $I_{SINK}$ | $I_{STR}$ =3mA, $V_I \geq$ 10mV<br>$V_O$ =15V, $V_{CC}$=±15V | | - | 0.2 | 50 | nA |
| Input Voltage Range | $V_{I(R)}$ | Note 1 | | -14.5 to 13.0 | -14.7 to 13.8 | - | V |
| Positive Supply Current | $I_{CC}$ | - | | - | 3.0 | 7.5 | mA |
| Negative Supply Current | $I_{EE}$ | - | | - | -2.2 | -5.0 | mA |
| Strobe Current | $I_{STR}$ | - | | - | 3 | - | mA |

**Notes :**

1. $0 \leq T_A \leq +70°C$
2. The response time specified is for a 100mV input step with 5mV over drive.

# Typical Performance Characteristics

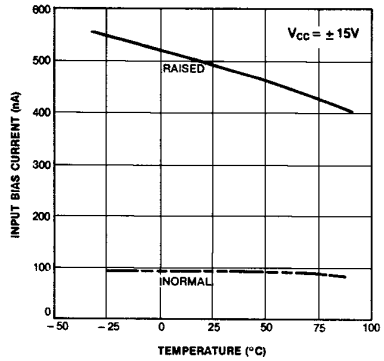



**Figure 1. Input Bias Current vs Temperature**

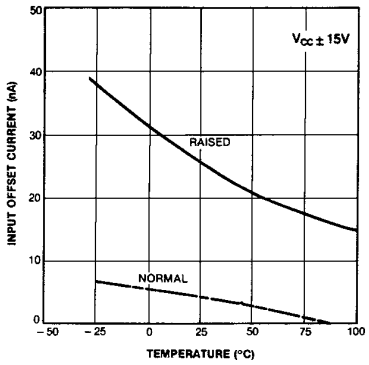



**Figure 2. Input Offset Current vs Temperature**

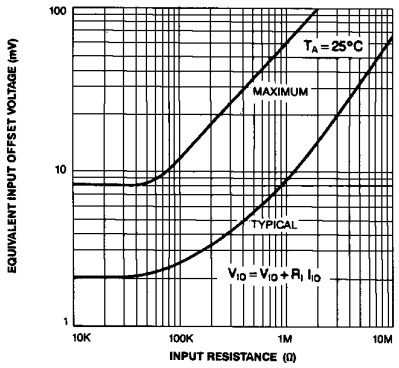



**Figure 3. Offset Voltage vs Input Resistance**

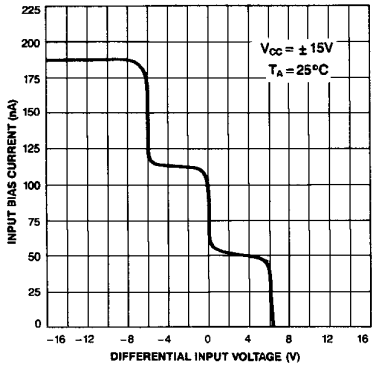



**Figure 4. Input Bias Current vs Differential input voltage**

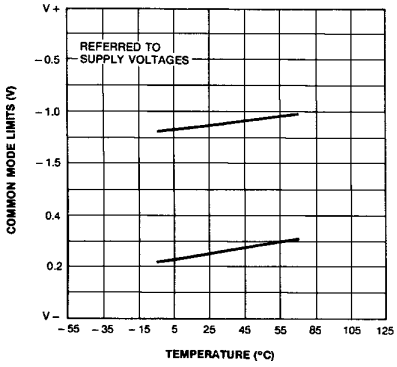



**Figure 5. Common Mode Limits vs Temperature**

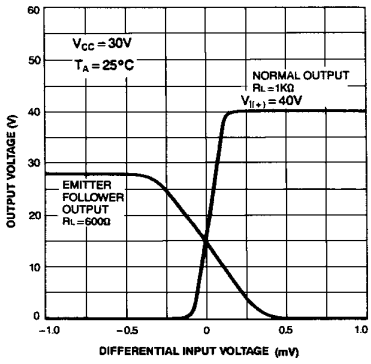



**Figure 6. Output Voltage vs Differential input voltage**

## Typical Performance Characteristics (continued)

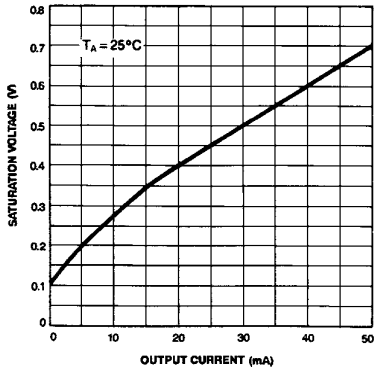



**Figure 7. Saturation voltage vs Current**

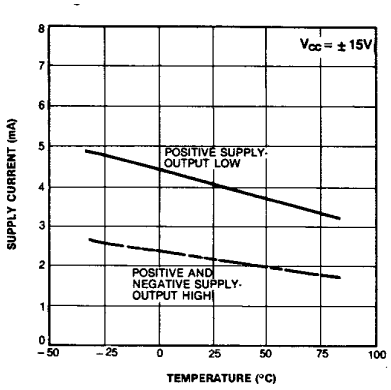



**Figure 8. Supply Current vs Temperature**

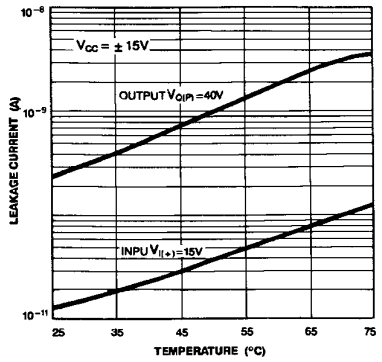



**Figure 9. Leakage Current vs Temperature**

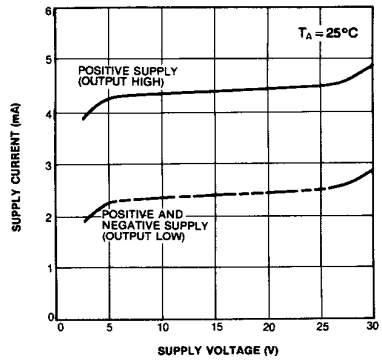



**Figure 10. Supply Current vs Supply Voltage**

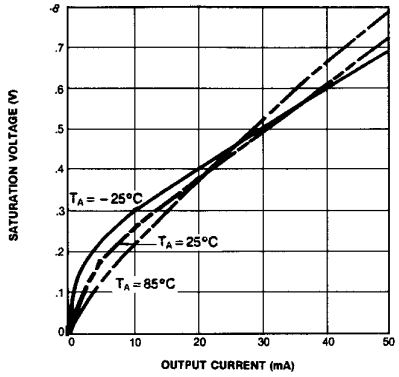



**Figure 11. Current Saturation Voltage**

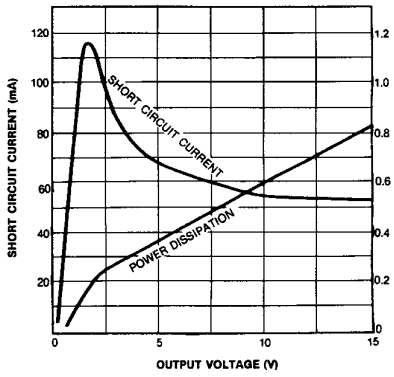
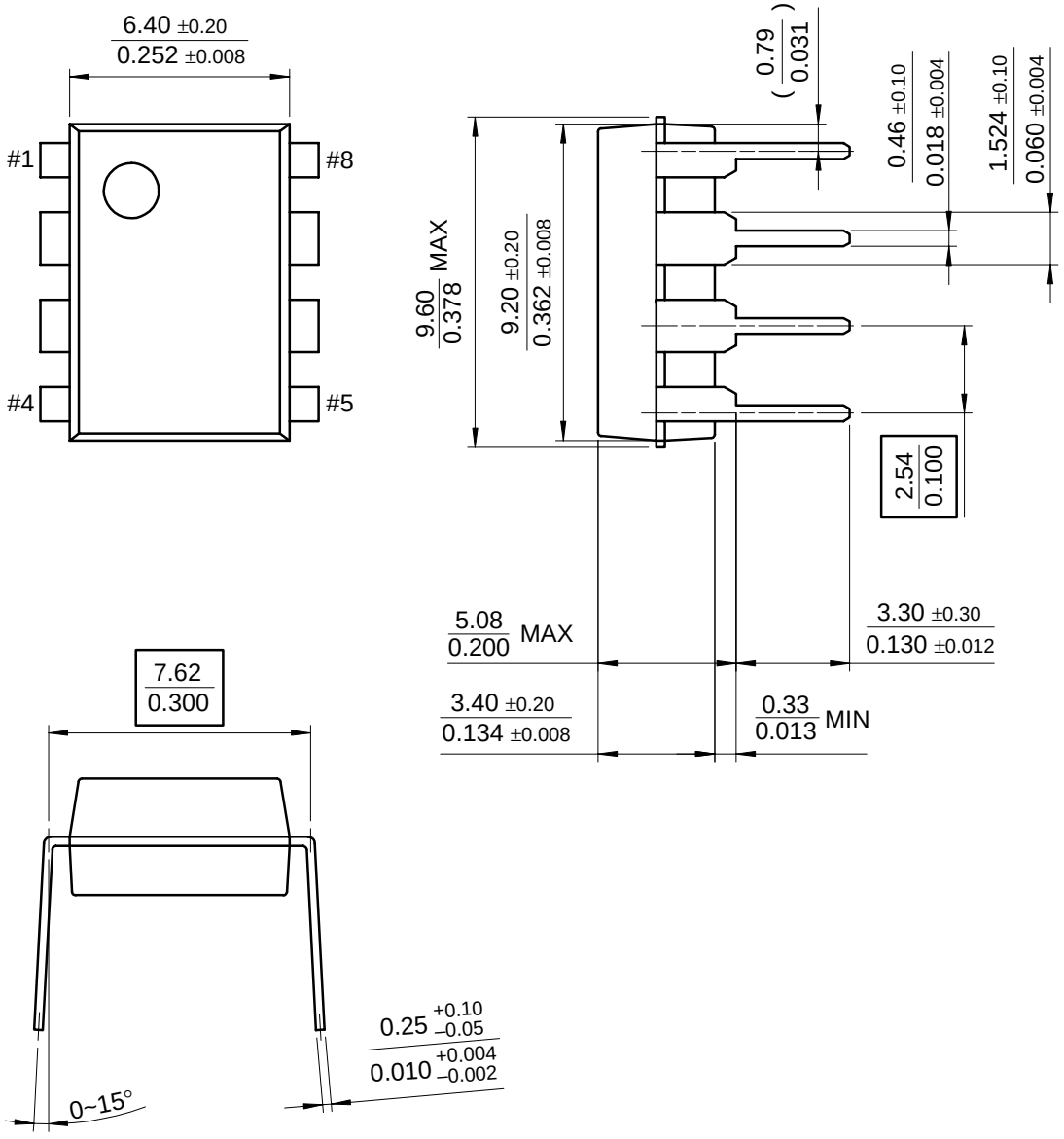



**Figure 12. Output Limiting Characterstics**

## Mechanical Dimensions

### Package

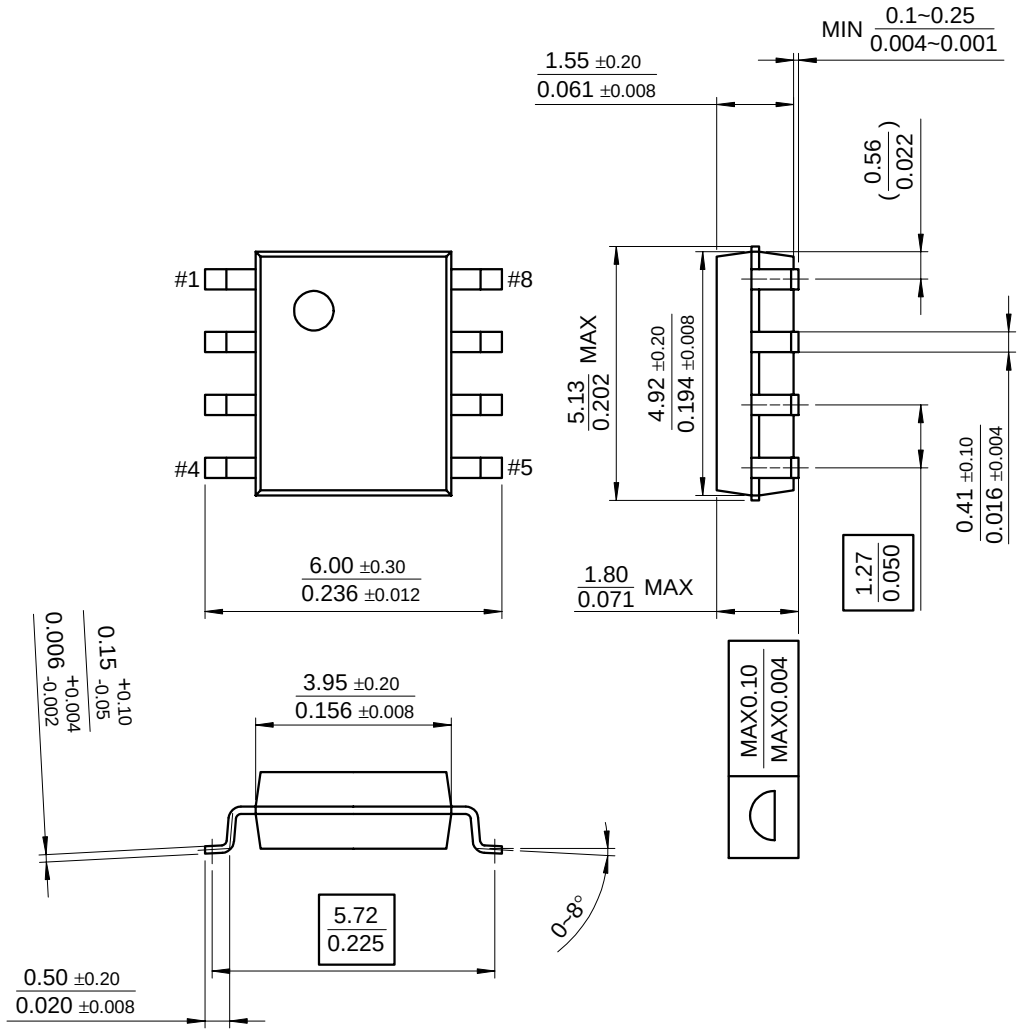
**8-DIP**



## Mechanical Dimensions (Continued)

### Package

# 8-SOP



## Ordering Information

| Product Number | Package | Operating Temperature |
|---|---|---|
| LM311N | 8-DIP | 0 ~ +70°C |
| LM311M | 8-SOP | |

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