# LM339 - Low Power Low Offset Voltage Quad Comparator

## Features

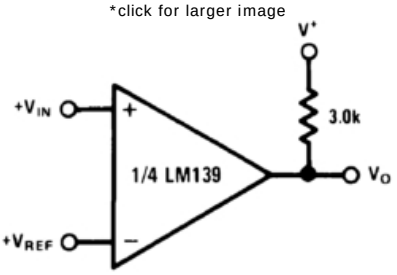
| | |
|---|---|
| Wide supply voltage range | |
| LM139/139A Series | 2 to 36 $V_{DC}$ or ±1 to ±18 $V_{DC}$ |
| LM2901: | 2 to 36 $V_{DC}$ or ±1 to ±18 $V_{DC}$ |
| LM3302: | 2 to 28 $V_{DC}$ or ±1 to ±14 $V_{DC}$ |
| Very low supply current drain (0.8 mA) - independent of supply voltage | |
| Low input biasing current: | 25 nA |
| Low input offset current: | ±5 nA |
| Offset voltage: | ±3 mV |
| Input common-mode voltage range includes GND | |
| Differential input voltage range equal to the power supply voltage | |
| Low output saturation voltage: | 250 mV at 4 mA |
| Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems | |

## Applications

- High precision comparators
- Reduced $V_{OS}$ drift over temperature
- Eliminates need for dual supplies
- Allows sensing near GND
- Compatible with all forms of logic
- Power drain suitable for battery operation

## Typical Application

*click for larger image

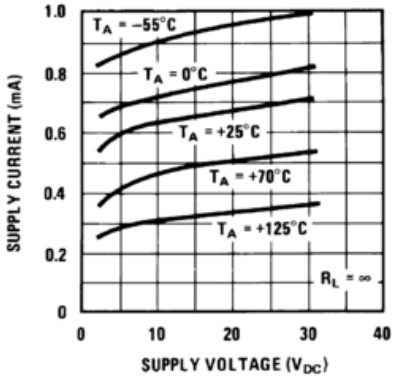



## Parametric Table

| | |
|---|---|
| Response Time | 0.5 us |
| Output Bus | Open Drain |
| Supply Min | 2 Volt |
| Supply Max | 36 Volt |
| Channels | 4 Channels |
| Offset Voltage max, 25C | 2, 5 mV |
| Output Current | 16 mA |
| Input Range | Vcm to V- |
| Supply Current Per Channel | 0.2 mA |
| PowerWise Rating 3 | 100 uA x us |
| Max Input Bias Current | 400 nA |
| Special Features | Undefined |
| Temperature Min | -25 deg C |
| Temperature Max | 85 deg C |
| Function | Comparator |

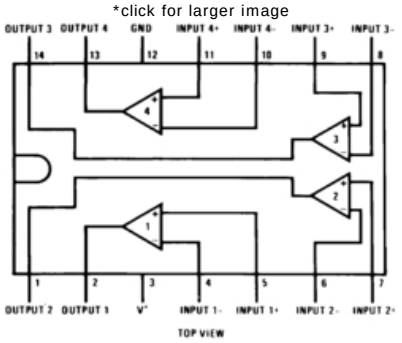
## Typical Performance

*click for larger image




## Connection Diagram

*click for larger image



Datasheet

RoHS Compliance Information

LM139/LM239/LM339/LM2901/LM3302 Low Power Low Offset Voltage Quad Comparators

## Package Availability, Models

| Part Number | Package | | | | | | | Factory Lead Time | | Models | | | | Std Pack Size | Package Marking Format |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Pins | Spec. | MSL Rating | Peak Reflow | RoHS Report | CAD Symbols | Weeks | Qty | | | | | | |
| LM339AM | SOIC NARROW | 14 | STD | 1 | 235 | RoHS | Download | Full production | | N/A | | | | rail of 55 | NSUZXYTT LM339AM |
| | | | NOPB | 1 | 260 | | | 6 weeks | 2500 | | | | | | |
| LM339M | SOIC NARROW | 14 | STD | 1 | 235 | RoHS | Download | Full production | | N/A | | | | rail of 55 | NSUZXYTT LM339M |
| | | | NOPB | 1 | 260 | | | 6 weeks | 2000 | | | | | | |
| LM339AMX | SOIC NARROW | 14 | STD | 1 | 235 | RoHS | Download | Full production | | N/A | | | | reel of 2500 | NSUZXYTT LM339AM |
| | | | NOPB | 1 | 260 | | | 6 weeks | 7500 | | | | | | |
| LM339MX | SOIC NARROW | 14 | STD | 1 | 235 | RoHS | Download | Full production | | N/A | | | | reel of 2500 | NSUZXYTT LM339M |
| | | | NOPB | 1 | 260 | | | 6 weeks | 5000 | | | | | | |
| LM339AN | MDIP | 14 | STD | 1 | NA | RoHS | Download | Full production | | N/A | | | | rail of 25 | NSUZXYYTTE# LM339AN |
| | | | NOPB | 1 | NA | | | 8 weeks | 3000 | | | | | | |
| LM339N | MDIP | 14 | STD | 1 | NA | RoHS | Download | Full production | | N/A | | | | rail of 25 | NSUZXYYTTE# LM339N |
| | | | NOPB | 1 | NA | | | 6 weeks | 3000 | | | | | | |
| LM339J | CERDIP | 14 | STD | 1 | NA | RoHS | Download | Full production | | N/A | | | | rail of 25 | NSUZXYYTT LM339J |
| | | | | | | | | 6 weeks | 500 | | | | | | |
| LM339 MDC | Unpackaged Die | | | | | | | Obsolete | | N/A | | | | tray of N/A | - |
| | | | | | | | | N/A | 40000 | | | | | | |
| LM339 MWC | Wafer | | | | | | | Lifetime buy | | N/A | | | | wafer jar of N/A | - |
| | | | | | | | | N/A | 75000 | | | | | | |

### Obsolete Versions

| Obsolete Part | Alternate Part or Supplier | Source | Last Time Buy Date |
|---|---|---|---|
| LM339AJ | LM339AN | NATIONAL SEMICONDUCTOR | 04/04/95 |

## General Description

The LM139 series consists of four independent precision voltage comparators with an offset voltage specification as low as 2 mV max for all four comparators. These were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The LM139 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, they will directly interface with MOS logic- where the low power drain of the LM339 is a distinct advantage over standard comparators.

## Reliability Metrics

| Part Number | Process | EFR Reject | EFR Sample Size | PPM * | LTA Rejects | LTA Device Hours | FITS | MTTF (Hours) |
|---|---|---|---|---|---|---|---|---|
| LM339 MDC | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339 MWC | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339AM | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339AMX | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339AN | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339J | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339M | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339MX | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |
| LM339N | SLM | 0 | 42786 | 0 | 0 | 3352500 | 2 | 951281028 |

*Note: The Early Failure Rates were calculated as point estimates. The Long Term Failure Rates were calculated at 60% confidence using the Arrhenius equation at 0.7eV activation energy and derating the assumed stress temperature of 150°C to an application temperature of 55°C.*

For more information on Reliability Metrics, please click here.

National Semiconductor

# LM139/LM239/LM339/LM2901/LM3302
# Low Power Low Offset Voltage Quad Comparators

## General Description

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Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The LM139 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, they will directly interface with MOS logic— where the low power drain of the LM339 is a distinct advantage over standard comparators.

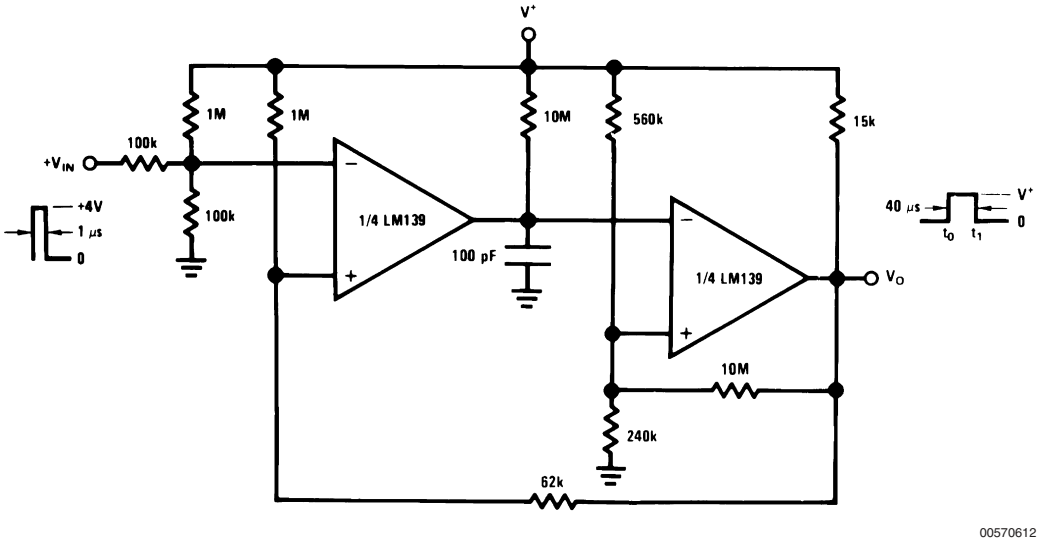
## Features

- Wide supply voltage range
- LM139/139A Series 2 to 36 $V_{DC}$ or ±1 to ±18 $V_{DC}$
- LM2901: 2 to 36 $V_{DC}$ or ±1 to ±18 $V_{DC}$
- LM3302: 2 to 28 $V_{DC}$ or ±1 to ±14 $V_{DC}$
- Very low supply current drain (0.8 mA) — independent of supply voltage
- Low input biasing current: 25 nA
- Low input offset current: ±5 nA
- Offset voltage: ±3 mV
- Input common-mode voltage range includes GND
- Differential input voltage range equal to the power supply voltage
- Low output saturation voltage: 250 mV at 4 mA
- Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems

## Advantages

- High precision comparators
- Reduced $V_{OS}$ drift over temperature
- Eliminates need for dual supplies
- Allows sensing near GND
- Compatible with all forms of logic
- Power drain suitable for battery operation

## One-Shot Multivibrator with Input Lock Out

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## Absolute Maximum Ratings (Note 10)

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

| | LM139/LM239/LM339 LM139A/LM239A/LM339A LM2901 | LM3302 |
|---|---|---|
| Supply Voltage, $V^+$ | 36 $V_{DC}$ or ±18 $V_{DC}$ | 28 $V_{DC}$ or ±14 $V_{DC}$ |
| Differential Input Voltage (Note 8) | 36 $V_{DC}$ | 28 $V_{DC}$ |
| Input Voltage | −0.3 $V_{DC}$ to +36 $V_{DC}$ | −0.3 $V_{DC}$ to +28 $V_{DC}$ |
| Input Current ($V_{IN}$<−0.3 $V_{DC}$), (Note 3) | 50 mA | 50 mA |
| Power Dissipation (Note 1) | | |
| Molded DIP | 1050 mW | 1050 mW |
| Cavity DIP | 1190 mW | |
| Small Outline Package | 760 mW | |
| Output Short-Circuit to GND, (Note 2) | Continuous | Continuous |
| Storage Temperature Range | −65˚C to +150˚C | −65˚C to +150˚C |
| Lead Temperature | | |
| (Soldering, 10 seconds) | 260˚C | 260˚C |
| Operating Temperature Range | | −40˚C to +85˚C |
| LM339/LM339A | 0˚C to +70˚C | |
| LM239/LM239A | −25˚C to +85˚C | |
| LM2901 | −40˚C to +85˚C | |
| LM139/LM139A | −55˚C to +125˚C | |
| Soldering Information | | |
| Dual-In-Line Package | | |
| Soldering (10 seconds) | 260˚C | 260˚C |
| Small Outline Package | | |
| Vapor Phase (60 seconds) | 215˚C | 215˚C |
| Infrared (15 seconds) | 220˚C | 220˚C |
| See AN-450 “Surface Mounting Methods and Their Effect on Product Reliability” for other methods of soldering surface mount devices. | | |
| ESD rating (1.5 kΩ in series with 100 pF) | 600V | 600V |

## Electrical Characteristics

($V^+$=5 $V_{DC}$, $T_A$ = 25˚C, unless otherwise stated)

| Parameter | Conditions | LM139A | | | LM239A, LM339A | | | LM139 | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | (Note 9) | | 1.0 | 2.0 | | 1.0 | 2.0 | | 2.0 | 5.0 | $mV_{DC}$ |
| Input Bias Current | $I_{IN(+)}$ or $I_{IN(-)}$ with Output in Linear Range, (Note 5), $V_{CM}$=0V | | 25 | 100 | | 25 | 250 | | 25 | 100 | $nA_{DC}$ |
| Input Offset Current | $I_{IN(+)}$−$I_{IN(-)}$, $V_{CM}$=0V | | 3.0 | 25 | | 5.0 | 50 | | 3.0 | 25 | $nA_{DC}$ |
| Input Common-Mode Voltage Range | $V^+$=30 $V_{DC}$ (LM3302, $V^+$ = 28 $V_{DC}$) (Note 6) | 0 | | $V^+$−1.5 | 0 | | $V^+$−1.5 | 0 | | $V^+$−1.5 | $V_{DC}$ |
| Supply Current | $R_L$ = ∞ on all Comparators, | | 0.8 | 2.0 | | 0.8 | 2.0 | | 0.8 | 2.0 | $mA_{DC}$ |
| | $R_L$ = ∞, $V^+$ = 36V, (LM3302, $V^+$ = 28 $V_{DC}$) | | | | | 1.0 | 2.5 | | 1.0 | 2.5 | $mA_{DC}$ |
| Voltage Gain | $R_L$≥15 kΩ, $V^+$ = 15 $V_{DC}$ $V_O$ = 1 $V_{DC}$ to 11 $V_{DC}$ | 50 | 200 | | 50 | 200 | | 50 | 200 | | V/mV |
| Large Signal Response Time | $V_{IN}$ = TTL Logic Swing, $V_{REF}$ = 1.4 $V_{DC}$, $V_{RL}$ = 5 $V_{DC}$, | | 300 | | | 300 | | | 300 | | ns |

## Electrical Characteristics (Continued)

($V^+$=5 $V_{DC}$, $T_A$ = 25˚C, unless otherwise stated)

| Parameter | Conditions | LM139A | | | LM239A, LM339A | | | LM139 | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| | $R_L$ = 5.1 kΩ | | | | | | | | | | |
| Response Time | $V_{RL}$ = 5 $V_{DC}$, $R_L$ = 5.1 kΩ, (Note 7) | | 1.3 | | | 1.3 | | | 1.3 | | µs |
| Output Sink Current | $V_{IN(-)}$ = 1 $V_{DC}$, $V_{IN(+)}$ = 0, $V_O \leq$ 1.5 $V_{DC}$ | 6.0 | 16 | | 6.0 | 16 | | 6.0 | 16 | | $mA_{DC}$ |
| Saturation Voltage | $V_{IN(-)}$ = 1 $V_{DC}$, $V_{IN(+)}$ = 0, $I_{SINK} \leq$ 4 mA | | 250 | 400 | | 250 | 400 | | 250 | 400 | $mV_{DC}$ |
| Output Leakage Current | $V_{IN(+)}$ = 1 $V_{DC}$, $V_{IN(-)}$ = 0, $V_O$ = 5 $V_{DC}$ | | 0.1 | | | 0.1 | | | 0.1 | | $nA_{DC}$ |

## Electrical Characteristics

($V^+$ = 5 $V_{DC}$, $T_A$ = 25˚C, unless otherwise stated)

| Parameter | Conditions | LM239, LM339 | | | LM2901 | | | LM3302 | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | (Note 9) | | 2.0 | 5.0 | | 2.0 | 7.0 | | 3 | 20 | $mV_{DC}$ |
| Input Bias Current | $I_{IN(+)}$ or $I_{IN(-)}$ with Output in Linear Range, (Note 5), $V_{CM}$=0V | | 25 | 250 | | 25 | 250 | | 25 | 500 | $nA_{DC}$ |
| Input Offset Current | $I_{IN(+)}$–$I_{IN(-)}$, $V_{CM}$ = 0V | | 5.0 | 50 | | 5 | 50 | | 3 | 100 | $nA_{DC}$ |
| Input Common-Mode Voltage Range | $V^+$ = 30 $V_{DC}$ (LM3302, $V^+$ = 28 $V_{DC}$) (Note 6) | 0 | | $V^+$–1.5 | 0 | | $V^+$–1.5 | 0 | | $V^+$–1.5 | $V_{DC}$ |
| Supply Current | $R_L$ = ∞ on all Comparators, $R_L$ = ∞, $V^+$ = 36V, (LM3302, $V^+$ = 28 $V_{DC}$) | | 0.8<br>1.0 | 2.0<br>2.5 | | 0.8<br>1.0 | 2.0<br>2.5 | | 0.8<br>1.0 | 2.0<br>2.5 | $mA_{DC}$<br>$mA_{DC}$ |
| Voltage Gain | $R_L \geq$ 15 kΩ, $V^+$ = 15 $V_{DC}$ $V_O$ = 1 $V_{DC}$ to 11 $V_{DC}$ | 50 | 200 | | 25 | 100 | | 2 | 30 | | V/mV |
| Large Signal Response Time | $V_{IN}$ = TTL Logic Swing, $V_{REF}$ = 1.4 $V_{DC}$, $V_{RL}$ = 5 $V_{DC}$, $R_L$ = 5.1 kΩ, | | 300 | | | 300 | | | 300 | | ns |
| Response Time | $V_{RL}$ = 5 $V_{DC}$, $R_L$ = 5.1 kΩ, (Note 7) | | 1.3 | | | 1.3 | | | 1.3 | | µs |
| Output Sink Current | $V_{IN(-)}$= 1 $V_{DC}$, $V_{IN(+)}$ = 0, $V_O \leq$ 1.5 $V_{DC}$ | 6.0 | 16 | | 6.0 | 16 | | 6.0 | 16 | | $mA_{DC}$ |
| Saturation Voltage | $V_{IN(-)}$ = 1 $V_{DC}$, $V_{IN(+)}$ = 0, $I_{SINK} \leq$ 4 mA | | 250 | 400 | | 250 | 400 | | 250 | 500 | $mV_{DC}$ |
| Output Leakage Current | $V_{IN(+)}$ = 1 $V_{DC}$, $V_{IN(-)}$ = 0, $V_O$ = 5 $V_{DC}$ | | 0.1 | | | 0.1 | | | 0.1 | | $nA_{DC}$ |

## Electrical Characteristics

($V^+$ = 5.0 $V_{DC}$, (Note 4))

| Parameter | Conditions | LM139A | | | LM239A, LM339A | | | LM139 | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | (Note 9) | | | 4.0 | | | 4.0 | | | 9.0 | $mV_{DC}$ |
| Input Offset Current | $I_{IN(+)}$–$I_{IN(-)}$, $V_{CM}$ = 0V | | | 100 | | | 150 | | | 100 | $nA_{DC}$ |
| Input Bias Current | $I_{IN(+)}$ or $I_{IN(-)}$ with Output in Linear Range, $V_{CM}$ = 0V (Note 5) | | | 300 | | | 400 | | | 300 | $nA_{DC}$ |
| Input Common-Mode Voltage Range | $V^+$=30 $V_{DC}$ (LM3302, $V^+$ = 28 $V_{DC}$) (Note 6) | 0 | | $V^+$–2.0 | 0 | | $V^+$–2.0 | 0 | | $V^+$–2.0 | $V_{DC}$ |

## Electrical Characteristics (Continued)

($V^+$ = 5.0 $V_{DC}$, (Note 4))

| Parameter | Conditions | LM139A | | | LM239A, LM339A | | | LM139 | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| Saturation Voltage | $V_{IN(-)}$=1 $V_{DC}$, $V_{IN(+)}$ = 0, $I_{SINK} \leq$ 4 mA | | | 700 | | | 700 | | | 700 | $mV_{DC}$ |
| Output Leakage Current | $V_{IN(+)}$ = 1 $V_{DC}$, $V_{IN(-)}$ = 0, $V_O$ = 30 $V_{DC}$, (LM3302, $V_O$ = 28 $V_{DC}$) | | | 1.0 | | | 1.0 | | | 1.0 | $\mu A_{DC}$ |
| Differential Input Voltage | Keep all $V_{IN}$'s $\geq$ 0 $V_{DC}$ (or $V^-$, if used), (Note 8) | | | 36 | | | 36 | | | 36 | $V_{DC}$ |

## Electrical Characteristics

($V^+$ = 5.0 $V_{DC}$, (Note 4))

| Parameter | Conditions | LM239, LM339 | | | LM2901 | | | LM3302 | | | Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | (Note 9) | | | 9.0 | | 9 | 15 | | | 40 | $mV_{DC}$ |
| Input Offset Current | $I_{IN(+)}$–$I_{IN(-)}$, $V_{CM}$ = 0V | | | 150 | | 50 | 200 | | | 300 | $nA_{DC}$ |
| Input Bias Current | $I_{IN(+)}$ or $I_{IN(-)}$ with Output in Linear Range, $V_{CM}$ = 0V (Note 5) | | | 400 | | 200 | 500 | | | 1000 | $nA_{DC}$ |
| Input Common-Mode Voltage Range | $V^+$ = 30 $V_{DC}$ (LM3302, $V^+$ = 28 $V_{DC}$) (Note 6) | | | $V^+$–2.0 | 0 | | $V^+$–2.0 | 0 | | $V^+$–2.0 | $V_{DC}$ |
| Saturation Voltage | $V_{IN(-)}$ = 1 $V_{DC}$, $V_{IN(+)}$ = 0, $I_{SINK} \leq$ 4 mA | | | 700 | | 400 | 700 | | | 700 | $mV_{DC}$ |
| Output Leakage Current | $V_{IN(+)}$ = 1 $V_{DC}$, $V_{IN(-)}$ = 0, $V_O$ = 30 $V_{DC}$, (LM3302, $V_O$ = 28 $V_{DC}$) | | | 1.0 | | | 1.0 | | | 1.0 | $\mu A_{DC}$ |
| Differential Input Voltage | Keep all $V_{IN}$'s $\geq$ 0 $V_{DC}$ (or $V^-$, if used), (Note 8) | | | 36 | | | 36 | | | 28 | $V_{DC}$ |

**Note 1:** For operating at high temperatures, the LM339/LM339A, LM2901, LM3302 must be derated based on a 125˚C maximum junction temperature and a thermal resistance of 95˚C/W which applies for the device soldered in a printed circuit board, operating in a still air ambient. The LM239 and LM139 must be derated based on a 150˚C maximum junction temperature. The low bias dissipation and the "ON-OFF" characteristic of the outputs keeps the chip dissipation very small ($P_D \leq$100 mW), provided the output transistors are allowed to saturate.

**Note 2:** Short circuits from the output to $V^+$ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 20 mA independent of the magnitude of $V^+$.

**Note 3:** This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the $V^+$ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than –0.3 $V_{DC}$ (at 25˚)C.

**Note 4:** These specifications are limited to –55˚C $\leq T_A \leq$ +125˚C, for the LM139/LM139A. With the LM239/LM239A, all temperature specifications are limited to –25˚C $\leq T_A \leq$ +85˚C, the LM339/LM339A temperature specifications are limited to 0˚C $\leq T_A \leq$ +70˚C, and the LM2901, LM3302 temperature range is –40˚C $\leq T_A \leq$ +85˚C.

**Note 5:** The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.

**Note 6:** The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V^+$ –1.5V at 25˚C, but either or both inputs can go to +30 $V_{DC}$ without damage (25V for LM3302), independent of the magnitude of $V^+$.

**Note 7:** The response time specified is a 100 mV input step with 5 mV overdrive. For larger overdrive signals 300 ns can be obtained, see typical performance characteristics section.

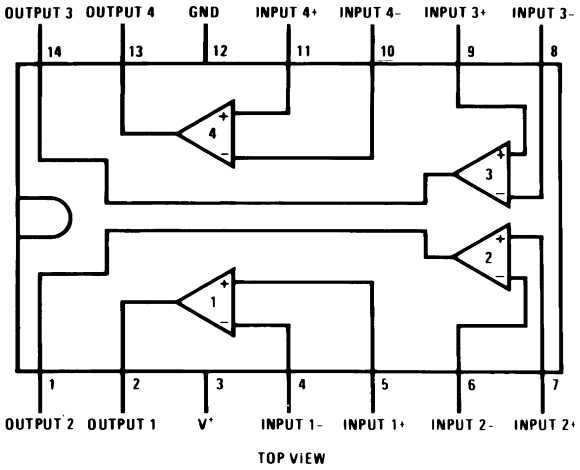
**Note 8:** Positive excursions of input voltage may exceed the power supply level. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than –0.3 $V_{DC}$ (or 0.3 $V_{DC}$below the magnitude of the negative power supply, if used) (at 25˚C).

**Note 9:** At output switch point, $V_O \simeq$1.4 $V_{DC}$, $R_S$ = 0Ω with $V^+$ from 5 $V_{DC}$ to 30 $V_{DC}$; and over the full input common-mode range (0 $V_{DC}$ to $V^+$ –1.5 $V_{DC}$), at 25˚C. For LM3302, $V^+$ from 5 $V_{DC}$ to 28 $V_{DC}$.

**Note 10:** Refer to RETS139AX for LM139A military specifications and to RETS139X for LM139 military specifications.

# Connection Diagrams

**Dual-In-Line Package**

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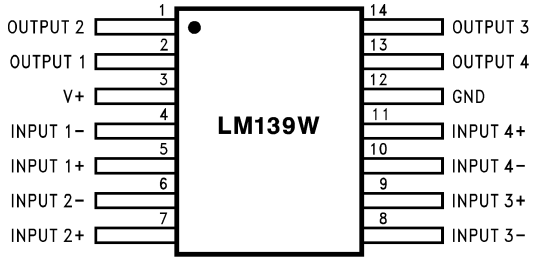
**Order Number LM139J, LM139J/883** (Note 11)**, LM139AJ, LM139AJ/883** (Note 12)**, LM239J, LM239AJ, LM339J**
**See NS Package Number J14A**
**Order Number LM339AM, LM339AMX, LM339M, LM339MX or LM2901M**
**See NS Package Number M14A**
**Order Number LM339N, LM339AN, LM2901N or LM3302N**
**See NS Package Number N14A**

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**Order Number LM139AW/883 or LM139W/883** (Note 11)
**See NS Package Number W14B,**
**LM139AWGRQMLV** (Note 13)
**See NS Package Number WG14A**

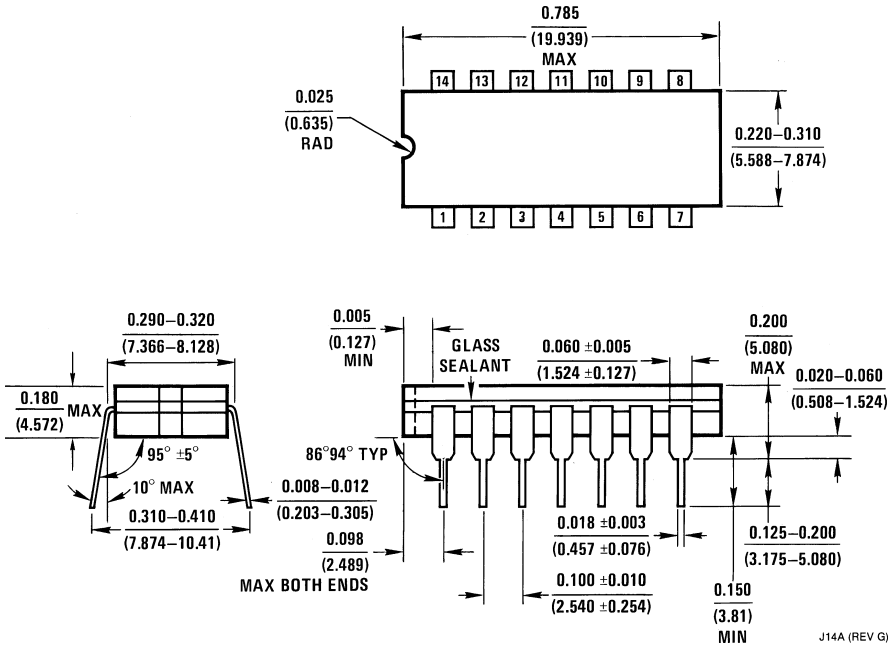
**Note 11:** Available per JM38510/11201

**Note 12:** Available per SMD# 5962-8873901

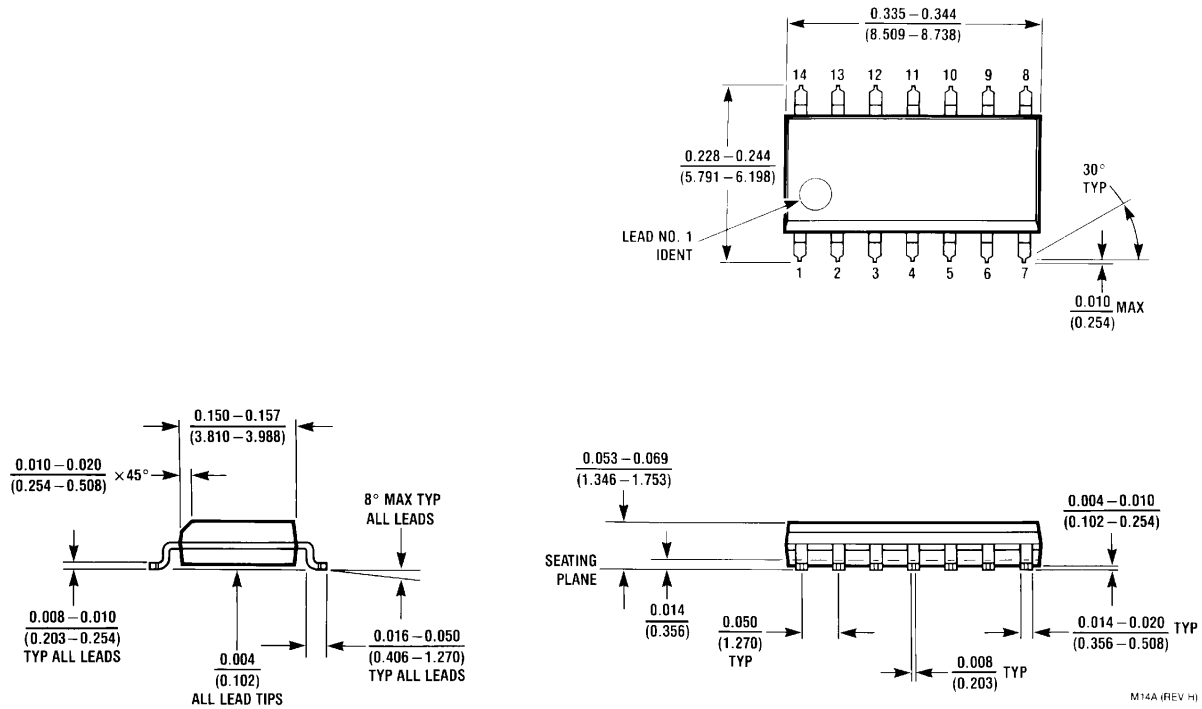
**Note 13:** See STD Mil Dwg 5962R96738 for Radiation Tolerant Device

## Physical Dimensions inches (millimeters)

unless otherwise noted




**Ceramic Dual-In-Line Package (J)**
**Order Number LM139J, LM139J/883, LM139AJ, LM139AJ/883, LM239J, LM239AJ, LM339J**
**NS Package Number J14A**




**S.O. Package (M)**
**Order Number LM339AM, LM339AMX, LM339M, LM339MX, LM2901M or LM2901MX**
**NS Package Number M14A**