

NEC

# BIPOLAR ANALOG INTEGRATED CIRCUIT

## $\mu$ PC319

### HIGH SPEED DUAL COMPARATORS

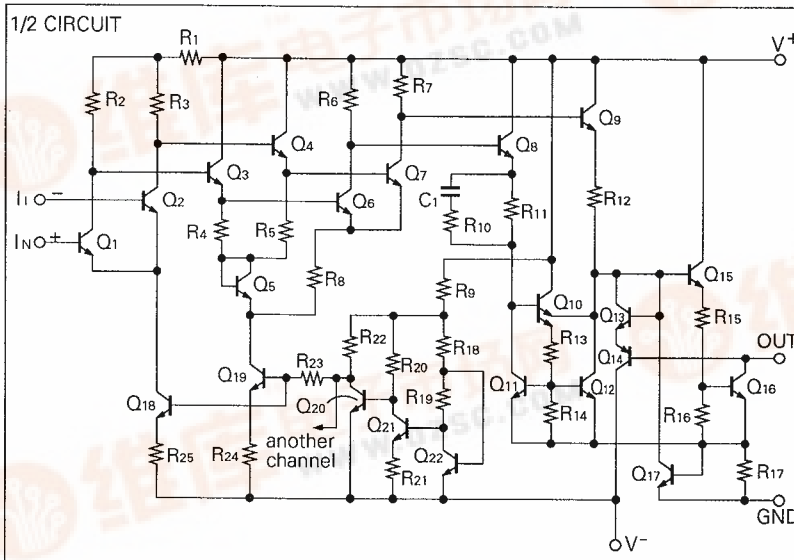
#### DESCRIPTION

The  $\mu$ PC319 is a precision high speed dual comparator designed to operate over a wide range of supply voltage down to a 5 V logic supply and ground. Further advantage, they have excellent input characteristics and direct drive capability to all the popular logic families.

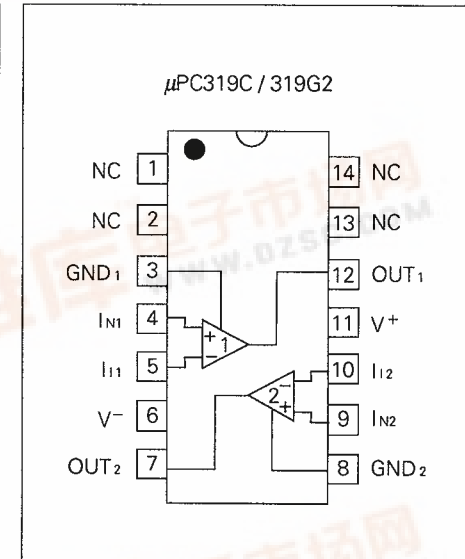
#### FEATURES

- Operate from single 5 V supply
- Typically 80 ns response time at  $\pm 15$  V
- Open collector output
- Minimum fan-out of 2 each side (TTL)
- High common mode slew rate

#### EQUIVALENT CIRCUIT



#### CONNECTION DIAGRAM (Top View)



#### ORDERING INFORMATION

| PART NUMBER   | PACKAGE                      | QUALITY GRADE |
|---------------|------------------------------|---------------|
| $\mu$ PC319C  | 14 PIN PLASTIC DIP (300 mil) | Standard      |
| $\mu$ PC319G2 | 14 PIN PLASTIC SOP (225 mil) | Standard      |

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

# ABSOLUTE MAXIMUM RATINGS (T<sub>a</sub> = 25 °C)

| PARAMETER                                                  |                     | SYMBOL                            | μPC319                                       | UNIT |
|------------------------------------------------------------|---------------------|-----------------------------------|----------------------------------------------|------|
| Voltage between V <sup>+</sup> and V <sup>-</sup> (Note 1) |                     | V <sup>+</sup> - V <sup>-</sup>   | -0.3 to +36                                  | V    |
| Differential Input Voltage                                 |                     | V <sub>ID</sub>                   | ±5                                           | V    |
| Input Voltage (Note 2)                                     |                     | V <sub>I</sub>                    | V <sup>-</sup> - 0.3 to V <sup>+</sup> + 0.3 | V    |
| Output to Negative Supply Voltage (Note 3)                 |                     | V <sub>O</sub> - V <sup>-</sup>   | -0.3 to +36                                  | V    |
| Ground to Negative Supply Voltage (Note 3)                 |                     | V <sub>GND</sub> - V <sup>-</sup> | -0.3 to +25                                  | V    |
| Ground to Positive Supply Voltage (Note 3)                 |                     | V <sup>+</sup> - V <sub>GND</sub> | -0.3 to +18                                  | V    |
| Power Dissipation                                          | C Package (Note 4)  | P <sub>T</sub>                    | 570                                          | mW   |
|                                                            | G2 Package (Note 5) |                                   | 550                                          | mW   |
| Output Short Circuit Duration (Note 6)                     |                     |                                   | 10                                           | sec  |
| Operating Temperature Range                                |                     | T <sub>opt</sub>                  | -20 to +80                                   | °C   |
| Storage Temperature Range                                  |                     | T <sub>stg</sub>                  | -55 to +125                                  | °C   |

**Note 1.** Reverse connection of supply voltage can cause destruction.

**Note 2.** The input voltage should be allowed to input without damage or destruction. Even during the transition period of supply voltage, power on/off etc., this specification should be kept. The normal operation will establish when the both inputs are within the Common Mode Input Voltage Range of electrical characteristics.

**Note 3.** This specification is the voltage which should be allowed to supply to the output and GND terminal from external without damage or destructive. Even during the transition period of supply voltage, power on/off etc., this specification should be kept.

**Note 4.** Thermal derating factor is -7.6 mW/°C when ambient temperature is higher than 50 °C.

**Note 5.** Thermal derating factor is -5.5 mW/°C when ambient temperature is higher than 25 °C.

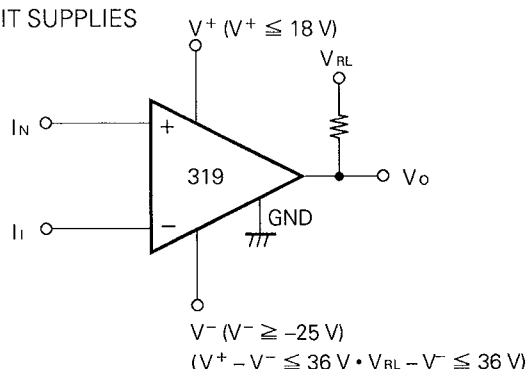
**Note 6.** Pay careful attention to the total power dissipation not to exceed the absolute maximum ratings, Note 4 and Note 5.

## RECOMMENDED OPERATING CONDITIONS

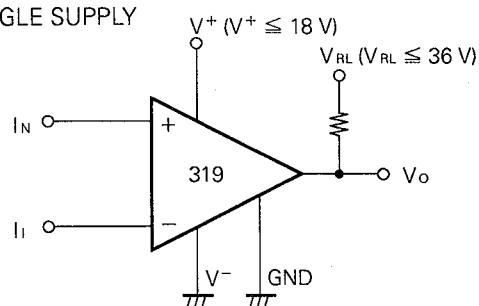
| CHARACTERISTIC                        | SYMBOL         | MIN. | TYP. | MAX. | UNIT |
|---------------------------------------|----------------|------|------|------|------|
| Supply Voltage (Split)                | V <sup>±</sup> | ±5   |      | ±16  | V    |
| Supply Voltage (V <sup>-</sup> = GND) | V <sup>+</sup> | +5   |      | +32  | V    |

## TYPICAL CONNECTIONS

SPLIT SUPPLIES



SINGLE SUPPLY

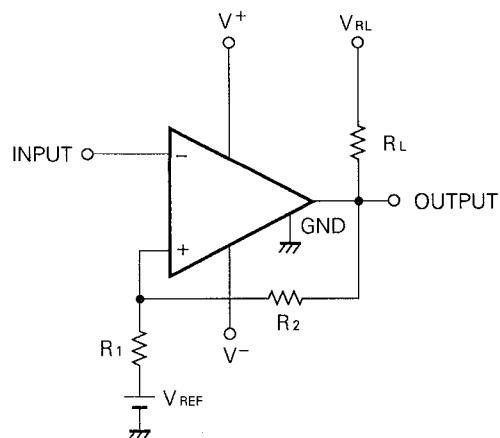


**ELECTRICAL CHARACTERISTICS ( $V^{\pm} = \pm 15 \text{ V}$ ,  $T_a = 25^{\circ}\text{C}$ )**

| CHARACTERISTIC                  | SYMBOL             | MIN. | TYP.      | MAX.      | UNIT | CONDITIONS                                                                                                           |
|---------------------------------|--------------------|------|-----------|-----------|------|----------------------------------------------------------------------------------------------------------------------|
| Input Offset Voltage            | $V_{IO}$           |      | $\pm 2.0$ | $\pm 8.0$ | mV   | $V^+ - V^- = 5 \text{ V to } 30 \text{ V}$ , $R_s \leq 5 \text{ k}\Omega$                                            |
| Input Offset Current            | $I_{IO}$           |      | $\pm 80$  | $\pm 200$ | nA   | $V^+ - V^- = 5 \text{ V to } 30 \text{ V}$                                                                           |
| Input Bias Current              | $I_B$              |      | 400       | 1000      | nA   | $V^+ - V^- = 5 \text{ V to } 30 \text{ V}$                                                                           |
| Voltage Gain                    | $A_V$              | 8    | 40        |           | V/mV |                                                                                                                      |
| Response Time                   |                    |      | 80        |           | ns   | Input 100 mV, Overdrive 5 mV                                                                                         |
| Output Saturation Voltage       | $V_{OL}$           |      | 0.75      | 1.5       | V    | $V_{IN} \leq -10 \text{ mV}$ , $I_o = 25 \text{ mA}$                                                                 |
| Output Leakage Current          | $I_{O\text{LEAK}}$ |      | 0.2       | 10        | μA   | $V_{IN} \geq 10 \text{ mV}$ , $V_o = 35 \text{ V}$                                                                   |
| Positive Supply Current         | $I^+$              |      | 4.3       |           | mA   | $V^+ = +5 \text{ V}$ , $V^- = 0 \text{ V}$ , $I_o = 0 \text{ A}$ , Both Comparators                                  |
| Positive Supply Current         | $I^+$              |      | 8.0       | 12.5      | mA   | $I_o = 0 \text{ A}$ , Both Comparators                                                                               |
| Negative Supply Current         | $I^-$              |      | 3.0       | 5.0       | mA   | $I_o = 0 \text{ A}$ , Both Comparators                                                                               |
| Input Offset Voltage            | $V_{IO}$           |      |           | $\pm 10$  | mV   | $V^+ - V^- = 5 \text{ V to } 30 \text{ V}$ , $R_s \leq 5 \text{ k}\Omega$ , $T_a = 0 \text{ to } 70^{\circ}\text{C}$ |
| Input Offset Current            | $I_{IO}$           |      |           | $\pm 300$ | nA   | $V^+ - V^- = 5 \text{ V to } 30 \text{ V}$ , $T_a = 0 \text{ to } 70^{\circ}\text{C}$                                |
| Input Bias Current              | $I_B$              |      |           | 1200      | nA   | $V^+ - V^- = 5 \text{ V to } 30 \text{ V}$ , $T_a = 0 \text{ to } 70^{\circ}\text{C}$                                |
| Common Mode Input Voltage Range | $V_{ICM}$          |      | $\pm 13$  |           | V    |                                                                                                                      |
| Output Saturation Voltage       | $V_{OL}$           |      | 0.23      | 0.4       | V    | $V^+ \geq 4.5 \text{ V}$ , $V^- = 0 \text{ V}$ , $V_{IN} \leq -10 \text{ mV}$ , $I_o \leq 3.2 \text{ mA}$            |

**TYPICAL APPLICATION CIRCUIT**

CAMPARATOR with HYSTERESIS CIRCUIT



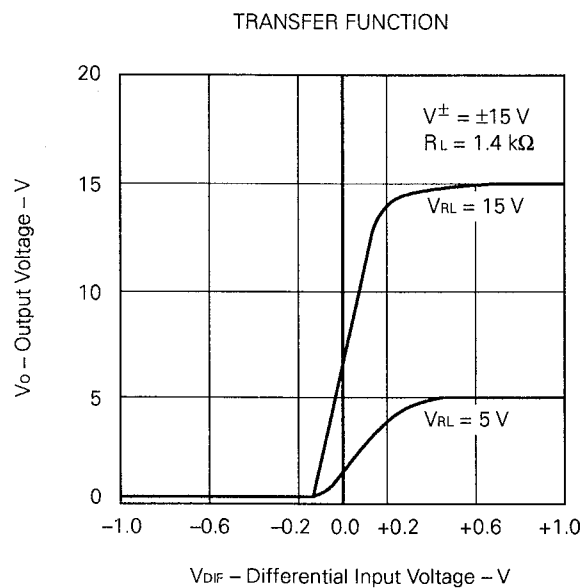
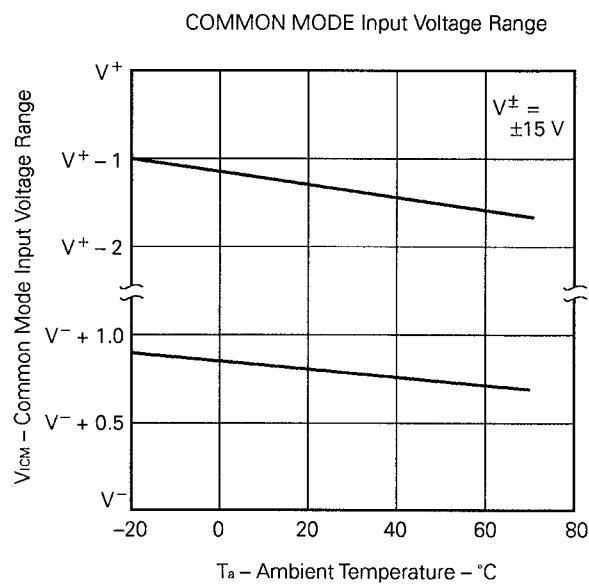
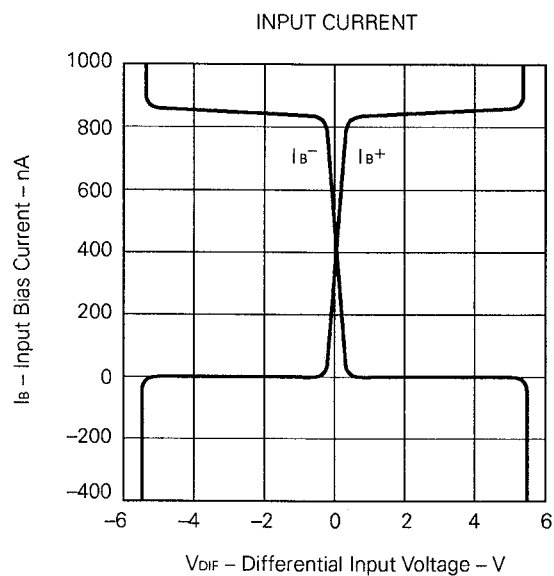
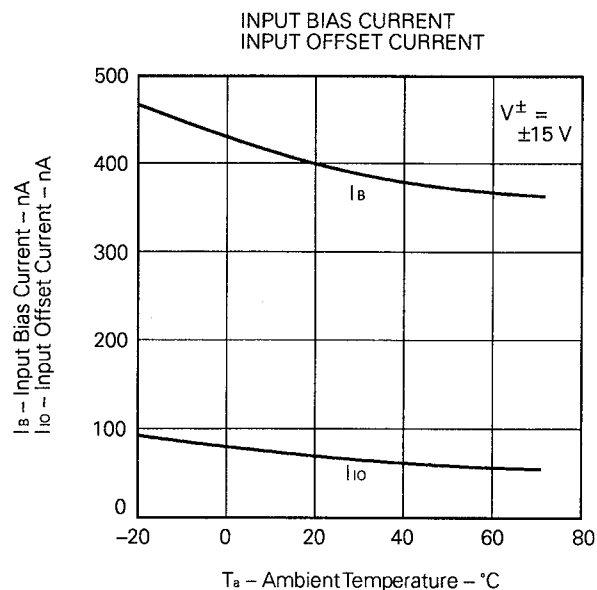
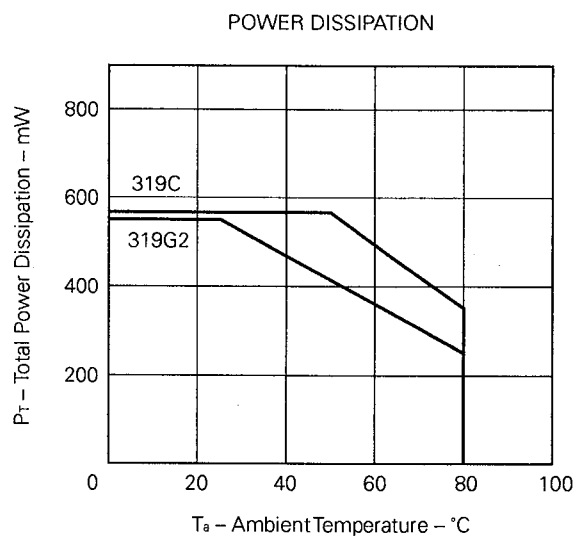
Threshold Voltage

$$V_{TH(HIGH)} \approx V_{REF} + \frac{R_1}{R_L + R_2 + R_1} (V_{RL} - V_{REF})$$

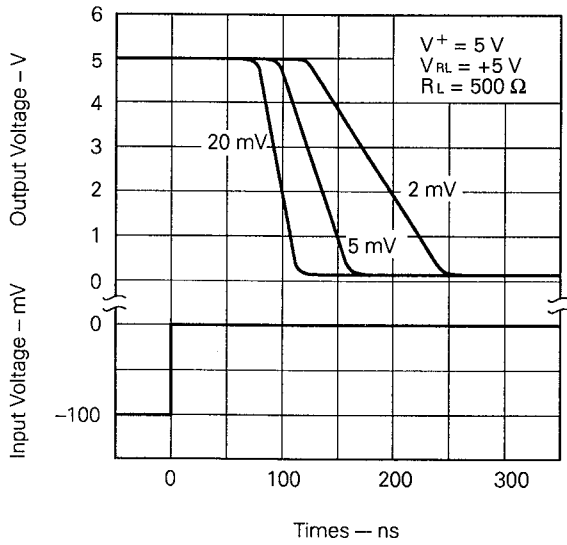
$$V_{TH(LOW)} \approx V_{REF} - \frac{R_1}{R_1 + R_2} (V_{REF} - V_{OL})$$

$$(V_{RL} > V_{REF} > V_{OL})$$

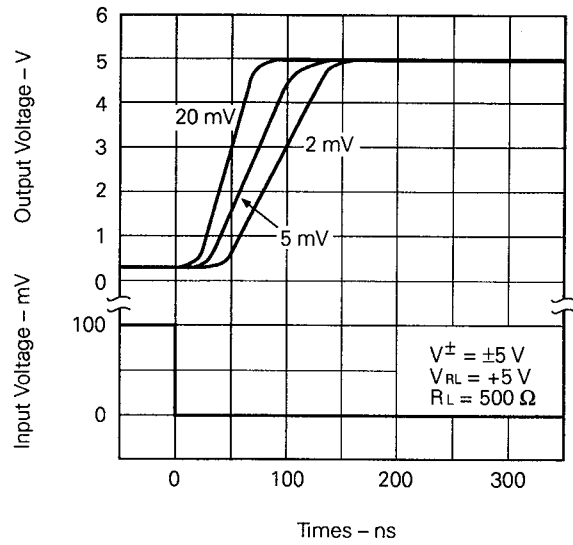
**TYPICAL PERFORMANCE CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ , TYP.)**



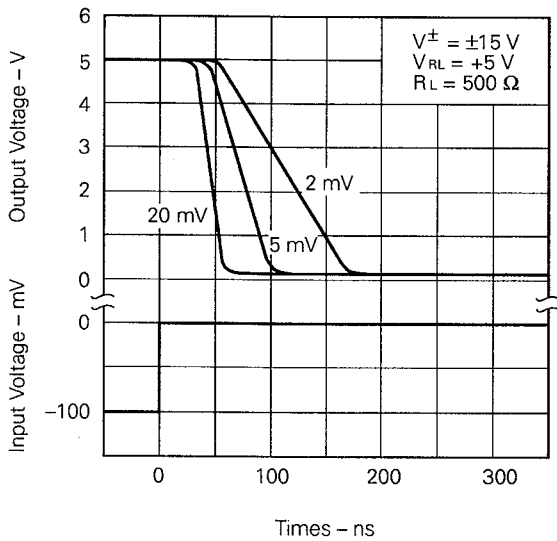
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



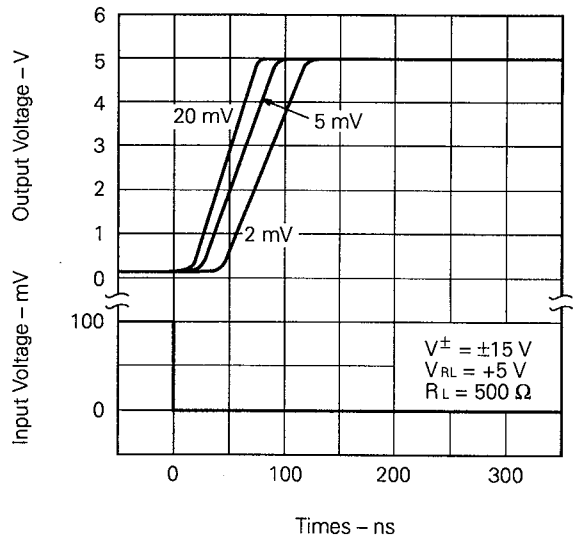
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



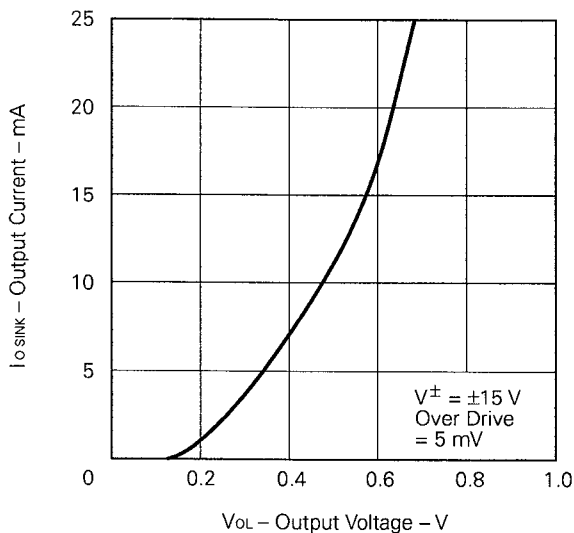
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



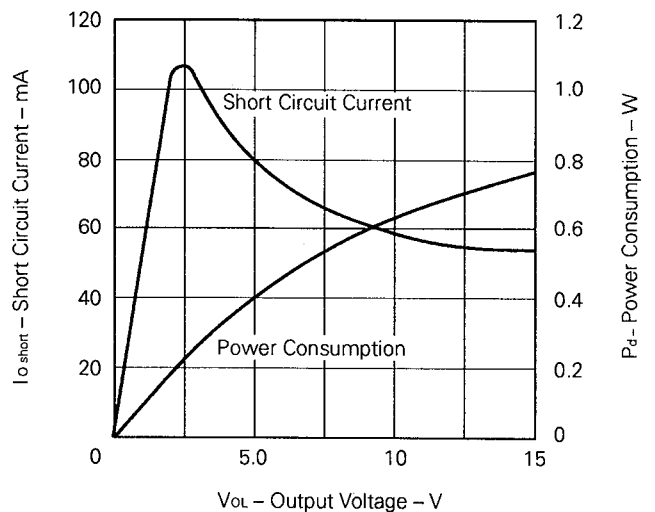
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

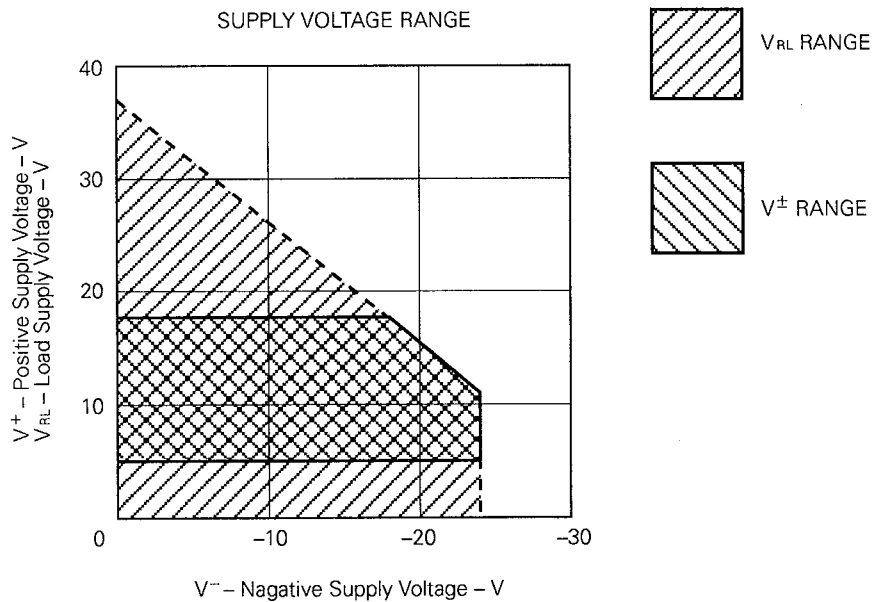
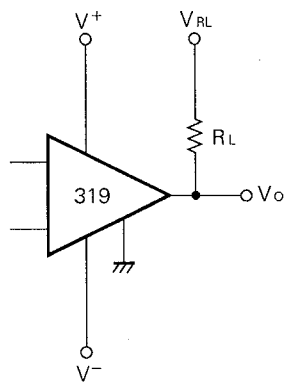
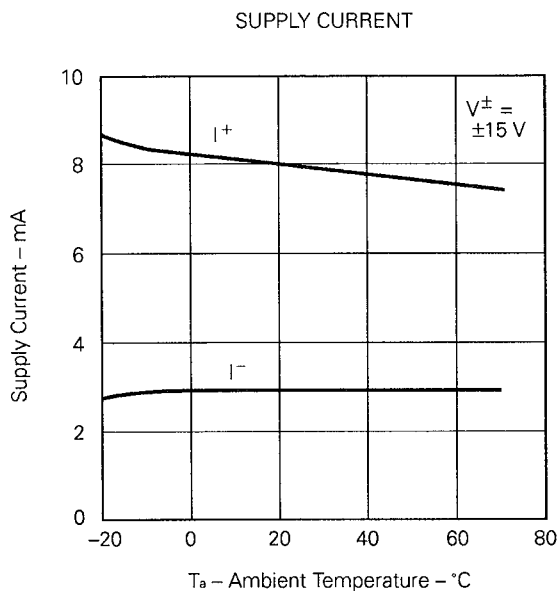
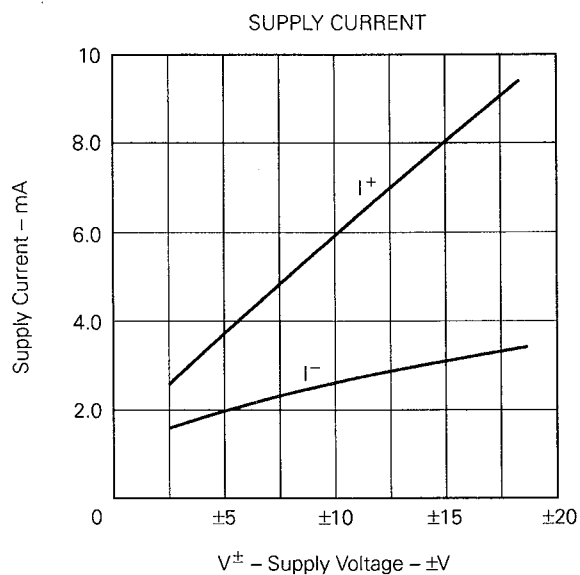


OUTPUT SATURATION VOLTAGE

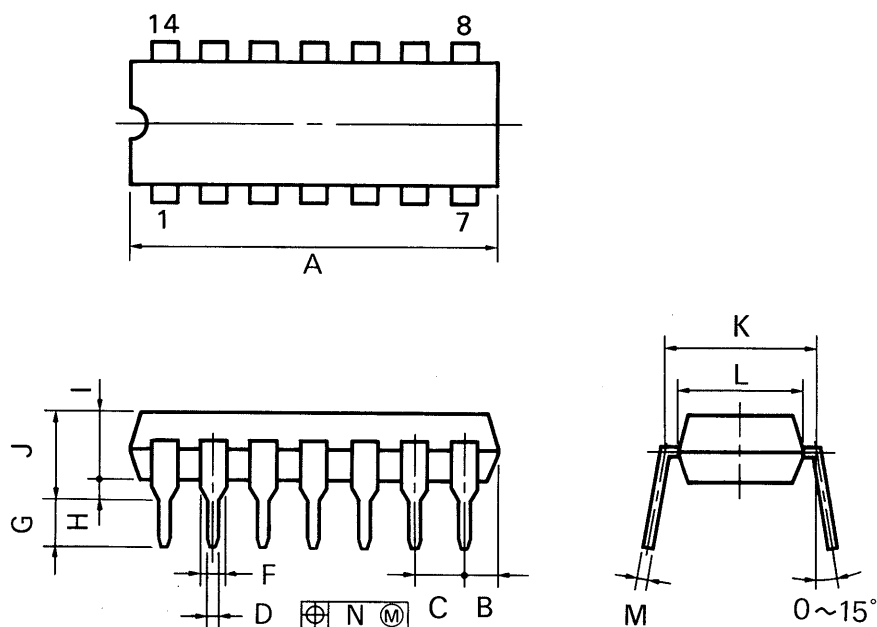


OUTPUT LIMITING CHARACTERISTICS





14PIN PLASTIC DIP (300 mil)



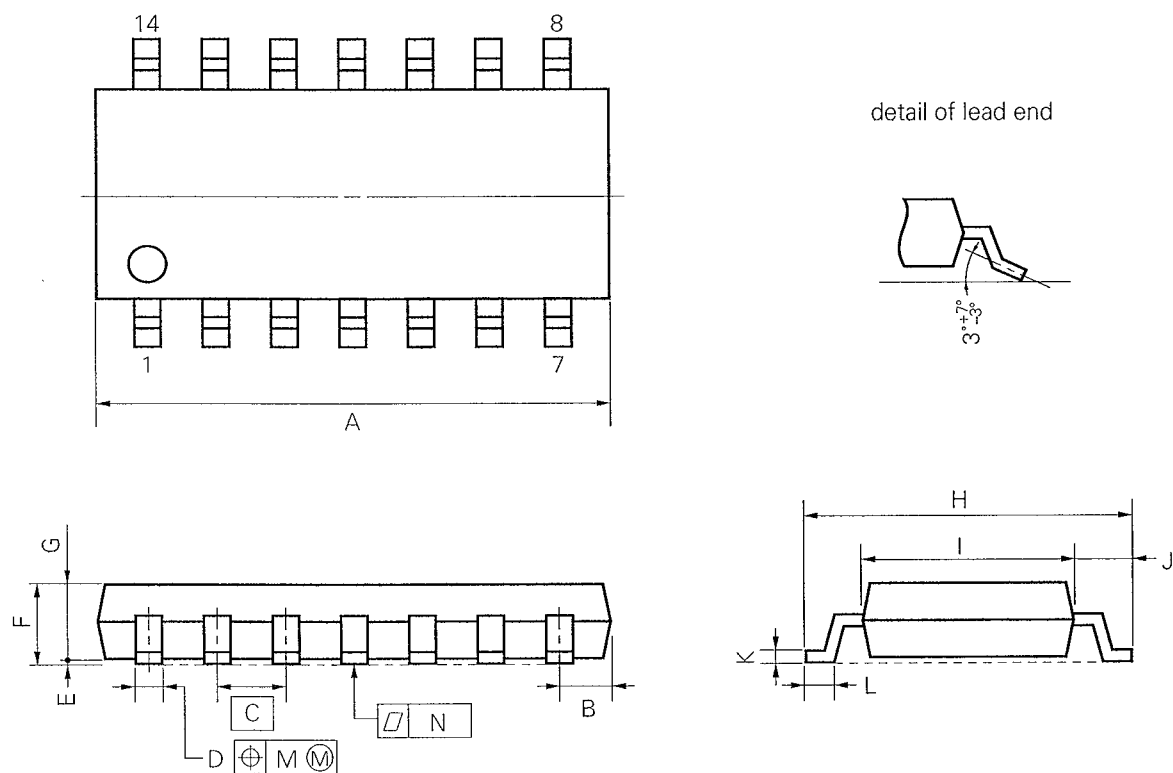
P14C-100-300B1

NOTES

- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

| ITEM | MILLIMETERS     | INCHES            |
|------|-----------------|-------------------|
| A    | 20.32 MAX.      | 0.800 MAX.        |
| B    | 2.54 MAX.       | 0.100 MAX.        |
| C    | 2.54 (T.P.)     | 0.100 (T.P.)      |
| D    | 0.50 $\pm 0.10$ | 0.020 $\pm 0.004$ |
| F    | 1.2 MIN.        | 0.047 MIN.        |
| G    | 3.6 $\pm 0.3$   | 0.142 $\pm 0.012$ |
| H    | 0.51 MIN.       | 0.020 MIN.        |
| I    | 4.31 MAX.       | 0.170 MAX.        |
| J    | 5.08 MAX.       | 0.200 MAX.        |
| K    | 7.62 (T.P.)     | 0.300 (T.P.)      |
| L    | 6.4             | 0.252             |
| M    | 0.25 $\pm 0.10$ | 0.010 $\pm 0.004$ |
| N    | 0.25            | 0.01              |

14 PIN PLASTIC SOP (225 mil)



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

S14GM-50-225B, C-2

| ITEM | MILLIMETERS                            | INCHES                                    |
|------|----------------------------------------|-------------------------------------------|
| A    | 10.46 MAX.                             | 0.412 MAX.                                |
| B    | 1.42 MAX.                              | 0.056 MAX.                                |
| C    | 1.27 (T.P.)                            | 0.050 (T.P.)                              |
| D    | 0.40 <sup>+0.10</sup> <sub>-0.05</sub> | 0.016 <sup>+0.004</sup> <sub>-0.003</sub> |
| E    | 0.1±0.1                                | 0.004±0.004                               |
| F    | 1.8 MAX.                               | 0.071 MAX.                                |
| G    | 1.49                                   | 0.059                                     |
| H    | 6.5±0.3                                | 0.256±0.012                               |
| I    | 4.4                                    | 0.173                                     |
| J    | 1.1                                    | 0.043                                     |
| K    | 0.15 <sup>+0.10</sup> <sub>-0.05</sub> | 0.006 <sup>+0.004</sup> <sub>-0.002</sub> |
| L    | 0.6±0.2                                | 0.024 <sup>+0.008</sup> <sub>-0.009</sub> |
| M    | 0.12                                   | 0.005                                     |
| N    | 0.15                                   | 0.006                                     |

## RECOMMENDED SOLDERING CONDITIONS

The following conditions (see tables below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case other soldering is done under different conditions.

## TYPES OF SURFACE MOUNT DEVICE

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

[μPC319G2]

| Soldering method       | Soldering conditions                                                                                                                                               | Recommended condition symbol |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Infrared ray reflow    | Peak package's surface temperature: 230 °C or below,<br>Reflow time: 30 seconds or below (210 °C or higher),<br>Number of reflow process: 1, Exposure limit*: None | IR30-00-1                    |
| VPS                    | Peak package's surface temperature: 215 °C or below,<br>Reflow time: 40 seconds or below (200 °C or higher),<br>Number of reflow process: 1, Exposure limit*: None | VP15-00-1                    |
| Wave soldering         | Solder temperature: 260 °C or below,<br>Flow time: 10 seconds or below,<br>Number of flow process: 1, Exposure limit*: None                                        | WS15-00-1                    |
| Partial heating method | Terminal temperature: 300 °C or below,<br>Flow time: 10 seconds or below,<br>Exposure limit*: None                                                                 |                              |

\*: Exposure limit before soldering after dry-pack package is opened.

Storage conditions: 25 °C and relative humidity at 65 % or less.

**Note:** Do not apply more than a single process at once, except for "Partial heating method".

## TYPES OF THROUGH HOLE DEVICE

[μPC319C]

| Soldering method | Soldering conditions                                                    | Recommended condition symbol |
|------------------|-------------------------------------------------------------------------|------------------------------|
| Wave soldering   | Solder temperature: 260 °C or below,<br>Flow time : 10 seconds or below |                              |

[MEMO]

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Application examples recommended by NEC Corporation.

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.