

## SINGLE SUPPLY VOLTAGE, HIGH SPEED, WIDE BAND, QUAD OPERATIONAL AMPLIFIERS

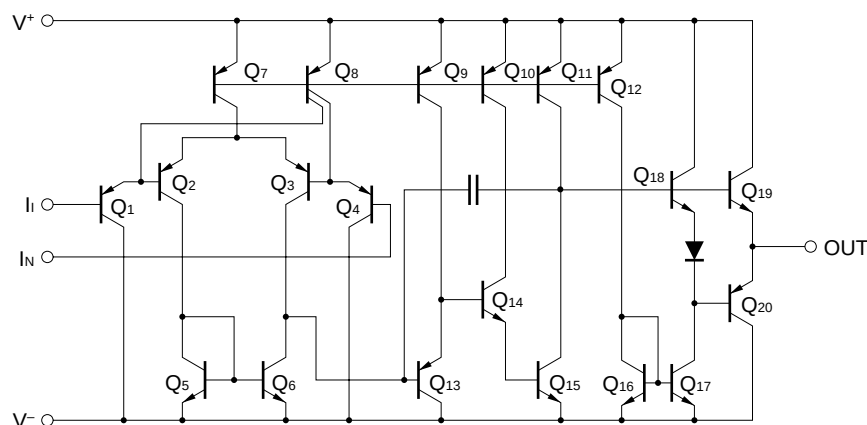
The  $\mu$ PC4744 is quad high speed, wide band operational amplifier designed for single supply operation from +3 V to +32 V with low supply current drain. By using high speed PNP transistors for input and output circuits, the excellent AC performance is achieved without degrading capacitive load drive capability.

With no crossover distortion and wide output voltage range characteristics, the  $\mu$ PC4744 is optimum choice for single supply AC amplifier, and active filters.

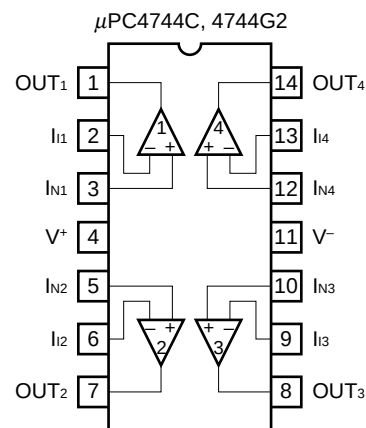
### FEATURES

- High slew rate: 8.5 V/ $\mu$ s TYP. ( $V^+ = +5$  V,  $V^- = \text{GND}$ )
- Wide gain band width product: 3.5 MHz TYP. ( $V^+ = +5$  V,  $V^- = \text{GND}$ )
- Wide supply voltage range: +3 V to +32 V
- Wide output voltage swing
- Common mode input voltage range includes  $V^-$
- Internal frequency compensation
- Output short circuit protection

### EQUIVALENT CIRCUIT (1/4 Circuit)



### PIN CONFIGURATION (Top View)



### ORDERING INFORMATION

| Part Number    | Package                      |
|----------------|------------------------------|
| $\mu$ PC4744C  | 14-pin plastic DIP (300 mil) |
| $\mu$ PC4744G2 | 14-pin plastic SOP (225 mil) |

The information in this document is subject to change without notice.

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^{\circ}\text{C}$ )**

| Parameter                                     |                          | Symbol      | Ratings                    | Unit               |
|-----------------------------------------------|--------------------------|-------------|----------------------------|--------------------|
| Voltage between $V^+$ and $V^-$ <b>Note 1</b> |                          | $V^+ - V^-$ | -0.3 to +36                | V                  |
| Differential Input Voltage                    |                          | $V_{ID}$    | $\pm 36$                   | V                  |
| Input Voltage <b>Note 2</b>                   |                          | $V_I$       | $V^- - 0.3$ to $V^- + 36$  | V                  |
| Output Voltage <b>Note 3</b>                  |                          | $V_O$       | $V^- - 0.3$ to $V^+ + 0.3$ | V                  |
| Power Dissipation                             | C Package <b>Note 4</b>  | $P_T$       | 570                        | mW                 |
|                                               | G2 Package <b>Note 5</b> |             | 550                        | mW                 |
| Output Short Circuit Duration <b>Note 6</b>   |                          |             | Indefinite                 | sec                |
| Operating Ambient Temperature                 |                          | $T_A$       | -20 to +80                 | $^{\circ}\text{C}$ |
| Storage Temperature                           |                          | $T_{stg}$   | -55 to +125                | $^{\circ}\text{C}$ |

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

2. The input voltage should be allowed to input without damage or destruction independent of the magnitude of  $V^+$ . Either input signal should not be allowed to go negative by more than 0.3 V. The normal operation will establish when the both inputs are within the Common Mode Input Voltage Range of electrical characteristics.

3. This specification is the voltage which should be allowed to supply to the output terminal from external without damage or destructive. Even during the transition period of supply voltage, power on/off etc., this specification should be kept. The output voltage of normal operation will be the Output Voltage Swing of electrical characteristics.

4. Thermal derating factor is  $-7.6\text{ mW}/^{\circ}\text{C}$  when operating ambient temperature is higher than  $50\text{ }^{\circ}\text{C}$ .

5. Thermal derating factor is  $-5.5\text{ mW}/^{\circ}\text{C}$  when operating ambient temperature is higher than  $25\text{ }^{\circ}\text{C}$ .

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

**RECOMMENDED OPERATING CONDITIONS**

| Parameter                                                | Symbol    | MIN.      | TYP. | MAX.     | Unit |
|----------------------------------------------------------|-----------|-----------|------|----------|------|
| Supply Voltage (Split)                                   | $V^{\pm}$ | $\pm 1.5$ |      | $\pm 16$ | V    |
| Supply Voltage ( $V^- = \text{GND}$ )                    | $V^+$     | +3        |      | +32      | V    |
| Output Current                                           | $I_O$     |           |      | $\pm 10$ | mA   |
| Capacitive Load ( $A_V = +1$ , $R_I = 0\text{ }\Omega$ ) | $C_L$     |           |      | 1000     | pF   |

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

| Parameter                            | Symbol    | Conditions                                            | MIN.       | TYP.         | MAX.        | Unit       |
|--------------------------------------|-----------|-------------------------------------------------------|------------|--------------|-------------|------------|
| Input Offset Voltage                 | $V_{IO}$  |                                                       |            | $\pm 1.0$    | $\pm 6.0$   | mV         |
| Input Offset Current                 | $I_{IO}$  |                                                       |            | $\pm 6$      | $\pm 75$    | nA         |
| Input Bias Current <sup>Note 7</sup> | $I_B$     |                                                       |            | 140          | 500         | nA         |
| Large Signal Voltage Gain            | $A_V$     | $R_L \geq 2\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$ | 25000      | 300000       |             |            |
| Supply Current                       | $I_{CC}$  | $I_O = 0\text{ A}$ , All Amplifiers                   |            | 7.5          | 11          | mA         |
| Common Mode Rejection Ratio          | CMR       |                                                       | 70         | 86           |             | dB         |
| Supply Voltage Rejection Ratio       | SVR       |                                                       | 70         | 93           |             | dB         |
| Output Voltage Swing                 | $V_{om}$  | $R_L \geq 10\text{ k}\Omega$                          | $\pm 13.7$ | +14<br>-14.3 |             | V          |
| Output Voltage Swing                 | $V_{om}$  | $R_L \geq 2\text{ k}\Omega$                           | $\pm 13.5$ |              |             | V          |
| Common Mode Input Voltage Range      | $V_{ICM}$ |                                                       | $V^-$      |              | $V^+ - 1.8$ | V          |
| Slew Rate (Rise)                     | SR        | $A_V = 1$ , $R_L \geq 2\text{ k}\Omega$               |            | 8.5          |             | V/ $\mu$ s |
| Gain Band Width Product              | GBW       | $f_o = 100\text{ kHz}$                                |            | 3.5          |             | MHz        |
| Channel Separation                   |           | $f = 20\text{ Hz}$ to $20\text{ kHz}$                 |            | 120          |             | dB         |

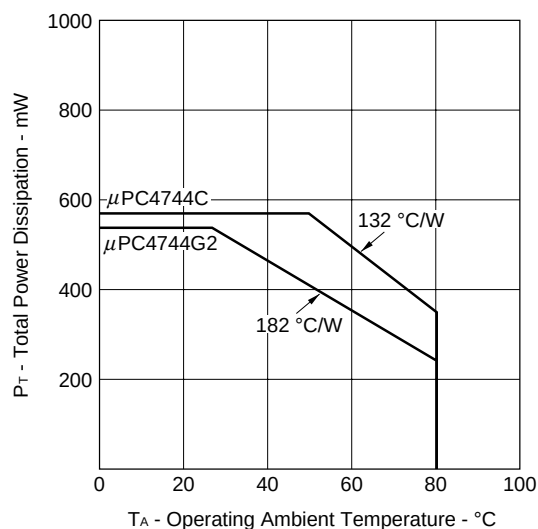
**ELECTRICAL CHARACTERISTICS ( $T_A = 25\text{ }^{\circ}\text{C}$ ,  $V^+ = 5\text{ V}$ ,  $V^- = \text{GND}$ )**

| Parameter                            | Symbol                | Conditions                                         | MIN.     | TYP.      | MAX.        | Unit       |
|--------------------------------------|-----------------------|----------------------------------------------------|----------|-----------|-------------|------------|
| Input Offset Voltage                 | $V_{IO}$              |                                                    |          | $\pm 1.0$ | $\pm 5$     | mV         |
| Input Offset Current                 | $I_{IO}$              |                                                    |          | $\pm 6$   | $\pm 75$    | nA         |
| Input Bias Current <sup>Note 7</sup> | $I_B$                 |                                                    |          | 160       | 500         | nA         |
| Large Signal Voltage Gain            | $A_V$                 | $R_L \geq 2\text{ k}\Omega$                        | 25000    | 300000    |             |            |
| Supply Current                       | $I_{CC}$              | $I_O = 0\text{ A}$ , All Amplifiers                |          | 6.0       | 9.0         | mA         |
| Common Mode Rejection Ratio          | CMR                   |                                                    | 70       | 80        |             | dB         |
| Supply Voltage Rejection Ratio       | SVR                   |                                                    | 70       | 95        |             | dB         |
| Output Voltage Swing                 | $V_{om}$              | $R_L \geq 2\text{ k}\Omega$ (Connect to GND)       | 3.7<br>0 | 4.0<br>0  |             | V          |
| Common Mode Input Voltage Range      | $V_{ICM}$             |                                                    | 0        |           | $V^+ - 1.8$ | V          |
| Output Current (SOURCE)              | $I_{O\text{ SOURCE}}$ | $V^+_{IN} = +1\text{ V}$ , $V^-_{IN} = 0\text{ V}$ | 10       | 30        |             | mA         |
| Output Current (SINK)                | $I_{O\text{ SINK}}$   | $V^+_{IN} = 0\text{ V}$ , $V^-_{IN} = +1\text{ V}$ | 10       | 30        |             | mA         |
| Slew Rate (Rise)                     | SR                    | $A_V = 1$ , $R_L \geq 2\text{ k}\Omega$            |          | 8.5       |             | V/ $\mu$ s |

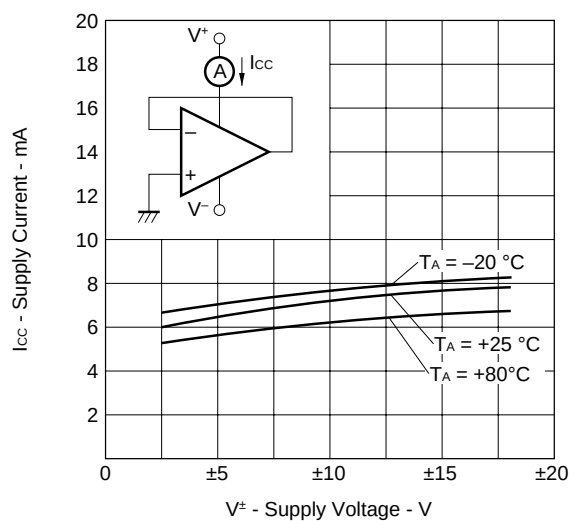
**Notes** 7. Input bias currents flow out from IC. Because each currents are base current of PNP-transistor on input stage.

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

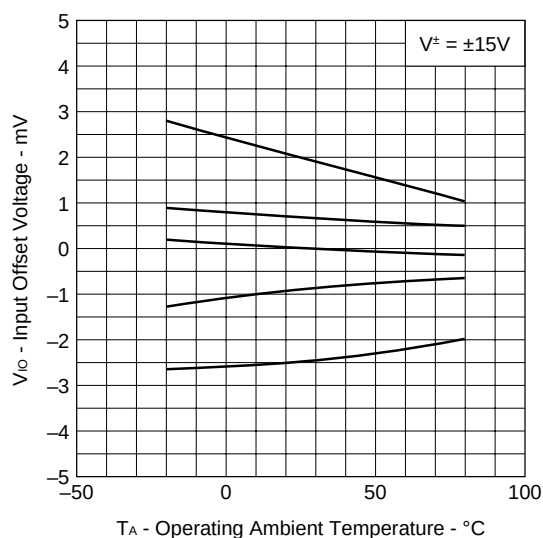
POWER DISSIPATION



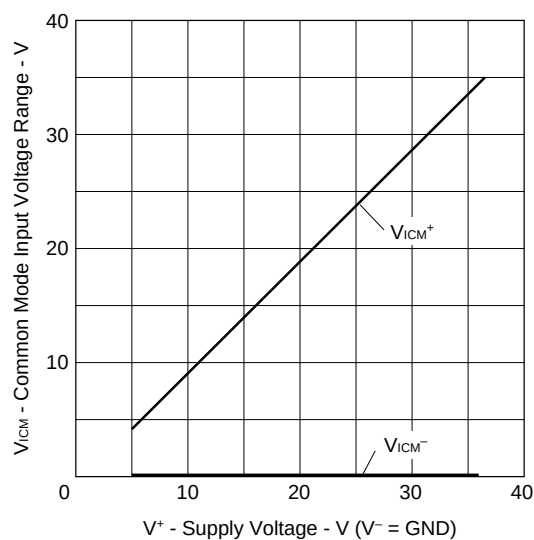
SUPPLY CURRENT



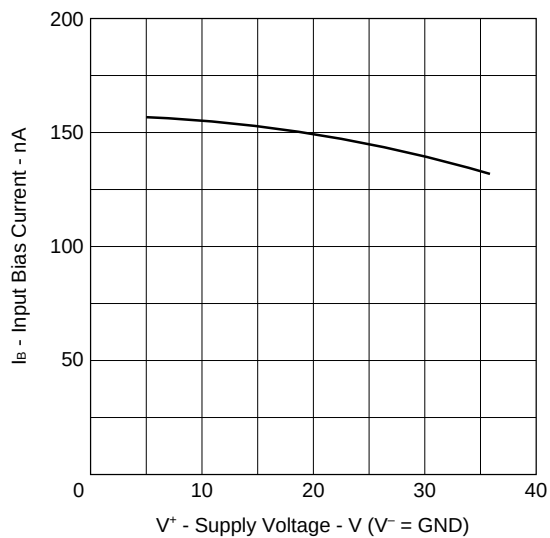
INPUT OFFSET VOLTAGE



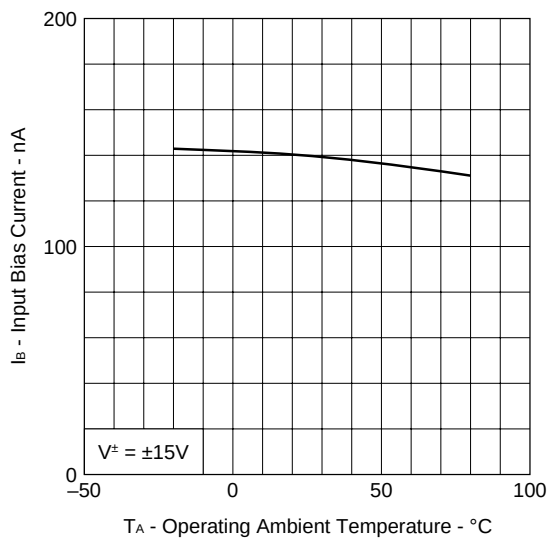
COMMON MODE INPUT VOLTAGE RANGE

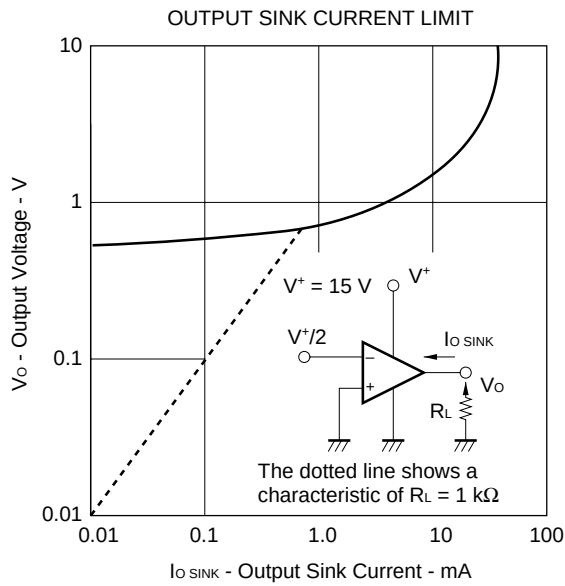
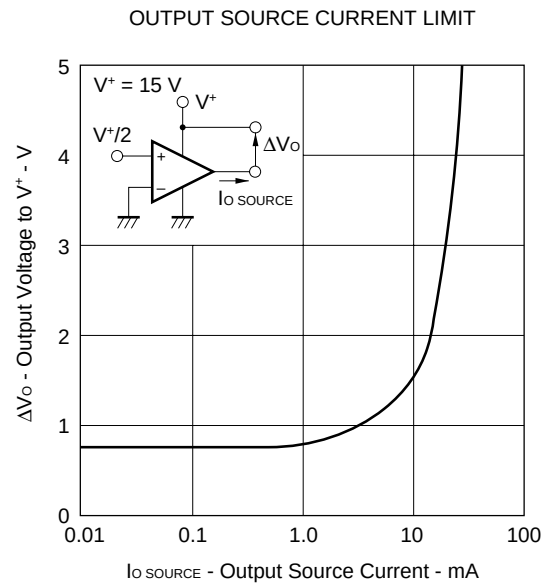
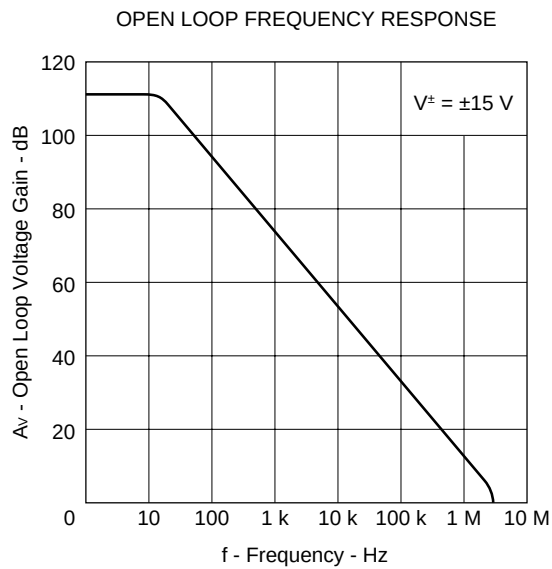
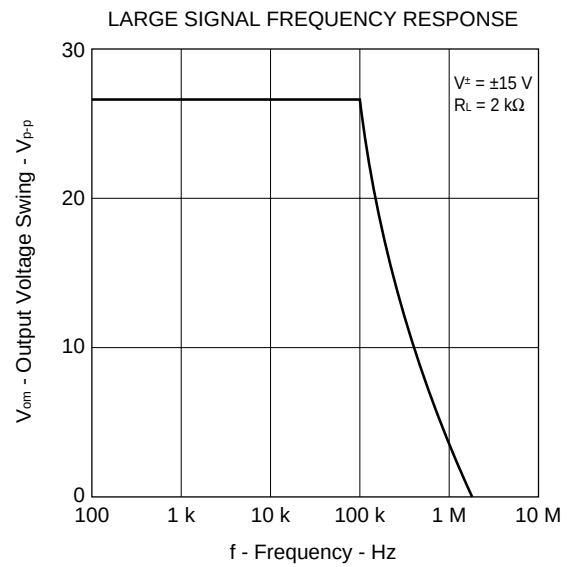
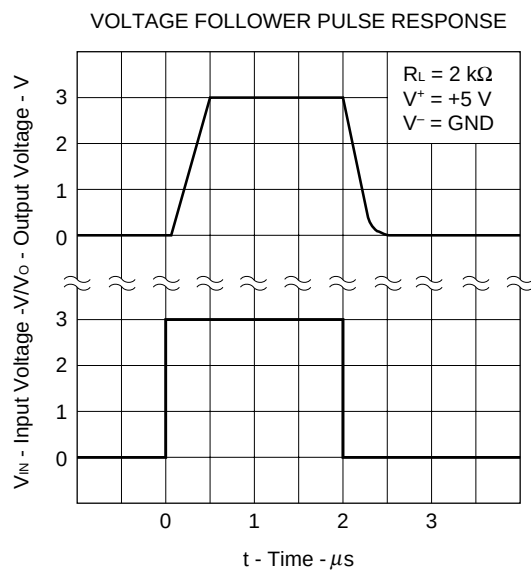
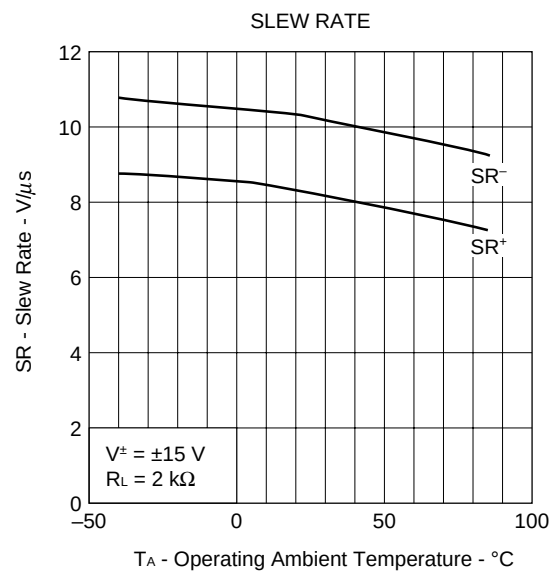


INPUT BIAS CURRENT



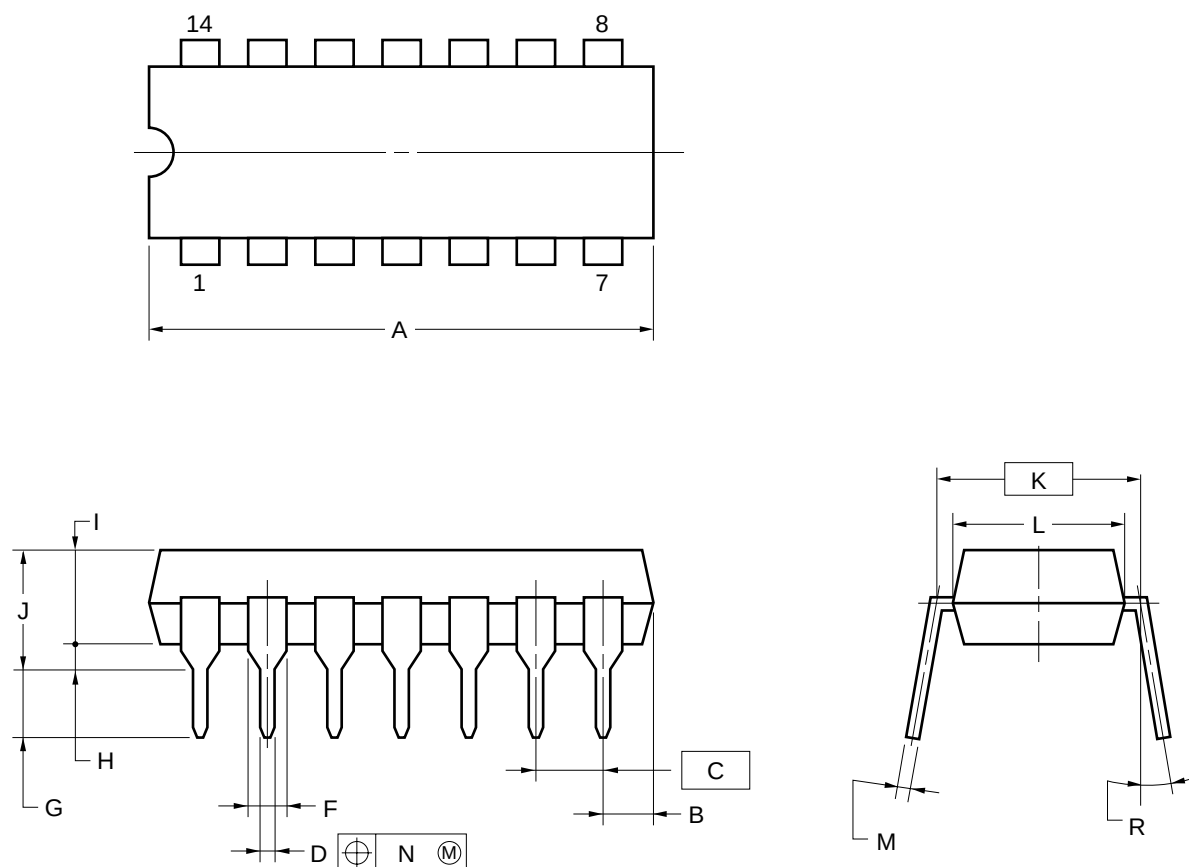
INPUT BIAS CURRENT





PACKAGE DRAWINGS

14PIN PLASTIC DIP (300 mil)



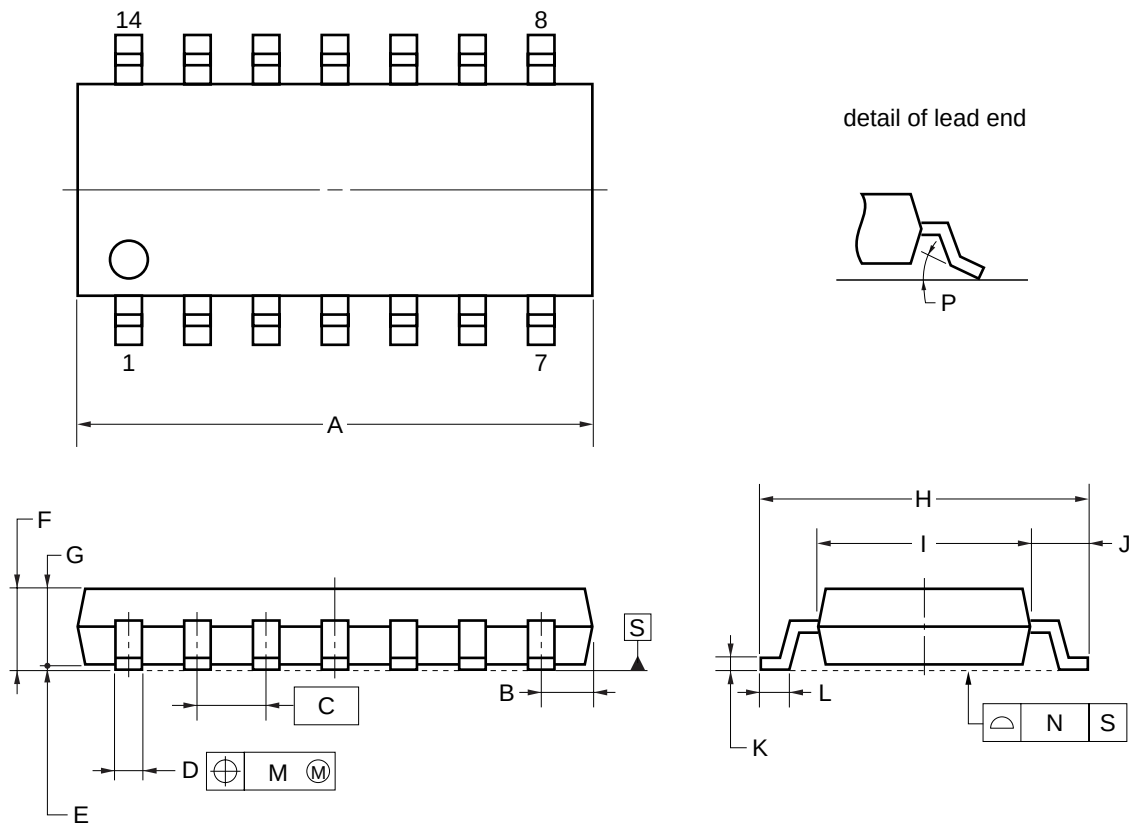
NOTES

- 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±0.10                              | 0.020 <sup>+0.004</sup> <sub>-0.005</sub> |
| F    | 1.1 MIN.                               | 0.043 MIN.                                |
| G    | 3.5±0.3                                | 0.138±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    | 6.5                                    | 0.256                                     |
| M    | 0.25 <sup>+0.10</sup> <sub>-0.05</sub> | 0.010 <sup>+0.004</sup> <sub>-0.003</sub> |
| N    | 0.25                                   | 0.01                                      |
| R    | 0~15°                                  | 0~15°                                     |

P14C-100-300B2-1

## 14 PIN PLASTIC SOP (225 mil)

**NOTE**

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

| ITEM | MILLIMETERS                            |
|------|----------------------------------------|
| A    | 10.2±0.26                              |
| B    | 1.42 MAX.                              |
| C    | 1.27 (T.P.)                            |
| D    | 0.42 <sup>+0.08</sup> <sub>-0.07</sub> |
| E    | 0.1±0.1                                |
| F    | 1.59 <sup>+0.21</sup> <sub>-0.2</sub>  |
| G    | 1.49                                   |
| H    | 6.5±0.2                                |
| I    | 4.4±0.1                                |
| J    | 1.1±0.16                               |
| K    | 0.17 <sup>+0.08</sup> <sub>-0.07</sub> |
| L    | 0.6±0.2                                |
| M    | 0.1                                    |
| N    | 0.10                                   |
| P    | 3° <sup>+7°</sup> <sub>-3°</sub>       |

S14GM-50-225B, C-5

## RECOMMENDED SOLDERING CONDITIONS

When soldering this product, it is highly recommended to observe the conditions as shown below. If other soldering processes are used, or if the soldering is performed under different conditions, please make sure to consult with our sales offices.

For more details, refer to our document “**Semiconductor Device Mounting Technology Manual**” (C10535E).

### Type of Surface Mount Device

#### μPC4744G2: 14-pin plastic SOP (225 mil)

| Process                | Conditions                                                                                                                                                                                  | Symbol    |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Infrared Ray Reflow    | Peak temperature: 230 °C or below (Package surface temperature),<br>Reflow time: 30 seconds or less (at 210 °C or higher),<br>Maximum number of reflow processes: 1 time.                   | IR30-00-1 |
| Vapor Phase Soldering  | Peak temperature: 215 °C or below (Package surface temperature),<br>Reflow time: 40 seconds or less (at 200 °C or higher),<br>Maximum number of reflow processes: 1 time.                   | VP15-00-1 |
| Wave Soldering         | Solder temperature: 260 °C or below, Flow time: 10 seconds or less,<br>Maximum number of flow processes: 1 time,<br>Pre-heating temperature: 120 °C or below (Package surface temperature). | WS60-00-1 |
| Partial Heating Method | Pin temperature: 300 °C or below,<br>Heat time: 3 seconds or less (Per each side of the device).                                                                                            | —         |

**Caution** Apply only one kind of soldering condition to a device, except for “partial heating method”, or the device will be damaged by heat stress.

### Type of Through-hole Device

#### μPC4744C: 14-pin plastic DIP (300 mil)

| Process                           | Conditions                                                                         |
|-----------------------------------|------------------------------------------------------------------------------------|
| Wave Soldering<br>(only to leads) | Solder temperature: 260 °C or below,<br>Flow time: 10 seconds or less.             |
| Partial Heating Method            | Pin temperature: 300 °C or below,<br>Heat time: 3 seconds or less (per each lead). |

**Caution** For through-hole device, the wave soldering process must be applied only to leads, and make sure that the package body does not get jet soldered.

## REFERENCE DOCUMENTS

|                                                                                     |          |
|-------------------------------------------------------------------------------------|----------|
| QUALITY GRADES ON NEC SEMICONDUCTOR DEVICES                                         | C11531E  |
| SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL                                     | C10535E  |
| NEC IC PACKAGE MANUAL (CD-ROM)                                                      | C13388E  |
| GUIDE TO QUALITY ASSUARANCE FOR SEMICONDUCTOR DEVICES                               | MEI-1202 |
| SEMICONDUCTORS SELECTION GUIDE                                                      | X10679E  |
| NEC SEMICONDUCTOR DEVICE RELIABILITY/QUALITY CONTROL SYSTEM<br>(STANDARD LINEAR IC) | IEI-1212 |

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Anti-radioactive design is not implemented in this product.