

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC4574

## QUAD ULTRA LOW-NOISE, WIDEBAND, OPERATIONAL AMPLIFIER

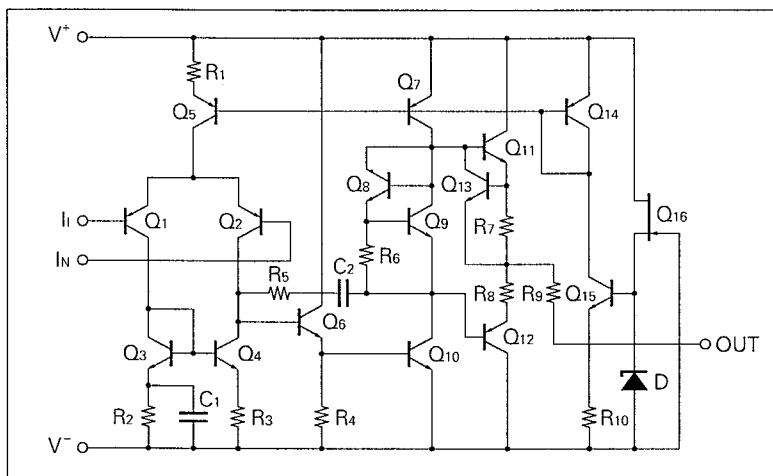
### DESCRIPTION

The  $\mu$ PC4574 is an ultra low noise, high slew rate quad operational amplifier specifically designed for audio, instrumentation, and communication circuits. The low noise and high frequency capabilities make it ideal for preamps and active filters for instrumentation and professional audio.

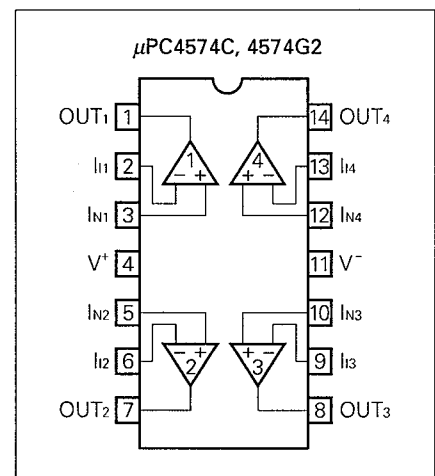
### FEATURES

- Ultra low noise
- High slew rate
- Wide bandwidth
- Internal frequency compensation

### EQUIVALENT CIRCUIT (1/4 Circuit)



### CONNECTION DIAGRAM (Top View)



### ORDERING INFORMATION

| PART NUMBER    | PACKAGE                      | QUALITY GRADE |
|----------------|------------------------------|---------------|
| $\mu$ PC4574C  | 14 PIN PLASTIC DIP (300 mil) | Standard      |
| $\mu$ PC4574G2 | 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                          | μPC4574                                    | 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>                 | ±30  | V    |
| Input Voltage (Note 2)                                     |                     | V <sub>I</sub>                  | V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3 | V    |
| Output Voltage (Note 3)                                    |                     | V <sub>O</sub>                  | V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3 | 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 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.

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

**Note 5.** Thermal derating factor is -5.5 mV / °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                        | V <sup>±</sup> | ± 4  |      | ± 16 | V    |
| Output Current                        | I <sub>o</sub> |      |      | ± 10 | mA   |
| Source Resistance                     | R <sub>s</sub> |      |      | 50   | kΩ   |
| Capacitive Load (A <sub>v</sub> = +1) | C <sub>L</sub> |      |      | 100  | pF   |

**ELECTRICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C, V<sup>±</sup> = ±15 V)**

| CHARACTERISTIC                         | SYMBOL             | MIN. | TYP.  | MAX. | UNIT                 | CONDITIONS   |
|--|--------------------|------|-------|------|----------------------|--|
| Input Offset Voltage                   | V <sub>io</sub>    |      | ±0.3  | ±5   | mV                   | R <sub>s</sub> ≤ 50 Ω  |
| Input Offset Current (Note 7)          | I <sub>io</sub>    |      | ±10   | ±200 | nA                   |  |
| Input Bias Current (Note 7)            | I <sub>b</sub>     |      | 500   | 1000 | nA                   |  |
| Large Signal Voltage Gain              | A <sub>v</sub>     | 30   | 300   |      | V/mV                 | R <sub>L</sub> ≥ 2 kΩ, V <sub>o</sub> = ±10 V                        |
| Supply Current                         | I <sub>cc</sub>    |      | 8.5   | 12   | mA                   | I <sub>o</sub> = 0 A, All Amplifiers                                 |
| Common Mode Rejection Ratio            | CMR                | 80   | 100   |      | dB                   |  |
| Supply Voltage Rejection Ratio         | SVR                | 80   | 100   |      | dB                   |  |
| Output Voltage Swing                   | V <sub>om</sub>    | ±12  | ±13.4 |      | V                    | R <sub>L</sub> ≥ 10 kΩ   |
|  |                    | ±10  | ±12.8 |      |                      | R <sub>L</sub> ≥ 2 kΩ  |
| Common Mode Input Voltage Range        | V <sub>icm</sub>   | ±12  | ±14   |      | V                    |  |
| Slew Rate                              | SR                 | 4    | 6     |      | V/μs                 | R <sub>L</sub> ≥ 2 kΩ  |
| Gain Band Width Product                | GBW                | 10   | 14    |      | MHz                  | f <sub>o</sub> = 100 kHz   |
| Unity Gain Frequency                   | f <sub>unity</sub> |      | 7     |      | MHz                  | open loop  |
| Phase Margin                           | φ <sub>unity</sub> |      | 50    |      | degree               | open loop  |
| Total Harmonic Distortion              | THD                |      | 0.002 |      | %                    | V <sub>o</sub> = 3 V <sub>r.m.s.</sub> , f = 20 Hz to 20 kHz (Fig.1) |
| Input Equivalent Noise Voltage         | V <sub>n</sub>     |      | 1.2   |      | μV <sub>r.m.s.</sub> | RIAA (Fig.2)   |
|  |                    |      | 0.53  | 0.65 |                      | FLAT + JIS A, R <sub>s</sub> = 100 Ω (Fig.3)                         |
| Input Equivalent Noise Voltage Density | e <sub>n</sub>     |      | 5.5   |      | nV/√Hz               | f <sub>o</sub> = 10 Hz, R <sub>s</sub> = 100 Ω                       |
|  |                    |      | 5.0   |      |                      | f <sub>o</sub> = 1 kHz, R <sub>s</sub> = 100 Ω                       |
| Input Equivalent Noise Current Density | i <sub>n</sub>     |      | 0.7   |      | pA/√Hz               | f <sub>o</sub> = 1 kHz   |
| Channel Separation                     |                    |      | 120   |      | dB                   | f = 20 Hz to 20 kHz  |

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

MEASUREMENT CIRCUIT

Fig. 1 Total Harmonic Distortion Measurement Circuit

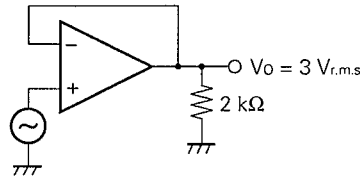


Fig. 2 Noise Measurement Circuit (RIAA)

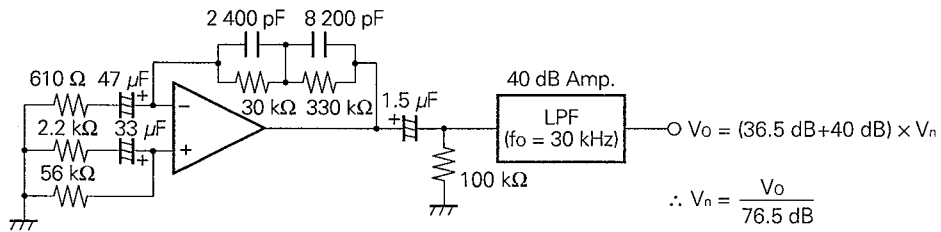
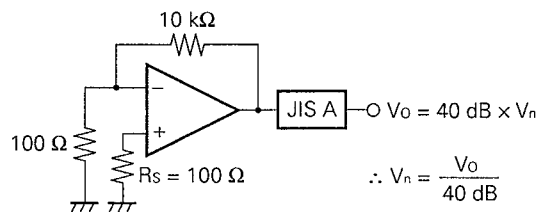
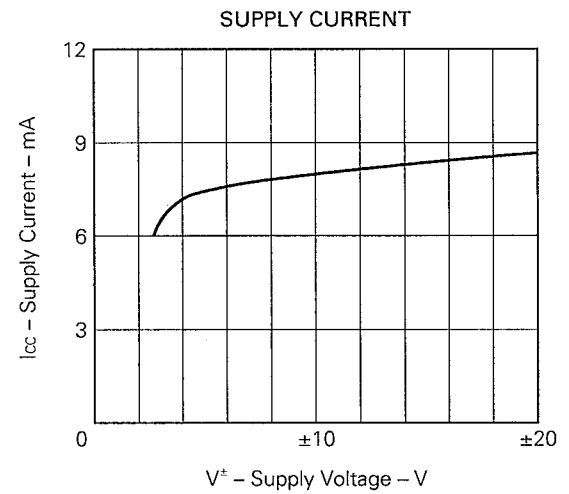
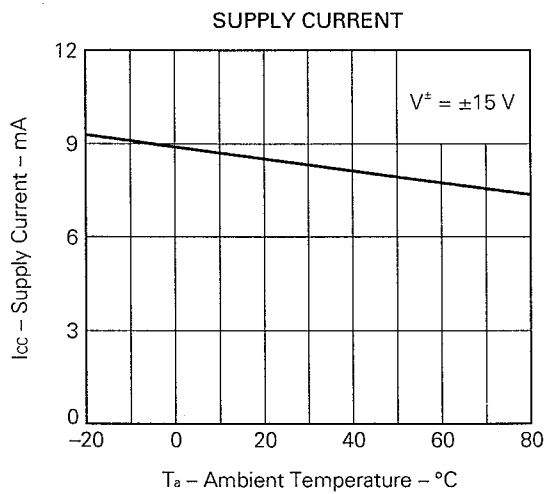
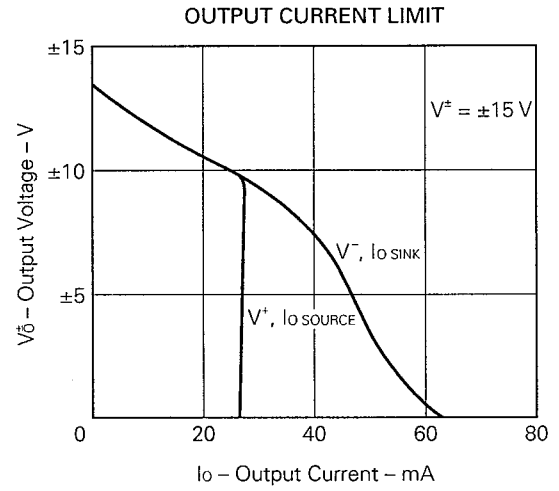
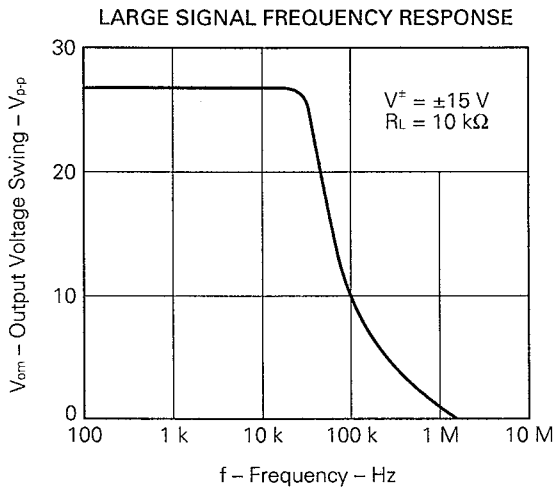
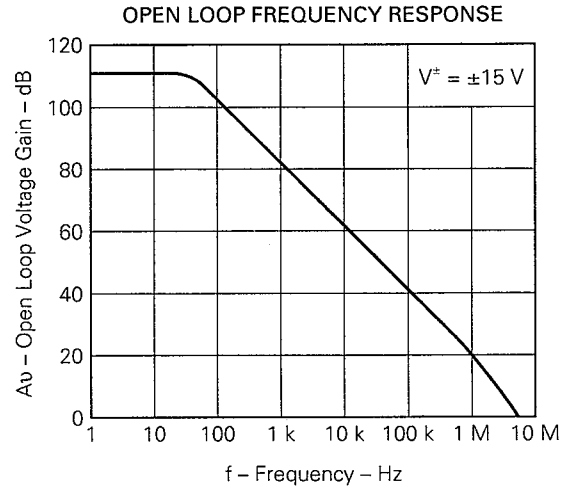
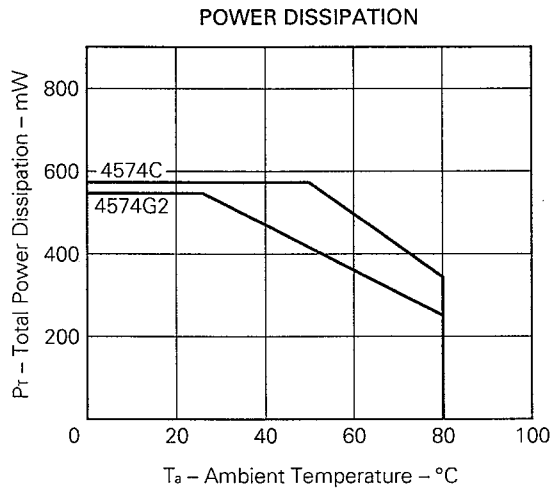
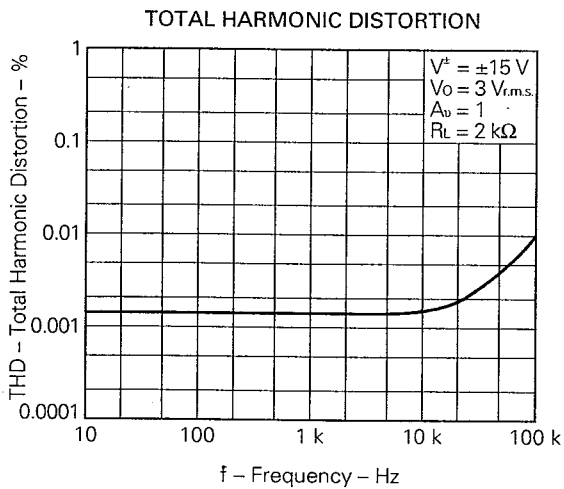
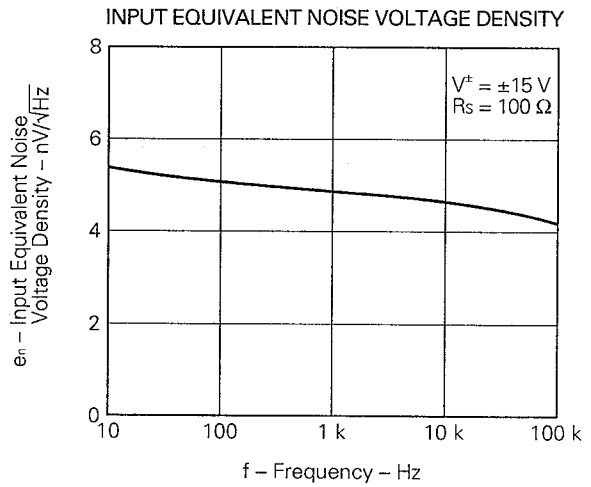
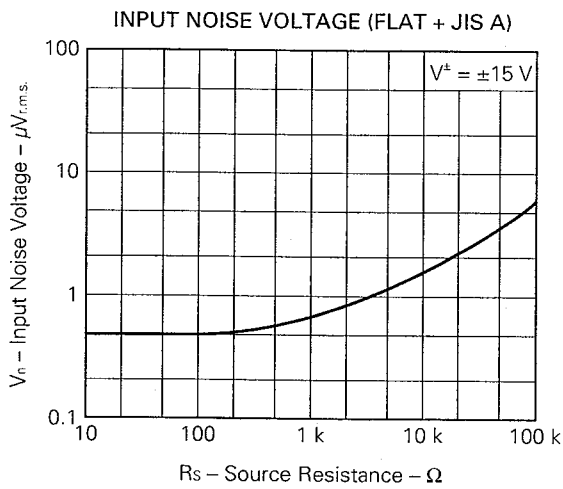
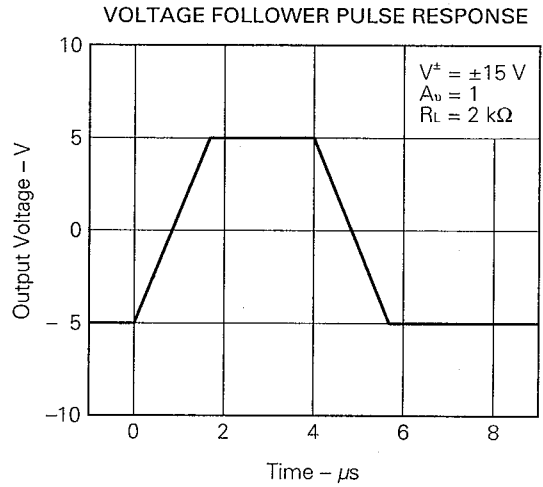
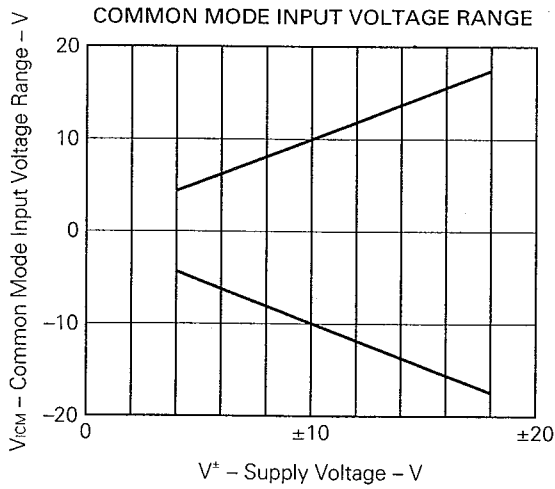


Fig. 3 Flat Noise Measurement Circuit (FLAT + JIS A)

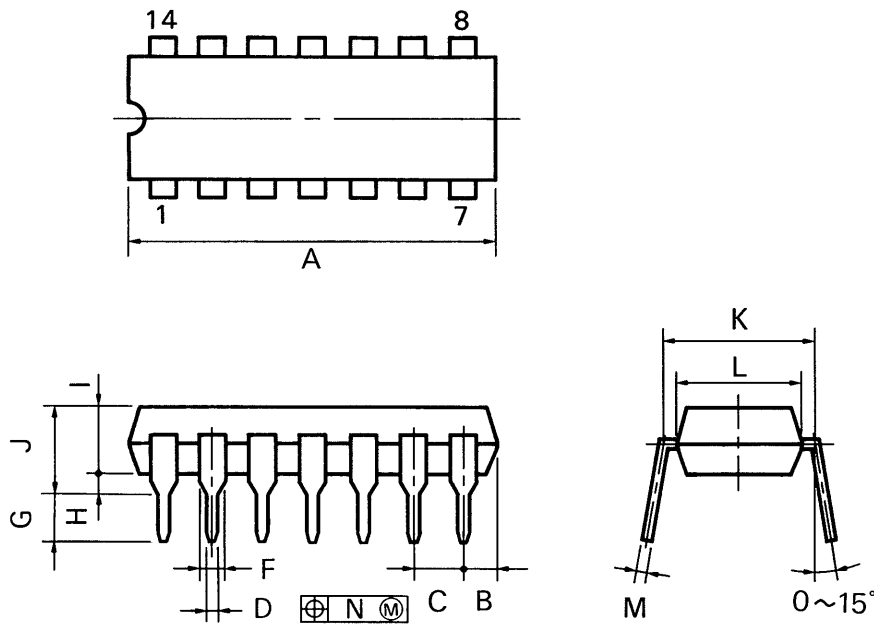


TYPICAL PERFORMANCE CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ , TYP.)





14PIN PLASTIC DIP (300 mil)



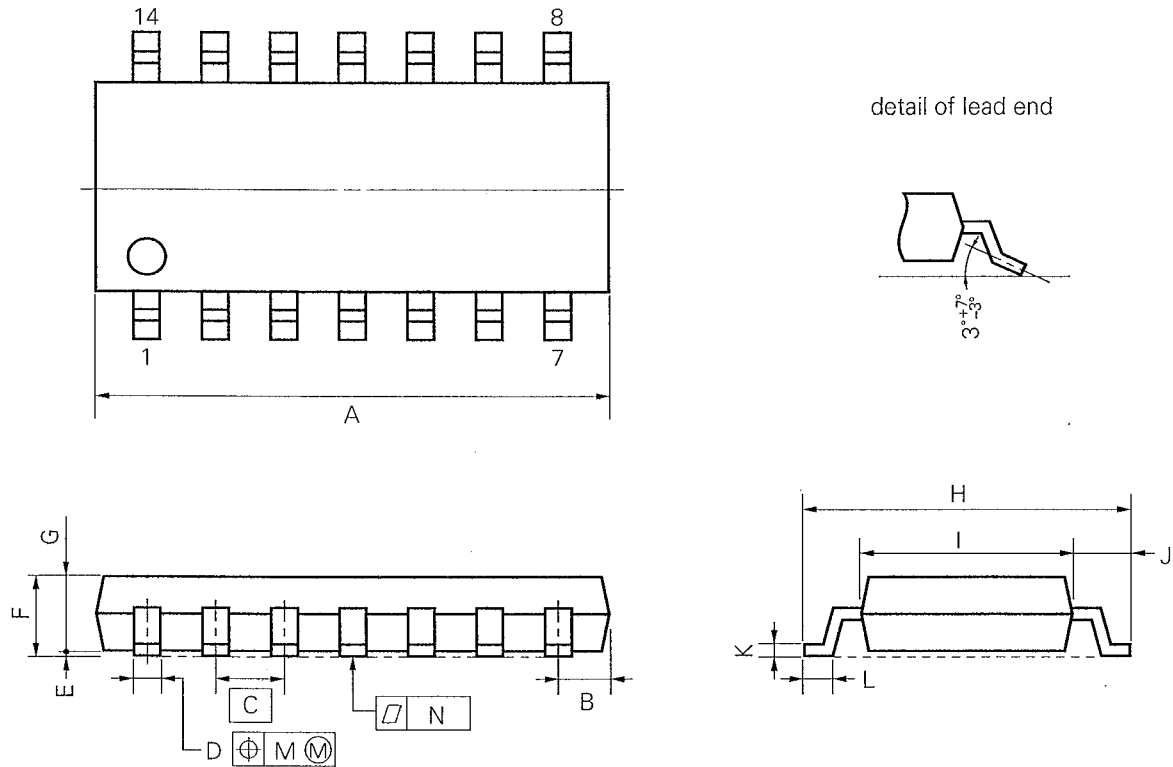
P14C-100-300B1

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 ±0.10                               | 0.020 <sup>+0.004</sup> / <sub>-0.005</sub> |
| F    | 1.2 MIN.                                 | 0.047 MIN.                                  |
| G    | 3.6 ±0.3                                 | 0.142 ±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 <sup>+0.10</sup> / <sub>-0.05</sub> | 0.010 <sup>+0.004</sup> / <sub>-0.003</sub> |
| 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 table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case 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).

[ μPC4574G2 ]

| 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**

[ μPC4574C ]

| 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.