

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC4560

HIGH PERFORMANCE DUAL OPERATIONAL AMPLIFIER

DESCRIPTION

The μ PC4560 is a dual operational amplifier which features more improved slew rate and G.B. products than that of μ PC4559 with unity gain frequency compensation. Also very low input noise and high output current drive capability make this device the optimum choice for audio applications and active filters.

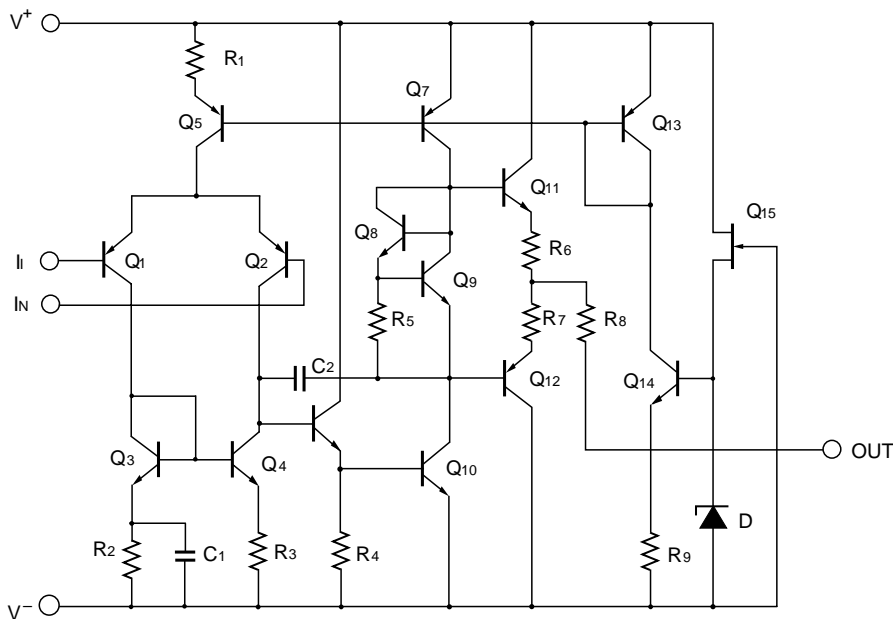
FEATURES

- Internal frequency compensation
- Gain bandwidth products: 10 MHz TYP.
- Low noise: 6 μ V_{p-p} TYP.
- High output current

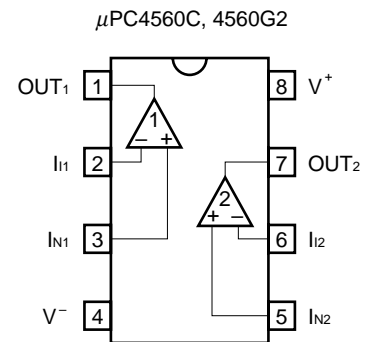
ORDERING INFORMATION

| Part Number | Package |
|----------------|-----------------------------------|
| μ PC4560C | 8-pin plastic DIP (7.62 mm (300)) |
| μ PC4560G2 | 8-pin plastic SOP (5.72 mm (225)) |

EQUIVALENT CIRCUIT (1/2 Circuit)



PIN CONFIGURATION (Top View)



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 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

★ ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

| Parameter | | Symbol | Ratings | Unit |
|---|------------------------------|---------------------------------|--|------|
| Voltage between V ⁺ and V ⁻ ^{Note 1} | | V ⁺ - V ⁻ | -0.3 to +36 | V |
| Differential Input Voltage | | V _{ID} | ±30 | V |
| Input Voltage ^{Note 2} | | V _I | V ⁻ -0.3 to V ⁺ +0.3 | V |
| Output Voltage ^{Note 3} | | V _O | V ⁻ -0.3 to V ⁺ +0.3 | V |
| Power Dissipation | C Package ^{Note 4} | P _T | 700 | mW |
| | G2 Package ^{Note 5} | | 440 | mW |
| Output Short Circuit Duration ^{Note 6} | | | 0 | sec |
| Operating Ambient Temperature | | T _A | -20 to +80 | °C |
| Storage Temperature | | T _{stg} | -55 to +125 | °C |

- Notes**
- Reverse connection of supply voltage can cause destruction.
 - 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.
 - This specification is the voltage which should be allowed to supply to the output terminal from external without damage or destruction. 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.
 - Thermal derating factor is -7.0 mW/°C when operating ambient temperature is higher than 25°C.
 - Thermal derating factor is -4.4 mW/°C when operating ambient temperature is higher than 25°C.
 - Must not short to GND, V⁺, V⁻, and other Voltage source. 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 | V [±] | ±4 | | ±16 | V |

★ ELECTRICAL CHARACTERISTICS (T_A = 25°C, V[±] = ±15 V)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--------------------------------------|------------------|---|--------|---------|------|-------------------|
| Input Offset Voltage | V _{IO} | R _S ≤ 10 Ω | | ±0.5 | ±6.0 | mV |
| Input Offset Current ^{Note} | I _{IO} | | | ±5 | ±200 | nA |
| Input Bias Current ^{Note} | I _B | | | 60 | 500 | nA |
| Large Signal Voltage Gain | A _V | R _L ≥ 2 kΩ, V _O = ±10 V | 20,000 | 180,000 | | |
| Power Consumption | P _d | I _O = 0 A, Both Amplifiers | | 120 | 170 | mW |
| Common Mode Rejection Ratio | CMR | R _S ≤ 10 kΩ | 70 | 100 | | dB |
| Source Variation Rejection Ratio | SVR | R _S ≤ 10 kΩ | | 10 | 150 | μV/V |
| Output Voltage Swing | V _{om} | R _L ≥ 2 kΩ | ±12 | ±14 | | V |
| | | I _O = ±25 mA | ±10 | ±13 | | V |
| Common Mode Input Voltage Range | V _{ICM} | | ±12 | ±14 | | V |
| Slew Rate | SR | A _V = 1 | | 2.8 | | V/μs |
| Input Equivalent Noise Voltage | V _n | R _S = 1 kΩ, f = 1 Hz to 1 kHz (Figure1) | | 6 | | μV _{p-p} |
| Channel Separation | | f = 1 kHz (Figure2) | | 105 | | dB |

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

MEASUREMENT CIRCUIT

Figure1 Noise Measurement Circuit

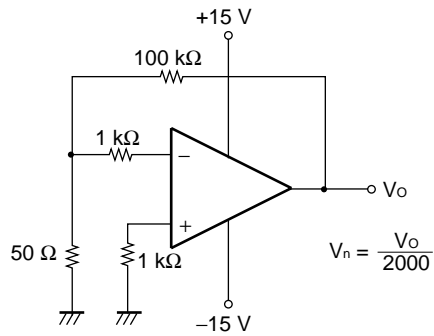
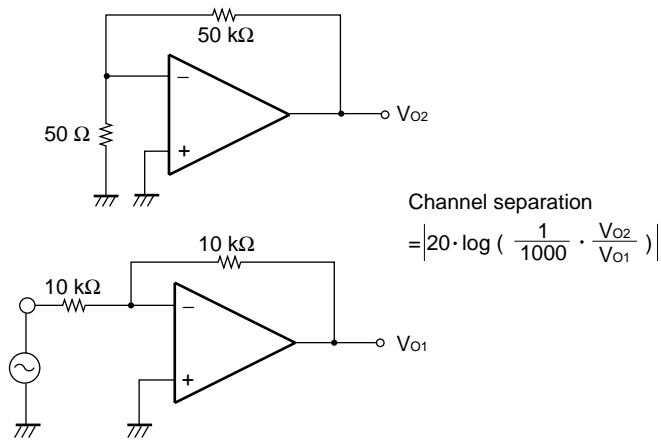
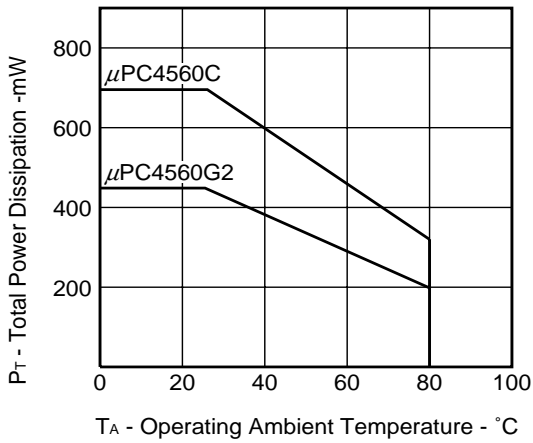


Figure2 Channel Separation Measurement Circuit

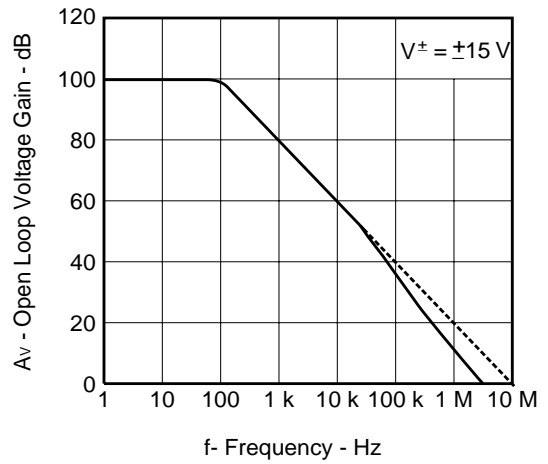


TYPICAL PERFORMANCE CHARACTERISTICS ($T_A = 25^\circ\text{C}$, TYP.)

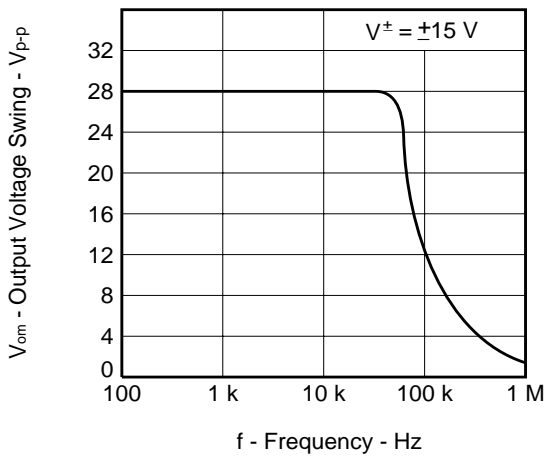
POWER DISSIPATION



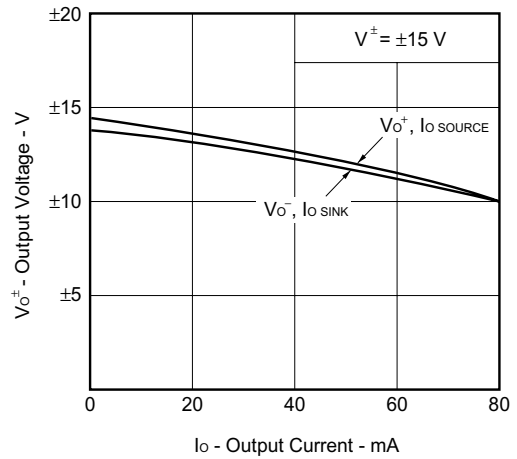
OPEN LOOP FREQUENCY RESPONSE



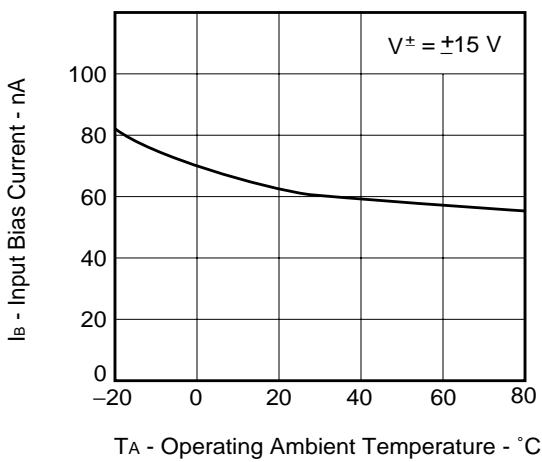
LARGE SIGNAL FREQUENCY RESPONSE



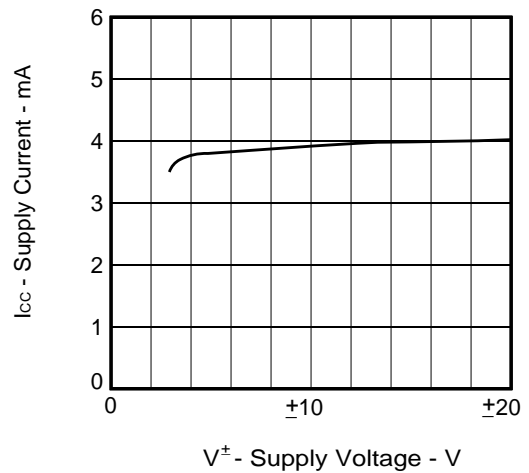
OUTPUT CURRENT LIMIT



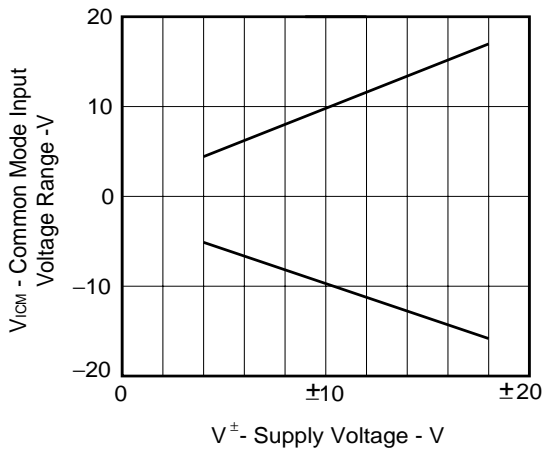
INPUT BIAS CURRENT



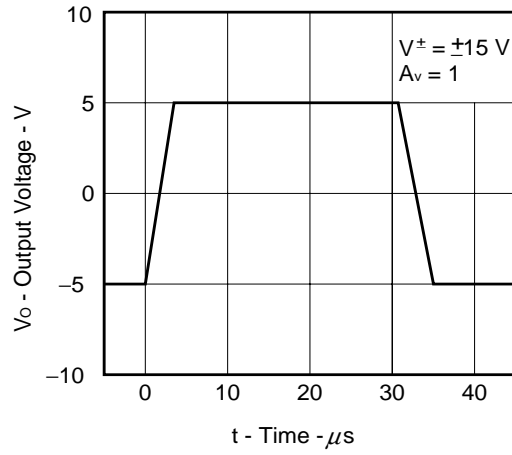
SUPPLY CURRENT



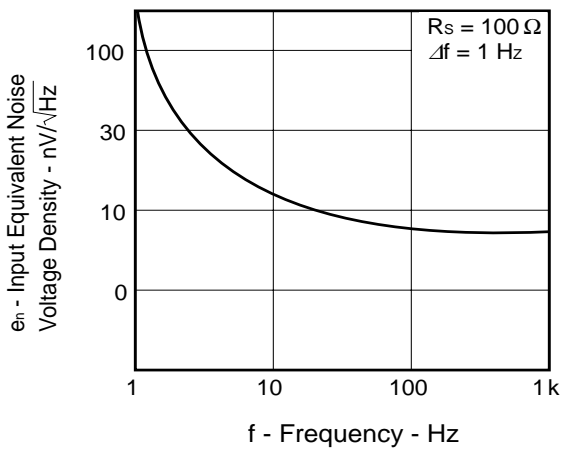
COMMON MODE INPUT VOLTAGE RANGE



VOLTAGE FOLLOWER PULSE RESPONSE

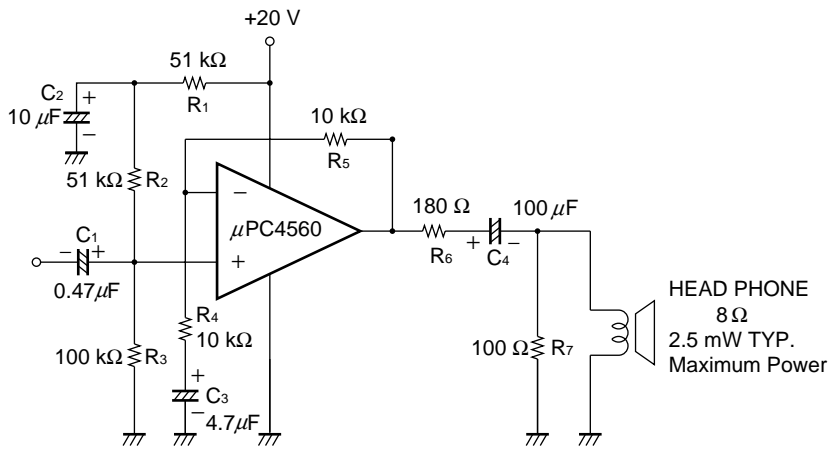


INPUT EQUIVALENT NOISE VOLTAGE DENSITY

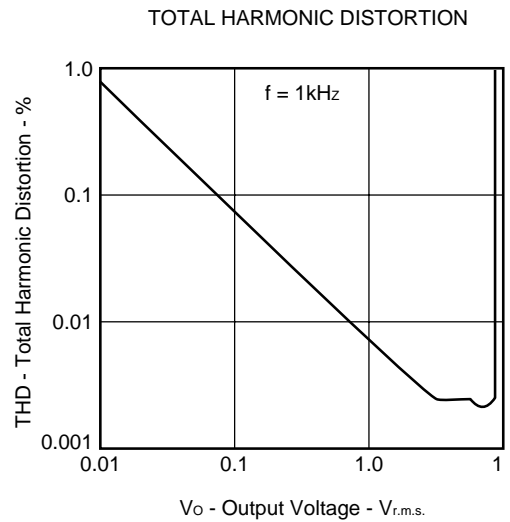
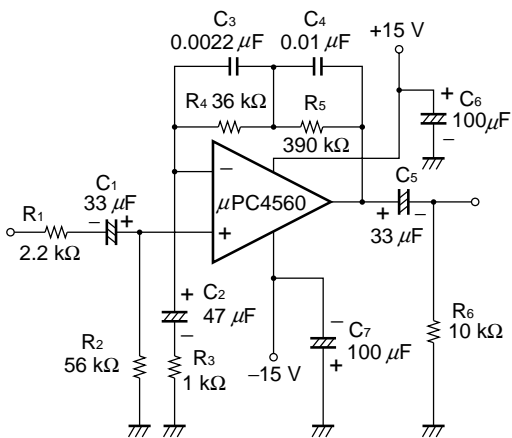


APPLICATION CIRCUITS

Head Phone Amp

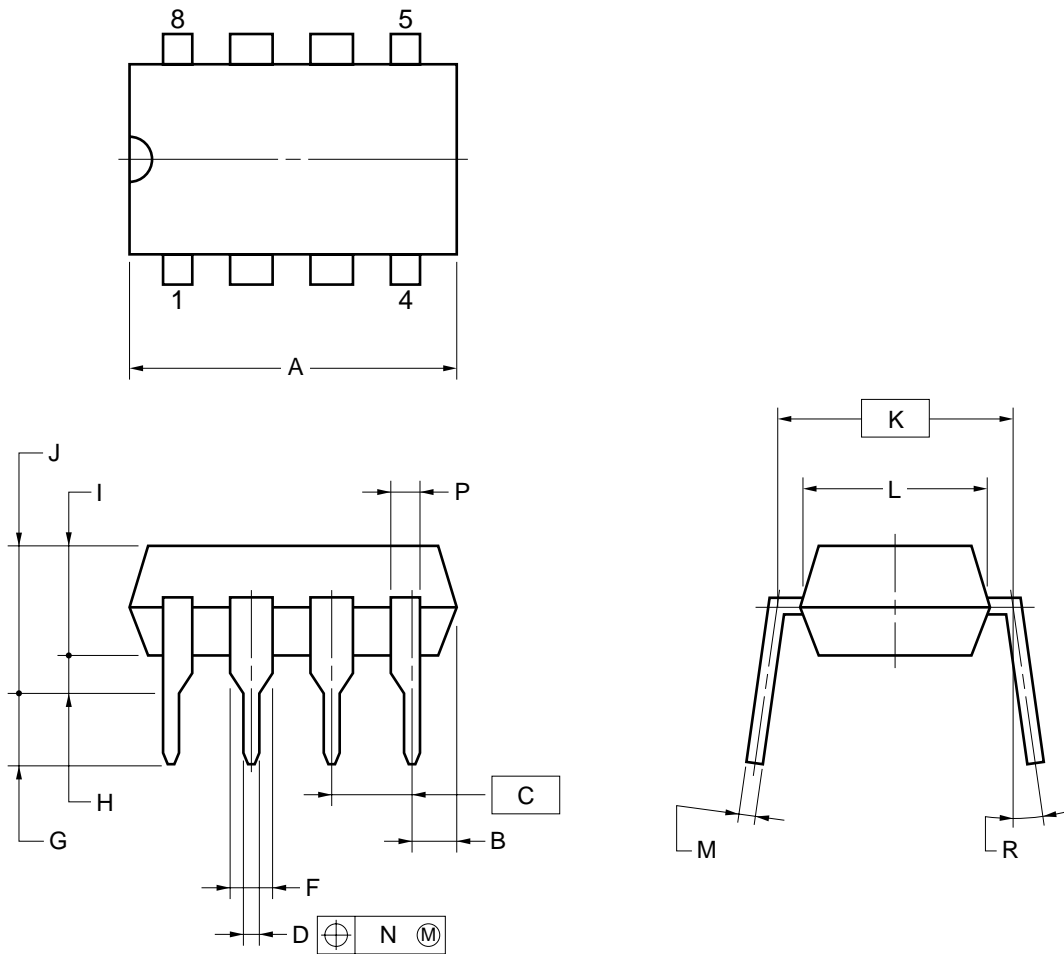


RIAA Amp



★ PACKAGE DRAWINGS (Unit : mm)

8-PIN PLASTIC DIP (7.62mm(300))



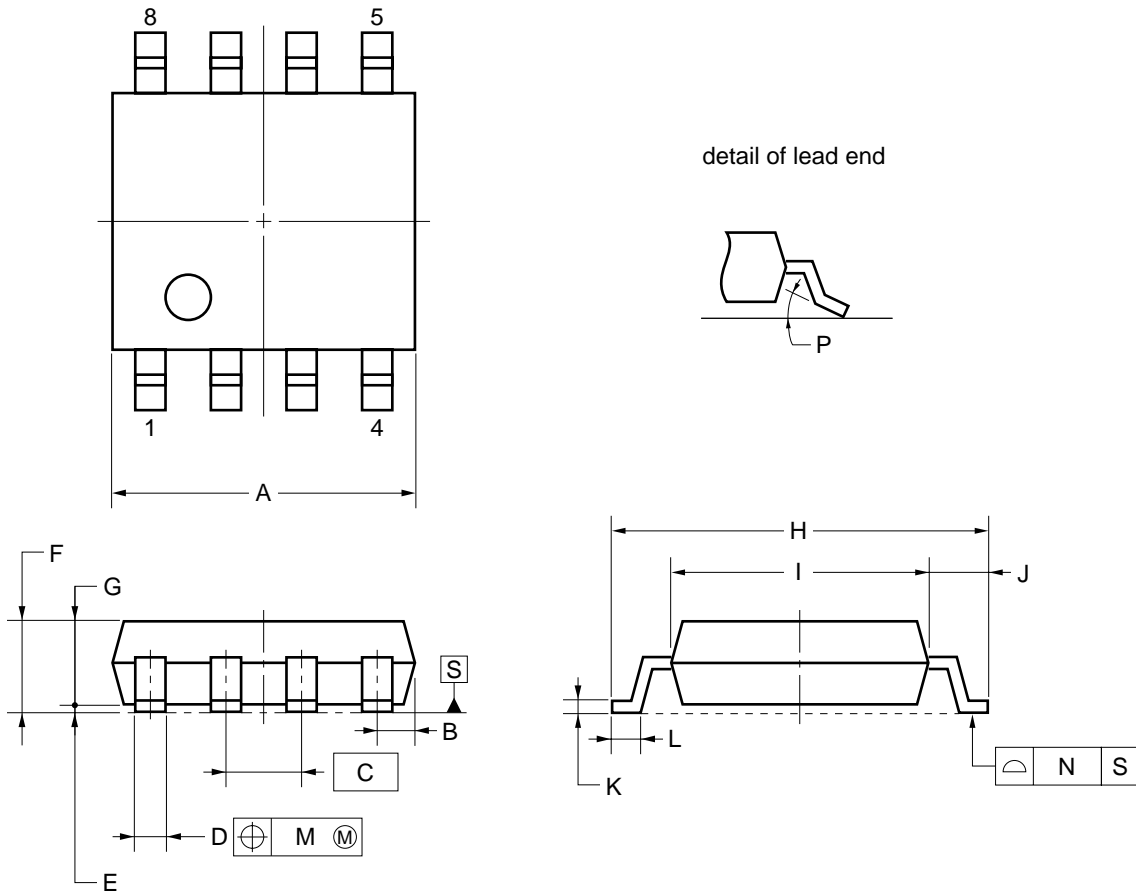
NOTES

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

| ITEM | MILLIMETERS |
|------|--|
| A | 10.16 MAX. |
| B | 1.27 MAX. |
| C | 2.54 (T.P.) |
| D | 0.50±0.10 |
| F | 1.4 MIN. |
| G | 3.2±0.3 |
| H | 0.51 MIN. |
| I | 4.31 MAX. |
| J | 5.08 MAX. |
| K | 7.62 (T.P.) |
| L | 6.4 |
| M | 0.25 ^{+0.10} _{-0.05} |
| N | 0.25 |
| P | 0.9 MIN. |
| R | 0~15° |

P8C-100-300B,C-2

8-PIN PLASTIC SOP (5.72 mm (225))



NOTE

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

| ITEM | MILLIMETERS |
|------|--|
| A | 5.2 ^{+0.17} / _{-0.20} |
| B | 0.78 MAX. |
| C | 1.27 (T.P.) |
| D | 0.42 ^{+0.08} / _{-0.07} |
| E | 0.1±0.1 |
| F | 1.59±0.21 |
| G | 1.49 |
| H | 6.5±0.3 |
| I | 4.4±0.15 |
| J | 1.1±0.2 |
| K | 0.17 ^{+0.08} / _{-0.07} |
| L | 0.6±0.2 |
| M | 0.12 |
| N | 0.10 |
| P | 3° ^{+7°} / _{-3°} |

S8GM-50-225B-6

★ **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

μPC4560G2: 8-pin plastic SOP (5.72 mm (225))

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

μPC4560C: 8-pin plastic DIP (7.62 mm (300))

| Process | Conditions |
|-----------------------------------|---|
| Wave Soldering (only to leads) | Solder temperature: 260°C or below, Flow time: 10 seconds or less. |
| Partial Heating Method | Pin temperature: 300°C or below, 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.

[MEMO]

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