To our customers,

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April 1st, 2010
Renesas Electronics Corporation

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DATA SHEET

NEC

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# μPC4559

## HIGH PERFORMANCE DUAL OPERATIONAL AMPLIFIER

### DESCRIPTION

The μPC4559 is a dual type operational amplifier having better slew rate and bandwidth than the μPC4558C with satisfying unity gain frequency compensation. Having low noise characteristics, this device is very convenient to make active filters and other audio application circuits.

### FEATURES

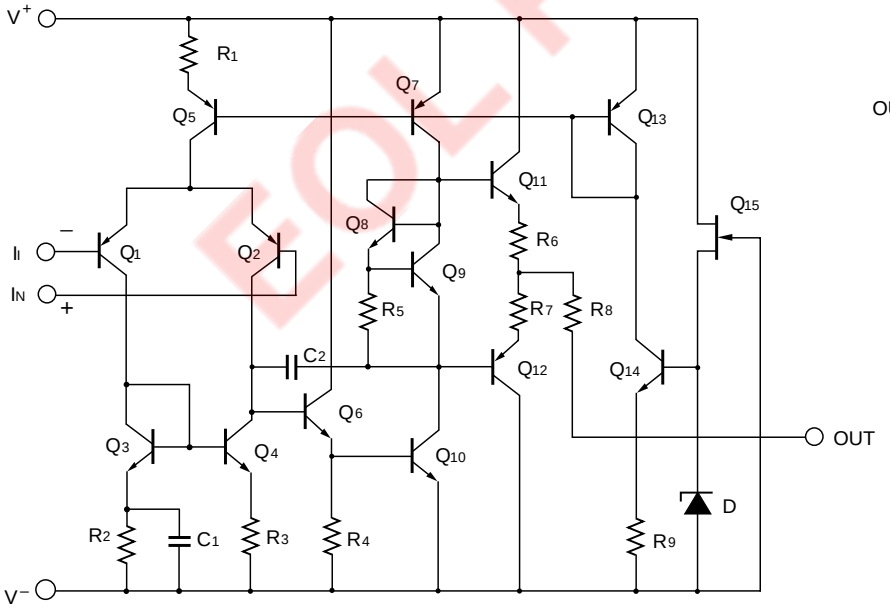
- Internal frequency compensation
- Low noise
- Output short circuit protection

### ORDERING INFORMATION

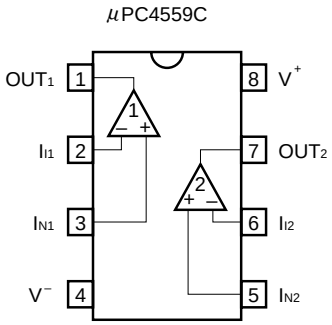
| Part Number | Package |
|---|---|
| μPC4559C | 8-pin plastic DIP (7.62 mm (300)) |

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### EQUIVALENT CIRCUIT (1/2 Circuit)




### PIN CONFIGURATION (Top View)




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Date Published March 2004 N CP(K)
Printed in Japan

The mark ★ shows major revised points.

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## 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 Note 4 | $P_T$ | 350 | mW |
| Output Short Circuit Duration Note 5 | | Indefinite | sec |
| Operating Ambient Temperature | $T_A$ | –20 to +80 | °C |
| Storage Temperature | $T_{stg}$ | –55 to +125 | °C |

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

**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.

**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 –5.0 mV/°C when ambient temperature is higher than 55°C.

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

## RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $V^{\pm}$ | ±4 | | ±16 | V |

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## ELECTRICAL SPECIFICATIONS ($T_A$ = 25°C, $V^{\pm}$ = ±15 V)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $R_S \leq 10\ \Omega$ | | ±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 | $A_V$ | $R_L \geq 20$ kΩ , $V_O$ = ±10 V | 20,000 | 100,000 | | |
| ★ Power Consumption | $P_d$ | $I_O$ = 0 A | | 90 | 170 | mW |
| Common Mode Rejection Ratio | CMR | $R_S \leq 10$ kΩ | 70 | 90 | | dB |
| Supply Voltage Rejection Ratio | SVR | $R_S \leq 10$ kΩ | | 30 | 150 | μV/V |
| Output Voltage Swing | $V_{om}$ | $R_L \geq 10$ kΩ | ±12 | ±14 | | V |
| | | $R_L \geq 2$ kΩ | ±10 | ±13 | | V |
| Common Mode Input Voltage Range | $V_{ICM}$ | | ±12 | ±14 | | V |
| Slew Rate | SR | $A_V$ = 1 | | 2.0 | | V/μs |
| Input Equivalent Noise Voltage | $V_n$ | $R_S$ = 1 kΩ, f = 1 Hz to 1 kHz (Figure1) | | 6 | | $\mu V_{p-p}$ |
| 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**

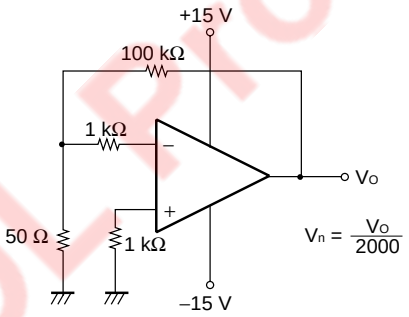
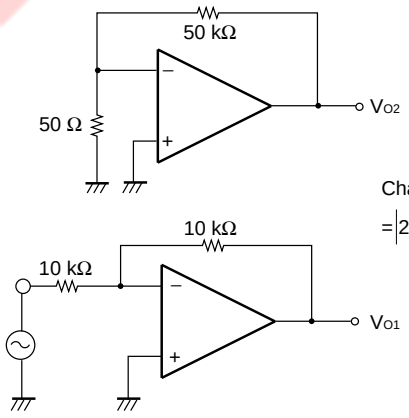



**Figure2 Channel Separation Measurement Circuit**




Channel separation

$$= \left| 20 \cdot \log \left( \frac{1}{1000} \cdot \frac{V_{O2}}{V_{O1}} \right) \right|$$

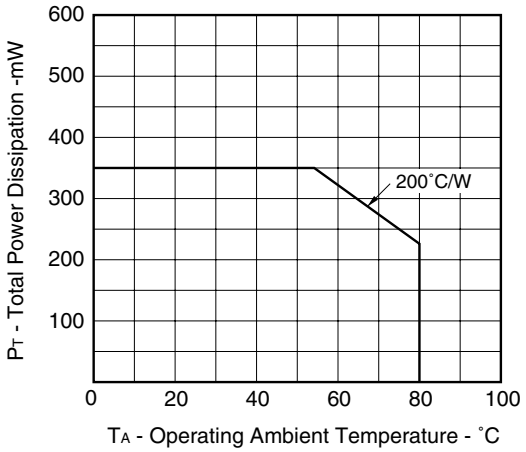
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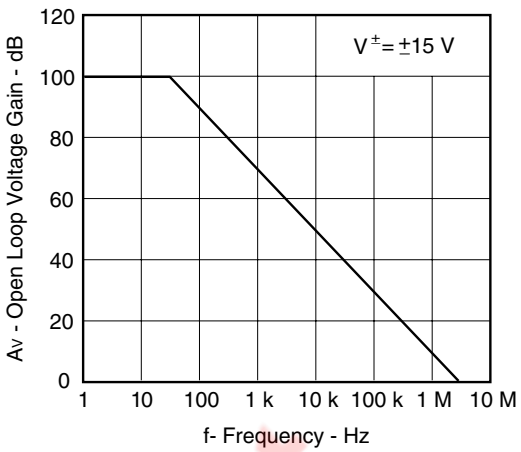
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## TYPICAL PERFORMANCE CHARACTERISTICS ($T_A$ = 25°C, TYP.)

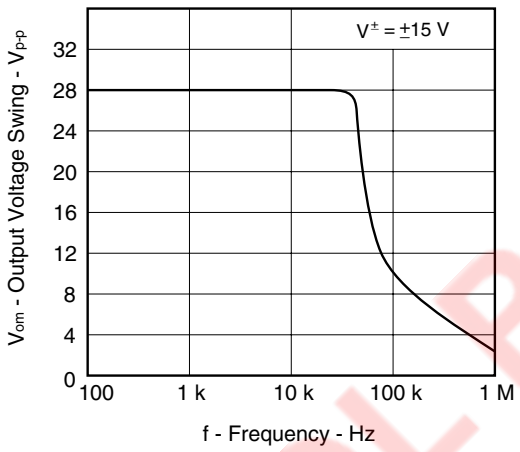
POWER DISSIPATION



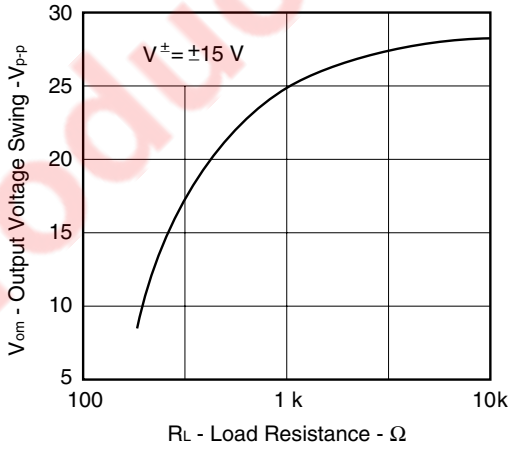

OPEN LOOP FREQUENCY RESPONSE



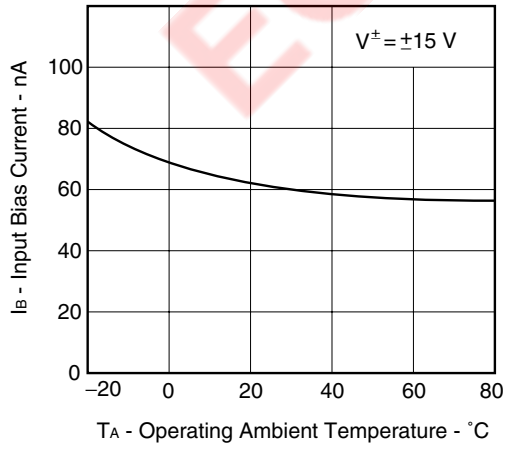

LARGE SIGNAL FREQUENCY RESPONSE



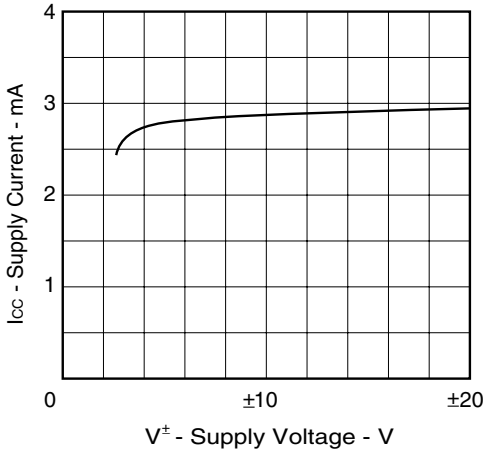

OUTOUT VOLTAGE SWING




INPUT BIAS CURRENT




SUPPLY CURRENT

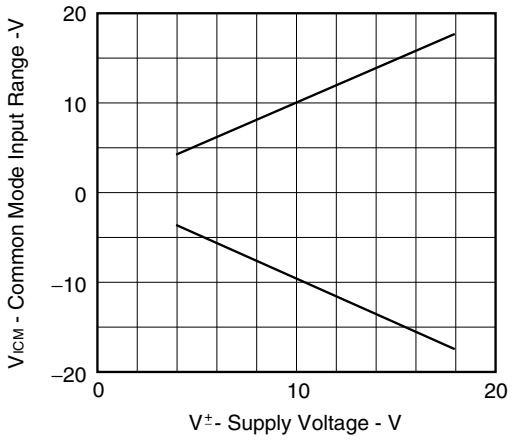



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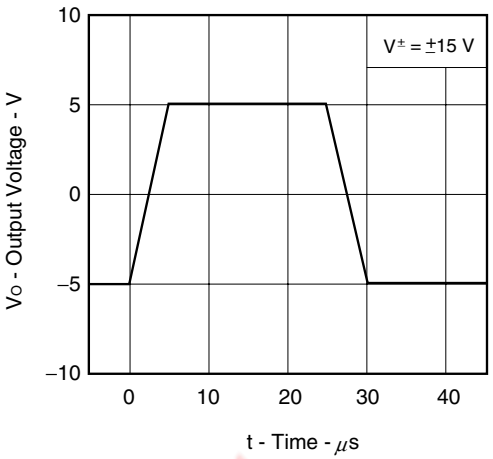


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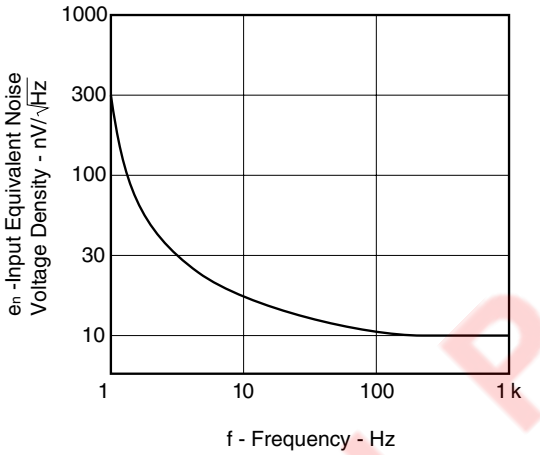
COMMON MODE INPUT VOLTAGE RANGE




VOLTAGE FOLLOWER PULSE RESPONSE




INPUT EQUIVALENT NOISE VOLTAGE DENSITY



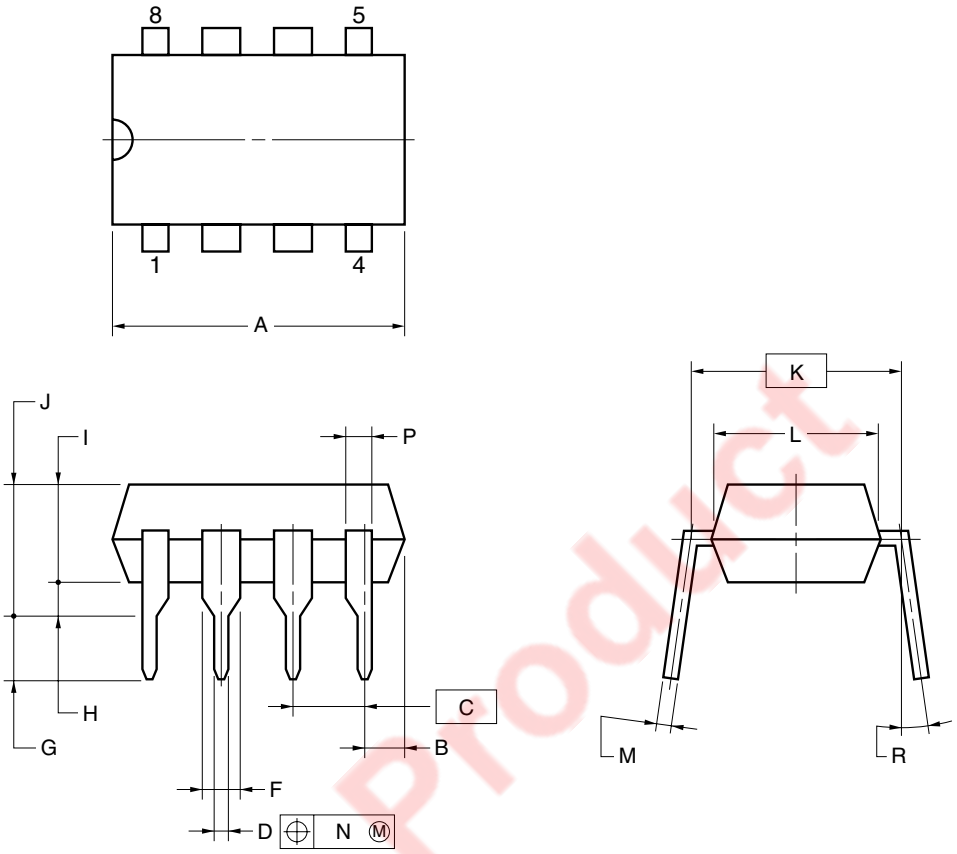

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**PACKAGE DRAWING (Unit : mm)**

## 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

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## ★ RECOMMENDED SOLDERING CONDITIONS

The μPC4559 should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, contact an NEC Electronics sales representative.

For technical information, see the following website.

**Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)**

**Type of Through-hole Device**

**μPC4559C: 8-pin plastic DIP (7.62 mm (300))**

| 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.**

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