# UPC458, UPC4741

## Low Noise Quad Operational Amplifiers

### DESCRIPTION

UPC458 and UPC4741 consist of four independent frequency compensated operational amplifiers featuring higher speed, broader band than general purpose type as 741. UPC458 and UPC4741 are most appropriate for AC signal amplifier applications such as active filters or pulse amplifiers.

Depending on the operating ambient temperature, UPC458 is suitable for communication application while UPC4741 is suitable for general-purpose usage.

In addition, special arrangement products with sorted DC items are available.

Along with this series of lineup, the dual type op-amp UPC258 and UPC4558 with the same circuit configuration are also available.

### FEATURES

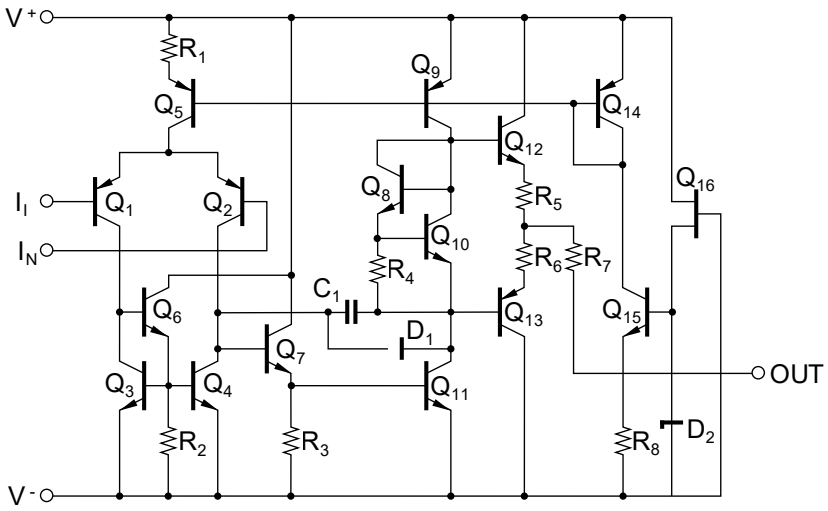
- Slew Rate 1.6 V/μs (TYP.)
- Zero-cross frequency 3.5 MHz (TYP.)
- Input Equivalent Noise Voltage Density 9 nV/$\sqrt{\text{Hz}}$ (TYP.)
- Input Offset Voltage ±1 mV (TYP.)
- Input Offset Current ±30nA (TYP.)
- Low noise
- Built-In Phase Compensation Circuit
- Built-In Output Short Circuit Protection
- Standard Quad Op-Amp terminal connection (pin compatible)

### ORDERING INFORMATION

| Order Name (1) | Selected Grade | Package |
|---|---|---|
| UPC458G2-AP | Standard | 14-pin plastic SOP ( 5.72 mm ( 225 )) |
| UPC458G2(5)-AP | DC item sorted product | 14-pin plastic SOP ( 5.72 mm ( 225 )) |
| UPC4741G2-AP | Standard | 14-pin plastic SOP ( 5.72 mm ( 225 )) |
| UPC4741G2(5)-AP | DC item sorted product | 14-pin plastic SOP ( 5.72 mm ( 225 )) |

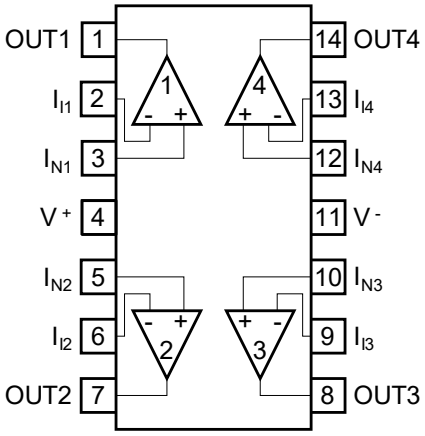
(1) Order names containing E1 or E2 indicate that the packaging format is embossed taping.
Pin 1 of E1 is on draw-out side, and pin 1 of E2 is at take-up side.

## EQUIVALENT CIRCUIT (1/4 Circuit)




## PIN CONFIGURATION (Top View)

UPC458G2, UPC4741G2




## ABSOLUTE MAXIMUM RATINGS

($T_A$ = 25 °C)

| Parameter | Symbol | UPC458G2<br>UPC458G2(5) | UPC4741G2<br>UPC4741G2(5) | Unit |
|---|---|---|---|---|
| Voltage between $V^+$ and $V^-$ Note 1 | $V^+ - V^-$ | -0.3 ~ +40 | | V |
| Differential Input Voltage | $V_{ID}$ | ±30 | | V |
| Input Voltage Note 2 | $V_I$ | $V^-$ -0.3 ~ $V^+$ +0.3 | | V |
| Output Applied Voltage Note 3 | $V_O$ | $V^-$ -0.3 ~ $V^+$ +0.3 | | V |
| Power Dissipation Note 4 | $P_T$ | 550 | | mW |
| Output Short Circuit Duration Note 5 | | Indefinite | | s |
| Operating Ambient Temperature | $T_A$ | -40 ~ +85 | -20 ~ +80 | °C |
| Storage Temperature | $T_{stg}$ | -55 ~ +125 | | °C |

【Note】 **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 -5.5 mW/°C when operating ambient temperature is higher than 25 °C.

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

## RECOMMENDED OPERATING CONDITIONS

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

## ELECTRICAL CHARACTERISTICS

UPC458G2, 4741G2 ($T_A$ = 25 °C, $V^{\pm}$ = ±15 V)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | | ±1.0 | ±5.0 | mV | $R_S$ ≤ 100 Ω |
| Input Offset Current | $I_{IO}$ | | ±30 | ±50 | nA | |
| Input Bias Current Note 6 | $I_B$ | | 70 | 300 | nA | |
| Large Signal Voltage Gain | $A_V$ | 25000 | 50000 | | | $R_L$ ≥ 2 kΩ, $V_O$ = ±10 V |
| Power Consumption | $P_d$ | | 150 | 210 | mW | $I_O$ = 0 A |
| Common Mode Rejection Ratio | CMR | 80 | 90 | | dB | |
| Supply Voltage Rejection Ratio | SVR | | 50 | 100 | μV/V | |
| Maximum Output Voltage | $V_{om}$ | ±12 | ±13.7 | | V | $R_L$ ≥ 10 kΩ |
| Maximum Output Voltage | $V_{om}$ | ±10 | ±12.5 | | V | $R_L$ ≥ 2 kΩ |
| Common Mode Input Voltage Range | $V_{ICM}$ | ±12 | ±14 | | V | |
| Slew Rate | SR | | 1.6 | | V/μs | $A_V$ = 1 |
| Input Equivalent Noise Voltage Density | $e_n$ | | 9 | | nV/$\sqrt{Hz}$ | f = 1 kHz |
| Channel Separation | | | 108 | | dB | f = 10 kHz |

UPC458G2 (5), 4741G2 (5) ($T_A$ = 25 °C, $V^{\pm}$ = ±15 V)

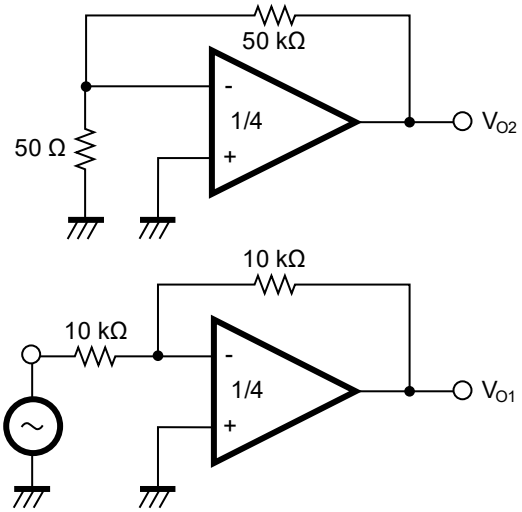
| Parameter | Symbol | MIN. | TYP. | MAX. | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | | ±1.0 | ±2.0 | mV | $R_S$ ≤ 100 Ω |
| Input Offset Current | $I_{IO}$ | | ±30 | ±50 | nA | |
| Input Bias Current Note 6 | $I_B$ | | | 100 | nA | |
| Large Signal Voltage Gain | $A_V$ | 28000 | 50000 | | | $R_L$ ≥ 2 kΩ, $V_O$ = ±10 V |
| Power Consumption | $P_d$ | | 150 | 210 | mW | $I_O$ = 0 A |
| Common Mode Rejection Ratio | CMR | 85 | 90 | | dB | |
| Supply Voltage Rejection Ratio | SVR | | | 50 | μV/V | |
| Output Voltage Swing | $V_{om}$ | ±12.5 | ±13.7 | | V | $R_L$ ≥ 10 kΩ |
| Output Voltage Swing | $V_{om}$ | ±11 | ±12.5 | | V | $R_L$ ≥ 2 kΩ |
| Common Mode Input Voltage Range | $V_{ICM}$ | ±13 | ±14 | | V | |
| Slew Rate | SR | | 1.6 | | V/μs | $A_V$ = 1 |
| Input Equivalent Noise Voltage Density | $V_n$ | | 9 | | nV/$\sqrt{Hz}$ | f = 1 kHz |
| Channel Separation | | | 108 | | dB | f = 10 kHz |

**【Note】 6.** Input bias currents flow out from IC. Because each currents are base current of PNP-transistor on input stage.

Note that the following when using this product.

In low Input level circuits, relative interferences may sometimes occur due to the temperature gradient in the IC chip when the difference of power dissipation between channels is extremely large.

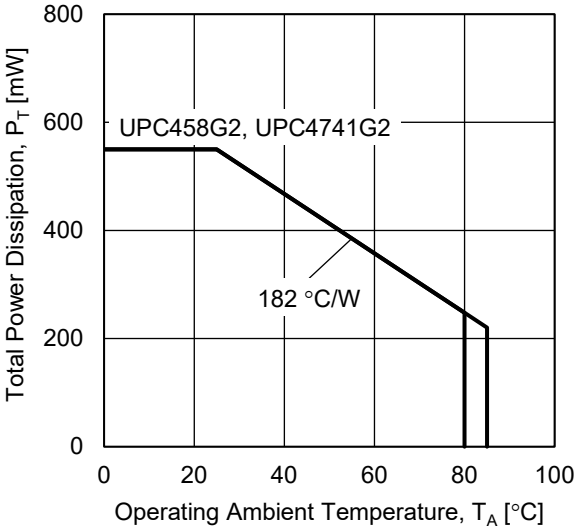
## CHANNEL SEPARATION MEASUREMENT CIRCUIT



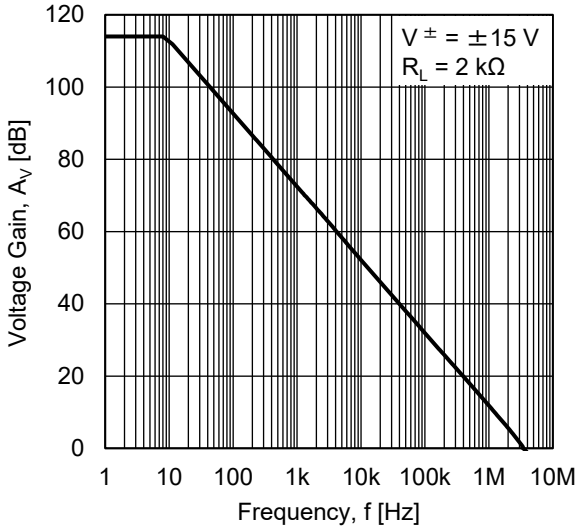

$$\text{Channel Separation} = \left| 20 \cdot \log \left( \frac{1}{1000} \cdot \frac{V_{O2}}{V_{O1}} \right) \right|$$

## ELECTRICAL CHARACTERISTICS CURVE ($T_A$ = 25 °C, TYP.) (REFERENCE VALUE)

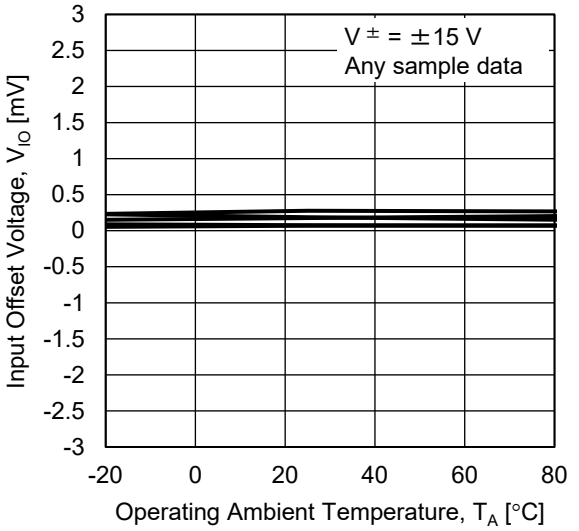
$P_T$ vs. $T_A$ (Absolute maximum rating)



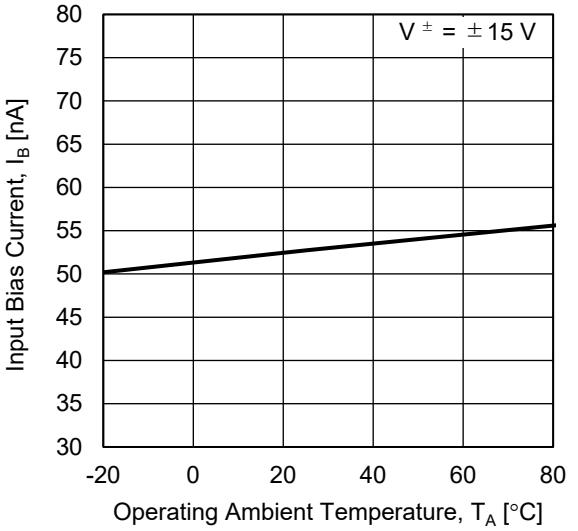

$A_V$ vs. f



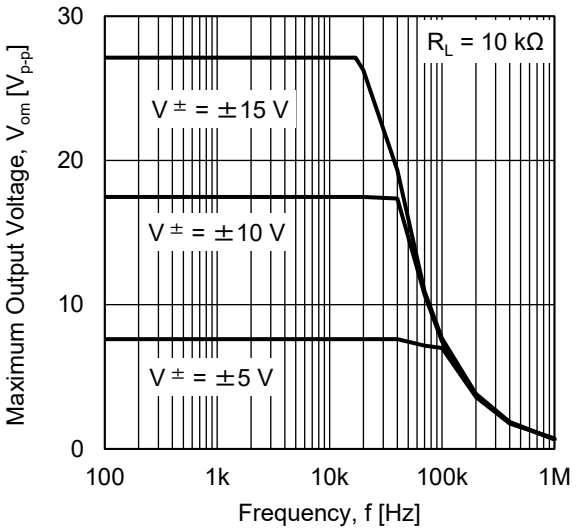

$V_{IO}$ vs. $T_A$



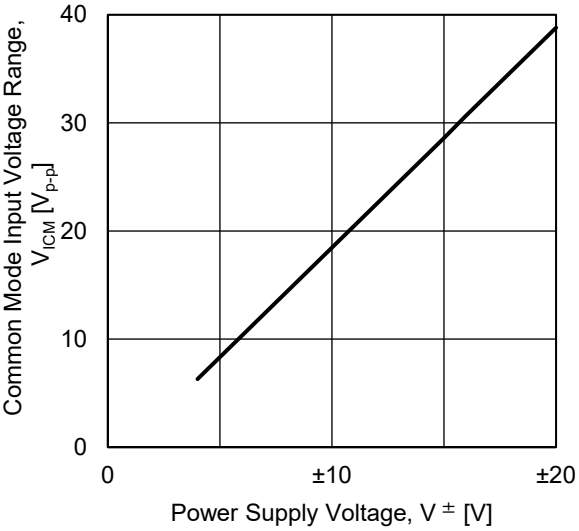

$I_B$ vs. $T_A$



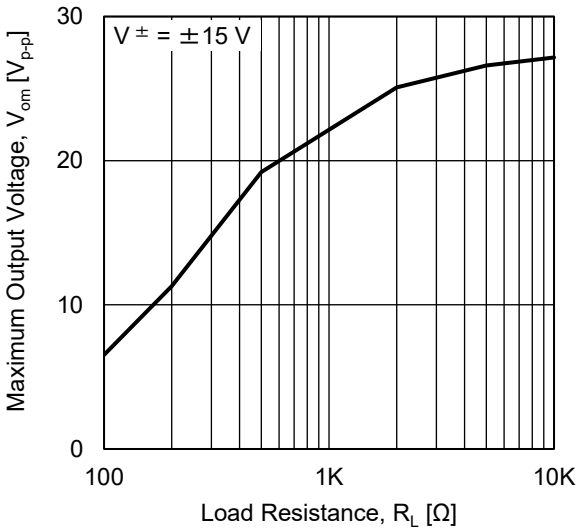

$V_{om}$ vs. f



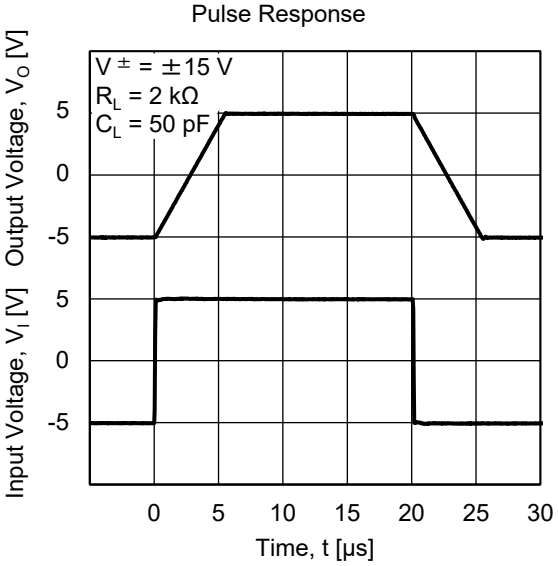

$V_{ICM}$ vs. $V^{\pm}$



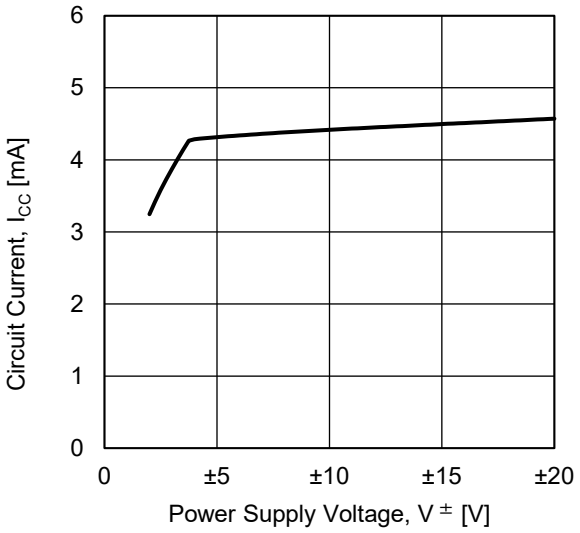
$V_{om}$ vs. $R_L$



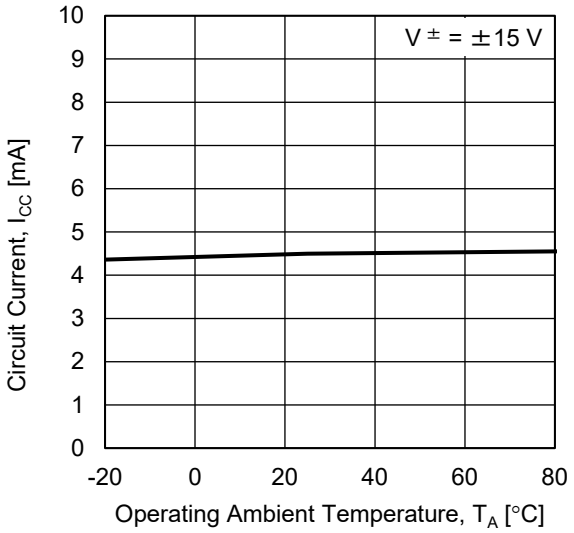

Pulse Response



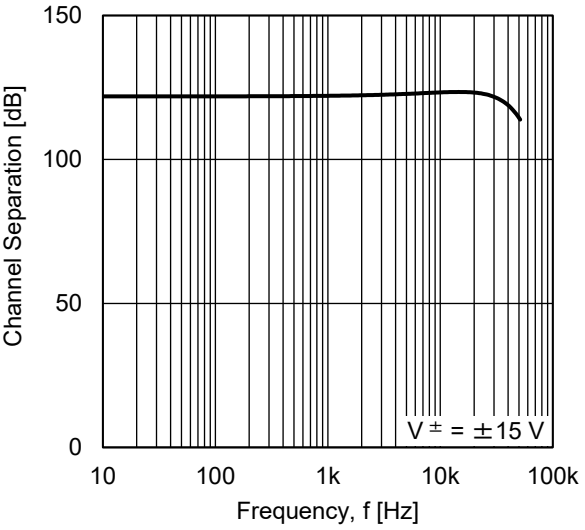

$I_{CC}$ vs. $V^{\pm}$



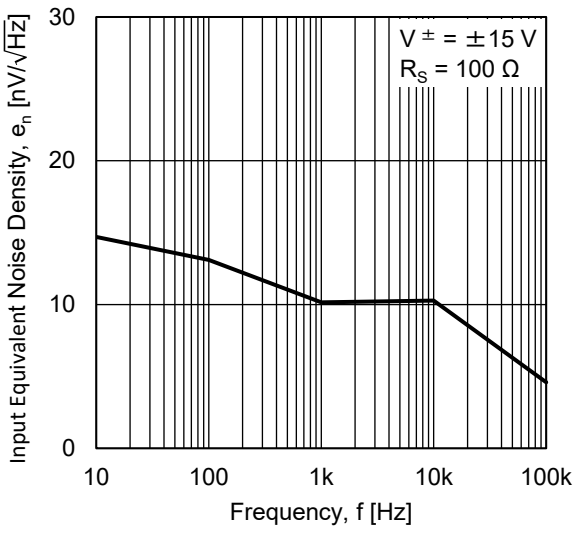

$I_{CC}$ vs. $T_A$




Channel Separation




$e_n$ vs. f

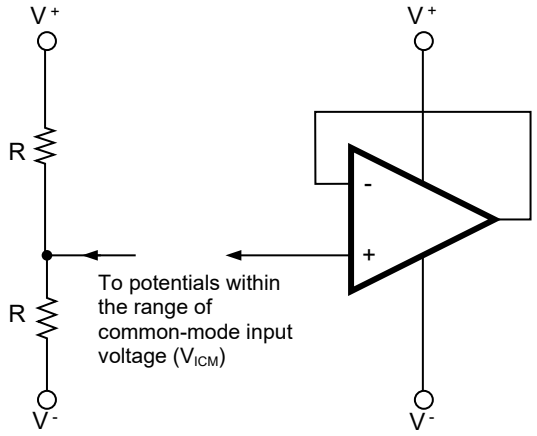


## USE WITH PRECAUTIONS

- **Managing unused circuits**

  If there is an unused circuit, the following connection is recommended.

Example of unused circuit process




Remark: In this example, an intermediate potential between $V^+$ and $V^-$ is applied.

- **Power Supply (Dual Power Supply / Single Power Supply)**

  The op amp operates when a predetermine voltage is applied between $V^+$ - $V^-$ . Therefore, while it operates from a single power supply ($V^-$ = GND), it is not possible to operate the input and output near GND. So please be careful of the common-mode input voltage range and maximum output voltage.

- **Ratings of input/output pin voltage**

  When the voltage of input/output pin exceeds the absolute maximum rating, the parasitic diode within the IC may conduct, causing characteristics degradation or damage. In addition, if the input pin is lower than $V^-$, or the output pin exceeds the power supply voltage, it is recommended to make a clamping circuit using a diode with low forward voltage (e.g.: Schottky diode) as protection.

- **Range of common-mode input voltage**

  When the supply voltage does not meet the condition of electrical characteristics, the range of common-mode input voltage is as follows.

  $V_{ICM}$ (TYP.): $V^-$ +1 ~ $V^+$ -1 [V] ($T_A$ = 25 °C).

  During designing, do include some margin by considering characteristics variation temperature characteristics etc.

- **Maximum output voltage**

  The TYP. value range of the maximum output voltage when the supply voltage does not meet the condition of electrical characteristics is as follows:

  $V_{om}{}^+$ (TYP.) : $V^+$ -1.3 [V] ($T_A$ = 25 °C), $V_{om}{}^-$ (TYP.) : $V^-$ +1.3 [V] ($T_A$ = 25 °C)

  During designing, do include some tolerance by considering characteristics variation, temperature characteristics and so on. In addition, also note that the output voltage range ($V_{om}{}^+ - V_{om}{}^-$) will become narrow when the output current increases.

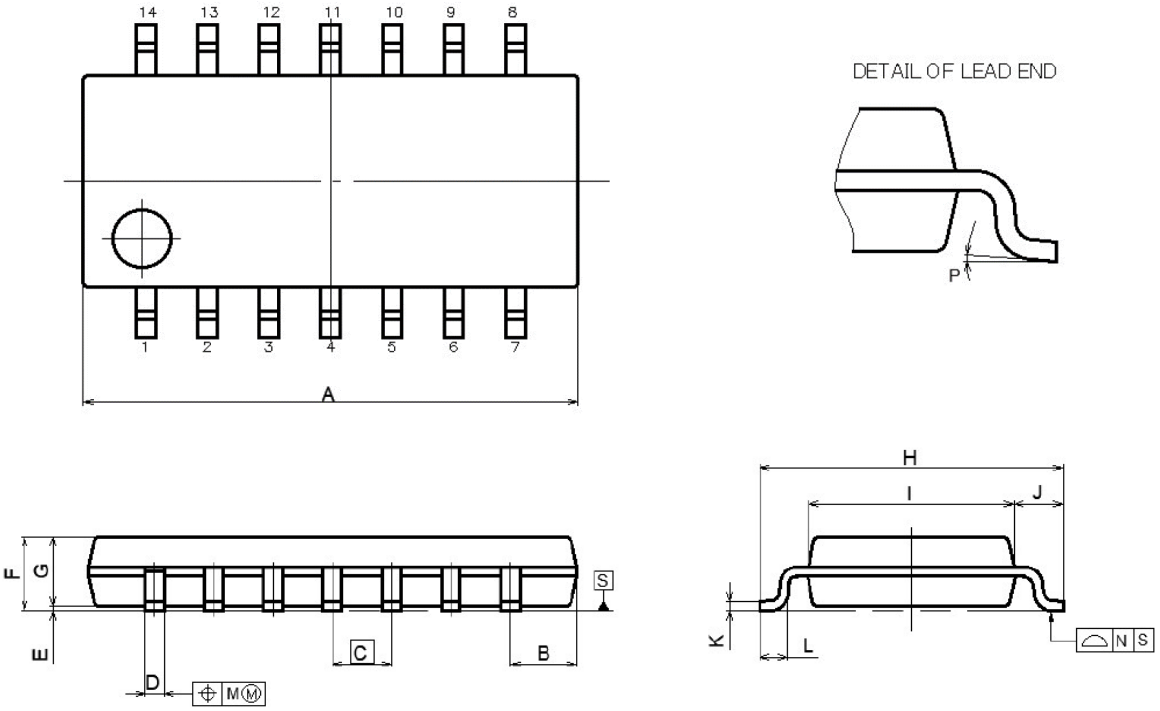
- **Handling of ICs**

  When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuate due to piezoelectric (piezo) effect. Therefore, pay attention to warpage or bending of a board.

# PACKAGE DRAWINGS

## 14-PIN PLASTIC SOP

| JEITA Package code | RENESAS code | MASS (TYP.) [g] |
|---|---|---|
| P-LSOP14-4.4×10.2-1.27 | PLSP0014DB-A | 0.17[g] |




NOTE
EACH LEAD CENTERLINE IS LOCATED WITHIN 0.12 MM OF
ITS TRUE POSITION(T.P.) AT MAXIMUM MATERIAL CONDITION.

(UNIT:mm)

| ITEM | DIMENSIONS |
|---|---|
| A | 10.2±0.2 |
| B | 1.42MAX |
| C | 1.27(T.P) |
| D | 0.40±0.05 |
| E | 0.1±0.1 |
| F | 1.59±0.20 |
| G | 1.49±0.1 |
| H | 6.5±0.2 |
| I | 4.4±0.1 |
| J | 1.05±0.15 |
| K | 0.2±0.07 |
| L | 0.6±0.20 |
| M | 0.1MAX |
| N | 0.1MAX |
| P | 4°±4° |

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(Rev.5.0-1 October 2020)

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