UPC259, UPC4560

High Performance, Low Noise Dual Operational Amplifiers

DESCRIPTION

UPC259 and 4560 are dual operational amplifiers with a built-in phase compensation circuit. The electrical characteristics are equivalent to the UPC258 and 4558, and can flow a large amount of output current. In addition, the slew rate is about 2.8 times of the UPC258, 4558.

Therefore, applications such as active filters, audio amplifiers and VCOs can be realized with a simple circuit configuration.

Depending on operating ambient temperature, UPC259 is suited for communication application while UPC4560 is suitable for general-purpose usage.

FEATURES

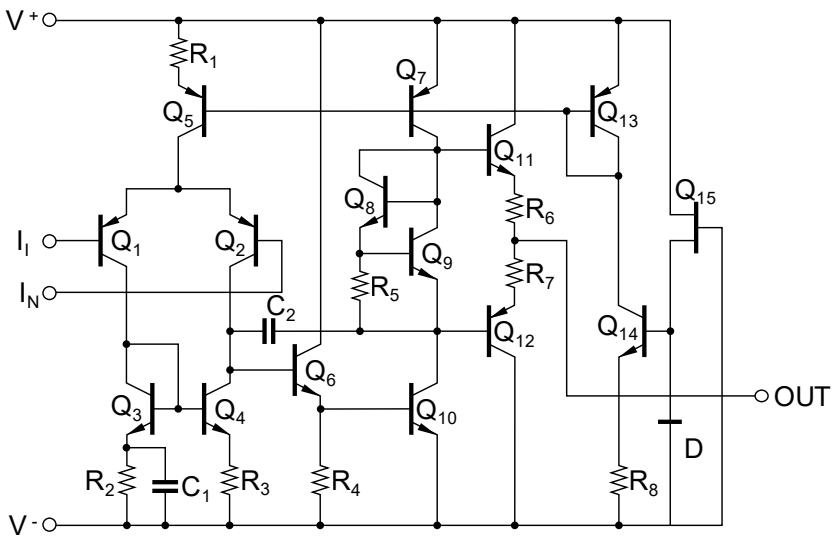
- Input Offset Voltage ±0.5 mV (TYP.)
- Input Offset Current ±5 nA (TYP.)
- Input Bias Current 60 nA (TYP.)
- Slew Rate 2.8 V/μs (TYP.)
- Output Current over 25 mA
- Built-In Phase Compensation Circuit
- Standard Dual Op-Amp terminal connection (pin compatible)

ORDERING INFORMATION

Order Name (1)	Package
UPC259G2-AP	8-Pin plastic SOP (5.72 mm (225))
UPC4560G2-AP	8-Pin plastic SOP (5.72 mm (225))

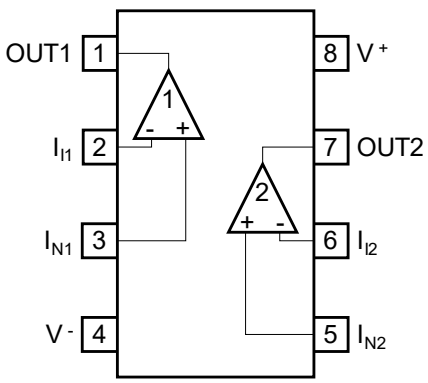
(1) Order names containing E1 or E2 indicate that the packaging format is embossed taping. Pin 1 of E1 is on draw-out side, and pin 1 of E2 is at take-up side.

EQUIVALENT CIRCUIT (1/2 Circuit)



PIN CONFIGURATION (Top View)

UPC259G2, UPC4560G2



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Parameter	Symbol	UPC259G2	UPC4560G2	Unit
Supply Voltage Note1	$V^+ - V^-$	-0.3 ~ +36		V
Differential Input Voltage	V_{ID}	±30		V
Input Voltage Note 2	V_I	V^- -0.3 ~ V^+ +0.3		V
Output applied Voltage Note3	V_O	V^- -0.3 ~ V^+ +0.3		V
Total Power Dissipation Note4	P_T	440		mW
Output Short Circuit Duration Note5		0		s
Operating Ambient Temperature	T_A	-40 ~ +85	-20 ~ +80	°C
Storage Temperature	T_{stg}	-55 ~ +125		°C

【Note】 **1.** Note that reverse connections of the power supply may damage the ICs.

2. The input terminal must be apply within the input voltage range to avoid deteriorating or damaging the device characteristic. Do not exceed the ratings including during transition state such as ON/OFF, etc. The Op-Amp input voltage must operates within the electrical characteristics range of input common-mode voltage.

3. The output terminal must be apply within the output voltage range to avoid deteriorating or damaging the device characteristic. Do not exceed the ratings including during transition state such as ON/OFF, etc. The Op-Amp output voltage must operates within the electrical characteristics range of maximum output voltage.

4. This is the value at $T_A \leq +25$ °C. De-rate value at -4.4 mW/ ˚C when $T_A > 25$ °C.

5. Protection against load shorts is required. Please use the total loss and the de-rating value from Note 4.

RECOMMENDED OPERATING CONDITIONS

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

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

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±0.5	±6.0	mV	R_S ≤ 10 kΩ
Input Offset Current	I_{IO}		±5	±200	nA	
Input Bias Current Note6	I_B		60	500	nA	
Large Signal Voltage Gain	A_V	20000	180000			R_L ≥ 2 kΩ, V_O = ±10 V
Power Consumption	P_d		120	170	mW	I_O = 0 A
Common Mode Rejection Ratio	CMR	70	100		dB	R_S ≤ 10 kΩ
Supply Voltage Rejection Ratio	SVR		10	150	μV/V	R_S ≤ 10 kΩ
Output Voltage Swing	V_{om}	±12	±14		V	R_L ≥ 2 kΩ
Output Voltage Swing	V_{om}	±10	±13		V	I_O = ±25 mA
Common Mode Input Voltage Range	V_{ICM}	±12	±14		V	
Slew Rate	SR		2.8		V/μs	A_V = 1
Input Equivalent Noise Voltage	V_n		6		μV_{p-p}	R_S = 1 kΩ, f = 1 Hz ~ 1 kHz (Fig 1)
Channel Separation			105		dB	f = 1 kHz (Fig 2)

【Note】 **6.** The direction of the input bias current is the same direction that flows out from the IC because the first stage is composed of PNP transistor.

TEST CIRCUIT

Fig 1 Noise Test Circuit

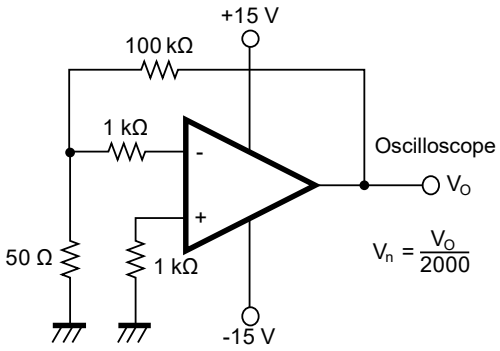
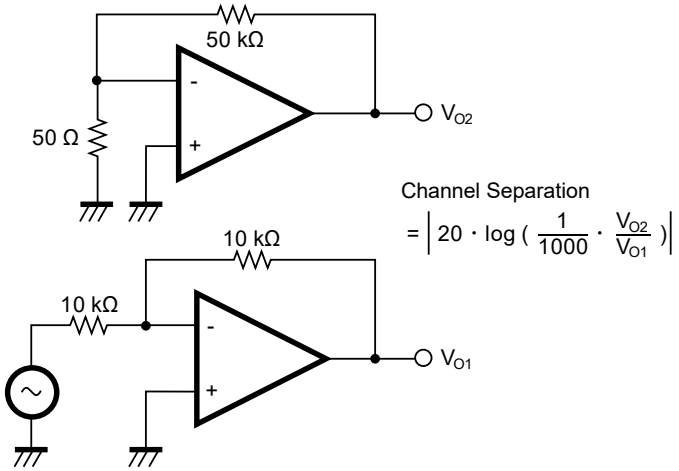
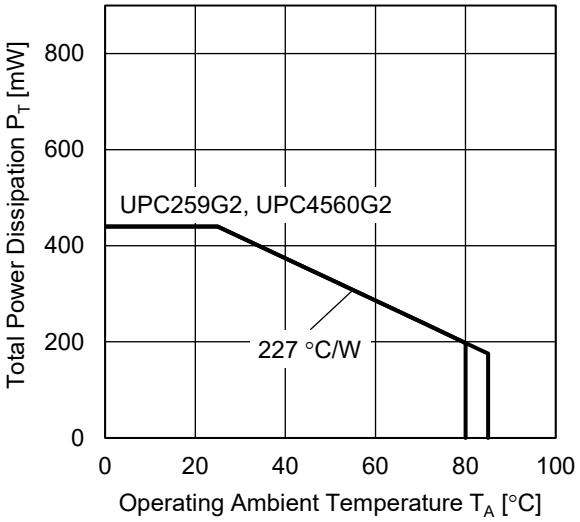


Fig 2 Channel Separation Test Circuit

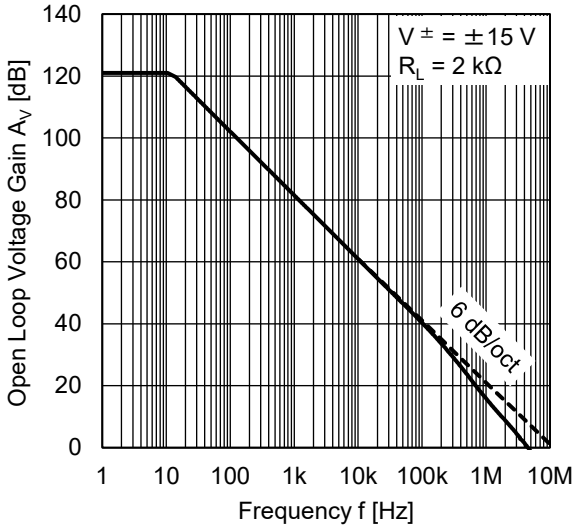


ELECTRICAL CHARACTERISTICS CURVE (T_A = 25 °C, TYP.) (REFERENCE VALUE)

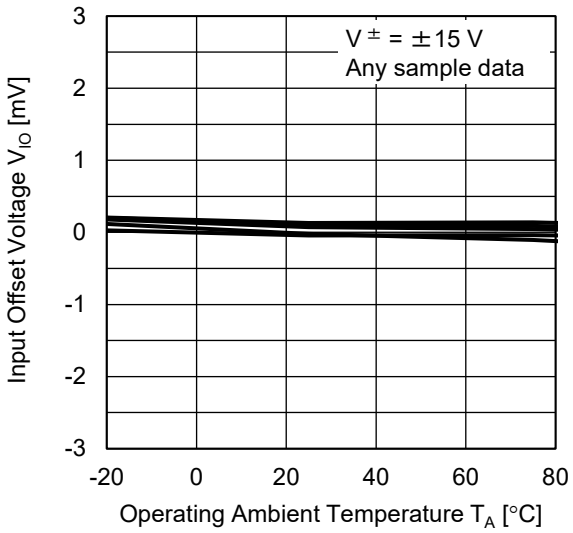
P_T vs. T_A (Absolute maximum rating)



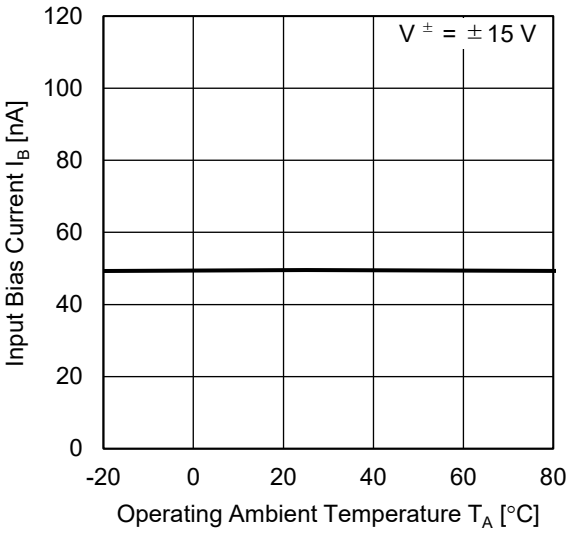
A_V vs. f



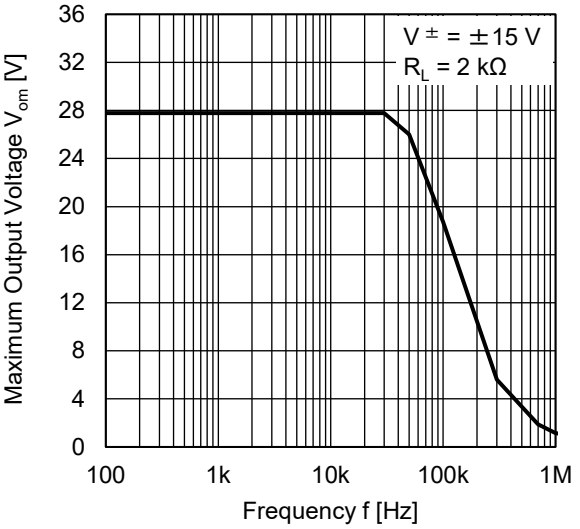
V_{IO} vs. T_A



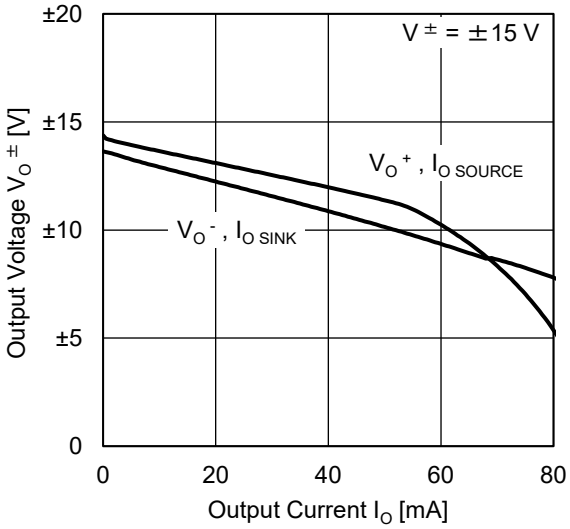
I_B vs. T_A

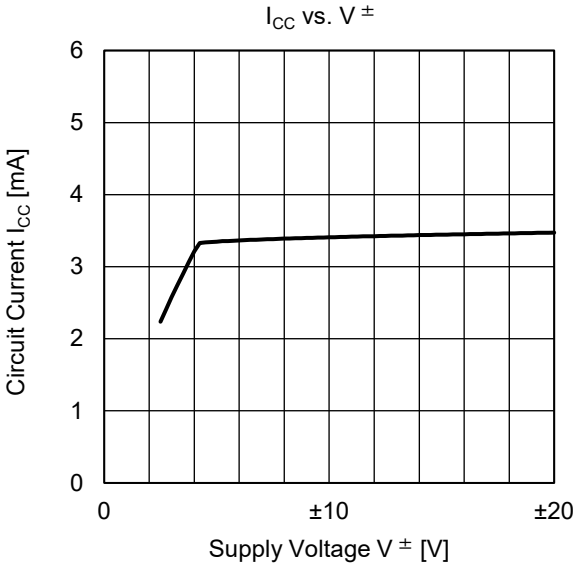


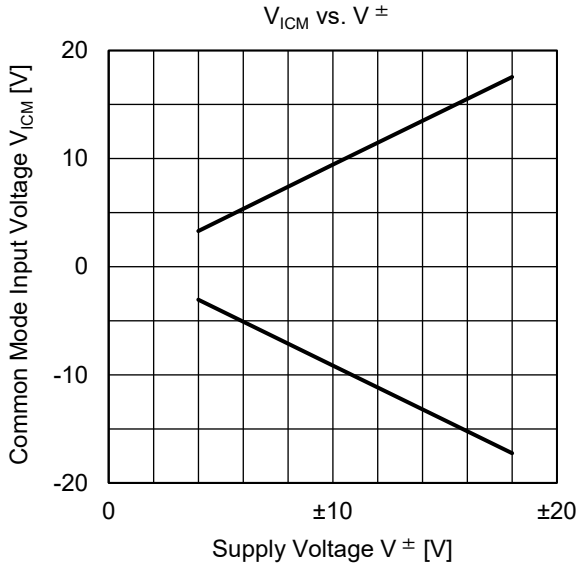
V_{om} vs. f

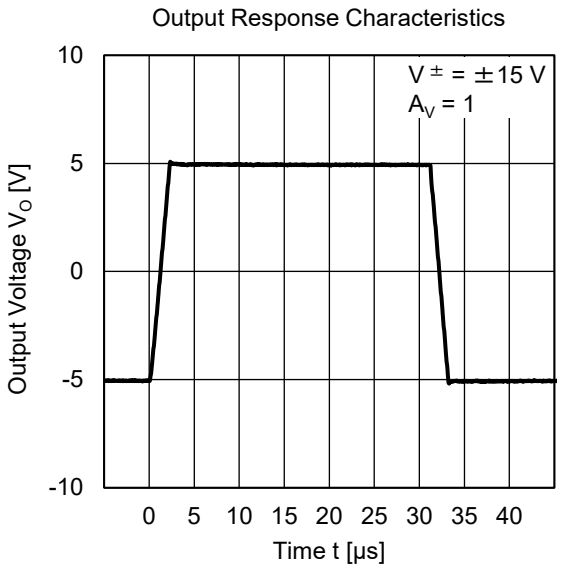


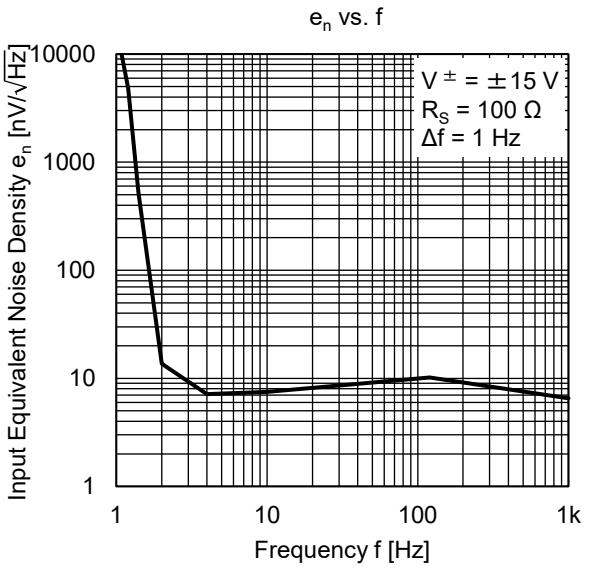
$V_O{}^{\pm}$ vs. I_O




I_{CC} vs. V ±
Circuit Current I_{CC} [mA]
6
5
4
3
2
1
0
0
±10
±20
Supply Voltage V ± [V]

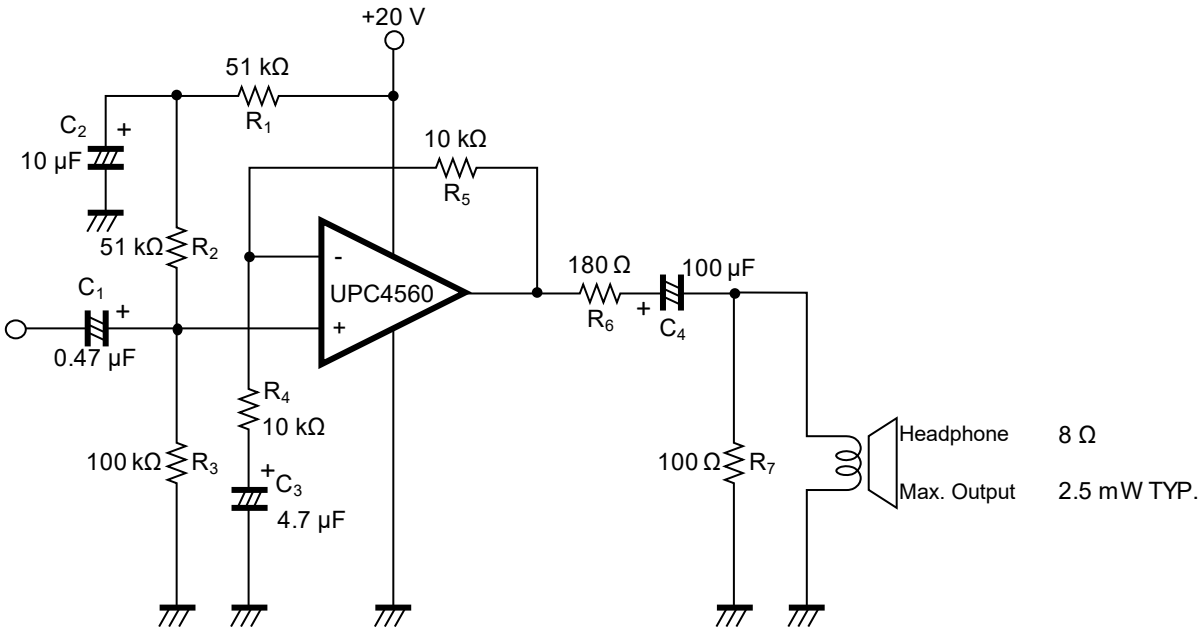

V_{ICM} vs. V ±
Common Mode Input Voltage V_{ICM} [V]
20
10
0
-10
-20
0
±10
±20
Supply Voltage V ± [V]


Output Response Characteristics
V ± = ±15 V
A_V = 1
Output Voltage V_O [V]
10
5
0
-5
-10
0 5 10 15 20 25 30 35 40
Time t [µs]

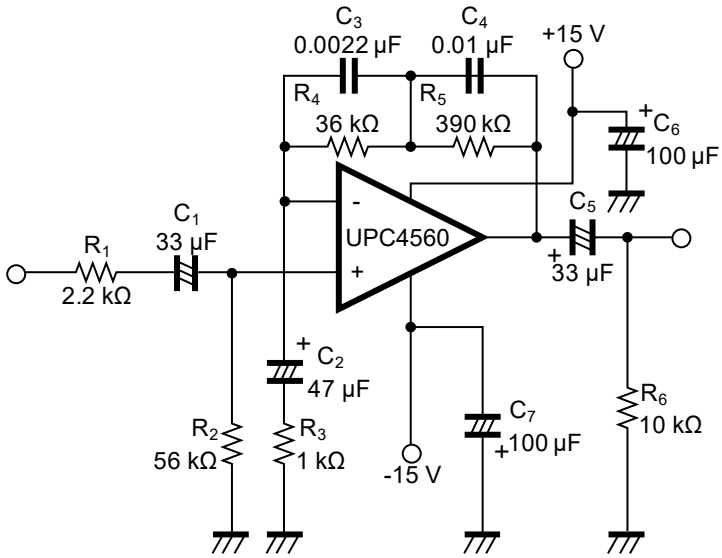

e_n vs. f
V ± = ±15 V
R_S = 100 Ω
Δf = 1 Hz
Input Equivalent Noise Density e_n [nV/√Hz]
10000
1000
100
10
1
1
10
100
1k
Frequency f [Hz]

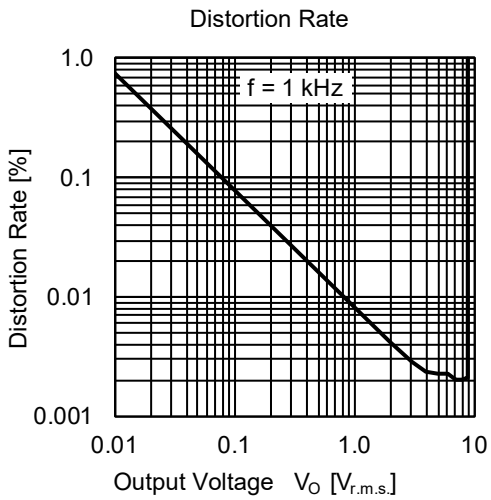
APPLICATION CIRCUIT EXAMPLE

Headphone Amplifier



RIAA Amplifier



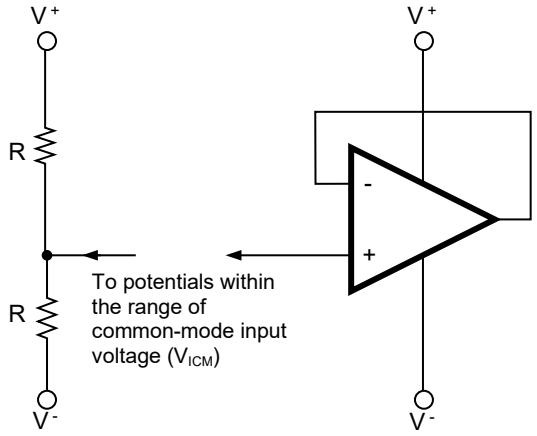


USE WITH PRECAUTIONS

- **Managing unused circuits**

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

Example of handling unused circuit



Remark Note in this example, an intermediate voltage of 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 [V] (T_A = 25°C), V_{om}^- (TYP.): V^- +1 [V] (T_A = 25°C)

  During designing, do include some margin 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.

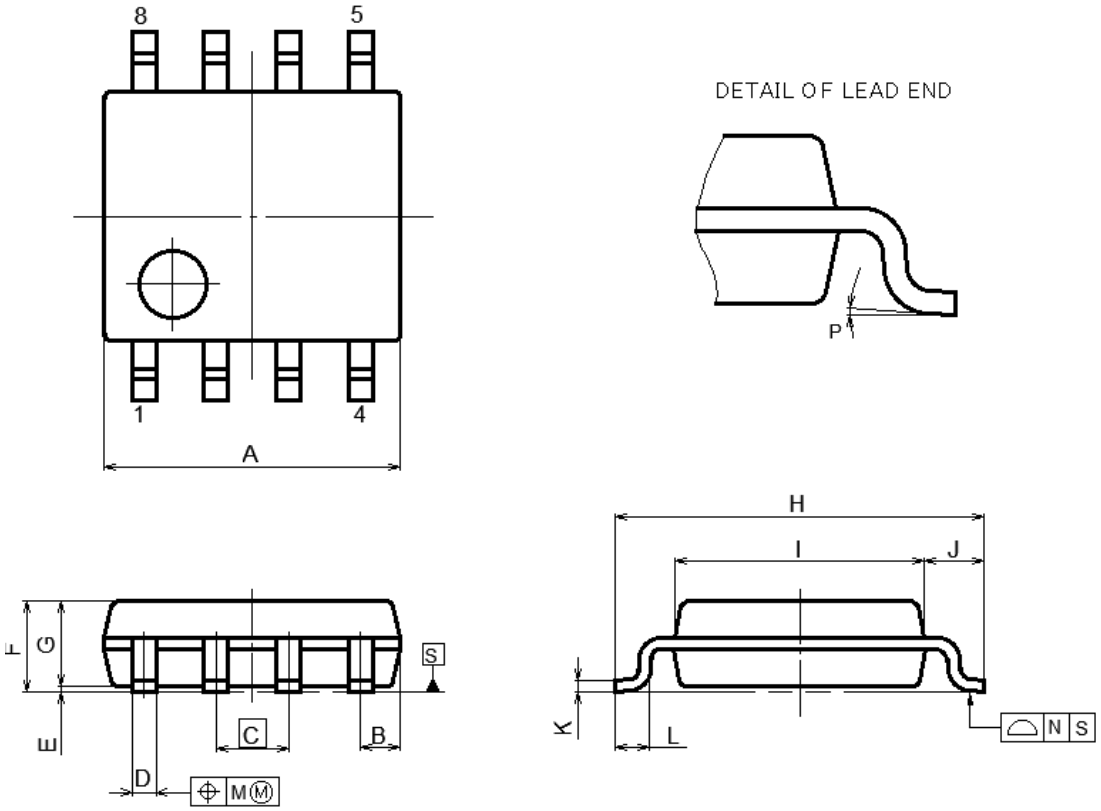
- **Handling of ICs**

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

PACKAGE DRAWINGS

8Pin PLASTIC SOP

JEITA Package code	RENESAS code	MASS (TYP.) [g]
P-LSOP8-4.4×5.2-1.27	PLSP0008DE-A	0.09[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	5.2±0.17
B	0.78MAX
C	1.27(T.P)
D	0.40±0.05
E	0.1±0.1
F	1.59±0.21
G	1.49
H	6.5±0.3
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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