µPC259, 4560

High Performance, Low Noise Dual Operational Amplifier

R03DS0146EJ0100
Rev.1.00
2019.06.13

DESCRIPTION

The µPC259 and 4560 are dual operational amplifier with a built-in phase compensation circuit. The electrical characteristics are equivalent to the µPC258 and 4558, and can flow a large amount of output current. In addition, the slew rate is about 2.8 times of the µPC258, 4558.

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

Depending on the operating ambient temperature, µPC259 is suitable for communication application while µPC4560 is suitable for general-purpose usage.

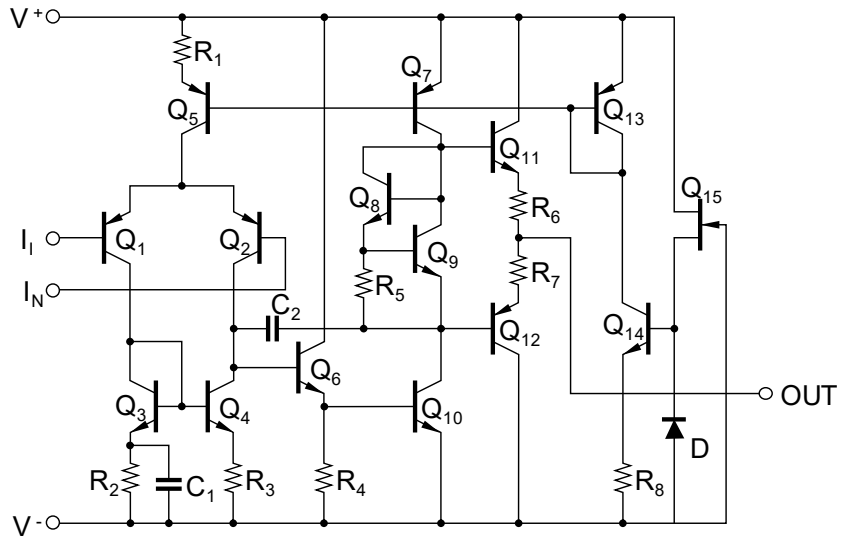
FEATURES

- 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

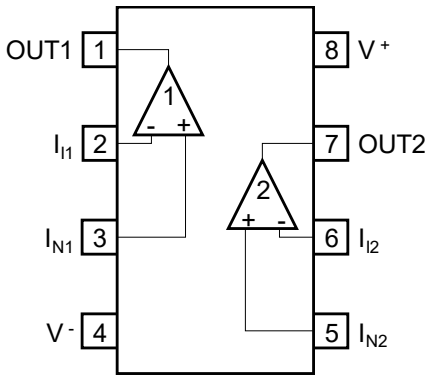
Ordering Name	Package
µPC259G2-A	8-pin plastic SOP (5.72 mm (225 mil))
µPC4560G2-A	8-pin plastic SOP (5.72 mm (225 mil))

EQUIVALENT CIRCUIT (1/2 Circuit)



PIN CONFIGURATION (Top View)

µPC259G2, µPC4560G2



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ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

PARAMETER	SYMBOL	µPC259G2	µPC4560G2	UNIT
Supply Voltage Note1	$V^+ - V^-$	-0.3 ~ +36		V
Differential Input Voltage	V_{ID}	±30		V
Input Voltage Note2	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 TA ≦ +25 °C. De-rate value at -4.4 mW/°C when TA ＞ 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	$V^±$	±4		±16	V

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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	$R_S \leqq 10$ 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			$R_L \geqq 2$ kΩ, V_O = ±10 V
Power Consumption	P_d		120	170	mW	I_O = 0 A
Common Mode Rejection Ratio	CMR	70	100		dB	$R_S \leqq 10$ kΩ
Supply Voltage Rejection Ratio	SVR		10	150	µV/V	$R_S \leqq 10$ kΩ
Output Voltage Swing	V_{om}	±12	±14		V	$R_L \geqq 2$ 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

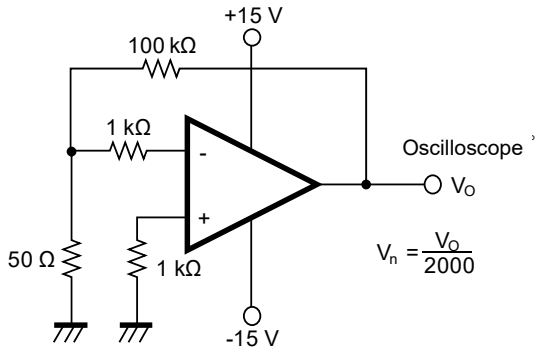
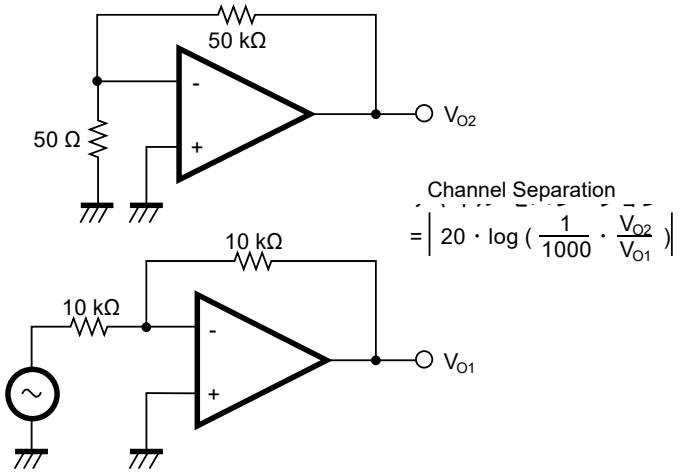


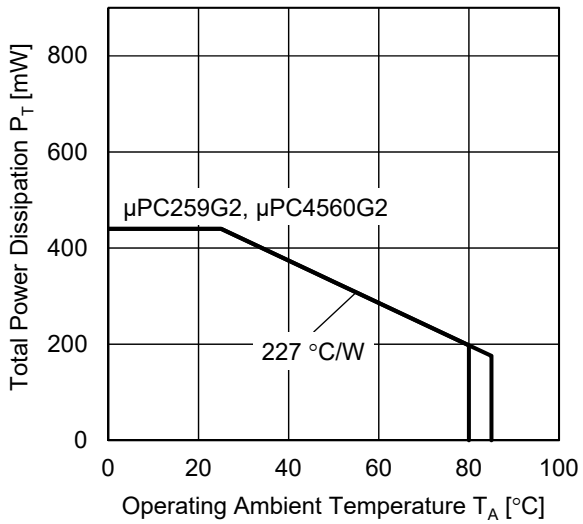
Fig 2 Channel Separation Test Circuit



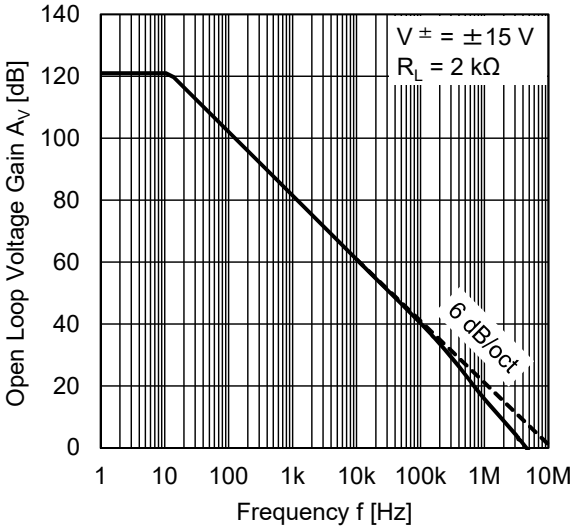
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ELECTRICAL CHARACTERISTICS CURVE (T_A = 25 °C, TYP.) (REFERENCE VALUE)

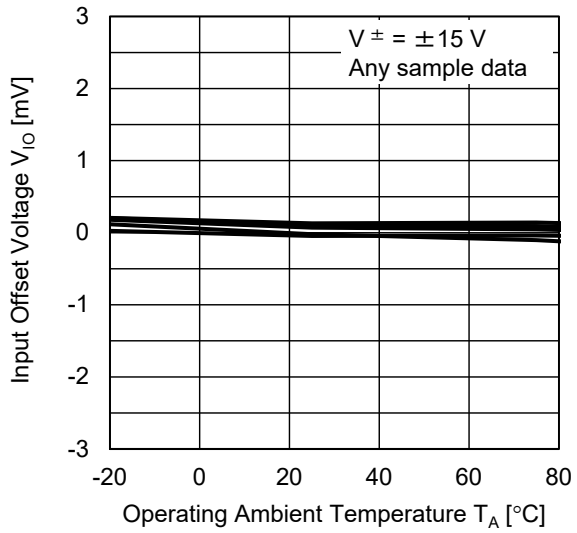
P_T vs. T_A (Absolute maximum rating)



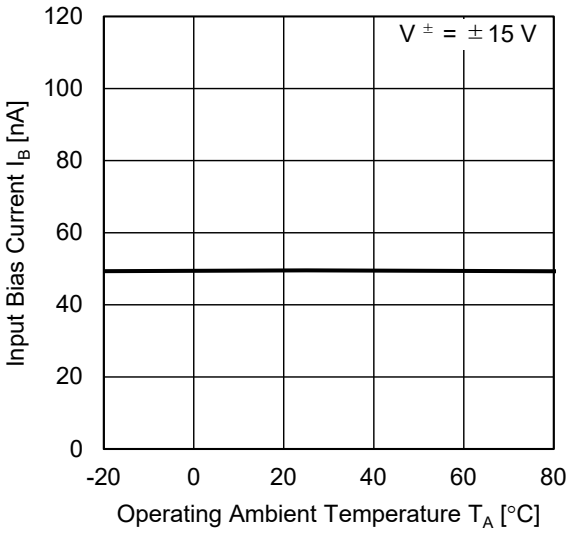
A_V vs. f



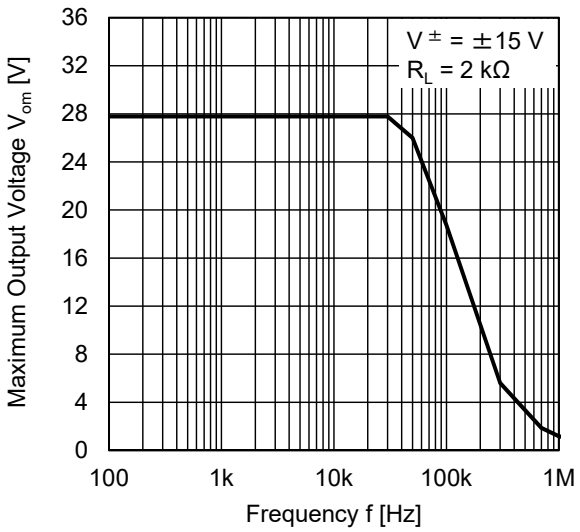
V_{IO} vs. T_A



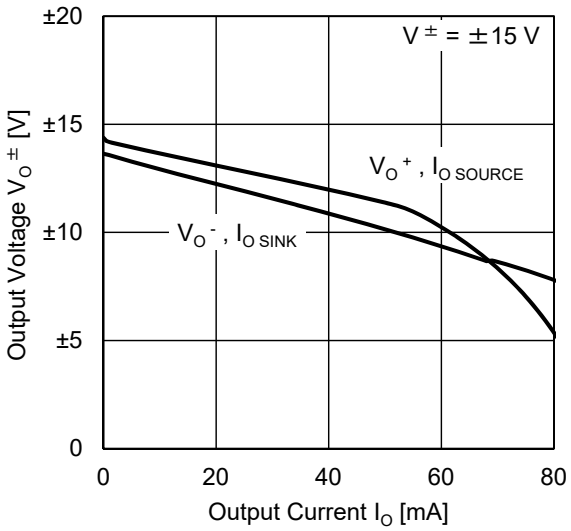
I_B vs. T_A



V_{om} vs. f

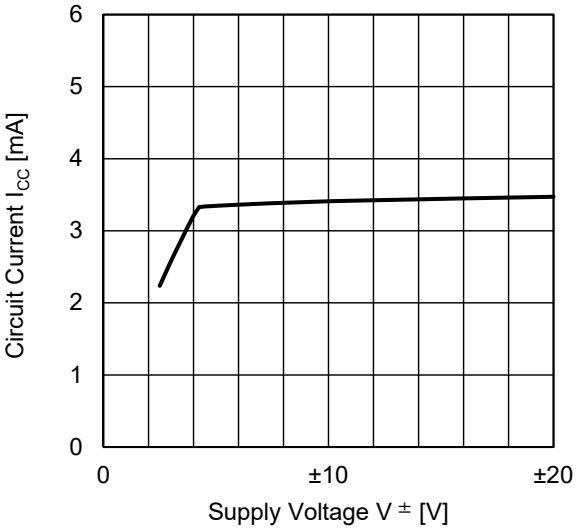


$V_O{}^{\pm}$ vs. I_O

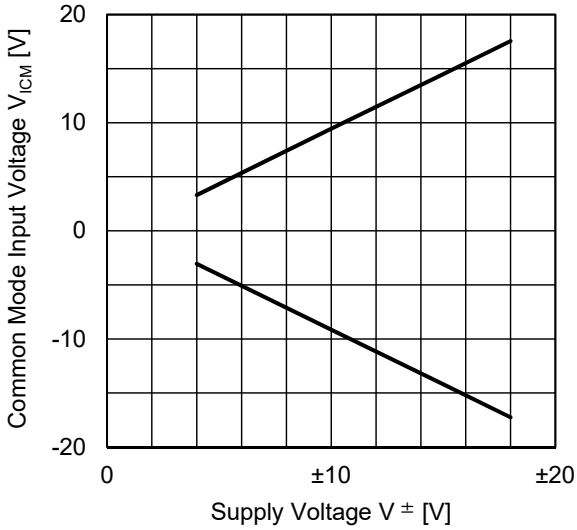


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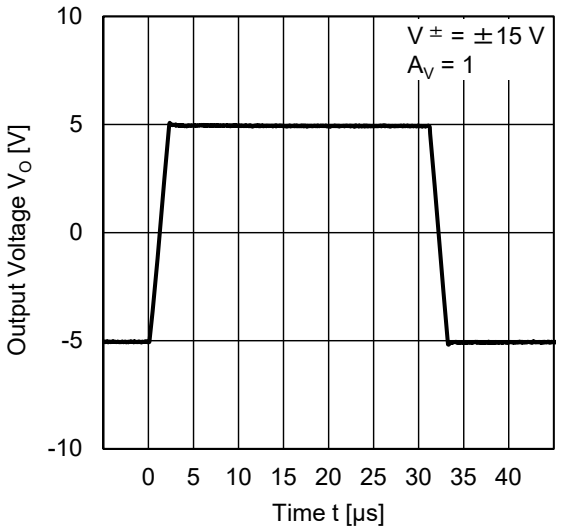
I_{CC} vs. V ±



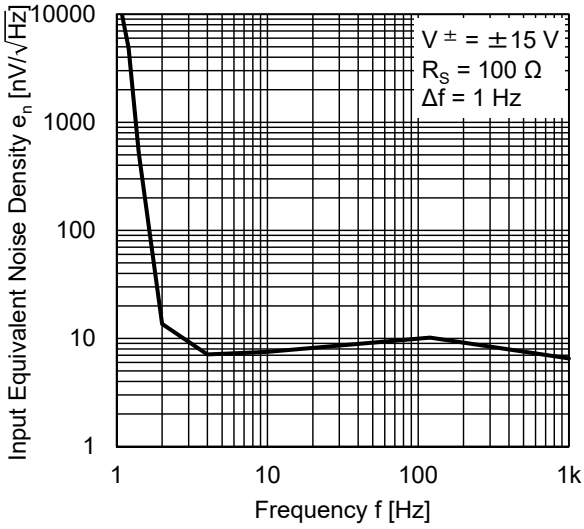
V_{ICM} vs. V ±



Output Response Characteristics



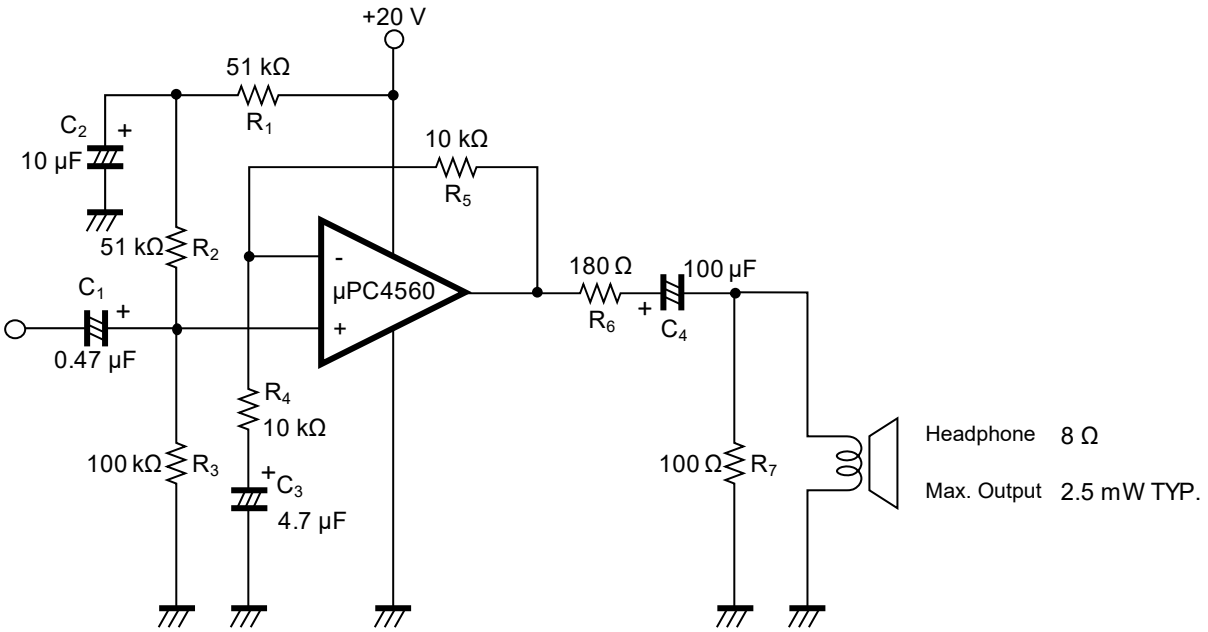
e_n vs. f



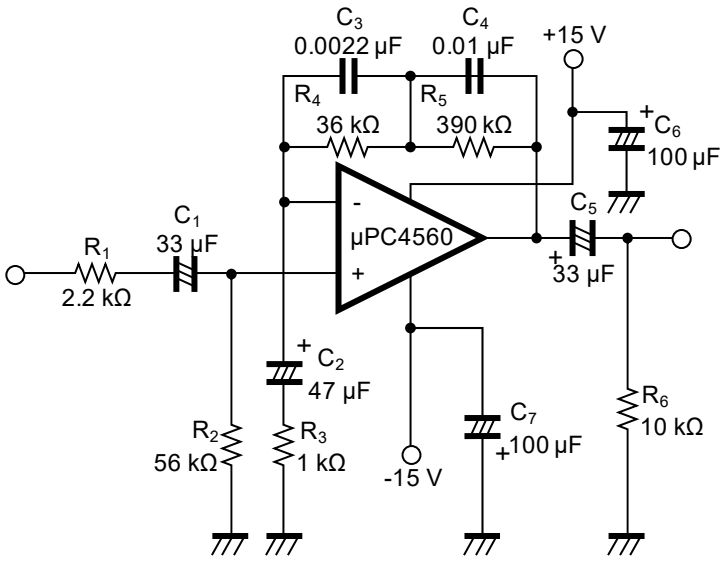
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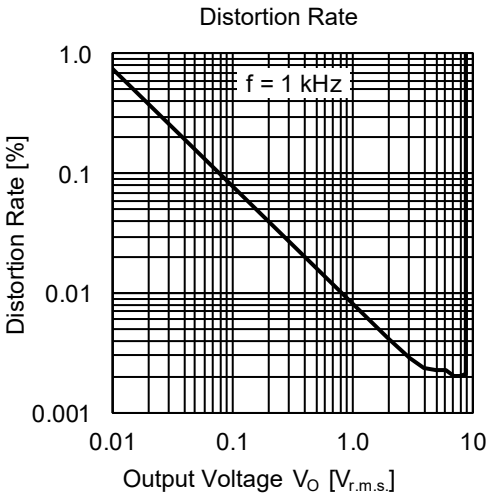
APPLICATION CIRCUIT EXAMPLE

Headphone Amplifier



RIAA Amplifier



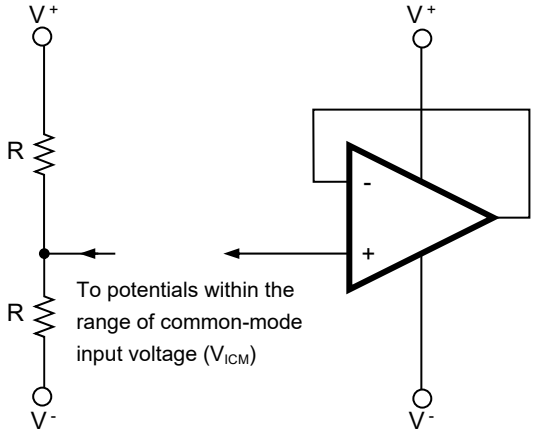


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USE WITH PRECAUTIONS

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

Example of handling unused circuit



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 the 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.

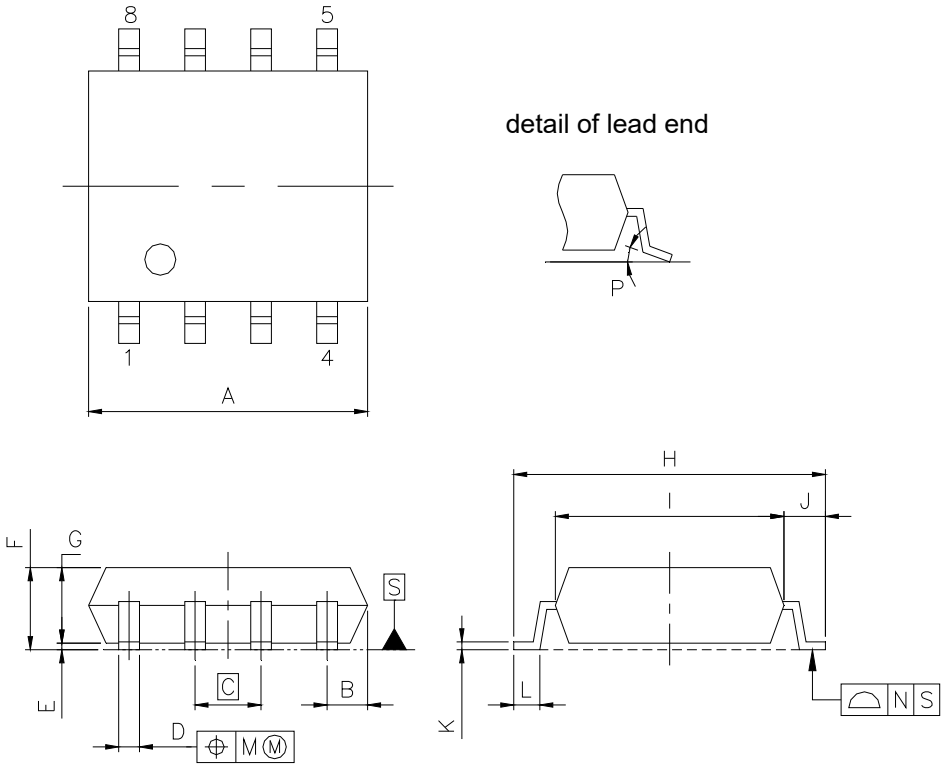
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PACKAGE DRAWINGS

8-PIN PLASTIC SOP

JEITA Package code	RENESAS code	Previous code	MASS (TYP.) [g]
P-SOP8-0225-1.27	PRSP0008DL-A	S8GM-50-225B	0.08

Unit: mm



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°

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8. 关于环境保护方面的详细内容，例如每种瑞萨电子产品的环境兼容性等，请与瑞萨电子的营业部门联系。用户负责仔细并充分查阅对管制物质的使用或含量进行管理的所有适用法律法规（包括但不限于《欧盟RoHS指令》），并在使用瑞萨电子产品时遵守所有适用法律法规。对于因用户未遵守相应法律法规而导致的损害或损失，瑞萨电子概不承担任何责任。
9. 不可将瑞萨电子产品和技术用于或者嵌入日本国内或海外相应的法律法规所禁止生产、使用及销售的任何产品或系统中。也不可将瑞萨电子产品或技术用于(1)与大规模杀伤性武器（例如核武器、化学武器、生物武器或运送此等武器的导弹，包括无人机(UAV)）的开发、设计、制造、使用、存储等相关的任何目的；(2)与常规武器的开发、设计、制造或使用相关的任何目的；(3)扰乱国际和平与安全的任何其他目的，并且不可向任何第三方销售、出口、租赁、转让、或让与瑞萨电子产品或技术，无论直接或间接知悉或者有理由知悉该第三方或任何其他方将从事上述活动。用户必须遵守对各方或交易行使司法管辖权的任意国家/地区政府所公布和管理的任何适用出口管制法律法规。
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（注1） 瑞萨电子：在本文档中指瑞萨电子株式会社及其控股子公司。
（注2） 瑞萨电子产品：指瑞萨电子开发或生产的任何产品。

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