

# μPC271, 311

R03DS0151EJ0100

Rev.1.00

## High Performance Comparator

2019.10.1

### DESCRIPTION

The μPC271 and μPC311 are high-performance general-purpose comparators that have the same input characteristics as general-purpose operational amplifiers and can directly drive standard logic circuits such as TTL, CMOS, and HNIL. Its power supply voltage range is flexible whereby it exhibits excellent characteristics not only in a 5 V single power supply but also in ± 15 V power supply which is equivalent to an operational amplifier.

These products are equipped with a strobe terminal and input offset adjustment terminals, thus they can be widely applied to various voltage comparison circuits.

Depending on the operating ambient temperature, the μPC271 is suitable for communication application while the μPC311 is suitable for general-purpose usage.

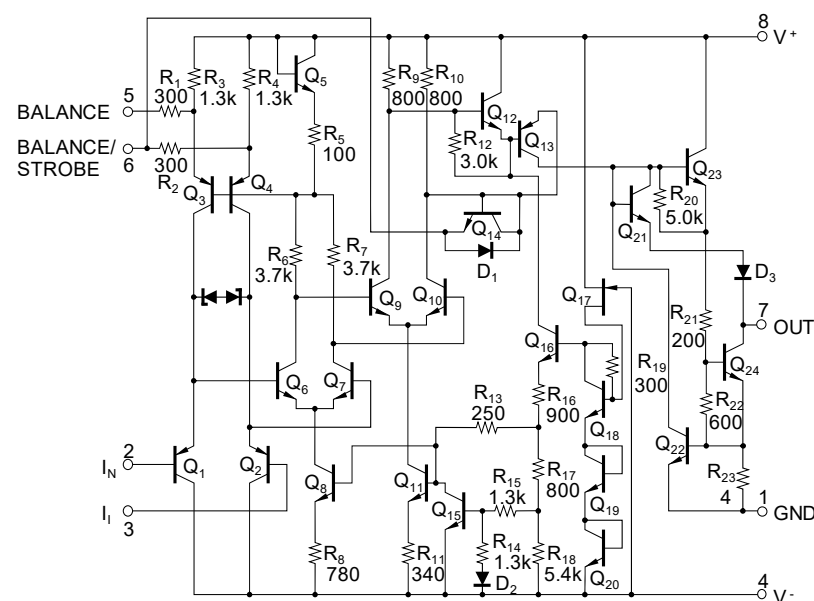
### FEATURES

- Input Offset Voltage                    ±2 mV (TYP.)
- Input Bias Current                    100 nA (TYP.)
- Pulse Response Time                200 ns (TYP.)
- Equipped with a Strobe Terminal, ideal for interfacing with logic circuits.
- Two output circuit formats are possible. (open collector, emitter follower)
- Large output current capacity to directly drive the LEDs and lamps.

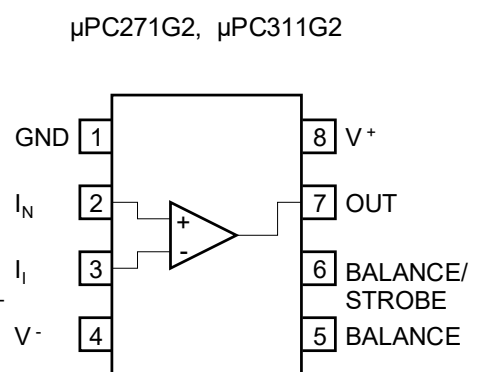
### ORDERING INFORMATION

Ordering Name	Package
μPC271G2-A	8-pin plastic SOP ( 5.72 mm ( 225 mil ) )
μPC311G2-A	8-pin plastic SOP ( 5.72 mm ( 225 mil ) )

### EQUIVALENT CIRCUIT



### PIN CONFIGURATION (Top View)



**ABSOLUTE MAXIMUM RATING (T<sub>A</sub> = 25 °C)**

PARAMETER	SYMBOL	μPC271G2	μPC311G2	UNIT
Power Supply Voltage <sup>Note1</sup>	V <sup>+</sup> - V <sup>-</sup>	-0.3 to +36		V
Differential Input Voltage	V <sub>ID</sub>	±30		V
Input Voltage <sup>Note2</sup>	V <sub>I</sub>	V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3		V
Output to Negative Supply Voltage <sup>Note3</sup>	V <sub>O</sub> - V <sup>-</sup>	-0.3 to +40		V
Ground to Negative Supply Voltage <sup>Note3</sup>	V <sub>GND</sub> - V <sup>-</sup>	-0.3 to +30		V
Total Power Dissipation <sup>Note4</sup>	P <sub>T</sub>	440		mW
Output Short Circuit Duration <sup>Note5</sup>		10		s
Operating Ambient Temperature	T <sub>A</sub>	-40 to +85	-20 to +80	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125		°C

[Note] 1. Note that reverse connections of the power supply may damage the ICs.

- The input terminal must be applied within the input voltage range to avoid deterioration or damaging the device characteristic. Do not exceed the ratings including during transient state such as ON/OFF, etc. The Comparator input voltage must operate within the electrical characteristics range of input common-mode voltage.
- The output terminal and GND terminal must be apply within the output voltage range to avoid deteriorating or damaging the device characteristic. The GND terminal must be less than V<sup>+</sup>. Do not exceed the ratings including during transient state such as ON/OFF, etc.
- This is the value at T<sub>A</sub> ≤ +25 °C. De-rate value at -4.4 mW/°C when T<sub>A</sub> > 25 °C.
- Pay attention to output terminal current and GND terminal current. 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 (Dual Supply)	V <sup>±</sup>	±4		±16	V
Power Supply Voltage (V <sup>-</sup> = GND)	V <sup>+</sup>	+5		+32	V

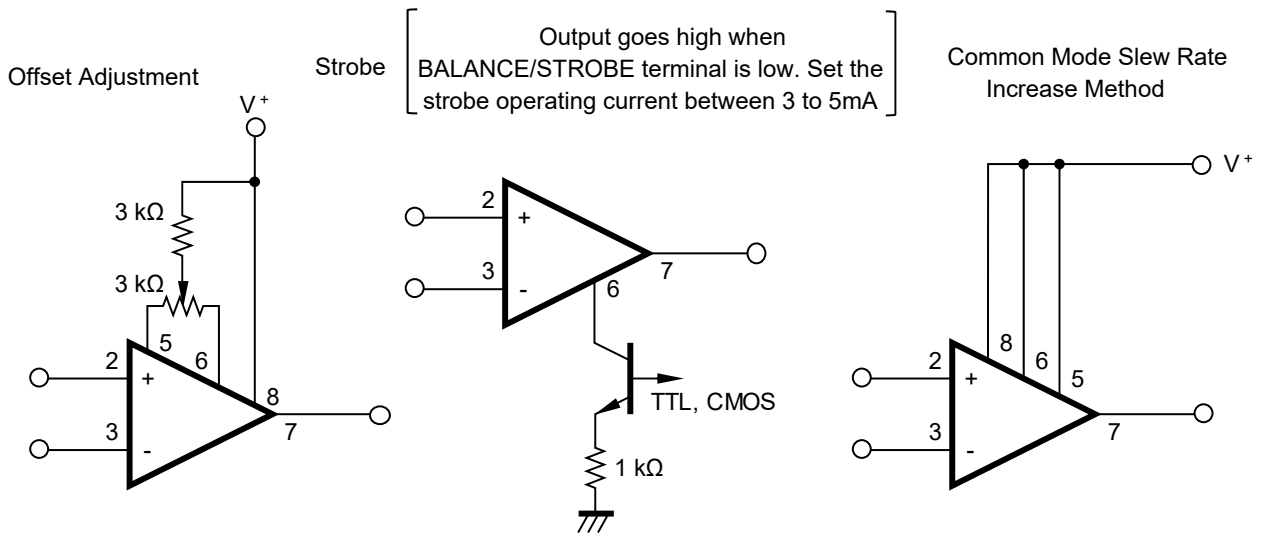
**ELECTRICAL CHARACTERISTICS (V<sup>±</sup> = ±15 V, T<sub>A</sub> = 25 °C)**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Input Offset Voltage <sup>Note6</sup>	V <sub>IO</sub>		±2.0	±7.5	mV	V <sup>+</sup> - V <sup>-</sup> = 5 V to 30 V, R <sub>S</sub> ≤ 50 kΩ
Input Offset Current <sup>Note6</sup>	I <sub>IO</sub>		±6.0	±50	nA	V <sup>+</sup> - V <sup>-</sup> = 5 V to 30 V
Input Bias Current	I <sub>B</sub>		100	250	nA	V <sup>+</sup> - V <sup>-</sup> = 5 V to 30 V
Voltage Gain	A <sub>V</sub>		200000			R <sub>L</sub> = 1.0 kΩ
Pulse Response Time			200		ns	Input step 100 mV, Overdrive 5 mV
Output Saturation Voltage	V <sub>OL</sub>		0.75	1.5	V	V <sub>I</sub> ≤ -10 mV, I <sub>O</sub> = 50 mA
Strobe Operating Current			3.0		mA	
Output Leakage Current	I <sub>O LEAK</sub>		0.2	50	nA	V <sub>I</sub> ≥ 10 mV, V <sub>O</sub> = 35 V
Positive Supply Current	I <sup>+</sup>		5.1	7.5	mA	I <sub>O</sub> = 0 A
Negative Supply Current	I <sup>-</sup>		4.1	5.0	mA	I <sub>O</sub> = 0 A
Input Offset Voltage <sup>Note6</sup>	V <sub>IO</sub>			±10	mV	V <sup>+</sup> - V <sup>-</sup> = 5 V to 30 V, R <sub>S</sub> ≤ 50 kΩ, T <sub>A</sub> = 0 to +70 °C
Input Offset Current <sup>Note6</sup>	I <sub>IO</sub>			±70	nA	V <sup>+</sup> - V <sup>-</sup> = 5 V to 30 V, T <sub>A</sub> = 0 to +70°C
Input Bias Current	I <sub>B</sub>			300	nA	V <sup>+</sup> - V <sup>-</sup> = 5 V to 30 V, T <sub>A</sub> = 0 to +70°C
Common Mode Input Voltage Range	V <sub>ICM</sub>	+13.0 -14.5	+13.8 -14.7		V	
Output Saturation Voltage	V <sub>OL</sub>		0.23	0.4	V	V <sup>+</sup> ≥ 4.5 V, V <sup>-</sup> = 0 V, V <sub>I</sub> ≤ -10 mV, I <sub>O</sub> = 8 mA

[Note] 6. The difference of the input voltage and the input bias current when the load current is 1 mA and the output is inverted.

### CIRCUIT CONNECTION EXAMPLE (1)

- BALANCE terminal, BALANCE/STROBE terminal

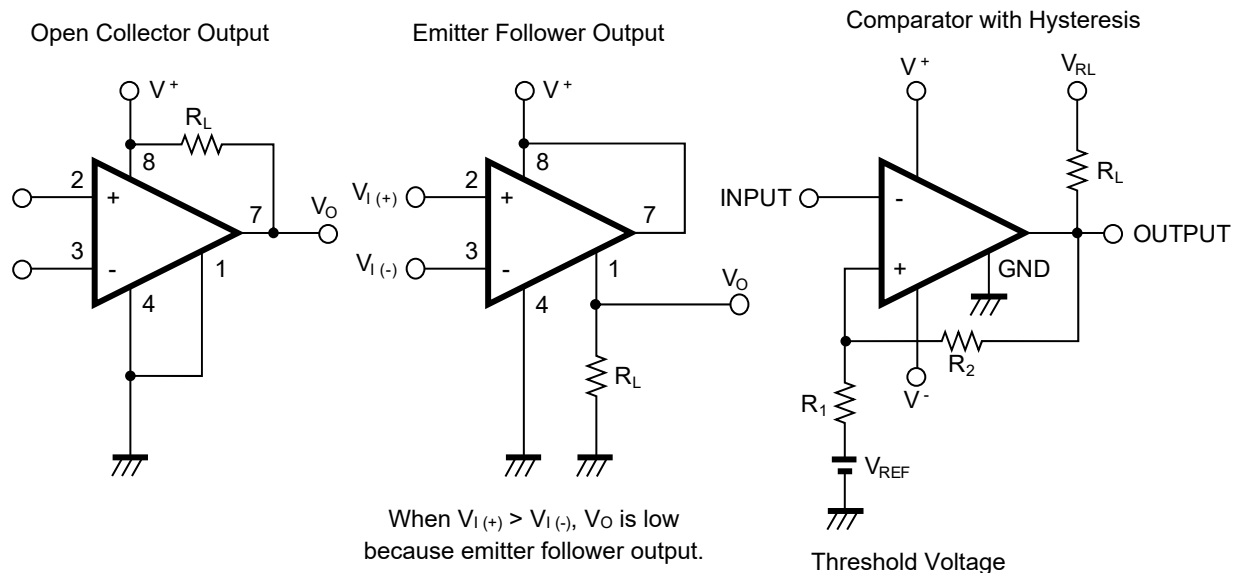


Note Use either pin 5 and pin 6 open (no offset adjustment), the offset adjustment circuit, the strobe circuit (pin 5 open) or the common mode slew rate increase method as shown in above figures. In other cases, malfunction, characteristic deterioration or damage may occur.

### CIRCUIT CONNECTION EXAMPLE (2)

### APPLICATION CIRCUIT EXAMPLE

- Output terminal, GND terminal



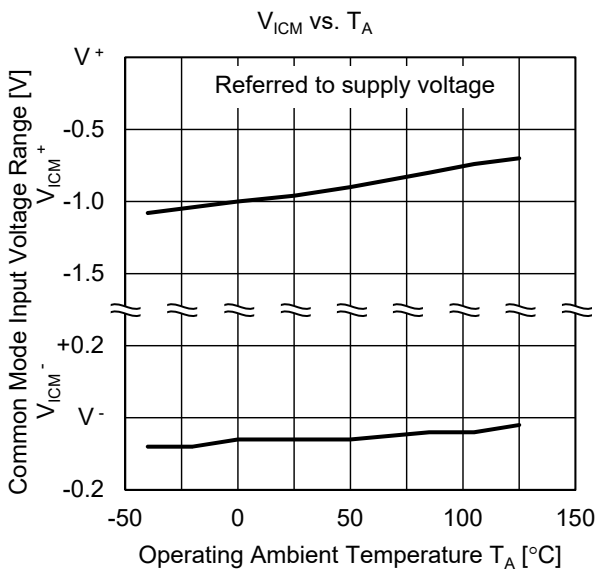
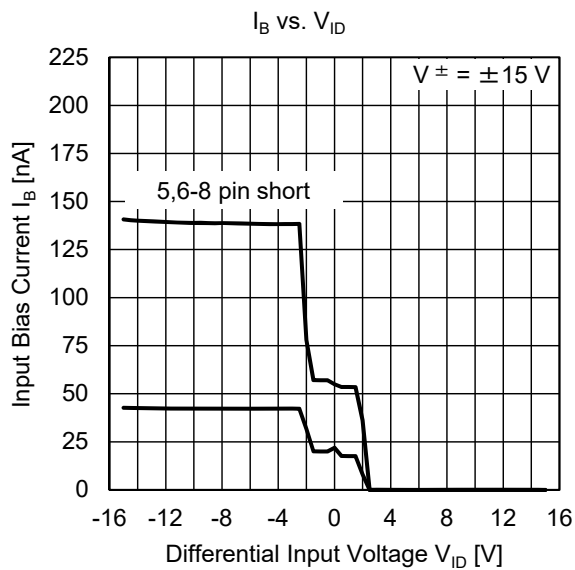
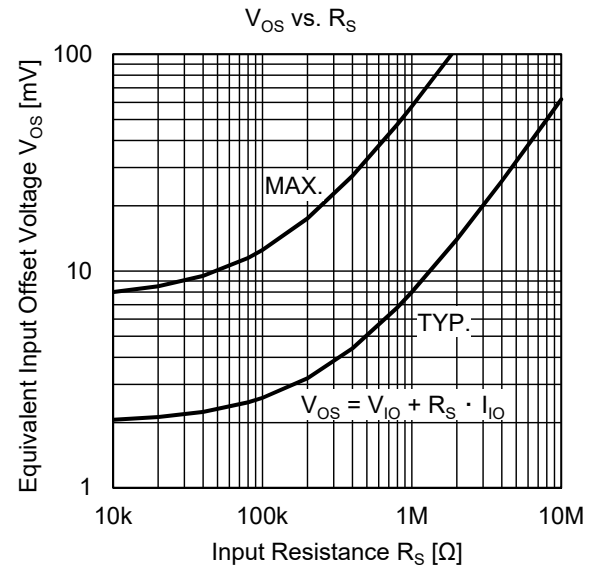
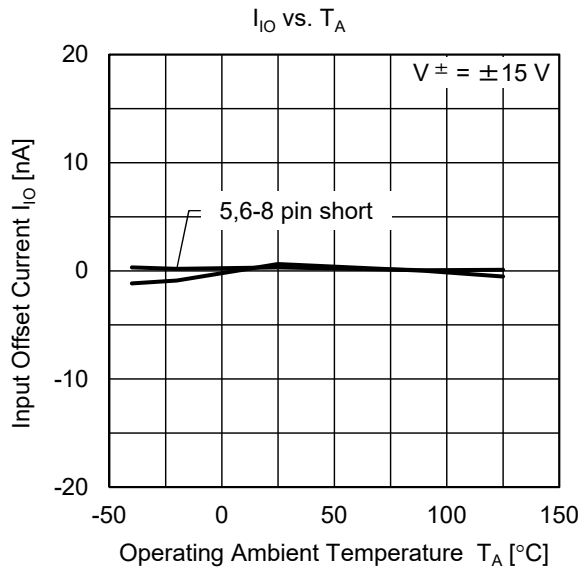
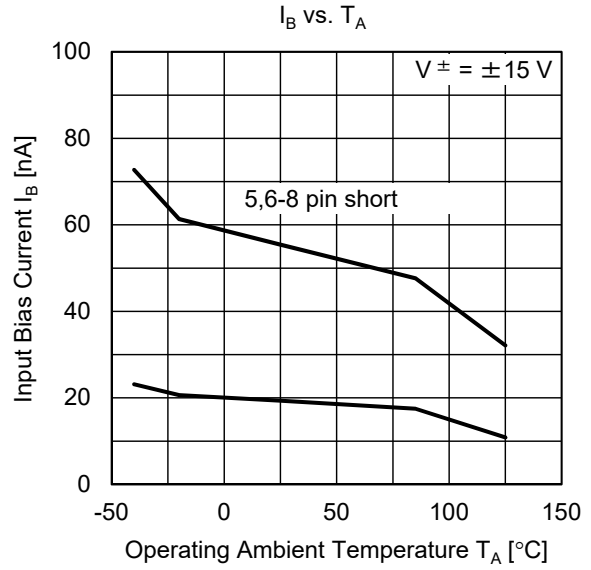
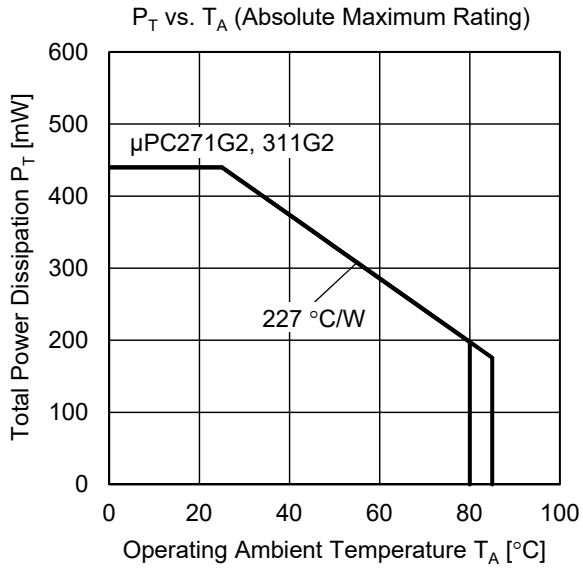
Threshold Voltage

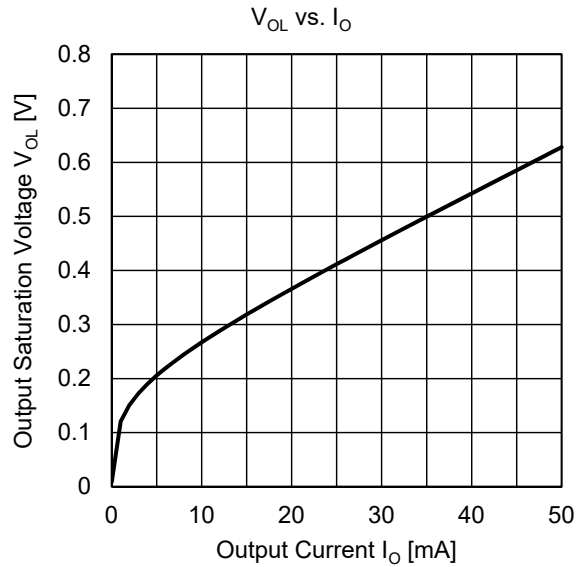
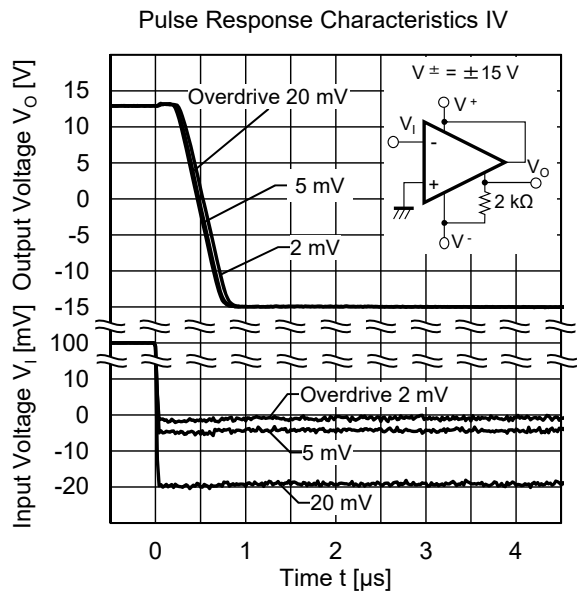
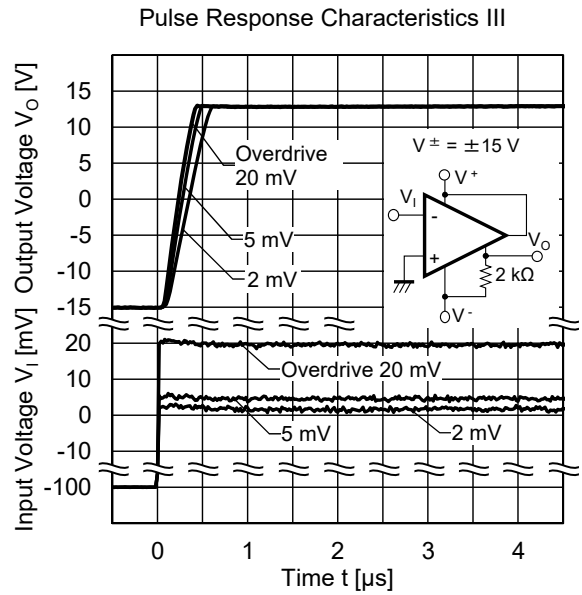
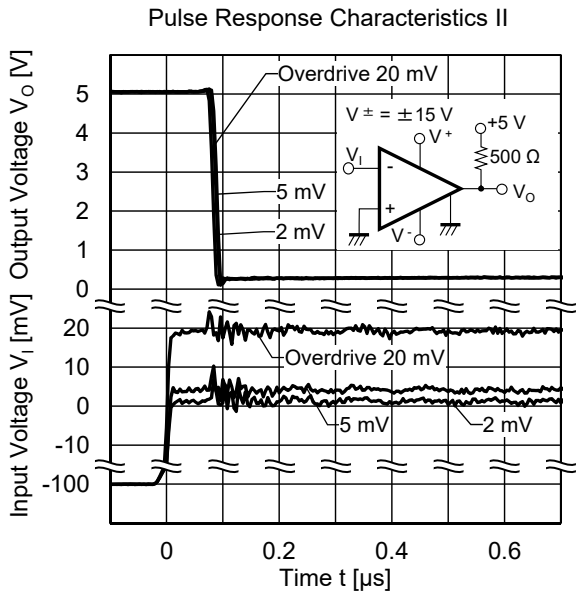
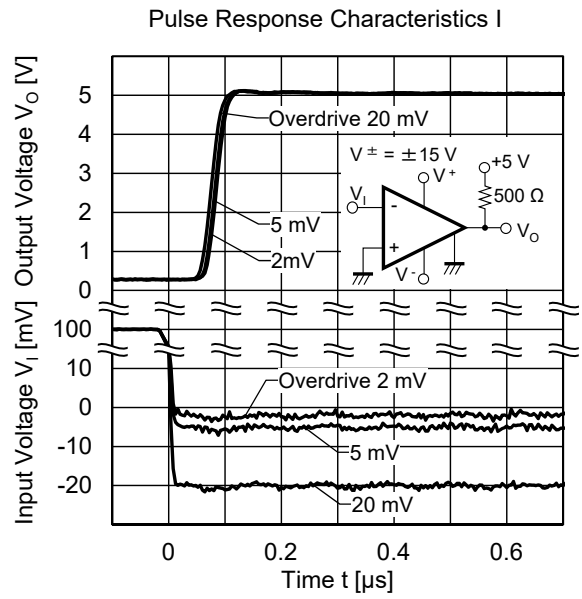
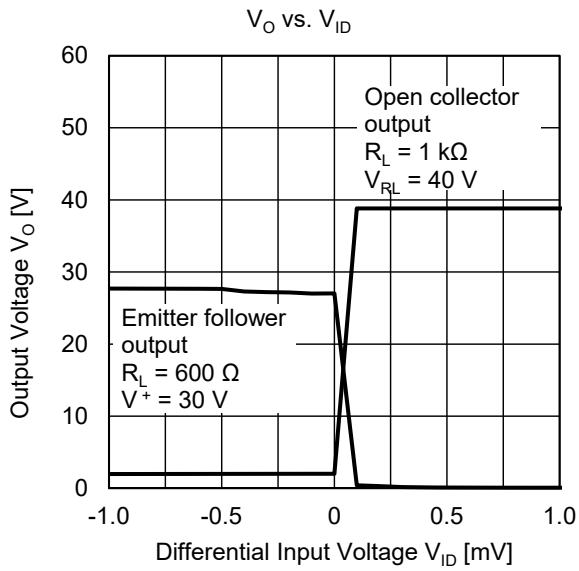
$$V_{TH(High)} \doteq V_{REF} + \frac{R_1}{R_L + R_2 + R_1} (V_{RL} - V_{REF})$$

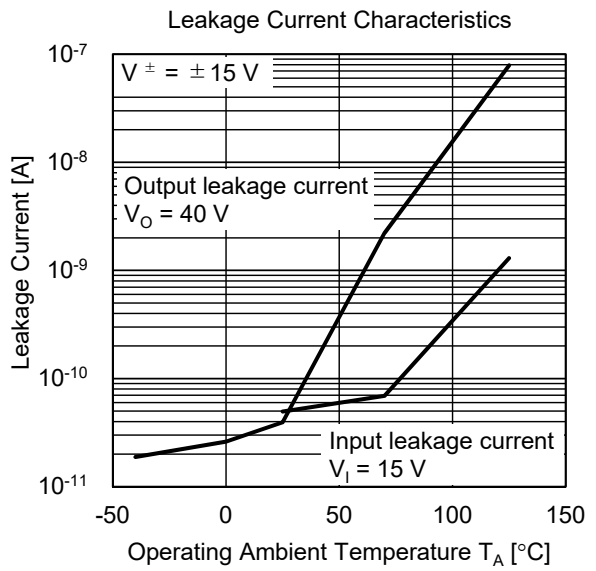
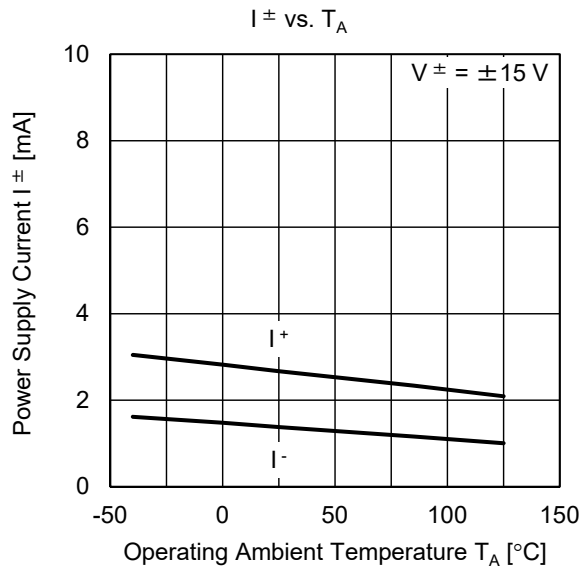
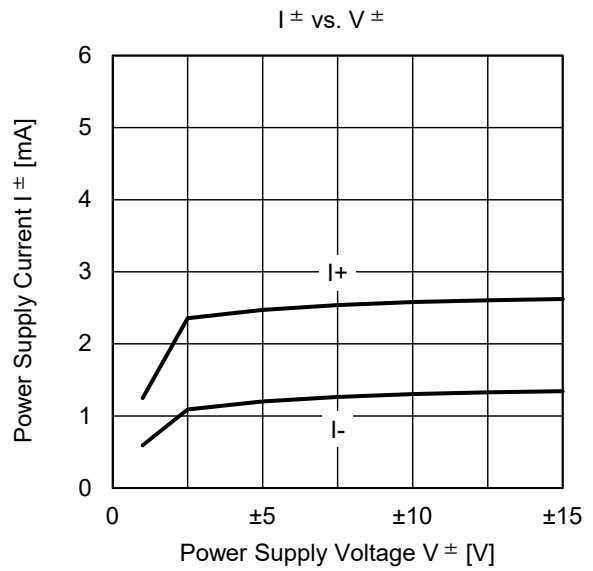
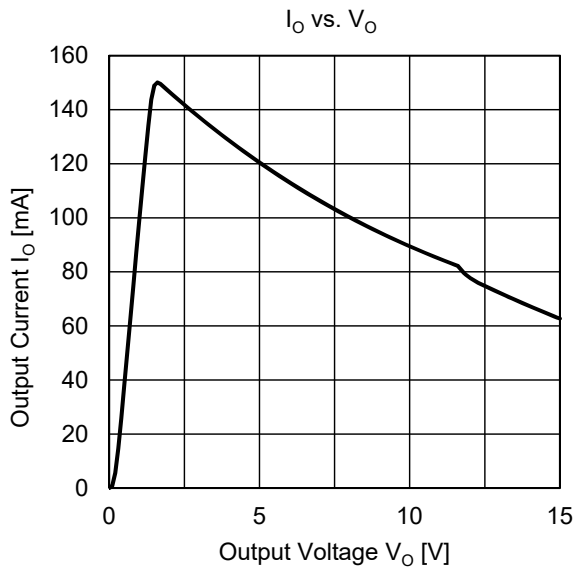
$$V_{TH(Low)} \doteq V_{REF} - \frac{R_1}{R_1 + R_2} (V_{REF} - V_{OL})$$

( $V_{RL} > V_{REF} > V_{OL}$ )

**TYPICAL PERFORMANCE CHARACTERISTICS (T<sub>A</sub> = 25 °C, TYP.) (Reference Value)**







## USE WITH PRECAUTIONS

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

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

- **Ratings of input pin voltage**

When the voltage of input pin exceeds the absolute maximum rating, the parasitic diode within the IC may conduct, causing characteristics degradation or damage. Therefore, please use the input pin within the power supply voltage range. In addition, if it 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 power supply voltage does not meet the condition of electrical characteristics, the range of common-mode input voltage is as follows.

$$V_{\text{ICM}} (\text{TYP.}) : V^- + 0.3 \text{ to } V^+ - 1.2 \text{ [V]} (T_A = 25 \text{ }^\circ\text{C})$$

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

- **Handling of ICs**

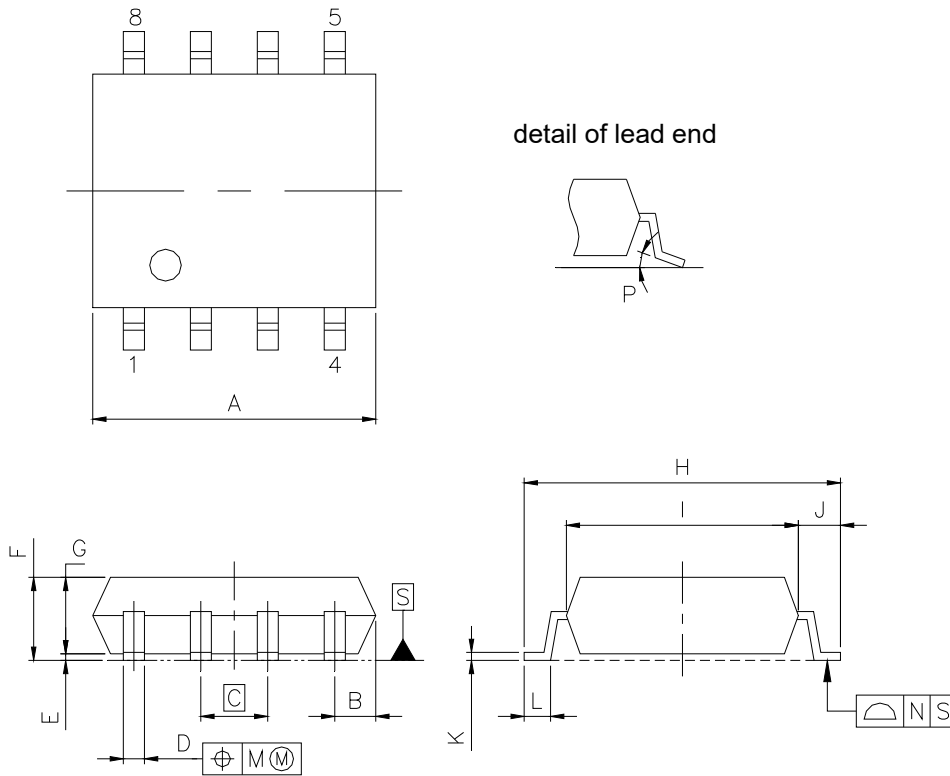
When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuate due to piezoelectric (piezo) effect. Therefore, please pay attention to warpage or bending of a board.

**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 <sup>+0.17</sup> / <sub>-0.20</sub>
B	0.78 MAX
<span style="border: 1px solid black;">C</span>	1.27 (T.P)
D	0.42 <sup>+0.08</sup> / <sub>-0.07</sub>
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 <sup>+0.08</sup> / <sub>-0.07</sub>
L	0.6 ±0.2
M	0.12
N	0.10
P	3° <sup>+7°</sup> / <sub>-3°</sub>



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- 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、使用或销售的任何产品或系统中。也不可将其用于(1)与大规模杀伤性武器（例如核武器、化学武器、生物武器或运送这些武器的导弹，包括无人飞行器(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。
- 瑞萨电子产品的买方或分销商，或者分销、处置产品、或以其他方式向第三方出售或转让产品的任何其他方有责任事先向所述第三方通知本文件规定的内容和条件。
- 在事先未得到瑞萨电子书面认可的情况下，不得以何形式部分或全部再版、转载或复制本文件。
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