

UPC271, UPC311

High Performance Comparator

DESCRIPTION

The UPC271 and UPC311 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 HN1L. 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 UPC271 is suitable for communication application while the UPC311 is suitable for general-purpose usage.

FEATURES

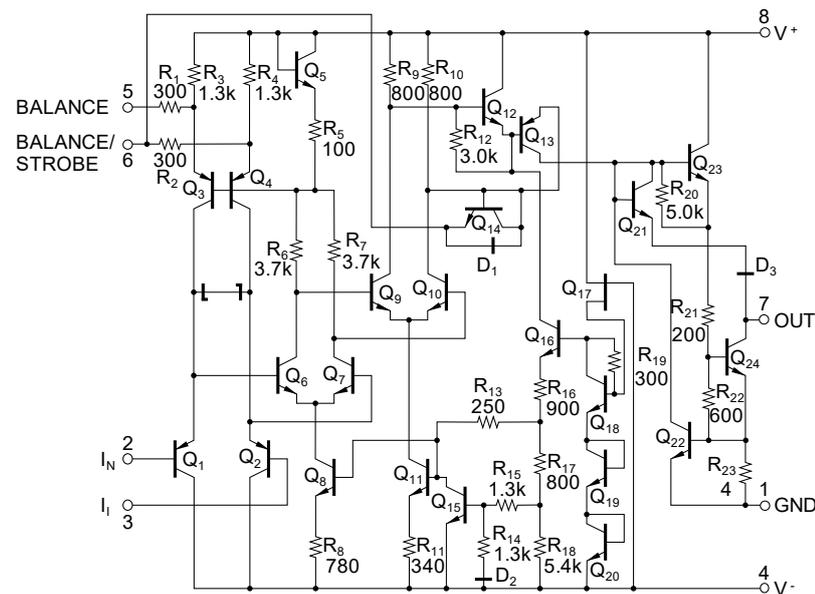
- Input Offset Voltage ± 2 mV (TYP.)
- Input Bias Current 100 nA (TYP.)
- Pulse Response Time 200 ns (TYP.)
- Equipped with a Strobe Terminal, ideal for interfacing with logic circuits.
- Two output circuit formats are possible. (open collector, emitter follower)
- Large output current capacity to directly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

ORDERING INFORMATION

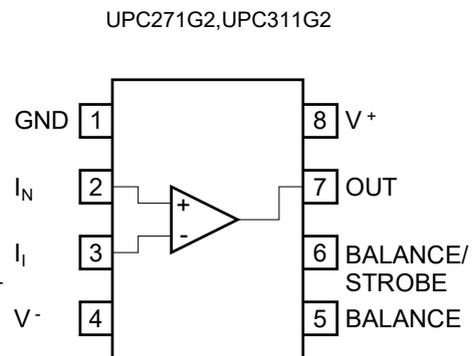
Order Name ⁽¹⁾	Package
UPC271G2-AP	8-pin plastic SOP (5.72 mm (225))
UPC311G2-AP	8-pin plastic SOP (5.72 mm (225))

(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



PIN CONFIGURATION (Top View)



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	UPC271G2	UPC311G2	Unit
Power Supply Voltage ^{Note1}	V ⁺ - V ⁻	-0.3 to +36		V
Differential Input Voltage	V _{ID}	±30		V
Input Voltage ^{Note2}	V _I	V ⁻ -0.3 to V ⁺ +0.3		V
Output to Negative Supply Voltage ^{Note3}	V _O - V ⁻	-0.3 to +40		V
Ground to Negative Supply Voltage ^{Note3}	V _{GND} - V ⁻	-0.3 to +30		V
Total Power Dissipation ^{Note4}	P _T	440		mW
Output Short Circuit Duration ^{Note5}		10		s
Operating Ambient Temperature	T _A	-40 to +85	-20 to +80	°C
Storage Temperature	T _{stg}	-55 to +125		°C

- [Note] 1. Note that reverse connections of the power supply may damage the ICs.
2. 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.
3. 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⁺. Do not exceed the ratings including during transient state such as ON/OFF, etc.
4. This is the value at T_A ≤ +25 °C. De-rate value at -4.4 mW/°C when T_A > 25 °C.
5. 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 [±]	±4		±16	V
Power Supply Voltage (V ⁻ = GND)	V ⁺	+5		+32	V

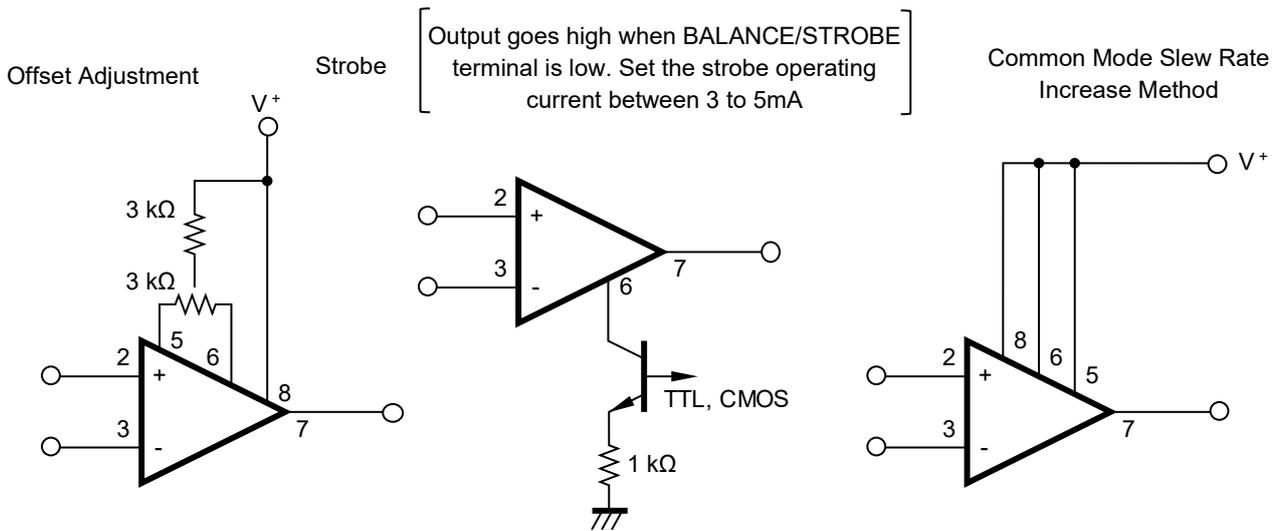
ELECTRICAL CHARACTERISTICS (V[±] = ±15 V, T_A = 25 °C)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage ^{Note6}	V _{IO}		±2.0	±7.5	mV	V ⁺ - V ⁻ = 5 V to 30 V, R _S ≤ 50 kΩ
Input Offset Current ^{Note6}	I _{IO}		±6.0	±50	nA	V ⁺ - V ⁻ = 5 V to 30 V
Input Bias Current	I _B		100	250	nA	V ⁺ - V ⁻ = 5 V to 30 V
Voltage Gain	A _v		200000			R _L = 1.0 kΩ
Pulse Response Time			200		ns	Input step 100 mV, Overdrive 5 mV
Output Saturation Voltage	V _{OL}		0.75	1.5	V	V _I ≤ -10 mV, I _O = 50 mA
Strobe Operating Current			3.0		mA	
Output Leakage Current	I _{O LEAK}		0.2	50	nA	V _I ≥ 10 mV, V _O = 35 V
Positive Supply Current	I ⁺		5.1	7.5	mA	I _O = 0 A
Negative Supply Current	I ⁻		4.1	5.0	mA	I _O = 0 A
Input Offset Voltage ^{Note6}	V _{IO}			±10	mV	V ⁺ - V ⁻ = 5 V to 30 V, R _S ≤ 50 kΩ, T _A = 0 to +70 °C
Input Offset Current ^{Note6}	I _{IO}			±70	nA	V ⁺ - V ⁻ = 5 V to 30 V, T _A = 0 to +70°C
Input Bias Current	I _B			300	nA	V ⁺ - V ⁻ = 5 V to 30 V, T _A = 0 to +70°C
Common Mode Input Voltage Range	V _{ICM}	+13.0 -14.5	+13.8 -14.7		V	
Output Saturation Voltage	V _{OL}		0.23	0.4	V	V ⁺ ≥ 4.5 V, V ⁻ = 0 V, V _I ≤ -10 mV, I _O = 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

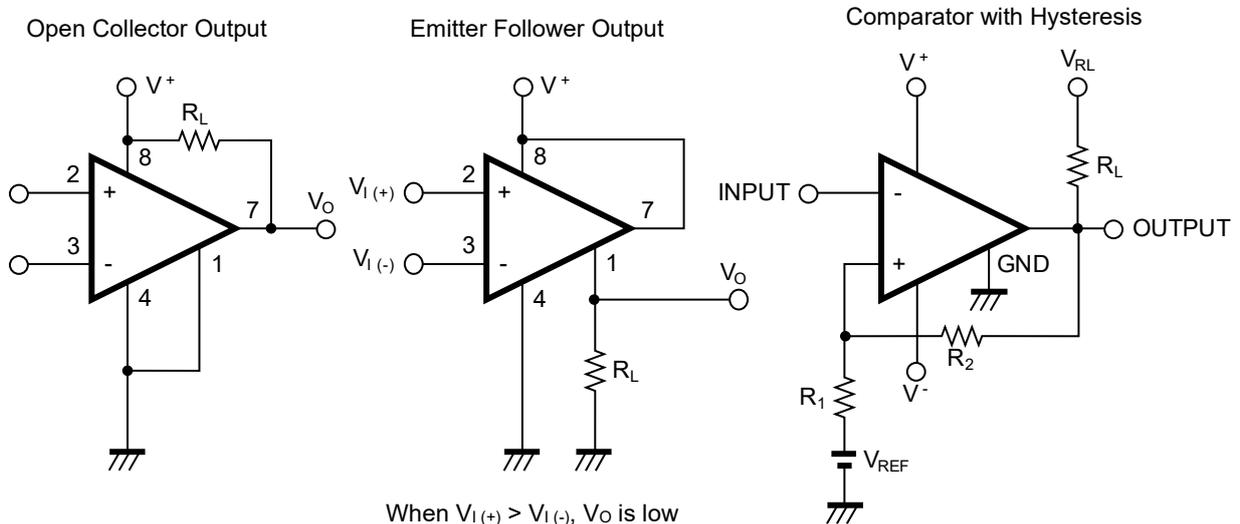


Note Use either pin 5 and pin 6 open (no offset adjustment), the offset adjustment circuit, the strobe circuit (pin 5 open) or the common mode slew rate increase method as shown in above figures. In other cases, malfunction, characteristic deterioration or damage may occur.

CIRCUIT CONNECTION EXAMPLE (2)

APPLICATION CIRCUIT EXAMPLE

- Output terminal, GND terminal



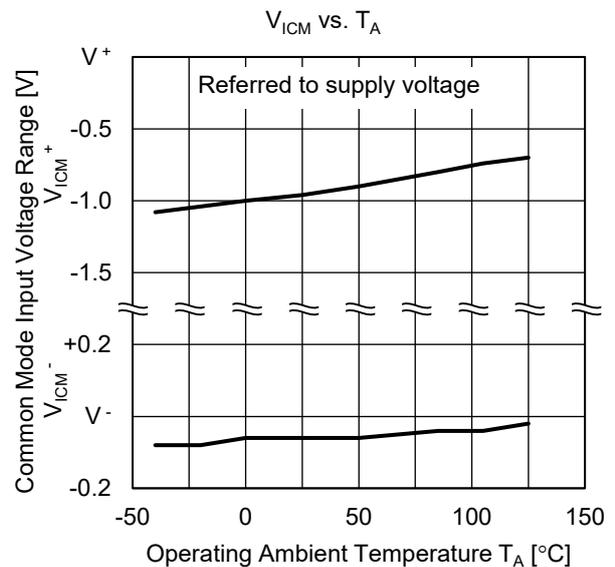
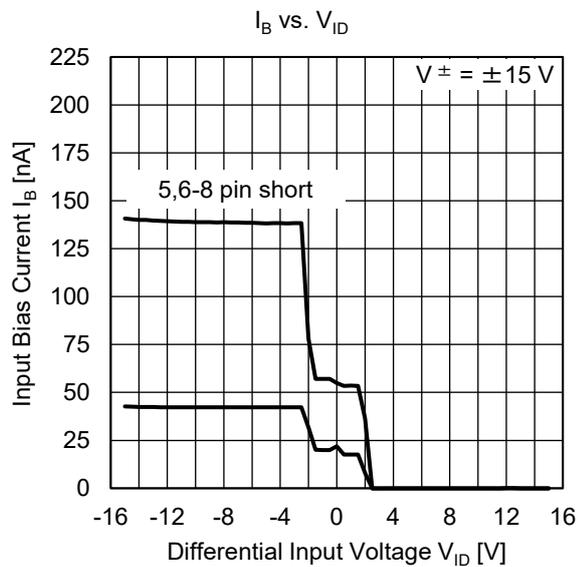
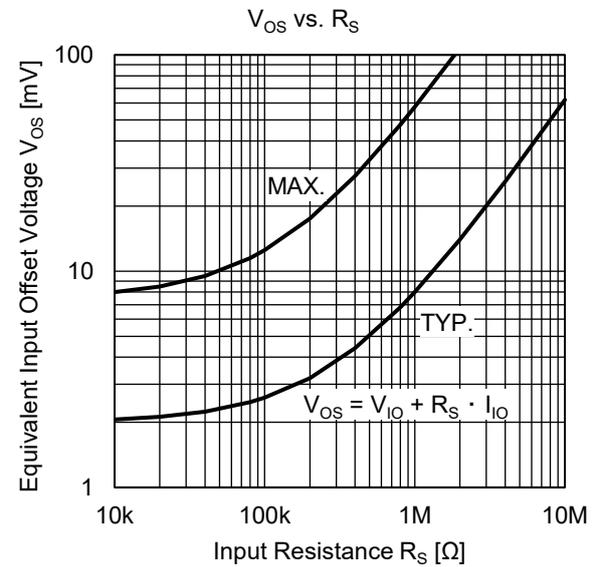
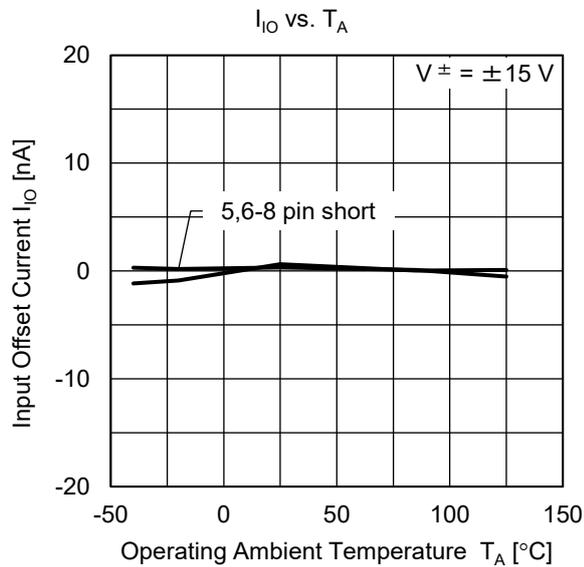
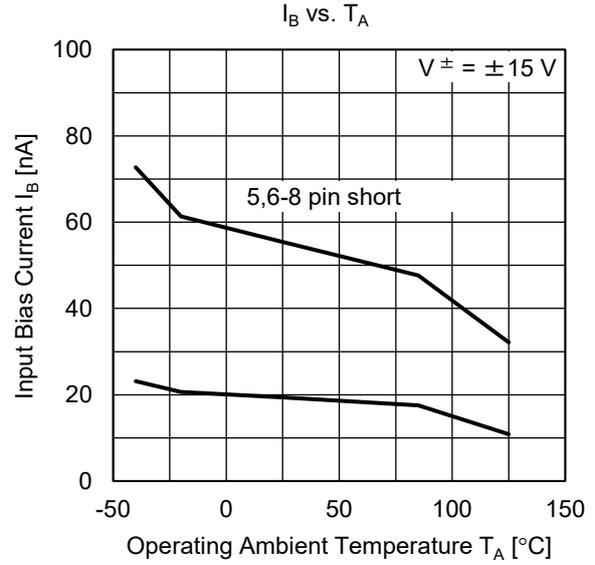
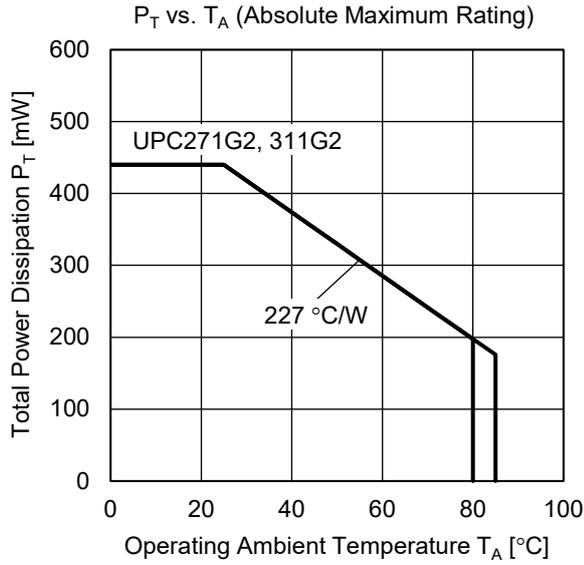
Threshold Voltage

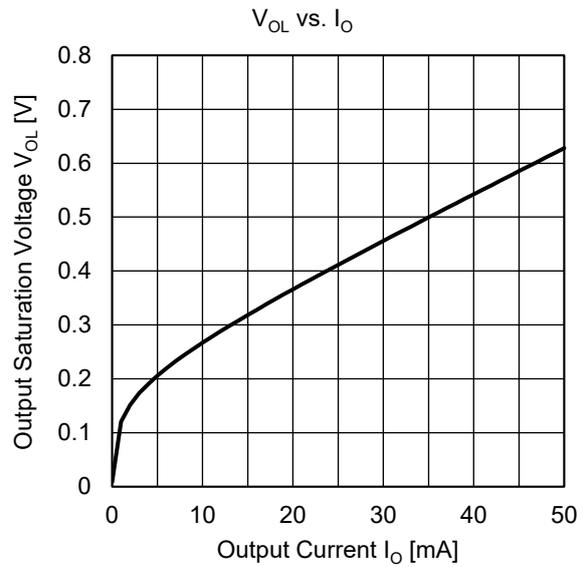
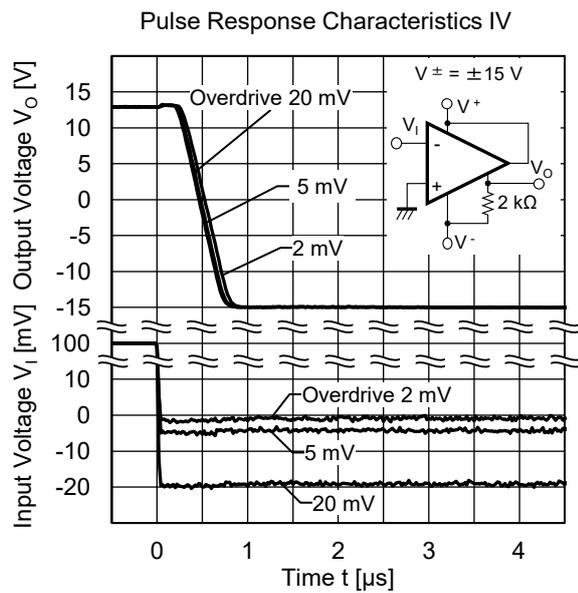
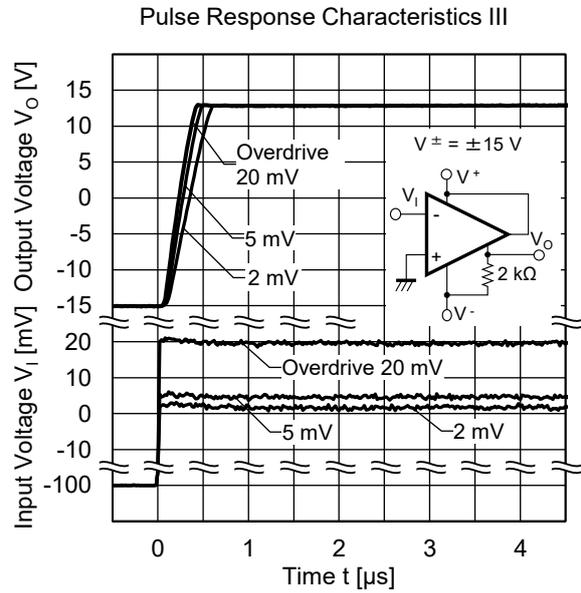
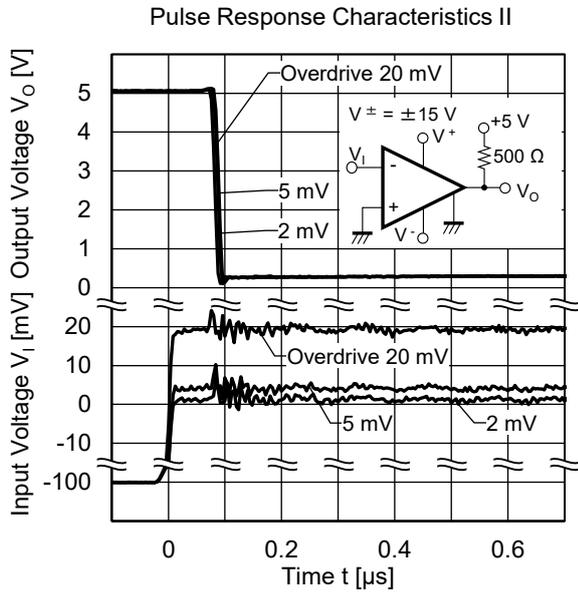
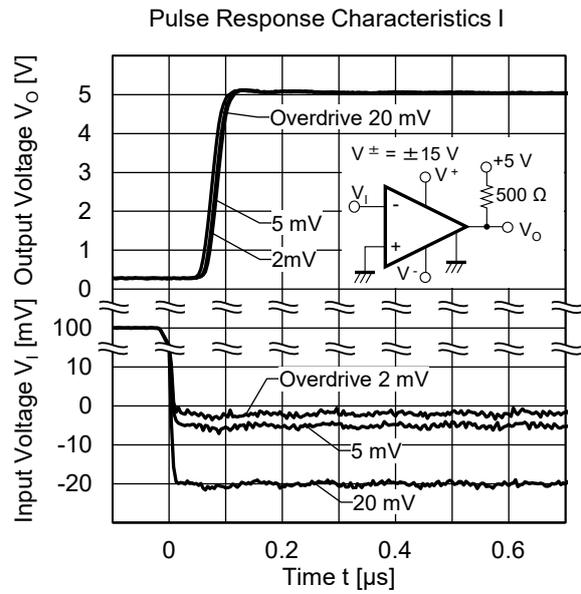
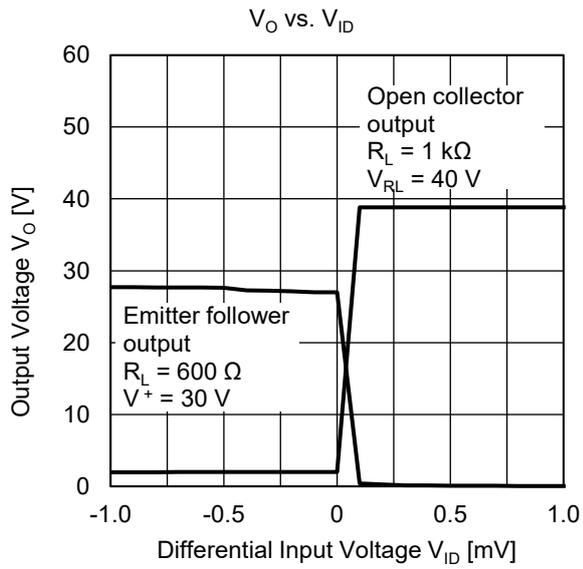
$$V_{TH(High)} \doteq V_{REF} + \frac{R_1}{R_L + R_2 + R_1} (V_{RL} - V_{REF})$$

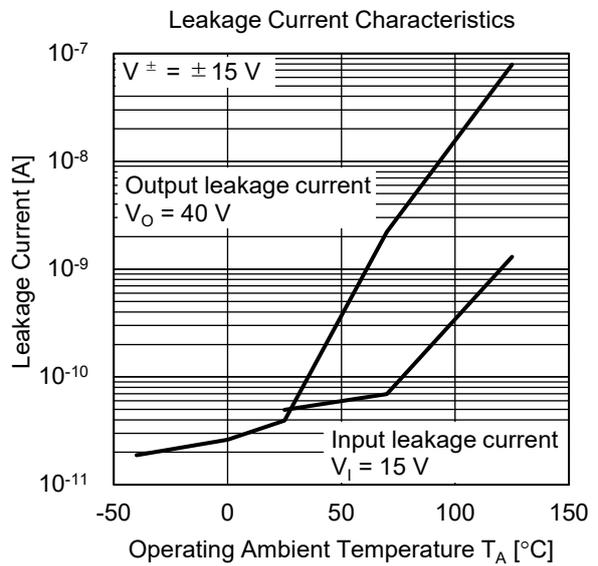
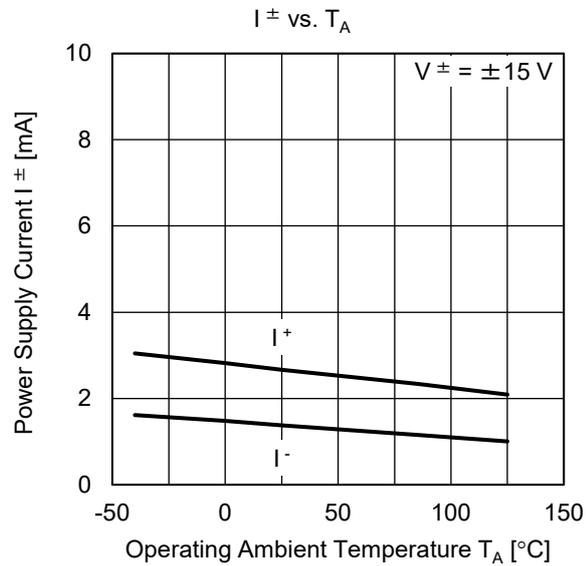
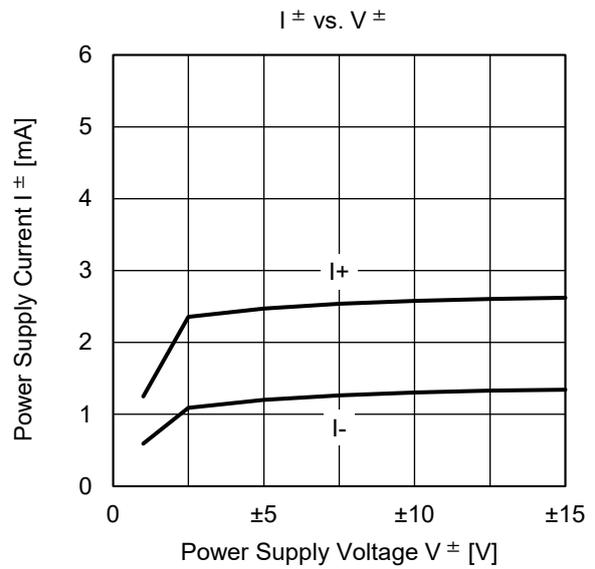
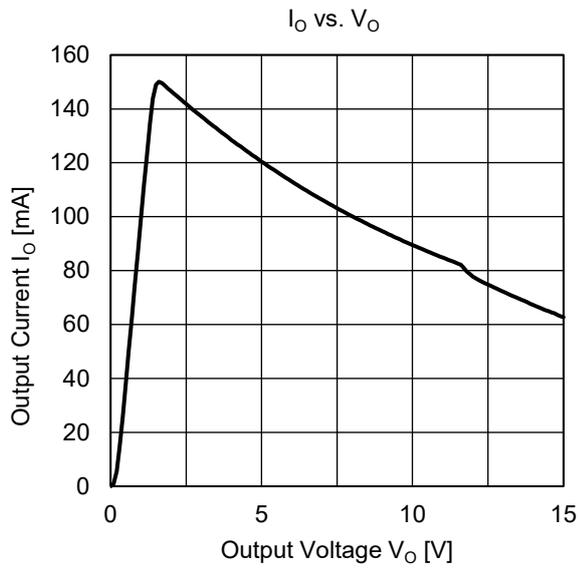
$$V_{TH(Low)} \doteq V_{REF} - \frac{R_1}{R_1 + R_2} (V_{REF} - V_{OL})$$

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

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 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.

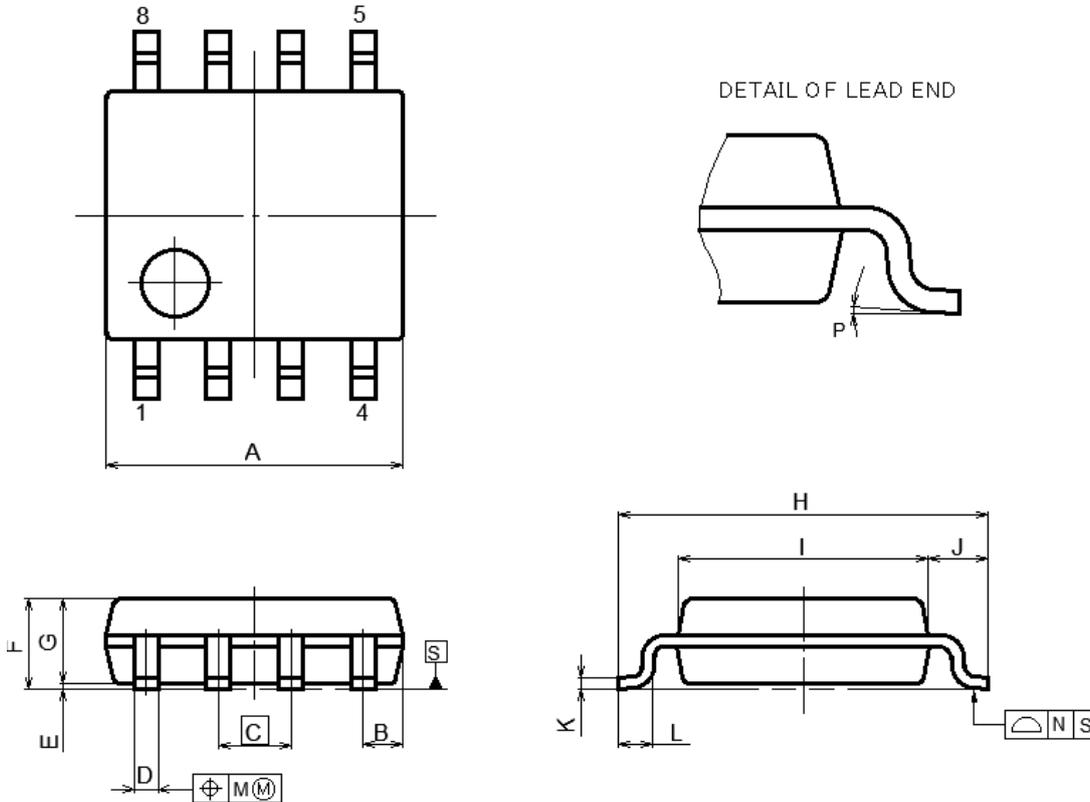
- **Handling of ICs**

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	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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