

UPC811

High Stability,

Low Offset Voltage J-FET Input Operational Amplifier

DESCRIPTION

UPC811 is a unique J-FET input operational amplifier that uses a high-speed PNP transistor ($f_T = 300 \text{ MHz}$) for the output stage to achieve fast response and high stability.

The resistor-trimming method proven in other Renesas High-Precision Op-Amp and High-Precision reference voltage is incorporate in this Op-Amp input stage, thus producing an excellent low offset voltage characteristics that has surpasses conventional general purpose op-amp in spite of being J-FET input.

Along with this series of lineup, the dual type operational amplifier, UPC812 and 4092 with the same circuit configuration are also available.

FEATURES

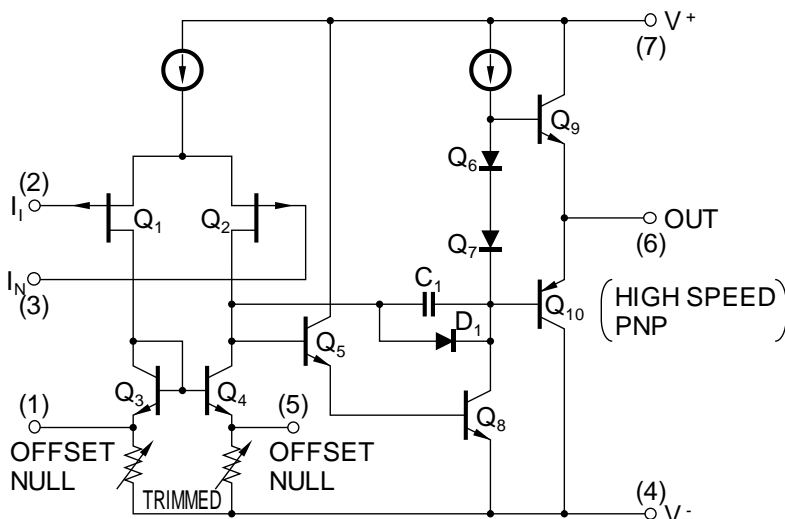
- Input Offset Voltage $\pm 1 \text{ mV (TYP.) (}\pm 2.5 \text{ mV MAX.)}$
- V_{IO} Temperature Drift $\pm 7 \mu\text{V}/^\circ\text{C (TYP.)}$
- Input Bias Current 50 pA (TYP.)
- Slew Rate $15 \text{ V}/\mu\text{s (TYP.)}$
- Unity Gain Frequency 4 MHz (TYP.)
- Input Equivalent Noise Voltage Density $19 \text{ nV}/\sqrt{\text{Hz}} \text{ (TYP.) (}f = 1 \text{ kHz)}$
- Stable operation against capacitive load (Capacitive Load at 10000 pF , $AV = +1$)
- Built-In Phase Compensation Circuit
- Built-In Output Short Circuit Protection
- Standard Single Op-Amp terminal connection (pin compatible)

ORDERING INFORMATION

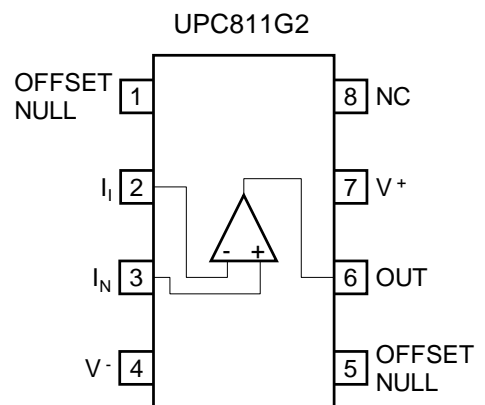
Order Name ⁽¹⁾	Package
UPC811G2-AP	8-Pin plastic SOP (5.72 mm (225))

(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)



Note NC : No Connection

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

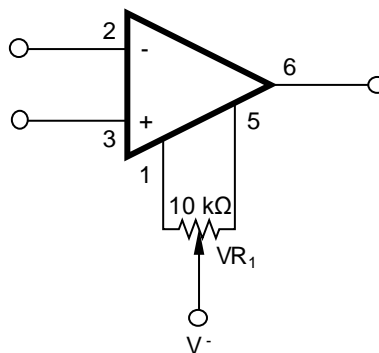
Parameter	Symbol	UPC811G2	Unit
Supply Voltage ^{Note1}	V ⁺ - V ⁻	-0.3 ~ +36	V
Differential Input Voltage	V _{ID}	±30	V
Input Voltage ^{Note2}	V _I	V ⁻ -0.3 ~ V ⁺ +0.3	V
Output Applied Voltage ^{Note3}	V _O	V ⁻ -0.3 ~ V ⁺ +0.3	V
Total Power Dissipation ^{Note4}	P _T	440	mW
Output Short Circuit Duration ^{Note5}		Indefinite	s
Operating Ambient Temperature	T _A	-40 ~ +85	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C

- [Note]**
- Note that reverse connections of the power supply may damage the ICs.
 - 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.
 - 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.
 - This is the value at T_A ≤ +25 °C. De-rate value at -4.4 mW/°C when T_A > 25 °C.
 - 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 [±]	±5		±16	V
Load Current	I _o			±10	mA
Load Capacitance (When A _v = +1)	C _L			10000 ^{Note6}	pF

- [Note]** 6. This is the value when the feedback resistor (R_f) = 0 Ω. The higher the R_f value, the more likely it is to oscillate due to the influence of the input capacitance. So connect a capacitor of about 100 pF in parallel with R_f.

OFFSET ADJUSTMENT METHOD

- [Note]** OFFSET NULL pin should be open or connected to V⁻ via a resistor as shown above. Any connection other than V⁻ may cause malfunction, characteristics degradation or damage.

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

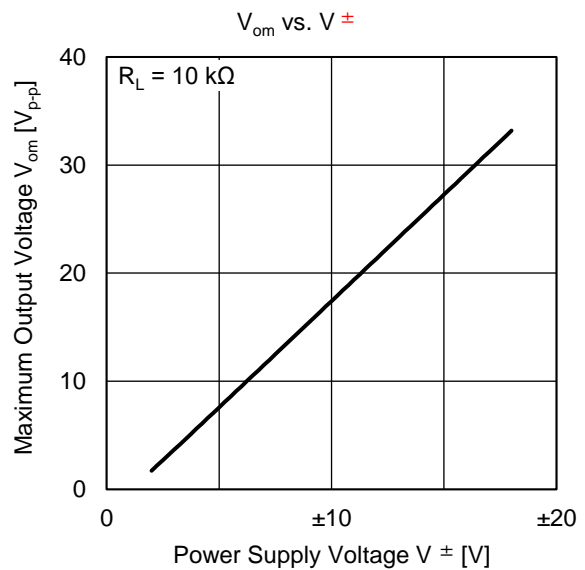
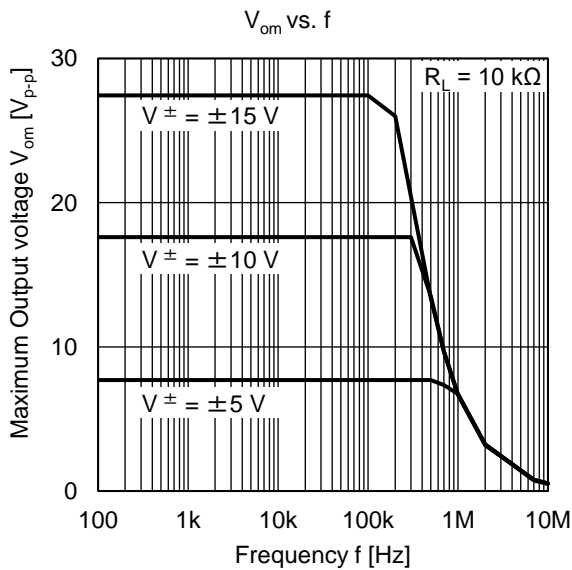
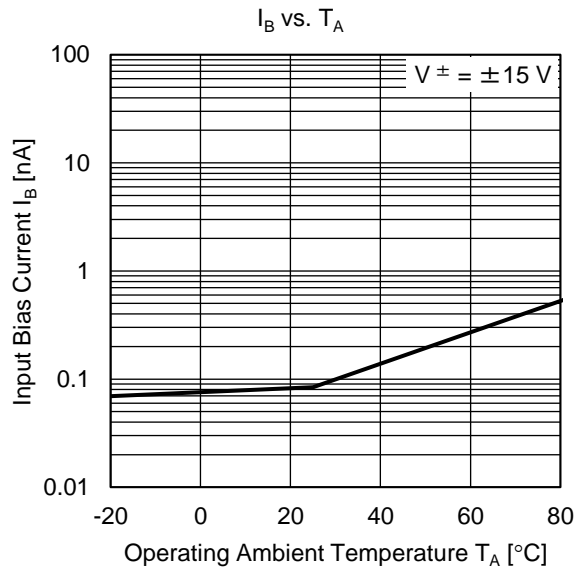
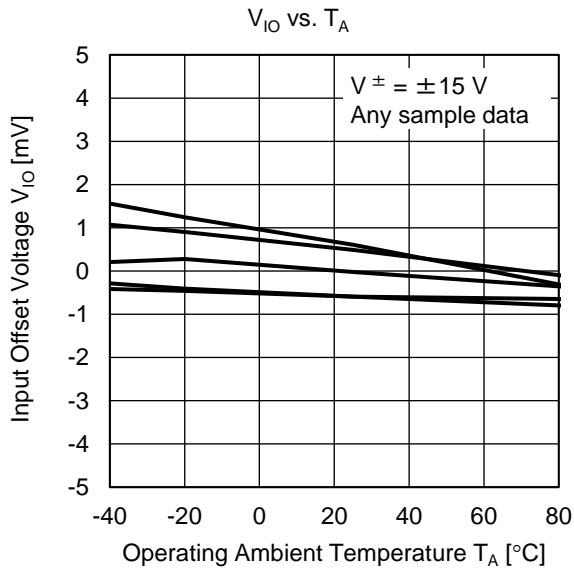
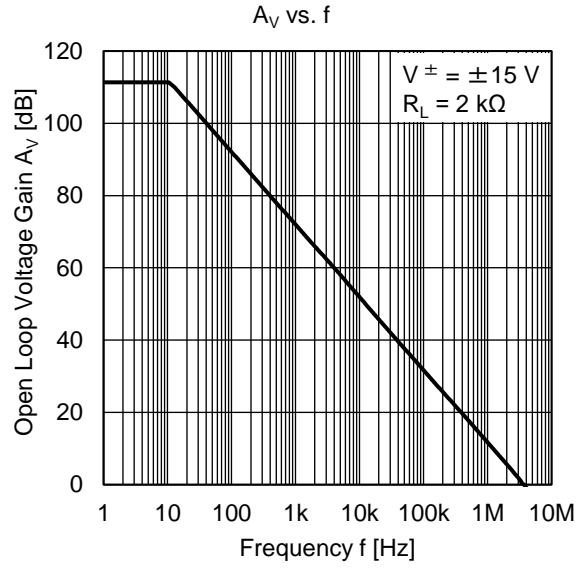
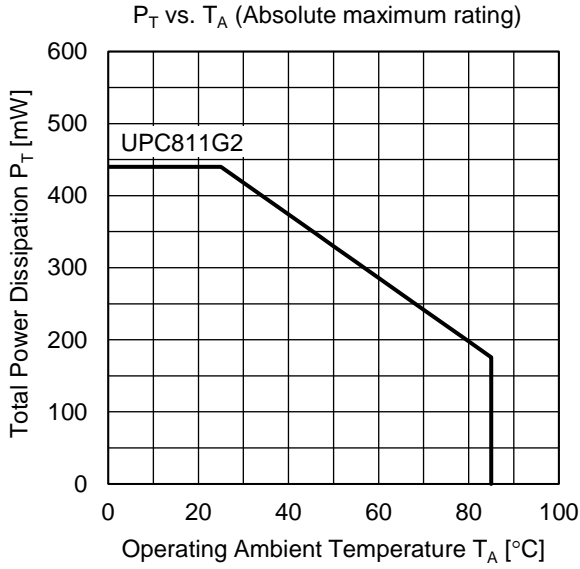
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V _{IO}		±1	±2.5	mV	R _S ≤ 50 Ω
Input Offset Current ^{Note7}	I _{IO}		±25	±100	pA	
Input Bias Current ^{Note7}	I _B		50	200	pA	
Large Signal Voltage Gain	A _V	25	200		V/mV	R _L ≥ 2 kΩ, V _O = ±10 V
Circuit Current	I _{CC}		2.5	3.4	mA	I _O = 0 A
Common Mode Rejection Ratio	CMR	70	100		dB	
Supply Voltage Rejection Ratio	SVR	70	100		dB	
Output Voltage Swing	V _{om}	±12	+14.0 -13.3		V	R _L ≥ 10 kΩ
Output Voltage Swing	V _{om}	±10	+13.5 -12.8		V	R _L ≥ 2 kΩ
Common Model Input Voltage Range	V _{ICM}	±11	+14 -12		V	
Slew Rate	SR		15		V/μs	A _V = 1
Unity Gain Frequency	f _{unity}		4		MHz	
Input Equivalent Noise Voltage Density	e _n		19		nV/√Hz	R _S = 100 Ω, f = 1 kHz
Input Offset Voltage	V _{IO}			±5	mV	R _S ≤ 50 Ω, T _A = -20 ~ +70 °C
Average V _{IO} Temperature Drift	ΔV _{IO} /ΔT		±7		μV/°C	T _A = -20 ~ +70 °C
Input Offset Current ^{Note7}	I _{IO}			±2	nA	T _A = -20 ~ +70 °C
Input Bias Current ^{Note7}	I _B			7	nA	T _A = -20 ~ +70 °C

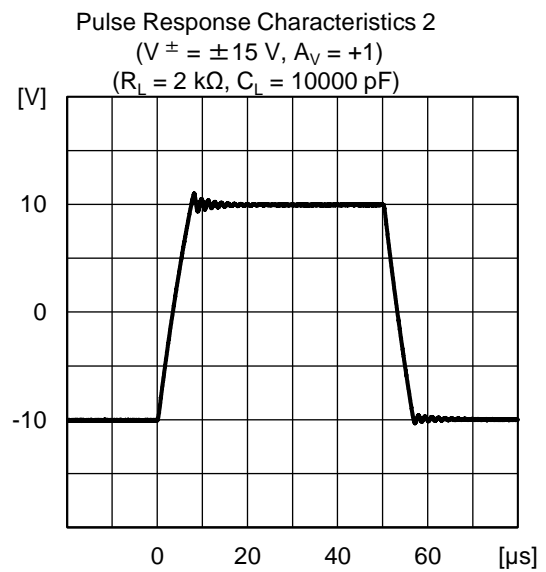
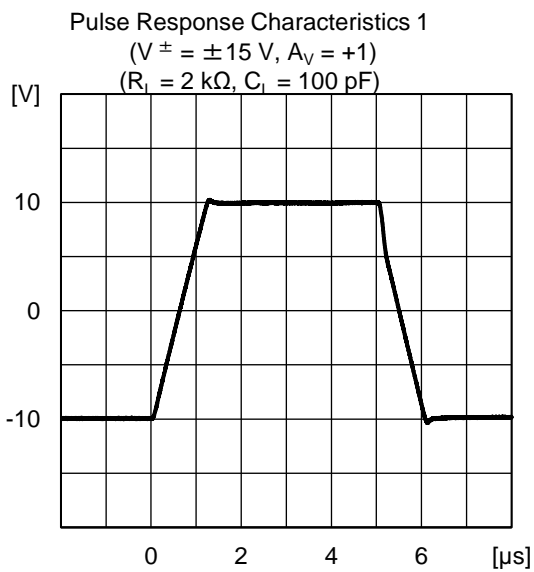
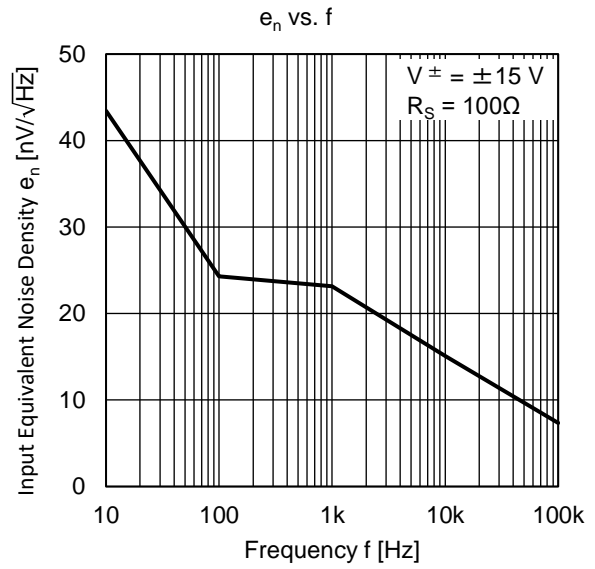
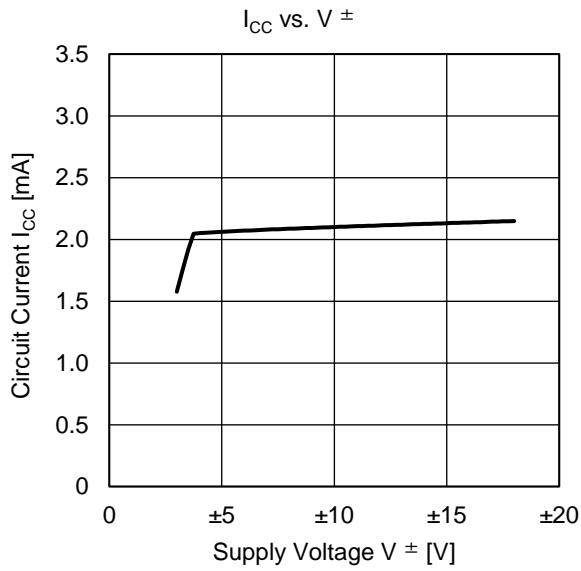
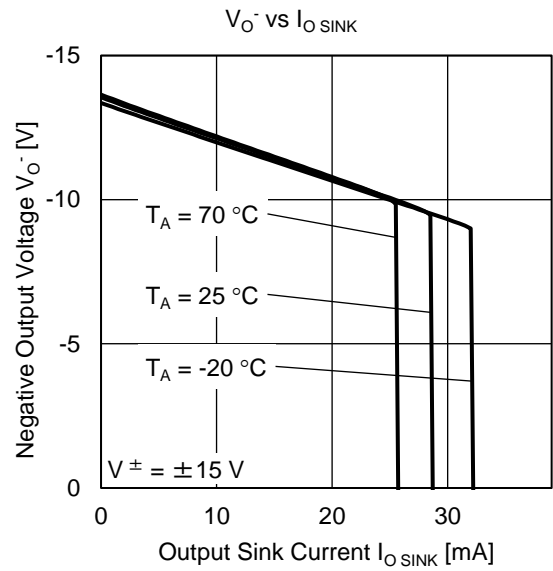
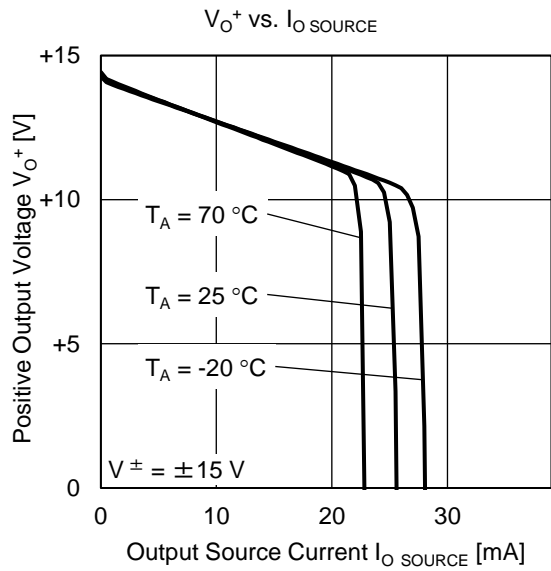
[Note] 7. The direction of the input bias current is the same direction that flows into the IC because the first stage is composed of Pch J-FET. When T_J = 25°C or higher, it increases exponentially with increase in temperature (please see I_B - T_A characteristics). During measurement, please kindly take care of T_J ≐ T_A.

Caution

Since UPC811 has high input impedance characteristics, please be careful of insulation between the terminals on the board.

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





USE WITH PRECAUTIONS

- **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 ($V^- = \text{GND}$), 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.

$$V_{\text{ICM}} (\text{TYP.}): V^- + 3 \sim V^+ - 1 \text{ [V]} (T_A = 25^\circ\text{C}).$$

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:

$$V_{\text{om}^+} (\text{TYP.}): V^+ - 1 \text{ [V]} (T_A = 25^\circ\text{C}), \quad V_{\text{om}^-} (\text{TYP.}): V^- + 1.7 \text{ [V]} (T_A = 25^\circ\text{C})$$

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

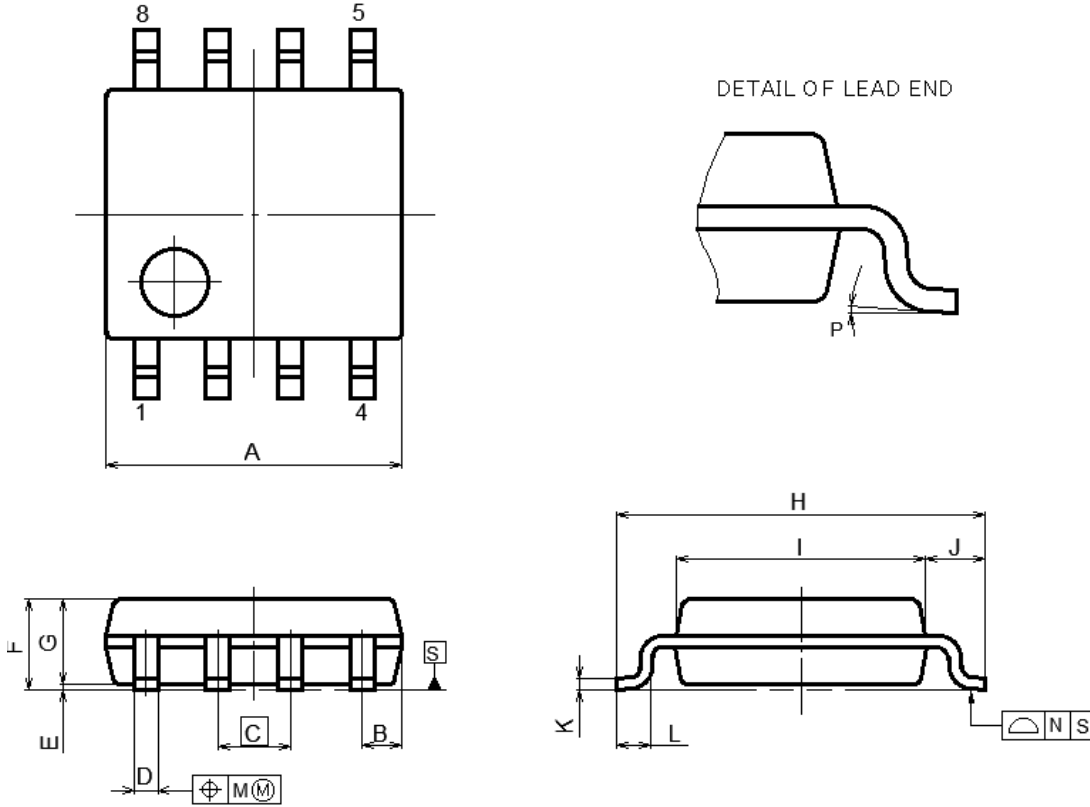
- **Handling of ICs**

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.

PACKAGE DRAWINGS

8-PIN PLASTIC SOP

JEITA Package code	RENESAS code	MASS (TYP.) [g]
P-LSOP8-4.4x5.2-1.27	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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