

UPC842, UPC4742

Single Power Supply, High Speed, Wide Band, Dual Operational Amplifiers

DESCRIPTION

UPC842 and UPC4742 are high-speed versions of single-power general-purpose operational amplifiers UPC1251 and UPC358, achieving high-speed pulse response characteristics and high stability. A high speed PNP transistor is used in the circuit which improves the characteristics such as a slew rate, gain-bandwidth product, stabilization of the withstand load capacitance, with no crossover distortion compared to UPC1251, UPC358.

Therefore, it can be used widely for various application circuits such as single power supply AC amplifier, active filter, line driver, amplifier for light receiving element, etc.

Depending on the usage and operating ambient temperature range, the UPC842 are designed for extended temperature and suited for wide operating ambient temperature application, and UPC4742 is design for general purposes.

Along with this series of lineup, the quad type operational amplifier, UPC844, UPC4744 with the same circuit configuration are also available.

FEATURES

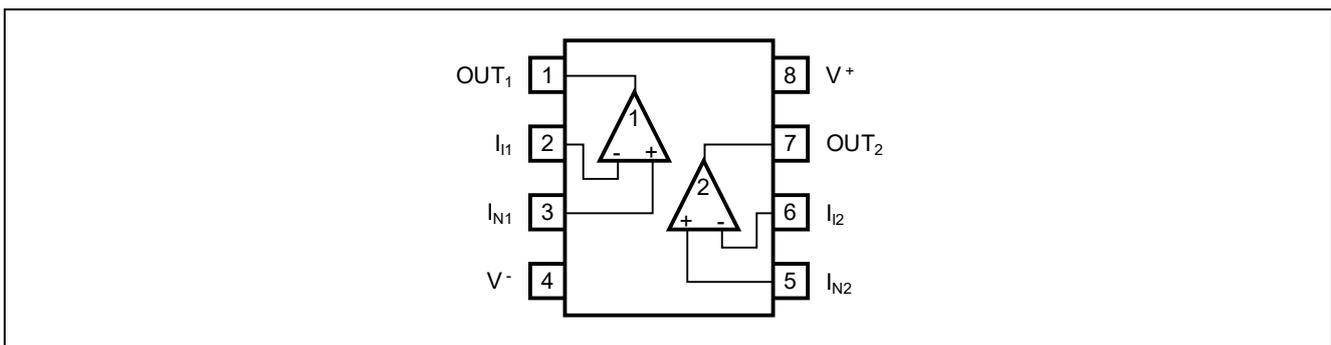
- Slew Rate ($A_V = 1$) 7 V/ μ s (TYP.) ($V^+ = +5$ V, $V^- =$ GND)
- Gain Bandwidth Product ($f = 100$ kHz) 3.5 MHz (TYP.)
- Input Offset Voltage ± 2 mV (TYP.)
- Input Offset Current ± 6 nA (TYP.)
- Operating Ambient Temperature
UPC842G2: $T_A = -40 \sim 85$ °C, UPC4742G2: $T_A = -20 \sim +80$ °C
UPC842GR-9LG: $T_A = -40 \sim +125$ °C, UPC4742GR-9LG: $T_A = -40 \sim +85$ °C
- Stability to capacitive load (Capacitive load, 1000 pF)
- Build-in phase correction circuit.
- Built-in output short-circuit protection circuit.
- A pin connection (pin compatible) of a standard dual operational amplifier.

ORDERING INFORMATION

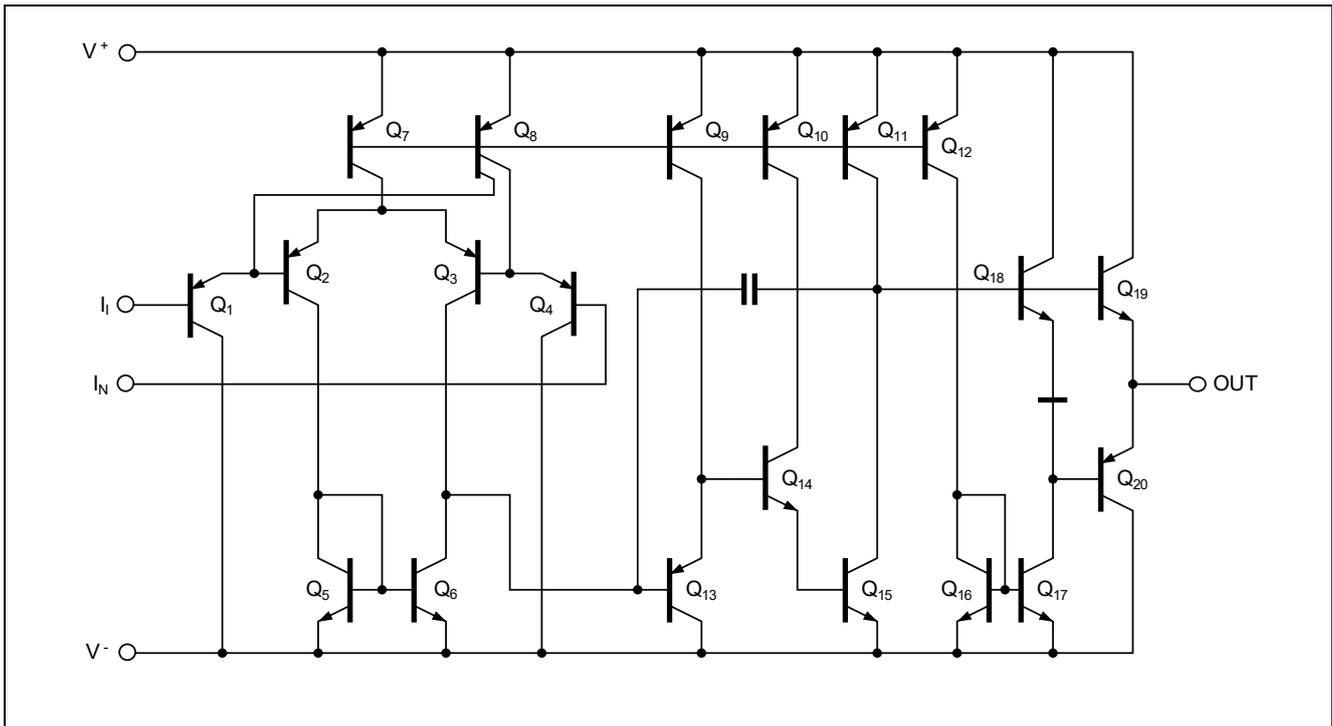
Order Name ⁽¹⁾	Selected Grade	Package
UPC842G2-AP	Standard	8-pin plastic SOP (5.72 mm (225))
UPC4742G2-AP	Standard	8-pin plastic SOP (5.72 mm (225))
UPC842GR-9LG-A	Standard	8-pin plastic TSSOP (5.72 mm (225))
UPC4742GR-9LG-A	Standard	8-pin plastic TSSOP (5.72 mm (225))

(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.

PIN CONFIGURATION (Marking side)



EQUIVALENT CIRCUIT (1/2 Circuit)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	UPC842G2	UPC4742G2	UPC842GR-9LG	UPC4742GR-9LG	Unit
Power Supply Voltage ^{Note 1}	V ⁺ - V ⁻	-0.3 ~ +36				V
Differential Input Voltage	V _{ID}	±36				V
Input Voltage ^{Note 2}	V _I	V ⁻ -0.3 ~ V ⁻ +36				V
Output Applied Voltage ^{Note 3}	V _O	V ⁻ -0.3 ~ V ⁺ +0.3				V
Total Power Dissipation ^{Note 4}	P _T	440				mW
Output Short Circuit Duration ^{Note 5}	t _s	Indefinite				s
Operating Ambient Temperature	T _A	-40 ~ +85	-20 ~ +80	-40 ~ +125	-40 ~ +85	°C
Storage Temperature	T _{stg}	-55 ~ +125		-55 ~ +150	-55 ~ +125	°C

- [Note]**
- Note that reverse connections of the power supply may damage the ICs.
 - This is the input voltage range that can be applied to the input terminal without any characteristics degradation or breakdown. It can be applied regardless of the supply voltage. Do not apply the voltage below V(GND)-0.3V. The operational amplifier electrical characteristics will operate normally when the input voltage is operating within the common-mode input voltage range.
 - Voltage range that can be applied externally to the output terminal without deteriorating or damage to the product. It can be applied regardless of the power supply. Caution not to exceed the ratings, including transient conditions such as when the power supply is ON/OFF.
 - This is the value when mounting the glass epoxy board (size 100 mm x 100 mm, thickness 1 mm, and copper foil only on one side with 15% solid wiring of the board area). Please take note that depending on the operating ambient temperature, each product following conditions and de-rating rate as below:

UPC842G2, 4742G2 : Derate at -4.4 mW/°C when T_A > 25 °C
(Junction - ambient thermal resistance R_{th(J-A)} = 227°C/W)

UPC842GR-9LG : Derate at -5.5 mW/°C when T_A > 69 °C
(Junction - ambient thermal resistance R_{th(J-A)} = 183°C/W)

UPC4742GR-9LG : Derate at -5.5 mW/°C when T_A > 44 °C
(Junction - ambient thermal resistance R_{th(J-A)} = 183°C/W)

- Please use the total loss and the de-rating factor of Note 4.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Power Supply Voltage (Dual Supply)	V^{\pm}	± 1.5		± 16	V
Power Supply Voltage ($V^- = \text{GND}$)	V^+	+3	+5 ~ +30	+32	V
Output Current	I_o			± 10	mA
Capacitive Load ($A_V = +1$)	C_L			1000 ^{Note 6}	pF

[Note] 6. This is the value when feedback resistor (R_f) = 0 Ω .

ELECTRICAL CHARACTERISTICS

($T_A = 25\text{ }^{\circ}\text{C}$, $V^{\pm} = \pm 15\text{ V}$)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		± 2	± 4.5	mV	
Input Offset Current	I_{IO}		± 6	± 75	nA	
Input Bias Current ^{Note 7}	I_B		120	500	nA	
Large Signal Voltage Gain	A_V	25000	300000			$R_L \geq 2\text{ k}\Omega$, $V_O = \pm 10\text{ V}$
Circuit Current ^{Note 8}	I_{CC}		4.3	5.5	mA	$I_o = 0\text{ A}$
Common Mode Rejection Ratio	CMR	70	86		dB	
Supply Voltage Rejection Ratio	SVR	70	93		dB	
Output Voltage Swing	V_{Om1}	± 13.7	+14 -14.3		V	$R_L = 10\text{ k}\Omega$
	V_{Om2}	± 13.5			V	$R_L \geq 2\text{ k}\Omega$
Common Mode Input Voltage Range	V_{ICM}	V^-		$V^+ - 1.8$	V	
Slew Rate	SR		8.5		V/ μ s	$A_V = +1$ (Rise)
Gain Bandwidth Product	GBW		3.5		MHz	$f = 100\text{ kHz}$
Channel Separation			120		dB	$f = 20\text{ Hz} \sim 20\text{ kHz}$

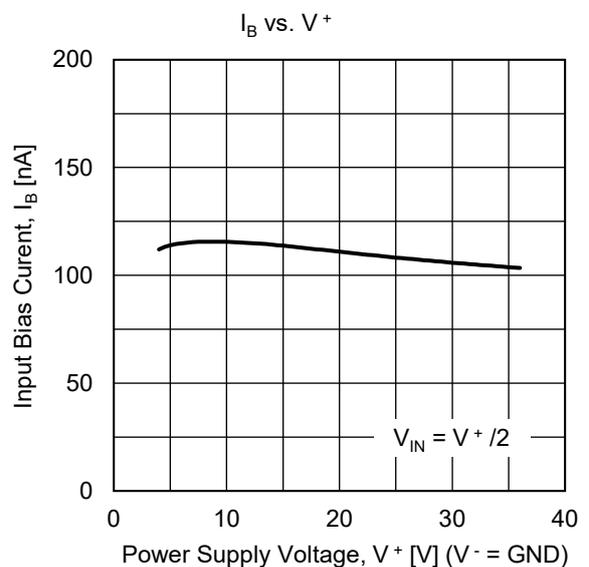
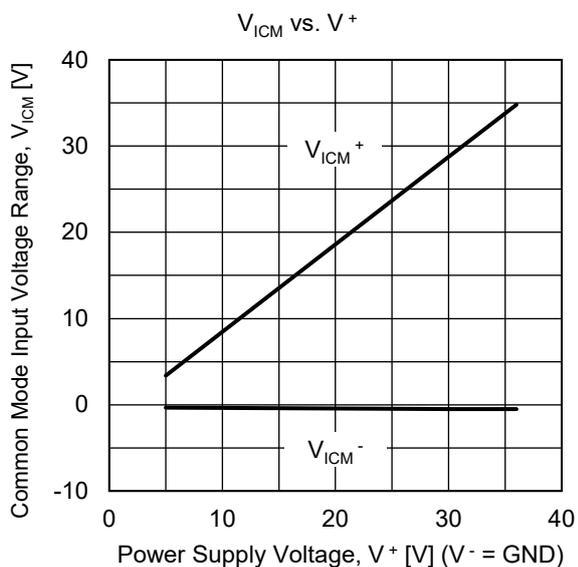
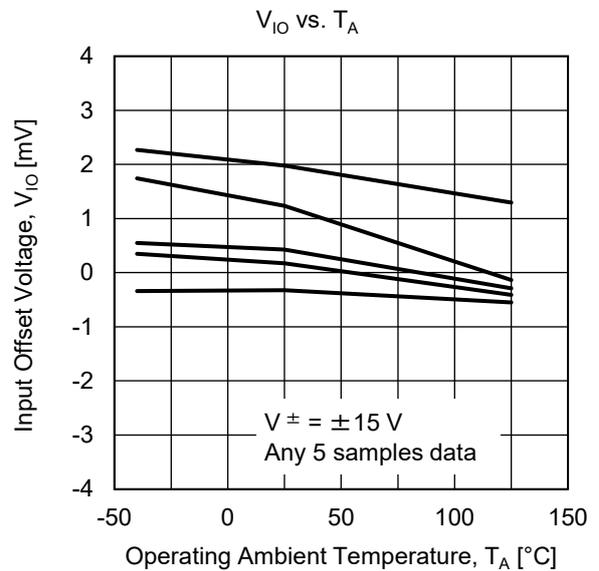
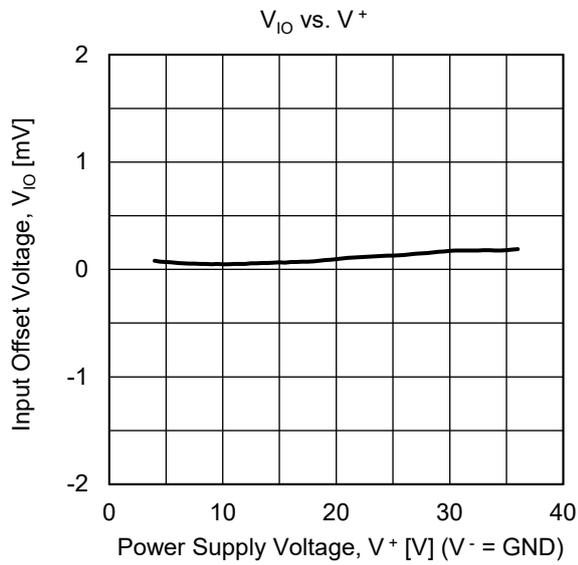
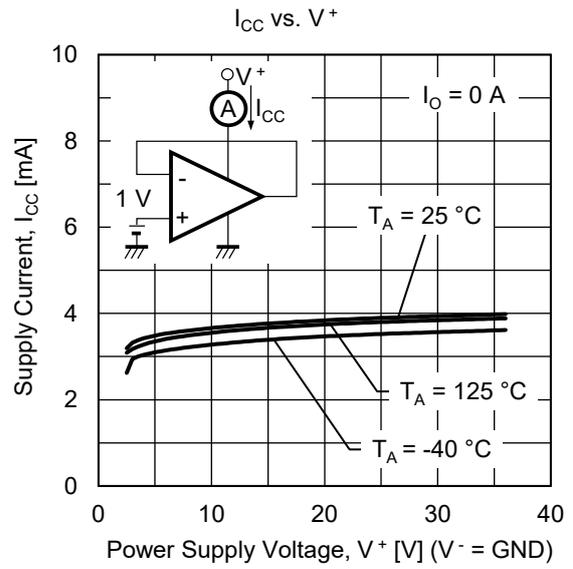
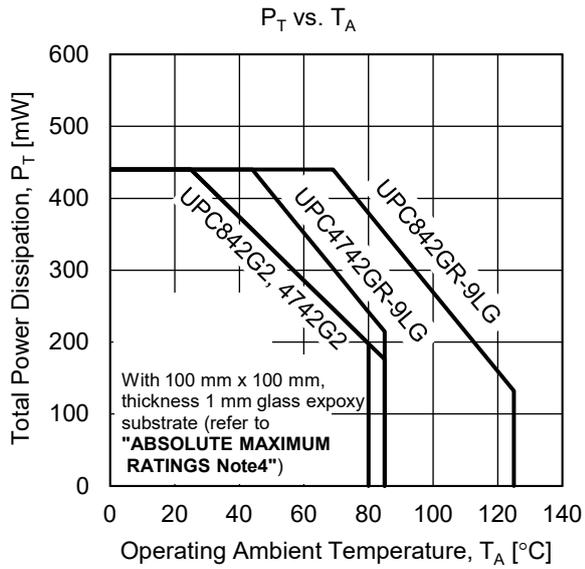
($T_A = 25\text{ }^{\circ}\text{C}$, $V^+ = +5\text{ V}$, $V^- = \text{GND}$)

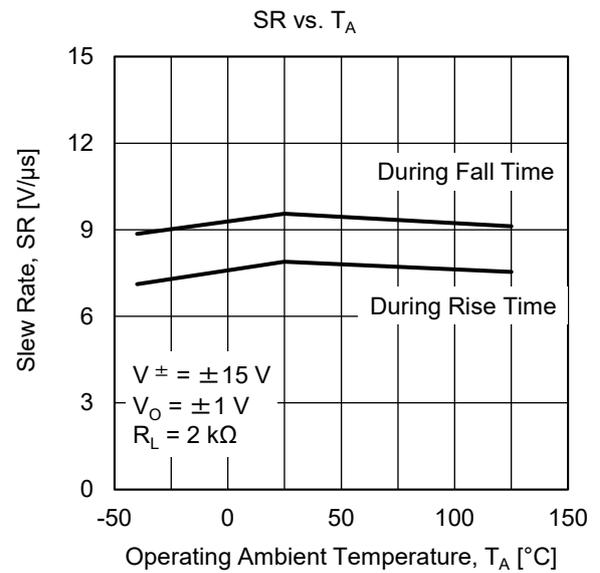
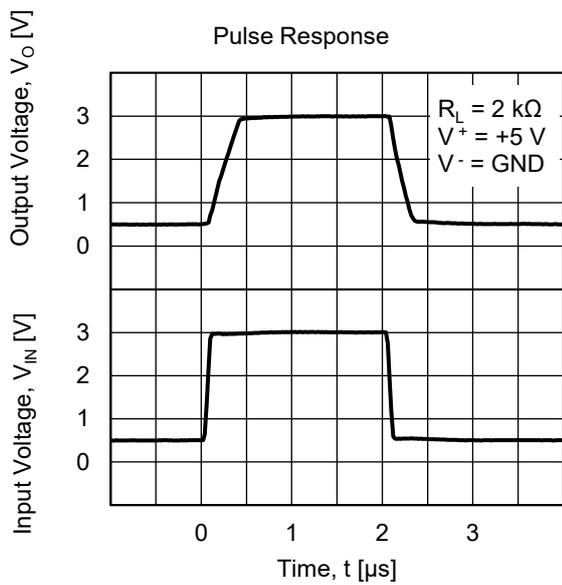
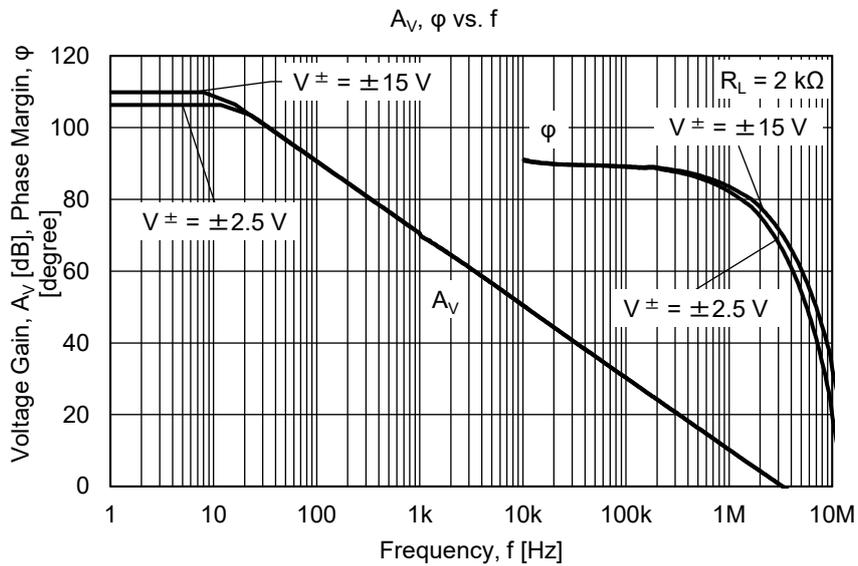
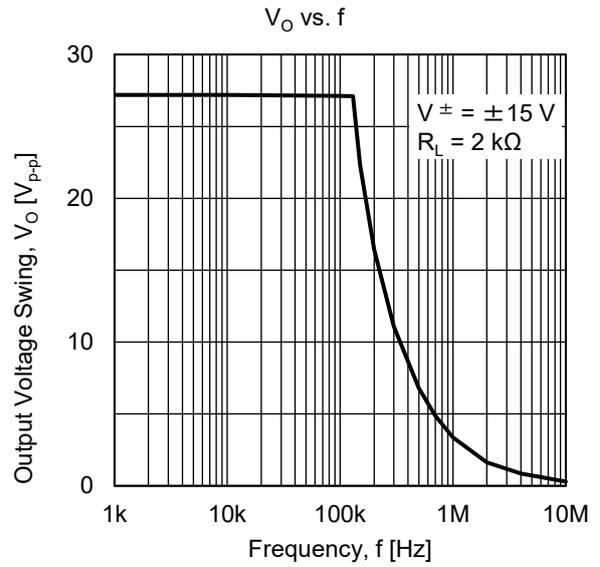
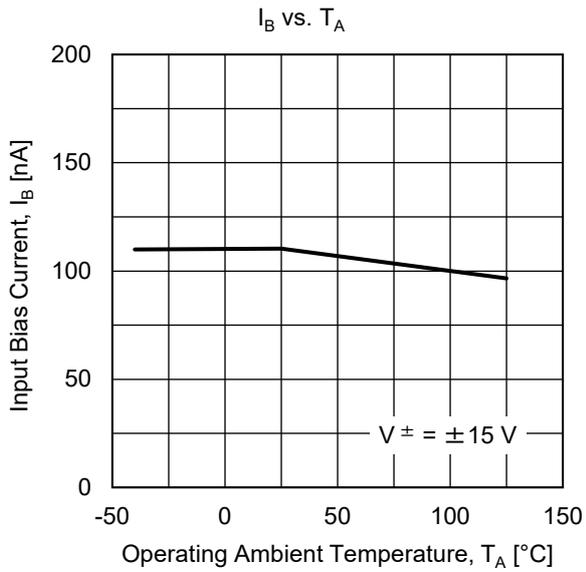
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		± 2	± 5	mV	
Input Offset Current	I_{IO}		± 6	± 75	nA	
Input Bias Current ^{Note 7}	I_B		140	500	nA	
Large Signal Voltage Gain	A_V	25000	300000			$R_L \geq 2\text{ k}\Omega$
Circuit Current ^{Note 8}	I_{CC}		3.3	4.5	mA	$I_o = 0\text{ A}$
Common Mode Rejection Ratio	CMR	70	80		dB	
Supply Voltage Rejection Ratio	SVR	70	95		dB	
Output Voltage Swing	V_{Om}	3.7	4.0		V	$R_L \geq 2\text{ k}\Omega$ (Connected to GND)
		0	0			
Common Mode Input Voltage Range	V_{ICM}	0		$V^+ - 1.8$	V	
Output Source Current	$I_{o\text{ SOURCE}}$	10	30		mA	$V_{IN(+)} = +1\text{ V}$, $V_{IN(-)} = 0\text{ V}$
Output Sink Current	$I_{o\text{ SINK}}$	10	30		mA	$V_{IN(+)} = 0\text{ V}$, $V_{IN(-)} = +1\text{ V}$
Slew Rate	SR		7		V/ μ s	$A_V = +1$ (Rise)

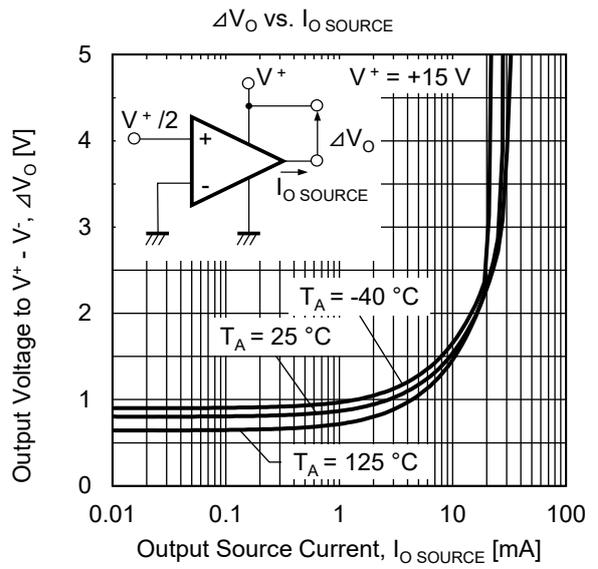
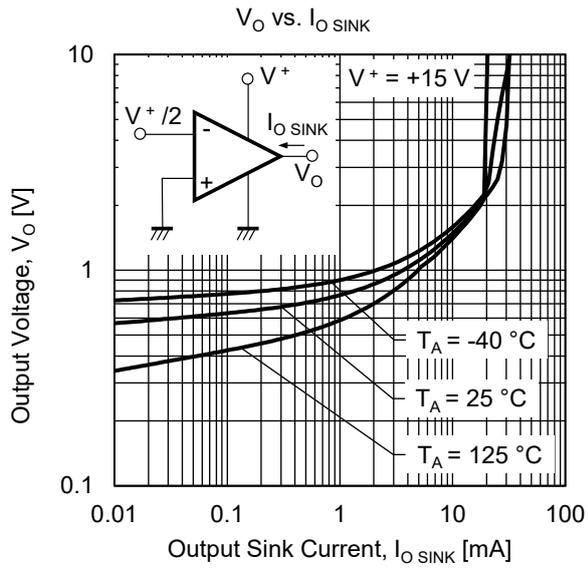
[Note] 7. The current flow direction of the input bias is out from the IC because the first stage of the IC composed of PNP transistor.

8. Current flowing through the internal circuit. This current flow regardless of the channel used.

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





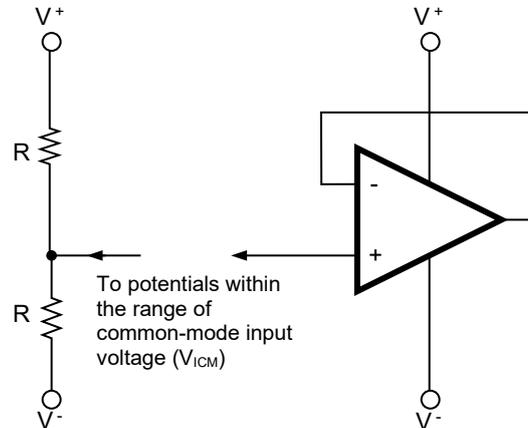


USE WITH PRECAUTIONS

• Managing unused circuits

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

Example of unused circuit process



Remark: In this example, an intermediate potential between V^+ and V^- is applied.

• 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.

$$V_{ICM} \text{ (TYP.)} : V^- \sim V^+ - 1.8 \text{ (V)} \text{ (} T_A = 25^\circ\text{C)}.$$

During designing, do include some tolerance by considering temperature characteristics and 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:

$$V_{om+} \text{ (TYP.)} : V^+ - 1 \text{ [V]} \text{ (} T_A = 25^\circ\text{C)}, V_{om-} \text{ (TYP.)} : V^- + 0.7 \text{ [V]} \text{ (} T_A = 25^\circ\text{C)}$$

During designing, do include some tolerance 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.

• Output Operation

This IC will not be able to sink output current when the output voltage is $V^- + 0.7 \text{ V}$ and below. In this case, the output voltage level can be improved to the V^- side by connecting the load resistor between the output terminal and V^- to sink the current at the load resistor. (The effect will differ depending on the flow of current in the load resistance.)

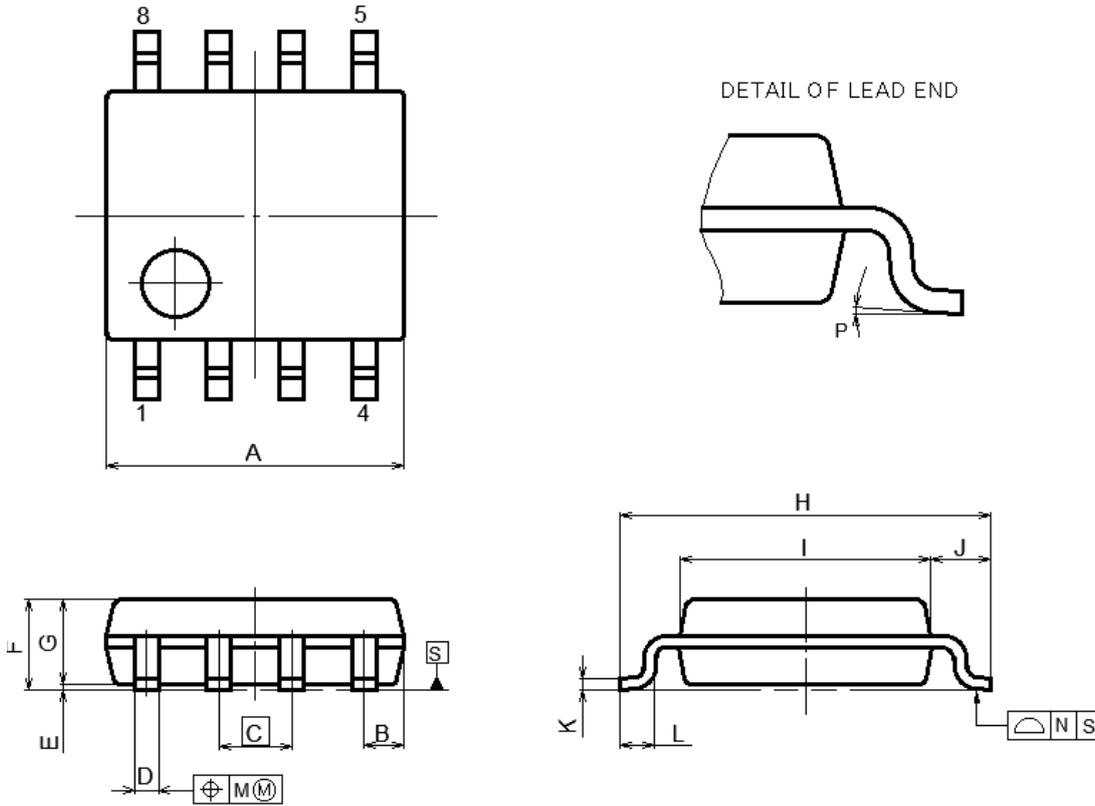
• Handling of ICs

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]



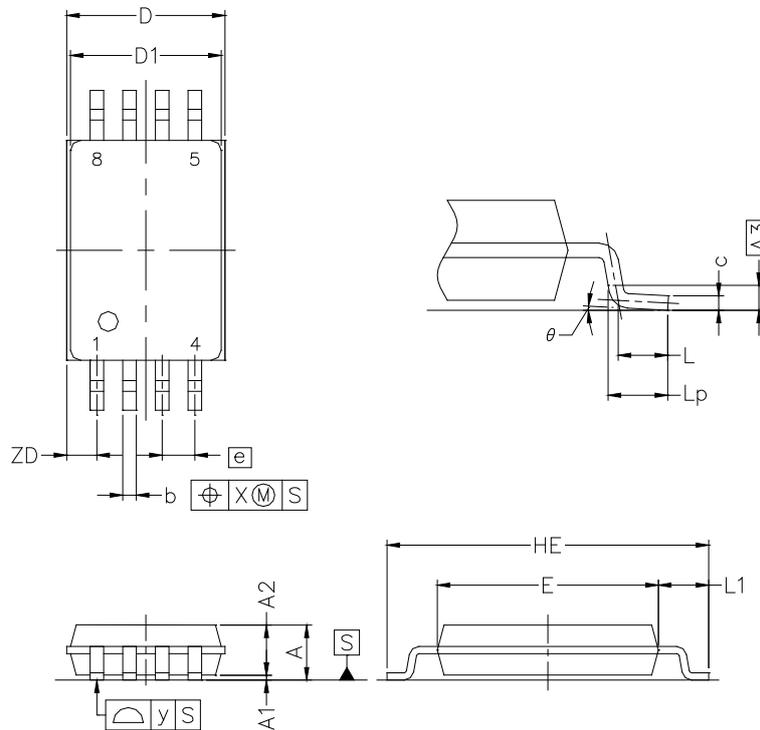
NOTE
 EACH LEAD CENTERLINE IS LOCATED WITHIN 0.12 MM OF
 ITS TRUE POSITION(T.P.) AT MAXIMUM MATERIAL CONDITION.

(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°

8-PIN PLASTIC TSSOP

JEITA Package code	RENESAS code	Previous code	MASS(TYP.) [g]
P-TSSOP8-0225-0.65	PTSP0008JD-A	P8GR-65-9LG	—



(Unit : mm)

NOTE

Each lead centerline is located within 0.10 mm of its true position at maximum material condition.

ITEM	MILLIMETERS
D	3.15 ±0.15
D1	3.00 ±0.10
E	4.40 ±0.10
HE	6.40 ±0.20
A	1.20 MAX.
A1	0.10 ±0.05
A2	1.00 ±0.05
A3	0.25
b	0.24 ^{+0.06} _{-0.05}
c	0.145 ±0.055
L	0.5
Lp	0.60 ±0.15
L1	1.00 ±0.20
θ	3° ^{+5°} _{-3°}
e	0.65
x	0.10
y	0.10
ZD	0.60

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(Rev.5.0-1 October 2020)

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