µPC842, µPC4742

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

R03DS0136EJ0100
Rev.1.00
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DESCRIPTION

µPC842 and µPC4742 are high-speed versions of single-power general-purpose operational amplifiers µPC1251 and µPC358, 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 µPC1251, µPC358.

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 µPC842 are designed for extended temperature and suited for wide operating ambient temperature application, and µPC4742 is design for general purposes.

Along with this series of lineup, the quad type operational amplifier, µPC844, µPC4744 with the same circuit configuration are also available.

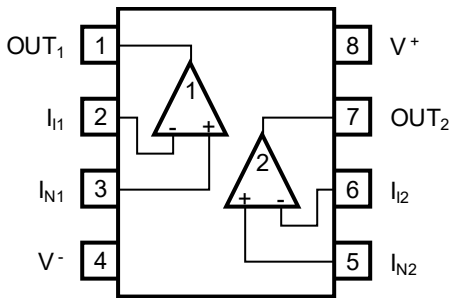
FEATURES

- Slew Rate (A_V = 1) 7 V/µs (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
  µPC842G2: T_A = -40 ~ 85 °C, µPC4742G2 : T_A = -20 ~ +80 °C
  µPC842GR-9LG : T_A = -40 ~ +125 °C, µPC4742GR-9LG : T_A = -40 ~ +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.

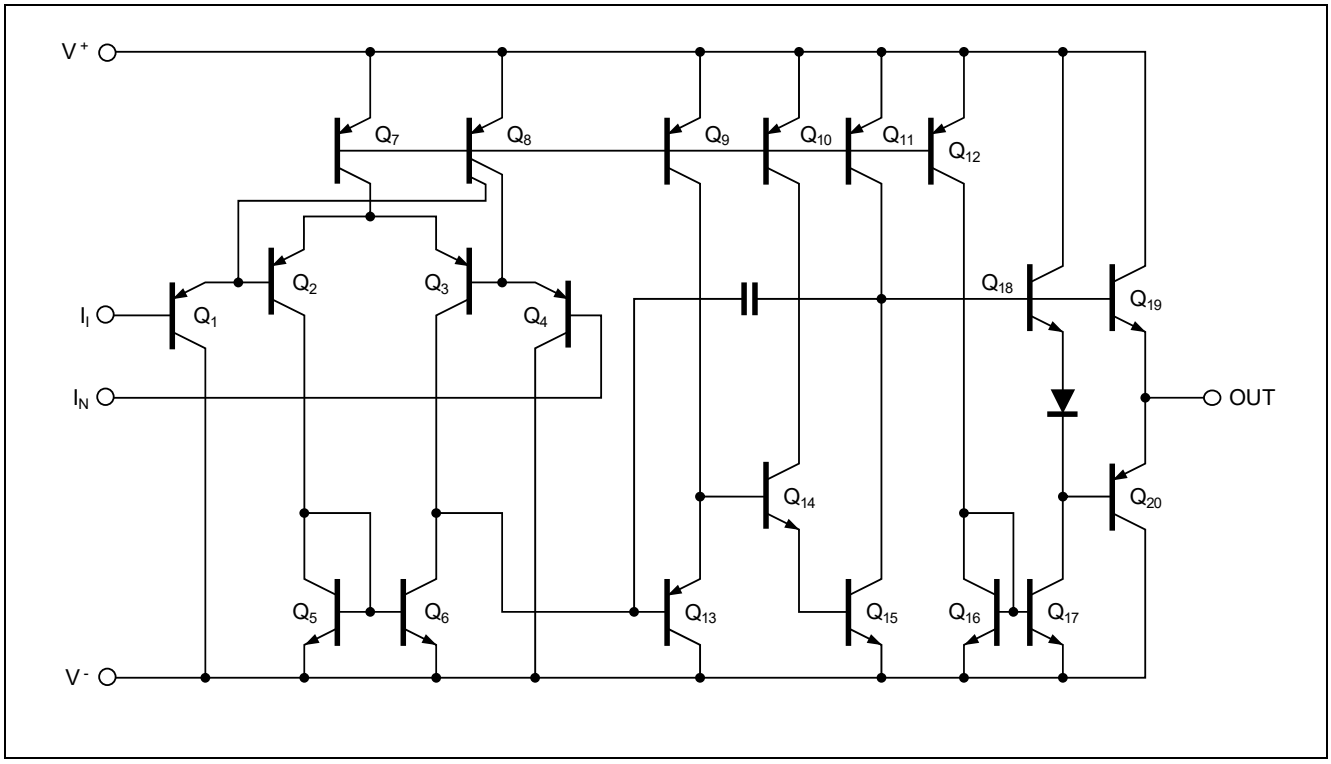
ORDERING INFORMATION

Order Name	Selected Grade	Package
µPC842G2-A	Standard	8-pin plastic SOP (5.72 mm (225))
µPC4742G2-A	Standard	8-pin plastic SOP (5.72 mm (225))
µPC842GR-9LG-A	Standard	8-pin plastic TSSOP (5.72 mm (225))
µPC4742GR-9LG-A	Standard	8-pin plastic TSSOP (5.72 mm (225))

PIN CONFIGURATION (Marking side)



EQUIVALENT CIRCUIT (1/2 CIRCUIT)



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	µPC842G2	µPC4742G2	µPC842GR-9LG	µPC4742GR-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】 1. Note that reverse connections of the power supply may damage the ICs.

2. 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.

3. 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.

4. 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:
   µPC842G2, 4742G2 : De-rate -4.4 mW/°C when T_A ＞ 25 °C.
   (Junction − ambient thermal resistance $R_{th(J-A)}$ = 227 °C/W)
   µPC842GR-9LG : De-rate -5.5 mW/°C when T_A ＞ 69 °C.
   (Junction − ambient thermal resistance $R_{th(J-A)}$ = 183 °C/W)
   µPC4742GR-9LG : De-rate -5.5 mW/°C when T_A ＞ 44 °C.
   (Junction − ambient thermal resistance $R_{th(J-A)}$ = 183 °C/W)

5. 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^- = 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 (Rf) = 0 Ω.

ELECTRICAL CHARACTERISTICS

(T_A = 25 °C, $V^{\pm}$ = ±15 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 ≧ 2 kΩ, V_O = ±10 V
Circuit Current Note 8	I_{CC}		4.3	5.5	mA	I_O = 0 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		V	R_L = 10 kΩ
			-14.3			
	V_{Om2}	±13.5			V	R_L ≧ 2 kΩ
Common Mode Input Voltage Range	V_{ICM}	V^-		V^+ -1.8	V	
Slew Rate	SR		8.5		V/µs	A_V = +1 (Rise)
Gain Bandwidth Product	GBW		3.5		MHz	f = 100 kHz
Channel Separation			120		dB	f = 20 Hz ~ 20 kHz

(T_A = 25 °C, V^+ = +5 V, V^- = GND)

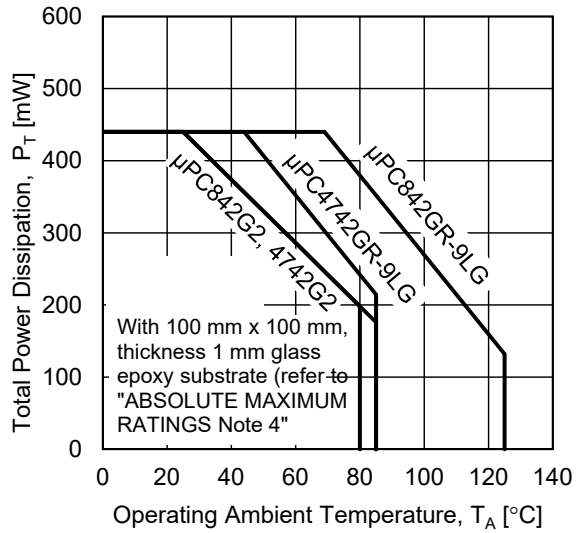
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±2	±5	mV	
Input Offset Current	I_{IO}		±6	±75	nA	
Input Bias Current Note 7	I_B		140	500	nA	
Large Signal Voltage Gain	A_V	25000	300000			R_L ≧ 2 kΩ
Circuit Current Note 8	I_{CC}		3.3	4.5	mA	I_O = 0 A
Common Mode Rejection 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 ≧ 2 kΩ (Connected to GND)
		0	0			
Common Mode Input Voltage Range	V_{ICM}	0		V^+ -1.8	V	
Output Source Current	$I_{O\ SOURCE}$	10	30		mA	$V_{IN\ (+)}$ = +1 V, $V_{IN\ (-)}$ = 0 V
Output Sink Current	$I_{O\ SINK}$	10	30		mA	$V_{IN\ (+)}$ = 0 V, $V_{IN\ (-)}$ = +1 V
Slew Rate	SR		7		V/µs	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.

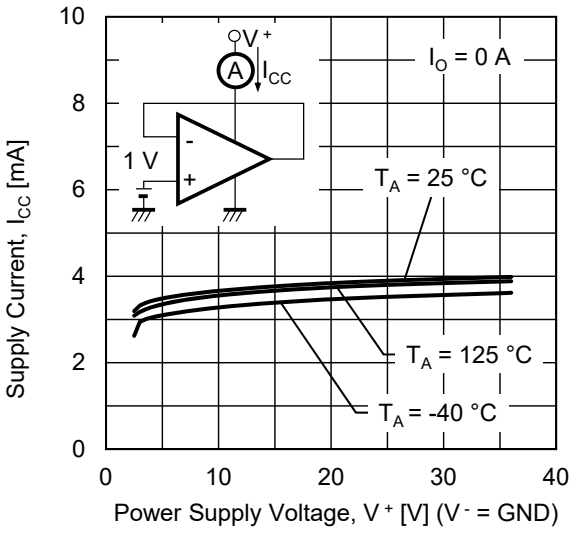
8. Current flowing through the internal circuit. This current flow regardless of the channel used.

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

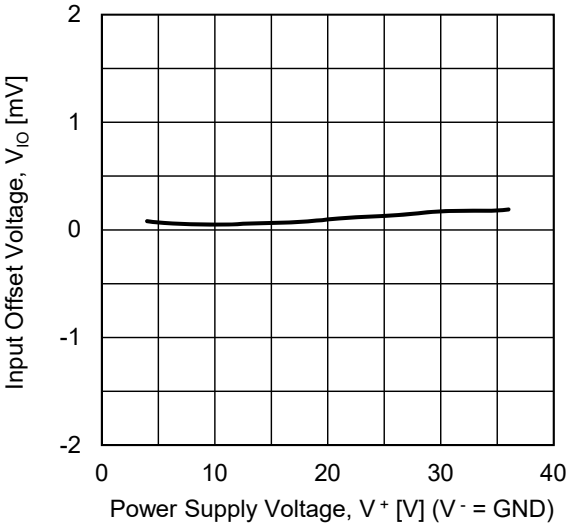
P_T vs. T_A



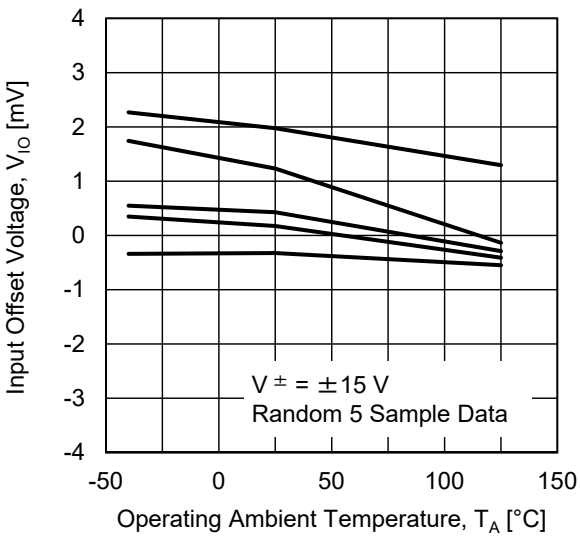
I_{CC} vs. V^+



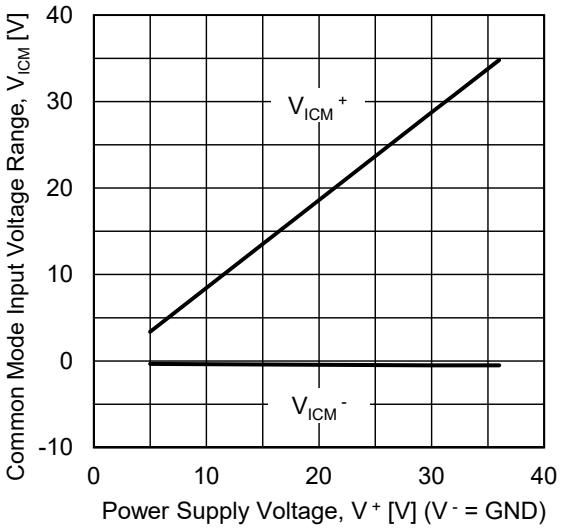
V_{IO} vs. V^+



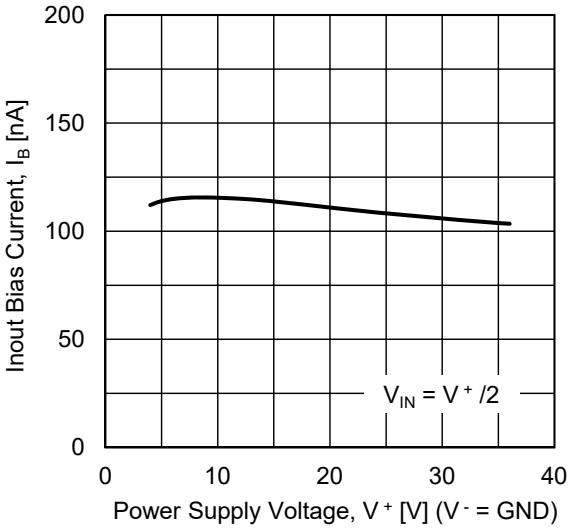
V_{IO} vs. T_A



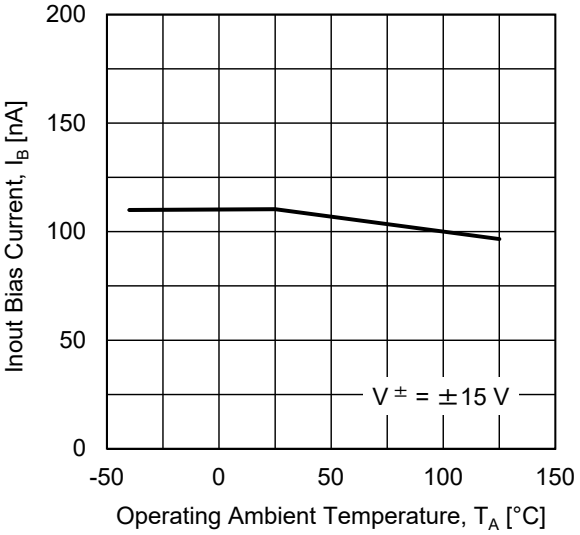
V_{ICM} vs. V^+



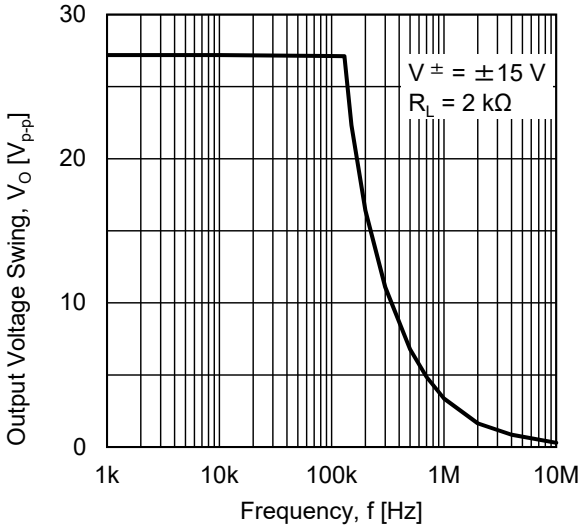
I_B vs. V^+



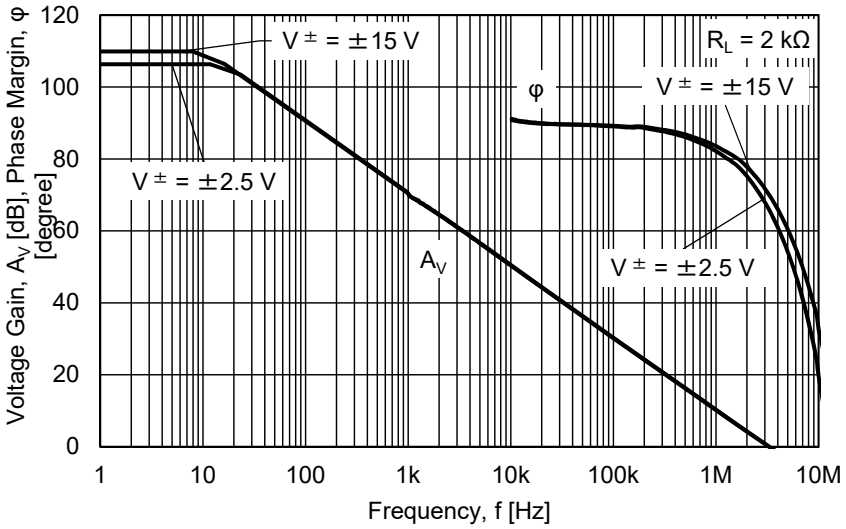
I_B vs. T_A



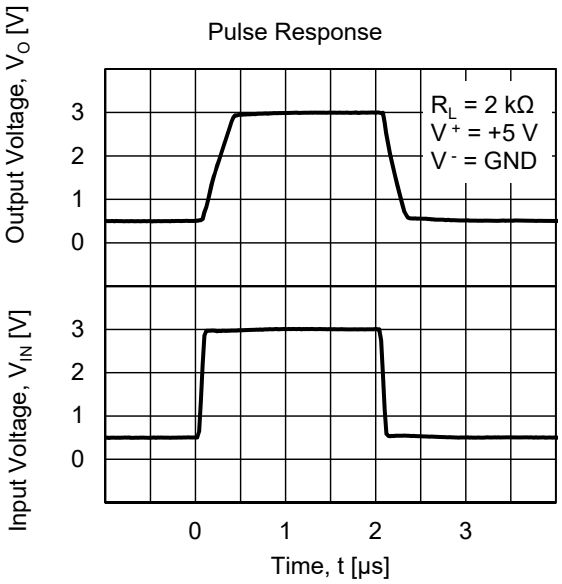
V_O vs. f



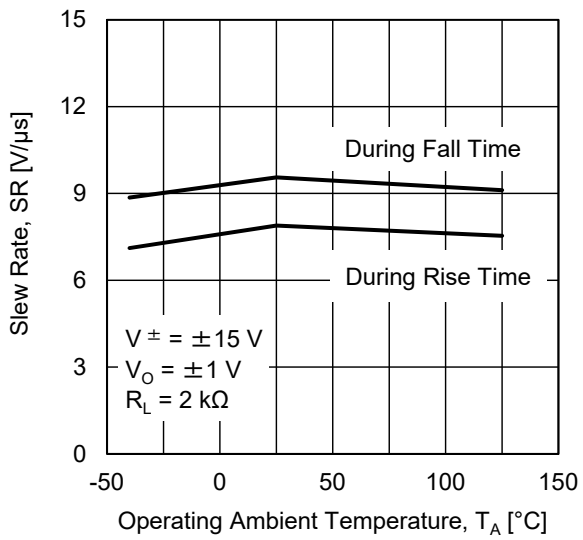
A_V, φ vs. f

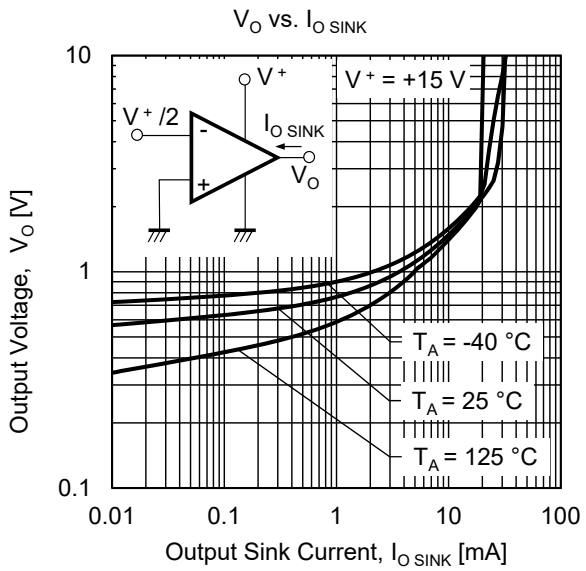


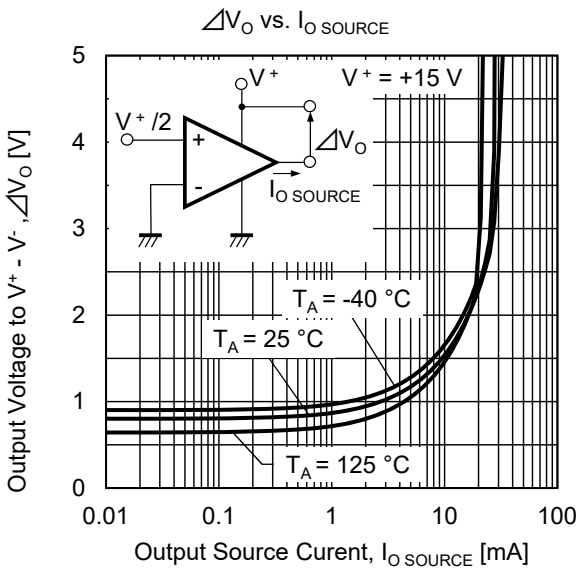
Pulse Response



SR vs. T_A



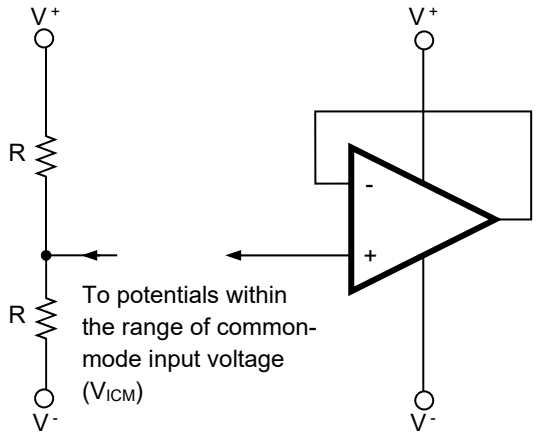

V_O vs. $I_{O\ SINK}$
10
1
0.1
0.01
0.1
1
10
100
Output Voltage, V_O [V]
Output Sink Current, $I_{O\ SINK}$ [mA]
V^+
V^+ /2
$I_{O\ SINK}$
V_O
V^+ = +15 V
T_A = -40 °C
T_A = 25 °C
T_A = 125 °C


ΔV_O vs. $I_{O\ SOURCE}$
5
4
3
2
1
0
0.01
0.1
1
10
100
Output Voltage to V^+ - V^-, ΔV_O [V]
Output Source Curent, $I_{O\ SOURCE}$ [mA]
V^+
V^+ /2
ΔV_O
$I_{O\ SOURCE}$
V^+ = +15 V
T_A = -40 °C
T_A = 25 °C
T_A = 125 °C

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} (TYP.) : V^- ~ V^+ -1.8 [V] (T_A = 25 °C)

  During designing, do include some tolerance by considering 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^- +0.7 [V] (T_A = 25 °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 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.)

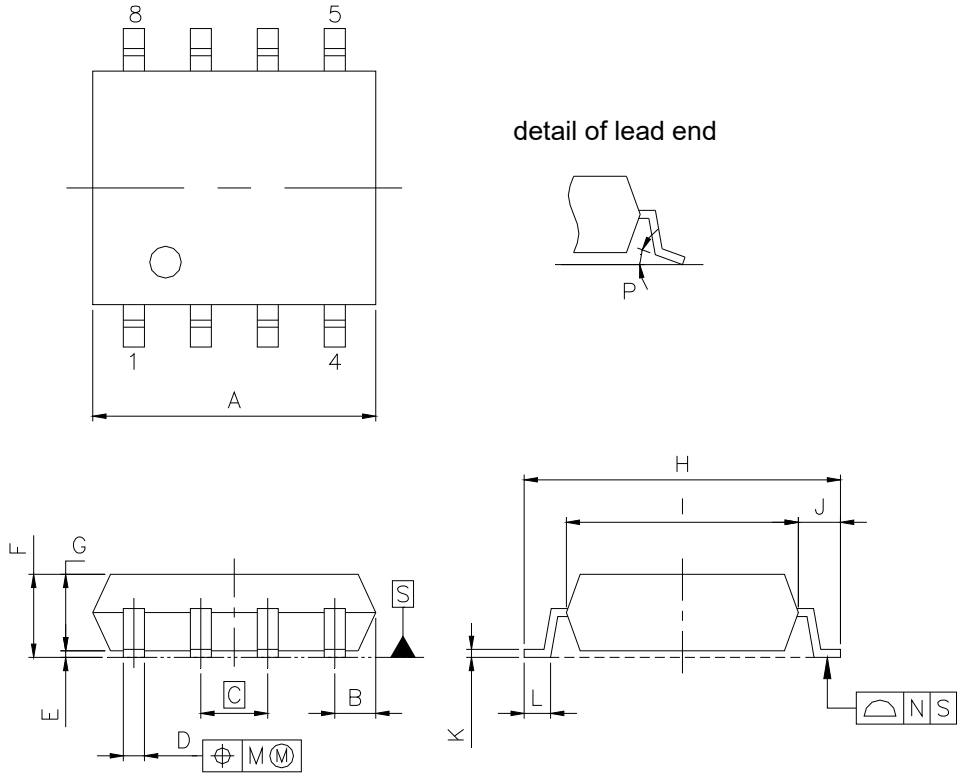
- **Handling of ICs**
  When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuates due to piezoelectric (piezo) effect. Therefore, pay attention to warpage or bending of a board.

PACKAGE DRAWINGS

8-PIN PLASTIC SOP

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

Unit : mm



NOTE

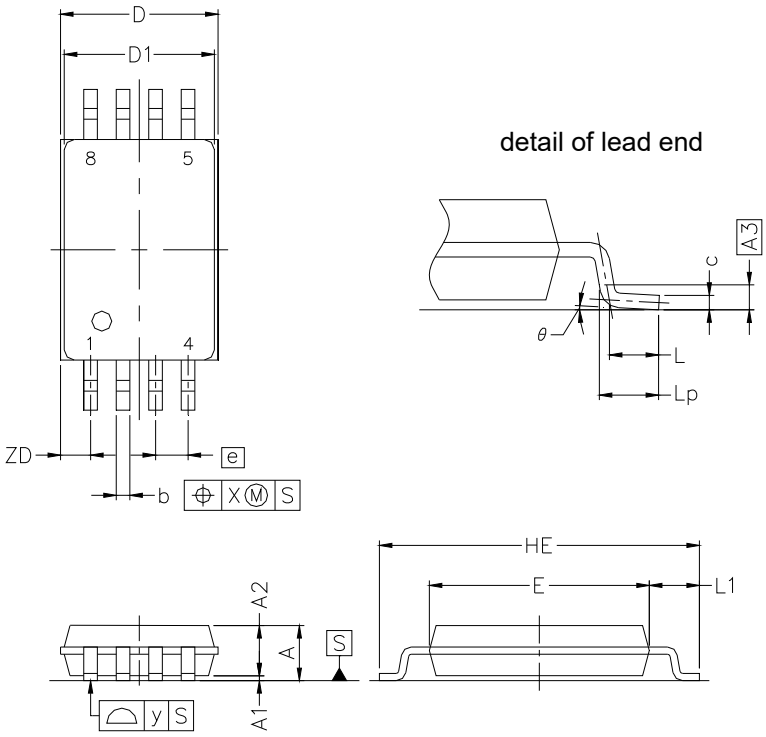
Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

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°

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	$3^{\circ}{}^{+5^{\circ}}_{-3^{\circ}}$
e	0.65
x	0.10
y	0.10
ZD	0.60

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6. 使用瑞萨电子产品时，请参阅最新产品信息（数据表、使用说明书、应用指南、可靠性手册中的“半导体元件处理和使用一般注意事项”等），并确保使用条件在瑞萨电子指定的最大额定值、电源工作电压范围、散热特性、安装条件等范围内使用。对于在上述指定范围之外使用瑞萨电子产品而产生的任何故障、失效或事故，瑞萨电子概不承担任何责任。
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SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

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Renesas Electronics Corporation
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

Renesas Electronics America Inc.
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338