µPC842A

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

R03DS0133EJ0100
Rev.1.00
2018.12.19

DESCRIPTION

The µPC842A is a high-speed version of the single-power general-purpose operational amplifier µPC1251, realizing high-speed response and high stability. A high speed PNP transistor is used in the circuit which improves the characteristics such as slew rate, gain-bandwidth product, stabilization of the withstand load capacitance, with no crossover distortion compared to µPC1251.

As this is a high slew rate product, it is able to provide high-speed signal amplification and can be applied to a wide range of sensor applications such as motors. Moreover, due to its small package (MSOP), mounting on the vicinity of the sensor becomes possible, which makes the board smaller and increases design freedom.

FEATURES

AEC-Q100 Compliant

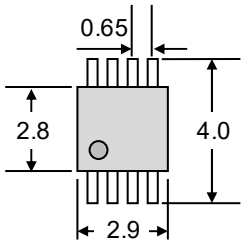
Absolute Maximum Ratings

- Power Supply Voltage -0.3 ~ +36 V
- Operating Ambient Temperature Range -40 °C ~ +125 °C

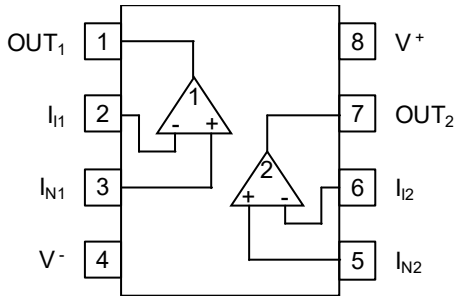
Electrical Characteristics

- Power Supply Voltage (MIN. MAX.) +3 V to 32 V
- Input Offset Voltage (TYP.) ±2.0 mV ($V^{\pm}$ = ±15 V)
- Gain Bandwidth Product (TYP.) 3.5 MHz
- Slew Rate (TYP.) 7 V/µs (V^{+} = 5 V, V^{-} = GND)

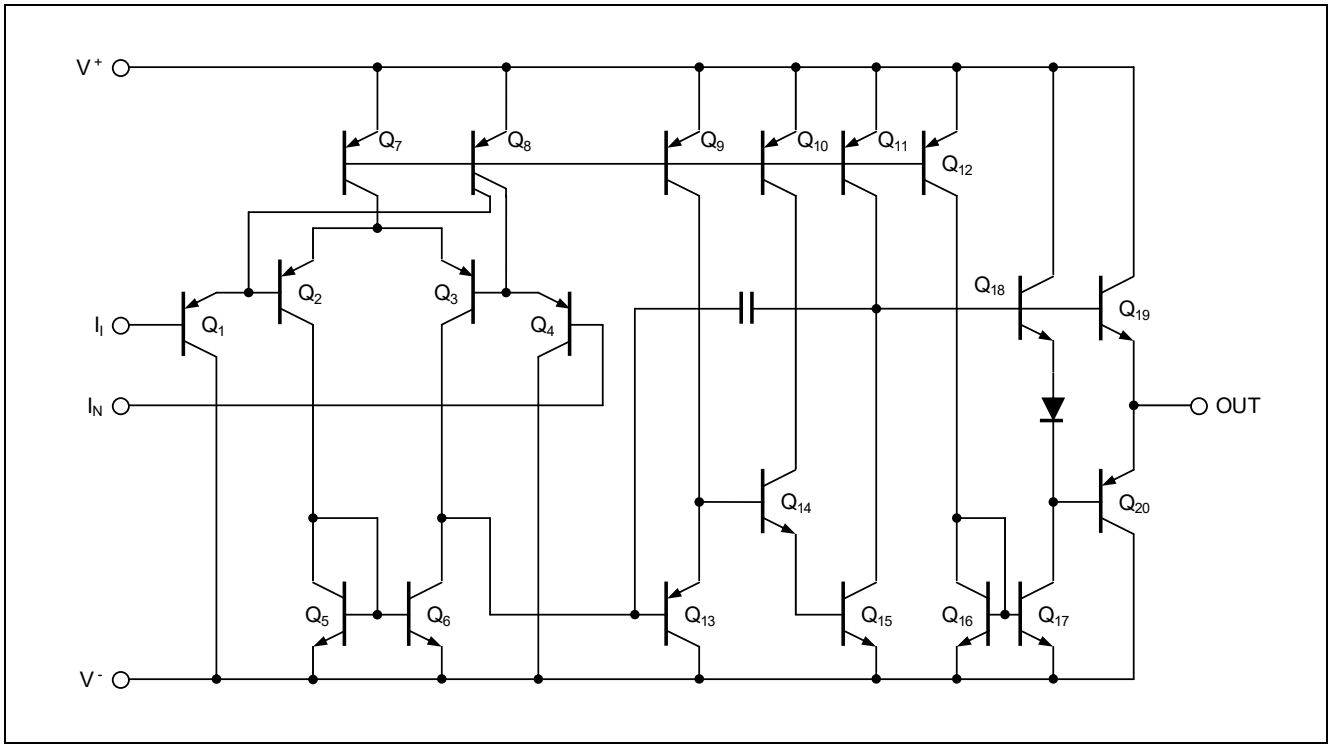
PRODUCT LINEUP

Package	MSOP (2.8 × 2.9)
Product Name	µPC842AMP
Outline	

PIN CONFIGURATION (Marking Side)



EQUIVALENT CIRCUIT (1/2 CIRCUIT)



ABSOLUTE MAXIMUM RATINGS

(T_A = 25 °C)

Parameter	Symbol	Rated Value	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	ts	Infinity	s
Operating Ambient Temperature	T_A	-40 ~ +125	°C
Storage Temperature	T_{stg}	-55 ~ +150	°C

【Note】

1. Note that reverse connections of the power supply may damage the ICs.
2. The allowable input voltage range without damaging or destructing the device. Independent to power supply voltage range.
   Do not apply voltage equivalent to V - (GND) - 0.3 V or less.
3. The input voltage range that can be applied to the output pin externally without deteriorating or damaging the device characteristic. The permitted input voltage that can be applied regardless of the power supply voltage. This specification also includes precaution during transition state such as ON/OFF, etc.
4. This is the value when the glass epoxy substrate (size: 100 mm x 100 mm, thickness: 1 mm, 15% of the substrate area where only one side is copper foiled is filling wired) is mounted.
   Note that restrictions will be made to the following conditions for each product, and the de-rating ratio depending on the operating ambient temperature.
   µPC842AMP : De-rate 4.8 mW/°C when T_A ＞ 58 °C.
5. A short circuit at the V + side may destroy the IC. Please use below the total loss and the de-rating of Note 4.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Power Supply Voltage (V^- = GND)	V^+	+3	+5 ~ +30	+32	V
Power Supply Voltage (Dual Supply)	$V^\pm$	±1.5		±16	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.

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 Edge)
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)

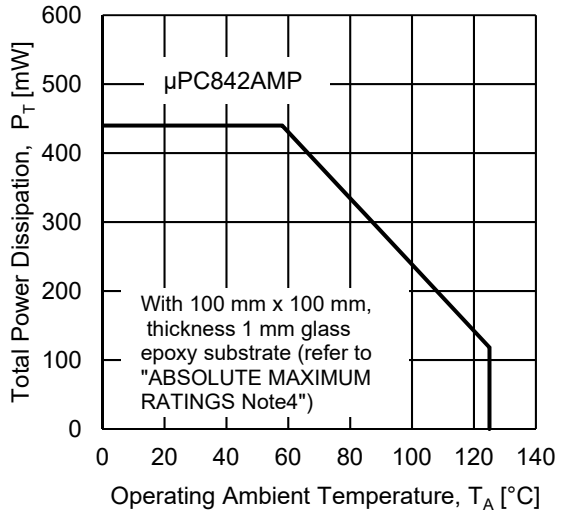
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±2	±5.0	mV	
Input Offset Current	I_{IO}		±6	±75	nA	
Input Bias Current Note 7	I_B		140	500	nA	
Large Signal Voltage Gain	A_v	25000	300000			R_L ≧ 2 kΩ
Circuit Current Note 8	I_{CC}		3.3	4.5	mA	I_O = 0 A
Common Mode Rejection 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 Edge)

【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.

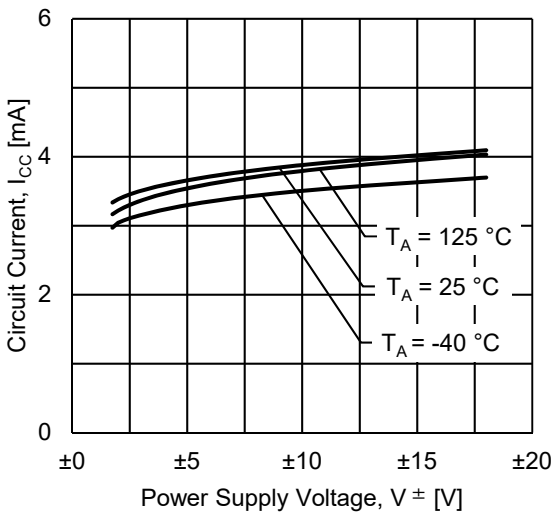
8. Current flowing through the internal circuit of this IC. This current flow regardless of the channel used.

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

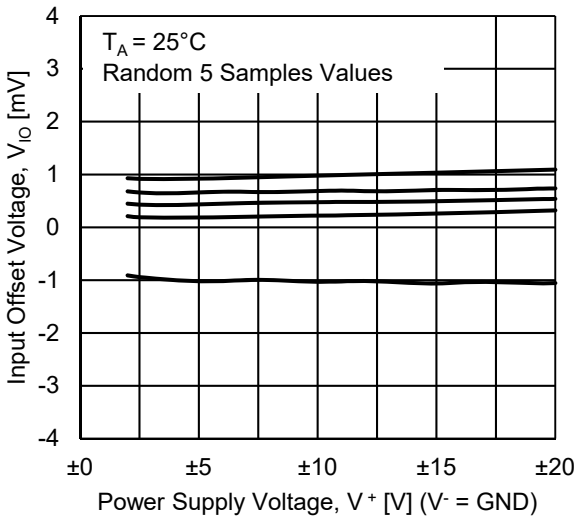
P_T - T_A



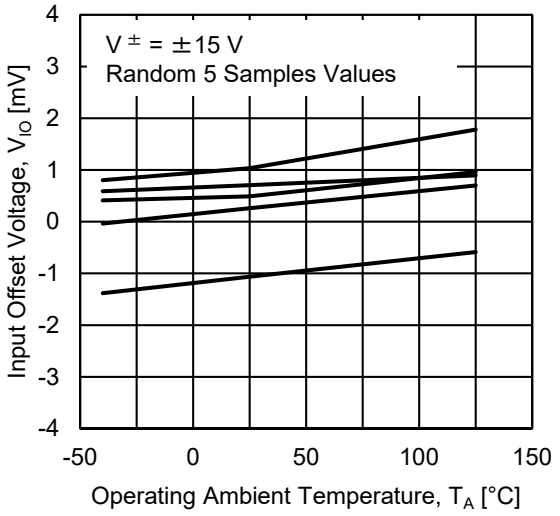
I_{CC} - $V^{\pm}$



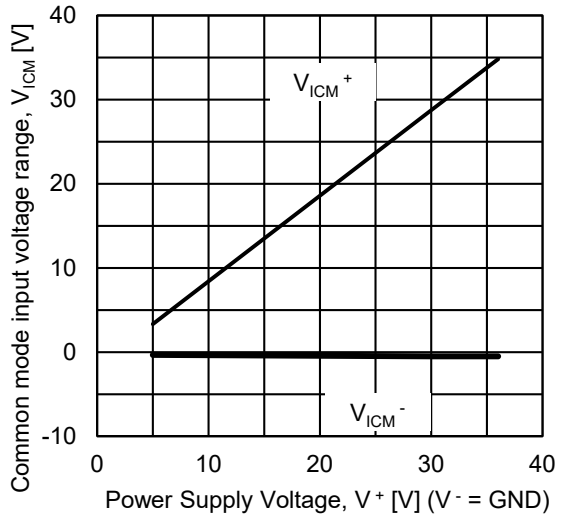
V_{IO} - $V^{\pm}$



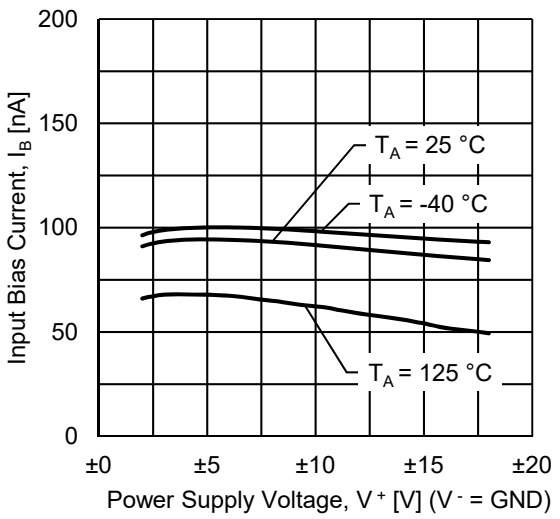
V_{IO} - T_A



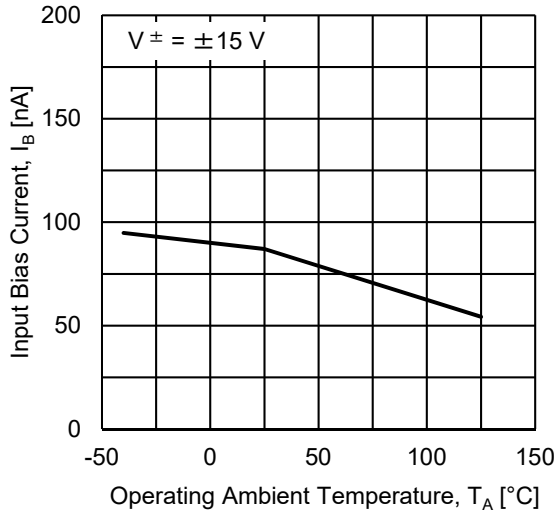
V_{ICM} - V^+



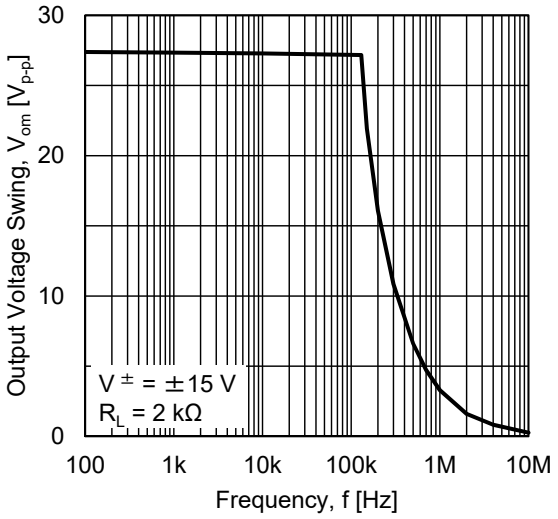
I_B - $V^{\pm}$



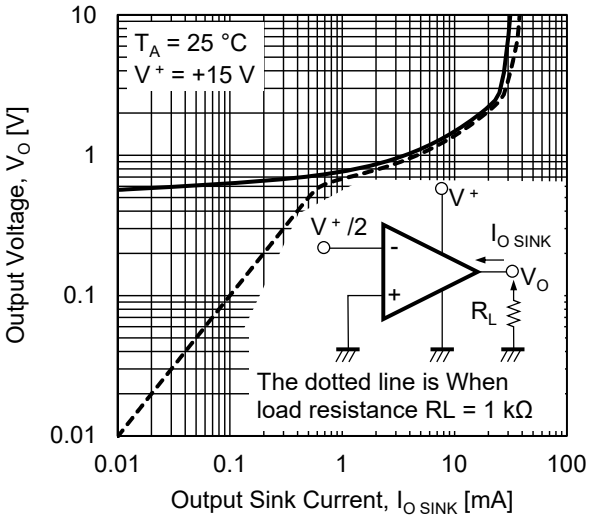
I_B - T_A



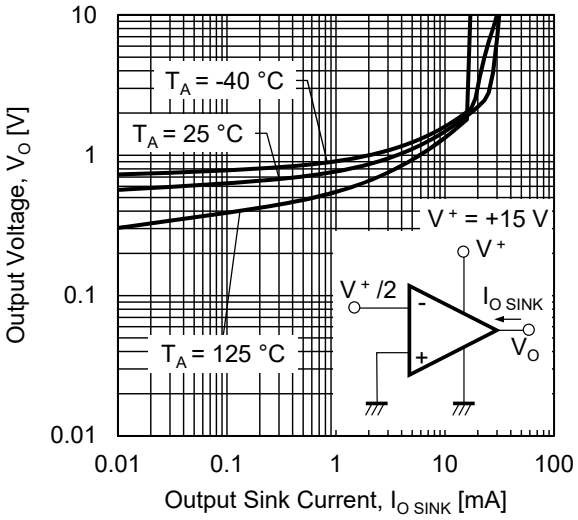
V_O - f



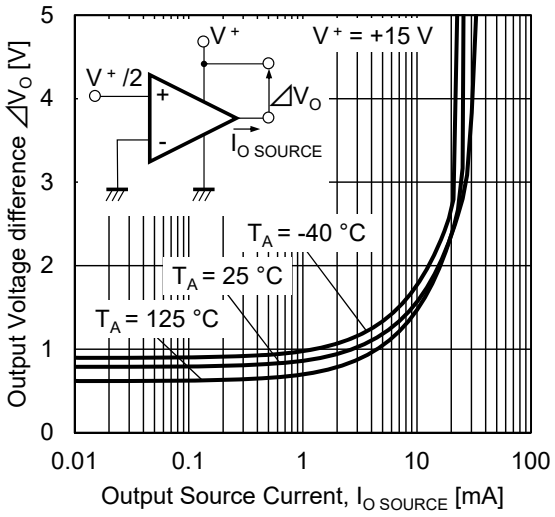
V_O - $I_{O\ SINK}$



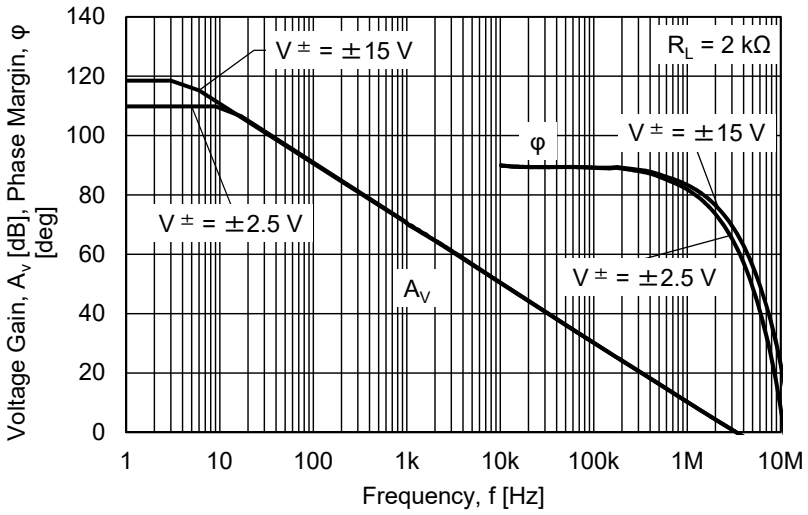
V_O - $I_{O\ SINK}$



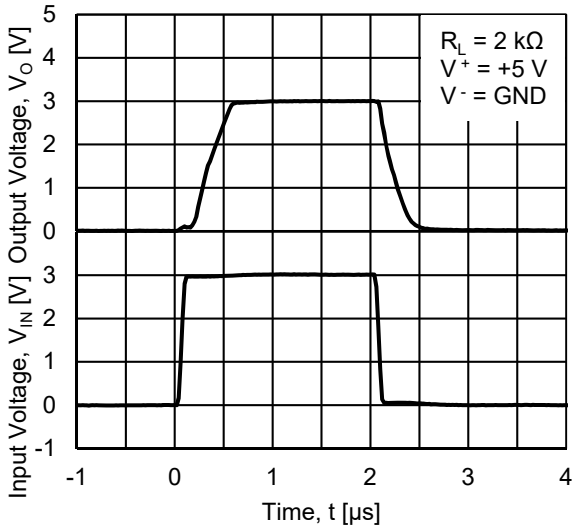
ΔV_O - $I_{O\ SOURCE}$



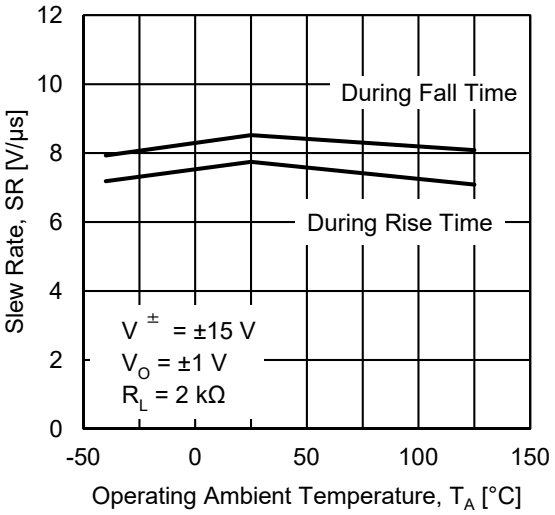
A_V, φ - f



Pulse Response



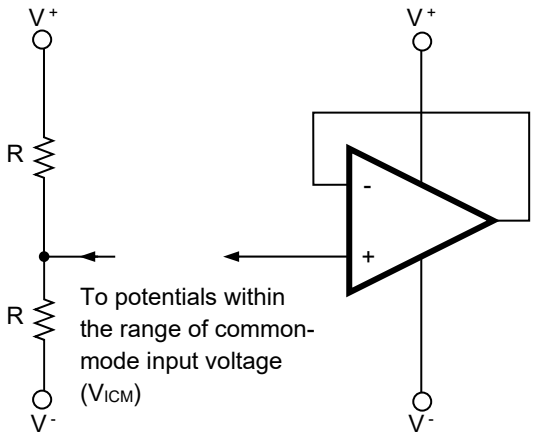
SR - T_A



USE WITH PRECAUTIONS

- **Managing unused circuits**
  If there is an unused circuit, the following connection is recommended.

Process example of unused circuits



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.

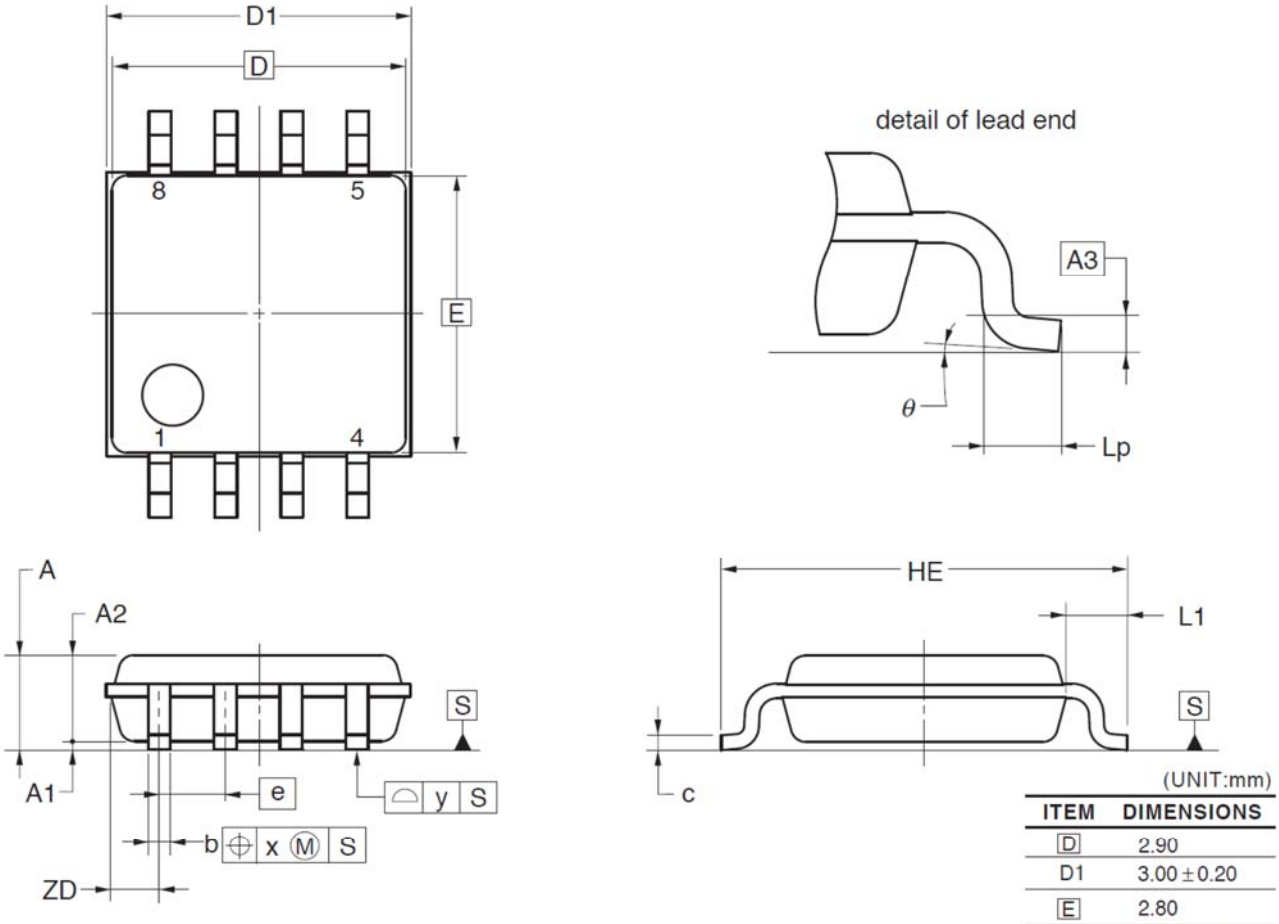
- **Output Operation**
  This IC will not be able to sink output current when the output voltage is V− + 0.7 V and below. In this case, the output voltage level can be improved to the V- side by connecting the load resistor between the output terminal and V- to sink the current at the load resistor. (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 effect. Therefore, pay attention to warpage or bending of a board.

PACKAGE DRAWINGS

8-PIN PLASTIC MSOP

JEITA Package Code	RENESAS Code	Previous Code	MASS (TYP.) [g]
P-TSSOP8-2.8x2.9-0.65	PTSP0008JF-A	P8MP-65-KAA-1	0.02



(UNIT:mm)

ITEM	DIMENSIONS
D	2.90
D1	3.00 ±0.20
E	2.80
HE	4.00 ±0.20
e	0.65
b	0.22 ±0.05
A	1.03 MAX.
A1	0.08 ±0.05
A2	0.85±0.05
A3	0.25
L1	0.60±0.20
c	$0.145^{+0.05}_{-0.03}$
Lp	0.37 ±0.10
x	0.10
y	0.10
θ	$3^{\circ}{}^{+5^{\circ}}_{-3^{\circ}}$
ZD	0.525

NOTE

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

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7. 虽然瑞萨电子一直致力于提高瑞萨电子产品的质量和可靠性，但是，半导体产品有其自身的具体特性，如一定的故障发生率以及在某些使用条件下会发生故障等。除非是瑞萨电子数据表或其他瑞萨电子文档中指定为高可靠性产品或用于恶劣环境的产品，否则瑞萨电子产品未进行防辐射设计。用户负责执行安全保护措施，以避免因瑞萨电子产品失效或发生故障而造成身体伤害、火灾导致伤害或损害和/或其他对公众构成危险的事故。例如进行软硬件安全设计（包括但不限于冗余设计、防火控制以及故障预防等）、适当的老化处理或其他适当的措施等。由于对微机软件单独进行评估非常困难且不实际，所以请用户自行负责对最终产品或系统进行安全评估。
8. 关于环境保护方面的详细内容，例如每种瑞萨电子产品的环境兼容性等，请与瑞萨电子的营业部门联系。用户负责仔细并充分查阅对管制物质的使用或含量进行管理的所有适用法律法规（包括但不限于《欧盟RoHS指令》），并在使用瑞萨电子产品时遵守所有适用法律法规。对于因用户未遵守相应法律法规而导致的损害或损失，瑞萨电子概不承担任何责任。
9. 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、使用及销售的任何产品或系统中。也不可将瑞萨电子产品或技术用于(1)与大规模杀伤性武器（例如核武器、化学武器、生物武器或运送此等武器的导弹，包括无人机(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使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。
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（注1） 瑞萨电子：在本文档中指瑞萨电子株式会社及其控股子公司。
（注2） 瑞萨电子产品：指瑞萨电子开发或生产的任何产品。

(Rev.4.0-1 November 2017)

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