µPC4570

Ultra Low-Noise, High Speed, Wide Band, Dual Operational Amplifier

R03DS0135EJ0100
Rev.1.00
2019.1.17

DESCRIPTION

µPC4570 is a high performance version of general-purpose low-noise operational amplifier µPC258, 4558. Various characteristics such as band, slew rate, including input equivalent noise were greatly improve in comparison to µPC258 and 4558. It is also possible to operate the amplifier with stability for gain of 1 (total feedback or unity gain)

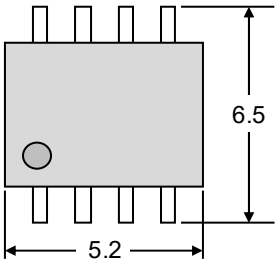
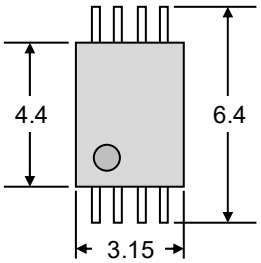
Therefore, it is ideal for application circuits such as audio preamplifiers, equalizers, tone controls, active filters.

Under this product series, there is also a quad type µPC4574 with equivalent characteristics.

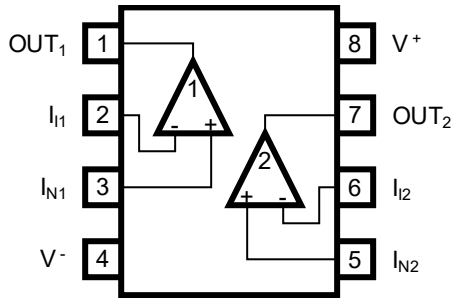
FEATURES

- Equivalent Input Noise Voltage (f = 1 kHz) 4.5 nV/√Hz (TYP.)
- Total Harmonic Distortion Rate (f = 20 Hz ~ 20 kHz) 0.002 % (TYP.)
- Slew Rate 7 V/µs (TYP.)
- Gain Bandwidth Product GBW (f = 100 kHz) 15 MHz (TYP.)
- Input Offset Voltage ±0.3 mV (TYP.)
- Operating Ambient Temperature -40 ~ +85 °C
- Internal Frequency Compensation
- AEC-Q100 Compliance

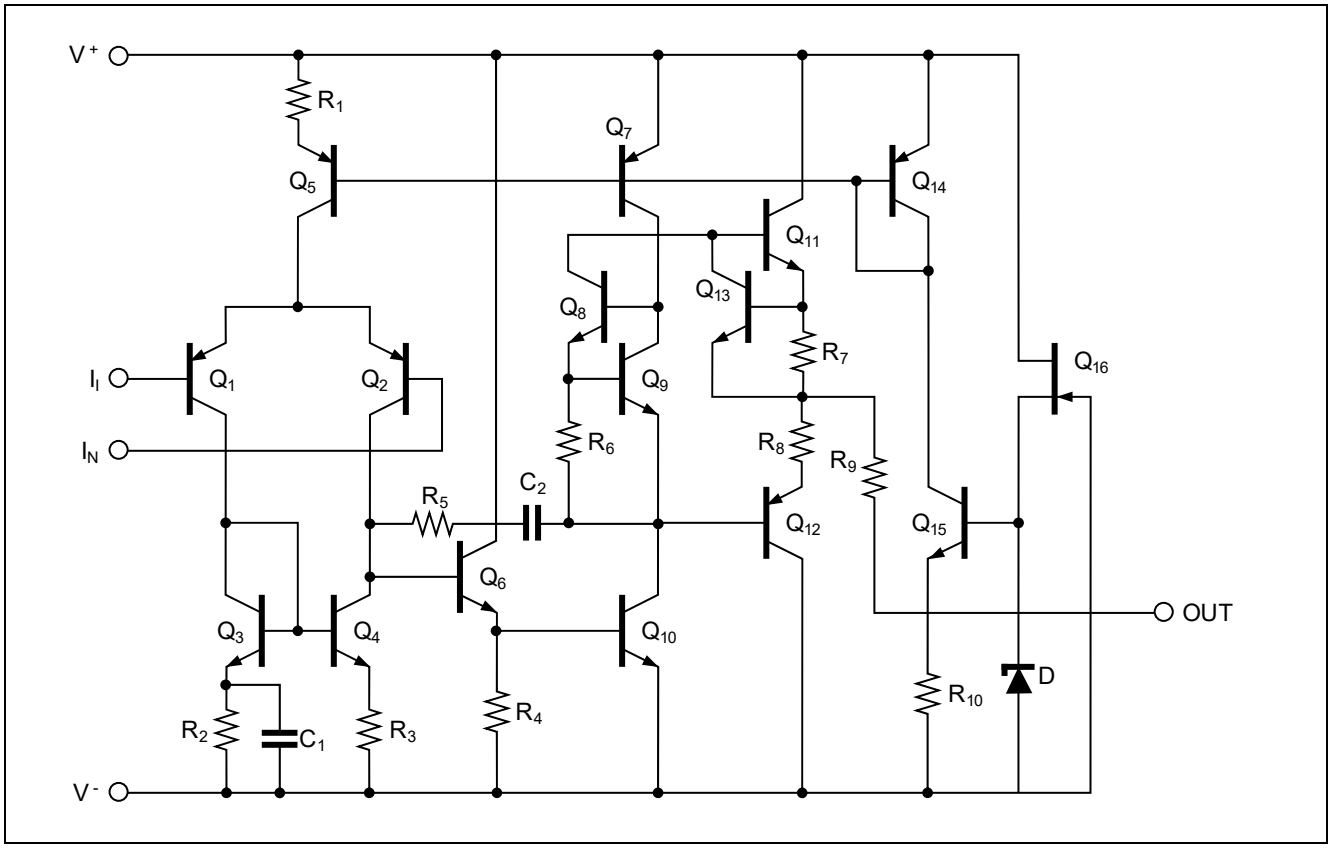
PRODUCT LINEUP

Package	Standard SOP	TSSOP
Product Name	µPC4570G2	µPC4570GR
Outline		
(Mounting Area Ratio)	(100%)	(60%)

PIN CONFIGURATION (Top View)



EQUIVALENT CIRCUIT (1/2CIRCUIT)



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}	±30	V
Input Voltage Note 2	V_I	V^- -0.3 ~ V^+ +0.3	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	10	s
Operating Ambient Temperature	T_A	-40 ~ +85	°C
Storage Temperature	T_{stg}	-55 ~ +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 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.
3. The output terminal must be applied 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.
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.
   µPC4570G2 : This is the value at $T_A \geqq 25$ °C. De-rate -4.4 mW/°C when $T_A > 25$ °C
   µPC4570GR : This is the value at $T_A \geqq 44$ °C. De-rate -5.5 mW/°C when $T_A > 44$ °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	$V^{\pm}$	±4		±16	V
Output Current	I_O			±10	mA
Source Resistance	R_S			50	kΩ
Capacitive Load (A_V = +1)	C_L			100	pF

ELECTRICAL CHARACTERISTICS

(T_A = 25 °C, $V^{\pm}$ = ±15 V)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±0.3	±5	mV	$R_S \leqq 50$ Ω
Input Offset Current	I_{IO}		±10	±100	nA	
Input Bias Current Note 6	I_B		100	400	nA	
Large Signal Voltage Gain	A_V	30000	300000			$R_L \geqq 2$ kΩ, V_O = ±10V
Circuit Current Note 7	I_{CC}		5	8	mA	
Common Mode Rejection Ratio	CMR	80	100		dB	
Supply Voltage Rejection Ratio	SVR	80	100		dB	
Output Voltage Swing	V_{om}	±12	±13.4		V	$R_L \geqq 10$ kΩ
Output Voltage Swing	V_{om}	±10	±12.8		V	$R_L \geqq 2$ kΩ
Common Mode Input Voltage Range	V_{ICM}	±12	±14		V	
Slew Rate	SR	5	7		V/μs	$R_L \geqq 2$ kΩ
Gain Bandwidth Product	GBW	10	15		MHz	f_O = 100 kHz
Unity Gain Frequency	f_{unity}		7		MHz	open loop
Phase Margin	φ_{unity}		50		度	open loop
Total Harmonic Distortion	THD		0.002		%	V_O = 3 $V_{r.m.s.}$, f = 20 Hz ~ 20 kHz (Figure 1)
Equivalent Noise Input Voltage	V_n		0.9		$\mu V_{r.m.s}$	RIAA (Figure 2)
Equivalent Noise Input Voltage	V_n		0.53	0.65	$\mu V_{r.m.s}$	FLAT + JIS A, R_S = 100 Ω (Figure 3)
Equivalent Noise Input Voltage Density	e_n		5.5		nV/√Hz	f_O = 10 Hz, R_S = 100 Ω
Equivalent Noise Input Voltage Density	e_n		4.5		nV/√Hz	f_O = 1 kHz, R_S = 100 Ω
Equivalent Noise Input Current Density	i_n		0.7		pA/√Hz	f_O = 1 kHz
Channel Separation			120		dB	f = 20 Hz ~ 20 kHz

【Note】6. The current flow direction of the input bias is out from the IC because the first stage of the IC is composed of PNP transistor.

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

MEASUREMENT CIRCUIT

Figure1: Total Harmonic Distortion Measurement Circuit

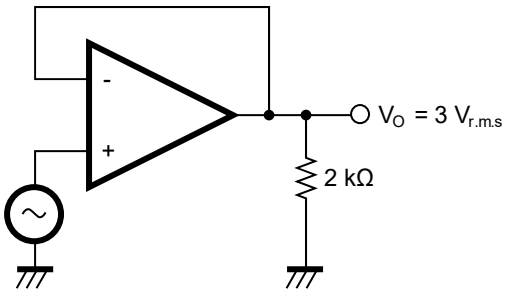


Figure2: Noise Measurement Circuit (RIAA)

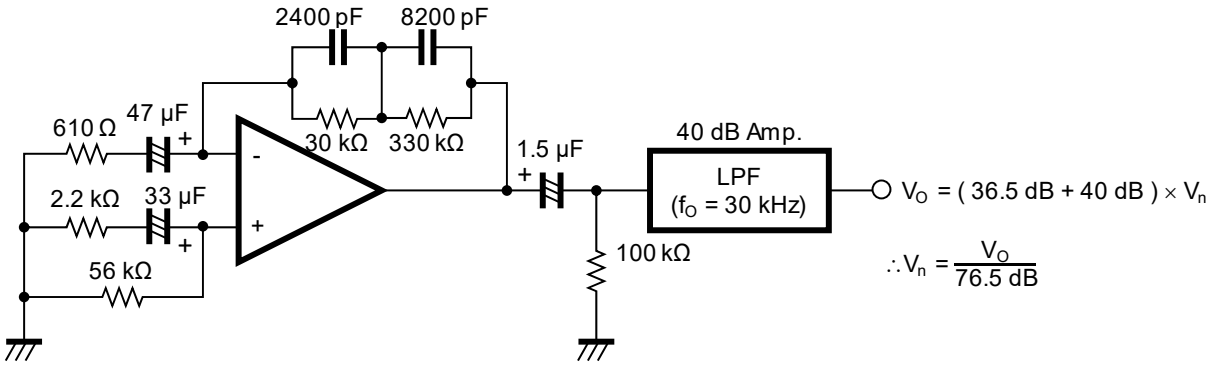
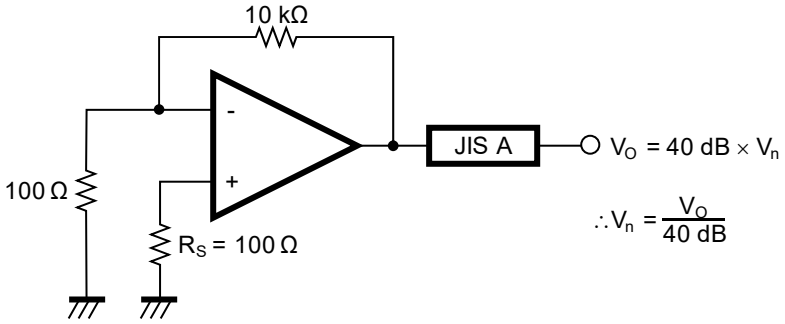
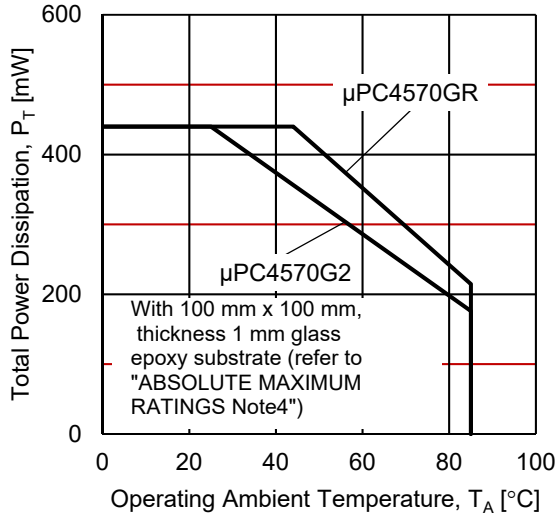


Figure3 Noise Measurement Circuit (FLAT+JIS A)

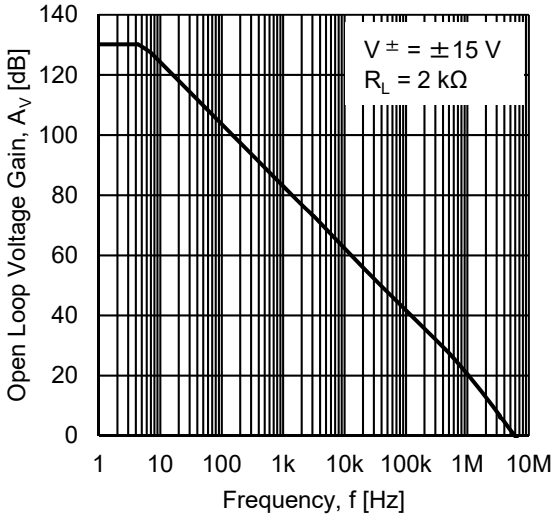


ELECTRICAL CHARACTERISTICS

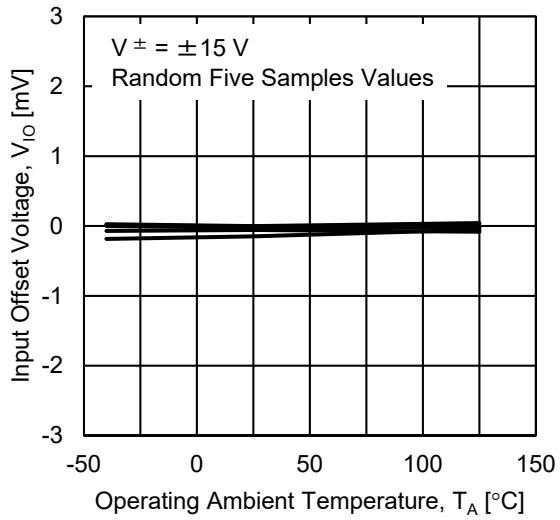
P_T vs. T_A



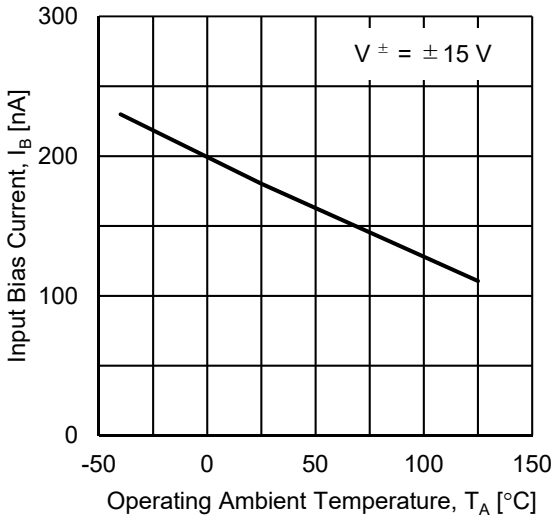
AV, φ vs. f



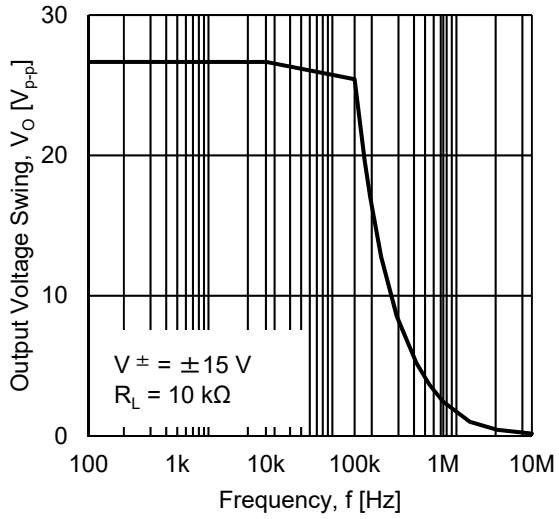
V_{IO} vs. T_A



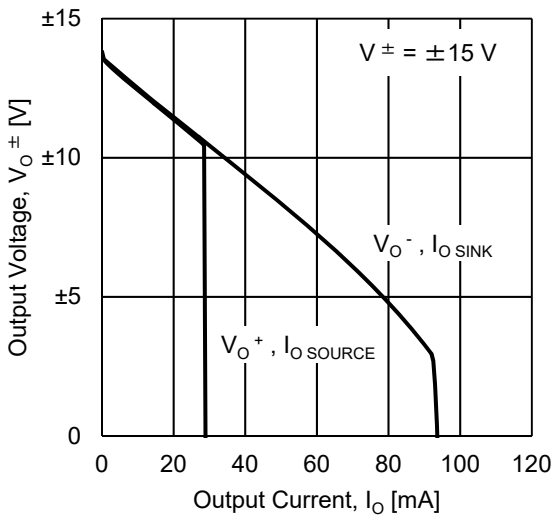
I_B vs. T_A



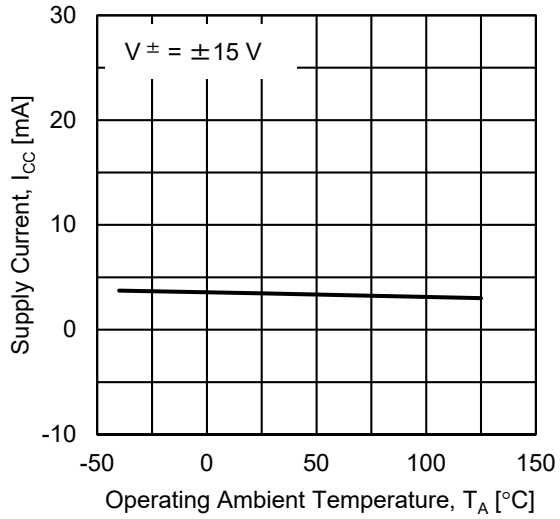
V_O vs. f



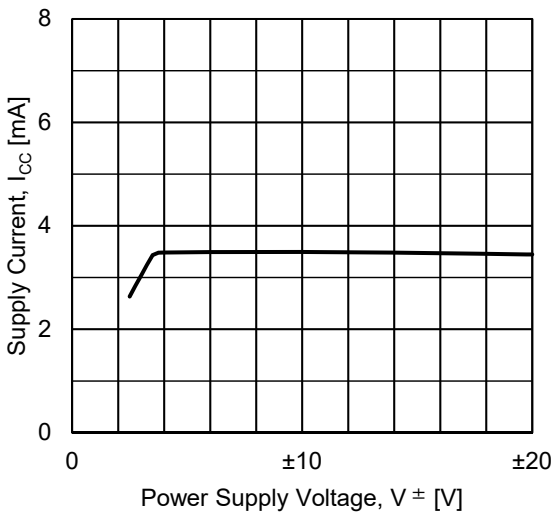
$V_O{}^{\pm}$ vs. I_O



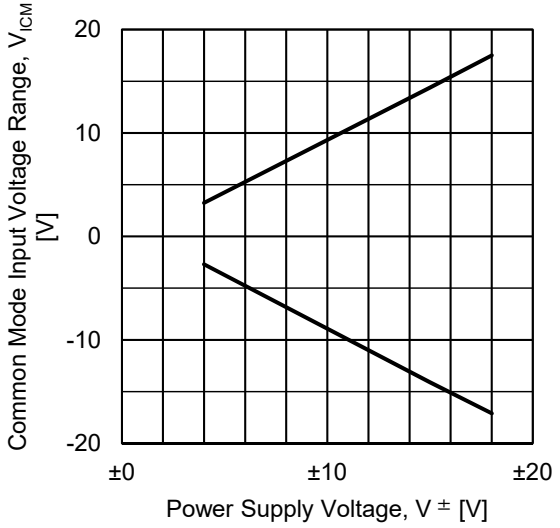
I_{CC} vs. T_A



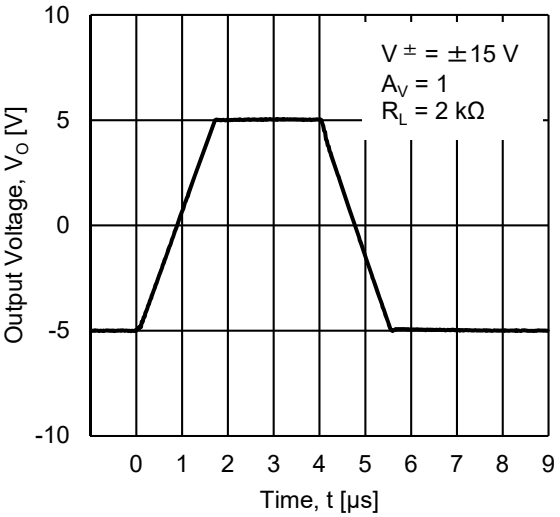
I_{CC} vs. $V^{\pm}$



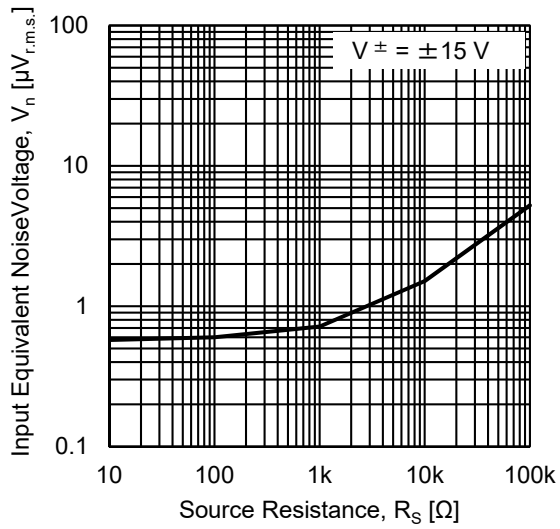
V_{ICM} vs. $V^{\pm}$



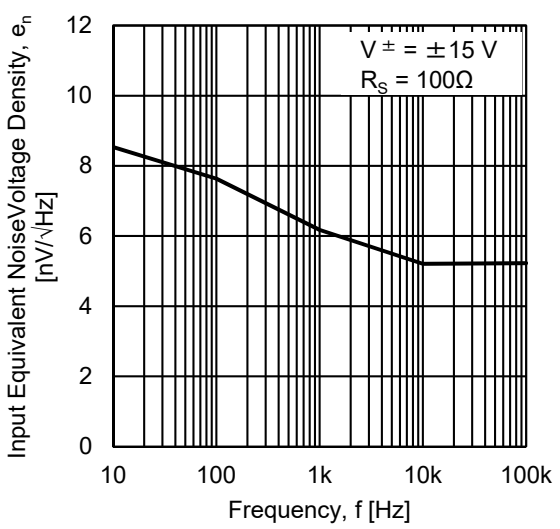
Voltage Follower Pulse Response

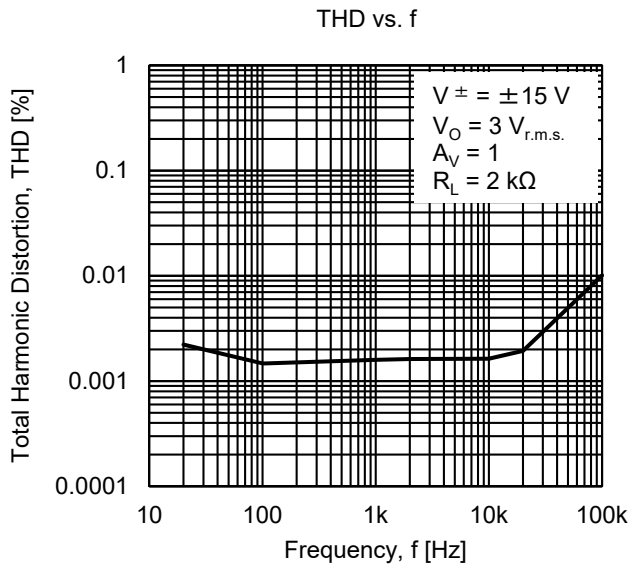


V_n vs. R_S (FLAT + JIS A)



e_n - f



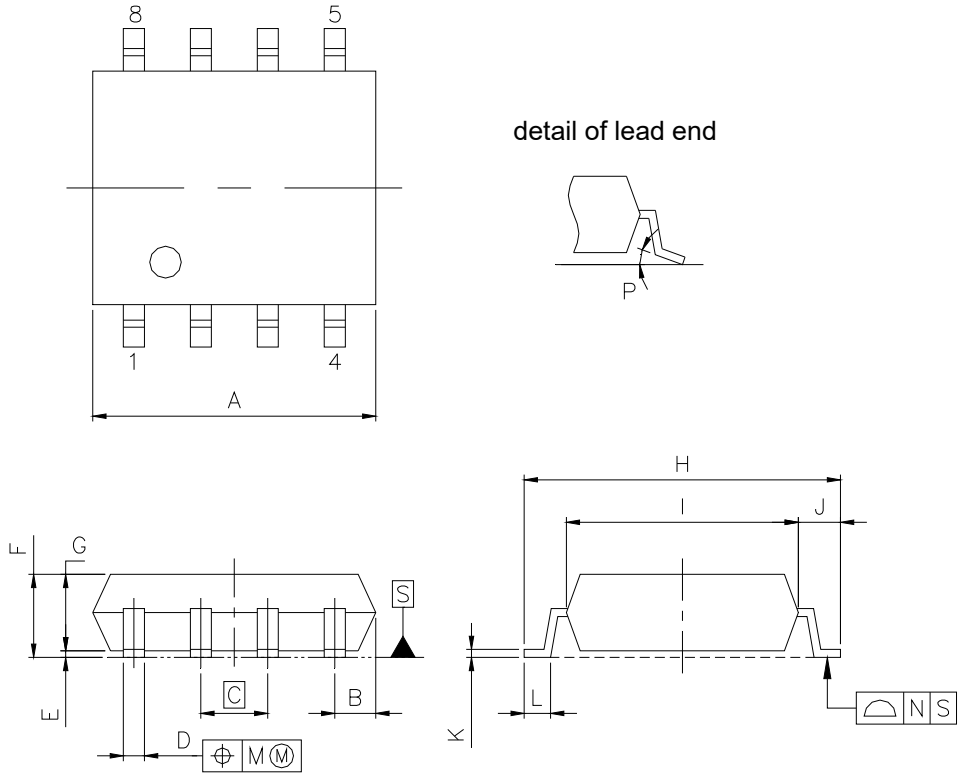

THD vs. f
Total Harmonic Distortion, THD [%]
1
0.1
0.01
0.001
0.0001
10
100
1k
10k
100k
Frequency, f [Hz]
V ± = ±15 V
VO = 3 Vr.m.s.
AV = 1
RL = 2 kΩ

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

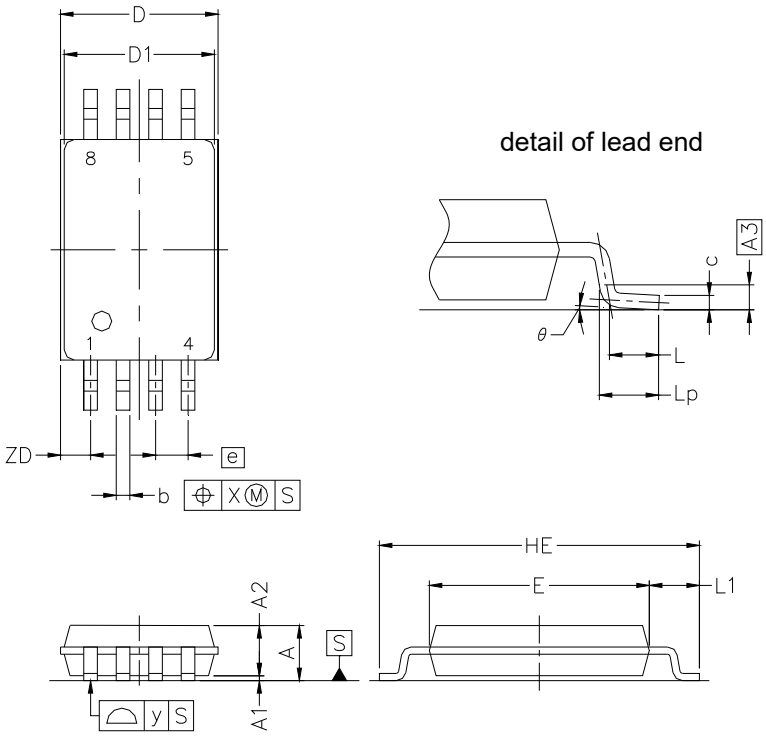
Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

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° +5° -3°
e	0.65
x	0.10
y	0.10
ZD	0.60

Revision Record	μPC4570 Datasheet

Rev.	Date of Issue	Revised Content	
		Page	Point
1.00	2017.08.31	9	New Datasheet Created

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   高质量等级： 运输设备（汽车、火车、轮船等）、交通控制系统（交通信号灯）、大型通讯设备、关键金融终端系统、安全控制设备等。
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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。
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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12. 如果对本文档所记载的信息或瑞萨电子产品有任何疑问，请向瑞萨电子的营业部门咨询。

（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。

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