µPC451, µPC324

Single Power Supply Quad Operational Amplifiers

R03DS0142EJ0100
Rev.1.00
2019.1.17

DESCRIPTION

µPC451, µ PC324 are quad operational amplifiers designed to operate on a single power supply. The features include low-voltage operation, a common-mode input voltage that range from V^- (GND) level, an output from a V^- (GND) level that is determined by the output stage of class C push-pull circuit and a 50 µA(TYP.) constant current, and a low current consumption.

In addition to that, these amplifiers can also operate in both positive and negative power supply and can be used extensively in various amplifier circuits.

The µPC451 is suited for wide operating ambient temperature use due to its temperature expansion type, while µPC324 is for general purposes usage.

A DC parameter selection that is compatible to operational amplifiers is also available.

µPC1251, µ PC358 which are dual types with the same circuit configuration are also available under this series of operational amplifiers.

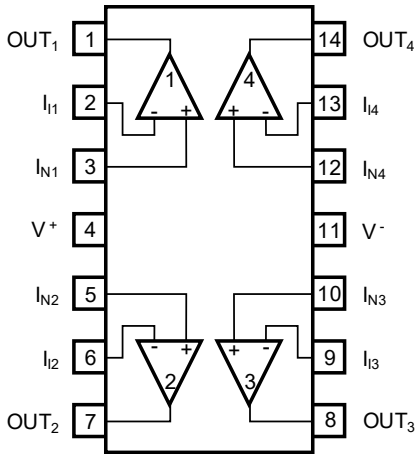
FEATURES

- Input Offset Voltage ±2 mV (TYP.)
- Input Offset Current ±5 nA (TYP.)
- Large Signal Voltage Gain 100000 (TYP.)
- Internal Frequency Compensation
- Output Short-Circuit Protection

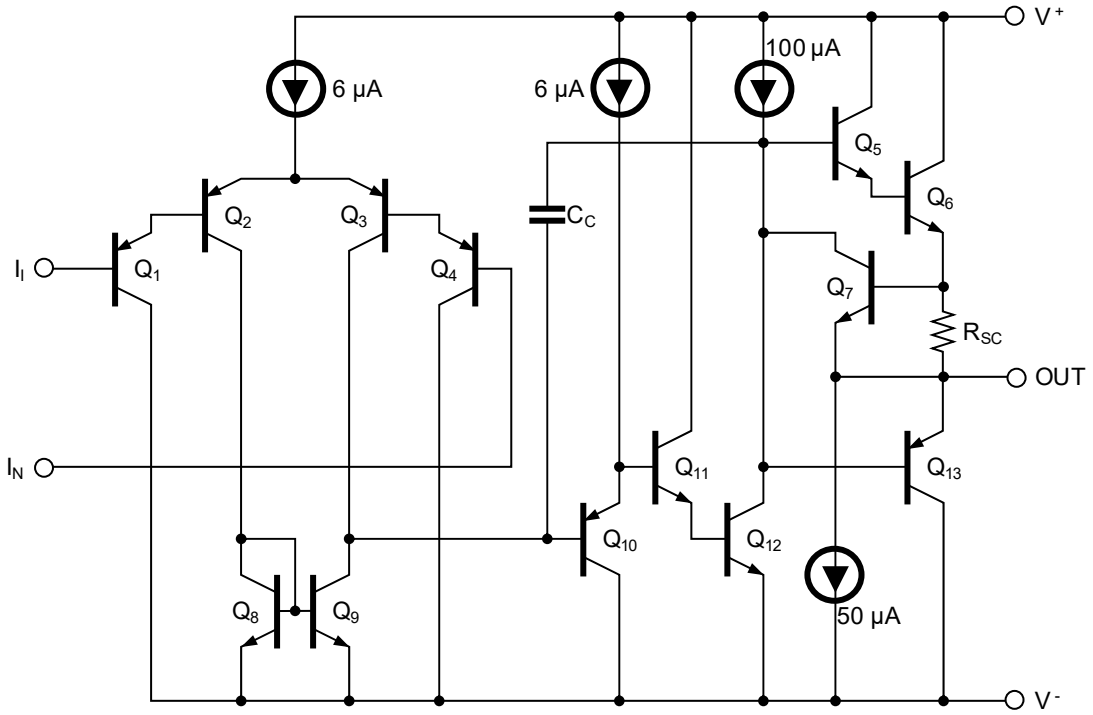
ORDERING INFORMATION

Ordering Name	Selection	Package
µPC451G2-A	General	14-pin plastic SOP (5.72 mm (225))
µPC451G2(5)-A	DC parameter selection	14-pin plastic SOP (5.72 mm (225))
µPC324G2-A	General	14-pin plastic SOP (5.72 mm (225))
µPC324G2(5)-A	DC parameter selection	14-pin plastic SOP (5.72 mm (225))
µPC451GR-9LG-A	General	14-pin plastic TSSOP (5.72 mm (225))
µPC451GR(5)-9LG-A	DC parameter selection	14-pin plastic TSSOP (5.72 mm (225))
µPC324GR-9LG-A	General	14-pin plastic TSSOP (5.72 mm (225))
µPC324GR(5)-9LG-A	DC parameter selection	14-pin plastic TSSOP (5.72 mm (225))

PIN CONFIGURATION (Marking side)



EQUIVALENT CIRCUIT (1/4 Circuit)



ABSOLUTE MAXIMUM RATINGS

(T_A = 25 °C)

Parameter	Symbol	µPC451G2, µPC451G2(5)	µPC324G2, µPC324G2(5)	µPC451GR, µPC451GR(5)	µPC358GR, µPC358GR(5)	Unit
Voltage between V+ and V– Note1	$V^+ - V^-$	-0.3 ~ +32				V
Differential Input Voltage	V_{ID}	±32				V
Input Voltage Note 2	V_I	V^- -0.3 ~ V^- +32				V
Output applied Voltage Note3	V_o	V^- -0.3 ~ V^+ +0.3				V
Total Power Dissipation Note4	P_T	550				mW
Output Short Circuit Duration Note5	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. The input voltage is allowed to input without damage or destruction independent of the magnitude of V+. Either input signal is not allowed to go negative by more than 0.3 V. In addition, the input voltage that operates normally as an operational amplifier is within the Common Mode Input Voltage range of an electrical characteristic.

3. A range where input voltage can be applied to an output pin externally with no deterioration or damage to the feature (characteristic). The input voltage can be applied regardless of the electric supply voltage. This specification which includes the transition state such as electric power ON/OFF must be kept.

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 derating ratio depending on the operating ambient temperature.

µPC4511G2, 324G2: Derate at -5.5 mW/°C when T_A ＞ 25 °C
µPC451GR-9LG : Derate at -7.0 mW/°C when T_A ＞ 71 °C
(Junction − ambient thermal resistance $R_{th(J-A)}$ = 144°C/W)
µPC324GR-9LG : Derate at -7.0 mW/°C when T_A ＞ 46 °C
(Junction − ambient thermal resistance $R_{th(J-A)}$ = 144°C/W)

5. Short circuits from the output to V^+ can cause destruction. (V^+ ≦ +15V, for any one channel only) Pay careful attention to the total power dissipation by not exceeding the absolute maximum ratings, **Note 4**.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Power Supply Voltage (Split)	$V^±$	±1.5		±15	V
Power Supply Voltage (V^- = GND)	V^+	+3		+30	V

ELECTRICAL CHARACTERISTICS

µPC451, µPC324 (T_A = 25 °C, V^+ = +5 V, V^- = GND)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±2	±7	mV	R_S = 0 Ω
Input Offset Current	I_{IO}		±5	±50	nA	
Input Bias Current note 6	I_B		15	250	nA	
Large Signal Voltage Gain	A_V	25000	100000			R_L ≧ 2 kΩ
Circuit Current note 7	I_{CC}		1.2	2.0	mA	R_L = ∞, I_O = 0 A
Common Mode Rejection Ratio	CMR	65	85		dB	
Supply Voltage Rejection Ratio	SVR	65	100		dB	
Output Voltage Swing	V_O	0		V^+ -1.5	V	R_L = 2 kΩ (Connected to GND)
Common Mode Input Voltage Range	V_{ICM}	0		V^+ -1.5	V	
Output Source Current	$I_{O\ SOURCE}$	20	40		mA	$V_{IN\ (+)}$ = +1 V, $V_{IN\ (-)}$ = 0 V
Output Sink Current	$I_{O\ SINK1}$	10	20		mA	$V_{IN\ (-)}$ = +1 V, $V_{IN\ (+)}$ = 0 V
	$I_{O\ SINK2}$	12	50		µA	$V_{IN\ (-)}$ = +1 V, $V_{IN\ (+)}$ = 0 V, V_O = 200 mV
Channel Separation			120		dB	f = 1 ~ 20 kHz

µPC451(5), µPC324(5) (T_A = 25 °C, V^+ = +5 V, V^- = GND)

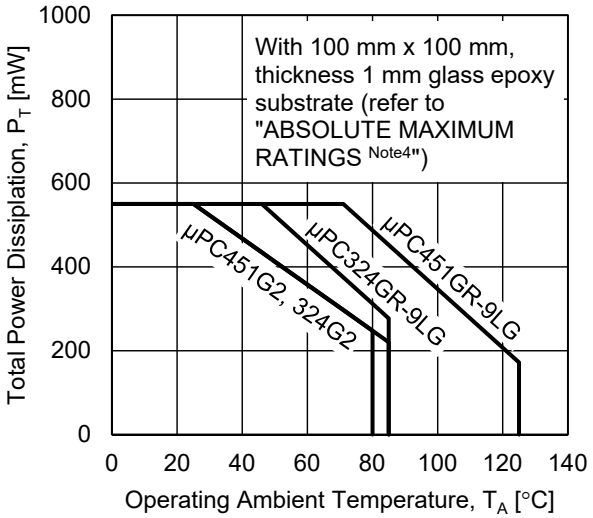
Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±2	±3	mV	R_S = 0 Ω
Input Offset Current	I_{IO}		±5	±50	nA	
Input Bias Current Note 6	I_B		15	60	nA	
Large Signal Voltage Gain	A_V	50000	100000			R_L ≧ 2 kΩ
Circuit Current Note7	I_{CC}		1.2	1.5	mA	R_L = ∞, I_O = 0 A
Common Mode Rejection Ratio	CMR	65	85		dB	
Supply Voltage Rejection Ratio	SVR	65	100		dB	
Output Voltage Swing	V_O	0		V^+ -1.5	V	R_L = 2 kΩ (Connected to GND)
Common Mode Input Voltage Range	V_{ICM}	0		V^+ -1.4	V	
Output Source Current	$I_{O\ SOURCE}$	30	40		mA	$V_{IN\ (+)}$ = +1 V, $V_{IN\ (-)}$ = 0 V
Output Sink Current	$I_{O\ SINK1}$	15	20		mA	$V_{IN\ (-)}$ = +1 V, $V_{IN\ (+)}$ = 0 V
	$I_{O\ SINK2}$	30	50	70	µA	$V_{IN\ (-)}$ = +1 V, $V_{IN\ (+)}$ = 0 V, V_O = 200 mV
Channel Separation			120		dB	f = 1 ~ 20 kHz

【Note】 6. The absolute value of the input bias current is small, thus the direction of the current flowing from the inside of the IC may be reversed due to variations in the product during high temperature.

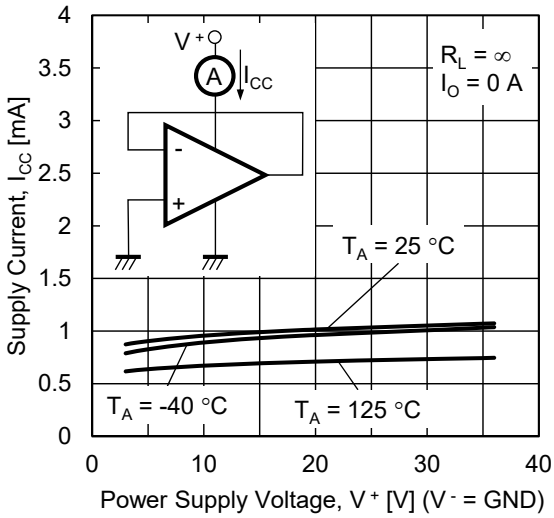
7. This is a current that flows in the internal circuit. This current will flow irrespective of the channel used.

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25 °C, TYP.) (Reference Value)

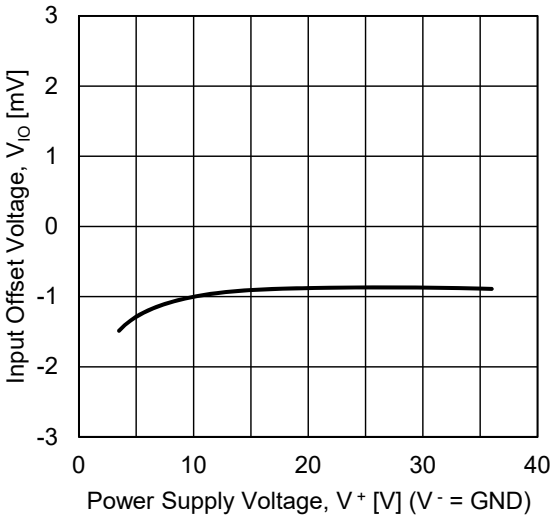
P_T vs. T_A



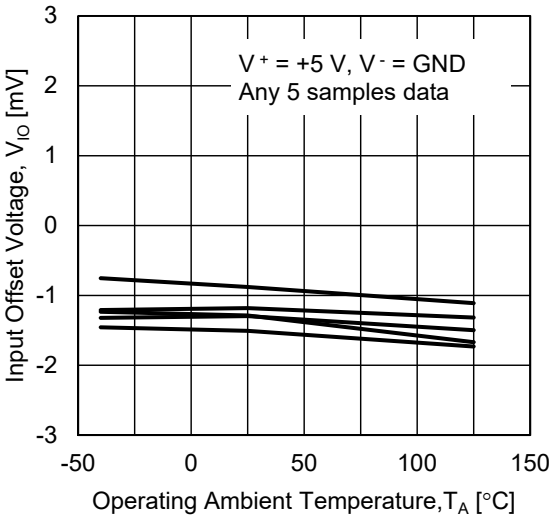
I_{CC} vs. V^+



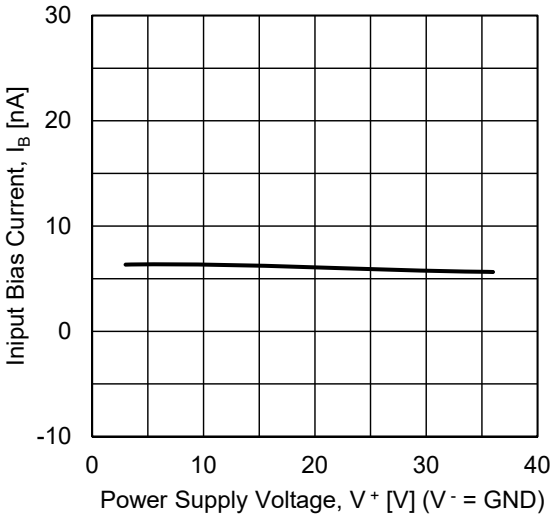
V_{IO} vs. V^+



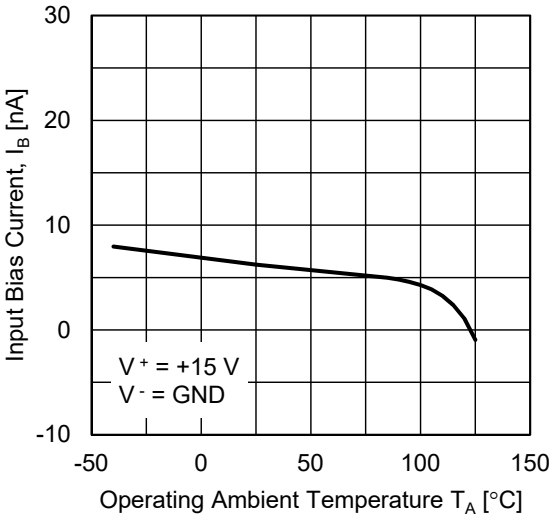
V_{IO} vs. T_A



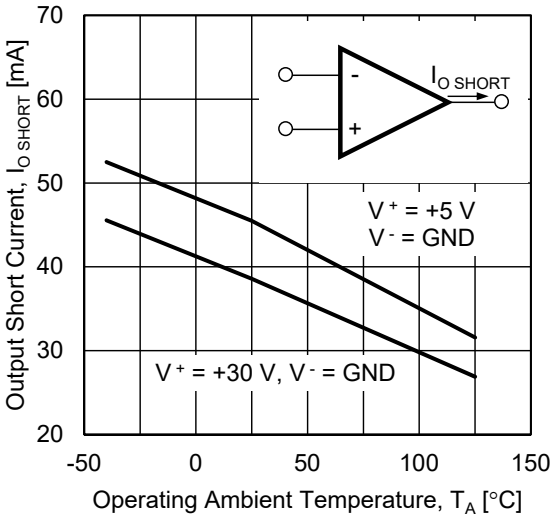
I_B vs. V^+



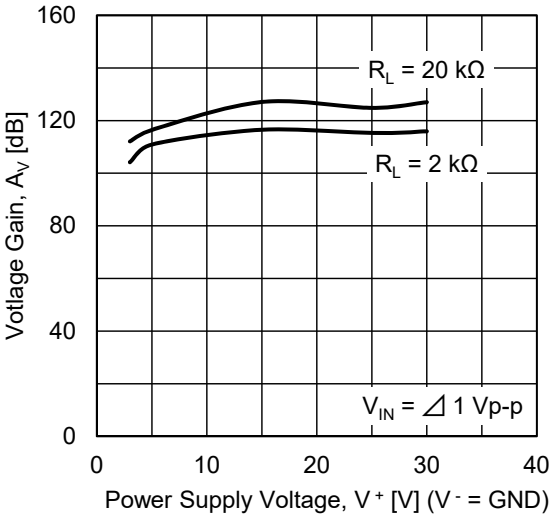
I_B vs. T_A



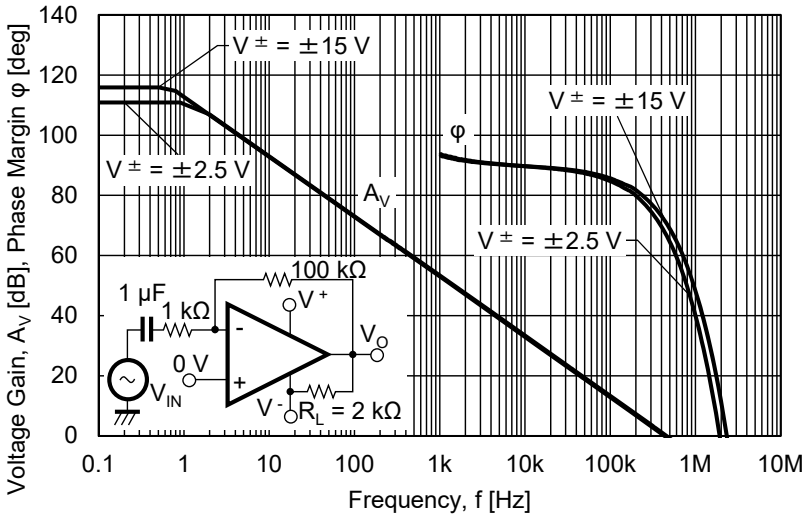
$I_{O\ SHORT}$ vs. T_A



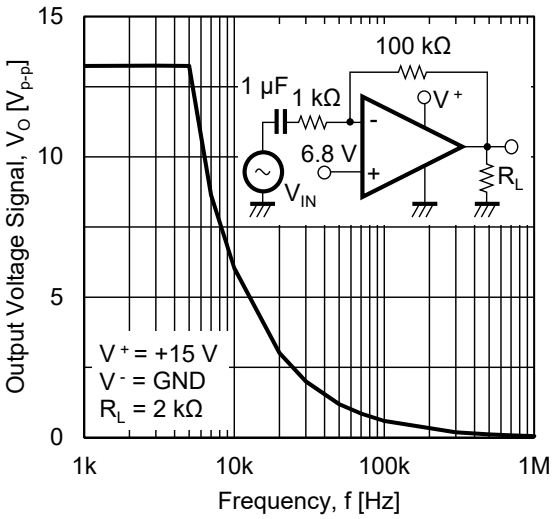
A_V vs. V^+



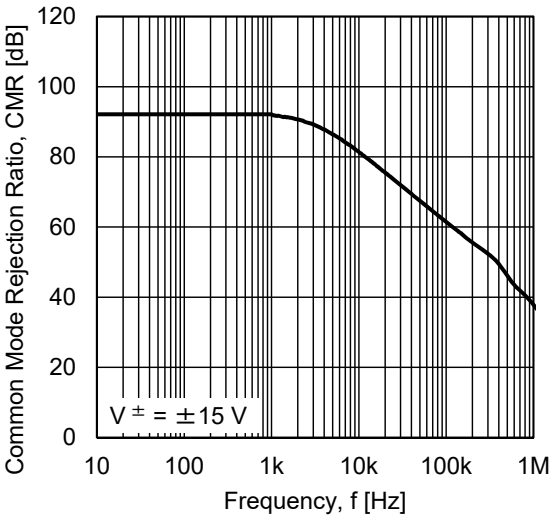
A_V, φ vs. f

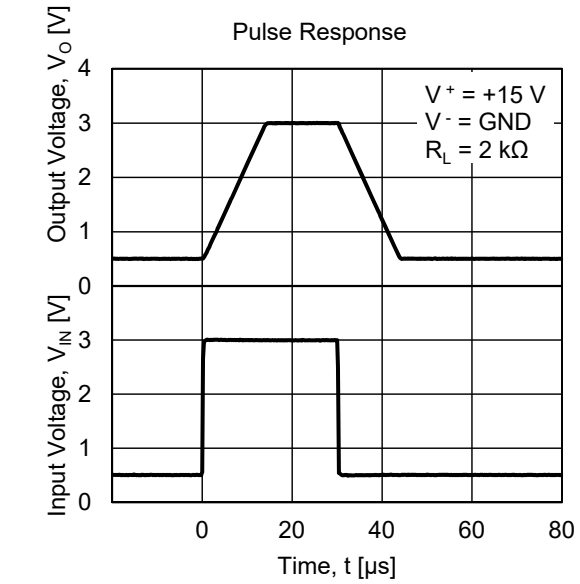


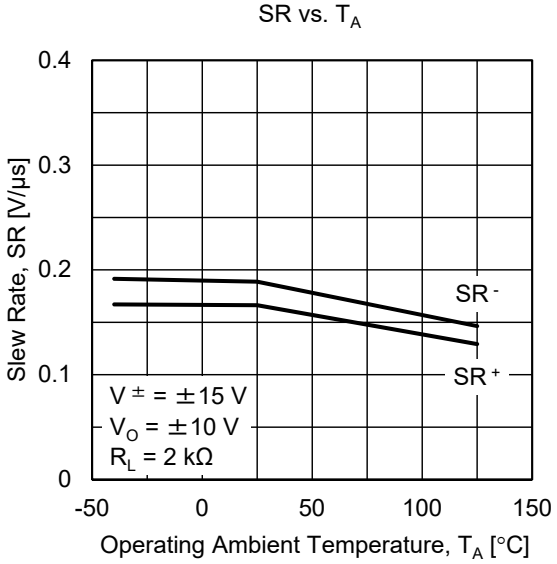
V_O vs. f

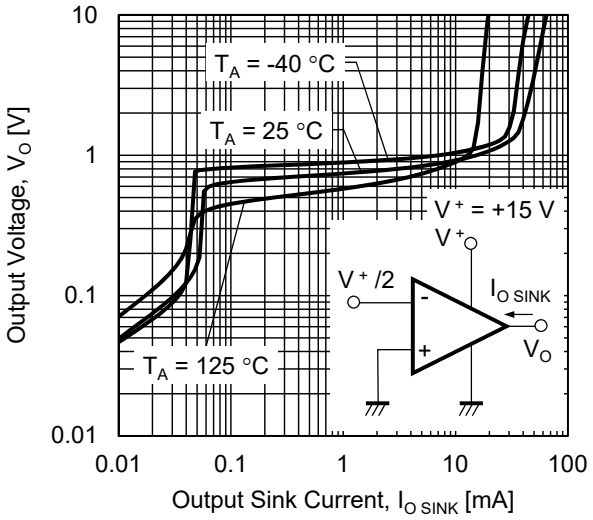


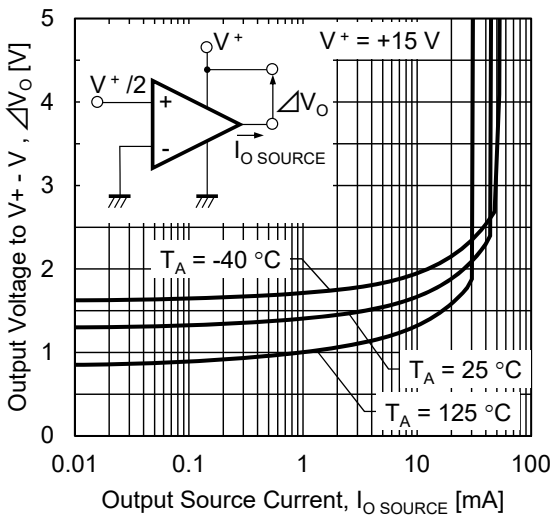
CMR vs. f




Pulse Response
Output Voltage, V_O [V]
Input Voltage, V_{IN} [V]
V^+ = +15 V
V^- = GND
R_L = 2 kΩ
Time, t [µs]


SR vs. T_A
Slew Rate, SR [V/µs]
SR -
SR +
$V^\pm$ = ±15 V
V_O = ±10 V
R_L = 2 kΩ
Operating Ambient Temperature, T_A [°C]


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

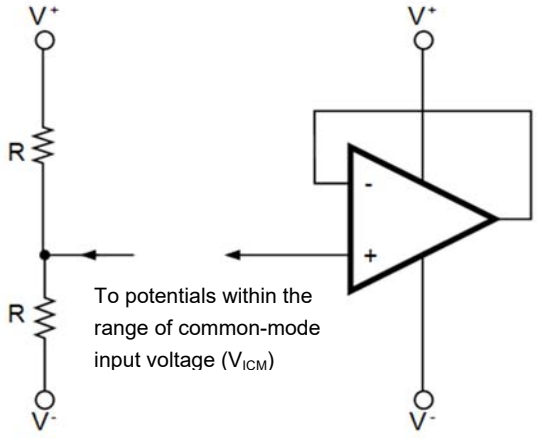

ΔV_O vs. $I_{O\ SOURCE}$
Output Voltage to V+ - V , ΔV_O [V]
V^+
V^+ /2
ΔV_O
$I_{O\ SOURCE}$
V^+ = +15 V
T_A = -40 °C
T_A = 25 °C
T_A = 125 °C
Output Source Current, $I_{O\ SOURCE}$ [mA]

PRECAUTIONS

- **The process of unused circuits**

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

Process example of unused circuits



Remark: A midpoint potential of V^+ and V^- is applied to this example.

- **Ratings of input/output pin voltage**
  When the voltage of input/output pin exceeds the absolute maximum rating, it may cause degradation of characteristics or damage, by a conduction of a parasitic diode within an IC. 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 clamp 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^- to $V^+ - 1.5$ (V) (T_A = 25°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}^+ (TYP.): $V^+ - 1.5$ (V) (T_A = 25°C), V_{om}^- (TYP.) ($I_{O\ SINK} \leq 50$ µA): Approx. V^- (V) (T_A = 25°C).
  During designing, include some tolerance such as characteristics variation and temperature characteristics consideration and so forth. In addition, also note that the output voltage range ($V_{om}^+ - V_{om}^-$) will become narrow when an output current increases.

- **Operation of output**
  This IC output level consist of a class C push-pull. Therefore, when a load resistance is connected to the midpoint potential of V^+ , V^- , a crossover distortion occurs during the transition state of output current flow direction (source, sink).

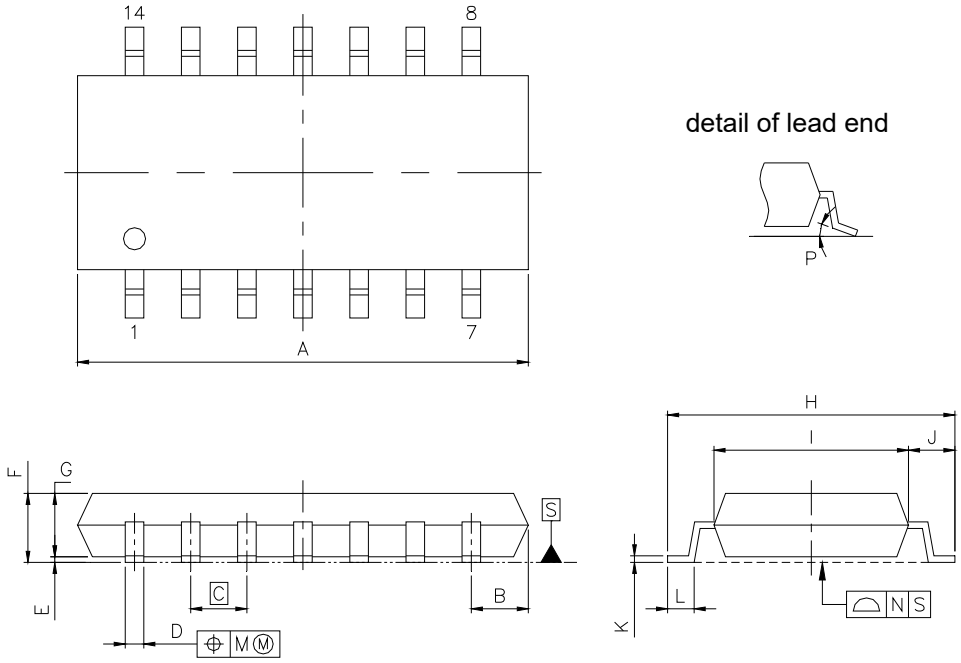
- **Handling of ICs**
  When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuates due to piezoelectric effect. Therefore, pay attention to warpage or bending of a board.

PACKAGE DRAWINGS

14-PIN PLASTIC SOP

JEITA Package code	RENESAS code	Previous code	MASS (TYP.) [g]
P-SOP14-0225-1.27	PRSP0014DI-A	P14GR-50-225B	0.14

Unit : mm



NOTE

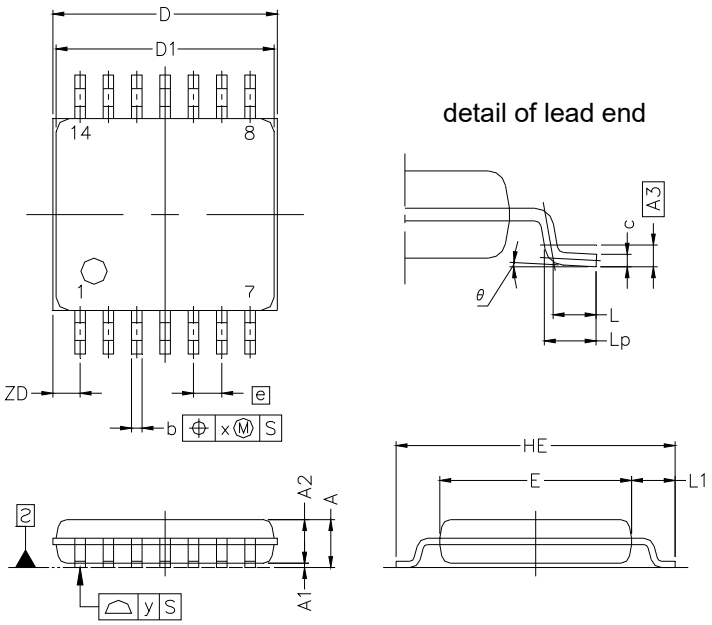
Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	10.2 ±0.26
B	1.42 MAX
C	1.27 (T.P)
D	0.42 +0.08 -0.07
E	0.1 ±0.1
F	1.59 +0.21 -0.2
G	1.49
H	6.5 ±0.2
I	4.4 ±0.1
J	1.1 ±0.16
K	0.17 +0.08 -0.07
L	0.6 ±0.2
M	0.1
N	0.10
P	3° +7° -3°

14-PIN PLASTIC TSSOP

JEITA Package code	RENESAS code	Previous code	MASS(TYP.) [g]
P-TSSOP14-0225-0.65	PTSP0014JB-A	P14GR-65-9LG-1	–

Unit : mm



NOTE

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

ITEM	MILLIMETERS
D	5.15 ±0.15
D1	5.00 ±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	0.625

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

以下“注意事项”为从英语原稿翻译的中文译文，仅作为参考译文，英文版的“Notice”具有正式效力。

注意事项

1. 本文档中所记载的关于电路、软件和其他相关信息仅用于说明半导体产品的操作和应用实例。用户如在产品或系统设计中应用本文档中的电路、软件和相关信息或将此等内容用于其他目的时，请自行负责。对于用户或第三方因使用上述电路、软件或信息而遭受的任何损失和损害，瑞萨电子概不承担任何责任。
2. 瑞萨电子在此明确声明，对于因使用瑞萨电子产品或本文档中所述技术信息（包括但不限于产品数据、图、表、程序、算法、应用实例）而造成的与第三方专利、版权或其他知识产权相关的侵权或任何其他索赔，瑞萨电子不作任何保证并概不承担责任。
3. 本文档所记载的内容不应视为对瑞萨电子或其他人所有的专利、版权或其他知识产权作出任何明示、默示或其它方式的许可及授权。
4. 用户不得对瑞萨电子的任何产品进行全部或部分更改、修改、复制或反向工程。对于用户或第三方因上述更改、修改、复制或对瑞萨电子产品进行反向工程的行为而遭受的任何损失或损害，瑞萨电子概不承担任何责任。
5. 瑞萨电子产品根据其质量等级分为两个等级：“标准等级”和“高质量等级”。 每种瑞萨电子产品的预期用途均取决于产品的质量等级，如下所示：
   标准等级： 计算机、办公设备、通讯设备、测试和测量设备、视听设备、家用电器、机械工具、个人电子设备、工业机器人等。
   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。
   除非是瑞萨电子数据表或其他瑞萨电子文档中明确指定为高可靠性产品或用于恶劣环境的产品，否则瑞萨电子产品不能用于、亦未授权用于可能对人类生命造成直接威胁的产品或系统及可能造成人身伤害的产品或系统（人工生命维持装置或系统、植埋于体内的装置等）中，或者可能造成重大财产损失的产品或系统（太空系统、海底增音机、核能控制系统、飞机控制系统、关键装置系统、军用设备等）中。对于用户或任何第三方因使用不符合瑞萨电子数据表、使用说明书或其他瑞萨电子文档的瑞萨电子产品而遭受的任何损害或损失，瑞萨电子概不承担任何责任。
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。
10. 瑞萨电子产品的买方或分销商，或者分销、处置产品、或以其他方式向第三方出售或转让产品的任何其他方有责任事先向所述第三方通知本文档规定的内容和条件。
11. 在事先未得到瑞萨电子书面认可的情况下，不得以任何形式部分或全部再版、转载或复制本文档。
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。

(Rev.4.0-1 November 2017)

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

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