µPC452, 3403

Single Power Supply Quad Operational Amplifier

R03DS0138EJ0100
Rev.1.00
2019.1.17

DESCRIPTION

µPC452, 3403 are high-performance version of the single-supply op-amp µPC451, 324.Class AB push-pull circuity is employed in the output stage to avoid crossover distortion, and the AC characteristics of this op-amp are also improved. In addition, this single-supply op-amp can operate in both positive and negative power supply and its common-mode input voltage range can also be used from the V-(GND) level. Therefore, this amplifier can be widely used in various application circuit including single-supply AC amplifiers.

Depending on operating ambient temperature, µPC452 are suited for communication application while µPC3403 are for general purpose usage.

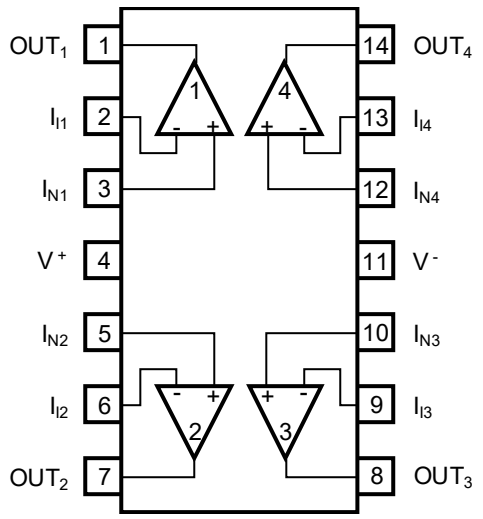
FEATURES

- Input Offset Voltage ±2 mV (TYP.)
- Input Offset Current ±5 nA (TYP.)
- Input Bias Current 45 nA (TYP.)
- Slew Rate 0.8 V/µs (TYP.)
- Built-In phase correction circuit
- Built-In Output Short-Circuit Protection
- Standard quad op-amp terminal connection (pin compatible)

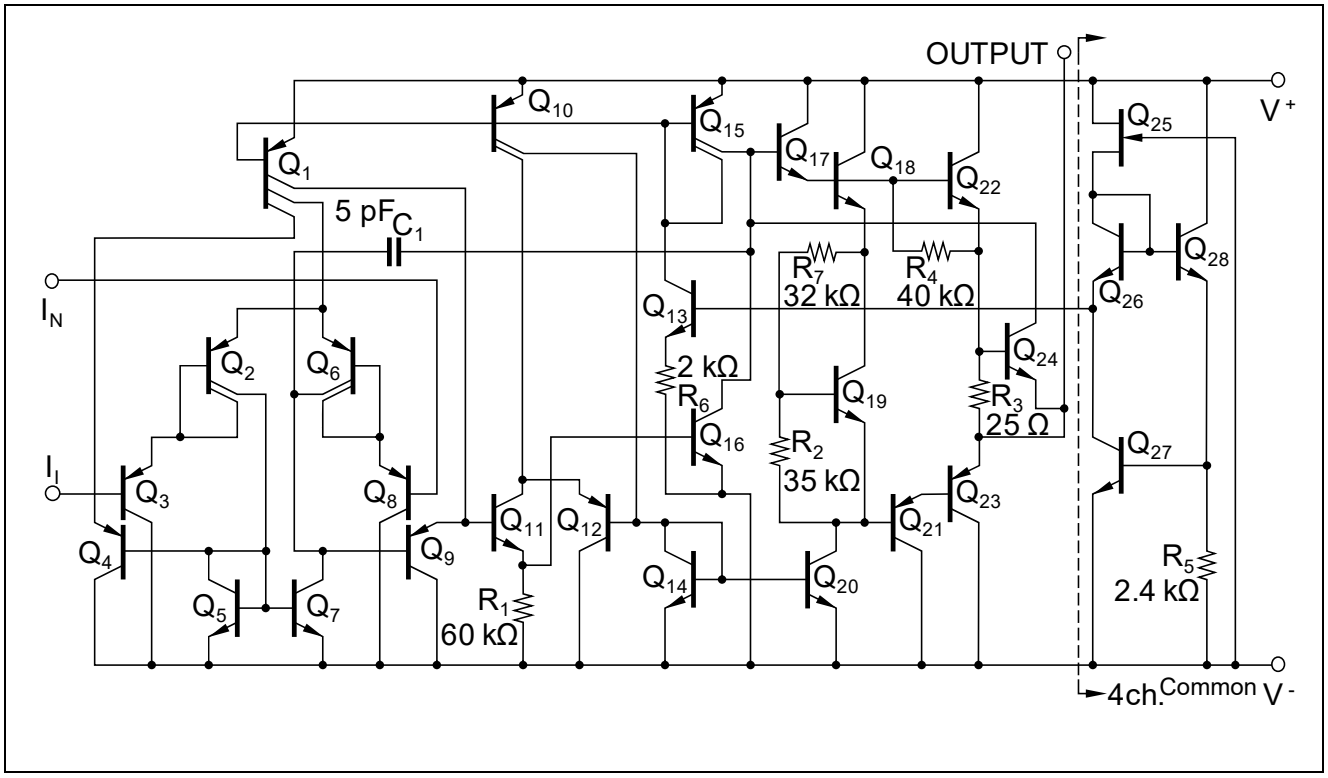
Ordering Information

Ordering Name	Package
µPC452G2-A	14-pin plastic SOP (5.72 mm (225))
µPC3403G2-A	14-pin plastic SOP (5.72 mm (225))

PIN CONFIGURATION (Top View)



EQUIVALENT CIRCUIT (¼ Circuit)



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	μPC452G2	μPC3403G2	Unit
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	550		mW
Output Short Circuit Duration Note 5	ts	Indefinite		s
Operating Ambient Temperature	T_A	-40 ~ +85	-20 ~ +80	°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 at $T_A \leqq$ +25 °C. De-rate value at -5.5 mW/°C when $T_A >$ 25 °C
5. Please use the total loss and the de-rating value from Note 4.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage (Dual Power Supply)	$V^{\pm}$	±1.5		±16	V
Power Supply Voltage (V^- = GND)	V^+	+3		+32	V

ELECTRICAL CHARACTERISTICS (T_A = 25 °C, $V^{\pm}$ = ±15 V)

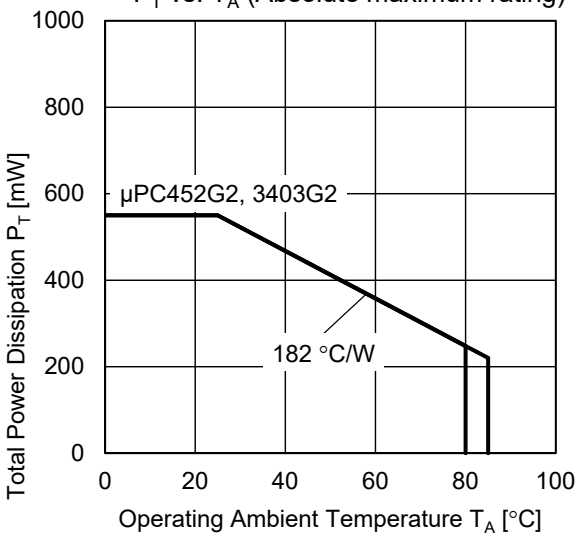
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Input Offset Voltage	V_{IO}		±2.0	±7.0	mV	
			±2.0	±7.0		V^+ = +5 V, V^- = GND
Input Offset Current	I_{IO}		±5	±50	nA	
			±5	±50		V^+ = +5 V, V^- = GND
Input Bias Current Note 6	I_B		45	250	nA	
			45	250		V^+ = +5 V, V^- = GND
Large Signal Voltage Gain	A_V	20000	80000			V_O = ±10 V , R_L = 2 kΩ,
		20000	80000			V^+ = +5 V, V^- = GND, R_L = 2 kΩ
Circuit Current Note 7	I_{CC}		2.8	7.0	mA	V_O = 0, R_L = ∞, I_O = 0 A
			2.5	7.0		V^+ = +5 V, V^- = GND, I_O = 0 A
Common Mode Rejection Ratio	CMR	70	90		dB	R_S ≦ 10 kΩ
Supply Voltage Rejection Ratio	SVR		30	150	μV/V	
				150		V^+ = +5 V, V^- = GND
Output Voltage Swing	V_{om}	±12	+13.5		V	R_L = 10 kΩ
		±10	+13			R_L = 2.0 kΩ
		V^+ -1.7 0	V^+ -1.5 0			R_L = 10 kΩ (Connect to GND), 5.0 V ≦ V^+ ≦ 30 V, V^- = GND
Common Mode Input Voltage Range	V_{ICM}	+13 -15	+13.5 -15		V	
Output Short-Circuit Current	I_{OS}	±10	±20	±45	mA	
Channel Separation			120		dB	f = 1 kHz ~ 20 kHz

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

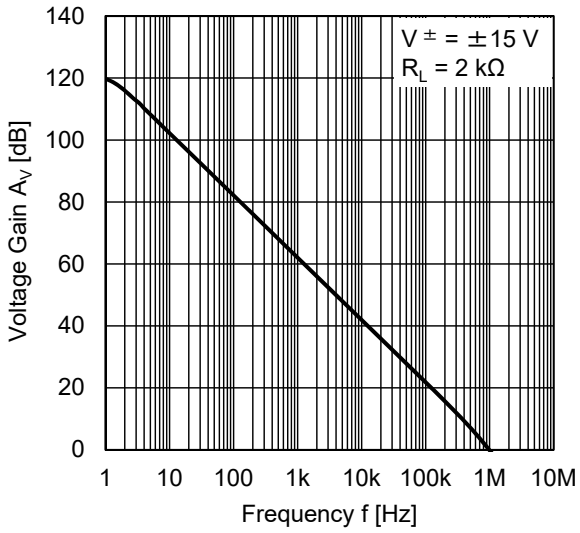
7. It is the current flowing into the internal circuit. This current flow is regardless of the channel used.

ELECTRICAL CHARACTERISTICS CURVE (T_A = 25 °C, TYP.) (Reference Value)

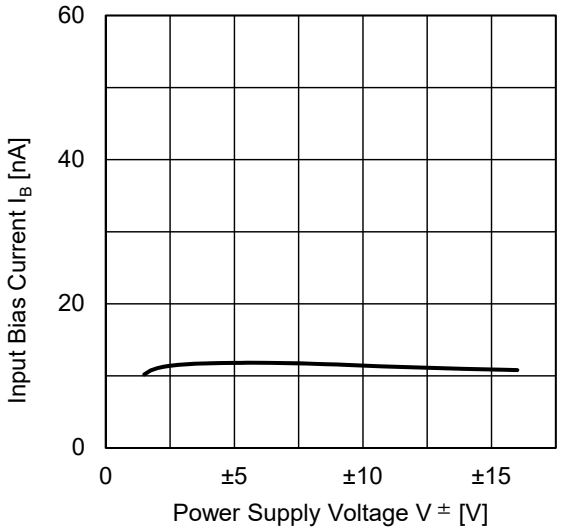
P_T vs. T_A (Absolute maximum rating)



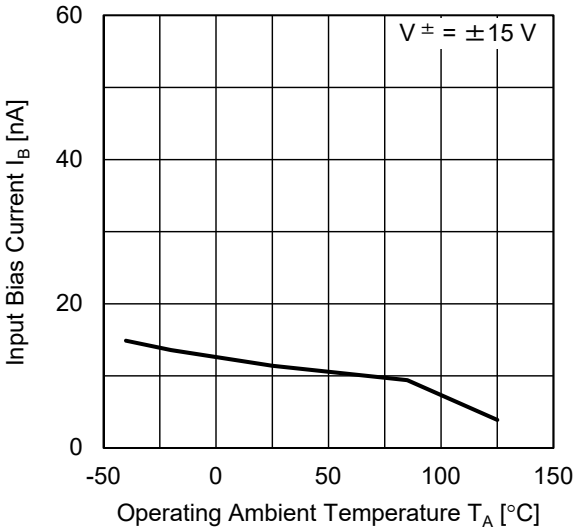
A_V vs. f



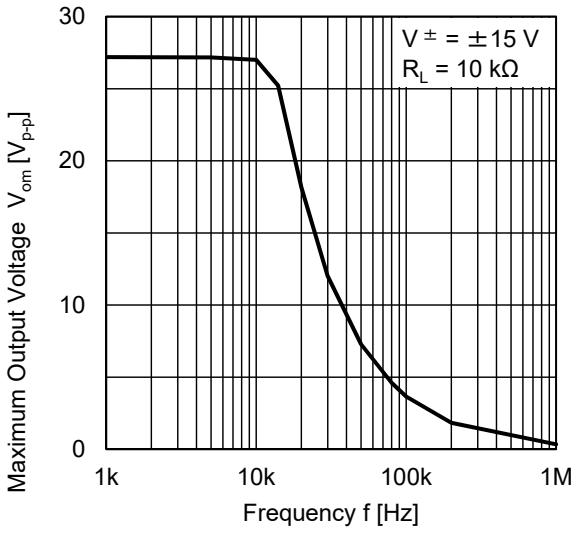
I_B vs. $V^{\pm}$



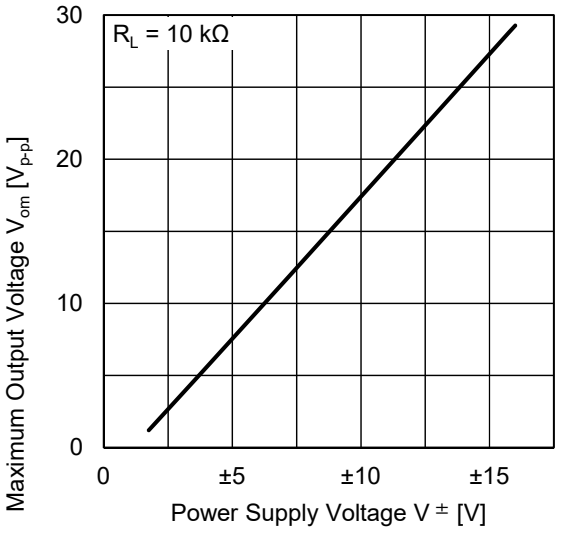
I_B vs. T_A

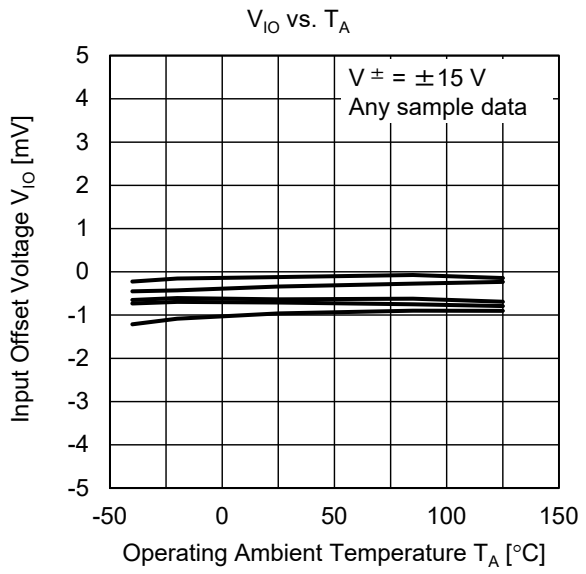


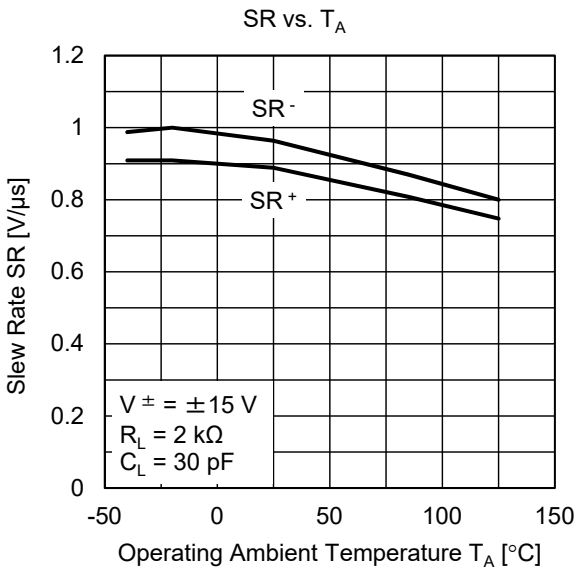
V_{om} vs. f



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



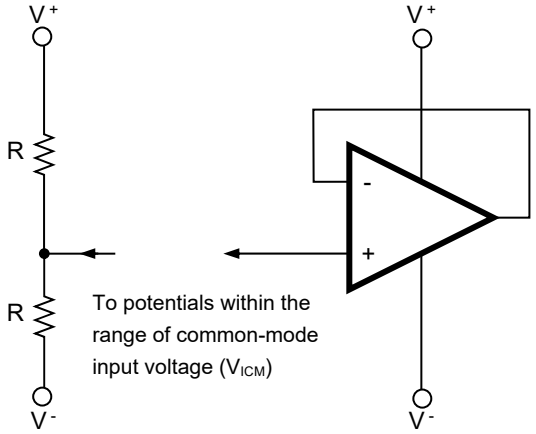

V_{IO} vs. T_A
$V^{\pm}$ = ±15 V
Any sample data
Input Offset Voltage V_{IO} [mV]
5
4
3
2
1
0
-1
-2
-3
-4
-5
-50
0
50
100
150
Operating Ambient Temperature T_A [°C]


SR vs. T_A
SR^-
SR^+
$V^{\pm}$ = ±15 V
R_L = 2 kΩ
C_L = 30 pF
Slew Rate SR [V/µs]
1.2
1
0.8
0.6
0.4
0.2
0
-50
0
50
100
150
Operating Ambient Temperature T_A [°C]

USE WITH PRECAUTIONS

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

Example of unused circuit process



Note in this example, an intermediate voltage of 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.)

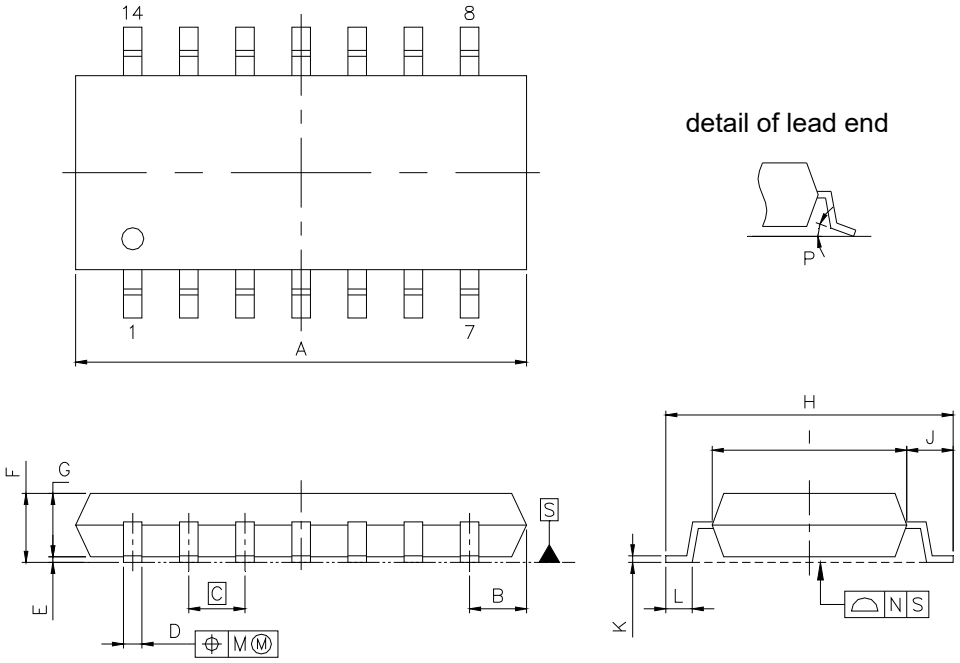
- **Handling of ICs**
  When stress is added to the ICs due to warpage or bending of a board, the characteristic may fluctuates due to piezoelectric (piezo) effect. Therefore, pay attention to warpage or bending of a board.

PACKAGE DRAWINGS

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°

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(Rev.4.0-1 November 2017)

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