

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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HIGH PERFORMANCE QUAD OPERATIONAL AMPLIFIER

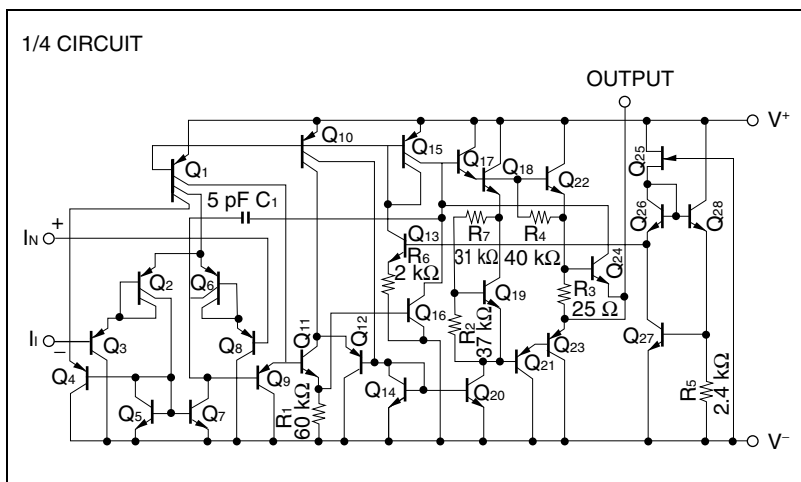
DESCRIPTION

The  $\mu$ PC3403 is monolithic Quad Operational Amplifier consists of four independent high-gain, internally frequency-compensated operational amplifiers, designed to operate from a single power supply or split power supplies over a wide range of voltages. The common mode input range includes the negative supply thereby eliminating the necessity for external biasing components in many applications.

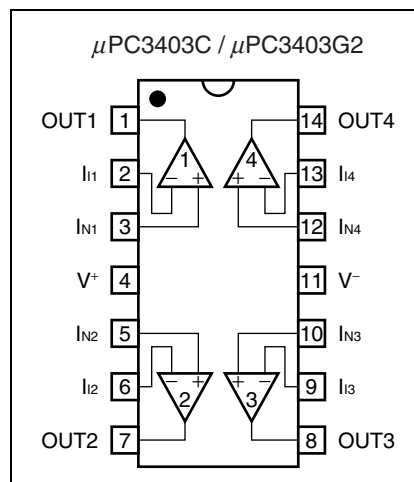
FEATURES

- Internal frequency compensation
- Common mode input voltage range includes  $V^-$
- Wide supply voltage range  
3 V to 32 V (Single)  
 $\pm 1.5$  V to 16 V (Split)
- Class AB Output Stage for Minimal Crossover Distortion
- Output short circuit protection

EQUIVALENT CIRCUIT



CONNECTION DIAGRAM (Top View)



★ ORDERING INFORMATION

PART NUMBER	PACKAGE	QUALITY GRADE
$\mu$ PC3403C	14-pin plastic DIP (7.62 mm (300))	Standard
$\mu$ PC3403G2	14-pin plastic SOP (5.72 mm (225))	Standard

Please refer to "Quality Grades on NEC Semiconductor Devices" (Document No: C11531E) published by NEC Electronics Corporation to know the specification of the quality grade on the device and its recommended applications.

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**ABSOLUTE MAXIMUM RATINGS (T<sub>a</sub> = 25 °C)**

PARAMETER		SYMBOL	μPC3403	UNIT
Voltage between V <sup>+</sup> and V <sup>-</sup> (Note 1)		V <sup>+</sup> - V <sup>-</sup>	-0.3 to +36	V
Differential Input Voltage		V <sub>ID</sub>	±30	V
Input Voltage (Note 2)		V <sub>I</sub>	V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3	V
Output Voltage (Note 3)		V <sub>O</sub>	V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3	V
Power Dissipation	C Package (Note 4)	P <sub>T</sub>	570	mW
	G2 Package (Note 5)		550	mW
Operating Temperature Range		T <sub>opt</sub>	-20 to +80	°C
Storage Temperature Range		T <sub>stg</sub>	-55 to +125	°C

**Note 1.** Reverse connection of supply voltage can cause destruction.

**Note 2.** The input voltage should be allowed to input without damage or destruction. Even during the transition period of supply voltage, power on/off etc., this specification should be kept. The normal operation will establish when the both inputs are within the Common Mode Input Voltage Range of electrical characteristics.

**Note 3.** This specification is the voltage which should be allowed to supply to the output terminal from external without damage or destructive. Even during the transition period of supply voltage, power on/off etc., this specification should be kept. The output voltage of normal operation will be the Output Voltage Swing of electrical characteristics.

**Note 4.** Thermal derating factor is -7.6 mW / °C when ambient temperature is higher than 50 °C.

**Note 5.** Thermal derating factor is -5.5 mW / °C when ambient temperature is higher than 25 °C.

**Note 6.** Pay careful attention to the total power dissipation not to exceed the absolute maximum ratings, Note 4 and Note 5.

**RECOMMENDED OPERATING CONDITIONS**

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage (Split)	V <sup>±</sup>	± 1.5		± 16	V
Supply Voltage (V <sup>-</sup> = GND)	V <sup>+</sup>	+ 3		+ 32	V

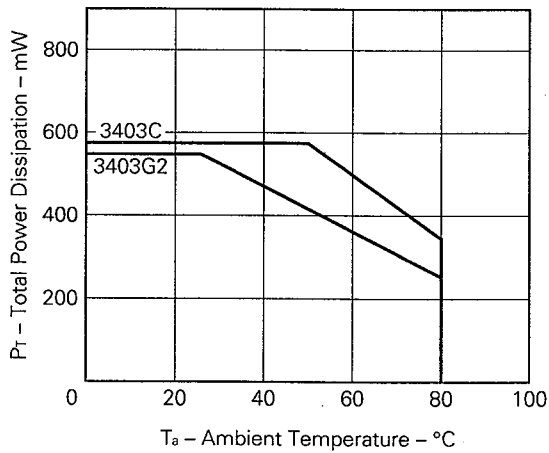
**ELECTRICAL CHARACTERISTICS (T<sub>a</sub> = 25 °C, V<sup>±</sup> = ±15 V)**

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Input Offset Voltage	V <sub>io</sub>		±2.0	±7.0	mV	
			±2.0	±7.0		V <sup>+</sup> = +5 V, V <sup>-</sup> = GND
Input Offset Current	I <sub>io</sub>		±5	±50	nA	
			±5	±50		V <sup>+</sup> = +5 V, V <sup>-</sup> = GND
Input Bias Current (Note 7)	I <sub>b</sub>		45	250	nA	
			45	250		V <sup>+</sup> = +5 V, V <sup>-</sup> = GND
Large Signal Voltage Gain	A <sub>v</sub>	86	98		dB	V <sub>O</sub> = ±10 V, R <sub>L</sub> = 2 kΩ
		86	98			V <sup>+</sup> = +5 V, V <sup>-</sup> = GND, R <sub>L</sub> = 2 kΩ
Supply Current	I <sub>cc</sub>		2.8	7.0	mA	V <sub>O</sub> = 0, R <sub>L</sub> = ∞, I <sub>o</sub> = 0 A, All Amplifiers
			2.5	7.0		V <sup>+</sup> = +5 V, V <sup>-</sup> = GND, I <sub>o</sub> = 0 A, All Amplifiers
Common Mode Rejection Ratio	CMR	70	90		dB	
Supply Voltage Rejection Ratio	SVR		30	150	μV/V	
				150		V <sup>+</sup> = +5 V, V <sup>-</sup> = GND
Output Voltage Swing	V <sub>om</sub>	±12	±13.5		V	R <sub>L</sub> = 10 kΩ
		±10	±13			R <sub>L</sub> = 2.0 kΩ
		V <sup>+</sup> -1.7 0	V <sup>+</sup> -1.5 0			R <sub>L</sub> = 10 kΩ (Connect to GND), 5 V ≤ V <sup>+</sup> ≤ 30 V, V <sup>-</sup> = GND
Common Mode Input Voltage Range	V <sub>icm</sub>	+13 -15	+13.5 -15		V	
Output Short Circuit Current	I <sub>O SHORT</sub>	±10	±20	±45	mA	
Channel Separation			120		dB	f = 1 kHz to 20 kHz

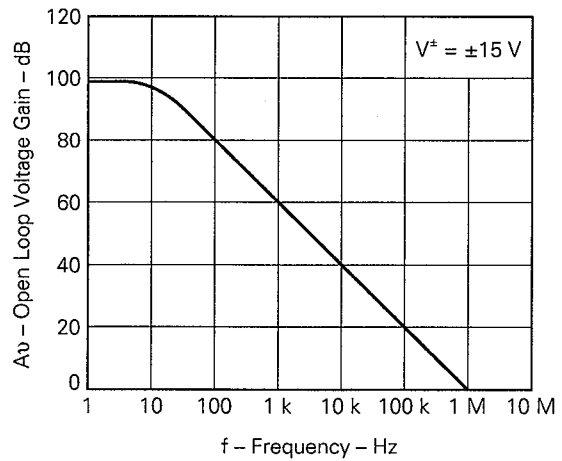
**Note 7.** Input bias currents flow out from IC. Because each currents are base current of PNP-transistor on input stage.

TYPICAL PERFORMANCE CHARACTERISTICS (T<sub>a</sub> = 25 °C, TYP.)

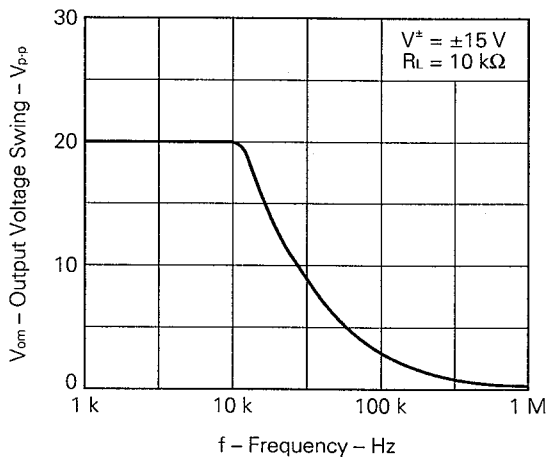
POWER DISSIPATION



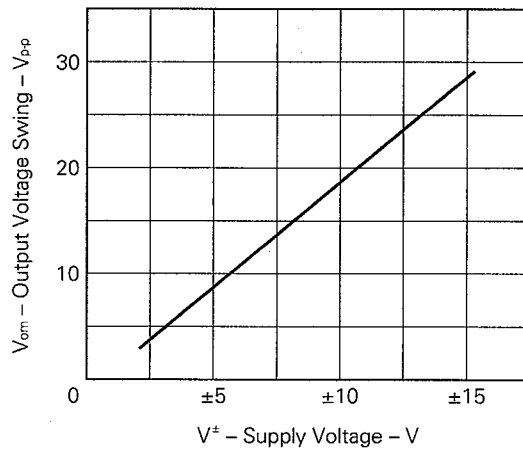
OPEN LOOP FREQUENCY RESPONSE



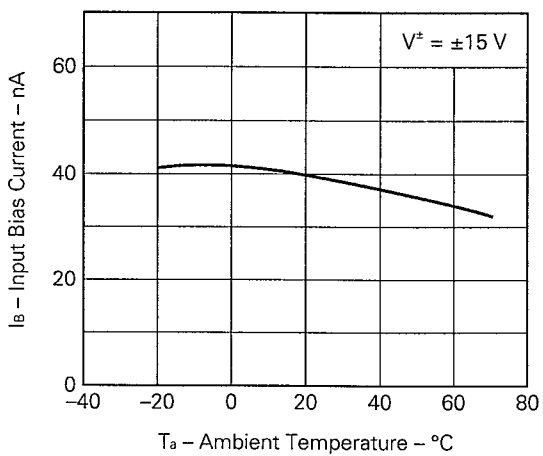
LARGE SIGNAL FREQUENCY RESPONSE



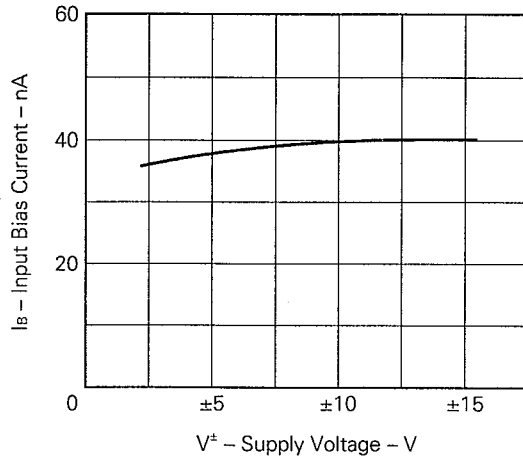
OUTPUT VOLTAGE SWING



INPUT BIAS CURRENT

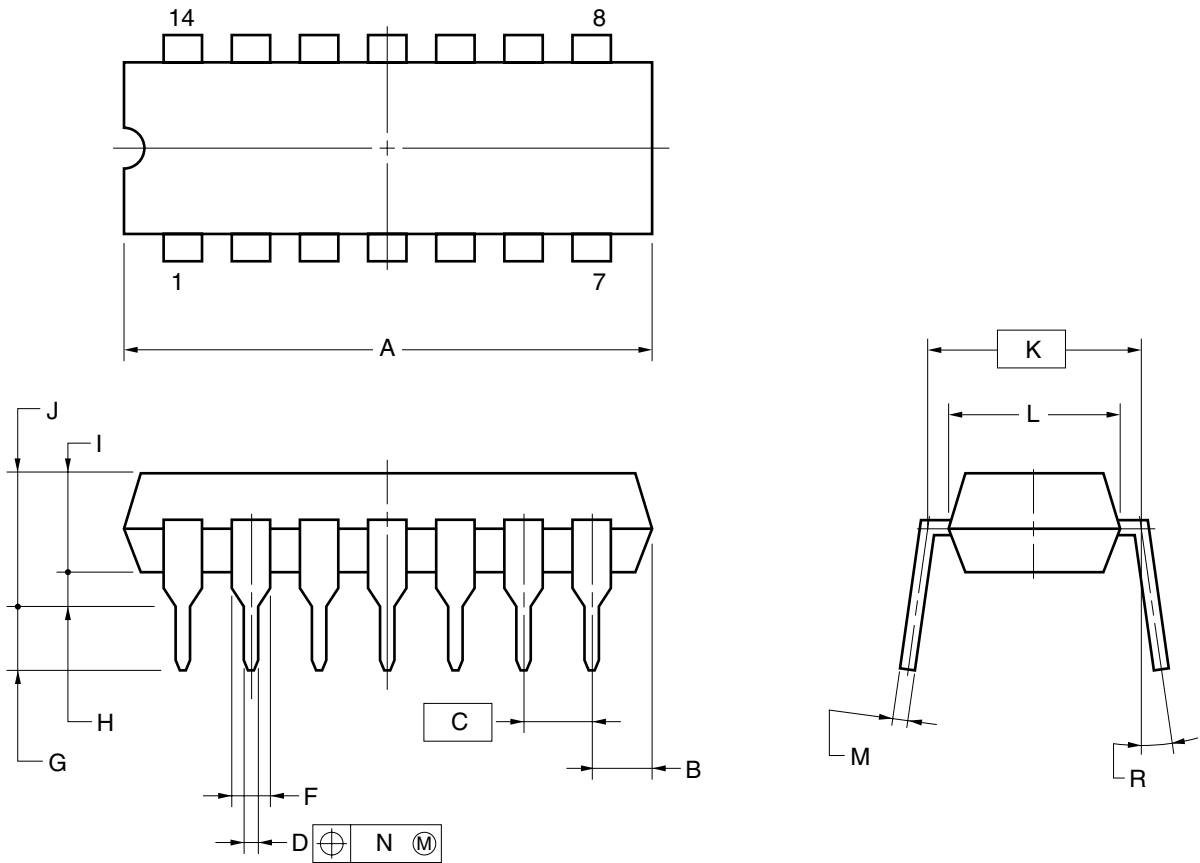


INPUT BIAS CURRENT



★ PACKAGE DRAWINGS (Unit: mm)

14-PIN PLASTIC DIP (7.62 mm (300))



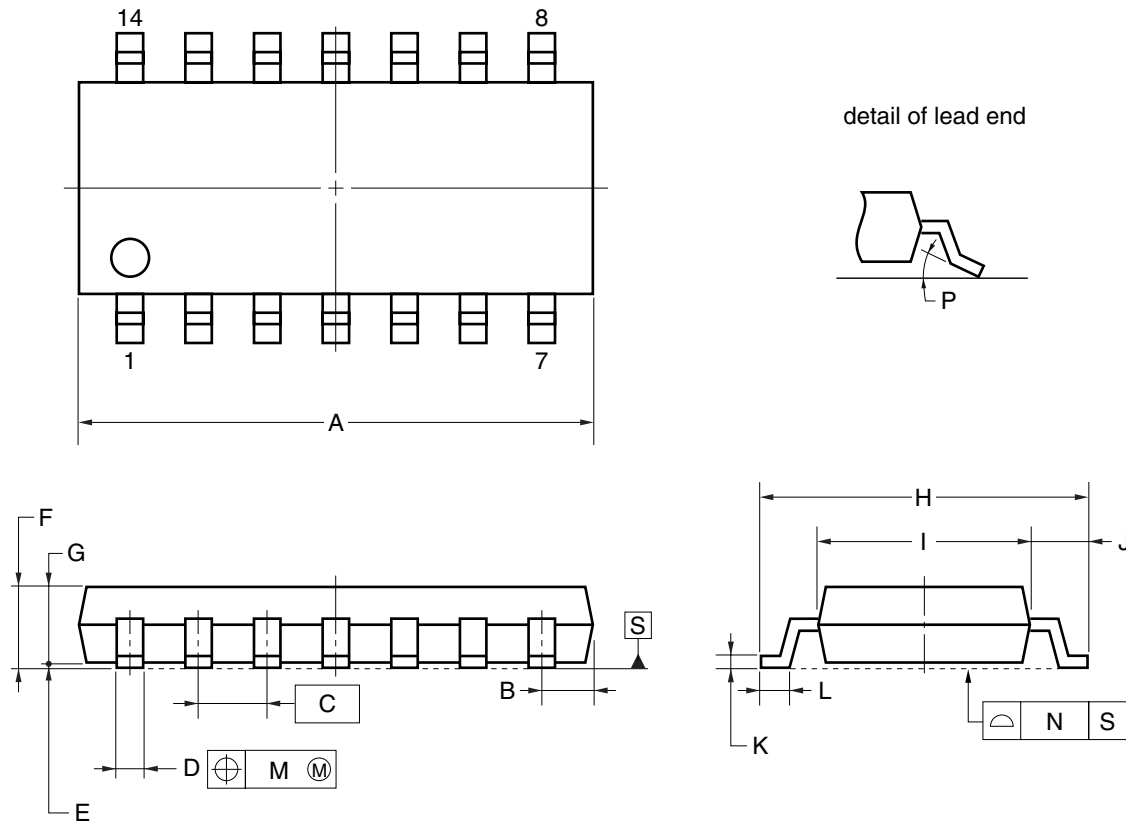
NOTES

1. Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.
2. Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS
A	19.22±0.2
B	2.14 MAX.
C	2.54 (T.P.)
D	0.50±0.10
F	1.32±0.12
G	3.6±0.3
H	0.51 MIN.
I	3.55
J	4.3±0.2
K	7.62 (T.P.)
L	6.4±0.2
M	0.25 <sup>+0.10</sup> <sub>-0.05</sub>
N	0.25
R	0~15°

P14C-100-300B1-3

14-PIN PLASTIC SOP (5.72 mm (225))



**NOTE**

Each lead centerline is located within 0.1 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 <sup>+0.08</sup> <sub>-0.07</sub>
E	0.1±0.1
F	1.59 <sup>+0.21</sup> <sub>-0.2</sub>
G	1.49
H	6.5±0.2
I	4.4±0.1
J	1.1±0.16
K	0.17 <sup>+0.08</sup> <sub>-0.07</sub>
L	0.6±0.2
M	0.1
N	0.10
P	3° <sup>+7°</sup> <sub>-3°</sub>

S14GM-50-225B, C-6



★ RECOMMENDED SOLDERING CONDITIONS

The μPC3403 should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (<http://www.necel.com/pkg/en/mount/index.html>)

TYPES OF SURFACE MOUNT DEVICE

μPC3403G2: 14-pin plastic SOP (5.72 mm (225))

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 230°C or below (Package surface temperature), Reflow time: 30 seconds or less (at 210°C or higher), Maximum number of reflow processes: 1 time.	IR30-00-1
Vapor Phase Soldering	Peak temperature: 215°C or below (Package surface temperature), Reflow time: 40 seconds or less (at 200°C or higher), Maximum number of reflow processes: 1 time.	VP15-00-1
Wave Soldering	Solder temperature: 260°C or below, Flow time: 10 seconds or less, Maximum number of flow processes: 1 time, Pre-heating temperature: 120°C or below (Package surface temperature).	WS60-00-1
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (Per each side of the device).	—

**Caution** Apply only one kind of soldering condition to a device, except for "partial heating method", or the device will be damaged by heat stress.

TYPES OF THROUGH HOLE DEVICE

μPC3403C: 14-pin plastic DIP (7.62 mm (300))

Soldering method	Soldering conditions	Recommended condition symbol
Wave soldering	Solder temperature: 260°C or below, Flow time: 10 seconds or below	

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