

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC4574GR-9LG

## QUAD ULTRA LOW-NOISE, WIDEBAND, OPERATIONAL AMPLIFIER

### DESCRIPTION

The  $\mu$ PC4574GR-9LG is an ultra low noise, high slew rate quad operational amplifier specifically designed for audio, instrumentation, and communication circuits. The low noise and high frequency capabilities make it ideal for preamps and active filters for instrumentation and professional audio.

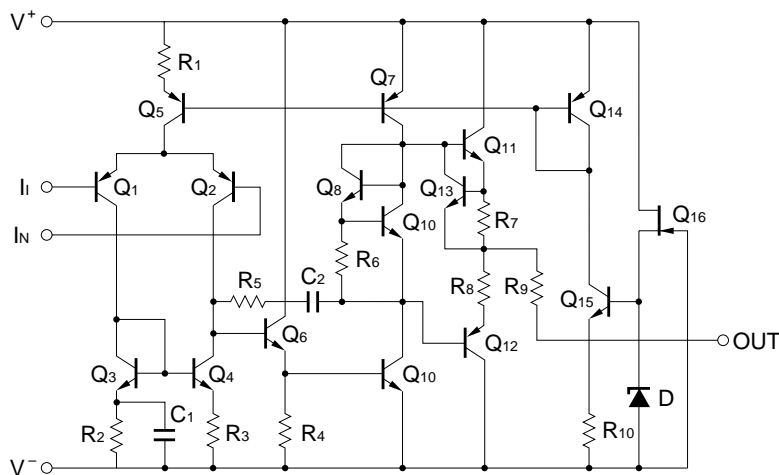
### FEATURES

- Ultra low noise
- High slew rate
- Wide bandwidth
- Internal frequency compensation

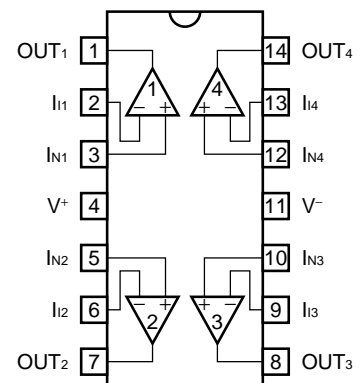
### ORDERING INFORMATION

Part Number	Package
$\mu$ PC4574GR-9LG-A	14-pin plastic TSSOP (5.72 mm (225))
$\mu$ PC4574GR(5)-9LG-A	14-pin plastic TSSOP (5.72 mm (225))

EQUIVALENT CIRCUIT (1/4 Circuit)



PIN CONFIGURATION (Top View)



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

Parameter	Symbol	Ratings	Unit
Voltage between V <sup>+</sup> and V <sup>-</sup> <sup>Note1</sup>	V <sup>+</sup> - V <sup>-</sup>	-0.3 to +36	V
Differential Input Voltage	V <sub>ID</sub>	±30	V
Input Voltage <sup>Note2</sup>	V <sub>I</sub>	V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3	V
Output Voltage <sup>Note3</sup>	V <sub>O</sub>	V <sup>-</sup> -0.3 to V <sup>+</sup> +0.3	V
Power Dissipation <sup>Note4</sup>	P <sub>T</sub>	550	mW
Output Short Circuit Duration <sup>Note5</sup>		10	sec
Operating Ambient Temperature	T <sub>A</sub>	-40 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C

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

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.

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.

4. Power dissipation is specified with mounting on the glass epoxy printed wiring board as follows, and ambient temperature condition is 46°C or less.

Board size : 100 mm square Thickness : 1.6 mm Copper area : 15% of mounting area (single side)

Thermal deleting factor is -7.0 mV/°C when operating ambient temperature is higher than 46°C.

5. Pay careful attention to the total power dissipation not to exceed the absolute maximum ratings, Note4.

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sup>±</sup>	±4		±16	V
Output Current	I <sub>O</sub>			±10	mA
Source Resistance	R <sub>S</sub>			50	kΩ
Capacitive Load (A <sub>V</sub> = +1)	C <sub>L</sub>			100	pF

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

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> ≤ 50 Ω		±0.3	±5	mV
Input Offset Current <sup>Note6</sup>	I <sub>IO</sub>			±10	±200	nA
Input Bias Current <sup>Note6</sup>	I <sub>B</sub>			500	1000	nA
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> ≥ 2 kΩ, V <sub>O</sub> = ±10 V	30000	300000		
Supply Current <sup>Note7</sup>	I <sub>CC</sub>	I <sub>O</sub> = 0 A		8.5	12	mA
Common Mode Rejection Ratio	CMR		80	100		dB
Supply Voltage Rejection Ratio	SVR		80	100		dB
Output Voltage Swing	V <sub>OM</sub>	R <sub>L</sub> ≥ 10 kΩ	±12	±13.4		V
		R <sub>L</sub> ≥ 2 kΩ	±10	+12.8 -12.4		V
Common Mode Input Voltage Range	V <sub>ICM</sub>		±12	±14		V
Slew Rate	SR	R <sub>L</sub> ≥ 2 kΩ	4	6		V/μs
Gain Band Width Product	GBW	f <sub>O</sub> = 100 kHz	10	14		MHz
Unity Gain Frequency	f <sub>unity</sub>	open loop		7		MHz
Phase Margin	φ <sub>unity</sub>	open loop		50		degree
Total Harmonic Distortion	THD	V <sub>O</sub> = 3 V <sub>r.m.s.</sub> , f = 20 Hz to 20 kHz (Fig.1)		0.002		%
Input Equivalent Noise Voltage	V <sub>n</sub>	RIAA (Fig.2)		1.2		μV <sub>r.m.s.</sub>
		FLAT+JIS A, R <sub>S</sub> = 100 Ω (Fig.3)		0.53	0.65	μV <sub>r.m.s.</sub>
Input Equivalent Noise Voltage Density	e <sub>n</sub>	f <sub>O</sub> = 10 Hz, R <sub>S</sub> = 100 Ω		5.5		nV/√Hz
		f <sub>O</sub> = 1 kHz, R <sub>S</sub> = 100 Ω		5.0		nV/√Hz
Input Equivalent Noise Current Density	i <sub>n</sub>	f <sub>O</sub> = 1 kHz		0.7		pA/√Hz
Channel Separation		f = 20 Hz to 20 kHz		120		dB

**Notes 6.** Input bias currents flow out from IC. Because each currents are base current of PNP-transistor on input stage.

**7.** This current flows irrespective of the existence of use.

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

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> ≤ 50 Ω		±0.3	±1	mV
Input Offset Current <sup>Note6</sup>	I <sub>IO</sub>			±10	±60	nA
Input Bias Current <sup>Note6</sup>	I <sub>B</sub>			500	650	nA
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> ≥ 2 kΩ, V <sub>O</sub> = ±10 V	50000	300000		
Supply Current <sup>Note7</sup>	I <sub>CC</sub>	I <sub>O</sub> = 0 A		8.5	11	mA
Common Mode Rejection Ratio	CMR		85	100		dB
Supply Voltage Rejection Ratio	SVR		85	100		dB
Output Voltage Swing	V <sub>OM</sub>	R <sub>L</sub> ≥ 10 kΩ	±13	±13.4		V
		R <sub>L</sub> ≥ 2 kΩ	±11.5	+12.8 -12.4		V
Common Mode Input Voltage Range	V <sub>ICM</sub>		±13	±14		V
Slew Rate	SR	R <sub>L</sub> ≥ 2 kΩ	4	6		V/μs
Gain Band Width Product	GBW	f <sub>O</sub> = 100 kHz	10	14		MHz
Unity Gain Frequency	f <sub>unity</sub>	open loop		7		MHz
Phase Margin	φ <sub>unity</sub>	open loop		50		degree
Total Harmonic Distortion	THD	V <sub>O</sub> = 3 V <sub>r.m.s.</sub> , f = 20 Hz to 20 kHz (Fig.1)		0.002		%
Input Equivalent Noise Voltage	V <sub>n</sub>	RIAA (Fig.2)		1.2		μV <sub>r.m.s.</sub>
		FLAT+JIS A, R <sub>S</sub> = 100 Ω (Fig.3)		0.53	0.65	μV <sub>r.m.s.</sub>
Input Equivalent Noise Voltage Density	e <sub>n</sub>	f <sub>O</sub> = 10 Hz, R <sub>S</sub> = 100 Ω		5.5		nV/√Hz
		f <sub>O</sub> = 1 kHz, R <sub>S</sub> = 100 Ω		5.0		nV/√Hz
Input Equivalent Noise Current Density	i <sub>n</sub>	f <sub>O</sub> = 1 kHz		0.7		pA/√Hz
Channel Separation		f = 20 Hz to 20 kHz		120		dB

**Notes 6.** Input bias currents flow out from IC. Because each currents are base current of PNP-transistor on input stage.

**7.** This current flows irrespective of the existence of use.

## MEASUREMENT CIRCUIT

Fig.1 Total Harmonic Distortion Measurement Circuit

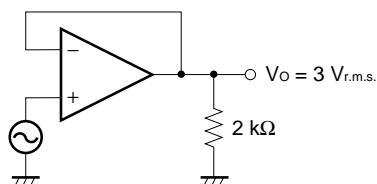


Fig.2 Noise Measurement Circuit (RIAA)

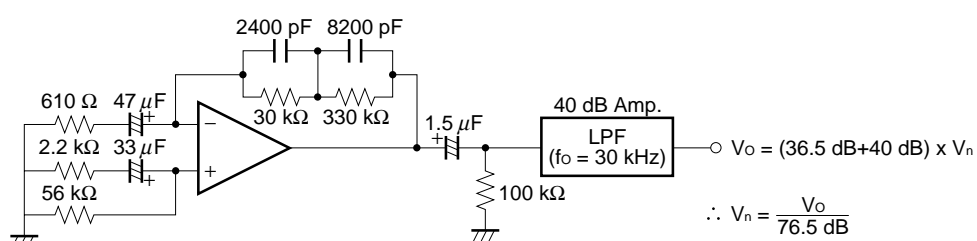
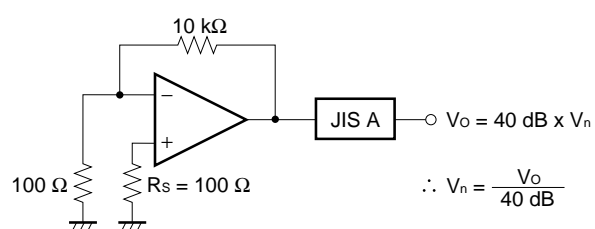
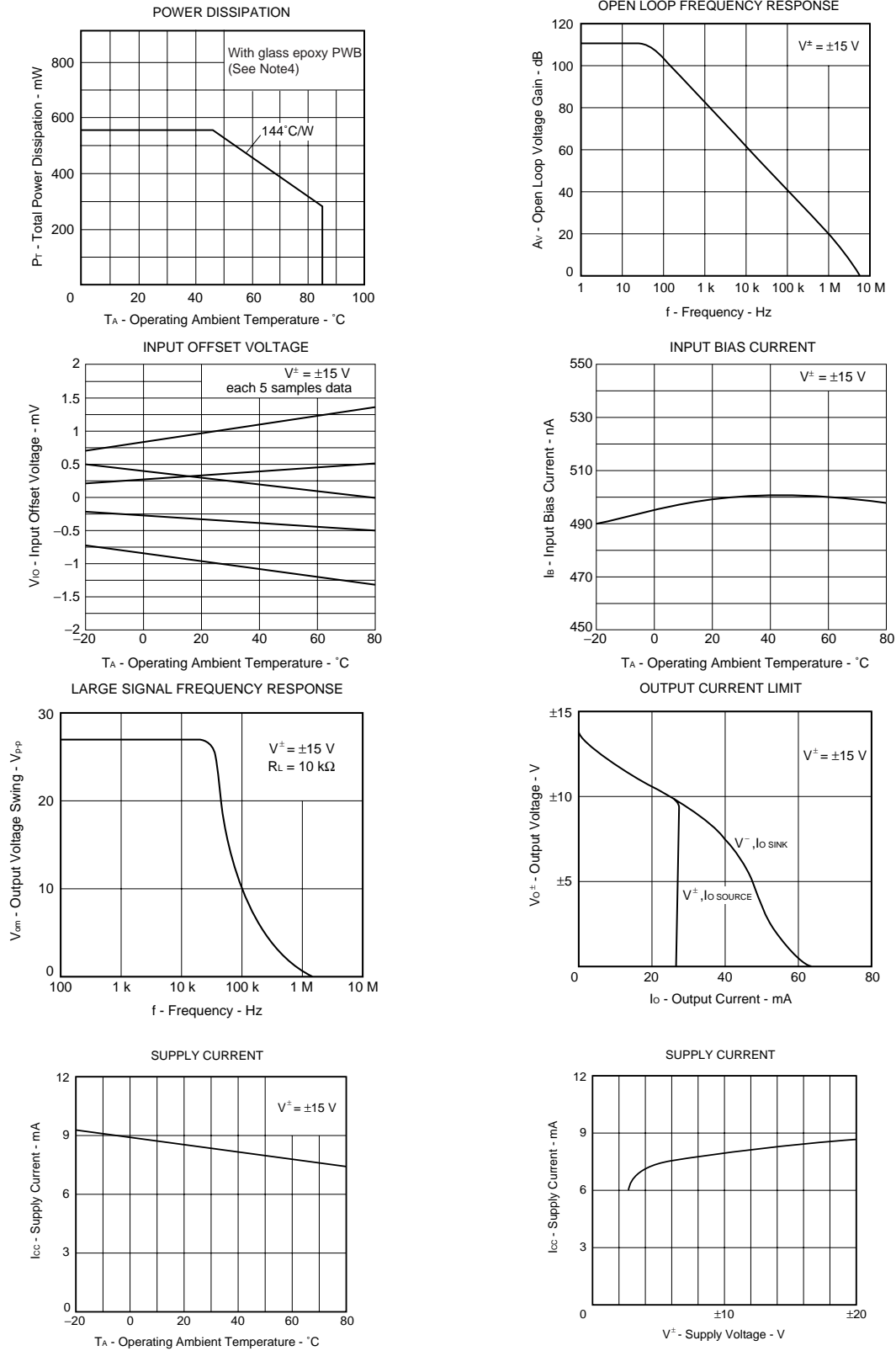
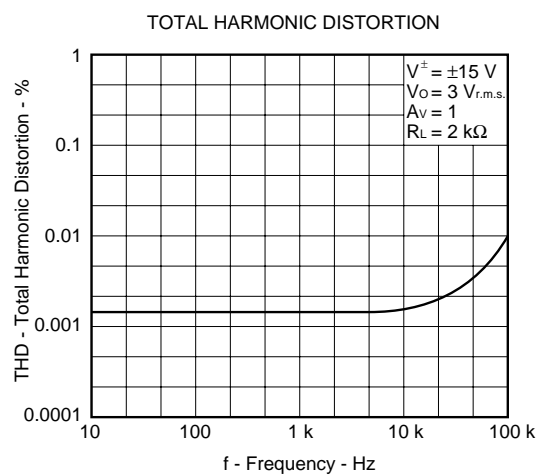
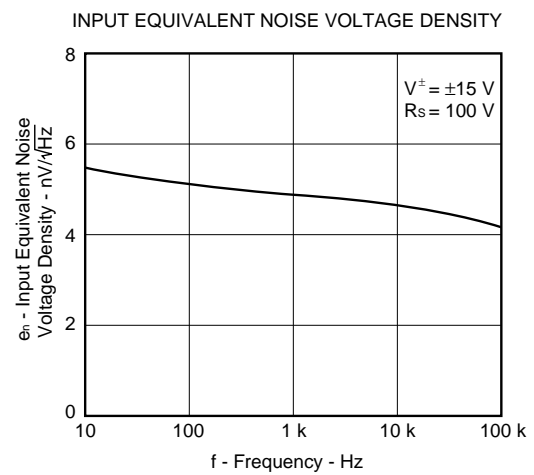
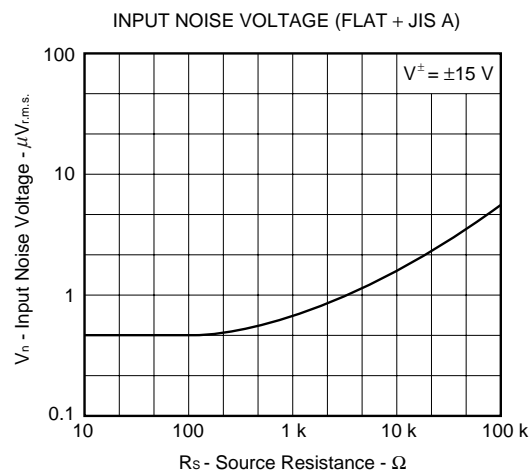
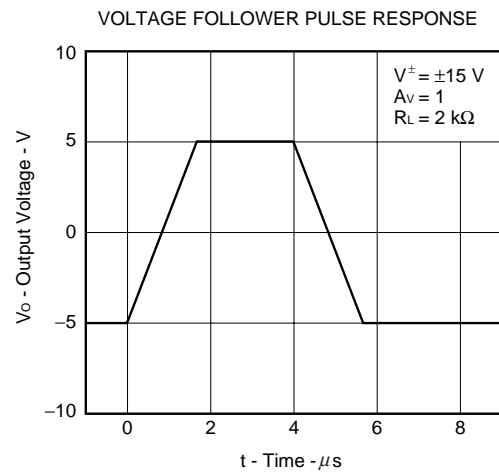
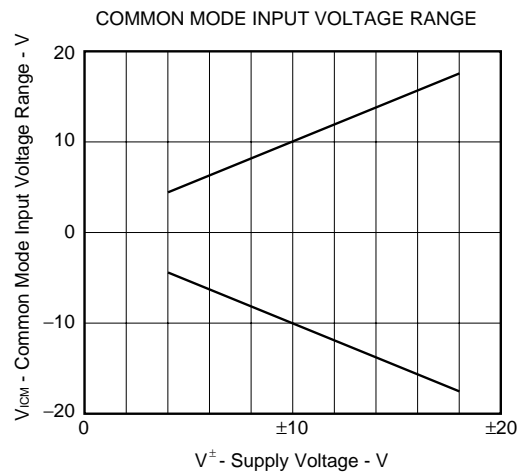


Fig.3 Flat Noise Measurement Circuit (FLAT+JIS A)



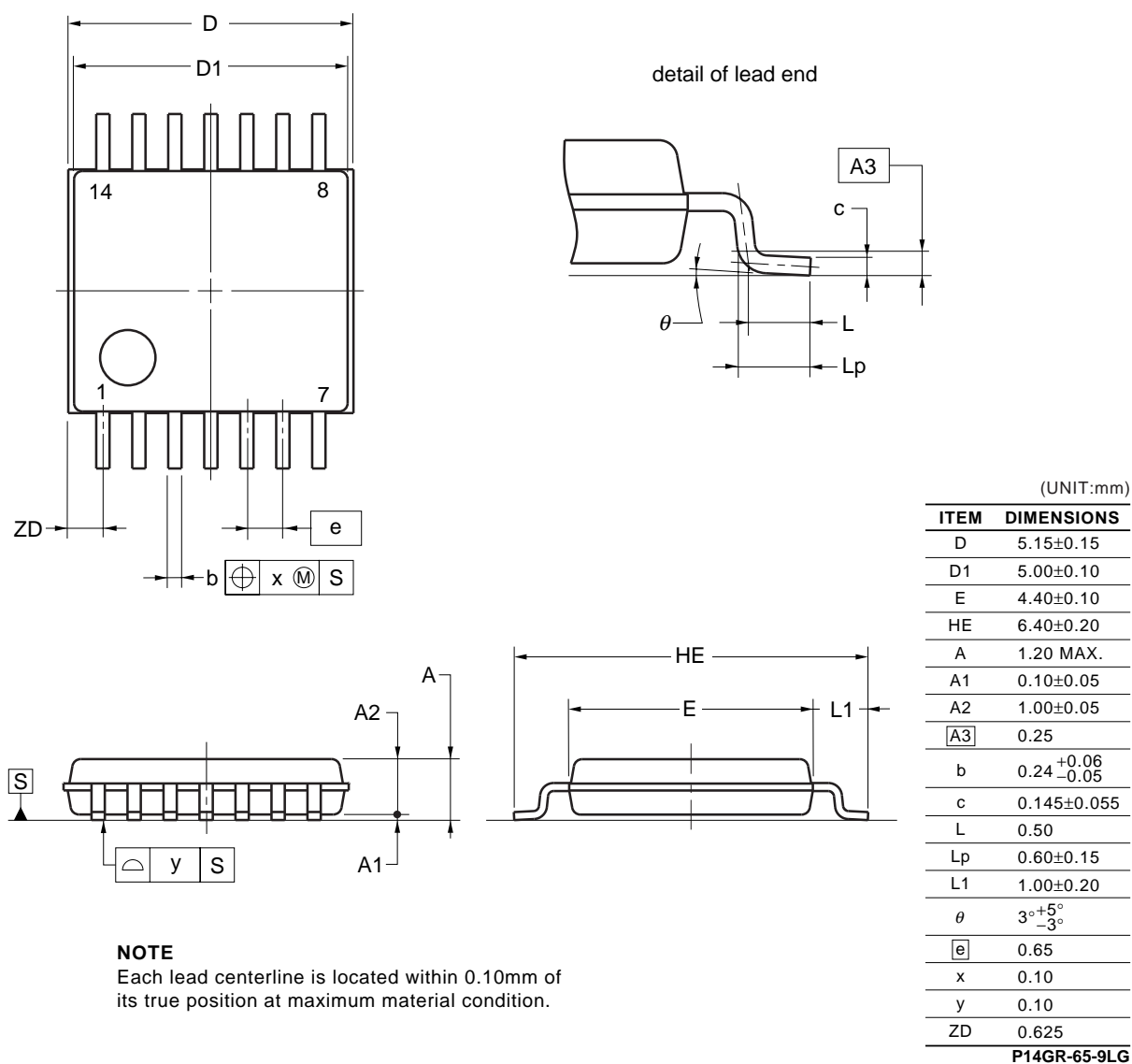
TYPICAL PERFORMANCE CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , TYP.)





PACKAGE DRAWING (Unit: mm)

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



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**RECOMMENDED SOLDERING CONDITIONS**

The  $\mu$ PC4574GR-9LG 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>)

Process	Conditions	Symbol
Infrared Ray Reflow	Peak temperature: 260°C or below (Package surface temperature), Reflow time: 60 seconds or less (at 220°C or higher), Maximum number of reflow processes: 1 time.	IR60-00-3
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: 350°C or below, Heat time: 3 seconds or less (Per each side of the device).	P350

**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.

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