NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC4572

LOW SUPPLY VOLTAGE, ULTRA LOW-NOISE, HIGH SPEED, WIDE BAND, LOW I_B DUAL OPERATIONAL AMPLIFIER

DESCRIPTION

The μPC4572 is a dual wide band, ultra low noise operational amplifier designed for low supply voltage operation Of +4 V to +14 V single supply and ±2 V to ±7 V split supplies. Using high h_{FE} PNP transistors for the input circuit, Input bias current and input equivalent noise are better than conventional wide band operational amplifier.

The μPC4572 is an excellent choice for preamplifiers and active filters in audio, instrumentation, and communication circuit.

FEATURES

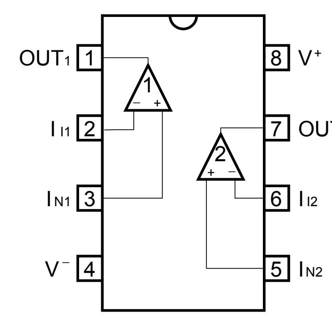
- Ultra low noise: e_n = 4.0 nV/ $\sqrt{Hz}$
- Low input bias current: 100 nA
- High slew rate: 6 V/ μs
- Low supply voltage: ±2 V to ±7 V (Split)
  +4 V to +14 V (Single)
- Internal frequency compensation

ORDERING INFORMATION

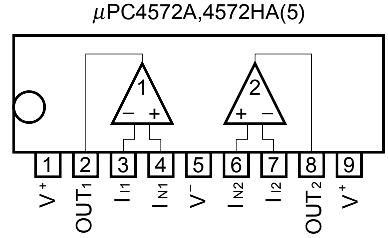
Part Number	Package
μPC4572C	8-pin plastic DIP (7.62 mm (300))
μPC4572C(5)	8-pin plastic DIP (7.62 mm (300))
μPC4572G2	8-pin plastic SOP (5.72 mm (225))
μPC4572G2(5)	8-pin plastic SOP (5.72 mm (225))
μPC4572HA	9-pin plastic slim SIP
μPC4572HA(5)	9-pin plastic slim SIP

PIN CONFIGURATION (Top View)

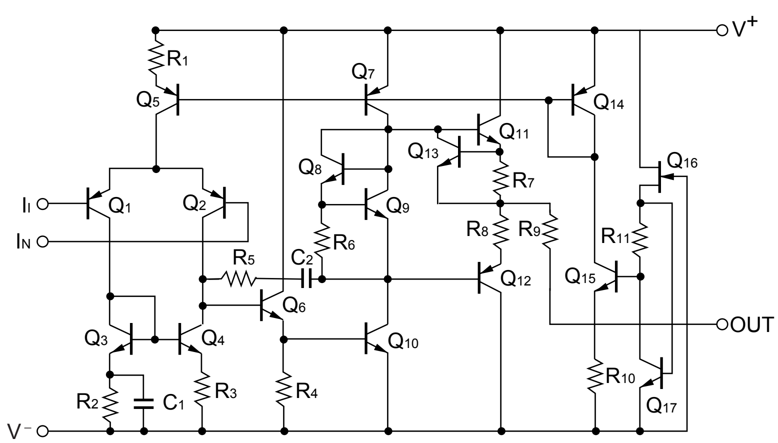
μPC4572C, 4572C(5), 4572G2, 4572G2(5)



μPC4572A,4572HA(5)



EQUIVALENT CIRCUIT (1/2 Circuit)



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The mark ★ shows major revised points.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Parameter		Symbol	Ratings	Unit
Voltage between V^+ and V^- Note1		$V^+ - V^-$	–0.3 to +15	V
Differential Input Voltage		V_{ID}	±10	V
Input Voltage Note2		V_I	V^- –0.3 to V^+ +0.3	V
Output Voltage Note3		V_O	V^- –0.3 to V^+ +0.3	V
Power Dissipation	C Package Note4	P_T	350	mW
	G2 Package Note5		440	mW
	HA Package Note4		350	mW
Output Short Circuit Duration Note6			10	sec
Operating Ambient Temperature		T_A	–20 to +80	°C
Storage Temperature		T_{stg}	–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. Thermal derating factor is –5.0 mW/°C when ambient temperature is higher than 55°C.

5. Thermal derating factor is –4.4 mW/°C when ambient temperature is higher than 25°C.

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

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage (Split)	$V^{\pm}$	±2	±5	±7	V
Supply Voltage (V^- = GND)	V^+	+4	+5/ +12	+14	V
Output Current	I_O			±10	mA
Capacitive Load (A_V = +1)	C_L			100	pF

μPC4572C, μPC4572G2, μPC4572HA

ELECTRICAL CHARACTERISTICS (T_A = 25°C, $V^{\pm}$ = ±5 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V_{IO}	$R_S \leq 50\ \Omega$		±0.3	±5	mV
Input Offset Current Note 7	I_{IO}			±10	±100	nA
Input Bias Current Note 7	I_B			100	400	nA
Large Signal Voltage Gain	A_V	$R_L \geq 2$ kΩ , V_O = ±2 V	10000	100000		
★ Supply Current Note 8	I_{CC}	I_O = 0 A		4.5	7	mA
Common Mode Rejection Ratio	CMR		70	90		dB
Supply Voltage Rejection Ratio	SVR		70	85		dB
Output Voltage Swing	V_{om}	$R_L \geq 10$ kΩ	±3.3	±3.7		V
		$R_L \geq 2$ kΩ	±3.0	±3.5		
Common Mode Input Voltage Range	V_{ICM}		±3.5	±4		V
Output Short Circuit Current	$I_{O\ short}$	R_L = 0	±15	±20		mA
Slew Rate	SR	AV = 1, $R_L \geq 2$ kΩ	3.5	6		V/ μs
Gain Band Width Product	GBW	f_O = 100 kHz	10	16		MHz
Unity Gain Frequency	f_{unity}	open loop		9		MHz
Phase Margin	ϕ_{unity}	open loop		60		degree
Total Harmonic Distortion	THD	V_O = 1 $V_{r.m.s.}$, f = 20 Hz to 20 kHz (Fig.1)		0.002		%
Input Equivalent Noise Voltage	V_n	RIAA (Fig.2)		0.8		$\mu V_{r.m.s.}$
		FLAT+JIS A, R_S = 100 Ω (Fig.3)		0.5	0.65	
Input Equivalent Noise Voltage Density	e_n	f_O = 10 Hz		4.5		nV/√Hz
		f_O = 1 kHz		4.0		
Input Equivalent Noise Current Density	i_n	f_O = 1 kHz		0.7		pA/√Hz
Channel Separation		f = 20 Hz to 20 kHz		120		dB
Average V_{IO} Temperature Drift	$\Delta V_{IO}/\Delta T$			±2		μV/°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, $V^{\pm}$ = 5 V, V^- = GND)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V_{IO}	$R_S \leq 50\ \Omega$		±0.3	±5	mV
Input Offset Current Note 7	I_{IO}			±10	±100	nA
Input Bias Current Note 7	I_B			100	400	nA
Large Signal Voltage Gain	A_V	$R_L \geq 2$ kΩ	8000	80000		
★ Supply Current Note 8	I_{CC}	I_O = 0 A		4	6	mA
Common Mode Rejection Ratio	CMR		60	75		dB
Supply Voltage Rejection Ratio	SVR		60	70		dB
Output Voltage (High)	V_{OH}	$R_L \geq 2$ kΩ (R_L to 1/2 V^+)	3.2	3.5		V
Output Voltage (Low)	V_{OL}	$R_L \geq 2$ kΩ (R_L to 1/2 V^+)		1.3	1.6	V
Common Mode Input Voltage Range	V_{ICM}		1.5		3.5	V
Slew Rate	SR	A_V = 1		4		V/ μs
Gain Band Width Product	GBW			12		MHz

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

★ **8.** This current flows irrespective of the existence of use.

μPC4572C(5), μPC4572G2(5), μPC4572HA(5)
ELECTRICAL CHARACTERISTICS (T_A = 25°C, $V^{\pm}$ = ±5 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V_{IO}	$R_S \le 50\ \Omega$		±0.3	±1.5	mV
Input Offset Current Note 7	I_{IO}			±10	±50	nA
Input Bias Current Note 7	I_B			100	200	nA
Large Signal Voltage Gain	A_V	$R_L \ge 2$ kΩ, V_O = ±2 V	30000	100000		
★ Supply Current Note 8	I_{CC}	I_O = 0 A		4.5	5.5	mA
Common Mode Rejection Ratio	CMR		75	90		dB
Supply Voltage Rejection Ratio	SVR		70	85		dB
Output Voltage Swing	V_{om}	$R_L \ge 10$ kΩ	±3.45	±3.7		V
		$R_L \ge 2$ kΩ	±3.3	±3.5		
Common Mode Input Voltage Range	V_{ICM}		+3.8 −3.7	±4		V
Output Short Circuit Current	$I_{O\ short}$	R_L = 0	±15	±20		mA
Slew Rate	SR	A_V = 1, $R_L \ge 2$ kΩ	3.5	6		V/ μs
Gain Band Width Product	GBW	f_O = 100 kHz	10	16		MHz
Unity Gain Frequency	f_{unity}	open loop		9		MHz
Phase Margin	ϕ_{unity}	open loop		60		degree
Total Harmonic Distortion	THD	V_O = 1 $V_{r.m.s.}$, f = 20 Hz to 20 kHz (Fig.1)		0.002		%
Input Equivalent Noise Voltage	V_n	RIAA (Fig.2)		0.8		μ$V_{r.m.s.}$
		FLAT+JIS A, R_S = 100 Ω (Fig.3)		0.5	0.65	
Input Equivalent Noise Voltage Density	e_n	f_O = 10 Hz		4.5		nV/$\sqrt{Hz}$
		f_O = 1 kHz		4.0		
Input Equivalent Noise Current Density	i_n	f_O = 1 kHz		0.7		pA/$\sqrt{Hz}$
Channel Separation		f = 20 Hz to 20 kHz		120		dB
Average V_{IO} Temperature Drift	$\Delta V_{IO}/\Delta T$			±2		μV/°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, V^+ = 5 V, V^- = GND)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input Offset Voltage	V_{IO}	$R_S \le 50\ \Omega$		±0.3	±1.5	mV
Input Offset Current Note 7	I_{IO}			±10	±50	nA
Input Bias Current Note 7	I_B			100	200	nA
Large Signal Voltage Gain	A_V	$R_L \ge 2$ kΩ ,	40000	80000		
★ Supply Current Note 8	I_{CC}	I_O = 0 A		4	5	mA
Common Mode Rejection Ratio	CMR		65	75		dB
Supply Voltage Rejection Ratio	SVR		60	70		dB
Output Voltage (High)	V_{OH}	$R_L \ge 2$ kΩ (R_L to 1/2 V^+)	3.4	3.5		V
Output Voltage (Low)	V_{OL}	$R_L \ge 2$ kΩ (R_L to 1/2 V^+)		1.3	1.45	V
Common Mode Input Voltage Range	V_{ICM}		1.2		3.8	V
Slew Rate	SR	A_V = 1		4		V/ μs
Gain Band Width Product	GBW			12		MHz

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

★ **8.** This current flows irrespective of the existence of use.

MEASUREMENT CIRCUITS

Fig. 1 Total Harmonic Distortion Measurement Circuit

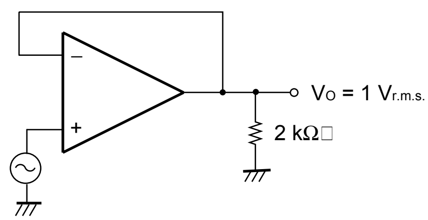


Fig. 2 Noise Measurement Circuit (RIAA)

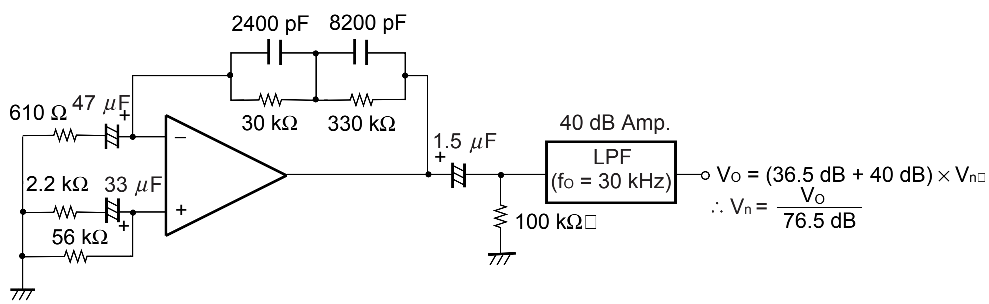
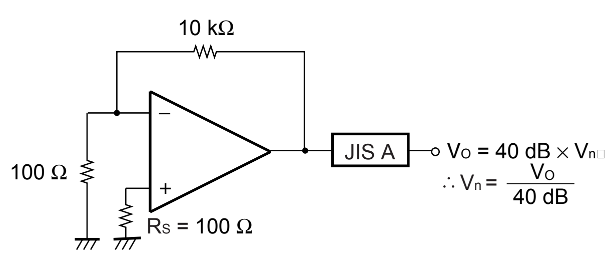
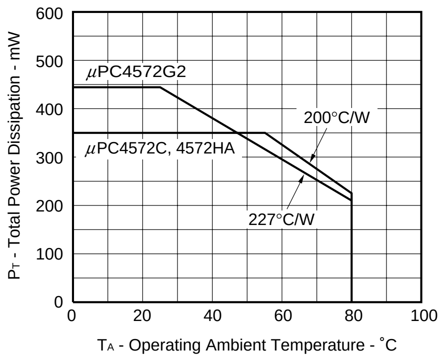


Fig. 3 Flat Noize Measurement Circuit (FLAT + JIS A)

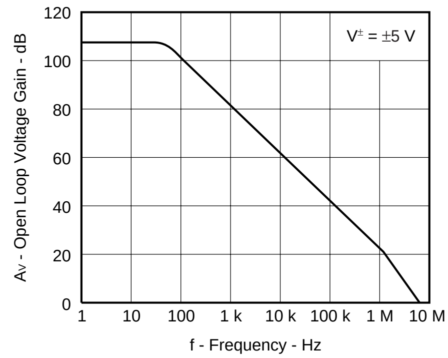


TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C, TYP.)

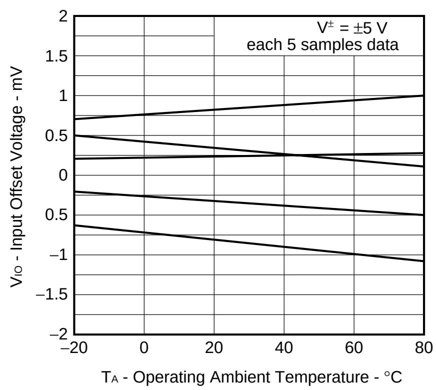
POWER DISSIPATION



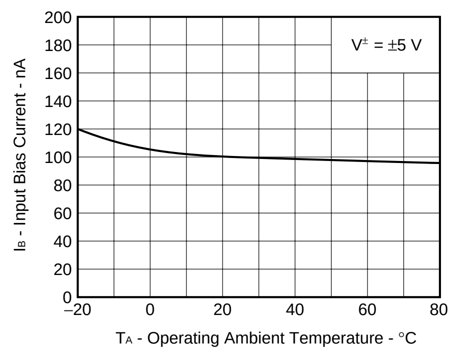
OPEN LOOP FREQUENCY RESPONSE



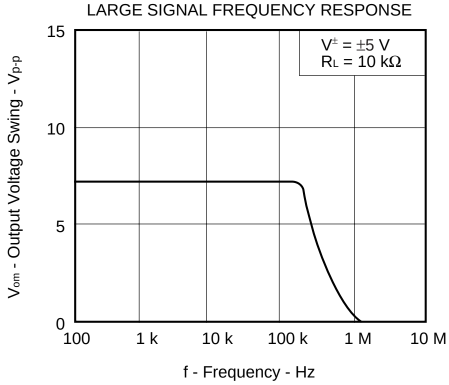
★ INPUT OFFSET VOLTAGE



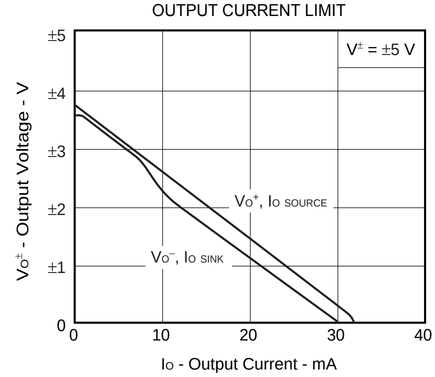
★ INPUT BIAS CURRENT



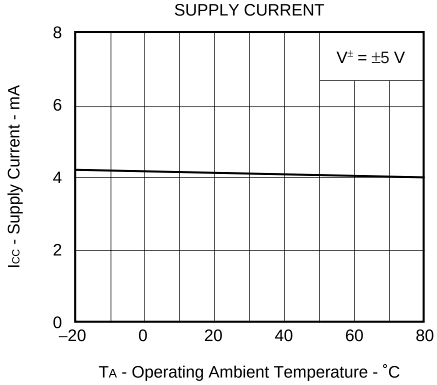
LARGE SIGNAL FREQUENCY RESPONSE



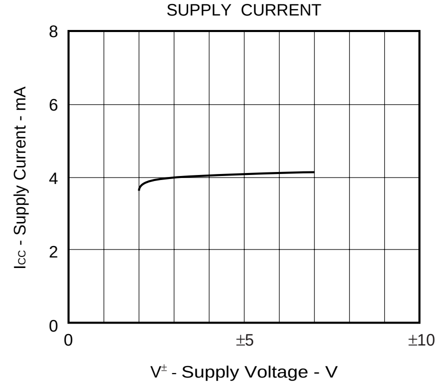
OUTPUT CURRENT LIMIT



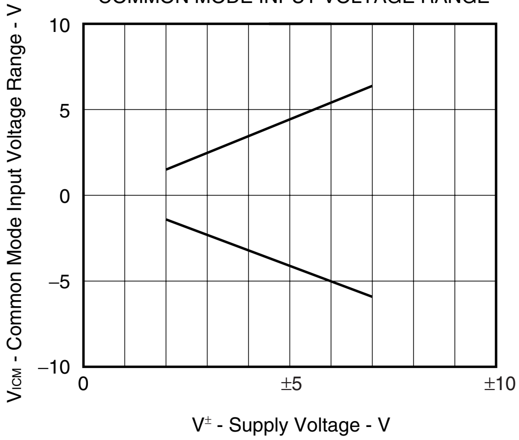
SUPPLY CURRENT



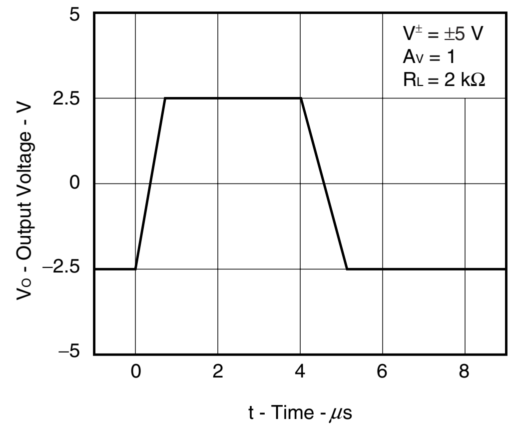
SUPPLY CURRENT



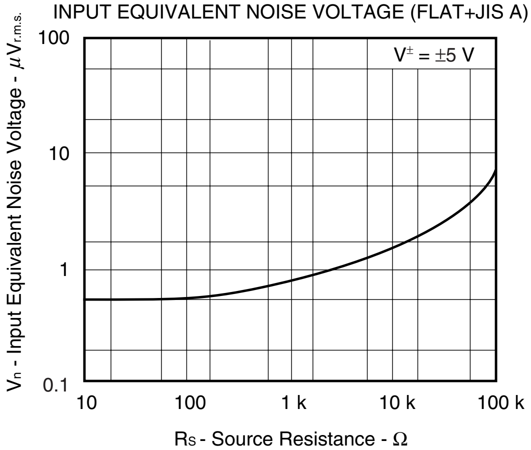
COMMON MODE INPUT VOLTAGE RANGE



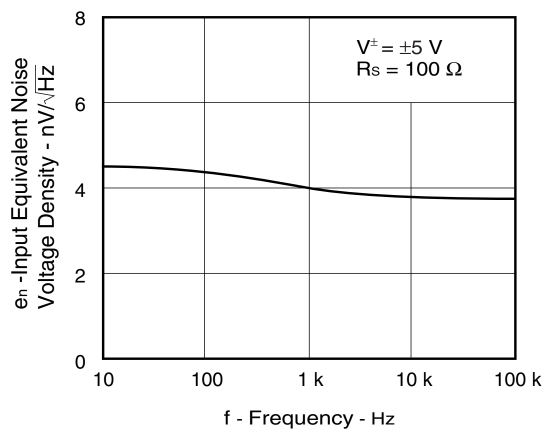
VOLTAGE FOLLOWER PULSE RESPONSE



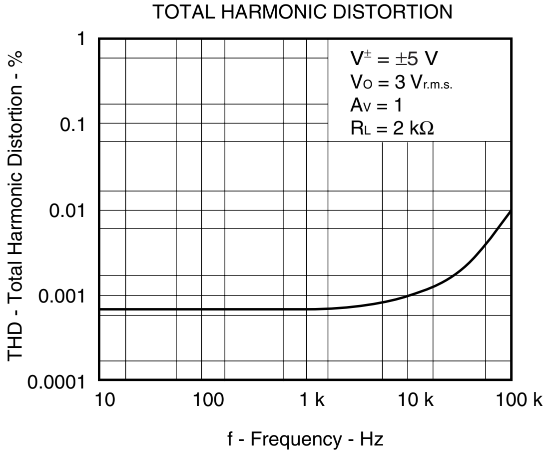
INPUT EQUIVALENT NOISE VOLTAGE (FLAT+JIS A)



INPUT EQUIVALENT NOISE VOLTAGE DENSITY

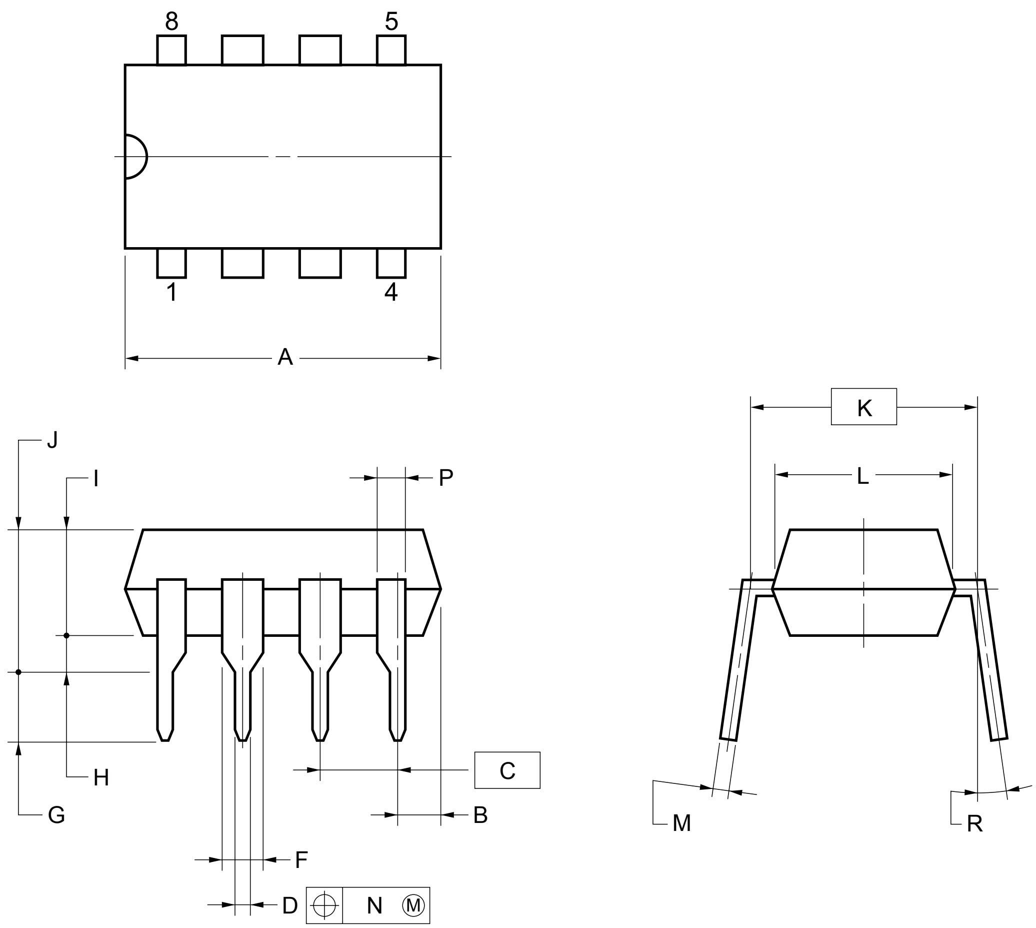


TOTAL HARMONIC DISTORTION



PACKAGE DRAWINGS (Unit: mm)

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



NOTES

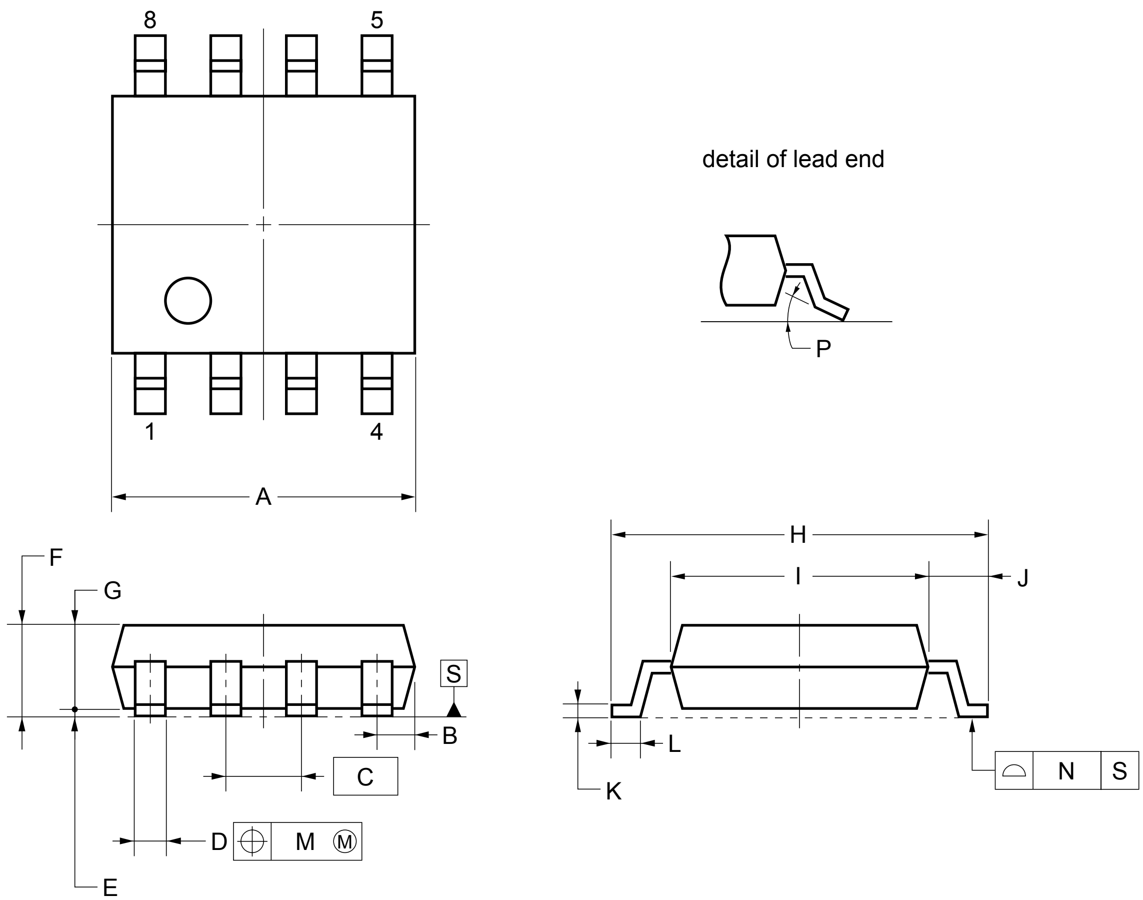
1. Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

2. Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS
A	10.16 MAX.
B	1.27 MAX.
C	2.54 (T.P.)
D	0.50±0.10
F	1.4 MIN.
G	3.2±0.3
H	0.51 MIN.
I	4.31 MAX.
J	5.08 MAX.
K	7.62 (T.P.)
L	6.4
M	$0.25^{+0.10}_{-0.05}$
N	0.25
P	0.9 MIN.
R	0~15∞

P8C-100-300B,C-2

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



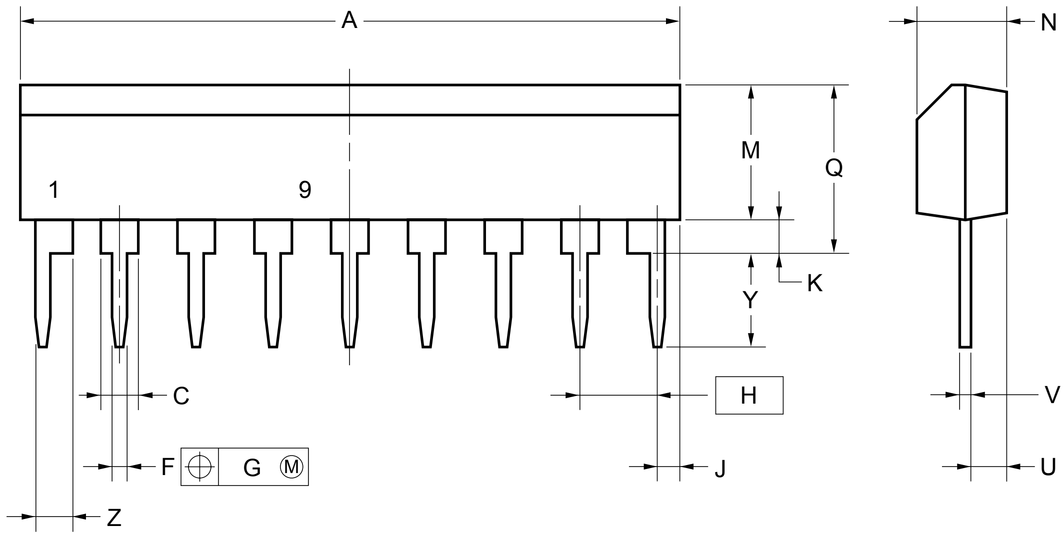
NOTE

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	$3∞^{+7∞}_{-3∞}$

S8GM-50-225B-6

9-PIN PLASTIC SLIM SIP



NOTE

Each lead centerline is located within 0.25 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	22.86 MAX.
C	1.1 MIN.
F	0.5±0.1
G	0.25
H	2.54
J	1.27 MAX.
K	0.51 MIN.
M	5.08 MAX.
N	2.8±0.2
Q	5.75 MAX.
U	1.5 MAX.
V	$0.25^{+0.10}_{-0.05}$
Y	3.2±0.5
Z	1.1 MIN.

P9HA-254B-2

★ RECOMMENDED SOLDERING CONDITIONS

The μPC4572 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)

Type of Surface Mount Device

μPC4572G2, 4572G2(5): 8-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.

Type of Through-hole Device

μPC4572C, 4572C(5): 8-pin plastic DIP (7.62 mm (300)), μPC4572HA, 4572HA(5): 9-pin plastic slim SIP

Process	Conditions
Wave Soldering (only to leads)	Solder temperature: 260°C or below, Flow time: 10 seconds or less.
Partial Heating Method	Pin temperature: 300°C or below, Heat time: 3 seconds or less (per each lead).

Caution For through-hole device, the wave soldering process must be applied only to leads, and make sure that the package body does not get jet soldered.