

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC4250

## PROGRAMMABLE OPERATIONAL AMPLIFIER

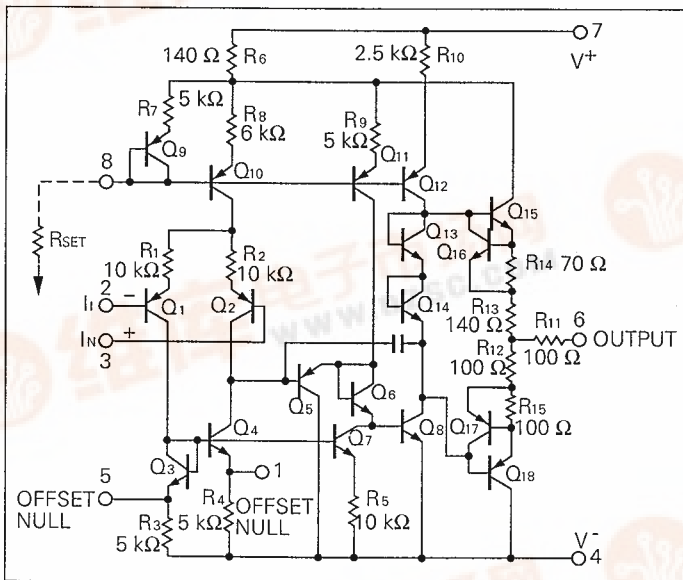
### DESCRIPTION

The  $\mu$ PC4250 is a highly versatile monolithic operational amplifier. The quiescent power dissipation, input offset and bias current, slew rate and gain-bandwidth product are determined by a single external programming resistor. Since the  $\mu$ PC4250 is in effect different op amps for each externally programmed set current, it is possible to use a single stock item for a variety of circuit function in a system.

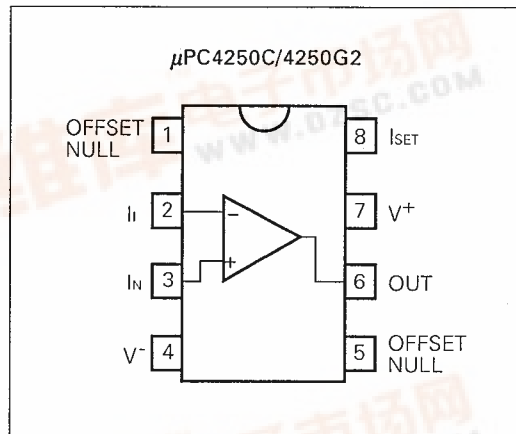
### FEATURES

- Wide supply voltage range:  $\pm 1$  V to  $\pm 18$  V
- Programmable electrical characteristics  
Power consumption, slew rate, etc.
- Internal frequency compensation
- Offset voltage null capability
- Output short circuit protection

### EQUIVALENT CIRCUIT



### CONNECTION DIAGRAM (Top View)



### ORDERING INFORMATION

PART NUMBER	PACKAGE	QUALITY GRADE
$\mu$ PC4250C	8 PIN PLASTIC DIP (300 mil)	Standard
$\mu$ PC4250G2	8 PIN PLASTIC SOP (225 mil)	Standard

**ABSOLUTE MAXIMUM RATINGS (Ta=25 °C)**

PARAMETER		SYMBOL	μPC4250	UNIT
Voltage between V+ and V- (Note 1)		V+ - V-	-0.3 to +36	V
Differential Input Voltage		V <sub>ID</sub>	±30	V
Input Voltage (Note 2)		V <sub>I</sub>	V- -0.3 to V+ +0.3	V
Output Voltage (Note 3)		V <sub>O</sub>	V- -0.3 to V+ +0.3	V
I <sub>SET</sub> Current		I <sub>SET</sub>	150	μA
Power Dissipation	C Package (Note 4)	P <sub>T</sub>	350	mW
	G2 Package (Note 5)		440	mW
Output Short Circuit Duration (Note 6)			Indefinite	sec
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 destruction. 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 -5.0 mW/°C when ambient temperature is higher than 55 °C.

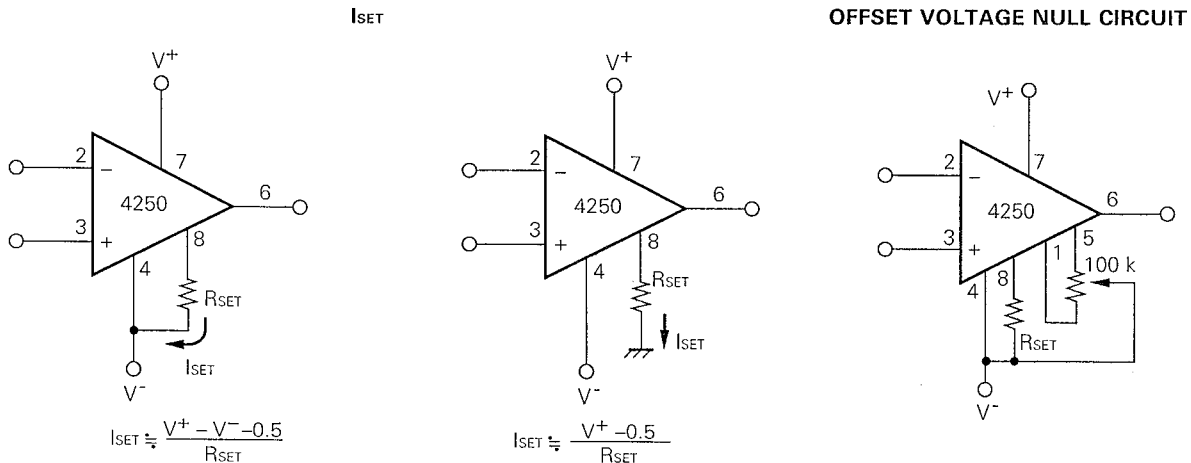
**Note 5.** Thermal derating factor is -4.4 mW/°C when ambient temperature is higher than 25 °C.

**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	V <sup>±</sup>	±1		±16	V
I <sub>SET</sub> Current	I <sub>SET</sub>	0.1		50	μA

**TYPICAL CONNECTIONS**



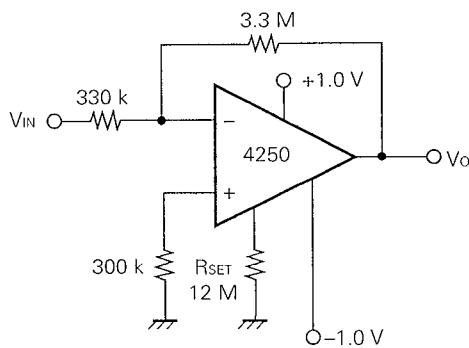
**Note 7.** I<sub>SET</sub> is indispensable to operate.

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

CHARACTERISTIC	SYMBOL	I <sub>SET</sub> = 1 $\mu$ A		I <sub>SET</sub> = 10 $\mu$ A		UNIT	TEST CONDITIONS
		MIN.	MAX.	MIN.	MAX.		
Input Offset Voltage	V <sub>IO</sub>		$\pm 5$		$\pm 6$	mV	R <sub>S</sub> $\leq$ 100 k $\Omega$
			$\pm 5$		$\pm 6$		V <sup>±</sup> = $\pm 1.5$ V, R <sub>S</sub> $\leq$ 100 k $\Omega$
Input Offset Current (Note 8)	I <sub>IO</sub>		$\pm 6$		$\pm 20$	nA	
Input Bias Current (Note 8)	I <sub>B</sub>		10		75	nA	V <sup>±</sup> = $\pm 1.5$ V
			10		75		
Voltage Gain	A <sub>v</sub>	60000					V <sub>O</sub> = $\pm 10$ V, R <sub>L</sub> = 100 k $\Omega$
				60000			V <sub>O</sub> = $\pm 10$ V, R <sub>L</sub> = 10 k $\Omega$
Supply Current	I <sub>CC</sub>		11		100	$\mu$ A	I <sub>O</sub> = 0 A
			8		90		V <sup>±</sup> = $\pm 1.5$ V, I <sub>O</sub> = 0 A
Power Dissipation	P <sub>d</sub>		330		3000	$\mu$ W	I <sub>O</sub> = 0 A
			24		270		V <sup>±</sup> = $\pm 1.5$ V, I <sub>O</sub> = 0 A
Common Mode Rejection Ratio	CMR	70		70		dB	R <sub>S</sub> $\leq$ 10 k $\Omega$
Supply Voltage Rejection Ratio	SVR	74		74		dB	R <sub>S</sub> $\leq$ 10 k $\Omega$
Output Voltage Swing	V <sub>om</sub>	$\pm 12$				V	R <sub>L</sub> = 100 k $\Omega$
		$\pm 0.6$					V <sup>±</sup> = $\pm 1.5$ V, R <sub>L</sub> = 100 k $\Omega$
Output Voltage Swing	V <sub>om</sub>			$\pm 12$		V	R <sub>L</sub> = 10 k $\Omega$
				$\pm 0.6$			V <sup>±</sup> = $\pm 1.5$ V, R <sub>L</sub> = 10 k $\Omega$
Input Voltage Range	V <sub>ICM</sub>	$\pm 13.5$		$\pm 13.5$		V	
		$\pm 0.6$		$\pm 0.6$			V <sup>±</sup> = $\pm 1.5$ V

**Note 8.** Input bias currents flow out from IC. Because each currents are base current of PNP-transistor on input stage.

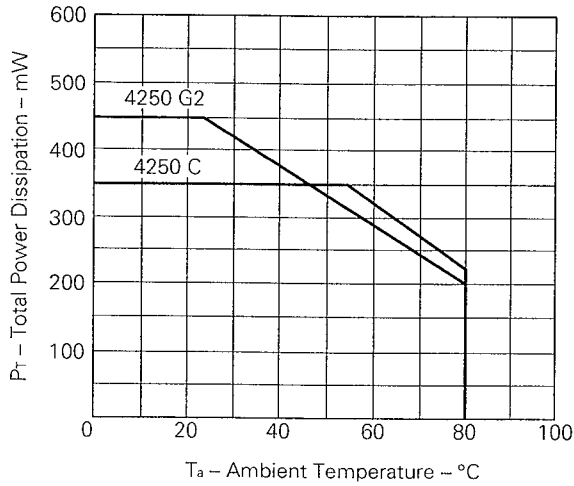
**TYPICAL APPLICATION**



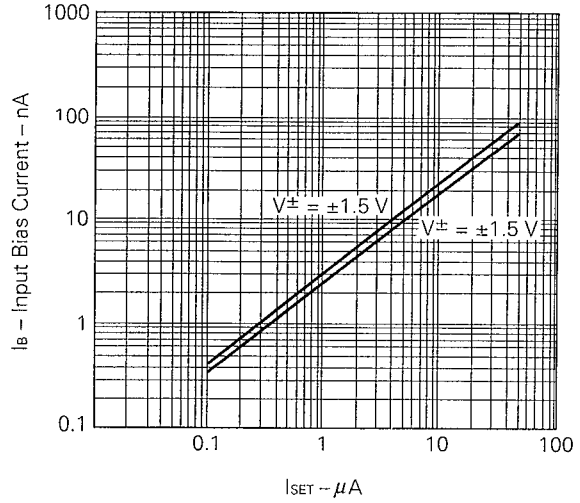
x10 Amplifier (500 nW)

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

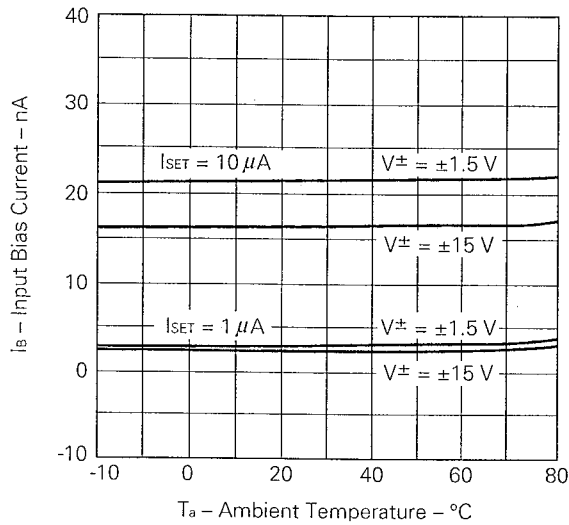
POWER DISSIPATION



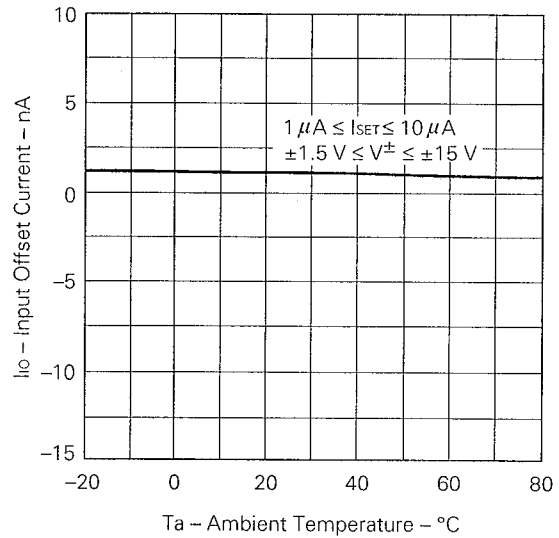
INPUT BIAS CURRENT



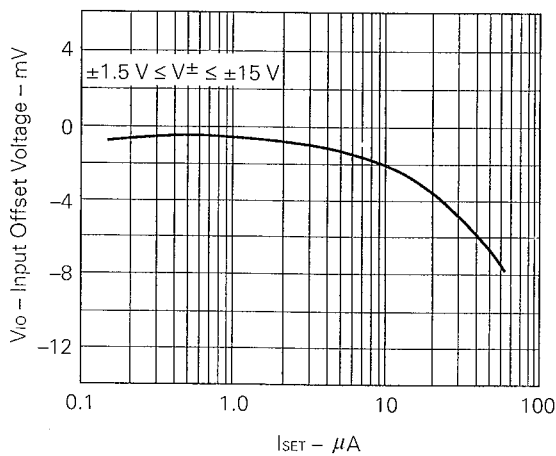
INPUT BIAS CURRENT



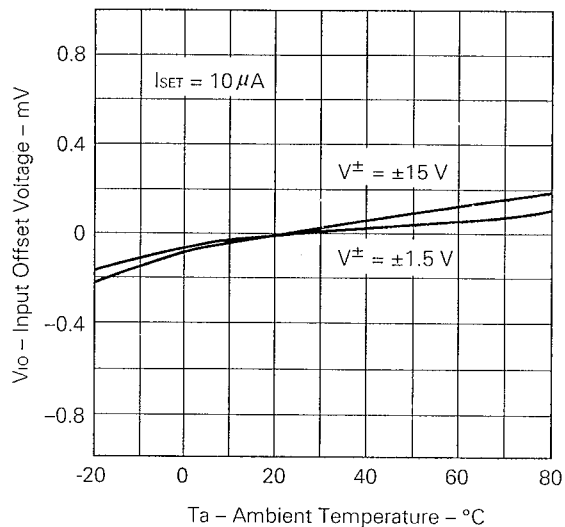
INPUT OFFSET CURRENT



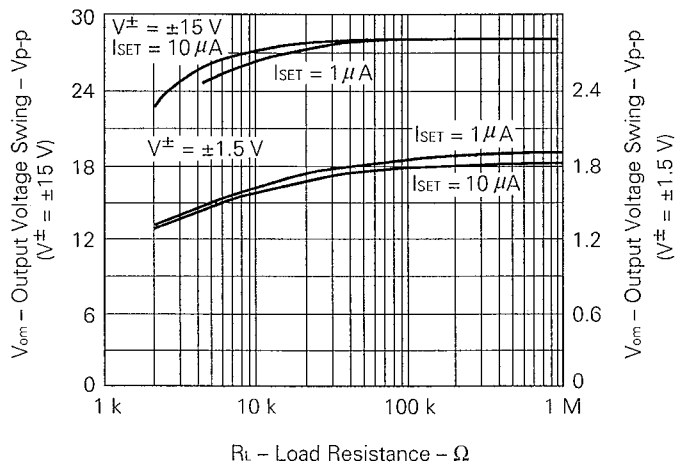
INPUT OFFSET VOLTAGE (unnull)



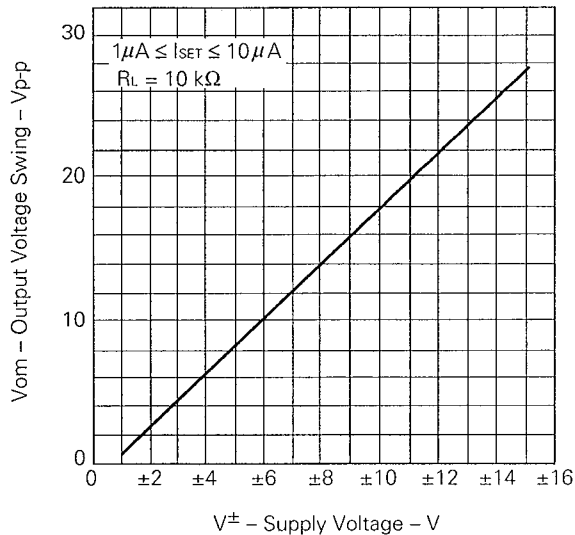
INPUT OFFSET VOLTAGE (unnull)



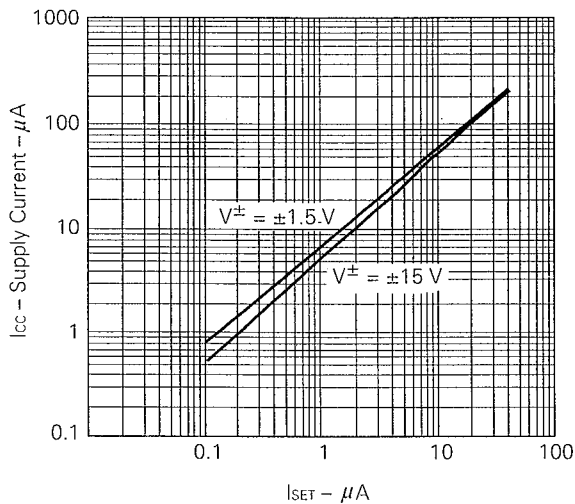
OUTPUT VOLTAGE SWING



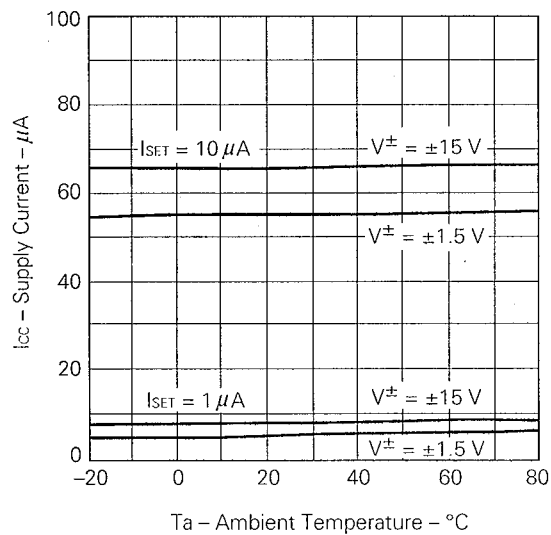
OUTPUT VOLTAGE SWING



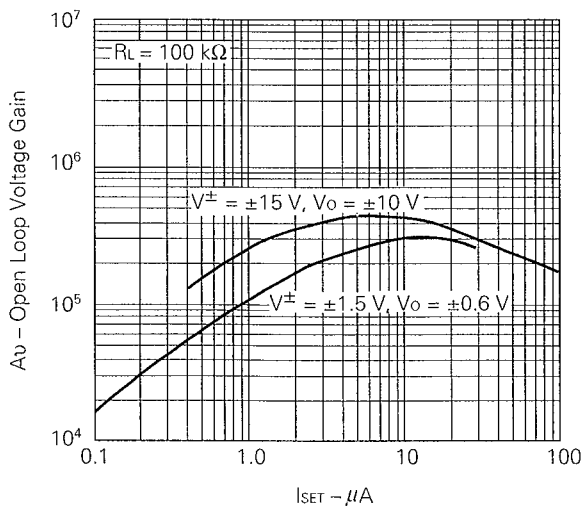
SUPPLY CURRENT



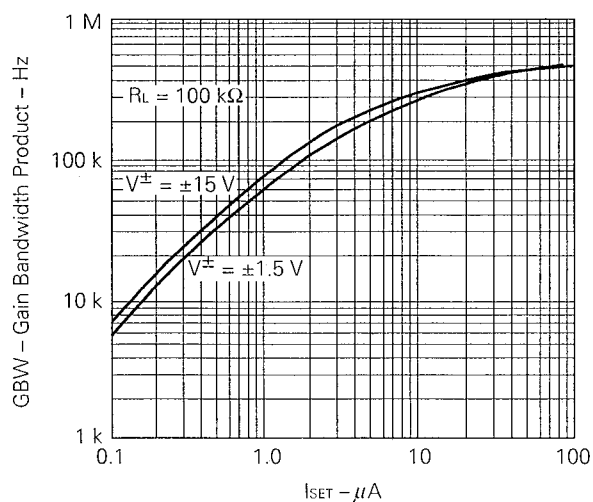
SUPPLY CURRENT



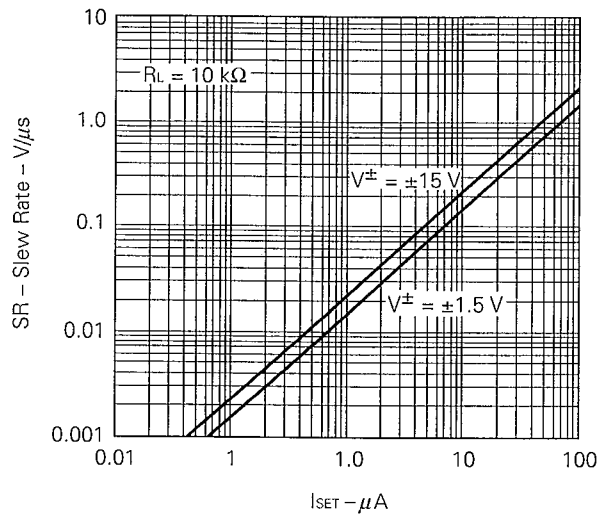
OPEN LOOP VOLTAGE GAIN



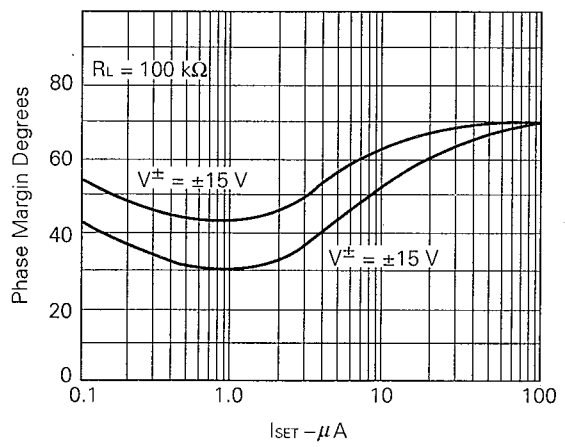
GAIN BANDWIDTH PRODUCT



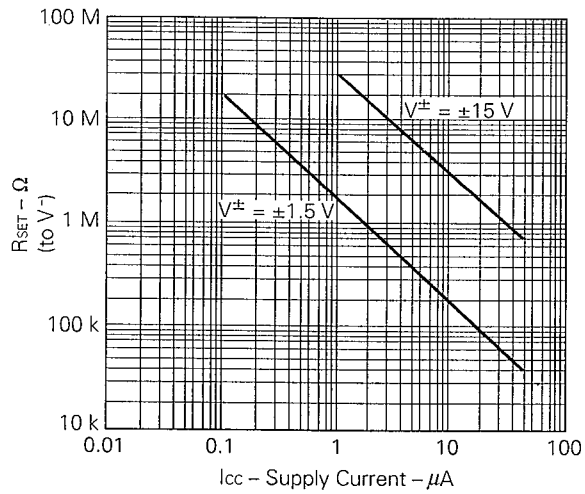
SLEW RATE



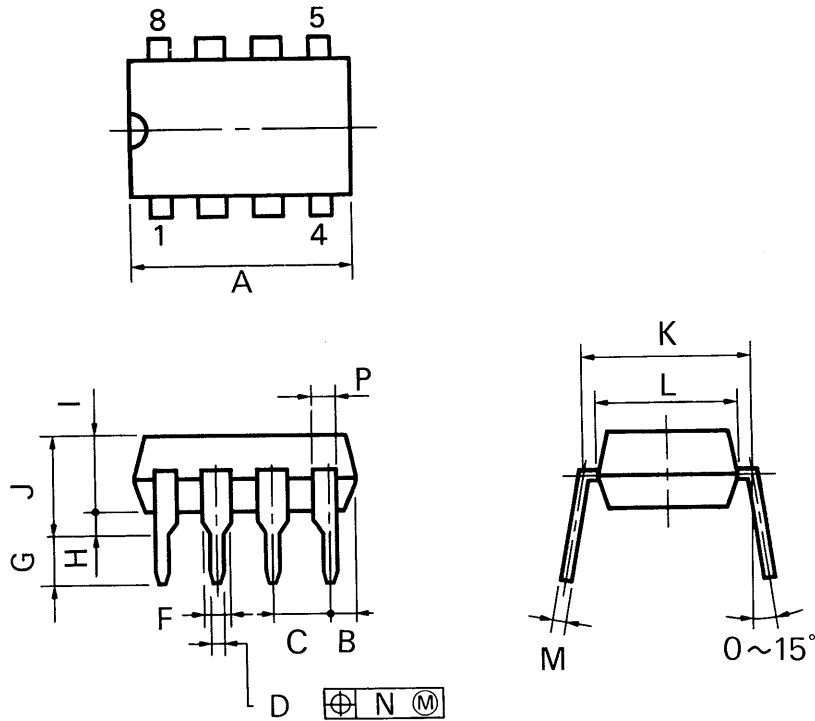
PHASE MARGIN



$R_{SET}$



8PIN PLASTIC DIP (300 mil)



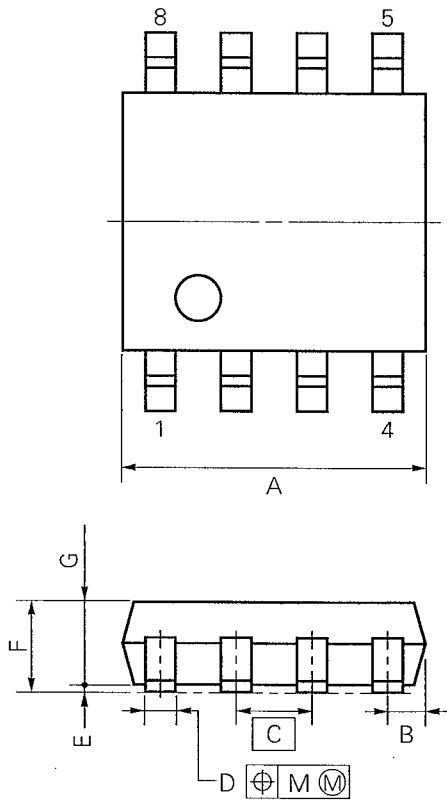
P8C-100-300B,C

NOTES

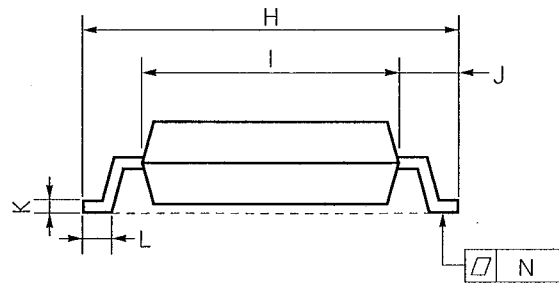
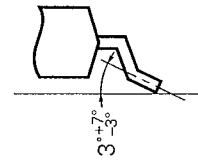
- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	10.16 MAX.	0.400 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50 ±0.10	0.020 <sup>+0.004</sup> / <sub>-0.005</sub>
F	1.4 MIN.	0.055 MIN.
G	3.2 ±0.3	0.126 ±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.4	0.252
M	0.25 <sup>+0.10</sup> / <sub>-0.05</sub>	0.010 <sup>+0.004</sup> / <sub>-0.003</sub>
N	0.25	0.01
P	0.9 MIN.	0.035 MIN.

8PIN PLASTIC SOP (225 mil)



detail of lead end



**NOTE**

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

S8GM-50-225B-2

ITEM	MILLIMETERS	INCHES
A	5.37 MAX.	0.212 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 <sup>+0.10</sup> <sub>-0.05</sub>	0.016 <sup>+0.004</sup> <sub>-0.003</sub>
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071MAX.
G	1.49	0.059
H	6.5±0.3	0.256±0.012
I	4.4	0.173
J	1.1	0.043
K	0.15 <sup>+0.10</sup> <sub>-0.05</sub>	0.006 <sup>+0.004</sup> <sub>-0.002</sub>
L	0.6±0.2	0.024 <sup>+0.008</sup> <sub>-0.009</sub>
M	0.12	0.005
N	0.15	0.006



**RECOMMENDED SOLDERING CONDITIONS**

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

**TYPES OF SURFACE MOUNT DEVICE**

For more details, refer to our document "SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL" (IEI-1207).

[μPC4250G2]

Soldering method	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Peak package's surface temperature : 230 °C or below, Reflow time : 30 seconds or below (210 °C or higher), Number of reflow process : 1, Exposure limit* : None	IR30-00-1
VPS	Peak package's surface temperature : 215 °C or below, Reflow time : 40 seconds or below (200 °C or higher), Number of reflow process : 1, Exposure limit* : None	VP15-00-1
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below, Number of flow process: 1, Exposure limit*: None	WS15-00-1
Partial heating method	Terminal temperature : 300 °C or below, Flow time : 10 seconds or below, Exposure limit* : None	○

\* Exposure limit before soldering after dry-pack package is opened.  
Storage conditions: 25 °C and relative humidity at 65 % or less.

**Note** Do not apply more than a single process at once, except for "Partial heating method".

**TYPES OF THROUGH HOLE DEVICE**

[μPC4250C]

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

[MEMO]

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Application examples recommended by NEC Corporation

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.