

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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# BIPOLAR ANALOG INTEGRATED CIRCUIT

## $\mu$ PC1228

### LOW NOISE DUAL PREAMPLIFIER

#### DESCRIPTION

The  $\mu$ PC1228, a silicon monolithic integrated circuit, is a low noise dual preamplifier designed for car stereo applications. The device consists of two separate amplification channels, and its major features are low noise, low distortion, high gain, large dynamic range and wide supply voltage range.

#### FEATURES

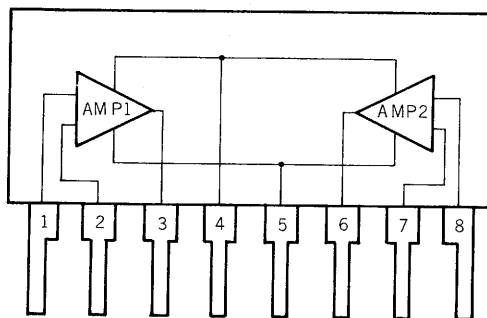
- High open loop gain :  $A_{VO} = 100$  dB TYP.
- Low noise :  $V_{nin} = 1.1$   $\mu$ V TYP.
- Low distortion : THD = 0.05 % TYP.
- Large dynamic range :  $V_{OM} = 2.0$  V TYP.
- Wide supply voltage range :  $V_{CC} = 6$  to 16 V
- High output current :  $I_{ODC} = 1$  mA MAX.
- Low impedance load driving capability :  $R_L = 1$  k $\Omega$  MIN.
- Small feedback capacitance capability

#### ORDERING INFORMATION

PART NUMBER	PACKAGE	QUALITY GRADE
$\mu$ PC1228HA	8 PIN PLASTIC SLIM SIP	Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

CONNECTION DIAGRAM



Pin No.	Electrical connection
1	Input 1
2	Negative feed back 1
3	Output 1
4	Power supply: +V <sub>CC</sub>
5	Ground
6	Output 2
7	Negative feed back 2
8	Input 2

ABSOLUTE MAXIMUM RATINGS ( $T_a = 25\text{ }^{\circ}\text{C}$ )

Supply Voltage	$V_{CC}$	18	V
Package Dissipation	$P_D$	270*	mW
Operating Temperature	$T_{opt}$	-30 to +75	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$	-40 to +125	$^{\circ}\text{C}$
* $T_a = 75\text{ }^{\circ}\text{C}$			

RECOMMENDED OPERATING CONDITIONS ( $T_a = 25\text{ }^{\circ}\text{C}$ )

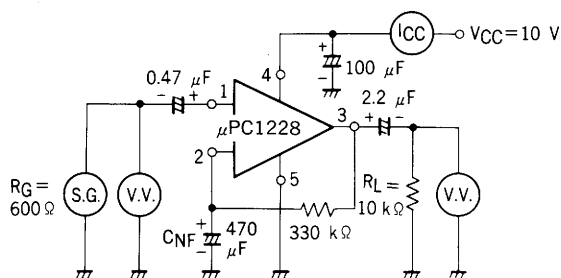
Operating Supply Voltage	$V_{CC}$	13.2	V
Supply Voltage Range	$V_{CC}$	6 to 16	V
Operating Ambient Temperature	$T_a$	-30 to +75	$^{\circ}\text{C}$
Load impedance	$R_L$	10	k $\Omega$

ELECTRICAL CHARACTERISTICS ( $T_a = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 10\text{ V}$ ,  $f = 1\text{ kHz}$ ,  $R_L = 10\text{ k}\Omega$ )

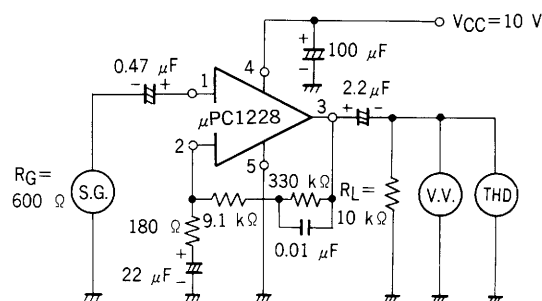
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CIRCUIT	TEST CONDITIONS
Quiescent Current	$I_{CC}$	2.5	3.3	4.8	mA	(1)	$V_{in} = 0$
Open Loop Voltage Gain	$A_{VO}$	90	100		dB	(1)	$V_O = 0.3\text{ V}$ , $f = 100\text{ Hz}$
Voltage Gain	$A_V$		40		dB	(2)	$V_O = 0.3\text{ V}$ , NAB
Maximum Output Voltage	$V_{OM}$	1.0	2.0		V	(2)	THD = 1 %, NAB
Total Harmonic Distortion	THD		0.05	0.3	%	(2)	$V_O = 0.3\text{ V}$ , NAB
Input Impedance	$r_i$	50	100		k $\Omega$	(2)	
Equivalent Input Noise Voltage	$V_{nin}$		1.1	1.7	$\mu\text{V}$	(3)	$R_G = 2.2\text{ k}\Omega$ , NAB
Cross Talk	CT	-50	-65		dB	(4)	$V_O = 1\text{ V}$ , (The other channel $V_{in} = 0$ , $R_G = 2.2\text{ k}\Omega$ )
Channel Balance	Ch. B	-0.3	0	+0.3	dB	(4)	$V_O = 0.3\text{ V}$

## TEST CIRCUITS

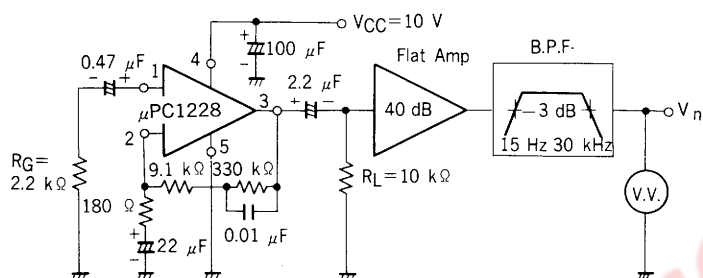
(1)  $I_{CC}$ ,  $A_{VO}$  test circuit



(2)  $A_V$ ,  $V_{OM}$ , THD,  $Z_{in}$  test circuit (for Ch. 1)

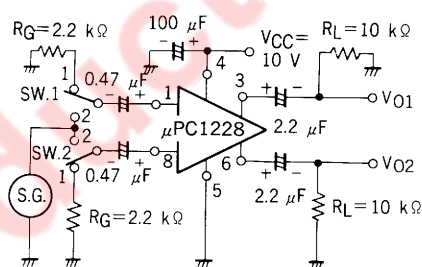


(3)  $V_{nin}$  test circuit (for Ch. 1)



**NOTE:**  $V_{nin}$  is calculated by  $V_n$  and amp. gain ( $A_V + 40$  dB).

(4) Cross talk, Channel balance test circuit



**NOTE 1:** External components of the IC are the same as the test circuit (2).

**2:** Cross talk procedure

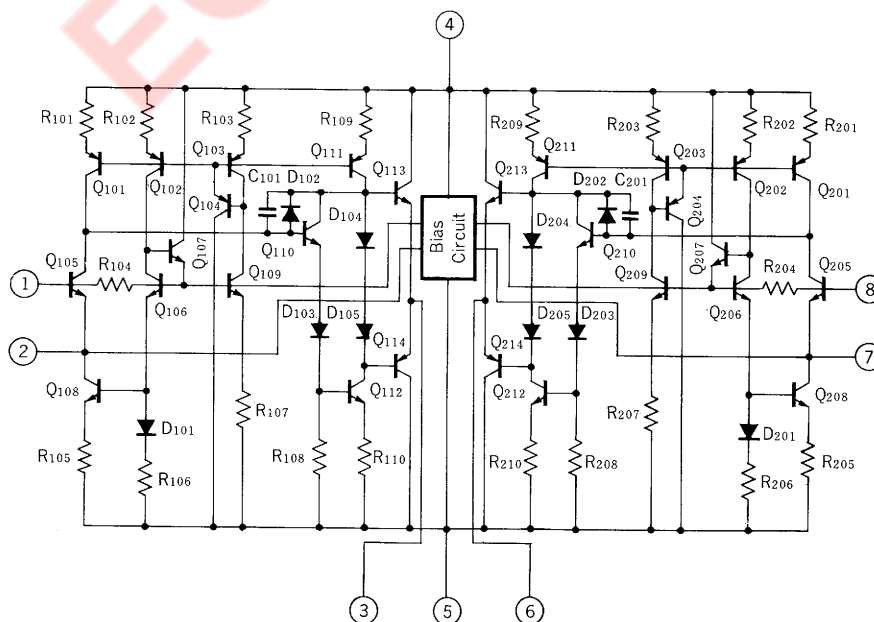
Switch position SW.1  $\rightarrow$  2, SW.2  $\rightarrow$  1,  $20 \log V_{O2}/V_{O1}$

Switch position SW.1  $\rightarrow$  1, SW.2  $\rightarrow$  2,  $20 \log V_{O1}/V_{O2}$

**3:** Channel balance

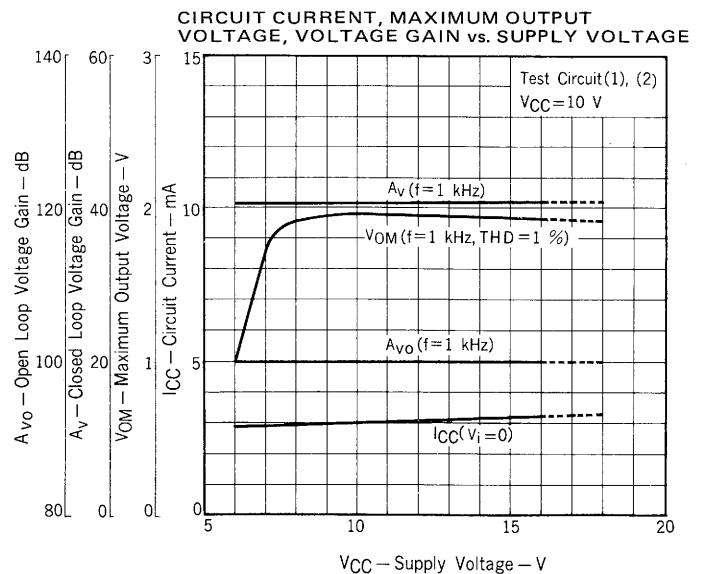
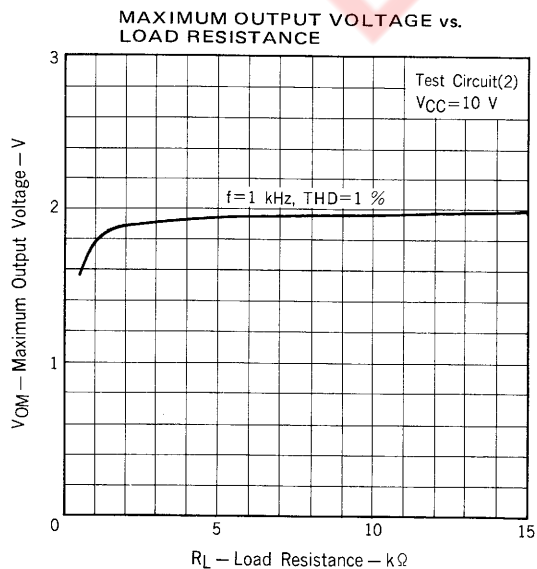
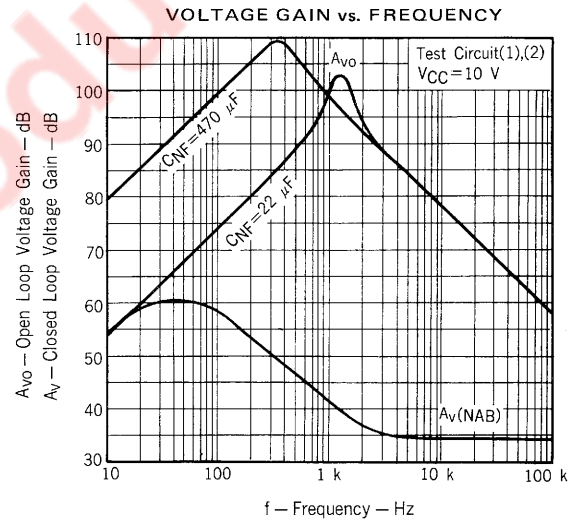
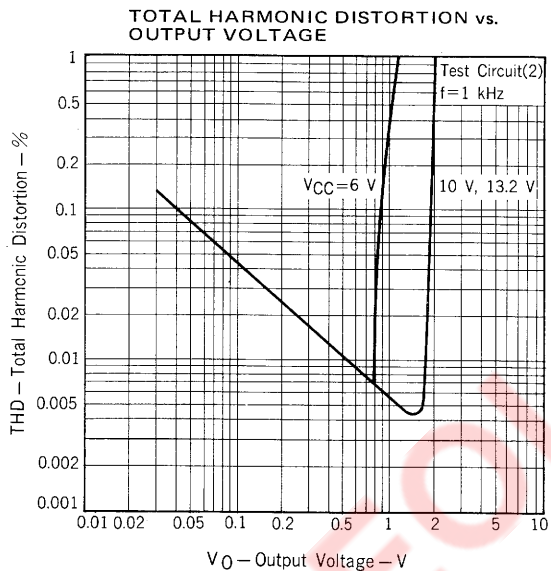
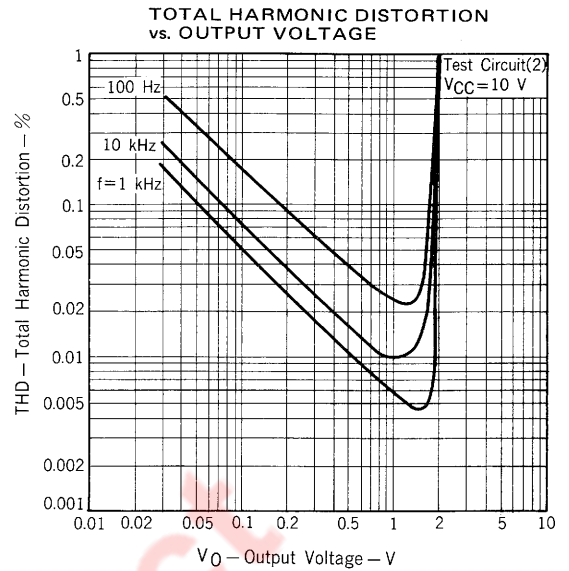
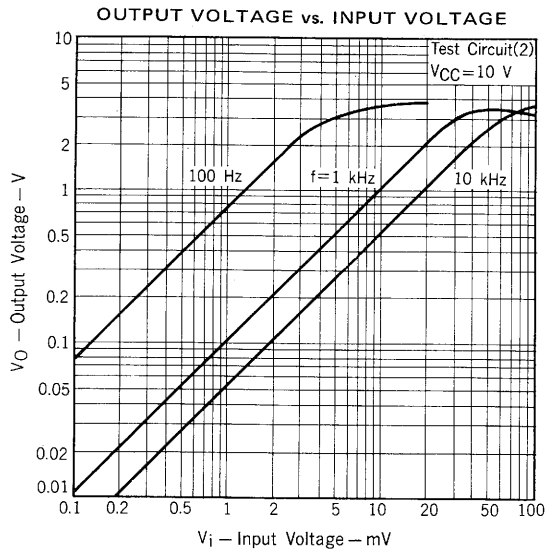
Switch position SW.1  $\rightarrow$  2, SW.2  $\rightarrow$  2,  $20 \log V_{O1}/V_{O2}$

## EQUIVALENT CIRCUIT

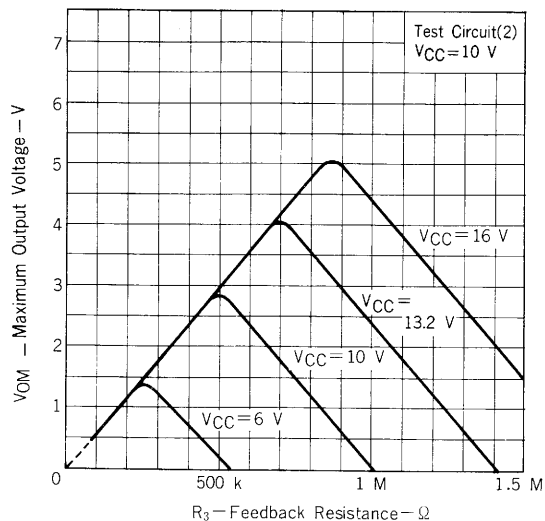




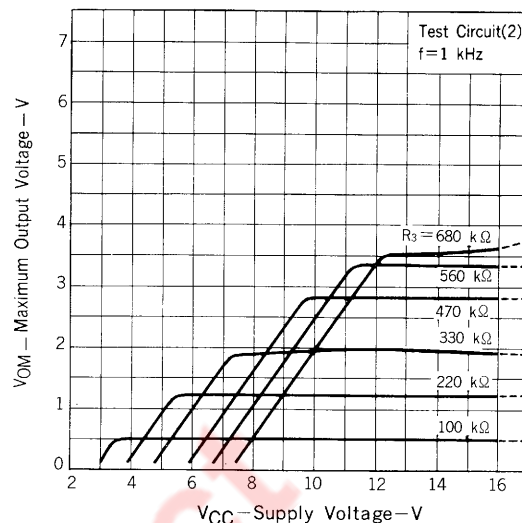
TYPICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )



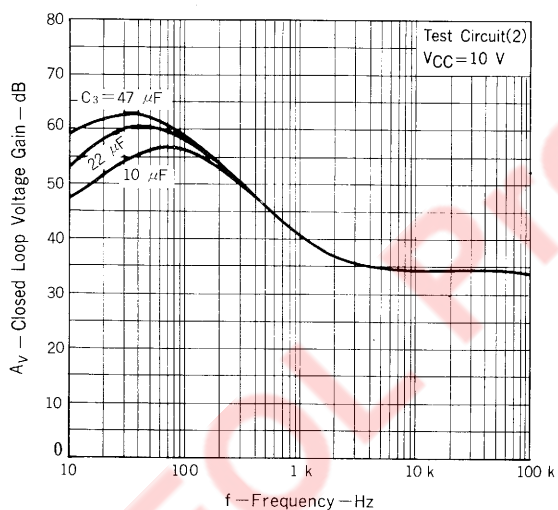
MAXIMUM OUTPUT VOLTAGE vs. FEEDBACK RESISTANCE



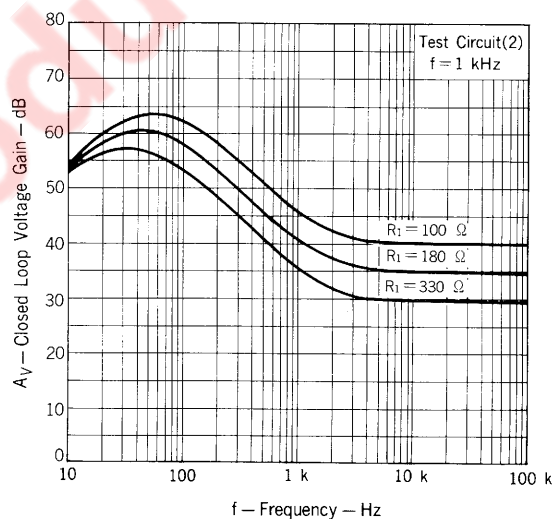
MAXIMUM OUTPUT VOLTAGE vs. SUPPLY VOLTAGE



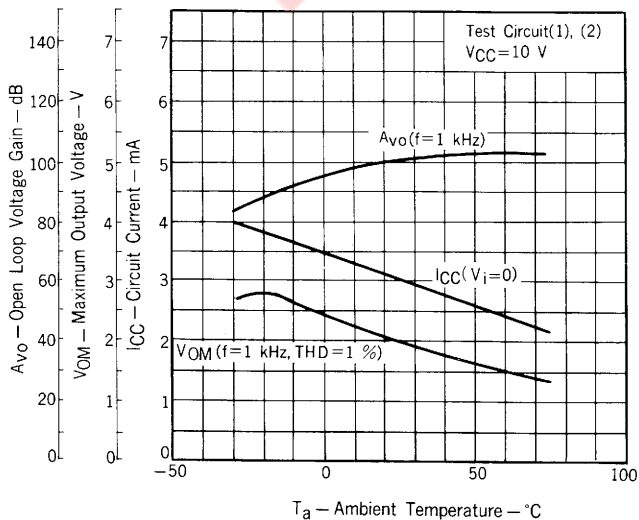
VOLTAGE GAIN vs. FREQUENCY



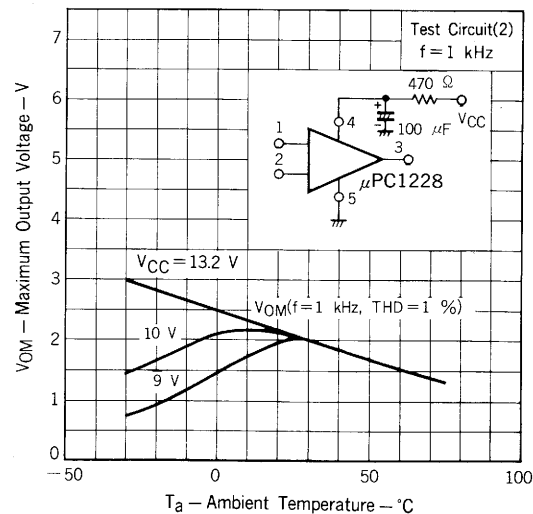
VOLTAGE GAIN vs. FREQUENCY



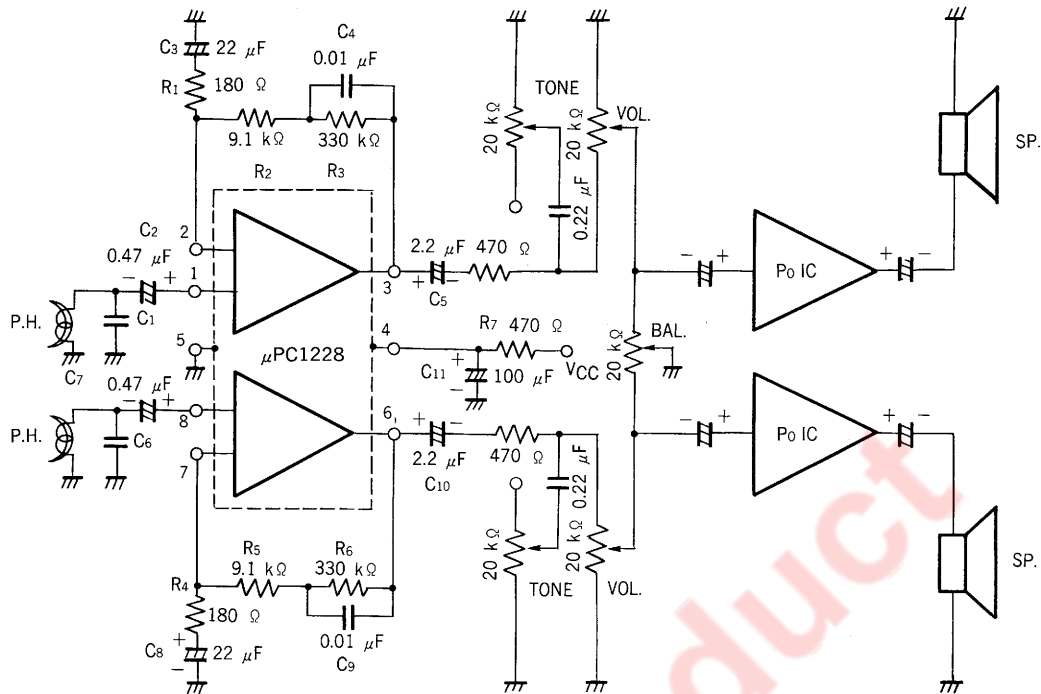
QUIESCENT CURRENT, MAXIMUM OUTPUT VOLTAGE, VOLTAGE GAIN vs. AMBIENT TEMPERATURE



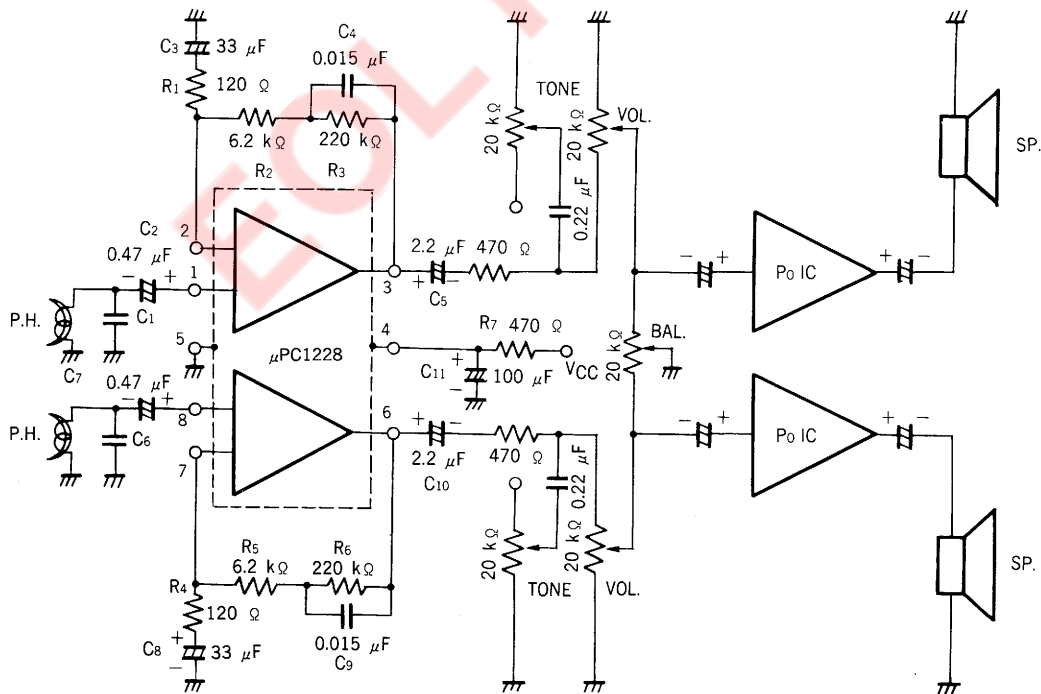
MAXIMUM OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



APPLICATION 1 (NAB EQ,  $V_{CC} = 8$  to 17 V,  $V_{OM} = 2$  V)



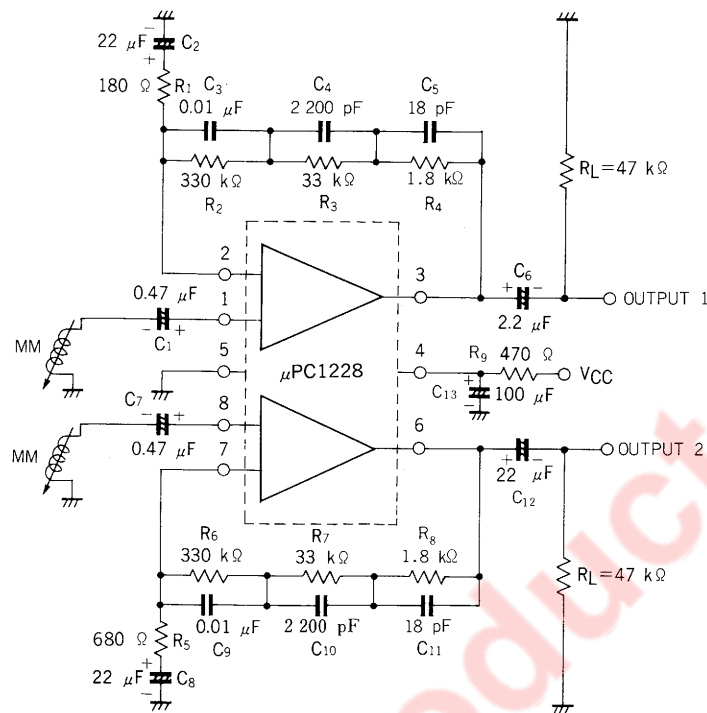
APPLICATION 2 (NAB EQ,  $V_{CC} = 6$  to 17 V,  $V_{OM} = 1.2$  V)



\* When supply voltage of pin ④ is down to 6 V, please use TYPICAL APPLICATION 2.

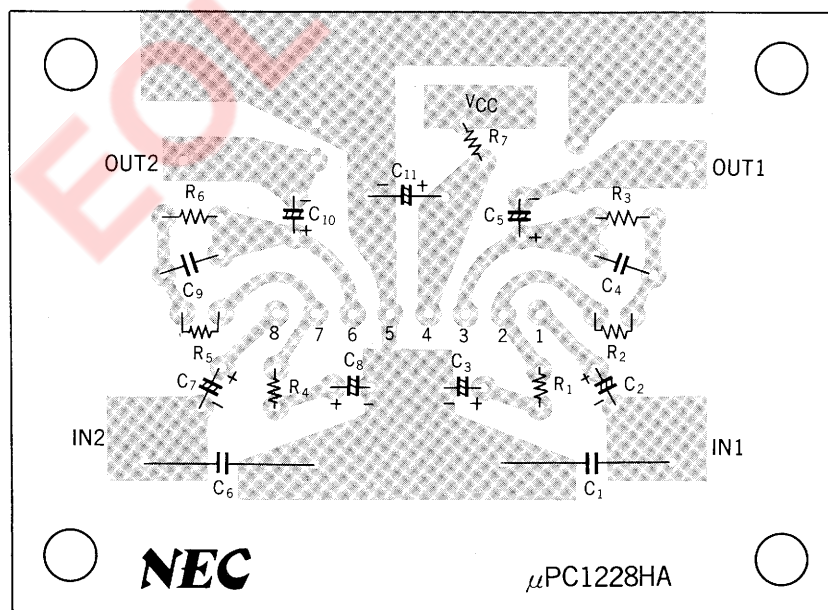


APPLICATION 3 (NAB EQ,  $V_{CC} = 8$  to  $18$  V,  $V_{OM} = 2$  V)

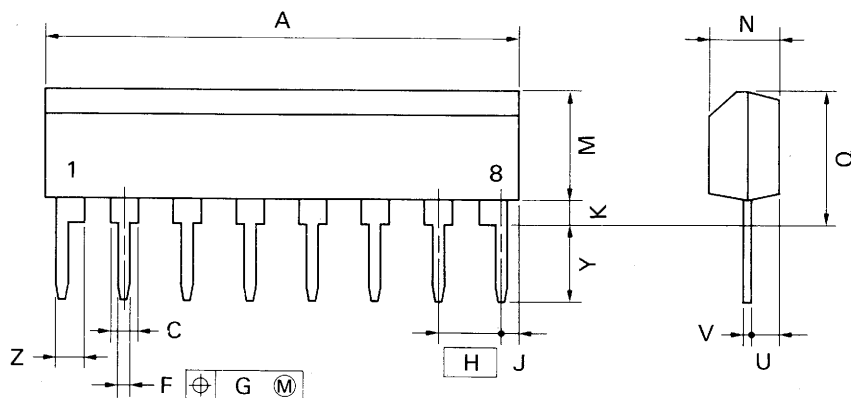


TYPICAL PRINTED CIRCUIT BOARD PATTERN

Copper foil side



8 PIN PLASTIC SLIM SIP



NOTE

Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

P8HA-254B

ITEM	MILLIMETERS	INCHES
A	20.32 MAX.	0.8 MAX.
C	1.1 MIN.	0.043 MIN.
F	0.5 <sup>+0.1</sup>	0.02 <sup>+0.004</sup> <sub>-0.005</sub>
G	0.25	0.01
H	2.54	0.1
J	1.27 MAX.	0.05 MAX.
K	0.51 MIN.	0.02 MIN.
M	5.08 MAX.	0.2 MAX.
N	2.8 <sup>+0.2</sup>	0.11 <sup>+0.008</sup> <sub>-0.008</sub>
Q	5.75 MAX.	0.227 MAX.
U	1.5 MAX.	0.059 MAX.
V	0.25 <sup>+0.10</sup> <sub>-0.08</sub>	0.01 <sup>+0.004</sup> <sub>-0.003</sub>
Y	3.2 <sup>+0.5</sup>	0.126 <sup>+0.02</sup>
Z	1.1 MIN.	0.043 MIN.

EOL Product

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