

6427525 N E C ELECTRONICS INC

05E 22688 D

BIPOLAR ANALOG INTEGRATED CIRCUIT

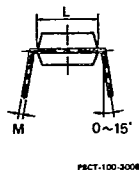
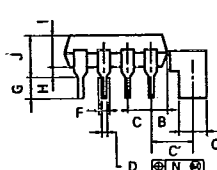
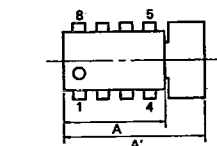
 μ PC1213C

T-74-05-01

AUDIO POWER AMPLIFIER**DESCRIPTION**

The μ PC1213C is a silicon monolithic integrated circuit designed for an audio power amplifier used in a portable radio receiver or a portable cassette tape recorder which works at 9-volt power supply.

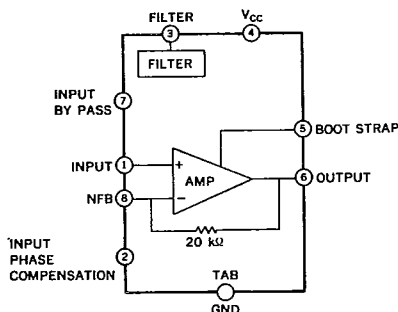
The μ PC1213C is encapsulated in an 8-pin dual in-line plastic package with a tab.

8 PIN PLASTIC DIP WITH TAB (300 mil)

P8CT-100-3008

FEATURES

- High output power.
 $P_o = 2.4$ W (TYP.)
at $V_{CC} = 9$ V, $R_L = 4 \Omega$, T.H.D. = 10 %
- Wide operating voltage range.
 $V_{CC} = 4.5$ to 9 to 11 V
- High ripple rejection ratio.
R.R.R. = 55 dB (TYP.)
- Soft clipping waveform.
- Have a muting circuit so that no shock noise at power supply switch on and off.
- Have a terminal to reject interference noise in strong electric field. (pin 2)

BLOCK DIAGRAM**CONNECTION DIAGRAM**

No.	CONNECTION	No.	CONNECTION
1	INPUT	5	BOOTSTRAP
2		6	OUTPUT
3	FILTER	7	FILTER
4	VCC	8	N. F. B.
TAB	GND		

NOTE

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

ITEM	MILLIMETERS	INCHES
A	12.70 MAX.	0.500 MAX.
A'	14.50 MAX.	0.571 MAX.
B	2.54 MAX.	0.100 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
C'	3.65	0.144
D	0.50 ± 0.10	0.020 ± 0.004
F	1.1 MIN.	0.043 MIN.
G	3.5 ± 0.3	0.138 ± 0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
L	6.4	0.252
M	0.30 ± 0.08	0.012 ± 0.003
N	0.25	0.01
Q	2.62 ± 0.50	0.103 ± 0.020

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

Supply Voltage	V_{CC1}	(No Signal)	16	V
Supply Voltage	V_{CC2}	(Operating)	11	V
Allowable Power Dissipation	P_d	*	2.4	W
Operating Temperature	T_{opt}	-20 to 70		$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to 150		$^\circ\text{C}$

* $50 \times 50 \times 0.035 \text{ mm}^3$ copper heat sink on P.C.B.

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

Supply Voltage	$V_{CC} = 4.5$ to 9 to 11 V
Load Impedance	$R_L = 4 \Omega$

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

($V_{CC} = 9 \text{ V}$, $R = 4 \Omega$, $f = 1 \text{ kHz}$, Refer to the test circuit
 $50 \times 50 \times 0.035 \text{ mm}^3$ copper heat sink on P.C.B. unless otherwise specified)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Quiescent Circuit Current	I_{CC}	8	15	25	mA	No Signal
Open Loop Voltage Gain	A_{vo}	55	65		dB	$P_O = 0.25 \text{ W}$
Voltage Gain (Closed Loop)	A_v	41	45 34	48	dB	$R_f = 100 \Omega$ $R_f = 360 \Omega$
Output Power	P_O	1.8	3.6 2.2 2.4 1.3 1.0 0.54		W	T.H.D. = 10% $R_f = 100 \Omega$ $V_{CC} = 11 \text{ V}$, $R_L = 4 \Omega$ $V_{CC} = 11 \text{ V}$, $R_L = 8 \Omega$ $V_{CC} = 9 \text{ V}$, $R_L = 4 \Omega$ $V_{CC} = 9 \text{ V}$, $R_L = 8 \Omega$ $V_{CC} = 6 \text{ V}$, $R_L = 4 \Omega$ $V_{CC} = 6 \text{ V}$, $R_L = 8 \Omega$
Input Sensitivity	$V_i(\text{rms})$		19.5 47.3		mV	$P_O = 2.4 \text{ W}$ $R_L = 4 \Omega$ $R_f = 100 \Omega$ ($A_v = 45 \text{ dB}$) $R_f = 360 \Omega$ ($A_v = 34 \text{ dB}$)
Input Sensitivity	$V_i(\text{rms})$		2.5 8.9		mV	$P_O = 50 \text{ mW}$ $R_L = 4 \Omega$ $R_f = 100 \Omega$ ($A_v = 45 \text{ dB}$) $R_f = 360 \Omega$ ($A_v = 34 \text{ dB}$)
Total Harmonic Distortion	T.H.D.		0.4	1.5	%	$P_O = 0.25 \text{ W}$
Output Noise Voltage	NL		0.2	0.8	mV _{r.m.s.}	$R_G = 0$
Supply Voltage Rejection Ratio	S.V.R.	40	55		dB	$R_G = 0$, $f_{\text{ripple}} = 100 \text{ Hz}$ $V_{\text{ripple}} = 0.3 \text{ V}_{r.m.s.}$
Input Impedance	R_i	10	20		k Ω	

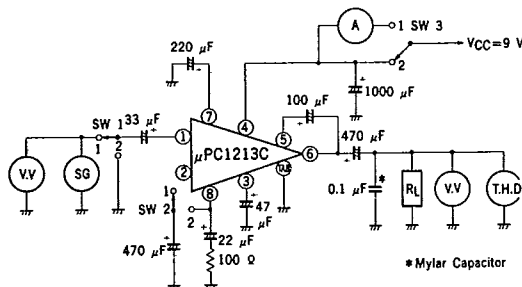
NOTE: In case that only a TYP. value is specified, this specification is for helping to design.

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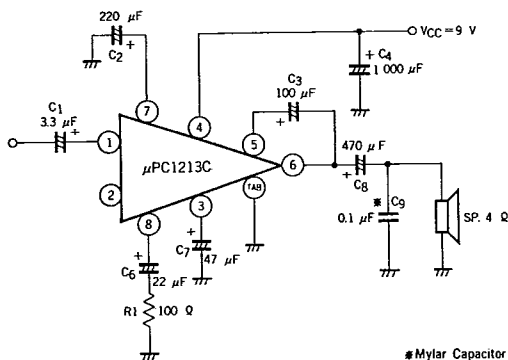
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TEST CIRCUIT
Fig. 1 TEST CIRCUIT

T-74-05-01**SWITCH POSITION**

SWITCH		SW1	SW2	SW3
ITEM				
Circuit Current	I_{CC}	2	1	1
Open Loop Voltage Gain	A_{VO}	1	2	2
Voltage Gain	A_V	1	1	2
Output Power	P_O	1	1	2
Total Harmonic Distortion	T.H.D.	1	1	2
Output Noise Voltage	NL	2	1	2

TYPICAL APPLICATION
Fig. 2 SINGLE OPERATION



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Fig. 3 BTL OPERATION

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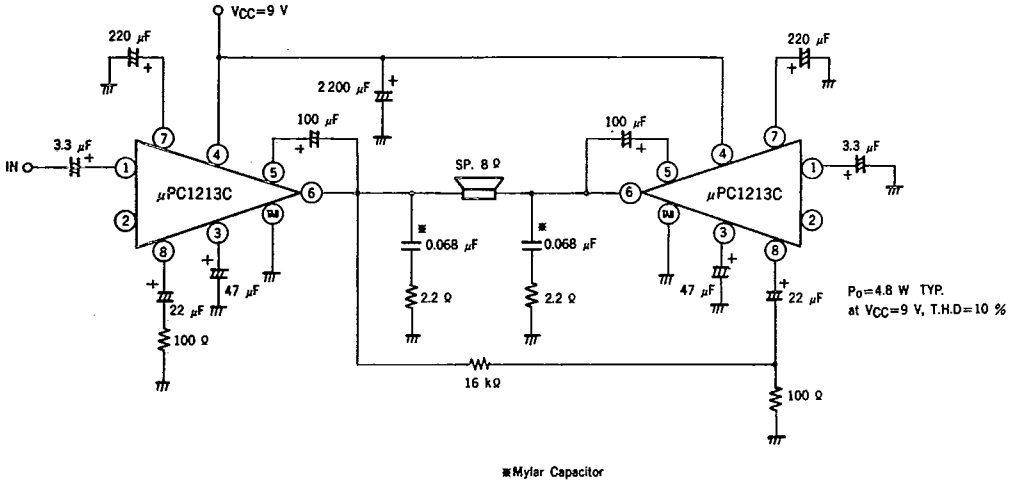
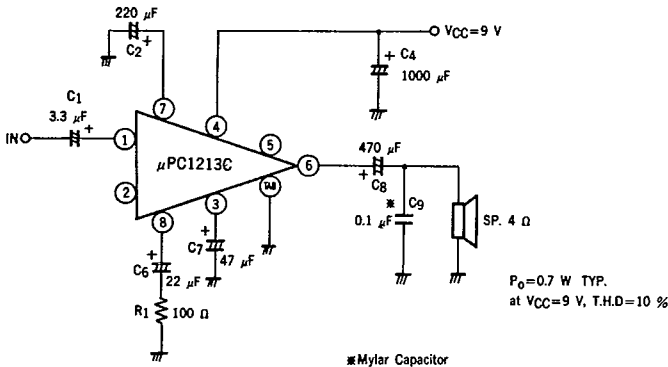


Fig. 4 SINGLE OPERATION WITHOUT BOOTSTRAP



NOTE FOR USE

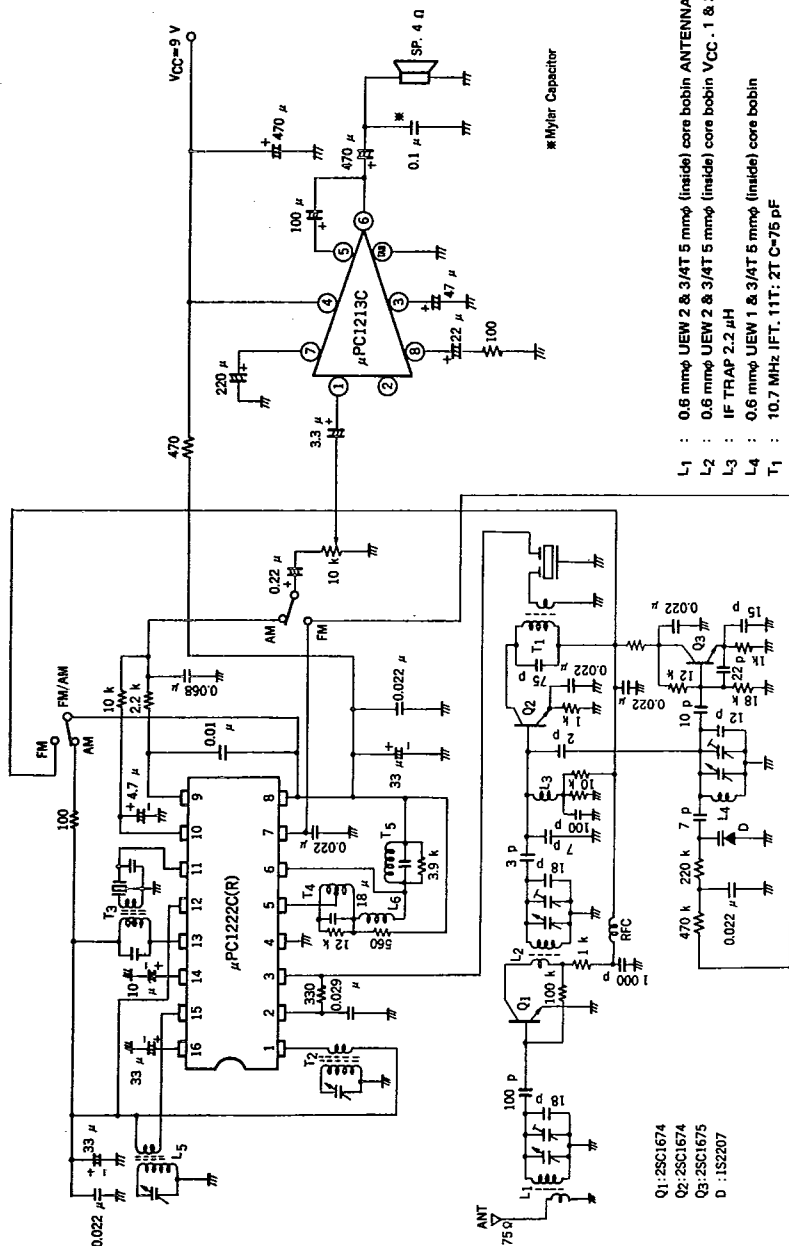
- (1) Capacitor C_9 is for preventing the parasitic oscillation.
A mylar capacitor is recommended for this position.
- (2) The ground side of C_4 , C_9 and the loud speaker should be attached at the place of the copper foil close to the tab of μ PC1212C.
- (3) Interference noise rejection in a strong electric field can be achieved by adding a capacitor (about 1 000 pF) between pin 1 and pin 2.

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- | | | | |
|----------------|-------------------------------------|-------------|--------------|
| L-1 | 0.6 mmφ UEW 2 & 3/AT 5 mmφ (inside) | core bobbin | ANTENNA 3/AT |
| L-2 | 0.6 mmφ UEW 2 & 3/AT 5 mmφ (inside) | core bobbin | 1 & 3/AT |
| L-3 | IF TRAP 2.2 uH | | |
| L-4 | 0.6 mmφ UEW 1 & 3/AT 5 mmφ (inside) | core bobbin | |
| T ₁ | 10.7 MHz IFT, 11T; 2T C=75 pF | | |
| L-5 | ANTENNA COIL 25A-195-08 (KOHRAIN) | | |
| T ₂ | AM OSC 26-1791-13 (KOHRAIN) | | |
| T ₃ | AM IFT CFZ-455C (TOKO) | | |
| T ₄ | AM DET. 5251 (TOKO) | | |
| T ₅ | FM DET. 12747 (TOKO) | | |
| L-6 | PHASE SHIFT COIL 78A180UH (TOKO) | | |

UNIT : Capacitance F
Resistance Ω

APPLICATION INFORMATION

Fig. 5 LOW COST FM-AM RADIO WITH 2.4 W OUTPUT POWER ($V_{CC} = 9\text{ V}$)

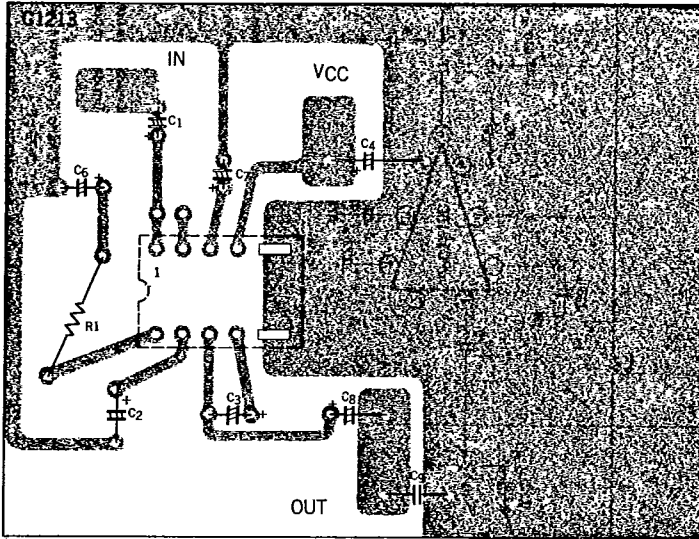
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P.C. BOARD PATTERN (COPPER SIDE)

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

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Fig. 6 OUTPUT POWER vs. SUPPLY VOLTAGE

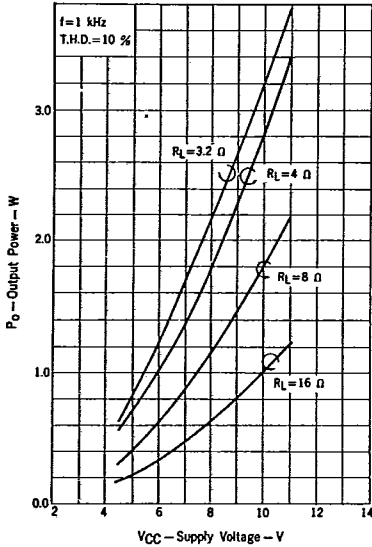


Fig. 7 TOTAL HARMONIC DISTORTION vs. OUTPUT POWER

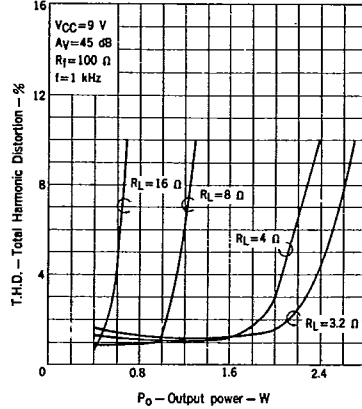
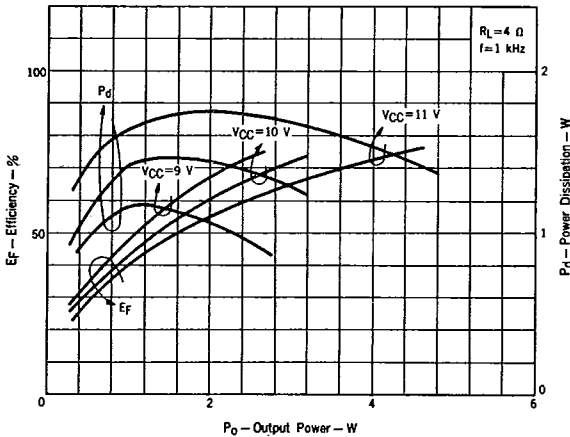


Fig. 8 POWER DISSIPATION AND EFFICIENCY vs. OUTPUT POWER



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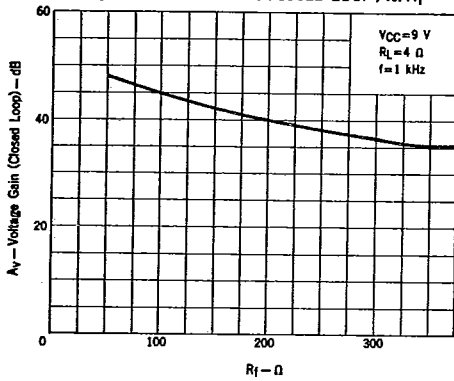
Fig. 9 VOLTAGE GAIN (CLOSED LOOP) vs. R_f 

Fig. 10 QUIESCENT OUTPUT VOLTAGE AT PIN 6 vs. SUPPLY VOLTAGE

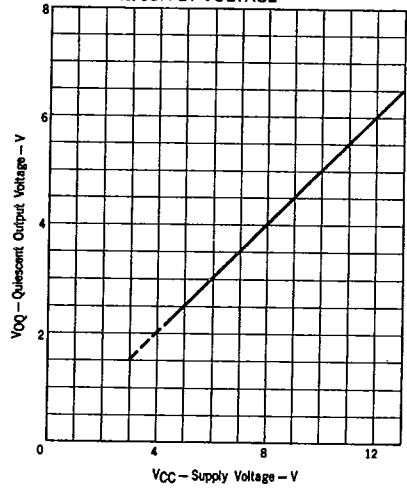
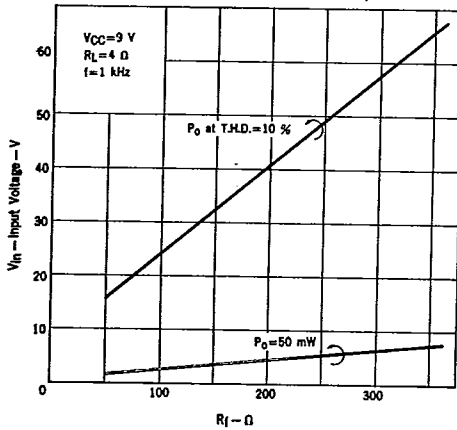
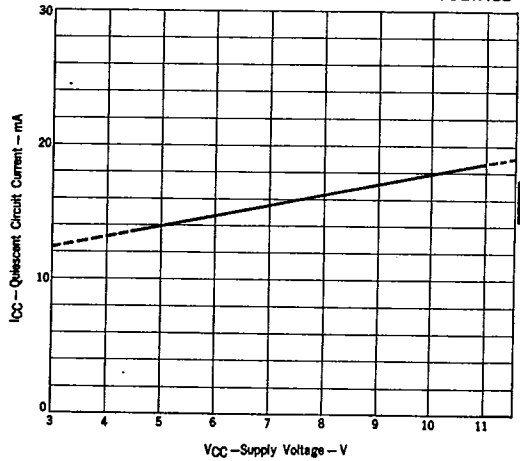
Fig. 11 INPUT SENSITIVITY vs. R_f 

Fig. 12 QUIESCENT CIRCUIT CURRENT vs. SUPPLY VOLTAGE



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Fig. 13 OPEN LOOP VOLTAGE GAIN, VOLTAGE GAIN vs. FREQUENCY

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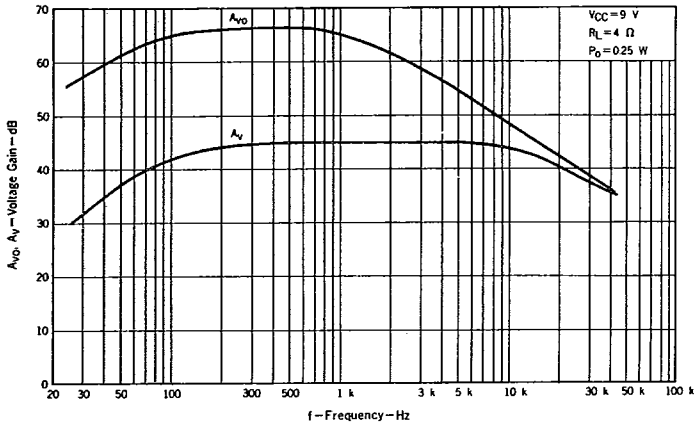


Fig. 14 TOTAL HARMONIC DISTORTION vs. FREQUENCY

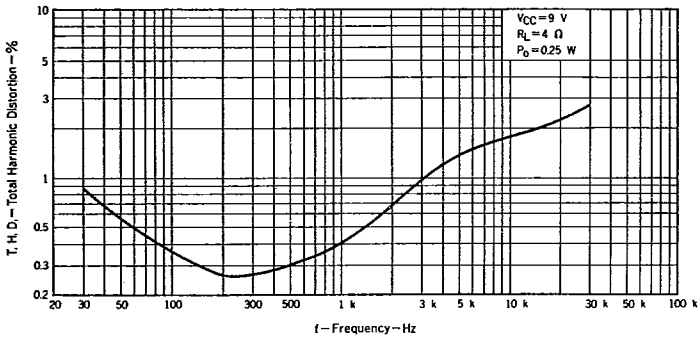
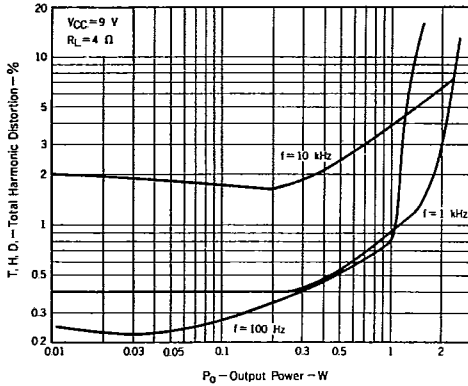


Fig. 15 TOTAL HARMONIC DISTORTION vs. OUTPUT POWER



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Fig. 16 THERMAL CHARACTERISTICS

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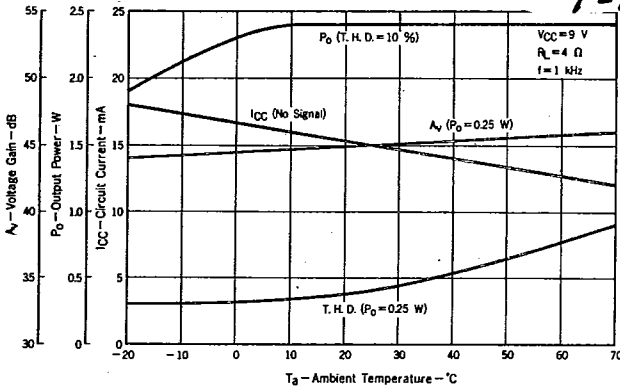


Fig. 17 OPEN LOOP VOLTAGE GAIN, VOLTAGE GAIN vs. SUPPLY VOLTAGE

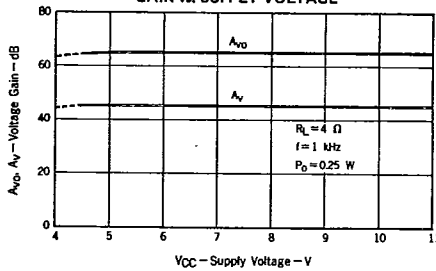
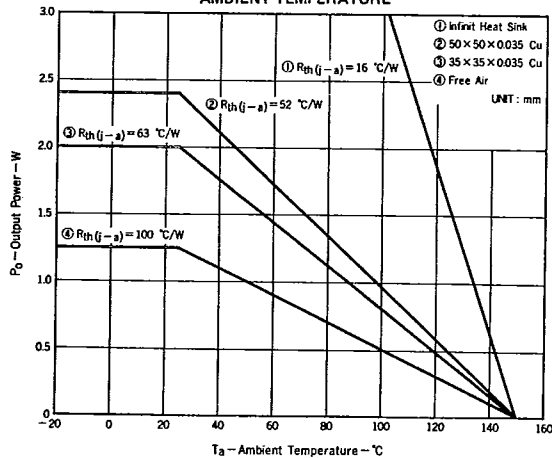


Fig. 18 AVAILABLE POWER DISSIPATION vs. AMBIENT TEMPERATURE



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DESIGN OF HEAT SINK

Keep much margin at the design of heat sink.

The heat sink shown the folling sentence is nessesary when the μ PC1213C is operated under next conditions.

Conditions : Maximum Operating Voltage	10 V
Maximum Ambient Temperature	70 °C
Load Impedance	4 Ω

There is the equation between junction temperature and thermal resistance.

$$T_j = T_a + R_{th(j-a)} \times P_d \quad (1)$$

T_j : Junction Temperature

T_a : Ambient Temperature

$R_{th(j-a)}$: Thermal Resistance (Junction to Ambient)

P_d : Power Dissipation

According to Fig. 8, $P_d(\text{MAX.}) = 1.42 \text{ W}$ at $V_{CC} = 10 \text{ V}$

And absolute maximum rating shows, $T_j < 150 \text{ °C}$

From the equation (1) and those values,

$$R_{th(j-a)} < 56.3 \text{ °C/W} \quad (2)$$

According to Fig. 18, copper size on P.C.B. satisfying the inequality (2) is $50 \times 50 \times 0.035 \text{ mm}^3$.