BIPOLAR ANALOG INTEGRATED CIRCUIT

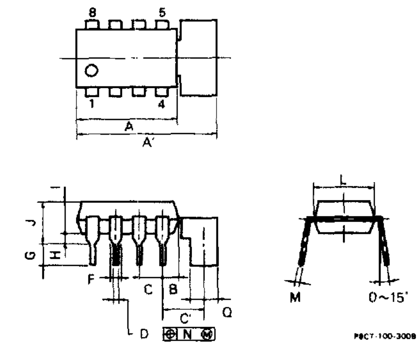
μPC1213C

AUDIO POWER AMPLIFIER

DESCRIPTION

The μPC1213C 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 μPC1213C is encapsulated in an 8-pin dual in-line prastic package with a tab.

8 PIN PLASTIC DIP WITH TAB (300 mil)



P8CT-100-3008

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	$0.50^{+0.10}$	$0.020^{+0.004}_{-0.005}$
F	1.1 MIN	0.043 MIN
G	$3.5^{\pm0.3}$	$0.138^{\pm0.012}$
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	$0.30^{+0.10}_{-0.05}$	$0.012^{+0.004}_{-0.003}$
N	0.25	0.01
Q	$2.62^{\pm0.50}$	$0.103^{\pm0.020}$

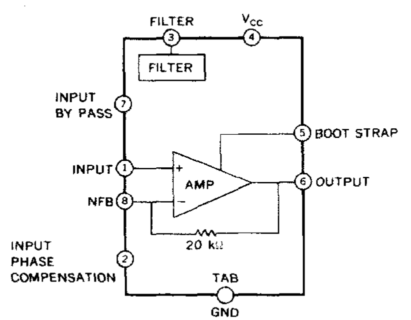
NOTE

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

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 cripping 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	V_{CC}	8	N. F. B.
TAB	GND		

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °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		°C
Storage Temperature	T_{stg}	−40 to 150		°C

* 50 x 50 x 0.035 mm^3 copper heat sink on P.C.B.

RECOMMENDED CONDITIONS (T_a = 25 °C)

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

ELECTRICAL CHARACTERISTICS (T_a=25 °C)

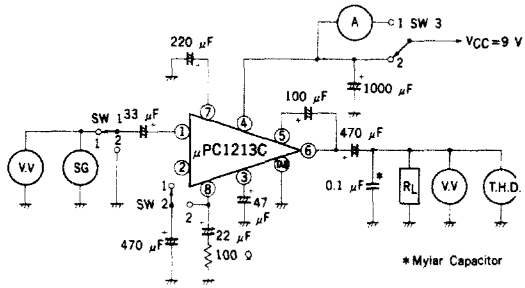
(V_{CC} = 9 V, R = 4Ω, f = 1 kHz, Refer to the test circuit
50 x 50 x 0.035 mm^3 copper heat sink on P.C.B. unless otherwise specified)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Quiscent Circuit Current	I_{CC}	8	15	25	mA	No Signal
Open Loop Voltage Gain	A_{VO}	55	65		dB	P_o=0.25 W
Voltage Gain (Closed Loop)	A_v	41	45 34	48	dB	R_f=100 Ω R_f=360 Ω
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 Ω V_{CC}=11 V, R_L=4 Ω V_{CC}=11 V, R_L=8 Ω V_{CC}=9 V, R_L=4 Ω V_{CC}=9 V, R_L=8 Ω V_{CC}=6 V, R_L=4 Ω V_{CC}=6 V, R_L=8 Ω
Input Sensitibity	$V_{i(rms)}$		 19.5 47.3		mV	P_o=2.4 W R_L=4 Ω R_f=100 Ω (A_v=45 dB) R_f=360 Ω (A_v=34 dB)
Input Sensitivity	$V_{i(rms)}$		 2.5 8.9		mV	P_o=50 mW R_L=4 Ω R_f=100 Ω (A_v=45 dB) R_f=360 Ω (A_v=34 dB)
Total Harmonic Distortion	T.H.D.		0.4	1.5	%	P_o=0.25 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_{ripple}=100 Hz V_{ripple}=0.3 $V_{r.m.s.}$
Input Impedance	R_i	10	20		kΩ	

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

TEST CIRCUIT

Fig. 1 TEST CIRCUIT



SWITCH POSITION

ITEM \ SWITCH		SW1	SW2	SW3
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

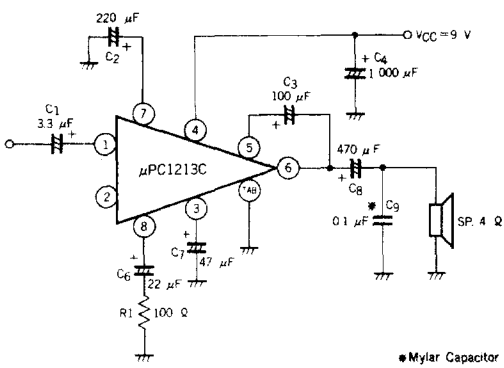
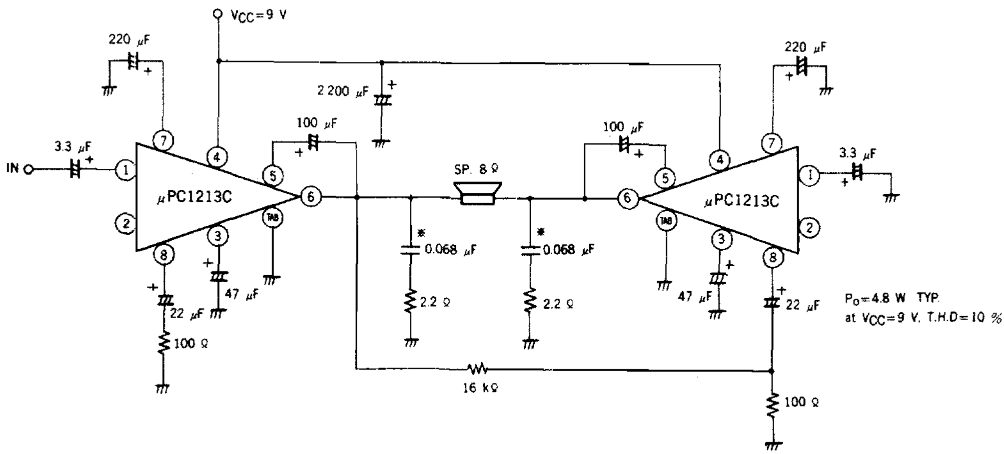
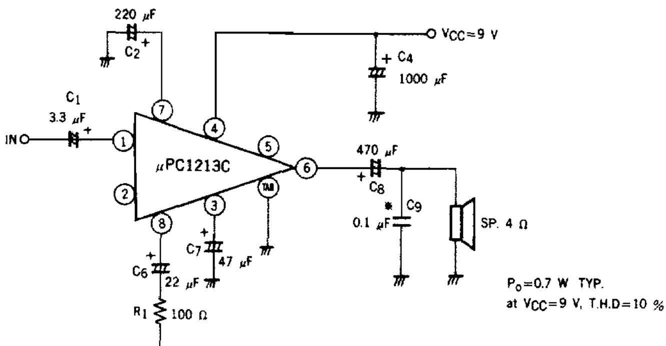


Fig. 3 BTL OPERATION



*Mylar Capacitor

Fig 4 SINGLE OPERATION WITHOUT BOOTSTRAP



*Mylar Capacitor

NOTE FOR USE

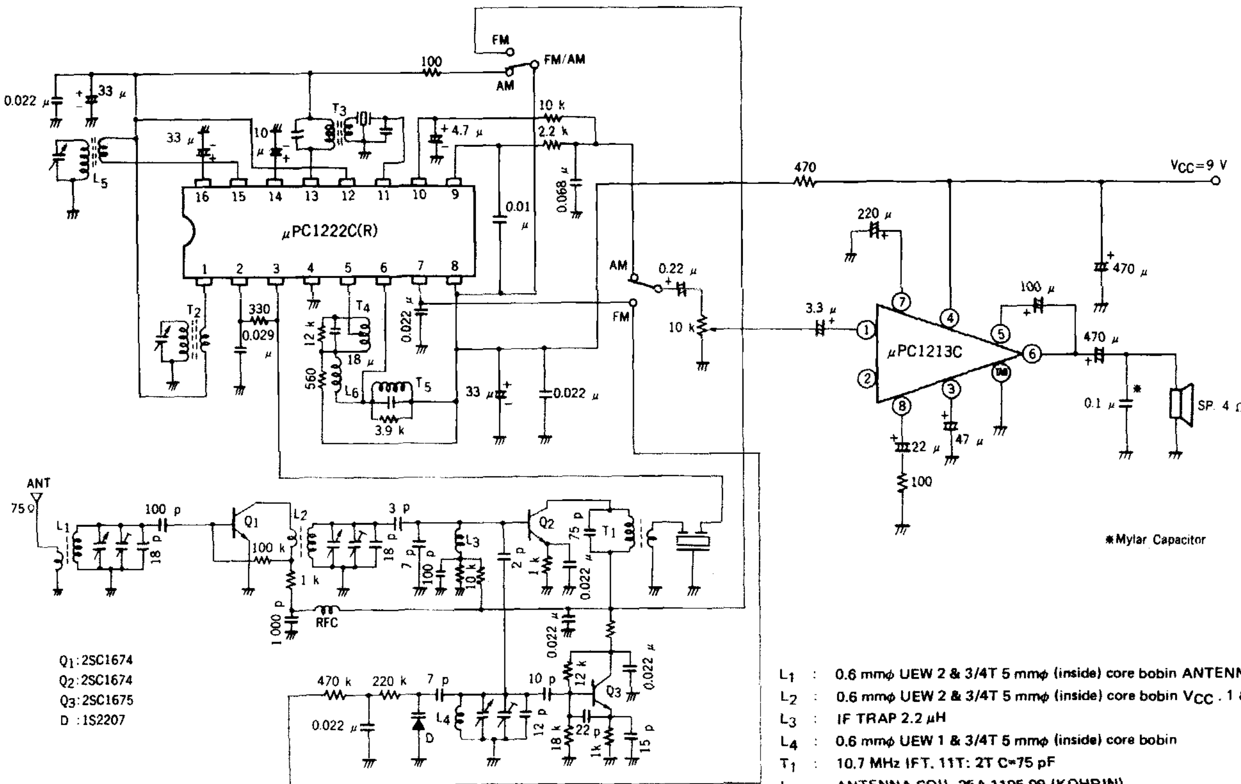
(1) Capacitor C_9 is for preventing the parastic oscillation.
A mylar capacitor is recommended for this position.

(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 μPC1212C.

(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.

APPLICATION INFORMATION

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

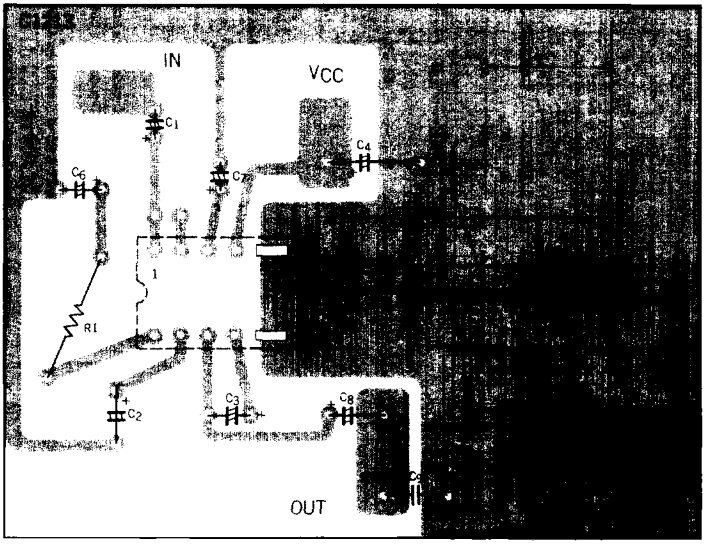


Q1 : 2SC1674
Q2 : 2SC1674
Q3 : 2SC1675
D : 1S2207

UNIT : Capacitance F
Resistance Ω

L_1	:	0.6 mmφ UEW 2 & 3/4T 5 mmφ (inside) core bobin ANTENNA 3/4T
L_2	:	0.6 mmφ UEW 2 & 3/4T 5 mmφ (inside) core bobin V_{CC} . 1 & 3/4T
L_3	:	IF TRAP 2.2 μH
L_4	:	0.6 mmφ UEW 1 & 3/4T 5 mmφ (inside) core bobin
T_1	:	10.7 MHz IFT. 11T: 2T C=75 pF
L_5	:	ANTENNA COIL 25A-1195-08 (KOHRIN)
T_2	:	AM OSC 26-1791-13 (KOHRIN)
T_3	:	AM IFT CFZ-455C (TOKO)
T_4	:	AM DET. 5251 (TOKO)
T_5	:	FM DET. 12747 (TOKO)
L_6	:	PHASE SHIFT COIL 78A180JH (TOKO)

P.C. BOARD PATTERN (COPPER SIDE)



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

Fig. 6 OUTPUT POWER vs. SUPPLY VOLTAGE

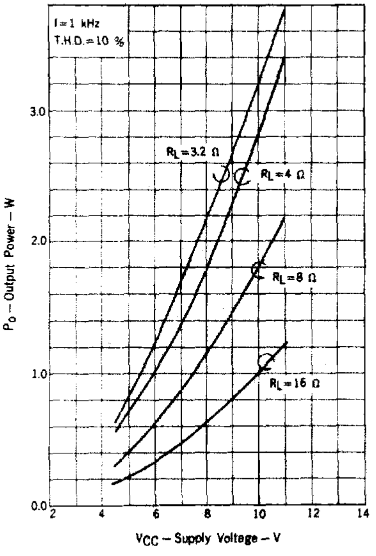


Fig. 7 TOTAL HARMONIC DISTORTION vs. OUTPUT POWER

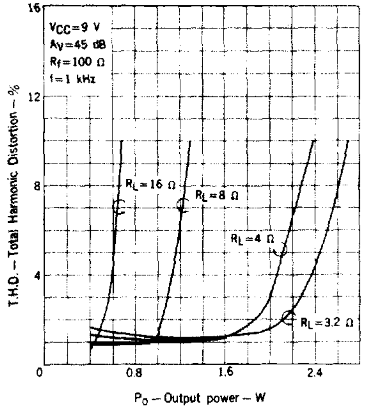


Fig. 8 POWER DISSIPATION AND EFFICIENCY vs. OUTPUT POWER

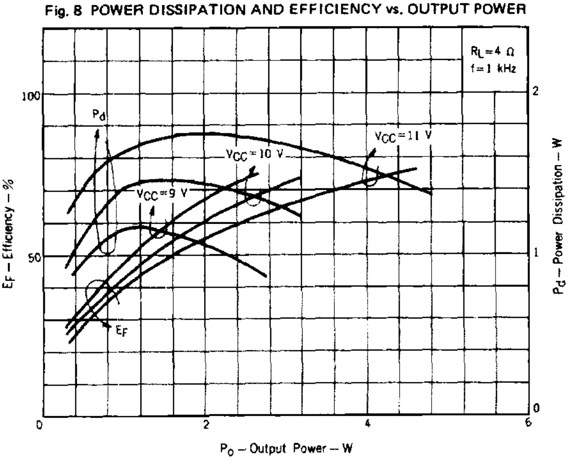


Fig. 9 VOLTAGE GAIN (CLOSED LOOP) vs. R_f

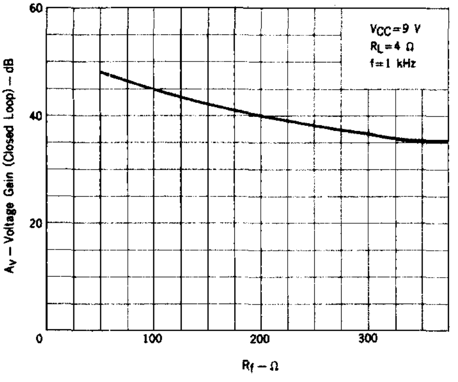


Fig. 10 QUISCENT OUTPUT VOLTAGE AT PIN 6 vs. SUPPLY VOLTAGE

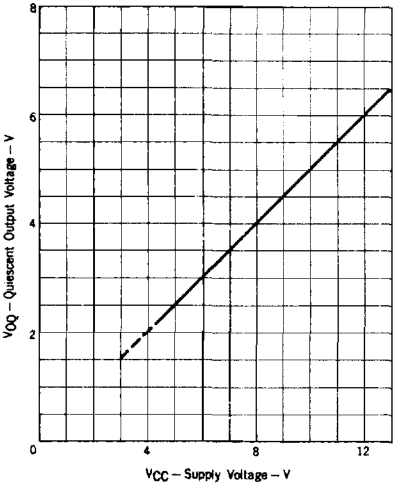


Fig. 11 INPUT SENSITIVITY vs. R_f

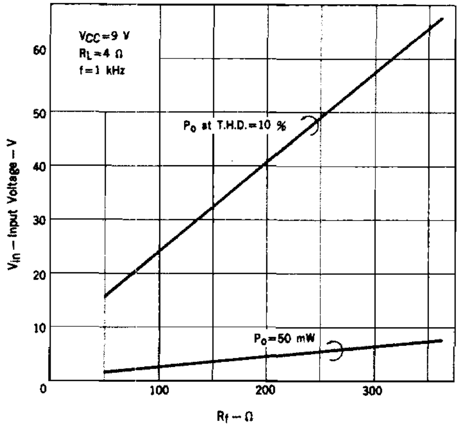


Fig. 12 QUIESCENT CIRCUIT CURRENT vs. SUPPLY VOLTAGE

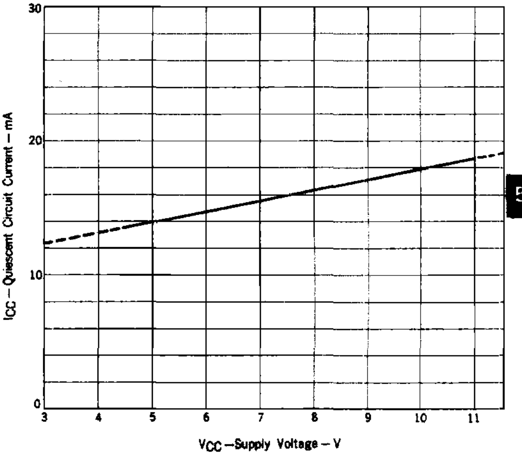


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Fig. 13 OPEN LOOP VOLTAGE GAIN, VOLTAGE GAIN vs. FREQUENCY

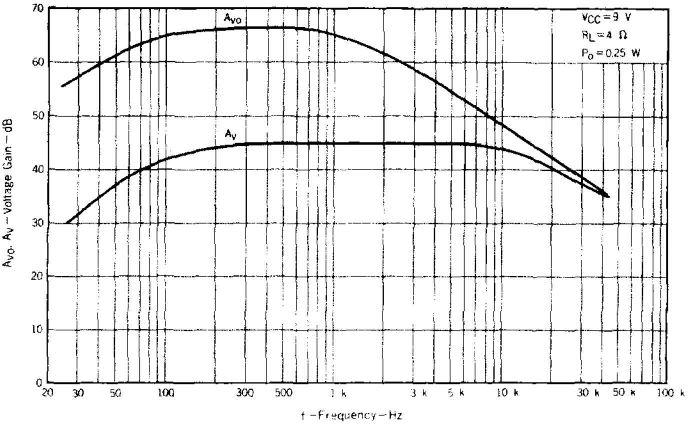


Fig. 14 TOTAL HARMONIC DISTORTION vs. FREQUENCY

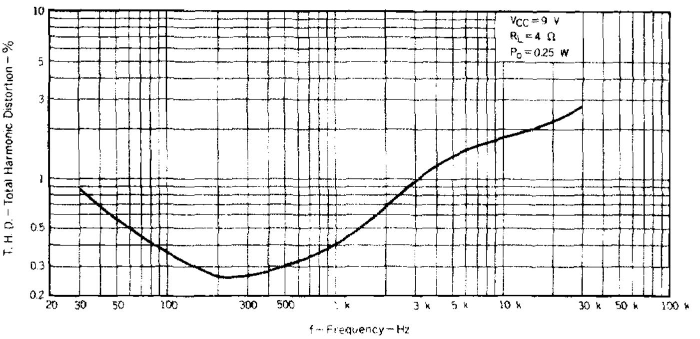


Fig. 15 TOTAL HARMONIC DISTORTION vs. OUTPUT POWER

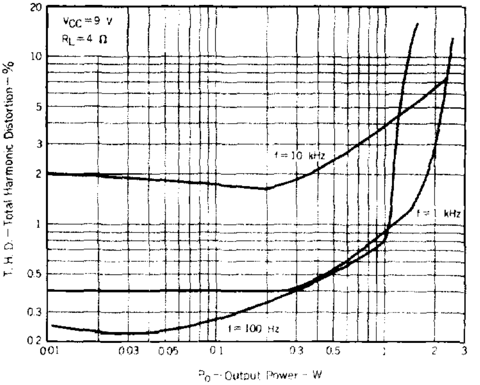


Fig. 16 THERMAL CHARACTERISTICS

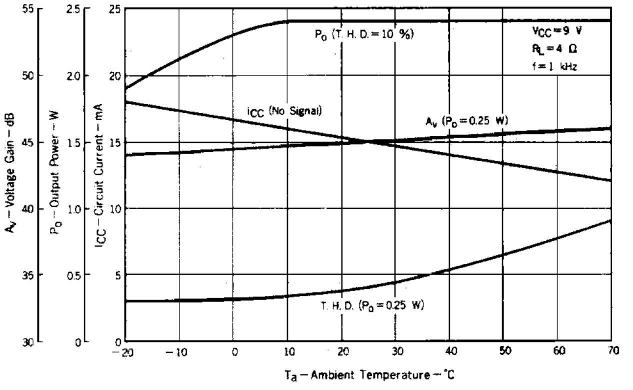


Fig. 17 OPEN LOOP VOLTAGE GAIN, VOLTAGE GAIN vs. SUPPLY VOLTAGE

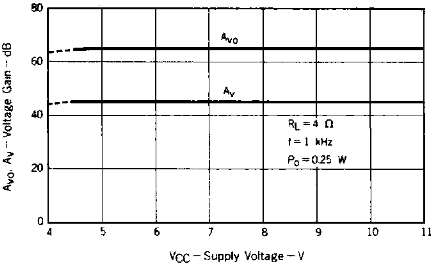
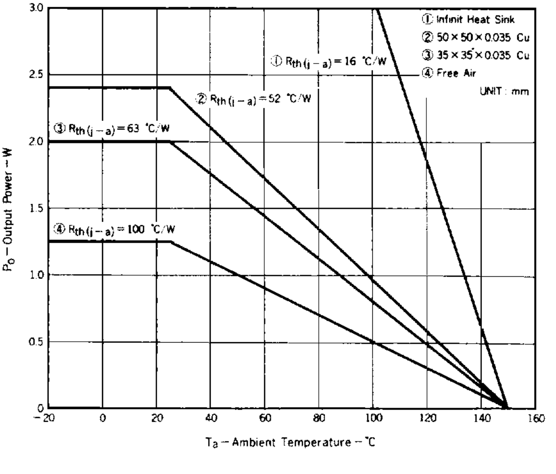


Fig. 18 AVAILABLE POWER DISSIPATION vs. AMBIENT TEMPERATURE



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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 μPC1213C 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.

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

T_j : Junction Temperature

Ta : Ambient Temperature

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

P_d : Power Dissipation

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

And absolute maximum rating shows, $T_j < 150$ °C

From the equation (1) and those values,

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

According to Fig. 18, copper size on P.C.B. satisfying the inequality (2) is 50 x 50 x 0.035 mm^3.