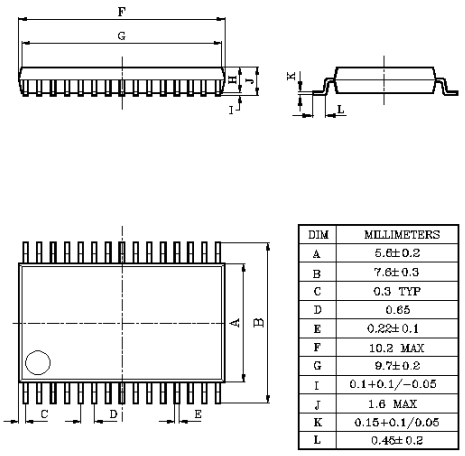
1.5V STEREO HEADPHONE AMPLIFIER

The KIA8159FN is developed for play-back stereo headphone equipments (1.5V use). It is built in dual auto-reverse pre amplifiers, dual OCL power amplifiers, and a ripple filter.



DIM	MILLIMETERS
A	5.6±0.2
B	7.8±0.3
C	0.3 TYP
D	0.65
E	0.22±0.1
F	10.2 MAX
G	9.7±0.2
I	0.1+0.1/−0.05
J	1.6 MAX
K	0.15+0.1/0.05
L	0.45±0.2

NMFP-30

FEATURES

Power Amp. Stage

- OCL (Output Condenser Less)
- Low Noise : V_{no}=48μV_{rms}(Typ.)
- Output Power : PO=6mW(Typ.)
  (at V_{CC}=1.5V, f=1kHz, THD=10%)
- Excellent ripple rejection ratio : RR=54dB(Typ.)
- Voltage Gain : G_V=28dB(Typ.)
- Built-in power amplifier mute.

Pre-Amp. Stage

- Auto-reverse with F/R control switch
- Low Noise : V_{no}=1.7μV_{rms}(Typ.)
- Input coupling condenser-less
- Built-in input capacitor for reducing buzz noise
- Built-in pre-amplifier mute

TOTAL

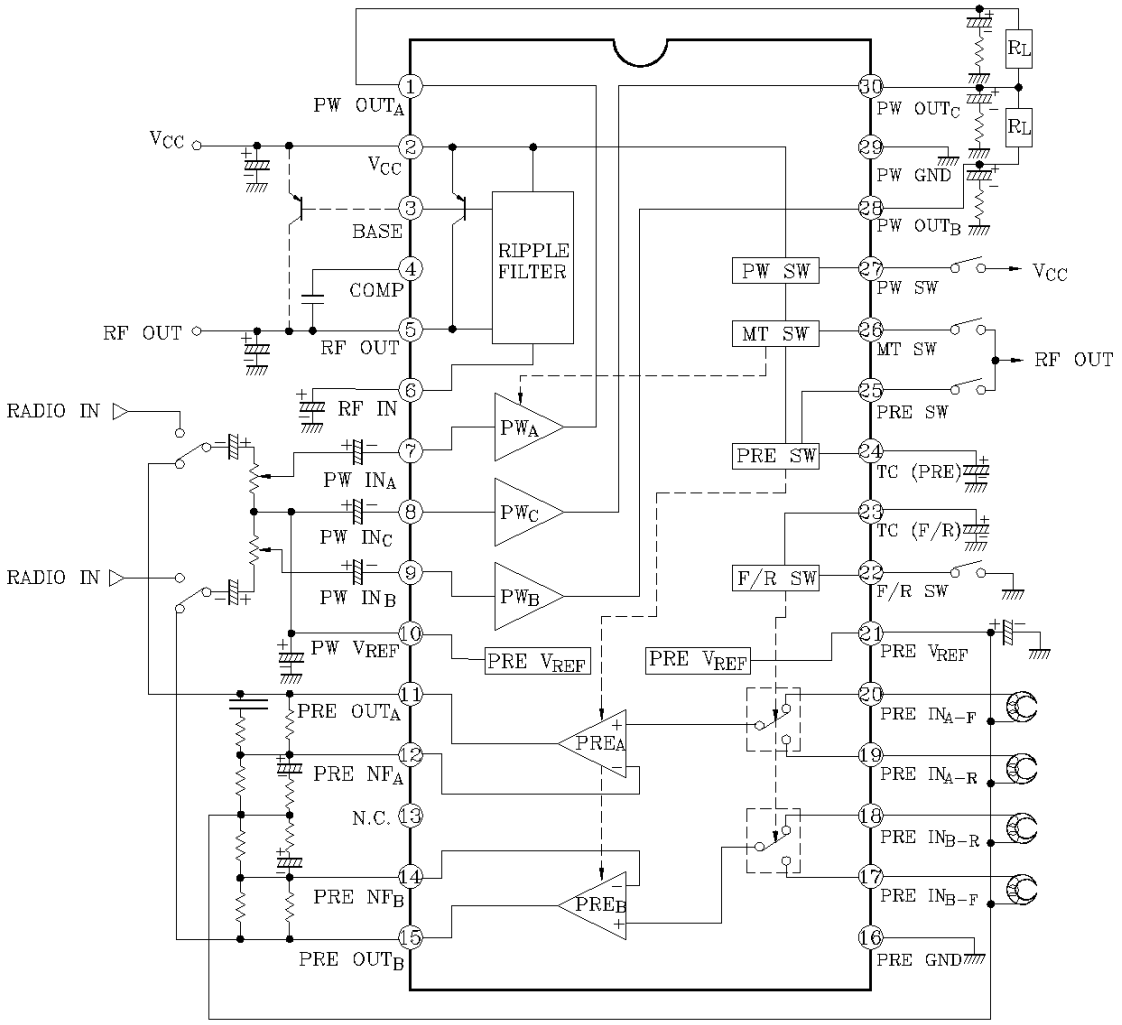
- Built-in ripple filter
- Built-in ower switch
- Operating supply voltage range : $V_{CC(opr)}$=0.9V~2.2V(Typ.)

MAXIMUM RATINGS (Ta=25℃)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	3	V
Output Current	Power	$I_{O(peak)}$	60	mA
	Ripple Filter	I_{RF}	5	
Power Dissipation		P_D (Note)	550	mW
Operating Temperature		T_{opr}	-25~75	℃
Storage Temperature		T_{stg}	-55~150	℃

Note) Derated above Ta=25℃ in the proportion of 4.4mW/℃ for KIA8159FN.

BLOCK DIAGRAM



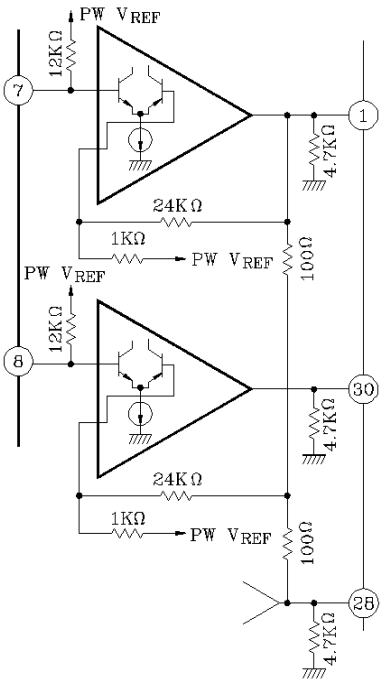
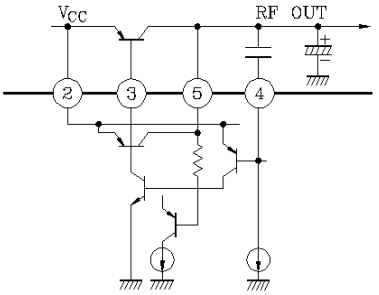
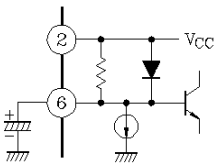
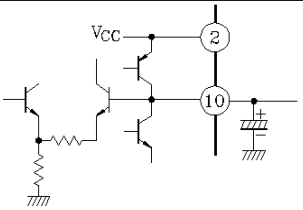
ELECTRICAL CHARACTERISTICS

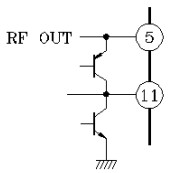
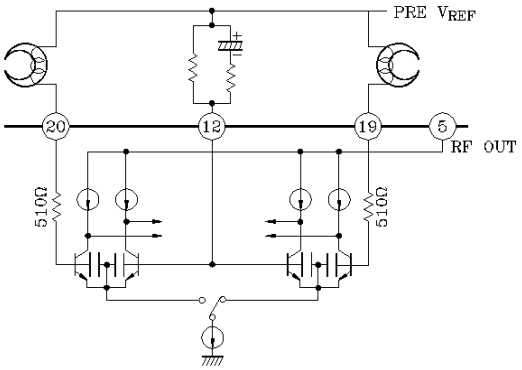
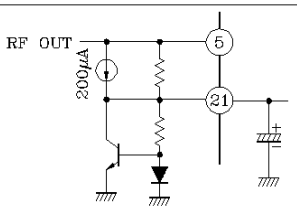
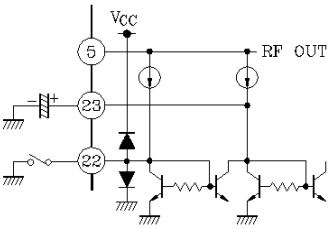
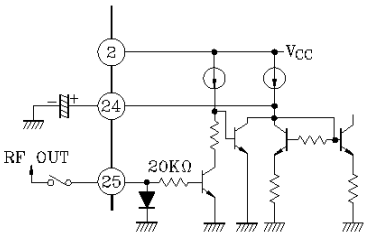
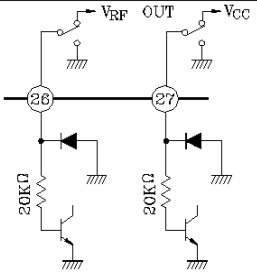
(Unless otherwise specified, V_{CC}=1.2V, f=1kHz, Ta=25℃ SW_1 : a, SW_2 : a, SW_3 : a, SW_7 : on,
Power-amplifier stage : Rg=600Ω, R_L=16Ω, SW_3 : b, SW_6 : a,
Power-amplifierstage : Rg=2.2kΩ, R_L=10kΩ, SW_2 : b, SW_5 : a,

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current		I_{CCQ1}	1	POWER OFF, SW_1:b, SW_2:b	-	0.1	5	μA
		I_{CCQ2}		POWER Amp. OFF, SW_2:b	-	2.8	4.5	mA
		I_{CCQ3}		V_{IN}=0	-	13	16	
Power-amplfier Stagne	Voltage Gain	G_V	2	V_O=-22dBV	26	28	30	dB
	Channel Balance	CB			-	0	1.5	
	Output Power	P_O		V_{CC}=1.5V, V_{IN}(A)=V_{IN}(B) THD=10%	5	6	-	mW
	Total Harmonic Distortion	THD_1		V_{CC}=1V, P_O(A)=P_O(B)=1mW	-	0.4	1.5	%
	Output Noise Voltage	V_{NO}		BPF:20Hz~20kHz, SW_6:b	-	48	70	μV_{rms}
	Ripple Rejection Ratio	RR_1		V_{CC}=1V, fr=100Hz, Vr=-32dBV I_{RF}=0, SW_6:b, SW_7:open	45	54	-	dB
	Cross Talk (CH-A/CH-B)	CT_1		V_O=-22dBV	30	38	-	
	Power Muting Attenuation	ATT_1		V_O=-22dBV, SW_2 : a→b	70	83	-	
Ripple Filter Stage	Output Voltage	V_{RF}	2	V_{CC}=1V, I_{RF}=0	0.88	0.92	-	V
	Ripple Rejection Ratio	RR_2		V_{CC}=1V, fr=100Hz, V_r=-32dBV I_{RF}=30mA, SW_7:open	38	45	-	dB
Play Amp.	Open Loop Voltage Gain	G_{VO}	2	V_O=-22dBm, SW_5:b	63	70	-	dB
	Closed Loop Voltage Gain	G_{VC}		V_O=-22dBm	-	34	-	
	Maximum Output Voltage	V_{OM}		THD=1%	160	290	-	mV_{rms}
	Total Harmonic Distortion	THD2		V_{CC}=1V, V_O=100mV_{rms}	-	0.06	0.3	%
	Equivalent Input Noise Voltage	V_{NI}		BPF:20Hz~20kHz SW_8:open NAB (f=1kHz, G_V=34dB)	-	1.7	2.7	μV_{rms}
	Cross Talk (CH-A/CH-B)	CT2		V_O=-22dBm	-	61	-	dB
	Cross Talk (Forward/Reverse)	CT3			-	61	-	
	Pre Muting Attenuation	ATT2		V_O=-22dBV, SW_3:a→b	-	75	-	
Power ON Current		I_{27}	1	V_{CC}=0.9V V_{10}≧0.5V, SW_1:c	5	-	-	μA
Power OFF Voltage		V_{27}		V_{10}≦0.3V, SW_1:d	0	-	0.3	V
Power Amp. Mute OFF Current		I_{26}		V_{30}≧0.4V, SW_2:c	5	-	-	μA
Power Amp. Mute ON Current		V_{26}		V_{30}≦0.3V, SW_2:d	0	-	0.3	V
Pre Amp. ON Current		I_{25}		V_{24}≧0.5V, SW_3:c	5	-	-	μA
Pre Amp. OFF Voltage		V_{25}		V_{24}≦0.3V, SW_3:d	0	-	0.3	V
Reverse Mode Voltage		V_{22}		V_{23}≧0.5V, SW_4:c	0	-	0.3	V

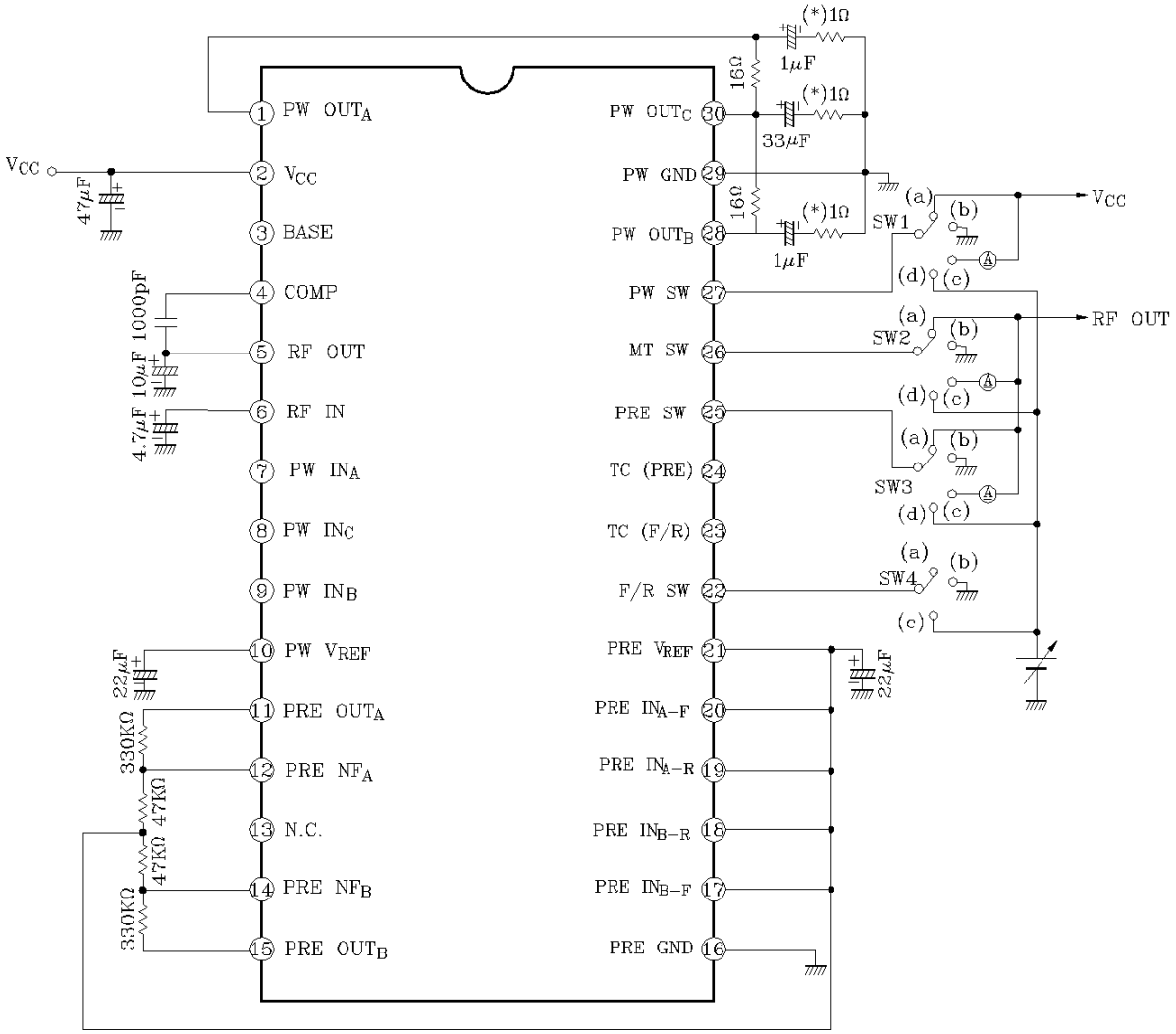
EXPLANATION OF TERMINALS

(Terminal Voltage : Typical terminal voltage at no signal with test circuit V_{CC}=1.2V, Ta=25℃)

PIN NO.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE(V)
1	PW OUT_A	Output of power amplifier.		0.6
28	PW OUT_B			
30	PW OUT_C	Output of common power amplifier.		0.6
7	PW IN_A	Input of power amplifier.		0.75
9	PW IN_B			
8	PW IN_C	Input of common power Amplifier.		0.75
2	V_{CC}	-		1.2
3	BASE	Base bias of an external PNP transistor for ripple filter.		0.5
4	COMP	Phase compensation of ripple filter circuit.		0.5
5	RF OUT	Ripple filter output. Ripple filter circuit supplies V_{REF} circuit, Pre-amplifier circuit, and F/R switch circuit with power source.		1.13
6	RF IN	Ripple filter terminal.		1.13
10	PW V_{REF}	Reference voltage of power amplifier.		0.75

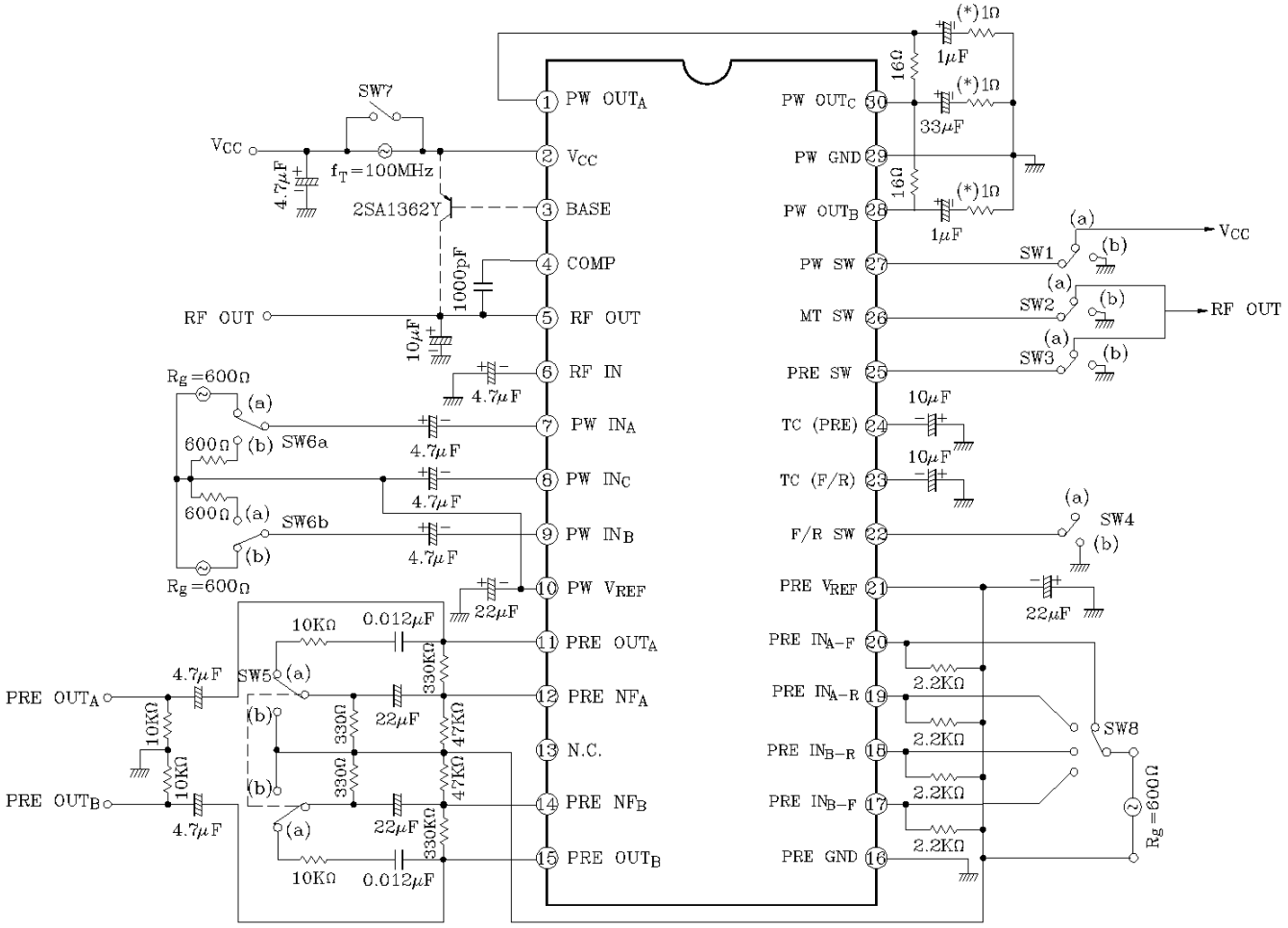
PIN NO.	TERMINAL NAME	FUNCTION	INTERNAL EQUIVALENT CIRCUIT	TERMINAL VOLTAGE(V)
11	PRE OUT_A	Output of pre-amplifier.		0.5
15	PRE OUT_B			
12	PRE NF_A	NF of pre-amplifier.		0.75
14	PRE NF_B			
17	PRE IN_{B-F}	Forward input of pre-amplifier. (at F/R SW : open)		0.75
20	PRE IN_{A-F}			
18	PRE IN_{B-R}	Reverse input of pre-amplifier. (at F/R SW : GND)		0.75
19	PRE IN_{A-R}			
13	NC	-	-	-
16	PRE GND	-	-	0
21	PRE V_{REF}	Reference voltage of pre-amplifier.		0.75
22	F/R SW	Forward/Reverse mode switch. · OPEN : Forward mode. · GND : Reverse mode.		-
23	TC (F/R)	Smoothing terminal. In order to reduce a pop noise at F/R switching.		0.7
24	TC (PRE)	Smoothing terminal. In order to reduce a pop noise at Pre-amplifier ON/OFF switching.		0.7
25	PRE SW	Pre-amplifier ON/OFF switch. · RF OUT : ON · GND/OPEN : OFF		-
26	MT SW	Muting switch for power amplifier · RF OUT : MUTE OFF · GND/OPEN : MUTE ON		-
27	PW SW	Power ON/OFF switch. · VCC : ON · GND/OPEN : OFF		-
29	PW GND	-	-	0

TEST CIRCUIT 1

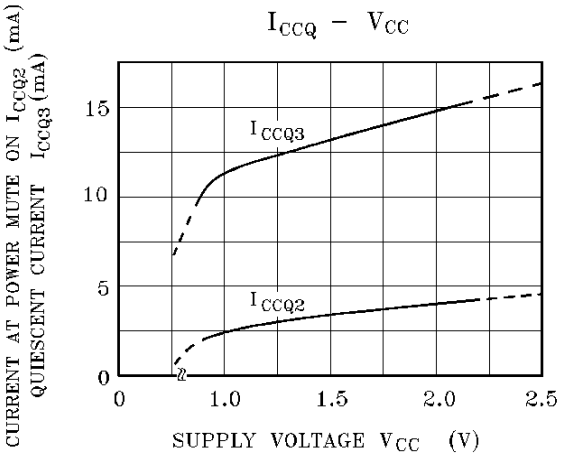


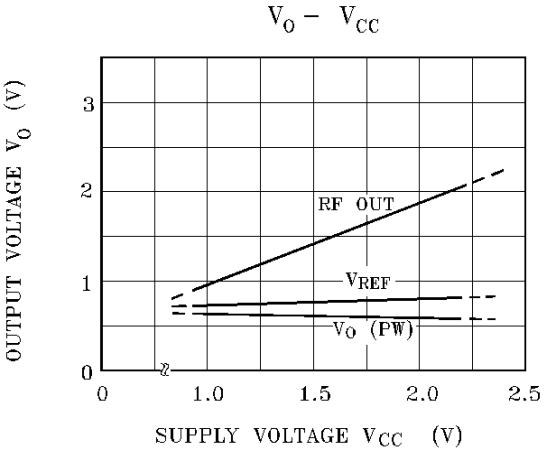
(*) Tantal Condenser

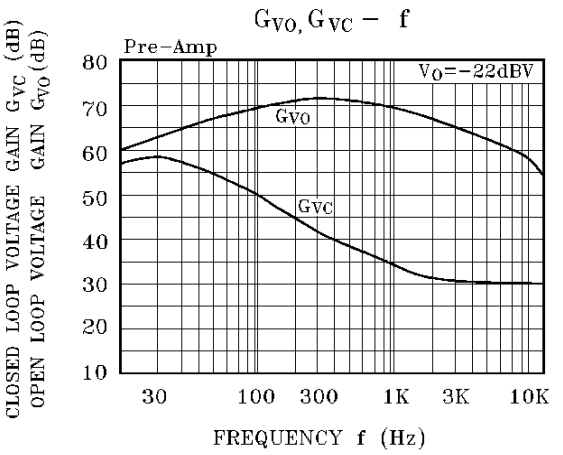
TEST CIRCUIT 2

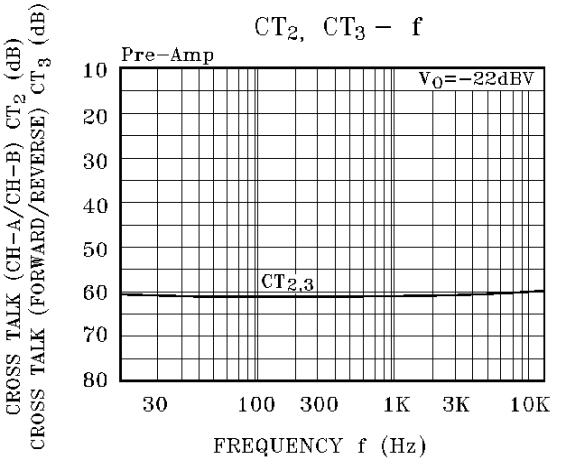


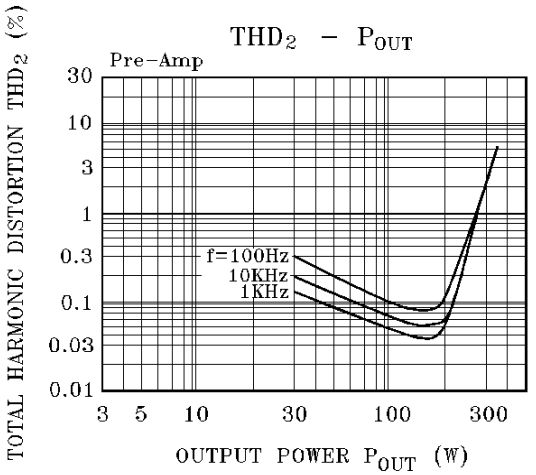
(*) Tantal Condenser

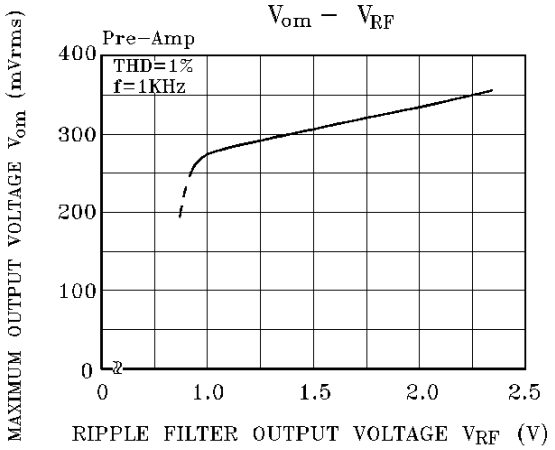

I_{CCQ} – V_{CC}
CURRENT AT POWER MUTE ON I_{CCQ2} (mA)
QUIESCENT CURRENT I_{CCQ3} (mA)
I_{CCQ3}
I_{CCQ2}
SUPPLY VOLTAGE V_{CC} (V)


V_O – V_{CC}
OUTPUT VOLTAGE V_O (V)
RF OUT
V_{REF}
V_O (PW)
SUPPLY VOLTAGE V_{CC} (V)

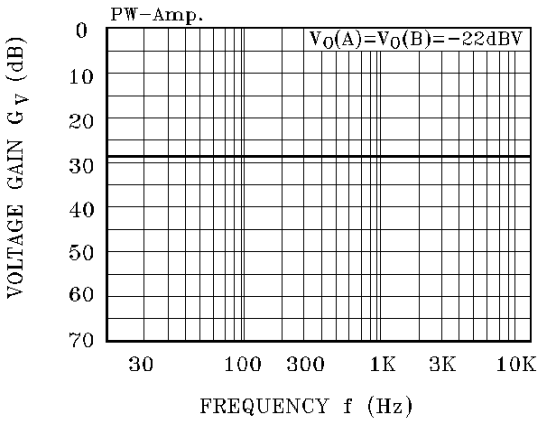

G_{VO}, G_{VC} – f
Pre-Amp
V_O=-22dBV
CLOSED LOOP VOLTAGE GAIN G_{VC} (dB)
OPEN LOOP VOLTAGE GAIN G_{VO} (dB)
G_{VO}
G_{VC}
FREQUENCY f (Hz)


CT_2, CT_3 – f
Pre-Amp
V_O=-22dBV
CROSS TALK (CH-A/CH-B) CT_2 (dB)
CROSS TALK (FORWARD/REVERSE) CT_3 (dB)
$CT_{2,3}$
FREQUENCY f (Hz)

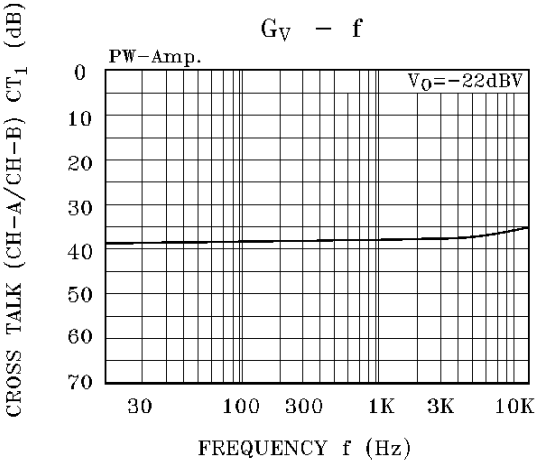

THD_2 – P_{OUT}
Pre-Amp
TOTAL HARMONIC DISTORTION THD_2 (%)
f=100Hz
10KHz
1KHz
OUTPUT POWER P_{OUT} (W)


V_{om} – V_{RF}
Pre-Amp
THD=1%
f=1KHz
MAXIMUM OUTPUT VOLTAGE V_{om} (mVrms)
RIPPLE FILTER OUTPUT VOLTAGE V_{RF} (V)

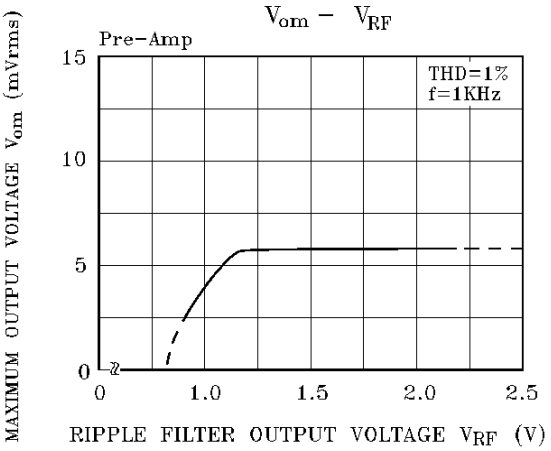
G_V – f



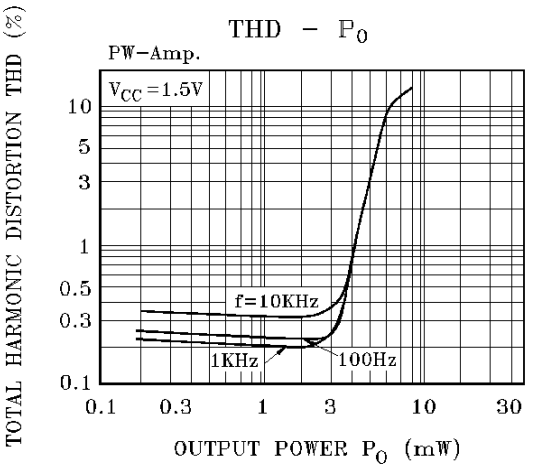
G_V – f



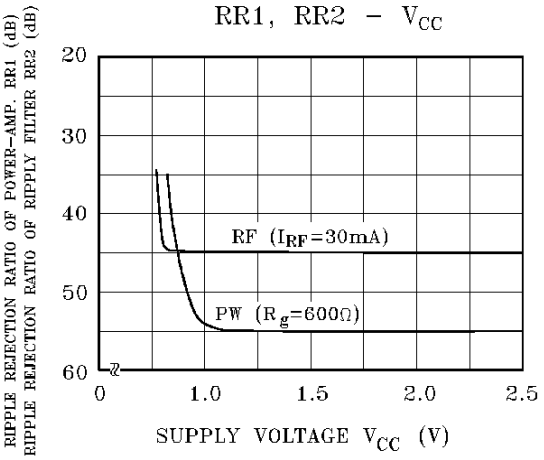
V_{om} – V_{RF}



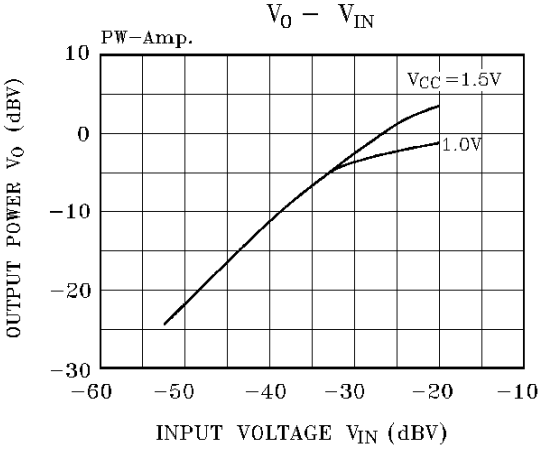
THD – P_O



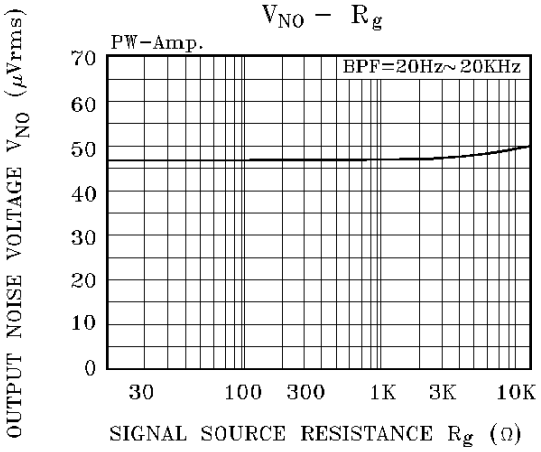
RR1, RR2 – V_{CC}



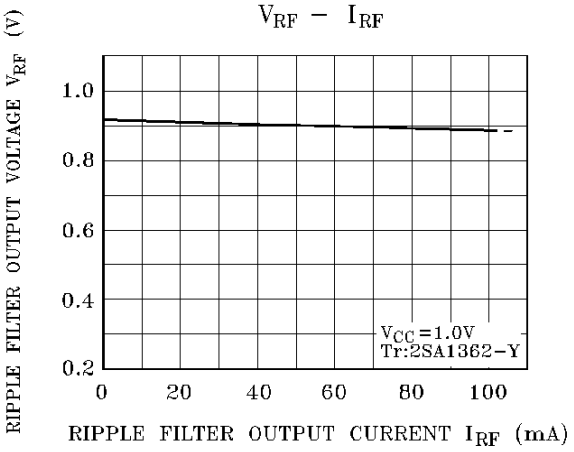
V_O – V_{IN}



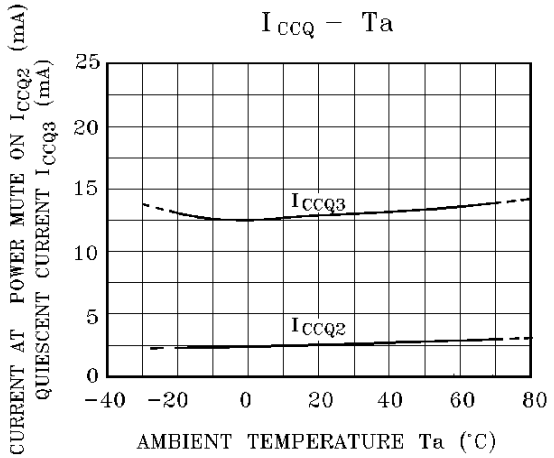
V_{NO} – R_g



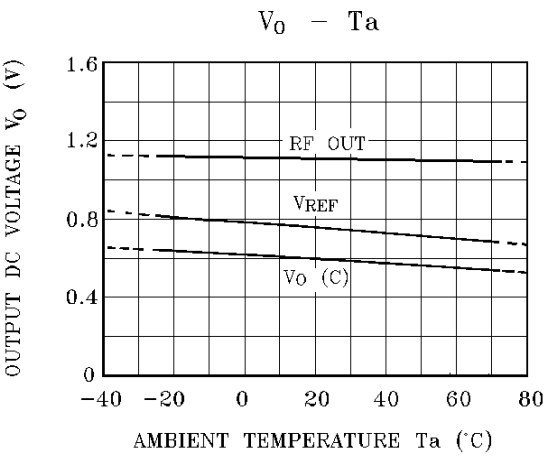
V_{RF} – I_{RF}



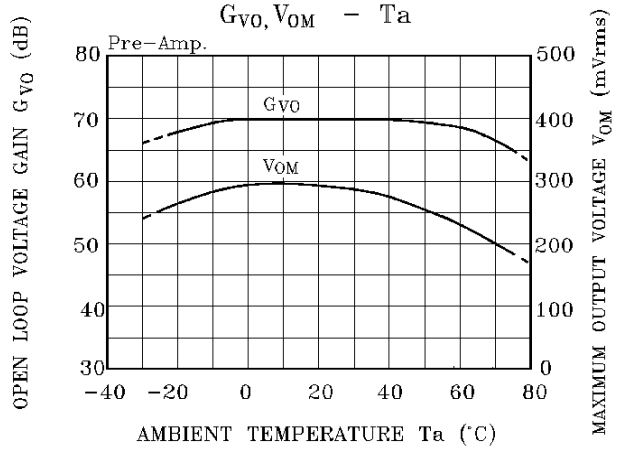
I_{CCQ} – Ta



V_O – Ta



G_{VO}, V_{OM} – Ta



G_V, P_O – Ta