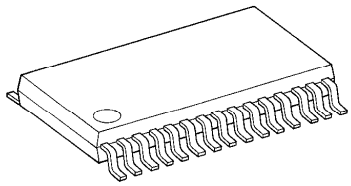
TENTATIVE TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8159FN

1.5V STEREO HEADPHONE AMPLIFIER

The TA8159FN 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.



SSOP30-P-300-0.65

Weight : 0.17g (Typ.)

FEATURES

Power amp. stage

- OCL (Output Condenser-Less)
- Low noise : $V_{no} = 48\mu V_{rms}$ (Typ.)
- Output Power : $P_O = 6mW$ (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.

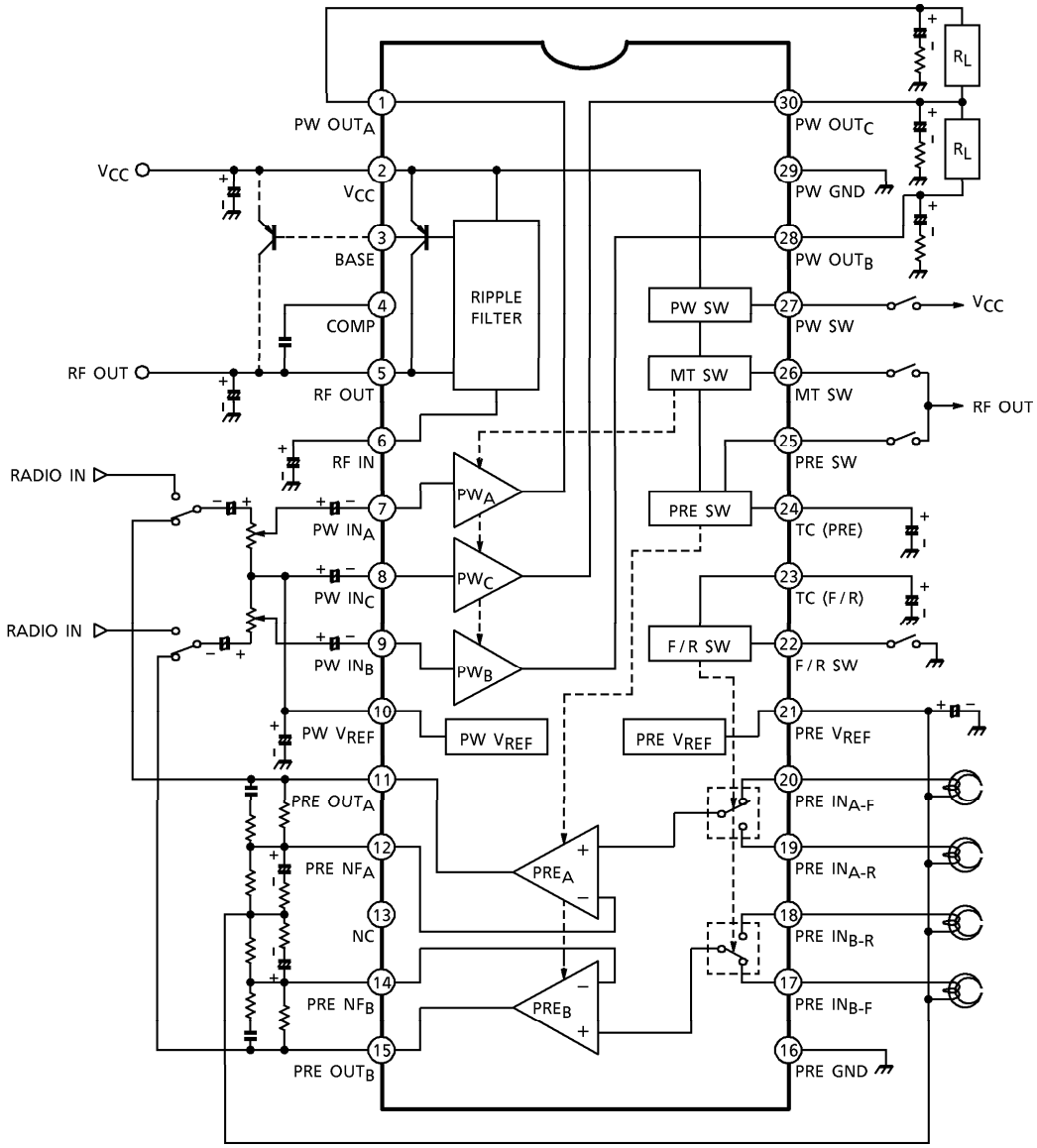
Pre-amp. stage

- Auto-reverse with F / R control switch
- Low noise : $V_{ni} = 1.7\mu V_{rms}$ (Typ.)
- Input coupling condenser-less
- Built-in input capacitor for reducing buzz noise
- Built-in pre-amplifier mute

Total

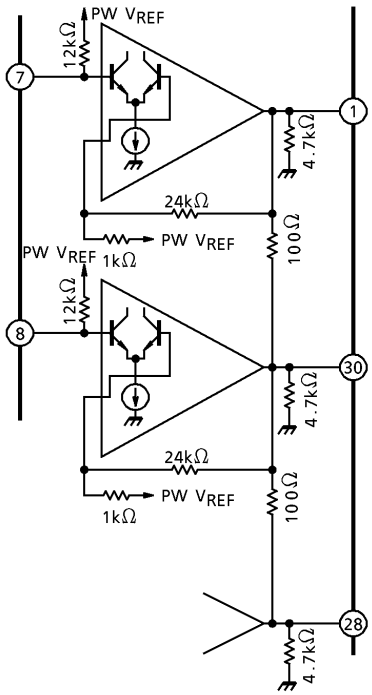
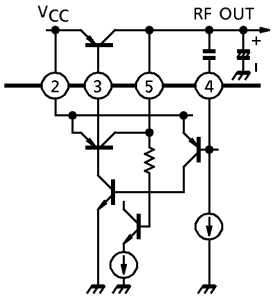
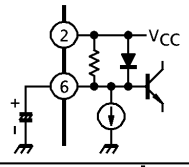
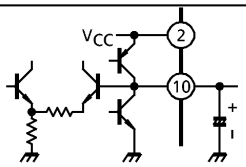
- Built-in ripple filter
- Built-in power switch
- Operating supply voltage range : $V_{CC\ (opr)} = 0.9V \sim 2.2V$ (Ta = 25°C)

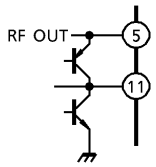
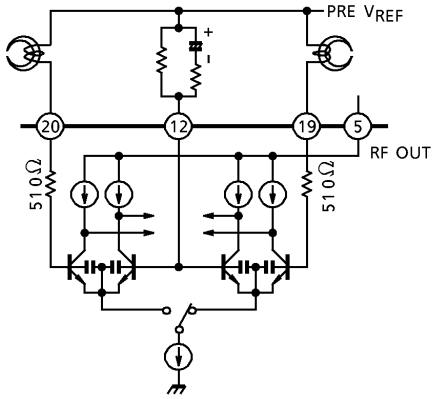
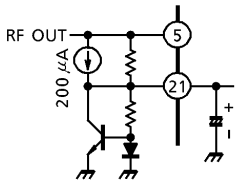
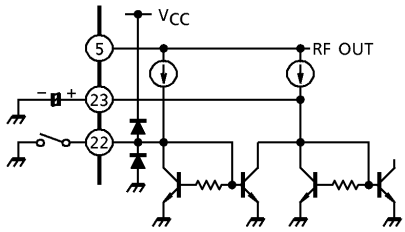
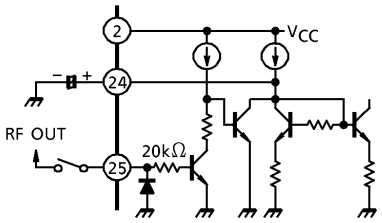
BLOCK DIAGRAM

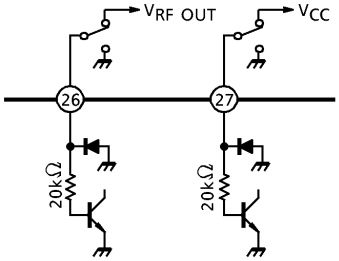


TERMINAL EXPLANATION

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

TERMINAL 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

TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL 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)		—

TERMINAL No.	TERMINAL NAME	FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
26	MT SW	Muting switch for power amplifier. (RF OUT : MUTE OFF / GND / OPEN : MUTE ON)		—
27	PW SW	Power ON / OFF switch. (V_{CC} : ON / GND / OPEN : OFF)		—
29	PW GND	—	—	0

MAXIMUM RATINGS (Ta = 25°C)

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 (Note)		P_D	550	mW
Operating Temperature		T_{opr}	− 25~75	°C
Storage Temperature		T_{stg}	− 55~150	°C

(Note) : Derated above Ta = 25°C in the proportion of 4.4mW / °C.

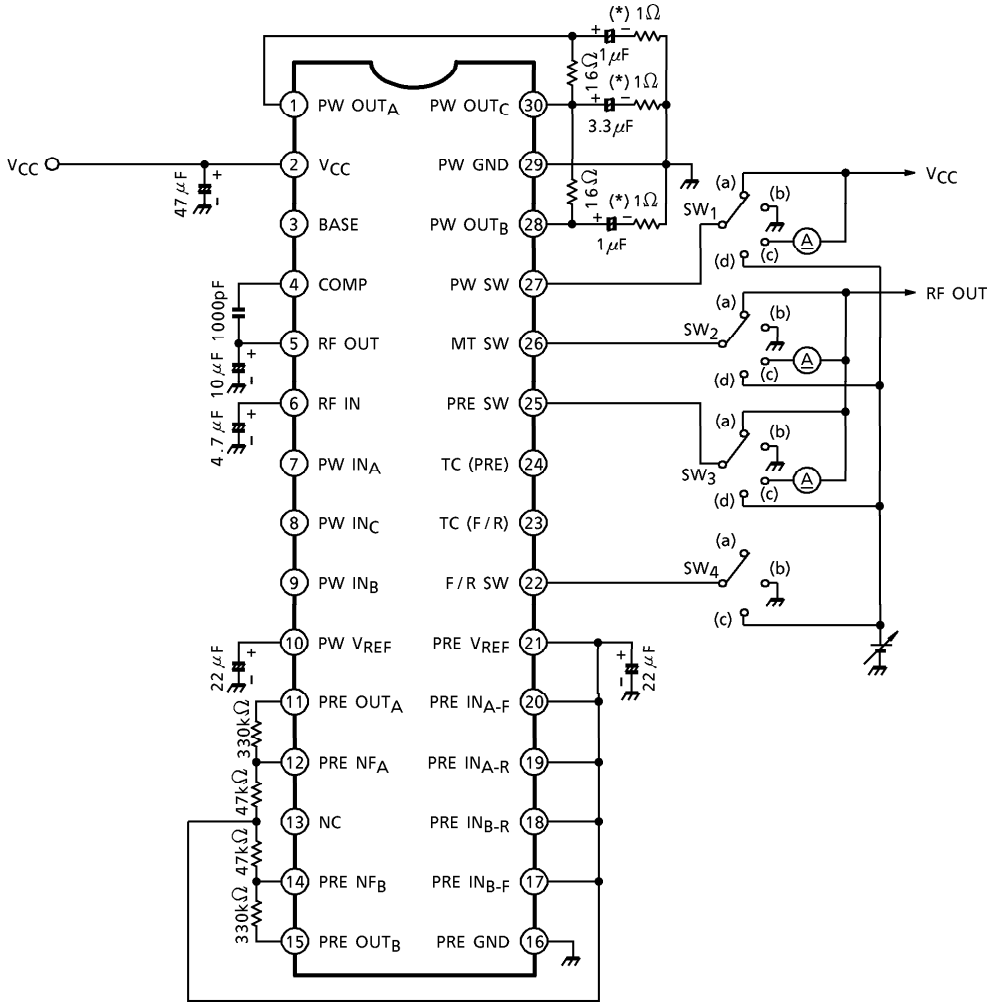
ELECTRICAL CHARACTERISTICS

Unless otherwise specified : V_{CC} = 1.2V, f = 1kHz, Ta = 25°C, SW_1 : a, SW_2 : a, SW_3 : a, SW_7 : on
Power-amplifier stage : R_g = 600Ω, R_L = 16Ω, SW_3 : b, SW_6 : a
Pre-amplifier stage : R_g = 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, SW2 : b	—	2.8	4.5	mA
		I_{CCQ3}		V_{in} = 0	—	13	16	
Power-amplifier Stage	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	μVrms

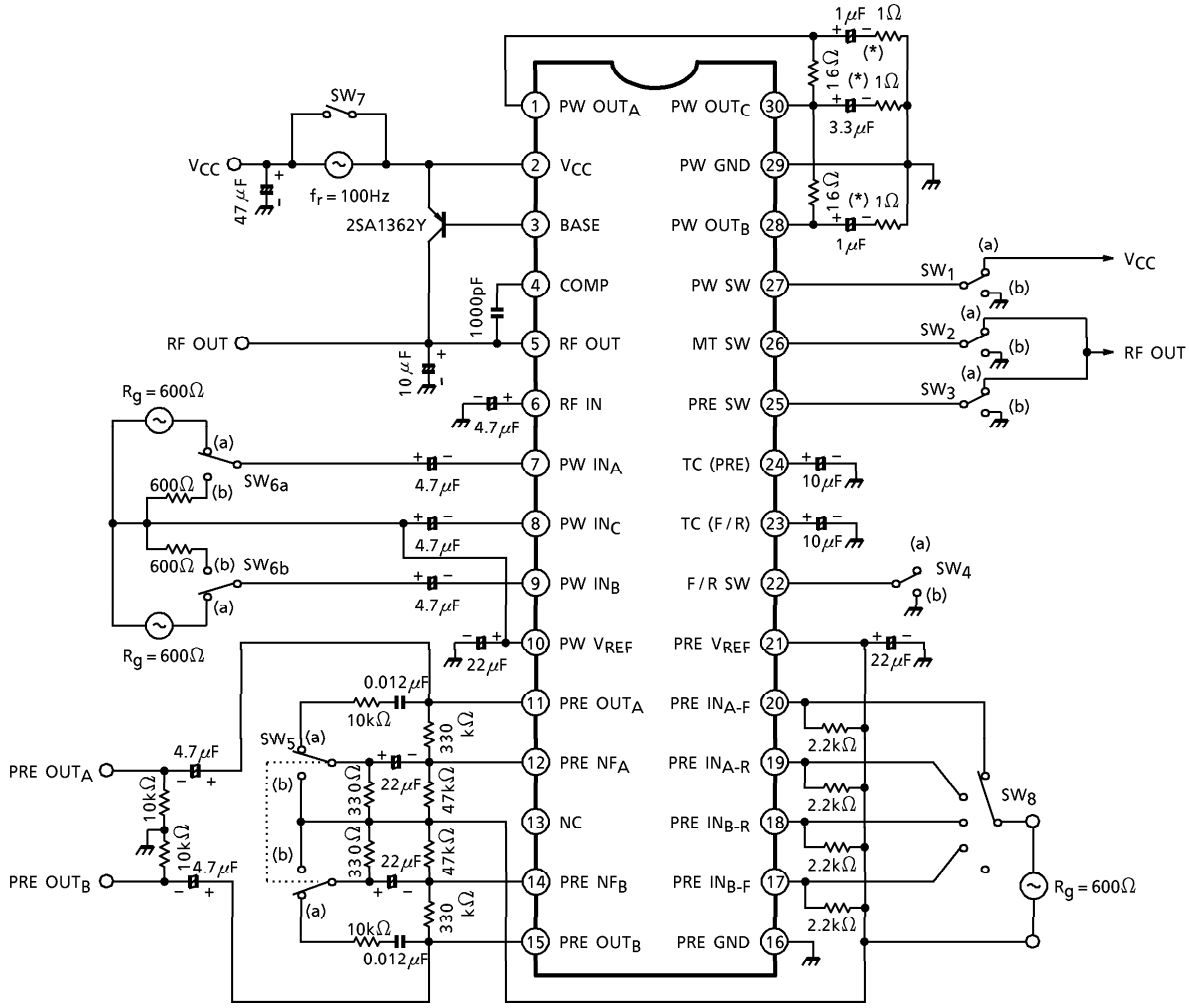
	CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Power-amplifier Stage	Ripple Rejection Ratio	RR_1	2	V_{CC} = 1V, f_r = 100Hz, V_r = −32dBV I_{RF} = 0, SW_6 : b, SW_7 : open		45	54	—	dB
	Cross Talk (CH-A / CH-B)	CT_1		V_o = −22dBV		30	38	—	
	Power Muting Attenuation	ATT_1		V_o = −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, f_r = 100Hz, V_r = −32dBV I_{RF} = 30mA, SW_7 : open		38	45	—	dB
Pre-amplifier Stage	Open Loop Voltage Gain	G_{VO}	2	V_o = −22dBV, SW_5 : b		63	70	—	dB
	Closed Loop Voltage Gain	G_{VC}		V_o = −22dBV		—	34	—	
	Maximum Output Voltage	V_{om}		THD = 1%		160	290	—	mV_{rms}
	Total Harmonic Distortion	THD_2		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)	CT_2		V_o = −22dBV		—	61	—	dB
	Cross Talk (Forward / Reverse)	CT_3				—	61	—	
	Pre Muting Attenuation	ATT_2		V_o = −22dBV, SW_3 : a→b		—	75	—	
Power ON Current		I_{27}	1	V_{CC} = 0.9V	$V_{10} \geqq$ 0.5V, SW_1 : c	5	—	—	μA
Power OFF Voltage		V_{27}			$V_{10} \leqq$ 0.3V, SW_1 : d	0	—	0.3	V
Power Amp. Mute OFF Current		I_{26}			$V_{30} \geqq$ 0.4V, SW_2 : c	5	—	—	μA
Power Amp. Mute ON Voltage		V_{26}			$V_{30} \leqq$ 0.3V, SW_2 : d	0	—	0.3	V
Pre. Amp. ON Current		I_{25}			$V_{24} \geqq$ 0.5V, SW_3 : c	5	—	—	μA
Pre. Amp. OFF Voltage		V_{25}			$V_{24} \leqq$ 0.3V, SW_3 : d	0	—	0.3	V
Reverse Mode Voltage		V_{22}			$V_{23} \geqq$ 0.5V, SW_4 : c	0	—	0.3	V

TEST CIRCUIT 1



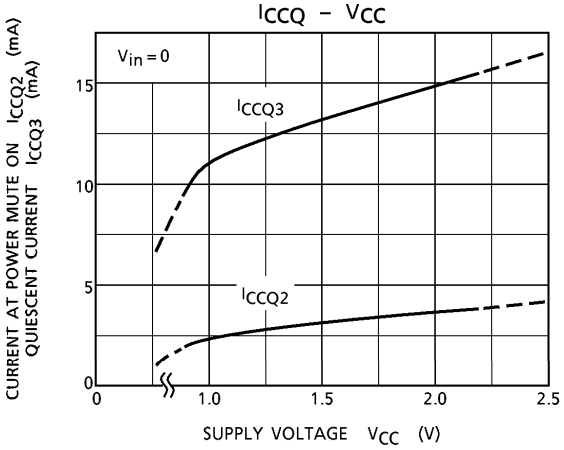
(*) Tantal Condenser

TEST CIRCUIT 2

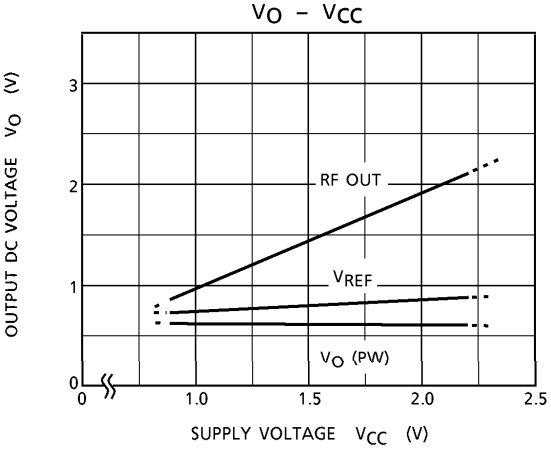


CHARACTERISTIC CURVES Unless otherwise specified : V_{CC} = 1.2V, Ta = 25°C, f = 1kHz
Pre-Amplifier Stage : R_g = 2.2kΩ, R_L = 10kΩ
Power Amplifier Stage : R_g = 600Ω, R_L = 16Ω

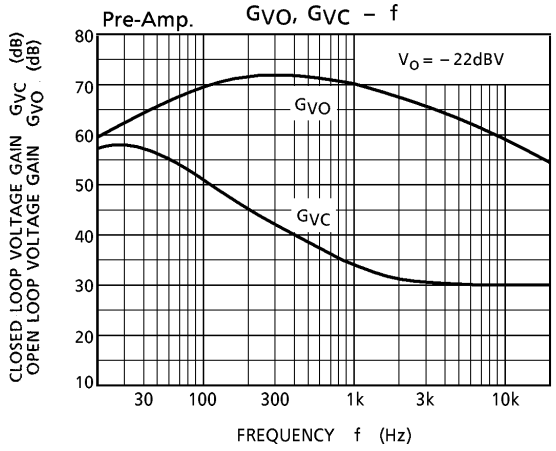
I_{CCQ} – V_{CC}



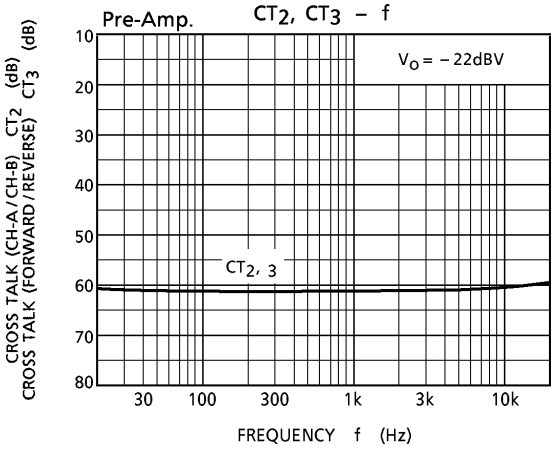
V_O – V_{CC}



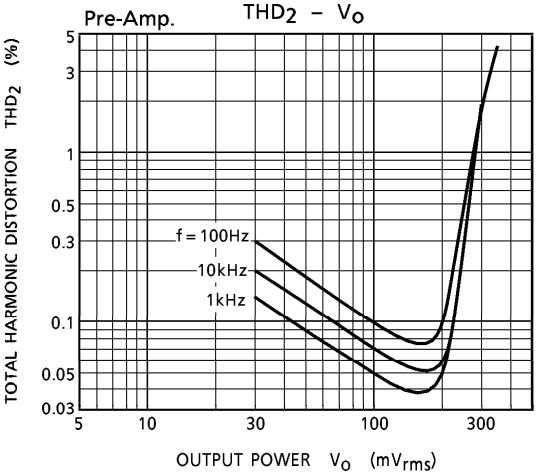
Pre-Amp. G_{VO}, G_{VC} – f



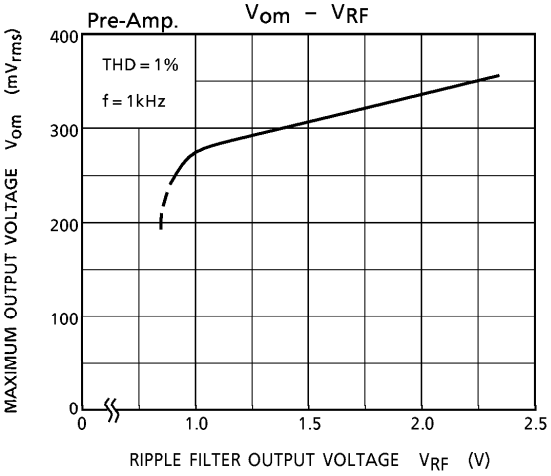
Pre-Amp. CT_2, CT_3 – f



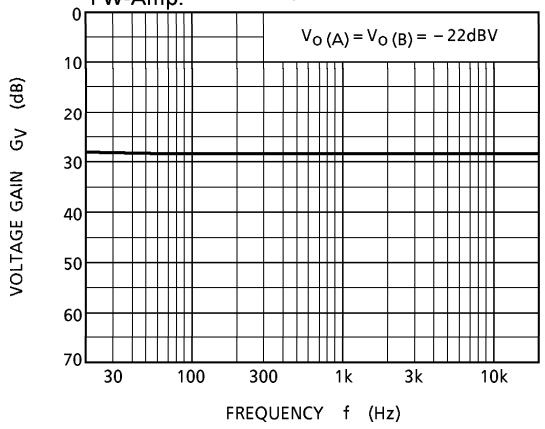
Pre-Amp. THD_2 – V_O



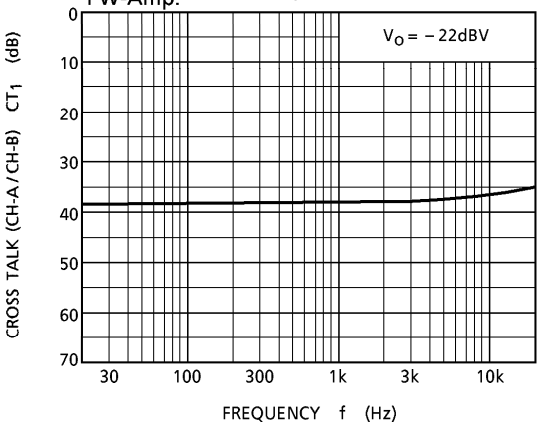
Pre-Amp. V_{om} – V_{RF}



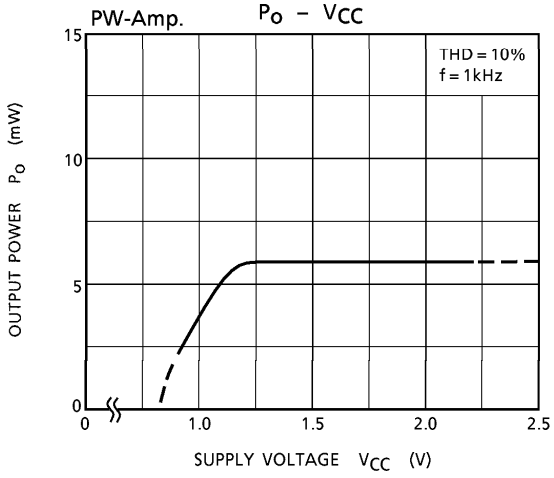
PW-Amp. G_V – f



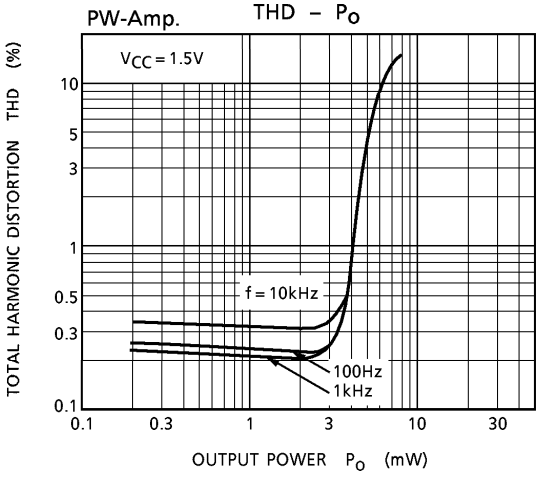
PW-Amp. CT_1 – f



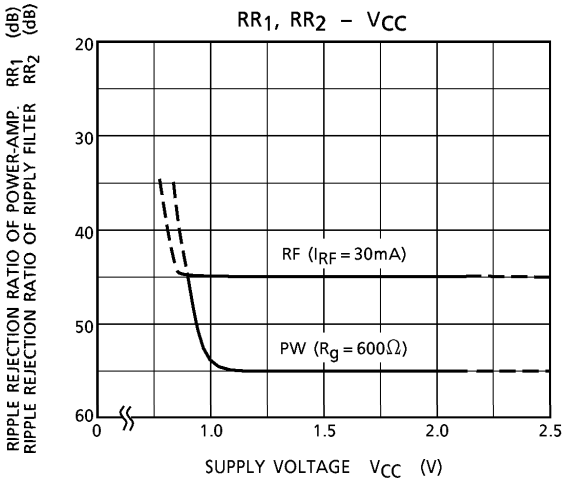
PW-Amp. P_O – V_{CC}



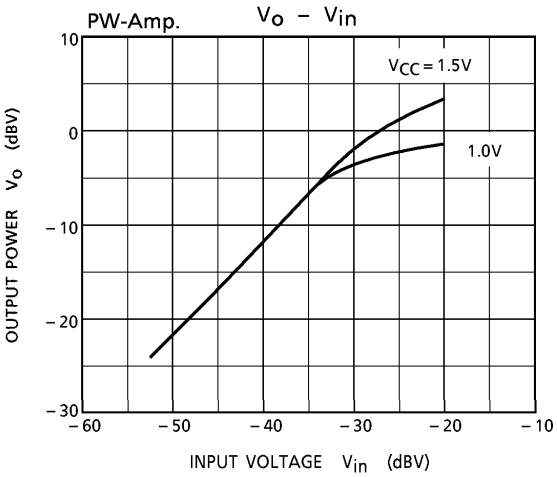
PW-Amp. THD – P_O



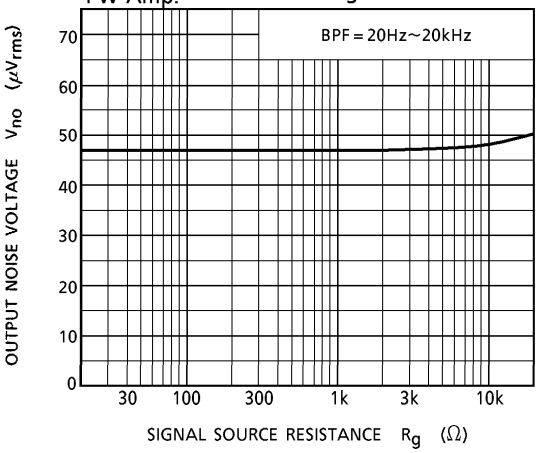
RR_1, RR_2 – V_{CC}



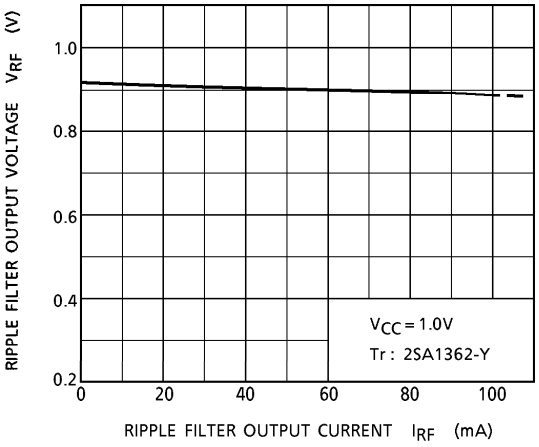
PW-Amp. V_O – V_{in}



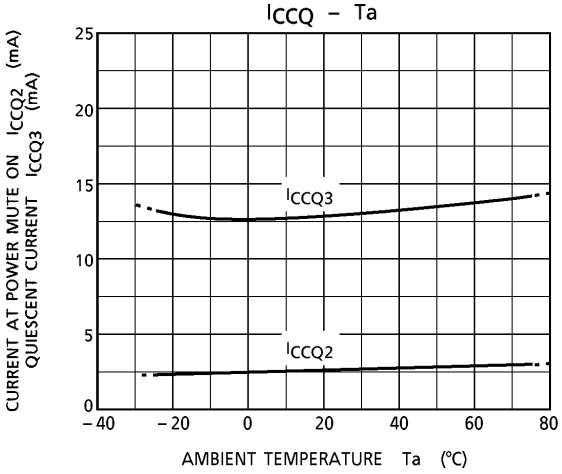
PW-Amp. V_{no} – R_g



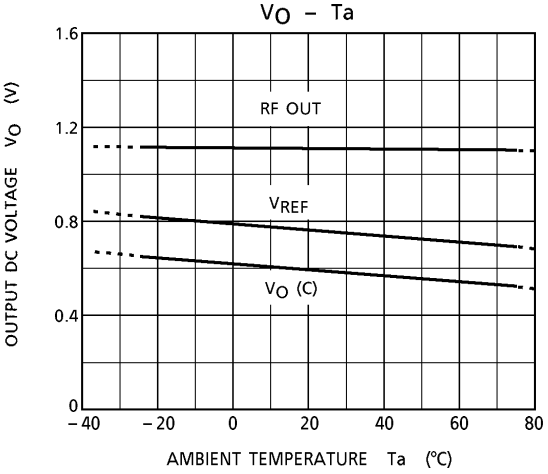
V_{RF} – I_{RF}



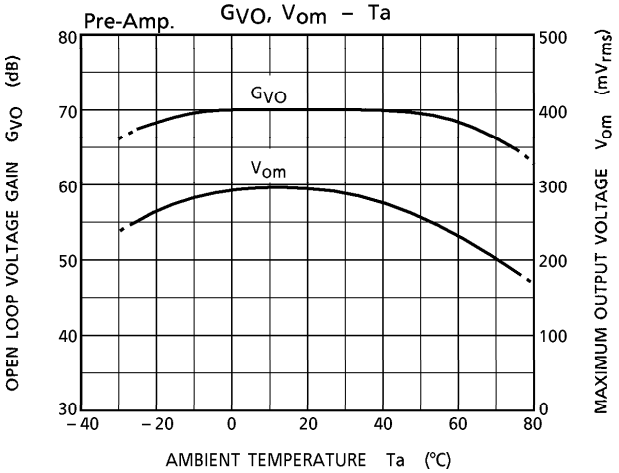
I_{CCQ} – Ta



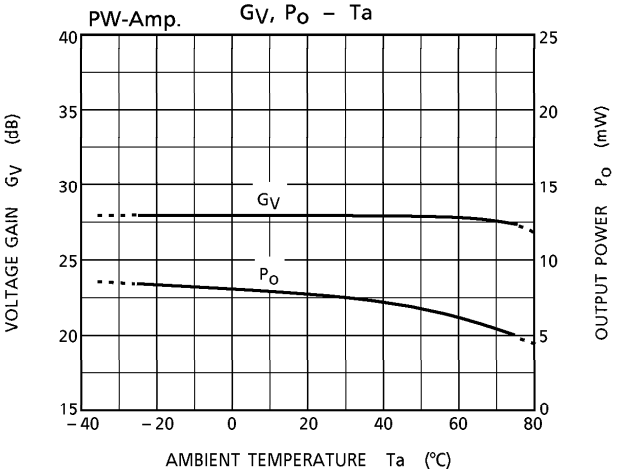
V_O – Ta



Pre-Amp. G_{VO}, V_{om} – Ta



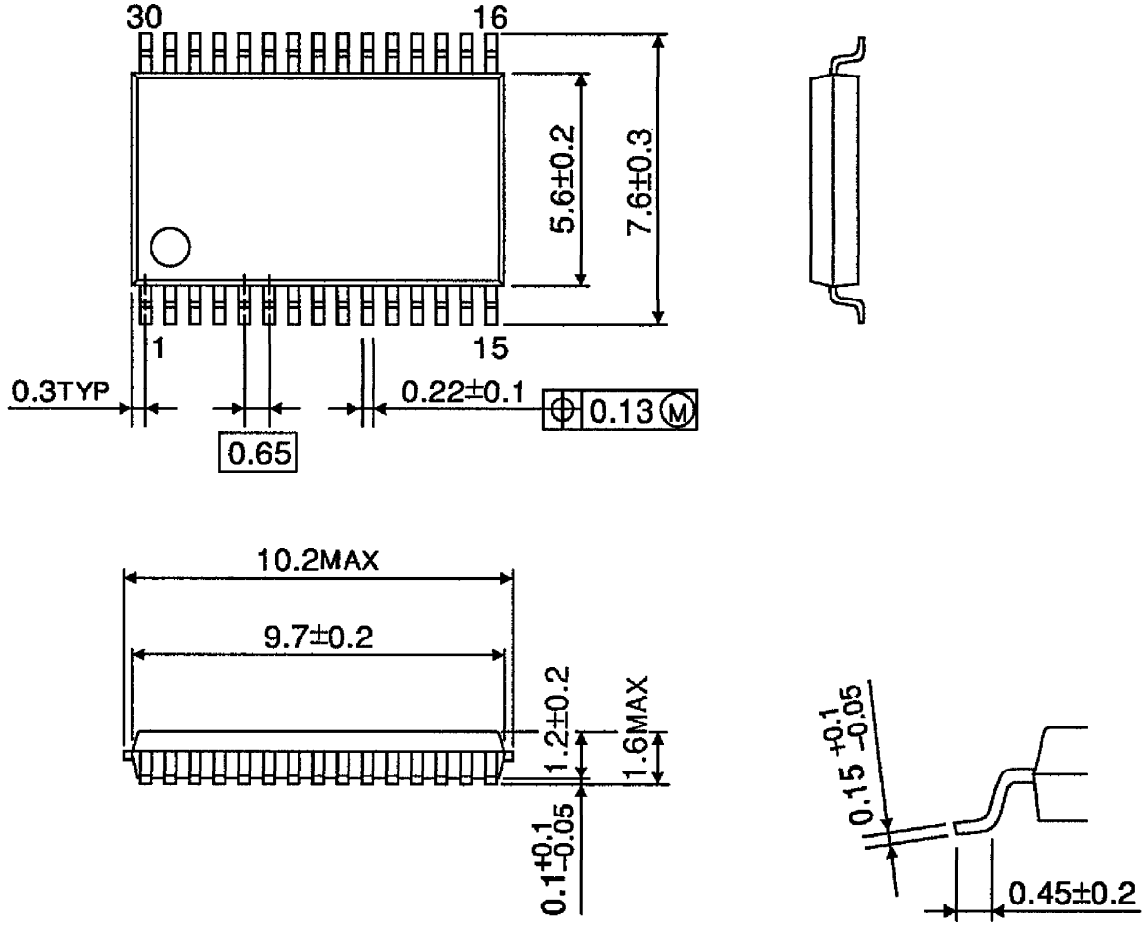
PW-Amp. G_V, P_O – Ta



OUTLINE DRAWING

SSOP30-P-300-0.65

Unit : mm



Weight : 0.17g (Typ.)