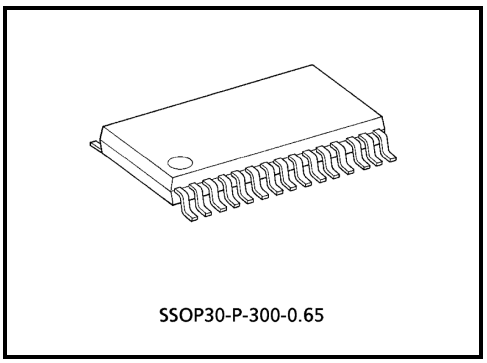
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8159FN

1.5V Stereo Headphone Amplifier

The TA8159FN developed for play−back stereo headphone equipments (1.5V use). It is built in dual auto−reverse pre amplifiers, dual OCL power ampilfiers, 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} = 48μV_{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.

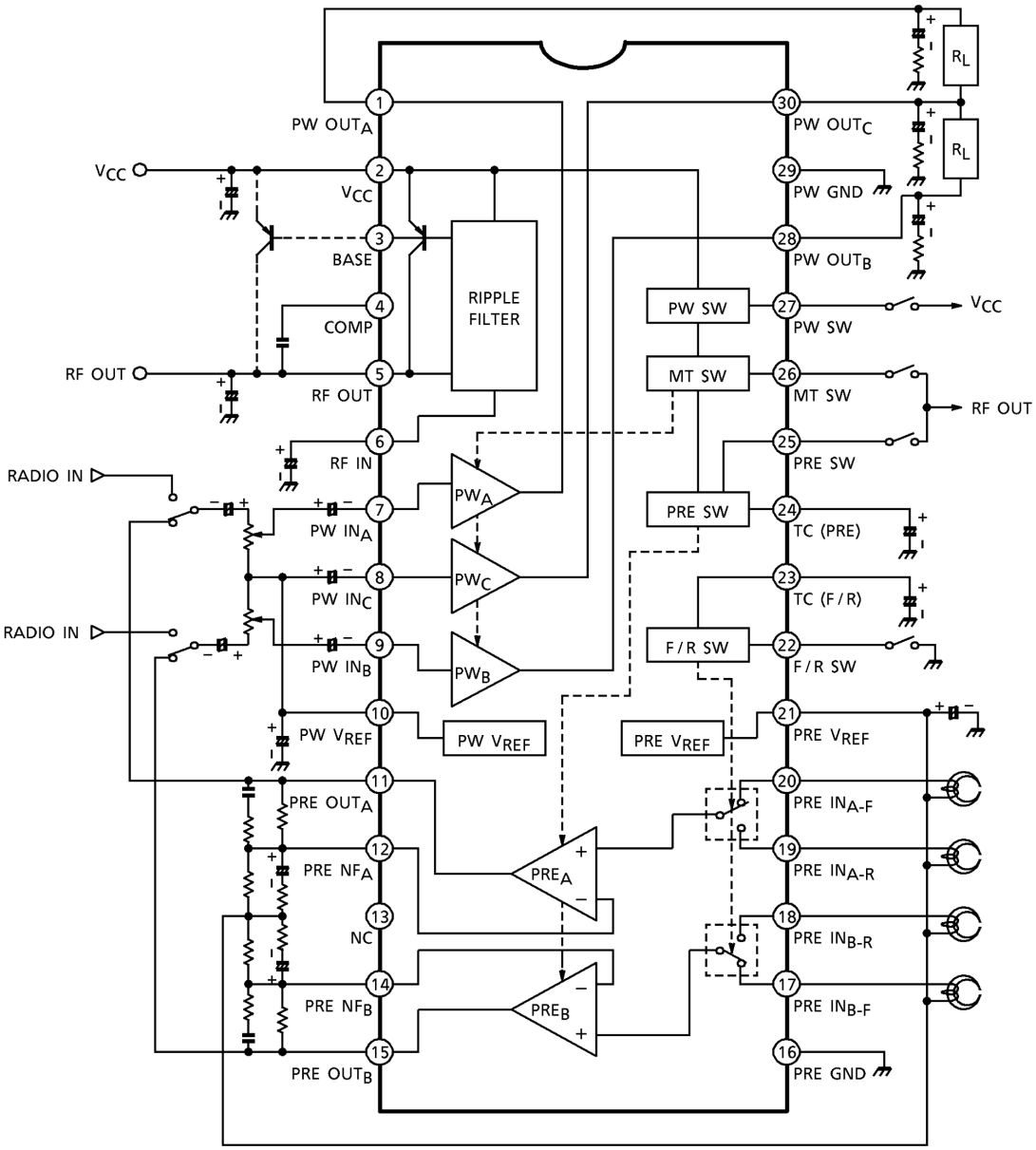
Pre−amp. Stage

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

Total

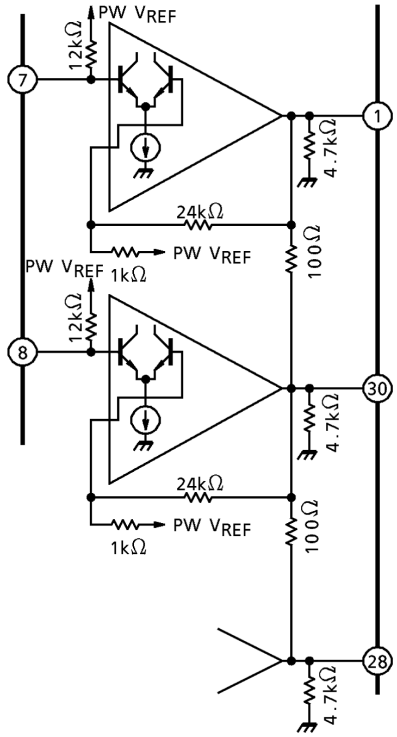
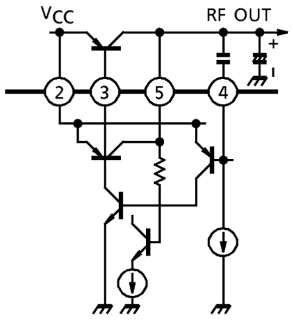
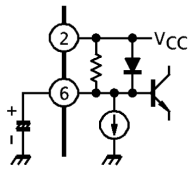
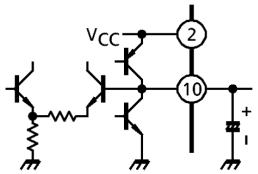
- Built−in ripple filter
- Built−in power switch
- Operating supply voltage range: $V_{CC\ (opr)}$ = 0.9V~2.2V (Ta = 25°C)

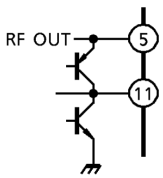
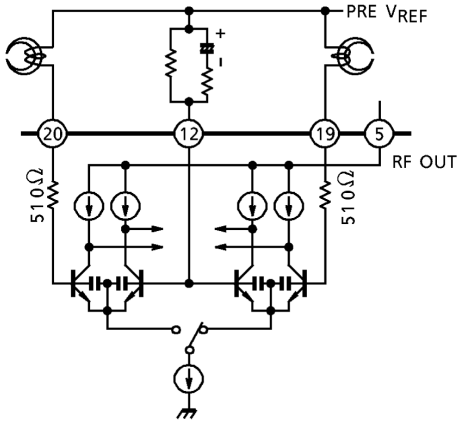
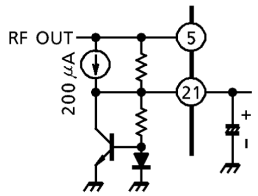
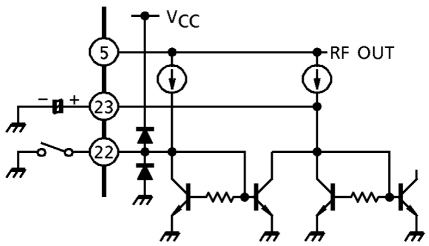
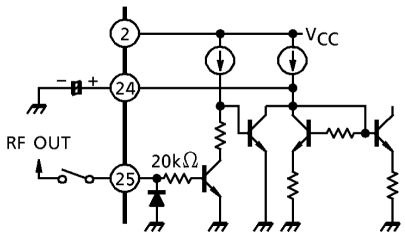
Block Diagram

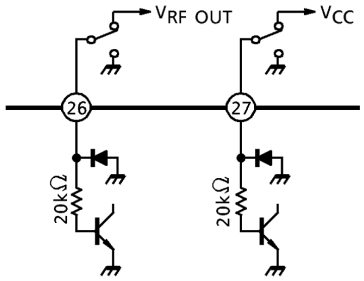


Terminal Explanation

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 fipple 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

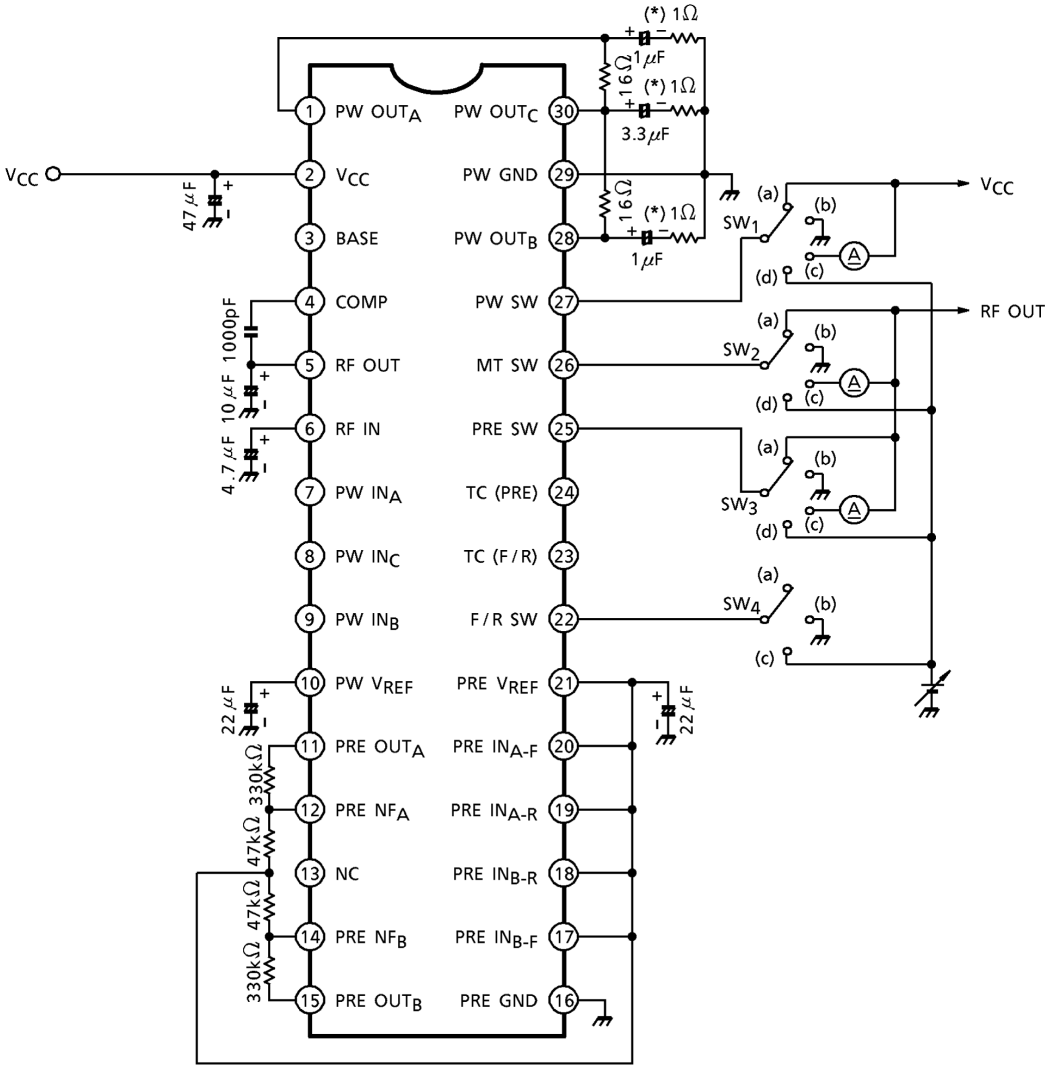
Electrical Characteristics

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 Cir−cuit	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	
		I_{CCQ3}		V_{in} = 0	—	13	16	mA
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	μV_{rms}

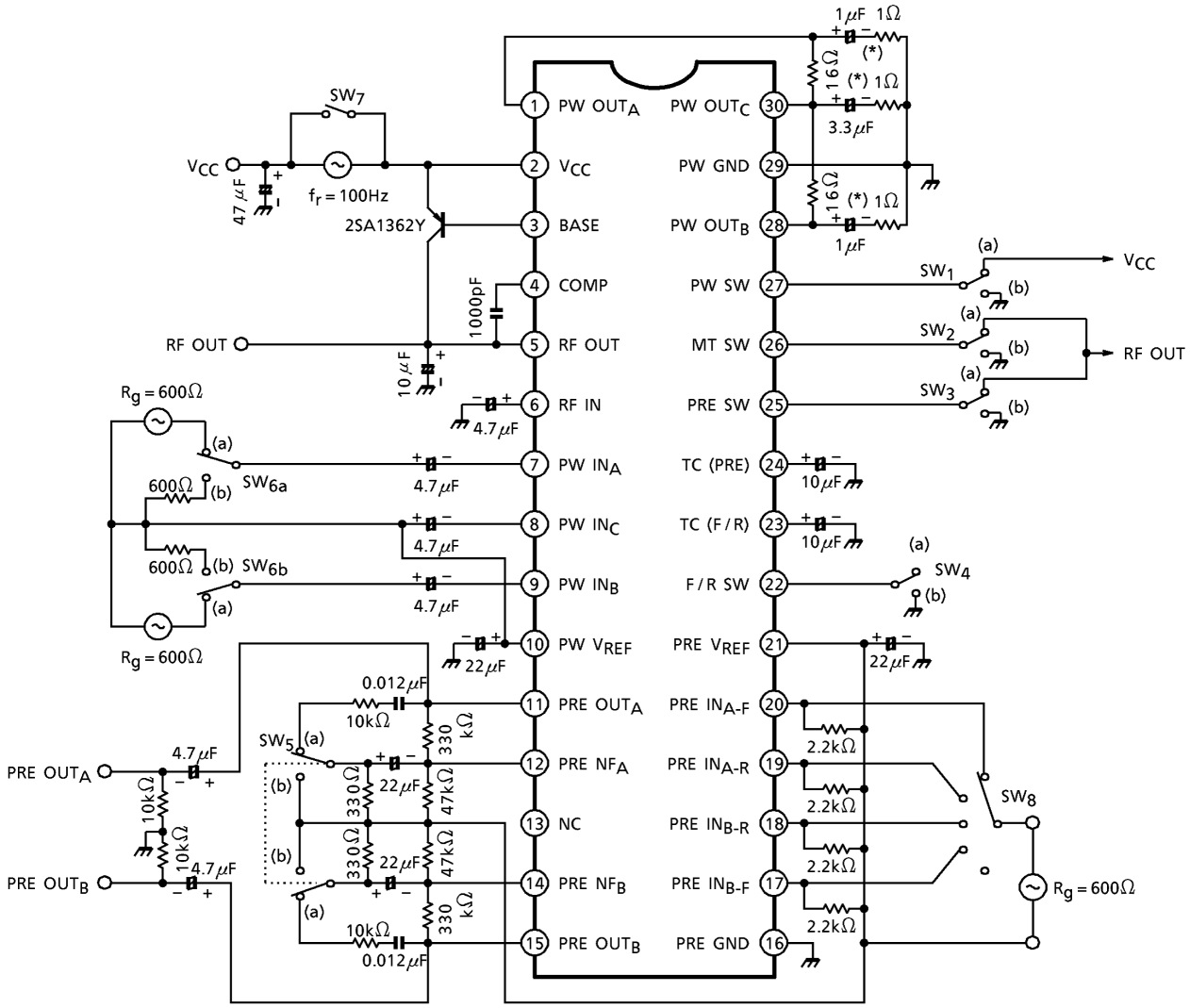
Characteristic		Symbol	Test Cir–cuit	Test Condition		Min.	Typ.	Max.	Unit
Power–amplifier stage	Ripple rejection ratio	RR_1	2	V_{CC} = 1V, f_r = 100Hz, V_r = –32dBV I_{RF} = 0, SW_6: b, SW_7: OPEN		45	54	—	dB
	Cross talk (CH–A / CH–B)	CT_1		V_o = –22dBV		30	38	—	
	Power muting attenuation	ATT_1		V_o = –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 satge	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} ≥ 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 voltage		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

Test Circuit 1



(*) Tantal condenser

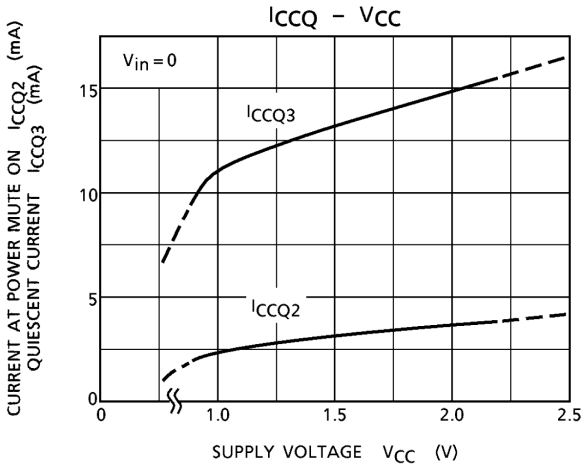
Test Circuit 2

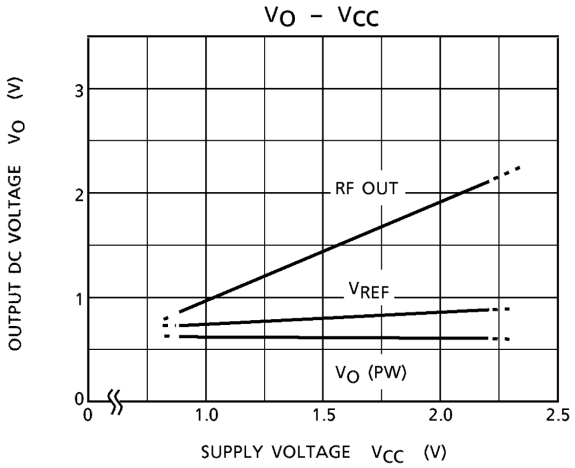


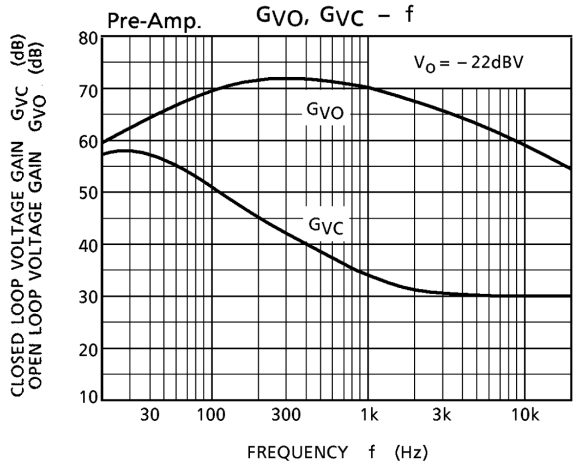
(*) Tantal condenser

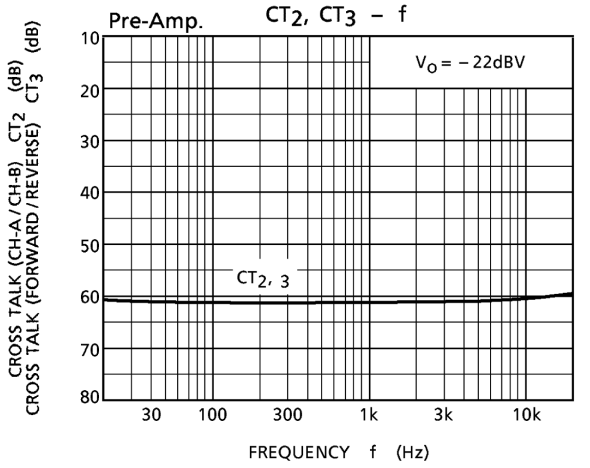
Characteristic Curves

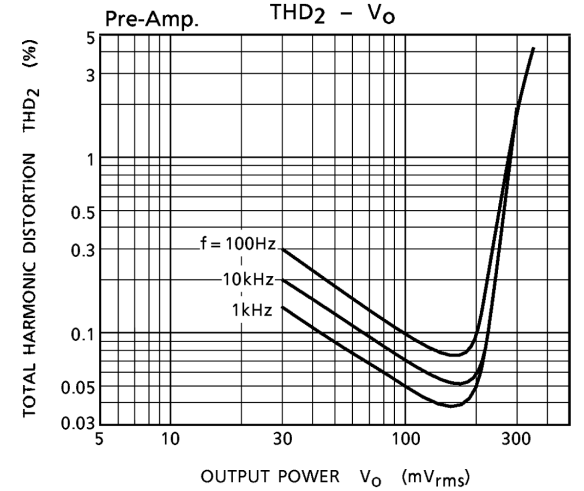
Unless Otherwise Specified: V_{CC} = 1.2V, Ta = 25°C, f = 1kHz
Pre−amplifier Stage: R_g = 2.2kΩ, R_L= 10kΩ
Power Amplifier Stage: R_g = 600Ω, R_L= 16Ω

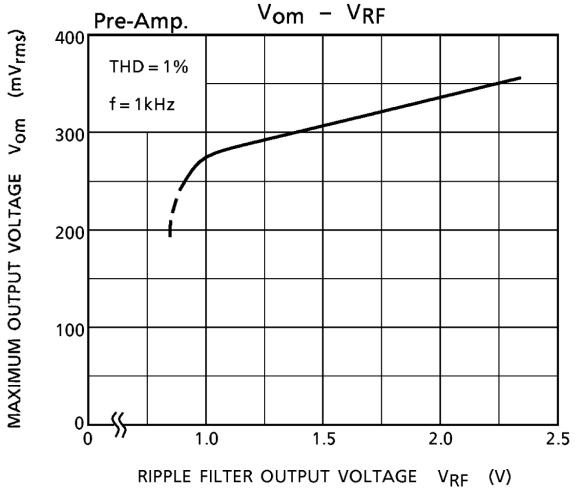




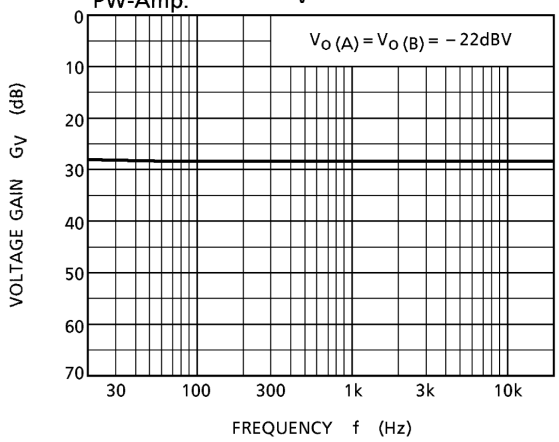




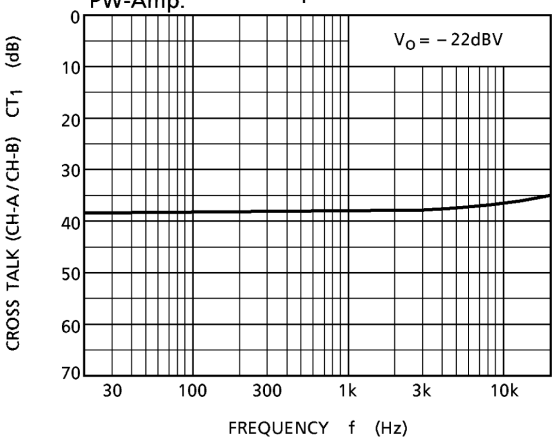




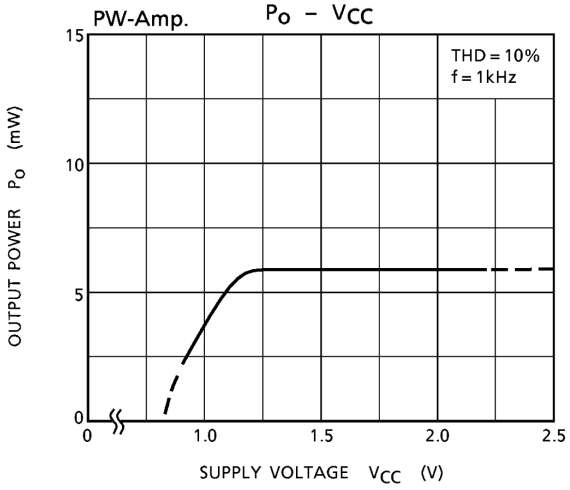
PW-Amp. G_V – f



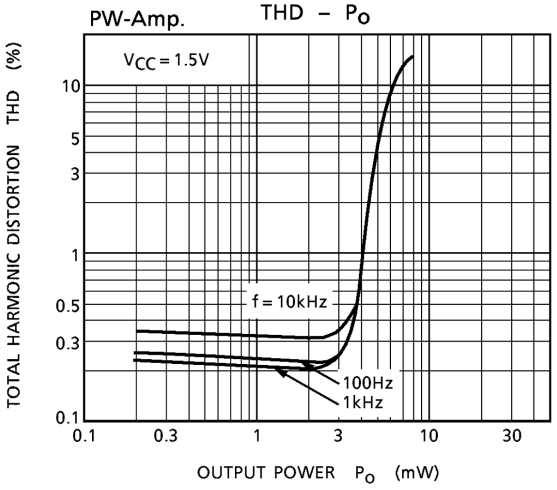
PW-Amp. CT_1 – f



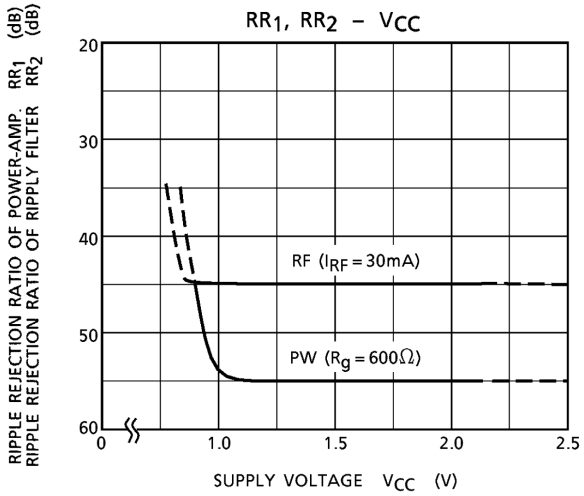
PW-Amp. P_O – V_{CC}



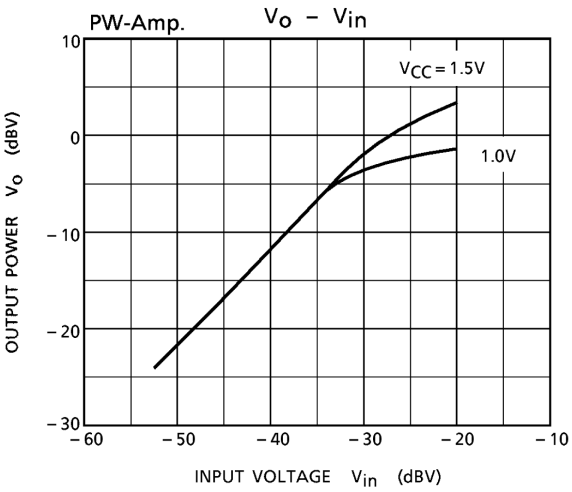
PW-Amp. THD – P_O



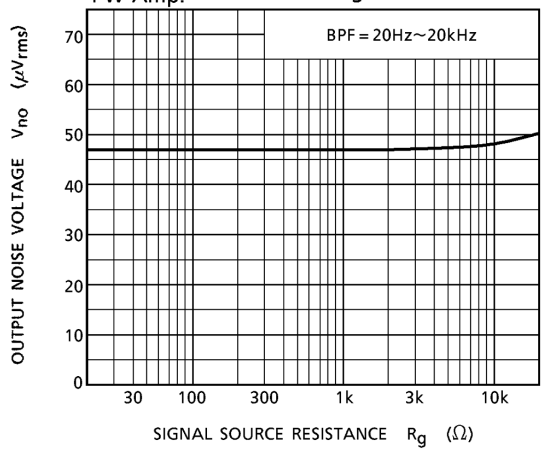
RR_1, RR_2 – V_{CC}



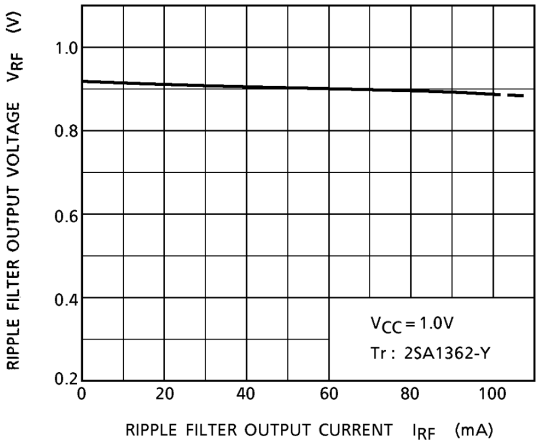
PW-Amp. V_O – V_{in}



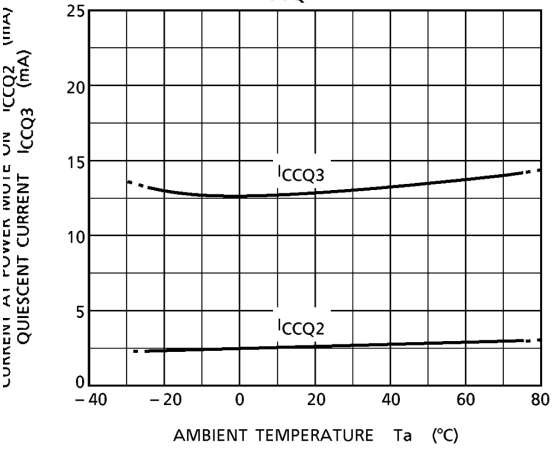
PW-Amp. V_{no} – R_g



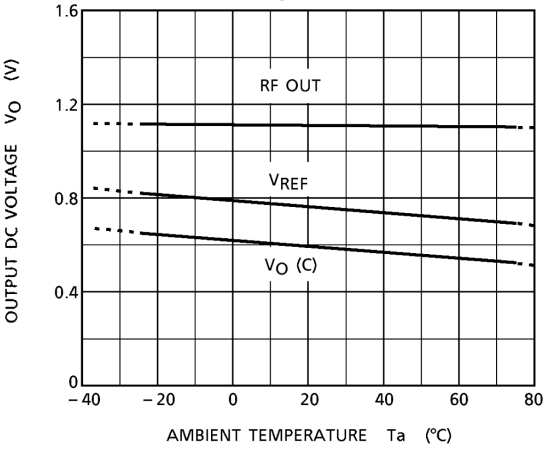
V_{RF} – I_{RF}



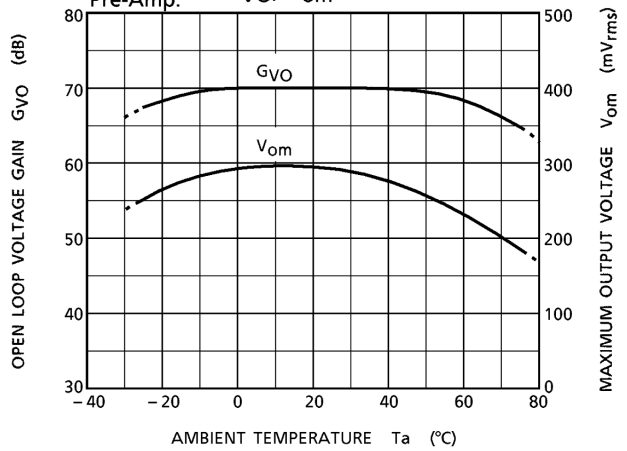
I_{CCQ} – Ta



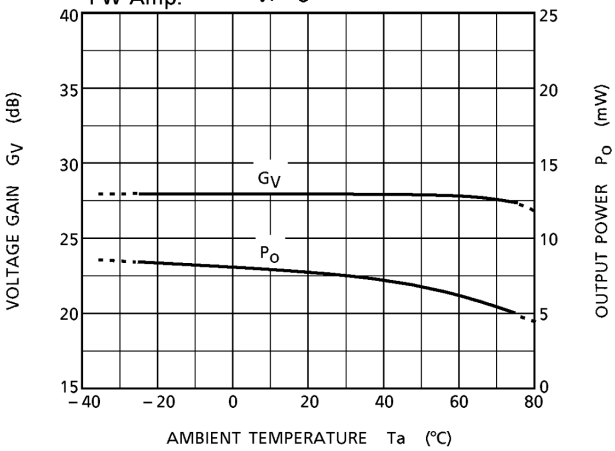
V_O – Ta



Pre-Amp. G_{VO}, V_{om} – Ta

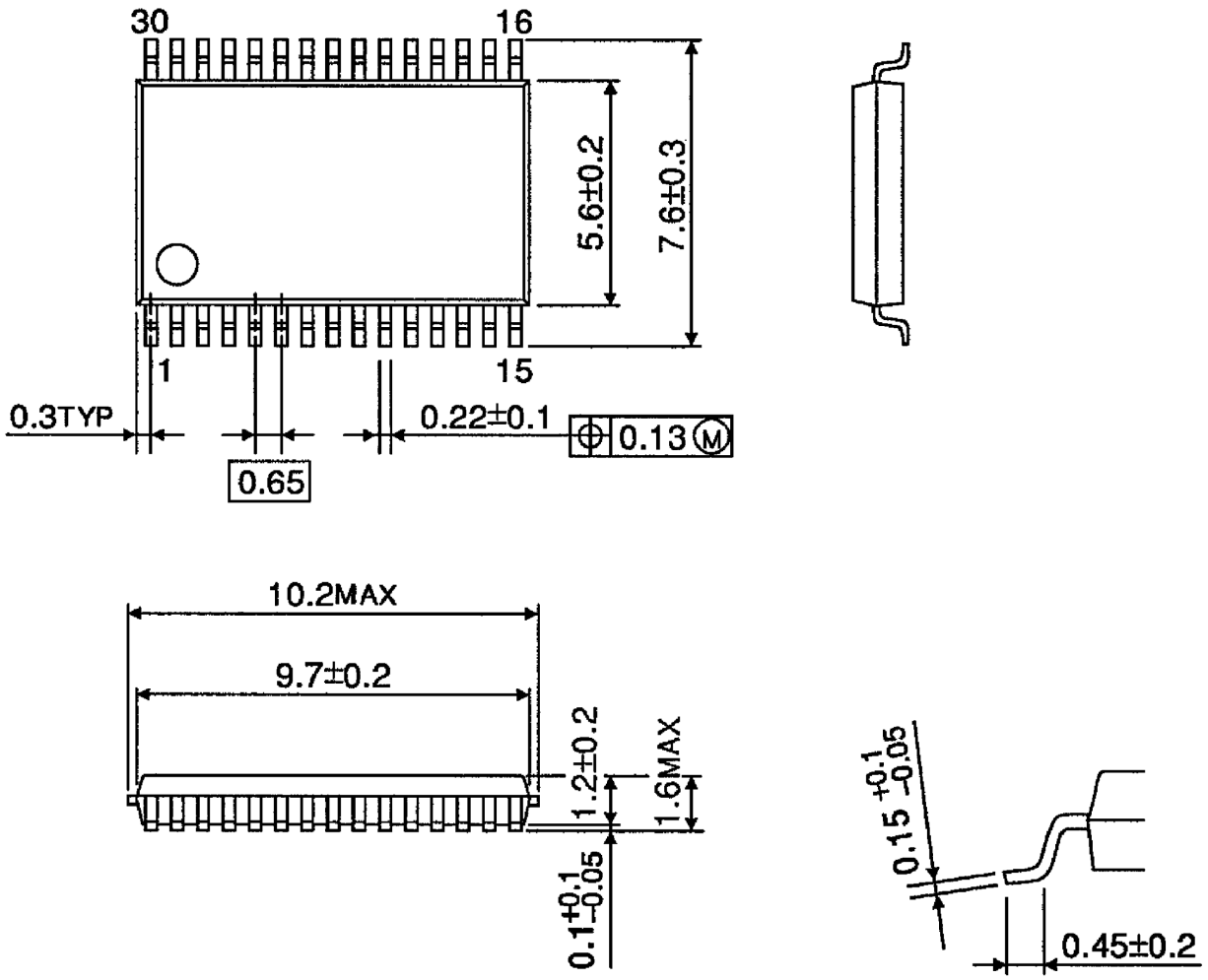


PW-Amp. G_V, P_O – Ta



Package Dimensions

SSOP30-P-300-0.65 Unit : mm



Weight: 0.17g (typ.)

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000707EBA

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