

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8157AF, TA8157AFN

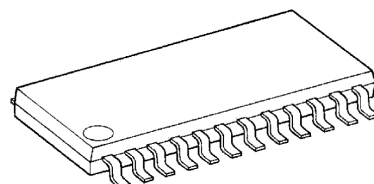
Stereo Headphone Power Amplifier (1.5V USE)

The TA8157AF and TA8157AFN are developed for play-back stereo headphone equipments at low voltage operation (1.5V use). Those are built in bass boost function.

Features

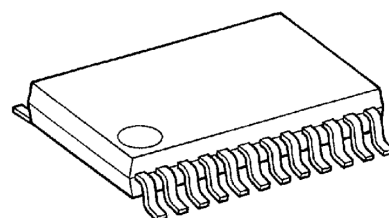
- OCL (output condenser less)
- Built-in ripple filter
- Output power ($V_{CC} = 1.5V$, $f = 1kHz$, $THD = 10\%$, $R_L = 16\Omega$)
 $P_o = 9mW$ (typ.)
- Voltage gain: $G_V = 24dB$ (typ.)
- Built-in boost amplifier
- Built-in power switch
- Built-in muting circuit
- Low quiescent supply current ($T_a = 25^\circ C$)
 $ICCQ = 8mA$ (typ.)
- Excellent ripple rejection ratio: $RR = 55dB$ (typ.)
- Low noise: $V_{no} = 25\mu V_{rms}$ (typ.)
- Operating supply voltage range ($T_a = 25^\circ C$)
 $V_{CC} (opr) = 0.9 \sim 2.2V$

TA8157AF



SSOP24-P-300-1.00

TA8157AFN



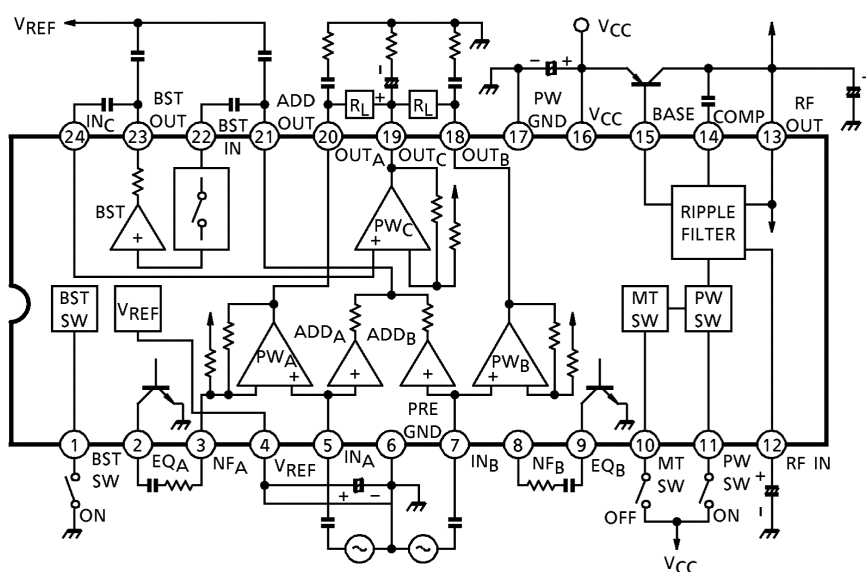
SSOP24-P-300-0.65A

Weight

SSOP24-P-300-1.00: 0.32g (typ.)

SSOP24-P-300-0.65A: 0.14g (typ.)

Block Diagram



Terminal Explanation

(terminal voltage: Typical terminal voltage at no signal with test circuit, $V_{CC} = 1.2V$,
 $T_a = 25^\circ C$)

Terminal		Function	Internal Circuit	Terminal Voltage (V)
No.	Name			
1	BST SW	Boost amplifier on / off switch (synchronized with equalizer circuit) V _{CC} / OPEN: BST amp. ON GND: BST amp. OFF		—
2	EQ _A	Equalizer circuit (controlled by BST SW) On resistance: 60Ω (typ.)		—
9	EQ _B			
4	V _{REF}	Reference voltage		0.75
5	IN _A	Input of power amplifier (This terminal is common with input of adder amplifier.)		0.75
7	IN _B			0.75
3	NF _A	NF of power amplifier		0.75
8	NF _B			
20	OUT _A	Output of power amplifier		0.6
18	OUT _B			
6	PRE GND	—	—	0
10	MT SW	Muting switch for power amplifier V _{CC} : Power amp. ON GND / OPEN: Power amp. OFF		—
11	PW SW	Power switch V _{CC} : Power ON GND / OPEN: Power OFF		—

Terminal		Function	Internal Circuit	Terminal Voltage (V)
No.	Name			
12	RF IN	Ripple filter terminal		1.2
13	RF OUT	Output of ripple filter Ripple filter circuit supplies VREF circuit, adder amplifier and boost amplifier with power source.		1.13
14	COMP	Phase-compensation terminal for a ripple filter circuit		0.7
15	Base	Base biasing terminal of transistor for ripple filter		0.5
16	VCC	—	—	1.2
17	PW GND	—	—	0
19	OUT _C	Output of center amplifier		0.6
24	IN _C	Input of center amplifier		0.75
21	ADD OUT	Output of adder amplifier Input of adder amplifier is common with input of power amplifier.		0.6

Terminal		Function	Internal Circuit	Terminal Voltage (V)
No.	Name			
22	BST IN	Input of boost amplifier		0.75
23	BST OUT	Output of boost amplifier (controlled by boost switch) BST ON: BST amp. ON BST OFF: BST amp. OFF (cut off input signal of BST amp.)		0.6

Application Note**(1) PW SW**

It is necessary to connect an external pull-down resistor with terminal PW SW (pin(11)), in case that this IC is turned on due to external noise etc.

(2) MT SW

The leak current flows through the terminal of MT SW (pin(10)), in case that this terminal is connected with VCC line independently, even though this IC is off-mode (the terminal of PW SW (pin(11)) is off-mode). It is necessary to connect an external pull-down resistor with terminal MT SW, in case that this IC is turned on due to external noise etc.

(3) BST SW

The leak current never flows through the terminal of BST SW (pin(1)) even though this terminal is at any condition, because the ripple filter circuit supplies the BST SW circuit with power source. The terminal of BST SW should not be applied higher voltage than VCC, to prevent IC from destruction. It is necessary to connect an external pull-up resistor with terminal BST SW, in case that this IC doesn't operate normally due to external noise etc.

In case that boost amplifier is on, BST SW terminal should be applied $V_{CC} \sim (V_{CC} - 0.3V)$.

(4) Input of amplifier

Each input signal should be applied through a condenser. In case that DC current or DC voltage is applied to each amplifier, the internal circuit has unbalance and the each amplifier doesn't operate normally.

It is advised that input signal refer to voltage of V_{REF} , in order to reduce a pop sound.

(5) Ripple filter

It is necessary to connect a transistor for ripple filter, because this IC doesn't have transistor for ripple filter. Care should be taken to stabilize the ripple filter circuit, because the ripple filter circuit supplies V_{REF} circuit, adder amplifier and boost amplifier with power source.

Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Supply voltage		V _{CC}	4.5	V
Output current		I _O (Peak)	100	mA
Power dissipation	TA8157AF	P _D (Note)	400	mW
	TA8157AFN		500	
Operating temperature		T _{opr}	-25~75	°C
Storage temperature		T _{stg}	-55~150	

(Note) Derated above Ta = 25°C in the proportion of 3.2mW / °C for TA8157AF, and of 4mW / °C for TA8157AFN.

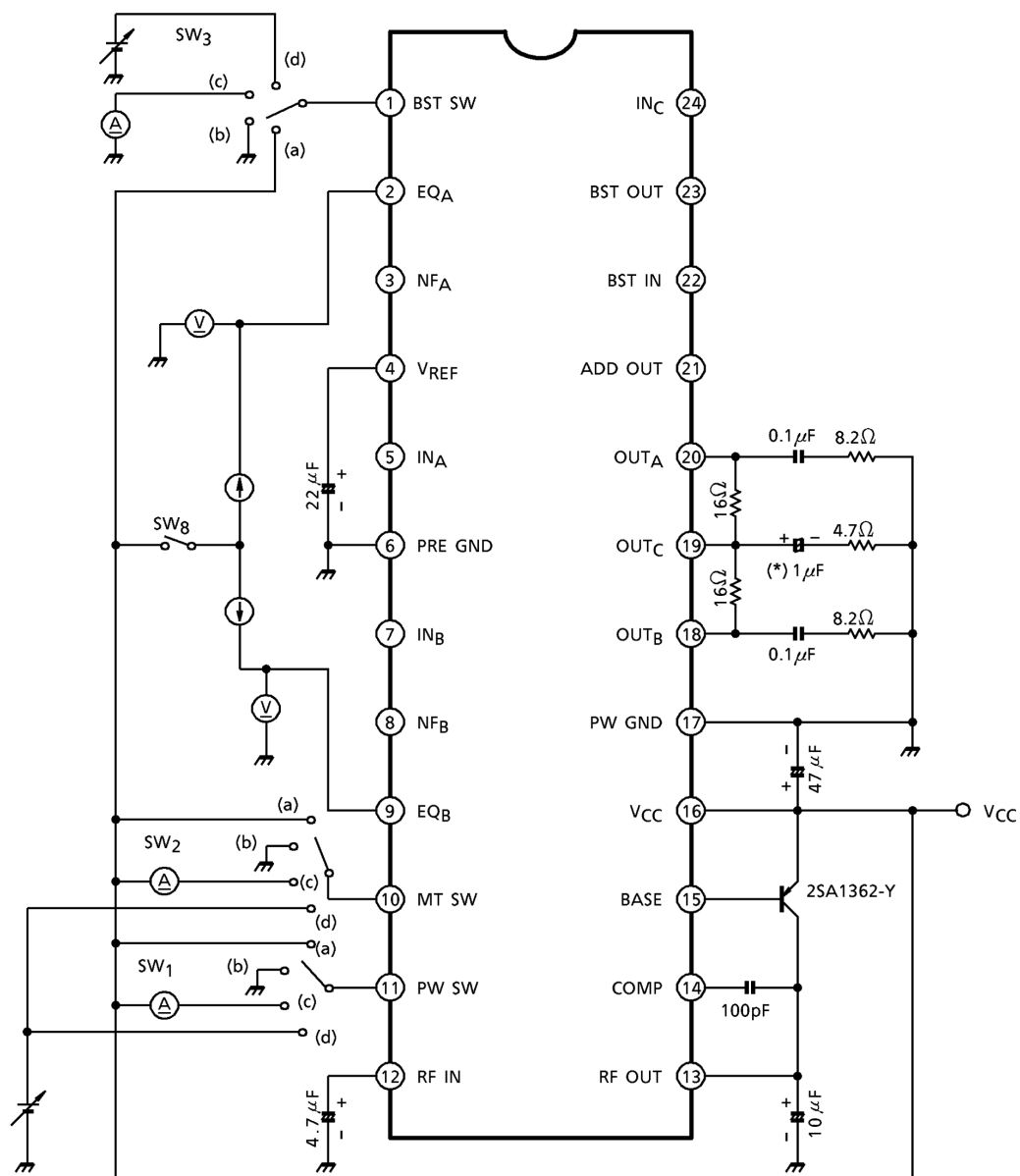
Electrical Characteristics

Unless Otherwise Specified : V_{CC} = 1.2V, R_L = 16Ω, R_g = 600Ω, f = 1kHz, Ta = 25°C
 SW₁: a, SW₂: a, SW₃: b, SW₄: a, SW₅: a
 SW₆: a, SW₇: ON, SW₈: OPEN

Characteristic		Symbol	Test Cir-cuit	Test Condition	Min.	Typ.	Max.	Unit
Quiescent supply current		I _{CC1}	1	Power OFF, SW ₁ : b SW ₂ : b	—	0.1	5	μA
		I _{CC2}		Power amp. OFF, SW ₂ : b	—	2.4	4.0	mA
		I _{CC3}		V _{in} = 0	—	8	11.5	
Power amplifier stage	Voltage gain 1	G _{V1}	2	V _O (A) = V _O (B) = -22dBV	22	24	26	dB
	Channel balance	CB1			—	0	1.5	
	Output power 1	P _{O1}	2	V _{CC} = 1.5V THD (A) = THD (B) = 10%	5	9	—	mW
	Output power 2	P _{O2}		V _{CC} = 1.5V THD (A) = THD (B) = 10% V _{in} (A) = V _{in} (B) = -V _{in} (C) f = 100Hz, * BTL operation SW ₃ : a, SW ₅ : b	8	14	—	
	Total harmonic distortion	THD	2	P _O (A) = P _O (B) = 1mW	—	0.6	1	%
	Output noise voltage	V _{no}	2	BPF = 20Hz~20kHz, SW ₄ : b	—	25	40	μV _{rms}
	Cross talk	CT	2	V _O = -22dBV, SW ₄ : b	35	42	—	dB
	Ripple rejection ratio	RR1	2	V _{CC} = 1.0V, f _r = 100Hz V _r = -32dBV, SW ₇ : OPEN	45	55	—	
	Muting attenuation	ATT1	2	V _O = -22dBV, SW ₂ : a→b	—	73	—	

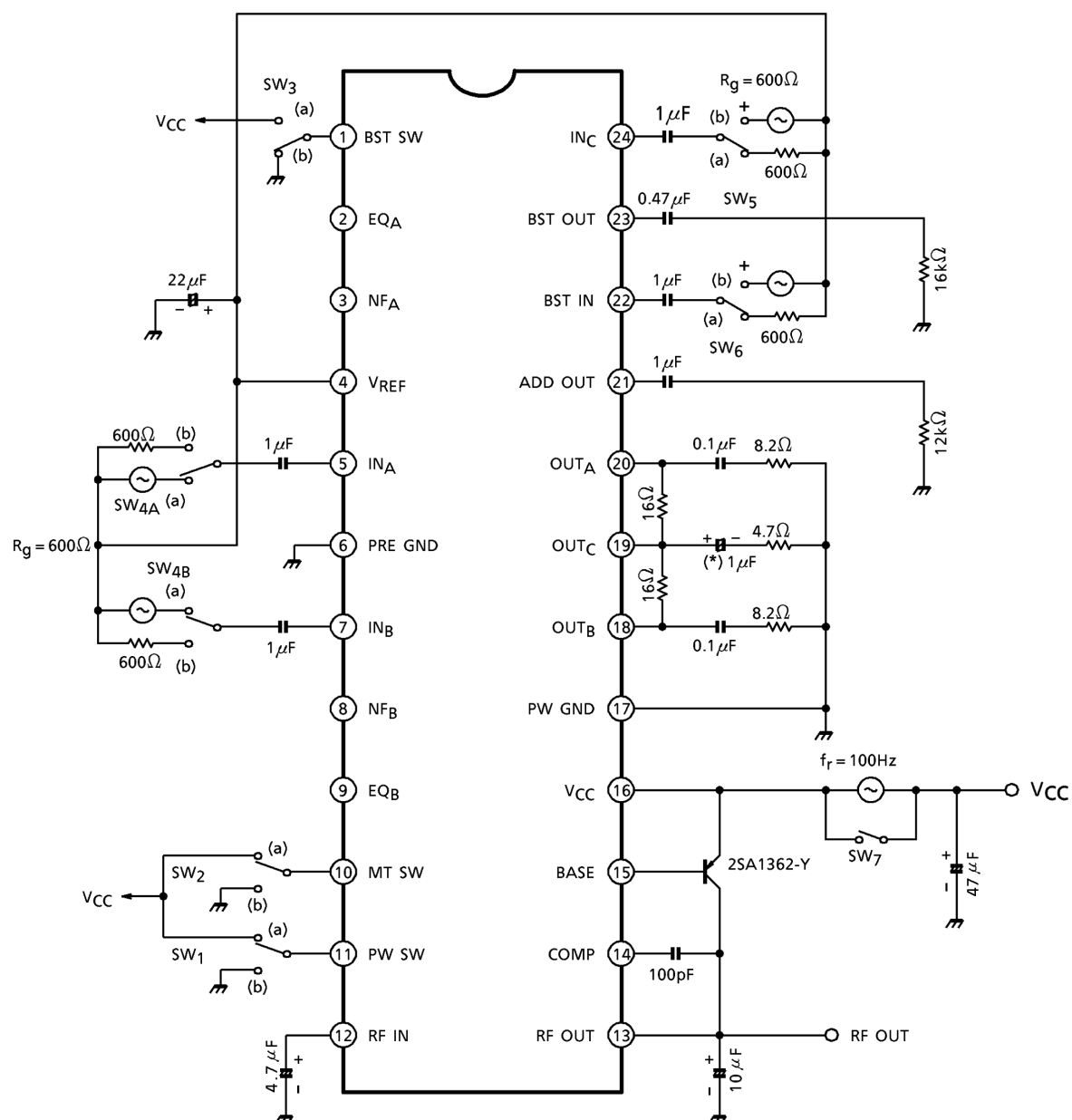
Characteristic		Symbol	Test Cir-cuit	Test Condition	Min.	Typ.	Max.	Unit
Bass boost function stage	ADD amp. voltage gain	Gv2	2	$V_{in(A)} = V_{in(B)}$, $R_L = 12k\Omega$ $V_o(ADD) = -22dBV$ SW ₃ : a / b	15	17.5	20	dB
	ADD amp. maximum output voltage	Vom2	2	$V_{in(A)} = V_{in(B)}$, $R_L = 12k\Omega$ THD (ADD) = 1%, SW ₃ : a / b	80	130	—	mV _{rms}
	BST amp. voltage gain	Gv3	2	$V_o = -37dBV$, $R_L = 16k\Omega$ SW ₆ : b	14	16.5	19	dB
	BST amp. maximum output voltage	Vom3	2	THD (BST) = 3%, $R_L = 16k\Omega$ SW ₆ : b	55	90	—	mV _{rms}
	BST amp. attenuation	ATT3	2	$V_o = -32dBV$, SW ₃ : a→b SW ₆ : b	—	73	—	dB
Ripple filter output voltage		V _{RF OUT}	2	$V_{CC} = 1V$, $I_{RF} = 20mA$	0.9	0.93	—	V
Ripple rejection ratio		RR4	2	$V_{CC} = 1V$, $I_{RF} = 20mA$ $f_r = 100Hz$, $V_r = -37dBV$ SW ₇ : OPEN	35	43	—	dB
Equalizer on resistance		R _{ON}	1	$I_{EQ} = 100\mu A$, SW ₃ : a SW ₈ : ON	—	60	—	Ω
Power switch	On current	I ₁₁	1	$V_{CC} = 0.9V$, $V_4 \geq 0.5V$ SW ₁ : c, SW ₂ : b	5	—	—	μA
	Off voltage	V ₁₁	1	$V_{CC} = 0.9V$, $V_4 \leq 0.2V$ SW ₁ : d, SW ₂ : b	0	—	0.3	V
Mute switch	Off current	I ₁₀	1	$V_{CC} = 0.9V$, $I_{CC} \geq 4.5mA$ SW ₂ : c	5	—	—	μA
	On voltage	V ₁₀	1	$V_{CC} = 0.9V$, $I_{CC} \leq 3.5mA$ SW ₂ : d	0	—	0.3	V
Boost switch	Off current	I ₁	1	$V_{CC} = 0.9V$, $I_{EQ} = 100\mu A$ $V_2 \geq 0.7V$, SW ₃ : c, SW ₈ : ON	5	—	—	μA
	On voltage	V ₁	1	$V_{CC} = 0.9V$, $I_{EQ} = 100\mu A$ $V_2 \leq 0.2V$, SW ₃ : d, SW ₈ : ON	0.6	—	0.9	V

Test Circuit 1



(*) Tantalum condenser

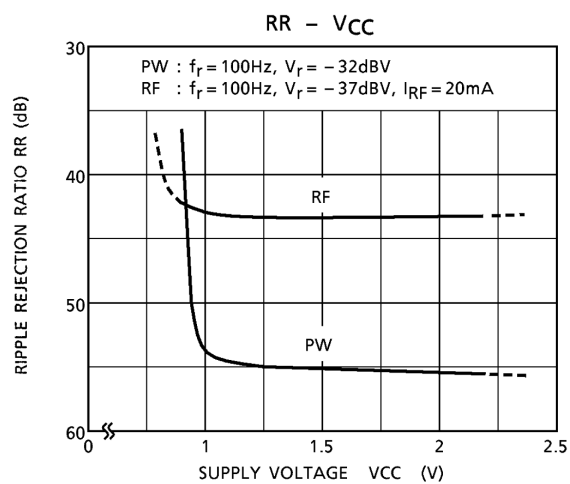
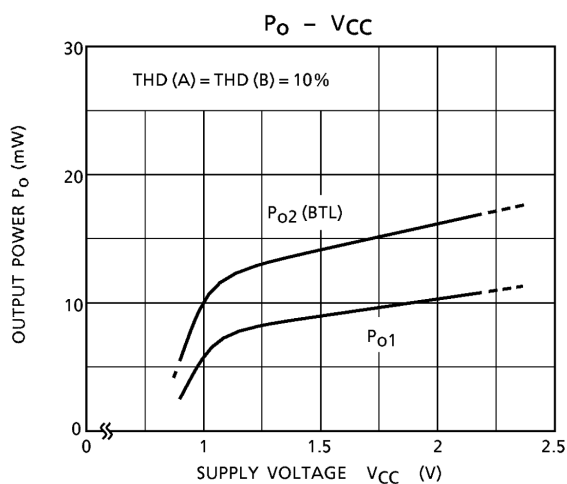
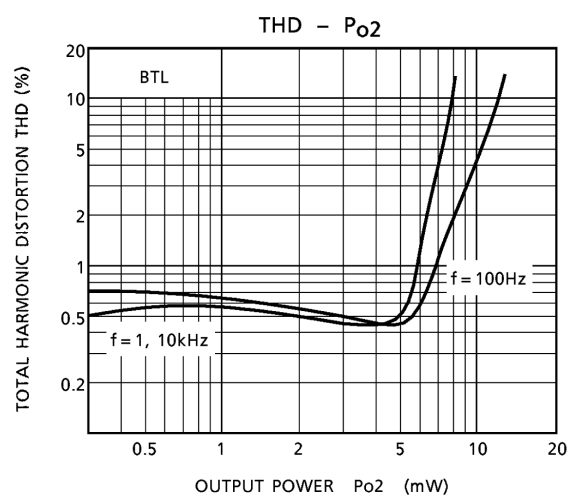
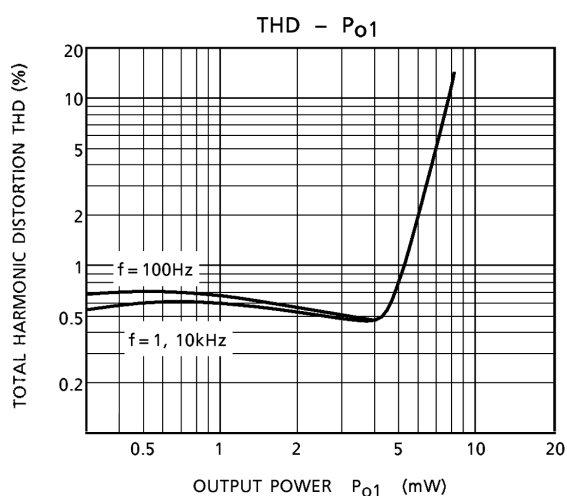
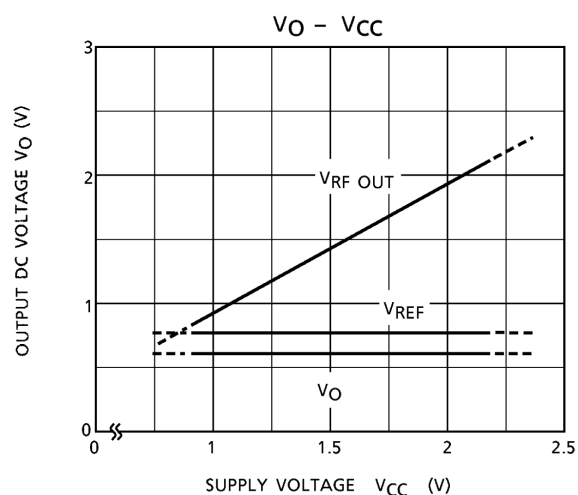
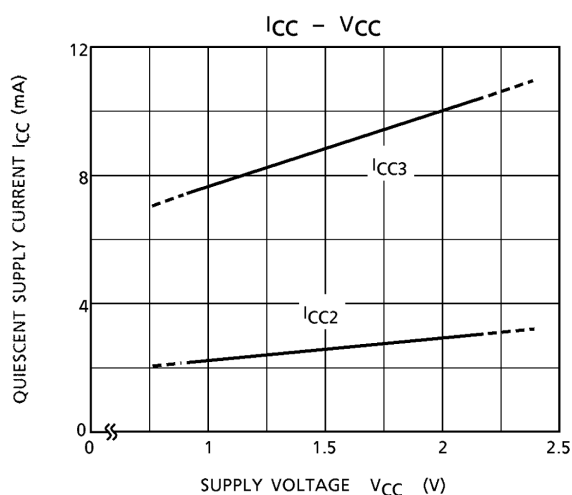
Test Circuit 2

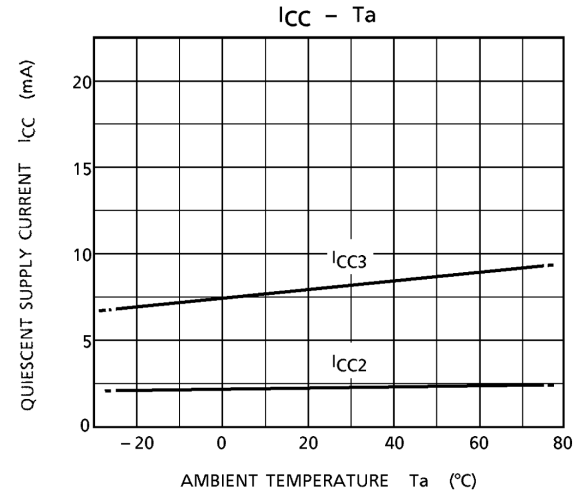
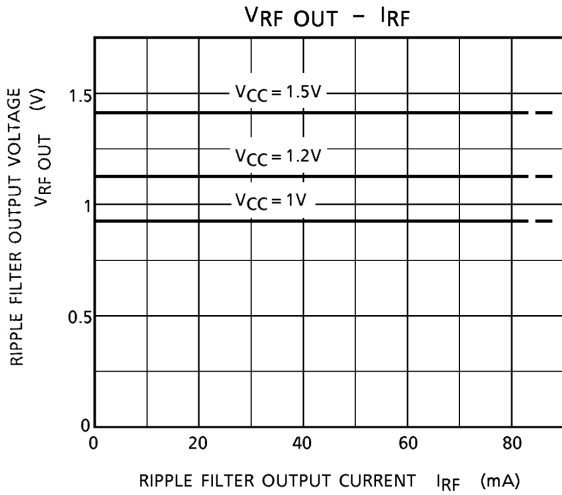
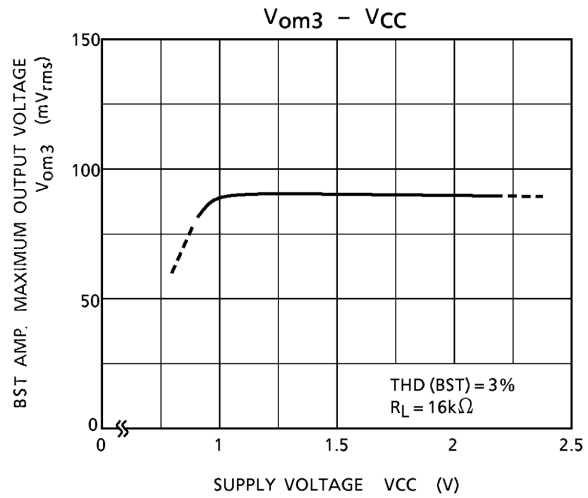
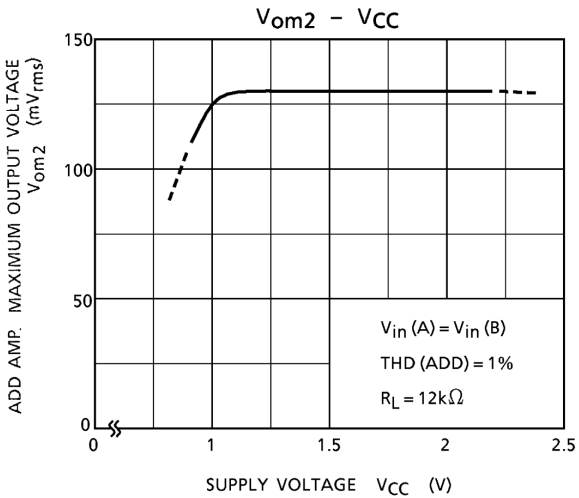
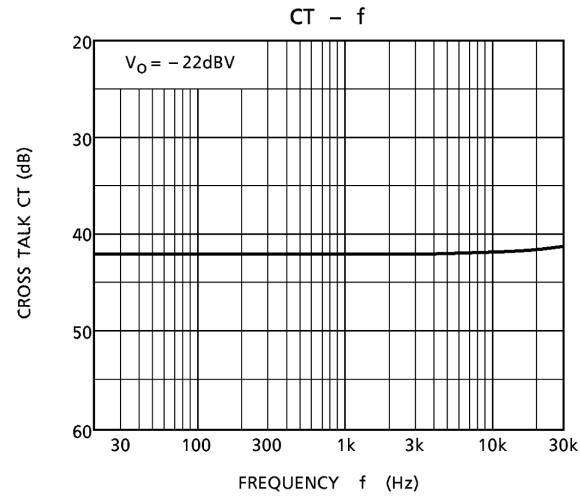
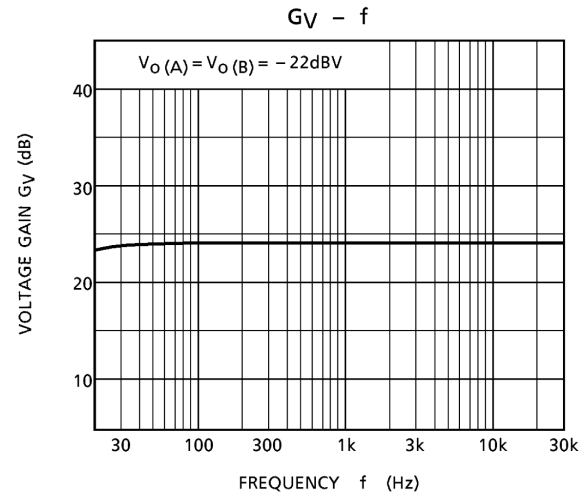


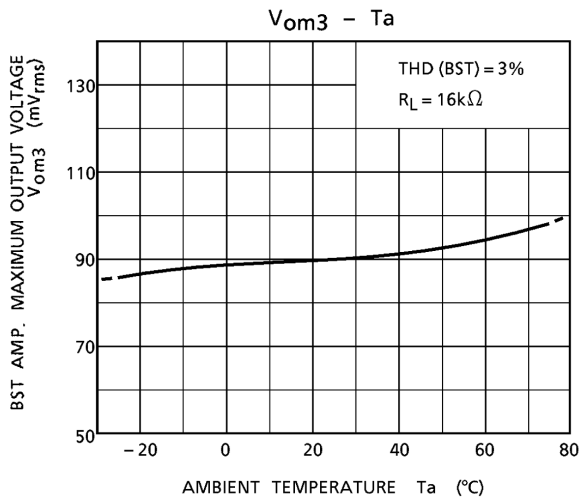
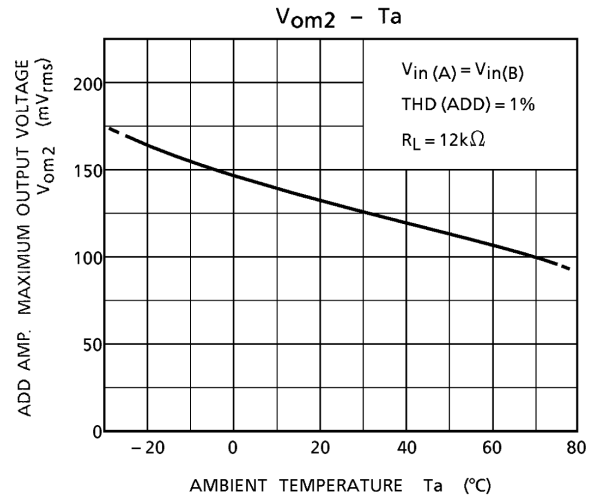
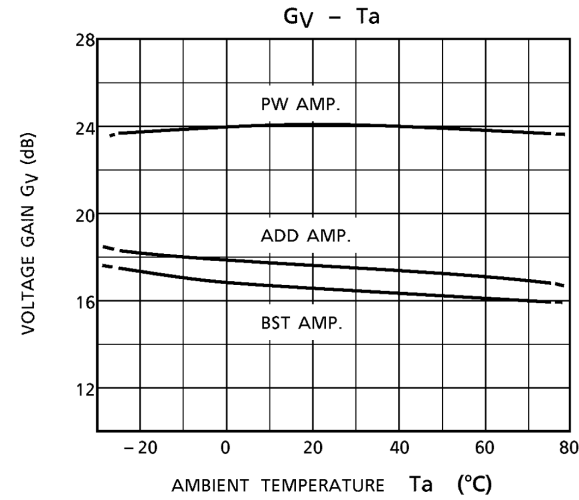
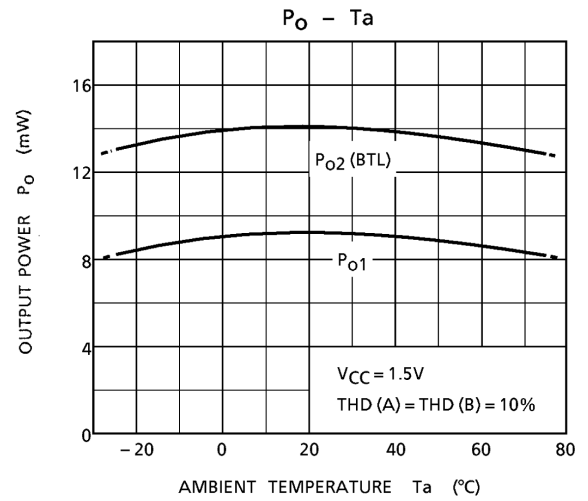
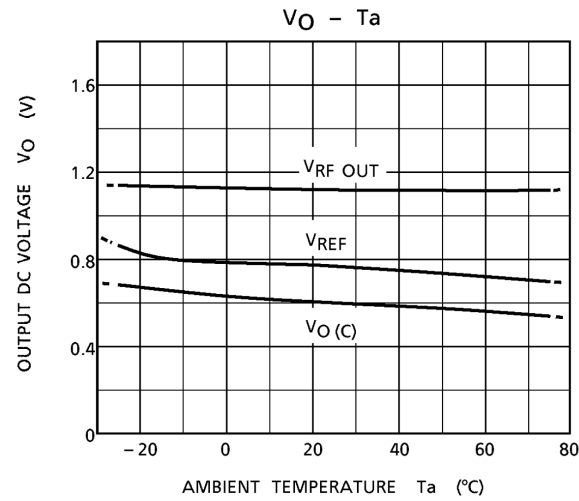
(*) Tantalum condenser

Characteristic Curves

Unless Otherwise Specified: $V_{CC} = 1.2V$, $R_L = 16\Omega$, $R_g = 600\Omega$, $f = 1kHz$, $T_a = 25^\circ C$



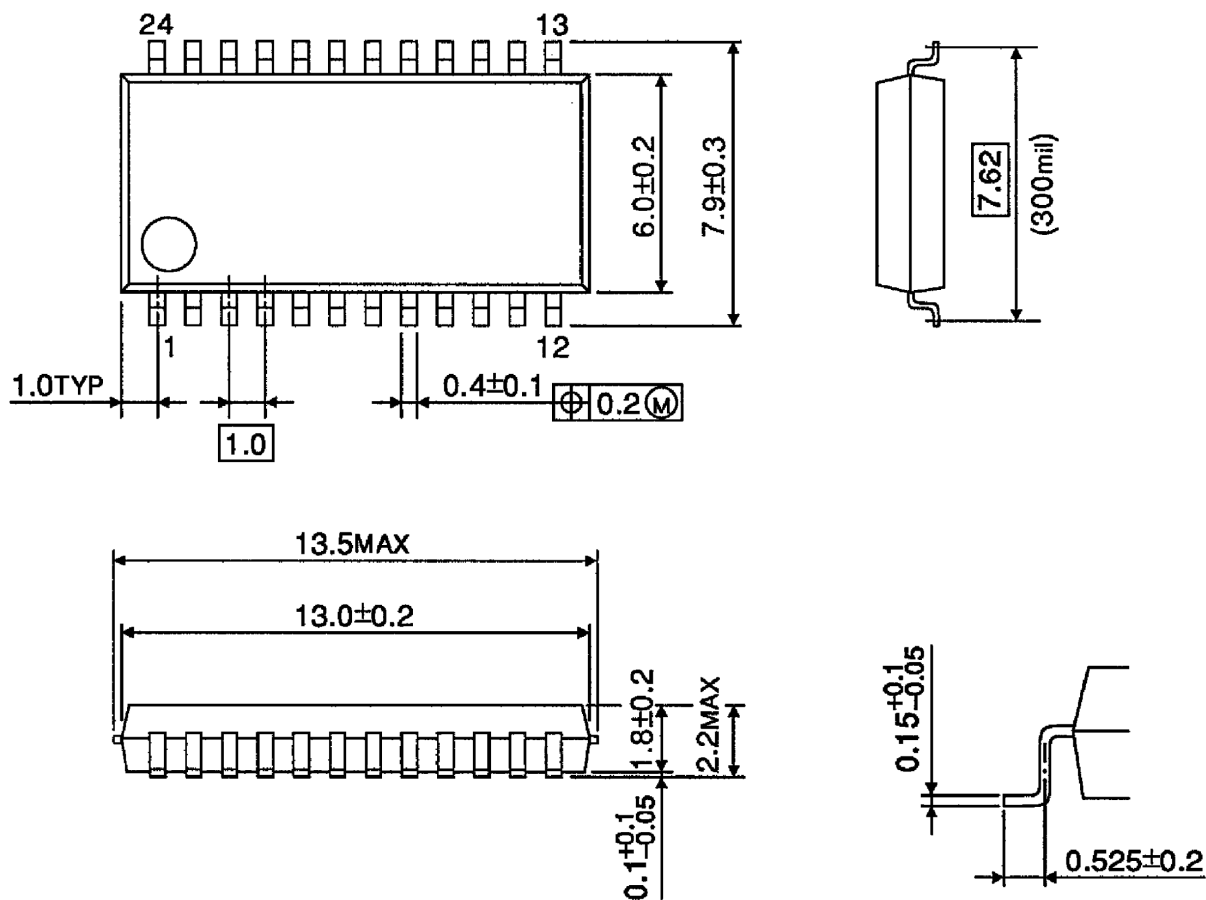




Package Dimensions

SSOP24-P-300-1.00

Unit : mm

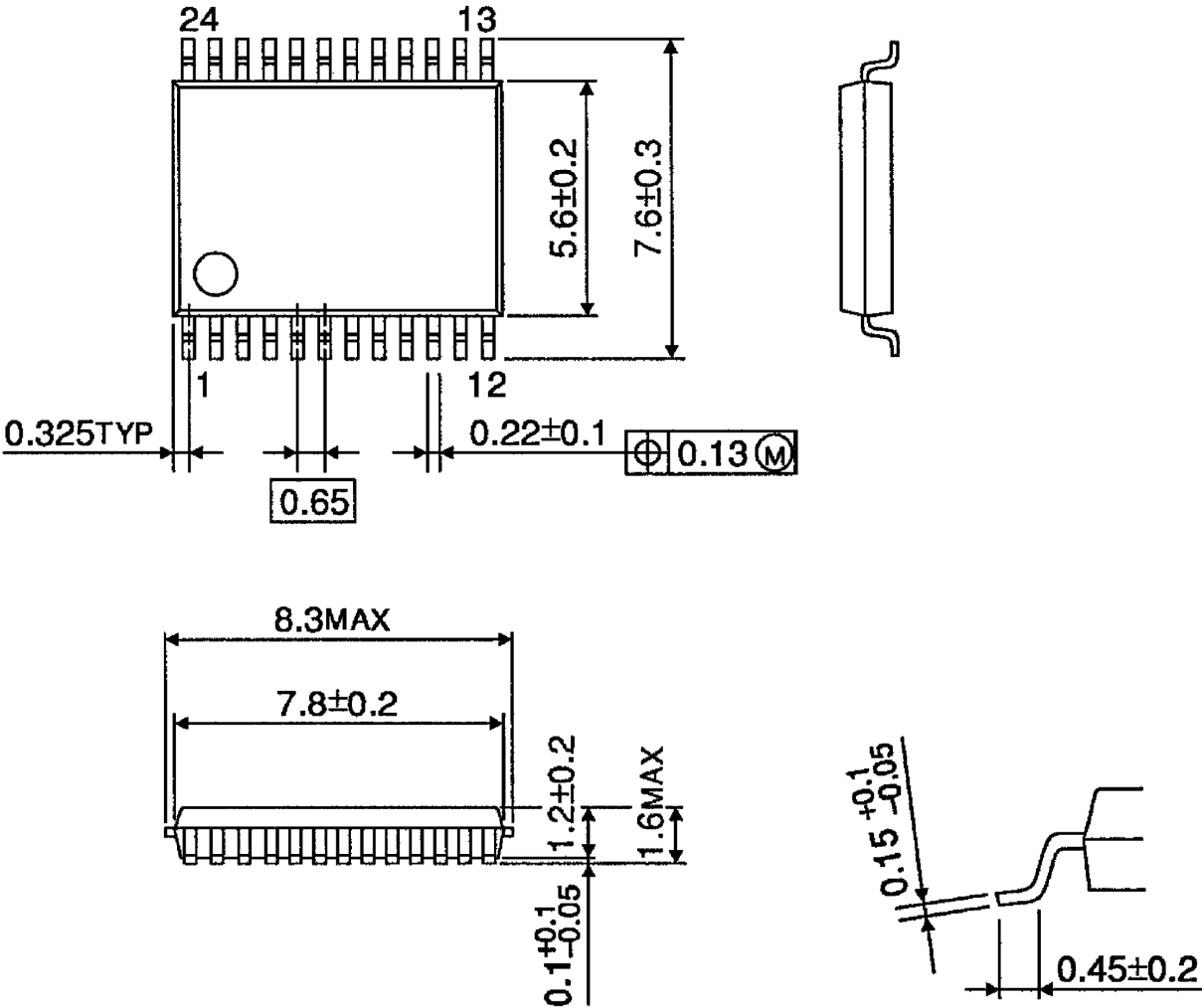


Weight: 0.32g (typ.)

Package Dimensions

SSOP24-P-300-0.65A

Unit : mm



Weight: 0.14g (typ.)

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