

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA2069AF

3 V STEREO HEADPHONE AMPLIFIER (3 V USE)

The TA2069AF is developed for play-back stereo headphone equipments (3 V USE).
It is built in dual preamplifiers, dual OCL power amplifiers, motor governor, DC volume control and volume limiter etc.

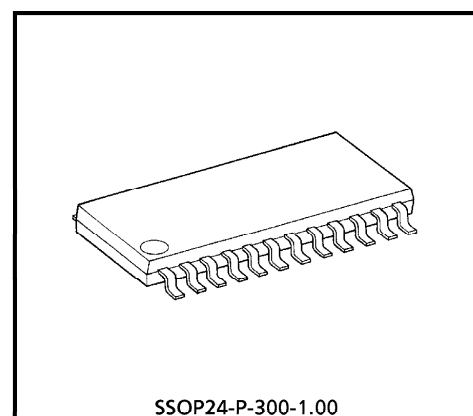
FEATURES

- Built-in preamplifier
Input coupling condenser-less
Built-in input capacitor for reducing buzz noise
Low noise : $V_{ni} = 1.2 \mu V_{rms}$ (Typ.)
- Built-in power amplifier
OCL (Output condenser-less)
Voltage gain : $G_V = 31$ dB (Typ.)
- Built-in motor governor
Current proportion type
- Built-in DC volume control function
DC volume maximum attenuation : $ATT = 82$ dB (Typ.)
- Built-in volume limiter function
- Built-in bass boost function
- Low supply current ($V_{CC} = 3$ V, $f = 1$ kHz, $T_a = 25^\circ\text{C}$, Typ.)
PRE + PW

	No Signal	Output Power	
		0.1 mW $\times 2$	0.5 mW $\times 2$
$R_L = 16 \Omega$	9.5 mA	14.2 mA	19.5 mA
$R_L = 32 \Omega$	9.5 mA	12.5 mA	16.5 mA

GVN : $I_{CC} = 2.5$ mA

- Operating supply voltage range ($T_a = 25^\circ\text{C}$)
PRE + PW : $V_{CC}(\text{opr}) = 1.8 \sim 3.6$ V
GVN : $V_{CC}(\text{opr}) = 2.1 \sim 3.6$ V (Motor Voltage = 1.8 V)



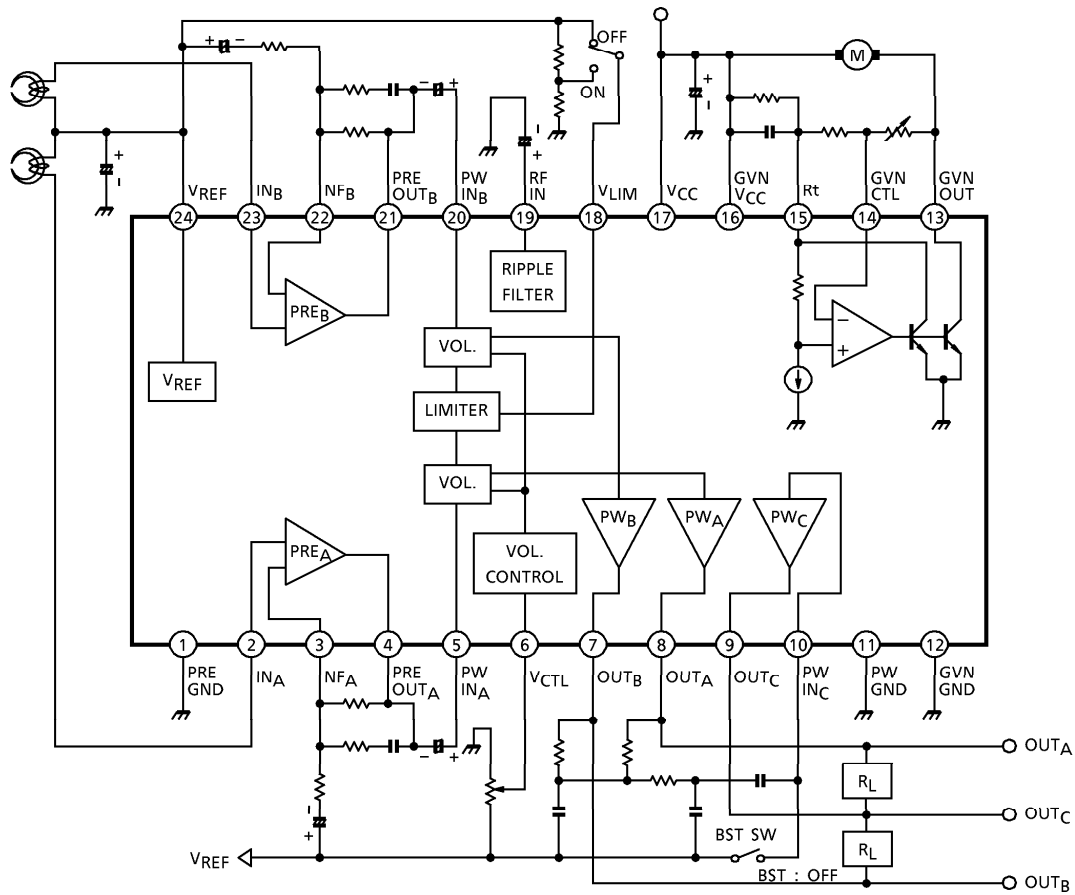
SSOP24-P-300-1.00

Weight : 0.32 g (Typ.)

980910EBA1

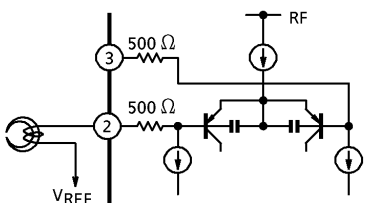
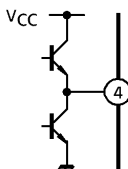
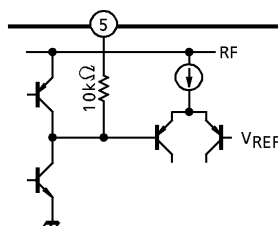
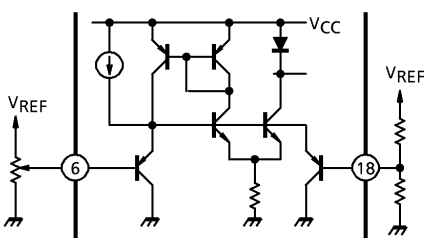
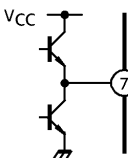
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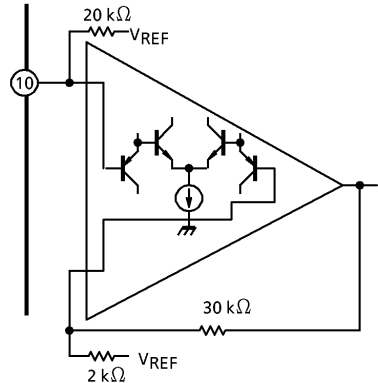
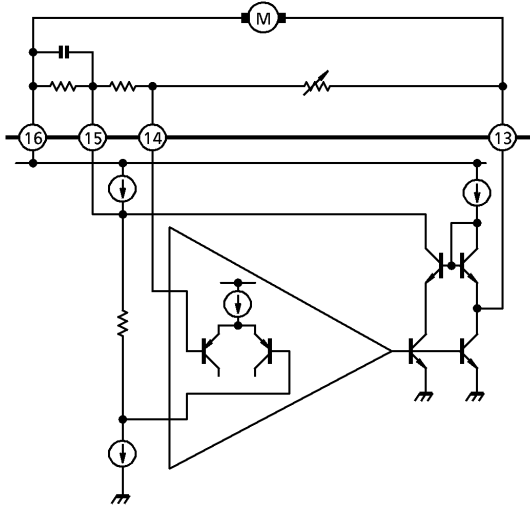
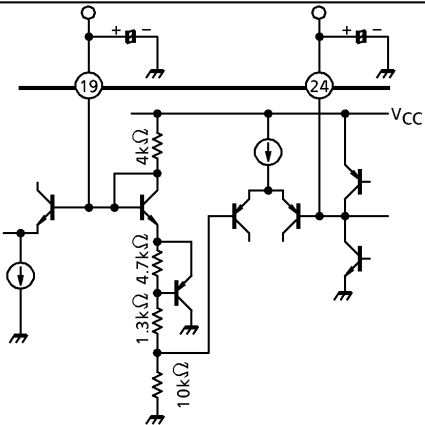
BLOCK DIAGRAM



TERMINAL EXPLANATION

TERMINAL VOLTAGE : Typical terminal voltage at no signal with test circuit ($V_{CC} = 3\text{ V}$, $T_a = 25^\circ\text{C}$)

TERMINAL		FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)	
No.	NAME				
1	PRE GND	The GND, except for power drive stage and motor governer stage.	—	0	
2	IN _A	Input of preamplifier		1.2	
23	IN _B			1.2	
3	NF _A	NF of preamplifier			
22	NF _B				
4	PRE OUT _A	Output of preamplifier		1.2	
21	PRE OUT _B				
5	PW IN _A	Input of power amplifier		1.2	
20	PW IN _B				
6	V _{CTL}	The terminal of DC volume control ● This terminal can be used also for V _{LIM} terminal.		—	
18	V _{LIM}	The terminal of volume limiter level control ● This terminal can be used also for V _{CTL} terminal.		—	
7	OUT _B	Output of power amplifier		1.2	
8	OUT _A				
9	OUT _C				

TERMINAL		FUNCTION	INTERNAL CIRCUIT	TERMINAL VOLTAGE (V)
No.	NAME			
10	PW INC	Input of center amplifier		1.2
11	PW GND	GND for power drive stage	—	0
12	GVN GND	GND for motor governor stage	—	0
13	GVN OUT	Motor terminal		—
14	GVN CTL	The terminal of motor speed control		—
15	Rt	The terminal of amateur compensation resistor		—
16	GVN VCC	VCC for motor governor stage		3
17	VCC	VCC for preamplifier stage and power amplifier stage.	—	3
19	RF IN	Ripple filter of power supply		2.5
24	VREF	Reference voltage ● Preamplifier and power amplifier operate on this reference.		1.2

APPLICATION NOTE

1. V_{CC} and GND

This IC has two V_{CC} terminals and three GND terminals. Pattern layout should be designed carefully to reduce the common impedance.

 V_{CC}

V_{CC} (pin 17) : Preamplifier stage and power amplifier stage.

GVN V_{CC} (pin 16) : Motor governor stage.

GND

PRE GND (pin 1) : Preamplifier stage and power amplifier stage except the power drive stage.

PW GND (pin 11) : Power drive stage of power amplifier.

GVN GND (pin 12) : Motor governor stage.

2. V_{REF}

It is necessary to stabilize the V_{REF} circuit, the internal circuit operate on this reference.

3. Preamplifier

Input signal should be applied to V_{REF} standard, otherwise pop noise become bigger when V_{CC} is turned on and off.

4. Power amplifier

It is necessary to insert the coupling capacitor through the PW IN terminal. In case that DC current or DC voltage is applied to the PW IN terminal, the internal circuit has unbalance and the power amplifier doesn't operate normally.

MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	4	V
Power Dissipation	P_D	(Note 1) 400	mW
		(Note 2) 925	
Output Current (PW AMP.)	I_O (PW)	200	mA
Output Current (GVN)	I_O (GVN)	700	mA
Operating Temperature	T_{opr}	- 25~75	$^\circ\text{C}$
Storage Temperature	T_{stg}	- 55~150	$^\circ\text{C}$

(Note 1) IC only : Derated above $T_a = 25^\circ\text{C}$ in the proportion $3.2\text{ mW}/^\circ\text{C}$

(Note 2) IC + PCB (TOSHIBA typical PCB) : Derated above $T_a = 25^\circ\text{C}$ in the proportion $7.4\text{ mW}/^\circ\text{C}$

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $V_{CC} = 3\text{ V}$, $T_a = 25^\circ\text{C}$, $f = 1\text{ kHz}$, SW2 : a, SW5 : a

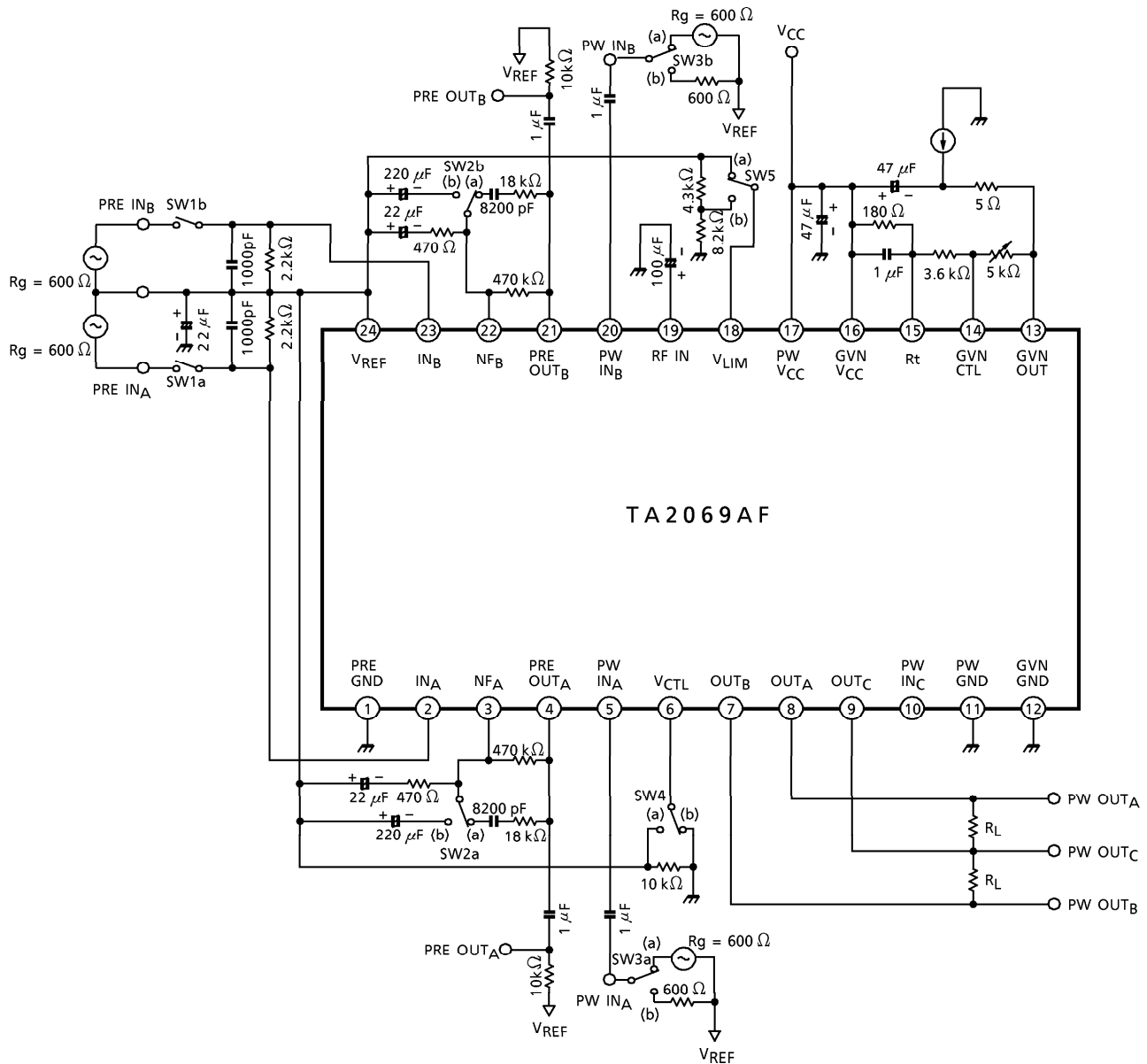
Preamplifier : $R_g = 2.2\text{ k}\Omega$, $R_L = 10\text{ k}\Omega$, SW1 : ON, SW3 : b, SW4 : b

Power amplifier : $R_g = 600\ \Omega$, $R_L = 16\ \Omega$, VOL : MAX, SW1 : OPEN, SW3 : a, SW4 : a

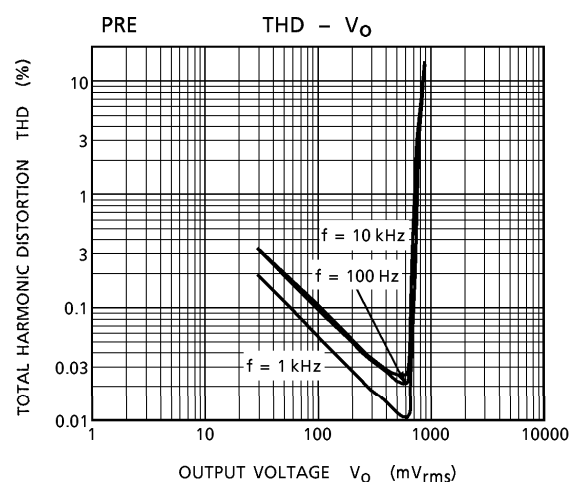
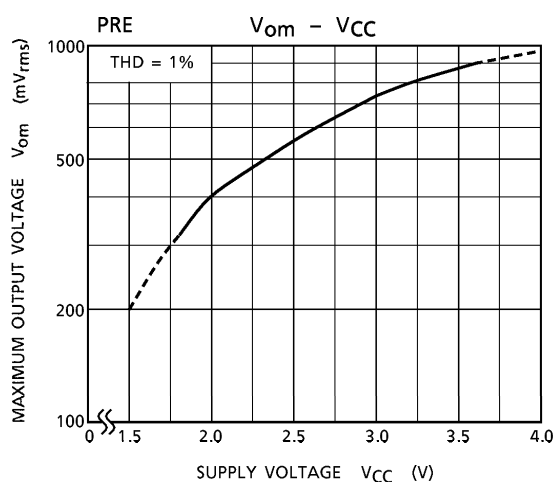
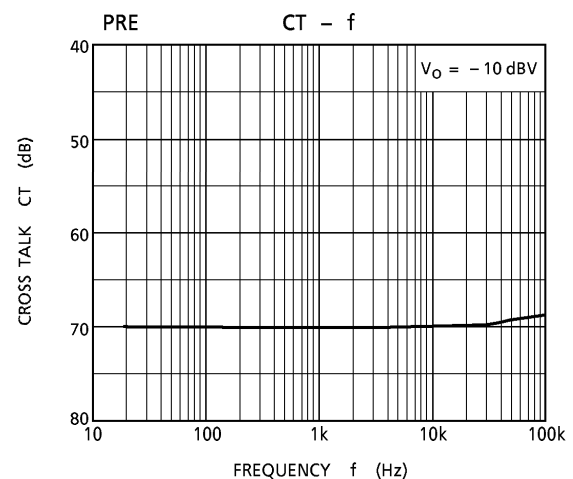
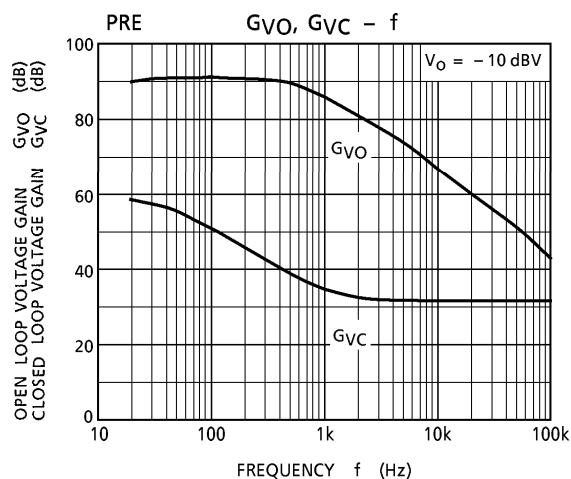
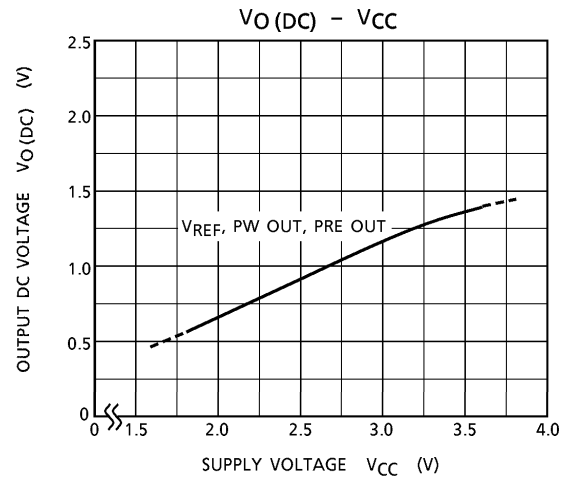
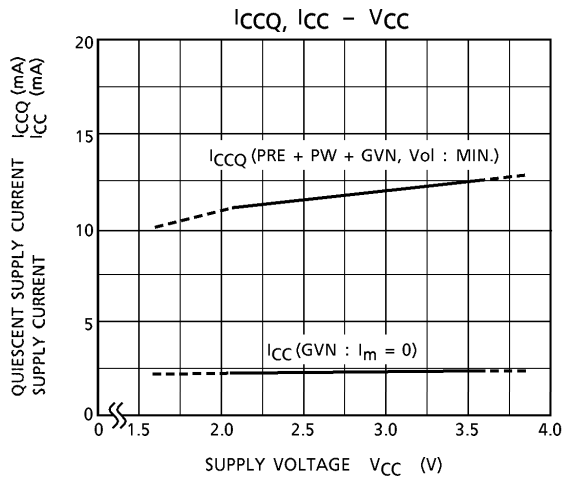
Motor governor : $I_m = 100\text{ mA}$, SW1 : OPEN, SW3 : b, SW4 : b

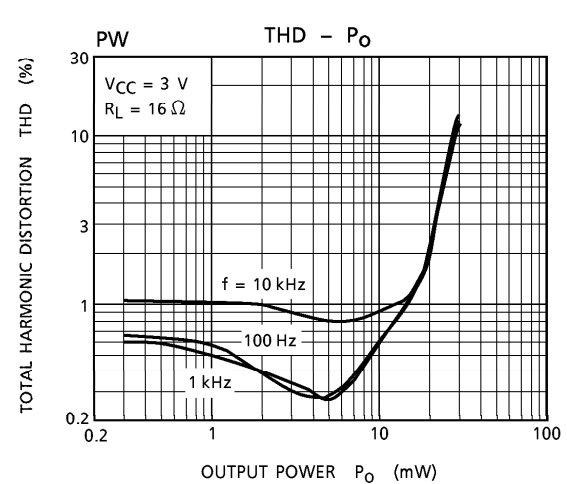
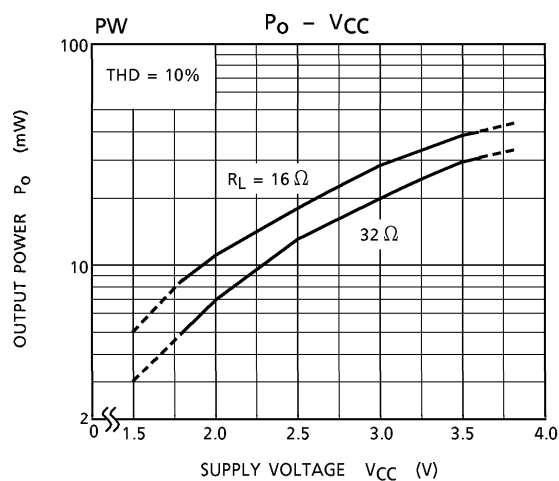
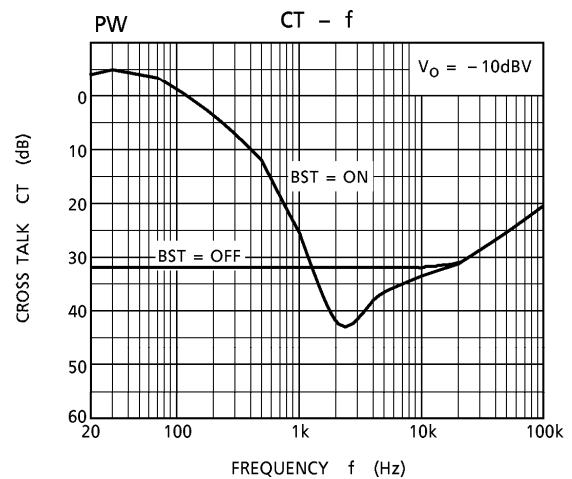
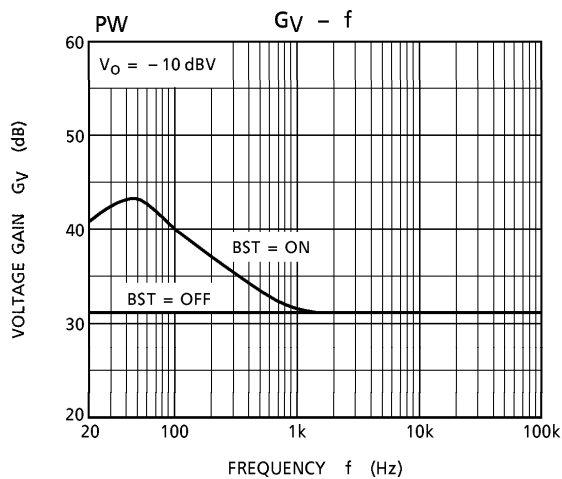
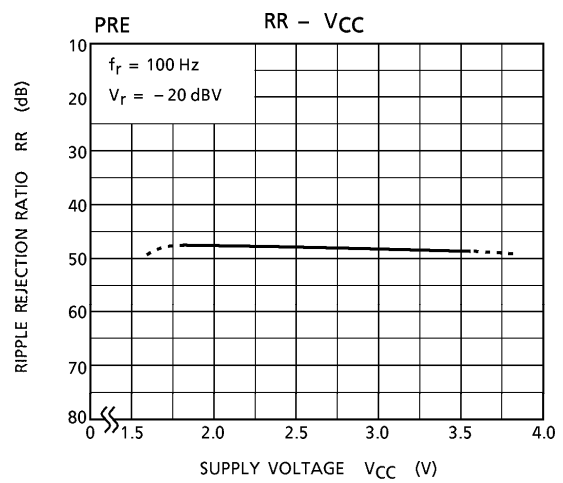
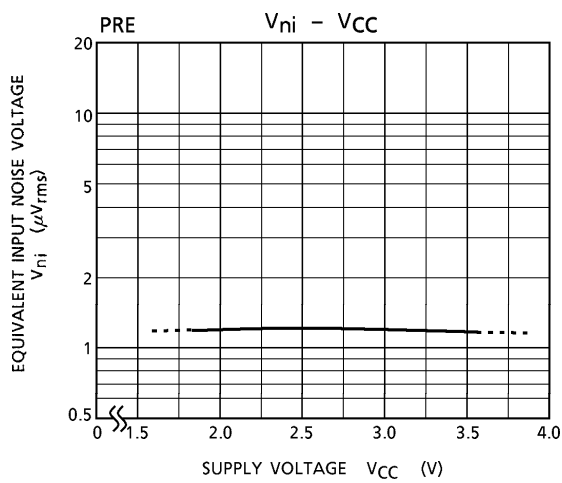
	CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
	Quiescent Supply Current	I_{CCQ}	—	PRE + PW + GVN $V_{in} = 0$, VOL : MIN, SW4 : b	—	12	18	mA
PRE AMP.	Open Loop Voltage Gain	G_{VO}	—	$V_O = -10\text{ dBV}$, SW2 : b	—	86	—	dB
	Closed Loop Voltage Gain	G_{VC}	—	$V_O = -10\text{ dBV}$	—	35	—	dB
	Maximum Output Voltage	V_{om}	—	THD = 1%	550	720	—	mV _{rms}
	Total Harmonic Distortion	THD1	—	$V_O = -10\text{ dBV}$	—	0.02	0.3	%
	Equivalent Input Noise Voltage	V_{ni}	—	$R_g = 2.2\text{ k}\Omega$, SW1 : OPEN BPF = 20 Hz~20 kHz, NAB (G_V = 35 dB, $f = 1\text{ kHz}$)	—	1.2	2.4	μV_{rms}
	Cross Talk	CT1	—	$V_O = -10\text{ dBV}$	—	70	—	dB
	Ripple Rejection Ratio	RR1	—	$f_r = 100\text{ Hz}$, $V_r = -20\text{ dBV}$	—	48	—	dB
POWER AMP.	Voltage Gain 1	G_{V1}	—	$V_O = -10\text{ dBV}$	29	31	33	dB
	Channel Balance	CB	—		-1.5	0	+1.5	dB
	Voltage Gain 2	G_{V2}	—	$V_O = -10\text{ dBV}$, SW5 : b	—	5	—	dB
	Output Power 1	P_{O1}	—	$R_L = 16\ \Omega$, THD = 10%	17	28	—	mW
	Output Power 2	P_{O2}	—	$R_L = 32\ \Omega$, THD = 10%	—	20	—	mW
	Total Harmonic Distortion	THD2	—	$P_O = 1\text{ mW}$	—	0.5	—	%
	Output Noise Voltage 1	V_{no1}	—	$R_g = 600\ \Omega$, SW3 : b BPF = 20 Hz~20 kHz	—	270	400	μV_{rms}
	Output Noise Voltage 2	V_{no2}	—	$R_g = 600\ \Omega$, SW3 : b SW5 : b, BPF = 20 Hz~20 kHz	—	45	—	μV_{rms}
	Ripple Rejection Ratio	RR2	—	$f_r = 100\text{ Hz}$, $V_r = -20\text{ dBV}$	—	52	—	dB
	Cross Talk	CT2	—	$V_O = -10\text{ dBV}$	—	32	—	dB
	DC Volume Maximum Attenuation	ATT	—	$V_O = -10\text{ dBV}$ SW4 : a→b (VOL : MAX→MIN)	—	82	—	dB
	Supply Current	I_{CC}	—	$I_m = 0$	—	2.5	4.3	mA
MOTOR GOVERNOR	Saturation Voltage	$V_{CE(sat)}$	—	$I_m = 200\text{ mA}$	—	—	0.5	V
	Reference Voltage	V_{REF}	—	$I_m = 100\text{ mA}$	0.76	0.81	0.86	V
	Reference Voltage Fluctuation 1	ΔV_{REF1}	—	$V_{CC} = 2.1\sim 3.6\text{ V}$	—	0.25	—	% / V
	Reference Voltage Fluctuation 2	ΔV_{REF2}	—	$I_m = 25\sim 250\text{ mA}$	—	0.003	—	% / mA
	Reference Voltage Fluctuation 3	ΔV_{REF3}	—	$T_a = -25\sim 75^\circ\text{C}$	—	0.005	—	% / $^\circ\text{C}$
	Current Ratio	K	—		34.5	37.5	40.5	
	Current Ratio Fluctuation 1	$\Delta K1$	—	$V_{CC} = 2.1\sim 3.6\text{ V}$	—	0.25	—	% / V
	Current Ratio Fluctuation 2	$\Delta K2$	—	$I_m = 25\sim 250\text{ mA}$	—	0.08	—	% / mA
	Current Ratio Fluctuation 3	$\Delta K3$	—	$T_a = -25\sim 75^\circ\text{C}$	—	0.005	—	% / $^\circ\text{C}$

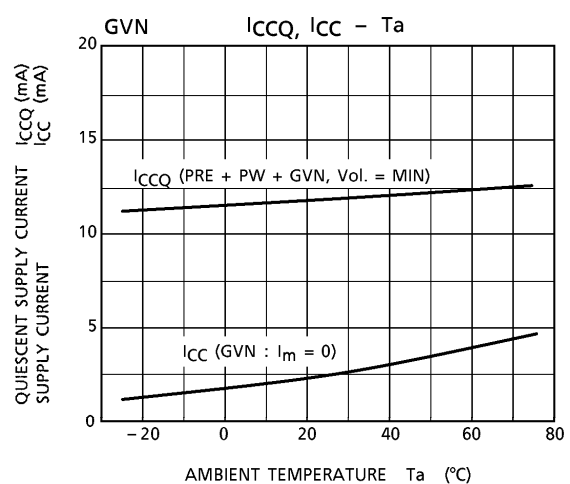
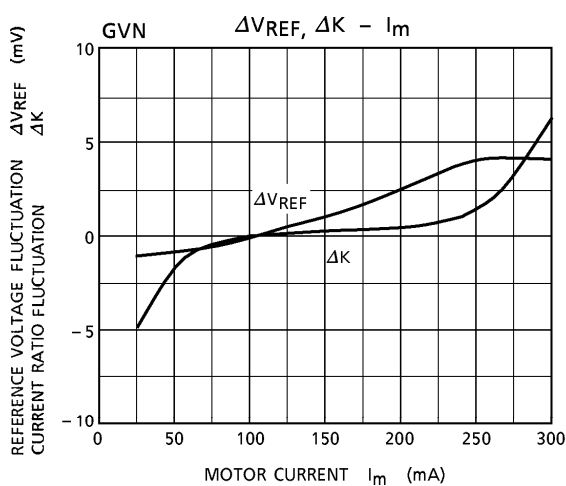
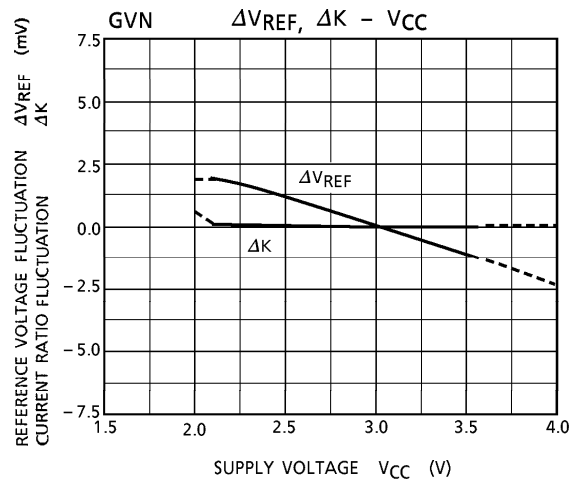
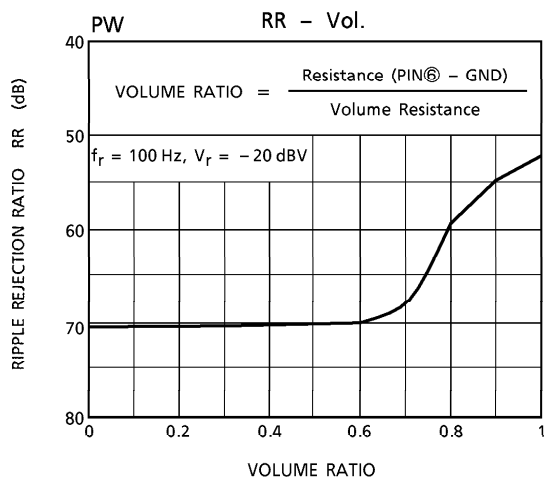
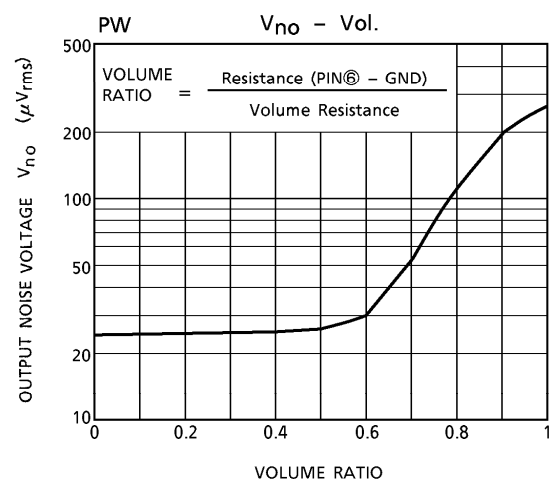
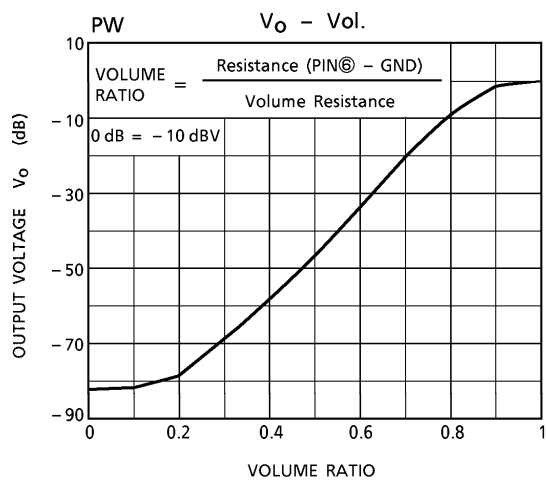
TEST CIRCUIT

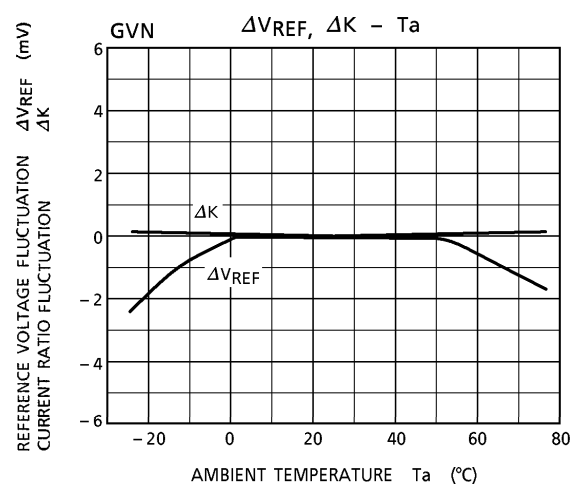
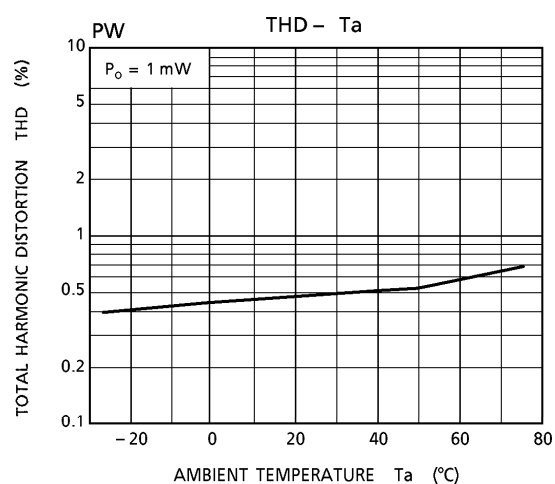
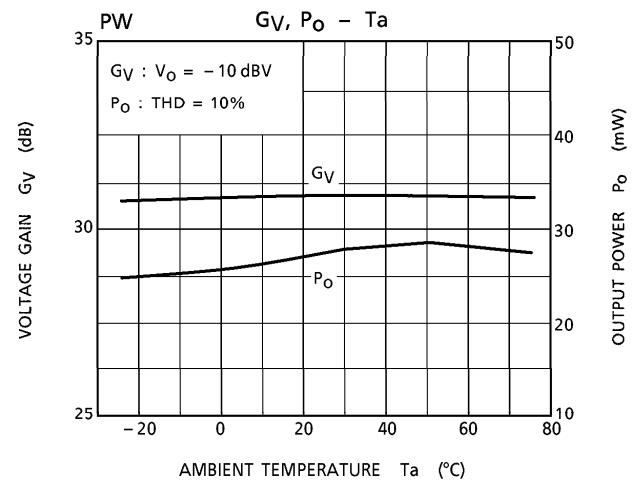
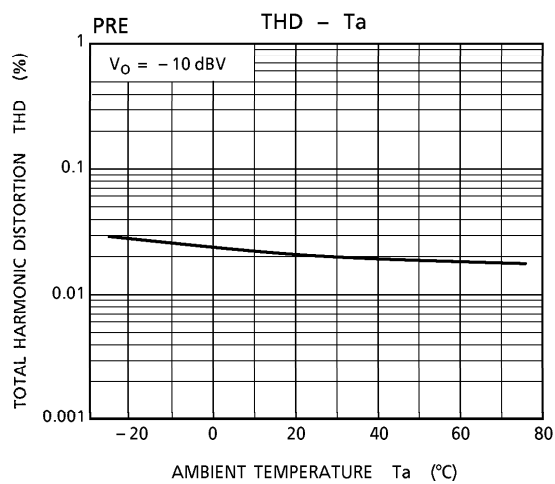
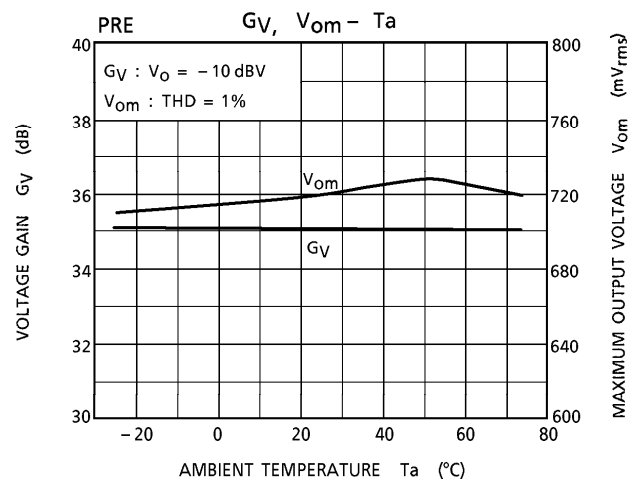
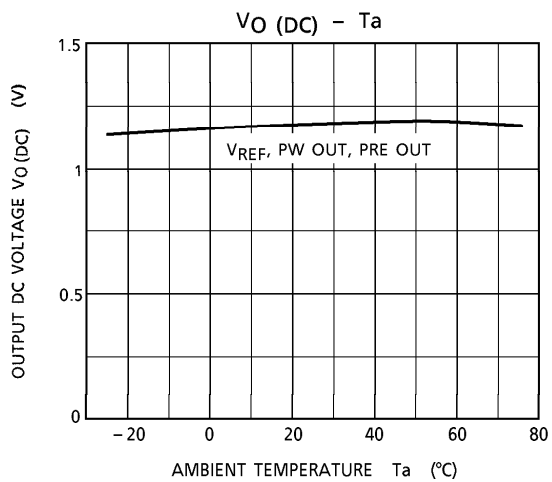


CHARACTERISTIC CURVES

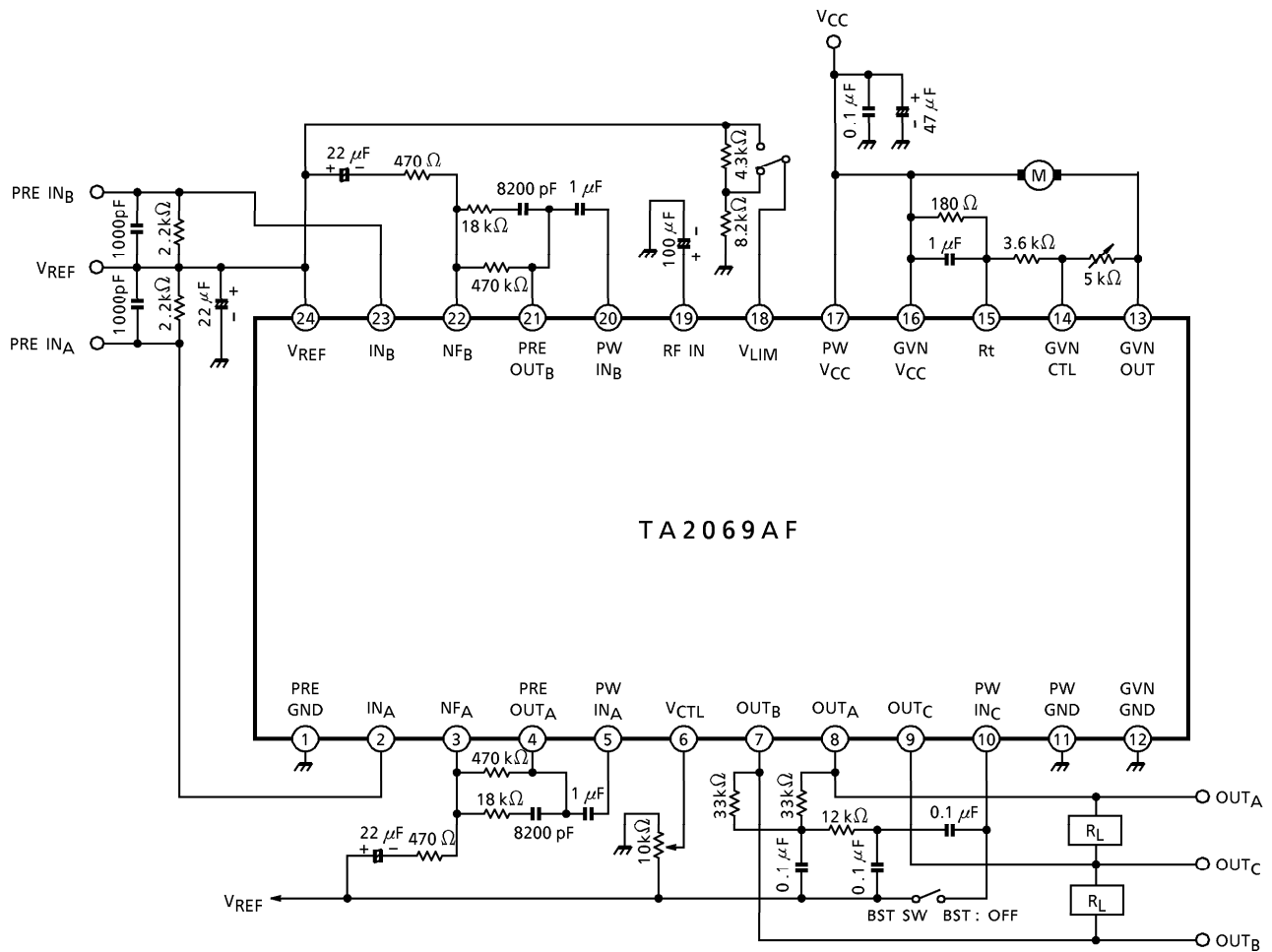
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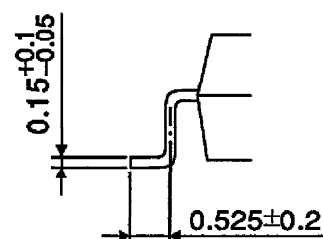
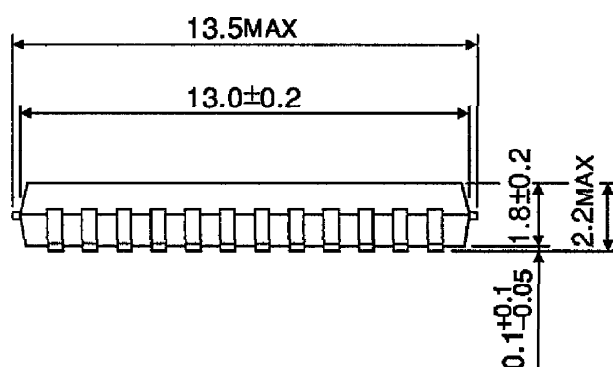
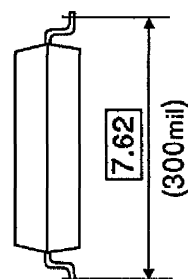
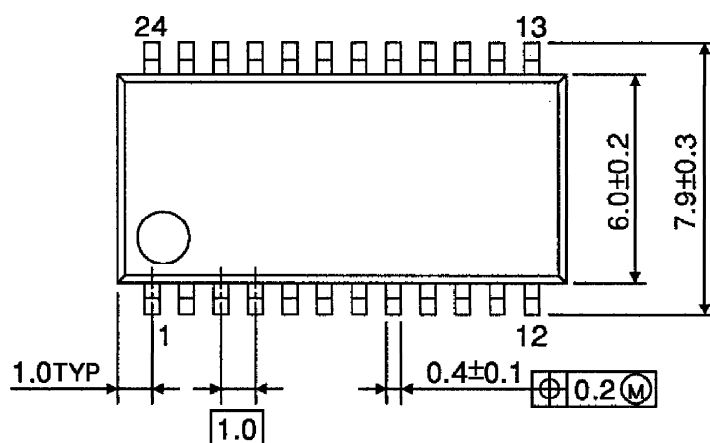


APPLICATION NOTE



PACKAGE DIMENSIONS
SSOP24-P-300-1.00

Unit : mm



Weight : 0.32 g (Typ.)