

**TA7688P**  
**TA7688F**

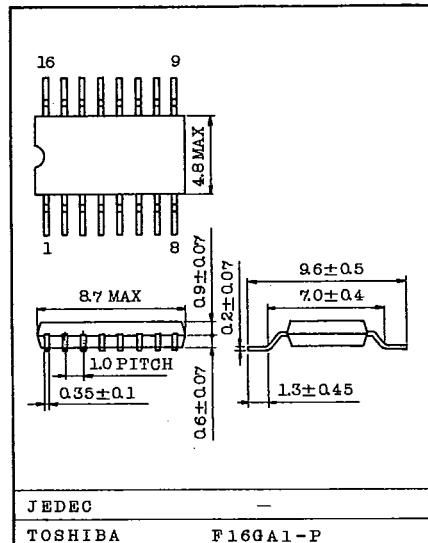
T-77-21

**DUAL HEADPHONE DRIVER (3V USE)**

The TA7688F/P are dual headphone driver ICS designed for portable cassette player applications.

- . Flat Package 16 pin (TA7688F), DIP 16 pin (TA7688P)
- . Small Installed Area and Few External Parts
- . Low Supply Current :  $I_{CCQ}=7\text{mA}$  (Typ.) at 3V
- . Built-in Ripple Filter
- . Built-in Power OFF Circuit
- . Operating Supply Voltage Range :  $V_{CC(\text{opr})}=1.8\sim 6\text{V}$
- . Recommended Supply Voltage :  $V_{CC}=3\text{V}$

Unit in mm

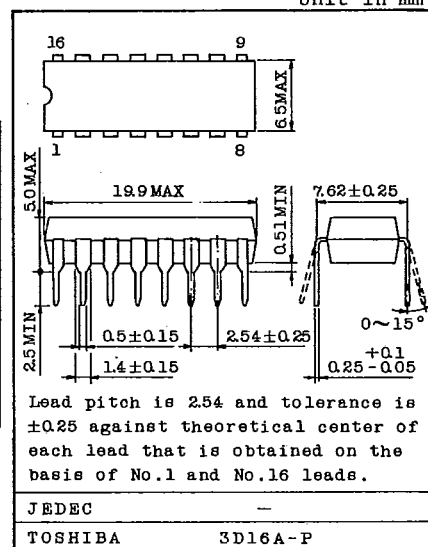


**MAXIMUM RATINGS (Ta=25°C)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	7	V
Output Current	I <sub>O</sub>	160/ch	mA
Filter Output Current	I <sub>r</sub>	10	mA
Power Dissipation (Note)	TA7688P	750	mW
	TA7688F	350	
Operating Temperature	T <sub>opr</sub>	-25 ~ 75	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ 150	°C

Note : Derated above Ta=25°C in the proportion of 6mW/°C for TA7688P and of 2.8mW/°C for TA7688F.

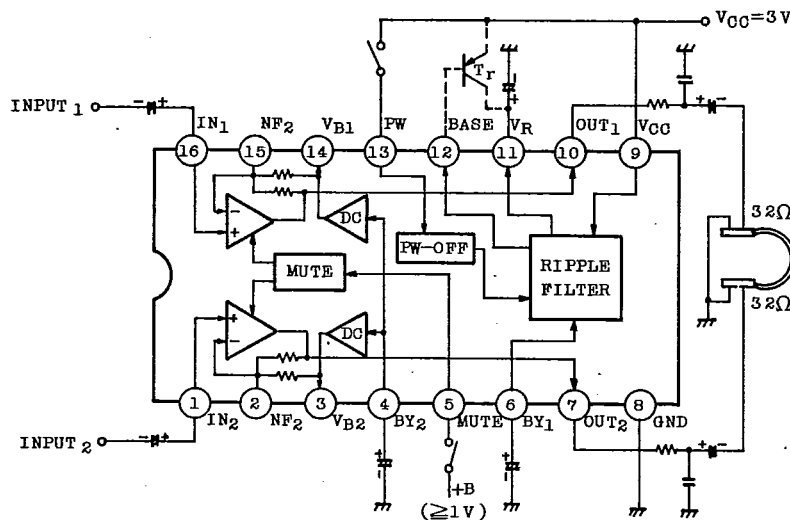
Unit in mm



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## BLOCK DIAGRAM



Dot Line is an additional circuit to boost the stabilized current. (Option)

## ELECTRICAL CHARACTERISTICS

1. DC CHARACTERISTICS ( $T_a=25^{\circ}\text{C}$ ,  $V_{CC}=3\text{V}$ ,  
Terminal Voltage at No Signal)

ITEM	SYMBOL	RATING	UNIT
Terminal 1 (IN <sub>2</sub> )	V <sub>1</sub>	1.5	V
2 (V <sub>B2</sub> )	V <sub>2</sub>	1.5	V
3 (NF <sub>2</sub> )	V <sub>3</sub>	1.5	V
4 (BYPASS <sub>2</sub> )	V <sub>4</sub>	1.5	V
5 (MUTE)	V <sub>5</sub>	0	V
6 (BYPASS <sub>1</sub> )	V <sub>6</sub>	2.2	V
7 (OUT <sub>2</sub> )	V <sub>7</sub>	1.5	V
8 (GND)	V <sub>8</sub>	0	V
9 (V <sub>CC</sub> )	V <sub>9</sub>	3.0	V
10 (OUT <sub>1</sub> )	V <sub>10</sub>	1.5	V
11 (V <sub>stb</sub> )	V <sub>11</sub>	2.3	V
12 (BASE)	V <sub>12</sub>	2.2	V
13 (PW ON/OFF)	V <sub>13</sub>	3.0	V
14 (V <sub>B1</sub> )	V <sub>14</sub>	1.5	V
15 (NF <sub>1</sub> )	V <sub>15</sub>	1.5	V
16 (IN <sub>1</sub> )	V <sub>16</sub>	1.5	V

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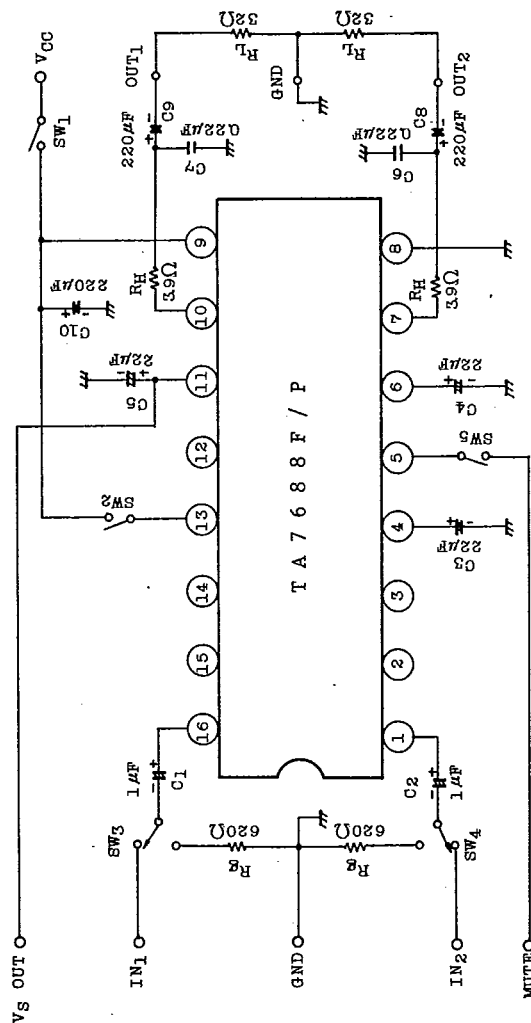
# TA7688F

2. AC CHARACTERISTICS (Unless otherwise specified,  $T_a=25^{\circ}\text{C}$ ,  $V_{CC}=3\text{V}$ ,  $R_g=600\Omega$ ,  $f=1\text{kHz}$ )  
 $R_H=3.9\Omega$ ,  $R_L=32\Omega$ )

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current		$I_{CCQ(1)}$	-	$V_{IN}=0$	-	7	12	mA
		$I_{CCQ(2)}$	-	$V_{IN}=0$ , SW <sub>2</sub> :OFF	-	1	10	$\mu\text{A}$
Output Power		$P_{OUT(1)}$	-	THD=10%	20	27	-	mW
		$P_{OUT(2)}$	-	$R_L=16\Omega$ , THD=10%	-	38	-	
Total Harmonic Distortion		THD	-	$P_O=10\text{mW/ch}$	-	0.12	1.0	%
Closed Loop Voltage Gain		$G_V$	-	$V_{IN}=-40\text{dBm}$	28.5	30.5	32.5	dB
Channel Balance		$\Delta G_V$	-	$V_{IN}=-40\text{dBm}$	-	0	$\pm 1$	dB
Cross Talk		C.T.	-	$V_{OUT}=0\text{dBm}$ , ch1 $\leftrightarrow$ ch2	45	65	-	dB
Ripple Rejection	Headphone AMP	R.R.(1)	-	$f=1\text{kHz}$ , $V_{IN}=-20\text{dBm}$	30	45	-	dB
	Ripple Filter	R.R.(2)	-	$f=100\text{Hz}$ , $V_{IN}=-20\text{dBm}$	-	40	-	dB
Output Noise Voltage		$V_{NO}$	-	$\text{BW}=20\text{Hz} \sim 20\text{kHz}$	-	0.06	0.2	$\text{mV}_{\text{rms}}$
Input Resistance		$R_{IN}$	-	$f=1\text{kHz}$	15	20	25	$\text{k}\Omega$
Ripple Filter Output Voltage		$V_S(1)$	-	$V_{CC}=2\text{V}$ , $I_r=10\text{mA}$	1.45	1.6	-	V
		$V_S(2)$	-	$I_r=10\text{mA}$	2.1	2.3	2.5	
		$V_S(3)$	-	$V_{CC}=4.5\text{V}$ , $I_r=10\text{mA}$	-	3.4	-	
Muting Attenuation		ATT	-	$V_{MUTE}=3\text{V}$ ( $0\text{dB}=240\text{mV}_{\text{rms}}$ )	60	80	-	dB
Muting Input Voltage		$V_{MUTE}$	-	ATT $\geq 50\text{dB}$ ( $0\text{dB}=240\text{mV}_{\text{rms}}$ )	-	0.7	1.0	V
Muting Input Current		$I_{MUTE}$	-	ATT $\geq 50\text{dB}$ ( $0\text{dB}=240\text{mV}_{\text{rms}}$ )	-	35	-	$\mu\text{A}$
Ripple Filter Current		$I_B$	-	-	-	0.05	-	mA

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TEST CIRCUIT



Note : RH : Protection resistance

C6 & C7 : Tantalum Capacitor or Polyester Film Capacitor

C5 : Tantalum Capacitor

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## APPLICATION

### 1. VOLTAGE GAIN ADJUSTMENT

The closed loop Voltage gain  $G_v$  is determined by the ratio of  $R_1$  and  $R_2$  shown in Fig. 1.

$$G_v = 20 \log \frac{R_1 + R_2}{R_2} = 32 \text{dB}, \quad R_1 = 33 \text{k}\Omega$$

$$R_2 = 820 \Omega$$

But the actual value is 30.5dB because of influence of the other circuit.

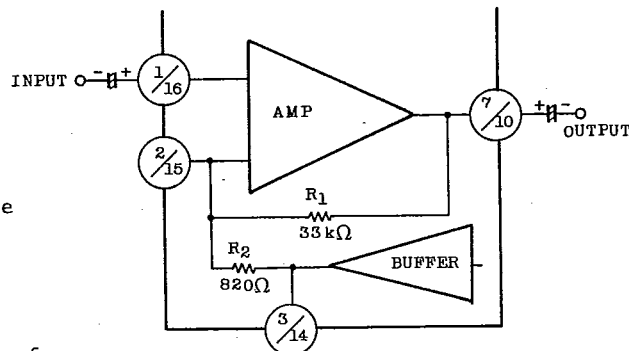
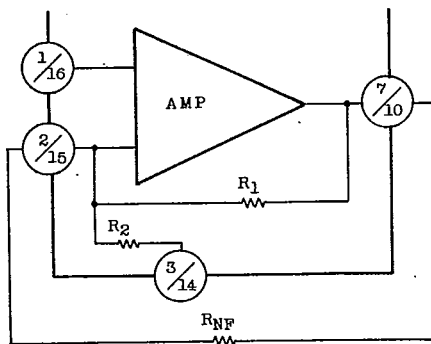


Fig. 1.

Fig. 2 shows the application circuit of higher or lower gain than recommended one.

(1)  $G_v < 30 \text{dB}$



(2)  $G_v > 30 \text{dB}$

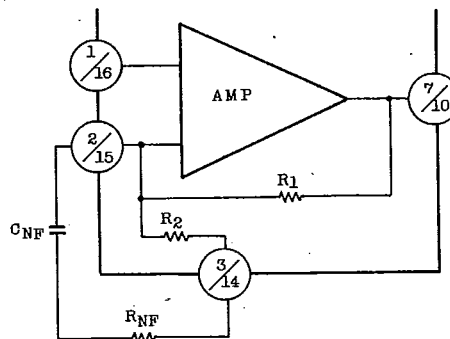


Fig. 2

In the case of  $G_v < 30 \text{dB}$ , it happens to oscillate by phase delay at high frequency. So this IC is not available at  $G_v < 30 \text{dB}$ . In the case of  $G_v > 30 \text{dB}$ , input offset is amplified, so that output DC voltage differs from center voltage. The unsymmetrical clipping wave is prevented by inserting capacitor  $C_{NF}$ . Therefore this IC is available at  $G_v > 30 \text{dB}$  by using  $C_{NF}$ . It is recommended to check pop noise based on  $C_{NF}$ .

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## 2. MUTING

Muting operates when the voltage is applied to pin 5 or the current is flowed into pin 5. Supply current is about half at muting ON. It is necessary that muting drive current  $I_{MUTE}$  is less than  $150\mu A$ .

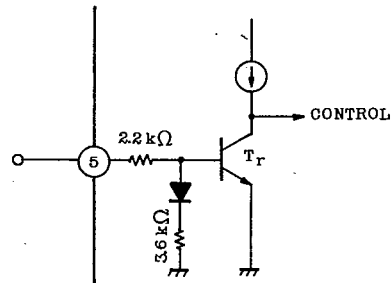


Fig. 3.

## 3. OSCILLATION PRECAUTION

- (1) Oscillation preventing capacitor between output pin and GND is recommended to use capacitor with less temperature drift. So suitable capacitor is not celamic or electrolytic capacitor, but tantalum or polyester film capacitor. When protector resistor  $3.9\Omega$  is rejected, output power increases.

In this case, it is necessary to insert  $3.9\Omega$  as shown in Fig. 4. When  $R_L=0$ , output current is very large in the circuit.

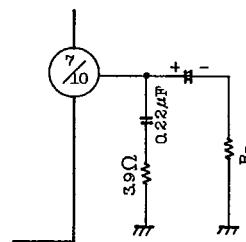


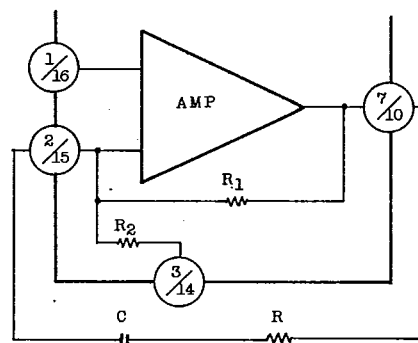
Fig. 4.

- (2) It is necessary to use tantalum capacitor at Pin 11 ( $22\mu F$ ).
- (3) Decoupling Capacitor  $C_{10}$  is necessary to be near the pin 9.

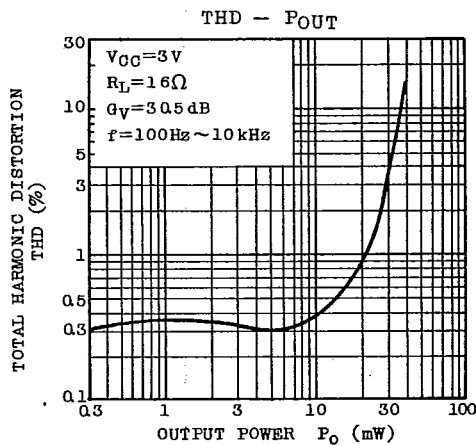
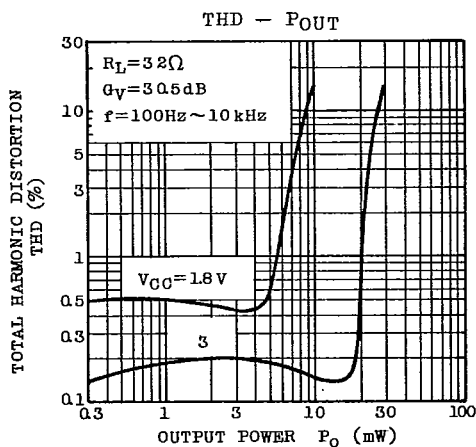
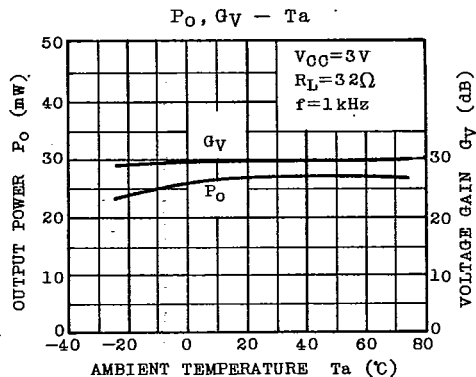
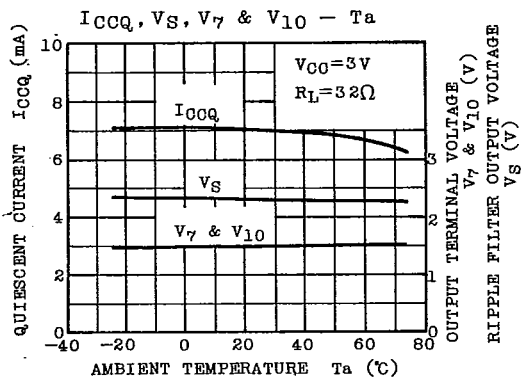
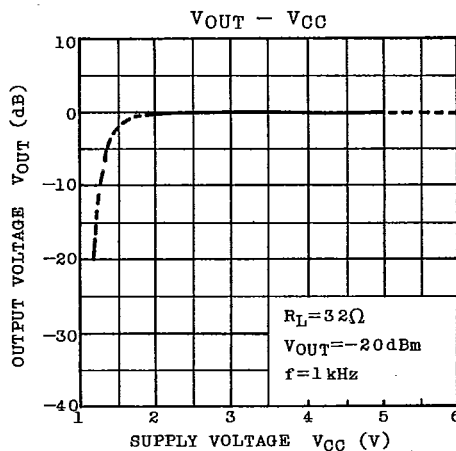
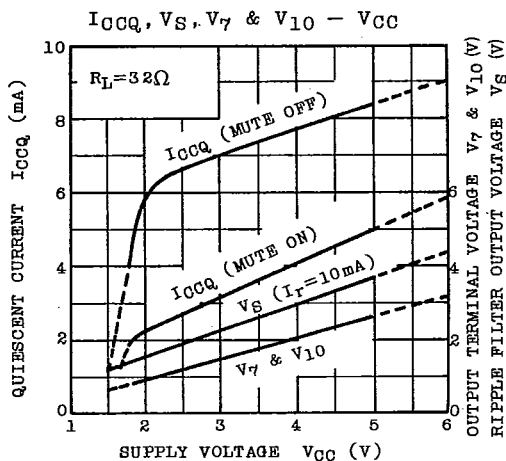
## 4. RADIATION PRECAUTION

Because of wide band (about 200kHz), the radiation from the amplifier degrade S/N at radio. As shown in Fig. 5, it recommended to limit the band by C and R. In this case, phase compensation check is necessary.

When  $C=100pF$ ,  $R=15k\Omega$ ,  
 $f_{HC}$  is  $30k\Omega \sim 50kHz$ .

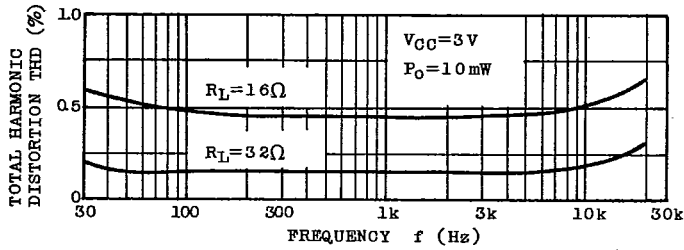


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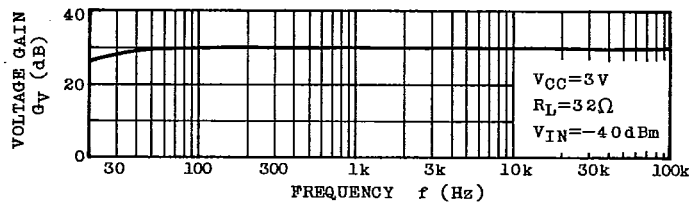


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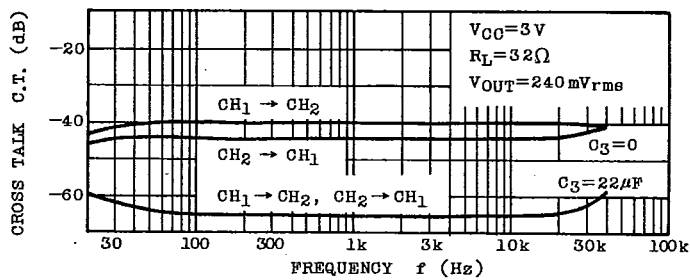
THD - f



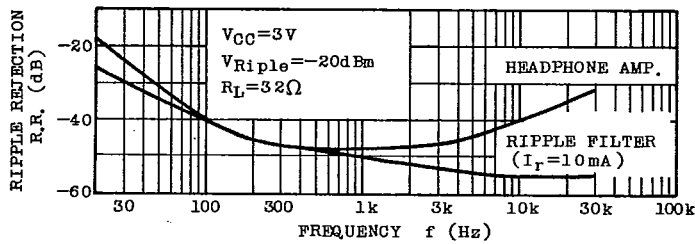
$G_v - f$



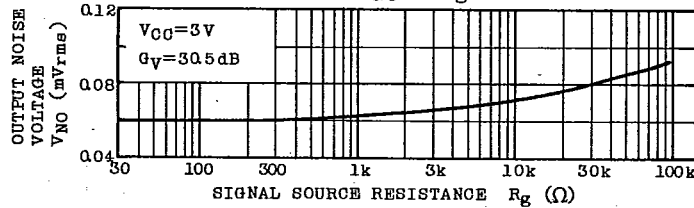
C.T. - f



R.R. - f



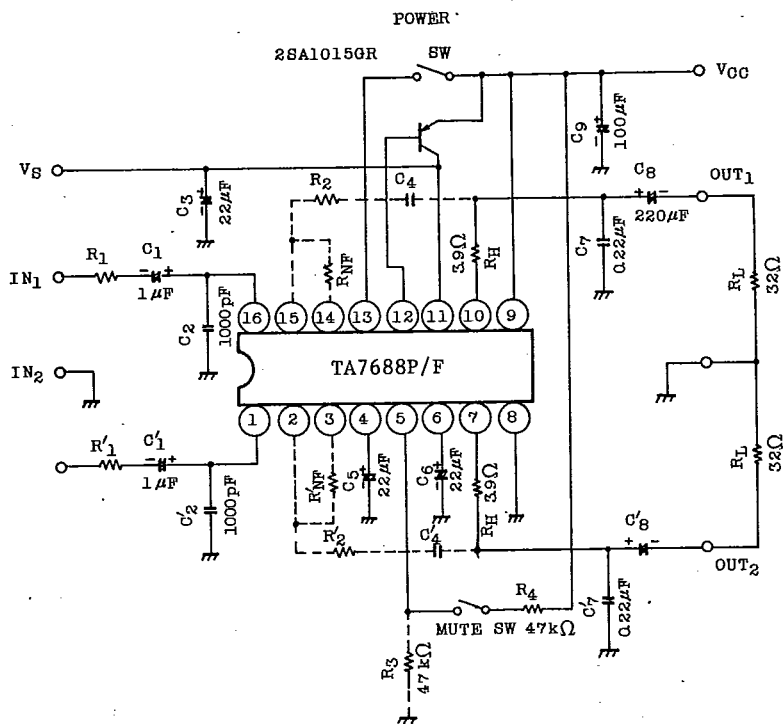
$V_{NO} - R_g$





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APPLICATION



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9097247 TOSHIBA, ELECTRONIC

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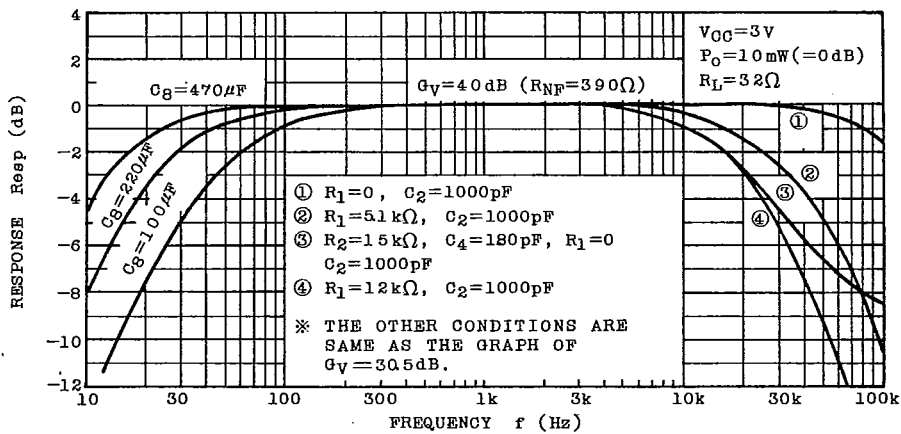
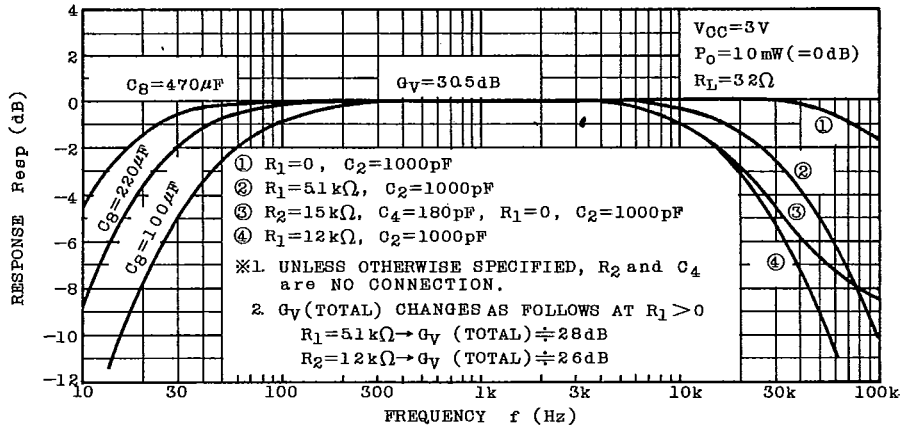
EXTERNAL PARTS TABLE (Mention only CH<sub>1</sub>)

PARTS No.	TYPICAL	PURPOSE	INFLUENCE		NOTE
			SMALLER THAN TYP.	GREATER THAN TYP.	
C <sub>1</sub>	1 $\mu$ F	Coupling	Bad low frequency response	"Pop" Noise is high	Input
C <sub>2</sub>	1000pF	L.P.F.	$f_{CH} = \frac{1}{2\pi C_2(R_1 // Z_{in})}$		Noise receiving protection
R <sub>1</sub>					-3dB(20kHz) at R <sub>1</sub> =12k $\Omega$
C <sub>3</sub>	22 $\mu$ F	Decoupling for V <sub>S</sub>	Stability (OSC) decreases V <sub>NO</sub> at V <sub>S</sub> increases	(It is better to connect to input side GND)	Use tantalum capacitor
R <sub>NF</sub>		G <sub>v</sub> Adjustment	Not available at G <sub>v</sub> < 30dB If necessary devide at input level by resistors		
R <sub>2</sub>	(15k $\Omega$ )	f-response control, THD improvement at hgh freq.	-3dB point is 20kHz. Check ringing at clip by OSC margine down.		Low OSC margine at G <sub>v</sub> < 40dB
C <sub>4</sub>	(180pF)				
C <sub>5</sub>	22 $\mu$ F	Bypass capacitor for bias	THD and V <sub>NO</sub> Degradation		It is better to connect to input side GND
C <sub>6</sub>	22 $\mu$ F	Bypass capacitor for ripple filter	Ripple rejection ratio degradation		It is better to connect to output side GND
R <sub>3</sub>	47k $\Omega$	Pull down resistor at mute pin	I <sub>CC</sub> increases at mute ON	Pull dwon effect down	Additional resistor at long pattern only
R <sub>4</sub>	47k $\Omega$	I <sub>MUTE</sub> limiter	I <sub>MUTE</sub> increases (Unnecessary at V <sub>CC</sub> =3V)	I <sub>MUTE</sub> decreases	I <sub>MUTE</sub> < 150 $\mu$ A
R <sub>H</sub>	3.9 $\Omega$	Protection resistance. Phase compensation	Rush current increases. Phase compensation is out	Output decreases. Phase compensation is out	CR filter with C <sub>7</sub>
C <sub>7</sub>	0.22 $\mu$ F	Phase compensation	Oscillation	THD degradation by load capacitance	Recommended to use tantalum or film capacitor
C <sub>8</sub>	220 $\mu$ F	Coupling	Bad low frequency response	"Pop" noise is high	Output
C <sub>9</sub>	100 $\mu$ F	V <sub>CC</sub> decoupling	Oscillation margin decreases		Necessary to be near pin 9
T <sub>r</sub>	2CA1015GR	Booster for V <sub>S</sub>			To be added at I <sub>r</sub> > 10mA

TOSHIBA

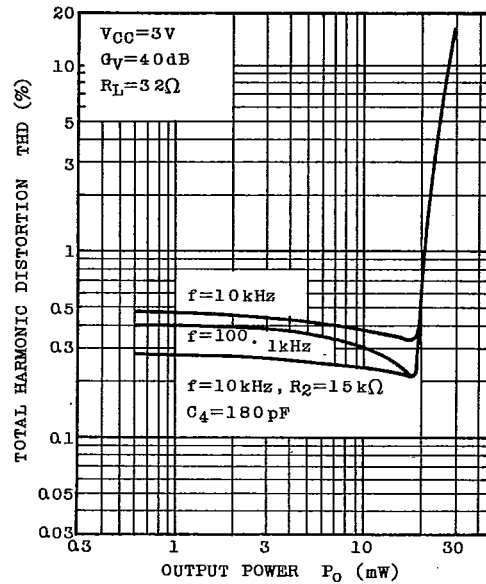
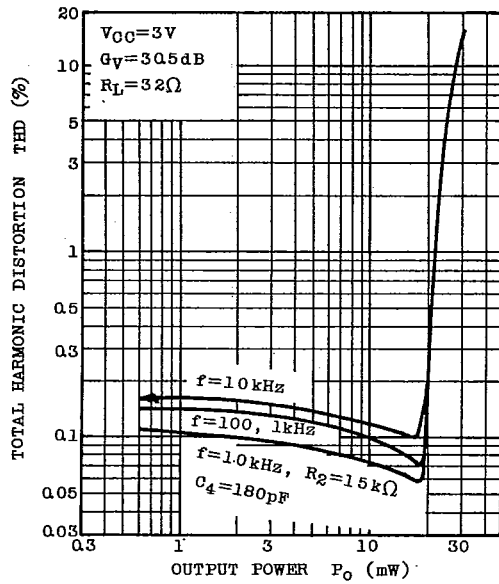
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1. f - Resp (Mention Only CH<sub>1</sub>)



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2.  $P_o$  - THD (Correspond to 1. f - Resp)



3.  $I_r$  -  $V_s$

