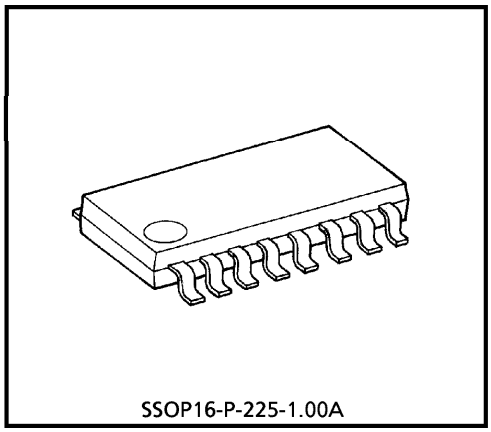
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA7688F

STEREO HEADPHONE AMPLIFIER (3V USE)

The TA7688F is a stereo headphone power amplifier IC designed for portable cassette player applications.



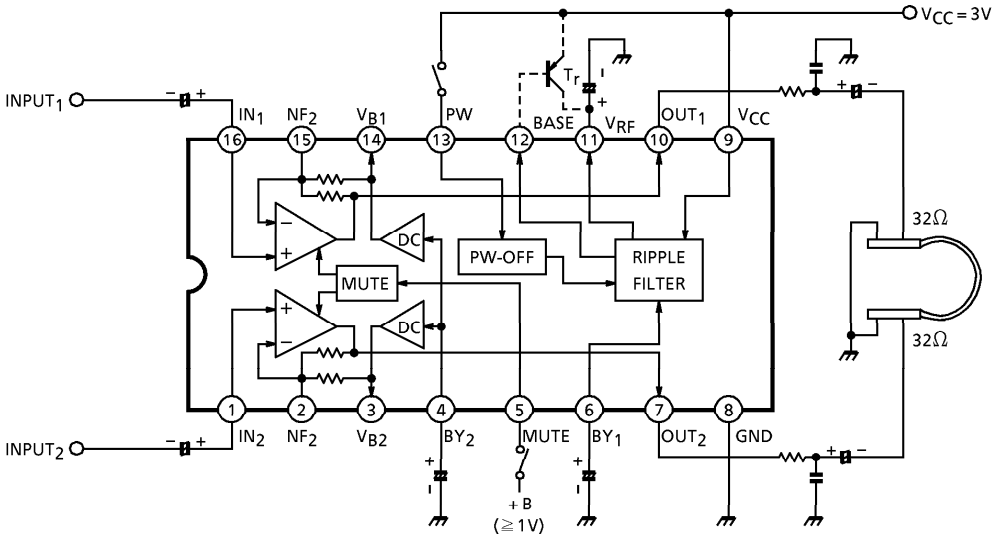
SSOP16-P-225-1.00A

Weight : 0.14g (Typ.)

FEATURES

- Small installed area and few external parts
- Low supply current : I_{CCQ} = 7mA (Typ.) at 3V
- Built-in a ripple filter
- Built-in a power amplifier mute
- Built-in a power off circuit
- Operating supply voltage range : $V_{CC\,(opr)}$ = 1.8~5V
- Recommended supply voltage : V_{CC} = 3V
- The standard model is TA7688F (SO)

BLOCK DIAGRAM



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

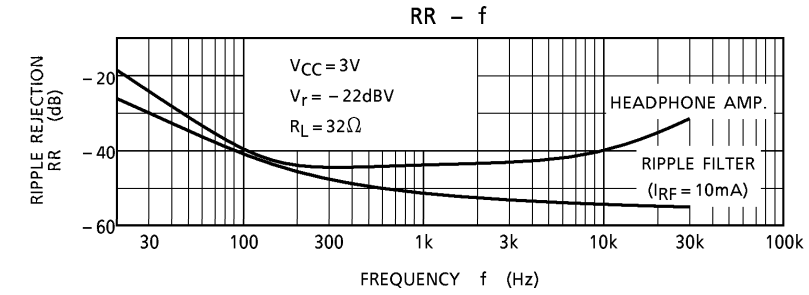
ELECTRICAL CHARACTERISTICS

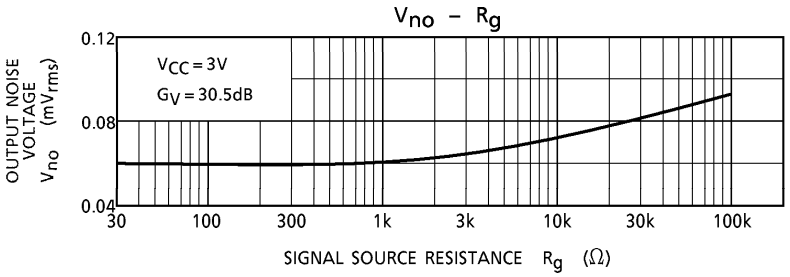
1. AC characteristics (Unless otherwise specified, Ta = 25°C, V_{CC} = 3V, R_g = 600Ω, f = 1kHz, R_H = 3.9Ω, R_L = 32Ω)

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_2 : OFF	—	1	10	μA
Output Power		P_O (1)	—	THD = 10%	20	27	—	mW
		P_O (2)		R_L = 16Ω, THD = 10%	—	38	—	
Total Harmonic Distortion		THD	—	P_O = 10mW / ch	—	0.12	1.0	%
Closed Loop Voltage Gain		G_V	—	V_{in} = − 42dBV	28.5	30.5	32.5	dB
Channel Balance		ΔG_V	—	V_{in} = − 42dBV	—	0	± 1	dB
Cross Talk		CT	—	V_O = − 2dBV, ch1↔ch2	45	65	—	dB
Ripple Rejection	Headphone AMP	RR (1)	—	f_r = 1kHz, V_r = − 22dBV	30	45	—	dB
	Ripple Filter	RR (2)	—	f_r = 100Hz, V_r = − 22dBV	—	40	—	dB
Output Noise Voltage		V_{no}	—	BPF = 20Hz~20kHz	—	0.06	0.2	mV_{rms}
Input Resistance		R_{IN}	—	f = 1kHz	15	20	25	kΩ
Ripple Filter Output Voltage		V_{RF} (1)	—	V_{CC} = 2V, I_{RF} = 10mA	1.45	1.6	—	V
		V_{RF} (2)		I_{RF} = 10mA	2.1	2.3	2.5	
		V_{RF} (3)		V_{CC} = 4.5V, I_{RF} = 10mA	—	3.4	—	
Muting Attenuation		ATT	—	V_{MUTE} = 3V (0dB = 240mV_{rms})	60	80	—	dB
Muting Input Voltage		V_{MUTE}	—	ATT ≧ 50dB (0dB = 240mV_{rms})	—	0.7	1.0	V
Muting Input Current		I_{MUTE}	—	ATT ≧ 50dB (0dB = 240mV_{rms})	—	35	—	μA
Ripple Filter Current		I_B	—	—	—	0.05	—	mA

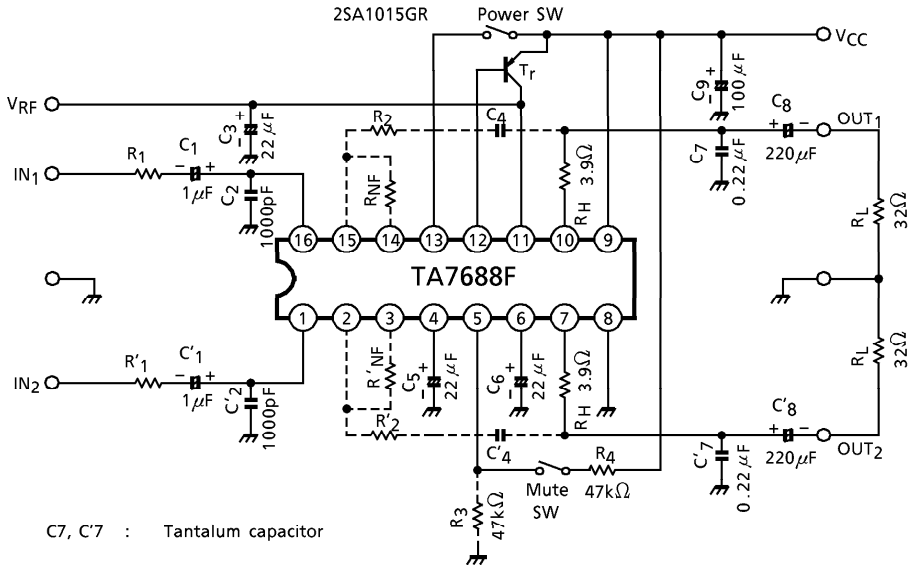
2. DC characteristics
(Ta = 25°C, V_{CC} = 3V, Terminal voltage at no signal)

ITEM	SYMBOL	RATING	UNIT
Terminal 1 (IN_2)	V_1	1.5	V
2 (NF_2)	V_2	1.5	V
3 (V_{B2})	V_3	1.5	V
4 ($BYPASS_2$)	V_4	1.5	V
5 (MUTE)	V_5	0	V
6 ($BYPASS_1$)	V_6	2.2	V
7 (OUT_2)	V_7	1.5	V
8 (GND)	V_8	0	V
9 (V_{CC})	V_9	3.0	V
10 (OUT_1)	V_{10}	1.5	V
11 (V_{RF})	V_{11}	2.3	V
12 (BASE)	V_{12}	2.2	V
13 (PW ON / OFF)	V_{13}	3.0	V
14 (V_{B1})	V_{14}	1.5	V
15 (NF_1)	V_{15}	1.5	V
16 (IN_1)	V_{16}	1.5	V





APPLICATION CIRCUIT



EXTERNAL PARTS TABLE (Mention only CH_1)

PARTS No.	TYPICAL	PURPOSE	INFLUENCE		NOTE
			SMALLER THAN TYP.	GREATER THAN TYP.	
C_1	1μF	Coupling	Bad low frequency response	"P_{op}" noise is high.	Input
C_2	1000pF	LPF	$f_{CH} = \frac{1}{2\pi C_2 (R_1 // Z_{in})}$ – 3dB (30kHz) at R_1 = 5.6kΩ – 3dB (20kHz) at R_1 = 12kΩ		Noise receiving protection
R_1	—				Equivalent signal source impedance
C_3	22μF	Decoupling for V_{RF}	Stability (OSC) decreases, V_{no} at V_{RF} increases	(It is better to connect to input side GND)	Use tantalum capacitor
R_{NF}	—	G_V Adjustment	Not available at G_V<30dB If necessary devide at input level by resistors		—
R_2 (15kΩ) C_4 (180pF)		f-response control, THD imperovement at high freq.	– 3dB point is 20kHz. Check ringing at clip by OSC margine down.		Low OSC margine at G_V<40dB
C_5	22μF	Bypass capacitor for bias	THD and V_{no} Degradation	—	It is better to connect to input side GND.
C_6	22μF	Bypass capacitor for ripple filter	Ripple rejection ratio degradation	—	It is better to connect to output side GND.
R_3	47kΩ	Pull down resistor at mute pin	I_{CC} increases at mute ON	Pull down effect down	Additional resistor at long pattern only
R_4	47kΩ	I_{MUTE} limiter	I_{MUTE} increases (Unnecessary at V_{CC} = 3V)	I_{MUTE} decreases	I_{MUTE}<150μA
R_H	3.9Ω	Protection resistance. Phase compensation	Rush current increases. Phase compensation is out.	Output decreases. Phase compensation is out.	CR filter with C_7
C_7	0.22μF	Phase compensation	Oscillation	THD degradation by load capacitance	Recommended to use tantalum or film capacitor
C_8	220μF	Coupling	Bad low frequency response	"P_{op}" noise is high.	Output
C_9	100μF	V_{CC} decoupling	Oscillation margin decreases	—	Necessary to be near pin 9
T_r	2SA1015GR	Booster for V_{RF}	—	—	To be added at I_{RF}>10mA