AN7168

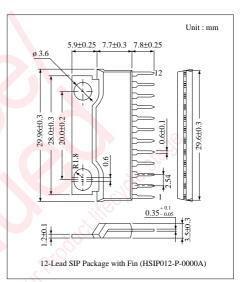
Dual 5.8W Audio Power Amplifier Circuit

Overview

The AN7168 is an integrated circuit designed for low distortion, low noise and low power dissipation audio set of 5.8W (13.2V, 4 Ω) output. Stereo operation is enabled due to incorporating two amplifiers on one chip. 12-pin SIL package enabled compact and high integrated set. Thermal protection, short protection and excessive protection circuits are built in.

Features

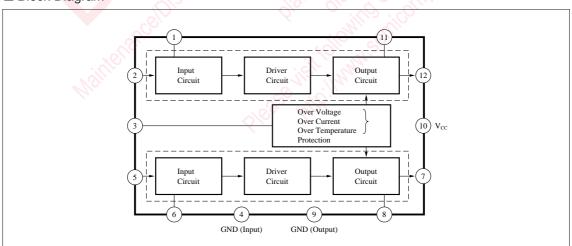
- Highly stable operation
- Low distortion
- Low quiescent current
- Low noise
- Low shock noise from power ON/OFF operation
- Built-in muting circuit
- Fewer external components
- Incorporating protection circuits



Pin Descriptions

Pin No.	Pin Name	Pin No.	Pin Name	
1	NFB Ch.1	7 0	Output Ch.2	
2	Input Ch.1	8	Bootstrap Ch.2	
3	Ripple Filter	9	GND (Output)	
4	GND (Input)	10	Vcc	
5	Input Ch.2	11	Bootstrap Ch.1	
6	NFB Ch.2	12	Output Ch.1	

Block Diagram



Panasonic

■ Absolute Maximum Ratings (Ta= 25°C)

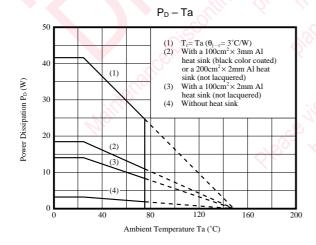
Parameter	Symbol Rating		Unit
Supply Voltage	V _{CC}	24	V
Supply Current	I _{CC}	4	А
Power Dissipation Note 1)	PD	41.7	W
Peak Supply Voltage Note 2)	V _{CC (surge)}	50	V
Operating Ambient Temperature	T _{opr}	- 30 ~ + 75	°C
Storage Temperature	T _{stg}	- 55 ~ + 150	°C

Note 1) $R_{\theta_{j-c}} = 3^{\circ}C/W$

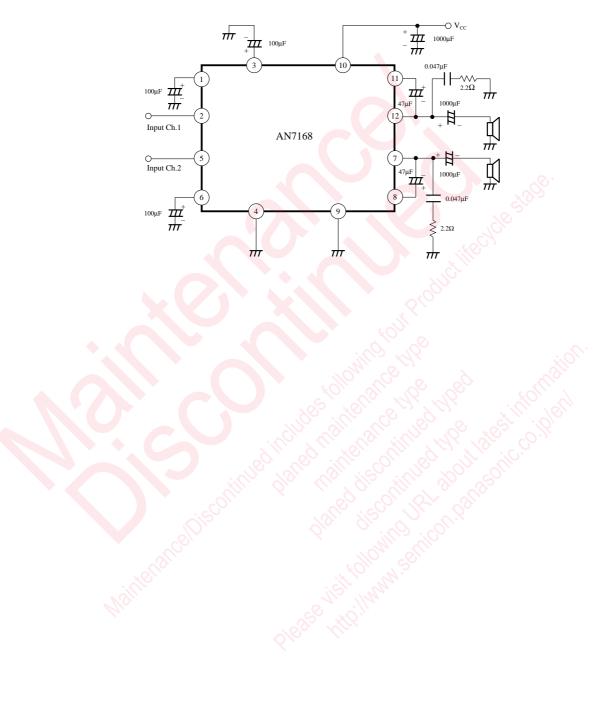
Note 2) Voltage applied time = 0.2s

Electrical Characteristics ($V_{cc} = 13.2V$, f = 1kHz, $R_L = 4\Omega$, $Ta = 25^{\circ}C$)

Quiescent Circuit Current I_{CQ} $V_{z} = 0nV$ 30 55 100 Voltage Gain G_V $P_0 = 0.5W$ 52 54 56 56 Total Harmonic Distortion THD $P_0 = 0.5W$, f= 1kHz 0.1 0.5 $P_0 = 0.5W$, f= 100Hz 0.1 0.1 $P_0 = 0.5W$, f= 10kHz 0.2 0.2 Maximum Output P_0 THD = 10%, R_L = 2Q 8.9 Maximum Output P_0 THD = 10%, R_L = 2Q 8.9 Output Noise Voltage P_0 $R_g = 10k\Omega, 1000pF$ 8.9 Output Noise Voltage V_{no} $R_g = 10k\Omega, 1000pF$, Without Filter 0.8 1.5 Channel Balance CB $P_0 = 0.5W$, $R_g = 10k\Omega, V_{ripple} = 280mVrms, 35 45 Ripple Rejection Ratio RR P_0 = 0.5W, R_g = 10k\Omega, V_{ripple} = 280mVrms, 35 45 $	Voltage Gain G_V $P_0=0.5W$ 52 54 56 Total Harmonic Distortion THD $P_0=0.5W, f=1kHz$ 0.1 0.5 Total Harmonic Distortion THD $P_0=0.5W, f=100Hz$ 0.1 $P_0=0.5W, f=100Hz$ 0.1 $P_0=0.5W, f=100Hz$ 0.1 Maximum Output P_0 THD $10\%, R_L= 2\Omega$ 8.9 Maximum Output P_0 THD = $10\%, R_L= 8\Omega$ 3.1 Maximum Output P_0 $R_g=10k\Omega, 1000pF$ - 0.8 1.5 Output Noise Voltage V_{no} $R_g=10k\Omega, 1000pF$, Without Filter 1.1 Channel Balance CB $P_0= 0.5W$ -0 1 0.5 Ripple Rejection Ratio RR $P_0= 0.5W, Rg= 10k\Omega, V_{ripple}= 280mVrms, 35$ 45 0 200 40 V_0 (offset) $V_i = 0mV$	Parameter	Symbol	Condition	min.	typ.	max.	Unit	
Total Harmonic Distortion THD $P_0 = 0.5W, f = 1kHz$ 0.1 0.5 $P_0 = 0.5W, f = 100Hz$ 0.1 $P_0 = 0.5W, f = 100Hz$ 0.1 $P_0 = 0.5W, f = 10kHz$ 0.2 0.2 Maximum Output P_0 THD = 10%, $R_L = 2\Omega$ 8.9 Output Noise Voltage V_{no} $R_g = 10k\Omega, 1000pF$ 0.8 1.5 R_g = 10k\Omega, 1000pF, 000pF,	Point Point <t< td=""><td>Quiescent Circuit Current</td><td>I_{CQ}</td><td>$V_i = 0mV$</td><td>30</td><td>55</td><td>100</td><td>mA</td></t<>	Quiescent Circuit Current	I _{CQ}	$V_i = 0mV$	30	55	100	mA	
Total Harmonic Distortion THD $P_0 = 0.5W, f = 100Hz$ 0.1 $P_0 = 0.5W, f = 10kHz$ 0.2 Maximum Output P_0 THD = 10% 5 5.7 Maximum Output P_0 THD = 10%, $R_L = 2\Omega$ 8.9 Output Noise Voltage V_{no} $R_g = 10k\Omega, 1000pF$ 0.8 1.5 Channel Balance CB $P_0 = 0.5W$ 0 1 Channel Separation CS $P_0 = 0.5W$ 40 50 Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, 35 45 Offset Voltage V_0 (offset) V_i = 0mV 0 200 $	Total Harmonic Distortion THD Po = 0.5W, f = 100Hz 0.1 $P_0 = 0.5W$, f = 10kHz 0.2 Maximum Output P_0 THD = 10% 5 5.7 Maximum Output P_0 THD = 10%, $R_L = 2\Omega$ 8.9 Output Noise Voltage V_{no} $R_g = 10k\Omega, 1000pF$ 0.8 1.5 R_g = 10k\Omega, 1000pF, Without Filter 0.8 1.5 Rage 10k\Omega, 1000pF, Without Filter 0.1 Channel Balance CB $P_0 = 0.5W$ 0 1 Channel Separation CS $P_0 = 0.5W$ 40 50 Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, 35 45 Offset Voltage V_0 (offset) V_i = 0mV 0 200 P_D - Ta M_{40} (1) T_e = Ta(\theta_{-e} = 3'CW) 0 200 (1) T_e = Ta(\theta_{-e} = 3'CW) 0 200 200 $	Voltage Gain	Gv	$P_0 = 0.5W$	52	54	56	dB	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $		THD	$P_0 = 0.5W$, f= 1kHz		0.1	0.5	%	
Maximum Output Po THD = 10% 5 5.7 Maximum Output Po THD = 10%, R _L = 2Ω 8.9 THD = 10%, R _L = 8Ω 3.1 Output Noise Voltage V_{no} $R_g^{=} 10k\Omega$, 1000pF 0.8 1.5 Output Noise Voltage V_{no} $R_g^{=} 10k\Omega$, 1000pF, Without Filter 0.8 1.5 Channel Balance CB $P_0 = 0.5W$ 0 1 Channel Separation CS $P_0 = 0.5W$, $Rg = 10k\Omega$, $V_{ripple} = 280mVrms$, 35 45 Ripple Rejection Ratio RR $P_0 = 0.5W$, $Rg = 10k\Omega$, $V_{ripple} = 280mVrms$, 35 45 Offset Voltage V_0 (offset) $V_i = 0mV$ 0 200 Super Ta 0 (1) $T_i = Ta (\theta_{i-e} = 3^*CW)$ (2) With a 100cm ² × 3mm Al heat 40 (1) (1) $T_i = Ta (\theta_i = a^*CW)$ (3) 45 0 (1) (1) $T_i = Ta (\theta_i = a^*CW)$ (4) (5) (5)	Maximum Output Po THD = 10%, R _L = 2Ω 5 5.7 THD = 10%, R _L = 8Ω 8.9 Output Noise Voltage V_{no} $R_g = 10k\Omega, 1000pF$ 0.8 1.5 R_g = 10k\Omega, 1000pF, Without Filter 0.8 1.5 R_g = 10k\Omega, 1000pF, Without Filter 0.1 Channel Balance CB $P_0 = 0.5W$ 0 1 Channel Separation CS $P_0 = 0.5W$ 40 50 Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, 35 45 Offset Voltage V_0 (offset) V_i = 0mV 0 200 P_D - Ta (1) T_i = Ta (\theta_{-c} = 3^* CW) (2) With a 100cm2 × 3mm Al 1 40 (1) T_i = Ta (\theta_i - e^{-3^* CW}) (2) With a 100cm2 × 3mm Al 1 40 (1) T_i = Ta (\theta_i - e^{-3^* CW}) (2) Vince Nor 200mi × 2mm Al 1 40 (1) T_i = Ta (\theta_i - e^{-3^* CW}) (2) Vincera the at the the the the the the the the t$	Fotal Harmonic Distortion		$P_0 = 0.5W, f = 100Hz$	1	0.1			
Maximum Output Po THD = 10%, R _L = 2Ω 8.9 THD = 10%, R _L = 8Ω 3.1 Output Noise Voltage V_{no} $R_g=10k\Omega, 1000pF$ f = 15Hz ~ 30kHz, 12dB/OCT 0.8 1.5 Output Noise Voltage V_{no} $R_g=10k\Omega, 1000pF, Without Filter 0.8 1.5 Channel Balance CB P_0=0.5W 0 1 Channel Separation CS P_0=0.5W, Rg=10k\Omega, V_{ripple}=280mVrms, 35 45 Ripple Rejection Ratio RR P_0=0.5W, Rg=10k\Omega, V_{ripple}=280mVrms, 35 45 Offset Voltage V_{0 (offset)} V_i=0mV 0 200 $	Maximum Output Po THD = 10%, R _L = 2Ω 8.9 THD = 10%, R _L = 8Ω 3.1 Output Noise Voltage V_{no} $R_g^{=1}$ 10kΩ, 1000pF f = 15Hz ~ 30kHz, 12dB/OCT 0.8 1.5 Output Noise Voltage V_{no} $R_g^{=1}$ 10kΩ, 1000pF, Without Filter 0.8 1.5 Channel Balance CB Po=0.5W 0 1 Channel Separation CS Po=0.5W, Rg= 10kΩ, Vripple= 280mVrms, fripple= 12Hz Sine wave 35 45 Offset Voltage Vo (offset) Viet 0 mV 0 200 PD – Ta S_0^{-1} S_0^{-1} S_0^{-1} S_0^{-1} S_0^{-1} S0 S_0^{-1} S_0^{-1} S_0^{-1} S_0^{-1} S_0^{-1} S_0^{-1} Balance CS Po=0.5W, Rg= 10kΩ, Vripple= 280mVrms, fripple= 280mVrms, fripple= 12Hz Sine wave S_0^{-1}			$P_0 = 0.5W, f = 10kHz$		0.2			
THD TO THD THD TO THD TO	THD TOR THD TOR TOD TOD TOD TOD TOD TOD TO TO </td <td></td> <td></td> <td>THD = 10%</td> <td>5</td> <td>5.7</td> <td></td> <td colspan="2" rowspan="3">w</td>			THD = 10%	5	5.7		w	
Output Noise Voltage V_{no} $R_g=10k\Omega, 1000pF_f=15Hz ~ 30kHz, 12dB/OCT$ - 0.8 1.5 R_g=10k\Omega, 1000pF, Without Filter - 0.8 1.5 R_g=10k\Omega, 1000pF, Without Filter - 0.1 - Channel Balance CB $P_0= 0.5W$ - 0 1 Channel Separation CS $P_0= 0.5W$ 40 50 - Ripple Rejection Ratio RR $P_0= 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, 35 45 - Offset Voltage V_{O (offset)} V_i = 0mV - 0 200 $	Output Noise Voltage V_{no} $R_g=10k\Omega, 1000pF_f=15HZ ~ 30kHZ, 12dB/OCT$ 0.8 1.5 Channel Balance CB $P_0=0.5W$ 0 1 Channel Separation CS $P_0=0.5W$ 0 1 Ripple Rejection Ratio RR $P_0=0.5W$, $Rg=10k\Omega$, $V_{ripple}=280mVrms$, 35 45 Offset Voltage $V_{0 (offset)}$ $V_i=0mV$ 0 200 P_D - Ta 0 (1) $T_e=Ta(\theta_{1,e}=3^{2}CW)$ (2) With a 100m ² x 3mm Al heat sink (klack color coated) or a 2000m ² x 2mm Al heat sink (not lacquered) (3) With a 100m ² x 2mm Al heat sink (not lacquered)	Maximum Output	Po	THD = 10%, $R_L = 2\Omega$		8.9			
Output Noise Voltage V_{no} $f = 15Hz \sim 30kHz, 12dB/OCT$ -1 0.8 1.3 R _g = 10kQ, 1000pF, Without Filter $$ 1.1 $$ Channel BalanceCB $P_0 = 0.5W$ $$ 0 1 Channel SeparationCS $P_0 = 0.5W$ 40 50 $$ Ripple Rejection RatioRR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, fripple = 12Hz Sine wave3545Offset VoltageV_{O (offset)}V_i = 0mV0200$	Output Noise Voltage V_{no} $f = 15Hz \sim 30kHz, 12dB/OCT$ -1 0.8 1.3 Rescaled the equation of			THD = 10%, $R_L = 8\Omega$		3.1			
Image: constraint of the start of the st	Image: constraint of the start of the st	Output Noise Voltage	V	$\begin{array}{l} R_{g} = 10k\Omega, \ 1000 \text{pF} \\ f = 15 \text{Hz} \sim 30 \text{kHz}, \ 12 \text{dB/OCT} \end{array}$		0.8	1.5	mV	
Channel Separation CS $P_0 = 0.5W$ 40 50 Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, 35$ 45 Offset Voltage V ₀ (offset) V _i = 0mV 0 200 P_D - Ta 0 (1) $T_i = Ta (\theta_{1,-e} = 3^{\circ}C/W)$ 0 200 40 (1) $T_i = Ta (\theta_{1,-e} = 3^{\circ}C/W)$ 0 200 40 (1) $T_i = Ta (\theta_{1,-e} = 3^{\circ}C/W)$ 0 200	Channel Separation CS $P_0 = 0.5W$ 40 50 Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, 35$ 45 Offset Voltage V ₀ (offset) V _i = 0mV 0 200 PD - Ta 0 200 0 200 PD - Ta 0 0 200 Offset Voltage (1) T _i = Ta ($\theta_{i-e} = 3^{\circ}CW$) 0 200 PD - Ta 0 0 200 0 200	I I I I I I I I I I I I I I I I I I I	no	$R_g = 10k\Omega$, 1000pF, Without Filter		1.1			
Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, fripple = 280mVrms, fripple = 12Hz Sine wave 35 45 Offset Voltage Vo (offset) Vi = 0mV 0 200 $	Ripple Rejection Ratio RR $P_0 = 0.5W, Rg = 10k\Omega, V_{ripple} = 280mVrms, fripple = 280mVrms, fripple = 12Hz Sine wave 35 45 Offset Voltage Vo (offset) Vi = 0mV 0 200 $	Channel Balance	CB	P ₀ = 0.5W	3	0	1	dB	
Kipple Rejection Ratio KR $f_{ipple}= 12Hz$ Sine wave 5.5 4.3 Offset Voltage V _{0 (offset}) V _i = 0mV — 0 200 P _D - Ta 40 (1) T _i = Ta ($\theta_{1-c}=3^{\circ}CW$) (2) (2) (2) 40 (1) T _i = Ta ($\theta_{1-c}=3^{\circ}CW$) (2) (2) (2) 40 (1) T _i = Ta ($\theta_{1-c}=3^{\circ}CW$) (2) (3) (4)	Kipple Rejection Ratio KR $f_{ipple}= 12Hz$ Sine wave 55 43 Offset Voltage V _{O (offset)} V _i = 0mV — 0 200 P _D - Ta 40 (1) T _i = Ta ($\theta_{i-c}=3^{\circ}C/W$) (2) With a 100m ² x 3mm Al heat sink (black color coated) or a 2000m ² x 2mm Al heat	Channel Separation	CS	P ₀ = 0.5W	40	50	<u>10-</u>	dB	
$P_{D} - Ta$ $(1) T_{c} = Ta (\theta_{j-c} = 3^{\circ}C/W)$ $(2) With a 100cm2 x 3mm Al heat sink (black color coated) or a 200cm2 x 2mm Al heat indicated or a coated) or a difference of the sink (black color coated) or a difference $	$P_{D} - Ta$ $(1) T_{e} = Ta (\theta_{j-e} = 3^{\circ}C/W)$ $(2) With a 100cm2 x 3mm Al heat sink (black color coated) or a 200cm2 x 2mm Al heat induction of the transmitted of the tra$	Ripple Rejection Ratio	RR	$P_0=0.5W$, $Rg=10k\Omega$, $V_{ripple}=280mVrms$, $f_{ripple}=12Hz$ Sine wave	35	45	. Ale	dB	
$\begin{array}{c} 50 \\ 40 \end{array}$	$\begin{array}{c} 50 \\ 40 \end{array}$	Offset Voltage	V _{O (offset)}	V _i =0mV	at 1	0	200	mV	
$\begin{array}{c c} \hline \\ \hline $	(4) Without heat sink		 T_c= Ta (θ_{j-c}= With a 100cm heat sink (bla or a 200cm²× sink (not lacq With a 100cm heat sink (not 	² ×3mm Al ck color coated) 2mm Al heat uered) ² ×2mm Al lacquered)					



Application Circuit



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