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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



AN5278

4.8 W × 1 (18 V, 8 Ω) Power Amplifier with Volume and Tone Control

■ Overview

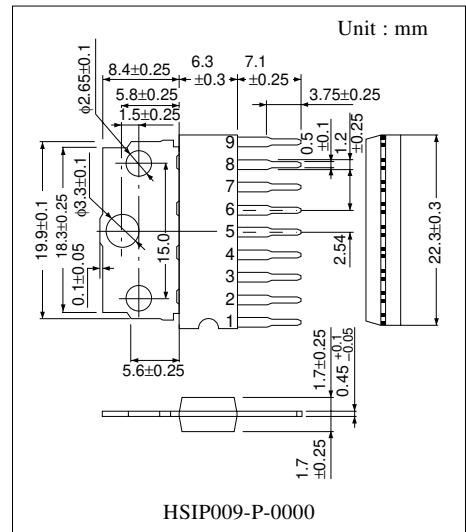
The AN5278 is a monolithic integrated circuit designed for 4.8 W × 1 channel OTL (18 V, 8 Ω) output audio power amplifier suitable for TV application.

■ Features

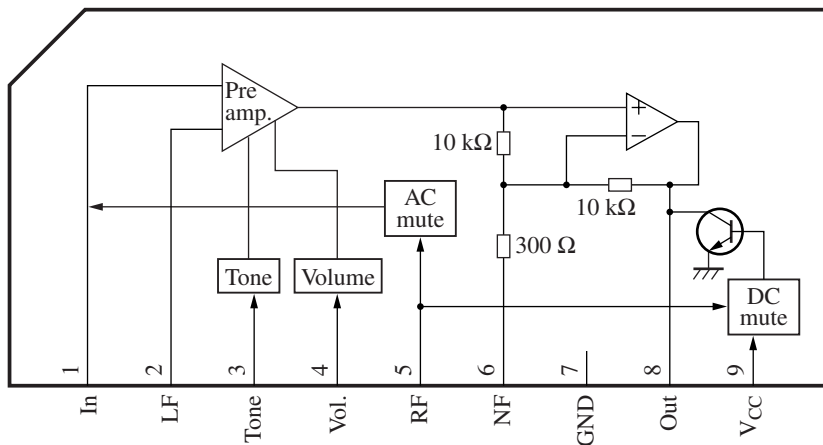
- Few external components :
 - No boucherot cells (output C, R)
 - No bootstrap capacitors
- Built-in DC mute of input pin during power-OFF
- Operating voltage range 12 V to 26 V (18 V typ.)

■ Applications

- TV



■ Block Diagram



■ Pin Descriptions

Pin No.	Description
1	Sound input
2	Low frequency input
3	Tone control
4	Volume control
5	Ripple filter
6	Negative feedback
7	GND
8	Sound output
9	V _{CC}

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage *2	V _{CC}	35.0	V
Supply current	I _{CC}	2	A
Power dissipation *3	P _D	1.6	W
Operating ambient temperature *1	T _{opr}	-20 to +70	°C
Storage temperature *1	T _{stg}	-55 to +150	°C

Note) *1 : T_a = 25 °C except operating ambient temperature and storage temperature.

*2 : Without input signal, V_{CC} is up to 35 V.

*3 : Power dissipation of the package at T_a = 70 °C.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V _{CC}	12 to 26	V

■ Electrical Characteristics at $V_{CC} = 18\text{ V}$, $R_L = 8\ \Omega$, $f = 1\text{ kHz}$, $\text{Vol.} = 5.0\text{ V}$, $\text{Tone} = 2.5\text{ V}$, $T_a = 25\text{ }^\circ\text{C}$

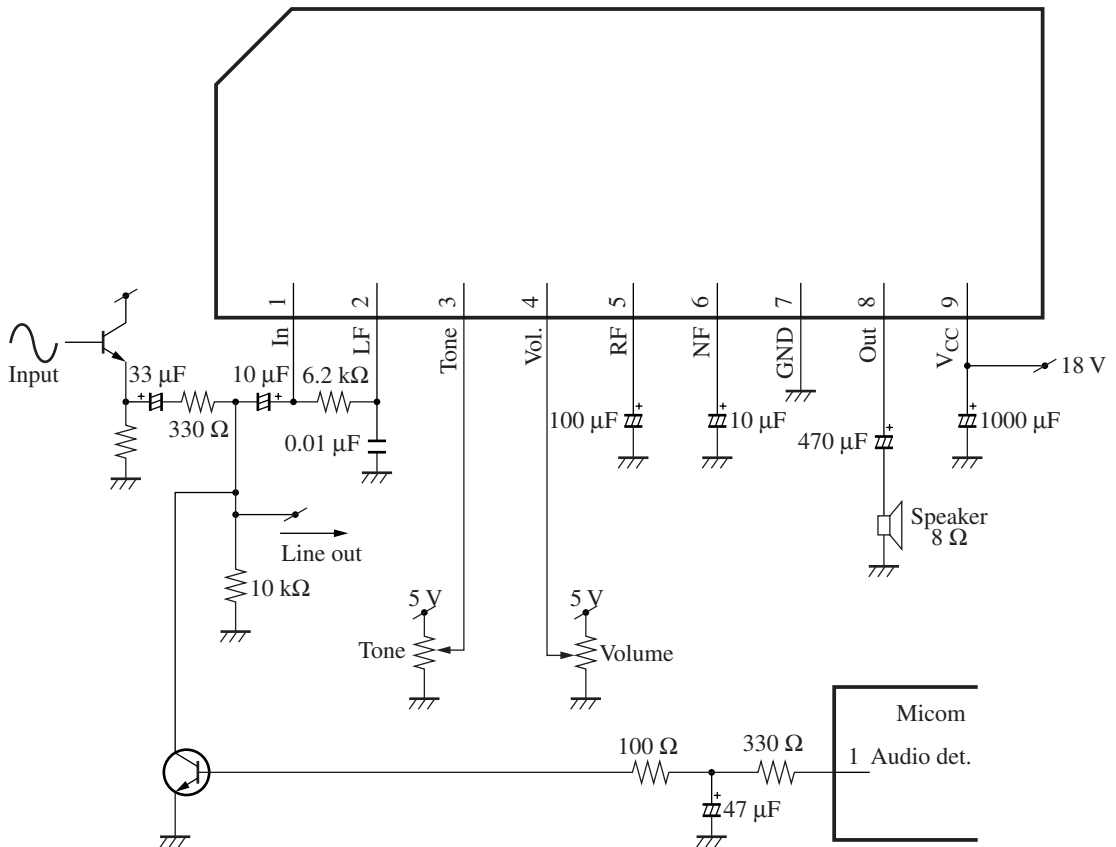
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent current	I_{CQ}	No input signal Measure V_{CC} current	20	27	48	mA
Voltage gain	G_V	$V_O = 1\text{ V[rms]}$ $G_V = 20 \log (V_O/V_{IN})$	27	30	33	dB
Total harmonic distortion	THD	$V_O = 1\text{ V[rms]}$ BPF : 400 Hz to 30 kHz	—	0.4	1.0	%
Max. output power	P_{Omax}	THD = 10 %, $P_O = V_O^2/R_L$	4.3	4.8	—	W
Max. output attenuation	Att_{max}	$V_O = 1\text{ V[rms]}$ Vol. = max. → min. $\text{Att}_{max} = 20 \log$ [$V_O(\text{Vol.} = \text{min.}) / V_O(\text{Vol.} = \text{max.})$]	-66	-69	—	dB
Tone variable range 1	ΔGTC1	$f = 15\text{ kHz}$, $V_O = 1\text{ V[rms]}$ $\Delta\text{GTC} = 20 \log$ [$V_O(\text{Tone} = 5.0\text{ V}) / V_O(\text{Tone} = 2.5\text{ V})$]	7	9	—	dB
Tone variable range 2	ΔGTC2	$f = 15\text{ kHz}$, $V_O = 1\text{ V[rms]}$ $\Delta\text{GTC} = 20 \log$ [$V_O(\text{Tone} = 0\text{ V}) / V_O(\text{Tone} = 2.5\text{ V})$]	—	-11	-9	dB

• Design reference data

Note) The characteristic values below are theoretical values for designing and not guaranteed.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input dynamic range	DR_{IN}	$V_{VOL} = 1\text{ V}$ vary V_{IN} until output THD = 1 %		4.5		V[rms]
Output DC bias	V_{ODC}	No input signal Measure Pin8 DC	7.9	8.3	8.7	V
Max. output power 1	P_{Omax1}	THD = 10 %, $V_{CC} = 18.4\text{ V}$ $P_O = V_O^2/R_L$		5		W
Max. output power 2	P_{Omax2}	THD = 10 %, $V_{CC} = 26\text{ V}$ $P_O = V_O^2/R_L$		9		W

■ Application Circuit Example



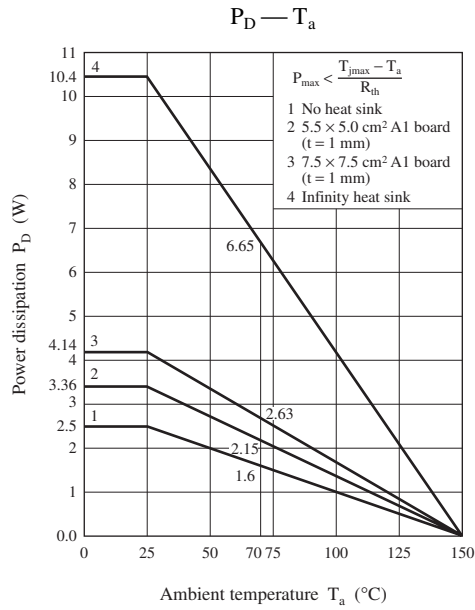
■ Usage Notes

- 1) External heatsink is needed when used. External heatsink should be fixed to the chassis.
- 2) Fin of the IC can be connected to GND.
- 3) Please prevent output to V_{CC} short, output to GND short and load short to GND.
- 4) The temperature protection circuit will operate at T_j around 150 °C. However, if the temperature decreases, the protection circuit would automatically be deactivated and resume normal operation.

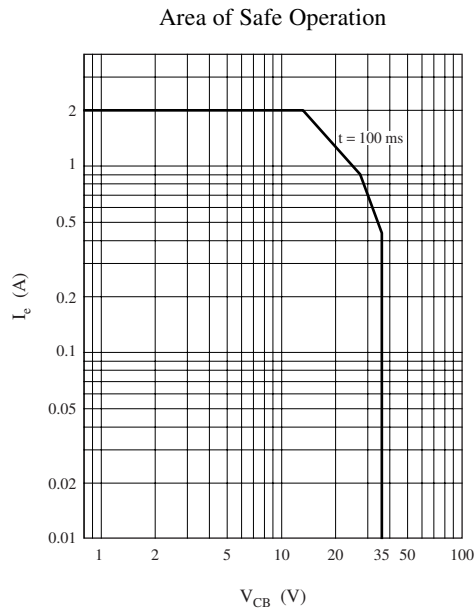
■ Technical Information

1.Characteristic Curve Chart

- HSIP009-P-0000 Package power dissipation



- ASO

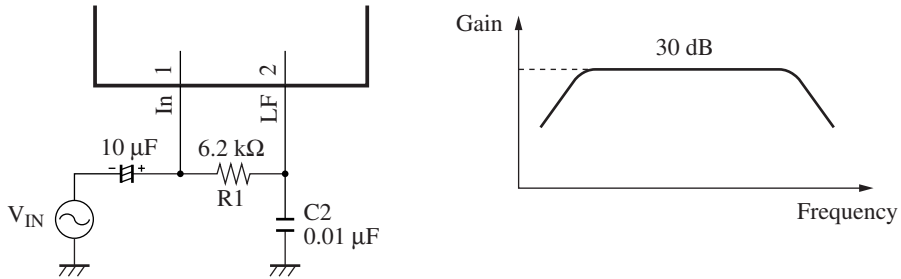


■ Technical Information (continued)

2. Application Note

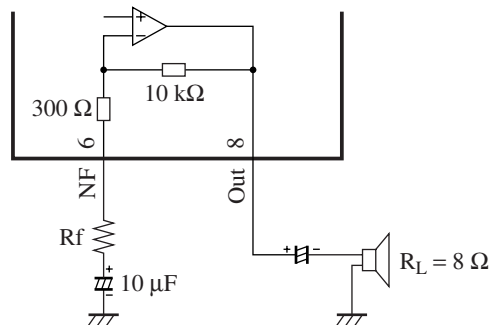
1) Gain setting and frequency response

The gain is fixed to be 30 dB by internal resistors. The frequency response is flat for the values of $R1 = 6.2 \text{ k}\Omega$, and $C2 = 0.01 \text{ }\mu\text{F}$, between pins 1 and 2 (other conditions : tone control voltage is set at 2.5 V, and volume control voltage is set at 5 V).

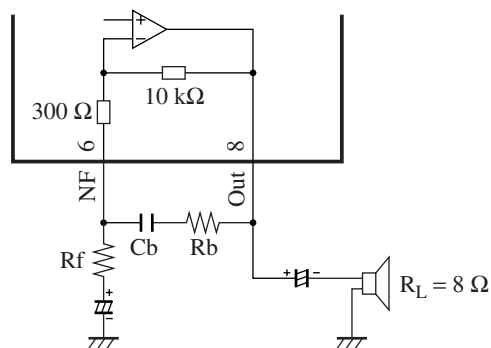


The gain can be reduced by inserting a resistor R_f in series with the electrolytic capacitor at Pin6.

$$\text{Voltage gain} = 20 \log [10 \text{ k}\Omega / (R_f + 300 \text{ }\Omega)]$$



Bass boost can be easily implemented by inserting a series connection of RC between Pin8 (output) and Pin6 (NF).
Example : $R_b = 12 \text{ k}\Omega$, $C_b = 0.022 \text{ }\mu\text{F}$



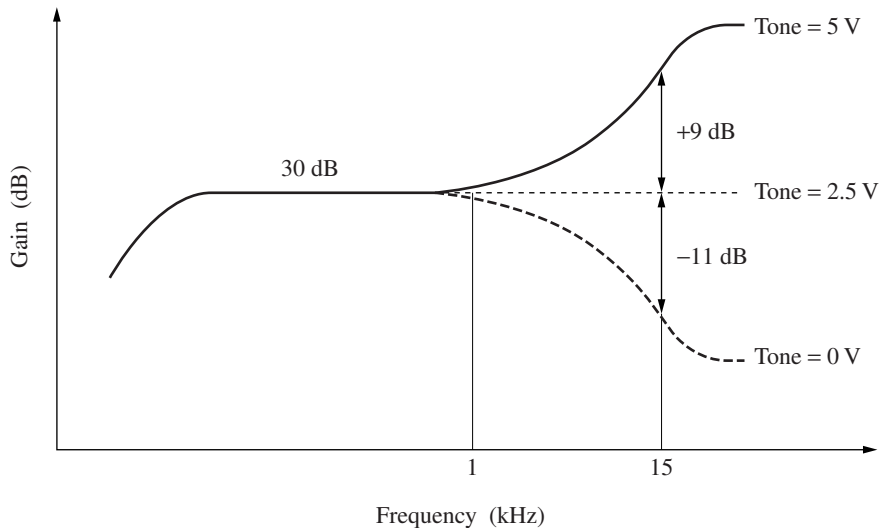
■ Technical Information (continued)

2. Application Note (continued)

2) Tone characteristics

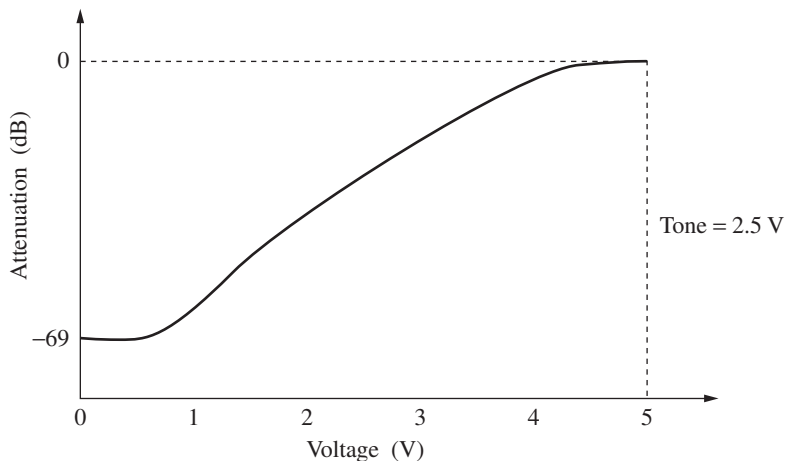
When the tone control voltage (V_T , at Pin3) is changed from 2.5 V to 5 V, the high frequency gain is increased gradually up by a max. of 9 dB. When V_T is changed from 2.5 V to 0 V, the high frequency gain is decreased gradually down by a max. of -11 dB.

By increasing the value of the capacitor at Pin2, the treble cut can be further decreased.



3) Volume characteristic

The volume characteristic is logarithmic type. When the volume control voltage (V_V , at Pin4) is 5 V, the gain is at max. (30 dB); that is, there is no attenuation. When V_V is decreased, the gain is decreased at the same time. When V_V is 0 V, the gain is at its minimum; that is, there is max. attenuation, -69 dB.



4) Dynamic range

The AN5278 has been designed, specially to have as large an input dynamic range as possible. The input D-range is about 4.5 V[rms], or 12.7 V[p-p] (conditions of measurement : $V_{CC} = 18$ V, adjust the gain downwards by decreasing the volume control voltage).

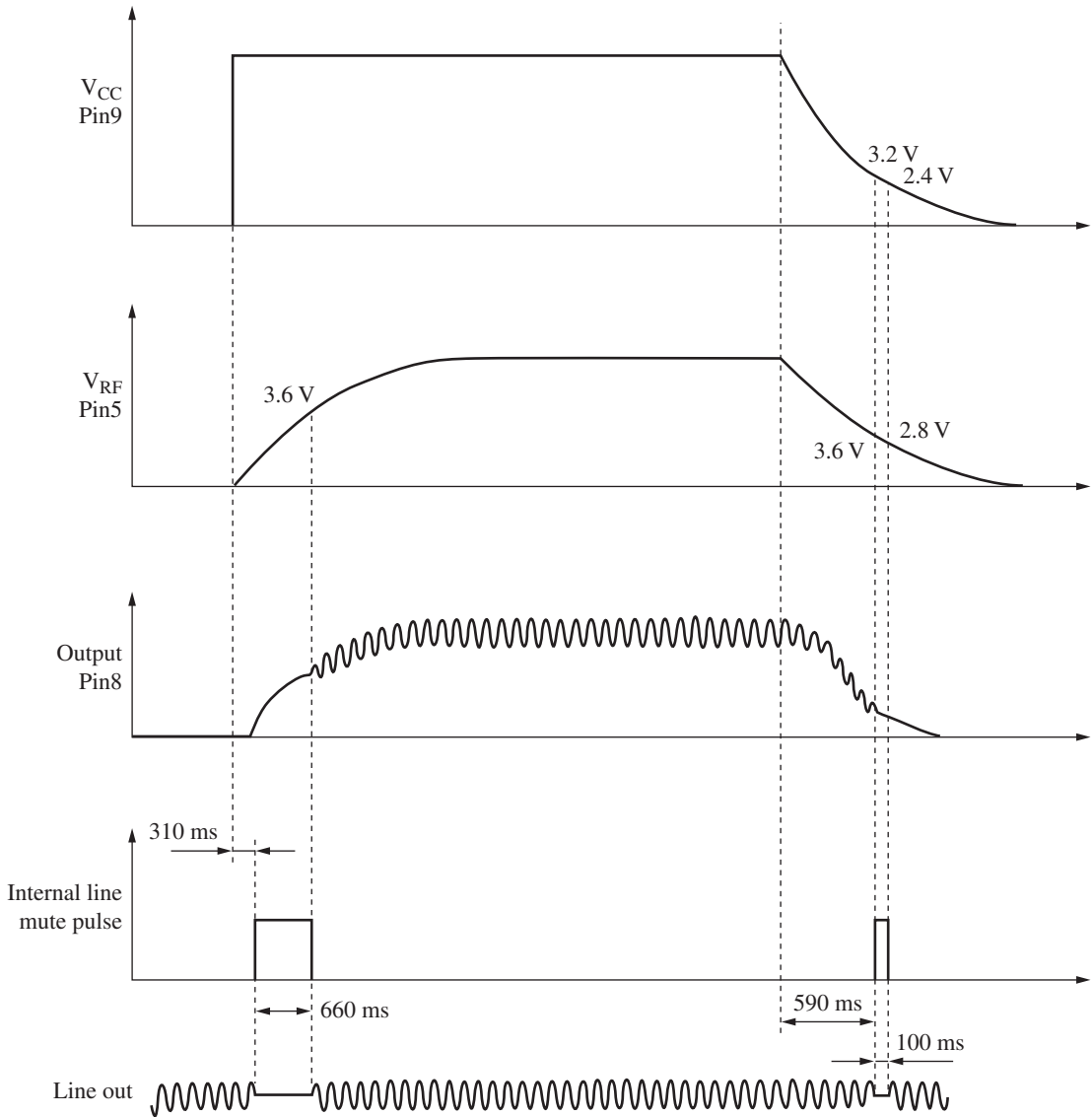
■ Technical Information (continued)

2. Application Note (continued)

5) Internal AC mute pulse (during power ON/OFF)

The start-up response of the AN5278 is designed to be as smooth as possible. During power ON and OFF, the AC mute circuit turn on momentarily. The input signal and any external noise interference are being mute. The output DC level follows the rise and fall time of RF pin.

Condition : $V_{CC} = 18 \text{ V}$, $C_{RF} = 100 \mu\text{F}$, $C_{NF} = 10 \mu\text{F}$, $C_{VCC} = 1000 \mu\text{F}$.



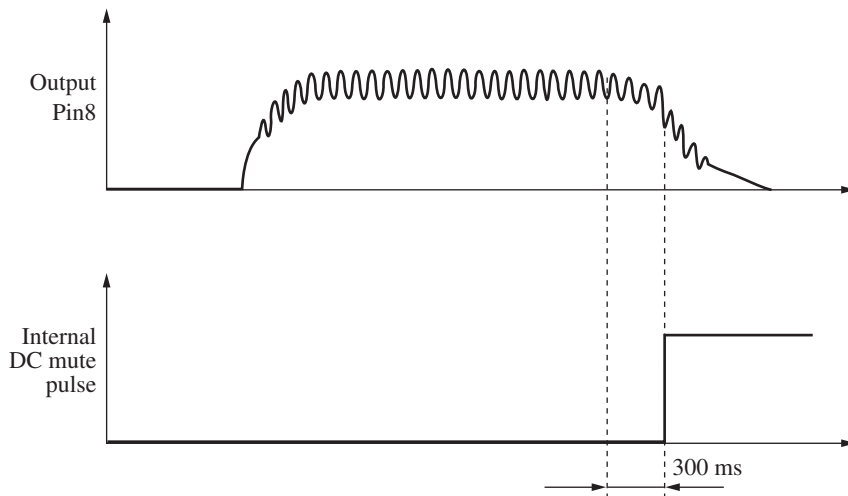
■ Technical Information (continued)

2. Application Note (continued)

6) Internal DC mute pulse (during power OFF)

During power OFF, the decay response of the RF pin is being made use of internally, to generate an internal DC mute pulse. The output DC level is made to fall quickly. As the output level falls, any transient noise that happens prior to the input pin is effectively cut off from the IC. The residual electric charge in the large output capacitor (at Pin8) is discharged into the IC internal path. By this manner, at the next start-up, the output will start from almost 0 V, and reduce the occurrence of shock noise.

Condition : $V_{CC} = 18 \text{ V}$, $C_{RF} = 100 \mu\text{F}$, $C_{NF} = 10 \mu\text{F}$, $C_{VCC} = 1000 \mu\text{F}$.



7) Shock noise precaution

During power ON, to reduce the occurrence of "Shock" noise, please be careful when selecting suitable capacitor values for RF (Pin5) and NF (Pin6).

Recommendation : –

1. $NF = 10 \mu\text{F}^*$ $RF = 100 \mu\text{F}$ to $330 \mu\text{F}$

* : Due to small NF capacitor, the low frequency cut-off is about 50 Hz.

2. $NF = 22 \mu\text{F}^*$ $RF = 220 \mu\text{F}$ to $330 \mu\text{F}$

* : Due to larger RF capacitor, the start-up time is longer, about 1 second.