

Monaural Microphone Amplifier

■ GENERAL DESCRIPTION

The **NJU7907A** is a monaural microphone amplifier IC including regulator for microphone capcel, pre-amplifier and line amplifier.

The **NJU7907A** features low consumption current, wide dynamic range, wide operating voltage range, wide operating temperature and urtla small and thin package.

It is suitable for microphone module, headset for conference system, automotive microphone for eCall, and any portable applications.

■ PACKAGE OUTLINE

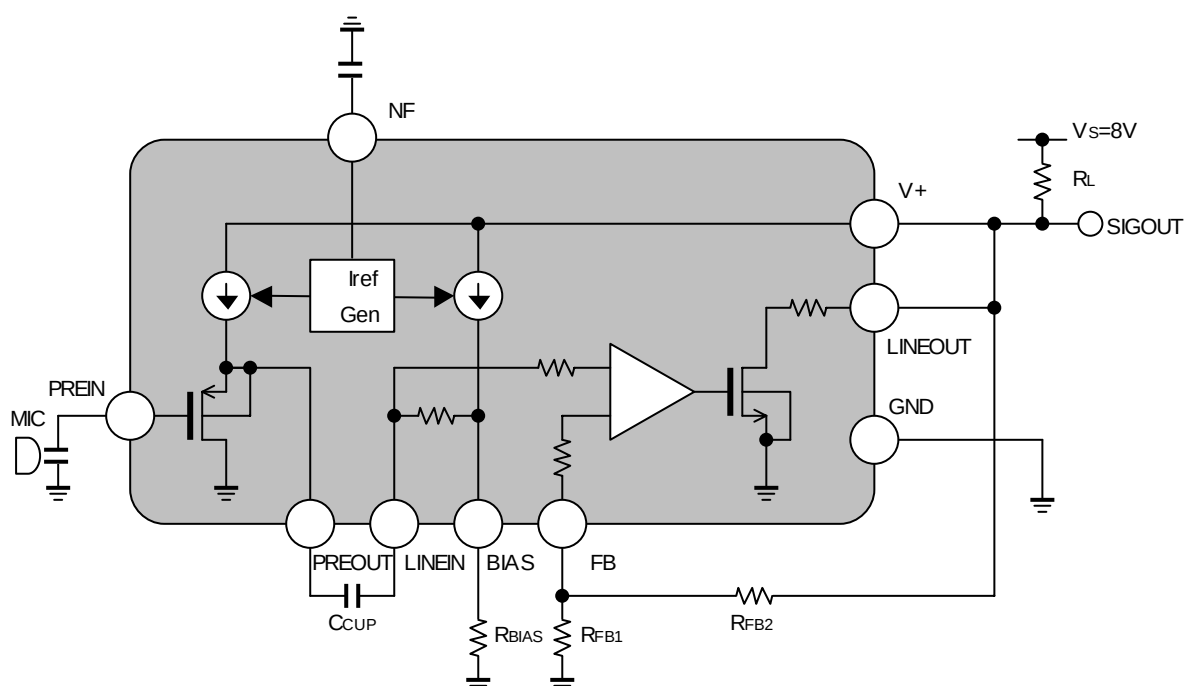


NJU7907AUC4

■ FEATURES

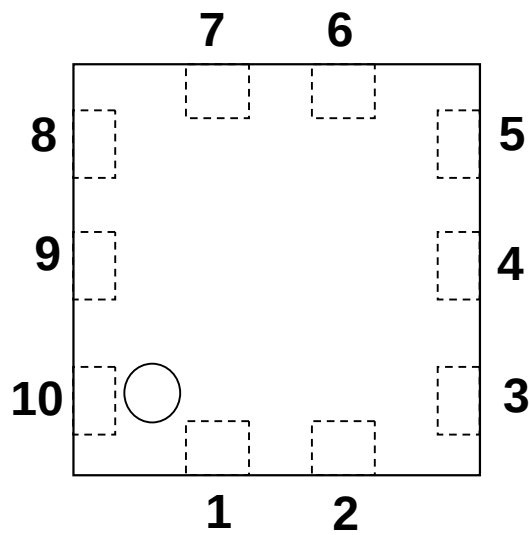
- Operating Voltage 4.5 to 16V
- Low Consumption Current
- Wide Dynamic Range
- Wide Operating Temperature
- CMOS Technology
- Package Outline EPFFP10-C4

■ BLOCK DIAGRAM

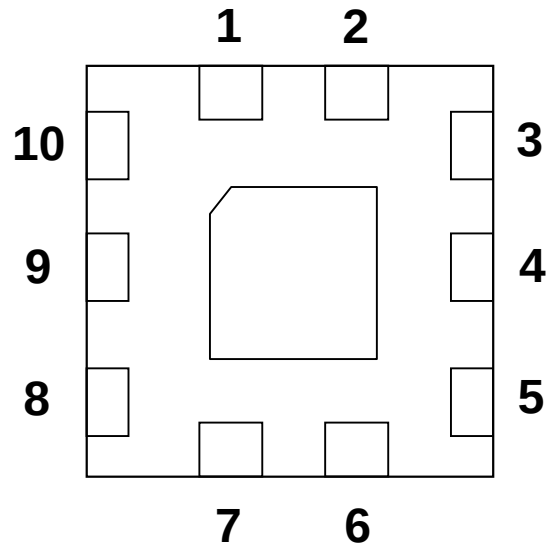


NJU7907A

PIN CONFIGURATION



Top View



Bottom View

No.	SYMBOL	FUNCTION
1	PREOUT	Pre-Amplifier Output Terminal
2	PREIN	Pre-Amplifier Input Terminal
3	NF	Noise Filter Terminal
4	GND	Ground Terminal
5	LINEOUT	Line Amplifier Output Terminal
6	NC	No Connect
7	V ⁺	Power Supply Terminal
8	FB	Line Amplifier Feedback Terminal
9	LINEIN	Line Amplifier Input Terminal
10	BIAS	Reference Current Setting Terminal

■ ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V ⁺	18	V
Power Dissipation	P _D	340 NOTE: EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting	mW
Maximum Input Voltage	V _{imax}	0.3	V _{rms}
Operating Temperature Range	T _{opr}	-40 to +85	°C
Storage Temperature Range	T _{stg}	-40 to +125	°C

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, V_S=8V, G_V=37.8dB, f=1kHz unless otherwise specified)

◆DC CHARACTERISTICS (R_g=0Ω, R_L=680Ω unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V _S		4.5	8.0	16.0	V
Supply Current1	I _{DD1}	No Signal	-	4.85	6.0	mA
Supply Current2	I _{DD2}	R _{FB1} =0Ω, R _{FB2} =∞	-	220	320	μA
Supply Current3	I _{DD3}	R _L =0Ω	-	28.0	50.0	mA
Reference Current	I _{ref}	No Signal	8.0	9.0	10.0	μA
Output DC Voltage	V _{OUT}	No Signal, LINEOUT	-	4.7	-	V

◆PreAmp CHARACTERISTICS (C_{IN}=1nF, R_L=100kΩ unless otherwise specified)

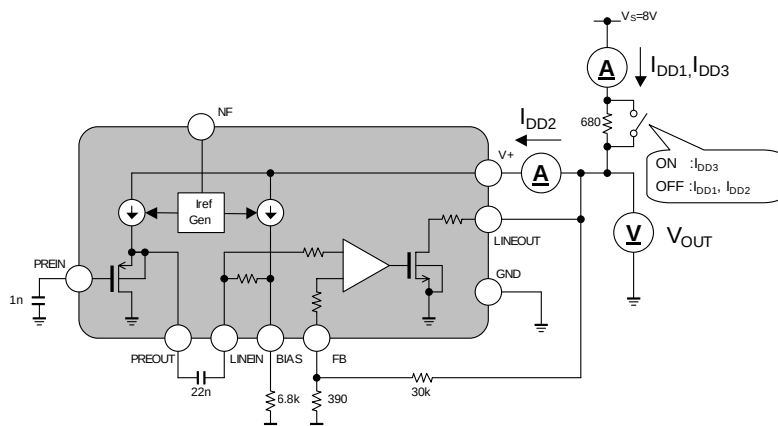
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Gain	G _V	V _{in} =50mV _{rms}	-0.8	-0.5	-0.2	dB
Frequency Response	ΔG _f	1kHz-10kHz	-0.5	0	0.5	dB
Input Capacitance	C _i		-	1.0	-	pF
Input Resistance	R _i		200	-	-	MΩ
Total Harmonic Distortion	THD	V _{in} =100mV _{rms} BW=400Hz to 30kHz	-	0.1	0.5	%
Output Noise Voltage 1	V _{NO1}	Weighted-A, C _{NF} =None	-	-108	-	dBV
Output Noise Voltage 2	V _{NO2}	Weighted-A, C _{NF} =1nF	-	-112	-	dBV
Output Noise Voltage 3	V _{NO3}	PREIN → LINEOUT Weighted-A, C _{NF} =None	-	-68	-63	dBV
Output Noise Voltage 4	V _{NO4}	PREIN → LINEOUT Weighted-A, C _{NF} =1nF	-	-73	-68	dBV

◆ LineAmp CHARACTERISTICS (R_g=0Ω, R_L=680Ω unless otherwise specified)

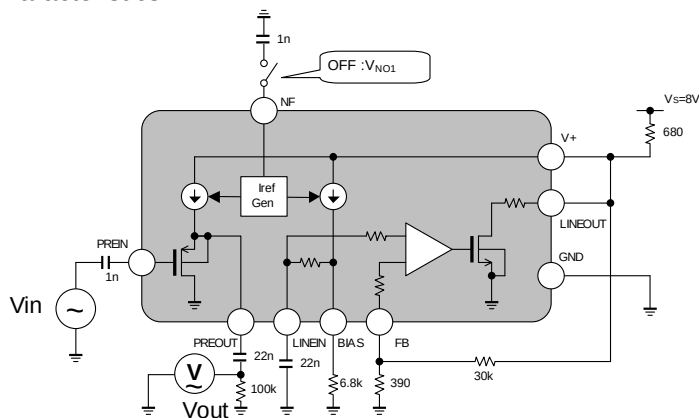
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Maximum Output Voltage	V _{OM}	OUTPUT, THD=3%	1.8	2.1	-	V _{rms}
Voltage Gain	G _V	V _{in} =10mV _{rms}	37.3	37.8	38.3	dB
Total Harmonic Distortion	THD	V _o =1.6V _{rms} BW=400Hz to 30kHz	-	0.1	0.5	%
Output Noise Voltage	V _{NO}	Weighted-A	-	-78	-72	dBV
Output Resistance	R _o		-	5	10	Ω
Input Resistance	R _i		60	100	130	kΩ
Ripple Rejection	RR	V _{Ripple} =0.5V _{rms} PREIN→LINEOUT	25	40	-	dB

■ MEASUREMENT CIRCUIT

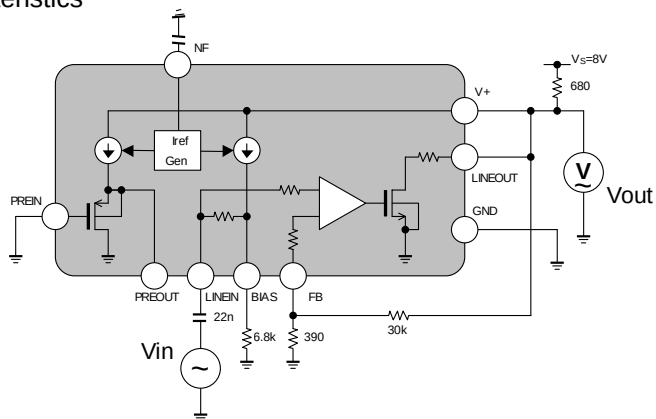
1. DC Characteristics



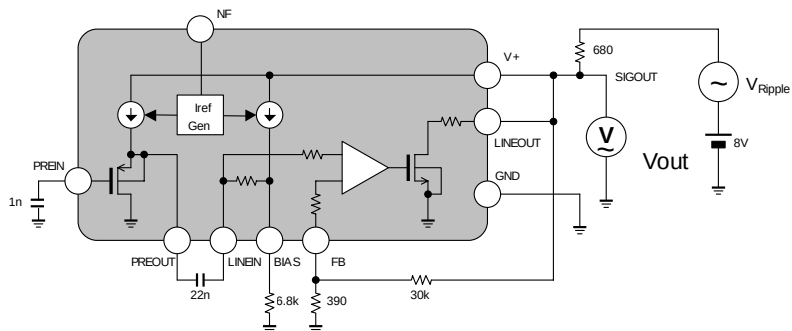
2. Pre-Amplifier Characteristics



3. Line Amplifier Characteristics



4. Ripple Rejection Characteristics



■ TERMINAL DESCRIPTION

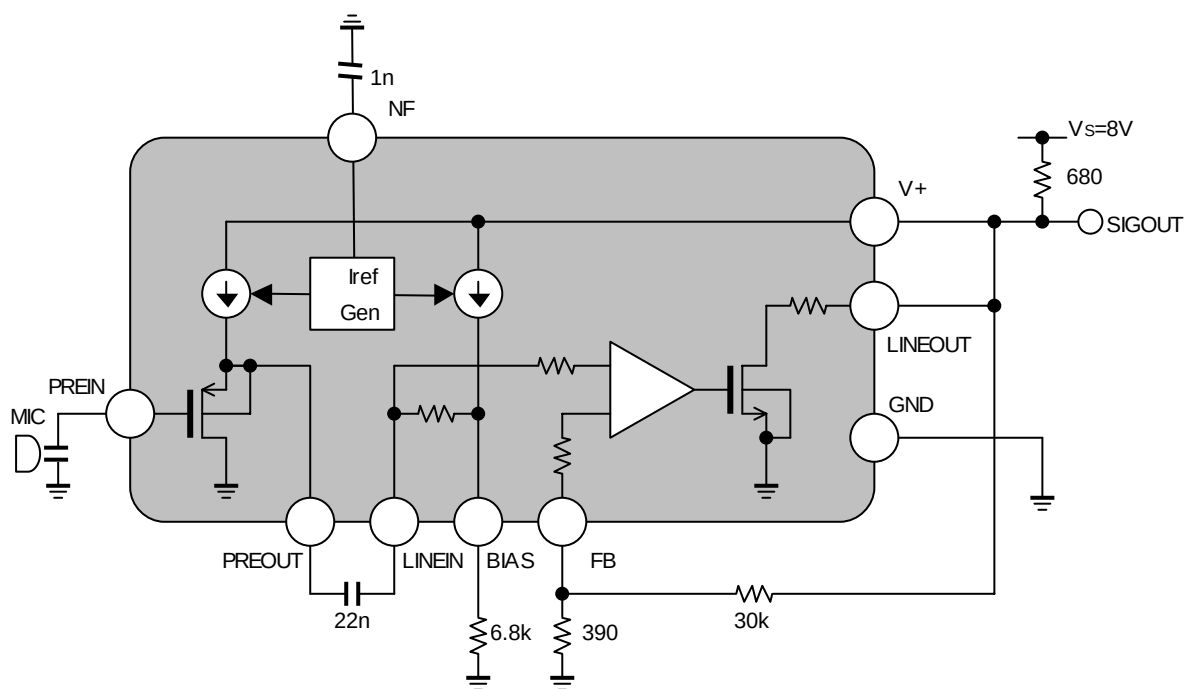
No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
1 2	PREOUT PREIN	Pre-Amplifier Output Terminal Pre-Amplifier Input Terminal		0.7V 0V
3	NF	Noise Filter		1.2V
4 7	GND V+	Ground Terminal Power Supply Terminal		0V 4.7V
5	LINEOUT	Line Amplifier Output Terminal		4.7V

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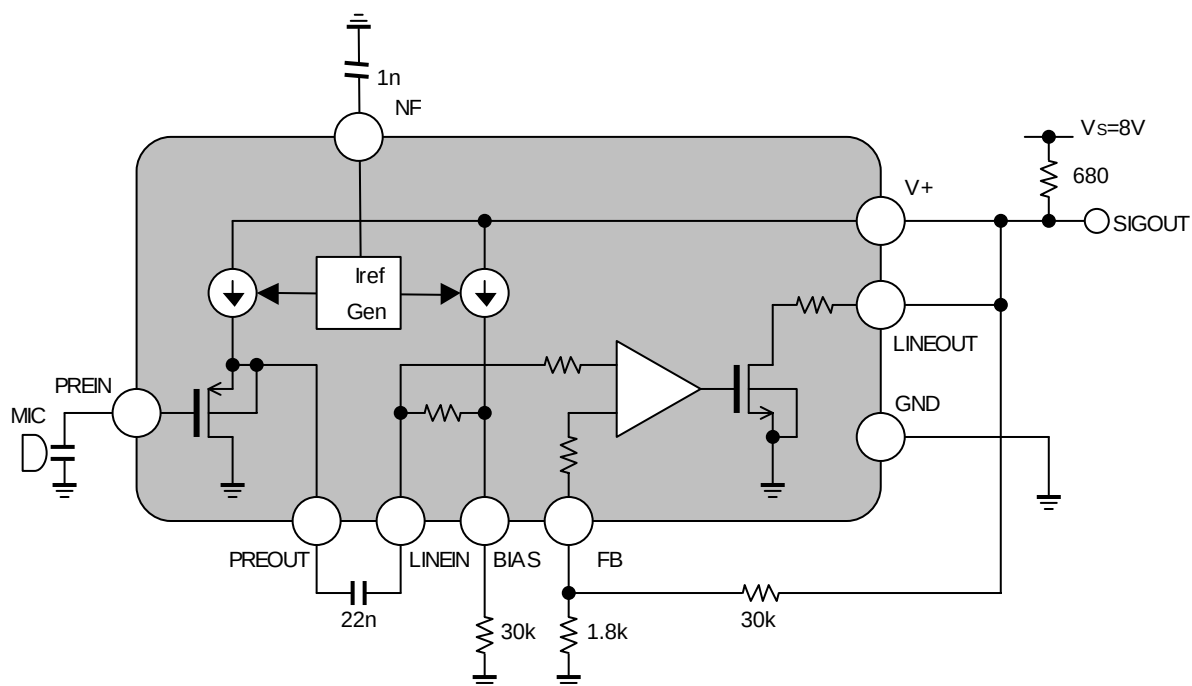
8	FB	Line Amplifier Feedback Terminal		60mV
9	LINEIN	Line Amplifier Input Terminal		60mV
10	BIAS	Reference Current Setting Terminal		60mV

■ APPLICATION CIRCUIT

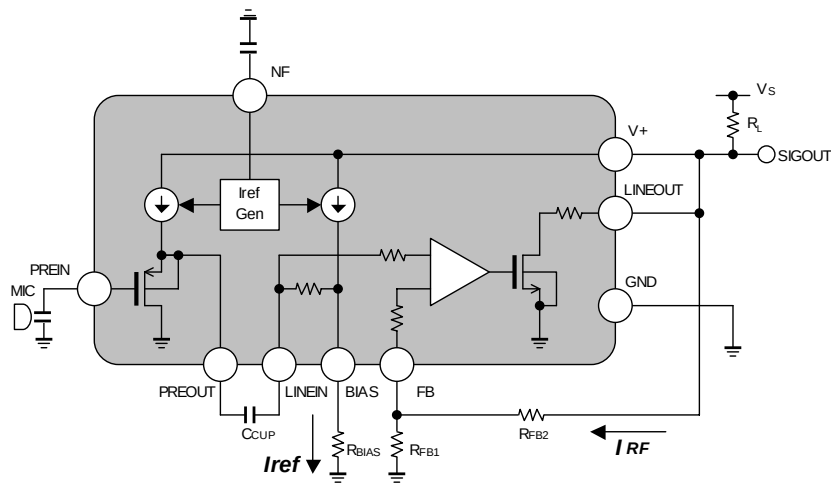
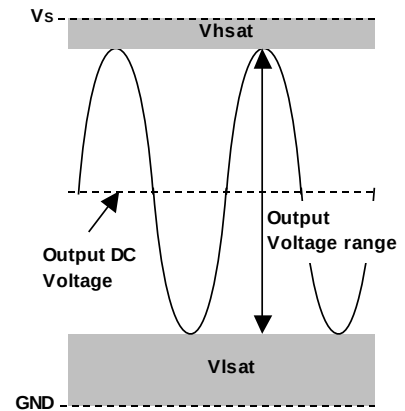
($G_V=37.8\text{dB}$)



($G_V=23.9\text{dB}$)



■ APPLICATION NOTE



Design Note:

1. Feeding resistor R_L range is 600Ω to $2.2k\Omega$.
Set by Operating Voltage and other electrical characteristics.
2. Output DC Voltage is set by R_{BIAS} .
 V_R is Voltage of R_{BIAS} .

$$V_R = (R_{FB1} / (R_{FB1} + R_{FB2})) \cdot V_{out} \quad V_{out} : \text{Output DC voltage}$$

$$R_{BIAS} = V_R / I_{ref} \quad I_{ref} : \text{reference Current}$$

Output DC Voltage is calculated with Output voltage range. (See Note.4)

3. Total Gain is determined with

$$G_V = 20 \log(R_{FB1} + R_{FB2}) / R_{FB1} \quad [\text{dB}]$$

Voltage gain range is 24dB to 40dB [@1kHz]

4. Output Voltage range is determined with

$$DCRANGE = V_S - (V_{hsat} + V_{lsat})$$

V_{hsat} : High side Minimum Saturation Voltage

$$V_{hsat} = (I_{DD2} + I_{RF}) \cdot R_L$$

I_{RF} : Current for feedback resistor. [R_{FB1}, R_{FB2}]

$$I_{RF} = V_0 / (R_{FB1} + R_{FB2}) \quad V_0 = \text{Output DC Voltage}$$

V_{lsat} : Low side Minimum Saturation Voltage (approximately 1.8V @25deg.)

ex.

$$V_S = 8V, V_0 = 4.7V, R_L = 680\Omega, R_{FB1} = 390\Omega, R_{FB2} = 30k\Omega, V_{lsat} = 1.8V$$

$$I_{RF} = 4.7V / (390\Omega + 30k\Omega) = 154.7\mu A$$

$$V_{hsat} = (220\mu A + 154.7\mu A) \cdot 680 = 254.8mV$$

$$DCRANGE = 8V - (254.8mV + 1.8V) = 5.95V_{P-P}.$$

5. Supply Current.

$$I_{DD1} = (V_S - V_{OUT}) / R_L \quad R_L: \text{Feeding Resistor.}$$

6. Maximum Load Capacitance

$$C_{Lmax} < 1,000 \text{pF}$$

7. Cut off frequency is determined with

$$f_c = 1 / (2\pi \cdot C_{CUP} (R_{IN} + R_{BIAS}))$$

$$R_{IN} : \text{Line Amp Input Resistance} = 100 \text{k}\Omega$$

■ Package Dimension.

