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.

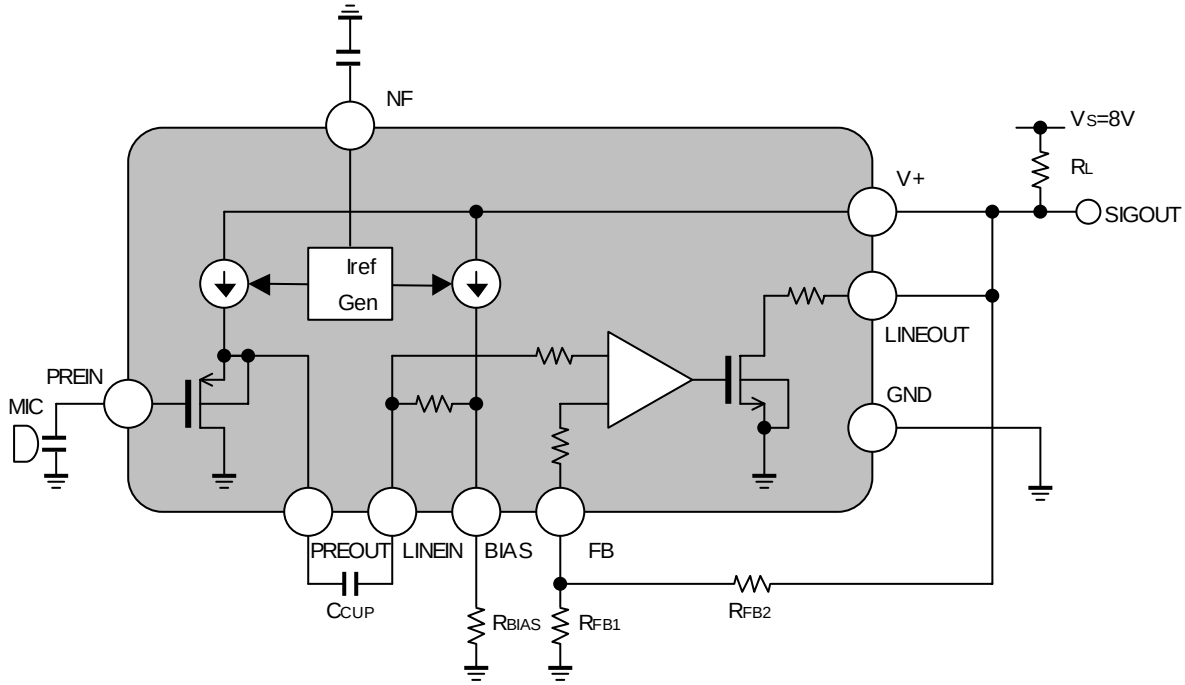
■ PACKAGE OUTLINE

NJU7907AUC4

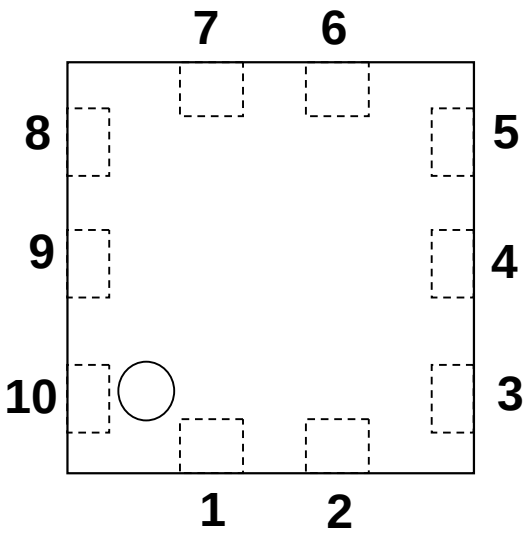
■ FEATURES

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

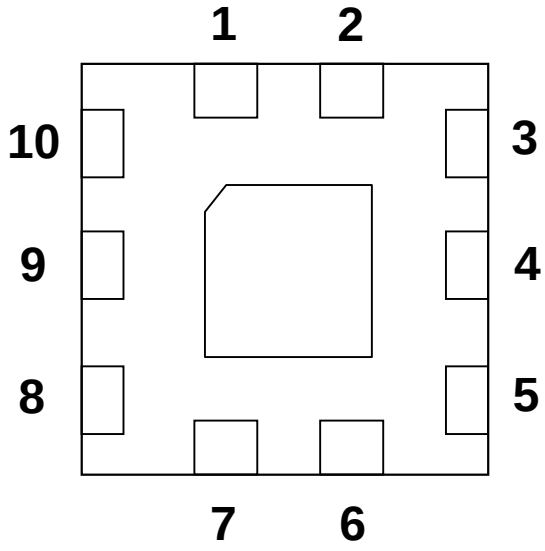
■ BLOCK DIAGRAM



■ **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℃)

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	Vimax	0.3	Vrms
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-40 to +125	°C

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

♦**DC CHARACTERISTICS** (Rg=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	Iref	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)

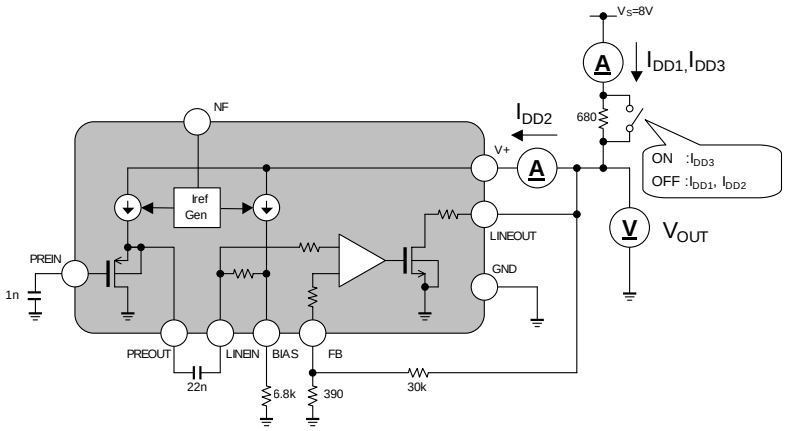
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Voltage Gain	Gv	Vin=50mVrms	-0.8	-0.5	-0.2	dB
Frequency Response	ΔG_f	1kHz-10kHz	-0.5	0	0.5	dB
Input Capacitance	Ci		-	1.0	-	pF
Input Resistance	Ri		200	-	-	MΩ
Total Harmonic Distortion	THD	Vin=100mVrms BW=400Hz to 30kHz	-	0.1	0.5	%
Output Noise Voltage 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** (Rg=0Ω, R_L=680Ω unless otherwise specified)

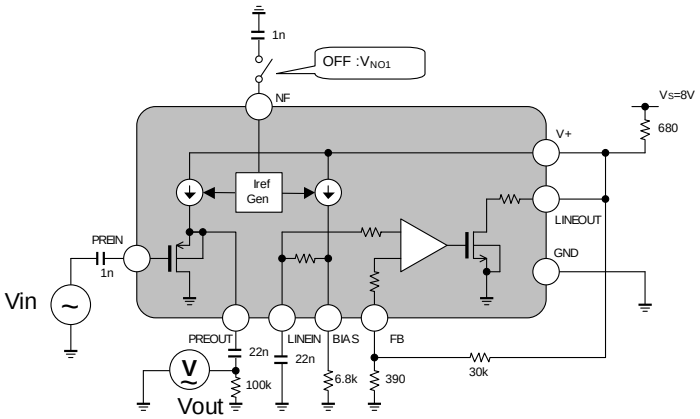
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Maximum Output Voltage	V_{OM}	OUTPUT, THD=3%	1.8	2.1	-	Vrms
Voltage Gain	G_V	Vin=10mVrms	37.3	37.8	38.3	dB
Total Harmonic Distortion	THD	Vo=1.6Vrms BW=400Hz to 30kHz	-	0.1	0.5	%
Output Noise Voltage	V_{NO}	Weighted-A	-	-78	-72	dBV
Output Resistance	Ro		-	5	10	Ω
Input Resistance	Ri		60	100	130	kΩ
Ripple Rejection	RR	V_{Ripple}=0.5Vrms PREIN→LINEOUT	25	40	-	dB

■ MEASUREMENT CIRCUIT

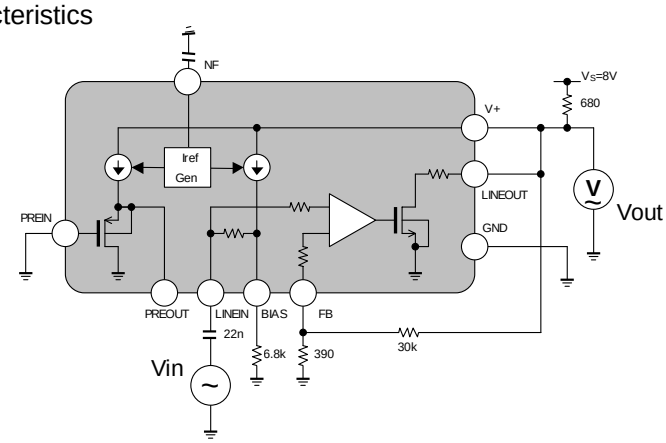
1. DC Characteristics



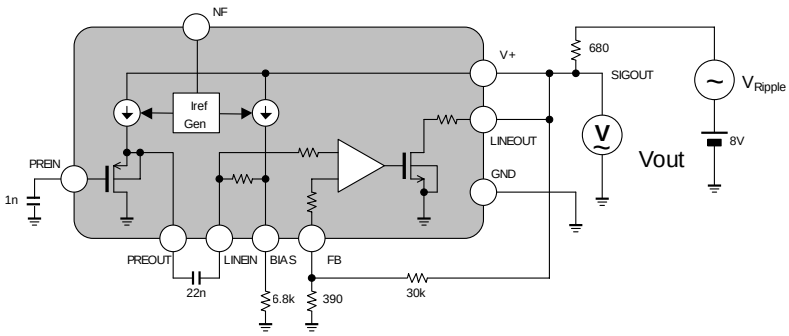
2. Pre-Amplifier Characteristics



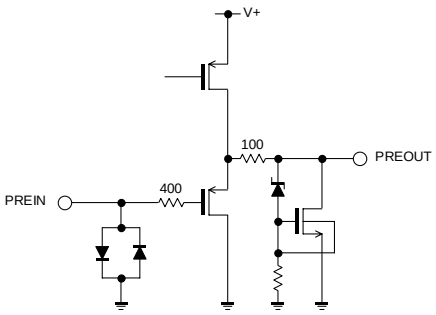
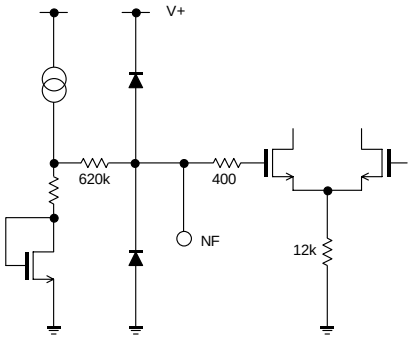
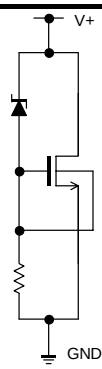
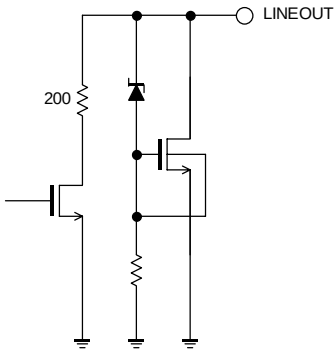
3. Line Amplifier Characteristics

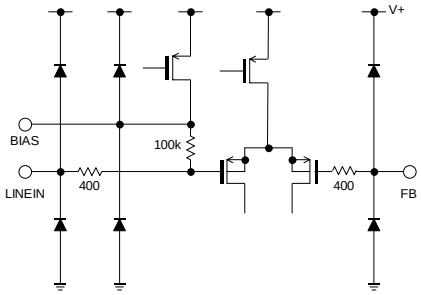


4. Ripple Rejection Characteristics



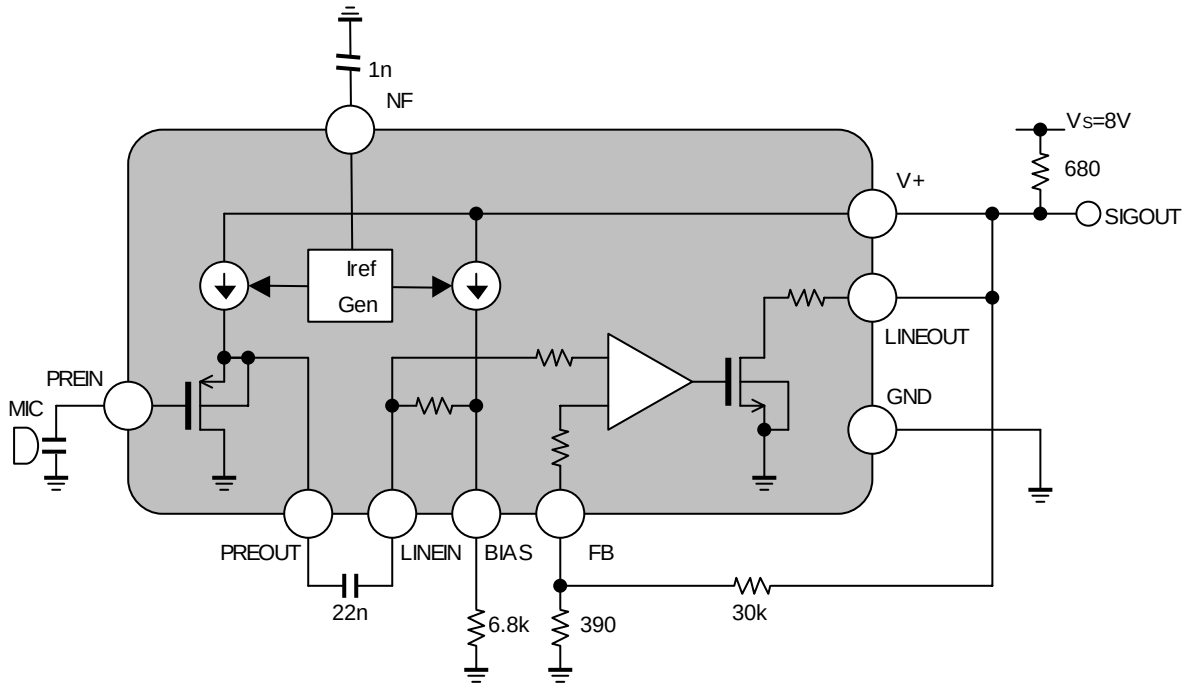
■ **TERMINAL DESCRIPTION**

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

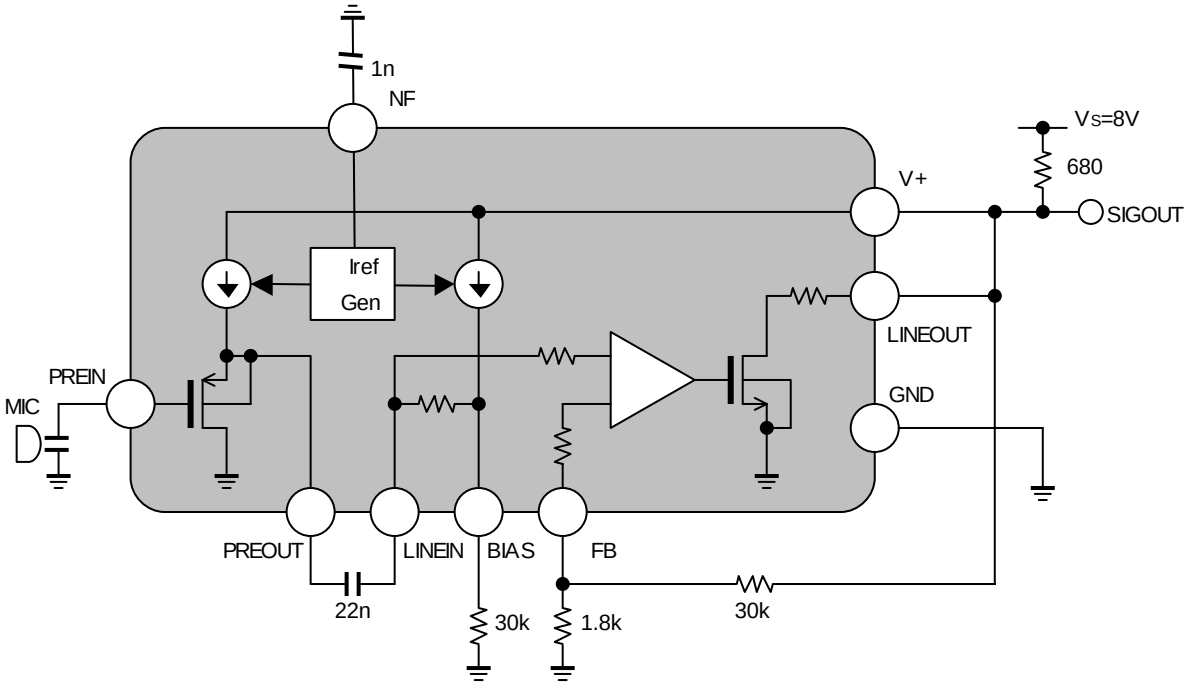
8	FB	Line Amplifier Feedback Terminal		60mV
9	LINEIN	Line Amplifier Input Terminal		60mV
10	BIAS	Reference Current Setting Terminal		60mV

■ APPLICATION CIRCUIT

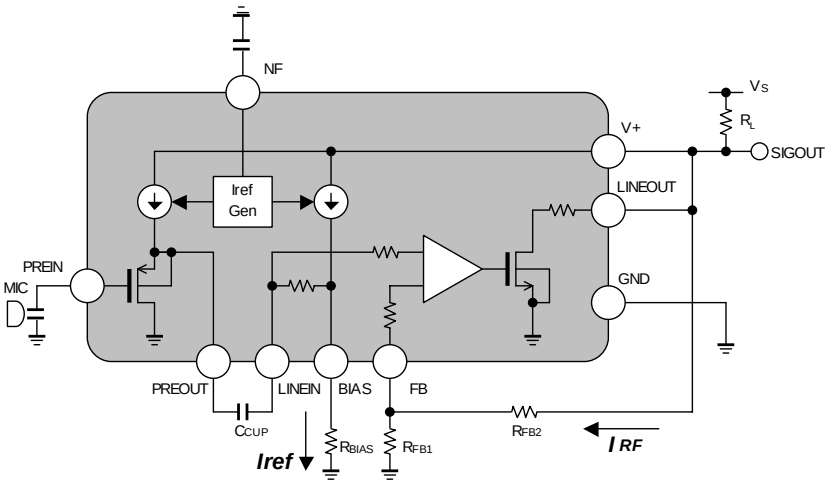
(G_V=37.8dB)

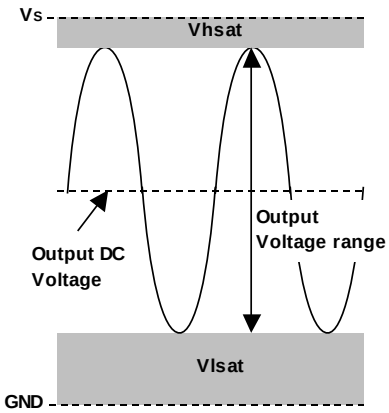


(G_V=23.9dB)



■ APPLICATION NOTE





Design Note:

1. Feeding resistor R_L range is 600Ω to 2.2kΩ.
   Set by Operating Voltage and other electrical characteristics.

2. Output DC Voltage is set by R_{BIAS}.
   V_R is Voltage of R_{BIAS}.

   $V_R = (R_{FB1}/(R_{FB1}+R_{FB2}))\bullet V_{out}$ Vout : Output DC voltage
   $R_{BIAS} = V_R/I_{ref}$ Iref : reference Current

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

3. Total Gain is determined with

   $G_v = 20\mathrm{Log}(R_{FB1}+R_{FB2})/ R_{FB1})$ [dB]
   Voltage gain range is 24dB to 40dB [@1kHz]

4. Output Voltage range is determined with

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

   Vhsat : High side Minimum Saturation Voltage
   $V_{hsat} = (I_{DD2}+I_{RF}) \bullet R_L$

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

   $I_{RF} = V_o/(R_{FB1}+R_{FB2})$ Vo= Output DC Voltage

   Vlsat : Low side Minimum Saturation Voltage (approximately 1.8V @25deg.)

   ex.
   V_S=8V, Vo=4.7V, R_L=680Ω, R_{FB1}=390Ω, R_{FB2}=30kΩ, Vlsat=1.8V

   I_{RF}=4.7V/(390Ω+30kΩ)=154.7uA
   V_{hsat} =(220μA+154.7μA) •680=254.8mV

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

5. Supply Current.

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

6. Maximum Load Capacitance

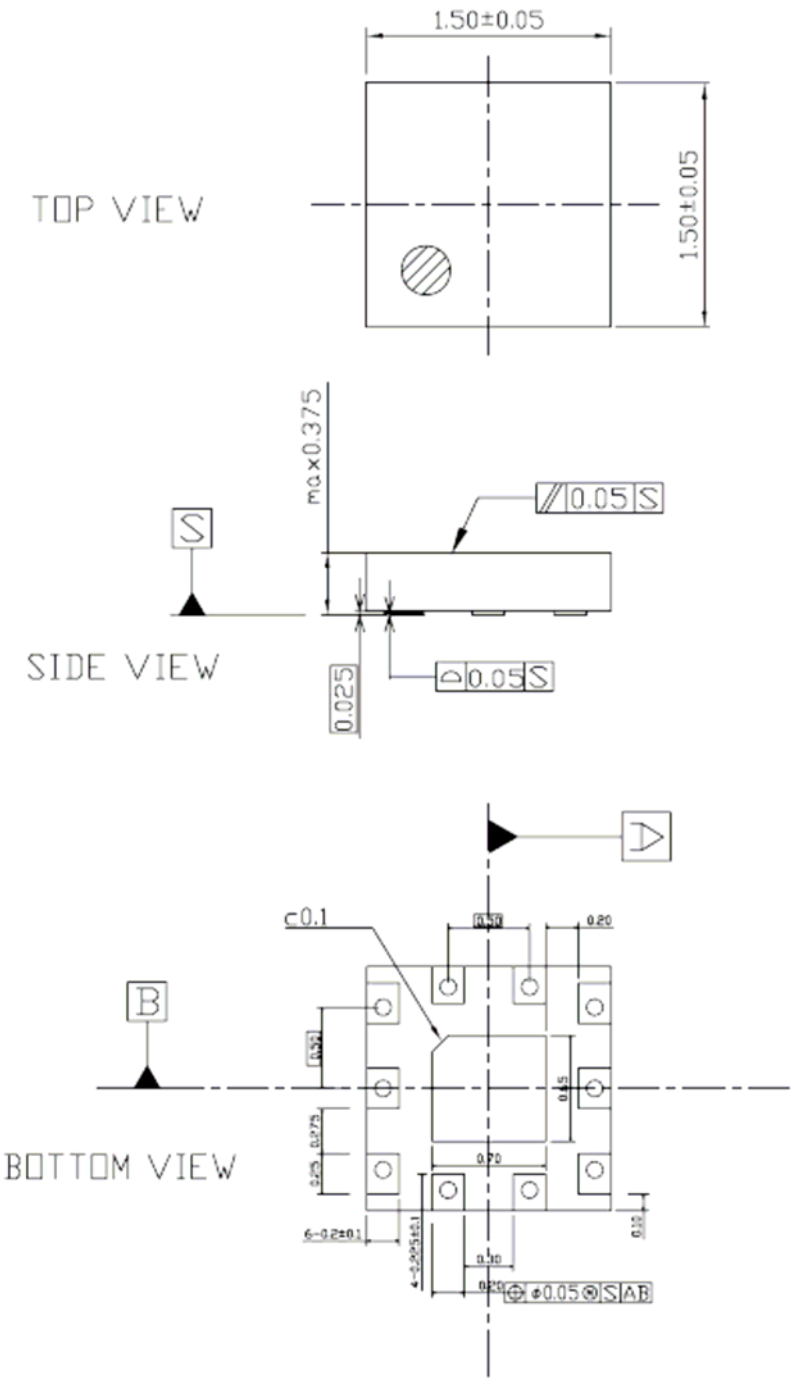
   C_{Lmax} <1,000pF

7. Cut off frequency is determined with

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

   R_{IN} :Line Amp Input Resistance=100kΩ

■**Package Dimension**.



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