

AAP661X

Electret Microphone (ECM) Pre-Amplifier w/Programmable Filter

PRELIMINARY DATA

DESCRIPTION

The AAP661X ECM Pre Amplifiers were designed for high end audio headset microphone applications. The performance of this Pre-Amplifier is such that it enables design of enhanced end system products, due to its various gain options, ultra-low noise and other high performance features.

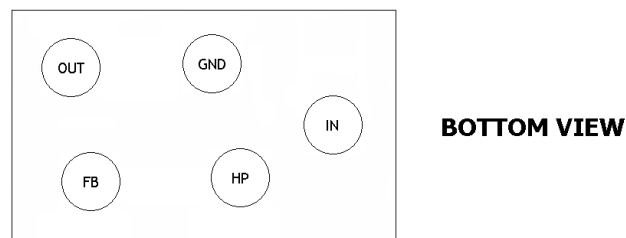
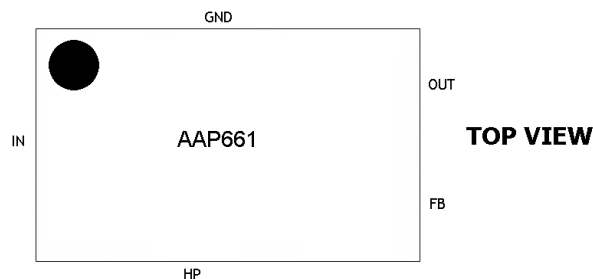
The AAP661X ECM Pre-Amplifier provides a number of performance advantages over prior ECM Pre-Amplifier products. Key features include ultra low input capacitance (0.35pF typical) and quiescent current (250μA typical), with ultra low equivalent input noise (1.9 μV RMS to 2.5 μV RMS, A-Weighted, with the microphone capacitor short circuited, gain version dependent). Additionally, the Pre-Amplifier supports a programmable high pass filter and DC output operation down to 1.23V. Other key features include THD performance 0.4% typical, output impedance of 25Ω typical, with exceptionally high tolerance to RF interference and ESD tolerance (8kV).

The AAP661X is offered with a fixed gain of 16dB, 19dB and 30dB. Packaging is bumped chip scale SMD configuration with a size of 930μm x 580μm and an overall thickness of 320μm (including solder bumps). Optimum for small diameter microphones, the die is RoHS compliant, with lead free solder pads of 118μm diameter. Packing styles available are 2" x 2" Waffle Pack or Tape and Reel.

- Selectable Gain Configuration — 16dB, 19dB and 30dB
- Ultra Low Input Capacitance—0.35pF Typ
- Ultra Low Equivalent Input Noise Performance—1.9 μV RMS to 2.5μV RMS, Cmic = SC, Varies with Gain
- 8kV ESD Tolerance
- High RFI Tolerance, Low Output Impedance (25Ω)
- Excellent THD Performance (< 0.5%)
- Ultra Low Quiescent Current (250μA Typical)
- Chip-Scale SMD Bumped Packaging (930μm x 580μm, 320μm thick)

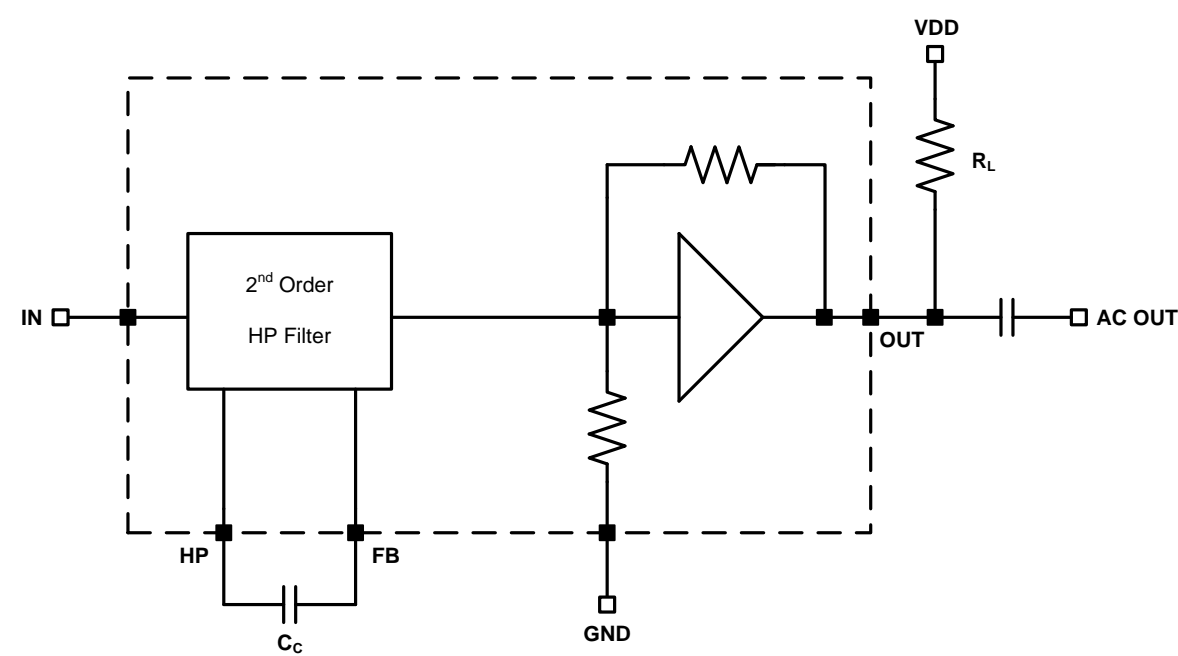
PIN CONFIGURATION: 5-Lead Micro SMD

AAP661X shown from the top and bottom.



FEATURES

Functional Block Diagram



MAXIMUM RATINGS

| PARAMETER | SYMBOL | PARAMETERS | | UNITS | CONDITIONS |
|----------------------------------|----------|------------|------|-------|---------------------------------|
| | | MIN. | MAX. | | |
| Applied Voltage (all pins) | | -0.5 | 2.5 | V | Max voltage between pin and GND |
| Supply Current | IDD | | 2 | mA | |
| ESD | Vesd,out | 8000 | | V | OUT terminal |
| | Vesd | 2000 | | | Other terminals |
| Operating Ambient Temp | | -40 | 85 | °C | |
| Storage Temp Range | | -40 | 100 | °C | |
| Performance Operating Temp Range | | -5 | 55 | °C | |

ELECTRICAL CHARACTERISTICS

Unless otherwise stated: T=25°C, VDD=1.8V, Vin=-40dBVrms for AAP661A and AAP661B, Vin=-60dBVrms for AAP661C
RL=2.2kΩ, Cc=100nF, Cmic=short

| PARAMETER | SYMBOL | PARAMETERS | | | UNITS | CONDITIONS |
|--------------------------|--------|------------|------|-----|-------|------------|
| | | MIN | TYP | MAX | | |
| OPERATING SUPPLY | | | | | | |
| Supply Voltage | VDD | 1.6 | 1.8 | 5.5 | V | RL=3.3kΩ |
| Operating Output Voltage | Vop | 1.18 | 1.23 | 1.3 | V | |
| Supply Current | IDD | | 250 | | μA | Note 1 |

Note 1: IDD= (VDD – Vop)/RL

| | | | | | | |
|---|--------------|------|------|------|-------------|--|
| PSRR | | | 60 | | dB | |
| AC CHARACTERISTICS | | | | | | |
| Transfer Function (AAP661A) | TF | 14 | 15 | 16 | dB | |
| Transfer Function (AAP661B) | TF | 18.5 | 19 | 19.5 | dB | |
| Transfer Function (AAP661C) | TF | 29 | 30 | 30.5 | dB | |
| Gain Variation over Supply | ΔA_v | | | 0.1 | dB | $1.6V < V_{DD} < 3.5V$ |
| Gain Variation over Temp (AAP661A & AAP661B) | ΔA_v | | | 0.2 | dB | $-5^{\circ}C < T < 55^{\circ}C$ |
| Gain Variation over Temp (AAP661C) | ΔA_v | | | 0.5 | dB | $-5^{\circ}C < T < 55^{\circ}C$ |
| Input Referred Noise | e_n | | 2 | 2.5 | μV RMS | Input shorted to GND, A-weighted values |
| Overload Margin (AAP661A & AAP661B) | V_{outmax} | | | 825 | mVpp | 5% distortion, TF=11dB |
| Overload Margin (AAP661C) | V_{outmax} | | | 422 | mVpp | 5% distortion, TF=11dB |
| LF Cutoff (AAP661A & AAP661B) | f_{LOW} | | 200 | | Hz | |
| LF Cutoff (AAP661C) | f_{LOW} | 180 | 265 | 360 | Hz | |
| HF Cutoff (AAP661A & AAP661B) | f_{HIGH} | 20 | 85 | | kHz | |
| HF Cutoff (AAP661C) | f_{HIGH} | 16 | 24 | | kHz | |
| Total Harmonic Distortion | THD | | 0.4 | | % | $V_{out} = -23dBV_{rms}$ |
| Input Capacitance | C_{IN} | | 0.35 | | pF | |
| Input Impedance | Z_{IN} | 10 | | | $G\Omega$ | |
| Output Impedance | Z_{OUT} | | 25 | 70 | Ω | |
| Input Impedance of FB (AAP661A) | Z_{INFB} | | 17 | | k Ω | |
| Input Impedance of FB (AAP661B) | Z_{INFB} | | 12.1 | | k Ω | |
| Input Impedance of FB (AAP661C) | Z_{INFB} | | 6 | | k Ω | |

APPLICATION

Use the following equation to calculate the capacitor (C_c) value to program the low frequency cutoff of the high-pass filter:

Example1: for a cutoff of $f = 100\text{Hz}$ using AAP661A

$$C_c = \frac{1}{2\pi * Z_{\text{INFB}} * f} = \frac{1}{2\pi * 17\text{k} * 100} = 94\text{nF}$$

Example2: for a cutoff of $f = 100\text{Hz}$ using AAP661B

$$C_c = \frac{1}{2\pi * Z_{\text{INFB}} * f} = \frac{1}{2\pi * 12.1\text{k} * 100} = 44\text{nF}$$

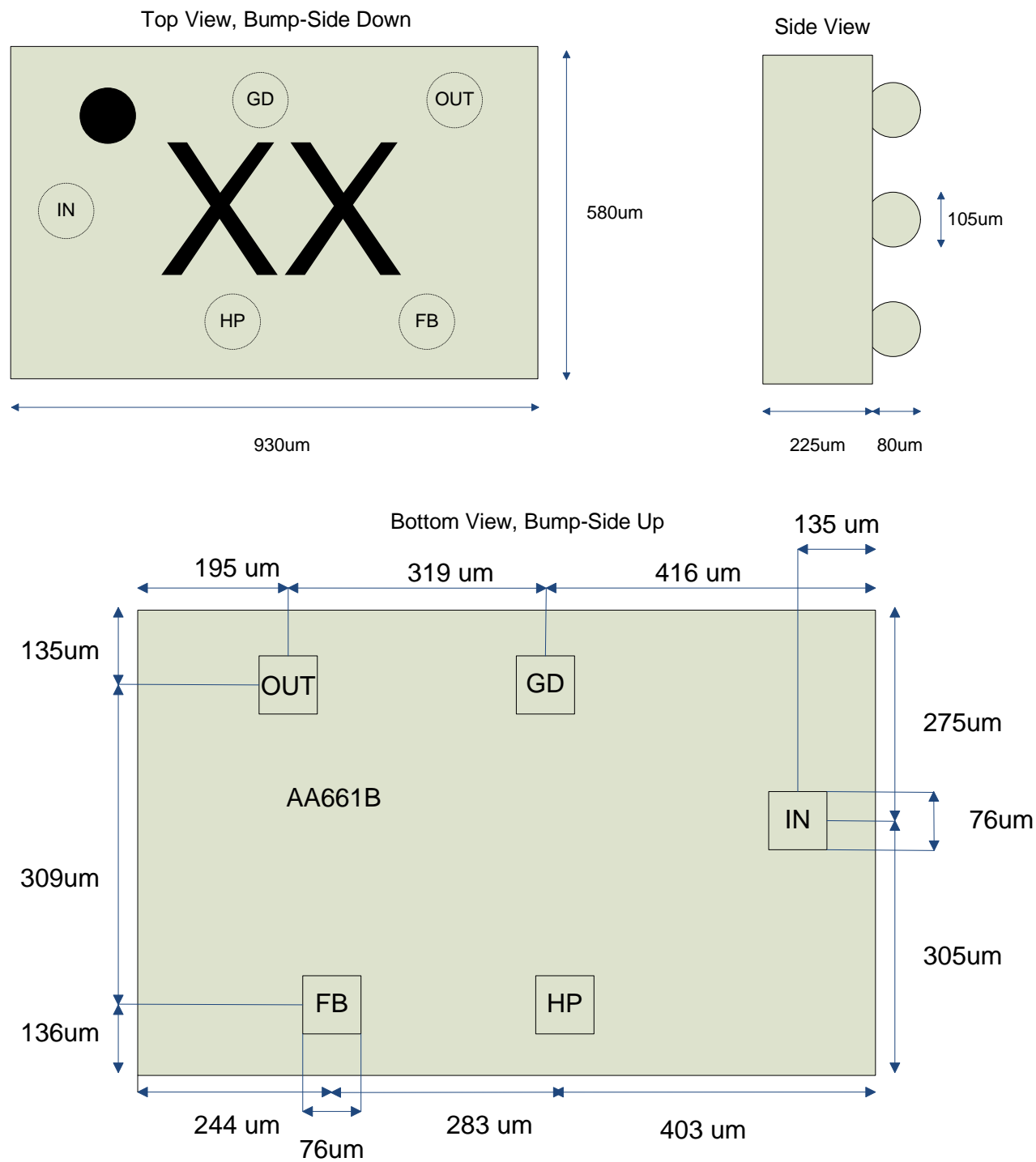
Example3: for a cutoff of $f = 100\text{Hz}$ using AAP661C

$$C_c = \frac{1}{2\pi * Z_{\text{INFB}} * f} = \frac{1}{2\pi * 6\text{k} * 100} = 265\text{nF}$$

ORDERING INFORMATION

| Ordering PN | Subgroup | Description | Temp. Range | Package | Packing Type | Packing Qty |
|-----------------------|--------------------------|--------------------------|------------------------------|-----------------|--------------|-------------|
| AAP661A S-M5A-G-LF-W | Microphone ECM Interface | Pre-Amplifier, 16dB gain | S - Special -5°C to +55°C | 5-pin Micro SMD | Waffle-Pack | 400 |
| AAP661A S-M5A-G-LF-TR | Microphone ECM Interface | Pre-Amplifier, 16dB gain | S - Special -5°C to +55°C | 5-pin Micro SMD | T&R | 3500 |
| AAP661B S-M5A-G-LF-W | Microphone ECM Interface | Pre-Amplifier, 19dB gain | S - Special -5°C to +55°C | 5-pin Micro SMD | Waffle-Pack | 400 |
| AAP661B S-M5A-G-LF-TR | Microphone ECM Interface | Pre-Amplifier, 19dB gain | S - Special -5°C to +55°C | 5-pin Micro SMD | T&R | 3500 |
| AAP661C S-M5A-G-LF-W | Microphone ECM Interface | Pre-Amplifier, 30dB gain | S - Special -5°C to +55°C | 5-pin Micro SMD | Waffle-Pack | 400 |
| AAP661C S-M5A-G-LF-TR | Microphone ECM Interface | Pre-Amplifier, 30dB gain | S - Special -5°C to +55°C | 5-pin Micro SMD | T&R | 3500 |

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