Electret Condenser Microphone Pre-Amplifer

Description

The AAP803AX ECM microphone preamplifier is a chip-scale device developed specifically for integrating in small form factor two terminal electret condenser microphones.

The AAP803Ax preamplifier provides reduced input capacitance, improved noise performance and larger output swing at a lower supply voltage.

The AAP803Ax is offered in two versions with the part numbers AAP803A1 and AAP803A3. The AAP803A1 has 3 gain settings (low, mid and high and the A3 has 2 gain settings (mid and max) both are designed with low quiescent current consumption for use in lower power typically battery powered applications. The gain setting is done by selecting the proper FB pin for the signal path (1, 2, or 1 and 2).

The AAP803Ax is provided in a chip scale SMD package. The package size is 820µm x 550µm; with an overall height of 315µm including solder bumps. This extremely small package size and aspect ratio is optimum for use in small diameter microphones.

Available for purchase in either waffle pack for low volume orders or in tape & reel for larger quantities.

Features

- Adjustable Voltage Gain up to 27dB, 100Hz to 10kHz
- Quiescent Current 125µA
- Low Voltage Operation 1.5V with 450Ω Load
- Low Input Capacitance 0.7pF
- Low Output Impedance <30Ω
- Low Noise <1.3µV RMS Input Noise (A-weighted, input shorted)
- ESD Protection 7.5kV Minimum at Output
- High Pass, Low Pass and Band Pass Filtering with External Components
- RoHS Compliant & Halogen Free

Applications

- Small Diameter Electret Microphones

Functional Block Diagram

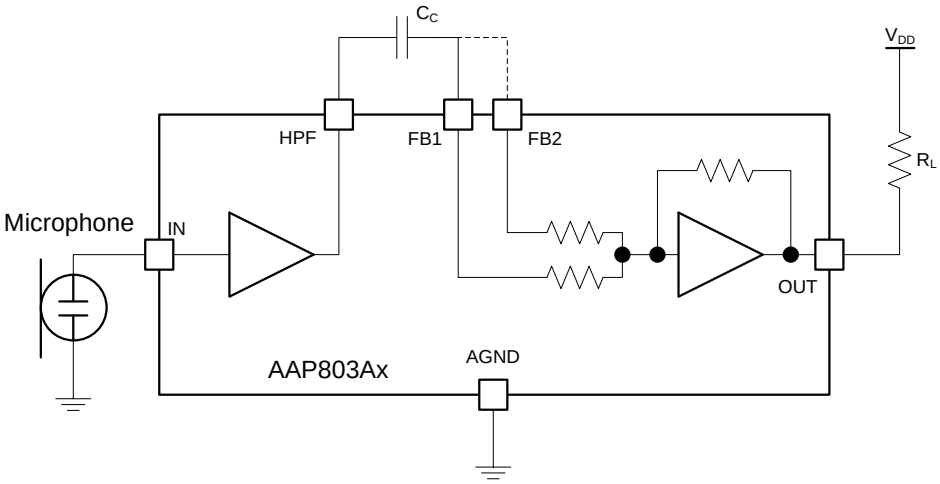


Figure 1 · Functional Block Diagram

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Pin Configuration

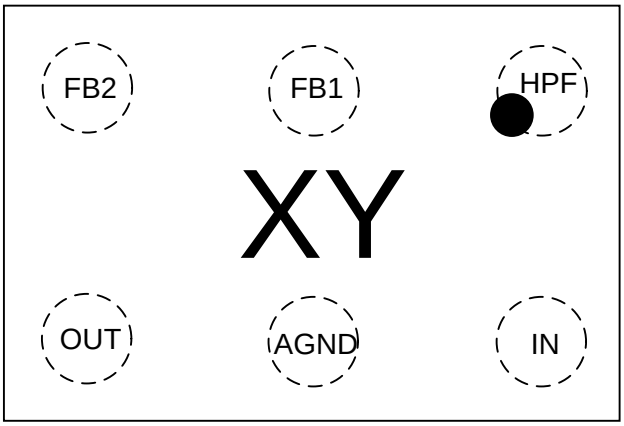


Figure 2 · Pinout (Top View)

- Top mark XY and pin 1 indicator
  XY= Unique lot code assigned for each assembly order

Ordering Information

Ambient Temperature	Type	Package	Part Number	Packaging Type
-5°C to 55°C	RoHS2 compliant, Pb-free Halogen Free	CSP	AAP803A1-TR	Tape and Reel
			AAP803A3-TR	Tape and Reel
Note T&R Quantity = 3500				

Pin Description

Pin Designator	Description
HPF	High Pass Filter. Connect a capacitor between this pin and FB1/FB2.
FB1	Feedback 1. High pass filter and gain setting signal path.
FB2	Feedback 2. High pass filter and gain setting signal path.
OUT	Output
AGND	Analog Ground
IN	EMC Input

Versions

Version	Gain Mode	Configuration
AAP803A1	Low	FB2
	Mid	FB1
	High	FB1 & FB2
AAP803A3	Mid	FB1
	High	FB2

Absolute Maximum Ratings

Parameter	Min	Max	Units
Maximum Voltage on any pin	-0.5	2.5	V
Maximum Output Current (R_L = 2kΩ)		2.5	mA
Maximum junction temperature (T_J max)	-20	70	°C
ESD Human Body Model (Output Pin)		7.5	kV
ESD Human Body Model (All other pins except input)		2	kV
ESD Human Body Model (Input Pin)		100	V
Maximum storage temperature	-65	150	°C
Peak package solder reflow temperature (40 seconds maximum exposure)		260	°C

Note: Exceeding any Absolute Maximum ratings could cause damage to the device. All voltages are with respect to GND. Currents are positive into, negative out of specified terminal. These are stress ratings only and functional operation of the device at these, or any other conditions beyond those indicated under “Recommended Operating Conditions” are not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Typical Operating Conditions

VCC Range	Typical VCC	I_{VCC} Range	Typical I_{VCC}	Conditions
1.6V to 5V	1.6V	150µA to 1.2mA	210µA	R_L= 3.3kΩ, C_C = 220nF[1]
3.5V to 10V	5V	240µA to 890µA	390µA	R_L= 10kΩ, C_C = 220nF[2]
1.5V to 2V	1.5V	866µA to 1.97mA	1mA	R_L= 450Ω, C_C = 220nF

Note: [1] Valid only for AAP803A3; [2] Condition not tested

Electrical Characteristics

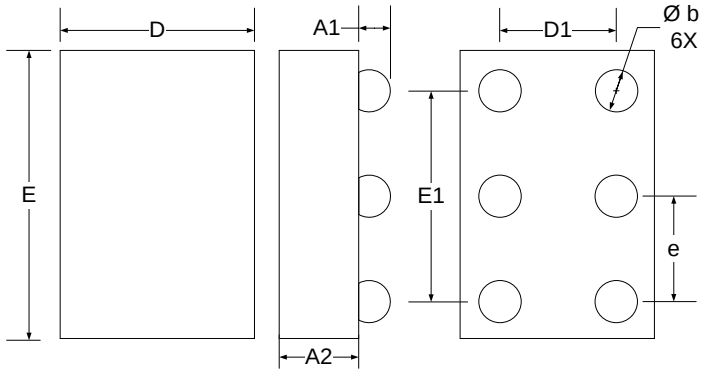
Note: Unless otherwise specified, all limits are guaranteed for T_J = 25°C, CC = 220nF, CMIC is short circuit.
TC1: AAP803A1 V_{DD} = 1.5V, R_L = 450Ω, V_{IN} = -40dBV_{RMS}, Gain = 16dB
TC3: AAP803A3 V_{DD} = 1.6V, R_L = 3.3kΩ, V_{IN} = -40dBV_{RMS}, Gain = 16dB

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
General Characteristics						
V_{O_DC}						
AAP803A1	Output DC	TC1	1.12	1.13	1.22	V
AAP803A3		TC3	1.05	1.11	1.22	
V_{O_DCTEMP}						
AAP803A1	Output DC	TC1 @ T_J = -5°C to 55°C	1.06	1.13	1.22	V
AAP803A3		TC3 @ T_J = -5°C to 55°C	1.03	1.11	1.22	
I_{CCMIN}						
AAP803A1	Minimum supply current	ICC = (V_{DD} – V_{ODC})/R_L	127			µA
AAP803A3			107			
I_{CCMAX}	Maximum supply current	Reference only, not production tested			2.5	mA
C_{IN}	Input Capacitance	Reference only, not production tested		0.7		pF
Z_{IN}	Input Impedance	V_{IN} < 20mV; Reference only, not production tested	8			GΩ
Z_{OUT}	Output Impedance			20	24	Ω
Z_{HPF}						
AAP803A1	Input Impedance on HPF	Force 0 µA to 10 µA on HPF	0.93	1.2	1.5	kΩ
AAP803A3			0.83	1	1.35	
Gain Characteristics						
A_V Range (AAP803A1)						
Low	Fixed Gain Range	IC gain select pins; FB2		11		dB
Mid		IC gain select pins; FB1		16		
High		IC gain select pins; FB1 & FB2		18		
A_V Range (AAP803A3)						
Mid	Fixed Gain Range	IC gain select pins; FB1		16		dB
High		IC gain select pins; FB2		26		
EMI_F	EMI Filter Rejection	Reference only, not production tested		-60		dB
ΔA_V	Gain variation for selected parameter		-1		1	dB
ΔTA_V	Gain variation over temperature	T_J = -5°C to 55°C, not production tested			0.5	
ΔIA_V	Gain variation over supply	200µA < I_{VCC} < 2.5mA			0.1	
Noise Characteristics						
e_n	RMS input noise (mid gain)	A weighted input shorted; not production tested		1.3	1.5	µV

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
e_{nc}	RMS input noise (mid gain)	C_{MIC} = 5pf, A weighted ; reference only, not production tested		1.5	1.8	µV
f_{LOWA11}	Lower -3dB Roll Off Frequency	AAP803A1, C_C = 220nF, FB1 connected; not production tested	135	200	240	Hz
f_{LOWA12}	Lower -3dB Roll Off Frequency	AAP803A1, C_C = 220nF, FB2 connected; not production tested	85	107	140	Hz
f_{LOWA31}	Lower -3dB Roll Off Frequency	AAP803A3, C_C = 220nF, FB1 connected; not production tested	135	200	240	Hz
f_{LOWA32}	Lower -3dB Roll Off Frequency	AAP803A3, C_C = 220nF, FB2 connected; not production tested	420	530	740	Hz
f_{HIGH}	Upper -3dB Roll Off Frequency	Not production tested	22	30		kHz
THD Characteristics						
THD @V_{OUT}= -24dBV	Maximum Output Signal	TC1 – AAP803A1; not production tested		0.8	0.85	%
		TC3 – AAP803A3; not production tested		0.8	1.1	
THD @V_{OUT}= -15dBV	Maximum Output Signal	TC1 – AAP803A1; not production tested		2.3	2.4	%
THD @V_{OUT}= -20dBV	Maximum Output Signal	TC3 – AAP803A3; not production tested		2.0	3.5	%

Package Outline Dimensions

The package is halogen free and meets RoHS2 and REACH standards.

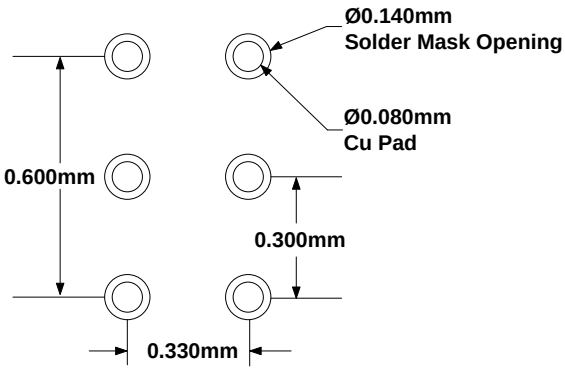


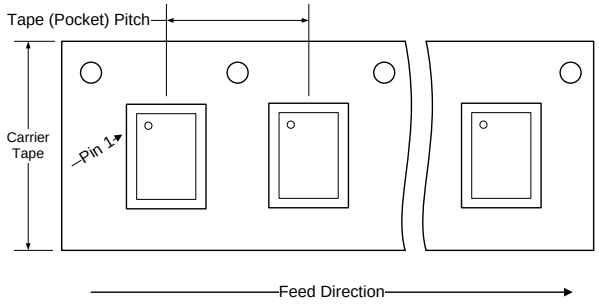
Dim	MILLIMETERS		INCHES	
	MIN	**MAX**	**MIN**	**MAX**
A1	0.075	0.105	0.0030	0.0041
A2	0.200	0.250	0.0079	0.0098
b	0.120		0.0047	
D1	0.330 BSC		0.0130 BSC	
D	0.530	0.570	0.0209	0.0224
e	0.300 BSC		0.0118 BSC	
E1	0.600 BSC		0.0236 BSC	
E	0.800	0.840	0.0315	0.0331

Note:

1. Solder ball composition is SnAgCu.
2. Dimensions are in mm, inches for reference only.

Figure 3 · 6 Bump X2CSP Micro SMD Package Dimensions





- Carrier tape width 8mm
- Reel Diameter 7”
- Devices per reel 3,500

Figure 4 · PCB Layout Footprint / Tape and Reel Information



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