 = Preliminary = AK5574
120dB 768kHz 32-bit 4ch $\Delta\Sigma$ ADC with 4Filters

1. General Description

The AK5574 is a 32bit, 768kHz sampling, differential input A/D converter for digital audio systems. It integrates an 4-channel A/D converter, suitable for mixers and automotive amplifier units. The AK5574 achieves 120dB dynamic range, 110dB S/(N+D) and 123dB dynamic range in Mono mode while keeping low power consumption performance. Four types of digital filters are selectable according to the application. The AK5574 can be easily connected to a DSP by supporting TDM audio formats.

2. Features

- **Sampling Rate: 8kHz ~ 768kHz**
- **Full Differential Inputs**
- **32Bit Digital Filter**
 - Sharp Roll-Off Filter
 - Slow Roll-Off Filter
 - Short Delay Sharp Roll-Off Filter
 - Short Delay Slow Roll-Off Filter
- **S/(N+D): 110dB**
- **DR, S/N: 120dB (Mono Mode: 123dB)**
- **Digital HPF**
- **Power Supply: 4.75~ 5.25V(Analog), 1.7~1.98V or 3.0 ~ 3.6V(Digital)**
- **Output Format: 24/32bit MSB justified, I²S or TDM**
- **Cascade TDM I/F: 16ch/48kHz, 8ch/96kHz, 4ch/192kHz**
- **DSD (64fs, 128fs, 256fs) Output Data**
- **Master & Slave Modes**
- **Overflow Flag**
- **3-wire Serial and I²C μ P I/F**
- **Power Consumption: 302.2mW (@ AVDD=5.0V, TVDD=3.3V, fs=48kHz)**
- **Package: 48-pin QFN**

3. Block Diagram

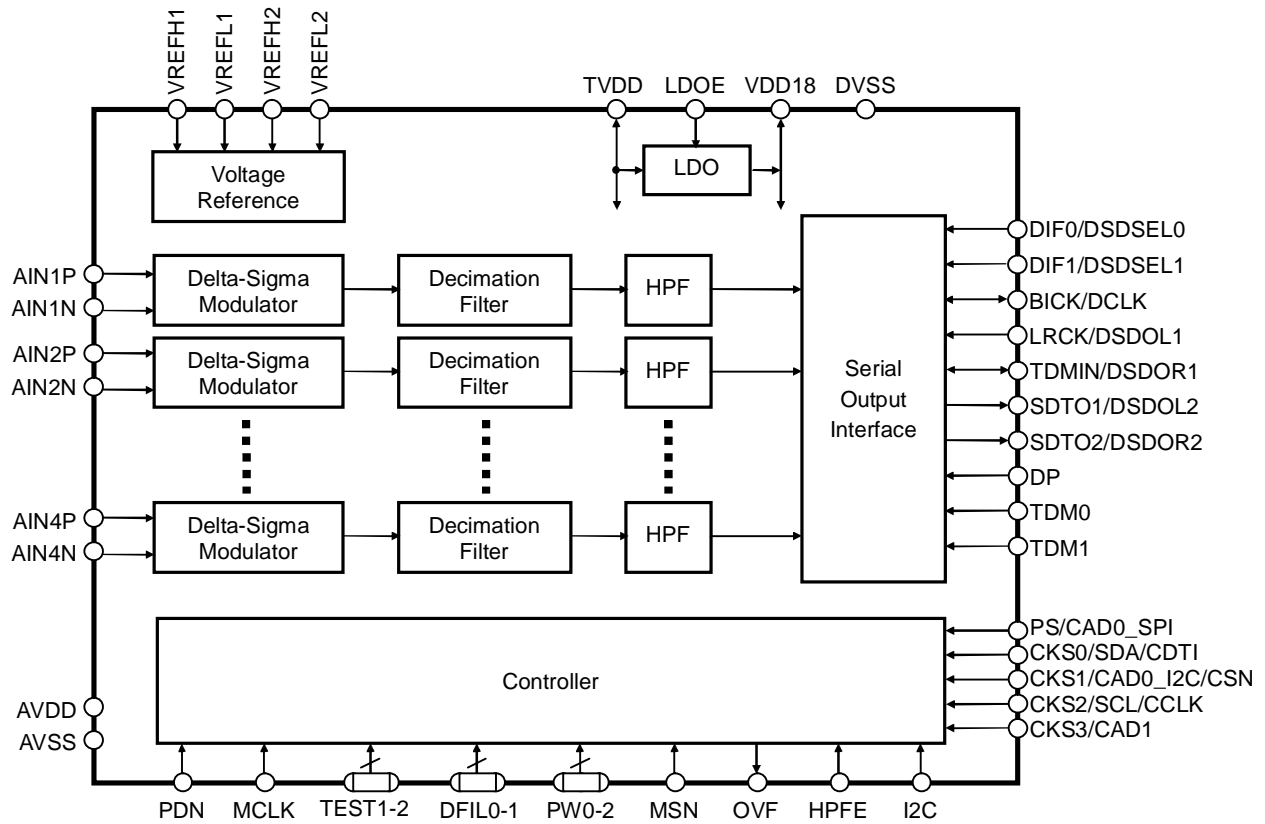


Figure 1. Block Diagram

4. Absolute Maximum Ratings

(VSS=0V; Note 1)

Parameter		Symbol	Min.	Max.	Unit
Power Supplies	Analog (AVDD pin)	AVDD	-0.3	6.0	V
	Digital (TVDD pin)	TVDD	-0.3	4.0	V
	Digital (VDD18 pin) (Note 2)	VDD18	-0.3	2.5	V
Input Current (Any Pin Except Supplies)		IIN	-	±10	mA
Analog Input Voltage (AIN1~8P, AIN1-8N pins)		VINA	-0.3	AVDD+0.3	V
Digital Input Voltage		VIND	-0.3	TVDD+0.3	V
Ambient Temperature (Power applied)					
When the back tab is connected to VSS		Ta	-40	105	°C
When the back tab is open		Ta	-40	85	°C
Storage Temperature		Tstg	-65	150	°C

Note 1. All voltages with respect to ground.

Note 2. The 1.8V LDO is off (LDOE pin = "L") and an external power is supplied to the VDD18 pin.

WARNING: Operation at or beyond these limits may result in permanent damage to the device.
Normal operation is not guaranteed at these extremes.

5. Recommended Operation Conditions

(VSS=0V; Note 1)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Power Supplies	Analog (AVDD pin)	AVDD	4.75	5.0	5.25	V
	(LDOE pin= "L") (Note 3)					
	IO Buffer (TVDD pin) (Note 4)	TVDD	1.7	1.8	1.98	V
	Digital Core (VDD18 pin)	VDD18	1.7	1.8	1.98	V
	(LDOE pin= "H") (Note 5)					
Voltage Reference (Note 7)	IO Buffer (TVDD pin)	TVDD	3.0	3.3	3.6	V
	"H" voltage Reference (Note 6)	VREFH1-4	4.75	5.0	5.25	V
	"L" voltage reference	VREFL1-4	-	AVSS	-	V

Note 1. All voltages with respect to ground.

Note 3. TVDD must be powered up before VDD18 when the LDOE pin = "L". The power up sequence between AVDD and TVDD or AVDD and VDD18 is not critical.

Note 4. TVDD must not exceed VDD18±0.1V when LDOE pin= "L".

Note 5. When LDOE pin = "H", the internal LDO supplies 1.8V (typ). The power up sequences between AVDD and TVDD is not critical.

Note 6. VREFH1~4 pin must not exceed AVDD+0.1V.

Note 7. VREFL1-4 pins must be connected to AVSS.

Analog Input Voltage is proportional to {(VREFH) – (VREFL)}.

 $V_{in}(\text{typ}, @ 0\text{dB}) = \pm 2.8 \times \{(VREFH) - (VREFL)\} / 5 [\text{V}]$.

* AKM assumes no responsibility for the usage beyond the conditions in this data sheet.

6. Analog Characteristics

(Ta=25°C; AVDD=5.0V; TVDD=3.3V, fs=48kHz, 96kHz; BICK=64fs; Signal Frequency=1kHz; 24bit Data; Measurement frequency=20Hz~20kHz at fs=48kHz, 40Hz~40kHz at fs=96kHz, 40Hz~40kHz at fs=192kHz, unless otherwise specified.)

Parameter	Min.	Typ.	Max.	Unit		
Analog Input Characteristics:						
Resolution	-	-	32	Bits		
Input Voltage	(Note 8)			Vpp		
S/(N+D)	fs=48kHz BW=20kHz	-1dBFS	100	110	-	dB
		-20dBFS		97	-	dB
		-60dBFS		57	-	dB
	fs=96kHz BW=40kHz	-1dBFS		110	-	dB
		-20dBFS		90	-	dB
		-60dBFS		50	-	dB
	fs=192kHz BW=40kHz	-1dBFS	-	110	-	dB
		-20dBFS		90	-	dB
		-60dBFS		50	-	dB
Dynamic Range (-60dBFS with A-weighted)	Stereo Mode	112	120	-	dB	
	Mono Mode	-	123	-	dB	
S/N (A-weighted)	Stereo Mode	112	120	-	dB	
	Mono Mode	-	123	-	dB	
Input Resistance	3.0	3.5	4.1	kΩ		
Interchannel Isolation	110	120		dB		
Interchannel Gain Mismatch		0	0.5	dB		
Power Supply Rejection	(Note 9)			dB		
Power Supplies						
Power Supply Current						
Normal Operation (PDN pin = "H")						
AVDD		57.4	TBD	mA		
TVDD (fs=48kHz)		8.45	TBD	mA		
TVDD (fs=96kHz)		TBD	TBD	mA		
TVDD (fs=192kHz)		TBD	TBD	mA		
Power down mode (PDN pin = "L")	(Note 10)					
AVDD+TVDD		10	100	μA		

Note 8. This value is (AINnP)-(AINnN) that the ADC output becomes full-scale (n=1~8). Input voltage is proportional to VREFH-VREFL.

$$V_{in} = 0.56 \times (V_{REFHm} - V_{REFLm}) [V_{pp}]. (m=1\sim 4)$$

Note 9. PSRR is applied to AVDD, TVDD with 1kHz, 20mVpp sine wave. The VREFH1~4 pins are held to the same voltage.

Note 10. All digital inputs are fixed to TVDD or TVSS.

IMPORTANT NOTICE

0. Asahi Kasei Microdevices Corporation (“AKM”) reserves the right to make changes to the information contained in this document without notice. When you consider any use or application of AKM product stipulated in this document (“Product”), please make inquiries the sales office of AKM or authorized distributors as to current status of the Products.
1. All information included in this document are provided only to illustrate the operation and application examples of AKM Products. AKM neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of AKM or any third party with respect to the information in this document. You are fully responsible for use of such information contained in this document in your product design or applications. **AKM ASSUMES NO LIABILITY FOR ANY LOSSES INCURRED BY YOU OR THIRD PARTIES ARISING FROM THE USE OF SUCH INFORMATION IN YOUR PRODUCT DESIGN OR APPLICATIONS.**
2. The Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact, including but not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for the above use unless specifically agreed by AKM in writing.
3. Though AKM works continually to improve the Product’s quality and reliability, you are responsible for complying with safety standards and for providing adequate designs and safeguards for your hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of the Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption.
4. Do not use or otherwise make available the Product or related technology or any information contained in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). When exporting the Products or related technology or any information contained in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. The Products and related technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
5. Please contact AKM sales representative for details as to environmental matters such as the RoHS compatibility of the Product. Please use the Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. AKM assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
6. Resale of the Product with provisions different from the statement and/or technical features set forth in this document shall immediately void any warranty granted by AKM for the Product and shall not create or extend in any manner whatsoever, any liability of AKM.
7. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of AKM.