AKM Semiconductor, Inc.

2012 Product Guide

Analog and Mixed Signal IC's for:

- Mobile Devices
- Automotive
- Consumer
- Communications
- Industrial

AKM People and Facilities

Design and Development

This is the starting point for AKM's acclaimed mixed-signal ASSP's, incorporating innovative AKM circuits and taking advantage of AKM's unique fabrication capabilities. The design center itself is known for its atmosphere of free-flowing creativity, unrestrained by conventional preconceptions, and for its wealth of experience and know-how gained in the course of constant breakthroughs made in over 500 unique designs.

The center creates core technologies in a dynamic process that includes participation in international symposia, joint development with overseas partners, and the fusing of AKM technology and concepts with those introduced from other sources. Its fast design and development speed and product quality are the result of the AKM "top-down design" techniques and long-standing policies such as the provision of a workstation for every person in the center. In both hardware and software, and in its free atmosphere unrestricted by conventional frames of thought, the center is now working to meet new needs and performance levels, including systemization of higher levels of integration and lower operating voltage and current levels.

Marketing and Sales

Technical innovation is important for meeting the diversified demands of the end-user market. The Marketing & Sales Center supports the planning, marketing, selling and development of new products to meet the system needs of our customers. We conduct business by comprehensively matching customers´ requests with AKM´s technical strength, development cycles, and matching cost to the market requirement. Since the foundation of AKM, a culture of "close to customers" and "customer-based product development" has taken root for the expansion of business centered on application-specific standard products (ASSP's).

Although this publication is focused primarily on audio, timing, power, and magnetic sensor products, AKM also designs and markets products for the telecommunications, networking, wireless and data storage markets. Among these products are TCXO analog controllers, analog front end chips for CD, laser diode controllers for communications infrastructure, CD-RW and DVD drives and wireless phone IC's. Visit www.akm.com for more details.

Manufacturing Facilities

The Nobeoka wafer fab, AKM's first facility for large-scale production, began commercial shipment of IC's in October 1993. Located along the Hohri River, one of the cleanest in Japan, the plant is highly renowned as the source of a wide variety of digital-analog mixed-signal IC's for specialized applications. In addition to its excellent location, it benefits from the inherent safety and functionality in plant design that comes from the plant engineering expertise of a parent company with industrial chemistry at its core. The production systems and equipment are among the world's most advanced, with a 0.1µm Class 1 clean room including below-floor space for support apparatus to manufacture products which meet the world's highest quality standards.

In addition to the Nobeoka CMOS Fab, AKM has other facilities for manufacturing analog and mixed-signal power products and magnetic sensors. Our staff of highly experienced and strongly motivated engineers continuously work to develop new testing techniques which ensure the highest level of product quality, and to develop proprietary new production processes to meet the market demand for high speed operation and low power dissipation.

World-leading examples include the combination of digital-analog CMOS and magnetic sensors to create an electronic compass, high-voltage CMOS processes to enable integration of high output voltage buffers, and a unique process to build an infrared-sensor without transmitting any light.

AKM

The world's premier supplier of digital audio converter IC's

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Contacting AKM

On the web: **http://www.akm.com**

Technical support: **icinfo@akm.com** - access to the entire AKM applications team. If you have questions or need help with an AKM part, send an e-mail to this address and get a response within minutes.

Sales support: **sales@akm.com** - if you need assistance purchasing parts, getting price quotes, or requesting samples, send an e-mail to this address and a North American sales representative will contact you.

USA headquarters: 408-436-8580
Toll-free: 1-888-AKM-SEMI (256-7364)

AKM Semiconductor, Inc.
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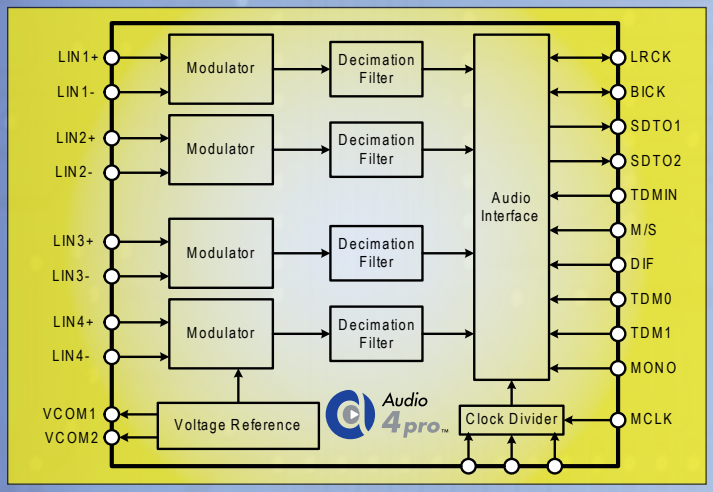
San Jose, CA 95110

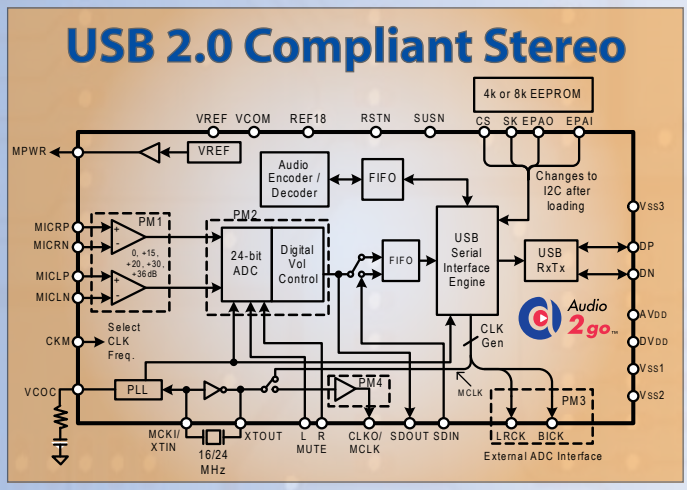
ADC

Analog-to-Digital Converters Product Spotlight

Quad-Channel Low Latency 120dB



USB Transceiver, Microphone Amp



AK5388A

- DR, SNR: 120dB (quad); 123dB (stereo)
  124.5dB (mono operation)
- THD+N: -110dB
- Sampling rate: 8kHz to 216kHz
- Low latency (12.6/fs)
- TDM interface mode
- Minimum-phase FIR filter
- 44-pin LQFP package

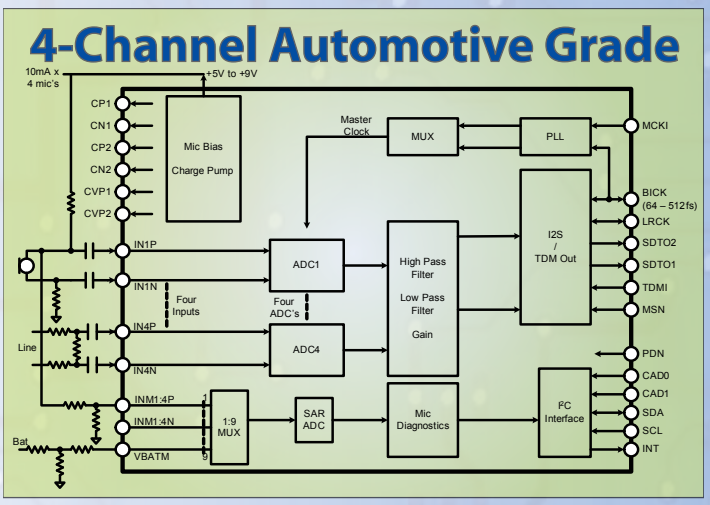
AK5373

- 24-bit stereo audio ADC
- USB 2.0 compliant (full speed audio class)
- USB serial interface engine
- Microphone amplifier
- Digital volume control (+24 to -31dB, 1dB steps)
- Integrated PLL
- External ADC interface option
- 48-pin LQFP package

	Performance				Temp Range		Power			Control	Pac
	Bits	Max fs	DR	THD+N	Low	High	VA	VD	mW	Interface	Pins
AK5353	24	96	96	-84	-40	85	3 to 5	3 to 5	70	HW	16
AK5354	20	48	89	-84	-40	85	2.5	2.5	17.5	3-wire	16
AK5355	16	48	91	-85	-40	85	2.4 to 3.3	2.4 to 3.3	15	HW	16
AK5356	20	48	89	-84	-40	85	2.0 to 3.3	1.8 to 3.3	24	HW	28
AK5357	24	96	102	-88	-40	85	3 to 5	3 to 5	70	HW	16
AK5358B	24	96	102	-92	-20	85	5	3.3	70	HW	16
AK5359	24	216	102	-94	-40	85	5	3 to 5	95	HW	16
AK5365	24	96	103	-94	-40	85	5	3 to 5	127	3-wire / I²C	44
AK5366	24	48	103	-94	-40	85	5	3.3	127	3-wire / I²C	44 or 48
AK5367A	24	96	102	-90	-20	85	5	3.3	97	I²C	30
AK5371	16	48	84	-70	0	70	3.3	3.3	86	USB	48
AK5373	24	48	90	-84	-10	70	3.3	3.3	100	USB / I²C	48
AK5374	24	48	90	-84	-10	70	3.3	3.3	100	USB / I²C	36
AK5381	24	96	106	-96	-40	85	5	3 to 5	120	HW	16
AK5384	24	96	107	-100	-40	85	5	5	215	HW	28
AK5385B	24	216	114	-103	-40	85	5	3 to 5	180	HW	28
AK5386	24	216	110	-96	-40	85	5	3.3	118	HW	16
AK5388A	24	216	124.5	-110	-10	70	5	3.3	575	HW	44
AK5393	24	96	117	-105	-10	70	5	3.3	470	HW	28
AK5394A	24	216	123	-110	-10	70	5	3.3	665	HW	28
AK5700	16	48	89	-78	-30	85	2.4 to 3.6	1.6 to 3.6	17	3-wire	24
AK5701	16	48	89	-78	-30	85	2.4 to 3.6	1.6 to 3.6	24	3-wire	24
AK5702	16	48	89	-78	-30	85	2.4 to 3.6	1.6 to 3.6	38	3-wire / I²C	32

# of digital audio converter IC's

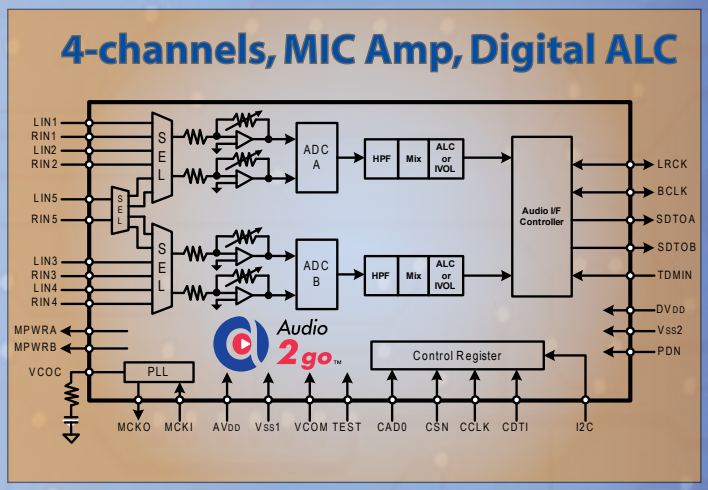
Differential Microphone Inputs



AK5730

- 4-channel differential microphone inputs
- DR, SNR: 100dB THD+N: -88dB
- Input levels:
  - 1.4VRMS (mic), 3VRMS (line), 11.7VRMS (boost)
- SAR ADC with 1:9 MUX, ground-referenced
- Channel-independent microphone diagnostics
- 24-bit TDM interface (cascade up to 4 devices)
- 48-pin LQFP package, -40˚C to +105˚C

Ideal for Wireless Microphones



AK5702

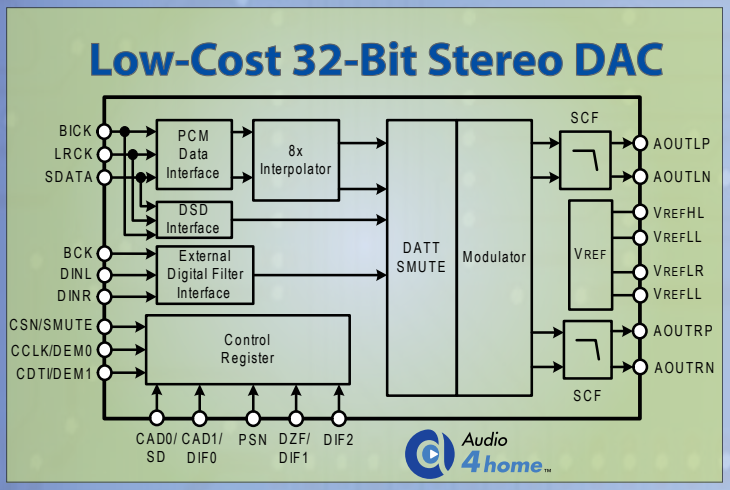
- 16-bit stereo audio ADC
- Sampling rate: 7.35kHz to 48kHz
- 2:1 stereo input selector
- Microphone amp: 0dB, +15dB, +30dB
- Digital ALC: -54dB to +36dB
- Analog PLL: master or slave mode
- VA: 2.4 to 3.6V, VD: 1.6 to 3.6V, IQ = 8mA
- Small 24-pin QFN package

ckage	Features			
Type	IPGA	Master	Channels	General
TSSOP			2	Low cost 24-bit ADC
TSSOP	Y		2	Ultra-low power, PGA, low cost
TSSOP	Y		2	Ultra-low power, fixed PGA, low cost, small QFN package
QFN	Y		2	Low power, PGA, microphone amp
TSSOP		Y	2	Low power, master or slave mode
TSSOP		Y	2	Low power, master or slave mode, lowest cost
TSSOP		Y	2	Low power, master or slave mode, lowest cost 192kHz ADC
LQFP	Y	Y	2	5-channel input selector, PGA, automatic level control
LQFP	Y	Y	2	5-channel input selector, peak hold circuit, PGA, automatic level control
VSOP	Y	Y	2	4-channel ground-referenced input selector, PGA
LQFP	Y		2	USB output interface, microphone amp, PGA, USB certified
LQFP	Y		2	USB 2.0 compliant interface, microphone amp, ALC, PLL, external ADC interface
QFN	Y		2	Low cost version of AK5373 (no external ADC interface)
TSSOP		Y	2	Selectable high pass filter, master or slave mode
VSOP		Y	4	4-channels, TDM interface, master or slave mode
VSOP		Y	2	Outstanding cost-to-performance ratio, fully differential
TSSOP		Y	2	Best performing single-ended ADC
LQFP		Y	4	Quad (120dB), stereo (123dB) or mono (124.5dB) operation, low latency, TDM mode
SOP		Y	2	Very high performance 96kHz ADC
SOP		Y	2	Highest performing audio ADC on the market
QFN		Y	1	2:1 input MUX, microphone amp, ALC, PLL, operates at 2.4V analog / 1.6V digital
QFN		Y	2	2:1 input MUX, microphone amp, ALC, PLL, operates at 2.4V analog / 1.6V digital
QFN		Y	4	2:1 X 2 input MUX, microphone amp, ALC, PLL, operates at 2.4V analog / 1.6V digital

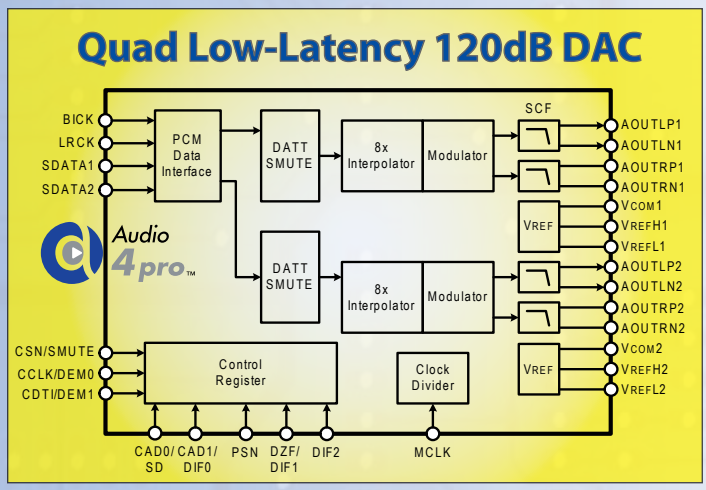
DAC

High-Performance Audio DAC Product Spotlight

Low Cost, High Sound Quality



High Performance, Low Latency



AK4480

- 32-bits, up to 216kHz sampling rate
- Designed for premium sound quality
- DR, SNR: 114dB (stereo); 117dB (mono)
- THD+N: -100dB
- Supports DSD or PCM interface
- Very low latency: 7/fs
- Single +5V power supply
- 30-pin VSOP package

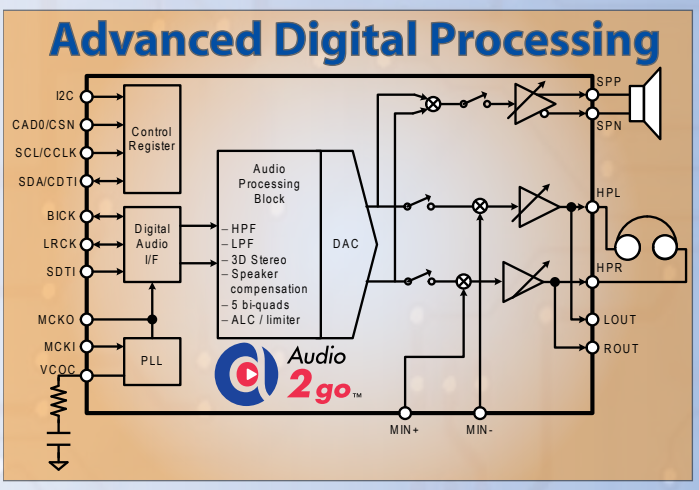
AK4413

- 24-bits, up to 216kHz sampling rate
- DR: 120dB (quad mode); 123dB (stereo mode)
- THD+N: -103dB
- TDM Interface
- Very low latency: 7/fs
- Minimum phase FIR filter
- Single +5V power supply
- 44-pin LQFP package

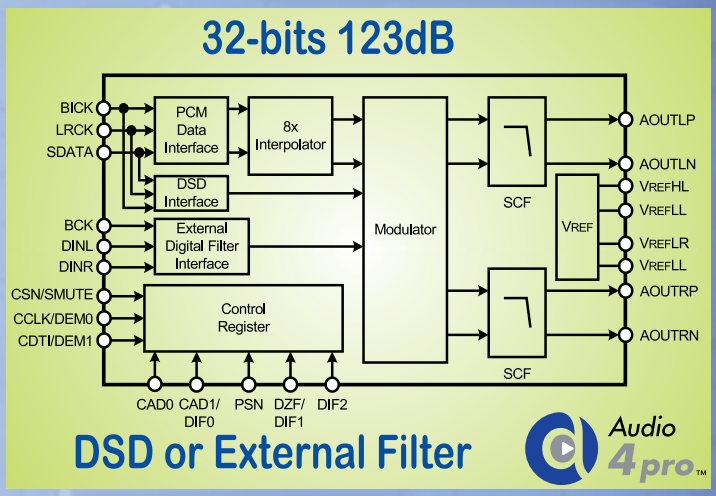
	Performance				Temp Range		Power			Control
	Bits	Max fs	DR	THD+N	Low	High	VA	VD	mW	Interface
Low Power DAC's with										
AK4342	24	96	100	-88	-20	85	3.3	1.8 to 3.3	96	3-wire / I²C
AK4343	24	48	90	-70 (HP)	-30	85	2.6 to 3.6	2.6 to 3.6	92	3-wire / I²C
AK4366	24	48	92	-55 (HP)	-40	85	2.2 to 3.6	2.2 to 3.6	6.2	3-wire / HW
AK4367	24	48	92	-55 (HP)	-40	85	2.2 to 3.6	2.2 to 3.6	6.7	3-wire / I²C
AK4368	24	48	92	-50 (HP)	-30	85	1.6 to 3.6	1.6 to 3.6	9.6	3-wire / I²C
AK4370	24	48	92	-50 (HP)	-30	85	1.6 to 3.6	1.6 to 3.6	6.8	3-wire / I²C
AK4371	24	48	92	-50 (HP)	-30	85	1.6 to 3.6	1.6 to 3.6	6.8	3-wire / I²C
AK4372	24	48	92	-50 (HP)	-40	85	1.6 to 3.6	1.6 to 3.6	6.8	3-wire / I²C
AK4373	24	48	98	-60 (HP)	-30	85	2.2 to 3.6	1.6 to 3.6	26	3-wire / I²C
High Performa										
AK4358	24	192	112	-94	-40	85	5	5	280	3-wire / I²C
AK4390	32	216	120	-103	-10	70	5	5	515	3-wire / HW
AK4392	32	216	120	-103	-10	70	5	5	515	3-wire / HW
AK4395	24	192	120	-100	-10	70	5	5	335	3-wire / HW
AK4396	24	192	120	-100	-40	85	5	5	180	3-wire / HW
AK4397	32	192	120	-103	-40	85	5	5	265	3-wire / HW
AK4399	32	216	123	-105	-10	70	5	5	515	3-wire / HW
AK4413	24	216	120 / 123	-103	-10	70	5	5	300	3-wire / HW
AK4414	32	216	120 / 123	-103	-10	70	5	5	300	3-wire / HW
AK4480	32	216	114	-100	-10	70	5	5	225	3-wire / HW

Audio DAC for Portable Applications Product Spotlight

Low Power w/ DSP Effects



Designed for Sound Quality



AK4373

- Low power 24-bit 96dB stereo DAC
- Headphone amp:
  - Single-ended, differential, pseudo-capless
- 400mW mono BTL speaker amp
- DSP: HPF, LPF, ALC/limiter, 5 biquads, 3D stereo
- Stereo lineout
- 32-pin QFN package

AK4399

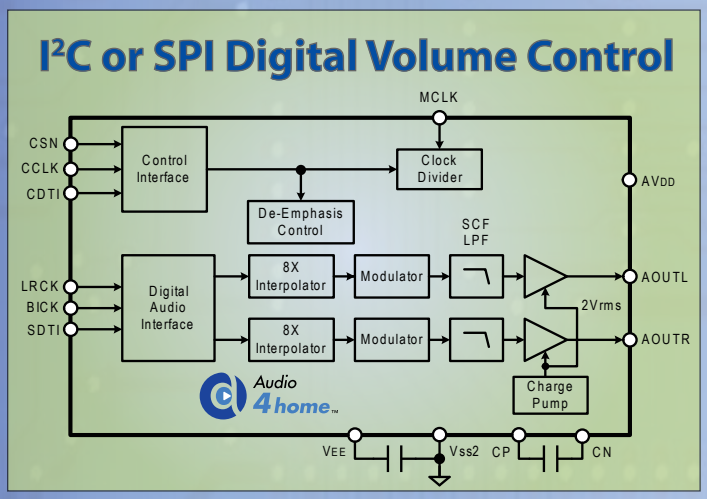
- 32-bits, up to 216kHz sampling rate
- Designed for premium sound quality
- DR, SNR: 123dB
- THD+N: -105dB
- Supports DSD or PCM interface
- External digital filter mode
- Single +5V power supply
- 44-pin LQFP package

Package		Channels	General
Pins	Type		
Headphone Amplifiers			
32	QFN	2	Triple output: 2Vrms, capless headphone (60mW into 16Ω), 700mV auxiliary, analog volume control
32	QFN	2	70mW headphone amp, 1W BTL mono speaker amp, line out, analog mixer, integrated PLL
16	TSSOP	2	50mW headphone amp, bass boost, ultra-low power
20	QFN	2	50mW headphone amp, analog mixer, mono line out, bass boost, ultra-low power
41	BGA	2	50mW headphone amp, wide-range analog PLL, analog mixer, stereo line out, 3-D stereo enhancement
24	QFN	2	40mW headphone amp, 4-input analog mixer, stereo line out, bass boost, analog volume control
32	QFN	2	40mW headphone amp, 6-input analog mixer, stereo and mono line out, PLL, analog volume control
24	CSP	2	40mW headphone amp, 3-input analog mixer, stereo line out, PLL, analog volume control
32	QFN	2	Headphone amp, speaker amp, audio DSP: HPF, LPF, 3D stereo, speaker compensation, 5 bi-quads
ance Products			
48	LQFP	8	Differential outputs, TDM mode, DSD input capable
30	VSOP	2	Very low latency (7/fs), high performance, 32-bit data interface
44	LQFP	2	32-bit data input, high performance and sound quality, DSD or external digital filter mode
28	VSOP	2	High performance, DSD input capable, pin compatible to AK4393/4394
28	VSOP	2	Very high performance, flat out-of-band noise, DSD input capable
44	LQFP	2	32-bit data input, high performance and sound quality, low out-of-band noise, DSD input capable
44	LQFP	2	32-bit data input, highest performance and sound quality, DSD or external digital filter mode
44	LQFP	4	**New!** Very low latency (7/fs), quad or stereo mode, digital attenuator, TDM interface
44	LQFP	4	**New!** 32-bit data input, high performance and sound quality, DSD or external digital filter mode
30	VSOP	2	32-bit data input, DSD or external digital filter mode, low cost

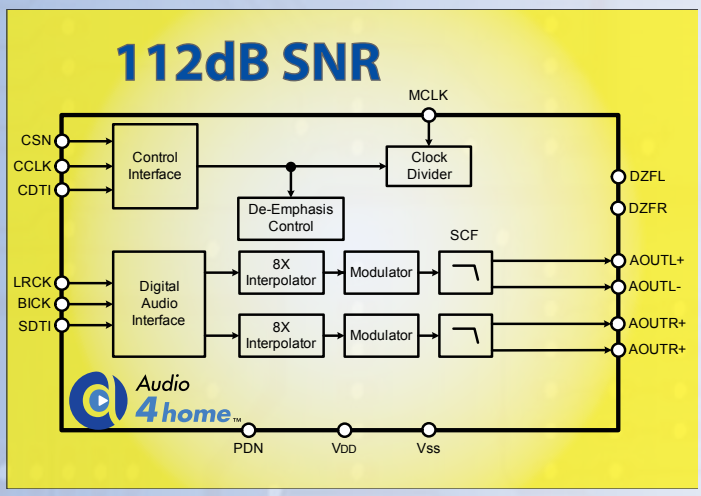
DAC

Digital-to-Analog Converters for Consumer

2Vrms Output with Serial Control



Low-Latency and Low Cost



AK4425A / 26

- AK4425A: 3-wire; AK4426: I²C
- DR, SNR: 106dB; THD+N: -95dB
- 24-bits, 192kHz sampling rate
- 2Vrms analog output (ground-referenced)
- 256 step digital attenuator
- 16-pin TSSOP package

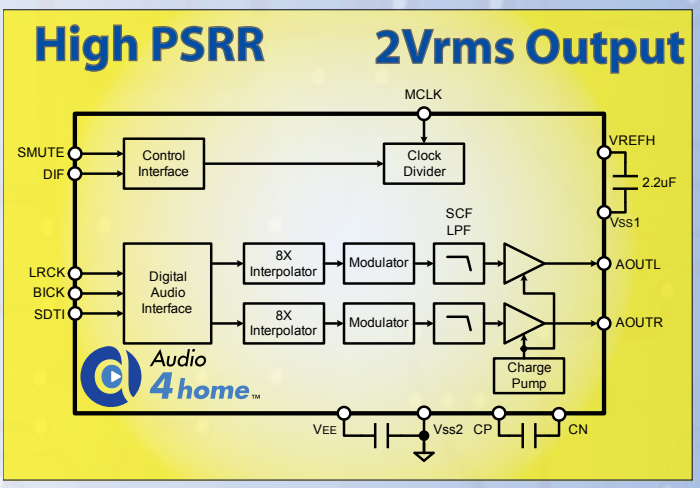
AK4482

- Stereo differential outputs
- DR, SNR: 112dB; THD+N: -94dB
- 24-bits, 216kHz maximum sampling rate
- Low-latency FIR filter option: <6/fs delay
- Wide temperature range: -40˚C to +85˚C
- 16-pin TSSOP package

	Performance				Temp Range		Power			Control
	Bits	Max fs	DR	THD+N	Low	High	VA	VD	mW	Interface
AK4340	24	192	106	-90	-20	85	5 / -4.5 to -13.2	5	150	3-wire / HW
AK4341	24	192	100	-86	-20	85	3.3 / 8.5 to 12.6	3.3	96	HW
AK4342	24	96	100	-88	-20	85	3.3	1.8 to 3.3	96	3-wire / I²C
AK4344	24	96	100	-86	-20	85	2.7 to 3.6	2.7 to 3.6	23	4-wire / 3-wire
AK4345	24	96	100	-86	-20	85	2.7 to 3.6	2.7 to 3.6	23	4-wire / 3-wire
AK4346	24	192	104	-88	-40	85	3.3	3.3	122 / 149	3-wire / I²C
AK4348	24	192	104	-88	-40	85	3.3	3.3	122 / 149	3-wire / I²C
AK4358	24	192	112	-94	-40	85	5	5	280	3-wire / I²C
AK4359A	24	192	106	-94	-40	85	5	5	235	3-wire / I²C
AK4382A	24	192	112	-94	-40	85	5	5	100	3-wire
AK4384	24	192	106	-94	-40	85	5	5	85	3-wire / HW
AK4385	24	192	108	-94	-40	85	5	5	90	3-wire
AK4386	24	96	100	-86	-40	85	2.2 to 3.6	2.2 to 3.6	14.4	HW
AK4387	24	192	106	-90	-20	85	5	5	85	3-wire
AK4388A	24	192	106	-90	-20	85	5	5	85	HW
AK4389	24	192	108	-92	-40	85	5	5	85	3-wire
AK4420	24	192	105	-92	-40	85	5	5	120	HW
AK4424	24	192	105	-92	-20	85	5	5	120	HW
AK4425A	24	192	106	-91	-20	85	5	5	120	3-wire
AK4426	24	192	106	-91	-20	85	5	5	120	I²C
AK4427	24	192	106	-90	-20	85	5	5	TBD	HW
AK4429	24	192	96	-90	-20	85	5	5	120	HW
AK4430	24	192	104	-90	-20	85	3.3	3.3	66	HW
AK4440	24	192	105	-93	-20	85	5	5	375	3-wire / I²C
AK4482	24	216	112	-94	-40	85	5	5	TBD	3-wire / HW

and Automotive Applications Product Spotlight

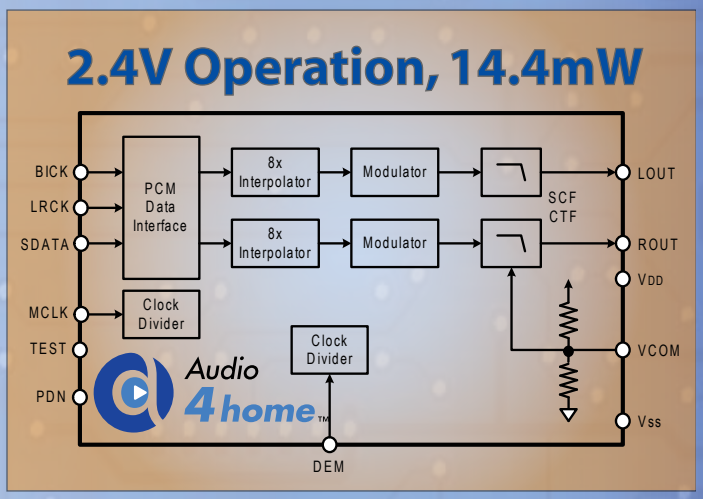
2Vrms from Single +3.3V supply



AK4430

- DR, SNR: 104dB THD+N: -92dB
- 24-bits, 192kHz sampling rate
- Single +3.3V supply with 80dB PSRR
- 2Vrms analog output (ground-referenced)
- No reset required
- 16-pin TSSOP package

Lowest Power and Cost



AK4386

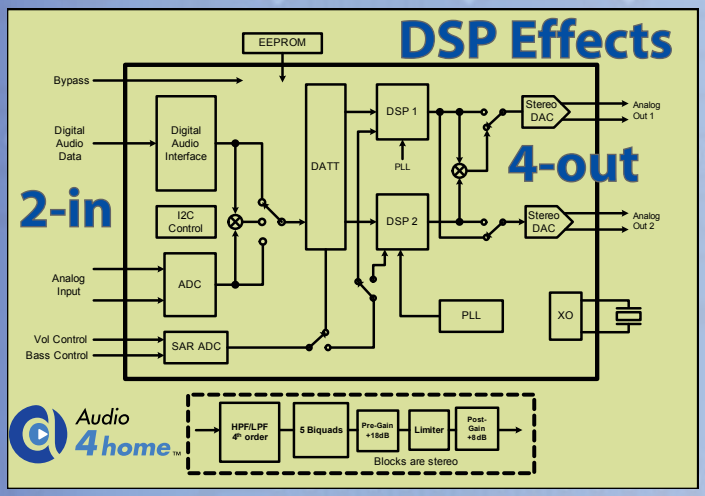
- DR, SNR: 100dB THD+N: -86dB
- 24-bits, 96kHz sampling rate
- Operates from 2.2V to 3.6V
- Low power consumption: 6mA
- Consumer or extended temperature range
- 16-pin TSSOP package

Package		Channels	General
Pins	Type		
16	TSSOP	2	2Vrms line output (ground-referenced)
16	TSSOP	2	2Vrms line output (biased to $HV_{DD}/2$)
32	QFN	2	Triple output: 2Vrms, capless headphone (60mW into 16Ω), 700mV auxiliary, analog volume control
16	TSSOP	2	Up to 1Vrms line output with 3.3V supply
16	TSSOP	2	Integrated S/PDIF transmitter, up to 1Vrms line output with 3.3V supply
30	VSOP	6	Single 3.3V supply, single-ended outputs, 6-channels
30	VSOP	8	Single 3.3V supply, single-ended outputs, 8-channels
48	LQFP	8	Differential outputs, TDM mode, DSD input capable
30	VSOP	8	Single-ended outputs, TDM mode
16	TSSOP	2	Excellent price : performance ratio, differential outputs
16	TSSOP	2	Single-ended outputs, low cost "E" version available
16	TSSOP	2	Differential outputs, low cost "E" version available
16	TSSOP	2	Excellent power : performance ratio, low cost "E" version available
16	TSSOP	2	Lowest cost, 3-wire serial control, single-ended outputs
16	TSSOP	2	Lowest cost, single-ended outputs; hardware control
16	TSSOP	2	Differential outputs, auto power down when MCLK is not present
16	TSSOP	2	2Vrms ground-referenced output, single +5V supply
16	TSSOP	2	2Vrms ground-referenced output, single +5V supply, only I^2S input, de-emphasis control
16	TSSOP	2	2Vrms ground-referenced output, single +5V supply, 3-wire control, digital attenuator
16	TSSOP	2	2Vrms ground-referenced output, single +5V supply, I^2C control, digital attenuator
16	TSSOP	2	2Vrms ground-referenced output, single +5V supply, de-emphasis control
16	TSSOP	2	1.5Vp-p out at -20dBFS in, 2Vrms out at -8dBFS, single +5V supply
16	TSSOP	2	2Vrms ground-referenced output, single +3.3V supply, 80dB PSRR
30	VSOP	8	8-channels, 2Vrms ground-referenced output, single +5V supply
16	TSSOP	2	Differential outputs, selectable digital filter options including low latency, wide temp range

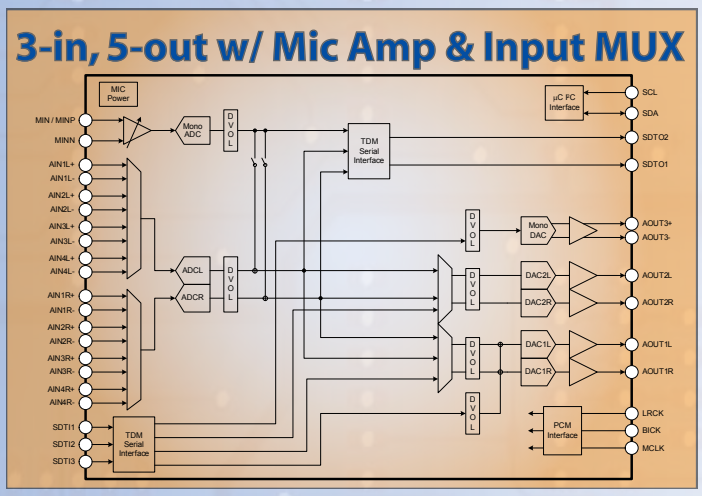
CODEC

Professional and Consumer Audio

Designed for Speaker Systems



Automotive Grade w/ Mic Channel



AK4753

- DR, SNR: 96dB (ADC); 100dB (DAC)
- DSP audio effects (with GUI programming)
- Integrated PLL for master clock-free mode
- SAR ADC with 2:1 MUX replaces audio pots
- Stereo ADC, quad DAC, stereo digital input
- Low power operation: 31mW, 3.3V
- 32-pin QFN package (4×4mm, 0.4mm pitch)

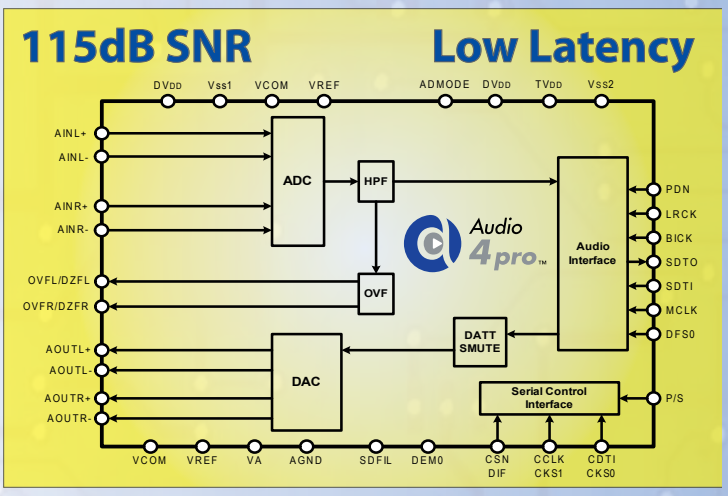
AK4616

- DR, SNR: 96dB (ADC); 105dB (DAC)
- THD+N: -84dB (ADC); -85dB (DAC)
- Mono channel w/ mic amp for voice application
- Differential input selector, single-ended output
- Channel independent volume control
- 3.3V core, 1.8V interface supply
- 48-pin LQFP package, -40°C to +85°C

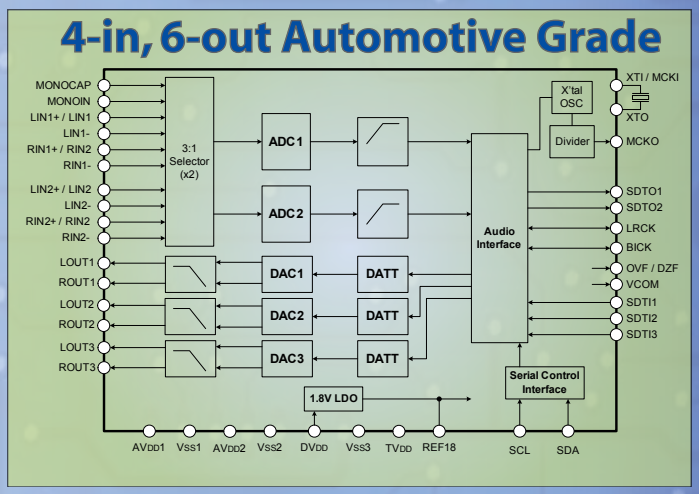
	Performance							Temp Range		Power		
	Bits	Max fs		Dynamic Range		THD+N		Low	High	VA	VD	mW
		ADC	DAC	ADC	DAC	ADC	DAC					
AK4528	24	96	96	108	110	-94	-94	-40	85	5	5	240
AK4552	24	96	96	97	100	-89	-88	-40	85	2.7 to 3.7	2.7 to 3.7	42
AK4554	16	48	48	89	92	-82	-85	-40	85	1.8 to 3.3	1.8 to 3.3	20
AK4555	20	48	48	89	92	-82	-85	-40	85	1.8 to 3.3	1.8 to 3.3	22
AK4556	24	192	192	103	106	-90	-90	-40	85	3	3	82.5
AK4588	24	96	192	102	106	-92	-90	-10	70	5	5	530
AK4589	24	96	192	102	114	-92	-90	-10	70	5	5	630
AK4611	24	192	192	104	108	-97	-100	-40	105	3.3	1.8	315
AK4612	24	192	192	104	108	-97	-100	-40	105	3.3	1.8	315
AK4613	24	192	192	104	108	-97	-100	-40	105	3.3	1.8	315
AK4614	24	192	192	104	108	-97	-100	-40	105	3.3	1.8	315
AK4615	24	96	192	106	111	100	102	-40	105	3.3 / 5	1.8 to 3.3	TBD
AK4616	24	48	48	96	105	-84	-85	-40	85	3.3	1.8 to 3.3	TBD
AK4620A	24	192	192	113	115	-100	-100	-10	70	5	3.3	285
AK4620B	24	192	192	113	115	-100	-97	-10	70	5	3.3	308
AK4621	24	216	216	115	115	-100	-100	-10	70	5	3.3	200
AK4626A	24	96	192	102	106	-92	-90	-40	85	5	5	315
AK4627	24	96	192	103	106	-92	-90	-40	105	5	2.7 to 5	355
AK4628A	24	96	192	102	106	-92	-90	-40	85	5	5	315
AK4629	24	96	192	103	106	-92	-90	-40	105	5	2.7 to 5	355
AK4682	24	48	192	96	102	-86	-86	-20	85	5 / 9 to 12	3 to 5	495
AK4683	24	96	192	100	106	-90	-90	-20	85	5	5	435
AK4753	24	48	48	96	100	-85	-88	-30	85	3.3	3.3	31

High Performance CODEC Product Spotlight

High Performance



Differential or Single-Ended Inputs



AK4621

- DR, SNR: 115dB (ADC), 115dB (DAC)
- THD+N: -100dB (ADC), -100dB (DAC)
- Differential inputs and outputs
- Low latency: 14/fs (ADC), 7/fs (DAC)
- Sampling rate: 8kHz to 216kHz
- Low power consumption: 200mW
- 30-pin VSOP package

AK4615

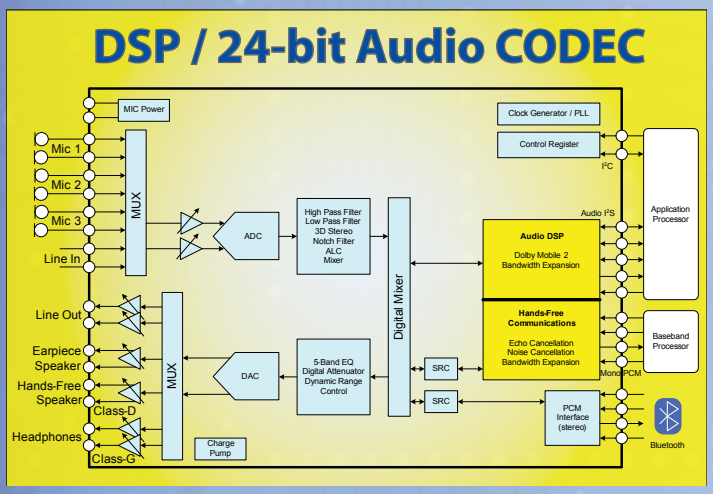
- DR, SNR: 106dB (ADC), 111dB (DAC)
- THD+N: -100dB (ADC), -102dB (DAC)
- Differential or single-ended operation
- Automotive temperature range: -40°C to +105°C
- Two 3:1 input selectors
- 3.3V or 5V operation (interface is 1.8V capable)
- 48-pin LQFP package

Control Interface	Package Pins	Channels ADC	Channels DAC	General
3-wire / HW	28	2	2	High performance, differential I/O, serial control for DAC volume
HW	16	2	2	Excellent performance and power : cost ratio
HW	16	2	2	Lowest voltage, low cost, single-ended I/O, MSB-first (ADC), LSB-first (DAC)
HW	16	2	2	Lowest voltage, low cost, single-ended I/O, I²S audio interface
HW	20	2	2	Lowest power 192kHz CODEC, highest performance at 3V
4-wire / I²C	80	2	8	S/PDIF transceiver, single-ended I/O, 3V logic interface
4-wire / I²C	80	2	8	Highest performance, S/PDIF transceiver, differential out, 3V logic interface
4-wire / I²C	80	4	8	4-in, 8-out, single-ended or differential operation, 3.3V, low power
4-wire / I²C	80	6	8	6-in, 8-out, single-ended or differential operation, 3.3V, low power
4-wire / I²C	80	4	12	4-in, 12-out, single-ended or differential operation, 3.3V, low power
4-wire / I²C	80	6	12	Highest channel count, single-ended or differential operation, 3.3V
I²C	48	4	6	**New!** Single-ended or differential I/O, two 3:1 input selectors
I²C	48	3	5	**New!** 2-in, 4-out w/ additional mono CODEC, microphone amp, mixer
3-wire / HW	30	2	2	Highest performance, analog PGA, single or differential in, differential out
3-wire / HW	30	2	2	Cost-reduced version of AK4620A
3-wire / HW	30	2	2	Very high performance, low latency, low power consumption
3-wire / I²C	44	2	6	TDM interface, single-ended I/O, channel-independent volume controls
3-wire / I²C	48	4	6	TDM, single-ended or differential in, single-ended out, wide temp range
3-wire / I²C	44	2	8	8-channel version of AK4626
3-wire / I²C	48	4	8	TDM, single-ended or differential in, single-ended out, wide temp range
I²C	48	2	4	8:1 input MUX, 8:3 output MUX, 2Vrms outputs, dual port I/O
4-wire / I²C	64	2	4	6:1 input MUX, PLL, dual port I/O, 50mW headphone amp, S/PDIF Rx/Tx
I²C	32	2	4	DSP audio processing, 2-input SAR ADC, PLL, stereo digital audio input

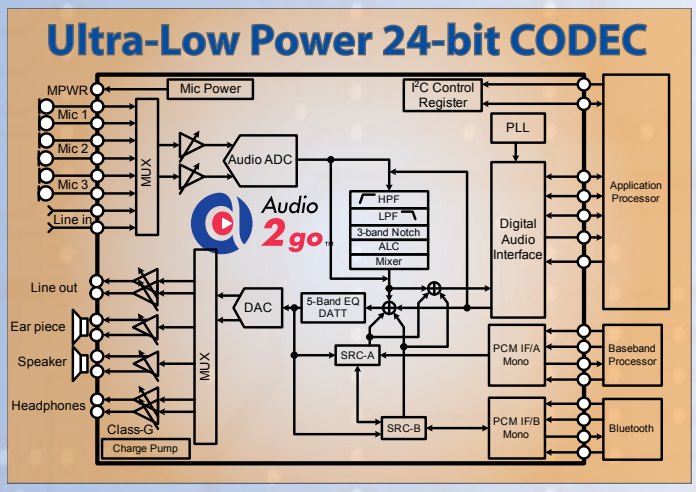
iCODEC

Portable Audio Applications

CODEC + DSP for Audio, Hands-Free



Ideal for Smartphone Audio



AK4679

- 24-bit stereo CODEC w/ open-core DSP
- Full-bandwidth audio processing
- Hands-free (echo & noise cancellation) capable
- Asynchronous dual PCM CODEC's (Bluetooth IF)
- Recording: MIC or line in, MIC amp, ALC, filters
- Stereo outputs: line, headphone, receiver
- 1.2W BTL speaker driver (A version: stereo)
- 78-pin BGA package (4.5 × 4.5mm, 0.4mm pitch)

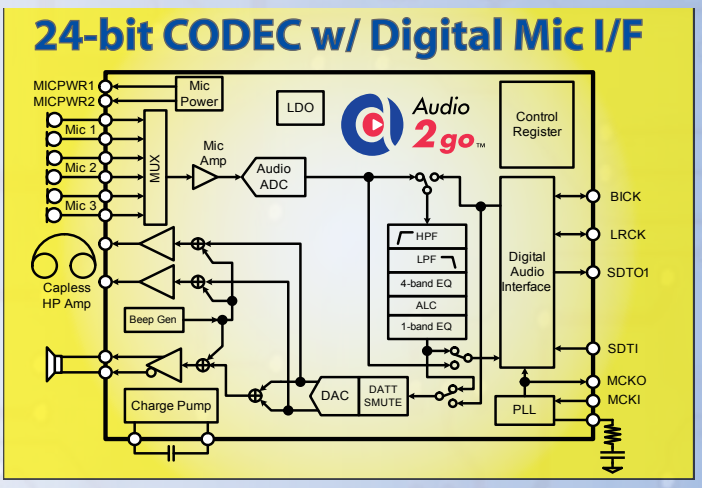
AK4678

- Stereo CODEC with two speaker drivers
- Recording: MIC or line in, MIC amp, ALC, filters
- Capless Class-G 25mW headphone amp
- Two BTL drivers: 60mW into 32Ω; 1.2W into 8Ω
- Asynchronous dual PCM CODEC's
- 1.8V core supply, up to 3.3V digital interface
- 49-pin CSP package

	Performance						Temp Range		Power		Control	Pac
	Bits	Max fs	Dynamic Range		THD		Low	High	VA	mW	Interface	Pins
			ADC	DAC	ADC	DAC						
AK4633	16	48	85	93	-84	-85	-40	85	2.2 to 3.6	40	3-wire	24
AK4634	16	48	85	93	-84	-85	-30	85	2.2 to 3.6	35	3-wire	29
AK4635	16	48	85	93	-84	-85	-30	85	2.2 to 3.6	63	3-wire / HW	29
AK4636	16	48	85	90	-83	-84	-30	85	2.6 to 3.6	36	3-wire /I²C	29
AK4641	16	48	86	90	-81	-86	-20	85	2.6 to 3.6	56	I²C	36
AK4643	16	48	95	92	-88	-88	-30	85	2.6 to 3.6	50	3-wire / I²C	32
AK4644	16	48	95	92	-88	-88	-30	85	2.6 to 3.6	50	3-wire / I²C	32
AK4645	16	48	95	92	-88	-88	-30	85	2.6 to 3.6	69	3-wire / I²C	32
AK4646	16	48	95	92	-88	-88	-30	85	2.2 to 3.6	70	3-wire	32
AK4647	16	48	95	92	-88	-88	-40	85	2.6 to 3.6	66	3-wire / I²C	48
AK4648	16	48	95	92	-88	-88	-30	70	2.6 to 3.6	147	I²C	47
AK4649	24	48	100	97	-80	-87	-30	85	2.4 to 3.6	66	3-wire / I²C	29
AK4665A	20	48	93	88	-90	-84	-30	85	3.3	66	3-wire	32
AK4671	16	48	95	92	-87	-85	-30	85	2.2 to 3.6	69	4-wire / I²C	57
AK4673	16	48	95	92	-88	-88	-30	85	2.6 to 3.6	70	I²C	57
AK4675	16	48	95	92	-87	-85	-30	85	2.2 to 3.6	90	I²C	83
AK4678	24	48	91	92	-82	-82	-30	85	1.8	14	I²C	49
AK4679/A	24	48	92	95	-80	-80	-30	85	1.8	20	I²C / SPI (DSP)	78
AK4691	16	48	90	90	-85	-85	-30	85	2.2 to 3.6	140	3-wire / I²C	57
AK4950	24	48	96	92	-85	-83	-30	85	2.7 to 3.6	73	3-wire / I²C	32
AK4953A	24	48	96	96	-85	-80 (HP)	-30	85	2.8 to 3.5	17	3-wire / I²C	36
AK4955	24	48	96	92	-82	-85	-30	85	2.7 to 3.6	59	3-wire / I²C	36

Highly Integrated CODEC Product Spotlight

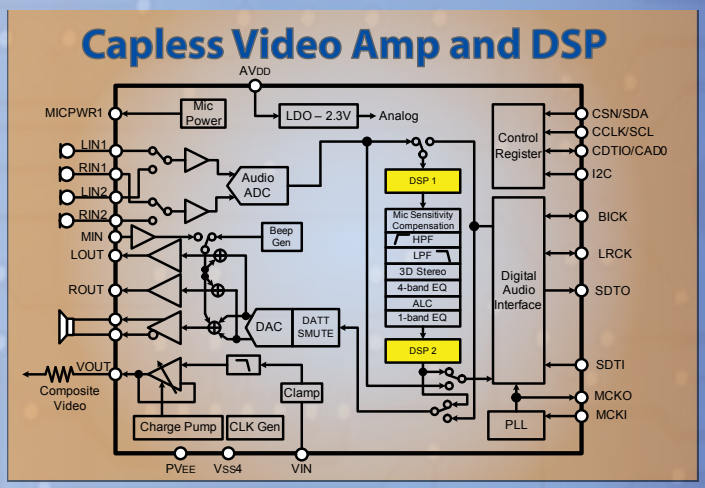
24-bit Ultra-Low Power



AK4953A

- 24-bits, 96dB dynamic range
- Recording: 4 mic inputs, ALC, 5-band EQ
- Playback: output ALC, capless headphone amp
- 400mW BTL speaker amp
- Digital microphone interface
- Integrated PLL
- Ultra-low power: 17mW record + playback
- 29-pin CSP package

Stereo /w Capless Video Amp, DSP



AK4955

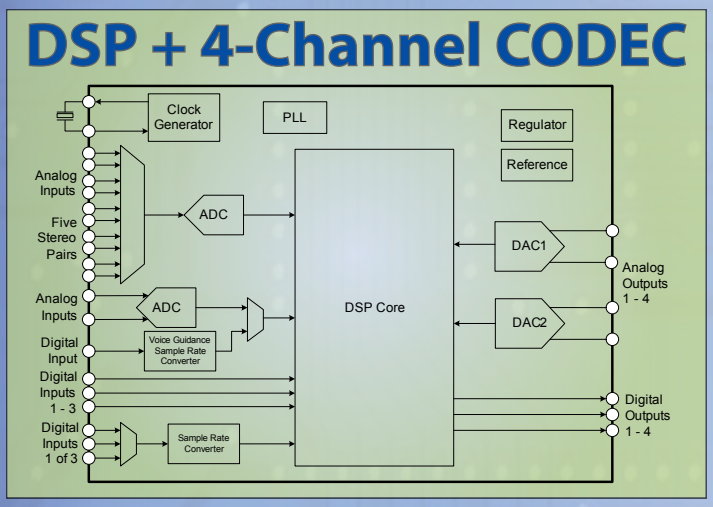
- Stereo CODEC with capless video amp
- Recording: 4 mic and 1 line input
- Playback: stereo line out, 600mW speaker amp
- Analog or digital mic interface with ALC
- DSP for wind & motor noise filtering, dynamic range control
- Output digital ALC and volume control
- 36-pin CSP package

kage	Channels		Input		Output		PLL	General
Type	ADC	DAC	Mic Amp	ALC	Speaker Amp	Headphone Amp		
QFN	1	1	Y	Y	Y		Y	Line output, 400mW speaker driver, master or slave mode PLL
WL-CSP	1	1	Y	Y	Y		Y	400mW mono Class-D speaker amp, 5-band EQ, beep generator
WL-CSP	1	1	Y	Y	Y		Y	AK4634 with a video amp and filter
WL-CSP	1	1	Y	Y	Y		Y	Also available in QFN package; video amp, speaker amp, EQ
QFN	1+1	2+1	Y	Y				Mono Bluetooth CODEC, 2:1 input MUX, 5-band EQ, aux input
QFN	2	2	Y	Y	Y	Y	Y	1W speaker driver version of AK4642
QFN	2	2	Y	Y		Y	Y	Headphone and line out only version of AK4642
QFN	2	2	Y	Y		Y	Y	Low digital I/O voltage version of AK4644
QFN	2	2	Y	Y	Y		Y	Speaker amp version of AK4645
LQFP	2	2	Y	Y		Y	Y	Wide temperature range, ALC, 62mW headphone amp
WL-CSP	2	2	Y	Y	Y	Y	Y	1.2W mono or stereo speaker amp, pseudo-capless headphone amp
CSP	2	2	Y	Y	Y		Y	5-band notch filter, output ALC, 3-D stereo, mono aux in
QFN	2	2	Y	Y		Y		Ground-referenced headphone output, analog volume control
BGA	2	2	Y	Y			Y	Stereo audio + dual PCM CODEC, 10-bit SAR ADC, 5-band EQ
BGA	2	2	Y	Y		Y	Y	70mW headphone amp, 4-wire TSC, programmable EQ
BGA	2	2	Y	Y	Y	Y	Y	1.6W Class-D SPK amp, capless HP amp, dual PCM CODEC, EQ
CSP	2	2	Y	Y	Y	Y	Y	1.2W Class-G SPK amp, capless 25mW HP amp, PCM CODEC
BGA	2	2		Y	Y	Y	Y	New! Open-core DSP for hands-free voice & full-bandwidth audio
BGA	4	2	Y	Y	Y	Y	Y	4-in, 2-out with headphone and speaker amp, line out, ALC
QFN	2	2	Y	Y	Y		Y	New! Capless composite video filter and amp, I/O ALC
QFN	2	2	Y	Y	Y	Y	Y	Capless headphone amp, digital mic I/F, speaker amp
CSP	2	2	Y	Y	Y		Y	New! Capless video amp, DSP for wind / motor noise filtering

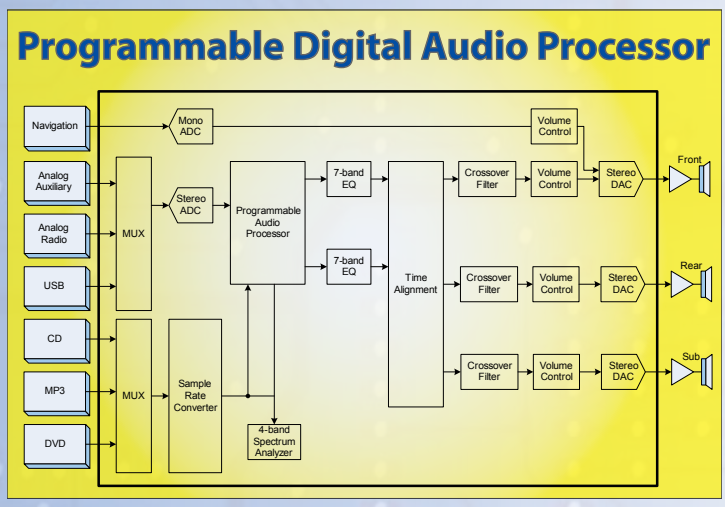
Audio DSP

DSP's With Integrated

Ideal for Automotive Audio / Voice



Enhances Head Unit Audio Quality



AK7722

- DSP with 4-in, 4-out CODEC and 2 SRC's
- 5:1 stereo input MUX, single-ended or differential
- SNR: 96dB (ADC) 108dB (DAC)
- Integrated PLL's and 1.8V regulator
- Six digital audio inputs + digital voice input
- Supports AKM royalty-free hands-free algorithm
- DSP core: 24-bits, floating point, 48kHz
  - 1536 lines @ 48kHz, 9216 lines @ 8kHz
  - 75k internal delay RAM
- Sample rate converters for external voice and audio inputs
- 80-pin LQFP package, -40 to +85˚C

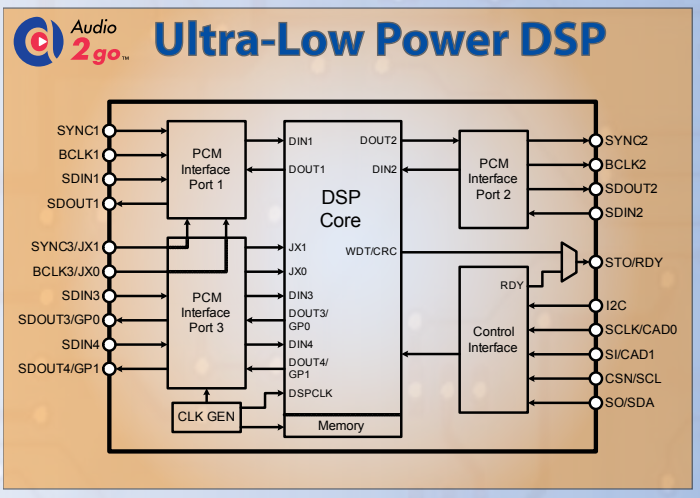
AK7601

- 3-in, 6-out digital audio processor
- Single-ended / differential inputs
- 4:1 stereo input selector
- SNR: 97dB (ADC) 102dB (DAC)
- Time alignment with delay up to 18ms
- Two stereo 7-band EQ blocks
- Programmable audio processing block
- Crossover filters: multi-stage 2nd order
- 4-band variable spectrum analyzer
- Sample rate converter for external digital inputs
  - Accepts sample rates up to 96kHz
- 48-pin LQFP package, -40 to +85˚C

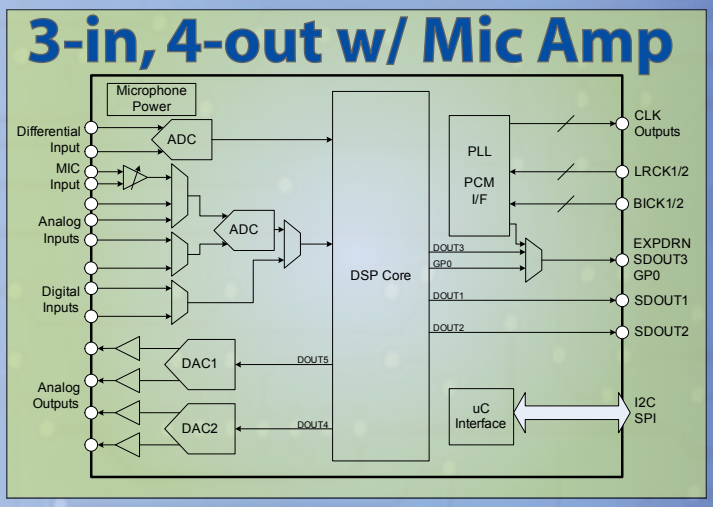
	Resolution ADC/DSP/DAC	DR / SNR ADC DAC	THD ADC/DAC	Sample Rate ADC/DSP/DAC	Channels ADC/DAC	Channels DSP Core In/Out	EEPROM Self-Boot
AK7600	24/ 24 / 24	97 / 100	-90 / -90	44.1 / 44.1 / 44.1	2 / 6	N/A	N/A
AK7601	24 / 24 / 24	97 / 102	-90 / -90	44.1 / 44.1 / 44.1	3 / 6	N/A	N/A
AK7718	-- / 16 / --	N/A	N/A	32	N/A	3 / 3	No
AK7719	-- / 20.4 / --	N/A	N/A	48	N/A	4 / 4	No
AK7730	24 / 24 / --	97 / --	-92 / --	96 / 192 / --	2 / --	8 / 8	Yes
AK7734	24 / 20.4 / --	95 ? --	-87 / --	48 / 48 / --	2 / --	8 / 8	No
AK7740	24 / 24 / 24	98 / 97	-89 / -89	48 / 48 / 48	2 / 4	4 / 6	No
AK7742	24 / 20.4 / 24	96 / 106	-84 / -86	48 / 96 / 96	2 / 4	3 / 5	No
AK7744	24 / 24 / 24	97 / 107	-86 / -92	48 / 48 / 48	3 / 4	5 / 6	No
AK7750	24 / 24 / 24	95 / 95	-88 / -86	48 / 192 / 48	2 / 2	10 / 8	Yes
AK7752/53	24 / 20.4 / 18	91 / 95	-86 / -90	48 / 48 / 48	2 / 2	2 / 2	Yes
AK7754	24 / 20.4 / 24	91 / 96	-82 / -88	48 / 48 / 48	2 / 2	3 / 3	No
AK7757	24 / 20.4 / 24	96 / 105	-84 / -85	48 / 48 / 48	3 / 4	4 / 5	No
AK7770/71	24 / 20.4 / 24	95 / 100	-82 / -86	48 / 48 / 48	4 / 6	4 / 6	No
AK7780	24 / 24.4 / --	96 / --	-92 / -	96 / 96 / -	5 / -	10 / 12	No
AK7782	24 / 24.4 / --	96 / --	-90 / --	96 / 48 / --	5 / --	14 / 14	No

Audio Converters

7mW DSP for Portable Apps



Ideal for Car Audio with Navigation



AK7719

- Ultra low power for portable voice applications
- Supports both voice and full-bandwidth audio
- 48kHz sampling rate for audio
- Integrated clock generator
- Delay RAM: 16,384 × 24-bits
- Two microphone operation for hands-free
- DSP core: 11,250 lines @ 8kHz sampling
- Available with AKM echo and noise cancellation algorithms (royalty-free)
- 1.2V core, 1.8V interface, 6.2mA (hands-free)
- 25-pin WL-CSP package (2.62mm × 2.93mm)

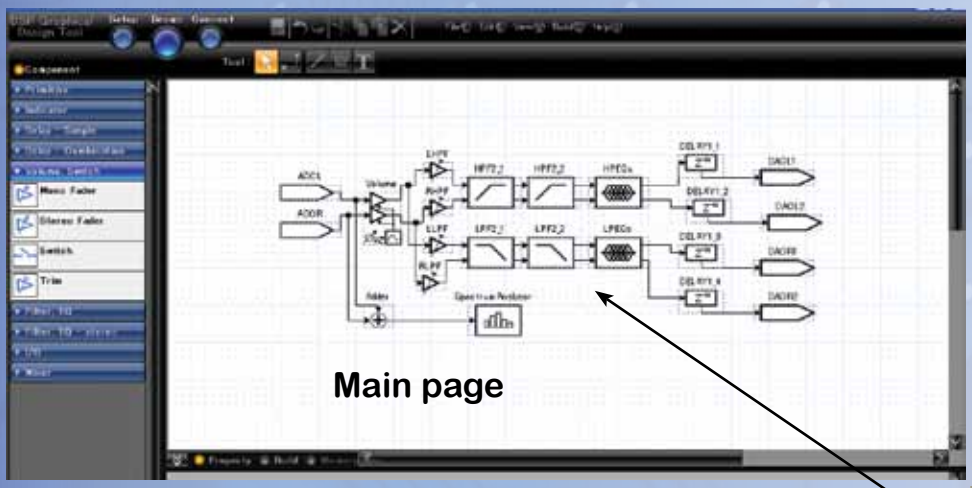
AK7757

- 3-in, 4-out CODEC + 24-bit floating point DSP
- Inputs: differential or single-ended
- Microphone amp with programmable gain
- DSP core: 24-bits, floating point, 48kHz
  - 1536 lines, 164k bits total delay RAM
  - 4k × 36-bit PRAM, 4k x 20-bit CRAM
- Processes AKM's hands-free algorithm
- Dynamic range: 96dB (ADC), 105dB (DAC)
- 3.3V operation (1.8V interface)
- I²C or SPI serial control
- 48-pin LQFP package

Instruction Lines	Delay RAM	Package		Power (mW)	Additional Features
		Pins	Type		
N/A	36ms	30	VSOP	250	Fixed-function DSP (EQ and delay)
N/A	36ms	48	LQFP	303	**New!** 14-band EQ, spectrum analyzer, programmable audio effects
1536 @ 48kHz		24	CSP	18	1.8V operation, CSP package, ideal for echo / noise cancellation
1875 @ 48kHz	393kbit	25	CSP	7.5	**New!** 1.2V operation, 6.2mA in hands-free mode, 48kHz audio
768	72kbit	48	LQFP	215	Integrated PLL, small package
1536	122kbit	48	LQFP	280	Sample rate converter w/ 96kHz in, 2 delay RAMs, hands-free capable
512	72kbit	48	LQFP	214	5:1 ADC input MUX, low cost
1536	74kbit	48	LQFP	248	Differential I/O, 3:1 analog input selector, AKM programming tool
512	24kbit	64	LQFP	330	6:1 ADC input MUX, high analog performance
768	64kbit	64	LQFP	365	Complete hands-free car kit solution
Optimized for hands-free		64	LQFP	330	Optimized for hands-free and speech recognition pre/post processing
1536	86kbit	48	QFN	137	Stereo CODEC, microphone and headphone amp, hands-free
9216 @ 8kHz	164kbit	48	LQFP	TBD	**New!** Programmable mic amp, single-ended or differential inputs
1536	280 / 560	80	LQFP	388	2 sample rate converters, S/PDIF Tx, headphone amp, input pre-amp
2560	168kbit	100	LQFP	396	Sample rate converter, floating point, 1.8V digital core
2560 @ 48kHz	168kbit	100	LQFP	450	**New!** Dual-core DSP, two sample rate converters, integrated PLL

DSP GUI Development Tool

Now available for selected AKM DSP products is a GUI-based development tool. The tool uses a drag 'n drop interface to build the desired circuit, allows for real-time tuning of audio parameters, and outputs assembly code that can be loaded into an evaluation board. No knowledge of DSP programming is needed to use the tool.

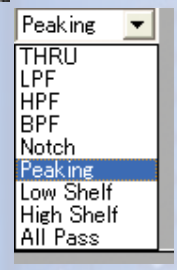


Main page

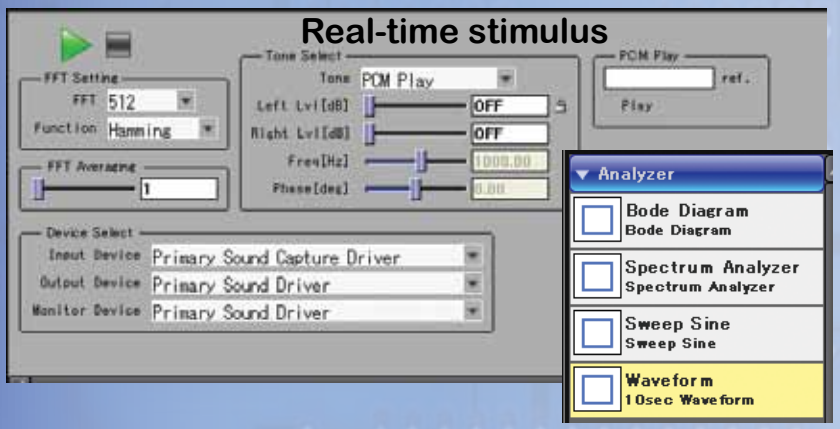
Primary Elements

- Compressor/Limiter
- Noise gate
- HPF/LPF
- Multi-band EQ
- Limiter
- Delay
- Volume control
- Faders

- Draw circuit using same method as CAD programs
- Pull in component blocks with parameter selection
- Resource requirements displayed during build
- No pop-up menus: pull-downs in original window
- Click on block to identify connected components
- Set default parameters for blocks prior to compiling

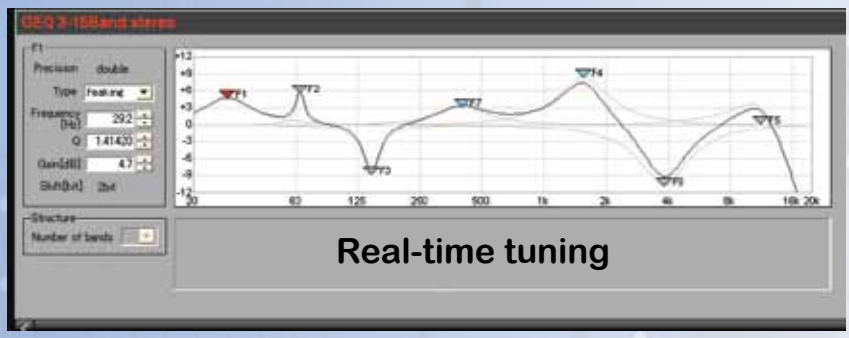


Menu to select block parameters



- Click "connect" to load program into development board
- Select stimulus (tone, noise, etc.)
- Select input / output device
- Display analytical results

Use real-time tuning page to adjust block parameters "on the fly" and get immediate audible feedback using the evaluation board

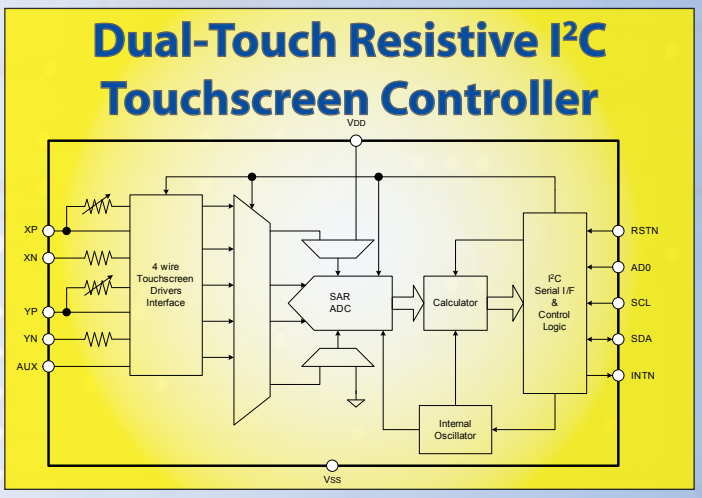


Real-time tuning

Touch Sensor Products

AKM offers a variety of touch sensor products, including resistive touchscreen controllers and capacitive touch sensor controllers. Touchscreen controllers are available in either stand-alone form or integrated with audio CODEC's. At the heart of our Touchscreen Controllers are 12-bit, >100kHz SAR-type A/D converters. The controllers accept 4-wire or 5-wire pen input, and they are capable of measuring pressure as well as position. They also include integrated references, battery monitors and temperature sensors. The AK4189 is a dual-touch resistive controller that can be used to support gesturing, using any 4-wire resistive overlay.

Dual-Touch Resistive Controller



AK4189

- 4-wire dual-touch touchscreen controller
- Works with any resistive touchscreen overlay
- Integrated reference resistors
- Accepts two independent touch inputs
  - Median averaging for additional inputs
- Internal oscillator for clock-free operation
- Low power operation: 1.8V, 266µW
- Supports gesturing with external firmware
- 12-pin CSP package (1.96 × 1.46mm)

Capacitive Touch Sensor Controllers

AK4160

- Up to 16 capacitive sensor inputs
- Up to 8 GPIO's configurable as PWM LED drivers
- Temperature drift compensation per channel
- Integrated median averaging filter
- I²C serial control interface
- Low power operation:
  - 1.71 to 3.6V, 4mA @ 512ms sampling time
- 28-pin QFN package (4 × 4mm, 0.4mm pitch)

AK4161

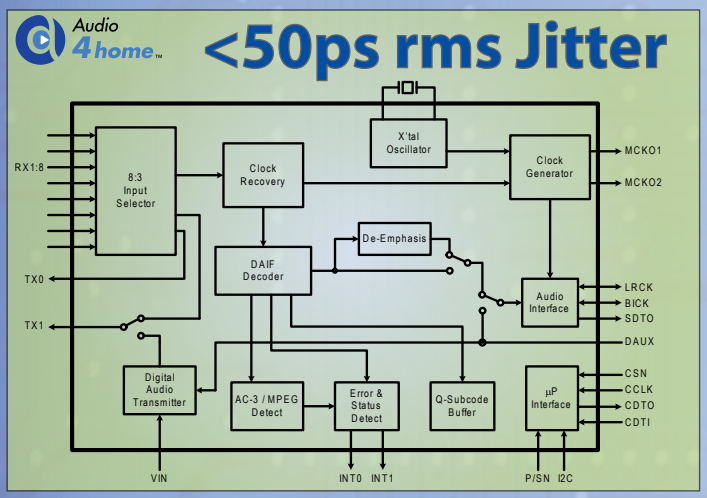
- Up to 6 capacitive sensor inputs
- Up to 6 GPIO's configurable as PWM LED drivers
- Auto inital settings for charge current & time
- Temperature drift compensation per channel
- Integrated median averaging filter
- I²C serial control interface
- Low power operation:
  - 1.6 to 3.6V, 4.3µA @ 512ms sampling time
- 16-pin QFN package (3 × 3mm, 0.5mm pitch)

	AK4181A	AK4182A	AK4183	AK4185/86	AK4187/88	AK4189
AVDD	2.7V to 3.6V	2.2V to 3.6V	2.5V to 3.6V	1.6V to 3.6V	2.7V to 3.6V	1.8
IOVDD	2.7V to 3.6V	1.5 to AVDD	2.5V to 3.6V	1.6 TO 3.6	1.6 TO 3.6	1.8
Features	X, Y, pen pressure, IN, VBAT, temp	X, Y, pen pressure, IN, VBAT, temp	X, Y	4/5 wire, X, Y, pen pressure, IN, temp	Dual touch, pen pressure, integrated averaging	Dual touch, pen pressure, integrated averaging
Interface	SPI	SPI	I²C	SPI/I²C	I²C (4187) SPI (4188)	I²C
Active Current	250µA	260µA	68µA	60µA	250µA (dual touch)	148µA
Internal Vref	Yes	Yes	No	No	No	Integrated resistors
Package	16-TSSOP	16-QFN	10-MSOP	12-CSP (both) 16-QFN (4186)	16-QFN	12-CSP
Industry Compatibility	ADS7846N AD7843ARU MXB7846	ADS7846IR AD7843	AKM Proprietary	AKM Proprietary	AKM Proprietary	AKM Proprietary

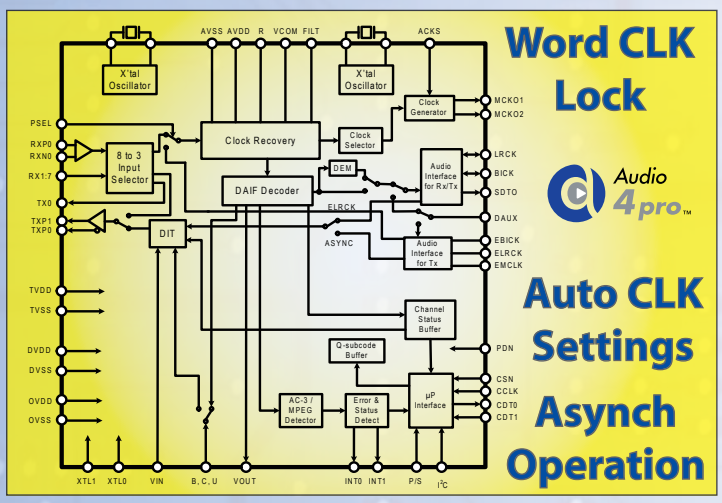
S/PDIF

S/PDIF Interface Products

Ultra Low Jitter Transceiver



Complete Clocking Solution



AK4118A

- 24-bits, 192kHz transceiver
- Ultra-low jitter: <50ps rms
- 8:1 input selector
- 40-bit channel status buffer
- Transmitter loop-through mode
- Hardware or serial control
- 48-pin LQFP package

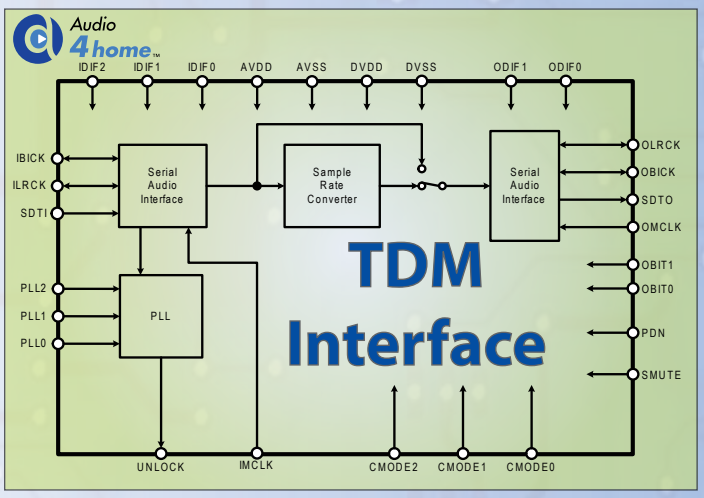
AK4115

- 24-bits, 216kHz transceiver
- Word clock (studio sync) lock
- Very low jitter: <80ps rms
- Two crystal oscillators
- 192-bit channel status buffer
- 8-channel receiver input (1 balanced)
- 2-channel transmitter output (1 RS422)
- 64-pin LQFP package

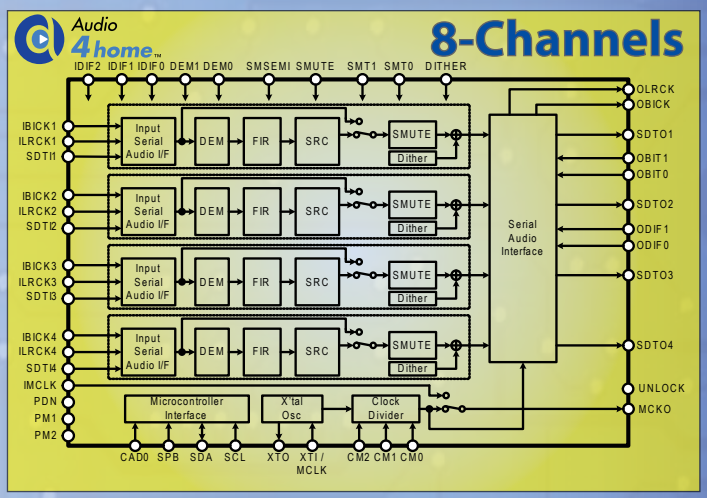
	Max fs	Inputs/Outputs		Temp Range		Power		Package		Control Interface	Functions		
		In	Out	Low	High	VD	mW	Pins	Type		DIR	DIT	SRC
AK4101A	192	N/A (Tx)	4	-40	85	5	50	44	LQFP	4-wire / HW		Y	
AK4103A	192	N/A (Tx)	1	-40	85	5	30	24	VSOP	4-wire / HW		Y	
AK4104	192	N/A (Tx)	1	-20	85	3.3	3	16	TSSOP	4-wire / 3-wire		Y	
AK4112B	96	4	N/A (Rx)	-40	85	3.3	66	28	VSOP	4-wire / HW	Y		
AK4113	216	6	N/A (Rx)	-40	85	3.3	86	30	VSOP	4-wire / I²C HW	Y		
AK4114	192	8	2	-10	70	3.3	92	48	LQFP	4-wire / I²C HW	Y	Y	
AK4115	216	8	2	-20	85	3.3	99	64	LQFP	4-wire / I²C HW	Y	Y	
AK4116	48	1	N/A (Rx)	-40	85	3.3	6.6	20	QFN	4-wire	Y		
AK4117	192	2	N/A (Rx)	-40	85	3.3	46	24	VSOP	4-wire	Y		
AK4118A	192	8	2	-10	70	3.3	106	48	LQFP	4-wire / I²C HW	Y	Y	
AK4122A	96	4	N/A (Rx)	-10	70	3.3	49	48	LQFP	4-wire	Y		Y
AK4345	96	N/A (Tx)	1	-20	85	3.3	23	16	TSSOP	4-wire / 3-wire		Y	

Sample Rate Converters

TDM Interface Mode



Fully Asynchronous 8-Channels



AK4127

- High performance:
  - THD+N: -130dB
  - Dynamic range: 140dB
- Input sample range: 8kHz to 216kHz
- Output sample range: 8kHz to 216kHz
- Input to output sample rate ratio: 1/6 to 6
- Low jitter internal PLL enables master clock free operation
- SRC bypass mode, soft mute
- TDM interface mode
- 30-pin VSOP package

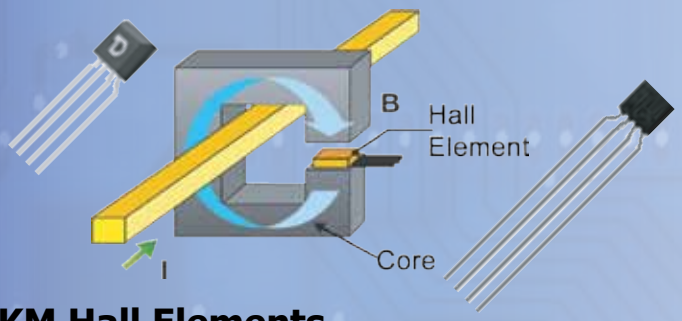
AK4128A

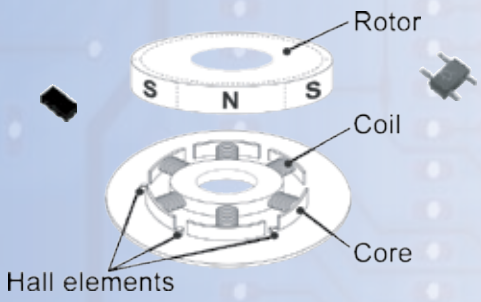
- High performance:
  - THD+N: -130dB
  - Dynamic range: 140dB
- Input sample range: 8kHz to 216kHz
- Output sample range: 8kHz to 216kHz
- Input to output sample rate ratio: 1/6 to 6
- Low jitter internal PLL enables master clock free operation
- Inputs can have independent sampling rates
- SRC bypass mode, soft mute
- Ideal for 8-channel audio systems
- 64-pin LQFP package

	Bits	Input Sample Rates	Clock Source	Output Sample Rates	THD+N	Temp Range		Power		Package		Additional Features
						Low	High	VD	mW	Pins	Type	
AK4120	20	8 to 96	Inputs 1, 2	32, 44.1, 48	-113	-40	85	3.3	70	24	VSOP	2 inputs
AK4121	20	8 to 96	PLL	32, 44.1, 48, 96	-113	-40	85	3.3	33	24	VSOP	PLL
AK4122A	24	8 to 96	S/PDIF, PLL	32, 44.1, 48, 96	-113	-10	70	3.3	45	48	LQFP	S/PDIF Transceiver
AK4125	24	8 to 216	PLL	8 to 216	-130	-40	85	3.3	43	30	VSOP	PLL
AK4126	24	8 to 192	PLL	8 to 192	-130	-40	85	3.3	158	64	LQFP	6-channels
AK4127	24	8 to 216	PLL	8 to 216	-130	-40	85	3.3	48	30	VSOP	TDM mode
AK4128A	24	8 to 216	PLL	8 to 216	-130	-40	85	3.3	82	64	LQFP	8-channels
AK4129	24	8 to 216	PLL	8 to 216	-130	-40	85	3.3	82	64	LQFP	6-channels

Magnetic Sensors

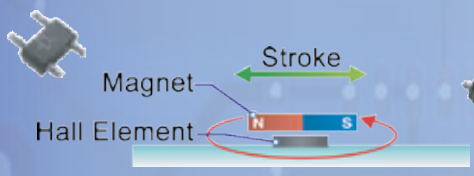
A Hall Element is a magneto-electric transducer which utilizes the Hall Effect to measure or sense a magnetic field perpendicular to the Element. AKM makes Hall Elements, Hall Effect IC's (digital switch, digital latch, linear output and other specialized functions) and Current Sense Modules. Hall Elements can be driven by either a voltage or a current source. The output from a Hall Element is analog and typically requires additional circuitry to interpret the output. AKM Hall Effect IC's and Current Sense Modules include the additional circuitry. AKM uses five different semiconductor materials in its Hall Elements and IC's. The different materials provide different performance characteristics (magnetic sensitivity represented by electron mobility and band gap, operating voltage, temperature sensitivity, etc.) allowing AKM and system design engineers to choose the best solution for the particular application.

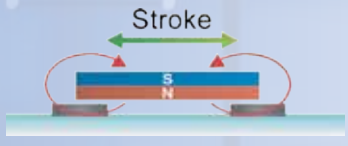


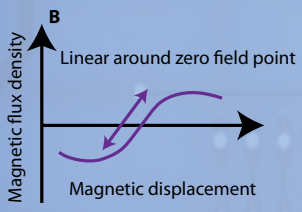


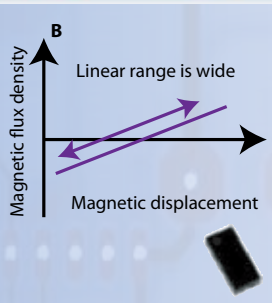
AKM Hall Elements

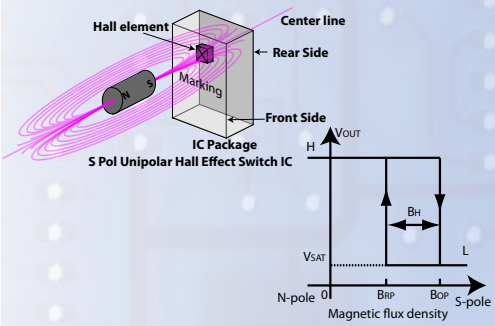
Applications	AKM Series	Hall Element Material	Magnetic Sensitivity		Temperature Coefficiency	
			Relative Ranking	Electron Mobility of Semiconductor (cm^2/Vs)	Temperature Dependence of Sensitivity	Band Gap Eg (eV)
---	---	Si	Low	1,450	Low (essentially none)	1.12
Weight sensor, Inverter, position sensor, current sensor (low cost)	HGXXX	GaAs	Medium	8,000	Low (essentially none)	1.43
Inverter, Smart Meter, Power Meter, current sensor, etc.	HZXXX	InAs	High	30,000	Medium	0.33
Position detection	HQXXX	InAs (Quantum well)	High	30,000	Medium	0.33
Brushless DC motor, current sensor	HWXXX	InSb	Ultra High	75,000	High	0.16

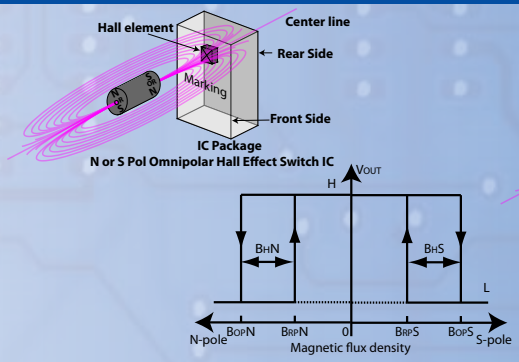


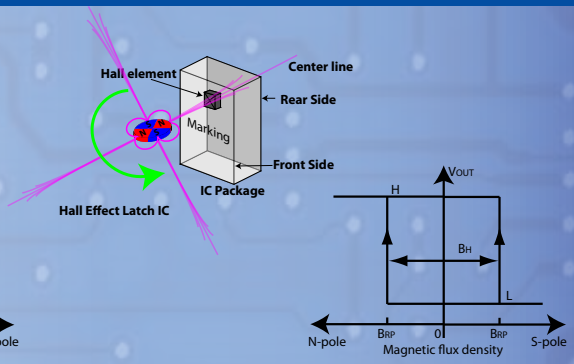






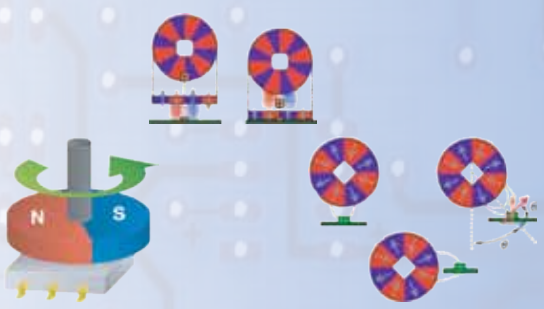


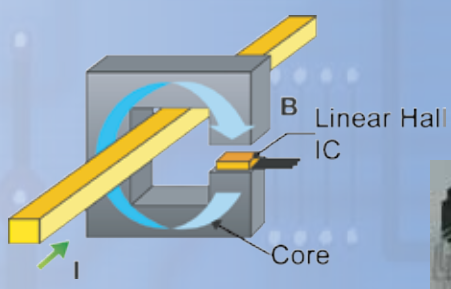




AKM Hall Effect IC's

Applications	AKM Series	Hall Element Material	Operating Voltage	Magnetic Sensitivity	Type	Output
Switches						
Open/Close detection: Laptop, flip phone, slide phone, appliance door, security door, portable game, switch, touch sensor, louvre, etc. **Presence detection:** Ice tray, phone is in holder, phone is near hearing aid, filter, etc.	EMXXXX	Si Monolithic	1.6~5.5V	B_{OP} 2.5mT or 3mT	Omnipolar Switch	CMOS Single & Dual
	AKXXXX	Si Monolithic	1.6~5.5V 1.7~3.6V	B_{OP} * 2.5mT or 3mT	Omnipolar Switch	CMOS Single & Dual
	EZXXX	InAs Hybrid	2~24V	B_{OP} S_{POLE} 26mT	Unipolar Switch	Open Collector
	EWXXX	InSb Hybrid	2.4~3.3V, 2.5~5.5V 3~26.4V	B_{OP} S_{POLE} 1.5, 3, or 6mT	Unipolar Switch	Open Collector & CMOS
*AK8783 allows user defined sensitivity (operate and release points) via external resistor						
Latches						
Position Detection: Flow sensor, speed sensor, jog dial, angle sensor, brushless DC motors, etc.	EMXXXX	Si Monolithic	1.6~5.5V 3.5~18V	B_{OP} 1.8mT or 3mT	Bipolar Latch	Open Drain & CMOS
	AKXXXX	Si Monolithic	1.6~5.5V	B_{OP} 1.5mT or 1.8mT	Bipolar * Latch	Open Drain & CMOS
	EZXXX	InAs Hybrid	3.8~24V	B_{OP} 4.2mT	Bipolar Latch	Open Collector
	EWXXX	InSb Hybrid	2.5~5.5V 3.0~26.4V 4.5~18V	B_{OP} 3 or 10mT	Bipolar Latch	Open Collector
*AK8775 & AK8776 detect both horizontal and vertical magnetic fields						
Linear						
Position: Weight sensor **Rotation/Angle:** Robot, jog dial, joy stick, etc. **Current sensor:** Inverter, Smart Meter, Power Meter, circuit protection, current monitoring, home & industrial equipment, etc.	EQXXX	InAs Hybrid (Quantum well)	3~5.5V	20, 40, 65, or 130mV/mT	Linear	Analog Ratiometric





Magnetic Sensors

Hall Effect Switch ICs

P/N	Feature	Supply Voltage	Sensitivity Bop/Brp @HIC	Response time	Supply Current	Output	Temp range	Package
AK8783	Omnipolar Adj sensitivity via external resistor	1.70 to 3.6	2.6 - 4.4 1.6 - 3.4	50ms	5.0µA at 1.8V	Push-pull CMOS	-30 to+85	4WLCSP
AK8788A	Omnipolar Ultra-small package	1.6 to 5.5	3.0 / 2.2	50ms	4.5µA at 1.85V	Push-pull CMOS	-30 to+85	4SON
AK8789	Dual Output Unipolar Ultra-small package	1.6 to 5.5	2.5 / 2.0	50ms	6.5µA at 1.85V	Push-pull CMOS	-30 to+85	4SON
EM1781	Omnipolar	1.6 to 5.5	3.0 / 2.2	50ms	6.5µA at 1.85V	Push-pull CMOS	-30 to+85	4SOP
EM1791	Dual Output Unipolar	1.6 to 5.5	2.5 / 2.0	50ms	6.5µA at 1.85V	Push-pull CMOS	-30 to+85	4SOP
EM6781	Omnipolar	1.6 to 5.5	3.0 / 2.2	50ms	6.5µA at 1.85V	Push-pull CMOS	-30 to+85	3SOT
EW463	Unipolar	2.5 to 5.5	3 / 2.2	3µs	6mA at 3V	Open collector	-30 to+115	3SOT
EW650B	Unipolar	3 to 26.4	6 / 5	3µs	5mA at 12V	Open collector	-40 to+115	3SOT
EW652B	Unipolar Internal pull-up	3 to 26.4	6 / 5	3µs	5mA at 12V	Open collector	-40 to+115	3SOT
EW6672	Unipolar	2.4 to 3.3	1.5 / 1.2	50ms	5µA at 3V	Push-pull CMOS	-30 to+85	3SOT
EW750B	Unipolar	3 to 26.4	6 / 5	3µs	5mA at 12V	Open collector	-40 to+115	3SIP
EW752B	Unipolar Internal pull-up	3 to 26.4	6 / 5	3µs	5mA at 12V	Open collector	-40 to+115	3SIP
EZ470	Unipolar	2 to 24	26 / 20	3µs	3mA at 12V	Open collector	-40 to+125	3SOT

Hall Effect Latch ICs

P/N	Feature	Supply Voltage	Sensitivity Bop/Brp @HIC	Response time	Supply Current	Output	Temp range	Package
AK8771	Ultra-small package	1.6 to 5.5	1.8 / -1.8	24µs	2.5mA at 3V	Push-pull CMOS	-30 to+85	4SON
AK8772	Ultra-small package	1.6 to 5.5	1.8 / -1.8	1ms	60µA at 3V	Push-pull CMOS	-30 to+85	4SON
EM1011		3.5 to 18	3.0 / -3.0	25µs	3mA at 12V	Open drain	-30 to+115	4SMT
EM1711		1.6 to 5.5	1.8 / -1.8	24µs	2.5mA at 3V	Push-pull CMOS	-30 to+85	4SOP
EM1712		1.6 to 5.5	1.8 / -1.8	1ms	60µA at 3V	Push-pull CMOS	-30 to+85	4SOP
EW400		4.5 to 18	10 / -10	3µs	6mA at 12V	Open collector	-20 to+115	3SOT
EW403		2.5 to 5.5	10 / -10	3µs	6mA at 3V	Open collector	-30 to+115	3SOT
EW413		2.5 to 5.5	3 / -3	3µs	6mA at 3V	Open collector	-30 to+115	3SOT
EW610B		3 to 26.4	3 / -3	3µs	5mA at 12v	Open collector	-40 to+115	3SOT
EW612B	Internal pull-up	3 to 26.4	3 / -3	3µs	5mA at 12v	Open collector	-40 to+115	3SOT
EW710B		3 to 26.4	3 / -3	3µs	5mA at 12V	Open collector	-40 to+115	3SIP
EW712B	Internal pull-up	3 to 26.4	3 / -3	3µs	5mA at 12V	Open collector	-40 to+115	3SIP
EZ410		3.8 to 24	4.2 / -4.2	3µs	5mA at 12V	Open collector	-40 to+125	3SOT

Hall Effect Linear ICs

P/N	Feature	Supply Voltage	Sensitivity mV/mT @ HE	Response time	Supply Current	Output	Temp range	Package
EQ430L	Ratiometric	3 to 5.5	130 at 5V	5µs	9mA at 5V	Analog	-40 to+100	3TSOP
EQ431L	Ratiometric	3 to 5.5	65 at 5V	5µs	9mA at 5V	Analog	-40 to+100	3TSOP
EQ432L	Ratiometric	3 to 5.5	40 at 5V	5µs	9mA at 5V	Analog	-40 to+100	3TSOP
EQ433L	Ratiometric	3 to 5.5	20 at 5V	5µs	9mA at 5V	Analog	-40 to+100	3TSOP
EQ730L	Ratiometric	3 to 5.5	130 at 5V	2µs	9mA at 5V	Analog	-40 to+100	3SIP
EQ731L	Ratiometric	3 to 5.5	65 at 5V	1µs	9mA at 5V	Analog	-40 to+100	3SIP
EQ732L	Ratiometric	3 to 5.5	40 at 5V	1µs	9mA at 5V	Analog	-40 to+100	3SIP
EQ733L	Ratiometric	3 to 5.5	20 at 5V	1µs	9mA at 5V	Analog	-40 to+100	3SIP

Hall Effect Special ICs

P/N	Feature	Supply Voltage	Sensitivity Bop/Brp @HIC	Response time	Supply Current	Output	Temp range	Package
AK8775	Encoder Dual output A - vertical B - horizontal	1.6 to 5.5	1.5 / -1.5	1ms	90µA at 3V	Pulse Push-pull CMOS	-30 to+85	4SMT
AK8776	Encoder Dual output F - pulse D - rotation direction	1.6 to 5.5	1.5 / -1.5	1ms	90µA at 3V	Push-pull CMOS	-30 to+85	4SMT
EM3242	Angle sensor Ratiometric	2.7 to 3.3	-	140µs	8mA	Analog	-30 to+85	6TSSOP
EQ0442	Hybrid APD Analog Pointing Device	VDD: 2.5 to 3.3 VDI: 1.65 to VDD	-	16ms	6uA at 3V (Ext Clk)	SPI	-30 to+85	20GFN

AKM Current Sensor Modules

The Current Sensor Modules use a Hybrid Hall IC with a high sensitivity Hall element and compensation circuitry to provide flat temperature dependence. CQ206x and CQ209x Series include an EEPROM unit providing factory-adjusted sensitivity and offset voltage for high accuracy. The current conductor is electrically isolated from the sensor IC. The output is linear and ratiometric.

P/N	Current (Feature)	Supply Voltage	Sensitivity mV/A	Response time	Supply Current	Output	Temp range	Package
CQ121E	20A	3 to 5.5	63.5	3µs	9mA at 5V	Analog (Ratiometric)	-30 to+85	5SIP
CQ131E	30A	3 to 5.5	27	3µs	9mA at 5V	Analog (Ratiometric)	-30 to+85	5SIP
CQ2063	35A (2% accuracy)	4.5 to 5.5	60	1µs	6.6mA at 5V	Analog (Ratiometric)	-40 to+90	7SIP
CQ2064	54A (2% accuracy)	4.5 to 5.5	40	1µs	6.6mA at 5V	Analog (Ratiometric)	-40 to+90	7SIP
CQ2065	85A (2% accuracy)	4.5 to 5.5	25	1µs	6.6mA at 5V	Analog (Ratiometric)	-40 to+90	7SIP
CQ2092	21A (2% accuracy)	4.5 to 5.5	100	1µs	6.6mA at 5V	Analog (Ratiometric)	-40 to+90	7SMT
CQ2093	35A (2% accuracy)	4.5 to 5.5	60	1µs	6.6mA at 5V	Analog (Ratiometric)	-40 to+90	7SMT

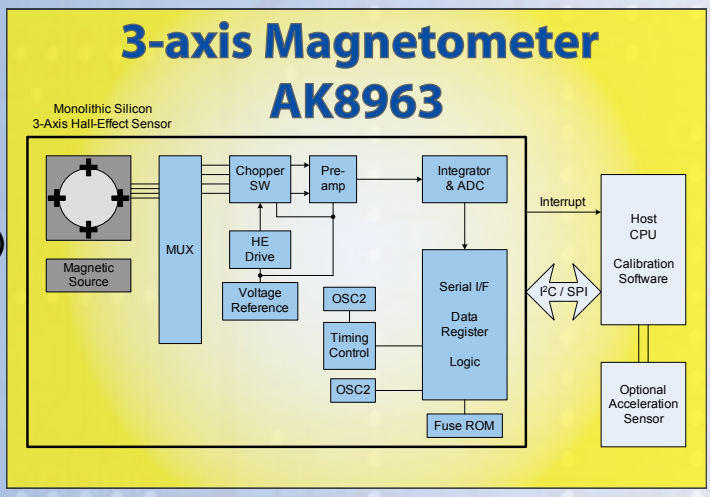
Electronic Compass

AKM is the world leader in designing and manufacturing electronic compass integrated circuits. Integrated Hall-Effect sensors are used to detect the earth's magnetic field in three axes. The integration allows for very small and thin packages, often required for state-of-the art portable appliances with GPS services. In addition to the integrated circuit, AKM may provide a software solution for calibrating offset, eliminating the need for adjustment and tuning during manufacturing. AKM has extensive experience providing 3-axis and 6-axis compass IC's, and the current products are fifth-generation.

The output is a vector that describes direction and magnitude, which can be translated into a directional heading. The silicon magnetic sensor enables a wide measurement range and provides an excellent signal-to-noise ratio. AKM's patented offset calibration software may be employed with the compass to calibrate offset induced by the static magnetic field generated inside the appliance. The solution offers a one degree resolution, with accuracy ranging from ±1° to ±5°, depending upon the parameters of the appliance design and software calibration.

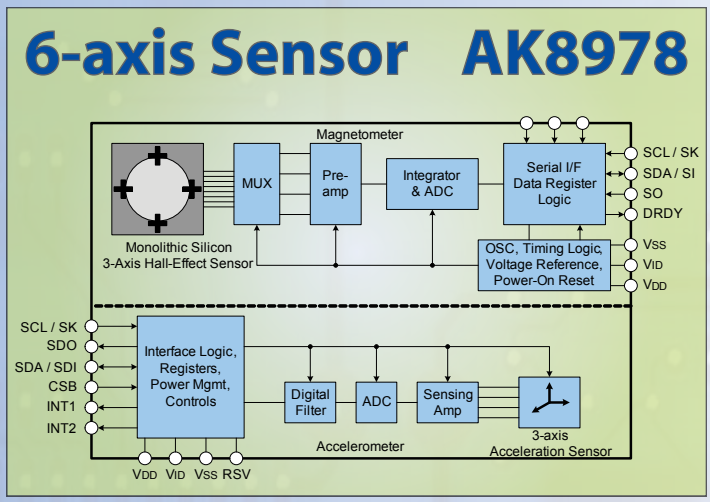
AK8963 (e-compass)

- 3-axis monolithic Si-Hall Effect magnetic sensor
- Time-shared processing: sequencer obtains 3-axis magnetic heading
- Selectable resolution:
  - 14-bits, 0.6µT; 16-bits, 0.15µT
- Single or continuous measurement (8Hz or 100Hz)
- Fuse ROM stores calibration data (AKM-generated)
- I²C or SPI control interface
- Integrated oscillator eliminates external CLK
- Automatic power-down mode
- Low power operation: 280µA at 8Hz sampling
- Two package options:
  - AK8963N: QFN (3.0 × 3.0 × 0.75mm)
  - AK8963C: WL-CSP (BGA) (1.6 × 1.6 × 0.5mm)



AK8978 (e-compass + accelerometer)

- 3-axis monolithic Si-Hall Effect magnetic sensor with 3-axis acceleration sensor
- E-compass:
  - Resolution: 0.3µT / LSB
  - Measurement range: ±1200µT
  - Internal oscillator
  - Low power: 350µA @ 8Hz sampling rate
- Accelerometer:
  - Resolution: 4mG / LSB
  - Measurement range: ±16G
  - Tap, activity, free-fall, orientation detection
  - Low power: 30µA @ 10Hz sampling rate
- I²C or SPI control interface
- Package: 26-pin LGA (3.0 3.0 × 1.0mm)



Application Development

Auto-calibration Software (DOE)

The DOE (Dynamic Offset Estimation) algorithm provides automatic adjustment of the compass for extraneous magnetic field changes, and thus eliminates the need for repeated manual adjustment. In mobile phones and other handheld appliances, the extraneous magnetic fields are strong and subject to frequent change and distortion. The levels of mobile phone component magnetization may change in the strong magnetic fields often encountered around trains, stereo speakers, and other electrical equipment. The mobile phone's own speaker magnet will vary in strength over changing temperature. The interior magnetic field is also significantly affected by the insertion of memory cards and other accessories.

Without the DOE algorithm, frequent and troublesome manual adjustment is essential. With it, the adjustment is automatic, efficient, and highly effective for the maintenance of accurate and reliable direction finding, whether walking along the street, getting off a bus, leaving a subway station, or passing through other environments. This auto-adjust operation is made possible by the combination of the 3-axis sensor configuration and the DOE algorithm.

Designing an e-compass Application

The electronic compass is designed to measure a geomagnetic field, which consists of both the earth's magnetic filed and the local magnetic field, generated through a variety of magnetic sources. When the earth's field is greater than the local environmental field, it is possible to compensate for the local effects to generate an accurate directional heading. But, when there is a very strong local field that dominates the geomagnetic field, it is not possible to determine a heading. This can be shown by placing a conventional compass in the presence of a very strong local field, and observing the effect.

It is possible to offset the effects of fixed local magnetic fields through calibration software. AKM has created automatic calibration software, removing the need for lengthy and complicated manual calibration. Unwanted magnetic fields are generated by metals or magnetic materials contained in the appliance, and these fields influence the geomagnetic measurement results. For example, a mobile phone contains many magnetic field generators, including speakers (20,000μT), vibrator motors, screws, magnets for the open / close switches, metal shields, metal connectors, and others. However, it is not possible to compensate for the effects of external, random magnetic fields, including large electric motors and large metallic surfaces or equipment.

AKM's auto-calibration software is available under select conditions - contact your local sales representative for details.

Evaluation kit and development board

Evaluation kit (AKD8975 or AKD8963)
- **Azimuth output (tilt angle compensation)**
- **Automatic calibration using DOE™ software**
- **Logs measurement data and outputs to clipboard**
- **Proprietary Windows application**
- **Source code and API are not available**

Development kit (AKK8973)
- **Azimuth calculation (simple tilt compensation)**
- **Output measurement data over USB**
- **Schematic, C source code are available**
- **Automatic calibration is not included**

Clock and Timing

AKM is now utilizing its analog PLL technology for clock generators and other clocking devices. Known for its extremely low jitter, the PLL's offer unparalleled performance in products such as single clock generators, multi-clock generators, spread spectrum clock EMI-reduction, programmable clock generators and zero delay buffers. In addition to the low jitter characteristics, these products offer very low power consumption, low voltage operation, and small package sizes.

Multiple Clock Generators

The family of multi-clock generators have four outputs, plus the recovered input clock. The device architecture contains 3 PLL's and a VCXO or XO.

	In	CLK 1	CLK 2	CLK 3	CLK 4	Type
AK8130	27	74.250 74.1758 54.000	25.000	4.9152	24.576 33.333	VCXO
AK8130A AK8130AH	27	54.000 74.250 74.17582	25.000	12.000 48.000 4.9152	24.576 33.333	VCXO
AK8130B	27	74.250 74.17582	25.000	12.000 48.000 4.9152	24.576 33.333	VCXO
AK8131S	27	74.250 74.17582 55.000 61.875 68.333	74.25 66.000 82.000	27.000 54.000	27.000	VCXO
AK8132	13.5 16 12	41.85 48.0 12.0	24.576	54.000	27.000	XO
AK8133	27	24.576 36.864	4.096 8.192 11.2896 12.288 16.384 22.5792 24.576 49.152	8.4672 12.288 16.9344 18.432 24.576 33.8688 36.864 73.728	16.9344 33.8688	XO
AK8134	40.5	74.25 74.17582	24.576	27.000		Ref Input
AK8134A	49.5					
AK8136A	27	148.352 148.500	100.71 108.000	24.576 33.8688	27.000	VCXO
AK8137A	25	100.000 133.000 166.000 200.000	96.000	100.000	27.000	VCXO

Spread-Spectrum Clock Generators

AKM's spread spectrum clock generators are designed for applications requiring significant EMI reduction. Based on AKM's original spread spectrum profile (patent pending), excellent EMI reduction is achieved without degrading system performance. The profile enables lower spread ratios to realize required EMI reduction.

- **Output frequency range: 6MHz to 128MHz**
- **Spread spectrum modulation ratio:**
  - **Center spread: ±0.125%, 0.25%, 0.5%, 1.0%, 1.5%**
  - **Down spread: -0.25%, 0.5%, 1.0%, 2.0%, 3.0%**
- **Modulation frequency: 38.46kHz to 76.92kHz**
- **Low jitter performance: 100ps max cycle:cycle**
- **Low power operation: 3.3V, 2.5mA**
- **10-pin TMSOP package**

- **Available options**
  - **Integrated XO and output buffer**
  - **Mask-programmable PLL multiplier**
  - **Mask-programmable modulation frequency**

Programmable Clock Generators

In addition to mask-programmable devices, AKM provides a family of register-programmable single clock generators. The output may be selected from a series of fixed frequencies or it can be stepped to achieve the desired frequency. These devices offer the same low jitter characteristic as the mask-programmable family. Both Integer-N and Fractional-N devices are available.

Single Clock Generators

	Input CLK	Output CLK1	Output CLK2	Supply Current
AK8110	27	36.000	49.500	3.5mA
AK8111	27	12.288	24.576	3.5mA
AK8112	27	33.375	67.500	3.5mA
AK8113	27	74.17582	74.250	3.8mA
AK8114	27	33.333	48.000	3.5mA
AK8115	41.538	27.000	74.17582	3.8mA
AK8116	33.75	27.000	74.250	3.8mA
AK8117	27	38.000	38.6667	3.3mA
AK8118	27	32.000	40.500	3.5mA

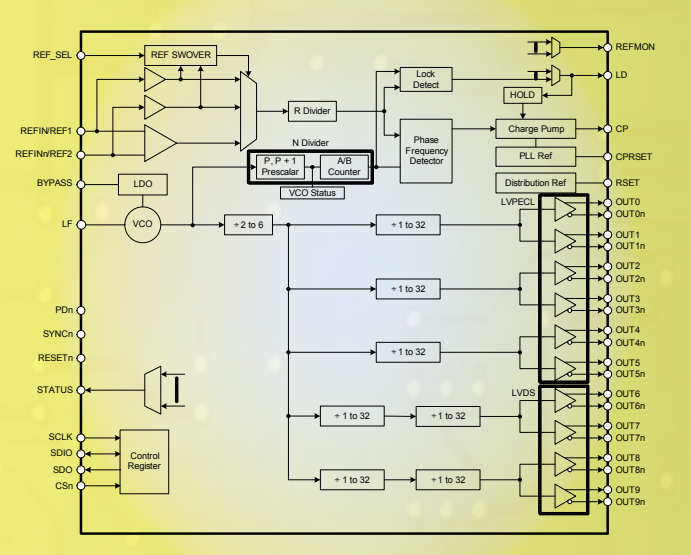
HDMI Clock Generators

- **Low jitter performance: period and long term**
- **Two selectable output frequencies**
- **Low power consumption**
- **10-pin TMSOP package**

	Period Jitter	Long Term Jitter	Output CLK1 (MHz)	Output CLK2 (MHz)
AK8128A	15ps (1σ)	37ps (1σ)	74.25	148.5
AK8128B	20ps (1σ)	50ps (1σ)	74.25	148.5
AK8128C	20ps (1σ)	60ps (1σ)	12.288 33.8688	24.576 36.864

Precision Generators & Buffers

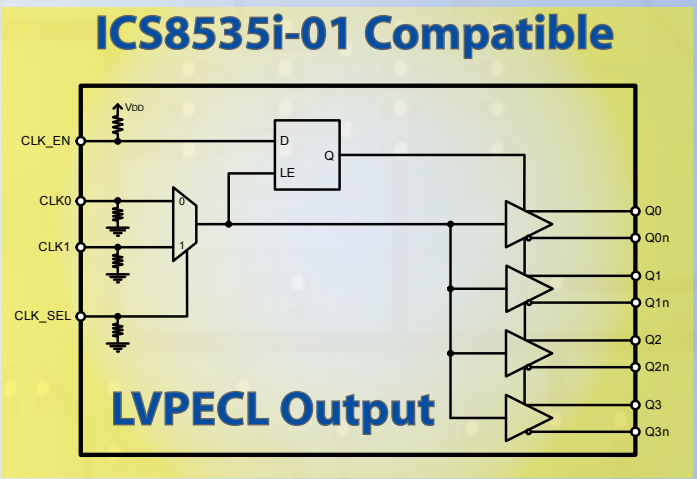
Ultra-Precise Multi-Clock Generator



AK8186

- LVPECL and LVDS/LVCMOS outputs
  - Three pairs of 900MHz LVPECL
  - Two pairs of 800MHz LVDS
  - Eight 156MHz LVCMOS (two per LVDS)
- Ultra-low jitter
  - 235fs @ 122.88MHz, BW = 12kHz to 20MHz
- Integrated 1.6GHz VCO (1.45 to 1.8GHz range)
- 3.3V operation, 2.5V to 3.3V LVPECL drive
- 64-pin QFN package

LVPECL 1:4, 266MHz Buffer



AK8181A

- 1:4 LVPECL clock fanout buffer
- Clock frequency: up to 350MHz
- Low skew: 30ps (between outputs)
- 20-pin TSSOP package

AK8180A

- 1:10 LVCMOS clock fanout buffer
  - Each output capable of driving two 50Ω lines
- Outputs divided into three banks (3 - 3 - 4)
- Clock frequency: up to 250MHz
- Low skew: 200ps (between outputs)
- Two selectable LVCMOS inputs
- Single, dual, or mixed supplies: 2.5V or 3.3V
- 32-pin TQFP, -40°C to +85°C
- Compatible with MPC9446

AK8180B

- 1:9 LVCMOS clock fanout buffer
  - Drives 9 parallel or 18 series terminated lines
- Synchronous output stop in logic low state
- Clock frequency: up to 350MHz
- Low skew: 150ps (between outputs)
- Two selectable LVCMOS inputs
- Low power: 2.5V or 3.3V supplies, 2mA I_Q
- 32-pin LQFP, -40°C to +85°C
- Compatible with MPC9447

AK8180C

- 1:12 LVCMOS clock fanout buffer
  - Drives 12 parallel or 24 series terminated lines
- Synchronous output stop in logic low state
- Clock frequency: up to 350MHz
- Low skew: 150ps (between outputs)
- Two selectable LVCMOS or LVPECL inputs
- Low power: 2.5V or 3.3V supplies, 2mA I_Q
- 32-pin LQFP, -40°C to +85°C
- Compatible with MPC9448

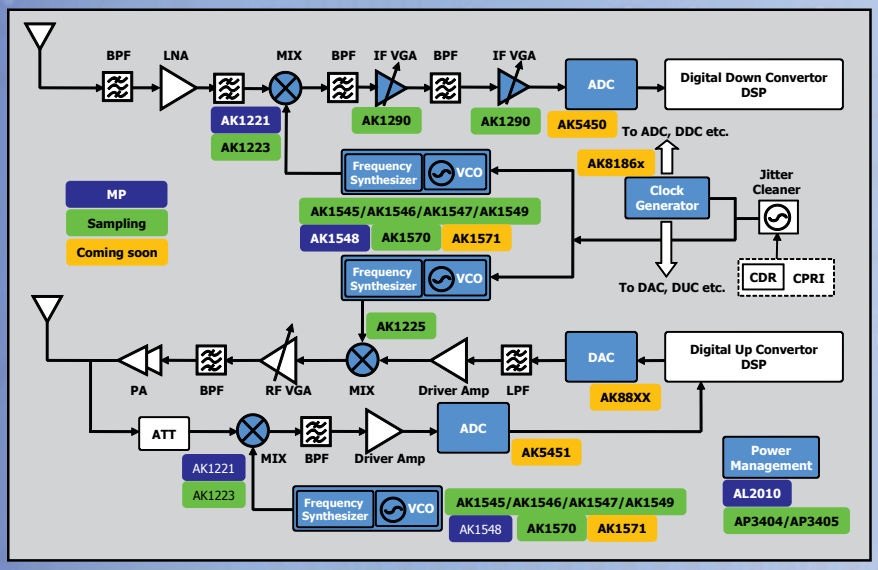
AK8180D

- 1:10LVCMOS clock fanout buffer
  - Drives 10 parallel / 20 series terminated lines
- Outputs divided into three banks (3 - 3 - 4)
- Clock frequency: up to 250MHz
- Low skew: 200ps (between outputs)
- Differential LVPECL input
- Single, dual, or mixed supplies: 2.5V or 3.3V
- 32-pin TQFP, -40°C to +85°C
- Compatible with MPC 9456

RF Products

AKM has extensive experience designing and manufacturing RFIC's. While the majority of applications have focused on mobile applications, AKM is expanding its RF device portfolio to address other wireless communications applications. The first product families consist of frequency synthesizers, frequency mixers, and RFID transceivers.

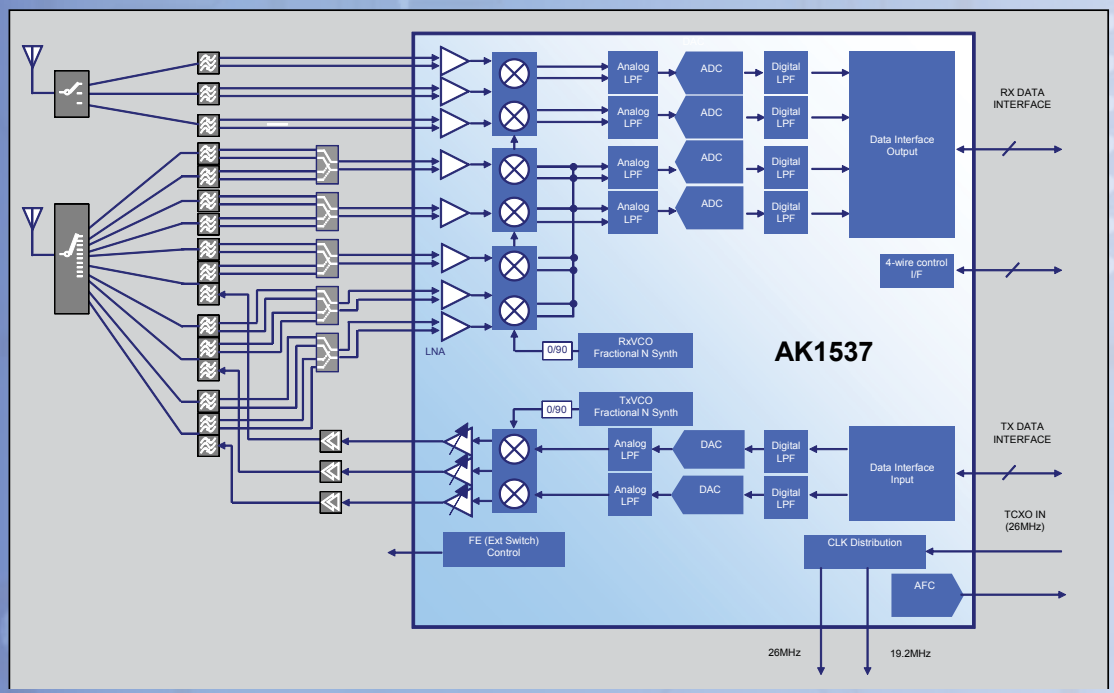
Products for BTS Applications



AKM BTS Solutions

- Low power frequency synthesizers
  - AK1542A: 600MHz integer-N
  - AK1544: 1.3GHz integer-N
- Low phase noise frequency synthesizers
  - AK1546: 3GHz, -226dBc / Hz phase noise
  - AK1548: 8GHz, -226dBc / Hz phase noise
- Low power down-conversion mixers
  - AK1220: 900MHz, 17mA @ IIP3 = +22dBm
  - AK1221: 3.5GHz, 45mA @ IIP3 = +25dBm
- Clock generator
  - AK8186A:
- High performance IF ADC
  - AK5450: 14-bits, 125MSPS, 84dB SFDR
  - AK5451: 16-bits, 250MSPS, 85dB SFDR

W-CDMA / HSPA Femto Cell Transceiver

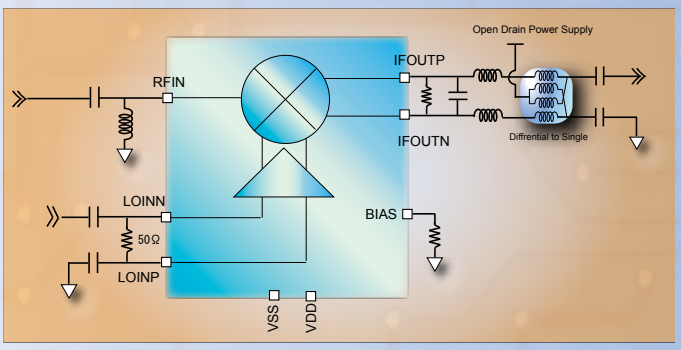


AK1537

- 10-band W-CDMA: I, II, V, etc.
- GSM detector
- JESD207 compliant
- One transmitter, two receivers
- 129 pin FBGA: 9mm × 9mm
- Tx integration:
  - DAC, MOD, RF VGA, PLL
- Rx integration:
  - LNA, DMOD, IF VGA, ADC
- Low power: <390mW

Frequency Mixer

High Linearity Down Convert Mixer



AK1220/21

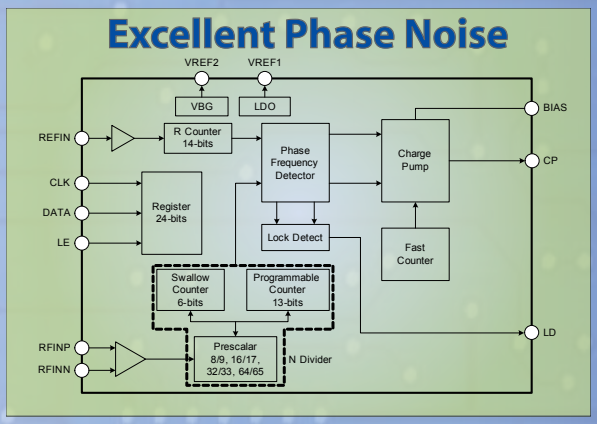
- Operating Frequency : 100MHz - 960MHz (AK1220)
  700MHz - 3.5GHZ (AK1221)
- Selectable Performance: Linearity vs. Power
  - AK1220: 17mA, IIP3+22dBm, gain -2dB, NF 11.5dB
    9mA, IIP3 +11dBm, gain -2dB, NF 11.5dB
  - AK1221: 45mA, IIP3 +25dBm, gain -0.5dB, NF 14dB
- LO level: -5 to +5 dBm
- Low LO to RF / RF to LO Leakage: -50dBc
- Operating supply voltage: 4.75V to 5.25V
- Operating temperature: -40 to +85°C
- Package : 16pin UQFN (3 × 3mm, 0.5mm pitch)

Benefits

- ✓ Single RF input
- ✓ Reduced external component count
- ✓ Linearity vs. input current
  Performance can be optimized for each application with an external resistor
- ✓ Small package

Frequency Synthesizer

Low Noise Integer-N Synthesizer



AK1546/48

- Operating Frequency : 500MHz - 3GHz (AK1546)
  1GHz - 8GHz (AK1548)
- Operating current: 12mA (AK1546), 17mA (AK1548)
- Programmable charge pump current
  - 650µA to 5.2mA, 8 steps
- Very low phase noise: -226dBc/Hz
- Fast lock mode for improved lock time
- Operating Supply Voltage: 2.7V to 3.3V (AVDD, PVDD)
- Operating temperature: -40 ~ +85°C
- Separate Charge Pump Power Supply:
  2.7V to 5.5V (CPVDD)
- Package : 20pin QFN (4 × 4 × 0.75mm, 0.5mm pitch)

Benefits

- ✓ Separate charge pump supply enables separate voltage control for serial I/F & charge pump blocks
- ✓ Excellent performance to power ratio
- ✓ Small package

Frequency Mixers

Part Number	Frequency	IIP3 [dBm]	IDD	Application	Package
AK1220	100MHz to 900MHz	+22	17mA	2-way radio, ISM	16UQFN
AK1221	700MHz to 3.5GHz	+25	45mA	BTS, Radio Link, ISM	16UQFN

Frequency Synthesizer

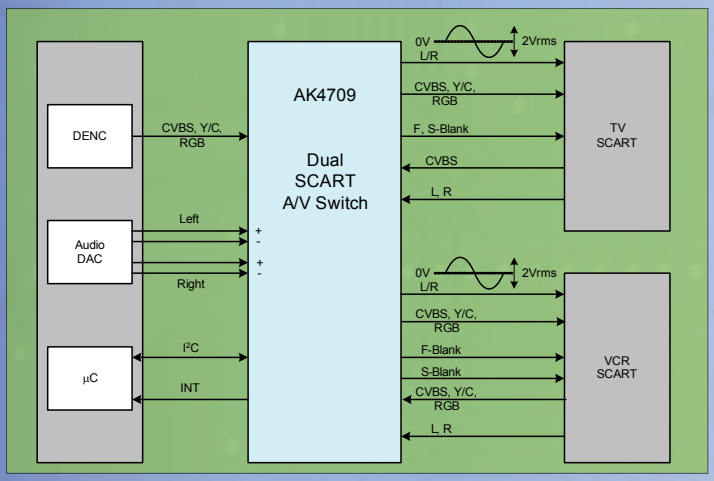
Category	Part Number	Frequency	Description	Application	Package
Single Fractional-N	AK1541	20MHz to 600MHz	Low spurious noise	2-way radio, ISM	24QFN
	AK1543	400MHz to 1.3GHz	Low spurious noise	2-way radio, ISM	24QFN
	AK1549	400MHz to 3.5GHz	Fast lock time	GSMBTS	32QFN
Single Integer-N	AK1542	20MHz to 600MHz	64 step charge pump	2-way radio, ISM	24QFN
	AK1542A	20MHz to 600MHz	Low power	2-way radio, ISM	24QFN
	AK1544	400MHz to 1.3GHz	Low power	2-way radio, ISM	24QFN
	AK1546	500MHz to 3GHz	Low power	BTS	20QFN
	AK1548	1GHz to 8GHz	Low power	BTS	20QFN

A/V Interface Products

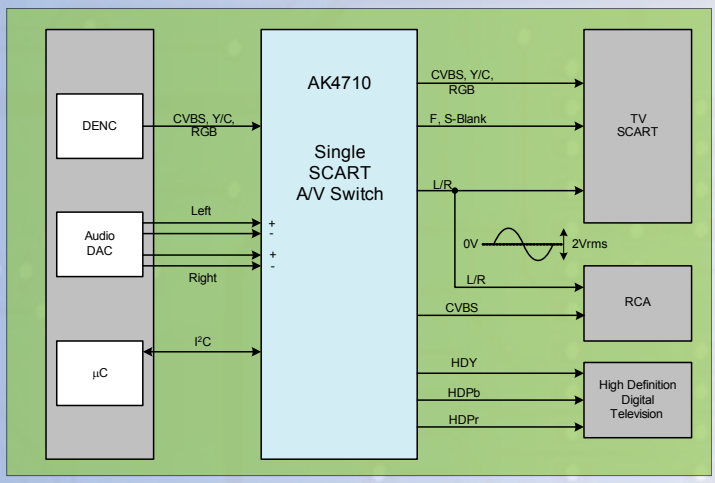
Audio / Video Switching and Processing

AKM manufactures devices for switching audio and video in set-top box and television applications. In addition to switching functions, selected devices include audio DAC's, audio amplifiers, video drivers, and video filters. The AK470x family conforms to the SCART specification. New for 2011 are the AK4710 and AK4710, offering low-cost and low power solutions for single-SCART systems.

Dual SCART, Capless Audio Out



Single SCART, HD Video, Capless Audio



AK4709

- Dual SCART video switch with audio amplifier
- 40mW power consumption
- Ground-referenced audio outputs
  - No DC-coupling capacitors
- Stereo analog volume control with no pop-noise
  - +6dB to -60dB, mute
- Auto start-up mode for power savings
- Loop-through mode for standby
- Power supplies: +3.3V, +12V (video blanking)
- 48-pin LQFP package

AK4711

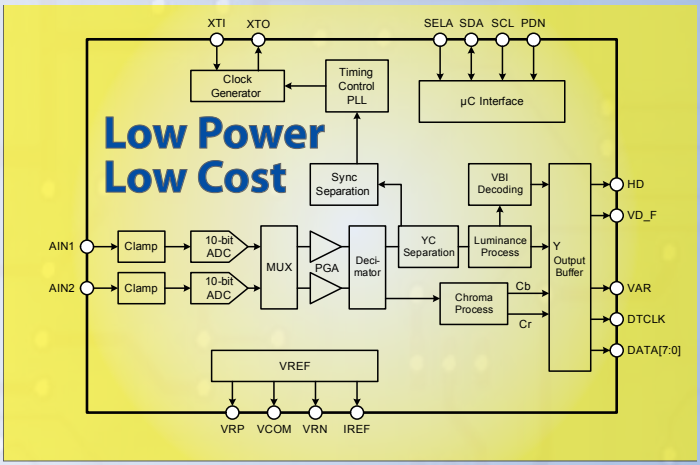
- Single SCART video switch with audio amplifier
- Ground-referenced audio outputs
  - No DC-coupling capacitors
- Stereo analog volume control with no pop-noise
  - +6dB to -60dB, mute
- Video filters and drivers for TV-SCART and RCA
- Video input matrix
- Analog HD component video (YPbPr) output
- Power supplies: +3.3V, +12V (video blanking)
- 32-pin QFN package
- SD version (AK4710) supports SD video

A/V Switch Selection Guide (SCART Products)

	Type	Bits	Audio Performance			Switching				Features
			fs	DR	THD	Audio I/O	Video I/O			
							CVBS/Y	R/C	G/B	
AK4702	Dual	18	48	96	-86	5 / 5	4 / 3	3 / 2	2 / 1	Audio DAC, 2Vrms out, video amps
AK4705	Dual	24	48	96	-86	6 / 5	4 / 3	3 / 2	2 / 1	Y/Pb/Pr version of 4704
AK4706	Dual	24	48	96	-86	5 / 5	4 / 3	3 / 2	2 / 1	HD or SD Y/Pb/Pr or RGB outputs
AK4707	Dual	No DAC		96	-86	6 / 4	4 / 2	3 / 1	2 / 1	Differential in, video amps
AK4708	Dual	No DAC		96	-86	6 / 4	4 / 2	3 / 2	2 / 2	Differential in, 2 RGB outputs
AK4709	Dual	No DAC		96	-92	6 / 4	4 / 2	3 / 2	2 / 1	Differential in, capless audio outputs
AK4710	Single	No DAC		96	-92	2 / 2	4 / 2	1 / 1	2 / 1	Differential in, capless audio out, YPbPr
AK4711	Single	No DAC		96	-92	2 / 2	4 / 2	1 / 1	2 /1	AK4710 with HD component video output

Video Decoders and Encoders

Low Cost Composite Video Decoder



AK8859

- 10-bit 27MHz ADC (two channels)
- NTSC, PAL, SECAM CVSB and S video decoding
- Line lock / frame lock PLL
- Adaptive 2D Y/C separation
- Auto signal detection
- Two analog inputs
- Wide temperature range: -40°C to +105°C
- Package options:
  - 32-pin QFN or 48-pin LQFP
- Low power: 81mW
- 1.8V core, 1.8V to 3.3V interface supply

Video Decoders (ADC)

	Input Format	Output Format	Analog Inputs	Input Standards	ADC	Temp Range	Power		Package	
							Voltage	Power	Pins	Type
AK8853	CVBS	ITU-R BT.656 ITU-R BT.601	4	NTSC, PAL, SECAM	1 x 10-bits	-40°C to +85°C -40°C to +105°C	1.8V core 1.8V - 3.3V IF	104mW	48	LQFP
AK8854	CVBS S-Video YPbPr, RGB	ITU-R BT.656 ITU-R BT.601	10	NTSC, PAL, SECAM	2 x 10-bits	-40°C to +85°C	1.8V core 1.8V - 3.3V IF	194mW	64	LQFP
AK8856	CVBS	ITU-R BT.656 Camera IF	2	NTSC, PAL	1 x 10-bits	-30°C to +85°C -40°C to +85°C	1.8V core 1.8V - 3.3V IF	59mW	41 48	FBGA QFN
AK8857	CVBS (dual) S-Video	ITU-R BT.656 ITU-R BT.601	4	NTSC, PAL, SECAM	1 x 11-bits	-40°C to +85°C	1.8V core 1.8V - 3.3V IF	TBD	64	LQFP
AK8858	CVBS S-Video YPbPr,	ITU-R BT.656 ITU-R BT.601	10	NTSC, PAL, SECAM	2 x 10-bits	-40°C to +85°C	1.8V core 1.8V - 3.3V IF	TBD	80	LQFP
AK8859	CVBS S-Video	ITU-R BT.656 ITU-R BT.601	2	NTSC, PAL, SECAM	2 x 10-bits	-40°C to +105°C	1.8V core 1.8V - 3.3V IF	81mW	32	QFN

Video Encoders (DAC)

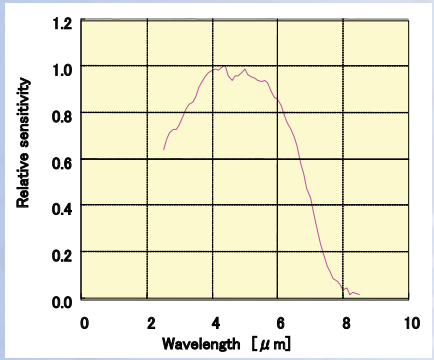
	Input Data	Output Format	Analog Outputs	Input Format	DAC	Temp Range	Power Supply		Package	
							Voltage	Power	Pins	Type
AK8813/14	8-bit ITU-R BT.656	CVBS S-Video	Y, C, CVBS	NTSC, PAL	3 x 10-bits	-20°C to +85°C	3.3V	79mW	57	FBGA
AK8817/18	9-bit ITU-R BT.656	CVBS YCbCr 4:2:2	CVBS	NTSC	1 x 9-bits	-40°C to +85°C	3.3V	81mW	41	FBGA
AK8823	ITU-R BT.601 1080i 720p	YPbPr Interlace YPbPr Progressive	YC YPbPr	YCbCr 4:2:2 525i/625i 525p/625p 1080i/720p	5 x 10-bits	-20°C to +85°C	Va = 3.0V Vd = 1.8V	237mW	65	FBGA
AK8825	525i/625i 525p/625p 1080i/720p	YPbPr Interlace YPbPr Progressive	YPbPr S-Video CVBS	YCbCr 4:2:2 RGB	3 x 10-bits	-40°C to +85°C	Va = 3.0V Vd = 1.8V	153mW	57 48	FBGA QFN

Infrared Sensor Products

Non-Transmitting Infrared Sensor Detects Human Body Heat

AK9720

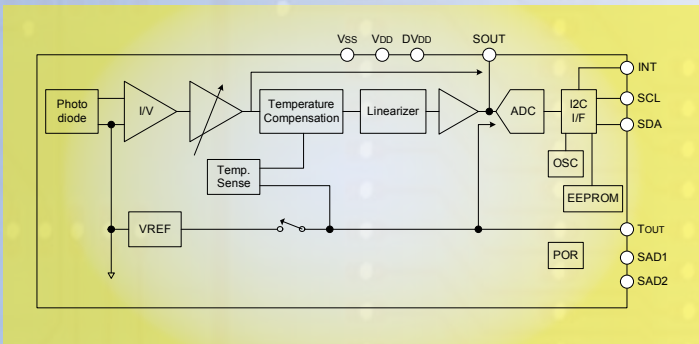
- Integrated IR sensor, linearizer, IR filter, and ADC
- Uses quantum IR sensor designed to detect human bodies
- Very low current consumption: 100µA @ 330ms period
- 16-bit ADC provides digital output
- Integrated temperature sensor used for sensor compensation
- Human body detection reference algorithm available



Spectral Response

Applications

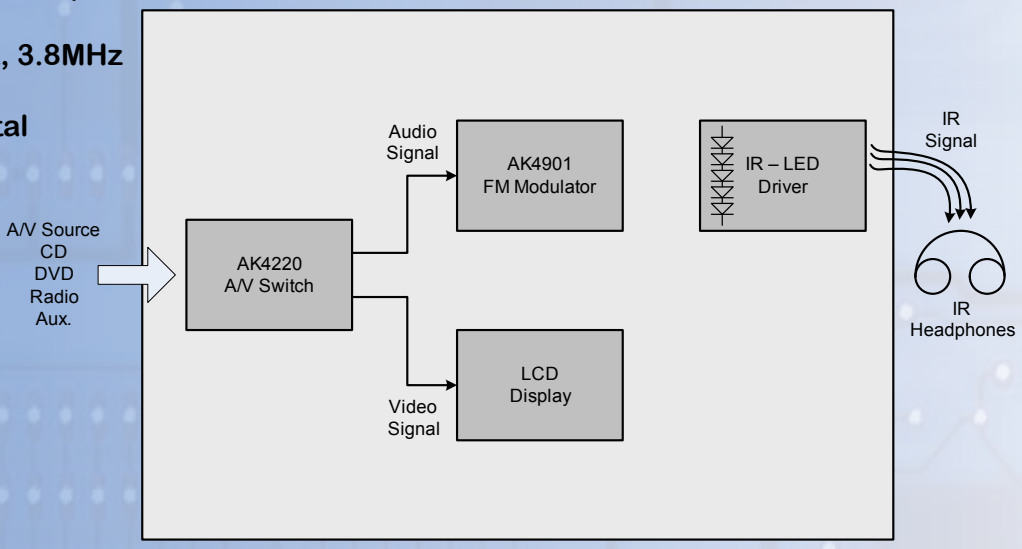
- Human body detection
  - Lighting, display wake-up, gaming
- Non-contact thermometer
  - Aural thermometer, process control, cabin temperature
- Proximity sensor
  - Motion-free display wake-up, non-contact switch
- NDIR gas sensor
  - CO^2, CO, NO, HCHO
  - Indoor air quality: IAQ monitoring



Infrared Linear AudioTransmitter for IR Headphone Applications

AK4901

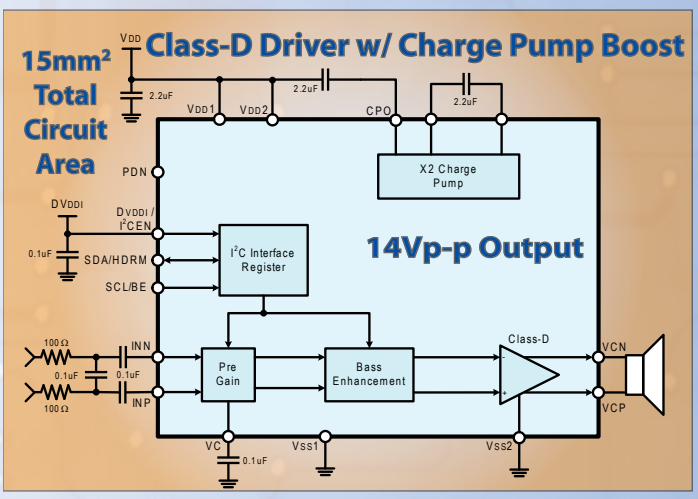
- Two analog stereo inputs
- VCO output controlled by pin settings or I^2C
- Pre-emphasis and limiter functions
- SNR: 60dB; THD: -0.18%
- VCO temperature drift: ±1.0%
- RF output level: 300mV over temperature
- Modulation frequencies:
  - 2.3MHz, 2.8MHz, 3.2MHz, 3.8MHz
- Power supplies:
  - 5V analog, 2.7V - 5V digital
- 30-pin VSOP package



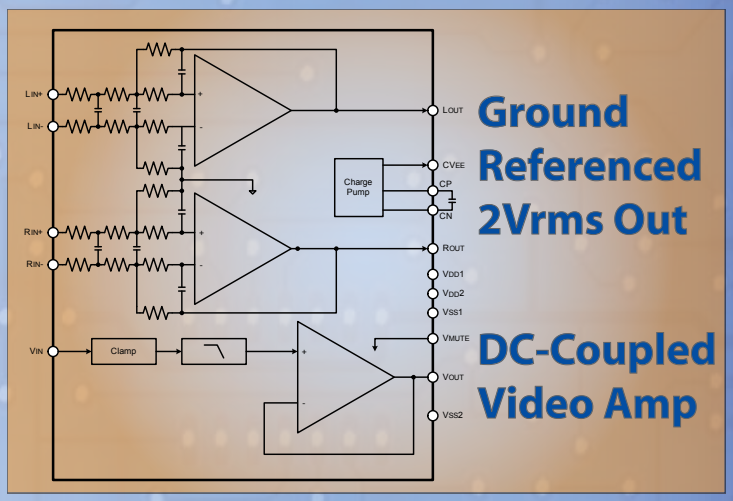
Audio Amplifiers

AKM has applied its industry-leading charge pump technology to audio amplifiers. For applications that have limited power supplies, AKM's capless audio amplifiers provide wide ground-referenced output swings with excellent PSRR characteristics, all achieved with the very low power consumption demanded by portable audio applications.

Piezo Driver w/ Bass Enhancement



Stereo Capless Line Driver, Video Amp



AK7811A

- Mono Class-D Piezo speaker driver
  - 14Vp-p @ VDD of 3.6V
  - Pop-noise free, filterless architecture
- Integrated Analog Bass Enhancement
  - Expands low frequency audio quality
  - Integrated dynamic range compressor
- Gain adjustment: -25dB to +48dB
- Serial I²C or hardware pin control
- Single-ended or differential inputs
- Wide supply range: 2.7V to 5.25V
- 16-pin CSP package (2.31 × 2.36mm, 0.5 pitch)

AK4203

- Capless line driver and video amp
- Audio line driver:
  - 2VRMS ground-referenced outputs
  - Differential inputs, single-ended outputs
  - SNR: 102dB THD+N: -90dB
- Composite video line driver:
  - DC-coupled output (no blocking caps needed)
  - +6dB video amp with low pass filter
  - SNR: 75dB Bandwidth: 100kHz to 6MHz
- Single +3.3V power supply
- 16-pin TSSOP package

Low-Power Class-D Speaker Drivers for Dynamic and Piezo Speakers

	Channels	Speaker Type	Output Power	Gain (dB)	ALC	Boost Converter	Power Supply	Package	
								Pins	Type
AK7811A	Mono	Piezo	14Vp-p	-25 to +48	Y	Y	2.7 to 4.5	16	CSP
AK7830	Stereo	8Ω	1W	0 to +20		Y	3 - 5	24	QFN
AK7831	Mono	8Ω	1.2W	+3 to +16			2.5 to 5.25	12	CSP
AK7832A	Stereo	8Ω 4Ω	1.3W 2.5W	-26.5 to +20	Y		3 - 5	24	CSP
AK7833	Mono	8Ω 4Ω	1.2W 2.0W	-48 to +25	Y		2.5 to 5.0	12	CSP
AK7835B	Mono	8Ω 4Ω	1.45W 2.5W	-4 to +8			2.5 to 5.5	9	CSP
AK7840	Stereo	Piezo	12.3Vp-p	-26.5 to + 18	Y	Y	2.7 to 4.5	31	CSP
AK7844	Stereo	Piezo	14Vp-p	-6 to +15		Y	2.7 to 4.5	31	CSP
AK7845	Mono	Piezo	23Vp-p	-4 to +8		Y	2.7 to 4.5	24	CSP
AK7846	Stereo	Piezo	23Vp-p	-6 to +15		Y	2.7 to 4.5	31	CSP

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A Corporation Focused On Multimedia and Communications Technologies

AKM is a corporation focused on the emerging information-communications society. Since its establishment in 1983, AKM has based its corporate operation and development in two fast-growing areas vital to the growth of information and communication systems custom and application-specific IC's. It has, in particular, developed CMOS technology for circuits that were generally considered difficult to implement in CMOS form, and rapidly expanded the development and application of this technology. This has led to world leading design and process technologies for high quality, low power consumption products for communications and multimedia applications. That family now includes analog-digital mixed circuit IC's for mobile communications equipment, A/D and D/A converters based on Delta-Sigma self-calibration technology, and data storage IC's incorporating lossless data compression and error correction technology.

The underlying corporate tenet at AKM is the development of technology, production, and products conducive to the human well-being and to the creation of an environment for life and livelihood of true value. As a vital, energetic corporation driven by the constant development of technology and its application to the growth of the information-communications society, AKM will continue to meet the rising expectations of its customers and the end users.