Audio Codec Overview

TEXAS INSTRUMENTS

Audio Portfolio

Texas Instruments' complete line of audio products feature over 2000 devices within our DAC, ADC, CODEC, AMP, Line driver, Interface, USB Audio, and other product families.

ADC

HW / SW Controlled

1.8-3.3-5V Power

Audio PLL

Energy Sense

#ADC	1-4
SNR	92-123dB
PWR	17-600mW

Packages: 5.3 - 144mm²

1K: $0.80 - $8.55

AMP

Stereo/Mono
Class AB & D w/Boost

Analog Input

Low Power options w/ PurePath™

Inputs	1-6
Output Power	0.35-400W

Packages: 2 - 517mm²

1K: $0.26 - $10.75

CODEC

Power and Performance Optimized

Integrated Amplifiers

Integrated DSP

#ADC/DAC	0-6 / 1-8
ADC/DAC SNR	72-112dB
PWR	6.7mw +

Packages: 7.8 - 170mm²

1K: $1.23 - $19.25

DAC

Current Output, Voltage Output, 2VRMS Output, Delta Sigma
Integrated Amplifiers

DSP integration

#DAC	1-8
SNR	92-127dB
THD (%)	0.0004-0.04

Packages: 6.4 - 144mm²

1K: $0.89 - $11.18

Smart AMP

Low and Mid Power Amplifiers with Smart Speaker Protection

Integrated IV Sense, Excursion and Temp sensing options

Output	7.5 – 50W
PSRR	75 dB
Inputs	Analog/Dig.

Packages: 7.5 - 76mm²

1K: $1.39 - $3.75

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Audio Codec Features

- **Low power without sacrificing performance**
  - Less than 10mW power – up to 102dB SNR
  - PowerTune^{TM} – Power vs. SNR

- **Optional Amplifier integration**
  - Class D, Headphone (DirectPath^{TM})

- **Wide range of inputs/outputs**
  - Up to 10 inputs / 7 outputs (AIC3106)

- **Integrated Signal Processing**
  - EQ, Bass Boost, Treble, Algorithm

- **Various Control and Audio I/F options**
  - I2C, SPI, H/W, DSP, L, R, I2S, etc

- **Multiple packaging options**
  - as small as 7.8mm^2
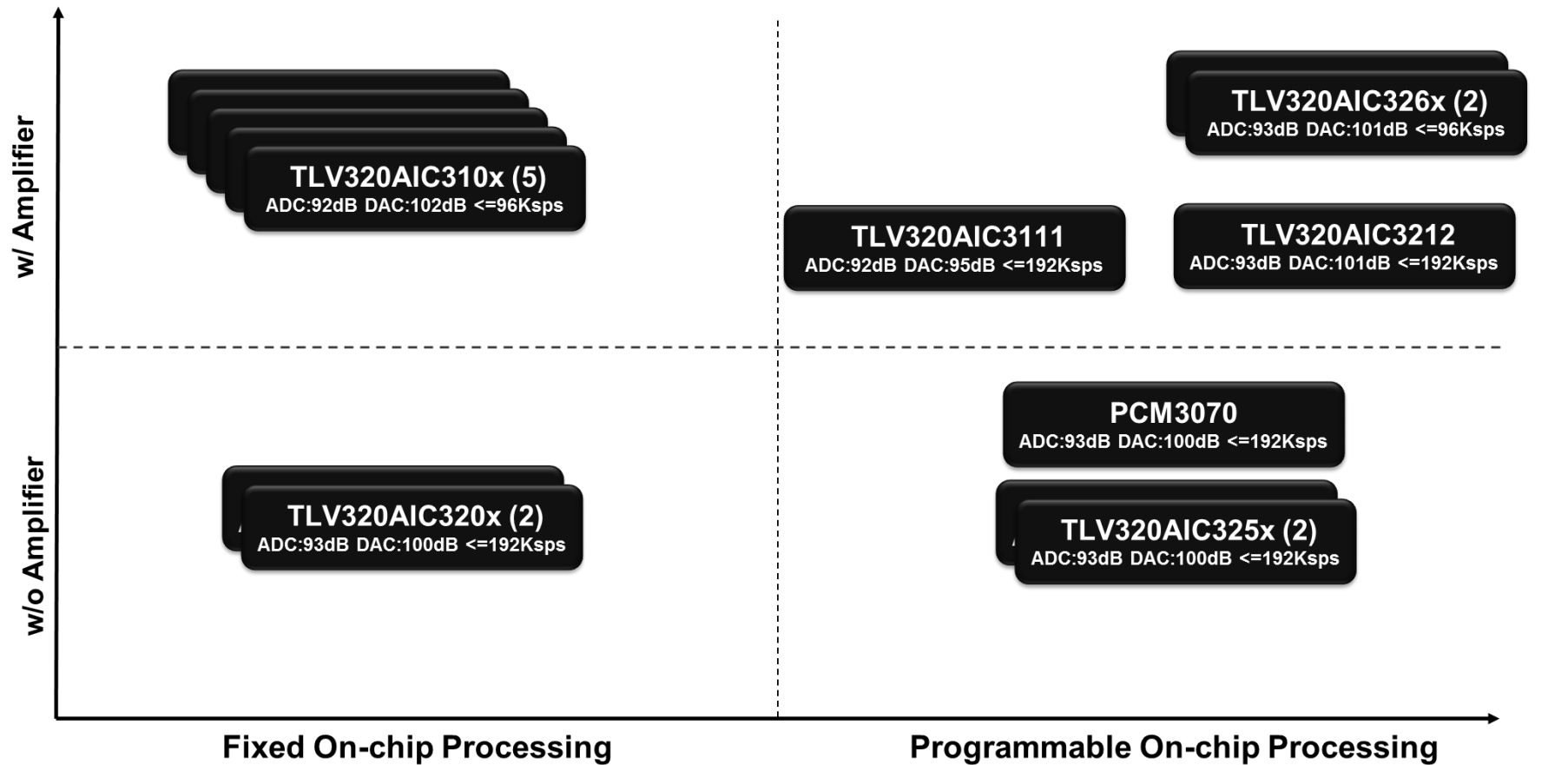 - Multiple pin to pin options
  - TQFP, CSP, BGA, TSSOP

TEXAS INSTRUMENTS

Audio Codecs

w/ Amplifier

TLV320AIC310x (5)
ADC:92dB DAC:102dB <=96Ksps

TLV320AIC326x (2)
ADC:93dB DAC:101dB <=96Ksps

TLV320AIC3111
ADC:92dB DAC:95dB <=192Ksps

TLV320AIC3212
ADC:93dB DAC:101dB <=192Ksps

w/o Amplifier

TLV320AIC320x (2)
ADC:93dB DAC:100dB <=192Ksps

PCM3070
ADC:93dB DAC:100dB <=192Ksps

TLV320AIC325x (2)
ADC:93dB DAC:100dB <=192Ksps

Fixed On-chip Processing   **Programmable On-chip Processing**

Additional CODEC solutions are available. These are our most popular!

TEXAS INSTRUMENTS

TLV320AIC320x Series

	LDO	THD (ADC/DAC)	SNR (ADC/DAC)	Inputs / Outputs	DirectPath™	Package	Pin Compatibility
AIC3206		-84 / -81			Ground Centered Output	BGA : 3.5x3.2 QFN : 5x5mm	AIC3256 w/DSP
			93 / 100	6 / 6			
AIC3204	1.8V to 3.6V	-85 / -83				QFN : 5x5mm	AIC3254 w/DSP

TLV320AIC320x
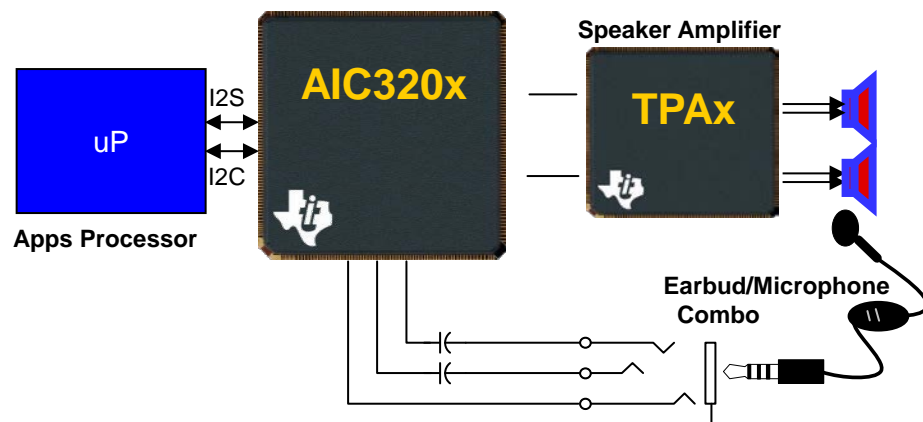## 1.8V Low Power Stereo Codecs

Features

- Stereo 8-192ksps audio DAC up to 100dB SNR
- Stereo 8-192ksps audio ADC up to 93dB SNR
- PowerTune™ adjustable Power vs. SNR
- DirectPath ™ Headphone AMP (3206 only)
- Integrated LDOs (3204 only)
- Extensive record/playback processing blocks
- Integrated PLL

Benefits

- User controls power vs. SNR tradeoff
- Eliminates DC-Blocking Caps (3206 only)
- Allow single-supply operation (1.9V – 3.6V)

- Flexible audio clock generation (512KHz to 50MHz input clock)

Applications

Cell Phones
Portable navigation Devices (PND)
Headsets

uP
Apps Processor

I2S
I2C

AIC320x

Speaker Amplifier
TPAx

Earbud/Microphone Combo

TLV320AIC320x Block Diagram
1.8V Low Power Stereo Codecs

3204/03 Only

3206 Only

PowerTune™

100dB SNR

Bypass mode

93dB SNR

DirectPath (capless) stereo headphones

18 processing blocks for audio effects

25 processing blocks for audio effects

6 SE/3 Diff audio inputs with mixing and level control
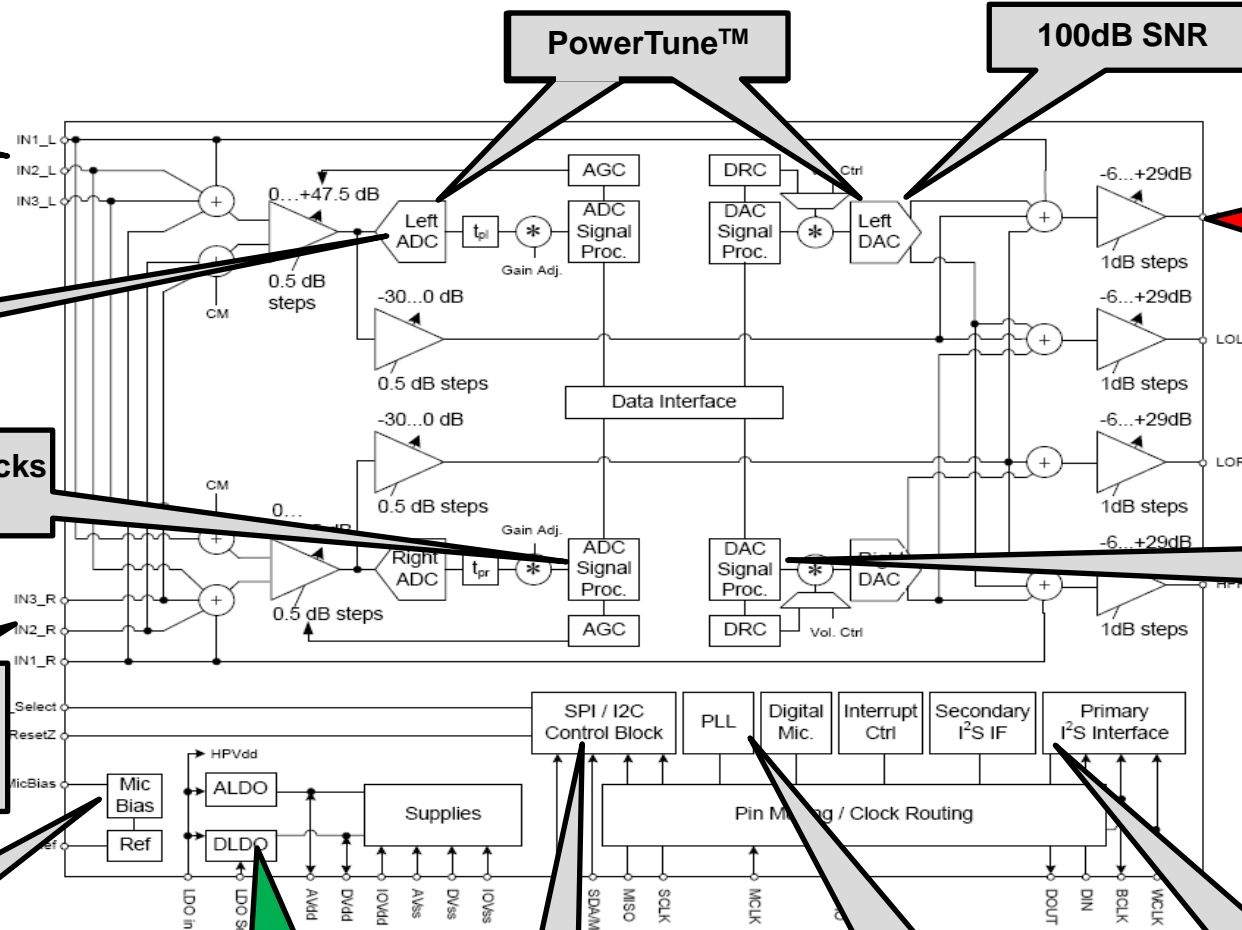
Microphone input w/ bias, preamp, AGC

Integrated LDO – Single-supply operation

I2C or SPI Control I/F

Integrated PLL 512KHz to 50MHz

I2S, L, R, DSP and TDM I/F

TEXAS INSTRUMENTS

TLV320AIC325x Series

	LDO	THD (ADC/DAC)	SNR (ADC/DAC)	Inputs / Outputs	DirectPath	Package	Pin Compatibility
AIC3256		-84 / -81	93 / 100	6 / 4	Ground Centered Output	BGA : 3.5x3.25 QFN : 5x5mm	AIC3206 w/o DSP
AIC3254	1.8V to 3.6V	-85 / -83		6 / 4		QFN : 5x5mm	AIC3204 w/o DSP
AIC3253	1.8V to 3.6V	No ADC / -80	- / 100	4 (PDM) / 2		CSP : 2.7x2.7mm QFN : 4x4mm	

TLV320AIC325x
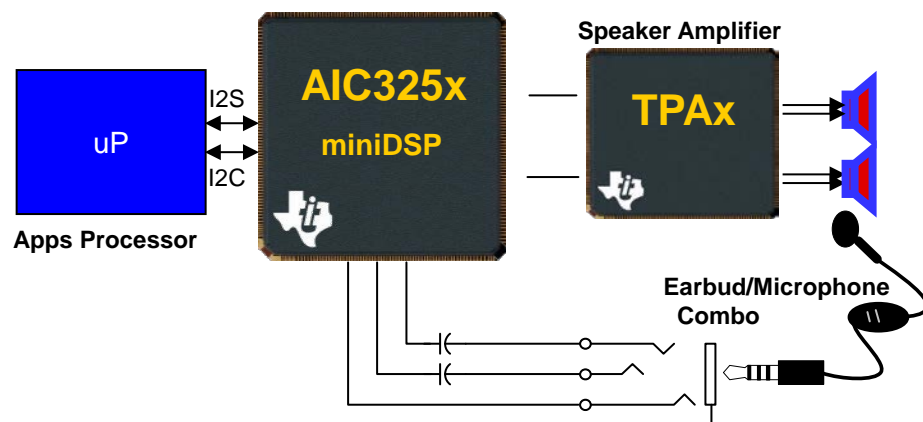## Low Power Stereo Codecs w/ MiniDSP

Features

- Stereo 8-192ksps audio DAC up to 100dB SNR
- Stereo 8-192ksps audio ADC up to 93dB SNR
  - ADC not included in AIC3253
- PowerTune™ adjustable Power vs. SNR
- DirectPath ™ Headphone AMP (3206 only)
- Integrated LDOs (3204 only)
- Integrated PLL
- Integrated DSPs

Benefits

- User controls power vs. SNR tradeoff
- Eliminates DC-Blocking Caps
- Allow single-supply operation (1.9V – 3.6V)

- Flexible audio clock generation (512KHz to 50MHz input clock)
- Offload host processor

Applications

Cell Phones
Portable navigation Devices (PND)
Headsets

TEXAS INSTRUMENTS

TLV320AIC325x Series
Low Power Stereo Codecs w/ MiniDSP

3256 Only

3254/53 Only

PowerTune™

100dB SNR

Bypass mode

93dB SNR (No ADCs on 3253)

DirectPath (capless) stereo headphones

MiniDSPs

6 SE/3 Diff audio inputs with mixing and level control

Microphone input w/ bias, preamp, AGC

Integrated LDO – Single-supply operation

I2C or SPI Control I/F

Integrated PLL 512KHz to 50MHz

I2S, L, R, DSP and TDM I/F

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TEXAS INSTRUMENTS

TLV320AIC325x Series
Low Power Stereo Codecs w/ MiniDSP

3256 Only

3254/53 Only

PowerTune™

100dB SNR

Bypass mode

93dB SNR (No ADCs on 3253)

MiniDSPs

DirectPath (capless) stereo headphones

6 SE/3 Diff audio inputs with mixing and level control

Microphone input w/ bias, preamp, AGC

Integrated LDO – Single-supply operation

I2C or SPI Control I/F

Integrated PLL 512KHz to 50MHz

I2S, L, R, DSP and TDM I/F

11
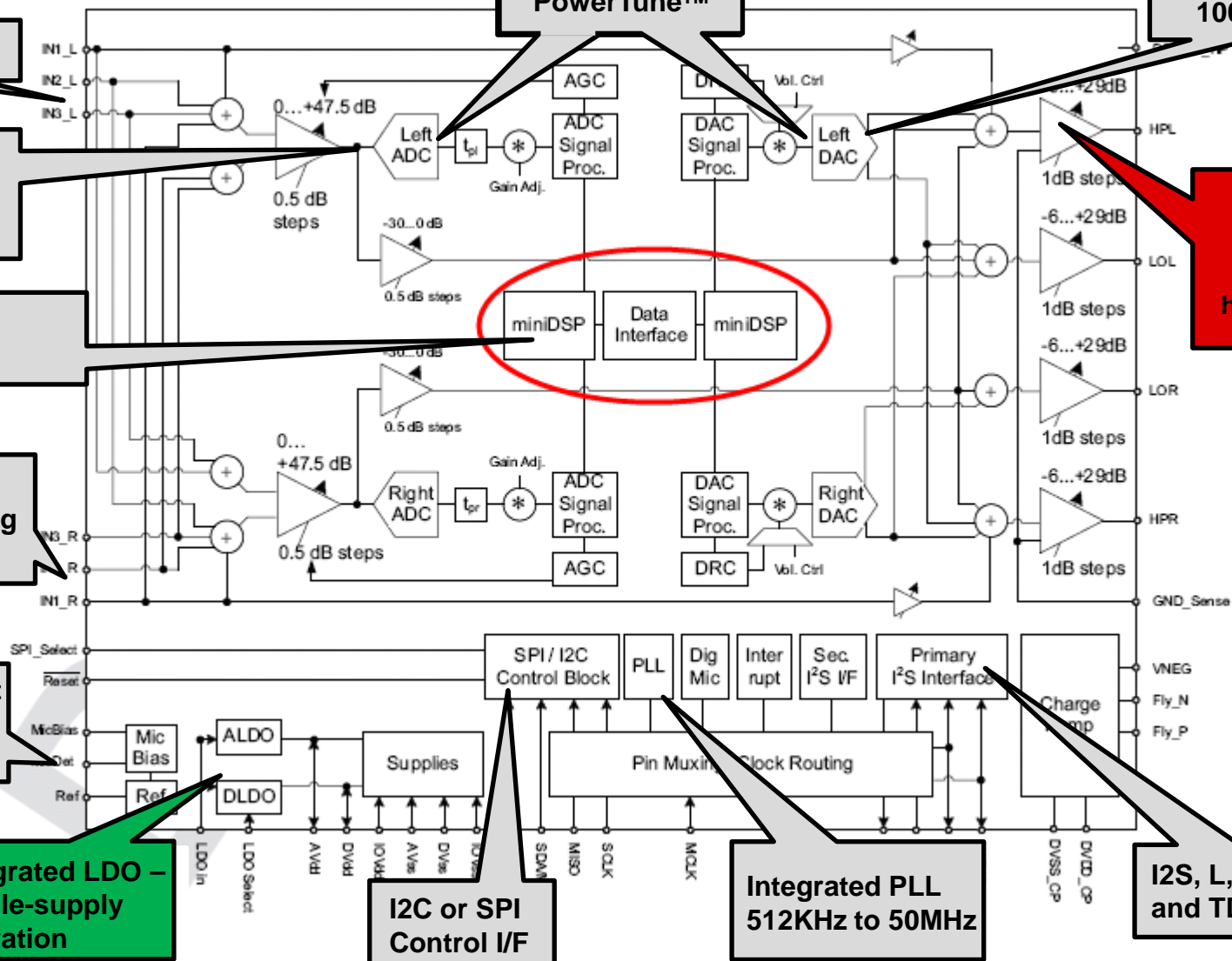
TEXAS INSTRUMENTS

TLV320AIC310x Series

	Amplifier	THD (ADC/DAC)	SNR (ADC/DAC)	Inputs / Outputs	Control I/F	Package
AIC3107	Class-D	-88 / -84	92 / 97	7 / 6	I2C	CSP : 3.5x3mm QFN : 5x5mm
AIC3106	Class-AB	-88 / -94	92 / 102	10 / 7	I2C , SPI	BGA : 5x5mm QFN : 7x7mm
AIC3105	Class-AB	-89 / -95	92 / 102	6 / 6	I2C	QFN : 5x5mm
AIC3104	Class-AB	-89 / -84	92 / 102	6 / 6	I2C	QFN : 5x5mm
AIC3101	Class-AB	-89 / -95	92 / 102	6 / 6	I2C	QFN : 5x5mm

Pin Compatible

TLV320AIC310x
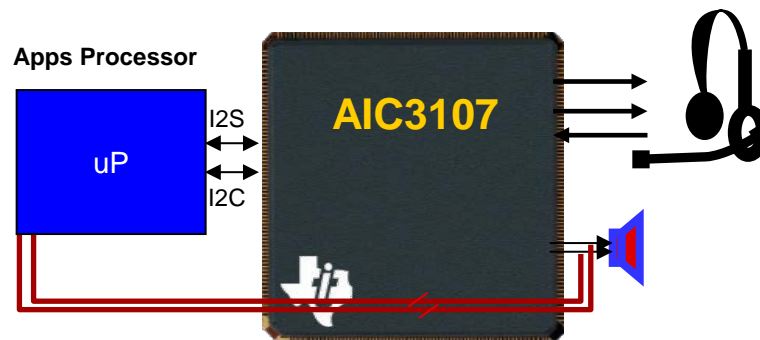**Low Power Stereo Codecs**

Features

- Stereo 8-96ksps audio DAC up to 102dB SNR
- Stereo 8-96ksps audio ADC up to 92dB SNR
- Integrated Amplifier
  - AIC3107 (Class D)
  - AIC3101-6(Class AB)
- Built-in Headphone Detect (3106/3107)
- Integrated PLL
- Programmable Input/Output Gains

Benefits

- No external Amp required - Single chip solution

- Flexible audio clock   generation (512KHz to 50MHz input clock)
- Longer AGC time constraints

Applications

Cell Phones
Portable navigation Devices (PND)
Headsets
Voice/audio processors
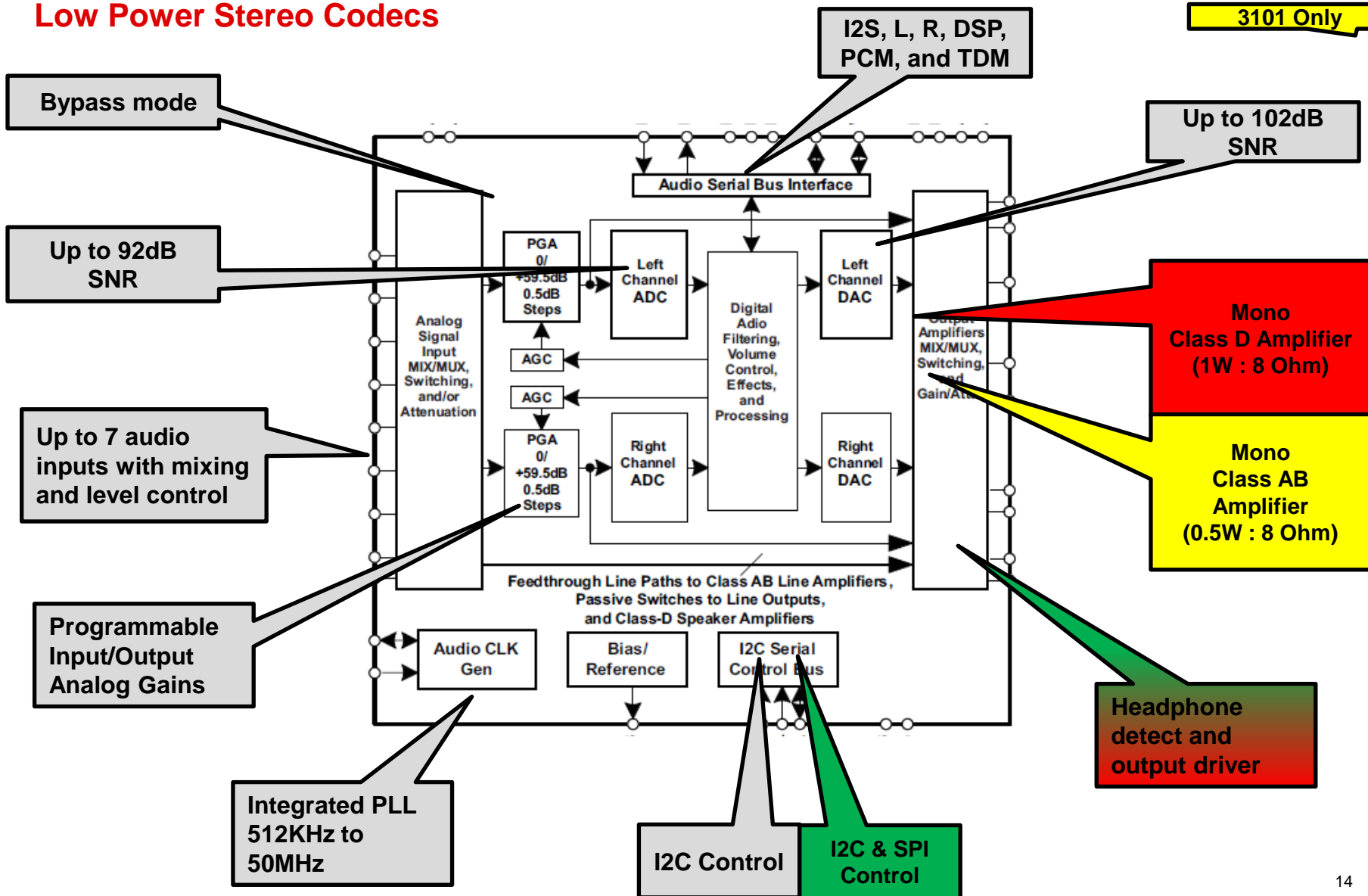Conference / IP Phones
General Portable Audio Equipment

Apps Processor

uP

I2S

I2C

AIC3107

TLV320AIC310x Series
Low Power Stereo Codecs

3106 Only
3107 Only
3101 Only

I2S, L, R, DSP, PCM, and TDM

Bypass mode

Up to 102dB SNR

Up to 92dB SNR

Up to 7 audio inputs with mixing and level control

Programmable Input/Output Analog Gains

Integrated PLL 512KHz to 50MHz

Audio Serial Bus Interface

Analog Signal Input MIX/MUX, Switching, and/or Attenuation

PGA 0/ +59.5dB 0.5dB Steps

Left Channel ADC

AGC

AGC

PGA 0/ +59.5dB 0.5dB Steps

Right Channel ADC

Digital Adio Filtering, Volume Control, Effects, and Processing

Left Channel DAC

Right Channel DAC

Output Amplifiers MIX/MUX, Switching, and Gain/Att

Feedthrough Line Paths to Class AB Line Amplifiers, Passive Switches to Line Outputs, and Class-D Speaker Amplifiers

Audio CLK Gen

Bias/ Reference

I2C Serial Control Bus

Mono Class D Amplifier (1W : 8 Ohm)

Mono Class AB Amplifier (0.5W : 8 Ohm)

Headphone detect and output driver

I2C Control

I2C & SPI Control

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TLV320AIC326x Series

Low Power Stereo Codecs w/ Amplifier and miniDSP

	Amplifier	THD (ADC/DAC)	SNR (ADC/DAC)	Inputs / Outputs	DirectPath	Package
AIC3268	Class-D	-88/ -91	95 / 105	8 / 7	Ground Centered Output	QFN : 9x9mm
AIC3263		-88 / -92	93 / 101	8 / 7		BGA : 5x5mm
AIC3262		-87 / -88				BGA : 5x5mm

TEXAS INSTRUMENTS

TLV320AIC326x
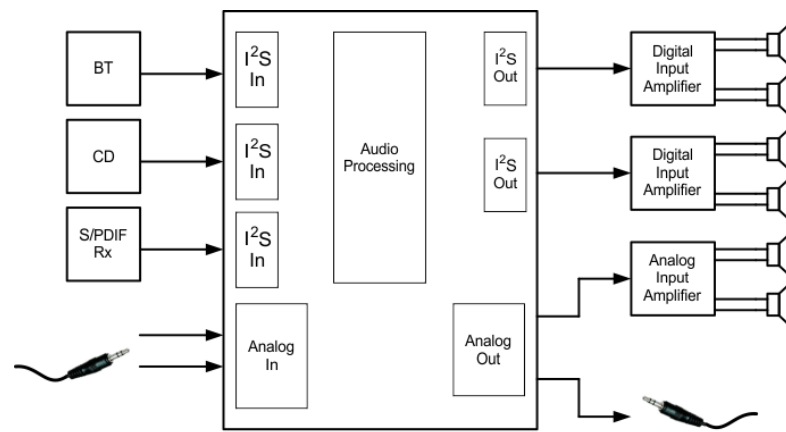## Low Power Stereo Codecs w/ Amplifier/On-chip Processing

Features

- Stereo 8-192ksps audio DAC up to 105dB SNR
- Stereo 8-192ksps audio ADC up to 95dB SNR
- Integrated Stereo Class-D Amplifier
- PowerTune™ adjustable Power vs. SNR
- DirectPath ™ Headphone Driver
- Fully Programmable Integrated DSPs
- 12-bit Secondary ADC w/ Temp Sensor
- Integrated PLL

Benefits

- No external Amp required - Single chip solution
- User controls power vs. SNR tradeoff
- Eliminates DC-Blocking Caps
- Extensive Signal Processing Options
- Voltage measurements for suspend settings
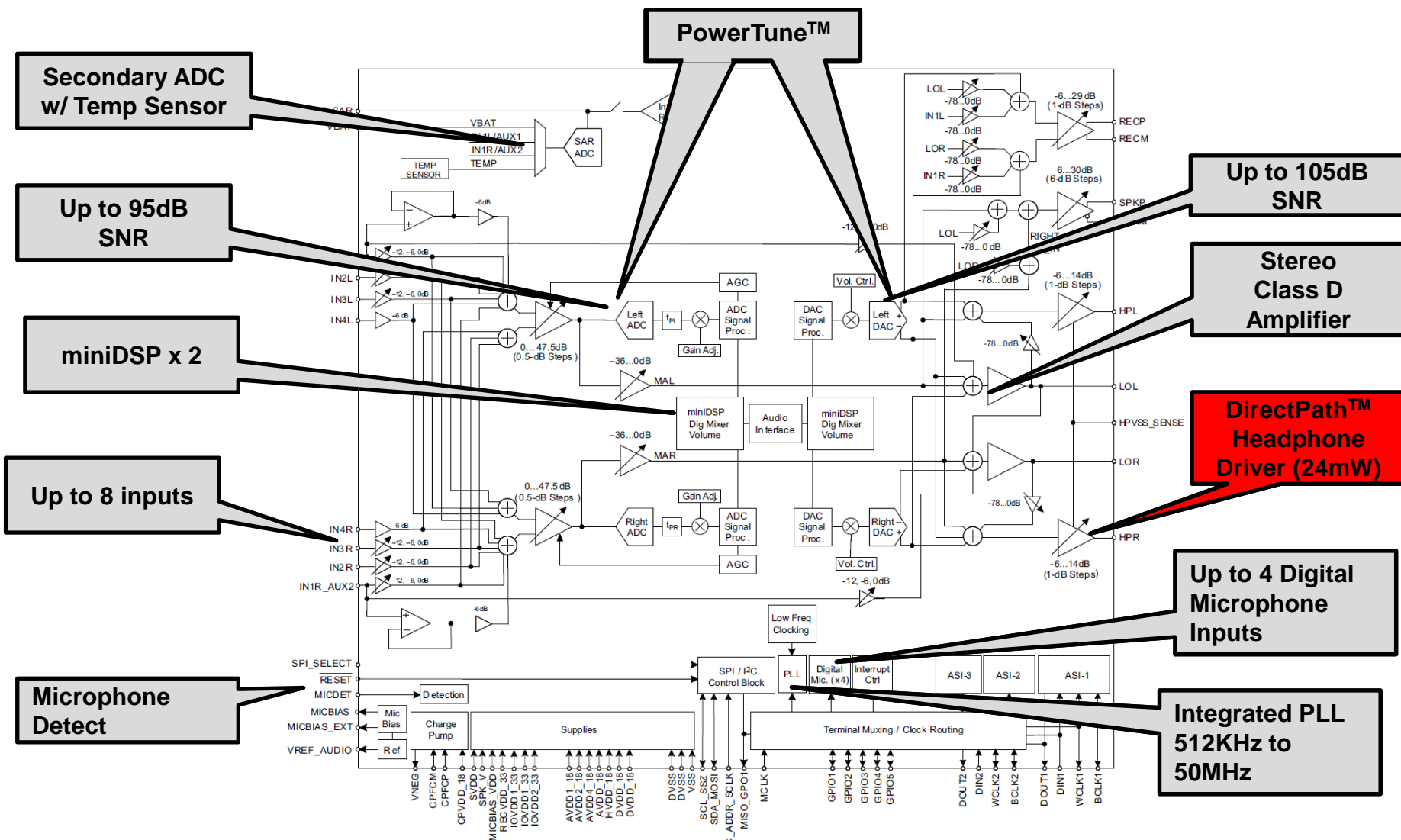- Flexible audio clock generation (512KHz to 50MHz input clock)

Applications

Cell Phones
Portable navigation Devices (PND)
Headsets
Voice/audio processors
Conference / IP Phones
General Portable Audio Equipment

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TLV320AIC326x Series
Low Power Stereo Codecs w/ Amplifier/miniDSP

3268Only

Secondary ADC w/ Temp Sensor

Up to 95dB SNR

miniDSP x 2

Up to 8 inputs

Microphone Detect

PowerTune™

Up to 105dB SNR

Stereo Class D Amplifier

DirectPath™ Headphone Driver (24mW)

Up to 4 Digital Microphone Inputs

Integrated PLL 512KHz to 50MHz

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TLV320AIC3212
Low Power Stereo Codec w/ Amplifier / HP Driver
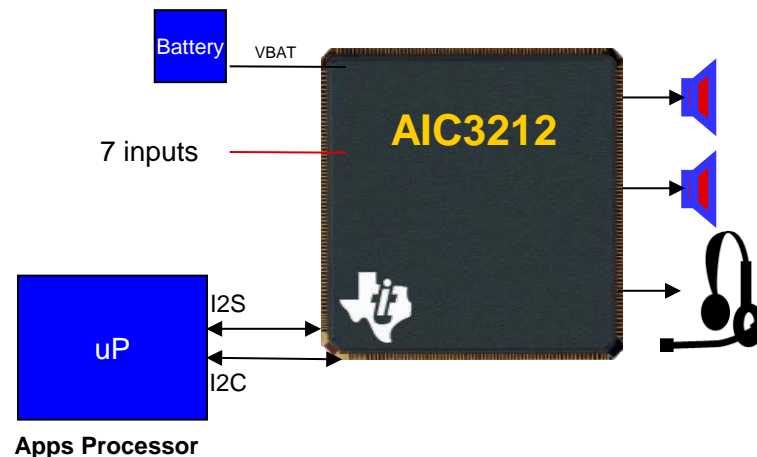
Features

- Stereo 8-192ksps audio DAC up to 101dB SNR
- Stereo 8-192ksps audio ADC up to 93dB SNR
- Integrated Stereo Class-D Amplifier
- PowerTune™ adjustable Power vs. SNR
- DirectPath ™ Headphone Driver
- Selectable audio-processing blocks
- 12-bit Secondary ADC w/ Temp Sensor
- Integrated PLL
- Small 4.81x4.81, 81-ball WCSP (YZF)

Benefits

- No external Amp required - Single chip solution
- User controls power vs. SNR tradeoff
- Eliminates DC-Blocking Caps
- Noise removal of mechanical coupling
- Voltage measurements for suspend settings
- Flexible audio clock   generation (512KHz to 50MHz input clock)
- Perfect for low power and small form factor designs

Applications

Cell Phones
Portable Computing
Tablets / E-Books
Headsets
Portable navigation Devices (PND)

Battery

VBAT

AIC3212

7 inputs

uP

I2S

I2C

Apps Processor

TLV320AIC3212 Block Diagram

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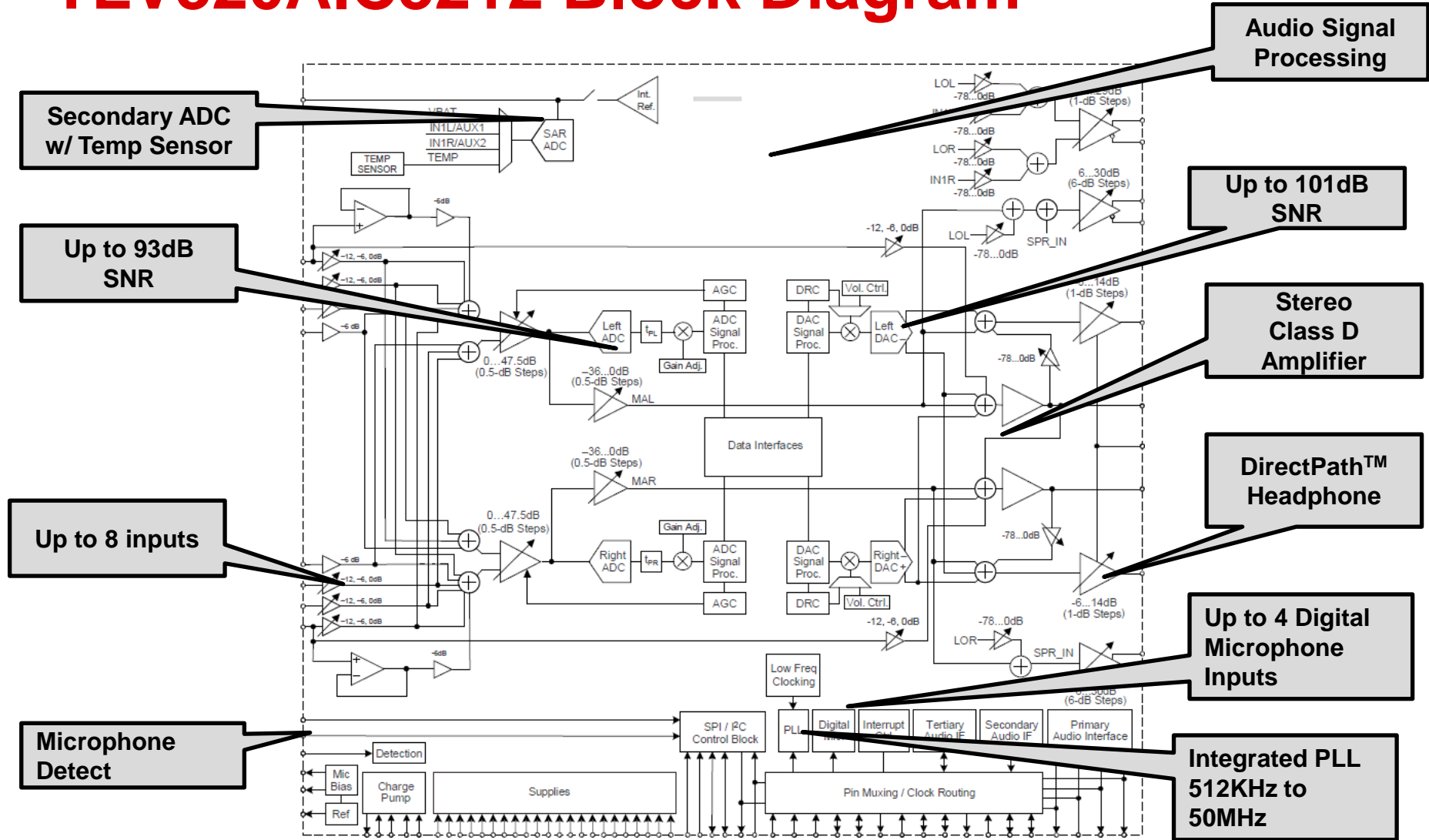
TLV320AIC3111
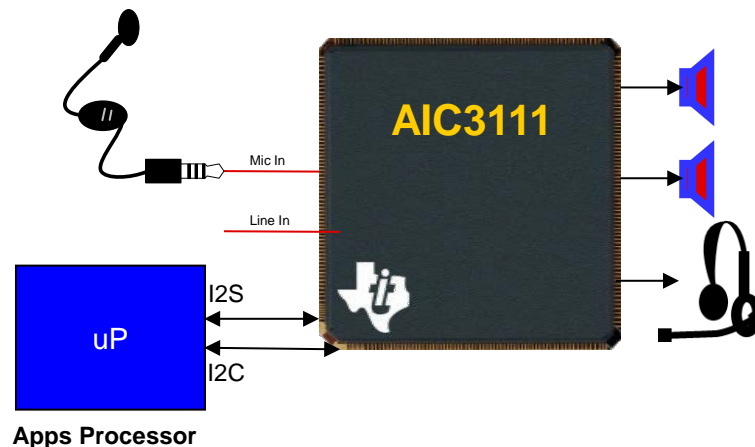## Low Power / High Performance Audio Codec w/ MiniDSP and Class-D Amplifier

Features

- Stereo 8-192ksps audio DAC up to 95dB SNR
- Mono 8-192ksps audio ADC up to 93dB SNR
- Integrated Stereo Class-D Amplifier
- MiniDSP
- Selectable audio-processing blocks
- Integrated PLL
- Small 5x5mm, 32-pin QFN (RHB)

Benefits

- No external Amp required - Single chip solution
- Advanced Audio Algorithms including SRS WOW
- Bass Boost/Treble/EQ
- Voltage measurements for suspend settings
- Flexible audio clock   generation (512KHz to 50MHz input clock)
- Perfect for low power and small form factor designs

Applications

Cell Phones
Portable Computing
Tablets / E-Books
Headsets
Portable navigation Devices (PND)

AIC3111

Mic In

Line In

I2S

I2C

uP

Apps Processor

PCM3070
High Performance Audio Codec w/ Programmable On-Chip Processing

Features

- Stereo 8-192ksps audio DAC up to 100dB SNR
- Stereo 8-192ksps audio ADC up to 93dB SNR
- Programmable On-Chip Processing
- Selectable audio-processing blocks
- Integrated PLL

- Up to six analog inputs, SE or Differenetial
- Core of TI's Value SoundBar reference design kit

Benefits

- Advanced Audio Algorithms including SRS WOW Bass Boost/Treble/EQ
- Voltage measurements for suspend settings
- Flexible audio clock   generation (512KHz to 50MHz input clock)
- Flexible inputs for analog, SPDIF, or USB
- Ready for production, 30% lower cost when compared to discrete solutions
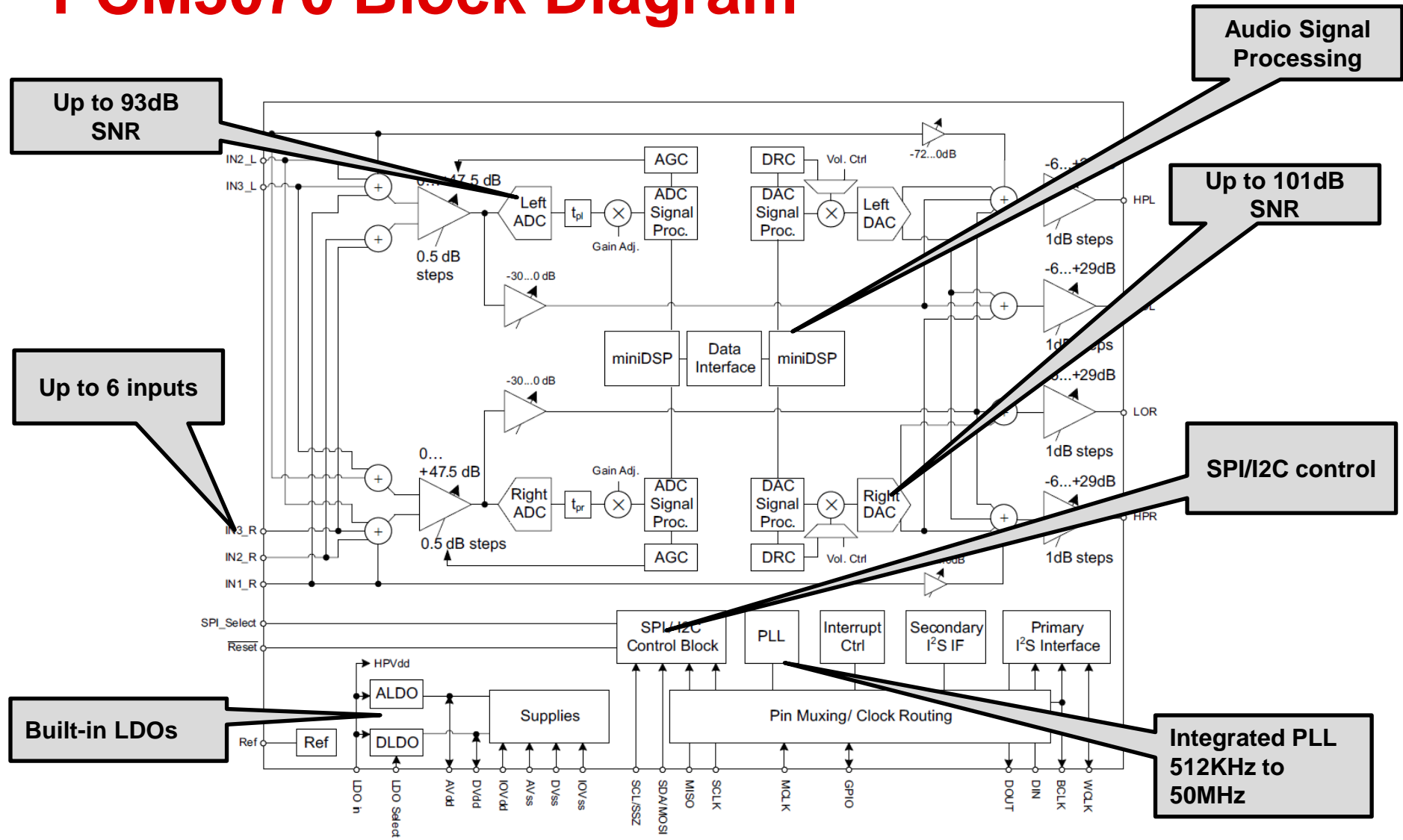
Applications

Soundbars
Docking Stations
TVs
2.0/2.1 Home Audio Systems

Analog Version
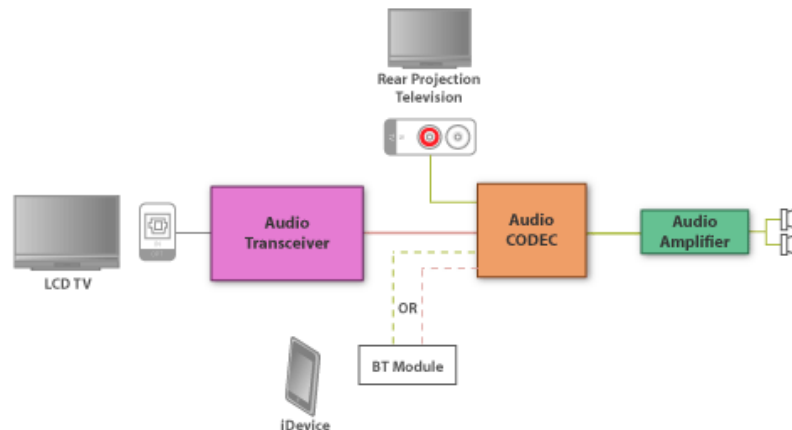
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PCM3070 Block Diagram

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R-E-D TODAY!

Research

www.ti.com/audio - **Learn about all our audio products**

Parametric Search – **Intuitive comparison tool**

Audio Selection Tool – **Let us help narrow your options**

Technical Documents – **Datasheets, package info, etc**

Evaluate

EVM & Development Kits – **Low cost, easy to use**

PurePath Software – **No Hassle, free software**

Training videos – **24/7, anytime, anywhere**

End Equipment Block Diagrams – **TI Companion devices**

Design

Audio Reference Designs –**schematics, gerbers, etc.**

Free Samples – **Try before you buy (qty limits)**

Models & Tools – **IBIS, symbols, calculators and more**

E2E Forum – **Get support from TI experts & community**

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