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8-CHANNEL HIGH DEFINITION AUDIO CODEC 92HD202

DESCRIPTION

The 92HD202 is a high fidelity, 8-channel audio CODEC compatible with Intel's High Definition (HD) Audio Interface. The 92HD202 CODEC provides stereo 24-bit resolution with sample rates up to 192 KHz. SPDIF I/O provides connectivity to consumer electronic equipment. The 92HD202 CODEC incorporates IDT's proprietary ΣΔ technology to achieve an estimated DAC SNR in excess of 95dB. The 92HD202 CODEC provides high quality HD Audio capability to notebook and media centric desktop PC applications.

FEATURES

- **High performance HD Audio CODEC provides Theater Quality Audio**
- **Targeted for designs meeting Premium Windows Logo Program**
- **High performance ΣΔ technology**
  - 95dB DAC SNR
- **Intel HD Audio interface**
- **Eight Channel (4 DAC pairs and 2 stereo ADCs) with 24-bit resolution**
- **Sample Rates Up to 192 KHz**
- **Integrated Headphone Amps**
- **Stereo Microphone**
  - Supports Stereo Microphone
  - Microphone Boost 0, 10, 20, 30, 40dB
- **Direct CDROM Recording Mixerless Design**
- **SPDIF In and Out**
- **Two-Pin Volume Up/Down Control**
- **Impedance Sensing**
- **Universal Jacks™ Functionality for Jack Retasking**
  - Headphone, Line Out, Line In and Microphone Support
    - Pins 35/36
    - Pins 39/41
  - Line Out, Line In and Microphone Support
    - Pins 16/17 (with strong line out)
    - Pins 23/24
    - Pins 21/22
  - Line In and Microphone Support
    - Pins 14/15
- **Four Adjustable VREF Out pins for Microphone Bias**
- **Digital PC Beep to all outputs**
- **+5 V Analog Power Supply**
- **48-pin LQFP package (7mm x 7mm)**

THIRD PARTY SOFTWARE SUPPORT

- **WOW™ and Tru Surround™ from SRS**
- **Intellisonic Microphone Beam Forming from Knowles™**
- **Maxx BASS™ from Waves**
- **Dolby PC Audio Logo Program**
  - Program Levels
    - Dolby Sound Room™
    - Dolby Home Theater™
  - Dolby Technologies
    - Dolby Headphone™
    - Dolby ProLogic II™
    - Dolby Virtual Speaker™
- **Smart Stream™ from Sonic Focus**

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1. DESCRIPTION

1.1. Overview

The 92HD202 is a high fidelity, 8-channel audio CODEC compatible with Intel's High Definition (HD) Audio Interface. The 92HD202 CODEC provides stereo, 24-bit resolution, with sample rates up to 192 KHz. SPDIF I/O provides connectivity to consumer electronic equipment. The 92HD202 CODEC incorporates IDT's proprietary ΣΔ technology to achieve an estimated DAC SNR in excess of 95dB. The 92HD202 CODEC provides high quality HD Audio capability to notebook and media centric desktop PC applications.

1.2. Features List

- High performance HD Audio CODEC provides Theater Quality Audio
- Targeted for designs meeting Premium Windows Logo Program
- High performance ΣΔ technology
  - 95dB DAC SNR
- Intel HD Audio interface
- Eight Channel (4 DAC pairs and 2 stereo ADCs) with 24-bit resolution
- Sample Rates Up to 192 KHz
- Integrated Headphone Amps
- Stereo Microphone
  - Supports Stereo Microphone
  - Microphone Boost 0, 10, 20, 30, 40dB
- Direct CDROM Recording Mixerless Design
- SPDIF In and Out
- Two-Pin Volume Up/Down Control
- Impedance Sensing
- Universal Jacks™ Functionality for jack retasking
  - Headphone, Line Out, Line In and Microphone Support
    - Pins 35/36
    - Pins 39/41
  - Line Out, Line In and Microphone Support
    - Pins 16/17 (with strong line out)
    - Pins 23/24
    - Pins 21/22
  - Line In and Microphone Support
    - Pins 14/15
- Four Adjustable VREF Out pins for Microphone Bias
- Digital PC Beep to all outputs
- +5 V Analog Power Supply
- 48-pin LQFP package option (7mm x 7mm)

1.3. Third Party Software Support

- WOW™ and Tru Surround™ from SRS
- Intellisonic Microphone Beam Forming from Knowles™
- Maxx BASS™ from Waves
- Dolby PC Audio Logo Program*
  - Program Levels
    - Dolby Sound Room™
    - Dolby Home Theater™
  - Dolby Technologies
    - Dolby Headphone™
    - Dolby ProLogic II™
    - Dolby Virtual Speaker™
- Smart Stream™ from Sonic Focus

*Note: * System manufacturers must obtain system license from Dolby.*

1.4. Detailed Description

The 92HD202 is a high fidelity, 8-channel audio CODEC compatible with the Intel High Definition (HD) Audio Interface. The 92HD202 provides high quality, HD Audio capability to notebook and cost sensitive desktop PC applications.

The 92HD202 incorporates IDT's proprietary ΣΔ technology to achieve a DAC SNR of up to 95 dB. The higher performance and quality of IDT's audio solutions brings consumer electronics level performance to the notebook, desktop and media center PC.

The 92HD202 provide stereo 24-bit, full duplex resolution supporting sample rates up to 192 KHz by the DAC and ADC. The 92HD202 DAC, ADC and SPDIF In/Out support sample rates of 96 KHz, 48 KHz and 44.1 KHz. Additional sample rates are supported by the driver software.

The 92HD202 supports all desired eight channel configurations, including switchable Headphone Out, and Universal Jacks functionality for jack detection and re-tasking. The SPDIF interface provides connectivity to Consumer Electronic equipment, such as Dolby Digital decoders, powered speakers, mini disk drives or to a home entertainment system. All analog I/O pairs support LINE_IN, LINE_OUT and MIC.

Microphone inputs can be programmed with 0/10/20/30/40dB boost. For more advanced configurations, the 92HD202 has up to four General Purpose I/O (GPIO) pins. The 92HD202 also provides a single ended CD input for compatibility with Digital Rights Management (DRM) solutions and to support legacy OS issues.

The 92HD202 integrates a headphone amplifier which is available on Ports A and D. The headphone amplifier is switchable between these two outputs for increased flexibility, enhanced user experience, and reduced implementation costs. An additional, lower power, headphone supports Port F.

The Universal Jack capabilities allow the CODEC to detect when audio devices are connected, and allow the CODEC to be reconfigured to support these devices regardless of which port they are

plugged into. SPDIF input sensing is also supported. The fully parametric IDT SoftEQ can be initiated upon headphone jack insertion and removal for protection of notebook speakers.

Note: The Jack Detect circuit component selection are critical for accurate detection of audio jacks on individual ports. Please see the 92HD202 reference design for circuit implementation details.

The 92HD202 operates with a 3.3 V digital supply 5 V analog supply.

The 92HD202 is available in a 48-pin LQFP package. The 48-pin LQFP is only available in the Environmental package (Pb-free).

The 92HD202 is supported with IDT's high quality software solutions which include drivers for all major Windows operating systems from Microsoft, parametric SoftEQ, and Digital Rights Management. Third party plug-in capability is easily achieved with the IDT Kernel Processing Interface (SKPI), to support high-valued, third party technologies such as SRS WOW®, Knowles® Microphone Beam Forming, Waves MaxxBASS®, Dolby Headphone®, Dolby ProLogic II® and Dolby Virtual Speaker® and more.

Non-IDT companies mentioned are registered trademarks of their respective companies.

2. CHARACTERISTICS

2.1. Audio Fidelity

DAC SNR:	95dB	A-Weighted	5.0 V +/- 5%
ADC SNR:	90dB	A-Weighted	5.0 V +/- 5%

2.2. Electrical Specifications

2.2.1. Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the 92HD202. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

Item	Pin	Maximum Rating
Analog maximum supply voltage	AVdd	6 Volts
Digital maximum supply voltage	DVdd	5.5 Volts
VREFOUT output current		5 mA
Voltage on any pin relative to ground		Vss - 0.3 V to Vdd + 0.3 V
Operating temperature		0 ^{O}C to +70 ^{O}C
Storage temperature		-55 ^{O}C to +125 ^{O}C
Soldering temperature		260 ^{O}C for 10 seconds. Soldering temperature information for all available packages begins on page 165.

2.2.2. Recommended Operation Conditions

Parameter		Min.	Typ.	Max.	Units
Power Supply Voltage	Digital - 3.3 V	3.135	3.3	3.465	V
	Analog - 5 V	4.75	5	5.25	V
Ambient Operating Temperature		0		+70	°C
Case Temperature	T_{case} (48-LQFP)			+90	°C

ESD: The 92HD202 is an ESD (electrostatic discharge) sensitive device. The human body and test equipment can accumulate and discharge electrostatic charges up to 4000 Volts without detection. Even though the 92HD202 implements internal ESD protection circuitry, proper ESD precautions should be followed to avoid damaging the functionality or performance.

2.3. 92HD202/92HD202D 5 V Analog Performance Characteristics

($T_{ambient}$ = 25 ºC, AVdd = 5.0 V ± 5%, DVdd = 3.3 V ± 5%, AVss = DVss = 0 V; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0dB = 1 VRMS, 10 KΩ / 50 pF load, Testbench Characterization BW: 20 Hz – 20 KHz, 0dB settings on all gain stages)

Min and Max performance targets are not included here, as specific system characteristics, such as layout, routing and external CODEC component selection, influence the performance of the CODEC. To receive min/max levels for your system, please send us a unit and IDT will perform a full audio test suite and provide you with the results. Contact IDT for more information.

Parameter	Min.	Typ.	Max.	Unit
Full Scale Input Voltage:				
All Analog Inputs with out boost	-	1.00	-	Vrms
All Analog Inputs with boost (Note 1)	-	0.03	-	Vrms
Full Scale Output:				
PCM (DAC) to All Analog Outputs	-	1.00	-	Vrms
HEADPHONE_OUT (32 Ω load) per channel (peak)	-	50	-	mW
Dynamic Range: -60dB Signal Level: (Note 2)				
PCM to All Analog Outputs	-	95	-	dB
All Analog Inputs to A/D (1 Vrms Input Referenced)	-	90	-	dB
Analog Frequency Response (Note 3)	10		30,000	Hz
Total Harmonic Distortion + Noise (-3dB): (Note 4)				
PCM to All Analog Outputs	-	-88	-	dB
All Analog Inputs to A/D (-3dBV input Level)	-	-88	-	dB
HEADPHONE_OUT (32 Ω load)	-	-85	-	dB
HEADPHONE_OUT (10 KΩ load)	-	-90	-	dB
SNR (idle channel): (Note 5)				
DAC to All Analog Outputs	-	95	-	dB
All Analog Inputs to A/D with High Pass Filter enabled	-	90	-	dB
A/D & D/A Digital Filter Pass Band (Note 6)	20	-	19,200	Hz
A/D & D/A Digital Filter Transition Band	19,200	-	28,800	Hz
A/D & D/A Digital Filter Stop Band	28,800	-	-	Hz
A/D & D/A Digital Filter Stop Band Rejcn (Note 7)	-100	-	-	dB
DAC Out-of-Band Rejection (Note 8)	-55	-	-	dB
Group Delay (48 KHz sample rate)	-	-	1	ms
Power Supply Rejection Ratio (1 KHz)	-	-70	-	dB
Power Supply Rejection Ratio (20 KHz)	-	-40	-	dB
Any Analog Input to DAC (1 KHz Signal Frequency) Crosstalk		-101		dB

Parameter	Min.	Typ.	Max.	Unit
Any Analog Input to ADC (10 KHz Signal Frequency) Crosstalk	-	-85	-	dB
Any Analog Input to ADC (1 KHz Signal Frequency) Crosstalk	-	-80	-	dB
Spurious Tone Rejection	-	-100	-	dB
Attenuation, Gain Step Size ANALOG	-	1.5	-	dB
Attenuation, Gain Step Size DIGITAL	-	0.75	-	dB
Input Impedance	-	50	-	KΩ
Input Capacitance	-	15	-	pF
VREFout	-	0.5 X AVdd	-	V
VREF	-	0.45 X AVdd	0.5	V
Interchannel Gain Mismatch ADC	-	-	0.5	dB
Interchannel Gain Mismatch DAC	-	-	-	dB
Gain Drift	-	100	-	ppm/ºC
DAC Offset Voltage	-	5	20	mV
Deviation from Linear Phase	-	10	1	deg.
All Analog Outputs Load Resistance	-	10	-	KΩ
All Analog Outputs Load Capacitance	-	-	50	pF
HEADPHONE_OUT Load Resistance	-	32	-	W
HEADPHONE_OUT Load Capacitance	-	100	-	pF
Mute Attenuation	-	-	-	dB
PLL lock time	-	96	200	μsec
PLL (or HD Audio Bit CLK) 24.576 MHz clock jitter	-	100	300	psec

1. With +30 dB Boost on, 1.00 Vrms with Boost off.
2. Ratio of Full Scale signal to noise output with -60dB signal, measured “A weighted” over a 20 Hz to a 20 KHz bandwidth.
3. ± 1dB limits for Line Output & 0 dB gain, at -20dBV
4. Amplitude of THD+N, measured with A-weighting filter, over 20 Hz to 20 KHz bandwidth.
5. Ratio of Full Scale signal to idle channel noise output is measured “A weighted” over a 20 Hz to a 20 KHz bandwidth. (AES17-1991 Idle Channel Noise or EIAJ CP-307 Signal-to-noise Ratio).
6. Peak-to-Peak Ripple over Passband meets ± 0.25dB limits, 48 KHz Sample Frequency.
7. Stop Band rejection determines filter requirements. Out-of-Band rejection determines audible noise.
8. The integrated Out-of-Band noise generated by the DAC process, during normal PCM audio playback, over a bandwidth 28.8 to 100 KHz, with respect to a 1 Vrms DAC output.

2.4. Power Consumption

2.4.1. Digital: DVdd = 3.3 V

Table 1. Digital Power Consumption - DVdd = 3.3 V

Power State	Typical*	Max.	Units
D0	66	75	mA
D1	66	75	mA
D2	18	30	mA
D3	10	20	mA

2.4.2. Analog: AVdd = 5 V

Table 2. Analog Power Consumption - AVdd = 5 V

Power State	Typical*	Max.	Units
D0	55	65	mA
D1	55	65	mA
D2	25	35	mA
D3	15	20	mA

*Typical results are with all DACs and all ADCs on, and with audio playing.

3. DETAILED DESCRIPTION

3.1. Audio Jack Presence Detect

SENSE_A pin is used to detect the presence of plugs in ports A, B, C, and D. SENSE_B pin is used to detect the presence of plugs in ports E and F. Refer to the 92HD202 reference design for port detect circuitry.

3.2. Universal Jacks

There are 6 ports on the 92HD202:

- Port A: pins 39 & 41
- Port B: pins 21 & 22
- Port C: pins 23 & 24
- Port D: pins 35 & 36
- Port E: pins 14 & 15
- Port F: pins 16 & 17

IDT's Universal Jacks technology allows for the greatest flexibility in board design and implementation. For the 92HD202 the Universal Jacks capabilities are as follows:[1]

- Port A (pins 39 & 41) can be used for[2]:
  - Headphone Out
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]
- Port D (pins 35 & 36) can be used for[2]:
  - Headphone Out
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]
- Port C (pins 23 & 24) can be used for:
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]
- Port B (pins 21 & 22) can be used for:
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]
- Port F (pins 16 & 17) can be used for[2]:
  - Headphone Out
  - Line Out
  - Line In

  - Mic with 0/10/20/30/40 dB Mic boost[3]
- Port E (pins 14 & 15) can be used for:
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]

Note[1]: On the 92HD202, only one function can be selected on each pin pair at a time. For example, a pin pair cannot be configured as an input and output at the same time. Configuration can be changed at any time.

Note[2]: Headphone capabilities are provided on ports A, D and F. Do NOT put headphone loads on more than one port at a time. Port F (pins 16 & 17) can drive 32 ohm headphones, but is designed to provide less power than the headphone amplifiers on ports A (pins 39 & 41) and D (pins 35 & 36).

Note[3]: 40dB Microphone boost is not recommended.

3.3. SPDIF Input

SPDIF IN can operate at 44.1 KHz, 48 KHz or 96 KHz, and implements internal Jack Sensing.

A sophisticated digital PLL allows automatic rate detection and accurate data recovery. The ability to directly accept consumer SPDIF voltage levels eliminates the need for costly external receiver ICs. Advanced features such as record slot select and SPDIF_IN routing to the DAC allows for simultaneous record and play.

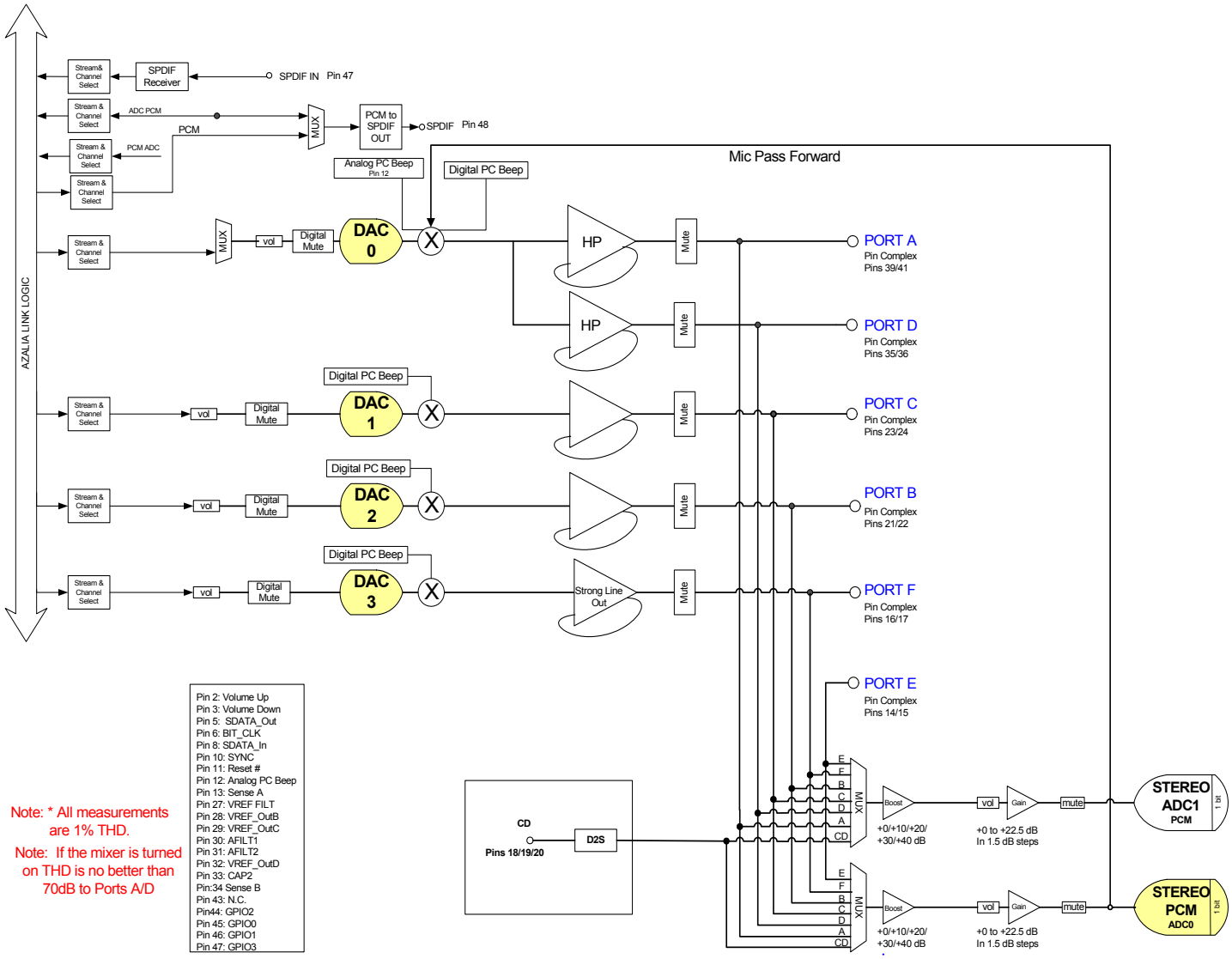
3.4. SPDIF Output

SPDIF Output can operate at 44.1 KHz, 48 KHz, and 96 KHz as defined in the Intel High Definition Audio Specification with resolutions up to 24 bits. This insures compatibility with all consumer audio gear and allows for convenient integration into home theater systems and media center PCs.

4. BLOCK AND FUNCTIONAL DIAGRAMS

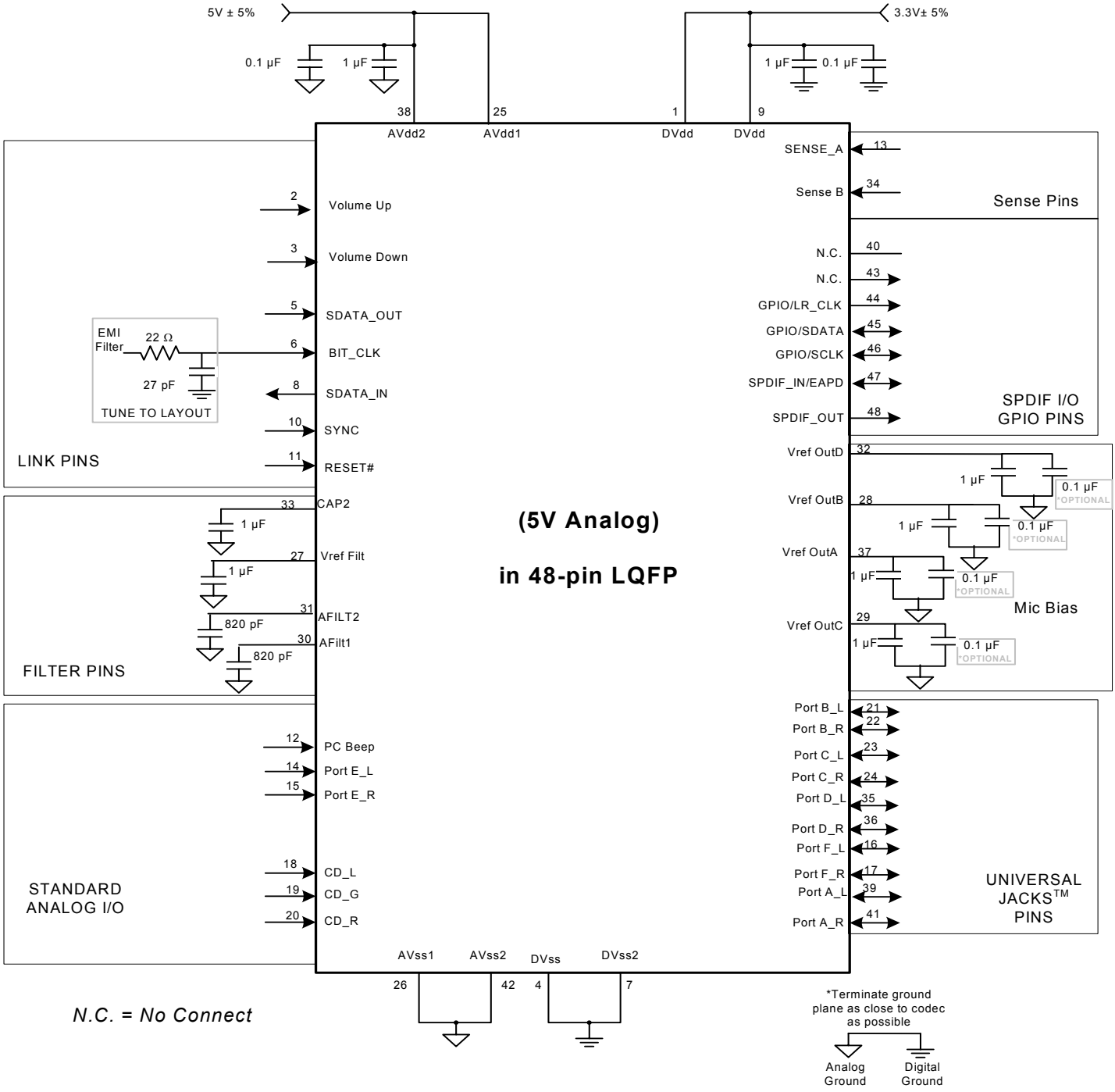
4.1. 92HD202 FUNCTIONAL BLOCK DIAGRAM

Figure 1. Functional Block Diagram - 92HD202



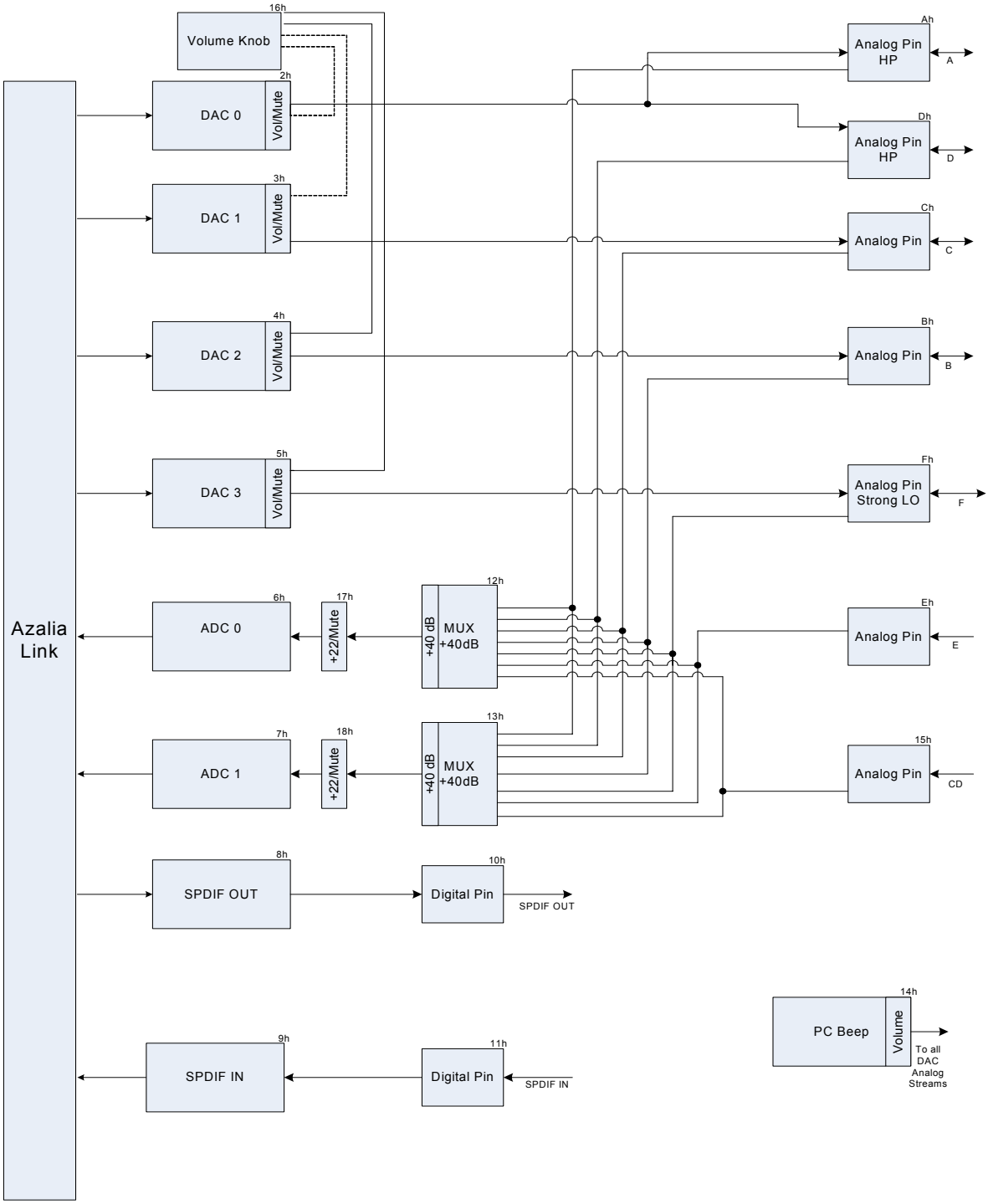
4.2. 92HD202 Typical Connection Diagram for 48-pin LQFP

Figure 2. Typical Connection Diagram for 48-pin LQFP 92HD202



5. 92HD202 WIDGET DIAGRAM

Figure 3. 92HD202 Widget Diagrams



6. 92HD202 WIDGET LIST

Table 3. High Definition Audio Widget

ID	Widget Name	Description
1h	Audio Function Group	Audio Function Group (AFG)
2h	DAC0	Stereo Output to DAC
3h	DAC1	Stereo Output to DAC
4h	DAC2	Stereo Output to DAC
5h	DAC3	Stereo Output to DAC
6h	ADC0	Stereo Input Mux from ADC
7h	ADC1	Stereo Input Mux from ADC
8h	SPDIF_OUT	Stereo Output for SPDIF_Out
9h	SPDIF_IN	Stereo Input for SPDIF_In
10h	SPDIF-Out Pin	Pin Widget for SPDIF_Out pin 48
11h	SPDIF-In Pin	Pin Widget for SPDIF_In pin 47
12h	ADC0Mux	ADC Mux and Boost for inputs to ADC
13h	ADC1Mux	ADC Mux and Boost for inputs to ADC
14h	Digital PC Beep	Digital PC Beep
15h	CD	CD Pin Widget pins 18/19/20
16h	Master Volume	Master Volume Controls
17h	ADC0Vol	ADC Mux and Volume for inputs to ADC
18h	ADC1Vol	ADC Mux and Volume for inputs to ADC
19h	Reserved	Reserved
Ah	Headphone	Headphone Pin Widget pins 39/41 (can also act as Line In, Line Out, or Mic)
Dh	Headphone	Headphone Pin Widget pins 35/36 (can also act as Line In, Line Out, or Mic)
Ch	Line In	Line In Pin Widget pins 23/24 (can also act as Mic or Line Out)
Bh	Mic	Mic Pin Widget pins 21/22 (can also act as Line Out and Line In)
Fh	Line Out	Line Out Pin Widget pins 16/17 (can also act as HP, Line In, or Mic)
Eh	Line In	Line In Pin Widget pins 14/15 (can also act as Mic)
1Ah	Reserved	Reserved
1Bh	Reserved	Reserved

7. WIDGET INFORMATION

7.1. Root Node (NID = 0x00)

7.1.1. Root ID

Table 4. Root ID Command Verb Format

	Verb ID	Payload	Response
Get	F00	00	See bitfield table

Table 5. Root ID Command Response Format

Bit	Bitfield Name	RW	Reset	Description
[31:16]	Vendor	R	0x8384	Vendor ID: 8384h
[15:8]	DeviceFix	R	0x76	Device ID: 92HD202 = 76h 92HD202-Dolby = 76h
[7:0]	DeviceProg	R	0x82	Device ID: 92HD202 = 82h 92HD202-Dolby = 83h

7.1.2. Root RevID

Table 6. Root RevID Command Verb Format

	Verb ID	Payload	Response
Get	F00	02	See bitfield table

Table 7. Root RevID Command Response Format

Bit	Bitfield Name	RW	Reset	Description
[31:24]	Rsvd	R	0x00	Reserved
[23:20]	Major	R	0x1	Major rev number of compliant HD Audio specification