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8-CHANNEL HIGH DEFINITION AUDIO CODEC 92HD206

Description

The 92HD206 is a Theater Quality 8-channel audio CODEC that enables systems with 7.1 audio or 5.1 audio playing simultaneously with VoIP or another stereo audio stream. IDT's proprietary SD technology provides high fidelity, with a DAC SNR of 95dB.

Features

- **High performance HD Audio CODEC provides Theater Quality Audio**
- **Targeted for designs meeting Premium Windows Logo Program**
- **High performance** SD **technology**
  - 95dB DAC SNR
  - 90dB ADC SNR
- **Four stereo DACs and two stereo ADCs**
  - Supports 7.1 Audio
  - Supports 5.1 Audio with simultaneous Real Time Communication (RTC) channel such as VoIP or separate stereo audio stream
- **24-bit resolution with up to 192 KHz sample rates**
- **Analog Stereo Microphone**
  - Microphone Boost 0, 10, 20, 30, 40dB
  - Six adjustable Vref outputs for microphone bias
- **Integrated Headphone Amps (3)**
- **S/PDIF In and Out**
- **Volume Up/Down Control**
- **Jack Insertion Detect and Impedance Sensing supports Jack Retasking and Universal Jacks™**
- **Digital PC Beep to all outputs**
- **+5 V Analog Power Supply**
- **Environmental 48-pin LQFP Package**

Software Support

- **SKPI (Kernel Processing Interface)**
  - Enables plug-ins that can operate globally on all audio streams of the system
- **12 band parametric equalizer SKPI plug-in**
  - Constant, system-level effects tuned to optimize a particular platform can be combined with user-mode “presets” tailored for specific acoustical environments and applications
  - System-level effects automatically disabled when external connections made
- **Dynamics Processing SKPI plug-in**
  - Enables improved voice articulation
  - Compressor/limiter allows higher average noise level without resonances
- **Dolby PC Entertainment Experience Logo Program**
  - Dolby Home Theater™
  - Dolby Sound Room™
- **Dolby Technologies**
  - Dolby Headphone™, Dolby Virtual Speaker™
  - Dolby ProLogic II™, Dolby ProLogic IIx™
  - Dolby Digital Live™
- **Intel Audio Studio™ from Sonic Focus**
- **Maxx Player™ from Waves**
- **Microphone Beam Forming, Acoustic Echo Cancellation, & Noise Suppression from Knowles™**

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1. DESCRIPTION

The 92HD206 is a high fidelity, 8-channel audio CODEC compatible with the Intel High Definition (HD) Audio Interface. The 92HD206 CODEC provides high quality HD Audio capability to notebook and cost sensitive desktop PC applications.

The 92HD206 incorporates IDT's proprietary technology to achieve a DAC SNR of 95dB. The higher performance and quality of IDT's audio solutions brings consumer electronics level performance to the notebook, desktop and media center PC.

The 92HD206 provides stereo, 24-bit, full duplex resolution, supporting sample rates up to 192 KHz by the DAC and ADC. The SPDIF In/Out supports sample rates of 96 KHz, 48 KHz and 44.1 KHz plus SPDIF OUT supports 88.2 KHz. Additional sample rates are supported by the driver software.

The 92HD206 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 like Dolby Digital decoders, powered speakers, mini disk drives or a home entertainment systems. All analog I/O pairs support LINE_IN, LINE_OUT and MIC.

MIC inputs can be programmed with 0/10/20/30/40dB boost. For more advanced configurations, the 92HD206 has up to three General Purpose I/O (GPIO) pins. The 92HD206 also provides a single ended CD input for compatibility with DRM solutions and to support leg¬acy OS issues.

The 92HD206 integrates a headphone amplifier on Ports A, B and D. The headphone amplifier is dedicated to these three outputs for increased flexibility, enhanced user experience, and reduced implementation costs.

The Universal Jack™ feature allows the CODEC to detect when audio devices are plugged in, and for 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/disabled upon headphone jack insertion/removal for protection of notebook speakers. Note: The Jack Detect circuit and component selection are critical for accurate detection of audio jacks on individual ports. Please see the IDT 92HD206 reference design for circuit implementation details.

The 92HD206 operates with a 3.3 V digital supply and a 5 V analog supply.

The 92HD206 is available in 48-pin LQFP Environmental (ROHS) packages.

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 92HD206. 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 173.

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 92HD206 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 92HD206 implements internal ESD protection circuitry, proper ESD precautions should be followed to avoid damaging the functionality or performance.

2.3. 92HD206 5 V Analog Performance Characteristics

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

Parameter	Conditions	AVdd	Min	Typ	Max	Unit
Digital to Analog Converters						
Resolution		5 V		24		Bits
SNR - DAC to All Line-Out Ports (Note 4)	Analog Mixer Disabled, PCM data	5 V		95		dB
THD+N - DAC to All Line-Out Ports (Note 3)	Analog Mixer Disabled, -3dB Signal, PCM data	5 V		90		dB
SNR - DAC to All Line-Out Ports (Note 4)	Analog Mixer Enabled, PCM data	5 V		90		dB
THD+N - DAC to All Line-Out Ports (Note 3)	Analog Mixer Enabled, -3dB Signal, PCM data	5 V		80		dB
Dynamic Range: DAC to All Line Out Ports (Note2)	-60dB Signal Level	5 V	-	93	-	dB
SNR - DAC to All Headphone Ports (Note 4)	Analog Mixer Disabled, 10 KΩ load, PCM data	5 V		95		dB
THD+N - DAC to All Headphone Ports (Note 3)	Analog Mixer Disabled, -3dB Signal, 10 KΩ load, PCM data	5 V		85		dB
SNR - DAC to All Headphone Ports (Note 4)	Analog Mixer Disabled, 32 Ω load, PCM data	5 V		95		dB
THD+N - DAC to All Headphone Ports (Note 3)	Analog Mixer Disabled, -3dB Signal, 32 Ω load, PCM data	5 V		85		dB
SNR - DAC to All Headphone Ports (Note 4)	Analog Mixer Enabled, 10 kΩ load, PCM data	5 V		90		dB
THD+N - DAC to All Headphone Ports (Note 3)	Analog Mixer Enabled, -3dB Signal, 10 kΩ load, PCM data	5 V		79		dB
SNR - DAC to All Headphone Ports (Note 4)	Analog Mixer Enabled, 32 Ω load, PCM data	5 V		87		dB
THD+N - DAC to All Headphone Ports (Note 3)	Analog Mixer Enabled, -3dB Signal,32 Ω load, PCM data	5 V		74		dB
Any Analog Input to DAC Crosstalk	10 KHz Signal Frequency	5 V	-	-85	-	dB
Any Analog Input to DAC Crosstalk	1 KHz Signal Frequency	5 V	-	-80	-	dB
Gain Error	Analog Mixer Disabled	5 V			0.5	dB
Interchannel Gain Mismatch	Analog Mixer Disabled	5 V			0.5	dB
D/A Digital Filter Pass Band (Note 5)		5 V	20	-	19,200	Hz
D/A Digital Filter Transition Band		5 V	19,200	-	28,800	Hz
D/A Digital Filter Stop Band		5 V	28,800	-	-	Hz
D/A Digital Filter Stop Band Rejcn (Note 6)		5 V	-100	-	-	dB
D/A Out-of-Band Rejection (Note 7)		5 V	-55	-	-	dB

Parameter	Conditions	AVdd	Min	Typ	Max	Unit
Group Delay (48 KHz sample rate)		5 V	-	-	1	ms
Attenuation, Gain Step Size DIGITAL		5 V	-	0.75	-	dB
Gain Drift		5 V	-	100	-	ppm/ºC
DAC Offset Voltage		5 V	-	100	20	mV
Deviation from Linear Phase		5 V	-	1	10	deg.
Analog Outputs						
Full Scale All Line-Outs	DAC PCM Data	5 V	1.00	-	-	Vrms
Full Scale All Line-Outs	DAC PCM Data	5 V	2.83	-	-	Vp-p
All Headphone Capable Outputs (peak)	32 Ω load	5 V	31	50	-	mW
Analog inputs						
Full Scale Input Voltage	0dB Boost @ 4.75 V	5 V	1.00	-	-	Vrms
All Analog Inputs with boost	10dB Boost	5 V	0.31	-	-	Vrms
All Analog Inputs with boost	20dB Boost	5 V	0.10	-	-	Vrms
All Analog Inputs with boost	30dB Boost	5 V	0.03	-	-	Vrms
All Analog Inputs with boost	40dB Boost	5 V	0.01	-	-	Vrms
Input Impedance		5 V	-	50	-	KΩ
Input Capacitance		5 V	-	15	-	pF
Analog Mixer						
SNR - CD to Ports A,B, & D Line-Out (Note 4)		5 V		90		dB
THD+N - CD to Ports A,B, & D Line-Out (Note 3)	-3dB Input	5 V		70		dB
SNR - All Line-In to A,B, & D Line-Out (Note 4)		5 V		90		dB
THD+N - All Line-In to A,B, & D Line-Out (Note 3)	-3dB Input	5 V		70		dB
SNR - Analog PC Beep to Ports A, B, & D Line-Out (Note 4)		5 V		85		dB
THD+N - Analog PC Beep to Ports A, B, & D Line-Out (Note 3)	-3dB Input	5 V		70		dB
Analog to Digital Converter						
Resolution		5 V		24		Bits
Dynamic Range, All Analog Inputs to A/D (Note 1)	High Pass Filer Enabled, 1 Vrms Input, No boost	5 V	88	90		dB
SNR All Analog Inputs to A/D (Note 4)	High Pass Filter enabled	5 V	88	90		dB
THD+N All Analog Inputs to A/D (Note 3)	High Pass Filter enabled, -3dBV input Level	5 V		85		dB
Analog Frequency Response (Note 2)		5 V	10	-	30,000	Hz
A/D Digital Filter Pass Band (Note 5)		5 V	20	-	19,200	Hz
A/D Digital Filter Transition Band		5 V	19,200	-	28,800	Hz

Parameter	Conditions	AVdd	Min	Typ	Max	Unit
A/D Digital Filter Stop Band		5 V	28,800	-	-	Hz
A/D Digital Filter Stop Band Rejection (Note 6)		5 V	-100	-	-	dB
Group Delay (48 KHz sample rate)		5 V	-	-	1	ms
Any Analog Input to ADC Crosstalk	10 KHz Signal Frequency	5 V	-	-85	-	dB
Any Analog Input to ADC Crosstalk	1 KHz Signal Frequency	5 V	-	-80	-	dB
Spurious Tone Rejection		5 V	-	-100	-	dB
Attenuation, Gain Step Size ANALOG		5 V	-	1.5	-	dB
Interchannel Gain Mismatch ADC		5 V	-	-	0.5	dB
Noise Floor when 40dB Mic Boost Enabled		5 V			0.01	mV
40dB Mic Boost Enabled SNR	5 mV Input	5 V		60		dB
40dB Mic Boost Enabled THD+N	5 mV Input	5 V		55		dB
Power Supply						
Power Supply Rejection Ratio	1 KHz	5 V	-	-70	-	dB
Power Supply Rejection Ratio	20 KHz	5 V	-	-40	-	dB
D0 Didd		5 V		75	90	mA
D0 Aidd		5 V		85		mA
D1 Didd		5 V		75	90	mA
D1 Aidd		5 V		85		mA
D2 Didd		5 V		23	30	mA
D2 Aidd		5 V		58		mA
D3 Didd		5 V		23	30	mA
D3 Aidd		5 V		37		mA
One Stereo ADC Didd		5 V		8	10	mA
One Stereo ADC Aidd		5 V		10		mA
One Stereo DAC Didd		5 V		3	5	mA
One Stereo DAC Aidd		5 V		2		mA
CD Input						
CD Common Mode Rejection (CMR)		All	50	55		dB
Voltage Reference Outputs						
VREFout (Note 8)		All	-	0.5 X AVdd	-	V
VREFILT (VAG)		5 V		0.45 X AVdd		V
Phased Locked Loop						
PLL lock time		5 V		96	200	μsec
PLL (HD Bit CLK) 24 MHz clock jitter		5 V		150	500	psec

1. Ratio of Full Scale signal to noise output with -60dB signal, measured “A weighted” over a 20 Hz to a 20 KHz bandwidth.
2. ± 3dB limits for Line Output and 0dB gain, at -20dBV

3. Amplitude of THD+N, measured with A-weighting filter, over 20 Hz to 20 KHz bandwidth.
4. 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.)
5. Peak-to-Peak Ripple over Passband meets ± 0.25dB limits, 48 KHz Sample Frequency.
6. Stop Band rejection determines filter requirements. Out-of-Band rejection determines audible noise.
7. The integrated Out-of-Band noise generated by the DAC process, during normal PCM audio playback, over a bandwidth 28.8 KHz to 100 KHz, with respect to a 1 Vrms DAC output.
8. Can be set to 0.5 or 0.8 AVdd.

3. DETAILED DESCRIPTION

3.1. Universal Jacks™

IDT's Universal Jacks technology allows for the greatest flexibility in board design and implementation.

For the 92HD206 family the Universal Jacks capabilities are as follows[1]:

- Ports A, B, and D support[2]:
  - Headphone Out
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]
- Ports C, E, F, G, H support[2]:
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic boost[3]
    - Ports G & H do not have VrefOut Support

Note[1]: On the 92HD206 family, 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]: Three headphones should not be used simultaneously. Performance degradation will occur when using two headphones simultaneously. See electrical specs for details.

Note[3]: When the 40dB microphone boost feature is enabled, additional gain increases greater than 6dB may result in significant audio quality degradation of the microphone audio input. In particular, when the 40dB microphone boost is active, the SNR, THD+N and DC offset will significantly degrade regardless of the input signal level.

3.1.1. 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, F, G, ad H. Refer to the reference design for details of the port detect circuitry.

Impedance Sense is accomplished by on-chip circuitry that measures the impedance at the pin of the chip and compares it to internal reference impedance bins. Below, is a table that contains the bin information and codes returned when the pin widget impedance field in the Port Pin Sense widget is read. Please note that even under the best conditions, there is no method to guarantee 100% impedance sensing due to variations in external circuitry and impedance overlap of devices that can be plugged into a jack. The impedance sense table reflects both standard Line Out and Headphone output drivers. Please reference the HD Audio Universal Jack Application Note on the IDT Extranet for more information.

Table 1. Impedance Sense Levels

Bins	Return Hex Code	Impedance Level (Ohms)	General Device Detected
000b	0064h	Impedance < 300	Passive Speakers, Headset Speakers
001b	012Ch	Impedance = 300 +/- 25%	Some Headset Speakers
010b	028Ah	300 > Impedance < 1275	Some Microphones
011b	03E8h	Impedance = 1275 +/- 25%	Microphones
100b	07D0h	1275 > Impedance < 2000	Microphones
101b	0BB8h	Impedance = 2000 +/- 25%	Amplified Speakers
110b	2710h	> 2000	Amplified Speakers, Line In
111b	2710h	> 2000	Amplified Speakers, Line In

3.2. SPDIF Input

SPDIF_IN can operate at 44.1 KHz, 48 KHz or 96 KHz and implements internal Jack Detect.

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.

3.3. SPDIF Output

SPDIF Ouput can operate at 44.1 KHz, 48 KHz, 88.2 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.

3.4. Headphone Drivers (Restrictions)

Three headphones should not be used simultaneously. Performance degradation will occur when using two headphones simultaneously. See electrical specifications for details.

3.5. Device IDs

Table 2. CODEC IDs

Part Number	DAC SNR dB	VID	DID	Rev ID	Step ID	SSID*	Assm ID*	Dolby	Volume	Pkg Pins
92HD206X	95	8384h	7645h	xxh	xxh	xxxxxxh	xxh	No	Yes	48
92HD206D	95	8384h	7646h	xxh	xxh	xxxxxx1h	xxh	HT/SR	Yes	48

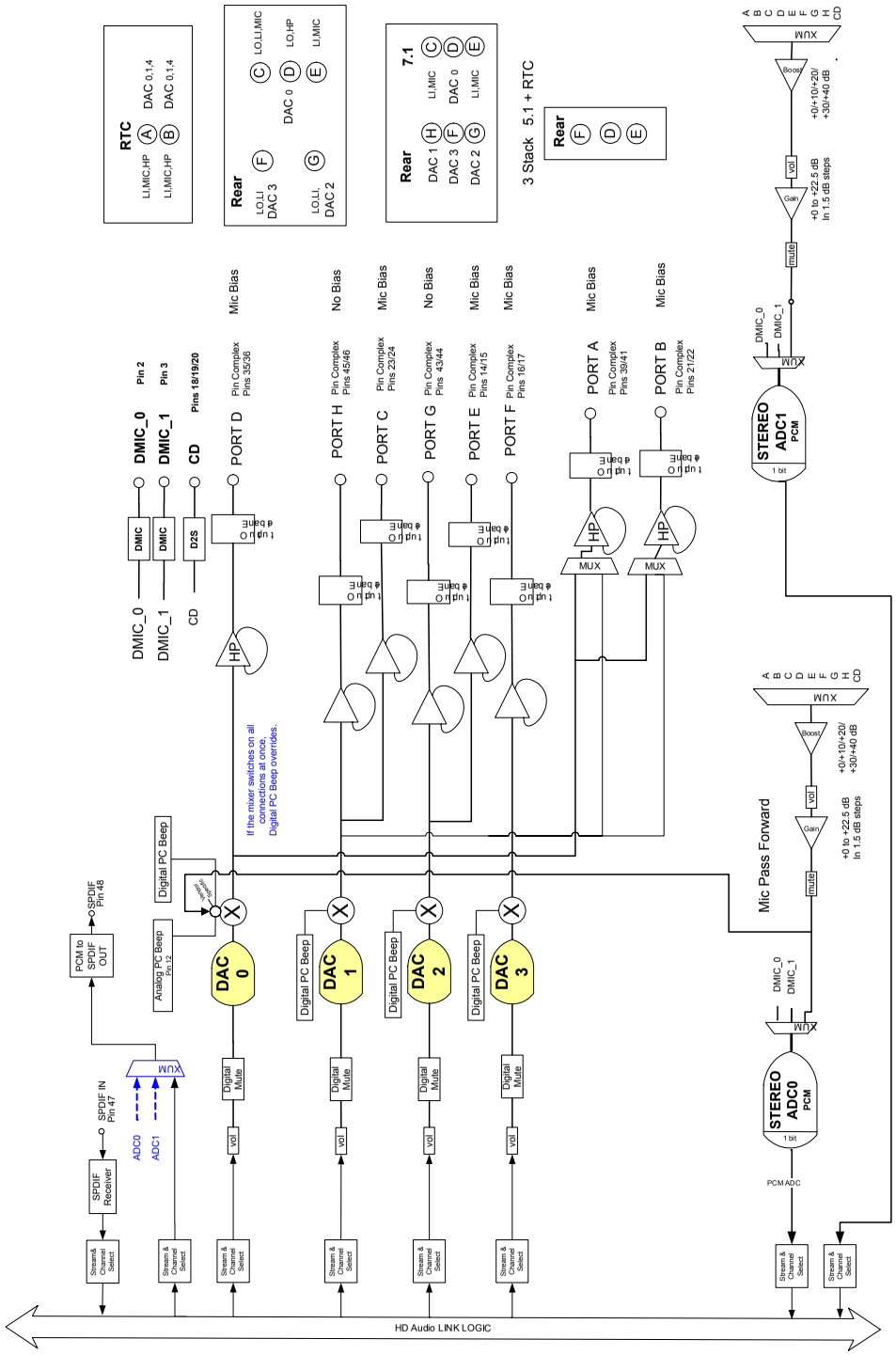
Note: SVIDs, SSIDs and Assembly IDs are read/writable by BIOS. All other ID fields are read-only.

Note: MS refers to Master Studio and HT/SR refers to Home Theater/Sound Room

4. FUNCTIONAL BLOCK DIAGRAMS

4.1. 92HD206

Figure 1. 92HD206 Functional Block Diagram



5. WIDGET DIAGRAM

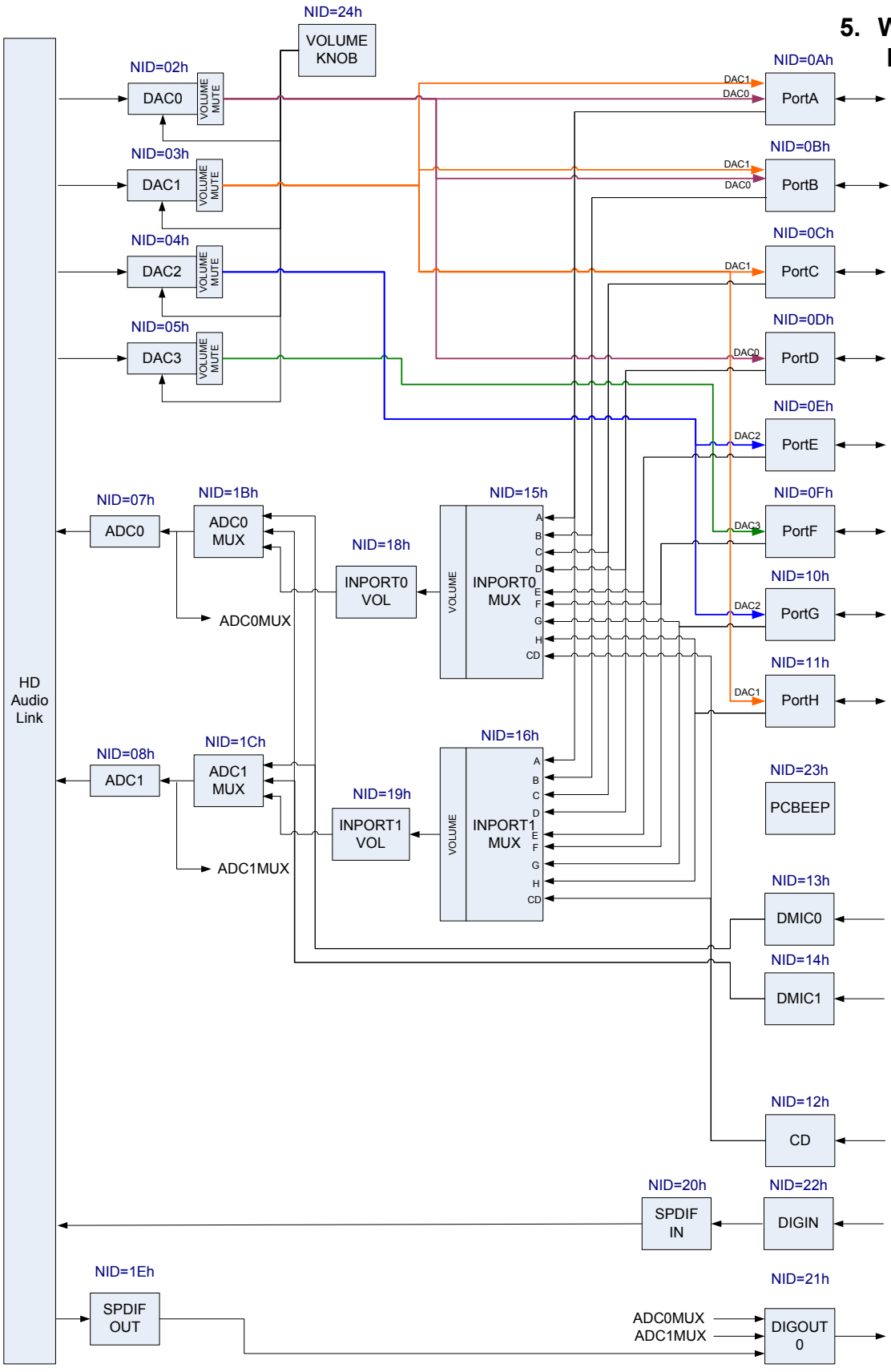


Figure 2. 92HD206 Widget Diagram

5.1. Pin Configuration Default Register Settings

The following table shows the Pin Widget Configuration Default settings.

Table 3. Pin Configuration Default Settings

Pin Name	Port	Location	Device	Connection	Color	Misc	Assoc.	Seq
DigInPin	Not Connected **01b**	Mainboard Rear **1h**	SPDIF In **Ch**	RCA **4h**	Gray **2h**	Jack Detect Overide = 1	9h	0h
DigOutPin	Connect to Jack **00b**	Mainboard Rear **1h**	SPDIF Out **4h**	RCA **4h**	Gray **2h**	Jack Detect Overide = 0	7h	0h
PortAPin	Connect to Jack **00b**	Mainboard Front **2h**	HP Out **2h**	1/8 inch Jack **1h**	Green **4h**	Jack Detect Overide = 0	2h	0h
PortBPin	Connect to Jack **00b**	Mainboard Front **2ht**	Mic In **Ah**	1/8 inch Jack **1h**	Pink **9h**	Jack Detect Overide = 0	8h	0h
PortCPin	Connect to Jack **00b**	Mainboard Rear **1h**	Line In **8h**	1/8 inch Jack **1h**	Blue **3h**	Jack Detect Overide = 0	4h	Eh
PortDPin	Connect to Jack **00b**	Mainboard Rear **1h**	Line Out **0h**	1/8 inch Jack **1h**	Green **4h**	Jack Detect Overide = 0	1h	0h
PortEPin	Connect to Jack **00b**	Mainboard Rear **1h**	Mic In **Ah**	1/8 inch Jack **1h**	Pink **9h**	Jack Detect Overide = 0	4h	0h
PortFPin	Connect to Jack **00b**	Mainboard Rear **1h**	Line Out **0h**	1/8 inch Jack **1h**	Black **1h**	Jack Detect Overide = 0	1h	2h
PortGPin	Connect to Jack **00b**	Mainboard Rear **1h**	Line Out **0h**	1/8 inch Jack **1h**	Orange **6h**	Jack Detect Overide = 0	1h	1h
PortHPin	Connect to Jack **00b**	Mainboard Rear **1h**	Line Out **0h**	1/8 inch Jack **1h**	Gray **2h**	Jack Detect Overide = 0	1h	Fh
CDPin	Not Connected **01b**	Internal **01000b**	CD **3h**	ATAPI Internal **3h**	Unknown **0h**	Jack Detect Overide = 1	Fh	0h

6. WIDGET INFORMATION FOR THE 92HD206 FAMILY

Table 4. High Definition Audio Widget

ID	Widget Name	Description
00h	Root	Root Node
01h	Audio Function Group	Audio Function Group
02h	DAC0	Stereo Output Converter to DAC
03h	DAC1	Stereo Output Converter to DAC
04h	DAC2	Stereo Output Converter to DAC
05h	DAC3	Stereo Output Converter to DAC
06h	Reserved	Reserved
07h	ADC0	Stereo Input Converter to ADC
08h	ADC1	Stereo Input Converter to ADC
09h	Reserved	Reserved
0Ah	Port A	Port A Pin Widget (Configurable as HP, Line In, Line Out, Mic)
0Bh	Port B	Port B Pin Widget (Configurable as HP, Line In, Line Out, Mic)
0Ch	Port C	Port C Pin Widget (Configurable as Line In, Line Out, Mic)
0Dh	Port D	Port D Pin Widget (Configurable as HP, Line In, Line Out, Mic)
0Eh	Port E	Port E Pin Widget (Configurable as Line In, Line Out, Mic)
0Fh	Port F	Port F Pin Widget (Configurable as Line In, Line Out, Mic)
10h	Port G	Port G Pin Widget (Configurable as Line In, Line Out, Mic)
11h	Port H	Port H Pin Widget (Configurable as Line In, Line Out, Mic)
12h	CD	CD Pin Widget
13h	Reserved	Reserved
14h	Reserved	Reserved
15h	InPort0Mux	ADC0 Input Port Mux
16h	InPort1Mux	ADC1 Input Port Mux
17h	Reserved	Reserved
18h	InPort0Vol	ADC0 Input Port Volume
19h	InPort1Vol	ADC1 Input Port Volume
1Ah	Reserved	Reserved
1Bh	ADC0Mux	ADC0 Mux
1Ch	ADC1Mux	ADC1 Mux
1Dh	Reserved	Reserved
1Eh	SPDIF_OUT	Stereo Output for SPDIF_Out
1Fh	Reserved	Reserved