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8-CHANNEL HIGH DEFINITION AUDIO CODEC STAC9220

DESCRIPTION

The STAC9220 is a high fidelity, 8-channel audio CODEC compatible with Intel's High Definition (HD) Audio Interface. The STAC9220 CODEC provide stereo 24-bit resolution with sample rates up to 192 KHz. SPDIF I/O provides connectivity to consumer electronic equipment. The STAC9220 CODEC incorporate IDT's proprietary ΣΔ technology to achieve an estimated DAC SNR in excess of 95dB. The STAC9220 CODECs provide high quality, HD Audio capability to notebook and media centric desktop PC applications.

FEATURES

- **High performance ΣΔ technology**
  - 95dB DAC SNR
- **Intel HD Audio interface**
- **Eight Channel (4 DAC pairs and 2 stereo ADCs) with 24-bit resolution**
  - Supports 7.1 Audio
  - Supports 5.1 Audio with Auxiliary channel for separate audio stream or Real Time Communication (RTC) channel
- **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 & Microphone
    - 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/MIC Support
    - Pins 14/15
- **Four Adjustable VREF Out pins for Microphone Bias**
- **Digital PC Beep to all outputs**
- **+3.3 V and +5 V analog power supply options**
- **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 Technologies**
  - Dolby Headphone™
  - Dolby ProLogic II™
  - Dolby Virtual Speaker™
- **Smart Stream™ from Sonic Focus**

Table of Contents

List of Figures

List of Tables

1. FEATURES

1.1. Overview

The STAC9220 is a high fidelity, 8-channel audio CODEC compatible with Intel's High Definition (HD) Audio Interface. The STAC9220 CODEC provide stereo 24-bit resolution with sample rates up to 192 KHz. SPDIF I/O provides connectivity to consumer electronic equipment. The STAC9220 CODEC incorporate IDT's proprietary ΣΔ technology to achieve an estimated DAC SNR in excess of 95dB. The STAC9220 CODECs provide high quality, HD Audio capability to notebook and media centric desktop PC applications.

1.2. Features

- High performance ΣΔ technology
  - 95dB DAC SNR
- Intel HD Audio interface
- Eight Channel (4 DAC pairs and 2 stereo ADCs) with 24-bit resolution
  - Supports 7.1 Audio
  - Supports 5.1 Audio with Auxiliary channel for separate audio stream or Real Time Communication (RTC) channel
- 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 & Microphone
    - 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/MIC Support
    - Pins 14/15
- Four Adjustable VREF Out pins for Microphone Bias
- Digital PC Beep to all outputs
- +3.3V and +5V/4V[1] analog power supply options
- 48-pin LQFP package option (7mm x 7mm)

Note: 1. The +4V Analog voltage is supported by the +5V version of the STAC9220. Request the +4V configuration of the driver.

1.3. Third Party Software Support

- WOW™ and Tru Surround™ from SRS
- Intellisonic Microphone Beam Forming from Knowles™
- Maxx BASS™ from Waves
- Dolby Technologies
    - Dolby Headphone™
    - Dolby ProLogic II™
    - Dolby Virtual Speaker™
- Smart Stream™ from Sonic Focus

1.4. Description

The STAC9220 is a high fidelity, 8-channel audio CODEC compatible with the Intel High Definition (HD) Audio Interface. The STAC9220 provides high quality, HD Audio capability to notebook and cost sensitive desktop PC applications.

The STAC9220 provides stereo 24-bit, full duplex resolution supporting sample rates up to 192 KHz by the DAC and ADC. The STAC9220 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 STAC9220 support 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 to a home entertainment system. 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 STAC9220 has three General Purpose I/O (GPIO) pins. The STAC920 also provides a single ended CD input for compatibility with DRM solutions and to support legacy OS issues.

The STAC9220 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 headphone is supported on Port F.

The Universal Jack capabilities allow the CODEC to detect when audio devices are connected to the CODEC, and to allow the CODEC to be reconfigured to support these devices regardless of which port they are plugged into the system. 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 and component selection are critical for accurate detection of audio jacks on individual ports. Please see the IDT STAC922x reference design for circuit implementation details.

The STAC9220 operates with a 3.3 V digital supply and is available in either 5 V analog supply or 3.3 V analog supply options.

The STAC9220 is available in a 48-pin LQFP package. The 48-pin LQFP is only available in the Environmental package (Pb-free).

The STAC9220 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, to support high-valued, third party technologies like SRS WOW®, Knowles® Microphone Beam Forming, Waves MaxxBASS®, Dolby Headphone®, Dolby ProLogic II® and Dolby Virtual Speaker® and more.

2. CHARACTERISTICS

2.1. Electrical Specifications

2.1.1. Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the STAC9220. 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 158.

2.1.2. Recommended Operation Conditions

Parameter		Min.	Typ.	Max.	Units
Power Supply Voltage	Digital - 3.3 V	3.135	3.3	3.465	V
	Analog - 3.3 V	3.135	3.3	3.465	V
(Note: The +4 V Analog voltage is supported by the +5 V version of the STAC922x or STAC922xD.)	Analog - 4 V	3.8	4	4.2	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 STAC9220 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 STAC9220 implements internal ESD protection circuitry, proper ESD precautions should be followed to avoid damaging the functionality or performance.

2.2. STAC9220 5V Analog Performance Characteristics

($T_{ambient}$ = 25 ºC, AVdd = 5.0 V ± 5%, DVdd = 3.3 V ± 5%, AVss=DVss=0V; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0dB = 1 VRMS, 10 KΩ / 50 pF load, Testbench Characterization BW: 20 KHz – 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	-	100	-	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	-	-93	-	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	-	93	-	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 Rejection (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	-	Ω
HEADPHONE_OUT Load Capacitance	-	100	-	pF
Mute Attenuation	-	-	-	dB
PLL lock time	-	96	200	μsec
PLL (or Azalia Bit CLK) 24.576 MHz clock jitter	-	100	300	psec

1. With +30dB 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 & 0dB 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.

2.3. STAC9220 4V Analog Performance Characteristics

($T_{ambient}$ = 25 ºC, AVdd = 4.0 V ± 5%, DVdd = 3.3 V ± 5%, AVss=DVss=0V; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0dB = 1 VRMS, 10 KΩ / 50 pF load, Testbench Characterization BW: 20 KHz – 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)	-	85	-	dB
Analog Frequency Response (Note 3)	10	-	30,000	Hz
Total Harmonic Distortion + Noise (-3dB): (Note 4)				
PCM to All Analog Outputs	-	-90	-	dB
All Analog Inputs to A/D(-3dBV input Level)	-	-85	-	dB
HEADPHONE_OUT (32 Ω load)	-	-88	-	dB
HEADPHONE_OUT (10 KΩ load)	-	-85	-	dB
SNR (idle channel) (Note 5)				
DAC to All Analog Outputs	-	95	-	dB
All Analog Inputs to A/D with High Pass Filter enabled	-	85	-	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 Rejection (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 ADC (10 KHz Signal Frequency) Crosstalk	-	-85	-	dB

Parameter	Min	Typ	Max	Unit
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	-	Ω
HEADPHONE_OUT Load Capacitance	-100		-	pF
Mute Attenuation	-	-	-	dB
PLL lock time	-	96	200	μsec
PLL (or Azalia Bit CLK) 24.576 MHz clock jitter	-	100	750	psec

1. With +30dB 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 & 0dB 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. STAC9220 3.3V Analog Performance Characteristics

($T_{ambient}$ = 25 ºC, AVdd = 3.3 V ± 5%, DVdd = 3.3 V ± 5%, AVss=DVss=0V; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0dB = 1 VRMS, 10 KΩ / 50 pF load, Testbench Characterization BW: 20 KHz – 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	-	0.7	-	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)	-	80	-	dB
Analog Frequency Response (Note 3)	10	-	30,000	Hz
Total Harmonic Distortion + Noise (-3dB): (Note 4)				
PCM to All Analog Outputs	-	-90	-	dB
All Analog Inputs to A/D(-3dBV input Level)	-	-75	-	dB
HEADPHONE_OUT (32 Ω load)	-	-85	-	dB
HEADPHONE_OUT (10 KΩ load)	-	-88	-	dB
SNR (idle channel) (Note 5)				
DAC to All Analog Outputs	-	95	-	dB
All Analog Inputs to A/D with High Pass Filter enabled	-	85	-	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 ADC (10 KHz Signal Frequency) Crosstalk	-	-85	-	dB

Parameter	Min	Typ	Max	Unit
Any Analog Input to ADC (1 KHz Signal Frequency) Crosstalk	-	-70	-	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	-	Ω
HEADPHONE_OUT Load Capacitance	-	100	-	pF
Mute Attenuation	-	-	-	dB
PLL lock time	-	96	200	μsec
PLL (or Azalia Bit CLK) 24.576 MHz clock jitter	-	100	750	psec

1. With +30dB 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 & 0dB 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.

3. POWER CONSUMPTION

3.1. Digital

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

Table 1. Digital Power Consumption

3.2. Analog: AVDD = 5 V

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

Table 2. Analog Power Consumption 5V

3.3. Analog: AVDD = 3.3 V

Power State	Typical*	Max	units
D0	45	55	mA
D1	45	55	mA
D2	20	30	mA
D3	13	18	mA

Table 3. Analog Power Consumption 3.3V

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

4. DETAILED DESCRIPTION

4.1. 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 reference design for port detect circuitry. Select the precision of the resistor used as follows.

Table 4. Audio Jack Presence Detect

Nominal Voltage (+-5%)	Resistor Tolerance Sense A (If port D is used)	Resistor Tolerance Sense A (If port D is not used)	Resistor Tolerance Sense B (For ports E and F)
5V	1%	1%	1%
4.5V	1%	1%	1%
4V	0.50%	1%	1%
3.3V	0.10%	1%	1%

4.2. 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.