

## 2- CHANNEL HIGH DEFINITION AUDIO CODEC

## STAC9200

### Description

The STAC9200 is a high quality, 2-channel audio CODEC compatible with the Intel High Definition (HD) Audio Interface. The STAC9200 provides Stereo 24-Bit resolution with sample rates up to 192 KHz. SPDIF I/O provides connectivity to consumer electronic equipment. The STAC9200 incorporates TSI's proprietary SD technology to achieve an estimated DAC SNR in excess of 100dB. The STAC9200 provides high quality, HD Audio capability to notebook and cost sensitive desktop PC applications.

### Features

- High performance SD technology
- 100dB DAC SNR
- Intel HD Audio Interface
- Two Channel DACs and ADCs with 24-bit resolution
- Sample rates up to 192 KHz
- Mixer-less design
  - Low-latency Karaoke Mode Supported
- Integrated Headphone Amplifiers
- Stereo Microphone
  - Supports Stereo Microphone
  - Microphone Boost 0, 10, 20, 30, 40dB
- Direct CDROM Recording Mixerless Design
- S/PDIF In and Out
- Universal Jacks™ Functionality for jack retasking
- Adjustable VREF Out
- Digital PC Beep to all outputs
- +3.3 V, +4 V and +5 V analog power supply options  
(The +4 V Analog voltage is supported by the +5 V version of the STAC9200. Request +4 V configuration of the driver.)
- 32-pad QFN (5mm x 5mm) and 48-pin LQFP package options

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#### 1. DESCRIPTION

The STAC9200 is a high quality, 2-channel audio CODEC compatible with the Intel High Definition (HD) Audio Interface (formerly known as "Azalia"). The STAC9200 provides high quality, HD Audio capability to notebook and cost sensitive desktop PC applications. The STAC9200 has been designed as a drop-in replacement for the STAC9772/73 Dual Mode (HD Audio and AC97) 2-channel CODEC once the need to support AC97 is eliminated.

The STAC9200 incorporates TSI's proprietary SD technology to achieve a DAC SNR in excess of 100dB. The higher performance and quality of TSI's audio solutions brings consumer device level performance to the notebook, desktop and media center PCs.

The STAC9200 provides Stereo 24-Bit, full duplex resolution supporting sample rates up to 192 KHz by the DAC and ADC. The STAC9200 DAC, ADC and SPDIF In/Out support sample rates of 96 KHz, 48 KHz and 44.1 KHz. Additionally, the SPDIF Out supports 32 KHz. The CODEC's driver supports additional sample rate options.

The STAC9200 supports all desired two channel configurations, including switchable Headphone Out, and Universal Jacks™ functionality for automatic jack detection sensing and retasking. 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 STAC9200 has four General Purpose I/O (GPIO) pins. The STAC9200 also provides a single ended CD input to avoid DRM incompatibility and to support legacy OS issues.

The STAC9200 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.

The Universal Jack capabilities allow the CODEC to detect when audio devices are connected to the CODEC, sense the type of device (LINE\_IN, LINE\_OUT, MIC, Headphone) that is inserted, and to allow the CODEC to be reconfigured to support these devices wherever they are plugged into the system. SPDIF input sensing is also supported. The fully parametric TSI SoftEQ can be initiated upon headphone jack insertion and removal for protection of notebook speakers.

The STAC9200 operates with a 3.3V digital supply and is available in either 5V, 4V or 3.3V analog supply. The +4V Analog voltage is supported by the +5V version of the STAC9200 appropriate configuration settings of the driver.

The STAC9200 is available in 48-pin LQFP and 32-pad QFN package options. The 32-pad QFN package can be co-located inside the standard 48-pin footprint allowing systems to be designed to accept either version of the STAC9200 or be compatible with existing 48-pin CODECs. Both the 48-pin LQFP and the 32-pad QFN are available in the ROHS compliant Lead (Pb) free package.

The STAC9200 is supported with TSI's high quality software solutions which include drivers for all major Windows operating systems from Microsoft Parametric SoftEQ, and Digital Rights Management. Third party plugin capability is easily achieved with the TSI Kernel Processing Interface, to support high valued third party technologies like SRS WOW®, Knowles® Microphone Beam forming, Waves MaxxBASS® and more.

## 2. PERFORMANCE

### 2.1. Audio Fidelity

DAC SNR: 100dB

ADC SNR: 90dB

### 2.2. Electrical Specifications

#### 2.2.1. Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the STAC9200. These ratings, which are standard values for TSI 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°C to +70°C                                                                                                |
| Storage temperature                   |      | -55 °C to +125 °C                                                                                           |
| Soldering temperature                 |      | 260 °C for 10 seconds *<br>Soldering temperature information for all available packages begins on page 123. |

#### 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 - 3.3 V              | 3.135 | 3.3  | 3.465 | V     |
| (Note: The +4V Analog voltage is supported by the +5V version of the STAC9200) | 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 <sub>case</sub> (48-LQFP) |       |      | +90   | °C    |

**ESD:** The STAC9200 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 STAC9200 implements internal ESD protection circuitry, proper ESD precautions should be followed to avoid damaging the functionality or performance.

## **2.3. Power Consumption**

### **2.3.1. Digital**

**Table 1. Digital Power Consumption**

| <b>Power State</b> | <b>Typical</b> | <b>Max</b> | <b>Units</b> |
|--------------------|----------------|------------|--------------|
| D0                 | 25             | 29         | mA           |
| D1                 | 12             | 16         | mA           |
| D2                 | 12             | 16         | mA           |
| D3                 | 12             | 16         | mA           |

### **2.3.2. Analog**

**Table 2. Analog Power Consumption**

| <b>Power State</b> | <b>Typical</b> | <b>Max</b> | <b>Units</b> |
|--------------------|----------------|------------|--------------|
| D0                 | 36             | 48         | mA           |
| D1                 | 26             | 35         | mA           |
| D2                 | 26             | 35         | mA           |
| D3                 | 26             | 35         | mA           |

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### 2.4. STAC9200 5V Analog Performance Characteristics

( $T_{\text{ambient}} = 25^{\circ}\text{C}$ ,  $AV_{\text{dd}} = 5.0\text{V} \pm 5\%$ ,  $DV_{\text{dd}} = 3.3\text{V} \pm 5\%$ ,  $AV_{\text{ss}}=DV_{\text{ss}}=0\text{V}$ ; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0 dB = 1 VRMS, 10 KW/50pF load, Testbench Characterization BW: 20 Hz – 20 KHz, 0 dB 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 TSI will perform a full audio test suite and provide you with the results. Contact TSI for more information.

| Parameter                                                   | Min    | Typ  | Max    | Unit |
|-------------------------------------------------------------|--------|------|--------|------|
| <b>Full Scale Input Voltage:</b>                            |        |      |        |      |
| All Analog Inputs with out boost                            | -      | 1.00 | -      | Vrms |
| All Analog Inputs with boost (Note 1)                       | -      | 0.03 | -      | Vrms |
| <b>Full Scale Output:</b>                                   |        |      |        |      |
| PCM (DAC) to All Analog Outputs                             | -      | 1.00 | -      | Vrms |
| HEADPHONE_OUT (32 $\Omega$ load) per channel (peak)         | -      | 50   | -      | mW   |
| <b>Dynamic Range: -60dB signal level (Note 2)</b>           |        |      |        |      |
| PCM to All Analog Outputs                                   | -      | 95   | -      | dB   |
| All Analog Inputs to A/D (1VRMS Input Referenced)           | -      | 85   | -      | dB   |
| Analog Frequency Response (Note 3)                          | 10     | -    | 30,000 | Hz   |
| <b>Total Harmonic Distortion + Noise (-3dB): (Note 4)</b>   |        |      |        |      |
| PCM to All Analog Outputs                                   | -      | -90  | -      | dB   |
| All Analog Inputs to A/D (-3dBV input Level)                | -      | -85  | -      | dB   |
| HEADPHONE_OUT (32 $\Omega$ load)                            | -      | -85  | -      | dB   |
| HEADPHONE_OUT (10 K $\Omega$ load)                          | -      | -88  | -      | dB   |
| <b>SNR (idle channel) (Note 5)</b>                          |        |      |        |      |
| DAC to All Analog Outputs                                   | -      | 100  | -      | 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 DAC (1 KHz Signal Frequency) Crosstalk  |        | -100 |        | dB   |
| 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   |

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| Parameter                                       | Min | Typ        | Max | Unit       |
|-------------------------------------------------|-----|------------|-----|------------|
| Attenuation, Gain Step Size ANALOG              | -   | 1.5        | -   | dB         |
| Attenuation, Gain Step Size DIGITAL             | -   | 0.75       | -   | dB         |
| Input Impedance                                 | -   | 50         | -   | K $\Omega$ |
| Input Capacitance                               | -   | 15         | -   | pF         |
| VREFout                                         | -   | 0.5 X AVdd | -   | V          |
| VREF                                            | -   | 0.45X AVdd | 0.5 | V          |
| Interchannel Gain Mismatch ADC                  | -   | -          | 0.5 | dB         |
| Interchannel Gain Mismatch DAC                  | -   | -          | -   | dB         |
| Gain Drift                                      | -   | 100        | -   | ppm/°C     |
| DAC Offset Voltage                              | -   | 5          | 10  | mV         |
| Deviation from Linear Phase                     | -   | 10         | 1   | deg.       |
| All Analog Outputs Load Resistance              | -   | 10         | -   | K $\Omega$ |
| 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 | $\mu$ sec  |
| PLL (or Azalia 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.  $\pm 1$ dB limits for Line Output & 0 dB gain, at -20dBV
4. Ratio of Full Scale signal to THD+N output with -3dB signal, measured "A weighted" over a 20 Hz to a 20 KHz bandwidth. Sample Frequency = 48 KHz.
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  $\pm 0.25$ dB 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.

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#### 2.5. STAC9200 4V Analog Performance Characteristics

( $T_{\text{ambient}} = 25^{\circ}\text{C}$ ,  $\text{AVdd} = 4.0\text{V} \pm 5\%$ ,  $\text{DVdd} = 3.3\text{V} \pm 5\%$ ,  $\text{AVss}=\text{DVss}=0\text{V}$ ; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0 dB = 1 VRMS, 10 KW/50 pF load, Testbench Characterization BW: 20 Hz – 20 Hz, 0 dB 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 TSI will perform a full audio test suite and provide you with the results. Contact TSI for more information.

| Parameter                                                   | Min    | Typ  | Max    | Unit |
|-------------------------------------------------------------|--------|------|--------|------|
| <b>Full Scale Input Voltage:</b>                            |        |      |        |      |
| All Analog Inputs with out boost                            | -      | 1.00 | -      | Vrms |
| All Analog Inputs with boost (Note 1)                       | -      | 0.03 | -      | Vrms |
| <b>Full Scale Output:</b>                                   |        |      |        |      |
| PCM (DAC) to All Analog Outputs                             | -      | 1.00 | -      | Vrms |
| HEADPHONE_OUT (32 $\Omega$ load) per channel (peak)         | -      | 50   | -      | mW   |
| <b>Dynamic Range: -60dB signal level (Note 2)</b>           |        |      |        |      |
| PCM to All Analog Outputs                                   | -      | 95   | -      | dB   |
| All Analog Inputs to A/D (1VRMS Input Referenced)           | -      | 85   | -      | dB   |
| Analog Frequency Response (Note 3)                          | 10     | -    | 30,000 | Hz   |
| <b>Total Harmonic Distortion + Noise (-3dB): (Note 4)</b>   |        |      |        |      |
| PCM to All Analog Outputs                                   | -      | -90  | -      | dB   |
| All Analog Inputs to A/D (-3dBV input Level)                | -      | -85  | -      | dB   |
| HEADPHONE_OUT (32 $\Omega$ load)                            | -      | -85  | -      | dB   |
| HEADPHONE_OUT (10 K $\Omega$ load)                          | -      | -88  | -      | dB   |
| <b>SNR (idle channel) (Note 5)</b>                          |        |      |        |      |
| DAC to All Analog Outputs                                   | -      | 100  | -      | 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 Hz)                         | -      | -70  | -      | dB   |
| Power Supply Rejection Ratio (20 Hz)                        | -      | -40  | -      | dB   |
| 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   |

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| Parameter                                       | Min | Typ        | Max | Unit              |
|-------------------------------------------------|-----|------------|-----|-------------------|
| Attenuation, Gain Step Size DIGITAL             | -   | 0.75       | -   | dB                |
| Input Impedance                                 | -   | 50         | -   | K $\Omega$        |
| Input Capacitance                               | -   | 15         | -   | pF                |
| VREFout                                         | -   | 0.5 X AVdd | -   | V                 |
| VREF                                            | -   | 0.45X AVdd | 0.5 | V                 |
| Interchannel Gain Mismatch ADC                  | -   | -          | 0.5 | dB                |
| Interchannel Gain Mismatch DAC                  | -   | -          | -   | dB                |
| Gain Drift                                      |     | 100        | -   | ppm/ $^{\circ}$ C |
| DAC Offset Voltage                              | -   | 5          | 10  | mV                |
| Deviation from Linear Phase                     | -   | 10         | 1   | deg.              |
| All Analog Outputs Load Resistance              | -   | 10         | -   | K $\Omega$        |
| All Analog Outputs Load Capacitance             | -   | -          | 50  | pF                |
| HEADPHONE_OUT Load Resistance                   | -   | 32         | -   | $\Omega$          |
| HEADPHONE_OUT Load Capacitance                  |     | -100       | -   | pF                |
| Mute Attenuation                                | -   | -          | -   | dB                |
| PLL lock time                                   | -   | 96         | 200 | $\mu$ sec         |
| 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.  $\pm 1$ dB limits for Line Output & 0 dB gain, at -20dBV
4. Ratio of Full Scale signal to THD+N output with -3dB signal, measured "A weighted" over a 20 Hz to a 20 KHz bandwidth. Sample Frequency = 48 KHz.
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  $\pm 0.25$ dB 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.

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### 2.6. STAC9200 3.3V Analog Performance Characteristics

( $T_{\text{ambient}} = 25^{\circ}\text{C}$ ,  $AV_{\text{dd}} = 3.3\text{V} \pm 5\%$ ,  $DV_{\text{dd}} = 3.3\text{V} \pm 5\%$ ,  $AV_{\text{ss}}=DV_{\text{ss}}=0\text{V}$ ; 1 KHz input sine wave; Sample Frequency = 48 KHz; 0 dB = 1 VRMS, 10 KW/50 pF load, Testbench Characterization BW: 20 Hz – 20 KHz, 0 dB 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 TSI will perform a full audio test suite and provide you with the results. Contact TSI for more information.

| Parameter                                                   | Min    | Typ  | Max    | Unit |
|-------------------------------------------------------------|--------|------|--------|------|
| <b>Full Scale Input Voltage:</b>                            |        |      |        |      |
| All Analog Inputs with out boost                            | -      | 0.7  | -      | Vrms |
| All Analog Inputs with boost (Note 1)                       | -      | 0.03 | -      | Vrms |
| <b>Full Scale Output:</b>                                   |        |      |        |      |
| PCM (DAC) to All Analog Outputs                             | -      | 1.00 | -      | Vrms |
| HEADPHONE_OUT (32 $\Omega$ load) per channel (peak)         | -      | 50   | -      | mW   |
| <b>Dynamic Range: -60dB signal level (Note 2)</b>           |        |      |        |      |
| PCM to All Analog Outputs                                   | -      | 95   | -      | dB   |
| All Analog Inputs to A/D (1VRMS Input Referenced)           | -      | 80   | -      | dB   |
| Analog Frequency Response (Note 3)                          | 10     | -    | 30,000 | Hz   |
| <b>Total Harmonic Distortion + Noise (-3dB): (Note 4)</b>   |        |      |        |      |
| PCM to All Analog Outputs                                   | -      | -90  | -      | dB   |
| All Analog Inputs to A/D (-3dBV input Level)                | -      | -75  | -      | dB   |
| HEADPHONE_OUT (32 $\Omega$ load)                            | -      | -85  | -      | dB   |
| HEADPHONE_OUT (10 K $\Omega$ load)                          | -      | -88  | -      | dB   |
| <b>SNR (idle channel) (Note 5)</b>                          |        |      |        |      |
| DAC to All Analog Outputs                                   | -      | 100  | -      | 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   |
| Any Analog Input to ADC (1 KHz Signal Frequency) Crosstalk  | -      | -75  | -      | dB   |
| Spurious Tone Rejection                                     | -      | -100 | -      | dB   |
| Attenuation, Gain Step Size ANALOG                          | -      | 1.5  | -      | dB   |

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| Parameter                                       | Min | Typ        | Max | Unit              |
|-------------------------------------------------|-----|------------|-----|-------------------|
| Attenuation, Gain Step Size DIGITAL             | -   | 0.75       | -   | dB                |
| Input Impedance                                 | -   | 50         | -   | K $\Omega$        |
| Input Capacitance                               | -   | 15         | -   | pF                |
| VREFout                                         | -   | 0.5 X AVdd | -   | V                 |
| VREF                                            | -   | 0.45X AVdd | 0.5 | V                 |
| Interchannel Gain Mismatch ADC                  | -   | -          | 0.5 | dB                |
| Interchannel Gain Mismatch DAC                  | -   | -          | -   | dB                |
| Gain Drift                                      |     | 100        | -   | ppm/ $^{\circ}$ C |
| DAC Offset Voltage                              | -   | 5          | 10  | mV                |
| Deviation from Linear Phase                     | -   | 10         | 1   | deg.              |
| All Analog Outputs Load Resistance              | -   | 10         | -   | K $\Omega$        |
| All Analog Outputs Load Capacitance             | -   | -          | 50  | pF                |
| HEADPHONE_OUT Load Resistance                   | -   | 32         | -   | $\Omega$          |
| HEADPHONE_OUT Load Capacitance                  | -   | 100        | -   | pF                |
| Mute Attenuation                                | -   | -          | -   | dB                |
| PLL lock time                                   | -   | 96         | 200 | $\mu$ sec         |
| PLL (or Azalia 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.  $\pm 1$ dB limits for Line Output & 0 dB gain, at -20dBV
4. Ratio of Full Scale signal to THD+N output with -3dB signal, measured "A weighted" over a 20 Hz to a 20 KHz bandwidth. Sample Frequency = 48 KHz.
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  $\pm 0.25$ dB 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. EXTENDED FEATURE EXPLANATION

#### 3.1. SPDIF Input

SPDIF IN can run at 44.1 KHz, 48 KHz and 96 KHz, and has 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.

#### 3.2. SPDIF Output

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

#### 3.3. Universal Jacks™

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

For the STAC9200 the Universal Jacks™ capabilities are as follows

- All of the STAC9200 ports support:
  - Line Out
  - Line In
  - Mic with 0/10/20/30/40 dB Mic Boost
- Ports A and D also support
  - Headphone Out<sup>1</sup>

<sup>1</sup>Headphone capabilities are available on pins 39/41 and 35/36, but one should not put headphone loads on both sets of pins at the same time.

*Note: On the STAC9200 only one function can be selected at a time, you cannot have an input and output at the same time on the same set of pins. This function can be changed at any time.*

#### 3.4. Audio Jack Presence Detect

Sense\_A pin is used to detect the presence of plugs in ports A, B, C, and D. Refer to the reference design for port detect circuitry. Select the precision of the resistors used as follows:

| AVDD Nominal Voltage<br>(+/- 5%) | Resistor Tolerance<br>(If Port D is used) | Resistor Tolerance<br>(If Port D is not used) |
|----------------------------------|-------------------------------------------|-----------------------------------------------|
| 5V                               | 1%                                        | 1%                                            |
| 4.5V                             | 1%                                        | 1%                                            |
| 4V                               | 0.50%                                     | 1%                                            |
| 3.3V                             | 0.10%                                     | 1%                                            |

Includes pull-up resistors on Sense A and series resistors between jack switch and Sense A.

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#### 4.1. Functional Block Diagram

The diagram illustrates the AZALIA LINK LOGIC architecture. It features several input pins on the left: Pin 47 (SPDIF IN), Pin 5 (SD0), Pin 6 (BIT\_CLK), Pin 8 (SDI), Pin 10 (SYNC), and Pin 11 (Reset #). These inputs feed into a central logic block. The logic block includes a SPDIF Receiver, four Stream/Channel Select blocks, and a DAC BYPASS MODE input. The outputs of the Stream/Channel Select blocks and the DAC BYPASS MODE input feed into a MUX. The MUX output goes to a PCM to SPDIF OUT block, which outputs SPDIF to Pin 48. The MUX also feeds into a DAC A Digital block, which is part of a feedback loop (Loop 1) with a DAC A Analog block. The DAC A Analog block outputs to a MUX, which then feeds into four output blocks: HP Out, HP Out, Line Out, and Line Out. These output blocks are connected to various pin complexes: Pin Complex Pins 39/41 (Port A), Pin Complex Pins 35/36 (Port D), Pin Complex Pins 23/24 (Port C), and Pin Complex Pins 21/22 (Port B). Additionally, the DAC A Analog block outputs to a MONO\_OUT block (Pin 37) and a STEREO ADC block. The STEREO ADC block outputs to a MUX, which then feeds into a MIC Boost block. The MIC Boost block outputs to a CD In block (Pin Complex Pins 18/20). The diagram also shows a Digital PC Beep input and an Analog PC Beep input (Pin 12) connected to the STEREO ADC block. A feedback loop (Loop 3) is shown from the DAC A Analog block back to the DAC A Digital block. A final output block (Loop 1) is shown at the bottom left, connected to the STEREO ADC block.

Pin 13: Sense A  
Pin 27: VREF In  
Pin 28: VREF Out (switchable Mic Bias)  
Pin 32: CAP 2  
Pin 33: GPIO0  
Pin 34: GPIO1  
Pin 45: GPIO2  
Pin 47: GPIO3

#### **4.2. STAC9200 Typical Connection Diagram for 48-pin LQFP**

Please see the reference design for this information.

#### **4.3. STAC9200 Split Independent Power Supply for 48-pin LQFP**

Please see the reference design for this information.

#### **4.4. STAC9200 Typical Connection Diagram for 32-pad QFN**

Please see the reference design for this information.

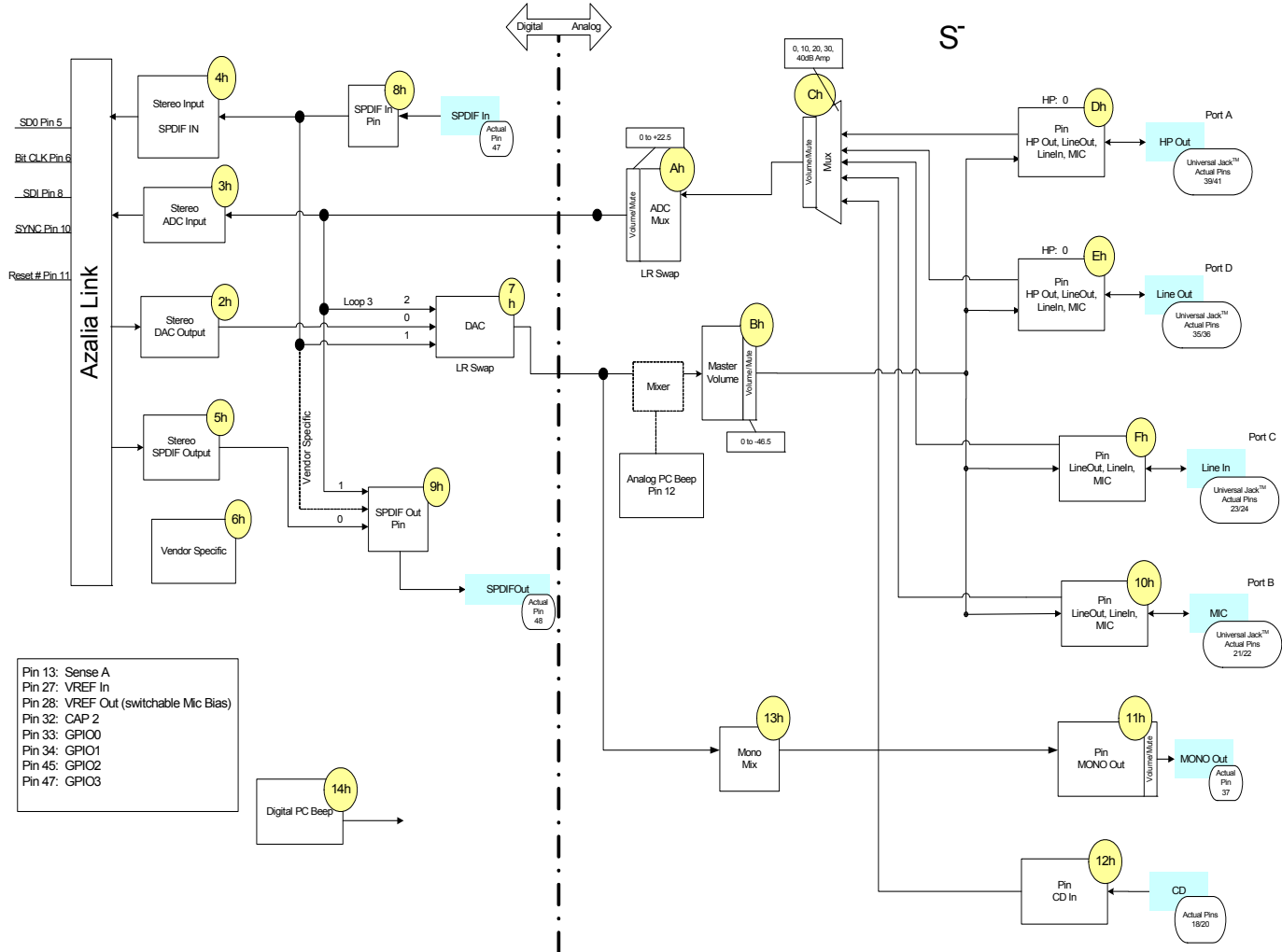
#### **4.5. STAC9200 Split Independent Power Supply for 32-pad QFN**

Please see the reference design for this information.

## 5. WIDGET INFORMATION

## 5.1. Widget Diagram

Figure 2. Widget Diagram



## STAC9200

### 2-Channel High Definition Audio Codec

#### 5.2. STAC9200 Widget List

| ID      | Widget Name          | Description                                                                 |
|---------|----------------------|-----------------------------------------------------------------------------|
| 1h      | Audio Function Group | Audio Function Group                                                        |
| 2h      | DAC0                 | Stereo Output to DAC                                                        |
| 3h      | ADC0                 | Stereo Input Mux from ADC                                                   |
| 4h      | SPDIF_IN             | Stereo Input for SPDIF_In                                                   |
| 5h      | SPDIF_OUT            | Stereo Output for SPDIF_Out                                                 |
| 6h      | Reserved             | Reserved: Unused                                                            |
| 7h      | DAC0Mux              | Digital Mux for DAC                                                         |
| 8h      | SPDIF-In Pin         | Pin Widget for SPDIF_In Pin 47                                              |
| 9h      | SPDIF-Out Pin        | Pin Widget for SPDIF_Out Pin 48                                             |
| 10h     | Mic                  | Mic Pin Widget pins 21/22 (can also act as Line Out and Line In)            |
| 11h     | Mono Out             | Mono Out Volume Controls and Capabilities for pin 37                        |
| 12h     | CD                   | CD Pin Widget pins 18/20                                                    |
| 13h     | Mono Mix             | Combines the Two Stereo Channels into one Mono Signal                       |
| 14h     | Digital PC Beep      | Digital PC Beep                                                             |
| 15h-19h | Reserved             | Reserved: Unused                                                            |
| Ah      | ADC0Mux              | ADC Mux and Volume Control for inputs to ADC                                |
| Bh      | Master Volume        | Master Volume Controls                                                      |
| Ch      | Input Mux            | Input Mux to ADC for Widgets Dh, Eh, Fh, 10h, and 12h                       |
| Dh      | Headphone            | Headphone Pin Widget pins 39/41 (can also act as Line In, Line Out ,or Mic) |
| Eh      | Line Out             | Line Out Pin Widget pins 35/36 (can also act as HP, Line In, or Mic)        |
| Fh      | Line In              | Line In Pin Widget pins 23/24 (can also act as Mic or Line Out)             |

**Table 3. High Definition Audio Widget**

*Note: All widgets in this document are applicable to the STAC9200 B1 Revision. For widgets pertaining to the STAC9200 A1 Revision, see STAC9200 Datasheet Revision 0.8.*

### 5.3. Root Node (NID = 0x00)

#### 5.3.1. Root PnpID

Table 4. Root PnpID Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 00      | See bitfield table |

Table 5. Root PnpID Command Response Format

| Bit      | Bitfield Name | RW | Reset  | Description                 |
|----------|---------------|----|--------|-----------------------------|
| [31..16] | Vendor        | R  | 0x8384 | Vendor ID STAC9200 = 8384h  |
| [15..0]  | Device        | R  | 0x7690 | Device ID: STAC9200 = 7690h |

#### 5.3.2. 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 Azalia spec.                              |
| [19..16] | Minor         | R  | 0x0   | Minor rev number of compliant Azalia spec.                              |
| [15..8]  | Vendor        | R  | 0x22  | Vendor rev number for this device ID:<br>STAC9200 = xxh                 |
| [7..0]   | Stepping      | R  | 0x01  | Vendor stepping number within the given<br>Vendor RevID: STAC9200 = xxh |

**5.3.3. Root NodeInfo****Table 8. Root NodeInfo Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 04      | See bitfield table |

**Table 9. Root NodeInfo Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                        |
|----------|---------------|----|-------|----------------------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x00  | Reserved                                           |
| [23.:16] | StartNID      | R  | 0x01  | Starting node number (NID) of first function group |
| [15.:8]  | Rsvd1         | R  | 0x00  | Reserved                                           |
| [7.:0]   | TotalNodes    | R  | 0x01  | Total number of nodes                              |

**5.4. AFG Node (NID = 0x01)****5.4.1. AFG Reset****Table 10. AFG Reset Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | 7FF     | 00                               | See bitfield table |
| <b>Set1</b> | 7FF     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 11. AFG Reset Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                                                                                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:0] | Response      | R  | 0x0   | Reserved. Overlaps Execute.                                                                                                                                                                                                                                                                                                                                                           |
| [0]     | Execute       | W  | 0x0   | Function Reset. Function Group reset is executed when the Set verb 7FF is written with 8-bit payload of 00h. The CODEC should issue a response to acknowledge receipt of the verb, and then reset the affected Function Group and all associated widgets to their power-on reset values. Some controls such as Configuration Default controls should not be reset. Overlaps Response. |

**5.4.2. AFG NodeInfo****Table 12. AFG NodeInfo Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 04      | See bitfield table |

**Table 13. AFG NodeInfo Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                |
|----------|---------------|----|-------|------------------------------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x0   | Reserved                                                   |
| [23.:16] | StartNID      | R  | 0x02  | Starting node number for function group subordinate nodes. |
| [15.:8]  | Rsvd1         | R  | 0x0   | Reserved                                                   |
| [7.:0]   | TotalNodes    | R  | 0x13  | Total number of nodes.                                     |

**5.4.3. AFG Type****Table 14. AFG Type Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 05      | See bitfield table |

**Table 15. AFG Type Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                   |
|---------|---------------|----|-------|-------------------------------------------------------------------------------------------------------------------------------|
| [31.:9] | Rsvd          | R  | 0x0   | Reserved                                                                                                                      |
| [8]     | Unsol         | R  | 0x1   | This node is capable of generating an unsolicited response, and will respond to the Unsolicited Response verb (Verb ID 708h). |
| [7.:0]  | NodeType      | R  | 0x01  | Node type = Audio Function Group                                                                                              |

**5.4.4. AFG GrpCap****Table 16. AFG GrpCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 08      | See bitfield table |

**Table 17. AFG GrpCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                                                                              |
|----------|---------------|----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..17] | Rsvd3         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [16]     | BeepGen       | R  | 0x1   | Optional Beep Generator is present                                                                                                                                                       |
| [15..12] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [11..8]  | InputDelay    | R  | 0xD   | Typical latency = 13 frames. Number of samples between when the sample is received as an analog signal at the pin and when the digital representation is transmitted on the Azalia link. |
| [7..4]   | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [3..0]   | OutputDelay   | R  | 0xD   | Typical latency = 13 frames. Number of samples between when the signal is received from the Azalia link and when it appears as an analog signal at the pin.                              |

**5.4.5. AFG FrmtCap****Table 18. AFG FrmtCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 0A      | See bitfield table |

**Table 19. AFG FrmtCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..21] | Rsvd2         | R  | 0x0   | Reserved                               |
| [20]     | B32           | R  | 0x0   | 32 bit audio formats are NOT supported |
| [19]     | B24           | R  | 0x1   | 24 bit audio formats are supported     |
| [18]     | B20           | R  | 0x1   | 20 bit audio formats are supported     |

Table 19. AFG FrmtCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                  |
|----------|---------------|----|-------|----------------------------------------------|
| [17]     | B16           | R  | 0x1   | 16 bit audio formats are supported           |
| [16]     | B8            | R  | 0x0   | 8 bit audio formats are NOT supported        |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                     |
| [11]     | R12           | R  | 0x0   | 384 KHz rate (8/1*48 KHz) NOT supported      |
| [10]     | R11           | R  | 0x1   | 192.0 KHz rate (4/1*48 KHz) supported        |
| [9]      | R10           | R  | 0x1   | 176.4 KHz rate (4/1*44.1 KHz) supported      |
| [8]      | R9            | R  | 0x1   | 96.0 KHz rate (2/1*48 KHz) supported         |
| [7]      | R8            | R  | 0x1   | 88.2KHz rate (2/1*44.1KHz) supported         |
| [6]      | R7            | R  | 0x1   | 48.0 KHz rate supported (REQUIRED)           |
| [5]      | R6            | R  | 0x1   | 44.1 KHz rate supported                      |
| [4]      | R5            | R  | 0x0   | 32.0 KHz rate (2/3*48 KHz) NOT supported     |
| [3]      | R4            | R  | 0x0   | 22.05 KHz rate (1/2*44.1 KHz) NOT supported  |
| [2]      | R3            | R  | 0x0   | 16.0 KHz rate (1/3*48 KHz) NOT supported     |
| [1]      | R2            | R  | 0x0   | 11.025 KHz rate (1/4*44.0 KHz) NOT supported |
| [0]      | R1            | R  | 0x0   | 8.0 KHz rate (1/6*48 KHz) NOT supported      |

#### 5.4.6. AFG StreamCap

Table 20. AFG StreamCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0B      | See bitfield table |

Table 21. AFG StreamCap Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                        |
|---------|---------------|----|-------|------------------------------------|
| [31..3] | Rsvd          | R  | 0x0   | Reserved                           |
| [2]     | NonPCM        | R  | 0x0   | No support for non-PCM (AC3) data. |

Table 21. AFG StreamCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                          |
|-----|---------------|----|-------|------------------------------------------------------|
| [1] | Float32       | R  | 0x0   | No support for single-precision floating-point data. |
| [0] | PCM           | R  | 0x1   | PCM-formatted data supported.                        |

#### 5.4.7. AFG PwrCap

Table 22. AFG PwrCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0F      | See bitfield table |

Table 23. AFG PwrCap Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                               |
|---------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:4] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                                  |
| [3]     | D3            | R  | 0x1   | Power State D3 is supported. Allows for lowest possible power consuming state under software control (and still properly respond to a subsequent Power State command).                                    |
| [2]     | D2            | R  | 0x1   | Power State D2 is supported. Allows for lowest possible power consuming state from which it can return to fully on state within 10 ms.                                                                    |
| [1]     | D1            | R  | 0x1   | Power State D1 is supported. Allows for lowest possible power consuming state from which it can return to fully on state within 10 ms, excepting analog pass-through circuits which must remain fully on. |
| [0]     | D0            | R  | 0x1   | Power State D0 is supported. Node power state is fully on.                                                                                                                                                |

**5.4.8. AFG GPIOCap****Table 24. AFG GPIOCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 11      | See bitfield table |

**Table 25. AFG GPIOCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                         |
|----------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31]     | GPIWake       | R  | 0x1   | Wake capability. Assuming the Wake Enable Mask controls are enabled, GPIOs configured as inputs can cause a wake (generate a Status Change event on the link) when there is a change in level on the pin.           |
| [30]     | GPIUnsol      | R  | 0x1   | Unsolicited Response capability. Assuming the Unsolicited Enable Mask controls are enabled, GPIOs configured as inputs can generate an Unsolicited Response on the link when there is a change in level on the pin. |
| [29.:24] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                                            |
| [23.:16] | NumGPIs       | R  | 0x00  | Number of GPI pins supported                                                                                                                                                                                        |
| [15.:8]  | NumGPOs       | R  | 0x00  | Number of GPO pins supported                                                                                                                                                                                        |
| [7.:0]   | NumGPIOs      | R  | 0x04  | Number of GPIO pins supported                                                                                                                                                                                       |

**5.4.9. AFG OutAmpCap****Table 26. AFG OutAmpCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 12      | See bitfield table |

**Table 27. AFG OutAmpCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                 |
|----------|---------------|----|-------|---------------------------------------------|
| [31]     | Mute          | R  | 0x1   | Amplifier is capable of muting              |
| [30.:23] | Rsvd3         | R  | 0x0   | Reserved                                    |
| [22.:16] | StepSize      | R  | 0x05  | Size of each step in the gain range = 1.5dB |
| [15]     | Rsvd2         | R  | 0x0   | Reserved                                    |

Table 27. AFG OutAmpCap Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                              |
|---------|---------------|----|-------|----------------------------------------------------------|
| [14.:8] | NumSteps      | R  | 0x1F  | Number of steps in the gain range = 32 (-46.5dB to +0dB) |
| [7]     | Rsvd1         | R  | 0x0   | Reserved                                                 |
| [6.:0]  | Offset        | R  | 0x1F  | 0dB-step is programmed with this offset                  |

## 5.4.10. AFG PwrState

Table 28. AFG PwrState Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F05     | 00                               | See bitfield table |
| <b>Set1</b> | 705     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 29. AFG PwrState Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                          |
|---------|---------------|----|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                                             |
| [7.:4]  | Act           | R  | 0x2   | PS-Act: Actual power state of referenced node.                                                                                                                                                                       |
| [3.:2]  | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                                             |
| [1.:0]  | Set           | RW | 0x2   | PS-Set: Current power setting of referenced node.<br>0: All Powered-On<br>1: D1 => PR0, PR1<br>2: D2 => PR0, PR1, PR2, PR6, EAPD<br>3: D3 => PR6, PR5, PR3, PR2, PR1, PR0, EAPD<br>Note: PR4 is not mapped in Azalia |

**5.4.11. AFG UnsolResp****Table 30. AFG UnsolResp Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F08     | 00                               | See bitfield table |
| <b>Set1</b> | 708     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 31. AFG UnsolResp Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                        |
|---------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd2         | R  | 0x0   | Reserved                                                                                                           |
| [7]     | En            | RW | 0x0   | Allow generation of Unsolicited Responses.                                                                         |
| [6]     | Rsvd1         | R  | 0x0   | Reserved                                                                                                           |
| [5..0]  | Tag           | RW | 0x0   | Software programmable field returned in top six bits (31:26) of every Unsolicited Response generated by this node. |

**5.4.12. AFG GPIO****Table 32. AFG GPIO Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F15     | 00                               | See bitfield table |
| <b>Set1</b> | 715     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 33. AFG GPIO Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                            |
|---------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..4] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                               |
| [3]     | Data3         | RW | 0x0   | Data for GPIO3 (Pin 47/EAPD). If this GPIO bit is configured as Sticky (edge-sensitive) input, it can be cleared by writing zero (one) here when the corresponding Polarity Control bit is zero (one). |
| [2]     | Data2         | RW | 0x0   | Data for GPIO2 (Pin 45). If this GPIO bit is configured as Sticky (edge-sensitive) input, it can be cleared by writing zero (one) here when the corresponding Polarity Control bit is zero (one).      |

Table 33. AFG GPIO Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                                                                                                                                       |
|-----|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [1] | Data1         | RW | 0x0   | Data for GPIO1 (Pin 34). If this GPIO bit is configured as Sticky (edge-sensitive) input, it can be cleared by writing zero (one) here when the corresponding Polarity Control bit is zero (one). |
| [0] | Data0         | RW | 0x0   | Data for GPIO0 (Pin 33). If this GPIO bit is configured as Sticky (edge-sensitive) input, it can be cleared by writing zero (one) here when the corresponding Polarity Control bit is zero (one). |

## 5.4.13. AFG GPIOEn

Table 34. AFG GPIOEn Command Verb Format

|      | Verb ID | Payload                          | Response           |
|------|---------|----------------------------------|--------------------|
| Get  | F16     | 00                               | See bitfield table |
| Set1 | 716     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 35. AFG GPIOEn Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                               |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------|
| [31..4] | Rsvd          | R  | 0x0   | Reserved                                                                                                                  |
| [3]     | Mask3         | RW | 0x0   | Enable for GPIO3:<br>0= pin is disabled (Hi-Z state);<br>1= pin is enabled; behavior determined by GPIO Direction control |
| [2]     | Mask2         | RW | 0x0   | Enable for GPIO2:<br>0= pin is disabled (Hi-Z state);<br>1= pin is enabled; behavior determined by GPIO Direction control |
| [1]     | Mask1         | RW | 0x0   | Enable for GPIO1:<br>0= pin is disabled (Hi-Z state);<br>1= pin is enabled; behavior determined by GPIO Direction control |
| [0]     | Mask0         | RW | 0x0   | Enable for GPIO0:<br>0= pin is disabled (Hi-Z state);<br>1= pin is enabled; behavior determined by GPIO Direction control |

**5.4.14. AFG GPIODir****Table 36. AFG GPIODir Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F17     | 00                               | See bitfield table |
| <b>Set1</b> | 717     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 37. AFG GPIODir Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                    |
|---------|---------------|----|-------|----------------------------------------------------------------------------------------------------------------|
| [31..4] | Rsvd          | R  | 0x0   | Reserved                                                                                                       |
| [3]     | Control3      | RW | 0x0   | Direction control for GPIO3<br>0= GPIO signal is configured as input<br>1= GPIO signal is configured as output |
| [2]     | Control2      | RW | 0x0   | Direction control for GPIO2<br>0= GPIO signal is configured as input<br>1= GPIO signal is configured as output |
| [1]     | Control1      | RW | 0x0   | Direction control for GPIO1<br>0= GPIO signal is configured as input<br>1= GPIO signal is configured as output |
| [0]     | Control0      | RW | 0x0   | Direction control for GPIO0<br>0= GPIO signal is configured as input<br>1= GPIO signal is configured as output |

**5.4.15. AFG GPIOWake****Table 38. AFG GPIOWake Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F18     | 00                               | See bitfield table |
| <b>Set1</b> | 718     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 39. AFG GPIOWake Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                 |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..4] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                    |
| [3]     | En3           | RW | 0x0   | Wake enable for GPIO3:<br>0 = wake-up event is disabled;<br>1= when Azalia link is powered down (RST# is asserted), a wake-up event will trigger a Status Change Request event on the link. |
| [2]     | En2           | RW | 0x0   | Wake enable for GPIO2:<br>0 = wake-up event is disabled;<br>1= when Azalia link is powered down (RST# is asserted), a wake-up event will trigger a Status Change Request event on the link. |
| [1]     | En1           | RW | 0x0   | Wake enable for GPIO1:<br>0 = wake-up event is disabled;<br>1= when Azalia link is powered down (RST# is asserted), a wake-up event will trigger a Status Change Request event on the link. |
| [0]     | En0           | RW | 0x0   | Wake enable for GPIO0:<br>0 = wake-up event is disabled;<br>1= when Azalia link is powered down (RST# is asserted), a wake-up event will trigger a Status Change Request event on the link. |

**5.4.16. AFG GPIOUnsolEn****Table 40. AFG GPIOUnsolEn Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F19     | 00                               | See bitfield table |
| <b>Set1</b> | 719     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 41. AFG GPIOUnsolEn Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                 |
|---------|---------------|----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..4] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                                    |
| [3]     | Mask3         | RW | 0x0   | Unsolicited enable mask for GPIO3. If set, and the Unsolicited Response control for this widget has been enabled, an unsolicited response will be sent when GPIO3 is configured as input and changes state. |
| [2]     | Mask2         | RW | 0x0   | Unsolicited enable mask for GPIO2. If set, and the Unsolicited Response control for this widget has been enabled, an unsolicited response will be sent when GPIO2 is configured as input and changes state. |
| [1]     | Mask1         | RW | 0x0   | Unsolicited enable mask for GPIO1. If set, and the Unsolicited Response control for this widget has been enabled, an unsolicited response will be sent when GPIO1 is configured as input and changes state. |
| [0]     | Mask0         | RW | 0x0   | Unsolicited enable mask for GPIO0. If set, and the Unsolicited Response control for this widget has been enabled, an unsolicited response will be sent when GPIO0 is configured as input and changes state. |

**5.4.17. AFG GPIOSticky****Table 42. AFG GPIOSticky Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F1A     | 00                               | See bitfield table |
| <b>Set1</b> | 71A     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 43. AFG GPIOSticky Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                                                                                   |
|---------|---------------|----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..4] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                                                                                                      |
| [3]     | Mask3         | RW | 0x0   | GPIO3 input type (when configured as input):<br>0= Non-Sticky (level-sensitive);<br>1= Sticky (edge-sensitive).<br>Sticky inputs are cleared by writing zero to<br>corresponding bit of GPIO Data register.<br>GPIOPolarity determines rising or falling edge<br>sensitivity. |
| [2]     | Mask2         | RW | 0x0   | GPIO2 input type (when configured as input):<br>0= Non-Sticky (level-sensitive);<br>1= Sticky (edge-sensitive).<br>Sticky inputs are cleared by writing zero to<br>corresponding bit of GPIO Data register.<br>GPIOPolarity determines rising or falling edge<br>sensitivity. |
| [1]     | Mask1         | RW | 0x0   | GPIO1 input type (when configured as input):<br>0= Non-Sticky (level-sensitive);<br>1= Sticky (edge-sensitive).<br>Sticky inputs are cleared by writing zero to<br>corresponding bit of GPIO Data register.<br>GPIOPolarity determines rising or falling edge<br>sensitivity. |
| [0]     | Mask0         | RW | 0x0   | GPIO0 input type (when configured as input):<br>0= Non-Sticky (level-sensitive);<br>1= Sticky (edge-sensitive).<br>Sticky inputs are cleared by writing zero to<br>corresponding bit of GPIO Data register.<br>GPIOPolarity determines rising or falling edge<br>sensitivity. |

**5.4.18. AFG SysID****Table 44. AFG SysID Command Verb Format**

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F20     | 00                                 | See bitfield table |
| <b>Set1</b> | 720     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 721     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 722     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 723     | See bits [31:24] of bitfield table | 0000_0000h         |

**Table 45. AFG SysID Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                    |
|----------|---------------|----|-------|------------------------------------------------|
| [31.:24] | Subsystem3    | RW | 0x00  | Subsystem ID. (Any non-zero value)             |
| [23.:16] | Subsystem2    | RW | 0x00  |                                                |
| [15.:8]  | Subsystem1    | RW | 0x01  |                                                |
| [7.:0]   | Assembly      | RW | 0x00  | Assembly ID. (Not applicable to CODEC vendors) |

**5.5. DAC0Cnvtr Node (NID = 0x02)****5.5.1. DAC0Cnvtr Frmt****Table 46. DAC0Cnvtr Frmt Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | A       | 0000                              | See bitfield table |
| <b>Set1</b> | 2       | See bits [15:0] of bitfield table | 0000_0000h         |

**Table 47. DAC0Cnvtr Frmt Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                 |
|----------|---------------|----|-------|-------------------------------------------------------------|
| [31.:16] | Rsvd2         | R  | 0x0   | Reserved                                                    |
| [15]     | StrmType      | R  | 0x0   | Stream Type: only PCM streams are supported by this widget. |

Table 47. DAC0Cnvtr Frmt Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                                                                              |
|----------|---------------|----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [14]     | RateBase      | RW | 0x0   | Sample Base Rate<br>0= 48 KHz<br>1= 44.1 KHz                                                                                                                                             |
| [13.:11] | RateMult      | RW | 0x0   | Sample Base Rate Multiple<br>000= 48 KHz / 44.1 KHz or less<br>001= x2<br>010= Reserved (x3)<br>011= x4<br>100-111= Reserved                                                             |
| [10.:8]  | RateDiv       | RW | 0x0   | Sample Base Rate Divisor<br>000= Divide by 1<br>001= Divide by 2<br>010= Divide by 3<br>011= Divide by 4<br>100= Divide by 5<br>101= Divide by 6<br>110= Divide by 7<br>111= Divide by 8 |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [6.:4]   | NumBits       | RW | 0x3   | Bits per Sample<br>000= 8 bits<br>001= 16 bits<br>010= 20 bits<br>011= 24 bits<br>100-111= Reserved                                                                                      |
| [3.:0]   | NumChan       | RW | 0x1   | Number of Channels in each frame of the stream.<br>0000= 1 channel<br>0001 = 2 channels<br>...<br>1111= 16 channels                                                                      |

5.5.2. *DAC0Cnvtr WCap*

Table 48. DAC0Cnvtr WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 49. DAC0Cnvtr WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                          |
|----------|---------------|----|-------|--------------------------------------------------------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x0   | Reserved                                                                             |
| [23.:20] | Type          | R  | 0x0   | Widget type = Audio Output                                                           |
| [19.:16] | Delay         | R  | 0xD   | Number of sample delays through widget                                               |
| [15.:12] | Rsvd1         | R  | 0x0   | Reserved                                                                             |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                                |
| [10]     | PwrCntrl      | R  | 0x1   | Power State control is supported                                                     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                                                     |
| [8]      | ConnList      | R  | 0x0   | No connection list is present                                                        |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response                                                  |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                     |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                              |
| [4]      | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead       |
| [3]      | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2]      | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1]      | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0]      | Stereo        | R  | 0x1   | Stereo widget                                                                        |

**5.5.3. DAC0Cnvtr PwrState****Table 50. DAC0Cnvtr PwrState Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F05     | 00                               | See bitfield table |
| <b>Set1</b> | 705     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 51. DAC0Cnvtr PwrState Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                   |
|---------|---------------|----|-------|-------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                      |
| [7.:4]  | Act           | R  | 0x3   | PS-Act: Actual power state of referenced node.                                                                                |
| [3.:2]  | Rsvd1         | R  | 0x0   | Reserved                                                                                                                      |
| [1.:0]  | Set           | RW | 0x3   | PS-Set: Current power setting of referenced node.<br>00 - Fully on.<br>01 - Fully on.<br>10 - Fully on.<br>11 - Powered down. |

**5.5.4. DAC0Cnvtr Stream****Table 52. DAC0Cnvtr Stream Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F06     | 00                               | See bitfield table |
| <b>Set1</b> | 706     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 53. DAC0Cnvtr Stream Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved                                                                                                                              |
| [7.:4]  | ID            | RW | 0x0   | Software-programmable integer representing link stream ID used by the converter widget. By convention stream 0 is reserved as unused. |
| [3.:0]  | Ch            | RW | 0x0   | Integer representing lowest channel used by converter.                                                                                |

## 5.6. ADC0Cnvtr Node (NID = 0x03)

### 5.6.1. ADC0Cnvtr Frmt

Table 54. ADC0Cnvtr Frmt Command Verb Format

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | A       | 0000                              | See bitfield table |
| <b>Set1</b> | 2       | See bits [15:0] of bitfield table | 0000_0000h         |

Table 55. ADC0Cnvtr Frmt Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                                                                              |
|----------|---------------|----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:16] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [15]     | StrmType      | RW | 0x0   | Stream Type<br>0= PCM<br>1= Non-PCM<br>(remaining bits in this verb have other meanings)                                                                                                 |
| [14]     | RateBase      | RW | 0x0   | Sample Base Rate<br>0= 48 KHz<br>1= 44.1 KHz                                                                                                                                             |
| [13.:11] | RateMult      | RW | 0x0   | Sample Base Rate Multiple<br>000= 48 KHz / 44.1 KHz or less<br>001= x2<br>010= Reserved (x3)<br>011= x4<br>100-111= Reserved                                                             |
| [10.:8]  | RateDiv       | RW | 0x0   | Sample Base Rate Divisor<br>000= Divide by 1<br>001= Divide by 2<br>010= Divide by 3<br>011= Divide by 4<br>100= Divide by 5<br>101= Divide by 6<br>110= Divide by 7<br>111= Divide by 8 |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                 |

Table 55. ADC0Cnvtr Frmt Command Response Format

| Bit    | Bitfield Name | RW | Reset | Description                                                                                                         |
|--------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------|
| [6.:4] | NumBits       | RW | 0x3   | Bits per Sample<br>000= 8 bits<br>001= 16 bits<br>010= 20 bits<br>011= 24 bits<br>100-111= Reserved                 |
| [3.:0] | NumChan       | RW | 0x1   | Number of Channels in each frame of the stream.<br>0000= 1 channel<br>0001 = 2 channels<br>...<br>1111= 16 channels |

### 5.6.2. ADC0Cnvtr WCap

Table 56. ADC0Cnvtr WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 57. ADC0Cnvtr WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                              |
|----------|---------------|----|-------|--------------------------------------------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x0   | Reserved                                                                 |
| [23.:20] | Type          | R  | 0x1   | Widget type = Audio Input                                                |
| [19.:16] | Delay         | R  | 0xD   | Number of sample delays through widget                                   |
| [15.:12] | Rsvd1         | R  | 0x0   | Reserved                                                                 |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                    |
| [10]     | PwrCntrl      | R  | 0x1   | Power State control is supported                                         |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                                         |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                                               |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response                                      |
| [6]      | ProcWidget    | R  | 0x1   | Software should query the Processing Controls parameter for this widget. |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                  |

Table 57. ADC0Cnvtr WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [4] | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead       |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                        |

### 5.6.3. ADC0Cnvtr ConnLen

Table 58. ADC0Cnvtr ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 59. ADC0Cnvtr ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6.:0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.6.4. ADC0Cnvtr ConnLst****Table 60. ADC0Cnvtr ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 61. ADC0Cnvtr ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry. |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry. |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry. |
| [7.:0]   | Entry0        | R  | 0x0A  | ADC Mux widget.    |

**5.6.5. ADC0Cnvtr ProcState****Table 62. ADC0Cnvtr ProcState Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F03     | 00                               | See bitfield table |
| <b>Set1</b> | 703     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 63. ADC0Cnvtr ProcState Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                     |
|---------|---------------|----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                        |
| [7]     | HPFOffsetDis  | RW | 0x0   | High Pass Filter Offset Calculation Disable<br>0 = Calculation enabled.<br>1 = Calculation disabled.                                            |
| [6.:2]  | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                        |
| [1.:0]  | HPFByp        | RW | 0x1   | Processing State = 00 (OFF): bypass the ADC high pass filter;<br>Processing State = 01, 10, 11 (ON or BENIGN): ADC high pass filter is enabled. |

**5.6.6. ADC0Cnvtr PwrState****Table 64. ADC0Cnvtr PwrState Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F05     | 00                               | See bitfield table |
| <b>Set1</b> | 705     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 65. ADC0Cnvtr PwrState Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                         |
|---------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                            |
| [7..4]  | Act           | R  | 0x3   | PS-Act: Actual power state of referenced node.                                                                                                      |
| [3..2]  | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                            |
| [1..0]  | Set           | RW | 0x3   | PS-Set: Current power setting of referenced node.<br>00 - Fully on.<br>01 - Fully on.<br>10 - Fully on.<br>11 - Powered down (default powered down) |

**5.6.7. ADC0Cnvtr Stream****Table 66. ADC0Cnvtr Stream Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F06     | 00                               | See bitfield table |
| <b>Set1</b> | 706     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 67. ADC0Cnvtr Stream Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved                                                                                                                              |
| [7..4]  | ID            | RW | 0x0   | Software-programmable integer representing link stream ID used by the converter widget. By convention stream 0 is reserved as unused. |
| [3..0]  | Ch            | RW | 0x0   | Integer representing lowest channel used by converter                                                                                 |

## 5.7. SPDIFinCnvtr Node (NID = 0x04)

### 5.7.1. SPDIFinCnvtr Frmt

Table 68. SPDIFinCnvtr Frmt Command Verb Format

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | A       | 0000                              | See bitfield table |
| <b>Set1</b> | 2       | See bits [15:0] of bitfield table | 0000_0000h         |

Table 69. SPDIFinCnvtr Frmt Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                                                                              |
|----------|---------------|----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..16] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [15]     | StrmType      | RW | 0x0   | N/A. (Stream Type)<br>0= PCM<br>1= Non-PCM                                                                                                                                               |
| [14]     | RateBase      | RW | 0x0   | Sample Base Rate<br>0= 48 KHz<br>1= 44.1 KHz                                                                                                                                             |
| [13..11] | RateMult      | RW | 0x0   | Sample Base Rate Multiple<br>000= 48 KHz / 44.1 KHz or less<br>001= x2<br>010= Reserved (x3)<br>011= x4 100-111= Reserved                                                                |
| [10..8]  | RateDiv       | RW | 0x0   | Sample Base Rate Divisor<br>000= Divide by 1<br>001= Divide by 2<br>010= Divide by 3<br>011= Divide by 4<br>100= Divide by 5<br>101= Divide by 6<br>110= Divide by 7<br>111= Divide by 8 |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                 |

Table 69. SPDIFinCnvtr Frmt Command Response Format

| Bit    | Bitfield Name | RW | Reset | Description                                                                                                         |
|--------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------|
| [6..4] | NumBits       | RW | 0x3   | Bits per Sample<br>000= 8 bits<br>001= 16 bits<br>010= 20 bits<br>011= 24 bits<br>100-111= Reserved                 |
| [3..0] | NumChan       | RW | 0x1   | Number of Channels in each frame of the stream.<br>0000= 1 channel<br>0001 = 2 channels<br>...<br>1111= 16 channels |

### 5.7.2. SPDIFinCnvtr WCap

Table 70. SPDIFinCnvtr WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 71. SPDIFinCnvtr WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x1   | Widget type = Audio Input              |
| [19..16] | Delay         | R  | 0x4   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x1   | Widget supports a Digital stream       |
| [8]      | ConnList      | R  | 0x1   | Connection list is present             |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response    |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter       |
| [5]      | Stripe        | R  | 0x0   | No support for striping                |

Table 71. SPDIFinCnvtr WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [4] | FormatOvrd    | R  | 0x1   | Widget contains format info; software should query                                   |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                        |

### 5.7.3. SPDIFinCnvtr FrmtCap

Table 72. SPDIFinCnvtr FrmtCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0A      | See bitfield table |

Table 73. SPDIFinCnvtr FrmtCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                 |
|----------|---------------|----|-------|---------------------------------------------|
| [31..21] | Rsvd2         | R  | 0x0   | Reserved                                    |
| [20]     | B32           | R  | 0x0   | 32 bit audio formats are NOT supported      |
| [19]     | B24           | R  | 0x1   | 24 bit audio formats are supported          |
| [18]     | B20           | R  | 0x1   | 20 bit audio formats are supported          |
| [17]     | B16           | R  | 0x1   | 16 bit audio formats are supported          |
| [16]     | B8            | R  | 0x0   | 8 bit audio formats are NOT supported       |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                    |
| [11]     | R12           | R  | 0x0   | 384 KHz rate (8/1*48 KHz) NOT supported     |
| [10]     | R11           | R  | 0x0   | 192.0 KHz rate (4/1*48 KHz) NOT supported   |
| [9]      | R10           | R  | 0x0   | 176.4 KHz rate (4/1*44.1 KHz) NOT supported |
| [8]      | R9            | R  | 0x1   | 96.0 KHz rate (2/1*48 KHz) supported        |
| [7]      | R8            | R  | 0x0   | 88.2 KHz rate (2/1*44.1 KHz) NOT supported  |
| [6]      | R7            | R  | 0x1   | 48.0 KHz rate supported (REQUIRED)          |

Table 73. SPDIFinCnvtr FrmtCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                  |
|-----|---------------|----|-------|----------------------------------------------|
| [5] | R6            | R  | 0x1   | 44.1 KHz rate supported                      |
| [4] | R5            | R  | 0x0   | 32.0 KHz rate (2/3*48 KHz) NOT supported     |
| [3] | R4            | R  | 0x0   | 22.05 KHz rate (1/2*44.1 KHz) NOT supported  |
| [2] | R3            | R  | 0x0   | 16.0 KHz rate (1/3*48 KHz) NOT supported     |
| [1] | R2            | R  | 0x0   | 11.025 KHz rate (1/4*44.0 KHz) NOT supported |
| [0] | R1            | R  | 0x0   | 8.0 KHz rate (1/6*48 KHz) NOT supported      |

#### 5.7.4. SPDIFinCnvtr StreamCap

Table 74. SPDIFinCnvtr StreamCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0B      | See bitfield table |

Table 75. SPDIFinCnvtr StreamCap Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                   |
|---------|---------------|----|-------|-------------------------------|
| [31..3] | Rsvd          | R  | 0x0   | Reserved                      |
| [2]     | NonPCM        | R  | 0x1   | Non-PCM data supported.       |
| [1]     | Float32       | R  | 0x0   | No support for Float32 data.  |
| [0]     | PCM           | R  | 0x1   | PCM-formatted data supported. |

**5.7.5. SPDIFinCnvtr ConnLen****Table 76. SPDIFinCnvtr ConnLen Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

**Table 77. SPDIFinCnvtr ConnLen Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6.:0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.7.6. SPDIFinCnvtr ConnLst****Table 78. SPDIFinCnvtr ConnLst Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F02     | 00      | See bitfield table |

**Table 79. SPDIFinCnvtr ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description          |
|----------|---------------|----|-------|----------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry.   |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry.   |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry.   |
| [7.:0]   | Entry0        | R  | 0x08  | SPDIF-In Pin widget. |

**5.7.7. SPDIFinCnvtr Stream****Table 80. SPDIFinCnvtr Stream Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F06     | 00                               | See bitfield table |
| <b>Set1</b> | 706     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 81. SPDIFinCnvtr Stream Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved                                                                                                                              |
| [7.:4]  | ID            | RW | 0x0   | Software-programmable integer representing link stream ID used by the converter widget. By convention stream 0 is reserved as unused. |
| [3.:0]  | Ch            | RW | 0x0   | Integer representing lowest channel used by converter                                                                                 |

**5.7.8. SPDIFinCnvtr DigCtl****Table 82. SPDIFinCnvtr DigCtl Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F0D     | 00                                | See bitfield table |
| <b>Set1</b> | 70D     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 70E     | See bits [15:8] of bitfield table | 0000_0000h         |

**Table 83. SPDIFinCnvtr DigCtl Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description             |
|----------|---------------|----|-------|-------------------------|
| [31.:15] | Rsvd2         | R  | 0x0   | Reserved                |
| [14.:8]  | CC            | R  | 0x00  | CC[6:0] - Category Code |
| [7]      | L             | R  | 0x0   | L - Generation Level    |
| [6]      | PRO           | R  | 0x0   | PRO - Professional      |
| [5]      | AUDIO         | R  | 0x0   | /AUDIO - Non-Audio      |
| [4]      | COPY          | R  | 0x0   | COPY - Copyright        |
| [3]      | PRE           | R  | 0x0   | PRE - Preemphasis       |

Table 83. SPDIFinCnvtr DigCtl Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                        |
|-----|---------------|----|-------|----------------------------------------------------|
| [2] | Rsvd1         | R  | 0x0   | Reserved (VCFG bit applies only to output streams) |
| [1] | V             | R  | 0x0   | V - Validity                                       |
| [0] | DigEn         | RW | 0x0   | DigEn - Digital Enable                             |

## 5.8. SPDIFoutCnvtr Node (NID = 0x05)

### 5.8.1. SPDIFoutCnvtr Frmt

Table 84. SPDIFoutCnvtr Frmt Command Verb Format

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | A       | 0000                              | See bitfield table |
| <b>Set1</b> | 2       | See bits [15:0] of bitfield table | 0000_0000h         |

Table 85. SPDIFoutCnvtr Frmt Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                       |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------|
| [31.:16] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                          |
| [15]     | StrmType      | RW | 0x0   | Stream Type<br>0= PCM<br>1= Non-PCM<br>(remaining bits in this verb have other meanings)                                          |
| [14]     | RateBase      | RW | 0x0   | Sample Base Rate<br>0= 48 KHz<br>1= 44.1 KHz                                                                                      |
| [13.:11] | RateMult      | RW | 0x0   | Sample Base Rate Multiple:<br>000= 48 KHz / 44.1 KHz or less;<br>001= x2;<br>010= Reserved (x3);<br>011= x4;<br>100-111= Reserved |

Table 85. SPDIFoutCnvtr Frmt Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                              |
|---------|---------------|----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [10..8] | RateDiv       | RW | 0x0   | Sample Base Rate Divisor<br>000= Divide by 1<br>001= Divide by 2<br>010= Divide by 3<br>011= Divide by 4<br>100= Divide by 5<br>101= Divide by 6<br>110= Divide by 7<br>111= Divide by 8 |
| [7]     | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                 |
| [6..4]  | NumBits       | RW | 0x3   | Bits per Sample<br>000= 8 bits<br>001= 16 bits<br>010= 20 bits<br>011= 24 bits<br>100-111= Reserved                                                                                      |
| [3..0]  | NumChan       | RW | 0x1   | Number of Channels in each frame of the stream.<br>0000= 1 channel<br>0001 = 2 channels<br>...<br>1111= 16 channels                                                                      |

### 5.8.2. SPDIFoutCnvtr WCap

Table 86. SPDIFoutCnvtr WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 87. SPDIFoutCnvtr WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x0   | Widget type = Audio Output             |
| [19..16] | Delay         | R  | 0x4   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |

Table 87. SPDIFoutCnvtr WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [9] | DigitalStrm   | R  | 0x1   | Widget supports a Digital stream                                                     |
| [8] | ConnList      | R  | 0x0   | No connection list is present                                                        |
| [7] | UnsolCap      | R  | 0x0   | No support for Unsolicited Response                                                  |
| [6] | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                     |
| [5] | Stripe        | R  | 0x0   | No support for striping                                                              |
| [4] | FormatOvrd    | R  | 0x1   | Widget contains format info; software should query                                   |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                        |

### 5.8.3. SPDIFoutCnvtr FrmtCap

Table 88. SPDIFoutCnvtr FrmtCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0A      | See bitfield table |

Table 89. SPDIFoutCnvtr FrmtCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..21] | Rsvd2         | R  | 0x0   | Reserved                               |
| [20]     | B32           | R  | 0x0   | 32 bit audio formats are NOT supported |
| [19]     | B24           | R  | 0x1   | 24 bit audio formats are supported     |
| [18]     | B20           | R  | 0x1   | 20 bit audio formats are supported     |
| [17]     | B16           | R  | 0x1   | 16 bit audio formats are supported     |
| [16]     | B8            | R  | 0x0   | 8 bit audio formats are NOT supported  |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |

Table 89. SPDIFoutCnvtr FrmtCap Command Response Format

| Bit  | Bitfield Name | RW | Reset | Description                                  |
|------|---------------|----|-------|----------------------------------------------|
| [11] | R12           | R  | 0x0   | 384 KHz rate (8/1*48 KHz) NOT supported      |
| [10] | R11           | R  | 0x0   | 192.0 KHz rate (4/1*48 KHz) NOT supported    |
| [9]  | R10           | R  | 0x0   | 176.4 KHz rate (4/1*44.1 KHz) NOT supported  |
| [8]  | R9            | R  | 0x1   | 96.0 KHz rate (2/1*48 KHz) supported         |
| [7]  | R8            | R  | 0x1   | 88.2 KHz rate (2/1*44.1 KHz) supported       |
| [6]  | R7            | R  | 0x1   | 48.0 KHz rate supported (REQUIRED)           |
| [5]  | R6            | R  | 0x1   | 44.1 KHz rate supported                      |
| [4]  | R5            | R  | 0x0   | 32.0 KHz rate (2/3*48 KHz) NOT supported     |
| [3]  | R4            | R  | 0x0   | 22.05 KHz rate (1/2*44.1 KHz) NOT supported  |
| [2]  | R3            | R  | 0x0   | 16.0 KHz rate (1/3*48 KHz) NOT supported     |
| [1]  | R2            | R  | 0x0   | 11.025 KHz rate (1/4*44.0 KHz) NOT supported |
| [0]  | R1            | R  | 0x0   | 8.0 KHz rate (1/6*48 KHz) NOT supported      |

#### 5.8.4. SPDIFoutCnvtr StreamCap

Table 90. SPDIFoutCnvtr StreamCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0B      | See bitfield table |

Table 91. SPDIFoutCnvtr StreamCap Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                   |
|---------|---------------|----|-------|-------------------------------|
| [31..3] | Rsvd          | R  | 0x0   | Reserved                      |
| [2]     | NonPCM        | R  | 0x1   | Non-PCM data supported.       |
| [1]     | Float32       | R  | 0x0   | No support for Float32 data.  |
| [0]     | PCM           | R  | 0x1   | PCM-formatted data supported. |

**5.8.5. SPDIFoutCnvtr Stream****Table 92. SPDIFoutCnvtr Stream Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F06     | 00                               | See bitfield table |
| <b>Set1</b> | 706     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 93. SPDIFoutCnvtr Stream Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved                                                                                                                              |
| [7..4]  | ID            | RW | 0x0   | Software-programmable integer representing link stream ID used by the converter widget. By convention stream 0 is reserved as unused. |
| [3..0]  | Ch            | RW | 0x0   | Integer representing lowest channel used by converter                                                                                 |

**5.8.6. SPDIFoutCnvtr DigCtl****Table 94. SPDIFoutCnvtr DigCtl Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F0D     | 00                                | See bitfield table |
| <b>Set1</b> | 70D     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 70E     | See bits [15:8] of bitfield table | 0000_0000h         |

**Table 95. SPDIFoutCnvtr DigCtl Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description             |
|----------|---------------|----|-------|-------------------------|
| [31..16] | Rsvd2         | R  | 0x0   | Reserved                |
| [15]     | Rsvd1         | R  | 0x0   | Reserved                |
| [14..8]  | CC            | RW | 0x00  | CC[6:0] - Category Code |
| [7]      | L             | RW | 0x0   | L - Generation Level    |
| [6]      | PRO           | RW | 0x0   | PRO - Professional      |
| [5]      | AUDIO         | RW | 0x0   | /AUDIO - Non-Audio      |

Table 95. SPDIFoutCnvtr DigCtl Command Response Format

| Bit | Bitfield Name | RW | Reset | Description            |
|-----|---------------|----|-------|------------------------|
| [4] | COPY          | RW | 0x0   | COPY - Copyright       |
| [3] | PRE           | RW | 0x0   | PRE - Preemphasis      |
| [2] | VCFG          | RW | 0x0   | VCFG - Validity Config |
| [1] | V             | RW | 0x0   | V - Validity           |
| [0] | DigEn         | RW | 0x0   | DigEn - Digital Enable |

## 5.9. DAC0Mux Node (NID = 0x07)

### 5.9.1. DAC0Mux WCap

Table 96. DAC0Mux WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 97. DAC0Mux WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x3   | Widget type = Audio Selector           |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x1   | Left and right channels can be swapped |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream       |
| [8]      | ConnList      | R  | 0x1   | Connection list is present             |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response    |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter.      |
| [5]      | Stripe        | R  | 0x0   | No support for striping                |

Table 97. DAC0Mux WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [4] | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead       |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                        |

### 5.9.2. DAC0Mux ConnLen

Table 98. DAC0Mux ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 99. DAC0Mux ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x03  | Number of NID entries in connection list.            |

**5.9.3. DAC0Mux ConnSel****Table 100. DAC0Mux ConnSel Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F01     | 00                               | See bitfield table |
| <b>Set1</b> | 701     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 101. DAC0Mux ConnSel Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                      |
|---------|---------------|----|-------|----------------------------------|
| [31..2] | Rsvd          | R  | 0x0   | Reserved                         |
| [1..0]  | Index         | RW | 0x0   | Connection select control index. |

**5.9.4. DAC0Mux ConnLst****Table 102. DAC0Mux ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 103. DAC0Mux ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                  |
|----------|---------------|----|-------|------------------------------|
| [31..24] | Entry3        | R  | 0x00  | Unused list entry.           |
| [23..16] | Entry2        | R  | 0x0A  | ADC Mux widget.              |
| [15..8]  | Entry1        | R  | 0x08  | SPDIF-In Pin widget.         |
| [7..0]   | Entry0        | R  | 0x02  | DAC Analog converter widget. |

**5.9.5. DAC0Mux LR****Table 104. DAC0Mux LR Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F0C     | 00                               | See bitfield table |
| <b>Set1</b> | 70C     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 105. DAC0Mux LR Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                     |
|---------|---------------|----|-------|-------------------------------------------------|
| [31..3] | Rsvd2         | R  | 0x0   | Reserved                                        |
| [2]     | SwapEn        | RW | 0x0   | 1= swap left and right channels of this Widget. |
| [1..0]  | Rsvd1         | R  | 0x0   | Reserved                                        |

**5.10. DigInPin Node (NID = 0x08)****5.10.1. DigInPin WCap****Table 106. DigInPin WCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 09      | See bitfield table |

**Table 107. DigInPin WCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex              |
| [19..16] | Delay         | R  | 0x3   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x1   | Power State control is supported       |
| [9]      | DigitalStrm   | R  | 0x1   | Widget supports a Digital stream       |
| [8]      | ConnList      | R  | 0x0   | No connection list is present          |

Table 107. DigInPin WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [7] | UnsolCap      | R  | 0x1   | Unsolicited Response is supported                                                    |
| [6] | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                     |
| [5] | Stripe        | R  | 0x0   | No support for striping                                                              |
| [4] | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                  |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                        |

### 5.10.2. DigInPin Cap

Table 108. DigInPin Cap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0C      | See bitfield table |

Table 109. DigInPin Cap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                             |
|----------|---------------|----|-------|-------------------------------------------------------------------------|
| [31..17] | Rsvd2         | R  | 0x0   | Reserved                                                                |
| [16]     | EapdCap       | R  | 0x1   | This widget controls EAPD pin                                           |
| [15..8]  | VRefCntrl     | R  | 0x00  | VRef generation not supported by this pin complex.                      |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                                |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.                                |
| [5]      | InCap         | R  | 0x1   | Pin complex is input capable.                                           |
| [4]      | OutCap        | R  | 0x0   | Pin complex is not output capable.<br>(EAPD not equal to output stream) |
| [3]      | HPhnDrvCap    | R  | 0x0   | Pin does not have a headphone amplifier.                                |
| [2]      | PresDtctCap   | R  | 0x1   | Pin complex can perform Presence Detect.                                |

Table 109. DigInPin Cap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                   |
|-----|---------------|----|-------|-----------------------------------------------|
| [1] | TrigRqd       | R  | 0x0   | N/A                                           |
| [0] | ImpSenseCap   | R  | 0x0   | Pin complex does not support impedance sense. |

### 5.10.3. DigInPin PwrState

Table 110. DigInPin PwrState Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F05     | 00                               | See bitfield table |
| <b>Set1</b> | 705     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 111. DigInPin PwrState Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                         |
|---------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                            |
| [7.:4]  | Act           | R  | 0x3   | PS-Act: Actual power state of referenced node.                                                                                                      |
| [3.:2]  | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                            |
| [1.:0]  | Set           | RW | 0x3   | PS-Set: Current power setting of referenced node.<br>00 - Fully on.<br>01 - Fully on.<br>10 - Fully on.<br>11 - Powered down (default powered down) |

**5.10.4. DigInPin Ctl****Table 112. DigInPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 113. DigInPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                    |
|---------|---------------|----|-------|------------------------------------------------|
| [31.:6] | Rsvd2         | R  | 0x0   | Reserved                                       |
| [5]     | InEn          | RW | 0x0   | 1= (CODEC) input path of Pin Widget is enabled |
| [4.:0]  | Rsvd1         | R  | 0x0   | Reserved                                       |

**5.10.5. DigInPin UnsolResp****Table 114. DigInPin UnsolResp Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F08     | 00                               | See bitfield table |
| <b>Set1</b> | 708     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 115. DigInPin UnsolResp Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                |
|---------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x00  | Reserved                                                                                                                                   |
| [7]     | En            | RW | 0x0   | Allow generation of Unsolicited Responses. Unsolicited response events occur upon lock or loss-of-lock by SPDIF-in clock recovery circuit. |
| [6]     | Rsvd1         | R  | 0x0   | Reserved.                                                                                                                                  |
| [5.:0]  | Tag           | RW | 0x00  | Software programmable field returned in top six bits (31:26) of every Unsolicited Response generated by this node.                         |

**5.10.6. DigInPin Sense****Table 116. DigInPin Sense Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F09     | 00                                | See bitfield table |
| <b>Set1</b> | 709     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 709     | See bits [15:8] of bitfield table | 0000_0000h         |

**Table 117. DigInPin Sense Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                                                                                                   |
|---------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31]    | Present       | R  | 0x0   | 1= something is plugged into jack associated with Pin Complex. For this widget, Presence Detect indicates that the SPDIF-in clock recovery circuit has locked onto a valid SPDIF-in sampling frequency. Any change in status will generate an Unsolicited Response, if enabled with verb 708. |
| [30.:0] | Rsvd          | R  | 0x0   | Reserved. Impedance sense not supported for this Pin Complex.                                                                                                                                                                                                                                 |

**5.10.7. DigInPin EAPD****Table 118. DigInPin EAPD Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F0C     | 00                               | See bitfield table |
| <b>Set1</b> | 70C     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 119. DigInPin EAPD Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                                                      |
|---------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:2] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                                                                         |
| [1]     | Data          | RW | 0x0   | EAPD value reflected on the EAPD pin.<br>0= power down external amp;<br>1= power up external amp if PwrState < 0x2.<br>If PwrState >= 0x2, Pin47 is Hi-Z. An external pull-down is required if EAPD must be low when Pin Widget is powered down. |
| [0]     | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                                                                         |

**5.10.8. DigInPin Config****Table 120. DigInPin Config Command Verb Format**

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

**Table 121. DigInPin Config Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                       |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------|
| [31.:30] | Port          | RW | 0x0   | External Port Connectivity of the Pin Complex.<br>0 = Port Complex is connected to a jack                                         |
| [29.:24] | Location      | RW | 0x01  | Physical location of the jack. Optical jack at mainboard rear.                                                                    |
| [23.:20] | Device        | RW | 0xC   | Default Device, indicating intended use of jack.<br>C = SPDIF In                                                                  |
| [19.:16] | Connection    | RW | 0x5   | Connection Type. 5 = optical                                                                                                      |
| [15.:12] | Color         | RW | 0xE   | Color of physical jack. E = White                                                                                                 |
| [11.:8]  | Misc          | RW | 0x0   | Misc[0] == Jack Detect override.                                                                                                  |
| [7.:4]   | Assoc         | RW | 0x3   | Default Association for Pin Complex groups.<br>Reserved value 0000b should not be used.<br>Value 1111b indicates lowest priority. |
| [3.:0]   | Sequence      | RW | 0x0   | All Widgets in an association must have unique sequence number.                                                                   |

## 5.11. DigOutPin Node (NID = 0x09)

### 5.11.1. DigOutPin WCap

Table 122. DigOutPin WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 123. DigOutPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                          |
|----------|---------------|----|-------|--------------------------------------------------------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                                                                             |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex                                                            |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget                                               |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                                                             |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                                |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control                                                   |
| [9]      | DigitalStrm   | R  | 0x1   | Widget supports a Digital stream                                                     |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                                                           |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response                                                  |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                     |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                              |
| [4]      | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                  |
| [3]      | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2]      | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1]      | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0]      | Stereo        | R  | 0x1   | Stereo widget                                                                        |

**5.11.2. DigOutPin Cap****Table 124. DigOutPin Cap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 0C      | See bitfield table |

**Table 125. DigOutPin Cap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                 |
|----------|---------------|----|-------|-------------------------------------------------------------|
| [31..17] | Rsvd2         | R  | 0x0   | Reserved                                                    |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin                       |
| [15..8]  | VRefCntrl     | R  | 0x00  | VRef generation N/A since pin complex is not input capable. |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                    |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.                    |
| [5]      | InCap         | R  | 0x0   | Pin complex is not input capable.                           |
| [4]      | OutCap        | R  | 0x1   | Pin complex is output capable.                              |
| [3]      | HPhnDrvCap    | R  | 0x0   | Pin does not have a headphone amplifier.                    |
| [2]      | PresDtctCap   | R  | 0x0   | Pin complex cannot perform Presence Detect.                 |
| [1]      | TrigRqd       | R  | 0x0   | N/A                                                         |
| [0]      | ImpSenseCap   | R  | 0x0   | Pin complex does not support impedance sense.               |

**5.11.3. DigOutPin ConnLen****Table 126. DigOutPin ConnLen Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 0E      | See bitfield table |

**Table 127. DigOutPin ConnLen Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x02  | Number of NID entries in connection list.            |

**5.11.4. DigOutPin ConnSel****Table 128. DigOutPin ConnSel Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F01     | 00                               | See bitfield table |
| <b>Set1</b> | 701     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 129. DigOutPin ConnSel Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                      |
|---------|---------------|----|-------|----------------------------------|
| [31.:2] | Rsvd          | R  | 0x0   | Reserved                         |
| [1.:0]  | Index         | RW | 0x0   | Connection select control index. |

**5.11.5. DigOutPin ConnLst****Table 130. DigOutPin ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 131. DigOutPin ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                 |
|----------|---------------|----|-------|-----------------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry.          |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry.          |
| [15.:8]  | Entry1        | R  | 0x0A  | ADC Mux widget.             |
| [7.:0]   | Entry0        | R  | 0x05  | SPDIF Out converter widget. |

**5.11.6. DigOutPin Ctl****Table 132. DigOutPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 133. DigOutPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                     |
|---------|---------------|----|-------|-------------------------------------------------|
| [31..7] | Rsvd2         | R  | 0x0   | Reserved                                        |
| [6]     | OutEn         | RW | 0x0   | 1= (CODEC) output path of Pin Widget is enabled |
| [5..0]  | Rsvd1         | R  | 0x0   | Reserved                                        |

**5.11.7. DigOutPin Config****Table 134. DigOutPin Config Command Verb Format**

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

**Table 135. DigOutPin Config Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                               |
|----------|---------------|----|-------|-------------------------------------------------------------------------------------------|
| [31..30] | Port          | RW | 0x0   | External Port Connectivity of the Pin Complex.<br>0 = Port Complex is connected to a jack |
| [29..24] | Location      | RW | 0x01  | Physical location of the jack. Optical jack at mainboard rear.                            |
| [23..20] | Device        | RW | 0x4   | Default Device, indicating intended use of jack.<br>4 = SPDIF Out                         |
| [19..16] | Connection    | RW | 0x5   | Connection Type. 5 = optical                                                              |

Table 135. DigOutPin Config Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                 |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------|
| [15.:12] | Color         | RW | 0x1   | Color of physical jack. 1 = Black                                                                                           |
| [11.:8]  | Misc          | RW | 0x0   | Misc[0] == Jack Detect override.                                                                                            |
| [7.:4]   | Assoc         | RW | 0x1   | Default Association for Pin Complex groups. Reserved value 0000b should not be used. Value 1111b indicates lowest priority. |
| [3.:0]   | Sequence      | RW | 0x2   | All Widgets in an association must have unique sequence number.                                                             |

## 5.12. ADC0Mux Node (NID = 0x0A)

### 5.12.1. ADC0Mux VolRight

Table 136. ADC0Mux VolRight Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | B80     | 00                               | See bitfield table |
| <b>Set1</b> | 390     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 137. ADC0Mux VolRight Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                |
|---------|---------------|----|-------|----------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                   |
| [7]     | Mute          | RW | 0x1   | 1= mute is active          |
| [6.:4]  | Rsvd1         | R  | 0x0   | Reserved                   |
| [3.:0]  | Gain          | RW | 0x0   | Amplifier gain step number |

**5.12.2. ADC0Mux VolLeft****Table 138. ADC0Mux VolLeft Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | BA0     | 00                               | See bitfield table |
| <b>Set1</b> | 3A0     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 139. ADC0Mux VolLeft Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                |
|---------|---------------|----|-------|----------------------------|
| [31..8] | Rsvd2         | R  | 0x0   | Reserved                   |
| [7]     | Mute          | RW | 0x1   | 1= mute is active          |
| [6..4]  | Rsvd1         | R  | 0x0   | Reserved                   |
| [3..0]  | Gain          | RW | 0x0   | Amplifier gain step number |

**5.12.3. ADC0Mux WCap****Table 140. ADC0Mux WCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 09      | See bitfield table |

**Table 141. ADC0Mux WCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x3   | Widget type = Audio Selector           |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x1   | Left and right channels can be swapped |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream       |
| [8]      | ConnList      | R  | 0x1   | Connection list is present             |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response    |

Table 141. ADC0Mux WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                    |
|-----|---------------|----|-------|--------------------------------------------------------------------------------|
| [6] | ProcWidget    | R  | 0x0   | No Processing Controls parameter.                                              |
| [5] | Stripe        | R  | 0x0   | No support for striping                                                        |
| [4] | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead |
| [3] | AmpParamOvrd  | R  | 0x1   | This widget contains its own amplifier parameters.                             |
| [2] | OutAmpPrsnt   | R  | 0x1   | Output amp is present                                                          |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                   |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                  |

#### 5.12.4. ADC0Mux OutAmpCap

Table 142. ADC0Mux OutAmpCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 12      | See bitfield table |

Table 143. ADC0Mux OutAmpCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                             |
|----------|---------------|----|-------|---------------------------------------------------------|
| [31]     | Mute          | R  | 0x1   | Amplifier is capable of muting                          |
| [30.:23] | Rsvd3         | R  | 0x0   | Reserved                                                |
| [22.:16] | StepSize      | R  | 0x05  | Size of each step in the gain range = 1.5dB             |
| [15]     | Rsvd2         | R  | 0x0   | Reserved                                                |
| [14.:8]  | NumSteps      | R  | 0x0F  | Number of steps in the gain range = 16 (0dB to +22.5dB) |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                |
| [6.:0]   | Offset        | R  | 0x00  | 0dB-step is programmed with this offset                 |

**5.12.5. ADC0Mux ConnLen****Table 144. ADC0Mux ConnLen Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

**Table 145. ADC0Mux ConnLen Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved                                             |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.12.6. ADC0Mux ConnLst****Table 146. ADC0Mux ConnLst Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F02     | 00      | See bitfield table |

**Table 147. ADC0Mux ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                       |
|----------|---------------|----|-------|-----------------------------------|
| [31..24] | Entry3        | R  | 0x00  | Unused list entry.                |
| [23..16] | Entry2        | R  | 0x00  | Unused list entry.                |
| [15..8]  | Entry1        | R  | 0x00  | Unused list entry.                |
| [7..0]   | Entry0        | R  | 0x0C  | Input Port (UnivJack) Mux widget. |

**5.12.7. ADC0Mux LR****Table 148. ADC0Mux LR Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F0C     | 00                               | See bitfield table |
| <b>Set1</b> | 70C     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 149. ADC0Mux LR Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                     |
|---------|---------------|----|-------|-------------------------------------------------|
| [31..3] | Rsvd2         | R  | 0x0   | Reserved                                        |
| [2]     | SwapEn        | RW | 0x0   | 1= swap left and right channels of this Widget. |
| [1..0]  | Rsvd1         | R  | 0x0   | Reserved                                        |

**5.13. MasterVol Node (NID = 0x0B)****5.13.1. MasterVol Right****Table 150. MasterVol Right Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | B80     | 00                               | See bitfield table |
| <b>Set1</b> | 390     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 151. MasterVol Right Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                |
|---------|---------------|----|-------|----------------------------|
| [31..8] | Rsvd2         | R  | 0x0   | Reserved                   |
| [7]     | Mute          | RW | 0x1   | 1= mute is active          |
| [6..5]  | Rsvd1         | R  | 0x0   | Reserved                   |
| [4..0]  | Gain          | RW | 0x1F  | Amplifier gain step number |

**5.13.2. MasterVol Left****Table 152. MasterVol Left Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | BA0     | 00                               | See bitfield table |
| <b>Set1</b> | 3A0     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 153. MasterVol Left Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                |
|---------|---------------|----|-------|----------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                   |
| [7]     | Mute          | RW | 0x1   | 1= mute is active          |
| [6.:5]  | Rsvd1         | R  | 0x0   | Reserved                   |
| [4.:0]  | Gain          | RW | 0x1F  | Amplifier gain step number |

**5.13.3. MasterVol WCap****Table 154. MasterVol WCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 09      | See bitfield table |

**Table 155. MasterVol WCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23.:20] | Type          | R  | 0x3   | Widget type = Audio Selector           |
| [19.:16] | Delay         | R  | 0x0   | Number of sample delays through widget |
| [15.:12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream       |
| [8]      | ConnList      | R  | 0x1   | Connection list is present             |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response    |

Table 155. MasterVol WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [6] | ProcWidget    | R  | 0x0   | No Processing Controls parameter.                                                    |
| [5] | Stripe        | R  | 0x0   | No support for striping                                                              |
| [4] | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead       |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x1   | Output amp is present                                                                |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                        |

#### 5.13.4. MasterVol ConnLen

Table 156. MasterVol ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 157. MasterVol ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved                                             |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.13.5. MasterVol ConnLst****Table 158. MasterVol ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 159. MasterVol ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry. |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry. |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry. |
| [7.:0]   | Entry0        | R  | 0x07  | DAC Mux widget.    |

**5.14. InPortMux Node (NID = 0x0C)****5.14.1. InPortMux VolRight****Table 160. InPortMux VolRight Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | B80     | 00                               | See bitfield table |
| <b>Set1</b> | 390     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 161. InPortMux VolRight Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                |
|---------|---------------|----|-------|----------------------------|
| [31.:3] | Rsvd          | R  | 0x0   | Reserved                   |
| [2.:0]  | Gain          | RW | 0x0   | Amplifier gain step number |

**5.14.2. InPortMux VolLeft****Table 162. InPortMux VolLeft Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | BA0     | 00                               | See bitfield table |
| <b>Set1</b> | 3A0     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 163. InPortMux VolLeft Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                |
|---------|---------------|----|-------|----------------------------|
| [31.:3] | Rsvd          | R  | 0x0   | Reserved                   |
| [2.:0]  | Gain          | RW | 0x0   | Amplifier gain step number |

**5.14.3. InPortMux WCap****Table 164. InPortMux WCap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 09      | See bitfield table |

**Table 165. InPortMux WCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23.:20] | Type          | R  | 0x3   | Widget type = Audio Selector           |
| [19.:16] | Delay         | R  | 0x0   | Number of sample delays through widget |
| [15.:12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream       |
| [8]      | ConnList      | R  | 0x1   | Connection list is present             |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response    |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter.      |
| [5]      | Stripe        | R  | 0x0   | No support for striping                |

Table 165. InPortMux WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                    |
|-----|---------------|----|-------|--------------------------------------------------------------------------------|
| [4] | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead |
| [3] | AmpParamOvrd  | R  | 0x1   | This widget contains its own amplifier parameters.                             |
| [2] | OutAmpPrsnt   | R  | 0x1   | Output amp is present                                                          |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                   |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                  |

#### 5.14.4. InPortMux ConnLen

Table 166. InPortMux ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 167. InPortMux ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved                                             |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6.:0]  | N             | R  | 0x05  | Number of NID entries in connection list.            |

#### 5.14.5. InPortMux AmpCap

Table 168. InPortMux AmpCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 12      | See bitfield table |

Table 169. InPortMux AmpCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31]     | Mute          | R  | 0x0   | No mute capability |
| [30.:23] | Rsvd3         | R  | 0x0   | Reserved           |

Table 169. InPortMux AmpCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                          |
|----------|---------------|----|-------|------------------------------------------------------|
| [22.:16] | StepSize      | R  | 0x27  | Size of each step in the gain range = 10dB           |
| [15]     | Rsvd2         | R  | 0x0   | Reserved                                             |
| [14.:8]  | NumSteps      | R  | 0x04  | Number of steps in the gain range = 5 (0dB to +40dB) |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                             |
| [6.:0]   | Offset        | R  | 0x00  | 0dB-step is programmed with this offset              |

**5.14.6. InPortMux ConnSel**

Table 170. InPortMux ConnSel Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F01     | 00                               | See bitfield table |
| <b>Set1</b> | 701     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 171. InPortMux ConnSel Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                      |
|---------|---------------|----|-------|----------------------------------|
| [31.:3] | Rsvd          | R  | 0x0   | Reserved                         |
| [2.:0]  | Index         | RW | 0x0   | Connection select control index. |

**5.14.7. InPortMux ConnLst0**

Table 172. InPortMux ConnLst0 Command Verb Format

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

Table 173. InPortMux ConnLst0 Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31.:24] | Entry3        | R  | 0x0D  | Port A pin widget. |
| [23.:16] | Entry2        | R  | 0x0E  | Port D pin widget. |

Table 173. InPortMux ConnLst0 Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description        |
|---------|---------------|----|-------|--------------------|
| [15.:8] | Entry1        | R  | 0x0F  | Port C pin widget. |
| [7.:0]  | Entry0        | R  | 0x10  | Port B pin widget. |

#### 5.14.8. InPortMux ConnLst4

Table 174. InPortMux ConnLst4 Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F02     | 04      | See bitfield table |

Table 175. InPortMux ConnLst4 Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry. |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry. |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry. |
| [7.:0]   | Entry0        | R  | 0x12  | CDin pin widget.   |

### 5.15. PortAPin Node (NID = 0x0D)

#### 5.15.1. PortAPin WCap

Table 176. PortAPin WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 177. PortAPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31.:24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23.:20] | Type          | R  | 0x4   | Widget type = Pin Complex              |
| [19.:16] | Delay         | R  | 0x0   | Number of sample delays through widget |

Table 177. PortAPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                           |
|----------|---------------|----|-------|---------------------------------------------------------------------------------------|
| [15.:12] | Rsvd1         | R  | 0x0   | Reserved                                                                              |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                                 |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control                                                    |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                                                      |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                                                            |
| [7]      | UnsolCap      | R  | 0x1   | Unsolicited Response is supported                                                     |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                      |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                               |
| [4]      | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                   |
| [3]      | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead. |
| [2]      | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                         |
| [1]      | InAmpPrsnt    | R  | 0x0   | No input amp                                                                          |
| [0]      | Stereo        | R  | 0x1   | Stereo widget                                                                         |

### 5.15.2. PortAPin Cap

Table 178. PortAPin Cap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0C      | See bitfield table |

Table 179. PortAPin Cap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                        |
|----------|---------------|----|-------|----------------------------------------------------|
| [31.:17] | Rsvd2         | R  | 0x0   | Reserved                                           |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin              |
| [15.:8]  | VRefCntrl     | R  | 0x00  | VRef generation not supported by this pin complex. |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                           |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.           |

Table 179. PortAPin Cap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                   |
|-----|---------------|----|-------|-----------------------------------------------|
| [5] | InCap         | R  | 0x1   | Pin complex is input capable.                 |
| [4] | OutCap        | R  | 0x1   | Pin complex is output capable.                |
| [3] | HPhnDrvCap    | R  | 0x1   | Pin complex has headphone amplifier.          |
| [2] | PresDtctCap   | R  | 0x1   | Pin complex can perform Presence Detect.      |
| [1] | TrigRqd       | R  | 0x1   | Trigger is required for impedance measurement |
| [0] | ImpSenseCap   | R  | 0x1   | Pin complex supports impedance sense.         |

### 5.15.3. PortAPin ConnLen

Table 180. PortAPin ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 181. PortAPin ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6.:0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

### 5.15.4. PortAPin ConnLst

Table 182. PortAPin ConnLst Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F02     | 00      | See bitfield table |

Table 183. PortAPin ConnLst Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry. |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry. |

Table 183. PortAPin ConnLst Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description           |
|---------|---------------|----|-------|-----------------------|
| [15.:8] | Entry1        | R  | 0x00  | Unused list entry.    |
| [7.:0]  | Entry0        | R  | 0x0B  | Master Volume widget. |

## 5.15.5. PortAPin Ctl

Table 184. PortAPin Ctl Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 185. PortAPin Ctl Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                      |
|---------|---------------|----|-------|------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                                                         |
| [7]     | HPhnEn        | RW | 0x0   | 1= enable the low impedance amplifier associated with the output |
| [6]     | OutEn         | RW | 0x0   | 1= (CODEC) output path of Pin Widget is enabled                  |
| [5]     | InEn          | RW | 0x0   | 1= (CODEC) input path of Pin Widget is enabled                   |
| [4.:0]  | Rsvd1         | R  | 0x0   | Reserved                                                         |

**5.15.6. PortAPin Unsolicited Response****Table 186. PortAPin Unsolicited Response Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F08     | 00                               | See bitfield table |
| <b>Set1</b> | 708     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 187. PortAPin Unsolicited Response Command Response Format**

| Bit    | Bitfield Name | RW | Reset | Description                                                                                                                           |
|--------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31:8] | Rsvd2         | R  | 0x00  | Reserved                                                                                                                              |
| [7]    | En            | RW | 0x0   | Allow generation of Unsolicited Responses. Unsolicited response events occur upon jack-insertion OR completion of a Jack-Sense cycle. |
| [6]    | Rsvd1         | R  | 0x0   | Reserved                                                                                                                              |
| [5:0]  | Tag           | RW | 0x00  | Software programmable field returned in top six bits (31:26) of every Unsolicited Response generated by this node.                    |

**5.15.7. PortAPin Sense****Table 188. PortAPin Sense Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F09     | 00                                | See bitfield table |
| <b>Set1</b> | 709     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 709     | See bits [15:8] of bitfield table | 0000_0000h         |

**Table 189. PortAPin Sense Command Response Format**

| Bit    | Bitfield Name | RW | Reset       | Description                                                                                                                                                                                       |
|--------|---------------|----|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31]   | Present       | R  | 0x0         | 1= something is plugged into jack associated with Pin Complex.                                                                                                                                    |
| [30:0] | Impedance     | R  | 0x7FFF_FFFF | Measured impedance of the widget. A value of all 1's indicates that a valid sense reading is not available, or the sense measurement is busy if it has been recently triggered. Overlaps RightCh. |

Table 189. PortAPin Sense Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                |
|-----|---------------|----|-------|----------------------------------------------------------------------------|
| [0] | RightCh       | W  | 0x0   | Set 1= perform impedance sensing on right channel or ring of the connector |
| [0] | LeftCh        | W  | 0x0   | Set 0= perform impedance sensing on left channel or tip of the connector   |

### 5.15.8. PortAPin Config

Table 190. PortAPin Config Command Verb Format

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

Table 191. PortAPin Config Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                 |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------|
| [31.:30] | Port          | RW | 0x0   | External Port Connectivity of the Pin Complex. 0 = Port Complex is connected to a jack                                      |
| [29.:24] | Location      | RW | 0x02  | Physical location of the jack. 02h = Mainboard, Front                                                                       |
| [23.:20] | Device        | RW | 0x2   | Default Device, indicating intended use of jack. 2 = HP Out                                                                 |
| [19.:16] | Connection    | RW | 0x1   | Connection Type. 1 = 1/8 inch jack                                                                                          |
| [15.:12] | Color         | RW | 0x4   | Color of physical jack. 4 = Green                                                                                           |
| [11.:8]  | Misc          | RW | 0x0   | Misc[0] = Jack Detect override.                                                                                             |
| [7.:4]   | Assoc         | RW | 0x1   | Default Association for Pin Complex groups. Reserved value 0000b should not be used. Value 1111b indicates lowest priority. |
| [3.:0]   | Sequence      | RW | 0x1   | All Widgets in an association must have unique sequence number.                                                             |

## 5.16. PortDPin Node (NID = 0x0E)

### 5.16.1. PortDPin WCap

Table 192. PortDPin WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 193. PortDPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                           |
|----------|---------------|----|-------|---------------------------------------------------------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                                                                              |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex                                                             |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget                                                |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                                                              |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                                 |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control                                                    |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                                                      |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                                                            |
| [7]      | UnsolCap      | R  | 0x1   | Unsolicited Response is supported                                                     |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                      |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                               |
| [4]      | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                   |
| [3]      | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead. |
| [2]      | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                         |
| [1]      | InAmpPrsnt    | R  | 0x0   | No input amp                                                                          |
| [0]      | Stereo        | R  | 0x1   | Stereo widget                                                                         |

**5.16.2. PortDPin Cap****Table 194. PortDPin Cap Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0C      | See bitfield table |

**Table 195. PortDPin Cap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                        |
|----------|---------------|----|-------|----------------------------------------------------|
| [31..17] | Rsvd2         | R  | 0x0   | Reserved2                                          |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin              |
| [15..8]  | VRefCntrl     | R  | 0x00  | VRef generation not supported by this pin complex. |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                           |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.           |
| [5]      | InCap         | R  | 0x1   | Pin complex is input capable.                      |
| [4]      | OutCap        | R  | 0x1   | Pin complex is output capable.                     |
| [3]      | HPhnDrvCap    | R  | 0x1   | Pin complex has headphone amplifier.               |
| [2]      | PresDtctCap   | R  | 0x1   | Pin complex can perform Presence Detect.           |
| [1]      | TrigRqd       | R  | 0x1   | Trigger is required for impedance measurement      |
| [0]      | ImpSenseCap   | R  | 0x1   | Pin complex supports impedance sense.              |

**5.16.3. PortDPin ConnLen****Table 196. PortDPin ConnLen Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

**Table 197. PortDPin ConnLen Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.16.4. PortDPin ConnLst****Table 198. PortDPin ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 199. PortDPin ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description           |
|----------|---------------|----|-------|-----------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry.    |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry.    |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry.    |
| [7.:0]   | Entry0        | R  | 0x0B  | Master Volume widget. |

**5.16.5. PortDPin Ctl****Table 200. PortDPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 201. PortDPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                      |
|---------|---------------|----|-------|------------------------------------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                                                         |
| [7]     | HPhnEn        | RW | 0x0   | 1= enable the low impedance amplifier associated with the output |
| [6]     | OutEn         | RW | 0x0   | 1= (CODEC) output path of Pin Widget is enabled                  |
| [5]     | InEn          | RW | 0x0   | 1= (CODEC) input path of Pin Widget is enabled                   |
| [4.:0]  | Rsvd1         | R  | 0x0   | Reserved                                                         |

**5.16.6. PortDPin Unsolicited Response****Table 202. PortDPin Unsolicited Response Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F08     | 00                               | See bitfield table |
| <b>Set1</b> | 708     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 203. PortDPin Unsolicited Response Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd2         | R  | 0x00  | Reserved                                                                                                                              |
| [7]     | En            | RW | 0x0   | Allow generation of Unsolicited Responses. Unsolicited response events occur upon jack-insertion OR completion of a Jack-Sense cycle. |
| [6]     | Rsvd1         | R  | 0x0   | Reserved                                                                                                                              |
| [5..0]  | Tag           | RW | 0x00  | Software programmable field returned in top six bits (31:26) of every Unsolicited Response generated by this node.                    |

**5.16.7. PortDPin Sense****Table 204. PortDPin Sense Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F09     | 00                                | See bitfield table |
| <b>Set1</b> | 709     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 709     | See bits [15:8] of bitfield table | 0000_0000h         |

**Table 205. PortDPin Sense Command Response Format**

| Bit     | Bitfield Name | RW | Reset       | Description                                                                                                                                                                                       |
|---------|---------------|----|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31]    | Present       | R  | 0x0         | 1= something is plugged into jack associated with Pin Complex.                                                                                                                                    |
| [30..0] | Impedance     | R  | 0x7FFF_FFFF | Measured impedance of the widget. A value of all 1's indicates that a valid sense reading is not available, or the sense measurement is busy if it has been recently triggered. Overlaps RightCh. |

Table 205. PortDPin Sense Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                |
|-----|---------------|----|-------|----------------------------------------------------------------------------|
| [0] | RightCh       | W  | 0x0   | Set 1= perform impedance sensing on right channel or ring of the connector |
| [0] | LeftCh        | W  | 0x0   | Set 0= perform impedance sensing on left channel or tip of the connector   |

### 5.16.8. PortDPin Config

Table 206. PortDPin Config Command Verb Format

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

Table 207. PortDPin Config Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                    |
|----------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------------------|
| [31..30] | Port          | RW | 0x0   | External Port Connectivity of the Pin Complex.<br>0 = Port Complex is connected to a jack                                      |
| [29..24] | Location      | RW | 0x01  | Physical location of the jack. 01h = Mainboard, Rear                                                                           |
| [23..20] | Device        | RW | 0x0   | Default Device, indicating intended use of jack.<br>0 = Line Out                                                               |
| [19..16] | Connection    | RW | 0x1   | Connection Type. 1 = 1/8 inch jack                                                                                             |
| [15..12] | Color         | RW | 0x4   | Color of physical jack. 4 = Green                                                                                              |
| [11..8]  | Misc          | RW | 0x0   | Misc[0] = Jack Detect override.                                                                                                |
| [7..4]   | Assoc         | RW | 0x1   | Default Association for Pin Complex groups.<br>Reserved value 0000b should not be used. Value 1111b indicates lowest priority. |
| [3..0]   | Sequence      | RW | 0x0   | All Widgets in an association must have unique sequence number.                                                                |

## 5.17. PortCPin Node (NID = 0x0F)

### 5.17.1. PortCPin WCap

Table 208. PortCPin WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 209. PortCPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                           |
|----------|---------------|----|-------|---------------------------------------------------------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                                                                              |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex                                                             |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget                                                |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                                                              |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                                 |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control                                                    |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                                                      |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                                                            |
| [7]      | UnsolCap      | R  | 0x1   | Unsolicited Response is supported                                                     |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                      |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                               |
| [4]      | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                   |
| [3]      | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead. |
| [2]      | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                         |
| [1]      | InAmpPrsnt    | R  | 0x0   | No input amp                                                                          |
| [0]      | Stereo        | R  | 0x1   | Stereo widget                                                                         |

**5.17.2. PortCPin Cap****Table 210. PortCPin Cap Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 0C      | See bitfield table |

**Table 211. PortCPin Cap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                        |
|----------|---------------|----|-------|----------------------------------------------------|
| [31..17] | Rsvd2         | R  | 0x0   | Reserved2                                          |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin              |
| [15..8]  | VRefCntrl     | R  | 0x00  | VRef generation not supported by this pin complex. |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                           |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.           |
| [5]      | InCap         | R  | 0x1   | Pin complex is input capable.                      |
| [4]      | OutCap        | R  | 0x1   | Pin complex is output capable.                     |
| [3]      | HPhnDrvCap    | R  | 0x0   | Pin does not have a headphone amplifier.           |
| [2]      | PresDtctCap   | R  | 0x1   | Pin complex can perform Presence Detect.           |
| [1]      | TrigRqd       | R  | 0x1   | Trigger is required for impedance measurement      |
| [0]      | ImpSenseCap   | R  | 0x1   | Pin complex supports impedance sense.              |

**5.17.3. PortCPin ConnLen****Table 212. PortCPin ConnLen Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 0E      | See bitfield table |

**Table 213. PortCPin ConnLen Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved                                             |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.17.4. PortCPin ConnLst****Table 214. PortCPin ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 215. PortCPin ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description           |
|----------|---------------|----|-------|-----------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry.    |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry.    |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry.    |
| [7.:0]   | Entry0        | R  | 0x0B  | Master Volume widget. |

**5.17.5. PortCPin Ctl****Table 216. PortCPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 217. PortCPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                     |
|---------|---------------|----|-------|-------------------------------------------------|
| [31.:7] | Rsvd2         | R  | 0x0   | Reserved                                        |
| [6]     | OutEn         | RW | 0x0   | 1= (CODEC) output path of Pin Widget is enabled |
| [5]     | InEn          | RW | 0x1   | 1= (CODEC) input path of Pin Widget is enabled  |
| [4.:0]  | Rsvd1         | R  | 0x0   | Reserved                                        |

**5.17.6. PortCPin UnsolResp****Table 218. PortCPin UnsolResp Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F08     | 00                               | See bitfield table |
| <b>Set1</b> | 708     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 219. PortCPin UnsolResp Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd2         | R  | 0x00  | Reserved                                                                                                                              |
| [7]     | En            | RW | 0x0   | Allow generation of Unsolicited Responses. Unsolicited response events occur upon jack-insertion OR completion of a Jack-Sense cycle. |
| [6]     | Rsvd1         | R  | 0x0   | Reserved                                                                                                                              |
| [5..0]  | Tag           | RW | 0x00  | Software programmable field returned in top six bits (31:26) of every Unsolicited Response generated by this node.                    |

**5.17.7. PortCPin Sense****Table 220. PortCPin Sense Command Verb Format**

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F09     | 00                                | See bitfield table |
| <b>Set1</b> | 709     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 709     | See bits [15:8] of bitfield table | 0000_0000h         |

**Table 221. PortCPin Sense Command Response Format**

| Bit     | Bitfield Name | RW | Reset       | Description                                                                                                                                                                                       |
|---------|---------------|----|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31]    | Present       | R  | 0x0         | 1= something is plugged into jack associated with Pin Complex.                                                                                                                                    |
| [30..0] | Impedance     | R  | 0x7FFF_FFFF | Measured impedance of the widget. A value of all 1's indicates that a valid sense reading is not available, or the sense measurement is busy if it has been recently triggered. Overlaps RightCh. |

Table 221. PortCPin Sense Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                |
|-----|---------------|----|-------|----------------------------------------------------------------------------|
| [0] | RightCh       | W  | 0x0   | Set 1= perform impedance sensing on right channel or ring of the connector |
| [0] | LeftCh        | W  | 0x0   | Set 0= perform impedance sensing on left channel or tip of the connector   |

### 5.17.8. PortCPin Config

Table 222. PortCPin Config Command Verb Format

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

Table 223. PortCPin Config Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                       |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------|
| [31..30] | Port          | RW | 0x0   | External Port Connectivity of the Pin Complex.<br>0 = Port Complex is connected to a jack                                         |
| [29..24] | Location      | RW | 0x01  | Physical location of the jack.<br>03h = Mainboard, Rear                                                                           |
| [23..20] | Device        | RW | 0x8   | Default Device, indicating intended use of jack.<br>8 = Line In                                                                   |
| [19..16] | Connection    | RW | 0x1   | Connection Type. 1 = 1/8 inch jack                                                                                                |
| [15..12] | Color         | RW | 0x3   | Color of physical jack. 3 = Blue                                                                                                  |
| [11..8]  | Misc          | RW | 0x0   | Misc[0] = Jack Detect override.                                                                                                   |
| [7..4]   | Assoc         | RW | 0x2   | Default Association for Pin Complex groups.<br>Reserved value 0000b should not be used.<br>Value 1111b indicates lowest priority. |
| [3..0]   | Sequence      | RW | 0x1   | All Widgets in an association must have unique sequence number.                                                                   |

## 5.18. PortBPin Node (NID = 0x10)

### 5.18.1. PortBPin WCap

Table 224. PortBPin WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 225. PortBPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                           |
|----------|---------------|----|-------|---------------------------------------------------------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                                                                              |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex                                                             |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget                                                |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                                                              |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability                                                 |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control                                                    |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                                                      |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                                                            |
| [7]      | UnsolCap      | R  | 0x1   | Unsolicited Response is supported                                                     |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                      |
| [5]      | Stripe        | R  | 0x0   | No support for striping                                                               |
| [4]      | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                   |
| [3]      | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead. |
| [2]      | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                         |
| [1]      | InAmpPrsnt    | R  | 0x0   | No input amp                                                                          |
| [0]      | Stereo        | R  | 0x1   | Stereo widget                                                                         |

**5.18.2. PortBPin Cap****Table 226. PortBPin Cap Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0C      | See bitfield table |

**Table 227. PortBPin Cap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                                                                                           |
|----------|---------------|----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:17] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                              |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin                                                                                                                                                                 |
| [15.:8]  | VRefCntrl     | R  | 0x17  | VRef generation is supported by this pin complex, and the following voltages can be produced on the associated VRef pin: 80% Avdd; 50% Avdd; GND; Hi-Z (required since pin complex is output capable) |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                              |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.                                                                                                                                                              |
| [5]      | InCap         | R  | 0x1   | Pin complex is input capable.                                                                                                                                                                         |
| [4]      | OutCap        | R  | 0x1   | Pin complex is output capable.                                                                                                                                                                        |
| [3]      | HPhnDrvCap    | R  | 0x0   | Pin does not have a headphone amplifier.                                                                                                                                                              |
| [2]      | PresDtctCap   | R  | 0x1   | Pin complex can perform Presence Detect.                                                                                                                                                              |
| [1]      | TrigRqd       | R  | 0x1   | Trigger is required for impedance measurement                                                                                                                                                         |
| [0]      | ImpSenseCap   | R  | 0x1   | Pin complex supports impedance sense.                                                                                                                                                                 |

**5.18.3. PortBPin ConnLen****Table 228. PortBPin ConnLen Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

**Table 229. PortBPin ConnLen Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31..8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6..0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.18.4. PortBPin ConnLst****Table 230. PortBPin ConnLst Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F02     | 00      | See bitfield table |

**Table 231. PortBPin ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description           |
|----------|---------------|----|-------|-----------------------|
| [31..24] | Entry3        | R  | 0x00  | Unused list entry.    |
| [23..16] | Entry2        | R  | 0x00  | Unused list entry.    |
| [15..8]  | Entry1        | R  | 0x00  | Unused list entry.    |
| [7..0]   | Entry0        | R  | 0x0B  | Master Volume widget. |

**5.18.5. PortBPin Ctl****Table 232. PortBPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 233. PortBPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                                                                                                               |
|---------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31..7] | Rsvd2         | R  | 0x0   | Reserved                                                                                                                                                                                                                                                                                                  |
| [6]     | OutEn         | RW | 0x0   | 1= (CODEC) output path of Pin Widget is enabled                                                                                                                                                                                                                                                           |
| [5]     | InEn          | RW | 0x1   | 1= (CODEC) input path of Pin Widget is enabled                                                                                                                                                                                                                                                            |
| [4..3]  | Rsvd1         | R  | 0x0   | Reserved                                                                                                                                                                                                                                                                                                  |
| [2..0]  | VRefSelect    | RW | 0x0   | VRefEn: Selects one of the possible states for the VRef signal associated with the Pin Widget. If the value written to this control does not correspond to a supported value defined in the VRefCntrl field of the Pin Capabilities parameter (0C), then this control will take the value of 000b (Hi-Z). |

**5.18.6. PortBPin UnsolicitedResp****Table 234. PortBPin UnsolicitedResp Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F08     | 00                               | See bitfield table |
| <b>Set1</b> | 708     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 235. PortBPin UnsolicitedResp Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                           |
|---------|---------------|----|-------|---------------------------------------------------------------------------------------------------------------------------------------|
| [31..8] | Rsvd2         | R  | 0x00  | Reserved                                                                                                                              |
| [7]     | En            | RW | 0x0   | Allow generation of Unsolicited Responses. Unsolicited response events occur upon jack-insertion OR completion of a Jack-Sense cycle. |

Table 235. PortBPin UnsolResp Command Response Format

| Bit    | Bitfield Name | RW | Reset | Description                                                                                                        |
|--------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------|
| [6]    | Rsvd1         | R  | 0x0   | Reserved                                                                                                           |
| [5.:0] | Tag           | RW | 0x00  | Software programmable field returned in top six bits (31:26) of every Unsolicited Response generated by this node. |

### 5.18.7. PortBPin Sense

Table 236. PortBPin Sense Command Verb Format

|             | Verb ID | Payload                           | Response           |
|-------------|---------|-----------------------------------|--------------------|
| <b>Get</b>  | F09     | 00                                | See bitfield table |
| <b>Set1</b> | 709     | See bits [7:0] of bitfield table  | 0000_0000h         |
| <b>Set2</b> | 709     | See bits [15:8] of bitfield table | 0000_0000h         |

Table 237. PortBPin Sense Command Response Format

| Bit     | Bitfield Name | RW | Reset       | Description                                                                                                                                                                                       |
|---------|---------------|----|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31]    | Present       | R  | 0x0         | 1= something is plugged into jack associated with Pin Complex.                                                                                                                                    |
| [30.:0] | Impedance     | R  | 0x7FFF_FFFF | Measured impedance of the widget. A value of all 1's indicates that a valid sense reading is not available, or the sense measurement is busy if it has been recently triggered. Overlaps RightCh. |
| [0]     | RightCh       | W  | 0x0         | Set 1= perform impedance sensing on right channel or ring of the connector                                                                                                                        |
| [0]     | LeftCh        | W  | 0x0         | Set 0= perform impedance sensing on left channel or tip of the connector                                                                                                                          |

**5.18.8. PortBPin Config****Table 238. PortBPin Config Command Verb Format**

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

**Table 239. PortBPin Config Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                 |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------|
| [31.:30] | Port          | RW | 0x0   | External Port Connectivity of the Pin Complex.<br>0 = Port Complex is connected to a jack                                   |
| [29.:24] | Location      | RW | 0x02  | Physical location of the jack. 02h = Mainboard, Front                                                                       |
| [23.:20] | Device        | RW | 0xA   | Default Device, indicating intended use of jack. A = Mic In                                                                 |
| [19.:16] | Connection    | RW | 0x1   | Connection Type. 1 = 1/8 inch jack                                                                                          |
| [15.:12] | Color         | RW | 0x9   | Color of physical jack. 9 = Pink                                                                                            |
| [11.:8]  | Misc          | RW | 0x0   | Misc[0] = Jack Detect override.                                                                                             |
| [7.:4]   | Assoc         | RW | 0x2   | Default Association for Pin Complex groups. Reserved value 0000b should not be used. Value 1111b indicates lowest priority. |
| [3.:0]   | Sequence      | RW | 0x0   | All Widgets in an association must have unique sequence number.                                                             |

## 5.19. MonoOutPin Node (NID = 0x11)

### 5.19.1. MonoOutPin Vol

Table 240. MonoOutPin Vol Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | BA0     | 00                               | See bitfield table |
| <b>Set1</b> | 3A0     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 241. MonoOutPin Vol Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                            |
|---------|---------------|----|-------|----------------------------------------|
| [31..8] | Rsvd2         | R  | 0x0   | Reserved                               |
| [7]     | Mute          | RW | 0x1   | 1= mute is active                      |
| [6..5]  | Rsvd1         | R  | 0x0   | Reserved                               |
| [4..0]  | Gain          | RW | 0x1F  | Mono (left) amplifier gain step number |

### 5.19.2. MonoOutPin WCap

Table 242. MonoOutPin WCap Command Verb Format

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F00     | 09      | See bitfield table |

Table 243. MonoOutPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex              |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream       |

Table 243. MonoOutPin WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                           |
|-----|---------------|----|-------|---------------------------------------------------------------------------------------|
| [8] | ConnList      | R  | 0x1   | Connection list is present                                                            |
| [7] | UnsolCap      | R  | 0x0   | No support for Unsolicited Response                                                   |
| [6] | ProcWidget    | R  | 0x0   | No Processing Controls parameter                                                      |
| [5] | Stripe        | R  | 0x0   | No support for striping                                                               |
| [4] | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                   |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead. |
| [2] | OutAmpPrsnt   | R  | 0x1   | Output amp is present                                                                 |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                          |
| [0] | Stereo        | R  | 0x0   | Mono widget                                                                           |

### 5.19.3. MonoOutPin Cap

Table 244. MonoOutPin Cap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0C      | See bitfield table |

Table 245. MonoOutPin Cap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                 |
|----------|---------------|----|-------|-------------------------------------------------------------|
| [31..17] | Rsvd2         | R  | 0x0   | Reserved                                                    |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin                       |
| [15..8]  | VRefCntrl     | R  | 0x00  | VRef generation N/A since pin complex is not input capable. |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                                    |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.                    |
| [5]      | InCap         | R  | 0x0   | Pin complex is not input capable.                           |
| [4]      | OutCap        | R  | 0x1   | Pin complex is output capable.                              |
| [3]      | HPhnDrvCap    | R  | 0x0   | Pin does not have a headphone amplifier.                    |

Table 245. MonoOutPin Cap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                   |
|-----|---------------|----|-------|-----------------------------------------------|
| [2] | PresDtctCap   | R  | 0x0   | Pin complex cannot perform Presence Detect.   |
| [1] | TrigRqd       | R  | 0x0   | N/A                                           |
| [0] | ImpSenseCap   | R  | 0x0   | Pin complex does not support impedance sense. |

#### 5.19.4. MonoOutPin ConnLen

Table 246. MonoOutPin ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 247. MonoOutPin ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved                                             |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6.:0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

#### 5.19.5. MonoOutPin ConnLst

Table 248. MonoOutPin ConnLst Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F02     | 00      | See bitfield table |

Table 249. MonoOutPin ConnLst Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description         |
|----------|---------------|----|-------|---------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry.  |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry.  |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry.  |
| [7.:0]   | Entry0        | R  | 0x13  | MonoOut Mix widget. |

**5.19.6. MonoOutPin Ctl****Table 250. MonoOutPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 251. MonoOutPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                     |
|---------|---------------|----|-------|-------------------------------------------------|
| [31.:7] | Rsvd2         | R  | 0x0   | Reserved                                        |
| [6]     | OutEn         | RW | 0x0   | 1= (CODEC) output path of Pin Widget is enabled |
| [5.:0]  | Rsvd1         | R  | 0x0   | Reserved                                        |

**5.19.7. MonoOutPin Config****Table 252. MonoOutPin Config Command Verb Format**

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

**Table 253. MonoOutPin Config Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                  |
|----------|---------------|----|-------|------------------------------------------------------------------------------|
| [31.:30] | Port          | RW | 0x1   | External Port Connectivity of the Pin Complex.<br>1 = no physical connection |
| [29.:24] | Location      | RW | 0x10  | Physical location of the jack. 10h = Internal, N/A                           |
| [23.:20] | Device        | RW | 0x1   | Default Device, indicating intended use of jack.<br>1 = Speaker              |
| [19.:16] | Connection    | RW | 0x7   | Connection Type. 7 = Other Analog                                            |

Table 253. MonoOutPin Config Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                 |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------|
| [15..12] | Color         | RW | 0x0   | Color of physical jack. 0 = Unknown                                                                                         |
| [11..8]  | Misc          | RW | 0x0   | Misc[0] = Jack Detect override.                                                                                             |
| [7..4]   | Assoc         | RW | 0x1   | Default Association for Pin Complex groups. Reserved value 0000b should not be used. Value 1111b indicates lowest priority. |
| [3..0]   | Sequence      | RW | 0x3   | All Widgets in an association must have unique sequence number.                                                             |

## 5.20. CDPin Node (NID = 0x12)

### 5.20.1. CDPin WCap

Table 254. CDPin WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 255. CDPin WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                            |
|----------|---------------|----|-------|----------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                               |
| [23..20] | Type          | R  | 0x4   | Widget type = Pin Complex              |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                               |
| [11]     | SwapCap       | R  | 0x0   | No left/right channel swap capability  |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control     |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream       |
| [8]      | ConnList      | R  | 0x0   | No connection list is present          |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response    |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter       |
| [5]      | Stripe        | R  | 0x0   | No support for striping                |

Table 255. CDPin WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                           |
|-----|---------------|----|-------|---------------------------------------------------------------------------------------|
| [4] | FormatOvrd    | R  | 0x0   | N/A for pin complex                                                                   |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead. |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                         |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                          |
| [0] | Stereo        | R  | 0x1   | Stereo widget                                                                         |

## 5.20.2. CDPin Cap

Table 256. CDPin Cap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0C      | See bitfield table |

Table 257. CDPin Cap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                        |
|----------|---------------|----|-------|----------------------------------------------------|
| [31..17] | Rsvd2         | R  | 0x0   | Reserved                                           |
| [16]     | EapdCap       | R  | 0x0   | This widget does not control EAPD pin              |
| [15..8]  | VRefCntrl     | R  | 0x00  | VRef generation not supported by this pin complex. |
| [7]      | Rsvd1         | R  | 0x0   | Reserved                                           |
| [6]      | BalancedIO    | R  | 0x0   | Pin complex does not have balanced pins.           |
| [5]      | InCap         | R  | 0x1   | Pin complex is input capable.                      |
| [4]      | OutCap        | R  | 0x0   | Pin complex is not output capable.                 |
| [3]      | HPhnDrvCap    | R  | 0x0   | Pin does not have a headphone amplifier.           |
| [2]      | PresDtctCap   | R  | 0x0   | Pin complex cannot perform Presence Detect.        |
| [1]      | TrigRqd       | R  | 0x0   | N/A                                                |
| [0]      | ImpSenseCap   | R  | 0x0   | Pin complex does not support impedance sense.      |

**5.20.3. CDPin Ctl****Table 258. CDPin Ctl Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F07     | 00                               | See bitfield table |
| <b>Set1</b> | 707     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 259. CDPin Ctl Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                                               |
|---------|---------------|----|-------|-----------------------------------------------------------|
| [31.:6] | Rsvd2         | R  | 0x0   | Reserved                                                  |
| [5]     | InEn          | RW | 0x1   | 1= (CODEC) input path of Pin Widget is enabled (un-muted) |
| [4.:0]  | Rsvd1         | R  | 0x0   | Reserved                                                  |

**5.20.4. CDPin Config****Table 260. CDPin Config Command Verb Format**

|             | Verb ID | Payload                            | Response           |
|-------------|---------|------------------------------------|--------------------|
| <b>Get</b>  | F1C     | 00                                 | See bitfield table |
| <b>Set1</b> | 71C     | See bits [7:0] of bitfield table   | 0000_0000h         |
| <b>Set2</b> | 71D     | See bits [15:8] of bitfield table  | 0000_0000h         |
| <b>Set3</b> | 71E     | See bits [23:16] of bitfield table | 0000_0000h         |
| <b>Set4</b> | 71F     | See bits [31:24] of bitfield table | 0000_0000h         |

**Table 261. CDPin Config Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                                                 |
|----------|---------------|----|-------|-----------------------------------------------------------------------------|
| [31.:30] | Port          | RW | 0x2   | External Port Connectivity of the Pin Complex.<br>2 = fixed function device |
| [29.:24] | Location      | RW | 0x10  | Physical location of the jack. 10h = Internal, N/A                          |
| [23.:20] | Device        | RW | 0x3   | Default Device, indicating intended use of jack.<br>3 = CD                  |
| [19.:16] | Connection    | RW | 0x3   | Connection Type. 3 = ATAPI internal                                         |

Table 261. CDPin Config Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                                                                                                 |
|----------|---------------|----|-------|-----------------------------------------------------------------------------------------------------------------------------|
| [15..12] | Color         | RW | 0x0   | Color of physical jack. 0 = Unknown                                                                                         |
| [11..8]  | Misc          | RW | 0x0   | Misc[0] = Jack Detect override.                                                                                             |
| [7..4]   | Assoc         | RW | 0x2   | Default Association for Pin Complex groups. Reserved value 0000b should not be used. Value 1111b indicates lowest priority. |
| [3..0]   | Sequence      | RW | 0x2   | All Widgets in an association must have unique sequence number.                                                             |

## 5.21. MonoOutMix Node (NID = 0x13)

### 5.21.1. MonoOutMix WCap

Table 262. MonoOutMix WCap Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

Table 263. MonoOutMix WCap Command Response Format

| Bit      | Bitfield Name | RW | Reset | Description                                       |
|----------|---------------|----|-------|---------------------------------------------------|
| [31..24] | Rsvd2         | R  | 0x0   | Reserved                                          |
| [23..20] | Type          | R  | 0x2   | Widget type = Audio Mixer                         |
| [19..16] | Delay         | R  | 0x0   | Number of sample delays through widget            |
| [15..12] | Rsvd1         | R  | 0x0   | Reserved                                          |
| [11]     | SwapCap       | R  | 0x0   | Swapping of left and right channels not supported |
| [10]     | PwrCntrl      | R  | 0x0   | No support for Power State control                |
| [9]      | DigitalStrm   | R  | 0x0   | Widget supports an Analog stream                  |
| [8]      | ConnList      | R  | 0x1   | Connection list is present                        |
| [7]      | UnsolCap      | R  | 0x0   | No support for Unsolicited Response               |
| [6]      | ProcWidget    | R  | 0x0   | No Processing Controls parameter.                 |
| [5]      | Stripe        | R  | 0x0   | No support for striping                           |

Table 263. MonoOutMix WCap Command Response Format

| Bit | Bitfield Name | RW | Reset | Description                                                                          |
|-----|---------------|----|-------|--------------------------------------------------------------------------------------|
| [4] | FormatOvrd    | R  | 0x0   | No format info; use default format parameters from Audio Function node instead       |
| [3] | AmpParamOvrd  | R  | 0x0   | No amplifier info; use default amplifier parameters from Audio Function node instead |
| [2] | OutAmpPrsnt   | R  | 0x0   | No output amp                                                                        |
| [1] | InAmpPrsnt    | R  | 0x0   | No input amp                                                                         |
| [0] | Stereo        | R  | 0x0   | Mono widget                                                                          |

### 5.21.2. MonoOutMix ConnLen

Table 264. MonoOutMix ConnLen Command Verb Format

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 0E      | See bitfield table |

Table 265. MonoOutMix ConnLen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                          |
|---------|---------------|----|-------|------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved.                                            |
| [7]     | LongForm      | R  | 0x0   | Connection list uses short-form (7-bit) NID entries. |
| [6.:0]  | N             | R  | 0x01  | Number of NID entries in connection list.            |

**5.21.3. MonoOutMix ConnLst****Table 266. MonoOutMix ConnLst Command Verb Format**

|            | Verb ID | Payload | Response           |
|------------|---------|---------|--------------------|
| <b>Get</b> | F02     | 00      | See bitfield table |

**Table 267. MonoOutMix ConnLst Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description        |
|----------|---------------|----|-------|--------------------|
| [31.:24] | Entry3        | R  | 0x00  | Unused list entry. |
| [23.:16] | Entry2        | R  | 0x00  | Unused list entry. |
| [15.:8]  | Entry1        | R  | 0x00  | Unused list entry. |
| [7.:0]   | Entry0        | R  | 0x07  | DAC Mux widget.    |

**5.22. PCBeep Node (NID = 0x14)****5.22.1. PCBeep Vol****Table 268. PCBeep Vol Command Verb Format**

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | BA0     | 00                               | See bitfield table |
| <b>Set1</b> | 3A0     | See bits [7:0] of bitfield table | 0000_0000h         |

**Table 269. PCBeep Vol Command Response Format**

| Bit     | Bitfield Name | RW | Reset | Description                            |
|---------|---------------|----|-------|----------------------------------------|
| [31.:8] | Rsvd2         | R  | 0x0   | Reserved                               |
| [7]     | Mute          | RW | 0x1   | 1= mute is active                      |
| [6.:2]  | Rsvd1         | R  | 0x0   | Reserved                               |
| [1.:0]  | Gain          | RW | 0x3   | Mono (left) amplifier gain step number |

**5.22.2. PCBeep WCap****Table 270. PCBeep WCap Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 09      | See bitfield table |

**Table 271. PCBeep WCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                        |
|----------|---------------|----|-------|----------------------------------------------------|
| [31.:24] | Rsvd3         | R  | 0x0   | Reserved                                           |
| [23.:20] | Type          | R  | 0x7   | Widget type = Beep Generator                       |
| [19.:4]  | Rsvd2         | R  | 0x0   | Reserved                                           |
| [3]      | AmpParamOvrd  | R  | 0x1   | This widget contains its own amplifier parameters. |
| [2]      | OutAmpPrsnt   | R  | 0x1   | Output amp is present                              |
| [1]      | InAmpPrsnt    | R  | 0x0   | N/A                                                |
| [0]      | Stereo        | R  | 0x0   | Mono widget                                        |

**5.22.3. PCBeep OutAmpCap****Table 272. PCBeep OutAmpCap Command Verb Format**

|     | Verb ID | Payload | Response           |
|-----|---------|---------|--------------------|
| Get | F00     | 12      | See bitfield table |

**Table 273. PCBeep OutAmpCap Command Response Format**

| Bit      | Bitfield Name | RW | Reset | Description                                          |
|----------|---------------|----|-------|------------------------------------------------------|
| [31]     | Mute          | R  | 0x1   | Amplifier is capable of muting                       |
| [30.:23] | Rsvd3         | R  | 0x0   | Reserved                                             |
| [22.:16] | StepSize      | R  | 0x17  | Size of each step in the gain range = 6 dB           |
| [15]     | Rsvd2         | R  | 0x0   | Reserved                                             |
| [14.:8]  | NumSteps      | R  | 0x03  | Number of steps in the gain range = 4 (-18dB to 0dB) |

Table 273. PCBeep OutAmpCap Command Response Format

| Bit    | Bitfield Name | RW | Reset | Description                             |
|--------|---------------|----|-------|-----------------------------------------|
| [7]    | Rsvd1         | R  | 0x0   | Reserved                                |
| [6.:0] | Offset        | R  | 0x03  | 0dB-step is programmed with this offset |

#### 5.22.4. PCBeep Gen

Table 274. PCBeep Gen Command Verb Format

|             | Verb ID | Payload                          | Response           |
|-------------|---------|----------------------------------|--------------------|
| <b>Get</b>  | F0A     | 00                               | See bitfield table |
| <b>Set1</b> | 70A     | See bits [7:0] of bitfield table | 0000_0000h         |

Table 275. PCBeep Gen Command Response Format

| Bit     | Bitfield Name | RW | Reset | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------|---------------|----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [31.:8] | Rsvd          | R  | 0x0   | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| [7.:0]  | Divider       | RW | 0x00  | <p>Enable internal PC-Beep generation.<br/>           Divider = 00h disables internal PC Beep generation and enables normal operation of the CODEC.<br/>           Divider not equal to 00h generates the beep tone on all Pin Complexes that are currently configured as outputs.<br/>           The Azalia spec states that the beep tone frequency = (48 KHz Azalia SYNC rate) / (4*Divider), producing tones from 47 Hz to 12 KHz (logarithmic scale). Instead, this part generates tones with frequency = <math>48000 * (257 - \text{Divider}) / 1024</math>, yielding a linear range from 12 KHz to 93.75 Hz in steps of 46.875 Hz. If JackSenseVSR[Rate2x], then the beep tones generated have frequency = <math>48000 * (513 - \text{Divider}) / 1024</math>, yielding a range of 24 KHz to 12093.75 Hz in steps of 46.875 Hz.</p> |

## **6. ORDERING INFORMATION**

### **6.1. STAC9200 Family Options and Part Order Numbers**

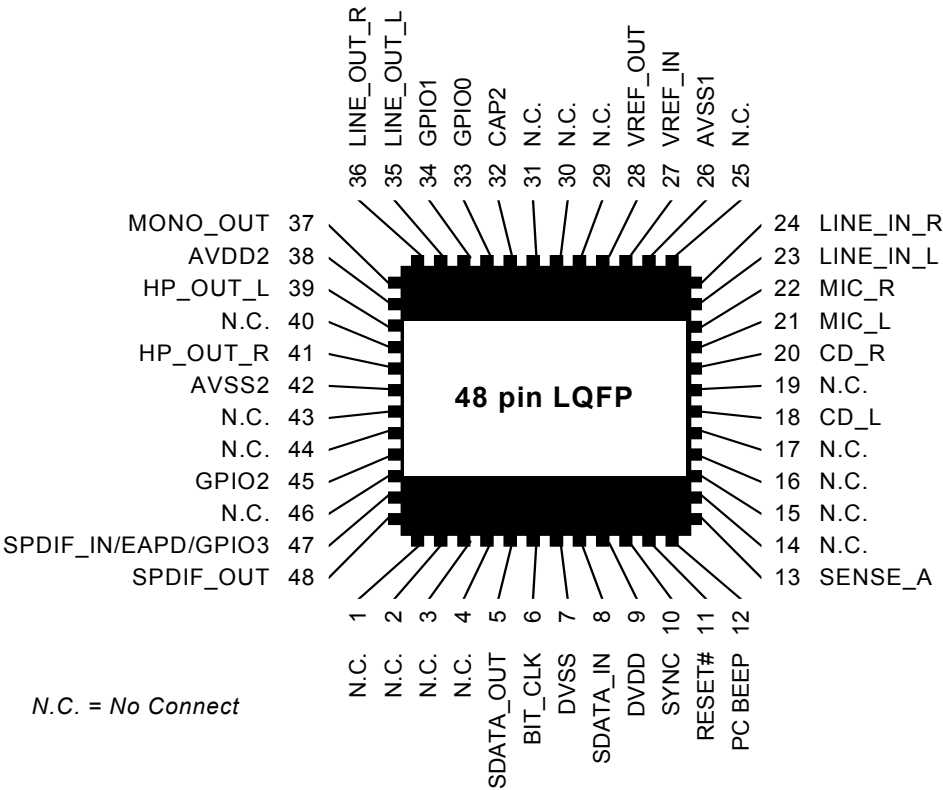
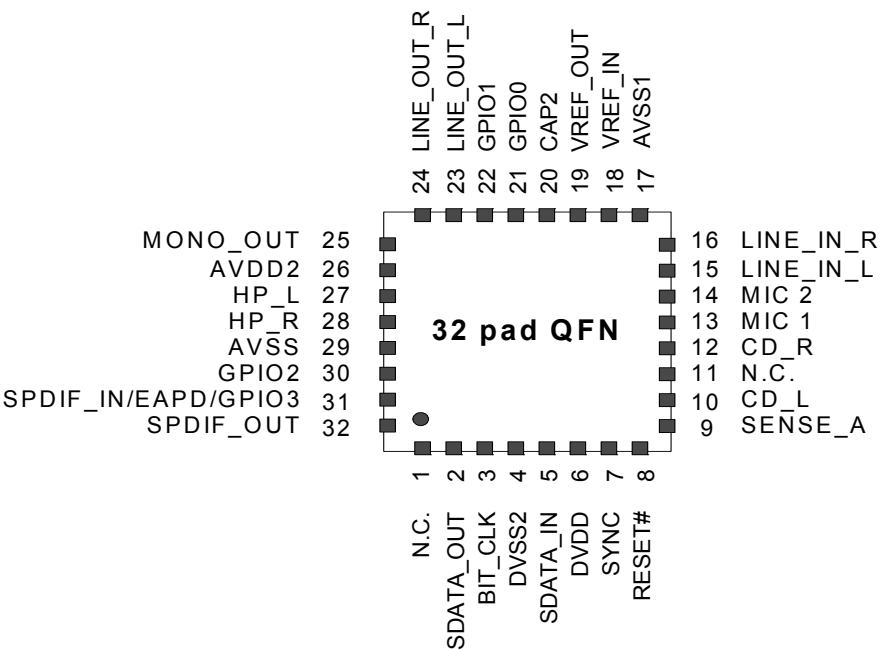
The +4V Analog voltage is supported by the +5 V version of the STAC9200.

| <b>Part Order Number</b> | <b>Voltage</b> | <b>DAC SNR</b> | <b>Pkg Pins</b> |
|--------------------------|----------------|----------------|-----------------|
| STAC9200X5TAEyy          | 5 V            | 100dB          | 48 LQFP         |
| STAC9200X5NAEyy          | 5 V            | 100dB          | 32 QFN          |
| STAC9200X3TAEyy          | 3.3 V          | 100dB          | 48 LQFP         |
| STAC9200X3NAEyy          | 3.3 V          | 100dB          | 32 QFN          |

NOTE: When ordering these parts the “yy” will be replaced with the CODEC revision. Add an “R” to the end of any of these part numbers for delivery on Tape and Reel. The minimum order quantity for Tape and Reel is 2,000 units for both package options.

7. PIN INFORMATION

7.1. Pin Out



N.C. = No Connect

## 7.2. Pin Table for 48-pin LQFP and 32-pad QFN Packages

| Pin Name   | Pin Function                                                       | I/O          | Internal Pull-up/<br>Pull-down | LQFP 48-pin Location | QFN 32-pin Location |
|------------|--------------------------------------------------------------------|--------------|--------------------------------|----------------------|---------------------|
| NC         | No Connect                                                         | -            | -                              | 1                    | -                   |
| NC         | No Connect                                                         | -            | -                              | 2                    | 1                   |
| NC         | No Connect                                                         | -            | -                              | 3                    | -                   |
| NC         | No Connect                                                         | -            | -                              | 4                    | -                   |
| SDATA_OUT  | High Definition Audio "Azalia" Serial Data output (inbound stream) | I (Digital)  | None                           | 5                    | 2                   |
| BIT_CLK    | High Definition Audio "Azalia" Bit Clock                           | I(Digital)   | Pull-down                      | 6                    | 3                   |
| DVSS       | Digital Ground                                                     | I(Digital)   | None                           | 7                    | 4                   |
| SDATA_IN   | High Definition Audio "Azalia" Serial Data input (outbound stream) | I/O(Digital) | Pull-down                      | 8                    | 5                   |
| DVDD_CORE3 | Digital Vdd = 3.3 V                                                | I(Digital)   | None                           | 9                    | 6                   |
| SYNC       | High Definition Audio "Azalia" Frame Sync                          | I(Digital)   | Pull-down                      | 10                   | 7                   |
| RESET#     | High Definition Audio "Azalia" Reset                               | I(Digital)   | Pull-down                      | 11                   | 8                   |
| PC Beep    | PC Beep                                                            | I(Analog)    | -                              | 12                   | -                   |
| Sense A    | Jack insertion detection Ports A, B, C, D                          | I(Analog)    | None                           | 13                   | 9                   |
| NC         | No Connect                                                         | -            | -                              | 14                   | -                   |
| NC         | No Connect                                                         | -            | -                              | 15                   | -                   |
| NC         | No Connect                                                         | -            | -                              | 16                   | -                   |
| NC         | No Connect                                                         | -            | -                              | 17                   | -                   |
| CD-L       | CD Audio Left Channel                                              | I(Analog)    | None                           | 18                   | 10                  |
| NC         | No Connect                                                         | -            | -                              | 19                   | 11                  |
| CD-R       | CD Audio Right Channel                                             | I(Analog)    | None                           | 20                   | 12                  |
| Port B-L   | Analog I/O                                                         | I/O(Analog)  | None                           | 21                   | 13                  |
| Port B-R   | Analog I/O                                                         | I/O(Analog)  | None                           | 22                   | 14                  |
| Port C-L   | Analog I/O                                                         | I/O(Analog)  | None                           | 23                   | 15                  |
| Port C-R   | Analog I/O                                                         | I/O(Analog)  | None                           | 24                   | 16                  |
| NC         | No Connect                                                         | -            | -                              | 25                   | -                   |
| AVSS1      | Analog Ground                                                      | I(Analog)    | None                           | 26                   | 17                  |
| VREF IN    | Reference Voltage In drive                                         | I(Analog)    | None                           | 27                   | 18                  |
| VREFOUT    | Reference Voltage Out drive                                        | O(Analog)    | None                           | 28                   | 19                  |
| NC         | No Connect                                                         | -            | -                              | 29                   | -                   |
| NC         | No Connect                                                         | -            | -                              | 30                   | -                   |
| NC         | No Connect                                                         | -            | -                              | 31                   | -                   |
| CAP2       | ADC reference Cap                                                  | O(Analog)    | None                           | 32                   | 20                  |
| GPI0*      | General Purpose I/O/Mic Bias                                       | I/O(Analog)  | Pull-up 50 K $\Omega$          | 33                   | 21                  |
| GPI01*     | General Purpose I/O/Mic Bias                                       | I/O(Analog)  | Pull-up 50 K $\Omega$          | 34                   | 22                  |

## STAC9200

### 2-Channel High Definition Audio Codec

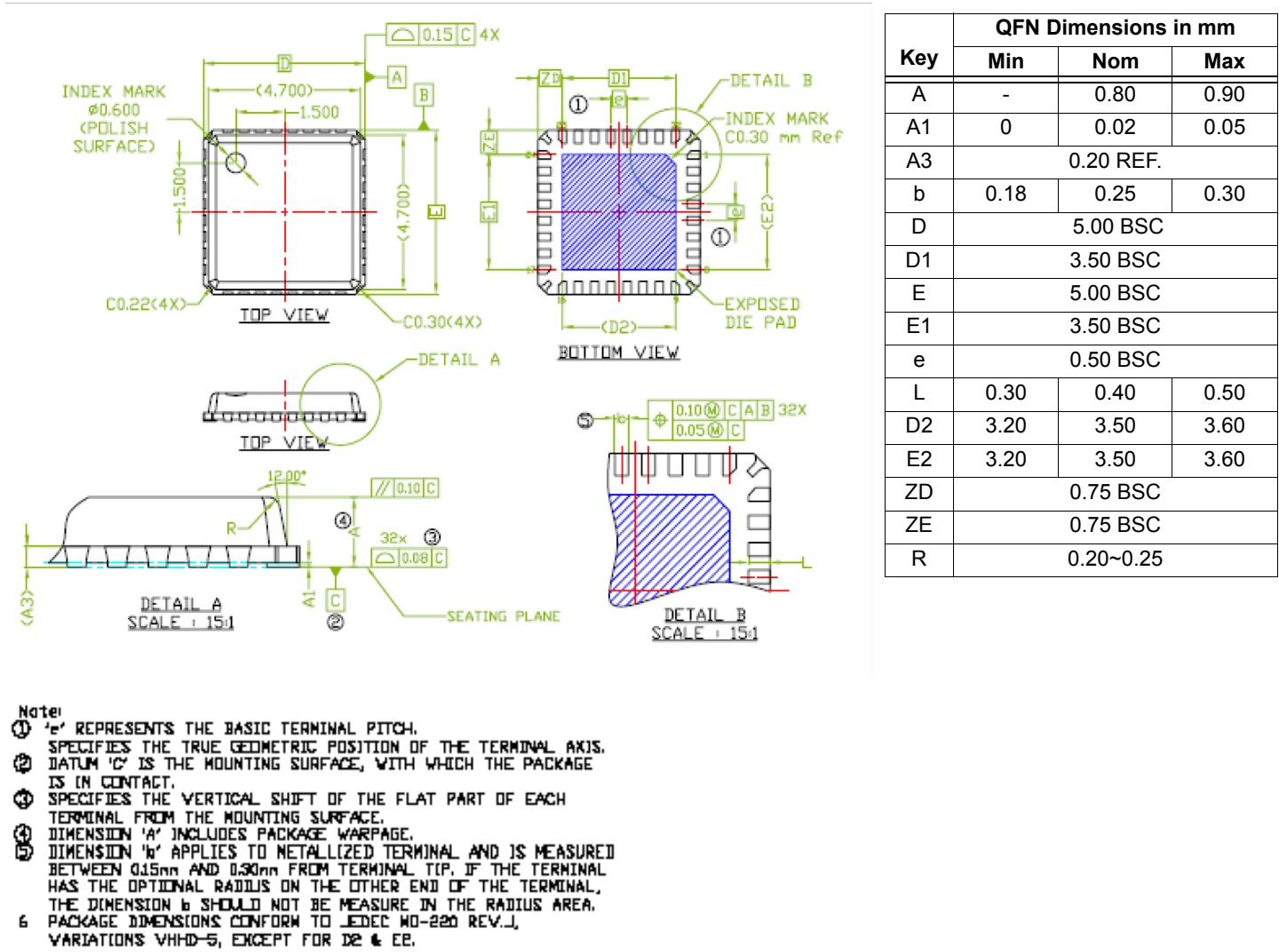
| Pin Name                 | Pin Function                                                                 | I/O                                              | Internal Pull-up/<br>Pull-down   | LQFP 48-pin Location | QFN 32-pin Location |
|--------------------------|------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------|----------------------|---------------------|
| Port D-L                 | Analog I/O with HP support                                                   | I/O(Analog2-Channel High Definition Audio codec) | None                             | 35                   | 23                  |
| Port D-R                 | Analog I/O with HP support                                                   | I/O(Analog)                                      | None                             | 36                   | 24                  |
| MONO                     | Mono Out from DAC                                                            | O(Analog)                                        | None                             | 37                   | 25                  |
| AVDD2                    | Analog Vdd = 5.0 V or 3.3 V                                                  | I(Analog)                                        | None                             | 38                   | 26                  |
| Port A-L                 | Analog I/O with HP support                                                   | I/O(Analog)                                      | None                             | 39                   | 27                  |
| NC                       | No Connect                                                                   | -                                                | -                                | 40                   | -                   |
| Port A-R                 | Analog I/O with HP support                                                   | I/O(Analog)                                      | None                             | 41                   | 28                  |
| AVSS2                    | Analog Ground                                                                | I(Analog)                                        | None                             | 42                   | 29                  |
| NC                       | No Connect                                                                   | -                                                | -                                | 43                   | -                   |
| NC                       | No Connect                                                                   | -                                                | -                                | 44                   | -                   |
| GPIO2*                   | General Purpose I/O /Mic Bias                                                | I/O(Digital)                                     | Pull-up 50 K $\Omega$            | 45                   | 30                  |
| NC                       | No Connect                                                                   | -                                                | -                                | 46                   | -                   |
| S/PDIFIN/EAPD/<br>GPIO3* | SPDIF Input, External Amplifier Power Down,<br>General Purpose I/O /Mic Bias | I/O(Digital)                                     | None                             | 47                   | 31                  |
| S/PDIF-OUT               | SPDIF digital output<br>(50 K $\Omega$ internal pull-down)                   | O(Digital)                                       | 50 K $\Omega$ internal pull-down | 48                   | 32                  |

\* GPIO Pins can also be used for Microphone Bias.

8. PACKAGE DRAWINGS

8.1. 32-pin QFN

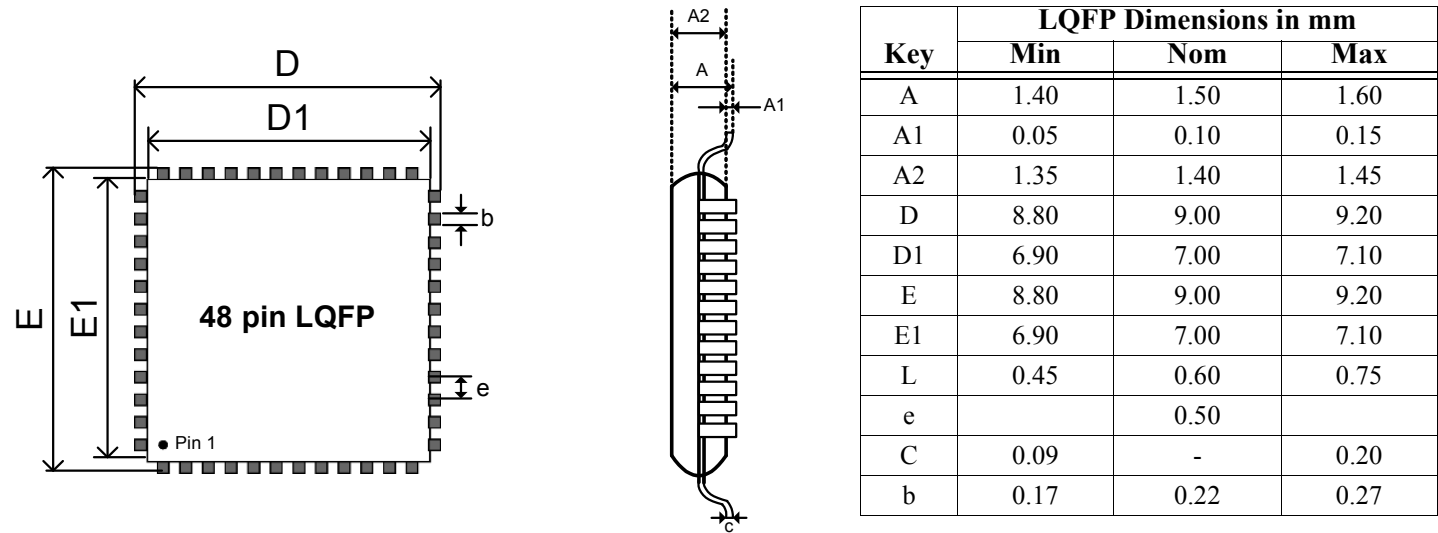
Figure 3. 32-Pad QFN Package Outline and Package Dimensions



NOTE: For more information on the QFN please see TSI QFN Application Note.

8.2. 48-Pin LQFP

Figure 4. 48-Pin LQFP Package Outline and Package Dimensions



9. SOLDER REFLOW PROFILE

9.1. Standard Reflow Profile Data

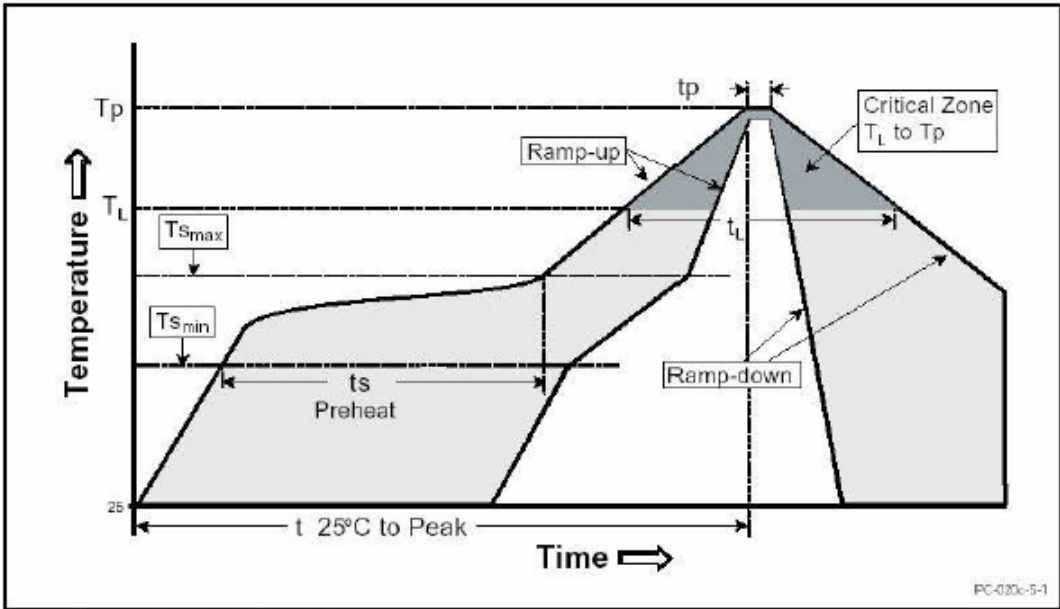
Note: These devices can be hand soldered at 360 °C for 3 to 5 seconds.

FROM: IPC / JEDEC J-STD-020C "Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices" (www.jedec.org/download).

| Profile Feature                                  | Pb Free Assembly                                              |
|--------------------------------------------------|---------------------------------------------------------------|
| Average Ramp-Up Rate (Ts_max - Tp)               | 3 °C / second max                                             |
| Preheat Temperature Min (Ts_min)                 | 150 °C                                                        |
| Preheat Temperature Max (Ts_max)                 | 200 °C                                                        |
| Preheat Time (ts_min - ts_max)                   | 60 - 180 seconds                                              |
| Time maintained above Temperature (TL)           | 217 °C                                                        |
| Time (tL)                                        | 60 - 150 seconds                                              |
| Peak / Classification Temperature (Tp)           | See "Package Classification Reflow Temperatures" on page 124. |
| Time within 5 °C of actual Peak Temperature (tp) | 20 - 40 seconds                                               |
| Ramp-Down rate                                   | 6 °C / second max                                             |
| Time 25 °C to Peak Temperature                   | 8 minutes max                                                 |

Note: All temperatures refer to topside of the package, measured on the package body surface.

Figure 5. Solder Reflow Profile



## STAC9200

### 2-Channel High Definition Audio Codec

#### 9.2. Pb Free Process - Package Classification Reflow Temperatures

| Package Type | MSL | Reflow Temperature |
|--------------|-----|--------------------|
| LQFP 48-pin  | 3   | 260 °C*            |
| QFN 32-pad   | 3   | 260 °C*            |

**10. REVISION HISTORY**

| Revision | Date            | Description of Change                                                                                                                                                                                                                                  |
|----------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |                 | <b>For STAC9200/9200D Revision CA1</b>                                                                                                                                                                                                                 |
| 0.5      | September 2004  | Initial release.                                                                                                                                                                                                                                       |
| 0.6      | November 2004   | Updated the Connection Diagrams                                                                                                                                                                                                                        |
| 0.7      | November 2004   | Added Widget Tables                                                                                                                                                                                                                                    |
| 0.8      | December 2004   | Added 5V Analog Performance Characteristics Table                                                                                                                                                                                                      |
|          |                 | <b>FOR STAC9200/9200D Revision CB1</b>                                                                                                                                                                                                                 |
| 0.9      | January 2005    | Updated LQFP Package Drawing. Updated QFN Drawing. Updated Reflow profile information. Updated Widget Information- This is for the B1 revision of STAC9200/9200D.                                                                                      |
| 0.91     | February 2005   | Added Ordering Information. Updated Reflow profile.                                                                                                                                                                                                    |
| 0.92     | April 2005      | Added Dolby part numbers, description and differences section, Added 5V Analog Performance Numbers with note about min/max, Added Power Consumption, Added 4V Analog supply information, Added comment for allowing GPIO to be used as microphone bias |
| 0.93     | July 2005       | Added in 3.3V Analog performance numbers. Added in 4V performance numbers. Replaced reflow profile- this was only for visual purposes. No changes were made to the Data.                                                                               |
| 1.0      |                 | Updated logo                                                                                                                                                                                                                                           |
| 1.1      |                 | Removed "Preliminary". Added Section 7.4 "Audio Jack Presence Detect."                                                                                                                                                                                 |
| 1.2      | June 2006       | Updated 32-pad Package Drawing                                                                                                                                                                                                                         |
| 1.3      | 10 October 2006 | Released in TSI format.                                                                                                                                                                                                                                |
| 1.4      | December 2006   | Updated AIDD Max spec                                                                                                                                                                                                                                  |
| 1.5      | April 2007      | Corrected 32QFN diagram, removed typical connection diagrams as the reference design should be used instead. Updated table of contents, list of tables and figures.                                                                                    |
| 1.6      | Jan 2008        | removed STAC9200D option, as EOL notice issued Jan 2008.                                                                                                                                                                                               |
| 1.7      | May 2012        | Corrected SDATA I/O assignments in pin table. Removed Confidential footer                                                                                                                                                                              |
| 1.8      | October 2014    | Released in TSI format                                                                                                                                                                                                                                 |

# STAC9200

## 2-Channel High Definition Audio Codec

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[www.temposemi.com](http://www.temposemi.com)  
8627 N. MoPac Expwy Suite 130  
Austin, Texas 78759

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А