



# High Definition Audio SoundMAX Codec

## AD1882

### FEATURES

#### Six 96 kHz DACs

Three independent stereo DAC pairs  
Independent 8, 11.025, 16, 22.05, 32, 44.1,  
48, 88.2, and 96 kHz sample rates  
16-, 20-, and 24-bit PCM resolution  
Selectable stereo mixer on outputs

#### Four 96 kHz ADCs

Two independent stereo ADC pairs  
Simultaneous record of up to four channels  
Independent 8, 11.025, 16, 22.05, 32, 44.1,  
48, 88.2, and 96 kHz sample rates  
16-, 20-, and 24-bit resolution

#### S/PDIF OUTPUT

Supports 44.1, 48, 88.2, and 96 kHz sample rates  
16-, 20-, and 24-bit data widths; PCM and AC3 formats  
Digital PCM gain control

### DEDICATED AUXILIARY PINS

Stereo CD input w/GND sense  
Mono out pin for internal speakers or telephony  
Analog PCBeep input pin

### ENHANCED FEATURES

Two stereo headphone amplifiers  
Microsoft Vista Premium logo for notebook and desktop  
95 dB audio outputs, 90 dB audio inputs  
Internal 32-bit arithmetic for greater accuracy  
Impedance and presence detection on all jack pins  
Digital synthesis PCBeep  
C/LFE channel swapping  
Two general-purpose digital I/O (GPIO) pins  
Advanced power management modes  
EAPD control for internal speakers  
48-lead, Pb-free LFCSP\_VQ package

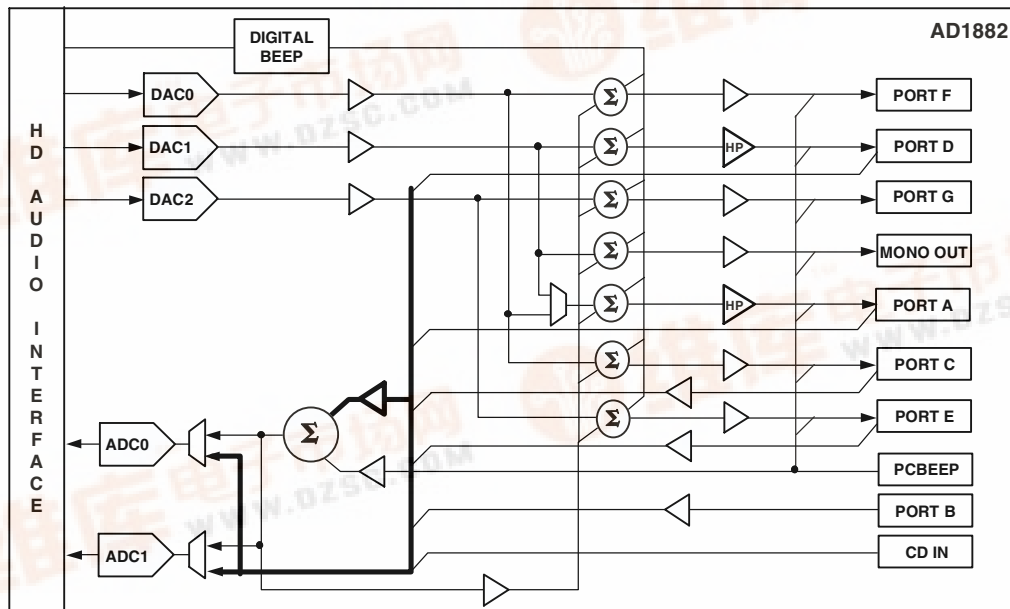


Figure 1. AD1882 Block Diagram

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REVISION HISTORY

7/07–Rev 0: Initial version

## GENERAL DESCRIPTION

The AD1882 audio codec and SoundMAX® software provides superior HD audio quality that exceeds Vista Premium performance. The AD1882 has six DACs and four ADCs, two stereo headphone ports, C/LFE swapping, digital and analog PCBeep, and S/PDIF output, making the AD1882 the right choice for desktop PCs where performance is the primary consideration.

The jack retasking feature on this product supports various configurations including platforms for 5.1 on 5 or 3 jacks, and front panel jack retasking.

The AD1882 is available in a 48-lead Pb-free frame chip scale package in both reels and trays. See [Ordering Guide on Page 16](#).

### ADDITIONAL INFORMATION

This data sheet provides a general overview of the AD1882 SoundMAX codec's architecture and functionality. Additional information on the AD1882 is available in the AD1882 Programmers Reference Manual. Please contact your local ADI sales representative for more information. For information on SoundMAX codecs and software see Analog Devices website at <http://www.analog.com/soundMAX>.

### JACK CONFIGURATION

The guidelines shown in [Table 1](#) through [Table 3](#) should be used when selecting ports for particular functions..

**Table 1. Typical Desktop Configuration with Discreet Jacks**

| Port   | Function                      |
|--------|-------------------------------|
| Port A | Front Panel Headphone         |
| Port B | Front Panel Microphone        |
| Port C | Rear Panel Line-In            |
| Port D | Rear Panel Line-Out/Headphone |
| Port E | Rear Panel Microphone         |
| Port F | Rear Panel Surround           |
| Port G | Rear Panel C/LFE              |

**Table 2. Typical Desktop Configuration with 5.1 on 3 Jacks**

| Port   | Function                      |
|--------|-------------------------------|
| Port A | Front Panel Headphone         |
| Port B | Front Panel Microphone        |
| Port C | Rear Panel Line-In/Surround   |
| Port D | Rear Panel Line-Out/Headphone |
| Port E | Rear Panel Microphone / C/LFE |

**Table 3. Typical Notebook Configuration**

| Port   | Function                           |
|--------|------------------------------------|
| Port A | Headphone                          |
| Port B | Microphone                         |
| Port C | Internal Microphone                |
| Port D | Internal Stereo Speakers           |
| Port E | Docking Station Line/Microphone In |

# AD1882

## AD1882 SPECIFICATIONS

### TEST CONDITIONS

| Parameter                          | Test Condition                                                                        |
|------------------------------------|---------------------------------------------------------------------------------------|
| Temperature                        | 25°C                                                                                  |
| Digital Supply                     | 3.3 V                                                                                 |
| Analog Supply                      | 3.3 V                                                                                 |
| MIC_BIAS_IN (via Low-Pass Filter)  | 5.0 V                                                                                 |
| Sample Rate $f_s$                  | 48 kHz                                                                                |
| Input Signal (Frequency Sine Wave) | 1008 Hz                                                                               |
| Amplitude for THD + N              | −3.0 dB Full Scale                                                                    |
| Analog Output Pass Band            | 20 Hz to 20 kHz                                                                       |
| DAC                                | 10 k $\Omega$ Output Load: Line Out Tests<br>32 $\Omega$ Output Load: Headphone Tests |
| ADC                                | 0 dB Gain                                                                             |

### PERFORMANCE

| Parameter                                         | Min | Typ | Max | Unit |
|---------------------------------------------------|-----|-----|-----|------|
| Line Out Drive (10 k $\Omega$ Loads—DAC to Pin)   |     |     |     |      |
| Total Harmonic Distortion (THD + N)               |     | −85 |     | dB   |
| Dynamic Range (−60 dB in Ref to $f_s$ A-Weighted) |     | 95  |     | dB   |
| Signal-to-Noise Ratio                             |     | 95  |     | dB   |
| Headphone Drive (32 $\Omega$ Loads—DAC to Pin)    |     |     |     |      |
| Total Harmonic Distortion (THD + N)               |     | −83 |     | dB   |
| Dynamic Range (−60 dB in Ref to $f_s$ A-Weighted) |     | 95  |     | dB   |
| Signal-to-Noise Ratio                             |     | 95  |     | dB   |
| Input Ports (Pin to ADC, Mic Boost = 0 dB)        |     |     |     |      |
| Total Harmonic Distortion (THD + N)               |     | −81 |     | dB   |
| Dynamic Range (−60 dB in Ref to $f_s$ A-Weighted) |     | 90  |     | dB   |
| Signal-to-Noise Ratio                             |     | 90  |     | dB   |

### GENERAL SPECIFICATIONS

Table 4. AD1882 General Specifications

| Parameter                                                                   | Min       | Typ  | Max         | Unit     |
|-----------------------------------------------------------------------------|-----------|------|-------------|----------|
| DIGITAL DECIMATION AND INTERPOLATION FILTERS <sup>1</sup>                   |           |      |             |          |
| Pass Band – $f_s$ (kHz) = 8 ~ 96                                            | 0         |      | 0.4 $f_s$   | Hz       |
| Pass-Band Ripple – $f_s$ (kHz) = 8 ~ 96                                     |           |      | $\pm 0.005$ | dB       |
| Stop Band – $f_s$ (kHz) = 8 ~ 96                                            | 0.6 $f_s$ |      |             | Hz       |
| Stop-Band Rejection – $f_s$ (kHz) = 8 ~ 96                                  |           |      |             | dB       |
| Group Delay – $f_s$ (kHz) = 8 ~ 96                                          |           | +20  | −100        | 1/ $f_s$ |
| Group Delay Variation Over Pass Band                                        |           | 0    |             | $\mu$ s  |
| ANALOG TO DIGITAL CONVERTERS                                                |           |      |             |          |
| Resolution                                                                  |           | 24   |             | Bits     |
| Gain Error (Full-Scale Span Relative to Nominal Input Voltage) <sup>2</sup> |           |      | $\pm 10$    | %        |
| Interchannel Gain Mismatch (Difference of Gain Errors)                      |           |      | $\pm 0.5$   | dB       |
| ADC Offset Error <sup>1</sup>                                               |           |      | $\pm 5$     | mV       |
| ADC Crosstalk <sup>1</sup>                                                  |           |      |             |          |
| Line Inputs (Input L, Ground R, Read R; Input R, Ground L, Read L)          |           | −85  |             | dB       |
| Line_In to Other                                                            |           | −100 | −80         | dB       |

Table 4. AD1882 General Specifications (Continued)

| Parameter                                                                                 | Min   | Typ   | Max   | Unit               |
|-------------------------------------------------------------------------------------------|-------|-------|-------|--------------------|
| <b>DIGITAL TO ANALOG CONVERTERS</b>                                                       |       |       |       |                    |
| Resolution                                                                                |       | 24    |       | Bits               |
| Gain Error (Full Scale Span Relative to Nominal Input Voltage) <sup>1</sup>               |       |       | ±10   | %                  |
| Interchannel Gain Mismatch (Difference of Gain Errors)                                    |       |       | ±0.5  | dB                 |
| Total Audible Out-of-Band Energy (Measured from $0.6 \times f_s$ to 100 kHz) <sup>1</sup> |       | –85   |       | dB                 |
| DAC Crosstalk                                                                             |       |       |       | dB                 |
| (Input L, Zero R, Read R_OUT; Input R, Zero L, Read L_OUT) <sup>1</sup>                   |       | –95   |       | dB                 |
| <b>DAC VOLUMES</b>                                                                        |       |       |       |                    |
| Step size (DAC-0, DAC-1, DAC-2)                                                           |       | 1.5   |       | dB                 |
| Output Gain/Attenuation Range                                                             | –58.5 |       | 0     | dB                 |
| Mute Attenuation of 0 dB Fundamental <sup>1</sup>                                         |       | –80   |       | dB                 |
| <b>ADC VOLUMES</b>                                                                        |       |       |       |                    |
| Step size (ADCSEL-0, ADCSEL-1)                                                            |       | 1.5   |       | dB                 |
| PGA Gain/Attenuation Range                                                                | –58.5 |       | +22.5 | dB                 |
| Mute Attenuation of 0 dB Fundamental <sup>1</sup>                                         |       | –80   |       | dB                 |
| <b>ANALOG MIXER</b>                                                                       |       |       |       |                    |
| Signal-to-Noise Ratio (SNR) Input to Output                                               |       | 95    |       | dB                 |
| CD to Port D Output                                                                       |       | 95    |       | dB                 |
| Port B, C, or E to Port D Output                                                          |       | 95    |       | dB                 |
| Port A to Port D Output                                                                   |       | 95    |       | dB                 |
| Port D to Port A Output                                                                   |       | 95    |       | dB                 |
| Step Size: All Mixer Inputs                                                               |       | 1.5   |       | dB                 |
| Input Gain/Attenuation Range: All Mixer Inputs                                            | –34.5 |       | +12.0 | dB                 |
| <b>ANALOG LINE LEVEL OUTPUTS</b>                                                          |       |       |       |                    |
| Full-Scale Output Voltage                                                                 | 1.0   | 1.0   |       | V rms <sup>3</sup> |
| Ports C, E, F, and G Mono Out                                                             | 2.83  |       |       | V p-p              |
| Output Impedance <sup>1</sup>                                                             |       |       | 300   | Ω                  |
| External Load Impedance <sup>1</sup>                                                      | 10    |       |       | kΩ                 |
| Output Capacitance <sup>1</sup>                                                           |       | 15    |       | pF                 |
| External Load Capacitance                                                                 |       |       | 1000  | pF                 |
| <b>ANALOG HP DRIVE OUTPUTS</b>                                                            |       |       |       |                    |
| Full-Scale Output Voltage                                                                 | 1.0   |       |       | V rms <sup>3</sup> |
| Ports A and D                                                                             | 2.83  |       |       | V p-p              |
| Output Impedance <sup>1</sup>                                                             |       |       | 0.5   | Ω                  |
| External Load Impedance <sup>1</sup>                                                      | 32    |       |       | Ω                  |
| Output Capacitance <sup>1</sup>                                                           |       | 15    |       | pF                 |
| External Load Capacitance <sup>1</sup>                                                    |       |       | 1000  | pF                 |
| <b>ANALOG INPUTS</b>                                                                      |       |       |       |                    |
| CD, Port D (When Used as Input)                                                           |       | 1     |       | V rms <sup>3</sup> |
|                                                                                           |       | 2.83  |       | V p-p              |
| Microphone Boost Amplifier, Ports B, C, or E (When Used as Inputs)                        |       | 1     |       | V rms <sup>3</sup> |
| Boost = 0 dB                                                                              |       | 2.83  |       | V p-p              |
| Boost = 10 dB                                                                             |       | 0.316 |       | V rms <sup>3</sup> |
| Boost = 20 dB                                                                             |       | 0.894 |       | V p-p              |
| Boost = 30 dB                                                                             |       | 0.1   |       | V rms <sup>3</sup> |
|                                                                                           |       | 0.283 |       | V p-p              |
|                                                                                           |       | 0.032 |       | V rms <sup>3</sup> |
|                                                                                           |       | 0.089 |       | V p-p              |
| Input Impedance <sup>1</sup>                                                              |       | 20    |       | kΩ                 |
| Input Capacitance <sup>1</sup>                                                            |       | 5     | 7.5   | pF                 |

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**Table 4. AD1882 General Specifications (Continued)**

| Parameter                                                       | Min                   | Typ  | Max                   | Unit    |
|-----------------------------------------------------------------|-----------------------|------|-----------------------|---------|
| Digital GPIO Pins: GPIO_0, GPIO_1/EAPD                          |                       |      |                       |         |
| Input Signal High ( $V_{IH}$ )                                  | $DV_{IO} \times 0.60$ |      | $DV_{IO}$             | V       |
| Input Signal Low ( $V_{IL}$ )                                   | 0                     |      | $DV_{IO} \times 0.24$ | V       |
| Input Leakage Current (Signal High, ( $I_{IH}$ ))               |                       | 150  |                       | nA      |
| Input Leakage Current (Signal Low, ( $I_{IL}$ ))                |                       | 50   |                       | $\mu$ A |
| Output Signal High ( $V_{OH}$ )                                 | $DV_{IO} \times 0.72$ |      | $DV_{IO}$             | V       |
| Output Signal Low ( $V_{OL}$ )                                  | 0                     |      | $DV_{IO} \times 0.10$ | V       |
| $I_{OUT} = -500 \mu$ A                                          |                       |      |                       |         |
| $I_{OUT} = +1500 \mu$ A                                         |                       |      |                       |         |
| S/PDIF_OUT                                                      |                       |      |                       |         |
| Output Signal High ( $V_{OH}$ )                                 | $DV_{IO} \times 0.72$ |      | $DV_{IO}$             | V       |
| Output Signal Low ( $V_{OL}$ )                                  | 0                     |      | $DV_{IO} \times 0.10$ | V       |
| $I_{OUT} = -500 \mu$ A                                          |                       |      |                       |         |
| $I_{OUT} = +1500 \mu$ A                                         |                       |      |                       |         |
| POWER SUPPLY                                                    |                       |      |                       |         |
| Analog ( $AV_{DD}$ ) 3.3 V $\pm$ 5%                             |                       |      |                       |         |
| Power Supply Range                                              | 3.13                  | 3.30 | 3.46                  | V       |
| Power Dissipation                                               |                       | 119  |                       | mW      |
| Supply Current                                                  |                       | 36   |                       | mA      |
| Digital ( $DV_{DD}$ ) 3.3 V $\pm$ 10%                           |                       |      |                       |         |
| Power Supply Range                                              | 2.97                  | 3.30 | 3.63                  | V       |
| Power Dissipation                                               |                       | 198  |                       | mW      |
| Supply Current                                                  |                       | 60   |                       | mA      |
| Digital I/O ( $DV_{IO}$ ) 3.3 V $\pm$ 10%                       |                       |      |                       |         |
| Power Supply Range                                              | 2.97                  | 3.30 | 3.63                  | V       |
| Power Dissipation                                               |                       | 3.96 |                       | mW      |
| Supply Current                                                  |                       | 1.20 |                       | mA      |
| Power Supply Rejection (100 mV p-p Signal @ 1 kHz) <sup>1</sup> |                       | 80   |                       | dB      |

<sup>1</sup> Guaranteed but not tested.

<sup>2</sup> Measurements reflect main ADC.

<sup>3</sup> RMS values assume sine wave input.

## HD-AUDIO LINK SPECIFICATIONS

HD-Audio signals comply with the High Definition Audio specifications. Please refer to these specifications at:  
<http://www.intel.com/standards/hdaudio/>

## POWER DOWN STATES

**Table 5. Power Down States**

| Parameter                                       | ID <sub>VDD</sub> Typ | IA <sub>VDD</sub> Typ | Unit |
|-------------------------------------------------|-----------------------|-----------------------|------|
| Function node in D0, all nodes active           | 60                    | 36                    | mA   |
| Function node in D3 <sup>1</sup>                | 23                    | 1.2                   | mA   |
| Codec in RESET                                  | 3                     | 3                     | mA   |
| Individual block power savings                  |                       |                       |      |
| DAC pair powered down saves (each)              | 6                     | 6                     | mA   |
| ADC pair powered down saves (each)              | 5                     | 4.4                   | mA   |
| Mixer power control (and associated amps) saves | 0                     | 3                     | mA   |
| MIC_BIAS powered down saves <sup>2</sup>        | 0                     | 1.0                   | mA   |

<sup>1</sup> Function node D3 state powers down all nodes except for the  $V_{REF}$ , Mixer and MIC\_BIAS nodes which have independent power controls.  $V_{REF}$  should be kept active when background functions such as jack presence detection or analog pass-through are required. Mixer should be kept active when analog pass-through is required. MIC\_BIAS can be disabled if microphones are not in use in the power-down state.

<sup>2</sup> Powering down the MIC\_BIAS powers down all port MIC\_BIAS pins. This disables all microphone bias circuits set to 100% or 50%, setting them to the Hi-Z state. The 0  $\Omega$  and Hi-Z states remain unaffected by the MIC\_BIAS power state.

## ABSOLUTE MAXIMUM RATINGS

Stresses greater than those listed in Table 6 may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Table 6. Absolute Maximum Ratings**

| Power Supplies                      | Min   | Max             | Units |
|-------------------------------------|-------|-----------------|-------|
| Digital ( $DV_{DD}$ )               | -0.30 | +3.65           | V     |
| Digital I/O ( $DV_{IO}$ )           | -0.30 | +3.65           | V     |
| Analog ( $AV_{DD}$ )                | -0.30 | +3.65           | V     |
| Input Current (Except Supply Pins)  |       | $\pm 10.0$      | mA    |
| Analog Input Voltage (Signal Pins)  | -0.30 | $AV_{DD} + 0.3$ | V     |
| Digital Input Voltage (Signal Pins) | -0.30 | $DV_{IO} + 0.3$ | V     |
| Ambient Temperature (Operating)     | 0     | +70             | °C    |
| Storage Temperature                 | -65   | +150            | °C    |

## ESD SENSITIVITY



### ESD (electrostatic discharge) sensitive device.

Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

## ENVIRONMENTAL CONDITIONS

### Ambient Temperature Rating

$$T_{AMB} = T_{CASE} - (PD \times \theta_{CA})$$

$T_{CASE}$  = Case Temperature in °C

PD = Power Dissipation in W

$\theta_{CA}$  = Thermal Resistance (Case-to-Ambient)

$\theta_{JA}$  = Thermal Resistance (Junction-to-Ambient)

$\theta_{JC}$  = Thermal Resistance (Junction-to-Case)

All measurements per EIA-JESD51 with 2S2P test board per EIA-JESD51-7.

**Table 7. Thermal Resistance**

| Package | $\theta_{JA}$ | $\theta_{JC}$ | $\theta_{CA}$ | Unit |
|---------|---------------|---------------|---------------|------|
| LCSP_VQ | 47            | 15            | 32            | °C/W |

# AD1882

## PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

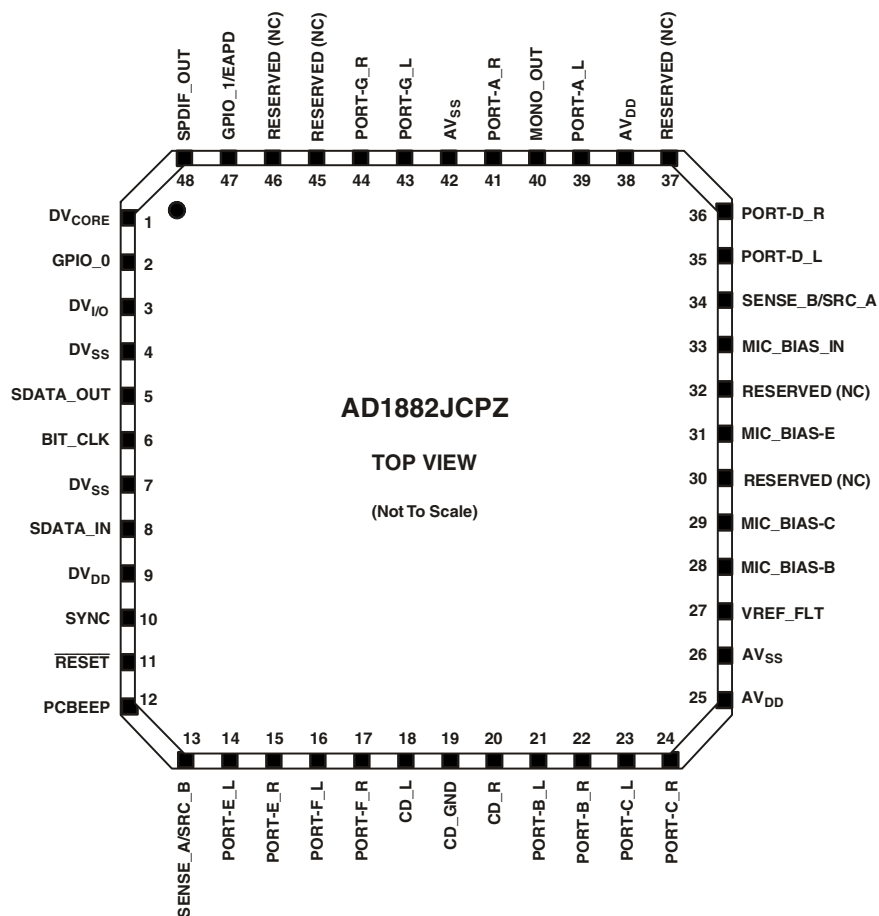


Figure 2. AD1882 48-Lead Package and Pinout



Table 8. AD1882 Pin Descriptions

| Mnemonic            | Pin No. | Function          | Description                                                                                                                                                                                                                                                 |
|---------------------|---------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DIGITAL INTERFACE   |         |                   |                                                                                                                                                                                                                                                             |
| SDATA_OUT           | 5       | I                 | Link Serial Data Output. AD1882 input stream. Clocked on both edges of the BIT_CLK.                                                                                                                                                                         |
| BIT_CLK             | 6       | I                 | Link Bit Clock. 24.000 MHz serial data clock.                                                                                                                                                                                                               |
| SDATA_IN            | 8       | I/O               | Link Serial Data Input. AD1882 output stream Clocked only on one edge of BIT_CLK.                                                                                                                                                                           |
| SYNC                | 10      | I                 | Link Frame Sync.                                                                                                                                                                                                                                            |
| RESET               | 11      | I                 | Link Reset. AD1882 master hardware reset                                                                                                                                                                                                                    |
| DIGITAL I/O         |         |                   |                                                                                                                                                                                                                                                             |
| GPIO_0              | 2       | I/O               | General Purpose Input/Output Pin. Digital signal used to control external circuitry.                                                                                                                                                                        |
| GPIO_1/EAPD         | 47      | I/O               | General Purpose Input/Output Pin/EAPD Pin. Digital signal used to control external circuitry. Defaults to Hi-Z. When used as EAPD: Hi-Z = amp-on, DV <sub>SS</sub> = amp off.                                                                               |
| S/PDIF_OUT          | 48      | O                 | S/PDIF_OUT. Supports S/PDIF output.                                                                                                                                                                                                                         |
| JACK SENSE AND EAPD |         |                   |                                                                                                                                                                                                                                                             |
| SENSE_A/SRC_B       | 13      | I/O               | JACK SENSE A-D Input/Sense B Drive.                                                                                                                                                                                                                         |
| SENSE_B/SRC_A       | 34      | I/O               | JACK SENSE E-H Input/Sense A Drive.                                                                                                                                                                                                                         |
| ANALOG I/O          |         |                   |                                                                                                                                                                                                                                                             |
| PCBEEP              | 12      | LI                | Monaural Input from System for Analog PCBeep.                                                                                                                                                                                                               |
| PORT-E_L            | 14      | LI, MIC, LO, SWAP | Auxiliary Input/Output Left Channel.                                                                                                                                                                                                                        |
| PORT-E_R            | 15      | LI, MIC, LO, SWAP | Auxiliary Input/Output Right Channel.                                                                                                                                                                                                                       |
| PORT-F_L            | 16      | I/O               | Auxiliary Input/Output Left Channel.                                                                                                                                                                                                                        |
| PORT-F_R            | 17      | I/O               | Auxiliary Input/Output Right Channel.                                                                                                                                                                                                                       |
| CD_L                | 18      | LI                | CD Audio Left Channel.                                                                                                                                                                                                                                      |
| CD_GND              | 19      | LI                | CD-Audio-Analog-Ground-Reference (for Differential CD Input). Must be connected to AGND via 0.1 mF capacitor if not in use as CD_GND.                                                                                                                       |
| CD_R                | 20      | LI                | CD Audio Right Channel.                                                                                                                                                                                                                                     |
| PORT-B_L            | 21      | LI, MIC, HP, LO   | Front Panel Stereo MIC/Line-In.                                                                                                                                                                                                                             |
| PORT-B_R            | 22      | LI, MIC, HP, LO   | Front Panel Stereo MIC/Line-In.                                                                                                                                                                                                                             |
| PORT-C_L            | 23      | LI, MIC, LO       | Rear Panel Stereo MIC/Line-In.                                                                                                                                                                                                                              |
| PORT-C_R            | 24      | LI, MIC, LO       | Rear Panel Stereo MIC/Line-In.                                                                                                                                                                                                                              |
| PORT-D_L            | 35      | LI, HP, LO        | Rear Panel Headphone/Line-Out.                                                                                                                                                                                                                              |
| PORT-D_R            | 36      | LI, HP, LO        | Rear Panel Headphone/Line-Out.                                                                                                                                                                                                                              |
| PORT-A_L            | 39      | LI, MIC, HP, LO   | Front Panel Headphone/Line-Out.                                                                                                                                                                                                                             |
| MONO_OUT            | 40      | LO                | Monaural Output to Internal Speaker or Telephony Subsystem Speakerphone.                                                                                                                                                                                    |
| PORT-A_R            | 41      | LI, MIC, HP, LO   | Front Panel Headphone/Line-Out.                                                                                                                                                                                                                             |
| PORT-G_L            | 43      | LO, SWAP          | Rear Panel C/LFE Output.                                                                                                                                                                                                                                    |
| PORT-G_R            | 44      | LO, SWAP          | Rear Panel C/LFE Output.                                                                                                                                                                                                                                    |
| FILTER/REFERENCE    |         |                   |                                                                                                                                                                                                                                                             |
| MIC_BIAS-B          | 28      | O                 | Switchable Microphone Bias. For use with Port B (Pins 21, 22).                                                                                                                                                                                              |
| MIC_BIAS-C          | 29      | O                 | Switchable Microphone Bias. For use with Port C (Pins 23, 24).                                                                                                                                                                                              |
| MIC_BIAS-E          | 31      | O                 | Switchable Microphone Bias. For use with Port E (Pins 14, 15).                                                                                                                                                                                              |
| DV <sub>CORE</sub>  | 1       | O                 | CAUTION: DO NOT APPLY 3.3 V TO THIS PIN!<br>Filter connection for internal core voltage regulator.<br>This pin must be connected to filter caps: 10 $\mu$ F, 1.0 $\mu$ F, and 0.1 $\mu$ F connected in parallel between Pin 1 and DV <sub>SS</sub> (Pin 4). |
| VREF_FLT            | 27      | O                 | Voltage Reference Filter. This pin must be connected to filter caps: 1.0 $\mu$ F and 0.1 $\mu$ F connected in parallel between Pin 27 and AV <sub>SS</sub> (Pins 26, 42).                                                                                   |

The symbols used in this table are defined as: I = Input, O = Output, LI = Line level input, LO = Line level output, HP = Output capable of driving headphone load, MIC = Input supports microphones with MIC bias and boost amplifier, SWAP = Outputs can swap L/R channels (typically used to support C/LFE or shared C/LFE function).

# AD1882

**Table 8. AD1882 Pin Descriptions (Continued)**

| Mnemonic                 | Pin No. | Function | Description                                                                                                                                                                                          |
|--------------------------|---------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| POWER AND GROUND         |         |          |                                                                                                                                                                                                      |
| DV <sub>I/O</sub> (3.3V) | 3       | I        | Connect to the I/O Voltage Used for the HD-Audio Controller Signals.                                                                                                                                 |
| DV <sub>SS</sub>         | 4, 7    | I        | Digital Supply Return (Ground).                                                                                                                                                                      |
| DV <sub>DD</sub> (3.3 V) | 9       | I        | Digital Supply Voltage 3.3 V. This is regulated down to DV <sub>CORE</sub> on Pin 1 to supply the internal digital core internal to the AD1882.                                                      |
| AV <sub>DD</sub> (3.3 V) | 25, 38  | I        | CAUTION: DO NOT APPLY 5.0 V TO THESE PINS!<br>Analog supply voltage 3.3 V ONLY.<br>Note: AV <sub>DD</sub> supplies should be well regulated and filtered as supply noise degrades audio performance. |
| MIC_BIAS_IN              | 33      | I        | Source Power for Microphone Bias Boost Circuitry.                                                                                                                                                    |
| AV <sub>SS</sub>         | 26, 42  | I        | Analog Supply Return (Ground). AV <sub>SS</sub> should be connected to DV <sub>SS</sub> using a conductive trace under, or close to, the AD1882.                                                     |

The symbols used in this table are defined as: I = Input, O = Output, LI = Line level input, LO = Line level output, HP = Output capable of driving headphone load, MIC = Input supports microphones with MIC bias and boost amplifier, SWAP = Outputs can swap L/R channels (typically used to support C/LFE or shared C/LFE function).

## HD AUDIO WIDGETS

In the following table, node IDs that are not shown are reserved for future use.

**Table 9. HD Audio Widgets**

| Node ID | Name                | Type ID | Type           | Description                                                         |
|---------|---------------------|---------|----------------|---------------------------------------------------------------------|
| 00      | ROOT                | x       | Root           | Device Identification                                               |
| 01      | FUNCTION            | x       | Function       | Designates this Device as an Audio Codec                            |
| 02      | S/PDIF DAC          | 0       | Audio Output   | S/PDIF Digital Stream Output Interface                              |
| 03      | DAC_0               | 0       | Audio Output   | Headphone/Surround Side (7.1) Channel Digital/Audio Converters      |
| 04      | DAC_1               | 0       | Audio Output   | Stereo Front Channel Digital/Audio Converters                       |
| 05      | DAC_2               | 0       | Audio Output   | Stereo C/LFE Channel Digital/Audio Converters                       |
| 08      | ADC_0               | 1       | Audio Input    | Stereo Record Channel 1 Audio/Digital Converters                    |
| 09      | ADC_1               | 1       | Audio Input    | Stereo Record Channel 2 Audio/Digital Converters                    |
| 0B      | S/PDIF Mix Selector | 3       | Audio Selector | Selects which ADC Drives the S/PDIF Mixer                           |
| 0C      | ADC Selector 0      | 3       | Audio Selector | Selects and Amplifies/Attenuates the Input to ADC_0                 |
| 0D      | ADC Selector 1      | 3       | Audio Selector | Selects and Amplifies/Attenuates the Input to ADC_1                 |
| 10      | Digital Beep        | 7       | Beep Generator | Internal Digital PCBeep Signal                                      |
| 11      | Port A (Headphone)  | 4       | Pin Complex    | Front Panel Headphone/Microphone Jack                               |
| 12      | Port D (Front L/R)  | 4       | Pin Complex    | Rear Panel Front/Headphone Jack                                     |
| 13      | Mono Out            | 4       | Pin Complex    | Monorail Output Pin (Internal Speakers or Telephony System)         |
| 14      | Port B (Front Mic)  | 4       | Pin Complex    | Front Panel Microphone/Headphone Jack                               |
| 15      | Port C (Line In)    | 4       | Pin Complex    | Rear Panel Line-In Jack                                             |
| 16      | Port F (Surr Back)  | 4       | Pin Complex    | Rear Panel Surround-Rear (5.1) Jack                                 |
| 17      | Port E (Rear Mic)   | 4       | Pin Complex    | Rear Panel Mic Jack                                                 |
| 18      | CD In               | 4       | Pin Complex    | Analog CD Input                                                     |
| 19      | Mixer Power Down    | 5       | Power Widget   | Powers Down the Analog Mixer and Associated Amps                    |
| 1A      | Analog PCBeep       | 4       | Pin Complex    | External Analog PCBeep Signal Input                                 |
| 1B      | S/PDIF Out          | 4       | Pin Complex    | S/PDIF Output Pin                                                   |
| 1D      | S/PDIF Mixer        | 2       | Audio Mixer    | Mixes the Selected ADC with the Digital Stream to Drive S/PDIF Out  |
| 1E      | Mono Out Mixer      | 2       | Audio Mixer    | Selects Which Source Drives the Mono Out Signal                     |
| 20      | Analog Mixer        | 2       | Audio Mixer    | Mixes Individually Gainable Analog Inputs                           |
| 21      | Mixer Output Atten  | 3       | Audio Selector | Attenuates the Mixer Output to Drive the Port Mixers                |
| 22      | Port A Mixer        | 2       | Audio Mixer    | Mixes the Port A Selected DAC and Mixer Output Amps to Drive Port A |
| 23      | VREF Power Down     | F       | Vendor Defined | Powers Down the Internal and External VREF Circuitry                |
| 24      | Port G (C/LFE)      | 4       | Pin Complex    | Rear Panel C/LFE Jack                                               |
| 26      | Port E Mixer        | 2       | Audio Mixer    | Mixes DAC_1 and Mixer Output Amps to Drive Port E                   |
| 27      | Port G Mixer        | 2       | Audio Mixer    | Mixes DAC_1 and Mixer Output Amps to Drive Port G                   |
| 29      | Port D Mixer        | 2       | Audio Mixer    | Mixes DAC_0 and Mixer Output Amps to Drive Port D                   |
| 2A      | Port F Mixer        | 2       | Audio Mixer    | Mixes DAC_2 and Mixer Output Amps to Drive Port F                   |
| 2C      | Port C Mixer        | 2       | Audio Mixer    | Mixes the Port C Selected DAC and Mixer Output Amps to Drive Port C |
| 2D      | Stereo Mix Down     | 2       | Audio Mixer    | Mixes the Stereo L/R Channels to Drive Mono Output                  |
| 2F      | BIAS Power Down     | F       | Vendor Defined | Powers Down the Internal MIC_BIAS_FILT and all MIC_BIAS Pins        |
| 37      | Port A Out Selector | 3       | Audio Selector | Selects the Port A DAC (0, 1)                                       |
| 39      | Port B Boost        | 3       | Audio Selector | Microphone Boost Amp for Port B                                     |
| 3A      | Port C Boost        | 3       | Audio Selector | Microphone Boost Amp for Port C                                     |
| 3C      | Port E Boost        | 3       | Audio Selector | Microphone Boost Amp for Port E                                     |

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## AD1882 HD AUDIO PARAMETERS

The SSID value is set on codec power-up only. SSID is not reset by link or soft reset in order to preserve modifications by BIOS control.

Table 10. Root and Function Node Parameters

| Node ID | Name     | Vendor ID<br>00 | 01 | Revision ID<br>02 <sup>1</sup> | 03 | Sub Node<br>Count<br>04 | Func. Group<br>Type<br>05 | Audio F.G.<br>Caps<br>08 | GPIO Caps<br>11 |
|---------|----------|-----------------|----|--------------------------------|----|-------------------------|---------------------------|--------------------------|-----------------|
| 00      | ROOT     | 11D41882        |    | 00100100                       |    | 00010001                |                           |                          |                 |
| 01      | FUNCTION |                 |    |                                |    | 0002003B                | 00000001                  | 00010C0C                 | 40000002        |

<sup>1</sup> Subject to change with silicon stepping.

Table 11. SubSystem ID <sup>1</sup>

| SubSystem ID |          |          | 31:16 | 15:8 | 7:0    |
|--------------|----------|----------|-------|------|--------|
| Node ID      | Name     | Value    | SSID  | SKU  | Asm ID |
| 01           | FUNCTION | BFD20000 | BFD2  | 00   | 00     |

<sup>1</sup> The default SSID is over-written by platform BIOS after power on. It is preserved across HD Audio link reset and verb reset.

Table 12. Widget Parameters

| Node ID | Widget Capabilities 09 | PCM Size, Rate 0A | Stream Formats 0B | Pin Capabilities 0C | Input Amp Capabilities 0D | ConnList Length 0E | Power States 0F | Processing Caps 10 | Output Amp Capabilities 12 | Volume Knob Capabilities 13 |
|---------|------------------------|-------------------|-------------------|---------------------|---------------------------|--------------------|-----------------|--------------------|----------------------------|-----------------------------|
| 01      | 00000480               | 000E01FF          | 00000001          |                     | 80000000                  |                    | 00000009        |                    | 00052727                   |                             |
| 02      | 0003031D               | 000E01E0          | 00000005          |                     |                           | 00000001           |                 |                    | 80052727                   |                             |
| 03      | 00000405               | 000E01FF          | 00000001          |                     |                           | 00000000           | 00000009        |                    | 00052727                   |                             |
| 04      | 00000405               | 000E01FF          | 00000001          |                     |                           | 00000000           | 00000009        |                    | 00052727                   |                             |
| 05      | 00000405               | 000E01FF          | 00000001          |                     |                           | 00000000           | 00000009        |                    | 00052727                   |                             |
| 08      | 00100501               | 000E01FF          | 00000001          |                     |                           | 00000001           | 00000009        |                    |                            |                             |
| 09      | 00100501               | 000E01FF          | 00000001          |                     |                           | 00000001           | 00000009        |                    |                            |                             |
| 0B      | 00300301               |                   |                   |                     |                           | 00000002           |                 |                    |                            |                             |
| 0C      | 0030010D               |                   |                   |                     |                           | 00000008           |                 |                    | 80053627                   |                             |
| 0D      | 0030010D               |                   |                   |                     |                           | 00000008           |                 |                    | 80053627                   |                             |
| 10      | 0070000C               |                   |                   |                     |                           | 00000000           |                 |                    | 800B0F0F                   |                             |
| 11      | 0040018D               |                   |                   | 0000373F            |                           | 00000001           |                 |                    | 80000000                   |                             |
| 12      | 0040058D               |                   |                   | 0001003F            |                           | 00000001           | 00000009        |                    | 80000000                   |                             |
| 13      | 0040050C               |                   |                   | 00010010            |                           | 00000001           | 00000009        |                    | 80051F1F                   |                             |
| 14      | 00400081               |                   |                   | 00003727            |                           | 00000000           |                 |                    |                            |                             |
| 15      | 0040018D               |                   |                   | 00003737            |                           | 00000001           |                 |                    | 80000000                   |                             |
| 16      | 0040018D               |                   |                   | 00000017            |                           | 00000001           |                 |                    | 80000000                   |                             |
| 17      | 0040098D               |                   |                   | 00003737            |                           | 00000001           |                 |                    | 80000000                   |                             |
| 18      | 00400001               |                   |                   | 00000020            |                           | 00000000           |                 |                    |                            |                             |
| 19      | 00500500               |                   |                   |                     |                           | 00000002           | 00000009        |                    |                            |                             |
| 1A      | 00400000               |                   |                   | 00000020            |                           | 00000000           |                 |                    |                            |                             |
| 1B      | 00400301               |                   |                   | 00000010            |                           | 00000001           |                 |                    |                            |                             |
| 1D      | 00200303               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 1E      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 1F      | 00F00100               |                   |                   | 00000010            |                           | 00000001           |                 |                    |                            |                             |
| 20      | 0020010B               |                   |                   |                     | 80051F17                  | 00000008           |                 |                    |                            |                             |
| 21      | 0030010D               |                   |                   |                     |                           | 00000001           |                 |                    | 80051F1F                   |                             |
| 22      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 23      | 00F00100               |                   |                   |                     |                           | 00000008           |                 |                    |                            |                             |
| 24      | 0040098D               |                   |                   | 00000017            |                           | 00000001           |                 |                    | 80000000                   |                             |
| 26      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 27      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 29      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 2A      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 2C      | 00200103               |                   |                   |                     | 80000000                  | 00000002           |                 |                    |                            |                             |
| 2D      | 00200100               |                   |                   |                     |                           | 00000001           |                 |                    |                            |                             |
| 2F      | 00F00100               |                   |                   |                     |                           | 00000003           |                 |                    |                            |                             |
| 37      | 00300101               |                   |                   |                     |                           | 00000002           |                 |                    |                            |                             |
| 39      | 0030010D               |                   |                   |                     |                           | 00000001           |                 |                    | 00270300                   |                             |
| 3A      | 0030010D               |                   |                   |                     |                           | 00000001           |                 |                    | 00270300                   |                             |
| 3C      | 0030010D               |                   |                   |                     |                           | 00000001           |                 |                    | 00270300                   |                             |

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Table 13. Connection List

| Node ID | Connections |          | 0   | 1 |     | 2 |     | 3 |     | 4 |     | 5 |     | 6 |     | 7 |     |
|---------|-------------|----------|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|
|         | [0-3]       | [4-7]    | NID | I | NID | I | NID | I | NID | I | NID | I | NID | I | NID | I | NID |
| 02      | 0000001D    |          | 1D  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 03      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 04      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 05      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 08      | 0000000C    |          | 0C  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 09      | 0000000D    |          | 0D  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 0B      | 00000908    |          | 08  |   | 09  |   |     |   |     |   |     |   |     |   |     |   |     |
| 0C      | 18BC3911    | 20123B3B | 11  |   | 39  | 1 | 3C  |   | 18  |   | 3B  |   | 3B  |   | 12  |   | 20  |
| 0D      | 18BC3911    | 20123B3B | 11  |   | 39  | 1 | 3C  |   | 18  |   | 3B  |   | 3B  |   | 12  |   | 20  |
| 10      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 11      | 00000022    |          | 22  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 12      | 00000029    |          | 29  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 13      | 0000002D    |          | 2D  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 14      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 15      | 0000002C    |          | 2C  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 16      | 0000002A    |          | 2A  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 17      | 00000026    |          | 26  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 18      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 19      | 00002120    |          | 20  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 1A      |             |          |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 1B      | 00000002    |          | 02  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 1D      | 00000B01    |          | 01  |   | 0B  |   |     |   |     |   |     |   |     |   |     |   |     |
| 1E      | 00002104    |          | 04  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 1F      | 00000002    |          | 02  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 20      | 12113A39    | 1A183B3C | 39  |   | 3A  |   | 11  |   | 12  |   | 3C  |   | 3B  |   | 18  |   | 1A  |
| 21      | 00000020    |          | 20  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 22      | 00002137    |          | 37  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 23      | A2209811    | BC30AE24 | 11  | 1 | 18  |   | 20  | 1 | 22  |   | 24  | 1 | 2E  |   | 30  | 1 | 3C  |
| 24      | 00000027    |          | 27  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 26      | 00002105    |          | 05  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 27      | 00002105    |          | 05  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 29      | 00002104    |          | 04  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 2A      | 00002106    |          | 03  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 2C      | 00002131    |          | 03  |   | 21  |   |     |   |     |   |     |   |     |   |     |   |     |
| 2D      | 0000001E    |          | 1E  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 2F      | 00171514    |          | 14  |   | 15  |   | 17  |   |     |   |     |   |     |   |     |   |     |
| 37      | 00000403    |          | 03  |   | 04  |   |     |   |     |   |     |   |     |   |     |   |     |
| 39      | 00000014    |          | 14  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 3A      | 00000015    |          | 15  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |
| 3C      | 00000017    |          | 17  |   |     |   |     |   |     |   |     |   |     |   |     |   |     |

In [Table 14](#), default configuration values are set on codec power-up only. Default configuration values are not reset by link or soft reset to preserve modifications by BIOS control.

**Table 14. Default Configuration Bytes**

|                    |          | 31:30        | 29:28    | 27:24     | 23:20       | 19:16        | 15:12   | 8            | 7:4      | 3:0      |
|--------------------|----------|--------------|----------|-----------|-------------|--------------|---------|--------------|----------|----------|
|                    |          |              | Location |           |             |              |         | Misc.        |          |          |
| Name               | Value    | Connectivity | Chasis   | Position  | Def. Device | Conn Type    | Color   | JD Over Ride | Def Assn | Sequence |
| Port A (Headphone) | 0221401F | Jack         | External | Front     | HP Out      | 1/8" Jack    | Green   | 0            | 1        | F        |
| Port D (Front L/R) | 01014010 | Jack         | External | Rear      | Line Out    | 1/8" Jack    | Green   | 0            | 1        | 0        |
| Mono Out           | 901701F0 | Fixed        | Internal | N/A       | Speaker     | Other Analog | Unknown | 1            | F        | 0        |
| Port B (Front Mic) | 02A190F0 | Jack         | External | Front     | Mic In      | 1/8" Jack    | Pink    | 0            | F        | 0        |
| Port C (Line In)   | 01813021 | Jack         | External | Rear      | Line In     | 1/8" Jack    | Blue    | 0            | 2        | 1        |
| Port F (Surr Back) | 01011012 | Jack         | External | Rear      | Line Out    | 1/8" Jack    | Black   | 0            | 1        | 2        |
| Port E (Rear Mic)  | 01A19020 | Jack         | External | Rear      | Mic In      | 1/8" Jack    | Pink    | 0            | 2        | 0        |
| CD IN              | 9933012E | Fixed        | Internal | Special 3 | CD          | ATAPI        | Unknown | 1            | 2        | E        |
| Analog PCBeep      | 90F701F0 | Fixed        | Internal | N/A       | Other       | Other Analog | Unknown | 1            | F        | 0        |
| S/PDIF Out         | 014511F0 | Jack         | External | Rear      | SPDIF Out   | Optical      | Black   | 1            | F        | 0        |
| Port G (C/LFE)     | 01016011 | Jack         | External | Rear      | Line Out    | 1/8" Jack    | Orange  | 0            | 1        | 1        |

# AD1882

## OUTLINE DIMENSIONS

Dimensions are shown in millimeters.

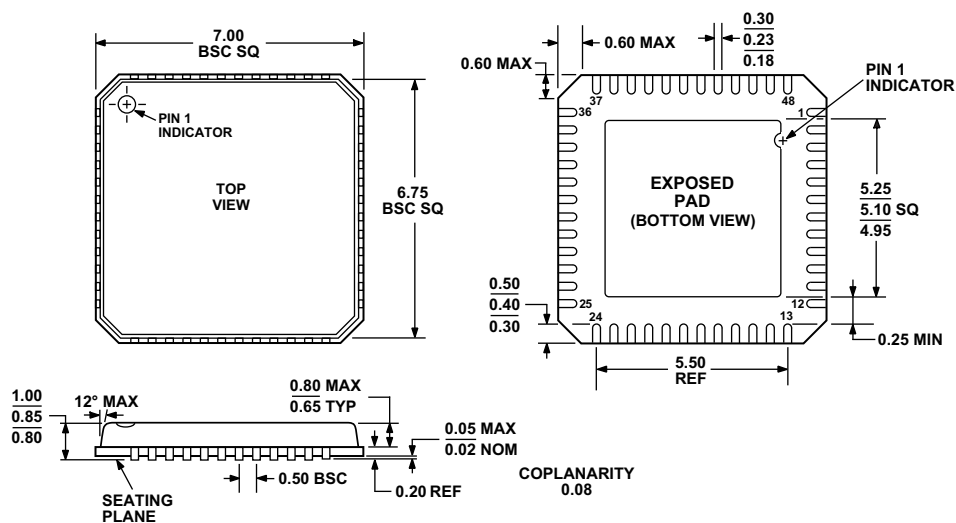


Figure 3. 48-Lead, Lead Frame Chip Scale Package [LFCSP\_VQ]  
7 mm x 7 mm Body, Very Thin Quad  
(CP-48-1)  
Dimensions shown in millimeters

## ORDERING GUIDE

| Model                      | Temperature Range | Package Description | Package Option |
|----------------------------|-------------------|---------------------|----------------|
| AD1882JCPZ <sup>1</sup>    | 0°C to 70°C       | 48-Lead LFCSP_VQ    | CP-48-1        |
| AD1882JCPZ-RL <sup>1</sup> | 0°C to 70°C       | 48-Lead LFCSP_VQ    | CP-48-1        |

<sup>1</sup> Z = RoHS Compliant Part.