



# Ordering Information

| Ordering Number                                       | Part Number | Features      | Package    |
|---|-------------|---------------|------------|
| DSAC-L762-11CH  | CX20762-11Z | USB interface | 48-pin QFN |
| The device is lead-free (Pb Free) and RoHS compliant. |             |               |            |

## Revision History

| Revision | Date          | Description        |
|----------|---------------|--------------------|
| A        | July 19, 2011 | Initial release    |
| B        | June 29, 2012 | Revision B release |

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# Introduction

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## 1.1 Summary

The Conexant CX20762 is a low-cost USB audio codec with on-chip configurable hardware equalizer feature in the USB Audio solutions family. The device is optimized with 16-bit DAC and 16-bit ADC for music and voice communication applications. CX20762 features 4 bands parametric EQ for playback and 2 bands for recording, Zipper Noise Filter, Side tone, microphone boost, and headphone driver. The entire reference design can fit on a small PCB, ideal for USB headset, headphone, handset, and microphone designs. This solution is a full-speed compliant USB codec with on-chip configurable equalizer in a low cost effective 48-pin QFN package

## 1.2 Features

### 1.2.1 Codec Features

- ◆ Stereo DAC, 16-bit
  - 44.1 kHz sampling rate
- ◆ Stereo ADC, 16-bit
  - 44.1 kHz sampling rate
- ◆ USB 2.0 full-speed compliant
- ◆ Headphone driver
  - 4 bands digital equalizer for playback
- ◆ Microphone Boost, 10, 20, 30, 40 dB
  - 2 bands digital equalizer for recording
- ◆ Microphone Bias
- ◆ Side tone
- ◆ Digital volume up/down control
- ◆ Mic Mute with LED
- ◆ Playback mute with LED GPIO
- ◆ USB bus powered 5 V, 500 mA
- ◆ 48-pin QFN package

## 1.2.2 Package and Ordering Information

Table 1 provides the package and ordering information

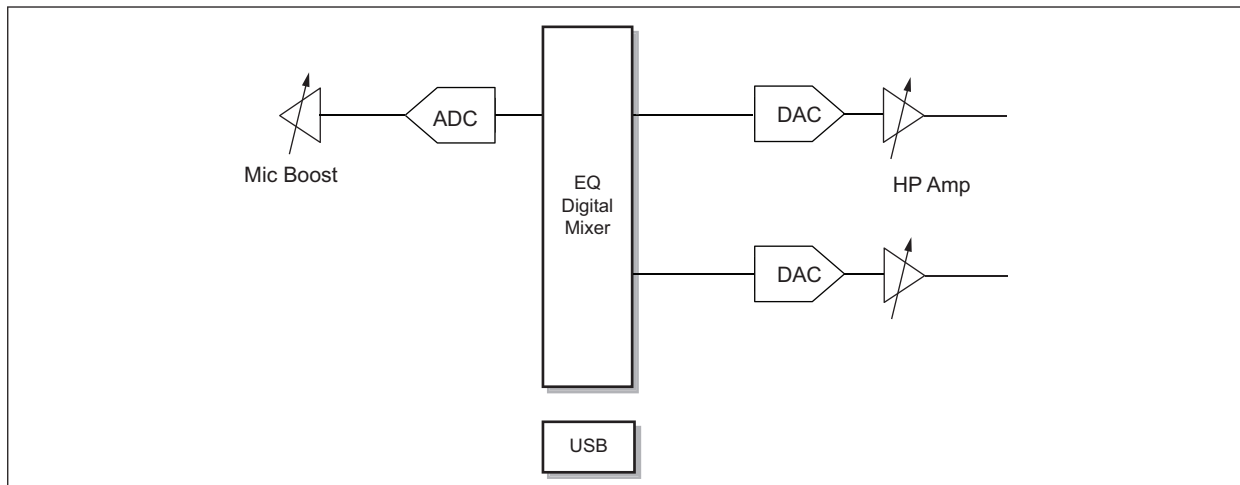
Table 1. Package and Ordering Information

| Ordering Number                                       | Part Number | Features      | Package    |
|---|-------------|---------------|------------|
| DSAC-L762-11CH  | CX20762-11Z | USB interface | 48-pin QFN |
| The device is lead-free (Pb Free) and RoHS compliant. |             |               |            |

## 1.2.3 CX20762 Interface Diagram

Figure 1 provides a diagram of the CX20762 interface.

Figure 1. CX20762 Interface Diagram



## 1.3 Applications

- ◆ USB Headset
- ◆ USB headphone
- ◆ USB Handset
- ◆ USB Microphone

# Hardware Interface

---

## 2.1 General

### 2.1.1 USB Interface

The USB interface conforms to the USB specification version 2.0

The USB signals are:

- ◆ USB\_DP, Serial data plus
- ◆ USB\_DM, Serial data minus

### 2.1.2 Audio Signals

Audio interface signals supported are:

- ◆ Stereo Headphone (HP\_L and HP\_R)
- ◆ Microphone (MIC\_L)
- ◆ Microphone Bias (MICBIAS)
- ◆ Headphone Jack Sense (HP\_SENSE)

### 2.1.3 Keypad Interface

- ◆ Key Scan IN [0:3] Keypad interface
- ◆ Key Scan OUT Keypad interface

### 2.1.4 Crystal Signals

- ◆ XTALI, 24.0 MHz crystal in
- ◆ XTALO, 24.0 MHz crystal out

### 2.1.5 LED Control Signals

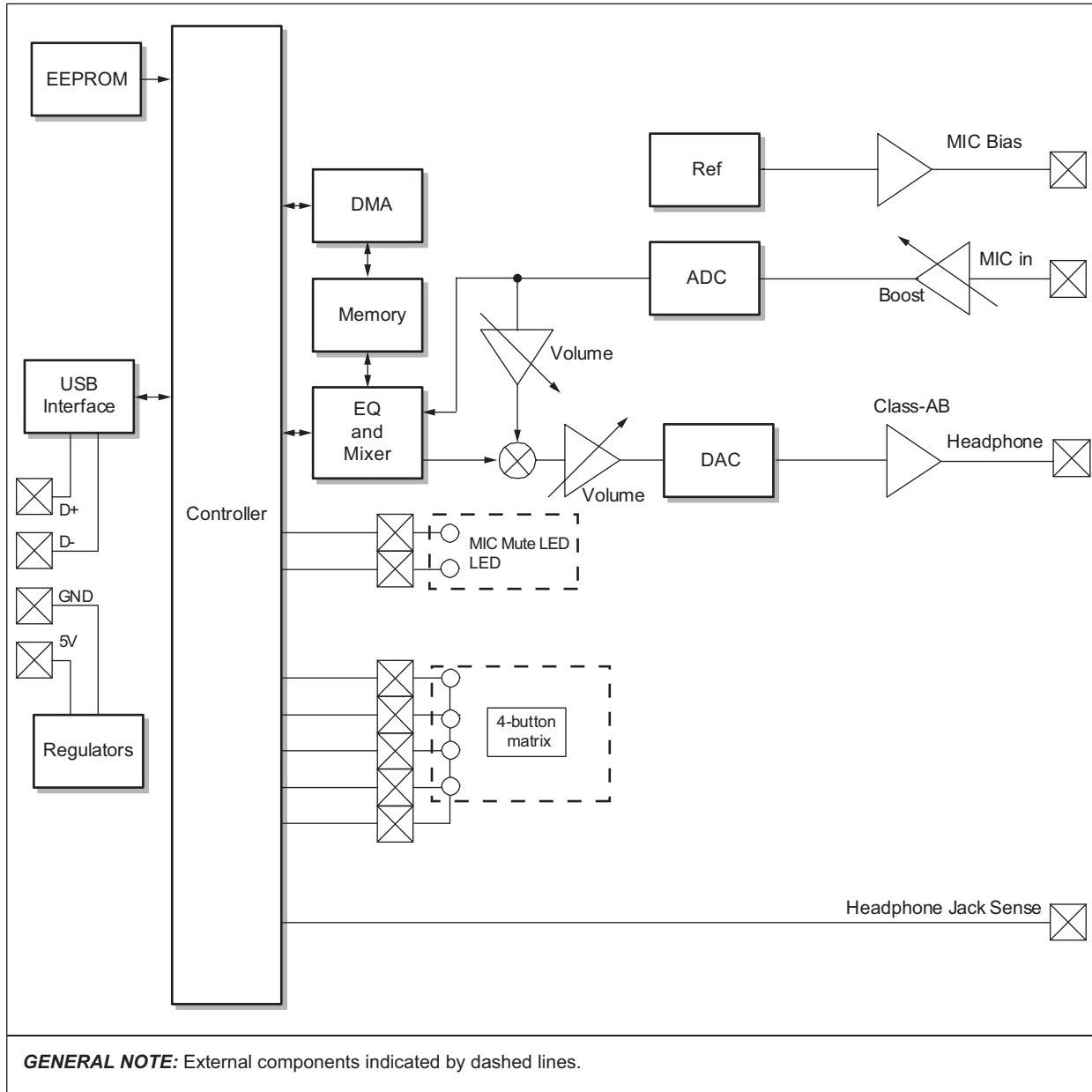
- ◆ Microphone Mute LED
- ◆ General LED

### 2.1.6 Additional Control Signals

- ◆ Reset
- ◆ USB 5V Detect
- ◆ Configuration Selection Pins

## 2.2 Block Diagram

Figure 2. CX20762 Block Diagram



## 2.3 Pin Assignments and Signal Definitions

The CX20762 pins are listed in [Table 2](#), and the pinout is shown in [Figure 3](#). The CX20762 48-pin QFN hardware interface signals are shown by major interface in [Figure 3](#) and by pin number in [Figure 4](#).

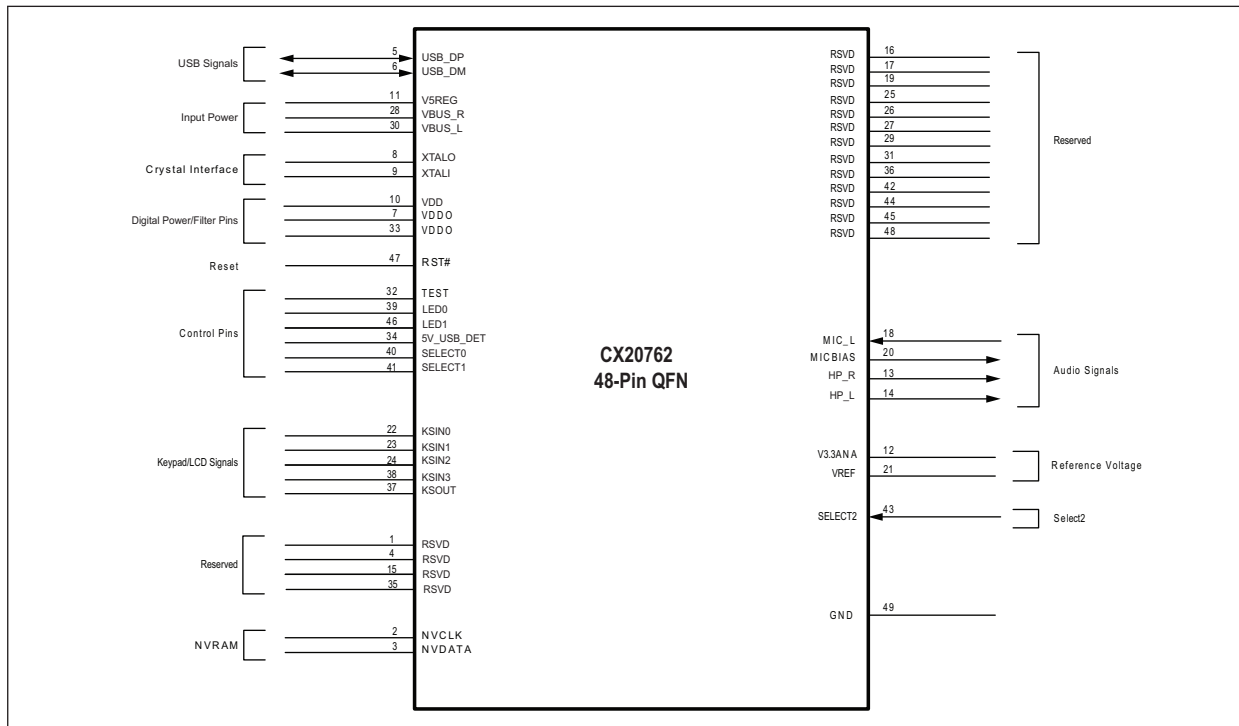
**Table 2. CX20762 Pin List**

| Pin No. | CX20762 Signal Name |
|---------|---------------------|
| 1       | RSVD                |
| 2       | NVCLK               |
| 3       | NVDATA              |
| 4       | RSVD                |
| 5       | USB_DP              |
| 6       | USB_DM              |
| 7       | VDDO                |
| 8       | XTALO               |
| 9       | XTALI               |
| 10      | VDD                 |
| 11      | V5REG               |
| 12      | V3.3ANA             |
| 13      | HP_R                |
| 14      | HP_L                |
| 15      | RSVD                |
| 16      | RSVD                |
| 17      | RSVD                |
| 18      | MIC_L               |
| 19      | RSVD                |
| 20      | MICBIAS             |
| 21      | VREF                |
| 22      | KSIN0               |
| 23      | KSIN1               |
| 24      | KSIN2               |
| 25      | RSVD                |
| 26      | RSVD                |
| 27      | RSVD                |
| 28      | VBUS_R              |
| 29      | RSVD                |
| 30      | VBUS_L              |
| 31      | RSVD                |
| 32      | TEST                |
| 33      | VDDO                |
| 34      | 5V_USB_DET          |

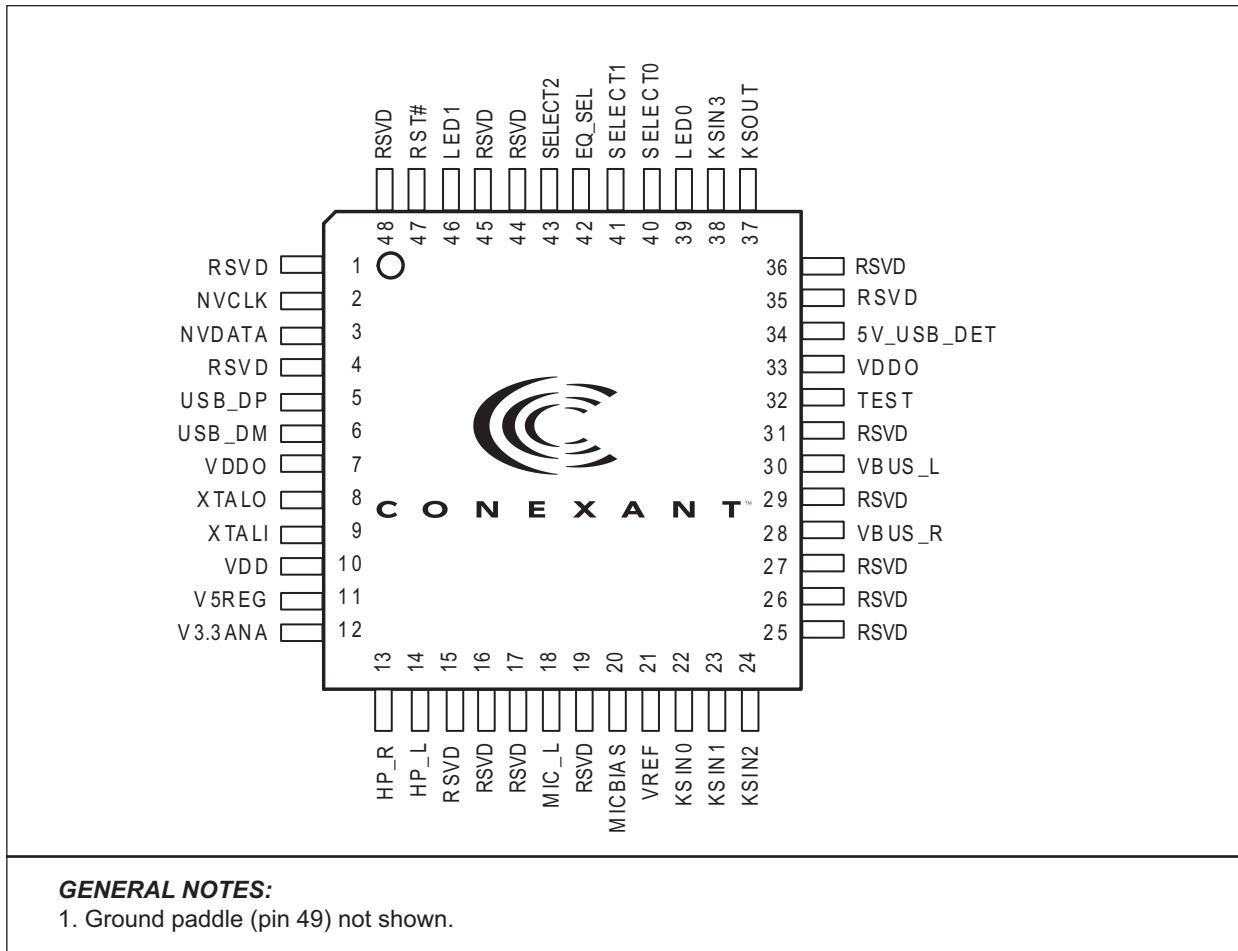
**Table 2. CX20762 Pin List**

| Pin No. | CX20762 Signal Name |
|---------|---------------------|
| 35      | RSVD                |
| 36      | RSVD                |
| 37      | KSOUT               |
| 38      | KSIN3               |
| 39      | LED0                |
| 40      | SELECT0             |
| 41      | SELECT1             |
| 42      | EQ_SEL              |
| 43      | SELECT2             |
| 44      | RSVD                |
| 45      | RSVD                |
| 46      | LED1                |
| 47      | RST#                |
| 48      | RSVD                |
| 49      | Ground Paddle       |

**Figure 3. CX20762 Hardware Interface Signals**



**Figure 4. CX20762 48-Pin QFN Pin Signals**



**Table 3. CX20762 Hardware Signal Definitions (1 of 2)**

| Label  | Pin     | I/O Type    | Signal Name/Description  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
|--|---------|-------------|--|--|---------|---------|--|---|---|---|---|---|--|---|---|--|---|---|
| <b>Crystal Signals</b>   |         |             |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| XTALI  | 9       | Digital In  | <b>Crystal In.</b> Connect XTALI to a 24.0 MHz crystal circuit.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| XTALO  | 8       | Digital Out | <b>Crystal Out.</b> Connect XTALO to the crystal circuit return.   |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>USB Signals</b>   |         |             |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| USB_DP   | 5       | Digital In  | USB Data Plus  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| USB_DM   | 6       | Digital In  | USB Data Minus   |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>Digital Power and Filter Pins</b>   |         |             |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| V5REG  | 11      | PWR         | <b>+5V Input power.</b> Connect to USB 5V or external 5V supply.   |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| VBUS_R   | 28      | PWR         | <b>+5V power.</b> Connect to USB 5V or external 5V supply.   |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| VBUS_L   | 30      |             |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| VDD  | 10      | PWR         | <b>Internal 1.8V core power.</b> Connect to ground through 0.1 $\mu$ F capacitor.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| VDDO   | 7, 33   | PWR         | <b>Internal 3.3V power.</b> Connect each pin to ground through 0.1 $\mu$ F capacitor.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>Control Signals</b>   |         |             |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| RST#   | 47      | Digital In  | <b>Reset.</b> Active low input asserted to initialize registers, sequencers, and signals to a consistent reset state.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| LED0   | 39      | Digital Out | <b>MUTE_LED.</b> Turns external LED on when microphone mute button pushed. Connect to anode of LED.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| LED1   | 46      | Digital Out | <b>GENERAL_LED.</b> Turns external LED on as defined by designer. Connect to anode of LED. Default is playback mute LED.   |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| TEST   | 32      | Digital In  | <b>TEST.</b> Connect to ground through 0 $\Omega$ resistor. Include test point on this pin for One Time Programmable programming.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| 5V_USB_DET   | 34      | Digital In  | <b>5V_USB_DETECT.</b> Connect this pin to USB 5V through external resistor divider.  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| SELECT0, SELECT1   | 40, 41  | Digital In  | <p>CX20762 can be configured to support 4 different terminal types by using Control Signals section pins:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>SELECT1</th> <th>SELECT0</th> </tr> </thead> <tbody> <tr> <td><b>Option 1 (Default-headset, Stereo headphone and mono mic)</b><br/>Playback terminal type: Headset stereo earphone<br/>Record terminal type: Headset mono microphone</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td><b>Option 2 (Microphone, mono mic)</b><br/>Record terminal type: Mono microphone</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td><b>Option 3 (Speakers and mono mic)</b><br/>Playback terminal type: Speakers<br/>Record terminal type: Mono microphone</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> </tr> <tr> <td><b>Option 4 (headset, mono headphone and mono mic)</b><br/>Playback terminal type: Headset mono earphone<br/>Record terminal type: Headset mono microphone</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> </tbody> </table> <p>Note: 0 = 10k pull-down resistor to ground.<br/>1 = 10k pull-up resistor to 3.3VD.</p> |  | SELECT1 | SELECT0 | <b>Option 1 (Default-headset, Stereo headphone and mono mic)</b><br>Playback terminal type: Headset stereo earphone<br>Record terminal type: Headset mono microphone | 0 | 0 | <b>Option 2 (Microphone, mono mic)</b><br>Record terminal type: Mono microphone | 0 | 1 | <b>Option 3 (Speakers and mono mic)</b><br>Playback terminal type: Speakers<br>Record terminal type: Mono microphone | 1 | 0 | <b>Option 4 (headset, mono headphone and mono mic)</b><br>Playback terminal type: Headset mono earphone<br>Record terminal type: Headset mono microphone | 1 | 1 |
|  | SELECT1 | SELECT0     |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>Option 1 (Default-headset, Stereo headphone and mono mic)</b><br>Playback terminal type: Headset stereo earphone<br>Record terminal type: Headset mono microphone | 0       | 0           |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>Option 2 (Microphone, mono mic)</b><br>Record terminal type: Mono microphone  | 0       | 1           |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>Option 3 (Speakers and mono mic)</b><br>Playback terminal type: Speakers<br>Record terminal type: Mono microphone   | 1       | 0           |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |
| <b>Option 4 (headset, mono headphone and mono mic)</b><br>Playback terminal type: Headset mono earphone<br>Record terminal type: Headset mono microphone             | 1       | 1           |  |  |         |         |  |   |   |   |   |   |  |   |   |  |   |   |



**Table 3. CX20762 Hardware Signal Definitions (2 of 2)**

| Label                                  | Pin  | I/O Type    | Signal Name/Description  |
|--|--|-------------|--|
| <b>Keypad/LCD Signals</b>              |  |             |  |
| KSIN[0:3]                              | 22, 23, 24, 38   | Digital In  | <b>Keypad Scan Inputs.</b> Assignment for standard 4 buttons:<br>KSIN0: Volume Up<br>KSIN1: Volume Down<br>KSIN2: Playback Mute<br>KSIN3: Microphone Mute                  |
| KSOUT                                  | 37   | Digital Out | <b>Keypad Scan Output.</b> Outputs a strobe signal as part of the process to detect if volume up, volume down, microphone mute, or playback mute buttons have been pushed. |
| <b>NVRAM Signals</b>                   |  |             |  |
| NVCLK                                  | 2  | Digital Out | <b>NVRAM Clock.</b> Connect to clock pin of external EEPROM.   |
| NVDATA                                 | 3  | Digital I/O | <b>NVRAM Data.</b> Connect to data pin of external EEPROM.   |
| <b>Audio I/O Signals</b>               |  |             |  |
| MIC_L                                  | 18   | Analog In   | <b>Left Microphone.</b> Connect to internal microphone or jack.  |
| MICBIAS                                | 20   | PWR         | <b>Microphone Bias.</b>  |
| HP_L                                   | 14   | Analog Out  | <b>Left Headphone.</b>   |
| HP_R                                   | 13   | Analog Out  | <b>Right Headphone.</b>  |
| SELECT2                                | 43   | Digital In  | <b>Headphone sense.</b> If asserted (low), headphone output is enabled.  |
| <b>Analog Power and Filter Signals</b> |  |             |  |
| V3.3ANA                                | 12   | PWR         | <b>Internal Analog 3.3V Power.</b> Connect to ground through 10 $\mu$ F and 0.1 $\mu$ F capacitor.   |
| VREF                                   | 21   | PWR         | <b>Internal 1.65 VREF Power.</b> Connect to ground through 1 $\mu$ F capacitor.  |
| <b>Ground Signal</b>                   |  |             |  |
| GROUND                                 | 49   | Power       | <b>Ground Paddle.</b>  |
| <b>Reserved</b>                        |  |             |  |
| RVSD                                   | 1, 4, 15, 16, 17, 19, 25, 26, 27, 29, 31, 35, 36, 44, 45, 48 | —           | <b>Reserved.</b>   |

## 2.4 Electrical Characteristics

**Table 4. CX20762 DC Supply Voltages**

| Parameter            | Symbol  | Min.  | Typ. | Max.   | Units | Notes |
|----------------------|---------|-------|------|--------|-------|-------|
| Digital Power Supply | V5REG   | 4.5   | 5.0  | 5.25   | V     |       |
| Core Voltage         | VDD     | 1.71  | 1.8  | 1.89   | V     |       |
| Digital 3.3 V        | VDDO    | 3.0   | 3.3  | 3.6    | V     |       |
| Analog 3.3 V         | V3.3ANA | 3.0   | 3.3  | 3.6    | V     |       |
| VREF                 | VREF    | 1.575 | 1.65 | 1.7325 | V     |       |

**Table 5. CX20762 Amplifier Characteristics**

| Parameter           | Symbol              | Min. | Typ. | Max. | Units    | Notes |
|---------------------|---------------------|------|------|------|----------|-------|
| Headphone Amp Power | P <sub>STEREO</sub> | —    | 30   | —    | mW (RMS) |       |

**Table 6. CX20762 DC Characteristics – TTL Compatible (GPIOs, Keypad Interface, LCD Interface)**

| Parameter                                    | Symbol          | Min  | Typ | Max      | Units | Notes      |
|--|-----------------|------|-----|----------|-------|------------|
| Input Voltage Low                            | V <sub>IL</sub> | -0.5 | —   | 0.8      | V     |            |
| Input Voltage High                           | V <sub>IH</sub> | 2.0  | —   | VDDO+0.5 | V     |            |
| Output Voltage Low                           | V <sub>OL</sub> | 0    | —   | 0.4      | V     |            |
| Output Voltage High                          | V <sub>OH</sub> | 2.4  | —   | VDDO     | V     |            |
| GPIO Output sink current at 0.4 V maximum    | -               | —    | —   | 12       | mA    |            |
| GPIO Output source current at 2.97 V minimum | -               | —    | —   | 12       | mA    |            |
| GPIO rise/fall time                          | -               | —    | —   | 4        | ns    | 25% to 75% |

**GENERAL NOTES:** Test Conditions unless otherwise stated: VDDO=+3.3±0.3 VDC; T<sub>A</sub> = 0°C to 70°C; external load = 50 pF

**Table 7. CX20762 Analog Performance Characteristics (1 of 2)**

| Parameter  | Minimum | Typical | Maximum | Units            |
|--|---------|---------|---------|------------------|
| Full Scale Input Voltage                               |         |         |         |                  |
| MIC (+20 dB Boost on)                                  | —       | 0.1     | —       | V <sub>rms</sub> |
| MIC (+20 dB Boost off)                                 | —       | 1.0     | —       | V <sub>rms</sub> |
| Full Scale Output Voltage                              |         |         |         |                  |
| Headphone  | —       | 1.0     | —       | V <sub>rms</sub> |
| Analog Dynamic Range                                   |         |         |         |                  |
| DAC (Class AB Headphone)                               | —       | -90     | —       | dB FSA           |
| ADC  | —       | -87     | —       | dB FSA           |
| Analog Frequency Response (±1 dB limits)               | 20      | —       | 20,000  | Hz               |
| Total Harmonic Distortion + Noise (THD+N)              |         |         |         |                  |
| DAC (Class AB Headphone)                               | —       | 0.005   | —       | %                |
| ADC  | —       | 0.006   | —       | %                |
| D/A and A/D Frequency Response (±0.25 dB limits)       | 20      | —       | 20,000  | Hz               |
| Attenuation, Gain Step Size                            | —       | 1       | —       | dB               |
| Interchannel Gain Mismatch (Difference between errors) | —       | 0.2     | —       | dB               |

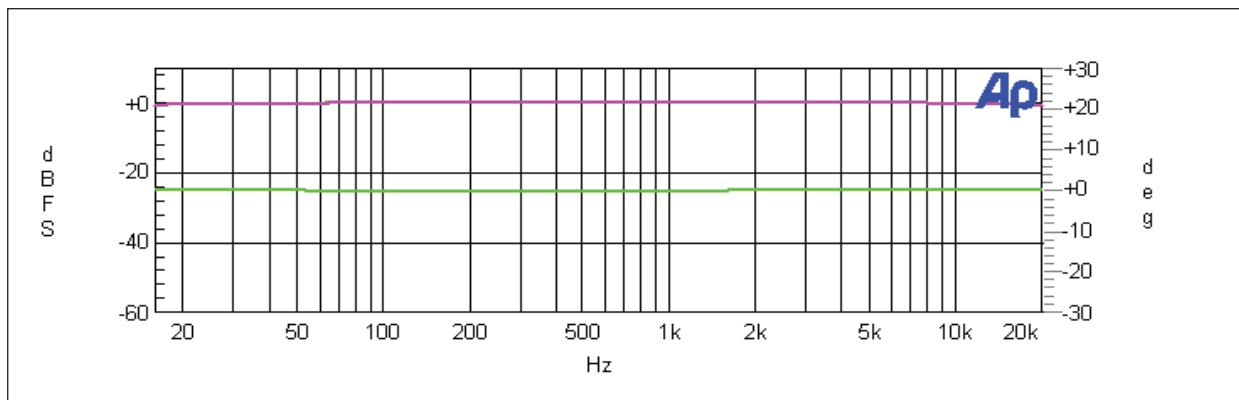
**Table 7. CX20762 Analog Performance Characteristics (2 of 2)**

| Parameter                                     | Minimum | Typical | Maximum | Units |
|---|---------|---------|---------|-------|
| Absolute Gain Step Error at any given setting | —       | —       | 0.2     | dB    |
| Microphone Input Resistance                   | —       | 5       | —       | kΩ    |
| Input Capacitance                             | —       | 5       | —       | pF    |
| Vrefout                                       |         |         |         |       |
| 50%   | —       | 1.65    | —       | V     |
| 80%   | —       | 2.64    | —       | V     |
| DC Offset                                     |         |         |         |       |
| ADC   | —       |         | 10      | mV    |
| DAC   | —       |         | 20      | mV    |

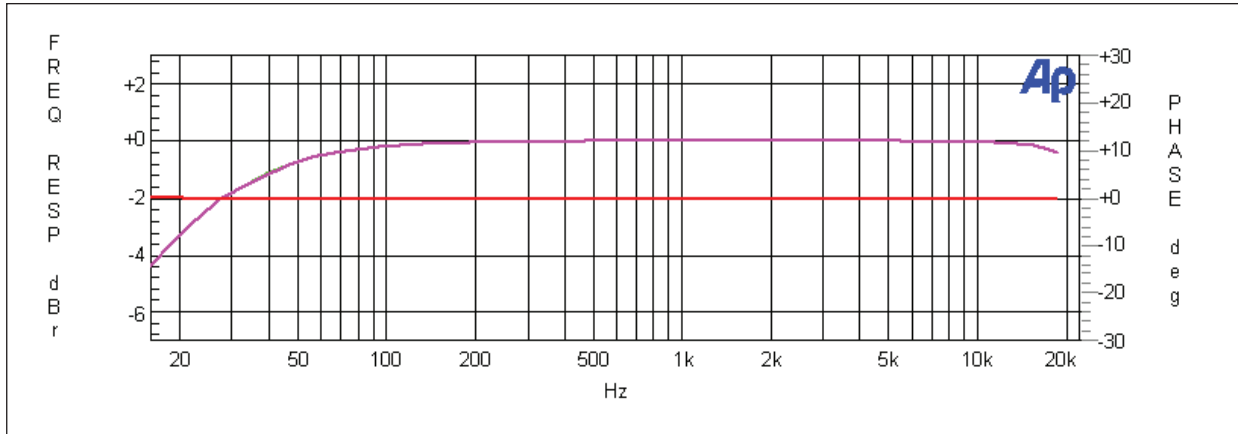
**GENERAL NOTES:**

1. The ratio of the rms output level with 997 Hz full scale input to the rms output level with all zeros into the digital input. Measured “A wtd” over a 20 Hz to a 20 kHz bandwidth. (AES17-1991 Idle Channel Noise or EIAJ CP-307 Signal-to-noise Ratio).
2. Stop Band rejection determines filter requirements. Out-of-Band rejection determines audible noise.
3. 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.
4. Standard test conditions unless otherwise noted:
5. Temperature 25 °C
6. Analog Supply (V3.3ANA) 3.3 V ±0.3 V
7. Digital Supply (VDDO) 3.3 V ±0.3 V
8. Input Voltage Levels: VDD = +3.3 V
9. Logic Low 0.8 V
10. Logic High 2.4 V
11. Input signal 1 kHz sine wave
12. 0 dBV = 1 Vrms
13. Headphone test load = 32 Ω.
14. Test bench Characterization BW:
15. Pass Band 20 Hz - 20 kHz
16. Attenuation 0 dB
17. Gain on inputs 0 dB

**Figure 5. Microphone Input Frequency Response (44.1k Sampling Rate)**



**Figure 6. Headphone Output Frequency Response (44.1k Sampling Rate)**



**NOTE:**

1. 220  $\mu$ F capacitor installed on headphone outputs. Using larger capacitors will improve the low frequency response.

**Table 8. Power Measurements**

| Configuration   | Current (mA) | Power (mW) |
|---|--------------|------------|
| Boot-Up driver not loaded                               | 86           | 430        |
| Headphone plugged in, audio playing, Volume = 0dB       | 136          | 680        |
| S1 Suspend State  | 1.3          | 6.5        |
| S3 Suspend State  | 1.3          | 6.5        |
| Hibernate   | 0            | 0          |
| <b>GENERAL NOTES:</b>                                   |              |            |
| 1. Audio: 1000 Hz tone, 0 dB, 44.1k sample rate, 16-bit |              |            |
| 2. Headphones: 32 $\Omega$                              |              |            |

## 2.5 Crystal Specifications Requirements

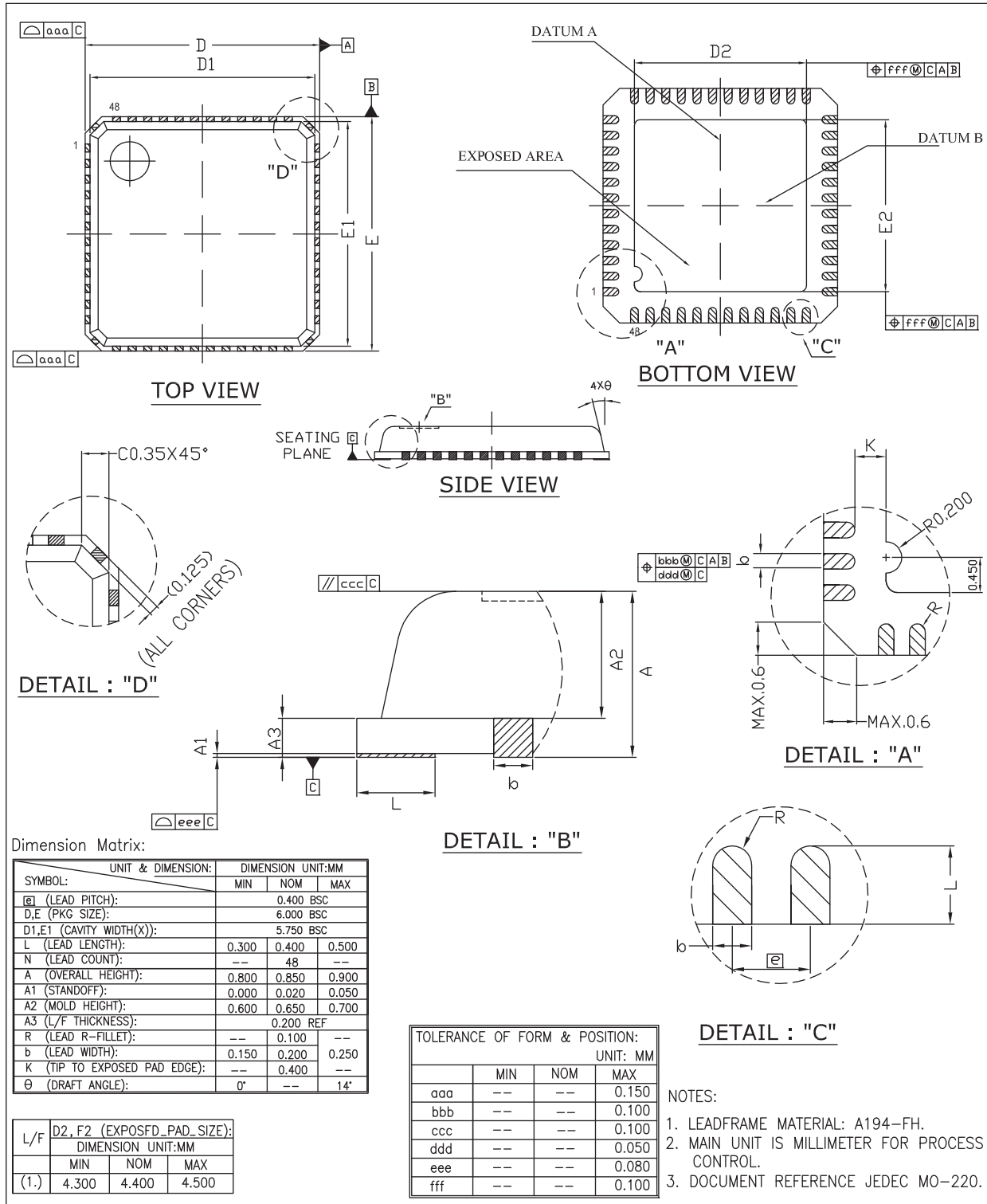
Crystal Specifications are listed in [Table 9](#).

**Table 9. Crystal Specifications**

| Characteristic                      | Value                              |
|-------------------------------------|------------------------------------|
| Frequency                           | 24.000 MHz nominal                 |
| Calibration Tolerance               | ±50 ppm at 25°C                    |
| Frequency Stability vs. Temperature | ±50 ppm (0°C to 70°C)              |
| Frequency Stability vs. Aging       | ±5 ppm/year                        |
| Oscillation Mode                    | Fundamental                        |
| Calibration Mode                    | Parallel resonant                  |
| Load Capacitance, $C_L$             | 18 pF nom.                         |
| Shunt Capacitance, $C_O$            | 7 pF max.                          |
| Series Resistance, $R_1$            | 50 $\Omega$ max.                   |
| Drive Level                         | 100 $\mu$ W correlation; 1 mW max. |
| Operating Temperature               | 0°C to 70°C                        |
| Storage Temperature                 | -40°C to 85°C                      |

## 2.6 CX20762 Package Dimensions

Figure 7. Package Dimensions 48-Pin QFN



# Reference Design and Application Information

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## 3.1 CX20762 Reference Schematic

The Orcad schematic, AVL, and Allegro layout files are available as part of the CX20762 evaluation kit. Please contact your local Conexant sales office for the CX20762 evaluation kit.

## 3.2 Application Information

### 3.2.1 Digital Volume, Playback Mute, and Microphone Mute Buttons

The button scan works as follows:

- ◆ Set KSOUT scan output to 1.
- ◆ Read KSIN0, KSIN1, KSIN2, and KSIN3. If any of these are 1, then the corresponding button has been pressed.

### 3.2.2 LED Functionality

There are 2 pins for driving LEDs, MUTE\_LED and GENERAL\_LED. Connect these pins the anode of the LED. The MUTE\_LED output will default to 0 and will switch states each time the mute button is pushed.

### 3.2.3 Inrush Current Circuit

The reference design includes an inrush current circuit. This allows for using larger bulk decoupling capacitors on the CX20762 +5V power pins without violating the USB specification for inrush current.

### 3.2.4 Microphone Input

The microphone input should be connected to the MICBIAS pin via a 2.2k resistor and DC isolated from the CX20762 device via a 2.2  $\mu$ F capacitor. See the reference design for details.

### 3.2.5 Cable Recommendations

To minimize noise and emissions, it is recommended that all cables connecting to the CX20762 board be twisted pair and shielded.





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