

## A Highly Integrated USB Audio Single Chip

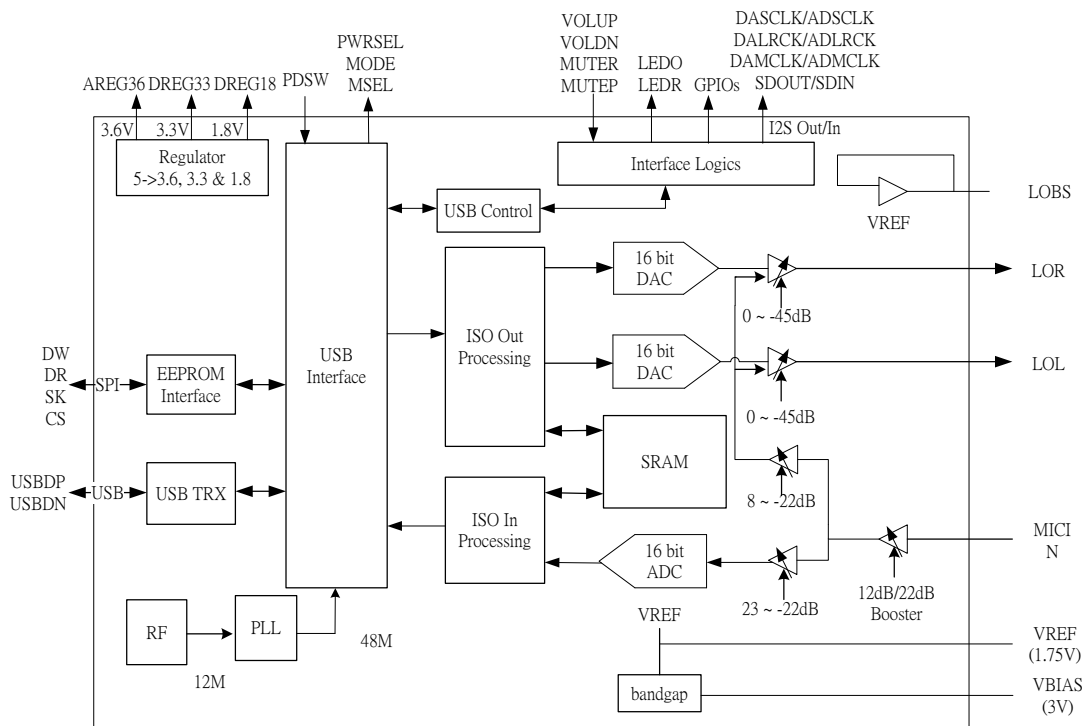
### DESCRIPTION

The CM108B is a highly integrated crystal-free USB audio single chip solution optimized for USB headset, headphone, and dongle applications. The CM108B comes with software driver interface which supports Xear™ sound effects for multimedia entertainments. All essential analog modules are embedded in the CM108B, including dual DAC and earphone driver, ADC, microphone booster, PLL, regulator and USB transceiver modules. Many features are programmable with jumper pins or by external EEPROM. Audio adjustments are easily controlled via specific HID-compliant volume control pins. An external codec or audio DSP can be connected to the CM108B via I2S pin for further processing. Vendors can customize unique USB VID/PID/Product String/Manufacture String and min/max/initial volumes to EEPROM. The CM108B also comes with an anti-pop noise circuits design and internal oscillator which can operate without an external crystal oscillator.

### FEATURES

- Compliant with USB 2.0 Full Speed Operation
- Compliant with USB Audio Device Class Specification v1.0
- Supports USB Suspend/Resume Mode and Remote Wakeup with Volume Control pins
- On-chip oscillator that provides reference sources for PLL and embedded USB transceiver
- Jumper pin for Headset Mode (Playback + Recording) and Speaker/Headphone Mode (Playback Only)
- Jumper pin for Mixer Unit enable/disable under Headset Mode and Power Mode setting
- I2S interfaces for external CODEC
- Anti-pop noise design for plugged and vice-versa
- Support Xear™ Audio Centre Software Driver for Windows OS

### BLOCK DIAGRAM



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**Release notes**

| Revision | Date        | Description                  |
|----------|-------------|------------------------------|
| 1.00     | 31 Oct 2013 | First release                |
| 1.11     | 18 Nov 2014 | Correction on page 6 diagram |

## 1 Description and overview

The CM108B is a highly integrated single-chip USB audio solution. All essential analog modules are embedded in the CM108B, including dual DAC and earphone driver, ADC, microphone booster, PLL, regulator and USB transceiver modules. It is perfectly suited to USB headset, USB earphone or USB audio-interface box applications. As well, many features are programmable with jumper pins or by external EEPROM.

The CM108B can connect to an external codec or audio DSP via I2S pins for further processing. Plus, 3 GPIO pins can be accessed with customer application software for additional value-adding applications. In addition, audio adjustments can be easily controlled via specific HID compliant volume control pins. Many features are programmable with jumper pins or external EEPROM. Vendors can customize unique USB VID/PID/Product String/Manufacture String and max/min/initial volumes to EEPROM. The CM108B also comes with an anti-pop noise circuits design and internal oscillator which can operate without an external crystal oscillator.

## 2 Ordering information

| Model No. | Package                                  | Operating Ambient Temperature | Supply Range         |
|-----------|--|-------------------------------|----------------------|
| CM108B    | 48-pin LQFP, 7mm × 7mm × 1.4mm (plastic) | -20°C to +70°C                | DVdd = 5V, AVdd = 5V |

## 3 Features

- Supports USB 2.0 full speed operation
- Compliant with USB audio device class specification 1.0
- Supports USB suspend/resume modes and remote wakeup with volume control pins
- On-chip oscillator that provides reference sources for PLL and embedded USB transceiver
- Support Xear™ audio driver for multimedia sound effects in Windows OS, for further information please refer to CM108B Xear™ Audio Center Driver User's Manual
- Jumper pin for speaker mode (playback only) or headset mode (playback plus recording)
- For headset mode, USB audio function topology has 2 input terminals, 2 output terminals, 1 mixer unit, 1 selector unit and 3 feature units
- Jumper pin allows for mixer unit enable/disable when in headset mode
- For speaker mode, the USB audio topology has 1 input terminal, 1 output terminal and 1 feature unit
- Supports one control endpoint, one isochroous OUT endpoint, one isochroous IN endpoint, and one interrupt IN endpoint
- Alternate zero bandwidth setting for releasing playback bandwidth on USB Bus when device is inactive
- Anti-pop noise design for device plugged and vice-versa, while A-A path is off
- Supports AES/EBU, IEC60958, S/PDIF consumer formats for stereo PCM data at S/PDIF output
- Volume up, volume down, and playback mute pins support USB HID for host control synchronization
- Record mute pin with LED indicator for record mute status
- Includes external EEPROM Interface for Vendor Specific USB VID, PID, Product String, Manufacture String, and max/min/initial volumes
- 3 GPIO pins with read/write via HID interface
- Jumper pin to set the power mode (100mA or 500mA, Bus-powered or self-powered)
- Isochronous transfer uses adaptive mode with internal PLL for synchronization
- 48K/44.1KHz sampling rate for both playback and recording
- Soft mute function

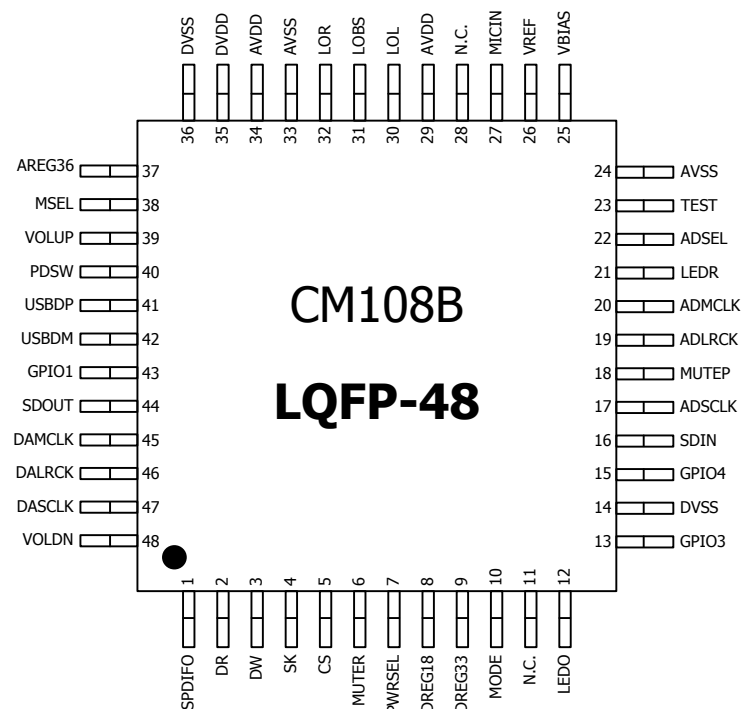
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- Embedded 16-bit ADC input with microphone boost
  - Embedded power-on reset block
  - Embedded 5V to 3.6V/3.3V/1.8V regulators for single external 5V power
  - 48-pin LQFP package

## 4 Pin descriptions

### 4.1 Pin assignment by pin number

| Pin # | Signal Name | Pin # | Signal Name | Pin # | Signal Name | Pin # | Signal Name |
|-------|-------------|-------|-------------|-------|-------------|-------|-------------|
| 1     | SPDIFO      | 13    | GPIO3       | 25    | VBIAS       | 37    | AREG36      |
| 2     | DR          | 14    | DVSS        | 26    | VREF        | 38    | MSEL        |
| 3     | DW          | 15    | GPIO4       | 27    | MICIN       | 39    | VOLUP       |
| 4     | SK          | 16    | SDIN        | 28    | N.C.        | 40    | PDSW        |
| 5     | CS          | 17    | ADSCLS      | 29    | AVDD        | 41    | USBDP       |
| 6     | MUTER       | 18    | MUTEP       | 30    | LOL         | 42    | USBDM       |
| 7     | PWRSEL      | 19    | ADLRCK      | 31    | LOBS        | 43    | GPIO1       |
| 8     | DREG18      | 20    | ADMCLK      | 32    | LOR         | 44    | SDOUT       |
| 9     | DREG33      | 21    | LEDR        | 33    | AVSS        | 45    | DAMCLK      |
| 10    | MODE        | 22    | ADSEL       | 34    | AVDD        | 46    | DALRCK      |
| 11    | N.C.        | 23    | TEST        | 35    | DVDD        | 47    | DASCLK      |
| 12    | LEDO        | 24    | AVSS        | 36    | DVSS        | 48    | VOLDN       |

### 4.2 Pin-out diagram



Pin Assignments (top view)

### 4.3 Pin signal descriptions

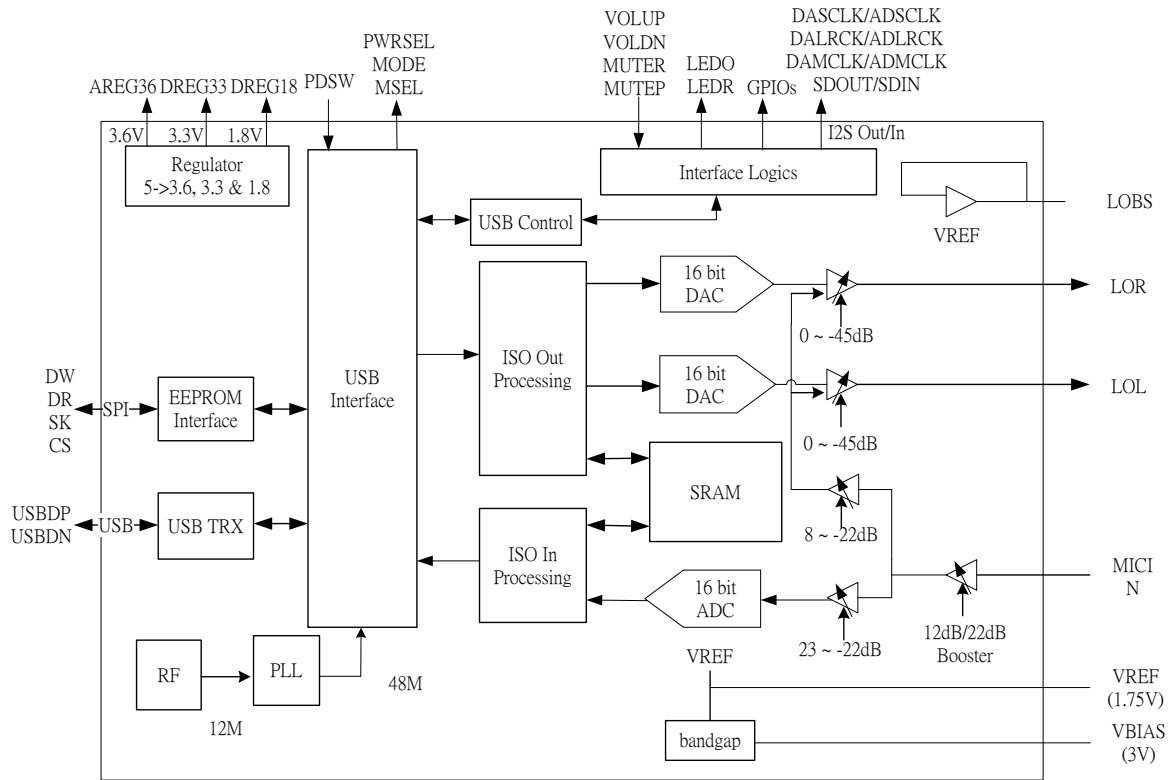
| Pin # | Symbol  | Type              | Description   |
|-------|---------|-------------------|---|
| 1     | SPDIFO  | DO, 4mA, SR       | SPDIF output  |
| 2     | DR      | DI, 8mA, PD, 5VT  | EEPROM interface data read from EEPROM  |
| 3     | DW      | DO, 4mA, SR       | EEPROM interface data write to EEPROM   |
| 4     | SK      | DO, 4mA, SR       | EEPROM interface clock  |
| 5     | CS      | DO, 4mA, SR       | EEPROM interface chip select  |
| 6     | MUTER   | DI, ST, PU        | Mute recording (edge trigger with de-bouncing)  |
| 7     | PWRSEL  | DI, ST, PU        | Chip power select pin:<br>H: push up to 3.3V, L: push down to ground<br>Speaker mode - H: 100mA self-powered, L: 500mA Bus-powered<br>Headset mode - H: 100mA Bus-powered, L: 500mA Bus-powered |
| 8     | DREG18  | P                 | 1.8V Regulator Output for Digital Core  |
| 9     | DREG33  | P                 | 3.3V Regulator Output for Digital I/O (driving current 40mA)  |
| 10    | MODE    | DI, ST, PD        | Operating mode selection:<br>H: push up to 3.3V, L: pull down to ground<br>H: speaker mode - playback only<br>L: headset mode - playback & recording  |
| 11    | N.C.    |                   |   |
| 12    | LEDO    | DO, SR, 4mA       | LED operation light: output H for power on, toggling for data transmit  |
| 13    | GPIO3   | DIO, 8mA, PD, 5VT | GPIO pin  |
| 14    | DVSS    | P                 | Digital ground  |
| 15    | GPIO4   | DIO, 8mA, PD, 5VT | GPIO pin  |
| 16    | SDIN    | DIO, 8mA, PD, 5VT | ADC I2S data input  |
| 17    | ADSCCLK | DO, 2mA, SR       | ADC I2S serial clock  |
| 18    | MUTEPL  | DI, ST, PU        | Mute playback (edge trigger with de-bouncing)   |
| 19    | ADLRCK  | DO, 2mA, SR       | ADC I2S left/right clock  |
| 20    | ADMCLK  | DO, 2mA, SR       | 11.2896MHz output for 44.1KHz sampled data and<br>12.288MHz output for 48KHz sampled data   |
| 21    | LEDR    | DO, SR, 4mA       | LED for mute recording indicator, output H when recording is muted  |
| 22    | ADSEL   | DI, ST, PD        | ADC input source select pin<br>H: use external (via I2S) ADC<br>L: use internal ADC<br>(H: push up to 3.3V, L: push down to ground)   |
| 23    | TEST    | DI, ST, PD        | Test mode select pin,<br>H: test mode<br>L: normal operation<br>(H: push up to 3.3V, L: push down to ground)  |
| 24    | AVSS    | P                 | Analog ground   |
| 25    | VBIAS   | AO                | Microphone bias voltage supply (3V), with a small driving capability  |
| 26    | VREF    | AO                | Connecting to external decoupling capacitor for embedded bandgap circuit, 1.75V output  |
| 27    | MICIN   | AI                | Microphone input, input impedance is 10k Ohm  |
| 28    | N.C.    |                   |   |
| 29    | AVDD    | P                 | 5V analog power for analog circuit  |
| 30    | LOL     | AO                | Line out: left channel  |
| 31    | LOBS    | AO                | DC 1.75V output for line out bias   |
| 32    | LOR     | AO                | Line out: right channel   |
| 33    | AVSS    | P                 | Analog ground   |
| 34    | AVDD    | P                 | 5V power supply for analog circuit  |
| 35    | DVDD    | P                 | 5V power supply for internal regulator  |
| 36    | DVSS    | P                 | Digital ground  |
| 37    | AREG36  | P                 | 3.6V analog power for analog circuit  |

|    |        |                   |  |
|----|--------|-------------------|--|
| 38 | MSEL   | DI, ST, PU        | Mixer enable select:<br>H: push up to 3.3V, L: push down to ground<br>H: with mixer/AA-path enabled (with default mute)<br>L: without mixer/AA-path disabled<br>USB descriptors will also be changed accordingly |
| 39 | VOLUP  | DI, ST, PU        | Volume up (edge trigger with de-bouncing)  |
| 40 | PDSW   | DO, 4mA, OD       | Power down switch control signal (for PMOS polarity)<br>0: normal operation<br>1: power down mode (suspend mode)   |
| 41 | USBDP  | AIO               | USB Data D+  |
| 42 | USBDM  | AIO               | USB Data D-  |
| 43 | GPIO1  | DIO, 8mA, PD, 5VT | GPIO pin   |
| 44 | SDOUT  | DO, 2mA, SR       | DAC I2S data output  |
| 45 | DAMCLK | DO, 2mA, SR       | 11.2896 MHz output for 44.1KHz sampled data and<br>12.288 MHz output for 48KHz sampled data  |
| 46 | DALRCK | DO, 2mA, SR       | DAC I2S left/right clock   |
| 47 | DASCLK | DO, 2mA, SR       | DAC I2S serial clock   |
| 48 | VOLDN  | DI, ST, PU        | Volume down (edge trigger with de-bouncing)  |

Note: DI / DO / DIO - Digital Input / Output / Bi-Directional Pad  
 AI / AO / AIO - Analog Input / Output / Bi-Directional Pad  
 SR - Slew Rate Control  
 ST - Schmitt Trigger  
 PD / PU - Pull Down / Pull Up  
 5VT - 5 Volt Tolerant (3.3V Pad)  
 OD - Open Drain  
 P - Power Supply Pin



## 5 Block diagram

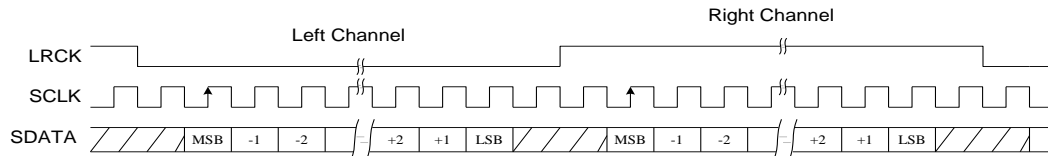


**CM108B Block Diagram**

## 6 I2S Interface

The CM108B provides an I2S interface for both playback and recording. External ADC, DAC, or DSP can be added to provide additional functions within the USB audio system. The CM108B sends out master clock (fixed at x256), LRCK (fixed at x64), and data clock data. Therefore, external ADCs, DACs, or DSPs should be set to slave mode.

The left channel of the CM108B's I2S bus is used for mono recording. Both IP<sup>2</sup>S buses use a 5V tolerant pad in order to easily interface with 5V or 3.3V devices. Playback data is simultaneously sent to both the DAC and I2S bus. The recording source (ADC or I2S bus) can be selected by ADSEL jumper pin.



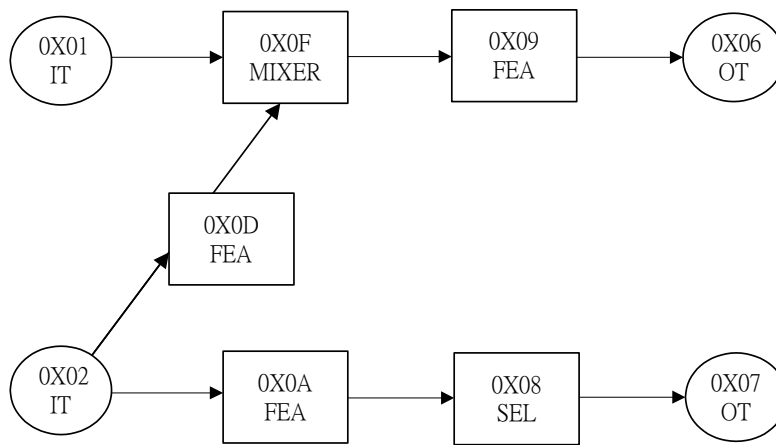
## 7 Function description

### 7.1 USB interface

The CM108B integrates USB transceiver, PLL and regulator modules, meaning only a few passive components are necessary for USB interface connection. Default USB descriptors are embedded in the CM108B, so no additional design effort is needed for generic USB operation. For custom orders, customers can attach a 93C46 EEPROM to override the embedded VID, PID, product and manufacturer strings, and initial/max/min volume settings. The CM108B automatically detects the 93C46, and the overwrite function is performed at start up.

#### 7.1.1 USB audio topology diagram for headset

The CM108B supports headset and speaker topology that can be selected by MODE pin. The topology setting as following: MODE=0, Headset Topology; MODE=1, Speaker Topology



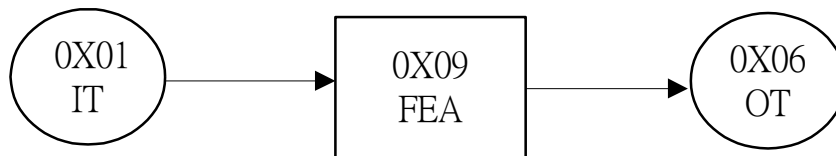
#### Device Descriptor

| Offset | Field              | Size | Value (Hex) | Description   |
|--------|--------------------|------|-------------|---|
| 0      | bLength            | 1    | 12          | Total 18 Bytes  |
| 1      | bDescriptorType    | 1    | 01          | Device Descriptor   |
| 2      | bcdUSB             | 2    | 0110        | USB 1.1 compliant.  |
| 4      | bDeviceClass       | 1    | 00          | Device class specified by interface                                   |
| 5      | bDeviceSubClass    | 1    | 00          | Device subclass specified by interface                                |
| 6      | bDeviceProtocol    | 1    | 00          | Device protocol specified by interface                                |
| 7      | bMaxPacketSize0    | 1    | 8           | Endpoint zero Size = 8 bytes  |
| 8      | idVendor           | 2    | 0d8c        | Vendor ID   |
| 10     | idProduct          | 2    | 0012        | Product ID  |
| 12     | bcdDevice          | 2    | 0100        | Device compliant to the Audio Device Class specification version 1.00 |
| 14     | iManufacturer      | 1    | 01          | Index of string descriptor describing manufacturer                    |
| 15     | iProduct           | 1    | 02          | Index of string descriptor describing product                         |
| 16     | iSerialNumber      | 1    | 00          | Index of string descriptor describing the device's serial number      |
| 17     | bNumConfigurations | 1    | 01          | Configurations number = 1   |

#### Configuration Descriptor

| Offset | Field               | Size | Value (Hex) | Description  |
|--------|---------------------|------|-------------|--|
| 0      | bLength             | 1    | 09          | Total 9 Bytes  |
| 1      | bDescriptorType     | 1    | 02          | Configuration Descriptor   |
| 2      | wTotalLength        | 2    | XXXX        | Total length of data returned for this configuration:<br>Programmable by MSEL and MODE pin   |
| 4      | bNumInterfaces      | 1    | 04          | Number of interfaces supported by this Configuration:<br>0: control interface      1: ISO-OUT interface<br>2: ISO-IN interface      3: INT-IN(HID) interface |
| 5      | bConfigurationValue | 1    | 01          | Configuration value  |
| 6      | iConfiguration      | 1    | 00          | Index of string descriptor describing this configuration   |
| 7      | bmAttributes        | 1    | 80          | Bus Power and support Remote Wakeup  |
| 8      | bMaxPower           | 2    | 32          | Maximum power consumption of the USB Device: 100mA   |

### 7.1.2 USB audio topology diagram for speaker



#### Device Descriptor

| Offset | Field              | Size | Value (Hex) | Description   |
|--------|--------------------|------|-------------|---|
| 0      | bLength            | 1    | 12          | Descriptor length                                   |
| 1      | bDescriptorType    | 1    | 01          | Device Descriptor                                   |
| 2      | bcdUSB             | 2    | 0110        | USB 1.1 compliant                                   |
| 4      | bDeviceClass       | 1    | 00          | Device class specified by interface                 |
| 5      | bDeviceSubClass    | 1    | 00          | Device subclass specified by interface              |
| 6      | bDeviceProtocol    | 1    | 00          | Device protocol specified by interface              |
| 7      | bMaxPacketSize0    | 1    | 08          | Endpoint zero packet size                           |
| 8      | idVendor           | 2    | 0d8c        | Vendor ID   |
| 10     | idProduct          | 2    | 0012        | Product ID  |
| 12     | bcdDevice          | 2    | 0100        | Device release number                               |
| 14     | iManufacturer      | 1    | 01          | Index of string descriptor describing manufacturer  |
| 15     | iProduct           | 1    | 02          | Index of string descriptor describing product       |
| 16     | iSerialNumber      | 1    | 00          | Index of string descriptor describing serial number |
| 17     | bNumConfigurations | 1    | 01          | Number of configuration                             |

#### Configuration Descriptor

| Offset | Field               | Size | Value (Hex) | Description   |
|--------|---------------------|------|-------------|---|
| 0      | bLength             | 1    | 09          | Descriptor length   |
| 1      | bDescriptorType     | 1    | 02          | Configuration Descriptor  |
| 2      | wTotalLength        | 2    | XXXX        | Total length of data returned for this configuration:<br>Programmable by MSEL and MODE pin              |
| 4      | bNumInterfaces      | 1    | 03          | Number of interfaces supported by this Configuration:<br>00: Control<br>01: ISO-Out<br>02: INT-IN (HID) |
| 5      | bConfigurationValue | 1    | 01          | Configuration value   |
| 6      | iConfiguration      | 1    | 00          | Index of string descriptor describing this configuration  |
| 7      | bmAttributes        | 1    | 80          | Attributes(PWRSEL=0:Bus Powered, 1:SELF Powered)  |
| 8      | bMaxPower           | 1    | 32          | Maximum power consumption from bus = 100mA  |

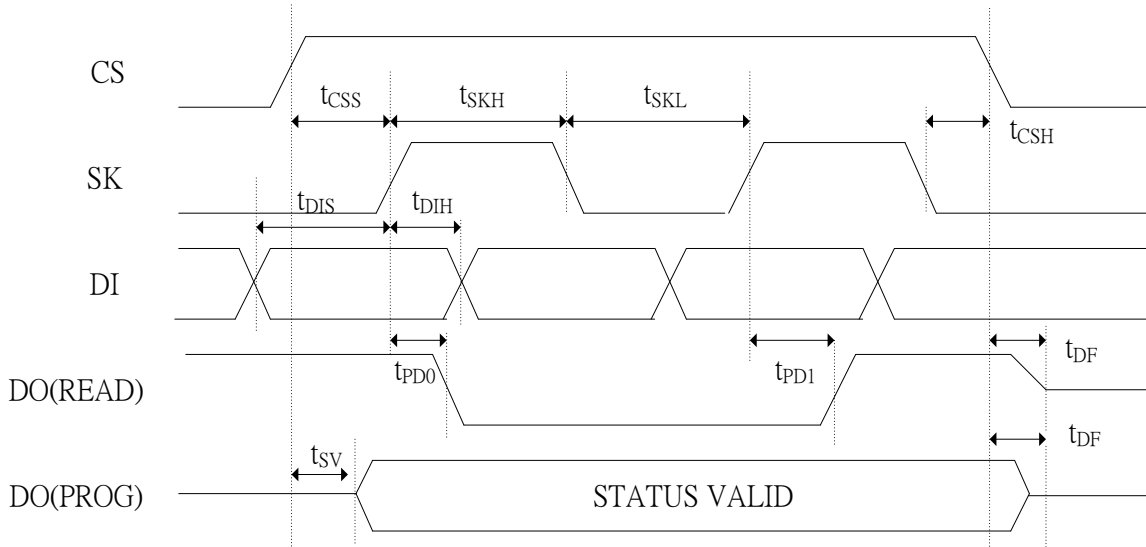
### 7.1.3 Content format for EEPROM (93C46)

Each address has 2-byte data, prefix `0x` means hex number

| Address(Hex)      | Description   |   |
|-------------------|---|---|
| 0x00              | bit[15:4] Magic Word<br>0x670X where X = bit 4, 3, 2, 1<br>bit[3] The value within address 0x2A, 0x2B, 0x32 is valid 1: valid 0: invalid<br>bit[2] reserved, should be 1<br>bit[1] serial number enable control 1: enable, 0: disable(default)<br>bit[0] reserved, should be 1  |   |
| 0x01              | VID 2-byte  |   |
| 0x02              | PID 2-byte  |   |
| 0x03              | Serial number 1st byte<br>(bit15-bit8, first character)   | Serial number length<br>(bit7-bit0)                               |
| 0x04<br>~<br>0x09 | Serial number 12-byte   |   |
| 0x0A              | Product string 1st byte (bit15-bit8, first character)   | Product string length<br>(bit7-bit0) [0x3E->30,0x40->31Char]      |
| 0x0B<br>~<br>0x19 | Product string 30-byte (default: USB Audio Device)  |   |
| 0x1A              | Manufacturer string 1st byte<br>(bit15-bit8, first character)   | Manufacturer string length<br>(bit7-bit0) [0x3E->30,0x40->31Char] |
| 0x1B<br>~<br>0x29 | Manufacturer string 30-byte (default: C-Media Electronics Inc.)   |   |
| 0x2A              | bit[15: 9] DAC initial volume (7-bit, default = -10dB)<br>bit[8: 3] ADC initial volume (6-bit, default = 8dB)<br>bit[2] DAC EEPROM MAX/MIN volume valid<br>bit[1] ADC EEPROM MAX/MIN volume valid<br>bit[0] AA EEPROM MAX/MIN volume valid  |   |
| 0x2B              | bit[15:11] AA initial volume (5-bit, default = -7dB)<br>bit[10] Reserved, should be 0<br>bit[9] Boost mode 0: 22dB 1:12dB (default)<br>bit[8] Shout down DAC analog circuits 1: shoutdown, 0: active(default)<br>bit[7] Total Power Control 1:enable, 0:disable(default)<br>bit[6] Reserved, should be 0<br>bit[5] MIC High Pass Filter 1:enable(default), 0:disable<br>bit[4] MIC PLL Adjust 1:enable, 0:disable(default)<br>bit[3] MIC BOOST 1:enable (default), 0:disable<br>bit[2] DAC Output Terminal property set to SPK or HP<br>1: Headset, 0: Speaker(default) bit[1] HID, 1: enable (default), 0: disable<br>bit[0] Remote wakeup, 1:enable, 0:disable(default) |   |
| 0x2C              | bit[15:0] DAC Minimum Volume (0xD300, DAC-Min.=-37dB, default=-37dB)  |   |
| 0x2D              | bit[15:0] DAC Maximum Volume (0x0000, DAC-Max.=0dB, default=0dB)  |   |
| 0x2E              | bit[15:0] ADC Minimum Volume(0xEA00, ADC-Min.=-22dB, default=-12dB)   |   |
| 0x2F              | bit[15:0] ADC Maximum Volume(0x1700, ADC-Max.=+23dB, default=+23dB)   |   |
| 0x30              | bit[15:0] AA Minimum Volume (0xE900, AA-Min.=-23dB, default=-23dB)  |   |
| 0x31              | bit[15:0] AA Maximum Volume (0x0800,AA-Max.+8dB, default=+8dB)  |   |
| 0x32              | EE_OPTION2 Register<br>bit[3] Reserved, should be 0<br>bit[2] Reserved, should be 0   |   |

|       |  |
|-------|--|
|       | bit[1] Reserved, should be 0<br>bit[0] Reserved, should be 0 |
| ~ END |  |

### 7.1.4 EEPROM SPI interface timing information



| Symbol    | Parameter                  | Test Condition*              | Min | Typ | Max | Units |
|-----------|----------------------------|------------------------------|-----|-----|-----|-------|
| $f_{SK}$  | SK Clock Frequency         | $2.7V \leq V_{CC} \leq 5.5V$ | 0   | -   | 200 | KHz   |
| $t_{SKH}$ | SK High Time               | $2.7V \leq V_{CC} \leq 5.5V$ | 250 | -   | -   | ns    |
| $t_{SKL}$ | SK Low Time                | $2.7V \leq V_{CC} \leq 5.5V$ | 250 | -   | -   | ns    |
| $t_{CS}$  | Minimum CS Low Time        | $2.7V \leq V_{CC} \leq 5.5V$ | 250 | -   | -   | ns    |
| $t_{CSS}$ | CS Setup Time              | $2.7V \leq V_{CC} \leq 5.5V$ | 50  | -   | -   | ns    |
| $t_{DIS}$ | DI Setup Time              | $2.7V \leq V_{CC} \leq 5.5V$ | 100 | -   | -   | ns    |
| $t_{CSH}$ | CS Hold Time               | $2.7V \leq V_{CC} \leq 5.5V$ | 0   | -   | -   | ns    |
| $t_{DIH}$ | DI Hold Time               | $2.7V \leq V_{CC} \leq 5.5V$ | 100 | -   | -   | ns    |
| $t_{PD1}$ | Output Delay to "1"        | $2.7V \leq V_{CC} \leq 5.5V$ | -   | -   | 250 | ns    |
| $t_{PD0}$ | Output Delay to "0"        | $2.7V \leq V_{CC} \leq 5.5V$ | -   | -   | 250 | ns    |
| $t_{SV}$  | CS to Status Valid         | $2.7V \leq V_{CC} \leq 5.5V$ | -   | -   | 250 | ns    |
| $t_{DF}$  | CS to DO in High Impedance | $2.7V \leq V_{CC} \leq 5.5V$ | -   | -   | 100 | ns    |
| $t_{WP}$  | Write Cycle Time           | $4.5V \leq V_{CC} \leq 5.5V$ | 0.1 | 3   | 10  | ms    |

\* based on ATMEL 93C46 EEPROM data

## 7.2 Jumper pins and mode setting:

The CM108B can be configured via several jumper pins. These jumper pin settings affect both USB descriptors and USB audio topology.

### 7.2.1 Mode pin and msel pin

If the MODE pin is pushed up to 3.3V (speaker mode), a playback-only function is activated and no recording function is declared to the host. At this setting, the MSEL pin is ignored and only one input terminal, one output terminal and one feature unit is declared in the USB audio topology.

If the MODE pin is pulled low (headset mode), a full-duplex playback and recording function is reported to the host. The MSEL pin setting activates one mixer unit and one feature unit.

- When MSEL = 1, the mixer is enabled (AA-path enabled), but with default mute setting
- When MSEL = 0, the mixer is disabled (AA-path disabled)

The above USB audio topology (7.1.4) is an example of headset mode with enabled mixer.

### 7.2.2 Mode pin and pwrssel pin

The PWRSEL pin affects the power configuration of the CM108B. Together with the MODE pin, there are a total of 4 programmable combinations.

| Combinations |      | MODE   |  |
|--------------|------|--|--|
|              |      | 3.3V   | GND  |
| PWRSEL       | 3.3V | Speaker mode:<br>Playback only<br>(100mA self-powered) | Headset mode:<br>Playback and recording<br>(100mA Bus-powered) |
|              | GND  | Speaker mode:<br>Playback only<br>(500mA Bus-powered)  | Headset mode:<br>Playback and recording<br>(500mA Bus-powered) |

USB Audio Topology Diagram

## 7.3 HID feature

USB protocols can configure devices at startup or when they are plugged in at run time. These devices are categorized into various device classes. Each device class defines the common behavior and protocols for devices that serve similar functions. The HID (Human Interface Device) class is one of the device classes.

The HID class consists primarily of devices that are used to control the operation of computer systems. Typical examples of HID class devices include:

The CM108B's HID feature allows users to set volume up, volume down, playback mute and recording mute button pins, and reports the changes to the host to synchronize host side settings. In addition, all CM108B internal registers can be accessed via HID function call.

### 7.3.1 HID descriptors

#### HID Interface Descriptor

| Offset | Field              | Size | Value (Hex) | Description   |
|--------|--------------------|------|-------------|---|
| 0      | bLength            | 1    | 09          | Size of this descriptor: 9 bytes                          |
| 1      | bDescriptorType    | 1    | 04          | Interface descriptor type                                 |
| 2      | bInterfaceNumber   | 1    | 03          | Interface number: 3                                       |
| 3      | bAlternateSetting  | 1    | 00          | Alternate: 0  |
| 4      | bNumEndpoints      | 1    | 01          | Number of endpoints used by this interface: 1             |
| 5      | bInterfaceClass    | 1    | 03          | Interface class: HID                                      |
| 6      | bInterfaceSubClass | 1    | 00          | Subclass: no  |
| 7      | bInterfaceProtocol | 1    | 00          | Must be set to 0  |
| 8      | iInterface         | 1    | 00          | String descriptor index that characterizes this interface |

#### HID Descriptor

| Offset | Field             | Size | Value (Hex) | Description                                     |
|--------|-------------------|------|-------------|---|
| 0      | bLength           | 1    | 09          | Total: 9 bytes                                  |
| 1      | bDescriptorType   | 1    | 21          | HID descriptor type                             |
| 2      | bcdHID            | 2    | 0100        | HID class version 1.0                           |
| 4      | bCountryCode      | 1    | 00          |   |
| 5      | bNumDescriptors   | 1    | 01          |   |
| 6      | bDescriptorType   | 1    | 22          | Report descriptor                               |
| 7      | wDescriptorLength | 2    | 003C        | Total size of the optional descriptor: 60 bytes |

#### Interrupt IN Endpoint Descriptor

| Offset | Field            | Size | Value (Hex) | Description                  |
|--------|------------------|------|-------------|------------------------------|
| 0      | bLength          | 1    | 07          | Total: 7 bytes               |
| 1      | bDescriptorType  | 1    | 05          | Endpoint descriptor type     |
| 2      | bEndpointAddress | 1    | 87          | In Endpoint Number = 3       |
| 3      | bmAttributes     | 1    | 03          | Interrupt endpoint type      |
| 4      | wMaxPacketSize   | 2    | 0004        | Maximum packet size: 4 bytes |
| 6      | bInterval        | 1    | 2           | 2ms                          |



## 7.4 Internal Registers

All of CM108B's internal registers can be accessed via generic HID functional calls without the need to develop a kernel mode driver. In total, 4 bytes of data can be read or written from the HID. The input report is for read and the output report is for write. These internal registers of CM108B are used to control GPIO pins, S/PDIF output and EEPROM data access.

### Access via HID Class Command

HID interrupt will occur when HID\_IR0-3 are updated by button status, or GPI in case HID\_IR0[7:6] == 2'b00).

### HID Get\_Input\_Report Format

Command Format:

| bmRequestType | bRequest               | wValue                            | wIndex                                  | wLength                 | Data   |
|---------------|------------------------|-----------------------------------|---|-------------------------|--------|
| 8'h A1        | 8'h 01<br>(Get_Report) | 16'h 01 00<br>(Rpt Type + Rpt ID) | 16'h 00 02<br>16'h 00 03<br>(Interface) | 16'h 00 04<br>(4 bytes) | Report |

### Input Data Format:

|        |              |
|--------|--------------|
| byte 0 | HID IR0[7:0] |
| byte1  | HID IR1[7:0] |
| byte2  | HID IR2[7:0] |
| byte3  | HID IR3[7:0] |

### HID Set\_Output\_Report Format

Command Format:

| bmRequestType | bRequest               | wValue                            | wIndex                                  | wLength                 | Data   |
|---------------|------------------------|-----------------------------------|---|-------------------------|--------|
| 8'h 21        | 8'h 09<br>(Set_Report) | 16'h 02 00<br>(Rpt Type + Rpt ID) | 16'h 00 02<br>16'h 00 03<br>(Interface) | 16'h 00 04<br>(4 bytes) | Report |

### Output Data Format:

|        |              |
|--------|--------------|
| byte 0 | HID OR0[7:0] |
| byte1  | HID OR1[7:0] |
| byte2  | HID OR2[7:0] |
| byte3  | HID OR3[7:0] |

### HID\_IR0 (HID input report byte 0)

Offset: 0x00

| Bits | Read/Write | Description   | Default |
|------|------------|---|---------|
| 7-6  | R          | 00: HID_IR1 is used as GPI,<br>10: values written to HID_IR0-3 are also mapped to<br>EEPROM_DATA0-1 and EEPROM_CTRL<br>Others: reserved | 0x0     |
| 5-4  | R          | Reserved  | 0x0     |
| 3    | R          | 0: no activity on record/mute button<br>1: record/mute button pressed then released   | 0x0     |
| 2    | R          | 0: no activity on playback/mute button<br>1: playback/mute button pressed then released   | 0x0     |
| 1    | R          | 0: volume-down button released  | 0x0     |

|          |   |   |     |
|----------|---|---|-----|
|          |   | 1: volume-down button pressed                               |     |
| <b>0</b> | R | 0: volume-up button released<br>1: volume-up button pressed | 0x0 |

HID\_IR1 (HID input report byte 1)

Offset: 0x01

| Bits       | Read/Write | Description   | Default |
|------------|------------|---|---------|
| <b>7-0</b> | R          | When HID_IR0[7:6] == 2'b00: HID_IR1[3:0] is the input from GPIO4 - GPIO1 in input mode<br>When HID_OR0[7] == 1'b1: mapped from EEPROM_DATA0 | 0x00    |

HID\_IR2 (HID input report byte 2)

Offset: 0x02

| Bits       | Read/Write | Description                                       | Default |
|------------|------------|---|---------|
| <b>7-0</b> | R          | When HID_OR0[7] == 1'b1: mapped from EEPROM_DATA1 | 0x00    |

HID\_IR3 (HID input report byte 3)

Offset: 0x03

| Bits       | Read/Write | Description                                      | Default |
|------------|------------|--|---------|
| <b>7-0</b> | R          | When HID_OR0[7] == 1'b1: mapped from EEPROM_CTRL | 0x00    |

HID\_OR0 (HID output report byte 0)

Offset: 0x04

| Bits       | Read/Write | Description  | Default |
|------------|------------|--|---------|
| <b>7-6</b> | R / W      | 0: HID_OR1-2 are used for GPO; HID_OR0, 3 are used for SPDIF<br>1: reserved<br>2: values written to HID_OR0-3 are also mapped to EEPROM_DATA0-1, EEPROM_CTRL (See Note)<br>3: reserved | 0x0     |
| <b>5</b>   | R / W      | Reserved   | 0x0     |
| <b>4</b>   | R / W      | When HID_OR0[7] == 1'b0: valid bit in SPDIF frame<br>When HID_OR0[7] == 1'b1: reserved   | 0x0     |
| <b>3-0</b> | R / W      | When HID_OR0[7] == 1'b0: first nibble of SPDIF status channel<br>When HID_OR0[7] == 1'b1: reserved   | 0x0     |

**Note 1:** When EEPROM access is done, HID interrupt will occur. USB host can get the result from interrupt pipe (endpoint 3).

**Note 2:** HID\_OR0 is used for SPDIF when SPDIF\_CONFIG[5] == 1'b0

HID\_OR1 (HID output report byte 1)

Offset: 0x05

| Bits       | Read/Write | Description  | Default |
|------------|------------|--|---------|
| <b>7-0</b> | R / W      | When HID_OR0[7:6] == 2'b00: HID_OR1[3:0] is the output to GPIO4 - GPIO1 in output mode<br>0: GPO drives L<br>1: GPO drives H<br>When HID_OR0[7:6] == 2'b01: reserved<br>When HID_OR0[7:6] == 2'b1x: mapped to EEPROM_DATA0 | 0x00    |

HID\_OR2 (HID output report byte 2)

Offset: 0x06

| Bits | Read/Write | Description   | Default |
|------|------------|---|---------|
| 7-0  | R / W      | When HID_OR0[7:6] == 2'b00: HID_OR2[3:0] is the mode setting for GPIO4 ~ GPIO1<br>0: set GPIO to input mode<br>1: set GPIO to output mode<br>When HID_OR0[7:6] == 2'b01: reserved<br>When HID_OR0[7:6] == 2'b1x: mapped to EEPROM_DATA1 | 0x00    |

HID\_OR3 (HID output report byte 3)

Offset: 0x07

| Bits | Read/Write | Description  | Default |
|------|------------|--|---------|
| 7-0  | R / W      | When HID_OR0[7] == 1'b0: category byte of SPDIF status channel<br>When HID_OR0[7] == 1'b1: mapped to EEPROM_CTRL | 0x00    |

Note: HID\_OR3 is used for SPDIF when SPDIF\_CONFIG[5] == 1'b0

## 8 Electrical characteristics

### 8.1 Absolute maximum rating

| Symbol    | Parameters                                 | Value         | Unit |
|-----------|--|---------------|------|
| Dvmin     | Min. digital supply voltage                | - 0.3         | V    |
| Dvmax     | Max. digital supply voltage                | + 6           | V    |
| Avmin     | Min. analog supply voltage                 | - 0.3         | V    |
| Avmax     | Max. analog supply voltage                 | + 6           | V    |
| Dvinout   | Voltage on any digital input or output pin | -0.3 to +5.5  | V    |
| Avinout   | Voltage on any analog input or output pin  | -0.3 to +3.96 | V    |
| TBstgB    | Storage temperature range                  | -40 to +125   | °C   |
| ESD (HBM) | ESD human body mode                        | + -4000       | V    |
| ESD (MM)  | ESD machine mode                           | + -200        | V    |
| Latch Up  | JEDEC standard no.78, Mar. 1997            | 200           | mA   |

### 8.2 Operation conditions

| Operation conditions           |     |       |     |      |
|--------------------------------|-----|-------|-----|------|
|                                | Min | Typ   | Max | Unit |
| Analog supply voltage          | 4.5 | 5.0   | 5.5 | V    |
| Digital supply voltage         | 4.5 | 5.0   | 5.5 | V    |
| Total power consumption        | -   | 37.25 |     | mA   |
| Suspend-mode power consumption | -   | 1.58  |     | uA   |
| Operating ambient temperature  | -20 | -     | 70  | °C   |

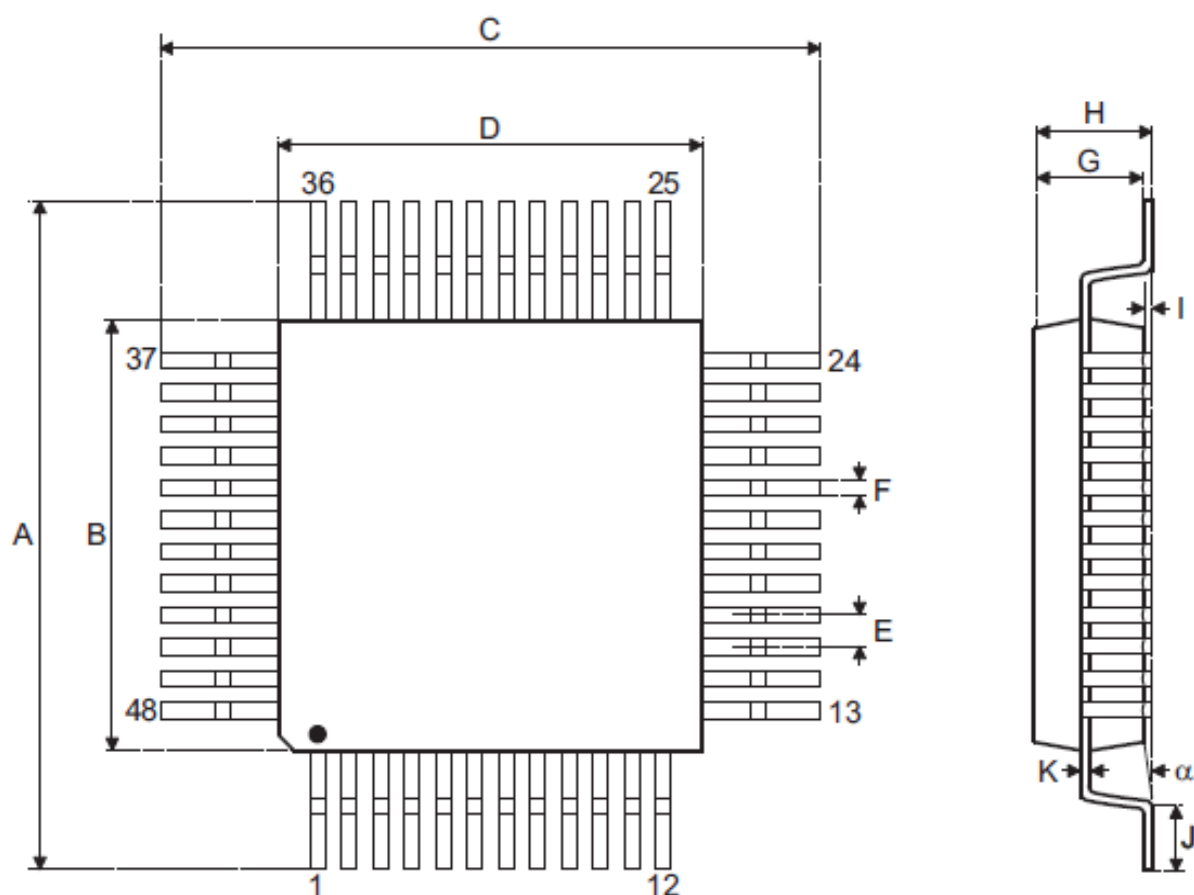
### 8.3 Electrical parameters

|                                 | Min. | Typ.  | Max. | Unit |
|---------------------------------|------|-------|------|------|
| <b>DAC (10K Ohm Loading)</b>    |      |       |      |      |
| Resolution                      | -    | 16    | -    | Bits |
| THD + N (-3dBr) @1KHz           | -    | -72   | -    | dB   |
| SNR                             | -    | 93    | -    | dB   |
| Silent SNR                      | -    | 98    | -    | dB   |
| Dynamic range                   | -    | 92    | -    | dB   |
| Frequency response 48KHz        | 20   | -     | 20K  | Hz   |
| Frequency response 44.1KHz      | 20   | -     | 20K  | Hz   |
| Full Scale Output voltage (rms) | -    | 0.995 | -    | Vrms |
| <b>DAC (32 Ohm loading)</b>     |      |       |      |      |
| Resolution                      | -    | 16    | -    | Bits |
| THD + N (-3dBr) @1KHz           | -    | -70   | -    | dB   |
| SNR                             | -    | 93    | -    | dB   |
| Silent SNR                      | -    | 98    | -    | dB   |
| Dynamic range                   | -    | 92    | -    | dB   |
| Frequency response 48KHz        | 20   | -     | 20K  | Hz   |
| Frequency response 44.1KHz      | 20   | -     | 20K  | Hz   |
| Full Scale Output voltage (rms) | -    | 0.442 | -    | Vrms |
| <b>Output Volume Control</b>    |      |       |      |      |
| Volume Control Initial Value    |      | -10   |      | dB   |

|                               |       |                |      |       |
|-------------------------------|-------|----------------|------|-------|
| Volume Control Level          | -37   | -              | 0    | dB    |
| Volume Control Step           | -     | 38             | -    | Steps |
| <b>ADC</b>                    |       |                |      |       |
| Resolution                    | -     | 16             | -    | bit   |
| THD + N (-3dBr) @1KHz         | -     | -84            | -    | dB    |
| SNR                           | -     | 90             | -    | dB    |
| Dynamic range                 | -     | 88.5           | -    | dB    |
| Frequency response 48KHz      | 100   | -              | 20K  | Hz    |
| Frequency response 44.1KHz    | 100   | -              | 20K  | Hz    |
| Input range                   | 0     | -              | 2.88 | Vpp   |
| <b>Microphone Input</b>       |       |                |      |       |
| Boost gain                    | -     | 12/22 (EEPROM) | -    | dB    |
| Gain Adjustment Initial Value |       | 8              |      | dB    |
| Gain adjustment range         | -12   | -              | 23   | dB    |
| Gain adjustment steps         | -     | 36             | -    | Steps |
| Mixer Gain Initial Value      |       | -7             |      | dB    |
| Mixer gain adjustment         | -23.0 | -              | 8.0  | dB    |
| Mixer gain adjustment steps   | -     | 32             | -    | Steps |

## 9 Package information

48-Lead Thin Plastic Quad Flatpack (LQFP)



| Symbol   | Dimensions in mm |        |         |
|----------|------------------|--------|---------|
|          | Minimum          | Normal | Maximum |
| A        | 8.90             | —      | 9.10    |
| B        | 6.90             | —      | 7.10    |
| C        | 8.90             | —      | 9.10    |
| D        | 6.90             | —      | 7.10    |
| E        | —                | 0.50   | —       |
| F        | —                | 0.20   | —       |
| G        | 1.35             | —      | 1.45    |
| H        | —                | —      | 1.60    |
| I        | —                | 0.10   | —       |
| J        | 0.45             | —      | 0.75    |
| K        | 0.10             | —      | 0.20    |
| $\alpha$ | 0°               | —      | 7°      |

Note: Outline Dimensions are shown in millimeters

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## Reference

- USB specification 1.1 and 2.0-compliant
- USB audio device class specification 1.0-compliant
- USB human interface device class specification 1.11-compliant

— End of Datasheet —

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