# CM108 High Integrated
# USB Audio I/O Controller

# DataSheet 1.5

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## 10. REFERENCE APPLICATION CIRCUIT

# 1. DESCRIPTION AND OVERVIEW

CM108 is a highly integrated single chip USB audio solution. All essential analog modules are embedded in CM108, including dual DAC and earphone driver, ADC, microphone booster, PLL, regulator, and USB transceiver. It is very suitable for USB headset, USB earphone or USB audio interface box application. Many features are programmable with jumper pins or external EEPROM. In addition, audio adjustment can be easily controlled via specific HID compliant volume control pins. For value added application, external codec or audio DSP can be connected to CM108 via $I^2S$ pin for further processing. 4 GPIO pins can be accessed with customer application software for additional value added application.

# 2. 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
- Single 12MHz Crystal Input with On-chip PLL and Embedded USB Transceiver
- Jumper Pin for Speaker Mode (Playback Only) or Headset Mode (Playback + 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 for Mixer Unit Enable / Disable under Headset Mode
- For Speaker Mode, USB Audio Function Topology has 1 Input Terminal, 1 Output Terminal, and 1 Feature Unit
- Support One Control Endpoint, One Isochronous Out Endpoint, One Isochronous In Endpoint, and One Interrupt In Endpoint

- Alternate Zero Bandwidth Setting for Releasing Playback Bandwidth on USB Bus when this Device is Inactive

- 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 device class for Host Control Synchronization

- Record Mute Pin with LED Indicator for Record Mute Status

- External EEPROM Interface for Vendor Specific USB VID, PID, and Serial Number

- EEPROM Write Function via Vendor Specific request for Mass Production Convenience

- Customized Embedded VID, PID, and Product String by Customer Request

- 4 GPIO Pins with Read/Write via HID Interface

- Jumper Pin to Set the Output Voltage Swing (3.5V or 2.5V)

- Jumper Pin to Set the Power Mode (100mA or 500mA, Bus Power or Self Power)

- Isochronous Transfer uses Adaptive Mode with Internal PLL for Synchronization

- 48K / 44.1KHz Sampling Rate for Both Playback and Recording

- Soft Mute Function

- Embedded High Performance 16-Bit Audio DAC with Earphone Phone Amplifier

- Host Side Data Loss Noise Reduction Function

- Embedded 16-Bit ADC Input with Microphone Boost

- Embedded Power-On-Reset Block

- Embedded 5V to 3.3V Regulator for Single External 5V Operation

- Compatible with Win98 SE / Win ME / Win 2000 / Win XP and Mac OS9 / OS X without Additional Driver

- 48 Pin LQFP Package

# 3. PIN DESCRIPTIONS

## 3.1 PIN ASSIGNMENT BY PIN NUMBER

| Pin # | Signal Name | Pin # | Signal Name | Pin # | Signal Name | Pin # | Signal Name |
|-------|-------------|-------|-------------|-------|-------------|-------|-------------|
| 1 | SPDIFO | 13 | GPIO3 | 25 | AO | 37 | REGV |
| 2 | DW | 14 | DVSS1 | 26 | AI | 38 | MSEL |
| 3 | DR | 15 | GPIO4 | 27 | AI | 39 | VOLUP |
| 4 | SK | 16 | SDIN | 28 | P | 40 | PDSW |
| 5 | CS | 17 | ADSCLS | 29 | AO | 41 | USBDP |
| 6 | MUTER | 18 | MUTEP | 30 | AO | 42 | USBDM |
| 7 | PWRSEL | 19 | ADLRCK | 31 | AO | 43 | GPIO1 |
| 8 | XI | 20 | ADMCLK | 32 | AO | 44 | SDOUT |
| 9 | XO | 21 | LEDR | 33 | AVSS2 | 45 | RAMCLK |
| 10 | MODE | 22 | ADSEL | 34 | AVDD2 | 46 | DALRCK |
| 11 | GPIO2 | 23 | TEST | 35 | DVDD | 47 | DASCLS |
| 12 | LEDO | 24 | AO | 36 | DVSS2 | 48 | VOLDN |

## 3.2 PIN-OUT DIAGRAM
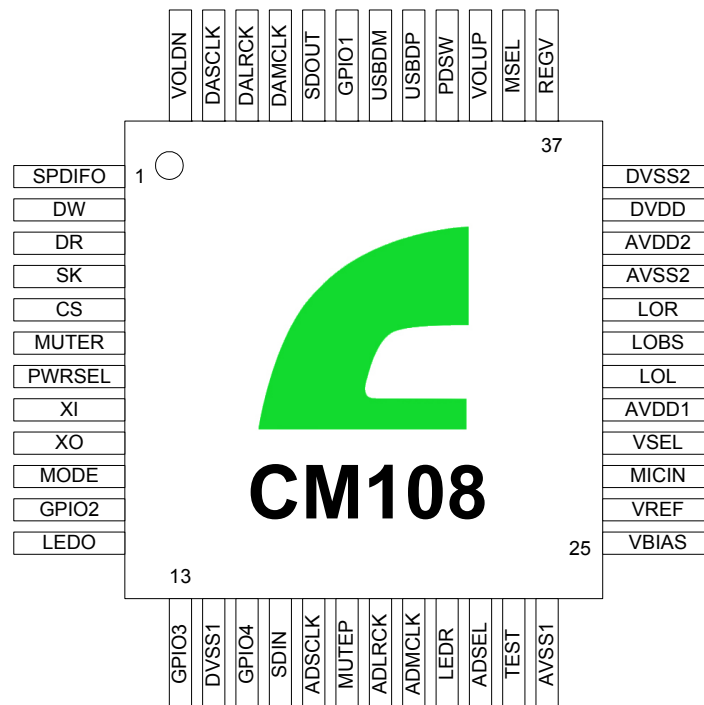


**Pin Assignments (Top View)**

## 3.3 PIN SIGNAL DESCRIPTIONS

| Pin # | Symbol | Type | Description |
|-------|--------|------|-------------|
| 1 | SPDIFO | DO, 8mA, SR | SPDIF Output |
| 2 | DW | DIO, 8mA, PD, 5VT | EEPROM Interface Data read from EEPROM |
| 3 | DR | 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 | Chip Power Select Pin, worked with MODE Pin<br>Speaker Mode　H：Self Power with 100mA<br>　　　　　　　　 L：Bus Power with 500mA<br>Headset Mode　H：Bus Power with 100mA<br>　　　　　　　　 L：Bus Power with 500mA<br>（ H: Pull Up to 3.3V;　L: Pull Down to Ground ) |
| 8 | XI | DI | Input Pin for 12MHz Oscillator |
| 9 | XO | DO | Output Pin for 12MHz Oscillator |
| 10 | MODE | DI, ST | Operating mode select<br>　H：Speaker Mode - Playback Only<br>　L：Headset Mode - Playback & Recording<br>（ H: Pull Up to 3.3V;　L: Pull Down to Ground ) |
| 11 | GPIO2 | DIO, 8mA, PD, 5VT | GPIO Pin |
| 12 | LEDO | DO, SR, 8mA | LED for Operation;<br>Output H for Power On; Toggling for Data Transmit |
| 13 | GPIO3 | DIO, 8mA, PD, 5VT | GPIO Pin |
| 14 | DVSS1 | P | Digital Ground |
| 15 | GPIO4 | DIO, 8mA, PD, 5VT | GPIO Pin |

| 16 | SDIN | DIO, 8mA, PD, 5VT | ADC I2S Data Input |
|---|---|---|---|
| 17 | ADSCLK | DIO, 4mA, SR | ADC I2S Serial Clock |
| 18 | MUTEP | DI, ST, PU | Mute Playback (Edge Trigger with de-Bouncing) |
| 19 | ADLRCK | DO, 4mA, SR | ADC I2S Left / Right Clock |
| 20 | ADMCLK | DIO, 4mA, SR | 11.2896MHz Output for 44.1KHz Sampled Data and 12.288MHz Output for 48KHz Sampled Data |
| 21 | LEDR | DO, SR, 8mA | 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: Pull Up to 3.3V;  L: Pull Down to Ground ) |
| 23 | TEST | DI, ST, PD | Test Mode Select Pin;<br>H: Test Mode<br>L: Normal Operation<br>( H: Pull Up to 3.3V;  L: Pull Down to Ground ) |
| 24 | AVSS1 | P | Analog Ground |
| 25 | VBIAS | AO | Microphone Bias Voltage Supply (4.5V), with a small Driving Capability |
| 26 | VREF | AO | Connecting to External Decoupling Capacitor for Embedded Bandgap Circuit; 2.25V Output |
| 27 | MICIN | AI | Microphone Input |
| 28 | VSEL | AI | Line Out Voltage Swing Select<br>H: Line out Vpp = 3.5 Volts<br>L: Line out Vpp = 2.5 Volts<br>( H: Pull Up to 5V;  L: Pull Down to Ground ) |
| 29 | AVDD1 | P | 5V Analog Power for Analog Circuit |
| 30 | LOL | AO | Line Out Left Channel |
| 31 | LOBS | AO | DC 2.25V Output for Line Out Bias |

| 32 | LOR | AO | Line Out Right Channel |
|----|-----|-----|------------------------|
| 33 | AVSS2 | P | Analog Ground |
| 34 | AVDD2 | P | 5V Power Supply for Analog Circuit |
| 35 | DVDD | P | 5V Power Supply for Internal Regulator |
| 36 | DVSS2 | P | Digital Ground |
| 37 | REGV | AO | 3.3V Reference Output for Internal 5V → 3.3V Regulator |
| 38 | MSEL | DI, ST | Mixer Enable Select, worked with MODE pin<br>    H: With Mixer / AA-Path Enable (With Default Mute)<br>    L: Without Mixer / AA-Path Disable<br>    ( H: Pull Up to 3.3V, L: Pull Down to Ground )<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, 4mA, SR | DAC I2S Data Output |
| 45 | DAMCLK | DO, 4mA, SR | 11.2896 MHz Output for 44.1KHz Sampled Data and<br>12.288 MHz Output for 48KHz Sampled Data |
| 46 | DALRCK | DO, 4mA, SR | DAC I2S Left/Right Clock |
| 47 | DASCLK | DO, 4mA, 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

# 4. I²S INTERFACE

CM108 provide I$^2$S interface for both playback and recording. External ADC, DAC, or DSP can be added to provide additional function in the USB audio system. CM108 sends out the master clock (fixed at x256), LRCK (fixed at x64), and data clock. Therefore external ADC, DAC, or DSP should be set at slave mode for I$^2$S interface. Left channel of I$^2$S bus is used for CM108 mono recording. Both I$^2$S buses use 5V tolerant pad so they can be easily interfacing with 5V or 3.3V devices. Playback data is simultaneously sent to both DAC and I$^2$S bus. Recording source (from ADC or from I$^2$S bus) can be selected by ADSEL jumper pin.
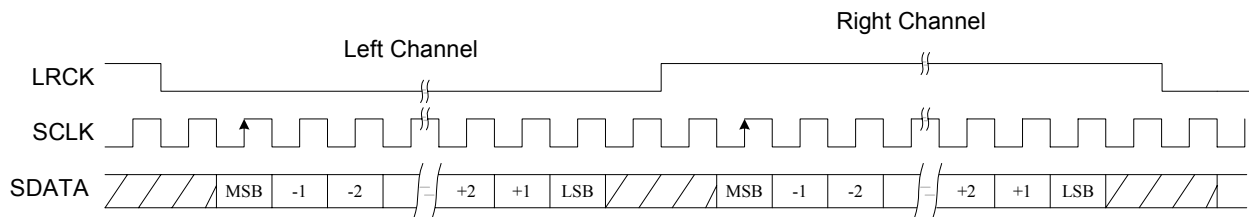
# 5. BLOCK DIAGRAM
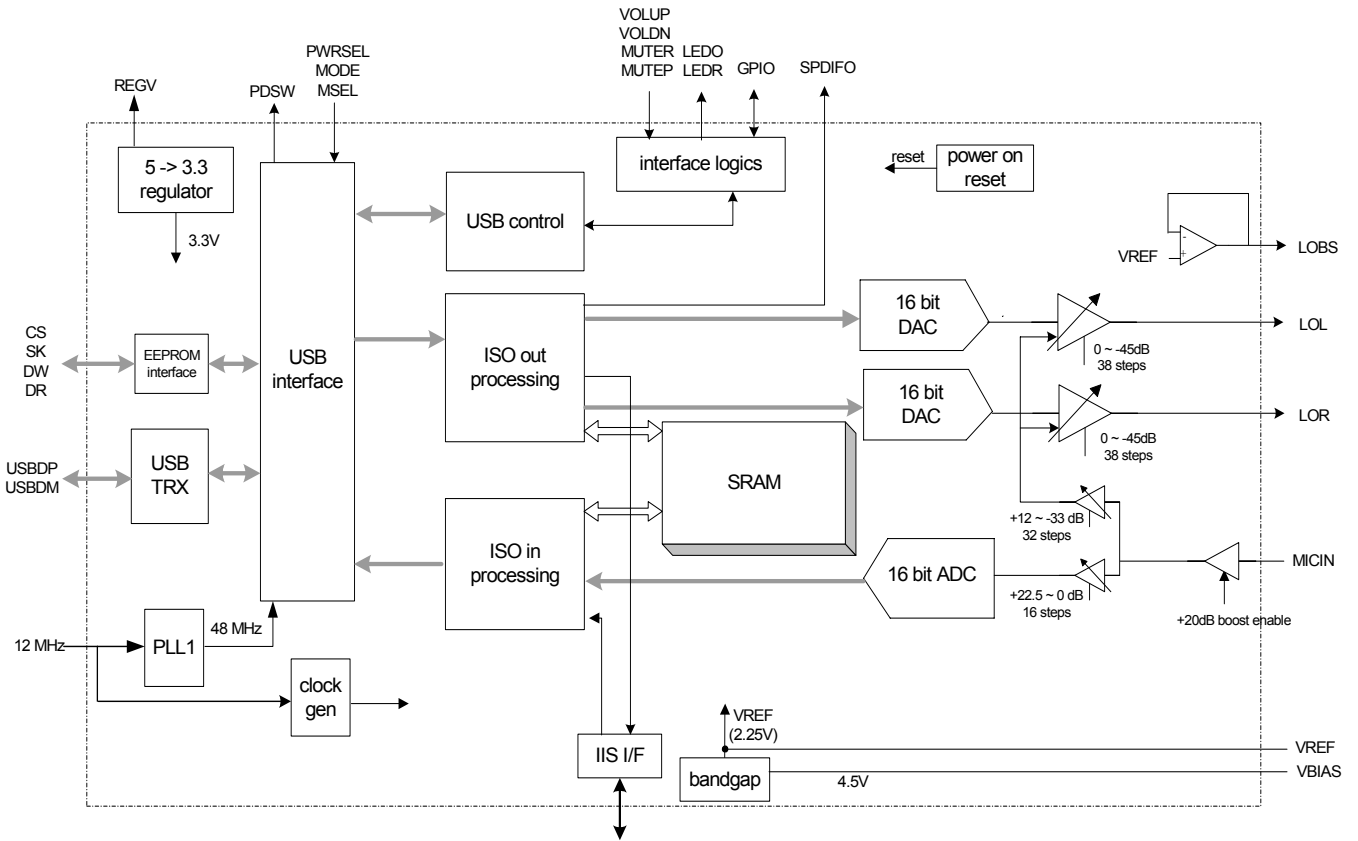
**Block Diagram Of CM108**

# 6. ORDERING INFORMATION

| Model Number | Package | Operating Ambient Temperature | Supply Range |
|---|---|---|---|
| CM108 | 48-Pin LQFP 7mm×7mm×1.4mm (Plastic) | 0 o C to +70 o C | DVdd = 5V, AVdd = 5V |

**Outline Dimensions**   *Dimensions shown in inches and (mm)

### 48-Lead Thin Plastic Quad Flatpack (LQFP)
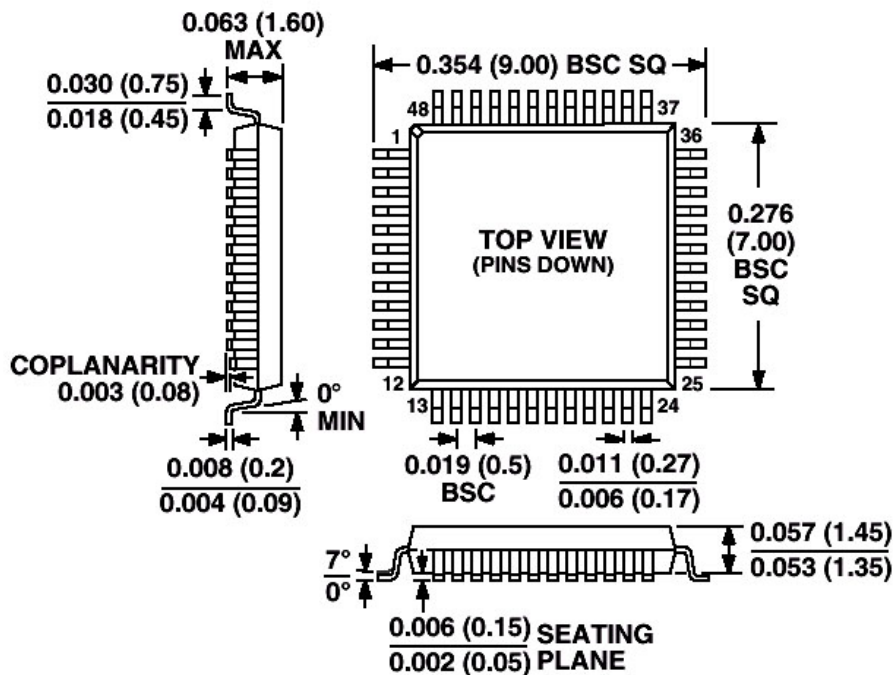


**Ordering Information Of CM108**

# 7. FUNCTION DESCRIPTIONS

## 7.1 USB Interface

CM108 integrates USB transceiver, PLL, and regulator. So only a few passive components are necessary for the USB interface connection. Default USB descriptors are embedded in CM108; therefore no additional design effort is needed for USB operation. PID will be changed with the MODE pin setting, so different setting will have different PID. For customized product, customer can attach a 93C46 EEPROM to override the embedded VID, PID and provide addition serial number for each set. CM108 will automatically detect the 93C46 existence and performs the overwrite function during power up.

### 7.1.1 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 | |
| 5 | bDeviceSubClass | 1 | 00 | |
| 6 | bDeviceProtocol | 1 | 00 | |
| 7 | bMaxPacketSize0 | 1 | 40 | Endpoint zero Size = 64 bytes |
| 8 | idVendor | 2 | 0d8c | Vendor ID |
| 10 | idProduct | 2 | 0008 ~ 000F | Product ID Programmable by MSEL and MODE pin |
| 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 | 03 | Index of string descriptor describing the device's serial number |
| 17 | bNumConfigurations | 1 | 01 | Configurations number = 1 |

**Note**: VID, PID, and serial number can be overridden by external EEPROM content

## 7.1.2 Configuration Descriptor

| Offset | Field | Size | Value (Hex) | Description |
|--------|-------|------|-------------|-------------|
| 0 | bLength | 1 | 09 | Total 9 Bytes |
| 1 | bDescriptorType | 1 | 02 | Configuration Descriptor |
| 2 | wTotalLength | 2 | | Total length of data returned for this configuration. Programmable by MSEL and MODE pin |
| 4 | bNumInterfaces | 1 | 04 or 03 | Number of interfaces supported by this Configuration, Changed by MODE pin. EP0: Control Interface EP1: ISO-OUT Interface EP2: ISO-IN Interface (Optional) EP3: INT-IN (HID) Interface |
| 5 | bConfigurationValue | 1 | 01 | |
| 6 | iConfiguration | 1 | 00 | |
| 7 | bmAttributes | 1 | A0 or E0 | Programmable by PWRSEL |
| 8 | bMaxPower | 2 | 32 or FA | Maximum power consumption of the USB. Programmable by MODE and PWRSEL Pin |

## 7.1.3 Content Format for EEPROM (93C46)

670X        where X = bit 4, 3, 2, 1
bit 2 serial number enable control  1: enable 0: disable
bit 1 product string enable control  1: enable 0: disable

1W = 2Bytes

| id code 2 bytes |  address = 0
| VID 2 bytes |
| PID 2 bytes |
| serial number 6 bytes |
| unused |

## 7.1.4 USB Audio Topology Diagram

**USB Out**

**IT**

**ID = 01**

**Feature Unit**
**(volume) (mute)**
**ID = 0D**

**Mixer Unit**
**ID = 0F**

enable or disable by
MSEL pin

**Speaker out**

**OT**

**ID = 06**

**Feature Unit**
**(volume) (mute)**
**ID = 09**

**Microphone In**

**IT**

**ID=02**

**Feature Unit**
**(volume) (mute)**
**ID= 0A**

**selector Unit**
**ID = 08**

**USB IN**

**OT**

**ID = 07**

## 7.2 Jumper Pins and Mode Setting:

Jumper pins can set the configuration of CM108. These jumper pin settings affect both USB descriptors and USB audio topology.

### 7.2.1 MODE Pin and MSEL Pin

If MODE pin is pulled high (Speaker Mode), a playback only function is activated and there is no recording function declared to the host. At this setting, MSEL pin is ignored and only one input terminal, one output terminal and one feature unit is declared in USB audio topology.

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

When MSEL = 1, Mixer is enable (AA-Path enable), but with default mute setting;
When MSEL = 0, Mixer is disable (AA-Path disable).
The above USB audio topology (7.1.4) is an example of headset mode with Mixer enable.

### 7.2.2 MODE Pin and PWRSEL Pin

PWRSEL pin affects the power configuration of CM108; together with MODE pin totally 4 combinations are programmable.

| Combinations | | MODE | |
|---|---|---|---|
| | | 3.3V | GND |
| PWRSEL | 3.3V | Speaker Mode: Playback Only (Self Power with 100mA) | Headset Mode: Playback + Recording (Bus Power with 100mA) |
| | GND | Speaker Mode: Playback Only (Bus Power with 500mA) | Headset Mode: Playback + Recording (Bus Power with 500mA) |

**USB Audio Topology Diagram**

### 7.2.3 VSEL Pin

VSEL jumper pin sets the output voltage swing. When VSEL is connected to 5V, output voltage swing is 3.5Vpp; when VSEL is connected to ground, output voltage is 2.5Vpp.

## 7.3 HID Feature

HID feature is provided by CM108 so user setting to Volume Up, Volume Down, and Playback Mute button pin is reported to the host to synchronize host side setting. In addition, all CM108 internal registers can be accessed via HID function call.

### 7.2.3 What's HID

USB protocols can configure devices at startup or when they are plugged in at run time. These devices are broken 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 by humans to control the operation of computer systems. Typical examples of HID class devices include:
- Keyboards and pointing devices, for example: mouse, trackballs, and joysticks.
- Front-panel controls, for example: knobs, switches, buttons, and sliders.
- Controls that might be found on devices such as VCR remote controls, games or simulation devices, for example: data gloves, throttles, and steering wheels.
- Devices that may not require human interaction but provide data in a similar format to HID class devices, for example: bar-code readers, thermometers, or voltmeters.

### 7.2.4 HID Descriptor

**HID Interface Descriptor**

| Offset | Field | Size | Value (Hex) | Description |
|--------|-------|------|-------------|-------------|
| 0 | bLength | 1 | 09 | Size of this descriptor: 9 byte |
| 1 | bDescriptorType | 1 | 04 | INTERFACE descriptor type |
| 2 | bInterfaceNumber | 1 | 03 | Number of Interface: 3 |
| 3 | bAlternateSetting | 1 | 00 | alternate 0 |
| 4 | bNumEndpoints | 1 | 01 | Number of endpoints used by this Interface: 1 |
| 5 | bInterfaceClass | 1 | 03 | HID Interface Class |
| 6 | bInterfaceSubClass | 1 | 00 | No Subclass |
| 7 | bInterfaceProtocol | 1 | 00 | Must be set to 0 |
| 8 | iInterface | 1 | 00 | Index of a string descriptor that describes 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 1.00 |
| 4 | bCountryCode | 1 | 00 | |
| 5 | bNumDescriptors | 1 | 01 | |
| 6 | bDescriptorType | 1 | 22 | Report Descriptor |
| 7 | wDescriptorLength | 2 | 0030 | Numeric expression that is the total size of the optional descriptor: 48 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 | 83 | IN Endpoint<br>Endpoint number = 3 |
| 3 | bmAttributes | 1 | 03 | Interrupt endpoint type |
| 4 | wMaxPacketSize | 2 | 0004 | Maximum packet size: 4 bytes |
| 6 | bInterval | 1 | 20 | 32ms |

### 7.2.5 Windows Software Architecture for HID
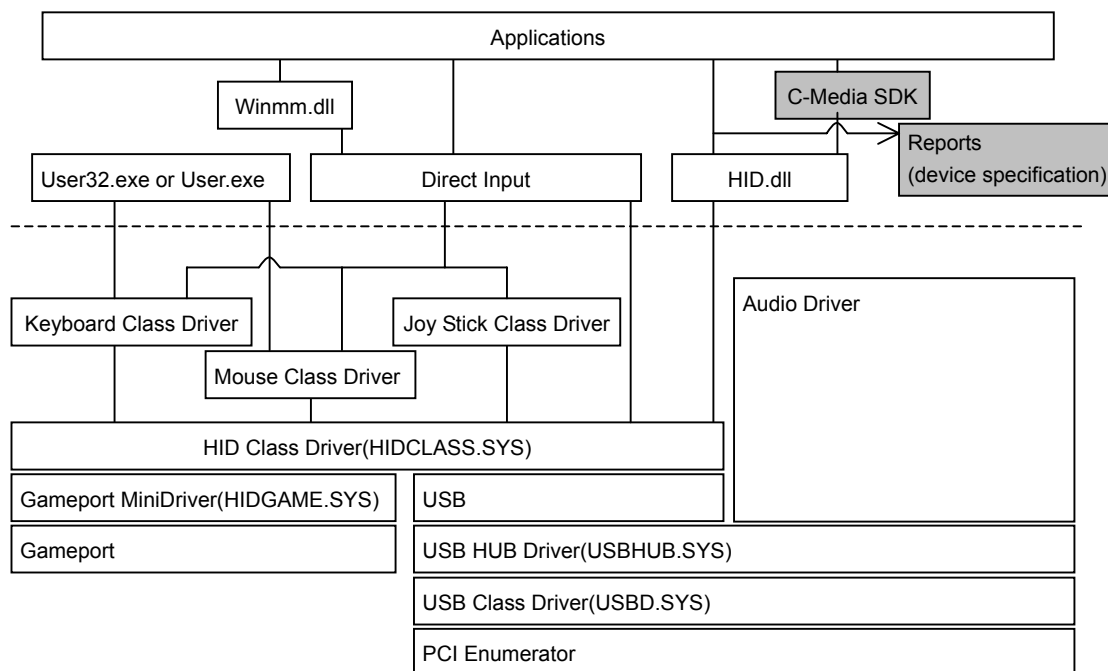


**Note:** Please contact with our sales for the C-Media SDK example if needed.

## 7.4 Internal Registers

All internal registers of CM108 can be accessed via generic HID functional calls without the need to develop kernel mode driver. Totally 4 bytes of data can be read or write from HID. Input report is for read and output report is for write. Internal registers of CM108 are used to control GPIO, S/PDIF output, and EEPROM data access.

### 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 EEPROM_DATA0-1, 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<br>1: Volume-Down button pressed | 0x0 |
| 0 | 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 |
|---|---|---|---|
| 7-0 | R | When HID_IR0[7:6] == 2'b00:<br>HID_IR1[3:0] is the input from GPIO4 ~ GPIO1 in input mode<br>When HID_OR0[7] == 1'b1:<br>Mapped from EEPROM_DATA0 | 0x00 |

### HID_IR2 (HID input report byte 2)

Offset : 0x02

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

### HID_IR3 (HID input report byte 3)

Offset : 0x03

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

### HID_OR0 (HID output report byte 0)

Offset : 0x04

| Bits | Read/Write | Description | Default |
|------|------------|-------------|---------|
| 7-6 | R / W | 0: HID_OR1-2 are used for GPO;<br>    HID_OR0, 3 are used for SPDIF<br>1: Reserved<br>2: Values written to HID_OR0-3 are also<br>    mapped to EEPROM_DATA0-1,<br>    EEPROM_CTRL (See Note)<br>3: Reserved | 0x0 |
| 5 | R / W | Reserved | 0x0 |
| 4 | R / W | When HID_OR0[7] == 1'b0:<br>    Valid bit in SPDIF frame<br>When HID_OR0[7] == 1'b1:<br>    Reserved | 0x0 |
| 3-0 | R / W | When HID_OR0[7] == 1'b0:<br>    First nibble of SPDIF status channel<br>When HID_OR0[7] == 1'b1:<br>    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 |
|------|-----------|-------------|---------|
| 7-0 | R / W | When HID_OR0[7:6] == 2'b00:<br>    HID_OR1[3:0] is the output to GPIO4 ~<br>GPIO1 in output mode<br>        0: GPO drives L<br>        1: GPO drives H<br>When HID_OR0[7:6] == 2'b01:<br>        Reserved<br>When HID_OR0[7:6] == 2'b1x:<br>        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:<br>    HID_OR2[3:0] is the mode setting for<br>GPIO4 ~ GPIO1<br>        0: Set GPIO to input mode<br>        1: Set GPIO to output mode<br>When HID_OR0[7:6] == 2'b01:<br>        Reserved<br>When HID_OR0[7:6] == 2'b1x:<br>        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:<br>    Category byte of SPDIF status channel<br>When HID_OR0[7] == 1'b1:<br>    Mapped to EEPROM_CTRL | 0x00 |

**Note:** HID_OR3 is used for SPDIF when SPDIF_CONFIG[5] == 1'b0

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# 8. ELECTRICAL CHARACTERISTICS

## 8.1 Absolute Maximum Rating

| Symbol | Parameter | 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 +5.5 | V |
| $T_{stg}$ | Storage Temperature Range | -40 to +125 | $^0C$ |
| ESD (HBM) | ESD Human Body Mode | 3500 | V |
| ESD (MM) | ESD Machine Mode | 200 | V |

## 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 | - | - | 70 | mA |
| Suspend Mode Power Consumption | - | - | 300 | uA |
| Operating ambient temperature | 0 | - | 70 | ºC |

## 8.3 Electrical Parameters

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| DAC (10K Ohm Loading) | | | | |
| Resolution | - | 16 | - | Bits |
| THD + N (-3dBr) | - | -74.29 | - | dB |
| SNR | - | 93.6 | - | dB |
| Silent SNR | - | 98.2 | - | dB |
| Dynamic range | - | 93.8 | - | dB |
| Frequency response 48KHz | 20 | - | 20K | Hz |
| Frequency Response 44.1KHz | 20 | - | 20K | Hz |
| Output Voltage (rms) | - | 1.25 | - | Vrms |
| Output Voltage Swing | 0.5 | - | 4.0 | V |

| DAC (32 Ohm Loading) | | | | |
|---|---|---|---|---|
| Resolution | - | 16 | - | Bits |
| THD + N (-3dBr) | - | -71.1 | - | dB |
| SNR | - | 93.7 | - | dB |
| Silent SNR | - | 98.2 | - | dB |
| Dynamic Range | - | 93.8 | - | dB |
| Frequency Response 48KHz | 20 | - | 20K | Hz |
| Frequency Response 44.1KHz | 20 | - | 20K | |
| Output Voltage (rms) | - | 1.25 | - | Vrms |
| Output Voltage Swing | 0.5 | - | 4.0 | V |
| ADC | | | | |
| Resolution | - | 16 | - | bit |
| THD + N (-3dBr) | - | -76.1 | - | dB |
| SNR | - | 83.1 | - | dB |
| Dynamic Range | - | 81.6 | - | dB |
| Frequency Response 48KHz | 20 | - | 19.2K | Hz |
| Frequency Response 44.1KHz | 20 | - | 17.6K | Hz |
| Input Range | 0 | - | 2.88 | Vpp |
| Amplification | | | | |
| Volume Control Level | -45 | - | 0 | dB |
| Volume Control Step | - | 38 | - | Steps |
| Microphone Input | | | | |
| Boost Gain | - | +20 | - | dB |
| Gain Adjustment Range | 0 | - | 22.5 | dB |
| Gain Adjustment Steps | - | 16 | - | Steps |
| Mixer Gain Adjustment | -33.0 | - | 12.0 | dB |
| Mixer Gain Adjustment Steps | - | 32 | - | Steps |

# 9. FREQUENCY RESPONSE GRAPHS

## 9.1 Digital Playback for Line Output Frequency (10K Ohm Loading)
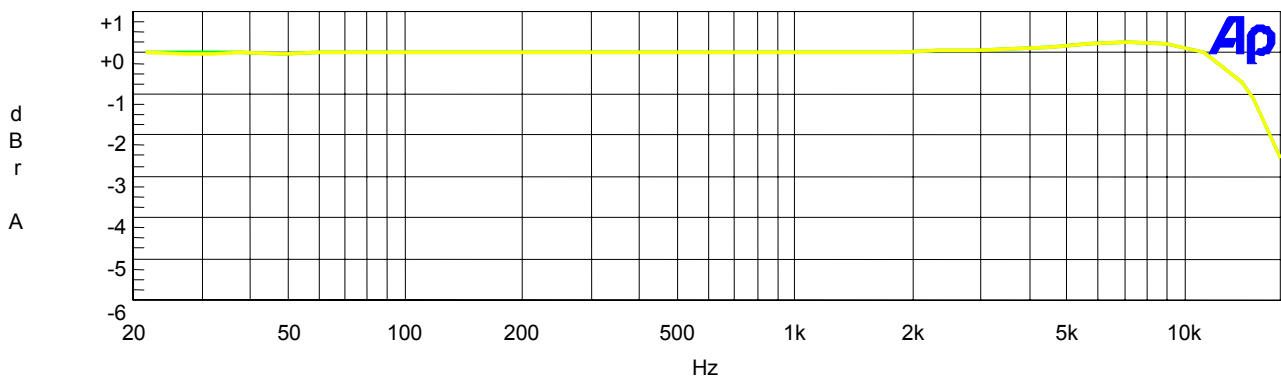
### 9.1.1 Frequency Response 48Ks/Sec (10K Ohm Loading)

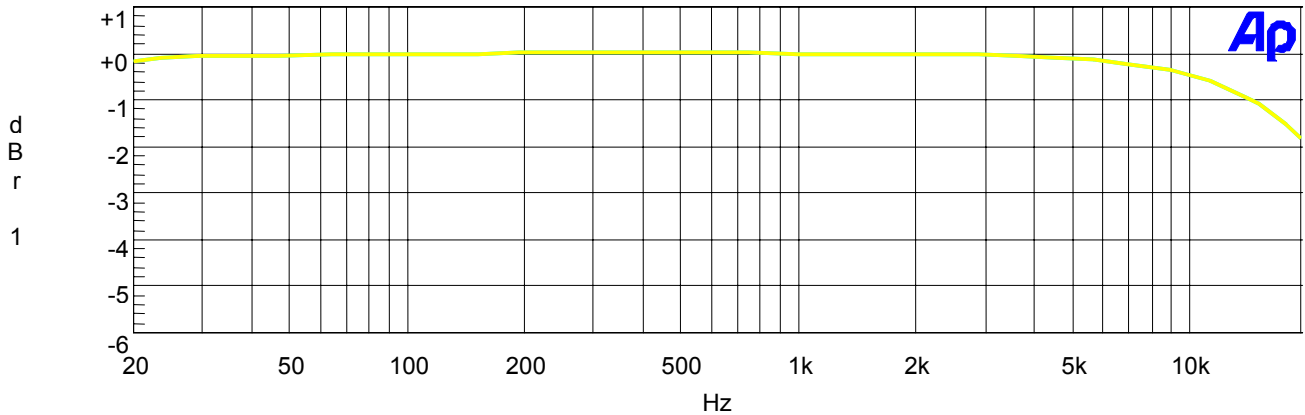C-Media     Digital Playback (PC-D-A) for Line Output Frequency Response     07/15/03 19:03:14
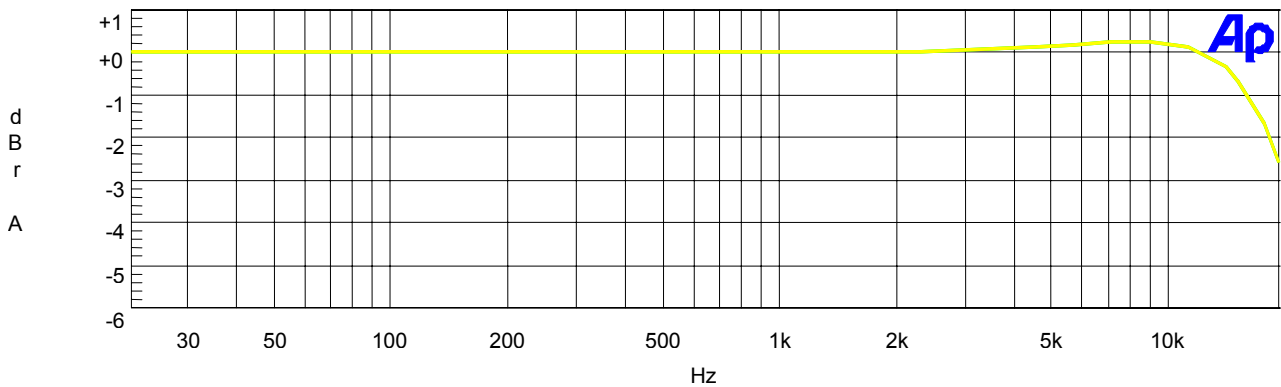


| Color | Line Style | Thick | Data | Axis |
|-------|-----------|-------|------|------|
| Green | Solid | 2 | Fasttest.Ch.1 Ampl!Normalize | Left |
| Yellow | Solid | 2 | Fasttest.Ch.2 Ampl!Normalize | Left |

### 9.1.2 Frequency Response 44.1Ks/Sec (10K Ohm Loading)

C-Media     Digital Playback (PC-D-A) for Line Output Frequency Response   07/15/03 19:05:40



| Color | Line Style | Thick | Data | Axis |
|-------|-----------|-------|------|------|
| Green | Solid | 2 | Fasttest.Ch.1 Ampl!Normalize | Left |
| Yellow | Solid | 2 | Fasttest.Ch.2 Ampl!Normalize | Left |

## 9.2 Digital Playback for Line Output Frequency (32 Ohm Loading)
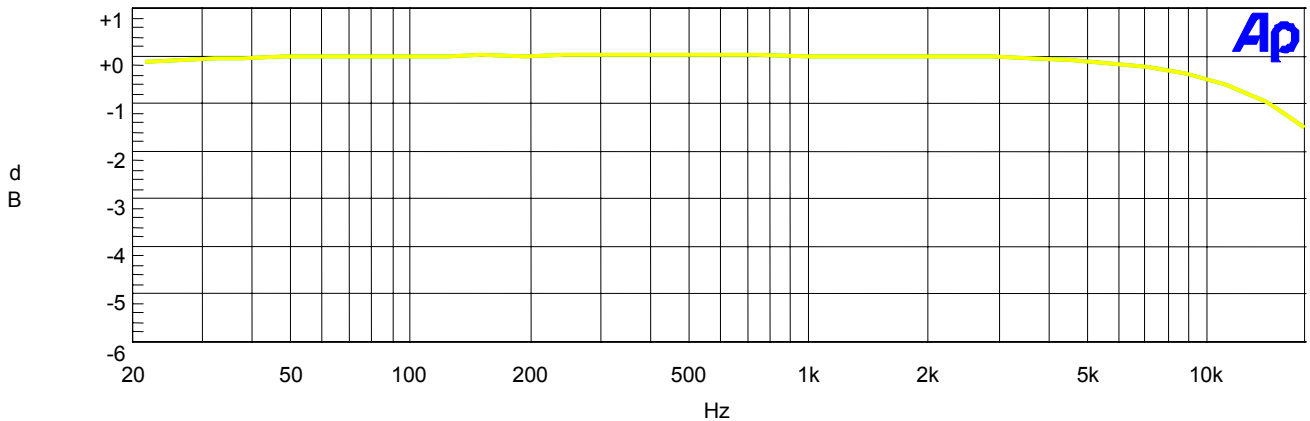
### 9.2.1 Frequency Response 48Ks/Sec (32 Ohm Loading)

C-Media            Digital Playback (PC-D-A) for Line Output Frequency Response



| Color | Line Style | Thick | Data | Axis |
|-------|-----------|-------|------|------|
| Cyan | Solid | 2 | Fasttest.Ch.1 Ampl!Normalize | Left |
| Yellow | Solid | 2 | Fasttest.Ch.2 Ampl!Normalize | Left |

### 9.2.2 Frequency Response 44.1Ks/Sec (32 Ohm Loading)

C-Media            Digital Playback (PC-D-A) for Line Output Frequency Response



| Color | Line Style | Thick | Data | Axis |
|-------|-----------|-------|------|------|
| Green | Solid | 2 | Fasttest.Ch.1 Ampl!Normalize | Left |
| Yellow | Solid | 2 | Fasttest.Ch.2 Ampl!Normalize | Left |

**Date: Nov/01/2004**                                                **Version:  1.5**

## 9.3 Digital Recording for Line Output Frequency
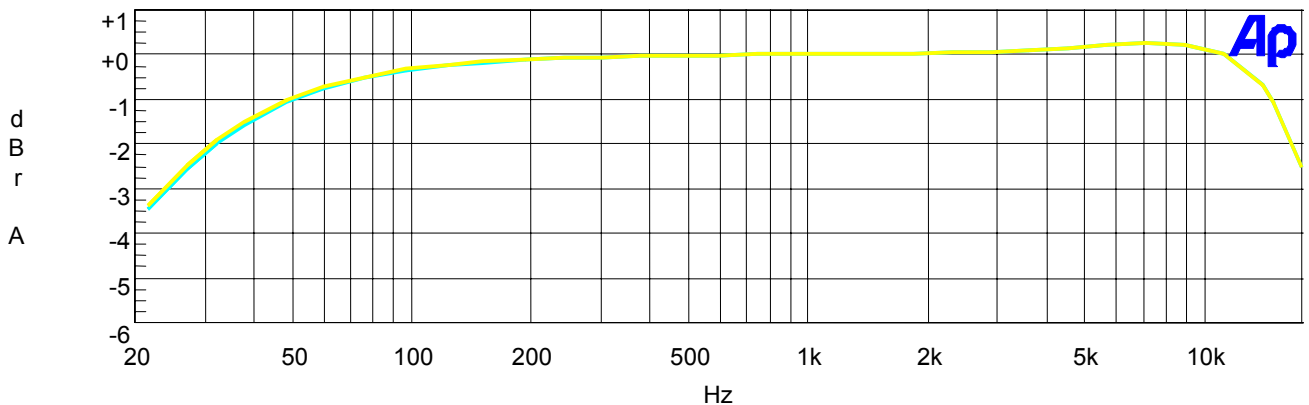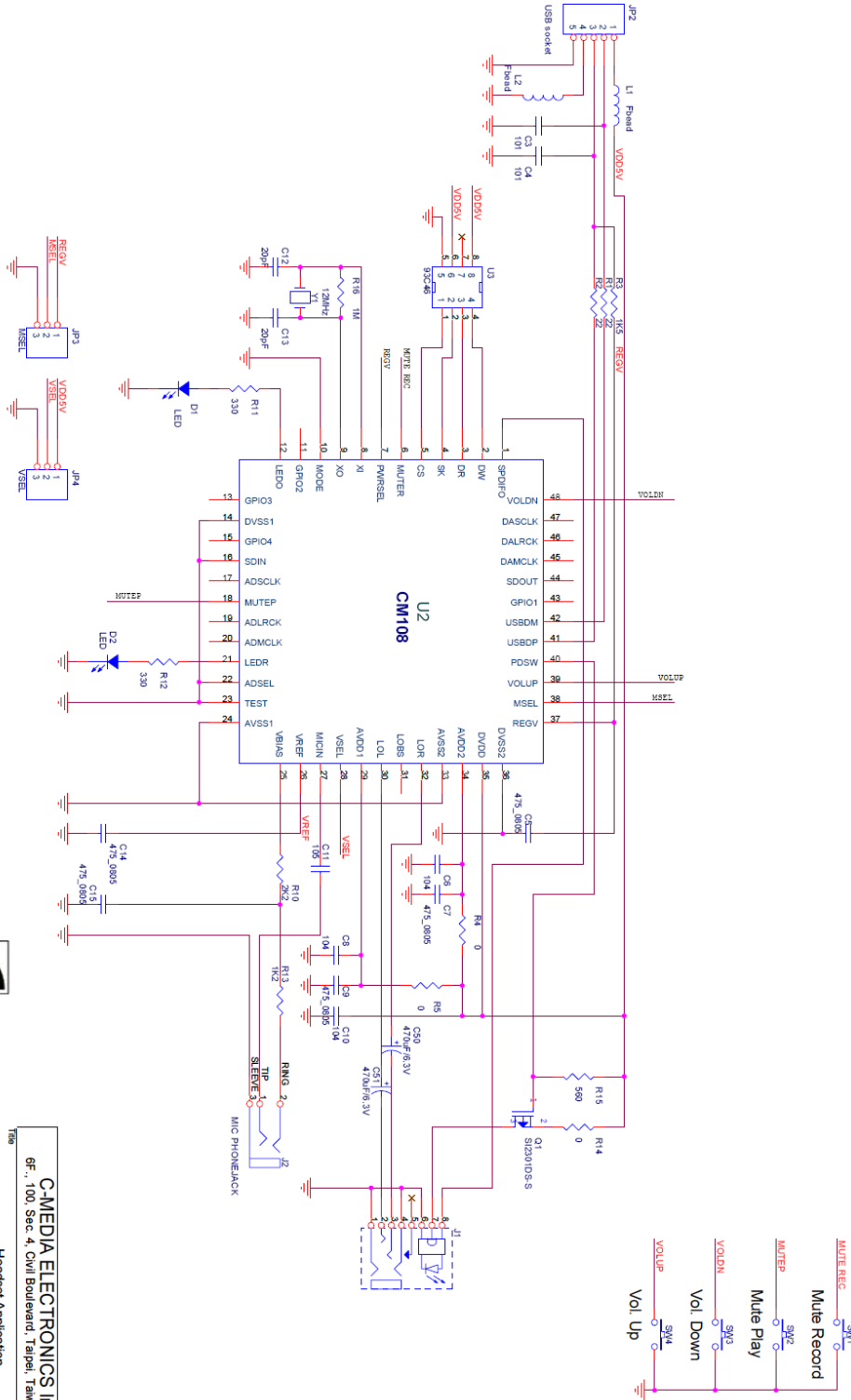
### 9.3.1 Frequency Response 48Ks/Sec

C-Media　　Digital Recording (A-D-PC) for Line Input Frequency Response　07/21/03 14:27:29
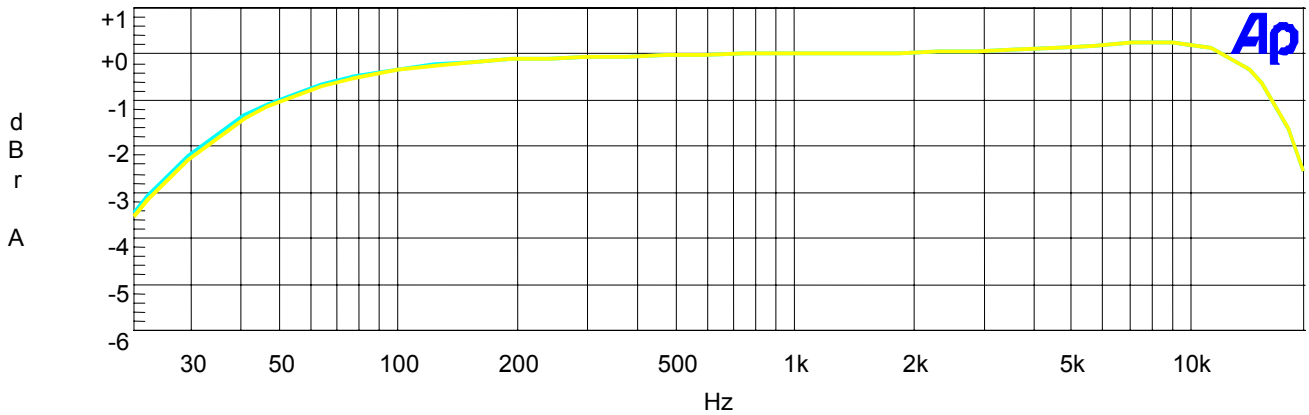


| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|-------|-------|-------|-----------|-------|------|------|---------|
| 1 | 1 | Cyan | Solid | 2 | Fasttest.Ch.1 Ampl!Normalize | Left | |
| 1 | 2 | Yellow | Solid | 2 | Fasttest.Ch.2 Ampl!Normalize | Left | |

### 9.3.2 Frequency Response 44.1Ks/Sec

C-Media　　Digital Recording (A-D-PC) for Line Input Frequency Response　07/21/03 15:16:55



| Sweep | Trace | Color | Line Style | Thick | Data | Axis | Comment |
|-------|-------|-------|-----------|-------|------|------|---------|
| 1 | 1 | Cyan | Solid | 2 | Fasttest.Ch.1 Ampl!Normalize | Left | |
| 1 | 2 | Yellow | Solid | 2 | Fasttest.Ch.2 Ampl!Normalize | Left | |

**Date: Nov/01/2004**　　　　　　　　　　　　　　　　　　　　　　**Version:　1.5**

# 10. REFERENCE APPLICATION CIRCUIT

## REFERENCE

- Universal Serial Bus Specification, Version 2.0

- Universal Serial Bus Device Class Definition for Audio Devices, Version 1.0.

- Universal Serial Bus Device Class Definition for Human Interface Devices, Version 1.11

# ─ End of Specifications ─

**Date: Nov/01/2004**　　　　　　　　　　　　　　　　　　**Version:　1.5**