36814-CP

Best USB Audio I/O Controller for Headset and Multi-Media Devices

CM108 High Integrated USB Audio I/O Controller

DataSheet 1.6

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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

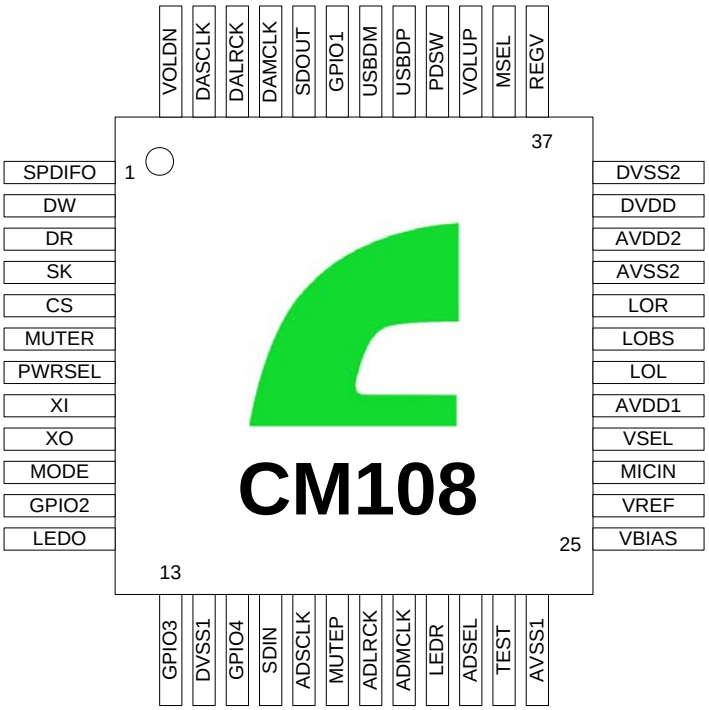
- Alternate Zero Bandwidth Setting for Releasing Playback Bandwidth on USB Bus when this Device is Inactive
- Supports AES/EBU, IEC60958, S/PDIF Consumer Formats for Stereo PCM Data at S/PDIF Output
- Volume Up, Volume Down, and Playback Mute Pins support USB HID device class for Host Control Synchronization
- 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 Speaker Mode H：Self Power with 100mA L：Bus Power with 500mA Headset Mode H：Bus Power with 100mA L：Bus Power with 500mA (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 H：Speaker Mode - Playback Only L：Headset Mode - Playback & Recording (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; 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 H: Use external (via I2S) ADC L: Use internal ADC (H: Pull Up to 3.3V; L: Pull Down to Ground)
23	TEST	DI, ST, PD	Test Mode Select Pin; H: Test Mode L: Normal Operation (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 H: Line out Vpp = 3.5 Volts L: Line out Vpp = 2.5 Volts (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 H: With Mixer / AA-Path Enable (With Default Mute) L: Without Mixer / AA-Path Disable (H: Pull Up to 3.3V, L: Pull Down to Ground) 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) 0: Normal Operation, 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 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

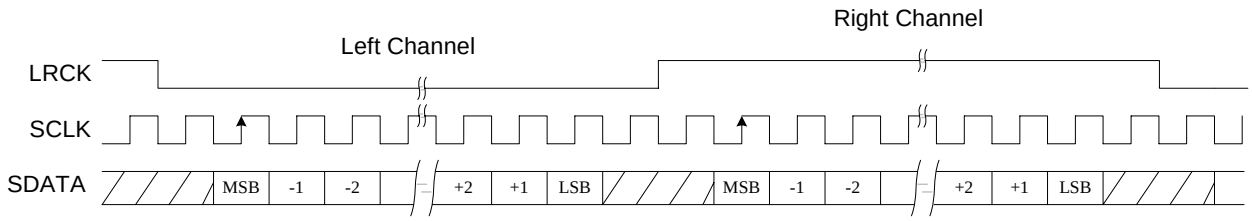
PD / PU – Pull Down / Pull Up

5VT – 5 Volt Tolerant (3.3V Pad)

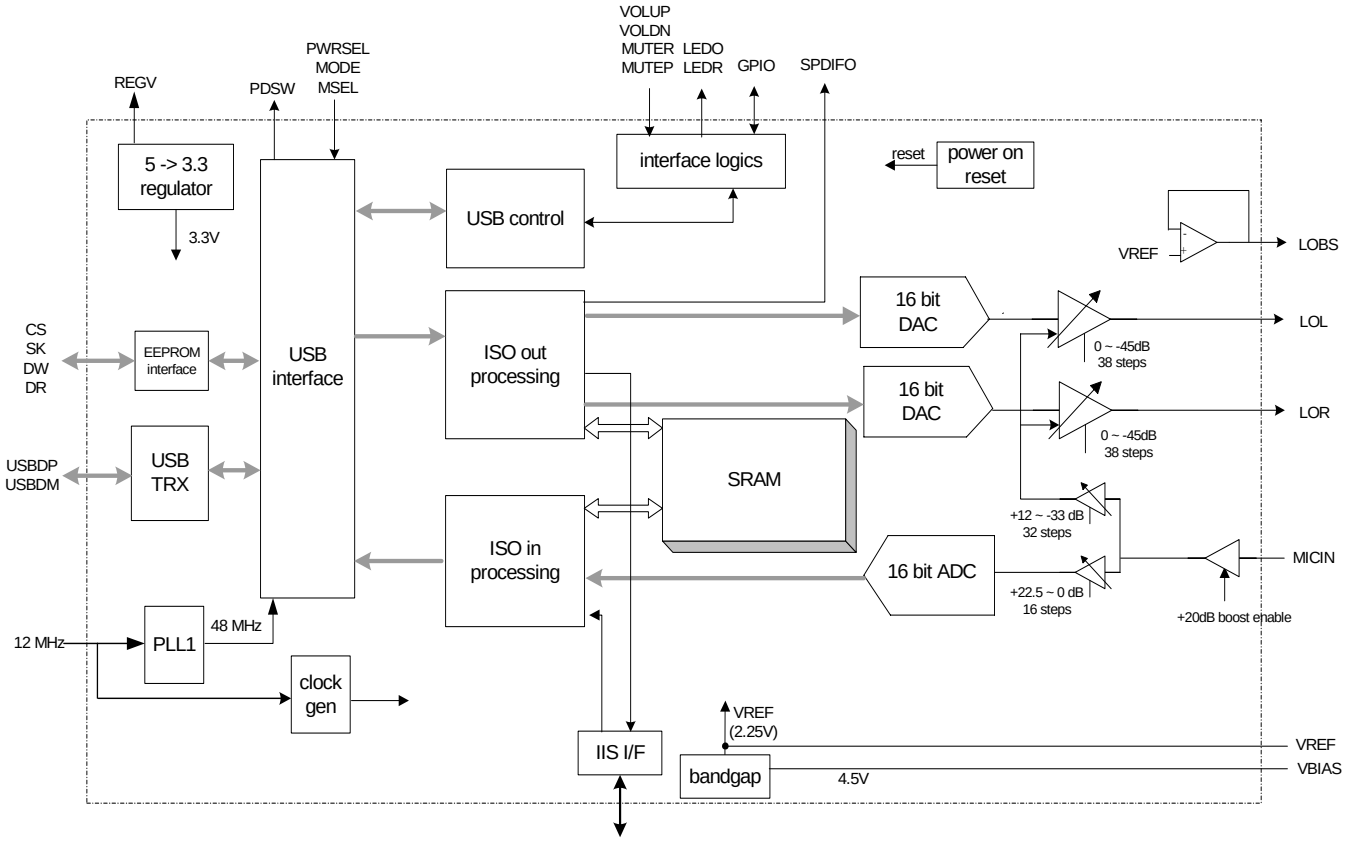
OD – Open Drain

4. I²S INTERFACE

CM108 provide I²S 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 I²S interface. Left channel of I²S bus is used for CM108 mono recording. Both I²S 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 I²S bus. Recording source (from ADC or from I²S bus) can be selected by ADSEL jumper pin.



5. BLOCK DIAGRAM



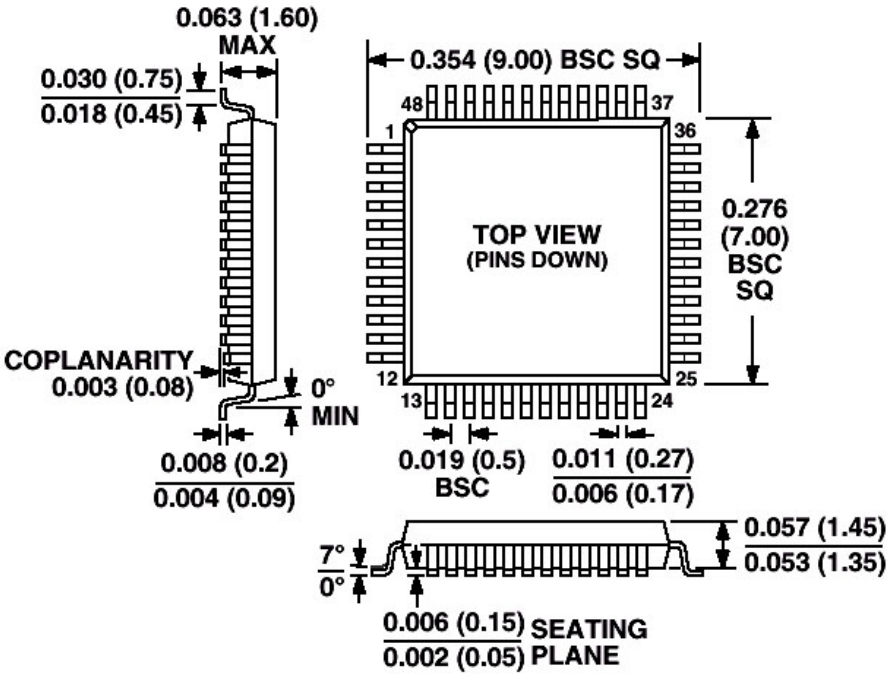
Block Diagram Of CM108

6. ORDERING INFORMATION

Model Number	Package	Operating Ambient Temperature	Supply Range
CM108	48-Pin LQFP 7mm×7mm×1.4mm (Plastic)	-15 ℃ to +70 ℃	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

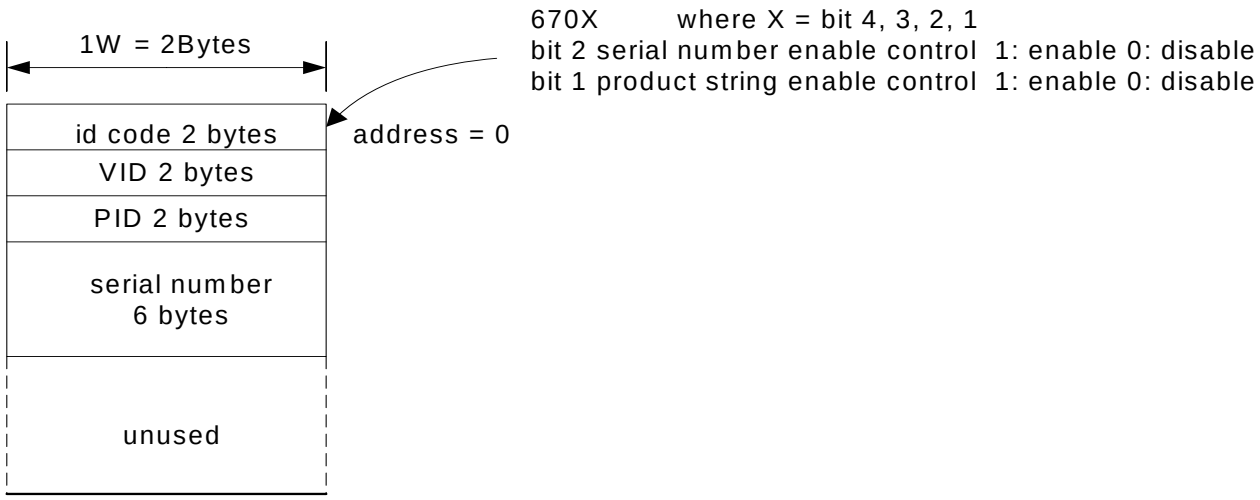
Offset	Field	Size	Value (Hex)	Description
0	bLength	1	12	Total 18 Bytes
1	bDescriptorType	1	01	Device Descriptor
2	bcdUSB	2	0110	USB 1.1 compliant.
4	bDeviceClass	1	00	
5	bDeviceSubClass	1	00	
6	bDeviceProtocol	1	00	
7	bMaxPacketSize0	1	40	Endpoint zero Size = 64 bytes
8	idVendor	2	0d8c	Vendor ID
10	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

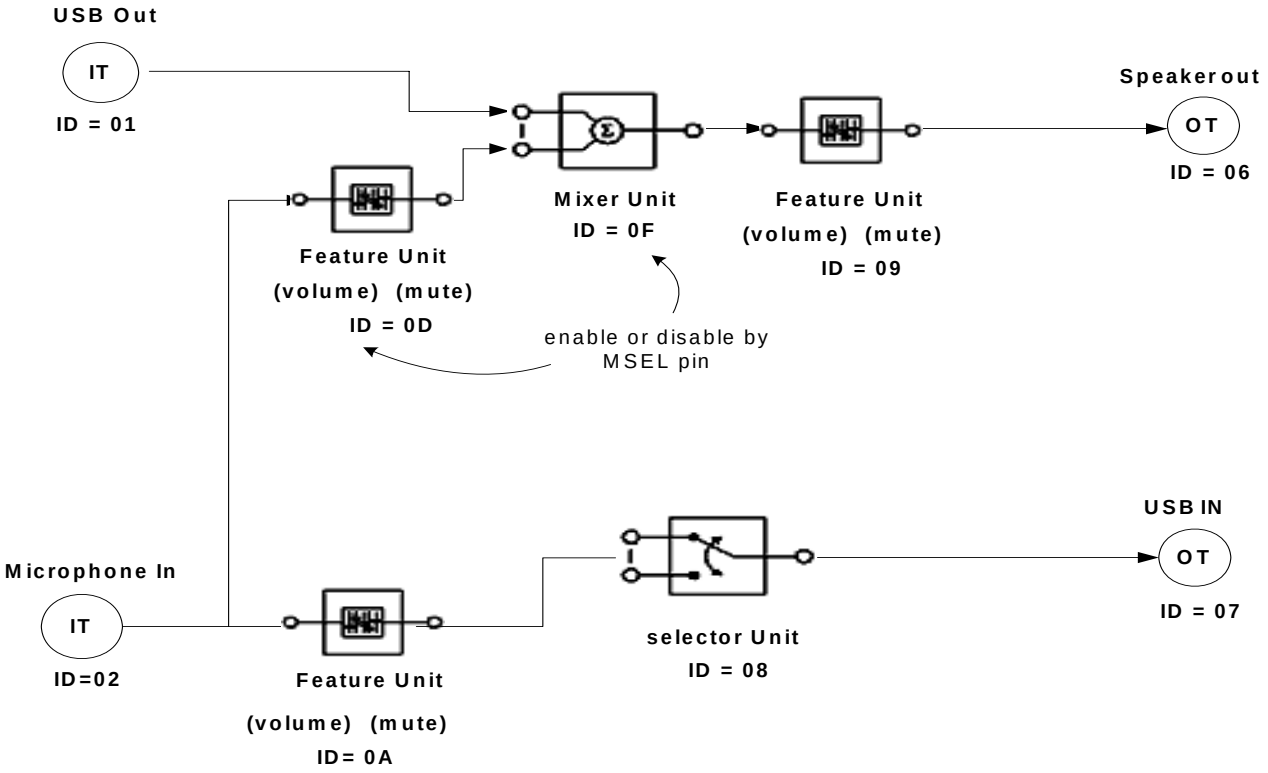
7.1.2 Configuration Descriptor

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)



7.1.4 USB Audio Topology Diagram



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.

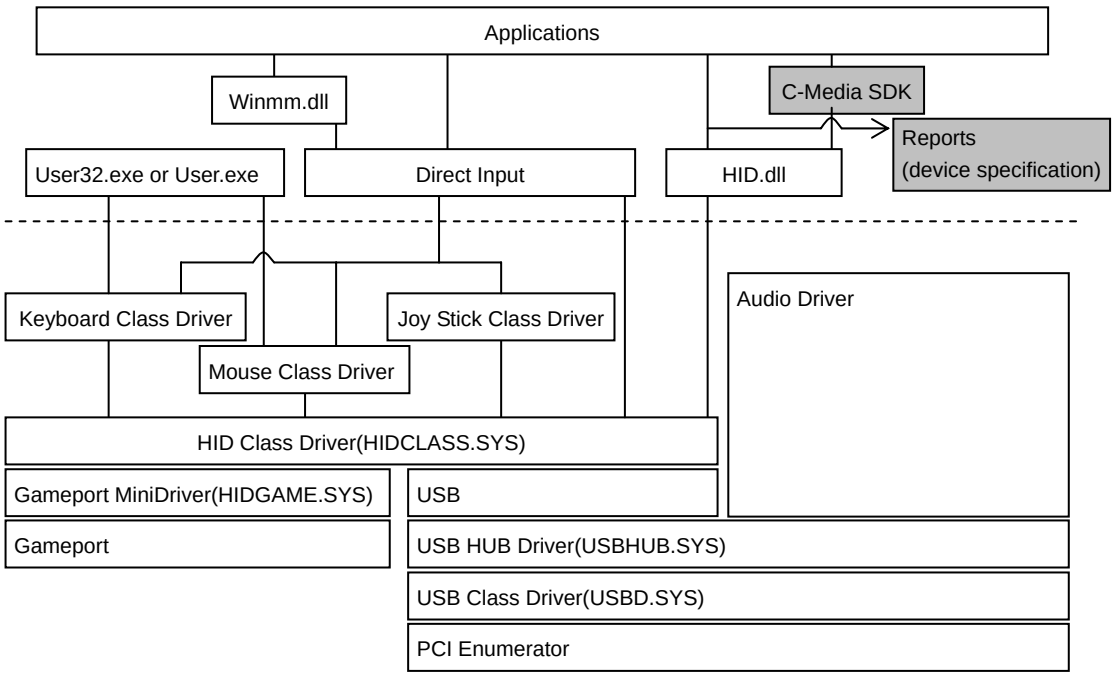
HID Descriptor

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 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 10: Values written to HID_IR0-3 are also mapped to EEPROM_DATA0-1, EEPROM_CTRL Others: Reserved	0x0
5-4	R	Reserved	0x0
3	R	0: No activity on Record-Mute button 1: Record-Mute button pressed then released	0x0
2	R	0: No activity on Playback-Mute button 1: Playback-Mute button pressed then released	0x0
1	R	0: Volume-Down button released 1: Volume-Down button pressed	0x0
0	R	0: Volume-Up button released 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: HID_IR1[3:0] is the input from GPIO4 ~ GPIO1 in input mode 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
7-0	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
7-0	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
7-6	R / W	0: HID_OR1-2 are used for GPO; HID_OR0, 3 are used for SPDIF 1: Reserved 2: Values written to HID_OR0-3 are also mapped to EEPROM_DATA0-1, EEPROM_CTRL (See Note) 3: Reserved	0x0
5	R / W	Reserved	0x0
4	R / W	When HID_OR0[7] == 1'b0: Valid bit in SPDIF frame When HID_OR0[7] == 1'b1: Reserved	0x0
3-0	R / W	When HID_OR0[7] == 1'b0: First nibble of SPDIF status channel 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
7-0	R / W	When HID_OR0[7:6] == 2'b00: HID_OR1[3:0] is the output to GPIO4 ~ GPIO1 in output mode 0: GPO drives L 1: GPO drives H When HID_OR0[7:6] == 2'b01: Reserved 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 0: Set GPIO to input mode 1: Set GPIO to output mode When HID_OR0[7:6] == 2'b01: Reserved 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 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	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	^{0}C
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	-15	-	70	^{0}C

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

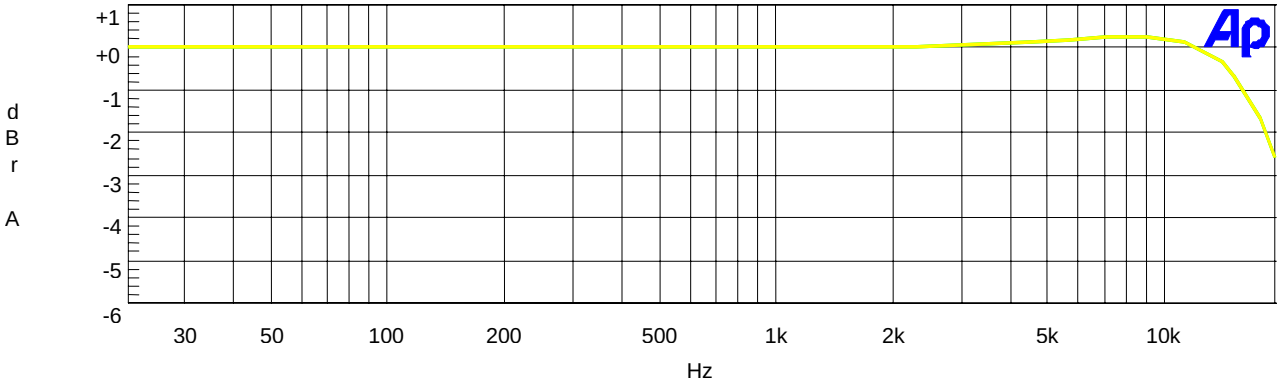
DAC (32 Ohm Loading)				
Resolution	-	16	-	Bits
THD + N (-3dBr)	-	-71.1	-	dB
SNR	-	93.7	-	dB
Silent SNR	-	98.2	-	dB
Dynamic Range	-	93.8	-	dB
Frequency Response 48KHz	20	-	20K	Hz
Frequency Response 44.1KHz	20	-	20K	
Output Voltage (rms)	-	1.25	-	Vrms
Output Voltage Swing	0.5	-	4.0	V
ADC				
Resolution	-	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)

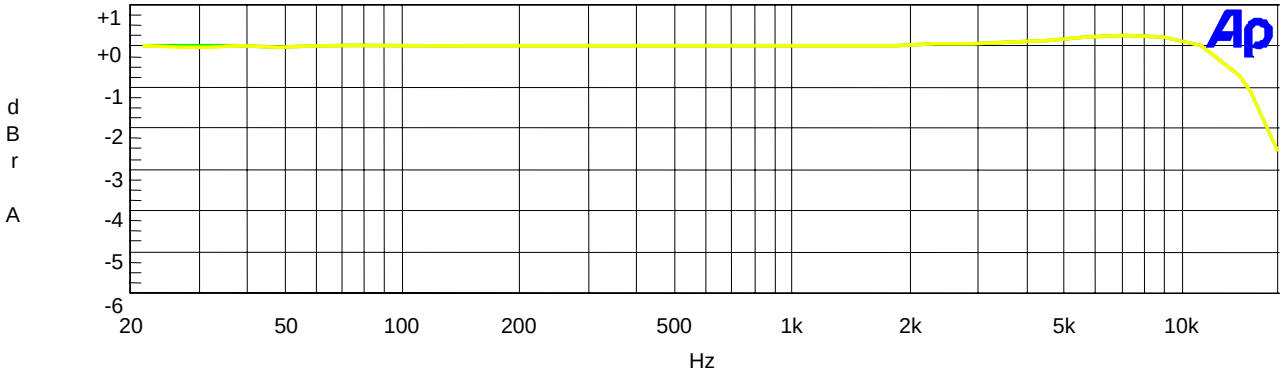
C-Media Digital Playback (PC-D-A) for Line Output Frequency Response 07/15/03 19:03:14



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

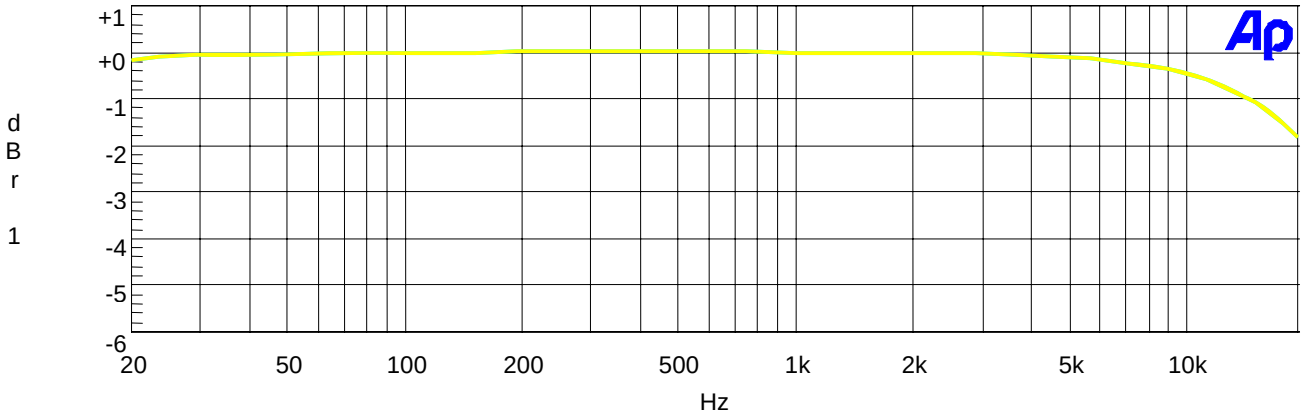


Color	Line Style	Thick	Data	Axis
Green	Solid	2	Fasttest.Ch.1 Ampl!Normalize	Left
Yellow	Solid	2	Fasttest.Ch.2 Ampl!Normalize	Left

9.2 Digital Playback for Line Output Frequency (32 Ohm Loading)

9.2.1 Frequency Response 48Ks/Sec (32 Ohm Loading)

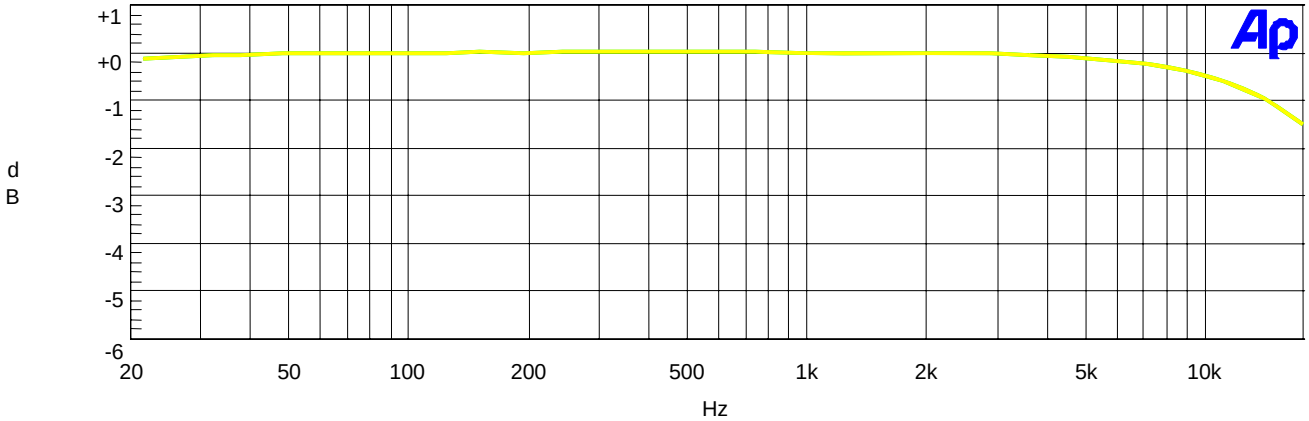
C-Media Digital Playback (PC-D-A) for Line Output Frequency Response



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

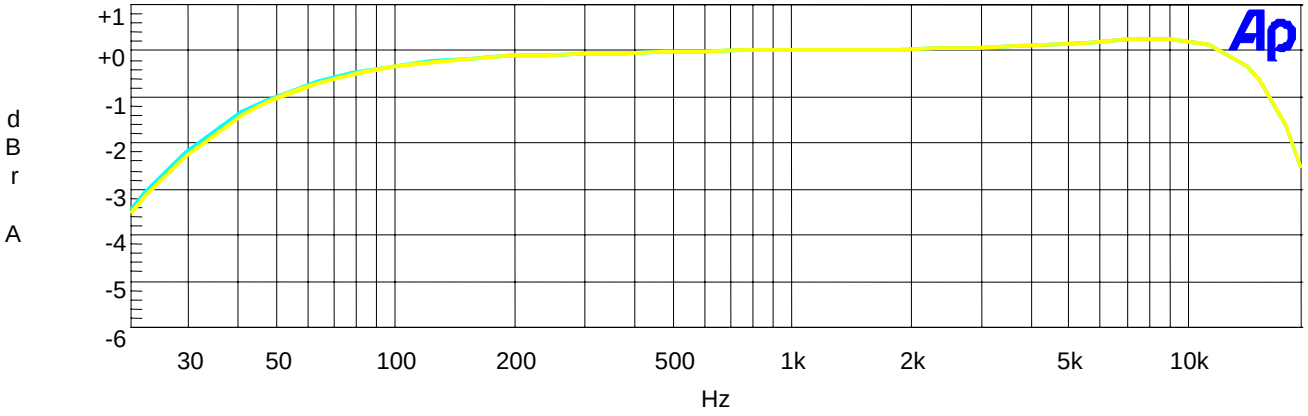


Color	Line Style	Thick	Data	Axis
Green	Solid	2	Fasttest.Ch.1 Ampl!Normalize	Left
Yellow	Solid	2	Fasttest.Ch.2 Ampl!Normalize	Left

9.3 Digital Recording for Line Output Frequency

9.3.1 Frequency Response 48Ks/Sec

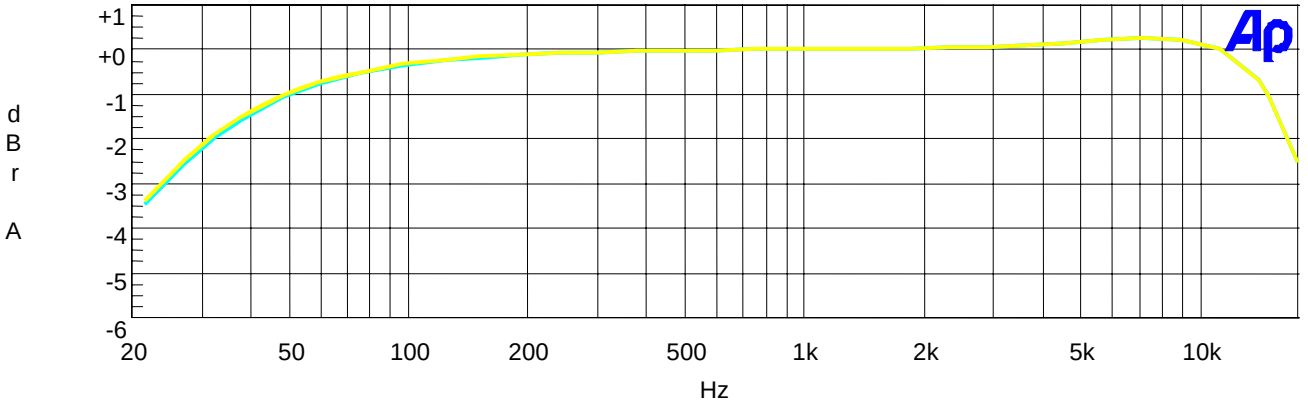
C-Media Digital Recording (A-D-PC) for Line Input Frequency Response 07/21/03 14:27:29



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	

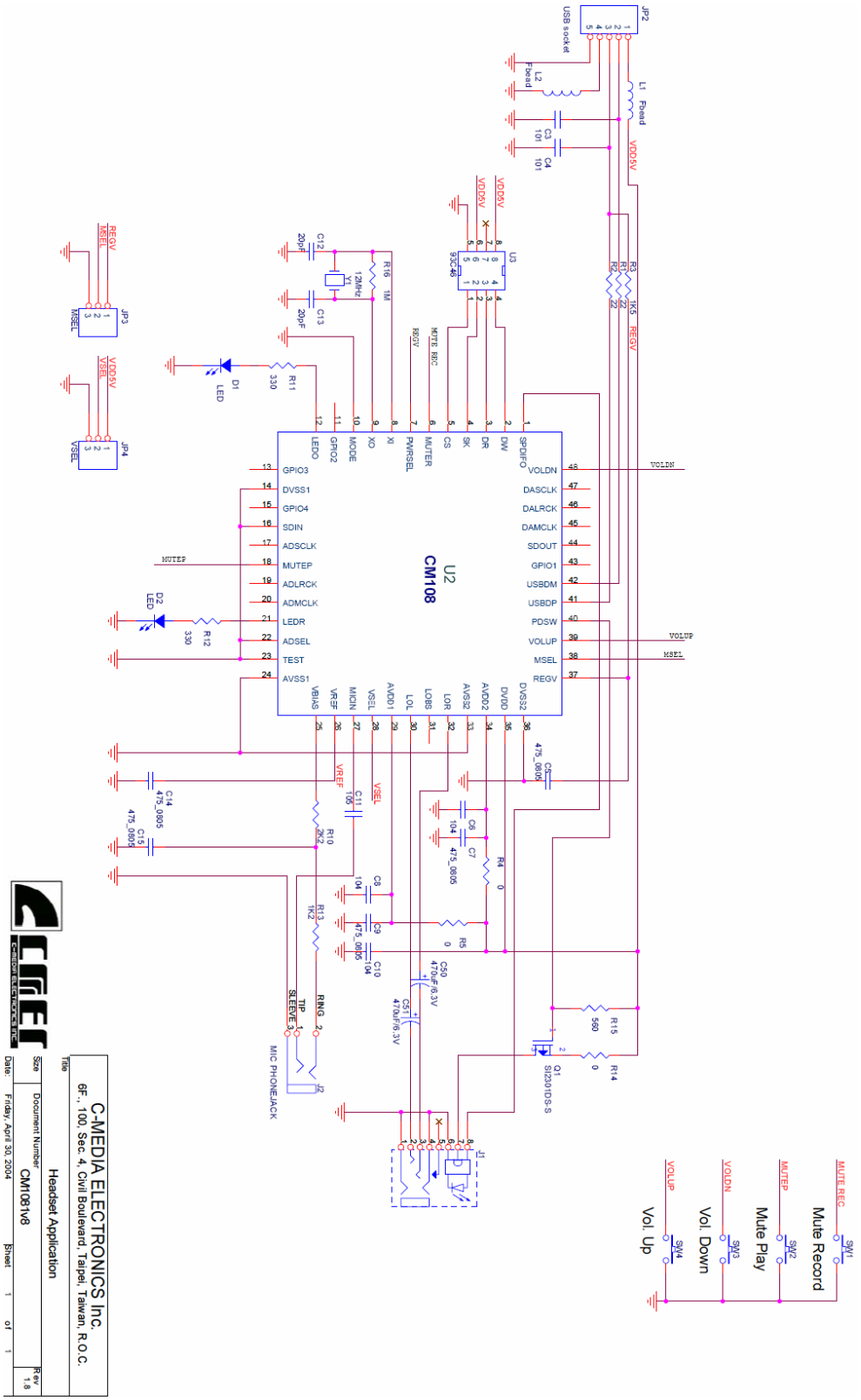
9.3.2 Frequency Response 44.1Ks/Sec

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	

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—

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