

CM6120-XL

USB 2CH Audio Controller for Speaker



DESCRIPTION

CM6120-XL series is a highly integrated single chip for USB speaker application with 2-Channel Class-D output. Minimum external components are needed for building an USB speaker system, which makes CM6120-XL a simple and very cost-effective solution. Since no driver is necessary for audio playback on all major OS. CM6120-XL provides a truly plug-and-play feature for external digital audio playback.

For energy saving, USB suspend mode and resume is supported by CM6120-XL. This new single chip not only support 44.1KHz and 48KHz sampling rate playback but also with X2 modulation for hi-frequency quality. Better yet, simplify anti-pop noise solution was embedded on chip for general pop noise issues. All of the functions have been approved by USB IF certification program.

FEATURES

- USB 2.0 Full Speed Compatible and USB IF Certification
- USB audio device class specification v1.0 Compatible
- USB bus powered 500mA, with No Need for External Power Supply
- High performance 16-Bit stereo, 44.1 / 48 KHz sampling rate for audio playback
- High efficiency high performance 2W x 2-CH Class D amplifier, differential output with no pop-noise
- S/PDIF output interface
- Embedded Power-On-Reset block
- Embedded 5V to 3.3V regulator for single 5V external power supply
- Self power / Bus power selectable (by EEPROM)
- Single 12MHz crystal input with embedded PLL
- Self power / Bus power selectable (by EEPROM)

BLOCK DIAGRAM

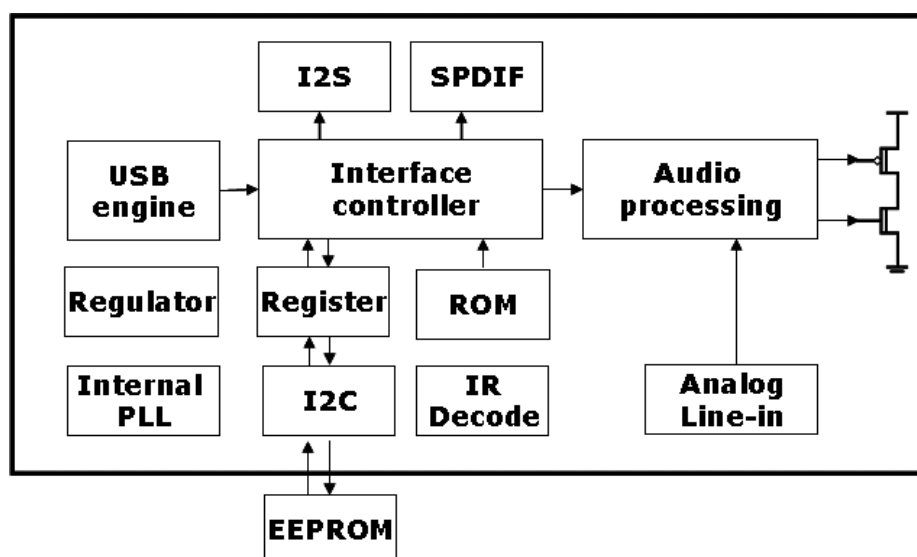


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1 Description and Overview

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For energy saving, USB suspend mode and resume is supported by CM6120-XL. This new single chip not only support 44.1KHz and 48KHz sampling rate playback but also with X2 modulation for hi-frequency quality. Better yet, simplify anti-pop noise solution was embedded on chip for general pop noise issues. All of the functions have been approved by USB IF certification program. More flexible and customized design is possible with GPIO pin, which is accessible by USB vendor specific request. This one chip solution not only embedded USB transceiver but also integrated digital control power amplifier function for USB digital sound application.

CM6120-XL support USB standard HID interface which provide Vol_up / Vol_dn / Play_mute / Prev / Next / Play_pause / Play_stop buttons for pure digital volume and media play control. CM6120-XL also provide EEPROM (24c02) connection interface for customers to define vendor specific VID / PID / Manufacture String / Product String, and even special hardware configuration. More flexible and customized design is possible with GPIO pin, which is accessible by USB HID command / Vender command. More over, CM6120-XL also provide the IR remote decoder function with certain IR device.

Moreover, customers can use C-Media USB Audio Driver with Xear 3D functions to show up digital speaker features and upgrade PC multi-media stereo function to be a CE like devices. Xear 3D can support 10 band Equalizer, EnvironmentFX sound effects and virtual 7.1CH speaker shifter. This driver is optional for valuable bundle.

2 Features

- USB 2.0 Full Speed Compatible and USB IF Certification
- USB audio device class specification v1.0 Compatible
- USB bus powered 500mA, with No Need for External Power Supply
- High performance 16-Bit stereo, 44.1 / 48 KHz sampling rate for audio playback
- High efficiency high performance 2W x 2-CH Class D amplifier, differential output with no pop-noise
- S/PDIF output interface
- Embedded Power-On-Reset block
- Embedded 5V to 3.3V regulator for single 5V external power supply
- Self power / Bus power selectable (by EEPROM)
- Single 12MHz crystal input with embedded PLL
- Isochronous transfer using adaptive synchronization with internal PLL

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- External 24c02 EEPROM interface for vendor specific VID / PID / Manufacture string / Product string and Hardware configuration (volume for DAC / Line-in AA, etc.)
- EEPROM Read / Write function via vendor command or HID command
- USB HID digital volume control input for Vol_up / Vol_dn / Play_mute / Prev / Next / Play_pause / Play_stop buttons and remote wakeup with HID buttons
- Playback with soft-mute function
- Digital volume boost function
- GPIO pin for application specific usage and LED Indicator Pin During Playback
- Supports standard I2S output interface
- Analog line-in w/ class D could work wo/USB (selector for USB/ line-in)
- IR remote decoder function base on PTK6221(32 keys)
- Optional USB Software Drive Xear 3D Sound Technology With Speaker Shifter and Virtual 7.1CH effects
- 3.3V IO with 5V tolerance
- Compact 48 pin LQFP package in CM6120-XL
- Compatible with Windows XP / Vista / 7, Mac OS*, no additional drivers are required

*Note: All Mac OS are supported except version 10.0.x

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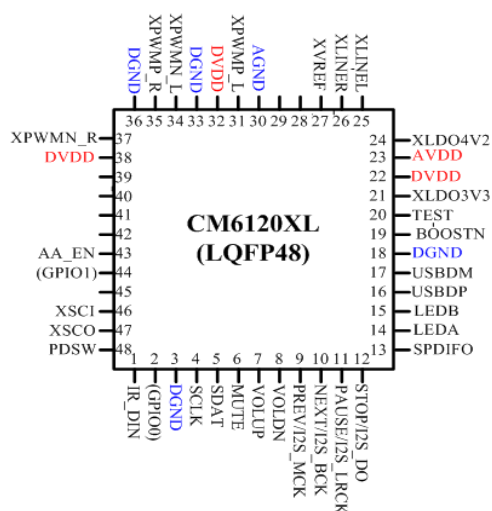


3 Pin/Signal Description

3.1 Pin Assignment by Pin Number

Pin #	Signal	Pin #	Signal	Pin #	Signal
1	IR_DIN	17	USBDM	33	DGND
2	GPI00	18	DGND	34	XPWMN_L
3	DGND	19	BOOSTN	35	XPWMP_R
4	SCLK	20	TEST	36	DGND2
5	SDAT	21	XLDO3V3	37	XPWMN_R
6	MUTE	22	DVDD	38	DVDD
7	VOLUP	23	AVDD	39	NC
8	VOLDN	24	XLDO4V2	40	NC
9	PREV / I2S_MCK	25	XLINEL	41	NC
10	NEXT / I2S_BCK	26	XLINER	42	NC
11	PAUSE / I2S_LRCK	27	XVREF	43	AA_EN
12	STOP / I2S_DO	28	NC	44	GPI01
13	SPDIFO	29	NC	45	NC
14	LEDA	30	AGND	46	XSCI
15	LEDB	31	XPWMP_L	47	XSCO
16	USBDP	32	DVDD	48	PDSW

3.2 Pin-Out Diagram



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3.3 Pin Signal Description

Pin #	Symbol	Type	Description
1	IR_DIN	DI, PU	IR remote control input
2	GPIO0	DIO, 5V tor	GPIO
3	DGND	P	Digital Ground
4	SCLK	DIO, OD, 5V tor	I2C
5	SDAT	DIO, OD, 5V tor	I2C
6	MUTE	DI, PU	HID for playback mute
7	VOLUP	DI, PU	HID for playback volume up
8	VOLDN	DI, PU	HID for playback volume down
9	PREV / I2S_MCK	DI, PU	HID for playback previous song or I2S master clock
10	NEXT / I2S_BCK	DI, PU	HID for playback next song or I2S bit clock
11	PAUSE / I2S_LRCK	DI, PU	HID for playback play/pause or I2S LR word clock
12	STOP / I2S_DO	DI, PU	HID for playback stop or I2S data output
13	SPDIFO	DIO	Output as SPDIFOUT Input as IIS mode switch
14	LEDA	AO	LED (Play or Record)
15	LEDB	DI, ST, PD	LED (Mute Play)
16	USBDP	AIO	USB Data D+
17	USBDM	AIO	USB Data D-
18	DGND	P	Digital Ground
19	BOOSTN	AI, PD	Digital volume boost function (active Low, boost enable)
20	TEST	DI, ST, PD	Test Mode Select Pin, Pull-Down in normal Operation
21	XLDO3V3	AO	3.3V regulator output
22	DVDD	P	5V Power Supply
23	AVDD	P	5V Power Supply
24	XLDO4V2	AO	4.2V regulator output
25	XLINEL	AI	Line in left channel

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Pin #	Symbol	Type	Description
26	XLINER	AI	Line in right channel
27	XVREF	AO	Connecting to External Decoupling Capacitor for Embedded Band-gap Circuit; 2.25V Output
28	NC		
29	NC		
30	AGND	P	Analog Ground
31	XPWMP_L	AO	PWM output for channel L positive
32	DVDD	P	Digital Power
33	DGND	P	Digital Ground
34	XPWMN_L	AO	PWM output for channel L negative
35	XPWMP_R	AO	PWM output for channel R positive
36	DGND	P	Digital Ground
37	XPWMN_R	AO	PWM output for channel R negative
38	DVDD	P	5V Power Supply
39	NC		
40	NC		
41	NC		
42	NC		
43	AA_EN	DI, PU	Analog Line in path enable 1: Select source from Line in 0: Select source from USB stream
44	GPIO1	DIO	GPIO
45	NC		
46	XSCI	AI	Input Pin for 12MHz Oscillator
47	XSCO	AO	Output Pin for 12MHz Oscillator
48	PDSW	DO, 8mA, SR	Power Down Switch Control Signal Output 1: Power Down Mode (Suspend Mode) 0: Normal Mode

***Note:** DI / DO / DIO - Digital Input / Output / Bi-Directional Pad

AI / AO / AIO - Analog Input / Output / Bi-Directional Pad

P - Power Pin

SR - Slew Rate Control

ST - Schmitt Trigger

PD / PU - Pull Down / Pull Up

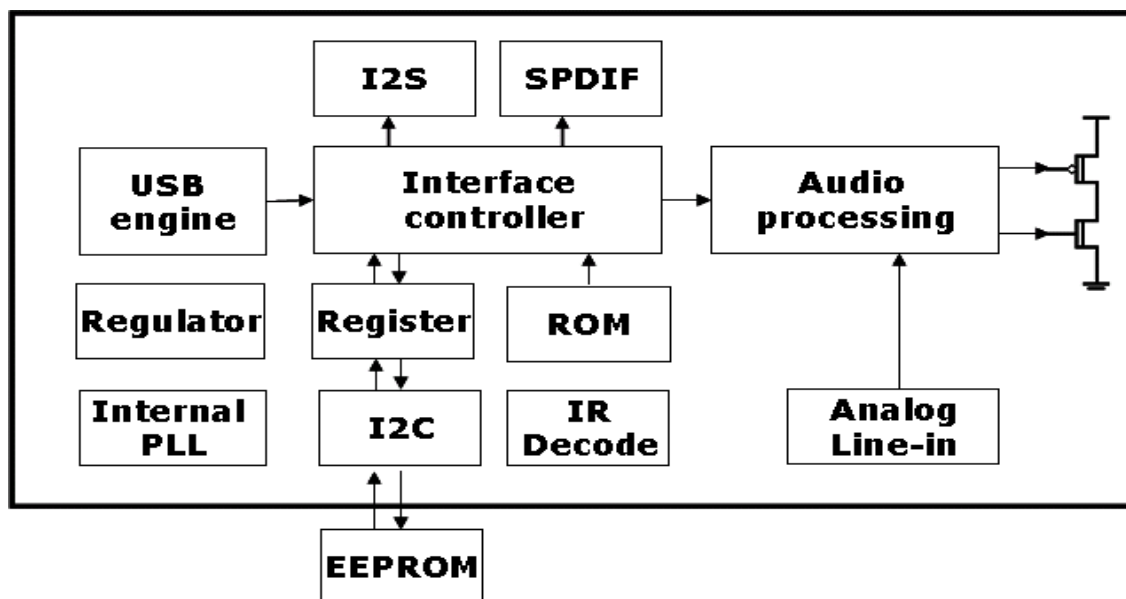
5VT - 5 Volt Tolerant (3.3V Pad)

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4 Block Diagram



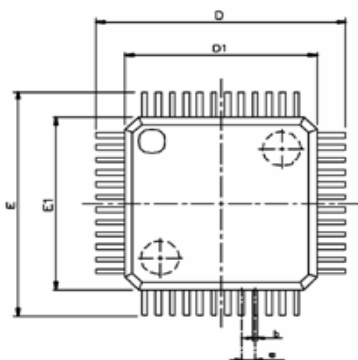
Block Diagram of CM6120-XL

5 Ordering Information

Model Number	Package	operating Ambient Temperature	Supply Range
CM6120XL	48-Pin LQFP	0 °C to +70 °C	DVdd = 5V, AVdd = 5V

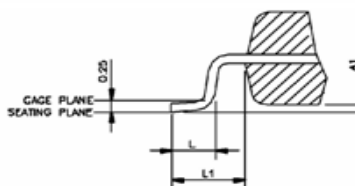
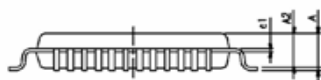
Outline of Dimensions Dimensions shown in inches and (mm)

◆48- Pin TSOP



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	MAX.
A	--	1.6
A1	0.05	0.15
A2	1.35	1.45
e1	0.09	0.16
D	9.00 BSC	
D1	7.00 BSC	
E	9.00 BSC	
E1	7.00 BSC	
e	0.5 BSC	
b	0.17	0.27
L	0.45	0.75
L1	1 REF	



6 Function Description

6.1 USB Interface

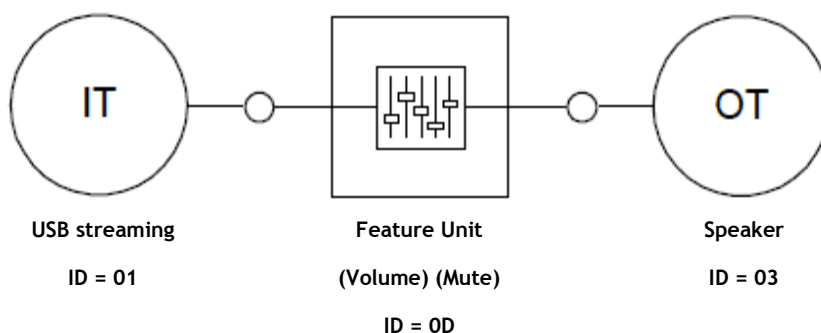
6.1.1 Device Descriptor

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	08	Endpoint Zero Size = 8 bytes
8	idVendor	2	0D8C	Vendor ID
10	idProduct	2	0126	Product ID
12	bcdDevice	2	0100	Device Release Number
14	iManufacturer	1	01	Index of string descriptor describing manufacturer -> "C-Media INC."
15	iProduct	1	02	Index of string descriptor describing product -> "USB Audio device "
16	iSerialNumber	1	00	Index of string descriptor describing the device's serial number
17	bNumConfigurations	1	01	Configurations number = 1

6.1.2 Configuration Descriptor

Offset	Field	Size	Value (Hex)	Description
0	bLength	1	09	Total 9 Bytes
1	bDescriptorType	1	02	Configuration Descriptor
2	wTotalLength	2	0086	Total length of data returned for this configuration: 249 bytes
4	bNumInterfaces	1	03	Number of interfaces supported by this Configuration.
5	bConfigurationValue	1	01	Configuration value
6	iConfiguration	1	00	Index of string descriptor describing this configuration
7	bmAttributes	1	a0 or 80 or e0 or c0	Bus Power and support Remote Wakeup: 8'ha0 (PWRSEL_1 = 1, HID_EN = 1) Bus Power and no Remote Wakeup: 8'h80 (PWRSEL_1 = 1, HID_EN = 0) Self Power and support Remote Wakeup: 8'he0 (PWRSEL_1 = 0, HID_EN = 1)) Self Power and no Remote Wakeup: 8'hc0 (PWRSEL_1 = 0, HID_EN = 0))
8	bMaxPower	1	FA	Maximum power consumption of the USB. 0xFA=500 mA

6.1.3 USB Audio Topology Diagram



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7 Electrical Characteristics

7.1 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
TBstgB	Storage Temperature Range	-40 to +125	POPC
ESD (HBM)	ESD Human Body Mode	4000	V
ESD (MM)	ESD Machine Mode	200	V
Latchup	Latch Up Test	200	mA

7.2 Operation conditions

	Min	Typ	Max	Unit
Analog Supply Voltage	4.5	5.0	5.25	V
Digital Supply Voltage	4.5	5.0	5.25	V
Total Power Consumption	-	-	500*	mA
Suspend Mode Power Consumption	-	450	2400	uA
Operating ambient temperature	0	-	70	PoPC

*Note: The measurement condition was under 4ohm loading and boost disable.

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7.3 Audio Performance

	Min	Typ	Max	Unit
Resolution	--	16	--	Bits
Frequency response @ 48KHz	20	--	20K	Hz
Frequency Response @ 44.1KHz	20	--	20K	Hz
Passband Ripple @ 48 KHz	40	--	9.6K	Hz
Passband Ripple @ 44.1 KHz	40	--	8.8K	Hz

DAC (8 Ohm Loading)				
SNR	--	~100	--	dB
Dynamic Range	--	~80	--	dB
THD + N	-43.6	--	-69	dB
Output Voltage (rms)	-	2.73	-	Vrms
DAC (4 Ohm Loading)				
SNR	--	~120	--	dB
Dynamic Range	--	~80	--	dB
THD + N	-37.2	--	-66	dB
Output Voltage (rms)	-	2.37	-	Vrms

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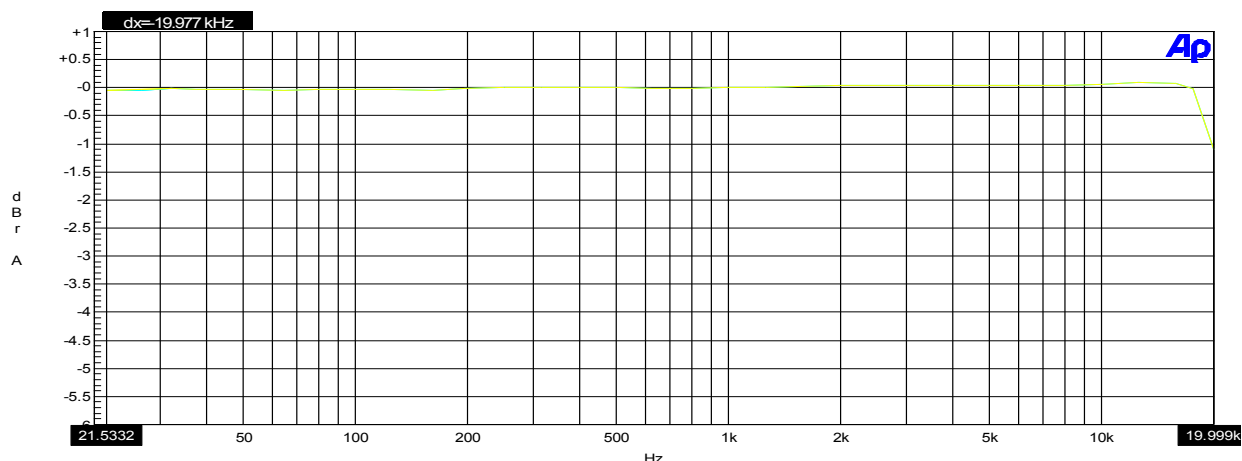
8 Audio Performance Curves

8.1 Frequency Response (8 ohm loading)

8.1.1 Frequency Response @ 44.1 ks/sec

Audio Precision

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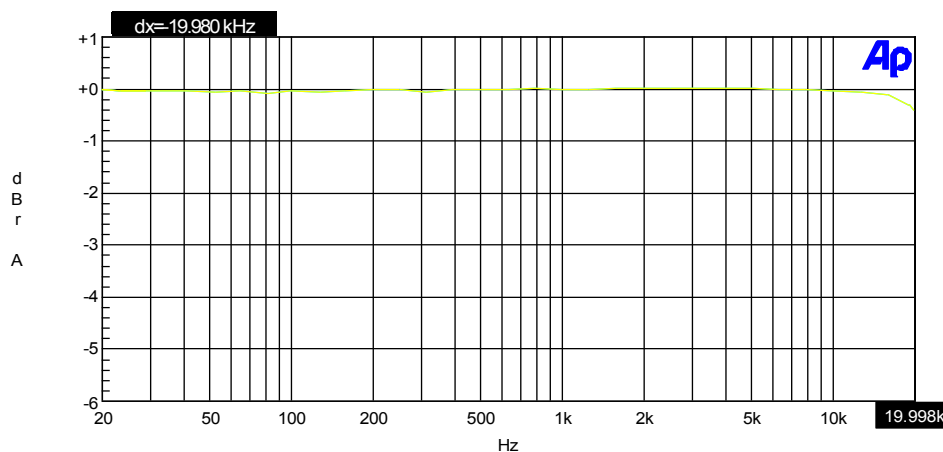
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment	Cursor1	Cursor2
1	1	Cyan	Solid	1	Fasttest.Ch.1 Ampl!Normalize	Left			
1	2	Yellow	Solid	1	Fasttest.Ch.2 Ampl!Normalize	Left			

WL-Frequency Response-M44k.at27

8.1.2 Frequency Response @ 48 ks/sec

Audio Precision

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

Vista-Frequency Response-M48k.at27

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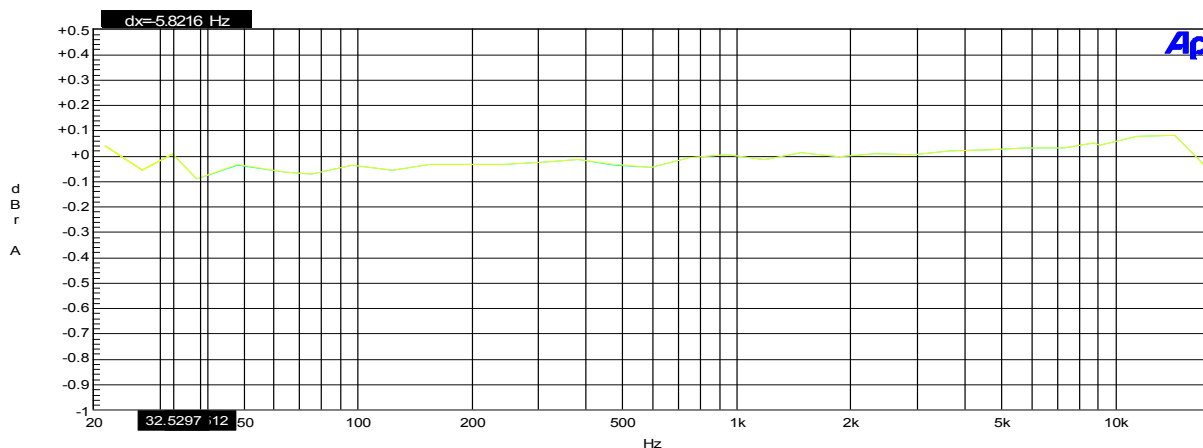


8.2 Passband Ripple (8 ohm loading)

8.2.1 Passband Ripple @ 44.1 ks/sec

Audio Precision

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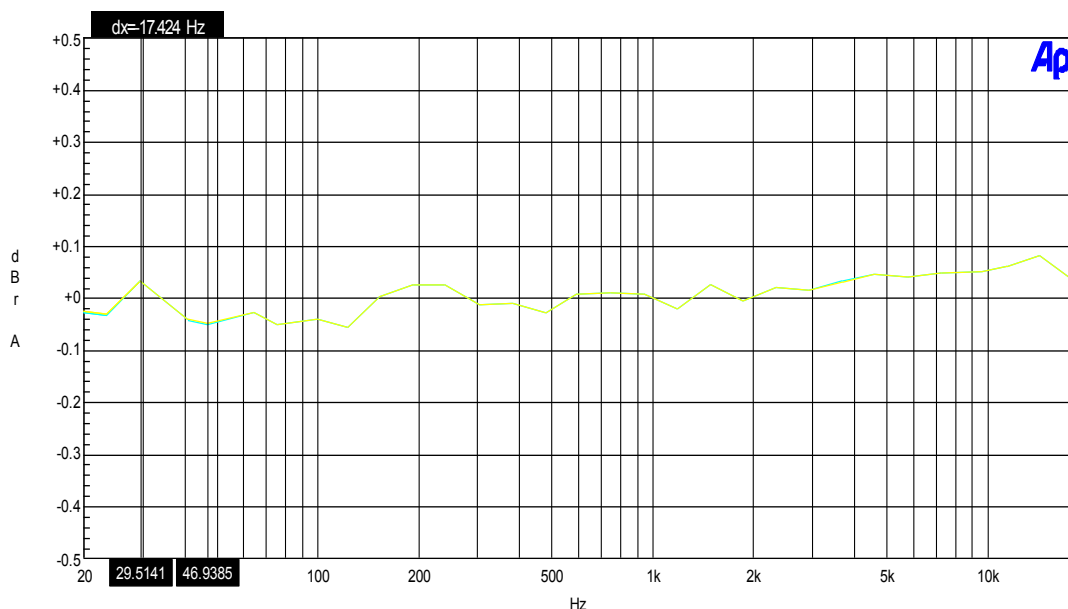
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment	Cursor1	Cursor2
1	1	Cyan	Solid	1	Fasttest.Ch.1 AmplNormalize	Left		□.	
1	2	Yellow	Solid	1	Fasttest.Ch.2 AmplNormalize	Left		□.	

WL-Passband Ripple-M44k.at27

8.2.2 Passband Ripple @ 48 ks/sec

Audio Precision

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Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment	Cursor1	Cursor2
1	1	Cyan	Solid	1	Fasttest.Ch.1 AmplNormalize	Left		□.	
1	2	Yellow	Solid	1	Fasttest.Ch.2 AmplNormalize	Left		□.	

Vista-Passband Ripple-M48k.at27

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9 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 (HID), Version 1.11

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— End of Specifications —

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