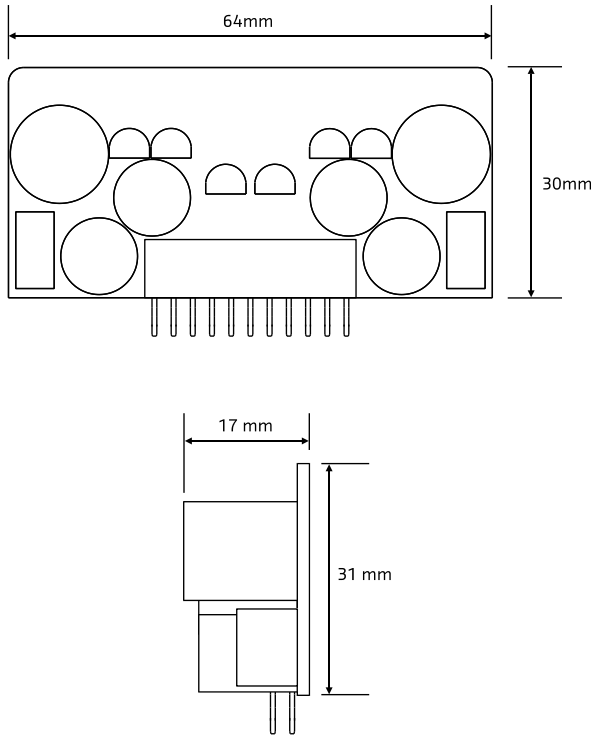


High Efficiency Dual Channel Power Amplifier Module



Highlights

- Flat, fully load-independent frequency response
- Low output impedance
- Very low, frequency-independent THD
- Fully passive loop control

Features

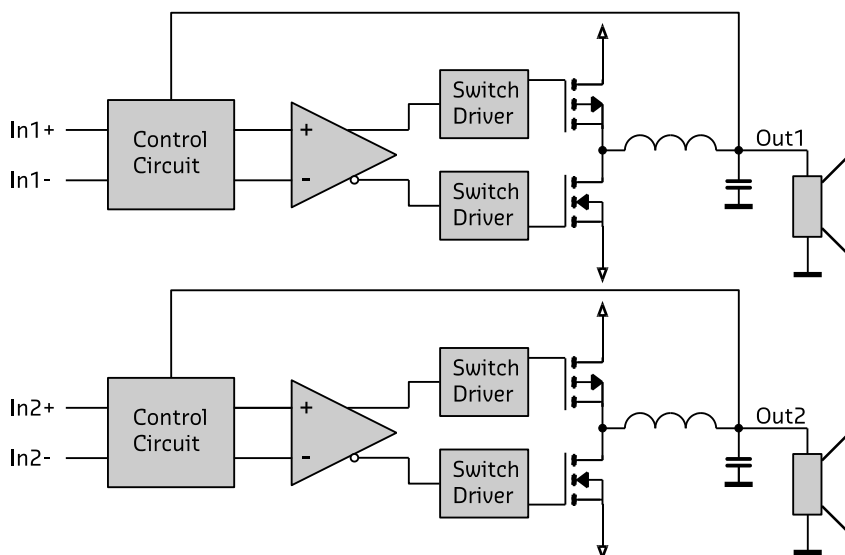
- Runs on unregulated +/- rails
- Pop-free start and stop control
- DC-fault detection
- Overcurrent protection
- Thermal protection
- Weight: 32g

Applications

- Monitor loudspeakers for recording and mastering studios
- Public Address systems
- Home theatre systems
- Active loudspeakers

Description

The UcD32 (OEM version) amplifier module is a self-contained high-performance class D amplifier intended for a wide range of audio applications, ranging from Public Address systems to ultrahigh-fidelity replay systems for studio and home use. Chief distinguishing features are flat frequency response irrespective of load impedance, nearly frequency-independent distortion behaviour and very low radiated and conducted EMI. Control is based on a phase-shift controlled self-oscillating loop taking feedback only at the speaker output.



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1 Performance data

Power supply = +/-20V, Load=4Ω, MBW=40kHz, unless otherwise noted

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Power	P _R	-	30+30	-	W	THD=1%, Load=4Ω
		-	TBD	-	W	THD=1%, Load=8Ω
Distortion	THD+N	-	-	0.25	%	20Hz<f<20kHz ¹⁾ P _{out} <P _R /2
		-	-	0.15	%	20Hz<f<20kHz P _{out} =1W
Output noise	U _N	-	-	120	μV	Unwtd, 20Hz-20kHz
Output Impedance	Z _{OUT}	-	-	50	mΩ	f<1kHz
		-	-	300	mΩ	f<20kHz
Power Bandwidth	PBW		20-35		kHz	²⁾
Frequency Response		10	-	50k	Hz	+0/-3dB. All loads.
Voltage Gain total	A _V	12	12.5	13	dB	
Supply Ripple Rejection	PSRR		TBD		dB	Either rail, all frequencies.
Required input level for 30W/4Ω/THD=1%			2.5		V	Appropriate supply voltage level assumed
Efficiency	η		85		%	Full power
Idle Losses	P _o		3		W	
Current Protection	I _{OUT,P}		6		A	Amplifiers are muted

Note 1: At higher audio frequencies there are not enough harmonics left in the audio band to make a meaningful THD measurement. High frequency distortion is therefore determined using a 18.5kHz+19.5kHz 1:1 two-tone IMD test.

Note 2: Dielectric losses in the output capacitor limit long term (>30s) full-power bandwidth to 15kHz.

2 Absolute maximum ratings

Correct operation at these limits is not guaranteed. Operation beyond these limits may result in irreversible damage.

Item	Symbol	Rating	Unit	Notes
Power supply voltage	V _B	+/-25	V	
Peak output current	I _{OUT,P}	6	A	Unit current-protects at 6A
Input voltage	V _{IN}	+/-5	V	Either input referenced to ground
Air Temperature	T _{AMB}	65	°C	

3 Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Notes
Power supply voltage	V_B	10 ¹⁾	18	22	V	
Driver supply voltage	V_{dr}	4.8	6.2	6.5	V	
Driver supply current			100		mA	
Load impedance	Z_{LOAD}	4			Ω	
Source impedance	Z_{SRC}			7k	Ω	Differential. Corresponds to 3dB noise increase.
Effective power supply storage capacitance	C_{SUP}	4700 μ^2)			F	Per rail, per attached amplifier. 4 Ω load presumed.

Note 1: Reduced performance

Note 2: The effective power supply storage capacitance of Hypex SMPS is already in excess of 4700uF. Do not add supplementary capacitance.

4 Connections

In order to ease connecting the amplifier, all necessary connections to operate the amplifier are grouped in one standard 2.54mm pitch dual row 22 pin header.

Pin	Type	Function
1	Out	Loudspeaker connection Channel 1 (Hot)
2 ¹⁾	Out	Loudspeaker connection Channel 1 (Cold)
3	In	Channel 1 input (Hot or noninverting)
4	In	Channel 1 input (Cold or inverting)
6	Open Collector	Amplifier Ready detection (low=not ready)
7	In, pulled up	ON/OFF control (Active low)
8	Open Collector	DC-fault detection (low=fault)
9,10	Power	Positive power supply connection
11,12	Power	Negative power supply connection
13,14 ¹⁾	GND	Power supply ground connection
15	Power	Positive Driver Voltage
16	Power	Negative Driver Voltage
19	In	Channel 2 input (Hot or noninverting)
20	In	Channel 2 input (Cold or inverting)
21	Out	Loudspeaker connection Channel 2 (Hot)
22 ¹⁾	Out	Loudspeaker connection Channel 2 (Cold)

Note 1: Electrically connected together on the amplifier module.

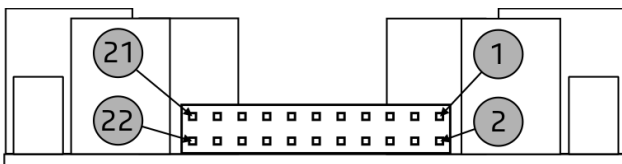


Fig1. Connector pinning UcD32 (OEM version).

4.1 Input Characteristics

Item	Symbol	Min	Typ	Max	Unit	Notes
Input Impedance	Z_{IN}		1.8k		Ω	
CM Rejection Ratio	CMRR		45		dB	All frequencies
Common Mode Range		-VDR		+VDR		

4.2 Amplifier Ready Detection Characteristics

This signal indicates whether the amplifier is muting or not by means of pulling the line low whenever the amps are muted. It is up to the user to verify whether this mute condition is forced by the user or by the amplifier itself. The latter indicates there is a fault condition forcing the amplifier in self protection mode. This protection mode can be triggered by over current. When the amplifier enters this mode it will wait a period of at least 1 second before trying to restart. It will keep trying to restart until the fault condition has disappeared.

Item	Type	Min	Typ	Max	Unit	Notes
Voltage on pin 21, AMP_Ready	Output			0,7	V	Internal open collector ¹⁾

Note 1: Must be pulled to a positive voltage by means of an external resistor. Open collector maximum output current: 100mA. Maximum collector voltage: 65V.

4.3 DC-Error Detection Characteristics

The UcD32 (OEM version) has an integrated DC-error detection which will pull pin 15 low in case of such an event. It is recommended to sense this fault condition and to interrupt both power supply lines in such an event.

Item	Type	Min	Typ	Max	Unit	Notes
Voltage on pin 15, DC-error	Output			0,7	V	Internal open collector ¹⁾

Note 1: Must be pulled to a positive voltage by means of an external resistor. Open collector maximum output current: 100mA. Maximum collector voltage: 65V.

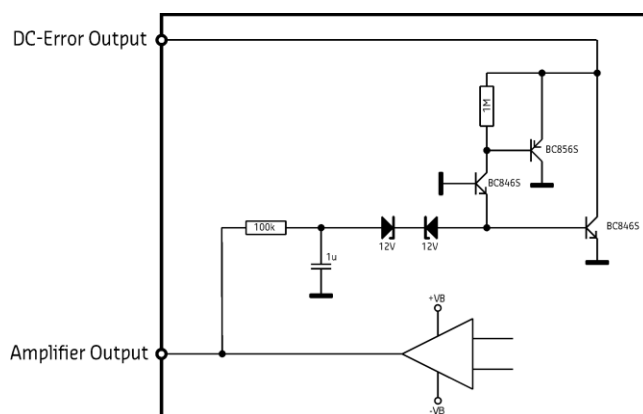


Fig3. DC-Error Output interface.

4.4 Amplifier Mute/Unmute Characteristics

The UcD32 (OEM version) is unmuted by pulling pin 8 low. Leaving pin 8 floating will put the amplifier in mute.

Item	Min	Typ	Max	Unit	Notes
Voltage on pin 8, left floating			5	V	Internally pulled up ¹⁾
Output attenuation when muted	85			dB	

Note 1: Must be pulled low by means of an open collector.

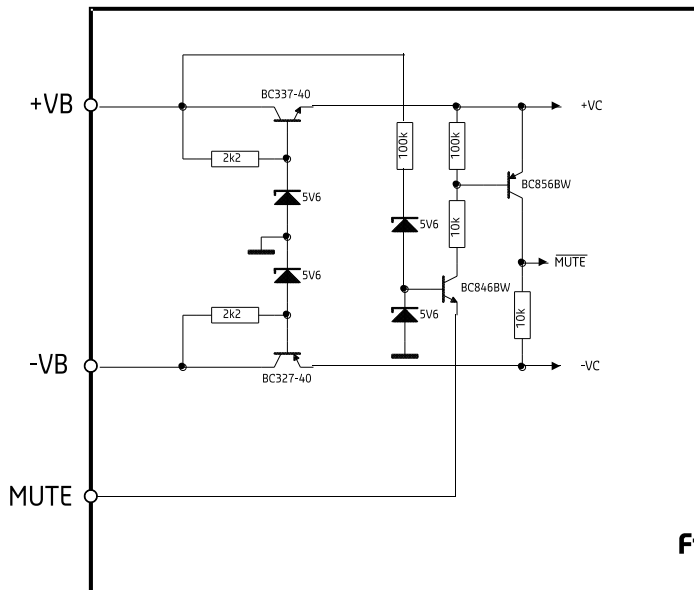


Fig4. Amplifier Mute/Unmute Control interface.

4.5 Input signal recommendation

The UcD32 (OEM version) is DC-coupled. Only when it is absolutely certain that the signal source does not contain a DC component, input capacitors may be omitted.

4.6 Amplifier start-up

Unlike other amplifiers from the UcD-series, this amplifier is automatically enabled right after power-up. When the amplifier is muted, the output level is attenuated by at least 85dB.

4.7 Loudspeaker connection recommendation

The loudspeaker is to be connected between Hot and Cold output pins. The loudspeaker should not be connected to any other circuit pin. The Cold pin should not be connected to anything else but the loudspeaker. Connecting the loudspeaker return and/or the Cold output pins to GND will adversely affect performance of the amplifier and the application circuit.

4.8 Input buffer recommendation

All standard recommendations apply. Note that the input common mode range is from +VDR to -VDR.

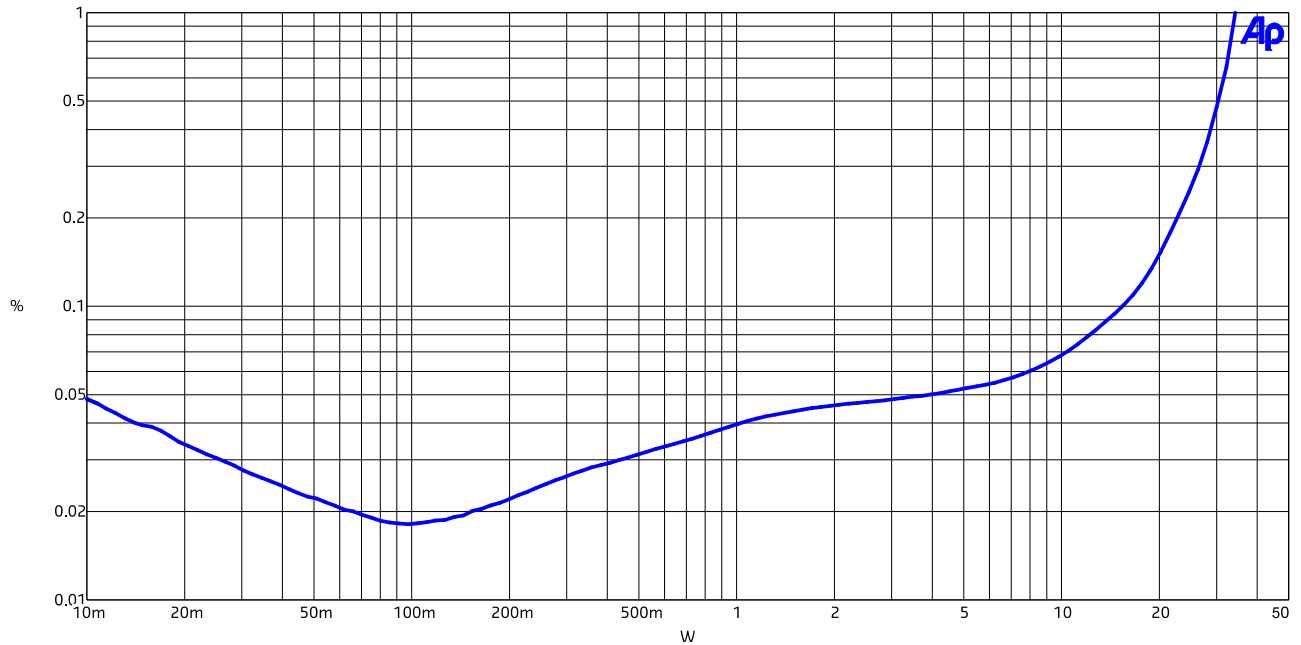
4.9 External drive voltages

The external +/-VDR inputs must be connected to +/-6V auxiliary rails. These should be up no later than 100ms after the power supplies. Running the UcD32 module without VDR supply for extended periods of time will irreparably damage the circuit.

Item	Min	Typ	Max	Unit	Notes
+VDR, pin 15	4.8	6.2	6.5	V	
-VDR, pin 16	-4.8	6.2	-6.5	V	

5 Typical Performance Graphs

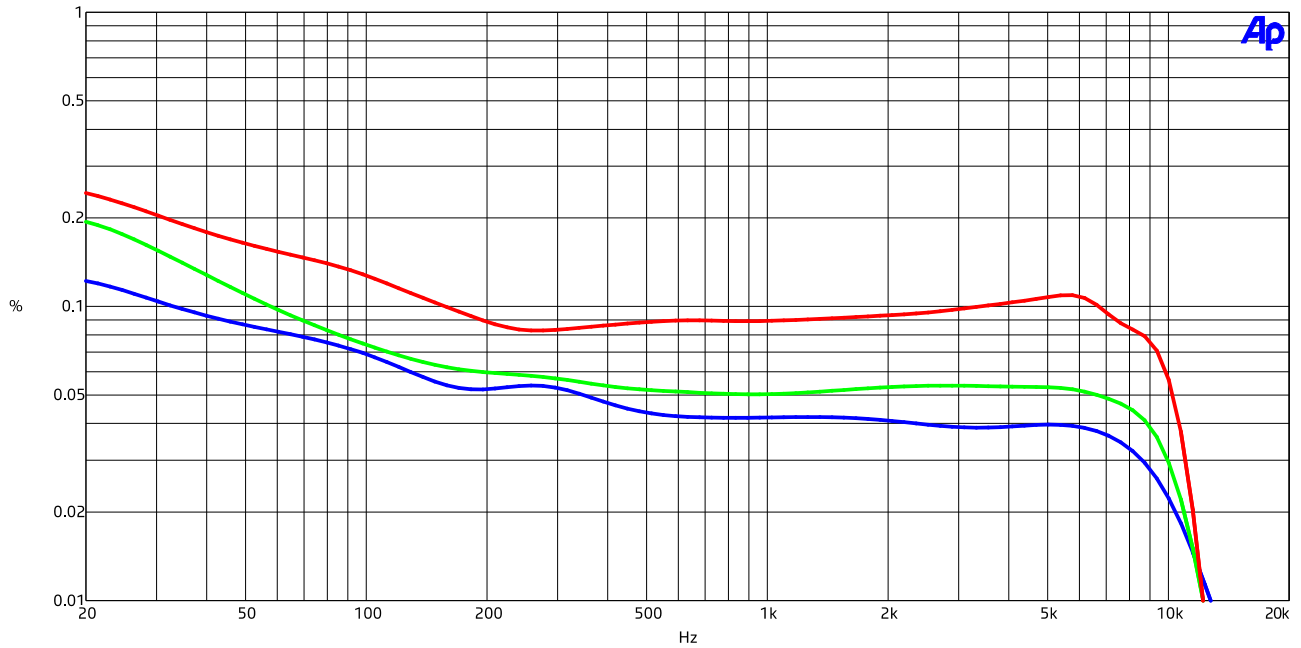
5.1 THD vs. Power (1kHz, 4Ω)



5.2 THD vs. Power (1kHz, 8Ω)

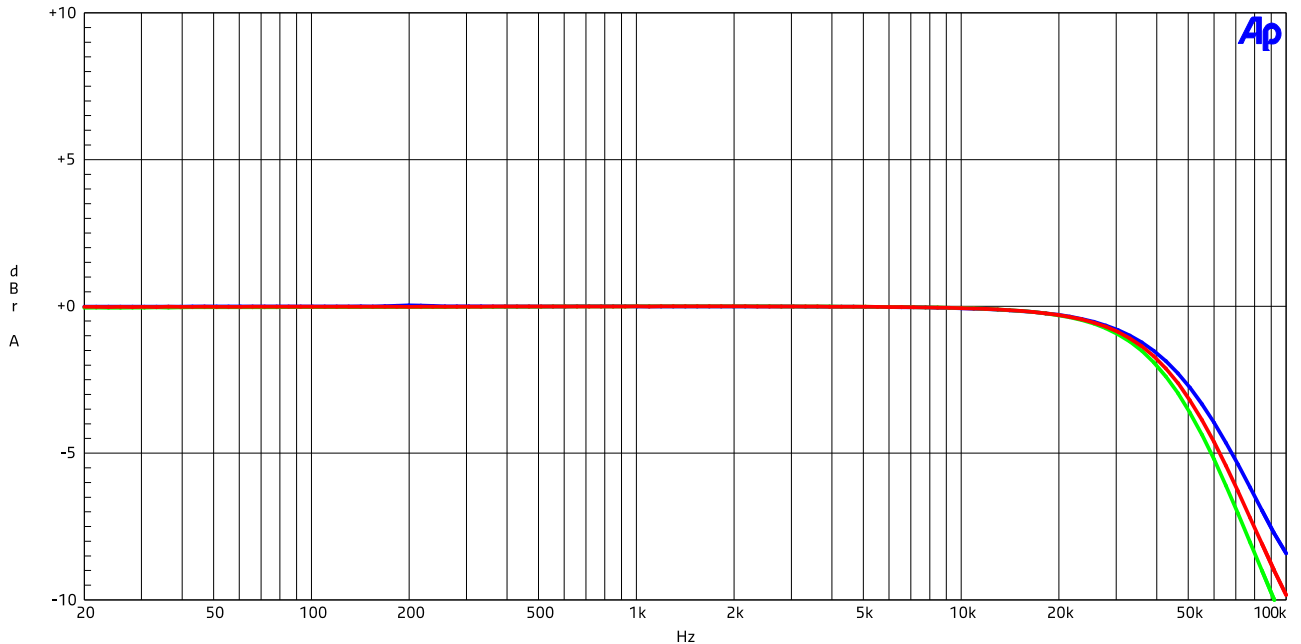
TBD

5.3 THD vs. Frequency (4Ω)



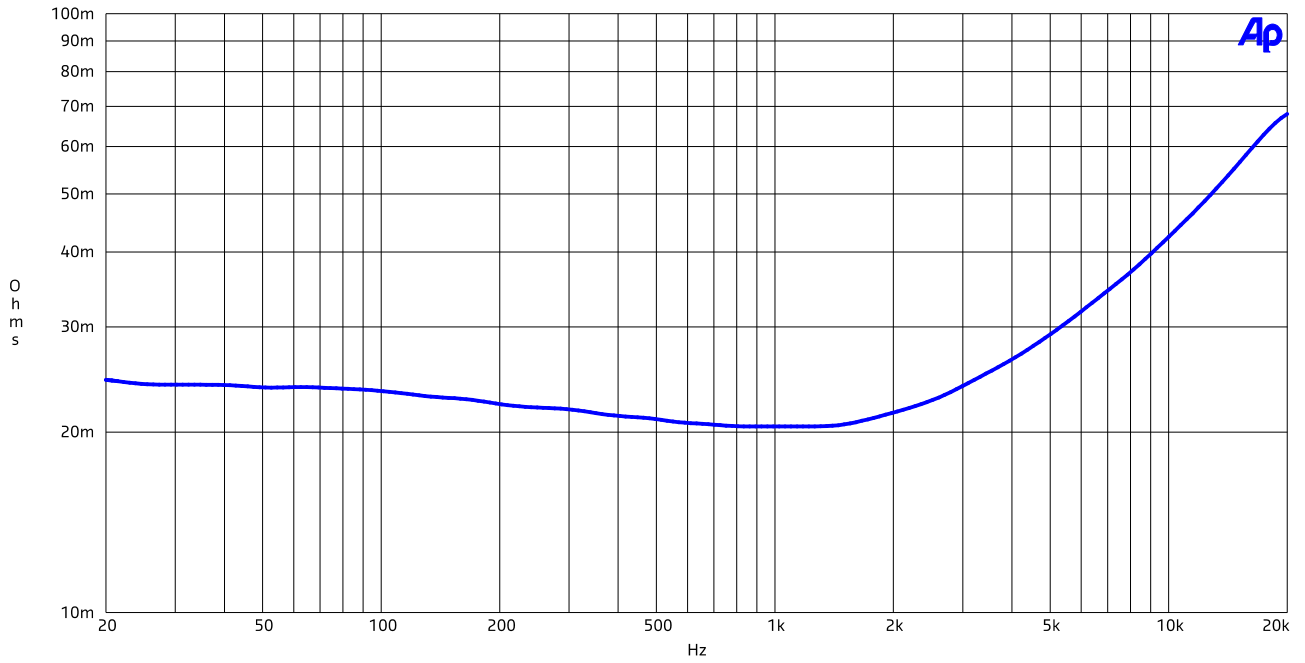
From top to bottom: 15W, 5W, 1W

5.4 Frequency Response (4Ω, 8Ω and open circuit)

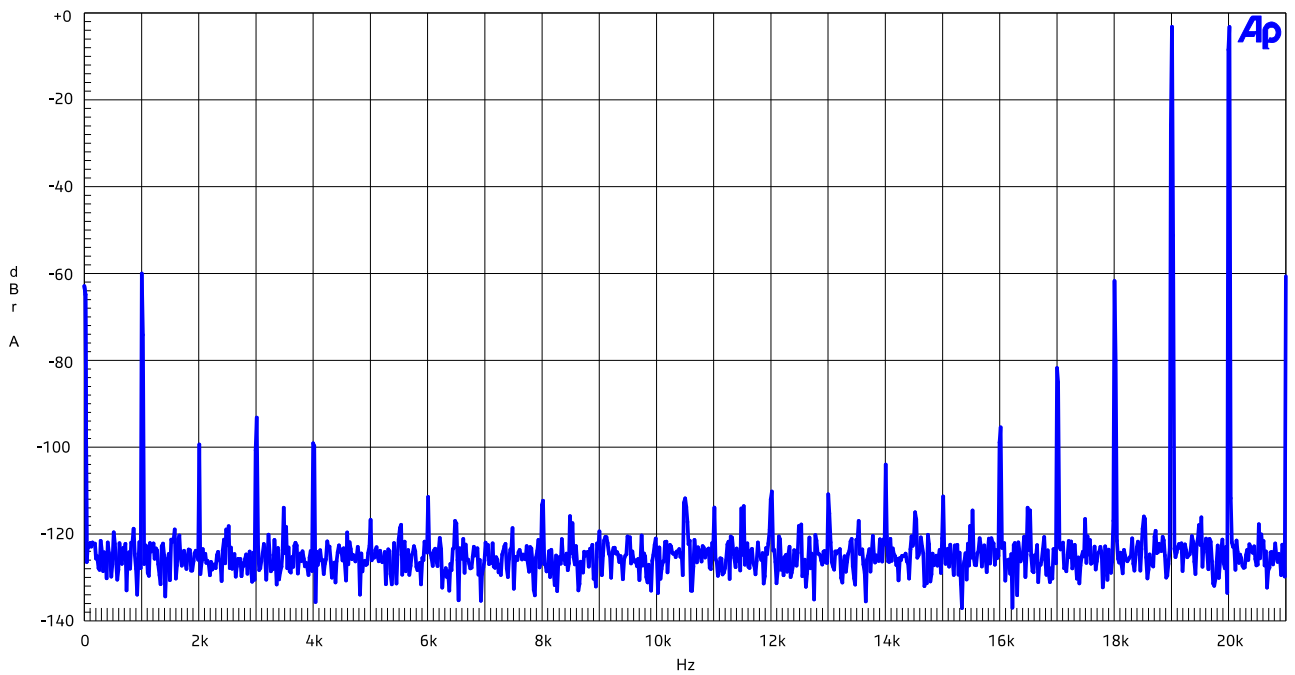


From top to bottom: open circuit, 8Ω and 4Ω

5.5 Output Impedance



5.6 19+20kHz IMD (5W, 4Ω)



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Document Revision	PCB Version	Description	Date
R1	UcD32OEMV1	Initial Draft.	16.04.09
R2	UcD32OEMV1	Input buffer bypassed to enable users own buffer configuration. This affects the input impedance and gain: - gain (26dB) > 13dB. - input impedance (100k) > 1k8. Input buffer recommendation added to doc.	09.07.09
R3	UcD32OEMV2	- Current limiter improved. Short circuit protection is now long term stable. - Gain is set to 12,5dB.	21.08.09
R4	UcD32OEMV3	- Muting circuit drastically improved (30dB -> 85dB). - Over temperature protection added. - Amplifier ready monitoring output added. - Signal-input changed to asymmetrically topology. - Input buffer requirement changed.	06.08.09
R6	UcD32OEMV5	- Pinouts changed - Driver voltage characteristics added - Temperature protection removed	16.03.11
R7	UcD32OEMV5	- Format changed	22.12.2011
R8	UcD32OEMV6	- Chapter 4, Function description updated.	31.01.2012
R9	UcD32OEMV6	- Recommended operating conditions updated	25.05.2012
R10	UcD32OEM V7	- Vdr supply requirements added	27.01.2015