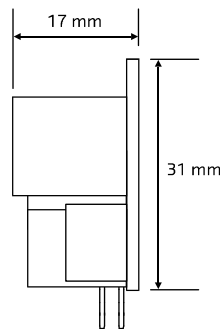
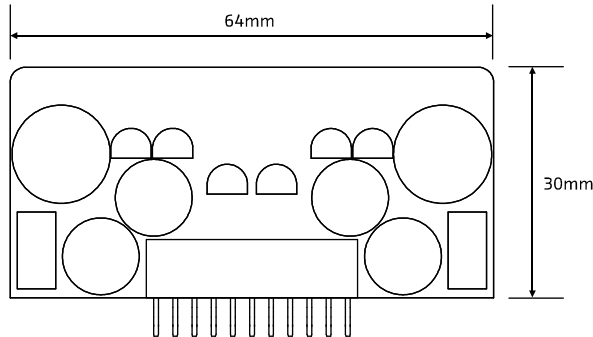


High Efficiency Dual Channel Power Amplifier Module



Highlights

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

Features

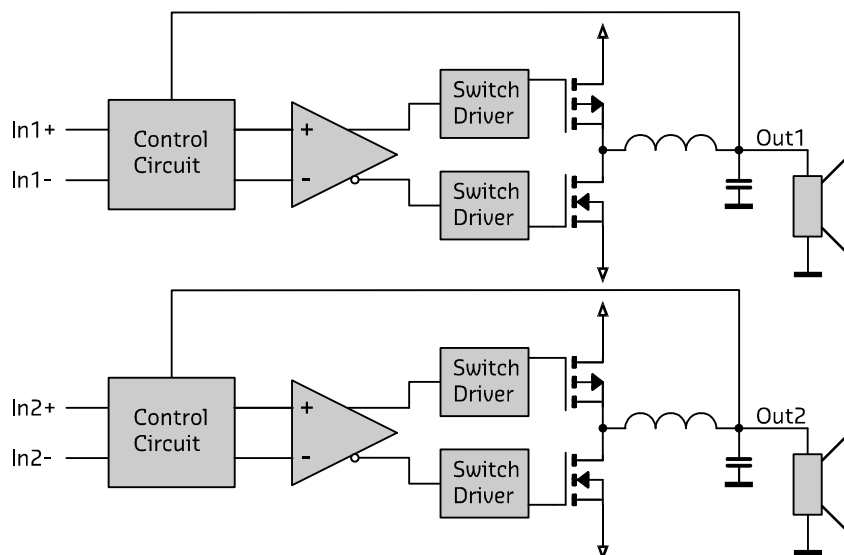
- Runs on unregulated +/- rails
- Pop-free start and stop control
- DC-fault detection
- Overcurrent protection
- Thermal protection
- Weight: 32g

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.



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%
Distortion	THD+N	-	-	0.25	%	20Hz<f<20kHz. Pout<P _R /2
		-	-	0.15	%	20Hz<f<20kHz Pout=1W
Output noise	U_N	-	-	120μ	V	Unwtd, 20Hz-20kHz
Output Impedance	Z_{OUT}	-	-	50m	Ω	f<1kHz
		-	-	300m	Ω	f<20kHz
Power Bandwidth	PBW		20-35k		Hz	
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_0		3		W	
Current Protection	$I_{OUT,P}$		6		A	Amplifiers are muted

Audio Input Characteristics

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

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 referred to ground
Air Temperature	T_{AMB}	65	°C	

Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Notes
Power supply voltage	V_B	10*	18	22	V	*Reduced performance
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}	1000μ			F	Per rail, per attached amplifier. 4Ω load presumed.

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	Not connected	Not connected
2	Output	Loudspeaker connection Channel 1 (HOT)
3,4*	Output	Loudspeaker connection Channel 1 (COLD)
5	Input	Channel 1 input reference
6*	Input	GND
7	Input	Channel 1 input signal**
8	Input	ON/OFF control (Active low)
9, 10	Input	Positive power supply connection
11, 12*	Input	Power supply ground connection
13, 14	Input	Negative power supply connection
15	Output	DC-fault detection (Open collector - Active low)
16	Input	Channel 2 input reference
17*	Input	GND
18	Input	Channel 2 input signal**
19,20*	Output	Loudspeaker connection Channel 2 (COLD)
21	Output	Amplifier Ready detection (Open collector-Active high)
22	Output	Loudspeaker connection Channel 2 (HOT)

Notes:

(*) are electrically connected together on the amplifier module.

(**) Inputs are inverting.

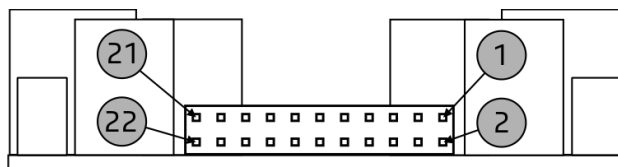


Fig1. Connector pinning UcD32™ (OEM version).

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 either by over current or over temperature. 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*

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

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*

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

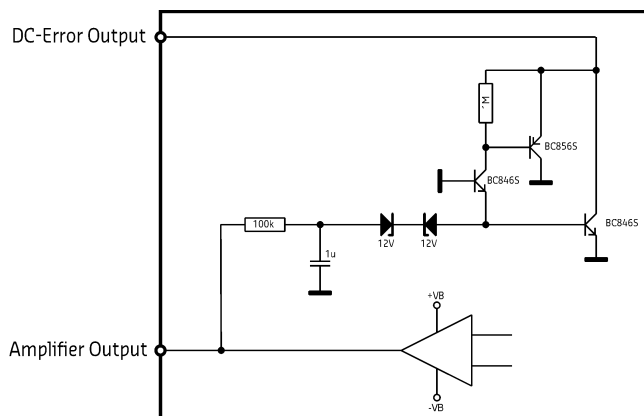


Fig3. DC-Error Output interface.

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*
Output attenuation when muted	85			dB	

* Must be pulled low by means of an open collector.

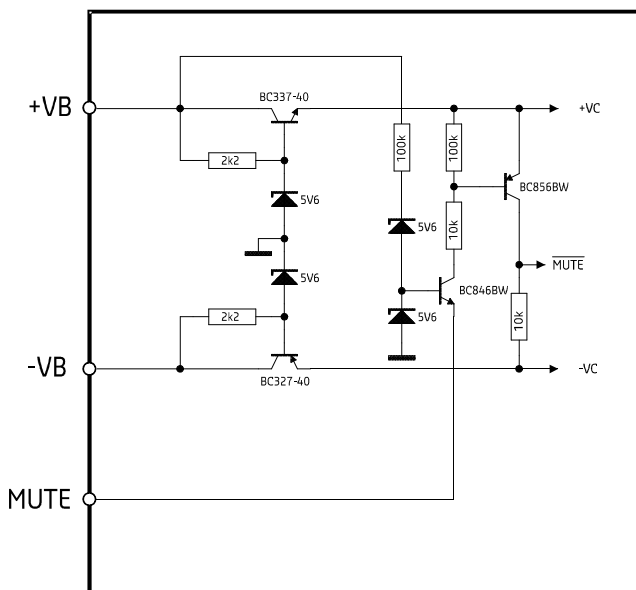


Fig4. Amplifier Mute/Unmute Control interface.

Input signal recommendation

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

Amplifier start-up

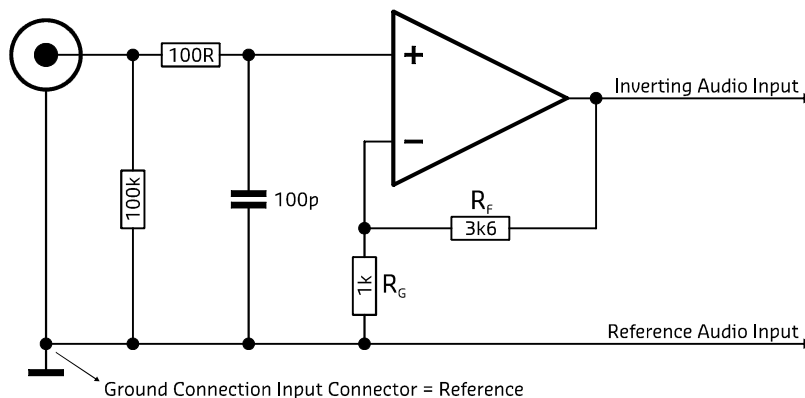
Unlike other amplifiers from the UcD-series, this amplifier is automatically enabled right after power-up. When the amplifier is muted, the output level is attenuated by at least 85dB.

Loudspeaker connection recommendation

It is highly recommended both COLD as HOT Loudspeaker output Lines are routed directly from the module to the loudspeaker output connector. This prevents high currents from traveling over the signal ground plane which can cause beat tones or other unwanted audible distortions.

Input buffer recommendation

The UcD32™ (OEM version) has no on-board input buffer. Unlike the other amplifiers in the UcD-series, these amplifiers need to be driven asymmetrically on their inverting input connections. The reference input should be routed parallel to the inverting input trace and be connected to the ground connection of the input connector. Applications that require a higher gain and/or a higher input impedance benefit from a buffer stage like the one shown below. As this buffer circuit is non-inverting, please keep in mind the total input to output gain will still be inverted.

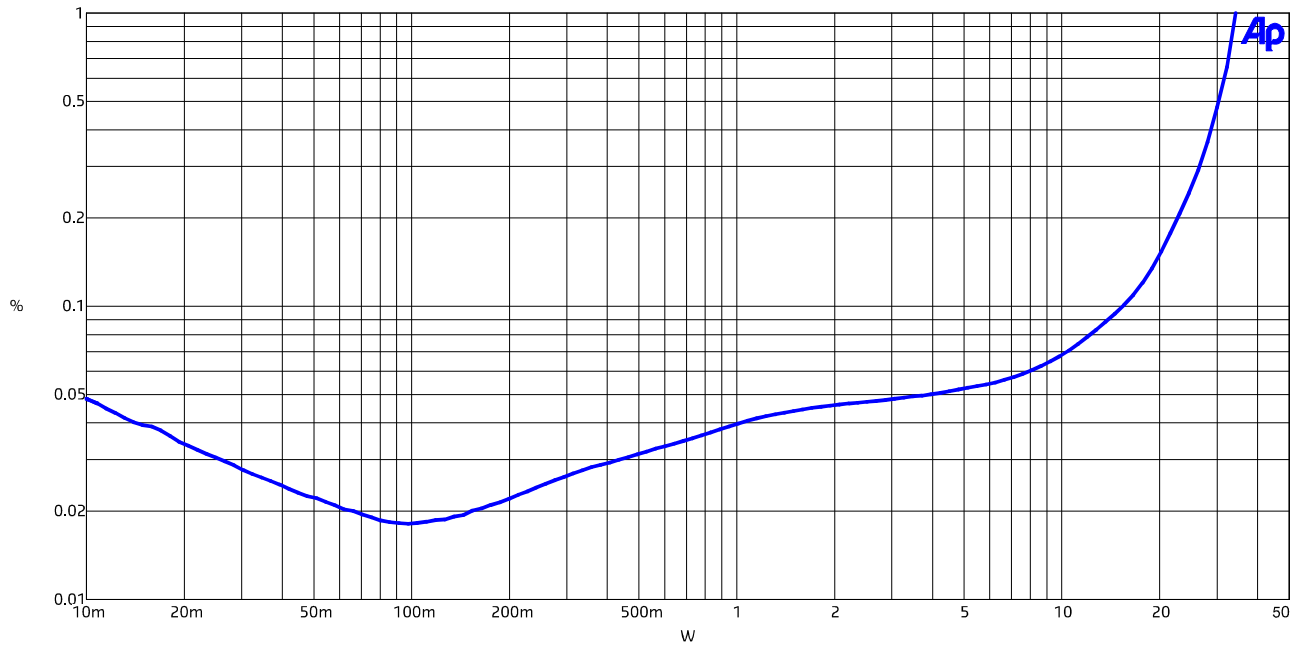


$$A_{V_{buffer}} = \frac{(R_F + R_G)}{R_G} = \frac{(3k6 + 1k)}{1k} = 4.6$$

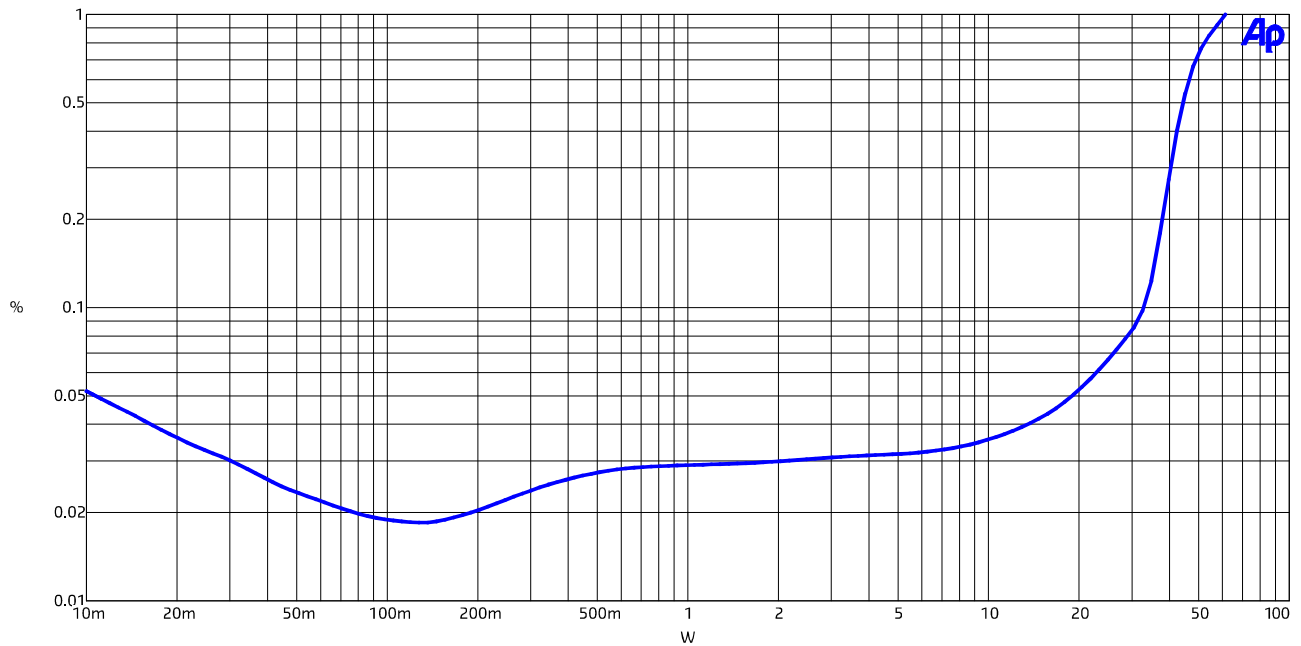
Fig5. Recommended Input buffer stage.

Typical Performance Graphs

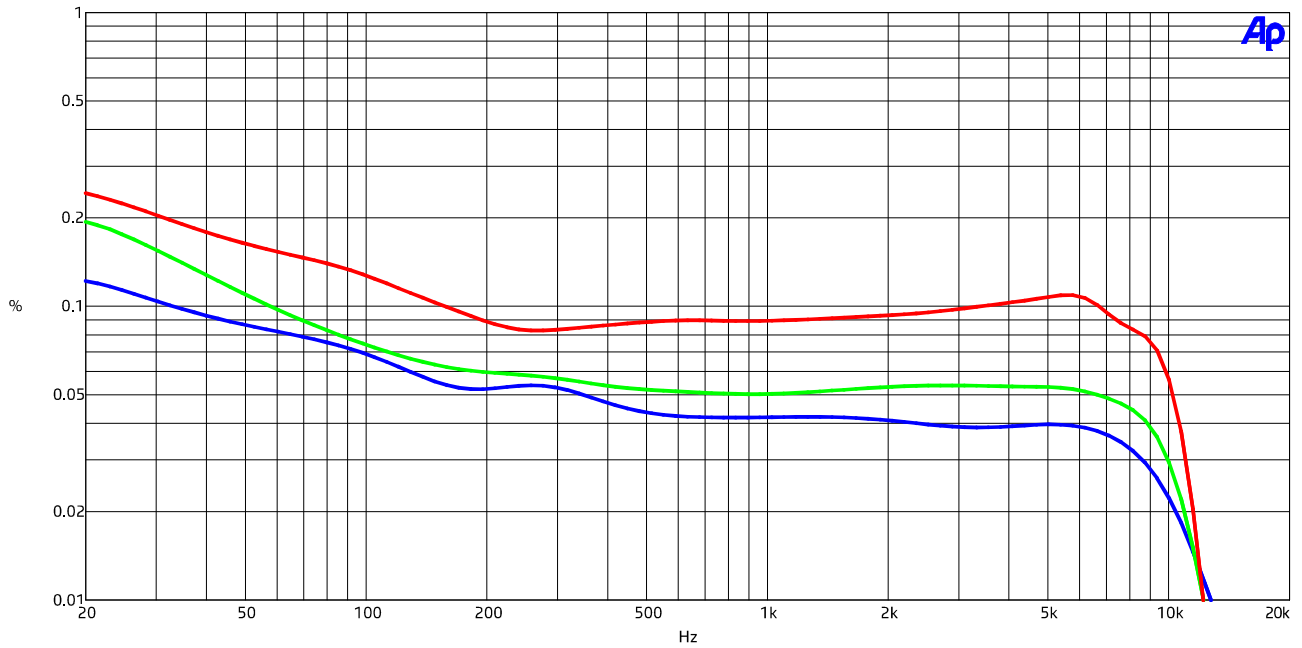
THD vs. Power (1kHz, 4Ω)



THD vs. Power (1kHz, 8Ω)

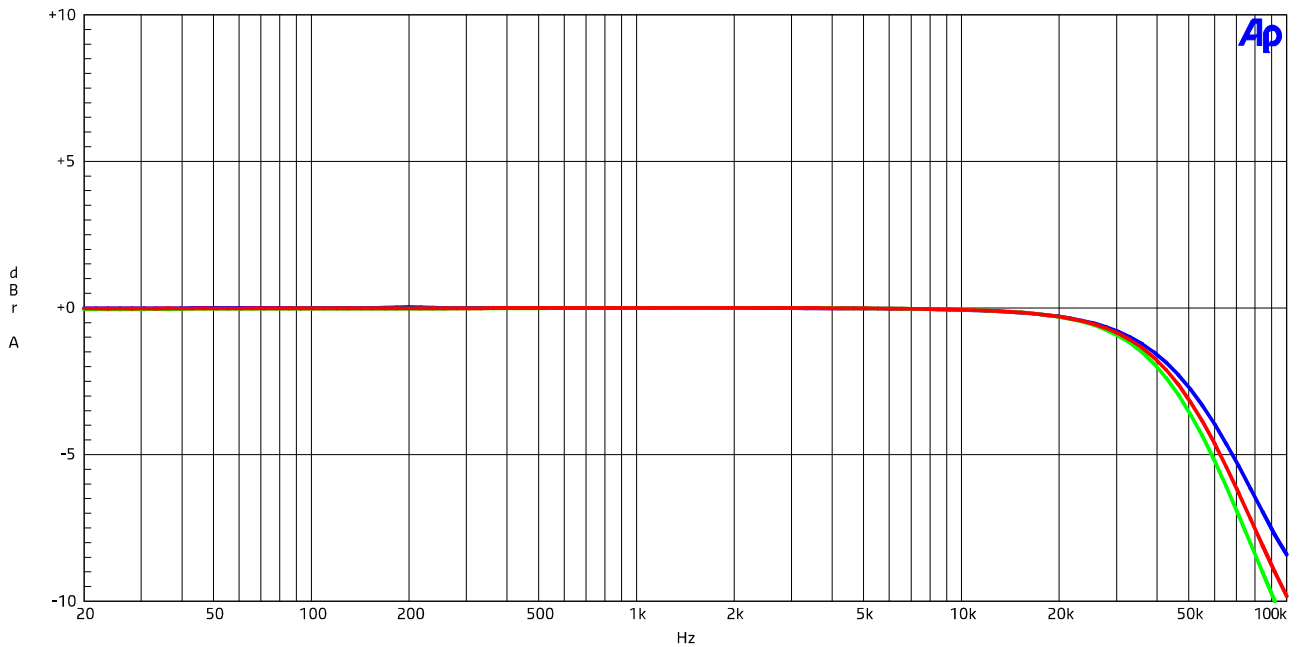


THD vs. Frequency (4Ω)



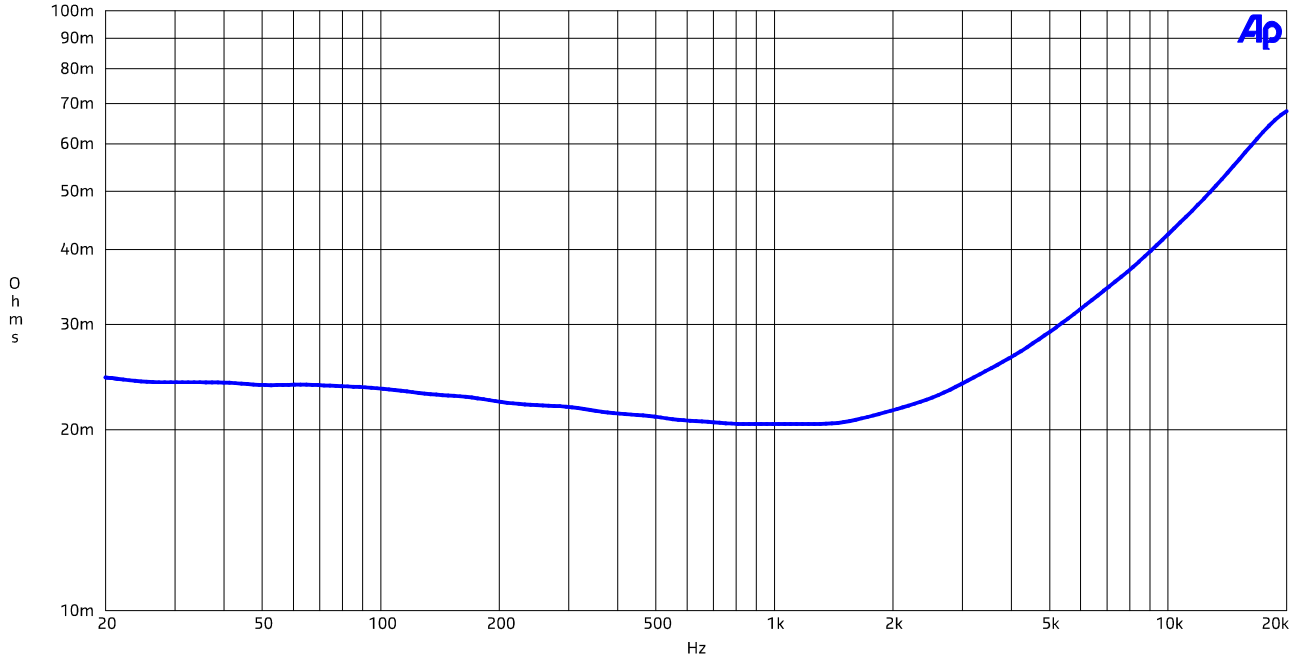
From top to bottom: 15W, 5W, 1W

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

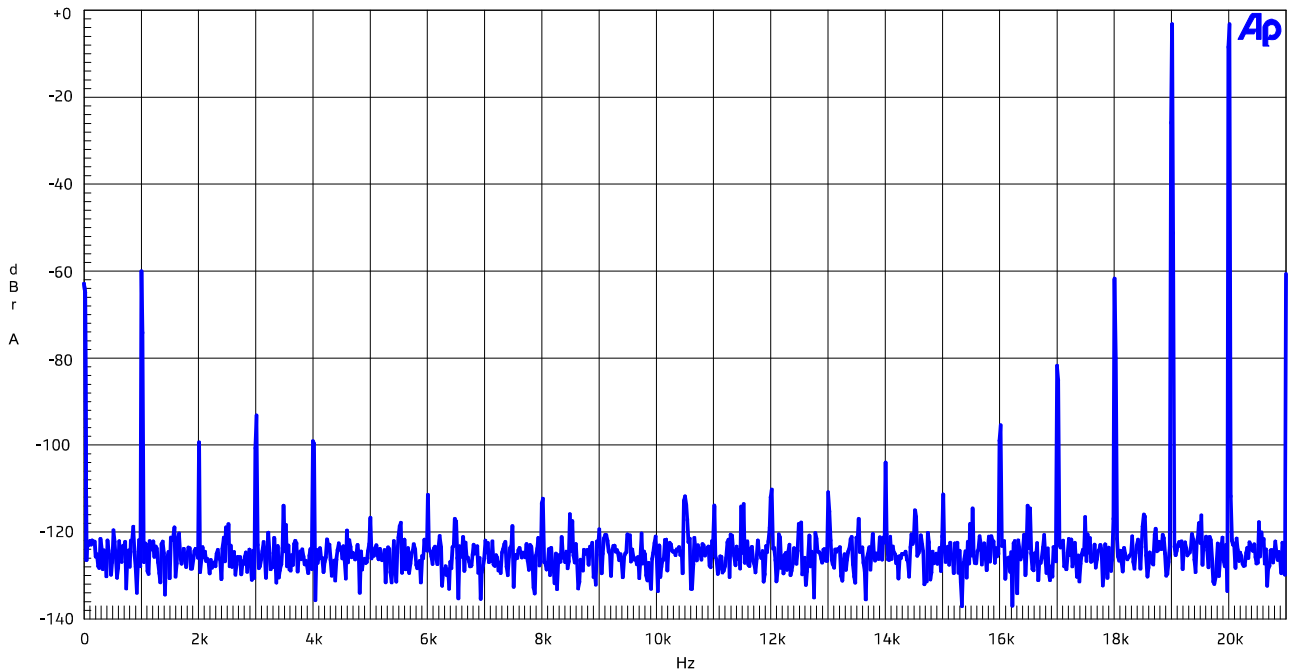


From top to bottom: open circuit, 8Ω and 4Ω

Output Impedance



19+20kHz IMD (5W, 4Ω)



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