

Highlights

- Flat, fully load-independent frequency response
- Low output impedance
- Very low, frequency-independent THD
- Very low noise
- Fully passive loop control
- Consistent top performer in listening trials

Features

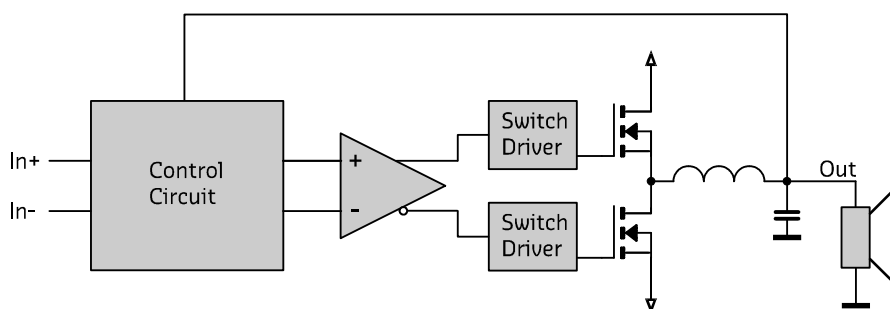
- Runs on unregulated +/- rails
- Pop-free start and stop control
- Differential audio input
- On-board clipping detection
- DC-fault detection
- Overcurrent and overvoltage protection
- Weight: 100g / Height: 33mm

Applications

- Monitor loudspeakers for recording and mastering studios
- Audiophile power amplifiers for professional and consumer use
- Public Address systems
- Home theatre systems
- Active loudspeakers

Description

The UcD180 (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 = +/-45V, Load=4Ω, MBW=40kHz, unless otherwise noted

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Power	P_R	-	180	-	W	THD=1%, Load=4Ω
		-	120	-	W	THD=1%, Load=8Ω
Distortion	THD+N	-	0.1	0.15	%	20Hz<f<20kHz ¹⁾ Pout<P _R /2
		-	-	0.05	%	20Hz<f<20kHz Pout=1W
Output noise	U_N	-	-	80μ	V	Unwtd, 20Hz-20kHz
Output noise (UcD only)	U_N	-	-	30μ	V	Unwtd, 20Hz-20kHz
Output Impedance	Z_{OUT}	-	-	20m	Ω	f<1kHz
		-	-	150m	Ω	f<20kHz
Power Bandwidth	PBW		20-35k		Hz	²⁾
Frequency Response		10	-	50k	Hz	+0/-3dB. All loads.
Voltage Gain total	A_V	25.5	26	26.5	dB	
Supply Ripple Rejection	PSRR		65		dB	Either rail, all frequencies.
Required input level for 180W/4Ω/THD=1%			1.34		V	Appropriate supply voltage level assumed
Efficiency	η		92		%	Full power
Idle Losses	P_o		4		W	
Standby Current	I_{STBY}		10m		A	
Current Limit			10		A	Hiccup mode after 40ms limiting

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 Audio Input Characteristics

Item	Symbol	Min	Typ	Max	Unit	Notes
Input Impedance	Z_{IN}		100k		Ω	Either input to ground
Input Impedance (unbuffered input)	Z_{IN}		1k8		Ω	Either input to ground
CM Rejection Ratio	CMRR		75		dB	All frequencies

3 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	+/-50	V	Unit shuts down when either rail exceeds 56V
Peak output current	$I_{OUT,P}$	10	A	Unit current-limits at 10A
Input voltage	V_{IN}	+/-12	V	Either input referenced to ground
Air Temperature	T_{AMB}	65	°C	
Heat-sink temperature	T_{SINK}	90	°C	User to select heat sink to insure this condition under most adverse use case

4 Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Notes
Power supply voltage	V_B	25 ¹⁾	45	50 ²⁾	V	
Load impedance	Z_{LOAD}	1			Ω	
Source impedance	Z_{SRC}			7k	Ω	Differential. Corresponds to 3dB noise increase.
Effective power supply storage capacitance	C_{SUP}	4700 μ ³⁾			F	Per rail, per attached amplifier. 4 Ω load presumed.

Note 1: Reduced performance.

Note 2: Unit shuts down when either rail exceeds 56V.

Note 3: The effective power supply storage capacitance of Hypex SMPS is already in excess of 4700uF. Do not add supplementary capacitance.

5 Connections

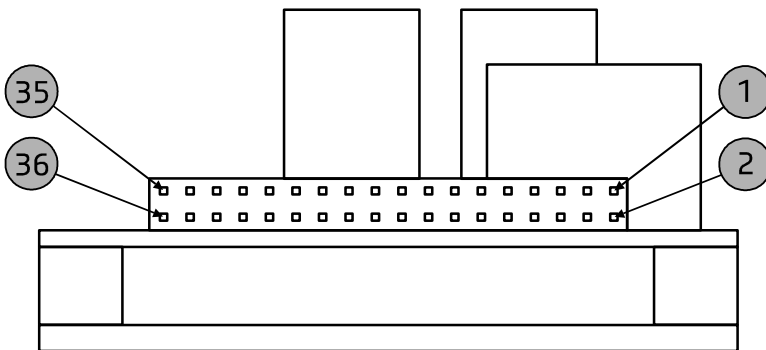


Figure 1: Connector pinning J1 UcD180 (OEM version).

5.1 J1

In order to ease connecting the amplifier, all necessary connections to operate the amplifier are grouped in one standard 2.54mm pitch dual row 36 pin header.

Pin	Type	Function
1, 2, 3, 4	Input	Positive power supply connection
5, 6, 7, 8	Input	Power supply ground connection ¹⁾
9, 10, 11, 12	Input	Negative power supply connection
13, 14, 15, 16, 18	Output	Loudspeaker connection (cold) ¹⁾
17	Input	Negative loudspeaker feedback
19	Input	Positive loudspeaker feedback
20, 21, 22, 23, 24	Output	Loudspeaker connection (hot)
25	Input	Buffered inverting audio input
26	Output	Buffered inverting audio output
27	Input	Unbuffered inverting audio input
28	Input	Ground ¹⁾

29	Input	Buffered non-inverting audio input
30	Output	Buffered non-inverting audio output
31	Input	Unbuffered non-inverting audio input
32	Output	Clipping detection output (open collector)
33	Output	DC-error output (open collector)
34	Input	ON/OFF control (active low)
35	Output	Amplifier Ready (I ² C SDA, not yet implemented)
36	-	NC, (I ² C SCL, not yet implemented)

Note 1: Physically connected to the same potential (ground).

5.2 Clipping Detection Characteristics

The UcD180 (OEM version) has an integrated output clipping detection which will pull pin 32 low in case of such an event.

Item	Min	Typ	Max	Unit	Notes
Voltage on pin 32, clipping			1	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.

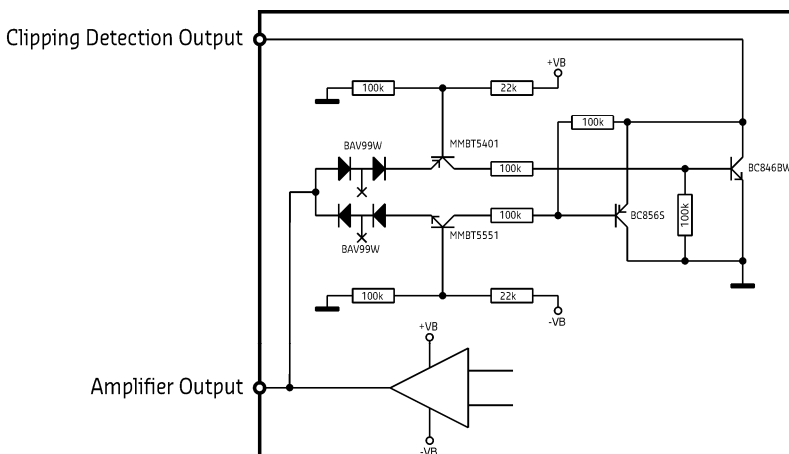


Figure 2: Clipping Detection Output interface.

5.3 DC-Error Detection Characteristics

The UcD180 (OEM version) has an integrated DC-error detection which will pull pin 33 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	Min	Typ	Max	Unit	Notes
Voltage on pin 33, DC-error			1	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.

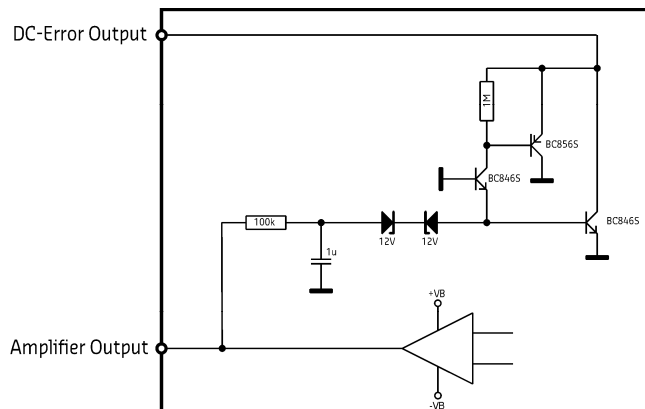


Figure 3: DC-Error Output interface.

5.4 Amplifier On/OFF Characteristics

The UcD180 (OEM version) is enabled by pulling pin 34 low. Leaving pin 34 floating will put the amplifier in standby.

Item	Min	Typ	Max	Unit	Notes
Voltage on pin 34, left floating			6,5	V	Internally pulled up ¹⁾

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

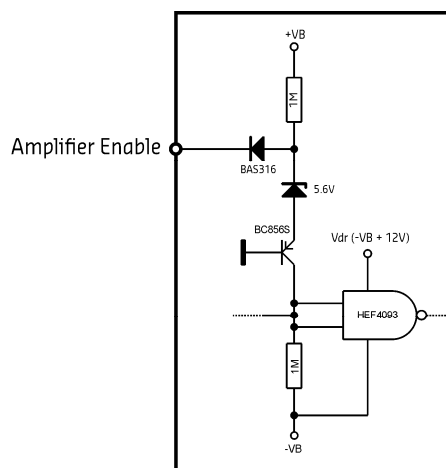


Figure 4: Amplifier On/Off Control interface.

5.5 Amplifier Ready Characteristics

The UcD180 (OEM version) has an integrated Amplifier Ready condition which will pull pin 35 high to indicate that the amplifier shut itself down due to an error. This error can be either an over voltage event or a shorted output.

Item	Min	Typ	Max	Unit	Notes
Voltage on pin 35, error			5,6	V	Internally pulled up

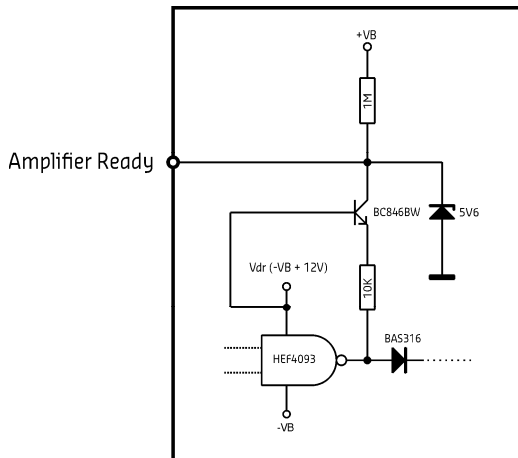


Figure 5: Amplifier Ready interface.

5.6 Signal path characteristics

The UcD180 (OEM version) enables the user to choose between two different ways of input signal routing.

- In order to use the on-board buffer opamp (TL072) two external connections need to be made: pins 30, 31 and pins 26, 27 must be tied together. The amplifier is driven through both inputs 25 and 29.
- If the user desires to utilize his own input buffer circuitry no external connections need to be made. The amplifier is now driven through inputs 27 and 31. Customer needs to take into account that the input impedance of the UcD core is relatively low (1k8).

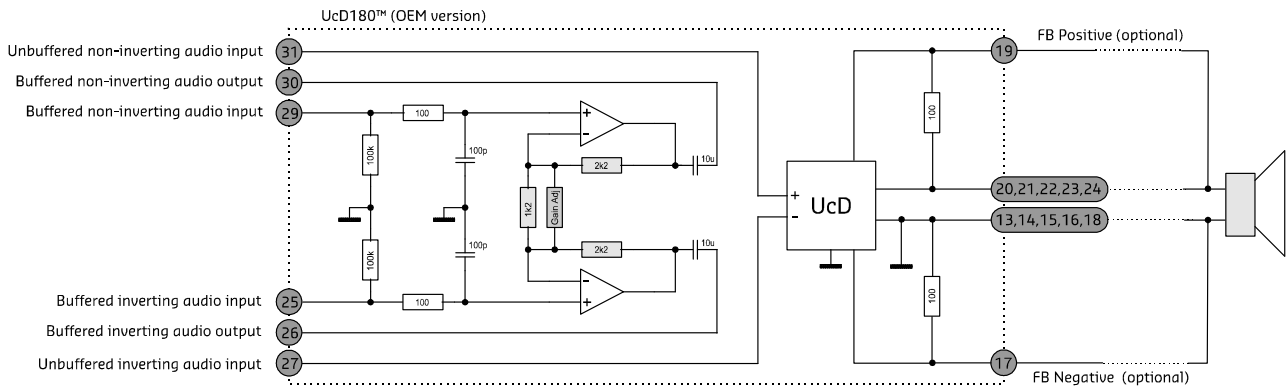


Figure 6: UcD180 (OEM version) block diagram clearly showing the signal path routing and optional loudspeaker feedback connections.

5.7 Optional remote (kelvin) feedback

When maximum control of the loudspeaker is needed it is possible to include the loudspeaker cables in the UcD control loop thus eliminating all negative effects of long cables etcetera.

Connect both the positive feedback (pin 19) and negative feedback (pin 17) connections as close to the loudspeaker as possible. No extra connections are needed.

5.8 Amplifier start-up delay

During initial power up the amplifier is disabled for approx. 1.5s regardless of the state of pin 34. Once powered up there is no start or stop delay. Pin 35 (Amplifier Ready) remains high during the initial power up.

6 Amplifier gain

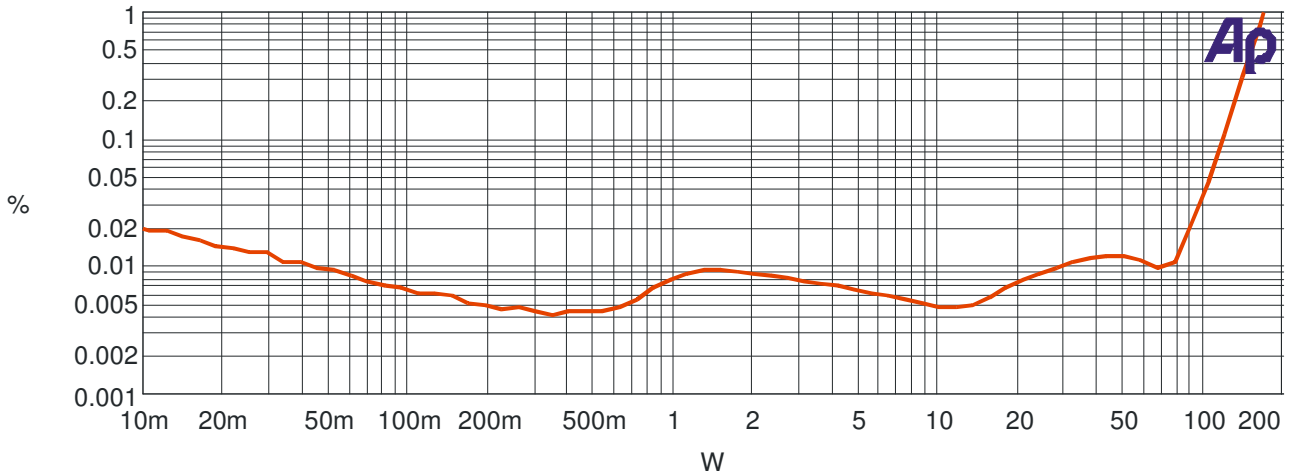
When the on-board input buffer is used the overall amplifier voltage gain is 20 times. The bare UcD stage has a voltage gain of 4.5 times. Input buffer voltage gain is user-changeable by means of the SMD footprint on top of the amplifier board which is marked 'gain adj'.

Input buffer voltage gain is: $A_v = 1 + 2 \times (2k2 / 1k2)$

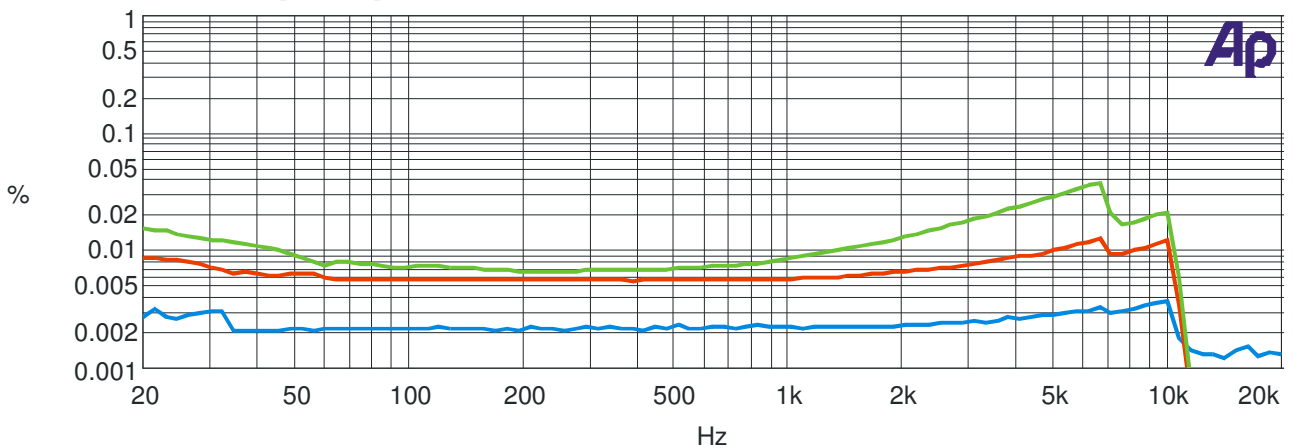
Overall amplifier voltage gain is: $A_v = 4.5 \times (1 + 2 \times (2k2 / 1k2))$

7 Typical Performance Graphs

7.1 THD vs. Power (1kHz, 4Ω)

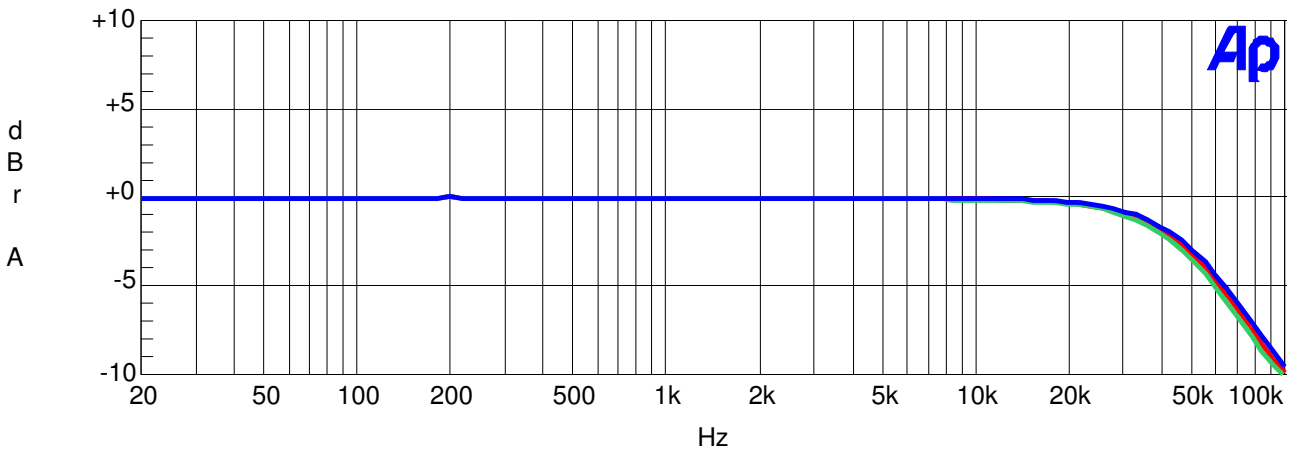


7.2 THD vs. Frequency (8Ω)



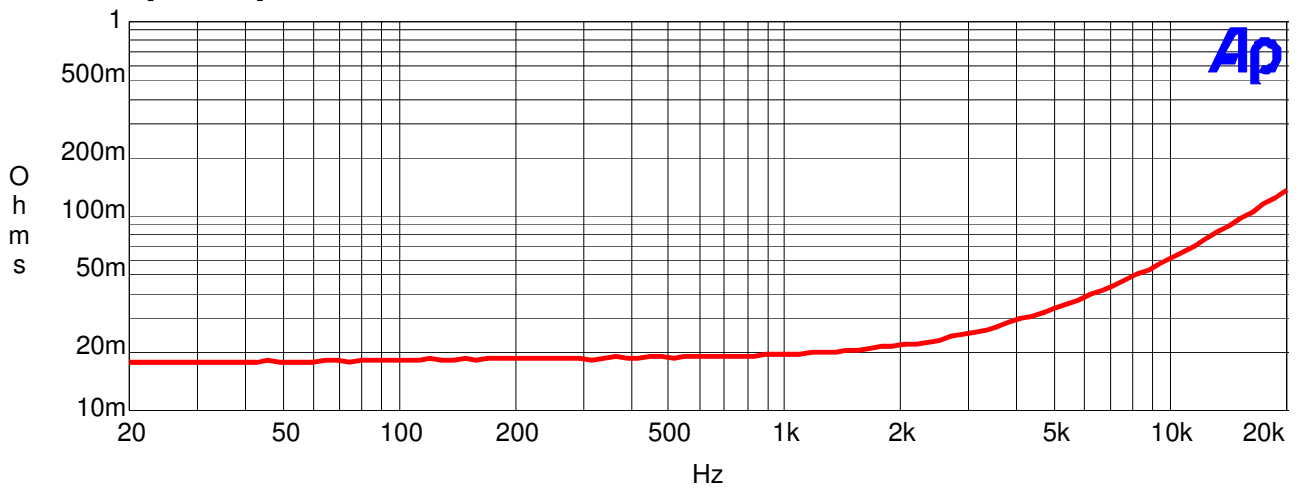
From top to bottom: 40W, 10W, 1W

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

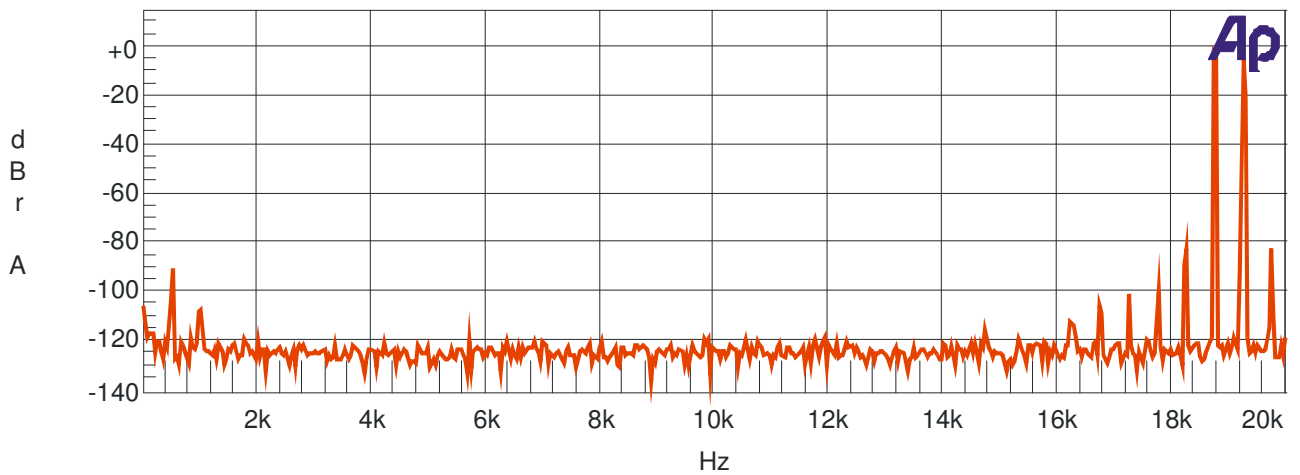


From top to bottom: open circuit, 8Ω, 4Ω

7.4 Output Impedance

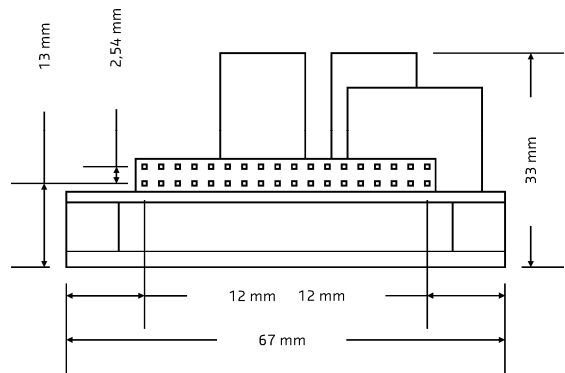
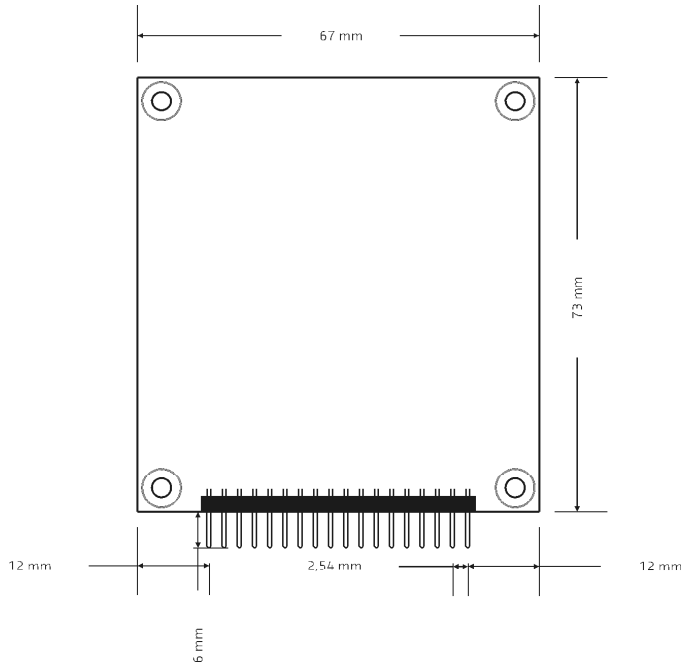


7.5 19+20kHz IMD (10W, 8Ω)

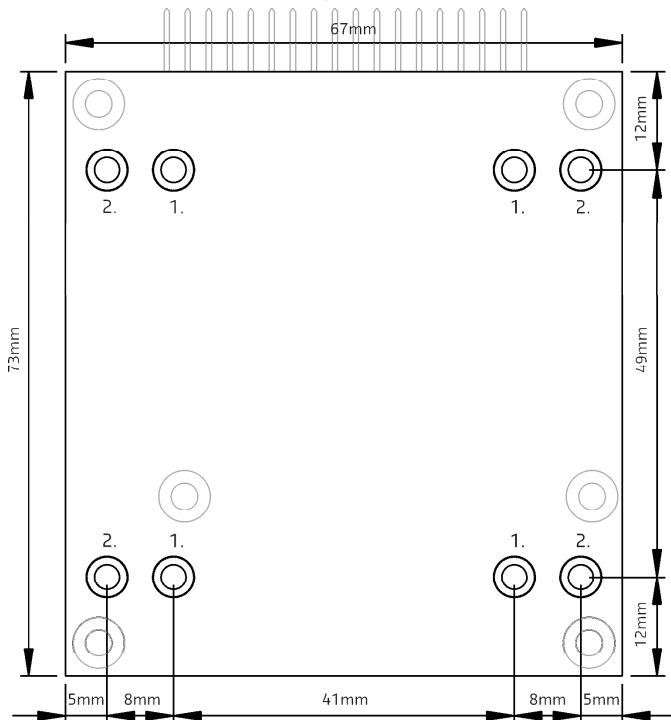


8 Connector layout

8.1 Top view / Frontview



8.2 Heatsink drill pattern. Bottom view.



1. Push-in nut UNC 6-32
2. Push-in nut Metric M3

DISCLAIMER: This subassembly is designed for use in music reproduction equipment only. No representations are made as to fitness for other uses. Except where noted otherwise any specifications given pertain to this subassembly only. Responsibility for verifying the performance, safety, reliability and compliance with legal standards of end products using this subassembly falls to the manufacturer of said end product.

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Document Revision	PCB Version	Description	Date
R1	UcD180OEMV3	Initial draft.	10.10.2007
R2	UcD180OEMV4	<ul style="list-style-type: none"> - J1 replaced by 36-pin header for improved reliability and to expand functionality. - Added functionality: <ul style="list-style-type: none"> - Amplifier enable - Kelvin sensing - Input buffer bypass - Input impedance changed from 10k to 100k. 	07.04.2008
R3	UcD180OEMV5	<ul style="list-style-type: none"> - 0805 position added for user adjustable gain. - OVP increased to 57V for better compatibility with SMPS400/49. - FET driver modified for better performance. - T57 changed into TO220 for thermal improvement. 	09.07.2008
R4	UcD180OEMV6	- Format changed	17.01.2013