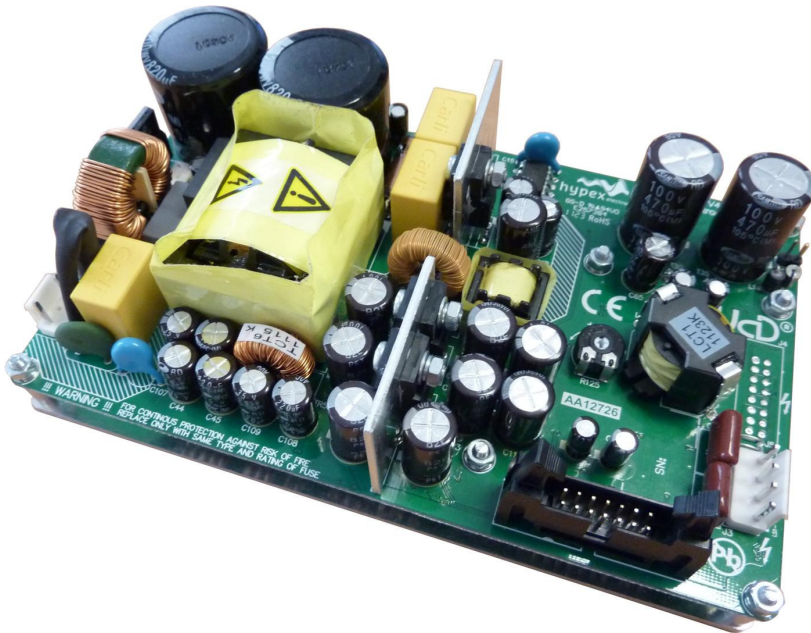


## High Efficiency Self Contained Amplifier Module



### Highlights

- High efficiency
- Universal input voltage range
- 5W standby SMPS
- Flat, fully load-independent frequency response
- Low output impedance
- Very low, frequency-independent THD
- Very low noise
- Fully passive control loop

### Features

- Advanced over current protection
- Remote controlled operation
- Low weight: 550gr.
- Compact: 165 x 100 x 48mm

### Applications

- Monitor loudspeakers for recording and mastering studios
- Audiophile power amplifiers for professional and consumer use.
- Public address systems
- Active loudspeakers
- Active subwoofers

## 1 Introduction

The UcD400MP amplifier module incorporates a low power standby power supply (meets 2013 ERP Lot 6 0.5W requirements), a highly efficient switch mode power supply and a high-performance Class D amplifier in one compact and easily applicable power brick.

The amplifier used in the UcD400MP 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.

The main SMPS providing the power for the amplifier is a compact, high power, highly efficient, unregulated half bridge converter with synchronous rectification on the main output rails. These properties make this technology ideal for powering Class D audio amplifiers.

For applications requiring a standby mode, a low power standby SMPS also has been integrated on this product. To achieve universal mains input compatibility this SMPS features an automatic input voltage doubler.

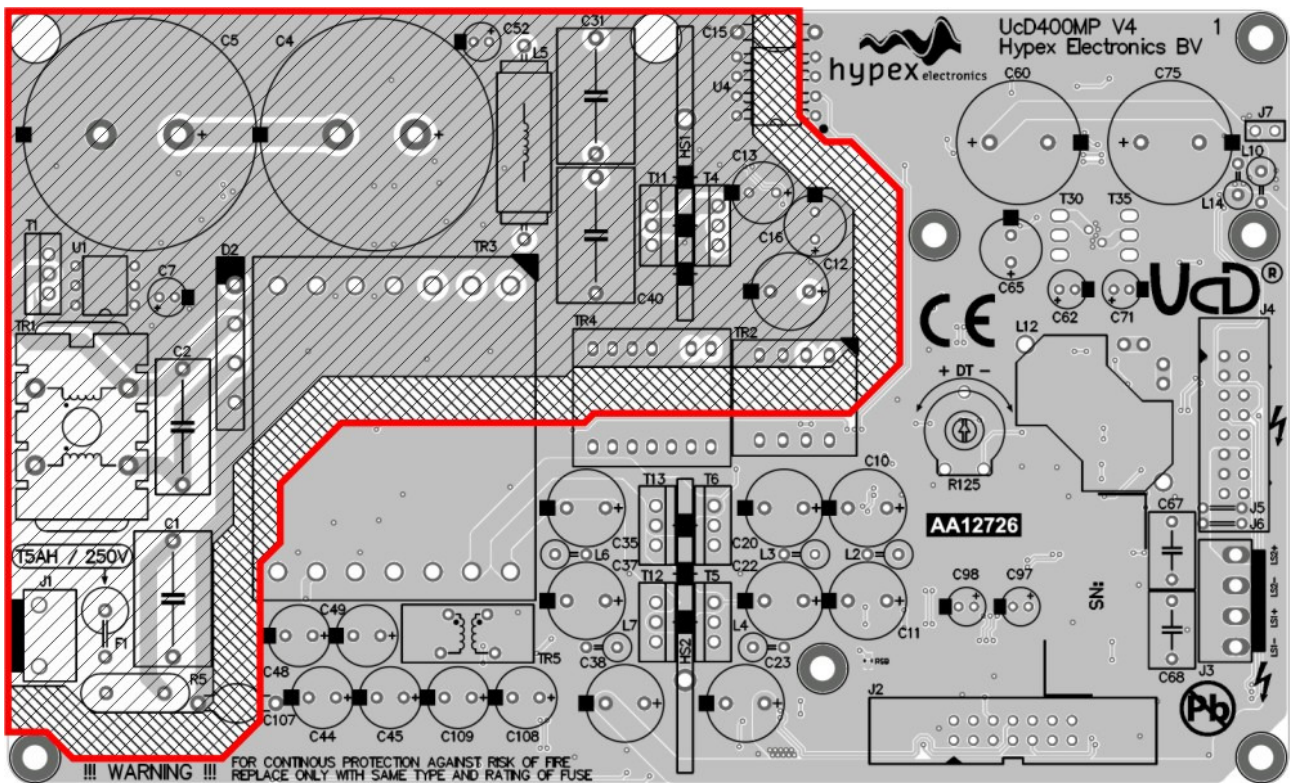
## 2 Safety precautions



The UcD400MP operates at mains voltage and carries hazardous voltages at accessible parts. These parts may never be exposed to inadvertent touch. Observe extreme care during installation and never touch any part of the unit while it is connected to the mains. Disconnect the unit from the mains and allow all capacitors to discharge for **10** minutes before handling it.

This product has no serviceable parts.

This is a Safety Class 2 device. It is very important to maintain a 6mm clearance with all possible conducting parts (housing etc.) and cables. All parts enclosed by the RED thick line below carry hazardous voltages. This includes parts on the top and the bottom of the board. When the UcD400MP is mounted in a tight space there needs to be at least 6mm clearance or a layer of insulation with a minimum thickness of 0.5mm between the top of the transformer and the housing.



### 3 Instructions For Installation

**Warning:** To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.

**Warning:** Disconnect the unit from the mains and allow all capacitors to discharge for 10 minutes before handling it.



This symbol indicates the presence of hazardous voltages at accessible conductive terminals on the board. Parts that are not highlighted in red (picture above) may carry voltages in excess of 150VDC!

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. This apparatus shall not be exposed to dripping or splashing water and no object filled with liquid such as a vase shall be placed on the apparatus.
6. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the application.
7. Only use attachments/accessories specified or approved by the manufacturer.
8. Unplug this apparatus during lightning storms or when unused for long periods of time.
9. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally or has been dropped.
10. This product is to be used with Hypex amplifier modules only.
11. Only the ready-made cable sets provided by Hypex may be used for external wiring of the UcD400MP.
12. Don't run any cables across the top or the bottom of the UcD400MP. Apply fixtures to cables to ensure that this is not compromised.
13. Observe a minimum distance of 6mm maintain clearance with all possible conducting parts (housing etc.). All parts enclosed by the dotted line below carry hazardous voltages. This includes parts on the top and the bottom of the board. When the UcD400MP is mounted in a tight space there needs to be at least 6mm clearance or a layer of insulation with a minimum thickness of 0.5mm between the top of the transformer and the housing.
14. Natural convection should not be impeded by covering the UcD400MP (apart from the end applications housing).

## 4 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
Input voltage	$V_{LINE}$	270	Vac	
Ambient Air Temperature	$T_{AMB}$	50	°C	

## 5 Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Notes
High Line Input Voltage	$V_B$	180	230	264	Vac	
Low Line Input Voltage	$V_{B,FP}$	90	115	132	Vac	
Line Input Frequency	$f$	47		63	Hz	

## 6 General Performance Data Standby SMPS

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Voltage	$V_{OUT}$	-	3.9	-	V	See Note 1
Max. Continuous output current	$I_{OUTMAX}$	1	-	-	A	
Efficiency	$\eta$	75	-	-	%	full power
Standby power	$P_{STANDBY}$	-	-	300m	W	
Output voltage Ripple	$V_{RIPPLE}$	-	-	100m	V	

**Note 1:** 5V is user selectable (V4.1 and up) by placing a 12k(0603) resistor on the empty footprint near J2.

## 7 General Performance Data Main SMPS

Item	Symbol	Min	Typ	Max	Unit	Notes
Max Continuous Output Power	$P_{CONT}$	65	-	-	W	
Max Output Power	$P_R$	600	-	-	W	See Note 1
Max Audio Output Power @ 20Hz into amplifier load	$P_{RALF}$	400	-	-	W	See Note 2
Efficiency	$\eta$	90			%	full power
Idle Losses	$P_0$	-	5	-	W	
Switching frequency	$F_{SW}$	80	100	120	kHz	
Maximum power consumption	$P_{max}$	-	-	800	W	See Note 4
Output Voltage	$V_{OUT}$	53	68	78	Vdc	See Note 3
Max Output Short Circuit Current (Rail to rail)	$I_{OUT,MAX}$	-	8	-	Adc	See Note 4
Unregulated Output Voltage Vaux	$V_{OUT,AUX}$	16	21	25	Vdc	See Note 3
Max Output Current Vaux	$I_{OUT,AUX}$	200m	-	-	A	per rail

**Note 1:** Output Power delivered to a resistive dummy load (generally the only specification supplied by other SMPS manufacturers).

**Note 2:** An audio amplifier actually draws twice the RMS power from the power supply. At high frequencies the secondary storage output caps are capable to provide this power. At very low frequencies however the SMPS is responsible for delivering this peak power to the amplifier.

**Note 3:** Output voltage is proportional to the mains line voltage (Min@180Vac, Typical@230Vac, Max@264Vac).

**Note 4:** Limited by over current protection.

## 8 General Performance Data UcD Amplifier

Item	Symbol	Min	Typ	Max	Unit	Notes
Output Power	$P_R$	400	-	-	W	THD=1%
Distortion	THD+N	-	0.01	0.05	%	20Hz<f<20kHz. Pout< $P_R/2$
		-	-	0.004	%	20Hz<f<20kHz Pout=1W
Output noise	$U_N$	-	-	80 $\mu$	V	Unwtd, 20Hz-20kHz
Output noise (UcD only)	$U_N$	-	-	30 $\mu$	V	Unwtd, 20Hz-20kHz
Output Impedance	$Z_{OUT}$	-	-	20m	$\Omega$	f<1kHz
		-	-	150m	$\Omega$	f<20kHz
Power Bandwidth	PBW		20-35k		Hz	
Frequency Response		10	-	50k	Hz	+0/-3dB. All loads.
Voltage Gain	$A_V$	25.5	26	26.5	dB	
Supply Ripple Rejection	PSRR		65		dB	Either rail, all frequencies.
Efficiency	$\eta$		92		%	Full power
Idle Losses	$P_o$		8		W	
Standby Current	$I_{STBY}$		10m		A	
Current Limit		16	18		A	hiccup after limiting 40ms

## 9 UcD Amplifier Audio Input Characteristics

Item	Symbol	Min	Typ	Max	Unit	Notes
Input Impedance (buffered input)	$Z_{IN}$		10k		$\Omega$	Either input to ground
Common Mode Rejection Ratio	CMRR		75		dB	All frequencies

## 10 Electrical Specification

### 10.1 Switch-On time of standby SMPS

The standby SMPS switches on in less than 3 seconds at maximum load and 115VAC (60Hz) input. (measured from the moment the input voltage is applied to the moment the standby output voltage reaches its specified output voltage).

### 10.2 Hold-Up time of standby SMPS

Minimum 10ms with 90% of full output load connected @115 VAC 60Hz input.

### 10.3 ON/OFF control main SMPS

Turn ON: The time delay counting from the moment the enable control signal reaches 2V until the main SMPS output voltage reaches 50% of its nominal value shall be less than 100ms (measured @ no-load condition)

Turn OFF: The time delay counting from the moment the enable control signal drops below 0.5V until the main SMPS output voltage drops below 50% shall be less than 100ms (measured @ full load condition).

### 10.4 Hi-Pot

The SMPS withstands minimum 1 minute without breakdown of the insulation a voltage of at least 3000VAC<1mA applied between all primary connections connected together and all secondary connections connected together.

### 10.5 Leakage current

The AC leakage current is less than 0.25mA when the power supply is operated at 230VAC/50Hz.

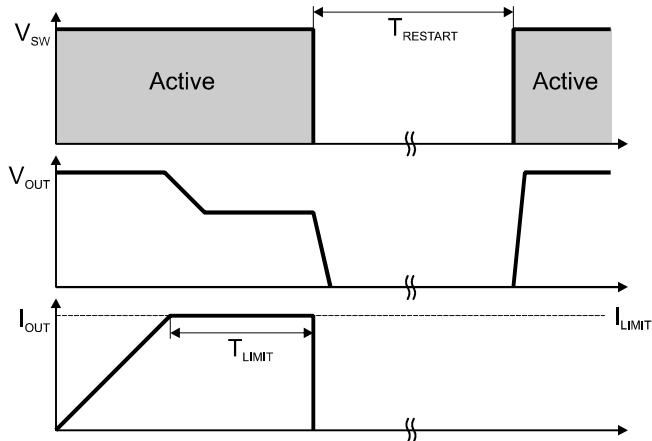
### 10.6 Automatic Input Voltage Selector Characteristics

In order to comply with the voltage DIP tests the SMPS features a delay timer to engage the voltage doubler in LOW input voltage range. If the input voltage reaches the specified threshold the voltage doubler will be instantly turned off and the delay timer will be reset.

Specification	Requirement	Notes
Input voltage threshold	132 – 140 VAC	
High to Low range switching delay	0,2 – 1 sec	



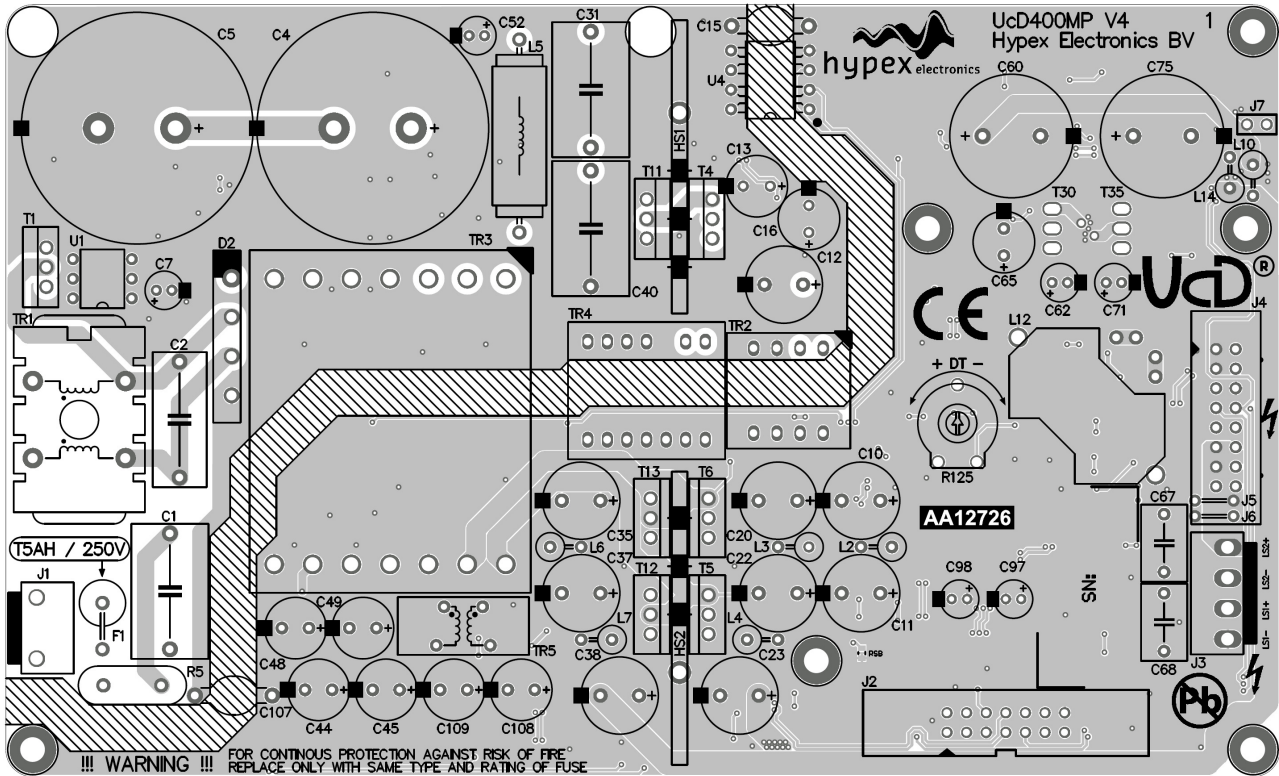
## 10.7 Over current/Short Circuit Protection (SMPS)



The SMPS features an over current/short circuit protection for the Main output rails. The current detection/limitation is done on the primary side of the transformer. This causes the current at which the SMPS protects on the secondary side to be the sum of all transformed currents. In case of a short circuit at a single winding all this current travels through this winding. The current  $I_{LIMIT}$  that is stated here is the current that flows in case of a short circuit across both main output rails. Please note the current for a short circuit across only one rail will be double.

Specification	Requirement	Notes
$I_{LIMIT}$	TBD	
$T_{LIMIT}$	>20ms	
$T_{RESTART}$	>1s	

## 11 Connector Layout



### 11.1 Connector Pinouts

#### 11.2 J1: Mains Input Connector (JST\_B2P3-VH or equivalent)

Pin	Description
1	MAINS Connection
2	MAINS Connection

### 12 J2: Application Interface Connector (14P Boxheader w/ retainers)

Pin	Description
1	Hot Input Connection Onboard Amplifier
2	Cold Input Connection Onboard Amplifier
3	NA
4	NA
5, 14	Ground Connections
6	READY output
7	Positive Auxiliary Output Voltage (+VAUX)
8	Negative Auxiliary Output Voltage (-VAUX)
9	DC-Error detection output
10	AMP_OFF Input
11	SMPS_OFF Output
12	Standby Output Voltage
13	PS_EN input



## 13 J4: External Amplifier Connector (16P Boxheader)\*

Pin	Description
1, 3	Negative Power Supply Rail
2, 4	Positive Power Supply Rail
5	AMP_READY Connection
6	Ground Connection
7	AMP_STBY Connection
8	DC_ERR Connection
9	Hot Input Connection
10	Cold Input Connection
11, 13	Hot Loudspeaker Connection
12, 14	Cold Loudspeaker Connection
15	Not Connected
16	External VDR Voltage

\* Not fitted

## 14 J3: Loudspeaker Connector (JST\_B4P-VH)

Pin	Description
1, 3	Hot Loudspeaker Output UcD Amplifier
2, 4	Cold Loudspeaker Output UcD Amplifier

### 14.1 DC-Fault Detection Characteristics

The UcD400MP has an integrated amplifier DC-error detection which will pull pin J2:9 low in case of such an event. The 400MP shuts down completely and needs to be disconnected from the mains for about 3 minutes to reset.

Item	I/O	Min	Typ	Max	Unit	Notes
Voltage on pin J2:9, DC-error	Out			1	V	Internal open collector <sup>1)</sup>

**Note 1:** Is internally pulled up to J2:12 (standby voltage) by a 3k resistor.

### 14.2 Power Supply Enable Characteristics

The UcD400MP is enabled when J2:12 and J2:13 are connected. The amplifier will be auto-enabled after a couple of seconds.

Item	I/O	Min	Typ	Max	Unit	Notes
Voltage on pin J2:13, left floating	In	3,3		12	V	

### 14.3 Amplifier Ready Characteristics

The UcD400MP has an integrated Amplifier Ready condition which will pull pin J2:6 high to indicate that the amplifier shut itself down due to an error. This error can be either an overvoltage event or a shorted output.

Item	I/O	Min	Typ	Max	Unit	Notes
Voltage on pin J2:6, error	Out	-0,6		5,6	V	Internally pulled up

### 14.4 Amplifier Off Characteristics

The amplifier can be disabled by driving J2:10 high.

Item	I/O	Min	Typ	Max	Unit	Notes
Voltage on pin J2:10, driven	In	3,3		12	V	

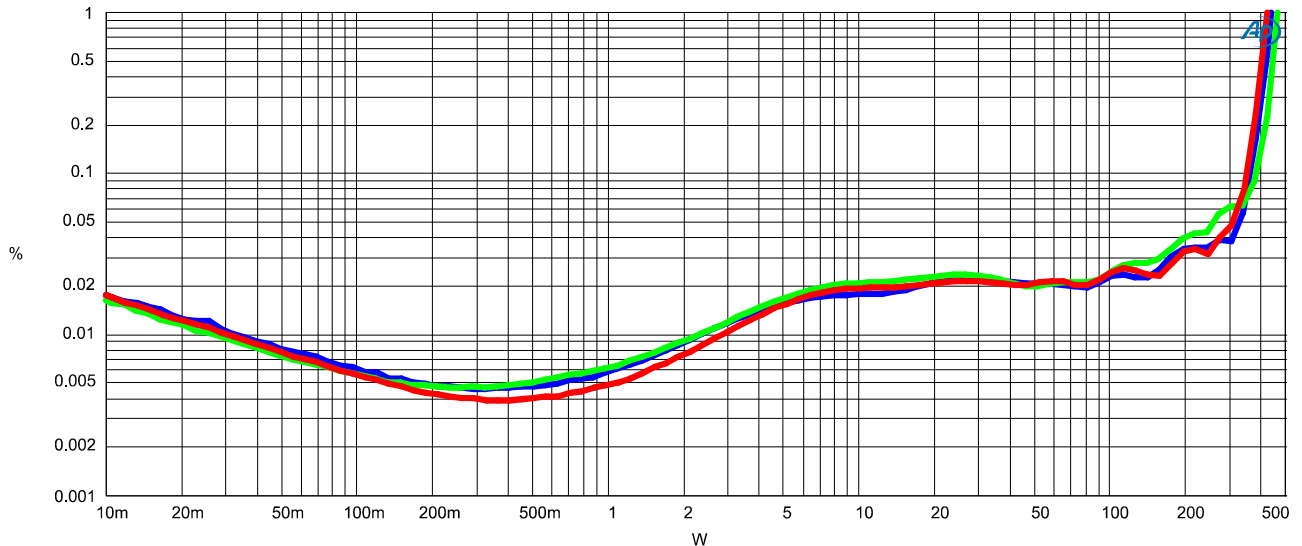
### 14.5 SMPS Power Off

This pin can be used to monitor the status of the SMPS output voltage. Once the SMPS starts switching pin J2:11 is pulled low.

Item	I/O	Min	Typ	Max	Unit	Notes
Voltage on pin J2:11, Power On	Out	200m			V	Open collector output. Must be pulled up by user

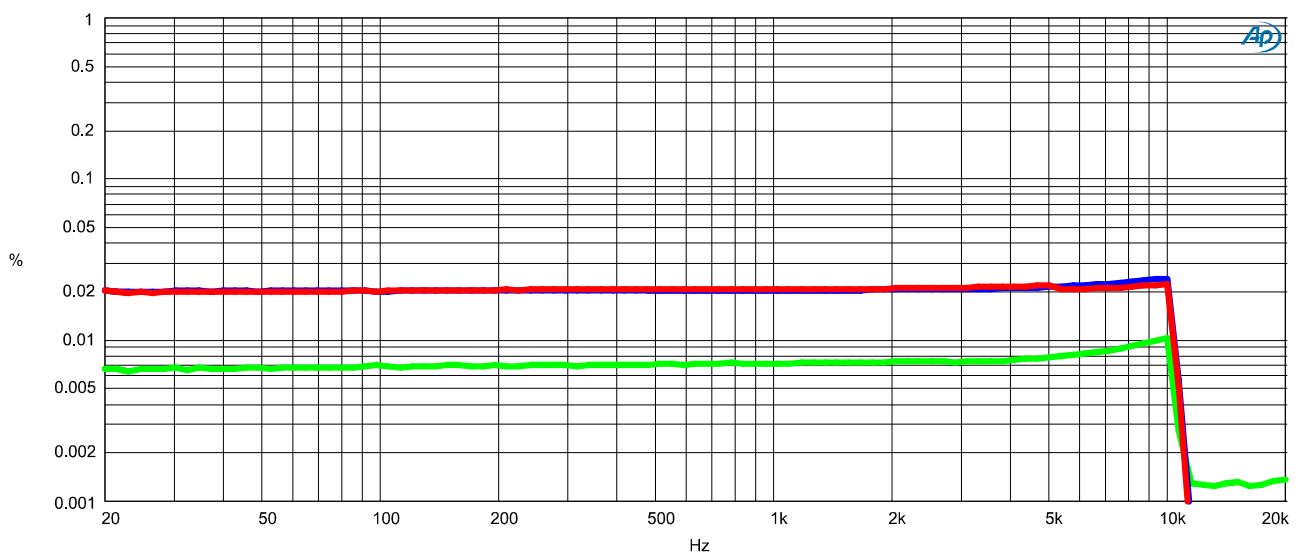
## 15 Typical Performance Graphs

### 15.1 THD vs. Power (4Ω)



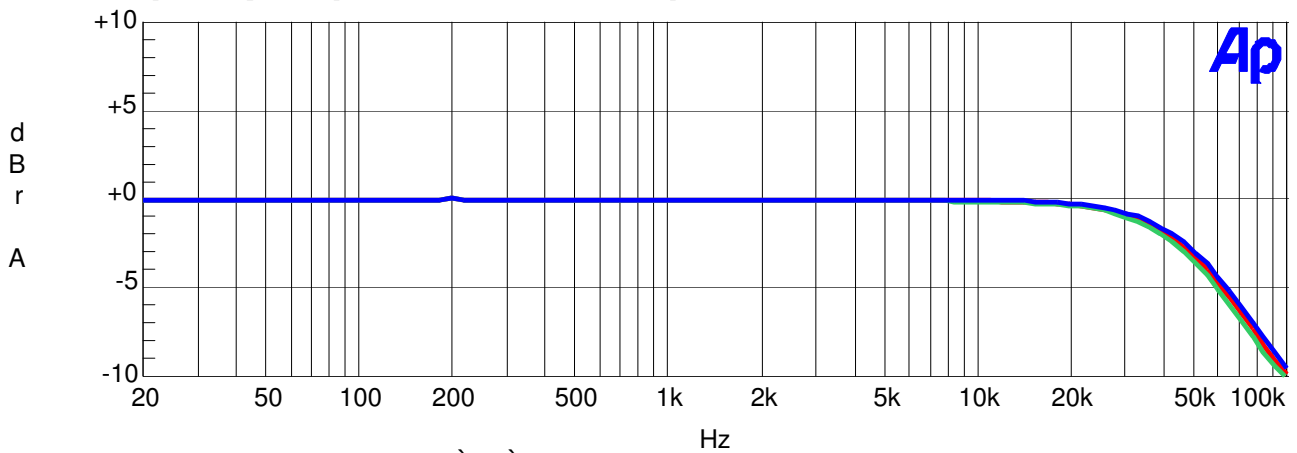
From top to bottom: 6kHz, 1kHz, 100Hz

### 15.2 THD vs. Frequency (4Ω)



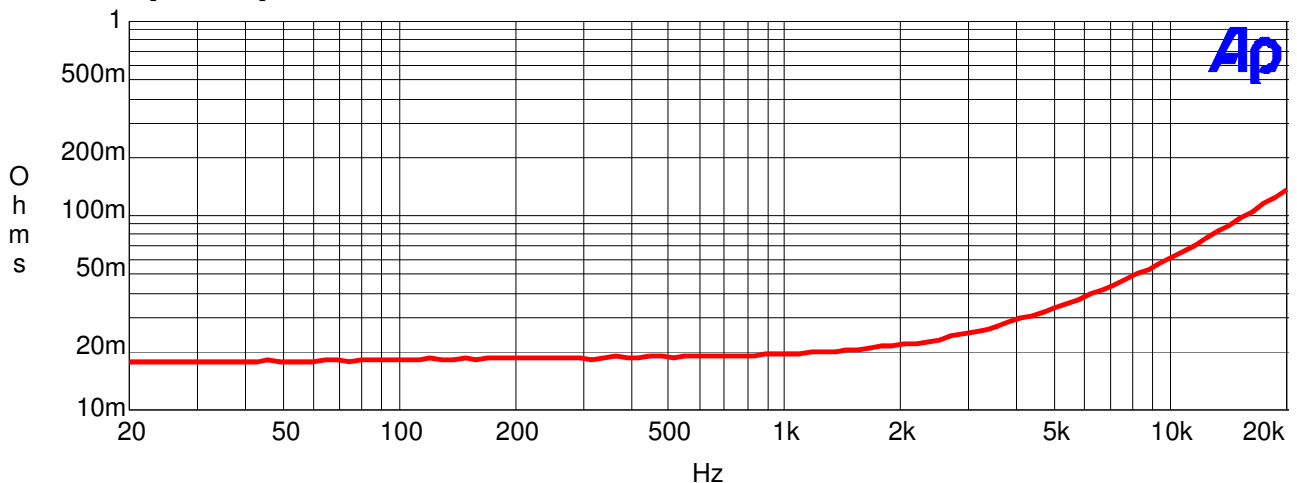
From top to bottom: 40W, 10W, 1W

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

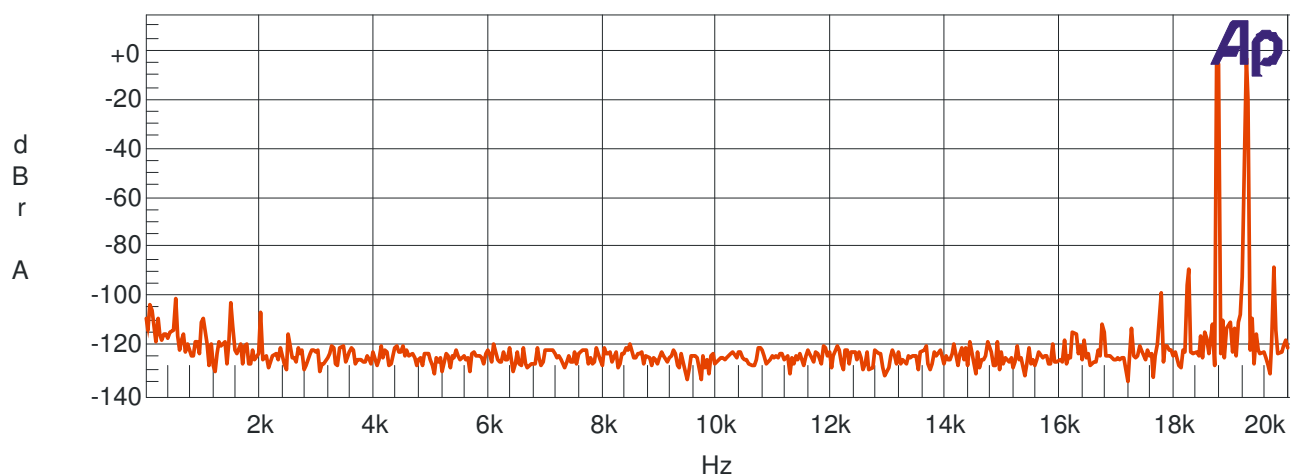


From top to bottom: open circuit, 8Ω, 4Ω

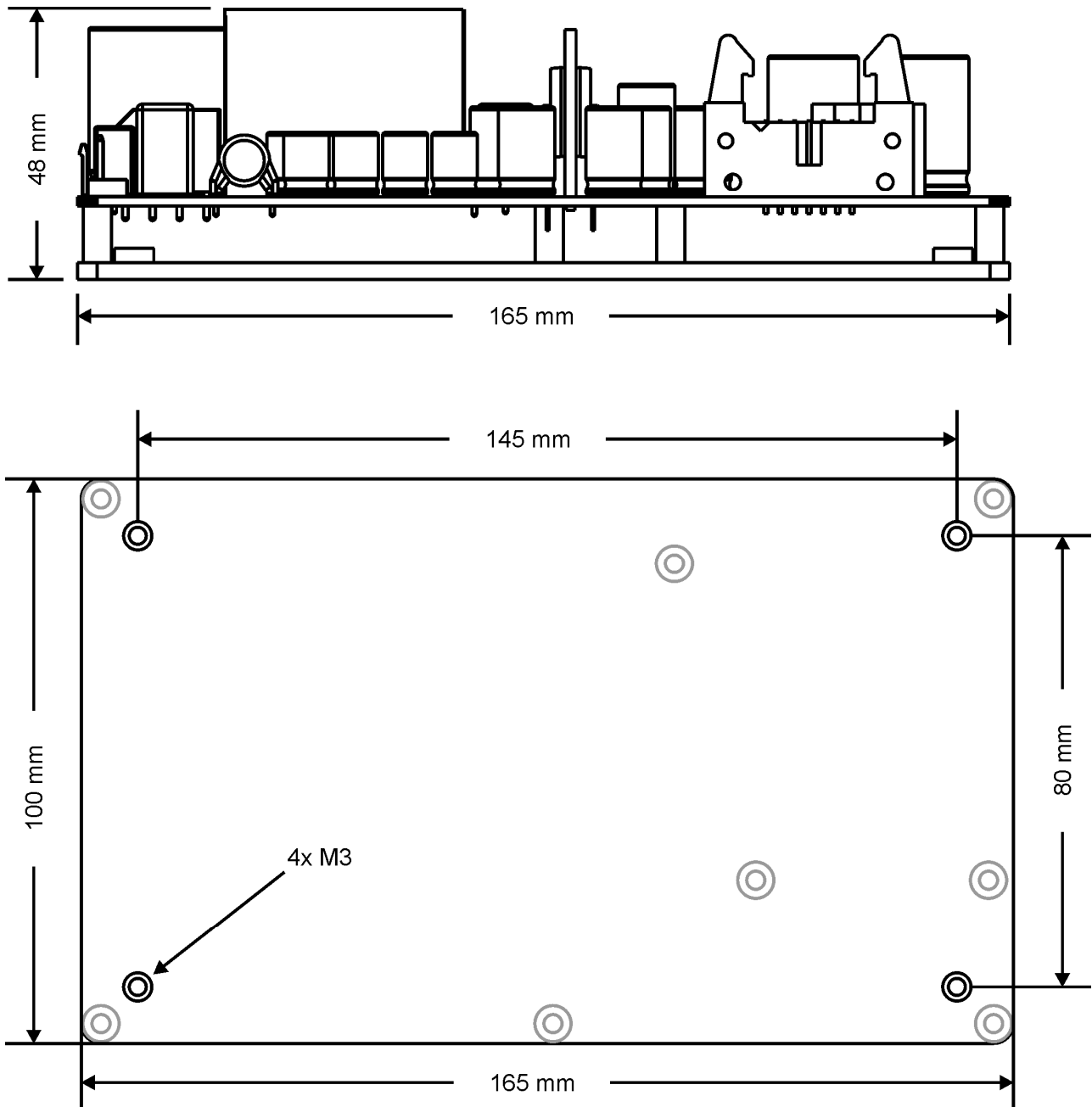
### 15.4 Output Impedance



### 15.5 19+20kHz IMD (10W, 8Ω)



## 16 Mechanical Dimensions



Heatsink drill pattern. Bottom view.

## 17 Legal notice

**DISCLAIMER:** This product is designed for use in sound reproduction equipment in conjunction with Hypex amplifier modules. No representations are made as to fitness for use in other applications. 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.

**LIFE SUPPORT POLICY:** Use of Hypex products in life support equipment or equipment whose failure can reasonably be expected to result in injury or death is not permitted except by explicit written consent from Hypex Electronics BV.

Document Revision	PCB Version	Description	Date
R1	UcD400MPV3/V4	Initial Draft.	29.07.2011
R2	UcD400MPV4	<ul style="list-style-type: none"> <li>- Added product picture</li> <li>- Added Highlights, Features, Applications</li> <li>- Added measurements</li> <li>- Added safety warnings</li> <li>- Added legal notice</li> </ul>	21.09.2011
R3	UcD400MPV4	<ul style="list-style-type: none"> <li>- Added ERP comment</li> <li>- Added 3V9/5V user select comment</li> </ul>	17.10.2011
R4	UcD400MPV4	<ul style="list-style-type: none"> <li>- Clarified 5V standby output option</li> </ul>	14.12.2012
R5	UcD400MPV4	<ul style="list-style-type: none"> <li>- I/O functionality clarified</li> </ul>	10.07.2013