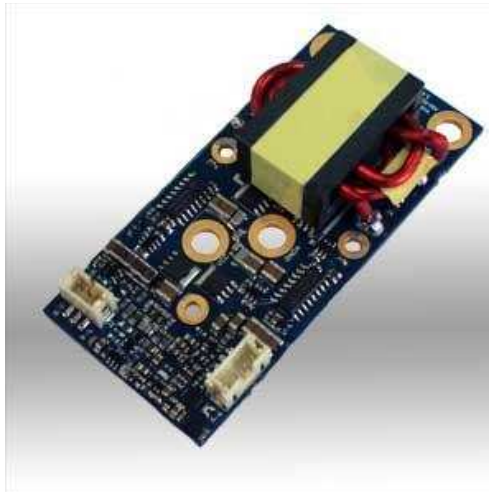


Katana – Professional Power Amplifier Module



Features

- Up to 1.5KW into 1ohm load
- THD: <0.003
- SNR: 118dB @ 50V into 2Ω or 4Ω load
- Differential audio input
- Module dimensions: 40mm x 85mm
- Screw terminal power connections
- Direct mounting to heat sink

Applications

- High power audio applications
- AV home audio, iPod docks, linear speakers, active speakers
- Automotive, marine
- Standalone power amps

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1 Introduction

1.1 Overview

Indice's Katana power amplifier module provides class leading acoustic fidelity and control in a highly efficient, small package. Delivering uncompromising control of speakers with excellent attack, fade and phase response, the Katana has an impressive 118dB SNR and THD < 0.003. This is only possible with Indice's proprietary Continuous Sigma encoding with direct drive technology.

1.2 Module Benefits

The Katana module enables audio equipment manufacturers to reduce power consumption, size, weight, and cost of their audio products. With direct heat sink mounting, the modules can be used either in isolation or with an additional passive heat sink. With heat sinking, up to 1200 WRMS into 1Ω per module is possible for high power professional applications.

- **Ultra Small Package:** Combined with ultra high efficiency reduces the size and space required for thermal heat sink and controls.
- **Ultra low THD:** Each *Katana* module is capable of >1200 WRMS @1% THD into a 1Ω load (with heat sinking)
- **High efficiency:** >96% efficient allows truly high density design with minimal heat sinking
- **Thermal cutout:** In the even the module gets too hot, it is intelligent enough to shutdown to prevent damage to the module and surrounding system.
- **Continuous sigma encoding:** Enables excellent attack, fade and phase alignment and with an asynchronous carrier, the EMI profile is dramatically reduced.
- **Single or differential input:** Provides the system integrator with flexibility to use either single ended or differential input modes
- **EMI Compliant:** Designed for CISPR 25 and FCC standards providing the data sheet design recommendations are followed

1.3 Indice Semiconductor Pty Ltd Support Contacts

The following key contacts should be used for any additional correspondence and queries in response to this document.

Email	support@indicesemi.com
Phone	+61 3 9831 7400 (9am – 5pm, Mon – Fri, UTC+10:00)

1.4 Module connectivity

Below in Figure 1 and Table 1 are details on the pin out and pin functions for the Katana audio module.

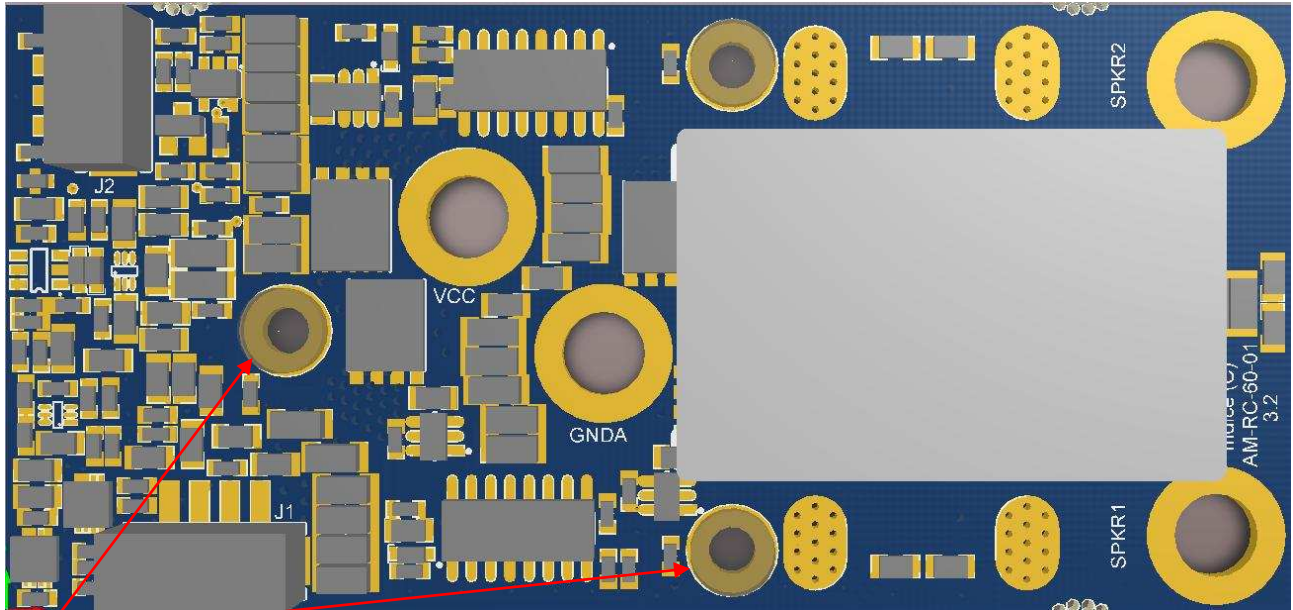


Figure 1: Top view of AM-RC-60-01 Module with pins labelled

CHASSIS

Name	Pin Number	I/O	A/D	Description
SPKR1	NA	O	-	Output 1 of the amplifier module
SPKR2	NA	O	-	Output 2 of the amplifier module
VCC	NA	I	A	Power input rail for amplifier module
GNDA	NA	-	-	Power ground connection
CHASSIS	NA	-	-	Chassis connection for EMI compliance
J1	P1 – VDRV	I	D	10V Supply for drive stage and other systems
	P2 – AMP_SHUTDOWN	O	D	Amplifier disable flag (High = ACTIVE, Low = Disabled)
	P3 – AMP_ENABLE	I	D	Amplifier enable / disable (High = ENABLE, Low = Disable)
J2	P1 – SIG+	I	A	Positive audio signal input
	P2 – GND	-	-	Signal ground
	P3 – SIG-	I	A	Negative audio signal input

Table 1: Pin functions of AM-RC-60-01– Input or O – Output. A/D column indicates either A – Analogue or D – Digital.

1.5 Basic System Diagram

The following is a basic system diagram for the AM-RC-60-01 power amplifier module.

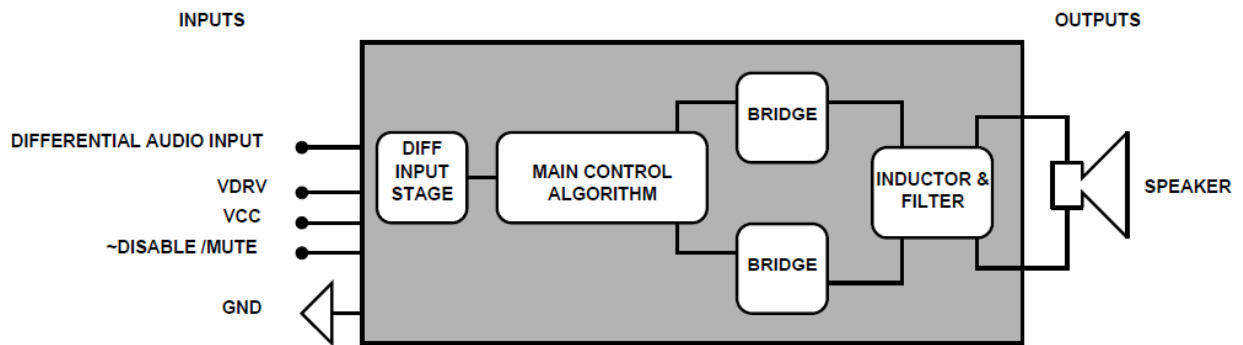


Figure 2: Basic system diagram

2 Operating Conditions

2.1 Absolute Maximum Ratings

Subjecting the AM-RC-60-01 to any conditions beyond those listed in this section may cause permanent damage to the device. These are maximum condition ratings only. Exposure to the absolute maximum rated conditions for long periods can adversely affect device reliability. Proper operation of the device under any conditions, other than those indicated in the “Recommended Operational Conditions” section, is not implied. Absolute maximum ratings of the AM-RC-60-01 are included in Table 2.

Parameter	Value
GND to VCC	-0.3 V to 58V
GND to VDRV	-0.3 V to 13V
GND to Sig+ / SIG-	-0.3 V to 9V
Maximum power to the load	1500W
Storage temperature range. $T_{STORAGE}$ ⁽¹⁾ .	-40 °C to 120 °C

(1) Higher temperatures can be applied during board soldering according to current JEDEC J-STD-020 standards specification.

Table 2: Absolute maximum ratings of the AM-RC-60-01 module.

2.2 Recommended Operational Conditions

Recommended operational conditions for AM-RC-60-01 are given in Table 3.

Parameter	Value
Operating ambient free air temperature. T_A	-40 °C to 85 °C
Idle Losses	4W @ VCC = 50V

Table 3: Recommended operational conditions of AM-RC-60-01.

2.3 Input Operating Ranges

The measured operational characteristics of the AM-RC-60-01 amplifier module are presented below in Table 4. All of these values are measured over recommended supply voltages and operating ambient free air temperatures (unless otherwise stated).

Parameter	Comment	MIN	TYP	MAX	Unit
VCC	VCC = 50V typical operating voltage	-0.3		50	V
VDRV	VDRV = 10V recommended drive voltage	9.5		12.5	V
AMP_ENABLE	Logic High – Enables amplifier	3		12.5	V
AMP_ENABLE	Logic Low – Disables amplifier	-0.3		1	
Sig + / Sig -		-0.3		9	V
VDRV Current draw	When VDRV = 10V		150		mA

Table 4: Input pin operation of AM-RC-60-01.

2.4 Output signals

Parameter	Comment	MIN	TYP	MAX	Unit
SPKR1	+ Speaker bridge connection	-0.3		VCC	V
SPKR2	- Speaker bridge connection	-0.3		VCC	V

2.5 Thermal Information

The measured operational characteristics of the AM-RC-60-01 directly to an aluminium 6063 heat sink within an ambient of 25 deg C.

Parameter	Test Conditions	MIN	TYP	MAX	Unit
Thermal resistance	$V_{CC} = 50\text{ V}$, $P_{out} = 900\text{ W}$			TBA	$^{\circ}\text{C/W}$
Thermal cut out	$V_{CC} = 50\text{ V}$, $P_{out} = 900\text{ W}$			100	$^{\circ}\text{C}$

Table 5: Thermal performance of the AM-RC-60-01.

2.6 Performance data

Item	Symbol	Typ	Unit	Notes
Rated Output Power ($V_{CC} = 50\text{ V}$)	P_R	340	W	@1%thd into 4 Ω
		687		@1%thd into 2 Ω
		1320		@1%thd into 1 Ω
Differential input voltage range	V_{in}	8	VRMS	
Distortion	THD, IMD	<0.003	%	$V_{CC} = 50\text{ V}$, Load = 4 Ω
Output noise	U_N	72	μV	$V_{CC} = 50\text{ V}$
Signal-to-noise ratio (A-weighted)	SNR	118	dBA	$V_{CC} = 50\text{ V}$, Load = 2 Ω / 4 Ω
Power Bandwidth	PBW	25	kHz	
Frequency Response		15 – 25k	Hz	+0/-3dB. All loads.
Voltage Gain	A_V	5.6	V/V	
Output Offset Voltage	V_{00}	15	mV	$V_{CC} = 50\text{ V}$
Supply Ripple Rejection	PSRR	-77	dB	$V_{CC} = 50\text{ V}$, $V_{ripple} = 1\text{ VRMS @ } 100\text{ Hz}$
Efficiency	η	>96	%	@1%THD into 2 Ω
Idle Losses	P_0	4	W	$V_{CC} = 50\text{ V}$

2.7 Typical Performance Graphs

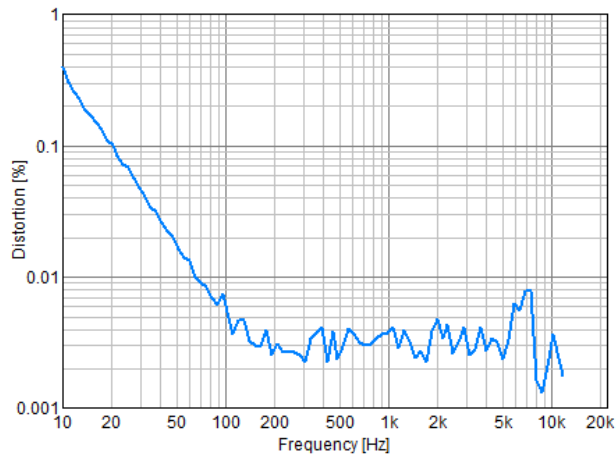


Figure 3 – THD vs Frequency

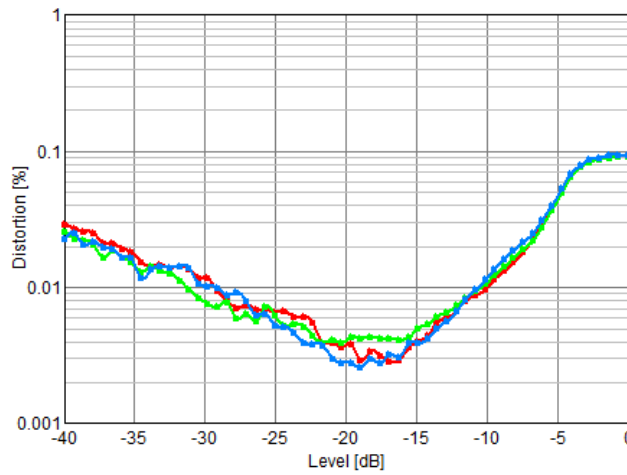


Figure 4 – THD vs Output power

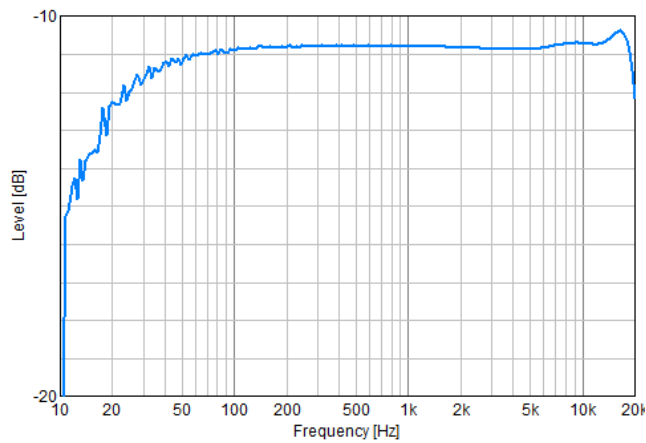


Figure 5 – Gain linearity vs Frequency

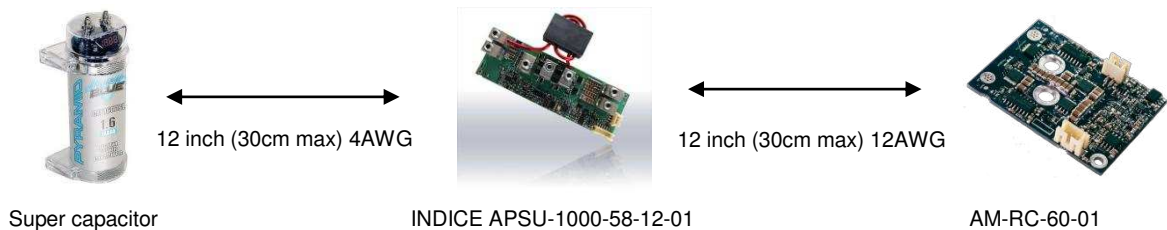
3 Module Functionality

3.1 Power connectivity

The AM-RC-60-01 is capable of switching up to 80 Amps into the load and as such consideration needs to be made for wiring and connectivity of the POWER and SPEAKER connections. Indice recommends the use of a solid copper bus bar or 12AWG wire to connect the power supply and speaker connections. See application recommendations below for further information.

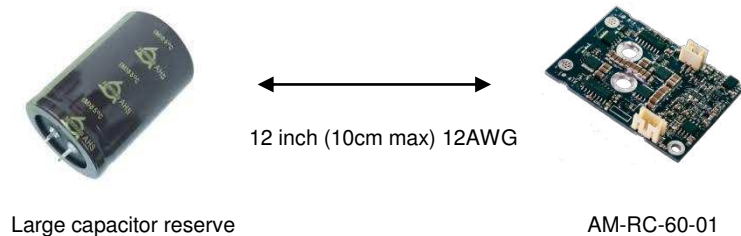
3.1.1 Automotive applications

For automotive INDICE recommends using our APSU-1000-58-12-01 bi-directional power supply which features a re-generative power supply that sends reactive energy back to the battery.



3.1.2 Mains powered applications

For mains powered amplifiers INDICE strongly recommends the designer use adequate capacitor banks to limit rail pumping and to absorb the reactive energy returned from the speaker. This will depend on the power being delivered to the load.



3.2 Over temperature shutdown

The module comes standard with over temperature protection circuitry that prevents damage to the internal electronics in the event that heat sinking is not sufficient for the power being driven into the load. When the over temperature shutdown activates the module output (audio) is muted. There is no external signal available to notify when the module has entered thermal shutdown.

3.3 Noise suppression and EMI filtering

The AM-RC-60-01 module contains onboard noise suppression, output stage and EMI filtering which requires a connection between the screws designated in Figure 6 and the metal housing / heat sink of the amplifier.

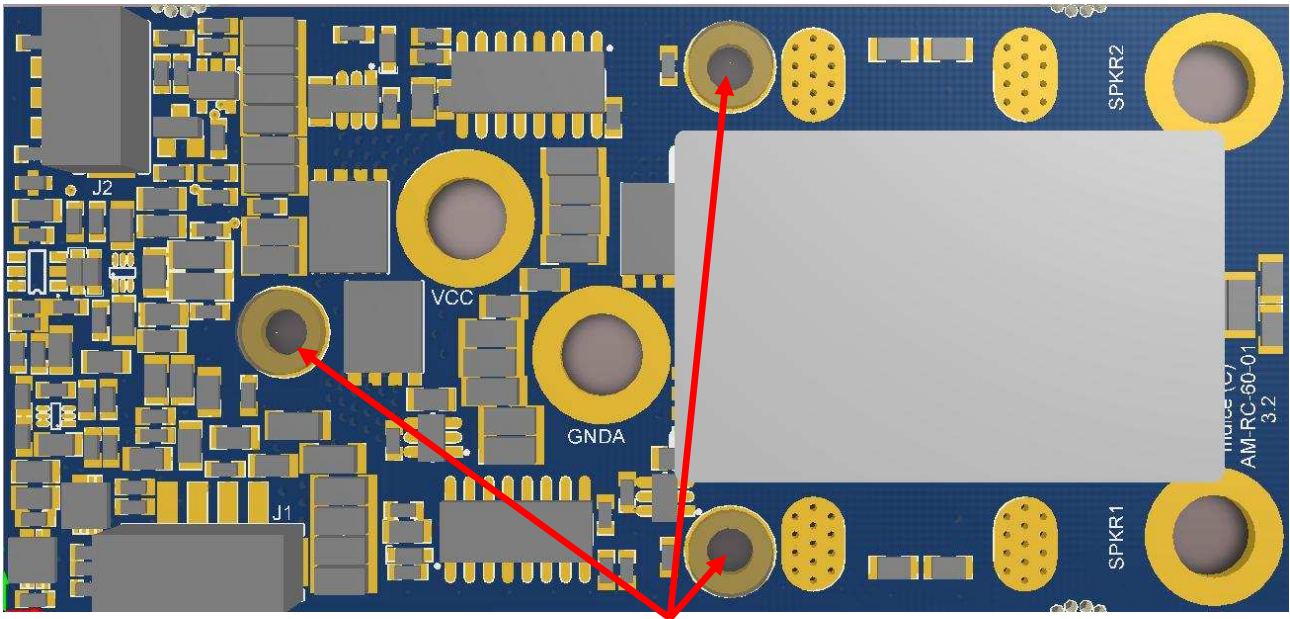


Figure 6: Recommended connections to CHASSIS / heat sink

3.4 Mounting guidelines

Figure 7 depicts the recommended mounting for the AM-RC-60-01 amplifier module. Power, GND and Speaker connections are secured with a copper spacer and insulator which allows the module to be securely screwed to the heat sink. The VCC and GND screw connections also serve to securely pin the AM-RC-60-01 module to the heat sink in the area where the most heat is generated. The 3 x M3 screws serve to create an electrical connection to the heat sink for the EMI and noise immunity filters specified in Figure 6.

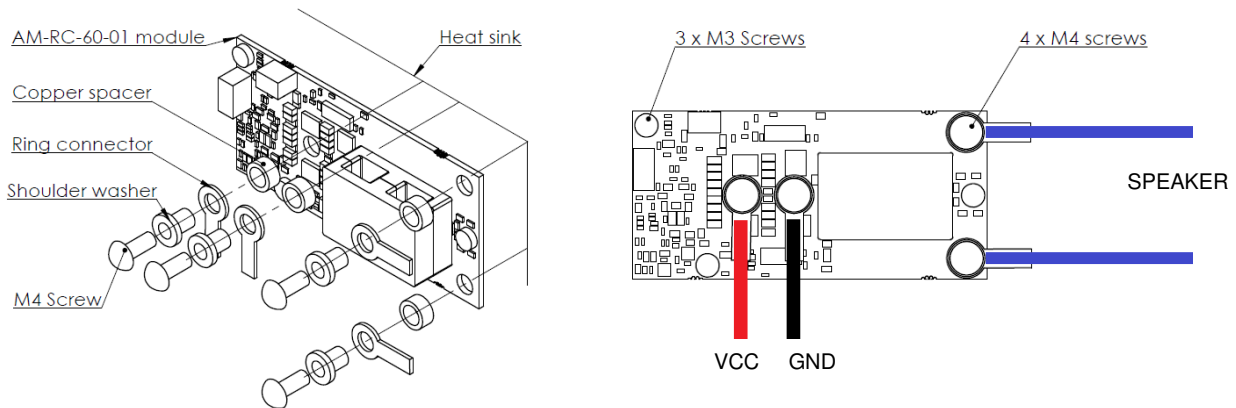


Figure 7: Mounting guidelines for the AM-RC-60-01 module

Component	Quantity	Manufacturer	Part number
Copper spacer (8mm wide x 3.8mm high x 5.5mm hole)	4	Custom part	-
Shoulder washer, Nylon	4	Richco (Essentra Components)	MNI-8-16
Ring terminal M5	4	Molex	0193230013
M4 screw x 10mm	4	GENERIC	-
M3 screws x 4mm	3	GENERIC	-

Table 6: BOM for mounting guidelines

4 Mechanical drawings

4.1 Module drawing

Below in Figure 8 are the dimensions of the AM-RC-60-01 module including screw hole placement.

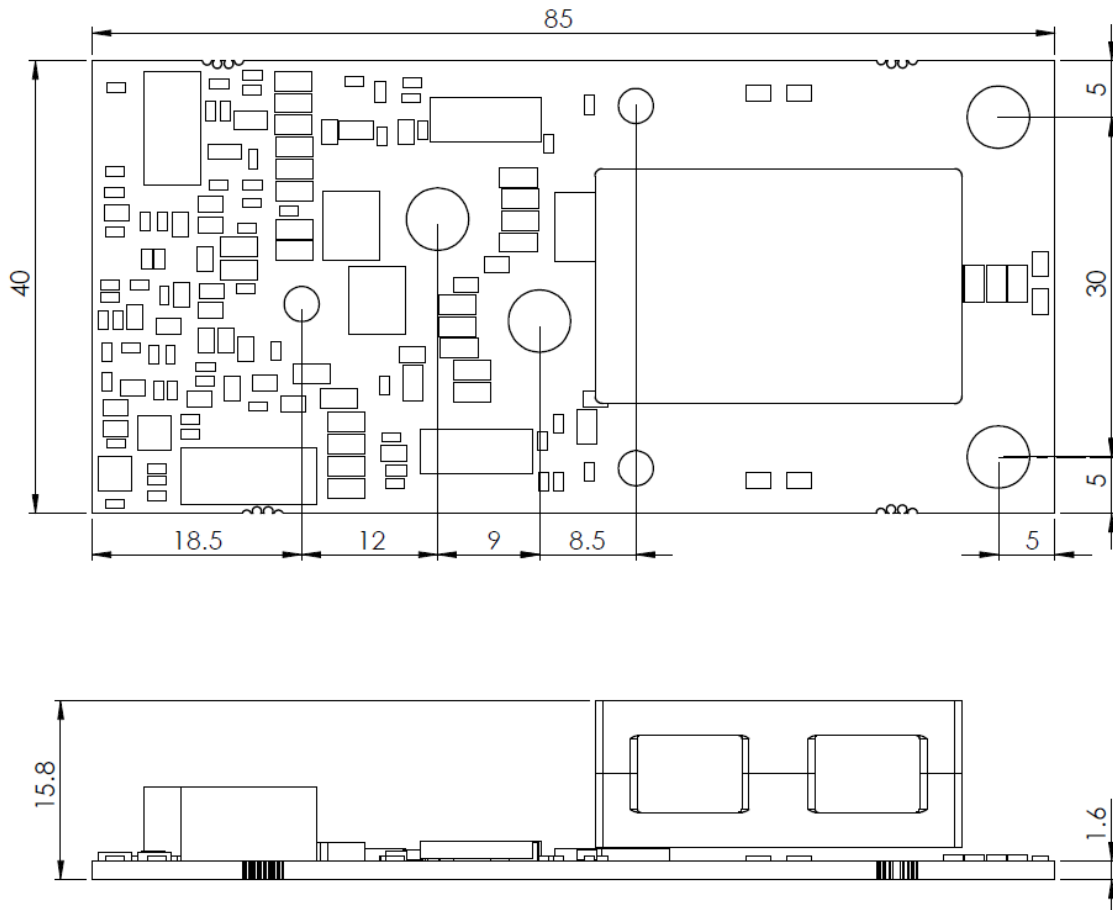



Figure 8: Module dimension drawing.

4.2 Packaging drawing

TBA

5 Ordering Information

Ordering code	Interface	Description
AM-RC-60-01	Chassis mount	Katana power amplifier module 

6 Revision Control

Version	Date	Details
0.1	11/07/2014	Document creation
0.2	06/08/2014	Updated mechanical drawings in Fig 1, 3 & 5 based on change of screw hole location
0.3	03/09/2014	Updated sections 1.2, 1.4, 2.1
0.4	25/09/2014	Added new image on front page, updated sections 1.1, 2.3, 2.6, 2.7, 3.1.2
0.5	29/09/2014	Updated sections 3.1 and 3.4
0.6	1/10/2014	Updated sections 1.4 to correct pin out of J1