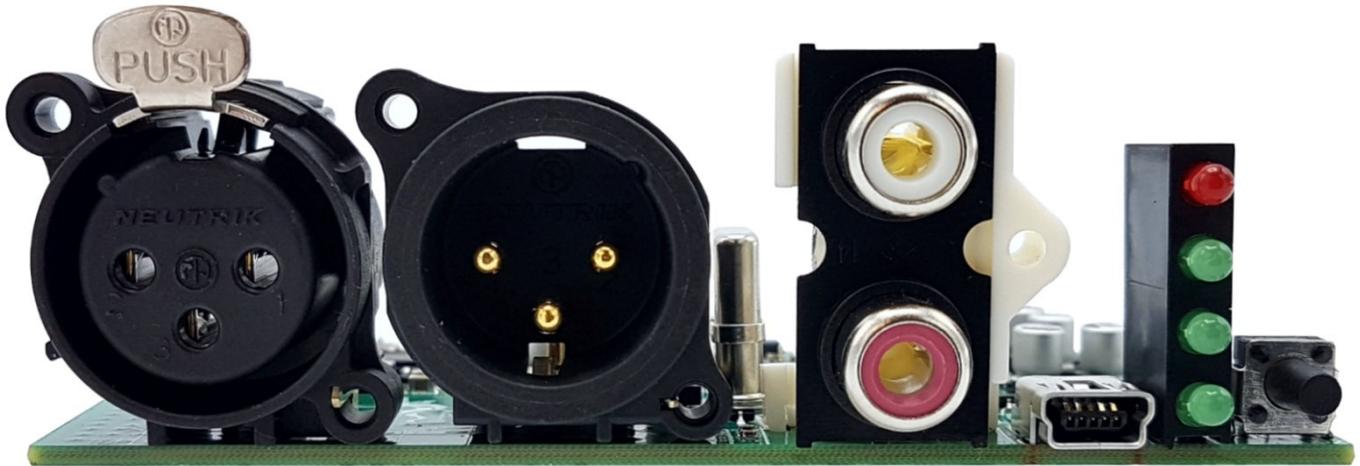

DSP3-213



Features

- Three channel active filtering
- Compatible with MP series
- 3 programmable presets
- One FIR (4500 taps) or 3 (1500 per channel) per preset
- Configurable Soft clip limiter
- Automatic source selection
- Automatic signal detection
- Optional IR remote control
- Master-slave operation

Applications

- Active speakers
- Active subwoofers
- PA systems
- Studio monitors

Introduction

The DSP3-213 is a high grade, three channel DSP board to be used specifically with the Hypex MP series amplifiers. It can be expanded with an optional digital input board or high level input board for subwoofers. Multiple DSP boards can be used in master-slave configuration to create a stereo or 2.1 system. Three presets are available to store different filter settings, inputs and volume offsets. In each preset either one 4500 tap FIR filter right after the input, or three 1500 tap FIR filters on the output (one for each channel) can be implemented.

If a 2-channel amplifier is connected the outputs can easily be configured for BTL operation. An optional infrared received board is available for remote control.

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1 Safety precautions



Attention: Observe precautions for handling electrostatic sensitive devices. This module uses semiconductors that can be damaged by electrostatic discharge (ESD).

Damage due to inappropriate handling is not covered by warranty.

This product has no user-serviceable parts.

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
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. Don't run any cables across the top or the bottom of the module. Apply fixtures to cables to ensure that this is not compromised.
11. Observe a minimum clearance of 6mm with all possible conducting parts (housing etc.).
12. Natural convection should not be impeded by covering the module (apart from the end applications housing).
13. This product is to be used with Hypex NCxxxMP modules only.
14. Before using this product, ensure all cables are correctly connected and the power cables are not damaged. If you detect any damage, do not use the product.
15. Changes or modifications not expressly approved by Hypex Electronics will void compliance and therefore the user's authority to operate the equipment.
16. Service or modifications by any person or persons other than by Hypex Electronics authorized personnel voids the warranty.

2 Block diagram

This block diagram shows an overview of the technical architecture of the DSP3-213. Depending on the configuration the available inputs may vary. The default configuration has analogue XLR and RCA inputs. This can be expanded with either a high level input board for subwoofers or with a digital input board which includes AES, SPDIF and optical inputs. Furthermore an optional IR receiver kit is available.

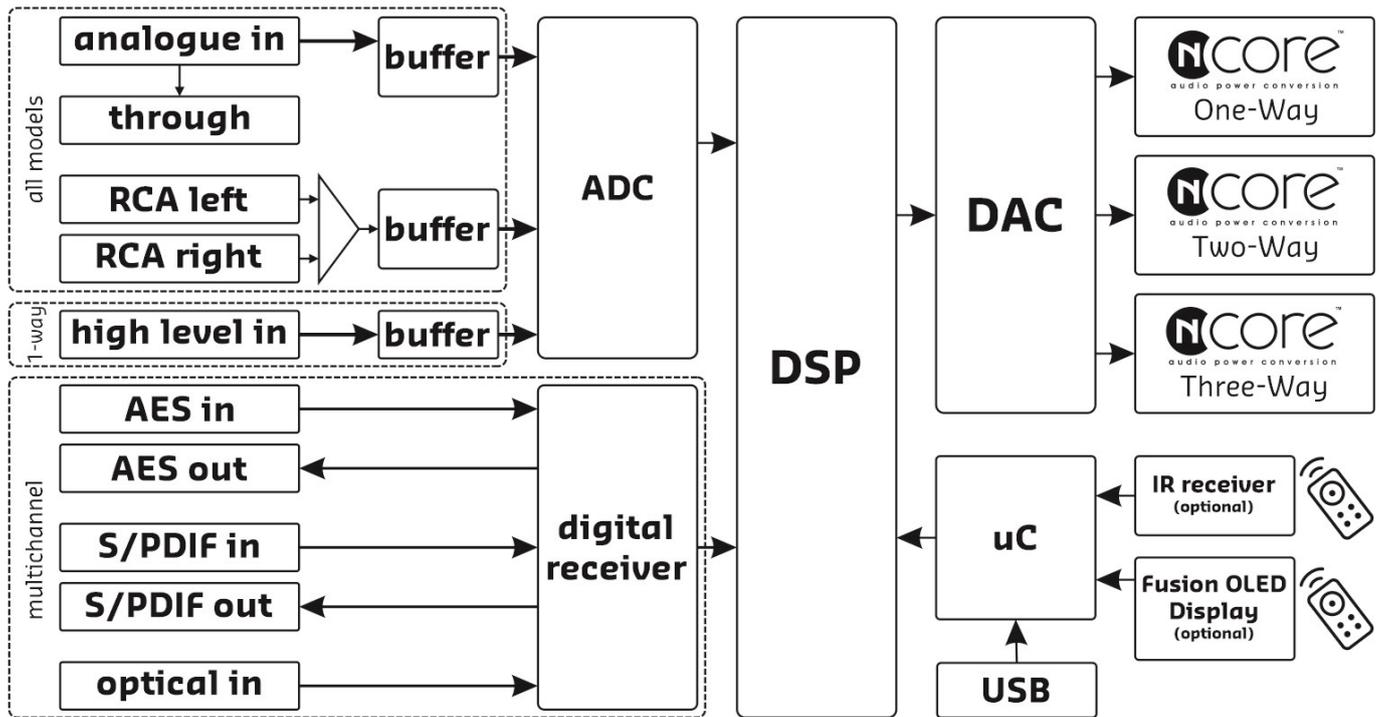


Figure 1: Block diagram

3 Electrical Specifications

3.1 Performance data

MBW=20kHz (20Hz-20KHz), unweighted, all filters set to unity, gain adjust 0dB unless otherwise noted

Item		Symbol	Min	Typ	Max	Unit	Notes
Input level	XLR	V _{IN}		18 (6.15)		dBu (V _{RMS})	Default gain setting (See p6.1)
	RCA			9 (2.18)			
	High level			36.2 (50)			
Output level	Channels 1 and 2	V _{OUT}			2.81	V _{RMS}	0 dBFS (differential) See gain table
	Channel 3				2.96		
Signal/Noise ratio		SNR		-111			Digital in
				-109			Analogue in
Total harmonic distortion + noise		THD+N		-102.5			Digital in, -1dBFS
				-100			Analogue in, -1dBFS
Input Impedance (DM) XLR		Z _{IN, DM}		44		kΩ	Differential mode
Input Impedance (CM) XLR		Z _{IN, CM}		2.2		MΩ	Common mode
Input impedance AES				110		Ω	
Input impedance RCA				54		kΩ	
Input impedance SPDIF				75		Ω	
Frequency Response (relative to 1kHz)			10		35k	Hz	+/- 0.1dB
DSP sampling rate		F _s		93.75		kHz	
ADC sampling rate		F _s		93.75		kHz	
Supported digital sampling rates		F _s	32, 44.1, 48, 88.2, 96, 192			kHz	All input rates converted to 93.75kHz ¹⁾
Delay per channel			0		32	mS	Set in software
CM Rejection Ratio		CMRR		-66		dB	All frequencies
Channel separation				-111		dB	Left/Right and inter-channel separation
Analogue latency				350		μs	
Digital latency				1.8		ms	96kHz input sample rate

Note 1 Optical input limited to 96 kHz

3.2 Gain table

The output voltage of the DSP3-213 is determined by the input level required for the rated power at 8 Ohm of the amplifier module selected in the software. Depending on the selected amplifier a correction is applied to the maximum output level of the respective channel.

Amp module	Output power @ 8 Ohm (W)	Amplifier gain (dB)	DSP output @0dB (V _{RMS})	
			Channel 1/2	Channel 3
NC250MP	130	25.5	1.71	
NC500MP	270	25.5	2.47	
NC122MP	75	25.5	1.30	
NC252MP	200	25.5	2.12	
NC502MP	350	25.5	2.81	
NC100HF	100	19.6		2.96

3.3 Recommended Operating Conditions and Supply Currents

Parameter		Symbol	Min	Typ	Max	Unit	Note
Supply voltage	Symmetric supply (+/-)	V _{Aux}	16	20	21	V	
Supply current (+)		I _{Aux}	64		57	mA	1)
	With optional DigIn		69		63	mA	1)
	With optional SubIn		74		67	mA	1)
Supply current (-)			35		35	mA	
	With optional DigIn		40		40	mA	
	With optional SubIn		45		44	mA	
Logic supply voltage		V _{logic}	4.75	5	5.25	V	
Logic supply current	DSP active	I _{Run}	160		145	mA	1,2)
	DSP in standby mode	I _{Stb}	18		16	mA	1,2)
	With optional DIGin3	I _{Run2}	200		185	mA	1,3)
	DSP in low-power mode	I _{LowPower}	100		92	mA	1,4)
	DSP in standby mode	I _{Stb2}	23		21	mA	1)
	With optional SUBin3	I _{Run3}	164		146	mA	1)
	DSP in standby mode	I _{Stb3}	23		21	mA	1)

Note 1 Maximum current value is drawn at minimum input supply voltage, minimum current value is drawn at maximum input supply voltage (due to DC-DC converters).

Note 2 No options attached.

Note 3 No FAN attached.

Note 4 Low-Power mode is only available when optional DIGin3 module is attached, FAN is off.

4 IO Specifications

4.1 Power Supply Enable

When the DSP3-213 board is switched out of standby mode, the PS Enable pin on the H-Bus connector is asserted and the Main SMPS of the NCxxxMP is enabled.

Parameter	Direction	Remarks	Min	Typ	Max	Unit	Note
SMPS enabled	Output	Active HIGH	2.7	-	3.3	V _{DC}	
SMPS in standby			0	-	0.6	V _{DC}	

4.2 Amplifier Mute

By asserting either of the Amplifier Mute pins on the H-Box connector both amplifiers of the NCxxxMP are muted. This pin is controlled by the DSP3-213.

Parameter	Direction	Remarks	Min	Typ	Max	Unit	Note
-----------	-----------	---------	-----	-----	-----	------	------

Amplifier mute	Output	Active HIGH	2.7	-	3.3	V _{DC}	
Amplifier un-mute			0	-	0.6	V _{DC}	

4.3 DC-Error

If a DC component is present at either of the speaker outputs of the NCxxxMP, the nFatal bus is pulled down. This triggers the main SMPS to switch off and the DC Error to be activated. The red Protection LED will light up when a DC error is detected.

Parameter	Direction	Remarks	Min	Typ	Max	Unit	Note
DC error	Input	Active LOW	0	-	0.66	V _{DC}	
No DC error			2.64	-	3.3	V _{DC}	

4.4 Power Good

The Power Good signal will be activated if the main SMPS is functioning correctly. If the main SMPS is disabled, the Power Good pin is immediately released and the DSP board is muted.

Parameter	Direction	Remarks	Min	Typ	Max	Unit	Note
Power good	Input	Active LOW	0	-	0.66	V _{DC}	
Power not good			2.64	-	3.3	V _{DC}	

4.5 Amplifier Clip Indicator

If a clip condition occurs the Amplifier Clip Indicator pin will be pulled to ground. De red Protection LED will light up.

Parameter	Direction	Remarks	Min	Typ	Max	Unit	Note
Clipping	Input	Active LOW	0	-	0.8	V _{DC}	
Not clipping			2	-	3.3	V _{DC}	

5 Connector pinouts

This chapter describes the functional connectors of the DSP module and optional digital and sub input boards. A connector not stated in this chapter is only used for production or quality control and must remain unconnected in the end user application. The arrow points towards pin 1 of the connector. For more information regarding a specific connector, please refer to the corresponding datasheet.

5.1 DSP3-213 and DIGin3-322 connectors and controls

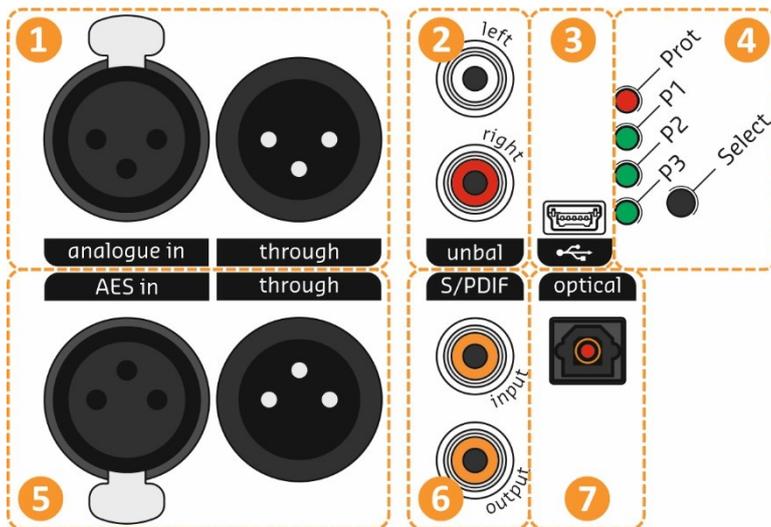


Figure 2: DSP with optional digital input board

DSP3-213 main board connectors

Number	Designator	Function	Pinout	Notes
1	J2	XLR analogue in	1: GND	
			2: positive (hot)	
			3: negative (cold)	
	J4	XLR analogue through	1: GND	J4 directly connected to J2
			2: positive (hot)	
			3: negative (cold)	
2	J5	RCA analogue in left		L/R internally summed
		RCA analogue in right		L/R internally summed
3	J11	USB mini		
4		LED indicators		
		Select button		

DIGin3-322 input board connectors

Number	Designator	Function	Pinout	Notes
5	J1	AES/EBU in	1: GND	
			2: positive (hot)	
			3: negative (cold)	
	J2	AES/EBU through	1: GND	
			2: positive (hot)	
			3: negative (cold)	
6	J4	S/PDIF in		
	J4	S/PDIF out		
7	J5	Toslink in		

5.2 SUBin3-110 connectors and controls

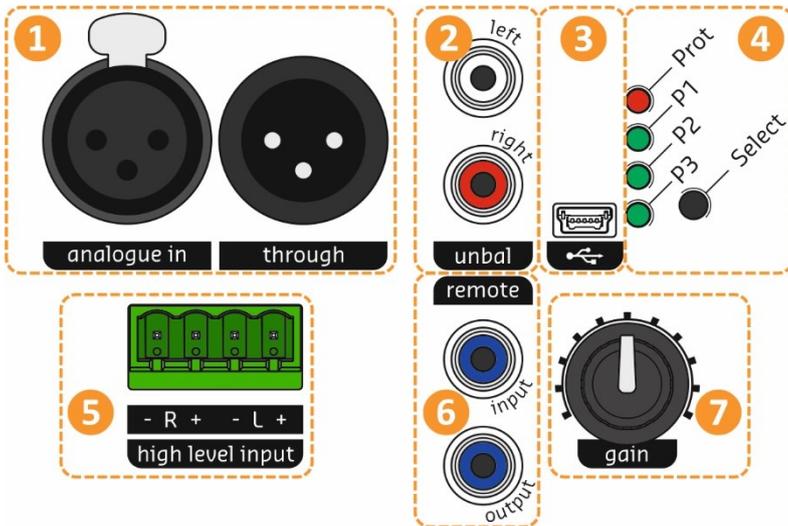


Figure 3: DSP with optional Sub input board

Sub input connectors

Number	Designator	Function	Pinout	Notes
5	J1	High level input L/R	1: L+ 2: L- 3: R+ 4: R-	L/R internally summed Connector type: Phoenix contact MSTB 2.5/4-ST-5.08 PRTD
6	J5	Remote input		
	J5	Remote output		
7		Gain control knob		

LED Indicators and button

Clip or Limit indication:

- Prot: Random blinking: Amplifier limits
Steady on: Fatal / DC Error / Power failure
Blink once per second: High temperature
Blink twice per second: Over temperature

Preset:

- P1: Preset 1 selected
- P2: Preset 2 selected
- P3: Preset 3 selected

When the DSP module is muted, the current preset LED will blink slowly.

Note: In case Hypex NC-MP/NCAS modules are used for powering the DSP, after removal of the mains voltage, the 5V standby supply will keep running until the buffer-capacitors are fully discharged, but the DSP will immediately fall into power-fail mode. Discharging the buffers can take up to two minutes, during which the red led will be lit and the DSP will try to reboot about every 5 seconds (green led will also be lit for a short duration).

Preset selection

The selected preset LED is lit by default. To change the preset, short press the select button.

Digital channel selection (Dig-in only):

When a digital source is selected, the current channel setting can be displayed by holding the select button for 3 seconds until the selected channel mode starts blinking.

Left: Left digital channel selected

Right: Right digital channel selected

L/R: Both digital channels mixed into mono

To change the selected channel mode, hold the select button after the long press. Every 1.5 seconds, the channel mode is switched.

Gain adjust (Sub-in only)

Sets the gain relative to the master volume (+/- 12 dB). It can also be configured in HFD to act as a master volume control with range -96dB .. +18dB.

5.3 DSP3-213 board IO pins

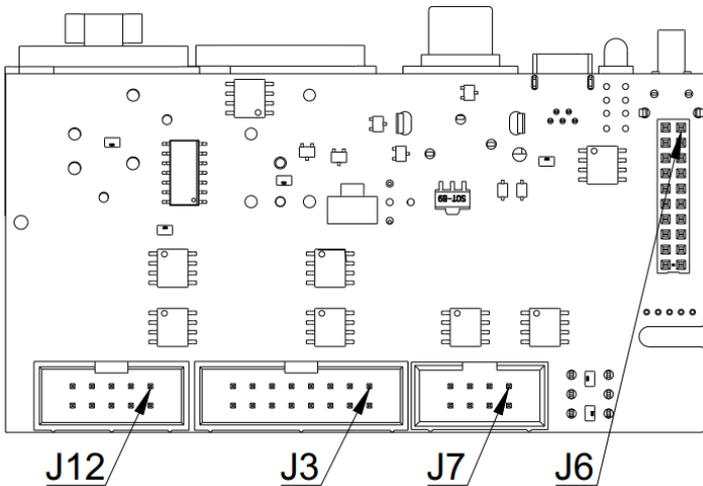


Figure 4: DSP board IO pins, bottom view

H-box connector J3

Pin	Direction	Function	Remarks
J3.1	Output	CH1 Out -	Inverting audio output Channel 1
J3.2	Output	CH1 Out +	Non-inverting audio output Channel 1
J3.3	-	CH1 GND	Ground
J3.4	Output	Mute	Amplifier mute (both channels)
J3.5	Input	CH1 Clip	Clip indicator Channel 1
J3.6	Output	CH1 HWAddr	Not connected
J3.7	Input	CH1 ISense(1)	Not connected
J3.8	Input	CH1 Thermal	Temperature readout Channel 1
J3.9	Input	CH2 Thermal	Temperature readout Channel 2
J3.10	Input	CH2 ISense(2)	Not connected
J3.11	Output	CH2 HWAddr	Not connected
J3.12	Input	CH2 Clip	Clip indicator Channel 2
J3.13	Output	Mute	Amplifier mute (both channels)
J3.14	-	CH2 GND	Ground
J3.15	Output	CH2 Out +	Non-inverting audio output Channel 2
J3.16	Output	CH2 Out -	Inverting audio output Channel 2

Connector type equivalent: T821116A1S100CEU

Contact material: Brass, gold flash over nickel

H-box connector J7

Pin	Direction	Function	Remarks
J7.1	Output	CH3 Out -	Inverting audio output Channel 3
J7.2	Output	CH3 Out +	Non-inverting audio output Channel 3
J7.3	-	CH3 GND	Ground
J7.4	Output	Mute	Not connected
J7.5	Input	CH3 Clip	Not connected
J7.6	Input	CH3 HWAddr	Not connected
J7.7	Input	CH3 ISense(1)	Not connected
J7.8	Input	CH3 Thermal	Not connected

Connector type equivalent: T821108A1S100CEU

Contact material: Brass, gold flash over nickel

H-bus connector J12

Pin	Direction	Function	Remarks
-----	-----------	----------	---------

J12.1	Input	V _{AUX}	Positive auxiliary supply
J12.2	Input	V _{AUX}	Negative auxiliary supply
J12.3	Input	V _{IN,STANDBY}	Regulated standby supply
J12.4	-	GND	Ground
J12.5	-	SDA (I ² C)	Not implemented
J12.6	-	SCL (I ² C)	Not implemented
J12.7	Input	DC Error	DC Offset detected, power supply disabled.
J12.8	Input	Power Good	Power supply stable indicator
J12.9	Output	PS Enable	Power supply enable
J12.10	Reserved	Reserved	Not connected

Connector type equivalent: T821110A1S100CEU

Contact material: Brass, gold flash over nickel

Expansion connector J6

This header is only to be used with the optional DIGin3-322 and SUBin3-110 boards.

Pin	Direction	Function	Remarks
J6:1	Output	VENT_DAC	Fan control voltage 0-3V
J6:2	Input	AIN_SPKRLR+	Positive high level analogue audio input
J6:3	Input	AIN_SPKRLR-	Negative high level analogue audio input
J6:4	Input	SIGDET_SPKR	High level signal detection input
J6:5	-	GND	Ground
J6:6	I/O	SPDIFdata	Communication over SPDIF data
J6:7	I/O	SRC_RESET/SUBLevel	DIGin3-322 reset signal or potentiometer volume input
J6:8	I/O	SDA	I ² C data
J6:9	Output	SCL	I ² C clock
J6:10	Output	SRC_MCLK	I ² S master clock
J6:11	Output	SRC_DATA	I ² S data
J6:12	Output	SDOUT3	I ² S auxiliary data
J6:13	Output	LRCK	I ² S LR clock
J6:14	Output	BCK	I ² S bit clock
J6:15	-	GND	Ground
J6:16	Output	+VAUX	Positive auxiliary supply voltage
J6:17	Output	+5VSB	Positive digital supply voltage
J6:18	Output	+3V3SB	Positive digital supply voltage
J6:19	Output	+12V	Positive analogue supply voltage
J6:20	Output	-12V	Negative analogue supply voltage

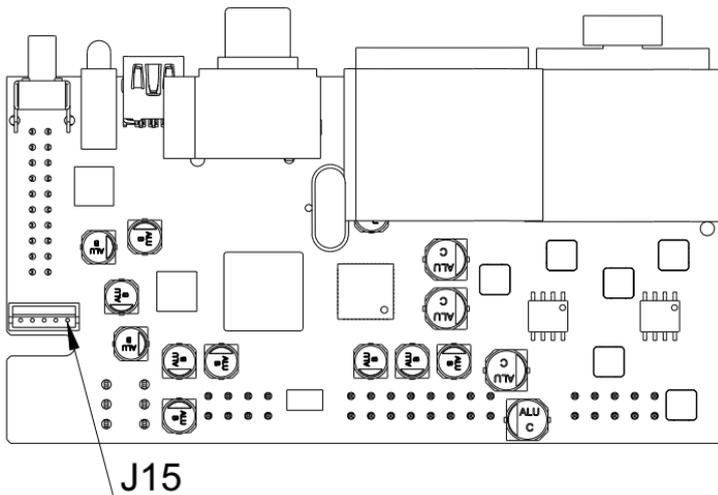


Figure 5: DSP main board IO pins, top view

IR kit connector J15

Pin	Direction	Function	Remarks
J15:1	Output	+3V3	
J15:2	Input	IR input	
J15:3	-	GND	
J15:4	Output	Front LED1	DSP on (blinks when muted)
J15:5	Output	Front LED2	Clip/error detected

Connector type JST B5B-ZR

5.4 DIGin3-322 IO pins

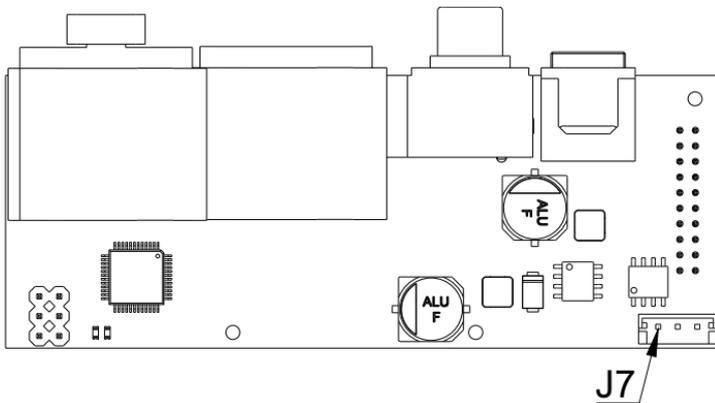


Figure 6: Dig-in IO pins, top view

Fan connector J7

Pin	Direction	Function	Remarks
J7:1	Output	+12V	4-14V controlled by DSP-main
J7:2	-	GND	
J7:3	-	NC	Not connected

Connector type JST B3B-EH-A

Compatible fan: JAMICON JF0925B1HS-R

6 Features

Gain setting

The gain can be increased for the XLR (two jumpers) and RCA (two jumpers) inputs individually by soldering the corresponding jumpers. The jumpers are located on the bottom side of the DSP board. ALWAYS treat both corresponding jumpers the same.

Input	Jumpers	Input level	
		dBu	V _{RMS}
XLR	Both not set (default)	18	6.15
	Both set	9	2.18
RCA	Both not set (default)	9	2.18
	Both set	2	0.98

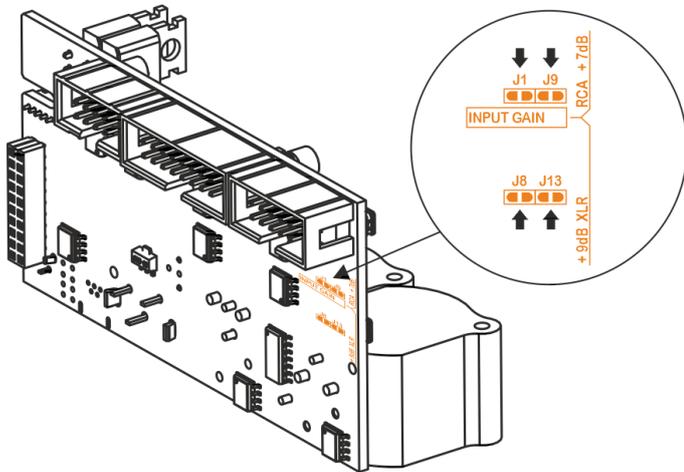


Figure 7: Gain jumper location

DSP Filters

- 15 biquads per channel. Channels configured for BTL still have 15 biquads available.
- One FIR filter with fixed 4500 taps on the input, or three 1500 tap FIR filters, one for each channel

Chip specification

DSP: ADAU1452
 ADC: AK5554
 DAC: AK4454
 SRC: SRC4382

Bridge-tied load (BTL)

Channels 1 and 2 can be configured for BTL operation by setting the BTL option in Hypex Filter design. This will invert the signal from Channel 2. Please refer to the NCxxxMP data sheet for information on speaker wiring.

Fan output

The optional DIGin3-322 board features a fan output to connect an optional cooling fan. The software monitors the output signal and NCxxxMP module temperature. A proportional–integral algorithm controls the fan speed. This ensures sufficient cooling when needed and quiet operation when desired.

Source select

Automatic source select automatically locks on to the first available source. The input scanner scans in the following order and cycles:

- DSP board only configuration:
XLR | RCA
- DSP board fitted with Sub-in board:
XLR | RCA | High level input
- DSP board fitted with Dig-in board:
AES | S/PDIF | Optical | XLR | RCA

During the scan cycle the output will be muted (Preset LED blinking). When no signal is detected on the active input for 15 seconds the cycle will start over. The source can also be selected manually. Configure manual or automatic source selection in HFD.

Daisy-chaining

The balanced analogue input can be daisy-chained using the XLR through connector. This output XLR is directly connected to the input XLR. The maximum number of chained modules is limited by the source's capabilities. When equipped with the DIGin3-322 board, multiple DSP3-213 boards can also be daisy chained in the digital domain. The signal on the AES and S/PDIF output is the signal of the current selected digital input.

Note: there is no link between analogue and digital domains. Analogue input signal cannot be routed to digital output and vice versa.

Master-slave operation

When equipped with a DIGin3-322 or SUBin3-110 expansion board, multiple DSP3-213 boards can be controlled by a single master DSP3-213 board by connecting an SPDIF cable from the SPDIF out or Remote out on the first module to the SPDIF in or Remote in on the second module, and so forth. In addition to the control signal, the SPDIF output on the Dig-in board also forwards the active digital input signal. The Remote output on the Sub-in board however only sends the control signal. Master unit should be the last with mains switched on (or at the same time as the last slave is connected to mains power).

Hypex Filter Design (HFD)

HFD is a free software tool required to configure the DSP3-213. The DSP does not contain any filter by default. At least a unity filter needs to be configured and uploaded before the DSP will produce an output signal.

HFD can be used to measure the frequency response of the speaker and this information can be used to design your filter. 15 biquad filters are available per amplifier channel. Please refer to the HFD help file for more information on using HFD. The most recent version of HFD is available for download on our website.

7 Dimensions

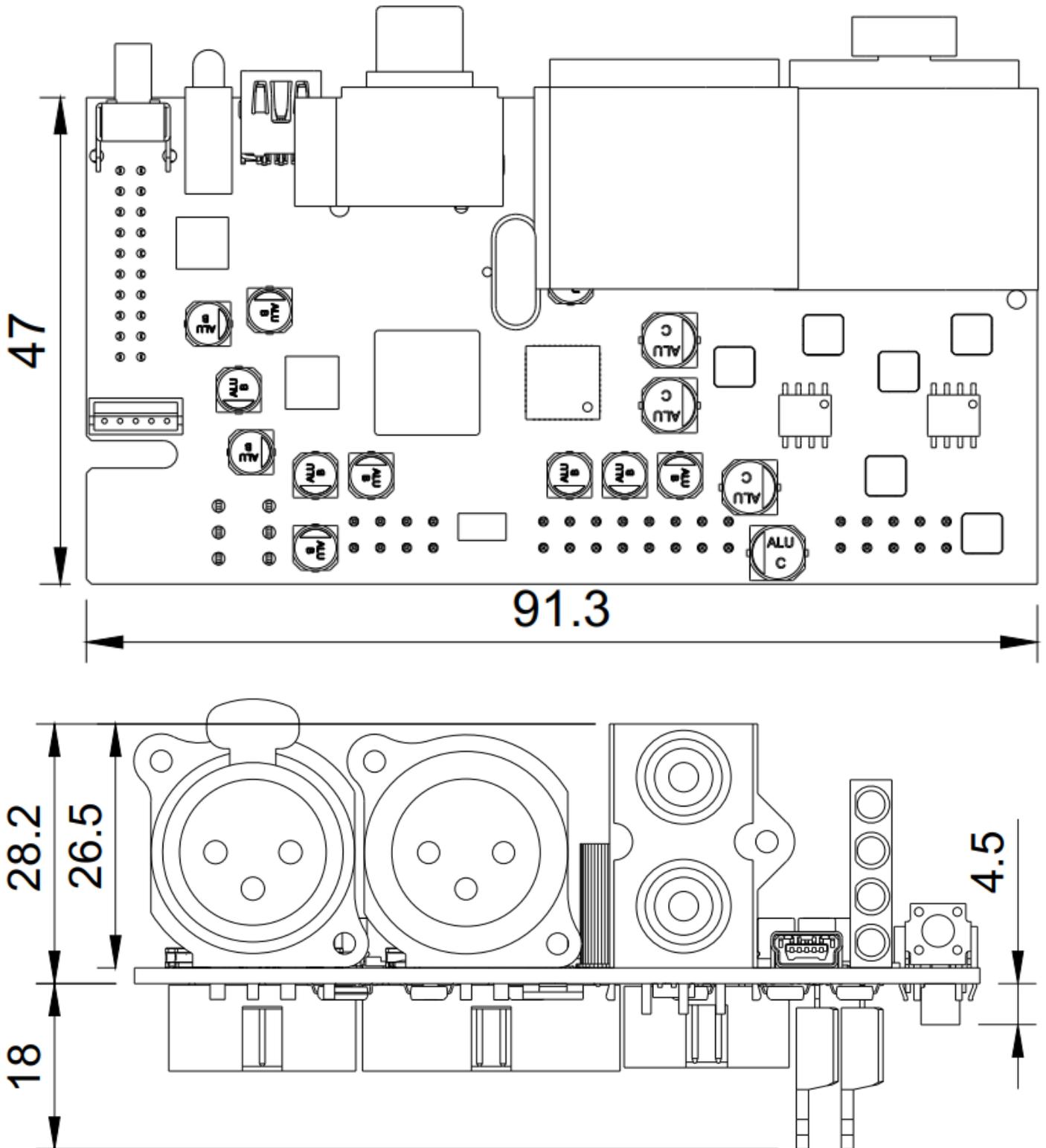


Figure 8: DSP main dimensions

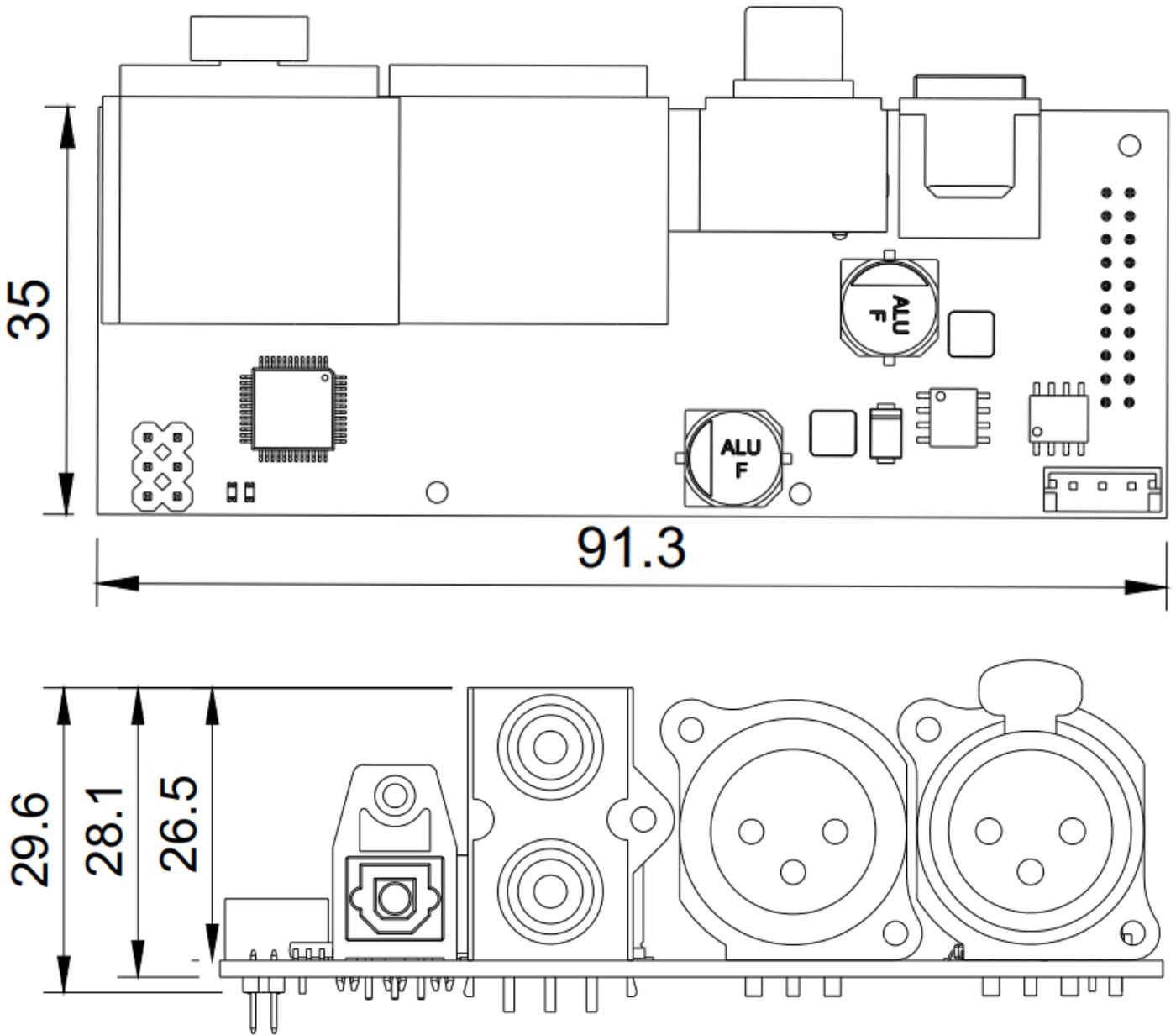


Figure 9: Dig-in dimensions

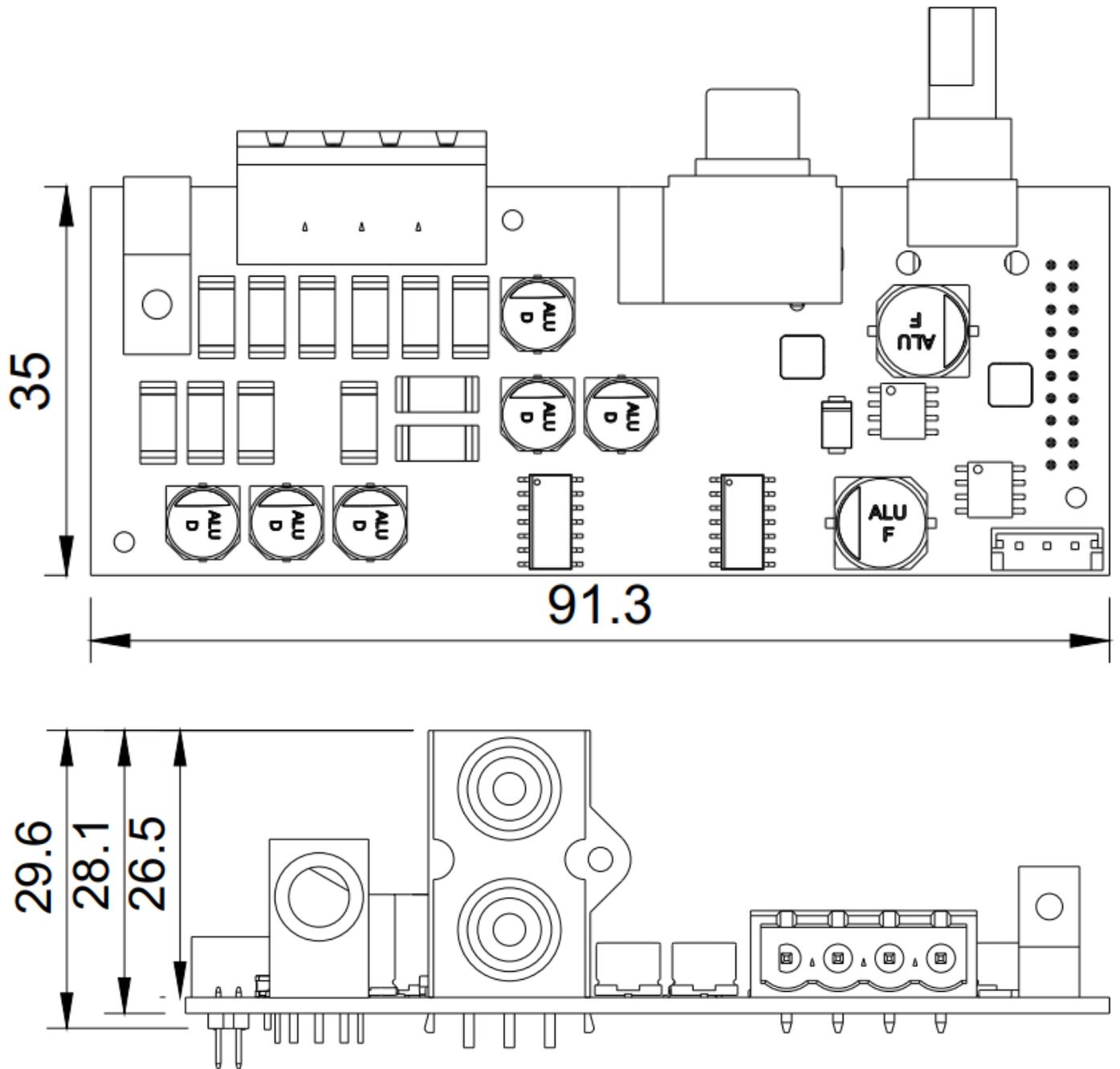


Figure 10: Sub-in dimensions

8 Revisions

Document revision	Module revision	Change log	Date
01xx	0200	First release	January '19
02xx	0200	Drawings updated	February '19
03xx	0200	Table J7 corrected	March '19
04xx	0200	Specs and block diagram updated	October '19
05xx	0400	Name change all modules, specs updated for B05+ boards	May '23
06xx	0400	Gain jumper settings clarified	September '23

9 Disclaimer

All products, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.

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