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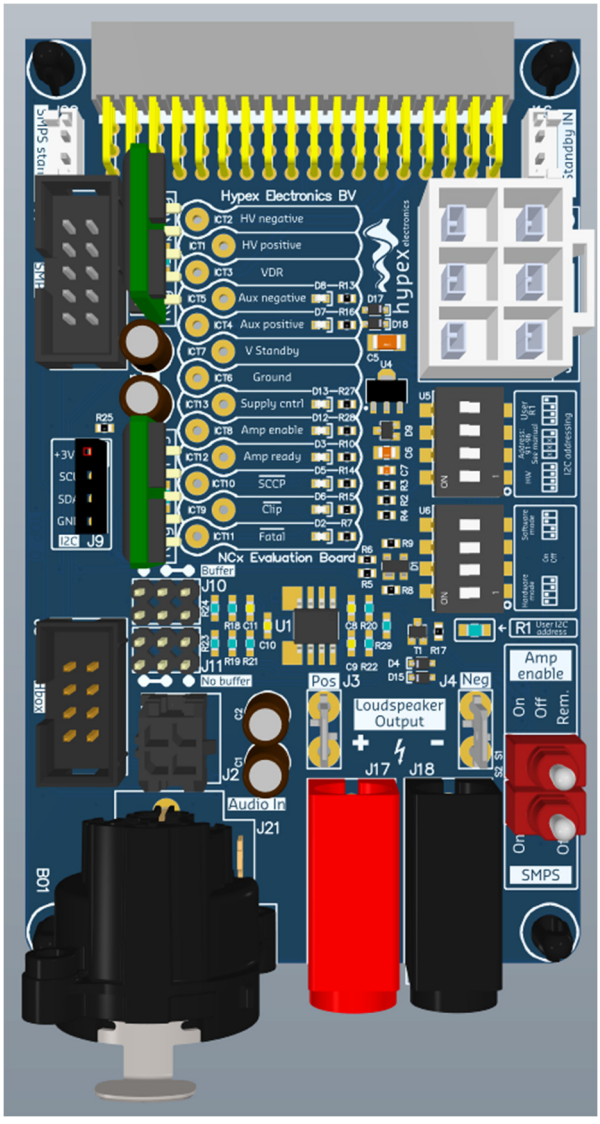
NCx Evaluation Board

NCx Evaluation Board Manual



Introduction

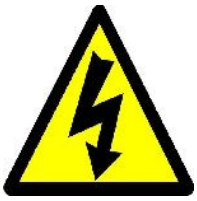
This document describes how to operate and connect the evaluation board. This evaluation board is designed to make evaluation of the NCx500 OEM amplifier or NCx1000 OEM amplifier easy. The Hypex SMPS1200 or SMPS3K can be easily connected to the evaluation board and used as a power supply for an evaluation setup. An H-box connector also allows for easy connection with a Hypex DSP3-213 or DSP3-224 board.

In addition to this evaluation board, Hypex offers cable sets to interface between the modules and the application. These cables have a standardized length. For more information, visit our website.

Please make sure you always download the latest datasheet from our website.

Contents

1 Safety precautions



This module operates at high 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.

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.

When mounting the module in an enclosure, a minimum safety distance of 6mm from the module to all possible conducting parts must be ensured. This includes parts on the top and the bottom of the board.

This symbol indicates the presence of hazardous voltages at accessible conductive terminals on the board. Parts that are not highlighted in red may also carry voltages in excess of 160 Vdc!

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

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. Do not 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 NCx series 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 Quickstart Guide

Operation In Hardware Mode

- Plug NCX500 or NCX1000 module into J1 of NCx Evaluation board. NCx500 must be placed on the bottom two rows of J1 connector.
- Place NCx Evaluation board with NCx amplifier module on a flat surface.
- Before applying power supplies, check if switches S1 and S2 are switched to off.
- Connect external power supplies to J1 (HV_P, HV_N, VDR, GND) and J6 (AUX_P and AUX_N). External power supplies can be laboratory supplies or a power supply module like the Hypex SMPS1200 or the Hypex SMPS3K.
- Connect audio source to Microfit (J2) or XLR connector (J21). Connect speakers (or test equipment / loads) to banana female socket (J17 & J18) or Faston (J3 & J4).
- Switch on Supply (S2).
- Switch Amp Enable on (S1).

All LEDs should be lit during proper operation except for $\overline{SCCP}$, $\overline{CLIP}$, $\overline{FATAL}$. These will indicate an error.

Switch Amp Enable (S1) to off before powering down.

3 Indicator LEDs and test pads

Designator	Label	Condition
D8	AUX negative	AUX negative present
D7	AUX positive	AUX positive present
D13	Supply control	Supply enabled when lit
D12	Amp enable	When lit amplifier is running
D3	Amp ready	only in HW mode
D5	$\overline{SCCP}$	Overcurrent detected when lit
D6	$\overline{CLIP}$	Clip detected when lit
D2	$\overline{FATAL}$	Fatal condition when lit

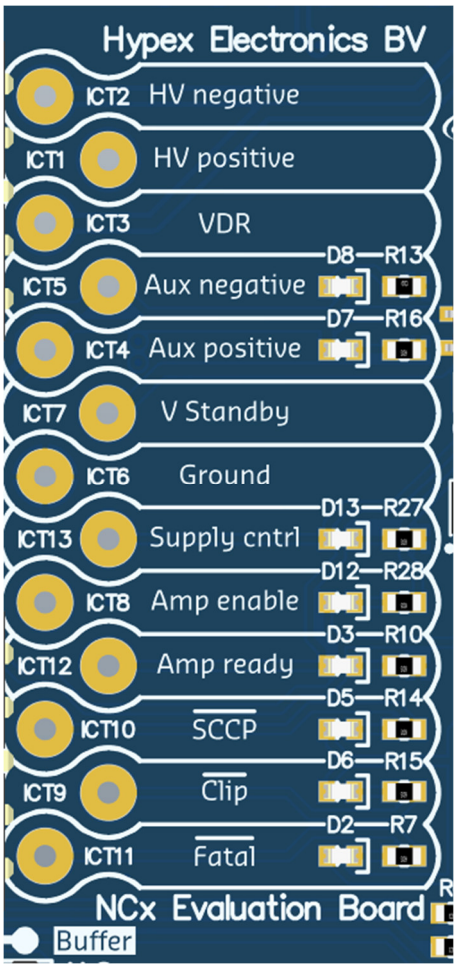


Figure 1. Location of indicator LEDs and test pads on PCB

The labelling on the PCB is indicative of the function. The Amp enable is slightly different as the LED indicates when the amplifier is running by lighting up. Test pad ICT12 is directly connected to the amplifier and is working in the active low method. The LED and ICT12 are opposite high and low to each other.

4 Buffer

The NCx OEM modules incorporate a buffer stage to increase voltage gain and input impedance and therefore make it easier to drive the amplifier. This buffer stage can be omitted so control over the design of this stage and thereby tuning to a 'house sound' can be done more easily. The selection of either using the module buffered or unbuffered can be done through jumper settings on J7/J15 on NCx500 OEM, or J1/J2 on NCx1000 OEM.
The buffer on the NCx evaluation board is bypassed by default. Jumpers J10 and J11 are used to change the buffer situation:

Default unbuffered situation: the four jumpers are placed in the left position on J10 and J11. The buffer on the evaluation board is bypassed.

Buffered situation: the four jumpers must be moved to the right position. The buffer is now in line with the input and the output of the evaluation board. The buffer circuit is shown in figure 4.

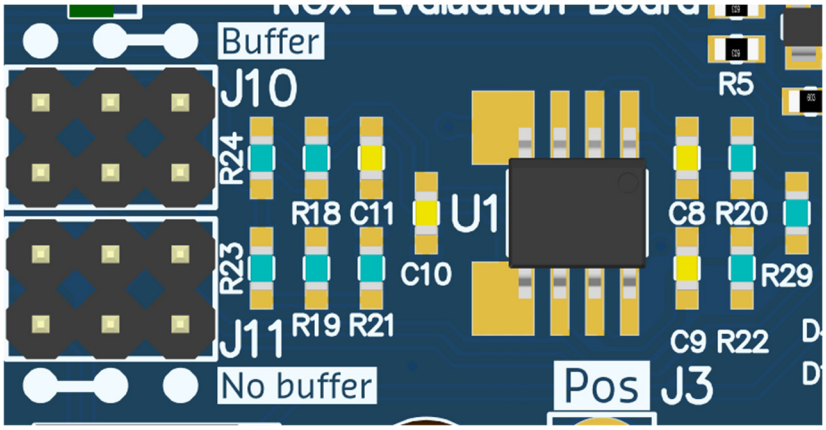


Figure 2. Jumpers Buffer

Before using the buffer on the NCx evaluation board, set the jumper on NCx500 OEM to unbuffered. Op amp U1 and capacitors C8 and C9 are not placed by default. The placement of U1 is necessary when using the buffer on the evaluation board. The placement of capacitors C8 and C9 is optional. Please make sure that the pinout of the op amp (U1) is as follows (see also figure 3):

4.1 Pinout U1

Pin number	Function
1	Output amplifier A
2	Inverting input amplifier A
3	Non-inverting input amplifier A
4	Negative supply voltage
5	Non-inverting input amplifier B
6	Inverting input amplifier B
7	Output amplifier B
8	Positive supply voltage

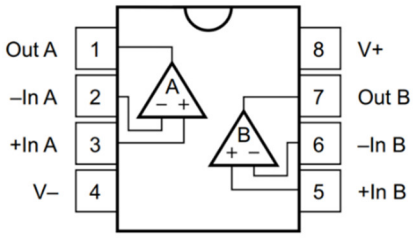


Figure 3. Opamp pinout

4.2 Input buffer gain

The input buffer has a gain of approximately 16 dB. This gain is set by R20, R22 (Rf) and R29 (Rg). The gain (dB) can by calculated using the following formula:

$$20\ Log(1 + \frac{2 * Rf}{Rg})$$

Where Rf = 3k3 and Rg = 1k2. To change the input buffer to unity gain, R29 should be removed.

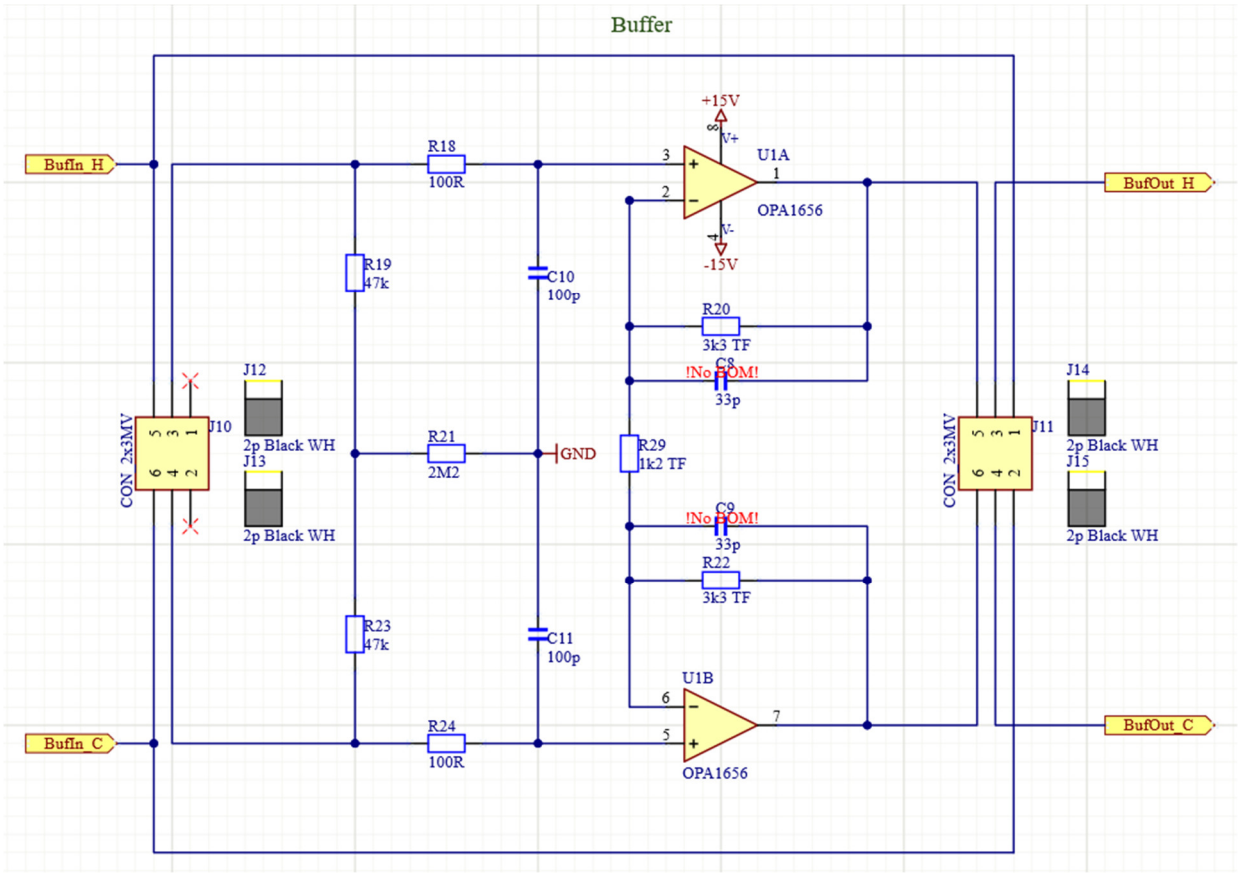


Figure 4. Buffer schematic

5 Voltage regulator buffer circuit

The NCx evaluation board has the option for 3 different types of supply for the buffer circuit. U2 is the place for the positive regulator and U3 for the negative regulator. **Onboard voltage regulators are placed on the NCx500 and NCx1000 amplifier module by default. Remove them first before placing Hypex HxR or 78xx / 79xx voltage regulators on the evaluation board and changing the solder jumpers settings (J19 and J20).**

Configuration	Function
0Ω resistor	Placing a 0Ω resistor on places R11 and R12 connects the aux supply (AUX_P and AUX_N) from the connected power supply to the buffer circuit.
78xx / 79xx	By placing a linear voltage regulator of the 78xx series for the positive and an 79xx series for the negative supply, the voltage level for the buffer circuit can be chosen. An xx15 regulator is advised. These can be placed in the middle 3 pads of the 5 pad footprints U2 and U3, with the heatsink towards the indicator LEDs. It is possible to route the output of the regulators to VAUX+ and VAUX - of the NCx. See the description below about solder jumpers J19 and J20 for more on this.
Hypex HxR	By placing a Hypex HPR for the positive and Hypex HNR for the negative supply voltages the op amp is supplied with the most optimal supply voltage. These are available for purchase through our website.

5.1 Solder jumpers J19 and J20

Figure 5. Solder jumpers are located on the bottom side. Grey rectangles indicate default configuration.

Solder jumpers J19 and J20 are located on the bottom side.
Default configuration: The centre pad is shorted to the upper pad to supply the NCx amplifier module with the unregulated aux supply.

If a 0Ω resistor is placed on R11 and R12, then the Regulated pad of J19 and J20 has the same unregulated voltage as the Unregulated pad of J19 and J20.
Do not short all three pads!!

Onboard voltage regulators are placed on the NCx500 and NCx1000 amplifier module by default. Remove them first before placing Hypex HxR or 78xx / 79xx voltage regulators on the evaluation board and changing the solder jumpers settings (J19 and J20).

6 Selecting Hardware/Software Mode

The evaluation board is set to hardware mode by default. Dipswitch U6 can be used to change the operation mode from hardware mode to software mode or vice versa. In software mode, it is possible to control the NCx amplifier module via I2C communication. The I2C registers can be used to check the status of the module. In case of an error, the first two registers to detect what the error exactly is. Vstdby on the NCx amplifier module can be used to power the microcontroller on the NCx amplifier module during standby.

6.1 Dipswitch U6

Switch configuration	Mode selected	Description
1100	Hardware mode	J1.18B has function Amp Ready
		J1.18C has function Fatal
0011	Software mode	J1.18B has function SDA and applies an 3k3Ω pull-up resistor
		J1.18C had function SDL and applies an 3k3Ω pull-up resistor

7 Operation In Software Mode

In Software mode, it is possible to establish an I2C communication with the microcontroller on the NCx amplifier module via the I2C Header (J9). The I2C Registers are described in detail in the NCx amplifier module datasheet.
Use Dipswitch U6 for selecting software mode.
Use Dipswitch U5 for selecting I2C address.
Vstandby (J16) is connected to VuC (External voltage supply for microcontroller) of the NCx amplifier module. This pin can be used to keep the Microcontroller powered while the rest of the system is not.

Further information: see chapter 4.2 Operation In Software Mode in NCx500 – Datasheet

7.1 Dipswitch U5

Switch configuration	Mode selected	Description
0000	No address selected.	HW mode.
0001	I2C address user defined	By placing a resistor on spot R1, any address from the table in paragraph 4.2.1 of the NCx datasheet can be selected.
0010	I2C address 96	
0100	I2C address 95	
1000	I2C address 94	
0110	I2C address 93	
1100	I2C address 92	
1110	I2C address 91	

8 Connector Pinouts

This chapter describes the functional connectors of the evaluation board module. 6 gives an overview of all the connectors on the board. The arrow points towards pin1 of the connector.

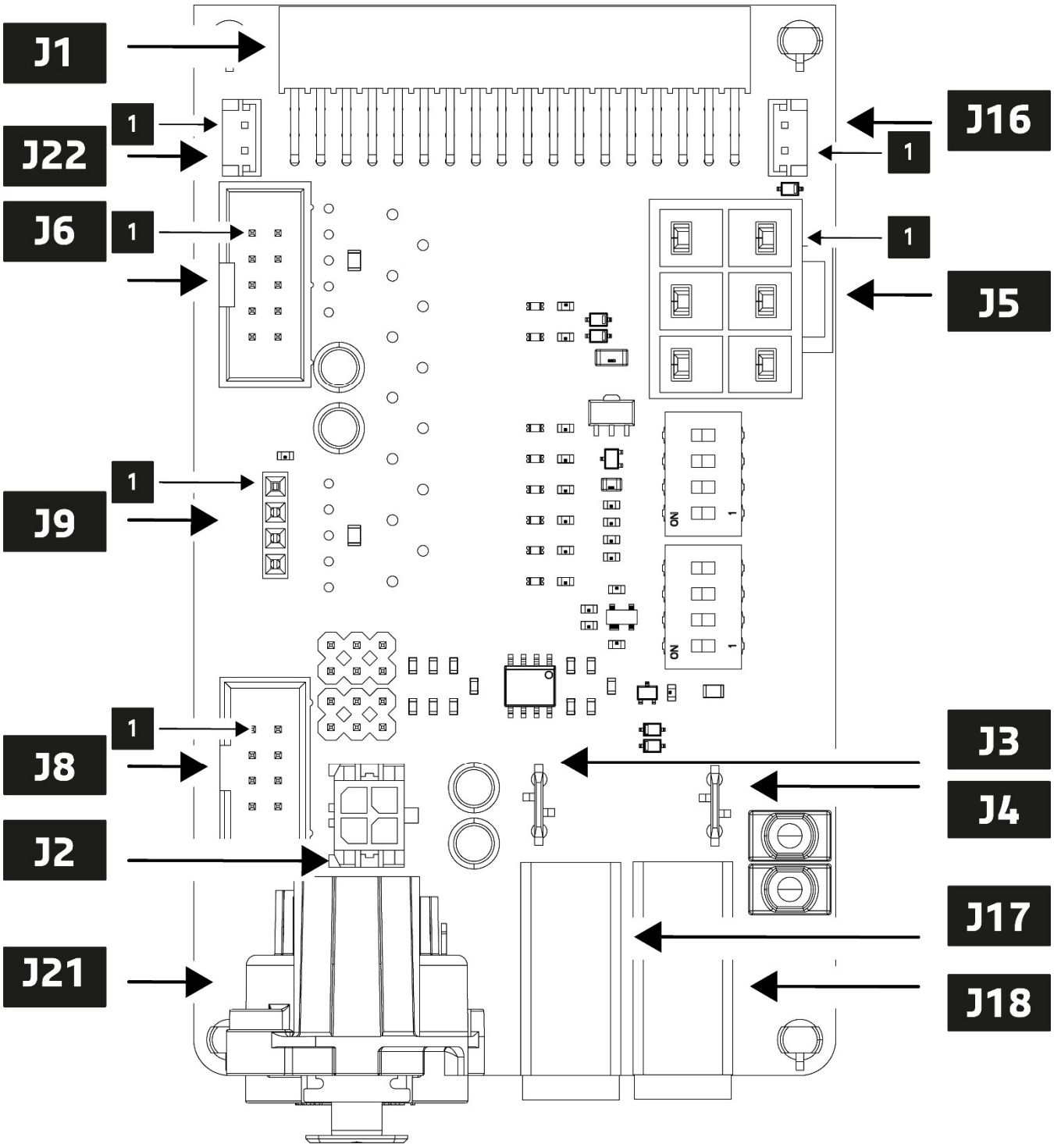


Figure 6. Connector locations and pin 1 markings

8.1 J1 NCx500 header 3x18p female horizontal

Pin Row B	Function	Pin (Row C, bottom)	Function
1	HV P	*2*	HV P
3	GND	*4*	GND
5	GND	*6*	GND
7	GND	*8*	GND
9	HV N	*10*	HV N
11	VDR P	*12*	V standby
13	LS N	*14*	LS N
15	LS N	*16*	LS N
17	Feedback N	*18*	LS N
19	Feedback P	*20*	LS P
21	LS P	*22*	LS P
23	LS P	*24*	LS P
25	Aux N	*26*	Aux P
27	GND	*28*	N.C.
29	Audio IN P	*30*	Audio IN N
31	I2C control	*32*	Amp ON
33	Clip	*34*	SCCP
35	SDA / Amp ready	*36*	SCL / Fatal

8.2 J1 NCx1000 header 3x18p female horizontal

Pin (Row A, top)	Function	Pin Row B	Function	Pin (Row C, bottom)	Function
1	HV P	*2*	HV P	*3*	HV P
4	HV P	*5*	GND	*6*	GND
7	HV P	*8*	GND	*9*	GND
10	HV N	*11*	GND	*12*	GND
13	HV N	*14*	HV N	*15*	HV N
16	HV N	*17*	VDR P	*18*	V standby
19	LS N	*20*	LS N	*21*	LS N
22	LS N	*23*	LS N	*24*	LS N
25	LS N	*26*	Feedback N	*17*	LS N
28	LS P	*29*	Feedback P	*30*	LS P
31	LS P	*32*	LS P	*33*	LS P
34	LS P	*35*	LS P	*36*	LS P
37	GND	*38*	Aux N	*39*	Aux P
40	GND	*41*	GND	*42*	N.C.
43	GND	*44*	Audio IN P	*45*	Audio IN N
46	GND	*47*	I2C control	*48*	Amp ON
49	GND	*50*	Clip	*51*	SCCP
52	High current select	*53*	SDA / Amp ready	*54*	SCL / Fatal

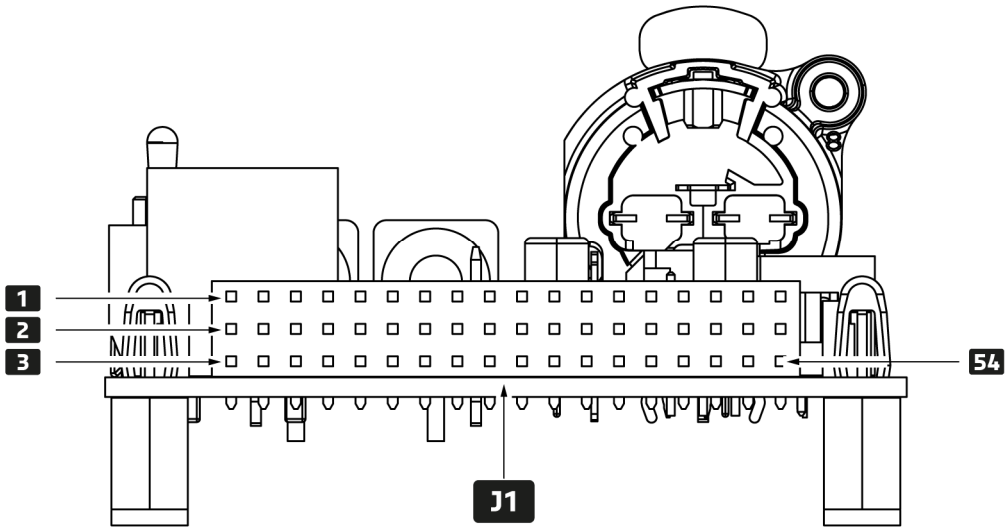


Figure 7. Connector J1, pins 1, 2, 3 and 54 marked

8.3 J2 Microfit 4p

Pin number	Description	Level	I/O
1	Audio input P	+/-5V	In
2	Audio input N	+/-5V	In
3	Amp enable (active low)	Floating: Off, Pulled down: On	In
4	GND		

Connector type equivalent: 43045-0412
Matching cable part: 43025-0400

8.4 J21 XLR Female

Pin number	Description	Level	I/O
1	Audio input P	+/-5V	In
2	Audio input N	+/-5V	In
3	Amp enable (active low)	Floating: Off, Pulled down: On	In
4	GND		

8.5 Audio output

Connector number	Description	Connector type	I/O
J3	Audio output P	Faston vertical 6,3x0,8mm	Out
J4	Audio output N	Faston vertical 6,3x0,8mm	Out
J17	Audio output P	Banana terminal Red	Out
J18	Audio output N	Banana terminal Black	Out

*Audio outputs on J3/J4 and J17/J18 are paralleled.

8.6 J5 JST B06P-VL: Hypex SMPS high power connector

Pin number	Description	Level	I/O
1	VDR P	+15V, referenced from HV N	In
2	HV P	63 - 85V	In
3	GND		
4	VDR N (Connected to HV N)	Same level as HV N	In
5	HV N	-63 - 85V	In
6	GND		

Connector type equivalent: B06P-VL
Matching cable part: VLP-06V

8.7 J6 Box header 10p: Hypex SMPS aux/IO connector

Pin number	Description	Level	I/O
1	Aux P	16 - 25V	In
2	Aux N	-16 - 25V	In
3	GND		
4	N.C.		
5	N.C.		
6	Amp enable (active low)	Floating: Off Pulled down: On	In
7	N.C.		
8	N.C.		
9	GND		
10	DC error (active low)	Floating: normal operation Pulled down: DC error occurred	Out

Connector type equivalent: T821114A1S100CEU
Matching cable part: T812114A100CEU
Contact material: Brass, gold flash over nickel

8.8 J8 Box header 8p: Hypex Hbox connector

Connect to J3 of DSP3-213 (pins 1 to 8)

Pin number	Description	Level	I/O
1	Audio input N		In
2	Audio input P		In
3	GND		
4	Amp mute	Floating: amp in normal operation 0,7V and higher: Amp muted	In
5	Clip (active low)	Normal operation: floating Pulled down when active	Out
6	I2C control		In
7	N.C.		
8	Thermal	Not used	

Connector type equivalent: T821108A1S100CEU
Matching cable part: T812108A100CEU

8.9 J16 JST B2B-EH-A: External standby supply input

Pin number	Description	Level	I/O
1	V standby	4-25V	In
2	GND		

Connector type equivalent: B2B-EH-A
Matching cable part: EHR-2

8.10 J22 JST B2B-EH-A: SMPS standby

Pin number	Description	Level	I/O
1	SMPS standby	Normal operation: V Standby mode: pulled down	Out
2	GND		

Connector type equivalent: B2B-EH-A
Matching cable part: EHR-2

8.11 J9 Header male vertical 4p (2,54mm): I2C connector

Pin number	Description	Level	I/O
1	+3V3	+3V3	
2	SCL	+3V3	In
3	SDA	+3V3	In/Out
4	GND		

See the description about I2C on this evaluation board and paragraph 4.2 of the NCx datasheet for the use of these pins.

Switches S2 (left) and S1 (right)

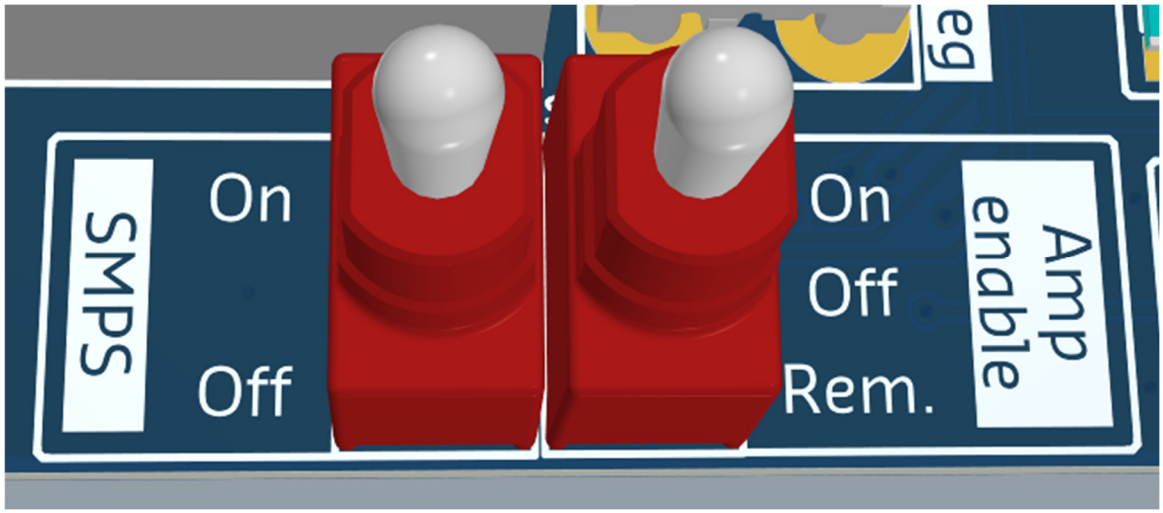


Figure 8. Switches S2 and S1

Always check if switches S1 and S2 are switched to off before turning on the power supplies. If SMPS1200 or SMPS3K is used as power supply and J6 is connected to SMPS, then it is also possible to switch S1 to remote (Rem.). In this case the SMPS or DSP can control the Amp enable signal. Vstandby (J16) is required for the Supply switch (S2).

S1: Amp enable.
Position 1: Amp ON.
Position mid : Amp OFF
Position 2: Amp ON or off, externally determined via Amp enable signal from Hbox (J8.4) or SMPS connector (J6.6).

S2: Supply control
Position 1: Supply ON
Position 2: Supply OFF
Controls SMPS standby pin on J22

9 Dimensions

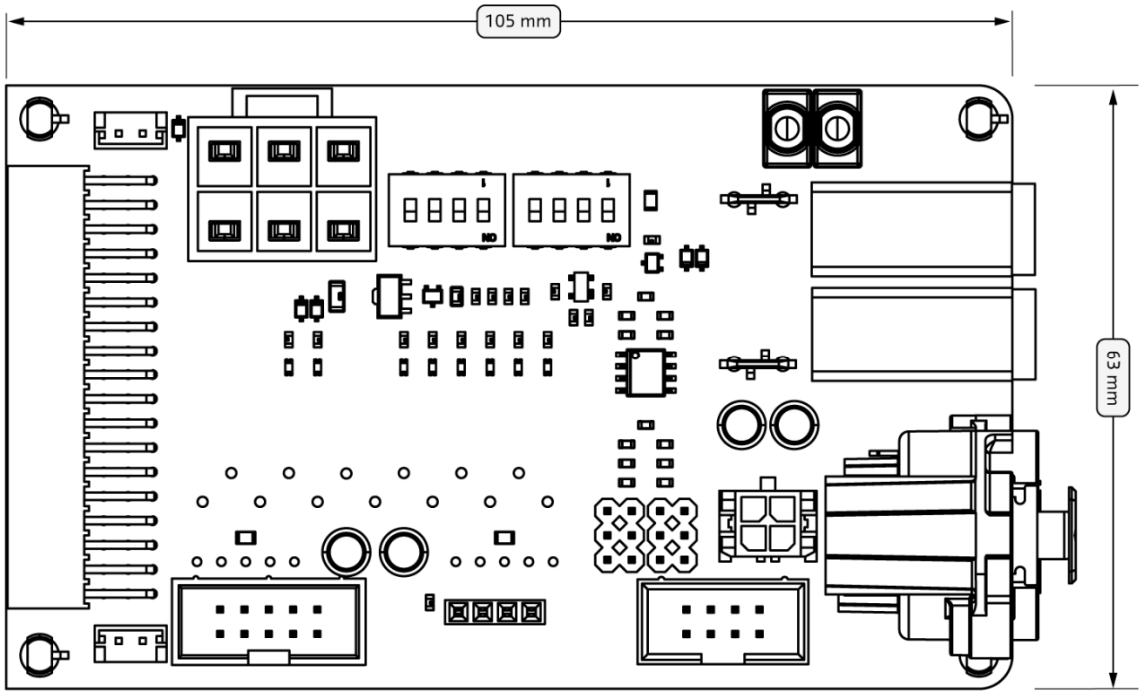


Figure 9. Top view

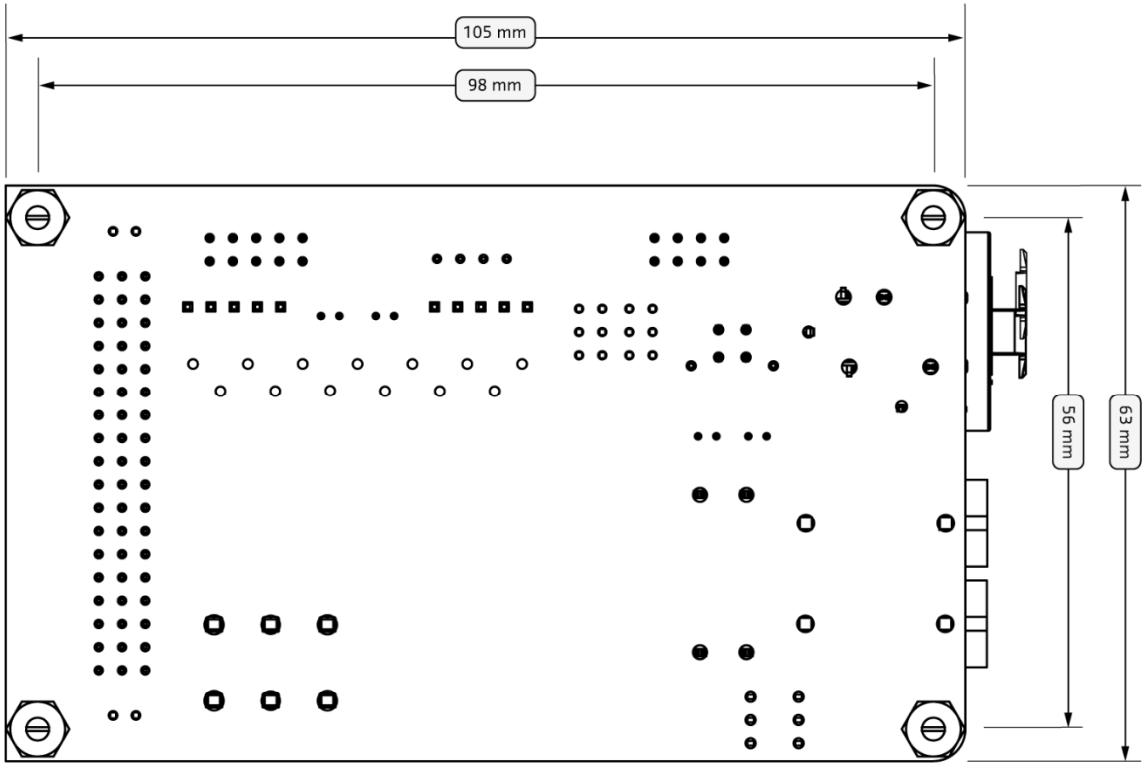


Figure 10. Bottom view

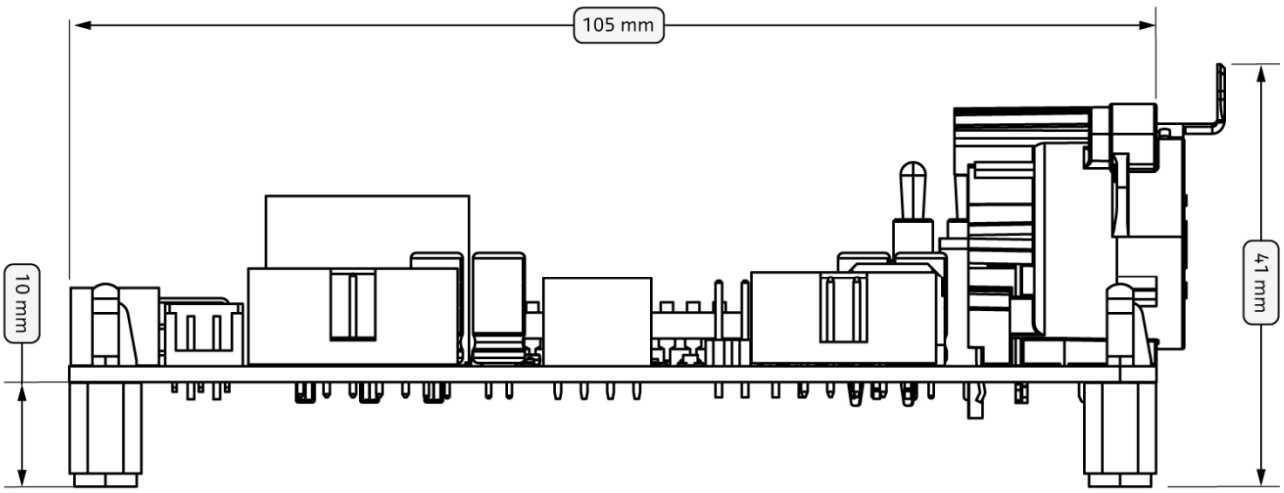


Figure 11. Side view

10 Revisions

Document revision	Change log	Date
01	Release version	Sep. '25

11 Disclaimer

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