AUVIDEA

X221D, X221D-AI

TECHNICAL REFERENCE MANUAL

SCOPE OF WORK
Providing technical information and documentation of the X221D and the X221D-AI carrier boards for the AGX series.

REPORT NUMBER
38500

ISSUE DATE
10.FEB.2022

[REVISED DATE]
[JAN.2023]

Version
1.0

PAGES
39

CONTENTS

SECTION 1 Document revisions and changes

Document version	Changes
0.1	Initial document, internal verification process
0.3	Reduced board variety, fixed appendix B,
0.4	Added AI Version and bottom pinout description and information about swapped labels for J5 and J28

SECTION 2 Product revisions and changes

Product version	Changes
38500	

SECTION 3 Overview

3.1 Introduction

The X221D is intended to be a great development platform with
These systems let you dive into AI with ease. They allow you to explore AI applications like people detection, face masking and more. The full suite of NVIDIA SDKs may be installed. At your choice these systems may be equipped with the entire family of NVIDIA compute modules with the AGX Xavier form factor.
The X221D features an industrial strength design and is commercially deployable in any volume.

3.2 Carrier board features

X221D only components on top side
X221D-AI (All In) top and bottom parts

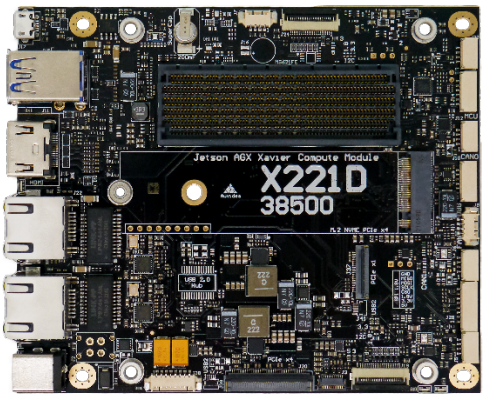
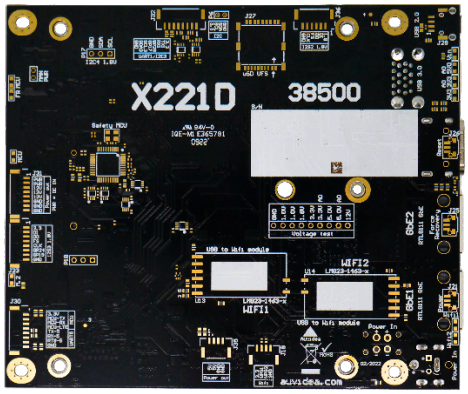
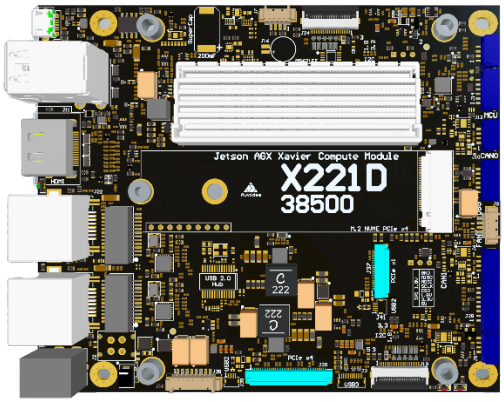
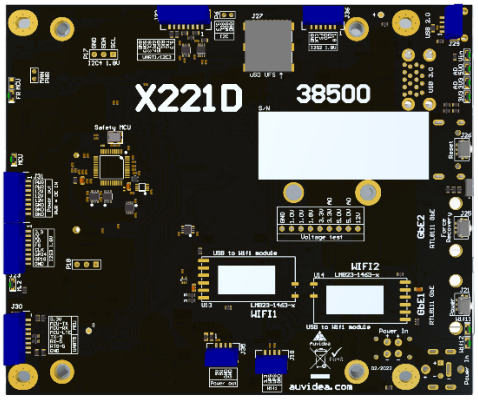
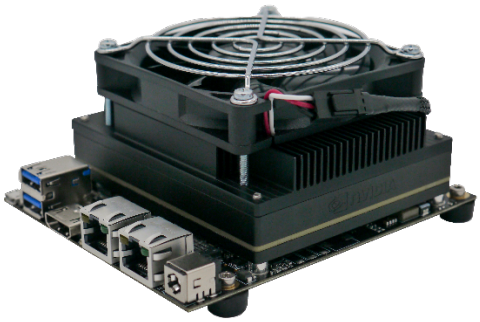
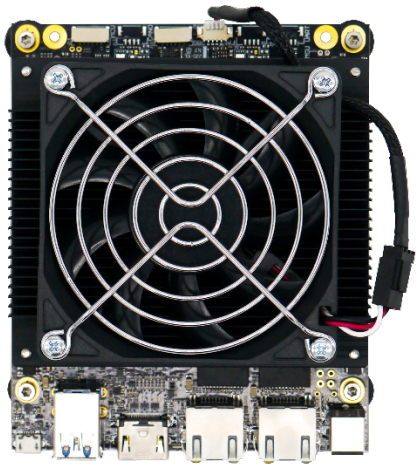
Description	X221D	X221D-AI
Operating Voltage	12V	12V
Jetson power modes	30W + MAXN	30W + MAXN
Supported modules	AGX-Xavier, AGX-Xavier-Industrial	AGX-Xavier, AGX-Xavier-Industrial
Supported module configurations	Configuration 2	Configuration 2
Super Cap UPS	(optional)	(optional)
RTC super cap	200mF	200mF
Rechargeable lithium cell (MS621FE)	(optional)	(optional)
Power out (12V, 5A)	yes	Yes (J31)
Power/Reset/Force-Recovery Buttons	-	yes
Revers voltage protection	yes	yes
Overvoltage protection	yes	yes
HDMI out	1x	1x
USB 2.0	1x microUSB	1xquad USB2.0 hub: (1: J3, 2: J41, 3: U14(LM823), 4: U13(LM823) or J39) 1x microUSB
USB 3.0	2xUSB-A(J15) +1xFPC(J3)	2xUSB-A(J15) +1xFPC(J3)
Safety MCU (for JAXi)	-	yes
Basic MCU	yes	-
GbE (RJ45)	2x RTL8111 (PCIe to Gbe)	2x RTL8111 (PCIe to Gbe)
WIFI	-	- (2x optional LM823-1463)
MicroSD/UFS card slot	-	1x (only SD-Card mode, no UFS)
CAN (RX/TX only)	1x	1x
CAN	1x	1x
UART5	-	1x (J30)
I2S2	-	1x
I2S3	-	1x
I2C	2x	2x
I2C4	-	1x
PCIe x4/I2C combo	1x	1x
PCIe x1	1x	1x
CSI	2x	2x
Auto flashing	yes	yes
Debug port	yes (J10)	yes (J10)

Fan connector (5V, PWM)	1x	1x
RGB LED (GPIO controlled)	yes	yes
Crypto authentication chip	- (planned for rev. 3)	- (planned for rev. 3)

3.3 Technical specification

Description		Note
HDMI	2.0, 4k60p	
USB 3.1	10Gb/s	
Physical size	125mm x 104.6mm	3D STP model available
Mounting holes	For 4x M3	
Temperature range	-25°C to +70°C	Cold temperature monitoring with MCU optional
Humidity	Noncondensing humidity	
Longevity	Very good	No temperature sensitive electrolytic capacitors

3.4 Model pictures

	Top side	Bottom side
X221D		
X221D-AI		
X221D with module and cooler		

The heatsink is designed for the AGX Xavier & AGX Xavier Industrial & AGX Orin. It is designed to mount a standard 80x80mm fan. A production version is available. The Heatsink is not included with the base board. Sets may be available.
Pleas see our Heatsink and Fan solution on our website: https://auvidea.eu/product/70861/
Or our Product Brief for the Heatsink and Fan: https://auvidea.eu/download/D70861.pdf

3.5 Power consumption and efficiency

Description	X221D & X221D-AI
Carrier board logic	1-2W

1.8/3.3/5V power converter efficiency	>90%
Power in converter efficiency	-

3.6 Carrier board comparison

Auvidea provides a variety of compatible boards for the AGX Xavier an AGX Orin. The following table tries to help you find the best fitting carrier board for your needs. For more in depth information about each board pleas see the respective manual.

Description	AGX Xavier compatible	AGX Orin compatible
The	X221	X230
The D-series (developer series) offers	X221D	X230D
This carrier board is similar to the X230D series adding a PCIex8 connector		X231

The following table shows the features and differences in more detail.

	AGX Xavier	AGX Xavier	AGX Orin	AGX Orin
Compatible board	**X220**	**X221D**	**X230D**	**X230**
Recommended configuration	conifg 2	conifg 2	conifg 2	conifg 2
UPHY_RX0/TX0	PCIe x1		PCIe x1 FPC	GbE 2
UPHY_RX1/TX1	USB 3 (ext. optional)	USB 3 FPC 12p	USB 3 Type A	USB 3 Type A
UPHY_RX20/TX20			USB 3 Type A	USB 3 Type A
UPHY_RX21/TX21			GbE 1	GbE 1
UPHY_RX22/TX22			GbE 2	M.2 NVME (C4), RP
UPHY_RX23/TX23				
UPHY_RX10/TX10	UFS	UFS		
UPHY_RX11/TX11	USB 3 Type A	USB 3 Type A		
UPHY_RX11/TX11	M.2 NVME	M.2 NVME	M.2 NVME	PCIe x8 (C5), RP/EP
UPHY_RX13/TX13				
UPHY_RX14/TX14				
UPHY_RX15/TX15				
UPHY_RX16/TX16				
UPHY_RX17/TX17				
UPHY_RX18/TX18				
UPHY_RX19/TX19				
UPHY_RX2/TX2	PCIe x4 on extension connector (for 38451 add-on)	PCIe x4 FPC (J20)	PCIe x4 FPC (J20)	PCIe x8 (C7), RP/EP
UPHY_RX3/TX3				
UPHY_RX4/TX4				
UPHY_RX5/TX5				
UPHY_RX6/TX6	USB 3 Type A	USB 3 Type A		
UPHY_RX7/TX7	GbE 1	GbE 1		
UPHY_RX8/TX8	GbE 2	GbE 2		
UPHY_RX9/TX9				
HDMI_DP2	HDMI	HDMI	HDMI	HDMI

CSI-0 & CSI-1	CSI-AB	CSI-AB	CSI-AB	CSI-AB
CSI-6 & CSI-7	CSI-CD	CSI-CD	CSI-CD	CSI-CD
	supported by X221 when usinga AGX Orin module	supported by X221 when usinga AGX Orin module		

SECTION 4 Features

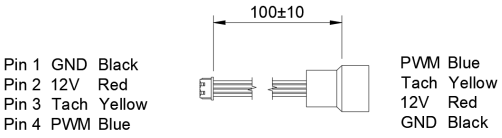
4.1 Crypto authentication chip

Pin	Description
Model	ATSHA204A-SSHDA-T
Datasheet	https://ww1.microchip.com/downloads/en/DeviceDoc/ATSHA204A-Data-Sheet-40002025A.pdf

The crypto chip can be used for authentication, software licensing and copy protection.
The crypto authentication chip is currently not supported. Support is planned for revision 3 of this product.

4.2 Fan connection

4.2.1 Fan + Adapter specification

	Image	Note
X221D + Fan		On the left you see a standard 80x80x15mm fan connected with the adapter cable to the J8 Fan connector.
Adapter cable		On the left you see a drawing of the adapter Kable and the pin description.

4.2.2 Set Fan speed

Set FAN speed to lowest value. Some FANs don't stop when speed is 0.

```
echo 0 > /sys/devices/pwm-fan/target_pwm
```

Set FAN speed to highest value possible

```
echo 255 > /sys/devices/pwm-fan/target_pwm
```

4.2.3 Read Fan speed

command to read FAN tachometer. Value displays in rounds per minute.
(Depending on the FAN this value may need to be scaled/converted)

```
cat /sys/devices/generic_pwm_tachometer/hwmon/hwmon1/rpm
```

4.3 Manufacturing options

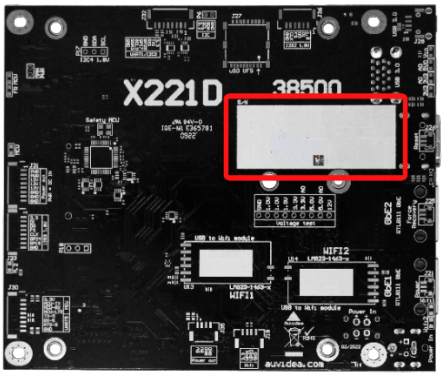
4.3.1 Enclosure

Auvidea can provide custom enclosures for its carrier boards. These enclosures provide a passively cooled solution. This solution is designed for the AGX models. With a max power draw of 35W (normal mode) the enclosure temperature reaches 55C° while in 24°C room temperature which is a safe temperature for Human contact.
The MaxN mode (up to 90W) is not recommended as the enclosure temperature increases above acceptable levels for direct human contact.

It is also possible to apply your branding on the front and back Plate of the Enclosure. Auvidea has inhouse capabilities of laser and milling engraving.

4.3.2 Branding and QR codes

Besides the branding options for the enclosure, it is also possible to customize the label field on the carrier board.

	Image	Note
		In the left image the label field is highlighted.

Auvidea uses the label field to engrave a small QR code and serial number to track production processes.
It is possible to add your custom engravings like logos, text or QR codes to this field.
A laser engraver is used.

4.3.3 Custom configurations

The standard carrier board configuration is designed to suit most use cases.
Please see the Pinout description for customization examples like voltage configurations (3.3V or 1.8V).
We take pride in tailoring our products to your special need and are capable to adjust it in small production series. Please contact Auvidea with your special requests to work out a solution.

SECTION 5 Pinout description top side

5.1 J1 – Power jack

Barrel plug.
12V Input, please use a high quality power supply for stable operation.

5.2 J2 – Power port

Molex MicroFit 3.0 (alternative power input)

5.3 J3 – USB3

Pin	Description	Socket pin	Note
1	VUSB3-3	??	3.3V (how to control power supply?)
2	VUSB3-3	??	3.3V
3	USB2_D_N	A11	
4	USB2_D_P	A10	
5	GPIO22	F54	
6	GND		
7	UPHY_RX1_N	C22	
8	UPHY_RX1_P	C23	
9	GND		
10	UPHY_TX1_N	G22	
11	UPHY_TX1_P	G23	
12	GND		

5.4 J4 – Ethernet

RJ45
Standard pinout.

5.5 J5 – CAM_LED

Pin	Description	Socket pin	Note
1	VCC_SRC		Max 1A
2	VDD_5V		Max 1A
3	GPIO35_PWM3	L50	Low side switch to GND, can be controlled with GPIO35_PWM3 or CAM1-MCLK (1.8-5V) or CAM2-MCLK (1.8-5V) (please see schematic image), Max 3.7A
4	GND		

Please note that on REV 2 and below the J5 and J28 label printed on the pcb is swapped, this mistake is fixed in newer revisions.
Q13 (pin 3) is not over current protected (Max 3.7A).
Set GPIO35_PWM3 too low to activate Q13 (pin3).
As you can see you can control the J5 pin 3 with three options.
The CAM1 and CAM2 control are intended to be set by your camera device

5.6 J6 – CAN1

JST-GH 1.25mm

Pin	Description	Socket pin	Note
1	NC		Not powered
2	CAN1_TX	H61	2.5V center voltage, with CAN transceiver
3	CAN1_RX	B61	2.5V center voltage, with CAN transceiver
4	GND		

CAN1 is RX/TX only and is not outputting power

5.7 J7 – I2C

PicoBlade 1.25mm

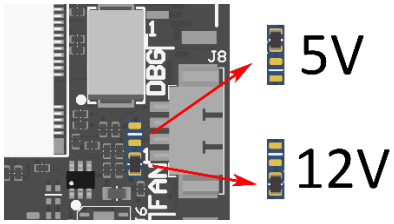
Pin	Description	Socket pin	Note
1	3.3V		
2	SCL	J61	3.3V, open drain
3	SDA	K61	3.3V, open drain
4	GND		

5.8 J8 – FAN

PicoBlade 1.25mm

Pin	Description	Socket pin	Note
1	GND		
2	12V		1A
3	TACH	E54	1.8V input 100K pull up to 1.8V, fan speed tacho
4	PWM	K62	open drain output with 10k pullup to 12V

For the use of a 5V fan there is an option to resolder a component appropriately.



5.9 J10 – Debug port

JST-GH 1.25mm

Pin	Description	Socket pin	Note
1	3.3V		
2	UART3_TX	H62	3.3V, AGX Xavier debug console transmit

3	UART3_RX	K60	3.3V, AGX Xavier debug console receive
4	GPIO13_OUT	G7	3.3V, G7 (AGX Xavier ball), output from Jetson
5	GPIO4_IN	B59	3.3V, B59 (AGX Xavier ball), input to Jetson
6	GND		

5.10 J11 – HDMI

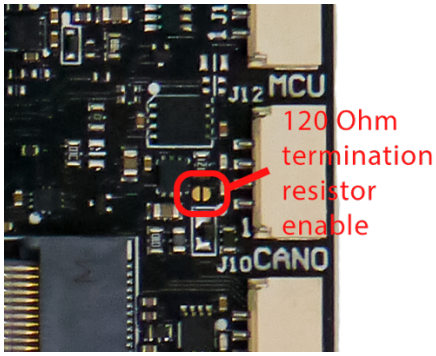
Standard pinout, connected to DP-2

5.11 J12 – CAN0

JST-GH 1.25mm

Pin	Description	Socket pin	Note
1	5V	C61	max 500mA (with current limiting switch), can be controlled with CAN0_STBY (GPIO09), socket pin C61 with low = on, high = off, pin is also reverse power protected
2	CAN0_H	F58	2.5V center voltage, with CAN transceiver
3	CAN0_L	D59	2.5V center voltage, with CAN transceiver
4	GND		

You can set a solder ball to enable 120Ohm Termination resistor as shown in the picture below.



5.12 J14 – MCU

JST-GH 1.25mm

Pin	Description	Socket pin	Note
1	3.3V		
2	MCU_TX		3.3V, MCU console debug port, transmit, 115200 baud, 8N1
3	MCU_RX		3.3V, MCU console debug port, receive, 115200 baud, 8N1
4	SWCLK		ST-Link programming interface of MCU
5	SWDIO		ST-Link programming interface of MCU
6	GND		

With the AI model of the X221 you have access to the safety MCU features. Please contact Auvidea for more information.
The basic MCU of the non AI models only handle power up functionality.

5.13 J15 – 2x USB 3.1

Nexus-3815RFY

Pin	Description	Socket pin	Note
1	Vin		1A, 5V
2	USB3_D_N	G10	
3	USB3_D_P	G11	
4	GND		
5	UPHY_RX11_N	D13	
6	UPHY_RX11_P	D12	
7	GND		
8	UPHY_TX11_N	H13	
9	UPHY_TX11_P	H12	
10	Vin		1A, 5V
11	USB1_D_N	C10	
12	USB1_D_P	C11	
13	GND		
14	UPHY_RX6_N	B17	
15	UPHY_RX6_P	B16	
16	GND		
17	UPHY_TX6_N	K16	
18	UPHY_TX6_P	K17	
19	GND		
20	GND		
21	GND		
22	GND		

Standard pinout (type A).
10Gb/s.
Power can be Enabled/Disabled with GPIO22

5.14 J17 – MICRO USB

Standard pinout.
Host and device mode supported.
Powered by power limiting switch with 500mA.
Alternatively, you can use the J29 connector, using the same pins.

5.15 J19 – CSI-2

Pin	Description	Socket pin	Note
1	VDD_3V3		3.3V
2	SDA-1		Connected to I2C_GP2_Dat_LVS or I2C_GP2_DAT depending on config. I2C bus number 1.
3	SCL-1		Connected to I2C_GP2_CLK_LVS or I2C_GP2_CLK depending on config. I2C bus number 1.
4	GND		
5	CAM1_MCLK	J28	Connected to J28 CAM LED pin 3

6	CAM1_PWDN	K57	Can be controlled with PWM01_40Pin (GPIO_07), default configuration is high, open drain output with pullup 2.2k to 3.3V, this also connects to CAM2_PWDN.
7	GND		
8	CSI_7_D1_P	C47	
9	CSI_7_D1_N	C48	
10	GND		
11	CSI_7_D0_P	A44	
12	CSI_7_D0_N	A45	
13	GND		
14	CSI_6_CLK_P	J44	
15	CSI_6_CLK_N	J45	
16	GND		
17	CSI_6_D1_P	H46	
18	CSI_6_D1_N	H45	
19	GND		
20	CSI_6_D0_P	K44	
21	CSI_6_D0_N	K43	
22	GND		

Per special request Auvidea can manufacture the board with CAM1_PWDN and CAM2_PWDN with pullup to 1.8V.

5.16 J20 – PCIe x4

Pin	Description	Socket pin	Note
1	VDD_3V3		3.3V
2	VDD_3V3		3.3V
3	VDD_3V3		3.3V
4	GND		
5	PEX_CLK0_P	E15	
6	PEX_CLK0_N	E14	
7	GND		
8	UPHY_TX2_P	K21	
9	UPHY_TX2_N	K20	
10	GND		
11	UPHY_RX2_P	B21	
12	UPHY_RX2_N	B20	
13	GND		
14	UPHY_TX3_P	H20	
15	UPHY_TX3_N	H21	
16	GND		
17	UPHY_RX3_P	D20	
18	UPHY_RX3_N	D21	
19	GND		
20	UPHY_TX4_P	J18	
21	UPHY_TX4_N	J19	
22	GND		
23	UPHY_RX4_P	A18	
24	UPHY_RX4_N	A19	

25	GND		
26	UPHY_TX5_P	G19	
27	UPHY_TX5_N	G18	
28	GND		
29	UPHY_RX5_P	C19	
30	UPHY_RX5_N	C18	
31	GND		
32	PEX_WAKE_N	A8	
33	PEX_L0_RST_N	D10	
34	GND		
35	I2C_GP2_DAT_LVS	???	
36	I2C_GP2_CLK_LVS	???	
37	PEX_L0_CRQ_N	E11	
38	VDD_3V3		3.3V
39	VDD_3V3		3.3V
40	VDD_3V3		3.3V

5.17 J22 – ETHERNET

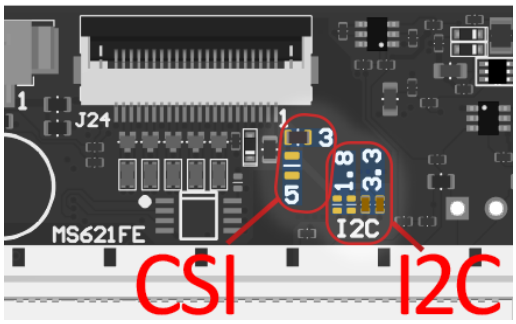
Standard pinout.

5.18 J24 – CSI-1

Pin	Description	Socket pin	Note
1	VDD		3.3V (5V see instructions)
2	FT-SDA		Connected to FT_SDA or I2C_GP5_DAT depending on configuration (what is standard?)
3	FT-SCL		Connected to FT_SCL or I2C_GP5_CLK (gibt kein GP5!!!)depending on configuration
4	GND		
5	CAM2_PWDN	F57	Can be controlled with PWM01_40Pin (GPIO_07, socket pin F57), default configuration is high, open drain output with pullup 2.2k to 3.3V, this also connects to CAM1_PWDN
6	CAM2—MCLK		Connected to J28 CAM LED pin 3
7	GND		
8	CSI_1_D1_P	J41	
9	CSI_1_D1_N	J42	
10	GND		
11	CSI_1_D0_P	G41	
12	CSI_1_D0_N	G42	
13	GND		
14	CSI_0_CLK_P	F43	
15	CSI_0_CLK_N	F42	
16	GND		
17	CSI_1_D1_P	E39	
18	CSI_1_D1_N	E38	
19	GND		
20	CSI_0_D0_P	E42	

21	CSI_0_D0_N	E41	
22	GND		

Per special request Auvidea can manufacture the board with CAM1_PWDN and CAM2_PWDN with pullup to 1.8V.
CSI default voltage is 3.3V but it can be changed to 5V. To perform this modification, you need to move the bead from the 3.3V location (marked with the number 3 as shown in the picture) to the 5V location (marked with the number 5 as shown in the picture).
The same process applies to I2C where you must move two beads to the desired location of 1.8 (1.8V) or 3.3 (3.3V).
This modification should be performed with care and some good soldering skills.
Auvidea does not cover damages inflicted by poorly performed modifications.
Please contact Auvidea for custom configurations.

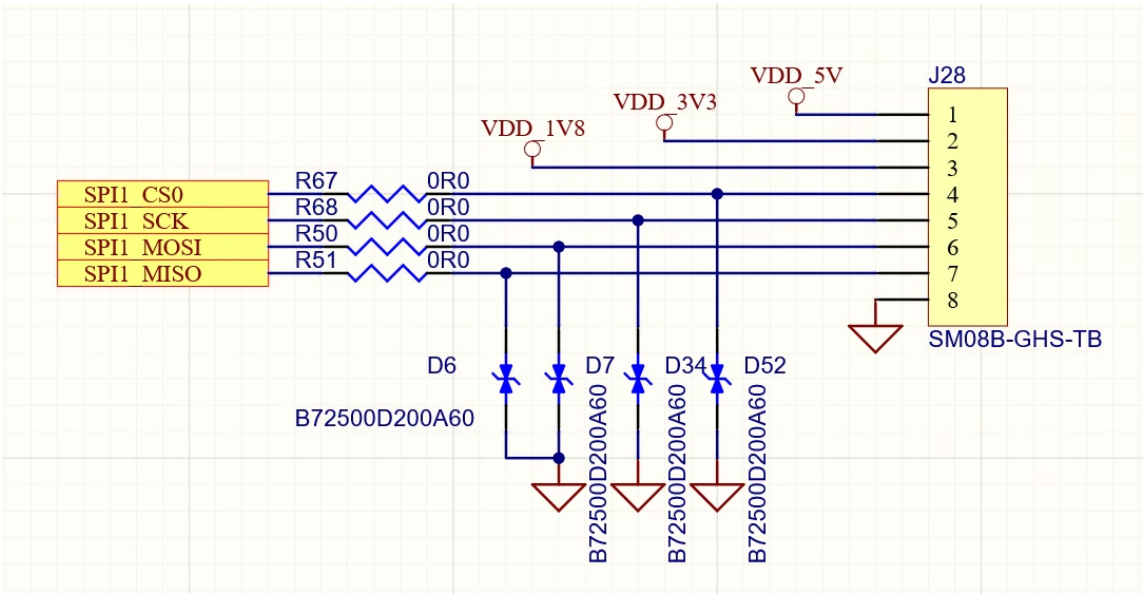


5.19 J28 – SPI

SM08B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD_5V		5V
2	VDD_3V3		3.3V
3	VDD_1V8		1.8V
4	SPI1_CS0	E55	
5	SPI1_SCK	J57	
6	SPI1_MOSI	D55	
7	SPI1_MISO	A56	
8	GND		

Please note that on REV 2 and below the J5 and J8 label printed on the pcb is swapped, this mistake is fixed in newer revisions.



5.20 J33 – I2C

Pin	Description	Socket pin	Note
1	VDD_5V		5V, overvoltage protected
2	FT_SCL	???	overvoltage protected
3	FT_SDA	???	overvoltage protected
4	GND		

5.21 J37 – PCIe x1

Pin	Description	Socket pin	Note
1	GND		
2	GPIO17_40HEADER	A54	
3	PEX_WAKE_N	A8	
4	GND		
5	PEX_L1_CRQ_N	D9	
6	PEX_L1_RST_N	B9	
7	GND		
8	UPHY_RX0_N	A23	
9	UPHY_RX0_P	A22	
10	GND		
11	UPHY_TX0_N	J23	
12	UPHY_TX0_P	J22	
13	GND		
14	PEX_CLK1_N	F17	
15	PEX_CLK1_P	F16	
16	GND		
17	VDD_3V3		3.3V
18	VDD_3V3		3.3V
19	GND		
20	VDD_5V		5V
21	VDD_5V		5V
22	GND		

5.22 J38 – VCC_SRC

Pin	Description	Socket pin	Note
1	VCC_SRC		12V
2	VCC_SRC		12V
3	VCC_SRC		12V
4	VCC_SRC		12V
5	GND		
6	GND		
7	GND		
8	GND		

5A total

5.23 J39 – USB2

Pin	Description	Socket pin	Note
1	GND		
2	VDD_3V3		3.3V
3	D1_P	A10	Internal USB hub AND LM823 module share lane! HUB: USB2_D_P (socket pin A10)
4	D1_N	A11	Internal USB hub AND LM823 module share lane! HUB: USB2_D_N (socket pin A11)
5	VUSB2_3		Spannung? 5V? schaltbar?

This functionality is not available in standard configuration.
Per special request Auvidea can manufacture the board with this function.

5.24 J41 – USB2

Pin	Description	Socket pin	Note
1	GND		
2	VDD_3V3		3.3V
3	D2_P	A10	Internal USB hub, HUB: USB2_D_P(socket pin A10)
4	D2_N	A11	Internal USB hub, HUB: USB2_D_N (socket pin A11)
5	VDD_5V		5V

This functionality is not available in standard configuration.
Per special request Auvidea can manufacture the board with this function.

5.1 RGB LED

Pin	Description	Socket pin	Note
LED-R	GPIO15_CAM1_PWDN	B8	
LED-G	GPIO16_CAM1_RST	F10	
LED-B	GPIO11_CODEC_INT	F9	

SECTION 6 Pinout description bottom side

6.1 J18 – WiFi

SM04B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD_3V3		
2	WPS_U13		
3	WPS_U14		1nF to GND, 10k series
4	GND		

6.2 J21 – Power button

6.3 J23 – I2S3

SM08B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD		3V3
2	I2S3_DIN		GPIO3 PA.06
3	I2S3_DOUT		GPIO3 PA.05
4	I2S3_FS		GPIO3 PA.07
5	I2S3_SCLK		GPIO3 PA.04
6	GPIO24_SAR_TOUT		GPIO3 PM.03, J51
7	GPIO19_SLVS_VSYNC		GPIO3 PQ.07, K56
8	GND		

6.4 J25 – Force recovery button

6.5 J26 – Reset button

6.6 J27 – MicroSD UFS

Standard pinout.

6.7 J29 – USB 2.0

SM04B-GHS-TB

Pin	Description	Socket pin	Note
1	V_USB		
2	USB0-D N		
3	USB0-D P		
4	GND		

Alternative connector for J17 (Micro USB), uses same pins.

6.8 J30 – UART5 + MCU

SM08B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD		3.3V
2	UART_TXD		3.3V, to safety MCU
3	UART_RXD		3.3V, to safety MCU
4	LTE_INT		3.3V, to safety MCU
5	UART5_TX		3.3V
6	UART5_RX		3.3V
7	UART5_RTS	K58	3.3V, output,
8	GND		

6.9 J31 – Power out

SM08B-GHS-TB

Pin	Description	Socket pin	Note
1	VCC_SRC_FET		Input Voltage = 12V (always on)
2	VCC_SRC_FET		Input Voltage = 12V (always on)
3	VCC_SRC		12V
4	VCC_SRC		12V
5	VCC_SRC		12V
6	GND		
7	GND		
8	GND		

6.10 J32 – UART1/I2C3

SM08B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD		3V3
2	UART1_TX		3V3
3	UART1_RX		3V3
4	GPIO_25_Out		
5	GPIO_17_In		
6	I2C_GP3_CLK_PEX_LVS		
7	I2C_GP3_DAT_PEX_LVS		
8	GND		

6.11 J35 – Power out

SM04B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD_5V		5V, 20.1uF
2	VDD_5V		5V, 20.1uF
3	GND		
4	GND		

6.12 J36 – I2S2

SM06B-GHS-TB

Pin	Description	Socket pin	Note
1	VDD_1V8		1.8V
2	I2S2_SDIN		
3	I2S2_SDOUT		
4	I2S2_FS		
5	I2S2_CLK		
6	GND		

6.13 U13 – LM823-1463 bay

Bay for the additional WiFi option. Default 3.3V, can be configured for 5V options.

6.14 U14 – LM823-1463 bay

Bay for the additional WiFi option. Default 3.3V, can be configured for 5V options.

6.15 P6 – Jumper

Do not use. For production purposes only.

6.16 P17 – I2C4

Pin	Description	Socket pin	Note
1	I2C_GP4_CLK		1k pullup to 1.8V
2	I2C_GP4_DAT		1k pullup to 1.8V
3	GND		

6.17 P18 – Alternativ power button and monitoring pin

Pin	Description	Socket pin	Note
1	BUTTON_POWER_ON*		Low active, secondary power button
2	VIN_PWR_ON		High active, output for monitoring power up of main power control of carrier board
3	GND		

SECTION 7 Frequently Asked Questions

- Why is my X221 not going into force recovery?
  - If your system is not going into force recovery, please contact our support as you may got a system with a mismatched firmware.
- Why is my system not entering the force recovery state?
  - Most of our carrier boards are design to enter force recovery mode when they detect a Host PC. This detection only works one time automatically after the system was connected to its power supply. We recommend unplugging your system bevor connecting to a Host PC and plugging it back in to power after connecting.
  - If your system still does not enter force recovery you may have to press the force recovery button or short the respective pins bevor connecting to power (please see the Technical Reference Manual for a detailed pinout description).
  - If you cannot disconnect your system from power, it is also possible to enter force recovery via a button sequence.
    - Press/jumper “force recovery” button/pins
    - Press/jumper “reset” button/pins
    - Release/disconnect “reset” button/pins
    - Release/disconnect “force recovery” button/pins a few seconds later then the “reset” button/pins

SECTION 8 Disclaimer

Thank you for reading this manual. If you have found any typos or errors in this document, please let us know.
This is the preliminary version of this data sheet. Please treat all specifications with caution as there may be any typos or errors.

The Auvidea Team

SECTION 9 Copyright notice

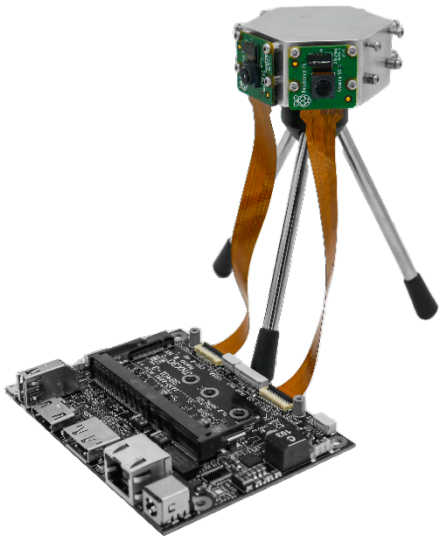
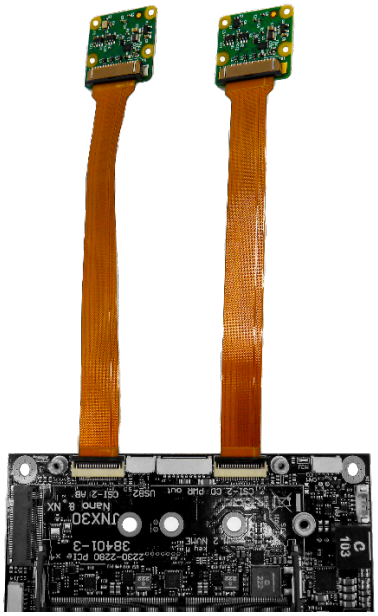
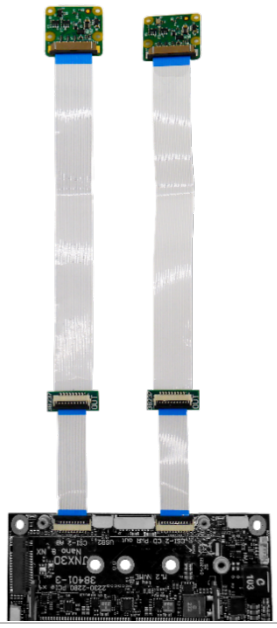
Trademarks
NVIDIA, the NVIDIA logo, CUDA, Jetson, Maxwell, Tegra, Nano and VisionWorks are registered trademarks and/or trademarks of NVIDIA Corporation in the United States and other countries. Other company and product names may be trademarks of the respective companies with which they are associated.

SECTION 10 Appendix A [CSI-Cameras]

This Appendix shows different CSI camera connection options and how to test your camera

10.1 Camera connection example

CSI cameras can connect to J5-CSI-2-CD and J19–CSI-2-AB connector as shown below.

	22 pin 0.5mm to 15 pin 1.0mm FPC cable	Using 38237 adapter + cable
		
		

10.2 Test CSI-Camera functionality

The CSI-Cameras should show up under /dev/video0 and /dev/video1
You can test the CSI-Cameras with the Gstreamer.
This framework should be already included in your Jetpack and can be used as follows:

```
//CSI-Camera0:
gst-launch-1.0 nvarguscamerasrc sensor-id=0 ! 'video/x-raw(memory:NVMM),width=3820, height=2464,
framerate=21/1, format=NV12' ! nvvidconv flip-method=0 ! 'video/x-raw,width=960, height=616' !
nvvidconv ! nvegltransform ! nveglglessink -e

//CSI-Camera1:
gst-launch-1.0 nvarguscamerasrc sensor-id=1 ! 'video/x-raw(memory:NVMM),width=3820, height=2464,
framerate=21/1, format=NV12' ! nvvidconv flip-method=0 ! 'video/x-raw,width=960, height=616' !
nvvidconv ! nvegltransform ! nveglglessink -e
```

*tested with raspberry pi camera module v2

A window with the camera stream is going to pop up if everything worked out correctly.

SECTION 11 Appendix B [GPIO]

This Appendix covers the basics of GPIO usage and provides a reference sheet for the socket pin to GPIOnumber correlation. This section only focuses on the GPIO capable pins. Pins that are not able to be used as GPIOs are not listed in the reference sheet. (They are most likely CSI, I2C or PCIe lanes)

11.1 GPIO control

This example shows how to set and read out GPIO 414.
For different GPIO numbers replace the number (414) accordingly.

11.1.1 Export GPIO

```
nvidia@nvidia-desktop:~$ echo 414 > /sys/class/gpio/export
nvidia@nvidia-desktop:~$
```

11.1.2 Change direction to in

```
nvidia@nvidia-desktop:~$ echo in > /sys/class/gpio/gpio414/direction
nvidia@nvidia-desktop:~$
```

11.1.3 Change direction to out

```
nvidia@nvidia-desktop:~$ echo out > /sys/class/gpio/gpio414/direction
nvidia@nvidia-desktop:~$
```

11.1.4 Set GPIO low

```
nvidia@nvidia-desktop:~$ echo 0 > /sys/class/gpio/gpio414/value
nvidia@nvidia-desktop:~$
```

11.1.5 Set GPIO high

```
nvidia@nvidia-desktop:~$ echo 1 > /sys/class/gpio/gpio414/value
nvidia@nvidia-desktop:~$
```

11.1.6 Readout GPIO value

```
nvidia@nvidia-desktop:~$ cat /sys/class/gpio/gpio414/value
0
nvidia@nvidia-desktop:~$ cat /sys/class/gpio/gpio414/value
1
```

Error! Not a valid link.

SECTION 12 Appendix C [I2C]

This Appendix shows the basic usage of the I2C bus.

12.1 I2C device bus

I2C Examples of configurations and how to use.

Bus	GEN1_I2C	GEN2_I2C	GEN3_I2C	CAM_I2C
Pins	185 and 187	189 and 191	232 and 234	213 and 215
Voltage (native)	3.3V	3.3V	1.8V	3.3V
Nano device	0	1		6
TX2 NX device	0	1		
Xavier NX device	1	8		2
Crypto chip		ATSHA204A		
CSI-2 camera	CSI-CD	CSI-E	CSI-F	CSI-AB
GPIO header	27 and 28	3 and 5		
EEPROM		24LC024		

12.2 I2C usage of devices and registers

12.2.1 List i2c devices on a specific bus

Syntax: i2cdetect [options] <busNr>

```
test@test-desktop:~$ i2cdetect -y -r 8
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00: -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- 76 --
test@test-desktop:~$
```

12.2.2 Dump i2c device registers

Syntax: i2cdump [options] <busNr> <deviceAddress>

```
test@test-desktop:~$ i2cdump -y -f 8 0x76
No size specified (using byte-data access)
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f  0123456789abcdef
00: 00 00 ff ff 00 00 ff ff XX XX XX XX XX XX XX XX ........XXXXXXXX
10: XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XXXXXXXXXXXXXXXX
20: XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XXXXXXXXXXXXXXXX
...
d0: XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XXXXXXXXXXXXXXXX
e0: XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XXXXXXXXXXXXXXXX
f0: XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XXXXXXXXXXXXXXXX
test@test-desktop:~$
```

12.2.3 Set register value:

Syntax: i2cset [options] <busNr> <deviceAddress> <register> <address> <value>

```
test@test-desktop:~$ sudo i2cset -y -f 8 0x76 0x06 0x00
test@test-desktop:~$
```

12.2.4 Read register value:

Syntax: i2cget [options] <busNr> <deviceAddress> <register> <address>

```
test@test-desktop:~$ sudo i2cget -y -f 8 0x76 0x06
0x00
test@test-desktop:~$
```

12.2.5 Test IMX219 camera stream

The parameter `sensor-id=` describes the camera target. This id can be found by using `ls /dev/`. If the camera correctly plugged in then there should be a device called `/dev/videoX`, where X is the camera id.

```
test@test-desktop:~$ gst-launch-1.0 nvarguscamerasrc sensor-id=0 ! 'video/x-
raw(memory:NVMM), width=(int)1280, height=(int)720, format=(string)NV12,
framerate=(fraction)30/1' ! nvvidconv ! queue ! xvimagesink
```

SECTION 13 Appendix D [SSD-Boot]

If you are interested at booting your system fully or partially from SSD pleas see our Software Setup Guide on our support site. https://auvidea.eu/manuals/
The information from this Appendix D has been moved to the Software Setup Guide.

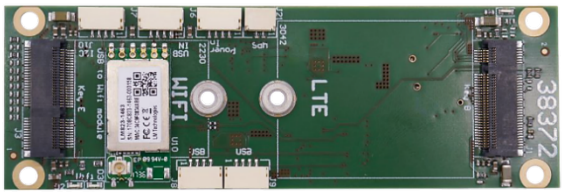
SECTION 14 Appendix E [Wi-Fi]

This appendix describes how you can bring Wi-Fi functionality to one of Auvidea JN boards afterwards. If you possess a different carrier board line-up parts of this Appendix still apply and provide valuable information.
Please note that exclusively USB-only Wi-Fi cards are supported at the moment.
This excludes PCIe Wi-Fi cards from Intel ore other vendors.
Future development aims to also provide solutions for PCIe Wi-Fi cards.
Please contact Auvidea for custom solutions when needed.

14.1 Options from AUVIDEA

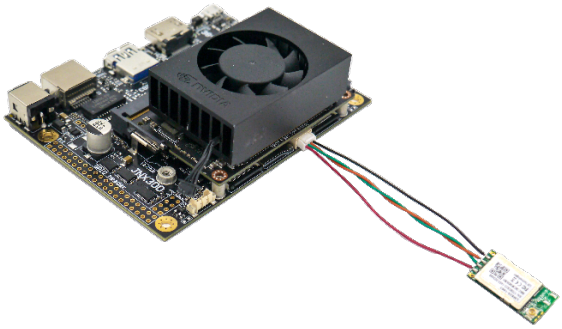
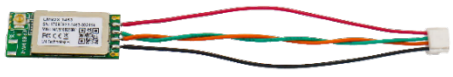
14.1.1 U100 Adapter

The U100 is an adapter board with four port USB 2.0 hub and 1x M.2 Key E slot for USB only Wi-Fi cards and M.2 Key B for LTE cards.
A version of U100 with already integrated LM823 Wi-Fi is available from Auvidea.

	U100	Note
Image		This adapter connects to the J8 connector as shown in “LM823 with cable” https://auvidea.eu/product/38372/

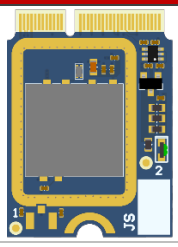
14.1.2 LM823 with cable

Simple solution to connect a LM823 (5V only!) module to the J8 connector on the JNX30D carrier board.

	Setup example	Kabel + LM823-module
Image		

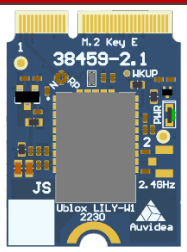
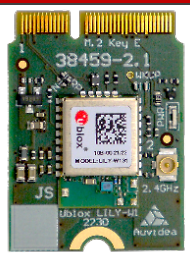
Please contact Auvidea for samples.

14.1.3 38458 Wi-Fi card

	38458 Wi-Fi card	Note
		M.2 Key E Wi-Fi card with RTL8188 module.

Please contact Auvidea for samples.

14.1.4 38459 Wi-Fi card

	38459 Wi-Fi card	38459 Wi-Fi card	Note
			M.2 Key E Wi-Fi card with Ublox Lily W-131 module.

Please contact Auvidea for samples.

14.1.5 U101 Adapter

[in development] A simple adapter from internal USB connector to M.2. Enables the use of USB only Wi-Fi cards.
Please contact Auvidea for samples.

14.1.6 U102 Adapter

[in development] A simple adapter board for the LM823 module with 3.3V power for the 3.3V version of LM823.
Please contact Auvidea for samples.

14.2 Options from other sources

14.2.1 ST60-2230C-UU by Laird

The M.2 Key E ST60-2230C-UU by Laird is evaluated and validated from Auvidea. Can be installed in the U100 Adapter. Auvidea can provide this card. Please ask for a quote.

14.2.2 Further modules

Also, any M.2 USB only Wi-Fi cards should be compatible with the boards from Auvidea.
When using different modules then suggested you must conduct your own verification process.

14.3 DIY integration

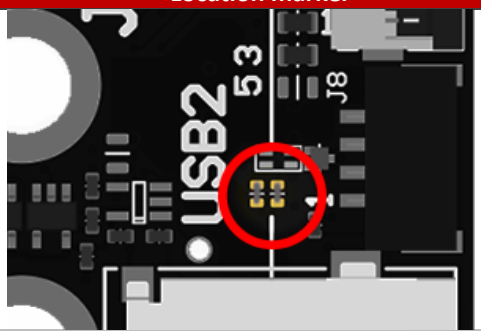
This example shows the integration of LM823 Wi-Fi module into the JN30D (38488-2). Similar steps may be applicable to your product.
Note that not all carrier boards support this modification/integration!
Please contact Auvidea for support if you have problems with different carrier boards.

You will need:

- LM823 Module (3.3V or 5V)
- Three beads (0201 0-Ohm)
- Soldering skills

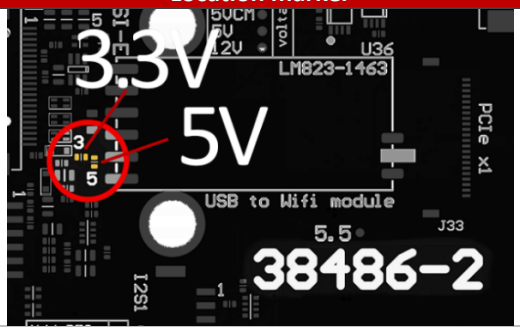
14.3.1 Enable USB interface

The LM823 module when soldered to the appropriate bay is using the USB 2.0 lanes from the J8 USB connector. When performing this modification, the J8 USB port must not be used afterwards!

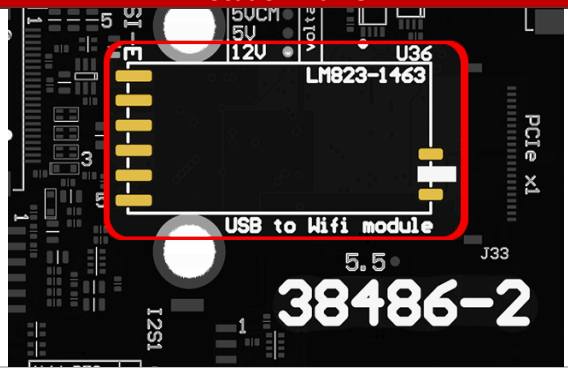
	Location marker	Note
USB-beads		Solder two beads next to the J8 USB 2.0 connector (vertical orientation) to the location marked with the red circle. This will connect J8 to the LM823 solder pins.

14.3.2 Set voltage

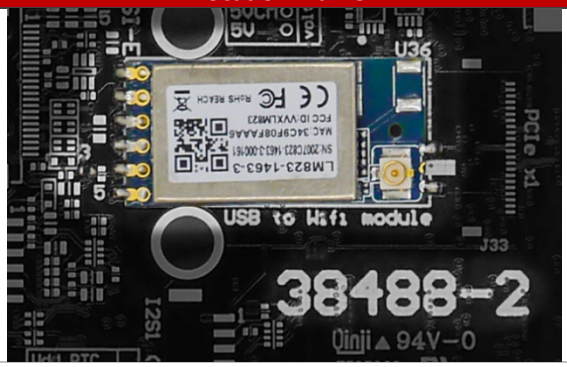
On the underside pleas first set the appropriate voltage for your LM823 module.

	Location marker	Note
Voltage select		Soldering on a bead to ether the 3 (3.3V) ore 5 (5V) location as displayed in the picture. Please check your LM823 module needs.

14.3.3 Soldering on Module

	Location marker	Note
LM823 bay		The LM823 module can be easily soldered to the pins.

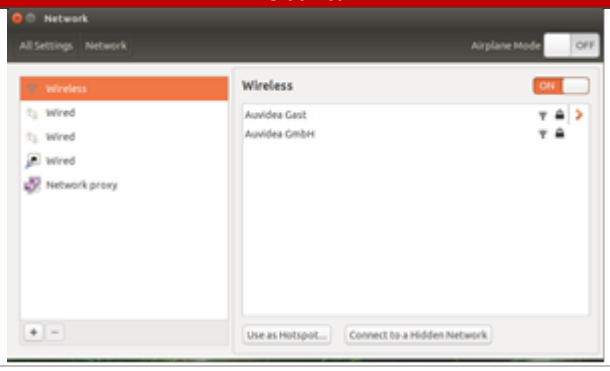
14.3.4 Result

	Location marker	Note
Reference		After soldering on your module your result should look like displayed here. After connecting the antenna to the Wi-Fi module, you can start your system and test if it gets recognised.

14.4 Test Wi-Fi module connection

14.4.1 With GUI

You can check Wi-Fi functionality with the Ubuntu GUI

	Ubuntu	Note
Wi-Fi test		After installing a Wi-Fi module, it should be a visible network in the Ubuntu Network GUI.

14.4.2 Without GUI

USB devices can also be listed with lsusb:
Module is highlighted in red.

```
test@test-desktop:~$ lsusb
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 003: ID 0bda:8179 Realtek Semiconductor Corp. RTL8188EUS 802.11n Wireless Network
Adapter <- LM module
Bus 001 Device 006: ID 1058:25a2 Western Digital Technologies, Inc.
Bus 001 Device 005: ID 04ca:007d Lite-On Technology Corp.
Bus 001 Device 004: ID 046d:c077 Logitech, Inc. M105 Optical Mouse
Bus 001 Device 002: ID 05e3:0608 Genesys Logic, Inc. Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
test@test-desktop:~$
```