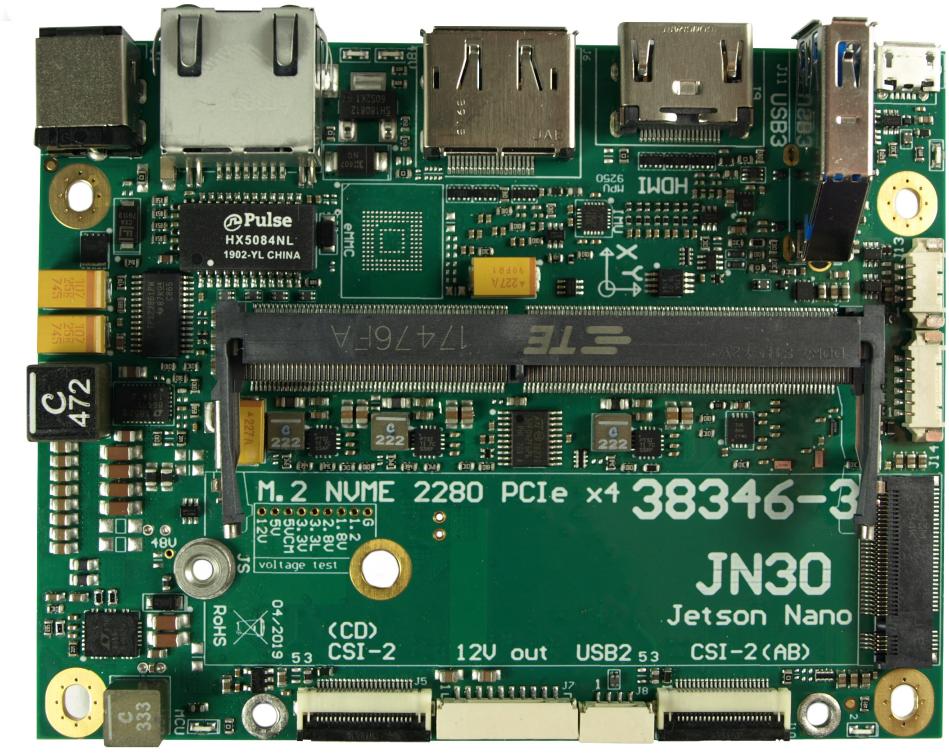
JN30
technical reference manual

38346-X

Version 1.0



Preliminary

September 2019

Auvidea GmbH
Kellerberg 3
D-86920 Denklingen
Tel: +49 8243 7714 622
info@auvidea.com
www.auvidea.com

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.

© Auvidea GmbH 2019

All Rights Reserved
No part of this document or any of its contents may be reproduced, copied, modified or adapted, without the prior written consent of the author, unless otherwise indicated for stand-alone materials.
You may share this document by any of the following means: this PDF file may be distributed freely, as long as no changes or modifications to the document are made.
For any other mode of sharing, please contact the author at the email below. info@auvidea.com
Commercial use and distribution of the contents of this document is not allowed without express and prior written consent of Auvidea GmbH.

Features

JN30 carrier board for the NVIDIA Nano

The JN30 has been designed slightly larger than the dev kit version but with the maximum performance and full use of all the interfaces needed to serve your needs.

Technical details

- carrier board for one NVIDIA® Nano™ compute module (dev kit or production version)
- PoE (PSE/PD) optional
- one USB 3.0 type A vertical
- RJ45 connector for 1000bT Ethernet (GbE)
- UART 0 (3.3V TTL) (6 pin) - console access
- fan connector (4 pin)
- HDMI and display port out
- M.2 key M 2280 NVME PCIe x4
- size: 81,7mm x 104,6mm (size of the PCB with all components)
- height: 21 mm (with NVIDIA® Nano™ compute module)
- mounting: 4 holes with 3.2mm each
- model: 38346

Power

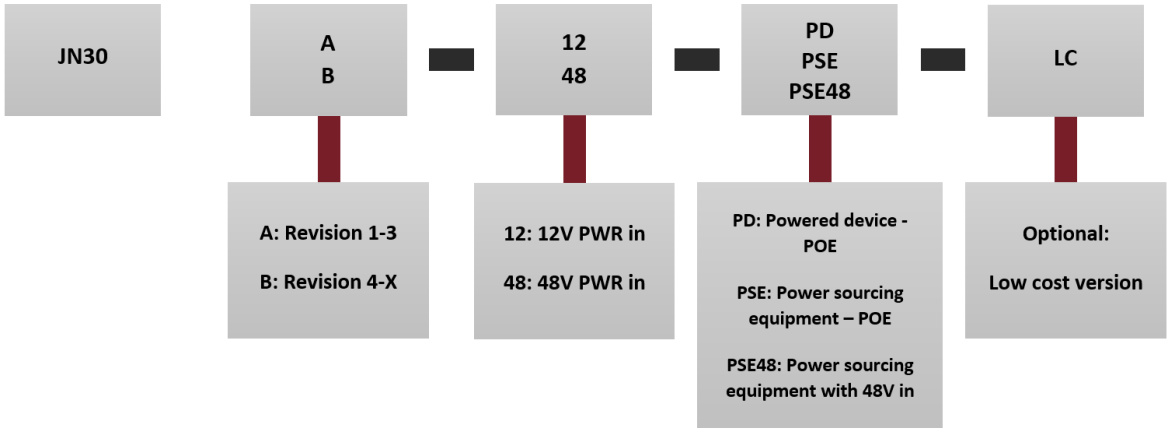
- power: 12 - 48V (depending on the version - more on page 05)

The JN30A is designed for the dev kit version of the Nano compute module.

The JN30B is designed for the production version of the Nano compute module. The version is shipped as a bare module. Auvidea can supply the mounting kit with spring and screws. Also a heat sink or a heat spreader.

The 2 versions of the Nano compute module are not pin compatible and therefore not interchangeable.

The diagram below shows how the ordering code is assembled.



Overview

Feature	JN30-LC	JN30-PD	JN30-PSE	JN30-PSE48
HDMI out	✓	✓	✓	✓
Display port out	-	✓	✓	✓
48V power in capable	-	✓	✓	✓
micro USB 2.0 OTG	✓	✓	✓	✓
USB 3.0 type A	✓	✓	✓	✓
10/100/1000 Ethernet (RJ45)	✓	✓	✓	✓
IMU MPU-9250 (optional 9 axis sensor)	-	✓	✓	✓
PoE version	-	PoE PD (class 4; up to 25.5W)	PoE PSE (up to 15W)	PoE PSE (up to 30W out)
Components on both sides	-	✓	✓	✓
M.2 slot (NVME PCIe x4)	-	✓	✓	✓
UART0 (3.3V TTL debug access)	1	1	1	1
CSI-2 (22 pin - 4 lanes)	2	2	2	2
CSI-2 (22 pin - 2 lanes) (starting rev 5 only)	-	✓	✓	✓
fan connector	✓	✓	✓	✓
power in (5.5/2.5mm)	6..12V	6 .. 48V	6 .. 48V	48V
UPS backup support (supercap add-on module)	-	✓	✓	✓

The JN30B starting with rev 5 adds to extra 2 lanes CSI-2 connectors on the bottom side.

The supercap add-on module is still in design. It allows to power the JN30 and Nano for a few minutes to supporters a graceful power down in case of a sudden power loss.

Auto flashing
Just connect a USB OTG cable from your host PC and power up the JN30/Nano. No need to press any switches. The MCU will detect this condition and control the switches appropriately.

Add -on modules

- 38363: 4 port 100bT Ethernet with PoE PSE to connect to 4 network IP cameras
- 38372: M.2 LTE and M.2 Wifi adapter

JN30

This new JN30 carrier board turns the Jetson Nano compute module into a super mini computer. The Nano offers very high computational (quad core ARM Cortex-A57 with up to 1.43 GHz) and graphical (NVIDIA Maxwell with 128 CUDA cores) processing performance in a tiny form factor.

The JN30 comes with three options for POE:

- PD
- PSE
- PSE48

PD:

The JN30 is a powered device (PD). The JN30 receives its power via the ethernet socket (RJ45) from an ethernet switch. The JN30-PD is designed to be a Class 4 device. This provides the power budget for a Nano at full power and USB3 peripherals connected (up to 25.5W; POE+). Optionally it may be set for class 3. Please contact us for details.

PSE:

A JN30 with POE PSE (power sourcing equipment) (PSE) can power a connected PoE device such h as a network IP camera. PSE is working with up to 12.95W (class 3). Please pay special attention to the temperature of the onboard 12V-48V power supply. At high loads the 12V to 48V power supply may heat up. Extra cooling may be required.

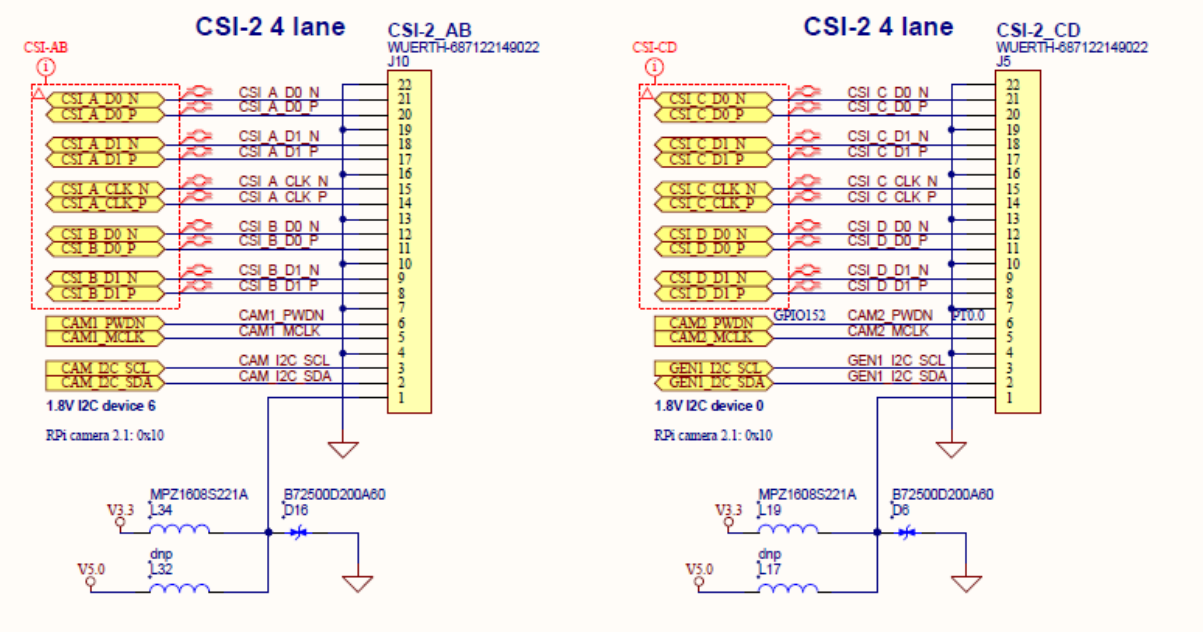
PSE48:

This version is very similar to the JN30 PSE version. The difference is that it does not have the on board 12V to 48V power supply. Instead it requires a 48V DC power adapter.
Advantages over PSE version:
+ less heat dissipation on the JN30 (no DC up converter)
+ class 4 support
+ lower cost

JN30-POE config	PD	PSE	PSE48
Only 12V	-	-	-
Only 48V	-	-	✔
12V-48V	✔	✔	-
Class	Class 4	Class 3	Class 4

CSI

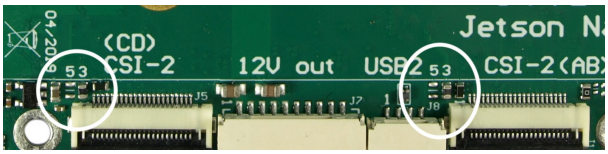
By default the CSI-2 connectors are configured for 3.3V power to power cameras such as the RPi camera 2.1 with imx219 sensor or B112 module.
You can find these beads on the picture below. If the beads L34 and/or L19 are populated, 3.3V is used for CSI. If L32 and/or L17 populated, 5V is used for CSI.



You can find that option near the CSI connector. These components are specially marked with a „3" and a „5“.

3: 3.3V for using Raspberry Pi camera; B101/B102

5: 5V for using a different camera; different peripheral



Pinout description

Note: all pin numbers of the Jetson Nano refer to the production version of the Nano module. The dev kit version has a different pinout which is not listed below.

USB 3.0 (J11)

This is single USB 3.0 type a (vertical) connector.

Pin	Function	Jetson Nano	Description
1	5V	-	5V power controlled by USB2_EN_OC (A19) - max. 900 mA
2	USB1-D-	115	USB 2.0 data / USB1_D_N
3	USB1-D+	117	USB 2.0 data / USB1_D_P
4	GND	-	Ground
5	USB3_RX2-	161	USB 3.0 receive data / USBSS_RX_N
6	USB3_RX2+	163	USB 3.0 receive data / USBSS_RX_P
7	GND	-	Ground
8	USB3_TX2-	166	USB 3.0 transmit data / USBSS_TX_N
9	USB3_TX2+	168	USB 3.0 transmit data / USBSS_TX_P
10	GND	-	Ground

USB 2.0 (J23)

USB 2.0 port for firmware upgrades and for USB 2.0 devices like mouse and keyboard. New revisions feature a parallel connected JST-GH connector on the bottom side.

Pin	Function	Jetson Nano	Description
1	5V	-	5V power controlled by USB0_EN_OC* (A17) - max. 500 mA
2	USB0-D-	109	USB 2.0 data / USB2_D_N
3	USB0-D+	111	USB 2.0 data / USB2_D_P
5	GND	-	Ground

CSI-AB (J10)

This is a 22 pin 4 lane CSI-2 connector with 0.5mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi compute module carrier board. The contacts are on the bottom.

Pin	Function	Jetson Nano	Description
1	3.3V / 5V	-	3.3V power supply; 5V optional
2	CAM_I2C_SDA	215	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 6
3	CAM_I2C_SCL	213	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 6
4	GND	-	Ground
5	CAM1_MCLK	122	CAM1_MCLK
6	CAM1_PWDN	120	CAM1_PWDN
7	GND	-	Ground
8	CSI-B_D1+	17	CSI1_D1_P
9	CSI-B_D1-	15	CSI1_D1_N
10	GND	-	Ground
11	CSI-B_D0+	5	CSI1_D0_P
12	CSI-B_D0-	3	CSI1_D0_N
13	GND	-	Ground
14	CSI-A_CLK+	12	CSI0_CLK_P
15	CSI-A_CLK-	10	CSI0_CLK_N
16	GND	-	Ground
17	CSI-A_D1+	18	CSI0_D1_P
18	CSI-A_D1-	16	CSI0_D1_N
19	GND	-	Ground
20	CSI-A_D0+	6	CSI0_D0_P
21	CSI-A_D0-	4	CSI0_D0_N
22	GND	-	Ground

CSI-CD (J5)

This is a 22 pin 4 lane CSI-2 connector with 0.5mm pitch (Wuerth 687122149022). To open the connector and to release the cable just lift the brown lid upwards. This connector has the same pinout as the CSI-2 connector on the Raspberry Pi compute module carrier board. The contacts are on the bottom.

Pin	Function	Jetson Nano	Description
1	3.3V/5V	-	3.3V power supply; 5V optional
2	CAM_I2C_SDA	215	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 2
3	CAM_I2C_CLK	213	3.3V level (converted from 1.8V of the Jetson TX1) - I2C device 2
4	GND	-	Ground
5	CAM2_MCLK		CAM2_MCLK
6	CAM3_GPIO		GPIO3_CAM1_RST*
7	GND	-	Ground
8	CSI-D_D1+	66	CSI4_D3_P
9	CSI-D_D1-	64	CSI4_D3_N
10	GND	-	Ground
11	CSI-D_D0+	42	CSI4_D2_P
12	CSI-D_D0-	40	CSI4_D2_N
13	GND	-	Ground
14	CSI-C_CLK+	54	CSI4_CLK_P
15	CSI-C_CLK-	52	CSI4_CLK_N
16	GND	-	Ground
17	CSI-C_D1+	60	CSI4_D1_P
18	CSI-C_D1-	58	CSI4_D1_N
19	GND	-	Ground
20	CSI-C_D0+	48	CSI4_D0_P
21	CSI-C_D0-	46	CSI4_D0_N
22	GND	-	Ground

Ethernet (J1)

The JN30 features an on-board RJ45 connector for 10/100/1000BT Ethernet with 2 LEDs.

LED	Function	Jetson Nano	Description
GBE0	GBE_LINK_ACT*	194	left LED
GBE1	GBE_LINK_100	188	right LED

HDMI (J3)

This is a 19 pin standard size HDMI connector.

Pin	Function	Jetson Nano	Description
1	HDMI_TXD2+	77	HDMI data lane 2
2	GND	-	Ground
3	HDMI_TXD2-	75	HDMI data lane 2
4	HDMI_TXD1+	71	HDMI data lane 1
5	GND	-	Ground
6	HDMI_TXD1-	69	HDMI data lane 1
7	HDMI_TXD0+	65	HDMI data lane 0
8	GND	-	Ground
9	HDMI_TXD0-	65	HDMI data lane 0
10	HDMI_TXC+	83	HDMI clock
11	GND	-	Ground
12	HDMI_TXC-	81	HDMI clock
13	HDMI_CEC	94	
14	RSVD	-	reserved pin
15	HDMI_DDC_SCL	100	DP1_AUX_CH
16	HDMI_DDC_SDA	98	DP1_AUX_CH*
17	GND	-	Ground
18	PWR	-	5V power (max. 500 mA)
19	HPD	96	inverted and connected to DP1_HPD

UART 1/2 (J14)

This is a 6 pin connector with 1.25 mm pitch. Please connect to USB TTL serial converter (3.3V TTL level). Normally just connect TXD, RXD, and GND. Swap data lines. Default speed: 115200 bps.

Pin	Function	Jetson Nano	GPIO	Description
1	5V	-	-	5V power output
2	UART1_TXD	103		UART 1 console port (3.3V TTL level): transmit data output
3	UART1_RXD	105		UART 1 console port (3.3V TTL level): receive data input
4	UART2_TXD /SWCLK	236		UART 2 console port (3.3V TTL level): transmit data output / SWCLK (to flash the MCU)
5	UART2_RXD / SWDIO	238		UART 2 console port (3.3V TTL level): receive data input / SWDIO
6	GND	-	-	Ground

UART1 is optionally tunnelled through the micro controller (MCU). Default: hardware bypass.

FAN (J8)

This is a 4 pin connector with 1.25 mm pitch.

Pin	Function	Jetson Nano	Description
1	GND	-	Ground
2	5V	-	5V power supply to the fan
3	FAN_TACH	208	tachometer from the fan (open drain input with 100k pull-up to 1.8V)
4	FAN_PWM	230	PWM control to the fan (open drain output: controlled by FAN_PWM and „disable fan“ with GPIO19 - F2)

Power out (J11)

This is a 10 pin connector with 1.25 mm pitch. Please note that this is the pinout is relevant for revisions 3.1 and better. 48V is derived from the DC power input. The PSE48 version only with a 48V DC adapter will provide this. Pin 3 to 6 provide 10.6V power from the 10.6V onboard DC converter. Current: 1A max per pin.

Pin	Function	Description
1	48V	power output: 48V (connected to power in - no conversion) - PSE48 only
2	48V	power output: 48V (connected to power in - no conversion) - PSE48 only
3	12V	power output: 12V (10.6V nominal)
4	12V	power output: 12V (10.6V nominal)
5	12V	power output: 12V (10.6V nominal)
6	12V	power output: 12V (10.6V nominal)
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground

SPI/I2C (J22)

This is a 6 pin connector with 1.25 mm pitch.

Pin	Function	Jetson Nano	GPIO	Description
1	3.3V	-	-	3.3V power supply
2	1.8V	-	-	1.8V power supply
3	SPI2_SCK	106		SPI2_SCK (1.8V)
4	SPI2_MISO	108		SPI2_MISO (1.8V)
5	SPI2_MOSI	104		SPI2_MOSI (1.8V)
6	SPI2_CS0	110		SPI2_CS0 (1.8V)
7	SPI2_CS1	112		SPI2_CS1 (1.8V)
8	GEN1_I2C_SCL	185		3.3V
9	GEN_1_I2C_SDA	187		3.3V

Buttons (J12)

There are 3 buttons on the bottom side of the JN30. These buttons are not populated with the LC version.

- Button 1 (J16) - Power on
- Button 2 (J18) - Force recovery
- Button 3 (J20) - Reset

M.2 type M 2280 (J15)

M.2 connector for NVMe cards.
Form factor: 2242, 2260 or 2280 (22 x 80 mm)
Interface: four PCIe lanes for top performance (no SATA support)
Recommended: Samsung EVO 960 ands 970 modules.

MCU

The JN30 features an on-board micro controller (MCU: STM32F042F6P6) with 32 kByte Flash and 6kByte RAM. It monitors the power input rail and resets the Nano, if it discovers a brown out condition (voltage drop). Also it controls the UART1 bypass and the auto flashing.

MCU pin description

MCU Pin	Name	Type	Function	Description
1	PB8/BOOT0	-	-	10k pull down
2	PF0	OD	POWER	1: inactive, 0: press power button
3	PF1	O	POWER	Power enable
4	NRST	-	-	hardware power on reset of MCU (RC circuit)
5	VddA	-	-	analog 3.3V supply (by always on LDO)
6	PA0	Ain0	V12_IN	measure input voltage (voltage divider: 100k up/10k down)
7	PA1	OD	SYS_RST_IN	System reset; open drain 1.8V
8	PA2	AF	UART1_RX	UART 1 to Nano (debug console)
9	PA3	AF	UART1_TX	UART 1 to Nano
10	PA4	PP	LED	0: LED off, 1: LED on (default MCU heartbeat)
11	PA5	AIN5	CM_PWR_ON	Compute module power on; 5V to Nano
12	PA6	AIN6	V5_IN	measure micro USB rail (voltage divider: 10k up/10k down)
13	PA7	IO	UART_BY	UART1 bypass *
14	PB1	Ain9	SHTDWN_REQ	Shutdown request
15	GND	-	-	Ground
16	VddA	-	-	digital 3.3V supply (by always on LDO)
17	PA9/PA11	AF	UART_TX	UART_TX to J14 connector (pin 2)
18	PA10/PA12	AF	UART_RX	UART_RX to J14 connector (pin 3)
19	PA13	-	SWDIO	SWD programming interface
20	PA14	-	SWCLK	SWD programming interface

Pin types:
PP - push/pull output
OD - open drain output
Ain - analog input
AF - alternate function
IO - Input/Output
The power supply to the MCU is supplied by a 3.3V LDO regulator which is always on. So the MCU is powered as soon as power is applied to the power input on J1. This allows the MCU to manage whether power should be applied to the carrier board.
The MCU tunnels the console UART interface to the Jetson Nano. Some instructions are intercepted by the MCU and executed by it. These instructions are not forwarded to the compute module.

UART1 Bypass *

„1“ - UART0 Jetson debug interface is tunneled through MCU

„0“ - UART0 Hardware bypass around MCU (required if baud rate is not 115200)

MCU command set

mcu --adc	read the 4 voltage rails (power in, 5V, 3.3V, and 1.8V)
mcu --reset	reset TX1/TX2
mcu --poweron	power on TX1/TX2
mcu --shutdown	power off TX1/TX2
mcu --version	display firmware version
mcu --help	display list of command available

MCU firmware upgrade

The C source code for the MCU is available on request (Attolic TrueStudio project). Please contact us. The MCU may be programmed with the ST/LINK programming adapter (SWCLK, SWDIO, GND). We recommend the use of the STM32VLDISCOVERY discovery kit for STM32F100 Value line. It is available in the Auvidea online shop and at digikey.com (497-10633-ND).

MCU firmware v1.1

This version of the MCU is limited to a UART baud rate of 38400 baud max. Please set the TX1/TX2 to 38400. Please edit the file /boot/extlinux/extlinux.conf. Please replace 115200n8 by 38400n8.

```
TIMEOUT 30
DEFAULT primary

MENU TITLE p2371-2180 eMMC boot options

LABEL primary
      MENU LABEL primary kernel
      LINUX /boot/Image
      INITRD /boot/initrd
      FDT /boot/tegra210-jetson-auvidea-j90.dtb
      APPEND fbcon=map:0 console=tty0 console=ttyS0,115200n8
```

Appendix A

TPS23861 POE PSE software control - POE controller power toggle

There are a multitude of I2C commands to control the TPS23861, the registers are described in the documentation starting at page 45 (http://www.ti.com/lit/ds/symlink/tps23861.pdf)

To simply toggle on and off the power on a port, in this case port 1, the following command has to be sent via I2C to put the port into manual mode, meaning the power has to be toggled manually and will not change automatically:

```
sudo i2cset -y 1 0x20 0x12 0x01
```

I2cset writes to the I2C device. The „-y“ part prevents the write confirmation, the 1 specifies the I2C bus, the „0x20“ is the device I2C address of the chip, the „0x12“ is the register address for the mode configuration and the „0x01“ is the value, which in this case sets port 1 to manual mode.

Next, to toggle the port on and off there are two commands:

```
sudo i2cset -y 1 0x20 0x19 0x01
```

To turn on the port, and

```
sudo i2cset -y 1 0x20 0x19 0x10
```

To turn off the port. You can read out the power status of all ports with the following command:

```
sudo i2cget -y 1 0x20 0x10
```

JN30 revisions

JN30 Revision 1

- First prototype of the JN30 with the pinout for the Jetson Nano dev kit version

JN30 Revision 2

- Fixed power sequencing
- Added J23 Connector on bottom side for USB flashing port

JN30 Revision 3

- Added connector on bottom side for USB 2.0 flashing
- Added PoE PD

JN30 Revision 3.1

- 12V/48V PWR connector to power 38363 4x Ethernet daughter module

JN30 Revision 4

- For production version of the Jetson Nano
- Modified for production pinout of Nano module

FAQ

to be added.

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