KAMAMI

KAmod ESP32-C3 DIN

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Źródło: https://wiki.kamamilabs.com/index.php?title=KAmod_ESP32-C3_DIN

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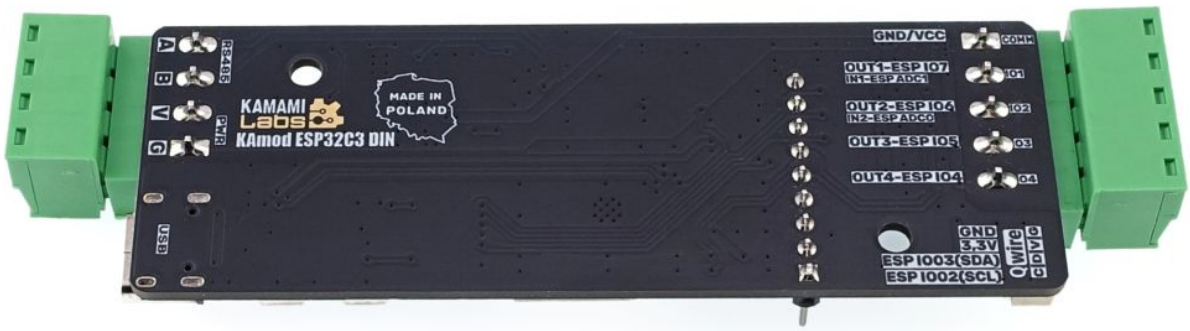
Description

KAmod ESP32-C3 DIN - Universal control module with ESP32-C3 microcontroller

The KAmod ESP32-C3 DIN board utilizes the ESP32-C3-WROOM-02U module, which enables 2.4 GHz Wi-Fi communication and is based on a microcontroller with RISC-V architecture. Furthermore, the board implements a USB interface for programming and application monitoring, an RS485 interface commonly used in automation, and an I2C interface in the Q-wire standard for easy system expansion. Additionally, the microcontroller can control 4 outputs with low-power MOSFET transistors, and the power supply circuit allows for an input voltage range of 7–32 V. The entire design fits on a small PCB tailored for the Z106 type enclosure, which can be mounted on a DIN35 rail.



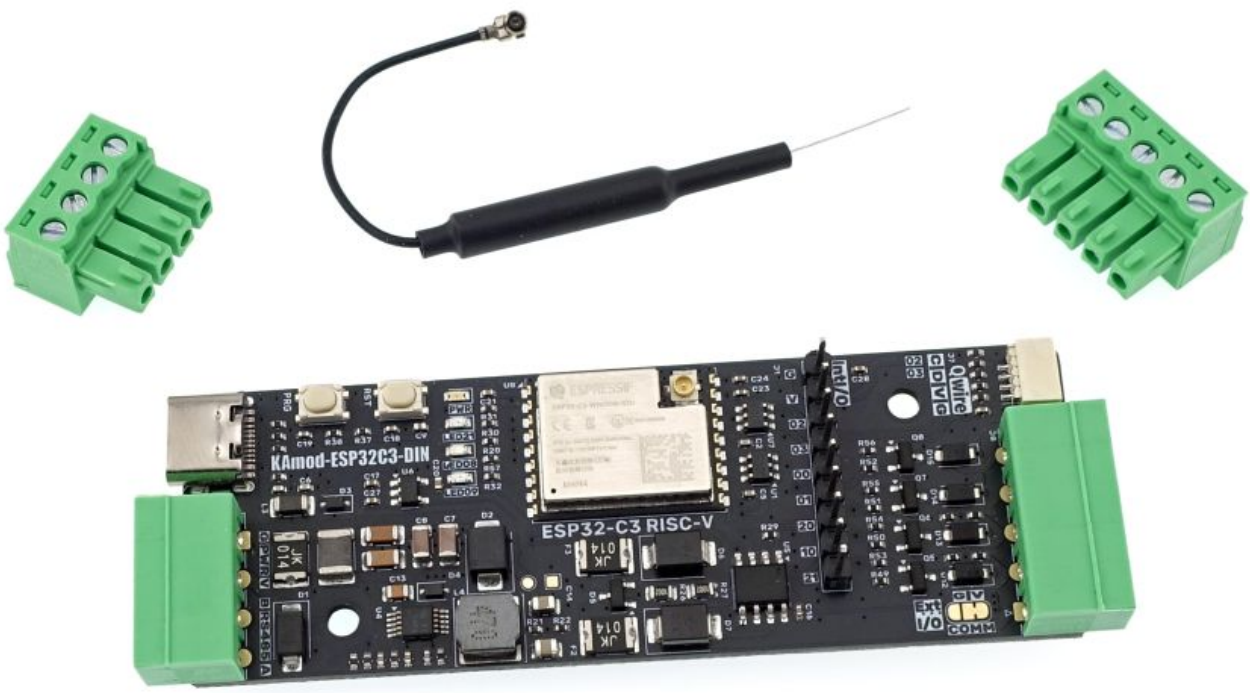
Basic Parameters

- ESP32-C3 Microcontroller - 32-bit RISC-V core, max 160 MHz
- Memory size: 400 kB SRAM, 4 MB SPI Flash
- Communication: 2.4 GHz Wi-Fi, IEEE 802.11 b/g/n and Bluetooth 5 LE
- Antenna connector: U.FL type

- RS485 interface equipped with surge protection
- USB interface for programming and application monitoring (implements USB-UART function)
- Micro-buttons for reset and initiating programming mode (bootloader)
- I²C interface with 3.3 V power supply in Q-Wire standard (Qwiic, Stemma QT)
- 4 LEDs signaling: power, RS485 communication, and application-controlled status
- Goldpin header with 3.3 V power output and 7 GPIO lines
- 4 low-power outputs with N-MOSFET transistors (max 1 A)
- 2 analog inputs with voltage dividers - 12-bit ADC resolution, max input voltage 32 V
- DC power supply range: 7–32 V, current consumption up to 100 mA (module only, in active mode)
- 5 V DC power supply via USB-C connector
- Power supply, RS485 interface, and output connectors: Phoenix MC 3.81 mm type
- Compatible with Arduino IDE
- Compact dimensions tailored for Z106 DIN35 rail enclosure (enclosure not included)

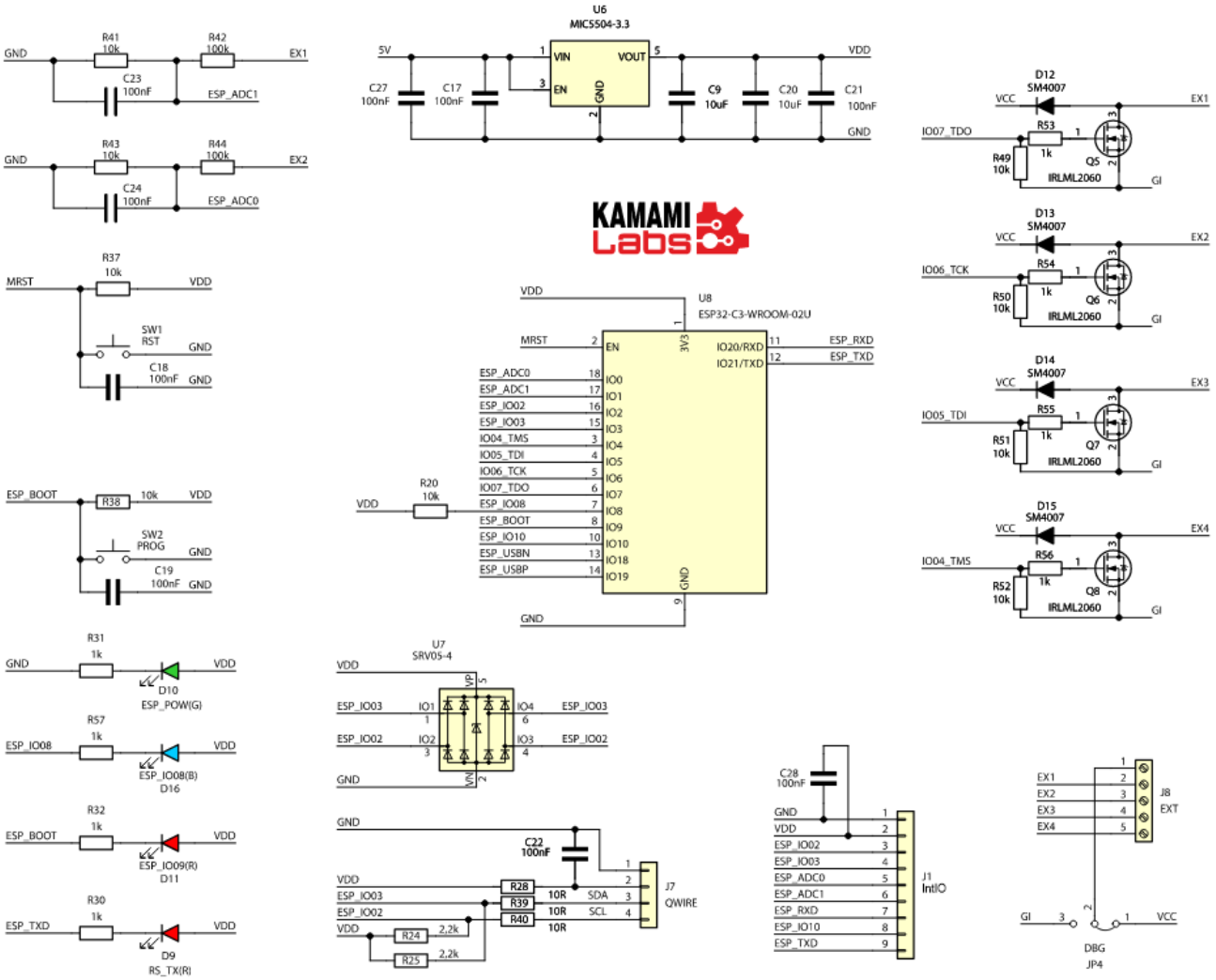
Standard Equipment

Code	Description
KAmod ESP32-C3 DIN	Assembled and tested module
2.4 GHz Wi-Fi Antenna	Antenna with U.FL connector

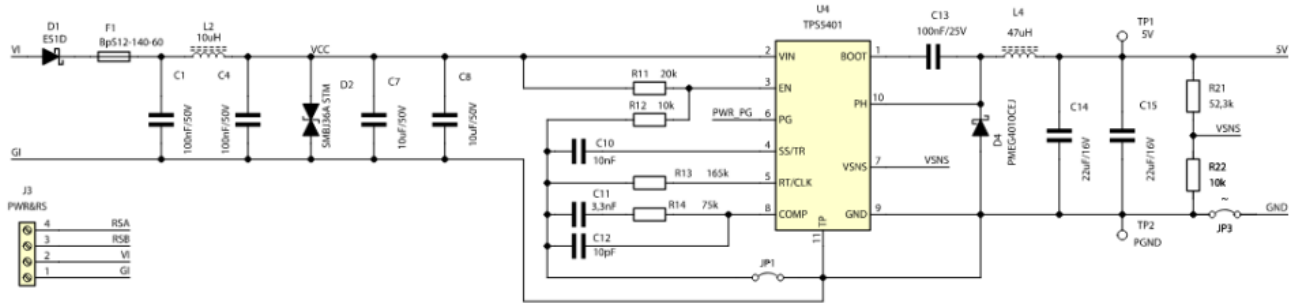


Electrical Schematic

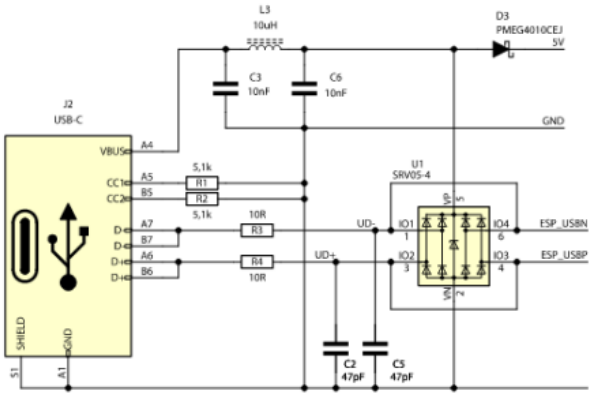
Main Schematic

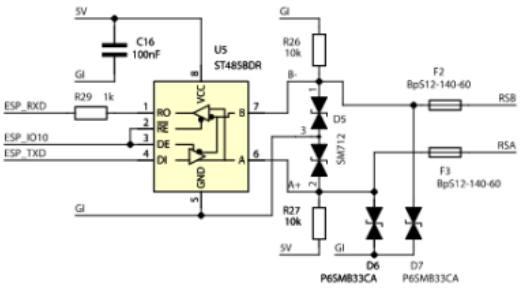


Power Supply Circuit Schematic



RS485 and USB Interface Schematic





Functions Assigned to GPIO Lines

The ESP32-C3-WROOM-02U module has 15 GPIO lines. The table below describes the functions assigned to specific lines on the KAmod ESP32-C3 DIN board.

GPIO	Function
00	ADC0-0 input, routed to the IntIO pin header and connected via a 100 k/10 k divider to Output 2
01	ADC0-1 input, routed to the IntIO pin header and connected via a 100 k/10 k divider to Output 1
02	I2C clock line - SCL, connected to the IntIO header and Q-Wire connector. Includes 2.2k pull-up resistor
03	I2C data line - SDA, connected to the IntIO header and Q-Wire connector. Includes 2.2k pull-up resistor
04	Controls N-MOSFET transistor, Output No. 4 available on J8 connector
05	Controls N-MOSFET transistor, Output No. 3 available on J8 connector
06	Controls N-MOSFET transistor, Output No. 2 available on J8 connector
07	Controls N-MOSFET transistor, Output No. 1 available on J8 connector
08	Controls LED - LED08, signal active LOW
09	Controls LED - LED09 and reads the state of the programming (PRG) button. Must be configured as *Open Drain IN/OUT*
10	Controls DE/RE signal of the RS485 transceiver; HIGH level activates the transmitter. Available on IntIO header
18	USB interface D- signal
19	USB interface D+ signal
20	UART RX interface input, connected to IntIO header and RS485 transceiver
21	UART TX interface output, connected to IntIO header, RS485 transceiver, and LED21

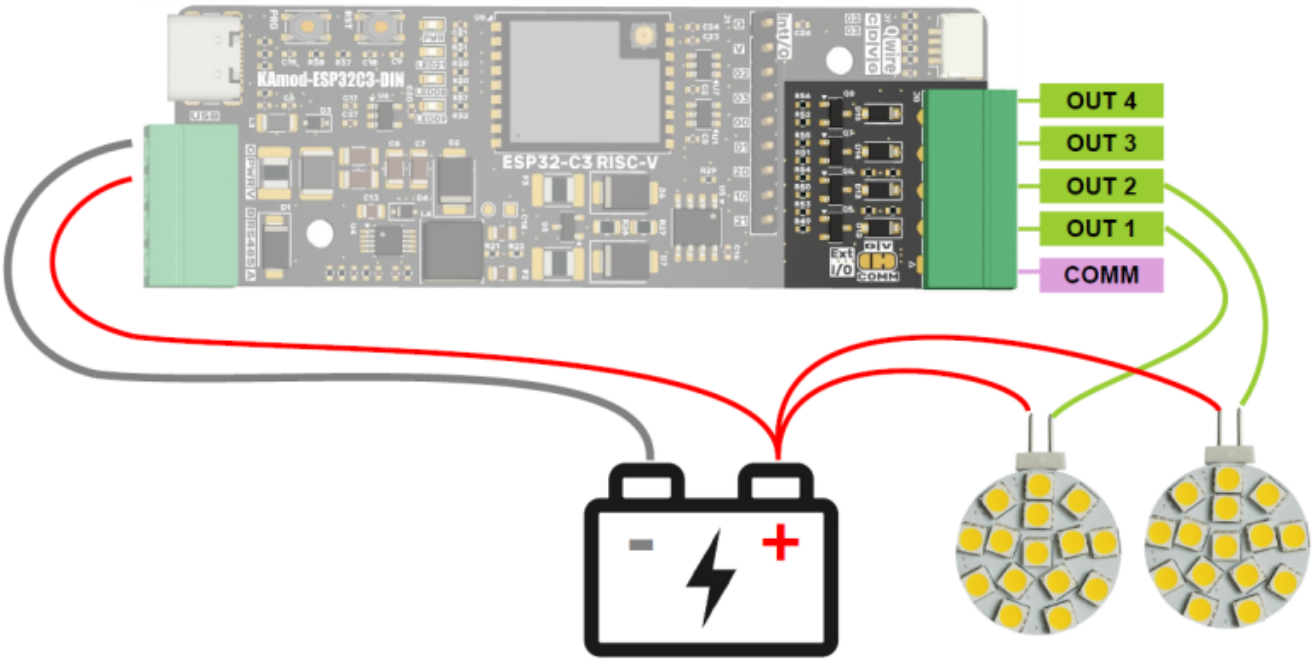
Low-Power Outputs

Output	GPIO Line / state to activate	Connector / Notes
1	GPIO 07 / H	J8-2 (OUT 1) / Active state on output - GND
2	GPIO 06 / H	J8-3 (OUT 2) / Active state on output - GND
3	GPIO 05 / H	J8-4 (OUT 3) / Active state on output - GND

4	GPIO 04 / H	J8-5 (OUT 4) / Active state on output - GND
COMM	-	J8-1 (COMM) connect to the positive power supply rail when controlling inductive loads (e.g., relays).

Output circuits are based on N-MOSFET transistors with a maximum continuous current of 1 A. The outputs are protected against overvoltages generated by inductive loads, so they can directly control electromagnetic relays, small valves, electromagnets, or DC motors. The maximum voltage on the outputs must not exceed 32 V.

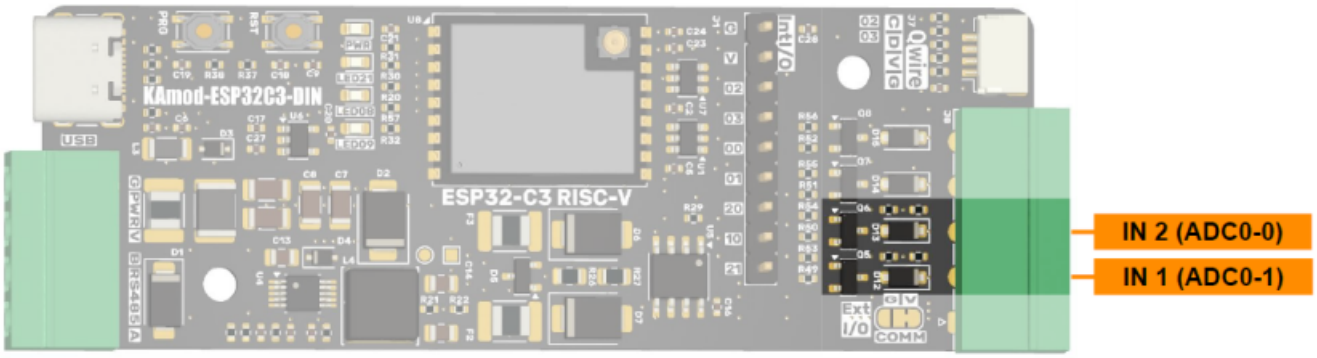
Connecting components to the module outputs should be done as shown in the following figure.



Analog Inputs

KAmod ESP32-C3 DIN has 2 analog inputs connected to an integrated 12-bit ADC. The analog inputs are equipped with 100 k/10 k voltage dividers, providing a division factor of 0.09 and allowing voltage measurement in a range up to approx. 32 V.

ADC Measurement Channel	Connector / Output	Notes
ADC0-1	J8-2 / OUT 1	Shared with Output OUT 1 / max 32 V
ADC0-0	J8-3 / OUT 2	Shared with Output OUT 2 / max 32 V



The analog inputs IN 1/2 are connected to outputs OUT 1/2. If a given output is activated, the analog reading will indicate a value close to 0. If you intend to use the analog input, you must ensure that the corresponding output is not activated.

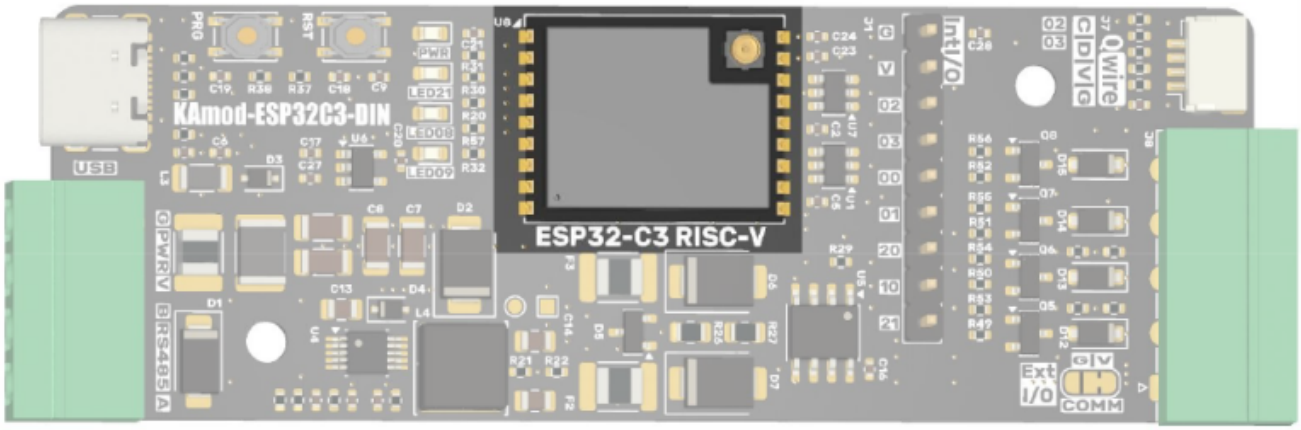
It is not recommended to connect power supply voltage (e.g., from a PSU or battery) directly to analog inputs IN 1/2. In case of an error where the output is activated, it will be damaged. Power supply/battery voltage should be connected to IN 1/2 via a small resistor (100–1000 Ω).

The ADC integrated into the ES32-C3 module has 12-bit resolution but does not allow for precise voltage measurements due to high non-linearity, unstable offset, and imprecise reference voltage.

Wi-Fi Communication

KAmod ESP32-C3 DIN is equipped with an ESP32-C3-WROOM-02U Wi-Fi communication module. Its basic parameters are:

- Frequency band: 2.4 GHz
- Communication standard: compatible with IEEE 802.11 b/g/n
- Bluetooth communication: Bluetooth LE, Bluetooth 5, Bluetooth mesh
- Equipped with a U.FL type antenna connector

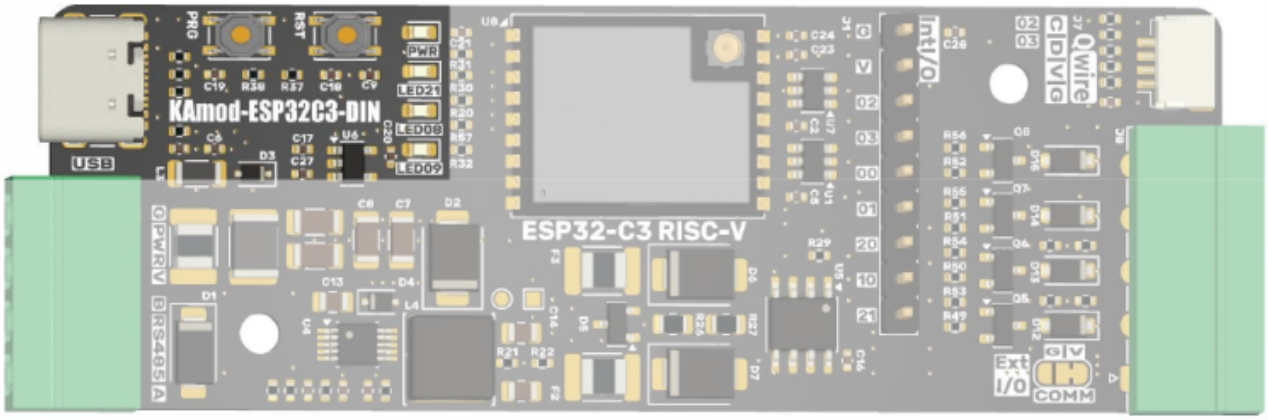


For the Wi-Fi module to function correctly, a compatible antenna must be attached via the U.FL connector located on the board.

USB Interface and Module Programming

KAmod ESP32-C3 DIN features a USB interface with a USB-C connector. Primary functions include:

- Acts as a USB-UART converter
- Used for programming the ESP32-C3-WROOM-02U module
- Enables application monitoring by sending messages via the serial interface
- Serves as an optional power supply port



Programming via the USB interface requires starting the so-called bootloader. To do this, while the KAmod ESP32-C3 DIN is connected via USB cable to a computer, perform the following sequence:

- Press and hold the RST button
- Press and hold the PRG button (LED09 will light up)
- Release the RST button but keep the PRG button pressed
- After a moment, release the PRG button.

This launches the bootloader, enabling the programming of the ESP32-C3 module, e.g., via the Arduino IDE.

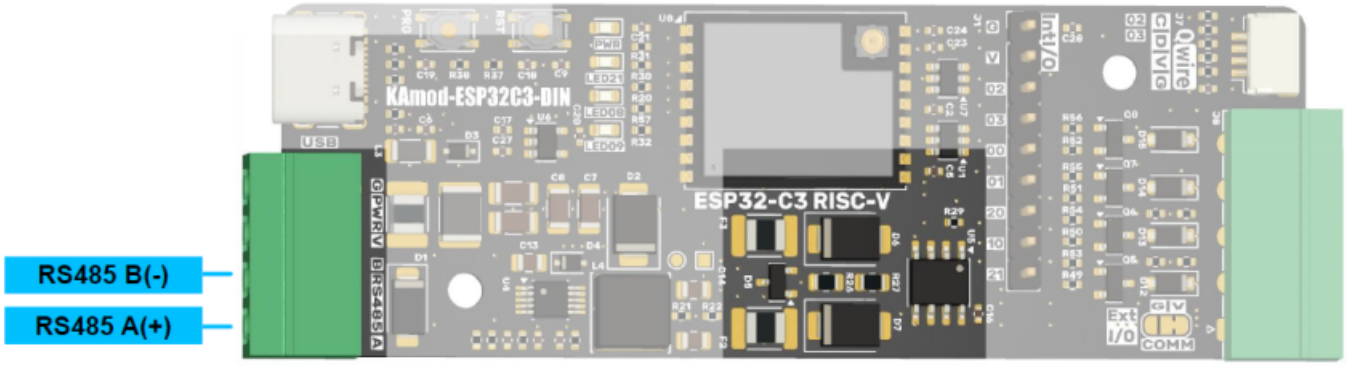
RS485 Interface

KAmod ESP32-C3 DIN is equipped with an RS485 interface with the following parameters:

- ST485 transceiver
- Communication speed up to 1 Mbps
- Surge protection

GPIO line assignment is described in the table below.

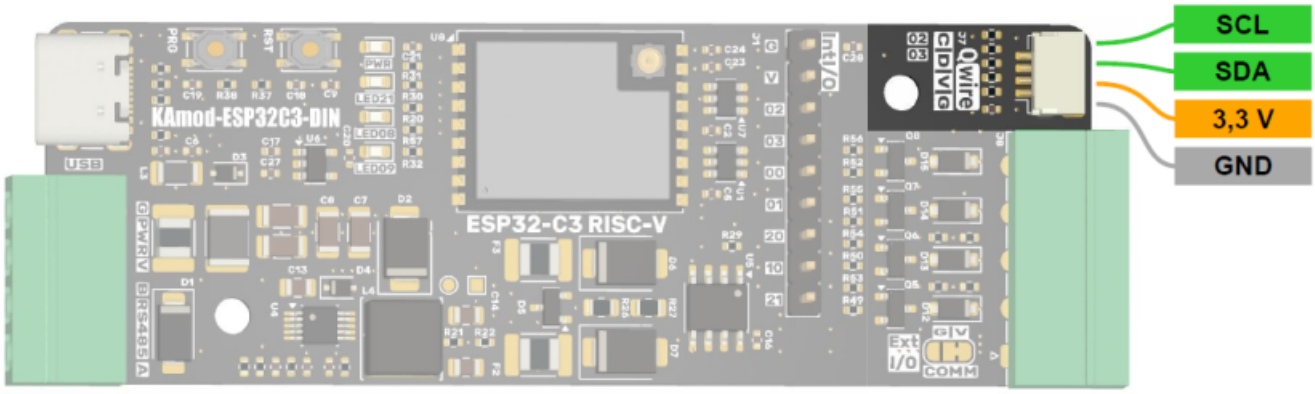
GPIO Line	RS485 Signal	Description
GPIO21	TXD	Data output to the RS485 bus
GPIO20	RXD	Data input from the RS485 bus
GPIO10	DE/RE	Transmission direction control - HIGH (H) state activates transmission to the RS485 bus



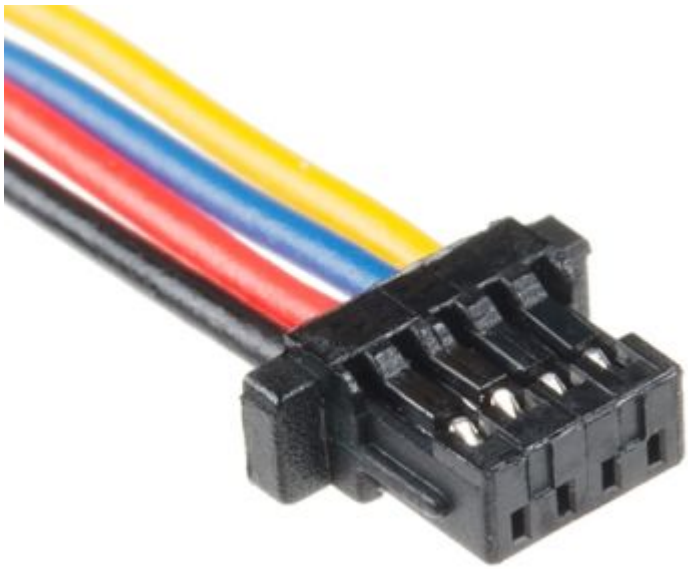
I2C Interface

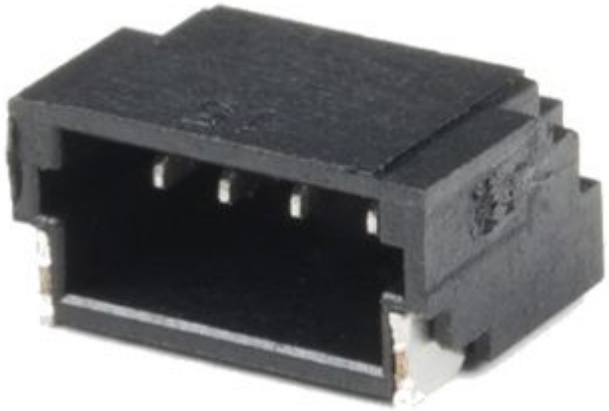
The I2C interface is broken out as a 1 mm JST socket referred to as Q-Wire, which is compatible with Qwiic and Stemma QT standards. Additionally, a 3.3 V supply with approx. 300 mA capacity is available on the connector. Pin functions are described in the table.

Connector/Pin	Signal Type	Description/Notes
Q-Wire / 1	Supply Ground (GND)	Power ground
Q-Wire / 2	3.3 V Supply	Maximum load approx. 300 mA
Q-Wire / 3	Data signal - SDA. Connected to GPIO03	Includes 2.2 k pull-up to 3.3 V
Q-Wire / 4	Clock signal - SCL. Connected to GPIO02	Includes 2.2 k pull-up to 3.3 V



JST 1 mm connectors in Q-Wire standard:

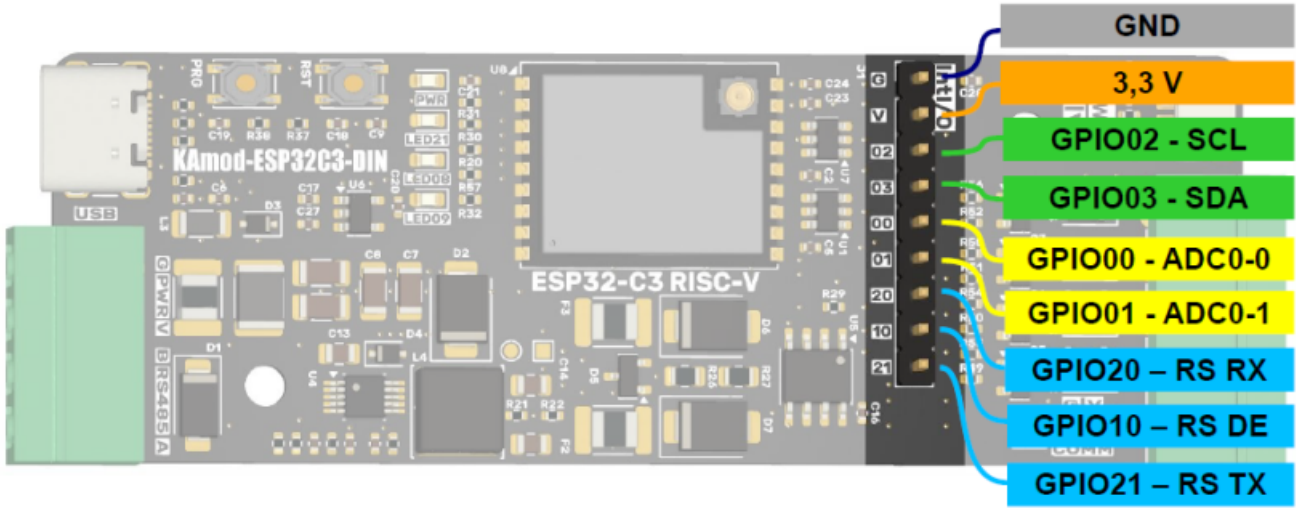




Int I/O Pin Header

On the KAmod ESP32-C3 DIN module, there is a goldpin header labeled Int I/O. Selected GPIO lines are broken out here – detailed descriptions are in the table.

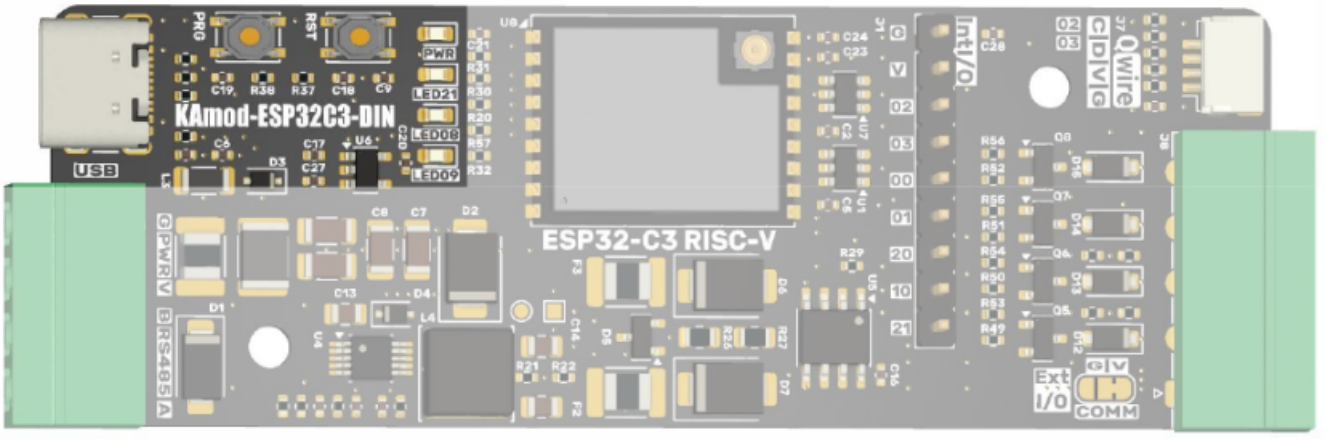
Pin	Signal Type	Description/Notes
Int I/O - 1	3.3 V Supply	Maximum load approx. 300 mA
Int I/O - 2	GND	Power ground
Int I/O - 3	GPIO02	Connected to I2C Interface - SCL
Int I/O - 4	GPIO03	Connected to I2C Interface - SDA
Int I/O - 5	GPIO00	Connected to ADC0-0 converter input
Int I/O - 6	GPIO01	Connected to ADC0-1 converter input
Int I/O - 7	GPIO20	Connected to RS485 data input
Int I/O - 8	GPIO10	Connected to DE/RE signal (RS485 control)
Int I/O - 9	GPIO21	Connected to RS485 data output



LED Indicators and Buttons

Button	Signal Type	Function
RST	EN	Restarts the ESP32-C3 microcontroller and restarts the control software
PRG	GPIO09	Launches bootloader if pressed during microcontroller restart

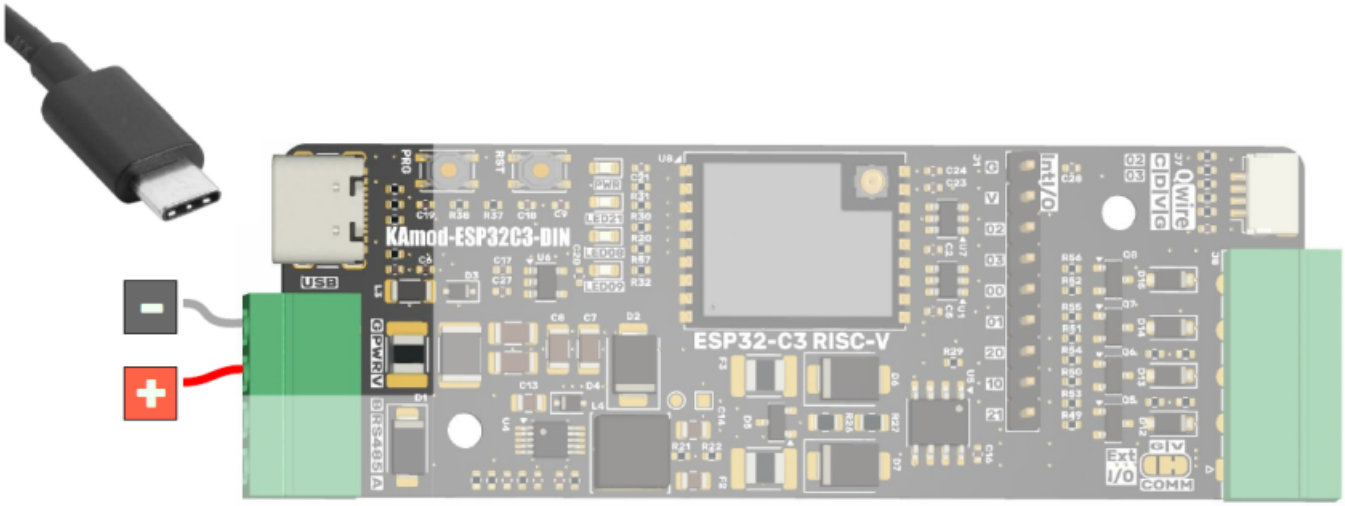
LED Indicator	Signal Type	Function
PWR	3.3 V Power	Signals correct power supply to the module
LED21	GPIO21 active LOW (L)	Connected to RS485 data output; signals RS485 transmission
LED08	GPIO08 active LOW (L)	Can be freely controlled by application
LED09	GPIO09 active LOW (L)	Connected in parallel with the PRG button. GPIO09 line should be configured as *Open Drain IN/OUT*



Power Supply

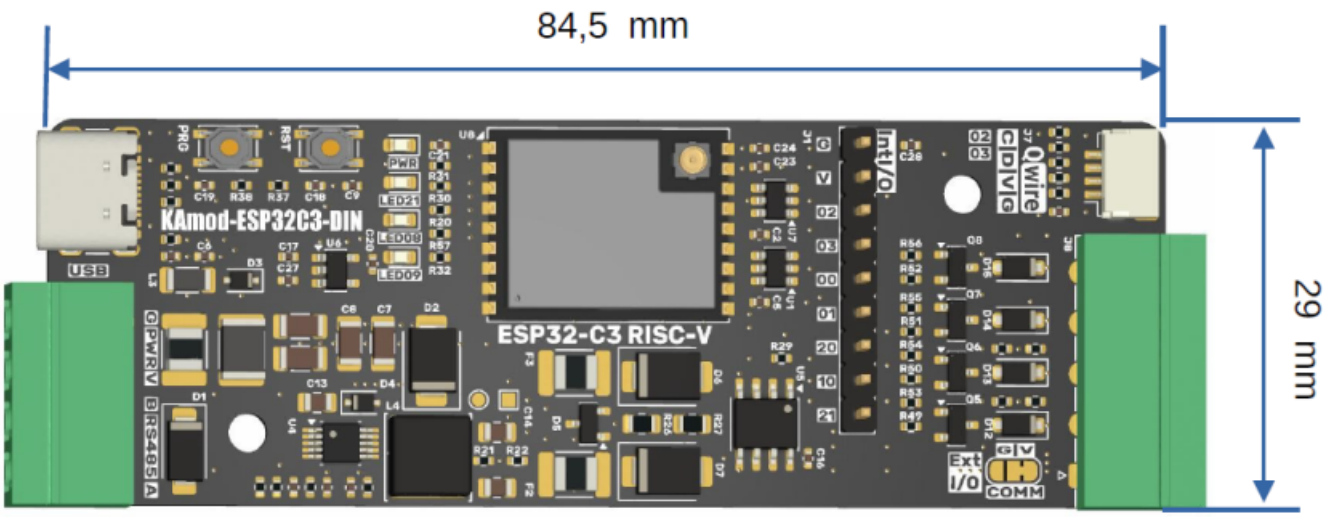
KAmod ESP32-C3 DIN should be powered with a DC voltage in the range of 7 to 32 V. The current consumption of the module itself does not exceed 100 mA during normal operation.

Alternatively, the module can be powered with 5 V DC through the USB-C connector.

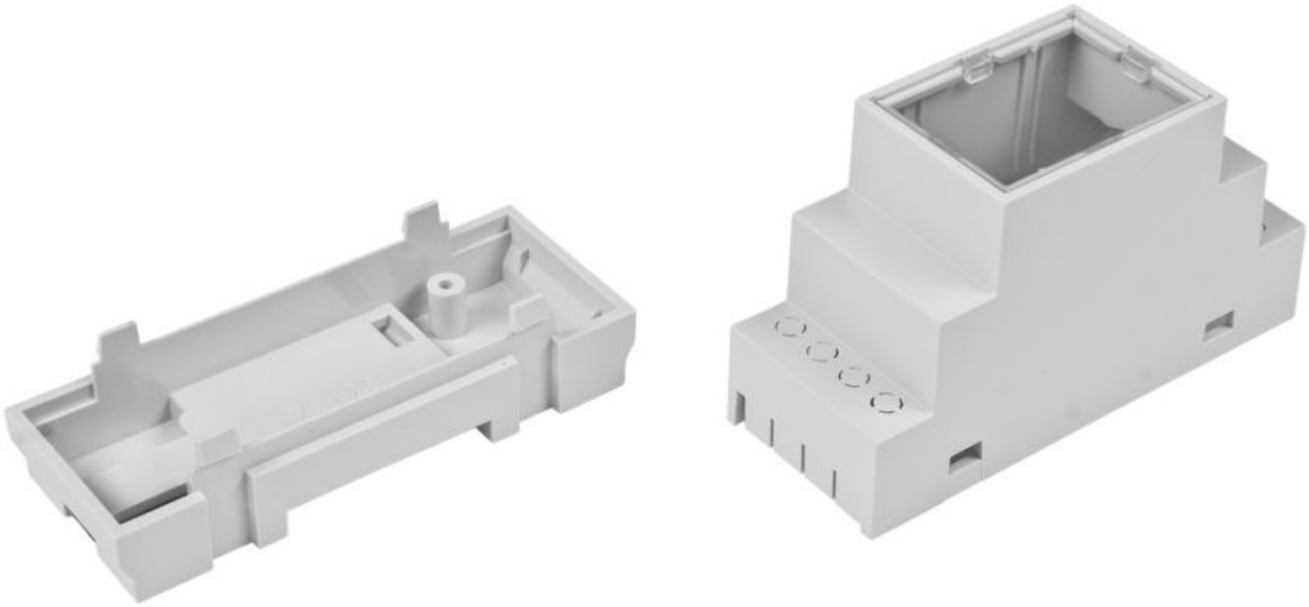


Dimensions

The dimensions of the KAmod ESP32-C3 DIN module are 84.5 x 29 x 12 mm.

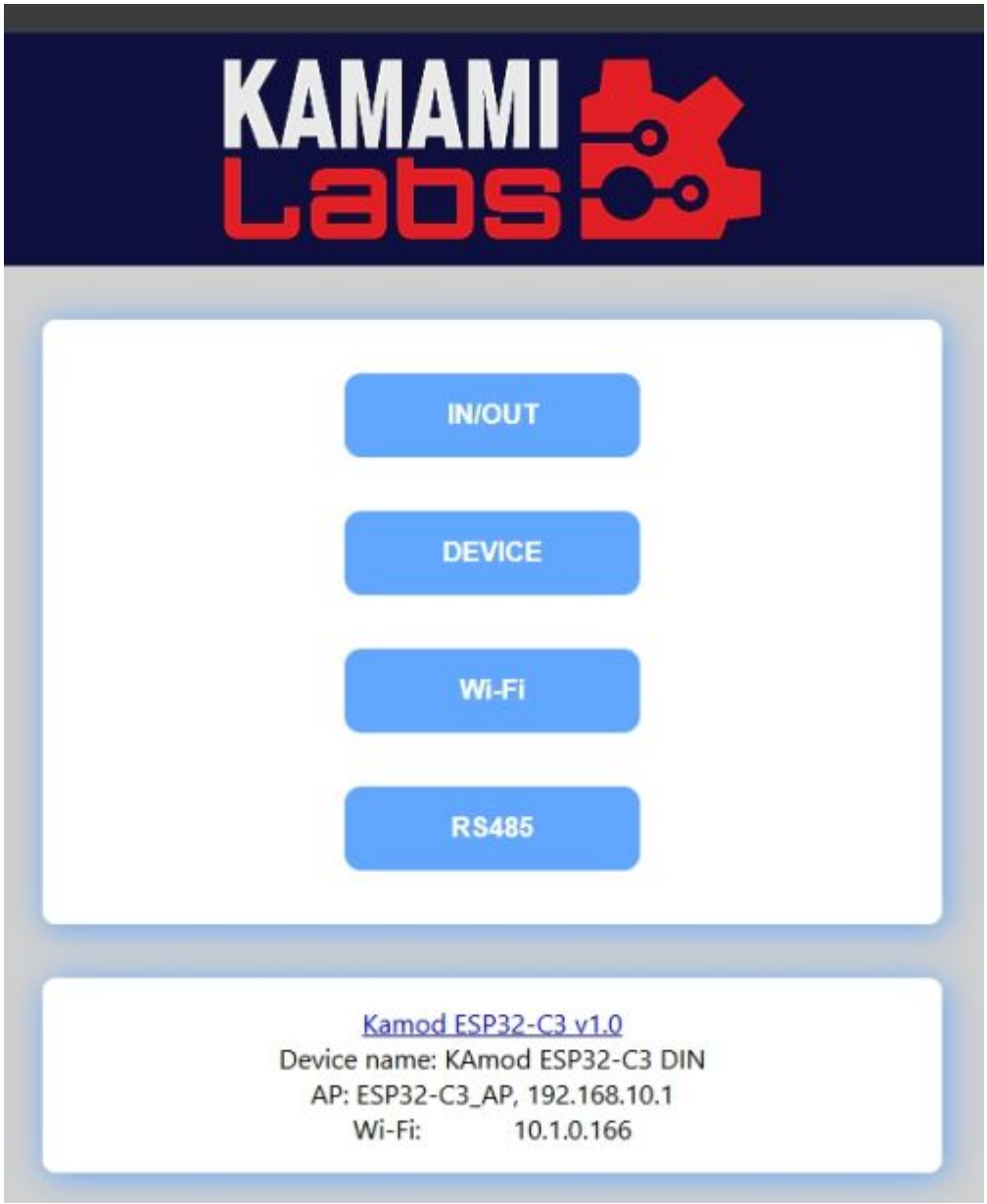


The board is designed to fit into a Z106 type modular enclosure mounted on a DIN35 rail.



Test Application

A test application has been developed for KAmod ESP32-C3 DIN, allowing you to check module functionality and serve as a base for expansion. The source code is available on KAMAMI-Labs GitHub:
https://github.com/KAMAMI-Labs/KAmod-ESP32-C3-DIN.git



Links

- Test Application
- CAD Model (STEP)
- ESP32-C3 series
- ESP32-C3 reference
- ESP32-C3 WROOM

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