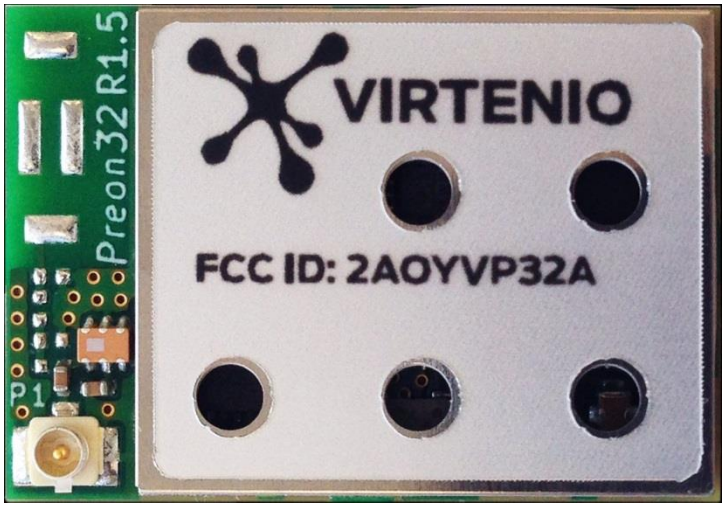
Preon32

User manual



FCC ID: 2AOYVP32A

The device complies with part 15 of the FCC Rules. Operation is subjected to the following 2 conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Revision History

Revision	Date	Author	Comments
1.0	05/03/2018	THR	Released version

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2 Description

The **Preon32** module is a universally applicable sensor and actuator platform for implementing sophisticated applications for short-range wireless networks. It consists of a Cortex M4 **microcontroller**, an IEEE 802.15.4 compliant **transceiver** with market-leading RF capabilities and a **serial flash** for data storage.

The integrated microcontroller is able to execute complex protocol stacks and also handle extensive customer applications. The footprint of the module is a **Land Grid Array (LGA)** with surface mountable pads. This makes it ideal for fully automatic placement.

2.1 Product features

- 32-bit Cortex-M4 microcontroller
- 512kB flash memory
- 160kB SRAM
- System clock frequency up to 80 MHz
- 37 general purpose I/O pins
- Royalty-free 2.4 GHz ISM frequency band
- Transceiver compatible with IEEE 802.15.4 standard
- Wireless data bandwidth up to 2 Mbps
- Sensitivity of -101 dBm and a link budget of 105 dB
- Range up to 250 m outdoor, 30 m in buildings
- u. FL connector for external antenna
- Dimensions of 27.5 x 19 x 3 mm
- Land Grid Array (LGA) with surface mountable pads
- Conforms to the European Radio Directive (RED)
- Conforms to Part 15 of the FCC regulations
- RoHS compliant

2.2 Applications

- ***fast time-to-market*** for innovative products and ideas
- Areas of application in which it is currently not possible to measure conditions and changes in ambient conditions for technical and economic reasons
- Applications in the field of Internet of Things (IoT), Industry 4.0 or Smart Logistics

2.3 Interfaces

The Preon32 has a variety of interfaces for connecting external peripherals such as I²C, SPI, USART or CAN as well as digital input and output pins. Analog signals can be sampled with the integrated analog to digital converter. The Preon32 also contains a DAC for the output of an analog signal.

2.4 Specifications

Microcontroller	
Microcontroller core:	32 Bit Cortex-M4 microcontroller, RISC
Main clock frequency:	Up to 80 MHz
System memory:	160 kByte SRAM
Data memory:	512 kByte flash
Current consumption (typ.)	84 µA/MHz run mode / 2.4 µA stop mode with RTC
Transceiver	
Frequency range:	2405 – 2480 MHz
Channels:	16
Channel interval:	5 MHz
Modulation:	DSSS employing Offset-QPSK
Data bandwidth:	250 Kbit/s - 2 Mbit/s
Output power:	-17 dBm to 4 dBm
Sensitivity:	-101 dBm
Range:	Up to 250 m outdoor, 30 m in buildings
Current consumption(typ.):	20 nA deep sleep / 11.8 mA receive / 13.8 mA transmit
Interfaces	
Serial interfaces:	1x CAN interface (2.0B Active) / 2x SPIs / 3x USARTs / 2x I²C
Analog interfaces:	1× 12-Bit ADC, 5 Msps, 15 channels / 1× 12-Bit DAC
Other interfaces:	37x general purpose I/O pins (GPIOs), 15x ext. IRQ
Additional peripherals	
Data memory:	32 Mbit serial Flash
Oscillator:	32678 Hz oscillator clock output
General	
Dimensions:	27.5 x 19 x 3 mm
Operating temperature:	-40°C up to +85°C
Storage temperature:	-40°C up to +85°C
Supply voltage:	2,0 – 3,6 V
Humidity (Non-condensing)	0 – 95% RH
Conformity:	ETSI EN 300 328, Part 15 FCC regulations

2.5 Antenna

The module Preon32 features an u.FL connector for the connection of the external antenna. Thus the user can position the antenna flexibly in his product. Please note that the specified antenna must be used for conformity to FCC regulations (see chapter 7.2.3 on page 11).

3 Mechanics

3.1 Size

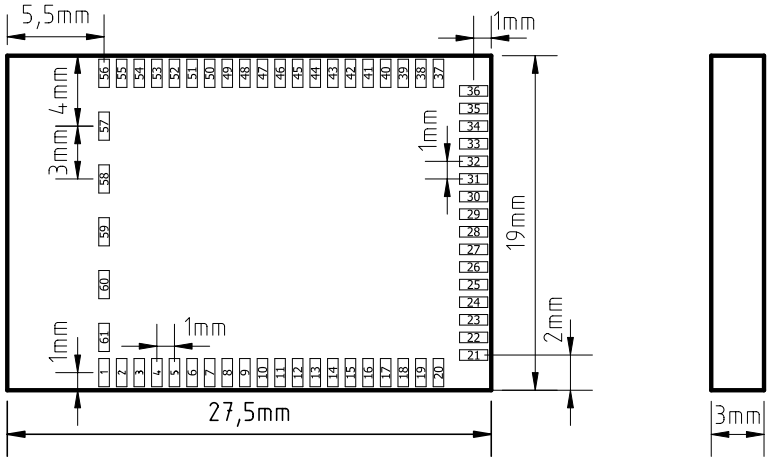

Figure 1: Dimensions and pad layout of the Preon32 (top view)

3.2 Recommended Footprint

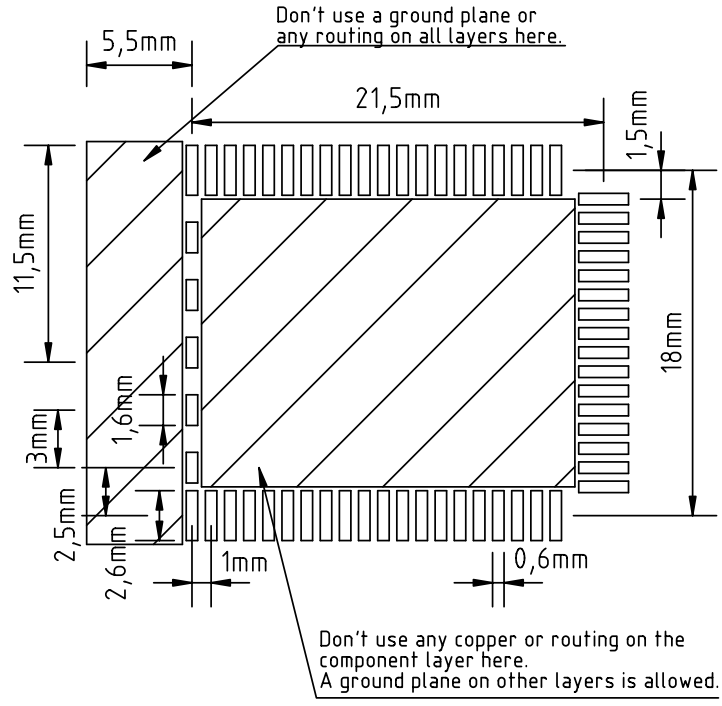

Figure 2: Recommended footprint of the Preon32

4 Connections

The Preon32 module contains user-accessible I/O pins; Table 1 shows the functions of the individual pins. Some of these pins are 5V-tolerant. The alternative function of the individual pins is shown in the corresponding column.

4.1 Pin Mapping

Table 1: Pin mapping of the Preon32

#	Function	5V tol.	Alternate functions				Description
1	RXSW						Control output for external PA (connect to GND if not used)
2	TXSW						Control output for ext. PA (connect to GND if not used)
3	GND						Ground
4	BOOT0						Boot mode pin
5	GPIO0	X	I²C0-SDA	CAN0-TX	T0-CH0	UIRQ0	Digital input or output pin / I²C data / CAN data / timer output / user interrupt
6	GPIO1	X	I²C0-SCL	CAN0-RX	T0-CH1	UIRQ1	Digital input or output pin / I²C clock / CAN data / timer output / user interrupt
7	GPIO2		ADC0-11			UIRQ2	Digital input or output pin / ADC input / user interrupt
8	VDD						Supply voltage input
9	VBAT						Battery input, connect to VDD if not used.
10	GND						Ground
11	GND						Ground
12	OSC32 OUT						Output 32 kHz oscillator
13	GND						Ground
14	GND						Ground
15	GND						Ground
16	GND						Ground
17	GND						Ground
18	GPIO3		ADC0-12			UIRQ3	Digital input or output pin / ADC input / user interrupt
19	GPIO4		ADC0-13			UIRQ4	Digital input or output pin / ADC input / user interrupt
20	VDDA						Analog power supply input
21	GPIO5		ADC0-0	T1-CH0		UIRQ5	Digital input or output pin / ADC input / timer output / user interrupt
22	GPIO6		ADC0-1	T1-CH1			Digital input or output pin / ADC input / timer output
23	GPIO7		ADC0-2	T1-CH2	USART 1-TX		Digital input or output pin / ADC input / timer output / USART data
24	GPIO8		ADC0-3	T1-CH3	USART 1-RX		Digital input or output pin / ADC input / timer output / USART data
25	GPIO9		ADC0-4	DAC0	SPI0-NSS	UIRQ6	Digital input or output pin / ADC input / DAC output / SPI select input / user interrupt
26	GPIO10		ADC0-5	DAC1	SPI0-SCK	UIRQ7	Digital input or output pin / ADC input / DAC output / SPI clock output / user interrupt
27	GPIO11		ADC0-6		SPI0-MISO		Digital input or output pin / ADC input / SPI data input

28	GPIO12		ADC0-7		SPI0-MOSI	UIRQ8	Digital input or output pin / ADC input / SPI data output / user interrupt
29	GPIO13		ADC0-14				Digital input or output pin / ADC input
30	GPIO14		ADC0-15				Digital input or output pin / ADC input
31	GPIO15		ADC0-8				Digital input or output pin / ADC input
32	GPIO16		ADC0-9				Digital input or output pin / ADC input
33	GPIO17	X	BOOT1				Digital input or output pin / boot mode pin
34	GPIO18	X	I²C1-SCL	USART2-TX		UIRQ9	Digital input or output pin / I²C clock / USART output / user interrupt
35	GPIO19	X	I²C1-SDA	USART2-RX		UIRQ 10	Digital input or output pin / I²C data / USART input / user interrupt
36	GND						Ground
37	GPIO20	X	SPI1-NSS	USART2-CK		UIRQ11	Digital input or output pin / SPI slave select / USART clock output / user interrupt
38	GPIO21	X	SPI1-SCK				Digital input or output pin / SPI clock
39	GPIO22	X	SPI1-MISO				Digital input or output pin / SPI data input
40	GPIO23	X	SPI1-MOSI				Digital input or output pin / SPI data output
41	GPIO24	X					Digital input or output pin
42	GPIO25	X					Digital input or output pin
43	GPIO26	X					Digital input or output pin
44	GPIO27	X					Digital input or output pin
45	GPIO28	X	USART0-TX[1]	BOOT-TX			Digital input or output pin / USART data output / Bootloader TX
46	GPIO29	X	USART0-RX[1]	BOOT-RX			Digital input or output pin / USART data input / Bootloader RX
47	GPIO30	X	USART0-CTS	CAN0-RX			Digital input or output pin / USART handshake signal / CAN input signal
48	GPIO31	X	USART0-RTS	CAN0-TX			Digital input or output pin / USART handshake signal / CAN output signal
49	GPIO32	X		JTAG-TMS		UIRQ12	Digital input or output pin / JTAG control signal / user interrupt
50	GPIO33	X		JTAG-TCK		UIRQ13	Digital input or output pin / JTAG clock / user interrupt
51	GPIO34	X	SPI0-NSS-REMAP	JTAG-TDI		UIRQ14	Digital input or output pin / SPI select input / JTAG data / user interrupt
52	GPIO35	X	SPI0-SCK-REMAP	JTAG-TDO			Digital input or output pin / SPI clock / JTAG data
53	GPIO36	X	SPI0-MISO-REMAP	JTAG-NTRST			Digital input or output pin / SPI data input / JTAG reset
54	GPIO37		SPI0-MOSI-REMAP				Digital input or output pin / SPI data output
55	RESET						Reset input
56	GND						Ground
57	GND						Ground
58	GND						Ground
59	GND						Ground
60	GND						Ground
61	TXSW						Control output for ext. PA (connect to GND if not used)

[1] Used for the integrated boot loader

5 Electrical characteristics

5.1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Power supply voltage (VDD/VBAT/VDDA)	-0.3	3.6	V
Voltage on 5V-tol. pins	-0.3	min(VDD, VDDA)+4.0	V
Voltage on any other pin	-0.3	3.6	V
Storage temperature range	-40	85	°C
Operation temperature range	-40	85	°C
RF input power		10	dBm
Output current sourced or sunk by any GPIO		20	mA
Total current into sum of all power lines		140	mA

5.2 Operating Conditions

Parameter	Min	Typ	Max	Unit
Power supply voltage	2.0	3.3	3.6	V
Ambient Temperature Range	-40	25	+85	°C

5.3 Power Consumption

Mode	Typ. Value	Unit
TX 4dBm / MCU active @ 48 MHz	19.7	mA
RX / MCU active @ 48 MHz	18.3	mA
MCU active @ 48 MHz / transceiver sleep	6	mA
MCU and transceiver sleeping	3	µA

5.4 RF Characteristic

Parameter	Min	Typ	Max	Unit
Frequency range	2405		2480	MHz
Channel spacing		5		MHz
RX sensitivity (1% PER, 20-byte packet)		-101		dBm
TX power (maximum)		4		dBm

6 Soldering

Figure 3 and Table 2 show the recommended solder profile for the Preon32.

It's **not** suggested to **clean** the Preon32 module; solder paste residuals underneath the module can't be removed. Use a **Pb-Free** and **No-Clean** solder paste to avoid cleaning requirements.

The module has moisture-sensitive components, it is recommended to bake the modules in a drying oven if the module is outside the sealed package for more than 72 hours to prevent package cracking (refer to IPC/JEDEC J-STD-033 Bake Conditions).

Only one soldering cycle for the Preon32 is recommended.

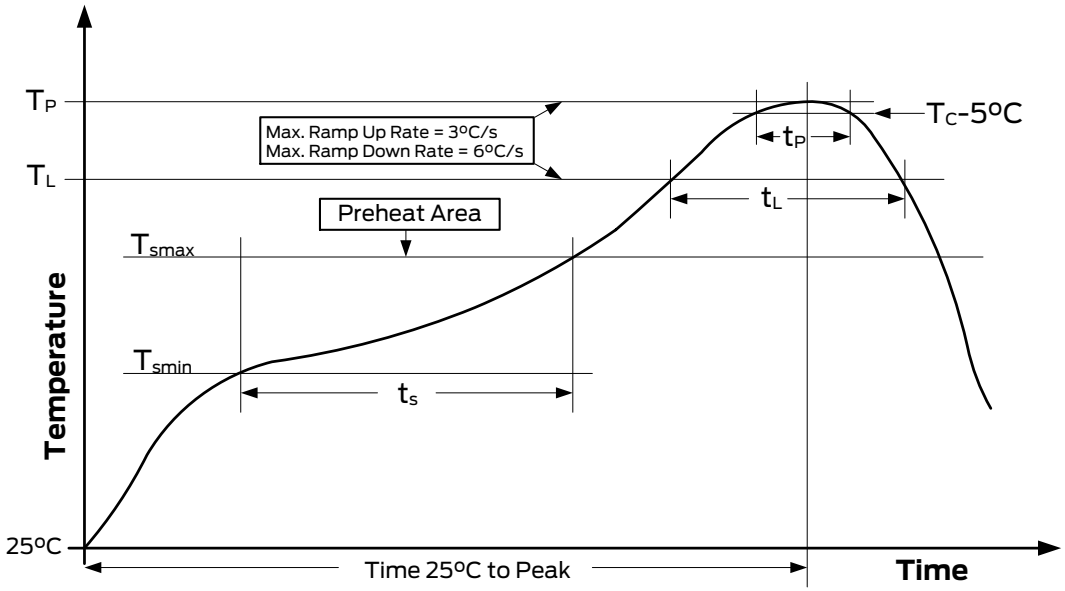

Figure 4: Recommended solder profile (refer to IPC/JEDEC J-STD-020D)

Table 3: Recommended solder profile, values (refer to IPC/JEDEC J-STD-020D)

Profile Property	Value
Temperature Min (T_{smin})	150°C
Temperature Max (T_{smax})	200°C
Time (t_s) from (T_{smin} to T_{smax})	60-120s
Ramp-Up Rate (T_L to T_P)	3°C/s max.
Liquidous temperature (T_L)	217°C
Time (t_L) maintained above T_L	60-150 s
Package Classification Reflow Temperature T_C	250°C
Peak package body temperature (T_p)	Equal to T_C
Time (t_p) within 5°C of the specified classification temperature (T_C)	30 s
Ramp-down rate (T_p to T_L)	6°C/s max.
Time 25°C to peak temperature	8 minutes max.

7 Regulatory Compliance

7.1 Europe (ETSI)

The Preon32 module has been successfully tested according to the ETSI EN 300 328 standard. This module is intended for an OEM integrator. The manufacturer must ensure that the end product complies with all applicable harmonised European standards, such as Directive 2014/53/EU (RED).

7.2 United States (FCC)

FCC ID:	2AOYVP32A
Model:	Preon32
Transmission frequency:	2405 – 2480 MHz

NOTE[2]:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution[3]:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. These modifications include software and hardware changes or modifications.

7.2.1 FCC RF Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. To maintain compliance with FCC RF exposure compliance requirements, please follow operation instructions as documented in this manual.[4]

[2] According to 47 CFR § 15.105 - Information to the user
[3] According to 47 CFR § 15.21 Information to user
[4] According to 47 CFR § 1.1310 and KDB 821551

Caution:

This module is intended for an OEM integrator. The installation of the module is restricted to mobile host devices only. In order to avoid the possibility of exceeding the FCC limit values for radiofrequency exposure, the human proximity to the antenna during normal operation shall not be less than 20 cm. For portable applications, the OEM integrator requires a SAR evaluation and its own FCC ID. The OEM integrator is responsible for compliance with all rules that apply to the product in which this certified RF module is integrated.

Additional tests and certifications may be required if multiple modules are used in the end product.

7.2.2 FCC Labelling Requirements

If the FCC identification number is not visible when the module Preon32 is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module Preon32.

This exterior label can use wording such as the following:

Contains Transmitter Module FCC ID: 2AOYVP32A

Or

Contains FCC ID: 2AOYVP32A

Any similar wording that expresses the same meaning may be used.[5]

The device in which the Preon32 module is installed shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.[6]

7.2.3 FCC Approved Antenna

The Preon32 module must be used with the approved antenna for conformity to FCC regulations.

Manufacturer	Part Number	Description
Molex	146153-0100	2.4GHz / 5GHz Wi-Fi Stand Alone Balance Antenna with MHF Connector, 9.00mm Width, Cable Length 100.00mm

[5] According to 47 CFR § 15.212 Modular transmitters
[6] According to 47 CFR § 15.19

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