

# PTR9818

## Full Bluetooth 5 ready multi-protocol SoC Module Embedded Cortex™ M4F 32 bit processor Support Bluetooth 5

The PTR9818 ultra-low power Bluetooth 5 ready multiprotocol System on Module based on the nRF52840 from Nordic Semiconductor. The module with an ARM® Cortex™ M4F 32 bit processor, 1MB Flash/256KB RAM, embedded 2.4GHz transceiver, and integrated antenna, provide a complete solution with no additional RF design, Bluetooth 5 , allowing faster time to market, while simplifying designs, reducing BOM costs, also reduce the burden of Regulatory approvals to enter the world market. Making you more quickly into the Bluetooth smart application and remove the worries. It has an ARM® TrustZone® CryptoCell-310 co-processor for implementation of IoT security.

### Features

- ◆ Nordic nRF52840 with ARM Cortex M4F
- ◆ Multiprotocol support :  
Bluetooth 5
- ◆ Bluetooth 5: 2 Mbps, 1 Mbps, 500 kbps, 125 kbps
- ◆ Integrated DC-DC converter
- ◆ Serial Wire Debug (SWD)
- ◆ Nordic SoftDevice Ready
- ◆ Over-the-Air (OTA) firmware update
- ◆ Flash/RAM: 1MB/256KB.
- ◆ 48 General purpose I/O pins
- ◆ 15 level low-power comparator with wake-up from System OFF mode
- ◆ Two 2-wire Master/Slave (I2C compatible)
- ◆ I2S audio interface

- ◆ 12 bit/200KSPS ADC
- ◆ 1 QSPI (32Mbps)
- ◆ 4 SPI Master/ 3 SPI Slave (8Mbps)
- ◆ 2 UART (with CTS/RTS and DMA)
- ◆ 4x 4-channel PWM unit with EasyDMA
- ◆ USB 2.0 full speed (12 Mbps) controller
- ◆ 20 channel CPU independent Programmable Peripheral Interconnect (PPI).
- ◆ Quadrature Demodulator (QDEC)
- ◆ 128-bit AES HW encryption
- ◆ 5 x 32 bits, 3 x 24 bits Real Time Counters (RTC)
- ◆ NFC-A tag interface for OOB pairing
- ◆ TX power: +8dBm to -20dBm in 4 dB steps.
- ◆ Sizes: 22.7x17.5 x1.8mm with Antenna
- ◆ Integrated high performance PCB antenna
- ◆ DC/DC on board
- ◆ No external components required
- ◆ Operation voltage: 1.7V to 5.5V

## Typical Applications:

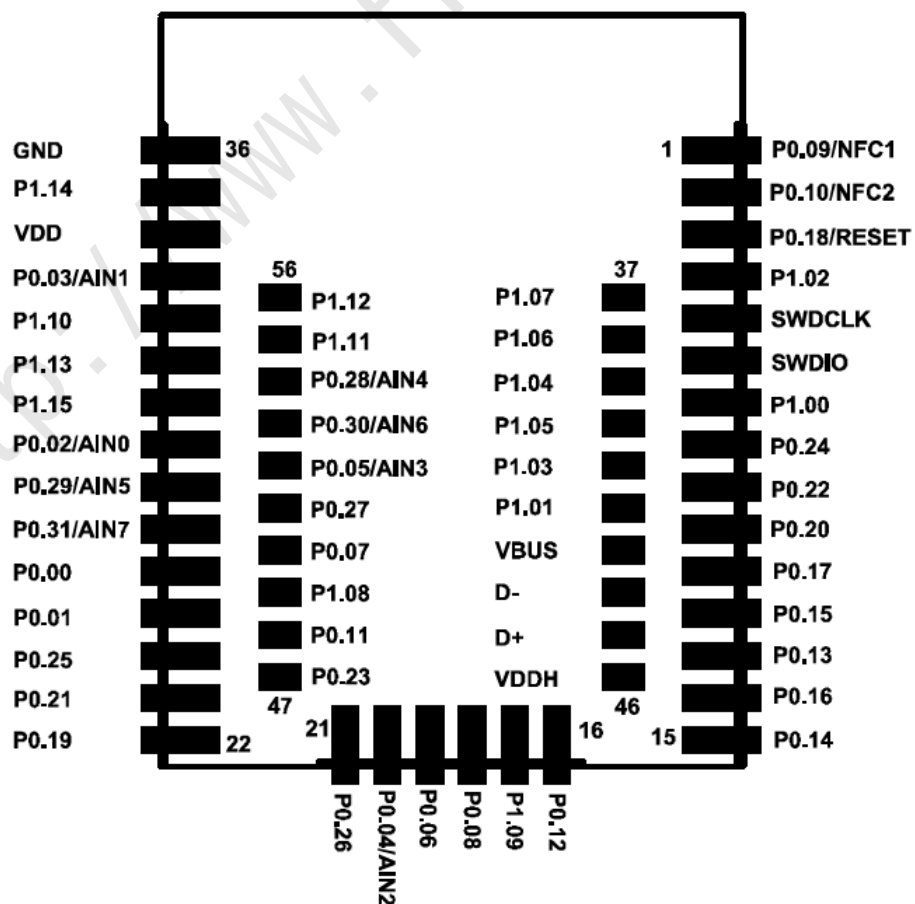
- - 2.4 GHz Bluetooth low energy systems
- - Sports and leisure equipment
- - Mobile phone accessories, Connected Appliances
- - Health Care and Medical
- - Consumer Electronics, Game pads
- - Human Interface Devices, Remote control
- - Building environment control / monitoring
- - RFID, Security Applications, Low-Power Sensors
- - Bluetooth Low Energy GateWay
- - iBeacons™, Eddystone™, Indoor navigation
- - Lighting Products
- - Fitness devices, Wearables

## Quick Specifications:

Multi-protocol	
Version	Bluetooth 5.0
Security	AES-128
Radio	
Frequency	2.402GHz to 2.480GHz
Modulations	GFSK at 1 Mbps, 2 Mbps data rates
Transmit power	+8dBm to -20dBm in 4 dB steps.
Receiver sensitivity	-103 dBm@BLE 125kbps(long range), -95 dBm@BLE 1M
Antenna	Integrated PCB Antenna
Current Consumption	
TX only @ +8 dBm, @ 3V, DC/DC enabled	14.1 mA
TX only @ 0 dBm, @ 3V, DC/DC enabled	4.9 mA
TX only @ +8 dBm	30.4 mA
TX only @ 0 dBm	10.2 mA
RX only @ 1 Mbps @ 3V, DC/DC enabled	4.8 mA
RX only @ 1 Mbps	10.3 mA
CPU @ 64MHz from flash @ 3V, DC/DC	3.6 mA
System On	1.2 μA
System Off	0.7μA
Operating conditions	
Power supply	1.7~5.5V
Operating temperature	-25~+85 °C

Block diagram:

Pin Description of Module (Top View) :



Pin	Name	Description	Recommend usage
Pin1	P0.09/NFC1	Digital I/O/ NFC input	Standard drive, low frequency I/O
Pin2	P0.10/NFC2	Digital I/O/ NFC input	Standard drive, low frequency I/O
Pin3	P0.18/RESET	Digital I/O/RESET	QSPI/CSN/RESET
Pin4	P1.02	Digital I/O	
Pin5	SWDCLK	HW debug and programming	
Pin6	SWDIO	HW debug and programming	
Pin7	P1.00	Digital I/O	
Pin8	P0.24	Digital I/O	QSPI
Pin9	P0.22	Digital I/O	QSPI
Pin10	P0.20	Digital I/O	
Pin11	P0.17	Digital I/O	
Pin12	P0.15	Digital I/O	
Pin13	P0.13	Digital I/O	
Pin14	P0.16	Digital I/O	
Pin15	P0.14	Digital I/O	
Pin16	P0.12	Digital I/O	
Pin17	P1.09	Digital I/O	
Pin18	P0.08	Digital I/O	
Pin19	P0.06	Digital I/O	
Pin20	P0.04/AIN2	Digital I/O/Analog input 2	
Pin21	P0.26	Digital I/O	
Pin22	P0.19	Digital I/O	QSPI/SCK
Pin23	P0.21	Digital I/O	QSPI
Pin24	P0.25	Digital I/O	
Pin25	P0.01	Digital I/O	
Pin26	P0.00	Digital I/O	
Pin27	P0.31/AIN7	Digital I/O/Analog input 7	Standard drive, low frequency I/O
Pin28	P0.29/AIN5	Digital I/O/Analog input 5	Standard drive, low frequency I/O
Pin29	P0.02/AIN0	Digital I/O/Analog input 0	Standard drive, low frequency I/O
Pin30	P1.15	Digital I/O	Standard drive, low frequency I/O
Pin31	P1.13	Digital I/O	Standard drive, low frequency I/O
Pin32	P1.10	Digital I/O	Standard drive, low frequency I/O
Pin33	P0.03/AIN1	Digital I/O/Analog input 1	Standard drive, low frequency I/O
Pin34	VDD	Power Supply	
Pin35	P1.14	Digital I/O	
Pin36	GND	Ground	
Pin37	P1.07	Digital I/O	Standard drive, low frequency I/O
Pin38	P1.06	Digital I/O	Standard drive, low frequency I/O
Pin39	P1.04	Digital I/O	Standard drive, low frequency I/O
Pin40	P1.05	Digital I/O	Standard drive, low frequency I/O
Pin41	P1.03	Digital I/O	Standard drive, low frequency I/O
Pin42	P1.01	Digital I/O	Standard drive, low frequency I/O
Pin43	VBUS	Power	5 V input for USB 3.3 V regulator

Pin44	D-	USB D-	USB
Pin45	D+	USB D+	USB
Pin46	VDDH	High voltage power supply	
Pin47	P0.23	Digital I/O	QSPI
Pin48	P0.11	Digital I/O	
Pin49	P1.08	Digital I/O	
Pin50	P0.07	Digital I/O	
Pin51	P0.27	Digital I/O	
Pin52	P0.05/AIN3	Digital I/O/Analog input 3	
Pin53	P0.30/AIN6	Digital I/O/Analog input 6	Standard drive, low frequency I/O
Pin54	P0.28/AIN4	Digital I/O/Analog input 4	Standard drive, low frequency I/O
Pin55	P1.11	Digital I/O	
Pin56	P1.12	Digital I/O	Standard drive, low frequency I/O

\*Low frequency I/O is signals with a frequency up to 10 kHz

Note: An internal 4.7μF bulk capacitor has been included on the module. For those application that with heavy GPIO usage and/or current draw, it is good design practice to add additional bulk capacitance as required for your application.

### General Purpose I/O:

Each GPIO can be accessed individually with the following user configurable features:

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high or low level triggers on all pins
- Trigger interrupt on all pins
- All pins can be used by the PPI task/event system; the maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels
- All pins can be individually configured to carry serial interface or quadrature demodulator signals

### Hardware RESET:

There is on-chip power-on reset circuitry, But can still be used in external reset mode, in this case, GPIO pin P0.18 as an external hardware reset pin. In order to utilize P0.18 as a hardware reset, the UICR registers PSELRESET[0] and PSELRESET[1] must be set alike, to the value of 0x7FFFFFF12. When P0.18 is programmed as RESET, the internal pull-up is automatically enabled.

### HW debug and flash programming of Module :

The Module support the two pin Serial Wire Debug (SWD) interface and offers flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints, single stepping, and instruction trace capture of code execution flow are part of this support.

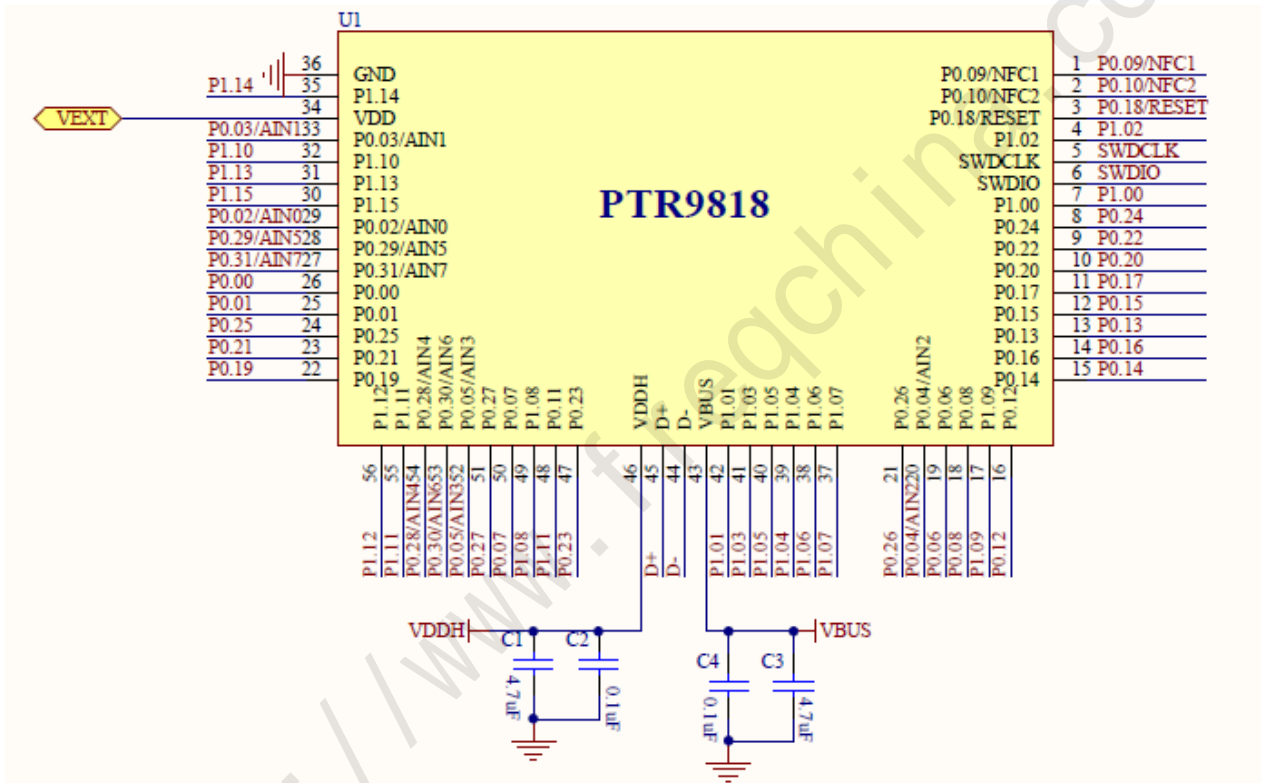
Pin	Flash Program interface
SWDIO	Debug and flash programming I/O
SWDCLK	Debug and flash programming I/O

This is the hardware debug and flash programming of module, J-Link Lite support, please refer [www.segger.com](http://www.segger.com).

### Reference circuitry:

In this section there are 5 reference circuits to show how to design an application circuit with this module.

#### Reference Circuit configuration 1



Configurations summary for reference circuit 1

Config no.	Main Supply		EXT Supply Output	USB
	VDDH	VDD		
Config.1	Battery/Ext.regulator	N/A	Yes	Yes

Explanation of symbols in reference circuit 1 schematic

Symbol	Parameter	Min.	Typ.	Max.	Units
V <sub>DDH</sub>	Main supply voltage in high voltage mode	2.5	3.7	5.5	V
V <sub>BUS</sub>	Supply voltage on VBUS pin	4.35	5	5.5	V
V <sub>EXT</sub>	Voltage output on VDD when supplied from internal regulator (REG0). V <sub>DDH</sub> is the input to REG0.	1.8		3.3	V



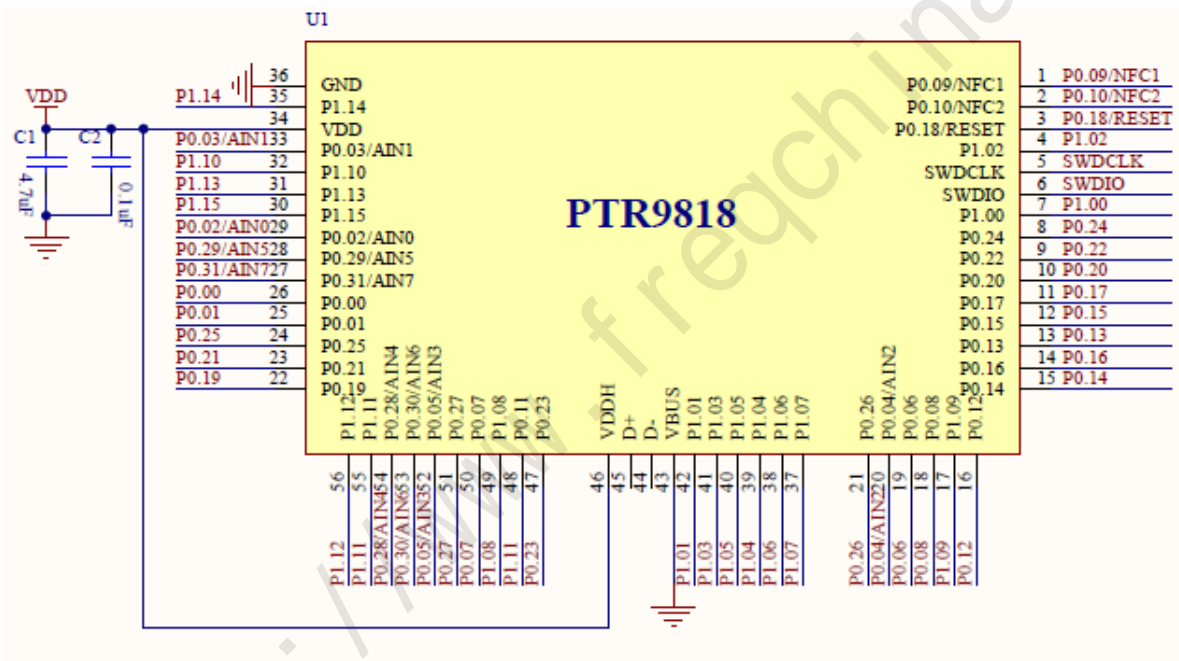
Configurations summary for reference circuit 3

Config no.	Main Supply		EXT Supply Output	USB
	VDDH	VDD		
Config.3	N/A	Battery/Ext.regulator	No	Yes

Explanation of symbols in reference circuit 3 schematic

Symbol	Parameter	Min.	Typ.	Max.	Units
V <sub>DD</sub>	Main supply voltage in normal voltage mode	1.7	3	3.6	V
V <sub>BUS</sub>	Supply voltage on VBUS pin	4.35	5	5.5	V

Reference Circuit configuration 4



Configurations summary for reference circuit 4

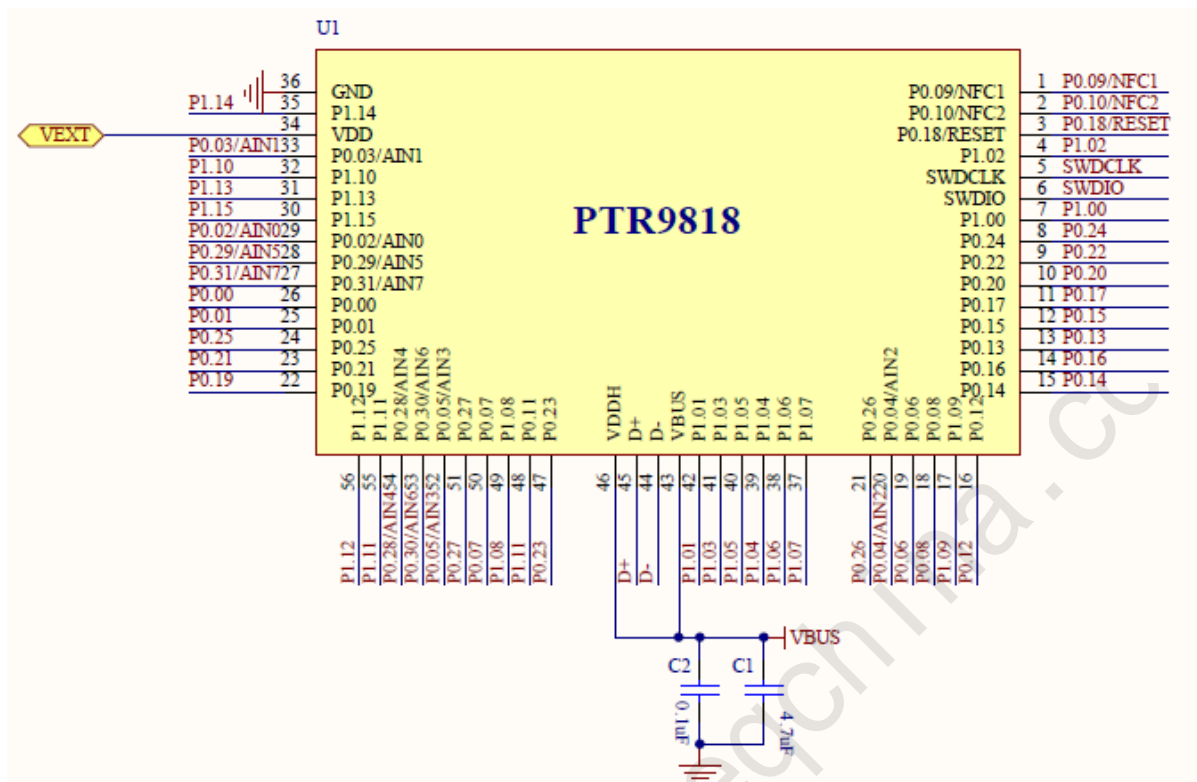
Config no.	Main Supply		EXT Supply Output	USB
	VDDH	VDD		
Config.4	N/A	Battery/Ext.regulator	No	No

Explanation of symbols in reference circuit 4 schematic

Symbol	Parameter	Min.	Typ.	Max.	Units
V <sub>DD</sub>	Main supply voltage in normal voltage mode	1.7	3	3.6	V



Reference Circuit configuration 5



Configurations summary for reference circuit 5

Config no.	Main Supply		EXT Supply Output	USB
	VDDH	VDD		
Config.5	USB(VDDH = VBUS)	N/A	Yes	Yes

Explanation of symbols in reference circuit 5 schematic

Symbol	Parameter	Min.	Typ.	Max.	Units
V <sub>BUS</sub>	Supply voltage on VBUS pin	4.35	5	5.5	V
V <sub>EXT</sub>	Voltage output on VDD when supplied from internal regulator (REG0). V <sub>BUS</sub> is the input to REG0.	1.8		3.3	V

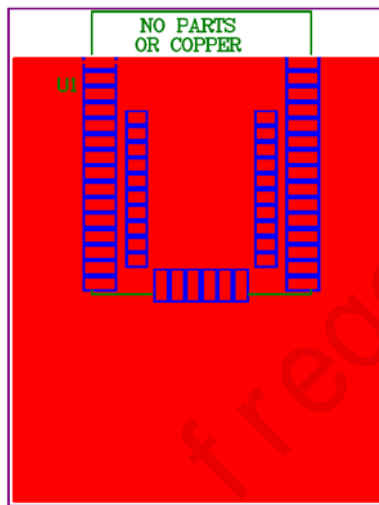
Some general guidance is summarized here:

- Main supply voltage is connected to VDD/VDDH. The system will enter one of two supply voltage modes, normal or high voltage mode, depending on how the supply voltage is connected to these pins. Normal voltage mode is entered when the supply voltage is connected to both the VDD and VDDH pins (so that VDD equals VDDH). High voltage mode is entered when the supply voltage is only connected to the VDDH pin and the VDD pin is not connected to any voltage supply.
- By default, the LDO regulators in the chip are enabled and the DC/DC regulators are disabled. Registers DC/DCEN0 and DC/DCEN are used to independently enable the DC/DC regulators. External LC filters has been connected in the Module for DC/DC regulators being used.
- The GPIO high reference voltage always equals the level on the VDD pin. In normal voltage mode, the GPIO high level equals the voltage supplied to the VDD pin, and in high voltage mode it equals the level specified in the register REGOUT0 UICR registers.

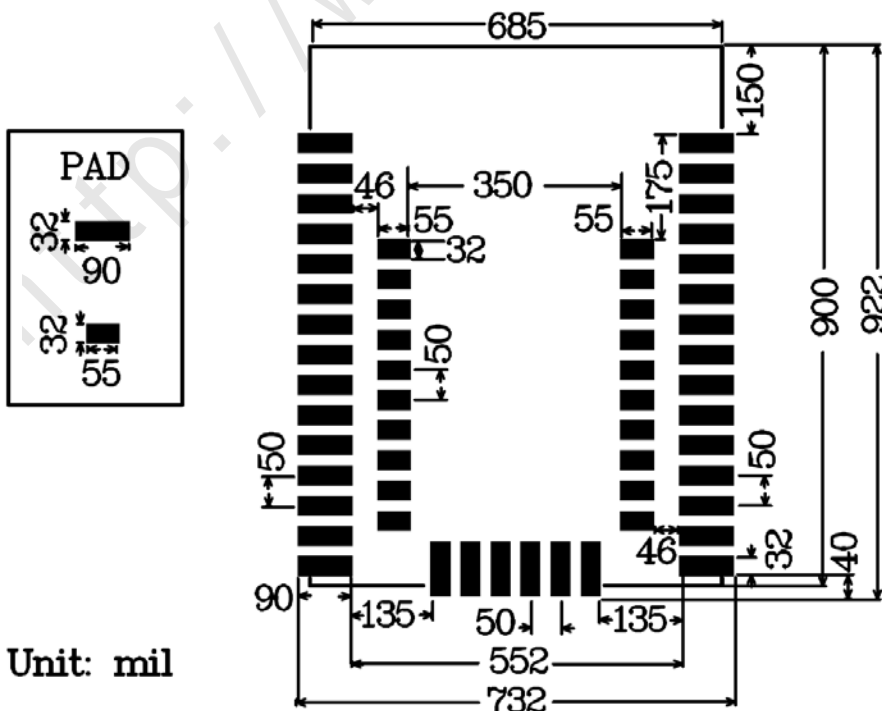
- When the power is supplied to VDDH, the output from the VDD pin could be used to supply external circuitry. The feature must be configured in the EXTSUPLY and REGOUT0 UICR registers. In the reference circuitry, External supply is annotated with the VEXT net name.
- When using the USB peripheral, a 5V USB supply needs to be provided on the VBUS pin.

### Recommended RF Layout & Ground Plane:

The module integrated antenna requires a suitable ground plane to radiate effectively. The area under and extending out from the antenna portion of the module should be kept clear of copper and other metal. The module should be placed at the edge of the PCB with the antenna edge facing out. Reducing the ground plane will reduce the effective radiated power.



### PCB Footprint (Top View) :



## Ordering Information:

Part Number	Description
PTR9818	Bluetooth Low Energy System on Module
PTR9818-EVB	Evaluation boards for module, with key, LED, I/O extend, sock for coin cell battery.

## Absolute Maximum Ratings:

Symbol	Parameter	Min.	Max.	Unit
V <sub>CC_MAX</sub>	Voltage on supply pin	-0.3	3.9	V
V <sub>IO_MAX</sub>	Voltage on GPIO pins (V <sub>CC</sub> > 3.6V)	-0.3	3.9	V
V <sub>IO_MAX</sub>	Voltage on GPIO pins (V <sub>CC</sub> ≤ 3.6V)	-0.3	V <sub>CC</sub> + 0.3V	V
T <sub>S</sub>	Storage Temperature Range	-40	125	°C

**Note:** Exceeding one or more of the limiting values may cause permanent damage to the module.

## Important Notice:

- Reserves the right to make corrections, modifications, and/or improvements to the product and/or its specifications at any time without notice.
- Assumes no liability for the user's product and/or applications.
- Products are not authorized for use in safety-critical applications, including but not limited to life-support applications.
- We have a strict and careful check and collation, but can not guarantee this manual without any errors and omissions.
- The contents of this manual by copyright protection laws and regulations, without our prior written authorization of any person shall, in any way to copy the copy or manual, this manual will all or any part of any form in any cable or wireless network transmission, or be compiled and translated into any other format, text or code.

## ATTENTION!

Electrostatic Sensitive Device  
Observe Precaution for handling.



#### FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247  
Integral antenna with antenna gain 0dBi

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.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: 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.

If any hardware modify or RF control software modify will be made by host manufacturer,C2PC or new certificate should be apply to get approval,if those change and modification made by host manufacturer not expressly approved by the party responsible for compliance ,then it is illegal.

#### FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If the FCC identification number is not visible when the module 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. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AA72-PTR9818 Or Contains FCC ID: 2AA72-PTR9818"

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

(2) This device must accept any interference received, including interference that may cause undesired operation.

Note: 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.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission,etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, then the host can be sold legally.