

PTR9618PA

Bluetooth 5 ready System on Module with PA Embedded Cortex™ M4F 32 bit processor

The PTR9618PA ultra-low power Bluetooth Low Energy modules based on the nRF52832 from Nordic Semiconductor. The module with an ARM® Cortex™ M4F 32 bit processor, embedded 2.4GHz transceiver, and integrated antenna, provide a complete solution with no additional RF design, 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.

Features

- System on Module(SOM) base on Nordic nRF52832
- Bluetooth Low Energy protocol support
- Complete Bluetooth Low Energy stack/profiles solution (Bluetooth 5.0 and Higher)
- ARM® Cortex™-M4F 32 bit processor, 512 kB flash memory, 64 kB RAM
- 31 General Purpose I/O, Configurable mapping Pins, Simple layout of external application
- 12-bit/200KSPS ADC
- Three SPI Master/Slave (8 Mbps)
- Low power comparator, Temperature sensor, Random Number Generator
- Two 2-wire Master/Slave (I2C compatible)
- I2S audio interface, PDM audio interface
- UART (w/ CTS/RTS and DMA)
- 3x4-channel PWMs
- 20 channel CPU independent Programmable Peripheral Interconnect (PPI)
- Quadrature Demodulator (QDEC)
- 128-bit AES HW encryption
- 5 x 32bit Timers, 3 x 24bit Real Timer Counters (RTC), Watchdog Timer
- NFC-A tag interface for OOB pairing
- Internal RC Oscillator 32.768 kHz(± 250 ppm).
- No external components required
- Over-the-Air (OTA) firmware updates available
- Small size about 22.7mmx17.5mm x2mm, 1.27mm pin pitch.

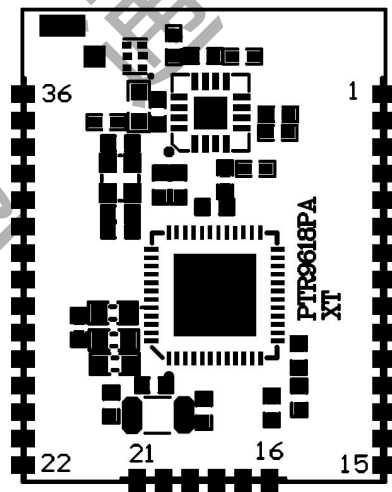
Typical Applications:

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

Quick Specifications:

Bluetooth	
Version	Bluetooth 5.0 and Higher
Security	AES-128
Radio	
Frequency	2.402GHz to 2.480GHz
Modulations	GFSK at 1 Mbps, 2 Mbps data rates
Receiver sensitivity	-103dBm (BLE mode)
Antenna	IPX interface
Current Consumption	
TX only @ +20 dBm	~110 mA
RX only @ 1 Mbps @ 3V, DC/DC enabled	~15 mA
Operating conditions	
Power supply	2.7~3.6V
Operating temperature	-25~+85 °C

Pin Description of Module (Top View) :



Pin	Name	Description	Note
Pin1	P0.23	Digital I/O	
Pin2	P0.22	Digital I/O	
Pin3	P0.21	Digital I/O	Configurable as pin reset.
Pin4	P0.20	NC	Reserved for control PA/LNA internal
Pin5	SWDCLK	HW debug and flash programming I/O	
Pin6	SWDIO	HW debug and flash programming I/O	

Pin7	P0.19	Digital I/O	
Pin8	P0.18	Digital I/O	
Pin9	P0.17	Digital I/O	
Pin10	P0.16	Digital I/O	
Pin11	P0.15	Digital I/O	
Pin12	P0.14	Digital I/O	
Pin13	P0.13	Digital I/O	
Pin14	P0.12	Digital I/O	
Pin15	P0.11	Digital I/O	
Pin16	P0.10	Digital I/O	
Pin17	P0.09	Digital I/O	
Pin18	P0.08	Digital I/O	
Pin19	P0.07	Digital I/O	
Pin20	P0.06	Digital I/O	
Pin21	P0.05	Digital I/O	
Pin22	P0.04	Digital I/O	
Pin23	P0.03	Digital I/O	
Pin24	P0.02	Digital I/O	
Pin25	P0.01	Digital I/O/XL2	
Pin26	P0.00	Digital I/O/XL1	
Pin27	P0.31	Digital I/O	
Pin28	P0.30	Digital I/O	
Pin29	P0.29	Digital I/O	
Pin30	P0.28	Digital I/O	
Pin31	P0.27	Digital I/O	
Pin32	P0.26	Digital I/O	
Pin33	P0.25	Digital I/O	
Pin34	VCC	Power Supply	
Pin35	P0.24	NC	Reserved for control PA/LNA internal
Pin36	GND	Ground	

Note 1: P0.20 and P0.24 are reserved for PA control internal , so pin4 and pin35 should be Not connect.

Note 2: An internal 4.7μF bulk capacitor has been included on the module. it is good design practice to add additional bulk capacitance(e.g 10uF) as required for your application.

General Purpose I/O:

The general purpose I/O is organized as one port enabling access and control of the 32 available GPIO pins through one port. 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

PA control:

Additional logic signals are needed to control TX PA and RX LNA. On the nRF51 there was an option to use the VDD_PA pin to detect when the radio was in TX mode, but this is not an option on the nRF52, making the SoftDevice solution necessary. The S132 SoftDevice for the nRF52 has support for enable/disable switching of external Power Amplifiers (PA) and LNA using GPIO pins.

On the module, P0.20 and P0.24 are reserved to control PA and LNA, so these two pins can Not be allocated to other usage.

The truth table of PA/LNA control signals as bellow:

PIN24	PIN20	PA status
1	0	TXEN
0	1	RXEN
0	0	IDLE
1	1	INVALID

The following function can be used to enable PA/LNA signal with P0.20 and P0.24. Add this function to your project and call it after ble_stack_init():

```
static void pa_assist(uint32_t gpio_pa_pin, uint32_t gpio_lna_pin)
{
    ret_code_t err_code;

    static const uint32_t gpio_toggle_ch = 0;

    static const uint32_t ppi_set_ch = 0;

    static const uint32_t ppi_clr_ch = 1;

    // Configure SoftDevice PA assist

    ble_opt_t opt;

    memset(&opt, 0, sizeof(ble_opt_t));
}
```

```
// Common PA config

opt.common_opt.pa_lna.gpiote_ch_id = gpio_toggle_ch; // GPIOTE channel

opt.common_opt.pa_lna.ppi_ch_id_clr = ppi_set_ch; // PPI channel for pin clearing

opt.common_opt.pa_lna.ppi_ch_id_set = ppi_clr_ch; // PPI channel for pin setting

// PA config

opt.common_opt.pa_lna.pa_cfg.active_high = 1; // Set the pin to be active high

opt.common_opt.pa_lna.pa_cfg.enable = 1; // Enable toggling

opt.common_opt.pa_lna.pa_cfg.gpio_pin = gpio_pa_pin; // The GPIO pin to toggle

opt.common_opt.pa_lna.lna_cfg.active_high = 1;

opt.common_opt.pa_lna.lna_cfg.enable = 1;

opt.common_opt.pa_lna.lna_cfg.gpio_pin = gpio_lna_pin;

err_code = sd_ble_opt_set(BLE_COMMON_OPT_PA_LNA, &opt);

APP_ERROR_CHECK(err_code);

}
```

The following main function is an example that to show you how to enable PA/LNA signal in your project:

```
int main(void)
{
    uint32_t err_code;

    // Initialize.

    APP_TIMER_INIT(APP_TIMER_PRESCALER, APP_TIMER_OP_QUEUE_SIZE, false);

    ble_stack_init();

    pa_assist(24,20);

    gap_params_init();
}
```

```

services_init();

advertising_init();

conn_params_init();

err_code = ble_advertising_start(BLE_ADV_MODE_FAST);

APP_ERROR_CHECK(err_code);

// Enter main loop.

for (;;)

{

    power_manage();

}

}
    
```

Hardware RESET:

There is on-chip power-on reset circuitry, But can still be used in external reset mode, in this case, GPIO pin P0.21 as an external hardware reset pin(Active Low). In order to utilize P0.21 as a hardware reset, the UICR registers PSELRESET[0] and PSELRESET[1] must be set alike, to the value of 0x7FFFFFF5. When P0.21 is programmed as RESET, the internal pull-up is automatically enabled.

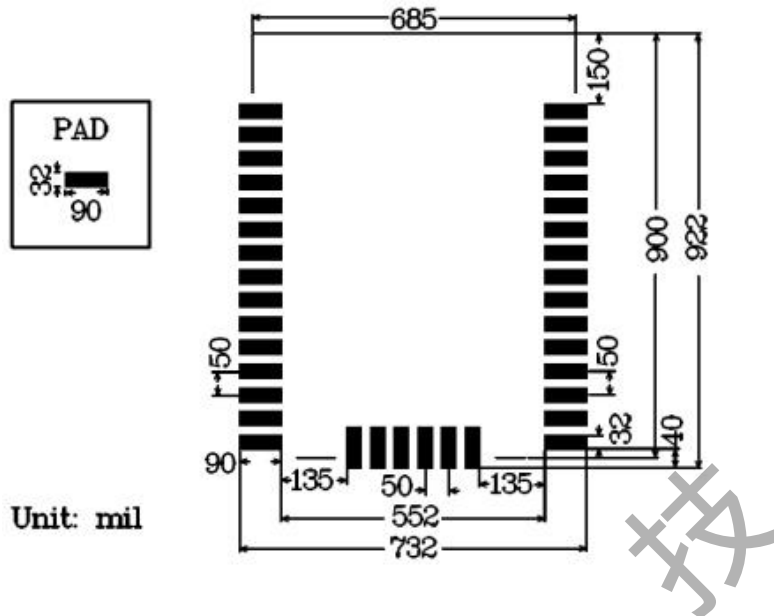
HW debug and flash programming of Module :

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
SWCLK	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.

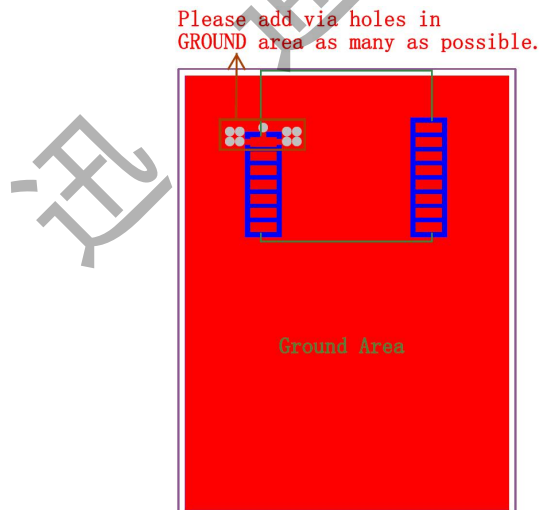
PCB Footprint (Top View) :



Recommended RF Layout & Ground Plane:

The module antenna requires a suitable ground plane to radiate effectively. Reducing the ground plane will reduce the effective radiated power.

Please add as more as possible via holes on the mother board near the GND pin of module, this will be good for the RF performance of system board.



Radio Specifications:

Parameter	Min.	Typ.	Max.	Unit
Frequency Range	2402		2480	MHz
Rx Sensitivity Level, @BLE1 Mbps		-103		dBm
Data Rate on air	1000		2000	kbps
Operating Temperature Range	-40	25	85	°C

Operating Conditions:

Parameter	Min.	Typ.	Max.	Unit
Supply voltages				
VDD	2.7	3.3	+3.6	V
Operating Temperature Range	-40	25	85	°C

Absolute Maximum Ratings:

Parameter	Min.	Max.	Unit
Supply voltages			
VDD	-0.3	+3.9	V
VSS	0	0	V
I/O pin voltage			
Voltage on GPIO pins ($V_{CC} \leq 3.6V$)	-0.3	VDD + 0.3	
Voltage on GPIO pins ($V_{CC} > 3.6V$)	-0.3	+3.9	
RF input level		10	dBm
Environmental			
ESD Human Body Model		2	KV
ESD Human Body Model Class		2	
ESD Charged Device Model		500	V
Storage temperature	-40	125	°C
Flash memory Endurance		10000	Write/erase cycles

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

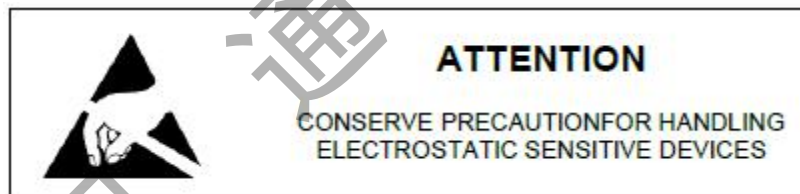
Notes and Cautions:

Design Notes

- (1) It is critical to following the recommendations of this document to ensure the module meets the specifications.
- (2) Power supply must be free of AC ripple voltage. If such noise is present, it is critical to provide proper filtering and decoupling.
- (3) The module should not be stressed mechanically after installation.
- (4) Exposing the module to significant temperatures will result in degradation and decreased lifetime.
- (5) Keep module away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies.
- (6) Avoid static electricity, ESD and high voltage as these may damage the module.

Handling and Storage

- (1) Keep module away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies.
- (2) Do not expose the module to the following conditions: Corrosive gasses such as Cl₂, H₂S, NH₃, SO₂, or NO_x Extreme humidity or salty air Prolonged exposure to direct Sunlight Temperatures beyond those specified for storage.
- (3) Do not apply mechanical stress.
- (4) Do not drop or shock the module.
- (5) Avoid static electricity, ESD and high voltage as these may damage the module.



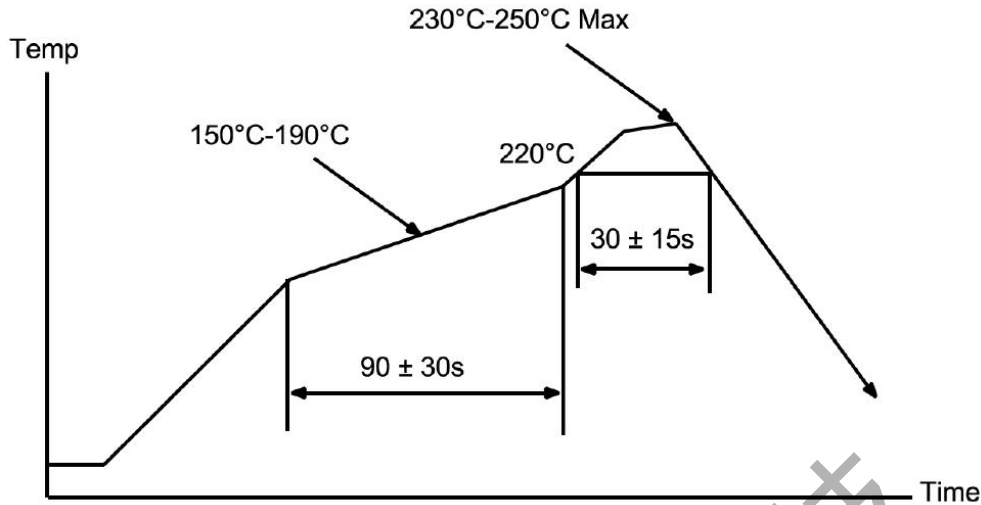
Moisture Sensitivity

All plastic packages absorb moisture. During typical solder reflow operations when SMDs are mounted onto a PCB, the entire PCB and device population are exposed to a rapid change in ambient temperature. Any absorbed moisture is quickly turned into superheated steam. This sudden change in vapor pressure can cause the package to swell. If the pressure exerted exceeds the flexural strength of the plastic mold compound, then it is possible to crack the package. Even if the package does not crack, interfacial delamination can occur.

Since the device package is sensitive to moisture absorption, it is recommended to bake the product before assembly.



Solder Reflow Temperature-Time Profile



Life Support Applications

Products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Customers using or selling these products for use in such applications do so at their own risk.

Additional Customization

We provide extensive customization, design and manufacturing services to ensure the perfect fit for your product. Our wide selection of modules allows developers to create any number of products. Should you need more information and assistance in integrating this module or developing your product, please contact us.

- Custom Hardware design including Modules, RF and Antenna Design
- Bluetooth Low Energy and Firmware Development
- Mobile Apps for iOS and Android
- Cloud Platform

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Antenna:
Maufacture: LANKE XUNTONG TECHNOLOGY CO.,LTD
Antenna type:XANT-IPX-10
Antenna gain:2dBi

Ordering Information:

Part Number	Description
PTR9618PA	Coin-size Bluetooth 5 ready multi-protocol System on Module with PA
PTR9618PA-EVB	Evaluation boards for module, with key, LED, I/O extend, sock for coin cell battery.

FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Integral antenna with antenna gain 2.0dBi

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.

FCC Radiation Exposure Statement

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

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. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

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-PTR9618PA Or Contains FCC ID: 2AA72-PTR9618PA"

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.