

# **PTR5618PALCI**

## ***Coin-size Bluetooth Low Energy System on Module with PA Embedded Cortex™ M4F 32 bit processor***

The PTR5618PALCI ultra-low power Bluetooth Low Energy/2.4GHz Proprietary Multi-protocol 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/2.4GHz Proprietary Multi-protocol support
- Complete Bluetooth Low Energy stack/profiles solution (Bluetooth 4.x and Higher)
- ARM® Cortex™-M4F 32 bit processor, 512 kB flash memory, 64 kB RAM
- 2.4 GHz transceiver, Max TX Power +20 dBm, -96 dBm sensitivity@BLE
- 11 General Purpose I/O, Configurable mapping Pins, Simple layout of external application
- 12-bit/200KSPS ADC, PWM, 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)
- 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
- Internal RC Oscillator 32.768 kHz(± 250 ppm).
- No external components required
- Over-the-Air (OTA) firmware updates available
- Ultra small size(smaller than CR2032 coin battery), about 15mmx15mmx1.8mm.

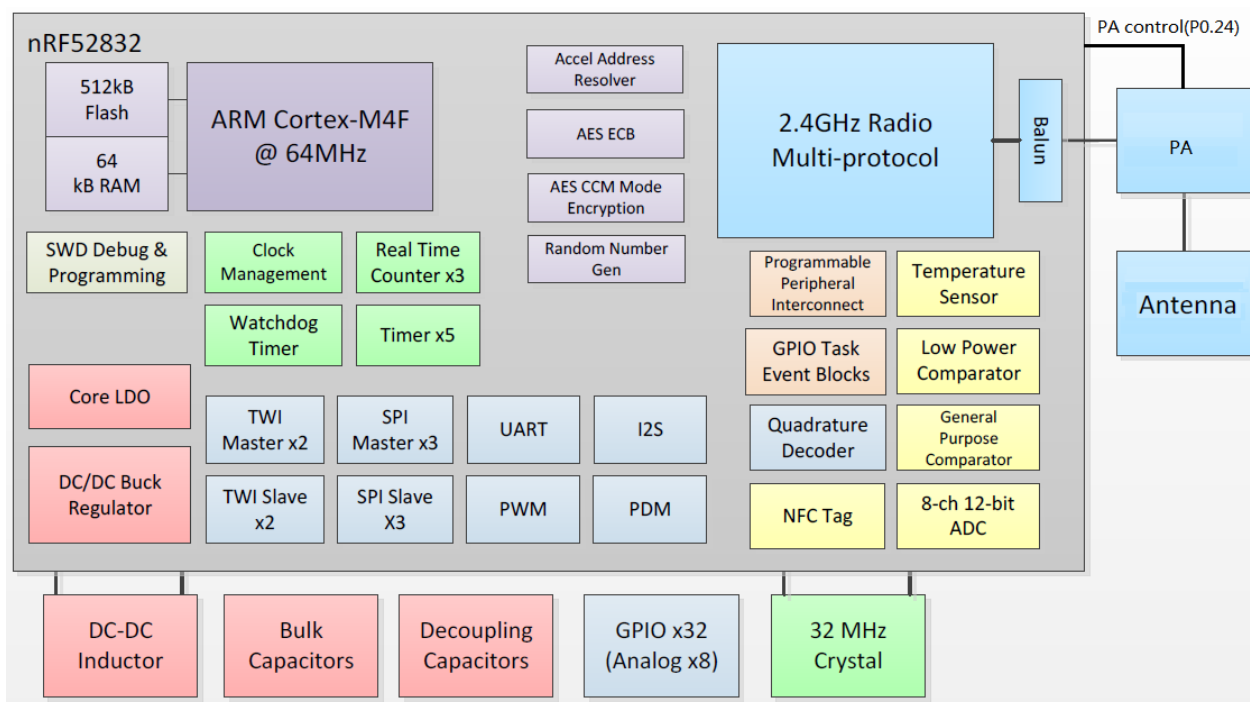
## Typical Applications:

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

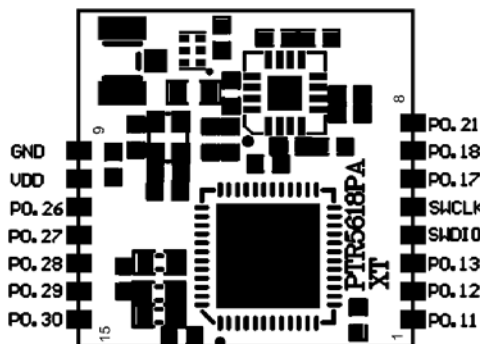
## Quick Specifications:

Multi-protocol	
Version	Bluetooth 4.x and Higher/ANT/2.4GHz Proprietary
Security	AES-128
Radio	
Frequency	2.402GHz to 2.480GHz
Modulations	GFSK at 1 Mbps
Receiver sensitivity	-96dBm (BLE mode)
Antenna	IPX interface
Current Consumption	
TX only @ +20 dBm	~100 mA
RX only @ 1 Mbps @ 3V, DC/DC enabled	~5.4 mA
RX only @ 1 Mbps	~11.7 mA
CPU @ 64MHz from flash	7.5 mA
CPU @ 64MHz from RAM	6.7 mA
CPU @ 64MHz from flash @ 3V, DC/DC	3.7 mA
CPU @ 64MHz from flash RAM @ 3V, DC/DC	3.3 mA
System On	1.2 $\mu$ A
System Off	0.7 $\mu$ A
Operating conditions	
Power supply	2.7~3.6V
Operating temperature	-25~+85 °C

## Block diagram:



## Pin Description of Module (Top View) :



14	P0.29	I/O	ADC IN
15	P0.30	I/O	ADC IN

Note 1: P0.20 and P0.24 are reserved for PA control internal.

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 0x7FFFFFFF15. When P0.21 is programmed as RESET, the internal pull-up is automatically enabled.

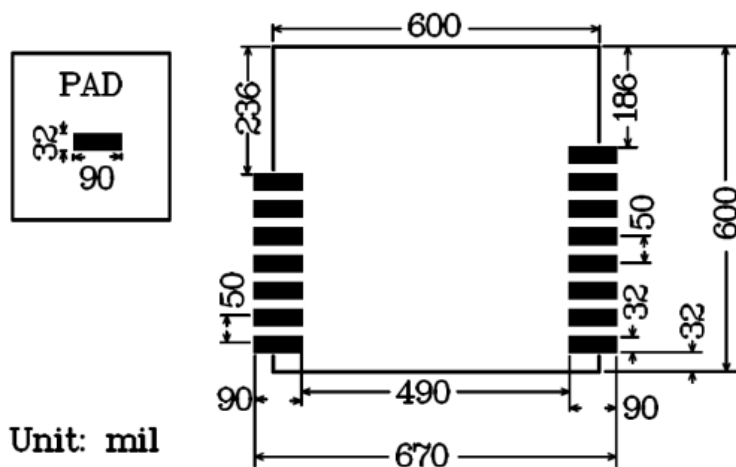
## HW debug and flash programming of Module:

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](http://www.segger.com).

## PCB Footprint (Top View) :



## Ordering Information:

Part Number	Description
PTR5618PALCI	Bluetooth Low Energy System on Module with PA
PTR5618PALCI-EVB	Evaluation boards for module, with key, LED, I/O extend, sock for coin cell battery.

## Absolute Maximum Ratings:

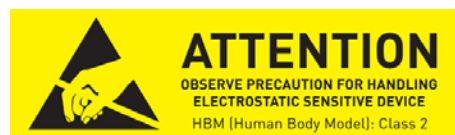
Symbol	Parameter	Min.	Max.	Unit
V <sub>CC_MAX</sub>	Voltage on supply pin	-0.3	3.9	V
V <sub>IO_MAX</sub>	Voltage on GPIO pins (V <sub>CC</sub> > 3.6V)	-0.3	3.9	V
V <sub>IO_MAX</sub>	Voltage on GPIO pins (V <sub>CC</sub> ≤ 3.6V)	-0.3	V <sub>CC</sub> + 0.3V	V
T <sub>S</sub>	Storage Temperature Range	-40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

## 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.

## ATTENTION!

Electrostatic Sensitive Device  
Observe Precaution for handling.





## FCC regulatory compliance statement

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.

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

This Module complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

### Labelling Instruction for Host Product Integrator

Please notice that 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 FCC ID: **2AKWC-PTR5618PALCI**" any similar wording that expresses the same meaning may be used.

§ 15.19 Labelling requirements shall be complied on end user device.

Labelling rules for special device, please refer to §2.925, § 15.19 (a)(5) and relevant KDB publications. For E-label, please refer to §2.935.

### Installation Notice to Host Product Manufacturer

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §2.1093 and difference antenna configurations.

### Antenna Change Notice to Host manufacturer

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

### FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.

Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 *Information to the user* or such similar statement and place it in a prominent location in the text of host product manual. Original texts as following:

## For Class B

*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.*

## For Class A

*Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*