PTR5518PA

Coin-size Bluetooth Low Energy System on Module with PA Embedded Cortex™ M0 32 bit processor

The PTR5518PA ultra-low power Bluetooth Low Energy/2.4GHz Proprietary Multi-protocol modules based on the nRF51822 from Nordic Semiconductor. The module with an ARM® Cortex™ M0 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 nRF51822

➢ Bluetooth Low Energy/2.4GHz Proprietary Multi-protocol support

➢ Complete Bluetooth Low Energy stack/profiles solution (Bluetooth 4.x and Higher)

➢ ARM® Cortex™-M0 32 bit processor, 256 kB flash memory, 16 kB RAM

➢ 2.4 GHz transceiver， Max TX Power +16 dBm， -93 dBm sensitivity@BLE

➢ 11 General Purpose I/O, Configurable mapping Pins, Simple layout of external application

➢ Internal RC Oscillator 32.768 kHz($\pm$ 250 ppm).

➢ Flexible real-time counter and Two 16 bit and one 24 bit timers with counter mode

➢ AES Coprocessor, Random Number Generator ,Watchdog Timer ,Temperature sensor

➢ Rich set of Peripheral: ADC, SPI, 2-wire , and UART. Programmable Peripheral Interconnect(PPI)

➢ Internal RC Oscillator 32.768 kHz($\pm$ 250 ppm).

➢ 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:

Bluetooth	
Version	Bluetooth 4.x and Higher
Security	AES-128
Radio	
Frequency	2.402GHz to 2.480 GHz
Modulations	GFSK at 1 Mbps, 2 Mbps data rates
Transmit power	+16 dBm @setting nRF51822 0dBm output
Receiver sensitivity	-93 dBm (BLE mode)
Antenna	IPX interface

Current Consumption	
TX only @ +16 dBm	~100 mA
RX only @ 1 Mbps @ 3V,	~13 mA
MCU running @16MHz code from Flash	~4.4 mA
MCU running @16MHz code from RAM	~2.4 mA
SYSTEM ON	~2.3 uA
SYSTEM OFF	~420 nA

Operating conditions	
Power supply	2.7~3.6V
Operating temperature	-25~+85 °C

Block diagram:
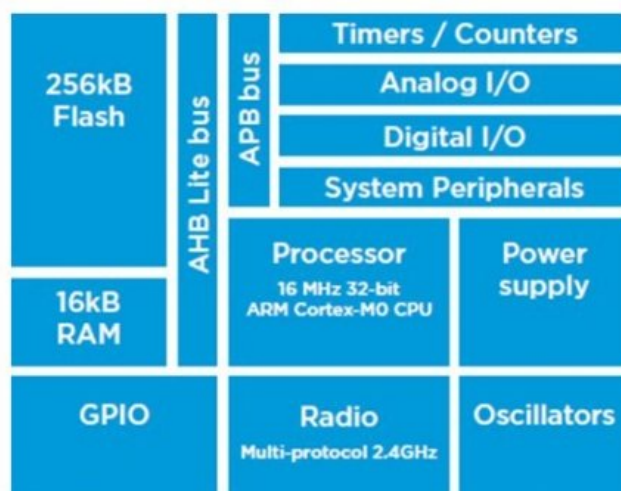
Pin Description of Module（Top View）:
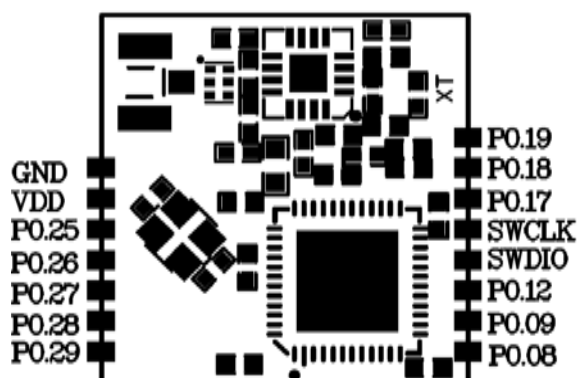
Pin No.	Name	Description	Note
1	P0.08	I/O	
2	P0.09	I/O	
3	P0.12	I/O	
4	SWDIO	Debug and flash programming I/O	
5	SWCLK	Debug and flash programming I/O	
6	P0.17	I/O	
7	P0.18	I/O	
8	P0.19	I/O	
9	GND	Power Ground	
10	VDD	Power Supply	
11	P0.25	I/O	
12	P0.26	I/O	ADC IN 0
13	P0.27	I/O	ADC IN 1
14	P0.28	I/O	
15	P0.29	I/O	

Note 1: 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:

A logic signal is needed to enable/disable PA/LNA part, P0.20 is used to achieve this purpose. Set P0.20 to high will enable PA/LNA. Set P0.20 to low will disable PA/LNA to deep sleep mode.

As the most basic use case, simply set the P0.20 to high will enable PA/LNA part always.

If you need to get lower power consumption, you need to accurately control the timing of the PA/LNA when it need to work, in accordance with the provisions of the timing will be closed.

In order to achieve this goal, need to know exactly time to control the PA/LNA. By calling the Notify Radio() function, you can know when the RF activation, resulting in the appropriate timing to control P0.20.

```
#define PIN_5518CTR 20

for (;;)

{

    if(m_radio_active_flag)//enable PA

    {

        m_radio_active_flag=0;

        nrf_gpio_pin_set(PIN_5518CTR);//pin 20

        err_code = app_timer_start(m_apps_timer_id, APP_TIMER_TICKS(10,
        APP_TIMER_PRESCALER) , NULL);//app_timer 10ms

        APP_ERROR_CHECK(err_code);

```

```
        }

        if(apptimer_timeout_flag)//disable PA

        {

          apptimer_timeout_flag=0;

          nrf_gpio_pin_clear(PIN_5518CTR);

        }

        power_manage();

    }
```

We have modified the source code ble_radio_notification.c that provided by nRF51 SDK, to achieve this purpose.

The modified ble_radio_notification.c is located in the directly \nRF51_SDK_9.0.0_2e23562_5518PA_DEMO\components\ble\ble_radio_notification of source code package we provided.

By add the ble_radio_notification.c file to the project, the Radio Notify() function can be used to detect if RF is active, below is the key code for the usage of Radio Notify() function:

```
bool m_radio_active_flag=0;

void ble_radio_active_evt(bool radio_active)

{

        m_radio_active_flag=1;

}

static void radio_notification_open_init(void)

{

        uint32_t err_code;

        err_code = ble_radio_notification_init(NRF_APP_PRIORITY_LOW,


NRF_RADIO_NOTIFICATION_DISTANCE_800US,
```

```
ble_radio_active_evt,1);

    APP_ERROR_CHECK(err_code);

}
```

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

```
int main(void)

{

    uint32_t err_code;

    app_timers_init();

    nrf_gpio_cfg_output(PIN_5518CTR);

    nrf_gpio_pin_set(PIN_5518CTR);

    nrf_delay_ms(2000);

    ble_stack_init();

    gap_params_init();

    services_init();

    advertising_init();

    conn_params_init();

    err_code = ble_advertising_start(BLE_ADV_MODE_FAST);

    APP_ERROR_CHECK(err_code);

    radio_notification_open_init();

    // Enter main loop.

    for (;;)

    {

        if(m_radio_active_flag)//enable PA
```

```
    {

        m_radio_active_flag=0;

        nrf_gpio_pin_set(PIN_5518CTR);//pin 20

        err_code = app_timer_start(m_apps_timer_id, APP_TIMER_TICKS(10,
        APP_TIMER_PRESCALER) , NULL);//app_timer 10ms

        APP_ERROR_CHECK(err_code);

    }

    if(apptimer_timeout_flag)//disable PA

    {

        apptimer_timeout_flag=0;

        nrf_gpio_pin_clear(PIN_5518CTR);

    }

    power_manage();

    }

}
```

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）:

Unit: mil
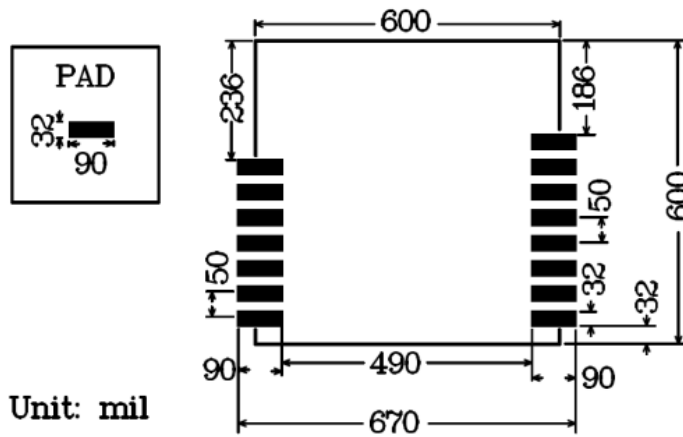
Ordering Information:

Part Number	Description
PTR5518PA	Bluetooth Low Energy System on Module with PA
PTR5518PA-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_{CC_MAX}	Voltage on supply pin	-0.3	3.9	V
V_{IO_MAX}	Voltage on GPIO pins ($V_{CC} > 3.6V$)	-0.3	3.9	V
V_{IO_MAX}	Voltage on GPIO pins ($V_{CC} \leq 3.6V$)	-0.3	$V_{CC} + 0.3V$	V
T_S	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.