

ABBLUE TECHNOLOGY

PTR9818PA *Full Bluetooth 5 ready multi-protocol SoC Module with PA, Embedded Cortex™ M4F 32 bit processor Support Bluetooth 5, Zigbee, Thread, MESH, ANT Ideal choice of IoT and Smart product*

The PTR9818PA ultra-low power Bluetooth 5 ready multiprotocol System on Module based on the nRF52840 from Nordic Semiconductor,, designed for longer distance communication, built-in maximum +20dBm RF output. The module can support Bluetooth 5.4 by upgrading the protocol stack. 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 support, 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 smartapplication and remove the worries. It has an ARM® TrustZone® CryptoCell-310 co-processor for implementation of IoT security.

Features

- | | |
|--|--|
| <ul style="list-style-type: none">◆ Nordic nRF52840 with ARM Cortex M4F◆ Multiprotocol support : Bluetooth 5◆ Bluetooth 5: 2 Mbps, 1 Mbps, 500 kbps, 125kbps◆ IEEE 802.15.4-2006: 250 kbps◆ Integrated DC-DC converter◆ Serial Wire Debug (SWD)◆ Nordic SoftDevice Ready◆ Over-the-Air (OTA) firmware update◆ Flash/RAM: 1MB/256KB.◆ 46 General purpose I/O pins(reserve 2 I/O for RF front-end control)◆ 15 level low-power comparator with wake-up from System OFF mode◆ Two 2-wire Master/Slave (I2C compatible) | <ul style="list-style-type: none">◆ 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◆ Sizes: 24.3x17.5 x1.8mm◆ Ext. IPX Antenna◆ DC/DC on board◆ No external components required◆ Operation voltage: 2.7V to 3.6V |
|--|--|

ABBLUE TECHNOLOGY

Typical Applications:

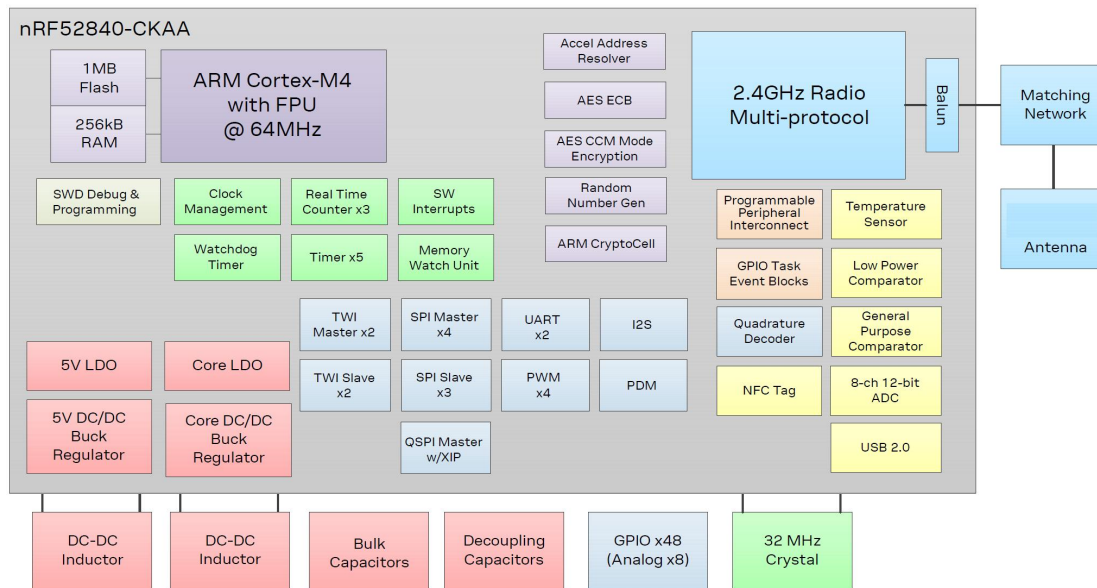
- 2.4 GHz Bluetooth low energy systems
- Sports and leisure equipment
- Mobile phone accessories, Connected Appliances
- Health Care and Medical
- Consumer Electronics, Game pads
- Human Interface Devices, Remote control
- Building environment control / monitoring
- RFID, Security Applications, Low-Power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

Quick Specifications:

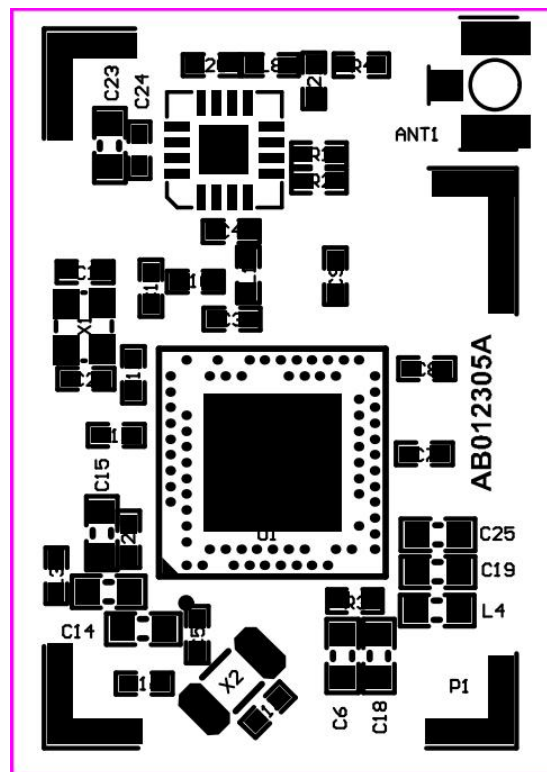
Multi-protocol	
Version	Bluetooth 5.0 and Higher/ANT/2.4GHz Proprietary/802.15.4/Zigbee
Security	AES-128
Radio	
Frequency	2402MHz to 2480GHz
Modulations	GFSK at 2/1 Mbps, Long range 125/500kbps, 802.15.4- 250 kbps
Transmit power	Max +12dBm
Receiver sensitivity	-103dBm@BLE 125kbps(long range), -95dBm@BLE 1M
Antenna	Ext. IPX Antenna
Current Consumption	
TX only @ 20 dBm	~100 mA
RX only @ 1 Mbps @ 3V, DC/DC enabled	4.6 mA
CPU @ 64MHz from flash @ 3V, DC/DC	3.3 mA
System On	1.5 μ A
System Off	0.4 μ A
Operating conditions	
Power supply	2.7~3.6V
Operating temperature	-25~+85 °C

ABLU TECHNOLOGY

Block diagram:

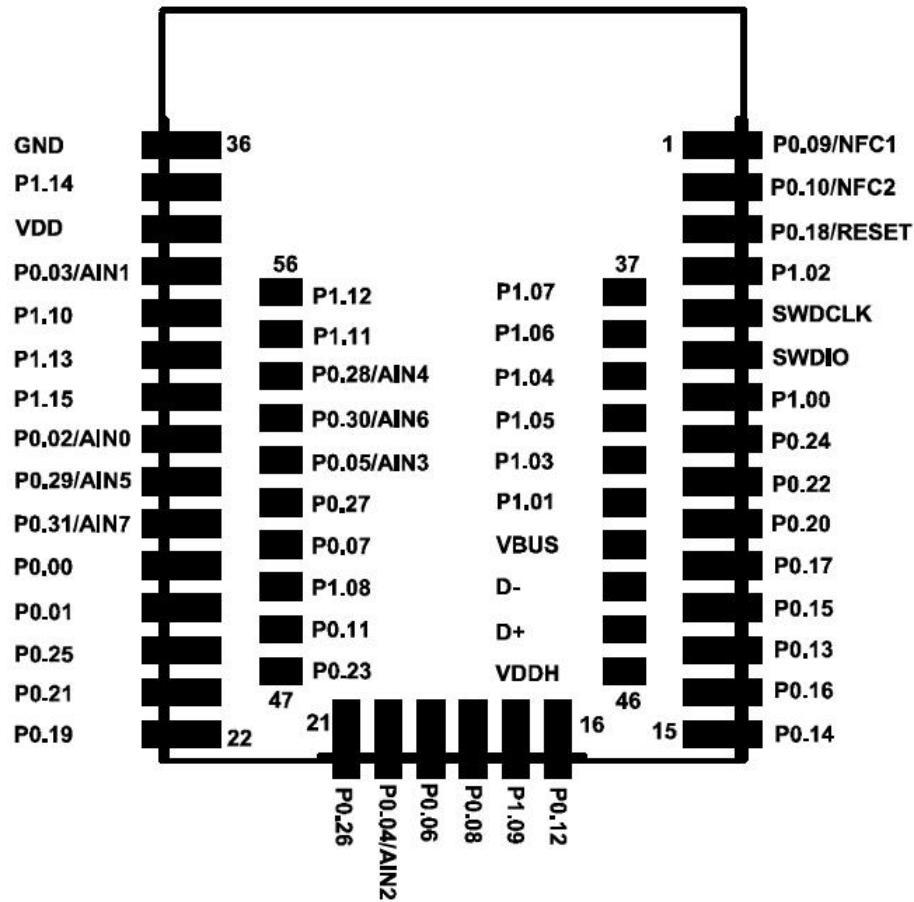


Module Top View:



ABBLUE TECHNOLOGY

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	

ABBLUE TECHNOLOGY

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/XL2	Reserve for 32.768KHz use	
Pin26	P0.00/XL1	Reserve for 32.768KHz use	
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	Reserved for control PA/LNA internal
Pin38	P1.06	Digital I/O	Reserved for control PA/LNA internal
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

*The module needs to reserve 2 I/O for RF front-end control , already internally connected on module.

ABLUE TECHNOLOGY

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 0x7FFFFFFF. 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.

PA control:

1. Hardware connection

nRF52840	PA/LNA
P1.07	RXEN
P1.06	TXEN

2. Device control

The SoftDevice for the nRF52 has support for enable/disable switching of external Power Amplifiers (PA) using GPIO pins.

In the module, P1.06 and P1.07 is reserved to control PA. The following function can be used to enable PA signal . Add this function to your project and call it after ble_stack_init():

P1.06	P1.07	PA status
1	0	TXEN
0	1	RXEN
0	0	IDLE
1	1	INVALID

```
#define PA_TX_EN   (38) //P1.06
#define PA_RX_EN   (39) //P1.07

static void pa_assist(uint32_t pa_pin, uint32_t lna_pin){
    ret_code_t err_code;
    static const uint32_t gpio_toggle_ch = 7;
    static const uint32_t ppi_set_ch = 7;
    static const uint32_t ppi_clr_ch = 6;

    ble_opt_t opt;
    memset(&opt, 0, sizeof(ble_opt_t));
    opt.common_opt.pa_lna.gpiote_ch_id = gpio_toggle_ch;
    opt.common_opt.pa_lna.ppi_ch_id_clr = ppi_set_ch;
    opt.common_opt.pa_lna.ppi_ch_id_set = ppi_clr_ch;

    opt.common_opt.pa_lna.pa_cfg.active_high = 1;
    opt.common_opt.pa_lna.pa_cfg.enable = 1;
    opt.common_opt.pa_lna.pa_cfg.gpio_pin = pa_pin;

    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 = lna_pin;

    err_code = sd_ble_opt_set(BLE_COMMON_OPT_PA_LNA, &opt);
}
```

ABLUE TECHNOLOGY

```
APP_ERROR_CHECK(err_code);  
}
```

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

```
int main(void)  
{  
    uint32_t err_code;  
    bool erase_bonds;  
    // Initialize.  
    APP_TIMER_INIT(APP_TIMER_PRESCALER, APP_TIMER_OP_QUEUE_SIZE, false);  
    uart_init();  
    buttons_leds_init(&erase_bonds);  
    ble_stack_init();  
    pa_assist(PA_TX_EN, PA_RX_EN); //after initializing ble stack, call this function will enable PA  
    signal  
    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();}  
}
```

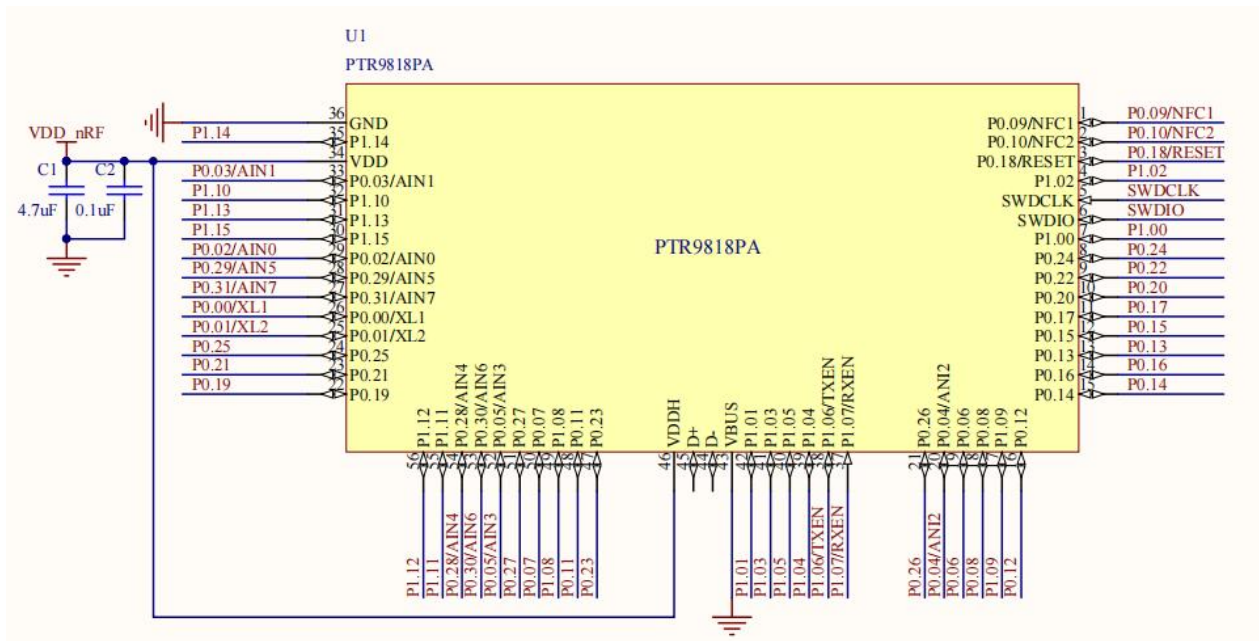
ABLU TECHNOLOGY

Reference circuitry:

In this section there are 2 reference circuits to show how to design an application circuit with this module.

Reference Circuit configuration 1

- Typical Applications
- Use Normal voltage mode
- Normal voltage mode is entered when the supply voltage is connected to both the VDD and VDDH pins (so that VDD equals VDDH).



Configurations summary for reference circuit 1

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

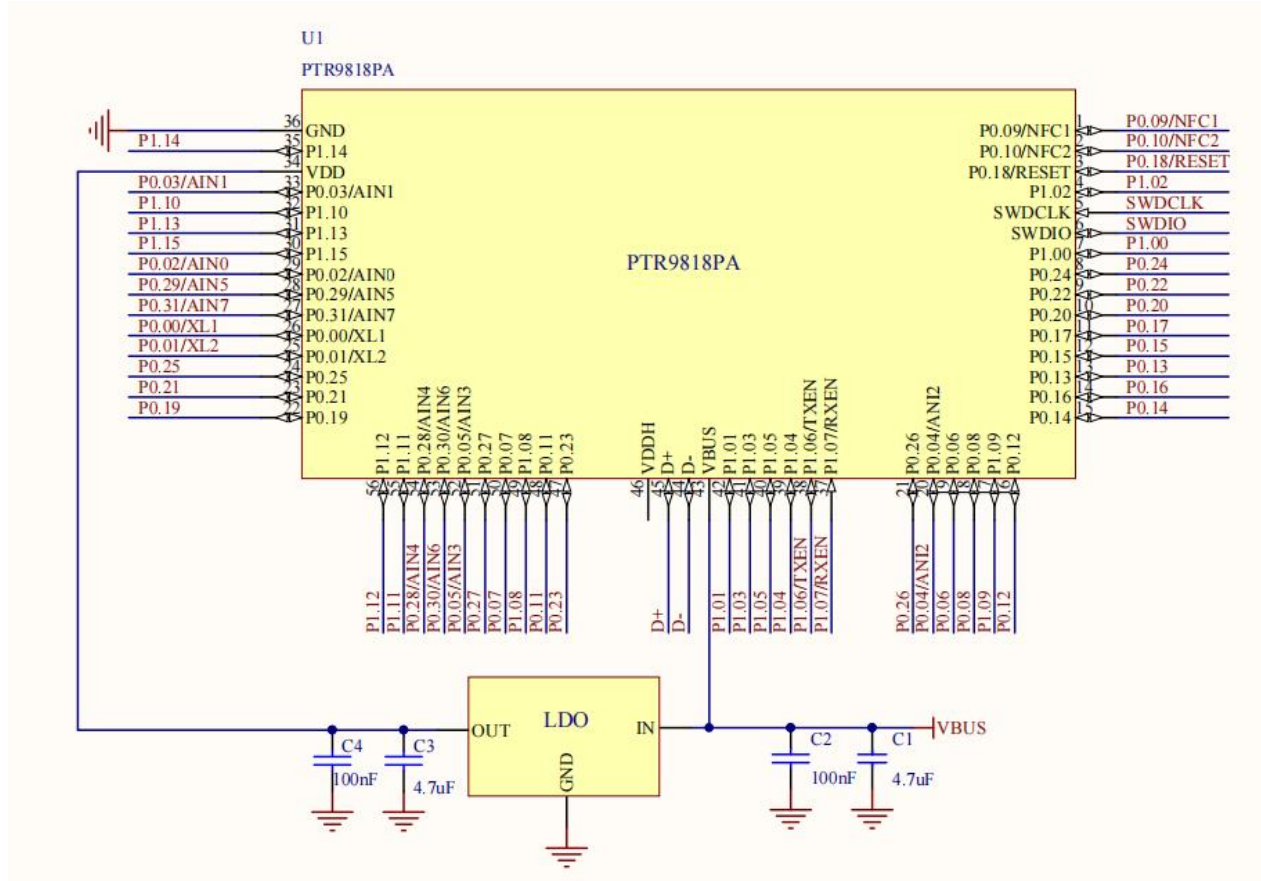
Explanation of symbols in reference circuit 1 schematic

Symbol	Parameter	Min.	Typ.	Max.	Units
V _{DD}	Main supply voltage in normal voltage mode	2.7	3	3.6	V

ABBLUE TECHNOLOGY

Reference Circuit configuration 2

- USB Applications
- When using the USB peripheral, 5V USB supply needs to be provided on the VBUS pin.



Configurations summary for reference circuit 2

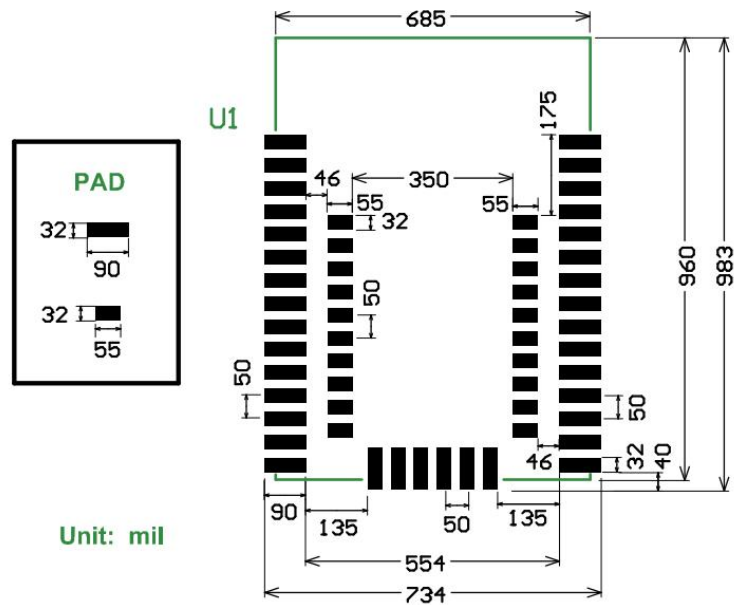
Config no.	Main Supply		EXT Supply Output	USB
	VDDH	VDD		
Config.2	N/A	Battery/Ext.regulator	No	Yes

Explanation of symbols in reference circuit 2 schematic

Symbol	Parameter	Min.	Typ.	Max.	Units
V _{DD}	Main supply voltage in normal voltage mode	2.7	3	3.6	V
V _{BUS}	Supply voltage on VBUS pin	4.35	5	5.5	V

ABBLUE TECHNOLOGY

PCB Footprint (Top View) :



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.

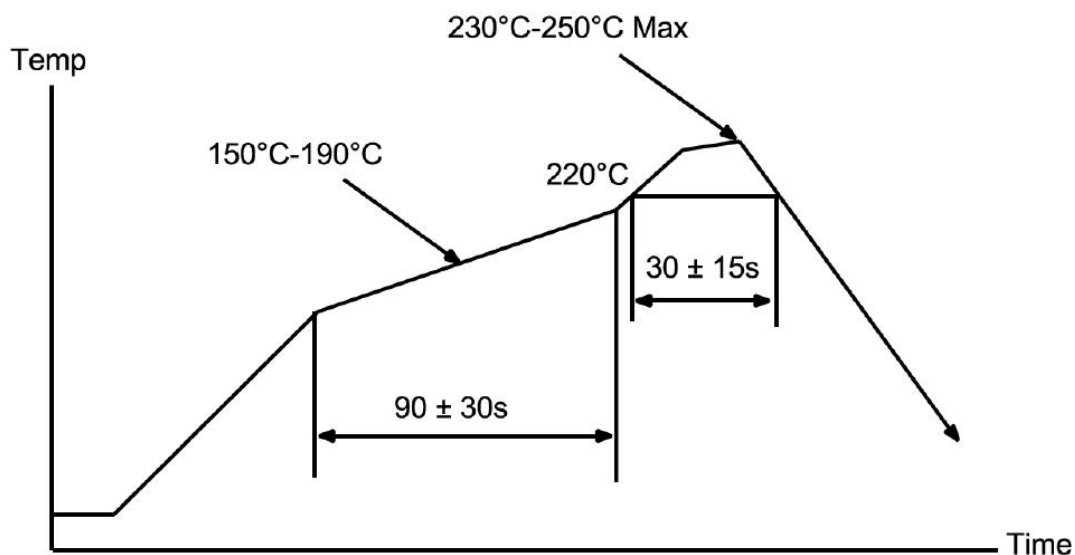
Moisture Sensitivity

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

ABLUE TECHNOLOGY

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

Trademarks

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc., Other trademarks and tradenames are those of their respective owners. ”

Right and Statements

- 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.
- 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.

Ordering Information:

Part Number	Description
PTR9818PA	Bluetooth Low Energy System on Module,EXT. IPX antenna
XANT-IPX-10	2.4GHz FPC Antenna with IPX connector, 2dB gain
XANT-SMA-10	2.4GHz Omni Antenna with SMA connector, 3dB gain
XIPX-SMA-10	IPX to SMA Converter RF cable, use for IPX type connector of RF module to SMA type Antenna.
PTR9818PA-EVB	Evaluation boards for module, with key, LED, I/O extend, sock for coin cell battery.

FCC 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.

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 important announcement

Important Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,

As long as the conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following"

Contains FCC ID: **2AA72-PTR9818PA** "

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

2.7 Antennas

This radio transmitter **FCC ID:2AA72-PTR9818PA** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
Bluetooth	/	FPC Antenna	3.57dBi	2402-2480MHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains **FCC ID:2AA72-PTR9818PA**".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.