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PTR9840PA ***Bluetooth 5 ready multi-protocol Module with PA Embedded Cortex™ M33F Dual-core processor Support LE Audio, Zigbee, Thread, Matter, ANT Ideal choice of IoT and Smart product***

The PTR9840PA ultra-low power Bluetooth 5 ready multiprotocol System on Module based on the nRF5340 from Nordic Semiconductor, designed for longer distance communication, built-in maximum +20dBm RF output. The module with an ARM® Cortex™ M33F Dual-core processor, support LE audio, Direct Finding AOA/AOD, embedded 2.4GHz transceiver, provide a complete solution with no additional RF design, Bluetooth 5, ANT/ANT+, Zigbee, Thread, Matter, 802.15.4 and 2.4GHz proprietary multi-protocol 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 smart application and remove the worries.

Features

- ◆ Nordic nRF5340 with ARM Cortex M33F Dual-core processor
- ◆ Multiprotocol support :Bluetooth 5, LE audio , ANT/ANT+, 2.4GHz proprietary, 802.15.4, Thread ,Matter and Zigbee
- ◆ Bluetooth 5.0: 2/1Mbps, 500 kbps, 125 kbps
- ◆ IEEE 802.15.4-2006: 250 kbps
- ◆ Proprietary 2.4 GHz: 2 Mbps, 1 Mbps
- ◆ Bluetooth 5.1 Direction Finding AOA/AOD
- ◆ Integrated DC-DC converter
- ◆ Serial Wire Debug (SWD)
- ◆ Nordic SoftDevice Ready
- ◆ Over-the-Air (OTA) firmware update
- ◆ 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
- ◆ IPX antenna interface
- ◆ Size:24.3x17.5 x2.5mm
- ◆ No external components required
- ◆ Operation voltage: 2.7V to 3.6V

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Application processor

- ◆ Flash/RAM: 1024KB/512KB.
- ◆ Arm TrustZone CryptoCell-312 security subsystem
- ◆ QSPI 32 MHz interface
- ◆ High-speed 32 MHz SPI
- ◆ NFC-A tag interface for OOB pairing
- ◆ 3 SPI Master/ SPI Slave
- ◆ Two 2-wire Master/Slave (I2C compatible)
- ◆ 2 UART (with CTS/RTS and DMA)
- ◆ I2S audio interface
- ◆ 3x 4-channel PWM unit with EasyDMA
- ◆ 12 bit/200KSPS ADC
- ◆ 3 x 32 bits timers,
- ◆ 2 x 24 bits Real Time Counters (RTC)
- ◆ Distributed Programmable Peripheral Interconnect (DPPI)
- ◆ Quadrature Demodulator (QDEC)

Network processor

- ◆ Flash/RAM: 256KB/64KB
- ◆ 128-bit AES HW encryption
- ◆ TX power: Max dBm
- ◆ 1 SPI Master/ SPI Slave
- ◆ 2-wire Master/Slave (I2C compatible)
- ◆ 1 UART (with CTS/RTS and DMA)
- ◆ 3 x 32 bits timers,
- ◆ 2 x Real Time Counters (RTC)
- ◆ USB 2.0 full speed (12 Mbps) controller

Typical Applications:

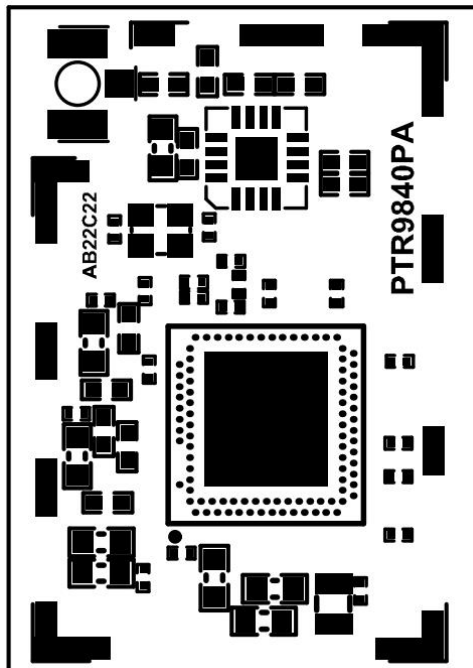
- 2.4 GHz Bluetooth low energy systems
- Proprietary 2.4 GHz systems
- Sports and leisure equipment
- Mobile phone accessories, Connected Appliances
- Health Care and Medical
- Consumer Electronics, Game pads
- Human Interface Devices, Remote control
- Building environment control / monitoring
- RFID,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

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Quick Specifications:

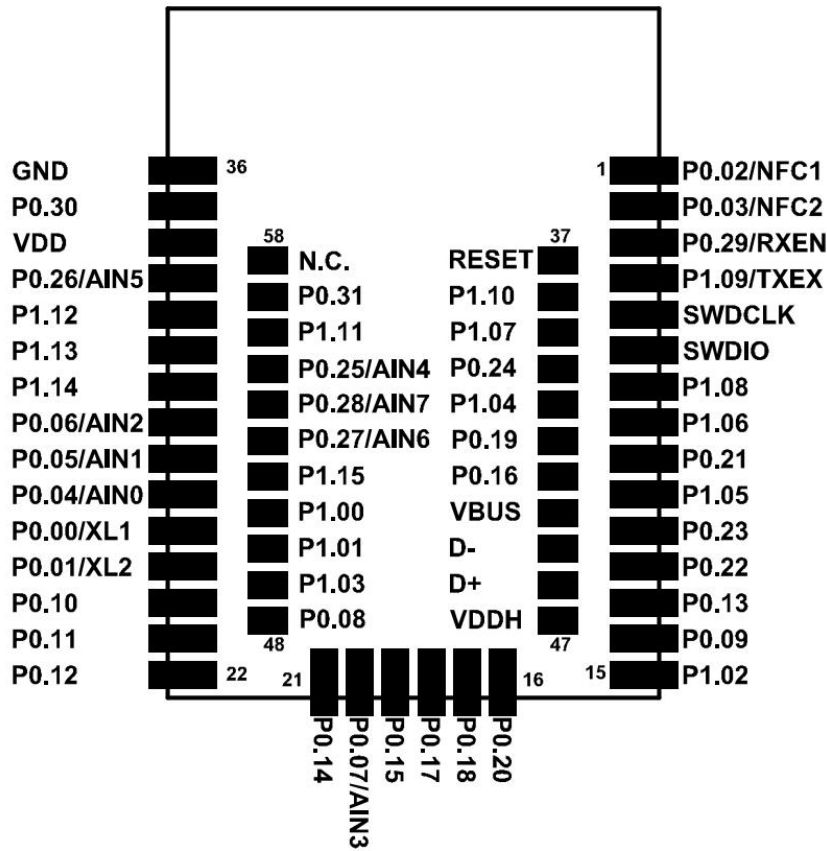
Multi-protocol	
Version	Bluetooth 5.3 and Higher/ANT/2.4GHz Proprietary/802.15.4/Zigbee/ Matter
Security	Arm TrustZone CryptoCell-312
Radio	
Frequency	2.360GHz to 2.500GHz
Modulations	GFSK at 2/1 Mbps, Long range 125/500kbps, 802.15.4 250 kbps
Transmit power	Max +20dBm @setting nRF5340 0dBm output
Receiver sensitivity	-97.5dBm@BLE 1M
Antenna	Ext. IPX Antenna
Current Consumption	
TX only @ +20 dBm	~100 mA
RX only @ 1 Mbps @ 3V, DC/DC enabled	~6 mA
System On, wake on any event	1.5 μ A
System Off, wake on reset	1.1 μ A
Operating conditions	
Power supply	2.7~3.6V
Operating temperature	-25~+85 $^{\circ}$ C

Module Top View:



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Pin Description of Module (Top View) :



Pin	Name	Description	Recommend usage
Pin1	P0.02/NFC1	Digital I/O/ NFC input	NFC antenna connection
Pin2	P0.03/NFC2	Digital I/O/ NFC input	NFC antenna connection
Pin3	P0.29	Digital I/O	Reserved for control PA/LNA internal
Pin4	P1.09	Digital I/O	Reserved for control PA/LNA internal
Pin5	SWDCLK	HW debug and rogramming	
Pin6	SWDIO	HW debug and rogramming	
Pin7	P1.08	Digital I/O	
Pin8	P1.06	Digital I/O	
Pin9	P0.21	Digital I/O	
Pin10	P1.05	Digital I/O	
Pin11	P0.23	Digital I/O	
Pin12	P0.22	Digital I/O	
Pin13	P0.13	Digital I/O	Quad SPI
Pin14	P0.09	Digital I/O	High-speed SPI
Pin15	P1.02	Digital I/O	High-speed pin for 1 Mbps TWI
Pin16	P0.20	Digital I/O	
Pin17	P0.18	Digital I/O	Quad SPI
Pin18	P0.17	Digital I/O	Quad SPI

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Pin19	P0.15	Digital I/O	Quad SPI
Pin20	P0.07/AIN3	Digital I/O/Analog input 3	
Pin21	P0.14	Digital I/O	Quad SPI
Pin22	P0.12	Digital I/O	High-speed SPI
Pin23	P0.11	Digital I/O	High-speed SPI
Pin24	P0.10	Digital I/O	High-speed SPI
Pin25	P0.01/XL2	for 32.768KHz use	
Pin26	P0.00/XL1	for 32.768KHz use	
Pin27	P0.04/AIN0	Digital I/O/Analog input 0	
Pin28	P0.05/AIN1	Digital I/O/Analog input 1	
Pin29	P0.06/AIN2	Digital I/O/Analog input 2	
Pin30	P1.14	Digital I/O	
Pin31	P1.13	Digital I/O	
Pin32	P1.12	Digital I/O	
Pin33	P0.26/AIN5	Digital I/O/Analog input 5	
Pin34	VDD	Power Supply	
Pin35	P0.30	Digital I/O	
Pin36	GND	Ground	
Pin37	RESET	RESET	
Pin38	P1.10	Digital I/O	
Pin39	P1.07	Digital I/O	
Pin40	P0.24	Digital I/O	
Pin41	P1.04	Digital I/O	
Pin42	P0.19	Digital I/O	
Pin43	P0.16	Digital I/O	Quad SPI
Pin44	VBUS	USB Power	5 V input for USB 3.3 V regulator
Pin45	D-	USB D-	USB
Pin46	D+	USB D+	USB
Pin47	VDDH	High voltage power supply	
Pin48	P0.08	Digital I/O	High-speed SPI
Pin49	P1.03	Digital I/O	High-speed pin for 1 Mbps TWI
Pin50	P1.01	Digital I/O	
Pin51	P1.00	Digital I/O	
Pin52	P1.15	Digital I/O	
Pin53	P0.27/AIN6	Digital I/O/Analog input 6	
Pin54	P0.28/AIN7	Digital I/O/Analog input 7	
Pin55	P0.25/AIN4	Digital I/O/Analog input 4	
Pin56	P1.11	Digital I/O	
Pin57	P0.31	Digital I/O	
Pin58	N.C.	NC	

*External 32.768 kHz oscillator is used to provide low frequency clock by default.

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

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Note: An internal 4.7 μ F 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, RESET pin as an external hardware reset pin. The RESET pin pull up in the internal.

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.

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PA control:

1. Hardware connection

nRF5340	PA/LNA
P0.29	RXEN
P1.09	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, P0.29 and P1.09 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()`:

P1.09	P0.29	PA status
1	0	TXEN
0	1	RXEN
0	0	IDLE
1	1	INVALID

```
static void pa_assist(uint32_t gpio_pa_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 setting
```

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

// 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    = NULL;

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

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

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 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(24); //after initializing ble stack, call this function will enable PA signal

    gap_params_init();

}
```


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```
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 (;;)

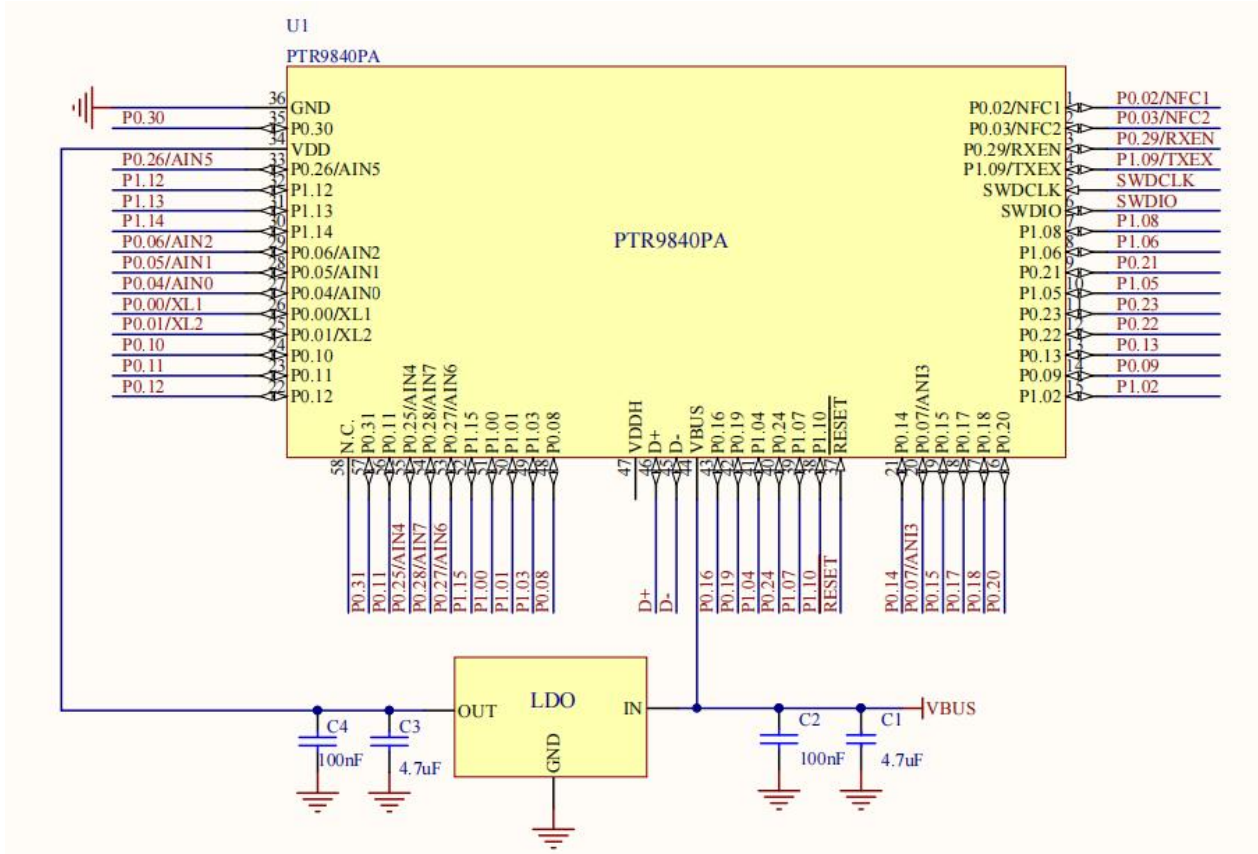
{power_manage();}

}
```


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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

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Operating Conditions:

Parameter	Min.	Typ.	Max.	Unit
Supply voltages				
VDD	1.7	3.0	+3.6	V
VDDH	2.5	3.7	+5.5	V
VBUS	4.35	5	+5.5	V
Operating Temperature Range	-40	25	85	°C

Absolute Maximum Ratings:

Parameter	Min.	Max.	Unit
Supply voltages			
VDD	-0.3	+3.9	V
VDDH	-0.3	+5.8	V
VBUS	-0.3	+5.8	V
VSS	0	0	V
I/O pin voltage			
Voltage on GPIO pins ($V_{DD} \leq 3.6V$)	-0.3	$V_{DD} + 0.3$	
Voltage on GPIO pins ($V_{DD} > 3.6V$)	-0.3	+3.9	
RF input level		20	dBm
Environmental			
ESD Human Body Model		2	kV
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

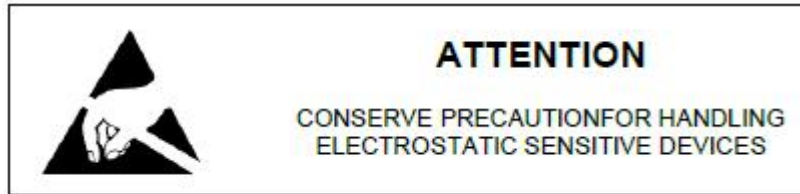
- (1) It is critical to following the recommendations of this document to ensure the module meets the specifications.
- (2) Power supply must be free of AC ripple voltage. If such noise is present, it is critical to provide proper filtering and decoupling.
- (3) The module should not be stressed mechanically 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.

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- (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.



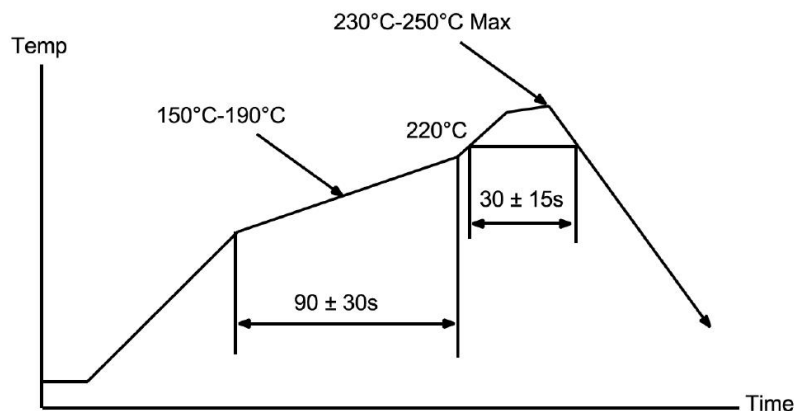
Moisture Sensitivity

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



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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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Ordering Information:

Part Number	Description
PTR9840PA	Bluetooth 5.3 System on Module, use with 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.
MPTR9840PA-EVB	Evaluation boards for module, with key, LED, I/O extend