HPZB01/HPZB01P
ZigBee RF Transceiver Module (IEEE802.15.4)

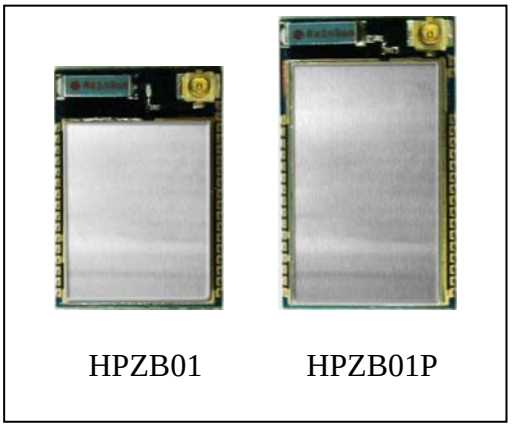
General Description

The HopeRF HPZB01/HPZB01P RF Transceiver Module is low cost, high performance and ultra compact size Module specially designed for Ember ZigBee protocol stack for wireless networks, EmberZNet, based on IEEE 802.15.4-2003 standard in the 2.4GHz ISM band. Built-in EM357 of ember integrated a 2.4GHz IEEE 802.15.4-2003 transceiver, a 32-bit ARM® Cortex™-M3 processor, a 192KB Flash and 12KB RAM for program and data storage. It utilizes the non-intrusive SIF module for powerful software debugging and programming of the network processor. The modules eliminate the need for costly and time- consuming RF development, and shortens time to market for wireless applications with extended range requirements.

HPZB01 output power is up to +8dBm, Size is 22X15X3.2mm.

HPZB01P is base on HPZB01 with additional PA , Its output power is up to +20dBm. ,Size is 26X15X3.2mm.

Three different versions of the HPZB01/HPZB01P modules are available: HPZP01-ANT/HPZB01P-ANT with built-in SMD antenna, HPZP01-IPEX/HPZB01P-IPEX with built-in IPEX connector for external antenna and HPZP01-UO/HPZB01P-UO with unbalanced RF output for external antenna.



HPZB01 HPZB01P

Features

- Low cost, High performance
- Easy to use, Support all ZigBee clusters
- Can be used for coordinator, router or sleeping device
- Integrated IEEE 802.15.4-2003 PHY and MAC layer
- 32-bit ARM® Cortex™-M3 processor
- 2.4 GHz ISM band ,Up to 16 channels
- Direct sequence spread spectrum RF transceiver
- Flexible ADC, UART/SPI/TWI serial communications and general purpose timers
- Ultra compact size: 22X15X3.2mm (HPZB01)
  26X15X3.2mm (HPZB01P)
- High Rx sensitivity: -102dBm (HPZB01 Boost mode)
  -110dBm (HPZB01P)
- High Output power: +8dBm (HPZB01 Boost mode)
  +20dBm (HPZB01P)
- Very low power consumption(＜1uA in sleep mode)
- 192KB Flash and 12KB RAM
- Non-intrusive debug interface (SIF)
- AES128 encryption accelerator

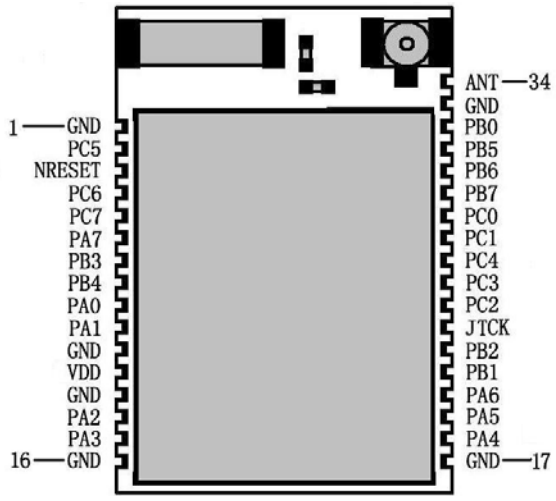
Applications

The applications include, but are not limited to:

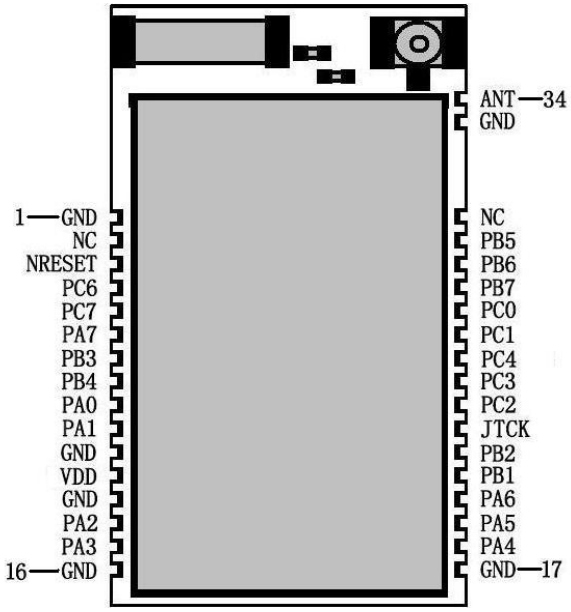
- Home automation
- lighting controls
- building control
- Inventory management
- Environmental monitoring
- Automated meter reading
- Industrial monitoring
- Security systems
- Sensor data capture

1 Pin Assignment and Pin Description

Figure 1-1:HPZB01/HPZB01P Pin Assignment



HPZB01



HPZB01P

Table 1-1:HPZB01/HPZB01P Pin Description

(For more details about the Pin description, Please take the datasheet of Ember EM357 as reference)

Pin#	Signal HPZB01	Signal HPZB01P	Direction	Description
1	GND	GND	Ground	Connect to ground
2	PC5	-	I/O	Digital I/O
	TX_ACTIVE	-	O	Logic-level control for external Rx/Tx switch
	-	NC	-	Do not connect
3	nRESET	nRESET	I	Active low chip reset (internal pull-up)
4	PC6	PC6	I/O	Digital I/O
	OSC32B	OSC32B	I/O	32.768 kHz crystal oscillator
	nTX_ACTIVE	nTX_ACTIVE	O	Inverted TX_ACTIVE signal
5	PC7	PC7	I/O	Digital I/O
	OSC32A	OSC32A	I/O	32.768 kHz crystal oscillator
	OSC32_EXT	OSC32_EXT	I	Digital 32.768 kHz clock input source
6	PA7	PA7	I/O High current	Digital I/O Disable REG_EN with GPIO_DBGCFG[4]
	TIM1C4	TIM1C4	O	Timer 1 Channel 4 output
	TIM1C4	TIM1C4	I	Timer 1 Channel 4 input
	REG_EN	REG_EN	O	External regulator open drain output

Pin#	Signal HPZB01	Signal HPZB01P	Direction	Description
7	PB3	PB3	I/O	Digital I/O
	TIM2C3	TIM2C3	O	Timer 2 channel 3 output
	TIM2C3	TIM2C3	I	Timer 2 channel 3 input
	SC1nCTS	SC1nCTS	I	UART CTS handshake of Serial Controller 1
	SC1SCLK	SC1SCLK	O	SPI master clock of serial Controller 1
	SC1SCLK	SC1SCLK	I	SPI slave clock of serial Controller 1
8	PB4	PB4	I/O	Digital I/O
	TIM2C4	TIM2C4	O	Timer 2 channel 4 output
	TIM2C4	TIM2C4	I	Timer 2 channel 4 input
	SC1nRTS	SC1nRTS	O	UART RTS handshake of Serial Controller 1
	SC1nSSEL	SC1nSSEL	I	SPI slave select of serial controller 1
9	PA0	PA0	I/O	Digital I/O
	TIM2C1	TIM2C1	O	Timer 2 channel 1 output
	TIM2C1	TIM2C1	I	Timer 2 channel 1 input
	SC2MOSI	SC2MOSI	O	SPI master data out of serial controller 2
	SC2MOSI	SC2MOSI	I	SPI slave data in of serial controller 2
10	PA1	PA1	I/O	Digital I/O
	TIM2C3	TIM2C3	O	Timer 2 channel 3 output
	TIM2C3	TIM2C3	I	Timer 2 channel 3 input
	SC2SDA	SC2SDA	I/O	TWI data of serial controller 2
	SC2MISO	SC2MISO	O	SPI slave data out of serial controller 2
	SC2MISO	SC2MISO	I	SPI master data in of serial controller 2
11	GND	GND	Ground	Connect to ground
12	VDD	VDD	Power	Supply voltage (2.1V-3.6V)
13	GND	GND	Ground	Connect to ground
14	PA2	PA2	I/O	Digital I/O
	TIM2C4	TIM2C4	O	Timer 2 channel 4 output
	TIM2C4	TIM2C4	I	Timer 2 channel 4 input
	SC2SCL	SC2SCL	I/O	TWI clock of serial controller 2
	SC2SCLK	SC2SCLK	O	SPI master clock of serial controller 2
	SC2SCLK	SC2SCLK	I	SPI slave clock of serial controller 2
15	PA3	PA3	I/O	Digital I/O
	SC2nSSEL	SC2nSSEL	I	SPI slave select of serial controller 2
	TRACECLK	TRACECLK	O	Synchronous CPU trace clock
	TIM2C2	TIM2C2	O	Timer 2 channel 2 output
	TIM2C2	TIM2C2	I	Timer 2 channel 2 input
16	GND	GND	Ground	Connect to ground
17	GND	GND	Ground	Connect to ground
18	PA4	PA4	I/O	Digital I/O
	ADC4	ADC4	Analog	ADC input 4
	PTI_EN	PTI_EN	O	Frame signal of packet trace interface(PTI)
	TRACEDATA2	TRACEDATA2	O	Synchronous CPU trace data bit 2

Pin#	Signal HPZB01	Signal HPZB01P	Direction	Description
19	PA5	PA5	I/O	Digital I/O
	ADC5	ADC5	Analog	ADC input 5
	PTI_DATA	PTI_DATA	O	Data signal of packet trace interface(PTI)
	nBOOTMODE	nBOOTMODE	I	Embedded serial bootloader activation out of reset
	TRACEDATA3	TRACEDATA3	O	Synchronous CPU trace data bit 3
20	PA6	PA6	I/O High current	Digital I/O
	TIM1C3	TIM1C3	O	Timer 1 channel 3 output
	TIM1C3	TIM1C3	I	Timer 1 channel 3 input
21	PB1	PB1	I/O	Digital I/O
	SC1MISO	SC1MISO	O	SPI slave data out of serial controller 1
	SC1MOSI	SC1MOSI	O	SPI master data out of serial controller 1
	SC1SDA	SC1SDA	I/O	TWI data of serial controller 1
	SC1TXD	SC1TXD	O	UART transmit data of serial controller 1
	TIM2C1	TIM2C1	O	Timer 2 channel 1 output
	TIM2C1	TIM2C1	I	Timer 2 channel 1 input
22	PB2	PB2	I/O	Digital I/O
	SC1MISO	SC1MISO	I	SPI master data in of serial controller 1
	SC1MOSI	SC1MOSI	I	SPI slave data in of serial controller 1
	SC1SC	SC1SC	I/O	TWI clock of serial controller 1
	SC1RXD	SC1RXD	I	UART receive data of serial controller 1
	TIM2C2	TIM2C2	O	Timer 2 channel 2 output
	TIM2C2	TIM2C2	I	Timer 2 channel 2 input
23	JTCK	JTCK	I	JTAG clock input from debugger
	SWCLK	SWCLK	I/O	Serial Wire Clock input/output with debugger
24	PC2	PC2	I/O	Digital I/O
	JTDO	JTDO	O	JTAG data out to debugger
	SWO	SWO	O	Serial Wire Output asynchronous trace output to debugger
25	PC3	PC3	I/O	Digital I/O
	JTDI	JTDI	I	JTAG data in from debugger
26	PC4	PC4	I/O	Digital I/O
	JTMS	JTMS	I	JTAG mode select from debugger
	SWDIO	SWDIO	I/O	Serial Wire bidirectional data to/from debugger
27	PC1	PC1	I/O	Digital I/O
	ADC3	ADC3	Analog	ADC input 3
	SWO	SWO	O	Serial Wire Output asynchronous trace output to debugger
	TRACEDATA0	TRACEDATA0	O	Synchronous CPU trace data bit 0
28	PC0	PC0	I/O High current	Digital I/O
	JRST	JRST	I	JTAG reset input from debugger
	IRQD[1]	IRQD[1]	I	Default external interrupt source D
	TRACEDATA1	TRACEDATA1	O	Synchronous CPU trace data bit 1

Pin#	Signal HPZB01	Signal HPZB01P	Direction	Description
29	PB7	PB7	I/O High current	Digital I/O
	ADC2	ADC2	Analog	ADC Input 2
	IRQC[1]	IRQC[1]	I	Default external interrupt source C
	TIM1C2	TIM1C2	O	Timer 1 channel 2 output
	TIM1C2	TIM1C2	I	Timer 1 channel 2 input
30	PB6	PB6	I/O High current	Digital I/O
	ADC1	ADC1	Analog	ADC Input 1
	IRQB	IRQB	I	External interrupt source B
	TIM1C1	TIM1C1	O	Timer 1 channel 1 output
	TIM1C1	TIM1C1	I	Timer 1 channel 1 input
31	PB5	PB5	I/O	Digital I/O
	ADC0	ADC0	Analog	ADC Input 0
	TIM2CLK	TIM2CLK	I	Timer 2 external clock input
	TIM1MSK	TIM1MSK	I	Timer 1 external clock mask input
32	PB0	-	I/O	Digital I/O
	VREF	-	Analog O	ADC reference output
	VREF	-	Analog I	ADC reference input
	IRQA	-	I	External interrupt source A
	TRACECLK	-	O	Synchronous CPU trace clock
	TIM1CLK	-	I	Timer 1 external clock input
	TIM2MSK	-	I	Timer 2 external clock mask input
	-	NC	-	Do not connect
33	GND	GND	Ground	Connect to ground
34	ANT	ANT	I/O	Unbalanced RF input/output , Connect to external antenna for HPZB01-UO and HPZB01P-UO

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1: Absolute Maximum Ratings

Parameter	Test Conditions	Min.	Max.	Unit
Regulator input voltage (VDD)		-0.3	+3.6	V
RF Input Power (for max level for correct packet reception)			+15	dBm
Voltage on any GPIO pin (PA4, PA5, PB5, PB6, PB7, PC1), when used as an input to the general purpose ADC with the low voltage range selected		-0.3	2.0	V
Voltage on any GPIO (PA[7:0], PB[7:0], PC[7:0]), SWCLK, nRESET, VREG_OUT		-0.3	VDD +0.3	V
Voltage on OSCA, OSCB, NC		-0.3	1.9V +0.3	V
Storage temperature		-40	+140	℃

2.2 Recommended Operating Conditions

Table 2-2: Operating Conditions

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Regulator input voltage (VDD)		2.1		3.6	V
Operating temperature range(**note1**)		-20		+70	℃

note1: -40°C to +85°C operational

2.3 Electrical Specifications

Table 2-3: Electrical Specifications

(VCC = 3.0V, Fo =2440MHZ, T=25°C, if nothing else stated)

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Operating frequency		2405		2485	MHZ
Supply voltage		2.1		3.6	V
Numbers of channels	For IEEE 802.15.4 compliance		16		
Channel spacing	For IEEE 802.15.4 compliance		5		MHz
Maximum output power	HPZB01 Programmable	-20		+8	dBm
	HPZB01P with PA		+20		dBm

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Sensitivity	HPZB01 PER = 1% PER, 20byte packet defined by IEEE 802.15.4 Boost mode		-102		dBm
	HPZB01 PER = 1% PER, 20byte packet defined by IEEE 802.15.4		-100		dBm
	HPZB01P with LNA PER = 1% PER, 20byte packet defined by IEEE 802.15.4		-110		dBm
Tx Current	HPZB01 +8dBm transmission power		42		mA
	HPZB01 +3dBm transmission power		29		mA
	HPZB01P with PA +20dBm transmission power		170		mA
Rx Current	HPZB01 boost mode		29		mA
	HPZB01 normal mode		27		mA
	HPZB01P with LNA		38		mA
On-Air Data Rate			250		Kbps
Deep sleep current			0.7		uA
Frequency stability				+/-40	ppm
RF Input/output impedance	IPEX connector output Unbalanced output		50		Ohm
Flash Memory Size			192		KB
RAM Size			12		KB
Main system clock frequency			24		MHz
Sub system clock frequency			32.768		KHz

3 Block Diagram

Figure 3-1: HPZB01-ANT Block Diagram

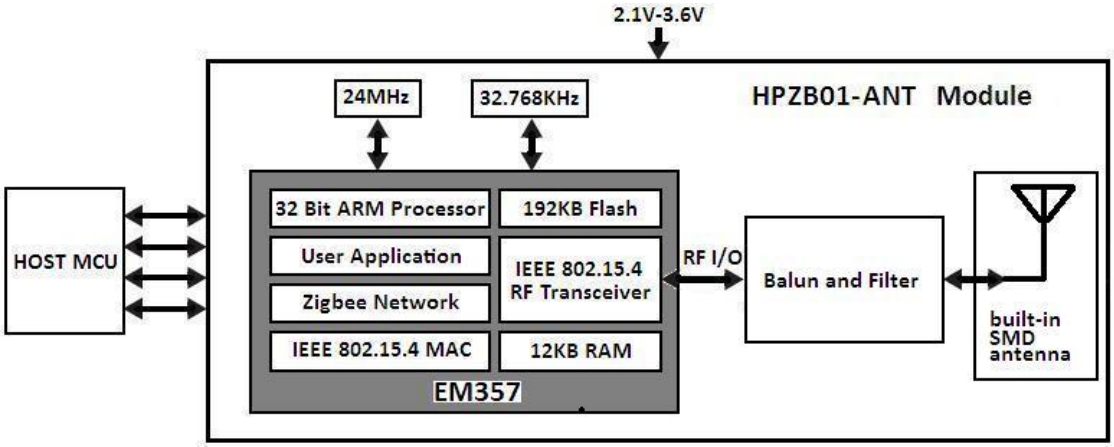


Figure 3-2: HPZB01-IPEX Block Diagram

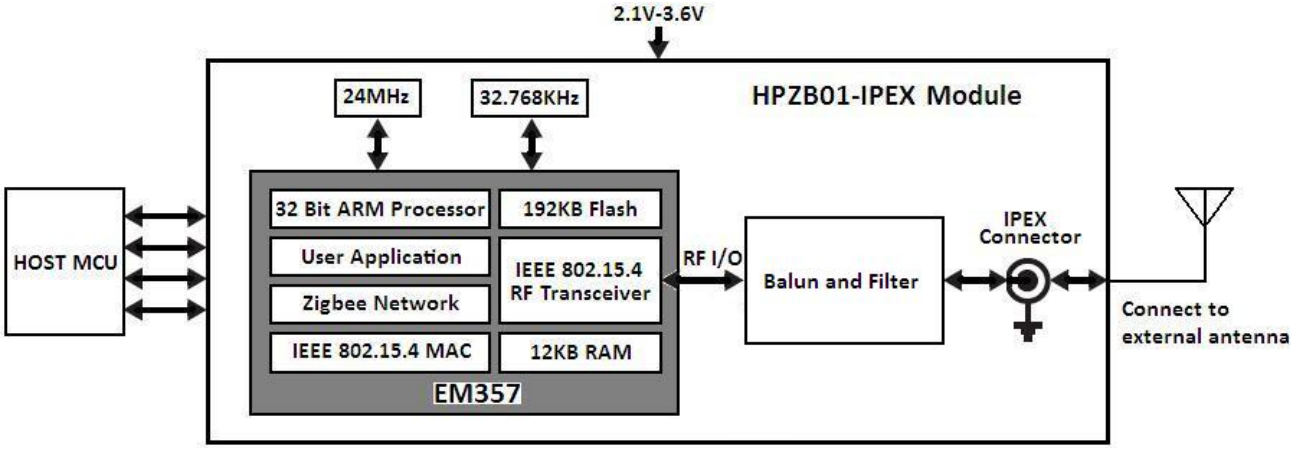


Figure 3-3: HPZB01-UO Block Diagram

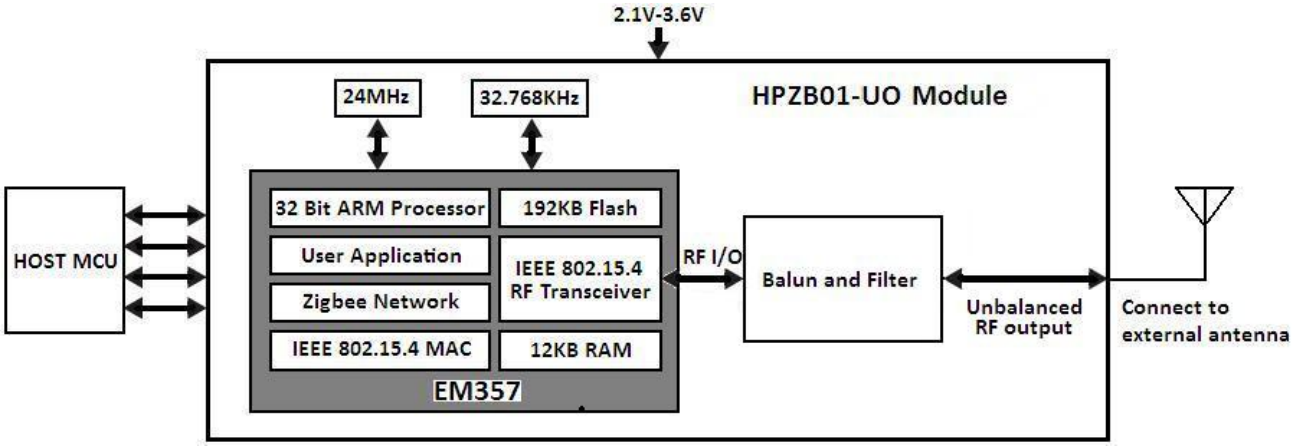


Figure 3-4: HPZB01P-ANT Block Diagram

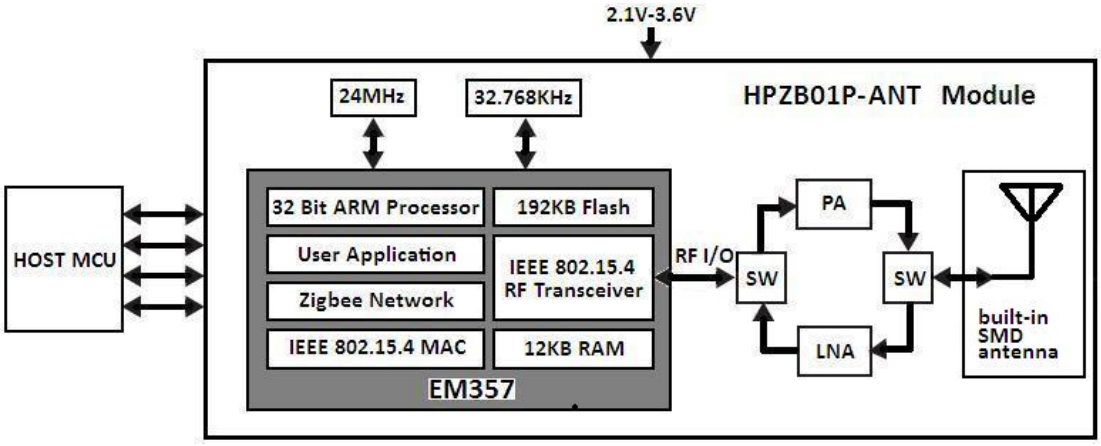


Figure 3-5: HPZB01P-IPEX Block Diagram

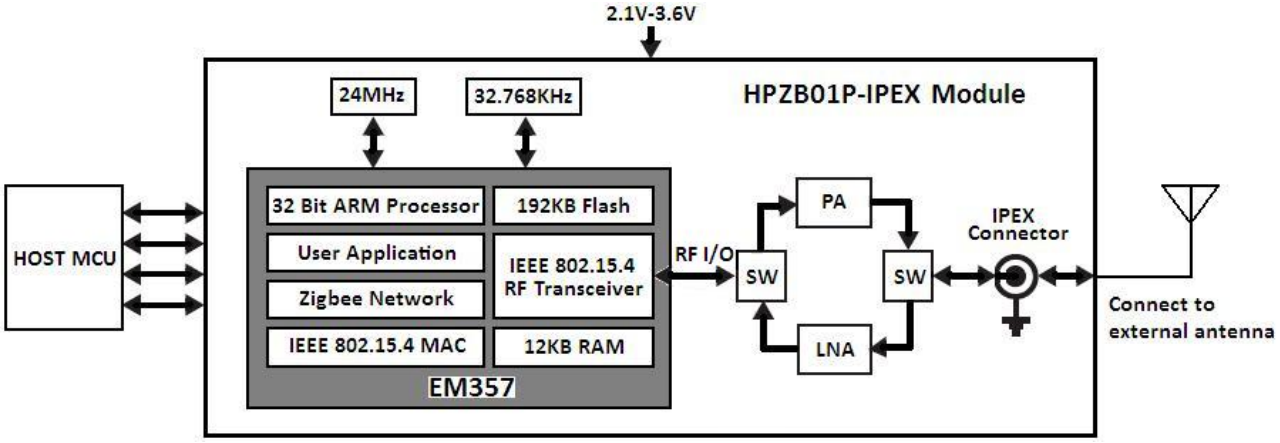
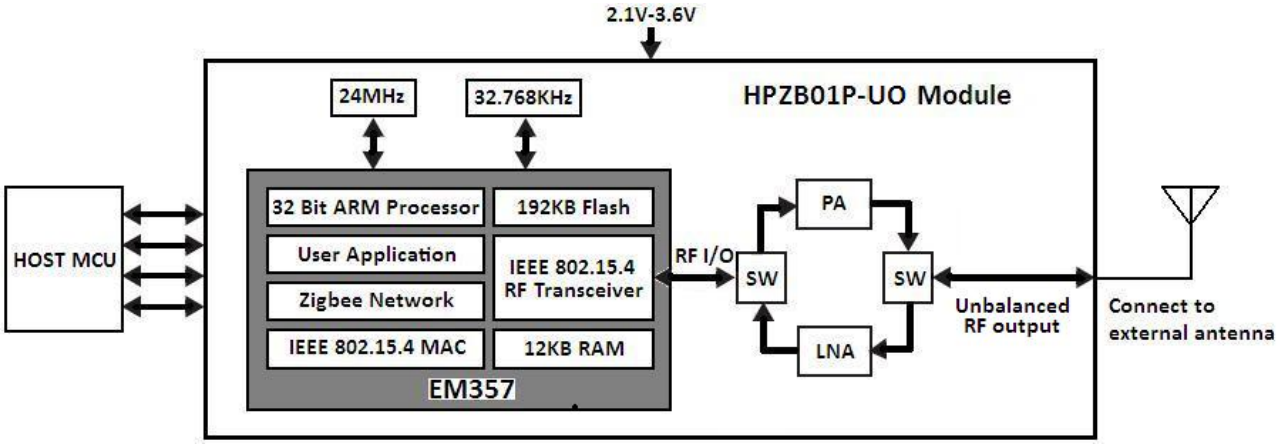


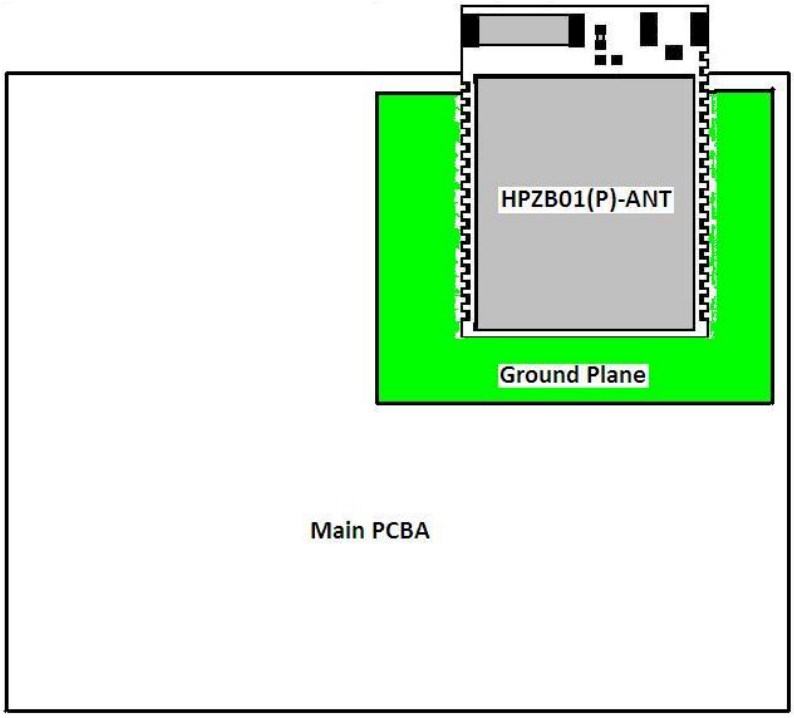
Figure 3-6: HPZB01P-UO Block Diagram



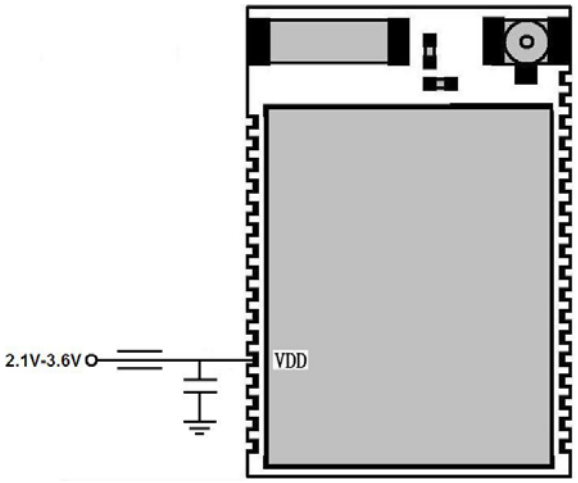
4 PCB Layout Recommendations

As the HPZB01(P)-ANT module integrated with SMD antenna, The mounting position of the module will have great impact on the RF performance. There should not be any trace, ground plane , metal part and PCB underneath or nearby the area of the SMD antenna. Except the area of the SMD antenna, A ground plane under the module is preferred. The figure below shows an example how the module positioned on the mother PCB.

Figure 4-1: A recommended placement of the module on a main PCB



Use ferrite bead and 1uF capacitor located closely to the power supply pin is recommended, As shown below.



5 Mechanical Dimensions

All dimensions in MM

Figure 5-1: HPZB01 Mechanical Dimensions

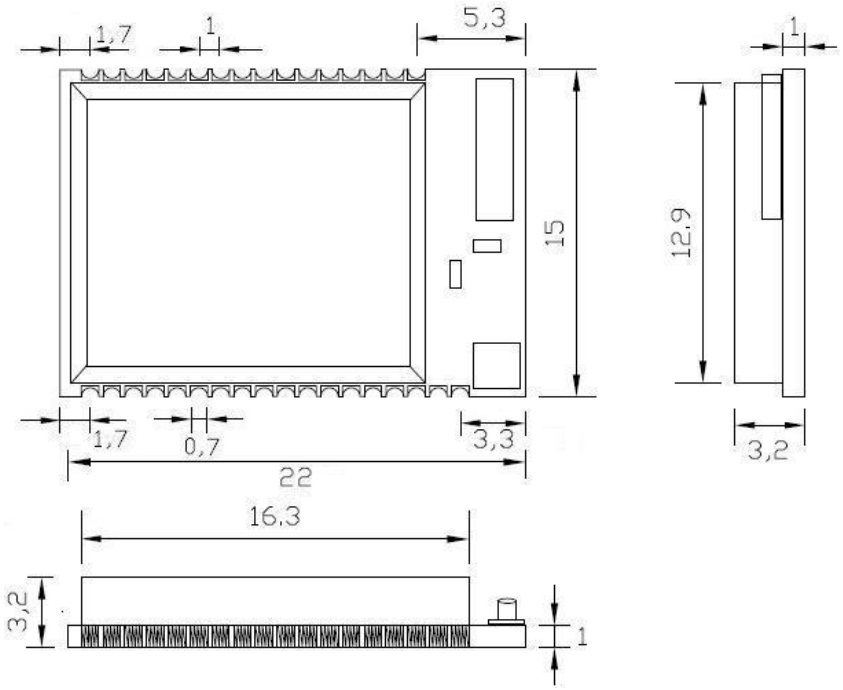
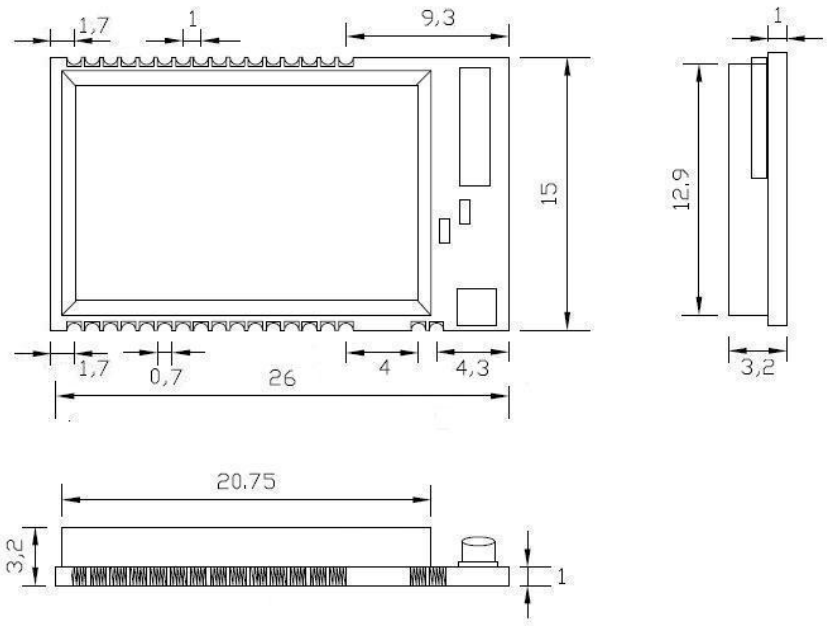


Figure 5-2: HPZB01P Mechanical Dimensions



6 Mounting Information

The below diagrams show the PCB footprint recommended for the modules.
All dimensions in MM

Figure6-1: HPZB01(P)-ANT and HPZB01(P)-IPEX module Recommended PCB footprint ,Top View

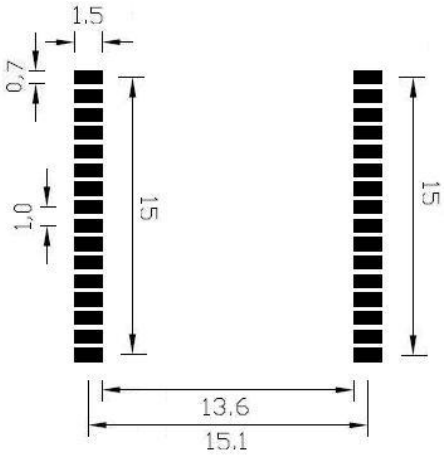


Figure6-2: HPZB01-UO module Recommended PCB footprint, Top View

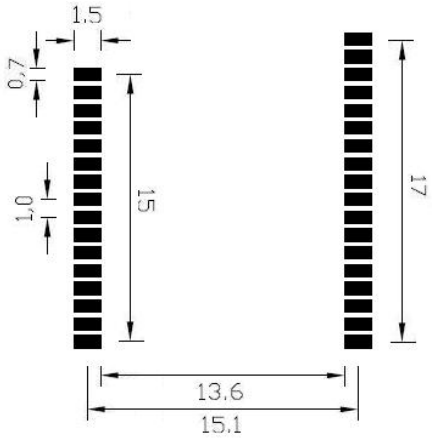
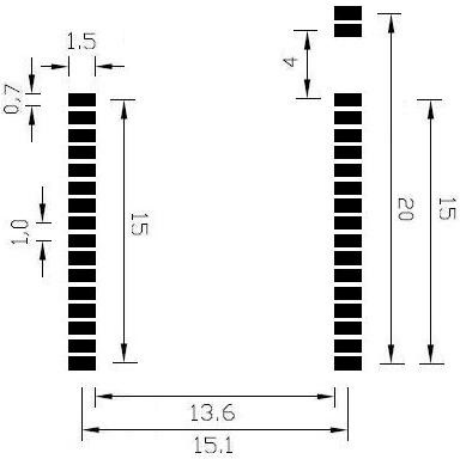


Figure6-3: HPZB01P-UO module Recommended PCB footprint, Top View



7 Soldering Profile

Table7-1: Soldering Profile

Profile Feature	Green Package
Average ramp-up rate(217°C to peak)	3°C/s max
Preheat temperature 175°C +/-25°C	180s max
Temperature maintained above 217°C	60S to 150S
Time within 5°C of actual peak temperature	20s to 40s
Peak temperature rang	260°C
Ramp-down rate	6°C/s max
Time within 25°C to peak temperature	8 minutes max

8 Ordering Information

Table8-1: Ordering Information

Part Number	Description
HPZB01-ANT	+8dBm output power, -102dBm sensitivity, With built-in SMD antenna
HPZB01P-ANT	+20dBm output power, -110dBm sensitivity, With built-in SMD antenna
HPZB01-IPEX	+8dBm output power, -102dBm sensitivity, With Built-in IPEX connector for external antenna
HPZB01P-IPEX	+20dBm output power, -110dBm sensitivity, With Built-in IPEX connector for external antenna
HPZB01-UO	+8dBm output power, -102dBm sensitivity, With unbalanced RF output for external antenna
HPZB01P-UO	+20dBm output power, -110dBm sensitivity, With unbalanced RF output for external antenna

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