mistBee™ Product Description (v3)

RSAE LABS
Whatever, Wherever, Whenever, You'll Know.

Overview

mistBee™ is a XBee Pro plug-in compatible 802.15.4 mesh radio module which utilizes the mist® network technology to deliver superior RF performance and scalability while consuming less than 250 uA average current at 3.3V. The mist® network has demonstrated sensor networks with over 10,000 active units through a single mist mesh gateway. The mistBee™ module includes both a precision temperature sensor and 3-axis accelerometer as well as support for serial communications and an array of external sensors. The mistBee module was created as an OEM solution to allow 3rd party companies to easily evaluate and implement the mist network technology.

mistBee™ Features

The mistBee™ module has a form-factor similar to the Digi XBee-Pro unit and fits into all of the currently available XBee adapter modules (shields). The mistBee™ provides a serial port interface so that host devices can connect to the mistBee®. Hosts connected to the mistBee can communicate proprietary data between each other or can implement the mist protocol. By implementing the mist protocol, a host device can query any other mist device in the network. This allows a host to query the sensor values of a mist device or the pin states of any mistBee device in the network.

The mistBee™ includes a precision temperature sensor and 3-axis accelerometer as well as twelve (12) user configurable GPIO pins, 5 of these pins can be configured as analog inputs. The mistBee® incorporates an analog to digital convertor (ADC) with 1 mV resolution.

Pin Assignments

Table 1 lists the pin assignments for the mistBee™ module.

Pin Table:

Pin #	Pin Function	Direction	Description
1	VCC	-	2.8V – 3.6V
2	Dout	Output	Serial Out
3	Din	Input	Serial In
4	GPIO	Both	Digital Input/Ouput
5	!RESET	Input	Module Reset
6	Not Associated/GPIO	Both	Not Associated LED drive or Digital Input/Output (20 mA)
7	I2C Data	Both	Reserved for I2C bus
8	GPIO/Analog Input	Both	Digital Input/Output or ADC input
9	GPIO	Both	Digital Input/Ouput
10	GND	-	Ground
11	GPIO/Analog Input	Both	Digital Input/Output or ADC input
12	GPIO	Both	Digital Input/Ouput
13	Sensor_On/GPIO	Both	Module Status Indicator/GPIO
14	GPIO	Both	Digital Input/Ouput
15	Associate	Both	Associate LED drive
16	GPIO	Both	Digital Input/Ouput
17	GPIO/Analog Input	Both	Digital Input/Output or ADC input
18	GPIO/Analog Input	Both	Digital Input/Output or ADC input
19	I2C Clock	Both	Reserved for I2C bus
20	GPIO/Analog Input	Both	Digital Input/Output or ADC input

Table 1 Pin assignments for mistBee™ module

The twelve user configurable GPIO pins can be set as digital outputs or inputs to read the state of external components. These GPIO pins can be configured as follows:

- Digital Output low
- Digital Output high
- Digital Input floating, No Interrupt
- Digital Input internal pull-up resistor applied, No Interrupt
- Digital Input internal pull-down resistor applied, No Interrupt
- Digital Input floating, Interrupt on falling edge
- Digital Input internal pull-up resistor applied, Interrupt on falling edge
- Digital Input internal pull-down resistor applied, Interrupt on falling edge
- Digital Input floating, Interrupt on rising edge
- Digital Input internal pull-up resistor applied, Interrupt on rising edge
- Digital Input internal pull-down resistor applied, Interrupt on rising edge
- Digital Input floating, Interrupt on both edges
- Digital Input internal pull-up resistor applied, Interrupt on both edges
- Digital Input internal pull-down resistor applied, Interrupt on both edges
- Pin not used

All GPIO pins are based upon 3.3V logic levels. Assigning the interrupt function to a GPIO pin provides a mechanism for a pin state change to cause an immediate report of the state of all of the pins. This report is sent by the mistBee™ to the Mesh Gateway. In a similar fashion, the 5 analog capable GPIO pins can be configured to trigger a report based upon a defined threshold or a change in value. Similarly, the temperature sensor, accelerometer and supply voltage (VCC) can be configured to provide alerts based upon a threshold value or a change (delta) in value.

Serial Data Lines

Pins 2 and 3 serve as the serial Dout and Din lines. The mistBee™ uses interrupt processing on the Din line to ensure that the unit is awake in order to process serial data. Serial data support is based upon the mist® Host Protocol. The default baud rate for the mistBee™ is 115,200 though it is configurable from 2400 to 460,800 baud.

Reset

To reset the mistBee™ module, a low logic level applied to Pin 5 must be held low for at least 1 ms. This pin should be left in an open state for normal operation so as not to interfere with the voltage supervisory circuit on the mistBee™. This pin is complaint with many of the XBee shields that have a momentary contact switch connected to this pin

Associate LED

Pin 15 is used to drive an LED to indicate that the unit is associated with a network. In the default configuration, Pin 15 will be raised high for approximately 15 msec every 3 seconds. If desired, an LED

with a dropping resistor (between 330 – 1K ohms) can be connected between this pin and ground. This pin is complaint with many of the XBee shields that have an Associate LED and dropping resistor connected to this pin.

Not Associated LED

Pin 6 can be used to drive an LED to indicate that the unit is not associated with a network. In the default configuration, Pin 6 will be raised high for approximately 15 msec every 3 seconds when the mistBee® is not associated with a network. If desired, an LED with a dropping resistor (between 330 – 1K ohms) can be connected between this pin and ground. This pin will drive the RSSI LED that is on many of the XBee shields, but it will not provide a measure of the RSSI. Note, since the mistBee™ is designed for very low power operation, it does not support a Pulse Wave Modulation (PWM) output. If desired, this pin can be configured as a GPIO instead of providing the Not Associated indication.

I2C Lines

Pins 7 and 19 are reserved for the I2C bus that is used by the mistBee™ to interface to the on board accelerometer and temperature sensor. These lines are exposed to provide for future support of external I2C sensors.

Sensor On

In the default configuration, pin 13 provides an indication or when the mistBee® unit is sampling the GPIO pins. Pin 13 is driven high for approximately 2 msec during the time in which the unit's sensors and pins states are read. Pin 13 can be used to drive external devices that need to be powered to be sampled. As an example, pin 13 can be connected to the collector of a phototransistor to read the analog voltage at the emitter resistor follower junction. Alternative, pin 13 could be used to drive the gate of a N-channel MOSFET (such as 2N7002). This pin is complaint with many of the XBee shields that have a Sleep LED and dropping resistor connected to this pin. If desired, this pin can be configured as a GPIO instead of providing the Sensor On functionality.

System Reset

The mistBee™ device can be reset to the default factory configuration should a configuration of the unit cause it to be non-functional. The user can cause the mistBee™ to perform a System Reset by connecting pin 15 to pin 8 prior to powering the mistBee or forcing a reset by grounding pin 5. Pin 15 and pin 8 must remain connected for at least 3 seconds following a reset. Once the connection between the pins has been removed, the mistBee™ will then perform the System Reset. Following the System Reset, the unit will boot up into the default factory configuration.