swarm bee LE Module V2

Embedded 2.4 GHz Chirp Radio
Location Awareness and Concurrent Wireless Communication

Overview

swarm bee LE is nanotron's first generation *swarm* product family combining flexibility and integration with enhanced power management housed in a rugged module suitable for embedded industrial environments. The swarm bee module provides continuous autonomous distance calculation, real-time location monitoring and concurrent wireless data communication using the same short RF signal.

- **Integrated API**
  The integrated firmware *swarm* API enables customers to speed up development and get the products to market quickly.

- **Ranging & Communication**
  With nanoLOC *swarm* bee LE radios can measure distance to each other using Time of Flight (TOF). At the same time, data can be exchanged between them.

- **Movement & Temperature Detection**
  The on-board MEMS sensor detects 3D acceleration and temperature changes. The sensor is controlled by *swarm* API.

- **RSSI Detection**
  RSSI values of signals from remote nodes are readable through *swarm* API.

- **Low Energy (LE)**
  With a new power saving concept, the radios can go to power-down mode to save energy consumption and thus ensure a longer battery lifetime. The power-down period is configurable through *swarm* API.

Key Features

Frequency range ....ISM-band 2.4 GHz (2.4~2.4835)

Modulation ....Chirp Spread Spectrum (CSS)

Transmission Modes.......................... 80 MHz, 1 Mbps or 250 Kbps

ToA resolution .... < 1 ns (better than 30 cm)

Typical air time per ranging cycle ....1.8 ms

RF output power............................configurable -22 to +16 ± 2 dBm

RF sensitivity @ 80/1 mode .... -89 dBm typ.

RF sensitivity @ 80/4 mode .... -95 dBm typ.

RF interface...50 Ohm RF Port

Host interface (UART)..115 kbps ~ 2 Mbps

Supply voltage ....3.3 V ~ 5.5 V

Maximum supply voltage ripple... 20 mVpp

Active current consumption.. max. 120 mA during transmission, 60 mA during receive (at 20 °C, 3.3 V, in 80/1 mode)

Current consumption in standby mode................................... 6.5 mA (CPU stopped, all peripherals on)

Current consumption in snooze mode ....max. 6 µA (Autonomous mode enabled, all peripherals off)

Current consumption in nap mode................................. max. 20 µA* (CPU stopped, GPIO off, UART off, MEMS alert)

Current consumption in nap mode................................ max. 500 µA (CPU stopped, GPIO alert, UART off, MEMS off)

Current consumption in deep-sleep mode................................≦ 1 µA (module completely disabled)

Operating temperature range.................................. -30°C to +85°C

Dimensions .... 40 mm x 24 mm x 3.5 mm

Weight... 7 g

* mode dependent

swarm API

The common swarm API supports three protocols: ASCII and BINARY on the host interface and AIR for controlling the module over the air. The ability of the module to be configured over the air allows for entirely autonomous operation even stand-alone without a host controller.

Using API commands, MEMS sensor data, RSSI value, battery level etc. of *swarm* radios can be accessed. Refer to [1] for a detailed description of API commands.

Power Supply & Power Management

A single 3.3 V supply voltage is required to operate the radio. Supply voltage tolerances allow for direct connection to a 3.6 V LiPo battery or 5 V USB.

The *swarm* bee LE radio can go to sleep and only wake up periodically. The underlying power management concept enables the cooperation between the radios even if they sleep most of the time.

Module Dimension & Pin Assignment
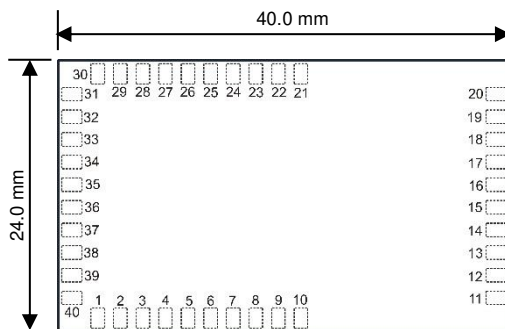
swarm bee LE Module – Top View

Pin Description

Pin No.	Pin Name	Pin No.	Pin Name
1,7,9,11,23,28,31-33,37-40	Reserved	25	DIO_0
2	VIN	26	DIO_1
3,10,12,14-22	GND	27	DIO_2
4	A_MODE	34	DIO_3
6	MOD_EN	29	UART_TX
13	RF_PORT	30	UART_RX
24	ADC_IN	35	TX_ON
5	/NRST	36	COEX_DIV
8	+2V6	11	/TX_RX

Applications

The *swarm* bee LE radio is a fully integrated wireless node. It works in applications with both collaborative location technology based on TOF (ranging) and fixed location technology based on TDOA (time difference of arrival), and supports concurrent data communication. Moreover, it can range and be located at the same time. Depending on application requirements, *swarm* bee LE can be designed as a basic tag without host controller or as a smart tag with an external host. Refer to [2] for more information.

swarm bee DK+

The swarm bee Development Kit Plus (DK+) is a useful tool for users to get quick acquaintance with the basic functionality of swarm bee LE. The Development Kit Plus consists of several DK+ Boards (see figure below) with antenna, swarm PC Tool which demonstrates ranging application, sensor monitor as well as to use the API via GUI and sniffer which allows to monitor the air interface.

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swarm bee LE V2 DK Plus Board

Ordering Information

Order No.	Description
MN02SWBLE	*swarm* bee LE V2
KN02SWBLE	3 x DK+ Boards with *swarm* FW, 3 x antenna, sniffer GUI, swarm PC Tool
BN02SWBLP	Additional *swarm* bee LE V2 Development Kit Plus Board

References

[1] *swarm* API Description

[2] Application Note – Tag Design with *swarm* bee LE