swarm bee LE Module

Embedded 2.4 GHz Chirp Radio Location Awareness and Concurrent Wireless Communication

Overview

swarm bee LE is nanotron's second generation *swarm* product family combining flexibility and integration with enhanced power management, simultaneous support for collaborative and fixed location systems, all housed in a rugged module suitable for embedded industrial environments.

- **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 management concept the radios can work in different power modes to optimize energy consumption and lengthen the battery lifetime. Power modes can be configured 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 capture accuracy	< 1 ns (better than 30 cm)
Typical air time per ranging cycle	1.8 ms
RF output power	-22 ~ 16 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)	500 bps ~ 2 Mbps
Supply voltage	3.0 V ~ 5.5 V
Maximum supply voltage ripple	20 mVpp
Active power consumption* during transmission, 60 mA during receive @80/1 mode	max. 120 mA
Power consumption in sleep mode* (transceiver disabled, all peripherals on)	5.5 mA
Power consumption in snooze mode* (transceiver disabled, all peripherals off, wake-up by timer))	4.5 µA
Power consumption in nap mode** (transceiver disabled, UART off, wake-up by interrupt)	4.5 ~ 600 µA
Power consumption in deep-sleep mode* (device completely disabled)	≤ 1 µA
Operating temperature range	-30 ~ 85 °C
Dimensions	40 mm × 24 mm × 3.5 mm
Weight	7 g

*Power consumption in all modes is measured at 20 °C, 3.3 V.
**Power consumption in nap mode depends on interrupt sources (GPIO pins or MEMS or both).

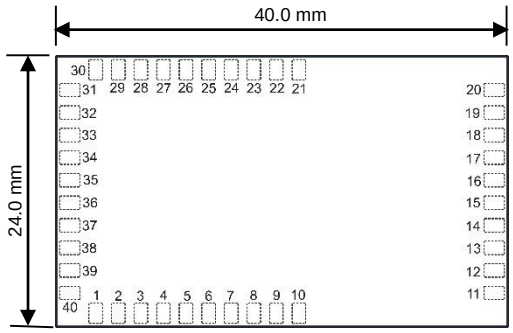
swarm API

From version 2.1 onwards, the enhanced firmware *swarm* API supports three protocols – ASCII, BINARY and AIR - for direct communication between host and *swarm* radios as well as for reconfiguration of remote *swarm* radio nodes over the air. 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	29	UART_TX
6	MOD_EN	30	UART_RX
13	RF_PORT	34	DIO_3
24	ADC_IN	35	TX_ON
5	/NRST	36	CO_DIV
8	+2V6		

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 communication. 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 LE Dev. Board & DK Plus

swarm bee LE Development Board ("Dev. Board" for short) and Development Kit Plus ("DK Plus" for short) are useful tools for users to get quick acquaintance with the basic functionality of *swarm* bee LE. The Dev. Board consists of a *swarm* bee LE module, a header board and an antenna (see figure below). The DK Plus consists of several DK Plus Boards (see figure below) with antenna and *swarm* PC Tool which demonstrates ranging application, sensor monitor etc.

swarm bee LE Development Board

swarm bee LE DK Plus Board

Ordering Information

Order No.	Description
MNSWABEE	*swarm* bee LE
BNSWABEE	*swarm* bee LE Development Board
BNSWABEEP	*swarm* bee LE Development Kit Plus Board
KNSWABEEP	*swarm* bee LE Development Kit Plus
PE232RG	Optional USB-to-Serial Cable for *swarm* bee LE Development Board

References

[1] *swarm* API User Guide V 3.0.

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

Today nanotron's *embedded location platform* delivers location-awareness for safety and productivity solutions across industrial and consumer markets. The platform consists of chips, modules and software that enable precise real-time positioning and concurrent wireless communication. The ubiquitous proliferation of interoperable location platforms is creating the location-aware Internet of Things.

Visit www.nanotron.com for more information on nanotron's complete line of products and tools or write to us at nanotron Technologies GmbH, Alt-Moabit 60, 10555 Berlin, Germany.

 Subject to changes without notice.