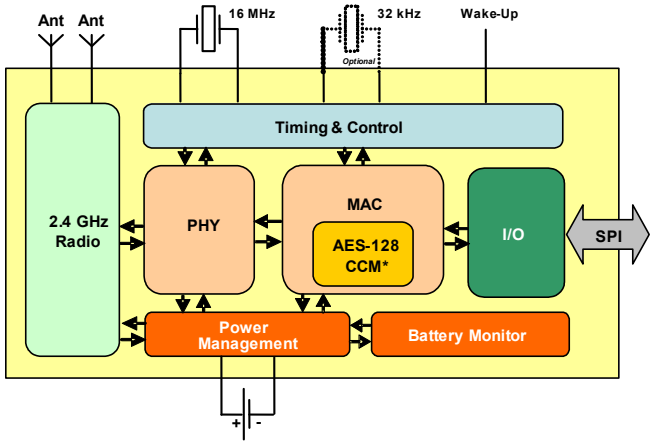
GreenPeak Emerald GP500C

2.4 GHz ZigBee-ready IEEE 802.15.4 Communications Controller

v1.10



Key Features

- IEEE802.15.4 PHY and full-MAC in hardware, for lowest CPU power and lowest software complexity
- Hardware accelerated AES-128 CCM* security processor with automatic encryption, decryption, authentication and key management
- Optimized for lithium button cell batteries (low active currents and ultra low sleep currents)
- Includes sophisticated battery lifetime monitor
- Highly accurate and adaptive integrated timing engine and event handler which can autonomously enable receiver, trigger packet transmission, and trigger microprocessor intervention
- Smallest form factor by minimal package and minimal external component count (QFN-40, 6x6 mm)
- Excellent range by antenna diversity: 9 dB improved link budget
- Additional improved robustness by packet-in-packet resynchronization
- Support for external PA and LNA
- Operates in the worldwide 2.4 GHz ISM-band

Overview

The GreenPeak Technologies GP500C ZigBee-ready/ IEEE802.15.4 Communication Controller provides a fully integrated solution for ultra low power wireless applications running on batteries. It is fully compliant with the IEEE802.15.4 standard, providing robust spread spectrum data communication with a highly secure encrypted data flow.

The combination of an GP500C with a microprocessor forms an IEEE802.15.4 device, a ZigBee coordinator, router or end device or RF4CE Remote Control device. With the appropriate choice of a microprocessor and software the GP500C can transparently connect sensors, switches and actuators creating an IEEE802.15.4 and or a ZigBee and or RF4CE Remote Control networks. The built-in security processor automatically encrypts and decrypts messages with locally stored encryption keys, minimizing the overhead for the microprocessor.

Ultra Low Power

The GP500C is designed for ultra low power operation and can run on a standard lithium button cell battery, like the CR2032 (watch battery) allowing for very small form factor products. The battery lifetime monitor tracks the usage of the battery and provides an early exhaustion warning. With an ultra low leakage current during sleep mode and very low peak currents during receive and transmit, the battery life can exceed 10 years depending on the application.

The GP500C supports optimized sleep modes with extreme low supply currents:

- Time driven applications (with a 32 kHz crystal): 250 nA
- Event driven applications: 40 nA

A highly accurate and adaptive integrated timing engine provides a time base that spans up to 30 minutes with a 2 us resolution and can be kept running during sleep. This time base can be used by the integrated event handler to autonomously enable the receiver, trigger packet transmissions and/or trigger microprocessor interventions in a just-in-time manner, improving the overall power consumption. The peak currents during transmit and receive are as low as 25.5 mA without compromising range.

Excellent Range and Reliability

The GP500C has been optimized for reliable communication in harsh radio environments. The -93 dBm receiver sensitivity allows extended coverage. Built-in antenna diversity improves the effective link budget by 9 dB in noisy and reflective propagation environments, resulting in improved robustness and up to 80% more range. In high density networks the packet-in-packet resynchronization further improves the communication reliability. The potential risks of interference by WiFi and/or Bluetooth devices have been reduced by the combination of excellent receiver dynamic range and an auto tuned band-pass filter.

Highly Integrated

The device is designed to require a minimum number of off-chip components: a 16 MHz crystal, supply decoupling capacitors and a printed circuit antenna. A 32 kHz sleep mode crystal is optional.

Reference designs

GreenPeak Technologies reference designs provide a quick time-to-market solution for ZigBee, ZigBee Battery-Less and RF4CE Remote Control products.

Greenpeak is a fabless wireless semiconductor solutions provider.

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Electrical Characteristics

- Sleep Mode Currents*
  - Timed
    - Using 32 kHz crystal: 250 nA
    - Using 16 MHz crystal: 550 µA
  - Event Driven: 40 nA
- Wake-up delay: 2 ms (From sleep to either receive or transmit)
- Operational Currents*
  - Receive: 25.5 mA
  - Transmit: 24.7 mA (at 0dBm)
- Supply Voltage*: 2.1 – 3.6 V
- Interfaces: SPI Slave, CPU Clock output, CPU Interrupt output, Wake-up input, External LNA PA control
- Crystal Frequencies
  - Operational: 16.000 MHz (±40 ppm)
  - Sleep: 32.768 kHz (±40 ppm)

General Characteristics

- Package: QFN-40, 6x6 mm
- Operating Temperature: -40 – +85°C (industrial)
- Storage Temperature: -50 – +150°C
- Soldering Temperature: 260°C (40 s max)
- Compliance: RoHS

Radio Features

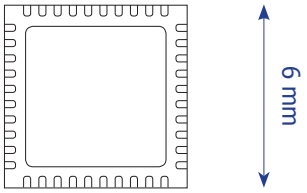
- Standards: IEEE802.15.4-2003, IEEE802.15.4-2006
- Radio Regulations: ETSI EN 300 328 and EN 300 440, FCC CFR-47 Part 15, ARIB STD-T66
- Frequency Band: 2400 – 2483.5 MHz
- Channels: 16 (programmable 5 MHz step size)
- Modulation: IEEE802.15.4
- Chip rate: 2 Mchips/s
- Data Rate: 250 kbps
- Receiver Sensitivity*: -91 dBm typical
- Antenna diversity gain**: 9 dB
- Co-channel Rejection: > -6 dB
- Adjacent Channel Rejection: > 30 dB
- Alternative Channel Rejection: > 40 dB
- WiFi IEEE 802.11g Rejection***: > 30 dB
- Bluetooth Rejection****: > 30 dB
- Transmit Power: -12 – +3 dBm (Programmable in 1 dB)
- Radio Management: Antenna Diversity, Digital RSSI, Link Quality Indication

*) At 3.0V and 25°C, unless specified otherwise

**) For typical indoor usage in an environment with 50nsec delay spread and 2 MHz signal bandwidth using the Rayleigh fading model: antenna diversity with 2 antennas results in a 9 dB improved link budget at a 1% outage probability compared to no antenna diversity. The 9 dB in link budget translates to 80% more range, if using a two slope range model with the breakpoint at 10m and g1 = 2, g2 = 3.5

***) At +12 MHz and -13 MHz

****) At +5 MHz and -5 MHz



QFN-40