

CC2431

► **WIRELESS SENSOR
NETWORK ZIGBEE™
/IEEE 802.15.4 SoC
RF SOLUTION WITH
LOCATION ENGINE**

THE MARKET'S MOST COMPETITIVE ZIGBEE™/IEEE 802.15.4 SOLUTION FOR WIRELESS POSITIONING

The CC2431 with Location Engine is a true System-on-Chip (SoC) solution for ZigBee™/IEEE 802.15.4 wireless sensor networking. The CC2431 combines the excellent performance of the industry leading CC2420 RF transceiver with an enhanced 8051 MCU, 8 kB of RAM, 128 kB Flash memory and many other powerful features.

Combined with Chipcon's industry leading ZigBee™ protocol stack (Z-Stack™) and the location engine support software, the CC2431 is the market's most competitive solution for positioning in low power wireless sensor networking.

The Location Engine is used to estimate the position of nodes in an ad-hoc wireless network. Reference nodes are placed with known coordinates, typically because they are part of an installed infrastructure. Other nodes are blind nodes, whose coordinates need to be estimated. These blind nodes are often mobile and attached to assets that need to be tracked.

The Location Engine implements a distributed computation algorithm that uses received signal strength indicator (RSSI) values from known reference nodes, such as mobile neighbour nodes with the same Location Engine or fixed infrastructure nodes. Performing position calculations at the node level reduces network traffic and communications delays otherwise present in a centralized computation approach.

The Location Engine has the following main features:

- A blind node can use from three to eight reference nodes for the location estimation algorithm
- Location estimate with resolution of 0.5 meters
- Time to estimate node location less than 40 µs
- Location range 64 x 64 meters
- Runs location estimation with minimum CPU usage
- Location error can be less than 3 meters, depending on factors described below

To achieve the best possible accuracy one should use antennas that have near-isotropic radiation characteristics. The location error depends on signal environment, deployment pattern of reference nodes and the density of reference nodes in a given area. In general, having more reference nodes available improves the accuracy of the location estimation.

► WORLD-CLASS DEVELOPMENT TOOLS

CC2431 is supported by a powerful and flexible development environment. This consists of a comprehensive Development Kit that includes CC2431 evaluation boards and In-Circuit Emulator (ICE).

In-Circuit debugging is supported by the industry leading IAR C-SPY IDE via a simple two-wire serial interface.

Chipcon offers an extensive C-code library with routines that makes it easy to start using the CC2431 and to get robust RF-links up and running quickly.

► APPLICATIONS

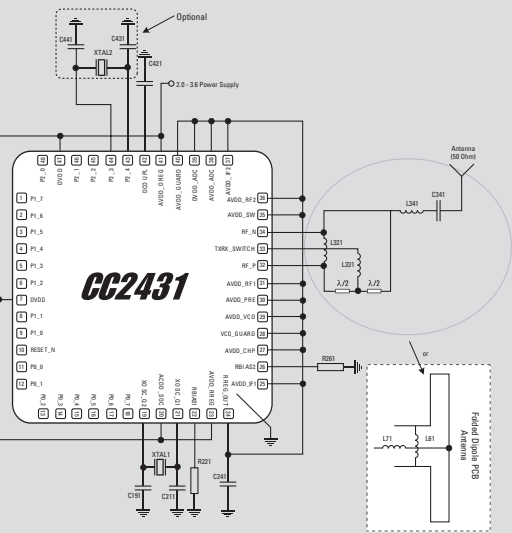
- Asset tracking
- Inventory control
- Container/pallet tracking
- Equipment and personnel tracking
- Security
- Vehicle (load) tracking
- Access and control systems
- Commissioning Networks

GENERAL CHARACTERISTICS

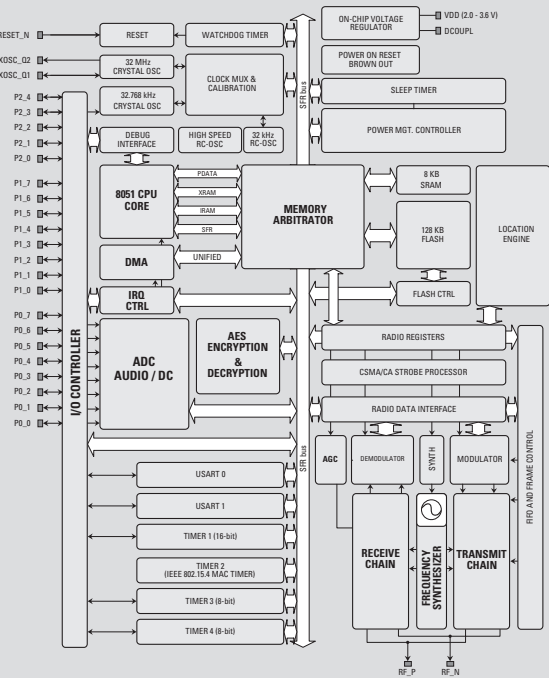
PARAMETER	MIN	TYP	MAX	UNIT	CONDITION
OPERATING CONDITIONS:					
Operating temperature	-40		85	°C	
Operating supply voltage	2.0		3.6	V	
CURRENT CONSUMPTION:					
MCU active and RX mode		27		mA	MCU running at full speed (32 MHz), radio in RX mode
MCU active and TX mode, 0 dBm		25		mA	MCU running at full speed (32 MHz), radio in TX mode, 0 dBm output power
Power mode 2		0.9		µA	32 kHz RC-oscillator (or 32,768 kHz crystal oscillator) and sleep timer running
Power mode 3		0.6		µA	No clocks running. Power-On-Reset (POR) active Can wake up on external interrupt
WAKE-UP AND TIMING:					
From power mode 2 or 3 to active		54		µs	Digital regulator and high-speed oscillators off Start-up of regulator and high-speed RC-oscillator
From active to RX or TX		450		µs	Time from enabling the 32 MHz crystal oscillator and the radio part until RX or TX starts
RF CHARACTERISTICS:					
RF frequency range	2400		2483.5	MHz	Programmable in 1 MHz steps, 5 MHz steps for compliance with IEEE 802.15.4
Radio bit rate		250		kbps	As specified by IEEE 802.15.4
Receiver sensitivity		-94		dBm	Test conditions as specified by IEEE 802.15.4
Adjacent channel rejection (+5 MHz /-5 MHz)		45 / 30		dB	Test conditions as specified by IEEE 802.15.4
Alternate channel rejection (+10 MHz /-10 MHz)		53 / 54		dB	Test conditions as specified by IEEE 802.15.4
Interfering channel rejection (> 15 MHz)		62		dB	Test conditions as specified by IEEE 802.15.4
Nominal output power in TX mode		0		dBm	
LOCATION ENGINE					
Time to estimate node location		< 40		µs	
Location range		64 x 64		m	
Reference node location resolution		0,5		m	
RSSI resolution		0,5		dB	
Number of reference nodes used in calculation		3 ≤ N ≤ 8			
Location error		< 3		m	The recommended density of reference nodes is one per 100 square meters



APPLICATION CIRCUIT DIAGRAM



BLOCK DIAGRAM



FEATURES

- RSSI based Location Engine
- Fully pin compatible to CC2430
- Enhanced version of the industry standard 8051 microcontroller core
- Typical performance is 8x of a standard 8051
- 2.4 GHz IEEE 802.15.4 compliant RF transceiver (industry leading CC2420 RF transceiver core)
- 128 kB in-system programmable Flash
- 8 kB RAM, 4 kB with data retention in all power modes
- Powerful DMA functionality
- Four flexible power modes for reduced power consumption
- System clock source can be 16 MHz RC oscillator or 32 MHz crystal oscillator. The 32 MHz oscillator is used when the radio is active
- Optional clock source for ultra-low power operation can be either the low-power 32 kHz RC oscillator or an optional 32.768 kHz crystal oscillator
- Very fast transition times from sleep modes to active enable ultra low average power consumption in low-duty cycle systems
- In deep sleep modes the system can wake up on external interrupts or real-time counter events
- AES security coprocessor
- Programmable watchdog timer
- Power-On-Reset/Brown-Out Detection
- One IEEE 802.15.4 MAC timer, one general 16-bit timer and two 8-bit timers
- Two programmable USARTs for master/slave SPI or UART operation
- True random number generator
- CSMA/CA coprocessor
- Digital RSSI / LQI support
- 8-14 bits ADC with up to eight inputs
- 21 general I/O pins, two with 20 mA sink/source capability
- Digital battery monitor
- On-chip temperature sensor
- Hardware debug support
- Reference design with external PA providing +10 dBm output power is easily made based on CC2420 with external PA solution
- RoHS compliant 7mm x 7mm QLP48 package

ABOUT CHIPCON

Chipcon is a leading international semiconductor company that designs, produces and markets high performance standard radio frequency integrated circuits (RF-ICs) for use in a variety of wireless applications in the 300 to 1000 MHz and 2.4 GHz frequency bands.

Chipcon targets both consumer electronics and home and building automation end markets and has a strong position within both proprietary and standards-based radio technologies.

Chipcon Group ASA is the parent company and holding company that controls the activities of its wholly owned subsidiaries Chipcon AS and Chipcon Inc. Chipcon's products are distributed worldwide and we are represented at 55 locations in 31 countries.



Gaustadalléen 21, N-0349 Oslo, Norway
Tel: +47 22 95 85 44 Fax: +47 22 95 85 46
www.chipcon.com E-mail: info@chipcon.com
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