Frequency Control Products and Zigbee Radio Applications

Introduction

ZigBee™ is a low-power, short-distance wireless standard that has great possibilities in applications from home automation to industrial control.

The Market

ABI Research has released a report calling the ZigBee market a "sleeping giant," and forecasting the deployment of over 100 million ZigBee devices by the end of 2007 and 500 million by the end of 2008. ZigBee is built as a low-cost, low power, low-data-rate wireless networking standard designed for monitoring and management control applications in industrial and home markets. (Hence; time lighting and appliances, irrigation systems, garage door openers, surveillance cameras and more).

ZigBee was developed to serve different applications than Bluetooth and its technology leads to "tremendous optimizations in power consumption," according to the ZigBee Alliance, a trade association formed to promote the standard. According to the organization, some key differentiators from Bluetooth include:

- Very low duty cycle, very long primary battery life
- Static and dynamic star and mesh networks, 65,000+ nodes, with low latency available
- Ability to remain quiescent for long periods without communications
- Direct Sequence Spread Spectrum allows devices to sleep without the requirement for close synchronization

Potential ZigBee applications include home automation, wireless sensors, interactive toys, smart badges and remote controls.

Market Complying Standard	**Zigbee 802.15.4**	**GPRS/GSM 1xRTT/CDMA**	**Wi-Fi 802.11b/g**	**Bluetooth 802.15.1**
Focus Application	Monitor & Control	Voice & Data	Data & Video	Interconnectivity
System Resources	4KB~32Kb	>16KB	>1MB	>250KM
Battery Life (days)	100~1000	1~7	0.5~5	1~7
Number of channels	Unlimited (2^64)	1	32	7
Bandwidth (KB/s)	20~250	64~128	>11,000	720
Transmission Range (m)	1~100	>1000	1~100	1~10

Table 1 – Comparison between Zigbee and other wireless standards

While ZigBee is applicable in industrial and consumer markets, ABI's report suggests that the consumer sector will provide "many times the revenue of the most optimistic predictions for industry," in a mature ZigBee market. And while industrial buyers will get the ZigBee ball rolling, ultimately the consumer sector will be easier for vendors to enter because technical requirements there are less stringent.

The ZigBee(TM) Alliance, a global union of companies offering wireless solutions for use in home, commercial and industrial applications. This alliance includes companies such as; BM Group, Ember Corporation, Freescale Semiconductor, Inc., Honeywell, Mitsubishi Electric, Motorola, Philips, Samsung, Siemens and Texas Instruments, Huawei Technologies, Schneider Electric and STMicroelectronics on the ZigBee Alliance Board of Directors.
Adding original equipment manufacturers (OEM) to the Alliance as well as platform providers expands synergy and expertise within the ZigBee Alliance while allowing a better support when it comes to large scale of new product introductions. ZigBee already offers the largest selection and most robust supply chain of any wireless control technology with 12 compliant platforms. OEMs are actively selling end-user products based on ZigBee for the medical, automated meter reading, marine safety and home automation markets.

Fundamentals of Zigbee Radio

IEEE's 802.15.4, the standard defining Zigbee radio, was completed in 2003. Zigbee radio is aimed at long battery life, low data rate, and low cost as well as big networks.
Zigbee radio includes the physical radio hardware and the MAC layers (Media Access Control). The Zigbee Alliance does the rest of work in a way of controlling OEM who build interoperable pieces of the network. A couple of key pieces of the stack are networking and the security algorithms.
The network layer enables self-organizing networks along with security. For example; while using a Zigbee radio in a remote control garage door opener, a proper utilization of security algorithms is essential to prevent hacking of the code and a possible trespassing. In a large commercial application such as a high rise building where all lights and all the HVAC are controlled by a Zigbee network, a full 128 bit encryption is used to avoid hacking that will result in turning on or off the lights.
The Zigbee platform includes the 15.4 radio, the network layer, the security layer, and the application services layer.
Zigbee radio's range can vary from 100 to 300 meters. Different Zigbee radio networks have the ability to communicate with each other and recognize each other. Another application that can utilize Zigbee network is golf course watering systems. Using a Zigbee network, one can turn ON or OFF sprinklers in certain sections but not in other sections of a given course. This becomes very important for water conservation, in a similar manner as used for power conservation.

The Zigbee Alliance had addressed some problems that were encountered by the Bluetooth Alliance concerning noise interference.
Noisy cordless phones, for example, utilize the old 802.11 technology, tends to interfere with Bluetooth WLAN applications. The Zigbee Alliance had addressed interference concerns through applying 16 channels in the 2.4 band and along with agile – frequency hoping that can move itself to an area within the band that is clear of interfering noise. On the other hand, 802.11 has only 3 channels that are utilized in the band, including two guard channels.

How does CTS support Zigbee Radio Applications?

Increasing demands grow for efficiency improvements within industrial control applications as well as secure features involving wireless applications within consumer electronics have opened new venues for wireless solutions encompassed within Zigbee Radio Protocol (hence IEEE 802.15.4). OEM and Semiconductors primarily focus their development efforts in the RF/ H.W portion as well as the encoding software. Every Zigbee radio utilizes a quartz crystal resonator that is utilized as a reference for the clock generator within the transceiver IC. Typical characteristics defining the reference crystal resonator are; frequency equal to 16MHz or 32MHz, stability over industrial temperature range does not exceed +/- 20PPM and load capacitance ranges from 12pF to 20pF (depends on transceiver IC used).
Examples for proposed P/Ns;

- CTS Model ATS-SM (Crystal HC49/S) at +/-20PPM stability and 16pF load

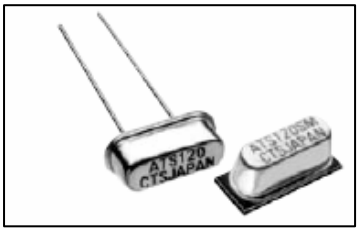
  Examples P/N; R1W22B16T032M00000 or R1W22B16T016M00000

- CTS Model 407 (5mm x 7mm crystal resonator) at +/-20PPM stability and 16pF load

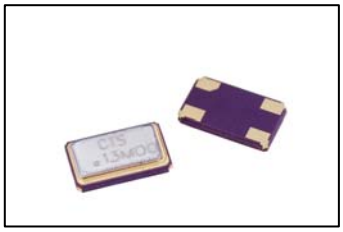
  Examples P/N; 407F16C032M0000 or 407F16C016M0000

All product families are RoHS compliant. The following web link offers access to CTS data sheets for each model, http://www.ctscorp.com/components/xtal.asp

Model Name	Frequency Range	Frequency Stability vs. Temp.	Temperature Ranges	Package Size
Model ATS-SM	3.5 - 60 MHz	± 50 ppm standard (tighter stabilities available)	-20 to 70°C -40°C to 85°C	10.85 x 4.50 x 3.68 mm 0.427 x 0.177 x 0.145 inch
Model 407	8-50MHz	± 50 ppm standard (tighter stabilities available)	-20 to 70°C -40°C to 85°C	7.5 x 5.0 x 1.8 mm 0.295 x 0.197 x 0.071 inch
Model 405	12-50MHz	± 50 ppm standard (tighter stabilities available	-20 to 70°C -40°C to 85°C	5.0 x 3.2 x 0.9 mm 0.197 x 0.126 x 0.035 inch



ATS & ATS-SM


Model 405


Model 407

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