PH240X Bluetooth Radio Family

Integrated 2.4 GHz ISM Band Low Power Transceiver

V1.1(Advanced)

Features

- Fully-integrated single-chip transceiver with on-chip VCO, synthesizer, PA, LNA, IF filters, RSSI, and bit slicer for ISM 2.4 GHz RF transceiver
- 0.5 um SiGe BiCMOS Silicon Monolithic IC
- Class 2 and 3 compliant with Bluetooth specification v1.0
- Low voltage supply 1.8 V
- Low power consumption (<20 mA typical)
- RF sensitivity to -84 dBm
- Output power selectable between 0dBm and -10dBm
- Software and hardware programmable
- Crystal independent fractional-N synthesizer
- Programmable Tx power control
- Requires no external shielding
- Serial port baseband RF Interface
- BCC48++ pin package

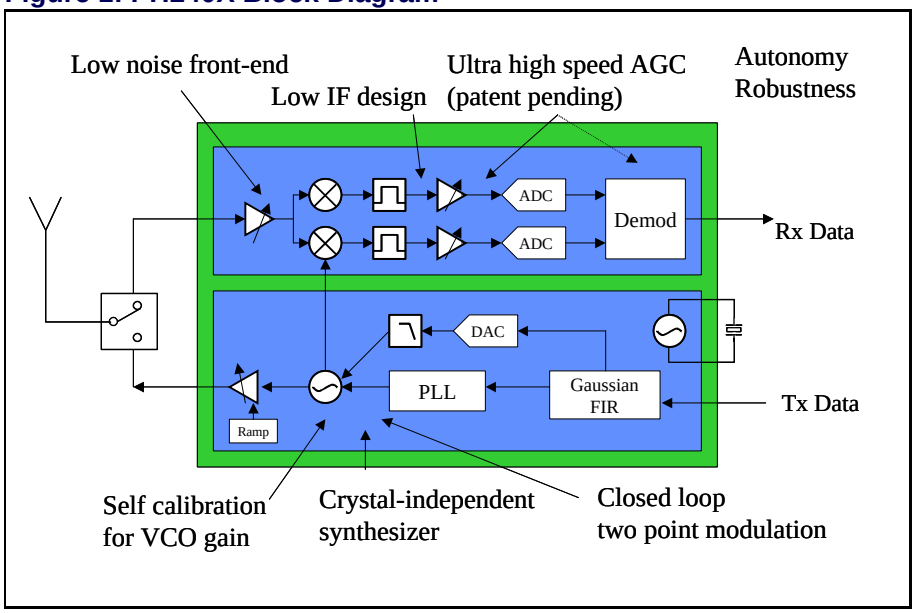
Product Description

The PH240X Family is a set of three integrated Bluetooth radio transceivers that are optimized for use in 2.4 GHz wireless systems. They have been designed for ultra-low power Personal Wireless Connectivity applications that require maximum battery life, small form factor, and low system cost. They are fully compliant with Bluetooth Specification v1.0.

The PH240X Family devices are based on a core short-range radio transceiver for Bluetooth communication links that operate in the ISM frequency band, 2.4 GHz. Fast frequency hopping (1600 hop/s), 79 available channels (2.402 to 2.480 GHz), and a maximum Tx and Rx bit rate of 1Mbit/s exploit the maximum channel bandwidth allowed in the ISM band.

The transceivers use a Guassian Frequency Shift Keying (GFSK) modulation technique with a modulation index of 0.3. The channel bandwidth is 1MHz, and the frequency deviation is between 140 and 175 kHz. They are designed in a SiGe BiCMOS ASIC process. Each device is packaged in a Bumped Chip Carrier (BCC++) package with 48 or fewer pins.

Figure 1: PH240X Block Diagram



The Bluetooth specification defines classes of radio operation based on transmit power. The three members of the PH240X family are designed to meet Bluetooth Class 2 and 3 operation. They operate over ranges from 1 to 10 meters. The transmitter power amplifier offers programmable output levels between -10 and +2 dBm.

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Typical Applications

- Personal wireless communications
- Personal data assistants (PDAs)
- Headsets
- Handsets
- Mobile computing
- Cameras
- Computer peripherals

PH2401

The PH2401 includes the base functionality to meet the Bluetooth requirements for general applications.

PH2402

The PH2402 adds an auxiliary synthesizer to the PH2401 in order to provide programmable clock to the Bluetooth baseband IC, for baseband architectures that require it.

PH2403

The PH2403 has been enhanced with a 12-bit ADC microphone and a voltage pump for use with 1.2 V power supplies to meet the Bluetooth Accessories market (e.g.: headset application).

All three members are designed using the following core technology:

- Delta-Sigma synthesizer incorporating two-point angle modulation stabilized over the operating temperature range (see Figure 1)
- Calibration method for two-point angle modulation scheme
- Radio receiver architecture based on complex AGC/filtering and PLL demodulation
- Fast dynamic-threshold MFSK bit slicer

In addition, each version includes serial interface logic, power management and a temperature measurement sensor.

The receiver is comprised of a complex RF-to-IF down converter LNA/Mixer, an AGC/complex filter, and a dual ADC for the I/Q signal paths. The digital outputs from the ADCs are passed to a 2FSK demodulator consisting of a complex PLL, Guassian filter, and a dynamic MFSK bit slicer for 2FSK data. The bit stream is passed to a baseband processor for symbol time recovery. An analog RSSI indicator is obtained by combining the outputs of the AGC control voltage. The receiver also supports crystal frequency error compensation to within 10s of Hertz via a digital algorithm in the demodulator. This feature allows the receiver to track and correct crystal errors using a feedback control loop.The transmitter consists of a Delta-Sigma controlled Fractional-N synthesizer with two-point direct digital modulation.

For complete operation, the radio transceiver must be connected to a baseband controller or to a device that emulates baseband functionality. The baseband function is required to read and write to the internal registers in the radio controller; these registers are used for programming the frequency, tuning, and control. Communication between the baseband and the radio is through the serial bus.

All members of the family can operate with a number of different crystal frequencies due to its 16-bit Fractional-N synthesizer. The Fractional-N design allows the synthesizer to be tuned to within 125 kHz of the desired channel; that is, to within 50 ppm. The tuning does not rely on the type of crystal used. Significant economies, therefore, are gained in systems like cell phone handsets, as the handset crystal can be used without sacrificing tuning speed or channel accuracy. The following crystal frequencies are supported: 10, 13, 19.2, 19.68, and 19.8 MHz.

The antenna should be connected through an external switch. The power supply is divided into three parts to supply the VCO, the digital logic, and the remainder of the radio.

Preliminary Data Sheet Available Under Non Disclosure Agreement