QPG6095

Zigbee / Thread / Bluetooth Low Energy Smart Home Communications Controller

Product Brief

Product Overview

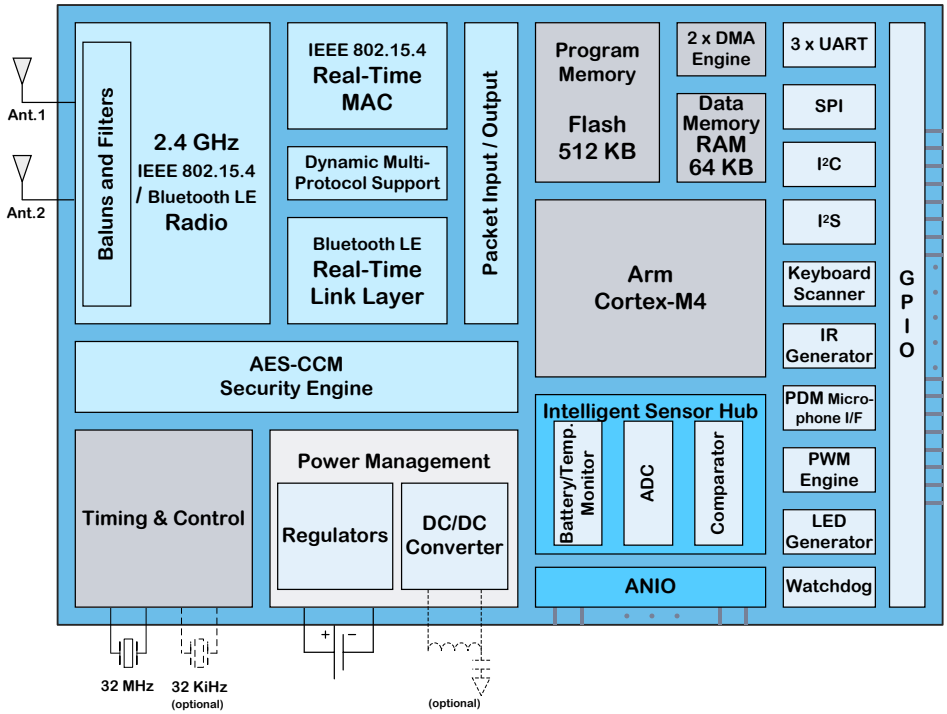
The QPG6095 **Zigbee** / **Thread** / **Bluetooth® Low Energy** Smart Home Communications Controller provides a fully integrated solution for ultra-low power wireless communications for Smart Home sentroller devices such as thermostats, motion sensors, smart plugs, keypads and door/window sensors. It is compliant with the IEEE Standard 802.15.4 for Zigbee and Thread, and the Bluetooth Core Specification v 5.0 [3] for Bluetooth Low Energy, providing robust spread spectrum data communication with a highly secure encrypted and authenticated data flow. For Zigbee communications, antenna diversity offers additional robustness in a crowded wireless 2.4 GHz environment.

The QPG6095 features a radio transceiver, integrated real-time Medium Access Control and Bluetooth Low Energy Controller, integrated Arm® Cortex®-M4 microprocessor, RAM and Flash memory, security engine, event scheduler, and an extensive set of peripherals including analog signal monitors and comparators. The QPG6095 integrated RF baluns and filters reduce the product's RF design complexity enabling very low cost single layer applications using simple PCB antennas requiring no shielding and a minimum number of external components. The Flash memory allows for software upgrade over the air.

The QPG6095 integrates full stack and applications for Zigbee 3.0 and Bluetooth Low Energy devices, as well as the OpenThread open-source implementation of the Thread networking protocols. Integrated multi-stack, multi-protocol support enables device vendors to operate multiple protocols on different channels, enabling innovative new applications combining Zigbee, Thread and Bluetooth Low Energy in one product.

Advanced power management features ensure that power consumption is minimized in active as well as in standby states, enabling maintenance free and very small form factor products. For lower power consumption, the integrated DC/DC Buck converter can be used together with a few external components. Alternatively, the internal regulator can be used instead of the integrated DC/DC converter, to minimize the bill of material.

Chip Overview



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Key Features

- Operates in the worldwide 2.4 GHz ISM-band
- Integrated baluns and RF filters
- Support for external LNA and/or PA
- IEEE 802.15.4 compliant PHY and Real-Time MAC
  - Preamble-based antenna diversity
  - Packet-in-Packet resynchronization
  - Multi-Stack / Multi-Channel support, operating in up to 3 PANs on different channels
- Bluetooth v 5.0 compliant LE Controller [3]
  - High Date Rate (2 Mbits/s)
- HW-accelerated Dynamic Multi-Protocol support
- HW-accelerated AES and CCM* encryption with 128, 192 and 256-bit keys
- Arm Cortex-M4 processor with DSP functionality
- 512 Kbyte Flash Program memory; allows OTA software upgrade
- 64 Kbyte Low Leakage Retention RAM
- Full internal IO pull-up / pull-down support during active and standby states
- Fast and low-power analog measurements

Low Cost

The QPG6095 has 2 single-ended RF ports with integrated matching. No expensive shielding, chip antennas or voltage regulators are required to design a high performance Smart Home application. The integrated Arm Cortex-M4 processor and program memory allow for fully integrated, single chip applications. The integrated Real-Time MAC and Bluetooth LE Link Layer reduce software complexity and improve stability.

Excellent Range and Reliability

The QPG6095 has been optimized for reliable communication in harsh radio environments. The excellent receiver sensitivity and superior receiver signal processing allow extended coverage. Built-in IEEE 802.15.4 antenna diversity with two antennas improves the reliable link budget by 8 dB resulting in approximately 70% more reliable range compared to similar systems with only one antenna. In high density networks the packet-in-packet resynchronization further improves the communication reliability. The QPG6095 provides a flexible interface to an external FEM or PA to boost the output power.

Ultra-Low Power Consumption

The QPG6095's advanced integrated energy management system allows it to operate from a standard lithium coin cell battery, like the CR2032, as well as from intermittent power supplies like photovoltaic (solar), with a minimum of additional components. It includes ultra-low power voltage level detectors and overvoltage protection circuitry, allowing safe operation and graceful shutdown. The battery lifetime monitor tracks the usage of the battery and provides an early exhaustion warning. The intelligent sensor hub allows for quick and low power measurements during standby. The integrated DC/DC Buck converter can be used to further lower the power consumption in active mode, at the cost of two external components.

General Characteristics

Package	QFN40, 6x6 mm
Operating Temperature	-40 to +125 °C (industrial)
Storage Temperature	-50 to +150 °C
Soldering Temperature	260 °C (10 s max)
Compliance	RoHS

Electrical Characteristics

Standby Mode Currents [1]	
Using internal RC oscillator	1.1 µA
Using 32KiHz crystal oscillator (optional)	1.2 µA
Using 32MHz crystal oscillator	760 µA
Operational Currents [1] (with / without DC/DC Converter)	
Receive IEEE (single antenna)	4 / 5.7 mA
Receive IEEE (antenna diversity)	5.1 / 7.4 mA
Receive Bluetooth	8.3 / 12.3 mA
Transmit (at 0 dBm)	11.2 / 16.7 mA
Transmit (at 10 dBm)	23.6 / 35 mA
Supply Voltage	1.8 to 3.6 V
Interfaces and Peripherals	
Programmable GPIO lines	up to 30
Analog input lines	up to 6
Keyboard (HW assisted)	max 8 x 8
8-bit PWM with fading support	4 outputs
16-bit PWM engine	6 outputs
UART interfaces	3 (one for debug)
SPI and I^2C Master and Slave peripheral interfaces	
I^2S Master interface for digital audio devices	
PDM Microphone Interface	
High drive sink (for IR)	
10/12-bit ADC to monitor the analog input lines, the power supply level and the temperature	
Low power comparator	
High speed programming interface	
Crystal Frequency	32.000 MHz (±40 ppm)
Optional	32.768 kHz

Radio Characteristics

Radio Regulations compliant	ETSI EN 300 328 FCC CFR-47 Part 15 ARIB STD-T66
Transmit Power	+10 dBm (adjustable down in 1 dB steps)

IEEE 802.15.4 Radio Characteristics

Standards compliant	IEEE 802.15.4-2003 IEEE 802.15.4-2006
Frequency Band	2400 – 2483.5 MHz
Channels	16 (programmable, 5 MHz steps)
Data Rate	250 kbit/s
Receiver Sensitivity [1]	-100 dBm typical
Antenna diversity gain [2]	8 dB (increases the 'effective' receiver sensitivity to -108 dBm)

Bluetooth Low Energy Radio Characteristics

Standards compliant	Bluetooth Core Specification v 5.0, Low Energy [3]
Frequency Band	2402 – 2480 MHz
Channels	40 (2 MHz step size)
Data Rate	1 Mbit/s, 2 Mbit/s [3]
Receiver Sensitivity [1]	-97 dBm typical

1) Typical, at 3.0 V and 25 °C, unless specified otherwise.
2) For typical indoor usage in an environment with 50 ns delay spread and 2 MHz signal bandwidth using the Rayleigh fading model: antenna diversity with 2 antennas results in a 8 dB improved link budget at a 1% outage probability compared to no antenna diversity. The 8 dB in link budget translates into 70% more range, if using a two slope range model with the breakpoint at 10 m and g1 = 2, g2 = 3.5.
3) The QPG6095 is certified for Bluetooth Low Energy 5.0 with support for the 2 Mbit/s data rate; it does not support other optional Bluetooth Low Energy 5.0 features like the Long Range Coded PHY and Advertising Extensions.

Reference Designs, Tools and SW

Qorvo reference designs, development kits, software libraries and production platforms provide a quick time-to-market solution for sensor and control devices for Smart Home networks and for other IEEE 802.15.4 / Bluetooth Low Energy communication products.

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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