TI’s Mobile Connectivity Solutions

Texas Instruments (TI’s) more than 15 years of wireless communications expertise positions it at the forefront of an exploding wireless world. Consumer electronics will connect wirelessly over any network, anywhere, anytime, giving users the ability to roam seamlessly among wireless networks using a single mobile device.

TI is in a unique position to make the vision of tomorrow’s wireless world a reality. TI provides interoperable solutions for all components of the system, including cellular and non-cellular wireless connectivity through Bluetooth®, 802.11 wireless LAN and global positioning services (GPS). For the consumer, TI supports all mobile communications and network technologies. TI is fueling the coexistence and convergence that promise an unprecedented wireless experience. For customers, TI’s optimized solutions leverage leading-edge integration and reference designs that speed time-to-market and enhance system performance with reduced size, power consumption and system cost, in addition to built-in coexistence between wireless technologies.

OVERVIEW

Bluetooth – Designed for mobile terminals, TI’s Bluetooth solutions offer cost-effective, cable-free connectivity to a growing number of devices such as wireless phones, Personal Digital Assistants (PDA’s) and a plethora of converged mobile devices such as smartphones and hands-free car kits. TI leverages an exclusive digital radio processor (DRP) architecture that integrates RF in CMOS to enable true, high-performance single-chip solutions that use little power and board space—and mix with all 2.5G and 3G communication standards.

Mobile WLAN – TI’s strong role in developing the open IEEE 802.11 standard and TI’s heritage as a leading mobile communications semiconductor vendor position the company as a leading provider of wireless LAN (WLAN) technology optimized for battery-powered mobile devices such as laptops, smartphones and PDAs. TI offers interoperable and power-efficient Wi-Fi CERTIFIED™ solutions that wirelessly transfer large amounts of data at high speeds and with low power consumption.

GPS – TI offers faster, more accurate location-based services through its highly optimized assisted-global positioning services (A-GPS) chipset that is designed for current and evolving mobile standards. TI’s solution interfaces with its wireless chipsets and delivers precision location services to markets ranging from voice-centric handsets to high-end multimedia smart phones and PDAs.
**Bluetooth® technology**

*Overview*

Geared toward low-cost, low-power and high-volume applications such as mobile handheld devices, TI’s Bluetooth offerings are single-chip solutions that integrate the Bluetooth baseband, RF, memory and power management to enhance performance, reduce cost and minimize board space.

TI is the only manufacturer to offer a revolutionary digital radio processing (DRP) architecture that provides increased scalability, ultra-stable performance, low power consumption, reduced size and lower cost. In addition, TI’s Bluetooth solutions are part of a coexistence solution with TI WLAN offerings, enabling users to benefit from simultaneous voice calls with a Bluetooth handset and Web browsing via a WLAN access point.

**Key benefits**

- Single-chip, integrated solutions deliver low cost, increased performance
- Unique DRP technology with RF integration in CMOS process saves board space and cost
- Meets Bluetooth specifications v1.1 and v1.2
- Provides low power consumption and longest talk, standby and shut-down times
- Offers improved power management through direct connection to battery
- Complete reference designs available with TI’s OMAP™ platform and GSM/GPRS/WLAN chipsets provide fast time-to-market
- Collaborative coexistence with TI WLAN solutions

**BRF6100 single-chip solution**

Fabricated using TI’s 130-nm CMOS process, the BRF6100 is a single-chip solution that provides industry-leading power consumption and meets consumer desires for longer talk and standby times. It provides seamless integration with OMAP processors in support of all major operating systems and coexists with TI’s WLAN solutions to enable simultaneous voice calls and Web browsing.

**BRF6100/6150 functional diagram**
**Leading wireless integration with DRP**

TI’s digital RF processor architecture (DRP) is a radical approach to wireless chip design that cuts the cost and power consumption of transmitting and receiving information wirelessly. By integrating RF in digital CMOS, DRP-based designs such as the BRF6100 and BRF6150 deliver reduced power consumption, die area and system board space by up to 50 percent over traditional analog RF designs.

The DRP approach frees up board space required for today’s advanced feature sets, including color displays, cameras, GPS location-based service, LAN capabilities, digital audio/video, games and more. In addition, DRP is leading the industry toward a future where wireless modules can be integrated into any kind of product and provide users with seamless access to a variety of network connections.

**Key features:**
- Certified single-chip solution for Bluetooth specification v1.1 (over −40 to +85 degrees)
- Leading RF performance, RF stability (below ±1.5 dBm variations) and low power consumption through DRP
- Complete reference designs available with TI OMAP platform and wireless chipsets
- Best-in-class power consumption (HV3/13 mA)
- Fast, low-cost production line testing
- Small form factor (~70 mm²)
- WLAN coexistence

**BRF6150 single-chip solution**

Based on the BRF6100, TI’s BRF6150 offers improved RF performance, power management capabilities and integration resulting in a 50 mm² Bluetooth solution for wireless handsets. It leverages TI’s DRP architecture and is tailored to suit cellular application requirements including RF performance, power consumption, solution size, ease of integration and cost.

Like the BRF6100, the BRF6150 includes complete reference designs with TI’s GSM/GPRS chipsets and OMAP platform. It combines TI’s collaborative coexistence mechanism to enhance WLAN data throughout when co-located into small mobile products such as smartphones and wireless PDAs.

**Key features**
- Industry’s longest talk and standby times
- Full Bluetooth specification v1.2, including eSCO, AFH and faster connection
- Direct connection to battery improves power management (2.7 V to 5.5 V)
- High integration and improved interfaces result in low part count and cost
- Complete reference designs with TI OMAP platform and GSM/GPRS chipsets
- Pin-to-pin compatible stacked-flash prototypes of 4.5 mm x 4.5 mm
- WLAN coexistence
- Manufactured in 130-nm process to meet mass-production needs

**Smartphone application: BRF6150 interconnects with the OMAP™ applications processor, GSM/GPRS chipset and WLAN**
**Mobile WLAN technology**

**Overview**

TI WLAN solutions meet the full range of 802.11 standards, including 802.11b, 802.11d and 802.11e, 802.11g and 802.11i. TI’s innovative performance levels, low power consumption and high levels of interoperability give users seamless connectivity anytime, anywhere.

The company’s third-generation 802.11 chipset is specifically designed for mobile devices including cell phones, smart phones and PDAs. It offers dramatic improvements in size, power and battery life, reducing developer costs and providing users with increased “active” time. Additionally, TI’s 802.11 solutions for mobile devices include advanced features that support coexistence with Bluetooth, providing simultaneous voice and data transmission.

**Key benefits**

- Industry-leading performance and standards conformance
- High levels of integration provide cost savings and small form factors
- Migration path as future 802.11 standards evolve to embrace new enhanced features such as standardized fast roaming and continuous connectivity without user intervention
- Full reference design support
- Bluetooth/WLAN coexistence
- Extensive interoperability track record/testing
- Optimized for low power operation while supporting real data and voice applications

**TNETW1250-based module**

With a complete 802.11 subsystem, the self-contained TNETW1250-based module was developed specifically for mobile applications such as wireless handsets and PDAs and is the third generation of market-proven WLAN technology. The module integrates a WLAN media access controller, baseband processor, 2.4-GHz RF transceiver and power amplifier, and delivers a high-performance, low-power architecture in a small form factor. With features such as Quality of Service (QoS) capabilities for voice, advanced Bluetooth coexistence and low-power optimized modes, it is ideal for today’s multimedia applications and emerging applications such as voice over WLAN (VoWLAN).

The TNETW1250-based module offers new, record low power consumption and a standby mode that consumes less than 400 microamperes (µA) of current. It also uses up to 50 percent less power over past generation interfaces when in active modes transmitting or receiving data. Additional optimization of TI’s ELP™ technology gives the module more time in standby mode, resulting in significant battery life improvements.
Key features

- Complete support for 802.11bg and enhancements such as 802.11dei for global interoperability
- Optimized for cellular handsets
- High integration meets OEM board space requirements
- Operation from cellular clock reference eliminates need for discrete WLAN crystal
- Streamlined host interfaces with low pin count serial connectivity
- SPI, SDIO interfaces deliver full-rate communication
- Integrated power management saves cost, reduces system size and adapts to a variety of typical mobile power supply architectures
- Advanced Bluetooth/WLAN coexistence for data and voice permits simultaneous operation of WLAN and Bluetooth subsystems
- VoWLAN capability including QoS and Cisco® Compatible Extensions support
- Low-power direct conversion (DC) RF architecture simplifies integration, eliminates IF noise and reduces BOM
- Consumes less than 400 µA of current in 802.11 infrastructure power save mode for extended battery life
- Uses up to 50 percent less power in active modes over previous generation
- Embedded Station Software Development Kit (eSTADK) includes tools optimized for easy integration into the mobile handset development environment
**GPS technology**

**Overview**

TI offers a highly integrated and power-efficient solution for delivering faster, more accurate location-based services across a wider area. Specifically designed for assisted-global positioning services (A-GPS), TI’s solution interfaces with TI’s OMAP platform and TCS chipsets to deliver reliable and precise location capabilities to devices ranging from voice-centric handsets to high-end multimedia smart phones and PDAs.

**Key benefits**

- A-GPS solution supports standalone, MS-assisted and MS-based modes of operation
- Support of current and future standards and algorithms
- Optimized for wireless terminals
- Designed for simultaneous operation with cellular phone system
- Reduced board space
- Greater accuracy and reliability through flexible design
- Increased performance and low power consumption
- Interfaces with TI’s TCS chipsets and OMAP platform
- Air-interface independent with support for current and future standards
- Support for evolving GPS algorithms through software upgrades

**GPS technology solution**

**TGS5000 wireless GPS chipset solution**

The power-efficient TGS5000 chipset is a complete programmable solution for A-GPS location-based services. It provides a fast and accurate method of geolocation for a variety of applications, including future capabilities such as navigation and emergency location. Because of its high levels of integration, the TGS5000 saves on board space, reducing overall cost and allowing for greater flexibility for manufacturers of voice-centric handsets to high-end multimedia smart phones and PDAs.

The TGS5000 consists of a proven baseband processor and RF receiver in ultra-small chip scale packages to extend board space savings. It also includes the logic, memory, analog and software needed for A-GPS implementation and testing. As a companion to TI’s wireless chipsets, the TGS5000 is optimized for all current and developing wireless standards, including GSM, GPRS, EDGE, CDMA, UMTS and WCDMA. It operates in the standalone, MS-assisted or MS-based modes and can maneuver between modes as required for seamless worldwide operation.
**Key features**

- Designed to interface with OMAP platform and TCS chipsets
- High integration and small package saves board space and cost
- Two-chip solution provides faster, more accurate location-based service across a wider area
- Supports current and developing wireless standards
- Operates in standalone, MS-assisted or MS-based modes and can switch modes as needed
- Programmable design supports evolving standards and algorithms
- Power management hardware and software provide extended battery life in active and standby modes

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**TGS5000 A-GPS solution**

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**Bluetooth and 802.11 coexistence**

**Overview**

TI is enabling simultaneous functionality of Bluetooth and 802.11a/b/g WLAN through its Bluetooth/WLAN coexistence package. A combined hardware and software solution, the coexistence package solves interference concerns by deploying simultaneous 802.11 and Bluetooth functionality in a small form factor to cell phones, laptop computers, PDAs, Web tablets and other mobile terminals.

Smart and seamless coordination at the MAC layer between TI WLAN and Bluetooth technologies eliminates RF isolation between the 802.11 and Bluetooth antennas, resulting in a fast, flexible and simple design with effective operation. Software monitors WLAN and Bluetooth traffic patterns and deploys multiplexing techniques when simultaneous bandwidth is required. This allows high throughput rates to be maintained, while RF interference, packet collisions and antenna isolation are eliminated.
Future wireless technologies

Overview

TI supports many emerging connectivity standards to provide users with options for efficiently transmitting data wirelessly from their mobile devices. TI is actively defining and developing Ultra Wideband (UWB) technology for carrying data at high speeds over a short range. Geared toward wireless personal area network applications (WPANs), UWB transmits digital data over a wide spectrum of frequency bands using very low power. TI's multi-band OFDM approach has gained a broad range of support across the consumer electronics, computing, cellular and semiconductor industries. This industry support and TI's wireless and connectivity expertise will help answer the consumer demand for higher quality video, higher resolution pictures, increased memory and ease of use for applications such as camera phones, large-memory personal digital assistants (PDAs) and digital video camcorders to name a few.

Bluetooth and 802.11 coexistence

Adaptive Frequency Hopping (AFH) and Extended Synchronous Connection Oriented (eSCO) features provide added capabilities to devices in close proximity to the Bluetooth/WLAN combination device. The eSCO strengthens protection to voice packages so channels can manage uncoordinated transmissions from other devices using the 2.4-GHz band. Bluetooth devices utilizing AFH can communicate using frequencies that do not interfere with the WLAN channel used by the coexisting Bluetooth/WLAN combination device.

Key benefits

- Coexisting and simultaneous 802.11 data with Bluetooth voice functionality
- Highest efficiency of 2.4-GHz band use, by time and frequency domain sharing
- Full utilization of Bluetooth specification v1.1 and v1.2 for coexistence enhancement
- Addresses Bluetooth voice protection for mobile terminals
- No RF isolation requirements save board space
- Small footprint geared toward handheld devices
- Seamlessly coordinated two-chip solution
- Low power consumption
- Simplified design

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