Leveraging its industry leadership in the GSM/GPRS market, Texas Instruments (TI) has developed the highly integrated, low-power TCS4105 chipset and reference design for the Universal Mobile Telecommunications Services (UMTS) market.

The processing capabilities of the TCS4105 chipset with the family of OMAP™ application processors are very scalable. As a result, the chipset can be deployed in a wide variety of platforms such as handsets, smartphones, wireless PDAs, PC cards and other new types of mobile devices. A TCS4105-based mobile device can meet the requirements of every segment in the UMTS market, from users who are transferring large amounts of data to those who are multimedia-intense power users.

Because the TCS4105 chipset provides sophisticated control over its power management resources, a design based on the chipset has double the battery standby time over existing 3G handsets. And the high level of integration in the chipset saves board space and reduces parts count by approximately 30 percent over today’s 3G handset designs.

For rich 3G multimedia applications like imaging and video, video conferencing, interactive 3D gaming and entertainment, location-based services, high-end stereo music, polyphonic audio and many others, the TCS4105 chipset can be paired with a seamless interface to TI’s OMAP family of wireless application processors, including the new OMAP1610 device. The complementary nature of TI’s TCS chipsets and the OMAP family of application processors ensures a high level of software and engineering reuse among a manufacturer’s mobile device product lines.
A complete system solution

In keeping with TI's track record of success in the GSM/GPRS market, the TCS4105 will provide a complete system solution comprised of hardware, a comprehensive software package with protocol stack, operating system (OS), development tools, and worldwide technical support that slashes a manufacturer's time-to-market. With the TCS4105 chipset and reference design, manufacturers can begin development immediately in anticipation of the emergence of the UMTS marketplace. The flexibility of the chipset as well as the sophistication of its development tools efficiently streamlines the addition of features and capabilities in response to the demands of subscribers.

The TCS4105 is a dual-mode chipset for both the WCDMA and GSM/GPRS communications protocols. The chipset supports Class 12 GSM/GPRS and 384 Kbps WCDMA services.

Because of several innovative power management techniques, the TCS4105 chipset can provide double the standby time over existing 3G handsets in the market today.

TI's advanced integration capabilities have allowed for many low-dropout voltage regulators and other associated power circuitry to be integrated into the TCS4105 chipset's analog baseband and power management processor, the TWL3024. This device not only manages all power functions associated with the UMTS solution but also all the common application needs for a 3G handset.

The TWL3024 is capable of very granular power control procedures for the entire system, including all the radio components of the TCS4105 chipset and an OMAP application processor. The system can be partitioned into narrowly defined sections, and when appropriate, the TWL3024 will place various partitions into one of several low-power sleep or shut-down modes, thereby doubling the standby battery life over existing 3G mobile devices without sacrificing high-performance application processing.

Doubling standby time

Reducing costs through silicon integration

TI has applied its silicon integration skills and advanced fabrication processes to all aspects of the TCS4105, reducing by approximately 30 percent the parts count in a 3G UMTS handset based on this chipset. This translates into reduced bill of materials (BOM) costs and board space savings. Two examples of the high level of integration in the TCS4105 chipset are the TWL3024 analog baseband device and the chipset's RF subsystem, the TRF6151 and TRF6301. The TWL3024 has integrated 27 low-dropout voltage regulators and their associated circuitry. Additionally the two-chip RF transceiver subsystem features advanced direct conversion (DC) technology along with integration of many external components such as LNAs, VCOs and PLLs.
Application processing for 2.5G and 3G

The TCS4105 chipset can be seamlessly paired with the OMAP family of wireless application processors, including the new OMAP1610 device. The OMAP1610 and other OMAP application processors provide access to high level operating systems (HLOS) along with their familiar application programming interfaces (API) and their many sophisticated development tools. The HLOS supported by the OMAP family include Linux®, Microsoft® Windows® CE, Palm OS® and Symbian OS™.

The OMAP161x series of application processors offer application performance 1.5x greater than the previous generation of the OMAP platform. For mobile device manufacturers, that means more compelling 2.5G and 3G multimedia-rich applications like video conferencing, interactive gaming, speech processing, location-based services, video streaming for entertainment and many others.

The OMAP161x processors have accelerators for Java programs that increase Java application performance by 8x. In addition, the OMAP161x devices have numerous peripherals integrated on-chip, reducing a manufacturer’s time-to-market, saving board space and lowering the system’s overall BOM cost.

Many new 2.5G and 3G applications will require that mobile devices store and transmit valuable and extremely sensitive personal information. As a result, the security concerns of subscribers will drive the success of many new services. The OMAP platform, and in particular the OMAP161x devices, lead the industry in hardware-based security features which include a secure bootloader, secure mode of operation, secure RAM and ROM, and hardware accelerators for several security standards.

The many third-party applications and software modules that have been developed by members of the OMAP Developer Network are available to TCS4105-based designs which include an OMAP application processor. And the OMAP family is supported by a worldwide network of highly expert wireless system designers who are associated with one of the Independent OMAP Technology Centers (OTC).
TI’s TCS4105 UMTS chipset solution paired with the OMAP1610 application processor

TCS4105 elements
- TBB4105 UMTS/GPRS digital baseband processor
- TWL3024 analog baseband integrated with power management
- TRF6151 DC, quad-band RF Transceiver (GMS/GPRS)
- TRF6301 RF Transceiver (WCDMA)

TCS4105 features
- Complete hardware and software chipset and reference design for fast time-to-market
- Double the battery standby time over existing 3G handsets
- Multimedia-rich 2.5G and 3G applications through a seamless interface to an OMAP™ processor
- Highly integrated four-chip solution lowers parts count by approximately 30 percent
- Dual-mode GSM/GPRS and WCDMA
- Enables popular applications like MMS, digital camera, hardware-accelerated Java applications, MP3 and other music formats, streaming video and more

Four-chip UMTS solution
The TCS4105 dual-mode UMTS chipset comprises four highly-integrated devices:

- TBB4105 digital baseband
- TWL3024 analog baseband with complete power management
- TRF6151 GSM/GPRS transceiver
- TRF6301 WCDMA transceiver
The dual-mode WCDMA and GSM/GPRS TBB4105 digital baseband processor supports Class 12 GSM/GPRS data communications and WCDMA service up to 384 Kbps. The device includes two processing cores: a DSP core based on TI's leading TMS320C55x™ digital signal processor (DSP) and an ARM 926 general-purpose processor (GPP). The TBB4105 is manufactured in TI's leading 0.13-micron CMOS process that supports 1.5V core operation with 1.8V and 3.3V I/Os. It comes in a space-saving 293-pin, 12-mm x 12-mm MicroStar BGA™ package.

The TBB4105 is compatible with all the current requirements of the 3rd-Generation Partnership Project (3GPP) Release 99 specification for UMTS. Because of the high degree of flexibility in the TBB4105 partitioning of the hardware, a TCS4105-based design can be quickly adapted to changes in the 3GPP specification as it evolves in the future.

The TWL3024 manages the analog baseband processing for the TCS4105 chipset along with power management functions. By integrating all the power management functionality for the TCS4105 chipset and applications powered by OMAP processor, the TWL3024 cuts the overall parts count of the system by minimizing external power components. Some 27 programmable low-dropout voltage regulators are integrated on-chip to manage the power consumption of the entire TCS4105 chipset as well as any application processing devices in the design. The TWL3024 incorporates all the baseband codecs needed for GSM/GPRS and WCDMA, a voiceband codec and a stereo DAC. It also features a battery charge controller and a USB OTG transceiver.

The TWL3024 makes use of TI’s innovative power management system, which reduces power consumption considerably by partitioning the system and placing portions of the architecture into one of several low-power standby modes whenever possible. With these techniques, the standby time for an advanced 3G handset can be doubled over existing designs without sacrificing the application processing capabilities of the system.
The RF subsystem of the TCS4105 chipset is made up of two highly integrated RF transceivers. The TRF6151 transceiver provides direct conversion (DC) GSM/GPRS reception and transmission. The TRF6301 transceiver performs the same functions for WCDMA with DC reception and dual conversion transmission with a single synthesizer. In addition to offering DC technology, these devices also leverage TI's integration capabilities by incorporating many external components such as LNAs, VCOs, and PLLs. This significantly reduces the complexity and parts count of the RF subsystem.

**TRF6151 and TRF6301 RF transceivers**

Besides offering the strongest lineup of wireless chipsets and reference designs, TI is unique in the industry because it offers an entire portfolio of other complementary wireless technologies that are being incorporated into next-generation mobile devices. This comprehensive offering of wireless solutions ensures that mobile device manufacturers can quickly integrate related wireless technologies into their product platforms and, by providing better cost-to-performance points, establish a leadership position in terms of market share.

TI has been very active in leading the development of open industry standards as well as introducing high-performance solutions for Bluetooth’s™ personal area networking (PAN), 802.11 wireless local area networking (WLAN) and global positioning services (GPS). In fact, TI introduced the industry's first device with digital RF and a Bluetooth baseband processor on the same chip, the BRF6100. TI's WLAN technology, which has a history of consistently out performing the industry, is leading the way toward a converged multimode 802.11a/b/g market.

TI plans to provide a fully tested, certified and type-approved reference design for a TCS4105-based wireless handset that will free up mobile device manufacturer’s development resources to concentrate on those features and capabilities that provide competitive advantage in the marketplace and create value in the eyes of consumers. The TCS4105 reference design will include a complete parts list as well as board design, layout and schematics. The TCS4105 reference design will also include an OMAP application processor for high-performance and low-power application processing.

To find out more about TI’s TCS4105 UMTS chipset and reference design, contact your local TI field sales representative or visit: [www.ti.com/tcs4105](http://www.ti.com/tcs4105)