TCS2500 GPRS Smartphone Chipset and Reference Design

Designed specifically to enable the coming wave of smartphones and wireless personal digital assistants (PDAs), the new TCS2500 chipset from Texas Instruments is the first to combine a TI DSP-based GSM/GPRS baseband and high-level applications processing and operating system (OS) support in a single device. The high level of integration in the TCS2500 chipset will bring major system cost advantages and significant form factor reductions. The chipset, which is based on TI’s industry-leading OMAP™ platform for wireless devices, has been architectured to help designers achieve the lowest possible system cost and smallest system size for smartphone and wireless PDA platforms. 2.5G wireless products based on the TCS2500 chipset can achieve 30-50 percent size reductions and 20-40 percent weight reductions over current smartphone and wireless PDA solutions, while maintaining low power performance similar to today’s voice-centric 2G wireless phones.

And, the TCS2500 chipset enables a new generation of feature-rich smartphones and multimedia handsets by supporting real-time Internet connectivity, e-mail, interactive games and high fidelity audio—while still providing

**Key Benefits**

- Highly integrated three-chip solution for smartphones and wireless PDAs
  - Lowest system cost
  - Smallest system size
- First to combine on a single chip:
  - TI DSP-based GSM/GPRS baseband and application processor
  - High-level operating system support
- Enables wireless Internet, audio, video and gaming
- Enables 30-50 percent size reduction over current 2.5G systems
- Open platform supports advanced operating systems:
  - Microsoft® Windows® CE
  - Palm OS®
  - Symbian OS™
  - Linux®
- Full backwards code compatibility with other TI wireless processors
- Complete reference design
the long battery life, extended talk-time and small form factors of today's 2G voice-centric wireless products.

Some of the capabilities the TCS2500 will cost-effectively enable in next-generation 2.5G wireless products include:

- Wireless synchronization of address and appointment book between smartphone and PC
- Download and play short video clips, such as movie trailers, over wireless PDAs or smartphones
- Send and receive e-mail, with full wireless synchronization between PC and wireless smartphone
- Play wireless, multi-user interactive games
- Utilize location-based services such as mapping and traffic updates

The TCS2500 Chipset

The TCS2500 chipset is composed of three chips: including the OMAP710 integrated digital baseband application processor, the TWL3012 integrated analog baseband and power management device and the TRF6150 dual-band RF IC.

The OMAP710 Processor

The OMAP710 smartphone and PDA processor is the heart of the TCS2500 chipset solution and breaks new ground by enabling the seamless convergence of voice telephony and wireless data. The device combines a TI-enhanced ARM925 processor with integrated MMU and cache, with a GSM/GPRS digital baseband along with a wide range of general-purpose peripherals and dedicated multimedia application peripherals. With processing support for MPEG-4, MP3, JPEG and speech technologies like speech recognition, the OMAP710 device combines the industry's most highly integrated wireless processing platform with best-in-class power and performance.

Open Platform and Software Developer Network -

The OMAP710 device provides a flexible open hardware and software platform for quickly introducing next-generation wireless PDAs and smart phones. The processor supports advanced operating systems, such as Microsoft® Windows® CE, Palm OS®, Symbian OS™ and Linux®. TI provides optimized ports for these OSs, which include complete sets of drivers. In addition, the OMAP710 device provides optimized support for Java™ applications.

OEMs and software developers also have access to an entire palette of development companies and technologies, including members of TI's OMAP Developer Network, Independent OMAP Technology Centers, ARM third parties and OS developers. TI supports the TCS2500 with its OMAP Developer Network, which is designed to assist software developers interested in creating differentiated wireless applications for the broadest possible market opportunity. Additionally, OEs and developers have the ability to enhance applications by easily integrating a library of OMAP application developers and hardware peripherals to add multimedia, speech recognition, security and gaming functionality by calling a single application programming interface (API).

OMAP application areas include:

- Audio: streaming audio, ring tones, broadcast players
- Location-based services: GPS, network assisted solutions
- M-commerce: digital wallets
- Games: 2D, 3D
- Productivity (PIMS): database management, spreadsheet
- Speech: Internet navigation via speech, commands and feedback via speech; dictated SMS messages
- Security: biometrics, user authentication
- Video: streaming video, broadcast, players

By leveraging this network of developers and advanced software solutions, handset and PDA manufacturers can quickly design and produce feature-rich products with complete application suites.

Full backwards compatibility –

As part of the open OMAP platform for wireless application development, the OMAP710 device is part of TI's growing continuum of code-compatible wireless baseband processors. Designed to enable the fast development of mass-market smartphone and wireless PDAs, the device provides code compatibility with TI's OMAP1510 processor. The OMAP1510...
application processor is designed to power high-end wireless products and the dual-core TI-DSP and ARM architecture enables advanced product features such as full video encode and decode, telephony, streaming multimedia and 3D games with lowest power consumption. Full backward code compatibility among OMAP processors gives both OEMs and software developers major time-to-market and cost advantages. Developers currently building products based on the OMAP710 device can quickly and easily port the same code to the OMAP1510 device, and for OEMs, code compatibility allows significant cost savings through efficient reuse of engineering resources.

OMAP710 TI-enhanced Processor Features –
The OMAP710 is a feature-rich device that allows developers to customize products based on customer needs. The ARM925 core is an industry-leading RISC processor operating at 132 MHz (maximum frequency). The core provides support for the command and control functions, user interface and high-interrupt, computer-like applications. The ARM925 microprocessor core includes a memory management unit (MMU) for virtual-to-physical memory translation and task-to-task memory protection as well as 16-KB instruction cache, an 8-KB data cache and a 17-word write buffer. In addition, the core features 192-KB of internal SRAM, providing a large memory space for on-chip data storage, such as frame buffer memory.

This integrated ARM925 application processor guarantees seamless communication with the on-chip GPRS modem, and enables multimedia capabilities without the cost of an external processor. This ensures dedicated performance for open high-level operating systems and support for differentiated applications.

A broad range of software for the applications processor is available through TI’s OMAP Developer Network to support popular applications, including audio, video, m-commerce, gaming and security.

An integrated frame buffer and LCD controller on the OMAP710 device allow a direct connection to a color LCD panel, reducing system component count and power consumption. The frame buffer can be allocated in the external SDRAM or internal SRAM. A dedicated channel on the ARM DMA unit is used to transfer data from the frame buffer to the LCD controller. The LCD controller can support 2/4/8/16 bits per pixel and a 240 x 360 display, internally and 640 x 480 and beyond displays using external SDRAM.

The OMAP710 device acts as a USB client, allowing 12-Mbps data transfer between the OMAP710 device and a USB host controller, such as a PC, for fast synchronization of critical data. The USB client controller supports the USB 1.1 standard with Tier 4 compliance.

A multimedia card (MMC/SD) interface on the OMAP710 device allows for removable storage of multimedia data such as MP3 or WMA audio files, mapping data and personal information manager data like contact lists and agendas.

The OMAP710 device combines the applications processing engine with a fully integrated GSM/GPRS modem. The GSM/GPRS digital baseband includes a complete Class 8 GPRS protocol stack to support communications on 2.5G wireless networks.

Analog and RF Devices
“Antenna-to-Applications” Solution

TWL3012 Analog Baseband
The TWL3012 is a highly integrated analog baseband that utilizes TI’s industry-leading mixed-signal and analog baseband technology.

TWL3012 Features and Benefits:
• Voiceband codecs
• Baseband codecs single and multi-slot with I/Q RF interface
• Auxiliary RF converters
• 3-V, 5-V SIM Card interface
• Low-dropout voltage regulators
• Li-Ion or NiMH charging control
• Voltage detectors (with power-off delay)
• 10 mm x 10 mm, 100-ball

![TI's Complete Portfolio of Wireless Chipsets](image)
MicroStar™ BGA, 0.8-mm pitch

TRF6150 RF IC

The TRF6150 is a highly integrated RF IC based on a direct conversion architecture. Utilizing this advanced technology, the device offers bill of materials (BOM) reductions of about 30 percent versus super heterodyne architectures.

TRF6150 Features and Benefits:
- Single-chip dual-band/tri-band transceiver
- Direct-conversion receiver with front-end filters only
- Low BOM cost: 30 percent reduction versus super-heterodyne architecture
- GPRS class 12-compliant
- Single external VCO solution
- N-fractional synthesizer
- PA control loop
- On-chip voltage regulators
- Frequency plan compatible with Bluetooth™ and GPS
- RF BiCMOS 2 process
- 64-pin TQFP Package

Complete Smartphone Reference Design

For the ultimate time-to-market advantage, TI provides a complete reference design based upon the OMAP710 processor that can reduce development time by more than half a year. The reference design is a complete wireless smart phone handset that is ready to be manufactured and put into final plastics.

The reference design includes:
- Full type-approval
- Complete BOM
- Support for leading mobile operating systems (OS), including Windows CE, Palm OS, Symbian OS, Linux and Java, as well as the powerful software development tools for these platforms
- A complete GSM/GPRS Layer 1, 2 and 3 protocol stack
- Access to optimized builds of Windows CE, Symbian OS and Palm OS
- Complete application software suite including MMI
- Board design and layout
- Best-in-class and worldwide customer support structure with locations in Europe, USA, China and Taiwan to assist from design start to full-scale production

Development Tools

TI’s wireless chipset products mean total solutions, including all the complementary hardware and software development tools required to take products from concept to production. And since TI provides a complete range of software and hardware technology, customers are assured of a single resource for assistance in optimizing their application. Designers can choose from a full line of software development tools, including C compilers, assemblers, linkers, simulators, emulators and high-level language debuggers.

TI supports the TCS2500 with the Code Composer Studio™ Integrated Development Environment (IDE) for the OMAP platform, a component of TI’s award-winning eXpressDSP™ Real-Time Software Technology. Code Composer Studio is a fully integrated development environment that improves time-to-market and covers all phases of development, from editing and building to debugging, code profiling and project management. Code Composer Studio IDE for the OMAP platform includes a full compiler, simulator and debugger for the OMAP710 device.

For more information

The OMAP710 device and the TCS2500 chipset build on TI’s seven-year history of providing complete and leading-edge GSM/GPRS chipsets, providing handset designers with a powerful and highly integrated wireless smartphone platform.

To learn more contact your local TI field sales office or visit: www.ti.com/tcs2500