Diverse Technologies for the Global Wireless Marketplace

Serving every corner of today’s global wireless industry requires vast experience and expertise, innovative research and development, advanced chip processing technologies, a network of like-minded technology partners and much more. For nearly 20 years, TI has delivered technology for each generation of the wireless industry. Today, TI has a diverse portfolio of technologies for every region and every market segment. TI provides industry-leading solutions for cost-sensitive emerging markets like China and India, as well as established markets, where mobile entertainment, productivity tools and other types of functionality are converging on mobile devices. TI’s portfolio is comprised of a comprehensive selection of wireless chipsets, low-power baseband, modem and application processors, digital RF technology, power management, security, high-performance analog, functionality like single-chip Bluetooth®, Wireless LAN (WLAN) and GPS, and much more. TI gives mobile device manufacturers the flexibility and capability they need to deliver the next billion phones.
The astounding diversity of the wireless industry will increase during the years ahead as more technologies, applications and capabilities converge on mobile devices. Emerging markets around the world are driving new subscriber growth as wireless communications becomes available. The requirements of these regions place a premium on cost-effective silicon process technologies, manufacturing and packaging innovations, breakthrough integration techniques, system design expertise, software re-use and other factors that deliver compelling value in handsets that are economically accessible to a broad cross section of consumers.

TI is the leading supplier to the wireless industry with solutions as diverse as the industry itself.

From the comprehensive TCS family of wireless chipsets to OMAP™ applications processors, sophisticated DRP™ technology, security technology, power management, high-performance analog and much more, TI’s wireless technology can form the basis for a complete line of mobile devices serving every geographic region and every market segment. TI’s hardware and software reference designs, as well as functionality like Bluetooth® technology, WLAN and GPS solutions, USB connectivity, removable flash cards, camera controllers, stereo codecs, drivers and other solutions all simplify the development process and speed new mobile devices to market.

At a time when mobile entertainment on handsets has become critical, TI technology, including the OMAP family of processors, can meet the requirements of the most demanding applications, such as 2D and 3D video gaming, stereo FM radio, high-resolution digital photography, CD-quality music and others.

TI has the technology and expertise, as well as the advanced silicon processes to support all of your next generation of mobile devices.
TI long ago demonstrated that true breakthrough innovations often cross over the neat lines imposed by conventional solutions. Innovation knows no boundaries between product categories or end equipment market segments. Because of the breadth of its expertise and core competencies in many divergent technologies, TI has been able to develop innovations that are foundational to a broad range of technologies. These innovations stretch across product lines and defy the demarcations between markets. In the end, these innovations render a diverse spectrum of technologies and products that are more efficient and effective. Innovations like DRP™ technology, SmartReflex™ power and performance optimization techniques and M-Shield™ security capabilities are being applied across many wireless technologies in a wide variety of handsets.

**DRP™ Single-Chip Technology**

TI’s DRP technology has emerged from the demands placed on wireless handset manufacturers for higher levels of integration. Manufacturers are faced with providing greater, more compelling functionality while at the same time lowering costs, improving power efficiency and enabling smaller, lighter mobile devices.

TI has applied its digital expertise to migrate much of the RF analog content, which often accounts for as much as 30 to 40 percent of a handset, to the digital domain. By doing so, DRP technology frees up board space for added functionality. Digital technology can be much more power efficient than many analog devices, so standby and talk times can be extended. With DRP technology, handsets are able to take advantage of the efficiencies and cost-reductions inherent in each new submicron digital process node.

DRP technology has been deployed in several wireless technologies, such as TI’s single-chip cell phone platforms, “LoCosto” and “eCosto”, BlueLink™ Bluetooth® solutions, Hollywood™ mobile digital television (DTV) solution, the NaviLink™ GPS single-chip solution and the single-chip WiLink™ wireless LAN (WLAN) devices.

**SmartReflex™ Power and Performance Management Technology**

The objective of SmartReflex technology is to optimize wireless handset performance and functionality at the lowest possible level of power consumption. Achieving this goal involves intelligent and adaptive silicon IP, advanced system-on-a-chip architectural techniques and innovative software. All of these aspects of SmartReflex technology address power consumption challenges such as leakage at submicron process geometries and many others.

In the wireless industry, SmartReflex technology is having far-reaching effects on lowering power consumption without sacrificing system functionality. Millions of wireless devices have already deployed one or more aspects of SmartReflex technology. TI has produced more than 120 million devices that incorporate SmartReflex innovations. Moving forward, SmartReflex technology will leverage the momentum it has gained from its application in wireless handsets into other high-performance, power-sensitive segments.

**M-Shield™ Mobile Security Technology**

M-Shield technology is one of the industry’s most robust security solutions for mobile devices. Its hardware and software features include a complete security infrastructure with on-chip cryptographic keys, as well as a secure execution environment, protected storage mechanisms, secure chip-to-chip interconnects and other features. M-Shield technology enables a transparent security architecture with standard application programming interfaces (APIs) that ensure a streamlined deployment as well as faster development and provisioning of security applications.

M-Shield capabilities ensure end-to-end security for the mobile device itself and any sensitive personal information or high-value creative content stored on the device. For example, a public-key infrastructure that ensures end-to-end security for the mobile device itself as well as any high-value content transmitted and stored on the device. This infrastructure offers a hardware-enforced secure environment for the safe execution of sensitive applications and the secure storage of important data. For example, a public-key infrastructure with secure on-chip keys (e-fuse) gives manufacturers one-time programmable keys that are accessible only in secure mode for authentication and encryption.

M-Shield technology is the keystone security technology for all of TI’s TCS wireless chipsets and the complete line of OMAP™ processors.
TI’s DRP™ technology is a direct response to the dilemma wireless handset manufacturers confront: attract new users by delivering compelling functionality to all segments of the marketplace while at the same time fulfilling user demand for less expensive, more power-efficient, smaller and lighter mobile devices. Achieving these two seemingly opposed objectives is only possible by aggressively integrating handset electronics. DRP technology does just that by targeting the analog content of devices, which often accounts for as much as 30 to 40 percent of total board real estate.

TI’s digital radio frequency (RF) processor architecture applies digital techniques to simplify RF processing and dramatically cut the cost and power consumption of transmitting and receiving information wirelessly. The processing of radio signals with digital logic can significantly shift the paradigm for embedding wireless communications by making it easier to implement and to scale. For handset manufacturers, DRP technology delivers many benefits including:

- Lower solution cost and bill of materials
- Increased system performance
- Longer battery life - better active and stand-by times
- Smaller form factor to enable small, sleek mobile devices
- Flexibility to integrate multiple radios if the market conditions warrant
- Easier design and test for wireless designers due to turn-key, ready-to-manufacture solutions

DRP technology oversamples analog signals and processes them in the digital domain, capturing all of the benefits of digital CMOS fabrication and the astounding advancements to smaller submicron process geometries.

At each successively smaller process node, digital components achieve faster process switching speeds. With DRP technology, handset designers can take advantage of these faster switching speeds to further decrease the analog content of their designs. With higher speeds, the oversampling rate of analog input signals can be increased and this, in turn, reduces noise aliasing problems so that the design of input networks may be relaxed.

TI’s DRP architecture has been successfully integrated onto a single chip for mobile phones, as well as the WiLink™ 4.0 and WiLink 5.0 WLAN platforms and four generations of Bluetooth® products, NaviLink™ GPS solution and the Hollywood™ mobile TV solution.

Key Benefits

- Migrating RF processing from the analog to the digital domain makes possible higher levels of integration in wireless handsets
- Highly integrated single-die RF and baseband processors reduce design complexity, size, power consumption and cost while enabling greater functionality
- Takes advantage of the ongoing advances in digital CMOS fabrication to smaller submicron process nodes
- Simplifies testing procedures and increases manufacturing yields

Wireless Single-Chip Solutions

- "LoCosto" GSM/GPRS
- "LoCosto" OMAPV1035 GSM/GPRS/EDGE
- "LeCosto" TCE2305/TCE2315 GSM/GPRS
- "LoCosto ULC" TCE2305/TCE2315 GSM/GPRS
- "eCosto" eCosto Multimeda
- "eCosto MDM" WiLink™ Wi-Fi™
- Hollywood™ mobile TV solution
- WiLink™ Wi-Fi™
- NaviLink™ GPS
- BlueLink™ Bluetooth®
- "LoCosto ULC" TCE2305/TCE2315 GSM/GPRS
- More to come...
M-Shield™ Mobile Security Technology

M-Shield™ mobile security technology is a system-level solution that involves both hardware and software mechanisms for the highest level of terminal and content security in the wireless industry. Moreover, M-Shield technology sets the benchmark for the security needed for wireless financial applications and transactions. M-Shield technology is the keystone security technology for TI’s OMAP™ wireless platform and its wireless chipsets.

M-Shield technology provides an infrastructure that ensures end-to-end security for the mobile device itself as well as any high-value content transmitted and stored on the device. This infrastructure offers a hardware-enforced secure environment for the safe execution of sensitive applications and the secure storage of important data. For example, a public-key infrastructure with secure on-chip keys (e-fuse) gives manufacturers one-time programmable keys that are accessible only in secure mode for authentication and encryption.

Central to M-Shield technology is the industry’s first hardware-based secure execution environment. A one-of-a-kind secure state machine (SSM) applies and guarantees the system’s security policy rules while entering, executing and exiting from the secure environment. Eliminating the vulnerability of chip-interconnects is also critical to the overall protection of M-Shield technology. Certain peripherals and partitions of the system, such as keyboards, displays, fingerprint sensors, smartcard physical interfaces and cryptoprocessors, can be disabled to ensure that sensitive information cannot be accessed and stolen. Secure memory storage and memory access further safeguard the device and its content.

Complementing M-Shield technology’s hardware-based capabilities is a software framework that includes device drivers, security software libraries and application programming interfaces (APIs) that support a wide range of cryptographic functions. In addition, this software framework interfaces the cryptography engine to higher levels of the system, such as the operating system (OS), industry-standard security protocols and security interfaces like SSL, TLS, IPSec and Public Key Cryptography Standards. Third-party security applications are available from a wide range of TI partners.

Key Benefits

- Transparent security architecture with standard APIs ensures a streamlined deployment as well as faster development and provisioning of security-based applications
- Industry’s most robust security solution includes a complete security infrastructure with on-chip cryptographic keys, secure execution environment, secure storage, secure chip-interconnects and other features
- Compelling user experience through high-performance hardware-based cryptographic accelerators that eliminate latencies and deliver rapid system-level response
- Tampering detection triggers effective protective actions
- Low power consumption maintains extended battery life
- Flexible security software solution includes device drivers, security software libraries and APIs to support third-party middleware software and applications

Complementing M-Shield technology’s hardware-based capabilities is a software framework that includes device drivers, security software libraries and application programming interfaces (APIs) that support a wide range of cryptographic functions. In addition, this software framework interfaces the cryptography engine to higher levels of the system, such as the operating system (OS), industry-standard security protocols and security interfaces like SSL, TLS, IPSec and Public Key Cryptography Standards. Third-party security applications are available from a wide range of TI partners.
SmartReflex™ Power and Performance Management Technology

SmartReflex™ technology is a holistic approach to power reduction without sacrificing performance. More so than the piecemeal power reduction techniques of the past, the rich, product-proven portfolio of SmartReflex technologies takes a comprehensive system-wide perspective on the interrelated issues of power and performance in mobile devices and offers a pathway to future solutions.

SmartReflex technology has three facets: silicon intellectual property (IP); techniques that can be applied at the system-on-a-chip (SoC) architectural design level; and system software that manages many of the hardware-enabled SmartReflex technologies which seamlessly interfaces to other power management techniques based in operating systems (OS) or third-party software subsystems.

SmartReflex technologies are leveraged by TI for industry-leading power and performance management in custom and standard devices.

SmartReflex Silicon IP

TI has developed a significant number of sophisticated power reduction solutions at the chip level, many of which have transitioned into SmartReflex technology. One emerging power challenge relevant to wireless handsets is static leakage power. Leakage becomes a significantly greater part of a device’s total power consumption at the smaller submicron fabrication process nodes, such as 90 nanometer (nm) and 65 nm. Several SmartReflex technologies can be applied to drastically limit leakage from a device. Many of TI’s wireless components already implement SmartReflex technology to reduce leakage power.

SmartReflex technology also includes a library of power management cells to facilitate a granular approach to partitioning a device’s power domains. These cells can be used to architect multiple power domains so the device’s functional blocks can be independently powered down or put into a standby power mode, significantly reducing power.

SmartReflex SoC Architectural and Design Technologies

Beyond established power reduction techniques such as low power modes and clock gating, SmartReflex technology includes innovative techniques at the architectural level of SoC design that reduce both dynamic and static power consumption. For example, adaptive voltage scaling (AVS), dynamic voltage and frequency scaling (DVFS), dynamic power switching (DPS) and standby leakage management (SLM) are innovative technologies in the SmartReflex portfolio.

Key Benefits

- Optimized performance with lowest possible power consumption
- Lower power with high performance enables smaller, sleeker mobile devices with less heat dissipation
- Lengthens standby time, talk time and battery life without sacrificing performance
- Drastically limits chip-level power leakage that is exacerbated as process geometries shrink

SmartReflex System Software

The SmartReflex portfolio includes intelligent software that controls lower-level hardware technologies to optimize power consumption and performance. For example, workload predictor, resource manager and device driver power management software are a few of the system-level capabilities of SmartReflex technology. Additionally, SmartReflex technology features DSP/BIOS™ power management software for DSP resources.

SmartReflex technology crosses over traditional boundary lines to support power reduction across multiple cores, hardware accelerators, functional blocks, peripherals and other system components. And system-level SmartReflex technology is open to OS-based and third-party power management software developing a collaborative and cooperative environment with regards to power and performance.

SmartReflex Technology’s Pathway to the Future

More than 250 billion components with SmartReflex technology have been shipped by TI.

The roadmap for SmartReflex technology stretches far into the future, penetrating deeper into mobile devices and leveraging the application of SmartReflex technology into other high-performance, power-sensitive industry segments.
TI’s family of TCS and OMAP-Vox™ solutions give mobile device manufacturers complete, scalable platforms that meet the requirements of all leading market segments and standards, including GSM, GPRS, EDGE and WCDMA. TI’s solutions provide the necessary elements to bring differentiated mobile devices to market fast, including a broad range of hardware, software, reference designs, development tools and support. Digital and analog baseband processors, applications processors capable of real-time multimedia processing, power management ICs, RF transceivers and more are also part of TI’s broad range of TCS Chipset offerings.

**Highly integrated TCS chipsets give manufacturers:**
- Real-time multimedia processing
- High-performance processing
- Low power consumption
- Small form factors

From traditional, cost-sensitive voice-centric handsets to high-end multimedia-rich smartphones, TCS chipsets support leading mobile operating systems (OSs). Standards-compliant protocol stacks,
TI’s Family of Single-Chip Handset Solutions
TI’s integration capabilities are shown in its unique “LoCosto” and “eCosto” platforms, the industry’s first architectures to provide single-chip solutions for low- to mid-range wireless handsets. Using TI’s advanced DRP™ technology, “LoCosto” and “eCosto” solutions combine radio and baseband processing into one highly integrated device. The result is a lower BOM and savings in board space, power consumption and system cost. Utilizing “LoCosto” and “eCosto” technology, wireless handsets can be designed in sleeker form factors and at costs affordable to new markets.

OMAP-Vox™ Solutions: Offering Scalable and Flexible Roadmaps
OMAP-Vox™ integrated solutions merge both modem and applications functionality onto the existing OMAP architecture. These solutions share a common software platform that can be re-used for a variety of growing market requirements, thus saving manufacturers years of software design effort and reducing overall development costs. TI’s OMAP-Vox modem technology is optimized to efficiently run a dynamic mixture of applications and baseband communications on the same hardware. The scalable OMAP-Vox hardware architecture has enough performance to run modem and applications on the same processing core sharing hardware resources and is designed to easily extend from 2.5G to 3G and beyond. And to meet the stringent security requirements set by mobile operators, manufacturers, content providers and financial services, TI’s OMAP-Vox solutions include embedded security technology, a set of hardware accelerators including terminal security, financial transaction security and content security, without the latencies and risks associated with software-only solutions.

Incorporating OMAP™ applications processors within many TCS chipset solutions allows TI to deliver the most highly integrated modems, baseband and dedicated smartphone solutions available.

TI’s TCS chipsets offer advanced real-time and general purpose processing for the most advanced applications, including streaming media, graphics, high-end stereo, polyphonic audio, interactive 3D gaming and entertainment, speech processing, location-based services and more. The advanced integration of TI’s TCS chipsets reduces part count and size, delivering a low bill of materials (BOM) and continuing TI’s industry-leading track record of the lowest power consumption and longest battery life.

More recent generations of TCS chipsets address the growing importance of security, providing a comprehensive set of hardware-based security features, software libraries and services that allow manufacturers to add enhanced protection. TI’s built-in M-Shield™ security technology enables phone manufacturers and mobile operators to support value-added services including:

- Content protection
- Transaction security
- Secure network access
- Terminal security functions
- Flashing and booting
- Terminal identity protection
- Network lock protection

Value-added software and services are available as part of TCS chipsets and reference designs. The application software suite enables an easy-to-use PC-based software development environment, optimized JAVA™ Sun KVM, MIDI, MP3, WAP2.0 stack and browser, EMS and MMS KVM messaging clients, Bluetooth® wireless technology and more. TI’s OMAP Developer Network and Independent OMAP Technology Centers (OTC) serve as additional resources for quickly deploying compelling 2G/2.5G and 3G devices.
TCS2010 Chipset

Designed for low power, TI’s TCS2010 chipset offers a full Class 12 GSM/GPRS platform with applications processing abilities. The solution combines a dual-core digital baseband processor based on TI’s low power TMS320C54x™ DSP and ARM® general-purpose processing cores, along with an analog baseband that uses power-down sleep modes to reduce power consumption and increase standby time of mobile devices.

**TCS2010 components include:**
- TBB2010 dual core digital baseband processor
- TWL3014 analog baseband with sleep modes for reduced power consumption
- TRF6151 direct conversion, quad-band RF transceiver

When additional application processing is required, the TCS2010 is optimized to interface with TI OMAP™ applications processors. The combination of the TCS2010 and an OMAP processor delivers the processing performance needed for advanced multimedia applications.

**Key Benefits**
- Complete GSM/GPRS handset reference design
- Dual-core digital baseband with TI proven GSM/GPRS modem architecture
- Reduced BOM costs for high-volume low-cost handsets
- Low power consumption with twice the standby time of previous generation
- Pin compatibility with TBB2100 GSM/GPRS modem
- Integrated quad-band, direct conversion, single-chip RF transceiver
- Software compatible with TCS2200 and TCS2110 GSM/GPRS chipsets
- Class 12 GPRS support
- Adaptive MultiRate Narrow Band (AMR-NB) vocoders
- Integrated EOTD location determination
- Optimized interface to OMAP™ applications processors
- Full range of software applications through TCS wireless software suite
**TBB2010 Digital Baseband**

Based on TI’s leading TMS320C54x™ DSP for wireless-centric applications, the TBB2010 is extremely efficient. The baseband’s on-chip memory and fast, four-channel DMA controller allow for quick data transfers. Page mode with external memory access also facilitates data movement.

**Key Features**
- Dual-core architecture combining TI’s C54x™ DSP and an ARM7TDMI® core
- On-chip memory
- Four-channel DMA controller
- Page mode for external memory access

**TWL3014 Analog Baseband**

The TWL3014 analog baseband integrates all the power management and analog functions on a single chip, reducing board space requirements, chip count and development costs. The device includes voiceband and baseband codecs and features programmable low-dropout voltage regulators.

**Key Features**
- Single-chip solution integrates power management functions
- Voice band codecs
- Single/Multi-slot baseband codecs
- I/O RF interface and GMSK modulator in UL path
- LDO voltage regulators with programmable voltage
- Battery charger interface; control of either 1-cell Li-ion or 3-series Ni-MH/Ni-CD cell batteries
- 1.8-V or 3-V automatic frequency control/power Control SIM interface
- 1.8-V or 3.3-V external memory
- Headset audio interface, LED drivers
- 10 mm x 10 mm MicroStar BGA™ package

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**TRF6151 RF Transceiver**

The TRF6151 is a single-chip transceiver with quad-band support based on a direct conversion (DC) architecture. This device integrates several external components to reduce complexity, part count and cost of the RF subsystem, including vocoders and vocoder tanks. By integrating what was previously several external filtering devices, the DC architecture of the TRF6151 reduces a manufacturer’s BOM by approximately 30 percent from RF devices with the super heterodyne architecture.

**Key Features**
- Single-chip transceiver with quad-band support
- Direct conversion architecture
- GPRS Class12/CS4 compliant
- Full integration of VCO and VCO tanks
- Integrated voltage regulators, PA control loop, PLL loop filters and VCXO
- N-fractional synthesizer
- 7 mm x 7 mm QFP package
TCS2110 Chipset

The TCS2110 chipset and complete reference design support Class 12 GPRS and offer software compatibility with TI's TCS2010 and TCS2200 GSM/GPRS chipset solutions. It provides MIPS processing headroom for manufacturers to add features and applications, and also incorporates a power-split technique for delivering low power consumption.

**TCS2110 components include:**
- TBB2110 digital baseband combines TMS320C54x™ DSP with ARM7TDMI® processor
- TWL3014 analog baseband with power-split technique for low power consumption
- TRF6151 single-chip, quad-band RF transceiver with dual-conversion architecture

A complete set of communication software is provided as part of the TCS2110 solution, along with a comprehensive TCS wireless software suite that provides a range of embedded applications including WAP2.0 stack and browser, EMS and MMS messaging clients, Bluetooth® protocol stack and profiles.

**Key Benefits**

- Complete hardware and software solution for GPRS handset
- Class 12 GPRS with headroom for additional applications and features
- Reduced BOM cost through high integration levels
- Software compatible with TCS2200 and TCS2010 GSM/GPRS chipsets
- Integrated EOTD location determination
- Optimized interface to OMAP™ applications processors for multimedia applications
- Easy-to-use software development environment for embedded applications
**TBB2110 Digital Baseband**

The TBB2110 is a dual-core, high-performance digital baseband that includes a powerful shared-memory architecture. It combines TI's low-power TMS320C54x™ DSP with an ARM7TDMI® RISC processor to support multi-slot GPRS Class 12 with the corresponding data throughput and extra processing headroom for manufacturers to deliver their own value through added applications and features.

**Key Features**
- TMS320C54x DSP with Data/Program memory on-chip
- ARM7TDMIE™ running internal SRAM
- 130-nm CMOS technology
- 3.3-V I/Os, 1.8-V cores
- Memory protection unit
- DMA controller
- Real Time Clock (RTC)
- GSM ultra-low-power device (ULPD)
- HW accelerator for GPRS encryption
- Die-ID cell
- Two UARTS, one supporting IRDA control
- SIM interface (3.3-V and 1.8-V compliant)
- 12 mm x 12 mm MicroStar BGA™ package

**TWL3014 Analog Baseband**

The TWL3014 analog baseband integrates all the power management and analog functions on a single chip, reducing board space requirements, chip count and development costs. The device includes voiceband and baseband codecs and features programmable low-dropout voltage regulators.

**Key Features**
- Single-chip solution integrates power management functions
- Voice band codecs
- Single/Multi-slot baseband codecs
- I/Q RF interface and GMSK modulator in UL path
- LDO voltage regulators with programmable voltage
- Battery charger interface; control of either single-cell Li-Ion or 3-series Ni-MH/Ni-CD cell batteries
- 1.8-V or 3-V automatic frequency control/power Control SIM interface
- 1.8-V or 3.3-V external memory
- Headset audio interface, LED drivers
- 10 mm x 10 mm MicroStar BGA™ package

**TRF6151 RF Transceiver**

The TRF6151 delivers GSM/GPRS reception as part of the TCS2110 chipset. It is a single-chip transceiver with quad-band support based on a direct conversion (DC) architecture. This device brings together several external components to reduce complexity, part count and cost of the RF subsystem, including vocoders and vocoder tanks. By integrating what was previously several external filtering devices, the DC architecture of the TRF6151 reduces a manufacturer’s BOM by approximately 30 percent from RF devices with the super heterodyne architecture.

**Key Features**
- Single-chip transceiver with quad-band support
- Direct conversion architecture
- GPRS Class 12/CS4 compliant
- Full integration of VCO and VCO tanks
- Integrated voltage regulators, PA control loop, PLL loop filters and VCXO
- N-fractional synthesizer
- 7 mm x 7 mm QFP package
**TCS2200 Chipset**

Targeted at multimedia Java™ handsets, TI's TCS2200 chipset solution and reference design deliver the enhanced performance and low power consumption required for processing-intense multimedia applications.

**TCS2200 components include:**
- TBB2200 digital baseband with integrated TI DSP and ARM® cores
- TWL3016 analog baseband with integrated power management
- TRF6151 quad-band RF transceiver

Storage and fast data movement facilities are gained through the TCS2200's extended memory resources and fast direct memory access (DMA) controller. The solution is software compatible with the TCS2110 and TCS210, includes a L1/L2/L3 GSM/GPRS protocol stack and a full peripheral set with USB, MMC, Memory Stick®, Bluetooth® wireless technology and others. The fully type-approved TCS2200 reference design includes a full BOM, detailed board design with schematics and layout. A complete set of development tools allows manufacturers to easily differentiate capabilities.

**Key Benefits**

- Integrated applications processor and digital baseband leverage proven dual-core modem architecture
- Enhanced application processing with color display, music and security
- Low system power consumption through split power-down techniques
- Security protection through hardware features and third-party security library
- Fast data movement and extended memory resourced with DMA
- Page-mode interface for external memory
- Location determination through integrated EOTD
- Full peripheral set including USB, MMC, Memory Stick®, Bluetooth® wireless technology and others

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**Wireless Terminals Solutions Guide**

Texas Instruments 2007
**TBB2200 Digital Baseband**

The TBB2200 provides the connectivity and capabilities required for the latest multimedia applications. It features TI's proven digital baseband architecture, integrating TI's leading, low power TMS320C54x™ DSP and the ARM7TDMI® core. The TBB2200 runs a complete Class 12 modem and includes a TCS wireless software suite.

**Key Features**
- Dual core architecture including C54x™ DSP and ARM7TDMI core
- ARM® processor with DMA and page-mode access
- Complete Class 12 modem
- Full suite of Java™ and embedded multimedia applications
- USB client port
- Parallel port for color LCDs
- Interfaces for Smart Card, Bluetooth® wireless technology
- 12 mm x 12 mm MicroStar BGA™ package
- 130-nm CMOS technology

**TWL3016 Analog Baseband**

The TWL3016 analog baseband integrates all analog and power management functionality on a single chip. Through power-down sleep modes, the TWL3016 extends system standby time significantly, contributing to the overall battery savings the TCS2200 provides. The device also includes a D/A converter for applications like MP3 music, and an 8-Ω amplifier for hands-free speaker phone operation.

**Key Features**
- Integrated high-fidelity audio DAC
- Integrated hands-free and headphone amplifiers
- Overall clock input reduction of 50 percent
- 10 mm x 10 mm MicroStar BGA™ package

**TRF6151 RF Transceiver**

Specifically designed for GSM/GPRS reception as part of the TCS2200 chipset, the TRF6151 transceiver is a single-chip transceiver with quad-band support based on a direct conversion (DC) architecture. This device integrates several external components to reduce complexity, part count and cost of the RF subsystem. By integrating what was previously several external filtering devices, the DC architecture of the TRF6151 reduces a manufacturer's BOM by approximately 30 percent from RF devices with the super heterodyne architecture.

**Key Features**
- Single-chip transceiver with quad-band support
- Direct conversion architecture
- GPRS Class 12/CS4 compliant
- Full integration of VCO and VCO tanks
- Integrated voltage regulators, PA control loop, PLL loop filters and VCXO
- N-fractional synthesizer
- 7 mm x 7 mm QFP package
### TCS2300 “LoCosto” Single-Chip Handset Solution

TI’s unique TCS2300 “LoCosto” solution is the industry’s first architecture to provide single-chip solutions for ultra low-cost to entry-level wireless handsets. Using TI’s advanced DRP™ technology and 90-nm process technology, the TCS2300 solution combines radio and all baseband processing into one highly integrated solution, reducing component count, board space, power consumption and system cost. With the TCS2300 solution, wireless handsets can be made as compact as match boxes and inexpensively enough to open new markets around the world.

The TCS2300 solution combines an ARM7™ general-purpose RISC processor core with a TMS320C54x™ DSP core, both operating at 104 MHz, for high performance with low power consumption. An improved memory interface with DMA supports a variety of external memory types efficiently. Reference designs are available for the solutions and come with extensive software support for codecs, testing and other standards to help simplify design.

The TCS2300 solution supports standard voice codecs in dual-band phones. Support for both color and monochrome displays, MIDI 16 polyphonic ringtones, system security and highly optimized memory footprint offering provides the normal complement of features demanded in basic phones.

The TCS2300 solution offers a scalable platform enabling cost-effective development of handsets ranging from ultra low-cost GSM handsets with a black-and-white display to a slightly more expensive device including a color display and FM radio. These sub-$40 handsets lower the threshold for mass market adoption especially in emerging markets where the next billion subscribers will come from.

TI’s TCS2300 “LoCosto” solution is currently in volume production.
### TCS2310 “LoCosto” Single-Chip Handset Solution

Integrating TI’s groundbreaking DRP™ technology and advanced 90-nm process technology, the TCS2310 “LoCosto” solution successfully incorporates functions that previously have not been combined in a single device. With the RF section included in the device, designs save space and components while requiring less interconnect for greater reliability. The digitization of what was formerly analog functionality improves testability, enables built-in calibration, reduces drift effects and allows for auto-compensation for process and temperature variances. All of these advantages add to the cost savings and the potential to create phones in new sleeker form factors.

The TCS2310 solution adds support for MP3/AAC ringers and players, camera and video, MIDI 32 polyphonic ringtones, Bluetooth®, non-removable and removable mass storage media, additional external program and data memory, peripheral interfaces and a complete set of functionality required for entry-level handsets.

The scalable TCS2310 solution enables cost-effective development of differentiated handsets addressing multiple market segments, from low-cost GPRS handsets with a black-and-white screen to entry-level GPRS devices featuring a basic VGA camera and MP3 player, to high-end GPRS devices with features including 1-megapixel camera, video, and advanced connectivity such as Bluetooth, WLAN or GPS.

TI’s TCS2310 “LoCosto” solution is currently in volume production.

### Key Benefits
- GPRS Class 10
- SAIC and TTY support
- WAP/SMS/EMS/MMS
- Dual-color displays
- MP3/AAC player and ringers
- MIDI 32 polyphonics player and ringer
- Integrated camera support up to 1 megapixel
- Video MPEG-4/H.263 support up to QCIF15 fps
- TI Bluetooth® protocol stack and profiles include stereo headset and A2DP
- Advanced connectivity support including WLAN and GPS
- Hardware security (Flash content protection, ME personalization, IMEI protection) OMTP1.0 compliant
- Non-removable and removable mass storage interface

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**TCS2310 “LoCosto” Solution**

- **Power Management**
- **Audio Codec**
- **USB Transceiver**
- **Vibrator**
- **White LED Boost**
- **MADC**
- **PCI**
- **RTC**
- **ULPD**
- **ARM7DMIE**
- **DMA**
- **CDSP Subchip**
- **EMIF**
- **Nand Flash Interface**
- **USB**
- **VSP**
- **IrDA**
- **NAND FLASH**
- **RAM**
- **NOR FLASH**
- **Bluetooth™ Companion**
- **Sim Card**
- **Front-end + PA**
- **26 MHz**
- **Short MMC/SD-FLASH**
- **Secondary LCD**
- **Camera**
- **Keyboard**
- **LCD**
- **PS**
- **VSP**
- **USB**
- **Mics**
- **UART**
- **DRP™**
- **MCSI**
- **SPI**
- **DS MMC/T-FLASH**
- **Secondary LCD**

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**Wireless Terminals Solutions Guide**

**GPRS**

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**TCS Chipset and OMAP-Vox™ Solutions**
TCS2305 GSM “LoCosto ULC” and TCS2315 GPRS “LoCosto ULC” Chipsets

The TCS2305 (GSM) and TCS2315 (GPRS) are part of TI’s “LoCosto ULC” family of single-chip third-generation Ultra Low-Cost (ULC) solutions which have set a new standard for features and a compelling user experience in the ULC handset segment. By combining advanced 65-nm process technology, a TMS320C54x™ DSP with a powerful ARM7™ core, and integrating TI’s market-leading DRP™ technology, “LoCosto ULC” handsets with high performance, robust functionality and innovative form factors are possible in the most price-sensitive handsets.

The TCS2305 and TCS215 “LoCosto ULC” solutions are optimized for emerging regions such as India, China, Brazil and Russia. In addition to enabling lowest cost color phones, these highly flexible and scalable solutions also address value-conscious segments in more mature markets.

The “LoCosto ULC” solutions extend the established performance of TI’s successful “LoCosto” family of single-chip wireless handset solutions. The software portability from one generation of “LoCosto” solution to the next gives manufacturers and operators the ability to rapidly and cost-effectively differentiate products and service offerings for both emerging and mature markets, crossing over every language, region and subscriber type.

Key Benefits

TCS2305 GSM Solution:
- Leverages 65-nm process with advanced DSP and ARM® technologies
- Integrated DRP™ technology, single-chip solution
- Delivers a compelling next-generation user experience in ULC handsets
  - Lowest cost color handset with no additional external SRAM memory (128 x 160, 65-k color displays)
  - Fast CPU processing for smooth user interface processing
  - CD-quality (44.1 kHz) MP3 ringers and polyphonic ringers
  - High-end full-duplex voice quality
  - FM connectivity with integrated stereo support
  - Record FM for on-the-fly ringers
- Optimized system design reduces component count and PCB board size relative to previous generation
  - Over 25 percent reduction in eBOM
  - Lower overall component count by some 40 percent
  - Smaller modem by as much as 35 percent reduces PCB board size
- USB charging for universal and easy charger access
- Lower power consumption for longer talk (30%) and standby (60%) times
- Innovative handset form factors and larger batteries enabled by smaller PCB requirements
The Richest Feature Set for ULC Handsets

The TCS2305 and TCS2315 solutions have the powerful processing capabilities required for a ULC feature set far richer than previously possible.

Enhanced capabilities now possible in ULC handsets include a relatively high-resolution color display without additional external SRAM, high-end full-duplex voice quality, near CD-quality MP3 and polyphonic ringer, longer talk time and standby time, stereo FM radio connectivity, VGA camera support, MP3 playback and mass storage (SD/MMC) support, USB connectivity and charging, handsfree speakerphone operation, vibration ringer, headset support, Bluetooth® connectivity and other functionality.

Sustainable Low Cost Structure

Several chip- and system-level factors contribute to the sustainable low cost structure of “LoCosto ULC” solutions. Starting with 65-nm process technology, additional cost-optimization techniques include an approximate 25 percent reduction in a ULC handset’s electronic eBOM, reduced PCB area caused by smaller chips and greater silicon integration, and a cost-optimized PCB technology. Integration of power management with the digital baseband into a single chip also yields reduction in the modem PCB area.

With the RF section included in one device, space requirements and component counts are reduced. Reduced chip count, smaller PCBs, increased integration and advanced packaging enable handsets in innovative and fashionable form factors. A smaller PCB means that the size of the handset’s battery can be increased, giving the device a longer battery life with extended standby and talk times.

Even low-cost handsets are afforded the protection of TI’s scalable and hardware-based M-Shield™ security technology. The M-Shield capabilities of the “LoCosto ULC” solutions safeguard the handset owner’s sensitive personal information and defeat attempts to unlock the handset’s SIMlock code.
TCS2600/TCS2630 Chipsets

The TCS2600 and TCS2630 are complete hardware/software reference designs for high-performance multimedia smartphones, delivering twice the performance of TI’s previous generation while extending battery life. It’s reduced part count and integrated set of peripherals on-chip lower BOM costs and free up space for additional functionality.

Designed for security, the TCS2600 and TCS2630 include 48-kB secure ROM and 16-kB secure RAM with dedicated NOR/NAND flash memory and write production. A true random number generator (TRNG) aids in encryption and authentication standards. The numerous software modules and hardware features of the chipsets ensure a secure mode of operation where information stored on the device is safeguarded and ownership rights of content and programs are protected.

TCS2600 components include:
- OMAP730 with integrated Class 12 GSM/GPRS digital baseband and dedicated ARM926™ applications processor
- TWL3016 analog baseband with complete power management
- TRF6151 quad-band RF transceiver

TCS2630 components include:
- OMAP733 (OMAP730 with 256 MB stacked SDRAM)
- TWL3016 analog baseband with complete power management
- TRF6151 quad-band RF transceiver

Key Benefits

- Proven GSM/GPRS modem technology and EDGE upgradeable
- Complete reference design includes S60 Platform and Microsoft® Windows Mobile®
- Twice the performance over previous generation, including 70 percent audio performance improvement and 8X Java™ processing increase
- High-level mobile OS support
- Software compatible with OMAP™ processors and applications
- OMAP Developer Network and Independent OMAP Technology Centers support
- Highly integrated with reduced smartphone BOM and chip count
- Memory protection on FLASH and SDRAM interface
- Hardware acceleration for Java
- Complete peripherals set: USB On-the-Go, SD/MMC/SDIO, dedicated 802.11 a/b/g high-speed interface, Fast IrDA and more

See OMAP™ Processor information on page 32
OMAP730 and OMAP733 Integrated Digital Baseband and Dedicated Applications Processors

TI’s OMAP730 combines an ARM926EJ-S™ applications processing core with TI’s GSM/GPRS digital baseband modem, delivering twice the application performance of its predecessor (OMAP710), and doubling standby time for handsets and smartphones.

The OMAP733 includes the same features as the OMAP730 and adds support for 256-MB stacked SDRAM. The result is less power consumption versus traditional external memory configurations, making the OMAP733 an ideal engine for space-constrained systems or small, light mobile devices.

Over 40 on-chip integrated peripherals reduce board space by half, as compared with the previous generation, saving cost and providing space for added functionality. An SRAM frame buffer delivers faster streaming media and application performance. The OMAP73x includes a standard interface to 54-Mbps WLAN technology, along with accelerated Java™ processing, web browsing, personal information management (PIM) applications, location-based services and more. A comprehensive hardware-based security system features bootloaders, secure RAM and ROM, a secure mode of operation, and hardware accelerators to address security standards.

Key Features
- Low-voltage 130-nm technology
- 1.1-V to 1.5-V core, 1.8-V to 2.75 V I/O
- Extremely low power consumption: less than 10 µA in standby mode
- Split power supplies for application processing, digital baseband and real-time clock enable precise control over power consumption
- Optimized clocking and power management: only two clocks required at 13 MHz and 32 kHz

TWL3016 Analog Baseband

The TWL3016 analog baseband integrates all analog and power management functionality on a single chip. Through power-down sleep modes, the TWL3016 is able to extend system standby time significantly, contributing to the overall battery savings the TCS2600/TCS2630 provides. The device also includes a D/A converter for applications like MP3 music and an 8-Ω amplifier for hands-free speakerphone operation.

Key Features
- Integrated high-fidelity audio DAC
- Integrated hands-free and headphone amplifiers
- Overall TCS2600/TCS2630 clock input reduction of 50 percent

TRF6151 RF Transceiver

Specifically designed for GSM/GPRS reception as part of the TCS2600/TCS2630 chipsets, the TRF6151 transceiver is a single-chip transceiver with quad-band support based on a direct conversion (DC) architecture. This device integrates several external components to reduce complexity, part-count and cost of the RF subsystem, including vocoders and vocoder tanks. By integrating what was previously several external filtering devices, the DC architecture of the TRF6151 reduces a manufacturer’s BOM by approximately 30 percent from RF devices with the super heterodyne architecture.

Key Features
- Single-chip transceiver with quad-band support
- Direct conversion architecture
- GPRS Class12/CS4 compliant
- Full integration of VCO and VCO tanks
- Integrated voltage regulators, PA control loop, PLL loop filters and VCXO
- N-fractional synthesizer
- 7 mm x 7 mm, 48-pin QFP package
**TCS2700 Chipset**

The TCS2700 chipset solution and reference design includes a range of features that deliver improved multimedia applications performance to wireless handsets, smartphones and other Internet access devices. Based on the OMAP750 applications processor, the TCS2700 chipset’s improved throughput and faster memory options enhance the processing speed of applications including streaming video and high-end imaging.

The TCS2700 is designed for Class 12 GSM/GPRS and includes three components as part of the chipset, providing battery savings, reduced board space and lower cost.

**TCS2700 components include:**
- OMAP750 integrates a GPRS modem baseband and ARM926™ core for applications processing
- TWL3016 analog baseband with integrated power management
- TRF6151 RF transceiver based on direct conversion (DC) architecture

**Key Benefits**
- Ideal for Class 12 GSM/GPRS wireless handsets, smartphones and Internet access devices
- Leverages OMAP750 processor for enhanced performance of streaming video and high-end imaging applications
- D/A converter in analog baseband enables longer MP3 music playback and better hands-free speaker phone operation
- Extended standby time and battery savings through integrated analog baseband and power management devices
- Compatibility across all OMAP™ applications processors
- OMAP Developer Network and Independent OMAP Technology Centers support
- Complete reference design and set of peripherals
- Mobile OS support
OMAP750 Integrated Communication and Dedicated Applications Processor

The OMAP750 extends capabilities of the OMAP73x devices while including a range of features that improve multimedia application performance. The single-chip OMAP750 integrates an ARM926™ core dedicated to applications processing with a complete Class12 GSM/GPRS modem baseband subsystem that consists of an ARM7™ core with TI’s low-power TMS320C54x™ DSP core.

The OMAP750 incorporates faster memory options, including support of double data rate (DDR) memory that increases processing speed over the OMAP730, which only supported SDRAM. Improved throughput from an internal frame buffer also enhances processing of multimedia applications, including streaming video and high-end imaging functions.

Key Features
- Improved multimedia and application performance
- Class 12 GSM/GPRS modem baseband and ARM926 core for applications processing
- Increased processing speeds through DDR memory option and internal frame buffer
- Security protection through hardware-based security platform
- Extended list of peripherals, including parallel OCP camera interface for high-resolution imaging
- GPS, WLAN and Bluetooth® wireless technology
- 2.0-megapixel camera
- Pin-to-pin compatible with OMAP730

TWL3016 Analog Baseband

The TWL3016 analog baseband integrates all analog and power management functionality on a single chip. Through power-down sleep modes, the TWL3016 is able to extend system standby time significantly, contributing to the overall battery savings the TCS2700 provides. The device also includes a D/A converter for applications like MP3 music and an 8-Ω amplifier for hands-free speakerphone operation.

Key Features
- Integrated high-fidelity audio DAC
- Integrated hands-free and headphone amplifiers
- Overall TCS2700 clock input reduction of 50 percent

TRF6151 RF Transceiver

The TRF6151 delivers GSM/GPRS reception as part of the TCS2700 chipset. It is a single-chip transceiver with quad-band support based on a direct conversion (DC) architecture. This device brings together several external components to reduce complexity, part-count and cost of the RF subsystem, including vocoders and vocoder tanks. By integrating what was previously several external filtering devices, the DC architecture of the TRF6151 reduces a manufacturer’s BOM by approximately 30 percent from RF devices with the super heterodyne architecture.

Key Features
- Single-chip transceiver with quad-band support
- Direct conversion architecture
- GPRS Class12/CS4 compliant
- Full integration of VCO and VCXO tanks
- Integrated voltage regulators, PA control loop, PLL loop filters and VCXO
- N-fractional synthesizer
- 7 mm x 7 mm, 48-pin QFP package
OMAP850 Chipset

The OMAP850 EDGE chipset and complete reference design are targeted at wireless smartphones and PDAs. It serves as the ideal migration path to EDGE for manufacturers using the TCS2600 GSM/GPRS chipset.

**OMAP850 chipset components include:**
- OMAP850 applications processor with quad-band EDGE modem
- TWL3027 integrated analog baseband with full power management and audio codec
- BRF6150 Bluetooth® single chip featuring TI’s patented DRP™ technology
- Fully optimized third-party RF

The OMAP850 chipset is a flexible, scalable solution with the performance and low power required for systems addressing EDGE applications, including multimedia, gaming and camera functionality. In addition to the solution’s components, modules are also available for incorporating camera, GPS and WLAN capabilities to bring added, optional capabilities.

**Key Benefits**
- Complete pre-FTA certified, smartphone EDGE Class 12 reference design
- Data rates of 3X the throughput of GSM/GPRS devices
- Applications including MPEG-4 video and Windows Media® video, MP3, 2.0 megapixel camera, etc.
- Software compatible with TCS2600 GSM/GPRS chipset
- Modules available for camera, GPS and WLAN
- TI’s highly integrated BRF6150 Bluetooth® wireless technology based on TI’s patented DRP™ technology
- High-level mobile OS support, including Symbian OS™, S60, Microsoft® Windows Mobile® and Linux®
- OMAP™ Developer Network and Independent OMAP Technology Centers support

See OMAP™ Processor information on page 34
**OMAP850 Integrated Digital Baseband and Dedicated Applications Processor**

The OMAP850 high-performance applications processor is integrated with a digital baseband and EDGE co-processor. It is based on the OMAP750 applications processor for GSM/GPRS with added EDGE capabilities. It enables applications including MPEG-4 video and Microsoft® Windows Media® video, MP3, 2-megapixel camera and more.

**Key Features**
- Based on previous generation OMAP750 applications processor
- EDGE Class 12
- Quad vocoders for AMR, EFR, RF and HR
- Camera sensors and support for up to 2.0 megapixels
- Enhanced frame-buffer interface data rate
- DDR support addition
- Secure boot, secure mode and hardware encryption accelerators
- Complete peripheral set
- Complete reference design, hardware and software

**TWL3027 Analog Baseband**

The TWL3027 is an analog baseband device which, together with a digital baseband device is part of a TI DSP solution intended for digital cellular telephone applications including GSM 900, DCS 1800 and PCS 1900 standards (dual-band capability).

The TWL3027 includes a complete set of baseband functions to perform the interface and processing of voice signals, interface and processing of baseband in-phase (I) and quadrature (Q) signals which support single-slot and multi-slot mode for both GMSK and 8-PSK modulations. The TWL3027 also includes associated auxiliary RF control features, supply voltage regulation, battery charging controls, and switch ON/OFF system analysis.

**Key Features**
- Applications include EGPRS, GSM900 and PCS1900 DCS1800 cellular telephones
- Baseband codec single and multi-slot
- GMSK/8PSK with I/Q RF interface
- Auxiliary RF converters
- SIM card interface
- Five channel analog to digital converter
- Audio DAC based on I2S format
- Voice codec
- Six low-dropout low-noise linear voltage regulators
- Dedicated low quiescent current mode on regulators
- High voltage (20 V), Li-Ion or NiMH battery charging control
- Voltage detectors (with power-off delay)
- Dedicated very low quiescent current supply domain
- 143-ball MicroStar Junior BGA™ package

**BRF6150 Bluetooth® Solution**

TI’s BRF6150 is a highly integrated Bluetooth v1.2 single-chip solution that integrates TI’s baseband with Bluetooth® wireless technology, RF, ARM7TDMI® and power management into a single device for enhanced performance, reduced cost and reduced board space. The BRF6150 is optimized for mobile terminals where performance and space are critical. The device leverages TI’s advanced 130-nm digital CMOS process while incorporating advantages of DRP™ technology in a board layout of 50 mm².

**Key Features**
- Full Bluetooth® wireless technology specification v1.2, including eSCO, AFH and faster connection
- Direct connection to battery at 2.7 V to 5.5 V; 1.65 V to 3.6 V via LDO
- RF TX: 25 µA; RF RX: 27 µA; Deep-sleep 30 µA
- Improved RF performance with sensitivity of −85 dBm, TX Power + 7 dBm and Class 1 ready
- Blocking ~0 dBm at GSM bands
- Direct connection to battery with 8 external passives and a PCB layout area of 50 mm²
- Collaborative interface with WLAN and Bluetooth wireless technology v1.2 AFH
- Complete reference designs with TI’s TCS chipsets and OMAP™ platform
- Manufactured in TI’s 130-nm CMOS process
- Packaging: 4.5 x 4.5 x 0.8 ROM; or 4.5 x 4.5 stacked flash prototypes

**Third-Party RF Transceiver**

A third-party RF transceiver has been fully optimized to work with the other above components in the OMAP850 chipset smartphone solution.
### OMAPV1030 Integrated GSM/GPRS/EDGE Solution

The OMAPV1030 solution is one of the industry’s most highly integrated and optimized EDGE solutions, combining applications and modem on a single device to enable handset manufacturers to reduce costs and speed time to market. The baseband processor design expands on TI’s proven GSM/GPRS technology and leverages TI’s advanced high-volume, 90-nm digital CMOS process technology.

The OMAPV1030 processor is based on the OMAP™ architecture and runs both GSM/GPRS/EDGE modem and applications processing on a single OMAP core, ensuring a high-quality multimedia mobile experience. The combination of the ARM926EJ-S™ and TI DSP is used to improve performance while reducing costs and power consumption, resulting in longer battery life and usage times for consumers. Because all OMAP-Vox™ solutions share a common software platform, this solution maximizes software re-use to bring overall development costs down and provides a natural and affordable roadmap from GSM/GPRS/EDGE to WCDMA.

The OMAPV1030 solution is specifically designed to bring multimedia functionality to mass market mobile phones, and delivers advanced capabilities to mid-range wireless handsets. The OMAPV1030 solution includes best-in-class high-end multimedia performance including:

- Comprehensive audio/video codecs and imaging algorithms
- Ringtones: 64-polyphonic MIDI
- Audio: MP3, stereo, AAC, AAC+, enhanced AAC+, WMA
- Still image: Camera up to 2 megapixel with 1.3 second shot-to-shot imaging: JPEG, GIF, EXIF, PNG, BMP
- Dual LCD support (main LCD up to QVGA 256-k color)

#### Key Benefits

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated modem and applications processing on a single core</td>
<td>EDGE Class 10 support, Class 12 capable, UMA support</td>
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<tr>
<td>High-performance Java™ (including Java acceleration)</td>
<td>Ability to support HLOSs and Nucleus™ applications suites</td>
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<tr>
<td>Ability to support external memory cards including MMC/SD</td>
<td>Support for external memory cards including MMC/SD</td>
</tr>
<tr>
<td>Connectivity includes Wi-Fi®, Bluetooth®, and USB OTG</td>
<td>Embedded security via hardware accelerators supporting terminal security, transactions security, and content security</td>
</tr>
<tr>
<td>Re-use APIs for maximum re-use across OMAP-Vox family</td>
<td>Re-use APIs for maximum re-use across OMAP-Vox family improving time-to-market</td>
</tr>
<tr>
<td>Complete TI system solution offering</td>
<td>Complete TI system solution offering</td>
</tr>
</tbody>
</table>

#### Video

- Capture, playback and streaming MPEG-4/H.263 (QCIF) at 30-fps QVGA display
- H.264 (QCIF) playback at 20-fps QVGA display
- 2D and 3D gaming 60 k polygons per second, 2-megapixel rasterization, 15 fps

The OMAPV1030 solution supports all form factor requirements, including PDAs, clamshells, bar-types and other mechanical designs. TI’s open-platform architecture provides manufacturers the flexibility and choice needed to differentiate their products to emerging markets worldwide. TI’s OMAPV1030 feature phone solution has been in volume production since first quarter 2006.
OMAPV1035 “eCosto” Single-Chip Handset Solution

The OMAPV1035 solution is the first to integrate GSM/GPRS/EDGE modem, digital RF and applications processor functionality onto the same silicon. Codenamed “eCosto”, the device builds on the “LoCosto” single-chip cell phone solution and the multimedia capabilities of the OMAP-Vox™ platform.

Sharing the same platform with the OMAP-Vox family ensures software re-use for faster and more cost-effective feature phone development. Integrating the innovative RF capabilities of TI’s DRP technology with the powerful processing of the OMAP-Vox architecture yields significant cost savings. As a result, mobile device manufacturers can bring compelling multimedia applications to low- and mid-range wireless devices worldwide.

The OMAPV1035 is the first 65-nm single-chip solution to support EDGE, as well as to integrate modem, applications processor and RF into a single offering. A powerful multimedia platform, the OMAPV1035 leverages the capabilities of advanced ARM® and DSP technologies to deliver the following:

- 30 fps video playback and record with QVGA display
- A full 256-k palette of colors
- 3-megapixel resolution camera support with sub-second delay
- User responsiveness as fast as 0.3 seconds shot-to-shot.
- “See What I See” at 15 fps, 2D/3D gaming, audio/video codecs and imaging algorithms (MP3, AAC+, eAAC+, WMA/WMV, Real)
- 3D graphic processing up to 100-k polygons per second

Key Benefits

- Single chip with integrated RF, digital baseband and application processor for affordable EDGE multimedia devices
- EDGE Class 12 release 4/5 compliant, DTM Class 11, UMA
- 65-nm process for smallest footprint and circuit board costs
- Leverages TI’s innovative DRP™ technology
- Extensive connectivity options: BlueLink™ Bluetooth®, WiLink™ WLAN, NaviLink™ GPS and Hollywood™ DTV
- USB high-speed and USB OTG support for high-speed connectivity
- TV-out support
- SD/MMC/MS-Pro support for external storage
- IMS/SIP support to enable VoIP, Push-to-Audio, Push-to-Video, and video sharing
- Embedded TI’s M-Shield™ technology for strong HW- assisted security and SmartReflex™ technologies for advanced power reduction
- Complete TI system software offering with seamless migration from the OMAPV1030

The OMAPV1035 is more scalable and adaptable to customer needs with wide range of configuration and connectivity capabilities. The common software foundation used across TI solutions allows for maximum software re-use, improving time to market and easing the processing of porting application suites. TI’s open-platform architecture provides manufacturers the flexibility and choice needed to differentiate their products to emerging markets worldwide.
OMAPV2230 Integrated Solution

The OMAPV2230 solution for 3G handsets provides size, performance and power consumption benefits by integrating both modem and applications on a single device. The digital baseband is based on proven WCDMA/EDGE/GPRS/GSM technology, and the applications processor is based on TI’s OMAP™ 2 architecture. Manufactured using TI’s 90-nm advanced CMOS process technology, the OMAPV2230 enables worldwide roaming and supports a variety of multimedia applications with consumer electronics quality. The OMAP-Vox™ architecture makes it easy to migrate existing OMAP software, and the open platform and flexible connectivity options enable product differentiation with value-added features.

The integrated applications processor enables a variety of mobile entertainment applications at streaming speeds up to 384 Kbps. The platform is capable of supporting video codecs such as H.263, MPEG-4, H.264, WMV and RealVideo®, plus high-quality audio codecs such as MP3, WMA, RealAudio® and AAC/AAC+. An advanced IVA™ 2 accelerator and a 3D graphics accelerator core enable:

- Video streaming and playback with high-quality audio up to 30-fps VGA
- Camcorder with high-quality audio up to 30-fps VGA
- Two-way video teleconferencing up to 30-fps CIF
- >5 megapixel digital still camera with < 1 second shot-to-shot delay
- Interactive 3D gaming rendering up to 1 M triangles/second
- Fast audio and video download
- Mobile digital TV decode and display

Key Benefits

- Advanced applications and modem integrated in one device enable a low-power, high-performance system solution
- Enables worldwide operation for WCDMA/EDGE/GPRS/GSM modem standards
- Advanced Imaging, Video and Audio Accelerator (IVA™ 2) boosts video performance in mobile phones up to 4X and imaging performance up to 1.5X
- Delivers a multimedia experience with consumer electronics quality to the handset
- Multi-engine parallel processing architecture supports complex usage scenarios
- Embedded M-Shield™ mobile security technology enables value-added services and terminal security
- Support for all major HLOSs aids applications development
- Optimized power management companion chip: TWL4030
**Chipset Reference Designs**

TI’s chipset family and supporting reference designs speed manufacturers’ new product development and time to market, and address market segments ranging from voice-centric phones to application-rich smartphones. In some cases, manufacturers can leverage a reference design to deliver a new product to market in less than six months.

Because they are fully tested and type-approved, TI’s wireless reference designs allow manufacturers to focus on product differentiation and product development. They come with a complete BOM and component list, along with board design and layout. A complete and fully validated wireless software suite includes communication protocol stacks for 2G, 2.5G and 3G, along with support for major mobile OS and the applications suite for the wireless chipsets.

TI’s best-in-class customer support guides manufacturers from design start through full-scale production. Worldwide locations are based in Europe, USA, China, Taiwan and Japan.

**Key Benefits**

- Manufacturing quality, with competitive BOM costs and full component list
- Designs tailored to all market segments
- Low power consumption
- Board design and layout
- Complete and fully validated wireless software suite includes communication protocol stacks and leading OS support
- Customizable-ready user interface
- Multimedia and PIM applications
- Worldwide support structure

**TI Chipset Reference Designs**

- TCS2010 GSM/GPRS
- TCS2110 GSM
- TCS2200 GSM/GPRS
- TCS2300 “LoCosto” GSM
- TCS2310 “LoCosto” GPRS
- TCS2305 “LoCosto ULC” GSM
- TCS2315 “LoCosto ULC” GPRS
- TCS2600 GSM/GPRS
- TCS2630 GSM/GPRS/WCDMA
- TCS2700 GSM/GPRS
- OMAP850 EDGE
- OMAPV1030 GSM/GPRS/EDGE
- OMAPV1035 “eCosto” GSM/GPRS/EDGE
- BRF6100 Bluetooth®
- And more
To Know More

**OMAP™ processors featured in this issue:**
- Integrated Modem and Applications Processors 32-34
- OMAP-Vox™ Solution 35-38
- Multimedia Processors 39-40
- High-Performance Multimedia-Rich Applications Processors 41-49
- OMAP Platform Resources 50-57
For designers looking to deliver the most compelling, multimedia-rich applications that will attract users to next-generation devices and services, TI’s OMAP™ platform is the answer. Its comprehensive mix of processors, software and support deliver the real-time processing and low power consumption necessary for 2.5G and 3G applications, including streaming media, security, interactive gaming, mobile commerce, location-based services and more.

The OMAP platform includes applications processors and integrated baseband and applications processors suited for a wide range of mobile devices from general-purpose handsets to high-end power-efficient multimedia smartphones and other Internet access devices. TI has maximized software re-use and has incorporated a high level of compatibility, making the OMAP platform an effective choice for implementing a complete multi-line product family for all market segments.

Optimized software, including the operating system port, is an essential element of the OMAP platform. TI delivers optimized OMAP reference software for all leading operating systems with key driver support and DSP-accelerated applications. An extensive selection of integrated peripherals and manufacturing-ready reference designs reduces a system’s bill-of-materials (BOM) cost, reduces board space and accelerates time to market.

A comprehensive, open-software infrastructure makes the OMAP platform an ideal complement to TCS wireless chipset solutions. TI provides support for the most prevalent OSs, high-level programming languages, third-party applications, multimedia components, basic building block algorithms and a host of software development tools. In addition, TI’s OMAP Developer Network of third-party application developers includes an extensive selection of innovative applications and media components that manufacturers can easily integrate into products for differentiation.

TI also offers support with its full complement of reference designs. Wireless design centers in the Americas, Europe and Asia provide quick access to TI expertise. Additionally, the worldwide Independent OMAP Technology Centers are staffed by development experts who provide system integration, development and other critical support for OMAP processor-based product development. Finally, TI offers training, technical documentation, an online knowledge base and interactive discussion groups—all designed to speed the development process and work with manufacturers to quickly get to market.

**OMAP™ 3 Platform**

TI’s OMAP 3 platform builds on the robust multimedia performance of TI’s OMAP 2 processors and adds a new realm of support for even higher-performance entertainment and productivity applications. As the industry’s first architecture to be based on the ARM® Cortex™-A8 processor, the OMAP 3 platform can triple the ARM performance of ARM11™-based processors. In addition, the DSP-based IVA™ 2+ accelerator provides up to 4X the performance of previous OMAP multimedia processing. Software-compatible with previous generations of OMAP technology, the OMAP 3 platform introduces a new level of performance that enables laptop-like productivity and advanced entertainment in 3G handsets. The OMAP 3 platform is a complete system solution for advanced graphics standards including OpenGL® ES 2.0 and Open VG™. Support for these open graphic standards gives developers the tools to create effects that deliver a level of cinematic realism rivaling that of Hollywood movies. Rich effects such as facial features and textured backgrounds that previously were only possible with PCs and gaming consoles will be brought to the mobile environment.
**OMAP730 Processor**

The OMAP730 builds on the proven foundation of previous processors and offers twice the application performance and double the standby time for handsets, smartphones and PDAs. It includes a dedicated TI-enhanced ARM926™ processor for applications processing, and TI’s Class 12 GSM/GPRS digital baseband that incorporates an ARM7TDMI® and TMS320C54x™ DSP core. The ARM926 applications processor enables applications like high-quality streaming audio, hardware-based security, accelerated Java™ processing, web browsing, personal information management (PIM) applications, location-based services and more. The OMAP730’s integrated SRAM frame buffer boosts streaming media performance and lowers IDLE-mode power.

Forty integrated on-chip peripherals included as part of the OMAP730 reduce board space by half over the previous generation and overall system cost by one-third. This integration provides additional space for functionality such as WLAN, GPS or Bluetooth® wireless technology. A comprehensive hardware security subsystem is also included and consists of a secure bootloader, secure execution environment with secure RAM and ROM, and hardware accelerators for encryption and authentication. The OMAP730 processor is available as part of the TCS2600 chipset and reference design.

**Key Benefits**

- Twice the application performance over the previous generation
- Double the standby time for handsets, smartphones and PDAs
- Half the board space over the previous generation and reduced system cost
- Enables applications including accelerated Java™ processing, web browsing, personal information management, location-based services and more
- Increased space for adding functionality including WLAN, GPS or Bluetooth® wireless technology
- Security protection through hardware security subsystem
- Integrated peripherals including USB On-the-Go and VLYNQ™
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
- Mobile SDR memory stacked option (OMAP733-256 MB)
OMAP750 Processor

Targeted at wireless handsets, smartphones, PDAs and Internet access devices, the OMAP750 extends capabilities of the OMAP73x device while including a range of features that improve multimedia application performance. The OMAP750 integrates an ARM926™ core dedicated to applications processing with a complete Class12 GSM/GPRS modem baseband subsystem that consists of an ARM7™ core with TI’s low power TMS320C54x™ core.

The OMAP750 incorporates faster memory options, including support of double data rate (DDR) memory that increases processing speed over the OMAP730, which only supported SDRAM. Improved throughput from an internal frame buffer also enhances processing of multimedia applications, including streaming video and high-end imaging functions.

The OMAP750 provides strong security safeguards, as its hardware-based measures offer a higher degree of protection over software-only features. A secure bootloader, secure memory (ROM and RAM), and random number generators are included. Security hardware accelerators also address popular security standards like MD5/SHA1 and DES/3DES.

Key Benefits

- Improved multimedia and application performance
- Class 12 GSM/GPRS modem baseband and ARM926 core for applications processing
- Increased processing speeds through DDR memory option and internal frame buffer
- Protection through hardware-based security platform
- Extended list of peripherals, including parallel OCP camera interface for high resolution imaging
- GPS, WLAN and Bluetooth® wireless technology capable
- 2-megapixel camera
- Pin-to-pin compatible with OMAP730
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
OMAP850 Processor

The OMAP850 integrated modem and applications processor offers the high performance and low power required for GSM/GPRS and EDGE applications including multimedia, gaming and camera functionality. Because it is software compatible with other OMAP™ applications processors, it serves as an ideal choice for upgrading wireless smartphones and PDAs to meet the EDGE standard requirements.

The OMAP850 processor integrates into a single package an ARM9®-based applications processor and a GSM/GPRS/EDGE digital baseband. The OMAP850 supports MPEG-4 video, Windows Media® Video, MP3, up to 2.0 megapixel still image capture and more.

TI includes a security hardware platform as part of the OMAP850 that includes secure mode, secure boot and hardware encryption accelerators. It supports high-level mobile OSs, such as Symbian OS™, Microsoft® Windows Mobile®, S60 and Linux®.

Key Benefits

- Enables multimedia, gaming and camera functions in high-performance smartphones and PDAs
- Based on previous generation OMAP730 applications processor
- GSM/GPRS/EDGE capable
- Software compatible with family of OMAP™ applications processors
- Support for various software standards including MPEG-4 video, Microsoft® Windows Media® Video, MP3, 2-megapixel camera and others
- HLOSs support
- Broad range of applications through OMAP Developer Network
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
OMAP-Vox™ Solutions

One important aspect of 2.5G and 3G success is the ability to bring advanced services to the broadest possible population of mobile users. TI’s OMAP-Vox™ platform is the answer. With OMAP-Vox solutions, TI adds modem functionality to its successful OMAP™ architecture. With software compatibility across the platform, customers can easily scale across multiple market segments from GSM/GPRS/EDGE to WCDMA. OMAP-Vox solutions are optimized to efficiently run a dynamic mix of application and communication functions on the same hardware. They integrate proven modem, multimedia and applications processing onto a single chip with a compatible software foundation that can be re-used for evolving market segment requirements.

Designed to scale from cost-effective handsets to high-end mobile entertainment phones, the OMAP-Vox platform continues TI’s legacy of software compatibility and re-use, saving years of software design effort. This software serves as the foundation for applications, multimedia and communications development on all OMAP-Vox solutions, saving manufacturers time and money.

The OMAP-Vox platform offers complete system solutions encompassing an integrated modem and applications processor, RF, analog and power management functions, complete field-tested protocol stack software, high-performance multimedia codecs and functions, applications software suite via ecosystem partners, a competitive handset reference design and a complete development toolkit.

The OMAP-Vox family includes the OMAPV1030 (GSM/GPRS/EDGE), OMAPV1035 “eCosto” GSM/GPRS/EDGE and OMAPV2230 (WCDMA) integrated solutions. Optimized to enable mid-range multimedia devices, the OMAPV1030 supports applications such as high-quality video capture and playback, video streaming and downloads, megapixel digital still cameras and interactive 2D/3D gaming.

A powerful multimedia solution, the OMAPV1035 is the first 65-nm single-chip solution to support EDGE, as well as to integrate modem, applications processor and RF into a single offering.

The OMAPV2230, designed for high-end mobile communications, enables worldwide roaming and supports an even wider variety of multimedia applications with consumer electronics quality. OMAP-Vox solutions are built on TI’s leading modem and OMAP technology and leverage TI’s advanced high-volume 90-nm digital process technology.

Customers using TI’s wireless chipsets will also be able to re-use the GSM/GPRS protocol stack software when migrating to the OMAP-Vox platform. These complete, scalable solutions deliver the necessary elements to bring differentiated mobile devices to market fast, including a broad range of hardware, software, reference designs, development tools and support.
OMAPV1030 Integrated GSM/GPRS/EDGE Solution

The OMAPV1030 solution is one of the industry’s most highly integrated and optimized EDGE solutions, combining applications and modem on a single device to enable handset manufacturers to reduce costs and speed time to market. The baseband processor design expands on TI’s proven GSM/GPRS technology and leverages TI’s advanced high-volume, 90-nm digital CMOS process technology.

The OMAPV1030 processor is based on the OMAP™ architecture and runs both GSM/GPRS/EDGE modem and applications processing on a single OMAP core, ensuring a high-quality multimedia mobile experience. The combination of the ARM926EJ-S™ and TI DSP is used to improve performance while reducing costs and power consumption, resulting in longer battery life and usage times for consumers. Because all OMAP-Vox™ solutions share a common software platform, this solution maximizes software reuse to bring overall development costs down and provides a natural and affordable roadmap from GSM/GPRS/EDGE to WCDMA.

The OMAPV1030 solution is specifically designed to bring multimedia functionality to mass market mobile phones, and delivers advanced capabilities to mid-range wireless handsets. The OMAPV1030 solution includes best-in-class high-end multimedia performance including:

- Comprehensive audio/video codecs and imaging algorithms
- Ringtones: 64-polyphonic MIDI
- Audio: MP3, stereo, AAC, AAC+, enhanced AAC+, WMA
- Still image: Camera up to 2 megapixel with 1.3 second shot-to-shot
- Imaging: JPEG, GIF, EXIF, PNG, BMP
- Dual LCD support (main LCD up to QVGA 256-k color)

Key Benefits

- Integrated modem and applications processing on a single core
- EDGE Class 10 support, Class 12 capable, UMA support
- High-performance Java™ (including Java acceleration)
- Ability to support HLOSs and Nucleus™ applications suites
- Support for external memory cards including MMC/SD
- Connectivity includes Wi-Fi®, Bluetooth® 2.0/EDR, IrDA and USB OTG
- Embedded security via hardware accelerators supporting terminal security, transactions security, and content security
- Re-usable APIs for maximum re-use across OMAP-Vox family improving time-to-market
- Complete TI system solution offering

- Video:
  - Capture, playback and streaming MPEG-4/H.263 (QCIF) at 30-fps QVGA display
  - H.264 (QCIF) playback at 20-fps QVGA display
  - 2D and 3D gaming 60 k polygons per second, 2-megapixel rasterization, 15 fps

The OMAPV1030 solution supports all form factor requirements, including PDAs, clamshells, bar-types and other mechanical designs. TI’s open-platform architecture provides manufacturers the flexibility and choice needed to differentiate their products to emerging markets worldwide. TI’s OMAPV1030 feature phone solution has been in volume production since first quarter 2006.
OMAPV1035 “eCosto” Single-Chip Handset Solution

The OMAPV1035 solution is the first to integrate GSM/GPRS/EDGE modem, digital RF and applications processor functionality onto the same silicon. Codenamed “eCosto”, the device builds on the “LoCosto” single-chip cell phone solution and the multimedia capabilities of the OMAP-Vox™ platform.

Sharing the same platform with the OMAP-Vox family ensures software re-use for faster and more cost-effective feature phone development. Integrating the innovative RF capabilities of TI’s DRP technology with the powerful processing of the OMAP-Vox architecture yields significant cost savings. As a result, mobile device manufacturers can bring compelling multimedia applications to low- and mid-range wireless devices worldwide.

The OMAPV1035 is the first 65-nm single-chip solution to support EDGE, as well as to integrate modem, applications processor and RF into a single offering. A powerful multimedia platform, the OMAPV1035 leverages the capabilities of advanced ARM® and DSP technologies to deliver the following:

- 30-fps video playback and record with QVGA display
- A full 256-k palette of colors
- 3-megapixel resolution camera support with sub-second delay
- User responsiveness as fast as 0.3 seconds shot-to-shot.
- “See What I See” at 15 fps, 2D/3D gaming, audio/video codecs and imaging algorithms (MP3, AAC+, eAAC+, WMA/WMV, Real)
- 3D graphic processing up to 100-k polygons per seconds

OMAPV1035 is more scalable and adaptable to customer needs with wide range of configuration and connectivity capabilities. The common software foundation used across TI solutions allows for maximum software re-use, improving time to market and easing the processing of porting application suites. TI’s open-platform architecture provides manufacturers the flexibility and choice needed to differentiate their products to emerging markets worldwide.

Key Benefits

- Single chip with integrated RF, digital baseband and application processor for affordable EDGE multimedia devices
- EDGE Class 12 release 4/5 compliant, DTM Class 11, UMA
- 65-nm process for smallest footprint and circuit board costs
- Leverages TI’s innovative DRP™ technology
- Extensive connectivity options: BlueLink™ Bluetooth®, WiLink™ WLAN, NaviLink™ GPS and Hollywood™ DTV
- USB High-Speed and USB OTG support for high-speed connectivity
- TV-out support
- SD/MMC/MS-Pro support for external storage
- IMS/SIP support to enable VoIP, Push-to-Audio, Push-to-Video, and video sharing
- Embedded TI’s M-Shield™ technology for strong HW-assisted security and SmartReflex™ technologies for advanced power reduction
- Complete TI system software offering with seamless migration from the OMAPV1030
OMAPV2230 Integrated WCDMA Solution

The OMAPV2230 WCDMA solution for 3G handsets provides size, performance and power consumption benefits by integrating both modem and applications on a single device. The digital baseband is based on proven WCDMA/EDGE/GPRS/GSM technology, and the applications processor is based on TI’s OMAP™ 2 architecture. Manufactured using TI’s 90 nm advanced CMOS process technology, the OMAPV2230 enables worldwide roaming and supports a variety of multimedia applications with consumer electronics quality. The OMAP-Vox™ architecture makes it easy to migrate existing OMAP software, and the open platform and flexible connectivity options enable product differentiation with value-added features.

The integrated applications enables a variety of mobile entertainment applications at streaming speeds up to 384 Kbps. The platform is capable of supporting video codecs such as H.263, MPEG-4, H.264, WMV and RealVideo, plus high-quality audio codecs such as MP3, WMA, RealAudio and AAC/AAC+. An advanced IVA™ 2 accelerator and a 3D graphics accelerator core enable:

- Video streaming and playback with high-quality audio up to 30-fps VGA
- Camcorder with high-quality audio up to 30-fps VGA
- Two-way video teleconferencing up to 30-fps CIF
- >5 megapixel digital still camera with < 1 second shot-to-shot delay
- Interactive 3D gaming rendering up to 1M triangles/second
- Fast audio and video download
- Mobile digital TV decode and display

Key Benefits

- Advanced applications and modem integrated in one device enable a low-power, high-performance system solution
- Enables worldwide operation for WCDMA/EDGE/GPRS/GSM modem standards
- Advanced Imaging, Video and Audio Accelerator (IVA™ 2) boosts video performance in mobile phones up to 4X and imaging performance up to 1.5X
- Delivers a multimedia experience with consumer electronics quality to the handset
- Multi-engine parallel processing architecture supports complex usage scenarios
- Embedded M-Shield™ mobile security technology enables value-added services and terminal security
- Support for all major HLOSs aids applications development
- Optimized power management companion chip: TWL4030
**OMAP331 Processor**

The OMAP331 processor provides a feature-rich platform for price-sensitive 2.5G and 3G handsets, PDAs and other mobile devices. Based on an ARM926™ processing core, the OMAP331 delivers multimedia functionality while maintaining power efficiency. Software re-use and compatibility with higher end OMAP™ devices provide manufacturers a migration path to higher performing smartphones, Internet appliances and multimedia devices.

Features found in the OMAP331 include robust multimedia performance, fast processing speeds, a 2D-graphics accelerator engine, a high-throughput direct memory access interface and much more. An on-chip frame buffer improves performance of multimedia applications like streaming video and graphics. Enhanced, high-resolution imaging is possible through a parallel OCP camera port.

The OMAP331 includes a hardware-based security engine and random number generator for transparent security algorithm processing. Hardware accelerators are also included to address industry security standards such as MD5/SHA1 and DES/3DES.

**Key Benefits**

- 17 percent faster performance and enhanced features over the previous generation
- Low power consumption
- Software re-use and compatibility with other OMAP™ devices
- On-chip frame buffer and 2D-graphics accelerator speeds multimedia performance
- High-resolution imaging through OCP camera port
- Hardware-based security platform
- 802.11 capable up to 54 Mbps
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
**OMAP-DM270**

The OMAP-DM270 combines image-processing capabilities with a highly integrated imaging peripheral set in a programmable platform. Consisting of ARM7TDMI® and TMS320C54x™ DSP cores with on-chip program and data memory, the OMAP-DM270 offers enhanced performance and flexibility for camera-enabled mobile handsets and PDAs and fulfills customer demands for image quality, feature richness and low cost.

Platform programmability is achieved through a DSP-based imaging co-processor that gives manufacturers the ability to implement proprietary image processing algorithms in software and differentiate their products. In addition, the OMAP-DM270 architecture supports various types of CCD and CMOS sensors, signal conditioning circuits, power management, SDRAM, shutter, iris and auto-focus motor controls.

The OMAP-DM270 supports all the popular audio, video, imaging and voice standards, including MPEG-4 video up to 30 fps (VGA). A full set of peripherals includes on-screen display and an interface for color LCD. Seamless interface to CompactFlash™, SmartMedia™, Secure Digital™ and Memory Stick™ cards are also provided as part of the OMAP-DM270 multimedia processor.

**Key Benefits**

- Integrated programmable platform lets manufacturers add image-processing algorithms
- Performance delivers high image quality and rich features in a cost-effective solution
- Broad range of encoding support, including support of all major audio, video, imaging and voice standards
- MPEG-4 video support of up to 30 fps (VGA)
- Live view and digital zoom through preview engine
- Real-time auto focus, auto-white balance and auto-balance statistics
- Highly integrated peripheral set
- Leverages 130-nm process technology for low power and increased performance
OMAP1610 Processor

The OMAP1610 applications processor features a dual-core architecture based on TI's TMS320C55x™ DSP and TI-enhanced ARM926™ cores. Each core has processing capabilities of up to 200 MHz, resulting in enhanced performance for processing multimedia applications in handsets for 2.5G, 3G and beyond, including videoconferencing, interactive gaming, speech processing, location-based services, video streaming and others. Manufacturers benefit with scalability across the OMAP™ processor family and gain a path to higher end market segments.

The high-speed DSP and ARM® engines include hardware-based application accelerators such as a dedicated on-chip 2D-graphics engine that eliminates the need for discrete graphic chips and multimedia acceleration. Java™ program accelerators are also incorporated into the OMAP1610, and a hardware-based security system provides protection of creative content or software, guarding confidential information and securing information transmission.

The OMAP1610 applications processor maintains standby power consumption levels of less than 10 µA, which is among the lowest in the industry. It supports all cellular standards, and complements any modem technology.

Key Benefits

- Multimedia applications including videoconferencing, interactive gaming, speech processing, m-commerce, location-based services and others
- Supports all cellular standards
- Migration path to high-end market segments through scalability of the OMAP™ platform
- Reduced power consumption through hardware-based accelerators
- Secure mode of operation with wireless security hardware
- Dedicated on-chip 2D-graphics engine
- TI-enhanced ARM926™ core
- Leverages TI’s TMS320C55x™ DSP and TI-enhanced 200 MHz processing capabilities
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
OMAP1621 Processor

The OMAP1621 applications processor is a software compatible upgrade to the OMAP1610 processor. The OMAP1621 boasts improved ARM® and DSP performance versus previous devices to meet the increasing performance demands of multimedia-enabled handsets. Additionally, the OMAP1621 processor adds 2 MB of internal SRAM optimized to act as a frame buffer enabling higher graphics and streaming media performance. To support higher resolution cameras, the OMAP1621 includes an enhanced camera port interface bus that results in higher throughput.

The OMAP1621 includes several hardware-based application accelerators that eliminate the need for discrete graphic chips and multimedia accelerators. Java™ acceleration is also included in the ARM and a hardware-based security system enables secure e-commerce applications and the replay of copyright-protected digital media content.

The OMAP1621 and other OMAP16xx applications processors maintain standby power consumption levels of less than 10 µA and are among the lowest in the industry. The processors support all cellular standards and complement any modem technology.

Key Benefits

- The OMAP1621 processor enjoys all the same features, functionality and benefits of the OMAP1610 and more
- Increased DSP and ARM® performance
- Improved graphics and streaming media performance
- Improved support for higher resolution camera via an enhanced camera port interface bus
- Support of all cellular standards
- WLAN-capable to speeds up to 54-Mbps data throughput with integrated VLYNO™ interface
- Scalable solution provides path to high-end market segments
- Reduced power consumption through hardware-based accelerators
- Secure mode of operation through wireless security hardware
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
- Mobile DDR memory stacked option (OMAP1623-512 Mb)
OMAP1710 Processor

The OMAP1710 applications processor combines an ARM926™ processor with a TMS320C55x™ DSP core operating at 220 MHz. Manufactured on TI’s advanced 90-nm CMOS process technology, the OMAP1710 provides up to 40 percent more performance for a variety of applications, while consuming half the power of previous TI applications processors in active mode.

A range of software and hardware accelerators are included as part of the OMAP1710, including video encode and decode, still picture compression, Java™ and security. TI’s advanced security hardware provides a secure execution environment and an ideal platform to address a range of security threats. Features including a secure bootloader, secure mode of operation, secure RAM and ROM and various accelerators are all aspects of TI’s security-based capabilities.

The OMAP1710 is designed to handle a variety of applications in parallel for concurrent features and service. This unique approach ensures that applications are not interrupted or degraded when additional operations are launched or run simultaneously.

For manufacturers looking to increase performance and multimedia capabilities of their product line, the OMAP1710 offers an easy migration path due to software compatibility with previous generations of OMAP™ applications processors.

Key Benefits

- Advanced 90-nm CMOS process technology
- 40 percent performance improvement in a variety of mobile applications compared to previous generations
- TMS320C55x™ DSP and ARM926 at 220 MHz
- Software re-use due to compatibility and flexibility across other OMAP devices
- Multiple engines enable concurrent features and service without quality degradation
- High-performance camera interface supports up to 2 megapixels
- 802.11 capable up to 54-Mbps data throughput with integrated VLYNQ™ interface
- Integrated hardware and software security
- Improved multimedia and graphics
- Optimized for TI’s TCS wireless chipsets
- High-level OS support
- Development support and access to open programming interfaces and development tools
- 12 mm x 12 mm, 289-ball MicroStar BGA™, 0.5-mm pitch
OMAP™ Platform

High-Performance Multimedia-Rich Applications Processors

OMAP2420 Processor

The OMAP2420, software compatible with previous OMAP™ processors, adds capabilities for further enhancing the “All-in-One Entertainment” capabilities that the OMAP 2 architecture brings to smartphones and wireless PDAs.

The OMAP2420 includes the benefits of the OMAP 2 architecture’s parallel processing, giving users the ability to instantly run applications and operate multiple functions simultaneously without compromising quality of service. The OMAP2420 includes an integrated ARM1136™ processor (330 MHz), a TI TMS320C55x™ DSP (220 MHz), 2D/3D graphics accelerator, imaging and video accelerator (IVA™), high-performance system interconnects and industry-standard peripherals.

Multimedia enhancements made in the OMAP2420 include an imaging and video accelerator for higher resolution still capture applications, multi-megapixel cameras and full-motion video encode and decode with VGA resolution up to 30 frames per second. An added TV video output supports connections to television displays for displaying images and video captured from the handset. Streaming media performance is boosted by 5-MB internal SRAM.

Key Benefits

- Dedicated 2D/3D graphics accelerator at 2 million polygons per second
- IVA™ enables high-resolution still image capture, larger screen sizes and higher video frame rates
- Supports high-end features including 4+ megapixel cameras, VGA-quality video, high-end interactive gaming functionality and analog/digital TV video output
- 5-MB internal SRAM boosts streaming media performance
- Software compatibility with previous OMAP™ processors
- Parallel processing ensures no interruptions or degradation of service with simultaneously running applications
- Optimized power management companion chip: TWL92230
- 14 mm x 14 mm, MicroStar BGA™, memory stackable package
- 12 mm x 12 mm MicroStar BGA package
- Mobile DDR memory stacking options (OMAP2422-512 Mb; OMAP2423-768 Mb)
**OMAP2430 and OMAP2431 Processors**

The OMAP2430 and OMAP2431 high-performance applications processors deliver best-in-class performance to multimedia-enabled handsets and wireless PDAs for 2.5G, 3G and beyond. Based on TI’s enhanced OMAP™ 2 multi-engine parallel processing architecture and high-performance, low-leakage 90-nm CMOS process technology, the OMAP2430 and OMAP2431 processors balance multimedia performance, flexibility, power and cost. IVA™ 2, TI’s latest-generation imaging, video and audio accelerator (OMAP2430 only), boosts mobile video playback performance to DVD quality. The processors also integrate a 330-MHz ARM1136® RISC processor core, dedicated 2D/3D graphics hardware acceleration, high-speed system interconnect, numerous peripherals, and camera, display and memory subsystems.

Multimedia features supported include:

- Downloadable media playback and digital TV decode: MPEG-4, H.264, Windows Media® Video (VC-1), RealVideo® version 10 decode up to D1 (720 x 480) 30 fps
- Still image capture: > 5 megapixel with 1 second shot-to-shot delay
- Motion video capture: MPEG-4, H.264 encoding up to VGA 30 fps
- Video teleconferencing: H.263, H.264 videoconferencing with simultaneous recording of VTC session up to CIF 30 fps
- 2D/3D gaming: rasterization up to 1 million polygons per second (OMAP2430 only)

**Key Benefits**

- Advanced IVA™ 2 boosts video performance in mobile phones by up to 4X and imaging performance by up to 1.5X
- Delivering a multimedia experience with consumer electronics quality to the handset
- Multi-engine parallel processing architecture for supporting complex usage scenarios
- Embedded M-Shield™ mobile security technology enables value-added services and terminal security
- Support for all major HLOSs aids applications development
- Optimized power management companion chip: TWL4030
- 14 mm x 14 mm, MicroStar BGA™, memory stackable package

The OMAP2430 and OMAP2431 support HLOSs, including Linux®, Microsoft® Windows Mobile® and Symbian™. The processors’ high performance enables the use of more highly compressed codecs that bring spectral efficiency and cost savings. Embedded M-Shield™ security technology enables value-added services for content protection, transaction security and secure network access, plus terminal security functions such as secure flashing and booting, terminal identity protection and network lock protection.
OMAP™ 3 Applications Processors

The OMAP™ 3 family of multimedia applications processors from Texas Instruments (TI) introduces a new level of performance that enables laptop-like productivity and advanced entertainment in multimedia enabled handsets. The OMAP 3 family includes the OMAP3430 targeted at high-end multimedia enabled handsets, the OMAP3420 targeted at mid-tier multimedia enabled handsets, and the OMAP3410 targeted at basic multimedia enabled handsets. TI’s OMAP 3 family of applications processors integrate the ARM® Cortex™-A8 superscalar microprocessor core, delivering up to 3X gain in performance over ARM11-based processors. These new processors leverage industry-leading technologies to provide mobile phone battery life together with the performance needed for laptop-comparable productivity software and an audio-video experience equivalent to that of consumer electronics devices.

The OMAP 3 family is the industry’s first applications processors to be designed in a 65-nm CMOS process technology, reflecting TI’s commitment to providing advanced silicon technology that drives a revolution in mobile communications. The device can operate at a higher frequency than previous generation OMAP processors, increasing its clock speed over the OMAP 2 platform, while lowering the core voltage and adding power reduction features to help prolong battery life. Multimedia applications benefit from faster, higher-quality image capture and processing for cameras, exceptional audio/video performance, enhanced support for external displays and high-speed connectivity interfaces. Compatible with a wide range of modems, the OMAP 3 family opens new areas for compelling new mobile applications that will revolutionize handheld communications in both work and play.

The OMAP 3 family of applications processors boast the most advanced and effective power management techniques in the market. The chips make exhaustive use of TI’s SmartReflex™ technologies which include a broad range of intelligent and adaptive hardware and software techniques that dynamically control voltage, frequency and power based on device activity, modes of operation and temperature.

The OMAP 3 processors support HLOS including Linux®, Microsoft® Windows Mobile® and Symbian™. Built-in M-Shield™ security technology enables value-added services for content protection, transaction security and secure network access, plus terminal security functions such as secure flashing and booting, terminal identity protection and network lock protection. Enhanced with ARM TrustZone™ support, OMAP 3 security is based on open APIs, providing an environment for secure applications that deliver robust performance and interoperability.
OMAP3430 Processor

The OMAP3430 applications processor with the ARM® Cortex™-A8 core delivers up to 3X the performance of ARM11-based processors, enabling laptop-like productivity and advanced entertainment in 3G handsets. The industry’s first applications processor to be designed in a 65-nm CMOS process, the OMAP3430 combines the optimal mix of advanced technology and innovation to provide the most advanced applications processor in the market. Designed in a 65-nm CMOS process, the OMAP3430 operates at a higher frequency than previous generation OMAP processors, while lowering the core voltage and adding power reduction features.

IVA™ 2+ a second-generation, power-optimized version of TI’s imaging, video and audio accelerator used in TI’s DaVinci™ technology provides up to 4X performance improvement in multimedia processing versus previous OMAP processors. The increased capabilities of the IVA2+ enables multi-standard (MPEG-4, H.264, Windows® Media Video®, RealVideo®, etc.) encode and decode at DVD resolutions. With the advanced multi-media capabilities a multi-standard DVD-quality camcorder can be added to a phone for the first time. In addition, the ARM’s vector floating-point acceleration, coupled with the OMAP3430’s dedicated 2D/3D graphics hardware accelerator, provides outstanding gaming capabilities.

System features include an integrated image signal processor, support for parallel and serial displays and cameras, Composite and S-video TV output, high-speed USB 2.0 OTG support and much more.
OMAP3420 Processor

The OMAP3420 is designed to provide the right mix of performance and cost to meet the needs of the mid-tier multimedia enabled handsets market. Like the OMAP3430 and 3410 devices, the OMAP3420 is designed in a 65-nm CMOS process to allow a higher operating frequency while lowering core voltage and power consumption. The ARM® Cortex™-A8 superscalar microprocessor core provides exceptional performance to deliver laptop-like productivity and entertainment at a price point for the mid-tier multimedia enabled handsets market. The IVA™2 imaging, video and audio accelerator in the OMAP3420 enables VGA quality video camcorder and playback for multiple standards, including MPEG-4, H.264, Windows Media Video, and RealVideo. Like the OMAP3430, the OMAP3420 device includes a 2D/3D graphics hardware accelerator to provide high quality, OpenGL® ES gaming capabilities.

Additional system features include an image signal processor which allows up to 5-megapixel still image capture, as well as support for parallel and serial displays and cameras, composite and S-Video TV output, high-speed USB 2.0 OTG support and seamless hard disk drive interfaces. In addition, the OMAP3420 is software compatible with all OMAP 2 and OMAP 3 processors, allowing a fully software scalable solution.

Key Features and Benefits

- Advanced Superscalar ARM® Cortex™-A8 RISC core
- 65-nm CMOS process technology adds processing performance while reducing power consumption
- IVA™2 accelerator enables VGA resolution video playback for multiple video standards
- Integrated image signal processor (ISP) for faster, higher-quality image capture and lower system cost
- Flexible system support
  - Composite and S-video TV output
  - VGA (640 x 480 pixels), 16 M-color (24-bit definition) display support
  - Flatlink™3G-compliant serial display and parallel display support
  - High-speed USB 2.0 OTG support
- Seamless connectivity to HDD devices for mass storage
- SmartReflex™ technologies for advanced power reduction
- M-shield™ mobile security enhanced with ARM TrustZone™ support
- Software-compatible with OMAP™2 and OMAP 3 processors
- HLOS support for customizable interface
- Optimized power management companion chip: TWL4030

Wireless Terminals Solutions Guide
Texas Instruments 2007
OMAP3410 Processor

The OMAP3410 is designed to meet the needs of the basic multimedia enabled handsets market, which includes CIF quality video camcorder and playback for multiple standards (MPEG-4, Windows® Media Video® 9, RealVideo®, H.264), up to 3-megapixel still image capture, music playback and 3D gaming. The lowest cost member of the OMAP™ 3 family, the OMAP3410 shares many of the technologies that are present in the OMAP3430 and OMAP3420 devices, including a 65-nm CMOS process, the ARM® Cortex™-A8 superscalar microprocessor core as well as IVA™ 2 imaging, video and audio accelerator, for a rich multimedia experience and targeted general purpose processing. In addition, the OMAP3410 is software compatible with all OMAP 2 and OMAP 3 processors, allowing a fully software scalable solution.

Key Features and Benefits

- Advanced Superscalar ARM Cortex-A8 RISC core
- 65-nm CMOS process technology adds processing performance while reducing power consumption
- IVA™ 2 accelerator enables CIF resolution video playback for multiple video standards
- Seamless connectivity to HDD devices for mass storage
- SmartReflex™ technologies for advanced power reduction
- M-shield™ mobile security enhanced with ARM TrustZone™ support
- Software-compatible with OMAP 2 and other OMAP 3 processors
- HLOS support for customizable interface
- Optimized power management companion chip: TWL4030
Operating Systems Optimized for the OMAP™ Platform

Through close collaboration with OS providers and key third parties, TI provides robust development packages for the OMAP™ platform that support all wireless communications standards and the most widely used high-level programming languages. Complete reference designs, board support packages (BSP) and reference software packages provide everything needed to get started with the OMAP platform, including integrated development environments, driver support, accelerated DSP software, JTAG emulators, and more depending on the selected OS. TI’s OMAP 2 and OMAP 3 platforms include innovative power management and hardware acceleration for multimedia codecs and graphics which provide a richer multimedia experience with leading enterprise and entertainment applications. These platform capabilities and tools, in addition to applications and support available through the OMAP Developer Network and Independent OMAP Technology Centers (OTCs), enable developers to create and optimize real-time execution of applications that leverage the processing power and low power consumption of the OMAP platform.

Symbian OS™

Developing with the Symbian OS and the OMAP platform gives developers an open, easy-to-develop software environment with access to DSP-based hardware acceleration through a high-level API. TI is a Symbian Platinum Partner and offers full support for Symbian OS v8 and v9 ports. TI is also qualified to support S60 Software Platform and has access to S60 APIs. This gives TI’s hardware platform a higher level of integration with S60 Software Platform. Software libraries from TI and the OMAP Developer Network provide manufacturers with innovative software applications to further differentiate devices. Also supported is UIQ, a user interface platform for Symbian OS, especially designed for media rich mobile phones. These user interface platforms are designed to offer easy access to the wide variety of data services for networks supporting 2.5G, 3G and beyond.

Microsoft® Windows Mobile®

Collaboration with Microsoft has enabled TI to design optimized solutions that get manufacturers to market fast. Windows Mobile software is certified for OMAP processors, and TI will continue to support further OS versions. TI offers DSP hardware accelerated Windows Media in certain OMAP platforms. Platform reference designs with software packages and BSPs for Microsoft Windows Mobile-based devices on Pocket PC, Pocket PC Phone Edition, and Microsoft Smartphone are included. A full range of easy-to-use software development tools is also available through the OMAP Developer Network and Microsoft’s mobile2market programs.

Linux®

A full board support package for Linux helps software developers get started quickly with the performance and power efficiency of the OMAP platform. The open source BSP includes the basics plus a set of advanced and fully tested tools to accelerate development. This includes GNU Linux OS, source-level debugging tools, Linux trace tools, language tools including C, C++ and Java™. Commercial support is available from MontaVista, for both their MontaVista CEE 3.x and Mobilinux 4.x products, Wind River also is offering commercial grade Linux on the OMAP platform. These offerings include the Linux kernel, software updates, utilities, development tools and technical support. Additionally, there are partners including Trolltech and Access that offer complete user interface (UI) and application platforms on the OMAP platform with Linux.
Java™
TI, Sun Microsystems and other Java™ leaders have created a complete Java solution and development environment for TI’s wireless chipsets and the OMAP™ platform. Through Java virtual machines (VMs) companies like Aplix, Esmertec and TAO Group combine enhanced Java applications and services with TI’s TCS wireless chipsets, OMAP-Vox™ chipsets and OMAP processors. Enhanced Java features include MIDP and CDLC, which provide a complete J2ME™ (Java 2 Micro Edition) application runtime environment. TI’s OMAP platform supports Mobile Media APIs (JSR-135), MPEG-4, MP3, MIDI and other MIME types.
Wireless Applications Center

The Wireless Applications Center helps handset makers to see a variety of solutions for cellular, Wireless LAN and Bluetooth® wireless technology. Manufacturers use the applications center to gain firsthand experience with new wireless software programs and services on the market and under development from TI’s OMAP Developer Network. Current locations include Dallas, Bangalore, Taipei and Nice.

Within each center are targeted areas to meet customer needs, including a wireless demo area to see actual solutions in use. The OMAP Developer Network Support Lab provides extensive support tools and programs to assist design from the beginning of development through to customer demonstrations and volume manufacturing. Additionally, several advanced test systems facilitate thorough and rapid testing of new systems and subsystems.

Other offerings of the center include an application benchmarking program to compare OMAP technology performance numbers with those of competitive platforms; a device loan and support program that gives customers access to tools and devices for development and demonstrations at tradeshows and customer meetings; and a website database where demos are accessible online.
Application Suite Ecosystem

Broadening its commitment to accelerate wireless development in high-growth markets worldwide, TI is working with leading application software providers to offer a scalable, integrated application suite for affordable feature phones. Partner application suites are integrated onto TI’s “LoCosto” single-chip mobile phone solution and OMAP-Vox™ product family for a highly customizable application solution that greatly reduces the overall handset development cycle. Working with market-leading solutions including Motorola AJAR, OpenPlug’s ELIPS, Sasken Application Framework and SKY MobileMedia’s SKY-MAP™, TI gives its customers the flexibility to select an application suite that can be easily adapted to the unique needs of handsets and specific operator and consumer requirements.

Porting, validating and integrating software requires significant monetary and time investment. Working with an ecosystem of application software providers, TI handset customers have the flexibility to choose a preintegrated solution, simplifying the development process. With the technical integration work complete, handset manufacturers reduce time to market by approximately six months, opening doors to quickly deliver new phone models, particularly for high-growth markets. A common TI software foundation built with open industry standard application programming interfaces (APIs) allows for software re-use and easy consistent migration across TI’s roadmap of “LoCosto” solutions and OMAP-Vox platforms.

TI is committed to delivering solutions for emerging markets as they require increasingly advanced technologies. TI and its applications suite partners make efficient use of system resources and promote seamless interaction between applications. These integrated offerings reduce time to market, allowing mobile device manufacturers to introduce new differentiated models faster and reduce costs.

Key Benefits

- All partner application suites are available on TI’s “LoCosto” platform today
- Accelerated porting on OMAP-Vox™ solutions allowing manufacturing production as early as 3Q07
- Committed and aligned roadmap with all partners for future TI products
The OMAP Gaming Development Platform allows developers and publishers to create a portfolio of mobile games with significantly reduced time and monetary investments. With this gaming platform based on Ideaworks3D’s Airplay™ and TI’s OMAP2430 processor, developers will be able to create games targeting a broad range of mobile handsets. Developers will be able to create the majority of a game before new handsets are available on the market, enabling prompt availability of games on new mobile phones as they enter the market.

The combined solution from TI and Ideaworks3D changes the current mobile gaming development process by allowing developers to create one game which runs on leading open operating systems (OSs), including Symbian OS™, Linux® and Microsoft® Windows Mobile®. As part of this effort, Ideaworks3D will optimize and integrate its industry leading Airplay game software development kit (SDK) for TI’s OMAP2430 processor which benefits TI’s extensive OMAP™ ecosystem of leading game publishers and developers, serving handset manufacturers and mobile operators worldwide.

TI’s OMAP2430 processor integrates advanced 3D graphics hardware acceleration enabling mobile game developers to extract new levels of performance and enhance the game-play experience. The new OMAP Gaming Platform with Ideaworks3D allows developers to take full advantage of the powerful 3D graphics capabilities of the OMAP architectures for popular mobile operating systems.

Key Features

- Complete hardware and software package to enable developers to optimize performance-, timing- and memory-related design factors early in the game development process
- Based on the OMAP2430 processor with Ideaworks3D Airplay™ software
- Increases the target market for a game by increasing the footprint
- Reduces mobile gaming fragmentation and developers costs
- Offers a complete single-game developer package enabling 3D development across multiple operating systems

TI’s OMAP2430 processor-based mobile gaming platform is a complete hardware and software package that will enable developers to optimize performance-, timing- and memory-related design factors early in the game development process.

TI’s mobile gaming website provides additional resources for developers, handset manufacturers and operators. The site contains information on all of TI’s mobile gaming developments and includes downloadable SDK and tools, and market and standards information. Visit www.ti.com/omap gaming to learn more about how TI is changing the mobile gaming market.
OMAP Developer Network

TI's OMAP™ Developer Network provides innovative applications, services and multimedia modules for TI's OMAP processors, cellular modem solutions and non-cellular wireless technologies including WLAN, Bluetooth® and GPS. Consisting of an extensive range of third party software developers, the ready-to-implement OMAP software and algorithms deliver the latest, most compelling applications for handsets in 2.5G and 3G and beyond.

OMAP Developer Network members are continuously building new multimedia-rich applications and capabilities on the entire TI wireless portfolio to enable product differentiation, quick time to market and fast return on investment. Just a few of the applications available through the OMAP Developer Network include streaming media, voice recognition, 3D gaming, Java™ virtual machines, high-end audio, speech recognition, text-to-speech, videoconferencing, location-based services and security. TI works with the industry's most innovative developers, including Access, Aricent, Ingenient, McubeWorks, Ideaworks3D, InterVideo, Hi Corp, Nuance, PacketVideo, NXP Software, SafeNet, Sasken, Trolltech, Trusted Logic, Motorola TTPCom Product Group, SKY MobileMedia, Open-Plug, and hundreds more.

Training
Various online and live workshop training opportunities are available for software development, DSP algorithm development, development tools and other subjects.

Developer Catalog
TI's online OMAP Developer Network catalog serves as an important place to assist TI customers in identifying solutions offered by Developer Network members. Application descriptions and services are provided for additional information to aid in selecting an application mix or to seek engineering assistance in a particular application area.

Invitation to Join Network
If you are developing software applications for handsets and PDAs supporting 25, 3G and beyond, apply for membership to the OMAP Developer Network.

www.ti.com/omapdevnet

Member Benefits/Product Exposure
Prospective customers will be exposed to developer product information through a variety of marketing opportunities including:

- OMAP Developer Network online catalog
- TI collateral
- Wireless Access e-newsletter
- Website promotions
- Online demos

Network members may have their application demos selected for use in one or more of TI’s regional Wireless Applications Centers for direct exposure to TI customers. Members may also be invited to participate at select tradeshows using TI booth properties and exhibit space. Members can also be included in OEM/ODM proposals and Requests for Quotation to complement TI's products.
OMAP™ Platform

OMAP Platform Resources

**Independent OMAP Technology Centers**

Wireless manufacturers are seeking expert support for emerging technologies and specialized techniques that are continually evolving. While TI is the world leader in wireless expertise, the skills and time-to-market requirements of manufacturers in the wireless industry today are tremendously divergent. Manufacturers must consider communications protocols, baseband processors and other wireless design technologies, in addition to other requirements like security, HLOSs, multimedia coders/decoders (codecs), consumer applications and services, interactive gaming, location-based services, WLAN (802.11), and Bluetooth® wireless technology.

To further streamline the development process, TI offers support and service through its worldwide Independent OMAP Technology Centers (OTCs). Manufacturers can use OTCs to leverage leading expertise in hardware design, embedded software development, HLOSs support and system integration. It’s possible to assemble a team of world class experts locally for your project using OTCs.

TI’s global network of OTCs provides the diverse expertise that wireless manufacturers need locally:

- Systems integration
- Full turnkey design (hardware and software)
- Wireless systems architecture
- Embedded software development
  - Device drivers
  - OS baseport development
  - OS optimization
  - Middleware
  - Applications
- Hardware design
- RF and antenna design
- Communication protocols and telephony
- GSM/GPRS, EDGE, WCDMA protocols
- WLAN 802.11x, Bluetooth® wireless technology
- Multimedia codec development
- ARM® and DSP algorithm development

OTCs are valued members of TI’s wireless offering with proven track records. As wireless designs become more integrated and complex, TI and its OTCs are working to ensure that manufacturers receive the support and solutions they need to capitalize on the rapidly changing wireless market in the locale they want it. When you plan your next product development, consider the benefits of partnering with TI and an OTC for support.

**www.ti.com/otc**

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OMAP™ Software Development Tools

From early development to final optimization, TI and partners provide a complete line of products that enable effective, efficient development for architectures based on the OMAP™ platform. Even before silicon is available, models allow you to simulate the device. Then, when silicon is ready, development platforms aid you in coding and debugging performance-critical applications.

TI’s highly optimized Code Composer Studio™ integrated development environment (IDE) provides best-in-class support for development of DSP-based codecs and multimedia functions. TI also includes ARM® compilers with industry-standard ABI support that deliver fast, compact executable files. For debugging, TI’s XDS-560 emulator allows you to take advantage of the emulation capabilities designed into OMAP processors. Finally, our innovative visualization and optimization tools help you to achieve the greatest performance possible with your design.

Complementary tool solutions are also available from TI’s many partners. Close support from the emulation developer community helps third parties to develop their products early and effectively. For example, companies such as Lauterbach and Sophia Systems provide powerful products for OMAP devices.

The comprehensive toolset for OMAP developers gives TI customers significant options to help system integrators solve the functional requirements, performance goals and power constraints they face when developing wireless handsets.

OMAP2430 Software Development Platform (SDP)

The OMAP2430 SDP offers an easy, cost-effective way to develop, evaluate and test software for next-generation advanced smartphones and converged portable multimedia devices based on the OMAP™2 architecture. The SDP provides a full range of software, services and support, including board support packages for access to HLOSs such as Symbian™, Linux® and Microsoft® Windows Mobile®. Throughout development, designers have flexible tools for developing all aspects of the system, including peripheral drivers. Visibility into each software component streamlines the debug process considerably. Tools for debugging mobile connectivity capabilities such as Bluetooth® or wireless LAN are also included.

TI’s OMAP2430 SDP saves time to market by providing all the hardware and software needed for cost-effective development of OMAP 2 processor-based systems.

Texas Instruments 2007
Overview

To deliver mobile connectivity on multiple networks in today’s complex mobile devices, TI’s integrated, proven wireless connectivity solutions ensure multi-mode operation and access to a variety of network connections for service anytime, anywhere. TI offers single-chip solutions for Bluetooth® technology, mobile WLAN, GPS, FM radio and mobile digital TV using TI’s DRP™ technology and 90-nm process technology. TI’s mobile connectivity solutions are tightly integrated with TI’s cellular modem solutions, OMAP™ processors and OMAP-Vox™ solutions so manufacturers can get products to market quickly. TI is also looking to the future by driving development of future mobile technologies such as Ultra Wideband and others.

Bluetooth® Wireless Technology

By leveraging its innovative DRP technology, TI’s single-chip Bluetooth wireless solutions integrate an RF and Bluetooth processor that is optimized to mix with the various communication standards for 2.5G, 3G and beyond. TI’s single-chip Bluetooth solutions deliver high performance with low power and lower system cost, enabling manufacturers to provide optimized Bluetooth wireless personal area networking (WPAN) connectivity to their mobile devices. TI also offers a single chip that integrates the industry’s best performing Bluetooth with high fidelity FM stereo and mono performance.

802.11/WLAN

Optimized at the hardware, firmware and driver level, TI solutions deliver the power efficiency, small size, data/access security and spectrum sharing required for mobile WLAN handsets. Innovative performance levels, the industry’s lowest power and smallest size and interoperability across mobile standards bring embedded and battery-powered applications a new level of functionality and extended battery life. TI also offers support for Voice over WLAN (VoWLAN) technologies to deliver seamless voice and data connectivity between WLAN and cellular networks.

TI has created a coexistence package for WLAN and Bluetooth wireless technologies in co-located environments. TI’s coexistence platform enables data and voice to be transmitted without interference while optimizing system throughput, range, and responsiveness. Additionally with no antennae isolation requirements, even providing for shared antenna designs, it is ideal for mobile handsets.

Mobile Digital TV

Mobile digital TV (DTV) combines the two best-selling consumer products in history—TVs and mobile phones. TV will be an ingredient that drives demand for the next generation of mobile phones because consumers want both communications and entertainment—all in one place and in one device. TI technology is driving mobile digital TV with OMAP™ processors and Hollywood™ mobile broadcast solution, the wireless industry's first digital TV on a single piece of silicon, which captures broadcast signals and allows consumers to watch live TV programming on their handset. Together, a Hollywood single chip and an OMAP™ processors will bring you the same TV experience you have at home—but on your mobile phone.

GPS

TI addresses GPS with a highly integrated single-chip solution that interfaces with TI’s wireless chipsets and delivers precision location capabilities to markets ranging from voice-centric handsets to high-end multimedia smartphones. TI’s GPS5300 NaviLink™ 4.0 single-chip solution is optimized for mobile phones. Through DRP technology, TI is able to provide the smallest size and lowest cost GPS discrete solution with low power and high performance to mobile phone manufacturers.

Ultra Wideband

Ultra Wideband (UWB) is a wireless technology for transmitting digital data at very high rates over a wide spectrum of frequency bands using very low power, targeted for wireless personal area networks (PANs). UWB is ideally suited for wireless communications, particularly short-range and high-speed data transmissions. TI is actively involved with the WiMedia™ Alliance to promote and enable the rapid adoption and standardization of UWB worldwide for high-speed wireless, multimedia-capable personal-area connectivity in the PC, CE and mobile market segments.
**BlueLink™ 7.0 WPAN Solution: Bluetooth® and FM RX/TX Single Chip**

The BL6450 BlueLink™ 7.0 single chip is the industry’s first Bluetooth solution manufactured in 65-nm CMOS and provides a complete hardware and software solution for Bluetooth and FM, enabling ease of design and expediting time to market for mobile device manufacturers. The solution’s Bluetooth function is based on TI’s fifth-generation Bluetooth core, and its FM function presents state-of-the-art performance in all critical FM parameters, such as current consumption, stereo signal-to-noise ratio (SNR) and sensitivity.

Since both the Bluetooth and FM functions are integrated on the same silicon, the solution ensures optimal RF coexistence. Consequently, the two functions can work simultaneously so that the FM function receives/scans/sends radio data system (RDS) information to a host, while the Bluetooth function is in any operational mode.

Additionally, the BlueLink 7.0 solution adds support for FM transmit, including a programmable gain power amplifier with levels compliant to FCC and ETSI specifications, and higher power levels. It also includes FM analog and digital (IFS) data interfaces supporting voice quality sample rate and MP3 audio quality sample rates.

TI’s power management hardware and software algorithms provide significant power savings in the most commonly used Bluetooth modes of operation, such as page and inquiry scan.

Leveraging TI’s DRP™ technology and 65-nm process technology, the BL6450 is the industry's smallest Bluetooth and FM single-chip solution. This allows customers to realize significant cost and size savings due to:

- Significantly lower number of external components compared to discrete Bluetooth and FM solutions

**Key Benefits**

- Industry's smallest Bluetooth® and FM single-chip solution based on TI's 65-nm CMOS process and DRP™ technology with low power and cost
- Supports Bluetooth Specification 2.1+ EDR and relevant features in next SIG releases
- Fully embedded FM and radio data system (RDS) receiver and transceiver, supporting U.S./European and Japanese FM band
- Enhanced Bluetooth and FM performance
- Highly optimized for mobile phones systems
- Advanced power management for extended battery life and ease of design
- Flexibility for easy integration into various host system topologies with shared and separated interfaces for Bluetooth and FM functions
- Supports multiple Bluetooth profile use-cases (complex scenarios) working concurrently with FM

- Significantly smaller number of interfaces (for the FM function) compared to a discrete Bluetooth and FM solutions

The BL6450 BlueLink 7.0 single chip also incorporates TI’s Bluetooth/WLAN coexistence hardware and software solution, providing a collaborative interface with TI’s WiLink™ mobile WLAN solutions for optimal bandwidth. TI’s coexistence solution enables advanced usage scenarios such as VoIP over WLAN with Bluetooth voice using a shared antenna.

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**Diagram:**

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2.4 GHz Filter

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FM Filter
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**BlueLink™ 6.0 Bluetooth® and FM Solution**

The BlueLink™ 6.0 platform provides a complete hardware and software solution, enabling ease of design and faster time to market. The BRF6350 BlueLink 6.0 single chip is the only 90-nm solution available in the WPAN marketplace. The solution's Bluetooth function is based on TI's 4th generation Bluetooth core that has been shipped in millions of units worldwide, while its FM function delivers state of the art performance in all critical FM parameters, such as current consumption, stereo SNR, and sensitivity.

Since both Bluetooth and FM functions are integrated on the same silicon, the solution ensures optimal RF coexistence. Consequently, the two functions can work simultaneously in such a way that the FM function receives/scans/sends RDS information to a host, while the Bluetooth function is in any operational mode.

BlueLink 6.0 platform software offers designers the flexibility to work with various operating systems, including Linux®, Microsoft® Windows Mobile®, Symbian™ and Nucleus. The BlueLink 6.0 software includes TI's Bluetooth Protocol Stack (BTIPS) running on Nucleus. BTIPS is optimized to work with TI's OMAP™ and OMAP-Vox™ platforms and TCS wireless chipsets. In addition to BTIPS, the BlueLink 6.0 software package includes an FM protocol stack.

Leveraging TI's DRP™ technology and 90-nm process, the BRF6350 BlueLink 6.0 single chip is an integrated Bluetooth and FM solution in a small form factor. This allows manufacturers to realize significant cost, size and power savings due to:

- 25 percent smaller device size compared to discrete Bluetooth and FM solutions;
- Lower number of external components compared to discrete Bluetooth and FM solutions;
- Lower number of balls (for the FM function) compared to discrete Bluetooth and FM solutions;
- Power savings in the most commonly used Bluetooth modes of operation, such as page and inquiry scan through hardware and software algorithms.

The BlueLink 6.0 single chip also incorporates TI's Bluetooth/WLAN coexistence hardware and software solution, providing a collaborative interface with TI's WiLink™ mobile WLAN solution for optimal bandwidth. TI's coexistence solution enables advanced usage scenarios such as VoIP over WLAN with Bluetooth voice using a shared antenna.

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**Key Benefits**

- Bluetooth® Specification 2.0 + EDR and high-fidelity FM stereo and mono performance on a single chip
- Integration of Bluetooth and FM in the same silicon provides 25 percent solution size savings compared to discrete solution
- Proven FM-Bluetooth RF coexistence
- Complete software stack support for Bluetooth and FM, enabling ease of design and quick time to market
- On-chip power management adapted to cellular applications
- Incorporates TI's Bluetooth and WLAN coexistence hardware and software solution, providing a collaborative interface with TI's mobile WLAN solutions
- TI’s DRP single-chip technology delivers smallest and lowest cost solution
BlueLink™ 5.0 Bluetooth® Single-Chip Solution

Optimized for mobile terminals, the BlueLink™ 5.0 platform from TI is a highly integrated, digital CMOS, single-chip solution supporting Bluetooth® Specification v2.0 and all software needed for Bluetooth operation. The BRF6300 BlueLink 5.0 solution is based on TI’s prior generation BRF6150, leveraging and exceeding its capabilities to provide maximum Enhanced Data Rate (EDR) support, lowest power consumption in most Bluetooth scenarios and lowest cost and bill of materials (BOM).

TI’s BRF6300 BlueLink 5.0 solution integrates the Bluetooth baseband, RF transceiver, ARM7TDMI®, memory (ROM and RAM) and power management on one chip. The single chip utilizes TI’s DRP™ technology, a revolution in RF technology offering major advantages over the existing solutions based on analog RF. All-digital single-chip benefits include increased scalability, lower power consumption, reduced size and ultimately lower system cost.

The single chip is optimized for mobile terminals delivering the RF performance and ease of integration required by manufacturers. TI’s advanced process and novel design enable the BRF6300 BlueLink 5.0 solution to connect directly to the battery (up to 5.4 V). This saves the cost and space of an external regulator and simplifies the interface and integration with the host by separating their power management entities.

For ease of design, the BlueLink 5.0 platform is pre-integrated in complete reference designs with TI’s cellular modem chipsets and OMAP™ processors. The single chip includes TI’s proven collaborative coexistence mechanism between WLAN and Bluetooth networks. This feature combined with Bluetooth Specification v2.0 adaptive frequency hopping (AFH) and extended Synchronous Connection Oriented (eSCO) allows TI to deliver a high-quality Bluetooth voice and enhanced data throughput when co-located in small mobile products such as smartphones and wireless PDAs.

Key Benefits

- Supports Specification v2.0 and Enhanced Data Rate (EDR) single-chip solutions for mobile terminals
- Industry best power management including lowest power consumption, direct connection to battery (up to 5.4 V) and shut-down (6 µA) to enable market’s longest talk, standby times
- Complete solution for faster time to market and integration
- Cost savings
  - Complete set of reference designs with TI’s OMAP™ processors and TCS chipsets
  - WLAN coexistence solution
- TI’s 90-nm CMOS and DRP™ single-chip technology

OMAP™ processors. The single chip includes TI’s proven collaborative coexistence mechanism between WLAN and Bluetooth networks. This feature combined with Bluetooth Specification v2.0 adaptive frequency hopping (AFH) and extended Synchronous Connection Oriented (eSCO) allows TI to deliver a high-quality Bluetooth voice and enhanced data throughput when co-located in small mobile products such as smartphones and wireless PDAs.

Smartphone application: BRF6300 BlueLink 5.0 solution interconnects with the OMAP™ applications processor, GSM/GPRS chipset and WLAN.
BRF6150 Single-Chip Bluetooth® Wireless Technology

Optimized for mobile terminals, TI’s BRF6150 is a highly integrated Bluetooth® wireless technology Specification v1.2 solution that combines TI’s Bluetooth wireless technology baseband, RF, ARM7TDMI® and power management into a single chip. Its extreme levels of integration enhance performance and lower power consumption while reducing cost and minimizing board space.

The BRF6150 offers improved RF performance and power management capabilities deliver higher integration and reduced package size, resulting in a 50 mm² PCB layout Bluetooth wireless technology solution for mobile phones. The BRF6150 is tailored to suit mobile applications requirements, including RF performance, power consumption, solution size, ease of integration and cost. It connects directly to the battery, saving cost and space of external regulators and simplifying the interface with the host by separating power management entities.

The BRF6150, which utilizes adaptive frequency hopping (AFH), offers an upgrade to the current coexistence solution. When manufacturers combine the v1.2 compliant BRF6150 with TI’s Bluetooth/WLAN coexistence hardware and software package and with a TI WLAN solution, improved coexistence performance is achieved. This results in better utilization of the 2.4 GHz frequency band and solves the most demanding coexistence scenarios for simultaneous Bluetooth wireless technology voice/data and high speed Wi-Fi data. It also enhances WLAN data throughput to maximum performance when co-located into mobile products such as smartphones and wireless PDAs. The BRF6150 includes complete reference designs with TI’s OMAP™ platform and GSM/GPRS chipsets.

Key Benefits

- Direct connection to battery provides improved power management (2.7 V to 5.5 V)
- Full Bluetooth® Specification v1.2, including AFH and faster connection
- Low cost and part count due to high integration and improved interfaces
- Reduced development time through availability of pin-to-pin compatible stacked-flash prototypes (4.5 mm x 4.5 mm)
- Complete reference designs with TI’s OMAP™ platform and GSM/GPRS chipsets provide fast time to market
- WLAN collaborative coexistence solution

Smartphone application: BRF6150 interconnects with the OMAP™ applications processor, GSM/GPRS chipset and WLAN.
**WiLink™ 6.0 Single-Chip WLAN, Bluetooth® and FM Solutions**

Texas Instruments' WiLink™ 6.0 mobile platform is a complete hardware and software offering comprising proven, carrier-quality mobile WLAN, Bluetooth and FM cores integrated onto a single chip.

There are two solutions in the WiLink 6.0 product offering. The WL1271 supports 802.11b/g, while the WL1273 supports 802.11a/b/g/n. Both single-chip solutions support Bluetooth Specification 2.1 + EDR and FM transmit and receive.

The WiLink 6.0 single-chip solutions are manufactured in 65-nm CMOS process and use Texas Instruments' DRP™ technology to deliver low power, a small form factor and low cost requirements of handset manufacturers worldwide.

Texas Instruments' WiLink 6.0 platform is designed to work with OMAP™ 2 processors, OMAP 3 processors, the OMAPV1030 processor, and the "eCosto" OMAPV1035 solution to provide an optimized modem, applications processor and mWLAN/Bluetooth/FM solution for low- to mid-tier handsets.

The WiLink 6.0 solution includes TI's proven, robust coexistence platform, which addresses system-wide interference issues, encompassing radio design, and hardware and software solutions. Coexistence expertise is becoming increasingly important as more radios are being added to the handset. TI leads the market in coexistence solutions for Bluetooth and mWLAN with more than 30 handsets using TI's coexistence platform.

**Key Benefits**

- Single-chip mobile WLAN, Bluetooth® and FM solution implemented in 65-nm CMOS process using TI's DRP™ technology enables:
  - Reduced power consumption for extended talk and standby times
  - Bill of material reduction
  - Small form factor
- Proven carrier quality to enhance the user experience with range-extended mobile WLAN (802.11a/b/g/n), Bluetooth Specification 2.1 and FM functional cores
- Sophisticated ELP™ low-power technology and VoWLAN support with on-chip UMA and IMS acceleration for extended talk time and battery life
- Coexistence features enable simultaneous operation of each integrated function

The WiLink Software Development Kit (SDK) 6.x included with the WiLink 6.0 platform is optimized for mobile phone applications. This includes support for Linux®, Windows® WinCE™, and Symbian™ operating systems, as well as lab testing and manufacturing software. It is also partitioned to minimize host CPU loading and power consumption in mobile applications.
**WiLink™ 5.0 Mobile WLAN Solution**

The WiLink™ 5.0 platform integrates mobile WLAN (mWLAN), Bluetooth® and FM stereo audio all in a space-saving platform for mobile phones. The WiLink™ 5.0 solution provides fast time to market for handset manufacturers and caters to evolving consumer tastes for rapid data access, mobile entertainment and seamless connectivity between the WLAN and cellular networks.

TI brings seamless cellular and Wi-Fi® connectivity to consumers with VoWLAN functionality, optimized on TI’s OMAP-Vox™ and WiLink solutions, enabling UMA on the handset across multiple operating systems such as Symbian™, Microsoft® Windows Mobile®, Linux® and low level operating systems. UMA provides consumers on-the-go voice access over WLAN or the cellular network using their mobile phones, and will transition to IMS as the fixed mobile convergence market matures.

The WiLink 5.0 platform integrates TI’s WiLink 4.0 mWLAN single chip with its BlueLink™ 6.0 solution, which combines Bluetooth® with high-fidelity FM stereo and mono performance on a single chip. The combination of mWLAN, Bluetooth and FM functionality allows users to perform a variety of simultaneous tasks, such as listening to the radio music on a Bluetooth headset while checking email via Wi-Fi.

Both devices in the WiLink 5.0 module are manufactured in TI’s innovative DRP™ technology at the 90-nm node, which cuts both solution size and power consumption by up to 20 percent over competitive solutions, in critical modes of operation.

With three co-located radios, efficient management of RF is required for simultaneous operation of WLAN, Bluetooth and FM applications. The WiLink 5.0 platform takes advantage of TI’s expertise from the company’s previous generations of mobile WLAN solutions, which are being shipped in more than 30 mobile handset devices and cellular convergence products today. The platform uses the second generation of TI’s Bluetooth/WLAN hardware and software co-existence package, enabling re-use of existing systems, quick time to market, and antenna sharing, reducing the bill of materials (BOM) for manufacturers.

**Key Benefits**

- Integrates TI’s BlueLink™ 6.0 solution, which combines Bluetooth® with high-fidelity FM stereo and mono performance on a single chip
- VoWLAN functionality, optimized on TI’s OMAP-Vox™ and WiLink solutions, enabling UMA on the handset
- 20 percent reduction in solution size and power consumption through use of TI’s innovative DRP™ technology at 90-nm
- Advanced Bluetooth and WLAN coexistence through use of TI’s second generation of Bluetooth/WLAN hardware and software co-existence package, enabling re-use of existing systems, quick time to market, and antenna sharing, reducing the bill of materials (BOM) for manufacturers
- Support for multiple operating systems: Symbian™, Microsoft® Windows Mobile®, Linux® and low level OSs
- Multiple package options, including on-board and module solutions

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**WiLink™ 5.0 Platform: WLAN, Bluetooth® + FM**

- **Battery**
- **Power Management**
- **WLAN MAC/BB/RF**
- **BlueLink™ 6.0 Bluetooth + FM**
- **Front End**

**2.4-GHz RF**

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**Wireless Terminals Solutions Guide**

Texas Instruments 2007
WiLink™ 4.0 Mobile WLAN Single-Chip Solutions

TI’s WiLink™ 4.0 mobile WLAN platform is a complete hardware and software offering optimized for mobile phones. TI’s WiLink 4.0 platform offers two different hardware single-chip implementations to provide flexibility for OEMs to offer 802.11b/g or 802.11a/b/g operation. The WL1251 802.11b/g solution and the WL1253 802.11a/b/g solution are single chips which integrate the media access controller (MAC), baseband processor and RF transceiver.

The WL1251 and WL1253 WiLink 4.0 single-chip solutions are manufactured in 90-nm process technology and extend TI’s leadership in single-chip integrated solutions using TI’s DRP™ technology. Both single-chip solutions are pin-for-pin compatible to simplify manufacturers’ product line strategies for 802.11b/g and 802.11a/b/g products. This compatibility enables just-in-time manufacturing options that are responsive to marketplace demand and design re-use to speed time to market of new products.

The WiLink Software Development Kit (SDK) 4.X included with the WiLink 4.0 platform is optimized for embedded applications. This includes support for Linux®, Windows® WinCE™, Symbian™ operating systems, as well as lab testing and manufacturing software. It is also partitioned to minimize host CPU loading and power consumption in mobile applications.

Key Benefits

- Complete WLAN hardware and software solutions optimized for mobile 802.11b/g, 802.11a/b/g applications
- Single-chip 802.11 Media Access Controller/Baseband/RF transceiver WLAN solutions (WL1251 and WL1253) reduce BOM, save PCB space and extend standby and talk times
- Voice over WLAN (VoWLAN)-ready: Sophisticated power-saving sleep modes match the packet and traffic characteristics of VoWLAN applications
- First WLAN solutions using 90-nm manufacturing process and uses TI’s DRP technology to enable market leading physical size (6 mm x 6 mm BGA) and low power consumption
- Industry’s lowest power consumption with TI’s ELP™ technology extends battery life of handsets, wireless PDAs and other mobile devices
- Bluetooth® coexistence technology ensures high quality of service during simultaneous voice and data WLAN and Bluetooth operations

*Optional: The WL1253FE is only used in conjunction with the WL1253 for 802.11a operation
WLAN and Bluetooth® Coexistence

TI has developed a coexistence solution for simultaneous functionality of 802.11b/g WLAN and Bluetooth® personal area networking in mobile devices. Because 802.11b/g and Bluetooth occupy the same 2.4-GHz ISM range of wireless communications spectrum, their RF signals can cause interference for each other unless a coexistence solution is deployed.

TI’s coexistence package provides intelligent and seamless coordination between TI’s WLAN and Bluetooth technologies at the media access control (MAC) layer. With this level of time domain coordination, no RF isolation is needed between the 802.11 and Bluetooth antennas, simplifying designs and ensuring effective operations in small form factors.

Designed for interoperability and coexistence, TI’s WLAN and Bluetooth single-chip solutions are capable of cost-efficient collaboration and effective coexistence with each other. For instance, WLAN and Bluetooth technologies are able to share the same antenna and antenna filter, reducing bill of materials (BOM) costs and circuit board space. In addition, TI’s WLAN/Bluetooth coexistence technology ensures effective simultaneous operations of voice and data.

Key Benefits
- Simultaneous 802.11 and Bluetooth functionality for data and voice applications
- Hardware and software solution
- Flexibility: supported by TI’s WLAN and Bluetooth single-chip solutions
- Low power consumption for mobile battery-operated platforms
- No RF isolation requirements reduces board space
- Shared antenna design
- Intelligent MAC-layer coordination eliminates performance penalties caused by allocating dedicated bandwidth
- Small footprint ideal for compact handheld devices

Coexistence Solution Architecture
Consumers are becoming accustomed to using global positioning system (GPS) services on handheld devices and are demanding similar functionality on their mobile phone so it is with them at all times. TI’s NL5350 NaviLink™ 5.0 single-chip solution for GPS and assisted GPS (A-GPS) applications is optimized for mobile phones to deliver applications such as mobile navigation, 3D maps, location-based services and safety services.

The NaviLink 5.0 GPS single-chip solution is manufactured in 90-nm process technology and uses TI’s DRP™ technology. Through DRP technology, TI is able to provide the smallest size, lowest cost, low power, and high performance discrete GPS solution to mobile phone manufacturers.

- **Smallest Size**: The NL5350 NaviLink 5.0 solution integrates a complete GPS system into one chip, significantly reducing the board layout area for a discrete GPS engine. The single chip enables a board area for the complete system of around 25 mm².

- **Lowest Cost**: As a single chip the NL5350 only requires 11 external passives, a significant reduction over existing solutions which require up to 30 external passives. This level of integration delivers a total bill of materials that is almost 50 percent less than competition today.

- **Low Power**: The NL5350 NaviLink 5.0 solution has power management integrated on-chip, which simplifies design and further reduces the bill of materials. The single chip also allows direct connect to battery for easy incorporation into mobile phone designs.

- **High Performance**: The NL5350 NaviLink 5.0 solution enables a rapid time to first fix (TTFF) from weak satellite signals exceeding the GPS requirements for 3GPP and 3GPP2 operation.

The NL5350 NaviLink 5.0 single-chip solution is expected to sample in 2Q 2007. Additionally, TI is collaborating with Murata to deliver a small module to handset OEMs to speed time to market of NaviLink solution-based GPS mobile phones.
**NaviLink™ 4.0 GPS Single-Chip Solution**

Global positioning system (GPS) applications are increasing in popularity in mobile phones worldwide for mobile navigation, mapping and safety services. TI’s GPS5300 NaviLink™ 4.0 single-chip solution for assisted global positioning system (A-GPS) and stand-alone GPS applications is optimized for 3G mobile phones.

The NaviLink single-chip solution is manufactured in 90-nm process technology and uses TI’s DRP™ technology. Through DRP technology, TI is able to provide a small size, low cost, low power and high performance discrete A-GPS solution to mobile phone manufacturers.

- **Small Size:** The GPS5300 NaviLink 4.0 solution integrates a complete GPS system into one chip, significantly reducing the board layout area for a discrete A-GPS engine. The single chip enables a board area for the complete system of less than 50 mm².

- **Lowest Cost:** As a single chip the GPS5300 only requires 11 external passives, a significant reduction over existing solutions which require up to 30 external passives.

- **Low Power:** The GPS5300 NaviLink 4.0 solution has power management integrated on-chip, which simplifies design and further reduces the bill-of-materials. The single chip also allows direct connect to battery for easy incorporation into mobile phone designs.

- **High Performance:** The GPS5300 NaviLink 4.0 solution enables a rapid time to first fix (TTFF) from weak satellite signals exceeding the A-GPS requirements for 3GPP and 3GPP2 operation.

To further speed time to market, manufacturers can work with members of TI’s worldwide wireless ecosystem to assist in integrating the NaviLink 4.0 solution into new GPS-enabled handsets. Additionally, TI is collaborating with Murata to deliver a small module to handset OEMs to speed time to market of NaviLink chip-based A-GPS mobile phones.
**Hollywood™ Mobile Single-Chip Solution**

TI's Hollywood™ mobile single chip is the first in the industry to integrate the mobile TV tuner and demodulator into one piece of silicon using standard 90-nm digital process. By using TI's DRP™ technology, the Hollywood solution delivers low cost and long battery life in the smallest board area.

The DTV1000 Hollywood mobile DTV solution supports DVB-H (digital video broadcast - handheld) operating at 470-750 MHz (UHF) and 1.6 GHz (L-band) frequency ranges.

The DTV1000 chip interfaces with TI's family of OMAP™ applications processors and OMAP-Vox™ integrated processor and cellular modem solutions to deliver crisp, clear video and stereo audio, offering consumers the quality of a living room TV-viewing experience in the palm of their hand.

Through TI's innovative DRP technology, the DTV1000 device combines a two-chip or system in package (SIP) solution into a single piece of silicon in standard 90-nm digital process to deliver:

- **Smallest Board Area**: High degree of integration and low ball count has lead to a footprint of less than 1cm² for the entire solution including all passive and power switch components, which is significantly smaller than current solutions that require a separate tuner, demodulator and external memory.

- **Low Part Count and Smaller Bill of Materials**: High integration has lead to a small number of low cost external components driving the estimated bill of materials in volume under $10.

- **Low Power**: Low 1-V RF CMOS process and low power design techniques have resulted in only 30 mW of power consumption for a typical category B DVB-H terminal. Combined with TI’s low power OMAP application processors this can deliver four to seven hours of view time depending on display size and battery rating.

- **Fast time to market**: Significant value-added processing in the DTV1000 results in a simple software driver and API integration package enabling fast time to market.

- **High Performance**: Multiple concurrent television channels (elementary streams) can be supported and fast channel switching times under 1.5 seconds are possible.

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**Key Benefits**

- First mobile DTV single chip solution—integrates RF, demodulator, decoder and memory
- World's smallest footprint package—less than 30 mm² resulting in low-cost BOM
- Low-Power Design—90-nm RF CMOS design, low 1-V core design
- Fast time to market: development platform, operating system agnostic driver and API integration package

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Overview

Texas Instruments provides a broad portfolio of high-performance analog and logic products, plus application knowledge, local technical support and easy-to-use design tools to help you differentiate your handset design and get to market faster. TI's high-performance analog offers the greatest amount of performance and efficiency from the smallest solution size. Visit [www.ti.com/analogportable](http://www.ti.com/analogportable) for data sheets, samples and evaluation modules. Visit [www.ti.com/analoglit](http://www.ti.com/analoglit) for a complete listing of TI literature including guides for Audio, Video, Amplifiers, Data Converters, Interface, Power Management and RF.

### Audio Power Amplifiers - Speaker

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPA2005D1</td>
<td>1.4-W Mono, Fully Diff, Filter-Free Class-D Audio Amp</td>
</tr>
<tr>
<td>TPA2006D1</td>
<td>Similar to TPA2005D1 with 1.8-V Shutdown Logic</td>
</tr>
<tr>
<td>TPA2010D1</td>
<td>2.5-W Mono, Fully Differential, Filter-Free Class-D Audio Amplifier in WCSP</td>
</tr>
<tr>
<td>TPA2032D1</td>
<td>2.75-W Fixed Gain Class-D Audio Amplifier in WCSP</td>
</tr>
<tr>
<td>TPA2012D2</td>
<td>2.1-W Stereo Class-D Audio Amplifier in WCSP</td>
</tr>
<tr>
<td>TPA6203A1</td>
<td>1.25-W Mono, Fully Differential, Class-AB Audio Amp</td>
</tr>
<tr>
<td>TPA6204A1</td>
<td>1.7-W Mono Fully Differential, Class-AB Audio Amp</td>
</tr>
<tr>
<td>TPA6205A1</td>
<td>Similar to TPA6203A1 with 1.8-V Shutdown Logic</td>
</tr>
</tbody>
</table>

### Audio Codecs and DACs

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>TLV320AIC32B</td>
<td>Low-Power Stereo Audio Codec with Headphone Amp</td>
</tr>
<tr>
<td>TLV320DAC23</td>
<td>Low-Power Stereo Audio DAC with Headphone Amp</td>
</tr>
<tr>
<td>TLV320AIC28/29</td>
<td>Low-Power Stereo Audio Codec with Integrated Headphone and Speaker Amps</td>
</tr>
<tr>
<td>TLV320AIC31</td>
<td>Low-Power Stereo Codec with 4 Inputs, 6 Outputs, HP/Speaker Amps, 3D Effects</td>
</tr>
<tr>
<td>TLV320AIC3104</td>
<td>Enhanced AIC31 Functionality without Speaker Amps</td>
</tr>
<tr>
<td>TLV320AIC33</td>
<td>Low-Power Stereo Codec with 6 Inputs, 7 Outputs, HP/Speaker Amps, 3D Effects</td>
</tr>
<tr>
<td>TLV320AIC3106</td>
<td>Enhanced AIC33 Functionality without Speaker Amps</td>
</tr>
</tbody>
</table>

### Audio Power Amplifiers - Headphone

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPA4411</td>
<td>80-mW DirectPath™ Stereo HP Amplifier</td>
</tr>
<tr>
<td>TPA6130A2</td>
<td>138-mW DirectPath™ Stereo HP Amplifier with PC Volume Control</td>
</tr>
<tr>
<td>TPA610xA2</td>
<td>Ultra Low Voltage Stereo Headphone Audio Amp</td>
</tr>
<tr>
<td>TPA611xA2</td>
<td>Stereo Headphone Audio Amplifier</td>
</tr>
</tbody>
</table>

### Video and Interface

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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<tbody>
<tr>
<td>OPA360/1</td>
<td>3-V Video Amplifier with 6db Gain and Filter</td>
</tr>
<tr>
<td>SN65LVD3S01/302</td>
<td>subLVDS 24-bit RGB Serdes for LCD Modules</td>
</tr>
<tr>
<td>SN74AVCA406L</td>
<td>Transceiver for MMC, SD Card, and Memory Stick</td>
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### Touch Screen Controllers

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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<tbody>
<tr>
<td>TSC2003</td>
<td>4-Wire Touch Screen Controller with I2C Interface</td>
</tr>
<tr>
<td>TSC2004/5</td>
<td>4-Wire Pre-Processing TSC with I2C/SPI, 1.5-V to 3.6-V in CSP</td>
</tr>
<tr>
<td>TSC2046</td>
<td>4-Wire Touch Screen Controller with Low-Voltage Digital I/O with Integrated Audio Converters</td>
</tr>
<tr>
<td>TSC2100</td>
<td>Programmable 4-Wire Touch Screen Controller with Stereo Audio Codec and Headphone/Speaker Amplifier</td>
</tr>
<tr>
<td>TSC2101</td>
<td>Programmable 4-Wire Touch Screen Controller with 6 Audio Inputs, Stereo Audio Codec and Headphone/Speaker Amp</td>
</tr>
</tbody>
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Wireless Terminals Solutions Guide

Texas Instruments 2007
### OLED and TFT Display Supplies

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>TPS61140</td>
<td>Dual Output, Single Inductor Boost Converter for OLED Sub- and WLED Main Display</td>
</tr>
<tr>
<td>TPS65110</td>
<td>3-Channel Charge Pump for TFD Displays</td>
</tr>
<tr>
<td>TPS65120</td>
<td>4-Channel Small Form-Factor TFT Display Power Supply</td>
</tr>
<tr>
<td>TPS65130</td>
<td>Dual ± Output Driver for Active-Matrix OLED Displays</td>
</tr>
</tbody>
</table>

### White LED and Xenon Camera Flash

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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<tbody>
<tr>
<td>TPS61058/9</td>
<td>500/700-mA WLED Flash Driver in 3 x 3 QFN</td>
</tr>
<tr>
<td>TPS6552A</td>
<td>Photo Flash Charger for Xenon Lamps</td>
</tr>
</tbody>
</table>

### White LED Backlight Drivers

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPS62230/1</td>
<td>5/3 WLED Charge Pump, Current-Regulated, 125 mA</td>
</tr>
<tr>
<td>TPS6106x</td>
<td>Inductive White LED Driver with Digital and PWM Brightness Control</td>
</tr>
<tr>
<td>TPS61150</td>
<td>Dual Output, Single Inductor Boost Converter for up to 12 WLEDs</td>
</tr>
<tr>
<td>TPS68000</td>
<td>CCFL Controller for Full Bridge Phase Shift Topologies</td>
</tr>
</tbody>
</table>

### Integrated Power Management

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>TPS65020</td>
<td>6-Channel Power Management IC with I2C for Li-Ion Powered Systems</td>
</tr>
<tr>
<td>TPS65800</td>
<td>10-Channel fully integrated Power Management IC with Li-Ion Charger</td>
</tr>
<tr>
<td>TPS75100</td>
<td>2 Bank WLED Driver with PWM Brightness Control for Up to 4 LEDs</td>
</tr>
<tr>
<td>TPS65030</td>
<td>Power Management IC for USG-OTG in CSP</td>
</tr>
<tr>
<td>TPS65040</td>
<td>USB 2.0 High-Speed On-the-Go Local Bus Interface Bridge Controller</td>
</tr>
</tbody>
</table>

### DC/DC Converter and LDO Supplies

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>TPS62220</td>
<td>400-mA, 1.25-MHz Step-Down Converter in Thin SOT-23</td>
</tr>
<tr>
<td>TPS62300</td>
<td>500-mA, 3-MHz, High Accuracy Step-Down DC/DC Converter with 1µH Inductor</td>
</tr>
<tr>
<td>TPS62350</td>
<td>800-mA, 3-Mz Step-Down Converter with I2C for Dynamic Voltage Scaling</td>
</tr>
<tr>
<td>TPS62402/20</td>
<td>Dual, 2.25-MHz Step-Down Converter with 1-Wire Interface (0.4A/0.6A, 0.6A/1A)</td>
</tr>
<tr>
<td>TPS63000</td>
<td>96% 1.2-A Buck-Booster Converter in 3 x 3 QFN</td>
</tr>
<tr>
<td>TPS712xx</td>
<td>Dual 250-mA Output, Ultra-Low-Noise, PSRR LDO</td>
</tr>
<tr>
<td>TPS799xx</td>
<td>200-mA, Low Noise, High PSRR LDO in CSP Package</td>
</tr>
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### Battery Management and Authentication

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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<tbody>
<tr>
<td>bq24020</td>
<td>1-Cell Li-Ion Fully Integrated Charger for AC/DC Adapter and USB</td>
</tr>
<tr>
<td>bq24070</td>
<td>Single-Chip Charge and System Power-Path Management IC</td>
</tr>
<tr>
<td>bq26150</td>
<td>CRC-Based Battery Authentication IC</td>
</tr>
<tr>
<td>bq27000/200</td>
<td>1-Cell Li-Ion Fully Integrated Battery Fuel Gauge with I2C</td>
</tr>
<tr>
<td>TLV3012</td>
<td>Low Battery Detector, 1.8 V to 5.5 V, 6 µs Comparator and 1.242 V 1% Reference, 5 µA Max, SC-70</td>
</tr>
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</table>

### Analog Switches and Logic

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
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<tbody>
<tr>
<td>TSSA23166</td>
<td>0.9-Ohm Dual SPST Analog Switch</td>
</tr>
<tr>
<td>PCA9536</td>
<td>Remote 8-bit I2C and SMBus I/O Expander</td>
</tr>
<tr>
<td>SN74AUP1Gxx</td>
<td>Advanced Ultra-Low Power CMOS Single-Gate Logic</td>
</tr>
</tbody>
</table>