OMAP™ 4 mobile applications platform

TEXAS INSTRUMENTS

Product Bulletin

TI's new OMAP 4 platform supports development of planned features for the Smartphones and MIDs of tomorrow with tremendous performance and programmability to support new applications yet to be imagined.

Texas Instruments' (TI) OMAP™ 4 mobile applications platform will redefine the mobile phone of tomorrow with new, innovative user experiences driven by PC-like web browsing, 1080p full HD video record and playback, intuitive user interfaces, location-based services and next-generation social networking applications. The OMAP 4 platform includes applications processors, a comprehensive software suite, power management technology and supporting components to bring next-generation Smartphones and Mobile Internet Devices (MIDs) to market quickly. The platform is future proof, offering the programmability and performance headroom to support new and emerging applications and standards. Not only will the OMAP 4 platform accelerate time to market and reduce research and development (R&D) time and costs for handset manufacturers, but its flexibility and openness will enable manufacturers to deliver innovative applications at breakthrough mobile computing performance. TI tests the OMAP 4 platform for real-world use cases, accelerating time to market and enabling stunning user experiences.

Overview

At the heart of the OMAP 4 platform is a powerful system-on-chip that includes the perfect balance of power efficiency and high performance. The OMAP 4 processor balances processing across four main engines: a programmable multimedia engine based on TI's C64x DSP and power-efficient, multi-format hardware accelerators; general-purpose processing based on the dual-core ARM® Cortex™-A9 MPCore™ supporting symmetric multiprocessing (SMP) and capable of speeds of more than 1 GHz per core; a high-performance programmable graphics engine; and an Image Signal Processor (ISP) for unparalleled video and imaging performance. The OMAP 4 family includes two applications processors, both based on the dual-core Cortex-A9 MPCore general purpose processors: the OMAP4430 operates at up to 1 GHz, while the OMAP4460 operates at up to 1+ GHz. Both processors offer the full variety of subsystems and applications discussed below to deliver hardware and software system solutions that scale across customer roadmaps optimizing time to market, flexibility and R&D efficiency.

Key Features

- Highly-optimized mobile applications platform including: applications processors, multimedia software and power management to drive Smartphones and MIDs
- IVA 3 accelerator enables full HD 1080p, multi-standard video encode/decode
- Integrated Image Signal Processor (ISP) for faster, higher-quality image and video capture with digital SLR-like 20-megapixel imaging
- Integrated POWERVR™ SGX540 graphics accelerator drives next-generation, 3D user interfaces with larger displays, life-like graphics and intuitive touch screens
- Dual-core ARM® Cortex™-A9 MPCore™ with SMP for higher mobile computing performance and PC-like, no compromise web browsing experience
- Support for leading mobile operating systems including Symbian™, Microsoft® Windows Mobile®, Linux® (Android, LiMo)
- Comprehensive software suite supporting all major mobile OSes that is fully integrated and tested for real-world use cases to reduce development time and costs
- Programmability and performance headroom to support new and emerging applications and standards
- Pre-integrated connectivity solutions from TI's portfolio of WiLink™, BlueLink™ and NaviLink™ mobile connectivity solutions and pre-validated modem interface software to connect with any external modem
- Industry-leading power management and SmartReflex™ 2 technologies delivers more than 10 hours of 1080p HD video playback, 4+ hours of 1080p HD video recording and 140+ hours of CD quality audio playback
- Designed in mobile 45-nm CMOS process technology for less power consumption and increased device performance
- M-Shield™ capability enhanced with ARM TrustZone™ support ensures mobile security
- Packaging: 12 mm x 12 mm, 0.4 mm pitch PoP (Package-on-Package)
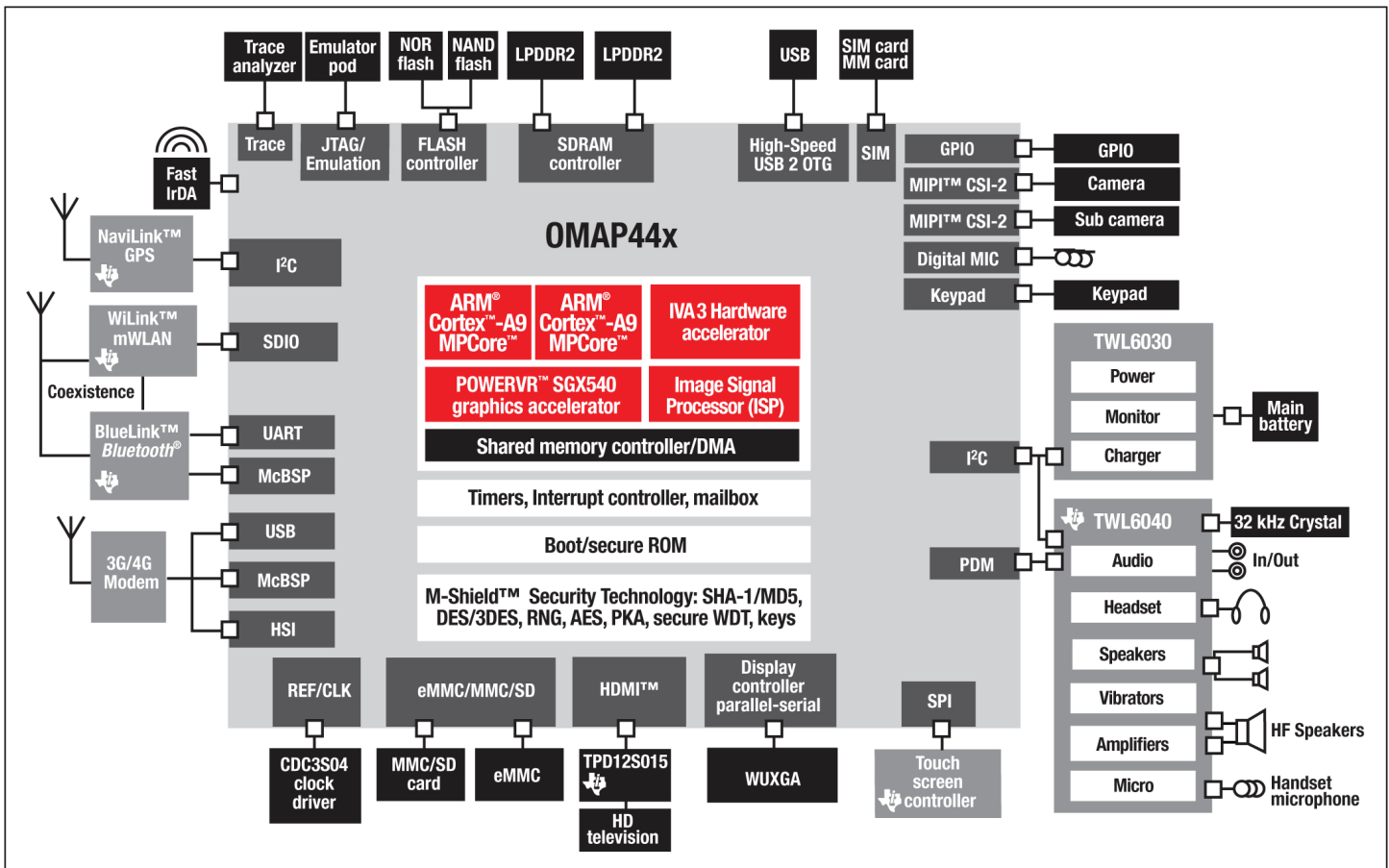
▲ *A OMAP44x system diagram*

OMAP 4 applications processors

The highly optimized OMAP 4 platform includes:

- Industry-leading OMAP 4 applications processors which deliver breakthrough multimedia improvements
- Comprehensive software suite which supports the leading mobile OSes and is integrated and tested for real-world use cases
- Optimized power management technology to maximize battery life
- Pre-integrated, complementary connectivity suite (GPS, WiFi, *Bluetooth* and FM)
- Pre-validated modem interface software to easily connect with any external modem

Device Features

- Dual-core ARM Cortex-A9 MPCore SMP general-purpose processors for higher performance and efficiency
- IVA 3 Hardware accelerator
  - Delivers true 1080p multi-standard HD record and playback with the industry's broadest support for multimedia codecs available today as well as programmability to add support for future codecs
  - Provides support for high de nition stereoscopic 3D encode/decode (OMAP4430: 720p, OMAP4460: 1080p)
- Image Signal Processor (ISP) for high-quality image and video capture, delivering digital SLR-like performance with 20-megapixel still image capture
- Imagination Technologies POWERVR™ SGX540 3D graphics core for stunning 3D user interfaces and high intensity 3D mobile gaming

- Audio back end (ABE) processor provides a virtual low power audio chip for significant power savings
- Flexible system support
  - Composite TV output
  - HDMI v1.3 output to drive HD displays
  - WUXGA display support
  - Peripheral interfaces: MIPI serial camera and serial display interfaces, MIPI® SLIMbus℠, MMC/SD, USB 2.0 On-The-Go High Speed, UART, SPI, and more
- Support for leading mobile OSes: Microsoft Windows Mobile, Symbian and Linux (Android, Limo)
- 45-nm mobile process technology for improved performance and power efficiency
- Optimized power and audio management companion chips: TWL6030 and TWL6040

SMP parallel processing for higher performance and efficiency – TI's OMAP 4 applications processor is one of the first dual-core, ARM Cortex-A9 MPCore based architectures and employs parallel processing for higher performance and efficiency. Handset developers and customers are demanding higher computing performance than single core solutions can offer today, driving the need for SMP-based architectures. But, what exactly is SMP? SMP allows identical processing subsystems to run the same instruction set; have equal access to memory, I/Os and external interrupts; and run a single copy of the operating system to control all the cores. SMP's scalable performance activates only the cores that are needed for that particular process to reduce power consumption or substantially increase performance.

IVA 3 Hardware accelerator – The third-generation IVA on the OMAP 4 applications processor is divided into two sections: a power-optimized, multi-format hardware accelerator for mainstream codecs and a programmable digital signal processor (DSP) based portion for emerging codecs and audio. IVA 3 delivers up to 1080p at 30-frames per second (fps) encode/decode and the broadest support for multimedia codecs available today, including, but not limited to:

- H.264 HP
- MPEG-2 MP
- MPEG4 ASP
- ON2 VP7
- VC-1 AP

IVA 3 enables advanced multimedia performance at low power levels while maintaining the flexibility to allow developers to quickly update devices to address the industry's evolving standards. IVA3 also provides support for High Dfinition stereoscopic 3D encode/decode (OMAP4430: 720p, OMAP4460: 1080p).

Graphics accelerator – Mobile handsets of today are being defined by the user interface and are more graphical than ever before. Handsets must support large screen sizes at higher frames per second while still consuming less power than before. To meet these needs and increase the appeal and marketability of consumer devices, hardware accelerated graphics are needed. TI's OMAP 4 applications processor integrates Imagination Technologies' POWERVR™ SGX540 graphics accelerator core to deliver immersive user interfaces, advanced gaming and rich 3D mapping at 4x the sustained performance compared to the previous SGX530 core.

The OMAP 4 graphics accelerator uses a Tile Based Deferred Rendering (TBDR) architecture to deliver state of the art support for 2D and 3D graphics and supports all the major APIs, including: OpenGL® ES v2.0, OpenGL ES v1.1, OpenVG v1.1 and EGL v1.3. The graphics accelerator is a fully programmable, multi-threaded IP core and provides optimal load balancing with advanced scheduling hardware.
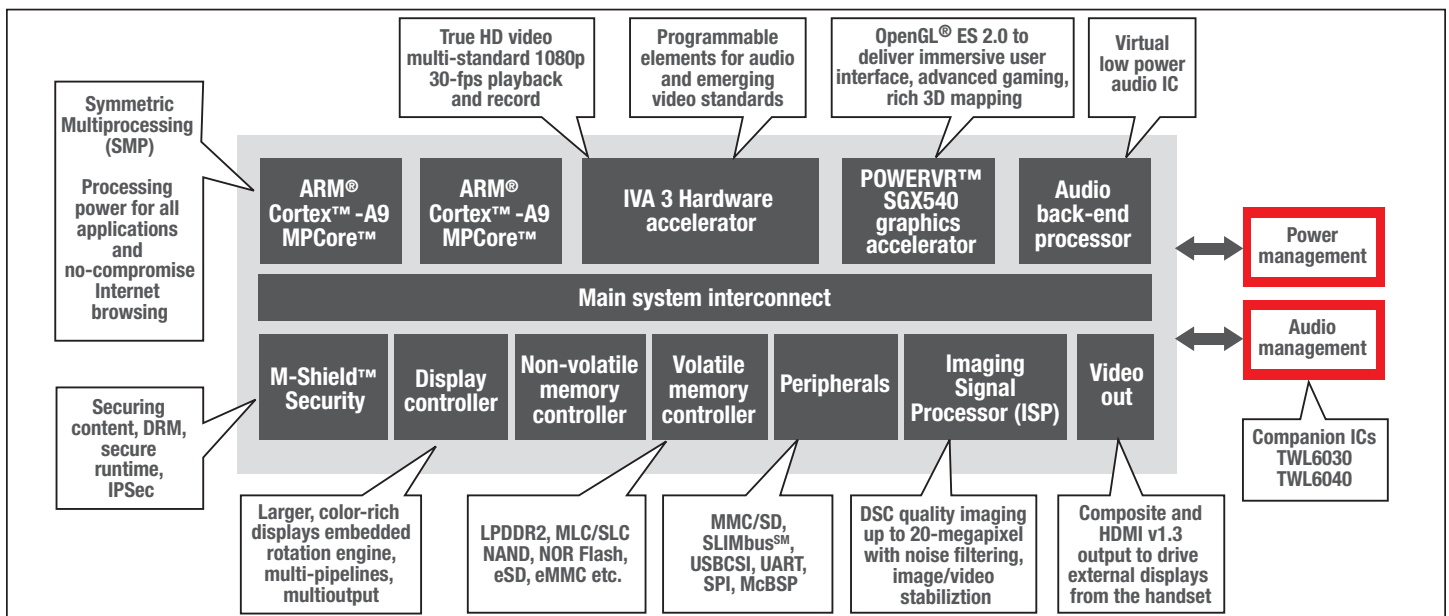
Display sub-system – The OMAP 4 applications processor display sub-system is a flexible multi-pipeline system that supports all displays, including multi-touch, to deliver larger, color-rich viewing of local or external displays. The platform can also interface to MIPI-compliant serial displays as well as parallel displays for use in Smartphones, Tablets and other multimedia-rich mobile devices.

To drive external displays, the OMAP 4 applications processor includes a PAL/NTSC composite output with an integrated 10-bit video digital-to-analog converter (DAC) and video amplifier featuring built-in TV cable detection. An integrated HDMI v1.3 transmitter with High-bandwidth Digital Content Protection (HDCP) and deep color support can drive an external HD display from the handset, making it easy to share multimedia content. The analog and digital TV outputs are mutually exclusive, giving customers full flexibility in choosing their display format.

Imaging sub-system – The OMAP 4 applications processor's imaging sub-system includes a flexible yet powerful image signal processor that is capable of supporting camera sensors up to 20-megapixel resolution at less than one-second shot-to-shot delay, comparable to the best digital still cameras available. The ISP also supports advanced image processing and quality enhancement features such as, but not limited to:

- Digital anti-aliasing
- On-the-fly defect pixel correction
- Lens-distortion correction
- Edge enhancement
- Noise filtering
- Stabilization
- Auto-focus/auto-white balance/ auto-exposure
- Digital zoom

▲ *OMAP44x block diagram*

The OMAP 4 applications processor's ISP is able to capture high quality digital pictures and provide greater design flexibility while saving printed circuit board (PCB) area, design cost and system power.

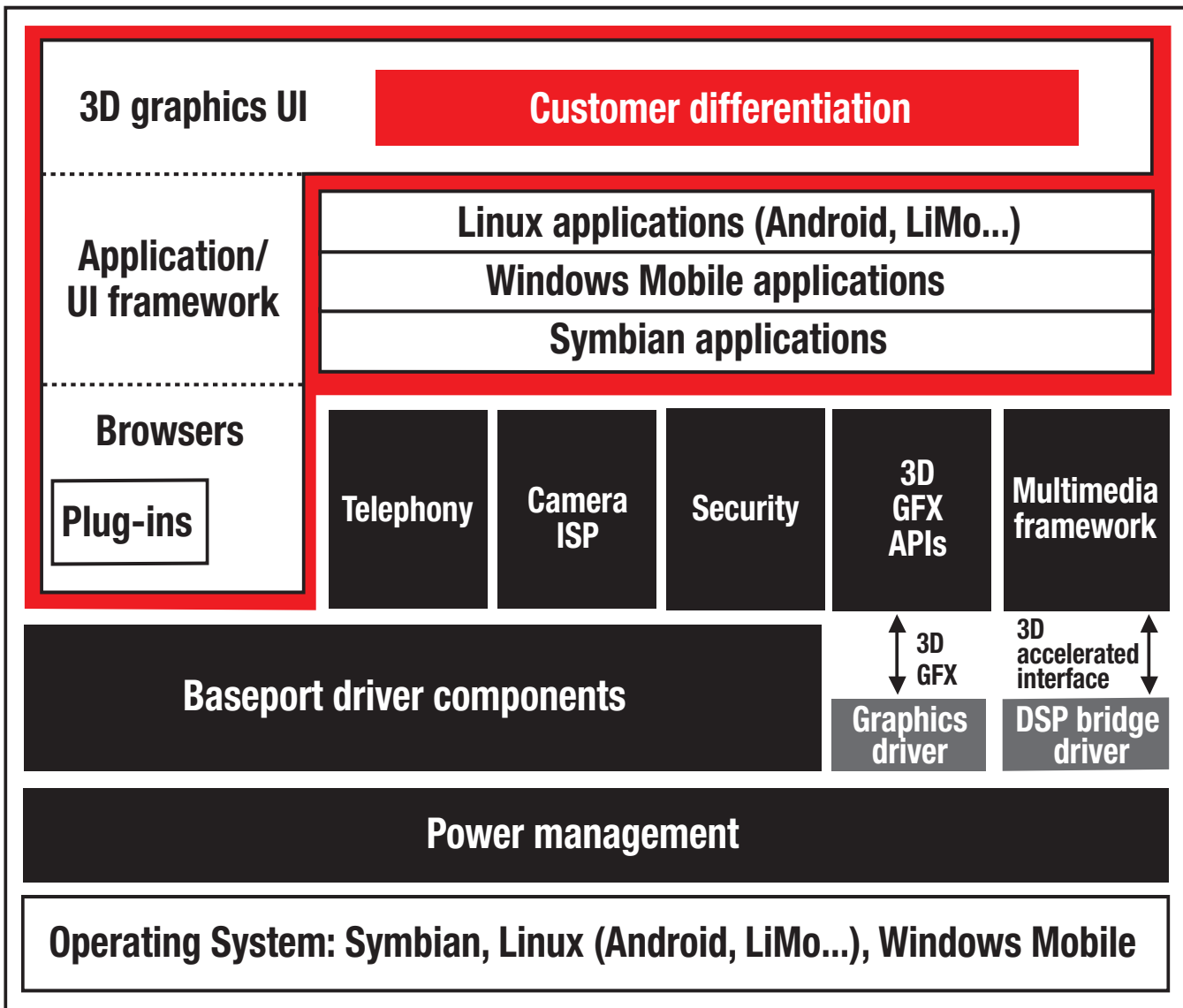## OMAP 4 platform comprehensive software suite

In addition to the OMAP 4 platform hardware, TI also provides a comprehensive software suite that supports the leading mobile OSes and is integrated and tested up to the application level, enabling faster and easier development for end equipment manufacturers and application developers. Additionally, the software platform has been performance and power optimized for the OMAP 4 platforms to ensure the highest performance in customers' products. The software suite allows OEMs and partners to spend their resources on differentiating their product at the user interface and application level while reusing most of the system platform software components directly from TI. The software components include:

- Mobile OS drivers, BSP (board support package) and Base enablers
- Pre-integrated hardware accelerated multimedia codecs with multimedia and UI/Applications frameworks
- Pre-Integrated connectivity (GPS, *Bluetooth*, FM, WiFi) solutions as a single software package with system-level optimizations
- System-level power management
- Integrated 3D graphics and hardware based security framework
- Integrated application suite and UI across multiple OSes

With mature, tested and validated software, handset manufacturers and applications developers will have faster development and will be ensured real-world use cases. Support of multiple mobile OSes on a single platform gives customers the flexibility to address multiple segments of the Smartphone and MID markets with minimal redesign.

▲ *Comprehensive software suite*

Power management architecture

The OMAP 4 platform leverages the most advanced and effective power management techniques in the market. The processors make extensive use of TI's SmartReflex™ 2 power and performance management 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, including:

- Dynamic Voltage and Frequency Scaling (DVFS)
- Adaptive Voltage Scaling (AVS)
- Dynamic Power Switching (DPS)
- Static Leakage Management (SLM)
- Adaptive Body Bias (ABB)
  ○ Forward Body Bias (FBB) for slower devices
 ○ Reverse Body Bias (RBB) for leakage reduction of faster devices

SmartReflex 2 technologies in OMAP 4 platforms minimize chip-level leakage power dissipation at 45 nm allowing the device to have ultra-low active and standby current drain, thereby increasing battery life.

Two companion devices to the OMAP 4 platform, the TWL6030 and TWL6040 power management/audio management, maximize battery life and boost system performance in mobile phones and MID products. The highly integrated TWL6030 and TWL6040 combine SmartReflex 2 technology-compliant voltage regulators and converters, high-fidelity audio/voice codecs, class-AB/D audio amplifiers, battery charger circuitry and more onto two chips – increasing flexibility, reducing board space and system cost while managing power consumption efficiently.

The Audio Back-End (ABE) processor

acts as a virtual audio chip within the OMAP 4 applications processor. This small, always-on power island is used during audio playback to provide system-level optimization delivering over 140 hours of music playback time.

Memory management – In order to support the OMAP 4 applications processors' performance improvements, support for high-bandwidth volatile and non-volatile memory interfaces have been integrated into the OMAP architecture to allow for 1080p video performance with concurrent system activity. OMAP 4 applications processors include support for memory technologies such as
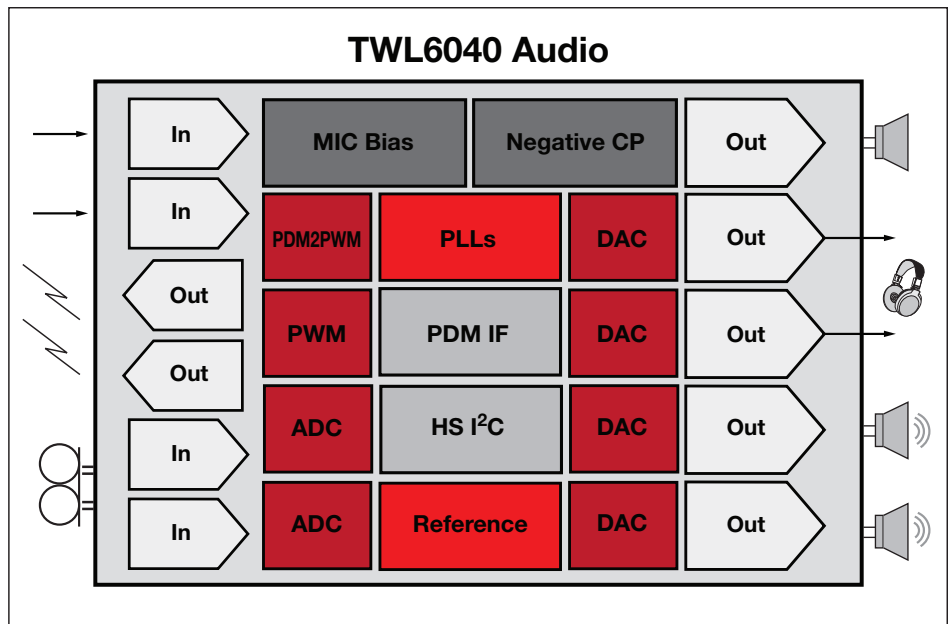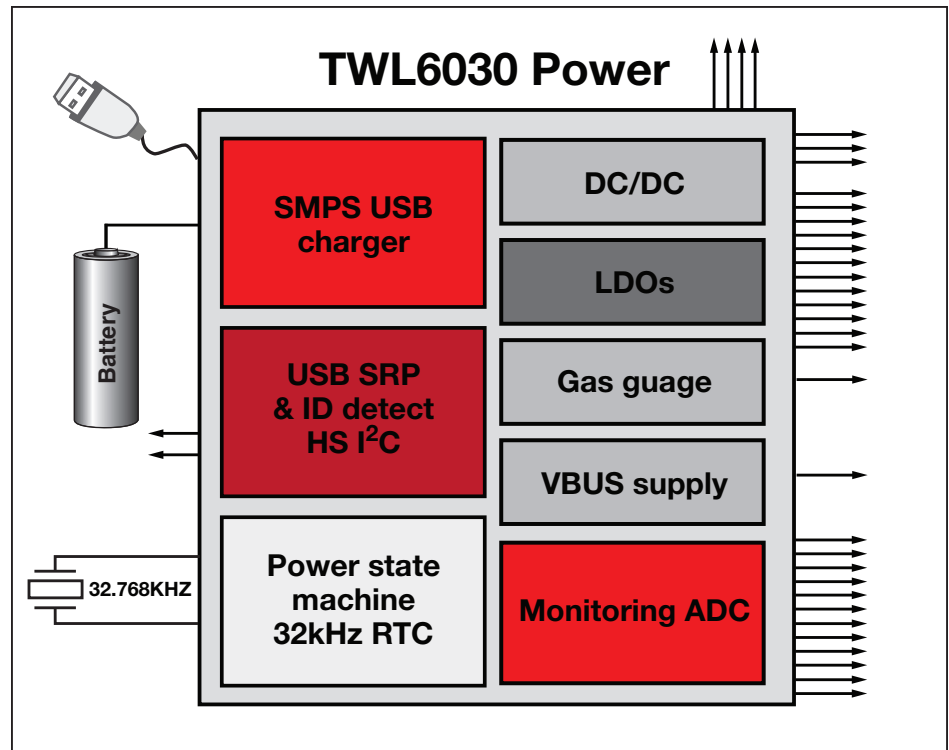
LPDDR2 – embedded SD (eSD), embedded MMC (eMMC) and NOR Flash – while a powerful DRAM memory manager and virtual memory managers provide bandwidth optimization for improved system performance.

OMAP 4 platform security

TI's M-Shield™ mobile security technology enables robust protection of premium copyrighted digital media content, secure protocol applications and e-commerce applications such as ticketing, banking, brokering and shopping. The OMAP 4 platform security offering is based on open APIs and provides an environment for secure applications that deliver robust performance, interoperability, greater development speed and large economies of scale.

As the advanced hardware and software security framework for the OMAP 4 platform, M-Shield technology enables value-added services and increased terminal security, allowing operators, content providers and manufacturers to secure sensitive assets and usage rights for protection against revenue loss.

Features include secure flashing and booting, so that only authorized software can be loaded on the handset, terminal identity protection that makes stolen phones useless, and network lock protection that prevents users from arbitrarily switching networks on the Web.

OMAP 4 platform HLOS support

The OMAP 4 platform supports the leading mobile high-level operating system (HLOS) platforms, including Microsoft Windows Mobile, Android, Symbian and Linux (Android, LiMo). HLOS platforms enable manufacturers and mobile operators to differentiate their products through an easy-to-use, customizable interface and robust, flexible architecture for applications and services. TI was the first wireless system vendor to offer all major HLOS platforms on mobile handsets. As a result, the great majority of smart phones running HLOS today are based on the OMAP platform.

Complete systems expertise

TI's pre-integrated, proven wireless connectivity solutions ensure multi-mode operation and access to a variety of wireless network connections for service any time and anywhere on a variety of wireless networks.

TI's highly integrated BlueLink™ *Bluetooth*® technology, mobile WiLink™ WLAN and NaviLink™GPS are developed with full understanding of the complete mobile phone system to give handset manufacturers a distinct competitive advantage.

Additionally, TI offers a broad portfolio of complementary hardware solutions optimized for the OMAP 4 platform, including: DLP® Pico projection technology, analog components, embedded processors and logic solutions.

In-depth development support

The OMAP 4 platform is backed by TI's extensive development support. Code compatibility with other OMAP processors makes it easy to port software and a sophisticated development environment speeds programming for all on-chip processors. In addition, the OMAP 4 platform is supported by the OMAP ecosystem, comprised of the OMAP Developers Network and OMAP Technology Centers (OTCs), as well as systems integrators, development tool providers and leading content providers worldwide. The OTC program has been extended to include support for TI's WiLink WiFi BlueLink *Bluetooth* technology as well as NaviLink™ GPS solutions.

TI's OTC program provides a system-level approach with support for the OMAP platform and non-cellular wireless solutions to give handset manufacturers and developers access to a broad range of wireless systems expertise. Information about the independent OMAP Technology Centers (OTCs), TI's extensive network of specialized system integrators skilled in all aspects of HLOS porting and integration is available at **www.ti.com/wireless**

Availability disclaimer – The OMAP 4 platforms are intended for high-volume OEMs and ODMs and are not available through distributors. If your company meets this description, please contact your TI sales representative.

For more information

To learn more about the OMAP 4 platform, including the OMAP4430 and the OMAP4460 platforms, or about other OMAP applications processors from TI, visit **www.ti.com/omap4**.

Key features at a glance

	OMAP 4430	OMAP4460
Process node	45nm	45nm
ARM® Cortex™-A9 Clock Speed (two)	1 GHz	1.5 GHz
2D & 3D Graphics	Hardware accelerated	Hardware accelerated
Video performance (2D)	1080p HD	1080p HD
Video performance (3D)	720p stereoscopic 3D	1080 p stereoscopic 3D
Imaging Performance (per second)	20 MP main camera 5MP stereo (dual cameras)	20MP main camera 12 MP stereo (dual cameras)
Availability	Currently sampling	Samples in 1Q 2011

Please note: OMAP™ 4 processors are intended for manufacturers of Smartphones and other mobile devices.

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