

Single-chip processor platforms deliver on power/performance balance for mobile devices

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As with every new technology, delivering LTE chipsets presents many technical challenges. Performance, power and price are key concerns. Higher data rates, such as LTE Cat4 with up to 150Mbps download speeds, require very high performance computing, which is achieved mostly through higher clock rates and more powerful DSP technologies. However, this results in higher power consumption, and therefore a short battery life and an often less-than-optimal user experience. To enable mobile devices to achieve the high transmission speeds that LTE offers, many of the LTE products available on the market today are based on multi-chip architectures. In these architectures, the LTE component is added as a separate modem to an existing chipset – effectively sandwiching two modems together. While this is a relatively fast route to market for LTE chips, this method does of course increase the cost of the device compared to today's 2G/3G single-chip communication processors. Furthermore, creating a separate modem requires a great deal of energy and additional board space. Just like the first 3G phones, the first LTE devices are expensive, relatively large and consume more energy than their predecessors.

The challenge: To drastically reduce the chipset cost for LTE solutions while remaining energy conscious. The approach: Leveraging highly integrated system on chip (SoC) technology based on the latest process technologies. For example, the Renesas Mobile MP5232 chipset was designed to meet the rigorous requirements of the volume market for full-featured LTE smartphones. The industry's first highly integrated LTE Smartphone platform is based on the MP5232 single-chip communication processor (see Figure 1), which integrates Renesas Mobile's 2G/3G/LTE multi-mode modem technology with a modern multi-core application processor and unique power saving technologies onto a single die.

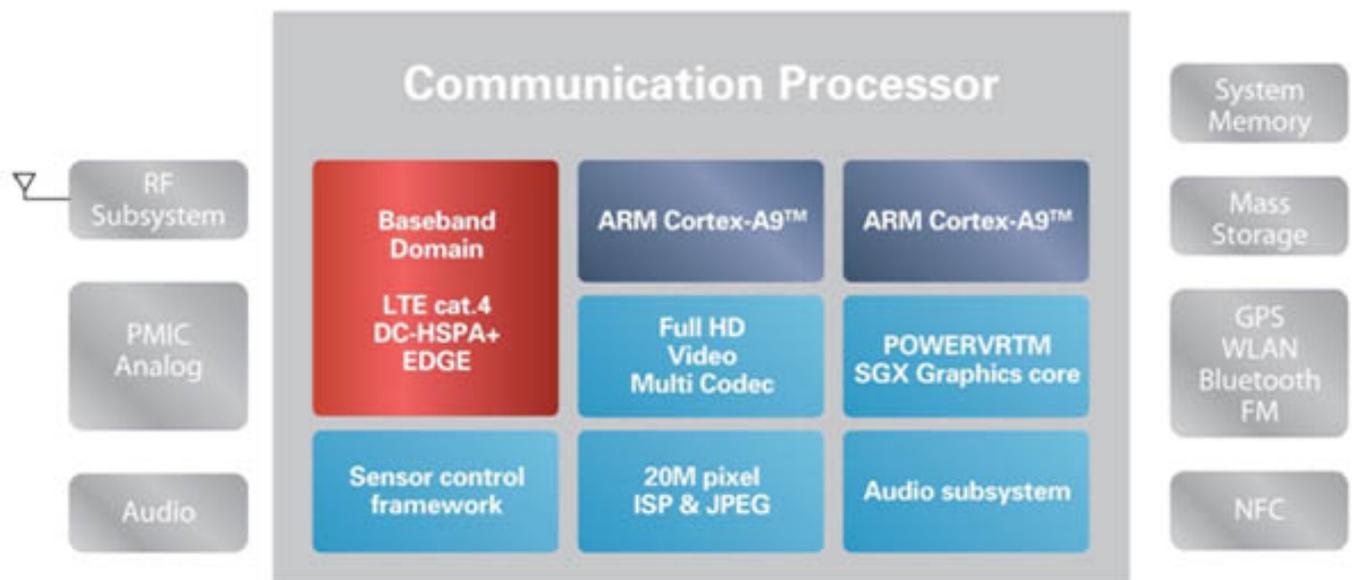


Figure 1. MP5232 single-chip communications processor diagram. Source: Renesas Mobile Corporation.

Energy-conscious, enhanced performance

A high level of integration, the use of advanced technologies and a very well thought out architecture are important elements for reducing costs while maintaining performance. For instance, a single-chip LTE platform with an integrated FDD/TDD Cat4-capable modem can support data rates of up to 150 Mbps in the downlink and 50Mbps uplink. Comparing this to today's state-of-the-art HSPA+ smartphones, which offer 21Mbps downlink speeds, this will enable users to download emails or web pages approximately 7 times faster than they can today. If this can be achieved with the same or better power efficiency, one can clearly see the customer benefits of transitioning to the new LTE technologies.

Application processors that support symmetric multi-core processing (SMP) enhance the mobile computing experience by enabling PC-like web browsing, higher mobile computing performance and faster user interfaces. The SMP scalable performance activates only the cores and the level of performance needed for particular use cases, hence, balancing processing performance and power efficiency.

Multimedia features including full-HD 1080p multi-format video, up to 20 megapixel camera support, and stereoscopic 3D (S3D) video provide an enhanced user experience similar to applications usually found in high-end digital still or video cameras. Improved graphics acceleration for compelling graphics interfaces, support for multiple displays and larger screen sizes at higher frames per second also bring game console-like performance to smartphones for gaming on the go.

Taking a fresh look at memory architecture can help address cost and power consumption issues. For instance, most of today's chipset architectures require a high memory bandwidth to an external LPDDR2 memory, typically implementing a dual-channel interface, to support compelling multimedia use cases and the high performance requirements for application processing and cellular data processing. The MP5232, instead, is based on a unique internal bus architecture implementing an additional cache memory to reduce access to the external memory. This enables the chipset to support the most performance-intensive multimedia use cases with

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minimal power consumption and a single-channel LPDDR2 memory interface.

On-chip support for multiple connectivity peripherals, such as WLAN, Bluetooth, GPS, FM and NFC, provides greater interoperability options for users who typically access their applications from a variety of locations.

As engineers face increasing design demands with decreasing development time and resources, reference boards also play an important role in helping teams accelerate the development of their mobile phones. Single-chip LTE platforms, like the Renesas MP5232 platform, offer OEM customers the flexibility to choose the functionality best suited for their target market segment. Reference boards are also pre-certified and tested for operator acceptance, which helps to drastically reduce development times for quicker time to market. This enables mobile device manufacturers to develop LTE devices at an attractive price point with clear competitive differentiation.



Figure 2. Components of the MP5232 platform are integrated into a smartphone reference design. Source: Renesas Mobile Corporation.

The benefits of a LTE single-chip platform offer a compelling approach for designers who are considering the move to mid-tier handsets. High-power computing with low power consumption support user expectations for their mobile devices while keeping the holy grail of long battery life in mind. The integrated platform approach also helps to reduce the bill of materials, decreasing hardware costs and allowing

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for a smaller, thinner profile device. Reference boards provide additional support for teams stretched to the limit but looking for ways to improve their design projects and speed time to market.

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