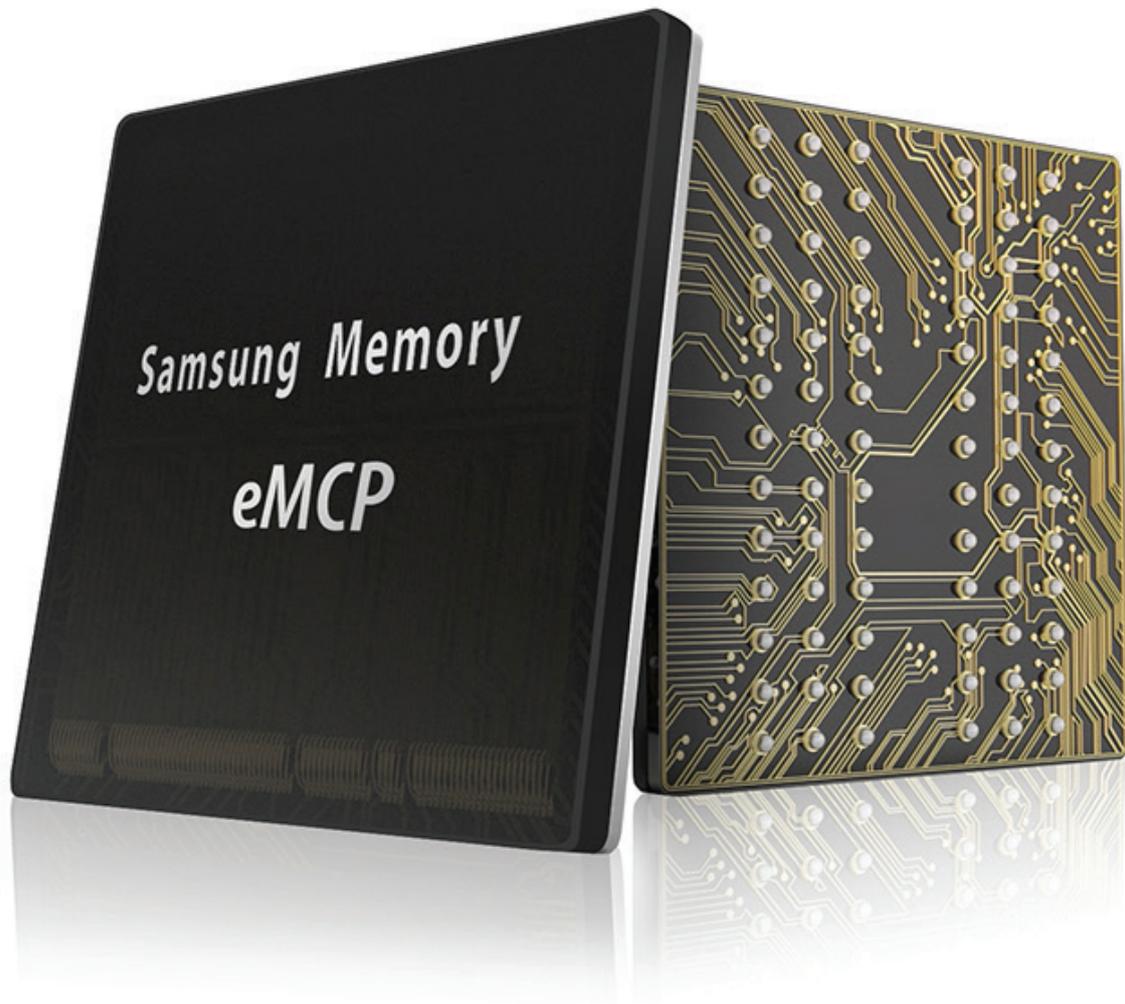


Samsung eMCP

Samsung Multi-Chip Packages can help reduce the time to market for handheld devices

Samsung
MEMORY
eMCP
activated



WLI DDP Package

Deliver innovative portable devices more quickly.

Offer higher performance for a rapidly evolving market

Companies that make and sell smartphones, digital cameras, tablet computers, portable media players (PMPs) and other portable, handheld products face many significant challenges.

Mobile device users expect those devices to accomplish a growing array of functions, such as high-definition video playback and multitasking. Those devices are expected to operate at increasingly faster speeds with higher-density displays. As wireless Internet usage grows, analysts report that data traffic has been doubling every year, requiring a higher-speed network.

In this evolving environment, the marketplace for portable devices continues to grow globally amid intense competition. To succeed, in this demanding arena, manufacturers must constantly improve performance and offer devices that operate at increasingly faster speeds. They also need to pack more memory into smaller spaces. Most importantly, manufacturers must find new ways to reduce the time to market.

Samsung Multi-Chip Packages (MCPs) comprise stacks of discrete memory die combined into single packages. Samsung offers a broad selection of leading-edge memory technologies on a single Printed Circuit Board (PCB).

These technologies include NAND Flash; embedded multi-media card (eMMC); LPDDR1 and LPDDR2 platforms. Device makers can choose among many memory configurations, most with multiple dies.



Figure 1. Handheld mobile devices represent a growing market

Samsung MCPs provide:

- **Higher power.** Samsung MCPs combine different capacities of volatile (RAM) and nonvolatile (ROM) memory in a closely positioned, tightly coupled design. This combination results in a significant performance boost for the memory and the overall system.
- **Improved energy savings.** Many Samsung MCPs use low-power memory technology combining Flash and DRAM, which consumes less energy as it extends battery life.
- **Greater compactness.** The “chip-stack” design of Samsung MCPs saves up to 40 percent of space on memory boards, based on internal Samsung tests.
- **Added stability.** As an in-house supplier of DRAM and Flash memory, Samsung provides more support for product development.
- **Improved efficiency.** Vendors can integrate MCPs from a single supplier into the overall system design more quickly. As a result, less time and fewer resources are needed to interface multiple memory devices with different timing parameters.
- **Faster time to market.** Integrating Samsung MCP memory modules into the system helps manufacturers develop and ship products faster.

Incorporate the latest technology using standardized packages.

Strengthen product offerings with higher memory performance

MCPs enhance products that require high density, small form factor, low electric power consumption and thermal stability. Using Samsung MCPs helps device makers manufacture those products more easily.

Samsung, a global leader in wafer thinning, die stacking and wire bonding, manufactures the memory chips used in its MCPs. As a result, Samsung MCPs provide:

- Tight coupling and close positioning of memory modules to shorten interconnections, which enhances memory and overall system performance
- Memory devices connected using multiple techniques, such as die-to-die bonding and die-to-frame bonding within the substrate
- Various package formats, including Quad Flat Package (QFP), Fine-Pitch Ball Grid Array (FBGA) and Chip Scale Package (CSP)
- Lead frame and Ball Grid Array (BGA) substrate
- Advanced process technologies, including 30 nm class DRAM chips currently
- MCPs in a broad range of configurations
- A combination of faster embedded MCPs (eMCPs), along with either LPDDR1 or LPDDR2 memory
- Leading-edge techniques, including wafer thinning, laser sawing and Redistributed Layer Technology (RLT)

Samsung low-power Flash and DRAM technology lengthens battery life

Samsung MCPs using LPDDR1 or LPDDR 2 speed the processes of powering up, self-refreshing and exiting to active command. Environmental benefits of using Samsung Mobile DRAM chips include:

- Lower power consumption in standby mode with Temperature-Compensated Self-Refresh (TCSR)
- Longer battery life in operational mode, with power consumption as low as 1.2 V, and up to an additional 45 minutes for a 7-hour battery
- Reduced current leakage while maintaining the same clock frequency
- Quicker adoption of innovations such as the Samsung new 30 nm class LPDDR3, offering higher peak bandwidth and improved energy efficiency

Enhance device design by reducing memory board space

Samsung pioneered stacking memory modules in a vertical configuration. It has developed MCP technology at thicknesses as low as 1 mm (0.039 in.).

Currently, ME MCP, applied with 64 GB eMMC and LPDDR2 8 GB DRAM, supports a package size of 12 mm x 16 mm (0.47 in. x 0.63 in.). However, in 2013, it will support a package size of 11.5 mm x 13 mm (0.45 in. x 0.51 in.).

Samsung tests show that combined with high-density chip-stacking, these innovations reduce the space required for memory by an average of 30 to 40 percent. Less space required for memory means a more compact design for various handheld products, including:

- Voice over Internet Protocol (VoIP) phones
- Still and video cameras
- Tablets
- PMPs
- Personal digital assistants (PDAs)
- Global positioning system (GPS) locators
- Game-playing devices

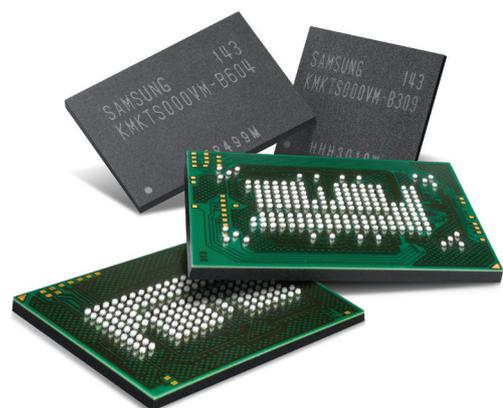


Figure 2. LPDDR2-based MCP chips

Answer changing demands by relying on an industry leader.

Improve time to market with tested, in-house supply capabilities

In the fast-moving environment, an industry leader like Samsung offers many advantages to device makers seeking to improve their growing spectrum of handheld products. Samsung MCPs assist in answering the industry's foremost challenges.

Simplicity

Working with one supplier lowers the bill-of-materials count, which helps simplify manufacturing and increase cost savings.

Standardization

Samsung's standardized packages include Package on Package (POP), System in Package (SIP), Through Silicon Via (TSV), Dual Die Package (DDP) and Quad Die Package (QDP). With these standardized packages, manufacturers can more easily scale among different MCP combinations.

Validation

Leading device makers have tested and validated the quality and efficacy of Samsung DRAM and Flash MCPs in enhancing device performance and memory. Several major application providers are also participating in the chipset validation process.

Compatibility

Samsung MCP technology is compatible with previous Samsung memory technology.

Growth

The usage of mobile devices including smartphones, tablets, and laptops are on the rise. Manufacturers of various types of portable and advanced consumer electronic devices can benefit from MCP memory.

Speed

Developers can integrate Samsung MCP memory modules into new designs with little delay and reduce their time to market.

Features and benefits

Features	Benefits
Tightly coupled higher-power chips	The combination significantly enhances memory performance.
Combined Flash and DRAM low-power technology	The combination consumes less energy and extends battery life.
Chip-stack design	Based on internal Samsung tests, the design can save up to 40 percent of space on memory boards.
Samsung in-house production of Flash and DRAM memory components	Working with a single supplier can decrease the time to market and provide more stability for product development.

Develop new products more quickly.

Move ahead of the competition in the mobile market

The market for portable, handheld devices and the multitude of applications developed for those devices are expanding. This evolution generates constant pressure for faster, higher-performing, better-designed products. In such a demanding environment, manufacturers need every advantage possible to survive and thrive.

Samsung has been leading the global memory chip market and Samsung MCPs offer many benefits to help device makers succeed such as:

- Robust performance, including extended battery life, for the growing range of mobile portable devices in use today and on the horizon for tomorrow
- Chip-stack technology that reduces the space required for memory and lowers the cost of integrating chips into evolving technology
- Standardized, tested and scalable components that reduce the time to market

MCPs from Samsung, the world's leading memory supplier, help reduce the time needed to introduce innovative mobile devices.

The Class 100 eMCP is the eMCP solution for smartphones, which includes an eMMC and LPDDR1/LPDDR2 lineup. Supported DRAM densities are 2 Gb, 4 Gb, 6 Gb and 8 Gb. Samsung's readiness for a full lineup helps deliver a faster time to market.

Specifications

Class 100 eMCP	Density Combination	Part number	Package size
LPDDR1based	eMMC 4GB + LPDDR1 4Gb	KMS5U000KM-B308	153B, 11.5 mm x 13 mm x 1 mmt
	eMMC 4GB + LPDDR1 6Gb	KMJ5U000WA-B409	153B, 11.5 mm x 13 mm x 1 mmt
	eMMC 4GB + LPDDR1 8Gb	KML5U000HM-B505	153B, 11.5 mm x 13 mm x 1.2 mmt
LPDDR 2 based	eMMC 2GB + LPDDR2 2Gb(x32 bit)	KMN9U000RM-B205	162B, 11.5 mm x 13 mm x 1 mmt
	eMMC 4GB + LPDDR2 4Gb(x16 bit)	KMN5U000FM-B203	162B, 11.5 mm x 13 mm x 1 mmt
	eMMC 4GB + LPDDR2 4Gb(x32 bit)	KMN5U000ZM-B203	162B, 11.5 mm x 13 mm x 1 mmt
	eMMC 4GB + LPDDR2 8Gb(x32 bit)	KMK5U000VM-B309	162B, 11.5 mm x 13 mm x 1 mmt

Legal and additional information

About Samsung Electronics Co., Ltd.

Samsung Electronics Co., Ltd. is a global leader in semiconductor, telecommunication, digital media and digital convergence technologies with 2011 consolidated sales of US\$143.1 billion. Employing approximately 222,000 people in 205 offices across 71 countries, the company operates two separate organizations to coordinate its nine independent business units: Digital Media & Communications, comprising Visual Display, Mobile Communications, Telecommunication Systems, Digital Appliances, IT Solutions, and Digital Imaging; and Device Solutions, consisting of Memory, System LSI and LCD. Recognized for its industry-leading performance across a range of economic, environmental and social criteria, Samsung Electronics was named the world's most sustainable technology company in the 2011 Dow Jones Sustainability Index. For more information, please visit www.samsung.com.



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For more information

For more information about Samsung Multi-Chip Packages, visit www.samsung.com/semiconductor.

