Micron® P5Q Serial PCM Innovates System Designs for Smart Grid Products

A Micron & Singhang Elec-Tech Co., Ltd., Case Study

About Singhang and Smart Grids

Founded in 1996, Shenzhen Singhang Elec-Tech is a young and dynamic, joint-stock, high-tech, enterprise authorized by Shenzhen China municipal government. Integrating R&D, manufacturing, and sales and service, Singhang provides products—including smart meters—and IT services for the electricity sector and related industries.

Smart grids are being promoted by many governments as a way to modernize electricity transmission and distribution. Smart grids, typically through the use of smart meters, help save energy and money by enabling improved response to power demand, more intelligent management of outages, and better integration of renewable forms of energy.

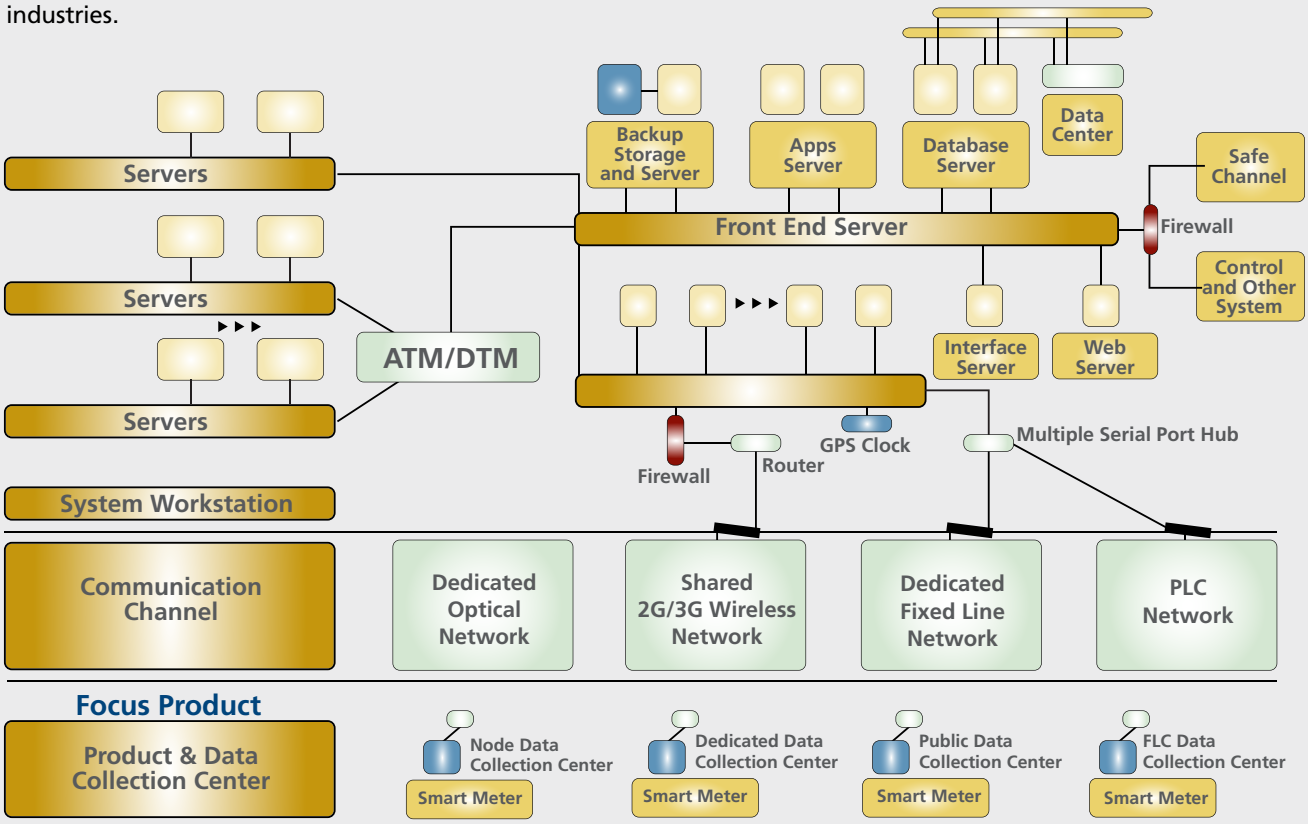

Figure 1: China Smart Grid Architecture

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China and other countries started the massive deployment of smart grids in 2009. Singhang responded by successfully developing several high-tech smart grid products, including electronic kilowatt hour meters, remote AMR systems, electric power marketing management systems, information management systems for power supply enterprises, and field management and public transformer area management systems.

Smart Grid Design Requirements Present Challenges

Given the depth and breadth of its product families, Singhang understood the specific memory system requirements associated with smart grids, as well as the cost sensitivity.

Two of the more challenging application requirements Singhang wanted to account for as they developed a new smart grid design were power loss and cycling. With smart grids, when the power is off, the memory needs to be written immediately with backup power support. If backup power takes the form of a large capacitor, it can only keep power on for approximately 100 milliseconds; but some bits need to be written more than twice. Consequently, SingHang was looking for a memory solution that met their needs for bit alterability (overwrite capability) and write speed.

Another important performance requirement for Singhang was write cycling, which refers to the total electricity consumption number. In smart grids, total electricity consumption numbers must be periodically updated and accessed within minutes and, in some cases, even seconds, which requires high write and read cycling performance.

Singhang was aware of an existing memory solution that could meet their basic smart grid design requirements, but it had drawbacks. It required three chips and a large capacitor as backup power. It required three serial interfaces, which would put constraints on the MCU SPI. Plus, in terms of supply chain management, there were simply too many parts and vendors to deal with.

The figure below shows an example of an implementation of the known solution. A combination of three memory chips—NOR, EEPROM, and RAM—was needed to deliver the required cost-effective high density (greater than 16Mb), bit alterability, write endurance, and write speed.

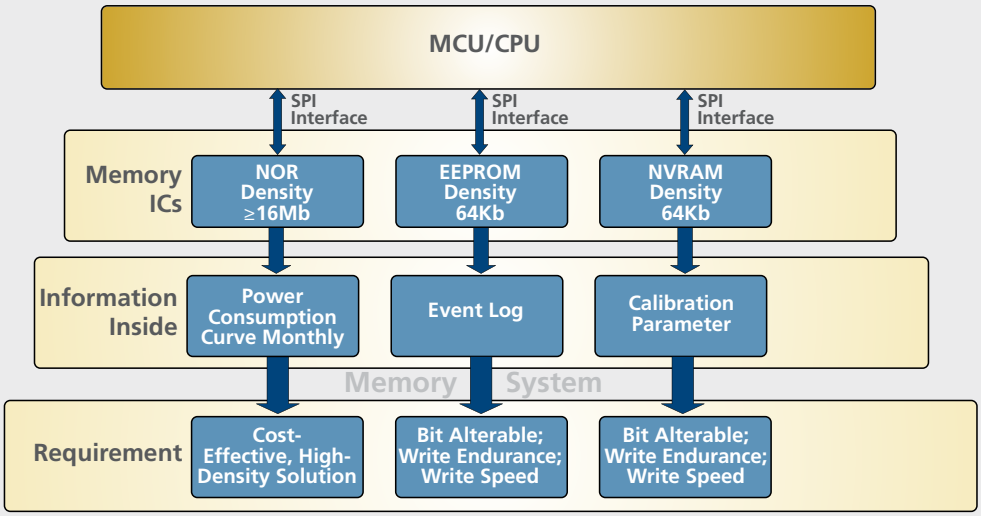

Figure 2: Smart Grid Memory System with Existing Solution

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Singhang Sets Their Sights on a Single-Chip Memory Solution

Because memory system cost was such a large percent of the their total BOM cost, Singhang wanted to consider other options and find a balanced solution that was cost competitive while meeting the most demanding application requirements.

Singhang had learned about PCM technology from Micron's online webinars. The webinars addressed their initial questions, but they needed more detail to know for sure whether PCM was right for their new smart grid design. They followed up with Micron's regional distributor, Rico Lok from Dragon, and with Micron's field applications engineer, Zou Strong, to get more specific information and discuss their design requirements.

Rico and Strong both played critical roles, working hands-on with Singhang's system design and verifying technical details such as voltage and I/O. Micron also brought in Frank Liu, their Embedded Systems Group business development manager, who helped identify the specific P5Q serial PCM solution and provided onsite support to develop P5Q software.

Frank said, "We were very happy to meet with Singhang to discuss how the P5Q could help innovate their product design. We are looking forward to supporting them and other smart grid customers. We are proud to enable products that save energy and better protect our earth."

Micron Phase Change Memory

Micron's P5Q serial PCM combines the best attributes of NOR, NAND, and RAM to provide unprecedented capabilities in a single, nonvolatile memory chip.

The P5Q offers a straightforward serial interface that is ideal for high-density SPI architectures. It simplifies design, improves system performance, and extends the capabilities of a wide variety of applications, including smart grids.

According to Mr. Lu, Singhang's vice manager of R&D, "Micron's P5Q serial PCM product completely meets our application requirement. It solves the cost issue as well as the other design/performance challenges we were facing. I am happy to see our first product with P5Q in mass production now and look forward to working with Micron on future business."

The following chart compares Micron's P5Q device versus the previous (or existing) solution, highlighting the P5Q's benefits, including cost-effective high density, bit alterability, write speed, and cycling. The system architecture is simplified, and the P5Q delivers all the customer requirements in a single-chip solution.

Figure 3: MIcron's P5Q Serial PCM

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Requirement	*Existing Solution*	*P5Q*	*P5Q Benefit*
Cost Effectiveness	Three components: • Serial NOR • EEPROM • NVRAM Backup Power: • Large capacitor	Single component: 128Mb P5Q Backup Power: Small capacitor	Cost-effective solution with BOM consolidation
System Complexity	3 SPI required; 10 MHz MAX CLK support	1 SPI interface required; 66 MHz MAX	Simplified system design
Bit Alterable	NOR – No (erase first) EEPROM – Yes NVRAM – Yes	Yes	Easier data manipulation
Write Cycling	NOR: 100K EEPROM: 1 million NVRAM: >1 million	1 million	High endurance
Write Speed (for 256 bytes)	NOR: 0.5-1s (write + erase required) EEPROM: 1–5ms NVRAM: ~0.1ms	0.2ms	High write performance, smaller capacitor

Table 1: Comparison of Existing Solution vs. New PCM Solution

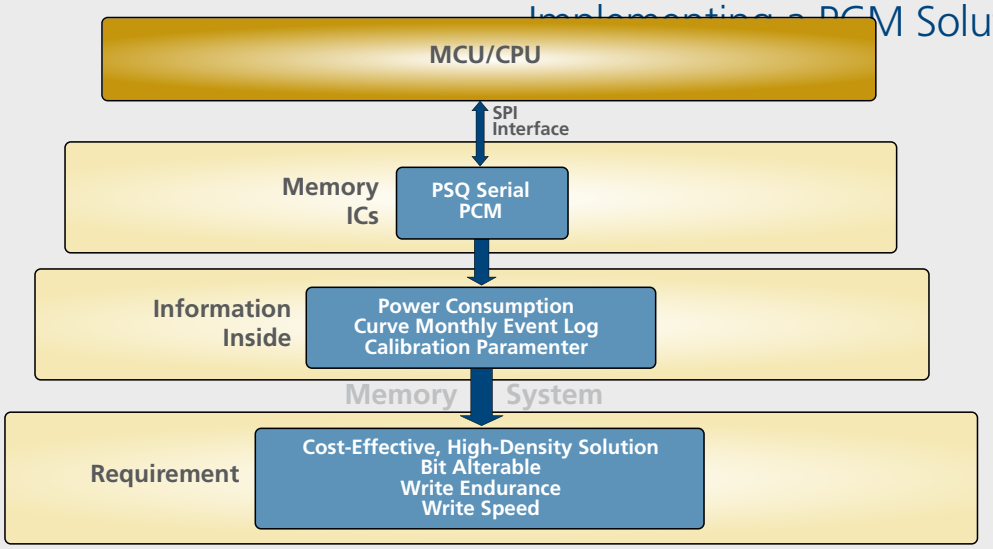

Figure 4: Smart Grid Memory System with PCM

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Micron's P5Q serial PCM opens the door to new, innovative memory system designs for smart grid products. For Singhang, it took the form of their DJGL23-SH298 data transmission terminal—an intelligent data collection hub that communicates and consolidates data for groups of smart meters (single phase and three phase) and then transfers that data into the upper level data management system and ultimately, the electric company data base and management system.

With Micron's consistent commitment to innovation and PCM development, this is just one of many exciting opportunities to help customers like Singhang maximize the performance of their design.

For a printable PDF of this information, download the Micron/SingHang Case Study. <INCLUDE LINK>

Figure 5: Data Collection Hub for Smart Grid by Singhang

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