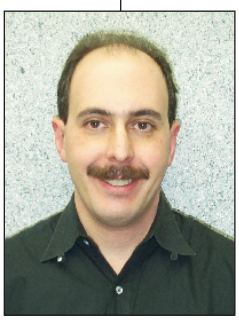
by **Mike Alwais** | Ramtron International

SATISFYING THE GROWING DEMAND FOR DATA STORAGE

Non-volatile memories store information without applied power. Uses for non-volatile memory can be divided into three categories: program or firmware storage, configuration storage and data storage. There are several differences in the character of these applications. For the purpose of selecting memory technology, however, the most relevant distinction is how the information changes.



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In program or firmware storage applications, programs are static and the memory is used as a read-only device. The program memory technology must be reprogrammable due to the need for occasional updates or bug fixes. Therefore, in a firmware application, the memory may be reprogrammed a few times throughout its operating life. The speed to reprogram is not a major factor since it is only done during maintenance.

Configuration, on the other hand, changes more frequently. The memory technology used for configuration must be able to accommodate change easily. In addition, the changes may be very small so that the memory should allow very granular modifications. In many cases, configuration may change up to multiple times per day, but not more often. Data is driven from sensors and automated processes, which change frequently. The memory that stores sensor data must change quickly and be capable of changing a large number of times during its life.

Established non-volatile memory choices include flash memory and electrically erasable read-only memory (EEPROM). A newer choice is ferroelectric random access memory (FRAM). Flash memory is well suited to program storage. It is large, comparatively inexpensive, and can be changed in large blocks, though slowly and with difficulty. Most flash devices are subject to wear out if changed more than 100,000 times, but this is more than adequate for program updates. Even the multiple seconds required to reprogram flash is acceptable for maintenance cycles when programs are updated.

EEPROM is suitable for configuration memory. Configuration typically calls for smaller memory than program storage, and can be changed at the level of individual bytes. It takes 0.01 seconds to change a byte and can normally be changed up to 1,000,000 times. This speed and endurance can accommodate human controlled configuration. For computer-controlled configuration, however, EEPROM's slow write speed and limited endurance could pose a problem.

Data comes in many forms, but commonly changes more frequently than configuration and often changed quickly. The ability to change an unlimited number of times and to write new information quickly makes FRAM the ideal choice for data storage.

Pricing on a per-bit basis is related to functionality. While EEPROM or Flash can serve as program storage, they are more expensive and their superior features are not required in the application. Each memory has a role based on its price/performance and the needs of the application. The major change in the memory market is increased need for data storage and the emergence of FRAM as a viable memory choice.

The need for FRAM technology in the automotive market is a recent development. As electronic content mushrooms with the widespread use of microcontrollers and sensors, the need for data storage is growing in automotive sub-systems. High-content features like smart airbags or sophisticated seat memory systems are being introduced in high-end automobiles and are migrating into mass-market models over time. FRAM is now established in high-end models across several applications and is expected to migrate to the mass market over the next few years.

Technology maturity is a larger concern for the automotive market than for others. Flash and EEPROM technologies are well understood, with established quality control infrastructures at major suppliers. The introduction of new technology naturally causes hesitation, as the technical community must become comfortable with its reliability and availability. With more than 100 million units shipped, FRAM has matured to the point where automotive customers can feel comfortable.

ABOUT THE AUTHOR

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