**SAMRH707 Unique Radiation-hardened MCU including a TID robust non-volatile memory**

For several decades, Microchip provides one of the industry’s most comprehensive space product portfolio of radiation-hardened and radiation-tolerant solutions that includes high-performance MCUs, MPUs, FPGAs, memories, communication interfaces, frequency and timing solutions, mixed-signal ICs, custom power supplies, diodes, transistors, RF components and more. With product development activities and qualified supply chain in Europe, Microchip France is key contributor to the European space ecosystem delivering European and ESCC qualified solutions.

Spacecraft and satellites are expanding in complexity to provide commercial and military operators with robust new communication and data capabilities, greater reliability, and faster speeds, while the operators continuously seek to reduce cost, size and weight. In this environment, lowering system development costs while enabling greater capabilities and space system integration are ever more critical.

The introduction of Arm technologies for space applications opens-up new perspectives by enabling the use of the same ecosystem well in place in the consumer and industrial sectors. The SAMRH707 is the second Microchip Arm Cortex M7-based rad-hard microprocessor available today on the market. It offers developers the simplicity of a single-core processor and the performance of an advanced architecture without having to implement heavy mitigation techniques as is required for non-space components.

Integration of digital-to-analog converters, analog-to-digital converters, and on-chip non-volatile memory together with a powerful processor core is a key requirement for addressing new challenges in aerospace applications. With the SAMRH707, Microchip provides easy-to-use capabilities in cost-effective, radiation hardened MCUs. Built to support up to 128kBytes of non-volatile code in its on-chip flash, the SAMRH707 is capable to run as a standalone computer without any need for external memories. Thanks to its embedded 128kBytes flash memory and more than 700kbytes of SRAM, the SAMRH707 enables a high level of integration embedding a >100 DMIPS processor unit with digital signal processing (DSP) capabilities, combined with space connectivity interfaces such as SpaceWire, MIL-STD-1553 and CAN FD, along with analog functions such as a 12-bit Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC), in a small footprint designed for high-level radiation performance, extreme temperatures and high reliability

The SAMRH707 can be seen as a new step ahead in the integration of the system directly on a single chip with the integration of the Non-Volatile Memory in addition to the standard peripherals. This leads to optimization of the BOM cost by removing external memory requirements from a board, enables reaching much performant memory access speed, minimizing the power consumption of the system…

The Flash memory embedded in the SAMRH707 product relies on a conventional eFlash with stacked floating gate. Requiring high voltage for programing and erasing, such flash is quite sensitive to TID, thus limiting the capability to increase the product performances up to 100krad(Si) and higher with the NVM activated.

During the last 2 years, Microchip has developed different strategies to improve the cumulated dose level of the Flash embedded in the SAMRH707. This presentation will expose the different technics applied for the TID hardening of the NVM in reading mode.