

PROJECT PROFILE

17013



Developing a secure, reliable and ultra-low power flash-memory controller for key industrial users
[XSR-FMC]

The 'eXtra'-Low Power, Secure and Reliable Flash-Memory Controller (XSR-FMC) project will focus on developing secure memory storage with high reliability and ultra-low power consumption. These are key requirements of demanding automotive, Industrial Internet of Things (IIoT) and Industry 4.0 markets.

Electronic devices require an increasing amount of storage as distributed intelligence spreads. These storage devices control sensitive and vulnerable social investments and infrastructure, making security an increasing concern as these devices become exposed to failure and hacking. Unfortunately, emerging Industrial Internet of Things (IIoT), Industry 4.0 (part of the fourth industrial revolution which deploys digital technologies to produce higher-quality goods at reduced costs), automotive and many other sensitive applications and industries are using storage that has not been designed with proper security.

Aside from implementing security features as proposed by the European Union Agency for Cybersecurity (ENISA), it is also essential to provide the highest reliability to protect related investments, as well as, ultra-low power consumption to promote sustainability. Different aspects of computing demand different solutions pertaining to bandwidth and memory-system capacity, regardless of the type of computing, such as local, cloud or fog (extending cloud computing to the edge of a network).

NAND flash memory system requirements for automotive, IIoT and Industry 4.0 are positioned between the industrial market (high reliability) and the consumer market (low cost, high volume), with both markets offering attractive opportunities. Crucially, however, neither has the necessary eco-system for these new markets, an essential ingredient XSR-FMC intends to develop.

Eco-system to create the right flash-memory controller

The XSR-FMC project will address the shortcomings of current flash memory controllers for two key highly demanding markets: IIoT and Industry 4.0. In particular, its goal is to build an eco-system to create, for those markets, flash memory controllers that offer: ultra-low power consumption; high reliability; and certifiable security for generations of flash memory to come. This will mean putting in place a development platform to build an eco-system to develop any kind of flash-memory controller. Crucially, the project consortium

will deliver the necessary project expertise and experience.

As performance requirements increase, the high-speed, serial computer expansion bus standard called Peripheral Component Interconnect Express (PCIe) has constantly evolved and the PCIe gen4 standard is expected to strike the right balance between power and performance, alongside Non-volatile Memory Express (NVMe), a protocol designed to take full benefit of flash memories.

The technology used in flash-memory controllers are driven, on the one hand, by the evolutions of NAND flash technology and their new requirements of error-correction coding, interface and flash-management features; and on the other hand, by the type of demand for memory systems.

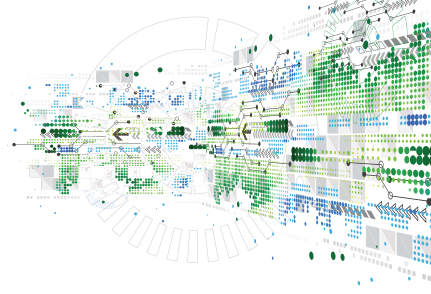
Key requirements of the target markets (as defined in this project) are summarised as follows:

- High reliability across large ambient temperature range (most likely -40°C to $+105^{\circ}\text{C}$);
- Extended lifetime;
- Resilience to sudden power failures;
- Ultra-low power;
- Fast interfaces;
- High security;
- Industrial/Automotive packaging grade;
- Diagnostic and support eco-system.

XSR-FMC will develop a demonstrator to ensure a rapid product ramp-up and time-to-market, and hence a better return on investment (ROI). The choice of interface will most likely be PCIe, but this can be revised, based on market changes. Notably, this interface will be flexible enough to adapt to, making only the host interface subject to change (although unlikely).

Added-value consortium

In order to offer a full NAND flash-memory system, the controller and memory must work symbiotically, which needs a very strong eco-system and relationship with flash suppliers. And the only way for Europe to



KEY APPLICATION AREAS

-  Computing and Storage
-  Security and Reliability
-  Digital Industry ECS Process
-  Transport and Smart Mobility
-  Equipment, Materials and Manufacturing Safety



ESSENTIAL CAPABILITIES

-  Systems and Components Architecture, Design & Integration
-  Connectivity & Interoperability
-  Safety, Security & Reliability
-  Computing & Storage
-  ECS Process Technology, Equipment, Materials & Manufacturing

PARTNERS

Extoll / Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (IZM) / GLOBALFOUNDRIES Dresden Module One LLC & Co. KG / HTWG (Hochschule Technik, Wirtschaft und Gestaltung, Konstanz) / Hyperstone GmbH / Racyics GmbH / SILICONGATE LDA / TIEMPO

COUNTRIES INVOLVED

-  France
-  Germany
-  Portugal

PROJECT LEADER

Damien Col
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KEY PROJECT DATES

15 November 2019 to 15 November 2022

successfully address those three markets is to join forces and foster partnerships. One way of achieving this is through a European project consortium comprising R&D-focused SMEs, research institutes and large manufacturing facilities, all capable of providing an ecosystem, a semiconductor product and platform, as well as, innovative, globally competitive intellectual property (IP) building-blocks. Importantly, several of these can be re-used and exploited independently in other future semiconductor designs, making them relevant to the ecosystem since they enable developments in semiconductor processes.

Furthermore, fostering cooperation between organisations that invest largely in R&D to develop state-of-the-art technology in their respective domains of expertise ensures the marketability of such a product. The consortium will also develop a reference design and packaging guidelines for a system-in-package (SiP) storage module, and deliver the necessary expertise to build a successful supply chain.

There are direct benefits for the entire consortium. XSR-FMC will provide project partners opportunities to address additional markets and applications outside their normal fields of operation. And relationships developed in this project could also trigger new opportunities.

What's in it for Europe?

With any flash-memory controller, there is a trade-off between cost, performance and reliability. Traditional Asia-based controller vendors tend to target consumer markets, and are therefore not interested in niche ones. However, opportunities arising from these key markets, together with their expected volumes, will encourage Asian and American suppliers to enter them. Europe can counter these moves with a good product and by partnering with experts.

Furthermore, providing such a technology platform will enable Europe to address different challenges within automotive, IIoT and Industry 4.0 with respect its storage requirements, and also strengthen Europe's leadership in highly demanding markets. The constant evolution of host and memory interfaces, and major flash-technology shifts, justify such a technology platform

and partner ecosystem. Crucially, critical security elements, building blocks and developments will all be done in Europe, strengthening the overall European security infrastructure, especially related to data storage.

What's more, added-value features of reliability, ultra-low power and security, both for the chip, but also the value chain, will more than make up for the price of the controller, which Europe cannot compete on.

Promising markets

Such trends as IIoT and Industry 4.0 will diversely re-shape social life and professional collaboration: from enabling services for the elderly, to maximising efficiency of industrial processes. Importantly, secure storage is part of all electronic systems involved.

And with cars and sensitive infrastructure-equipment or machines connected to the internet, security, especially for data storage, is of extreme importance. Many semiconductor sectors will also benefit from the increase in electronics in vehicles. All of this is reflected in market statistics. According to LP Information, automotive, IIoT and industrial markets had a CAGR of 10.2% from 2015 to 2020, and the trend is predicted to continue. According to HIS Markit, semiconductor revenue in automotive is forecast at over US\$ 40 billion by 2022. And Statista predicts global enterprise IIoT spending within automotive will be US\$ 303.3 billion in 2020. Finally, the automotive supply chain is also evolving and increasing in entropy. This creates new opportunities for semiconductor companies, which in turn will promote partnerships upstream.

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Penta (E!9911), is EUREKA Cluster whose purpose is to catalyse research, development and innovation in areas of micro and nanoelectronics enabled systems and applications.

