

## Reconfigurable computing crossbar architecture based on memFETs

New reconfigurable computing crossbar architecture based on memFETs has been developed and patented. This breakthrough technology, developed by a group of scientist from UAB and UPC represents an alternative to conventional computational systems as it adapts the size and composition dynamically, without any changes in CMOS manufacturing process required. Partners to further develop the system and/or to establish commercial agreements along with technical cooperation are sought.

### The Challenge

Today the advanced and promising computing industry, at all levels, from laptops to supercomputers, is based on the existence of complex and sophisticated monolithic integrated circuits implemented through circuits formed by billions of MOS transistors. The architecture or organization of such devices, usually called microprocessors, is the result of years of research and experience. Today's computational integrated circuits, both full-custom high performance or reconfigurable FPGA (Field Programmable Logic Arrays) types, are based on a pre-defined and fixed organization of processing entities that collaborate in the computing tasks. These entities are physically distributed though the entire surface of the integrated circuit in a fixed manner. Hence, each one of the entities that form the integrated circuit is characterized by a specific and fixed characteristic (e.g. the number of stored words in a memory, the number of core units, the number of I/O sections...), limiting the computing products capabilities.

### The Technology

This new technology represents an alternative to the state of the art which covers the gaps referring to the under-use of transistors and those referring to the lack of flexibility current reconfigurable processing architectures suffer from.

The invention consists of a reconfigurable crossbar architecture formed by memFETs. The memFET is a voltage-controlled electrically reconfigurable device based in the field effect and resistive switching phenomena that can be used to implement logic functions and memory blocks into a crossbar structure simplifying both the design and the implementation of computing hardware. Apart of the conventional operating mode (transistor mode), the memFET can be operated as a: 1-bit non volatile memory / Multibit non volatile memory / Multidirectional switch.

### Innovative advantages

- As opposed to what happens in conventional computational systems, the architecture is flexible and not fixed; it adapts the size and composition dynamically.
- memFET allows four different and interchangeable operation modes
- Highly dense and reconfigurable computing architectures possible
- No changes required in CMOS manufacturing process
- Reliability tested up to 1000 cycles without signs of degradations
- Similar performance as standard devices, within limits of transistor standard operation

### Current stage of development

Device produced at lab scale, experimentally characterized and validated. Proof of concept of the crossbar behavior and performance assessed by electrical simulation.

Proof of concept of the control unit (HOS) and capability to adapt architecture to computing task requirements assessed by abstract simulation.

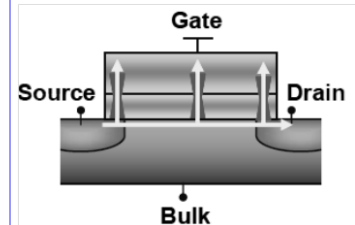
### Applications and Target Market

The technology can be used for adaptive computing and to produce fault-tolerant ICs, or ICs able to resist to harsh environments.

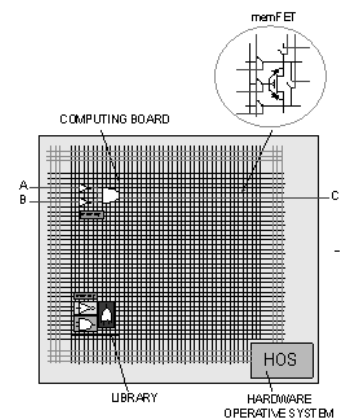
### Reference number

MKT2011/0080\_I

### Promising device for a future memories



MemFET used as a multibit memory cell by creating several resistive switching paths through



Crossbar architecture. Logic gates are stored in the library and the HOS mounts, dismounts or changes the position of any blocks following task requirements

### Business Opportunity

Technology available for licensing with technical cooperation

### Patent Status

EP Patent Application, followed by PCT

### Contact

Mr. Xavier Estaran Latorre  
Licensing Manager  
T. + 34 934 134 094  
M. +34 626 260 596  
f.xavier.estaran@upc.edu

### See more technologies at

[www.upc.edu/patents](http://www.upc.edu/patents)  
UPC—BarcelonaTech