ECSEL Pilot Lines Success Stories & Impact

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Strengthen the European supply chain of Electronic Components and Systems
Introduction

OUR COMPAGNY   OUR VISION
VISION

Innovate… for Next Generations of Semiconductor from Substrate to Solutions
BUSINESS MODEL

Create
Transfer
Innovation
to Industrial Partners

Mass production

Pilot line

Technological Research

Basic research

TRL 1 2 3 4 5 6 7 8 9
How does ECSEL comply with our company strategy and roadmap?
FUNDING PROJECTS IN ECSEL

3 POSSIBLE PATHS FOR SEMICONDUCTOR INNOVATION

Overview of Leti's 300 mm platforms
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SILICON ROADMAP

1. **Substrate, Techno FDSOI, Design platform**
   - Design Platform for 28FDSOI and 22FDX
   - ECOSYSTEM FDSOI
   - Scaling 22FDX to 12FDX
   - Scaling 18-12nm

2. **Enhancement to RF capabilities**
   - RIA: First 300mm RFSoI and RF/FDSOI
   - RFSoI & FDSOI for 5G and Beyond

3. **Embedded Memory for MCUs**
   - MCU 40nm / eNVM choice for 28FD
   - eNVM choice for 22FDX
   - MCU 40nm and PCM 28FD platform

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**FUNCTIONALITY**
- Mixed-signal
- RF
- Memories
- MEMS
- Photonics
- Imaging
- Biochips

**PERFORMANCE**
- Standard CMOS
- Bleeding edge

**3 POSSIBLE PATHS FOR SEMICONDUCTOR INNOVATION**
Overview of Leti's 300 mm platforms

CMOS Specific Strategies for Scaling
Our CMOS STRATEGY

Scaling

Power efficient FDSOI

28FD
22FD
12FD

Non planar / Stacked NW

Mainstream FinFET

2014
14nm
10nm
7nm
5nm
3nm

Materials

- III-V
- Ge

New Concept

Alternative to scaling and diversification

CoolCube™ for 3D VLSI

Power

Performance

- New Materials
- New Process Integration
- Device Physics
  & Compact Models
Overview of Leti's 300 mm platforms

Memories

Enabling Novel Computing Architectures

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ADVANCED MEMORIES
A UNIQUE VALUE PROPOSITION

DEFINITION OF TECHNOLOGY SPECIFICATIONS

MODULE DEVELOPMENT

TEST & CHARACTERIZATION

DESIGN ENABLEMENT

MODELING, SIMULATION & NANO-CHARACTERIZATION

200/300 MM INTEGRATION

Large variety of materials available
- GeSbTe
- SiOx
- TaOx
- ZrO2
- AlOx
- VOx
- HfAlxOy
- GeAsSbTe

Large variety of Memories available
- pSTT-Magnetic RAM
- Conductive Bridge RAM
- Oxide Resistive RAM
- Ferro-electric RAM
- Phase – Change Memory
OPENING OF THE POSSIBLE FIELD

Neuromorphic computing

Computing applications, AI

Quantum computing

Image sensor
Overview of Leti's 300 mm platforms

SPEED
QUBIT FIGURES OF MERIT
RUN-TIME CALCULATIONS
μs range

FIDELITY
LOGICAL QUBITS
WITH REDUNDANCY
>98% for single and two qubits gates

SCALING
QUBITS ARRAYS
VLSI
~(100nm)^2

A UNIQUE VALUE PROPOSITION:
ONLY TECHNOLOGY TO IMPLEMENT LARGE SCALE QUANTUM COMPUTING

Gate Defined Quantum Dots

QUBIT
SILICON

0 \rightarrow |1⟩
1 \rightarrow |0⟩

µs range >98% for single and two qubits gates

Gates to load carriers in sensing layer

Control gates to manage qubit to qubit coupling

Control gates to tune detector to qubit coupling

Sensing gates to load carriers in sensing layer

Overview of Leti's 300 mm platforms

Remote Secondary Storage
Cloud Storage
Local Storage
Flash
Main Memory
DRAM
Cache (L1-L2-L3)
Register files
Alu
Flip-Flops

STANDALONE

EMBEDDED

Volatile
Non-volatile

SPECIFICATIONS:
SPEED
POWER CONSUMPTION
ENDURANCE
HIGH TEMPERATURE
COST
SCALING

MAIN RESEARCH FOCUS:
MATERIAL STACKS
SELECTOR
ARCHITECTURES
HW ACCELERATORS
IC DESIGN

Storage Class Memory

Volatile Non-volatile

Very expensive (part of CPU)
Very expensive ($150/MB)
Inexpensive ($0.58/MB)
Very inexpensive ($0.0025/MB)
Least expensive

ADVANCED MEMORIES