



FRENCH STRATEGY ON UDSM TECHNOLOGY FOR SPACE

FLORENCE MALOU

CNES

ACCEDE | ESCCON

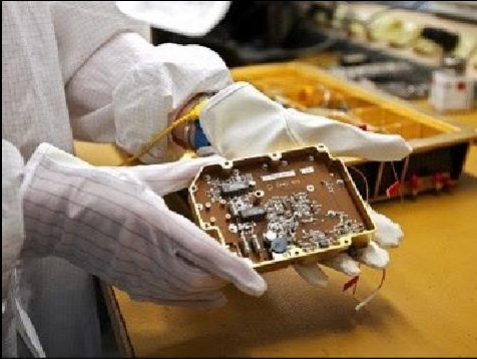
2025

Seville - Spain
25 to 27th March

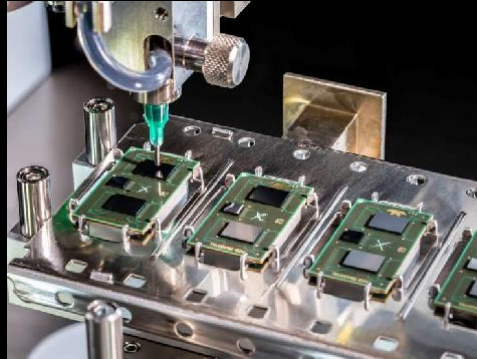
ALTER



COMPONENTS FOR SPACE CHALLENGES



SOVEREIGNTY



COMPETITIVENESS

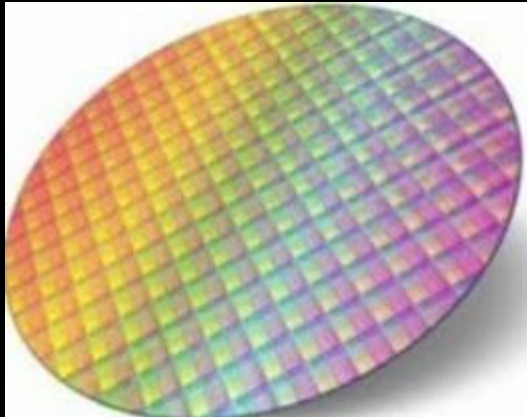


FOR THE BENEFIT OF
ECOSYSTEM



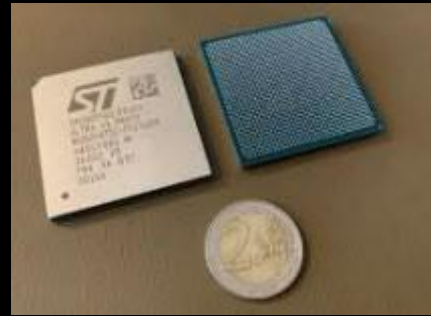
SPACE SPECIFICITIES

UDSM : A COMPETITIVENESS DIFFERENTIATOR



1 wafer

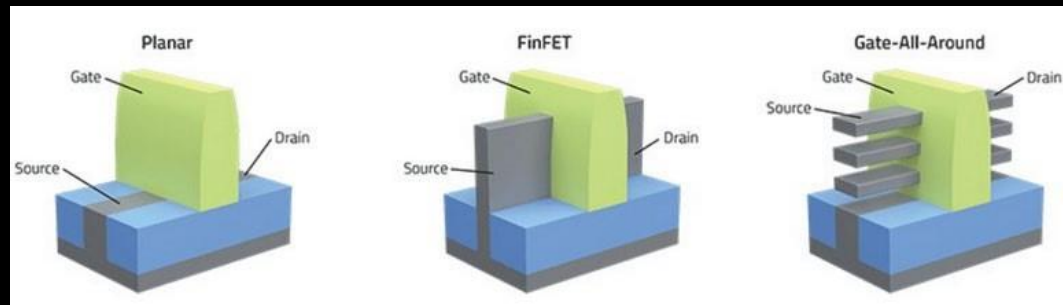
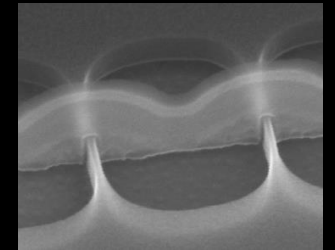
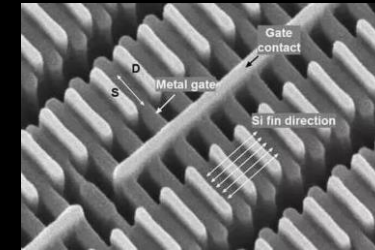
hundreds
of dies



billions
of transistors

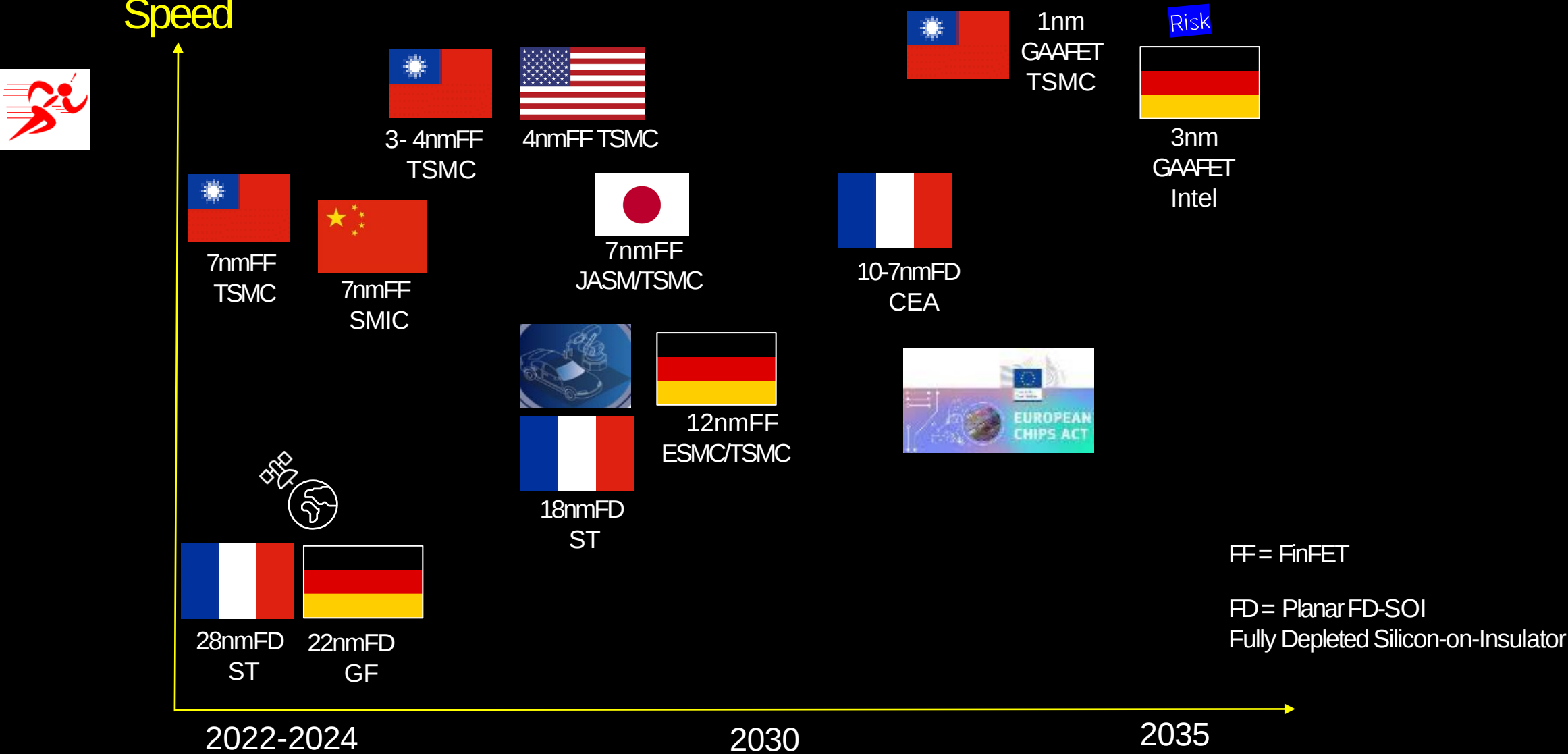
↗ Performance
↘ Power consumption

A few nm*



Transistor evolution

UDSM : A RACE FOR PERFORMANCE



UDSM STRATEGY

UDSM strategy
proposed by
Components & Critical
Technologies WG
COSPACE Fr



➤ Time to market

Acces to TSMC N7

Keep Design, System-In-Package Integration,
Industrialization, Qualification skills in France & Europe

→ Strategy shared with European Commission and ESA

➤ Long-term

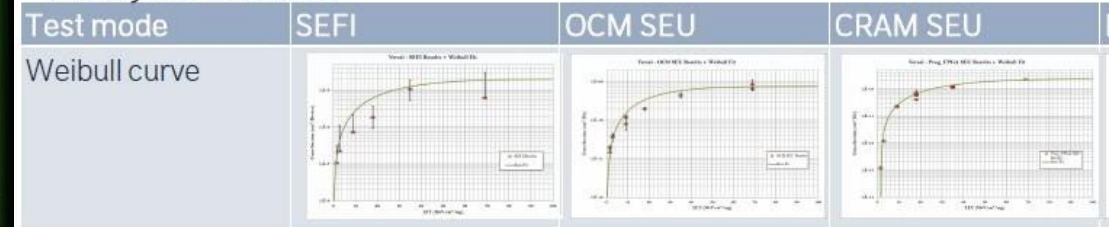
Follow national FD-SOI roadmap

N7 is the best compromise

- ✓ Performance / Cost/ Radiation
- ✓ Mature and wide ecosystem – Ips
- ✓ Radiation evaluation of AMD Versal SoC done by CNES : promising results



Heavy ions results



RADECS 2023: Heavy ion and proton Single Event Effect characterization of 7nm FinFET AMD Versal™

Arnaud Dufour¹, Florent Mami¹, François Pleron², David Dangot¹, Françoise Bezeard¹, Julien Mekki¹, Pierre Maillard³

¹CNES, ²Berth, ³AMD Xilinx

ETOILE

OBJECTIVE

To Develop and Validate building blocks in 7nm
For next FPGA & ASIC chiplet components in System-In-Package

Leader 



Chiplet strategy

Critical BB in N7
Design & Hardening

- DDR4/LPDDR5 phy interface
- ECC

eFPGA demonstrator in N7
Design, Hardening & Validation

- Q3/24
KO ETOILE
- Q3/25
Chiplet strategy
- Q2/26
CDR Interface phy
DDR4/LPDDR5
- Q3/26
eFPGA 7nm
Demonstrator
- Q3/27
eFPGA
Demonstrateur
Validation

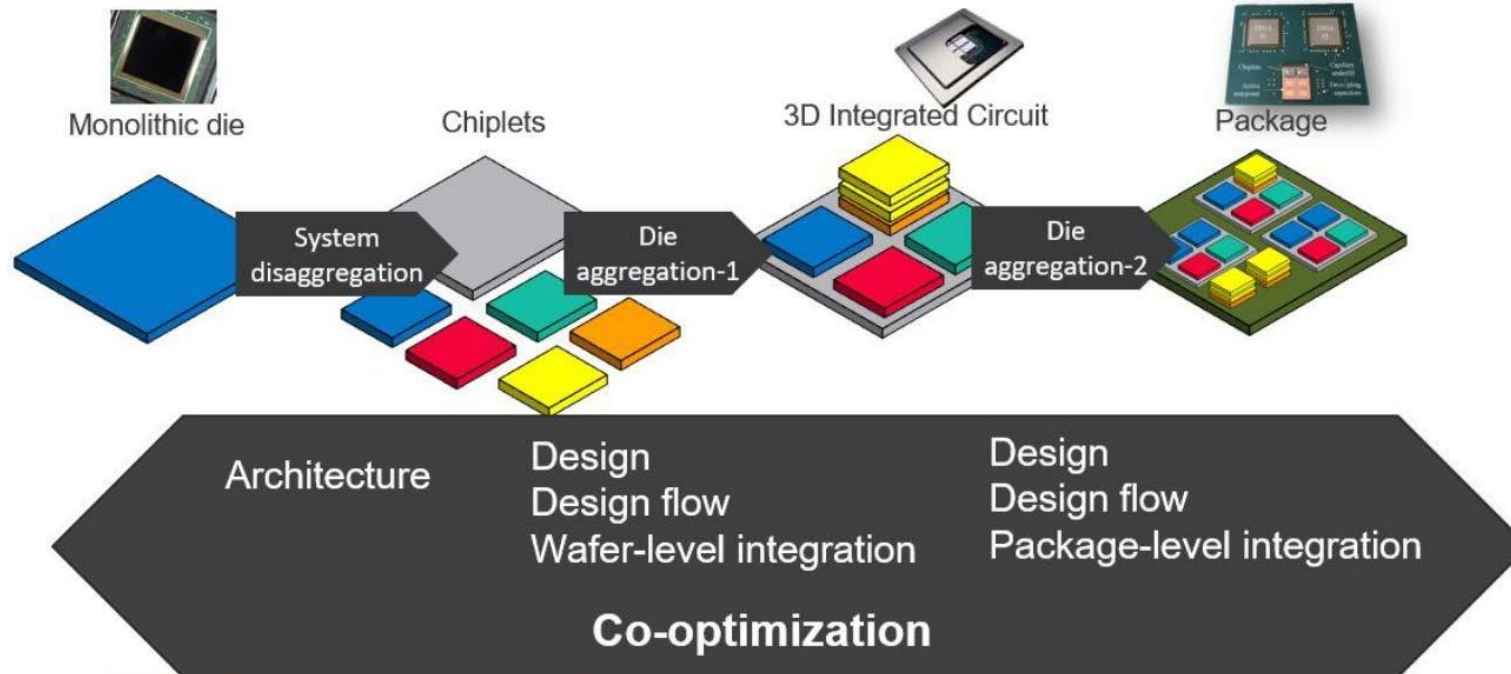


Project development part of the European strategy for building the next European space FPGA based on 7nm
Coordinated action among COMDEFIS-CNESESA

CHIPLET

Chiplet partitioning: the new IC design paradigm

list
cea tech



Source CEA

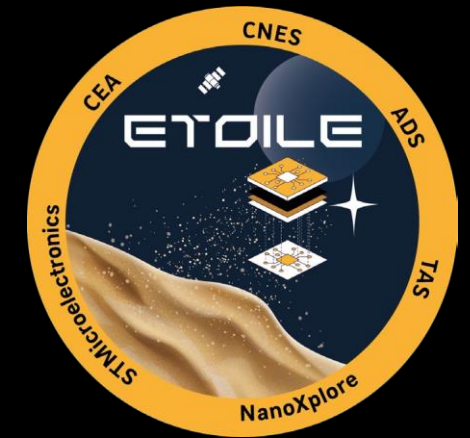
Chiplet Partitioning – Denis Dutoit – CEA List

2

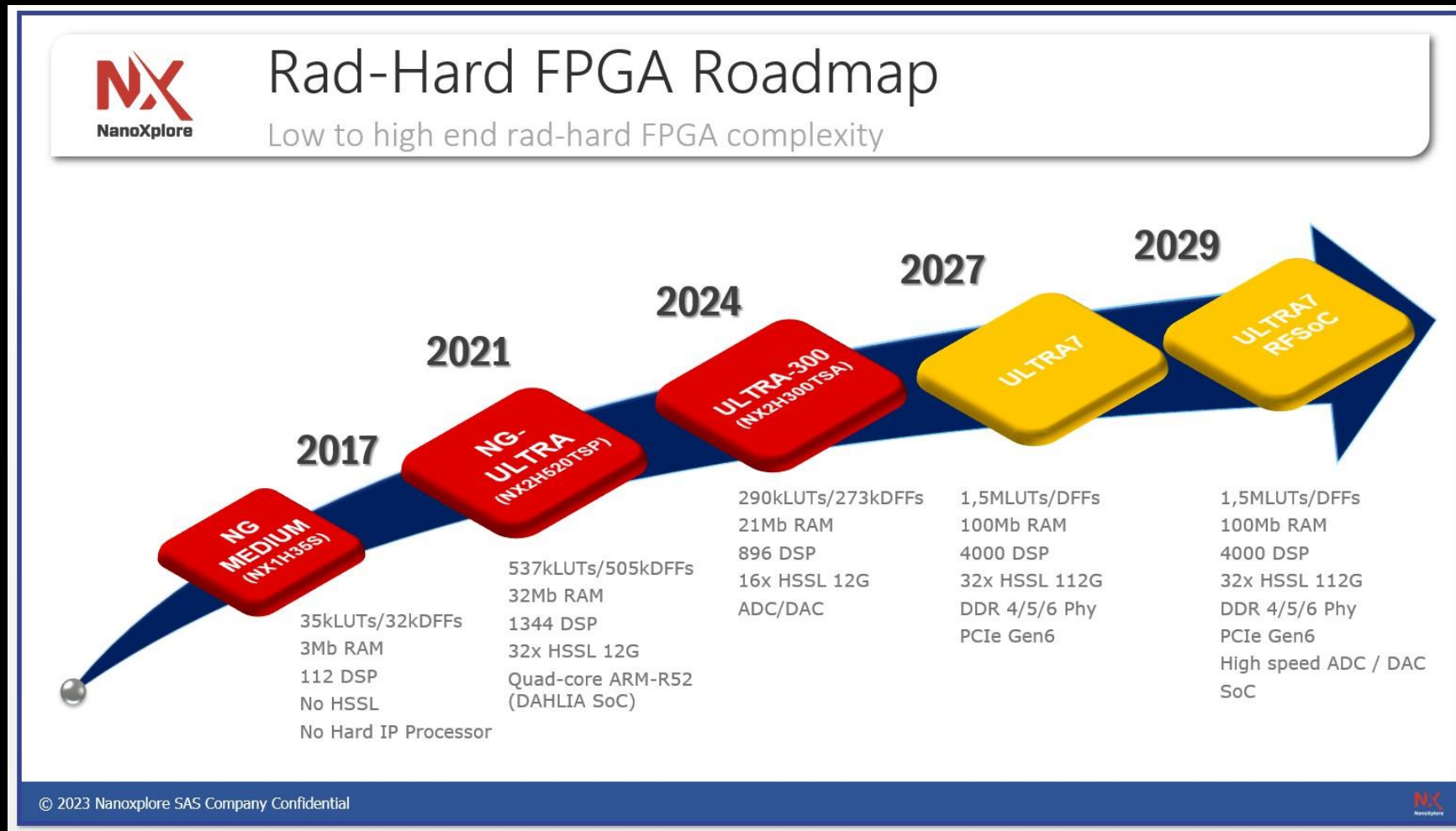


UDSM-FR L1.0 State of the art report

05/12/2024



EUROPEAN RAD-HARD FPGA

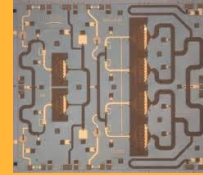


Project development part of the European strategy for building the next European space FPGA based on 7nm
Coordinated action among COMPEFIS-CNESESA



Silicon

ULTRA 7 FPGA
Chiplet, UDSM
Power GaN/SiC
Data converters



GaN RF

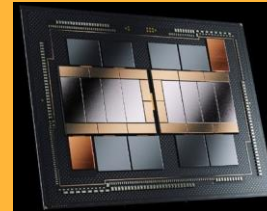


Photonics

Solar Cells

Detectors

Passives



Assembly & PCB

2.5D/3D SiP

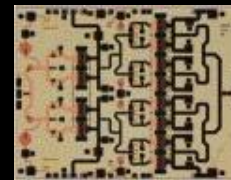
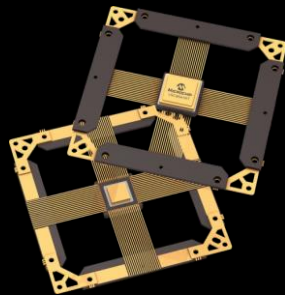
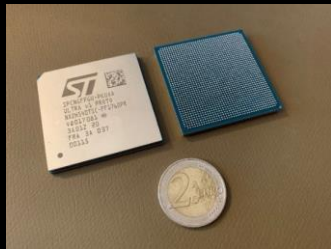


Radiation

CNES STRATEGIC COMPONENTS PLAN

Development , Evaluation and Space Qualification

- Rad-hard FPGA (NanoXplore / STMicroelectronics)
 - Rad-hard & Rad-Tol Microprocessors et Microcontrollers (Microchip)
 - Data converters (Teledyne-E2V)
 - GaN RF (UMS)
 - Power GaN/SiC (STMicroelectronics)
 - Oscillators, Resonators, Quarts material (AR Electronique, EZUS-Cristal Innov)
-
- COTS



2024 HIGHLIGHTS :VLSI

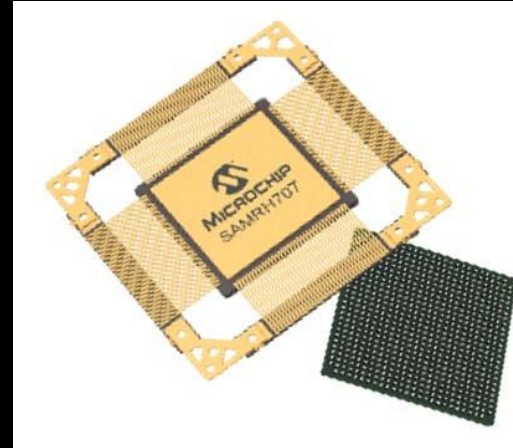
Rad-hard FPGA in 28FD-SOI technology

ULTRA : 1st FM delivered

ULTRA300 : Prototypes available since Sept.2024



Microchip SAMRH707 MCU Qualification



Teledyne DDR4 8Go SiP Development



2024 HIGHLIGHTS : POWER

LEO Diodes Qualification For Newspace application

ST LEO1N5811 Datasheet

Rad-hard 150 V, 6 A ultrafast rectifier in SOD128Flat package

Features

- Max. reverse voltage = 150 V
- Average on state current = 6 A
- Max. junction temperature = 175 °C
- DC thermal resistance $R_{th(j-a)}$ = 10 °C/W
- ESCC qualified diode die
- SOD128Flat surface mount package
- Reliability qualification based on AEC-Q101
- Tiny package : 2.5 x 4.8 x 12 mm³
- Low leakage current: 2 µA at V_{RRM} at 25°C
- Fast switching and low on-state voltage
- Radiation tested performances:
 - TID 300 krad(Si) at high dose rate
 - TNID 3.10¹¹ particles/cm²
 - SEB free at full V_{RRM} up to 60 MeV/cm²/mg

Product status link

LEO1N5811

Product summary

I_{VAO}	6 A
V_{RRM}	150 V
$V_f(max)$ at 150 °C and I_{VAO}	0.775 V
$T_j(max)$	175 °C

Applications

- Low earth orbit (LEO) space applications
- Satellite constellation
- High reliability systems
- Output high frequency rectification
- Free-wheeling diode
- Converter Or-ring
- Reverse polarity protection

Description

The 6 A, 150 V ultrafast rectifier LEO1N5811 is a rad-hard rectifier housed in the tiny surface-mount SOD128Flat package, operating with a junction temperature from -40 °C to +175 °C.

The LEO1N5811 meets the challenges of the LEO satellites for performance and reliability in a strict budget thanks to the STMicroelectronics LEO generic specification dedicated to space ready rad-hard plastic power discretes, this AEC-Q101-based specification offers a trade-off among foot-print size savings and cost of ownership together with radiation hardness and large production capacity.

The LEO1N5811 rectifier is suitable for switching mode power supplies and high frequency DC-to-DC converters such as low voltage high frequency inverter, OR-ring, free-wheeling, blocking diode or reverse polarity protection. It is well suited for critical mission equipment such as avionics and Hi-Rel industrial.



High voltage SiC Schottky diodes SEE assessment

- No SEB of STPSC20G12WY @250V and 275V
- Mission profile (limited SEE+HTRB) is validated
- A new SEE test methodology shall be defined for SiC Schottky diodes
- For higher voltage (500V target) at least process modification are required



2024 HIGHLIGHTS : MICROWAVE

QFN Packaging for GaN validated for space use

The screenshot shows the 'everythingRF' website. The main article is titled 'Plastic QFN Platform from UMS Evaluated by CNES for Use in Space Applications for Packaging GaN Components', dated February 11, 2025. The article features a large image of a satellite in space with the UMS logo. The text states that UMS has announced their plastic QFN platform, designed for GaN MMICs, has been officially evaluated by the CNES (Centre National d'études spatiales) – French Space Agency for use in space applications. This recognition is included in Note 19.

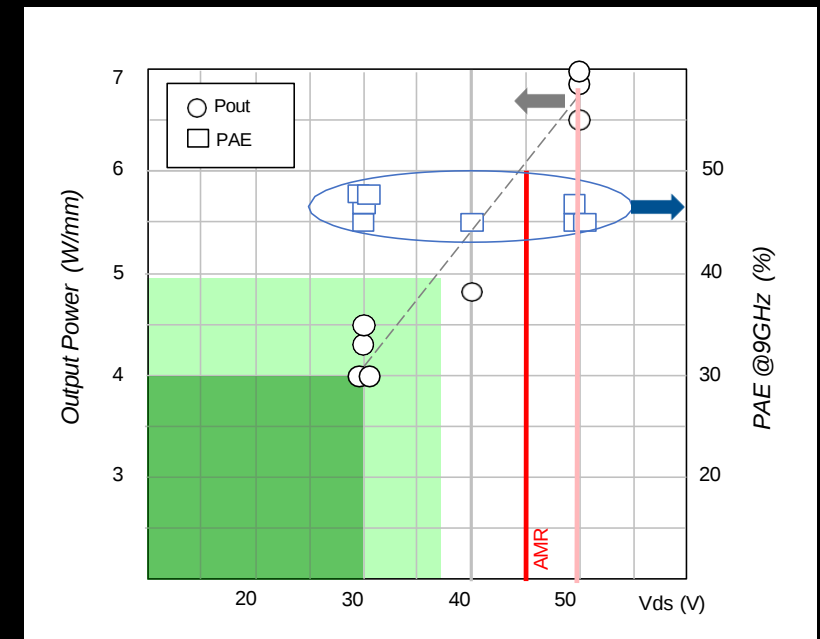
Advertisement: Coilcraft 1512SP/2712SP Mini Air Core Inductors. Features: Exceptionally high Q across a wide frequency range; Standard EIA inductance values from 2.5 to 150 nH; Tight tolerance can eliminate circuit tuning. >Click for Free Samples!

Featured News: IMS logo and image of the Golden Gate Bridge.



Microwave: GH25 extension to 35V

Operating the technology at $V_{ds} = 37V$ allows 15% increase of saturated output power, 0.5dB increase of linear Gain keeping similar power added efficiency



THANKS FOR YOUR ATTENTION !

FLORENCE.MALOU@CNES.FR

