OCEAN12: towards a green digital transition

F. Brunier (Soitec), Philipp Ritter (Bosch), November 24th 2021
OCEAN12 at a glance

- ECSEL IA - Call 2017
- 8 countries, 30 partners, SOITEC leader
- Value chain fostering most advanced ICs in EU
- Energy Efficient FD-SOI Chips
- European technology for Automotive
Engineering on the substrate allows innovation at chip level

- SOI Thickness uniformity and roughness improvements

<table>
<thead>
<tr>
<th></th>
<th>GEN1</th>
<th>eSOC.2</th>
<th>eSOC.3</th>
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</thead>
<tbody>
<tr>
<td>Global TSi unif.</td>
<td>+/-5Å</td>
<td>+/-4Å</td>
<td>+/-3.5Å</td>
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<tr>
<td>Min / Max WiW</td>
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<tr>
<td>Global TSi unif.</td>
<td>-</td>
<td>&lt;1.6Å</td>
<td>&lt;1.5Å</td>
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<td>σ WiW</td>
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<tr>
<td>Global TSi unif.</td>
<td>1.3Å</td>
<td>1Å</td>
<td>0.8Å</td>
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<td>σ all points all wfrs</td>
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<tr>
<td>Global TBox unif.</td>
<td>+/-10Å</td>
<td>+/-10Å</td>
<td>TBC</td>
</tr>
<tr>
<td>Min / Max WiW</td>
<td></td>
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<tr>
<td>Roughness DRM 6σ (Max of means)</td>
<td>&lt;10Å</td>
<td>&lt;8Å</td>
<td>&lt;6Å</td>
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</tbody>
</table>

Substrate: SOIL of FD-SOI tech

Si and BOX thickness uniformity

Atomic scale roughness

HVM compliance

Pave the way for higher performances

OCEAN12: towards a green digital transition
Concept: Always on Radio

Signal Detection → Signal Identification → Signal Classification → Signal Processing → Advanced Signal Processing

Radio Audio, Signals

ALWAYS-RESPONSIVE

pW-µW area

ON-DEMAND

mW area
Always-on Radio

FDSOI BACK BIASING

Always On Radio

Best trade off performance / Power

SOI Reverse Body Bias

Mixed Signal – Digital / RF

Tunability: “Big / Little” in a single implementation


Bosch Mission: *Invented for life*

- Spark enthusiasm
- Improve quality of life
- Help conserve natural resources

**Autonomous Driving**
- Enjoyable
- Safe
- Sustainable

**Automotive Radar**
- Reliable
- Affordable
- Synergetic

**Radar System-on-Chip**
- Compact
- Efficient
- Versatile

Bosch Radar Chip – Motivation
Bosch Radar Chip – Semiconductor Technology

Radar Sensor Evolution

- ACC1 (2000)
- LRR3 (2009)
- MRR (2013)
- LRR4 (2015)
- GEN5 (2019)

- 77 GHz SiGe
- SMD
- Single MMIC

SoC

CMOS

SiGe


RFCMOS Evolution

- SiGe BICMOS B11HFC
- SiGe BICMOS B9MW
- SiGe BiCMOS B55
- CMOS 65nm
- CMOS 45/40nm
- CMOS 28nm
- CMOS 22nm FDSOI
- CMOS 16nm FinFet

Technology Node

Frequency in GHz

P. Ritter, “Toward a fully integrated automotive radar system-on-chip in 22nm FD-SOI CMOS”, 2021, [https://doi.org/10.1017/S1759078721000088](https://doi.org/10.1017/S1759078721000088)


Radar becomes “commodity”

Advances in SC technology

Sensor level integration

Bosch Radar Chip – 22nm FDSOI Demonstrator

- Channel isolation
- Digital interference
- Package interaction
- High temperature operation
- Signal-to-noise ratio

Radar Sensor Demonstrator
- Target measurements
- Dual-SoC Demonstrator

- Noise
- High temperature
- Isolation
- Interference
- Antenna
- Echoes
- Chirps
OCEAN12 SOI technologies are specially developed to meet the manufacturing requirements of extremely energy-efficient components, especially for Automotive applications.

EU industry access to semiconductor components bring out the need, for Europe's technology sovereignty, to establish a complete supply-chain and eco-system for semiconductor industry.

OCEAN12 paves the way for a European manufacturing capacity on advanced CMOS technologies by
- Consolidating the existing 22nm technology
- Preparing the introduction of 18nm and 12nm FD-SOI technologies

The step forward will be to consolidate FD-SOI technology roadmap in EU with 18nm, 12nm and 9nm nodes.
Thank you

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