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IPCEI on Microelectronics

RF- mmW technologies & MPW offer

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STMicroelectronics France.

MRW 2020 Microwave and Radar Week

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ST Technologies for RF-mmW within IPCEI

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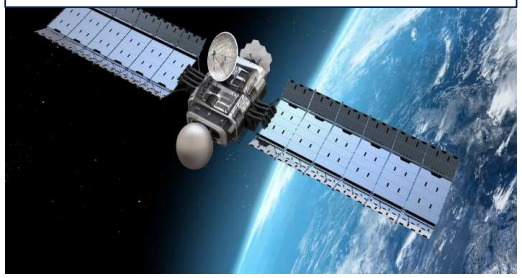
Position within IPCEI Technologies Fields

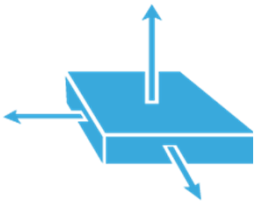
Automotive	IoT	Space & Avionics	Security



5 Technology Fields

Energy efficient chips (TF1)

Power semiconductors (TF2)



Smart sensors (TF3)

Optical equipment (TF4)

Compound materials (TF5)

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Why Rf-mmW capable technologies?

- Optical, wireline and wireless Telecom Network
- Automotive Radars
- Short range connectivity
- AR/VR remote links
- Gateway and Data-Centers High-Speed Interfaces
- Optical sensors (High-speed driving of modulated light sources)

…

➢ ***« Mainstream answer for high data rate multi-range links and high-speed driving »***

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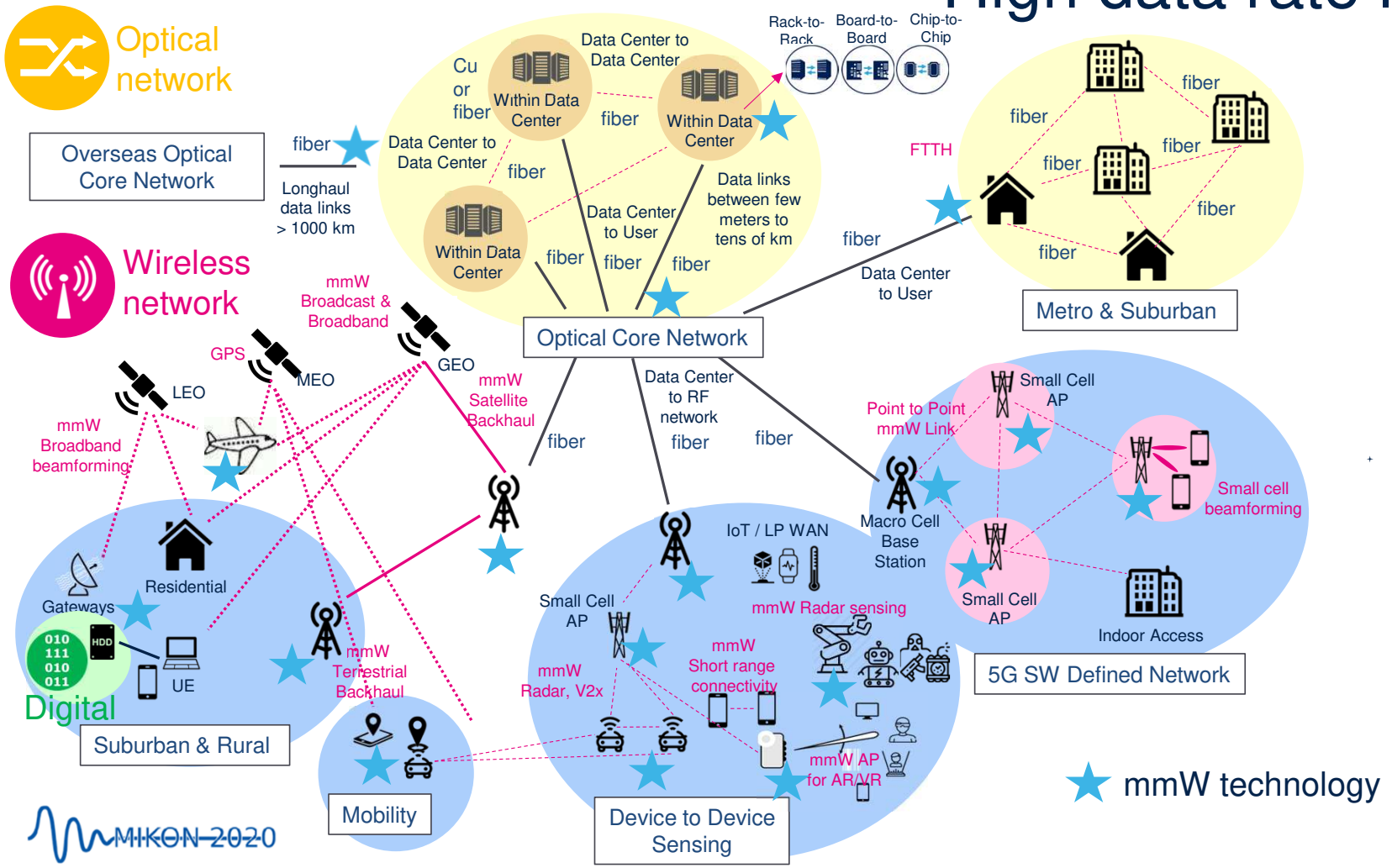
High data rate links



RF-mmW Technologies KPIs

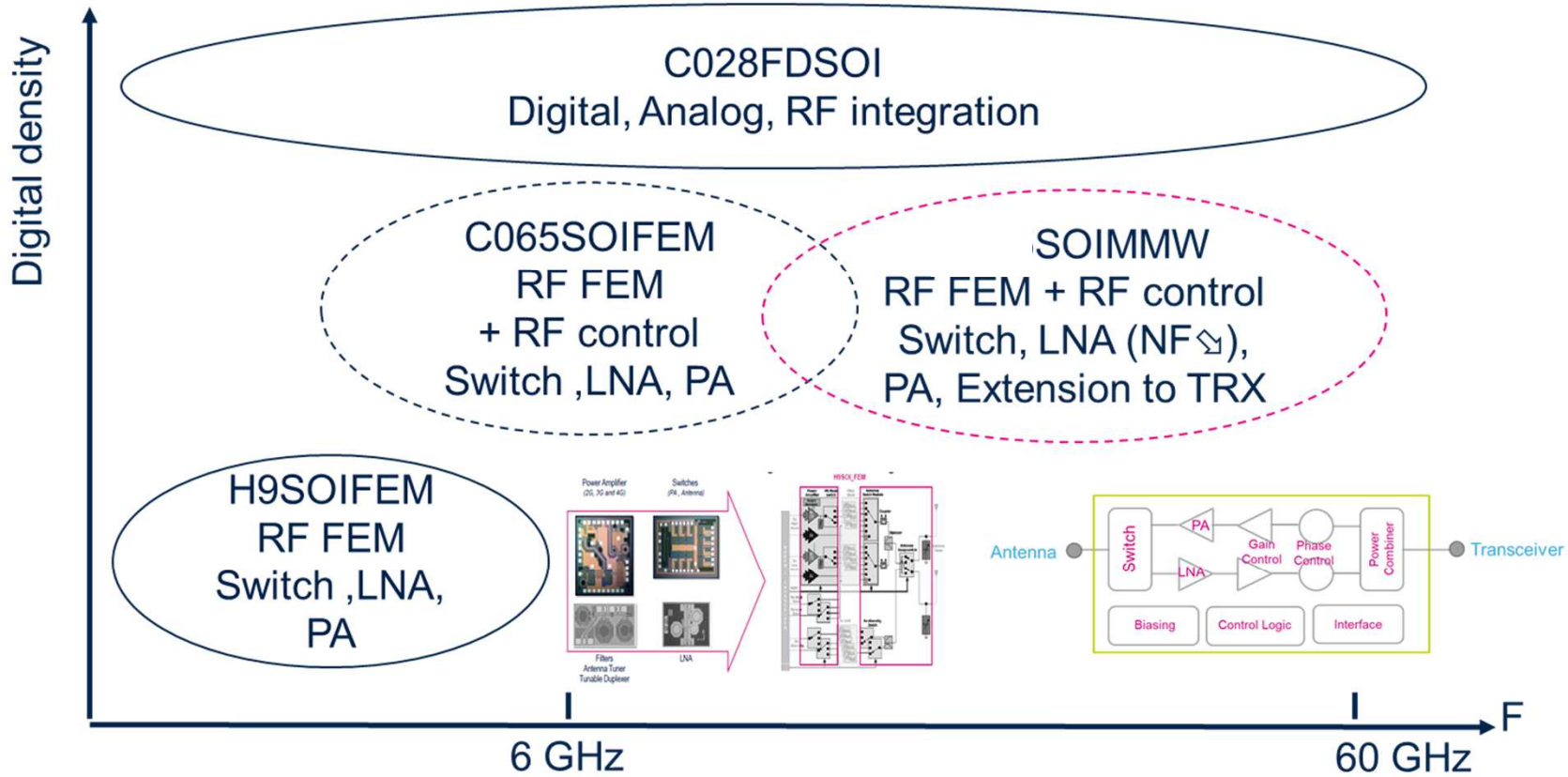
- Medium to Large volume capacity
- Cost effectiveness
- Speed/power efficiency
- RF dedicated devices
- Digital integration capability
- Noise hardening
- RF packaging capability

ST mainstream technologies for RF-mmW

- RF-mmW CMOS
  - H9SOIFEM: 130nm CMOS, 3 to 5ML
  - C065SOIFEM: 65nm SOI, 5ML
  - C028FDSOI-RF: 28nm, 5 & 6ML, 3MGates/mm2, Analog & RF devices

- BICMOS with SiGe HBTs
  - BICMOS9MW : 130nm CMOS DGO, 6ML, High-speed NPN Si-Ge-C Ft=230GHz, MV NPN
  - BICMOS055 : 55nm CMOS, 8ML, NPN SiGe Ft=320GHz

RF-mmW CMOS


Digital density
C028FDSOI
Digital, Analog, RF integration
C065SOIFEM
RF FEM
+ RF control
Switch ,LNA, PA
SOIMMW
RF FEM + RF control
Switch, LNA (NF↘),
PA, Extension to TRX
H9SOIFEM
RF FEM
Switch ,LNA,
PA
Antenna
Switch
PA
LNA
Gain Control
Phase Control
Power Combiner
Transceiver
Biasing
Control Logic
Interface
6 GHz
60 GHz
F

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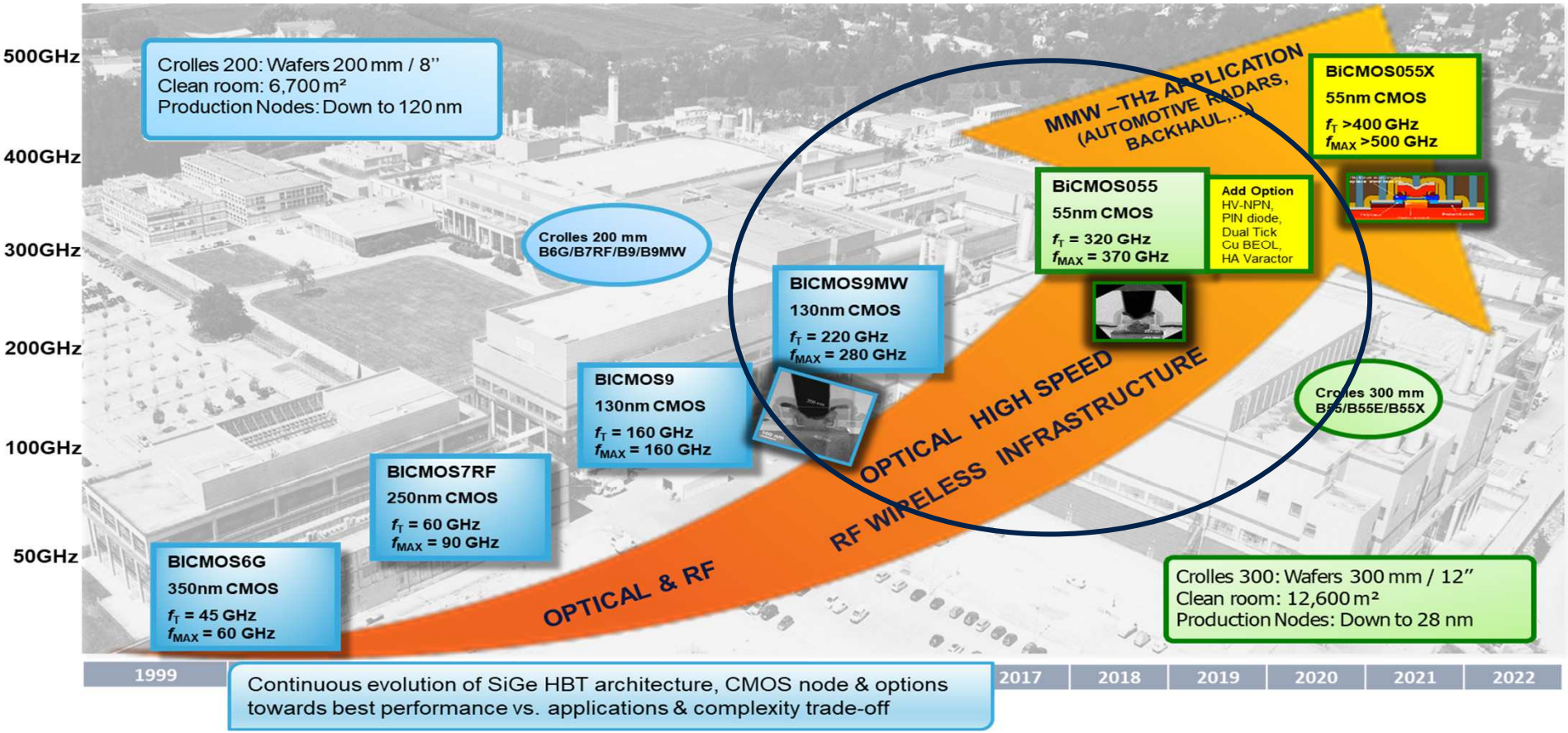
BICMOS with SiGe HBTs



Continuous evolution of SiGe HBT architecture, CMOS node & options towards best performance vs. applications & complexity trade-off

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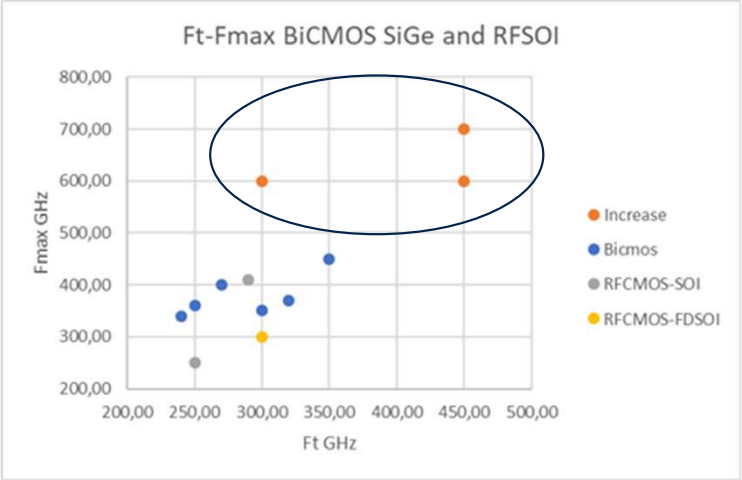
Perspectives

- BICMOS055X



INCREASE
Industrial innovative BiCMOS process for telecom, radar & sensors

- SOIMMW

BEYOND 5

RF MPW offer within IPCEI

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Dissemination scope within IPCEI

Knowledge creation & sharing

Education

Access to IPCEI technology → MPW

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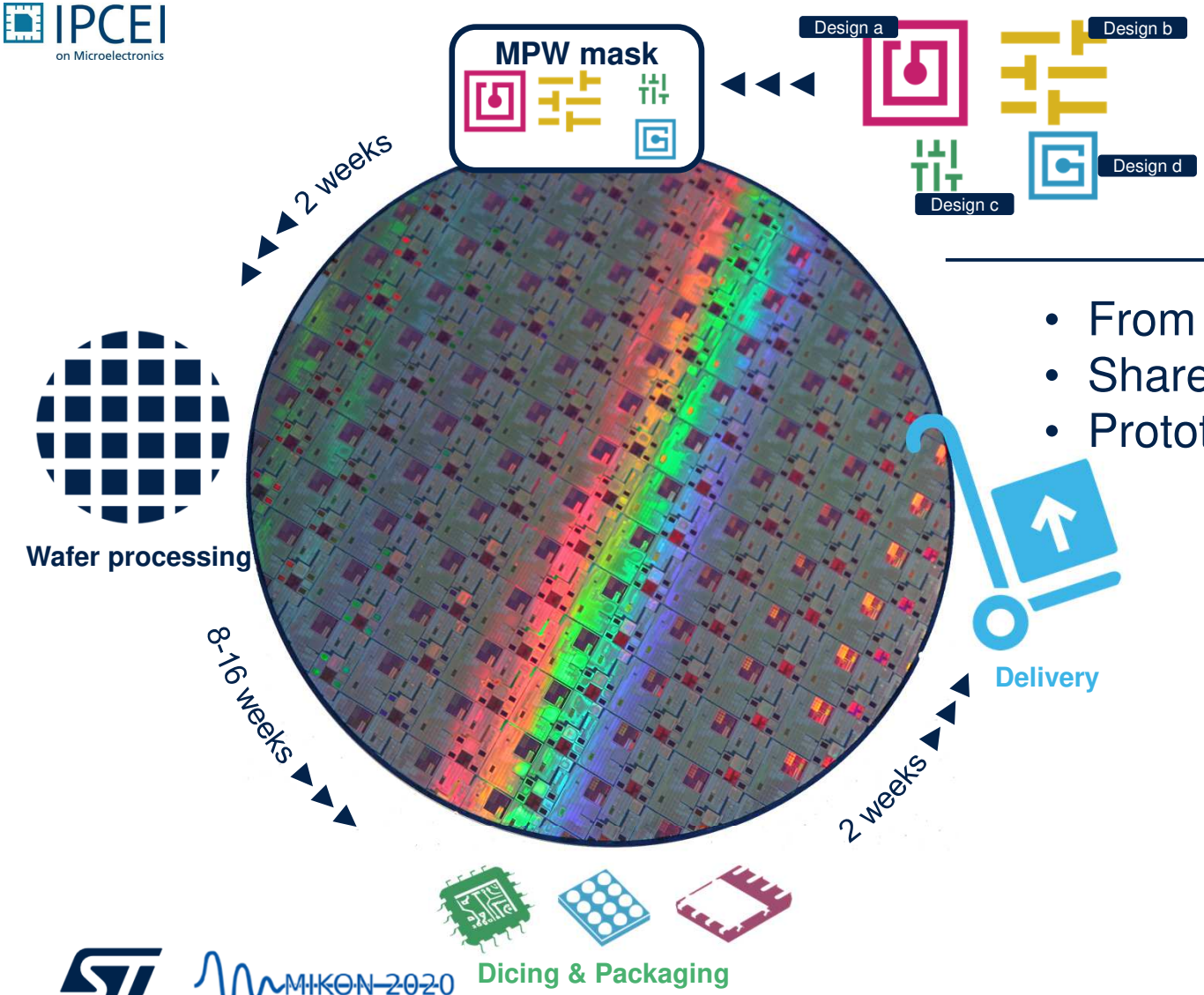
ST MPW RF offer

- ST in partnership with CMP proposes MPW opportunities

- **CMP makes available and affordable world class advanced CMOS/BICMOS/MEMS** technologies as well as mature and/or niche market technologies to cover a wide range of applications.
- **Affordable prototyping service**
  - CMP shares manufacturing cost of ICs prototyping and small volumes.
- **Technical supports**
  - CMP provides supports & training for Design Kit implementation and usage.
  - CMP offers several companion services for packaging and test

MPW cycle



- From layout to chips
- Shared cost wafer
- Prototypes or low volume production

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C028FDSOI-RF
Low Power & High Speed Digital, RF

- 28nm mixed A/D/RF CMOS SLP/8LM (triple Well).
- Gate length: 28nm
- 8 Cu metal layers (6 thin + 2 thick Cu top metal).
- **Body Biasing**
  - **Performance – Leakage balance**
  - **Process compensation**
- IO supply voltage: 1.8 V using the IO oxide.
- Ultra low k inter-level dielectric.
- Low leakage (High density) SRAMS.
- Analog / RF capabilities.
- MIM and Fringe MOM capacitors.
- Standard cell libraries (more than 3Mgates/mm²)

Available now

Applications: IoT / RF-IoT and Low power and high performance applications

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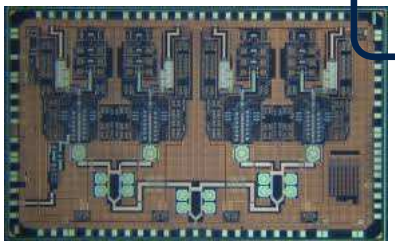
BICMOS9MW
Mixed A/D, RF

Available now



- 130nm mixed A/D/RF CMOS SLP/6LM (triple Well)
- Power supply: 1.2V for core and 2.5V & 3.3V for IO
- Threshold voltages: VTN = 500/380 mV, VTP = 480/390 mV
- 6 Cu Metal layers, thick top metal layer
- **SiGe-C bipolar transistor (fT = 230GHz)**
- **High performance and Medium voltage NPN bipolar transistor**
- MIM capacitors
- Damascene Copper from metal 1 to last metal
- Standard cells libraries

RF applications and Millimeter-Wave applications (frequencies up to 77GHz for automotive radars), WLAN, Optical

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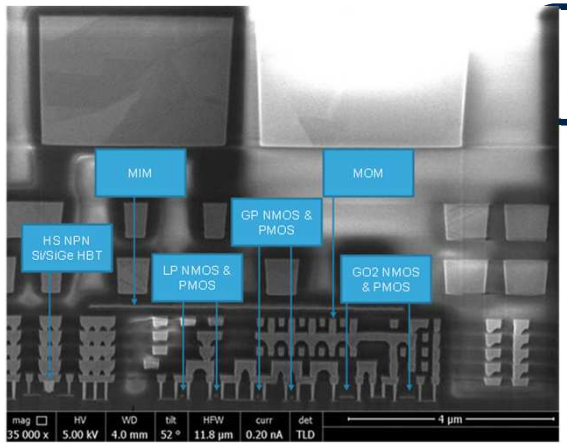
BiCMOS055
Optical, Wireless, Analog High Performance

- Gate length: 55nm (drawn).
- HS, MV and HV SiGe HBTs with HS HBT featuring **fT/fMAX = 320/370 GHz**
- LP/GP mix CMOS baseline with HVT, SVT, LVT and 2.5V IOs
- LVT + HVT SRAM
- High-quality millimeter-wave passive devices (transmission line, varactors, inductors and capacitors)
- 8 metal levels: **top Ultra-thick Cu top metal (3µm)**



Available now

Applications: Optical, RF and mmW, and High-Speed Analog Applications

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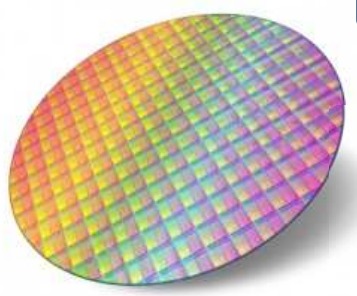
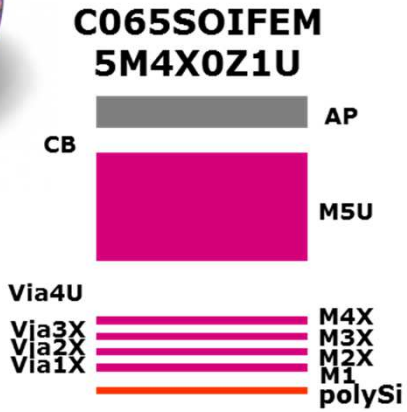
C065SOIFEM

- **Simplified Flow** for **price optimization and reduced prototyping cycle time**
- **No compromise with RF performances**
  - PMOS and NMOS 65nm 1.2V GO1 (FT ~ 170 GHz) driving LNA performances
  - Dedicated 2.5V GO2 RF MOS for best RF Switch performances
  - Full copper back-end
    - 5 ML with thick copper to **improve passives Quality** and **minimize matching losses**
  - 2 different SOI substrates supported
    - High Resistivity (HR)
    - **Trap Rich (TR) for highest performances**

Coming soon





Applications: Front end module, mmW, radar, short distance high speed communication

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MPW RF offer

- 2021 preliminary schedule

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
28FDSOI-RF		X							X			
BiCMOS055		X								X		
BiCMOS9MW			X			X					X	
C065SOIFEM				X							X	

Contacts
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