

Advanced High Voltage Passive devices for Automotive and Power applications

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muRata

INNOVATOR IN ELECTRONICS

Outline

- Introduction to Murata Integrated Passive Solutions
- Which technologies and products are made today?
- What are we targeting for the future and especially in IPCEI?
- Focus on high voltage and power applications
- Conclusion

We are part of Murata group



Our Business

We are worldwide leaders in the design, manufacture and supply of electronic components and solutions.
We are Innovators in Electronics.

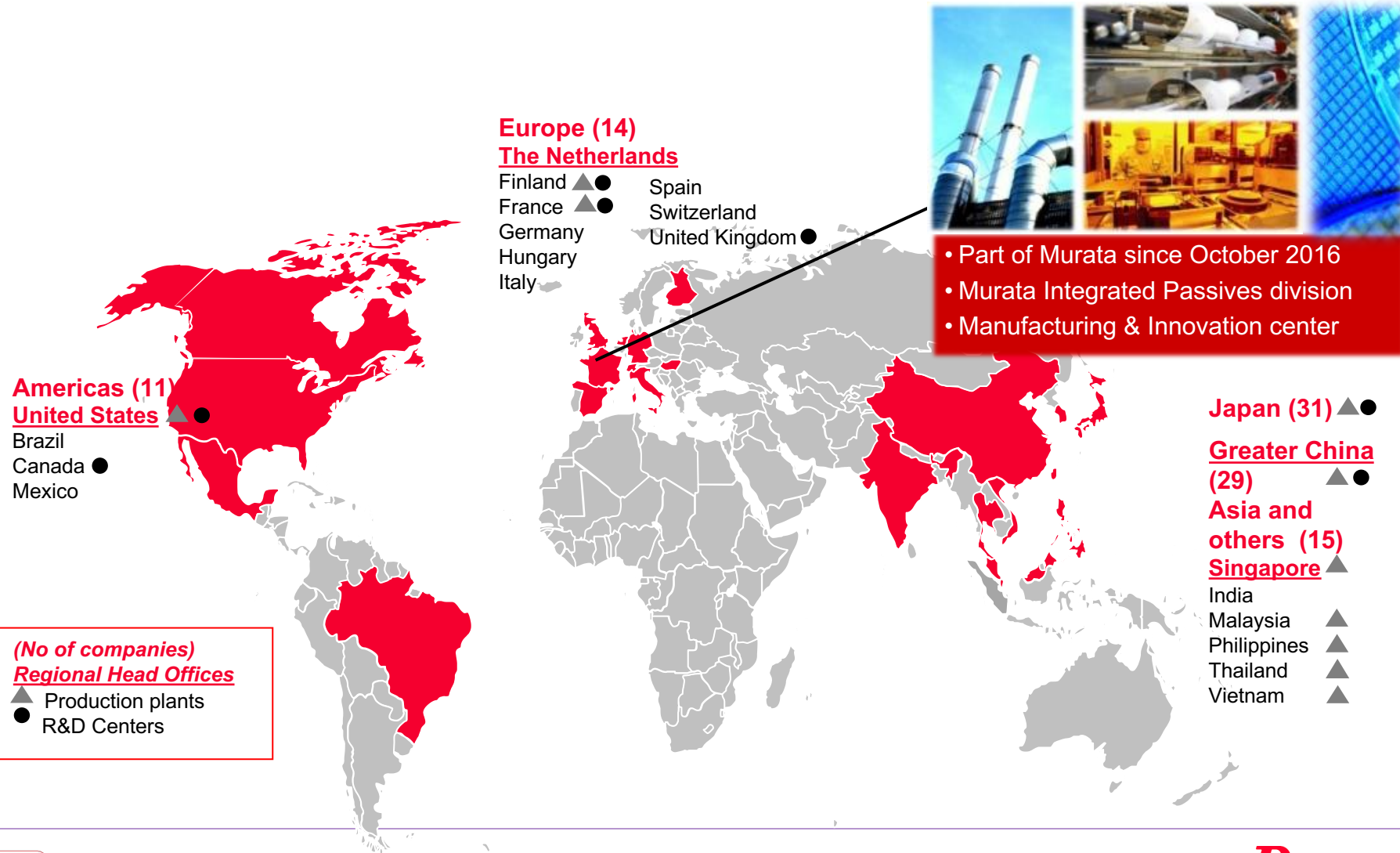
Our Strengths

- Advanced materials technology and expertise
- Broad product portfolio
- Extensive global manufacturing and sales network

Our Figures

- Net sales 1,534,045 million JPY (2019)
- Employees 74,109 as of March 2020
- Number of subsidiaries 92 (28 in Japan, 64 overseas)
- Established in 1944

Murata Integrated Passive Solutions

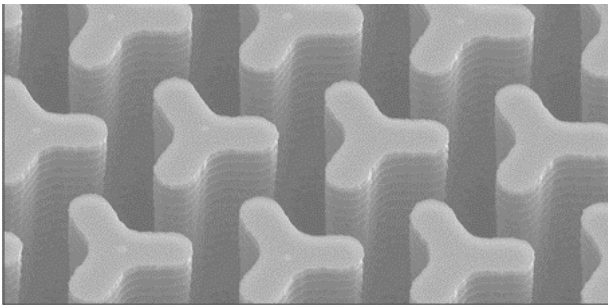


Our technology

3D Silicon Capacitors

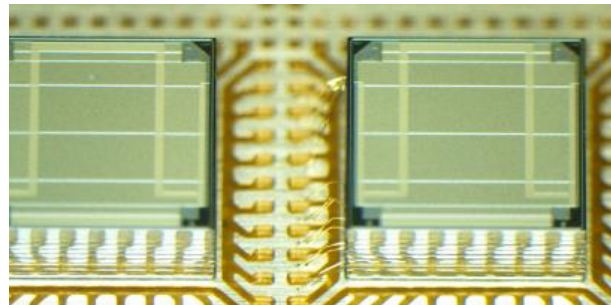
3D:

We have invented a unique technology based on **3D structures**. These structures enable high level of **integration** and **miniaturization** of capacitors.



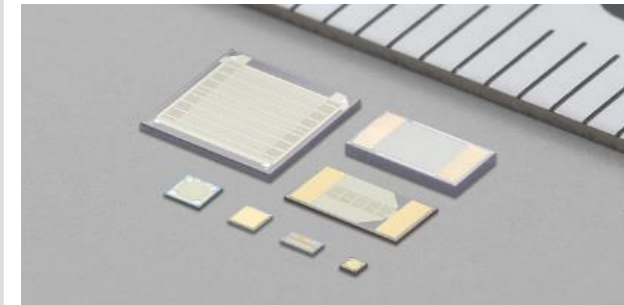
Silicon:

Our technology is based upon **silicon** components. Silicon capacitors can reach **outstanding performances** in stability, frequency and temperature

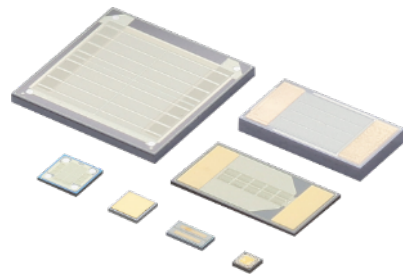


Capacitors:

We are specialized in integrating **passive components (custom and off-the-shelf)**, with a strong focus on high performances **capacitors**.



What does Silicon bring?



Silicon Capacitors



High stability in temperature

Up to **250° C** environments



Signal stability over frequency

Up to **110 GHz** applications



Stability regarding voltage

No voltage dependance



Stability over ageing

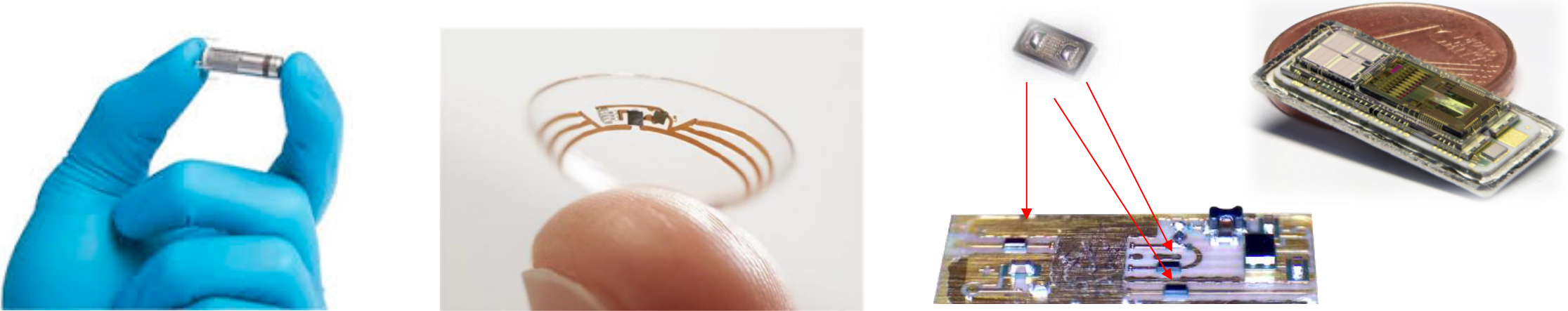
Minimum lifetime of **10 years**



Extreme low thickness

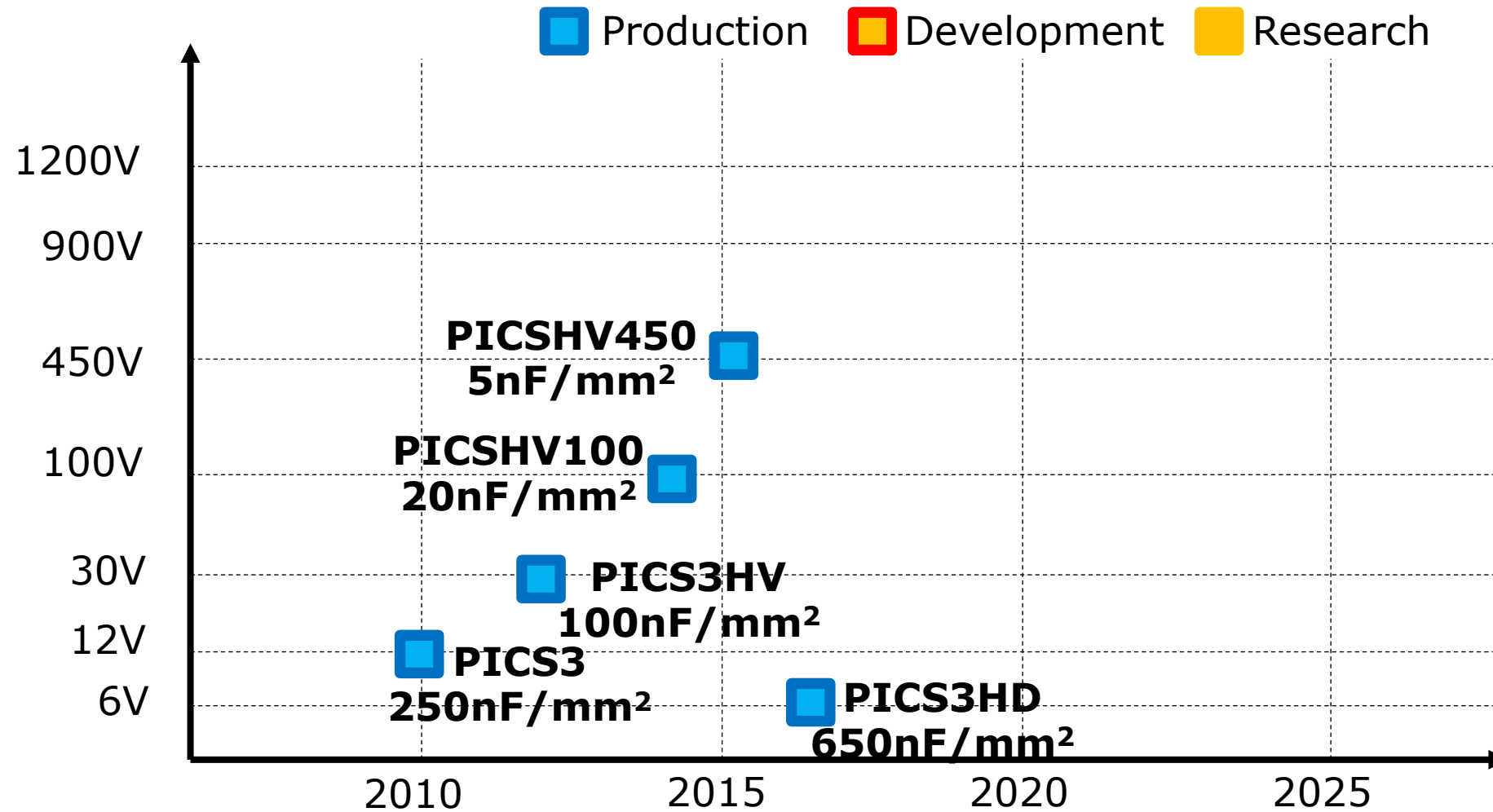
Down to less than **50 µm**

Where are they used today?

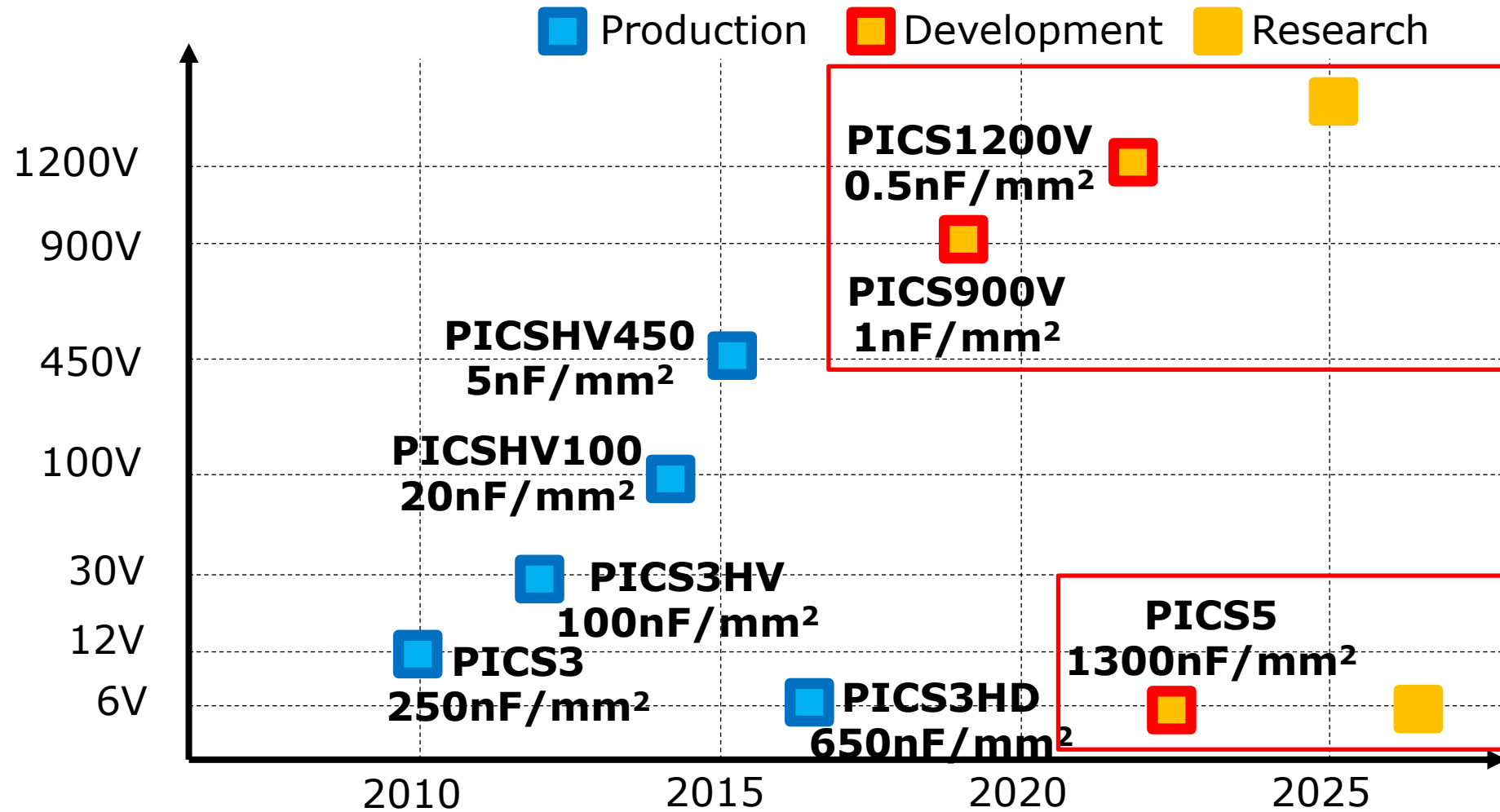


- Widely used in Implantable Devices like pacemakers, stimulators, etc...
- Also adopted in High Speed Data communication modules (optical and wireless) and in High Reliability Industrial applications
- Voltage range today is from 6V to 150V

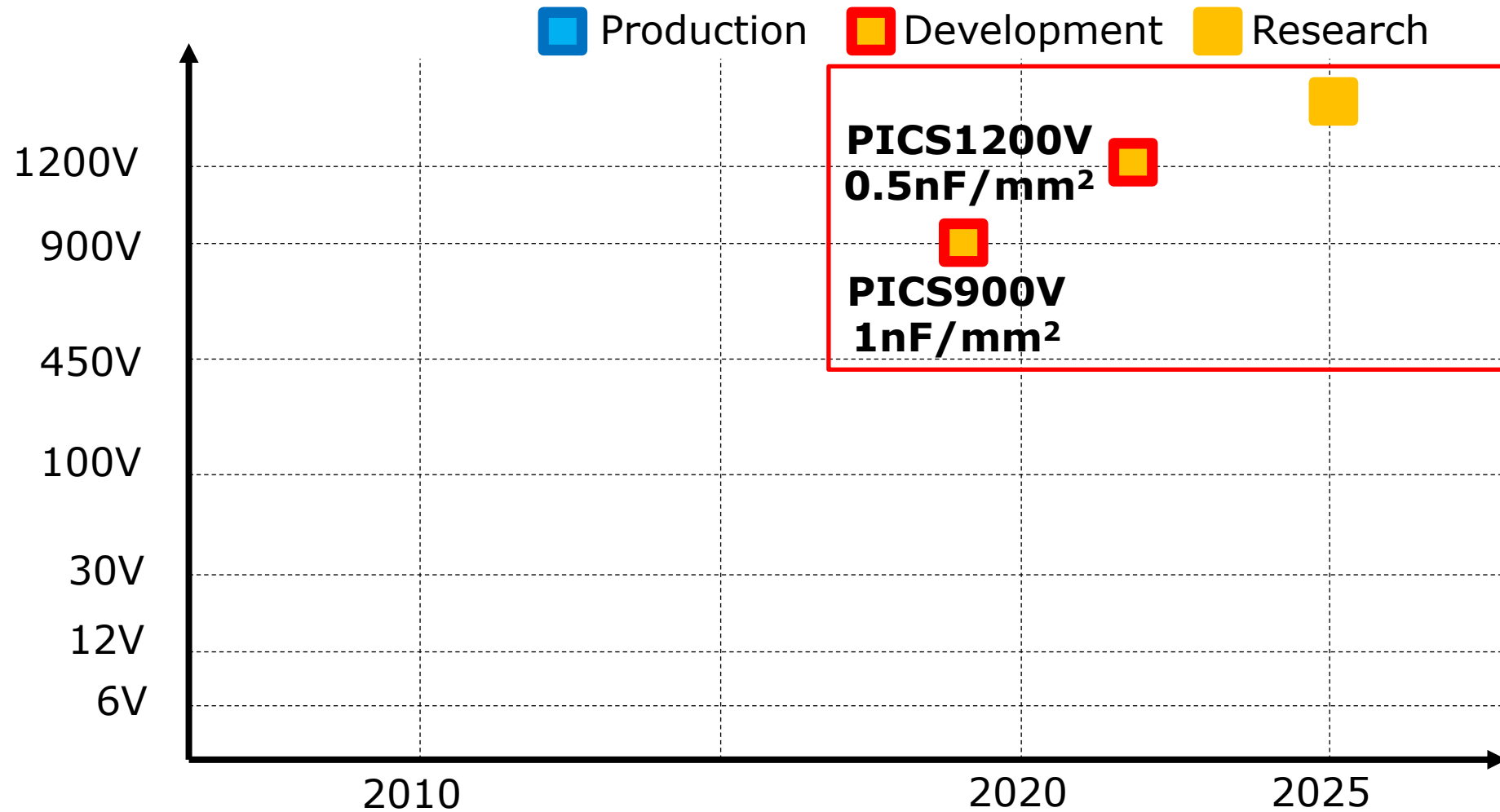
Which part of the roadmap is developed in IPCEI?

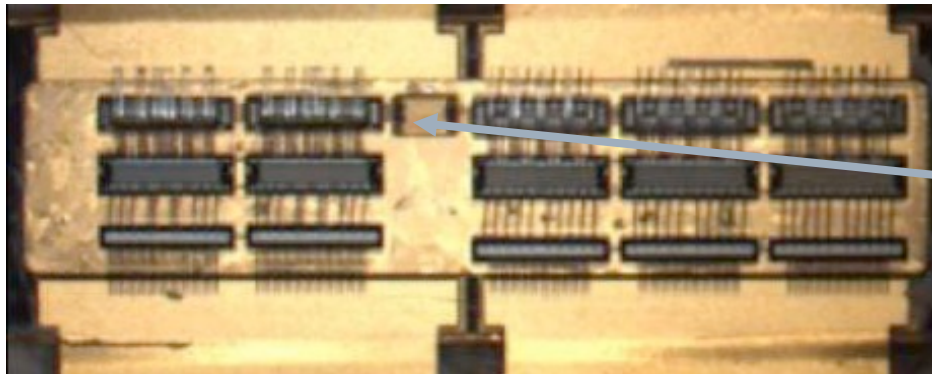


Which part of the roadmap is developed in IPCEI?

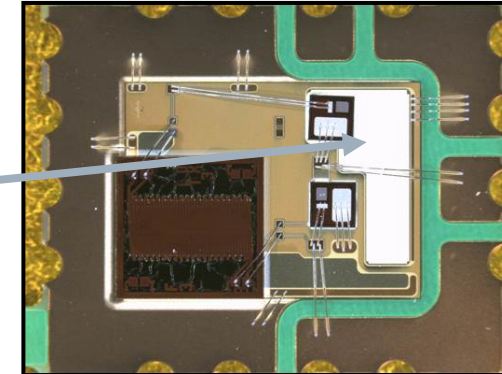


Focus on High Voltage and Power : main challenges



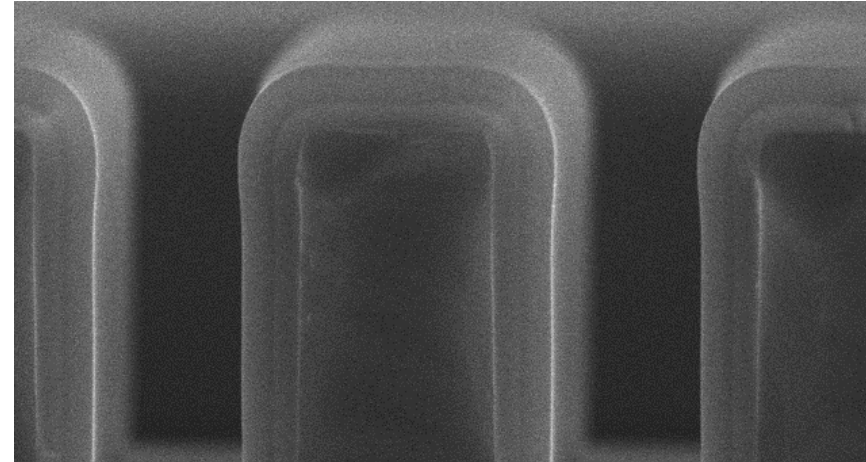
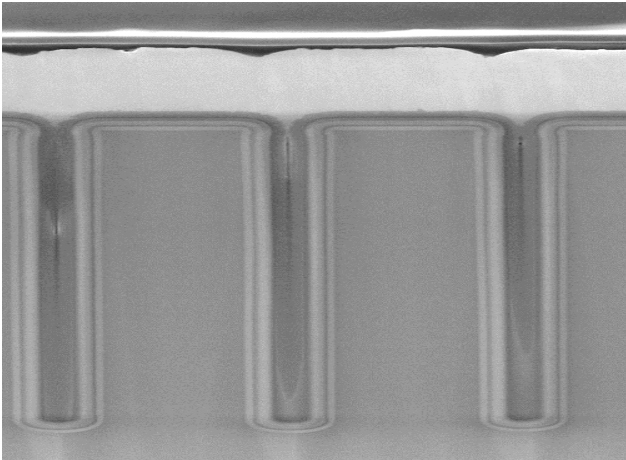


Silicon Cap



- ❑ One of the first challenges is Packaging and Thermal management
- ❑ This has been studied heavily for products used in RF Power transistors for Base Stations and integrated HV SiPs
- ❑ These products are using process nodes up to 150V for Si LDMOS or GaN transistors but the component structure is very similar to higher voltages
- ❑ We confirmed the possibility to use the same assembly technologies for Capacitors than for power transistors (wirebond mainly)

Focus on High Voltage and Power : main challenges



- ❑ The second important challenge is the deposition of high voltage dielectric material in high aspect ratio 3D structures
- ❑ The current R&D projects are concentrating on Silicon OxyNitride to ensure a high reliability and low leakage
- ❑ Next generations (>1200V) will require alternative solutions

Focus on High Voltage and Power : main challenges

- Our third challenge is more related to the definition of required characteristics of passive components
- Silicon passive components show some properties that are different from standard passive components
- This is changing the way of working of module design engineers : critical passive components should be designed also at the beginning of the projects, together with active functions

Conclusions and perspectives

- Thanks to this cooperative R&D project, we have been able to associate advanced power module designers with end users (mainly in automotive) and our advanced technology development teams
- This is allowing early definition and adoption of new technologies like Silicon passive components for high voltage and power!
- Targeted functions are :
 - DC-DC converters
 - On Board Chargers
 - Inverters
 - ...

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