Microwave & RF
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Le GaN chez TSA : des circuits aux systèmes

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Outline of the presentation

- Introduction
- Critical Microwave Technologies
- Microwave components
  - GaAs
  - GaN developments
  - SiGe opportunities
  - MEMS for power switching
- Perspectives

Requirements for new systems

- Radars
  - Air, Land, Sea, Space
- Electronic Warfare Systems
  - Air, Land, Sea, Space
- Mission systems
  - Manned and unmanned mission aircraft

Induces strong requirements for the RF sensors

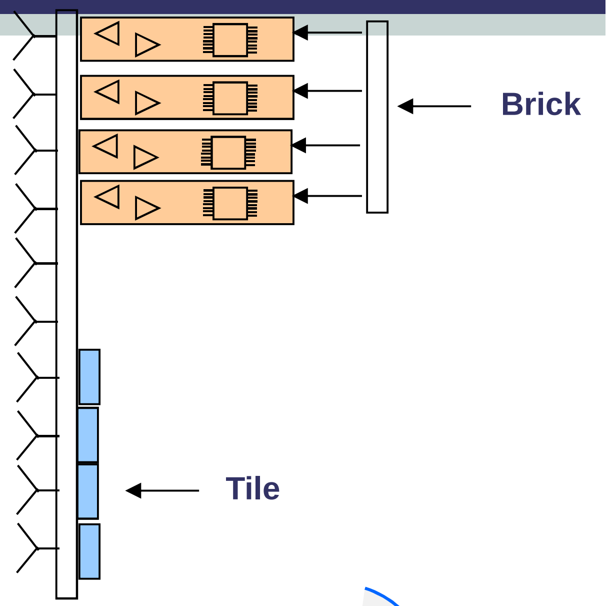
Future airborne and space defence systems

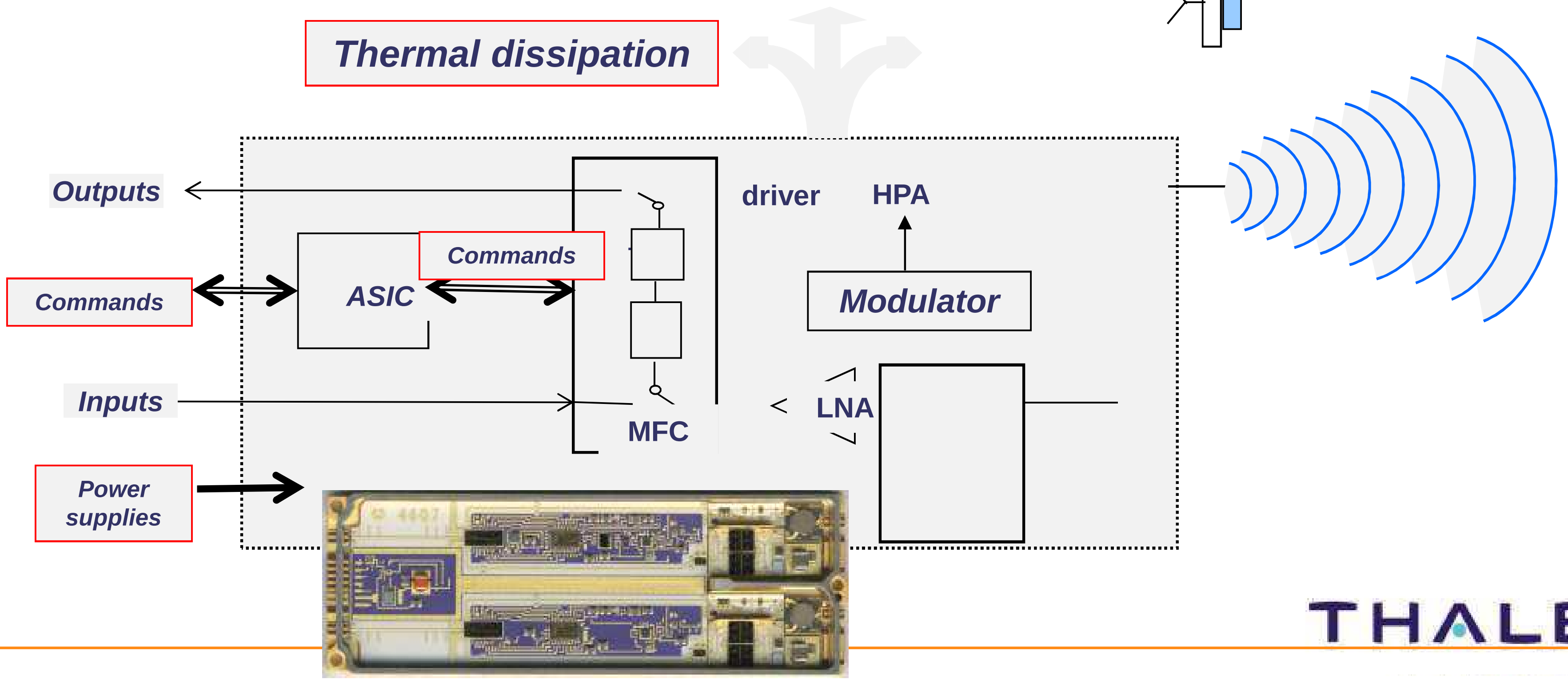
- **Radars**
  - Increased detection capabilities
    - → higher radiated power
    - → increased receiver performances
  - Thermal budget : advanced thermal management technology
  - Power consumption budget : low power consumption circuits

- **Electronic Warfare and Communications**
  - AESA architecture allows performance improvement for both receivers (sensitivity) and jammers (radiated power)
  - Broadband operation : 1 cm mesh → tile architecture, 3D packaging

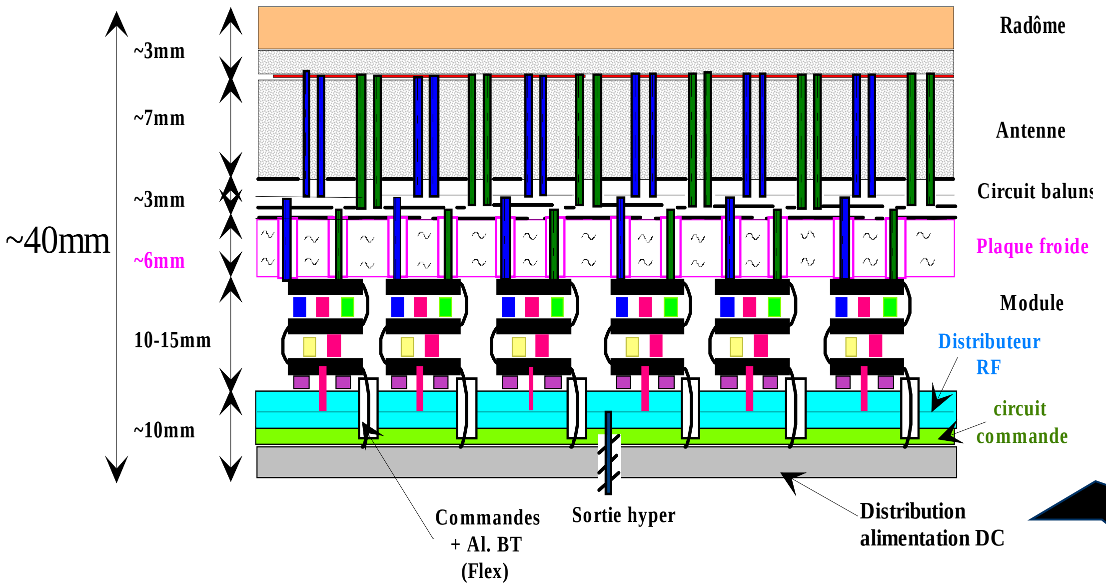
T/R Modules Architecture

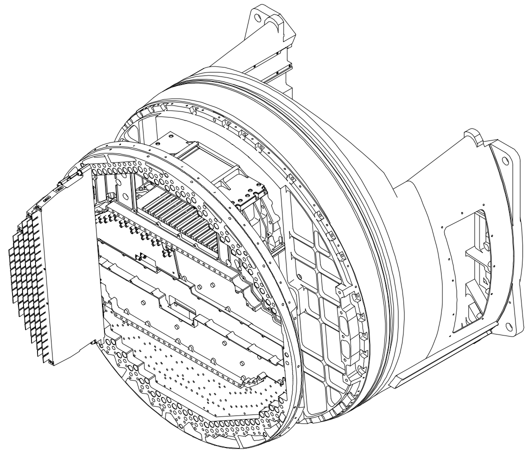
- **Mid term :**
  Brick architecture
- **Long term : Multifunction antenna**
  Tile architecture,3 D





Requirements for new systems

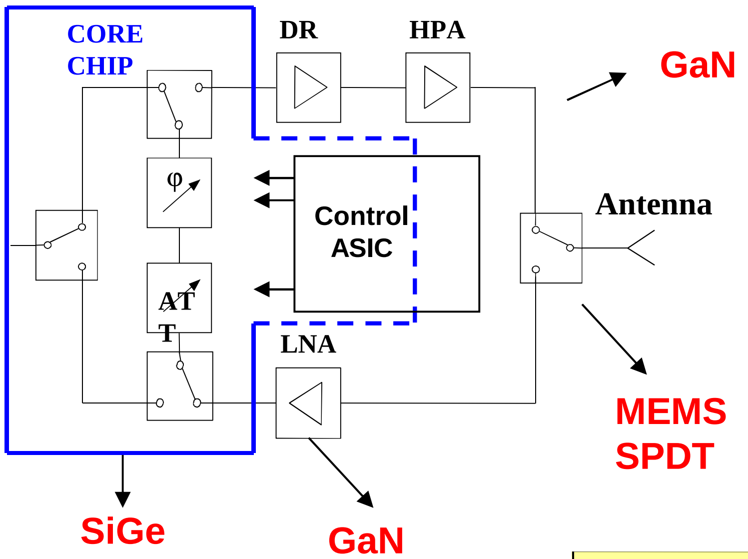


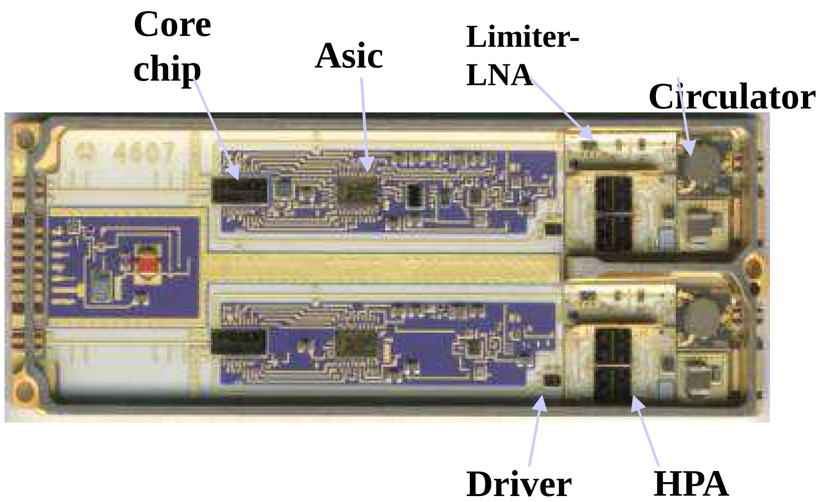


Significant reduction of the thickness

Solution : the tile architecture

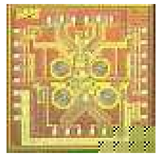
Critical Microwave Components Roadmap





		short-term solution	mid-term solution
HPA	S-band	Si BJT -> GaAs HBT	GaN HEMT
	X-band	GaAs HBT, P-HEMT	GaN HEMT
	C-Ku band	GaAs P-HEMT	GaN HEMT
Core-chip	all bands	GaAs P-HEMT	SiGe
LNA	all bands	GaAs P-HEMT	GaN HEMT
T/R Switch	all bands	Circulator	Power MEMS

< 5 years



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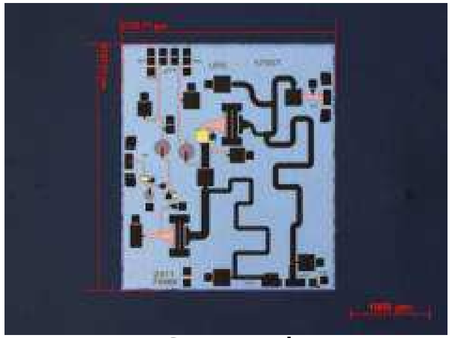
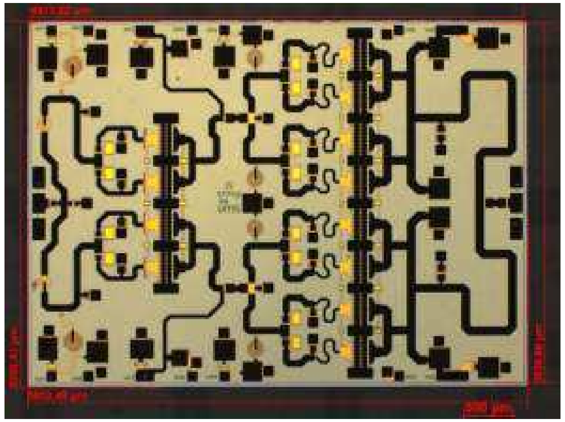
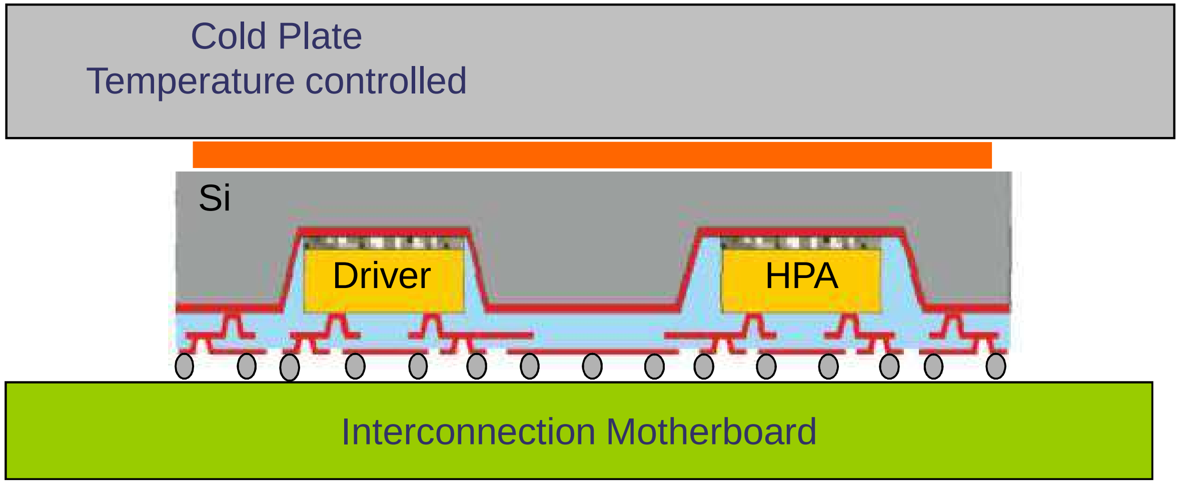
2D tile silicon substrate modules

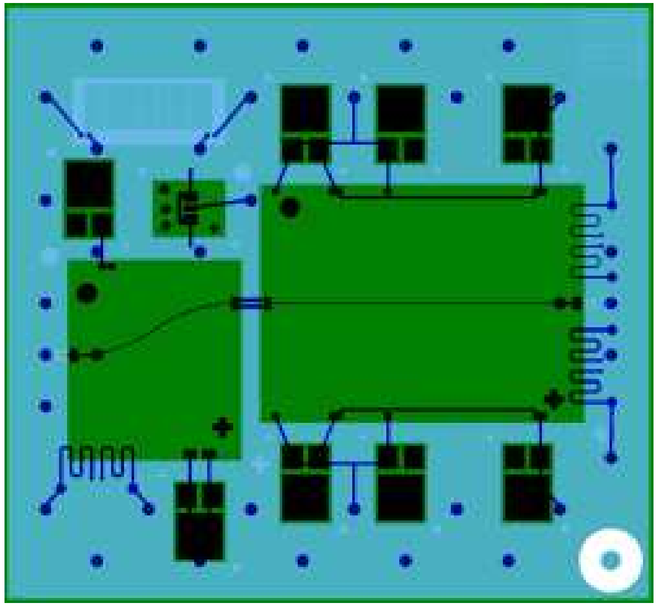


GaN Driver

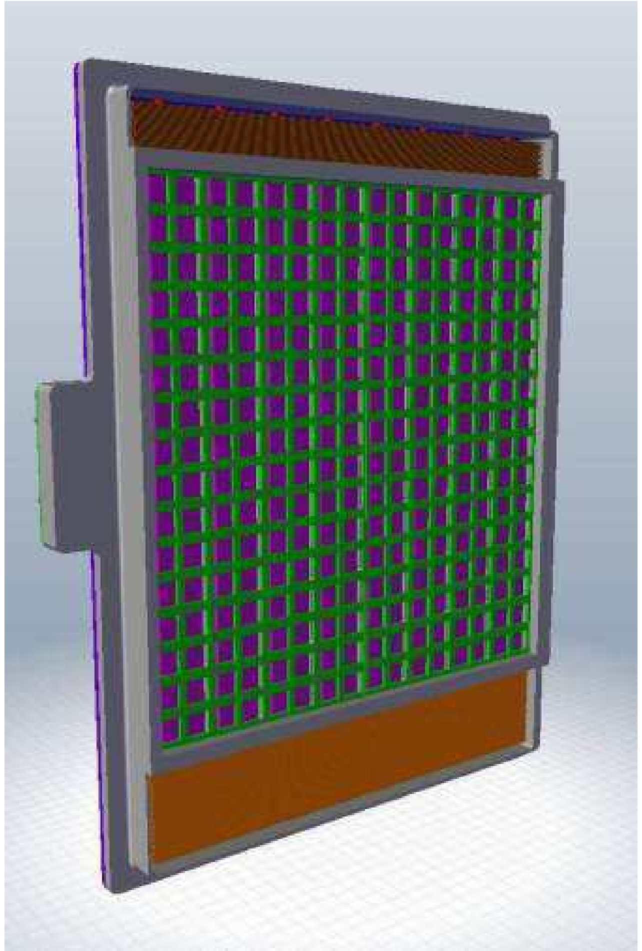


GaN HPA





X band 2D tile antenna for surveillance radars



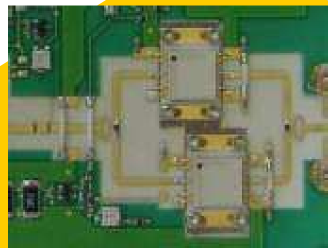
Solid-State Power Amplifiers in X-band

From MMIC to SSPA:
Design Approach using Building Blocks

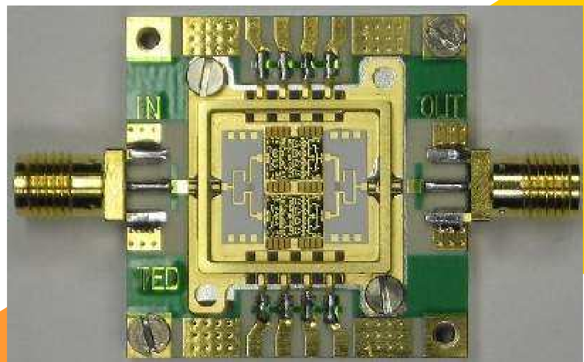
Architecture analysis

300 W SSPA

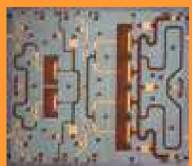
Demonstrators



100 W class MODULE
-



50 W class HPA



UMS chip

MMIC
25 W 40%

T/R modules - Conclusion

- **Achieving production of highly integrated T/R modules is a key point :**
  - Introduction of new components like GaN,SiGe,MEMS,…
  - Reduction of the module size
  - Compatibility with “tile” architectures
  - Cost reduction

- **The corresponding technologies are all mastered by THALES and multi- use for airborne ,space and ground T/R modules.**

- **The cost reduction will come from the experience gained in airborne active antennas large productions.**