Packaging and manufacturing approach for radar applications

Thales Microelectronics
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A lot of microwave sensors

- Air to Air/ Air to Ground Radar
- Data link
- Electronic warfare
- Electronic attack
- Electronic Support Measurement
- Airborne and space SAR
- Communication
- UCAVs , UAV

Induces strong requirements for the RF sensors

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Our positioning within Thales

Operational business units

Business lines

Production & Services Centres

Competence Centres

Thales Microelectronics

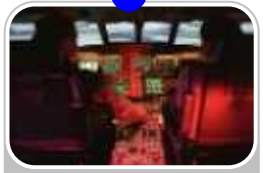
6 market-oriented worldwide activities (GBU)

Ground transportation systems

Secure communications and information systems

Land and Air systems

Space

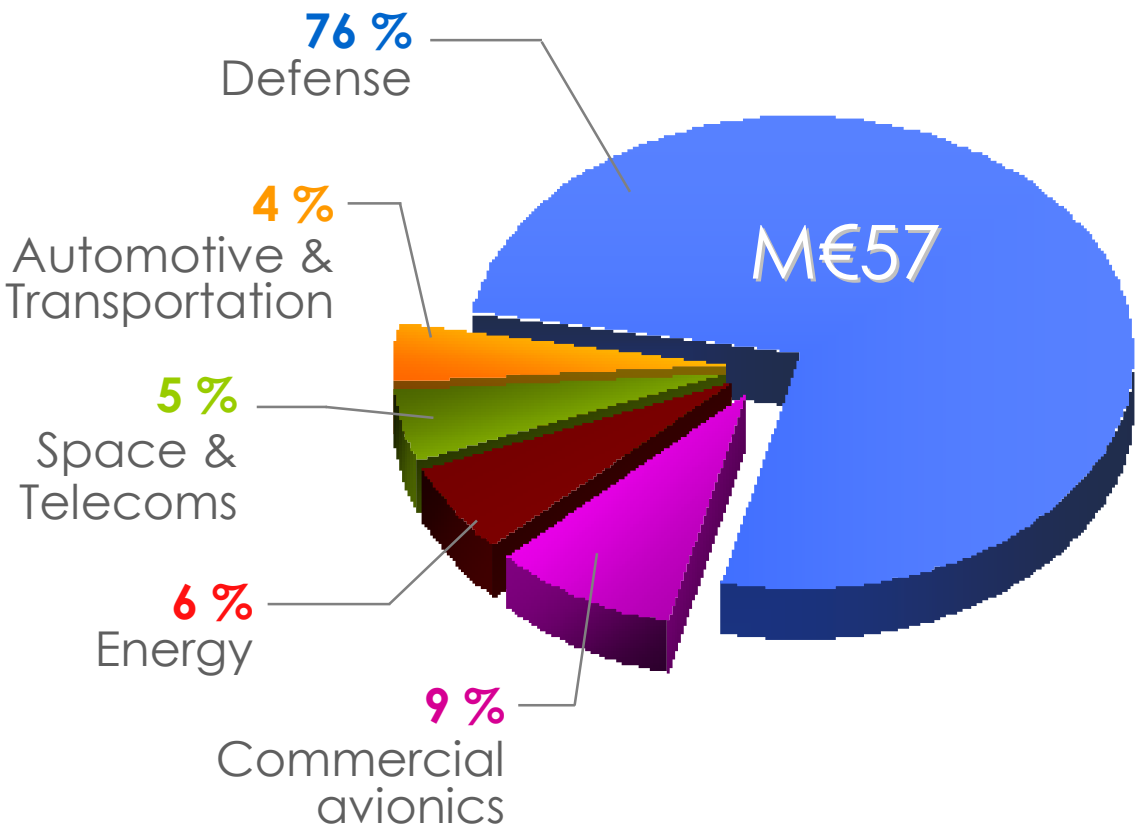


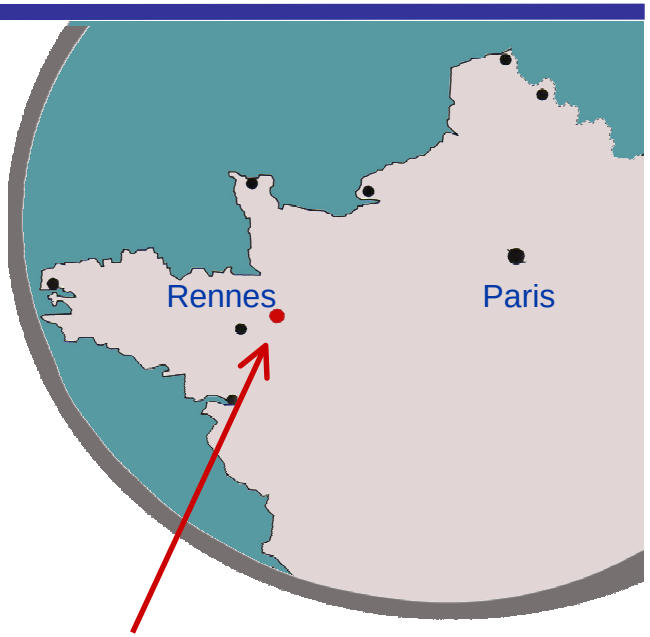
Avionics

Defence Mission Systems

Thales Microelectronics : activity

activity





450 employees
Etrelles- Brittany

One single site embracing the full spectrum of manufacturing means and development capabilities

Thales Microelectronics profile

Competence Centre

Production & services Centre

Our mission

Supplier of development, engineering and manufacturing (micro)electronics tailored solutions.

Full in-house package of services from designer support up to integration and support of products/equipments.

Our specifics

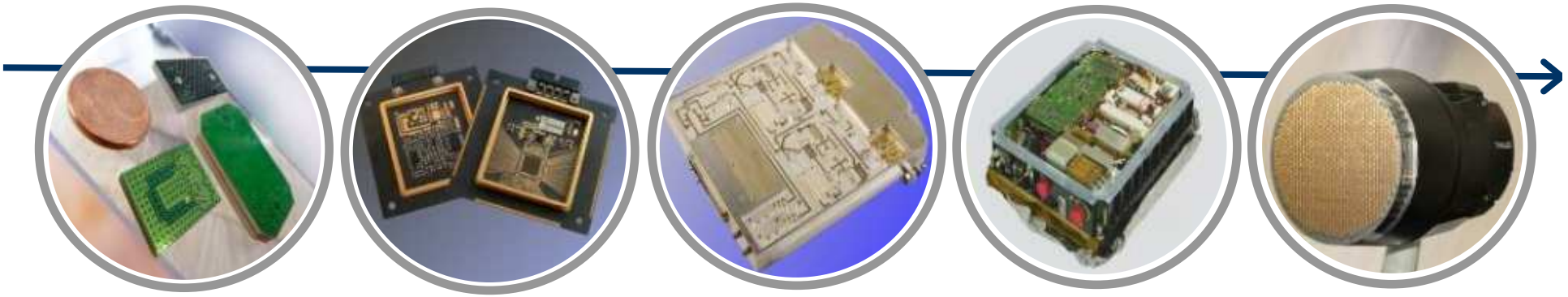
Command of applications operating in **harsh environments** (mechanical and thermal stress, radiations - *T°>200°C*).

2 interlocking hubs of know-how:
A technology & electronics development centre combined with a multi-technological industrial site.

Thales Competence Centre for packaging, interconnections and microelectronics assemblies technologies – Expert in microwaves.

Thales Microelectronics profile

From SiP (System in Package) up to LRU (Line Replaceable Unit)



An leading-edge expertise serving harsh environments

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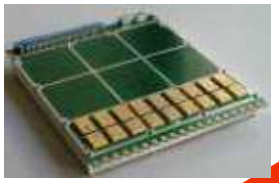
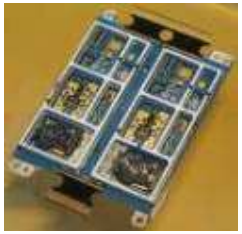
Packaging roadmap

X band TRMs

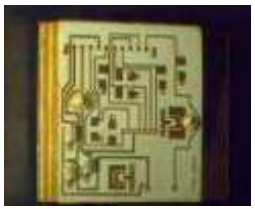




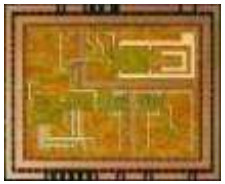
C band space TRM

wideband TRMs

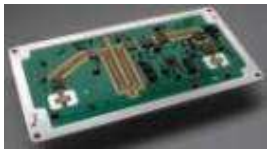
3D



wideband tile TRMs



X band space tile TRM



28 and 38 GHz telecom modules

2D

Thick film multilayers ceramic	HTCC / LTCC	PCBs + SMT assembly	Silicon substrate	Tile modules

years

Key success factors: technologies at stake

TARGET: MASS PRODUCTION OF SMD MICROWAVE COMPONENTS
- COMPLEX RF COMPONENTS -

KEY STAKES TO ADDRESS

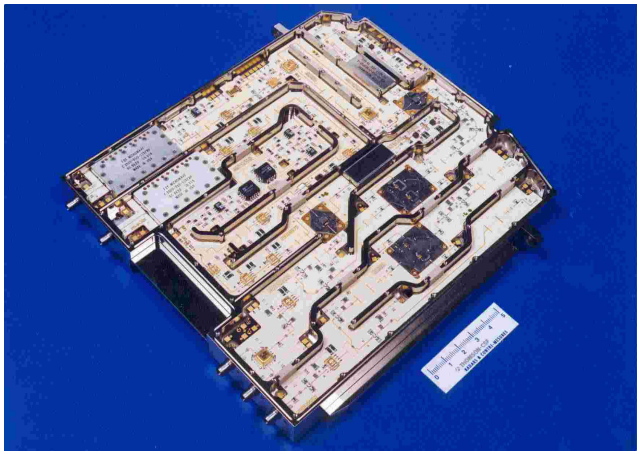
- **Miniaturisation of the microwave function**
- **High reliability**
- **Mass production repeatability**
- **Low cost**

KEY SUCCESS FACTORS

- **Full mastery of the substrate's supply chain**
- **Expert proficiency in microwave technology and assembly processes**
- **Top-level reliability and quality**

Enhancing the key components (1/2)

From multi-function microwave hybrid…

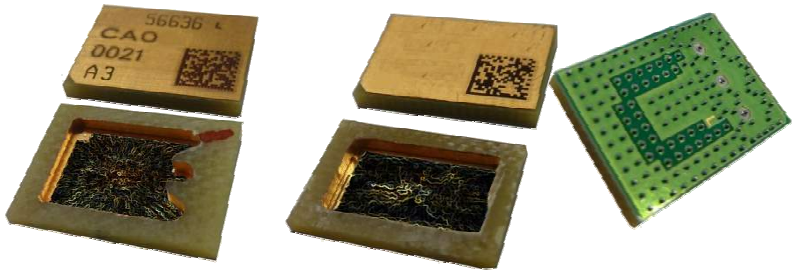


Mixing of material and technologies

Metal, ceramic, organic

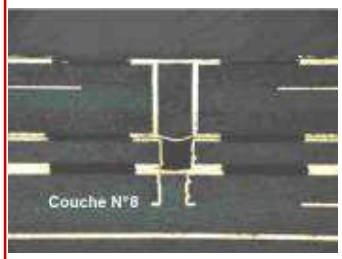
Wire bonding, gluing, soldering

…to full SMD self grounded complex modules



Full Organic complex module Microwave
Thales specific packaging

Global soldering on full organic approach



- Specific substrates: RF/digital mix
- Microwave materials
- Blind, buried vias
- Multisequential boards

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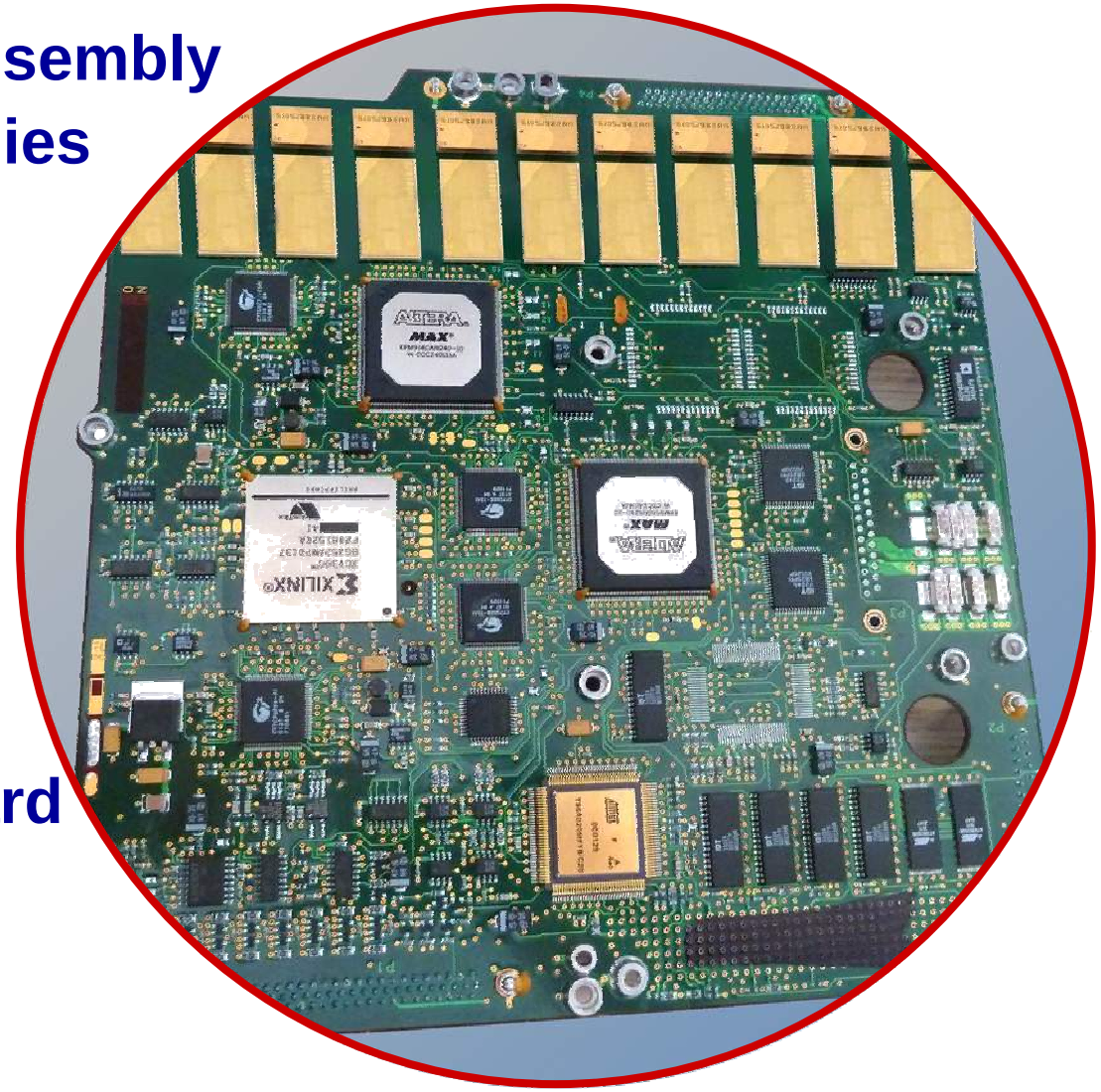
Enhancing the key components (2/2)

Full mixed SMT PCBA assembly for microwave technologies



A SMT rackable microwave multilayer board without metallic shielding

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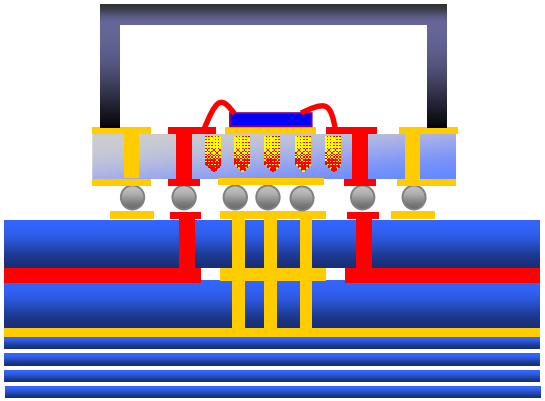
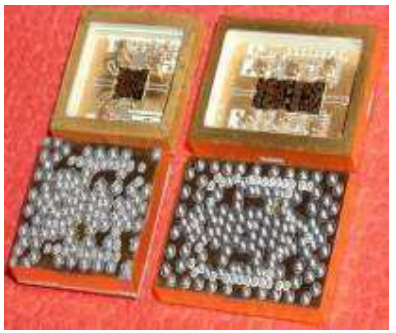
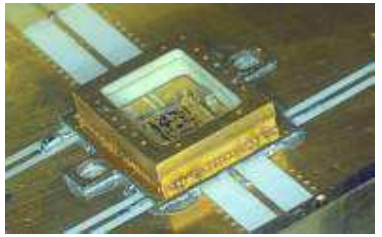
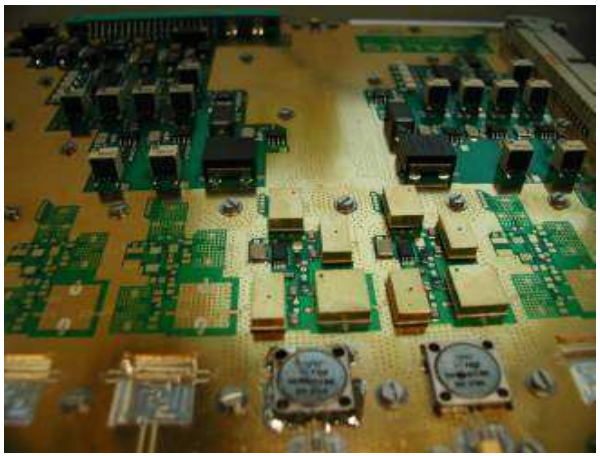
6 – 18 GHz T/R modules



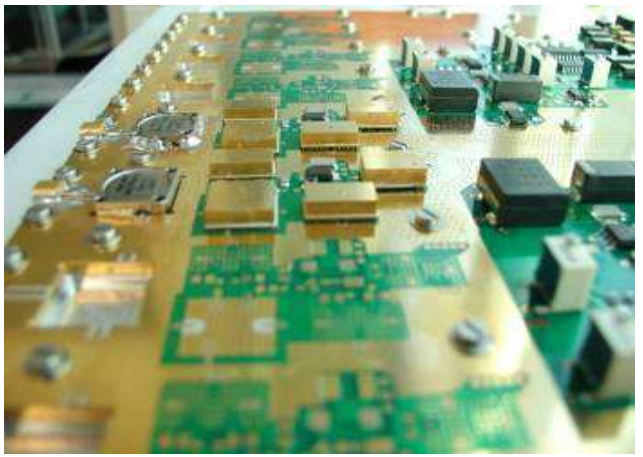




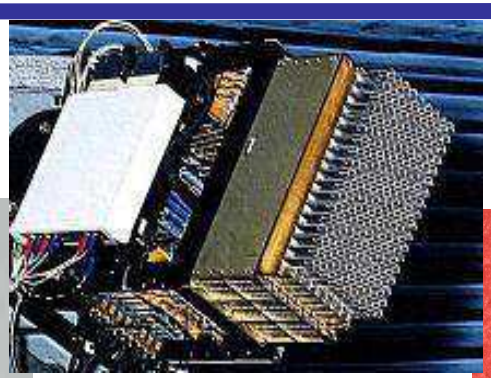
Organic BGA

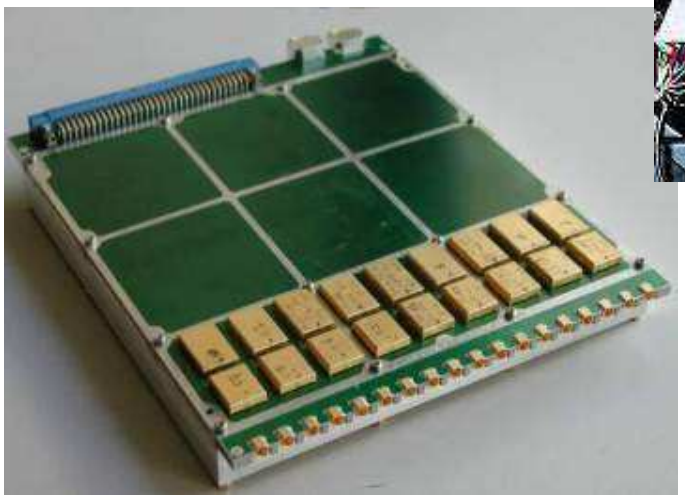


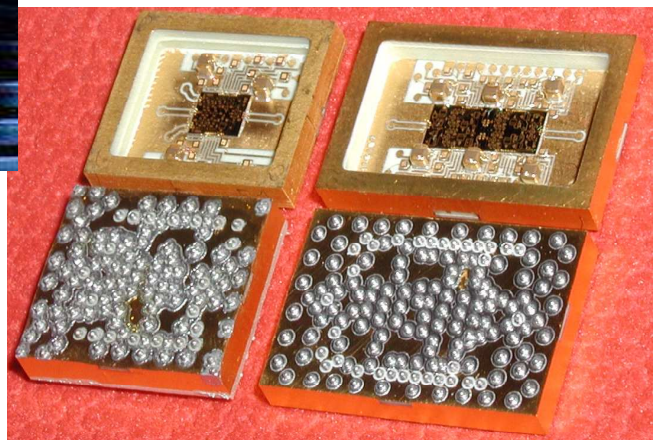
6-18 GHz T/R module

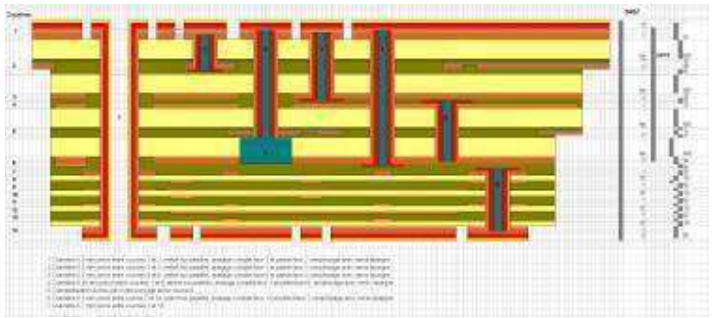


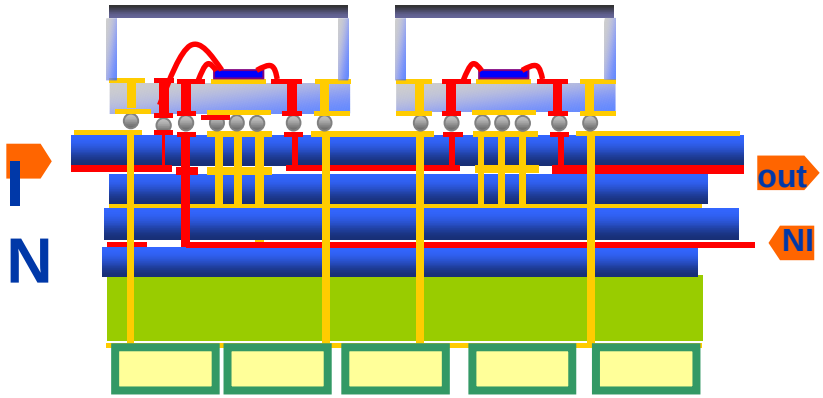
Wide-band space demonstrator











Manufacturing flowchart (1/2)

Cleanroom ISO 5 to 6

PROCESS STAGE	TECHNOLOGY	KEY METRICS
Traceability	Laser marking	Datamatrix identification
Micro-components assembly on carrier	Die & passive components automated placement	Positioning < to 10µm
Micro wire-bonding	Automated wedge-bonding	Precision : 1µm at 3 σ axis repeatability Speed : up to 7 wires/sec.
Lid placement		
Hermetic sealing	Patent process	

Manufacturing flowchart (2/2)

Cleanroom ISO 8

PROCESS STAGE	TECHNOLOGY	KEY METRICS
Balling	Gang ball placement	Own design equipment Over 2000 balls in one step
Automated inspection	Balling conformity by laser inspection	
BGA individual split	Automated cutting	
Functional testing	Fully automated test bench	Cutting precision < to 2µm
Packaging for automated SMT bonding	JEDEC carrier placement	

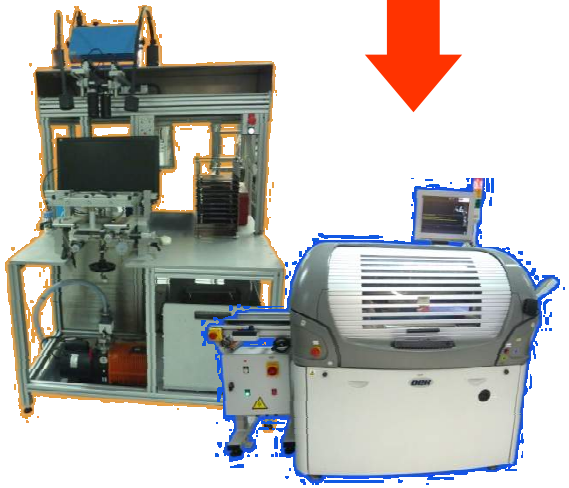
SMD microwave modules automated manufacturing line

Laser marking

Die auto-placement

Auto wedge-bonding

Hermetic sealing



Ball placement

Auto balling inspection

SMD cutting

Functional testing

Metrics

Some key metrics data :

- **Line Capacity microwave SMD Modules:**

  5 000 microwave modules per week (250 K units per year)
  in continuous production
  including functionnal caracterisation and screening,
  for military applications

- **First pass yield :**

  Fonctionnal and Quality > 99 %

Main achievements

A FULLY SMD TECHNOLOGY ENABLING:

- **High flexibility: repair up to unit (BGA)**
- **High repeatability: manufacturing processes compatible of mass production and low-cost targets**
- **A cost divided by a factor 10 for the global function (except components cost) an equal level of performances.**

A process designed for military applications compatible of automotive markets requirements

THANK YOU FOR YOUR ATTENTION

ANY QUESTIONS ?