

Micro-Assembly and Testing of Integrated Photonics in Large Volumes

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A E R O S P A C E | M E D I C A L | H I G H - T E C H | E N E R G Y



Technobis IPS

Mission & Market Statement



- ▶ **Technobis is setup for medium to high scale of PIC assembly and packaging for OEM and SME partners or Universities. The focus is Analog, RF, Telecom and Datacom devices and modules up to 250.000 packages a year.**
- ▶ **Large volume focus markets are Aerospace, Space, Medical and Automotive**
 - **Manual and Automatic Production**
 - ▶ Prototyping | Generic Testing | Small Series | Volumes
 - **Series & Volume Production**
 - ▶ 20% internal (sensing) products
 - ▶ 80% external for third parties
- ▶ **Qualifications**
 - ISO13485, since 2017
 - EN9100, planned 2020
 - Space, planned 2022



Integrated Photonics

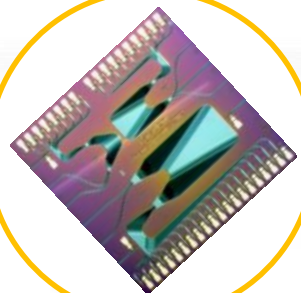
150+ chip designs manufactured
more than 35.000 chips produced

Technobis IPS

Integrated **P**hotonics **P**ackaging **S**ervices & **Gator®** Fiber Sensing Platform

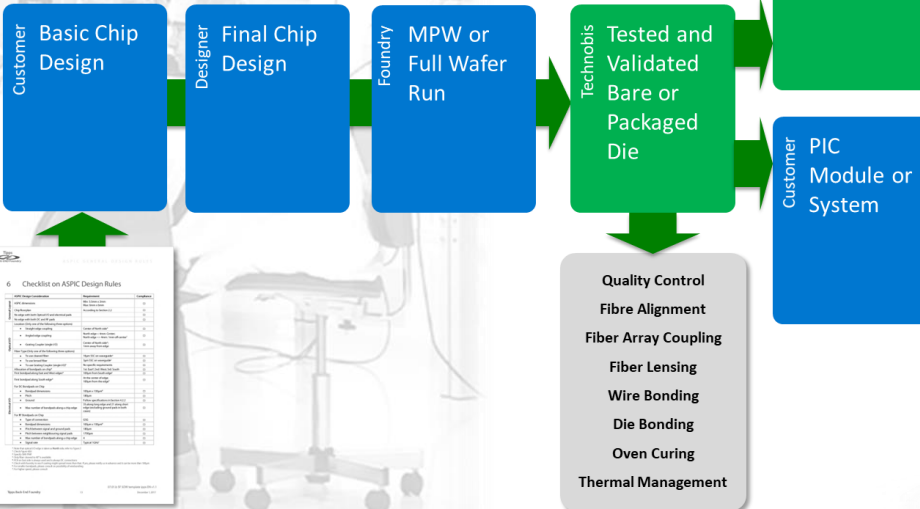
Photonic Integrated Circuits

Optical chip technology



Back-End Foundry

OEM Service Provider for PIC Packaging



Fibre Optic Sensing

200+ systems sold in key markets multiple
OEM platforms high volume
production scale up

FBG Interrogation technology

totally passive | small size & weight
chemically inert | intrinsically safe
non-conductive immune to EMI
low loss | remote sensing



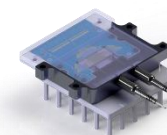
Gator®

Fiber Sensing Solutions



Custom

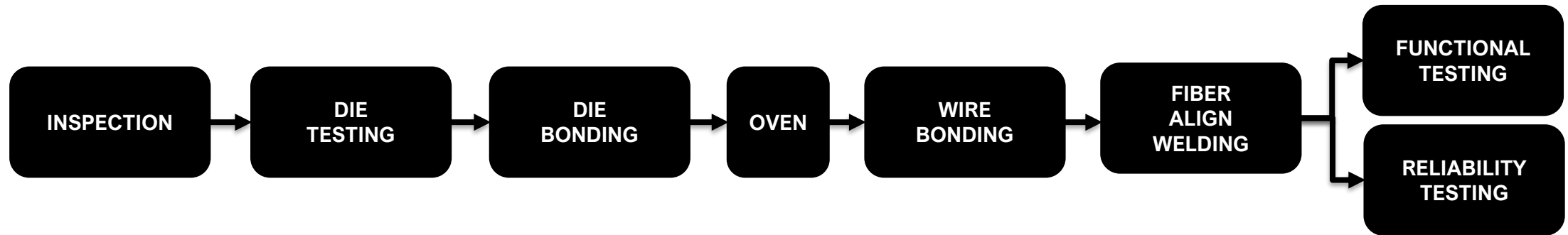
Packaging and Modules



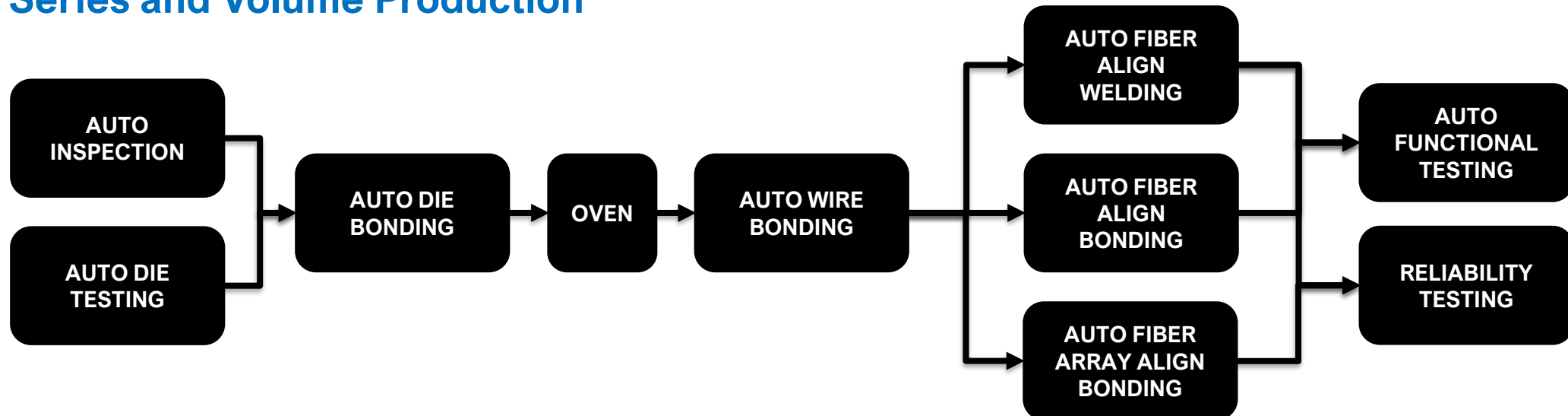
Back-End Foundry - Packaging Services

Standard Products | Custom Products | OEM modules

► Prototyping | Generic PIC testing | Small Series Production



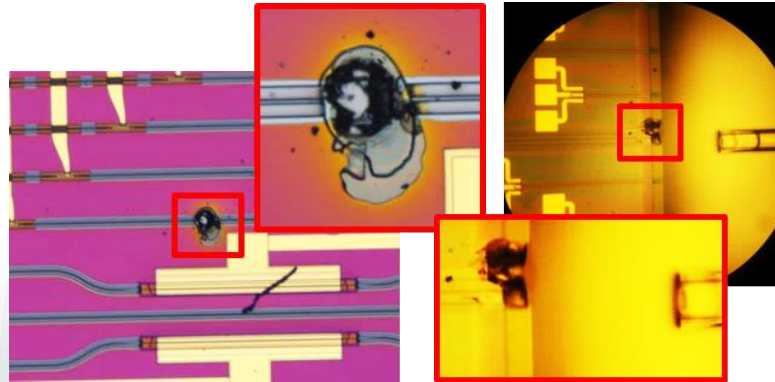
► Series and Volume Production



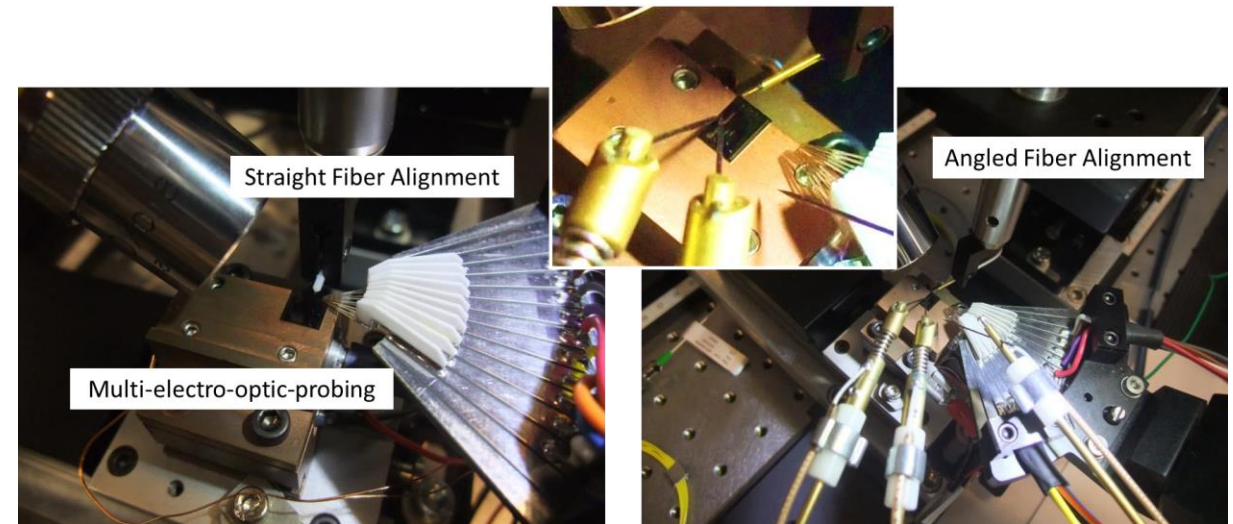
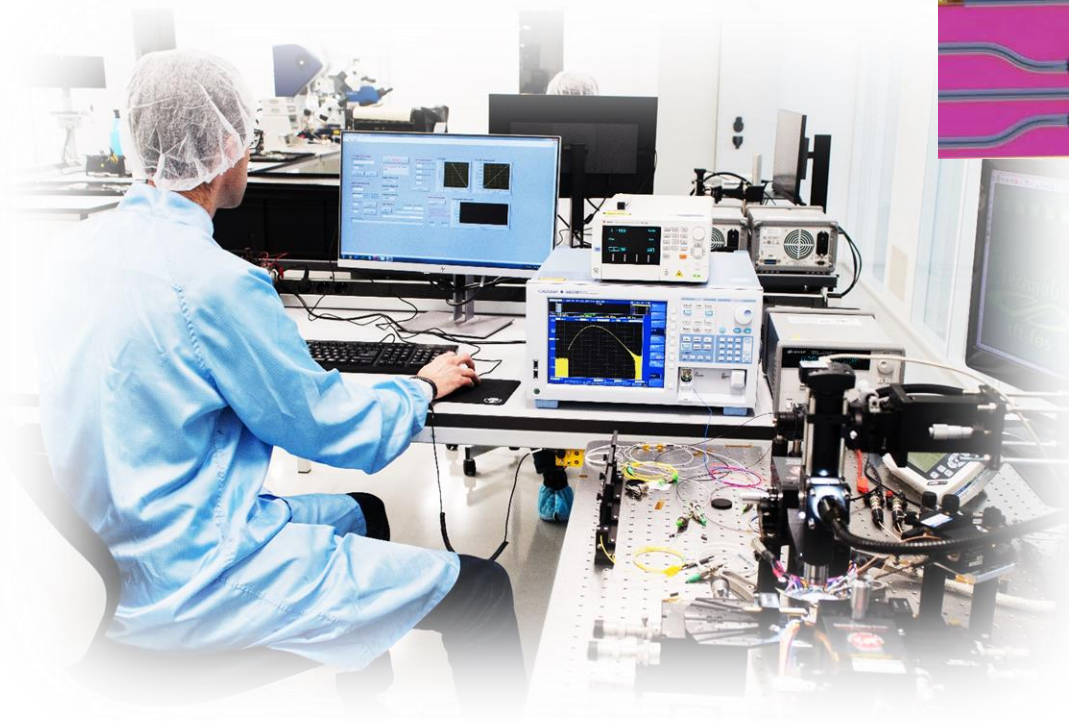
Passive and Active Inspection & Die Testing

Quality Control

*Examples of InP waveguide distortions
due to dust or micro damages*



*Passive bare die
inspection*

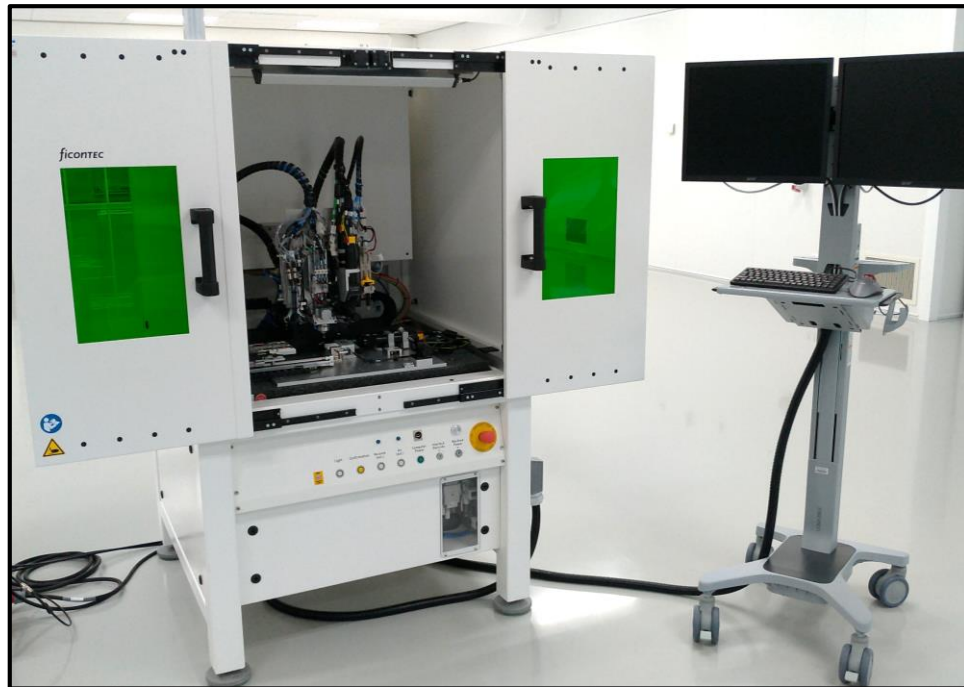
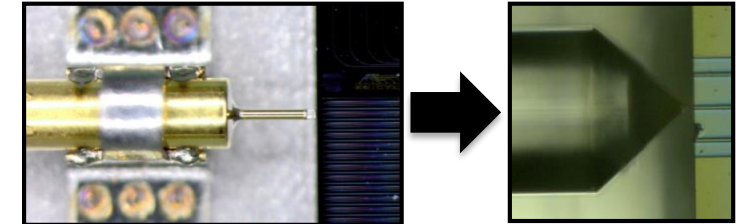


Active bare die inspection on test bench (automation planned 2020)

Die Bonding – Wire Bonding – Fiber Alignment

► In full Service

- Automatic Die and Wire Bonding
- Manual Fiber (Array) Aligner (automation planned 2020)



Automatic Die Bonder



Automatic Wire Bonder



Semi-Automatic Fibre (Array) Aligner

Functional & Reliability Test Capabilities

Prototyping, Series and Volume Production

► In-Product Functional Testing



Environmental Stress Chamber



- Environmental Stress (Thermal and Humidity)
- Shear Pull Tester
- Particle Impact Noise Detector (PIND) (2020)
- Shaker for Shock/Vibration (2020)

Shear Pull Tester

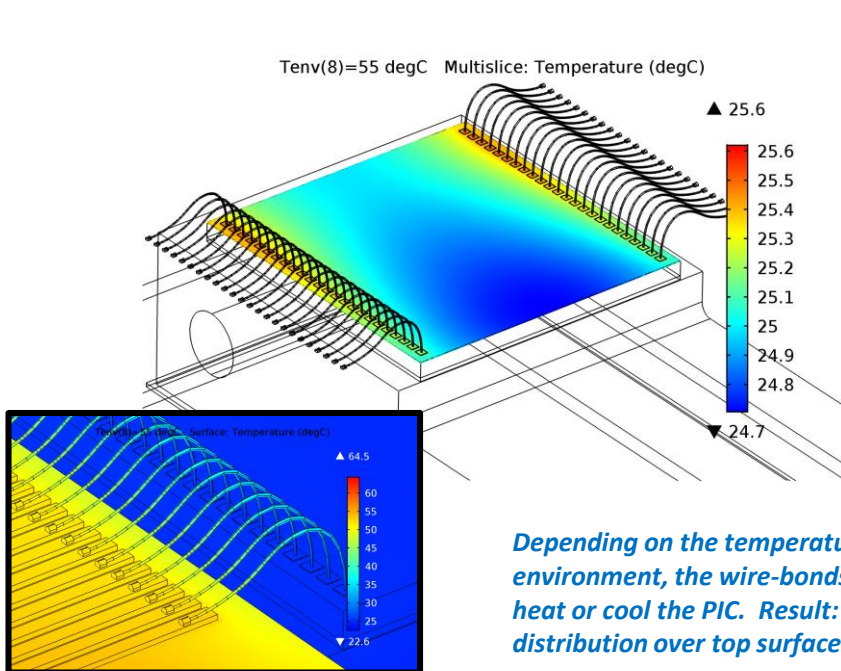


Technobis innovates through advanced Thermal Management

Another dimension in packaging

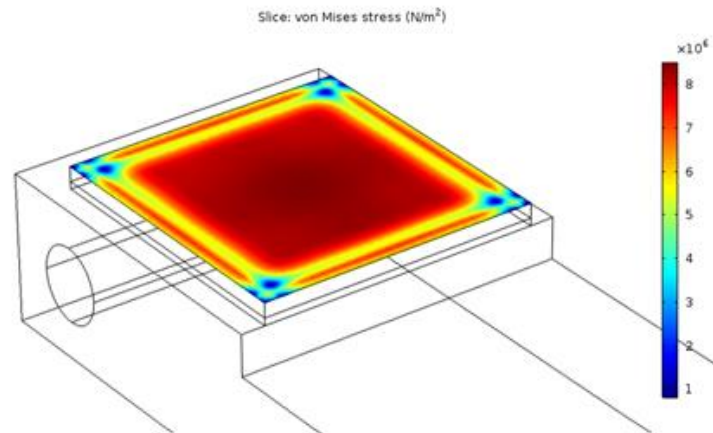
► Many aspects contribute to changes in functionality of the chip after packaging

- Internal stresses
- Temperature fluctuations (environment, electronics, on-chip heat sources, light losses)
- Temperature gradient on the chip

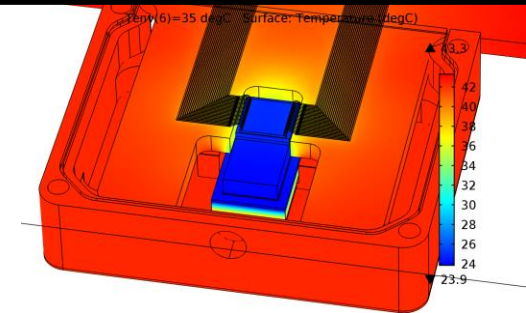
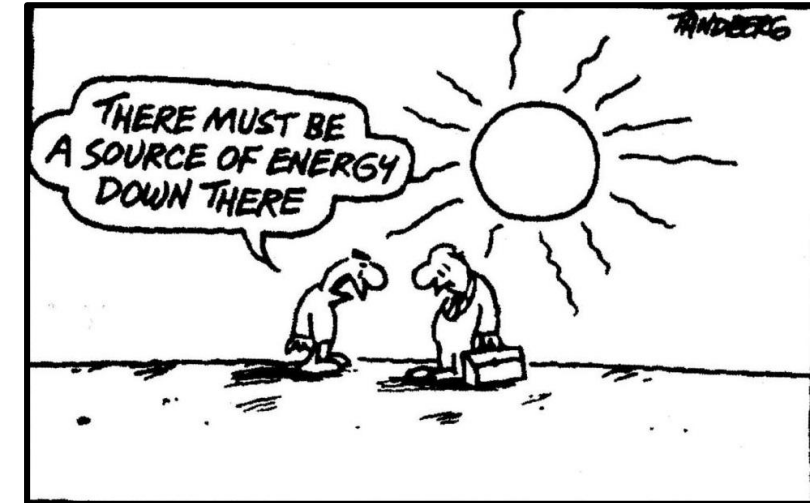


Depending on the temperature of the environment, the wire-bonds will locally heat or cool the PIC. Result: temperature distribution over top surface of PIC

Simulations show that the PIC is thermally connected to the bond-PCB through the wirebonds



Thermally Induced Stress in PIC caused by adhesive layer



The current design has a thermal feedback loop. Heat goes from the hot side of the peltier through the supports to the cold side of the peltier

Overview Packaging Capabilities

Design Capability and Units per week Capacity

Packaging Design Capability		
Themo-Mechanical Packaging		
Passive heat sinks	Yes	
Active heat sinks	Yes	
Microfluids	No	
Test & Reliability		
Optical	Yes	
Electrical	Yes	
Environmental stress		
Failure Analysis	Yes	
Test evaluation and design	Yes	
Others		
Design Rules for Packaging	Yes	
Active Thermal Control	0.1 mK	
Hermetically Sealed	Yes	
Space Qualifiable	Yes	
Aerospace Compliant	Yes	
System in a Package	Yes	

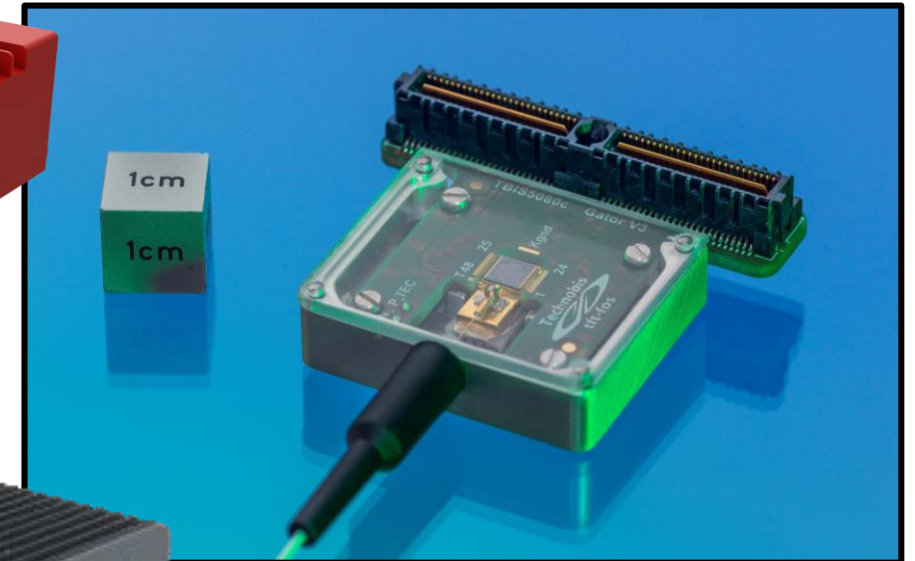
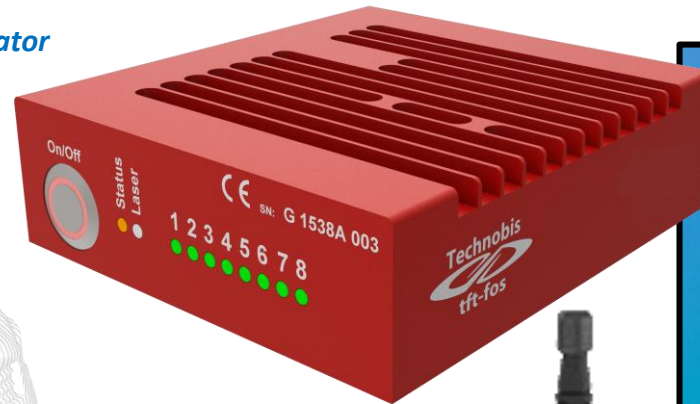
Packaging Design Capability	
Optical (Free Space)	Yes
Optical (Waveguide)	Yes
Electrical (DC)	Yes
Electrical (RF)	Yes
Thermal	Yes
Mechanical	Yes

Packaging Design Capability	Now	2020
Optical Packaging		
Optical Fibers (lensed)	Yes	Yes
Optical Fiber (arrays)	Yes	Yes
Micro Optics	No	No
PIC to PIC edge coupling	No	Yes
Photonic Wirebonds	No	Yes
Electrical packaging		
Wirebonding (ball bond)	Yes	Yes
Wirebonding (wedge bond)	No	Yes
Wirebonding (ribbon bond)	No	Yes
Gold stud Bumping	Yes	Yes
FlipChip Bonding	No	Yes
Ceramic Interposers	Yes	Yes
PCB Interposers	Yes	Yes

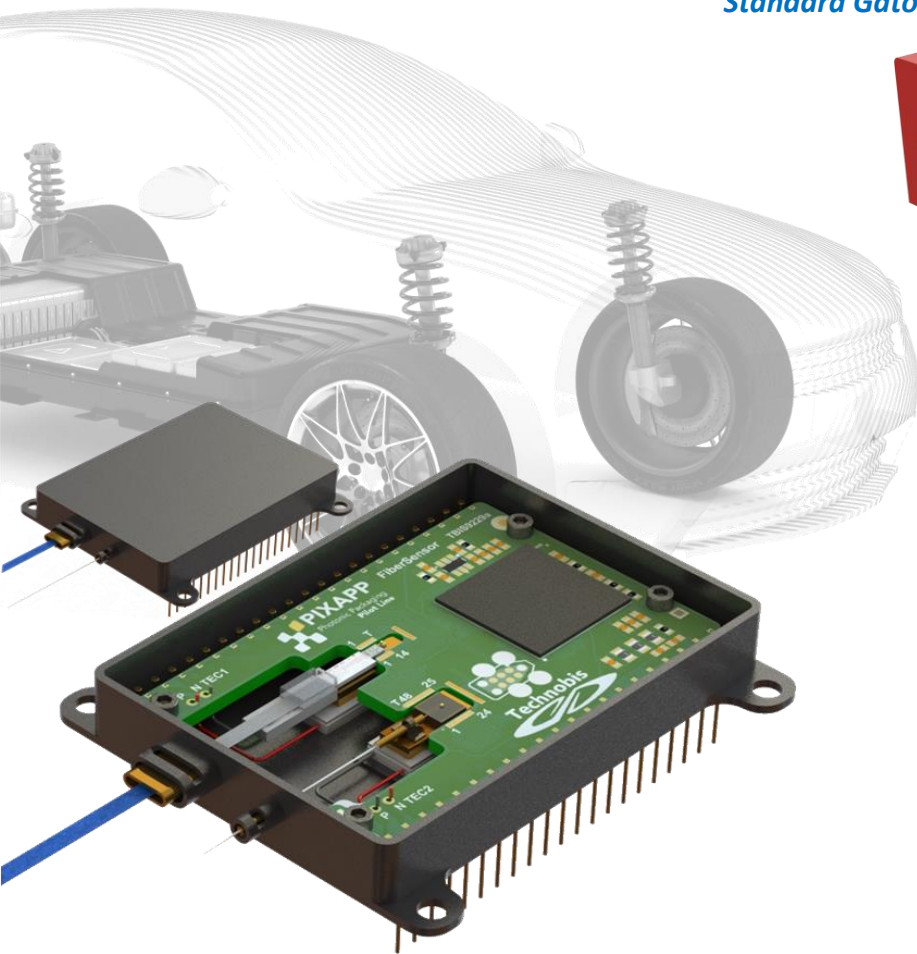
Standard Products and System-in-a-Package

Applications using Advanced Packaging

Standard Gator



Standard Gator package



System-in-a-package for large volume OEM modules for Medical, Automotive, etc.



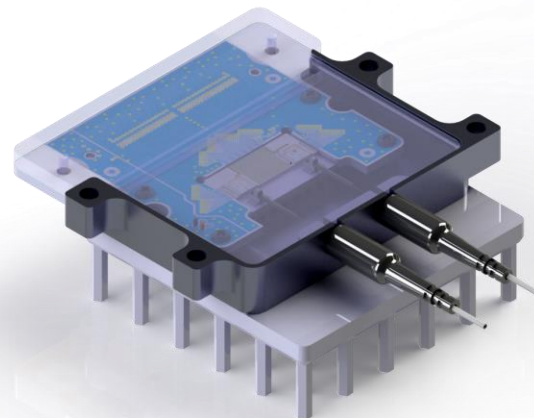
XGator – Standalone, wireless data (Aerospace)

Landing Gear Load Sensing

Applications using Advanced Packaging

► Volume production and long life support for multiple aircraft platforms

- Hard landing detection, Weight on wheels analysis
- Support to Flight management and Flight controls
- ARINC-600 2MCU implementation, OEM Multi-channel FBG interrogator
- Specifically designed optical chip package for Aerospace compliance (MIL-STD 810 and DO-160)



Dual-PIC package for Aerospace

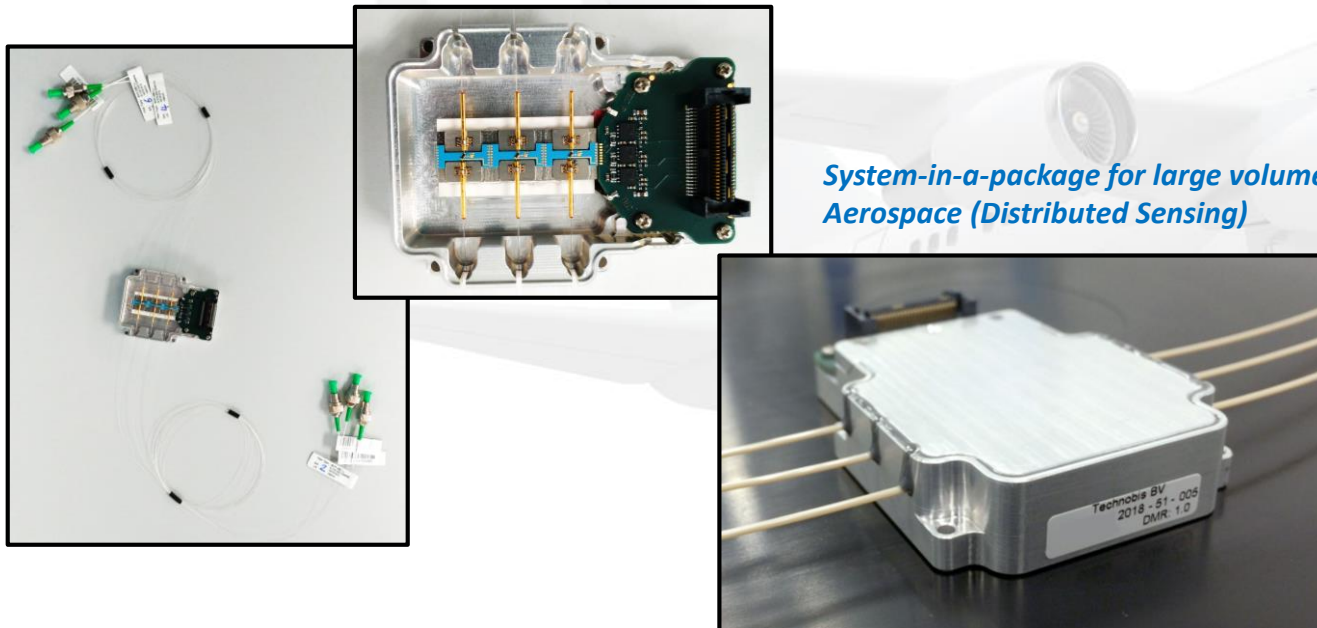


Distributed Temperature Sensing

Applications using Advanced Packaging

► Volume production and long life support for multiple aircraft platforms

- 2500+ uniquely identifiable fiber sensors in a single fiber with large dynamic range
- Multiple WDM/TDM implementations
- Aerospace compliant OEM modules





"Your productivity this quarter has been outstanding, your performance has been impeccable, and I'm someone who believes in rewarding perfection. Too bad about that speck of lint on your tie."



Integrated Photonics Systems

"we keep innovating to face the challenges of tomorrow"

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