

- **Jenoptik Group**
- Optical Systems Division
- Business Unit
Optoelectronic Systems



Jenoptik Group at a glance (2007)



- 3,436 employees worldwide
Of which about 532 abroad, Of which 130 trainees
- Sales: 521.7 million €
Of which 58 percent abroad
- Results from operating activities (EBIT)
35.3 million €
- Cash flow from operating activities: 73.8 million €
- Research and Development ratio
7.5 percent (excluding developments for customers)



Corporate Center

Optical Systems



- Optics
- Microoptics
- Optoelectronic Systems
- Digital Imaging

Lasers & Material Processing



- Diode Lasers
- Laser Systems
- Laser Processing Systems

Industrial Metrology



- Surface Roughness & Contour
- Form & Position Measurement
- Dimensional Measurement

Traffic Solutions



- Equipment
- Service Providing

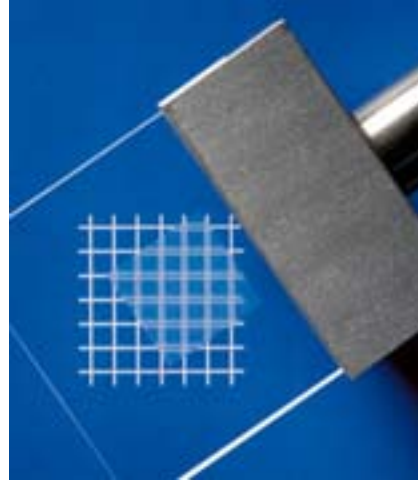
Defense & Civil Systems



- Mechatronic
- Optronics
- Sensor Systems



Optics



Microoptics



Optoelectronic
Systems



Digital Imaging

- Leading global solution provider of precision optical systems designed to meet the most stringent demands in terms of quality, reliability & lead time.
- Design-, development- and production partner for optical and micro-optical components, optical coating, opto-electronic and opto-mechanical assemblies, modules and systems made from plastic, glass and crystals.

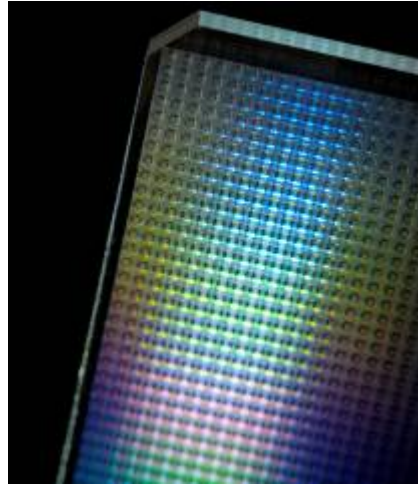
Optical Systems Division

Key technologies and products



Optics

- Classical optics (up to 300 mm)
- Plane, spherical and cylinder optics
- Asphere technology
- Coating EUV to IR
- Components assembly – ultra clean area



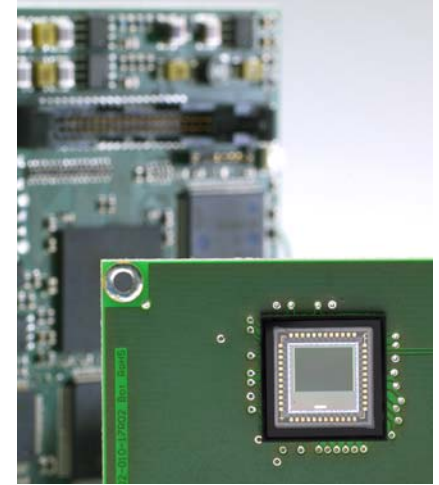
Microoptics

- Diffractive optical elements
- Refractive optical elements
- Gratings & digital filters
- Hybrid micro optics
- Computer generated holograms
- Sensors



Optoelectronic Systems

- Tooling and ultra precision diamond turning
- Injection molding
- Optical coatings
- Assembly and packaging
- System integration



Digital Imaging Systems

- Digital image capture & processing
- Visualization
- Hardware & software integration

Optical Systems Division

Customer oriented total solution provider



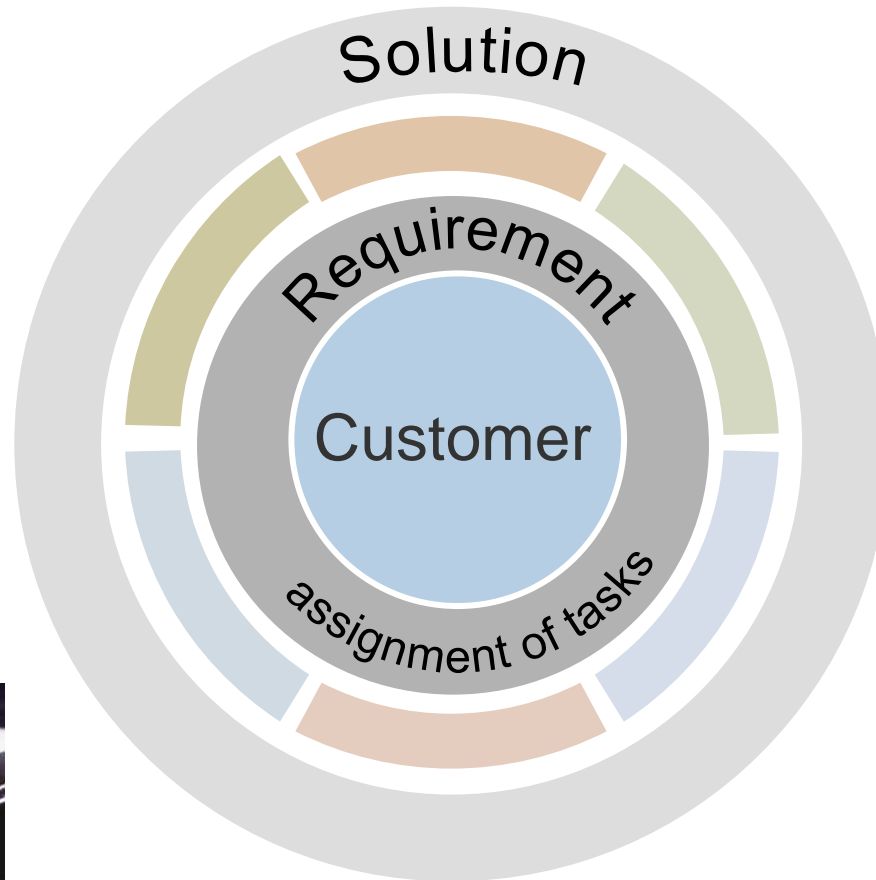
Service & logistics



Quality management



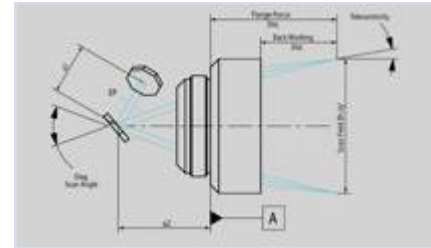
System assembly



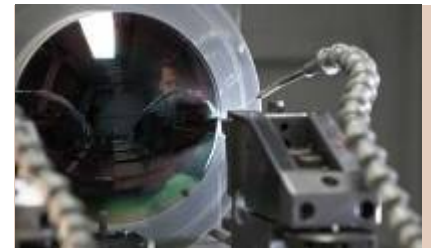
Requirement



Design



Component manufacture



Optical Systems Markets and synergies



Markets	Business unit	Optics	Microoptics	Optoelectronic Systems	Digital Imaging
Semiconductor Equipment					
Optical Measurement & Machine Vision					
Defense, Security & Aerospace					
Health Care & Life Science					
Laser Materials Processing					
Digital Imaging					
Lighting & Energy					

Optoelectronic Systems

Markets and core capabilities

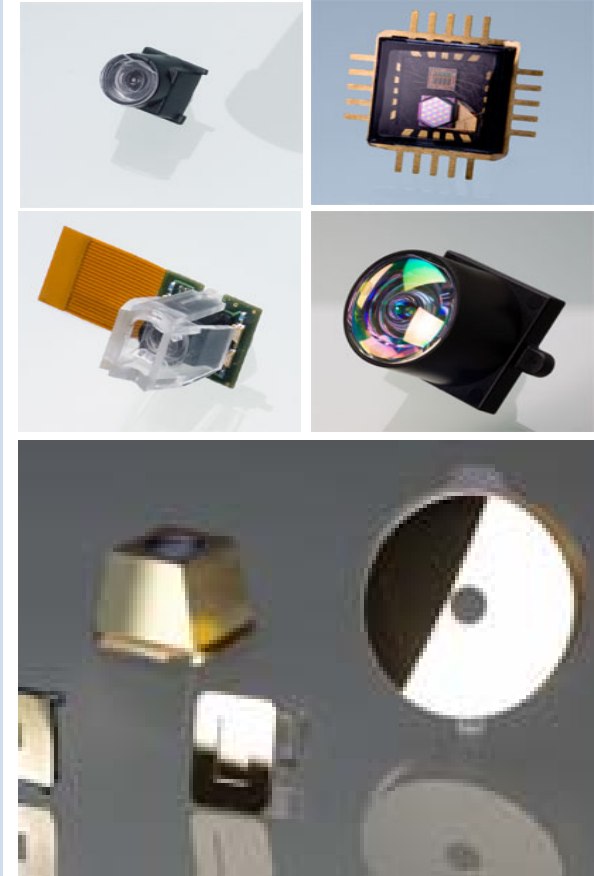


Markets:

- Optical Measurement & Machine Vision
- Health Care & Life Science
- Lighting & Energy
- Automotive
- Digital Imaging

Core capabilities:

- Product design
- Chip development
- Prototypes
- Fabrication of optical products
- Optical coatings
- Assembly/ packaging technology
- System integration



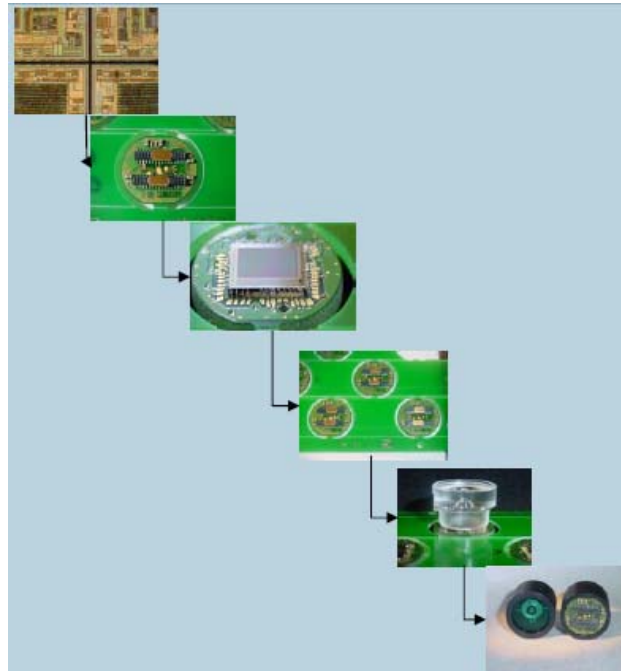
Optical Systems Markets



Technologies Markets	Injection Moulding	Coating	Packaging	Assembling
Health Care & Life Science				
Optical Measurement & Machine Vision Sensors				
Lighting & Energy				
Digital Imaging				

Optoelectronic Systems

Creation of value and core capabilities



Product
Design &
Development

Chip
development

Prototypes

Fabrication
of optical
products

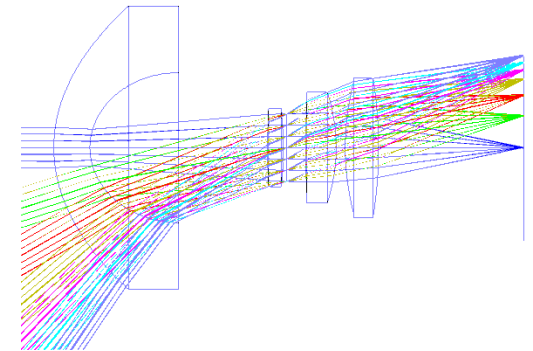
Optical
coatings

Assembly &
packaging
technology

System
integration

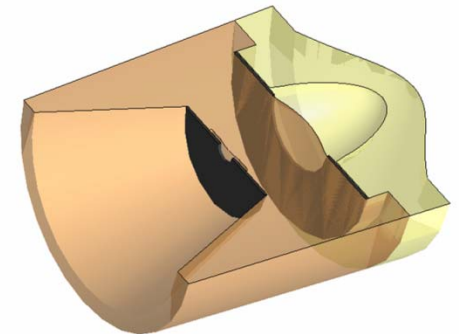
Optical and system design

- Scattered light simulation
- Suitable for production, construction for serial production
- Machinery and equipment
- Design of optical coatings
- Circuit design



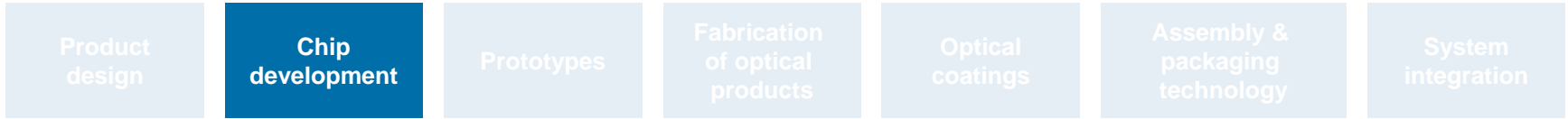
Feasibility, Package Analysis

- Tolerance analysis
- Development of test points and fixtures
- FMEA, risk analysis



Project control up to mass-production

Optoelectronic Systems Chip Development

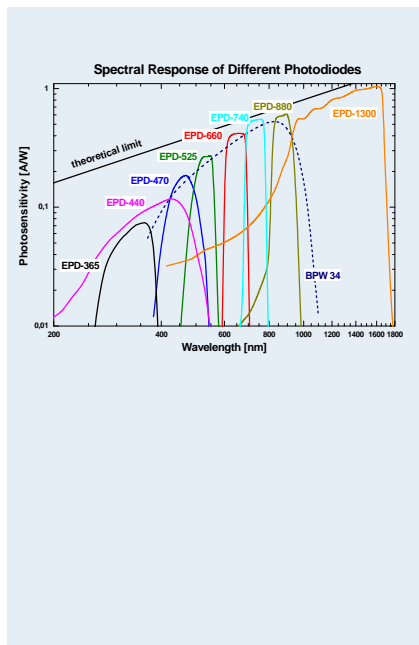
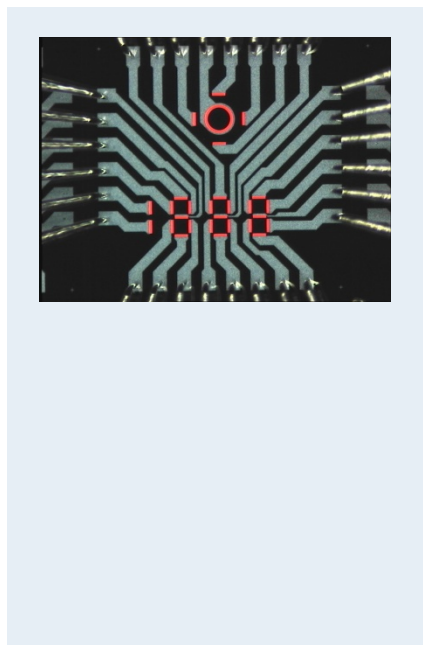


Chip layout

LED chips

Photodiode chips

Modules



Product
design

Chip
development

**Prototypes/
Tooling**

Fabrication
of optical
products

Optical
coatings

Assembly &
packaging
technology

System
integration

Ultra precision single point diamond turning

Parameters

- Precitech (Optimum 2400, Nanoform 200, 350)
- Coupled measuring system
- Processing diameters from 0.2 mm to 190 mm
- Form accuracy $\lambda / 4$ (with $\lambda = 632.8\text{nm}$)
- Roughness $< 5 \text{ nm (Rq)}$

Applications

- Tool inserts
- Prototypes
- Limited-lot productions



Optoelectronic Systems

Fabrication of optical products



Product design

Chip development

Prototypes

Fabrication of optical products

Optical coatings

Assembly & packaging technology

System integration

Continuous CAD/ CAM Process

Tooling

- Life Cycle Management

Injection Molding - Technology

- 47 molding machines with clamping forces from 50 kN to 3250 kN
- 2-component injection molding
- Micro injection molding
- Automated and semi-automated production lines, in-process metrology
- Spherical, aspheric, diffractive and freeform surfaces
- Non-symmetric optical surfaces, plano surfaces
- Micro-optical components



Product design

Chip development

Prototypes

Fabrication of optical products

Optical coatings

Assembly & packaging technology

System integration

Metallization (Al, Au, Ag)

- Dielectric layers on PMMA, PC, Zeonex and other materials

Broadband anti-reflection in VIS and NIR

- Scratch resistant layers and Easy-To-Clean coating
- Beam splitters and high-reflective layers

NANO-moth eye antireflection patterning

- Produced by a low-pressure plasma process



Optoelectronic Systems Assembly and Packaging Technology



Product
design

Chip
development

Prototypes

Fabrication
of optical
products

Optical
coatings

Assembly &
Packaging

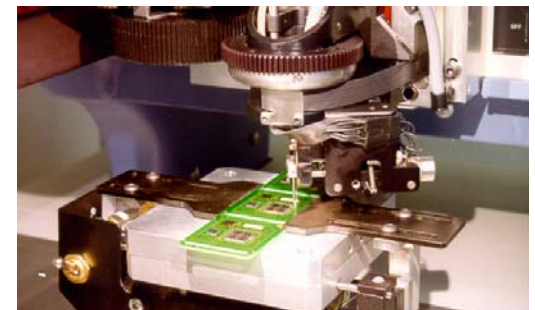
System
integration

Organization

- 400 m² clean room class 5 according to ISO 14644 standard (Fed. Std. 209E class 100)
- Production in 3 shifts for stable manufacturing processes & full equipment utilization

Advantages

- Assembly processes for high volume, high quality complex optoelectronic systems supported by automated high precision placement of optical components on sensors to $\ll 10 \mu\text{m}$
- No additional supplier interface required between the optical system and the electronic module supplier
- All process steps are done in a clean room environment



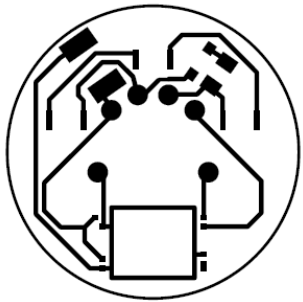
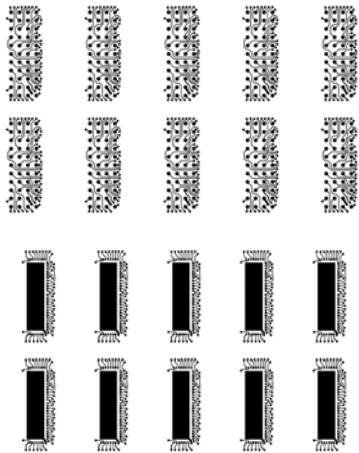
Optoelectronic Systems Assembly & Packaging Technology



Layout Design →

Layout development & transfer

Gerber file Preparation

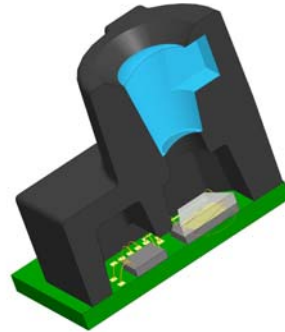


Development →

System development

Optical design

Temperature management for
LED's

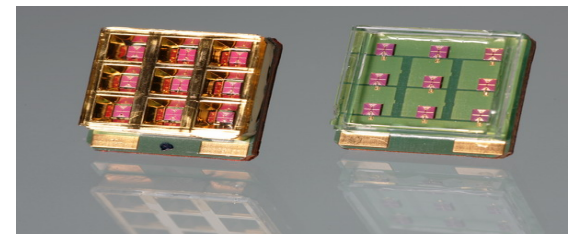
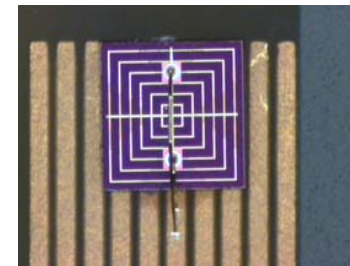
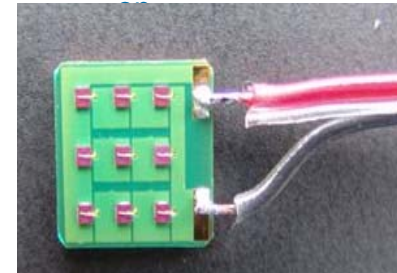


Prototypes →

Assembly of
prototypes

Sample production

Quantities from 1 unit

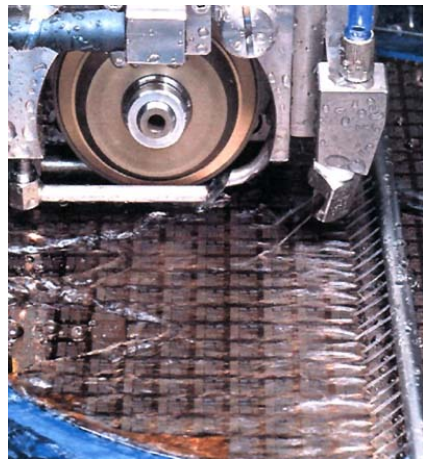
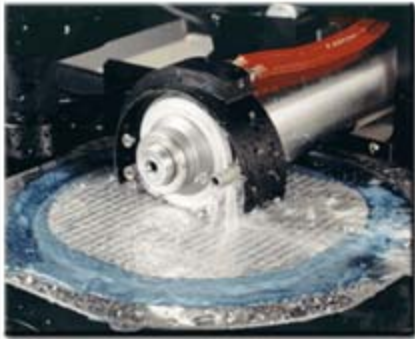


Optoelectronic Systems Assembly & Packaging Technologies

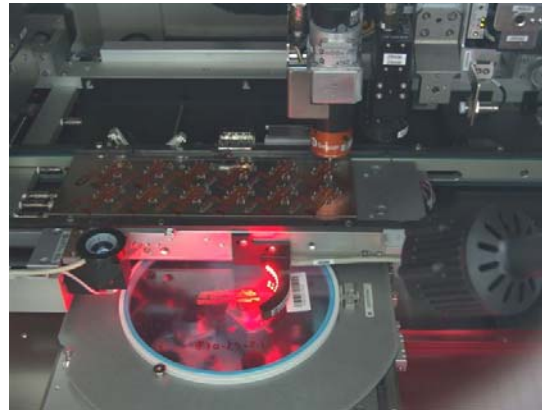


Wafer Dicing

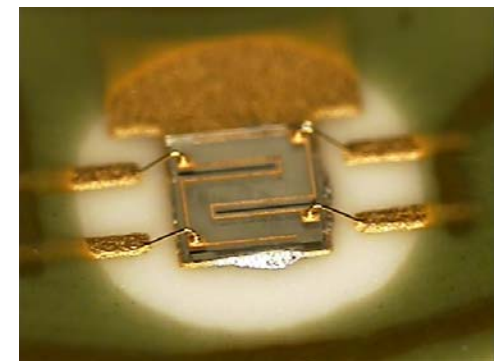
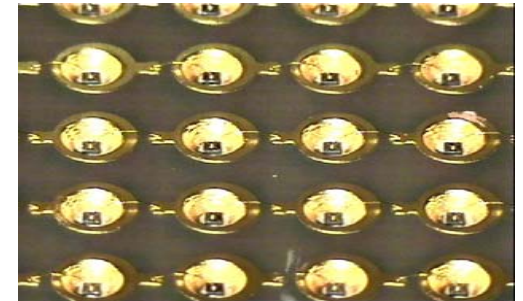
Up to 8" wafers on Ceramic, Glass,
Metal, Plastic & Organic boards



Die Bonding



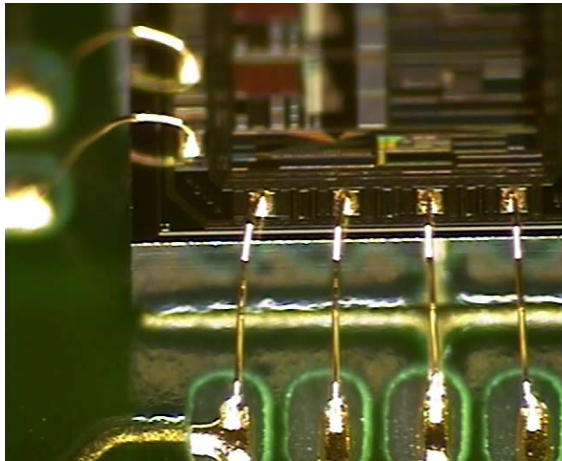
LED Assembly



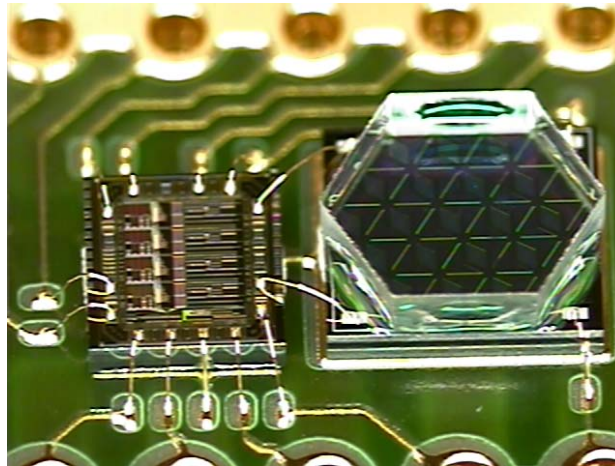
Optoelectronic Systems Assembly & Packaging Technologies con't.



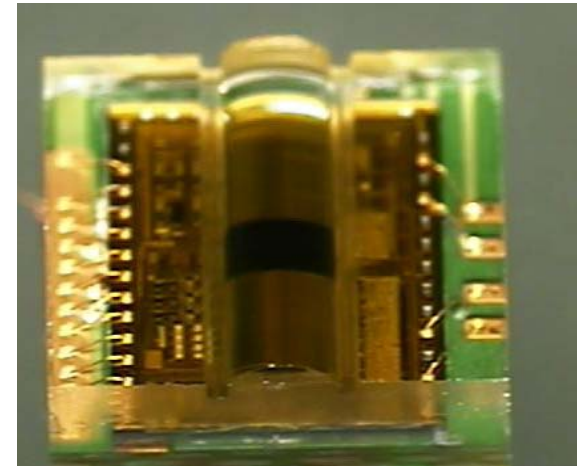
Wire Bonding



Optics & Filter Mounting



Optical Packages
including Lenses



Optoelectronic Systems Assembly & Packaging Technology con't.

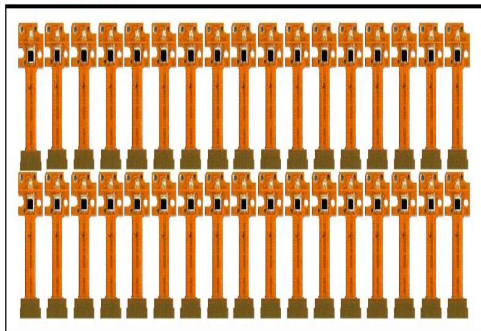
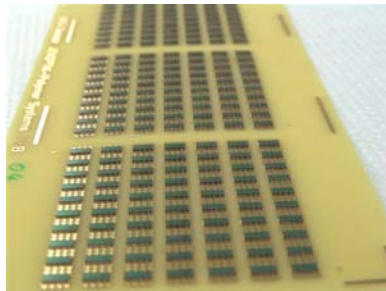


High Volume Production

Production up to 4.5 M/year

Full Production documentation

100% Traceability



Optoelectronic Systems

System integration



Product design

Chip development

Prototypes

Fabrication of optical products

Optical coatings

Assembly & packaging technology

System integration

Organization

- Quality Management and Quality Assurance according to FDA standards
- 1000 m² clean room class 100,000 (Fed.Std. 209E) up to class 10,000
- Computer-controlled production management
- Just-in-time production and delivery
- Supply Chain Management, supplier qualification
- Flexible organization for customized production

Technologies

- Automated and semi-automated mounting technology
- Snap-In, sticking, force fitting, beading, shrinkage
- Laser joining, ultrasonic welding, optical packaging
- Automated active alignment for high volume production



Product design

Chip development

Prototypes

Fabrication of optical products

Optical coatings

Assembly & packaging technology

System integration

Organization

- Certification according to DIN EN ISO 9001:2000 and ISO 13485:2003
- Accompanying process monitoring and survey of product parameters
- Constant training and practice of all employees
- High qualification and sense of responsibility

Technology

- Measurement of physical attributes
- Material and surface inspection
- Surface Form Accuracy
- Optical parameters
- Profiles



Optoelectronic Systems Competencies



- optical design
- mechanical design
- design for manufacturing
- high volume injection moulding technology (single use camera)
- alignment tool technology [$\ll 5\mu\text{m}$] (cell phone cam's)
- high volume automatization (single use camera, cell phone, POC)
- optopackaging, COB, (POC, endoscope)
- alignment assembling technology for high volume (POC)
- Poka Yoke assembly line (Automotive)
- high level quality management system (FDA, VDA)
- global Supply Chain and high volume logistics (POC, Automotive)

