

Integration technologies for sensors using LTCC

Imaps Nordic

„Integration Technologies for Sensors using LTCC“

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VIA electronic GmbH, Hermsdorf

www.via-electronic.de

Integration technologies for sensors using LTCC

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Company information



VIA electronic GmbH is located in Hermsdorf/Germany, a center for Technical Ceramics since 1910.

Until reunification 1989, the „Ceramic Plants“ of Hermsdorf were a 7.000 people company

Today, VIA is embedded in a network of SMEs and Research Institutes and reputed as a „SMART LTCC Foundry“

Specialised in the realisation of innovative solutions in LTCC Technology for low and medium volumes

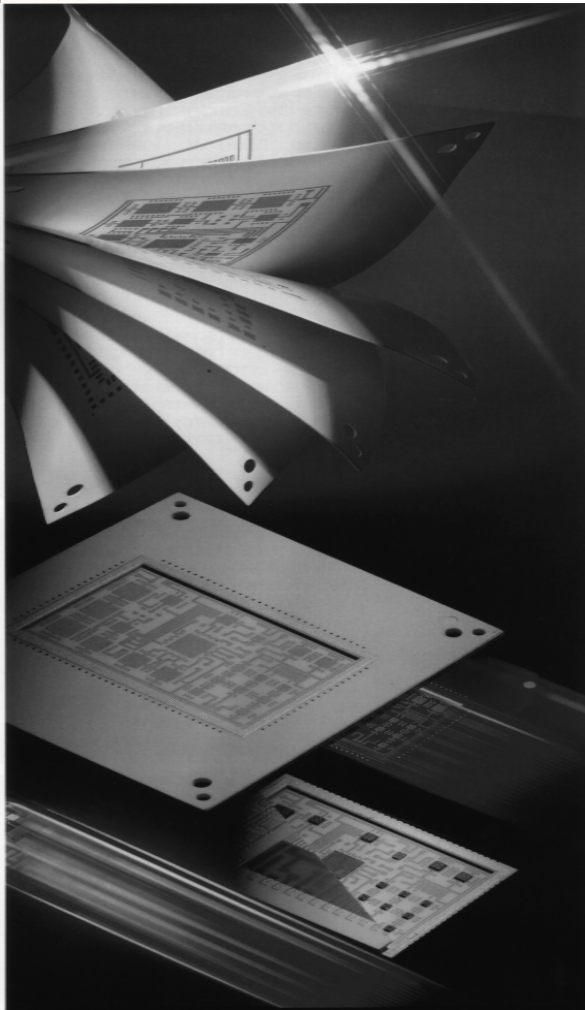
On the market since 1997 with 20 Employees per today

Certified according to ISO 9001:2000

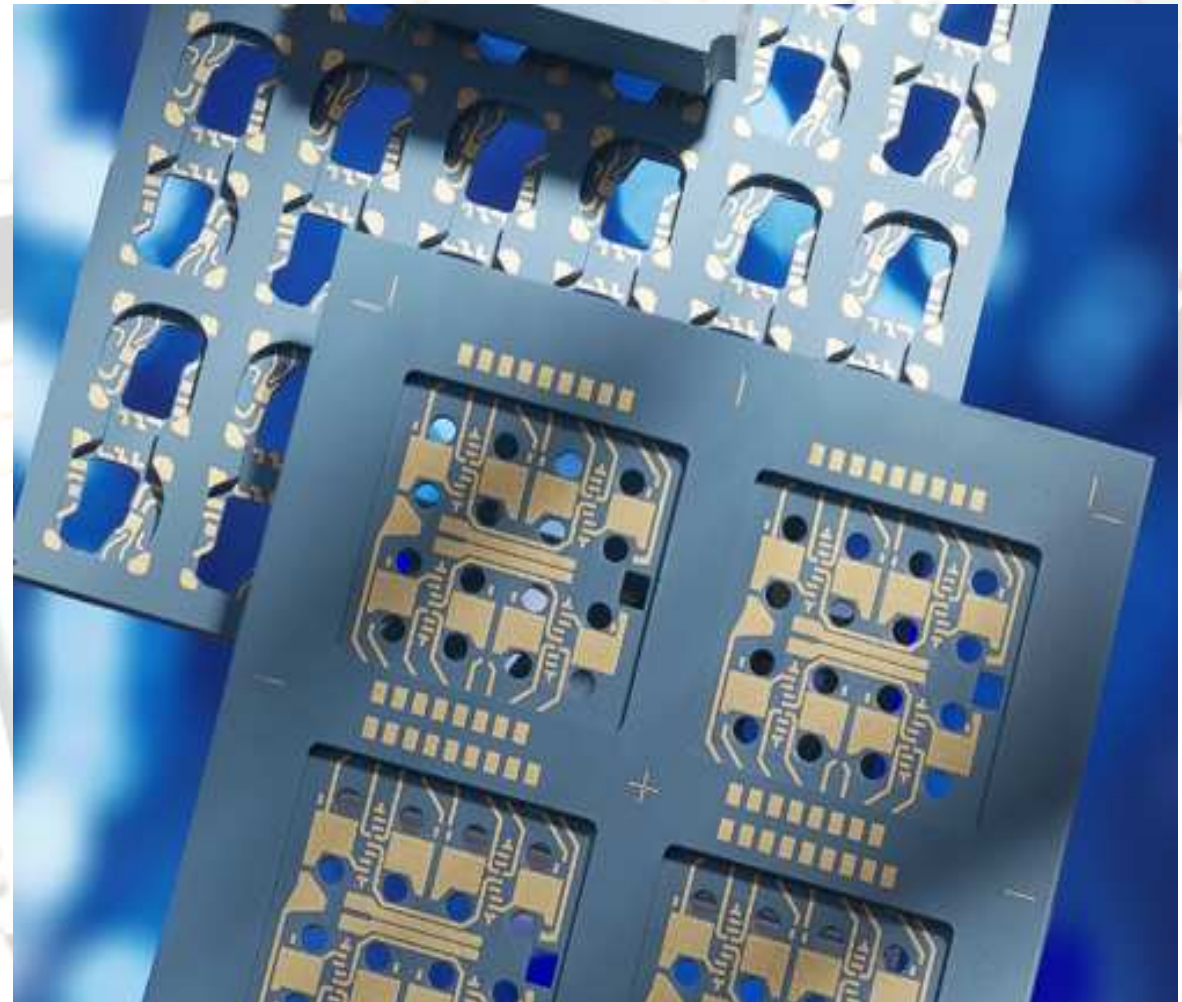
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Introduction

LTCC Process flow



LTCC Packages at panel level



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Advantages of the Technology

- Superior reliability performance
Low TCE (4ppm to 7ppm), hermeticity
- Flexibility
packaging structures, medium volumes
- System in Package capability
Fluidic structures, Buried passives
- Full Customization for low and medium volumes
Minaturisation, 3d packaging

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Advantages for Sensors

- Metallisation can be designed for:
conductor, transducer and sensor
- Coatings can be applied for:
selective layers Ag/AgCL, immobilizing layers
- High thermal conductivity of the via for:
dedicated heat dissipation
- Low thermal conductivity of the ceramic for:
thermal decoupling from the environment

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Advantages for Sensors

- Integrated passive components for:
pressure, temperature and proximity sensors
- Integrated fluidic components for:
channels, chambers and reactors
- Dedicated materials and processes for:
MEMS packaging, MOEMS packaging

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Comparison to other technologies

Technical Characteristics	PCB μVia	LTCC	HTCC	Si
Life time	-	+	+	+++
Insulation resistivity	-	+	+	-
High temperature resistivity	-	+	++	-
Acceleration resistivity	+	+	+	++
Thermal Conductivity	-	+	++	+++
Electrical Conductivity	+	+-	-	-
Integration Density	+-	+-	+-	+++
Integration of Passive components	-	+	-	+-
Integration of Fluidic components	-	+	-	+-
RF stability	-	+	+-	++

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Research and Development: local networking

UNIVERSITÄT JENA
UNTERNEHMEN
REGION
Die BMBF-Innovationsinitiative
Neue Länder



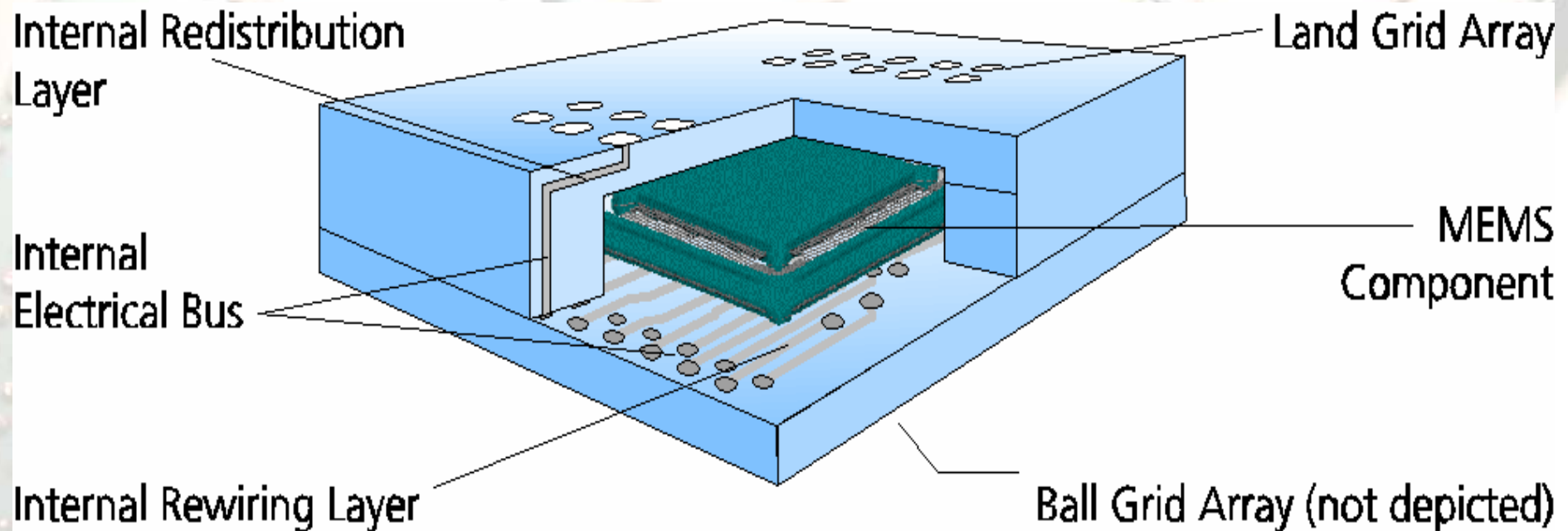
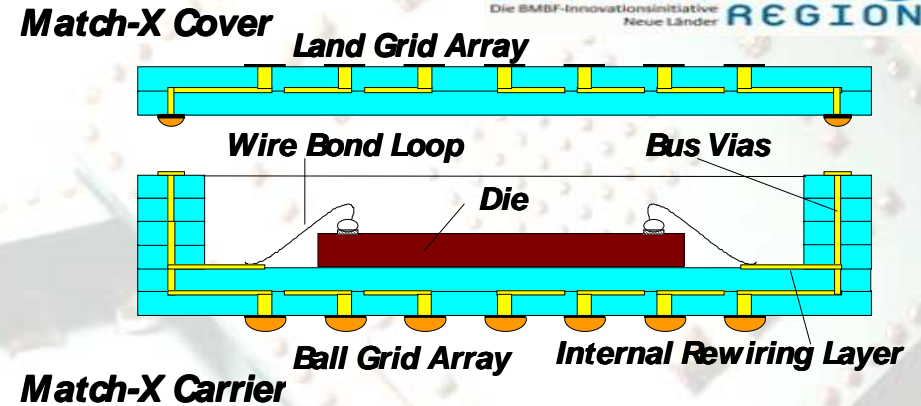
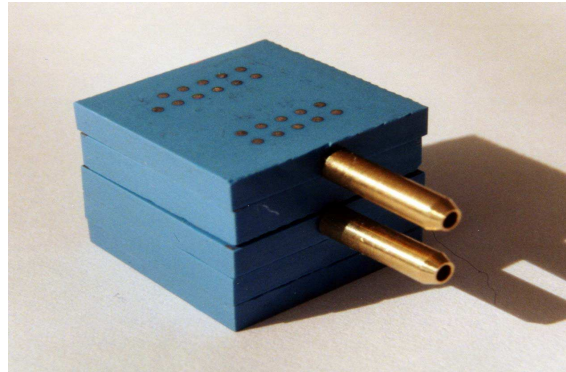
Within 30km distance, a Network of Industries, R&D Institutes and Universities is cooperating for the Development and Realisation of Ceramic Based Microelectronic Devices and Microsystems:

- 14 SMEs
- 2 Universities
- 4 Research Institutes

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Research and Development: Match-X Packaging concept

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Die BMBF-Innovationsinitiative
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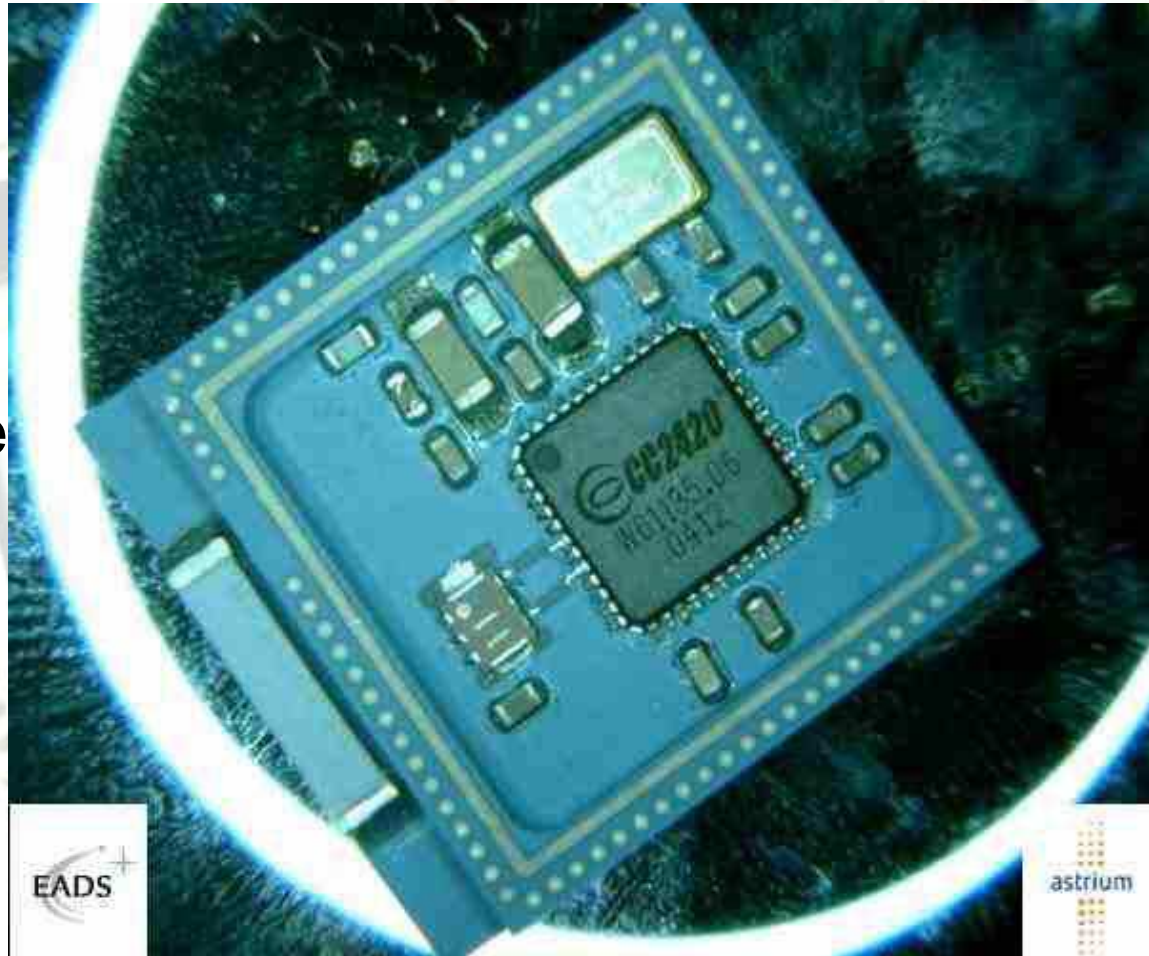
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Mach-X related products: Acceleration sensor



Modular LTCC Package (Astrium/EADS)

Key features:
bottom, frame and lid of the package are realised as separate solderable components



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Mach-X related products: Pressure sensor



Packaging concept

Modular pressure sensor
(Aktiv Sensor)



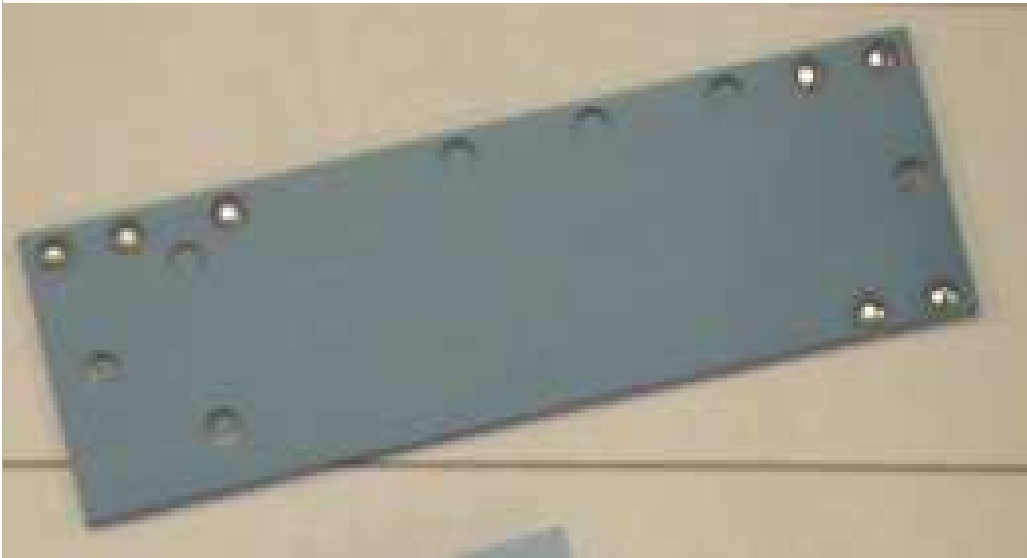
Key features:
Several sensitivity sections
 μ Processor close to the sensor
1 Design for absolute, relative and differential measurement

Package realisation



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Biosensors: Electrophoretic LTCC Chip



Detail: reactor with fluidic interconnection at 100 μ m channel and sensor construction

Integrated microchannels with high voltage conductors and reactor chamber

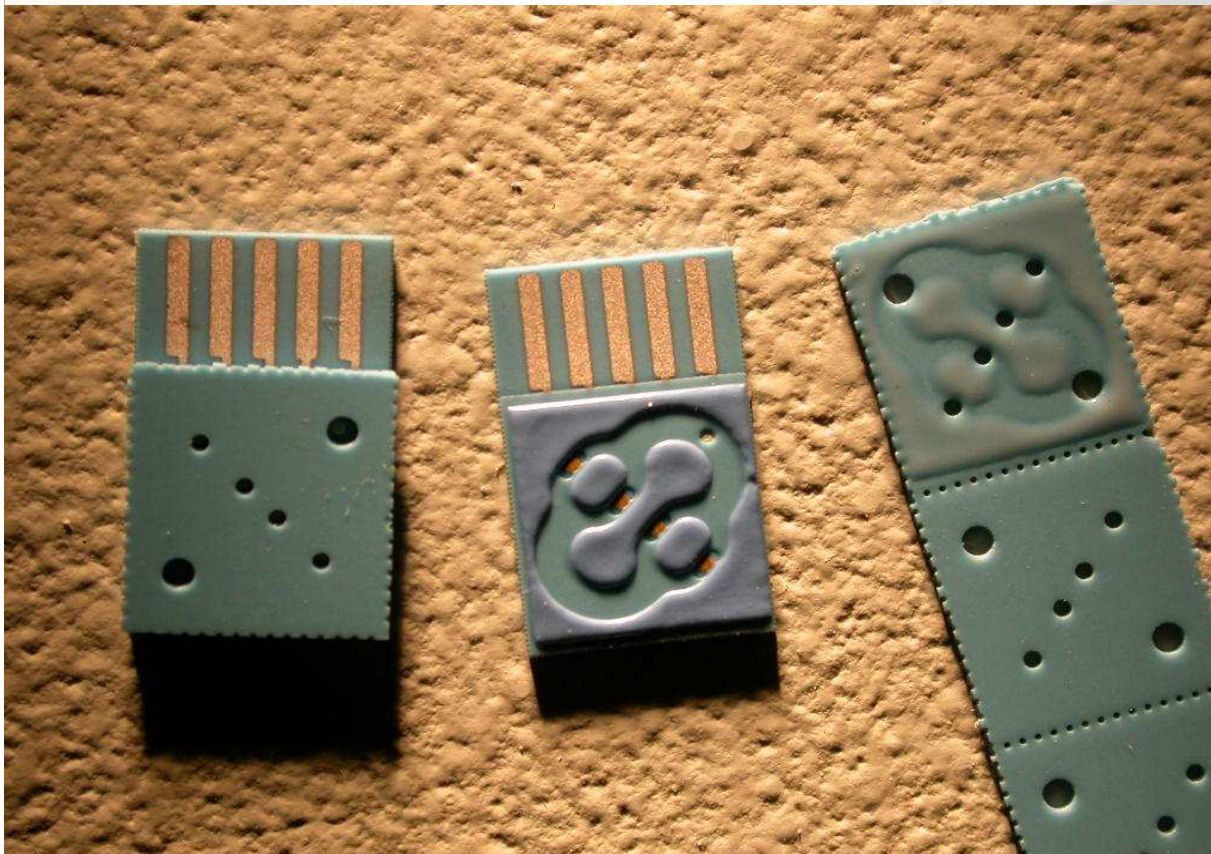
(Helmholtz-Gesellschaft Braunschweig)



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Biosensors: Glucose sensor

Glucose sensor with integrated fluidics
(BioSensor Technology)

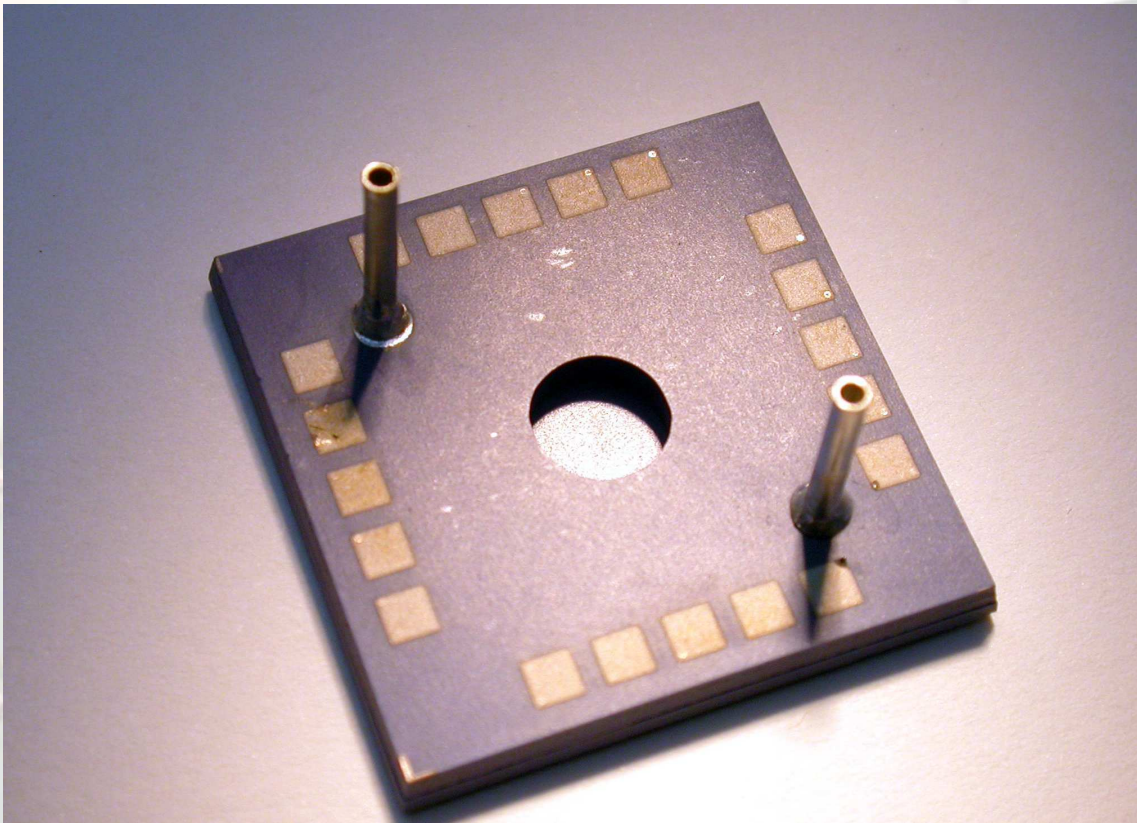


Key features:
Screen printed fluidic
structure, glass sealed lid
Enzyme immobilisation on
top of Ag filled vias

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Biosensors: Microreactor

Microreactor with integrated fluidics, connectors and detectors
(Helmholtz Gesellschaft Braunschweig)

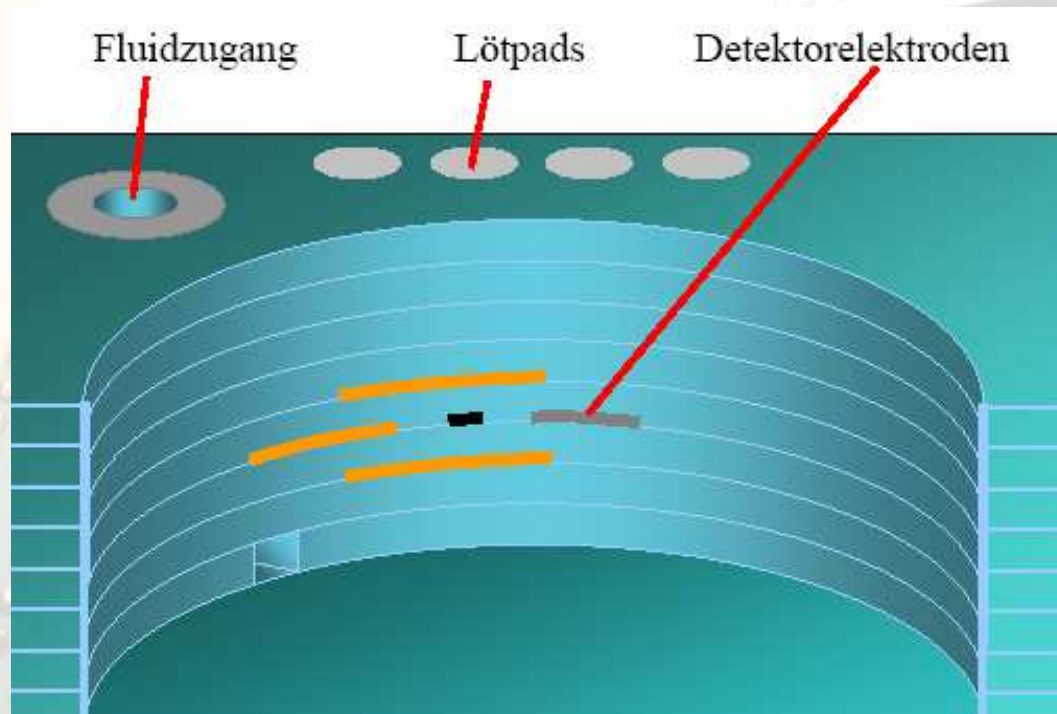


Key features:
50 μ l Chamber size
1 μ l per Minute
Enzyme immobilisation on
0,1x0,4mm 3d channel
Soldered connectors
Biocompatibility verified

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Biosensors: Microreactor

Microreactor details: Schematic and realisation

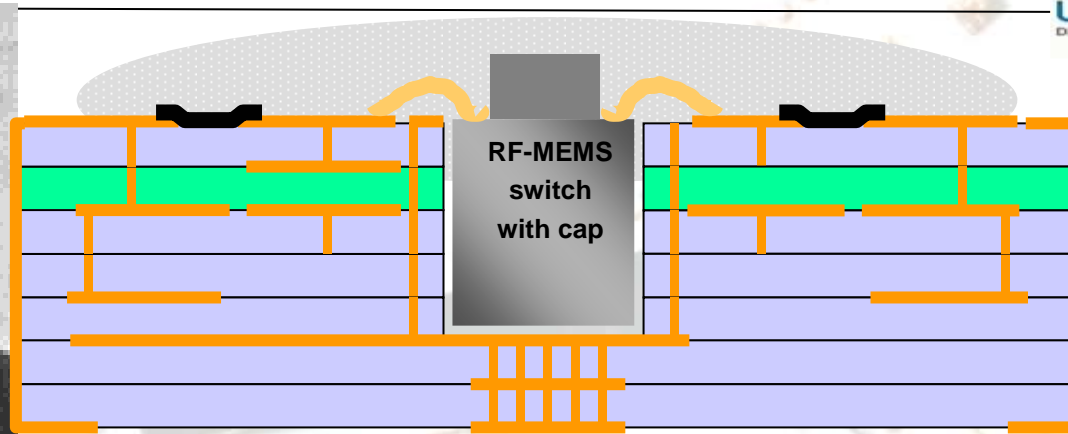


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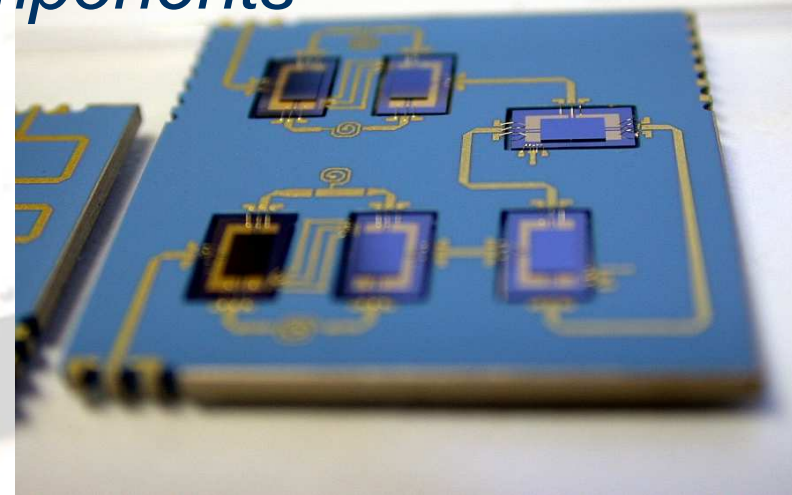
MEMS: RF MEMS Switch



Source: Daimler Chrysler Research



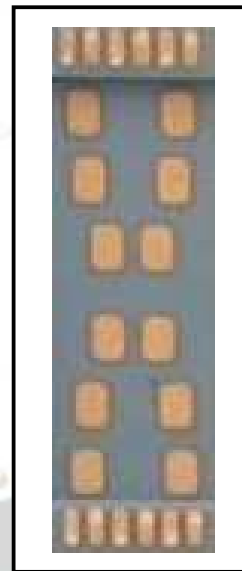
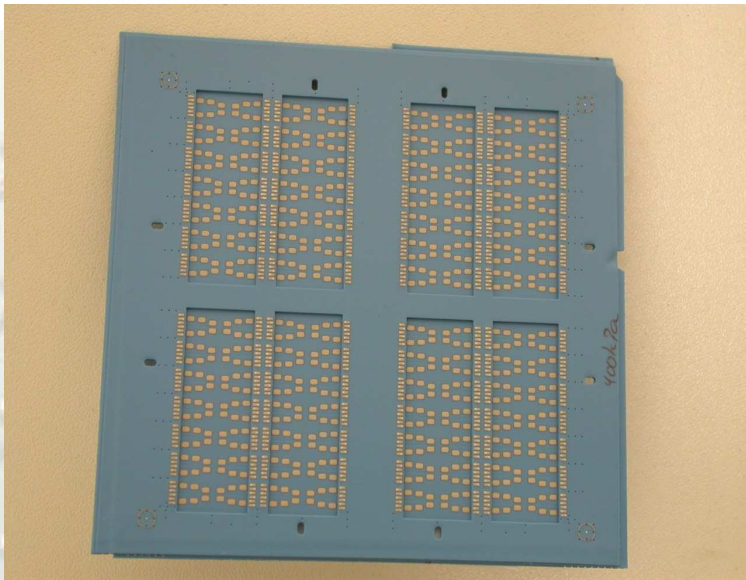
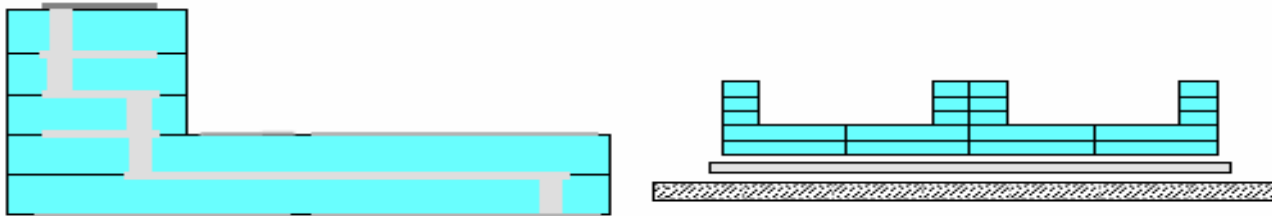
*Packaging concept and realisation
with integrated components
(Thales)*



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Medical: Photoplethysmographic optical sensor package

Measurement of vital parameters by spectral photometry
(Center for Intelligent Sensors CIS)

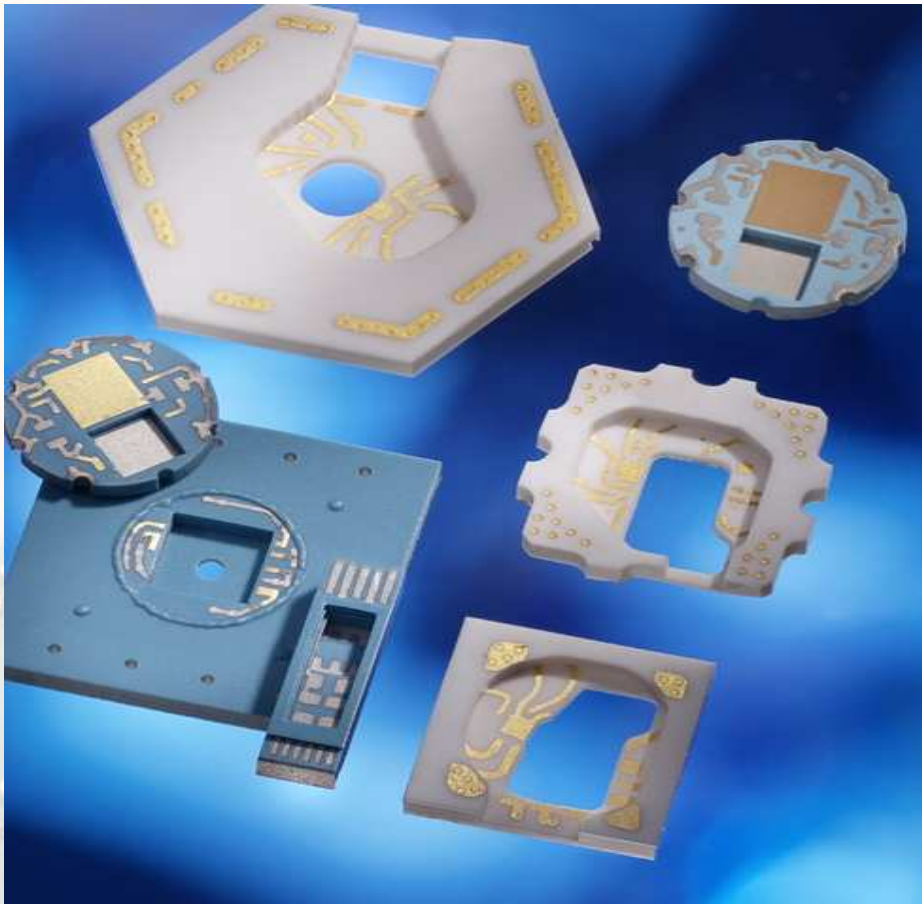


Key features:
3,00 x 5,00 mm size
Inner ear On body
meausurement

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Industrial: X-Ray Detector

Different customized sensor packages fo X-Ray Detectors (Ketek)

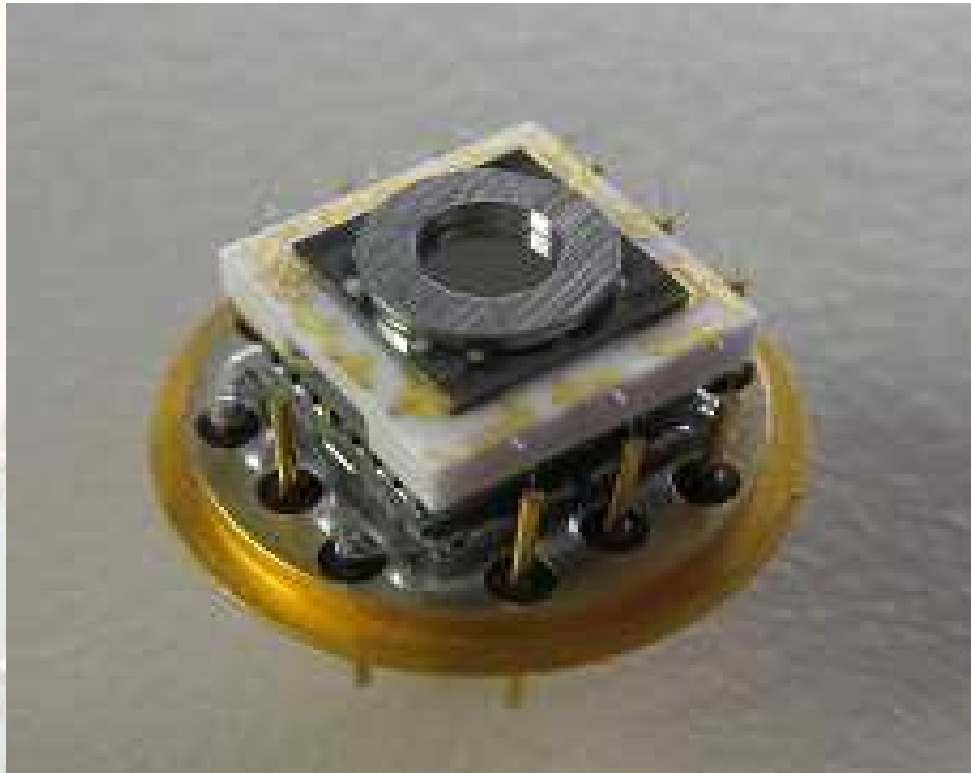


Key features:
Very specific package shapes
Low volumes
High variety

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Industrial: X-Ray Detector

Example of a fully assembled detector system (Ketek)



Key features:
Integrated thermal management
Spectroscopic neutral
Vacuum compatible
No outgassing

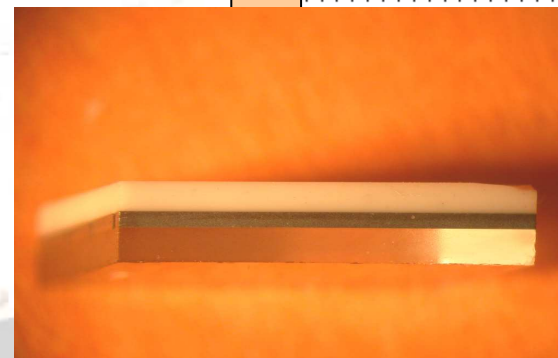
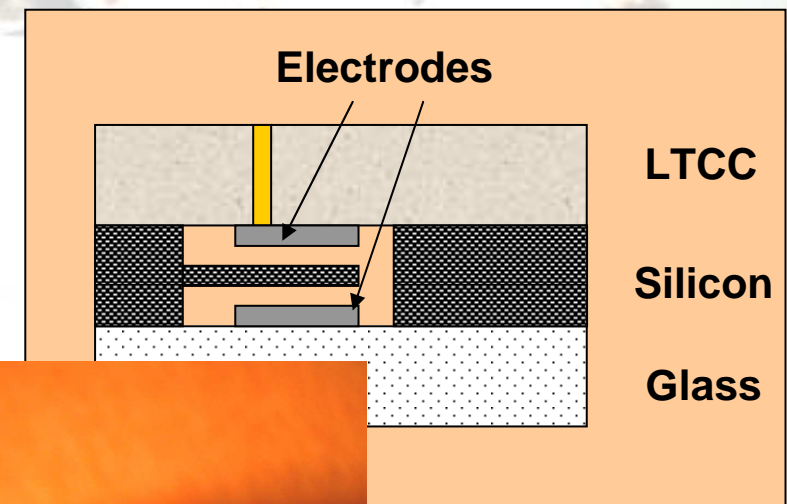
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New Materials and Processes: anodic bonding

LTCC substrate bonded with Si- wafer
and cross section of bonded area



LTCC metallized bonded with the Si- and
glass-wafer simultaneously by anodic
bonding at 400°C, 1500 V, Schematic and
Demonstrator

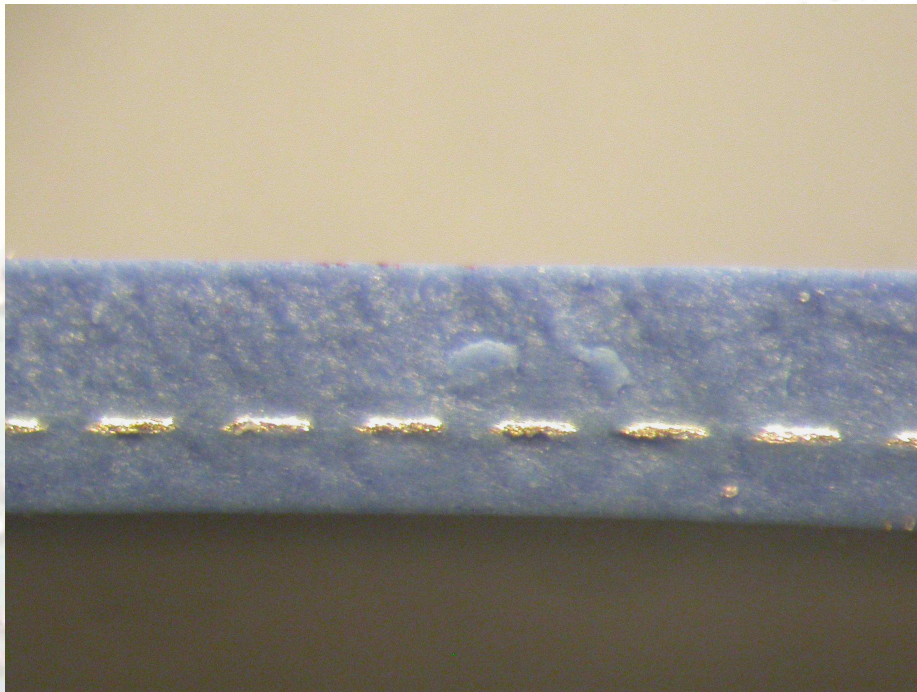


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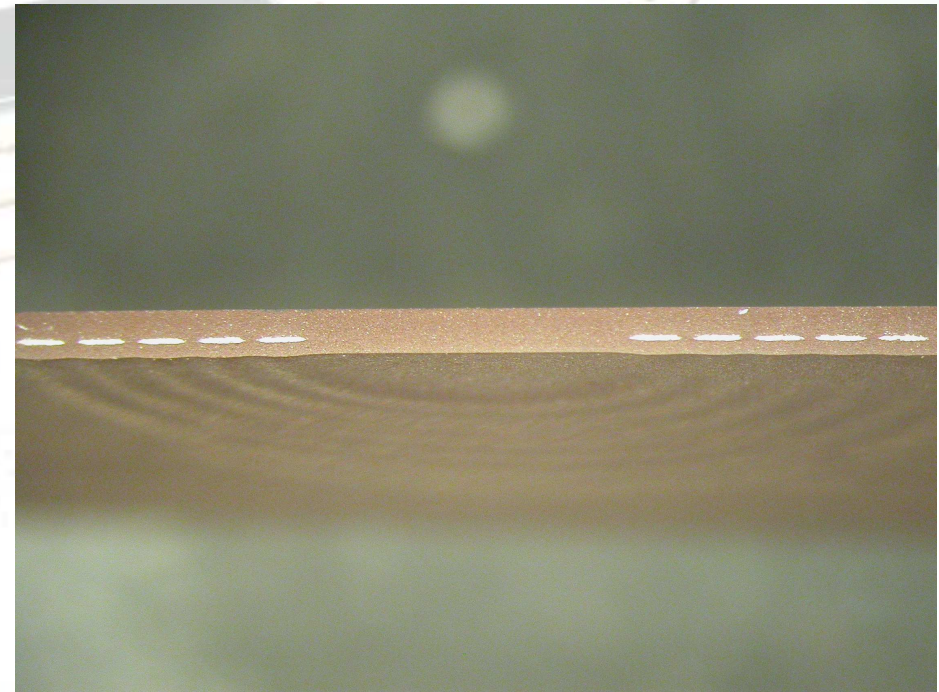
New materials and Processes: Ferromagnetics

Integrated inductors (approximity measurement)

Standard LTCC System



Ferrit Ag System



High currency conductors: 35 – 50 μm thickness

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Conclusions

- LTCC has demonstrated to be
 - Flexible in package design and construction
 - Capable for high miniaturisation
 - Capable for proper customisation
 - Suitable for different kind of sensors
 - Economic for low and medium volumes
 - innovative for futur packaging demands

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Acknowledgement



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Fanimat nano: FZ Jülich, Projektträger des BMBF für neue Materialien

Match Druck: VDE-VDI, Projektträger des BMBF Mikrosystemtechnik

CheapLab: AIF, Projektträger des BMBF zur Innovation von KMU

AHRMS: 6. Rahmenprogramm der EU

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Invitation



Integrated project FP6-2004-IST-4
Service Action

RF-PLATFORM

Call for the 4th Multiproject Wafer Run
6 Layers DuPont 943/Au

Dead line for data inputs: Week 4 2009

**Generic manufacturing and design technology
platforms based on
novel RF technologies**

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Questions

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Neue Länder REGION

Thanks for your Attention