Perspective of LTCC Technology for System in Package and MEMS Packaging

„The Smart LTCC Foundry“

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Perspective of LTCC Technology for SiP and MEMS Packaging

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Company Informations

VIA electronic GmbH is located in Hermsdorf/Germany

Embedded in a network of SMEs and Research Institutes

Reputated as a „SMART LTCC Foundry“

Specialised in the realisation of innovative solutions in LTCC Technology.

On the market since 1997 with 18 Employees per today

Certified according to ISO 9001:2000
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Background

VIA electronic is a Management buy out of the LTCC activity from Siegert electronic in Nürnberg.


In October 1997 VIA electronic was founded in the Industry Park Tridelta in Hermsdorf/Thuringia.

Core competence: customer tailored solutions in innovative LTCC multilayer ceramics from the development stage until series production.

Products: Multilayer substrates, Multichip Modules, 3-D Packages, Multilayer components.
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**Background: Historical Bricks**

**Region:** Hermsdorf is a center for Technical Ceramics since 1910.

Up to 1989 The „Ceramic Plants“ of Hermsdorf were a 7.000 people company

**Company:** VIA electronic was found in Hermsdorf in 1997 as a management buy out from Siegert electronic, a German Hybrid manufacturer dealing with LTCC since 1986
Unsintered ceramic foils (ceramic) are mechanical shaped

Vertical conductive paths (Vias) are punched as very small holes and filled with metal paste afterwards.

The lateral conductive pattern is screenprinted in advanced thickfilm technology

The separate layers are positioned accurately and laminated together by hot pressing.

This laminate is sintered in a singulare process (Cofiring) at low temperatures (low temperature) at about 900°C to the completely wired substrate or package.
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Services

- State of the art CAD design and layout
- Flexible manufacturing line
- All lot sizes
- Installed capacity of 5 Mn circuits per year
- High precision processing
- Experienced in different material systems
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**Products**

- RF modules
- 3D packages
- Multichip modules
- Multilayer ceramic boards
- Multilayer components
- Thinfilm substrates
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**Arguments for LTCC**

**Highest Integration Capability**

- < 150 µm lines and spaces
- < 150 µm via diameter
- integrated passive components: resistors, capacitors, inductors, filters
- integrated fluidic components: channels, chambers
- Cavities and windows for active components
- Integrated sensor components
- Integrated heater
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**Arguments for LTCC**

- **Superior Reliability**
  - Life Time of more then 50 Years
  - Operating Temperature up to 250°C
  - Temperature Cycling Stability from -55 to 150 °C
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Innovation Capability for LTCC

The nanotechnology approach

Gradient material properties

Surface properties

Mechanical properties
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Innovation Capability for LTCC

- High innovation force
  - High temperature electronics
  - Sensors
  - Microsystems
  - Optoelectronic systems
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Innovation Capability for LTCC

• High innovation speed
  • Material development
  • Process integration
  • Component integration
  • Hybrid microsystem integration
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R&D: Smart LTCC Components with integrated passives

SMT compatible LTCC Integrated Passive components for low power, high power, low frequency and high frequency applications using new dielectric materials and new manufacturing processes
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R&D - Wafer Level Packaging by anodic bonding to LTCC

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

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

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R&D: Integrated Passives for MEMS switch modules

Integrated high-k-tape
RF-structures
Integrated high-k ink

951C2/ 37µ layer

resistors
high k layer

sealing

RF-MEMS switch with cap

thermal vias / spreader

cavities for RF-MEMS

Source: Daimler Chrysler Research
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R&D: Integrated Fluidics

Fluidic channel
0.1 x 0.1 mm

Fluidic channel
0.2 x 0.2 mm

Fluidic channel
0.4 x 0.6 mm

Sensorpackage with integrated Fluidic
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Innovativ Processes and Materials

- AuSn brazing of Ring frames and heat sinks
- High performance LTCC for the Integration optical components
- Si Matched LTCC and anodic bonding at wafer lever
- Ferritic LTCC for flat inductors and transformers
- Direct bonded thinfilm on LTCC
- Fine pitch Technology for high frequencies

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Innovativ Processes and Materials

Integrated Microreactors

Integrated microembossing technology for high power

Monolithic integrated R-C-L components

0-Shrink Technology with highest precision

Integrated Sensors in thickfilm and thinfilm technology
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Advanced applications: Integrated Optoelectronics

Pressure assisted sintering

Material DuPont 951
Cavities, postfire laser cut
Blind holes, postfire laser drilled ±25µ
Vias 90µm, position ±50µm
Application: CSP for Si optical bench
Pressure assisted sintering

Lapped
ra<0,2µm

Thickness 1,5mm +/- 5µm

Vias Interconnection: Thinfilm

Interconnect: BGA Backside

Oprating speed up 10Gbit
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Advanced applications: Automotive

- Connection Electronic-Mechanics
- 25 Interconnections per cm²
- Thermal Conductivity through thermal Vias
- Operating Temperature up to 125 °C
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Advanced Applications: Biotechnology and Biosensors

Fluidic Chip with integrated high voltage conductors

Fluidic interconnection at 100µm channel
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Advanced applications: Optoelectronics
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Cooperation: Full R&D Chain from materials to products

From ceramic powders to ceramic based Microsystems and devices

Dedicated to Grow:

A local Network of Industries, R&D Institutes and Universities, for the Development and Realisation of Ceramic Based Microelelectronic Devices and Microsystems
**Perspective of LTCC Technology for SiP and MEMS Packaging**

**Involvement in European Projects**

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Project Details</th>
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<tbody>
<tr>
<td>1995 - 2000</td>
<td>DECCO, 4th FP</td>
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<tr>
<td>1998 - 2002</td>
<td>ALMA, Eureka Cluster PIDEA</td>
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<tr>
<td>2000 - 2003</td>
<td>ECO2, 5th FP</td>
</tr>
<tr>
<td>2002 - 2004</td>
<td>APIS, 5th FP</td>
</tr>
<tr>
<td>2003 - 2006</td>
<td>AHRMS, 5th FP</td>
</tr>
<tr>
<td>2004 - 2007</td>
<td>CheapLab, Eureka Cluster PIDEA</td>
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| 2006 - 2008         | RF Platform, 6th FP  
Integrated Project Service Action |
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Customer Benefit: LTCC Multiwafer Service

Integrated project proposal
IST Call 4
FP6-2004-IST-4
Service Action

RF-PLATFORM

Generic manufacturing and design technology platforms based on novel RF technologies