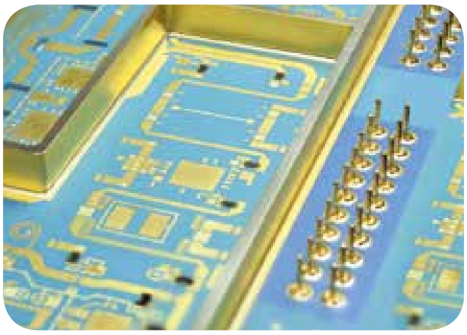
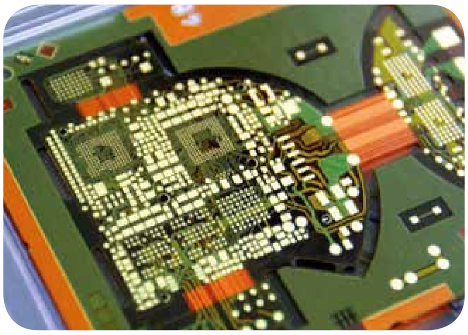
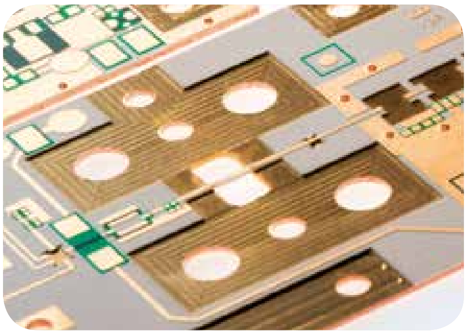

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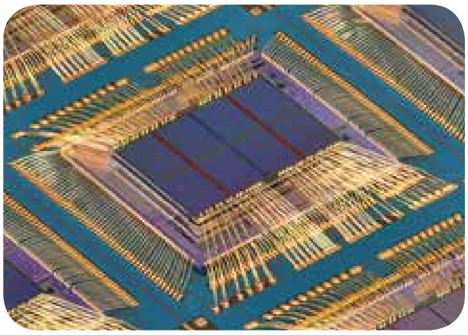
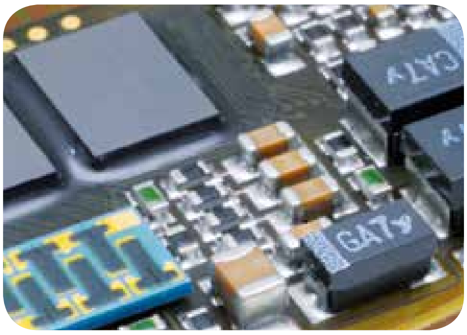


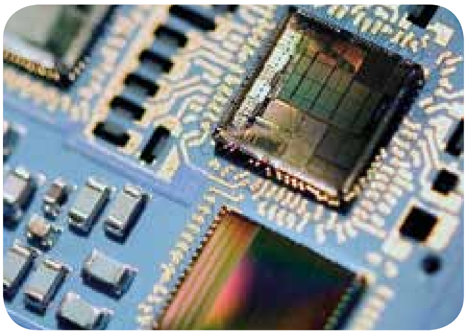
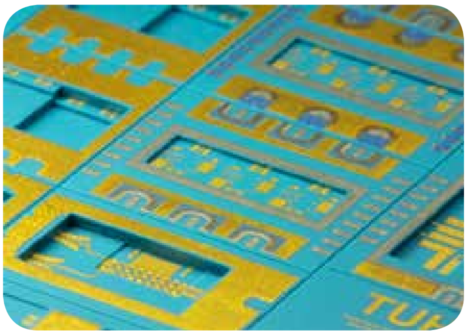
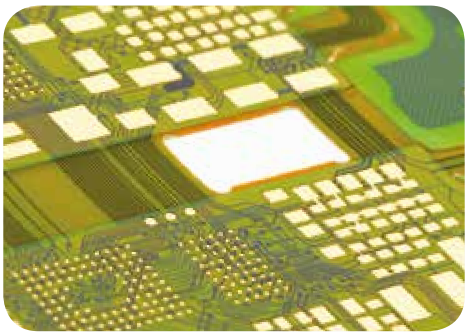
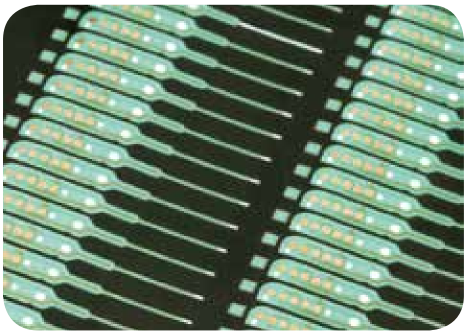
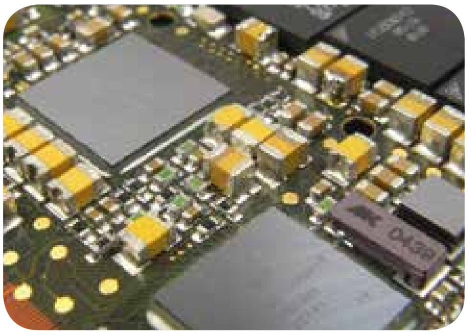

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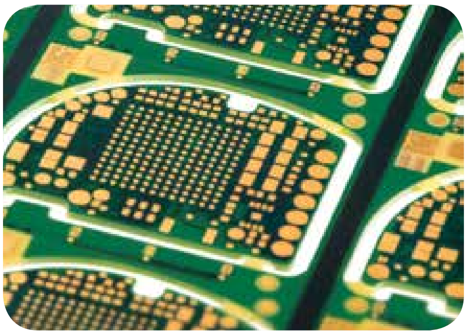

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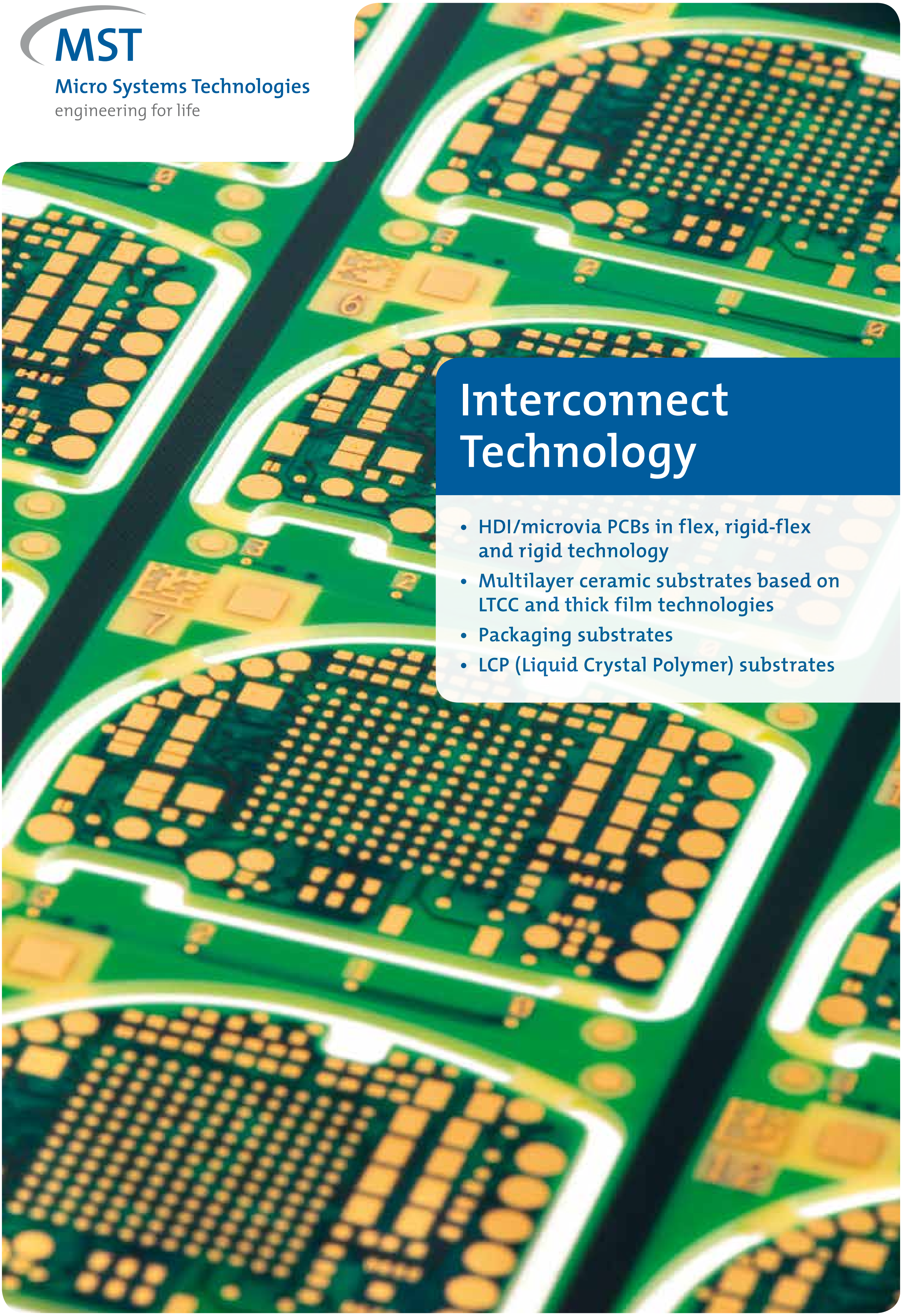

Interconnect Technology

- HDI/microvia PCBs in flex, rigid-flex and rigid technology
- Multilayer ceramic substrates based on LTCC and thick film technologies
- Packaging substrates
- LCP (Liquid Crystal Polymer) substrates

Interconnect Technology

The MST Group has extensive experience in designing and manufacturing electronic modules for medical devices and other high-reliability applications.

Interconnect technology is a crucial prerequisite for the production of miniaturized, highly reliable modules.

MST can offer a wide range of substrates – based on both organic and ceramic materials.

DYCONEX AG, an MST company located in Bassersdorf, Switzerland, is an expert and technology leader in HDI/microvia substrates based on flex, rigid-flex and rigid technology.

Micro Systems Engineering GmbH, an MST company located in Berg, Germany, is the leading European manufacturer of complex ceramic substrates in LTCC (Low Temperature Co-fired Ceramic) and thick film technologies.

CAPABILITIES AND SERVICES

DESIGN SERVICES

MST converts your design inputs and requirements into reliable and robust solutions. Assistance is offered for various technologies like HDI printed circuit boards, LTCC, thick film, HTCC (High Temperature Co-fired Ceramic) and thin film.

PRINTED CIRCUIT BOARDS AND CHIP PACKAGING SUBSTRATES

- High-reliability HDI/microvia substrates in flex, rigid-flex and rigid technology
- High-frequency/high-temperature applications
- Microfluidic substrates
- LCP (Liquid Crystal Polymer) substrates
- Comprehensive range of base materials, constraining materials and surface finishes
- Enhanced features such as embedded passives, wrap-around, cavities, etc.
- Substrates for BGAs, CSPs, SiPs, MCMs and folded packages

LTCC SUBSTRATES

- Excellent RF and microwave performance
- Hermetic and highly integrated packages
- Embedded passive components (capacitors, inductors, resistors)
- 3D solutions including stepped cavities and windows
- Brazing operations (metal plates, frames, pins)
- Mechanical processing (laser cutting, machining)

TEST SERVICES

A wide range of in-process and final inspection procedures, stress tests and other means of analysis is available to demonstrate the performance of the components.

QUALITY

The quality system of the MST Group derives from the stringent requirements of life-sustaining implants and assures 100% traceability of processes and materials.

MICRO SYSTEMS TECHNOLOGIES

Micro Systems Technologies Group (MST) consists of four technology companies that provide innovative products and services for medical devices and other high-reliability/high-performance industries. The offering includes HDI/microvia PCBs, ceramic substrates, assembly and semiconductor packaging processes, electronic module design and manufacturing, as well as batteries and battery packs for medical implants.

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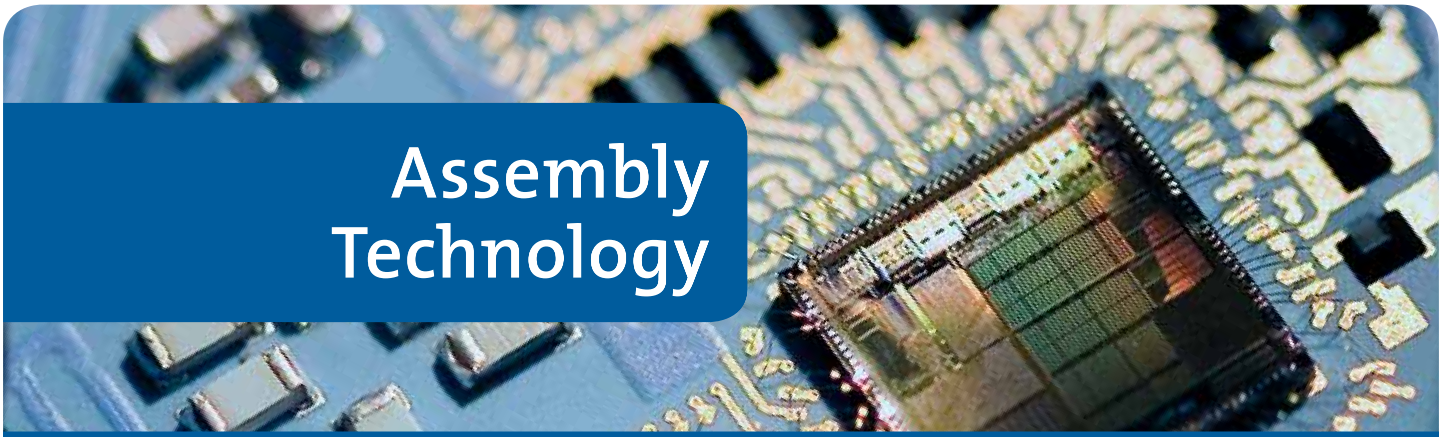
Assembly Technology

- Surface Mount Technology (SMT)
- Flip chip/CSP capability
- Die attach technologies
- Wire bonding
- Die protection, encapsulation

Assembly Technology



The MST Group is a leading specialist in the development and manufacture of electronic modules for active implants but also for other applications requiring exceptional performance and the highest level of reliability.

In addition to interconnect and semiconductor packaging technologies, the group covers all major board assembly technolgies.

Micro Systems Engineering GmbH, an MST company located in Berg, Germany, is the leading European manufacturer of complex LTCC substrates and offers a wide variety of advanced assembly and semiconductor packaging processes on both ceramic and organic substrates.

Micro Systems Engineering, Inc, an MST company located in Lake Oswego, USA, offers services in the design of complete electronic modules combined with state-of-the-art SMD assembly and test, fully MES controlled.

CAPABILITIES AND SERVICES

SMT (Surface Mount Technology) and chip & wire technologies are available for the assembly of components like SMDs, BGAs, LGAs, CSPs, flip chips or bare dies on ceramic and organic substrates.

SURFACE MOUNT TECHNOLOGY (SMT)

- Automated SMD assembly lines with full MES control
- On any board material
- Various cleaning procedures available
- Flip chip/CSP (Chip Scale Package) capability

DIE ATTACH TECHNOLOGIES

- Gluing by epoxy printing, epoxy dispensing, pre-forms and stamping
- Soldering by solder printing, solder dispensing and pre-forms
- High precision die bonder can pick from wafers, waffle packs or gel-packs

WIRE BONDING

- Ultrasonic bonding for Al thin wires
- Thermosonic wedge/wedge bonding for Au thin and Au cold wires
- Thermosonic ball/wedge bonding for Au thin wires

DIE PROTECTION/ENCAPSULATION

- Glop top (temperature or UV curing)
- Underfill
- Junction coating
- Transfer molding
- Soldering or gluing for covers and lids

TEST SERVICES

In addition to a fully automated test handling system, with MES integration, for all electrical tests a wide range of in-process and final inspection procedures, stress tests and other means of analysis is available to demonstrate the performance of the electronic modules.

QUALITY

The quality system of the MST Group derives from the stringent requirements of life-sustaining implants and assures 100% traceability of processes and materials.

MICRO SYSTEMS TECHNOLOGIES

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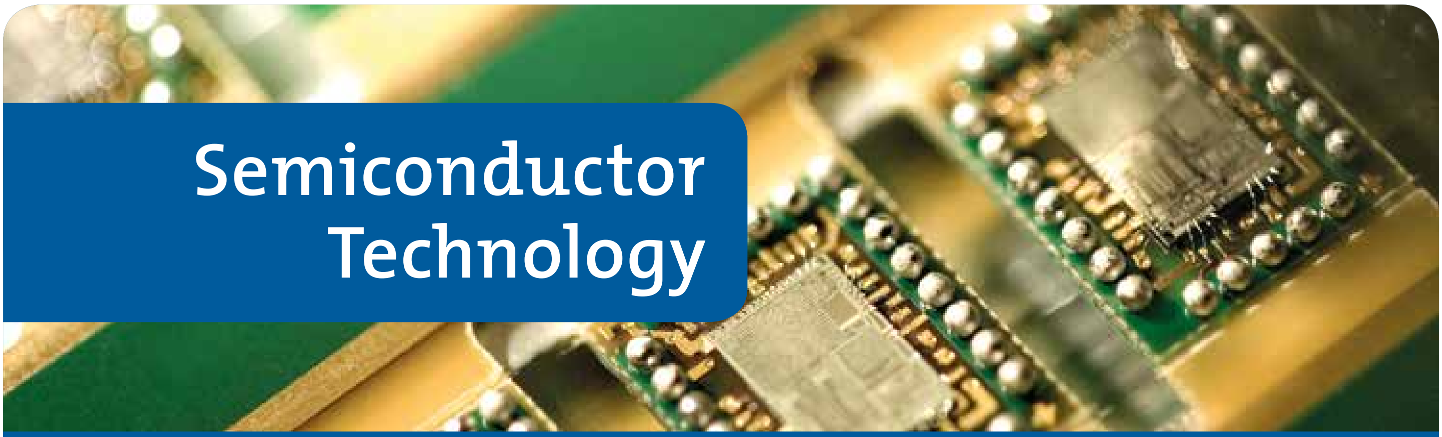
Semiconductor Technology

- Ceramic and metal packages
- Stacked die packages
- Hermetic packages
- Transfer molding
- A variety of I/O configurations
- Miniaturization solutions

Semiconductor Technology



One of MST's core areas of expertise lies in the development and manufacture of miniaturized, implantable electronic modules.

All mission critical functions are accessible within the group to provide customized solutions. Capabilities for providing miniaturized packages include design, substrate manufacturing, component selection and validation as well as all major semiconductor packaging processes.

DYCONEX AG, an MST company located in Bassersdorf, Switzerland, is an expert and technological leader in high-density interconnects based on flex, rigid-flex and rigid technology.

Micro Systems Engineering GmbH, an MST company located in Berg, Germany, is a leading manufacturer of ceramic substrates and has solid and proven expertise in applying all major semiconductor packaging technologies including transfer molding.

Micro Systems Engineering, Inc, an MST company located in Lake Oswego, USA, is a leading specialist in medical microelectronics for Class III applications. Its expertise in the development of complete packages includes the layout of printed circuit board, miniaturized component definition as well as design verification and extensive reliability tests.

SEMICONDUCTOR PACKAGING

MST offers various customized packaging solutions for a wide range of base materials, I/O configurations and housing types.

The newest technology development enables the production of SDBGAs (Stacked Die Ball Grid Arrays) in small and medium-sized volumes applying transfer molding technology, laser marking and singulation.

BASE MATERIALS

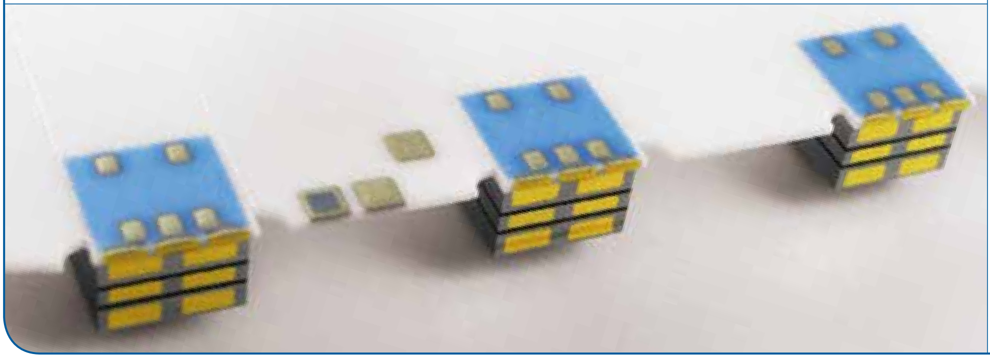
- **LTCC**
- **Al_2O_3**
- **PCB**

I/O-CONFIGURATIONS

- **Ball Grid Array (BGA)**
  - Stacked Die BGA (SDBGA)
  - High voltage BGA
- **Land Grid Array (LGA)**
- **Castellation**
- **Single In-Line/Dual In-Line (SIL/DIL)**
- **Quad Flat Packages (QFP)**

HOUSINGS

- **Non-hermetic housings using plastic/metal covers or organic coatings**
- **Hermetic housings by soldering**



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Battery Technology

- High-performance/high-reliability batteries for medical implants
- Based on Lithium-Iodine or Lithium-Manganese Dioxide
- Standard products lines and customized designs
- High volumetric energy densities
- Low self-discharge

Battery Technology

For more than 20 years LITRONIK Batterietechnologie GmbH, an MST company located in Pirna, Germany, has been active in the development and manufacture of highly reliable power sources. LITRONIK delivers innovative solutions to manufacturers of implantable pulse generators and implantable cardiac defibrillators in Europe and beyond.

The high-performance/high-reliability batteries and battery packs are based on Lithium-Iodine and Lithium Manganese Dioxide electrochemical systems.

LITRONIK's strong core areas of expertise in electrochemistry, materials science, chemical and physical engineering, powder processing, dry room technology as well as electrical characterization are the foundation for power sources providing today's state-of-the-art in battery technology for implantable medical devices.

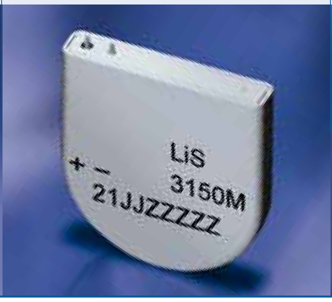
The batteries are manufactured within a tightly controlled atmosphere to ensure highly reproducible electrical characteristics. A completely laser or plasma welded stainless steel or Titanium case and a high-precision metal-to-glass feedthrough guarantee hermeticity and safe operation.

The cells and packs are 100% electrically characterized plus mechanically and visually inspected.

COSTUMIZED SOLUTIONS AND STANDARD PRODUCT LINES

Three base technologies are offered to cover three ranges of performance for standard product lines as well as for solutions tailored to particular needs of an application.

Li-Iodine High Energy Batteries	Li-Manganese Dioxide Medium Rate Batteries	Li-Manganese Dioxide High Power Batteries
• For implantable pulse generators or other medical devices with the highest reliability demands • Highest volumetric energy densities • Lowest self-discharge rates • Solid-state battery • Long operational safety	• For implantable devices with medium pulse power demands • Very high power densities • Direct power supply of telemetric units • Low self-discharge rates • No voltage delays	• For implantable defibrillators and other devices with high pulse power demands • Very high power densities • Fastest capacitor charging • Low self-discharge rates • No voltage delays



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Advanced technical solutions for high-reliability markets

Interconnect Technology

Assembly Technology

Semiconductor Technology

Battery Technology

DYCONEX Bassersdorf, Switzerland

High-end flex, rigid-flex and rigid PCBs,
LCP substrates, packaging substrates

LITRONIK Pirna, Germany

Batteries and battery packs for
active implants

MICRO SYSTEMS ENGINEERING Berg, Germany

LTCC substrates, advanced assembly
and semiconductor packaging

MICRO SYSTEMS ENGINEERING Lake Oswego, OR, USA

Development and manufacturing of complete
electronic modules, SMD assembly and test

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