LDS technology

Clever, flexible, successful, more than an option

LPKF Laser & Electronics AG · Osteriede 7 · 30827 Garbsen/Germany · www.lpkf.com

Content

Short Introduction to LPKF Laser & Electronics AG

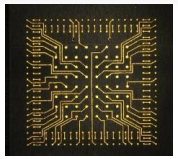
- Information on LDS-MID Manufacturing Technology and Design Rules
- Plating Process, Material and Applications
- Active Mold Packaging AMP

LPKF - Worldwide mechanical engineering company since 1976

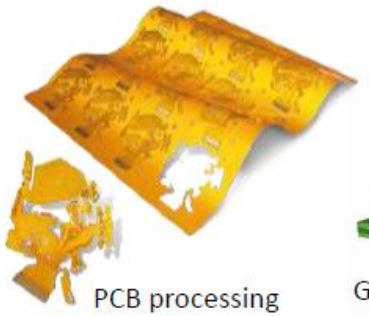
- Staff: 700
- Turnover: ~ 100 million €
- 10 percent of turnover invested in R&D
- Certified according to ISO 9001

(from the LPKF corporate mission statement)

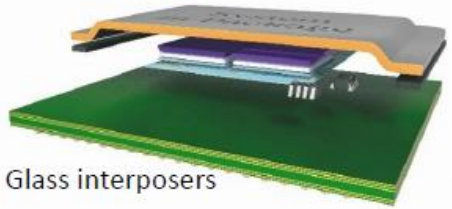
Company Portfolio - Laser for different applications



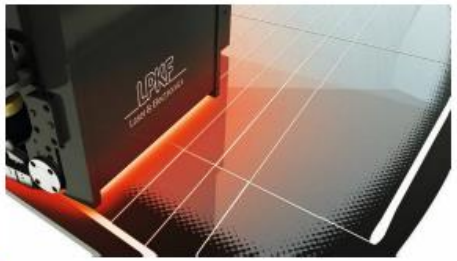
Active mold packaging



PCB processing

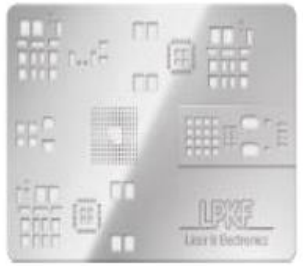


Glass interposers

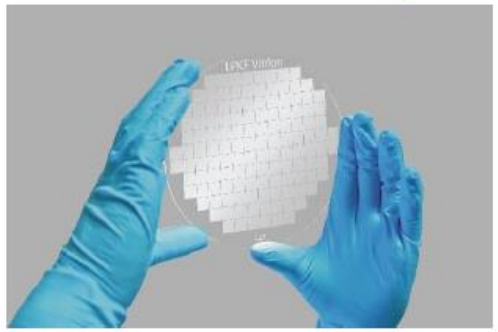


Digital printing of functional paste

PCB Prototyping



Solder paste stencils



LIDE Glass processing

MIDs with LDS

Laser plastic welding

Scribing of thin film solar panels

Electronics Development	Electronics Production	Welding	Solar

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⇨ **Information on LDS-MID Manufacturing Technology and Design Rules**

⇨ **Plating Process, Material and Applications**

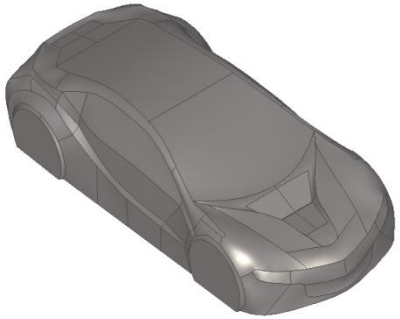
- Active Mold Packaging AMP

3D MID Technology

MID

Molded **I**nterconnect **D**evice

Mechatronic **I**ntegrated **D**evice

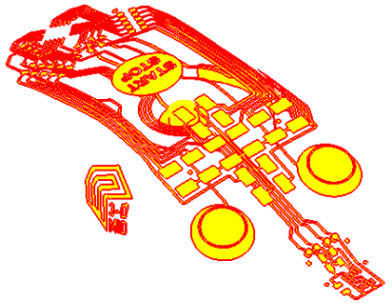


3D Carrier (e.g. injection molded part)

Mechanical device

3D MID

Mechatronic device



3D Circuitry

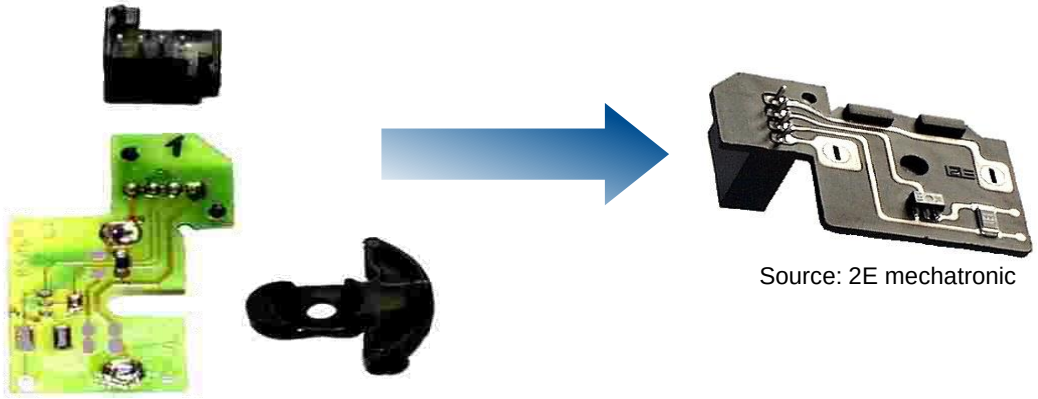
Electronical device

3D MID Technology

- Molded interconnect devices made their beginnings in the early 80s

- MIDs are not a substitution to PCBs but can be a reasonable supplement

- The biggest challenge is to re-think a conventional design using the possibilties of the third dimension



Source: 2E mechatronic

Conventional solution

MID solution

Motivation

- Miniaturization
- Integrating functionalities (e.g., antennas, sensors…)
- Reducing components
- Combining electrical and mechanical functions into a single device

LDS

Two- shot molding

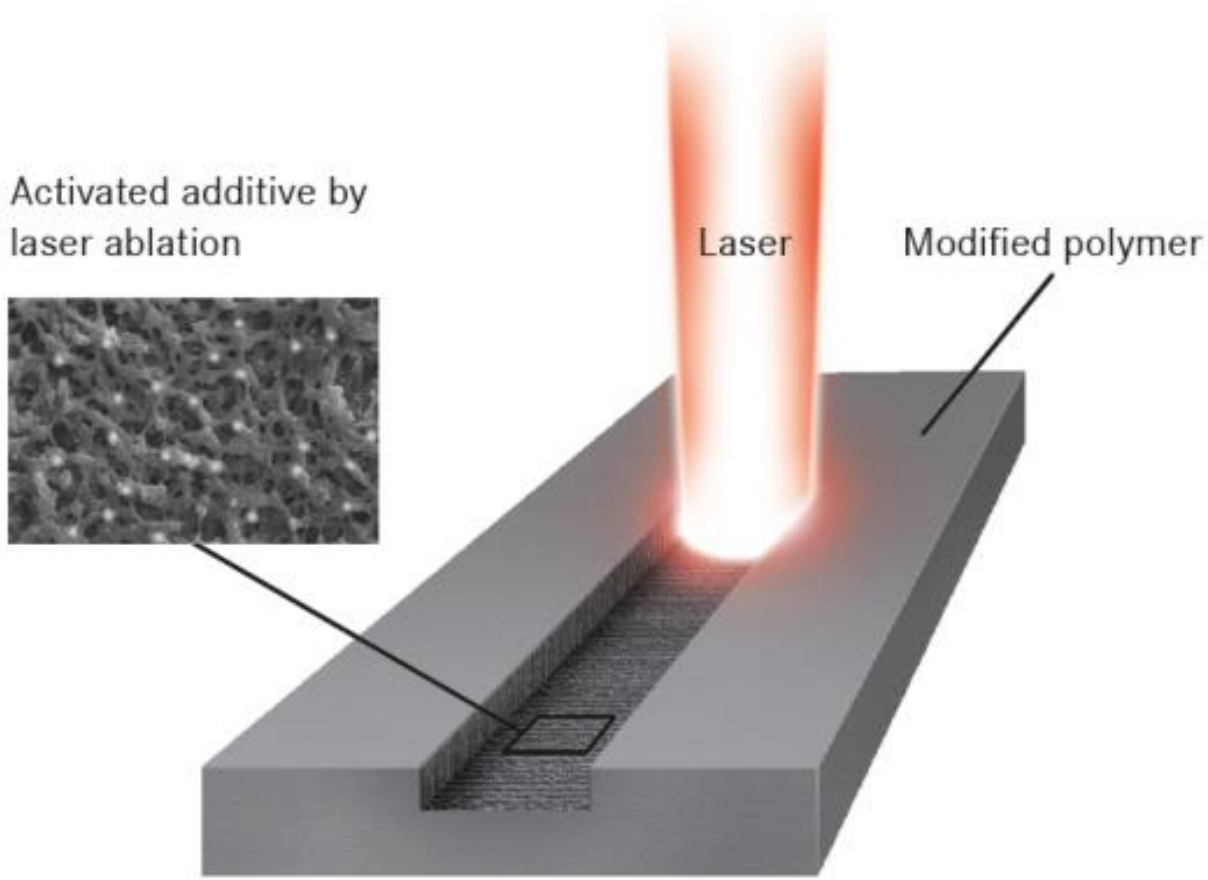
Aerosol- jet printing

Plasma coating

and others

LDS – Laser Direct Structuring

Laser Activation + Surface Treatment



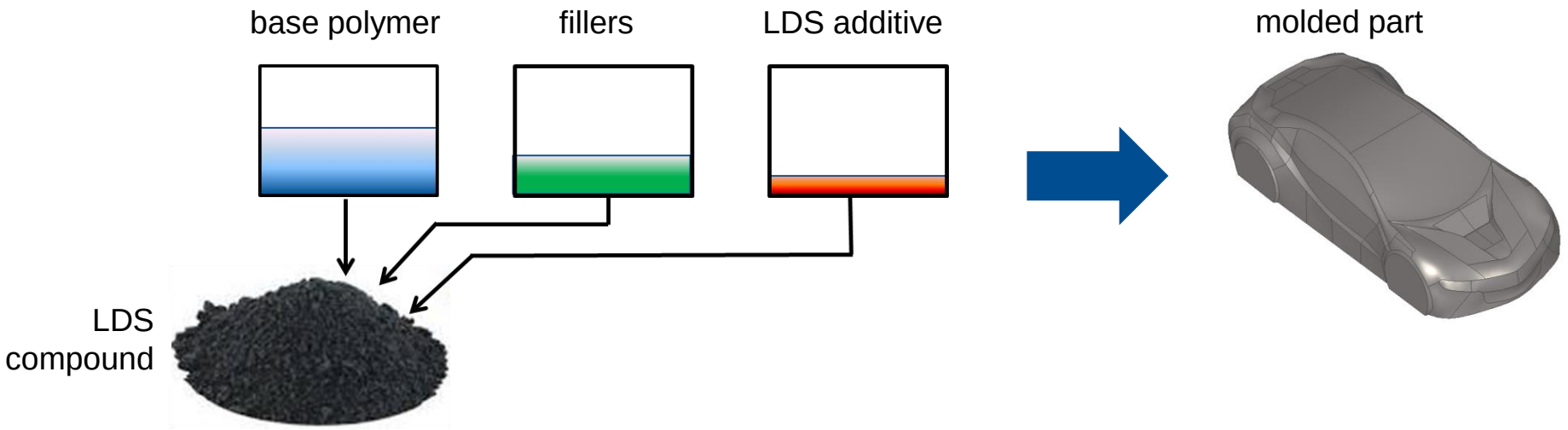
LDS – Laser Direct Structuring - Process

Patented LDS process for the production of three-dimensional molded interconnect device (MID)

Granulates

1. Injection Molding

2. Injection Molding



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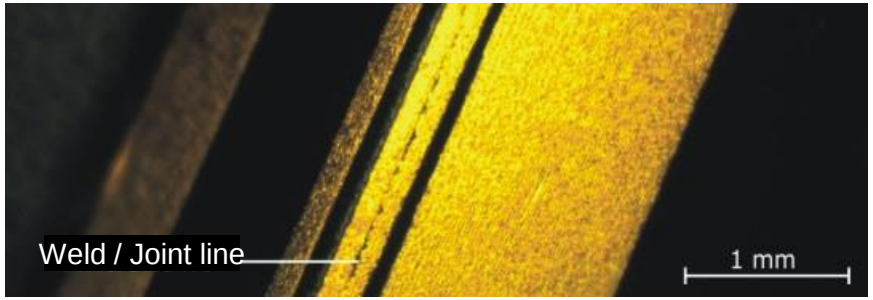
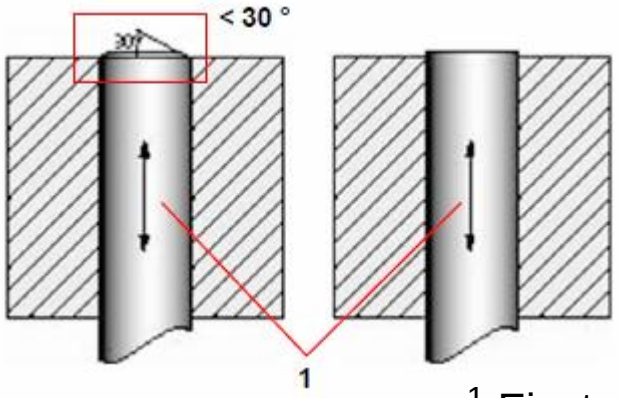
Design Rules for LDS MIDs: Injection Molding

Avoid circuit tracks in the area of joint lines

Consider the gate position for a homogenous filling of molding tool.



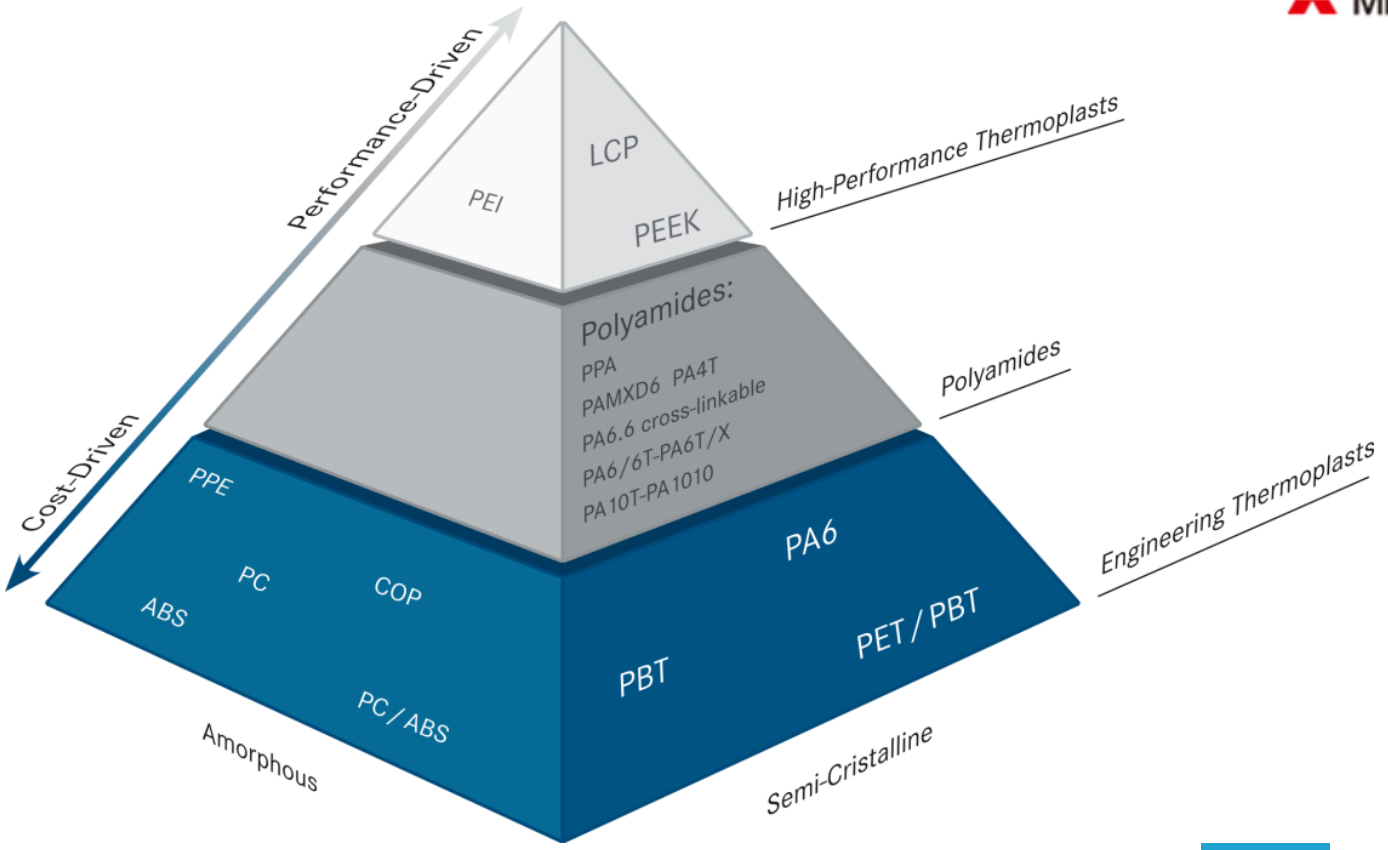
No ejector marks beneath intended circuit tracks



[1] Ejector pin of molding tool

LDS – Materials

Over **90 plastics** are commercially available and LDS-approved by LPKF



Mitsubishi Engineering-Plastics Corporation

Celanese
The chemistry inside innovation

RTP Company
Imagineering Plastics

EMS

EVONIK
INDUSTRIES

PolyOne

SINOPLAST

LANXESS
Energizing Chemistry

KINGFA

ZEON CHEMICALS

LK ENGINEERING PLASTIC
LUCKY ENPLA CO., LTD

Ensinger

TRINSEO

sabic

DSM

삼성SDI

LG Chem

BASF
The Chemical Company

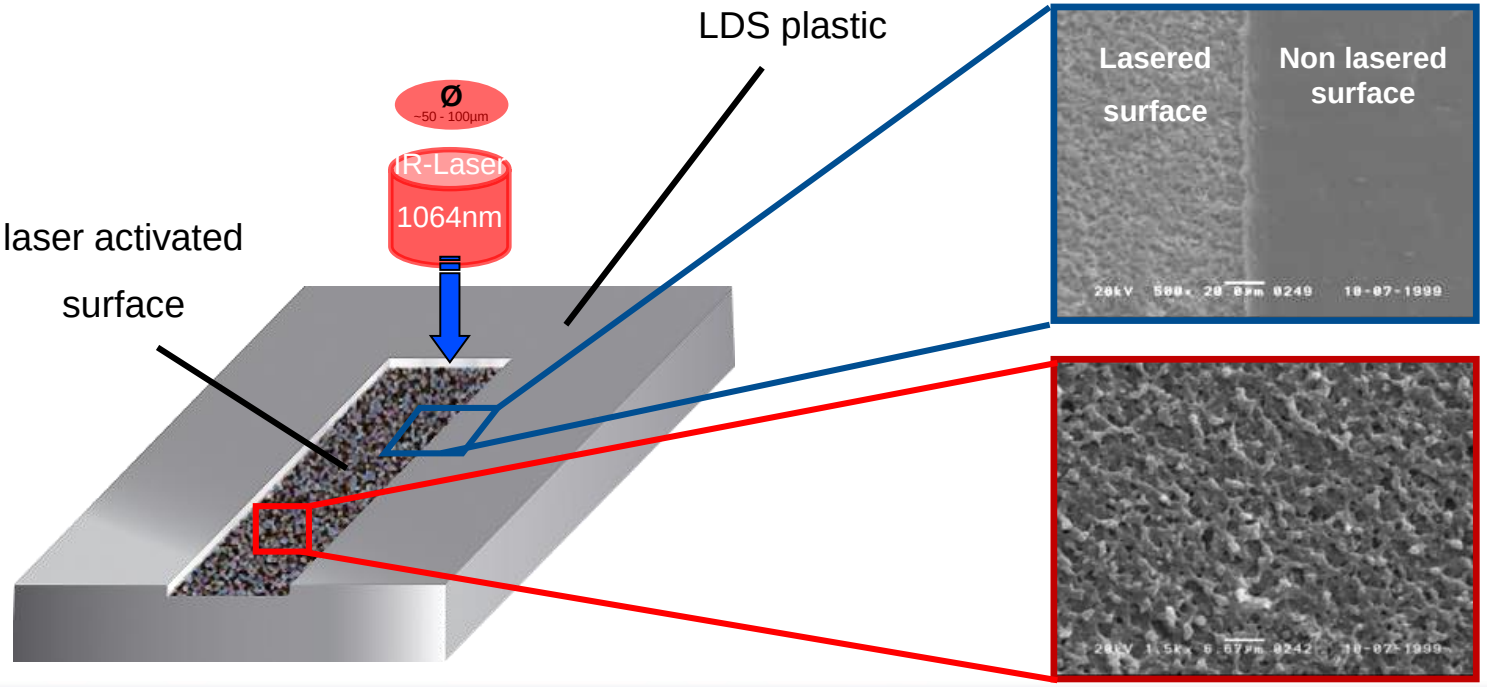
PREMIX

LDS – Laser Direct Structuring - Process

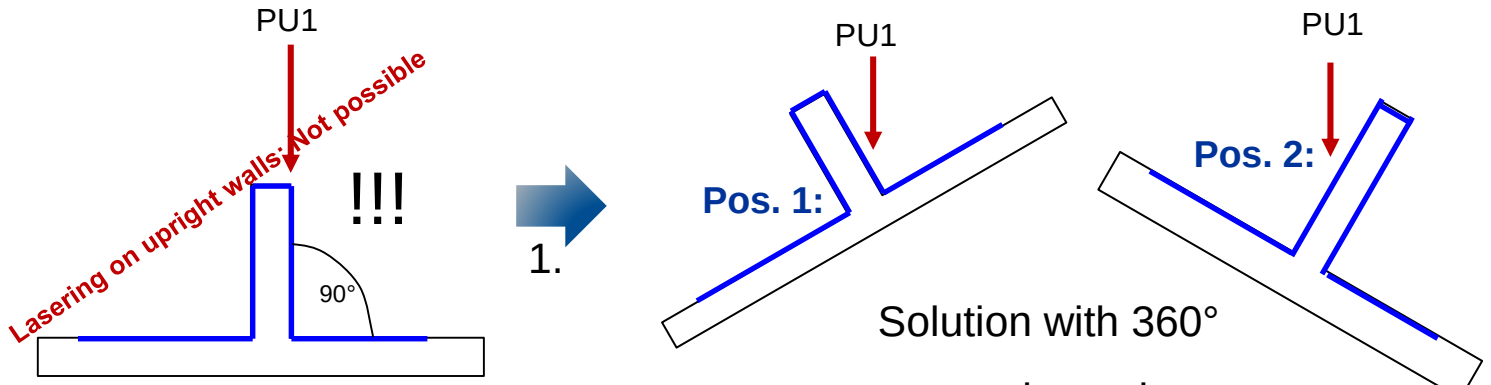
Patented LDS process for the production of three-dimensional molded interconnect device (MID)

Granulates → **1. Injection molding** → **2. Structuring** → **3. Metallization**

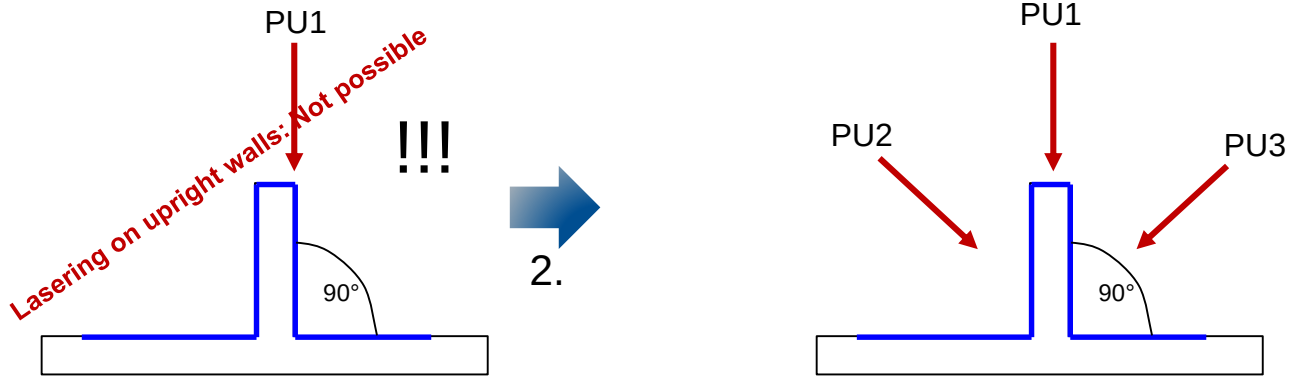
2. Structuring



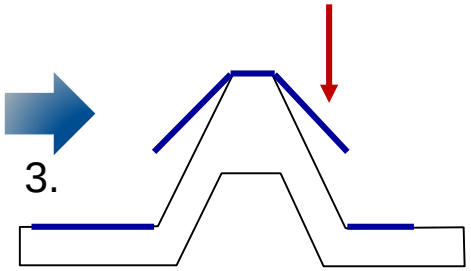
Design Rules for LDS MIDs: Laser Process



Solution with 360° rotation unit



Solution with 3 installed laser units



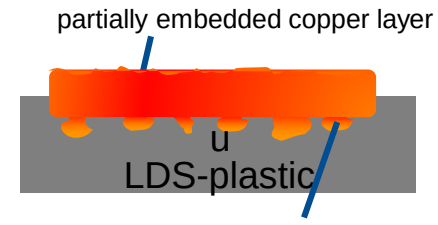
MID design specific

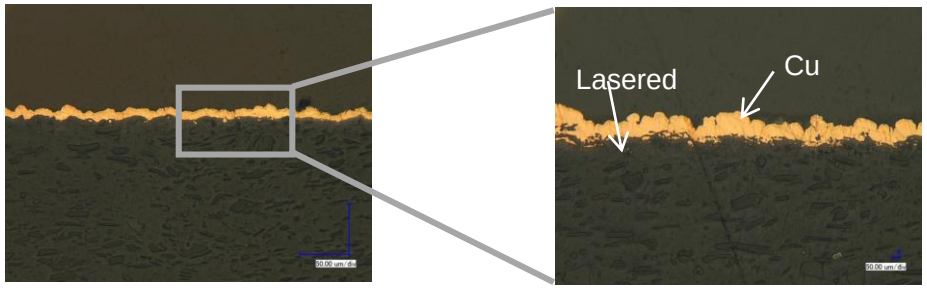
LDS – Laser Direct Structuring - Process

Patented LDS process for the production of three-dimensional molded interconnect device (MID)

Granulates → **1. Injection molding** → **2. Structuring** → **3. Metallization**

3. Metallization





Typical metallization: ~8 µm Cu; ~4 µm Ni; 0,1 µm Au

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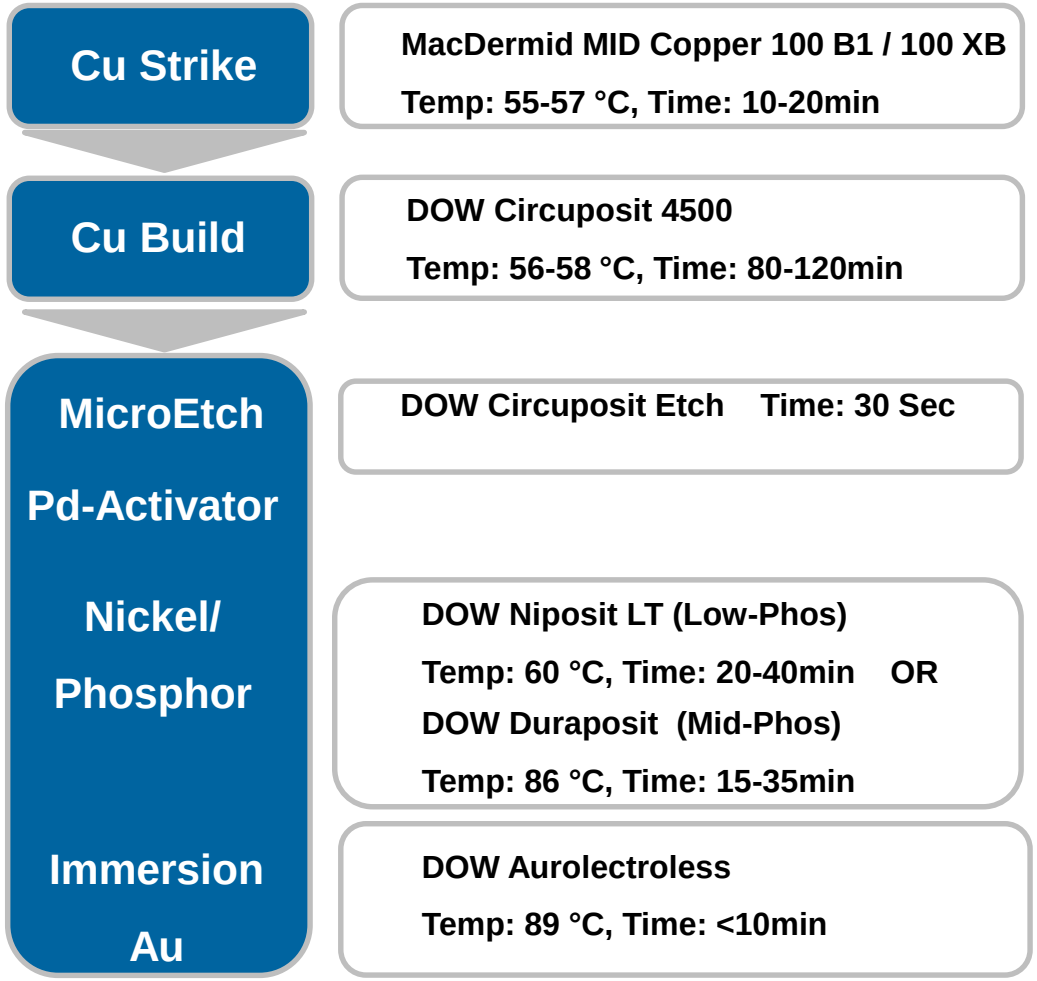
E-Less LDS classic plating process

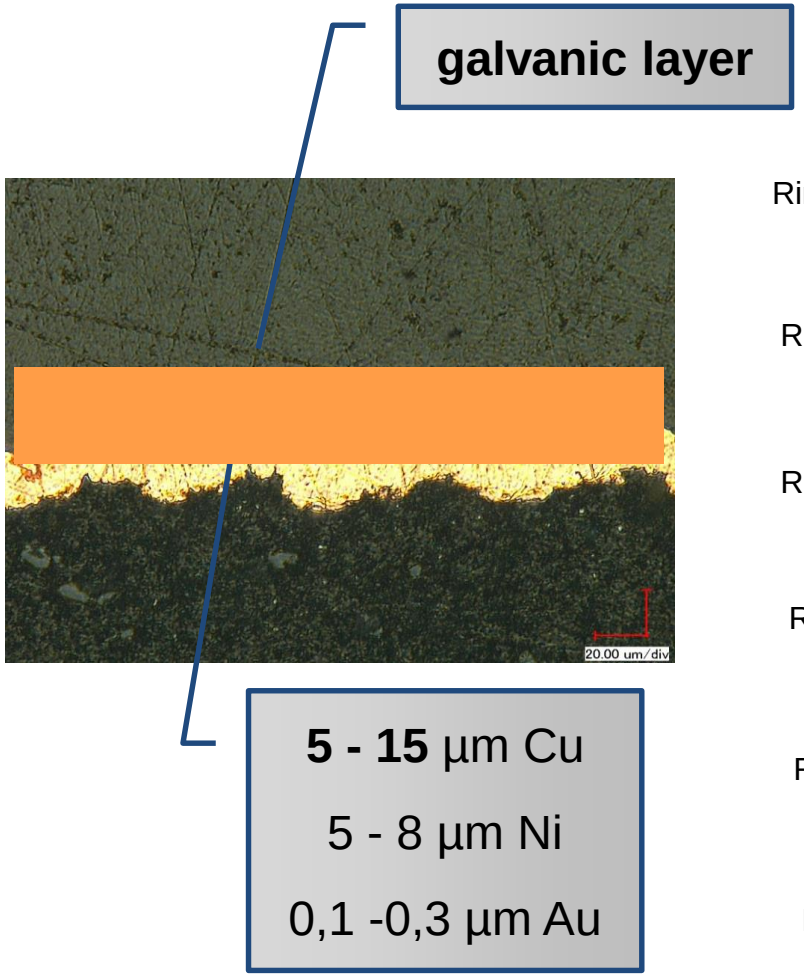
2-Step plating for materials like

- PC (GF / non-GF)
- PC/ABS (GF / non-GF)
- ABS
- LDS ProtoPaint
- LDS PowderCoating
- COP
- PA1010
- …



Electroless … Galvanic Plating

Electroless Copper Strike
Rinsing/Cleaning
Electroless Copper Build
Rinsing/Cleaning
Micro Etch
Rinsing/Cleaning
Pd-Activator
Rinsing/Cleaning
Electroless Nickel
Rinsing/Cleaning
Immersion Gold
Rinsing/Cleaning



Electroless Copper Strike
Rinsing/Cleaning
Galvanic Copper Bath
Rinsing/Cleaning
Micro Etch
Rinsing/Cleaning
Pd-Activator
Rinsing/Cleaning
Electroless Nickel
Rinsing/Cleaning
Immersion Gold
Rinsing/Cleaning

LDS-MIDs: Products and Applications

- 3D MIDs offer new potential for designers to reduce size and components by combining mechanical and electrical functionalities into a single device

- The LPKF-LDS technology has become established as the preferred manufacturing process for the production of molded interconnect devices

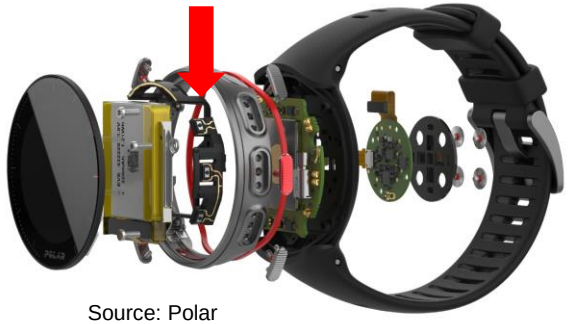
- LDS has been **predominantly** used for **mass-producing** components in the field of smart connected device markets (e.g. Smartphones, Tablets, etc)

- However, the fields of application for LDS technology is very extensive. From consumer electronics, wearables to medical technology, highly complex circuits to radar technology

Source: NORWE

Source: army.mil

Source: 2E Mechatronic



Source: Polar

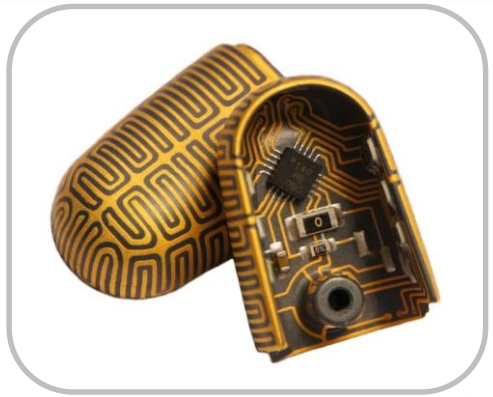
Source: mwrf.com

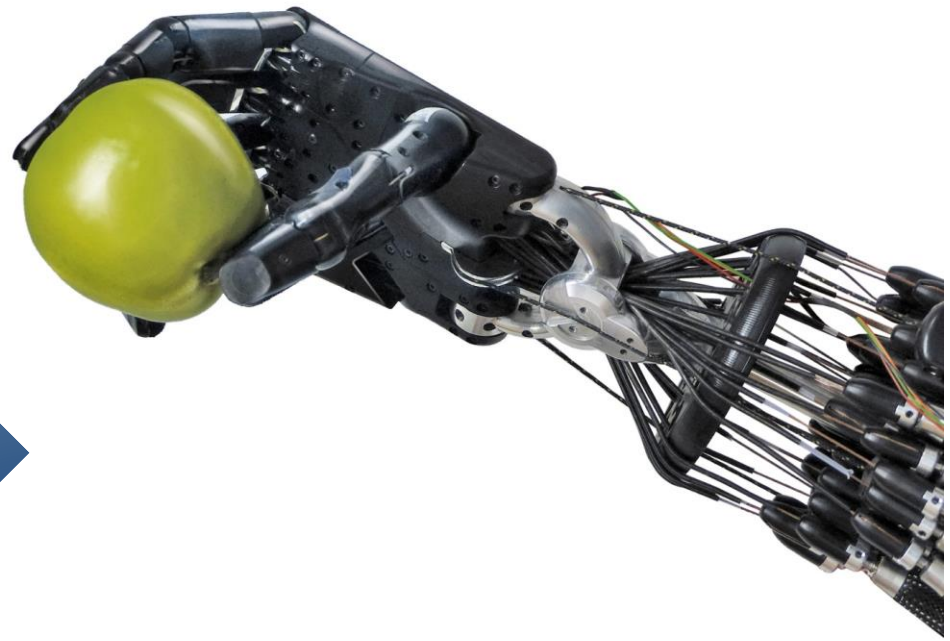
Source: UPI.com

Source: Festo

LDS Examples: Tactile Sensor

Research group:





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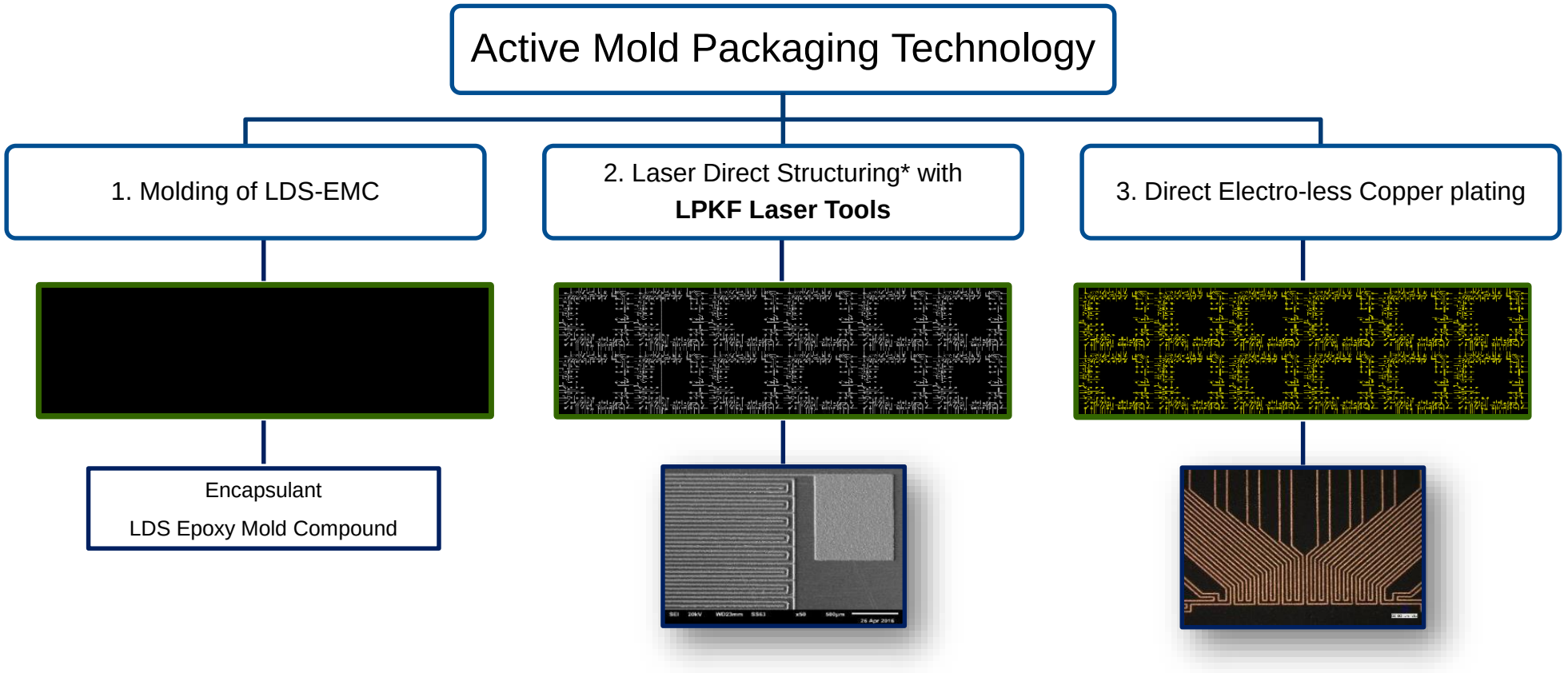
⇨ **Active Mold Packaging AMP**

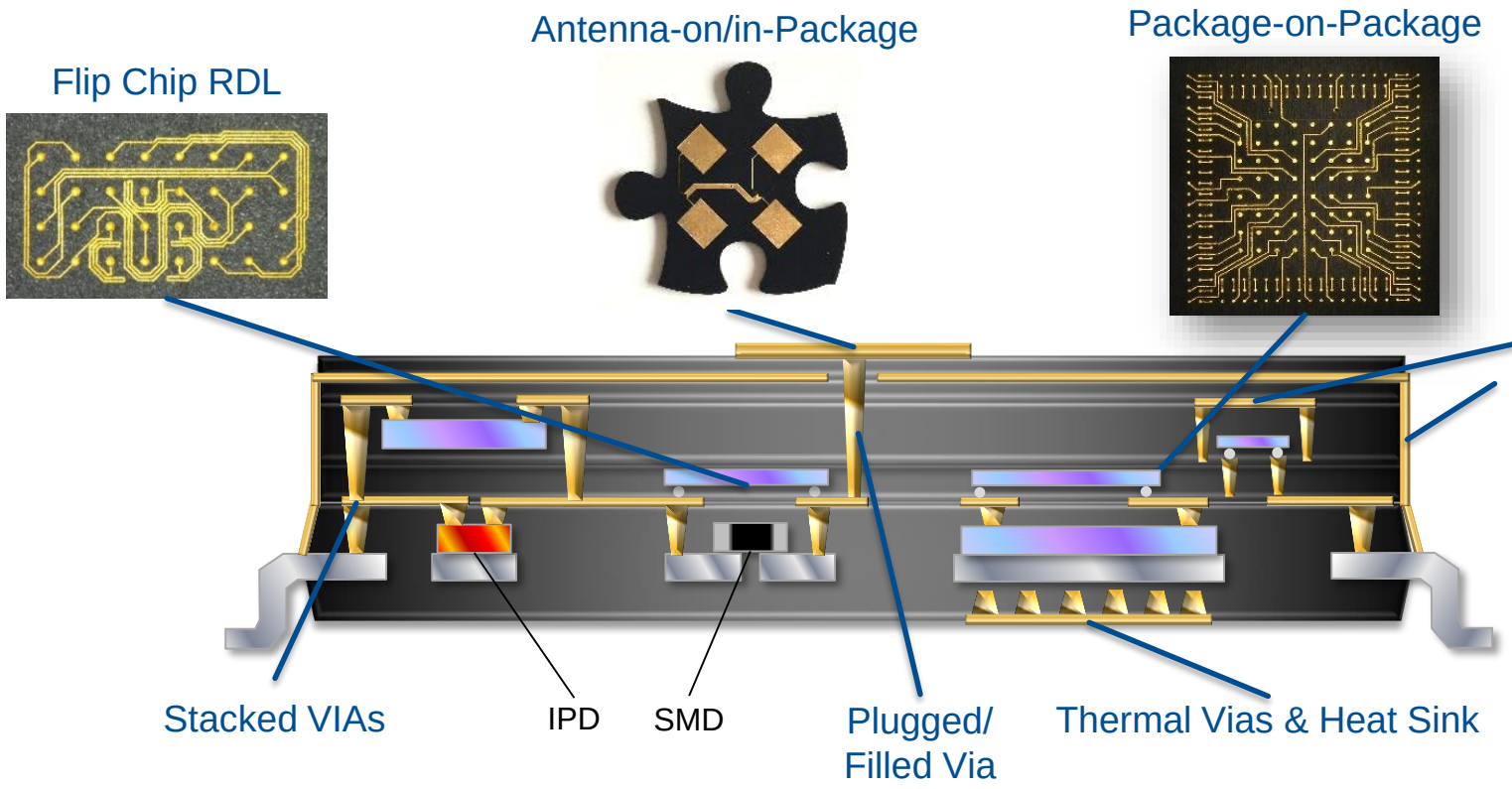
Active Mold Packaging AMP

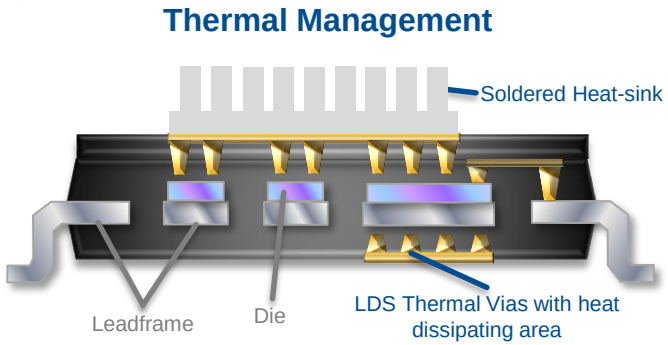


Active Mold Packaging – Concepts

Adding value through increased density and functionality at IC package level.

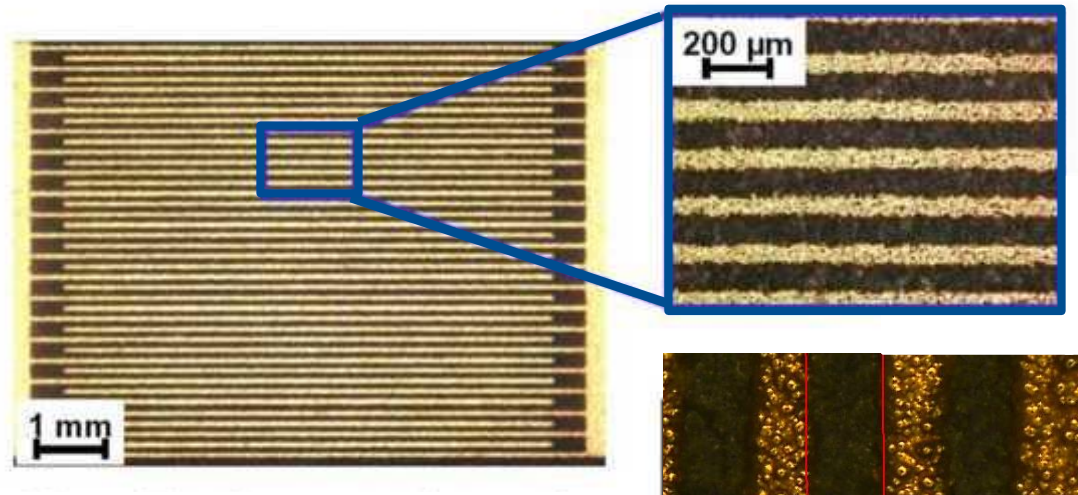
LPKF Active Mold Packaging (AMP) combines the patented LPKF Laser Direct Structuring (LDS) technology with Epoxy Mold Compounds (EMC) for the integration of electrical circuitry directly inside and onto the chip package housing.





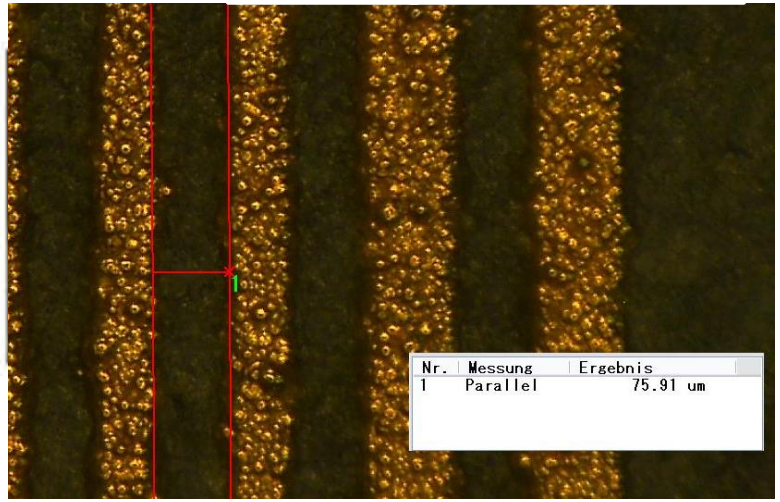
Current LDS Pitches

Fine Pitch in 3D (up to 45° inclination angle)

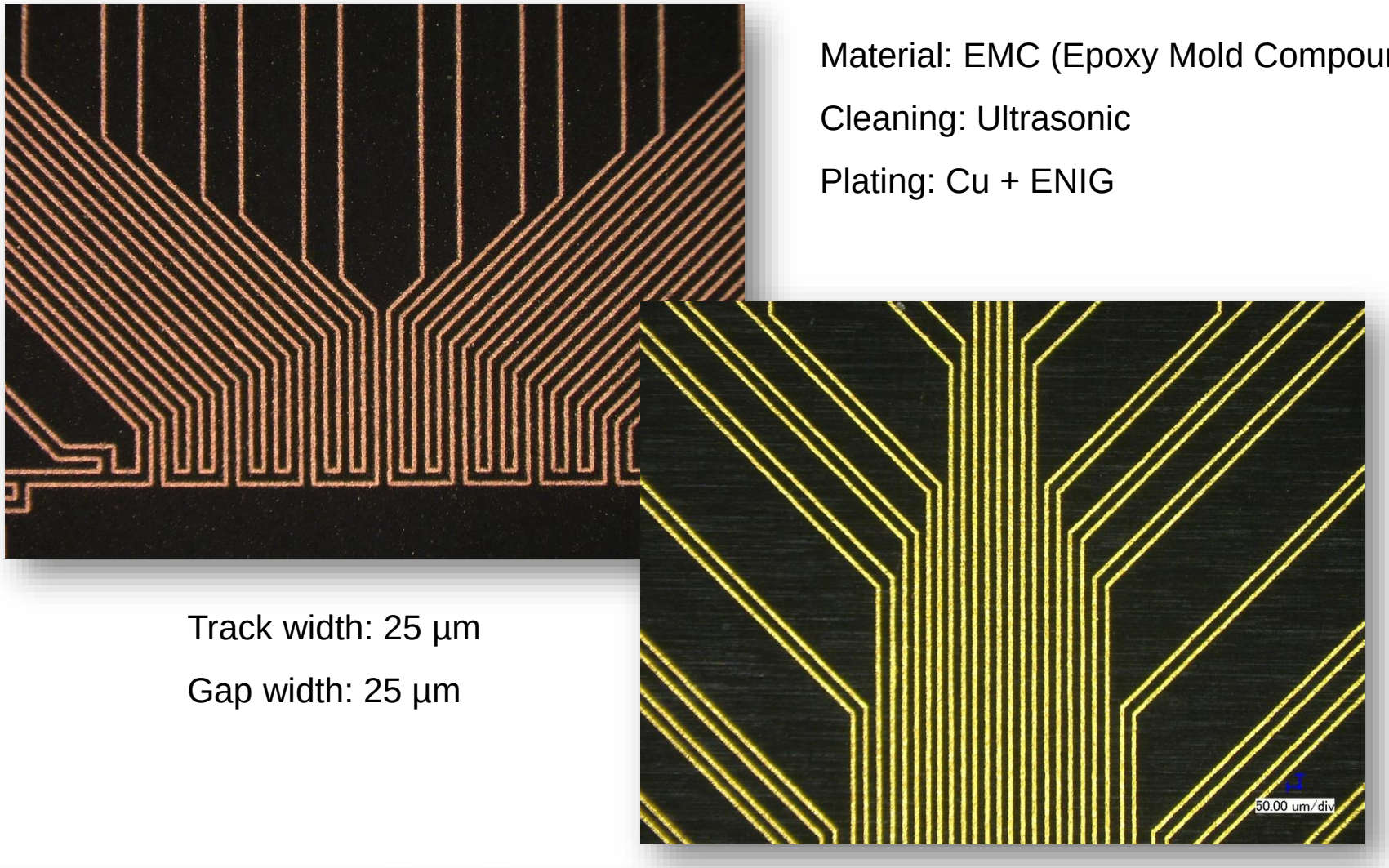


Minimum Pitch:

Line width:	75 µm
Space width	75 µm
Pitch	**150 µm**



Fine Lines Down to 25 µm



Material: EMC (Epoxy Mold Compound)

Cleaning: Ultrasonic

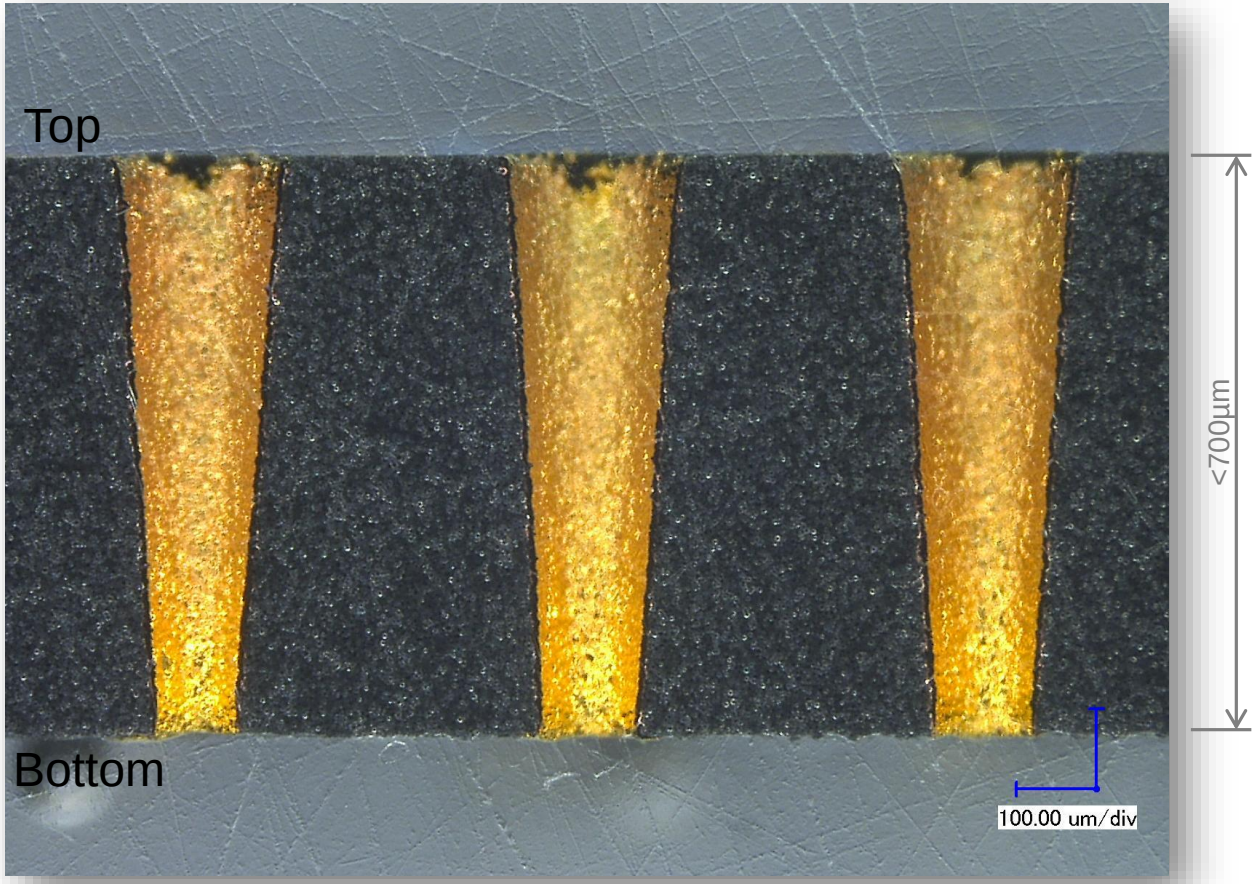
Plating: Cu + ENIG

Track width: 25 µm

Gap width: 25 µm

LDS Vias (Laser Drilled)

Laser drilled through-holes for interconnection



Material:
EMC (Epoxy
Mold Compound)

Contact at LPKF

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Thank you

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