3D Circuitry on Thermoplastics
Creating Molded Interconnect Devices with Laser Direct Structuring
Our presenters

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Questions

- Submit questions via…
  - Your GoTo Webinar panel
  - Twitter: @LPKF_USA
What’s on slate for today

1. The rise, fall, and rise of MIDs
2. MID manufacturing methods
3. An analysis of the laser direct structuring process
4. Applications
5. Next steps
Molded Interconnect Device (MID)

- Circuit board
- Housing
- Connector
- Cable
MID features

• Fewer components/parts

• Saves space, reduces weight, lowers cost

• 3D workspace opens up design possibilities
MID history

• Broke onto the scene in the 1980s

• Despite early fanfare, didn’t catch on
  - High threshold for entry

• In recent years, demand for MIDs has picked up
  - Miniaturization
  - New methods lower threshold
MID apps

What’s important about MIDs?

- Stephan: 3D workspace
- Don: Reducing components
## Common MID manufacturing methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Parts</th>
<th>Moldings</th>
<th>App. size</th>
<th>Circuit design</th>
<th>Manufacturing volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-shot molding</td>
<td>- 1 platable plastic part, 1 non-platable plastic part</td>
<td>- Complex</td>
<td>- Large</td>
<td>- Tied to molding of part - Ideal for simple designs</td>
<td>- Large batch</td>
</tr>
<tr>
<td>Laser direct structuring</td>
<td>- 1 platable plastic part</td>
<td>- Simple</td>
<td>- Medium</td>
<td>- Independent of molding - Ideal for complex designs</td>
<td>- Large batch - Small batch - Prototyping</td>
</tr>
</tbody>
</table>
What is laser direct structuring (LDS)?

- 3-step physiochemical process for creating 3D circuitry on MIDs
  1. Injection molding
  2. Laser activation
  3. Metallization
Injection Molding

- **1-shot** injection molding of doped thermoplastics
Result - Injection Molding
Laser activation

- Physiochemical reaction etches the wiring pattern on the plastic and prepares material for **selective** metallization
Laser activation

Laser radiation

polymer + metal-organic complex

Metal
Nitrogen
Oxygen
Laser activation

organic ligands

metal atom

metal seeds

polymer + metallorganic complex

Metal
Nitrogen
Oxygen
Laser activation

Micro-etched, laser activated surface

Smooth, unactivated surface
Animation
Result - Laser Activation
Metallization

- Electroless copper plating
  - *Metallization only in the laser activated areas*
Metallization

- Immersion Au 0.1µm
- Ni 3 µm
- Cu 5 µm
- Modified polymer
Result - Selective Metallization
Applications

• Telecommunications
  - You probably have an LDS antenna in your pocket right now!
Applications

- **Automotive**
  - Steering wheel
Applications

- **Automotive**
  - Motorcycle handlebar
Applications

• Automotive
  - Motorcycle handlebar
Applications

- Medical
  - Hearing aids
Applications

- Security
  - Drill shield
Applications

- Fine pitch capabilities
  - 6 mil trace/6 mil space or smaller
Applications

- RFID
  - Transponder
Applications

- **Sensors**
  - Pressure sensor

Source: VTI Oy
Why should you consider MIDs?

- Fewer components
- Lighter parts
- 3D workspace/design versatility
Why should you consider LDS?

• Ideal for high mix manufacturing environments

• Complex circuitry

• Cost-effective entry into the world of MIDs
Where to go from here?

If you’re interested in laser direct structuring…

Call us!

We can help you…
• Find an LDS service provider
Where to go from here?

Or…
- Start working with LDS yourself
Thank you for your attention!

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