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深圳蛇口希尔顿南海酒店
扫一扫，关注大会动态
Technology Platform and Trend for SiP Substrate

Steve Chiang, Ph.D
CSO of Unimicron Technology
Contents

➢ Unimicron Introduction
➢ SiP Evolution
➢ Unimicron SiP platform - PCB, RF, Substrate, Glass RDL Connector.
➢ Summary
Unimicron Manufacturing & Service

- Headquarters: Shanying, Hsinfeng
- Substrate - Plants: Shanying, Hsingpong, Luchu, Herjiang, Chungyuan
- Substrate - Technical Service Center: Shanying, Hsingpong, Luchu, Herjiang, Chungyuan
- Substrate - After Service (FVI): Shanying, Hsingpong, Luchu, Herjiang, Chungyuan
- PCB/HDI - Plants: Mauar, Shenzhen, Kunshan (FPC), Shenzhen, Taiwan HQ
Evolution of Semiconductor Packaging

Performance, Form Factor, Cost

Source: Prismark

Unimicron
Why SiP

- Size Reduction
- Complexity Reduction
- Design Effort Reduction
- Power Reduction
- Lower System Cost
Unimicron provides total SiP substrate solutions.
# PCB Evolution for Future SiP

![PCB Evolution for Future SiP](image)

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Current HDI PCB</th>
<th>SiP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamination materials</td>
<td>Mid-Tg</td>
<td>High Tg</td>
</tr>
<tr>
<td>Fine Line/Space</td>
<td>50 µm</td>
<td>40µm or less</td>
</tr>
<tr>
<td>Laser Via density</td>
<td>1x</td>
<td>50-100x</td>
</tr>
<tr>
<td>Thin Core</td>
<td>50 µm</td>
<td>40 µm or thinner</td>
</tr>
<tr>
<td>Thin Dielectric</td>
<td>50 µm</td>
<td>25 µm</td>
</tr>
<tr>
<td>S/R Registration</td>
<td>25 µm</td>
<td>15 µm</td>
</tr>
<tr>
<td>Au Surface Finish</td>
<td>ENIG</td>
<td>ENEPIG</td>
</tr>
</tbody>
</table>
# PCB for SiP Application

<table>
<thead>
<tr>
<th>Application</th>
<th>Product</th>
<th>Size (mm)</th>
<th>Structure</th>
<th>L/S (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wearable</td>
<td><img src="image" alt="Wearable" /></td>
<td>25 x 25</td>
<td>10L ELIC</td>
<td>40/60</td>
</tr>
<tr>
<td>Smartphone</td>
<td><img src="image" alt="Smartphone" /></td>
<td>26 x 30</td>
<td>12L ELIC</td>
<td>40/50</td>
</tr>
<tr>
<td>Wireless Module</td>
<td><img src="image" alt="Wireless Module" /></td>
<td>19 x 28</td>
<td>6L ELIC</td>
<td>30/35</td>
</tr>
<tr>
<td>Wireless Module for Automotive</td>
<td><img src="image" alt="Wireless Module" /></td>
<td>37 x 32</td>
<td>10L HDI (4/2/4)</td>
<td>50/75</td>
</tr>
<tr>
<td>OHRM Module</td>
<td><img src="image" alt="OHRM Module" /></td>
<td>6.5 x 4.4</td>
<td>2L</td>
<td>75/75</td>
</tr>
</tbody>
</table>
## PCB to Module Substrate

<table>
<thead>
<tr>
<th>Communication Module</th>
<th>Communication Module</th>
<th>Camera-Module</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Communication Module" /></td>
<td><img src="image2" alt="Communication Module" /></td>
<td><img src="image3" alt="Camera-Module" /></td>
</tr>
<tr>
<td>8L All Laser t=0.34㎜ L/S=40/40</td>
<td>6L All Laser t=0.25㎜ L/S=50/50</td>
<td>5L All Laser t=0.32㎜ L/S=50/50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Camera Module</th>
<th>Coil/Inductor</th>
<th>Coil/Inductor</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Camera Module" /></td>
<td><img src="image5" alt="Coil/Inductor" /></td>
<td><img src="image6" alt="Coil/Inductor" /></td>
</tr>
<tr>
<td>4L (B2it) t=0.28㎜ L/S=75/75</td>
<td>7L All Laser t=0.23㎜ L/S=80/35</td>
<td>10L All Laser t=0.32㎜ L/S=70/35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mobile Phone</th>
<th>Organic Device</th>
<th>Micro LED Display</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Mobile Phone" /></td>
<td><img src="image8" alt="Organic Device" /></td>
<td><img src="image9" alt="Micro LED Display" /></td>
</tr>
<tr>
<td>12L All Laser t=0.80㎜ L/S=50/50</td>
<td>2L (Laser) t=0.08㎜ L/S= No trace</td>
<td>4L 1-2-1 t=0.80㎜ L/S=50/50</td>
</tr>
</tbody>
</table>
Applications of Rigid Flex

Rigid Flex has expanded from camera module to wider module applications
Unimicron CSP/SiP Product Roadmap

- **Embedded Function**
  - EPS FC PoP

- **High Density**
  - FC PoP
  - FCCSP / Hybrid CSP
  - SiP
  - Hybrid Coreless (5~8 layers)

- **Ultra Thin**
  - 3L Coreless
  - ETS
  - 1L ETS
  - 2.1D/2.5D Substrate
  - Panel RDL Substrate

- **Finer, Thinner, System Integration**
Coreless Substrate

- Coreless: high electrical performance, high density design, low profile for AP & wearable.

- Coreless FCBGA Example (43 x 43mm)
Thermal Solutions

- **Cu Pillar (HCP)**
  - Precise Height Control Packaging
  - Excellent Co-planarity Warpage Improvement
  - Superior EE Performance Signal Integrity

- **Cu Inlay**
  - Rigidity PCBA Yield
  - Co-planarity PCBA Yield/CMOS Sensor...
  - Heat Spreading CIS...
  - Thermal Management

- **Cavity with Stainless Steel**
  - Rigidity PCBA Yield
  - Co-planarity PCBA Yield
  - Heat Spreading Thermal Management
Thermal Solutions, Continue

Copper inlay/High K dielectric

- 2 Layer
- 4 Layer
- 6 Layer

Integrated heat sink substrates

- 78(W)x88(L)x7(H) mm

Phase change cooling for power SiP

In production

In pilot
IPD SiP Applications

- Coil inductors made by PCB/substrate process.
- 3D solenoid inductors made by glass panel with TGV.

Total thickness: 0.23mm

Cross section point

Dielectric layer: 8µm
Cu 25µm
Space 35µm

PCB Coil

Glass 3D Inductor, Published on ECTC 2016
## Unimicron Next Generation SiP Platform

- Glass based panel fan-out RDL substrate
- Extend to high integrated 2.1D advanced substrate.

<table>
<thead>
<tr>
<th>Product Plan</th>
<th>Panel Fan-out Substrate</th>
<th>2.1D Advanced Substrate</th>
<th>Glass Substrate 2.5 D Glass Interposer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td><img src="image" alt="Glass Carrier" /></td>
<td><img src="image" alt="Generation II" /></td>
<td><img src="image" alt="ABF/PID" /></td>
</tr>
<tr>
<td>Layers (Material)</td>
<td>2 ~ 4 (PID)</td>
<td>2 ~ 4 (PID)</td>
<td>0/2/0 ~ 3/2/1 (ABF/PID)</td>
</tr>
<tr>
<td>BU L/S (μm)</td>
<td>8/8 ~ 5/5 <em>Gen I</em>, 5/5 ~ 2/2 <em>Gen II</em></td>
<td>3/3 ~ 2/2</td>
<td>10/10 ~ 5/5 Interposer</td>
</tr>
<tr>
<td>Application</td>
<td>SiP, PMIC, AP</td>
<td>GPU, HPC</td>
<td>RF IPD, GPU, HPC</td>
</tr>
</tbody>
</table>

**ABF**: Ajinomoto Build-up Film;  
**PID**: Photo Imaging Dielectric
Panel Fan-out Substrate Warpage (Die Last)

Warpage of molded glass panel with chips can be controlled to 2mm.

Attached Chips

Panel level molding

Molded Chips

510mm x 510mm

Warpage measurement

Chip thickness: 250 μm

Molding thickness: 400μm

Warpage: -2.0mm (crying)

Published on ECTC 2017
Glass Core Warpage Performance

Glass core has excellent flatness. (average<0.19mm in panel size)

Glass or CCL Core

<table>
<thead>
<tr>
<th>Leg</th>
<th>Core</th>
<th>Pattern</th>
<th>Build-up film</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.8mm CCL</td>
<td>Yes</td>
<td>35mmt BUB</td>
</tr>
<tr>
<td>2</td>
<td>0.41mm CCL</td>
<td>No</td>
<td>35mmt BUB</td>
</tr>
<tr>
<td>3</td>
<td>0.8mm CCL</td>
<td>No</td>
<td>35mmt BUB</td>
</tr>
<tr>
<td>4</td>
<td>0.38mm Glass</td>
<td>No</td>
<td>35mmt BUA (BUA x1L+BUB x 4L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35mmt BUB</td>
</tr>
</tbody>
</table>

Boxplot of BU1 ~ BU5

Published on ICEP 2016

Glass core performance

Unimicron
**Integrated FPC Jumper Platform**

- **8A Jumper**
- **GPU Jumper**
- **11A FPC jumper**
- **USB3.1 Jumper**
- **290mm High speed FPC**
- **High speed FPC MXM**

- **Length**
  - >120mm
  - 80mm
  - 25mm

- **GHz**
  - 5.0
  - 10.0
  - 20.0
  - 40.0

- **Key Features**
  - High speed & high power rating
  - Longer FPC to replace co-axial cable

*Unimicron/Neoconix*

Low Profile X-Beam™ Connector

<br>

CONFIDENTIAL
High Power FPC jumper on “Ultra thin Tablet”
Diverse technology platforms for SiP applications.

Thermal and IPD solutions for functional SiPs.

Glass panel RDL & substrate platform for advanced SiPs.

Key challenges:

- **Fine line and small pad size** for advanced chip integration.
- **IPD** and **power** management.
- **Warpage** optimization for thinner package.
- **Material & cost** optimization.
Thank you

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