PCB Design and Fabrication Trends – Telecom, Networking & Computing

PCB designs heading towards convergence of RF & digital with a need for thermal management solutions

**Shrinking geometries**
- Imaging accuracy
- Plating quality
- Etching accuracy
- Lamination tolerance
- Drilling tolerance
- Registration & dimensional tolerances
- New process innovations
- Cu surface & oxide treatments
- Measurements

**Lower noise budget**
- Imaging accuracy
- Plating thickness
- Etching accuracy
- Lamination tolerance
- Soldermask
- Chemicals
- Chemical residue
- Registration
- New process innovations
- Cu surface
- Measurement methods

**Complexity**
- Faster data rates
- Wide frequency range
- Hybrid stack ups
- HDI & Anylayer technologies
- Fine pitch for <0.5mm
- PCB with cavities
- High aspect ratio (1:20 – 1:25)
- Stub length ≤6±4mil
- Sub 3.5/3.5mil line/space
- Impedance Zo control ±5%
- Large format BGA (>70mmx70mm)
- PAM-4 requires tight Zo control (RL)

**Tightening tolerances**
- Cu surface roughness
- Extreme low loss (FR-4) materials (Df<0.002)
- Spread and low Dk glass
- PTFE, LCP etc.
- Flexible materials
- Material properties and tolerances (e.g. Dk, Df, thickness, TCDk etc.)
- Skew (e.g. spread glass)
- Halogen free materials
- Dimensional stability

**Lower total loss budget**
- Inlay and different coin structures
- High thermal conductivity materials
- Heavy plated vias
- Via farms
- Flexes/ rigid flexes
- Hybrid constructions
- New process & cooling innovations

**SI, PI & EMI**

**RF**

**Feature**

**Laminate**
- Cu surface roughness
- Extreme low loss (FR-4) materials (Df<0.002)
- Spread and low Dk glass
- PTFE, LCP etc.
- Flexible materials
- Material properties and tolerances (e.g. Dk, Df, thickness, TCDk etc.)
- Skew (e.g. spread glass)
- Halogen free materials
- Dimensional stability

**Thermal MGT**

**EPTC 2019**

IEEE EPS Flagship Conference in Asia Pacific Region
PCB Design and Fabrication Trends – Smart Phone and Portable Devices

Key smart phone PCB miniaturization drivers are; Increasing complexity of the advanced semiconductor package technology, battery capacity expansion & antenna integration and placement.

Portable PCB/SLP Technology Trends

HDI/SLP – Laser Drilling

USP technology enables smaller HAZ

Glass reinforced dielectrics

Femtosecond lasers (Ultra small via)

Non-reinforced dielectrics

Today

Development

Future solution

HDI/SLP Pattern Formation & Imaging

Subtractive

Advanced subtractive

Advanced mSAP

mSAP

SAP (primer)/SAP (ABF)/SAP (Dry)

Embedded trace, coreless, etc.

DI & LDI Exposure

Stepper exposure

Ultra thin dry film technology

 Imaging

EPTC 2019
PCB Design and Fabrication Trends – Automotive

### Diversity – Functionality – Complexity – Miniaturization - Connectivity

<table>
<thead>
<tr>
<th>ADAS/Automated Driving</th>
<th>Electrification</th>
<th>Digitalization/Infotainment</th>
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<tbody>
<tr>
<td>Now 77 – 81GHz, Next Gen up to 140GHz</td>
<td>A few 100A and 400/800/1200Vdc</td>
<td>25/56Gbps (13/28GHz)</td>
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<tr>
<td>Cu surface</td>
<td>Heavy Cu</td>
<td>≤0.4mm pitch</td>
</tr>
<tr>
<td>Hybrid stack-up</td>
<td>Standard HDI</td>
<td>Advanced HDI technology</td>
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<tr>
<td>HDI (≤0.4mm) &amp; anylayer technologies</td>
<td>CAF</td>
<td>New Surface finishes</td>
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### Material Technology

#### Registration Etching
- Surface treatments

#### Lamination Drilling
- Cleanliness

#### Imaging Etching
- Patterning

### RELIABILITY

- Harsh environment
- Longer T/H/B impact (>100000hrs)
- Space between conductors (e.g. CAF)
- Increasing temperature load (up to 170C) and hotspots
- High voltage CAF testing (+1000V)
- Increasing temperature load (up to 170C) and hotspots
- Local anisotropic heating e.g. power lines.

### THERMAL MANAGEMENT

- EV power train high voltage electronics
- Smaller feature size (hot spots)