Thick film Hybrids for Space application

RHe Microsystems GmbH

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Facts about RHe Microsystems Radeberg

- Foundation 1991
  Since 04 / 2007 a part of cicor

- Staff : 95 employees

- Service / Capabilities :
  - Assembly + Packaging + Screening + Test
    (ESA approved Hybrid line since 2004)
  - Thick Film Substrates
    (ESA approved Hybrid line since 2004)
  - Thin Film Substrates
    (delivered by Reinhardt Microtech)
  - PCB (Rigid/Flex)
    (delivered by Cicorel)
Avionics Modules in high volume - our daily business

- **Different types of technologies:**
  - Chip & Wire Hybrids
  - SMT-Hybrids
  - PCBs
  - Power Modules

- **Qualification / performance based on MIL-PRF-38534 / IPC-A-610**

- **Continuously in production since 2013:**
  - parts procurement, obsolescence management
  - assembly
  - screening
  - test
  - documentation

![Image of avionics modules](courtesy of UTC Aerospace Systems)
ESA qualified Thick film Hybrid Line

ESA Capability Approval for Hybrid Microcircuits

Contents / Scope of the Qualification / Technology

• Thick Film Multilayer Hybrid, Low / Medium Power
• Up to 5 conductor layers
• Ceramic substrate up to 60mm X 60mm
• Printed resistors, Chip and Wire
• Hermetic package, seam welded

Design / Manufacturing according ECSS-Q-ST-60-05

Extension of Capability Approval :

• Thick Film High Power Hybrids
• Delivery of multilayer substrates
• Sub-assemblies for oscillators
• Ceramic packages for different applications
• Upgrading of COTS parts

Defined within RHe-PID
ESA qualified Single Components Assembly Line

ESA Capability Approval for Monolithic Microwave Integrated Circuits (MMICs)

Defined within RHe-PID, fit to the processes:
- Chip- / Wire bonding
- package sealing
- Burn-In / RF-measurements
Our Core Competence - Thick-Film Hybrids

- Main advantages - Why Thick-film technology?
  - Check Materials securing excellent thermal management
    - Optimal for high power and sensor application
  - Check Integration of resistors, capacitors, inductivities, providing the possibility of active laser trimming
    - Optimal for R, C, L - Networks
  - Check TCE of ceramic fits well to semiconductor materials
  - Check Relatively low NRE costs, fast prototyping
Our Core Competence - Thick-Film Hybrids

✓ Already space-approved design - What are the limitations?

<table>
<thead>
<tr>
<th>thick-film circuit:</th>
<th>according RHe - PID</th>
</tr>
</thead>
<tbody>
<tr>
<td>line / space (on substrate)</td>
<td>100µm / 100µm</td>
</tr>
<tr>
<td>line / space (on dielectric)</td>
<td>100µm / 150µm</td>
</tr>
<tr>
<td>dimension via</td>
<td>300µm ... 400µm</td>
</tr>
<tr>
<td>distance via - via</td>
<td>300µm</td>
</tr>
</tbody>
</table>

New challenges / requirements on:

- HD interconnection
  - line / space  $$<< 100\mu m$$
  - dimension via  $$< 150\mu m$$

- High power application
  - flexible processability on one surface (soldering / sintering, gluing, wire bonding)
  - very thick films with sufficient line / space resolution
Our Core Competence - Thick-Film Hybrids

- New thick-film performance - potentials for space approval within HDI
  - etched thick-film
    - structuring of thick-film Au
    - on Al2O3, AlN
    - line / space minimum: 10µm / 10µm

- laser surface structuring
  - Au line / space: 50µm / 50µm

- laser drilled vias
  - via dimension 100µm
  - durability tested:
    in operation after 1500 cycles -55° C / +125° C
Our Core Competence - Thick-Film Hybrids

- New thick-film performance - potentials for space approval within Power Modules
  - plating
    - electroless NiPdAu plating of thick-film Ag on Al2O3, AlN
    - flexible processing by Au- / Al-wire bonding, soldering (high solder leach resistance)

- Thick Copper - the alternative to DCB
  - on Al2O3 / AlN
  - PTH possible
  - thickness 120µm Cu (… 200µm possible)
  - electroless Ni/Au plated
  - together on the same substrate:
    Cu thickness 25 … 200µm
    -> combination of logic & power possible
Thanks for your attention

further information:
www.cicor.com