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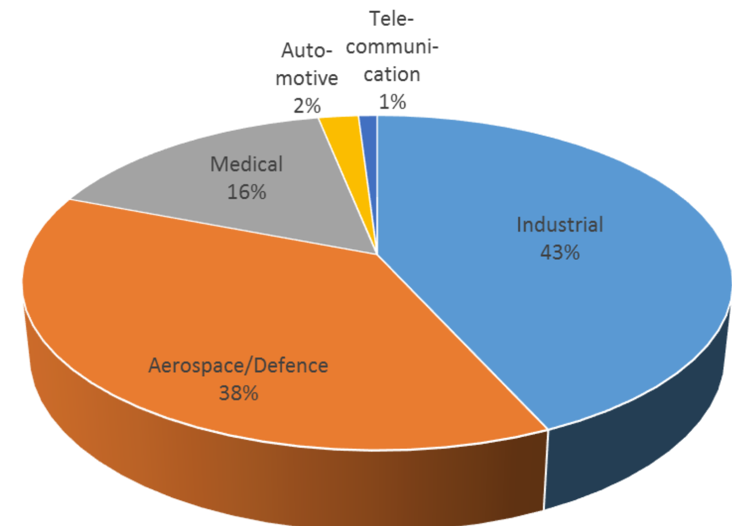
# Thick film Hybrids for Space application

## RHe Microsystems GmbH

Andreas Schwarz

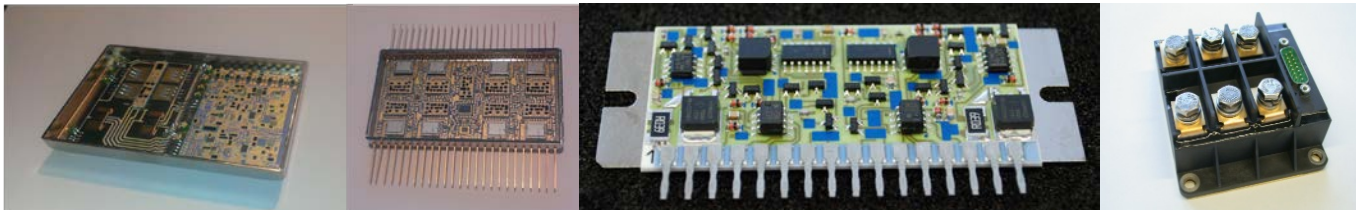
# Facts about RHe Microsystems Radeberg

- 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 cicor Reinhardt Microtech)
  - ✓ PCB (Rigid/Flex)
    (delivered by cicor 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



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

european space agency
agence spatiale européenne

Certificate of Process Capability Approval No. 354

This is to certify that the Hybrid Manufacturing Line of RHe Microsystems in Radeberg, Germany, has obtained Process Capability Approval in accordance with **ESCC 2566000** for their technology based on Thick Film Multilayer Hybrids, low and medium power, in Kovar and Ceramic Packages.

The associated **PID No. L7.103 Issue 07** includes RHe's manufacturing, assembly and test operations which have been approved for the supply of Hermetic Hybrid products for use in ESA space systems as a **Category 1, Option 1** Manufacturer, in accordance with **ECSS-Q-ST-60-05C Rev.1**

This certificate is valid until **30-June-2019**

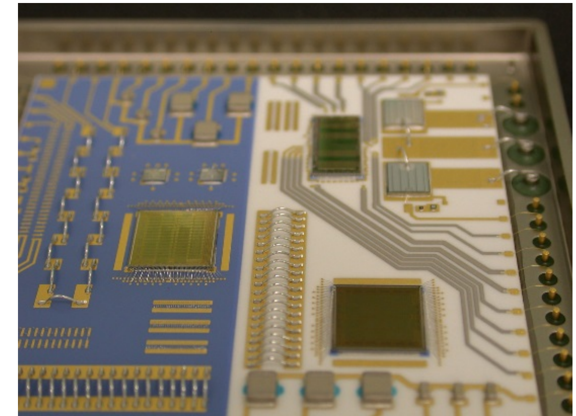
**Head of the Product Assurance and Safety Department**

**Date**
**24 September 2018**

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

### Extension of Capability Approval :

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



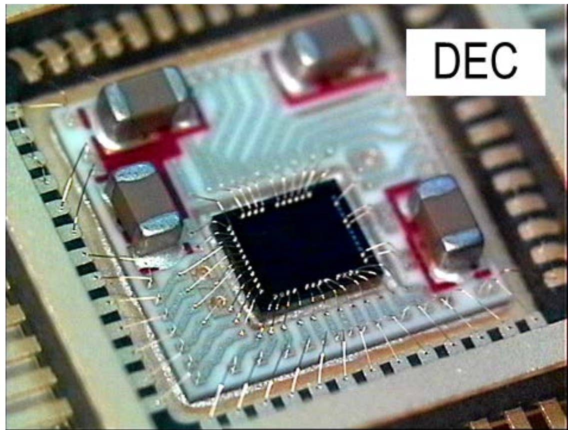
### Defined within RHe-PID

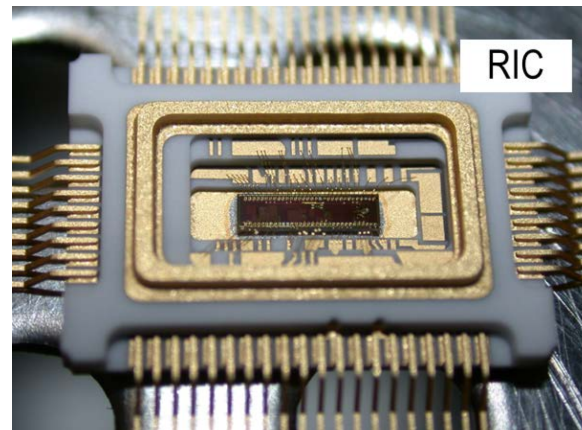
# ESA qualified Single Components Assembly Line

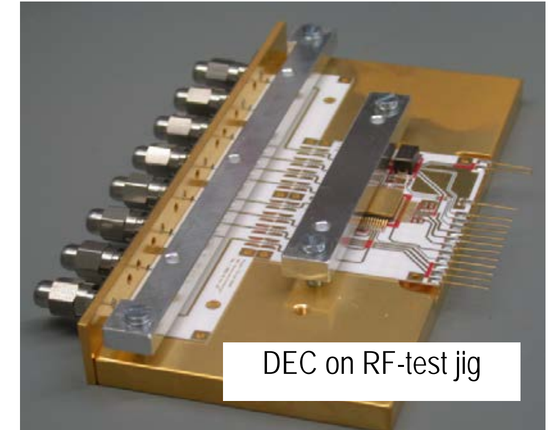
***ESA Capability Approval for***
***Monolithic Microwave Integrated Circuits (MMICs)***

**Defined within RHe-PID, fit to the processes :**

- **Chip- / Wire bonding**
- **package sealing**
- **Burn-In / RF-measurements**

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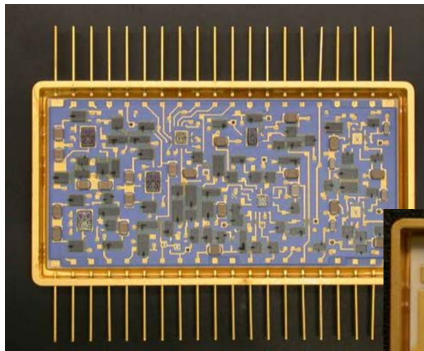
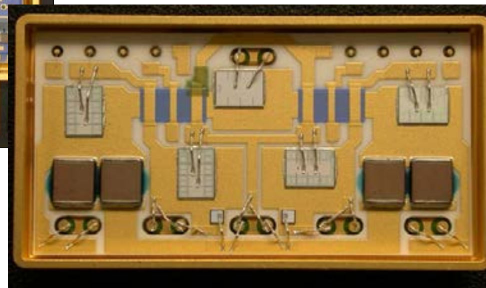
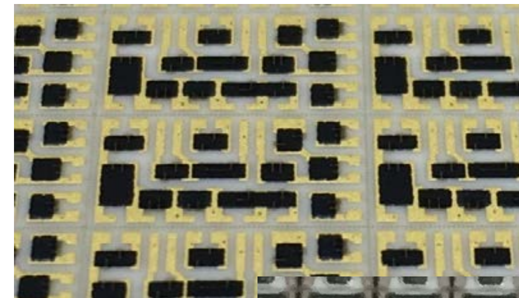
# Our Core Competence - Thick-Film Hybrids

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

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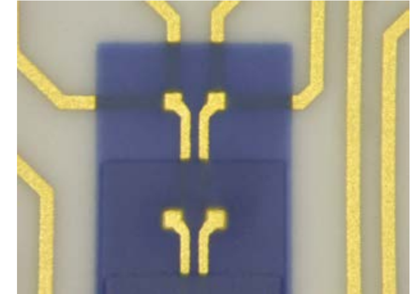
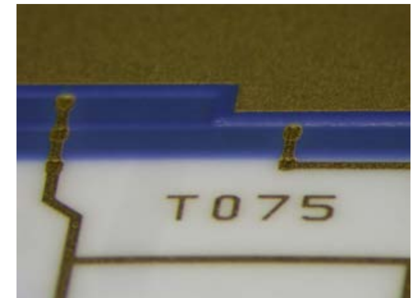
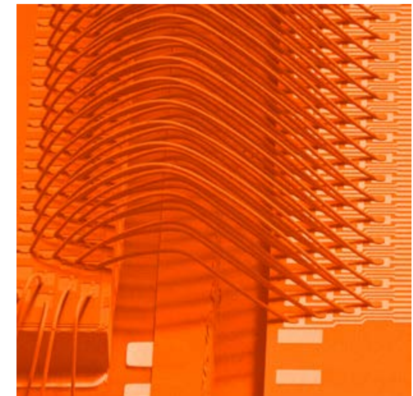
# Our Core Competence - Thick-Film Hybrids

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

| thick- film circuit : | according RHe - PID |
|---|---|
| line / space (on substrate) | 100µm / 100µm |
| line / space (on dielectric) | 100µm / 150µm |
| dimension via | **300µm … 400µm** |
| distance via - via | 300µm |





! **New challenges / requirements on :**

- **HD interconnection**
  - line / space << 100µm
  - dimension via **< 150µm**
- **High power application**
  - flexible processability on one surface (soldering / sintering, gluing, wire bonding)
  - very thick films with sufficient line / space resolution

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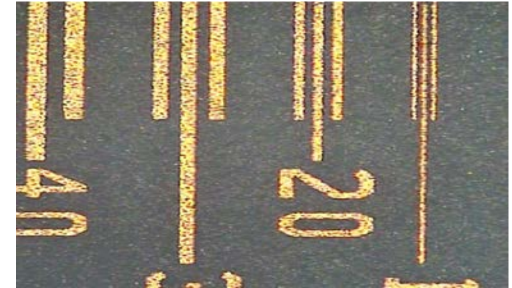
# Our Core Competence - Thick-Film Hybrids

- **New thick-film performance - potentials for space approval within HDI**

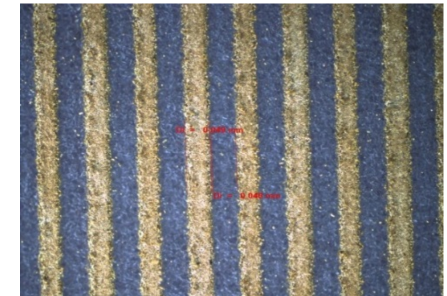
✓ etched thick-film

- structuring of thick-film Au
  on Al2O3, AlN
- line / space minimum: **10µm / 10µm**



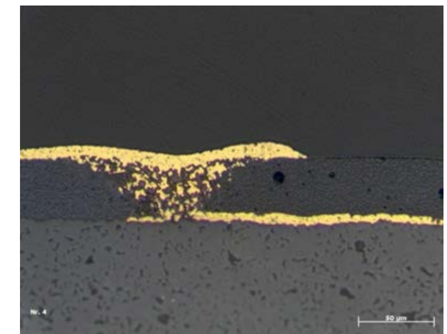

✓ laser surface structuring

- Au line / space: **50µm / 50µm**



✓ laser drilled vias

- via dimension **100µm**
- durability tested:
  in operation after 1500 cycles -55°C / +125°C



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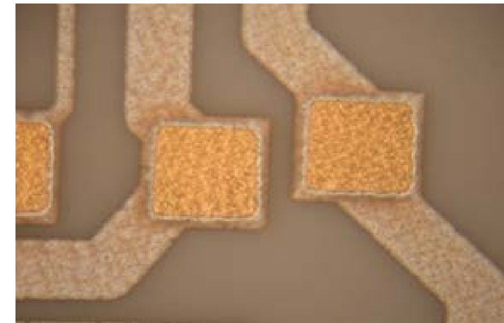
# Our Core Competence - Thick-Film Hybrids

- **New thick-film performance - potentials for space approval within Power Modules**

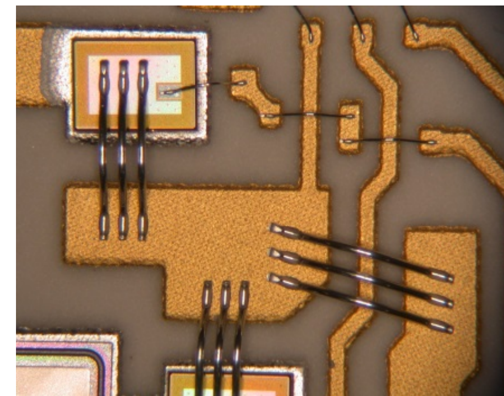
✓ plating

- 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 posible
- 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

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