DLR UPDATE ON EEE-COMPONENTS
27TH MARCH 2025, ESCCON

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German Space Agency at DLR

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German Space Agency at DLR

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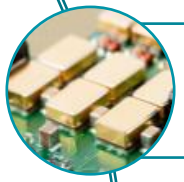
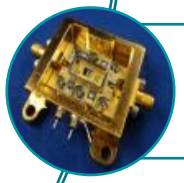
1. DLR EEE-Components Division Objectives

Ensuring German contributions on development and ESCC qualification, harmonization in Europe on ESCC level



National coordination and information exchange

German contribution to European Sovereignty and Independence



Support commercialisation and cross-sectorial technology transfer

International cooperation

2.1. Comparative Laser- and Heavy ion irradiation for SEE sensitivity Characterization of components – LUNT(E_2)

German Space Agency at DLR

Contractor(s): Ernst Abbe University of Applied Sciences, Jena				
Code: 50PS2105	**Funding:** DLR	**Start Date:** 04/21	**End Date:** 06/2025	**Budget:** 400 k€

Background and Justification:

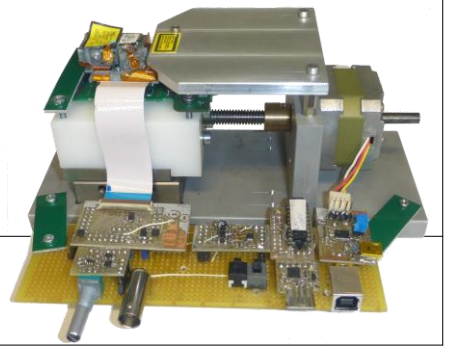
- Investigate the potential of a low cost Laser system for SEE testing

Objective(s):

1. Comparative analysis of Single-Event-Effects with Lasers, Heavy ions (high and low LET) and which parameters have an impact on the assessment. Chosen components will be Super-junction power semiconductors (CoolMOS) and microcontrollers.
2. Identify an inexpensive test methods, which is easy to carry out, for routine investigations. Contribute to a clearer understanding regarding the use of Lasers for SEE-Tests and a well founded assessment of the potential of this technology,

Achievements and Status:

- Laser system upgraded
- Opening of power devices
- 3 irradiation campaigns at GSI done and analyzed



Next Steps:

- Comparison to experiments at a high end Laser SEE system at Fraunhofer INT

2.2. CMOS TDI Detector – Feasibility Study

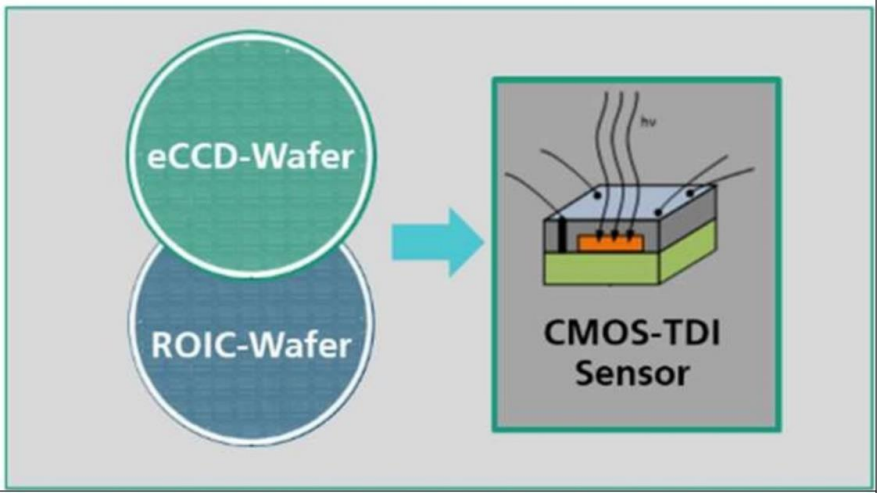
German Space Agency at DLR

Contractor(s): Fraunhofer IMS, Duisburg				
Code: 50PS2410	**Funding:** DLR	**Start Date:** 01.08.2024	**End Date:** 30.11.2025	**Budget:** 1.641 k€

Objective(s):

Conducting a feasibility study on the maintenance of a technology for small quantities CMOS BSI TDI detector

- Determination of suitable process measurement values for small quantities
- Development of suitable test structures for process control
- Development of measures for supply chain security



Achievements and Status:

- Start of Short-loop Wafer and Data-Recording

Next Steps:

- Bachelor Thesis

2.3. Enabling New Space Power Electronics (ENSPECT)

German Space Agency at DLR

Contractor(s): ILH (University of Stuttgart / Institute for Robust Power Semiconductor Systems) consortium				
Code: 50PS2401	**Funding:** DLR	**Start Date:** 11/24	**End Date:** 10/27	**Budget:** 1.342 k€

Background and Justification:

- Increase of efficiency and power density of power supply unit in smaller volume by using GaN technology for space applications.

Objective(s):

1. Investigation of radiation hardness of different German and European GaN transistors
2. Bringing IAF GaN technology to Technology Readiness Level 5 (TRL5)
3. Design of 100W power supply unit demonstrator for satellite payloads using radiation hardened GaN IC.

Achievements and Status:

- Preparation of the specification for power supply unit to be developed in the project
- Comparison of different DC/DC converter circuit concepts
- Market analysis of GaN transistors for power applications

Next Steps:

- SEE Test campaign on IAF GaN FETs and commercially available EU GaN FETs
- Design of 100W power supply unit for satellite payloads based on discrete GaN transistors

2.3. Enabling New Space Power Electronics (ENSPECT)

German Space Agency at DLR

Design and manufacturing of RadHard GaN components

Characterize transistors and extract models

Select GaN transistors for radiation testing

Design and test a DCU

Conduct radiation tests on selected transistors

TRL 4

TRL 5

Radiation resistant 100W GaN power supply unit

Institute of Robust Power Semiconductor Systems

Fraunhofer IAF

ims chips

TESAT

2.4. ESCC Single-Phase Qualification of rad-hard Extended Common-Mode LVDS family

German Space Agency at DLR

Contractor(s): SPACE IC GmbH				
Code: 50PS2409	**Funding:** DLR	**Start Date:** 01/2025	**End Date:** 12/2027	**Budget:** 896 k€

Background and Justification:

- Preparation of SPACE IC rad-hard ECM LVDS family for ESCC Single-Phase Qualification completed in previous GSTP “Manufacturing, test development and evaluation of a monolithic, rad-hard ECM LVDS component family“
- Important synergies with ESCC qualified POL SPPL12420RH

Objective(s):

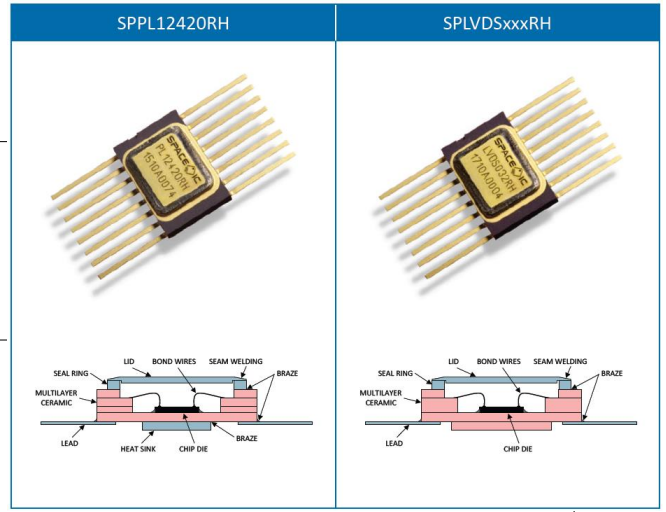
1. ESCC Single Phase Qualification of rad-hard ECM LVDS component family

Achievements and Status:

- Compilation of existing documentation to formally move on to ESCC qualification process
- Transfer from RHe Microsystems to First Sensor Lewicki for assembly, heavily relying on POL delta evaluation

Next Steps:

- Revision of (delta) Evaluation Test plan proposal
- Definition and agreement of activities as part of ESCC Single-Phase Qualification



3. GSTP Projects of German Companies

DLR EEE-Components Department is involved as Observer in EEE parts related GSTP projects to provide technical support to the German companies.

1. ATCOS - Alternative test method for COTS **Contractors**: OHB, DSI, ALTER-HTV, Berns Engineers, DLR Institute of Space Systems **Objectives:** 1) Gain further insight into performance and reliability of commercial (automotive) parts. 2) Investigate the effectiveness and suitability of board/unit compared to EEE Component level testing. 3) Address new highly accelerated test methods (HASS, HALT)	Code: GT17-304ED Start Date: 17.05.2021 End Date: 17.05.2023 (expected 30.09.2025) Budget: 1200 k€
2. ESCC Space Evaluation of 0.13um SiGe BiCMOS Technology **Contractor**: IHP **Objective:** Space evaluation of a SiGe 0.13µm BiCMOS process to offer the community the SiGe technology for custom designs	Code: GT17-137TI Start Date: 01.10.2019 End Date: 01.04.2022 (expected 01.12.2025) Budget: 500 k€

3. GSTP Projects of German Companies

German Space Agency at DLR

3. Definition and validation of a European source of bump services for 28nm and lower nodes flip-chip mounting **Contractor**: AEMtec **Objective:** To enable a validated European source for flip-chip wafer bumping for microelectronics packaging for VLSI technology (ASIC, FPGA, Memories, etc) using a technology node of 28 nm or smaller. Benefit the European Supply Chain High Density Assembly.	Code: GT17-009ED Start Date: 01.02.2021 End Date: 01.02.2025 Budget: 600 k€
4. RACOCO - Radiation characterization and functional verification of COTS components for space applications **Contractor**: Fraunhofer INT **Background and Justification:** • Meet technical, quality assurance, and cost requirements using COTS • To have COTS Components that have passed all comprehensive radiation and functional tests for further reliability screening and possibly qualification. **Objectives:** 1) Characterization and Assessment of COTS components and subsystems for radiation performances. (TID and SEE Test campaigns) 2) Critically survey components candidates and test methods. 3) Submit COTS guidelines to the CTB Radiation WG.	Code: GT17-008QE Start Date: 02.07.2019 End Date: 31.05.2025 Budget: 1200 k€

3. GSTP Projects of German Companies
3.5. European Power SiC Supply Chain (EPOSIC)

German Space Agency at DLR

Contractor(s): Infineon				
Code: FX/1-11970	**Funding:** ESA	**Start Date:** 01/10/2024	**End Date:** KO + 60 months	**Budget: 3.5Mio€ + 2.5Mio€**

Background and Justification:

- Increase of efficiency and power density of power supply unit in smaller volume by using SiC technology for space applications.

Objective(s):

1. Develop an European Power SiC Technology for Space, including the preparation of a European supply chain
2. To combine the low RDS(on) offered by SiC MOSFETs with a gate drive mode in which the device operates in the safe oxide field-strength conditions.
3. Bringing SiC technology to Technology Readiness Level 5 (TRL5)

Achievements and Status:

- Literature review and possible die design improvements
- SEE test methodology definition

Next Steps:

- SEE Test campaign in CW27

→ *see Infineon (Jutta Heinzelmann) presentation*

4. ESCC Qualifications and Certifications in Germany Manufacturer Overview

German Space Agency at DLR

Manufacturer	Location	Type
First Sensor Lewicki GmbH	Oberdischingen	Assembly and Test House
Tesat-Spacecom GmbH & Co. KG	Backnang	Hermetic Hybrids
Vishay Electronic GmbH	Selb	Resistors
Isabellenhütte Heusler GmbH & Co. KG	Dillenburg	Resistors
Infineon Technologies AG	Neubiberg	Diodes, Transistors
Rosenberger Hochfrequenztechnik GmbH & Co. KG	Fridolfing	RF Connectors
W. L. Gore & Associates GmbH	Pleinfeld	Wire / Cables
BizLink Special Cables Germany GmbH	Friesoythe	Wire / Cables
Space IC GmbH	Hannover	POL Converters
IMST GmbH	Kamp-Lintfort	ASICs

NEW

- In total 10 ESCC qualified/certified manufacturers, whereas 8 are listed on ESCC QPL and 2 are listed on ESCC PCAL
- 24 ESCC Certificates
- Covering 46 ESCC Detail Specifications

4. ESCC Qualifications and Certifications in Germany
New Certificate

German Space Agency at DLR

- Project 50PS1401of the DLR National Program
- ESCC Capability Approval qualification of the RF/MIXED SIGNAL ASIC based on Rad-Hard 0.18 Micron CMOS Process by X-Fab Malaysia XH018 IP Library and Assembly covering two package variants CQFN-256 and CQFN-132
- Listed on ESCC QPL, Certificate No. 387, ESCC9202/084 variant 01 and 02

IMST

esa

European Space Agency
Agence spatiale européenne

Certificate of Capability Approval No. 387

This is to certify that IMST, Kamp-Lintfort, Germany has been qualified by ESA for the supply of Integrated Circuits, Silicon Monolithic, CMOS, Mixed Signal ASIC on Rad-Hard XH018 IP Library for use in ESA space programmes, according to the ESCC Qualified Manufacturers List, ESCC Generic Specification 9000 and associated Detail Specification 9202/084 as recommended by the Space Components Steering Board.

This certificate is valid until February 2026.

Head of the Product Assurance and Safety Department

Date
29 February 2024

Coming soon:

NEW

on ESCC QPL
ESCC9202/085, NOVELO
MONOLITHIC, CMOS AND HBT ON SiGe:C, 1.6 TO 12 GHz FREQUENCY SYNTHESIZER WITH INTEGRATED SIGMA DELTA MODULATOR FRACTIONAL-N PLL
BASED ON TYPE NOV1G14

5. Planned and Ongoing ESCC Qualifications in Germany (1)

German Space Agency at DLR

Manufacturer: Isabellenhütte Heusler GmbH & Co. KG (self funded)

new qualifications

	Description	Status
1	Extension of the range of ESCC qualified **SMT** resistors (fixed, metal foil) per ESCC4001/027. Add new variant 07: type SMT-PW, size 2817, resistance 2.0 to 4.7 Ω, tol. +/-0.5%,+/-1%, rated dissipation 2 W.	• Completed • New Variant 07 in ESCC4001/027 • Listed on ESCC QPL, Certificate 285H rev. 1
2	ESCC Qualification of the fixed chip resistors, metal foil, of type **VMI** (0805) and **VMK** (1206) according to a new ESCC Detail Specification ESCC4001/0XX (0805: 0.010 to 0.10 Ω; 1206: 0.010 to 0.47Ω) 	• Chart F3 tests on AEC-Q200 qualified parts have been successfully completed • Draft ESCC Detail Specification and Evaluation Test Plan under ESCC Executive review, PID under preparation
3	ESCC qualification of Flexible **Heaters** of type **HFF** acc. to a new ESCC Detail Specification ESCC4009/0XX	• Re-activation of proprietary ISA-Flex technology; initial prototype run successfully completed in May 2024 • Manufacturing of customer samples • Draft Detail Spec and Evaluation Test Plan CW15 2025

5. Planned and Ongoing ESCC Qualifications in Germany (4)

German Space Agency at DLR

new qualification

Manufacturer

Rosenberger Hochfrequenztechnik GmbH & Co. KG (self funded)

Description

- Extension of the ESCC qualified range of RF Coaxial Connectors with femal contact, type SMA, iaw. ESCC 3402/002
  Add the High Temperature Range variants 73 to 85

Status

- Combine the extension of the qualified range with the Maintenance of Qualification for Certificate 329F
  Scheduled completion January 2026

6. National Exchange Platforms

1. **DLR Annual EEE-Components Conference** (*DLR Bauteilekonferenz*)
   14th +15th of May 2024, IMST in Kamp-Lintfort
   20th + 21st of May 2025, AIRBUS in Bremen

2. **DLR Stakeholder Workshops**
   1. **Gallium Nitride Initiative**
   2. **Optoelectronic Initiative**

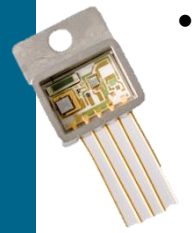
3. **DLR New Space** Activities
   Space2Motion Working Group
   Space sector meets automotive sector
   Use of automotive EEE parts in space applications
   → ***Presentation at ACCEDE 2025***

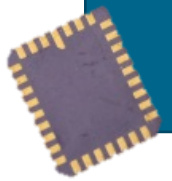
6.1. DLR Annual EEE-Components Conference

DLR BAUTEILEKONFERENZ

This national conference serves as information and professional exchange forum for:

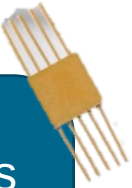
- Demand and availability of space EEE-components
- New technologies for future applications
- Status of the German national technology and qualification program
- Planned activities
- National funding opportunities
- Status on European and international level
- Updates on ESCC (European Space Components Coordination) and ECSS (European Cooperation for Space Standardization)





Discuss and determine the future national demand for space ready parts and technologies

Goals:



Harmonize the EEE parts activities for future national technology development and qualification programs.

6.1. DLR Annual EEE-Components Conference

German Space Agency at DLR

Special features of the conference:

- approx. 140 participants
- around 30 presentations
- Panel discussion on important future trends
- Industrial exhibition
- Participation of ESA, European Commission, political representatives
- Cross-industry exchange

Highlight – Special Edition

on 20th and 21st of May 2025
hosted by AIRBUS in Bremen

- First bi-national conference
- **Japan as guest country**
- Organization supported by **JAXA**

DLR
EEE Components Conference

6.2. National Exchange Platforms Stakeholder Workshops in General

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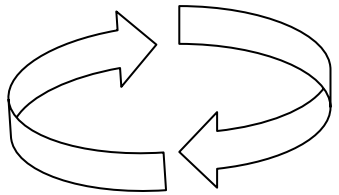
- **Gallium Nitride Initiative**
- **Optoelectronic Initiative**

} as exchange platforms

INSTITUTIONS
Fraunhofer, Ferdinand-Braun
Max-Planck, GSI Helmholtz Centre
for Heavy Ion Research, …

DLR
EEE-Components

DLR
Research and Development



DLR
Space Agency

INDUSTRY
Component Manufacturers,
Users, Assembly & Test Houses, …

UNIVERSITIES

PRIMES

TARGET: to match the NEED with the COMPETENCES in Germany to define a STRATEGY and ROADMAP

6.2. National Exchange Platforms Stakeholder Workshops

DLR GaN Initiative:

- Focus: normally-off GaN FETs
- Completed:
  - Identification of the companies/institutions working on GaN FETs development
  - Identification of the users' need
  - GaN Online Workshop in March 2021
  - Identification of critical aspects (epitaxy as critical step, buffer layer optimization required, packaging concept, thermal management)
  - First DLR project - ENSPECT
- Next Workshop in 2026

DLR Optoelectronic Initiative:

- Target: Streamlining the activities in the field of optoelectronics/photonics in Germany
- First 1.5-day Workshop at DLR in Cologne in June 2023 with participation of ESA
- Next Workshop in Q4 2025

Goal:
- support networking and search for partners for consortia
- establish supply chains in Germany

7. Consultancy of New Companies

German Space Agency at DLR

DLR Objective:

- Identify companies/institutes interested in space activities and with high potential/ promising competences
- Establish new supply chains in Germany
- Increase the number of ESCC qualified parts from German manufacturer
- Increase the number of parts/technologies suitable for space applications

Description:

- DLR provides consultancy, e.g. introduction to ESCC system, ESCC qualification options, national initiatives, DCL analysis etc.
- Company presentations: products and service portfolio, competences and interests

→ In-depth consultancy process started in 2020, about 50 companies and institutions already covered

→ Covering a broad spectrum of EEE part types, technologies, PCBs and EEE parts related services

8. EEE-Components SUPPLY CHAIN Digitalization

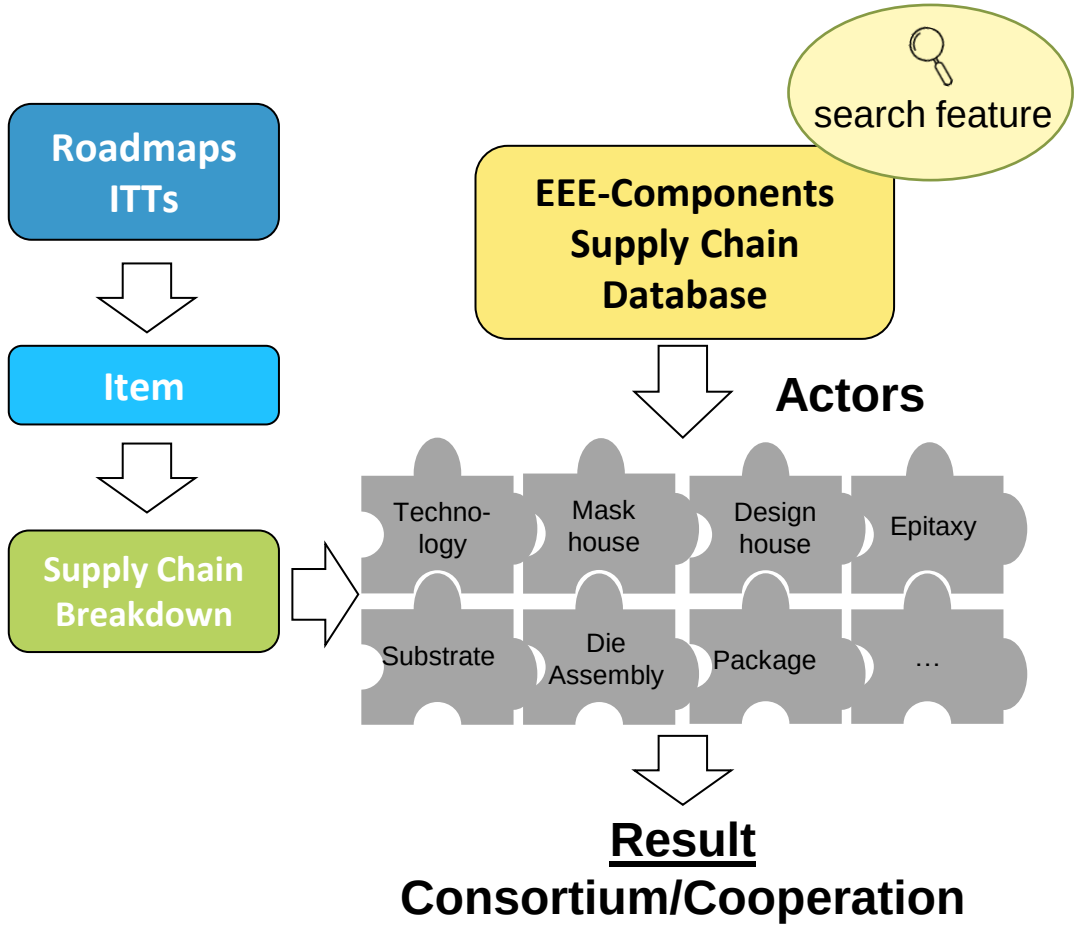
German Space Agency at DLR

EEE-Components Supply Chain Database

- DLR internal Database of German entities (companies, R&D institutes, universities) in the field of EEE components, especially in the aerospace sector
- In use since 2019, > 2600 entities, about 300 EEE component related, continuous database extension and improvement
- 3-Tier-Categorization

Objective

- Enhancement of visibility of German companies and institutes
- Identification of capabilities and competencies in the field of EEE components in Germany
- Support search for potential actors to establish new EEE component supply chains in Germany



9. Outlook

- Successful completion of ongoing projects of the national program
- Support of EEE components related GSTP projects of German companies
- Participation in the “EEE Space Component Sovereignty for Europe“ Initiative
- Contribution as defined in the ESCC Executive Implementation Agreement German Aerospace Center (DLR)
  Support of planned and ongoing ESCC qualifications
- Increase transparency of ESCC activities for German industry
- Extend DLR GaN and Optoelectronic Initiatives, support stakeholder workshops
- Continue activities in the field of COTS/automotive components,
  e.g. national Space2Motion working group and cooperation with Japan/JAXA
- Provide consultancy and trainings (e.g. ESCC, radiation, DCL analysis) to German companies, institutions and universities

Questions & Answers

German Space Agency at DLR

Thank you very much for your attention!