



The European Components Initiative (ECI) Contribution by DLR

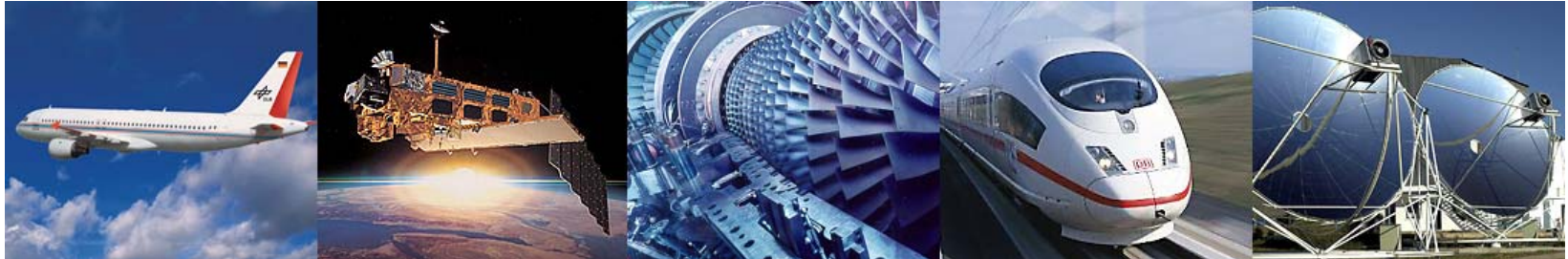
Dr.-Ing. Andreas K. Jain (andreas.jain@dlr.de),
Jürgen Tetzlaff (juergen.tetzlaff@dlr.de),
ESCCON, Noordwijk, 15. - 17. March 2011



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft



German Aerospace Center (DLR)



Aeronautics

Space

Transportation

Energy

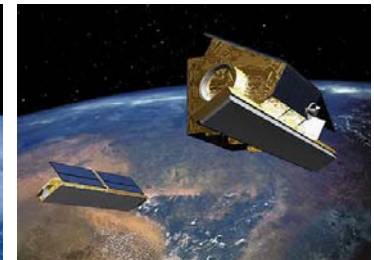
- Research Institution
- Space Administration
- Project Management Agency
- 6500 employees across 29 research institutes and facilities at 13 sites
- Total budget (2011) : 2980 Mio €



DLR Space Research and Technology Area

- Space exploration
- Zero gravity research
- Earth observation
- Communication and navigation
- Space transport
- Technology of space systems

More information see <http://www.dlr.de>





DLR's Tasks as the National Space Administration

- Defining German space planning on behalf of the federal government
- Representing German space-related interests in the international arena, in particular in ESA
- Tendering, award, and support of space projects in the context of the National Space Program





Tasks and Responsibilities within the DLR EEE-Parts Section on behalf of the Space Administration

- Determination and prioritization of the national EEE-parts demand
→ **National technology development and qualification program** → increasing EEE-part availability
- Launching EEE-part qualifications
- Performing qualification and re-qualification audits with manufacturers
- Establishing strategies to increase the availability of EEE-parts in the frame of the **European programs** (ECI, ESCC, FP7 ...)
- Representation of the German Space Administration, German manufacturers and users within the European Space Components Coordination (ESCC)
- EEE-part conferences for user and supplier needs and interests consolidation



Contribution to ECI :

- Since 2004, seven projects with a budget of 10.8 M€ were launched :
 - 2 finished
 - 5 in progress
 - 4 in preparation or planned
- Contribution by providing a national budget for :
 - Technology development
 - Evaluation & Qualification activitiesof needs identified by the ESCC space market size evaluation (2006)
- As part of the National program to be performed by German manufacturers



DLR EEE Parts ECI Contribution

Activity	Term	Status
Evaluation and Qualification of Shunt-Resistors	2005 - 2007	finished
Development, Assembly, Manufacturing, and Evaluation of an LDO-Regulator	2005 - 2007	finished
Qualification of Quartzes and Oscillators	2005 - 2011	in progress
Certification of an Assembly and Test House	2006 - 2011	in progress
Qualification of MMIC Local Oscillator	2007 - 2011	in progress
Development and Qualification of PowerMOSFETs	2008 - 2011	in progress
Development of a GaN 1000V Switching Transistor	2006 - 2011	in progress
Capability Approval of L-Foundry	2011 - 2013	Contracting phase
Capability Approval of IHP's SG13 Technology	2011 - 2013	planned
Qualification of a fully automatic LTCC Line	2011 - 2013	planned
Feasibility Study of the SiC Diodes Technology	2011 - 2013	planned

All projects under : www.dlr.de/qp/en/desktopdefault.aspx/tabid-3091/4699_read-6881/

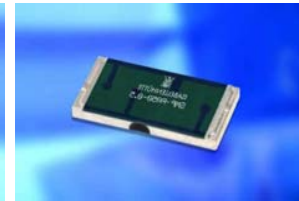


Evaluation and Qualification of Shunt-Resistors

Currently, space-qualified shunts (current measurement resistors) were not available on the European parts market. However, the non-qualified, low-impedance precision resistors of the company Isabellenhütte were already used in space projects for years. In order to avoid complex and expensive project qualifications, the shunt resistors have been ESCC qualified generally.



SMR, SMV



SMS, SMT, SMP

Info : www.isabellenhuette.de

Development, Assembly and Evaluation of an LDO-Regulator in a suitable Package for Space Applications

The future increase of 2.5-V components on the market indicates an increasing need of a 2.5-V regulator. In order to improve this situation, a DLR-project was conducted, in which commercially available components were assembled in a hermetically sealed housing followed by successful characterization and evaluation tests.



8 Pin Version (3 Pin possible)

Info : www.jena-optronik.com



Qualification of Quartzes and Oscillators

Within the scope of this project, KVG Quartz Crystal Technology performs a qualification of quartzes and oscillators. Quartzes from 2,5 - 140 MHz in TO-5 or TO-7 package and oscillators in hybrid technology (SMD and DIL), XO (8 - 125 MHz), and VCXO (10 - 90 MHz). The qualification tests are finalized for quartzes and in preparation for oscillators.

Info : www.kvg-gmbh.de



Quartz, SMD-, and DIL-Oscillator

Development and Qualification of PowerMOSFETs

After the positive results of the various studies performed, the Infineon Power MOSFET process has been modified in such a way that the manufactured transistors are RadHard while keeping good electrical performance (target types 250V 12A, or 47A, $R_{DS(on)}$ 25m Ω SMD2/130m Ω SMD0.5). Prototypes will be available 1. Q. 2011, followed by qualification.

SMD-2



Info : www.infineon.com/cms/en/ -> discretes



Certification of an Assembly and Test House

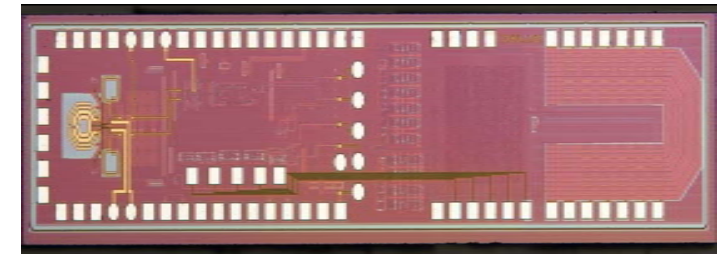
In fact, many semiconductor manufacturers are able to deliver suitable chips but have no intention or no chance to perform the complex chip assembly in space suitable housings and the required extensive tests for qualification and screening. The ATH shall take over these actions and act as sales organization for these components. Evaluation will start soon.

Info : www.lewicki-gmbh.de



Qualification of a MMIC Local Oscillator

For broad band satellite communication, modern MMIC-LOs are needed. Therefore, a Capability Domain Approval of the chip manufacturing and package process has started. First application is a MMIC-LO, but further RF-applications are possible within this domain.



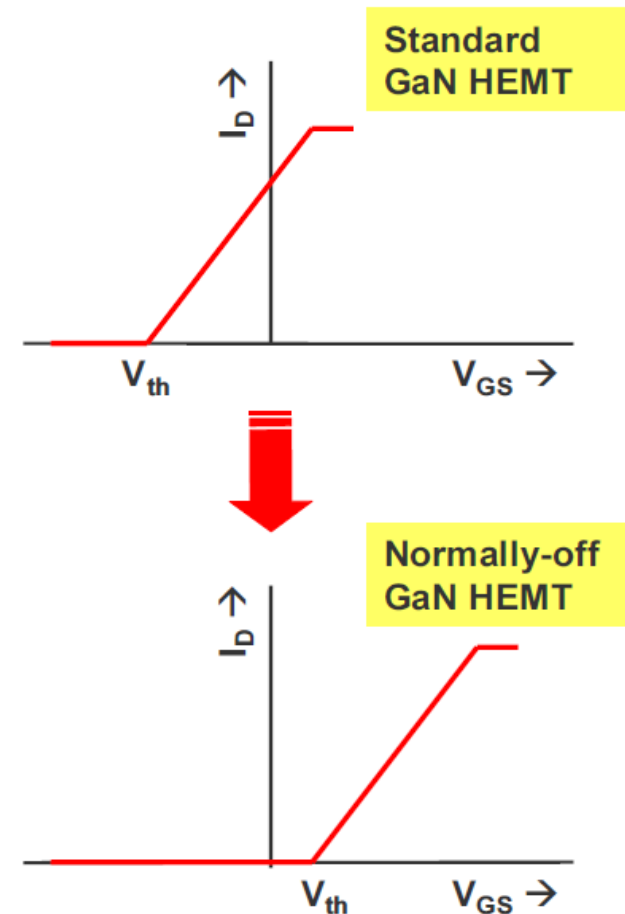
Info : www.kayser-threde.com/en/
www.ihp-microelectronics.com/



Development of a GaN 1000V Switching Transistor (1)

Targets

- **Normally-off GaN transistor technology for space borne power conditioning**
- **Requirements**
 - low on-state resistance
 - high breakdown voltage up to 1000V)
 - Threshold voltage $V_{th} > +1$ V
 - Large gate swing > 3 V
 - Low leakage currents
 - Reproducible process
 - Radiation hardness
 - High Reliability

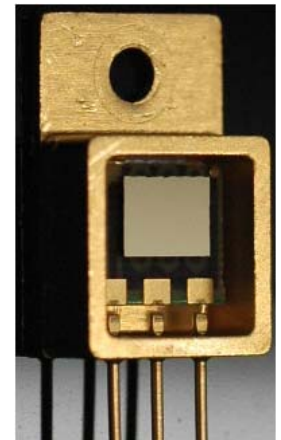




Development of a GaN 1000V Switching Transistor (2)

Actual Results

- Stable 3" GaN process
 - Positive threshold voltage (+1.2 V)
 - Large gate voltage swing (5 V)
 - High I_{DS-max} (0.5 A/mm) → good trade-off to normally-on devices)
 - Low leakage :
 - off-state drain leakage 10 μ A/mm @ $V_{GS} = 0$ V
 - on-state gate leakage 10 μ A/mm @ $V_{GS} = +5$ V
 - Good saturation properties
 - Transistor-channel conductive if operated in reverse direction
 - 3rd quadrant operation
 - May be used for "self protection" when switching inductive loads
 - Safe transistor operation up to 200°C ambient
 - I_{DS} decreases with $T_{CT} = -1.3$ mA/(mm K)
 - R_{ON} increases with $T_{CT} = 43$ mWmm/K
 - V_{th} constant with $T_{CT} = -0.24$ mV/K
- ➔ **No thermal run-away situation in p-GaN gate power-transistors**



50 A device flip-chip
mounted in
TO 220 package



Thank you for your attention!

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