ECI: EVALUATION OF EUROPEAN MICROWAVE SCHOTTKY DIODE TECHNOLOGY

Activity Summary

COMPANY PRESENTATIONS

United Monolithic Semiconductors
Website: www.ums-gaas.com
Address: Route Départementale 128 – BP 46 – 91401 Orsay Cedex (France)
Contact Person: Jean René Bois (+33 1 69 33 00 06)

United Monolithic Semiconductors (UMS) is a joint venture company founded in May 1996 by THOMSON-CSF, Daimler-Benz Aerospace and TEMIC. UMS is a supplier for leading edge GaAs components for both professional and consumer markets. The company has facilities at Orsay in France, and Ulm in Germany. UMS is an independent company with a workforce in 2006 of around 220 persons. Mother companies are now EADS Deutschland GmbH and THALES.

Thales Alenia Space
Website: www.thalesaleniaspace.com
Address: 26 Avenue JF. Champollion, 31037 Toulouse (France)
Contact Person: Philippe Jost (+33 1 55 66 12 08)

Thales Alenia Space is a major European manufacturer of satellite systems and orbit infrastructure.

ESA Technical Officer: Laurent Marchand (+31 71 565 4282)

OVERVIEW / SCOPE OF ACTIVITY

This activity is part of the European Component Initiative (ECI). ECI has been put in place by ESA with the aim to develop and qualify in Europe a number of critical space components in order to improve the autonomy of the European space industry.

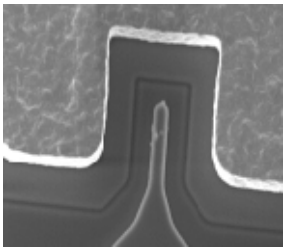
The study is targeted to the space evaluation of a European Microwave Schottky Diode process compatible with MMIC technology. The selected process is intended to serve the other microwave activities listed in the ECI plan and also guarantee European independence in terms of future Earth Observation radiometers and other scientific instruments functioning at millimetre wave frequencies.

The process selected by ESA is the MMIC Schottky BES process developed and offered by UMS.

The process provides monolithic integrated millimetre-wave mixers and switches. A Schottky diode is used as the active element. The width of the diode finger is 1.0 µm. The length of the diode finger varies between 3 and 10 µm.
This technology provides passive elements as lines, MIM capacitors, resistors and inductors. The diode and the passive elements are fully passivated using a silicon nitride layer.

The main features of the diode are:

- Cut-off frequency ≈ 3THz
- High breakdown voltage
- Low parasitics
- Low cost technology



ECI: EVALUATION OF EUROPEAN MICROWAVE SCHOTTKY DIODE TECHNOLOGY

UMS and Thales Alenia Space will carry out the different activities of the space evaluation. UMS will design the different test vehicles in cooperation with Thales Alenia Space and a test plan for the evaluation will be defined. The space evaluation testing will be a shared activity. A process review meeting (audit) will be performed at UMS before launching the manufacturing of the wafers, a test readiness review will be also carried out prior to the testing phase.

At the completion of the testing phase, a final review will be held to analyse all the results obtained (process audit, reliability tests, failure analysis, MTTF…) to validate the BES Schottky diode process space evaluation.

ACTIVITY APPROACH AND WORK STRUCTURE

The activity approach and work structure for the evaluation are based on the ESA Statement of Work ref. TEC-QCT/2005SoW/LM

The work breakdown structure is divided into 3 major technical tasks and one management task.

TASK 1 – Evaluation preparatory tasks

Task 1 covers the preparation work for the space evaluation testing. The task is divided into three work packages:

- **WP1100 Base-line Schottky process assessment**

This work package covers the assessment of the existing European Schottky process. For that, UMS will provide representative samples for physical analysis to ESA. A review of the existing PID, SPC data, design rules and design kit including electrical models will be performed. A formal ESCC audit of the process fabrication and foundry facilities will be arranged at ULM Germany in accordance with ESCC Basic specification N° 20200.

- **WP1200 Test structures definition and design**

For the space evaluation a dedicated vehicle will be designed to assess the reliability of the process. This test vehicle will include passive components, single diodes and a RIC (Representative Integrated Circuit). DC life-testing in hermetic packages will be performed on the test vehicle.

- **WP1300 Space evaluation test plan definition**

Based on the output of work package W1200, a complete space evaluation test plan will be defined. Three families of tests are proposed: storage tests, DC life-tests and humidity tests.
The test plan will be submitted to ESA for approval.

A Process Review Meeting will be held at UMS facilities to review the results of work packages 1100, 1200 and 1300.

TASK 2 – Processing, packaging and test preparation

Task 2 comprises the processing of the wafers on BES technology, the assembly of the different parts to be tested and the test set-up preparation. The task is divided into three work packages:

- **WP2100 Test structure processing**

This work package covers the manufacturing of the different test structures. Two wafers will be released and used for the evaluation after successful Process Control Monitor testing.

- **WP2200 Assembly, pre-cap and initial testing**

This work package covers the assembly of the test structures into a dedicated hermetic micro-package (except for humidity test parts). A 100% pre-cap inspection will be performed of the test structures and initial electrical measurements carried out.

- **WP2300 Test set-up preparation and test readiness review**

This work package covers the test set-up preparation. A test readiness review (TRR) will be held at the end of the work package to ensure that all facilities and the required test set-up for the performance of the space evaluation testing are available.

TASK 3 – Space evaluation and additional testing

Task 3 primarily covers the performance of the space evaluation testing. The task is divided into three work packages:

- **WP3100 Space evaluation testing**

This work package covers the performance of the evaluation testing. In case of failure or deviation, adequate investigation will be organised to establish the main failure mechanisms and associated degradation modes.

- **WP3200 Additional testing of modified diodes**

It is also proposed to test, if they become available, modified BES diodes arising from another ESA contract which is aiming at increasing the frequency capability of the BES diode technology (modification of the drawing, layout rules, anode size…). These specific components (out of the base-line process) will be compared to standard diodes and will give an indication of the effect of the process modification on process quality and reliability.

- **WP3300 Space evaluation and additional testing data review**

This work package covers a final review of the evaluation and the additional testing. All results will be analysed presented and explained. Reliability figures will be presented for the base-line Schottky process. A successful outcome is intended to enable the addition of the base-line Schottky process to the EPPL.

TASK 4 – Management, reporting, meetings and deliverables

Task 4 covers the management and reporting activities.

TIMESCALES.

The overall project duration is planned to be 16 months starting from December 4th, 2006.