TITLE:
Test chip and dedicated data acquisition system for reliability study of high current first level interconnections.

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DESCRIPTION:
Reliability of integrated circuits in electronic packages and connections is a major concern, due to the increasing die size, power dissipation and temperature. In this work a powerful system for experimental evaluation and reliability study for high current first level interconnections, until 10 A, is developed.
In order to understand what the connection technology limits are and how they are behaving under high current loads and high temperatures conditions, a dedicated high current **test chip** has been developed together with a dedicated **high current tester** for evaluating, stressing and testing different connection styles and materials. The described set up allows to make the necessary experiments and to have a better understanding of what is happening, what are the limits and what are the failure mechanisms that can occur.

TEST CHIP**:** A modular test chip (15 x 15 mm) (fig.1) consisting of 24 basic tiles (fig.2) and 4 small tiles has been designed and processed in a 0.35µ CMOS technology from AMIS. The basic tile on the test chip comprises a 10 A bonding pad structure, crack sensors, corrosion sensors, daisy chain structures, heaters and temperature monitoring diodes at the center of the chip and beneath the10 A bonding pad structure. The test chip comprises different track designs to check current crowding. The test chip is used to perform reliability tests on first level contacts for wire bonding and flip chip technologies at currents up to 10 A.

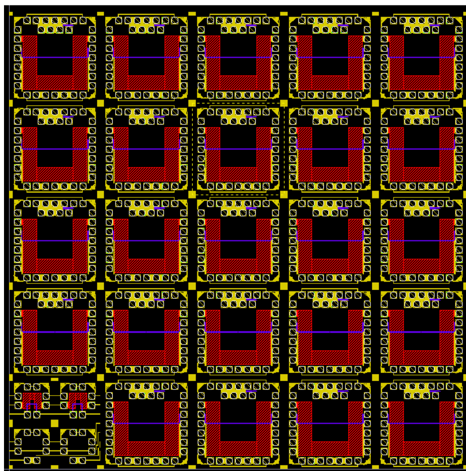

Fig.1 Modular test chip

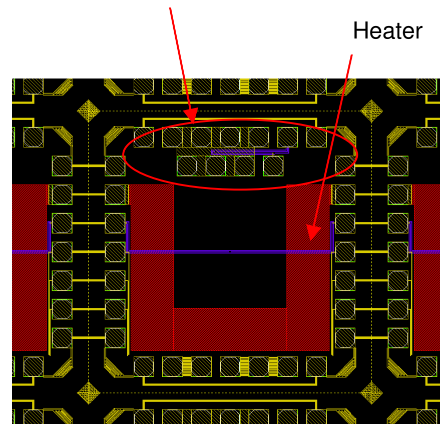

Fig.2 Detailed view of one tile of the test chip

HIGH CURRENT DRIVE AND MEASUREMENT UNIT:

In order to avoid a complete set of multi-meters and power supplies, a PC based stand alone measurement system is developed. The system sets and checks the parameters of the test chips and allows continued monitoring during the test loops like power cycling or temperature cycling. The system performs the necessary measurements and stores and analyzes the results. The complete measurement set up is shown in fig.3.

The developed high current driver module has DC and AC driving capability up to 10A with current setting resolution of 10 bit. The AC frequency is the ranging from 0 to 20 kHz with a duty cycle from 0 to 100%. The measured output voltages range from 0 to 10V with a 19 bit resolution, and a data acquisition rate of 15k samples/s. Fast USB communication between the PC and the high current driver and measurement unit is used.

The equipment is able to measure e.g. small changes in resistance during long term reliability tests like temperature cycling on multiple channels while driving high currents (up to 10A DC and AC). It is also able to perform contact tests on multiple channels during longer time periods.

Software takes care of the graphical user interface (GUI) and analyzes the measurement results. See fig.4 and fig.5.

Fig.3 Modular test chip and high current driver and measurement unit

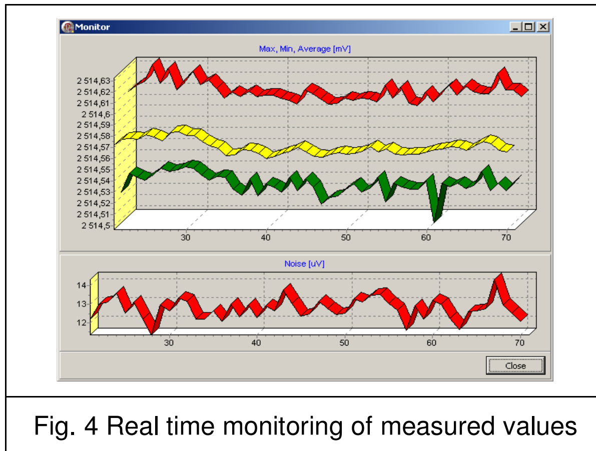

Fig. 4 Real time monitoring of measured values

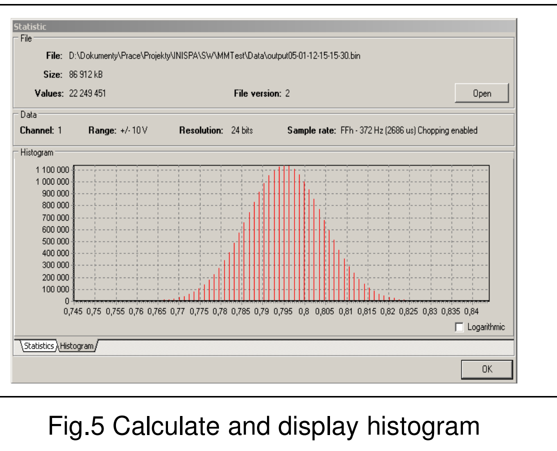

Fig.5 Calculate and display histogram