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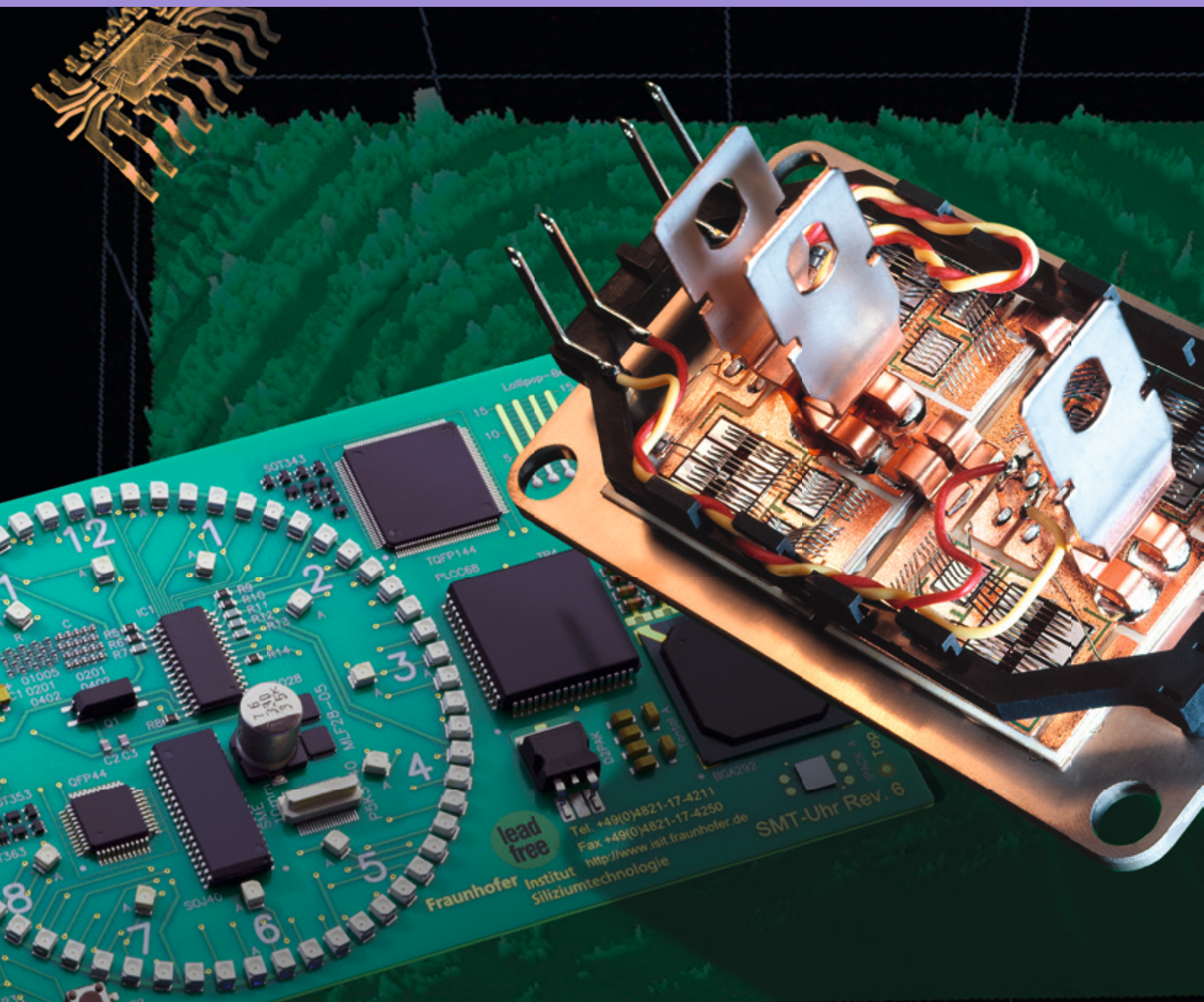
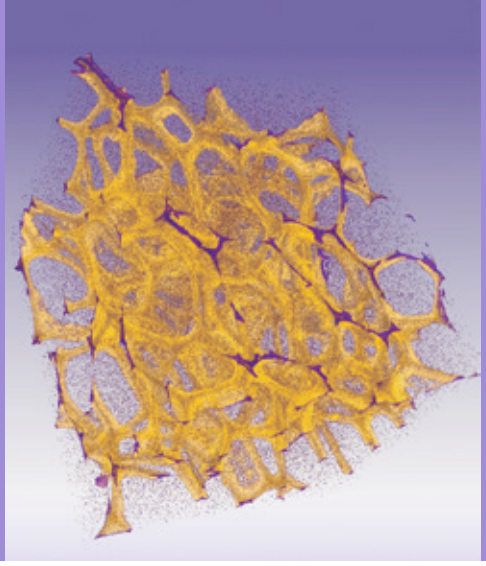
MODULE SERVICES: QUALITY AND RELIABILITY

COMPONENTS, MODULES, PRINTED CIRCUIT BOARD ASSEMBLIES, MICROSYSTEMS AND SYSTEMS OF ELECTRONICS AND POWER ELECTRONICS



Wafer measurement



CT of a foam structure

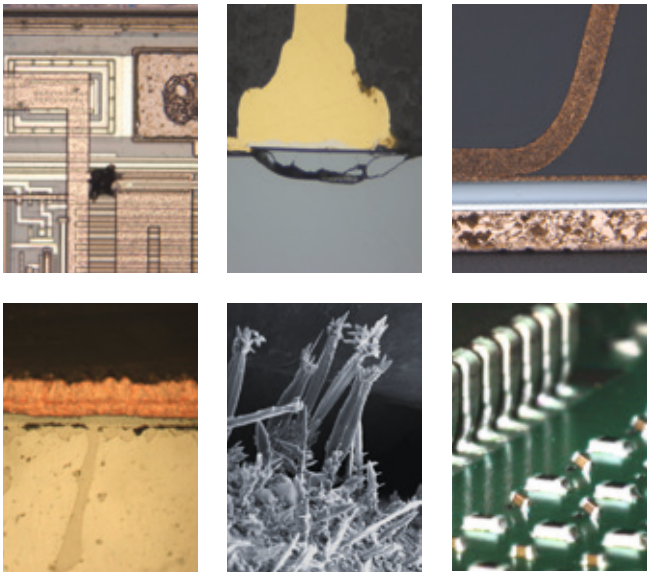
QUALITY AND RELIABILITY: COMPONENTS, MICRO SYSTEMS, MODULES, PRINTED CIRC

The "Module Services" working group deals with testing, assessment, failure and damage analysis as well as quality and reliability assessment of systems and assemblies of electronics and power electronics and provides consultance during electronics developement (including e.g. layout, assembly and production technology) by experts.

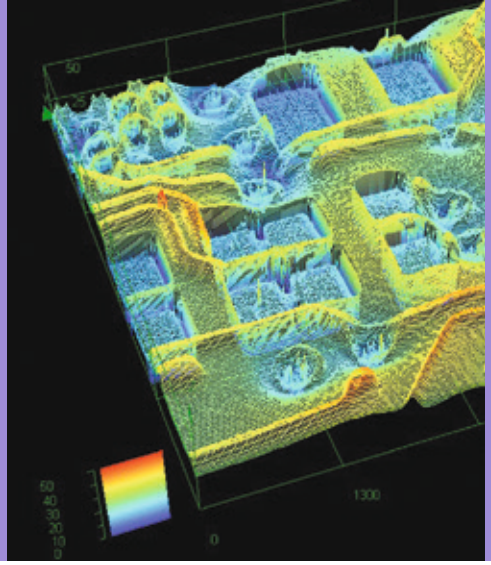
Product Quality Evaluation

Non destructive analysis methods

- Electrical characterization at wafer and module level (e.g., by automated wafer probing) for verification of characteristic data sheet specifications such as e.g. leakage current, dielectric withstanding voltage, dynamic behavior
- Laser vibrometry (e.g. for MEMS oscillating amplitude measurement)
- Layer thickness and optical parameter (n,k) measurement by monochromatic ellipsometry
- Determination of the switching characteristics
- High-resolution lock-in thermography
- Thermal measurements (for example by means of IR thermography) such as heat conductivity, static and dynamic thermal resistance (Rth and Zth from mW ... kW)
- Heating behavior and transient heat distribution (thermal impedance)
- Measurements under environmental conditions
- Combined and automated tests (electrical-thermal-mechanical)
- Evaluation of electronic assemblies according IPC-A-610 and other standards e.g. DIN, ISO, JEDEC, AEC-Q100 etc.
- Evaluation of PCBs according IPC-A-600, IPC-6012 etc.
- Optical inspection: Micro- and macro photography, digital microscopy
- Surface profile analysis (confocal laser profilometry, white light interferometry)
- X-ray inspection: 2D radiography, digital computer tomography (CT)
- Scanning acoustic microscopy (SAM)
- Thermography
- Infrared spectroscopy
- X-ray fluorescence analysis (coating thickness measurement, RoHS conformity test)

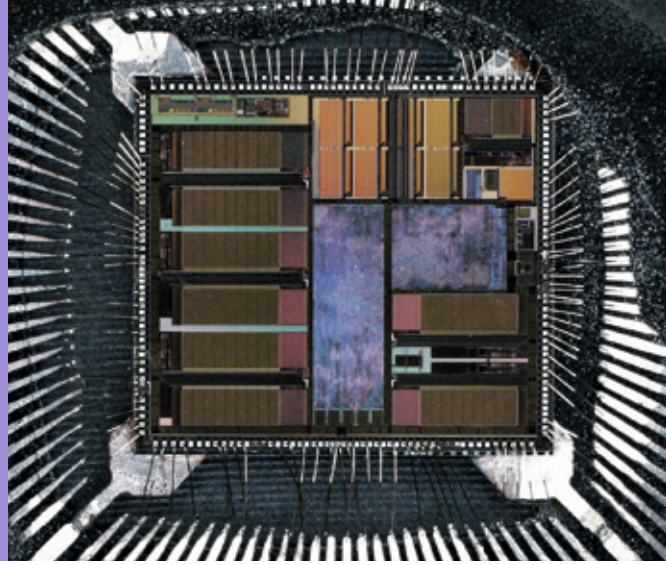


Upper from left to right:
Electrical breakdown between conductive layers on chip
Crack in surface Si below a wire bond contact
Cross section of a Cu ribbon contact (width 2 mm, thickness 200 µm)
Lower from left to right:
Diffusion controlled delamination of a Cu coating
Whisker growth
Tombstoning of SMD parts during reflow solder process



Profile of a PCB surface

SEM: Small Si bumps



Wet-etch opened chip package

UIT BOARD ASSEMBLIES, ELECTRONIC SYSTEMS

Destructive analysis methods

- Metallographic analysis / cross section polishing
- Focussed Ion Beam (FIB)
- Selective metal etching
- Package opening
- Solder heat resistance
- Process and production capability, e.g. Moisture Sensitivity Level (MSL)
- Scanning electron microscopy (SEM)
- Atomic force microscopy (AFM)
- Material analysis due to energy dispersive X-ray spectroscopy (EDX)
- Ionography
- Wetting balance test

Structure and material analysis

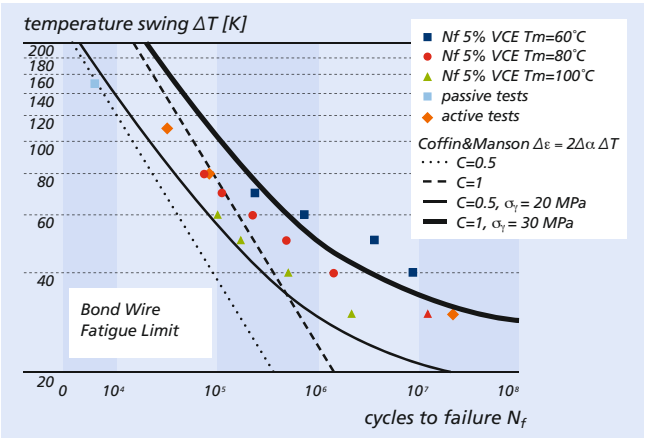
- Cracks (after aging)
- Damages after thermal overload
- De-alloying effects
- Visualisation of solder texture and and of boundary layers
- Intermetallic phase identification
- Determination of mechanical and structural material parameter, e.g. Young modulus, Shear modulus, tear-off forces, elastic-plastic transition etc.
- Draw, shear, strain and pressure testing, also combined with thermal loads
- Shock and vibration tests for MEMS
- Pull- und Shear tests (wire bonds, solder balls,…)
- Solder paste qualification

Surface analysis

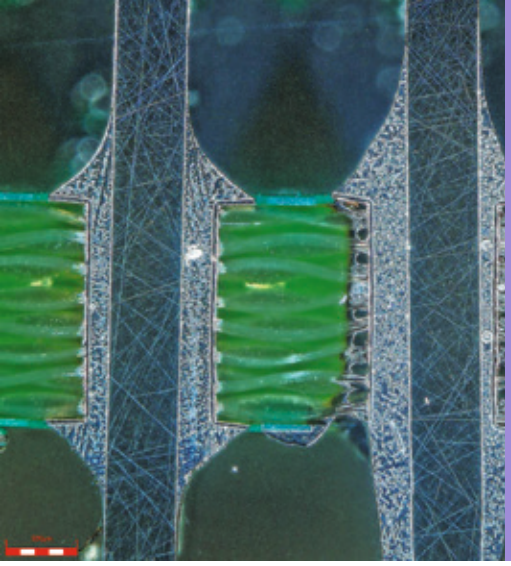
- Contact angle measurements
- Sticking tests
- Wetting tests
- Adhesion force measurements
- Particle contamination

Reliability Testing and Lifetime Prediction

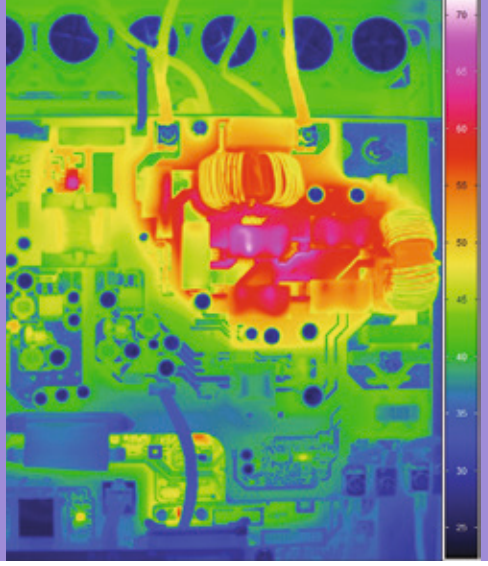
- Lifetime investigations with online data acquisition in customer-specific electrical and hydraulic wiring with active and passive accelerated aging
- Accelerated ageing with online data logging (climate testing, thermal shock, thermal cycling, high temperature storage)
- Active power cycle test up to 2000A (to intentionally induced component damage)
- Model calculations to the prediction of lifetime (by suited accelerated aging mechanisms) on basis of observed failure mechanisms
- Surface insulation resistance (SIR) test



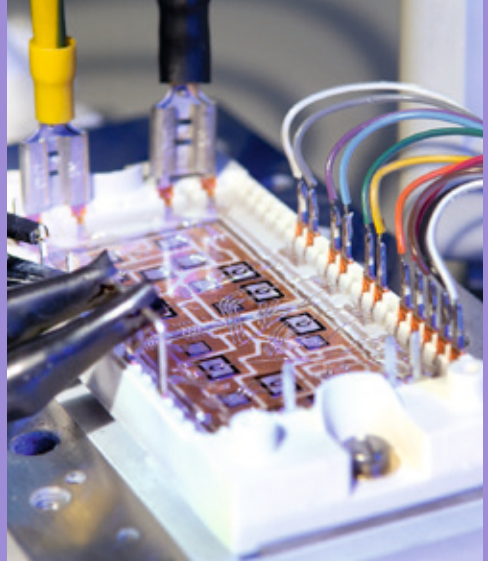
Reliability of heavy wire bond connects



Cross section of a THT connector pin



Heat image of a defect coil



Power module

Failure Analysis and material specific evaluation of structures

- Analysis of thermo-mechanical behaviour
- Thermomechanical damage mechanisms at solder joints, bond wire interconnects and material compounds
- Electrical overloads
- Electrostatic discharge (ESD)
- Cracks, contamination, corrosion, dendrites, whisker, defects in conformal coating, delamination
- Dimensioning and positioning errors, component counterfeits, 3D-SPI (solder paste inspection)
- Reconstruction of complex damage processes
- Evaluation of degradation

Development and Optimization of Electronics and Assembly Concepts

- Electronics and system conception (analog, digital, power electronics)
- Thermal design (simulation of the thermal management of components, modules and assemblies)
- Thermo-mechanic simulation (static, transient)
- Modelling of thermomechanical loads due to material incompatibilities (bending of laminates, creeping of solder)
- Modelling of cooling devices, e.g. geometry dimensioning of air coolers and liquid coolers
- Evaluation of the efficiency of cooling concepts
- Assessment of relevant features of manufacturing quality and reliability
- Strain measurement (CTE mismatch) for process qualification
- Prototyping

Fraunhofer ISIT
is participant of the

Forschungsfabrik Mikroelektronik
Deutschland

CONTACT

Module Services
Helge Schimanski
Phone +49 (0) 4821 / 17-4639
helge.schimanski@isit.fraunhofer.de

Saskia Schröder
Phone +49 (0) 4821 / 17-4618
saskia.schroeder@isit.fraunhofer.de

Fraunhofer-Institute for Silicon Technology ISIT
Fraunhoferstraße 1
D-25524 Itzehoe
Phone +49 (0) 4821 / 17-4222
Fax +49 (0) 4821 / 17-4250
info@isit.fraunhofer.de
www.isit.fraunhofer.de