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1 *Automatic wire bonding
of power electronic modules*

WIRE BONDING

TOPSIDE CONNECTION FOR SEMICONDUCTORS

Research fields

- New materials for bond wires like copper, composites or alloys
- Improvement of application's life time by bonding parameters, geometry, material and others
- Metalization and surface optimization of semiconductors for best bondability
- Cleaning process to achieve a reliable bond connection
- Correlation between bonding parameters and lifetime using power cycling tests to life time

Our services

- Aluminum and copper wedge-wedge-bonding with diameters from 100 μm to 500 μm possible
- Ribbon bonding
- Gold ball-wedge bonding with diameters from 25 μm to 75 μm possible
- Heatable work holder for bond process under temperature for up to 200 °C
- Quality assurance by pull and shear tests
- Control of reliability and life time by active power cycling test, passive temperature cycling and vibration tests
- Design of experiments to optimize bonding parameters

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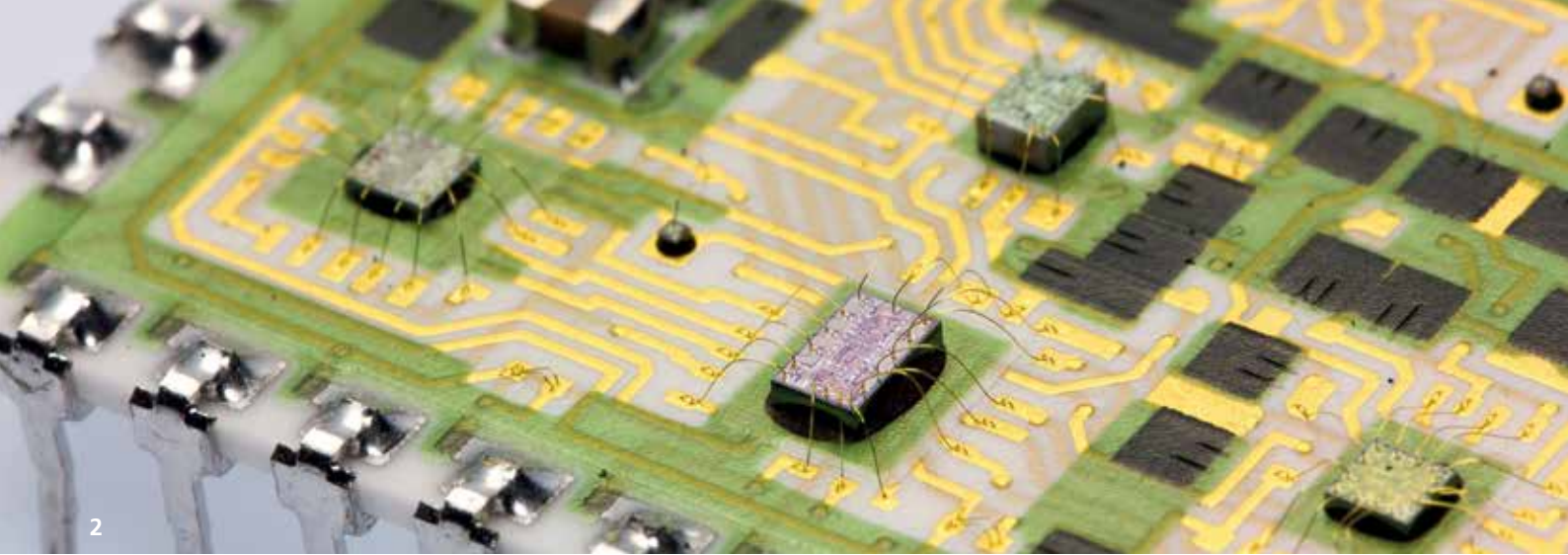
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Functional principle

- Ultrasonic bonding works with high-frequency acoustic vibrations under pressure creating a solid-state welding
- For aluminum wedge-wedge-wire bonding ultrasonic energy is applied to the wire for a specific duration while being held down by a bond force
- Thermosonic gold bonding includes heat treatment and can be used to form solid-state bonds below the melting point of the mating metals
- For ball-wedge-bonding, a gold ball is formed before the bonding process by melting the end of the wire applying a high voltage

Devices and packaging

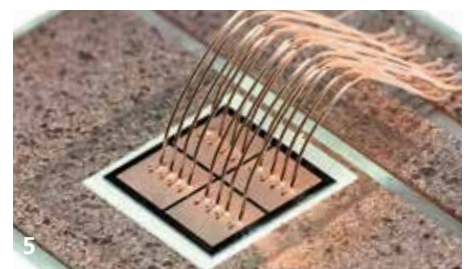
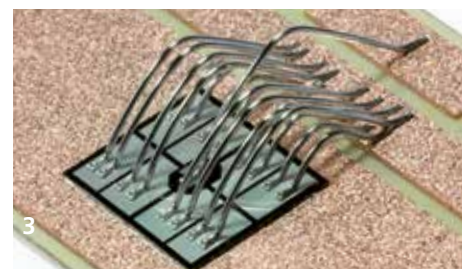
- Power electronic modules
- Single semiconductors
- Si, SiC, and GaN devices
- Surfaces providing best weld solutions:
Aluminum, copper, gold, and silver
- Various material combinations of wires and surfaces - please refer to table below

Bonding machine features

- Semi-automatic bonding process
- Programmable bond layouts
- Deformation limit control
- Image recognition of semiconductors and substrates
- Large area modules as well as small micro electronic devices bondable
- Fast switching of bond heads and pull or shear heads

Table of material combinations

Wires	Surfaces						
	Al	Cu	Au	Ni	Pd	Ag	Sn
Al	✓	✓	✓	✓	✓	✓	✓
Cu	✓	✓	✓	✓	x	✓	x
Au	✓	x	✓	✓	x	✓	x
Pd	✓	x	x	x	x	✓	x
Ag	✓	✓	✓	✓	✓	✓	x
Sn	✓	x	x	x	x	x	✓



2 Gold wire (25 μm)

3 Aluminum wire (125 μm)

4 Aluminum wire (375 μm)

5 Copper wire (250 μm)