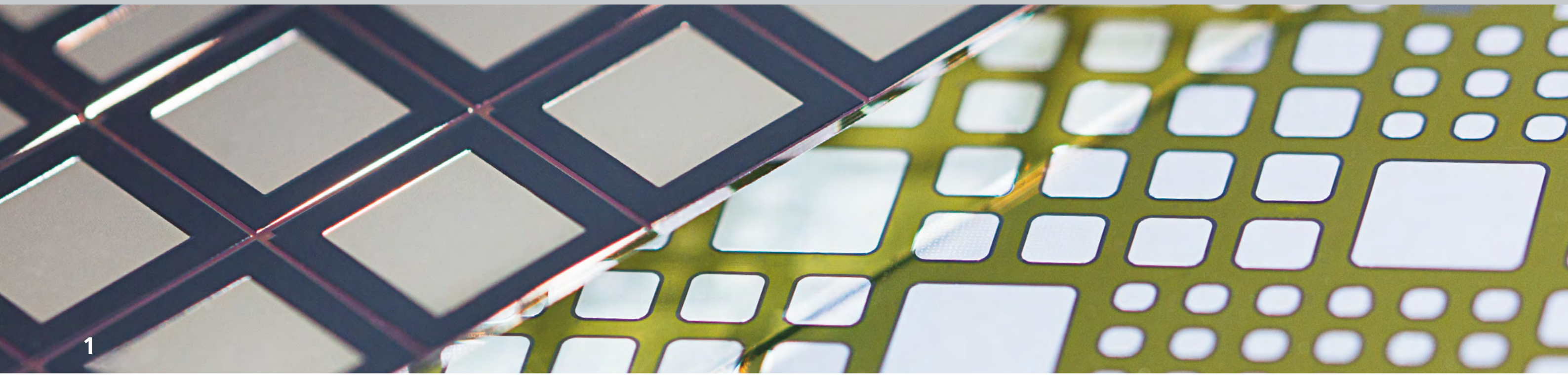
FRAUNHOFER INSTITUTE FOR INTEGRATED SYSTEMS AND DEVICE TECHNOLOGY



1 *Processed SiC wafers featuring JBS-diodes with different device area and current-handling capability*

3.3 KV SiC JBS-DIODES

APPLICATION-SPECIFIC SOLUTIONS

General description

A high-quality 4H-SiC n-type epitaxy layer with Al-implanted p-type areas and metallic electrodes forms the diode. The ohmic bottom-contact consists of a highly doped SiC-substrate and a solder- and sinterable metal stack. The top-side contact is provided by bondable aluminum with a titanium protection layer. Passivation is achieved by silicon dioxide and polyimide.

Features

- High breakdown voltage (> 4 kV)
- Low leakage current in reverse mode (< 1 µA @1.2 kV, < 100 µA @3.3 kV)
- Low turn-on voltage and high current in forward mode (I_f = 10 A @2.75 V, 20 A @4.2 V, A = 0.26 cm^2)
- Negligible switching loss of unipolar device
- Low thermal resistance of SiC substrate
- Available as bare-die

Advantages

- Application specific optimization, design and characterization tailored to your needs
- Lower leakage current than SiC SBD
- HV-application with a single device compared to SiC SBDs
- Replacement of bipolar Si diodes
  - Higher operating temperatures possible with reduced cooling effort
  - Lower dynamic power loss and loss in modules
  - Higher switching speed
  - Smaller device area

Benefits

- Less labor time due to lower manufacturing and module complexity
- Lower cost due to reduced cooling requirements
- Increased turn-over in high-power market
- Innovative and efficient product increases ecological reputation and reduces operating expenditures

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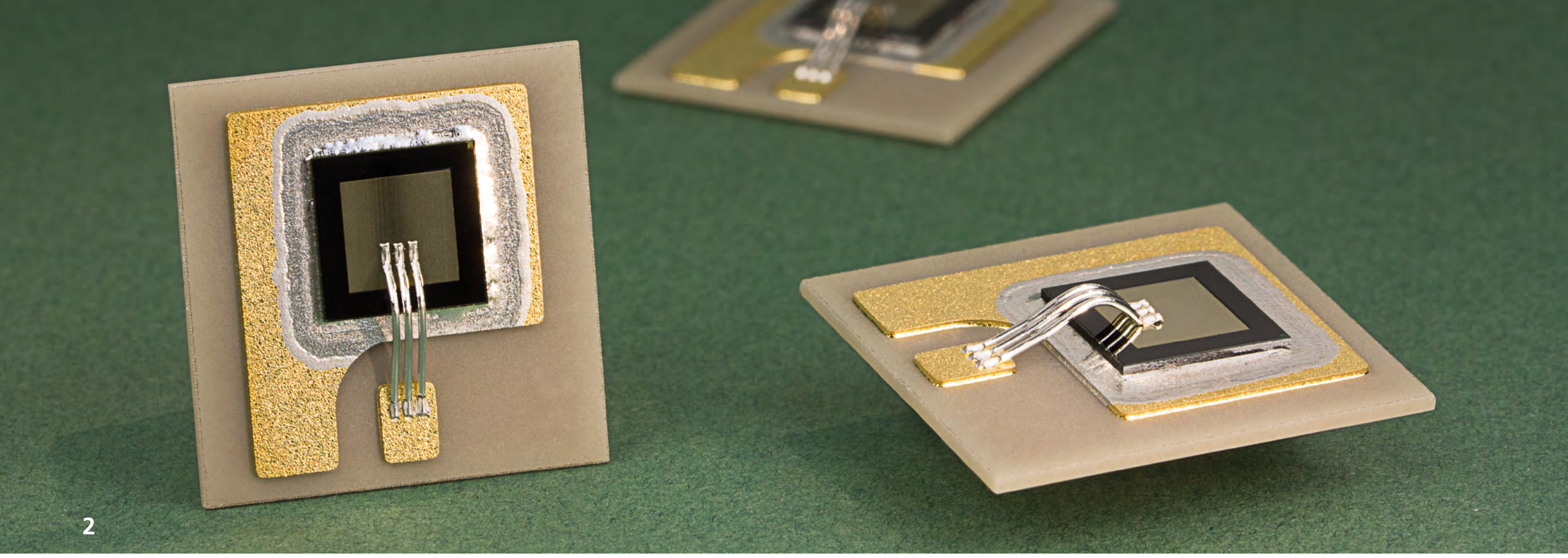


2 *High-voltage JBS-diodes soldered and bonded onto ceramic DCBs for high-current applications*

Current-voltage characteristics

A characteristic forward IV-curve of a 3.3 kV JBS-diode is shown in Fig. 1. It indicates a turn-on voltage of 1.0 V and a voltage drop of 2.75 V at 10 A and 4.2 V at 20 A. The serial resistance can be further reduced with optimized packaging.

Fig. 2 shows a typical reverse IV-curve of a JBS-diode for intended application up to 3.3 kV with a low leakage current of 0.3 µA at 1.2 kV and < 4 µA at 3.3 kV. The breakdown voltage is at remarkable 75 % of the theoretical limit.

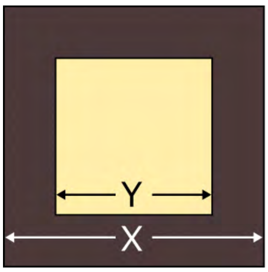
Temperature characteristics

Typical behavior of unipolar SiC diodes with increasing temperature is displayed in Fig. 3. At low voltages the current increases with temperature, at high voltages it decreases with temperature.

Application-specific development

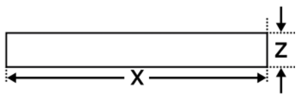
Depending on the requirements of your application, we can design and develop an optimized combination of diode forward and reverse characteristics. Customized areas, dicing and packaging, as well as a broad spectrum of static and dynamic tests are possible.
We are looking forward to customize our devices to your application needs and to be your partner in further advancing the development of SiC diode technology!

Device dimensions



Die thickness Z		< 0.45 mm *
Die size	X	2.0 – 7.5 mm *
Bond area	Y	1.0 – 4.0 mm *

* other dimensions on request



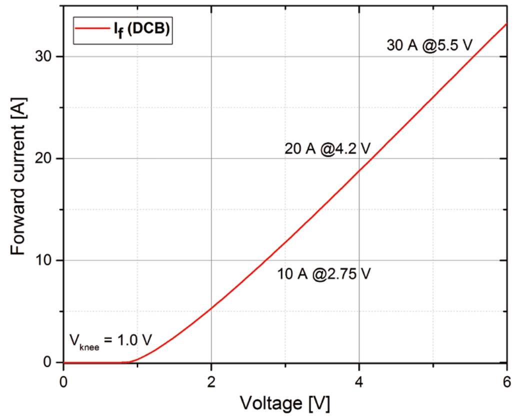


Fig. 1: Forward IV-curve (diode mounted on DCB)

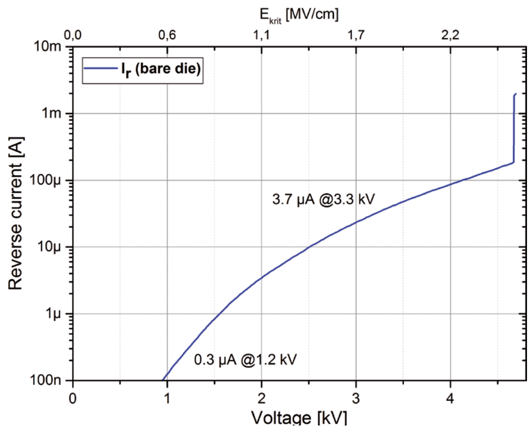


Fig. 2: Reverse IV-curve (3.3 kV diode)

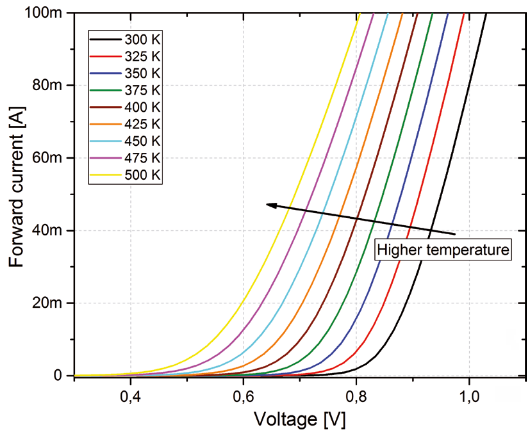


Fig. 3: Temperature-dependence of the conduction mode.