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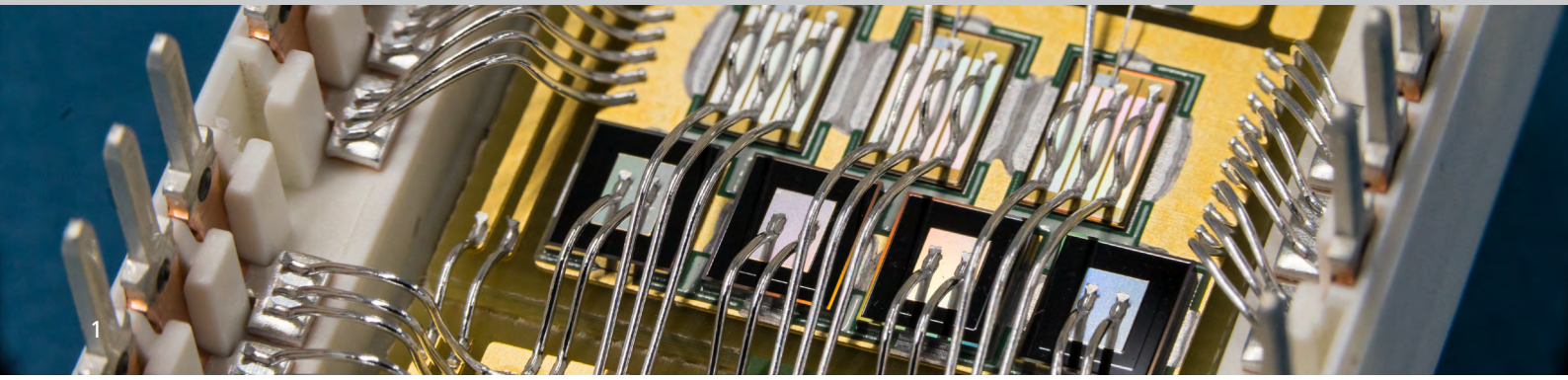

1 *High-voltage RC-snubber chips mounted on a power module for automotive applications (900 V_{DC} version).*

MONOLITHIC RC-SNUBBERS FOR 1200 V SiC-POWER MODULES

General Description

A deep trench in silicon filled with SiO_2 or Si_3N_4 as dielectric and doped poly-silicon as electrode forms the capacitor. The bulk silicon can be used to form the series resistor of a passive RC-snubber. The bottom side contact consists of a solder- and sinterable metal stack. The top side contact consists of bondable aluminum, or is solder- and sinterable on request. High voltage versions feature a polyimide passivation.

Features

- Low parasitic inductance (pH) compared to discrete solutions (nH)
- Available as bare-die
- High thermal conduction of Si substrate with low transition resistances
- Detailed understanding of failure mechanism and exact life-time prediction: Elimination of early failing devices
- Outstanding reproducibility and homogeneity of the fabrication process

Advantages

- Higher switching speeds and increased efficiency of the system, e.g. energy converter
- Simplified mounting together with power switches or ICs
- More efficient spread of the thermal power dissipation to the heat sink
- Increased mean-time-to-failure resulting in lower failure rate in the field
- Excellent device tolerances, minor deviations
- Custom designs regarding capacitance, resistance and voltage stability available

Benefits

- Increasing sales volume due to an innovative product with increased system efficiency and SOA
- Less labor time, higher profit due to faster mounting process and less rework
- Secure and reliable systems with reduced downtime in the field

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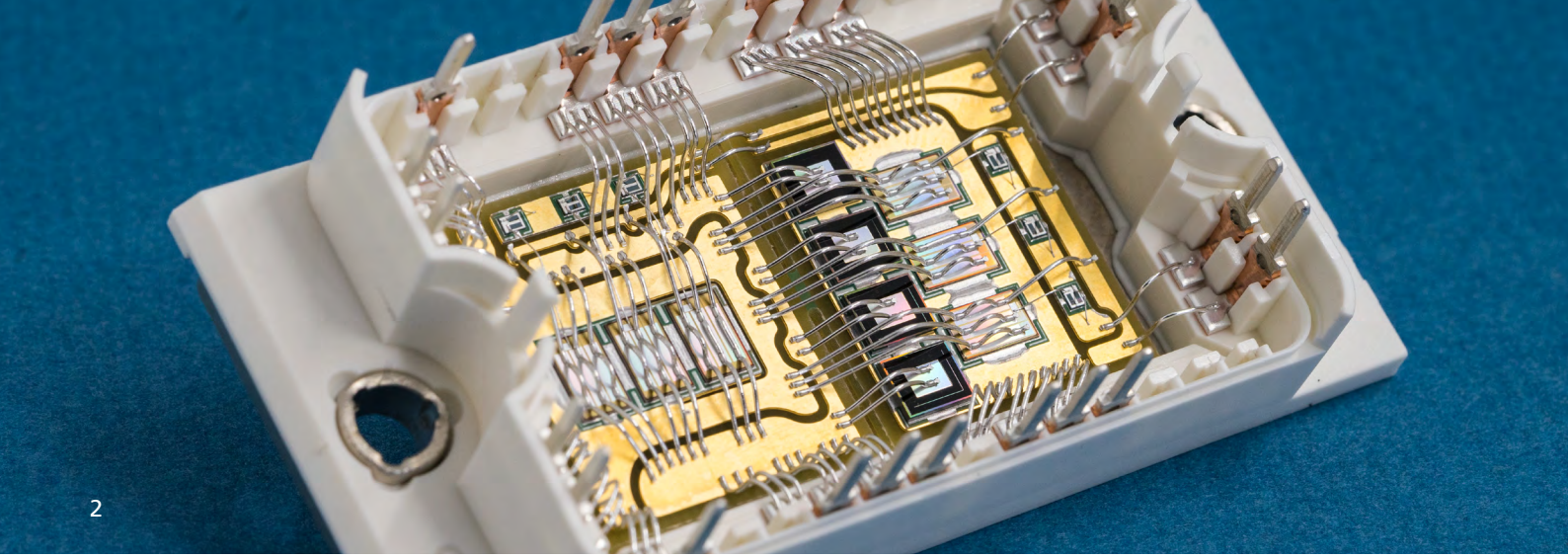
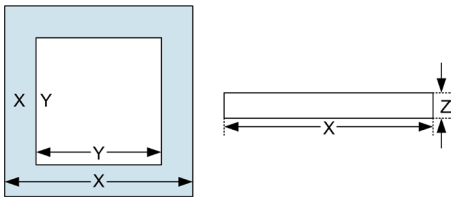


Device Dimensions



Die thickness	Z	< 0.68 mm*
Die size	X	1.5 mm – 5.0 mm*
Bond area	Y	1.0 mm – 4.5 mm*

*others on request

Performance Characteristics

Climatic category	40/200/56
Capacitance range	1 nF – 20 nF*
Resistance range	0.2 Ω – 20 Ω*
Tolerance on C_0	± 5%, ± 10%
Tolerance on R_0	± 15%
Operating voltage V_0	up to 900 V
Test voltage	1.4 V_0 for 2 sec @ 25 °C
Insulation resistance	> 2 GΩ @ 900 V DC
Temperature range	-40 °C – 200 °C
Δ C(T)	< 1% @ Δ T = 100 K
Δ R(T)	60% @ Δ T = 100 K
Leakage current at 900 V DC	< 1 µA
DC breakdown voltage	> 1500 V
Dissipation power	100 W @ 1 nF

*others on request

Voltage Characteristics

Fig.1 shows a typical CV-curve of an exemplary 10 nF / 1 Ω snubber capacitor with a nominal voltage of 900 V.

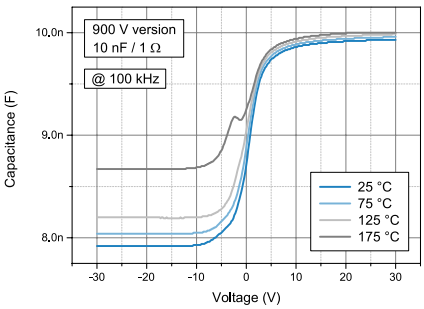


Fig. 1 Typical CV-curve (900 V / 10 nF / 1 Ω)

Fig. 2 shows a typical IV-curve of a 600 V / 1.5 nF / 5 Ω snubber capacitor.

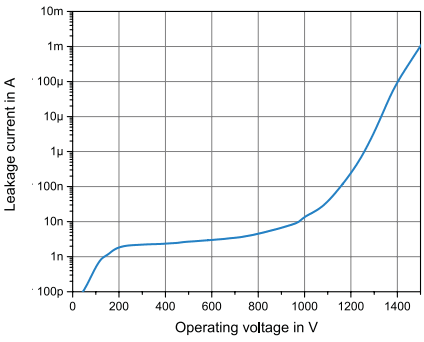


Fig. 2 Typical IV-curve (900 V / 1.5 nF / 5 Ω)

Temperature Characteristics

Fig. 3 shows a typical capacitance and ESR change versus the temperature curve, respectively. The trench capacitor exhibits an excellent temperature behaviour. The capacitance change is less than 1% of the nominal capacitance at room temperature with a temperature change of 100 K. The ESR change is less than 60 % of the nominal ESR at room temperature.

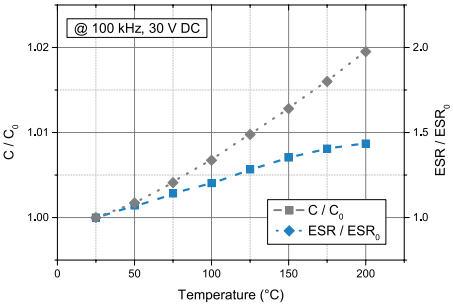


Fig. 3 Typical capacitance and ESR change vs. temperature (200 V / 10 nF / 1 Ω)

Frequency Characteristics

Fig. 4 shows a typical impedance curve of the integrated RC-snubber. Due to the very low ESL, the resonant frequency of the RC-snubber is very high (> 100 MHz).

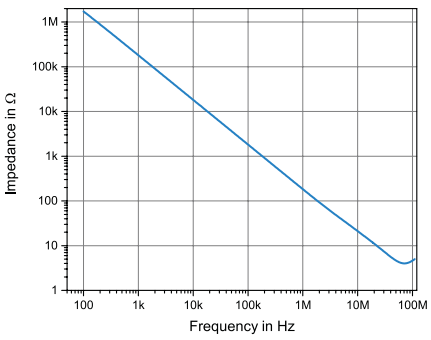


Fig. 4 Typical impedance curve (900 V / 1.5 nF / 5 Ω)

2 *SiC-based power module with integrated silicon RC-snubbers enabling high switching speeds with SiC power devices.*