SiC Schottky Barrier Diode (SBD) Absolute Mamimum Ratings and Electrical Characteristics

Description

This document mainly describes the absolute maximum ratings and electrical characteristics listed in the datasheets of SiC SBD used for switching power supplies, etc. The following items are the repetition peak reverse voltage, forward DC current, forward pulse current non-repetition peak forward current, junction temperature as maximum ratings, and forward voltage, reverse current, junction capacitance, total charge as electrical characteristics.

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1. Absolute Maximum Ratings

Absolute maximum ratings are specified for each item that must not be exceeded during operation even instantaneously.
The maximum allowable values of the current that can be applied to SiC SBD and the voltage that can be applied are specified as the maximum rated values. Recognizing the maximum rating in designing circuits is very important not only for the effective operation of SiC SBD but also for reliable operation that is sufficiently high for the target operating hours.

Characteristics may not be recovered if used beyond the rating. When designing a circuit, pay attention to fluctuations in the supply voltage, variations in the characteristics of electrical components, the stress higher than the maximum ratings at the time of circuit adjustment, changes in ambient temperature, fluctuations in the input signal, etc., and avoid even one of the ratings.

However, even if the product is used under the operating conditions (operating temperature, current, voltage, etc.) within the absolute maximum rating, if the product is used continuously under high loads (high temperature and large current, high voltage application, large temperature change, etc.), the reliability of the product may be significantly reduced. Therefore, in order to ensure reliability, we recommend an appropriate reliability design considering de-rating.

1.1. Parameters Specified as Absolute Maximum Ratings

1.1.1. Repetitive Peak Reverse Voltage V_{RRM}

The maximum value of the reverse voltage that can be repeatedly applied.

1.1.2. Forward DC Current $I_{F(DC)}$

Maximum value of the allowable DC current.

1.1.3. Forward Pulse Current I_{FP}

Maximum value of the allowable pulse current under the specified condition.

1.1.4. Non-Repetitive Peak Forward Surge Current I_{FSM}

Non-repetitive maximum allowable forward peak current as one cycle of 50Hz sine waveform (conduction angle 180°) at the specified junction temperature.

1.1.5. Junction Temperature T_j

The maximum allowable chip temperature at which a SBD operates.

2. Electrical Characteristics

Electrical characteristics specified in SiC SBD datasheet are explained by item. T_a = 25 °C unless otherwise specified.

2.1. Parameters Specified as Electrical Characteristics

2.1.1. Forward Voltage V_F

Voltage drop across terminals caused by forward current under specified current and temperature conditions. This item is usually specified with pulse current because of its high temperature dependence.

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Forward voltage	V_F (1)	I_F = 5 A (pulse measurement)	−	1.2	−	V
Forward voltage	V_F (2)	I_F = 10 A (pulse measurement)	−	1.45	1.6	V

The temperature coefficient of forward voltage is positive in the high current range.

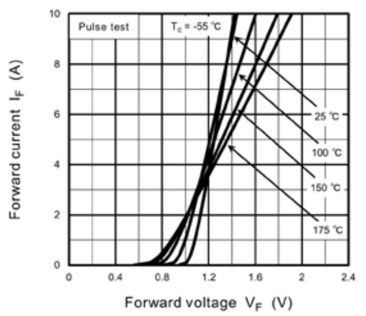

Figure 2.1 Example of SiC SBD I_F-V_F curve

2.1.2. Reverse Current I_R

Reverse leakage current at the specified reverse voltage. This item is usually specified by the pulse voltage because of its high temperature dependence.

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Reverse current	I_R	V_R = 650 V (pulse measurement)	−	0.5	50	μA

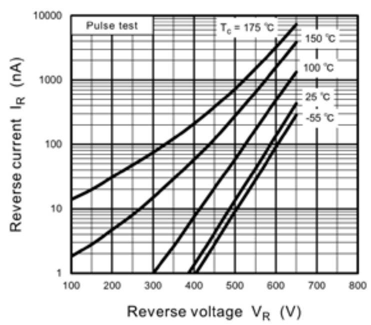

Figure 2.2 Example of I_R – V_R curve

2.1.3. Junction Capacitance C_j

The junction capacitance of SiC SBD is the capacitance between the anode-side metal or the P-type semiconductor and the cathode-side N-type semiconductor. The junction capacitance depends on the reverse voltage (V_R), and it is specified on the datasheet by the equivalent capacitance between the terminals to measure with specified V_R when a signal for measurement is applied at a certain frequency.

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction capacitance	C_j	V_R = 650 V, f = 1 MHz	–	36	–	pF

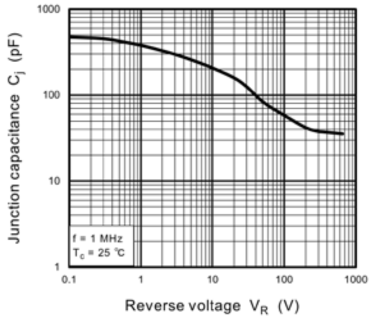

Figure 2.3 Example of C_j – V_R curve

2.1.4. Total Junction Capacitive Charge Q_{cj}

The total junction capacitive charge is the amount of charge to charge or discharge the parasitic capacitance. Therefore, it is calculated by the following equation (1). The values in the data sheet are calculated by integrating the Junction capacitance – Reverse voltage curve.

$$Q_{cj} = \int C_j(V)dv \quad \cdot\cdot\cdot\cdot (1)$$

The integration range is from 0 to V_R specified in the datasheet.

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