

V_{RRM}	=	4500 V
I_{FAVM}	=	320 A
I_{FSM}	=	5 kA
V_{F0}	=	2 V
r_F	=	1.5 m Ω
V_{DClink}	=	2400 V

Fast Recovery Diode

5SDF 03D4501

Doc. No. 5SYA1106-02 Sep. 01

- Patented free-floating silicon technology
- Low switching losses
- Optimized to use as snubber and clamp diode in GTO and IGCT converters
- Industry standard press-pack ceramic housing, hermetically cold-welded
- Cosmic radiation withstand rating

Blocking

V_{RRM}	Repetitive peak reverse voltage	4500 V	Half sine wave, $t_p = 10$ ms, $f = 50$ Hz	
I_{RRM}	Repetitive peak reverse current	≤ 50 mA	$V_R = V_{RRM}$, $T_J = 125^\circ\text{C}$	
V_{DClink}	Permanent DC voltage for 100 FIT failure rate	2400 V	100% Duty	Ambient cosmic radiation at sea level in open air.
V_{DClink}	Permanent DC voltage for 100 FIT failure rate	2800 V	5% Duty	

Mechanical data (see Fig. 8)

F_m	Mounting force	min.	10 kN	
		max.	12 kN	
a	Acceleration: Device unclamped Device clamped		50 m/s ²	
			200 m/s ²	
m	Weight		0.25 kg	
D_s	Surface creepage distance	\geq	30 mm	
D_a	Air strike distance	\geq	20 mm	

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On-state (see Fig. 2, 3)

I_{FAVM}	Max. average on-state current	320 A	Half sine wave, $T_c = 85^\circ\text{C}$	
I_{FRMS}	Max. RMS on-state current	500 A		
I_{FSM}	Max. peak non-repetitive surge current	5 kA	$t_p = 10\text{ ms}$	Before surge: $T_c = T_j = 125^\circ\text{C}$
		12 kA	$t_p = 1\text{ ms}$	
$\int I^2 dt$	Max. surge current integral	$125 \cdot 10^3\text{ A}^2\text{s}$	$t_p = 10\text{ ms}$	After surge: $V_R \approx 0\text{ V}$
		$72 \cdot 10^3\text{ A}^2\text{s}$	$t_p = 1\text{ ms}$	
V_F	Forward voltage drop	$\leq 3.5\text{ V}$	$I_F = 1000\text{ A}$	$T_j = 125^\circ\text{C}$
V_{F0}	Threshold voltage	2 V	Approximation for	
r_F	Slope resistance	1.5 m Ω	$I_F = 200 \dots 3000\text{ A}$	

Turn-on (see Fig. 4, 5)

V_{fr}	Peak forward recovery voltage	$\leq 140\text{ V}$	$di/dt = 1000\text{ A}/\mu\text{s}$, $T_j = 125^\circ\text{C}$
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Turn-off (see Fig. 6, 7)

I_{rr}	Reverse recovery current	$\leq 200\text{ A}$	$di/dt = 100\text{ A}/\mu\text{s}$, $T_j = 125^\circ\text{C}$, $I_F = 2000\text{ A}$, $V_{RM} = 4500\text{ V}$, $R_S = 22\ \Omega$, $C_S = 0.22\ \mu\text{F}$
Q_{rr}	Reverse recovery charge	$\leq 1000\ \mu\text{C}$	
E_{rr}	Turn-off energy	$\leq \text{-- J}$	

Thermal (see Fig. 1)

T_j	Operating junction temperature range	-40...125 $^\circ\text{C}$		
T_{stg}	Storage temperature range	-40...125 $^\circ\text{C}$		
R_{thJC}	Thermal resistance junction to case	$\leq 80\text{ K/kW}$	Anode side cooled	$F_m = 10 \dots 12\text{ kN}$
		$\leq 80\text{ K/kW}$	Cathode side cooled	
		$\leq 40\text{ K/kW}$	Double side cooled	
R_{thCH}	Thermal resistance case to heatsink	$\leq 16\text{ K/kW}$	Single side cooled	
		$\leq 8\text{ K/kW}$	Double side cooled	

Analytical function for transient thermal impedance.

$$Z_{thJC}(t) = \sum_{i=1}^n R_i (1 - e^{-t/\tau_i})$$

i	1	2	3	4
$R_i(\text{K/kW})$	20.95	10.57	7.15	1.33
$\tau_i(\text{s})$	0.396	0.072	0.009	0.0044
$F_m = 10 \dots 12\text{ kN}$ Double side cooled				

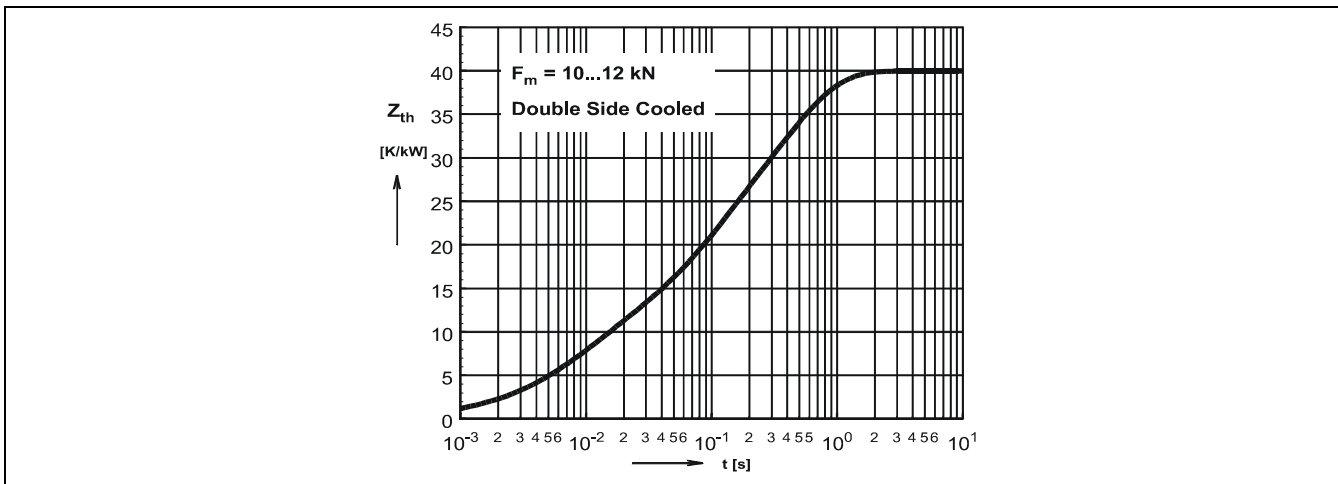


Fig. 1 Transient thermal impedance (junction-to-case) vs. time in analytical and graphical form (max. values).

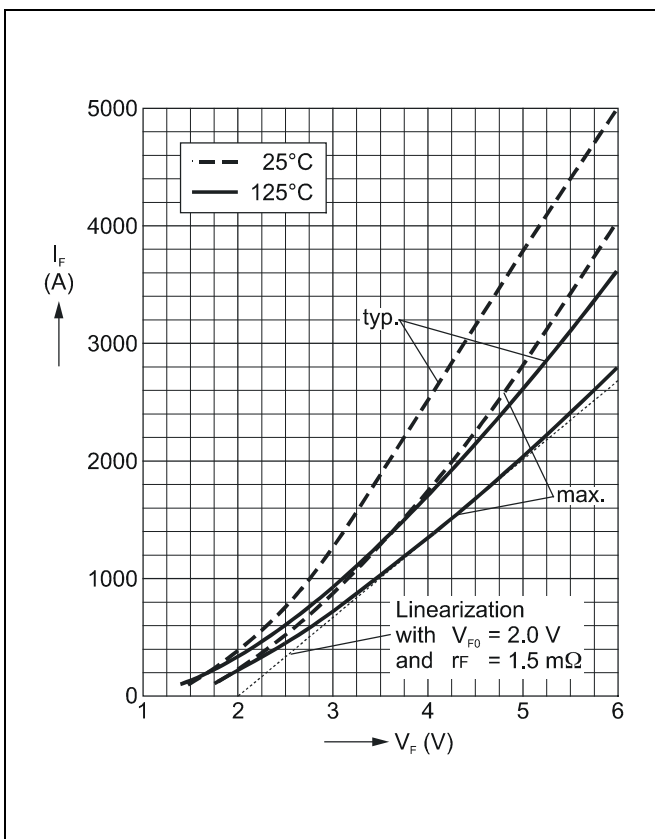


Fig. 2 Forward current vs. forward voltage (typ. and max. values) and linear approximation of max. curve at 125°C.

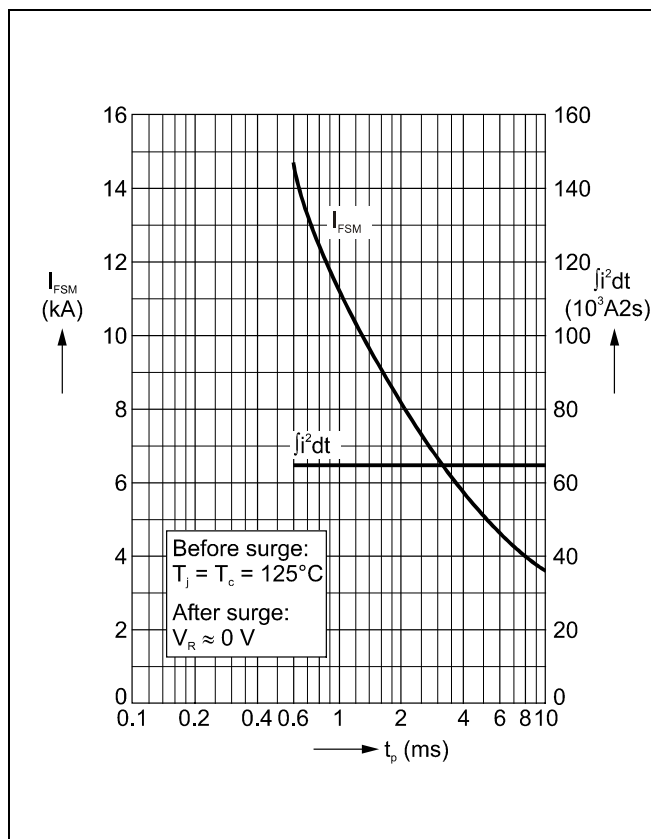


Fig. 3 Surge current and fusing integral vs. pulse width (max. values) for non-repetitive, half-sinusoidal surge current pulses.

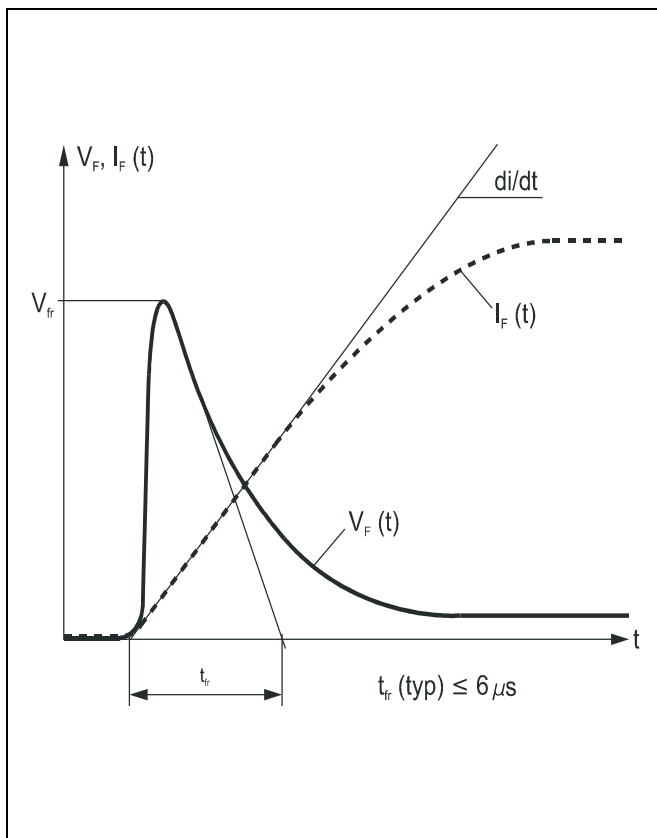


Fig. 4 Typical forward voltage waveform when the diode is turned on with a high di/dt.

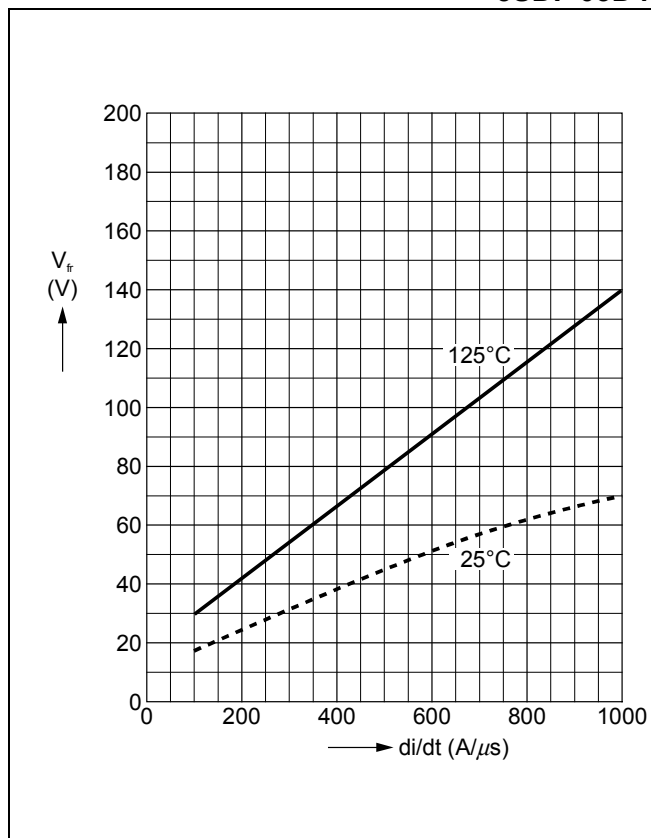


Fig. 5 Forward recovery voltage vs. turn-on di/dt (max. values).

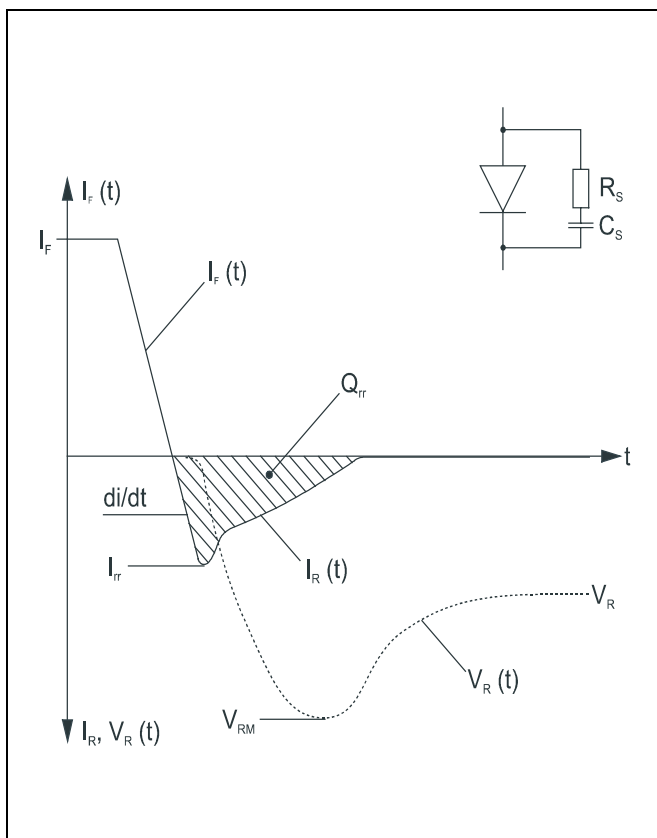


Fig. 6 Typical current and voltage waveforms at turn-off with conventional RC snubber circuit.

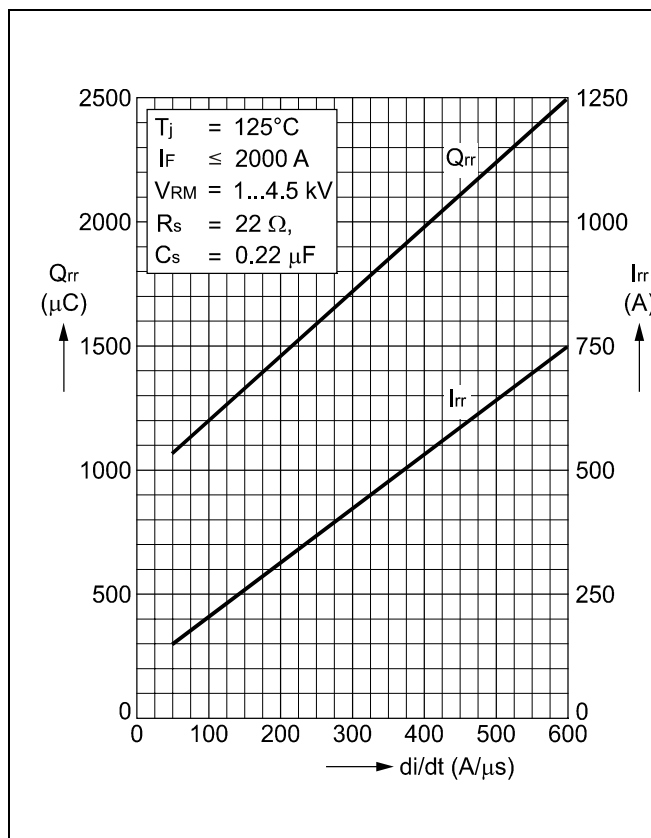


Fig. 7 Reverse recovery current and reverse recovery charge vs. di/dt (max. values).

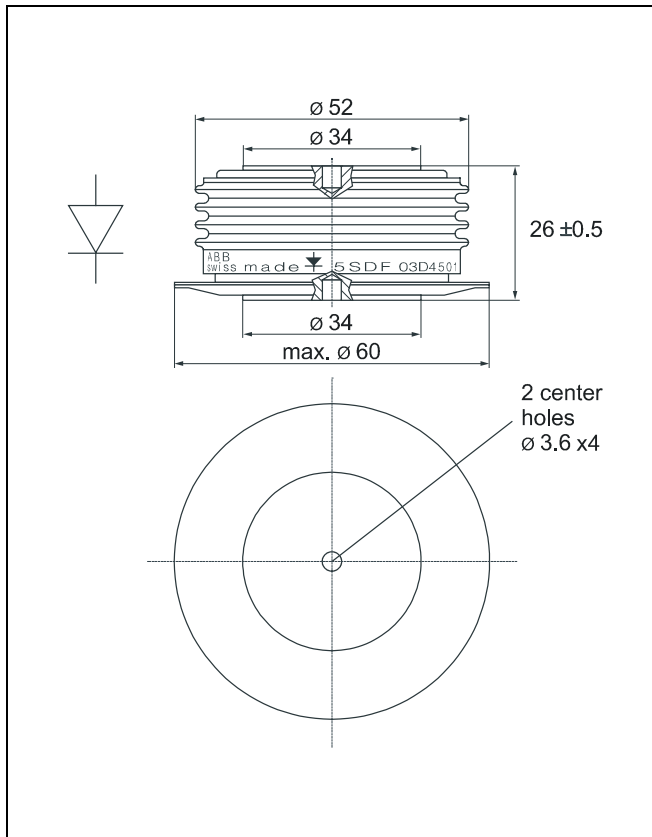


Fig. 8 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

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