

$V_{RRM}$	=	4500 V
$I_{FAVM}$	=	1200 A
$I_{FSM}$	=	25 kA
$V_{F0}$	=	1.3 V
$r_F$	=	0.48 m $\Omega$
$V_{DClink}$	=	2800 V

## Fast Recovery Diode

# 5SDF 13H4501

Doc. No. 5SYA1104-02 Sep. 01

- Patented free-floating silicon technology
- Low on-state and switching losses
- Optimized for use as freewheeling diode in GTO converters with high DC link voltages
- Standard press-pack housing, hermetically plasma-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	$\leq 50$ mA	$V_R = V_{RRM}, T_J = 125^\circ\text{C}$	
$V_{DClink}$	Permanent DC voltage for 100 FIT failure rate	2800 V	100% Duty	Ambient cosmic radiation at sea level in open air.
$V_{DClink}$	Permanent DC voltage for 100 FIT failure rate	V	5% Duty	

### Mechanical data (see Fig. 12)

$F_m$	Mounting force	min.	36 kN	
		max.	44 kN	
a	Acceleration: Device unclamped Device clamped		50 m/s <sup>2</sup>	
			200 m/s <sup>2</sup>	
m	Weight		0.83 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	1200 A	Half sine wave, $T_c = 85^\circ\text{C}$	
$I_{FRMS}$	Max. RMS on-state current	1900 A		
$I_{FSM}$	Max. peak non-repetitive surge current	25 kA	$t_p = 10\text{ ms}$	Before surge: $T_c = T_j = 125^\circ\text{C}$
		60 kA	$t_p = 1\text{ ms}$	
$\int I^2 dt$	Max. surge current integral	$3.13 \cdot 10^6\text{ A}^2\text{s}$	$t_p = 10\text{ ms}$	After surge: $V_R \approx 0\text{ V}$
		$1.8 \cdot 10^6\text{ A}^2\text{s}$	$t_p = 1\text{ ms}$	
$V_F$	Forward voltage drop	$\leq 2.5\text{ V}$	$I_F = 2500\text{ A}$	$T_j = 125^\circ\text{C}$
$V_{F0}$	Threshold voltage	1.3 V	Approximation for	
$r_F$	Slope resistance	0.48 m $\Omega$	$I_F = 400 \dots 4000\text{ A}$	

**Turn-on** (see Fig. 4, 5)

$V_{fr}$	Peak forward recovery voltage	$\leq 50\text{ V}$	$di/dt = 500\text{ A}/\mu\text{s}$ , $T_j = 125^\circ\text{C}$
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**Turn-off** (see Fig. 6 to 11)

$I_{rr}$	Reverse recovery current	$\leq 800\text{ A}$	$di/dt = 300\text{ A}/\mu\text{s}$ , $I_F = 1000\text{ A}$ , $T_j = 125^\circ\text{C}$ , $V_{RM} = 4500\text{ V}$ , $C_S = 3\mu\text{F}$ (GTO snubber circuit)
$Q_{rr}$	Reverse recovery charge	$\leq 3000\text{ }\mu\text{C}$	
$E_{rr}$	Turn-off energy	$\leq 1.25\text{ J}$	

**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	$\leq 24\text{ K/kW}$	Anode side cooled	$F_m = 36 \dots 44\text{ kN}$
		$\leq 24\text{ K/kW}$	Cathode side cooled	
		$\leq 12\text{ K/kW}$	Double side cooled	
$R_{thCH}$	Thermal resistance case to heatsink	$\leq 6\text{ K/kW}$	Single side cooled	
		$\leq 3\text{ K/kW}$	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
$R_i(\text{K/kW})$	7.44	2.00	1.84	0.71
$\tau_i(\text{s})$	0.47	0.091	0.011	0.0047
$F_m = 36 \dots 44\text{ kN}$ Double side cooled				

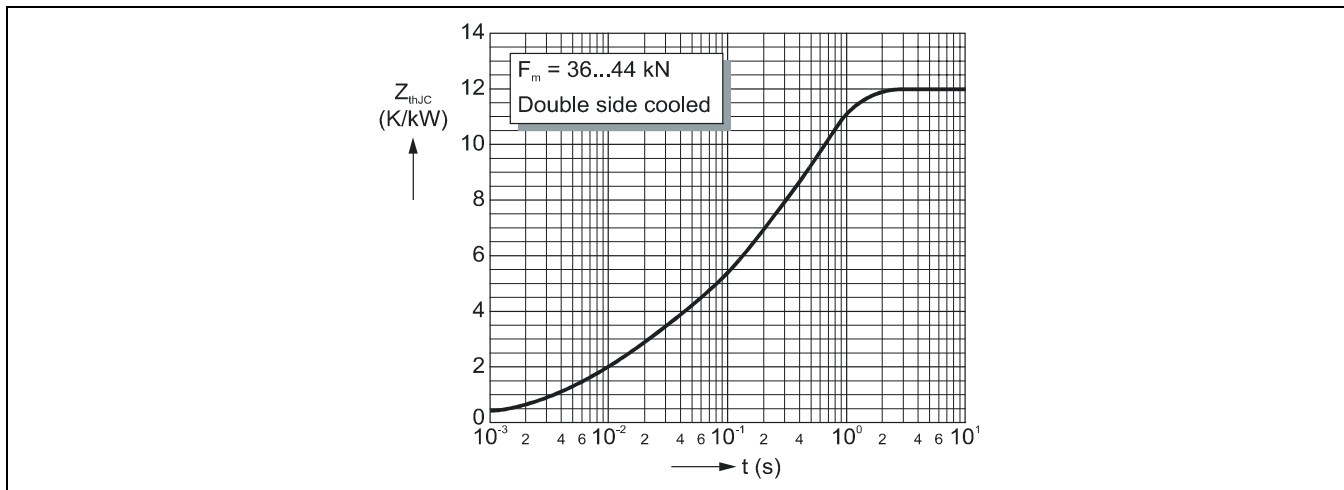


Fig. 1 Transient thermal impedance (junction-to-case) vs. time in analytical and graphical form (max. values).

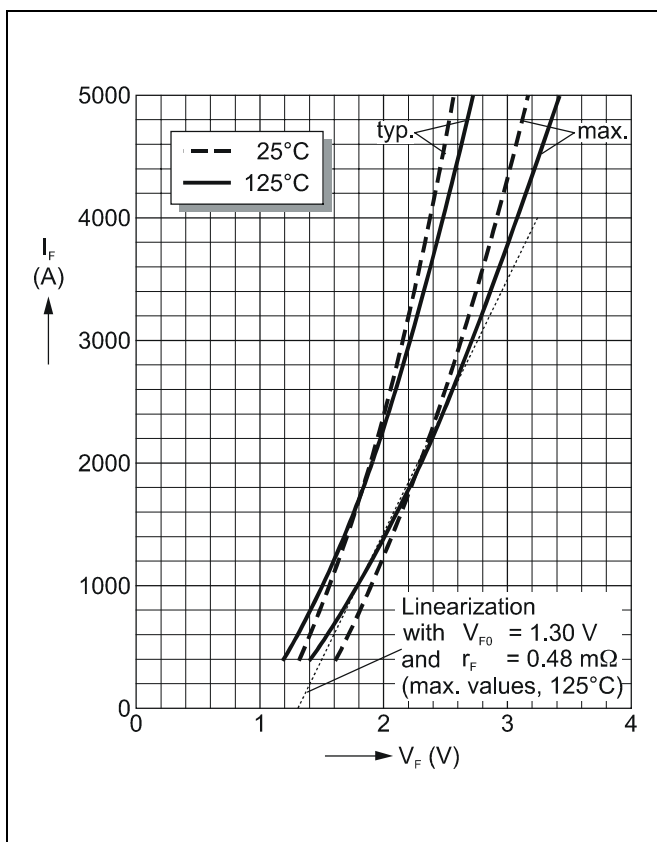


Fig. 2 Forward current vs. forward voltage (typ. and max. values) and linear approximation of max. curve at 125°C.

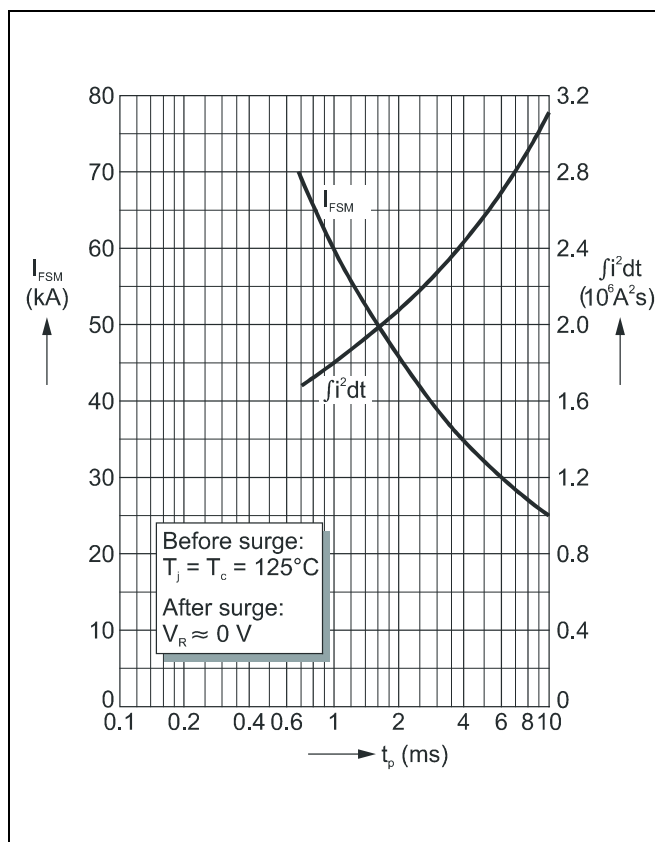


Fig. 3 Surge current and fusing integral vs. pulse width (max. values) for non-repetitive, half-sinusoidal surge current pulses.

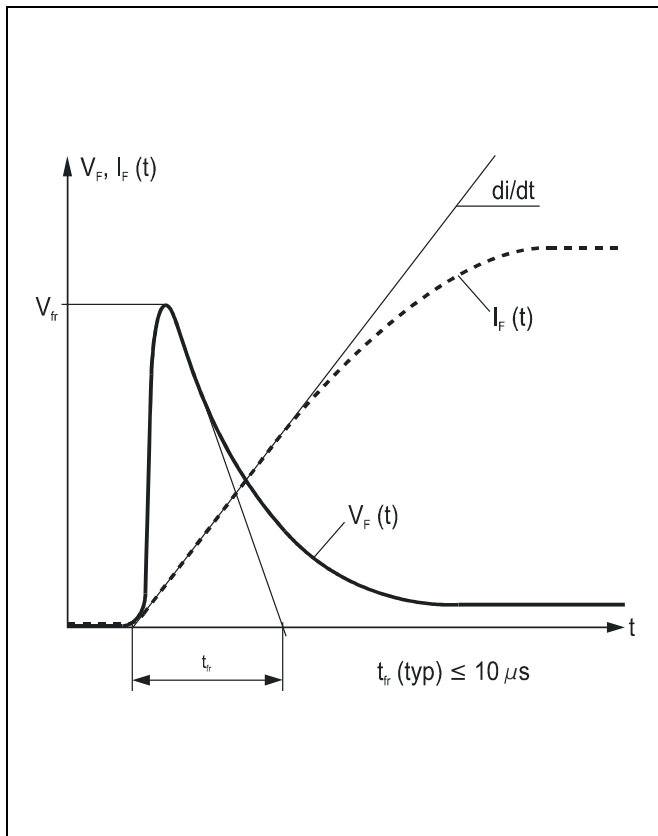


Fig. 4 Typical forward voltage waveform when the diode is turned on with a high di/dt.

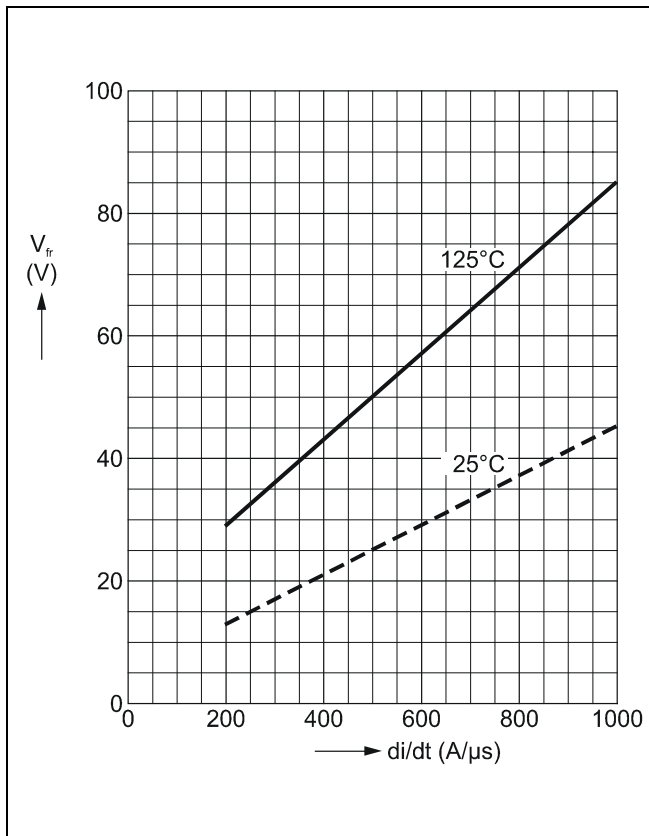


Fig. 5 Forward recovery voltage vs. turn-on di/dt (max. values).

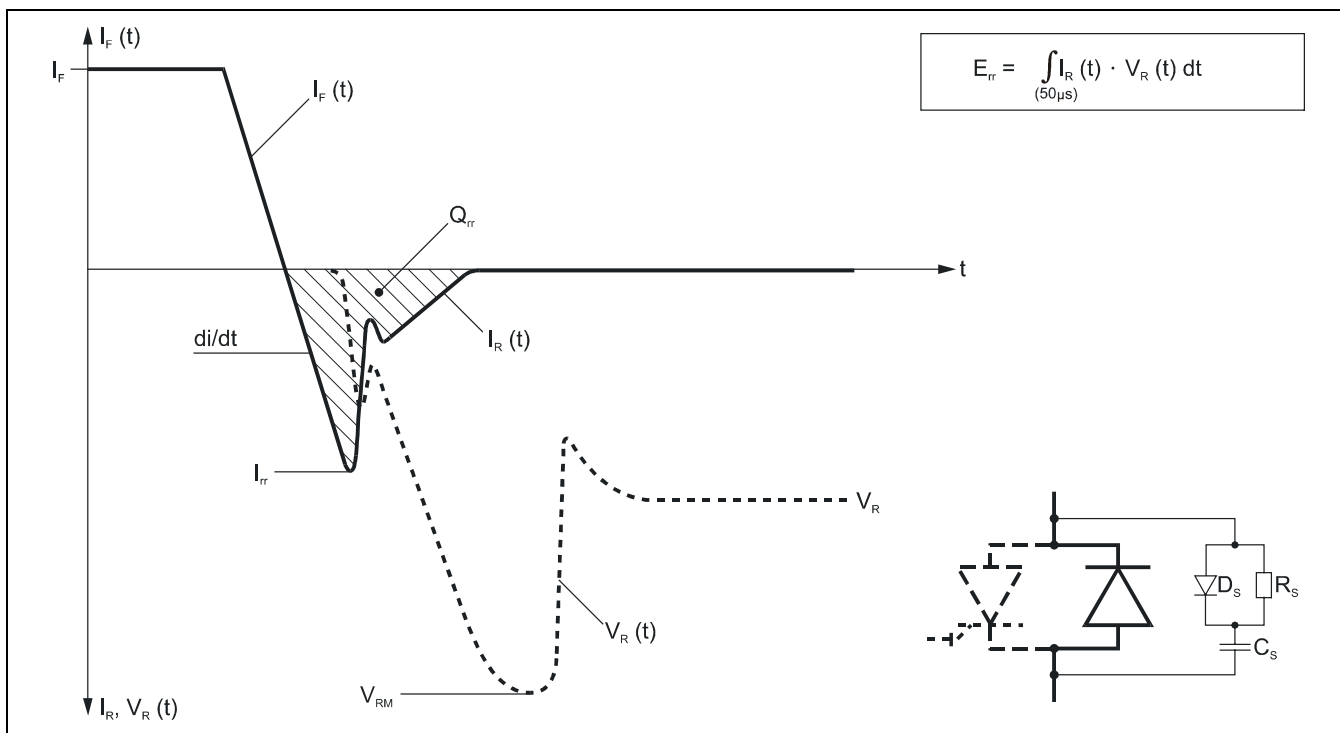


Fig. 6 Typical current and voltage waveforms at turn-off when the diode is connected to an RCD snubber, as often used in GTO circuits.

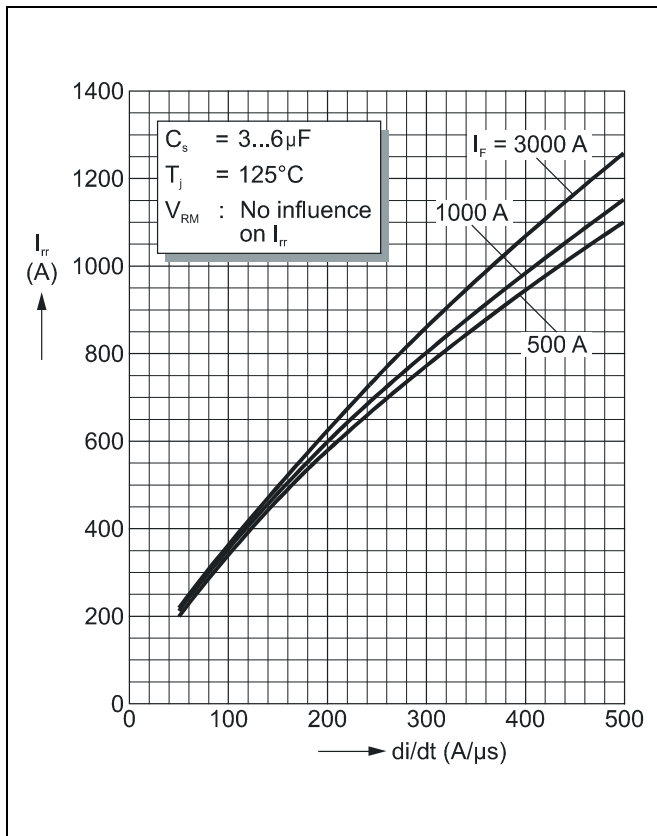


Fig. 7 Reverse recovery current vs. turn off di/dt (max. values).

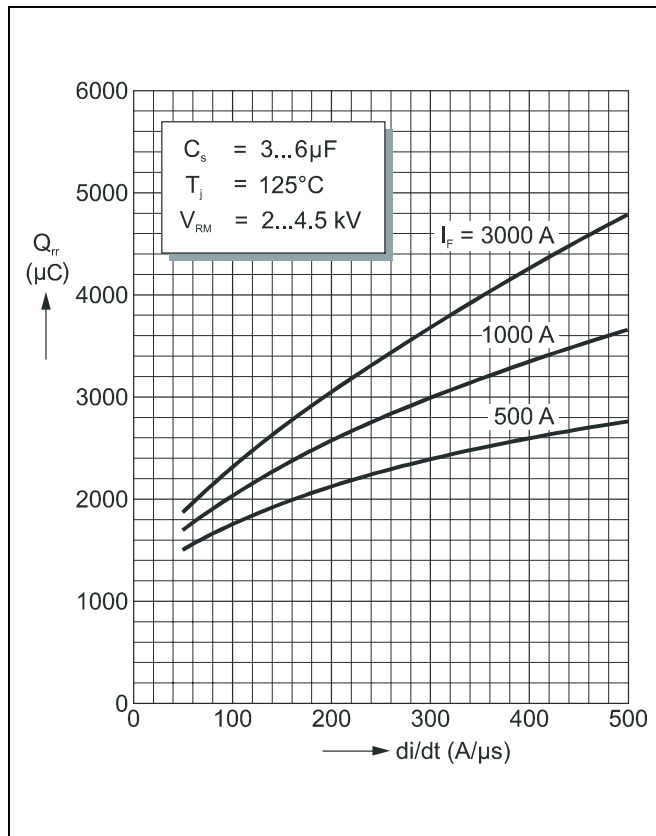


Fig. 8 Reverse recovery charge vs. turn off di/dt (max. values).

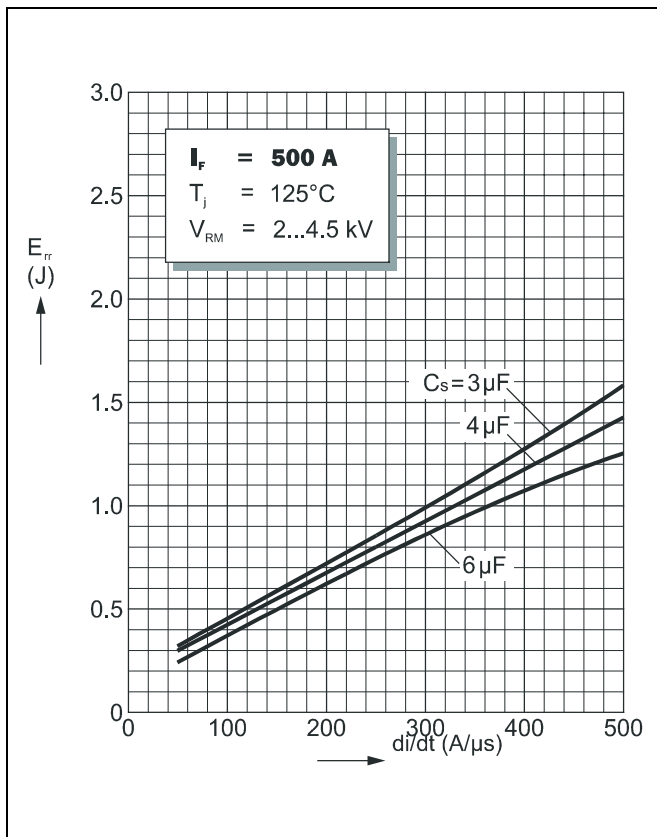


Fig. 9 Turn-off energy vs. turn-off di/dt for I<sub>F</sub> = 500 A (max. values).

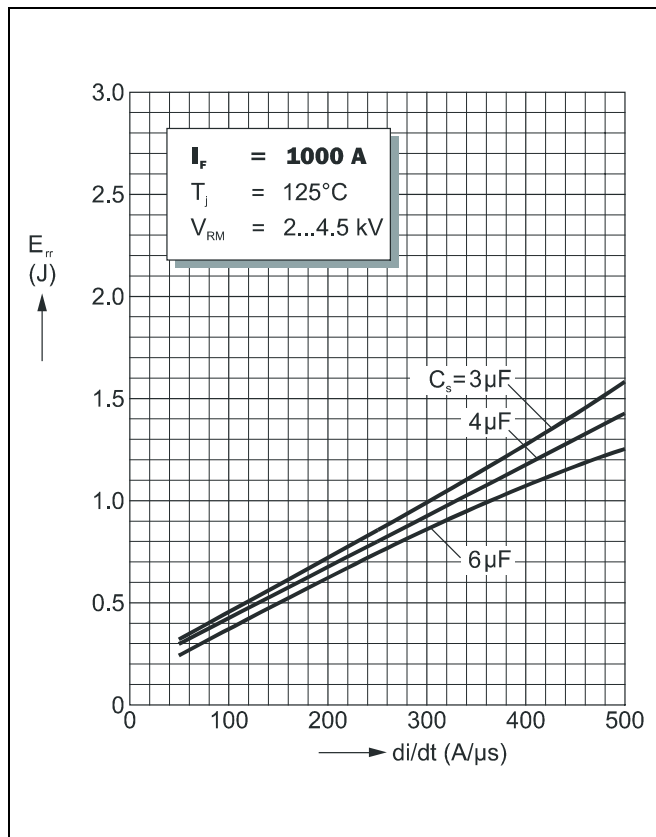


Fig. 10 Turn-off energy vs. turn-off di/dt for I<sub>F</sub> = 1000 A (max. values).

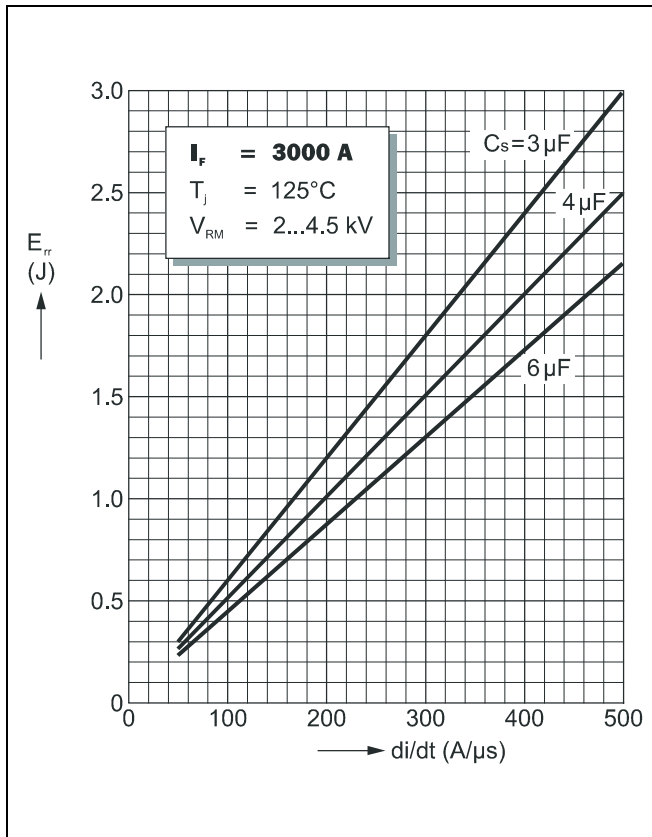


Fig. 11 Turn-off energy vs. turn-off  $di/dt$  for  $I_F = 3000 A$  (max. values).

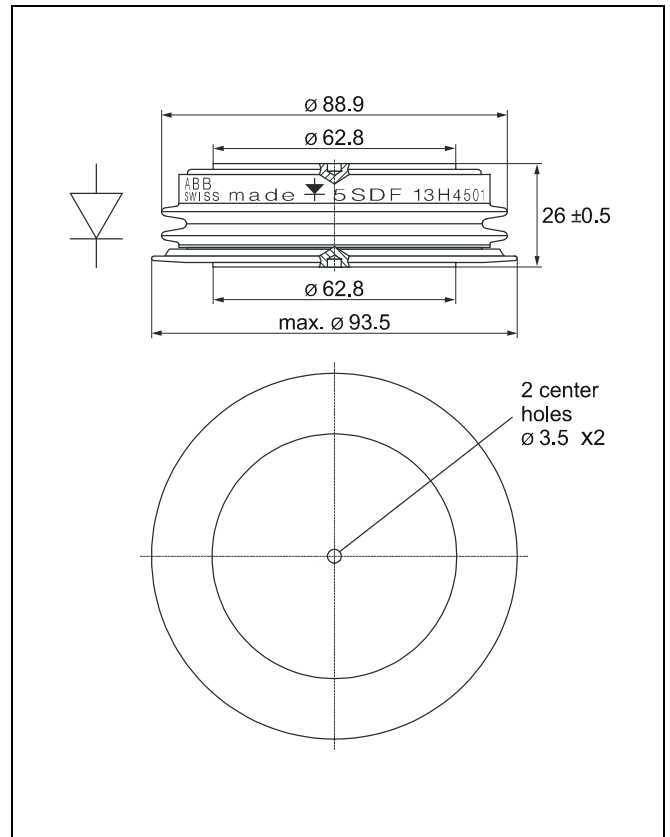


Fig. 12 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

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