

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

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, $t_p = 10 \text{ ms}$, $f = 50 \text{ Hz}$	
I_{RRM}	Repetitive peak reverse current	$\leq 50 \text{ mA}$	$V_R = V_{RRM}$, $T_J = 125^\circ\text{C}$	
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 ² 200 m/s ²	
m	Weight		0.83 kg	
D_s	Surface creepage distance	$\geq$	30 mm	
D_a	Air strike distance	$\geq$	20 mm	

ABB Semiconductors AG reserves the right to change specifications without notice.



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 Ω	$I_F = 400 \dots 4000\text{ A}$	

Turn-on (see Fig. 4, 5)

V_{fr}	Peak forward recovery voltage	$\leq 50\text{ V}$	$di/dt = 500\text{ A}/\mu\text{s}$, $T_j = 125^\circ\text{C}$
----------	-------------------------------	--------------------	--

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	$\leq 24\text{ K/W}$	Anode side cooled	$F_m = 36 \dots 44\text{ kN}$
		$\leq 24\text{ K/W}$	Cathode side cooled	
		$\leq 12\text{ K/W}$	Double side cooled	
R_{thCH}	Thermal resistance case to heatsink	$\leq 6\text{ K/W}$	Single side cooled	
		$\leq 3\text{ K/W}$	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
$R_i(\text{K/W})$	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				

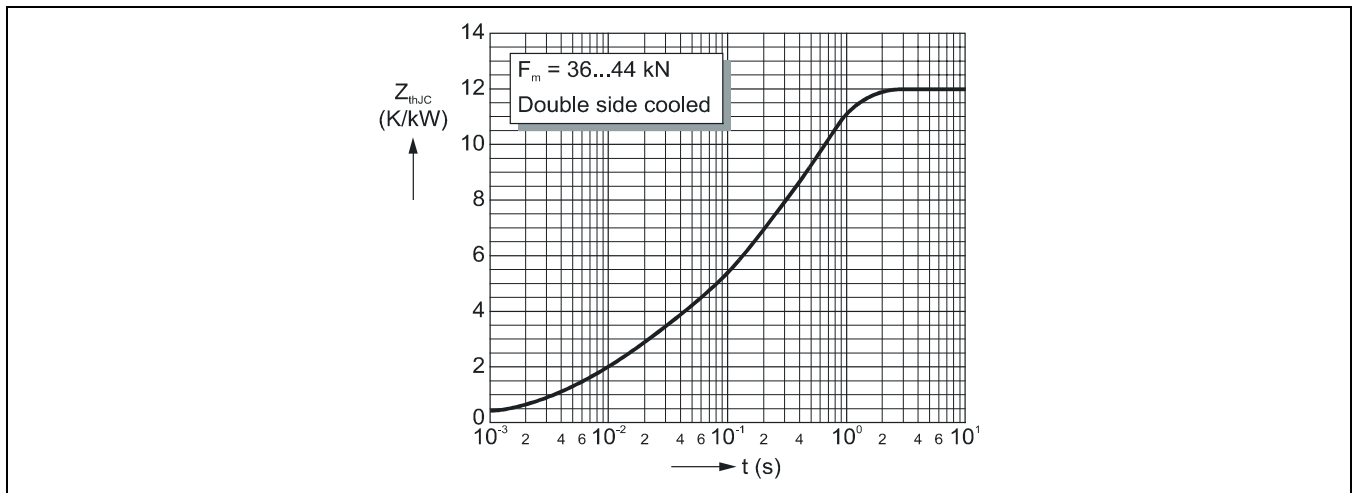


Fig. 1 Transient thermal impedance (junction-to-case) vs. time in analytical and graphical form (max. values).

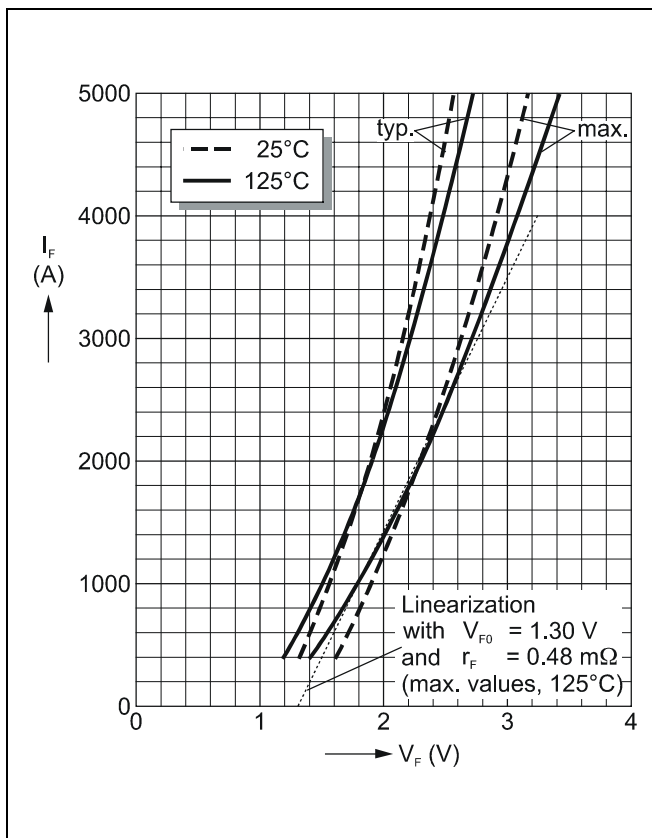


Fig. 2 Forward current vs. forward voltage (typ. and max. values) and linear approximation of max. curve at 125°C.

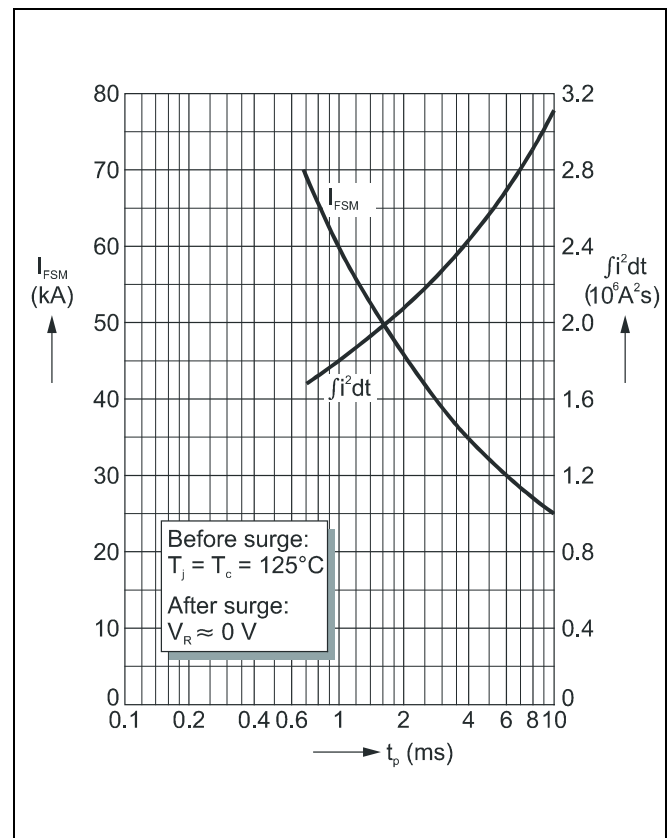


Fig. 3 Surge current and fusing integral vs. pulse width (max. values) for non-repetitive, half-sinusoidal surge current pulses.

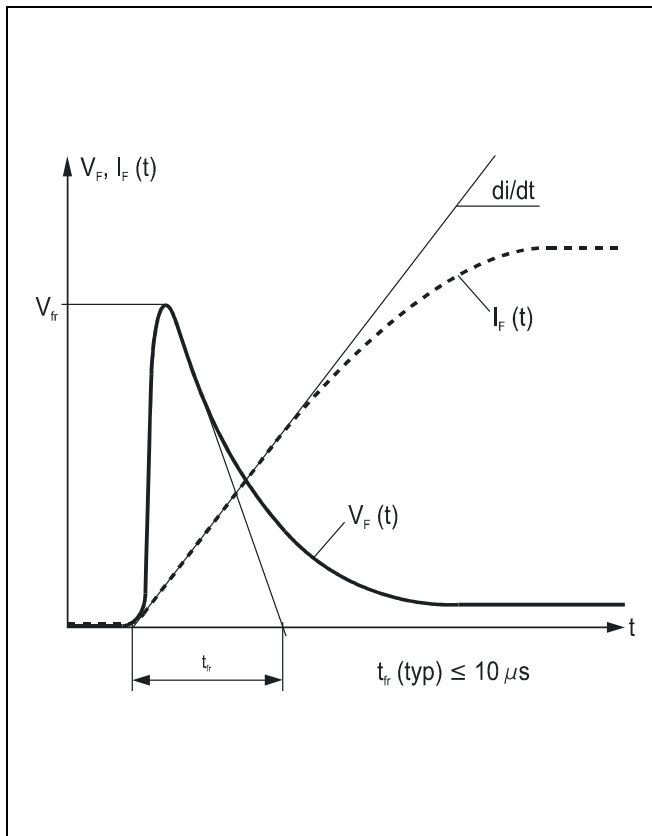


Fig. 4 Typical forward voltage waveform when the diode is turned on with a high di/dt .

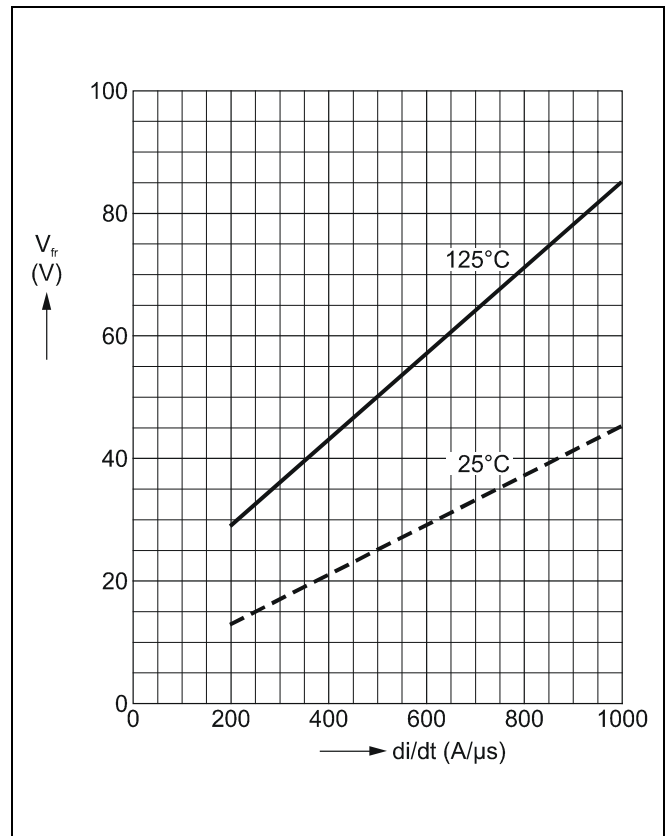


Fig. 5 Forward recovery voltage vs. turn-on di/dt (max. values).

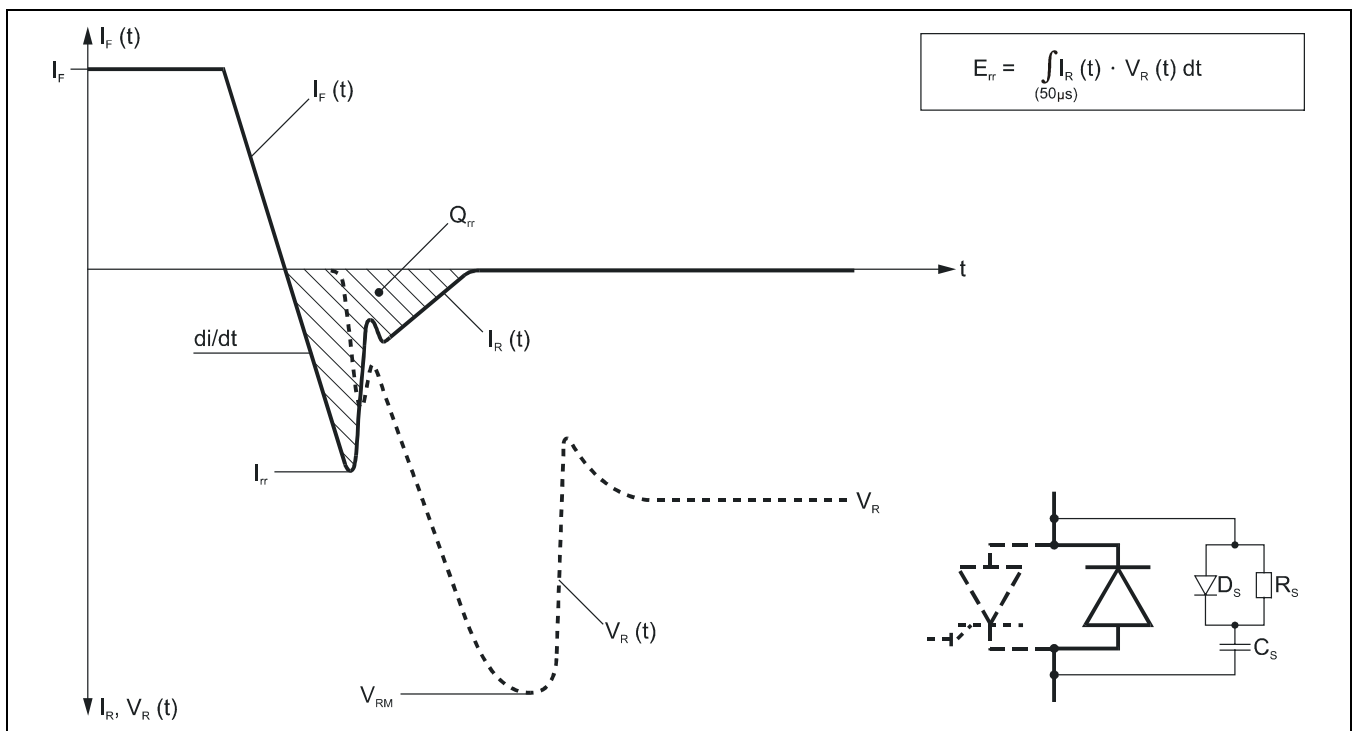


Fig. 6 Typical current and voltage waveforms at turn-off when the diode is connected to an RCD snubber, as often used in GTO circuits.

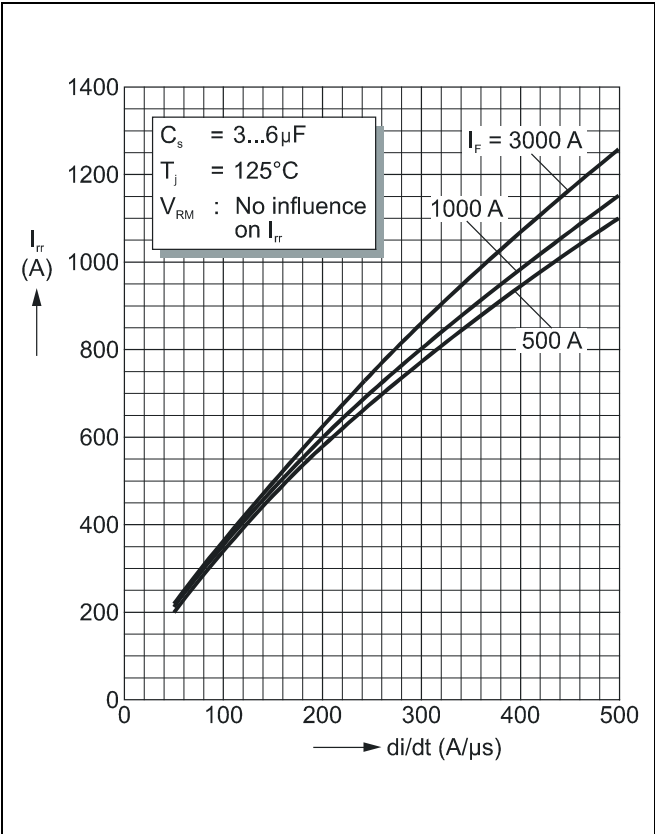


Fig. 7 Reverse recovery current vs. turn off di/dt (max. values).

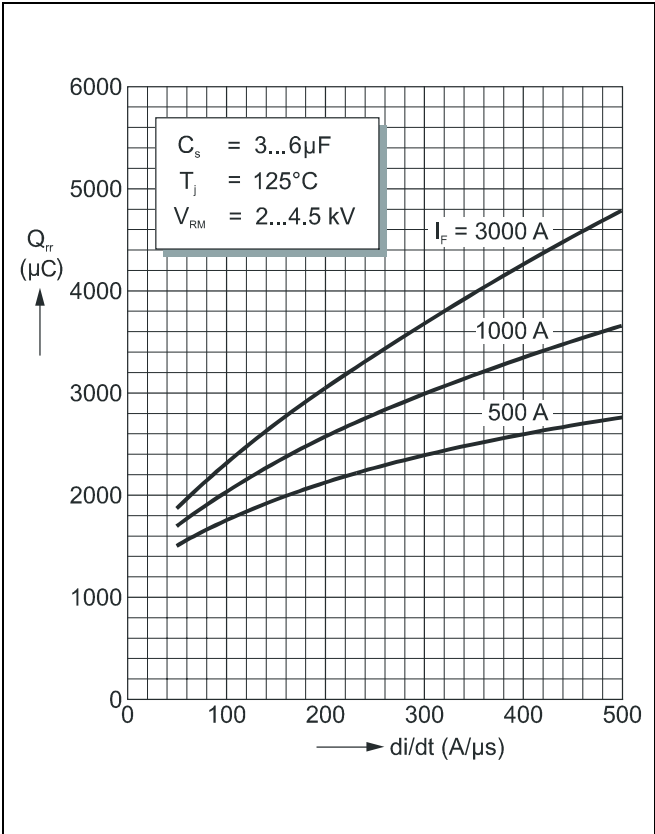


Fig. 8 Reverse recovery charge vs. turn off di/dt (max. values).

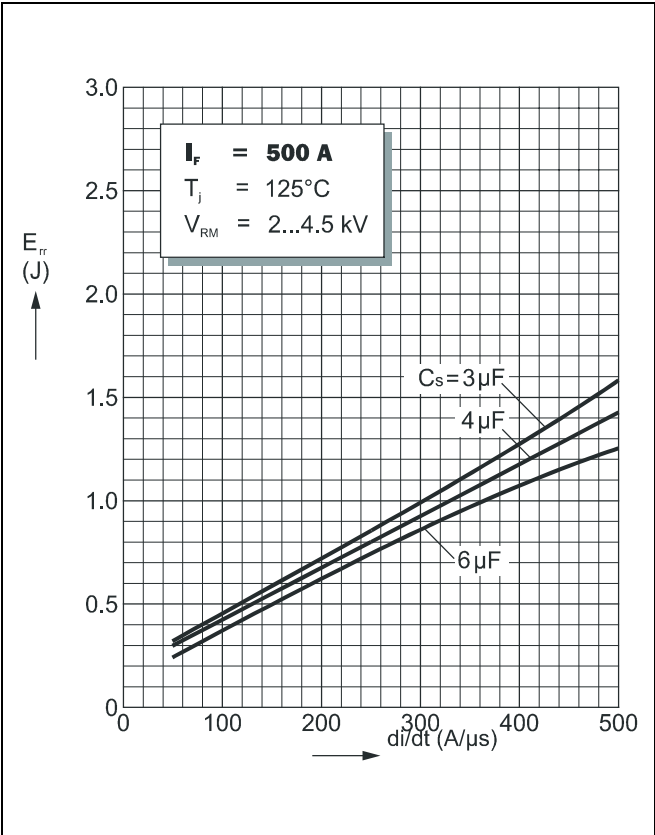


Fig. 9 Turn-off energy vs. turn-off di/dt for $I_F = 500$ A (max. values).

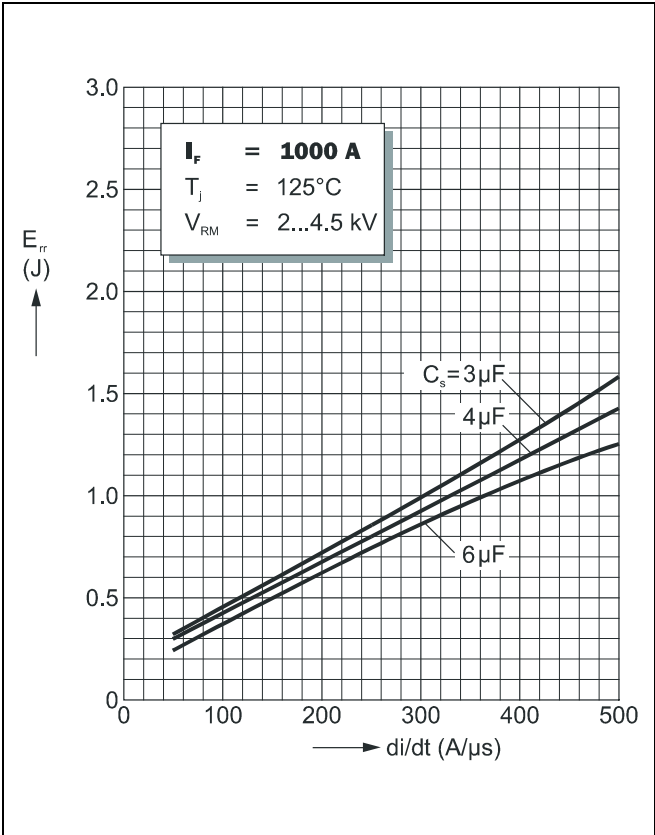


Fig. 10 Turn-off energy vs. turn-off di/dt for $I_F = 1000$ A (max. values).

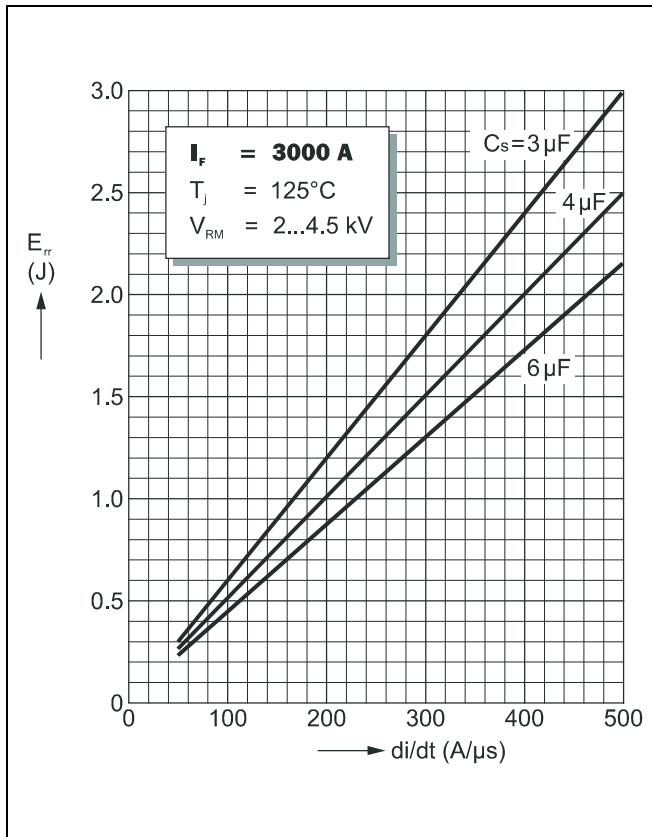


Fig. 11 Turn-off energy vs. turn-off di/dt for $I_F = 3000$ A (max. values).

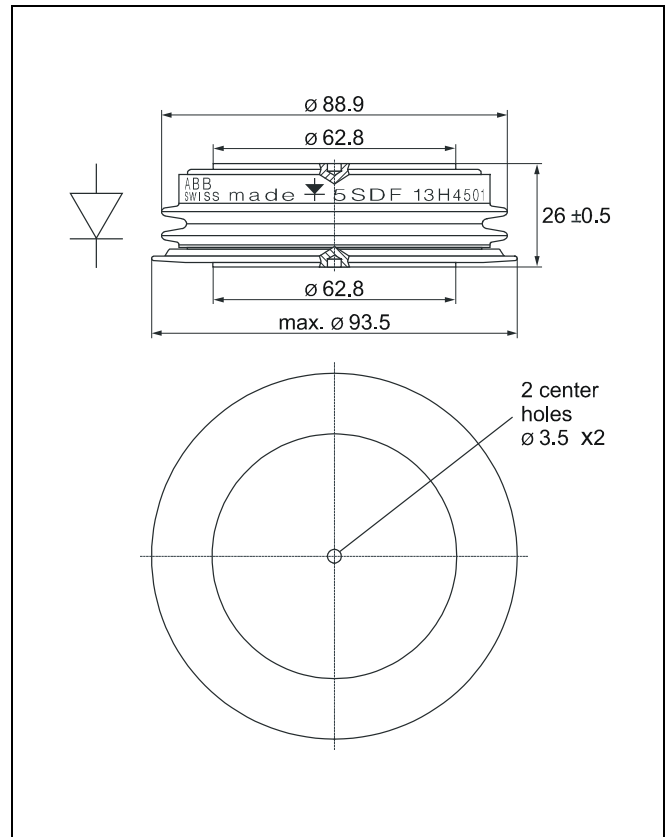


Fig. 12 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

ABB Semiconductors AG reserves the right to change specifications without notice.

ABB

ABB Semiconductors AG
 Fabrikstrasse 3
 CH-5600 Lenzburg, Switzerland

Telephone +41 (0)62 888 6419
 Fax +41 (0)62 888 6306
 Email abbsem@ch.abb.com
 Internet www.abbsem.com