

$V_{RRM}$  = 2500 V  
 $I_{FAVM}$  = 420 A  
 $I_{FSM}$  = 8.5 kA  
 $V_{F0}$  = 1.7 V  
 $r_F$  = 0.62 mΩ  
 $V_{DClink}$  = 1500 V

# Fast Recovery Diode

# 5SDF 05D2505

Doc. No. 5SYA1114-03 Sep. 01

- Patented free-floating silicon technology
- Low on-state and switching losses
- Optimized for use as freewheeling diode in GTO converters
- Standard press-pack housing, hermetically cold-welded
- Cosmic radiation withstand rating

## Blocking

$V_{RRM}$	Repetitive peak reverse voltage	2500 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	1500 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.	10 kN	
		max.	12 kN	
$a$	Acceleration: Device unclamped Device clamped		50 m/s <sup>2</sup> 200 m/s <sup>2</sup>	
$m$	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	420 A	Half sine wave, $T_c = 85^\circ C$					
$I_{FRMS}$	Max. RMS on-state current	670 A						
$I_{FSM}$	Max. peak non-repetitive surge current	8.5 kA	$tp = 10$ ms	Before surge: $T_c = T_j = 125^\circ C$	After surge: $V_R \approx 0 V$			
		27 kA	$tp = 1$ ms					
$\int I^2 dt$	Max. surge current integral	$0.36 \cdot 10^6 A^2 s$	$tp = 10$ ms	Approximation for $T_j = 125^\circ C$				
		$0.36 \cdot 10^6 A^2 s$	$tp = 1$ ms					
$V_F$	Forward voltage drop	$\leq 2.3$ V	$I_F = 1000$ A					
$V_{FO}$	Threshold voltage	1.7 V						
$r_F$	Slope resistance	0.62 m $\Omega$	$I_F = 500 \dots 3500$ A					

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

$V_{fr}$	Peak forward recovery voltage	$\leq 16$ V	$di/dt = 500 A/\mu s, T_j = 125^\circ C$
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**Turn-off** (see Fig. 6 to 11)

$I_{rr}$	Reverse recovery current	$\leq 470$ A	$di/dt = 300 A/\mu s, I_F = 700$ A,
$Q_{rr}$	Reverse recovery charge	$\leq 840 \mu C$	$T_j = 125^\circ C, V_{RM} = 2300$ V,
$E_{rr}$	Turn-off energy	$\leq 0.34$ J	$C_S = 2\mu F$ (GTO snubber circuit)

**Thermal** (see Fig. 1)

$T_j$	Operating junction temperature range	$-40 \dots 125^\circ C$		
$T_{stg}$	Storage temperature range	$-40 \dots 125^\circ C$		
$R_{thJC}$	Thermal resistance junction to case	$\leq 80$ K/kW	Anode side cooled	$F_m = 10 \dots 12$ kN
		$\leq 80$ K/kW	Cathode side cooled	
		$\leq 40$ K/kW	Double side cooled	
$R_{thCH}$	Thermal resistance case to heatsink	$\leq 16$ K/kW	Single side cooled	
		$\leq 8$ 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
$R_i$ (K/kW)	20.95	10.57	7.15	1.33
$\tau_i$ (s)	0.396	0.072	0.009	0.0044
$F_m = 10 \dots 12$ kN Double side cooled				

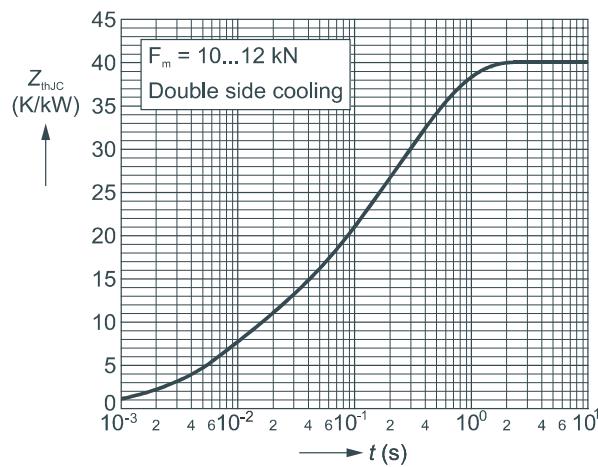


Fig. 1 Transient thermal impedance (junction-to-case) vs. time in analytical and graphical form (max. values).

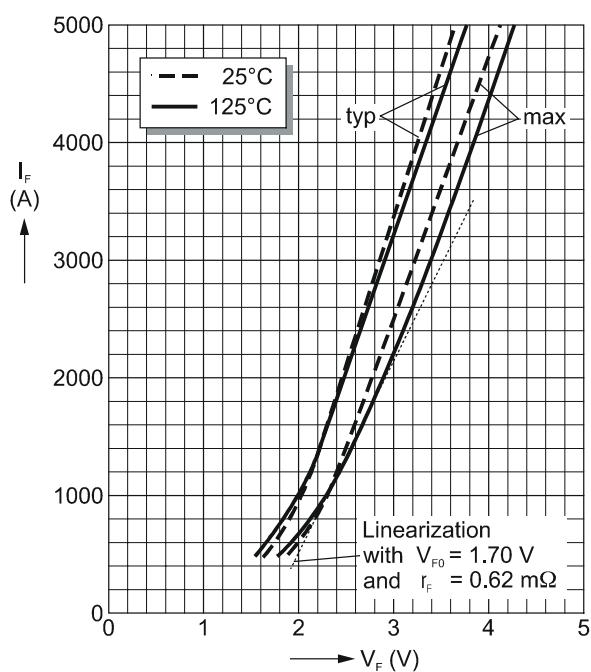


Fig. 2 Forward current vs. forward voltage (typ. and max. values) and linear approximation of max. curve at  $125^\circ\text{C}$ .

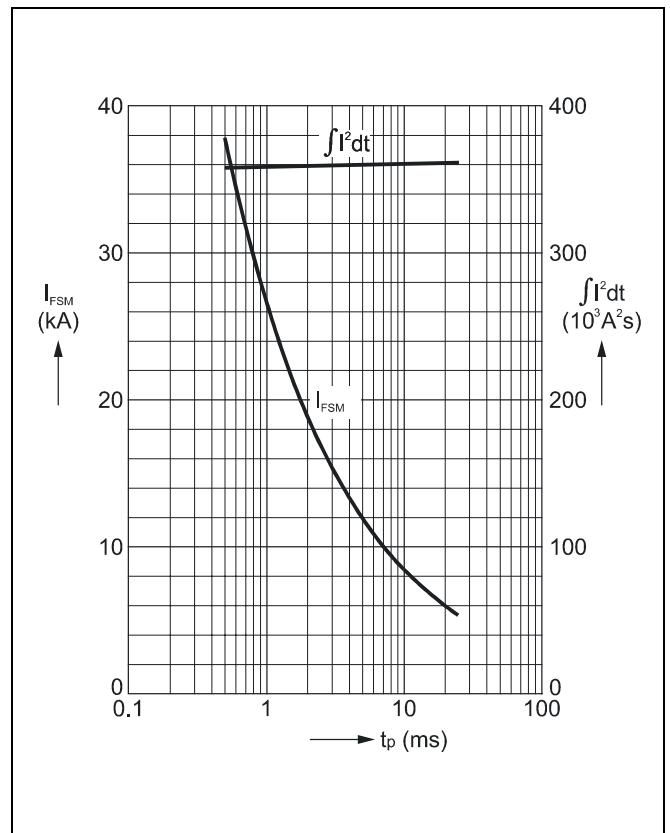


Fig. 3 Surge current and fusing integral vs. pulse width (max. values) for non-repetitive, half-sinusoidal surge current pulses.

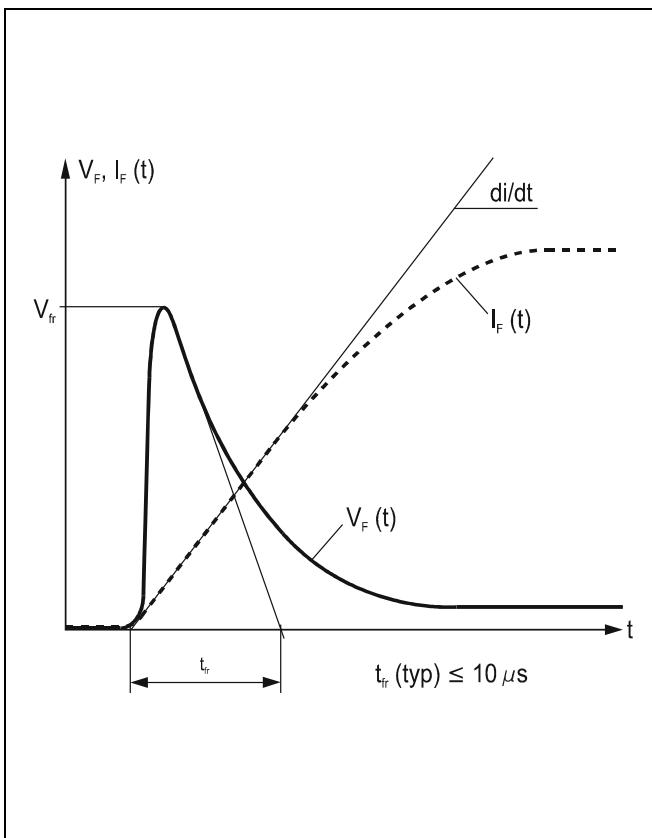


Fig. 4 Typical forward voltage waveform when the diode is turned on with a high  $di/dt$ .

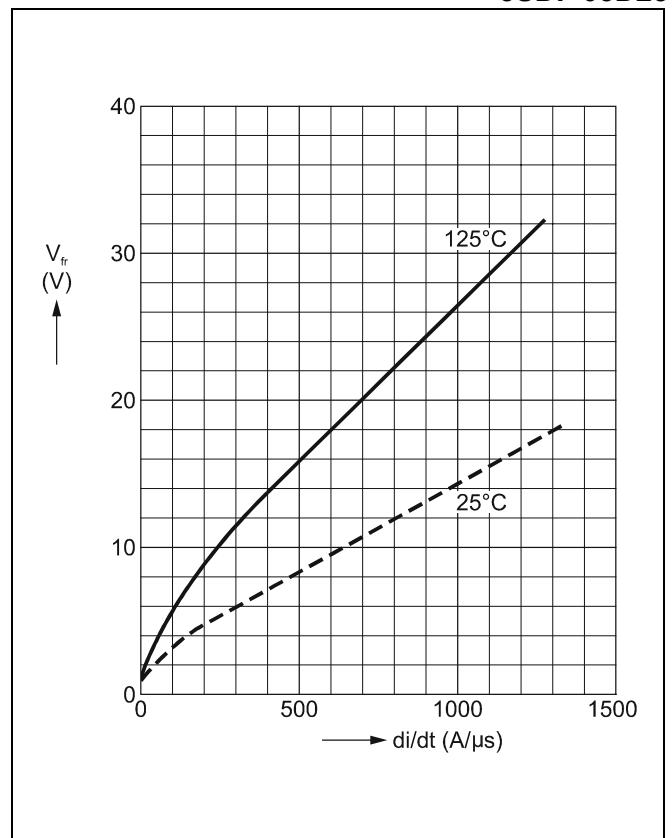


Fig. 5 Forward recovery voltage vs. turn-on  $di/dt$  (max. values).

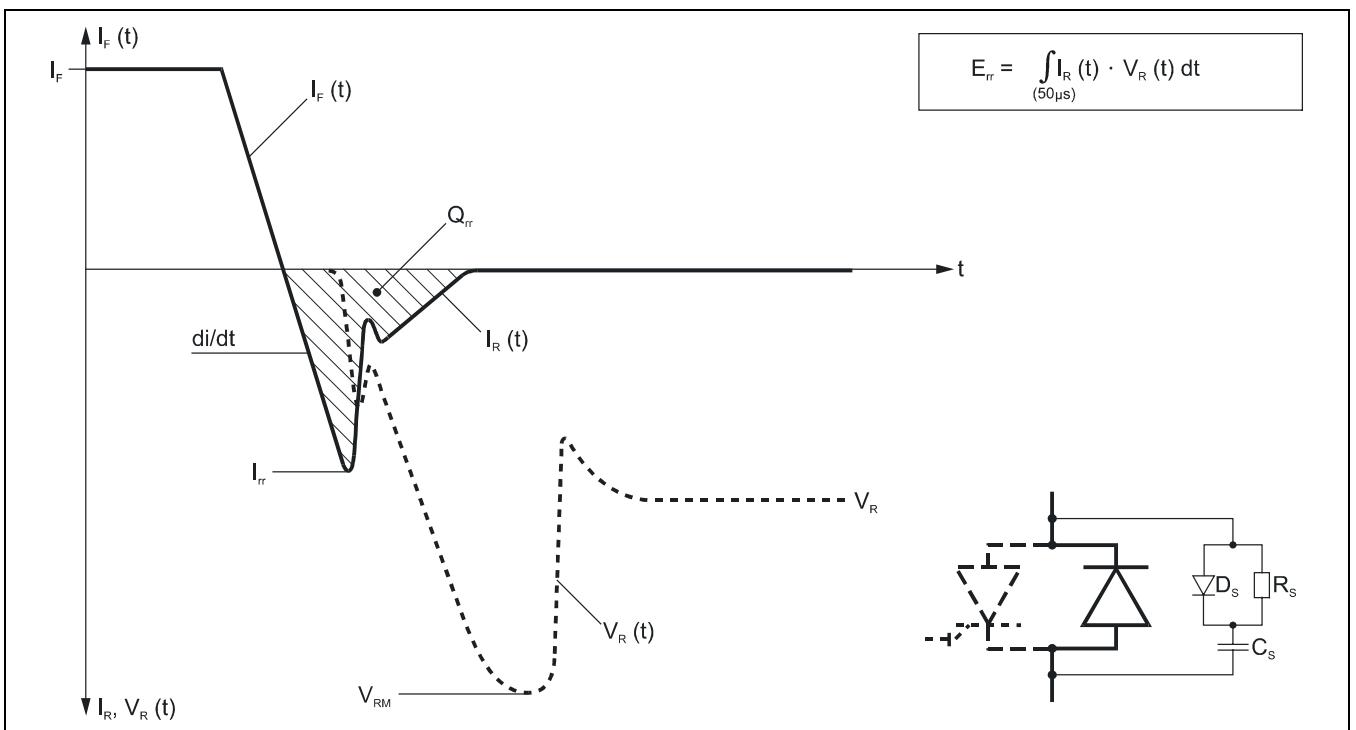


Fig. 6 Typical current and voltage waveforms at turn-off when the diode is connected to an RCD snubber, as often used in GTO circuits.

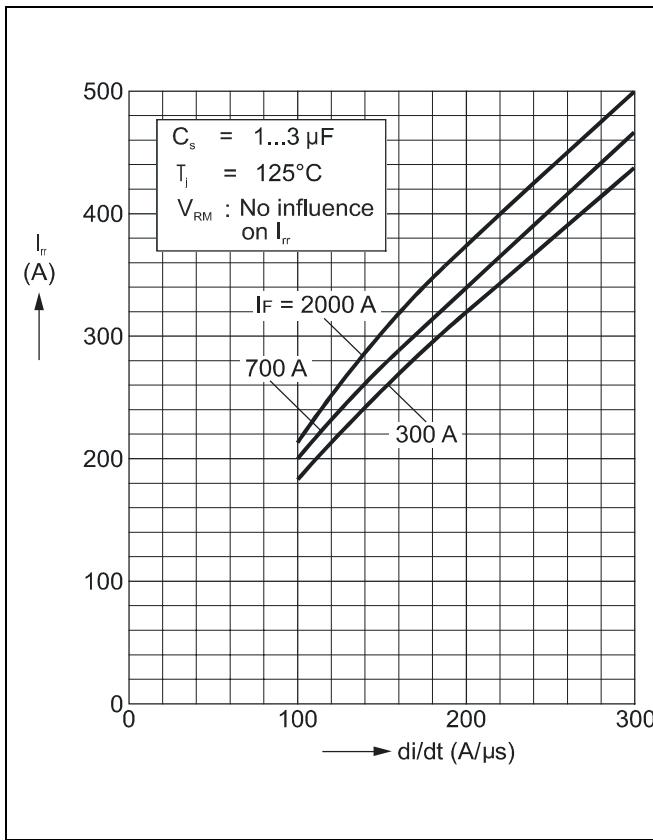


Fig. 7 Reverse recovery current vs. turn off  $di/dt$  (max. values).

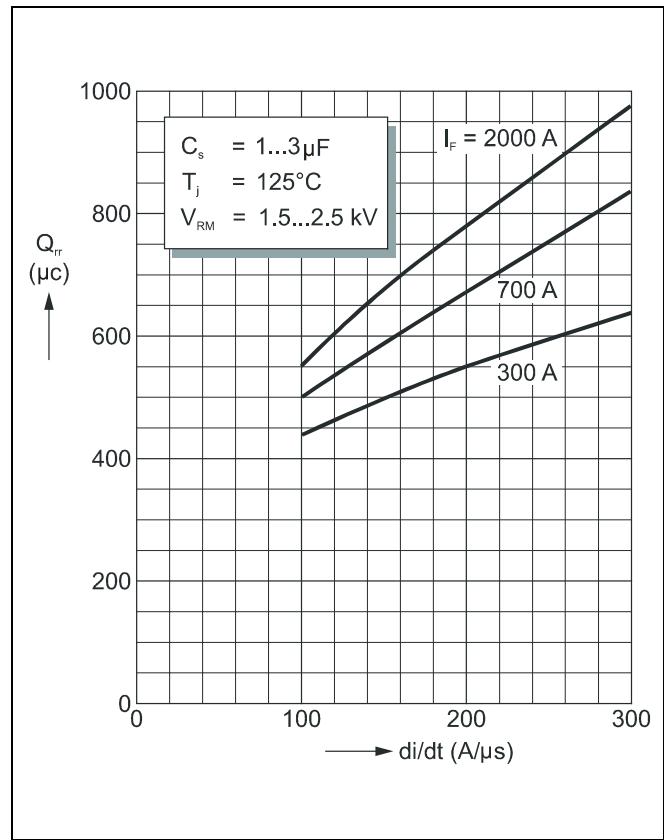


Fig. 8 Reverse recovery charge vs. turn off  $di/dt$  (max. values).

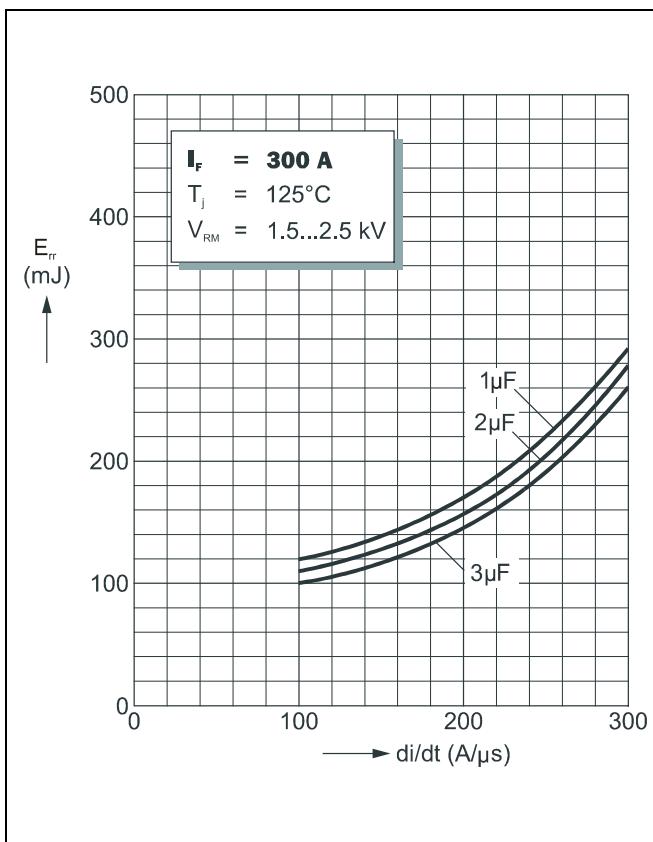


Fig. 9 Turn-off energy vs. turn-off  $di/dt$  for  $I_F = 300 A$  (max. values).

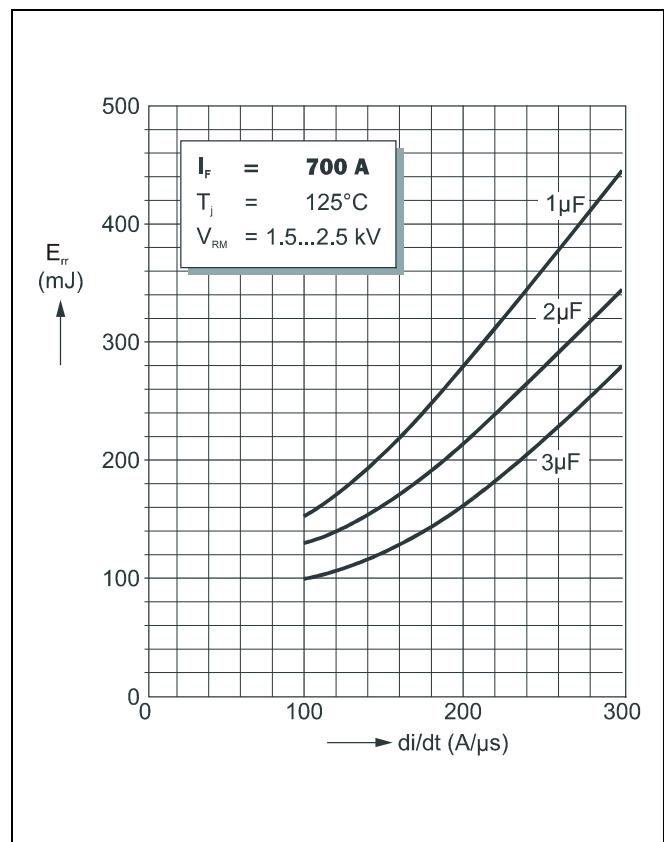


Fig. 10 Turn-off energy vs. turn-off  $di/dt$  for  $I_F = 700 A$  (max. values).

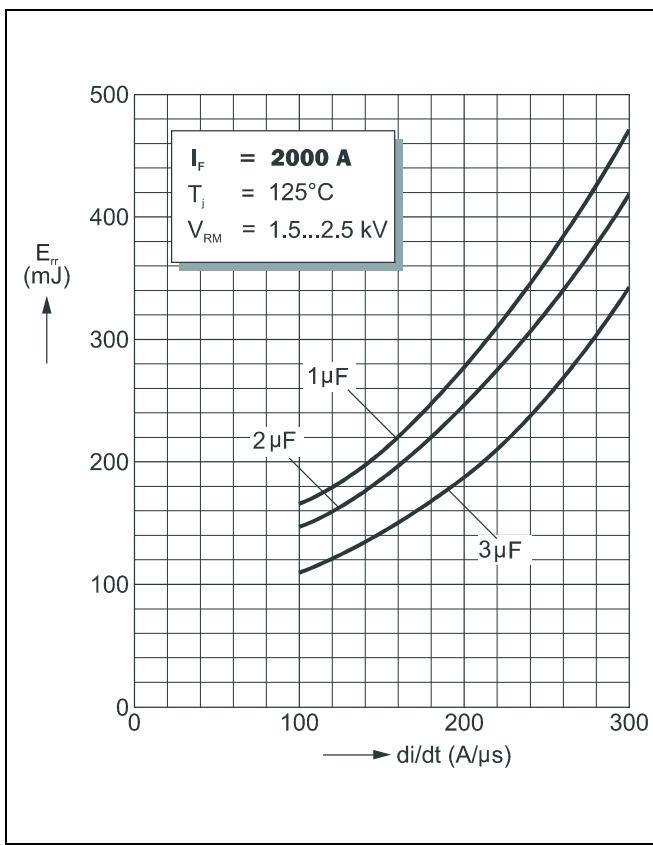


Fig. 11 Turn-off energy vs. turn-off  $di/dt$  for  $I_F = 2000$  A (max. values).

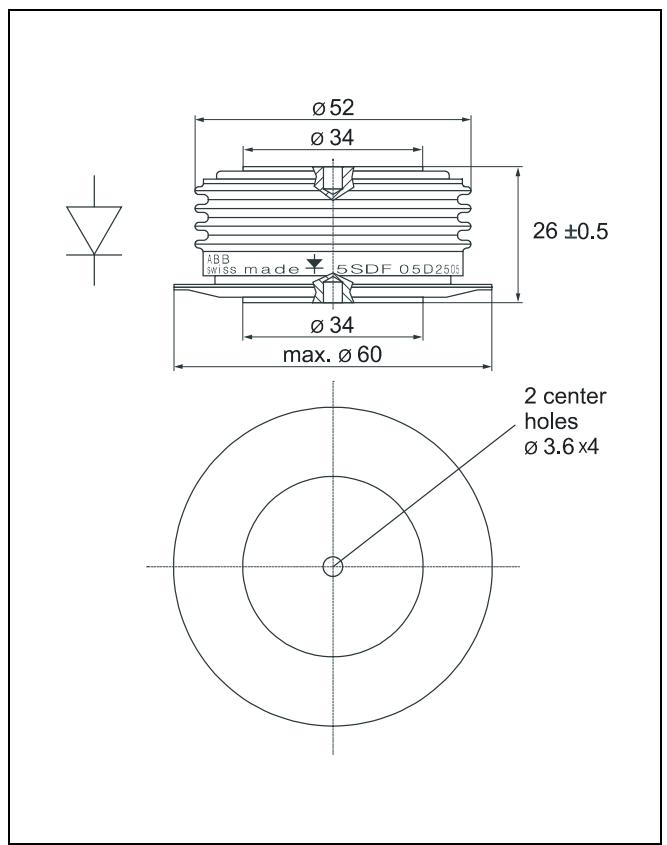


Fig. 12 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

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