V_{RRM}	=	4500 V
I_{FAVM}	=	1300 A
I_{FRMS}	=	2000 A
I_{FSM}	=	33 kA
V_{F0}	=	2.00 V
r_F	=	0.55 mΩ
V_{DClink}	=	2800 V

Fast Recovery Diode for IGCT applications

5SDF 16L4502

MARKETING INFORMATION

Doc. No. 5SYA 1153-00 Feb. 99

- **Patented free-floating silicon technology**
- **Industry standard housing**
- **Cosmic radiation withstand rating**
- **Low on-state and switching losses**
- **Optimized to use in snubberless operation**

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	T_j = 115 °C	$V_R = V_{RRM}$
V_{DClink}	Permanent DC voltage for 100 FIT failure rate	2800 3200	V V	100% Duty 5% Duty	Ambient cosmic radiation at sea level in open air.

Mechanical

F_M	Mounting force	min.	36 kN
		max.	70 kN
a	Acceleration: Device unclamped Device clamped		 50 m/s^2 200 m/s^2
m	Weight		1.45 kg
D_S	Surface creepage distance		35 mm
D_a	Air strike distance		14 mm

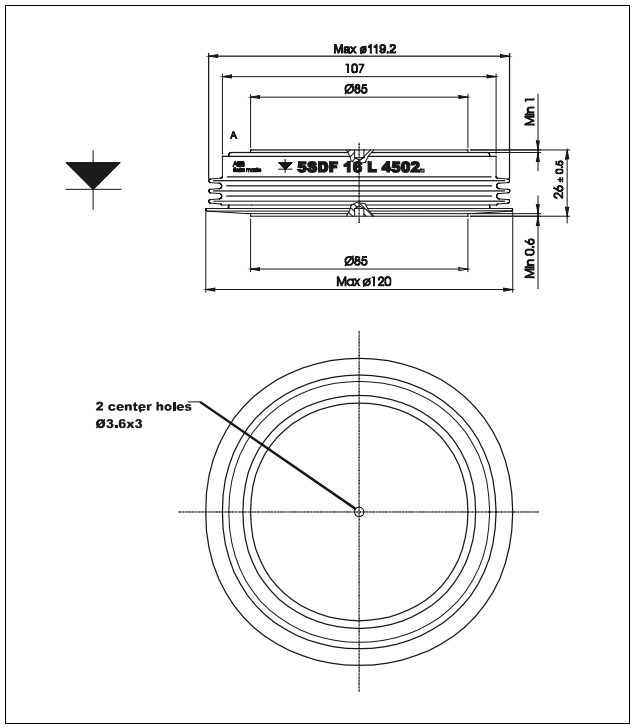


Fig. 1
Outline drawing.
All dimensions are in millimeters and represent nominal values unless stated otherwise.

On-state

I_{FAVM}	Max. average on-state current	1300 A	Half sine wave, T_c = 70 °C	
I_{FRMS}	Max. RMS on-state current	2000 A		
I_{FSM}	Max. peak non-repetitive surge current	33 kA	t_p = 10 ms	Before surge
		115 kA	t_p = 1 ms	T_j = 115 °C
$\int I^2dt$	Max. surge current integral	$5.45 \cdot 10^6$ A^2s	t_p = 10 ms	After surge:
		$6.6 \cdot 10^6$ A^2s	t_p = 1 ms	$V_R \approx 0V$
V_F	Forward voltage drop	≤ 4.20 V	I_F = 4000 A	
V_{F0}	Threshold voltage	2.00 V	Approximation for	T_j = 115 °C
r_F	Slope resistance	0.55 mΩ	I_F = 800…5000 A	

Turn-on

V_{fr}	Peak forward recovery voltage	≤ 30 V	di/dt = 500 A/µs, T_j = 115 °C

Turn-off

di/dt_{crit}	Max. decay rate of on-state current	≤ 1000 A/µs	I_F = 4000 A, T_j = 115 °C V_{DClink} = 2700 V
I_{rr}	Reverse recovery current	≤ 1500 A	I_F = 4000 A, V_{DClink} = 2700 V di/dt = 1000 A/µs, T_j = 115 °C
Q_{rr}	Reverse recovery charge	≤ 7000 µC	

Thermal

T_j	Operating junction temperature range	-40...115 °C		
T_{stg}	Storage temperature range	-40…125 °C		
R_{thJC}	Thermal resistance junction to case	≤ 18 K/kW	Anode side cooled	F_M = 36…44 kN
		≤ 18 K/kW	Cathode side cooled	
		≤ 9 K/kW	Double side cooled	
R_{thCH}	Thermal resistance case to heatsink	≤ 5 K/kW	Single side cooled	
		≤ 2.5 K/kW	Double side cooled	

On-state characteristics

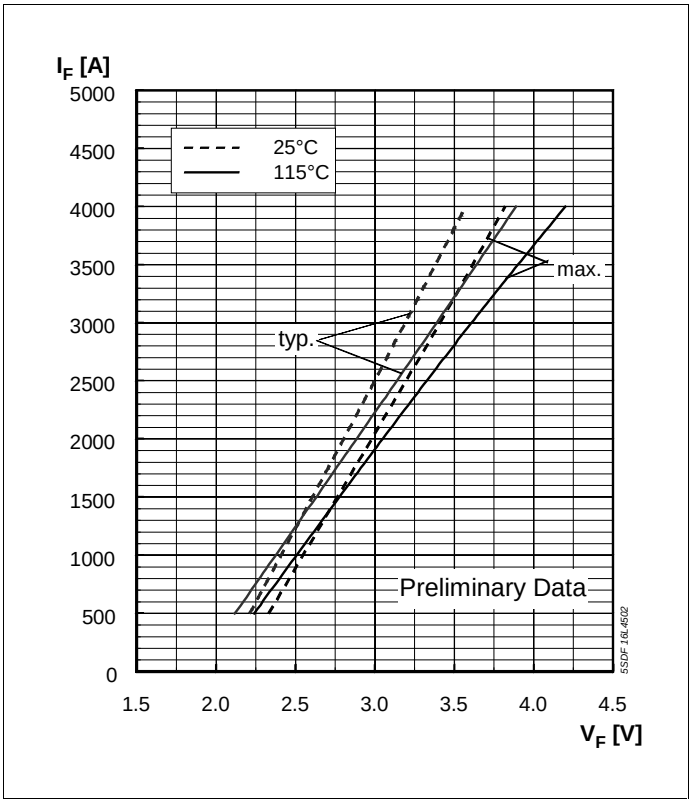


Fig. 2 Forward current vs. forward voltage (typ. and max. values).

Surge current characteristics

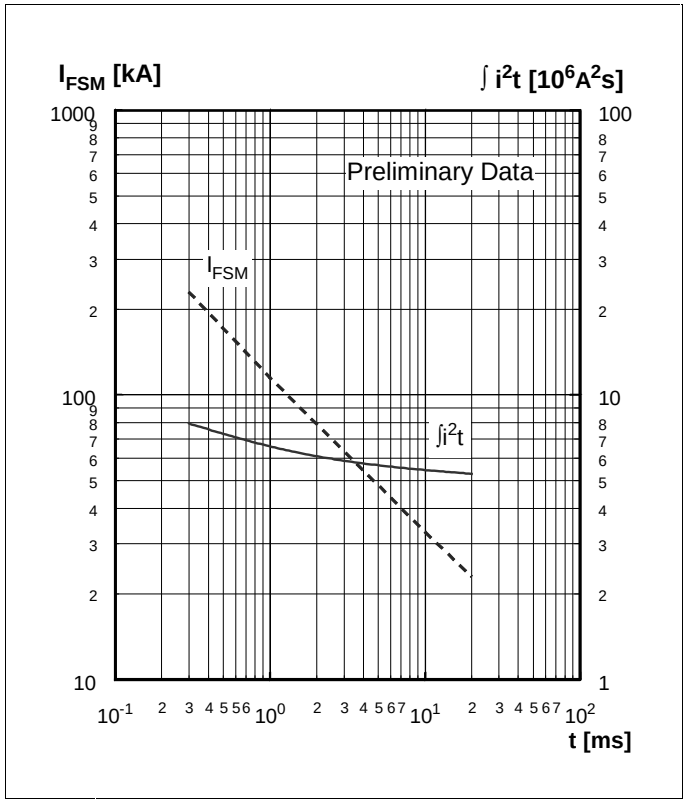


Fig. 3 Surge current and fusing integral vs. pulse width (max. values) for non-repetitive, half-sinusoidal surge current pulses.

Turn-on characteristics

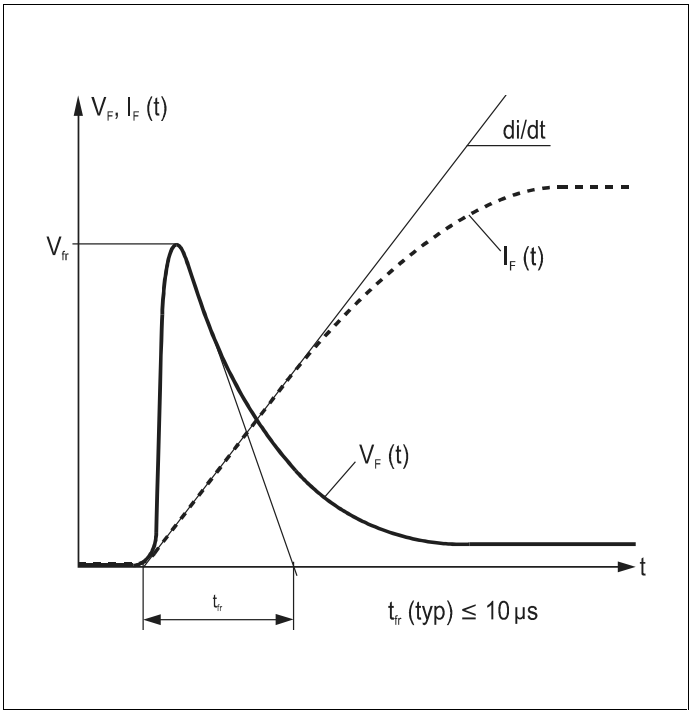


Fig. 4 Typical forward voltage waveform when the diode is turned on with a high di/dt

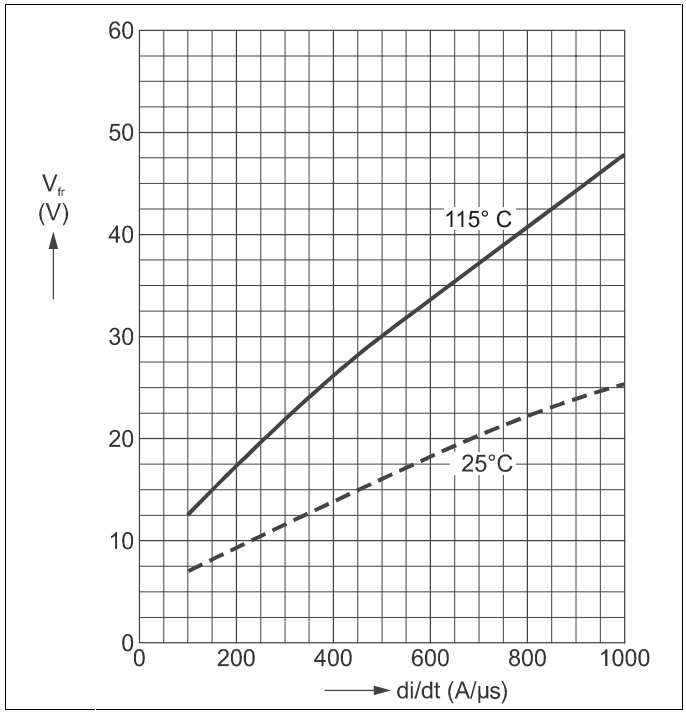


Fig. 5 Forward recovery voltage vs. turn-on di/dt (max. values)

Turn-off characteristics

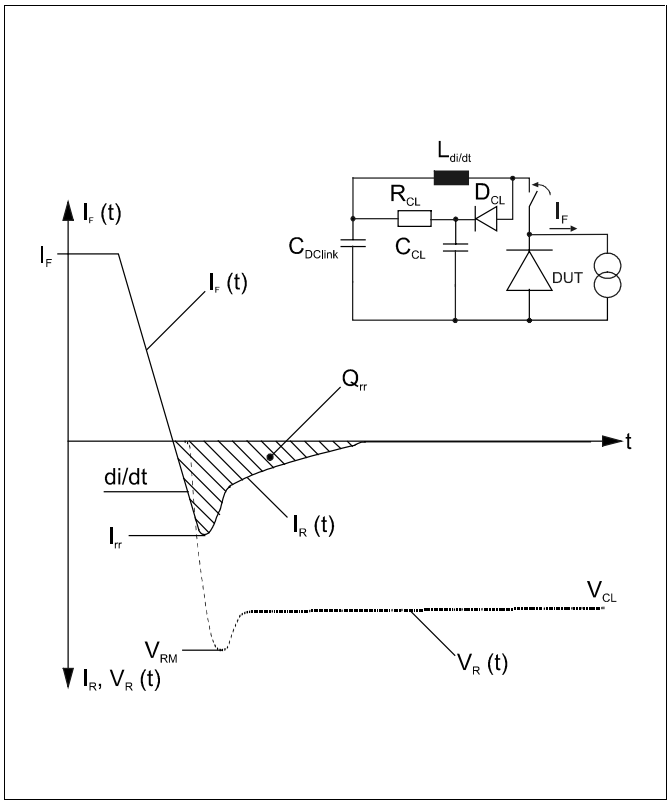


Fig. 6 Typical current and voltage waveforms at turn-off in a circuit with voltage clamp.

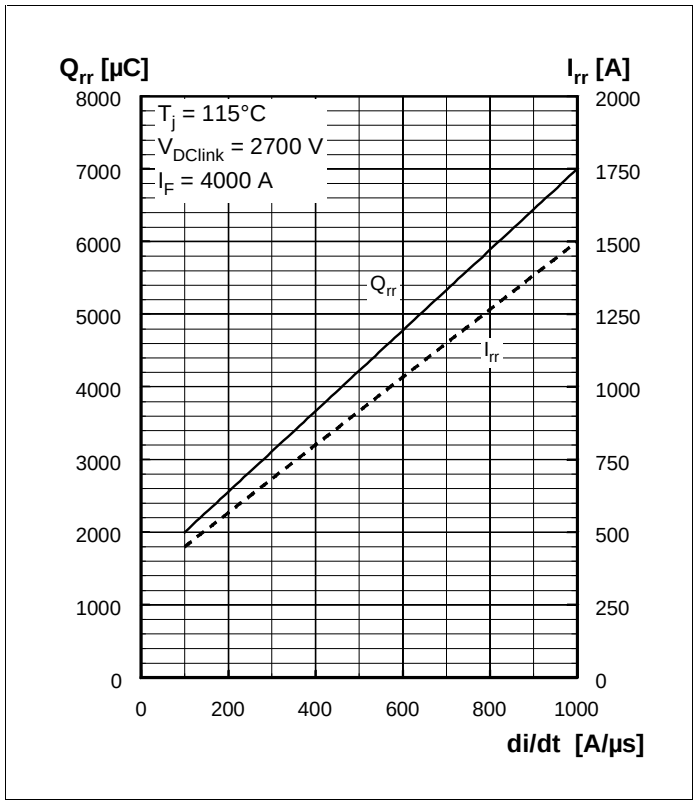
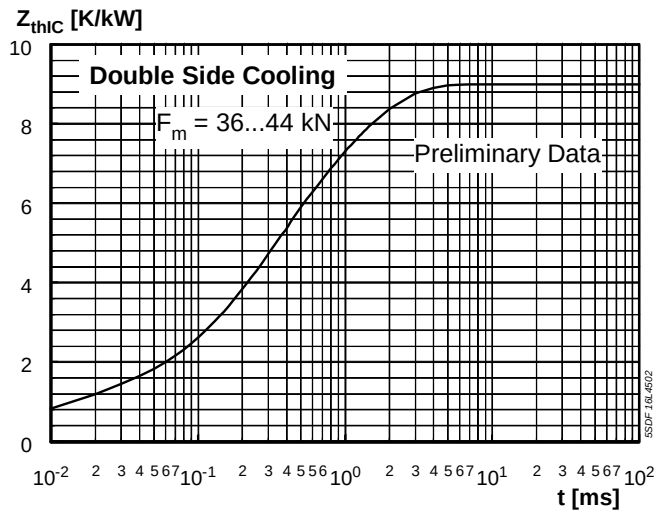


Fig. 7 Reverse recovery current and reverse recovery charge vs. di/dt (max. values).

Thermal characteristics



$$Z_{thJC}(t) = \sum_{i=1}^{4} R_i(1 - e^{-t/\tau_i})$$

i	1	2	3	4
R_I (K/kW)	4.40	3.70	0.70	0.20
τ_i (s)	0.9648	0.2286	0.0092	0.0001

F_M = 36… 44 kN

Double side cooled

Fig. 8 Transient thermal impedance (junction-to-case) vs. time in analytical and graphical forms (max. values).

ABB Semiconductors AG
Fabrikstrasse 2
CH-5600 Lenzburg, Switzerland

Tel: +41 (0)62 888 6419
Fax: +41 (0)62 888 6306
E-mail info@ch.abb.com
Internet www.abbsem.com

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