5SDF 11H4505

Old part no. DC 889-1100-45

Fast Recovery Diode

Properties

- Optimized soft recovery characteristics
- Enhanced Safe Operating Area
- Industry standard housing
- Cosmic radiation withstand rating

Applications

- suited for IGCT or GTO applications
- Snubber and clamp diode
- Freewheeling diode

Key Parameters

V_{RRM}	=	4 500	V
I_{FAVm}	=	1 340	A
I_{FSM}	=	23 000	A
V_{TO}	=	2.429	V
r_T	=	0.645	mΩ

5SDF 11H4505	**4 500 V**
Conditions:	*T_j = -40 ÷ 140 °C, half sine waveform, f = 50 Hz*

Mechanical Data

F_m	**Mounting force**	**40 ± 5 kN**
m	**Weight**	**0.9 kg**
D_S	**Surface creepage distance**	**40 mm**
D_a	**Air strike distance**	**20 mm**

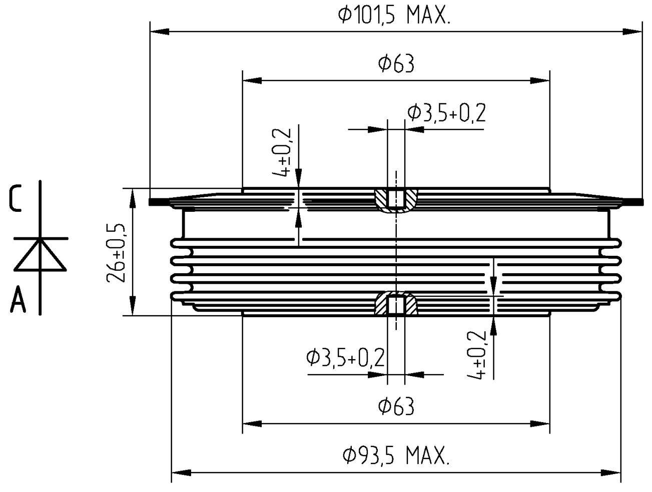

Fig. 1 Case

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Maximum Ratings			*Maximum Limits*	*Unit*
V_{RRM}	**Repetitive peak reverse voltage** *T_j = -40 ÷ 140 °C*		**4 500**	**V**
$V_{DC\ link}$	**Permanent DC voltage for 100 FIT failure rate** *Ambient cosmic radiation at sea level in open air*		**2 800**	**V**
I_{FAVm}	**Average forward current** *T_c = 85 °C*		**1 340**	**A**
I_{FRMS}	**RMS forward current** *T_c = 85 °C*		**2 105**	**A**
I_{RRM}	**Repetitive reverse current** *$V_R = V_{RRM}$*		**100**	**mA**
I_{FSM}	**Non repetitive peak surge current** *V_R = 0 V, half sine pulse*	*t_p = 8.3 ms*	**24 600**	**A**
		t_p = 10 ms	**23 000**	**A**
I^2t	**Limiting load integral** *V_R = 0 V, half sine pulse*	*t_p = 8.3 ms*	**2 505 000**	**A^2s**
		t_p = 10 ms	**2 645 000**	**A^2s**
P_{rrM}	**Reverse recovery maximum power**		**8.0**	**MW**
T_{jmin} - T_{jmax}	**Operating temperature range**		**-40 ÷ 140**	**°C**
T_{STG}	**Storage temperature range**		**-40 ÷ 140**	**°C**

Unless otherwise specified T_j = 140 °C

Forward characteristics		**_Value_**			**_Unit_**
		min	**_typ_**	**_max_**	
V_{T0}	**Threshold voltage**			**2.429**	**V**
r_T	**Forward slope resistance** *I_{F1} = 2 042 A, I_{F2} = 6 126 A*			**0.645**	**mΩ**
V_{FM}	**Maximum forward voltage** *I_{FM} = 2 000 A*			**3.710**	**V**

Unless otherwise specified T_j = 140 °C

Forward recovery characteristics			**_Value_**			**_Unit_**
			min	**_typ_**	**_max_**	
V_{fr}	**Forward recovery voltage**	*di_F/dt = 650 A/µs* *di_F/dt = 1 000 A/µs*			**75** **103**	**V**

Unless otherwise specified T_j = 140 °C

Reverse recovery characteristics			**_Value_**			**_Unit_**
			min	**_typ_**	**_max_**	
P_{rrM}	**Reverse recovery maximum power** *I_{FM} = 2 500 A, V_R = 2 800 V* *clamp circuit:* *L_{CL} ≤ 0.35 µH, C_{CL} = 10 µF*	*di_F/dt = -1 000 A/µs* *di_F/dt = -650 A/µs*			**5.5** **4.7**	**MW**
Q_{rr}	**Recovered charge** *the same conditions as at P_{rrM}*	*di_F/dt = -1 000 A/µs* *di_F/dt = -650 A/µs*			**3 500** **2 690**	**µC**
I_{rrM}	**Reverse recovery maximum current** *the same conditions as at P_{rrM}*	*di_F/dt = -1 000 A/µs* *di_F/dt = -650 A/µs*			**1 500** **1 170**	**A**
W_{rr}	**Reverse recovery energy** *the same conditions as at P_{rrM}*	*di_F/dt = -1 000 A/µs* *di_F/dt = -650 A/µs*			**7.0** **5.8**	**J**
Q_{rr3}	**Recovered charge** *I_{FM} = 2 000 A, di_F/dt = -80 A/µs, V_R = 100 V*			**550**	**600**	**µC**
I_{rrM3}	**Reverse recovery maximum current** *the same conditions as at Q_{rr3}*			**150**	**180**	**A**
t_{rr3}	**Reverse recovery time** *the same conditions as at Q_{rr3}*				**5.0**	**µs**

Unless otherwise specified T_j = 140 °C

Thermal Parameters			**Value**	**Unit**
R_{thjc}	**Thermal resistance junction to case**	*double side cooling*	**8.0**	**K/kW**
		anode side cooling	**14.5**	
		cathode side cooling	**18.0**	
R_{thch}	**Thermal resistance case to heatsink**	*double side cooling*	**2.5**	**K/kW**
		single side cooling	**5.0**	

Transient Thermal Impedance

Analytical function for transient thermal impedance

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

Conditions:

F_m = 45 ± 5 kN, Double side cooled

Correction for periodic waveforms

180°	**sine:**	**1.0**	**K/kW**
120°	**sine:**	**1.5**	**K/kW**
60°	**sine:**	**2.5**	**K/kW**
180°	**rectangular:**	**0.9**	**K/kW**
120°	**rectangular:**	**1.5**	**K/kW**
60°	**rectangular:**	**2.5**	**K/kW**

i	1	2	3	4
τ_i (s)	0.4406	0.1045	0.0092	0.0022
R_i(K/kW)	4.533	2.255	0.868	0.345

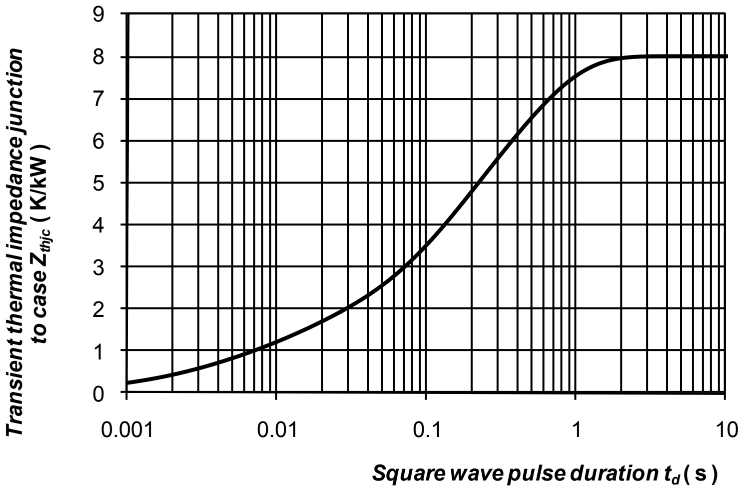

Fig. 2 Dependence transient thermal impedance junction to case on square pulse

Forward Characteristics

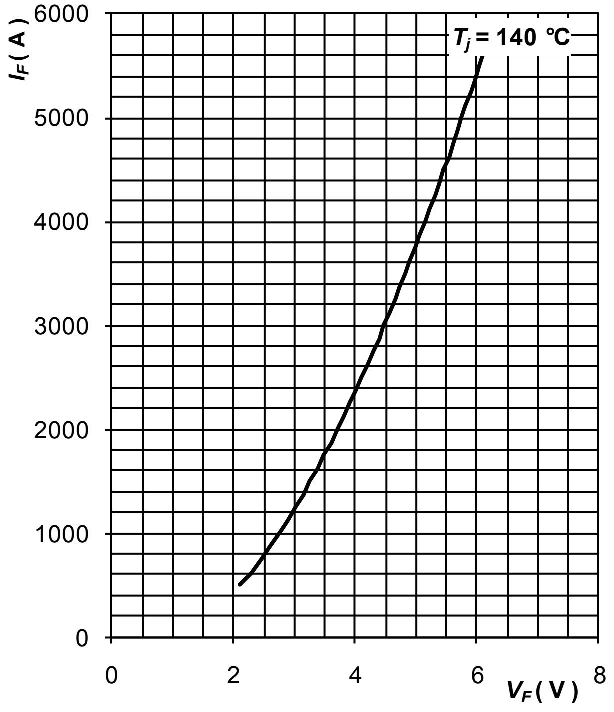

Fig. 3 Maximum forward voltage drop characteristics

Surge Characteristics

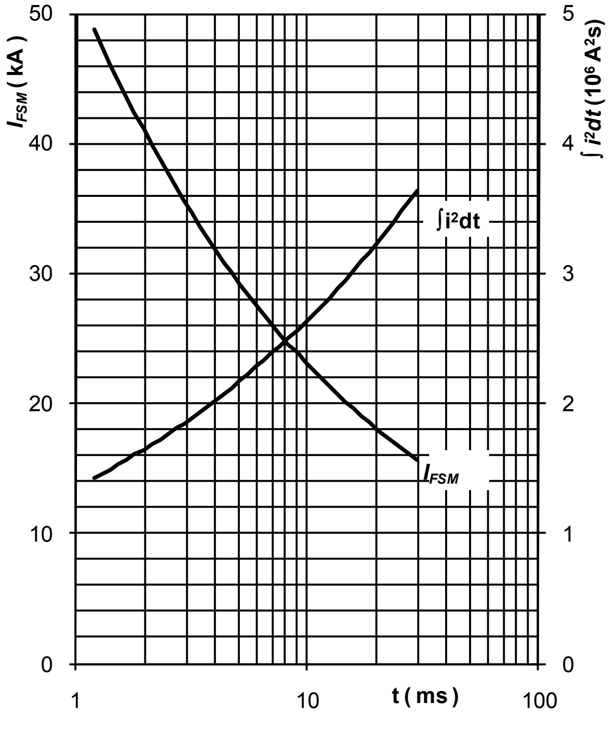

Fig. 4 Surge forward current vs. pulse length, half sine wave, single pulse, V_R = 0 V, T_j = T_{jmax}

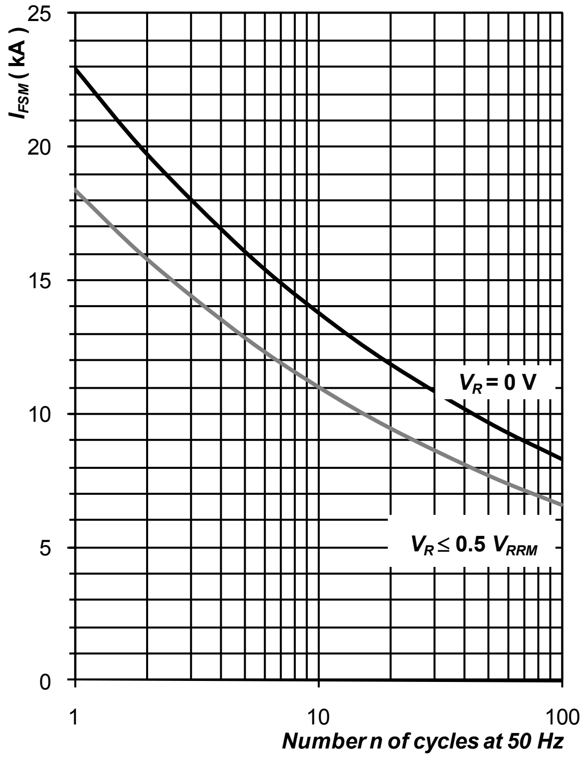

Fig. 5 Surge forward current vs. number of pulses, half sine wave, T_j = T_{jmax}

Power Loss and Maximum Case Temperature Characteristics

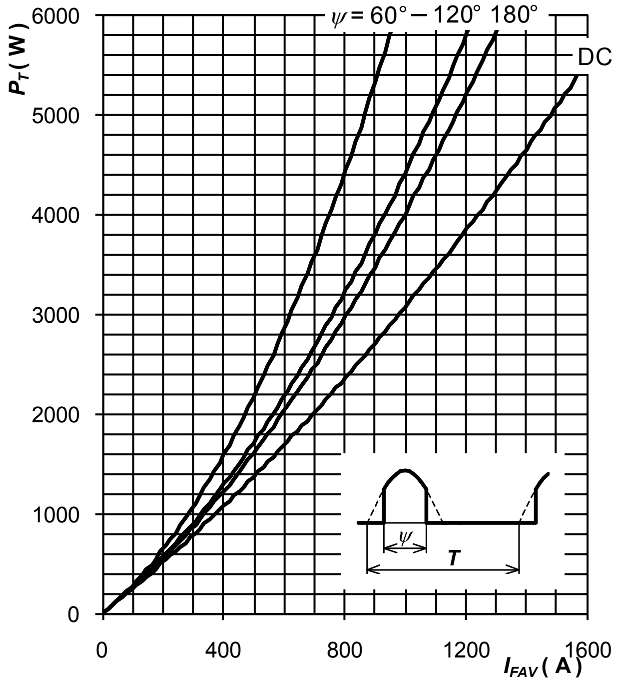

Fig. 6 Forward power loss vs. average forward current, sine waveform, f = 50 Hz, T = 1/f

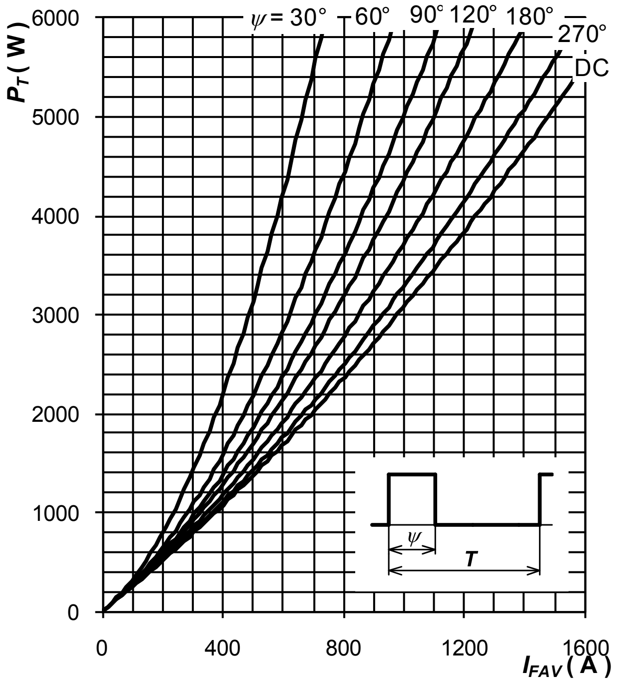

Fig. 7 Forward power loss vs. average forward current, square waveform, f = 50 Hz, T = 1/f

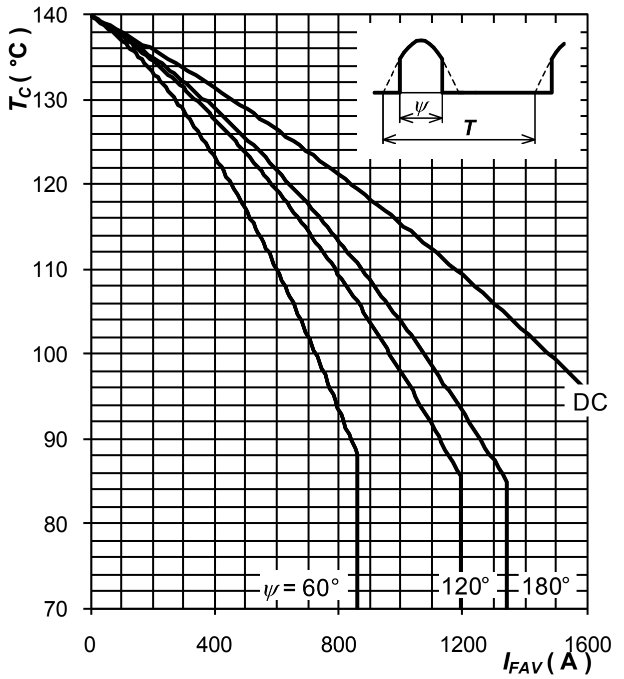

Fig. 8 Max. case temperature vs. aver. forward current, sine waveform, f = 50 Hz, T = 1/f

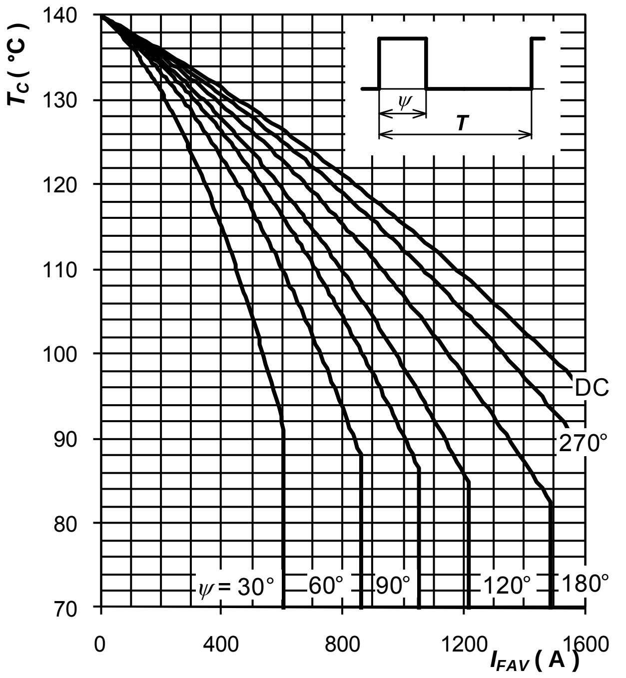

Fig. 9 Max. case temperature vs. aver. forward current, square waveform, f = 50 Hz, T = 1/f

Note 2: Figures number 6 ÷ 9 have been calculated without considering any forward and reverse recovery losses. They are valid for f = 50 or 60 Hz operation.

Forward Recovery Characteristics

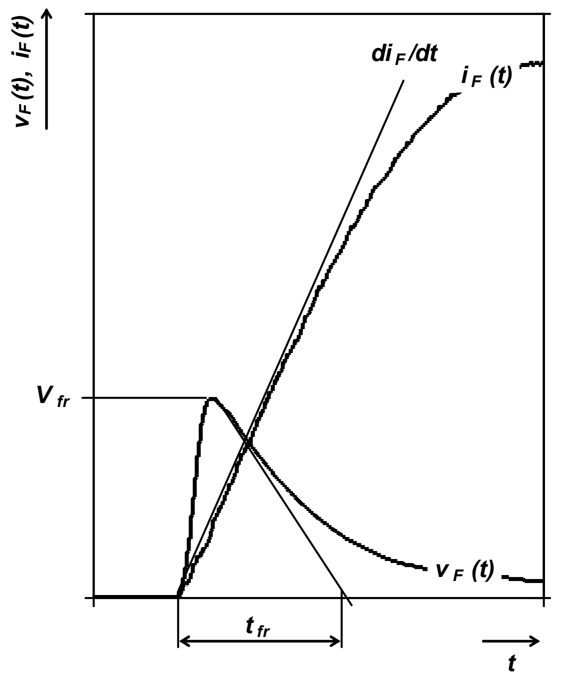

Fig. 10 Typical forward recovery voltage waveform when the diode is turned on with high di_F/dt

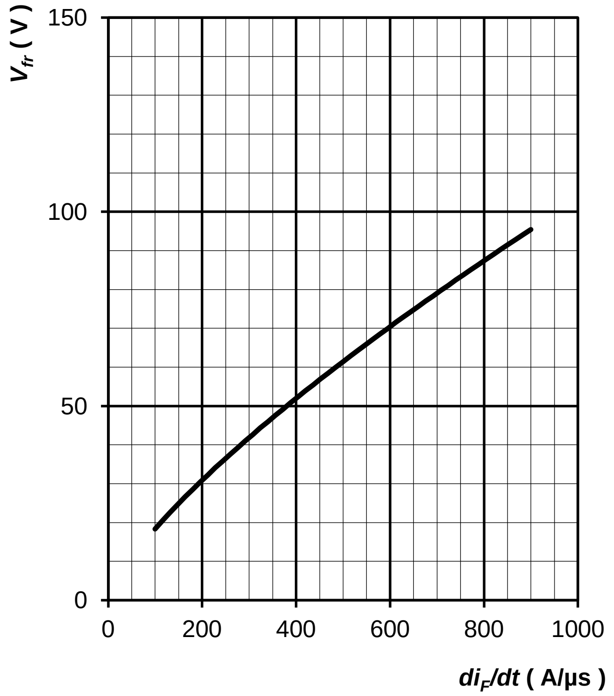

Fig. 11 Max. forward recovery voltage vs. rate of rise of forward current, trapezoid pulse, $T_j = T_{jmax}$, $t_{fr} \leq 10$ µs

Reverse Recovery Characteristics

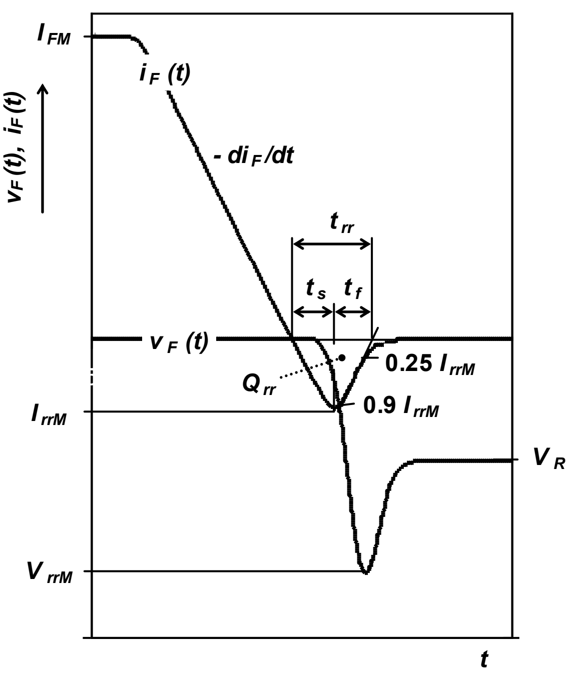

Fig. 12 Typical waveforms and definition of symbols at reverse recovery of a diode, inductive switching

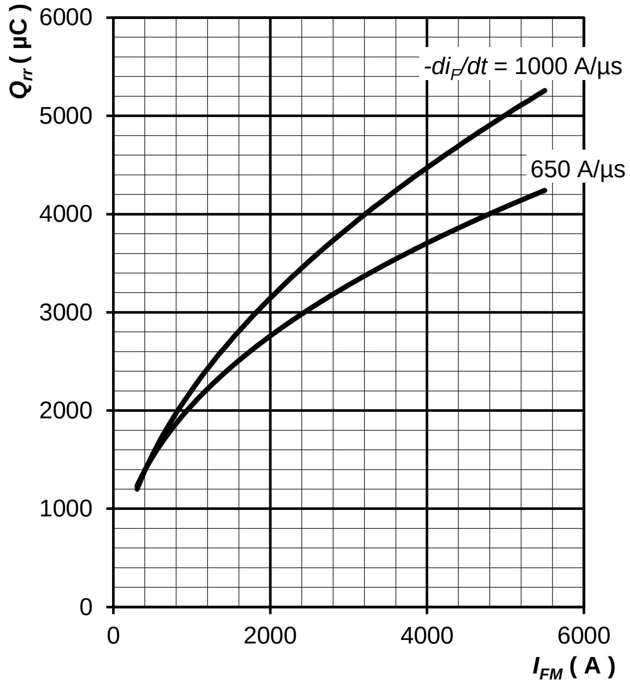

Fig. 13 Max. recovered charge vs. forward current,trapezoid pulse, $T_j = T_{jmax}$

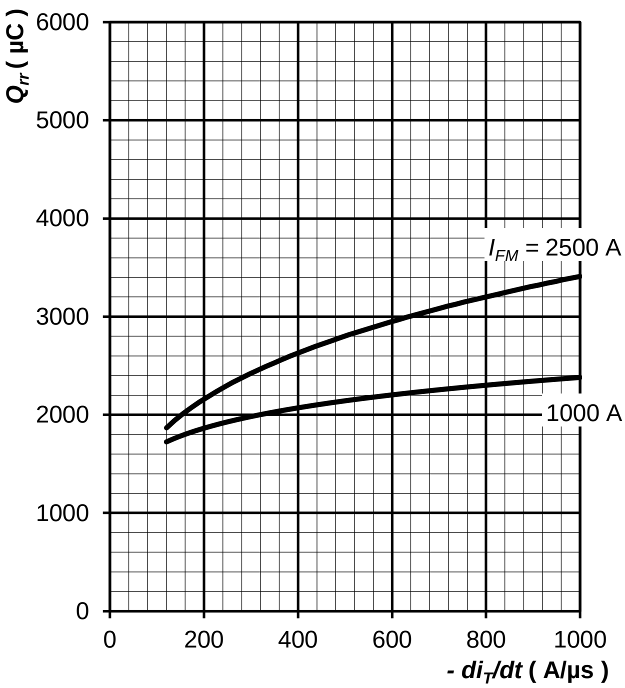

Fig. 14 Max. recovered charge vs. rate of fall of forward current, trapezoid pulse, $T_j = T_{jmax}$

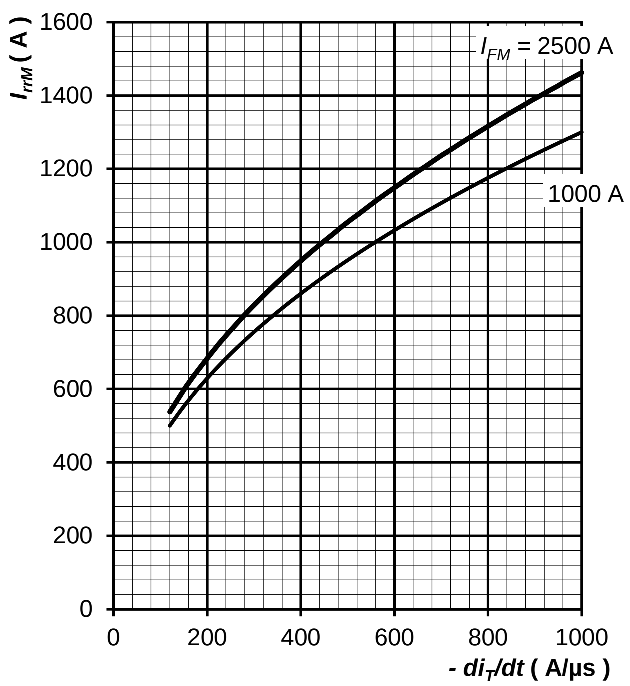

Fig. 15 Max. reverse recovery current vs. rate of fall of forward current, trapezoid pulse, $T_j = T_{jmax}$

Reverse Recovery Characteristics

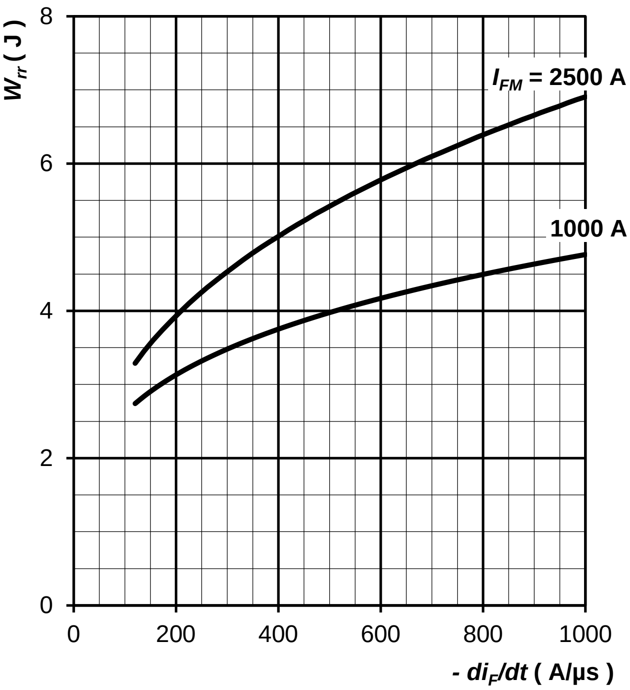

Fig. 16 Maximum reverse recovery energy per pulse vs. rate of fall of forward current, I_{FM} = 1 000, 2 500 A, $T_j = T_{jmax}$

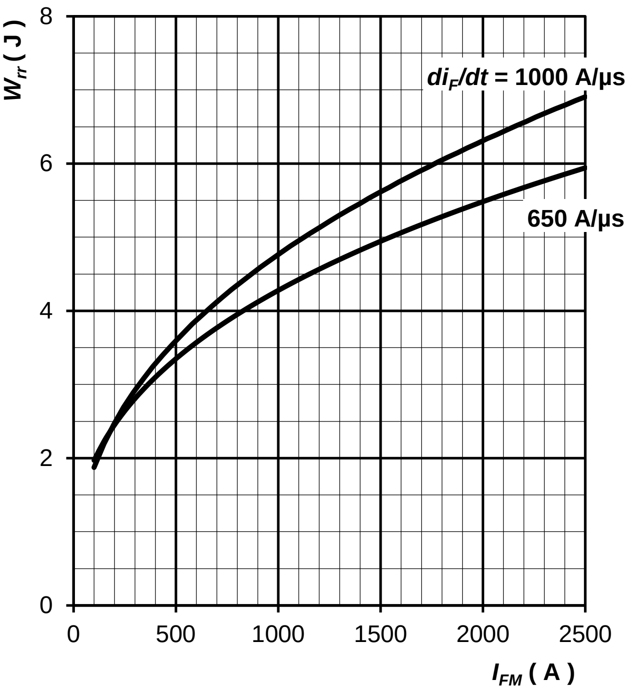

Fig. 17 Maximum reverse recovery energy per pulse vs. forward current, $-di_F/dt$ = 650, 1000 A/µs, $T_j = T_{jmax}$

Safe Operating Area

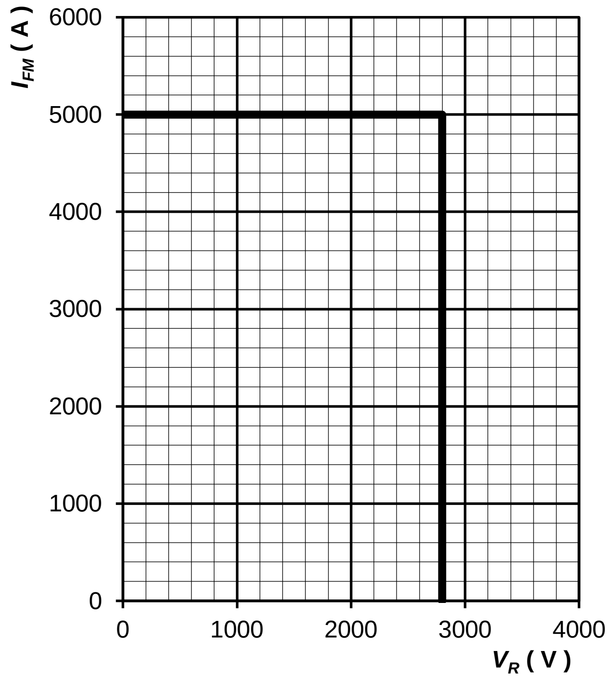

Fig. 18 Diode Safe Operating Area, $T_j = T_{jmax}$, di_F/dt = - 1000 A/µs

Frequency Ratings

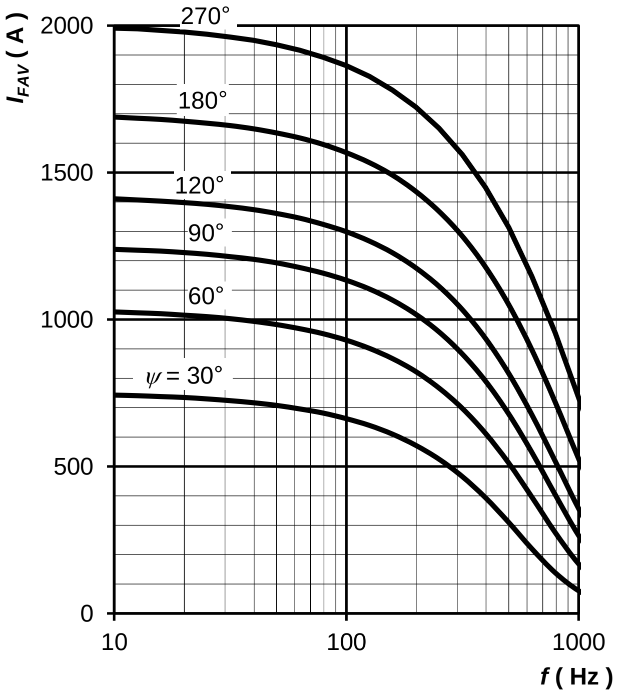

Fig. 19 Average on-state current vs. frequency, trapezoid waveform, T_C = 70 °C, $di_F/dt = \pm 1\ 000$ A/µs, V_R = 2 800 V

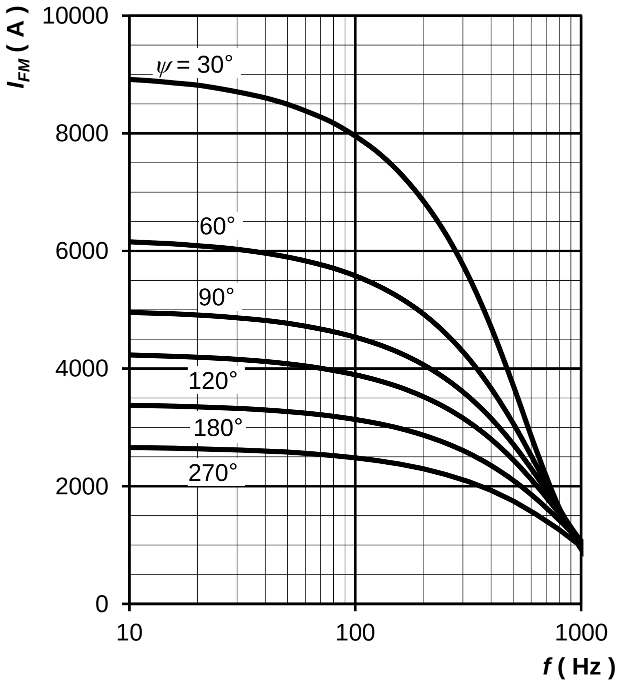

Fig. 20 Maximum on-state current vs. frequency, trapezoid waveform, T_C = 70 °C, $di_F/dt = \pm 1\ 000$ A/µs, V_R = 2 800 V

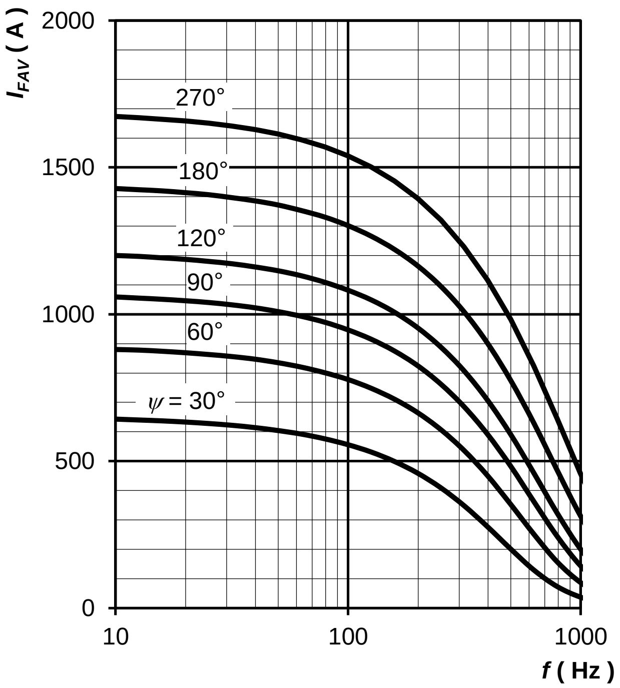

Fig. 21 Average on-state current vs. frequency, trapezoid waveform, T_C = 85 °C, $di_F/dt = \pm 1\ 000$ A/µs, V_R = 2 800 V

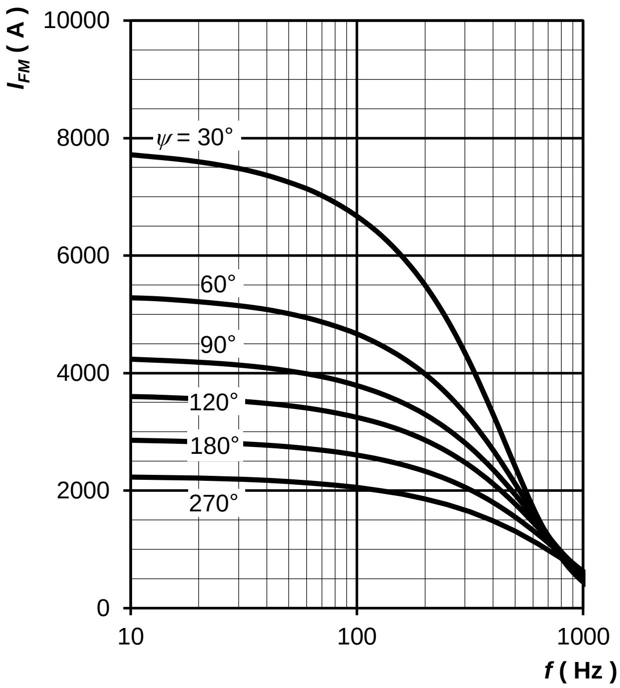

Fig. 22 Maximum on-state current vs. frequency, trapezoid waveform, T_C = 85 °C, $di_F/dt = \pm 1\ 000$ A/µs, V_R = 2 800 V

Notes: