5STR 03T2040

Old part no. TP 907FC-320-20

Reverse Conducting Thyristor

Properties

- Integrated freewheeling diode
- Optimized for low dynamic losses

Key Parameters

V_{DRM}	=	2 000	V
I_{TAVm}	=	360	A
I_{TSM}	=	5 000	A
V_{TO}	=	1.550	V
r_T	=	1.010	mΩ
t_q	=	40	µs

Applications

- Traction

Types

	V_{DRM}
5STR 03T2040	**2 000 V**
Conditions: *T_j = -40 ÷ 125 °C, half sine waveform, f = 50 Hz*	

Mechanical Data

F_m	**Mounting force**	10 ± 2	kN
m	**Weight**	0.20	kg
D_S	**Surface creepage distance**	13	mm
D_a	**Air strike distance**	8	mm

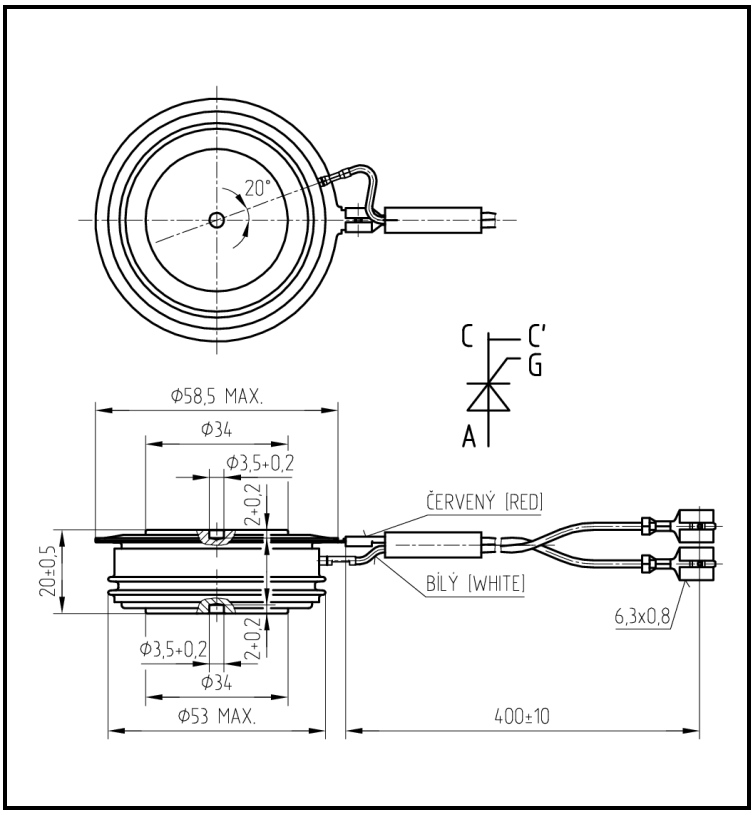

Fig. 1 Case

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Maximum Ratings - Thyristor			*Maximum Limits*	*Unit*
V_{DRM}	**Repetitive peak off-state voltage** *T_j = -40 ÷ 125 °C*		**2 000**	**V**
I_{TRMS}	**RMS on-state current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**566**	**A**
I_{TAVm}	**Average on-state current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**360**	**A**
I_{TSM}	**Peak non-repetitive surge** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**5 000** **5 300**	**A**
I^2t	**Limiting load integral** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**125 000** **118 000**	**A^2s**
$(di_T/dt)_{cr}$	**Critical rate of rise of on-state current** *I_T = 1 000 A, V_D = 0.67 V_{DRM},* *half sine waveform, f = 50 Hz*		**400**	**A/µs**
$(dv_D/dt)_{cr}$	**Critical rate of rise of off-state voltage** *V_D = 0.67 V_{DRM}*		**1 000**	**V/µs**
P_{AV}	**Maximum average gate power losses**		**5**	**W**
I_{GTM}	**Peak gate current**		**25**	**A**
V_{GTM}	**Peak gate voltage**		**15**	**V**
V_{RGTM}	**Reverse peak gate voltage**		**2**	**V**
T_{jmin} - T_{jmax}	**Operating temperature range**		**-40 ÷ 125**	**°C**
T_{stgmin} - T_{stgmax}	**Storage temperature range**		**-40 ÷ 125**	**°C**

Unless otherwise specified T_j = 125 °C

Maximum Ratings - Diode			*Maximum Limits*	*Unit*
V_{RRM}	**Repetitive peak reverse voltage** *T_j = -40 ÷ 125 °C*		**2 000**	**V**
I_{FRMS}	**RMS forward current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**351**	**A**
I_{FAVm}	**Average forward current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**223**	**A**
I_{FSM}	**Peak non-repetitive surge** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**3 500** **3 800**	**A**
I^2t	**Limiting load integral** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**61 000** **58 000**	**A^2s**

Unless otherwise specified T_j = 125 °C

Characteristics – Thyristor			*Value*			*Unit*
			min.	*typ.*	*max.*	
V_{TM}	**Maximum peak on-state voltage** I_{TM} = 1 000 A				**2.610**	**V**
V_{T0} r_T	**Threshold voltage** **Slope resistance** I_{T1} = 500 A, I_{T2} = 1 500 A				**1.550** **1.010**	**V** **mΩ**
I_{DM}	**Peak off-state current** $V_D = V_{DRM}$				**70**	**mA**
t_{gd}	**Delay time** T_j = 25 °C, V_D = 100 V, I_{TM} = 320 A, t_r = 0.5 µs, I_{GT} = 2 A				**1**	**µs**
t_{gt}	**Switch-on time** the same conditions as at t_{gd}				**4**	**µs**
t_q	**Turn-off time** I_T = 320 A, di_T/dt = -50 A/µs, V_D = 0.67 V_{DRM}, dv_D/dt = 50 V/µs				**40**	**µs**
I_H	**Holding current**	T_j = 25 °C T_j = 125 °C		**100**		**mA**
I_L	**Latching current**	T_j = 25 °C T_j = 125 °C			**500**	**mA**
V_{GT}	**Gate trigger voltage** V_D = 12V, I_T = 4 A	T_j = - 40 °C T_j = 25 °C T_j = 125 °C	 **0.25**		**4.5** **2.5** **2.0**	**V**
I_{GT}	**Gate trigger current** V_D = 12V, I_T = 4 A	T_j = - 40 °C T_j = 25 °C T_j = 125 °C	 **10**		**1000** **400** **250**	**mA**

Unless otherwise specified T_j = 125 °C

Characteristics – Diode		*Value*			*Unit*
		min.	*typ.*	*max.*	
V_{FM}	**Maximum forward voltage** I_{FM} = 1 000 A			**3.420**	**V**
V_{T0}	**Threshold voltage** I_{F1} = 310 A, I_{F2} = 940 A			**1.340**	**V**
r_T	**Forward slope resistance**			**2.100**	**mΩ**
Q_{rr}	**Reverse recovery charge** I_{FM} = 200 A, di_F/dt = -50 A/µs, V_D = 100 V		**250**		**µC**
I_{rrM}	**Maximum reverse recovery current** the same conditions as at Q_{rr}		**150**		**A**
t_{rr}	**Reverse recovery time** the same conditions as at Q_{rr}		**4**		**µs**

Unless otherwise specified T_j = 125 °C

Thermal Parameters - Thyristor		*Value*	*Unit*
R_{thjc}	**Thermal resistance junction to case** *double side cooling*	**55**	**K/kW**
	anode side cooling	**91**	
	cathode side cooling	**140**	
R_{thch}	**Thermal resistance case to heatsink** *double side cooling*	**10**	**K/kW**
	single side cooling	**20**	

Thermal Parameters - Diode		*Value*	*Unit*
R_{thjc}	**Thermal resistance junction to case** *double side cooling*	**88**	**K/kW**
	anode side cooling	**190**	
	cathode side cooling	**165**	

Transient Thermal Impedance - Thyristor

Correction for periodic waveforms - Thyristor

180°	**sine:**	**add 7.4 K/kW**
180°	**rectangular:**	**add 8.4 K/kW**
120°	**rectangular:**	**add 13.8 K/kW**
60°	**rectangular:**	**add 23.8 K/kW**

Analytical function for transient thermal impedance

$$Z_{thjc} = \sum_{i=1}^{5} R_i (1 - \exp(-t / \tau_i))$$

Conditions:
F_m = 10 ± 2 kN, Double side cooled

i	1	2	3	4	5
τ_i (s)	1.62	0.111	0.0236	0.00322	0.307e-3
R_i(K/kW)	3.77	36.70	9.64	3.54	1.38

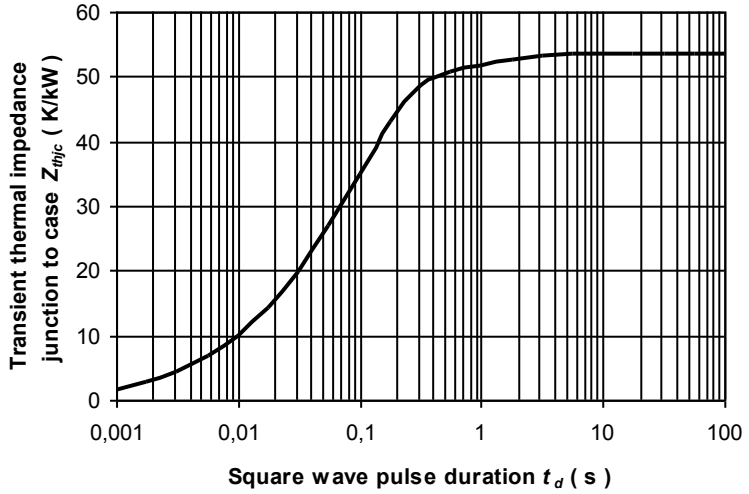

Fig. 2 Dependence transient thermal impedance junction to case on square pulse - Thyristor

Diode

Correction for periodic waveforms - Diode

180°	**sine:**	**add 10.7 K/kW**
180°	**rectangular:**	**add 11.1 K/kW**
120°	**rectangular:**	**add 18.2 K/kW**
60°	**rectangular:**	**add 31.9 K/kW**

i	1	2	3	4	5
τ_i (s)	0.401	0.108	0.0267	0.0034	0.584e-3
R_i(K/kW)	23.00	41.00	17.20	3.47	2.50

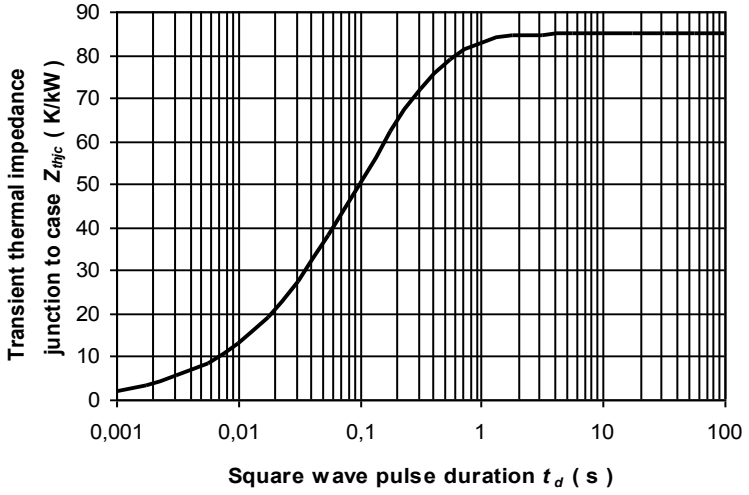

Fig. 3 Dependence transient thermal impedance junction to case on square pulse - Diode

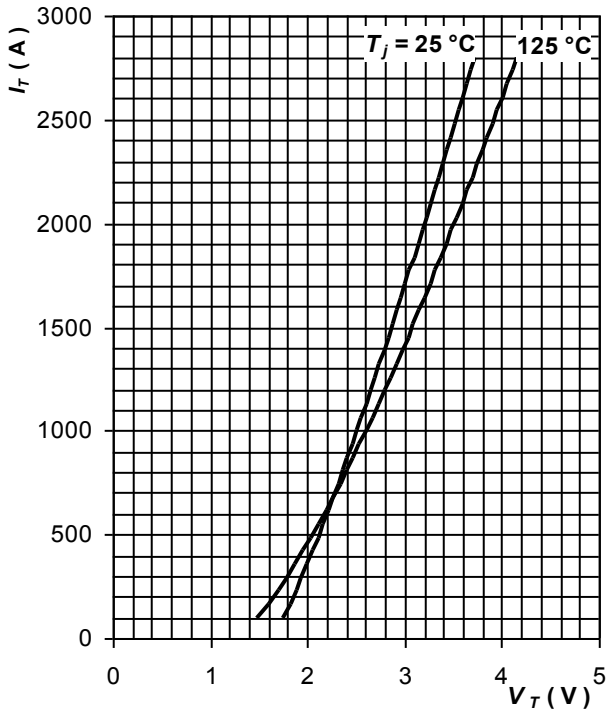

Fig. 4 Maximum on-state characteristics

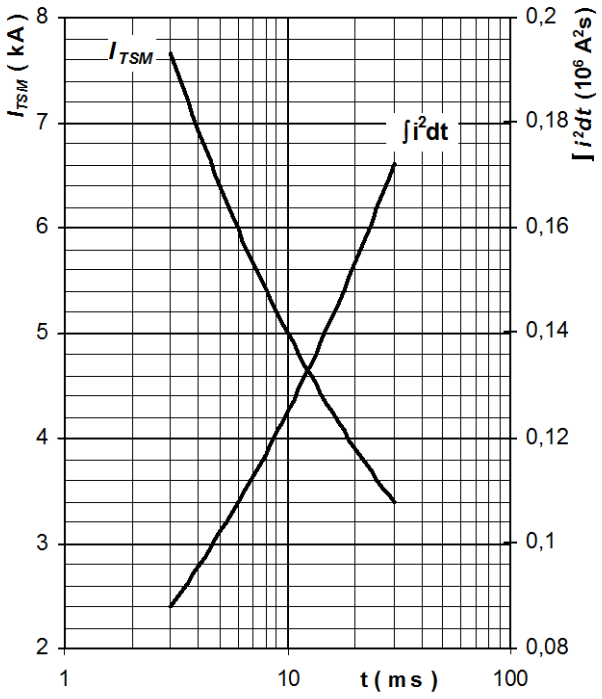

Fig. 5 Surge on-state current vs. pulse length, half sine wave, single pulse, V_R = 0 V, $T_j = T_{jmax}$

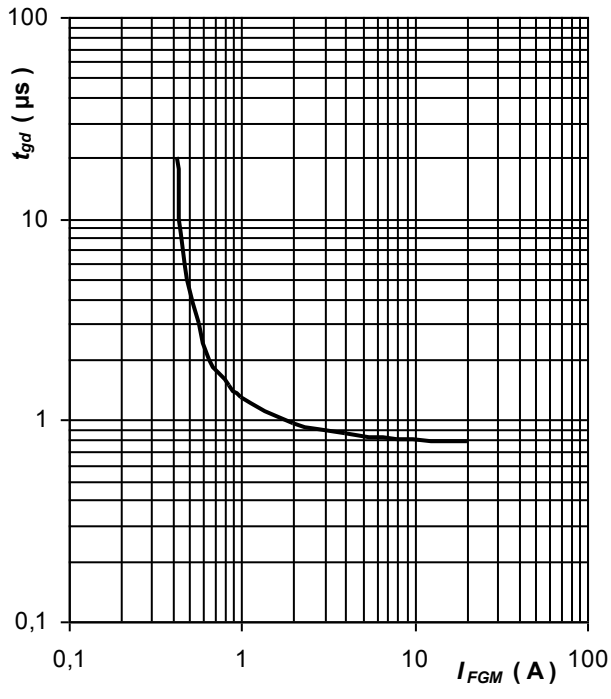

Fig. 6 Delay time vs. forward gate current, T_j = 25 °C, V_D = 100 V, $I_{TM} = I_{TAVm}$, $t_r \leq 0.5$ µs, t_p =1 ms

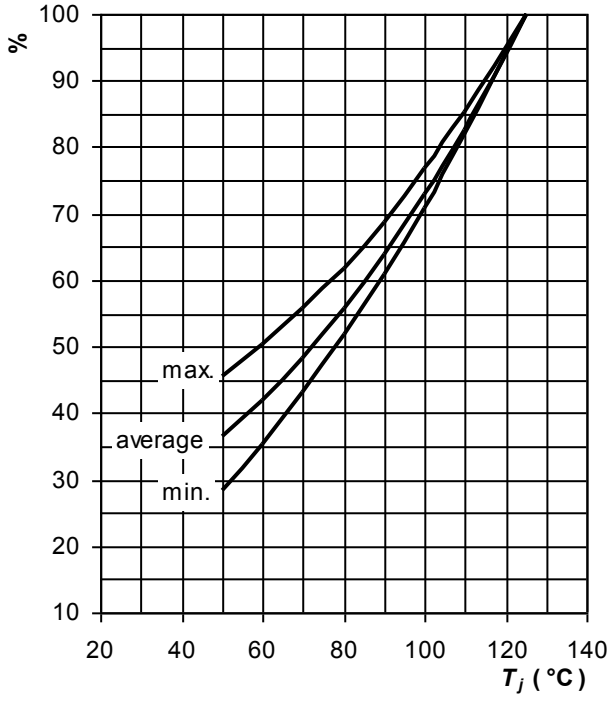

Fig. 7 Relative value of turn-off time vs. junction temperature

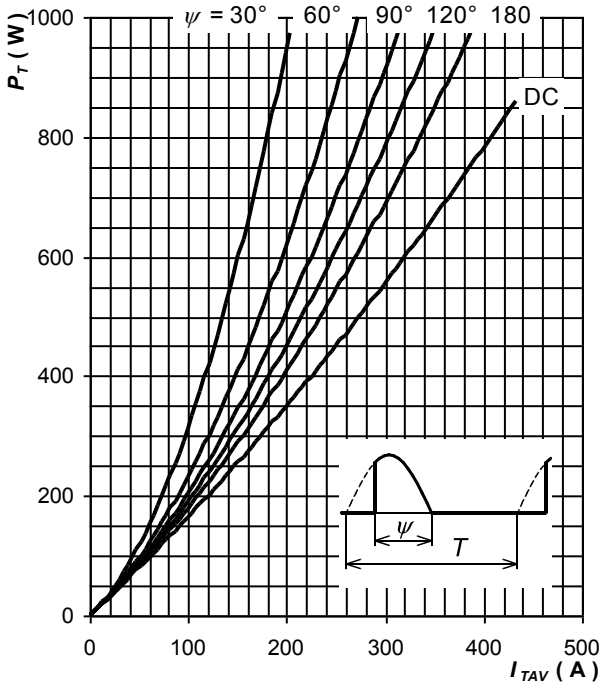

Fig. 8 On-state power loss vs. average on-state current, sine waveform, f = 50 Hz, T = 1/f

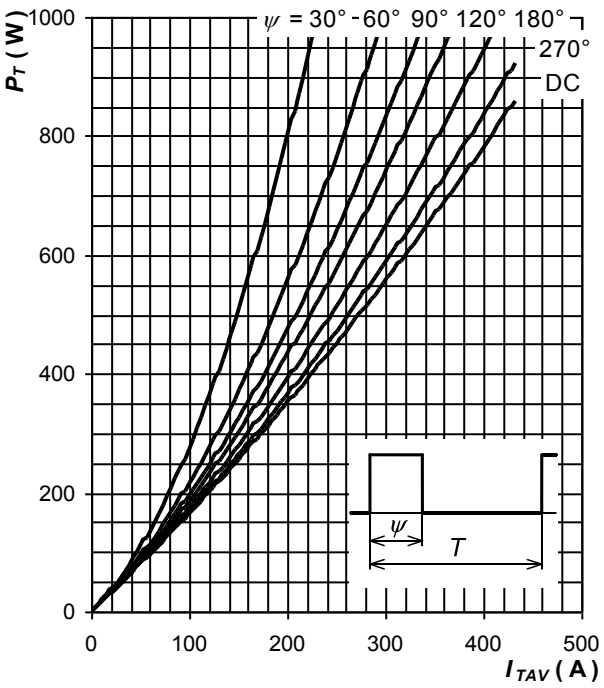

Fig. 9 On-state power loss vs. average on-state current, square waveform, f = 50 Hz, T = 1/f

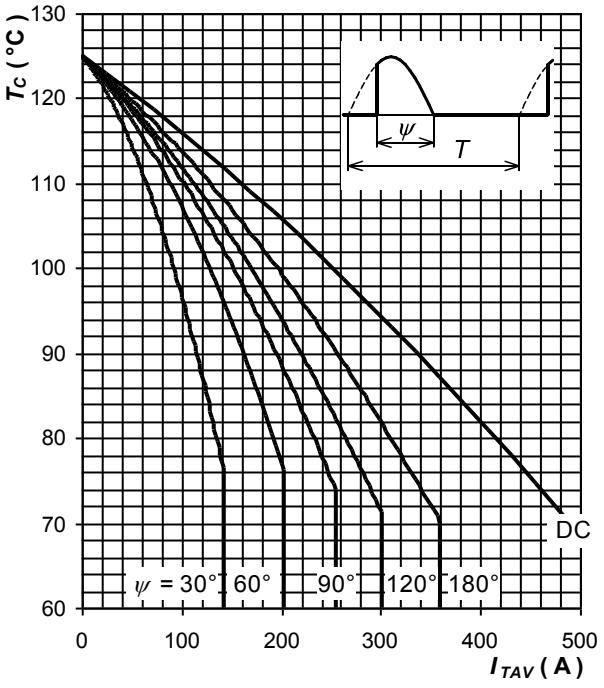

Fig. 10 Max. case temperature vs. aver. on-state current, sine waveform, f = 50 Hz, T = 1/f

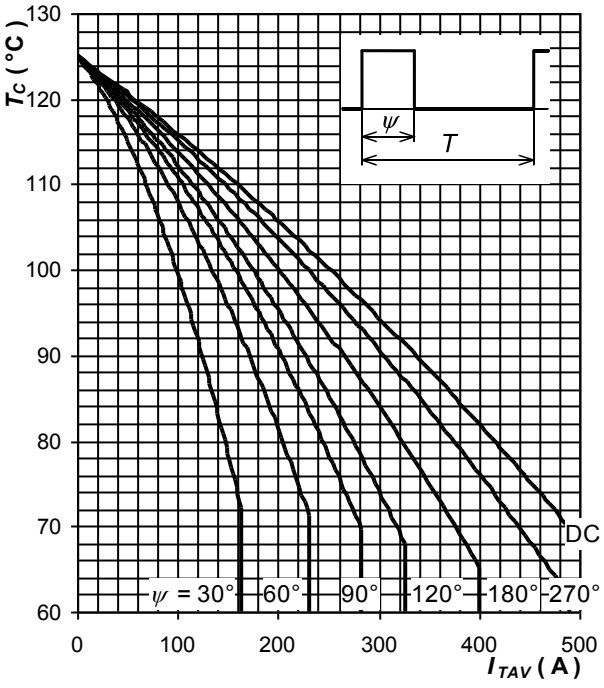

Fig. 11 Max. case temperature vs. aver. on-state current, square waveform, f = 50 Hz, T = 1/f

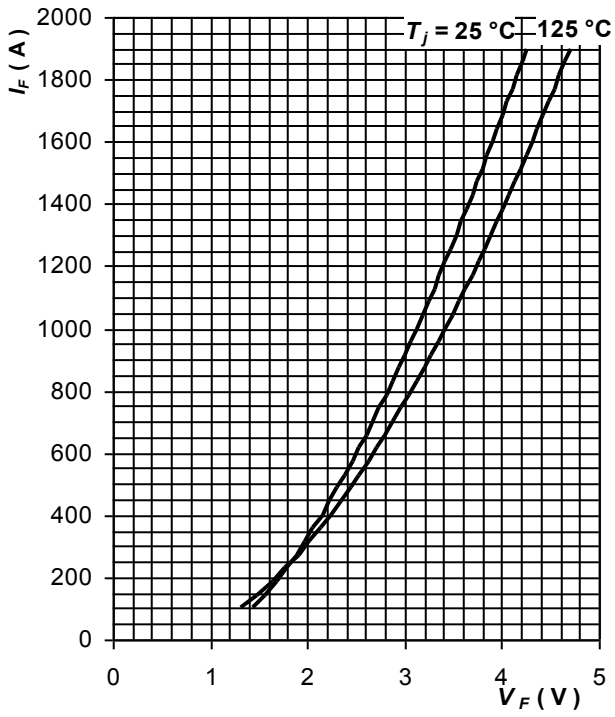

Fig. 12 Maximum forward voltage drop characteristics of the diode

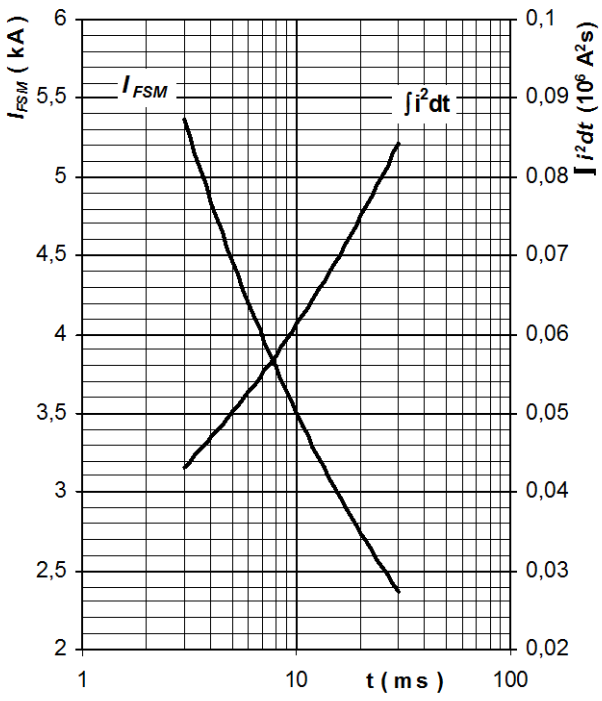

Fig. 13 Surge on-state current vs. pulse length of the diode. Half sine wave, single pulse, V_R = 0 V, $T_j = T_{jmax}$

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