5STR 04T2032

Old part no. TP 907FC-370-20

Reverse Conducting Thyristor

Properties

- § Integrated freewheeling diode
- § Optimized for low dynamic losses

Key Parameters

V_{DRM}	=	2 000	V
I_{TAVm}	=	374	A
I_{TSM}	=	5 000	A
V_{TO}	=	1.748	V
r_T	=	0.653	mΩ
t_q	=	32	µs

Applications

- § Traction

Types

	V_{DRM}
5STR 04T2032..2040	**2 000 V**
5STR 04T1832..1840	**1 800 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

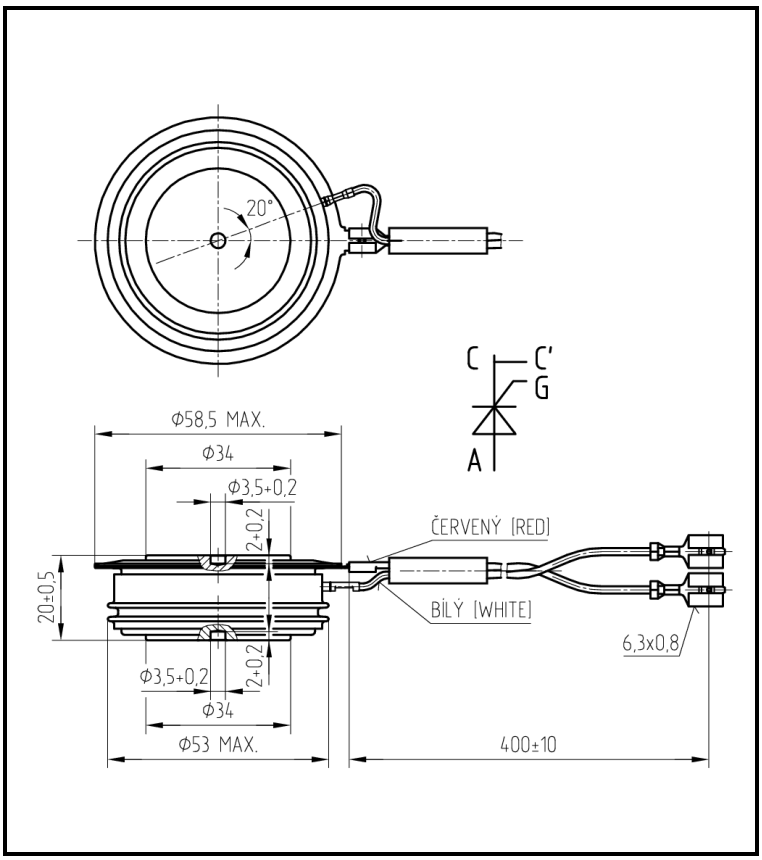

Fig. 1 Case

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Maximum Ratings - Thyristor				*Maximum Limits*	*Unit*
V_{DRM}	**Repetitive peak off-state voltage** *T_j = -40 ÷ 125 °C*	**5STR 04T2032..2040** **5STR 04T1832..1840**		**2 000** **1 800**	**V**
I_{TRMS}	**RMS on-state current** *T_c = 70 °C, half sine waveform, f = 50 Hz*			**588**	**A**
I_{TAVm}	**Average on-state current** *T_c = 70 °C, half sine waveform, f = 50 Hz*			**374**	**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*	**5STR 04T2032..2040** **5STR 04T1832..1840**		**2 000** **1 800**	**V**
I_{FRMS}	**RMS forward current** *T_c = 70 °C, half sine waveform, f = 50 Hz*			**453**	**A**
I_{FAVm}	**Average forward current** *T_c = 70 °C, half sine waveform, f = 50 Hz*			**288**	**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				**2.420**	**V**
V_{T0} r_T	**Threshold voltage** **Slope resistance** I_{T1} = 581 A, I_{T2} = 1 744 A				**1.748** **0.653**	**V** **m**Ω
I_{DM}	**Peak off-state current** $V_D = V_{DRM}$				**70**	**mA**
t_{gd}	**Delay time** T_j = 25 °C, V_D = 100 V, $I_{TM} = I_{TAVm}$, t_r = 0.5 µs, I_{GT} = 2 A				**1**	µ**s**
t_{gt}	**Switch-on time** *the same conditions as at* t_{gd}				**4**	µ**s**
t_q	**Turn-off time** $I_T = I_{TAVm}$, di_T/dt = -50 A/µs, V_D = 0.67 V_{DRM}, dv_D/dt = 50 V/µs	**group of t_q** **5STR 04T2032** **5STR 04T1832** **5STR 04T2040** **5STR 04T1840**			 **32** **40**	µ**s**
I_H	**Holding current**	T_j = 25 °C T_j = 125 °C		**500**		**mA**
I_L	**Latching current**	T_j = 25 °C T_j = 125 °C		**5 000**		**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			2.170	V
V_{T0}	**Threshold voltage** I_{F1} = 454 A, I_{F2} = 1 362 A			1.419	V
r_T	**Forward slope resistance**			0.714	mW
Q_{rr}	**Reverse recovery charge** $I_{FM} = I_{TAVm}$, di_F/dt = -50 A/ms, V_D = 100 V		250		mC
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

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

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

i	1	2	3	4	5
t_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

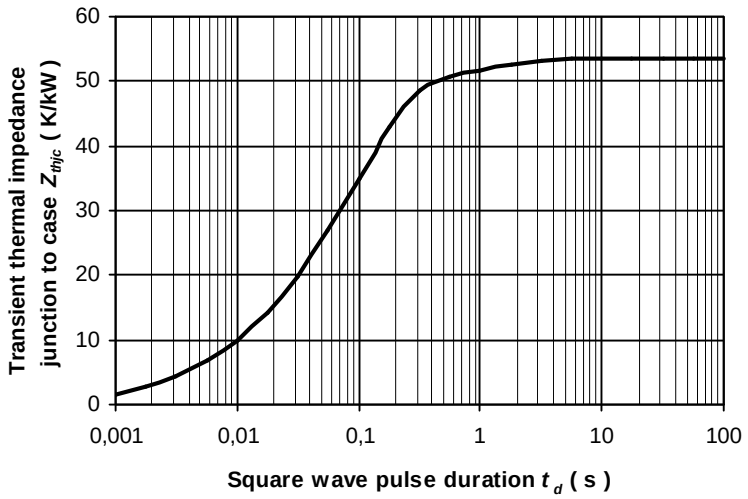

Fig. 2 Dependence transient thermal impedance junction to case on square pulse - Thyristor

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
t_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

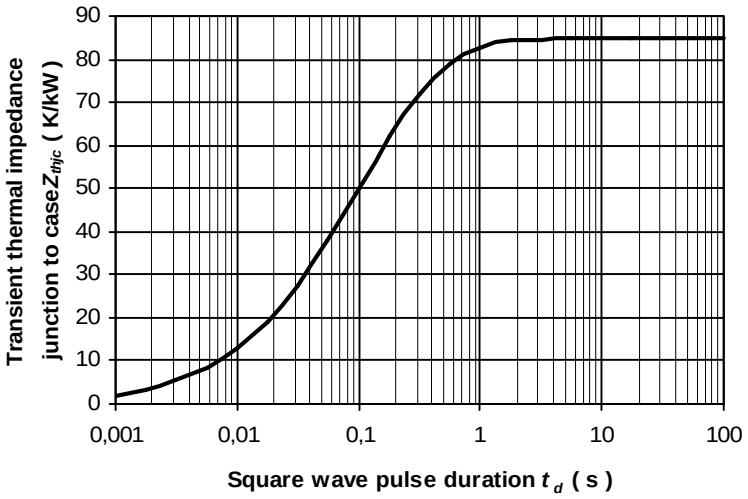

Fig. 3 Dependence transient thermal impedance junction to case on square pulse - Diode

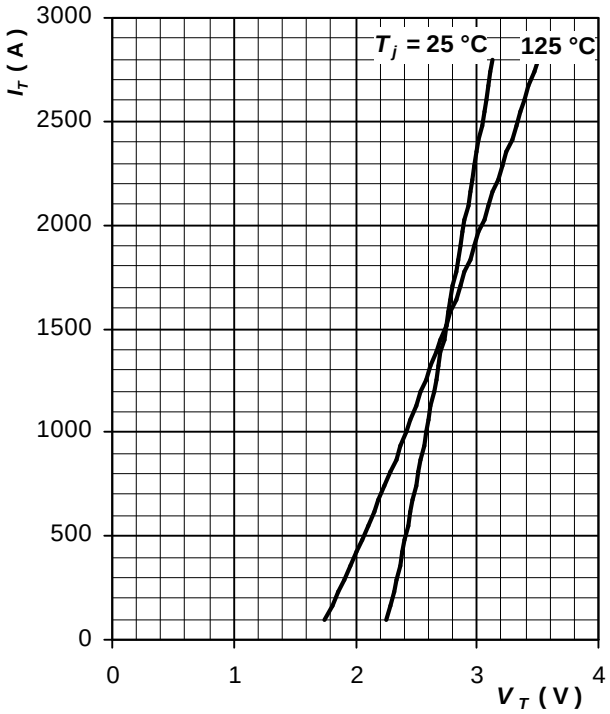

Fig. 4 Maximum on-state characteristics

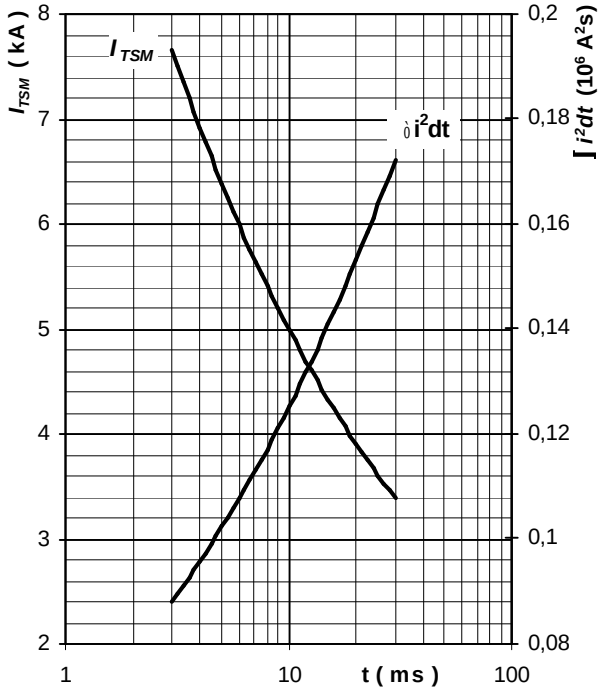

Fig. 5 Surge on-state current vs. pulse length, half sine wave, single pulse, V_R = 0 V, $T_j = T_{jmax}$

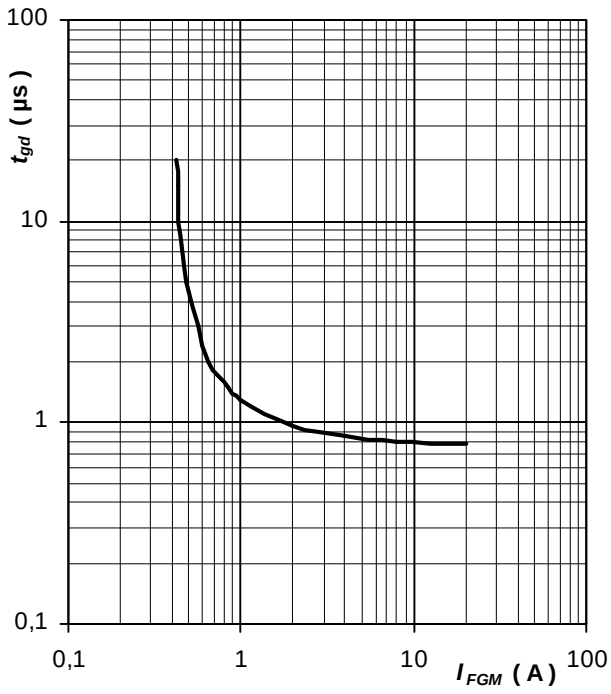

Fig. 6 Delay time vs. forward gate current, T_j = 25 °C, V_D = 100 V, $I_{TM} = I_{TAVm}$, $t_r \leq 0.5$ µs, t_p =1 ms

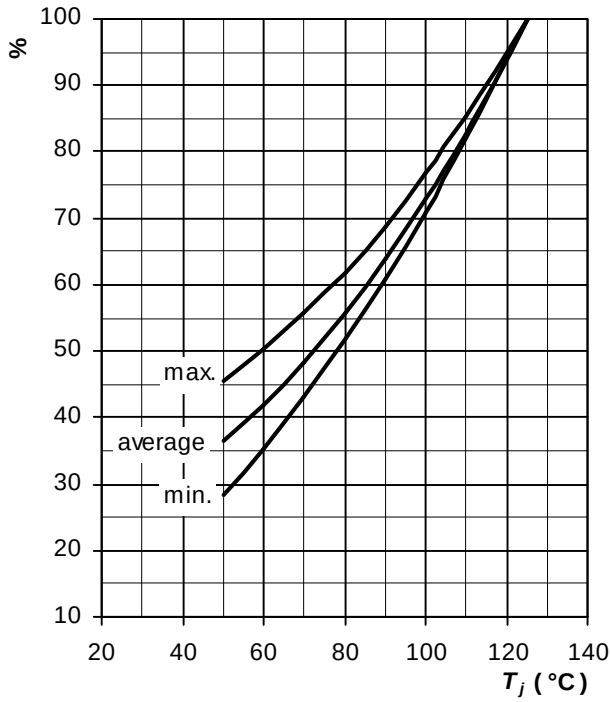

Fig. 7 Relative value of turn-off time vs. junction temperature

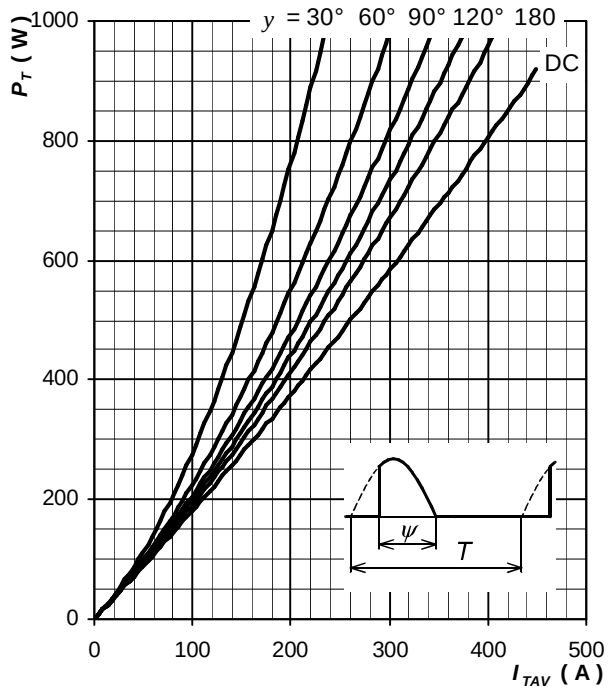

Fig. 8 On-state power loss vs. average on-state current, sine waveform, f = 50 Hz, T = 1/f

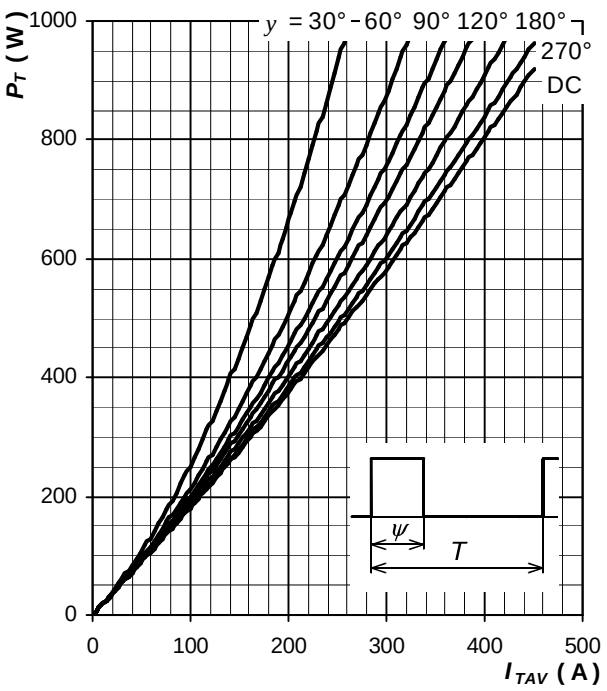

Fig. 9 On-state power loss vs. average on-state current, square waveform, f = 50 Hz, T = 1/f

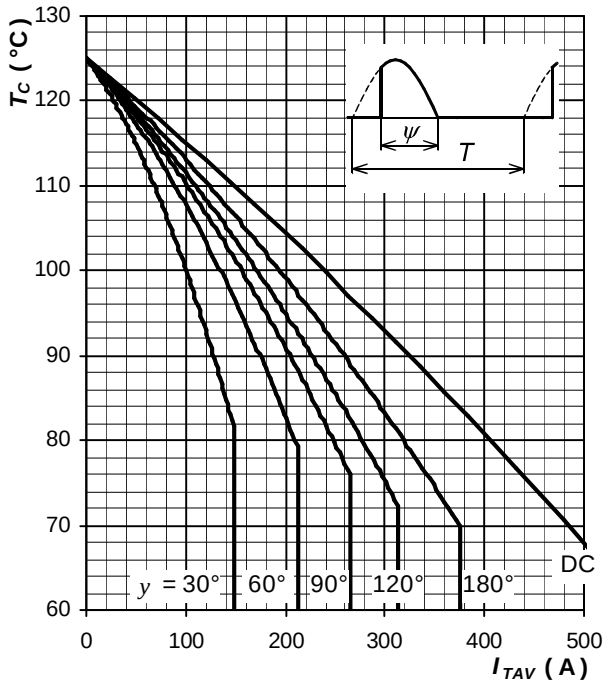

Fig. 10 Max. case temperature vs. aver. on-state current, sine waveform, f = 50 Hz, T = 1/f

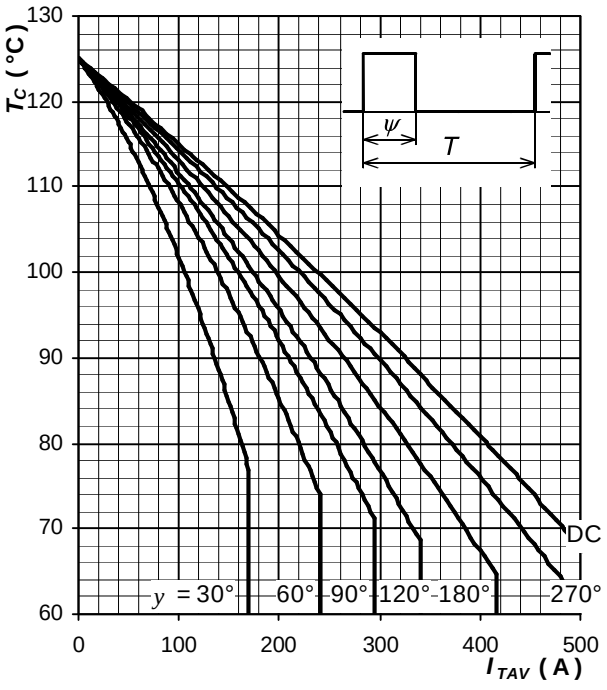

Fig. 11 Max. case temperature vs. aver. on-state current, square waveform, f = 50 Hz, T = 1/f

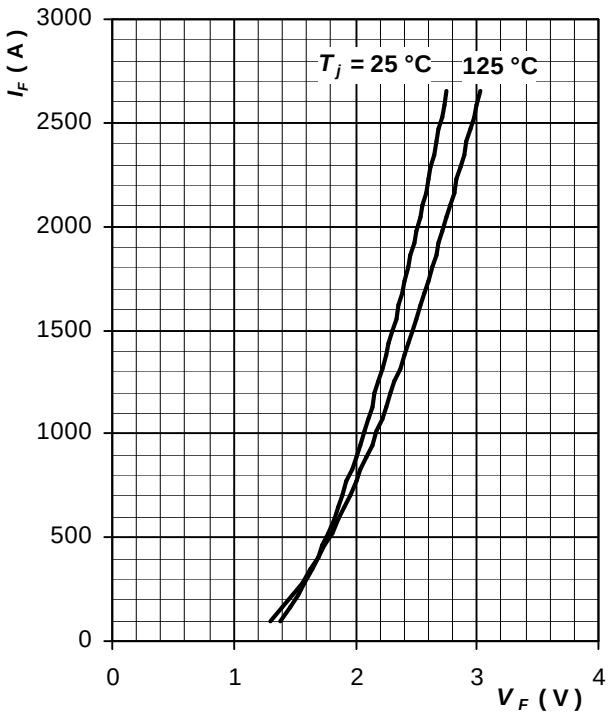

Fig. 12 Maximum forward voltage drop characteristics of the diode

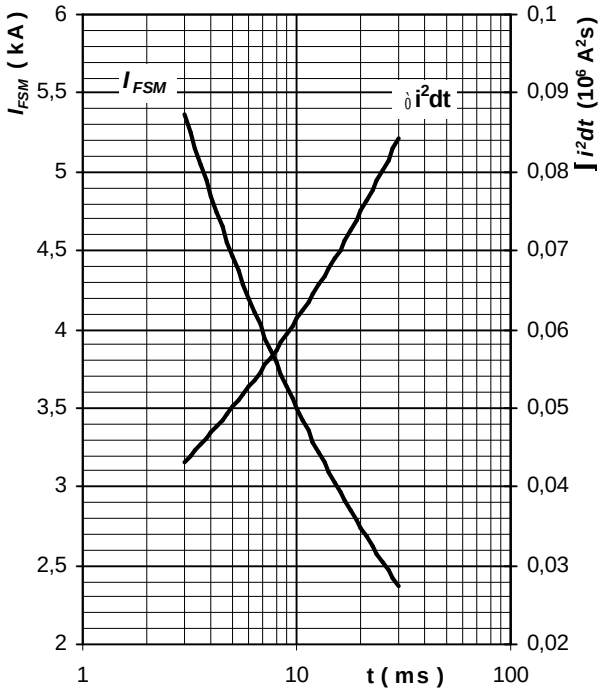

Fig. 13 Surge on-state current vs. pulse length of the diode. Half sine wave, single pulse, V_R = 0 V, $T_j = T_{jmax}$

Notes: