5STR 10T2520

Old part no. TP 919FC-1000-25

Reverse Conducting Thyristor

Properties

- Amplifying gate
- Integrated freewheeling diode
- Optimized for low dynamic losses

Applications

- Traction

Key Parameters

V_{DRM}	=	2 500	V
I_{TAVm}	=	857	A
I_{TSM}	=	14 000	A
V_{TO}	=	2.039	V
r_T	=	0.321	mΩ
t_q	=	20	µs

Types

	V_{DRM}
5STR 10T2520	**2 500 V**

Conditions:
T_j = -40 ÷ 125 °C,
half sine waveform, f = 50 Hz, note 1

Mechanical Data

F_m	**Mounting force**	30 ± 3 kN
m	**Weight**	0.700 kg
D_S	**Surface creepage d stance**	30.4 mm
D_a	**Air strike di tance**	13.2 mm

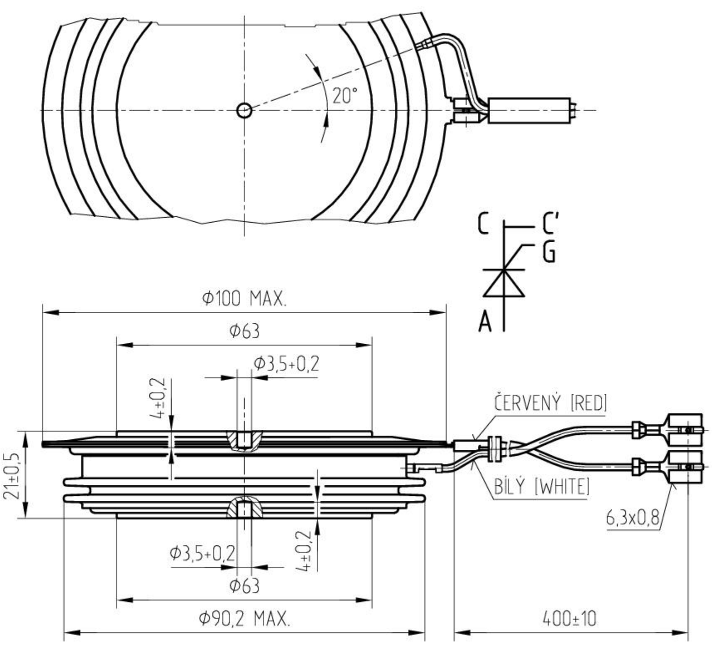

Fig. 1 Case

ABB s.r.o.
Novodvorska 1768/138a, 142 21 Praha 4, Czech Republic
tel.: +420 261 306 250, http://www.abb.com/semiconductors

Maximum Ratings - Thyristor			*Maximum Limits*	*Unit*
V_{DRM}	**Repetitive peak off-state voltage** *T_j = -40 ÷ 125 °C, note 1*		**2 500**	**V**
I_{TRMS}	**RMS on-state current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**1 347**	**A**
I_{TAVm}	**Average on-state current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**857**	**A**
I_{TSM}	**Peak non-repetitive surge** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**14 000** **15 000**	**A**
I^2t	**Limiting load integral** *half sine pulse, V_R = 0 V*	*t_p = 10 ms* *t_p = 8.3 ms*	**980 000** **928 000**	**A^2s**
$(di_T/dt)_{cr}$	**Critical rate of rise of on-state current** *I_T = 2000 A, V_D = 0.67 V_{DRM},* *half sine wave, 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
Note 1: De-rating factor of 0.13% V_{RRM} or V_{DRM} per °C is applicable for T_j below 25 °C

Maximum Ratings - Diode			***Maximum Limits***	***Unit***
V_{RRM}	**Repetitive peak reverse voltage** *T_j = -40 ÷ 125 °C, note 1*		**2 500**	**V**
I_{FRMS}	**RMS forward current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**610**	**A**
I_{FAVm}	**Average forward current** *T_c = 70 °C, half sine waveform, f = 50 Hz*		**388**	**A**
I_{FSM}	**Peak non-repetitive surge** *half sine pulse, V_R = 0 V*	t_p = 10 ms t_p = 8.3 ms	**6 000** **6 400**	**A**
I^2t	**Limiting load integral** *half sine pulse, V_R = 0 V*	t_p = 10 ms t_p = 8.3 ms	**180 000** **170 000**	**A^2s**

Unless otherwise specified T_j = 125 °C
Note 1: De-rating factor of 0.13% V_{RRM} or V_{DRM} per °C is applicable for T_j below 25 °C

Characteristics – Thyristor			***Value***			***Unit***
			min.	***typ.***	***max.***	
V_{TM}	**Maximum peak on-state voltage** I_{TM} = 2 000 A				**2.700**	**V**
V_{T0} r_T	**Threshold voltage** **Slope resistance** I_{T1} = 1 570 A, I_{T2} = 4 712 A				**2.039** **0.321**	**V** **mΩ**
I_{DM}	**Peak off-state current** $V_D = V_{DRM}$				**80**	**mA**
t_{gd}	**Delay time** T_j = 25 °C, V_D = 0.4 V_{DRM}, $I_{TM} = I_{TAVm}$, t_r = 0.3 µs, I_{GT} = 2 A				**2**	**µs**
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				**20**	**µs**
t_q	**Turn-off time** I_T = 2 000 A, di_T/dt = -50 A/µs, V_D = 1 250 V, dv_D/dt = 700 V/µs				**35**	**µs**
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		**2000**		**mA**
V_{GT}	**Gate trigger voltage** V_{AC} = 12V, I_T = 4 A	T_j = - 40 °C T_j = +25 °C T_j = +125 °C	 **0.25**		**4** **3** **2**	**V**
I_{GT}	**Gate trigger current** V_{AC} = 12V, I_T = 4 A	T_j = - 40 °C T_j = +25 °C T_j = +125 °C	 **10**		**1000** **500** **300**	**mA**

Unless otherwise specified T_j = 125 °C

Characteristics – Diode		***Value***			***Unit***
		min.	***typ.***	***max.***	
V_{FM}	**Maximum forward voltage** *I_{FM} = 1000 A*			**2.600**	**V**
V_{T0}	**Threshold voltage** *I_{F1} = 628 A, I_{F2} = 1 885 A*			**1.487**	**V**
r_T	**Forward slope resistance**			**1.066**	**mΩ**
Q_{rr}	**Reverse recovery charge** *I_{FM} = 1 000 A, di/dt = -50 A/µs, V_D = 100 V*			**250**	**µC**
I_{rrM}	**Maximum reverse recovery current** *the same conditions as at Q_{rr}*			**125**	**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*	**20**	**K/kW**
	anode side cooling	**30**	
	cathode side cooling	**60**	
R_{thch}	**Thermal resistance case to heatsink** *double side cooling*	**3**	**K/kW**
	single side cooling	**6**	

Thermal Parameters - Diode		***Value***	***Unit***
R_{thjc}	**Thermal resistance junction to case** *double side cooling*	**50**	**K/kW**
	anode side cooling	**75**	
	cathode side cooling	**150**	

Transient Thermal Impedance - Thyristor

Correction for periodic waveforms - Thyristor

180°	sine:	add 3.6 K/kW
180°	rectangular:	add 2.8 K/kW
120°	rectangular:	add 4.7 K/kW
60°	rectangular:	add 8.2 K/kW

i	1	2	3	4	5
τ_i (s)	0.3289	0.1376	0.0343	0.0037	0.0003
R_i(K/kW)	6.17	8.56	3.08	1.80	0.39

Analytical function for transient thermal impedance

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

Conditions:
F_m = 30 ± 3 kN, Double side cooled

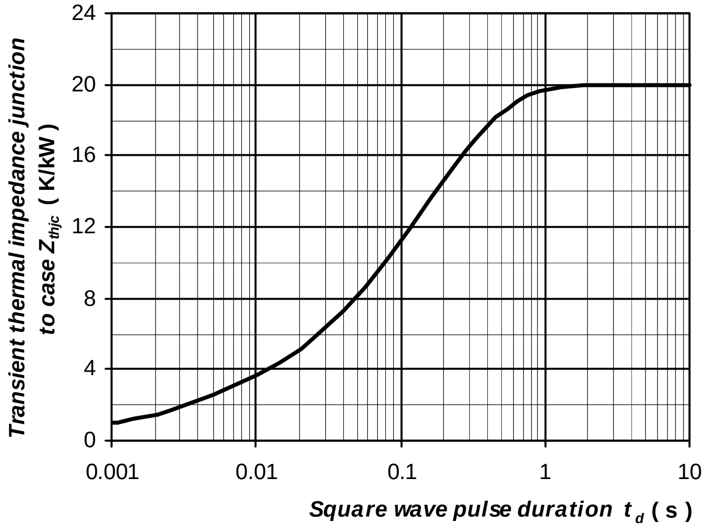

Fig. 2 Dependence transient thermal impedance junction to case on square pulse - Thyristor

Diode

Correction for periodic waveforms - Diode

180°	sine:	add 6.5 K/kW
180°	rectangular:	add 5.2 K/kW
120°	rectangular:	add 8.6 K/kW
60°	rectangular:	add 14.4 K/kW

i	1	2	3	4	5
τ_i (s)	0.3819	0.1733	0.0171	0.0046	0.0003
R_i(K/kW)	31.39	11.99	2.05	3.85	0.73

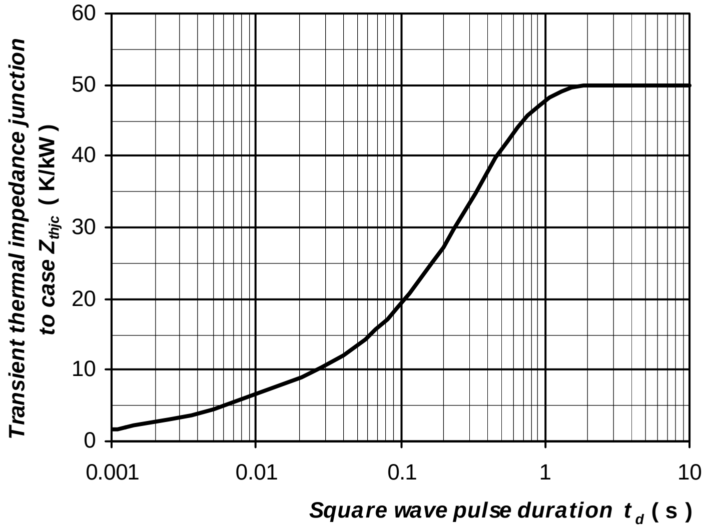

Fig. 3 Dependence transient thermal impedance junction to case on square pulse - Diode

On-State Characteristics - Thyristor

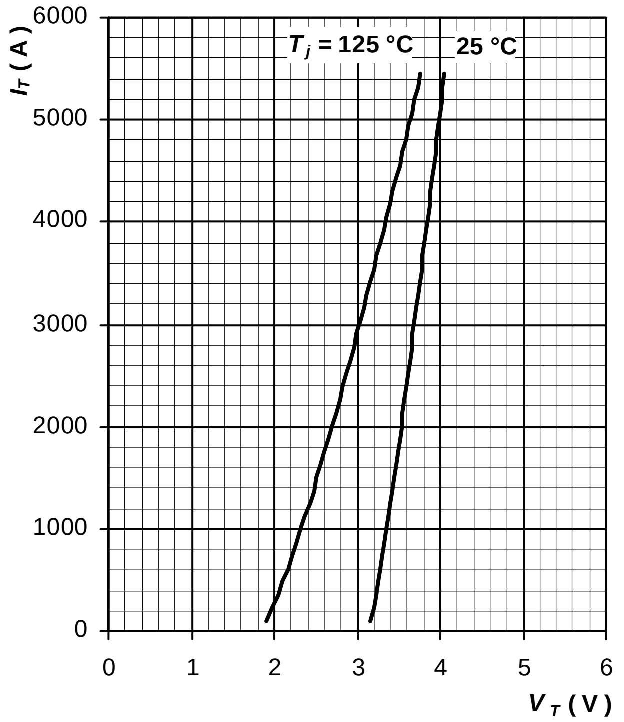

Fig. 4 Maximum on-state characteristics

Gate Trigger Characteristics

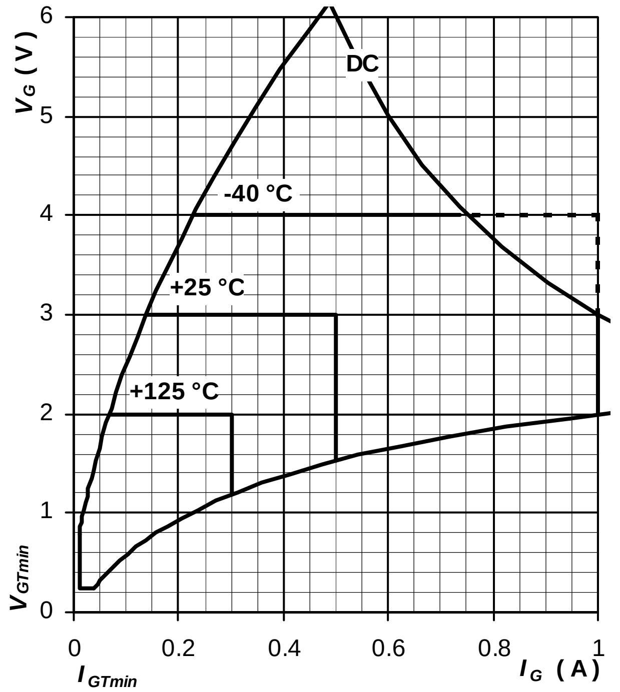

Fig. 5 Gate trigger characteristics

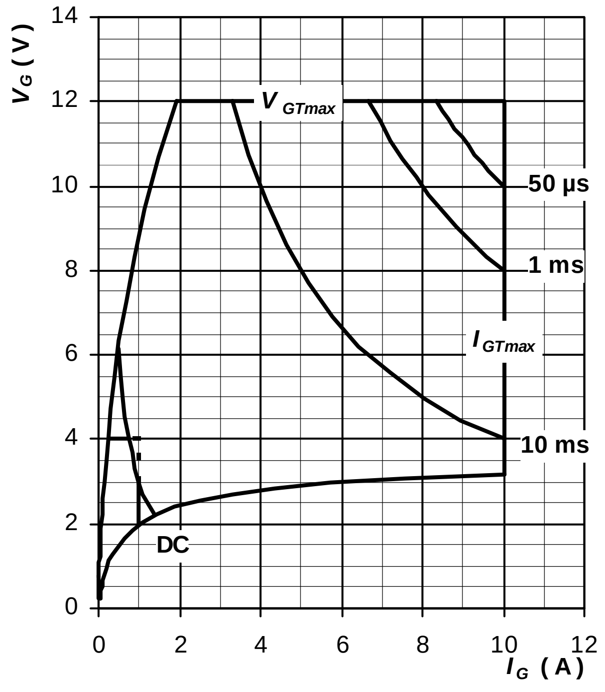

Fig. 6 Maximum peak gate power loss

Surge Characteristics - Thyristor

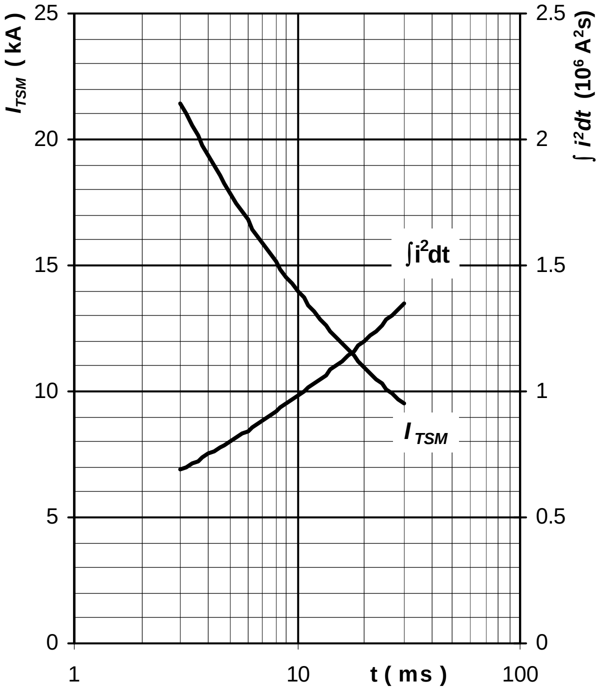

Fig. 7 *Surge on-state current vs. pulse length, half sine wave, single pulse, V_R = 0 V, T_j = T_{jmax}*

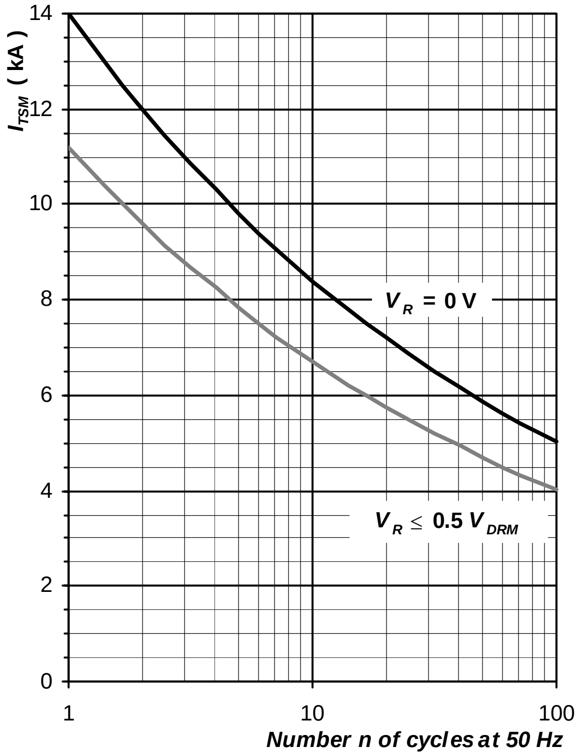

Fig. 8 *Surge on-state current vs. number of pulses, half sine wave, T_j = T_{jmax}*

Power Loss and Maximum Case Temperature Characteristics - Thyristor

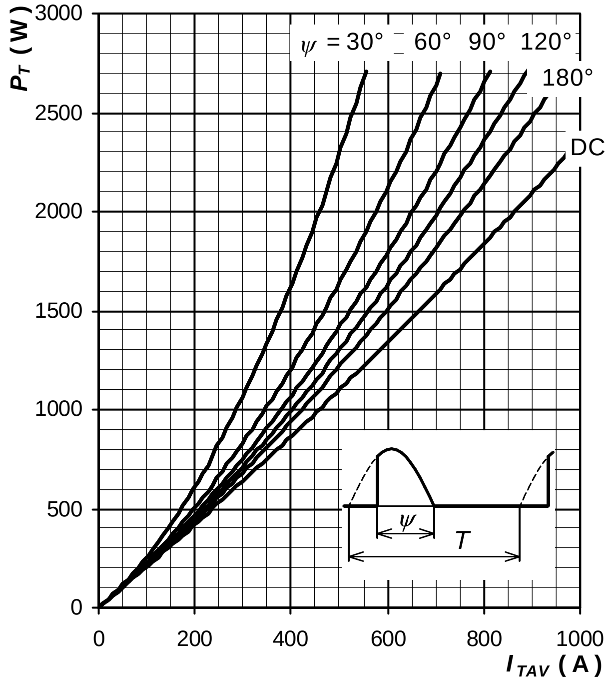

Fig. 9 On-state power loss vs. average on-state current, sine waveform, f = 50 Hz, T = 1/f

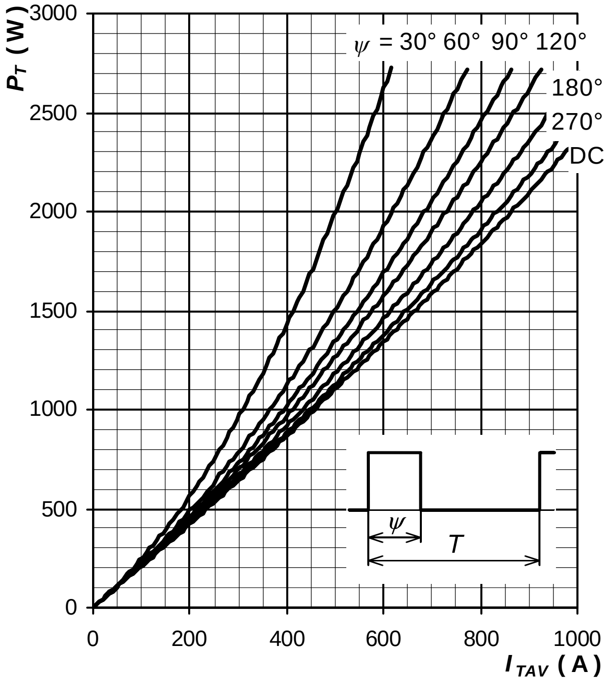

Fig. 10 On-state power loss vs. average on-state current, square waveform, f = 50 Hz, T = 1/f

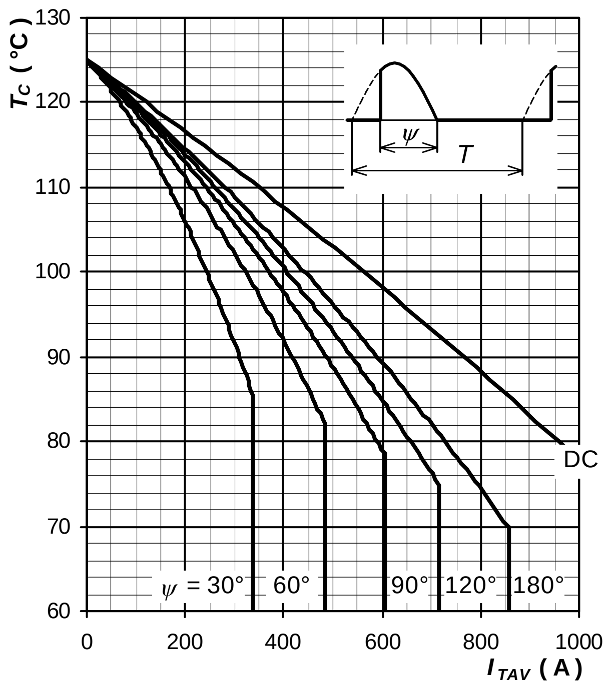

Fig. 11 Max. case temperature vs. aver. on-state current, sine waveform, f = 50 Hz, T = 1/f

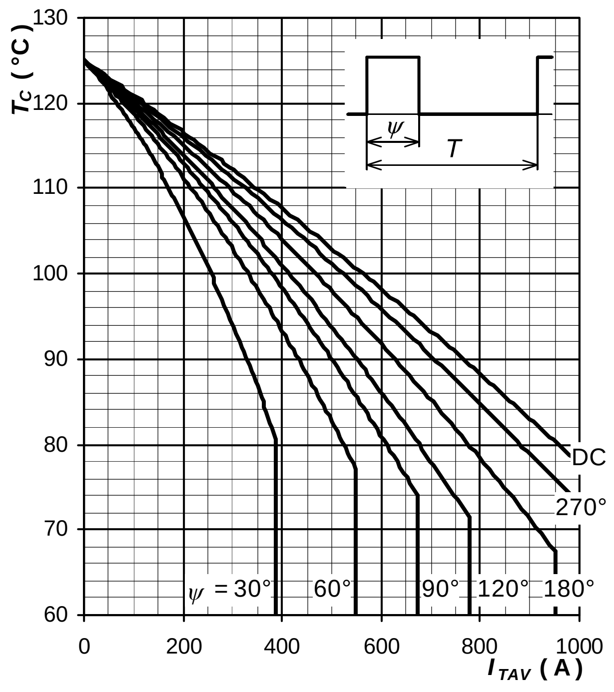

Fig. 12 Max. case temperature vs. aver. on-state current, square waveform, f = 50 Hz, T = 1/f

Note 2: Figures number 9 ÷ 12 have been calculated without considering any forward and reverse recovery losses. They are valid for f = 50 or 60 Hz operation.

Forward Characteristics - Diode

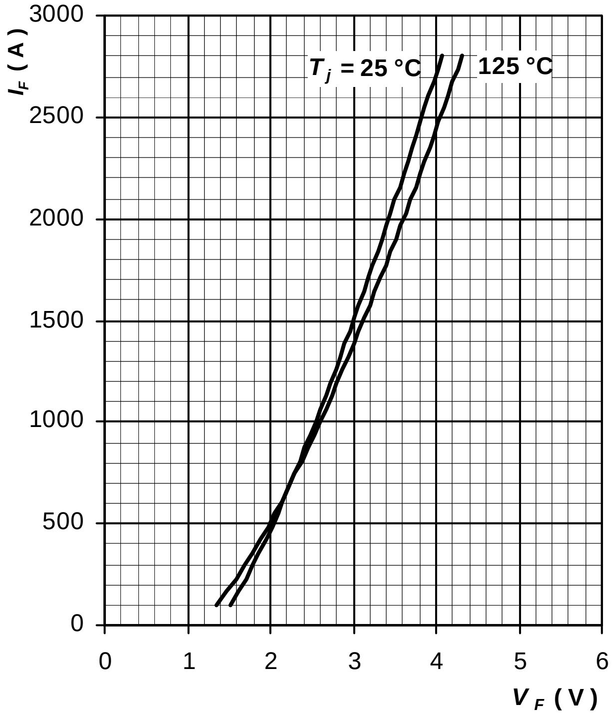

Fig. 13 Maximum forward voltage drop characteristics

Surge Characteristics - Diode

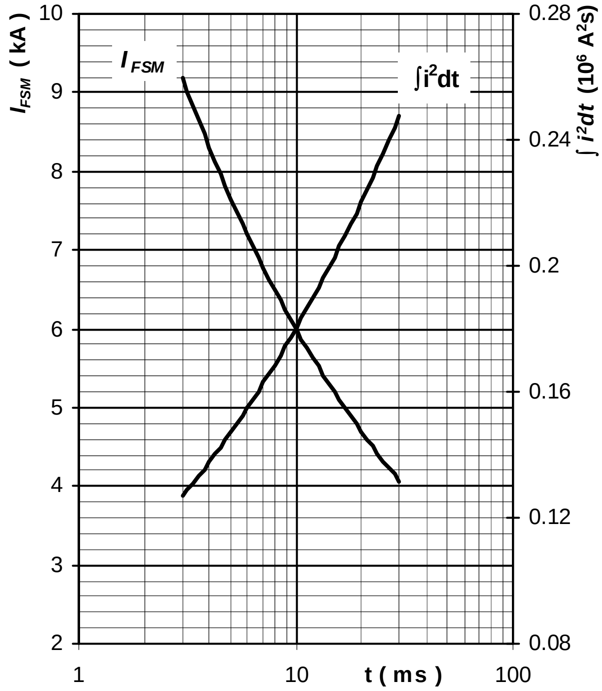

Fig. 14 Surge forward current vs. pulse length, half sine wave, single pulse, V_R = 0 V, T_j = T_{jmax}

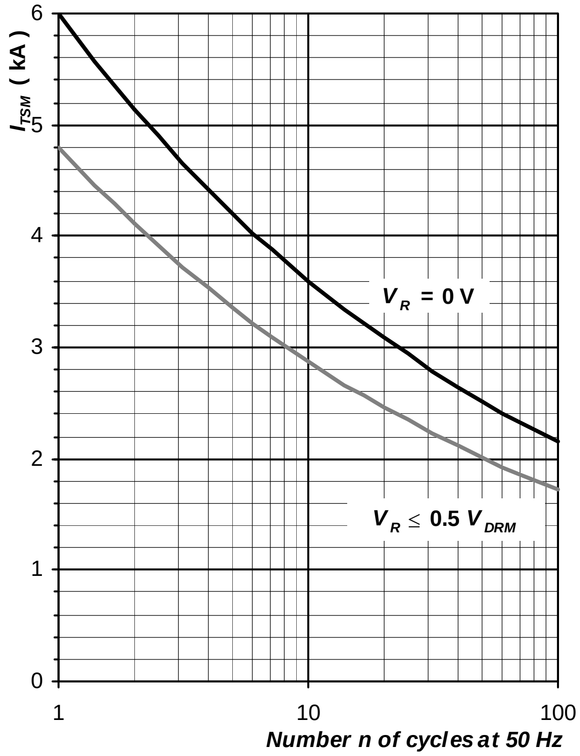

Fig. 15 Surge forward current vs. number of pulses, half sine wave, T_j = T_{jmax}

Power Loss and Maximum Case Temperature Characteristics - Diode

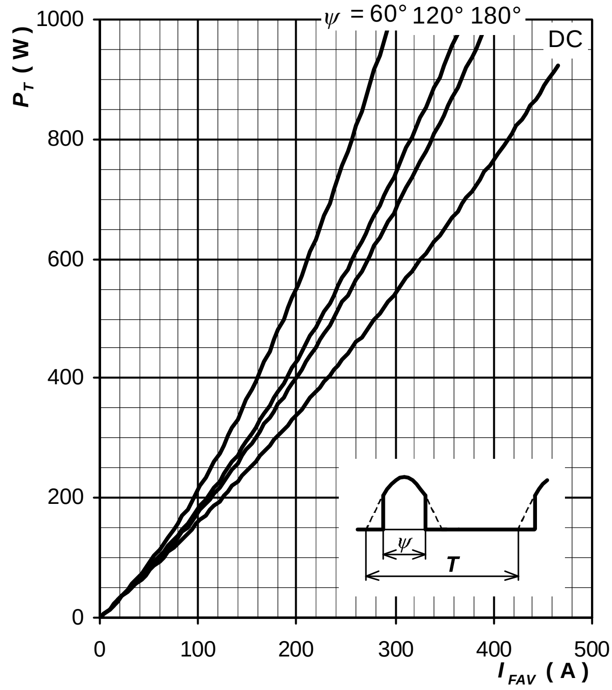

Fig. 16 Forward power loss vs. average forward current, sine waveform, f = 50 Hz, T = 1/f

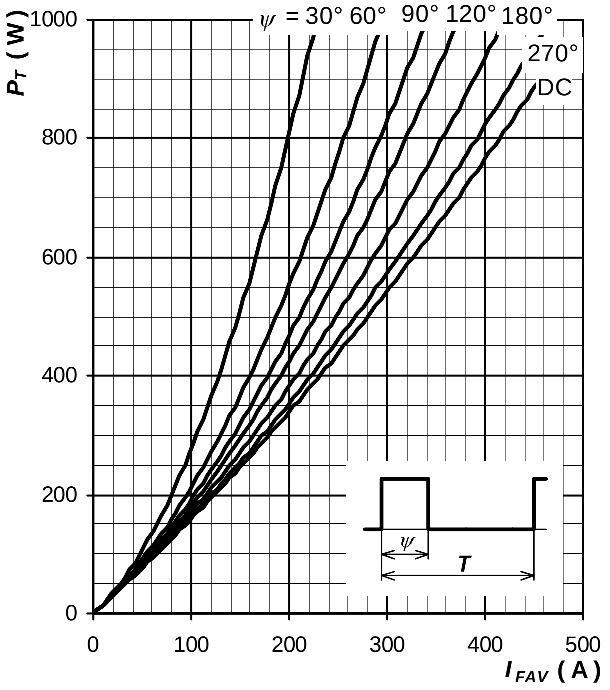

Fig. 17 Forward power loss vs. average forward current, square waveform, f = 50 Hz, T = 1/f

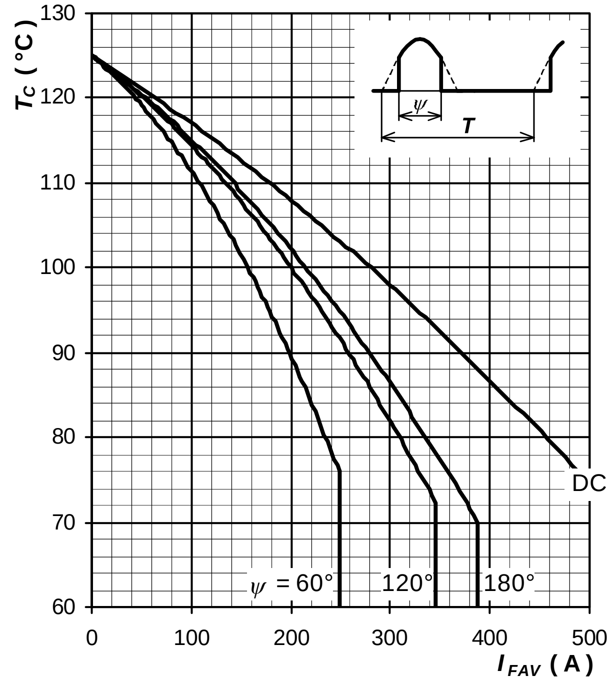

Fig. 18 Max. case temperature vs. aver. forward current, sine waveform, f = 50 Hz, T = 1/f

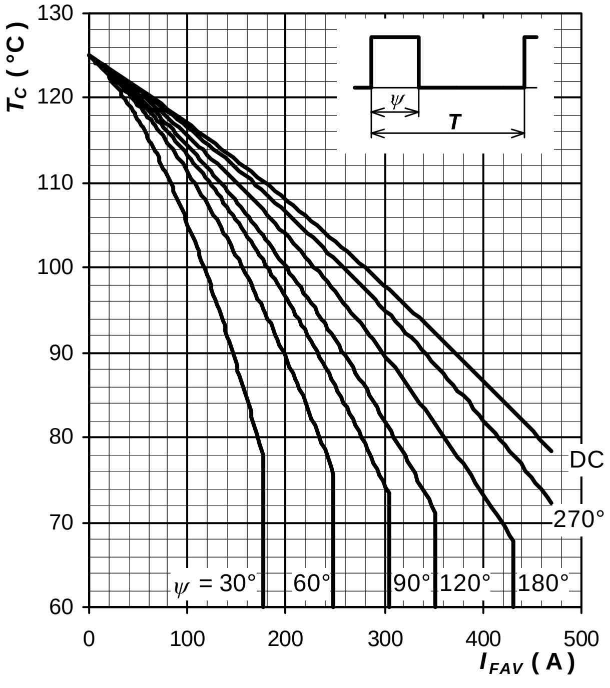

Fig. 19 Max. case temperature vs. aver. forward current, square waveform, f = 50 Hz, T = 1/f

Note 2: Figures number 16 ÷ 19 have been calculated without considering any forward and reverse recovery losses. They are valid for f = 50 or 60 Hz operation.

Notes: