Optimum power handling
Low on-state and switching losses
Designed for traction and industrial applications

Phase Control Stud Thyristor
Type T275-320-18

Mean on-state current							I_{TAV}			320 A						
Repetitive peak off-state voltage							V_{DRM}			100...1800 V						
Repetitive peak reverse voltage							V_{RRM}									
Turn-off time							t_q			125, 160, 200, 250, 320, 400, 500 µs						
V_{DRM}, V_{RRM}, V	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Voltage code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T_j, °C	–60...+125															

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{TAV}	Maximum allowable mean on-state current	A	320	T_c= 84 °C; 180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	502	T_c= 84 °C; 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	7.0 8.0	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_D=V_R=0 V; Gate pulse: I_G=2 A; t_{GP}=50 µs; di_G/dt≥1 A/µs
			7.5 8.5	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=8.3 ms; single pulse; V_D=V_R=0 V; Gate pulse: I_G=2 A; t_{GP}=50 µs; di_G/dt≥1 A/µs
I^2t	Safety factor	$A^2s\cdot10^3$	240 320	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_D=V_R=0 V; Gate pulse: I_G=2 A; t_{GP}=50 µs; di_G/dt≥1 A/µs
			230 290	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=8.3 ms; single pulse; V_D=V_R=0 V; Gate pulse: I_G=2 A; t_{GP}=50 µs; di_G/dt≥1 A/µs
BLOCKING					
V_{DRM}, V_{RRM}	Repetitive peak off-state and Repetitive peak reverse voltages	V	100...1800	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; 50 Hz; Gate open	
V_{DSM}, V_{RSM}	Non-repetitive peak off-state and Non-repetitive peak reverse voltages	V	200...1900	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; single pulse; Gate open	
V_D, V_R	Direct off-state and Direct reverse voltages	V	$0.6\cdot V_{DRM}$ $0.6\cdot V_{RRM}$	T_j=$T_{j\,max}$; Gate open	

TRIGGERING				
I_{FGM}	Peak forward gate current	A	6	$T_j=T_{j\,max}$
V_{RGM}	Peak reverse gate voltage	V	5	
P_G	Gate power dissipation	W	3	$T_j=T_{j\,max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/µs	1000	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; $I_{TM}=1700$ A; Gate pulse: $I_G=2$ A; $t_{GP}=50$ µs; $di_G/dt \geq 2$ A/µs
THERMAL				
T_{stg}	Storage temperature	°C	–60...+50	
T_j	Operating junction temperature	°C	–60...+125	
MECHANICAL				
F	Mounting force	kN	1.5...2.5	
a	Acceleration	m/s^2	100	

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{TM}	Peak on-state voltage, max	V	1.60	$T_j=25$ °C; $I_{TM}=1005$ A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.006	$T_j=T_{j\,max}$; $0.5\,\pi\,I_{TAV} < I_T < 1.5\,\pi\,I_{TAV}$	
r_T	On-state slope resistance, max	mΩ	0.612		
I_L	Latching current, max	mA	700	$T_j=25$ °C; $V_D=12$ V; Gate pulse: $I_G=2$ A; $t_{GP}=50$ µs; $di_G/dt \geq 1$ A/µs	
I_H	Holding current, max	mA	300	$T_j=25$ °C; $V_D=12$ V; Gate open	
BLOCKING					
I_{DRM}, I_{RRM}	Repetitive peak off-state and Repetitive peak reverse currents, max	mA	70	$T_j=T_{j\,max}$; $V_D=V_{DRM}$; $V_R=V_{RRM}$	
$(dv_D/dt)_{crit}$	Critical rate of rise of off-state voltage[1)], min	V/µs	200, 320, 500, 1000	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; Gate open	
TRIGGERING					
V_{GT}	Gate trigger direct voltage, max	V	3.00 2.50 1.50	$T_j=T_{j\,min}$ $T_j=25$ °C $T_j=T_{j\,max}$	$V_D=12$ V; $I_D=3$ A; Direct gate current
I_{GT}	Gate trigger direct current, max	mA	400 250 150	$T_j=T_{j\,min}$ $T_j=25$ °C $T_j=T_{j\,max}$	
V_{GD}	Gate non-trigger direct voltage, min	V	0.60	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	35.00		
SWITCHING					
t_{gd}	Delay time, max	µs	1.25	$T_j=25$ °C; $V_D=1000$ V; $I_{TM}=I_{TAV}$; $di/dt=200$ A/µs; Gate pulse: $I_G=2$ A; $V_G=20$ V; $t_{GP}=50$ µs; $di_G/dt=2$ A/µs	
t_{gt}	Turn-on time, max	µs	4.00		
t_q	Turn-off time[2)], max	µs	125, 160, 200, 250, 320, 400, 500	$dv_D/dt=50$ V/µs; $T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $di_R/dt=-10$ A/µs; $V_R=100$V; $V_D=0.67 \cdot V_{DRM}$	
Q_{rr}	Recovered charge, max	µC	1100	$T_j=T_{j\,max}$; $I_{TM}=320$ A; $di_R/dt=-10$ A/µs; $V_R=100$ V	
t_{rr}	Reverse recovery time, max	µs	20		
I_{rr}	Reverse recovery current, max	A	110		

THERMAL				
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0850	Direct current
MECHANICAL				
m	Weight, max	g	520	
D_s	Surface creepage distance	mm (inch)	12.40 (4.882)	
D_a	Air strike distance	mm (inch)	12.40 (4.882)	

PART NUMBERING GUIDE

T	275	320	18	A2	E2	N
1	2	3	4	5	6	7

1. Phase Control Thyristor
2. Design version
3. Mean on-state current, A
4. Voltage code
5. Critical rate of rise of off-state voltage, V/µs
6. Turn-off time (dv_D/dt=50 V/µs)
7. Ambient conditions: N – normal; T – tropical

NOTES

1) Critical rate of rise of off-state voltage

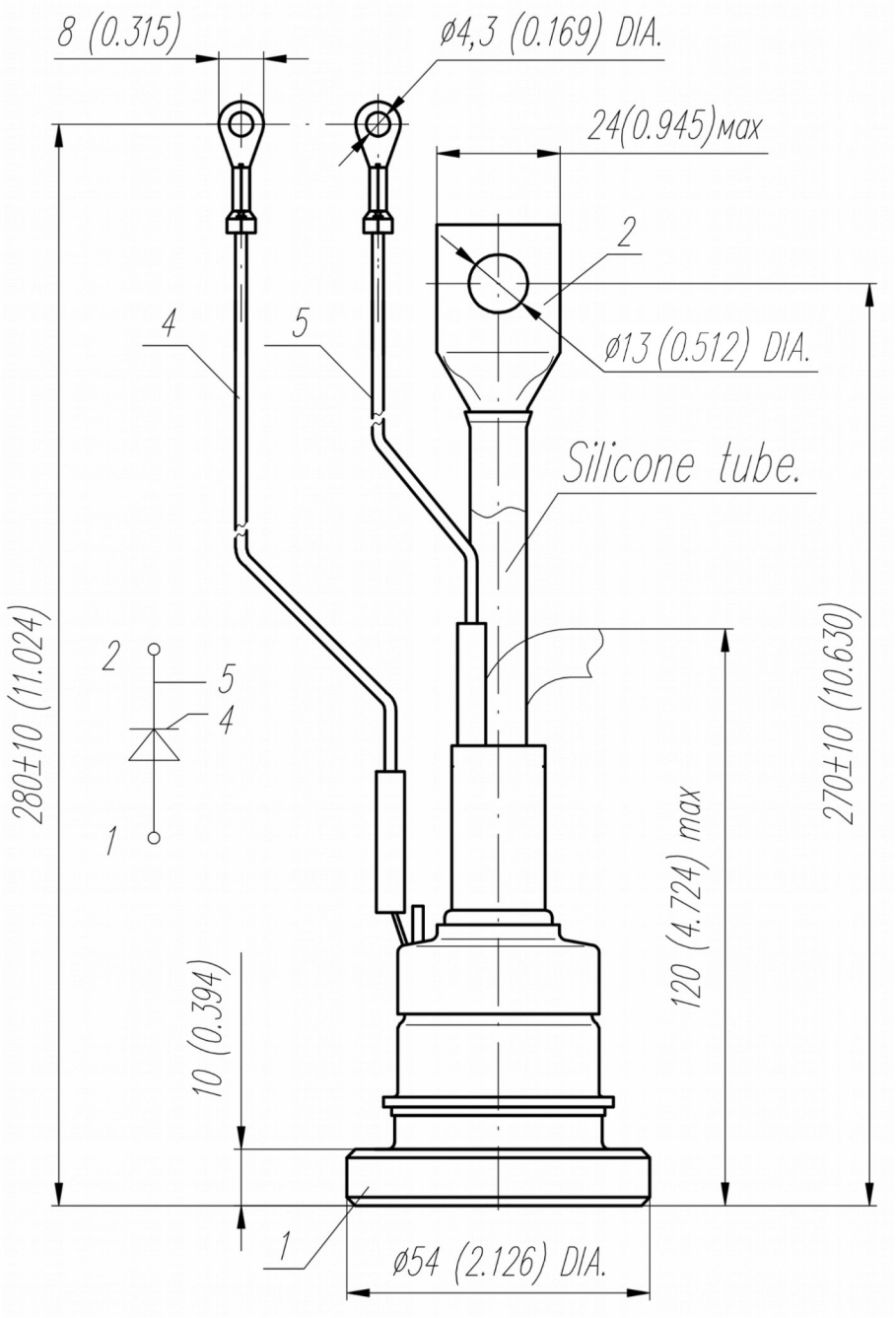
Symbol of Group	P2	K2	E2	A2
$(dv_D/dt)_{crit}$, V/µs	200	320	500	1000

2) Turn-off time (dv_D/dt=50 V/µs)

Symbol of Group	X2	T2	P2	M2	K2	H2	E2
t_q, µs	125	160	200	250	320	400	500

OVERALL DIMENSIONS

Package type: T.SB3



Polarity	Example of code designation	Reference designation	Colors		
			Anode	Cathode	Gate
Anode to stud	T275-320-18		-	Red tube	White

All dimensions in millimeters (inches)

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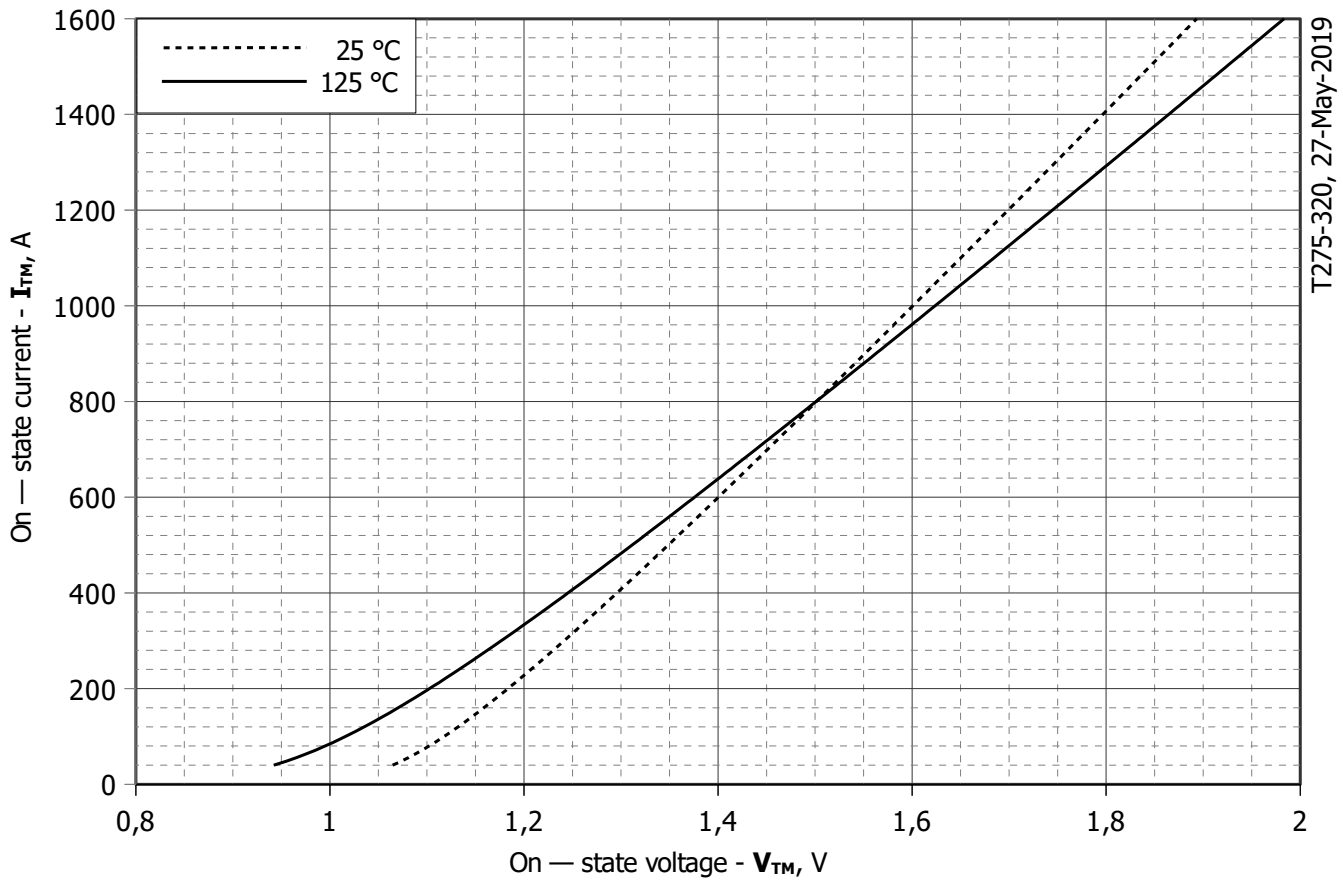

Fig 1 – On-state characteristics of Limit device

Analytical function for On-state characteristic:

$$V_T = A + B \cdot i_T + C \cdot \ln(i_T + 1) + D \cdot \sqrt{i_T}$$

	Coefficients for max curves	
	T_j = 25°C	$T_j = T_{j\,max}$
A	0.942360000000	0.75075000000
B	0.000465730000	0.00057179000
C	0.027899000000	0.04644400000
D	0.000000015635	-0.00062265000

On-state characteristic model (see Fig. 1)

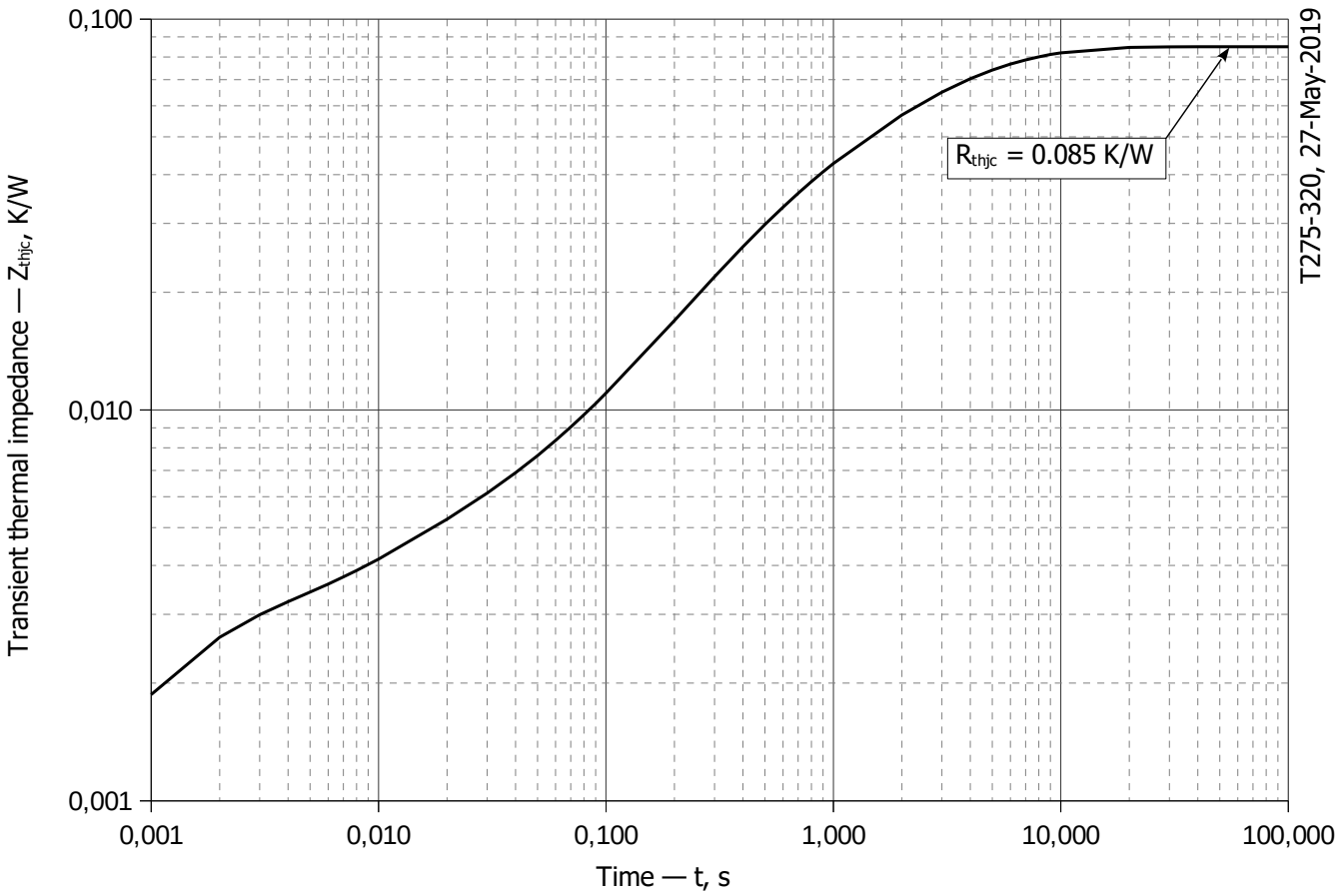

Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

Analytical function for Transient thermal impedance junction to case Z_{thjc} for DC:

$$Z_{thjc} = \sum_{i=1}^{n} R_i \left(1 - e^{-\frac{t}{\tau_i}}\right)$$

Where ***i*** = 1 to ***n***, ***n*** is the number of terms in the series.

t = Duration of heating pulse in seconds.

$\mathbf{Z_{thjc}}$ = Thermal resistance at time t.

$\mathbf{R_i}$ = Amplitude of p_{th} term.

τ_i = Time constatnt of r_{th} term.

DC

i	1	2	3	4	5	6
$\mathbf{R_i}$, **K/W**	0.023357	0.02733	0.01495	0.001445	0.002488	0.01543
τ_i, **s**	4.627	2.249	0.3406	0.01043	0.0009112	0.9081

Transient thermal impedance junction to case Z_{thjc} model (see Fig. 2)

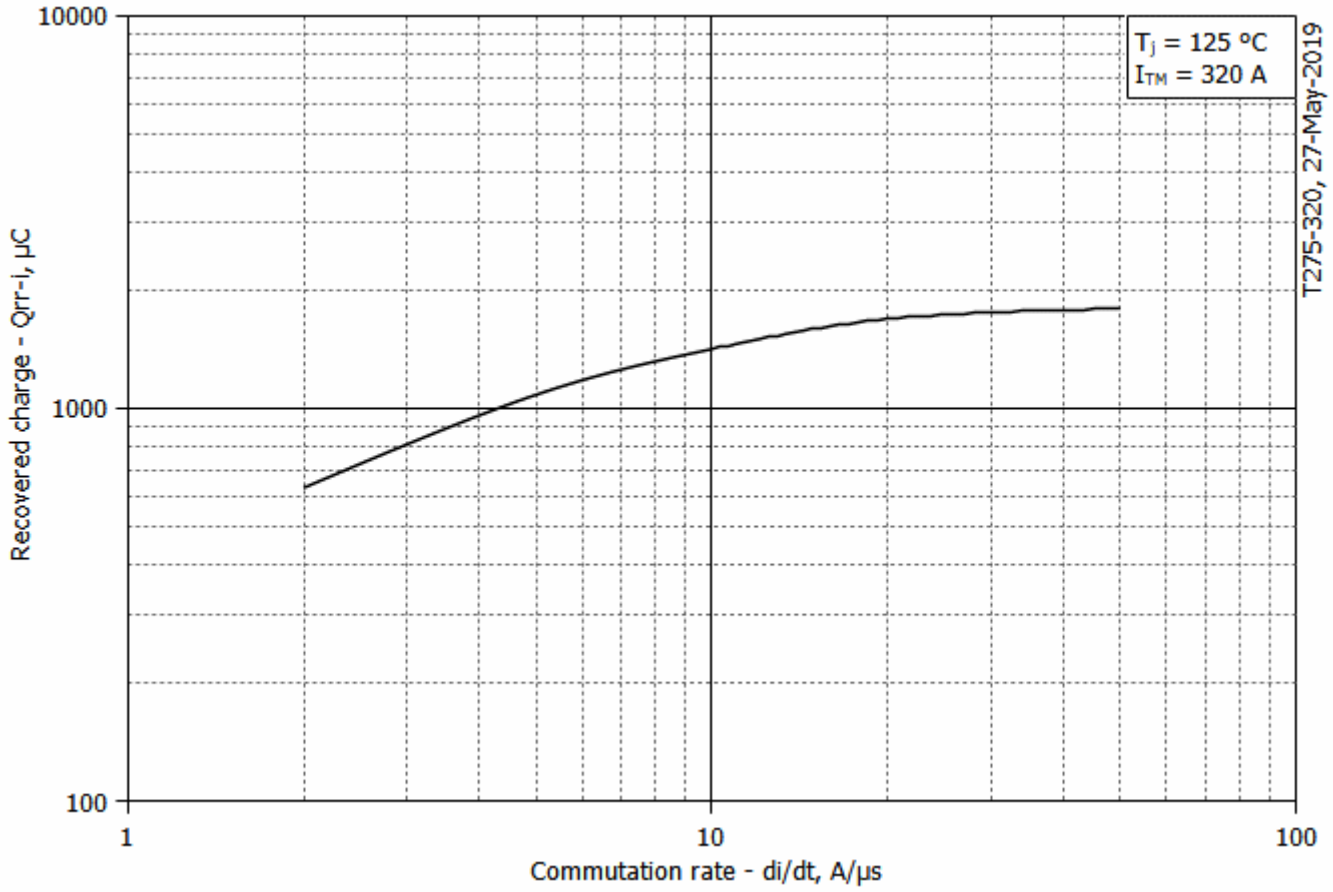

Fig 3 – Maximum recovered charge $Q_{rr\text{-}i}$ (integral) vs. commutation rate di_R/dt

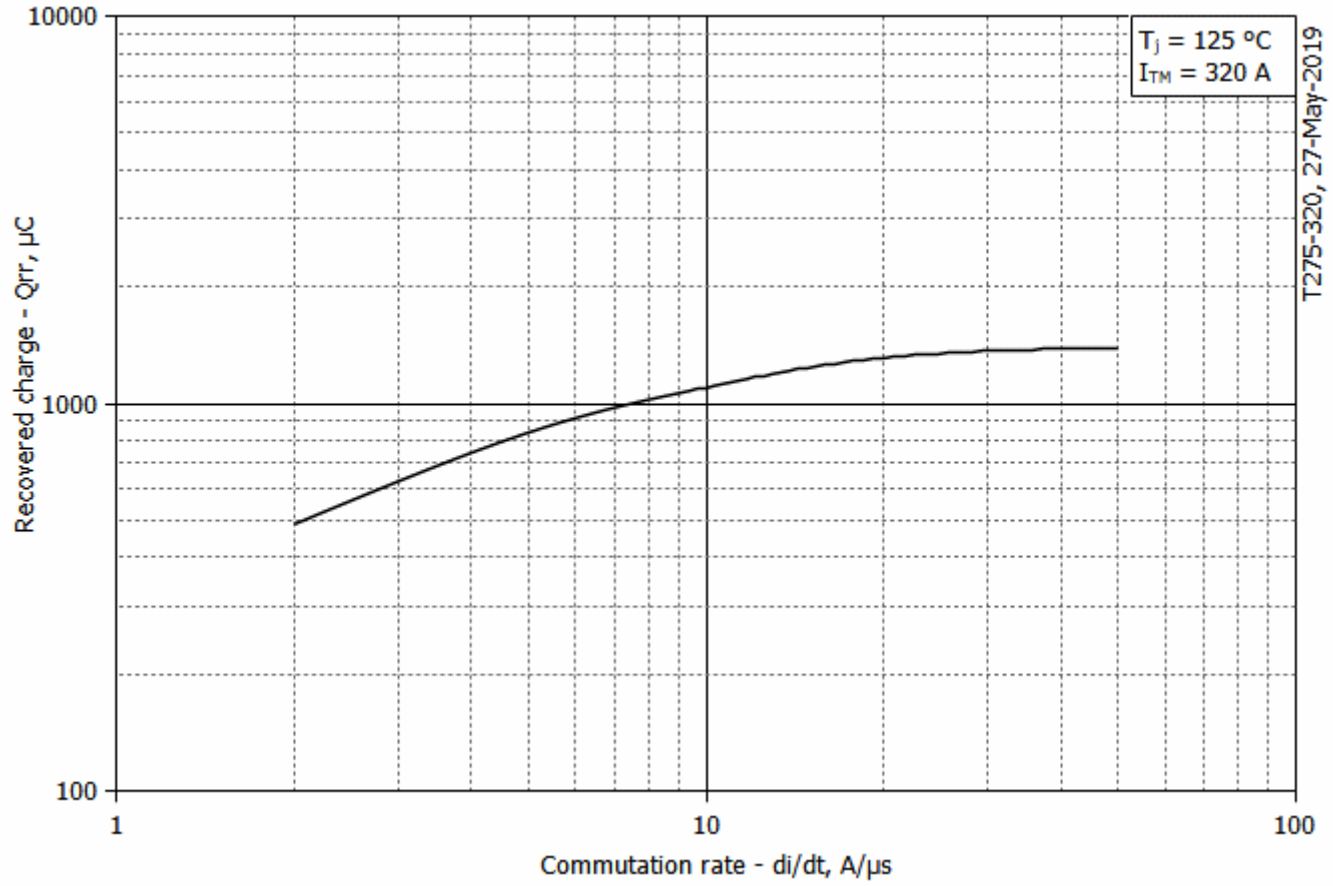

Fig 4 – Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

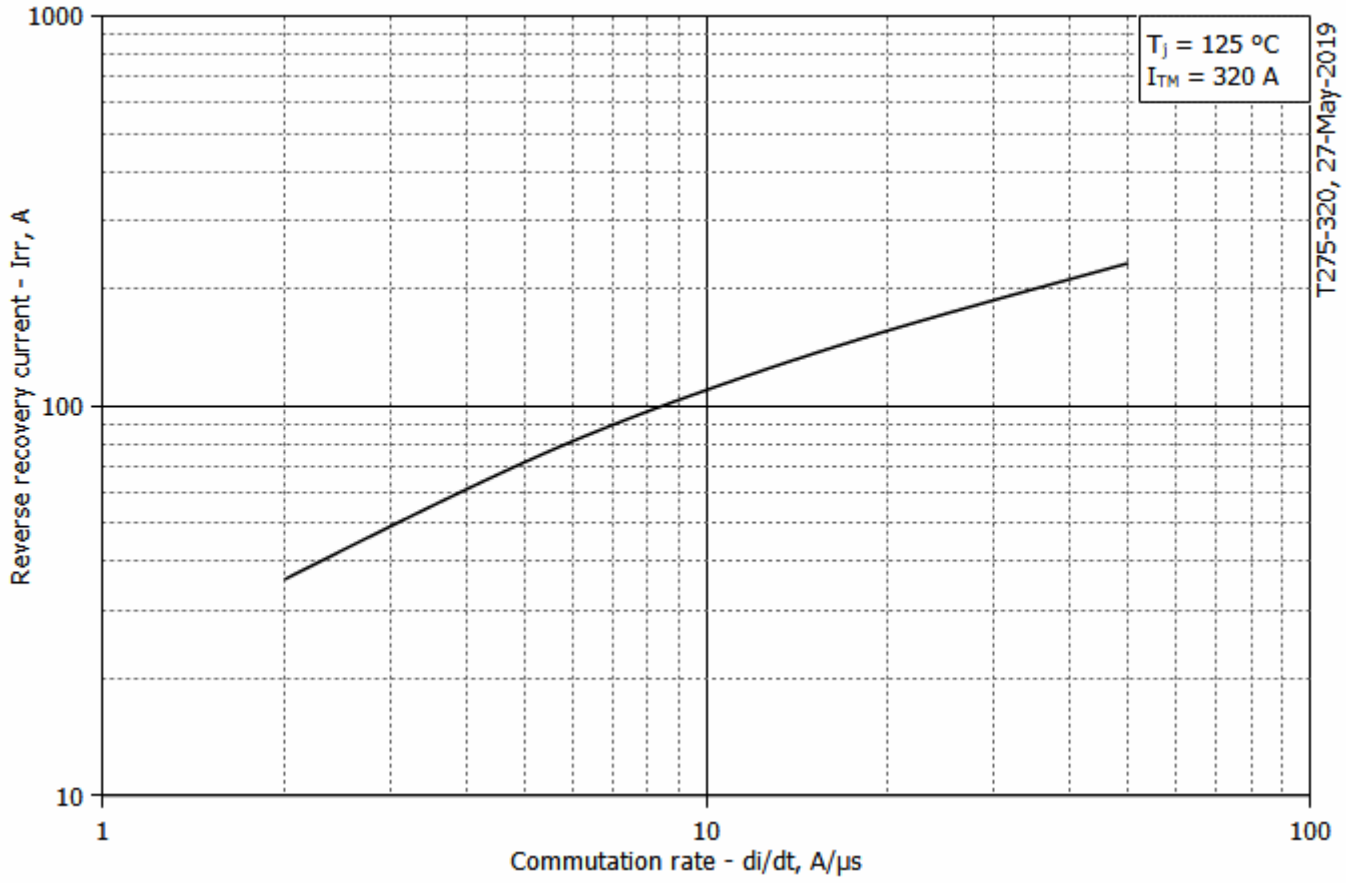

Fig 5 – Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

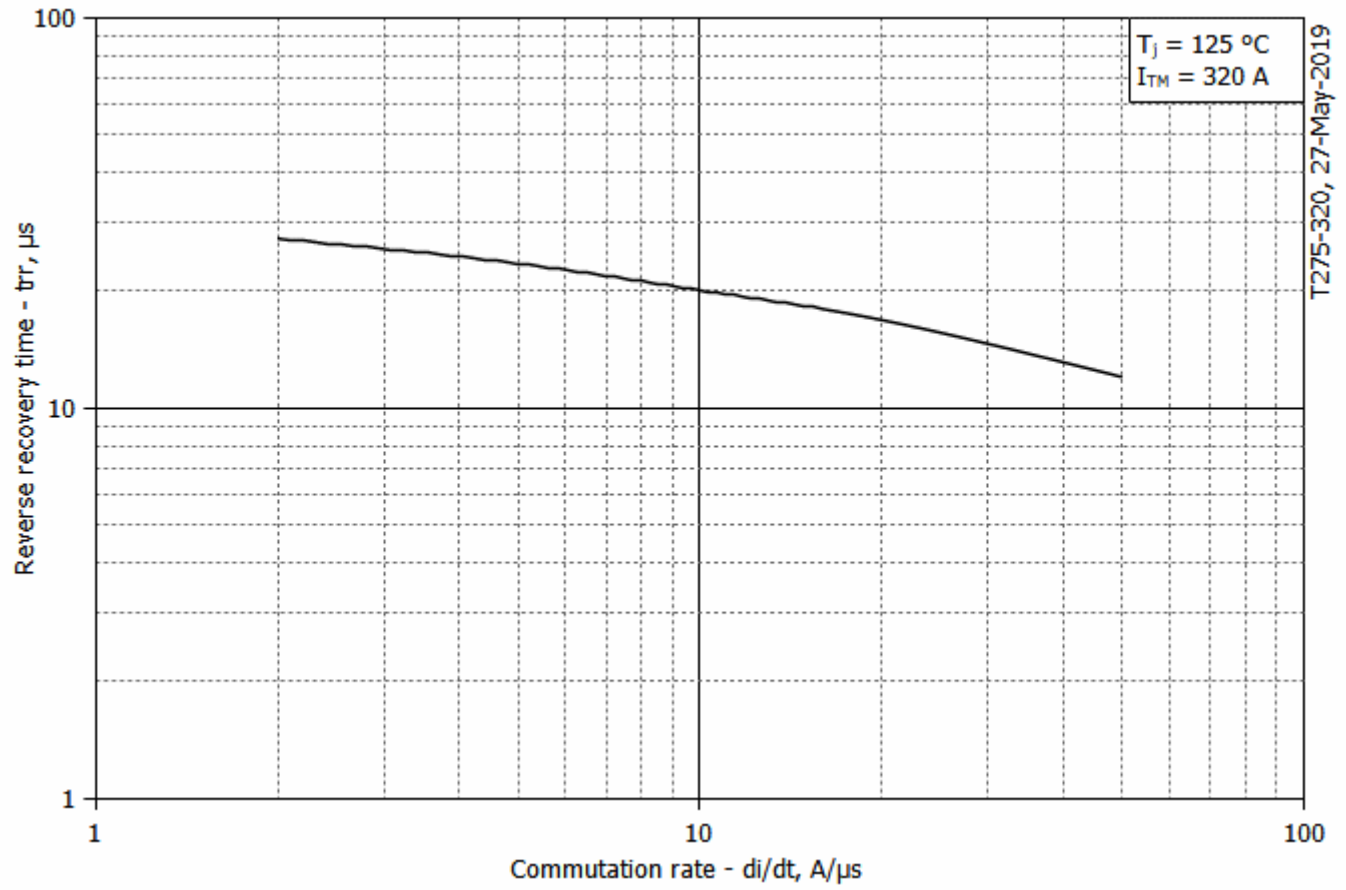

Fig 6 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

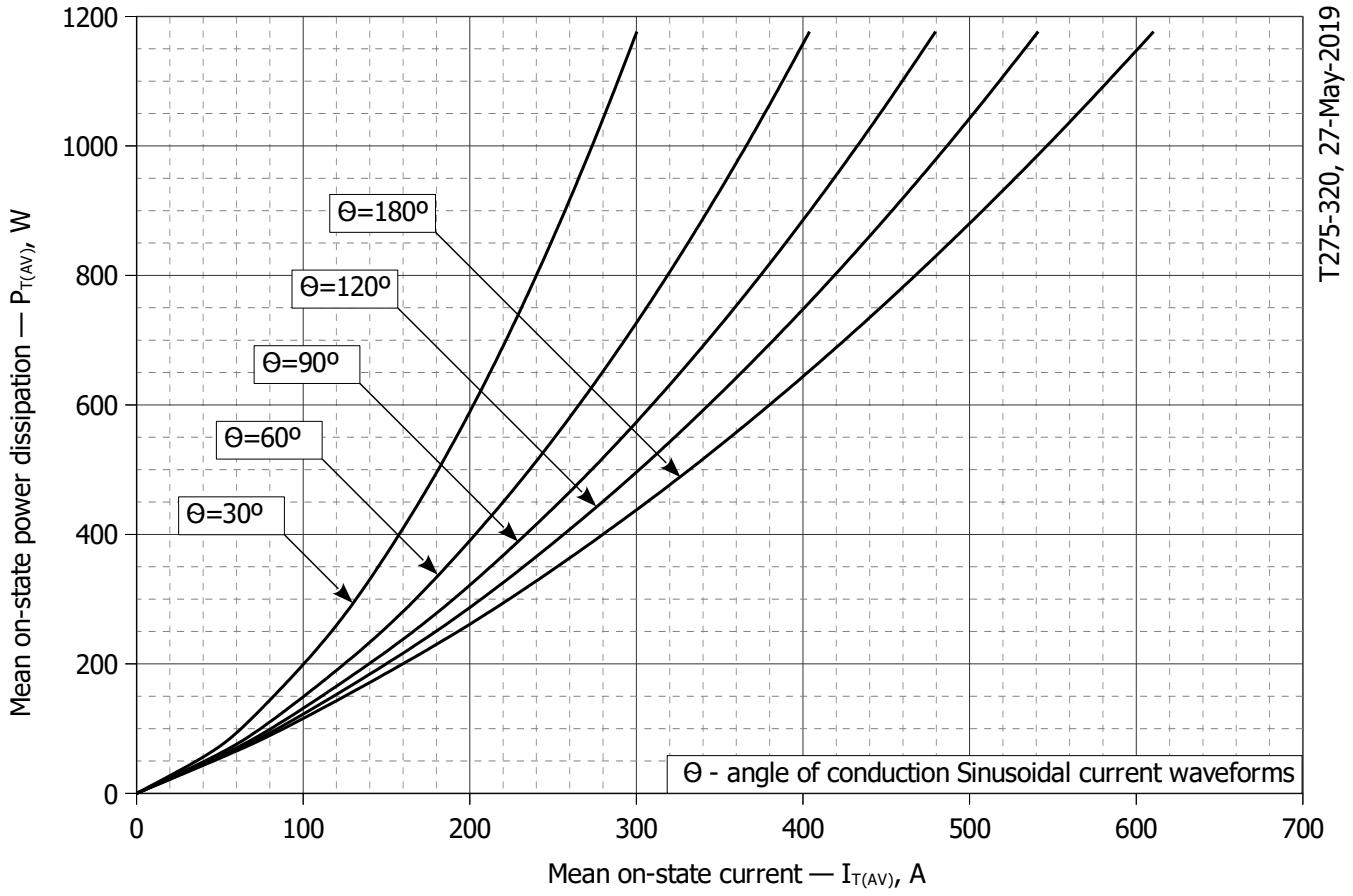

Fig. 7 - Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for sinusoidal current waveforms at different conduction angles (f=50Hz)

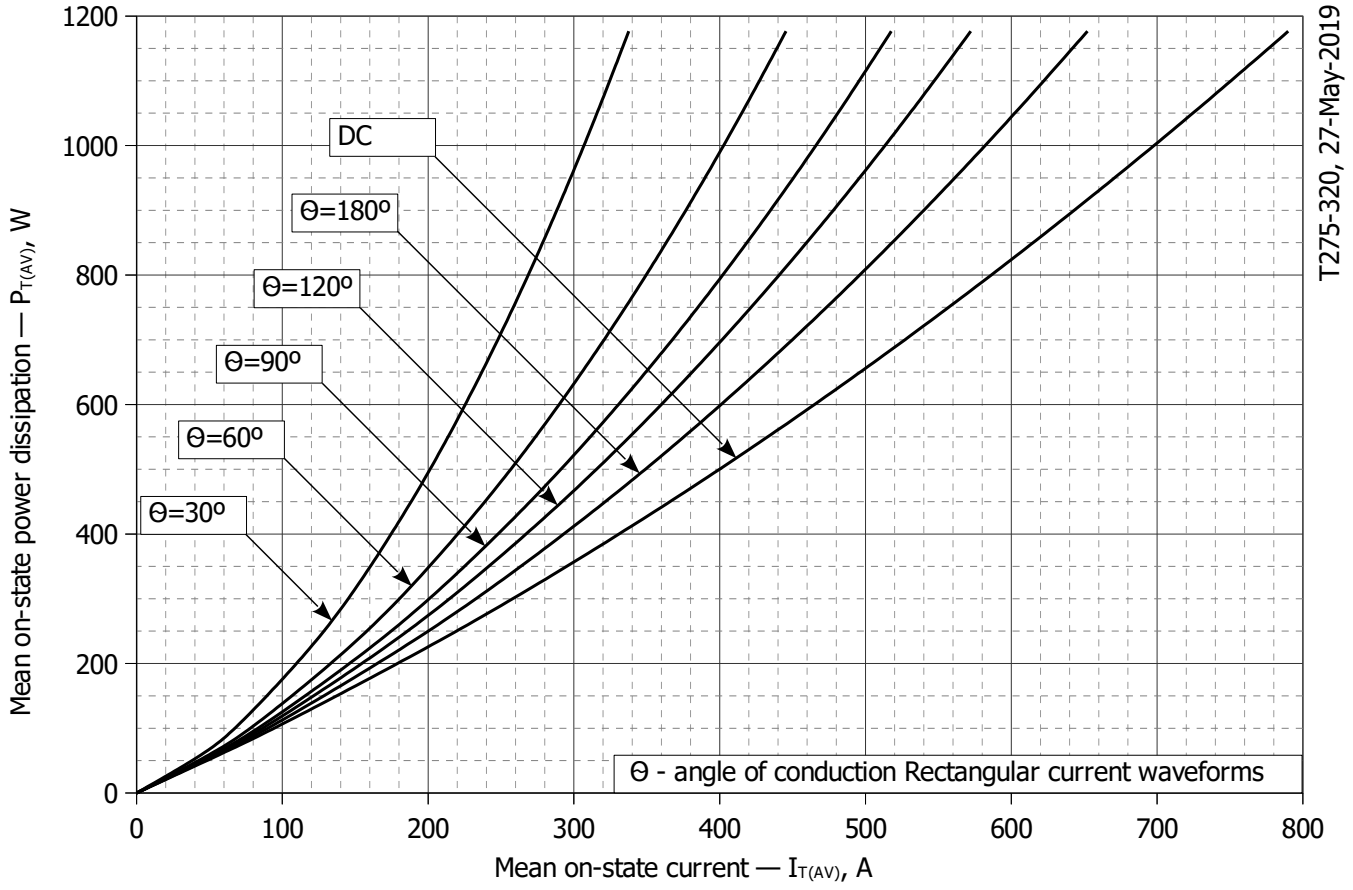

Fig. 8 – Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz)

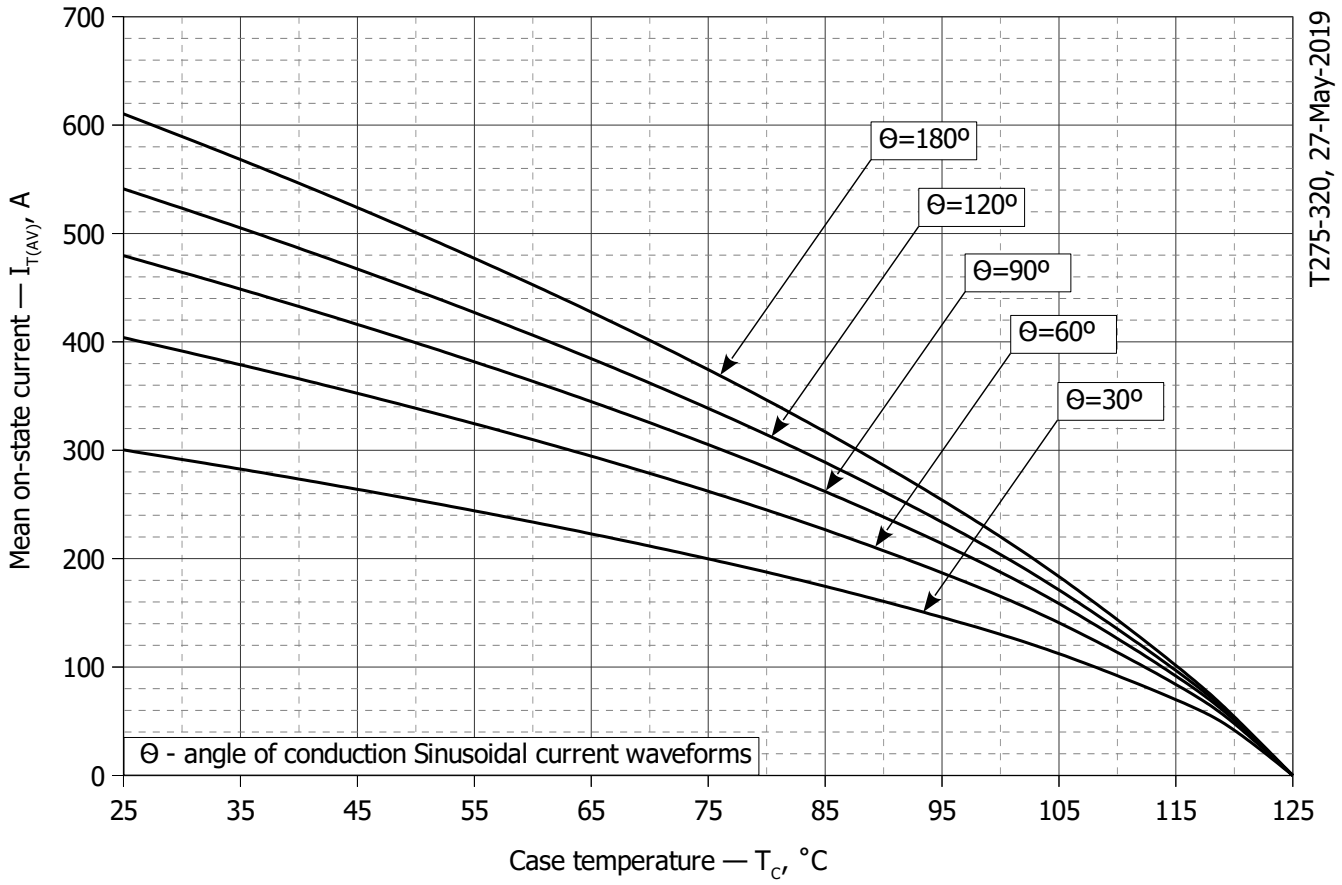

Fig. 9 – Mean on-state current I_{TAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz)

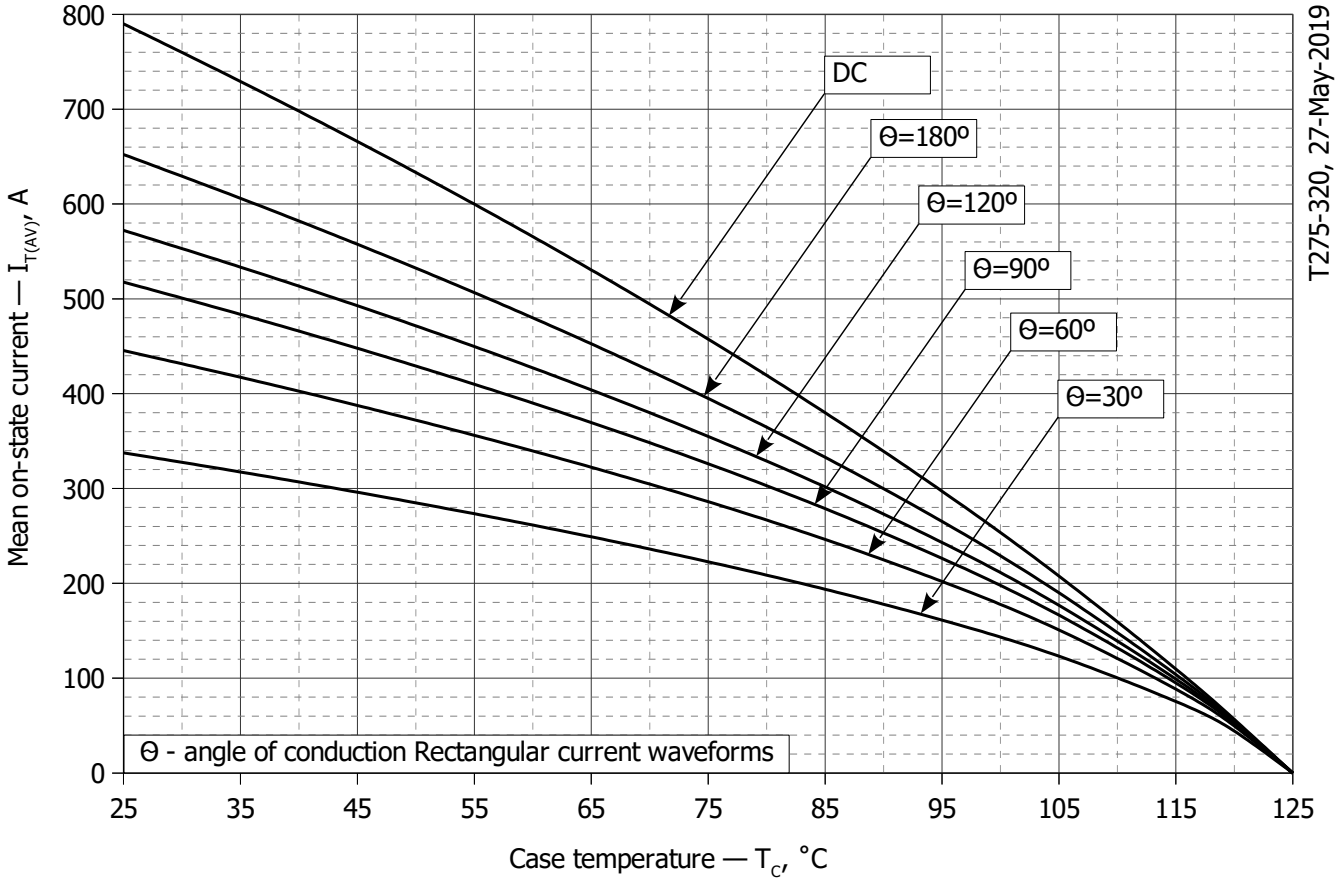

Fig. 10 - Mean on-state current I_{TAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz)

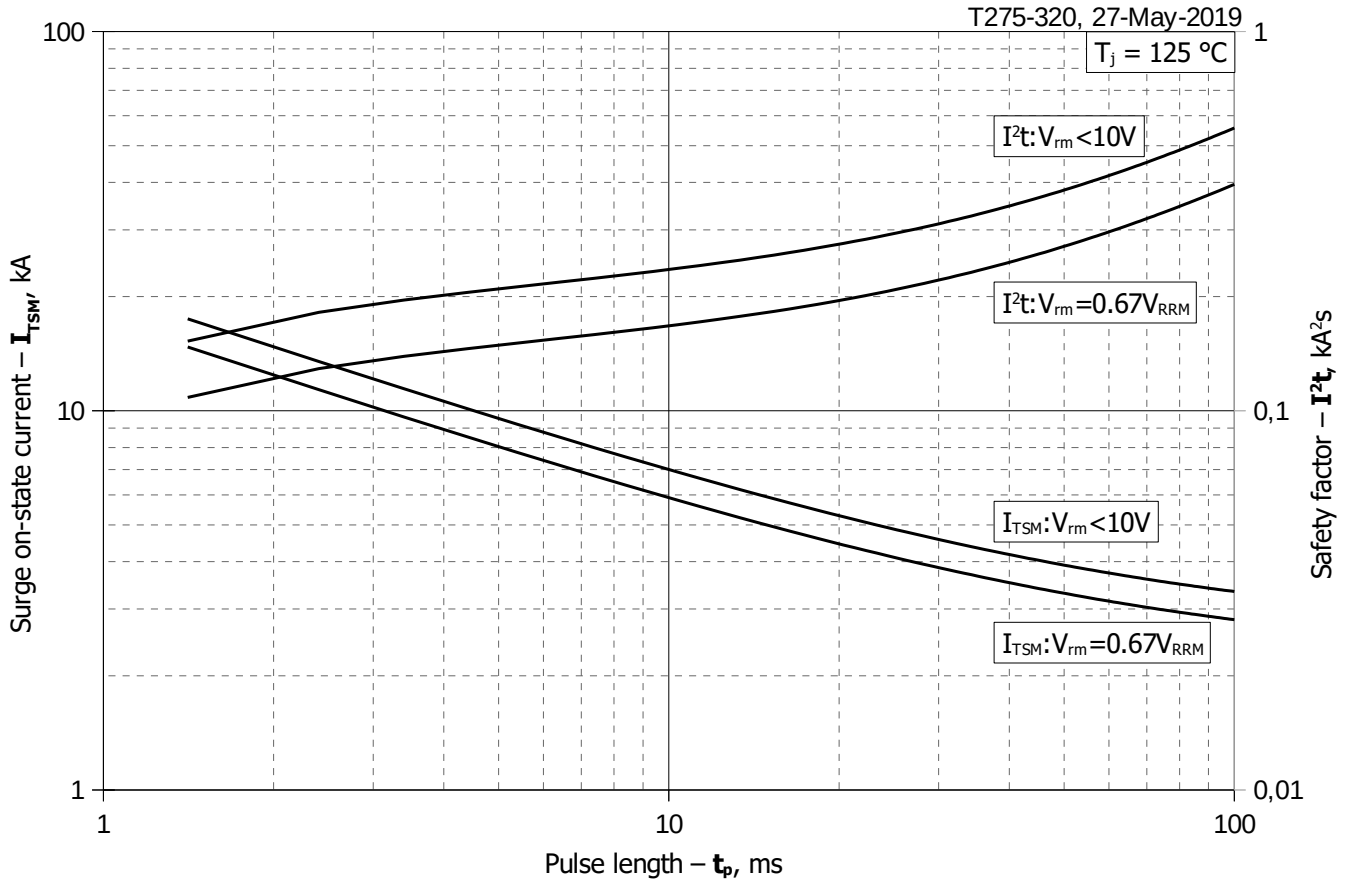

Fig. 11 – Maximum surge on-state current I_{TSM} and safety factor I^2t vs. pulse length t_p

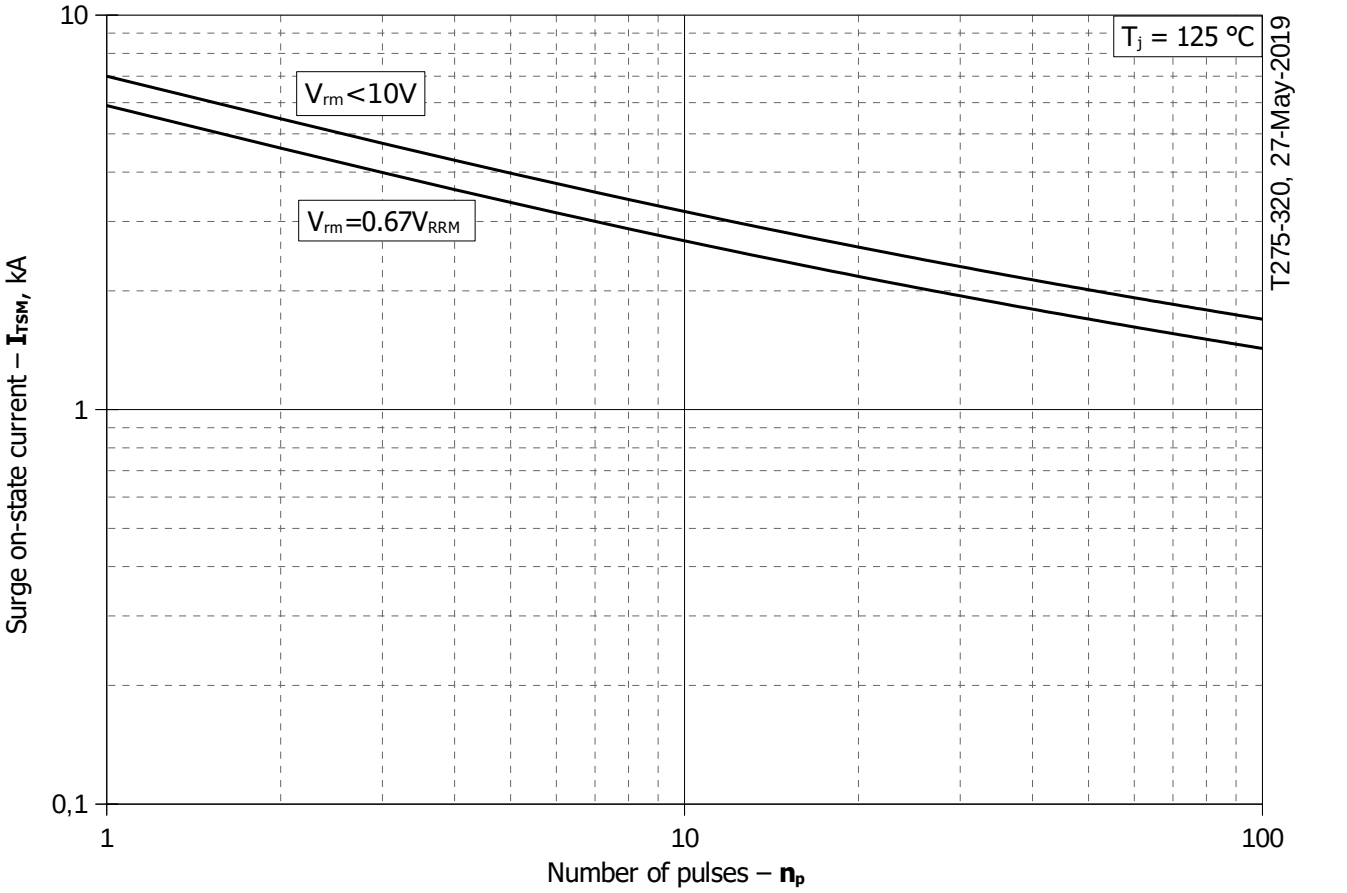

Fig. 12 - Maximum surge on-state current I_{TSM} vs. number of pulses n_p