АС ЭНЕРГИЯ

Thyristor T443-400-42

Mean on-state current		I_{TAV}	400 A
Repetitive peak off-state voltage		V_{DRM}	3800 - 4200 V
Repetitive peak reverse voltage		V_{RRM}	
Turn-off time		t_q	500, 630, 800 µs
V_{DRM}, V_{RRM}, V	3800	4000	4200
Voltage code	38	40	42
T_j, °C	-60 ÷ 125		

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{TAV}	Mean on-state current	A	400 455	T_c=92 °C, Double side cooled T_c=85 °C, Double side cooled 180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	628	T_c=92 °C, Double side cooled 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	6.5 7.5	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 ms; di_G/dt≥1 A/ms
			7.0 8.0	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 ms; di_G/dt≥1 A/ms
I^2t	Safety factor	$A^2s\cdot10^3$	210 280	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 ms; di_G/dt≥1 A/ms
			200 260	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 ms; di_G/dt≥1 A/ms
BLOCKING					
V_{DRM}, V_{RRM}	Repetitive peak off-state and Repetitive peak reverse voltages	V	3800 - 4200	$T_{j\,min}$< 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	3900 - 4300	$T_{j\,min}$< 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·V_{DRM} 0.6·V_{RRM}	T_j=$T_{j\,max}$; Gate open	

TRIGGERING				
I_{FGM}	Peak forward gate current	A	8	$T_j=T_{j\,max}$
V_{RGM}	Peak reverse gate voltage	V	5	
P_G	Gate power dissipation	W	4	$T_j=T_{j\,max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/ms	500	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; I_{TM}=1250 A; Gate pulse: I_G=2 A; t_{GP}=50 ms; $di_G/dt\geq$2 A/ms
THERMAL				
T_{stg}	Storage temperature	°C	-60...+50	
T_j	Operating junction temperature	°C	-60...+125	
MECHANICAL				
F	Mounting force	kN	14.0 - 16.0	
a	Acceleration	m/s^2	50	Device clamped

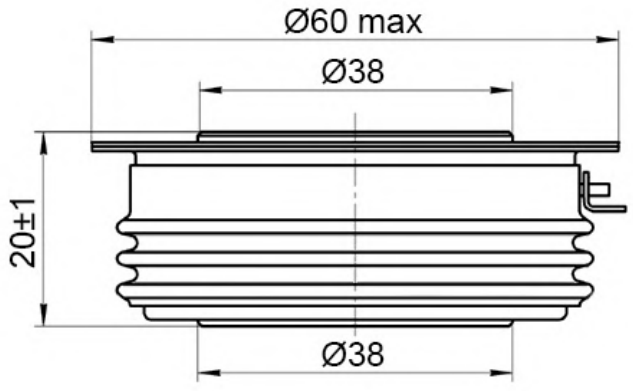
CHARACTERISTICS

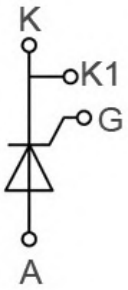
Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{TM}	Peak on-state voltage, max	V	2.25	T_j=25 °C; I_{TM}=1256 A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.117	$T_j=T_{j\,max}$; 0.5 p I_{TAV} < I_T < 1.5 p I_{TAV}	
r_T	On-state slope resistance, max	mW	1.245		
I_L	Latching current, max	mA	1000	T_j=25 °C; V_D=12 V; Gate pulse: I_G=2 A; t_{GP}=50 ms; $di_G/dt\geq$1 A/ms	
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	100	$T_j=T_{j\,max}$; $V_D=V_{DRM}$; $V_R=V_{RRM}$	
$(dv_D/dt)_{crit}$	Critical rate of rise of off-state voltage[1)], min	V/ms	200, 320, 500, 1000, 1600, 2000, 2500	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; 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	0.45	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	55.00		
SWITCHING					
t_{gd}	Delay time, max	ms	3.20	T_j=25 °C; V_D=1500 V; $I_{TM}=I_{TAV}$; di/dt=200 A/ms; Gate pulse: I_G=2 A; V_G=20 V; t_{GP}=50 ms; di_G/dt=2 A/ms	
t_{gt}	Turn-on time, max	ms	15.00		
t_q	Turn-off time[2)], max	ms	500, 630, 800	dv_D/dt=50 V/ms; $T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; di_R/dt=-5 A/ms; V_R=100V; $V_D=0.67\cdot V_{DRM}$	
Q_{rr}	Total recovered charge, max	mC	1760	$T_j=T_{j\,max}$; I_{TM}=400 A; di_R/dt=-5 A/ms; V_R=100 V	
t_{rr}	Reverse recovery time, max	ms	40		
I_{rrM}	Peak reverse recovery current, max	A	88		

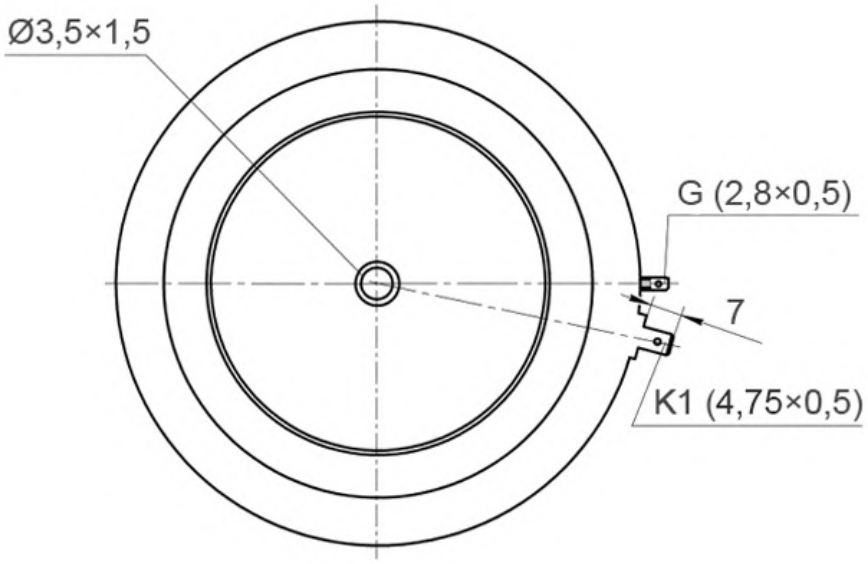
THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0350	Direct current	Double side cooled
R_{thjc-A}			0.0770		Anode side cooled
R_{thjc-K}			0.0630		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0060	Direct current	
MECHANICAL					
w	Weight, max	g	240		
D_s	Surface creepage distance	mm (inch)	19.44 (0.765)		
D_a	Air strike distance	mm (inch)	12.10 (0.476)		

OVERALL DIMENSIONS

Package type: T.C2, (PT42)







K – cathode;

A – anode;

K1 – auxiliary cathode;

G – gate;

All dimensions in millimeters

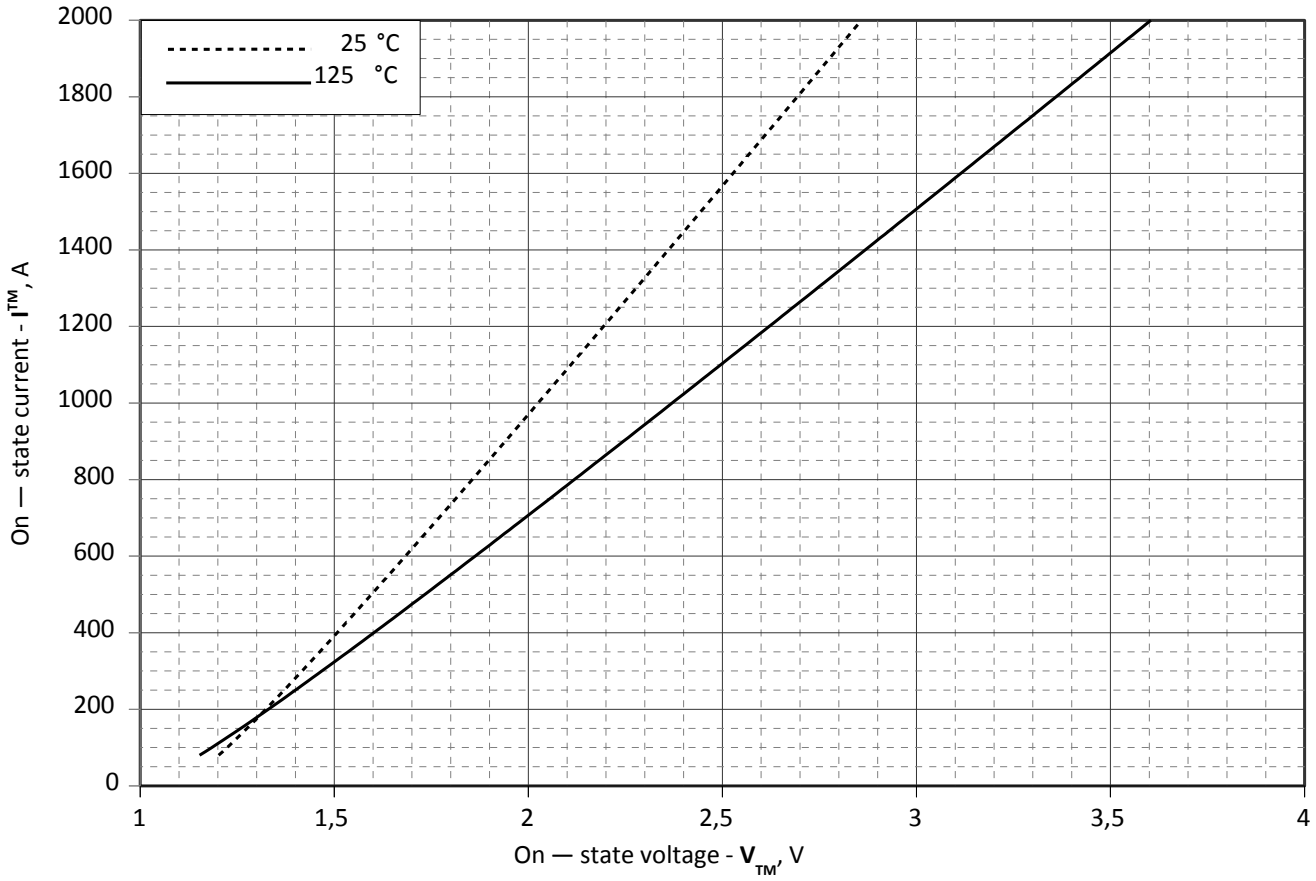


Fig 1 – On-state characteristics of Limit device

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	1.05900000	0.97757680
B	0.00078162	0.00114000
C	0.01165600	0.00518530
D	0.00329660	0.00687000

On-state characteristic model (see Fig. 1)

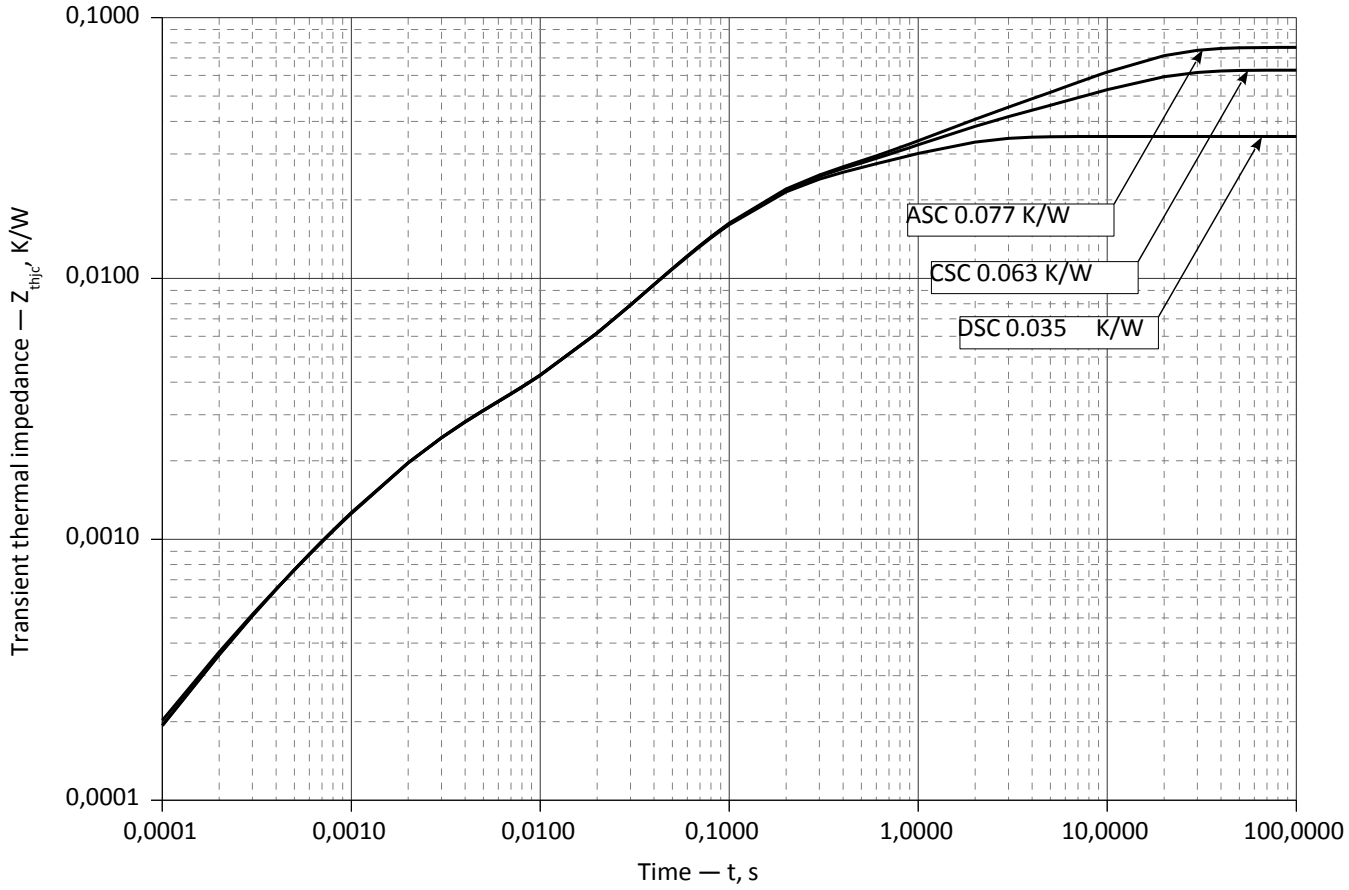


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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. **Z_{thjc}**

= Thermal resistance at time t.

R_i = Amplitude of p_{th} term.

t_i = Time constatnt of r_{th} term.

DC Double side cooled

i	1	2	3	4	5	6
R_i, K/W	2.007e-005	0.01412	0.01797	0.0007764	0.00193	0.0001844
t_i, s	4.957	0.9362	0.09335	0.04227	0.001702	0.0002492

DC Anode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.04173	0.01173	0.01847	0.001981	0.0001722	0.002719
t_i, s	9.751	1.085	0.09044	0.00175	0.0001916	0.791

DC Cathode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.02781	0.0007698	0.01797	0.001931	0.000209	0.01416
t_i, s	9.752	0.186	0.08881	0.001757	0.0002747	1.004

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

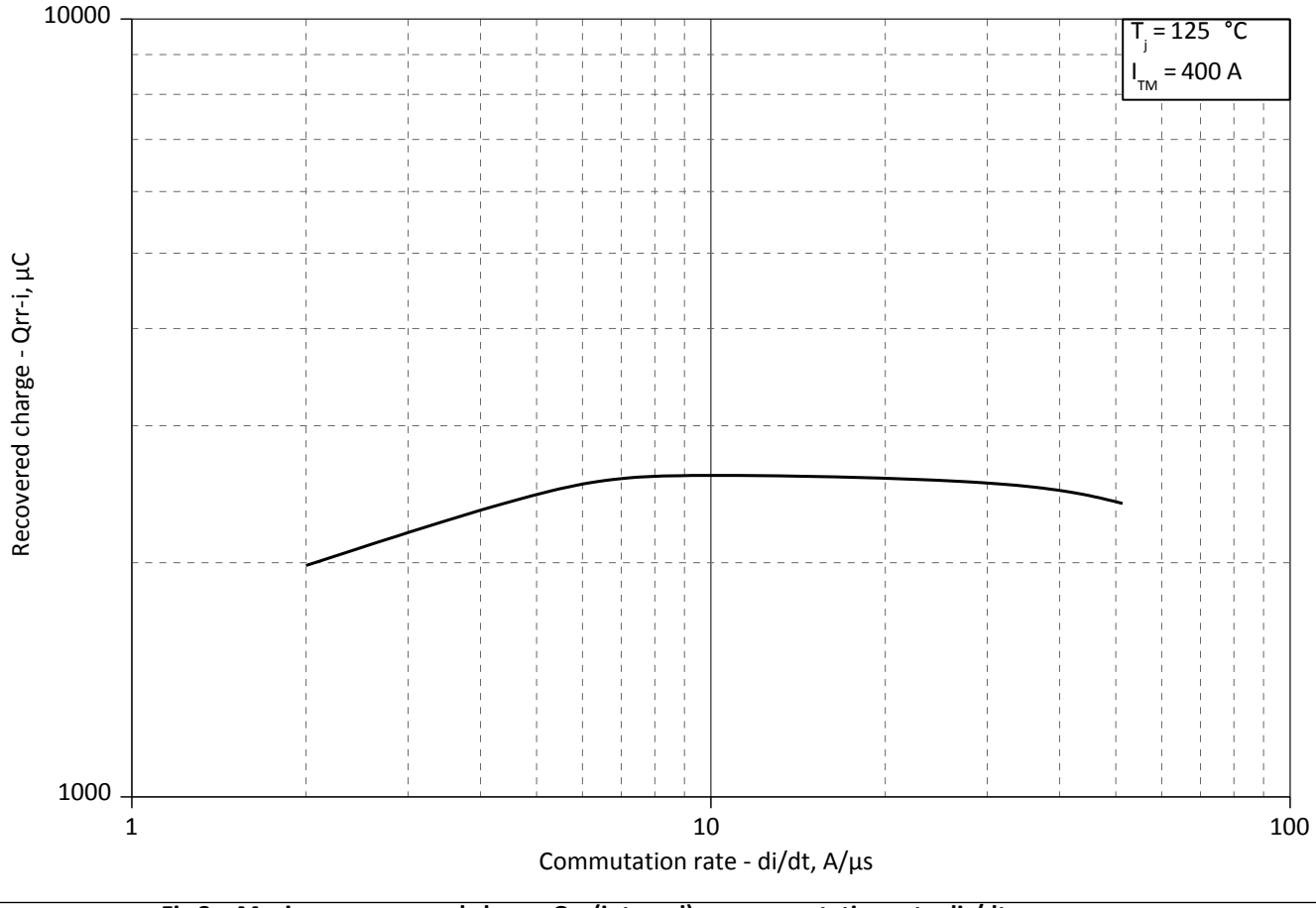


Fig 3 – Maximum recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

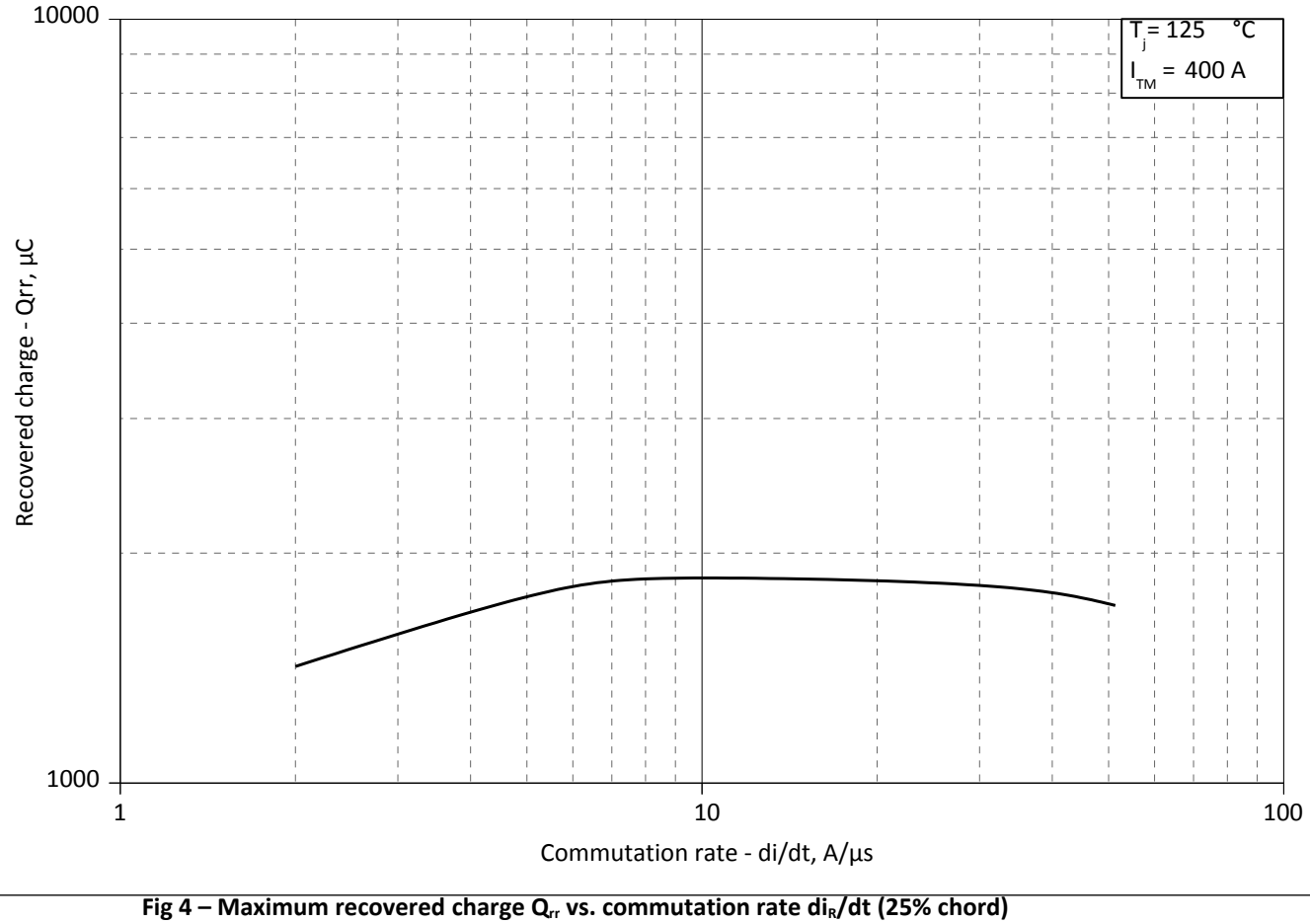


Fig 4 – Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

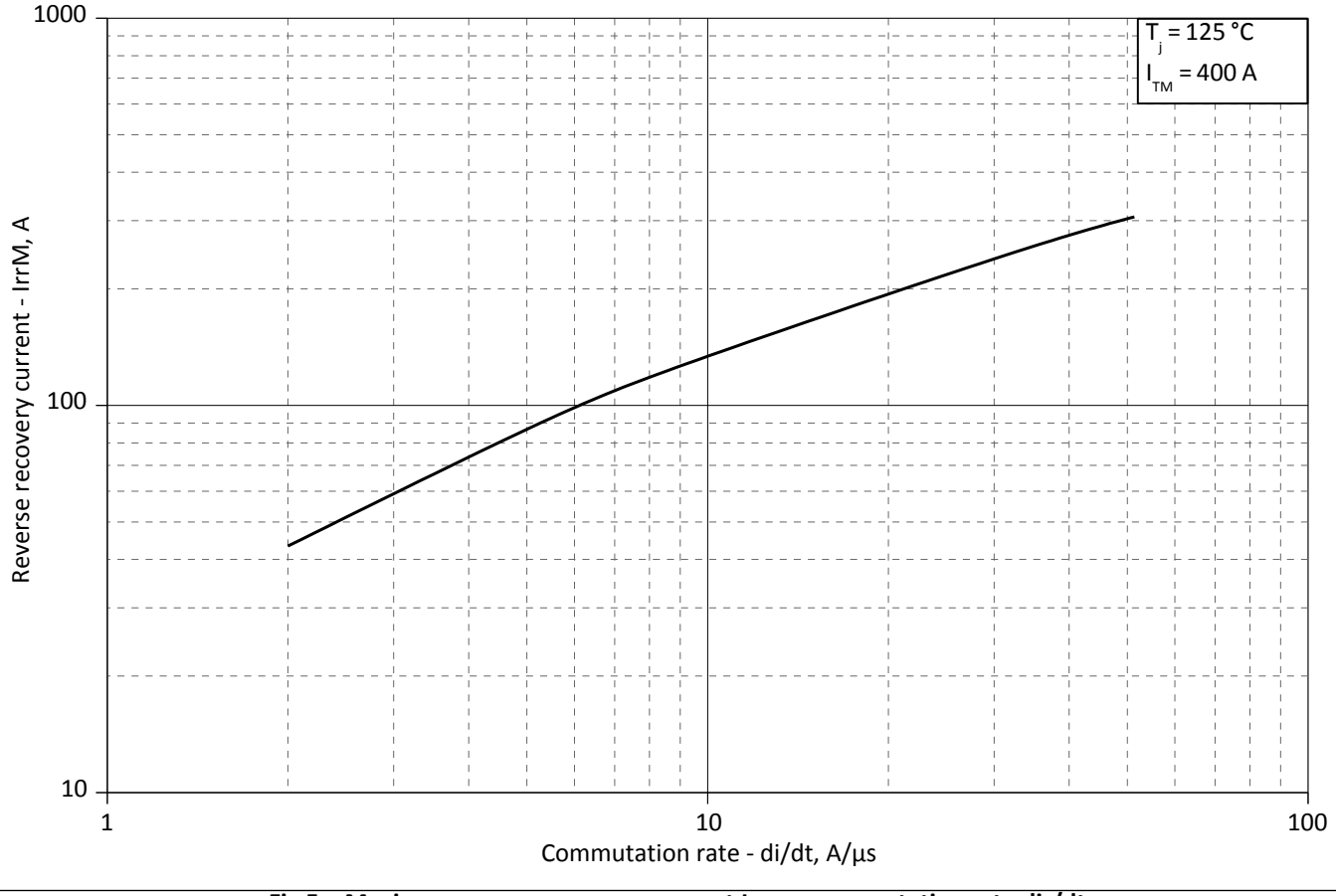


Fig 5 – Maximum reverse recovery current I_{rrM} vs. commutation rate di_R/dt

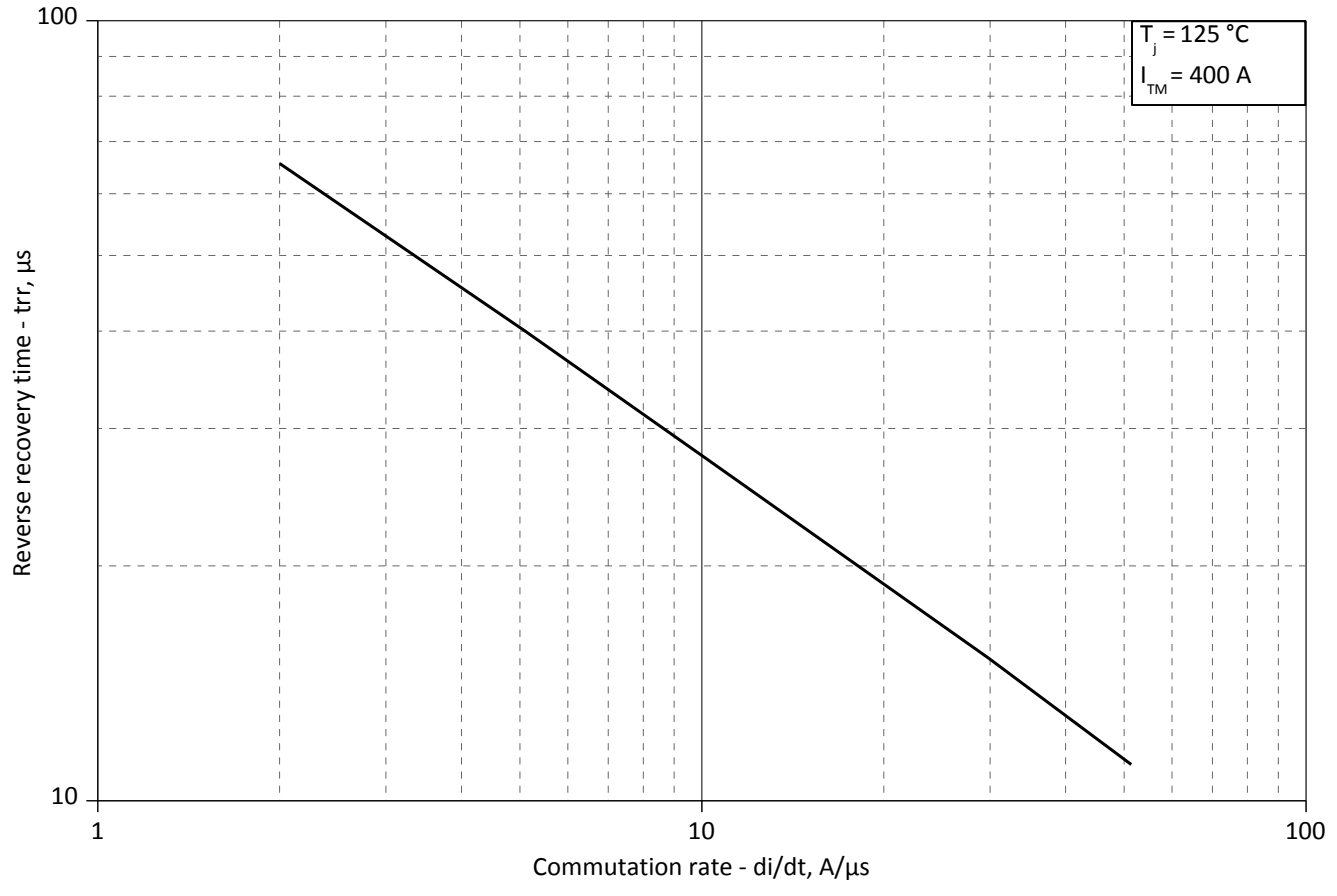


Fig 6 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

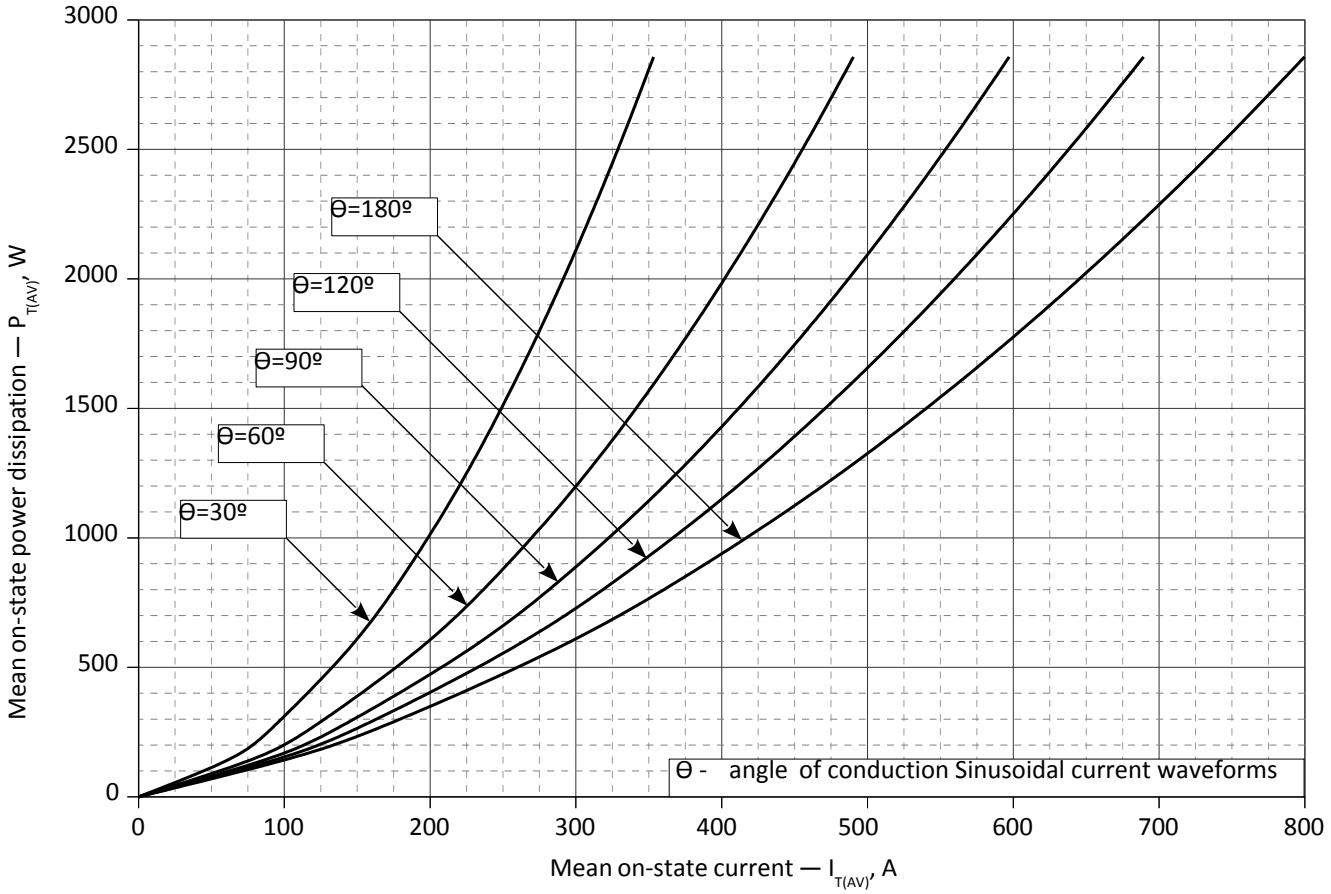


Fig. 7 - Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

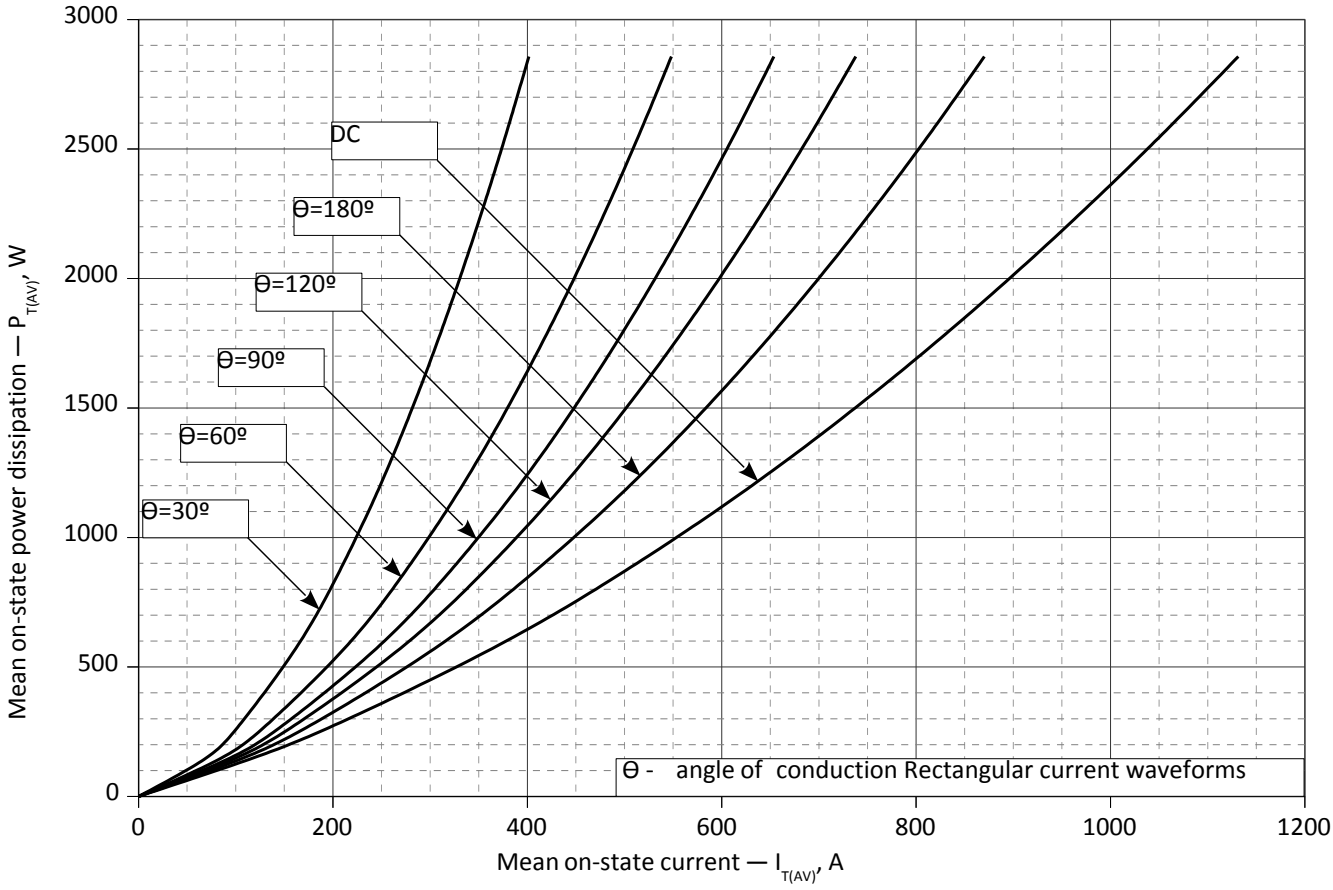


Fig. 8 – Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

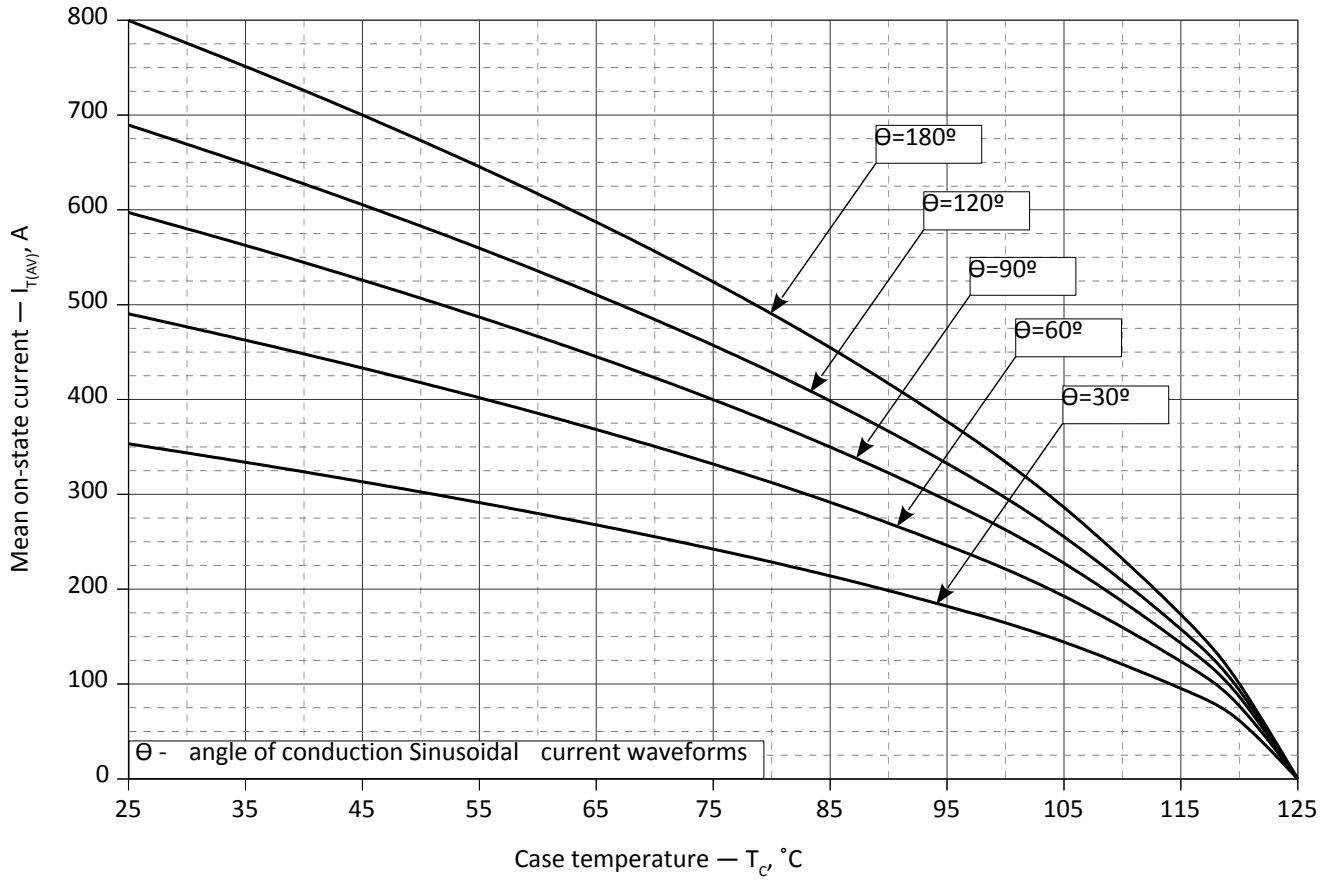


Fig. 9 – Mean on-state current I_{TAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

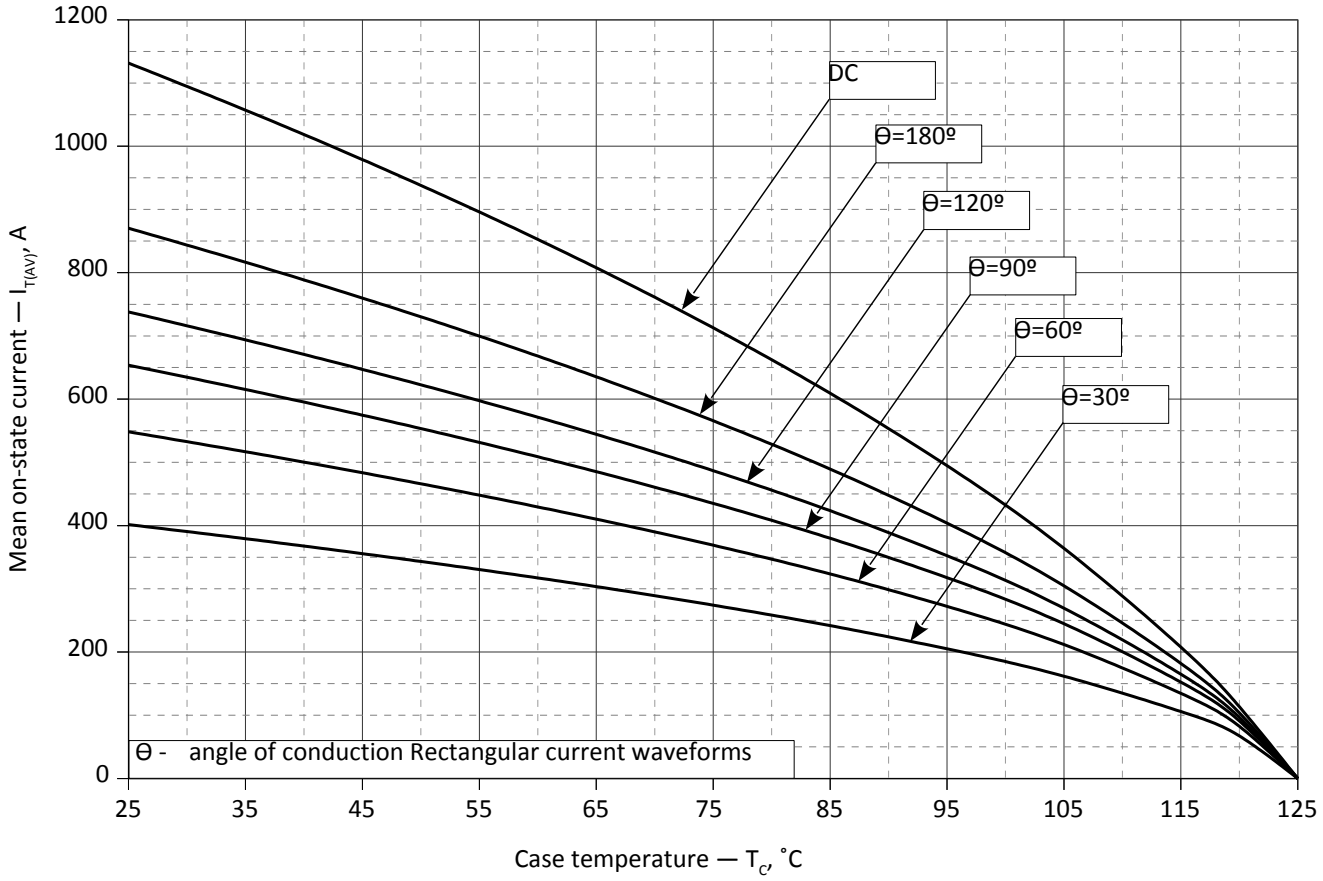


Fig. 10 - Mean on-state current I_{TAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

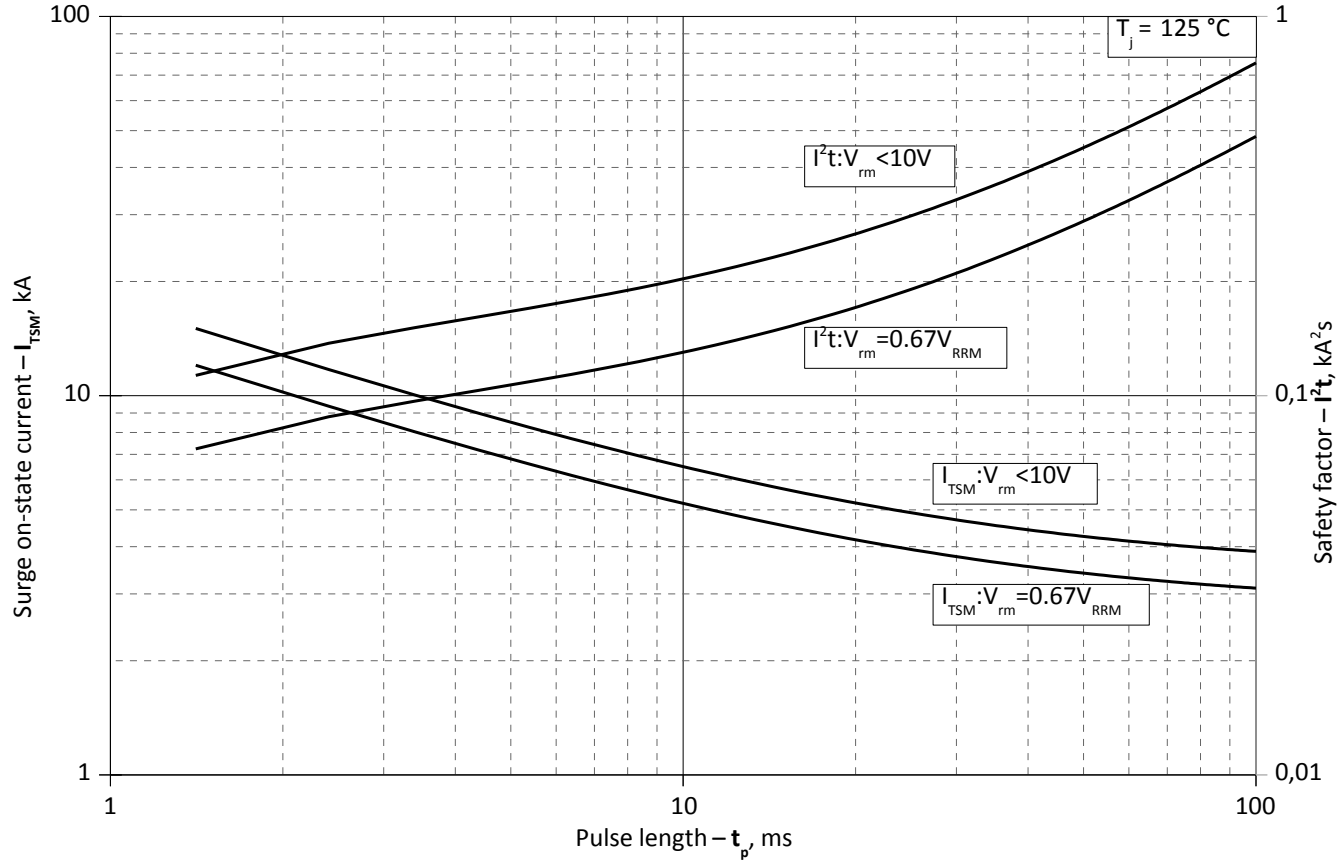


Fig. 11 – Maximum surge on-state current I_{TSM} and safety factor I^2t vs. pulse length t_p

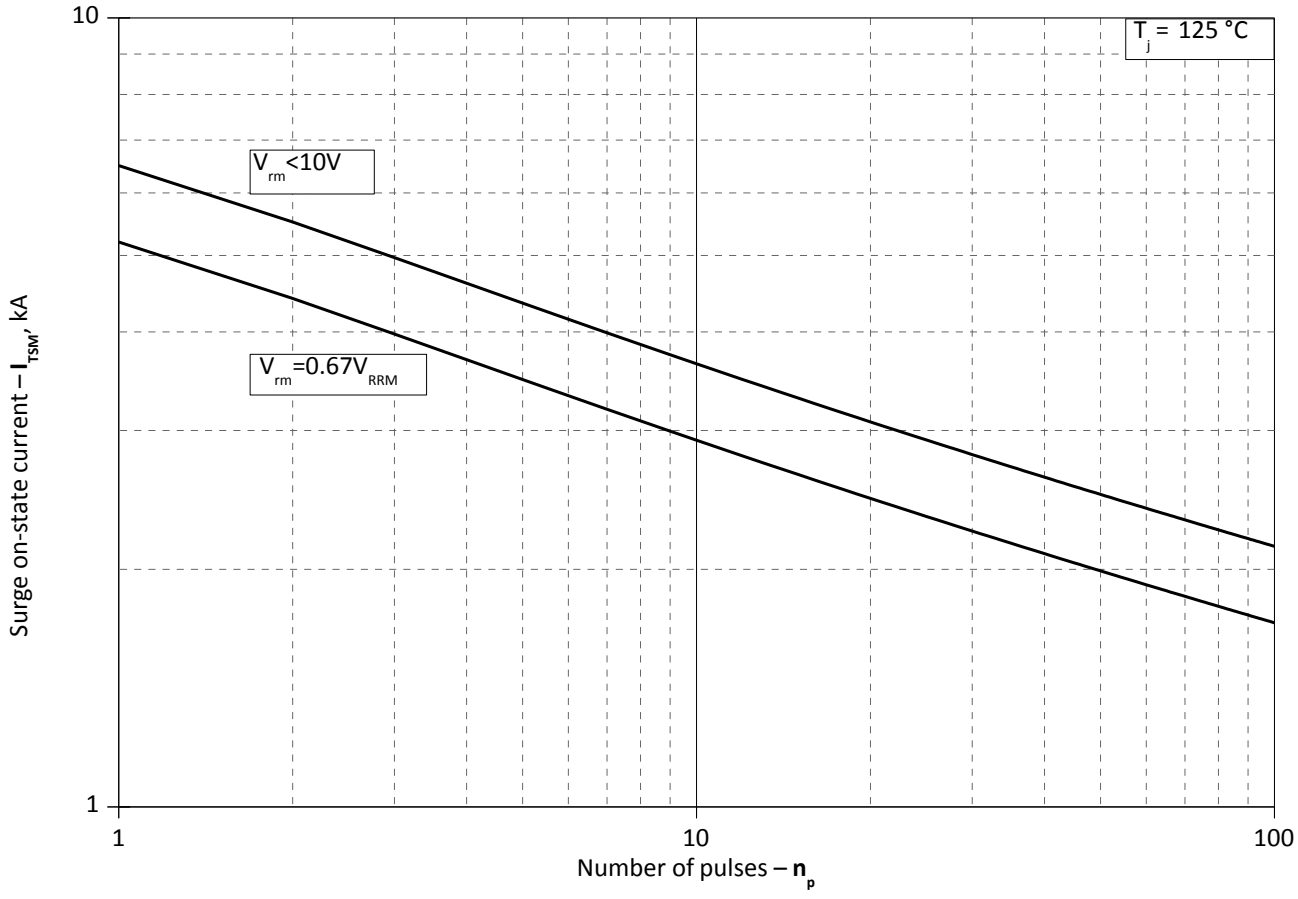


Fig. 12 - Maximum surge on-state current I_{TSM} vs. number of pulses n_p