



High power cycling capability
Low on-state and switching losses
Designed for traction and industrial applications

Phase Control Thyristor Type T143-1250-8

Mean on-state current				I _{TAV}		1250 A		
Repetitive peak off-state voltage				V _{DRM}		100...800 V		
Repetitive peak reverse voltage				V _{RRM}				
Turn-off time				t _q		160, 200, 250, 320, 400, 500 μs		
V _{DRM} , V _{RRM} , V	100	200	300	400	500	600	700	800
Voltage code	1	2	3	4	5	6	7	8
T _j , °C	-60...+150							

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I _{TAV}	Maximum allowable mean on-state current	A	1250 1446	T _c =97 °C, Double side cooled T _c =85 °C, Double side cooled 180° half-sine wave; 50 Hz	
I _{TRMS}	RMS on-state current	A	1962	T _c =97 °C, Double side cooled 180° half-sine wave; 50 Hz	
I _{TSM}	Surge on-state current	kA	22.0 25.0	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
			23.0 26.0	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 μs; di _G /dt≥1 A/μs
I ² t	Safety factor	A ² s·10 ³	2400 3100	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
			2100 2800	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...800	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...900	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/ μ s	800	$T_j = T_{j\max}$; $V_D = 0.67 \cdot V_{DRM}$; $I_{TM} = 3500$ A; Gate pulse: $I_G = 2$ A; $t_{GP} = 50$ μ s; $di_G/dt \geq 2$ A/ μ s
THERMAL				
T_{stg}	Storage temperature	$^{\circ}$ C	-60...+50	
T_j	Operating junction temperature	$^{\circ}$ C	-60...+150	
MECHANICAL				
F	Mounting force	kN	14.0...16.0	
a	Acceleration	m/s ²	50	Device clamped

CHARACTERISTICS

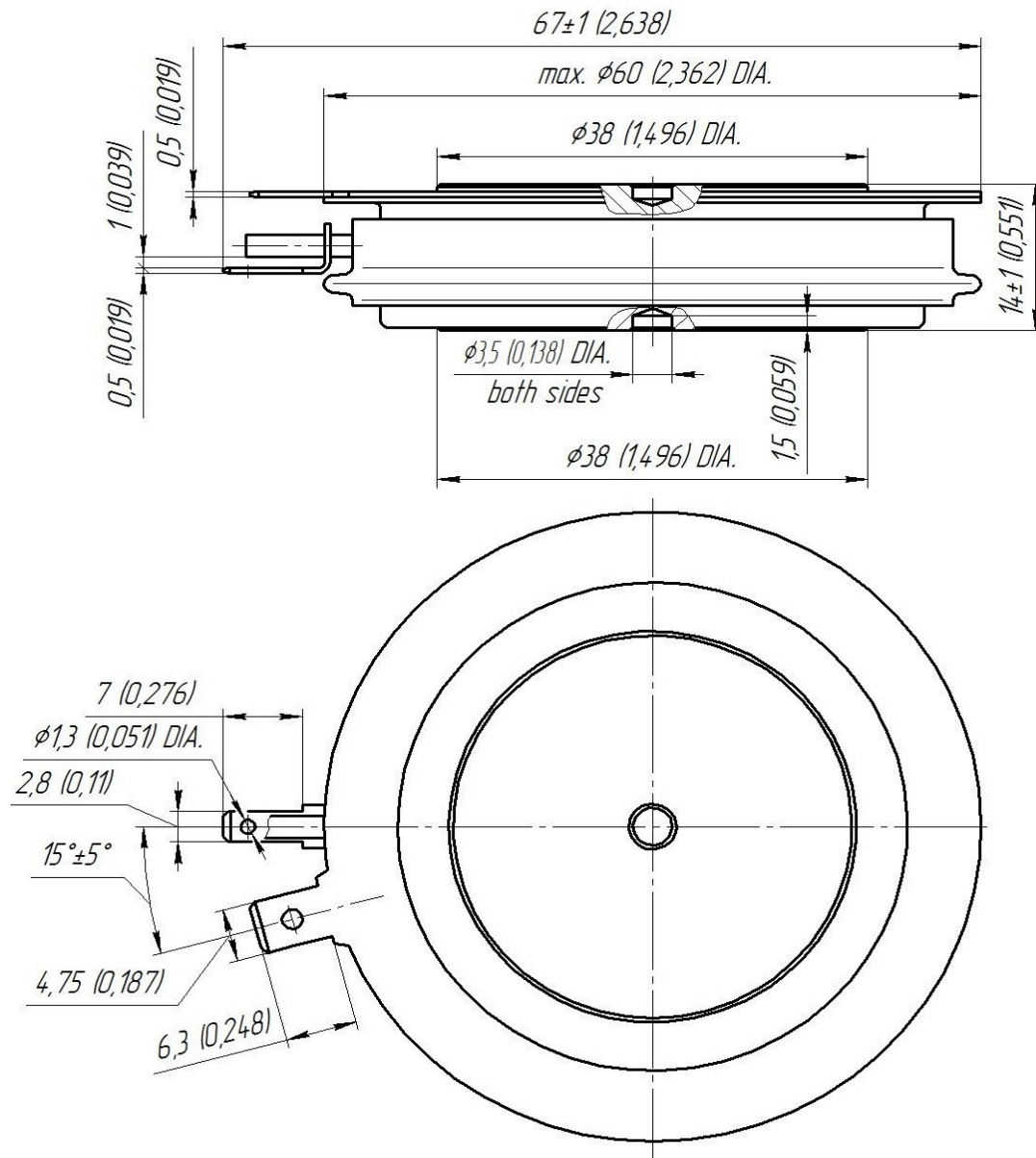
Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V _{TM}	Peak on-state voltage, max	V	1.55	T _j =25 °C; I _{TM} =3925 A	
V _{T(TO)}	On-state threshold voltage, max	V	0.870	T _j =T _{j max} ;	
r _T	On-state slope resistance, max	mΩ	0.177	0.5 π I _{TAV} < I _T < 1.5 π I _{TAV}	
I _L	Latching current, max	mA	1000	T _j =25 °C; V _D =12 V; Gate pulse: I _G =2 A; t _{GP} =50 μs; di _G /dt≥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	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/μs	200, 320, 500, 1000, 1600, 2000, 2500	T _j =T _{j max} ; V _D =0.67·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	0.55	T _j =T _{j max} ; V _D =0.67·V _{DRM} ;	
I _{GD}	Gate non-trigger direct current, min	mA	70.00	Direct gate current	
SWITCHING					
t _{gd}	Delay time, max	μs	0.85	T _j =25 °C; V _D =600 V; I _{TM} =I _{TAV} ; di/dt=200 A/μs;	
t _{gt}	Turn-on time, max	μs	4.00	Gate pulse: I _G =2 A; V _G =20 V; t _{GP} =50 μs; di _G /dt=2 A/μs	
t _q	Turn-off time ²⁾ , max	μs	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 =100V; V _D =0.67·V _{DRM}	
Q _{rr}	Recovered charge, max	μC	1100	T _j =T _{j max} ; I _{TM} =1250 A;	
t _{rr}	Reverse recovery time, max	μs	18	di _R /dt=-10 A/μs;	
I _{rr}	Reverse recovery current, max	A	122	V _R =100 V	

THERMAL					
R _{thjc}	Thermal resistance, junction to case, max	°C/W	0.030	Direct current	Double side cooled
R _{thjc-A}			0.066		Anode side cooled
R _{thjc-K}			0.054		Cathode side cooled
R _{thck}	Thermal resistance, case to heatsink, max	°C/W	0.006	Direct current	
MECHANICAL					
m	Weight, max	g	180		
D _s	Surface creepage distance	mm (inch)	7.86 (0.309)		
D _a	Air strike distance	mm (inch)	6.10 (0.240)		

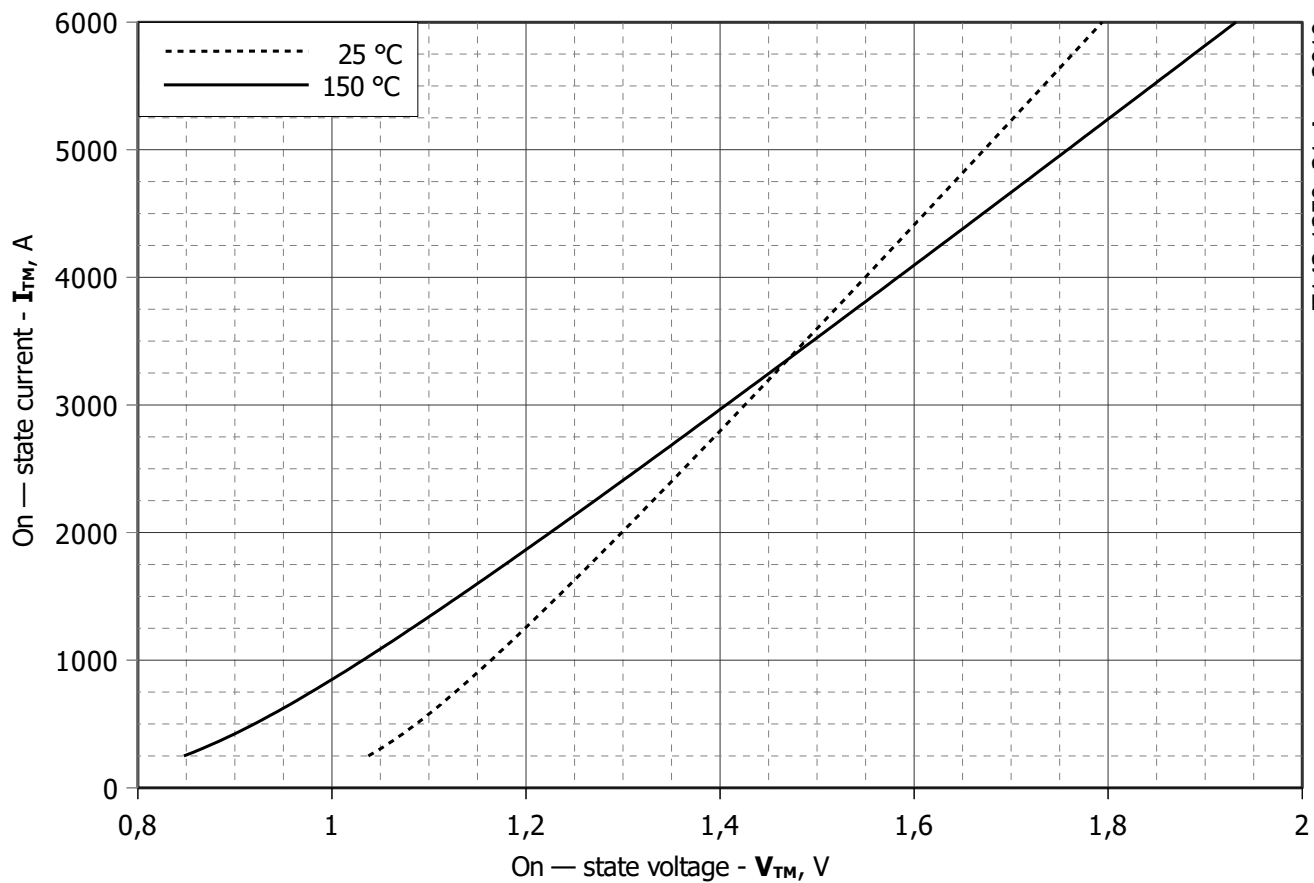
PART NUMBERING GUIDE						
T	143	1250	8	A2	E2	N
1	2	3	4	5	6	7
1. Phase Control Thyristor						
2. Design version						
3. Mean on-state current, A						
4. Voltage code						
5. Critical rate of rise of off-state voltage, V/μs						
6. Turn-off time (dv _D /dt=50 V/μs)						
7. Ambient conditions: N – normal; T – tropical						

NOTES							
1) Critical rate of rise of off-state voltage							
Symbol of Group	P2	K2	E2	A2	T1	P1	M1
(dv _D /dt) _{crit} , V/μs	200	320	500	1000	1600	2000	2500

2) Turn-off time (dv _D /dt=50 V/μs)							
Symbol of Group	T2	P2	M2	K2	H2	E2	
t _q , μs	160	200	250	320	400	500	



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	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\max}$
A	0.82795000	0.51947000
B	0.00012036	0.00017283
C	0.03462400	0.05552300
D	-0.00074257	-0.00139100

On-state characteristic model (see Fig. 1)

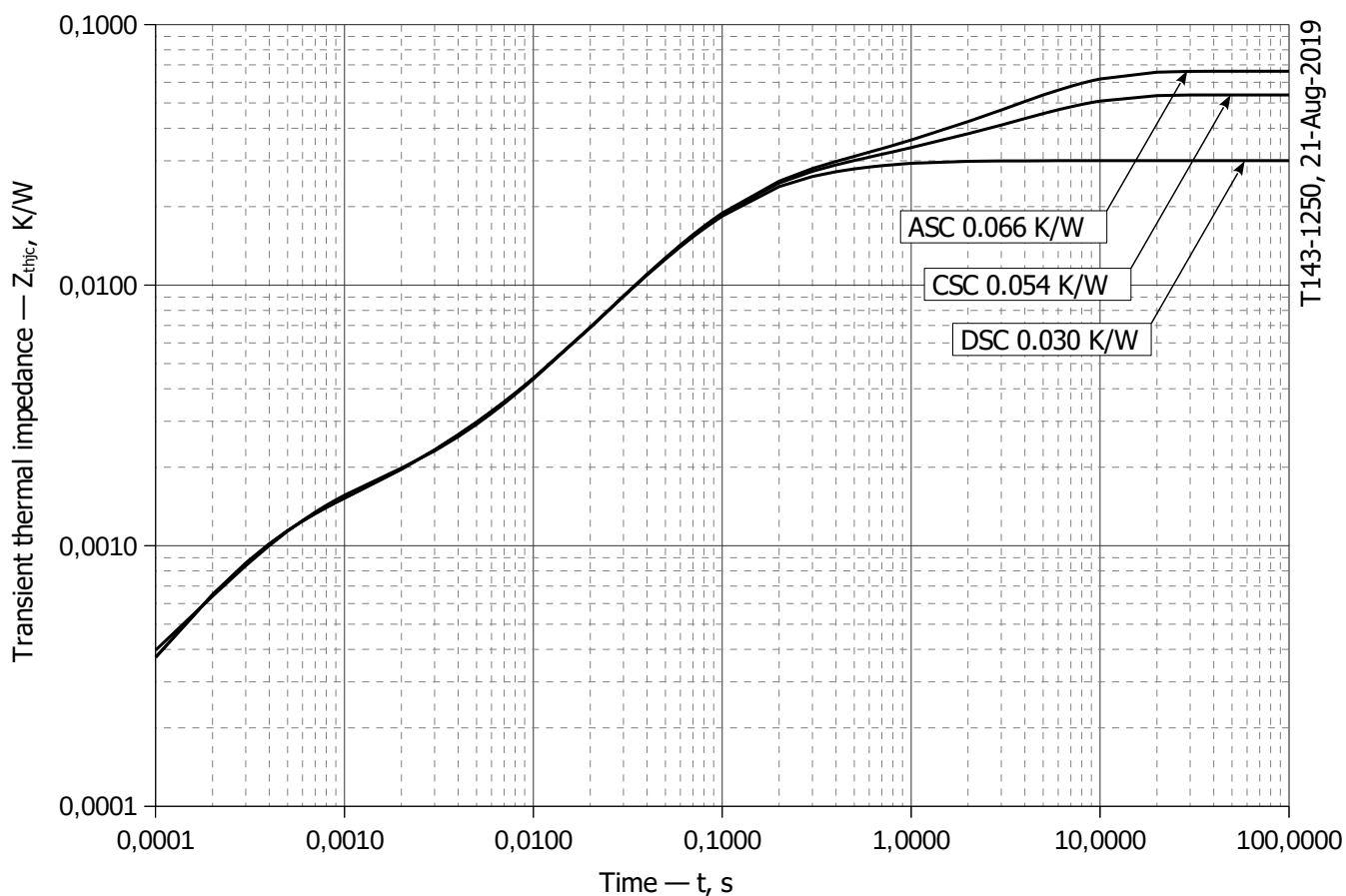


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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.

τ_i = Time constant of r_{th} term.

DC Double side cooled

i	1	2	3	4	5	6
R_i , K/W	0.0007052	0.01986	0.001443	0.006652	0.001253	0.00009733
τ_i , s	1.200	0.083	0.0205	0.350	0.0004173	0.000001

DC Anode side cooled

i	1	2	3	4	5	6
R_i , K/W	0.03615	0.006266	0.0178	0.004365	0.0004912	0.001067
τ_i , s	4.713	0.5062	0.09497	0.04557	0.002123	0.0002807

DC Cathode side cooled

i	1	2	3	4	5	6
R_i , K/W	0.001065	0.0004934	0.004583	0.01764	0.006202	0.0237
τ_i , s	0.0002798	0.002114	0.04598	0.09501	0.4891	4.712

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

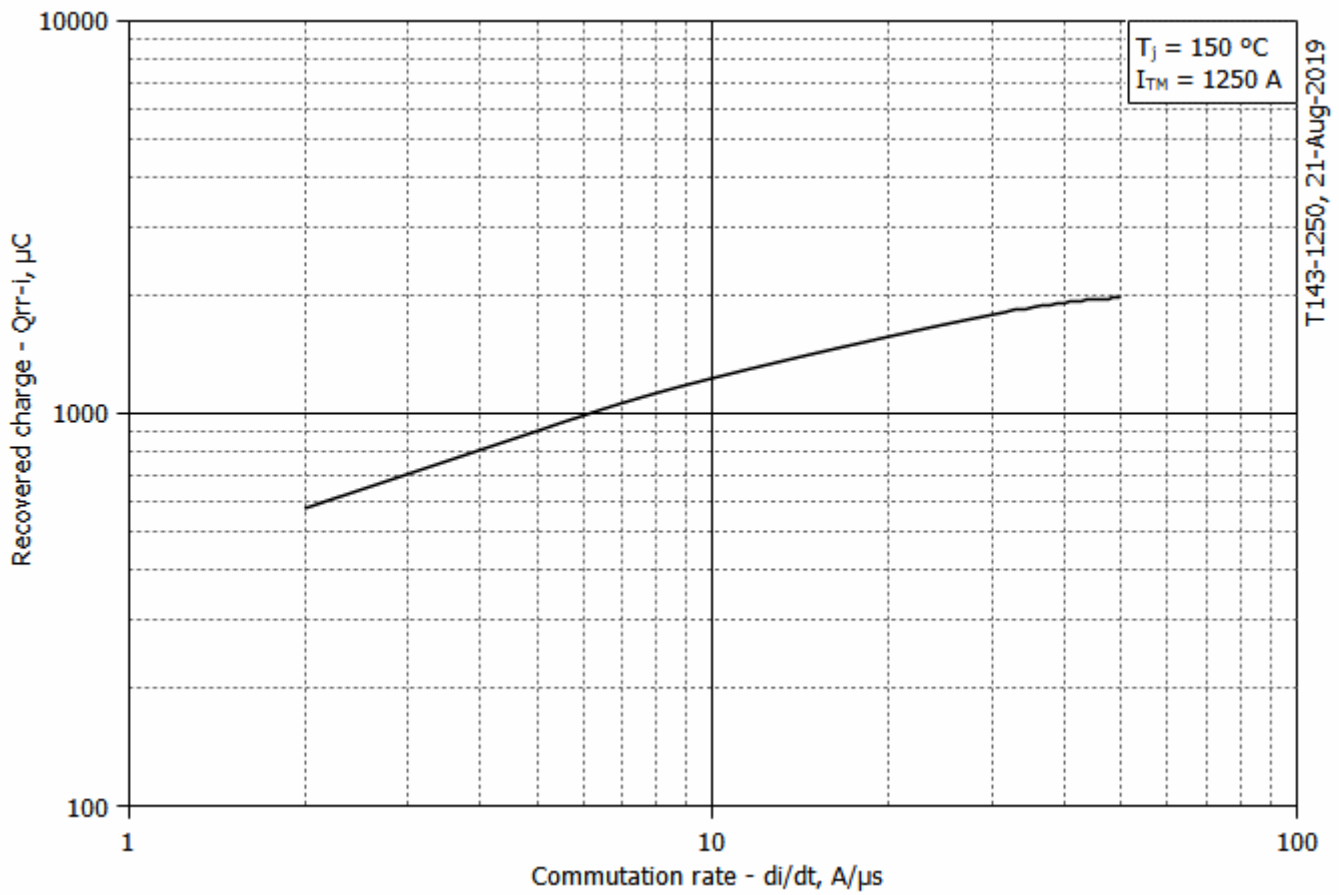


Fig 3 – Maximum recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

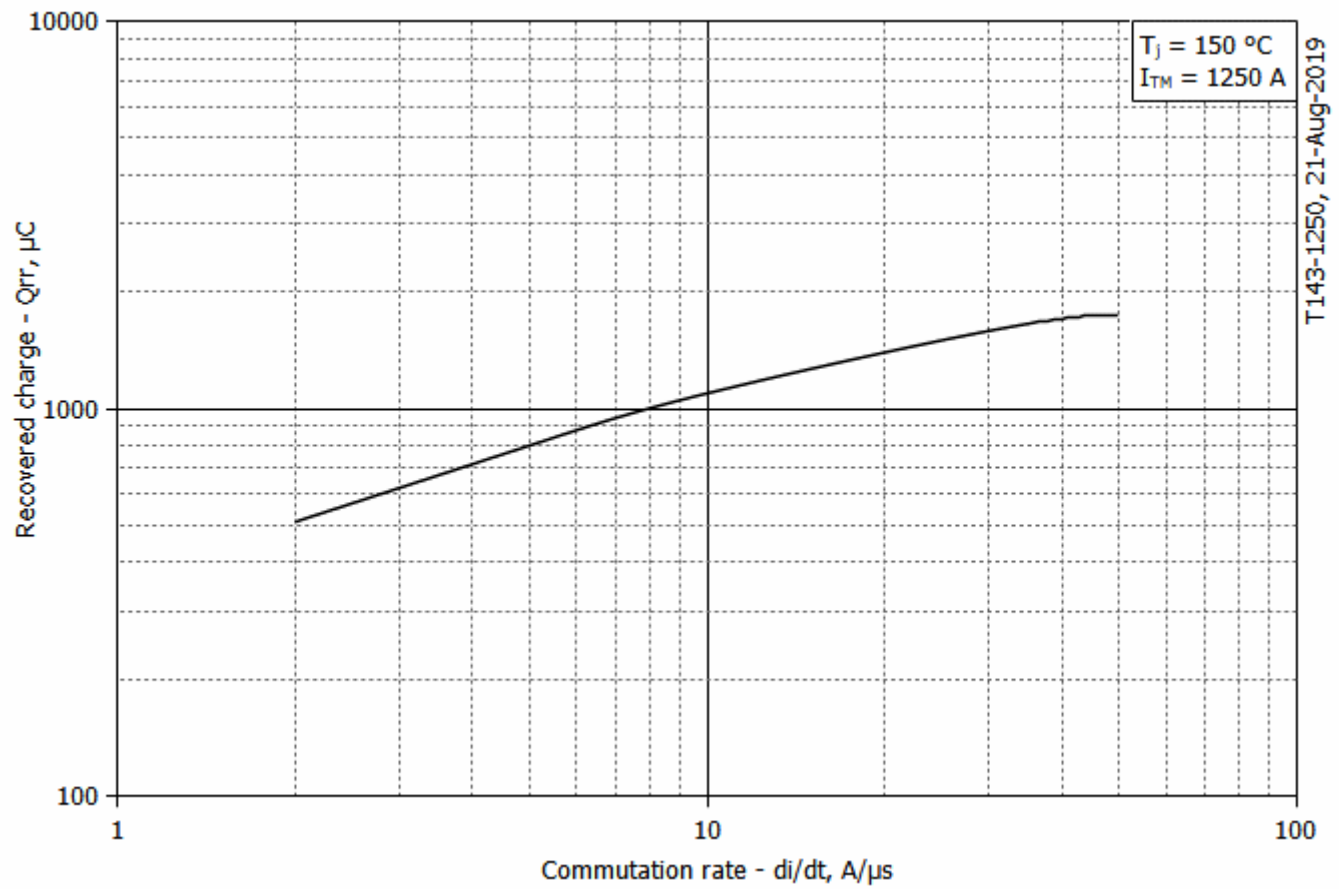


Fig 4 – Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

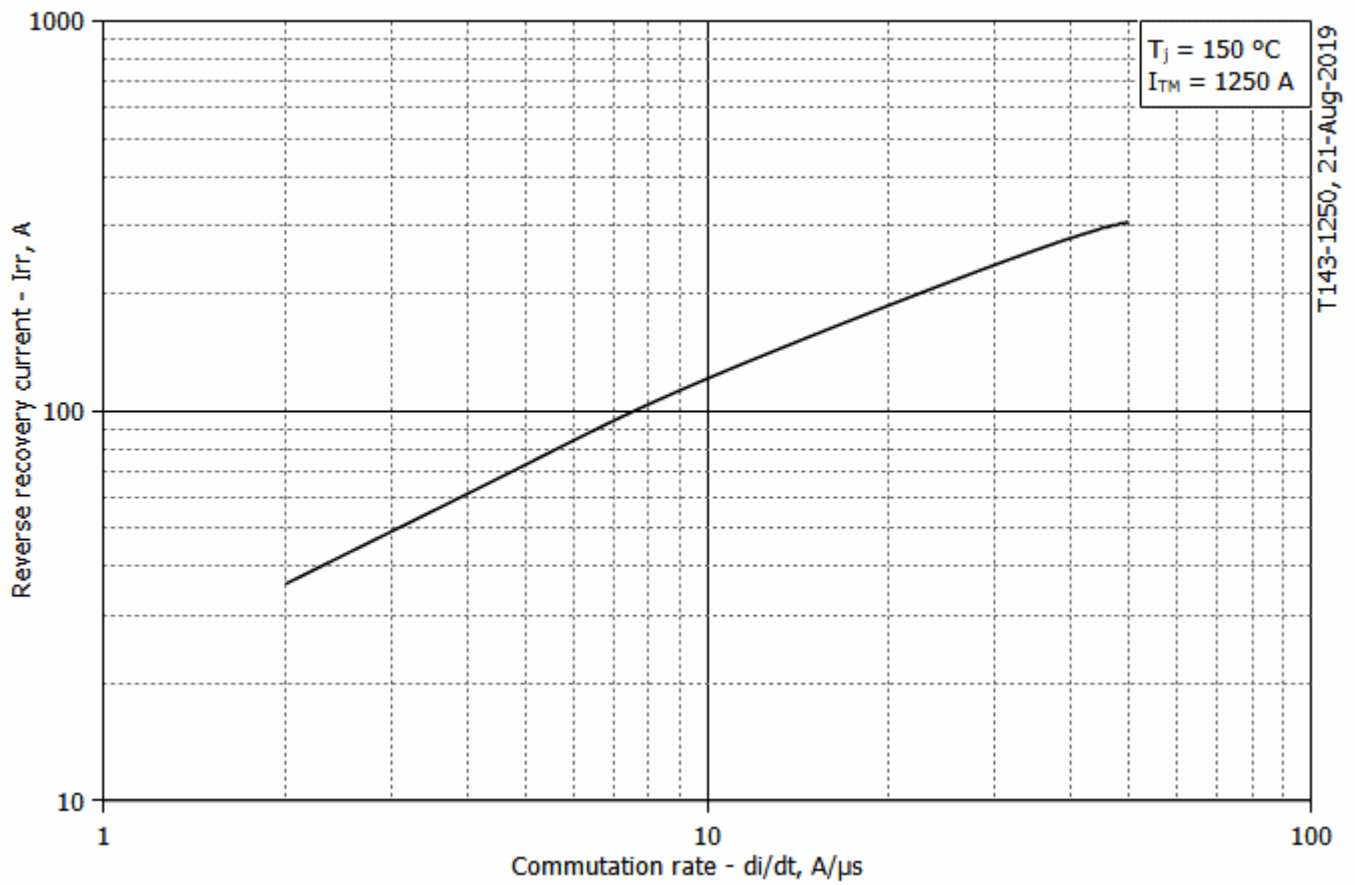


Fig 5 – Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

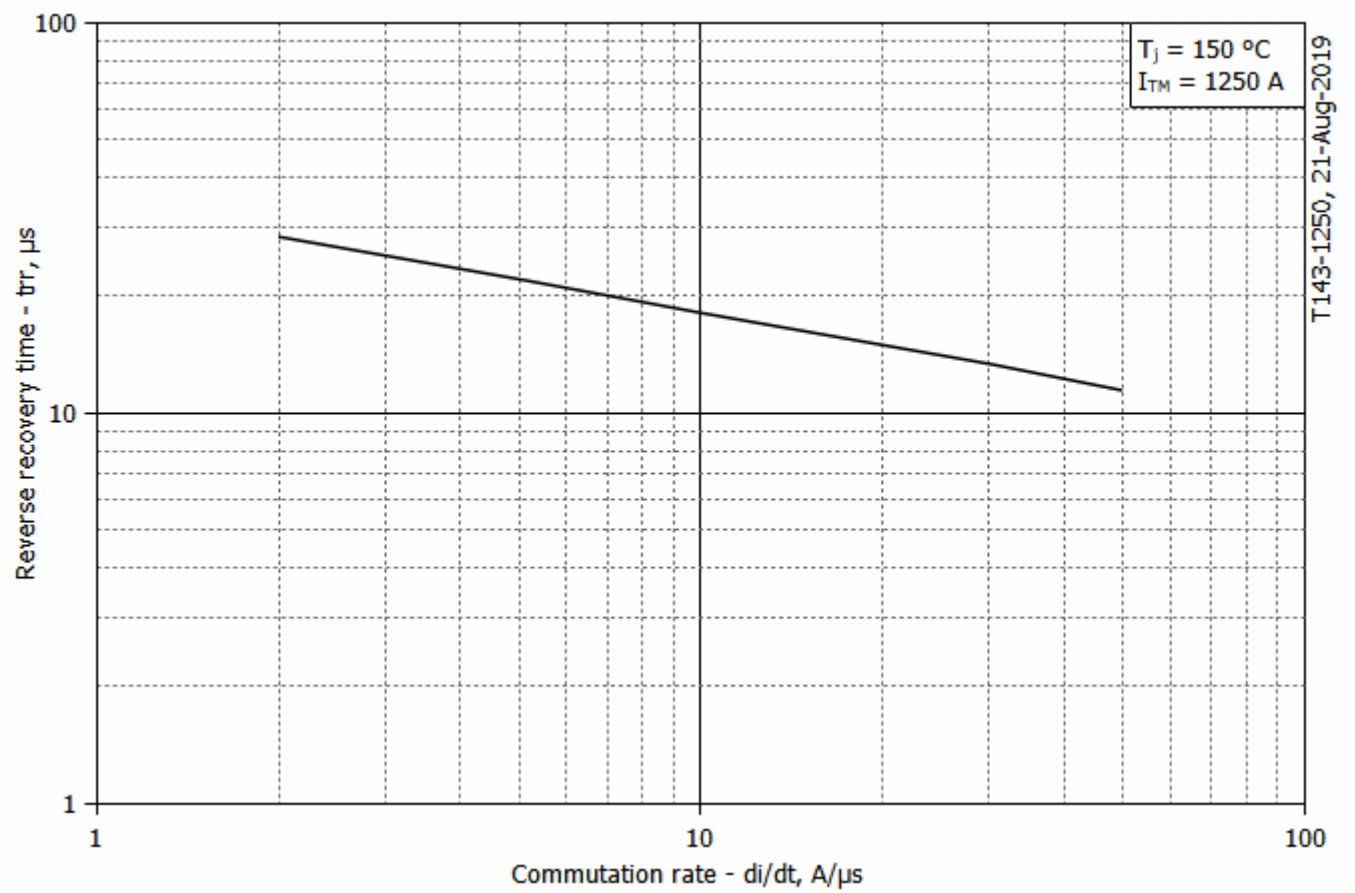
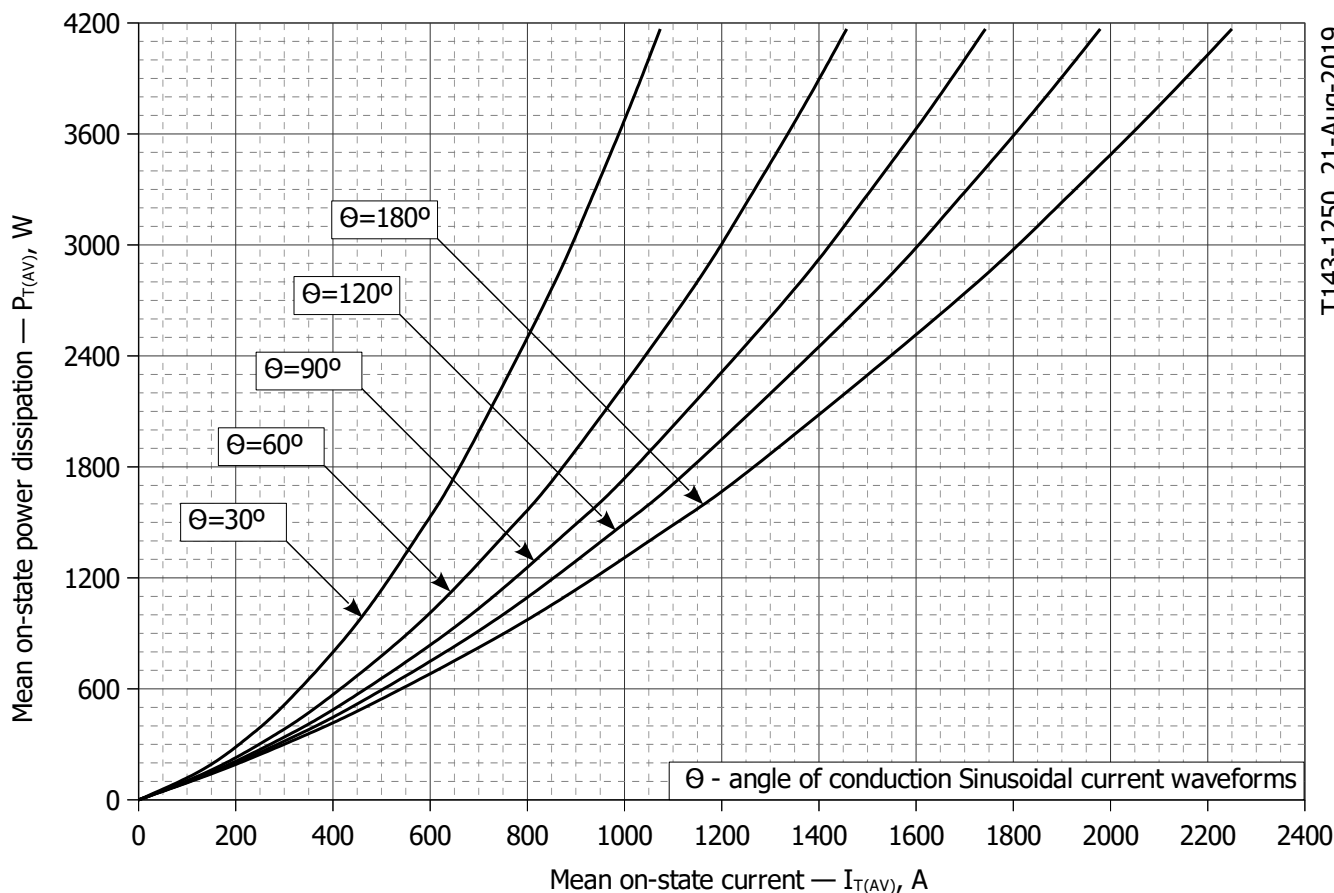
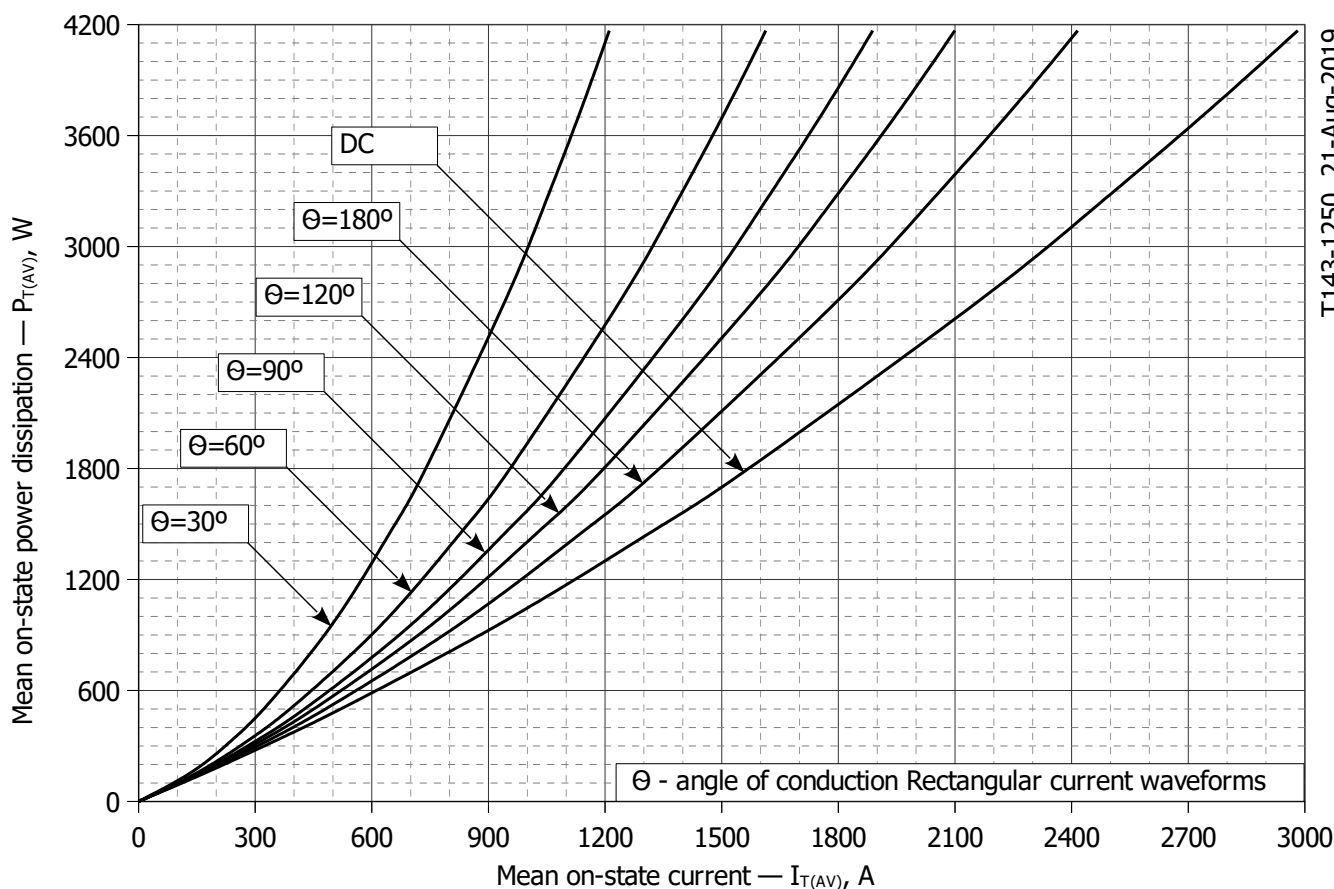


Fig 6 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)



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



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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 ($f=50\text{Hz}$, DSC)

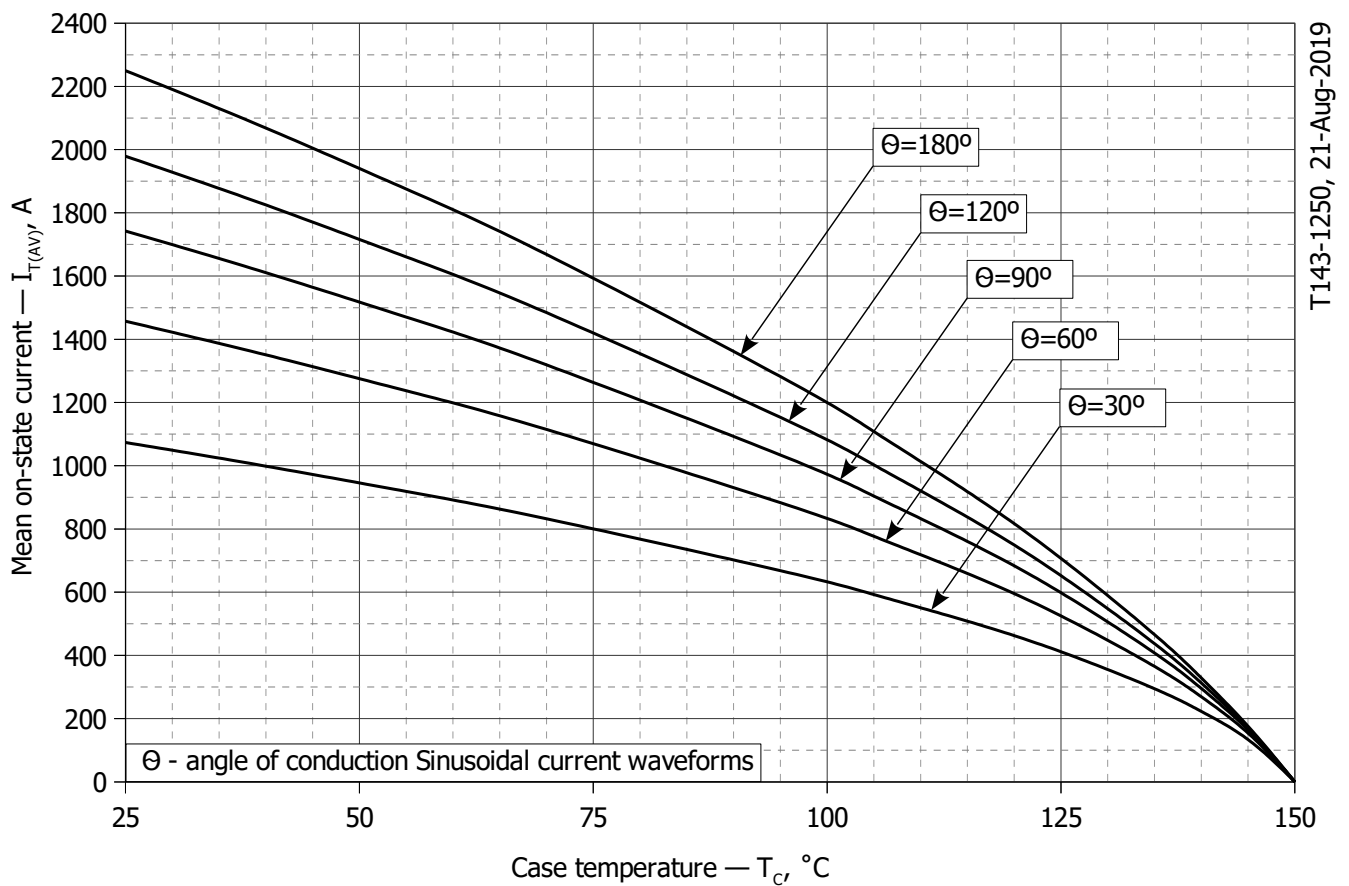


Fig. 9 – Mean on-state current I_{TAV} vs. case temperature T_c for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

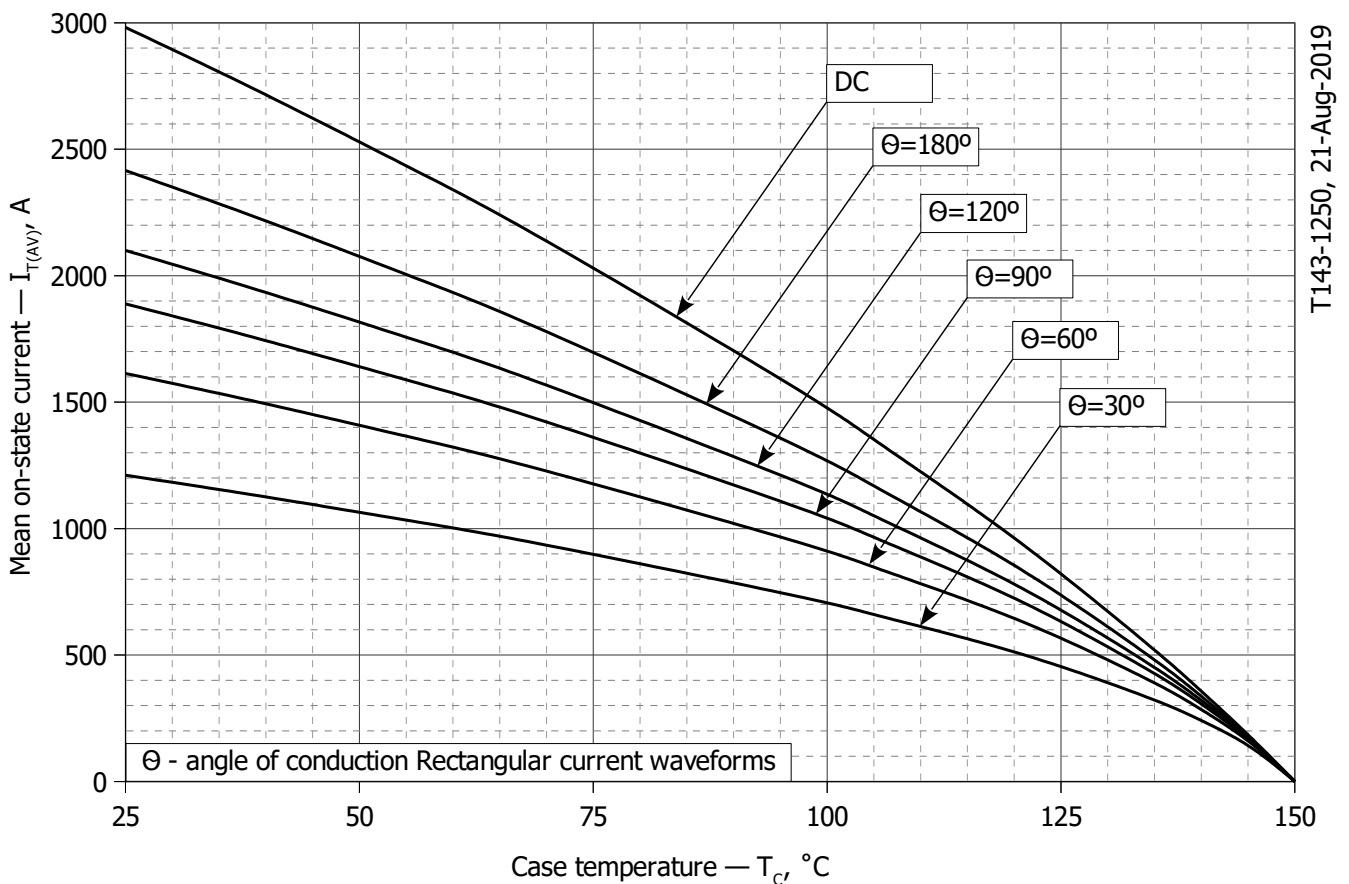


Fig. 10 - Mean on-state current I_{TAV} vs. case temperature T_c for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

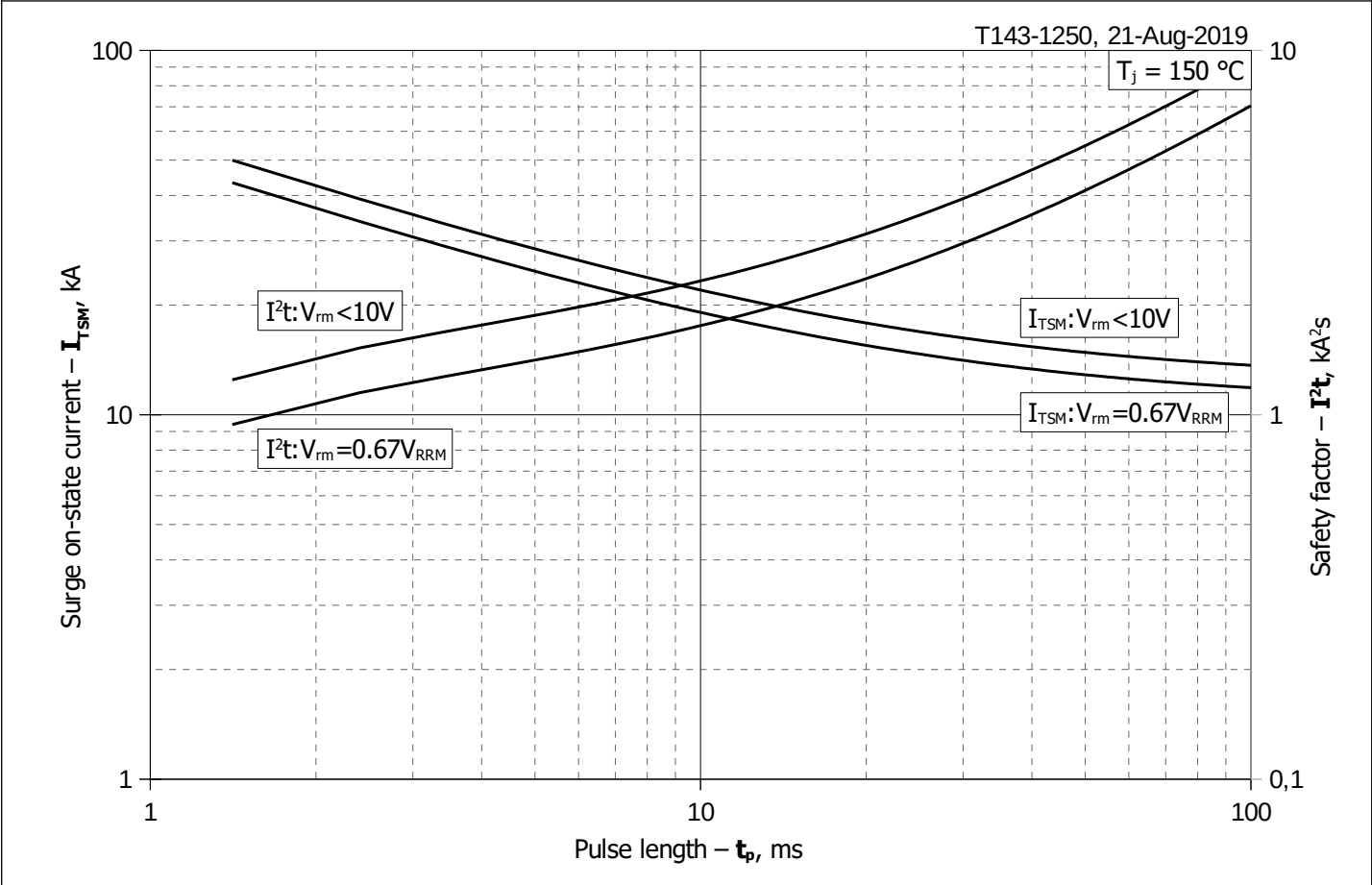


Fig. 11 – Maximum surge on-state current I_{TSM} and safety factor I^2t vs. pulse length t_p

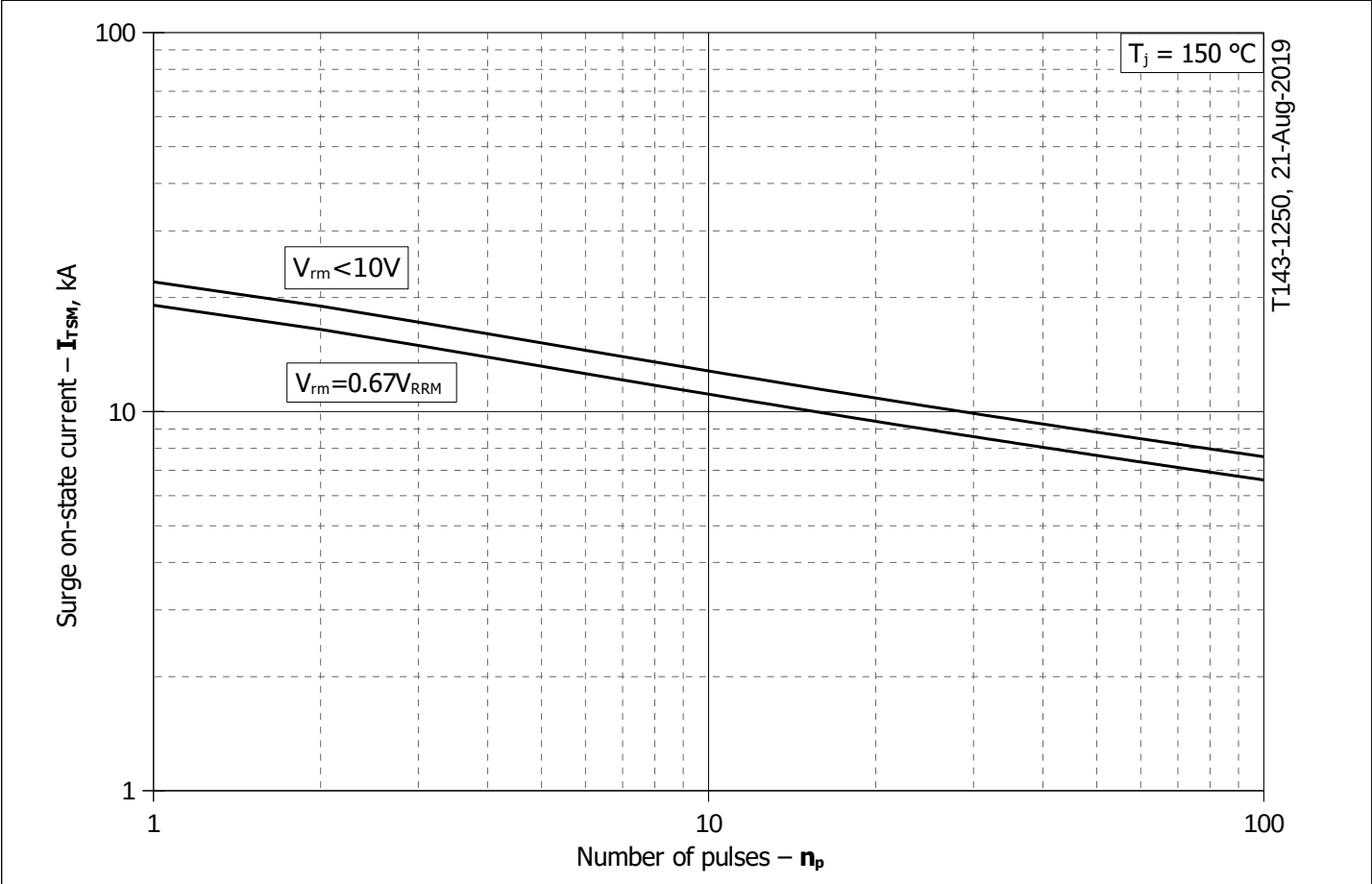


Fig. 12 - Maximum surge on-state current I_{TSM} vs. number of pulses n_p