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

Phase Control Thyristor
Type T183-4000-18

Mean on-state current				I_{TAV}		4000 A		
Repetitive peak off-state voltage				V_{DRM}		1000 ÷ 1800 V		
Repetitive peak reverse voltage				V_{RRM}				
Turn-off time				t_q		320 µs		
V_{DRM}, V_{RRM}, V	1000	1100	1200	1300	1400	1500	1600	1800
Voltage code	10	11	12	13	14	15	16	18
T_j, °C	-60 ÷ 125							

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{TAV}	Mean on-state current	A	4000 3840 4750	T_c=82 °C, Double side cooled T_c=85 °C, Double side cooled T_c=70 °C, Double side cooled 180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	6280	T_c=82 °C, Double side cooled 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	70.0 81.0	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
			74.0 85.0	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^2t	Safety factor	$A^2s\cdot10^3$	24500 32800	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
			22700 29900	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	1000÷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	1100÷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·V_{DRM} 0.6·V_{RRM}	T_j=$T_{j\,max}$; Gate open	

TRIGGERING				
I_{FGM}	Peak forward gate current	A	10	$T_j=T_{j\,max}$
V_{RGM}	Peak reverse gate voltage	V	5	
P_G	Gate power dissipation	W	5	$T_j=T_{j\,max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/μs	630	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; $I_{TM}=2\ I_{TAV}$; 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	60.0÷70.0	
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	1.35	$T_j=25$ °C; $I_{TM}=6300$ A	
$V_{T(TO)}$	On-state threshold voltage, max	V	0.85	$T_j=T_{j\,max}$; $0.5\ \pi\ I_{TAV} < I_T < 1.5\ \pi\ I_{TAV}$	
r_T	On-state slope resistance, max	mΩ	0.080		
I_L	Latching current, max	mA	1500	$T_j=25$ °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	300	$T_j=T_{j\,max}$; $V_D=V_{DRM}$; $V_R=V_{RRM}$	
$(dv_D/dt)_{crit}$	Critical rate of rise of off-state voltage[1], min	V/μs	500, 1000, 1600	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; Gate open	
TRIGGERING					
V_{GT}	Gate trigger direct voltage, max	V	5.00 3.00 2.00	$T_j=T_{j\,min}$ $T_j=25$ °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	500 300 200	$T_j=T_{j\,min}$ $T_j=25$ °C $T_j=T_{j\,max}$	
V_{GD}	Gate non-trigger direct voltage, min	V	0.35	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	15.00		
SWITCHING					
t_{gd}	Delay time, max	μs	4.00	$T_j=25$ °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_q	Turn-off time[2], max	μs	320	$dv_D/dt=50$ 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}	Total recovered charge, max	μC	3200	$T_j=T_{j\,max}$; $I_{TM}=1000$ A; $di_R/dt=-10$ A/μs; $V_R=100$ V	
t_{rr}	Reverse recovery time, max	μs	34		
I_{rrM}	Peak reverse recovery current, max	A	188		

THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0065	Direct current	Double side cooled
R_{thjc-A}			0.0143		Anode side cooled
R_{thjc-K}			0.0117		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0015	Direct current	
MECHANICAL					
w	Weight, max	g	1900		
D_s	Surface creepage distance	mm (inch)	36.50 (1.437)		
D_a	Air strike distance	mm (inch)	16.50 (0.650)		

PART NUMBERING GUIDE

T	183	4000	18	A2	K2	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

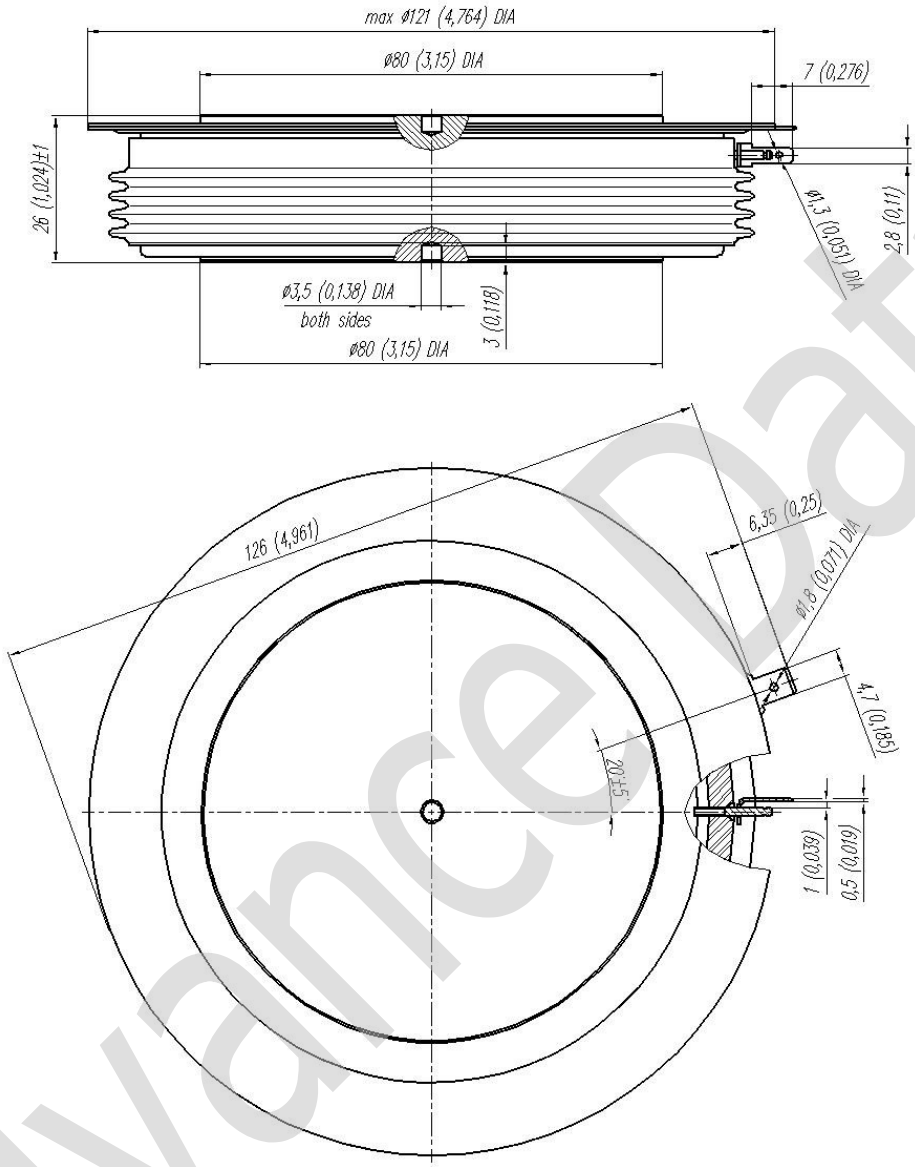
Symbol of Group	E2	A2	T1
$(dv_D/dt)_{crit}$, V/μs	500	1000	1600

2) Turn-off time (dv_D/dt=50 V/μs)

Symbol of Group	K2
t_q, μs	320

OVERALL DIMENSIONS

Package type: T.H1



All dimensions in millimeters (inches)

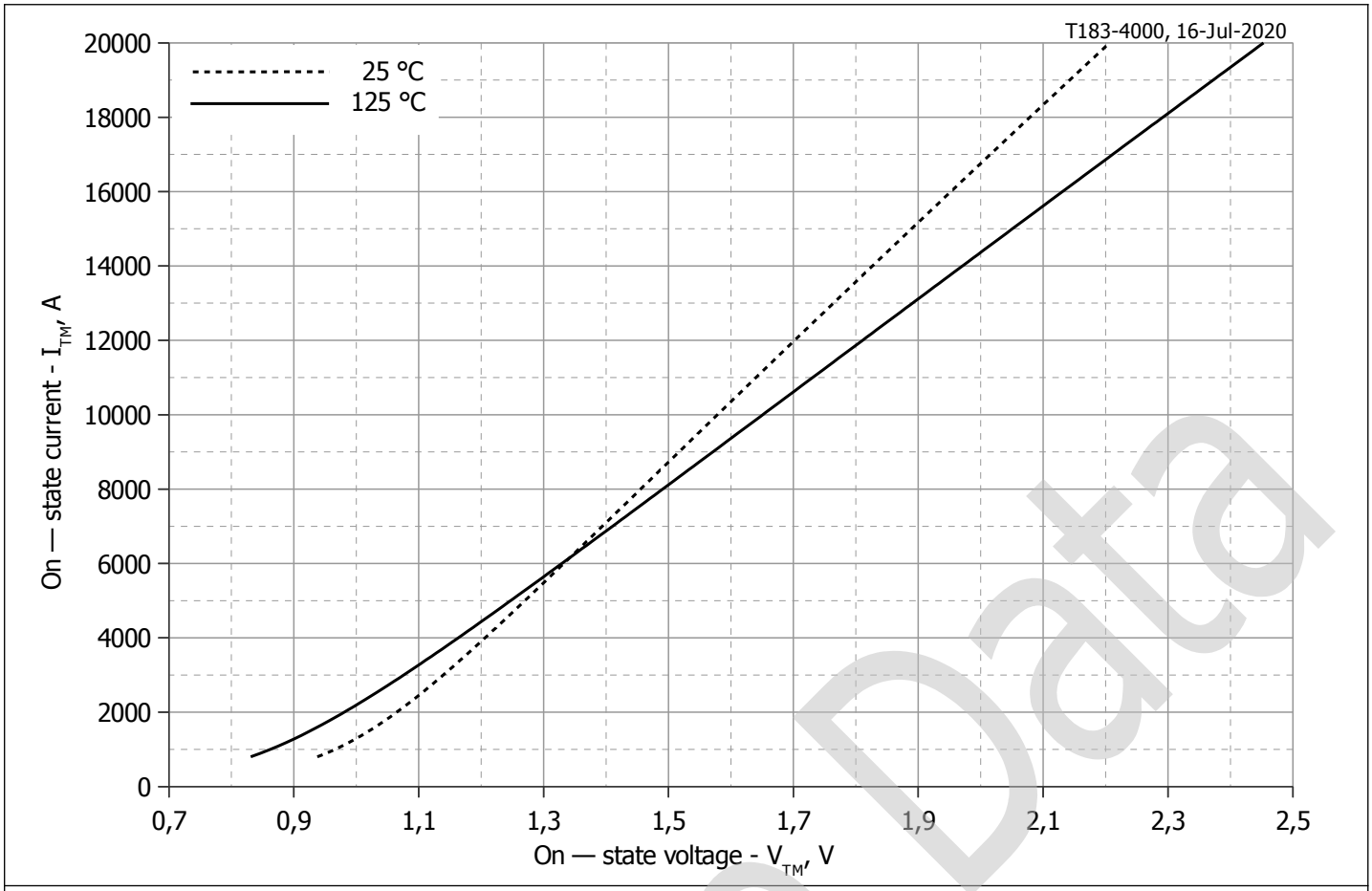


Fig 1 – On-state characteristics of Limit device

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	0.00020047	0.00014317
B	0.00008131	0.00009212
C	0.16075151	0.13494670
D	-0.00715596	-0.00513337

On-state characteristic model (see Fig. 1)

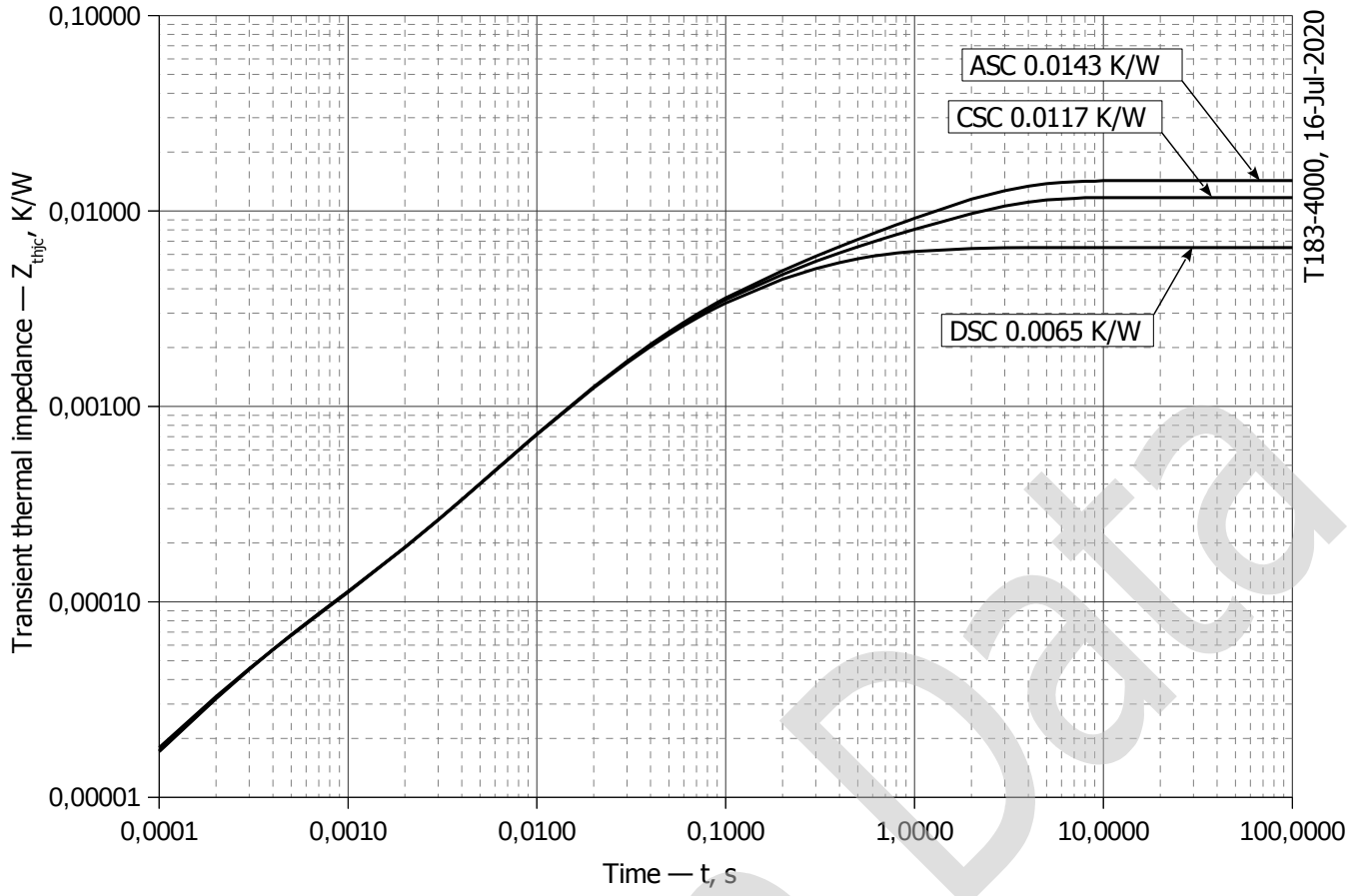


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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	0.001031	0.003117	0.001895	0.0004176	2.061e-005	1.999e-005
τ_i, s	0.7345	0.209	0.05291	0.01652	0.0006764	0.0002168

DC Anode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.00848	0.001792	0.002597	0.00179	0.0003904	3.851e-005
τ_i, s	1.845	0.9581	0.2011	0.05234	0.01605	0.0003606

DC Cathode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.001475	0.005797	0.002722	0.001822	0.0003923	3.824e-005
τ_i, s	0.8755	1.835	0.1997	0.05221	0.01594	0.0003499

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

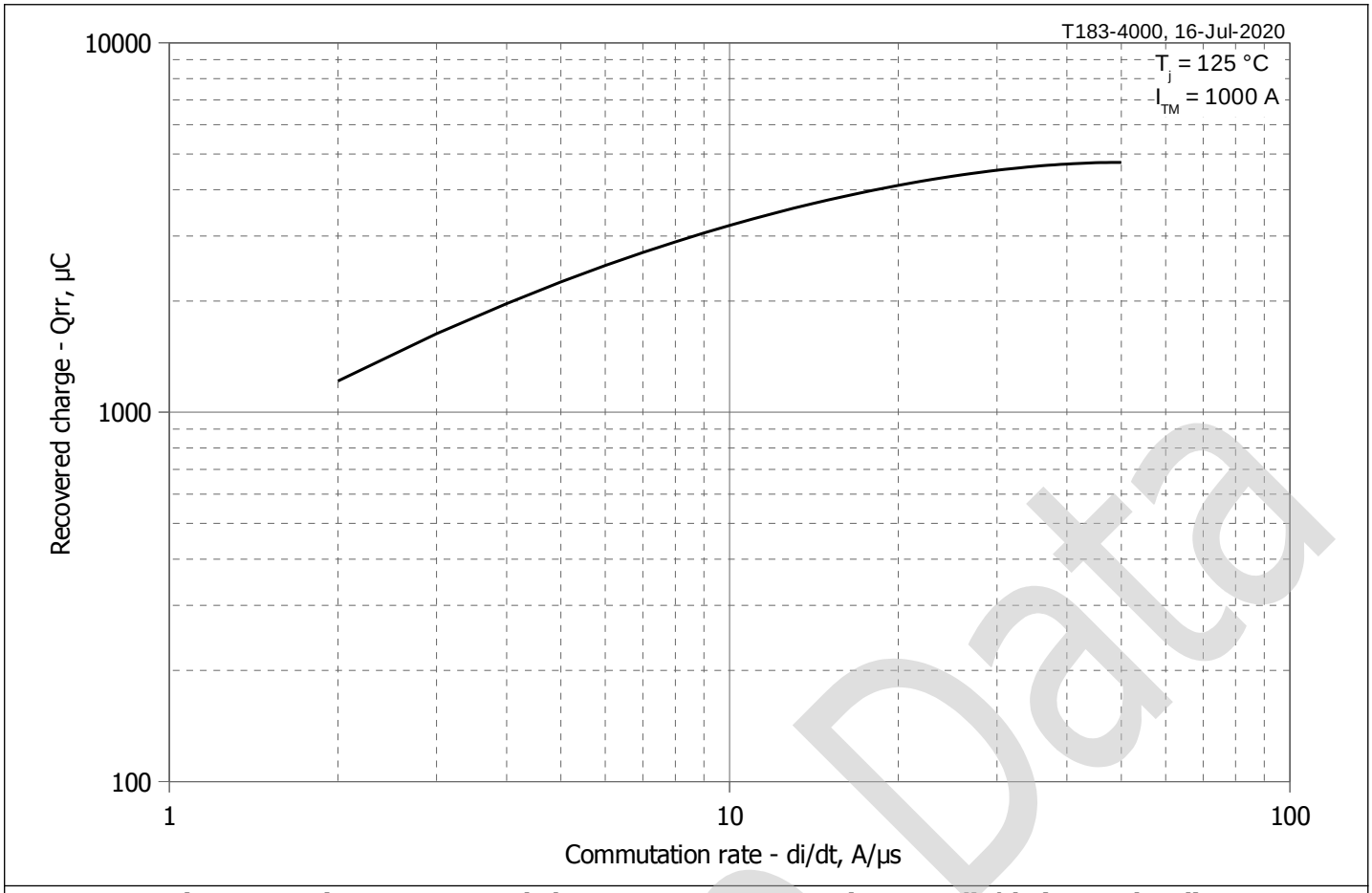


Fig. 3 – Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

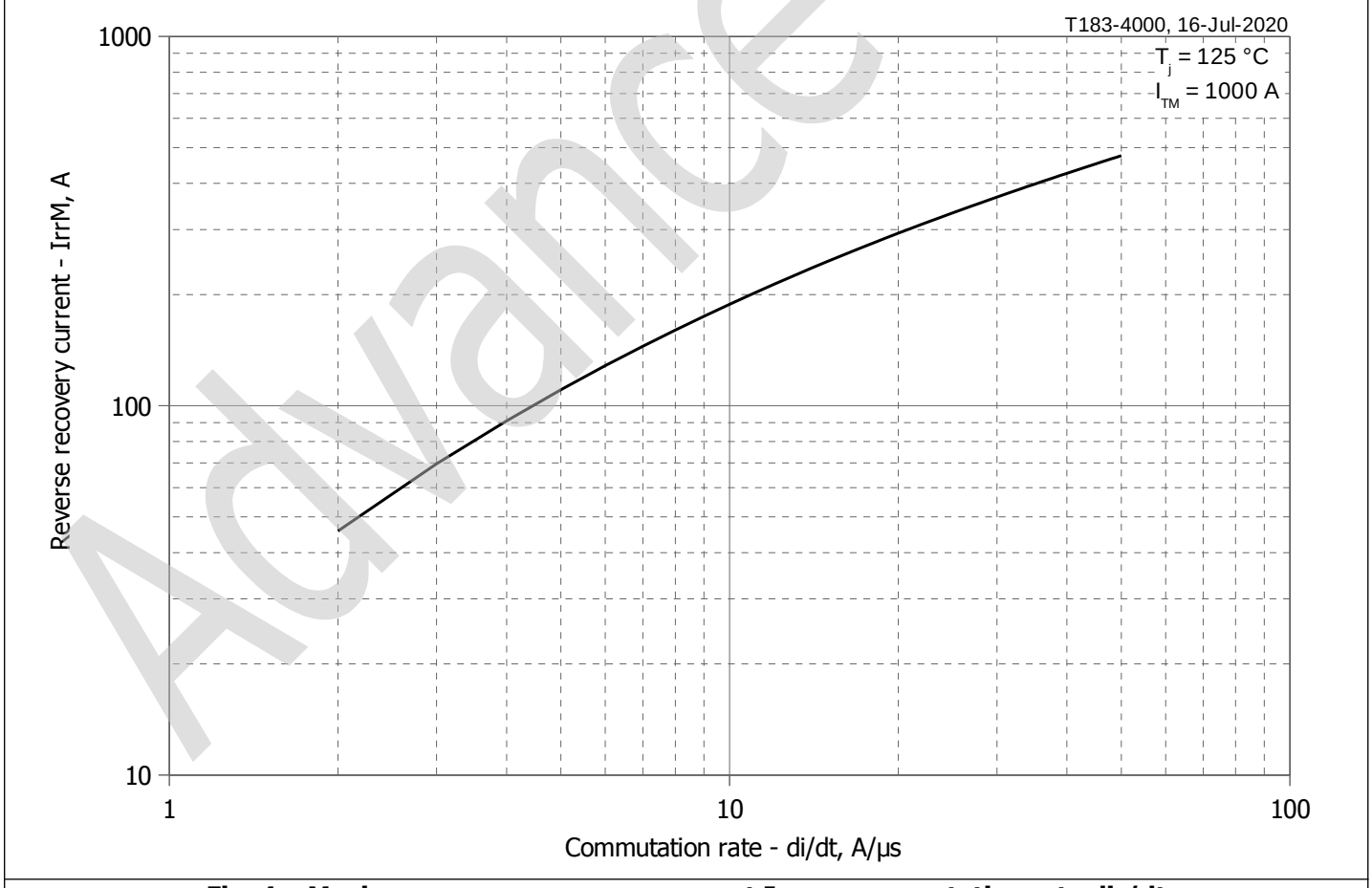


Fig. 4 – Maximum reverse recovery current I_{rrM} vs. commutation rate di_R/dt

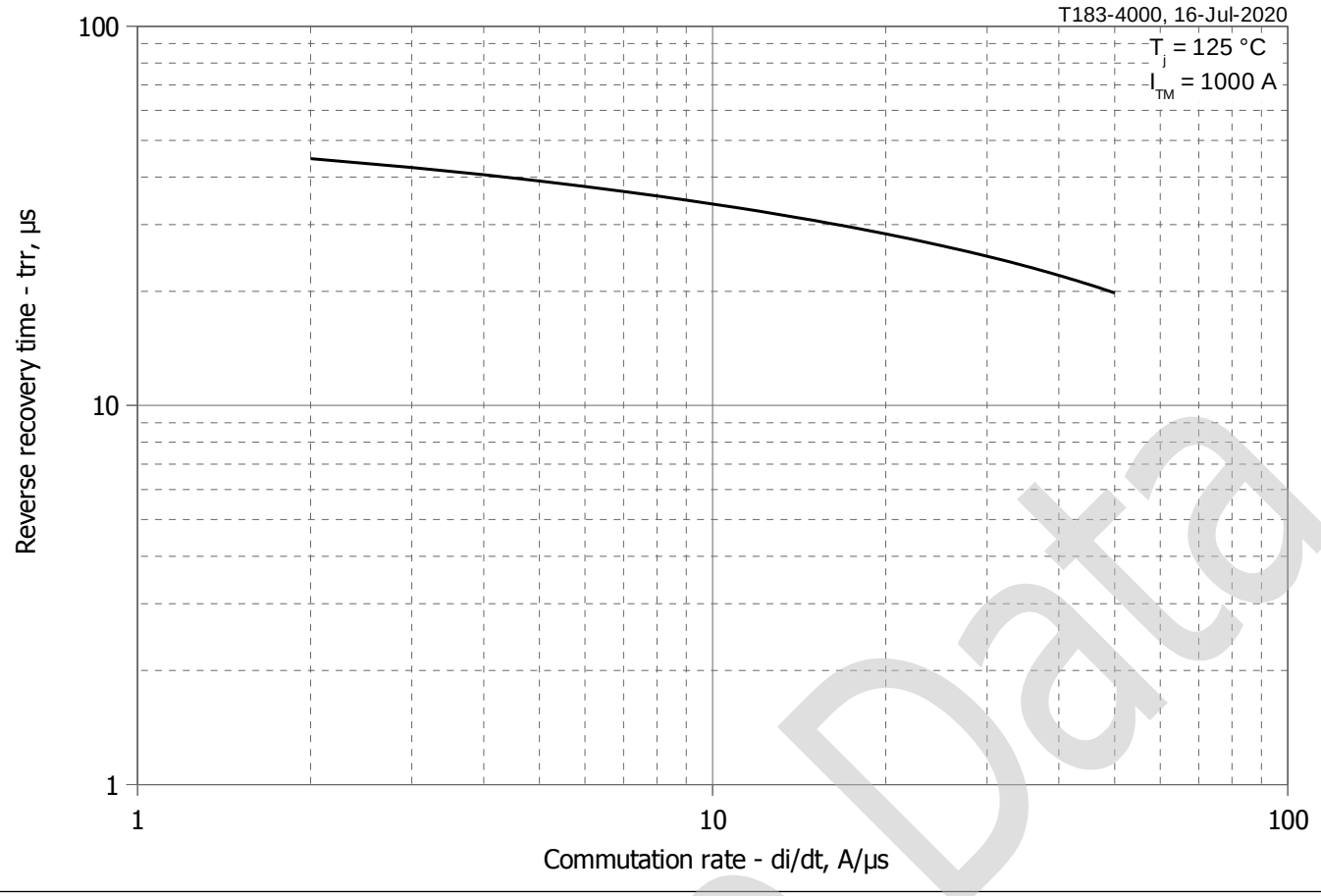


Fig. 5 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

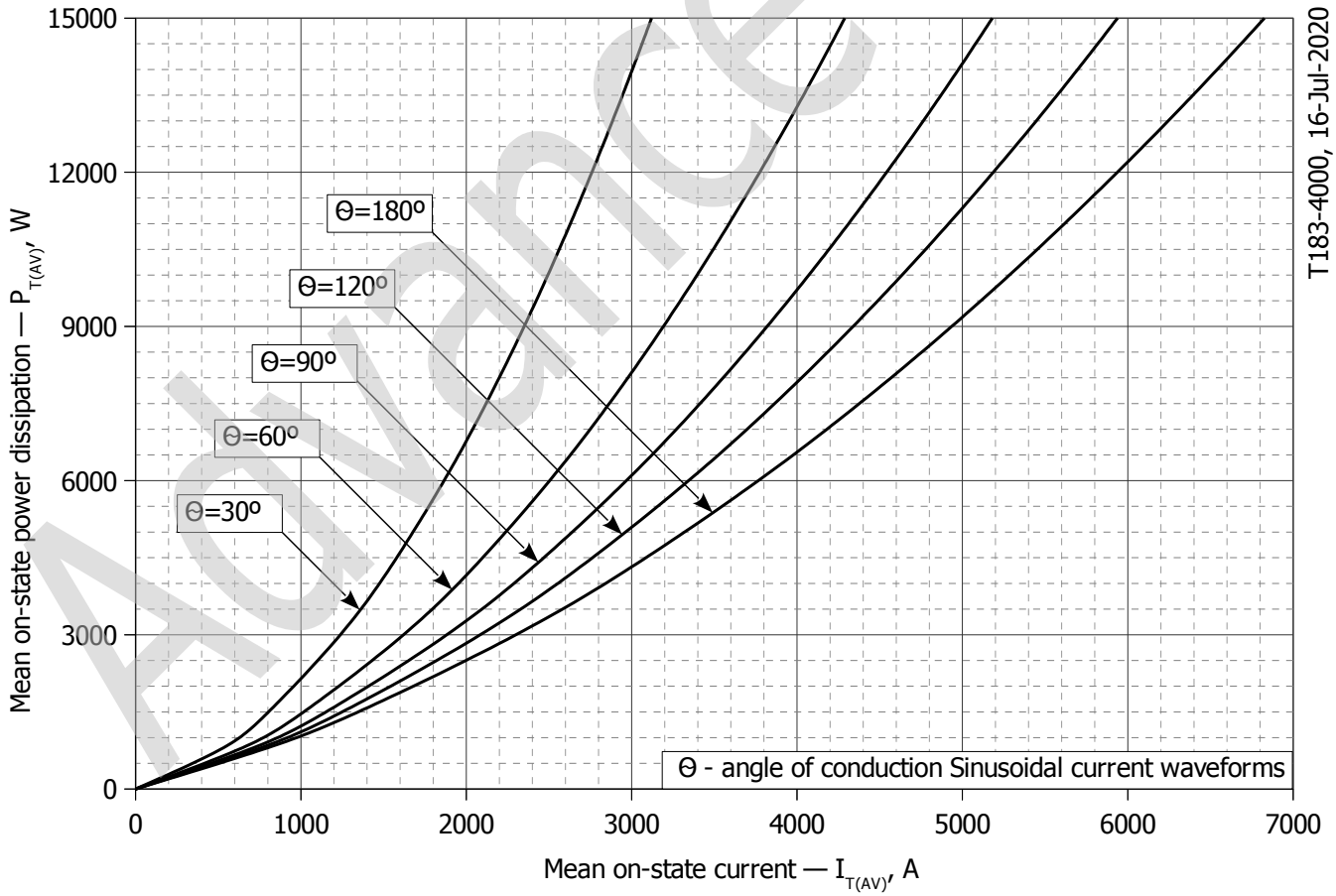


Fig. 6 - Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

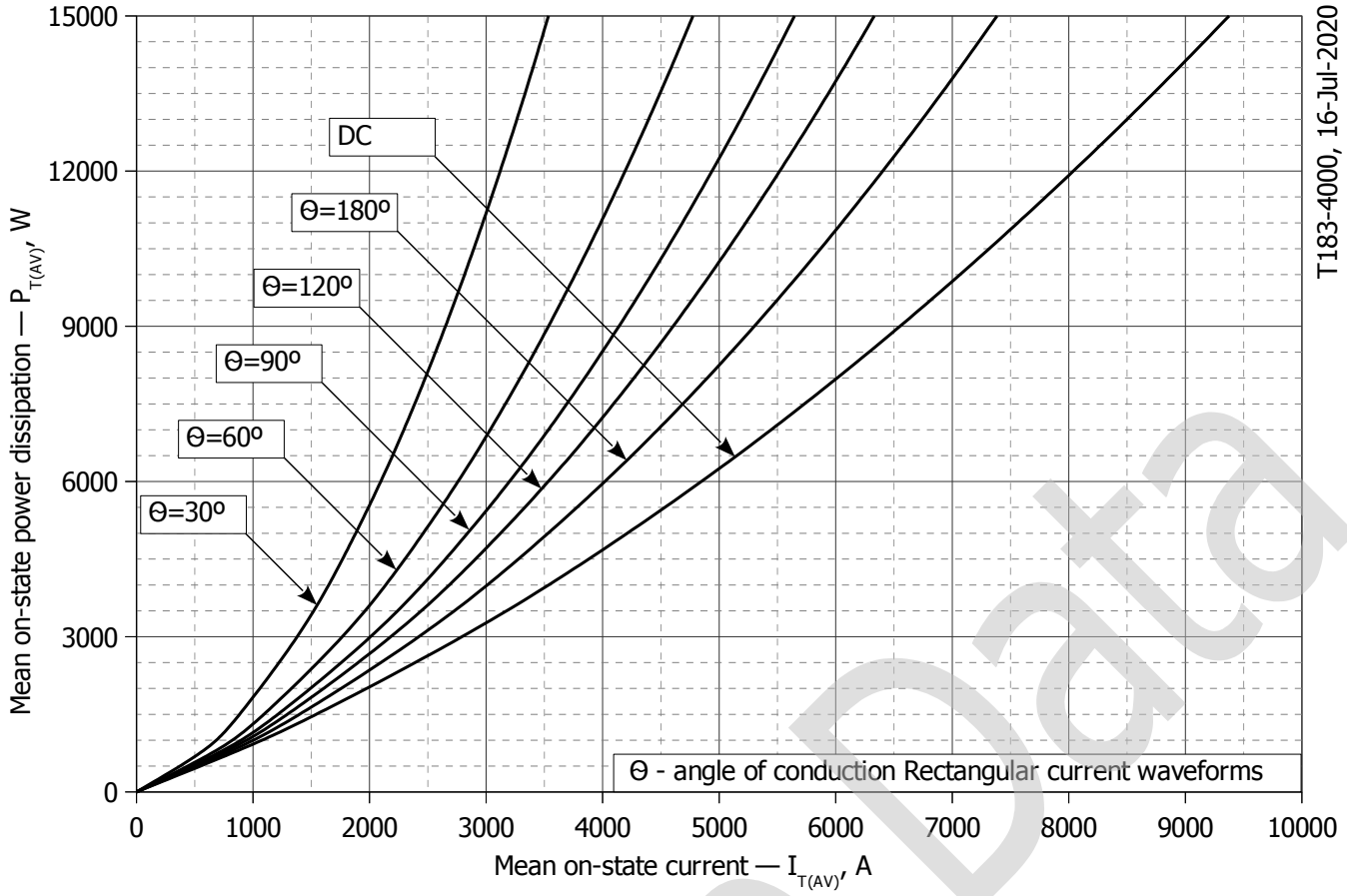


Fig. 7 – Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

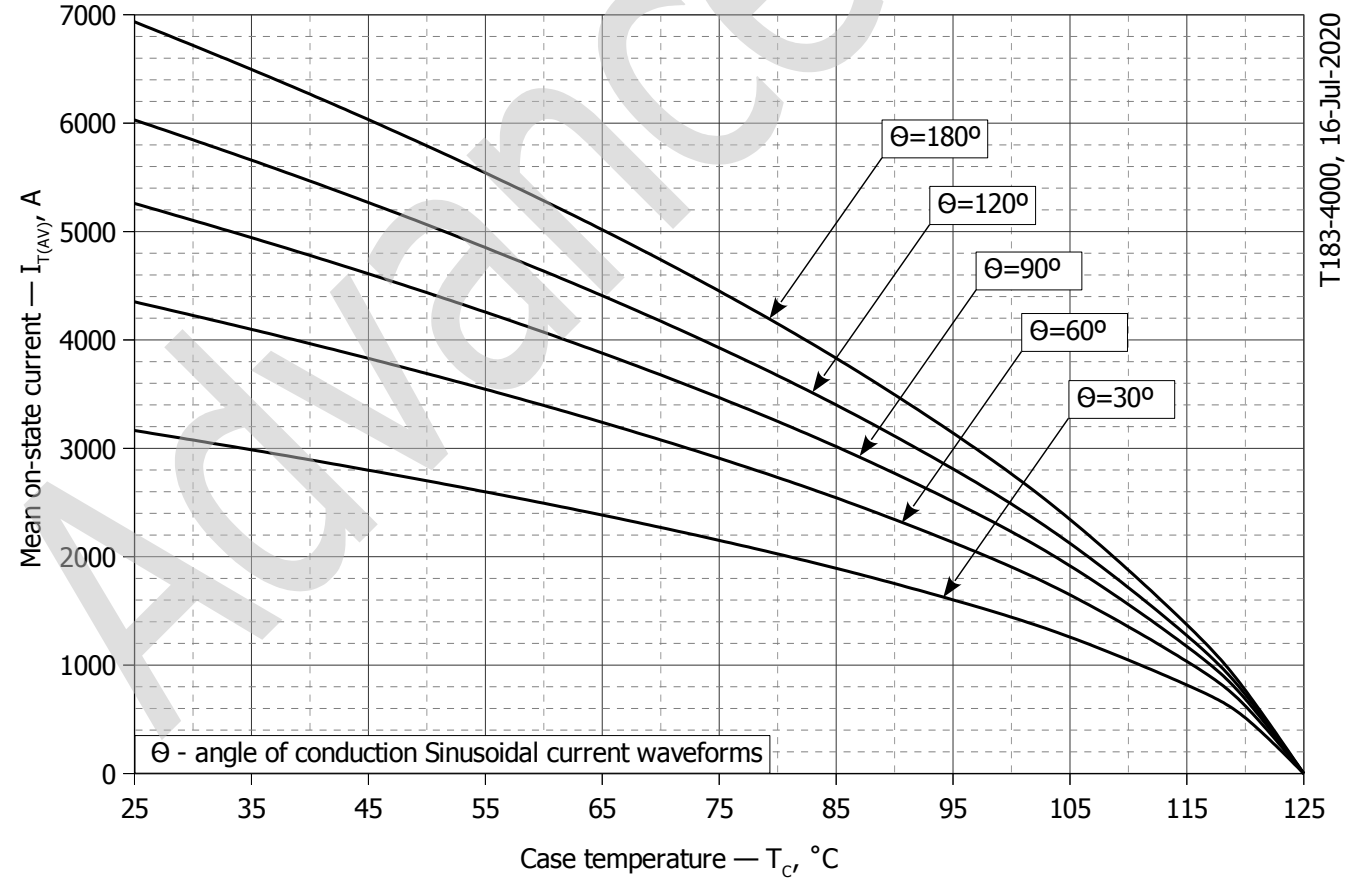


Fig. 8 – Mean on-state current I_{TAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

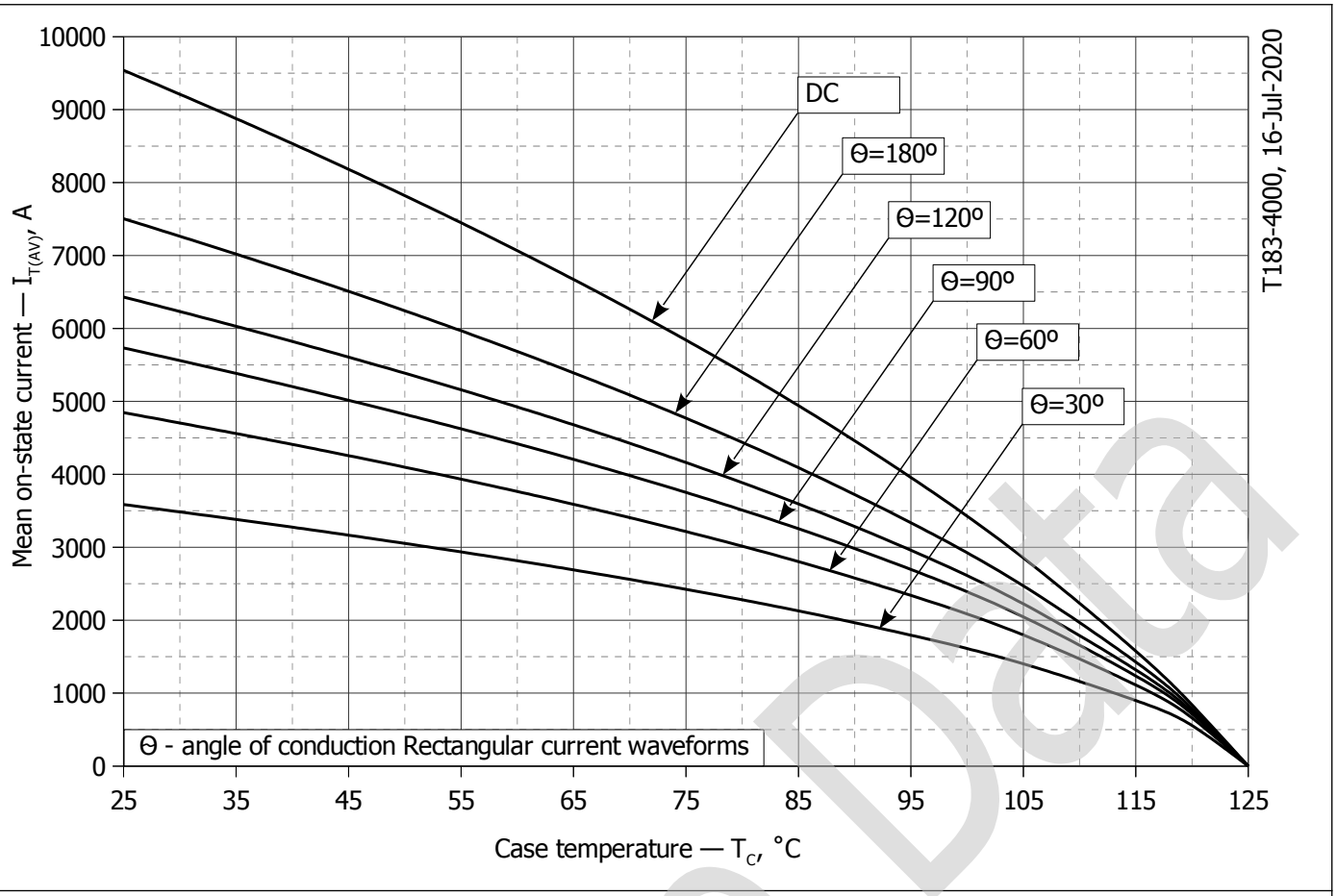


Fig. 9 - Mean on-state current I_{TAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

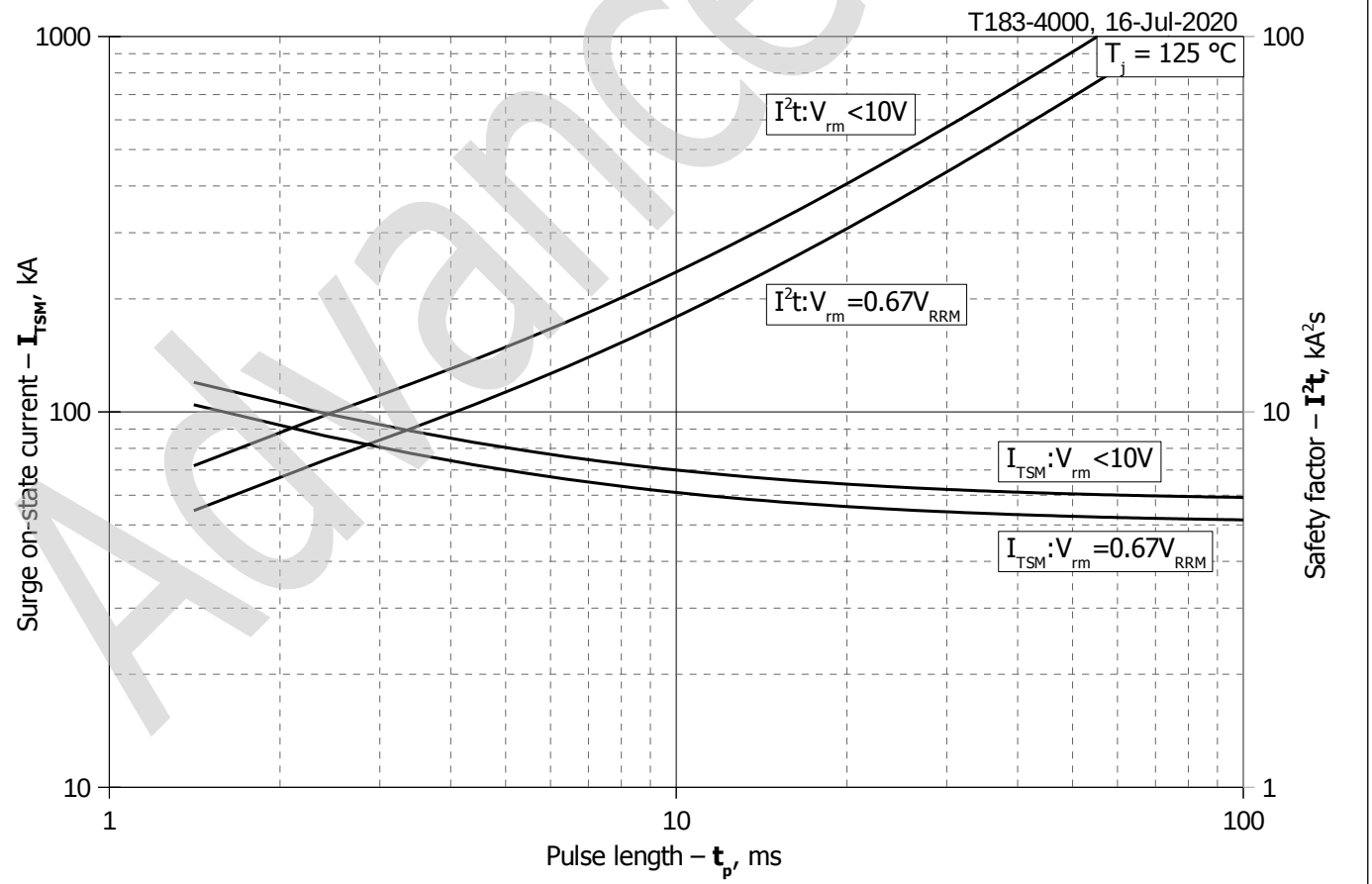


Fig. 10 – Maximum surge on-state current I_{TSM} and safety factor I^2t vs. pulse length t_p

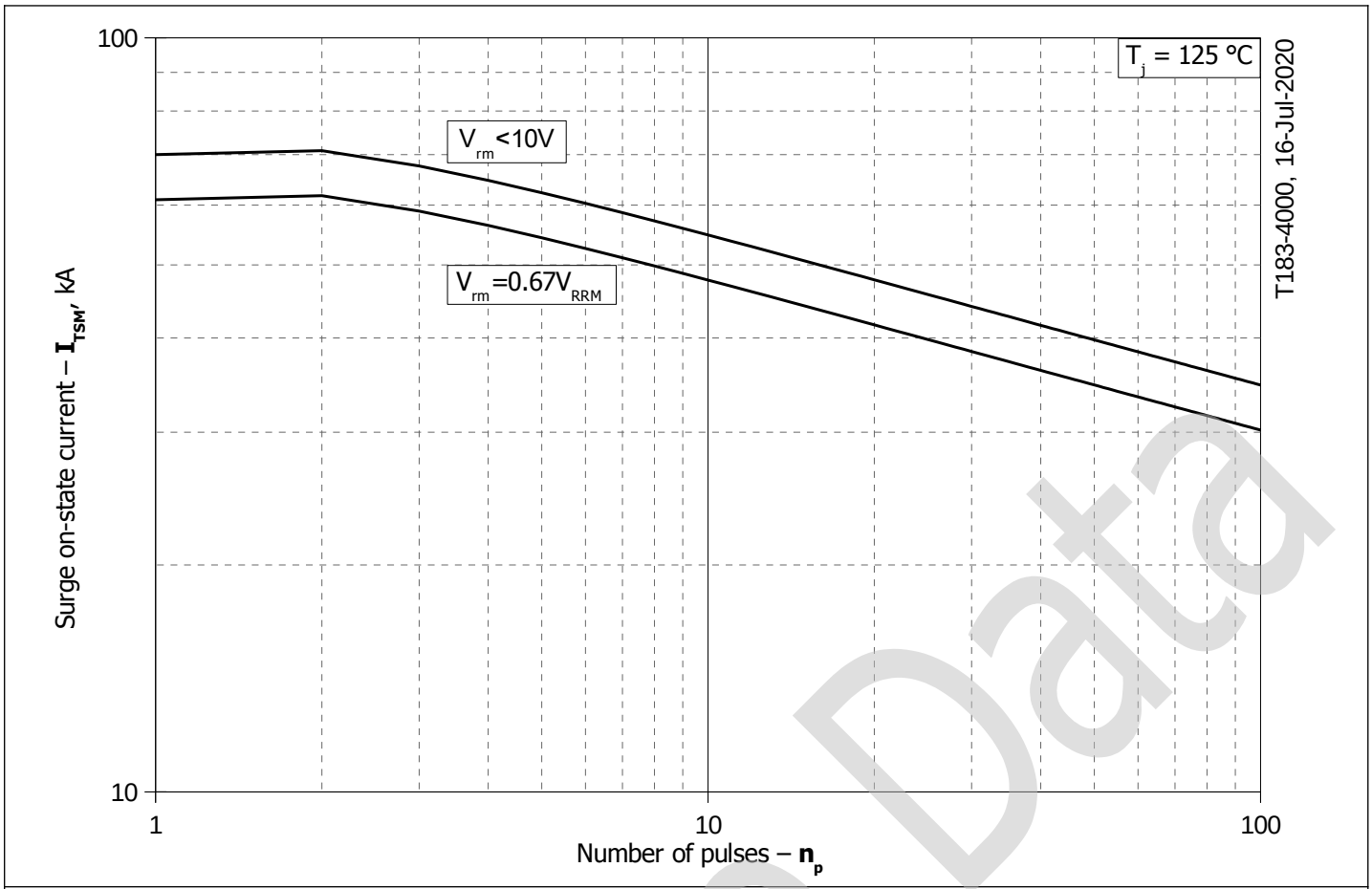


Fig. 11 - Maximum surge on-state current I_{TSM} vs. number of pulses n_p