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

Phase Control Thyristor
Type T133-630-8

Mean on-state current				I_{TAV}		630 A		
Repetitive peak off-state voltage				V_{DRM}		100 ÷ 800 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
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}	Mean on-state current	A	630 963	T_c=114 °C, Double side cooled T_c=85 °C, Double side cooled 180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	989	T_c=114 °C, Double side cooled 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	10.5 12.0	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
			11.0 12.5	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	$A^2s{\cdot}10^3$	550 720	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
			500 640	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	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	800	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; I_{TM}=3000 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÷150	
MECHANICAL				
F	Mounting force	kN	9.0÷11.0	
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	1.50	T_j=25 °C; I_{TM}=1978 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	0.354		
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, 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	0.50	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	35.00		
SWITCHING					
t_{gd}	Delay time, max	μs	0.70	T_j=25 °C; V_D=600 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	3.00		
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=100V; $V_D=0.67\cdot V_{DRM}$	
Q_{rr}	Total recovered charge, max	μC	650	$T_j=T_{j\,max}$; I_{TM}=630 A; di_R/dt=-10 A/μs; V_R=100 V	
t_{rr}	Reverse recovery time, max	μs	13		
I_{rrM}	Peak reverse recovery current, max	A	100		

THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.040	Direct current	Double side cooled
R_{thjc-A}			0.088		Anode side cooled
R_{thjc-K}			0.072		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.008	Direct current	
MECHANICAL					
w	Weight, max	g	110		
D_s	Surface creepage distance	mm (inch)	10.30 (0.405)		
D_a	Air strike distance	mm (inch)	6.30 (0.248)		

PART NUMBERING GUIDE

T	133	630	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

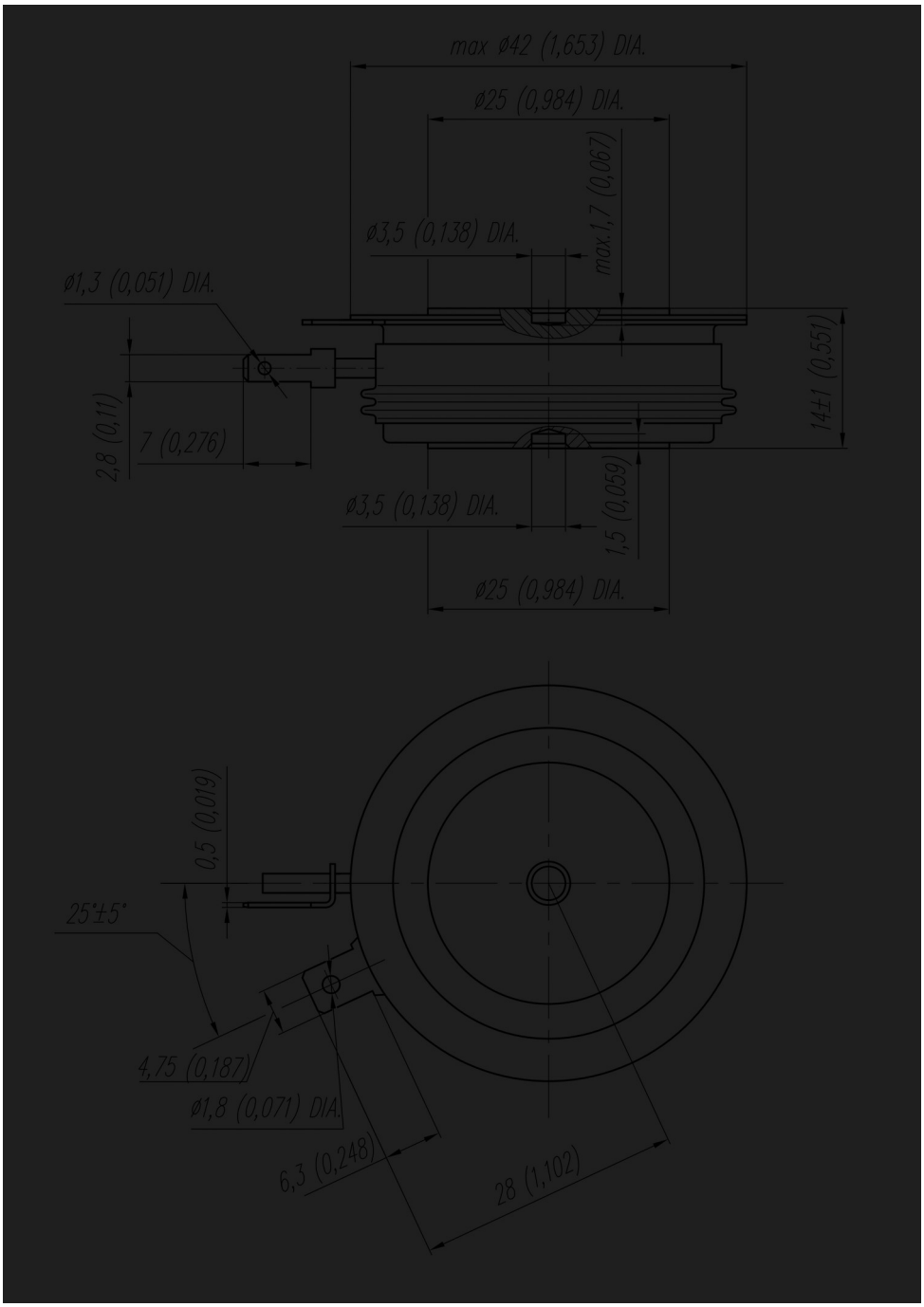
Symbol of Group	P2	K2	E2	A2	T1	P1	M1
$(dv_D/dt)_{crit}$, V/μs	200	320	500	1000	1600	2000	2500

[2] Turn-off time (dv_D/dt=50 V/μs)

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

OVERALL DIMENSIONS

Package type: T.B2



All dimensions in millimeters (inches)

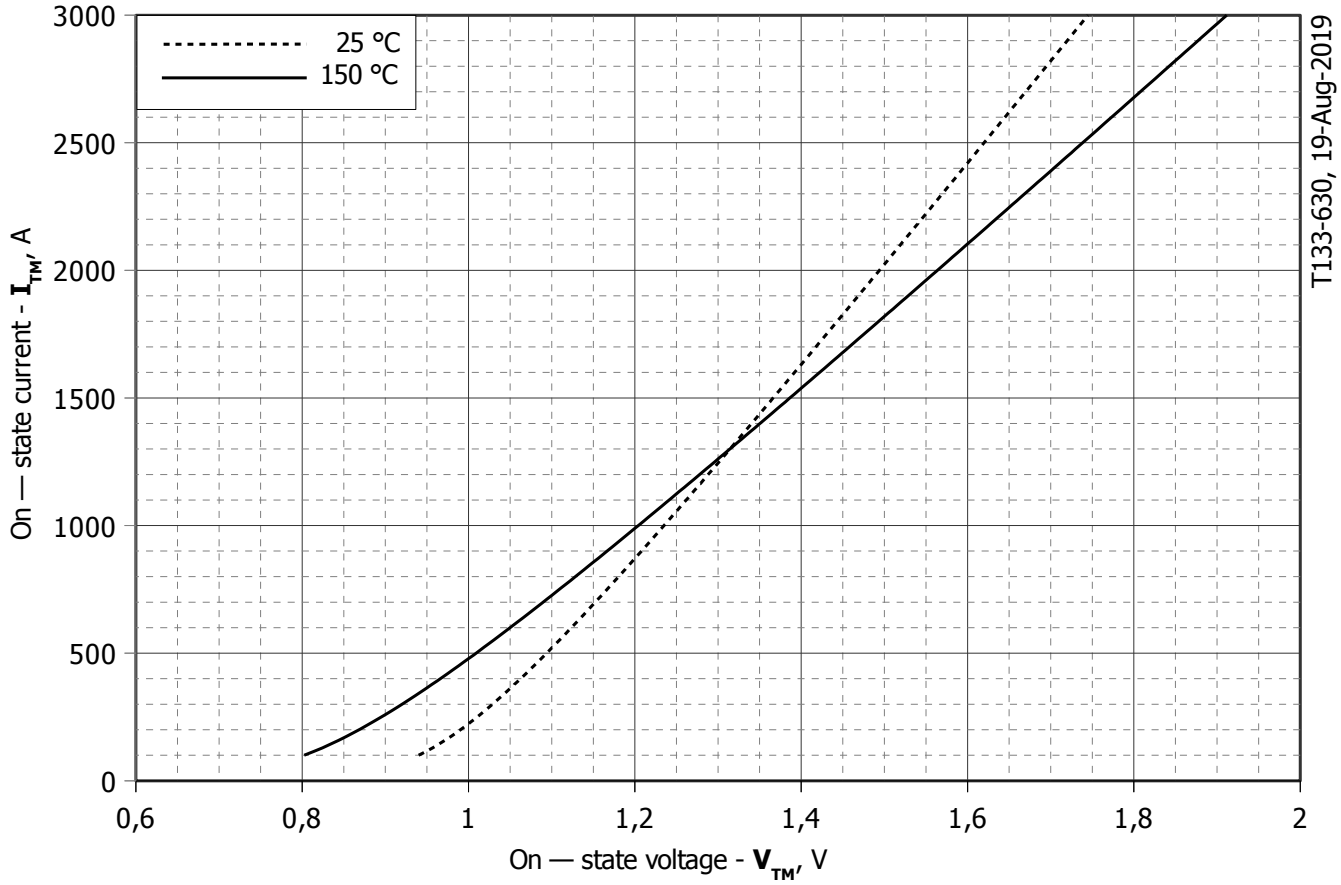


Fig 1 – On-state characteristics of Limit device

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	0.71244000	0.53052000
B	0.00024978	0.00033909
C	0.04785700	0.05441300
D	-0.00182920	-0.00131060

On-state characteristic model (see Fig. 1)

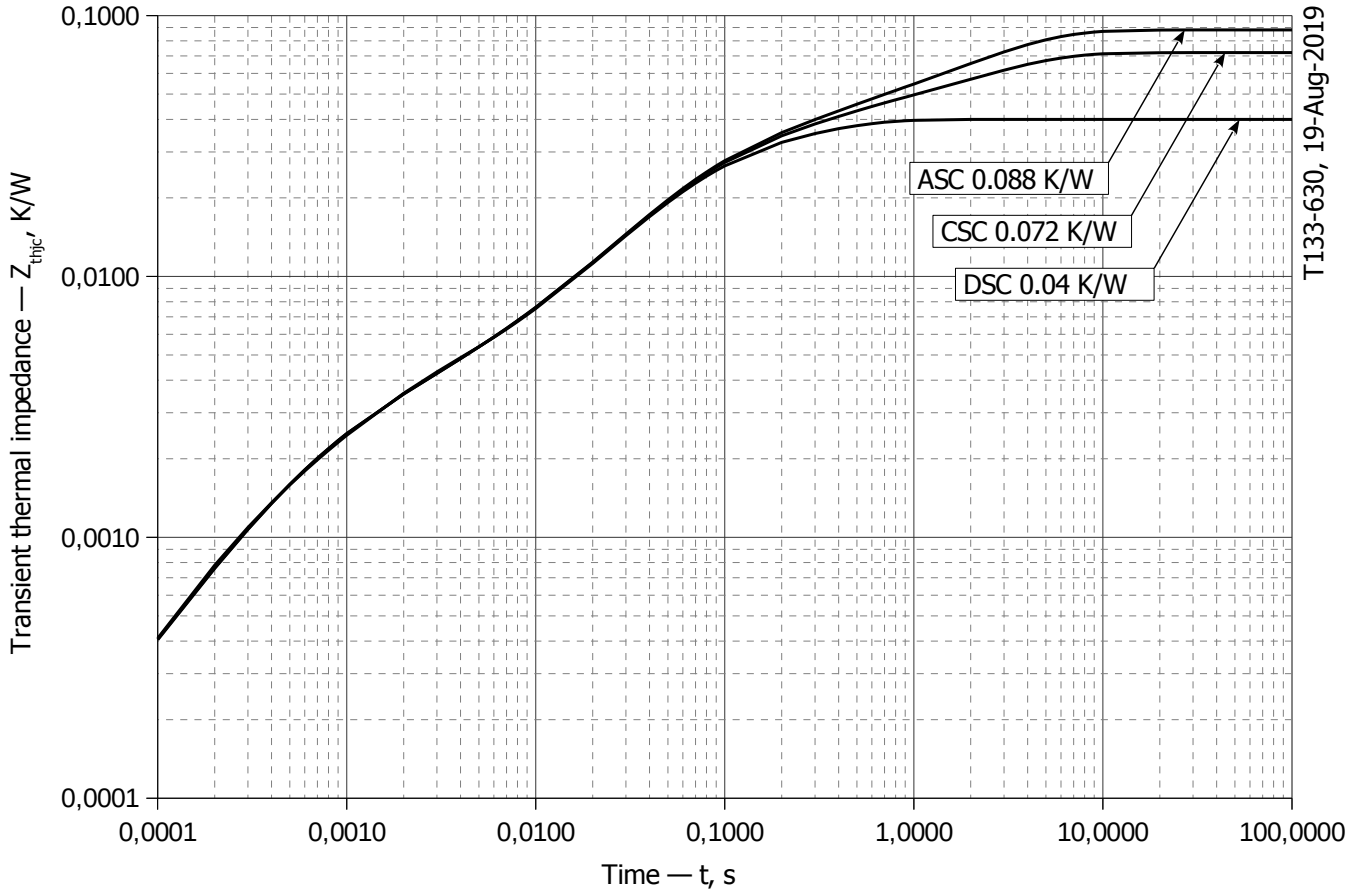


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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 constatnt of r_{th} term.

DC Double side cooled

i	1	2	3	4	5	6
R_i, K/W	0.01423	0.01906	0.003576	0.002535	-4.666e-005	0.0006479
τ_i, s	0.265	0.05901	0.03499	0.001252	0.000001	0.0002488

DC Anode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.04804	0.001789	0.01342	0.02147	0.001374	0.001945
τ_i, s	2.651	0.4195	0.2622	0.05451	0.002585	0.0005847

DC Cathode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.03216	0.01306	0.002934	0.02064	0.001493	0.001786
τ_i, s	2.647	0.2831	0.1455	0.05284	0.002255	0.0005519

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

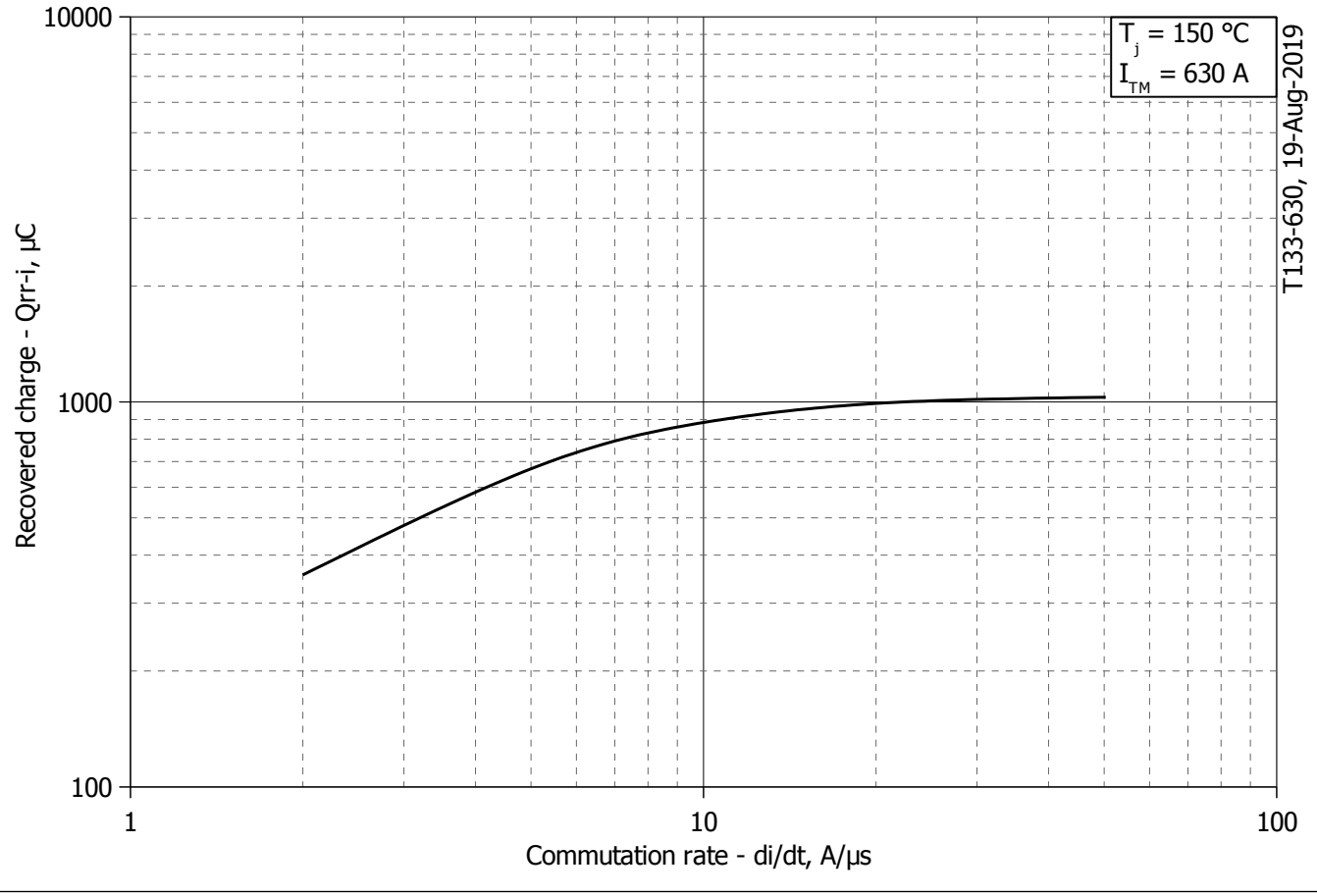


Fig 3 – Maximum recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

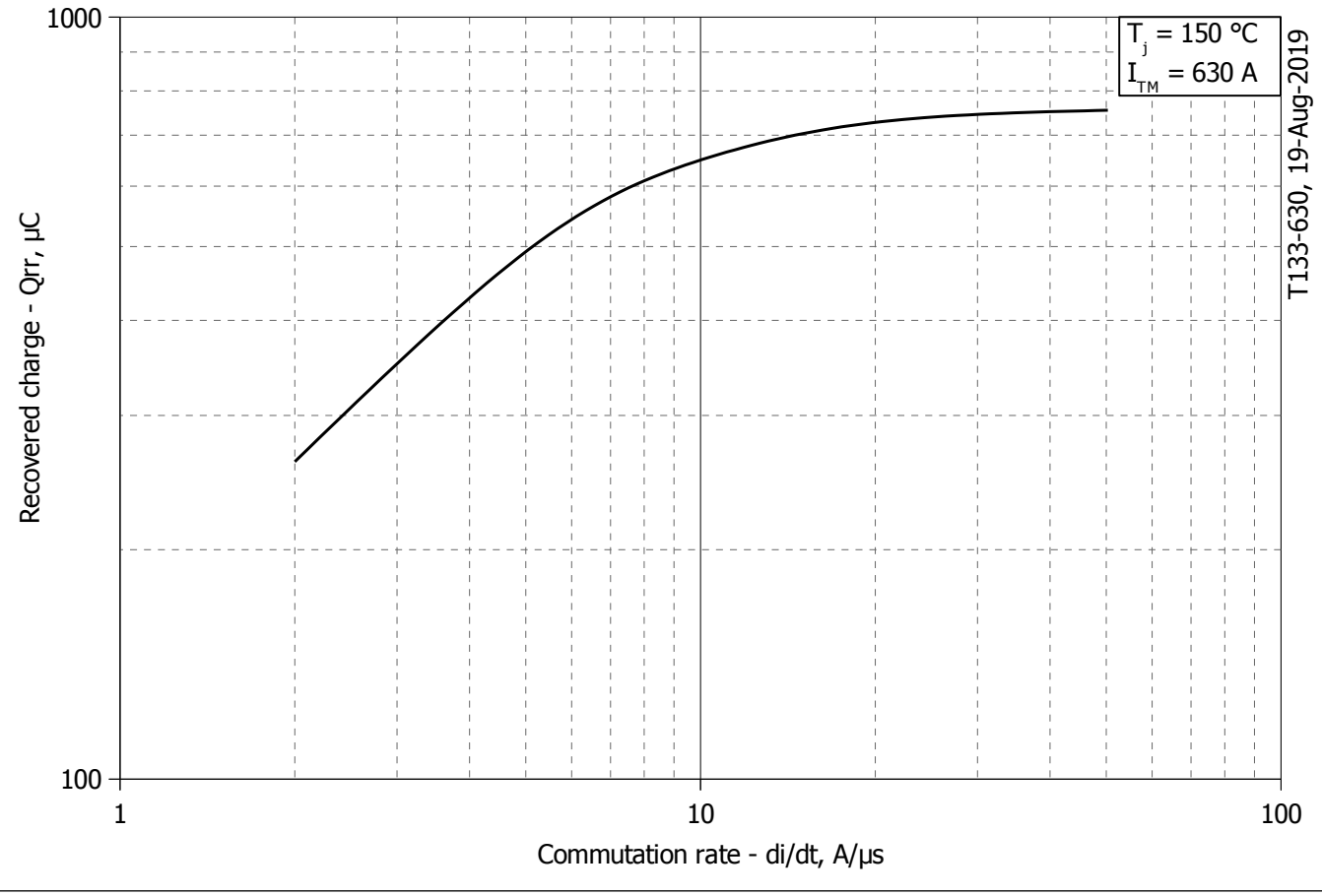


Fig 4 – Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

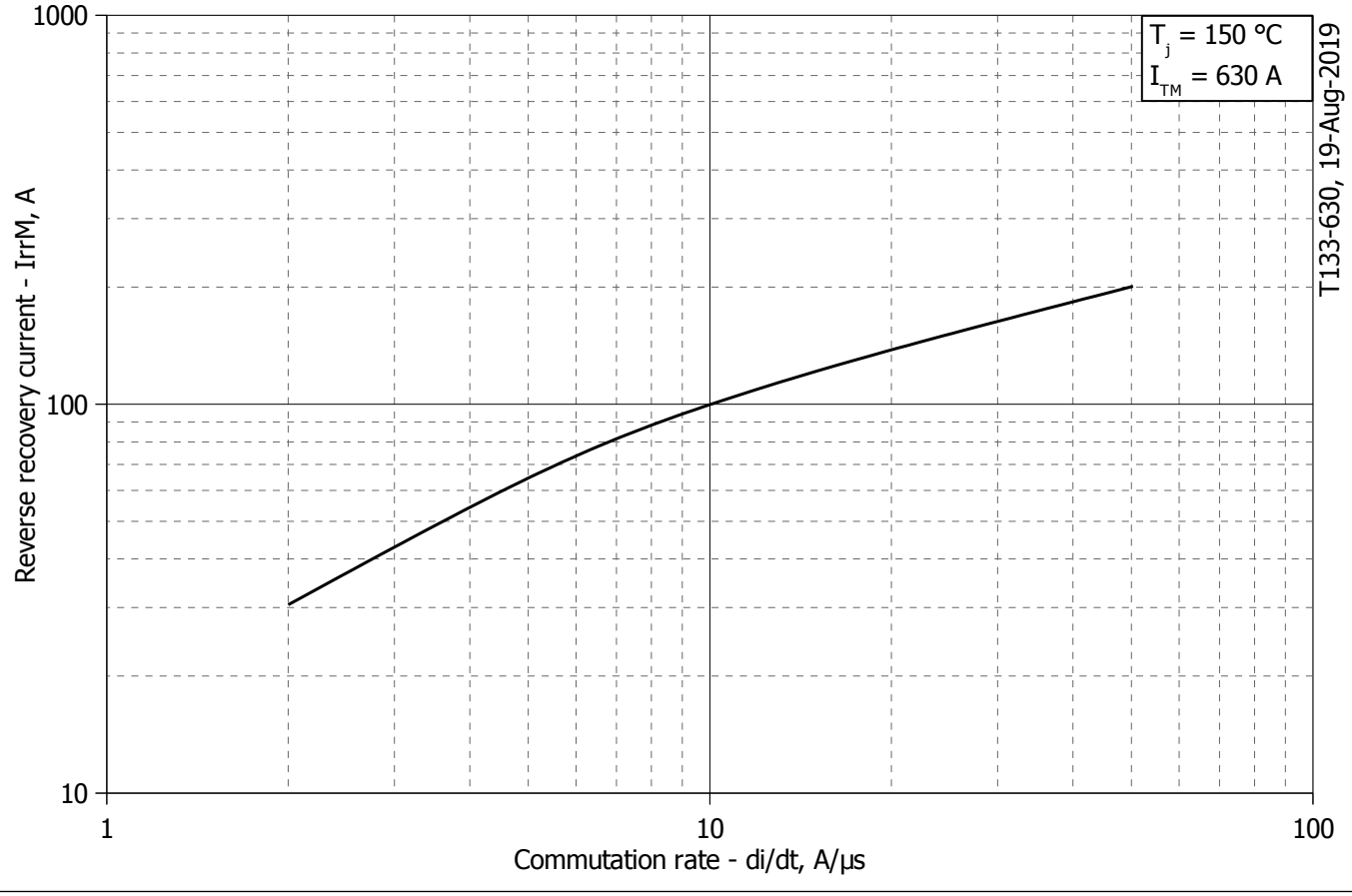


Fig 5 – Maximum reverse recovery current I_{rrM} vs. commutation rate di_R/dt

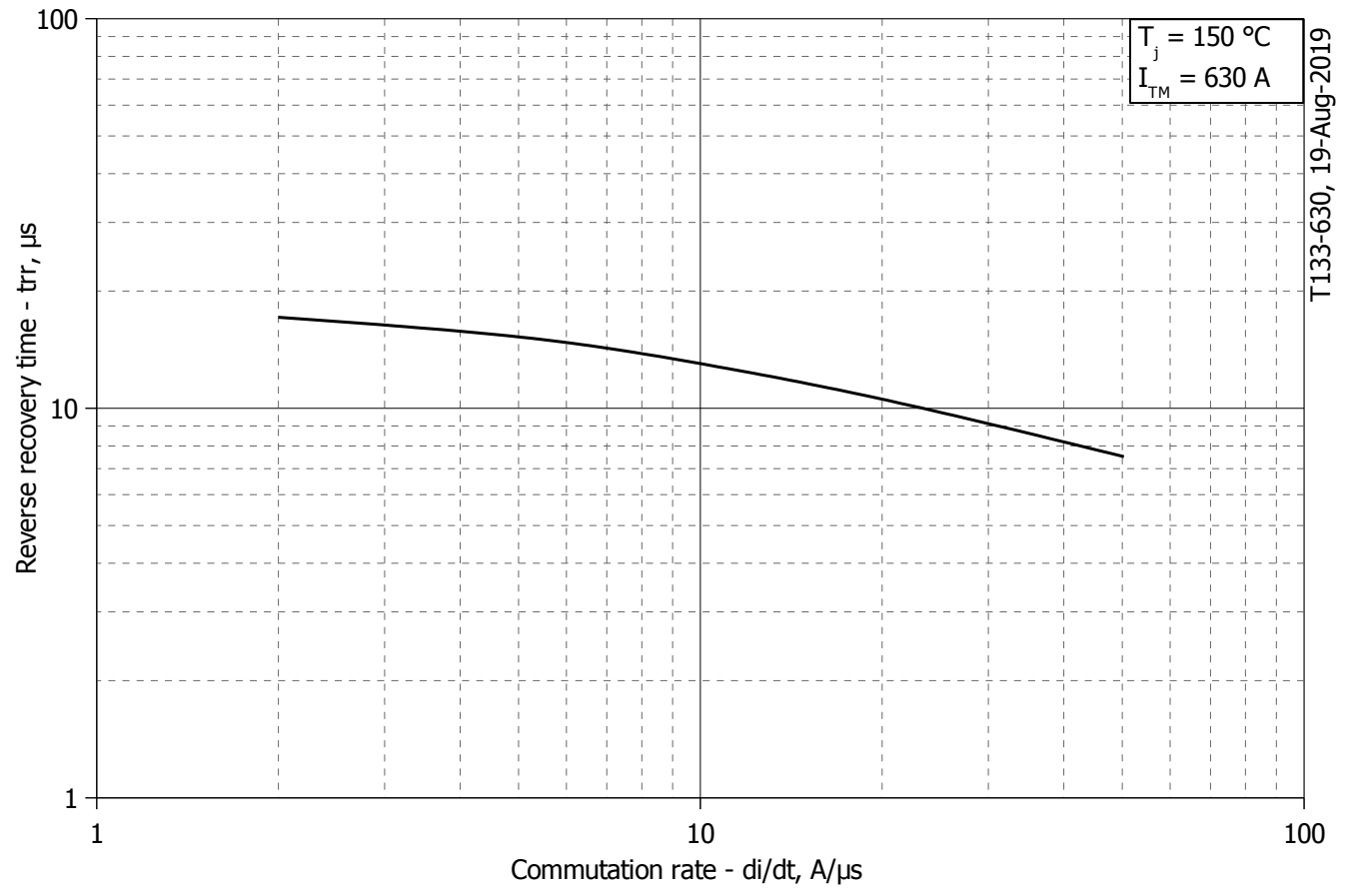


Fig 6 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

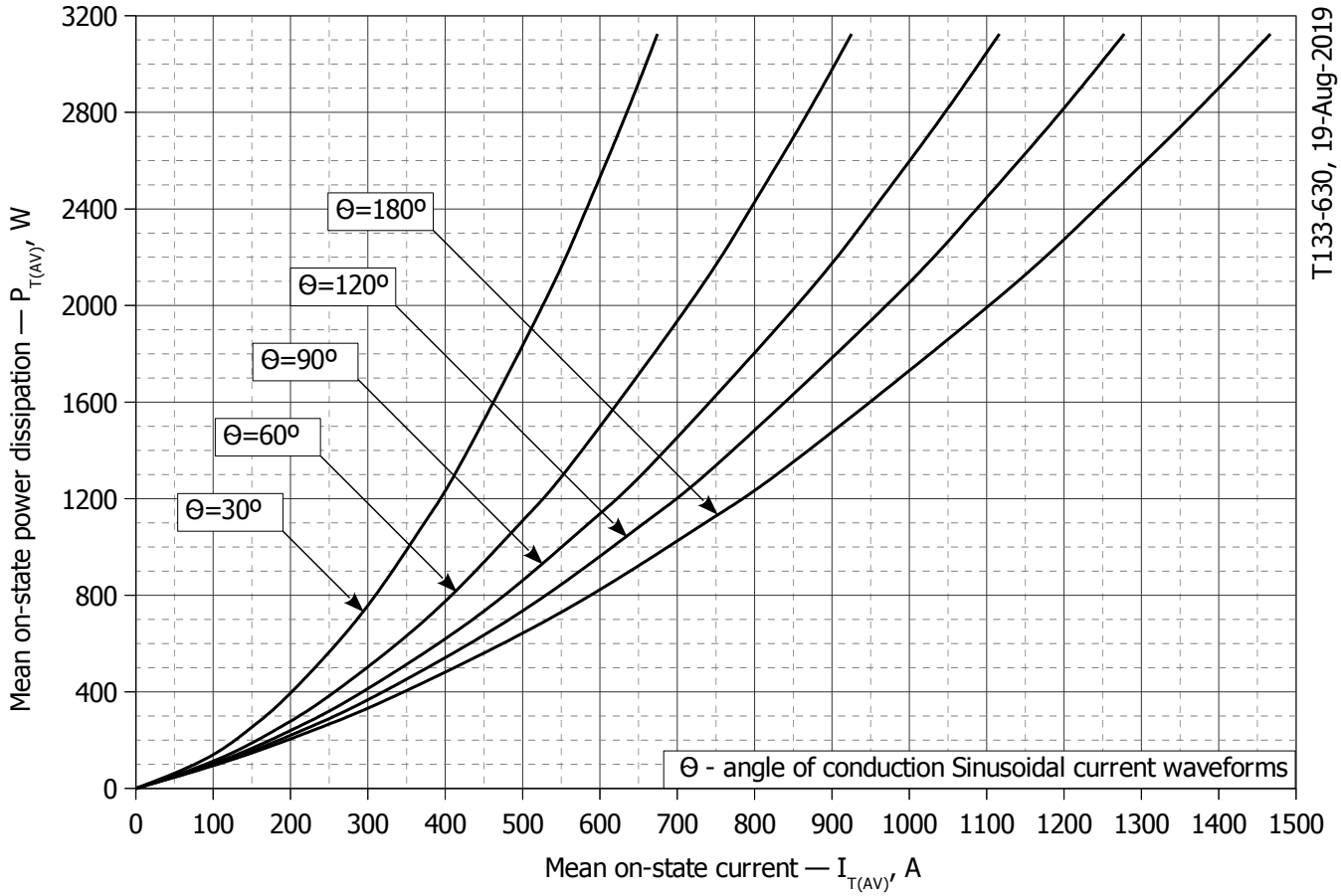


Fig. 7 - Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

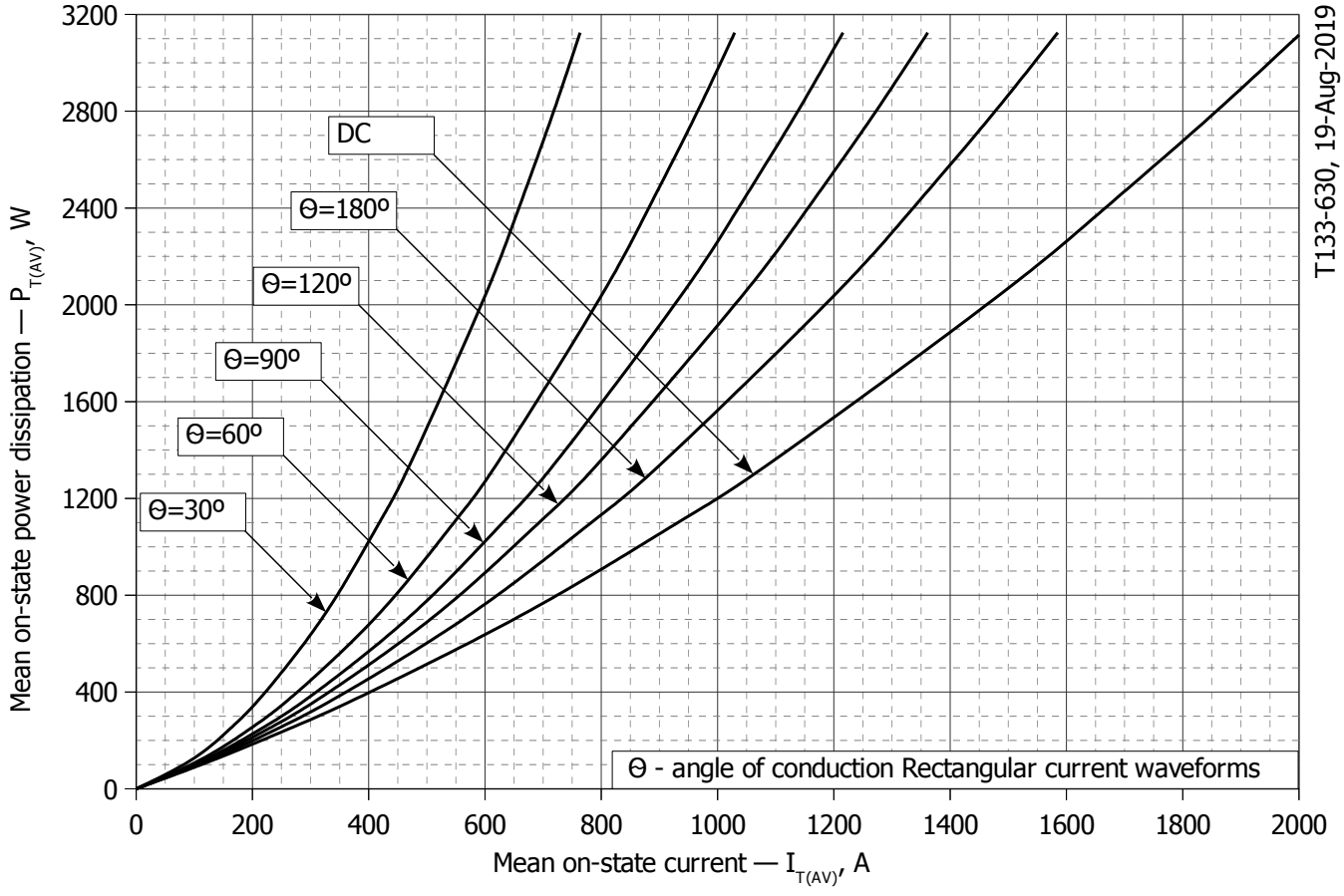


Fig. 8 – Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

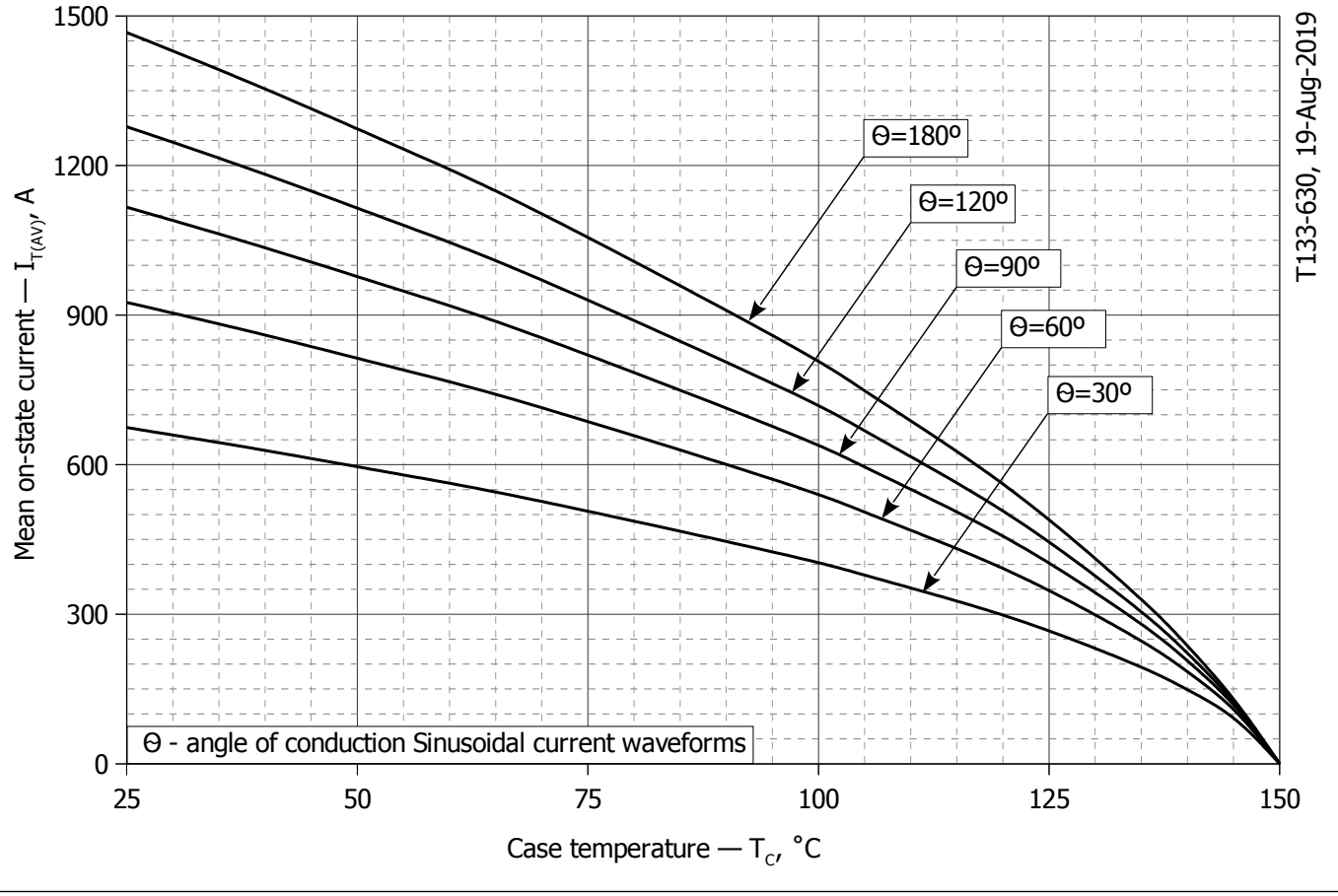


Fig. 9 – Mean on-state current I_{TAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

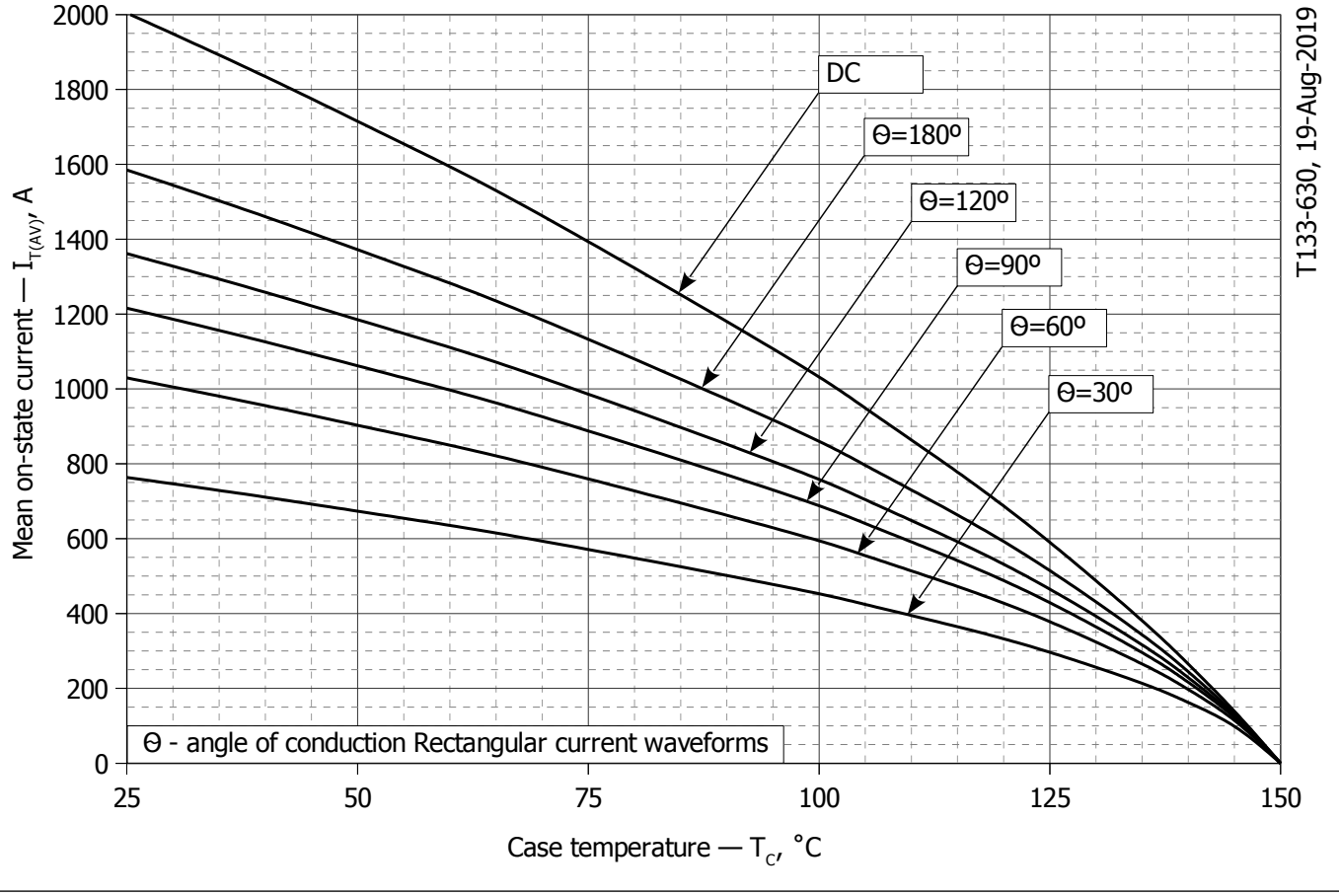


Fig. 10 - Mean on-state current I_{TAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

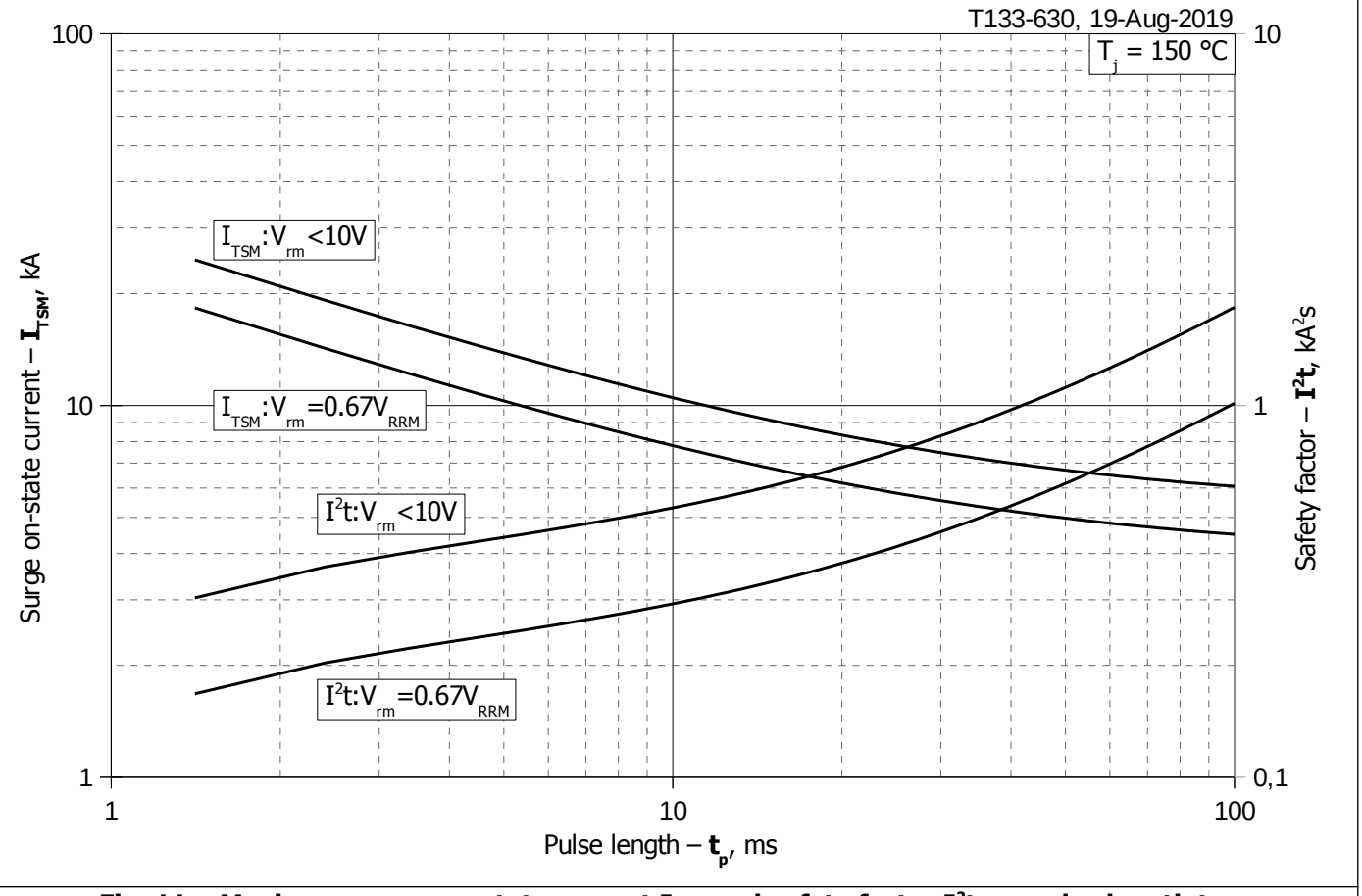


Fig. 11 – Maximum surge on-state current I_{TSM} and safety factor I^2t vs. pulse length t_p

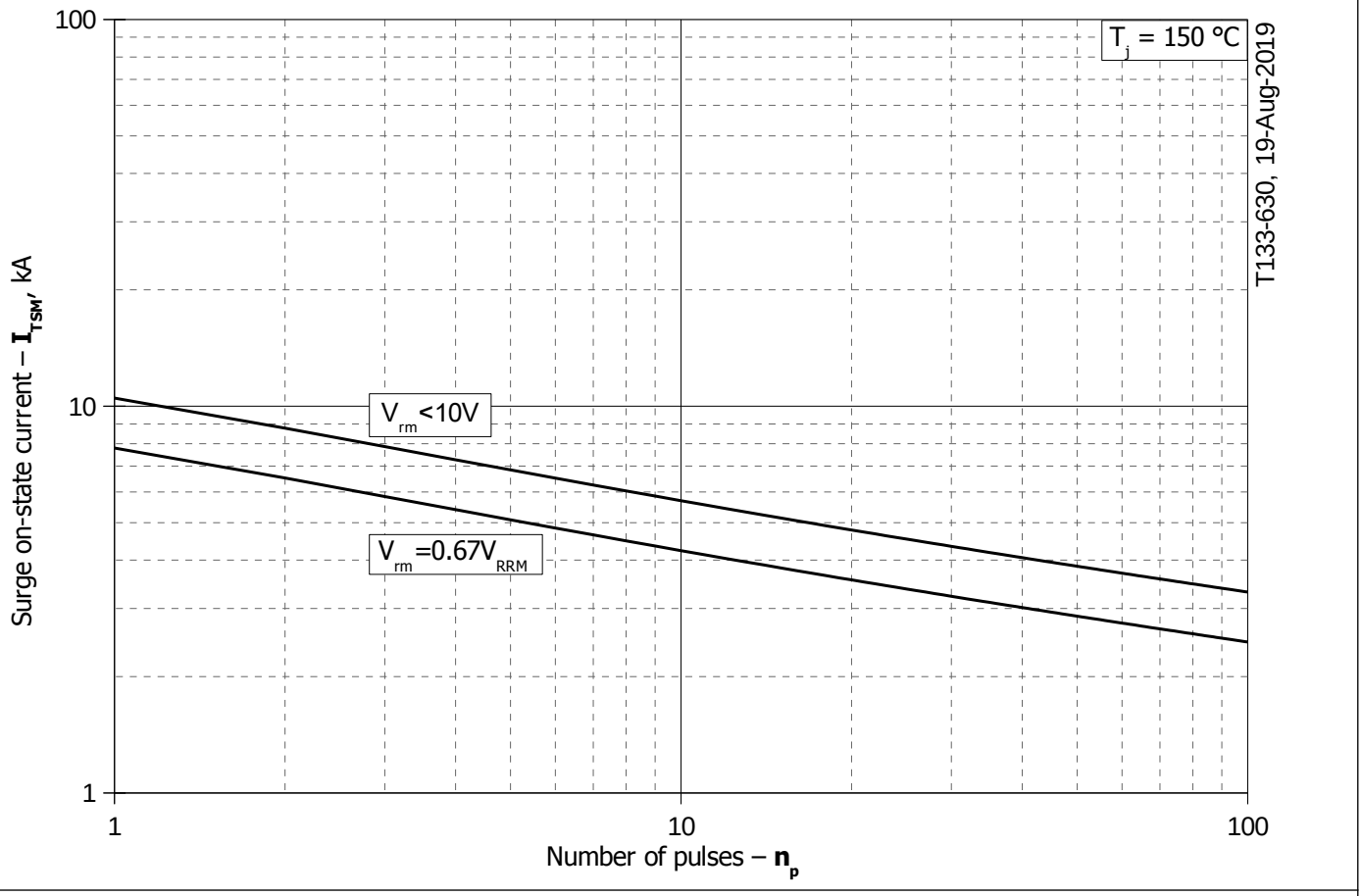


Fig. 12 - Maximum surge on-state current I_{TSM} vs. number of pulses n_p