



PROTON-ELECTROTEX RUSSIA

High forward current capability
Low forward losses
Low thermal resistance
High load cycle capability

Rectifier Diode For Welding Type D166-12500-4

Average forward current	I_{FAV}	12500 A
Repetitive peak reverse voltage	V_{RRM}	200...400 V
V_{RRM} , V	200	400
Voltage code	2	4
T_j , °C	-45...+180	

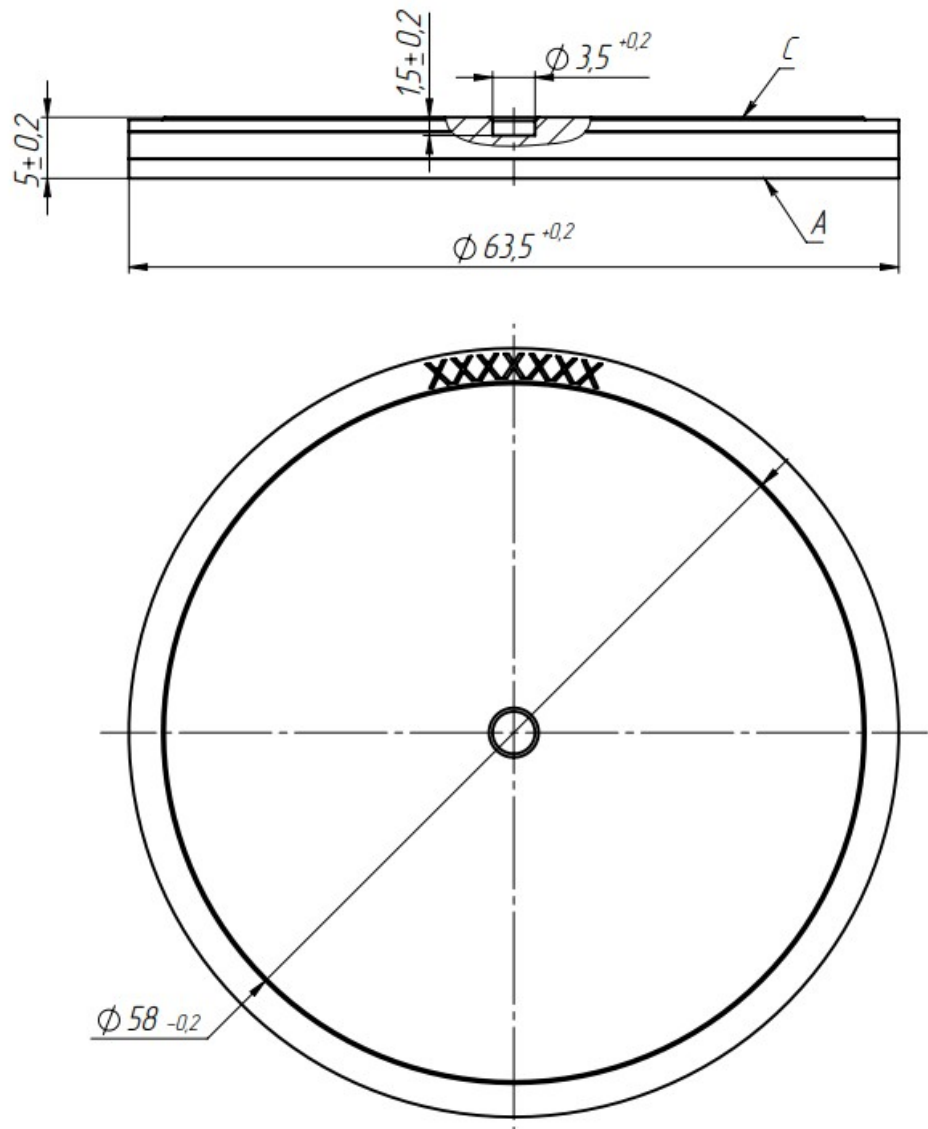
MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I _{FAV}	Maximum allowable average forward current ¹⁾	A	12500 15977	T _c = 113 °C; Double side cooled; T _c = 85 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I _{FRMS}	RMS forward current	A	19625	T _c = 113 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I _{FSM}	Surge forward current	kA	95.0 114.0	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V
			100.0 120.0	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =8.3 ms; single pulse; V _R =0 V
I ² t	Safety factor	A ² s·10 ³	45100 64900	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V
			41500 59700	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =8.3 ms; single pulse; V _R =0 V
BLOCKING					
V _{RRM}	Repetitive peak reverse voltages	V	200...400	T _{j min} < T _j <T _{j max} ; 180° half-sine wave; 50 Hz	
V _{RSM}	Non-repetitive peak reverse voltages	V	300...500	T _{j min} < T _j <T _{j max} ; 180° half-sine wave; single pulse	
V _R	Reverse continuous voltages	V	0.6·V _{RRM}	T _j =T _{j max}	
THERMAL					
T _{stg}	Storage temperature	°C	−45...+40		
T _j	Operating junction temperature	°C	−45...+180		
MECHANICAL					
F	Mounting force	kN	35.0...70.0		
a	Acceleration	m/s ²	50	Device clamped	

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V _{FM}	Peak forward voltage, max	V	1.04 0.92	T _j =25 °C; I _{FM} = 6300 A T _j =T _{j max} ; I _{FM} = 8000 A	
V _{F(TO)}	Forward threshold voltage, max	V	0.82 0.76	T _j =T _{j max}	19600 A < I _T < 58900 A 10000 A < I _T < 30000 A
r _T	Forward slope resistance, max	mΩ	0.018 0.019		19600 A < I _T < 58900 A 10000 A < I _T < 30000 A
BLOCKING					
I _{RRM}	Repetitive peak reverse current, max	mA	50	T _j =T _{j max} ; V _R =V _{RRM}	
SWITCHING					
Q _{rr}	Total recovered charge, max	μC	1250 780	T _j =T _{j max} ; I _{FM} =1000 A; di _{FM} /dt=-30 A/μs; V _R =100 B T _j =T _{j max} ; I _{FM} =1000 A; di _{FM} /dt=-10 A/μs; V _R =100 B	
THERMAL					
R _{thjc}	Thermal resistance, junction to case, max	°C/W	0.0039	Direct Current	Double side cooled
R _{thjc-A}			0.0052		Anode side cooled
R _{thjc-K}			0.0150		Cathode side cooled
R _{thck}	Thermal resistance, case to heatsink, max		0.0030	Direct Current	
MECHANICAL					
m	Weight, max	g	145		
D _s	Surface creepage distance	mm (inch)	2.0 (0.079)		
D _a	Air strike distance	mm (inch)	2.0 (0.079)		

PART NUMBERING GUIDE					NOTES
D	166	12500	4	N	1) Calculation at $U_{F(TO)} / r_T$ in the range 19600 A<I _T <58900 A
1	2	3	4	5	
1. Device type: D – Diode 2. Design version 3. Maximum allowable average forward current, A 4. Voltage code 5. Ambient conditions: N – normal					



All dimensions in millimeters (inches)

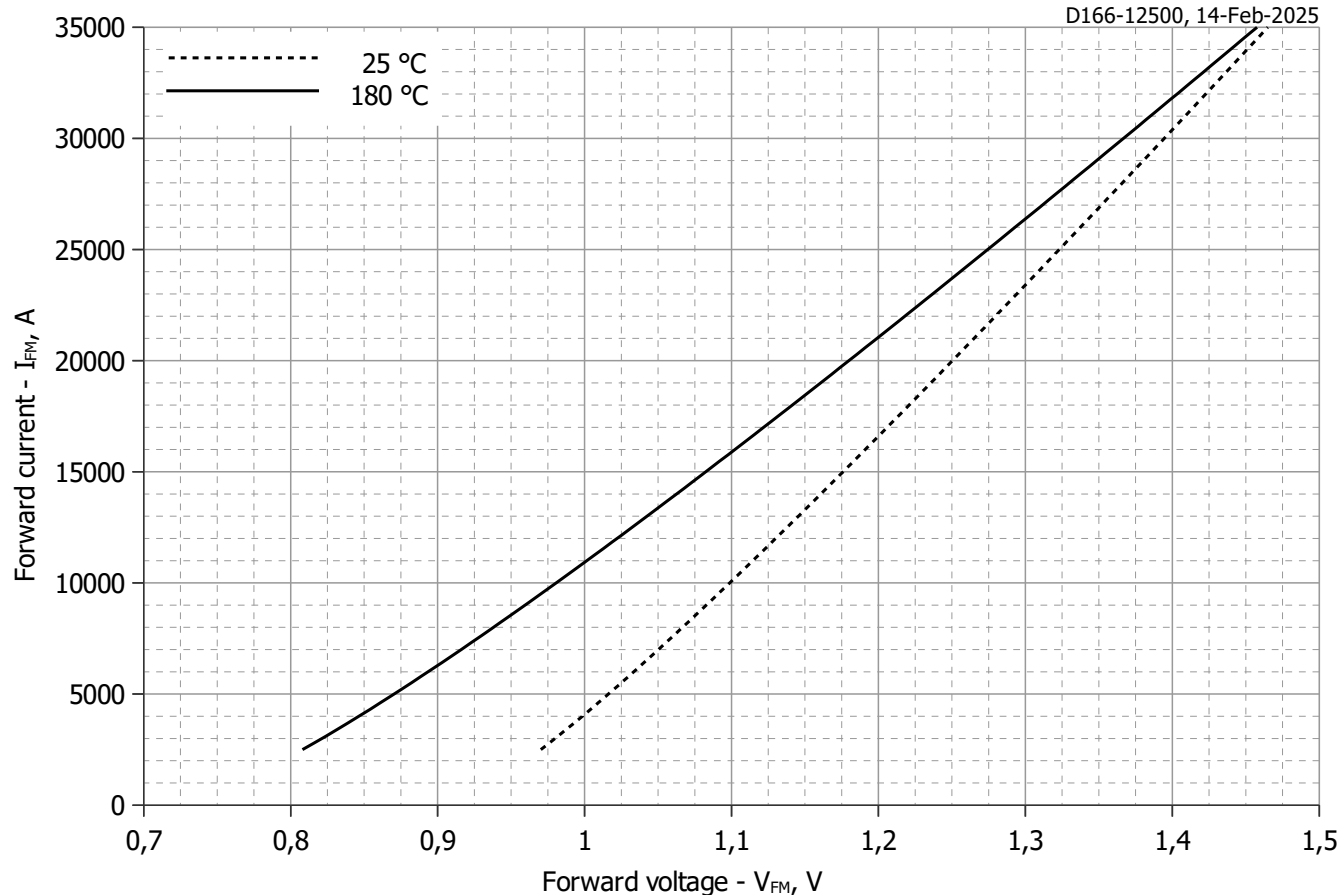


Fig 1 – Forward characteristics of Limit device

Analytical function for Forward characteristic:

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

	Coefficients for max curves	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\max}$
A	0.89993366	0.72931167
B	0.00001195	0.00001444
C	0.00023016	-0.00337811
D	0.00077210	0.00138075

Forward characteristic model (see Fig. 1).

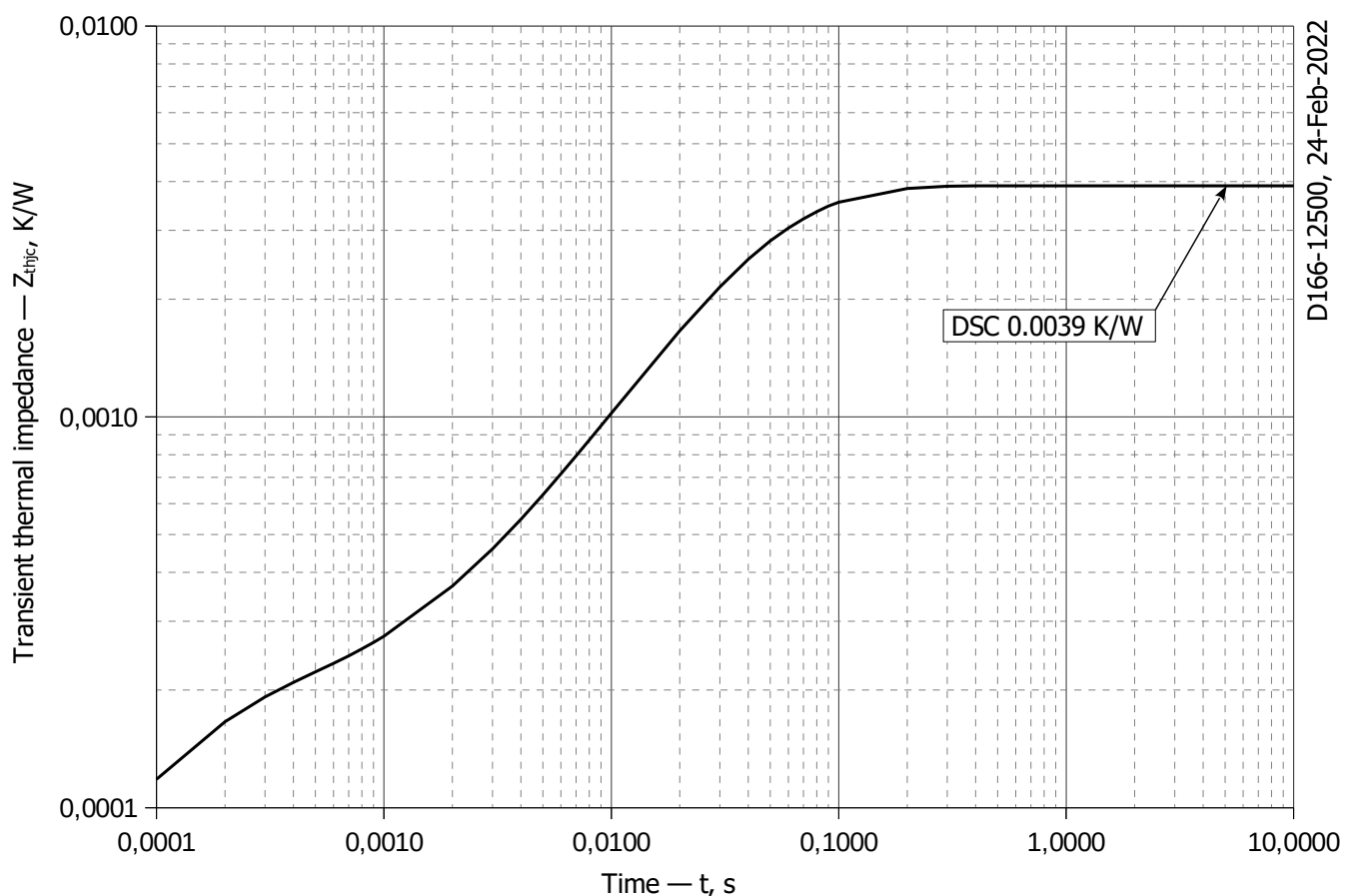


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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
$R_i, K/W$	0.0006931	0.003018	0.000008917	0.00001092	0.0001425	0.0000266
τ_i, s	0.07563	0.03513	0.003417	0.0004864	0.000118	0.00003592

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

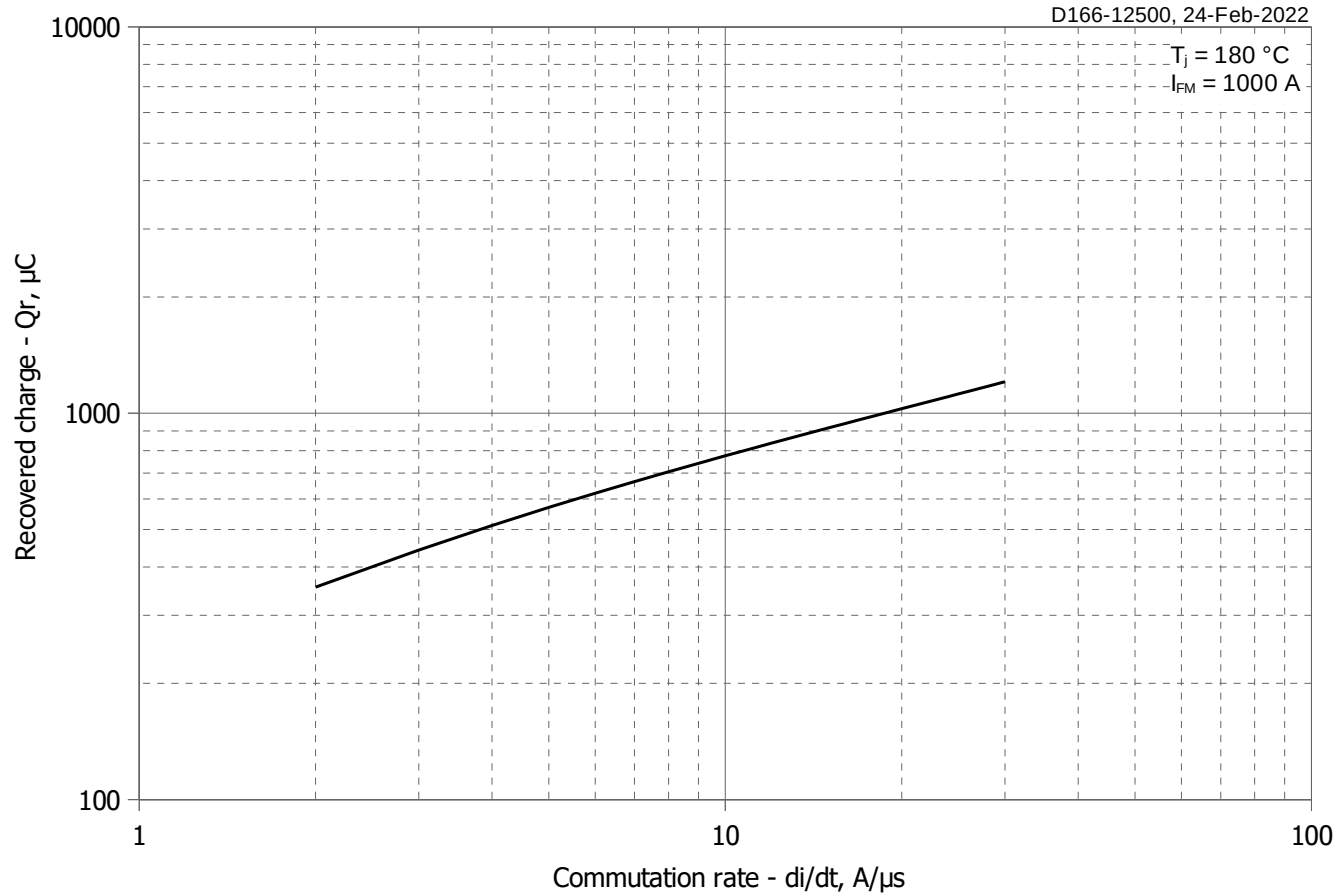


Fig 3 - Maximum recovered charge Q_{rr} vs. commutation rate di_r/dt (25% chord)

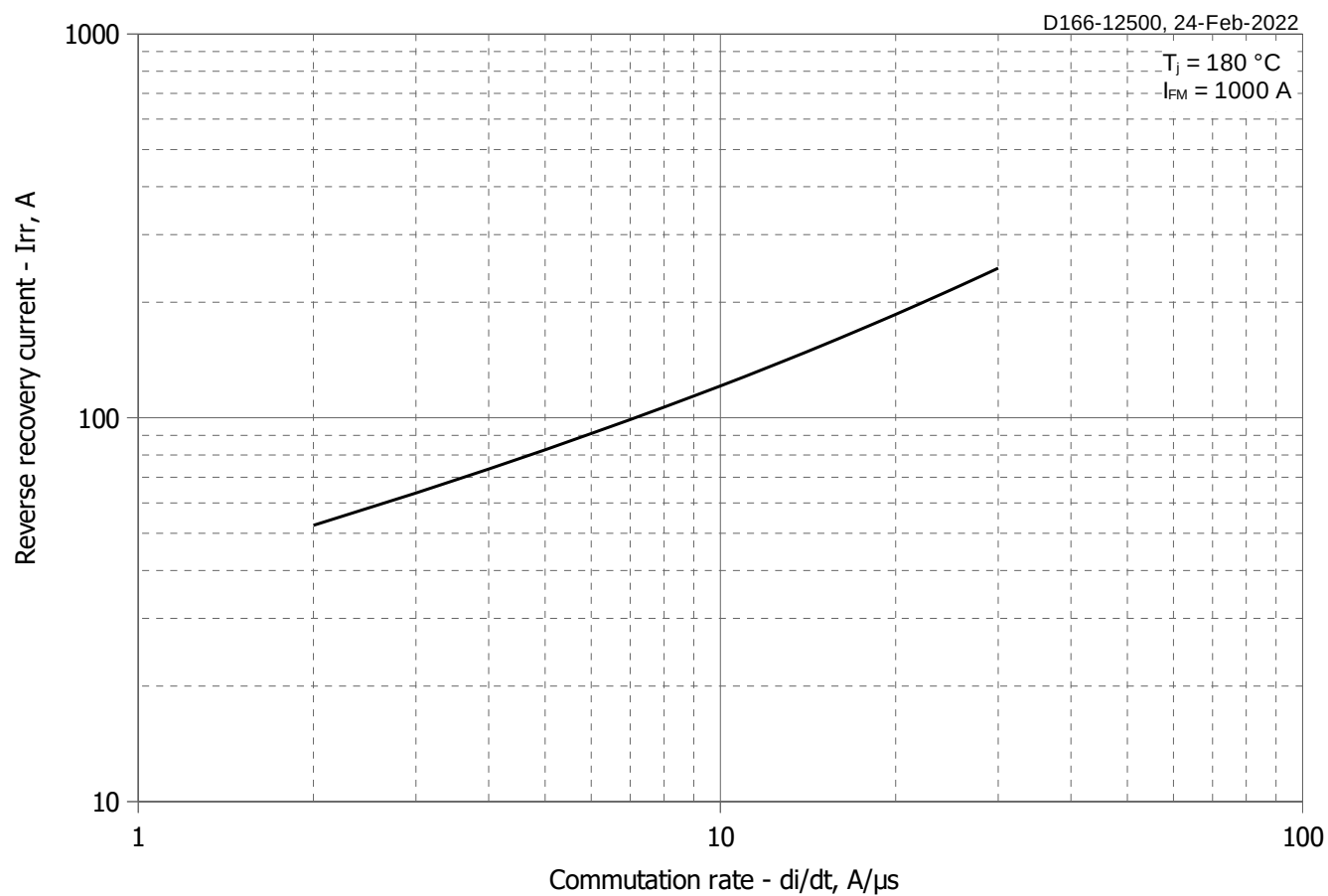


Fig 4 – Maximum reverse recovery current I_{rr} vs. commutation rate di_r/dt

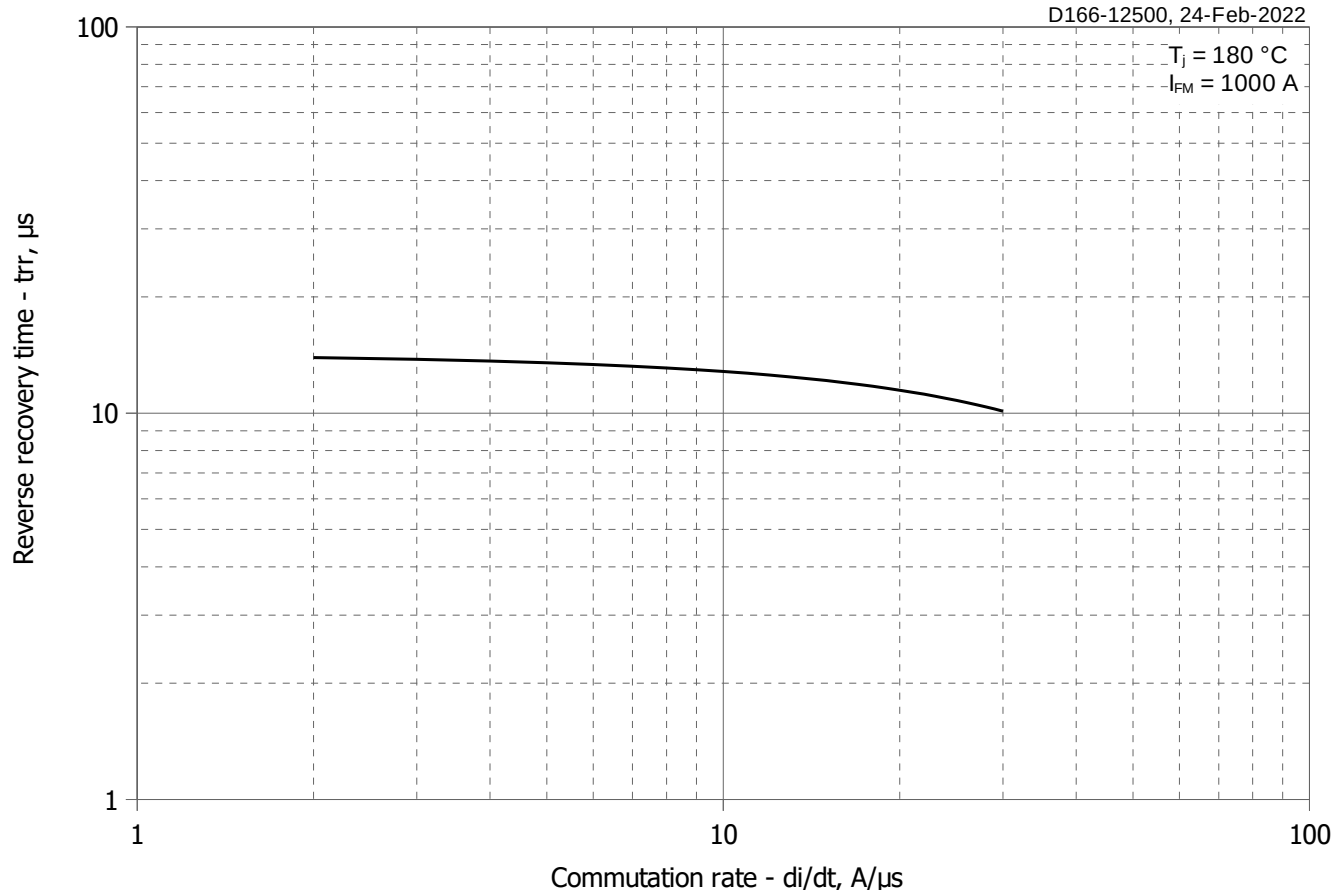


Fig 5 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

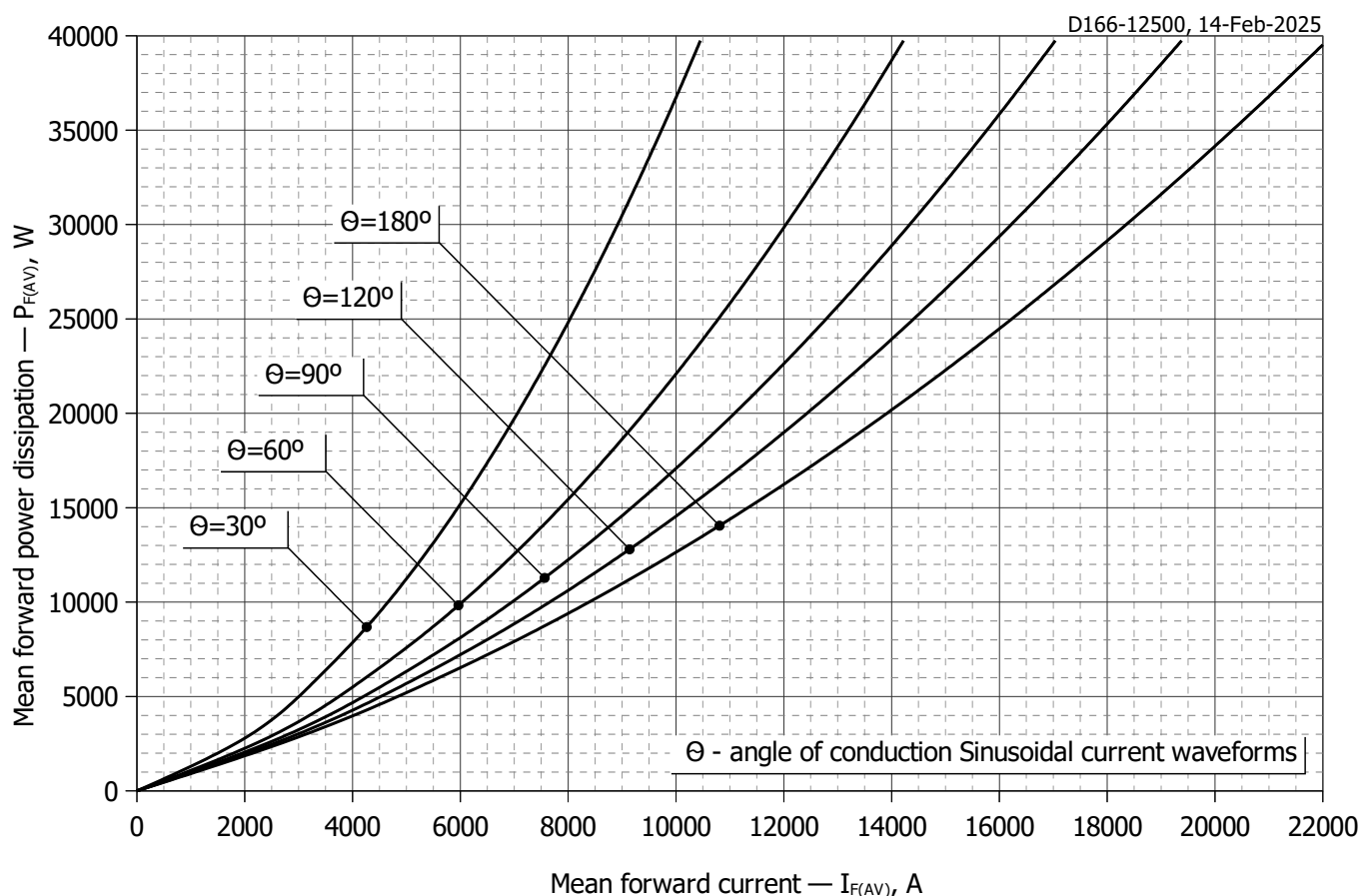


Fig 6 – Mean forward power dissipation P_{FAV} vs. Mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{ Hz}$, DSC)

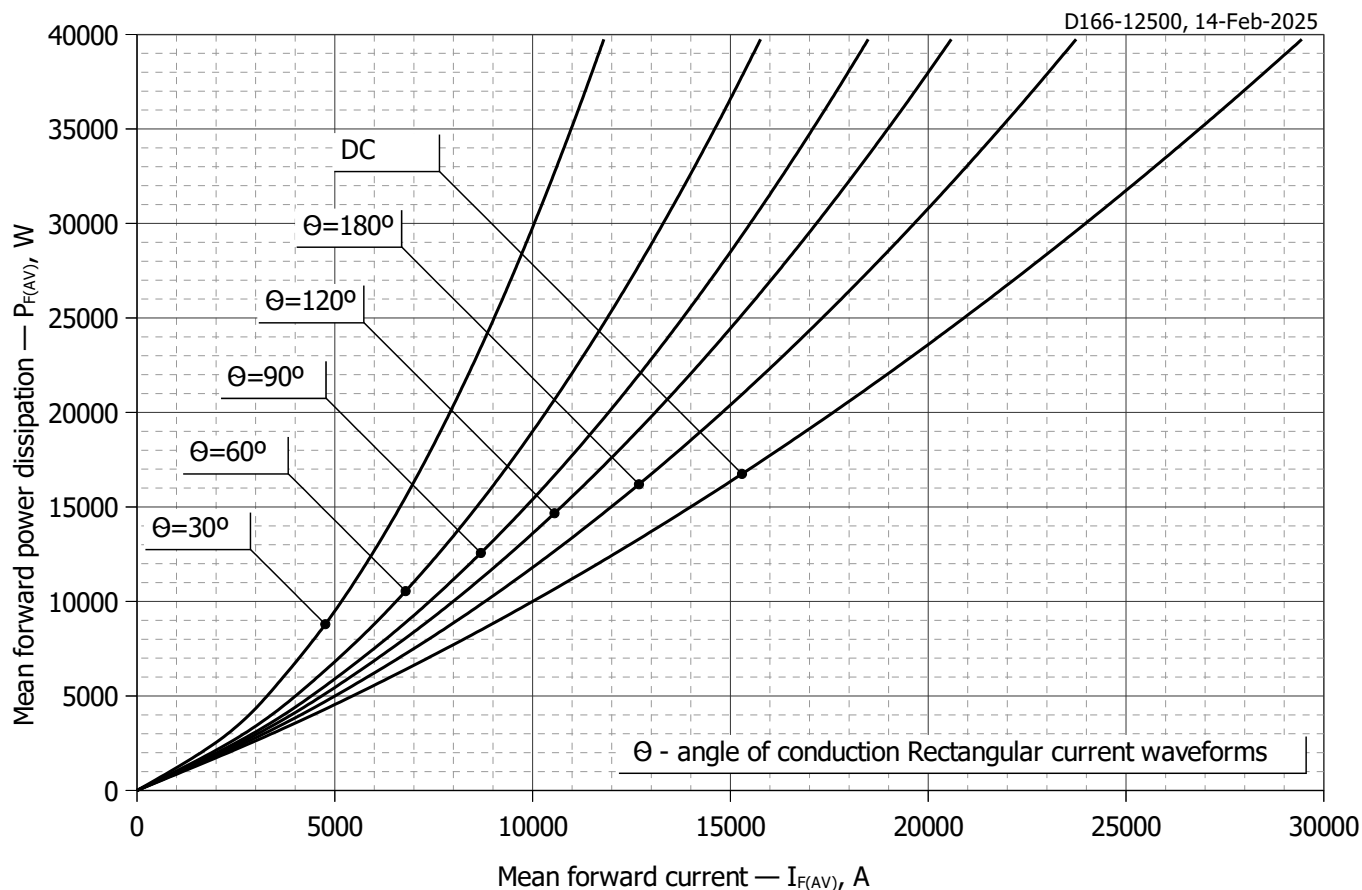


Fig 7 – Mean forward power dissipation $P_{F(AV)}$ vs. Mean forward current $I_{F(AV)}$ for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

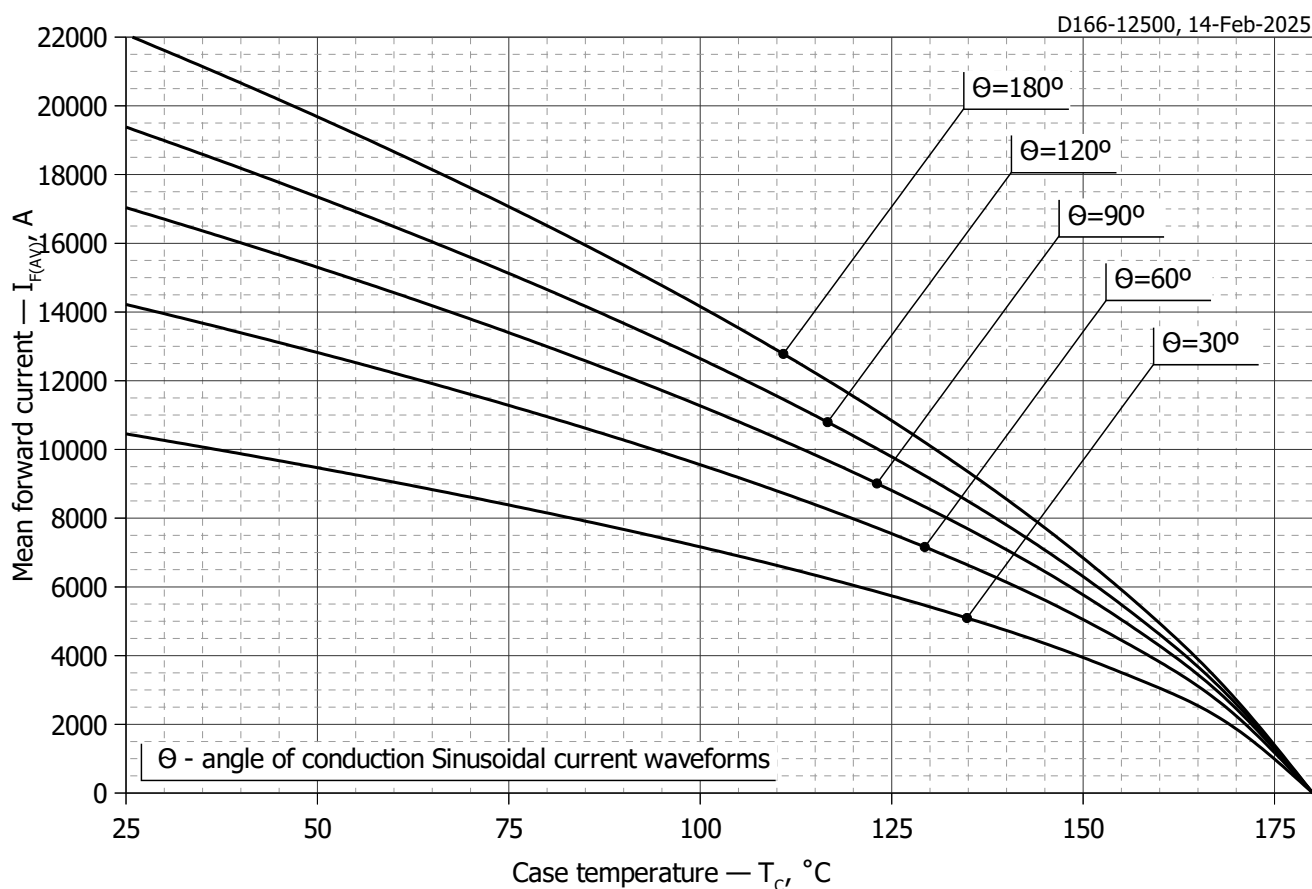


Fig 8 - Mean forward current $I_{F(AV)}$ vs. Case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

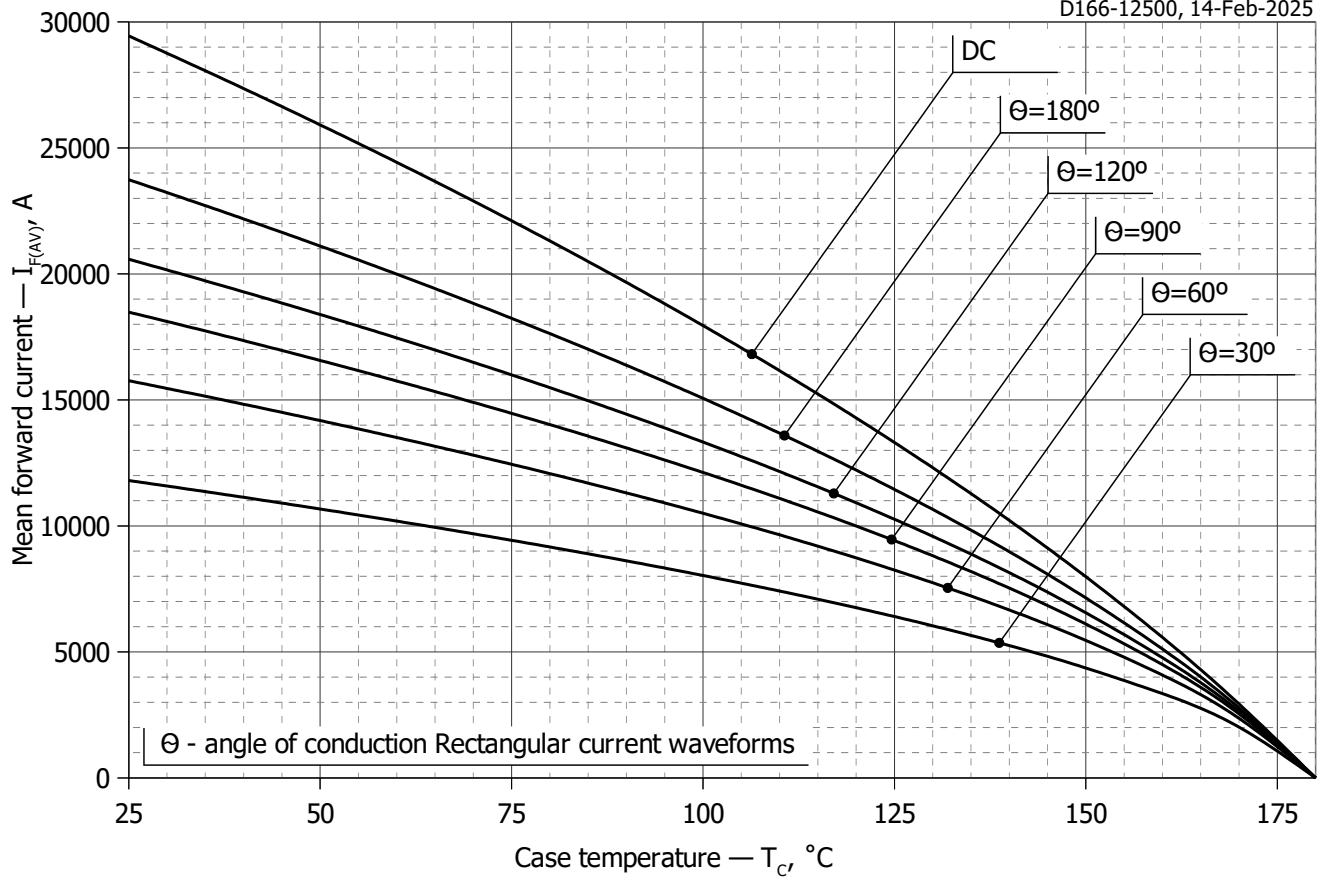


Fig 9 – Mean forward current I_{FAV} vs. Case temperature T_c for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

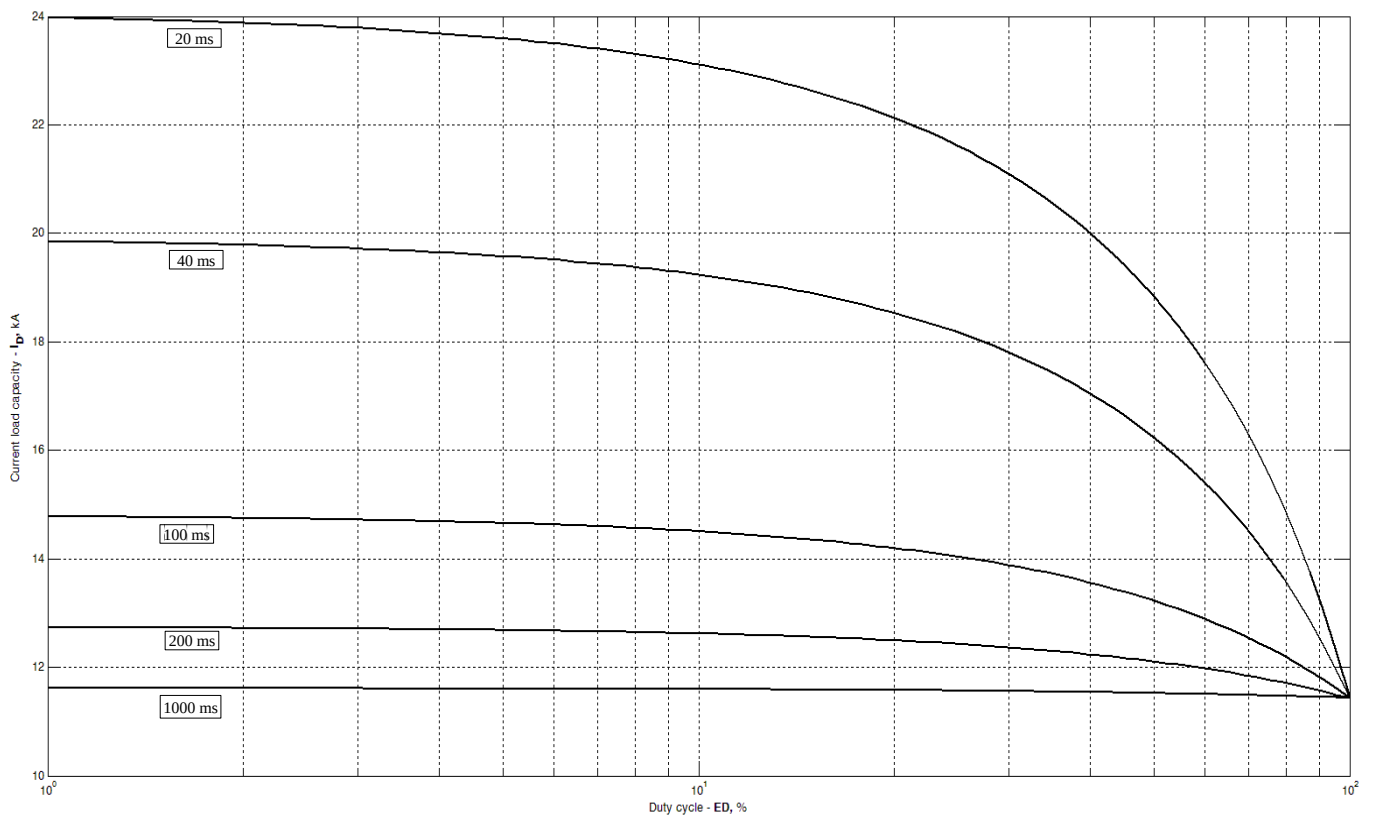


Fig 10 – Current load capability ($f=1000\text{ Hz}$, square wave, $\Delta T_j = 40\text{ °C}$)

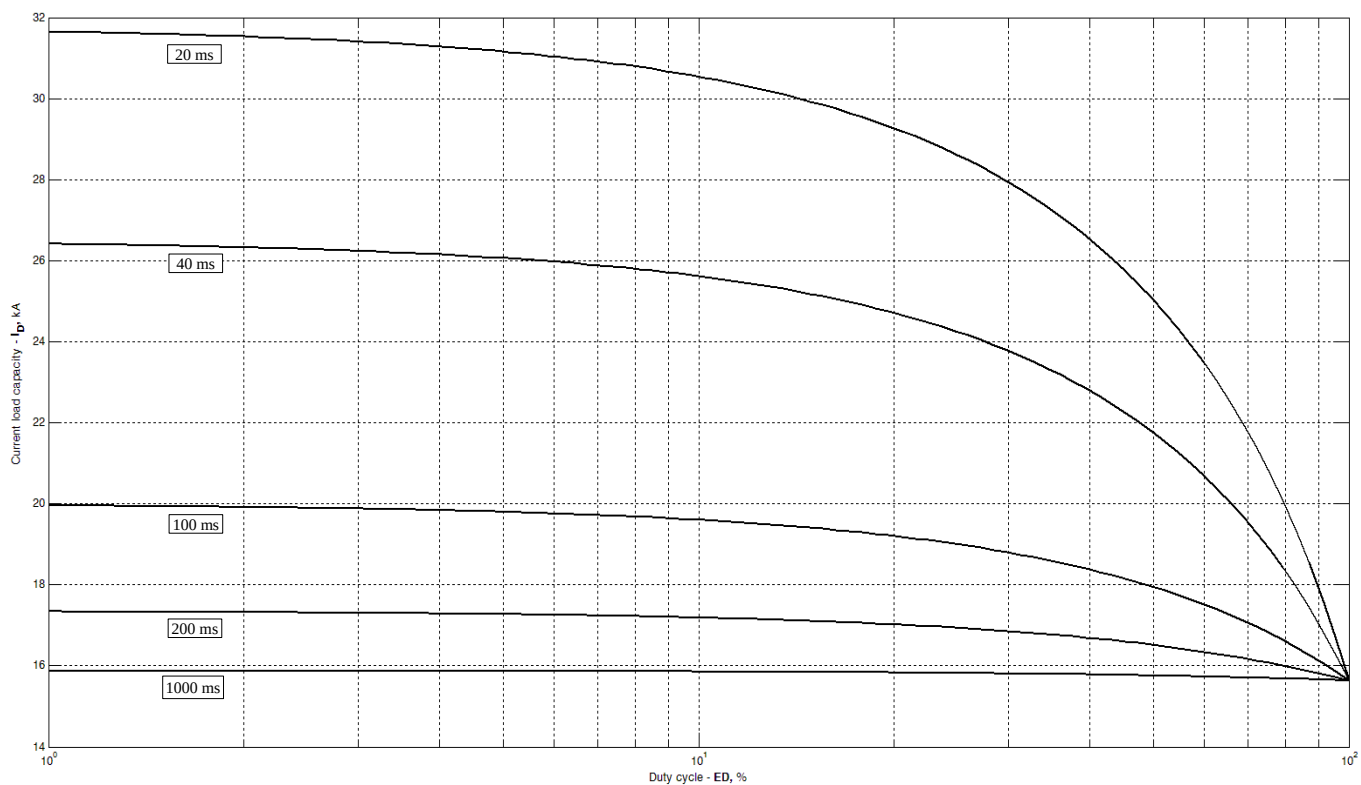


Fig 11 – Current load capability (f=1000 Hz, square wave, $\Delta T_j = 60\text{ }^{\circ}\text{C}$)

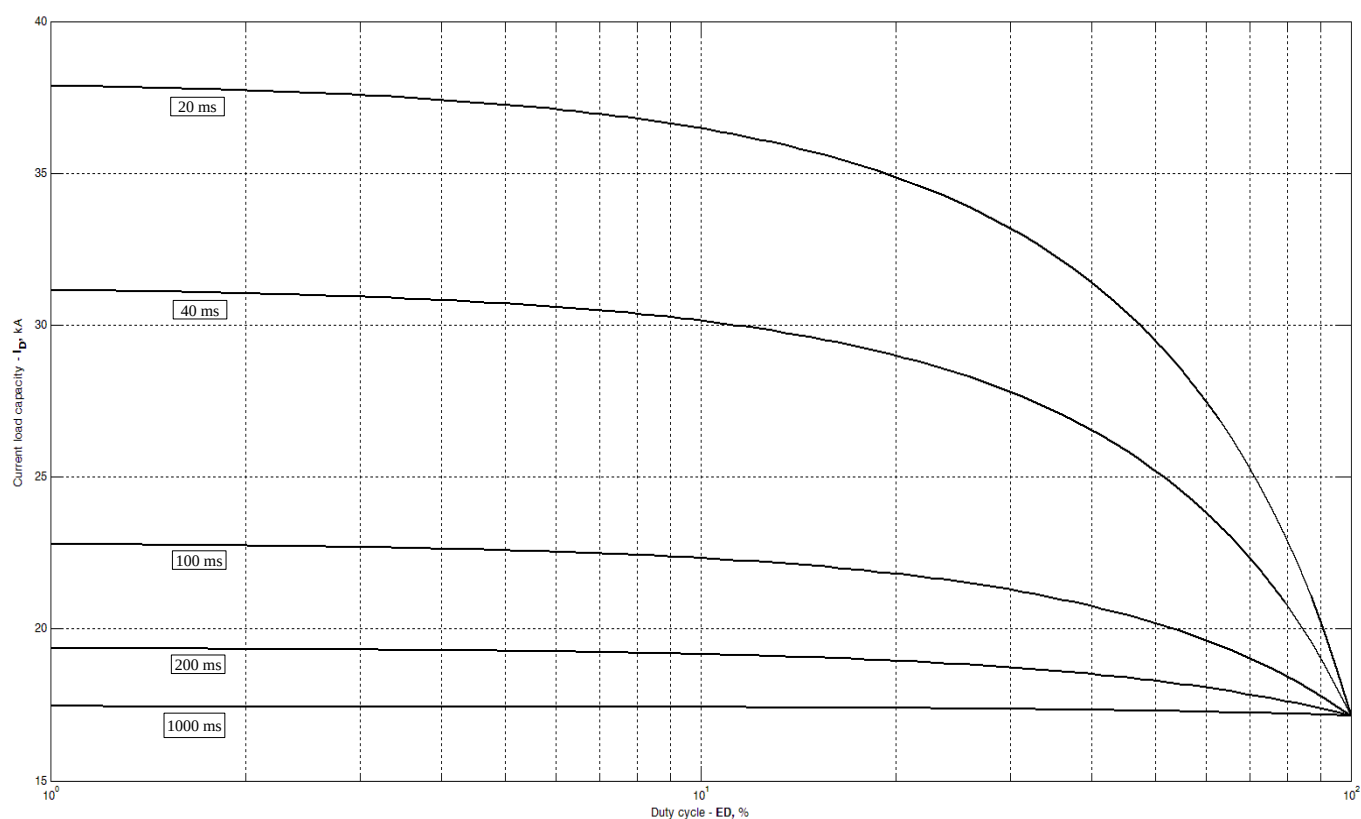


Fig 12 – Current load capability (f=1000 Hz, square wave, $\Delta T_j = 70\text{ }^{\circ}\text{C}$)

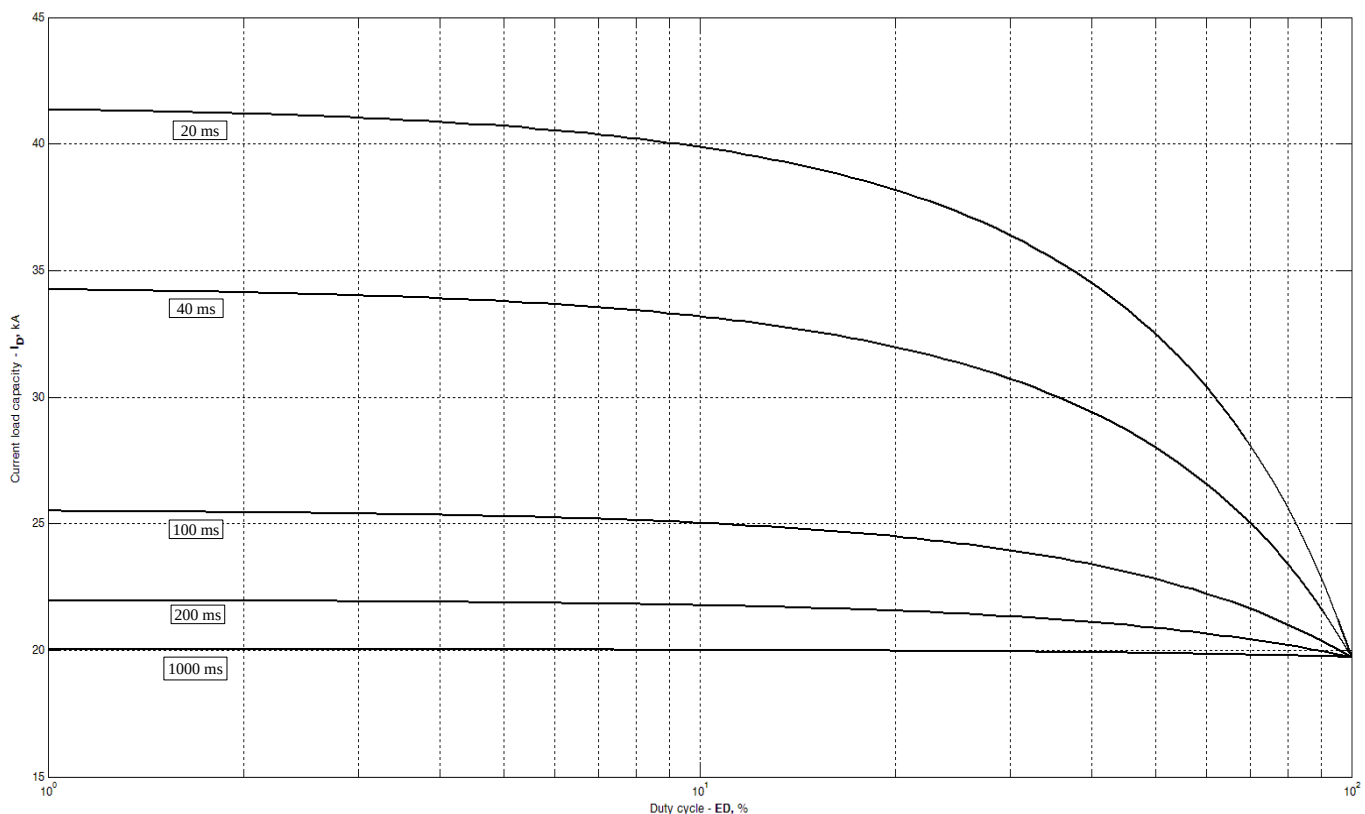


Fig 13 – Current load capability (f=1000 Hz, square wave, $\Delta T_j = 80^\circ\text{C}$)

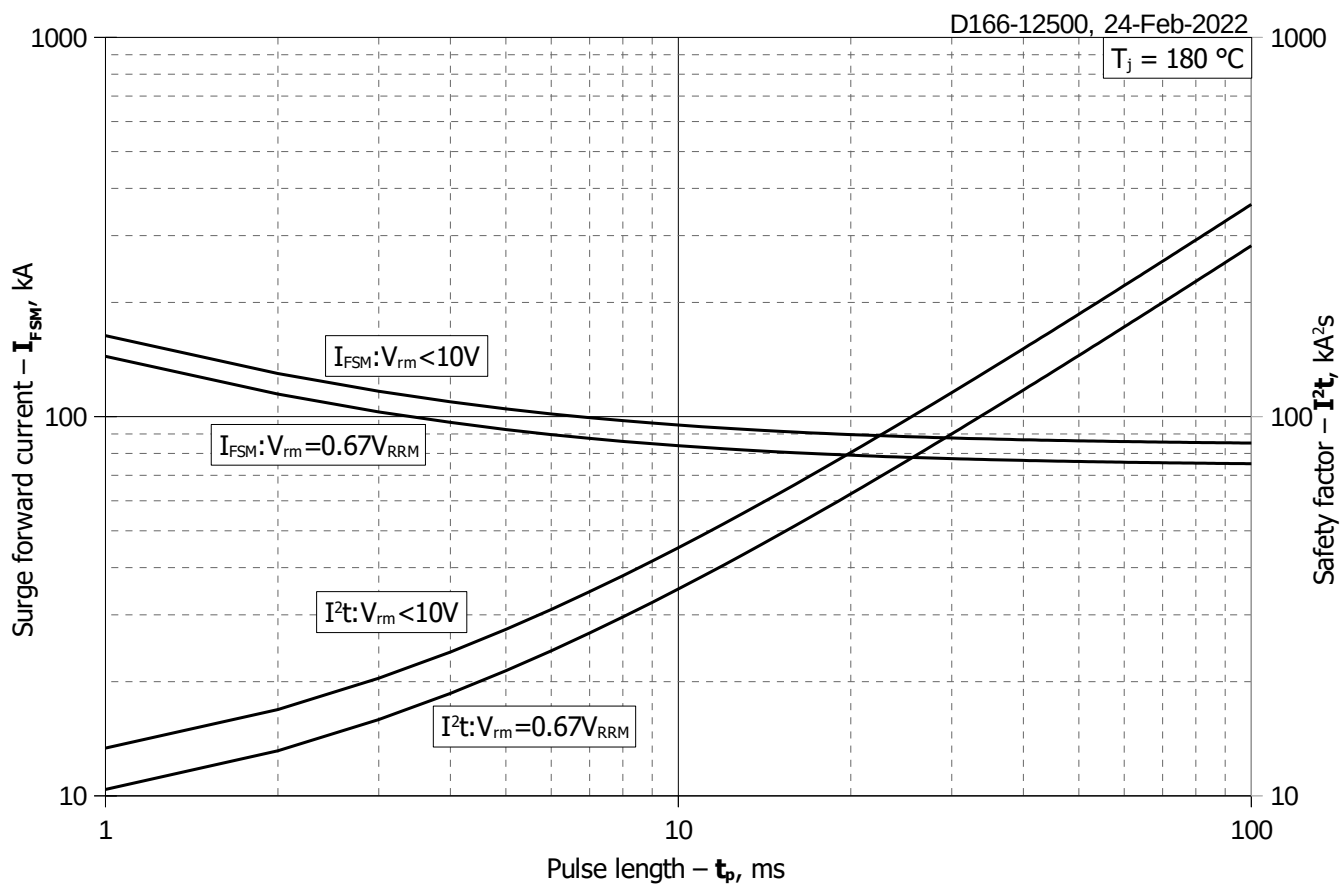


Fig 14 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

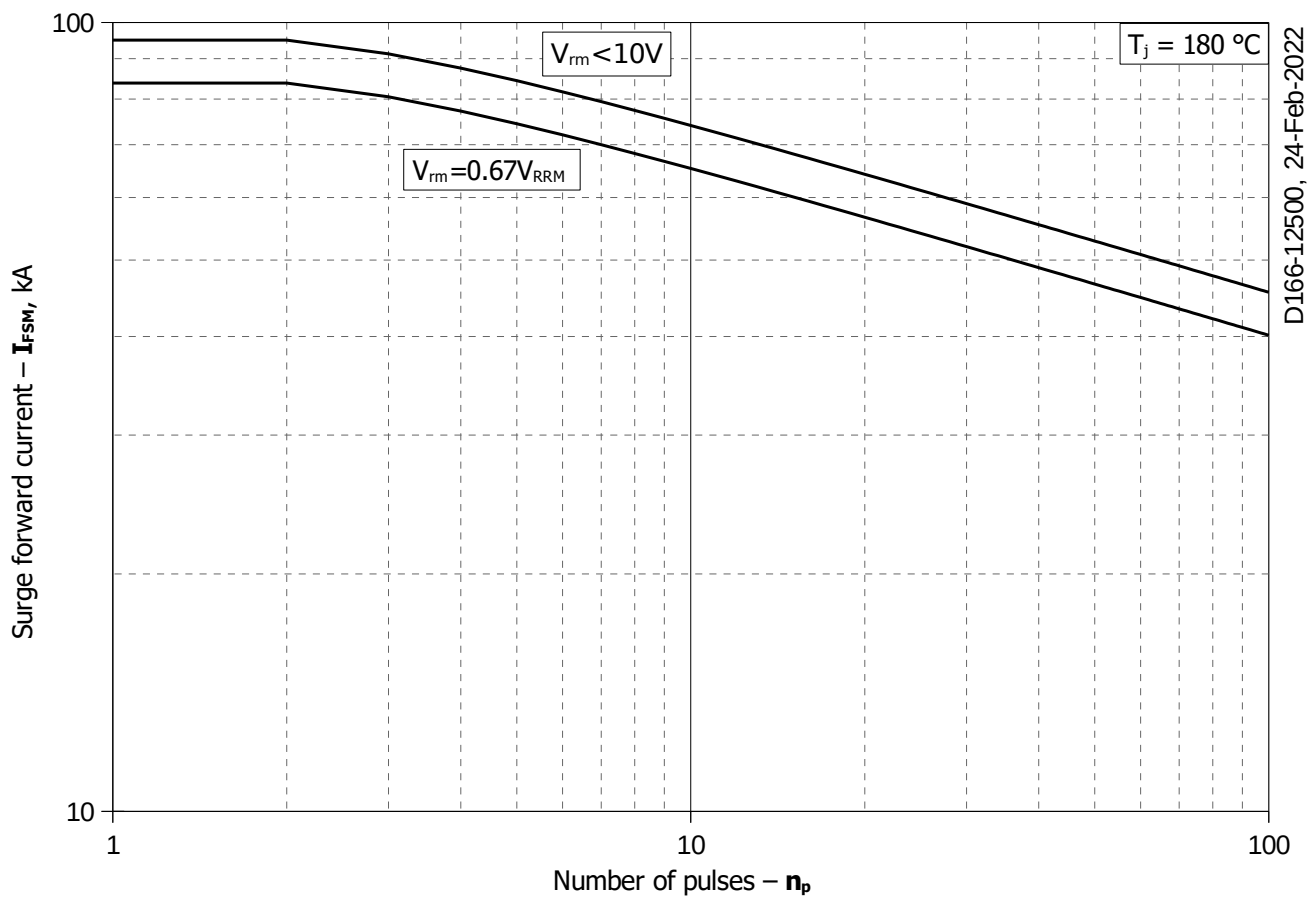


Fig 15 – Maximum surge forward current I_{FSM} vs. number of pulses n_p

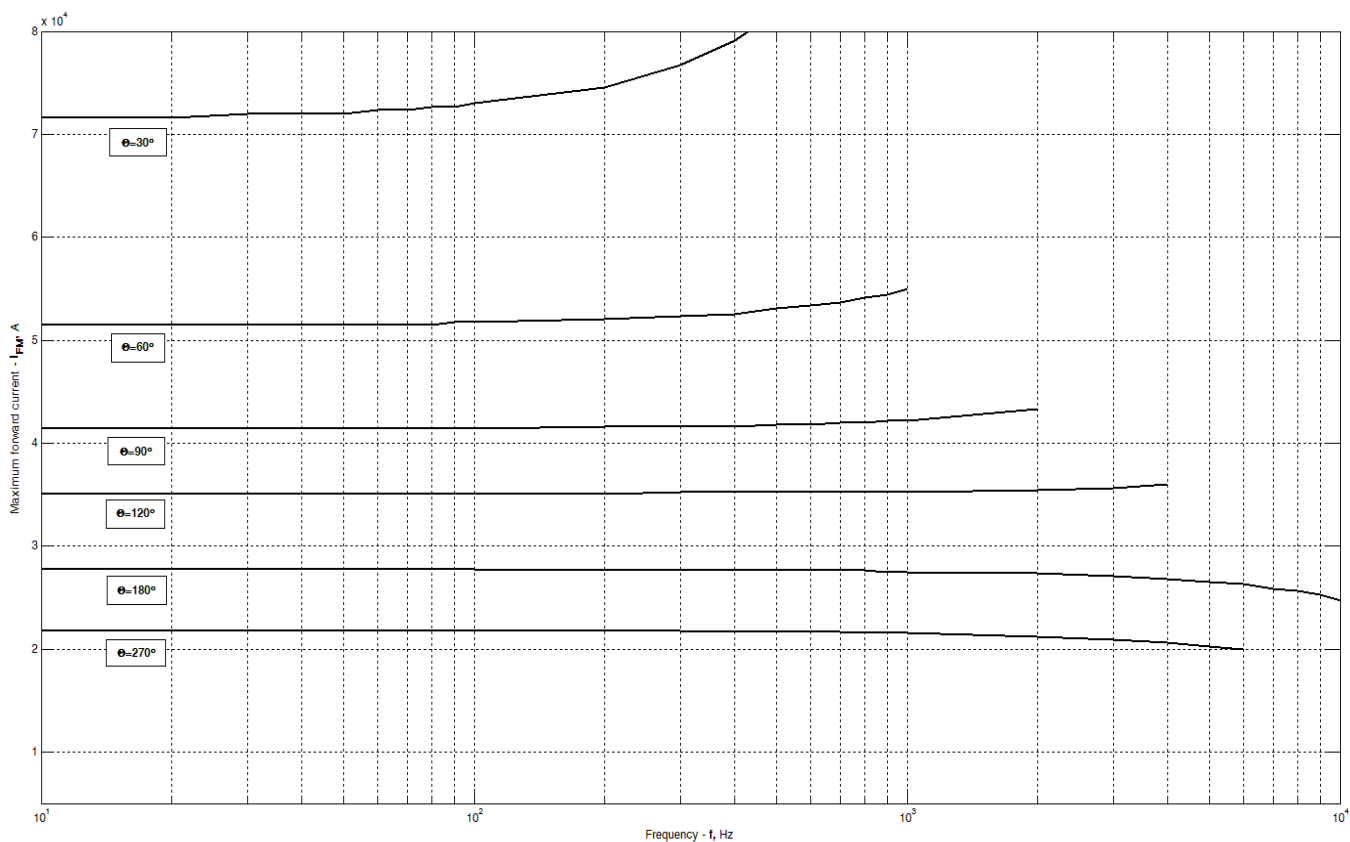
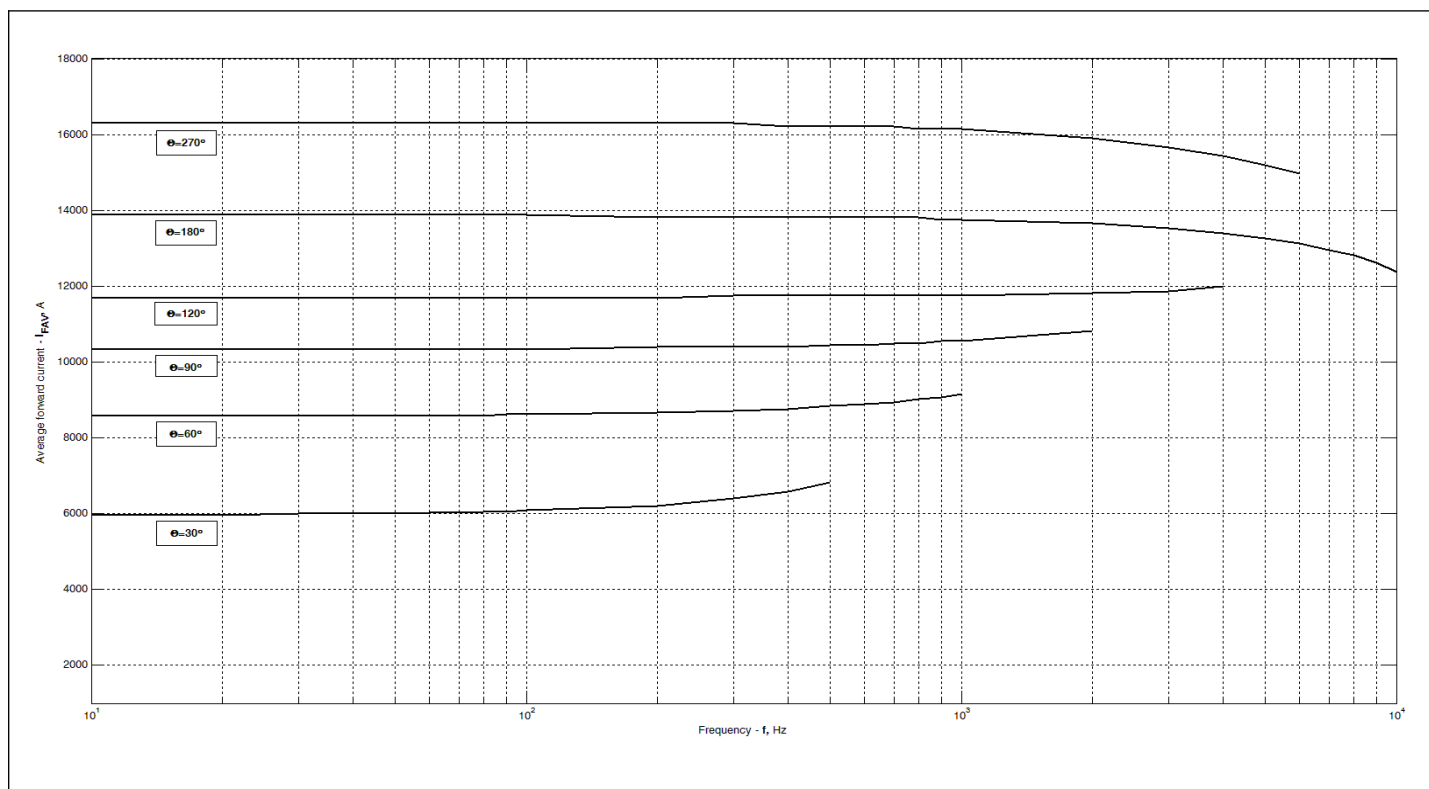


Fig 16 –Maximum forward current vs. frequency, trapezoid waveform, $T_C = 85\text{ }^{\circ}\text{C}$, $di_F/dt = \pm 500\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}$



**Fig 17 –Average forward current vs. frequency, trapezoid waveform,
 $T_C=85^\circ\text{C}$, $di_F/dt=\pm 500\text{ A}/\mu\text{s}$, $V_R=100\text{ V}$**