



Rectifier Diode D133-400-40



Average forward current										I_{FAV}		400A				
Repetitive peak reverse voltage										V_{RRM}		1000 - 4000V				
V_{RRM}, V	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000
Voltage code	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
$T_j, ^\circ C$	-60 ÷ 150															

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{FAV}	Maximum allowable average forward current	A	400 632	$T_c=124^\circ C$; Double side cooled; $T_c=100^\circ C$; Double side cooled; 180° half-sine wave; 50 Hz	
I_{FRMS}	RMS forward current	A	628	$T_c=124^\circ C$; Double side cooled; 180° half-sine wave; 50 Hz	
I_{FSM}	Surge forward current	kA	7.0 7.5	$T_j=T_{jmax}$ $T_j=25^\circ C$	180° half-sine wave; $t_p=10$ ms; single pulse; $V_R=0$ V
			7.5 8.5	$T_j=T_{jmax}$ $T_j=25^\circ C$	180° half-sine wave; $t_p=8.3$ ms; single pulse; $V_R=0$ V
I^2t	Safety factor	$A^2s \cdot 10^3$	240 280	$T_j=T_{jmax}$ $T_j=25^\circ C$	180° half-sine wave; $t_p=10$ ms; single pulse; $V_R=0$ V
			230 290	$T_j=T_{jmax}$ $T_j=25^\circ C$	180° half-sine wave; $t_p=8.3$ ms; single pulse; $V_R=0$ V
BLOCKING					
V_{RRM}	Repetitive peak reverse voltages	V	1000..4000	$T_{jmin} < T_j < T_{jmax}$; 180° half-sine wave; 50 Hz	
V_{RSM}	Non-repetitive peak reverse voltages	V	1100...4100	$T_{jmin} < T_j < T_{jmax}$; 180° half-sine wave; single pulse	
V_R	Reverse continuous voltages	V	$0.6 \cdot V_{RRM}$	$T_j=T_{jmax}$;	
THERMAL					
T_{stg}	Storage temperature	$^\circ C$	-60...+50		
T_j	Operating junction temperature	$^\circ C$	-60...+150		
MECHANICAL					
F	Mounting force	kN	9.0...11.0		
a	Acceleration	m/s^2	50	Device clamped	

CHARACTERISTICS

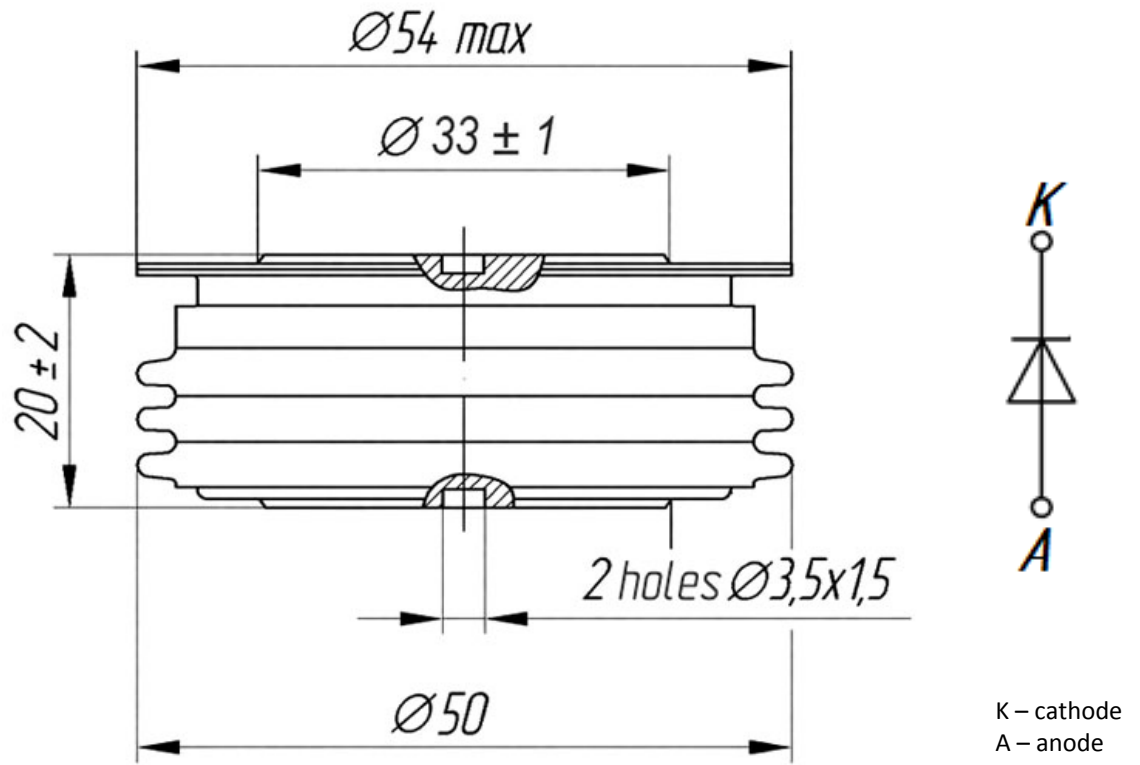
Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.85	$T_j=25\text{ }^\circ\text{C}; I_{FM}=1256\text{ A}$	
$V_{F(TO)}$	Forward threshold voltage, max	V	1.089	$T_j=T_{j\text{ max}};$ $0.5\text{ }\mu\text{ I}_{FAV} < I_T < 1.5\text{ }\mu\text{ I}_{FAV}$	
r_T	Forward slope resistance, max	mW	0.714		
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	50	$T_j=T_{j\text{ max}};$ $V_R=V_{RRM}$	
SWITCHING					
Q_{rr}	Total recovered charge, max	mC	2410	$T_j=150\text{ }^\circ\text{C}; I_{TM}=400\text{ A}; di_R/$ $dt=-5\text{ A/ms};$ $V_R=100\text{ V}$	
t_{rr}	Reverse recovery time, max	ms	37		
I_{rr}	Reverse recovery current, max	A	130		
THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	$^\circ\text{C/W}$	0.036	Direct current	Double side cooled
R_{thjc-A}			0.079		Anode side cooled
R_{thjc-K}			0.065		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	$^\circ\text{C/W}$	0.008	Direct current	
MECHANICAL					
m	Weight, max	g	180		
D_s	Surface creepage distance	mm (inch)	23.69 (0.933)		
D_a	Air strike distance	mm (inch)	19.10 (0.752)		

PART NUMBERING GUIDE

D	133	400
1	2	3

1. D — Rectifier Diode
2. Design version
3. Average forward current, A

Package type: PD32



All dimensions in millimeters

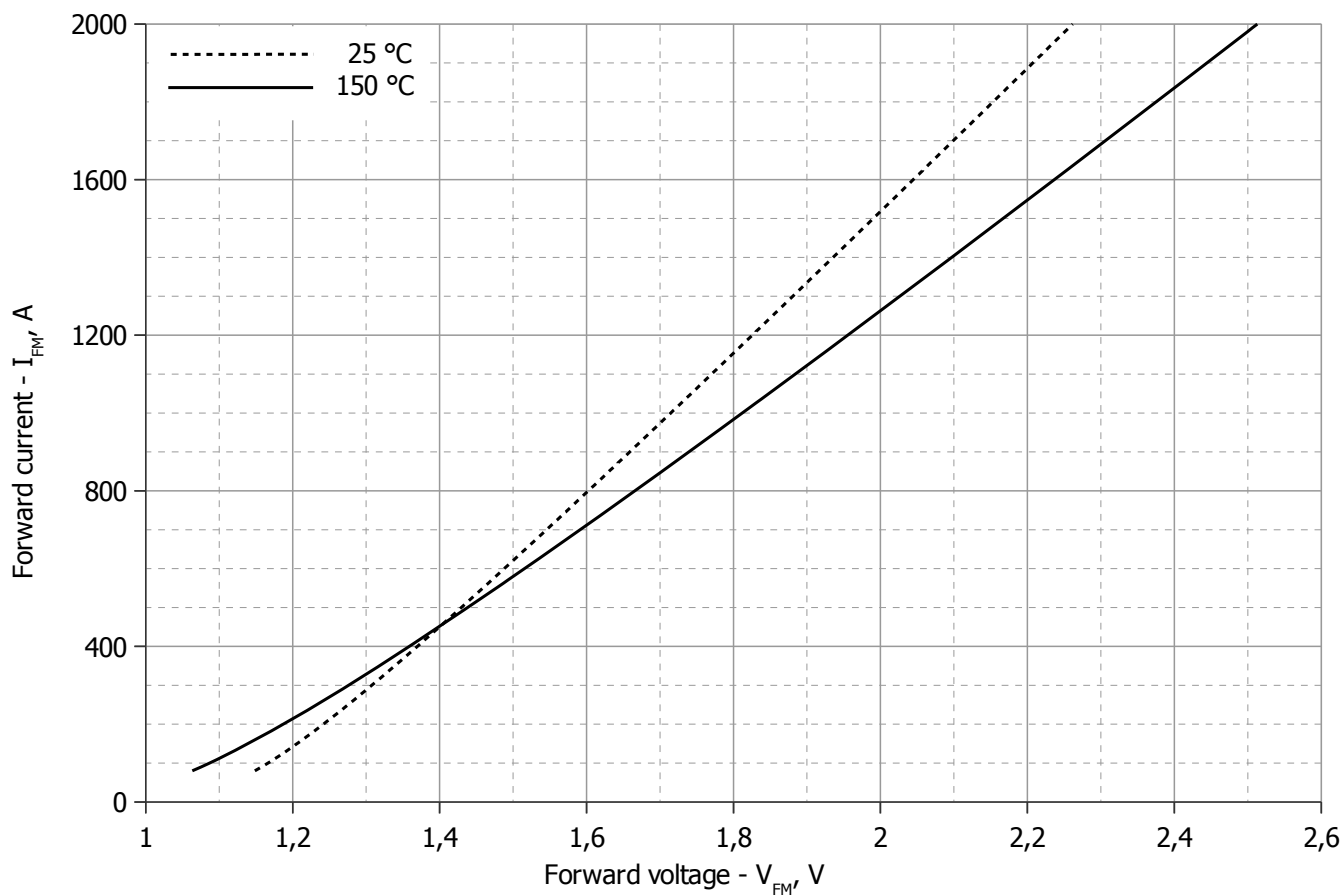


Fig 1 – Forward characteristics of Limit device

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	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\text{max}}$
A	0.95907119	0.85955567
B	0.00052398	0.00061229
C	0.03357297	0.02405616
D	-0.00001234	0.00550143

Forward characteristic model (see Fig. 1).

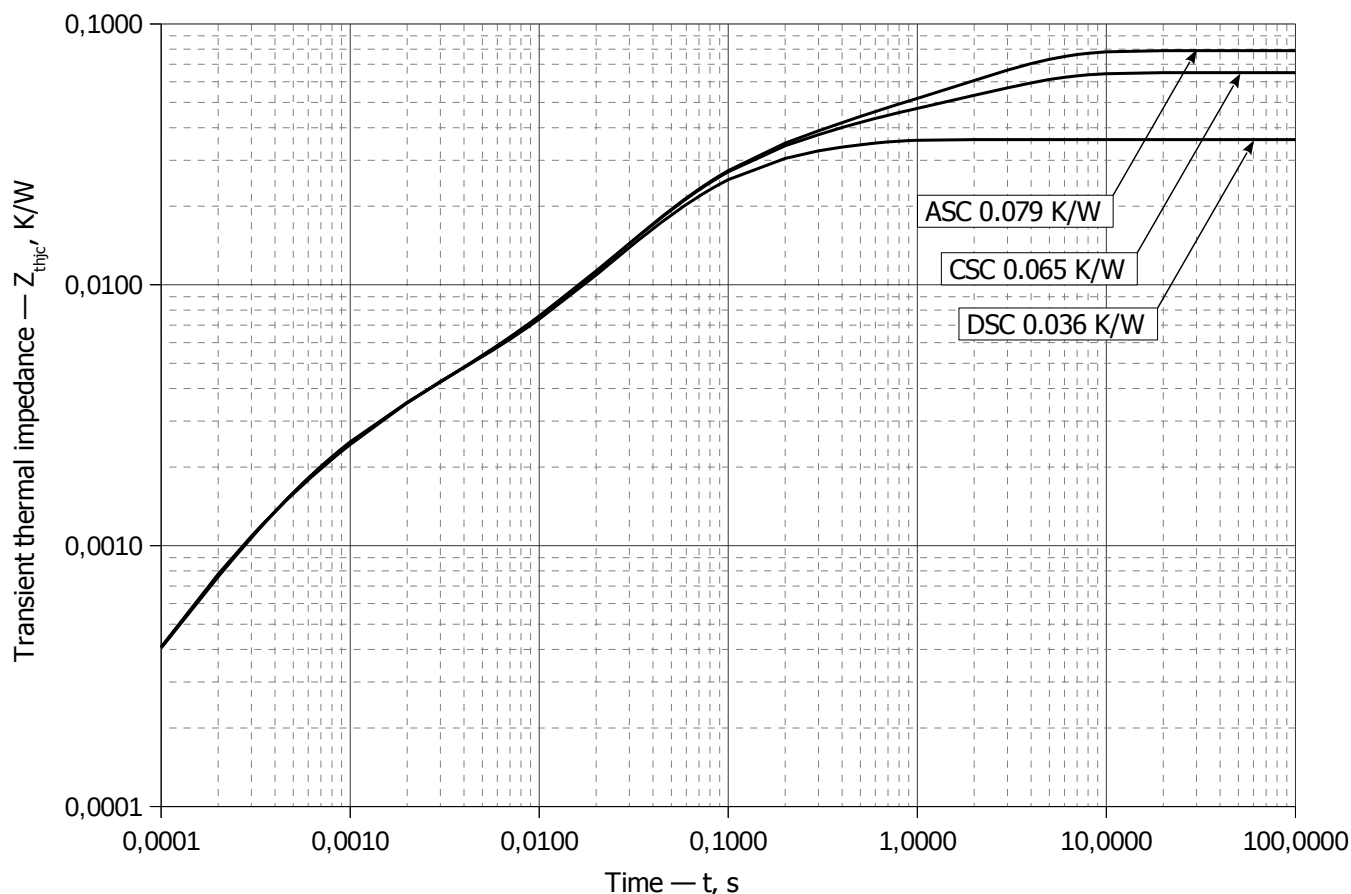


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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	0.0102	0.01906	0.003576	0.002535	-4.67e-005	0.000648
τ_i , s	0.265	0.05901	0.03499	0.001252	0.000001	0.0002488

DC Cathode side cooled

i	1	2	3	4	5	6
R_i , K/W	0.02506	0.01306	0.002934	0.0206	0.00149	0.00179
τ_i , s	2.647	0.2831	0.1455	0.05284	0.002255	0.0005519

DC Anode side cooled

i	1	2	3	4	5	6
R_i , K/W	0.03904	0.001789	0.01342	0.0215	0.00137	0.00195
τ_i , s	2.651	0.4195	0.2622	0.05451	0.002585	0.0005847

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

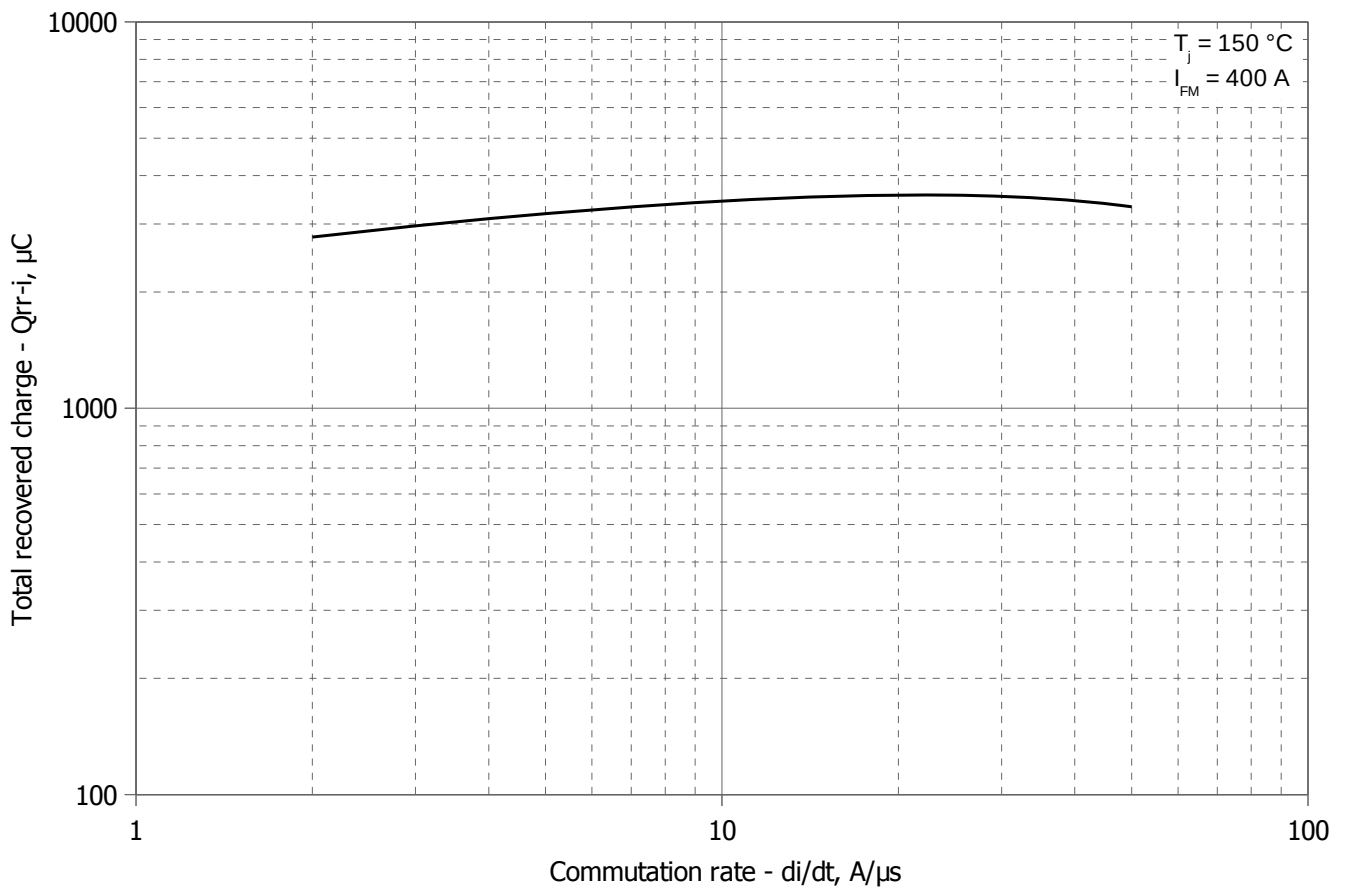


Fig 3 - Total recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

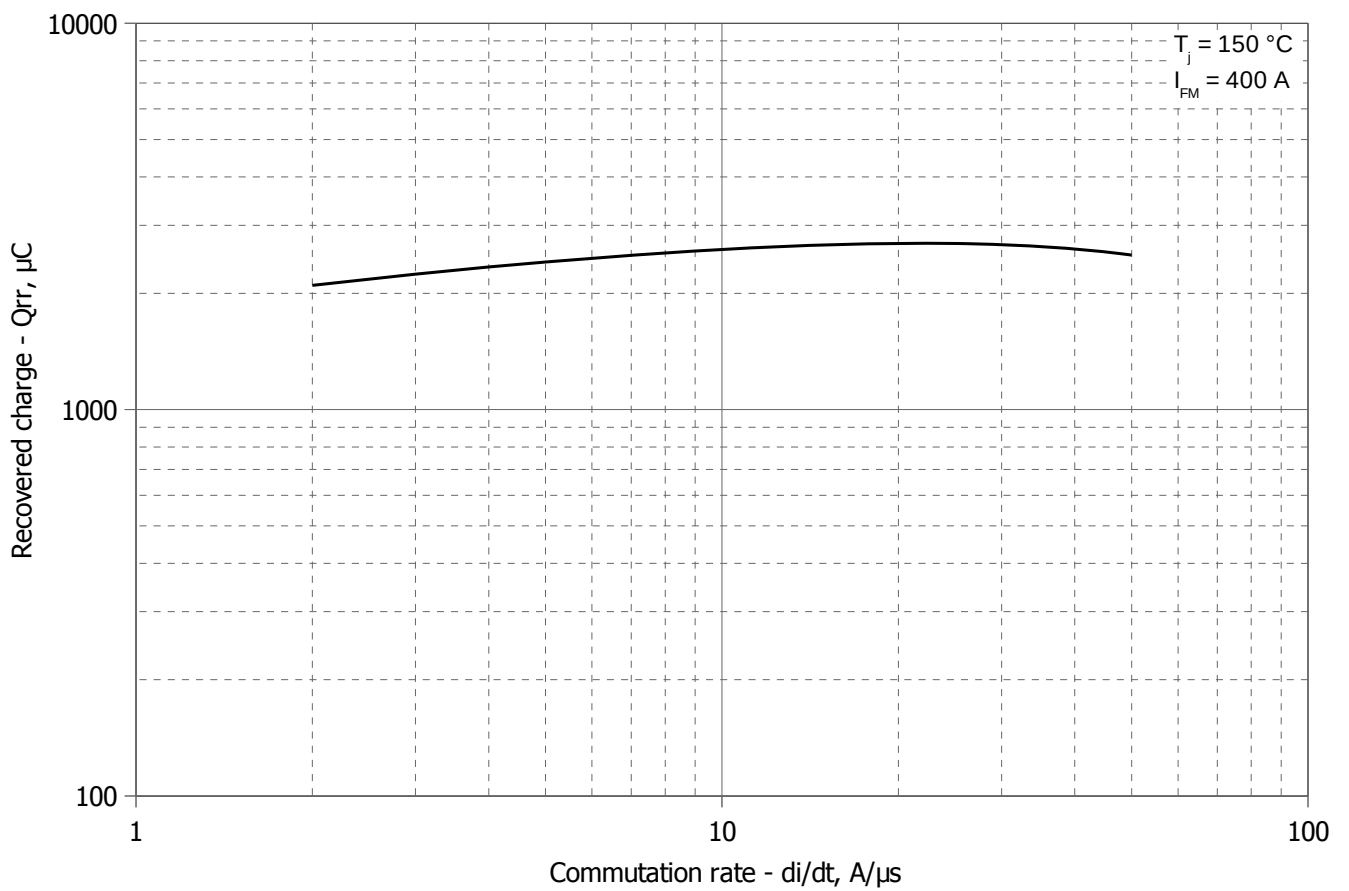


Fig 4 - Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

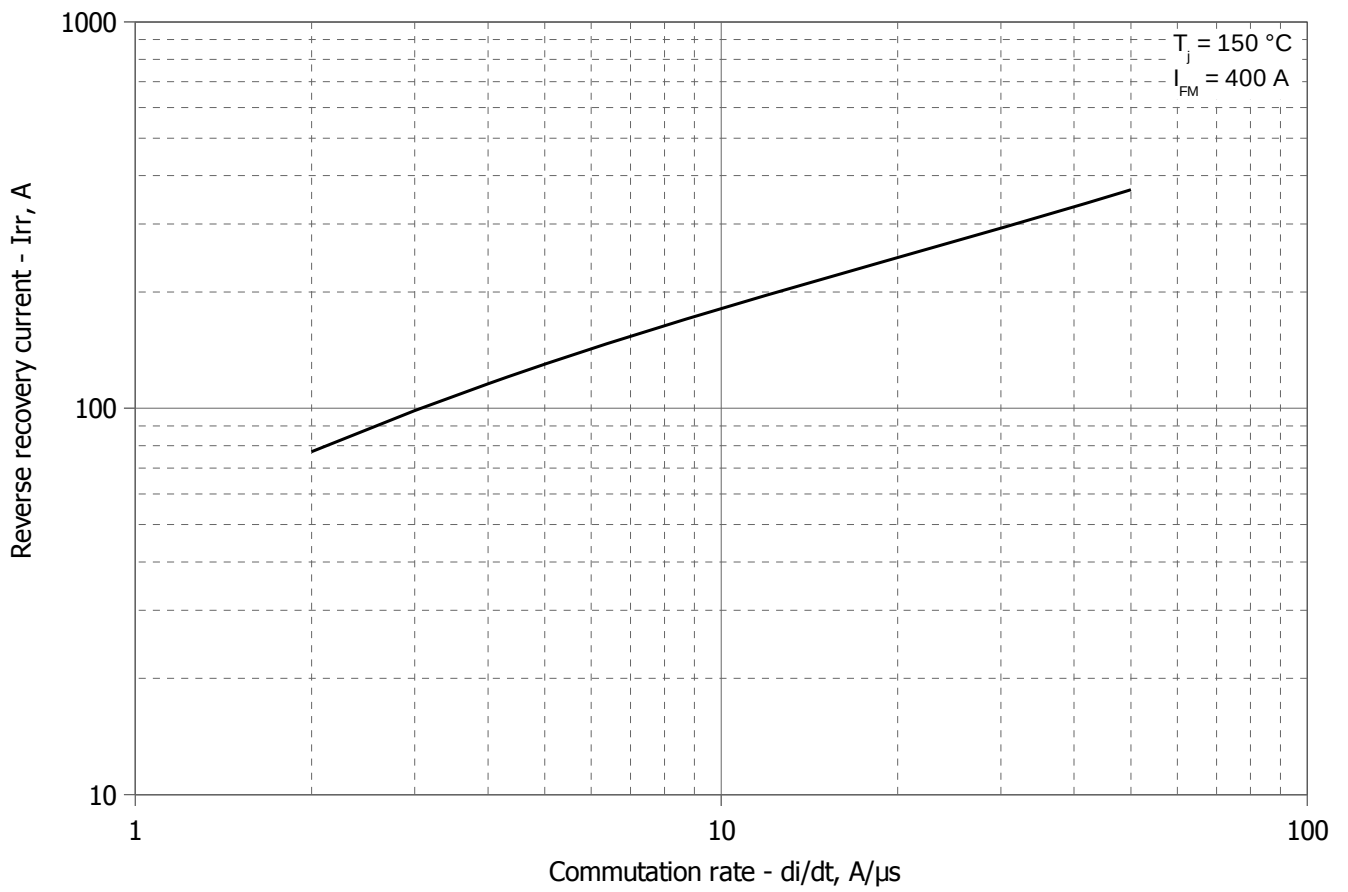


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

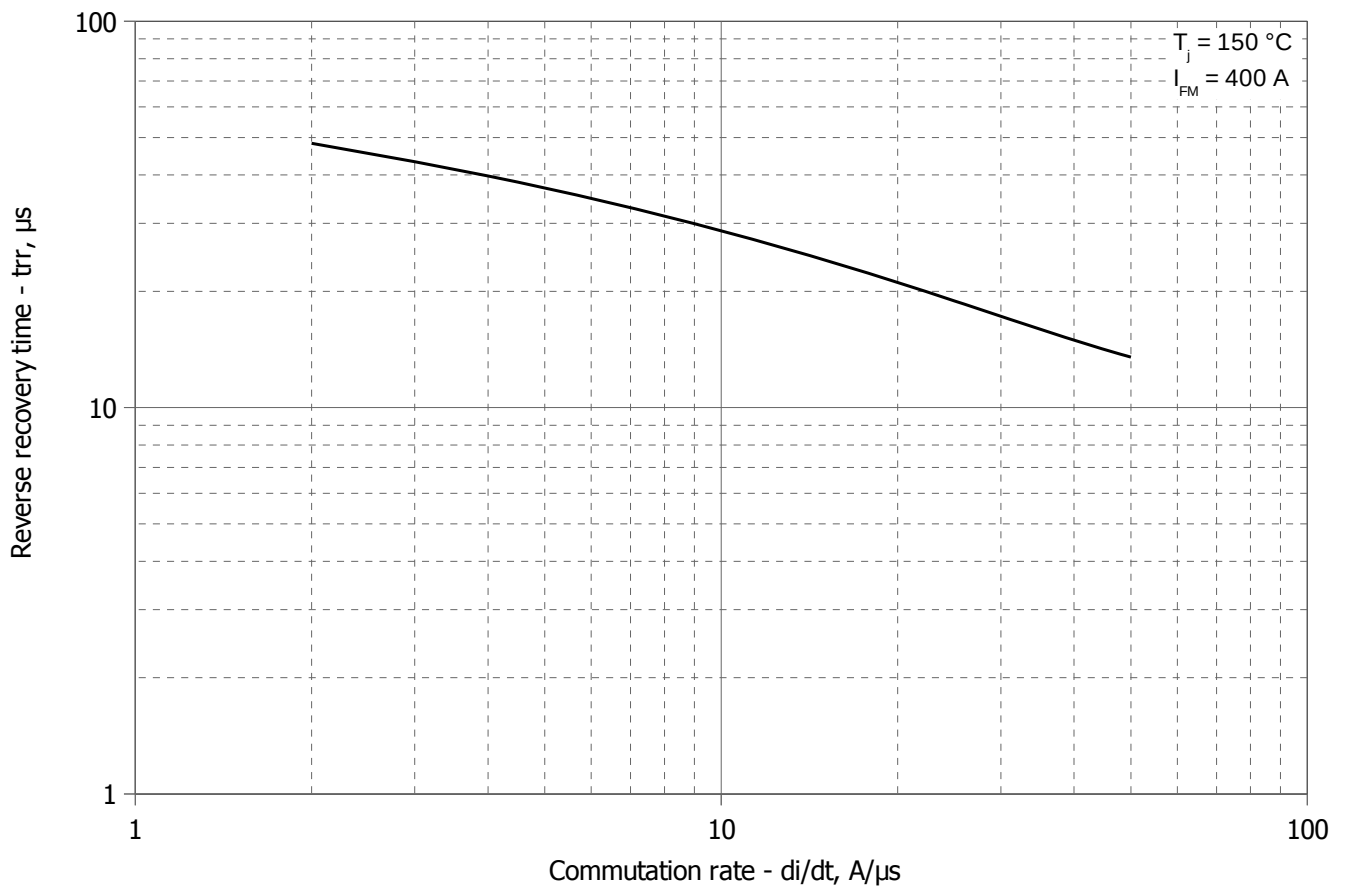


Fig 6 - Maximum recovery time t_r vs. commutation rate di_R/dt (25% chord)

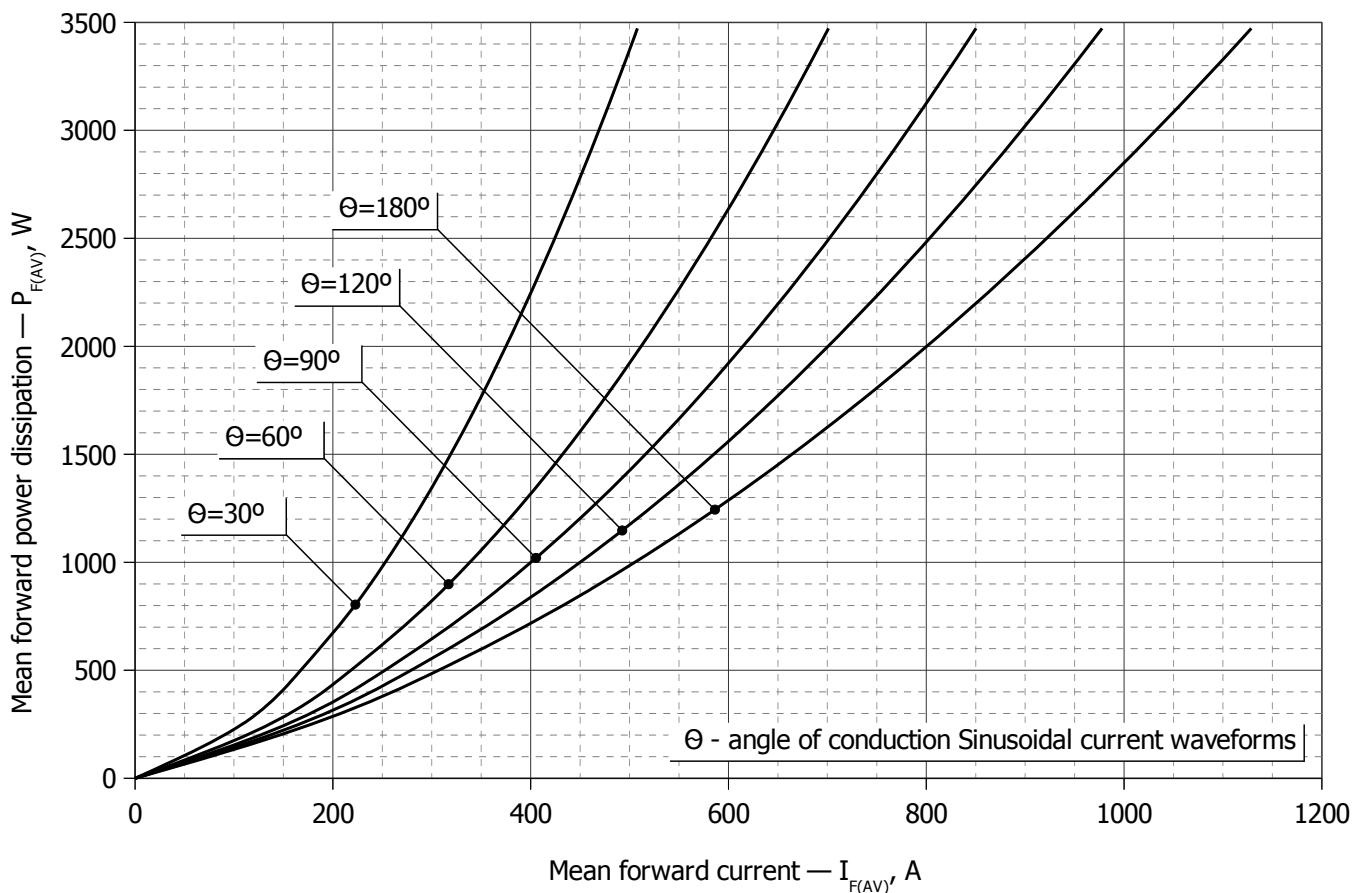


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

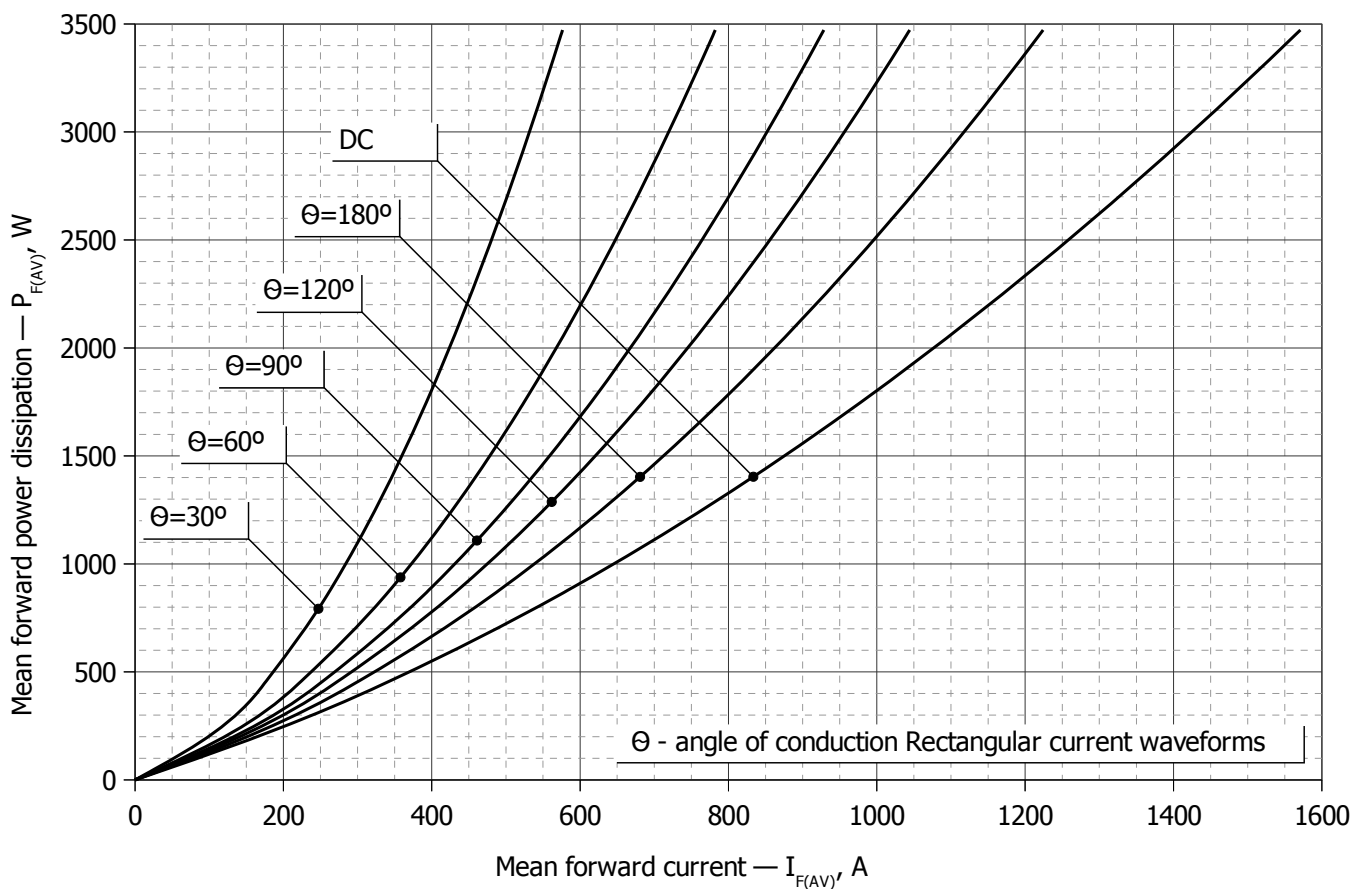


Fig. 8 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

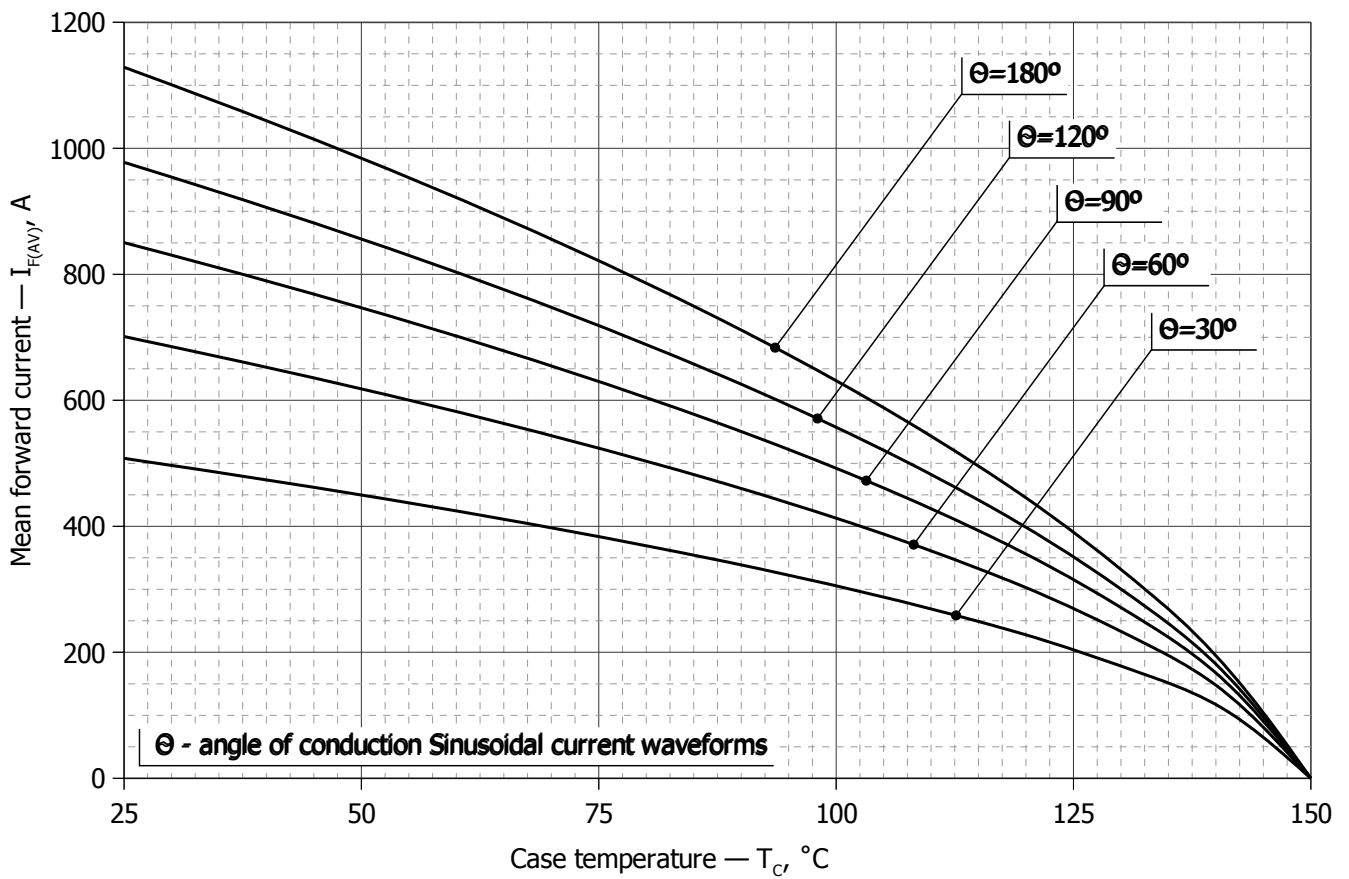


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_c for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

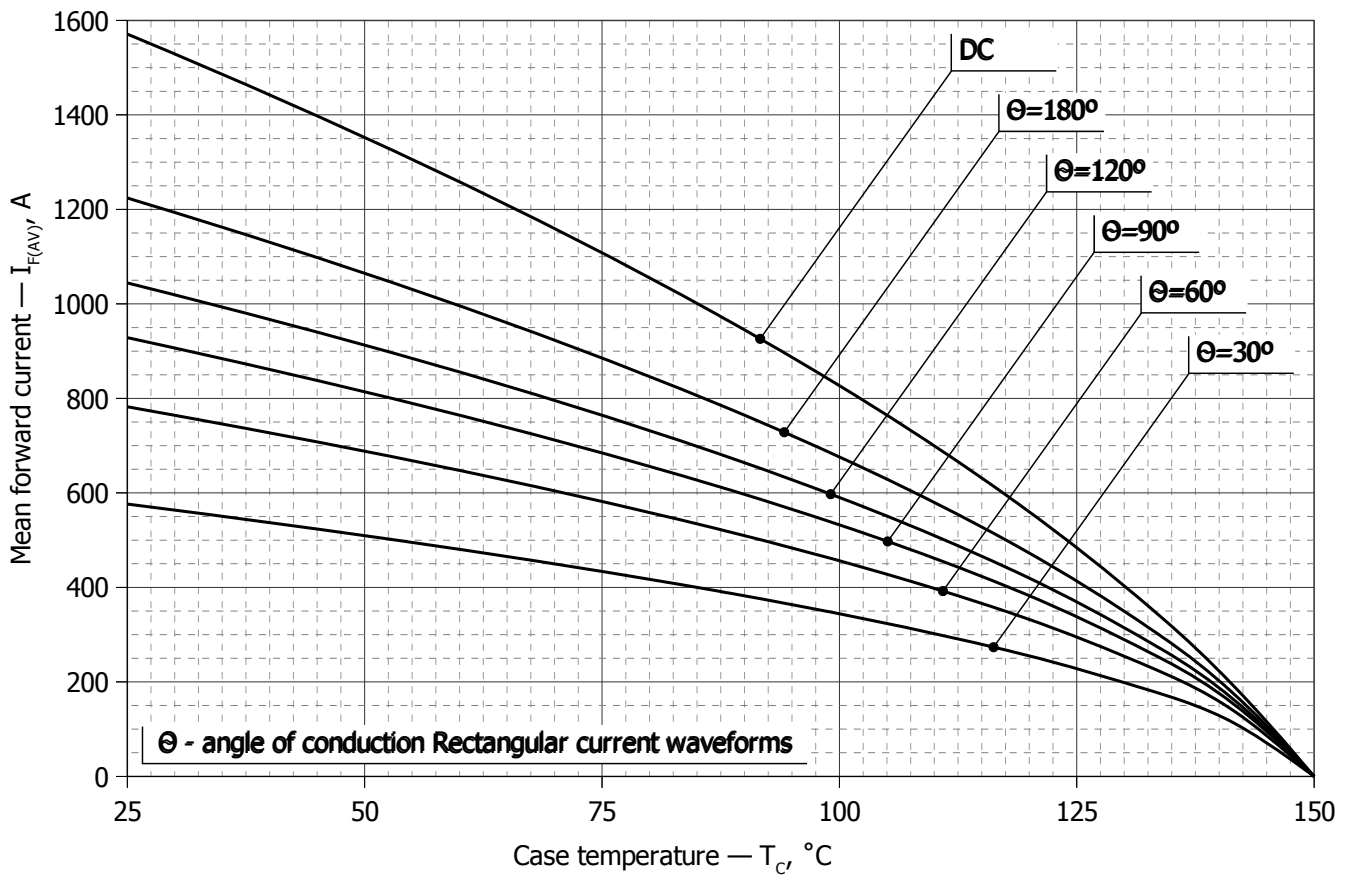


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_c for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

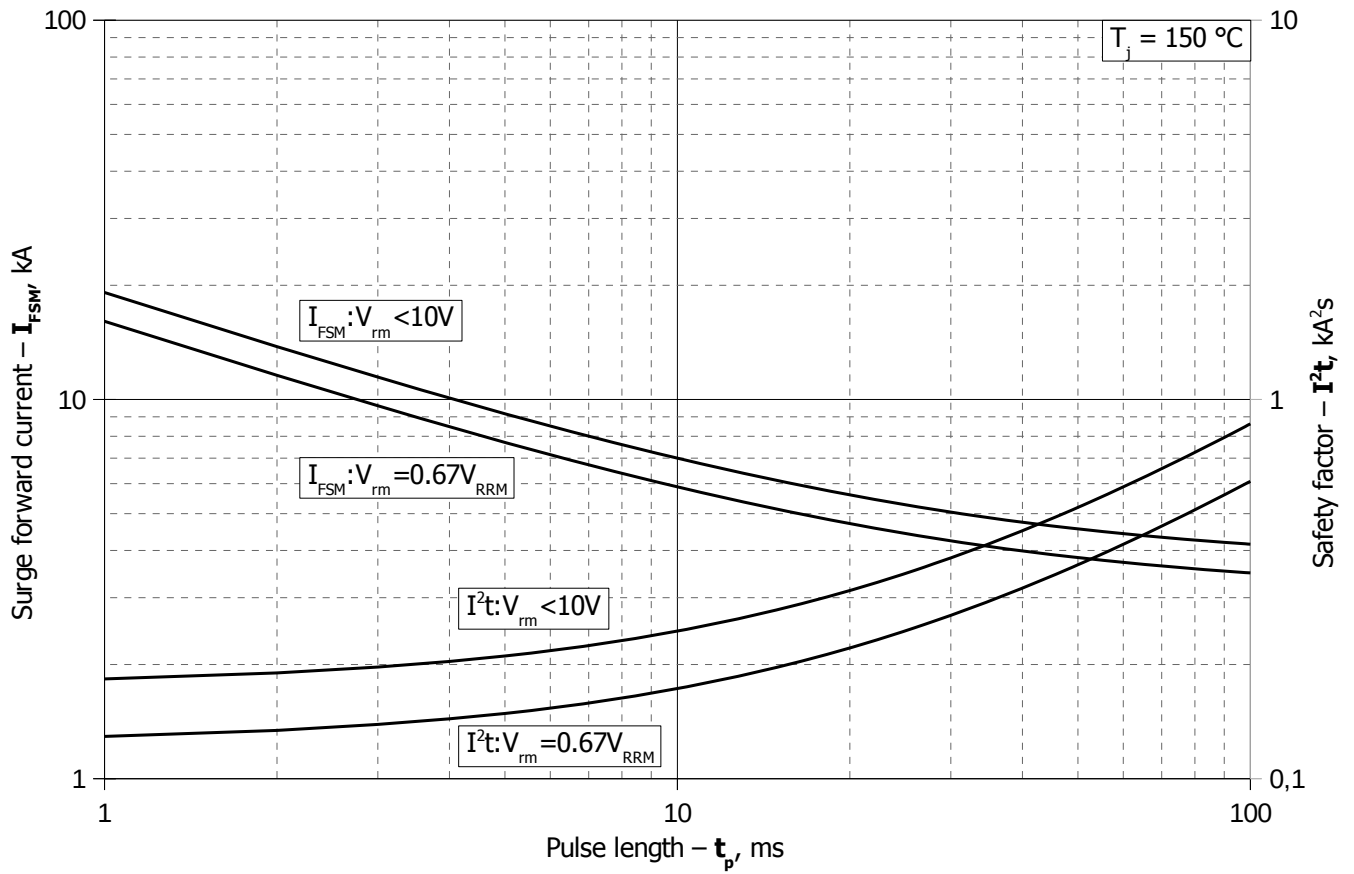


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

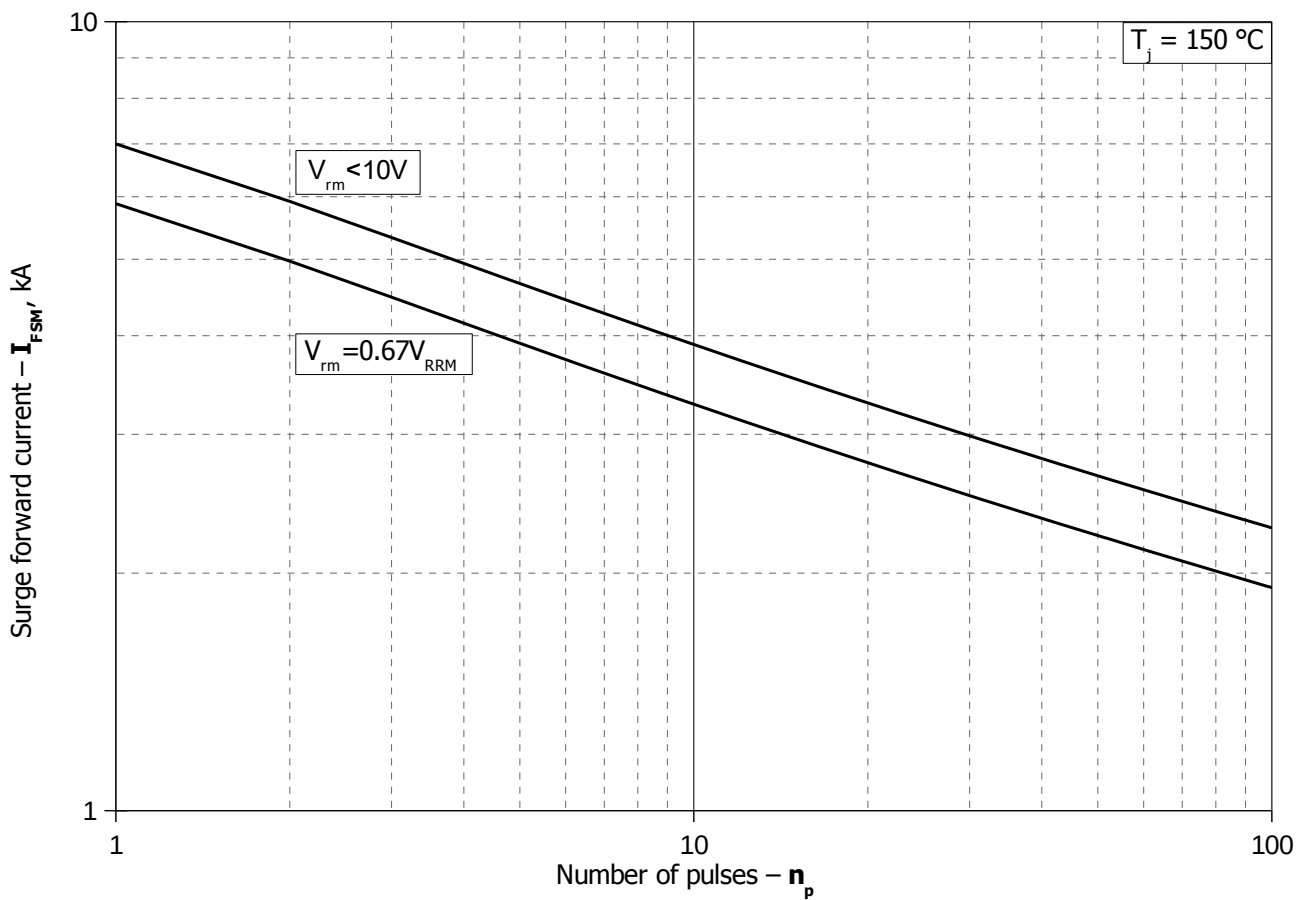


Fig. 12 - Maximum surge forward current I_{FSM} vs. number of pulses n_p