



PROTON-ELECTROTEX RUSSIA

Low switching losses
Low reverse recovery charge
High power cycling capability

Fast Recovery Diode Type DF453-800-45

Average forward current			I _{FAV}	800 A		
Repetitive peak reverse voltage			V _{RRM}	3800...4500 V		
Reverse recovery time			t _{rr}	5.00, 6.30, 8.00, 10.0 μs		
V _{RRM} , V	3800	4000	4200	4400	4500	
Voltage code	38	40	42	44	45	
T _j , °C	-60...+125					

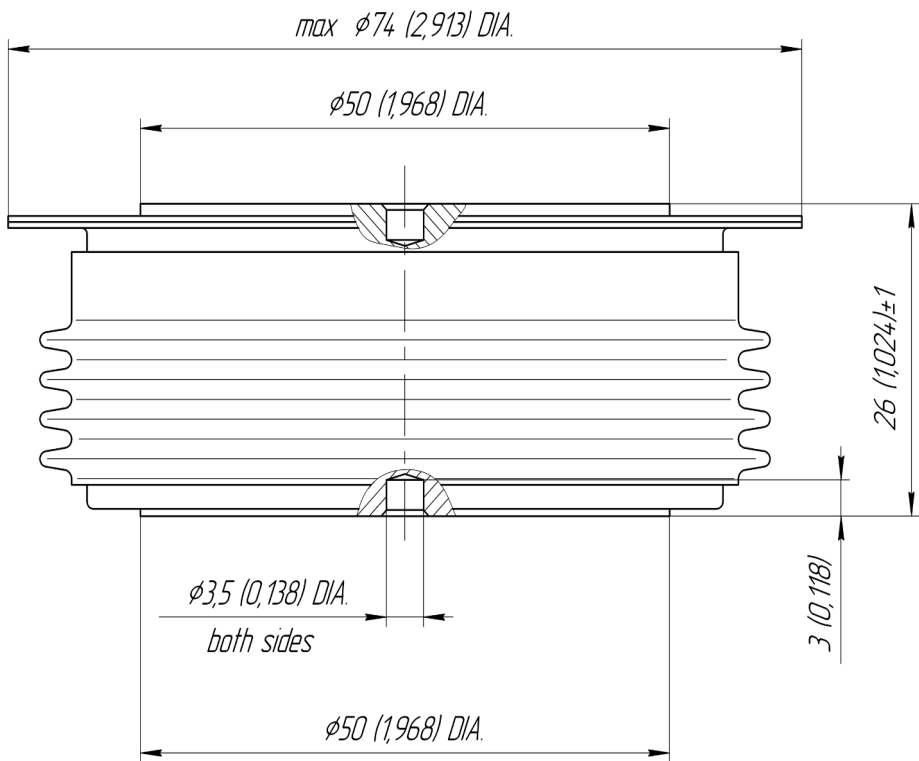
MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I _{FAV}	Maximum allowable average forward current	A	800 1167	T _c =85 °C; Double side cooled; T _c =55 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I _{FRMS}	RMS forward current	A	1256	T _c =85 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I _{FSM}	Surge forward current	kA	20.0 23.0	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V;
			21.0 24.0	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	2000 2600	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V;
			1800 2300	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	3800...4500	T _{j min} < T _j < T _{j max} ; 180° half-sine wave; 50 Hz;	
V _{RSM}	Non-repetitive peak reverse voltages	V	3900...4600	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	−60...+55		
T _j	Operating junction temperature	°C	−60...+125		
MECHANICAL					
F	Mounting force	kN	24.0...28.0		
a	Acceleration	m/s ²	50	Device clamped	

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V _{FM}	Peak forward voltage, max	V	2.90	T _j =25 °C; I _{FM} =2512 A	
V _{F(TO)}	Forward threshold voltage, max	V	1.500	T _j =T _{j max} ;	
r _T	Forward slope resistance, max	mΩ	0.640	0.5 π I _{FAV} < I _T < 1.5 π I _{FAV}	
BLOCKING					
I _{RRM}	Repetitive peak reverse current, max	mA	120	T _j =T _{j max} ; V _R =V _{RRM}	
SWITCHING					
Q _r	Recovered charge, max	μC	800	T _j =T _{j max} ; I _{FM} =I _{FAV} ; di _R /dt=-100 A/μs; V _R =100 V;	
t _{rr}	Reverse recovery time ¹⁾ , max	μs	5.00, 6.30, 8.00, 10.0		
I _{rr}	Reverse recovery current, max	A	320		
THERMAL					
R _{thjc}	Thermal resistance, junction to case, max	°C/W	0.0180	Direct current	Double side cooled
R _{thjc-A}			0.0396		Anode side cooled
R _{thjc-K}			0.0324		Cathode side cooled
R _{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0040	Direct current	
MECHANICAL					
m	Weight, max	g	550		
D _s	Surface creepage distance	mm (inch)	38.84 (1.529)		
D _a	Air strike distance	mm (inch)	22.50 (0.886)		

PART NUMBERING GUIDE						NOTES										
DF	453	800	45	E4	N	1) Reverse recovery time <table><tr><th>Symbol of group</th><th>E4</th><th>C4</th><th>B4</th><th>A4</th></tr><tr><td>t_{rr}, μs</td><td>5.00</td><td>6.30</td><td>8.00</td><td>10.0</td></tr></table>	Symbol of group	E4	C4	B4	A4	t _{rr} , μs	5.00	6.30	8.00	10.0
Symbol of group	E4	C4	B4	A4												
t _{rr} , μs	5.00	6.30	8.00	10.0												
1	2	3	4	5	6											
1. Fast recovery diode 2. Design version 3. Average forward current, A 4. Voltage code 5. Group of reverse recovery time 6. Ambient conditions: N – normal; T – tropical																



All dimensions in millimeters (inches)

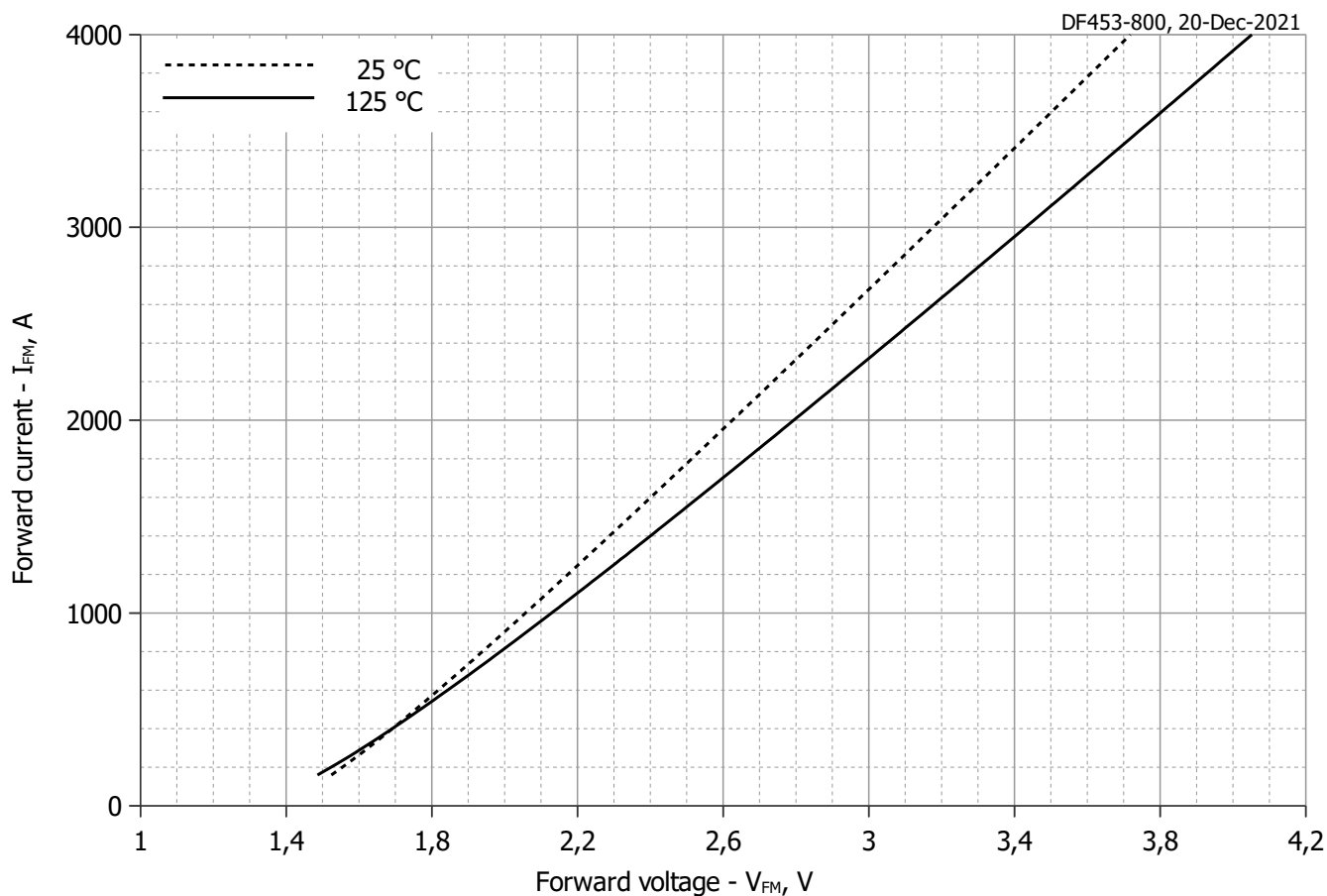


Fig 1 – Forward characteristics of Limit device

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	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\text{ max}}$
A	1.29558710	1.21887367
B	0.00050290	0.00054804
C	0.01917705	0.01496303
D	0.00398876	0.00817028

Forward characteristic model (see Fig. 1).

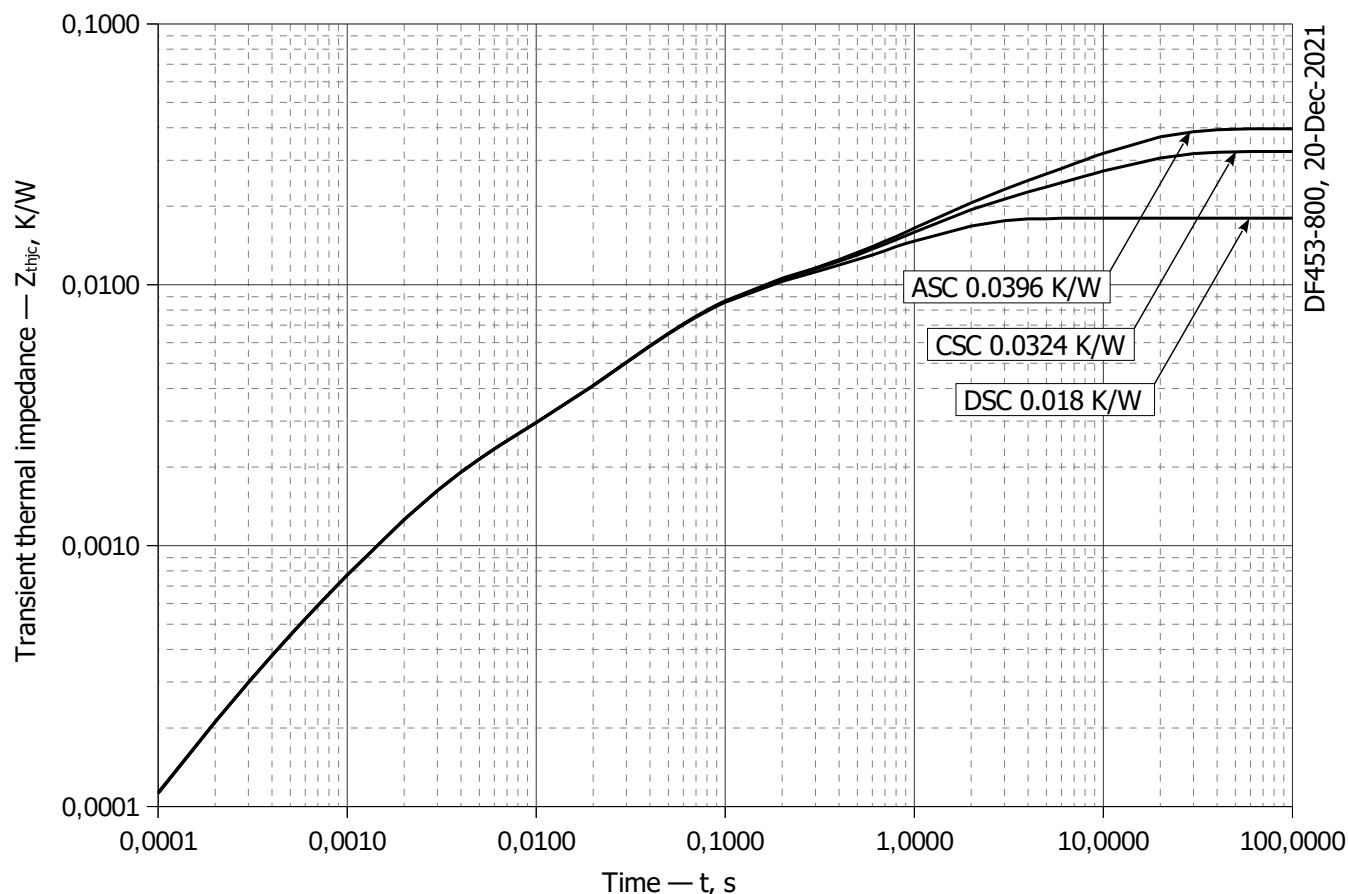


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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	0.009241	0.006037	0.001231	0.001054	0.0003396	0.00009575
τ_i , s	0.9673	0.04967	0.002733	0.07734	0.001638	0.0002248

DC Cathode side cooled

i	1	2	3	4	5	6
R_i , K/W	0.0144	0.009281	0.006055	0.001018	0.001535	0.0001182
τ_i , s	9.745	1.028	0.05591	0.03732	0.002468	0.0002687

DC Anode side cooled

i	1	2	3	4	5	6
R_i , K/W	0.0216	0.009325	0.006949	0.0001252	0.001516	0.0001119
τ_i , s	9.752	1.065	0.05344	0.01407	0.002421	0.0002554

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

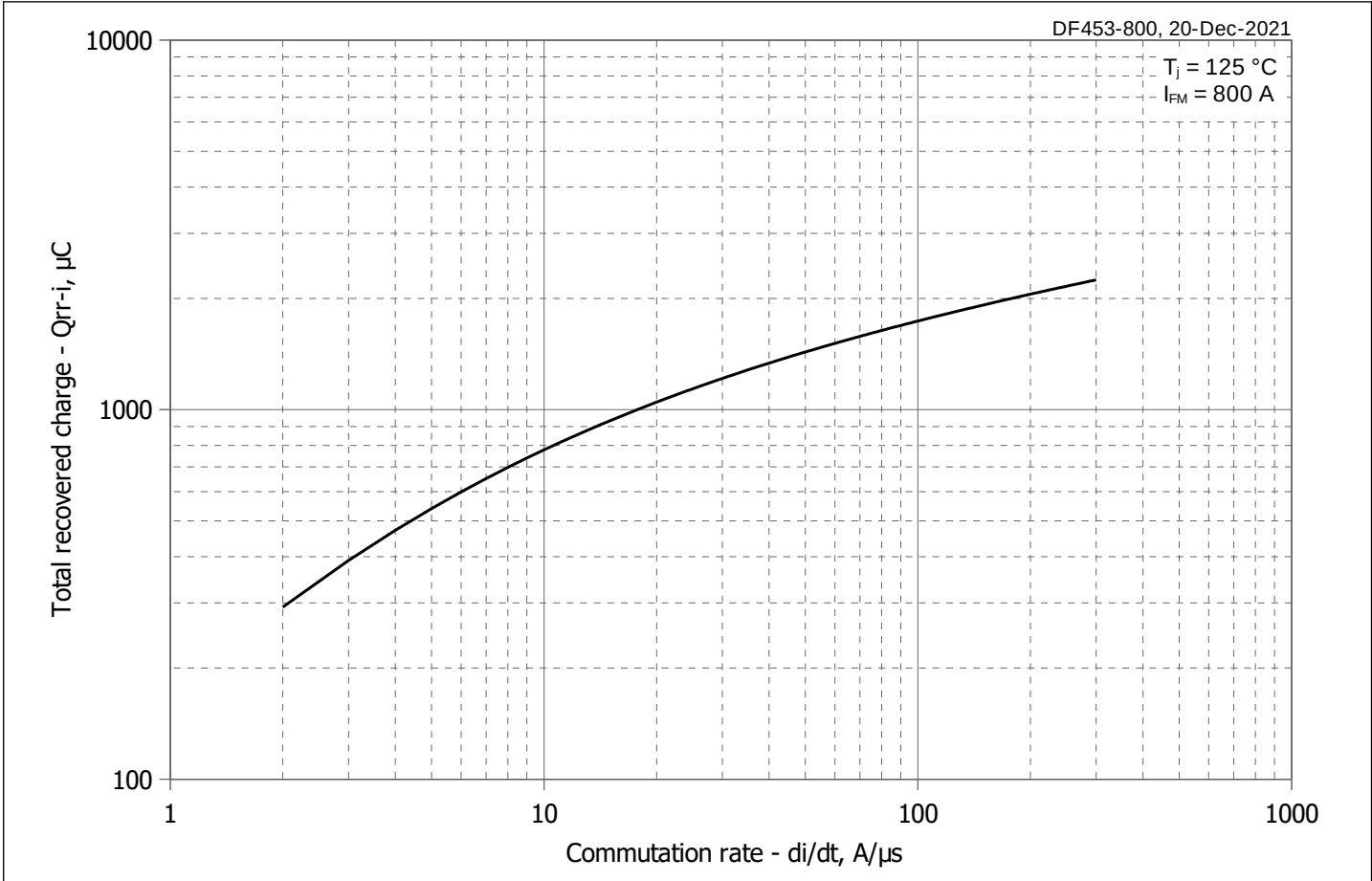


Fig 3 - Total recovered charge Q_{r-i} (integral) vs. commutation rate di_R/dt

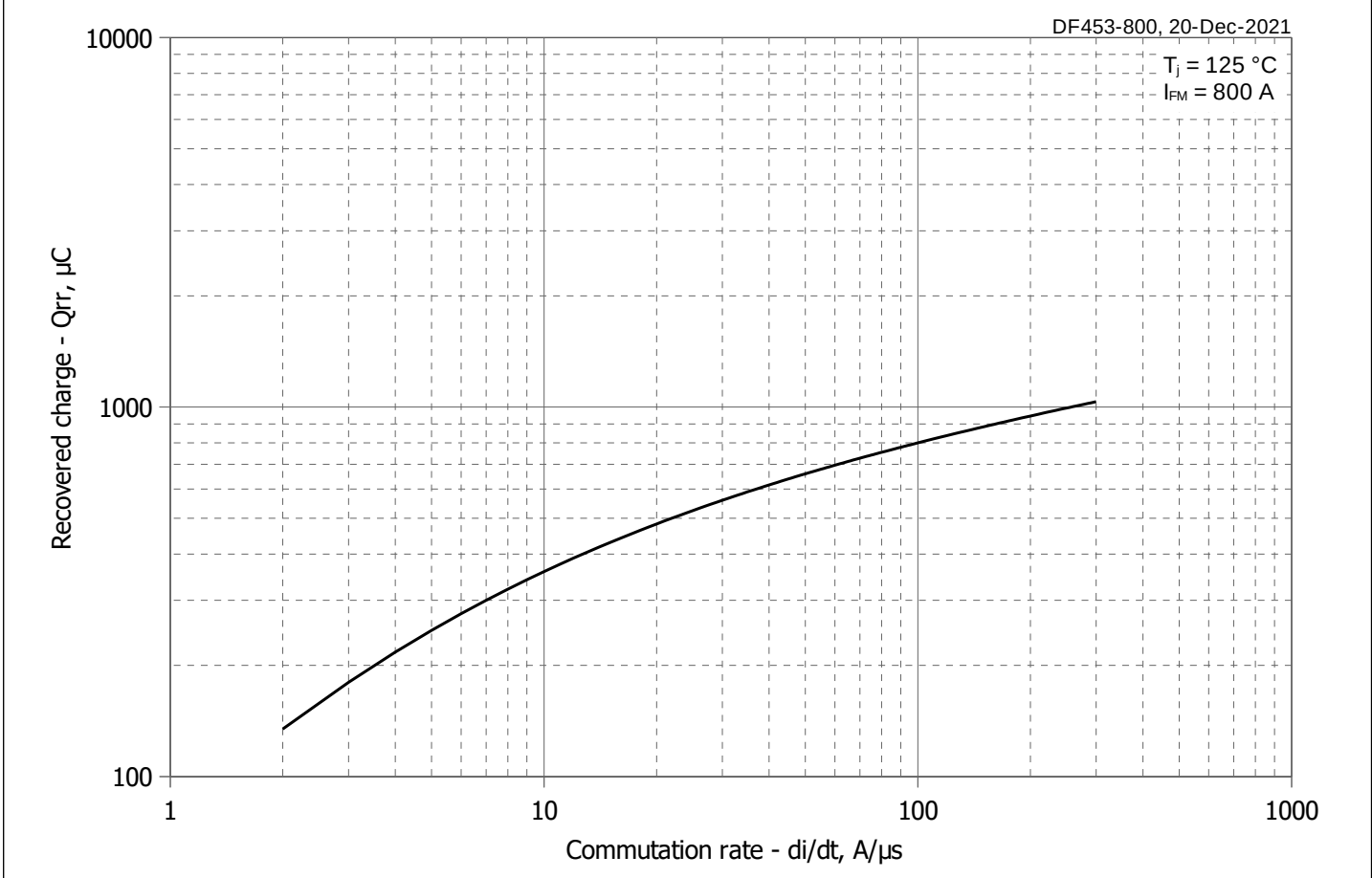


Fig 4 - Maximum recovered charge Q_r vs. commutation rate di_R/dt (50% chord)

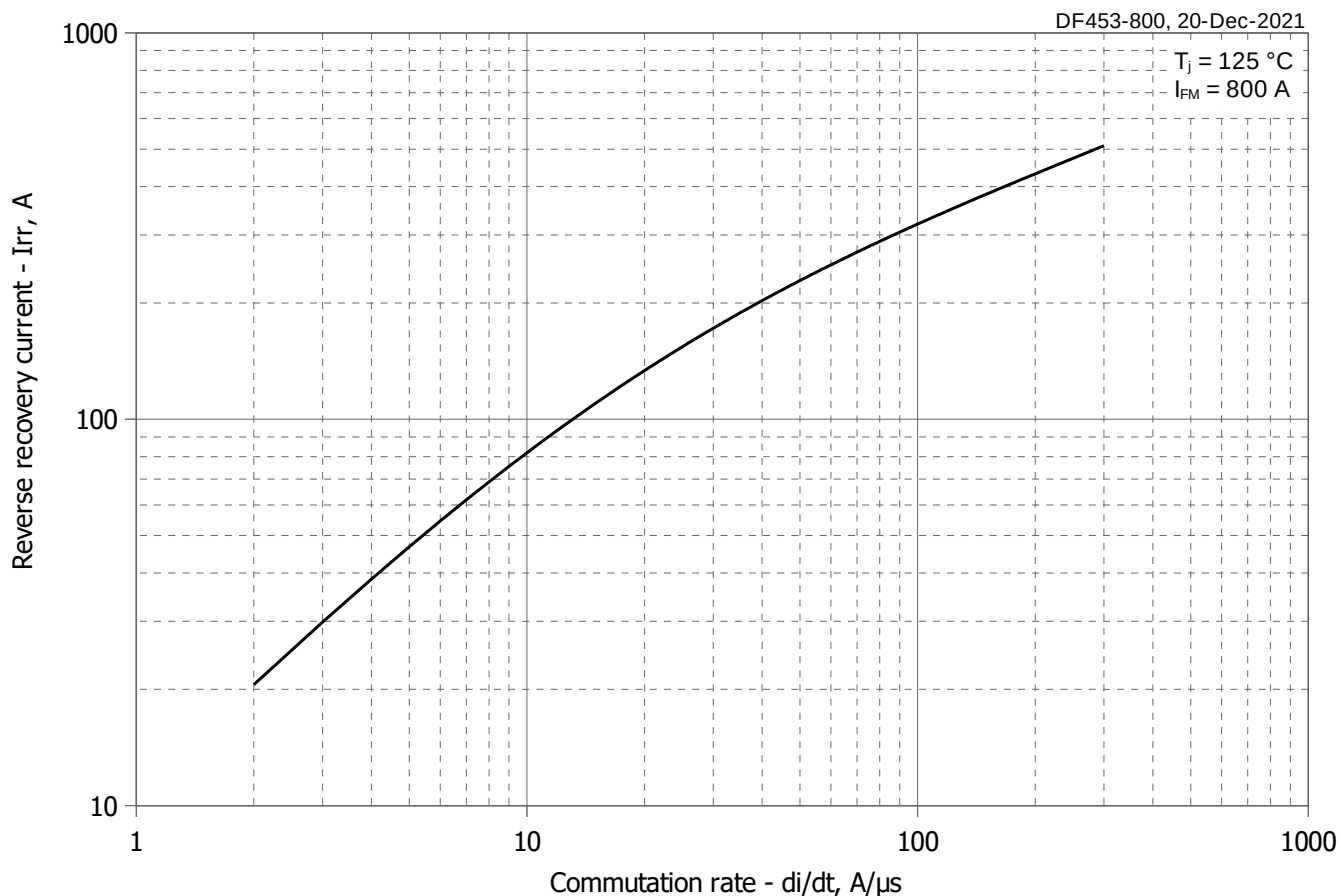


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

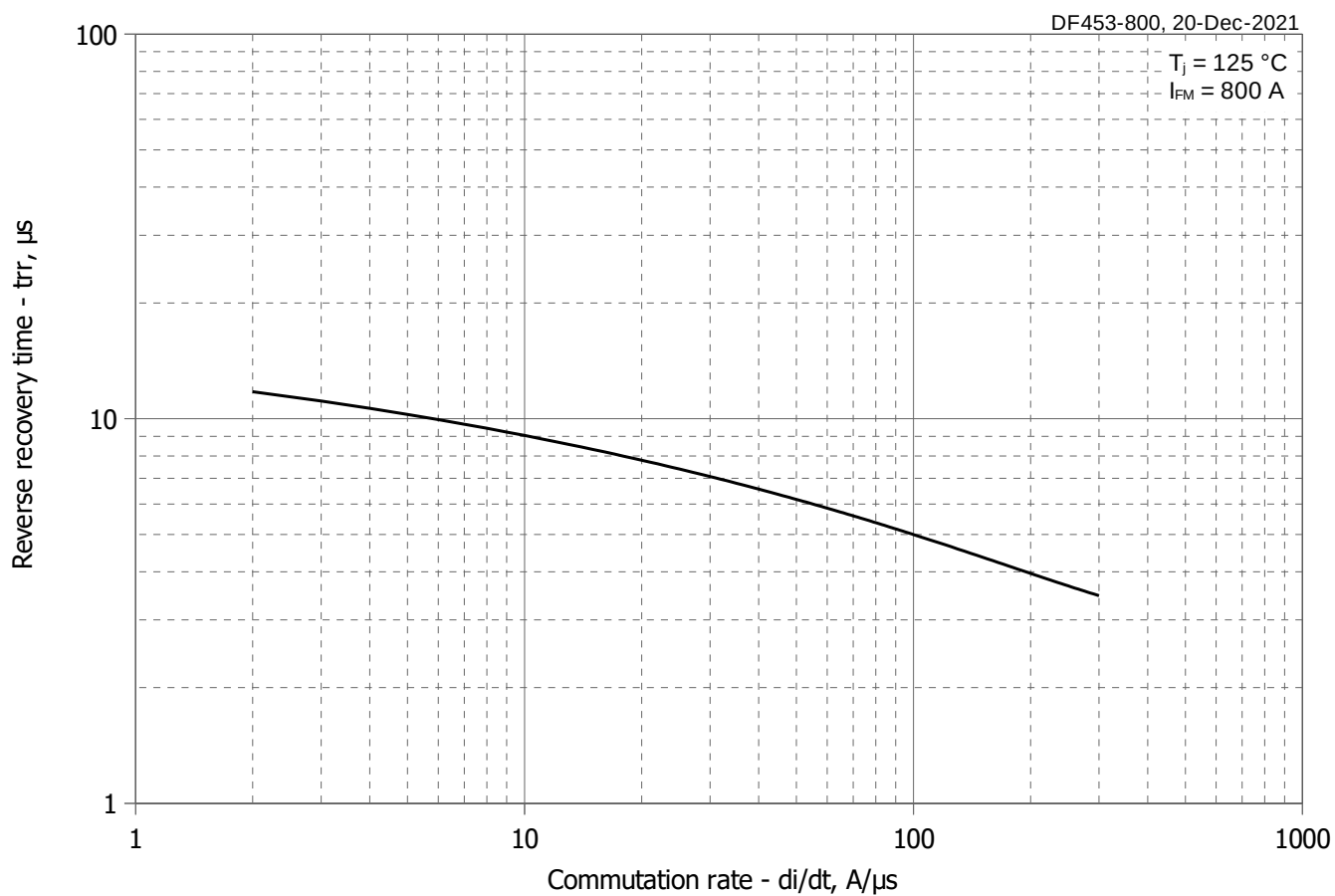


Fig 6 - Maximum recovery time t_{rr} vs. commutation rate di_R/dt (50% chord)

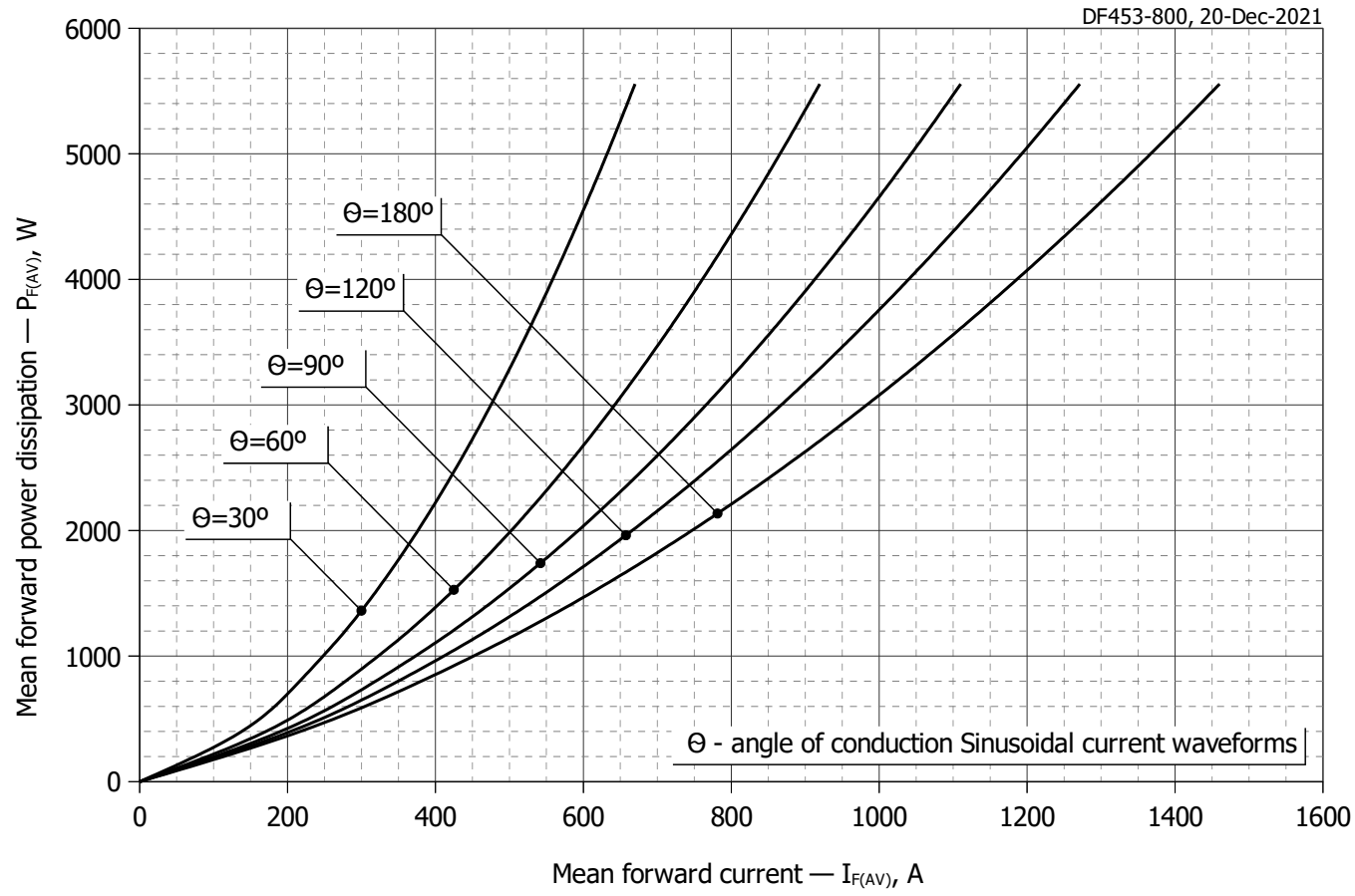


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

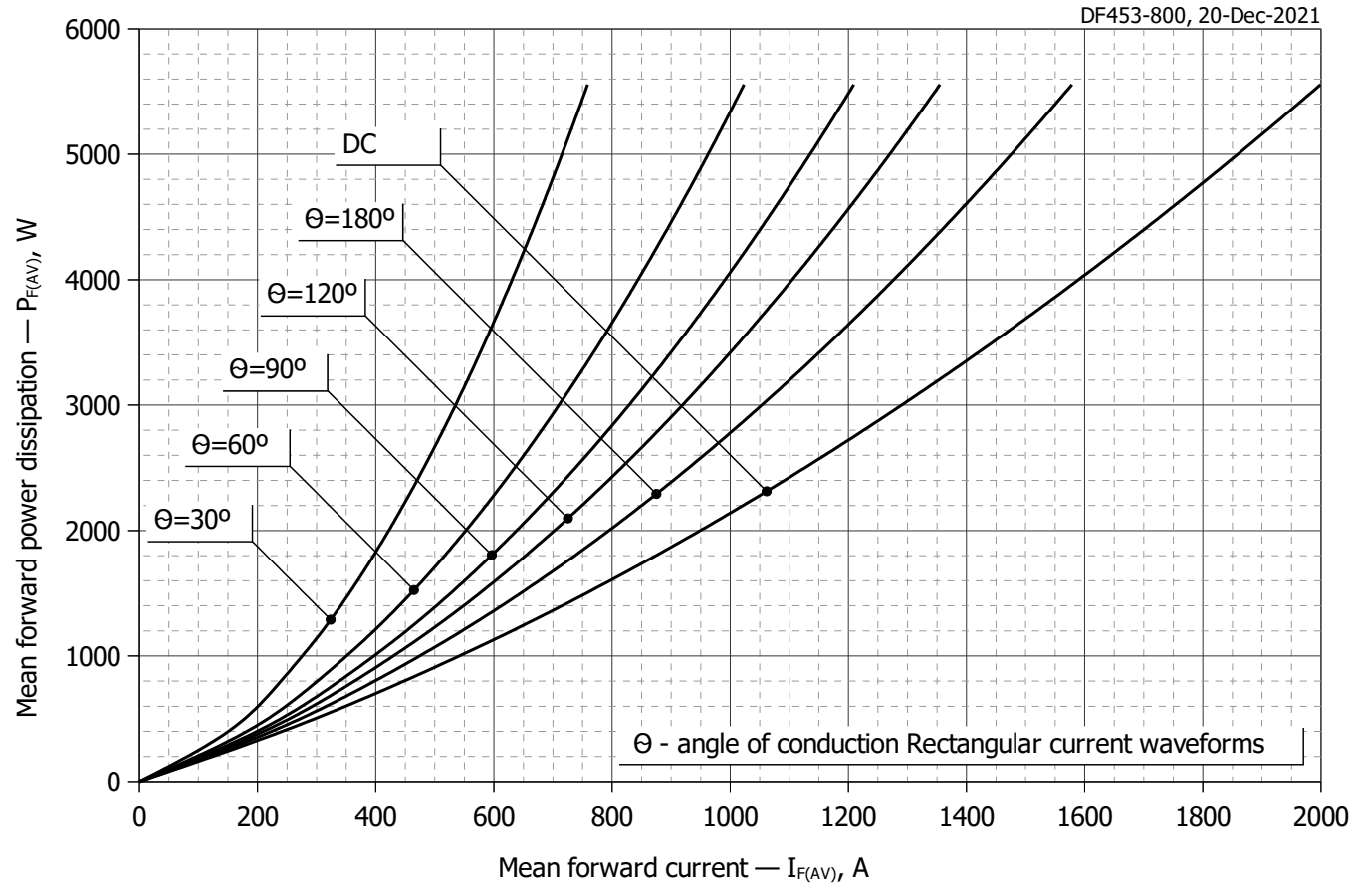


Fig. 8 – Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

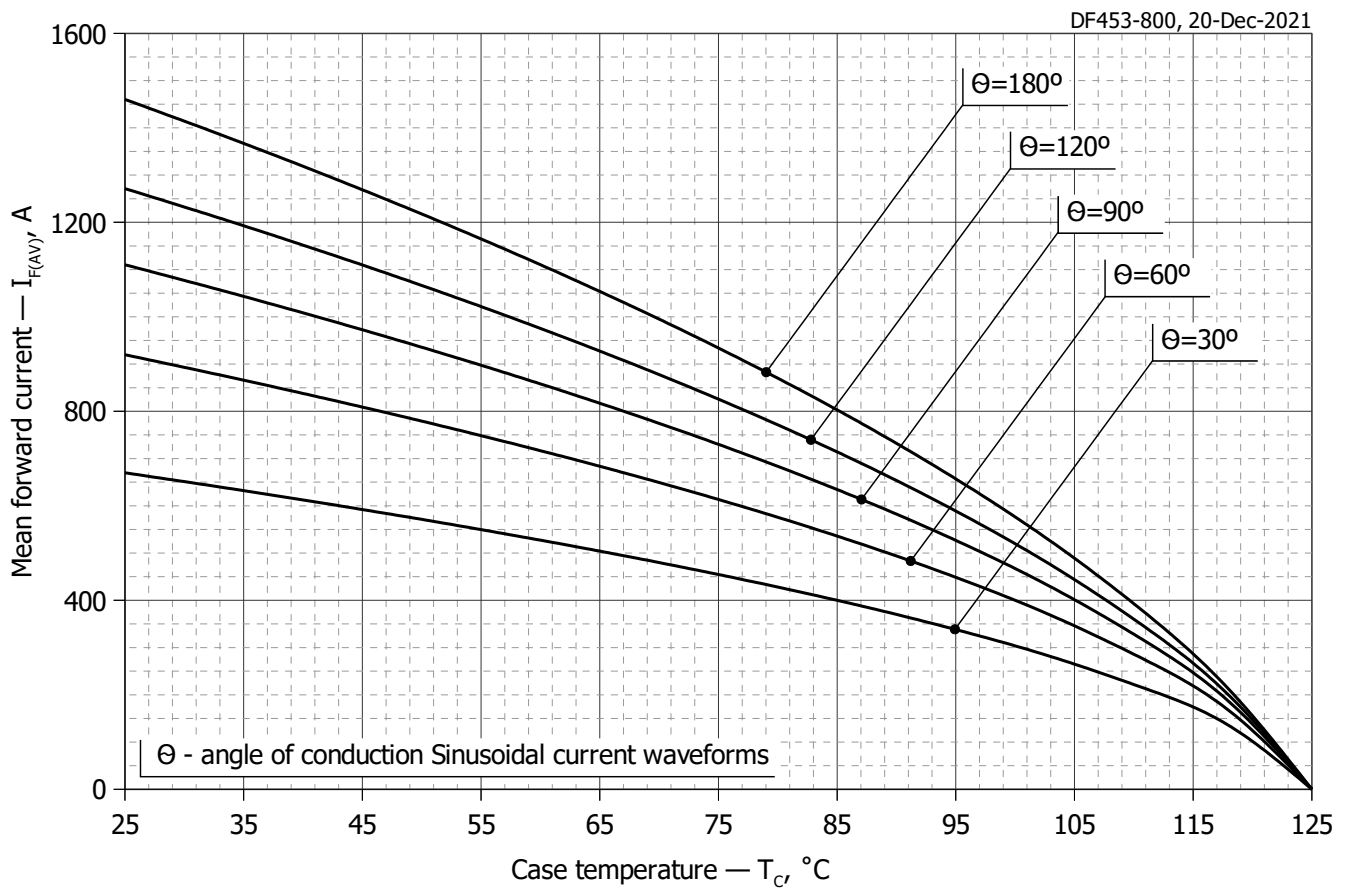


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

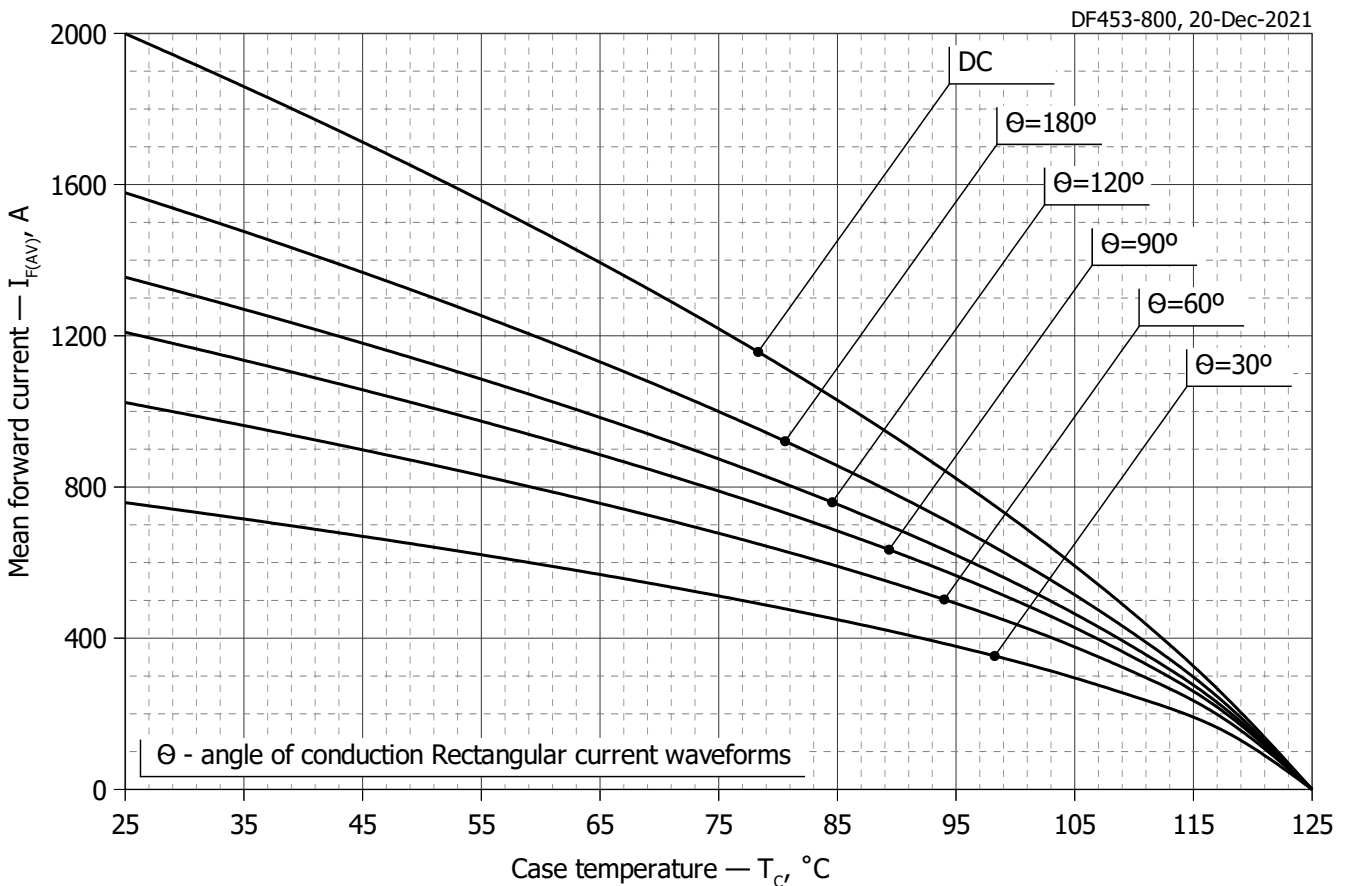


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

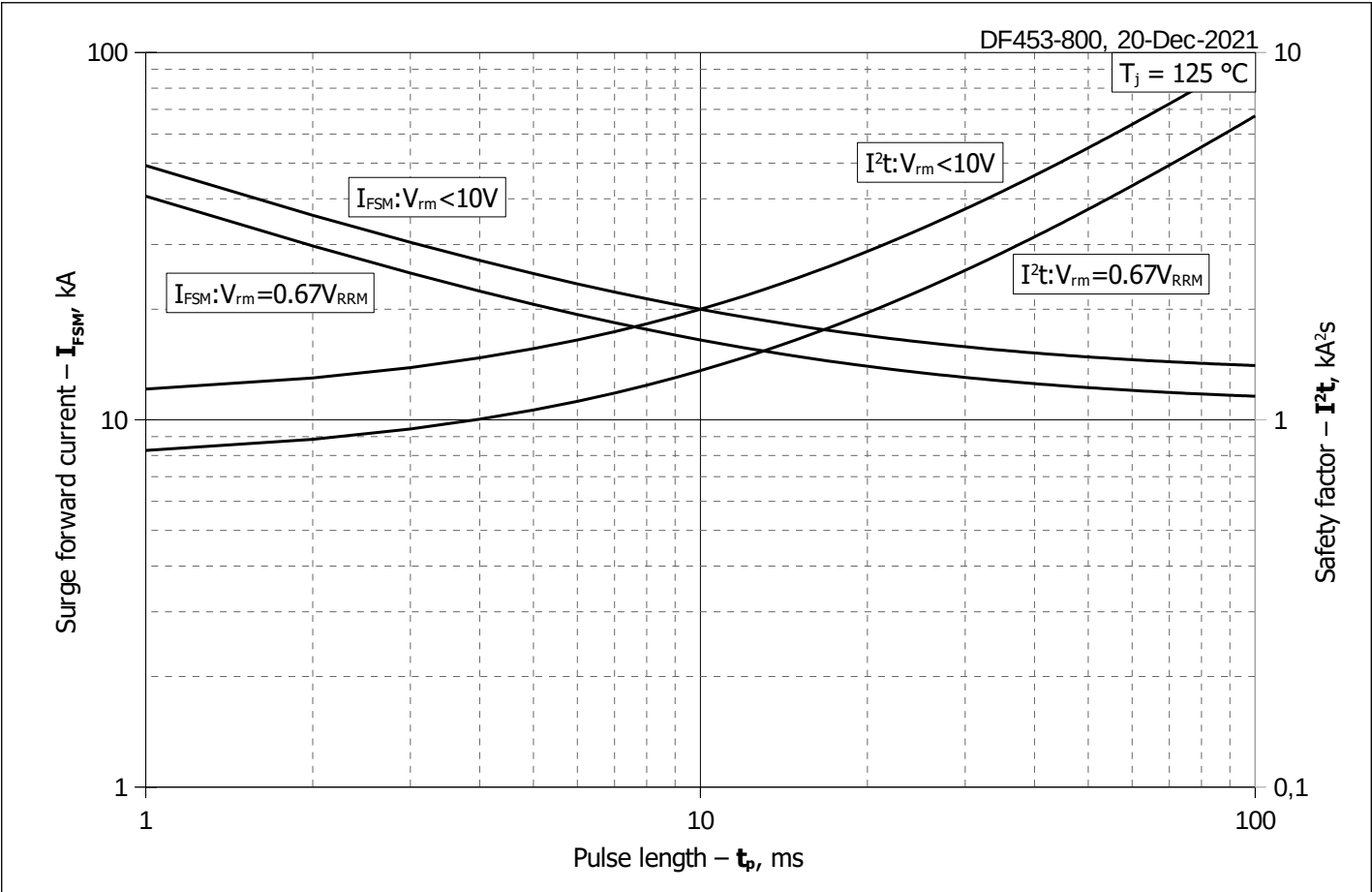


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

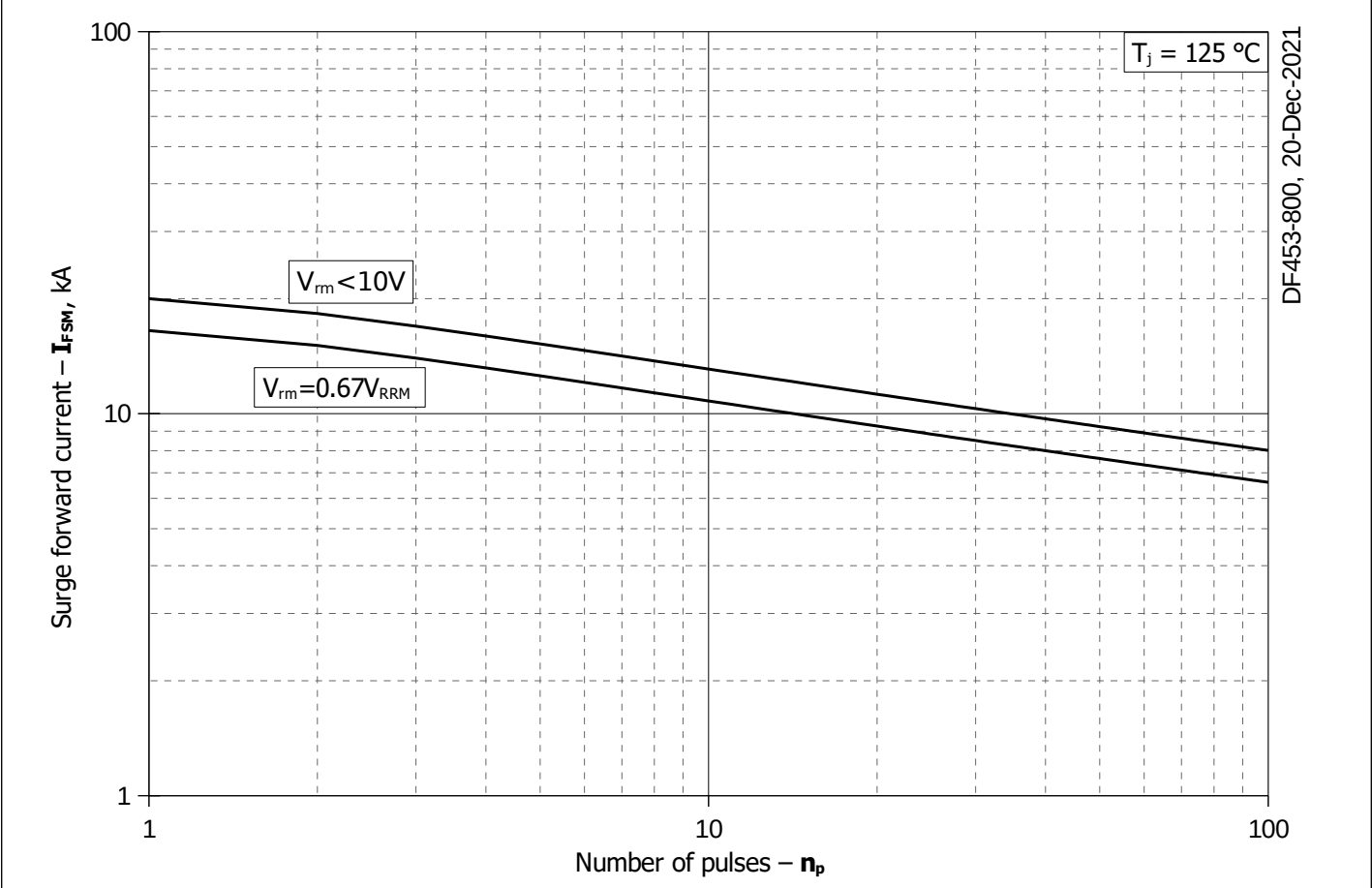


Fig. 12 - Maximum surge forward current I_{FSM} vs. number of pulses n_p