



Fast Recovery
Avalanche Diode
Type DFA133-200-22

Low switching losses
Low reverse recovery charge
High power cycling capability

Average forward current		I_{FAV}	200 A
Repetitive peak reverse voltage		V_{RRM}	1800...2200 V
Reverse recovery time		t_{rr}	1.6, 2.0, 2.5, 3.2 μ s
V_{RRM} , V	1800	2000	2200
Voltage code	18	20	22
T_j , °C	- 60...+125		

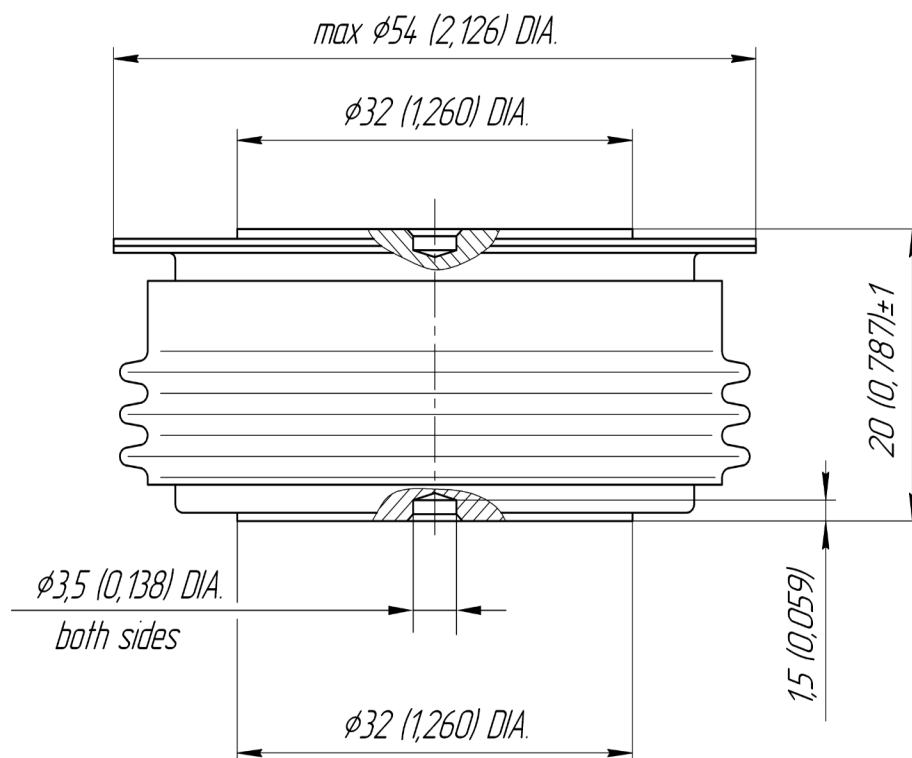
MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I _{FAV}	Maximum allowable average forward current	A	200 313	T _c =88 °C; Double side cooled; T _c =55 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I _{FRMS}	RMS forward current	A	314	T _c =88 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I _{FSM}	Surge forward current	kA	4.8 5.5	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V;
			5.0 6.0	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	110 150	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V;
			100 140	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	1800...2200	T _{j min} < T _j < T _{j max} ; 180° half-sine wave; 50 Hz;	
V _{RSM}	Non-repetitive peak reverse voltages	V	1900...2300	T _{j min} < T _j < T _{j max} ; 180° half-sine wave; single pulse;	
V _(BR)	Breakdown voltage	V	2000...2400	T _j =25 °C; I _{br} =100 mA; t _p = 10 ms; 5 Hz	
V _R	Reverse continuous voltages	V	0.6·V _{RRM}	T _j =T _{j max} ;	
P _{RSM}	Surge reverse power dissipation	kW	16	T _j = T _{j max} ; t _p = 100 μs; 180° half-sine current waveforms; single pulse	
THERMAL					
T _{stg}	Storage temperature	°C	−60...+55		
T _j	Operating junction temperature	°C	−60...+125		
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	3.50	T _j =25 °C; I _{FM} =628 A	
V _{F(TO)}	Forward threshold voltage, max	V	2.345	T _j =T _{j max} ;	
r _T	Forward slope resistance, max	mΩ	2.750	0.5 π I _{FAV} < I _T < 1.5 π I _{FAV}	
BLOCKING					
I _{RRM}	Repetitive peak reverse current, max	mA	40	T _j =T _{j max} ; V _R =V _{RRM}	
SWITCHING					
Q _r	Recovered charge, max	μC	120	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	1.6, 2.0, 2.5, 3.2		
I _{rr}	Reverse recovery current, max	A	150		
THERMAL					
R _{thjc}	Thermal resistance, junction to case, max	°C/W	0.0500	Direct current	Double side cooled
R _{thjc-A}			0.1100		Anode side cooled
R _{thjc-K}			0.0900		Cathode side cooled
R _{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0090	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						NOTES										
DFA	133	200	22	K4	N	1) Reverse recovery time										
1	2	3	4	5	6											
1. DFA – Fast recovery avalanche 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																
						<table><tr><th>Symbol of group</th><th>T4</th><th>P4</th><th>M4</th><th>K4</th></tr><tr><td>t_{rr} μs</td><td>1.6</td><td>2.0</td><td>2.5</td><td>3.2</td></tr></table>	Symbol of group	T4	P4	M4	K4	t _{rr} μs	1.6	2.0	2.5	3.2
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All dimensions in millimeters (inches)

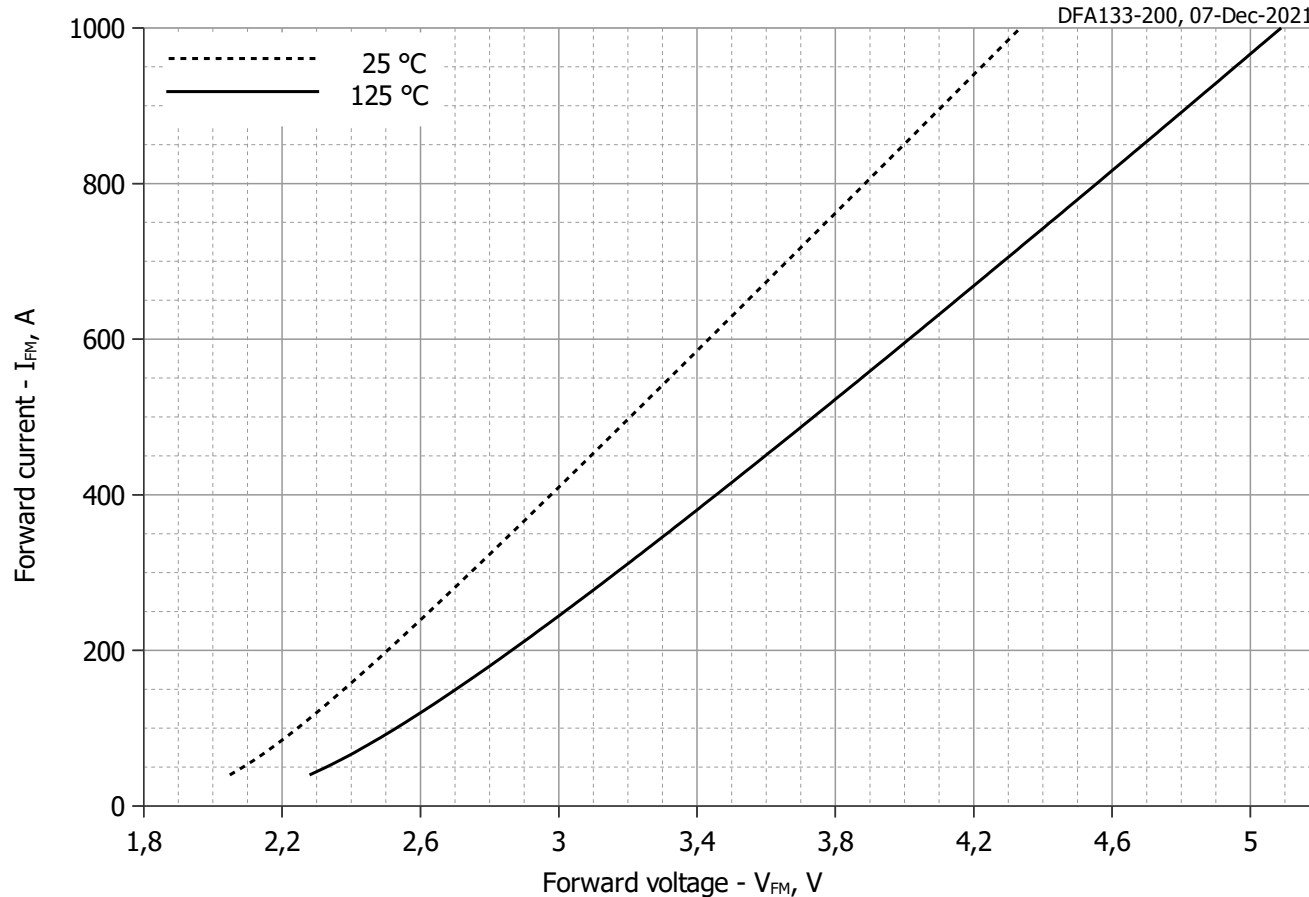


Fig 1 – Forward characteristics of Limit device

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	1.62522566	1.82620029
B	0.00230556	0.00244206
C	0.10740189	0.08217250
D	-0.01068668	0.00799572

Forward characteristic model (see Fig. 1).

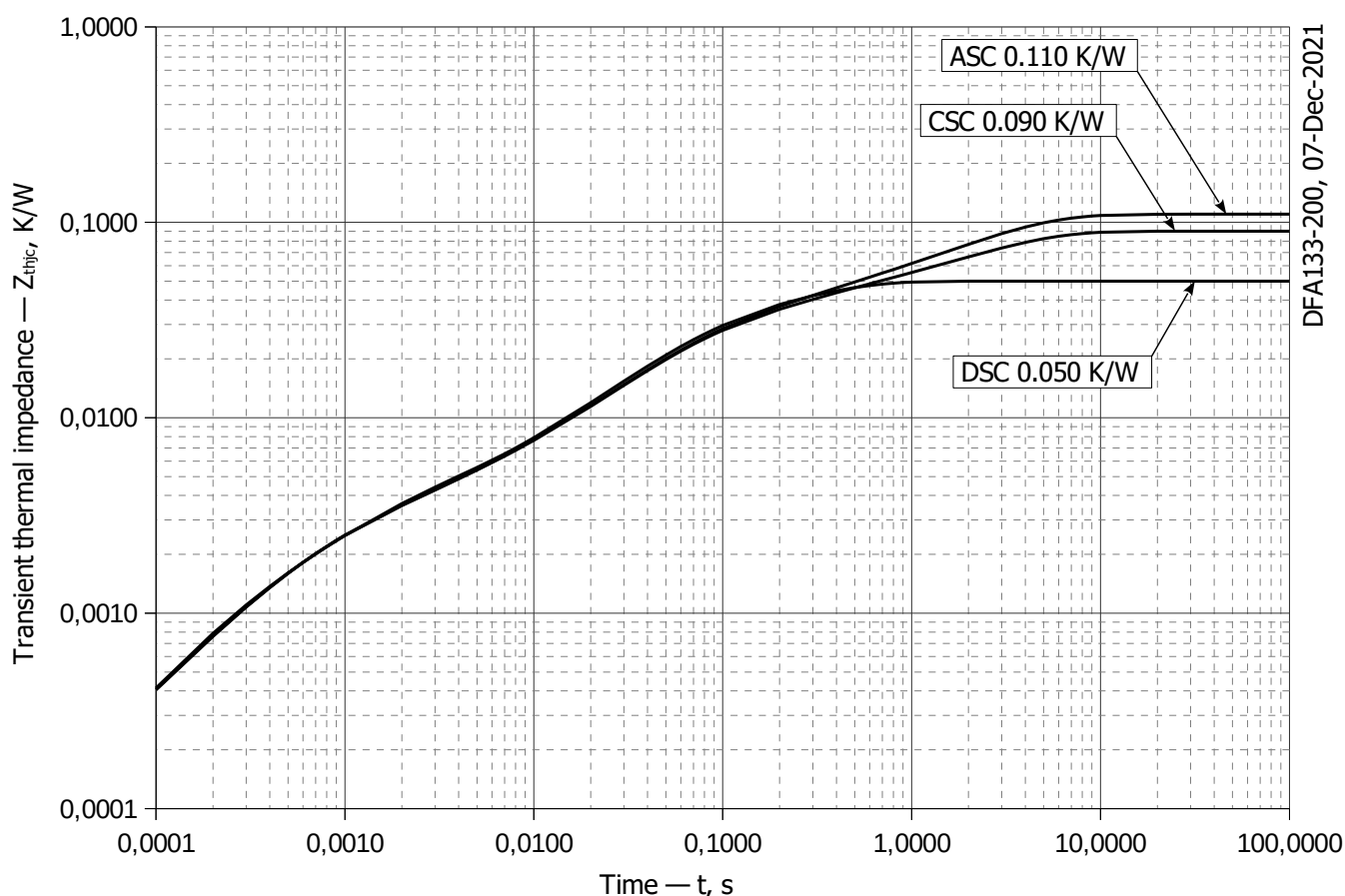


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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	0.02423	0.01906	0.003576	0.002535	-0.00004666	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	0.070002	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	0.05009	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)

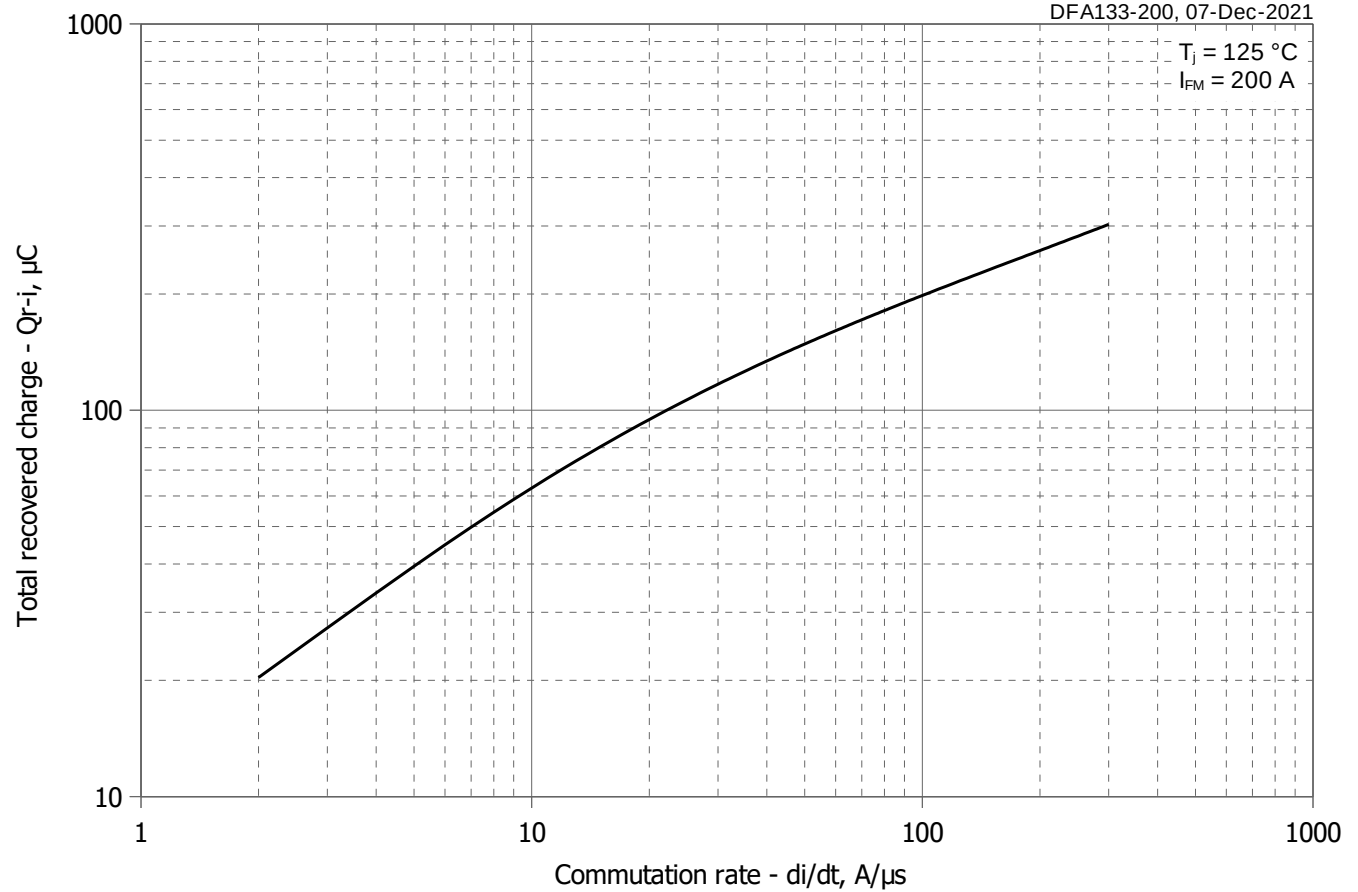


Fig 3 - Total recovered charge Q_{r-i} (integral) vs. commutation rate di_R/dt

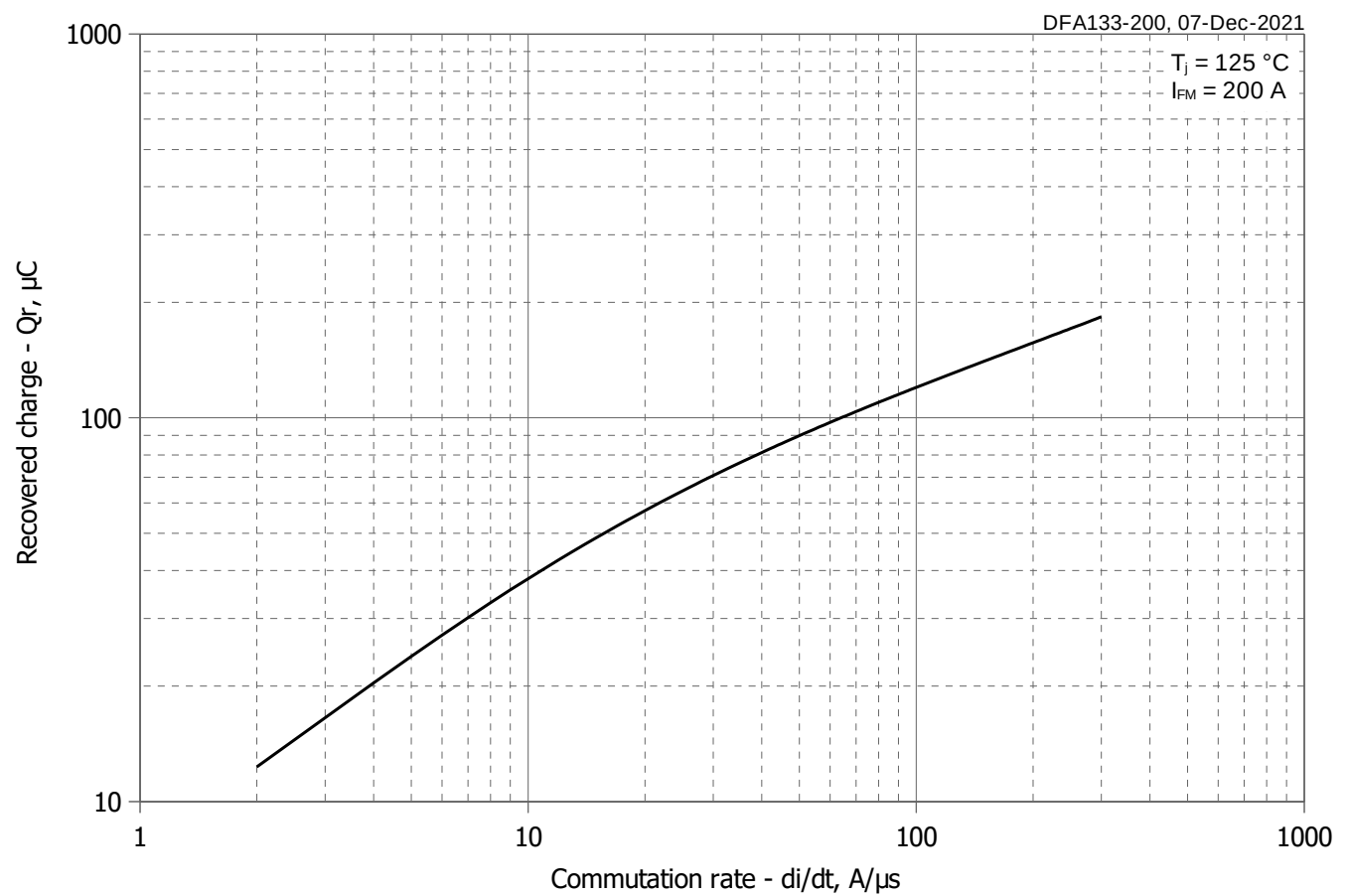
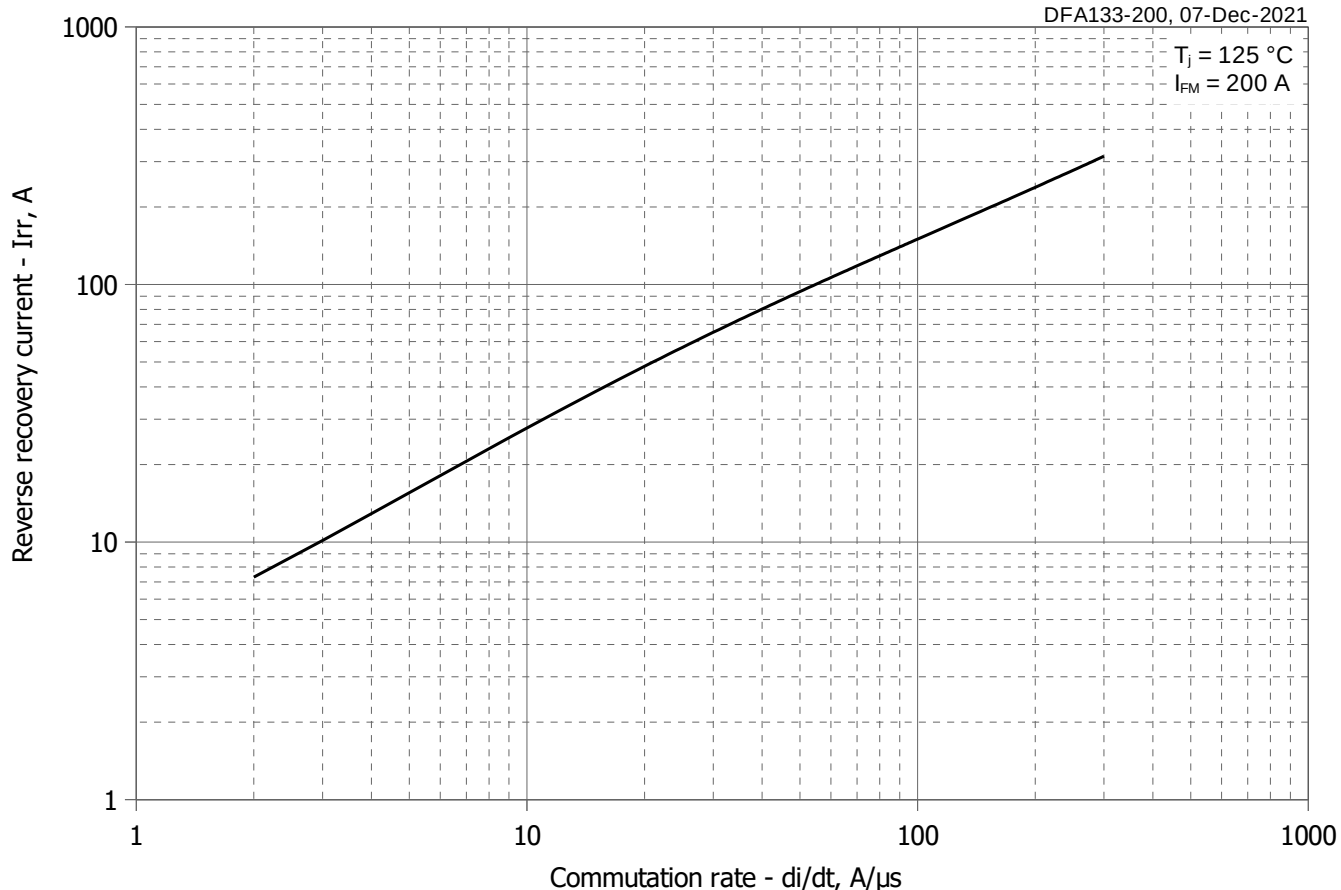
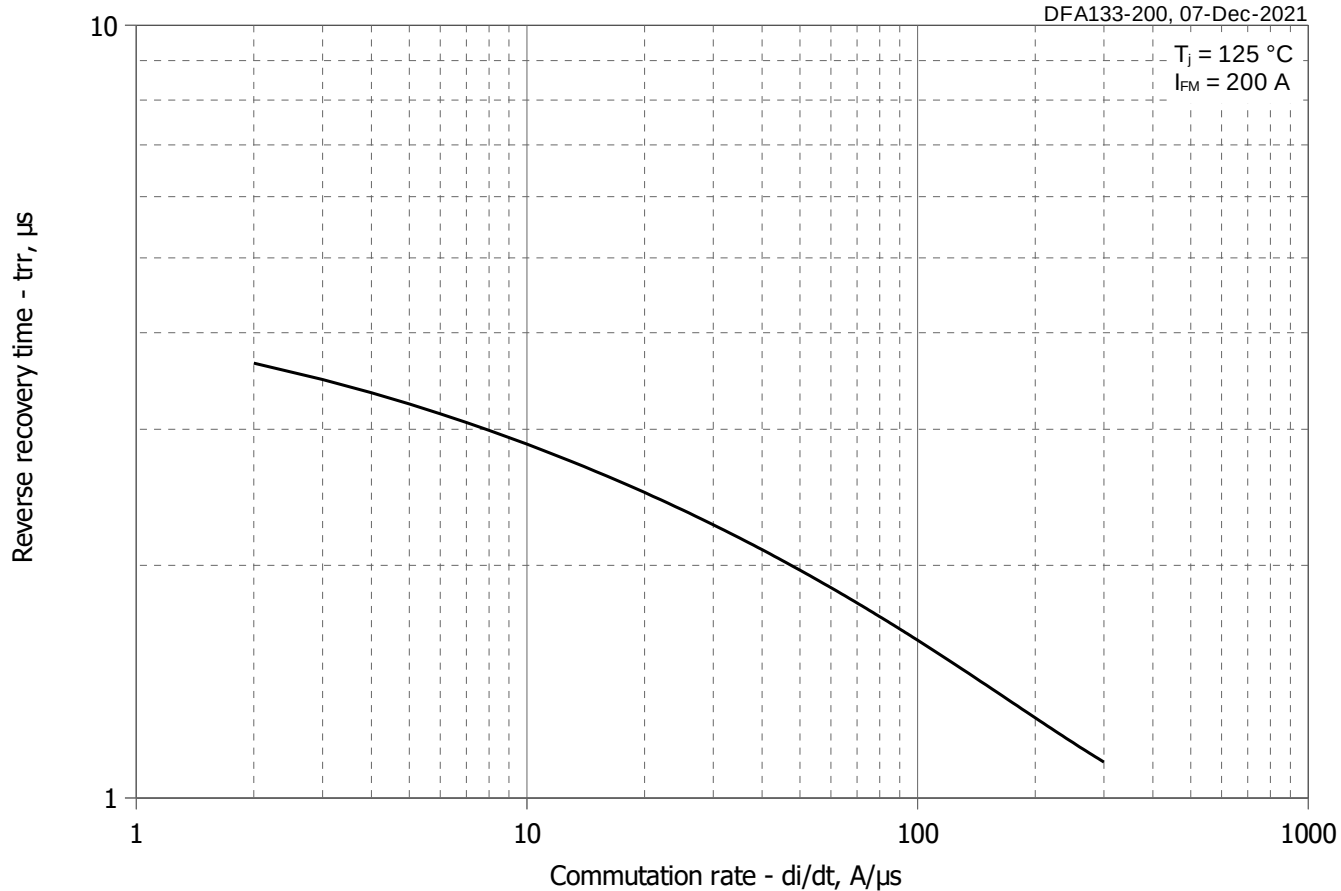


Fig 4 - Maximum recovered charge Q_r vs. commutation rate di_R/dt (50% chord)

$T_j = 125\text{ }^{\circ}\text{C}$
 $I_{FM} = 200\text{ A}$

Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt
 $T_j = 125\text{ }^{\circ}\text{C}$
 $I_{FM} = 200\text{ A}$

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

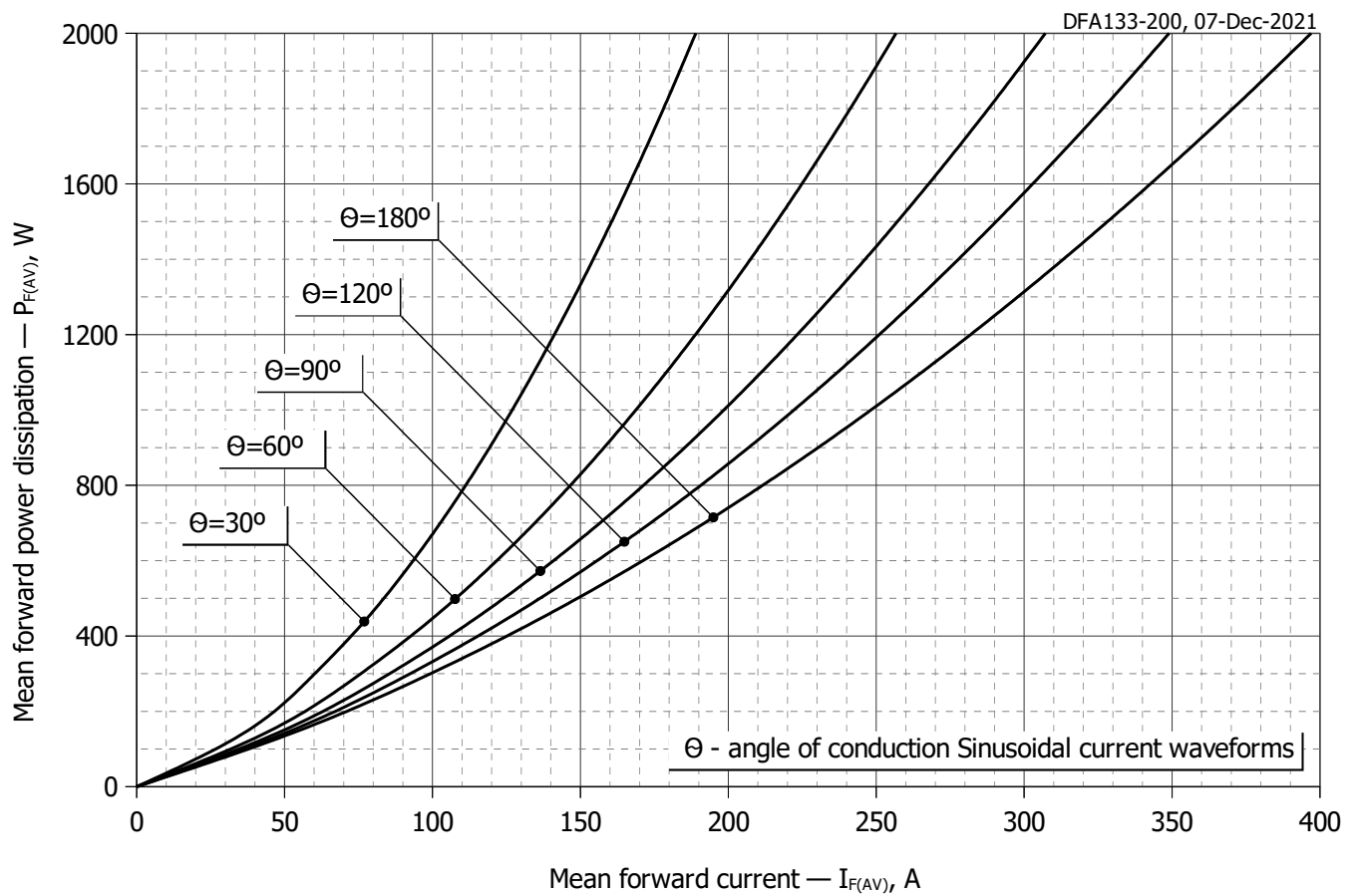


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

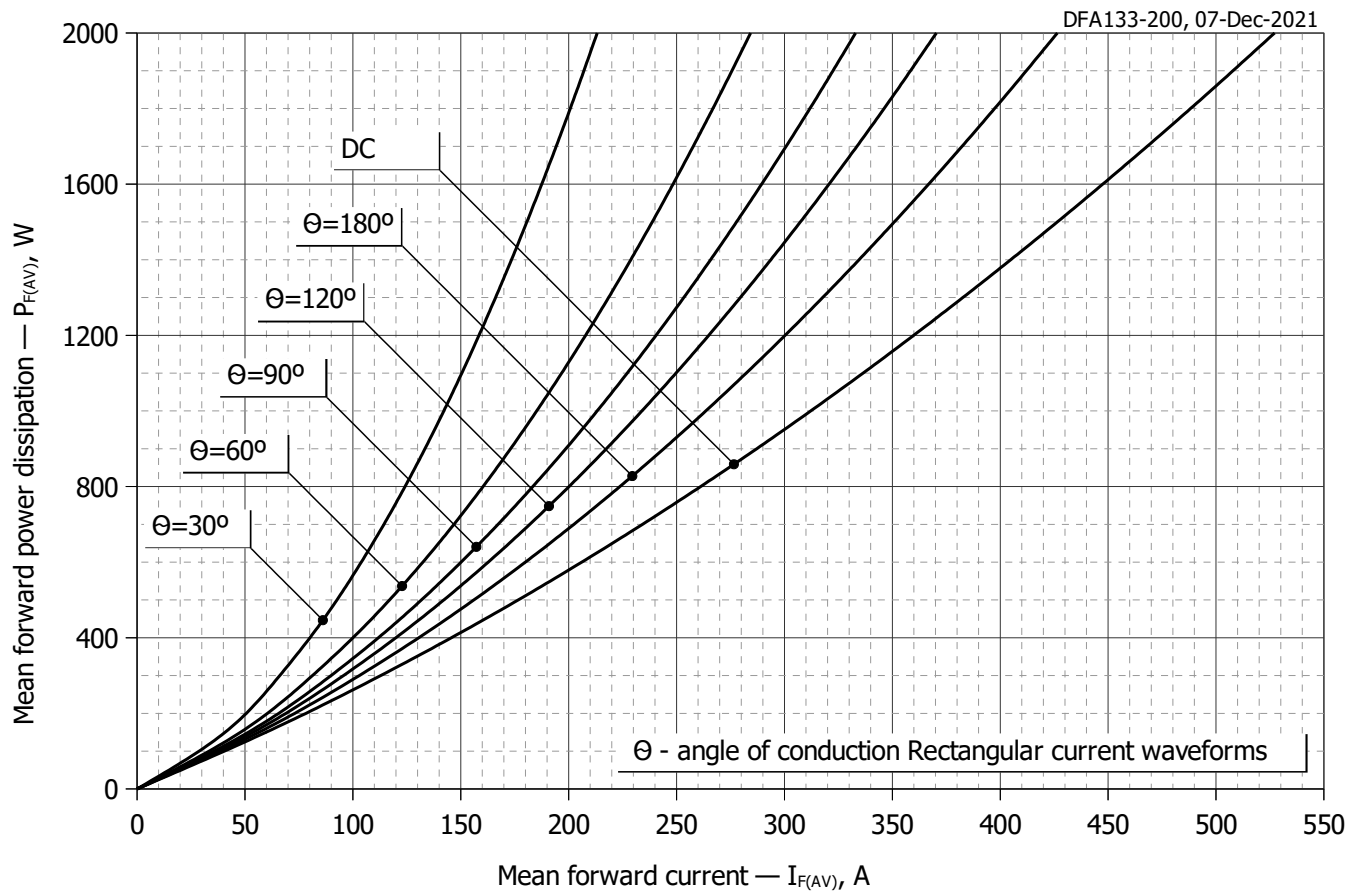


Fig. 8 – Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

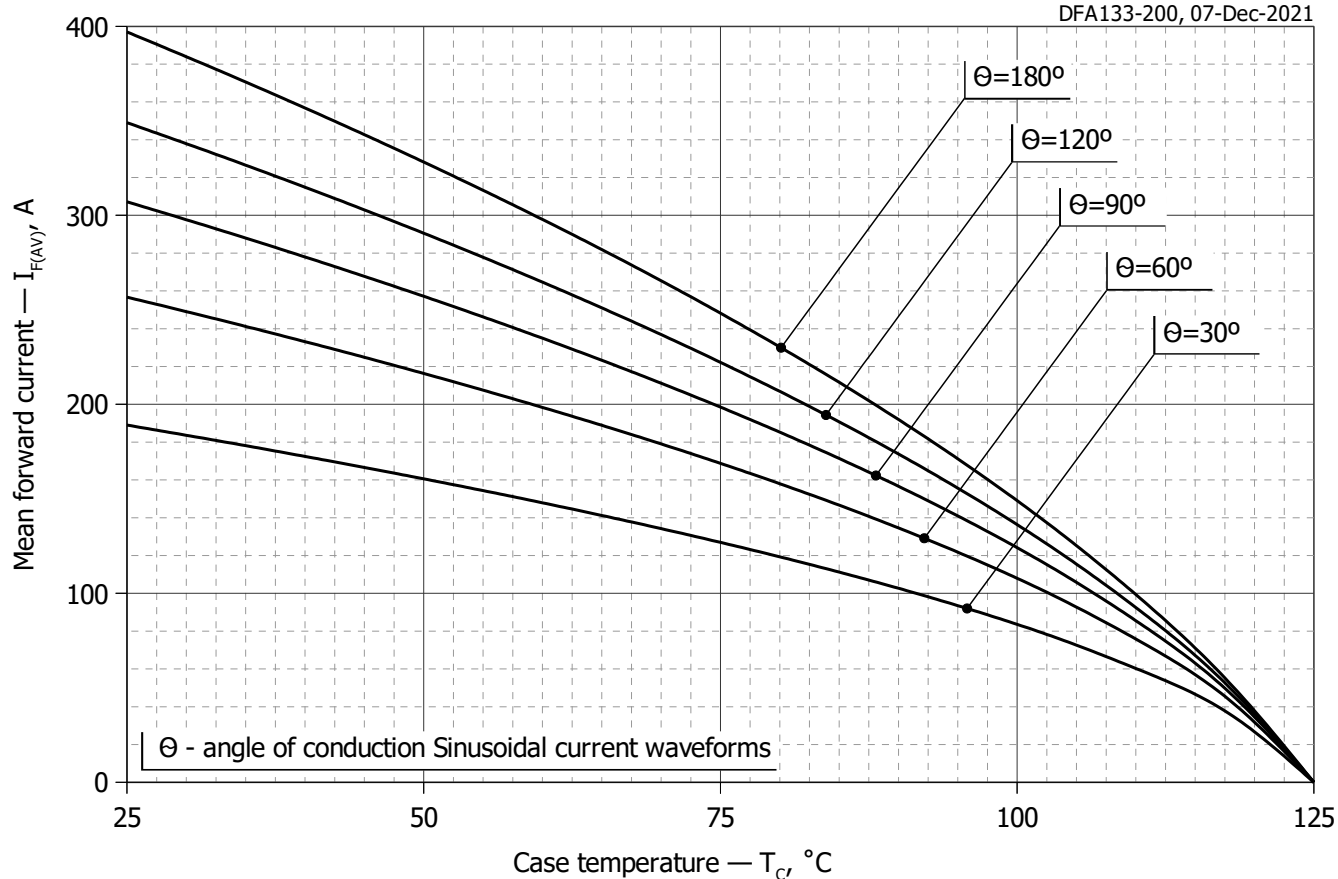


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$, DSC)

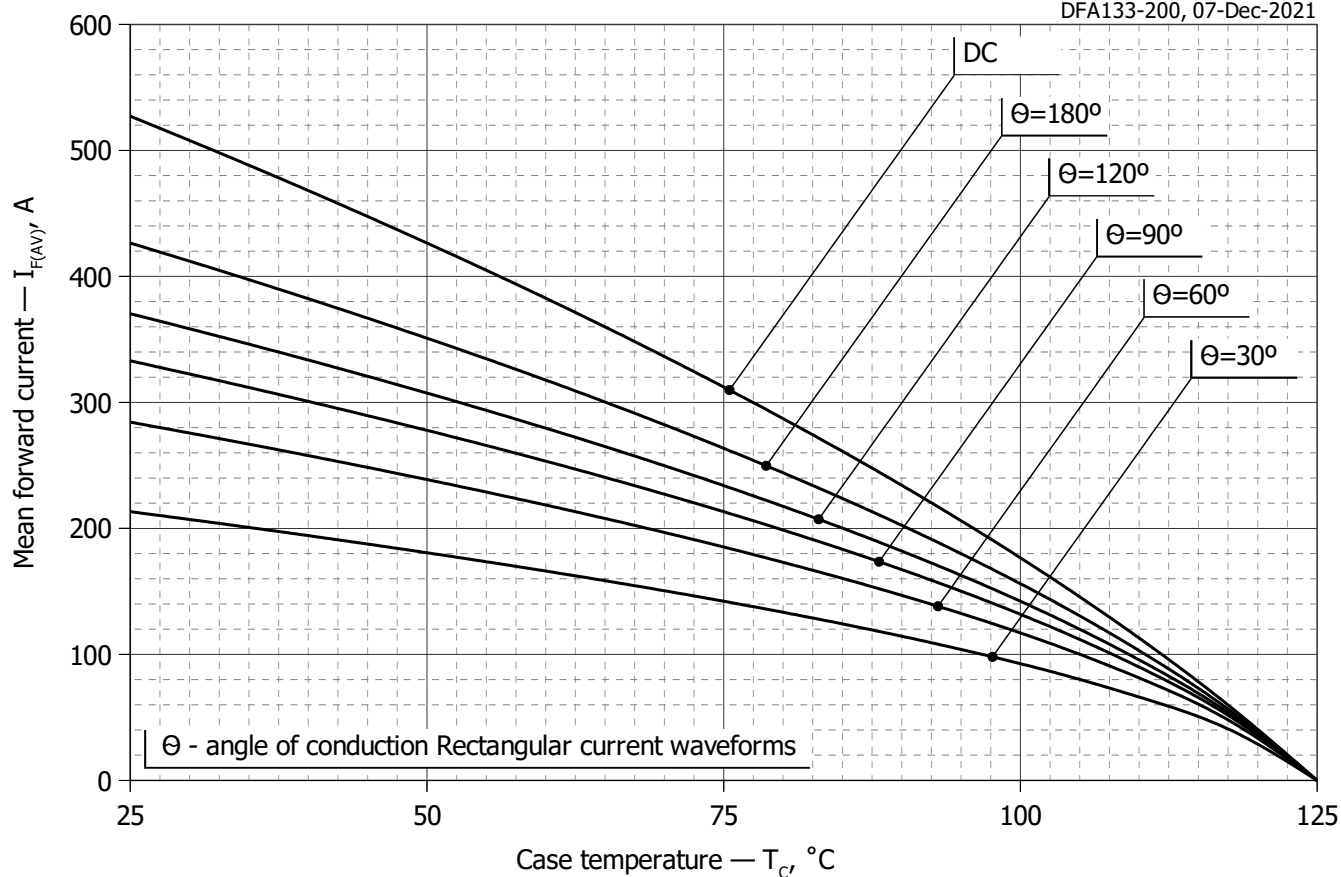


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$, DSC)

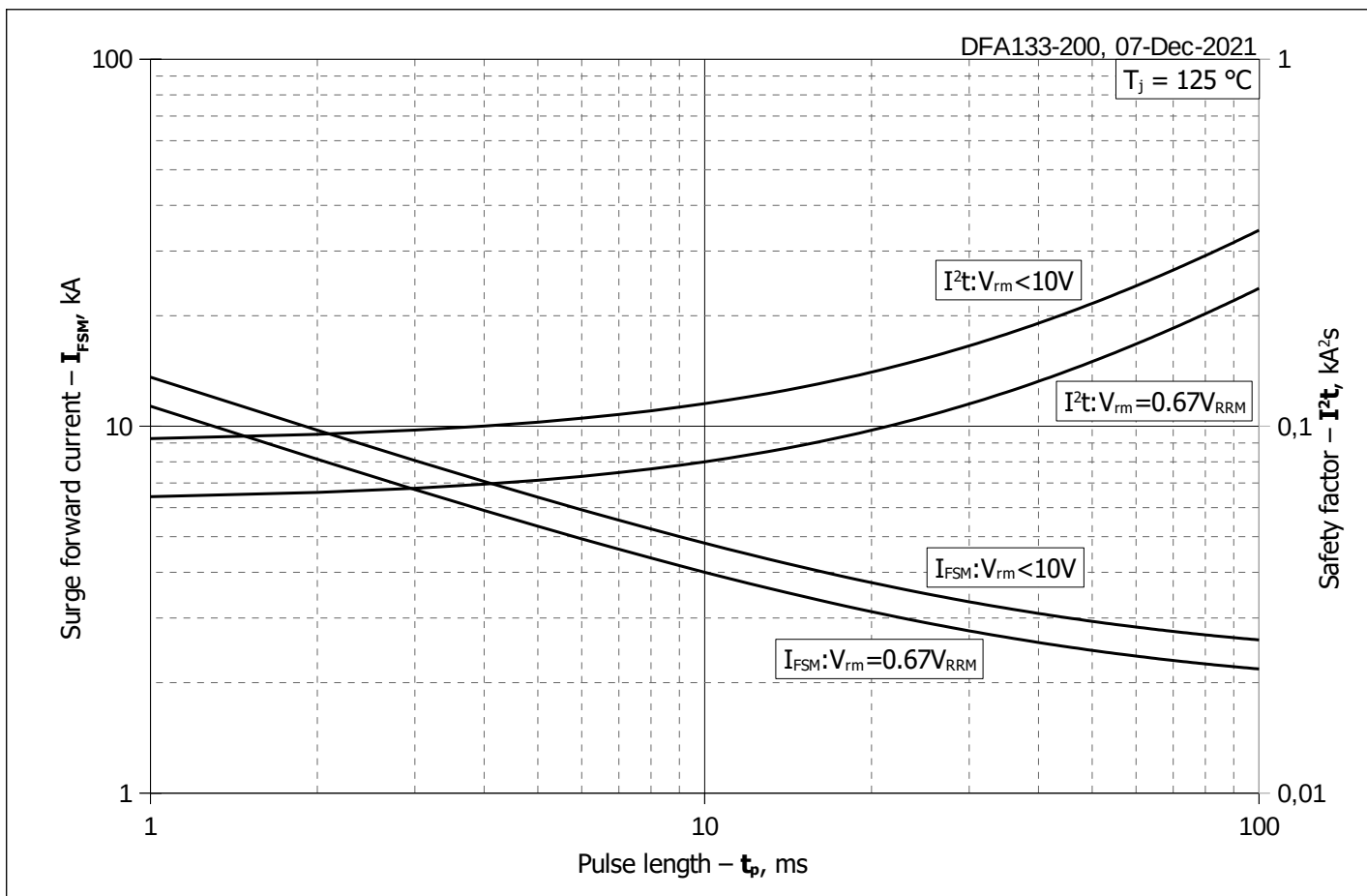


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

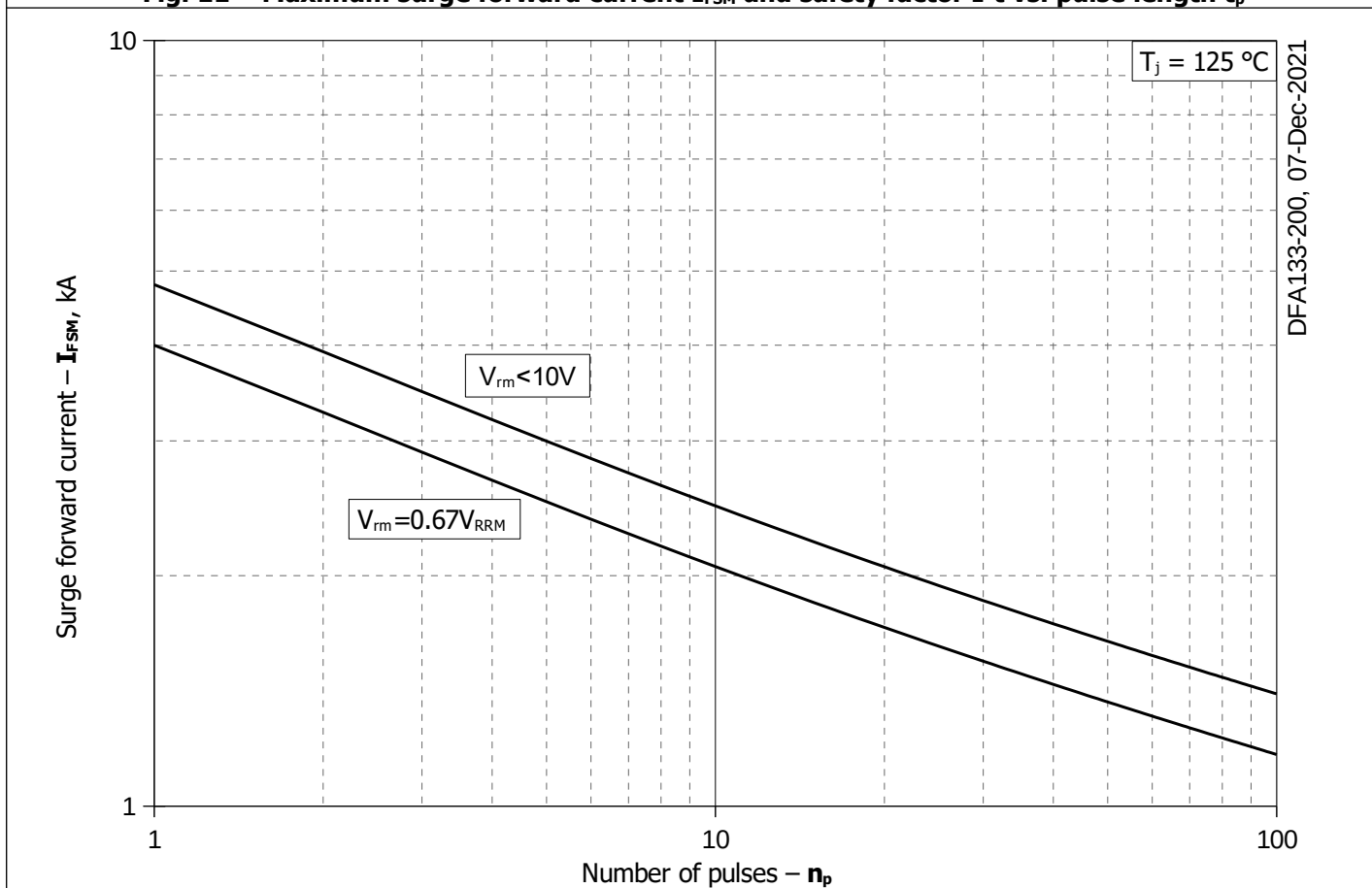


Fig. 12 - Maximum surge forward current I_{FSM} vs. number of pulses n_p