PROTON-ELECTROTEX
RUSSIA

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

Power Rectifier Avalanche Diode Type DA123-320-18

Average forward current				I_{FAV}		320 A		
Repetitive peak reverse voltage				V_{RRM}		1000...1800 V		
V_{RRM}, V	1000	1100	1200	1300	1400	1500	1600	1800
Voltage code	10	11	12	13	14	15	16	18
T_j, °C	–60...+150							

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{FAV}	Maximum allowable average forward current	A	320 424	T_c=116 °C; Double side cooled; T_c=100 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{FRMS}	RMS forward current	A	502	T_c=116 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{FSM}	Surge forward current	kA	5.5 6.5	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V
			6.0 7.0	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^2t	Safety factor	$A^2s\cdot10^3$	150 210	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V
			140 200	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 voltage	V	1000...1800	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; 50 Hz	
$V_{(BR)}$	Breakdown voltage	V	1250...2250	T_j=25 °C; I_{br}=100 mA; t_p = 10 ms; 5 Hz	
V_R	Reverse continuous voltage	V	$0.6\cdot V_{RRM}$	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...+50		
T_j	Operating junction temperature	°C	–60...+150		
MECHANICAL					
F	Mounting force	kN	5.0...7.0		
a	Acceleration	m/s^2	50	Device clamped	

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.60	T_j=25 °C; I_{FM}=1005 A	
$V_{F(TO)}$	Forward threshold voltage, max	V	0.949	$T_j=T_{j\ max}$; $0.5\ \pi\ I_{FAV} < I_T < 1.5\ \pi\ I_{FAV}$	
r_T	Forward slope resistance, max	mΩ	0.706		
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	35	$T_j=T_{j\ max}$; $V_R=V_{RRM}$	
SWITCHING					
Q_{rr}	Total recovered charge, max	µC	1080	$T_j=T_{j\ max}$; $I_{FM}=I_{FAV}$; di_R/dt=-10 A/µs; V_R=100 V	
t_{rr}	Reverse recovery time, max	µs	20		
I_{rr}	Reverse recovery current, max	A	108		
THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.070	Direct current	Double side cooled
R_{thjc-A}			0.154		Anode side cooled
R_{thjc-K}			0.126		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.010	Direct current	
MECHANICAL					
m	Weight, max	g	65		
D_s	Surface creepage distance	mm (inch)	11.74 (0.462)		
D_a	Air strike distance	mm (inch)	11.60 (0.457)		

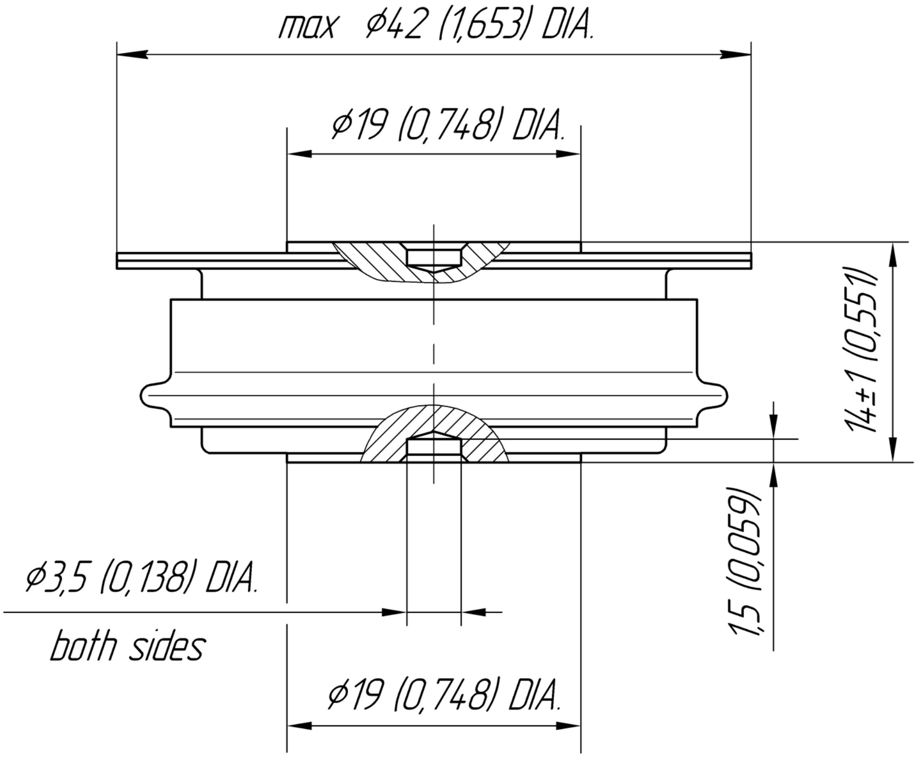
PART NUMBERING GUIDE

DA	123	320	18	N
1	2	3	4	5

1. DA — Avalanche Diode
2. Design version
3. Average forward current, A
4. Voltage code
5. Ambient conditions: N – normal; T – tropical

OVERALL DIMENSIONS

Package type: D.A1



All dimensions in millimeters (inches)

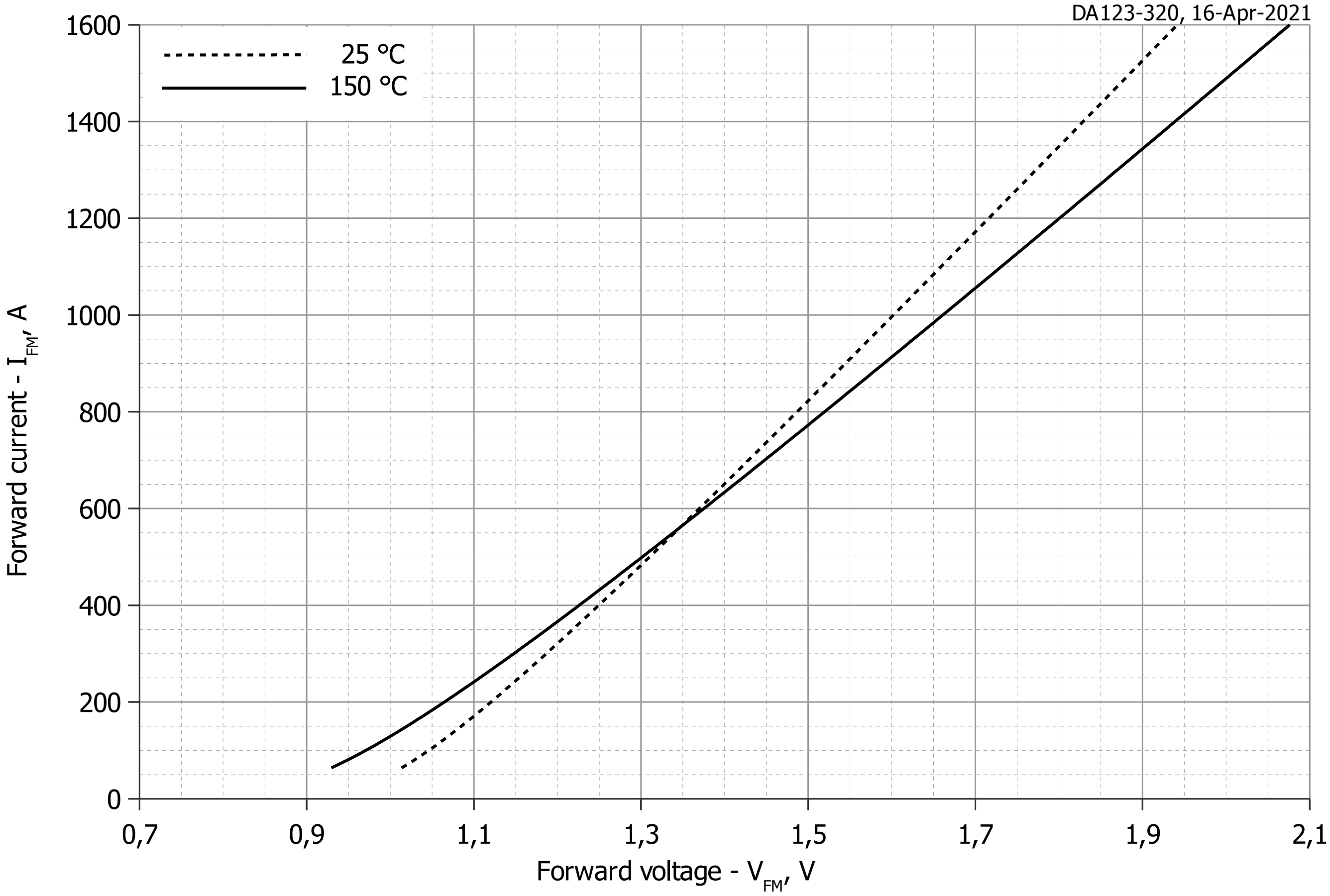


Fig 1 – Forward characteristics of Limit device

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	
	$T_j = 25^oC$	$T_j = T_{j\,max}$
A	0.85699474	0.73590240
B	0.00054225	0.00064253
C	0.02904189	0.03337101
D	0.00006702	0.00164717

Forward characteristic model (see Fig. 1).

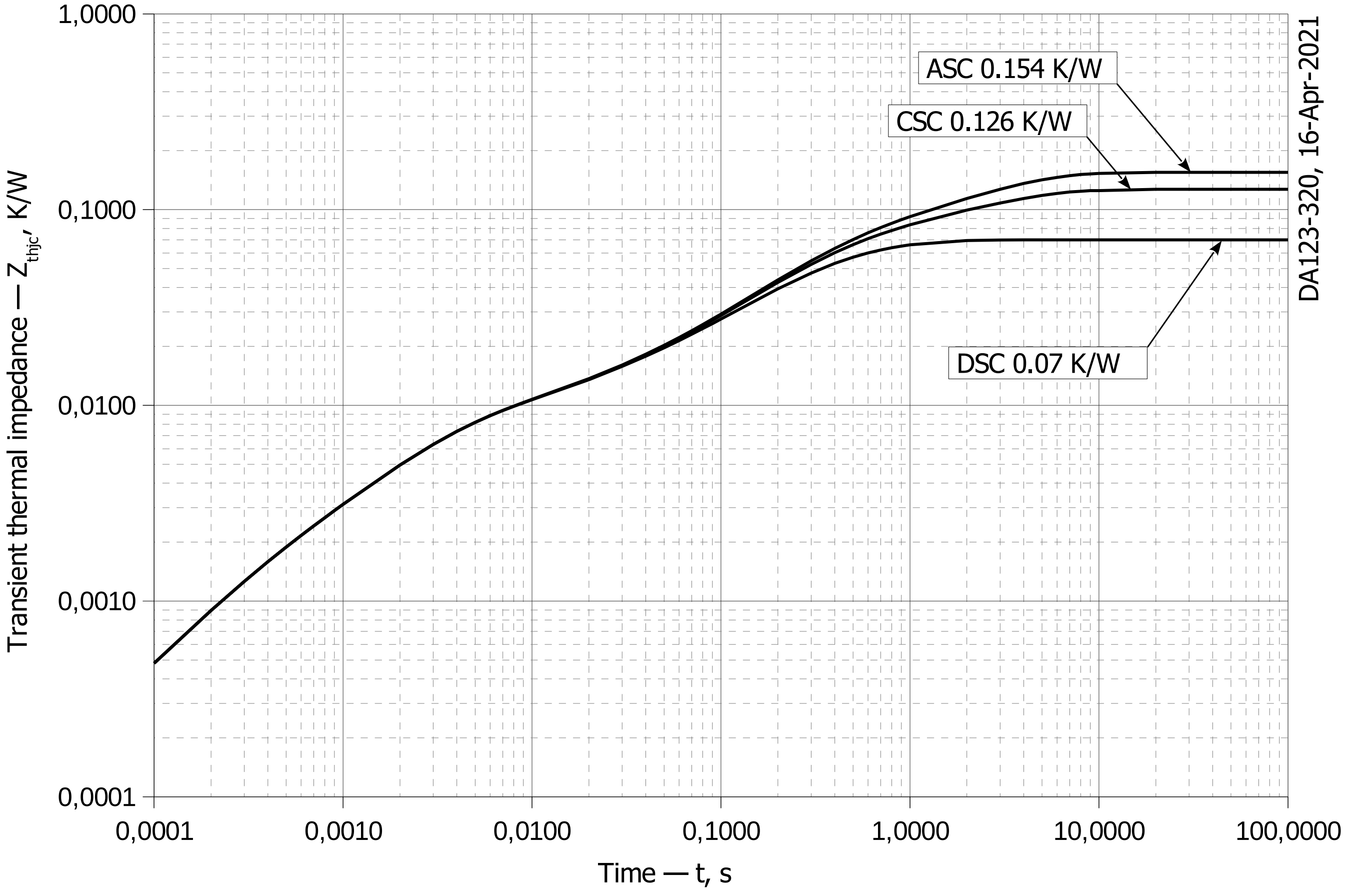


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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.

$\mathbf{Z_{thjc}}$ = Thermal resistance at time t.

$\mathbf{R_i}$ = 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	0.03233	0.02226	0.005231	0.002739	0.006738	0.0006988
τ_i, s	0.2392	0.533	0.1478	0.01499	0.002749	0.0002969

DC Anode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.08459	0.02327	0.002598	0.006598	0.0006736	0.03694
τ_i, s	2.653	0.5669	0.01311	0.00269	0.0002871	0.2416

DC Cathode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.05654	0.03706	0.002638	0.006637	0.0006786	0.02303
τ_i, s	2.653	0.2338	0.01361	0.002704	0.000289	0.5476

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

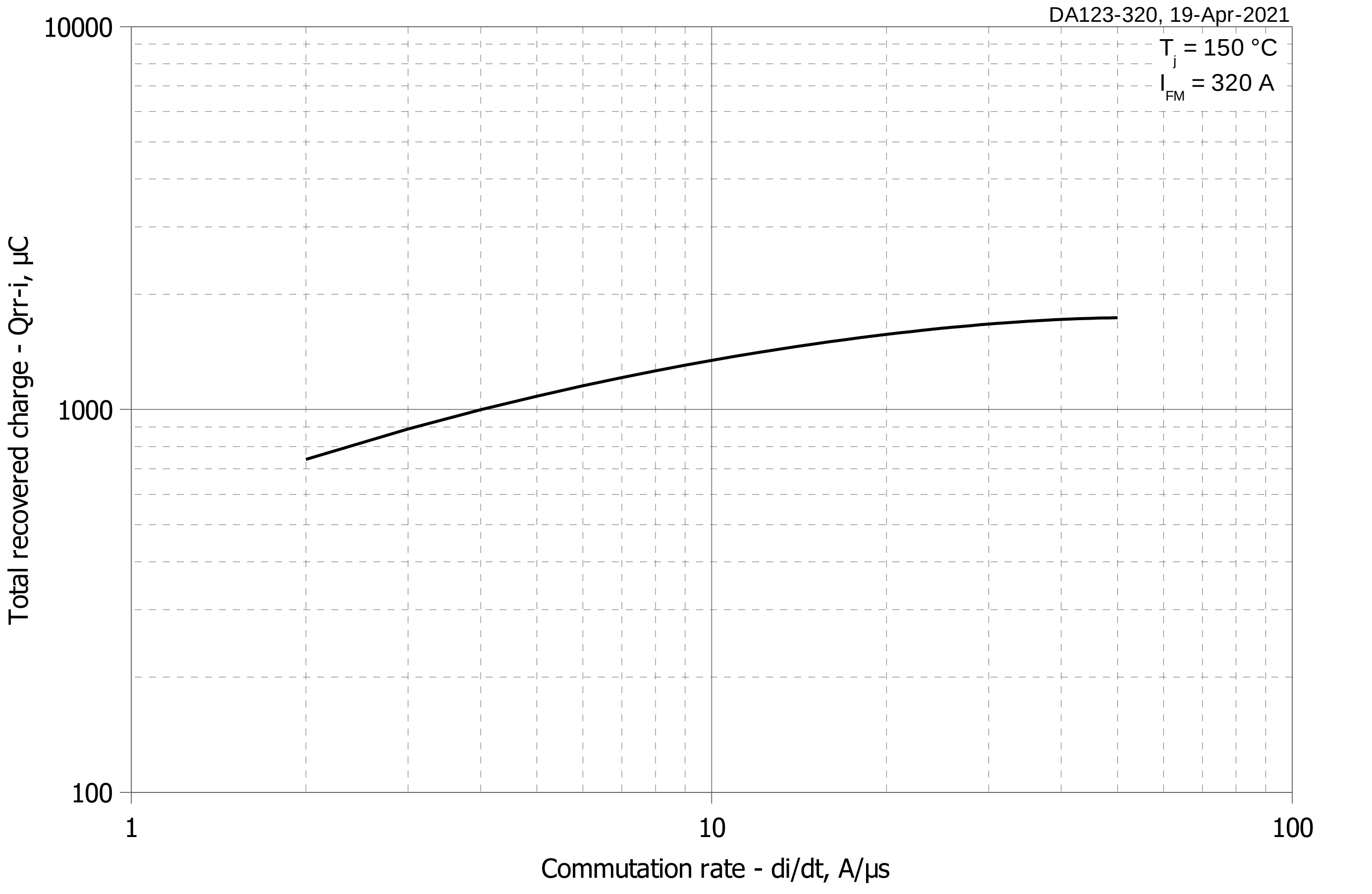


Fig 3 - Total recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

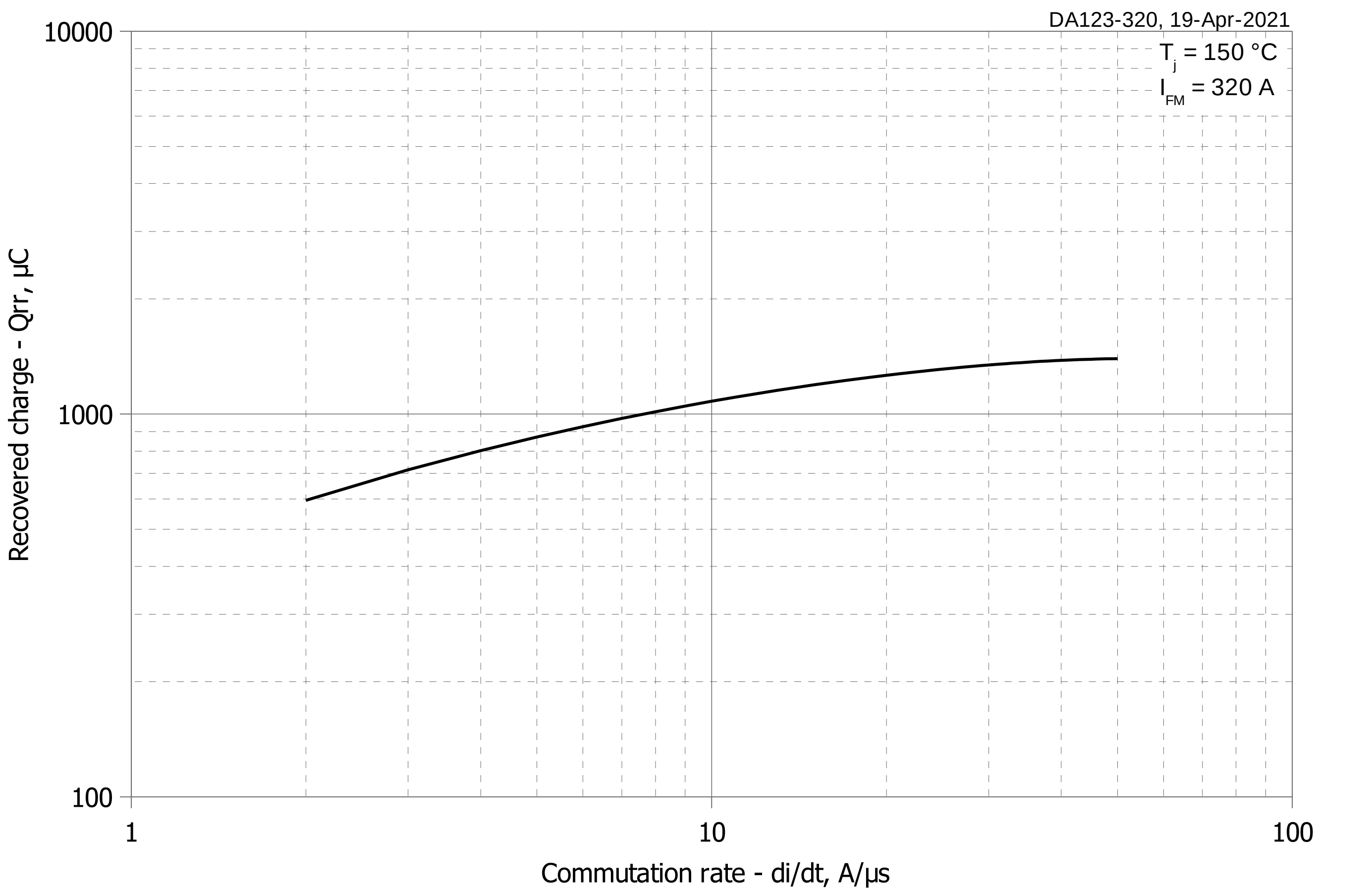


Fig 4 - Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

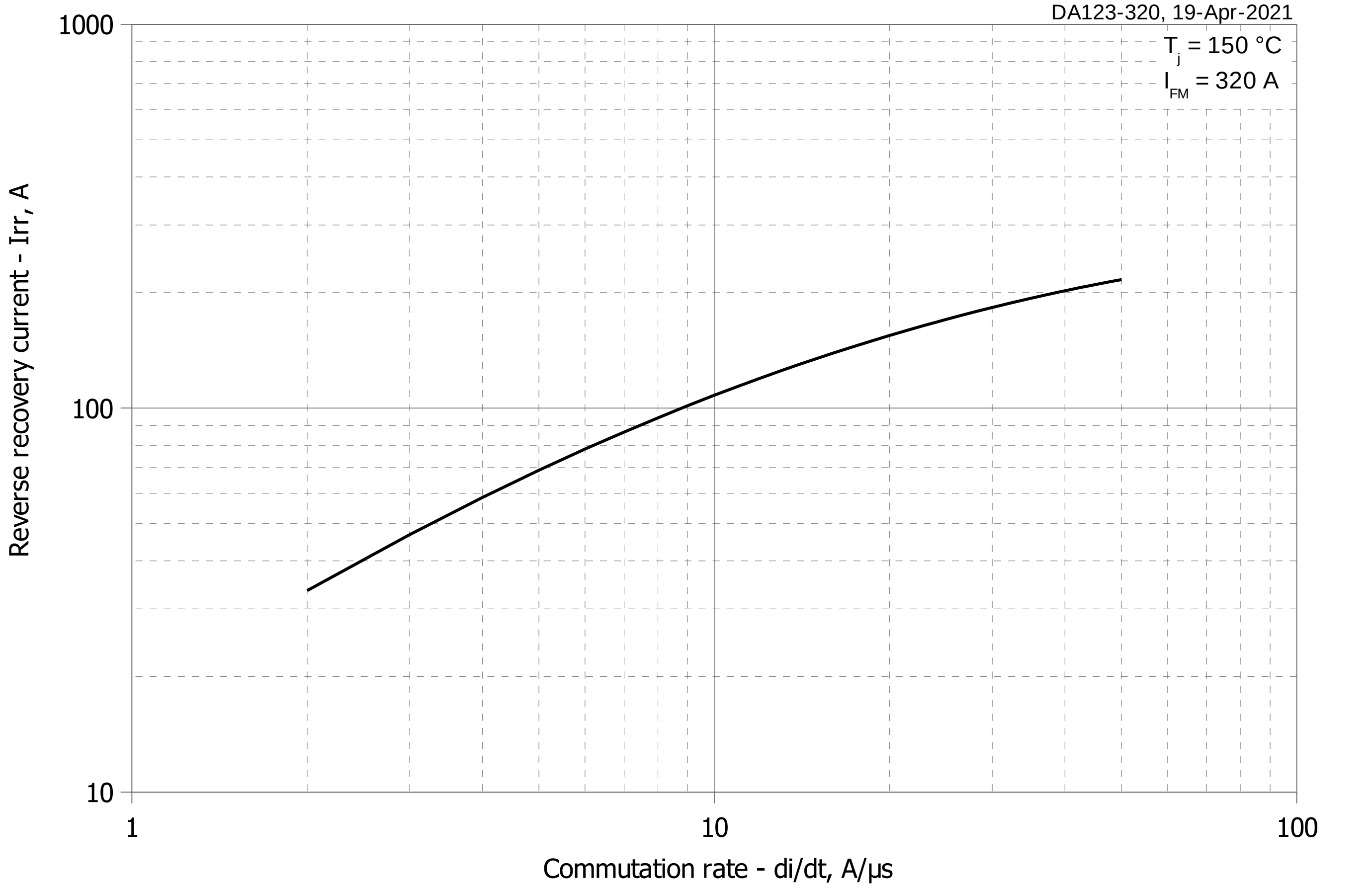


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

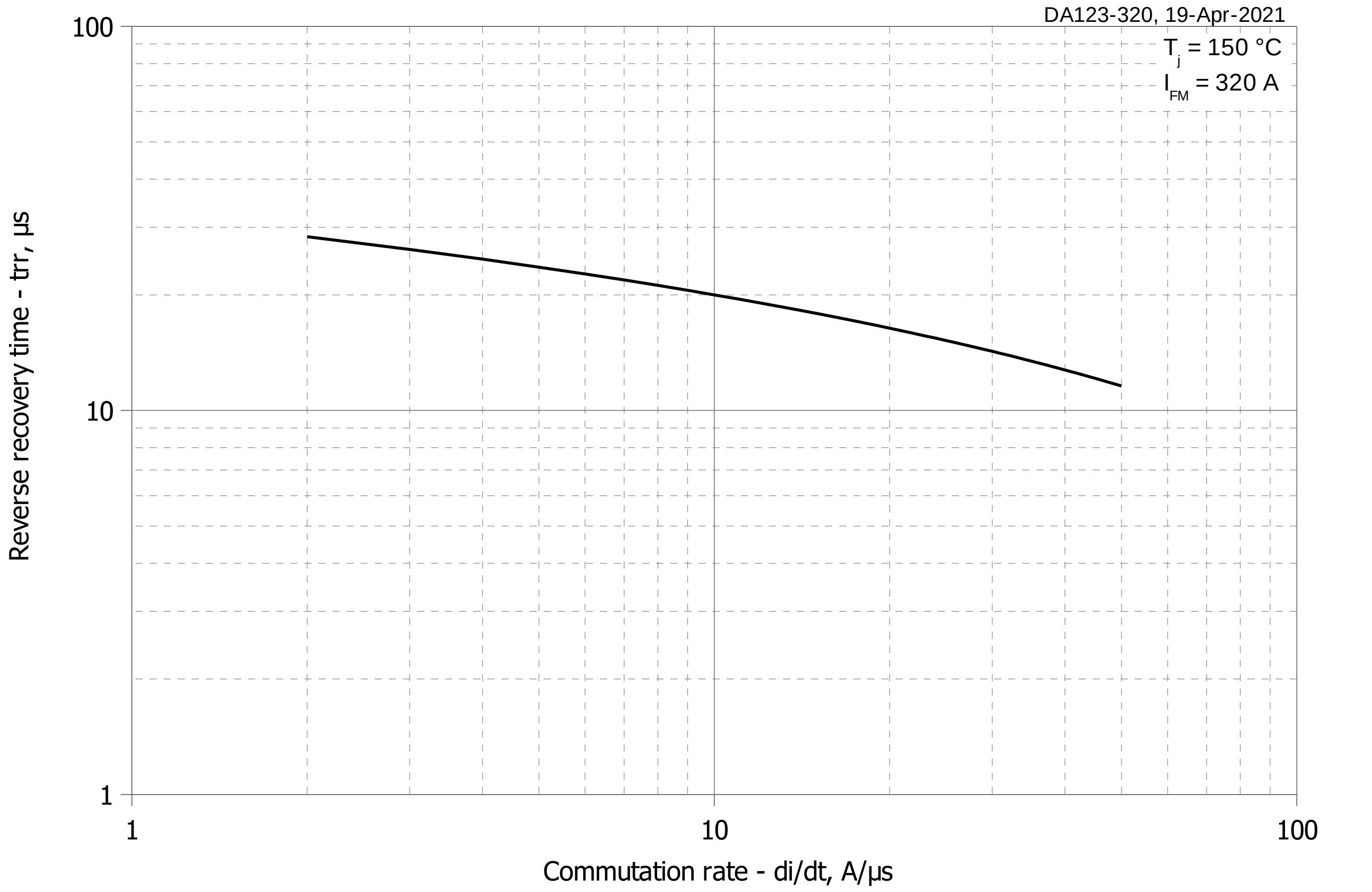


Fig 6 - Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

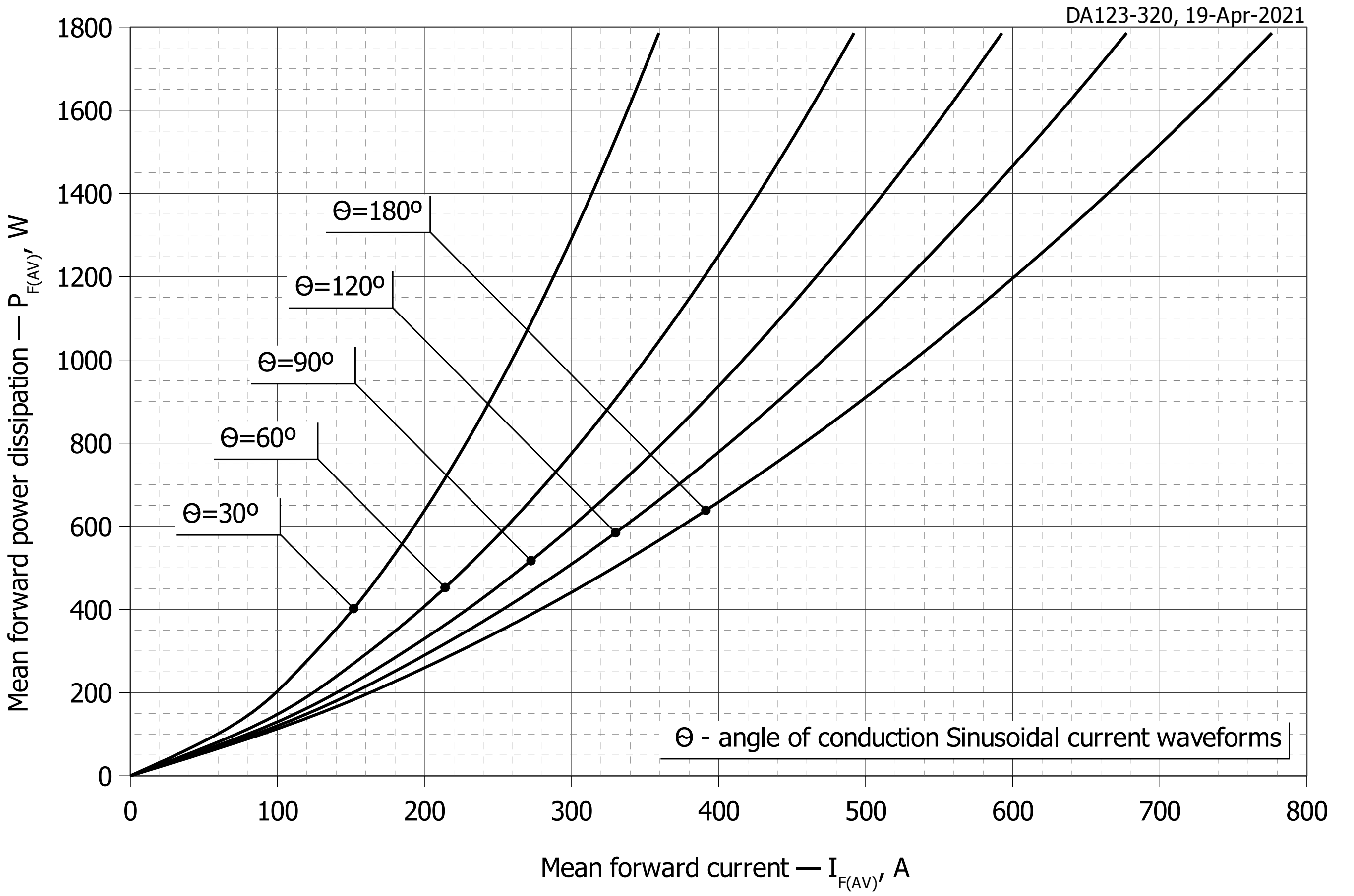


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

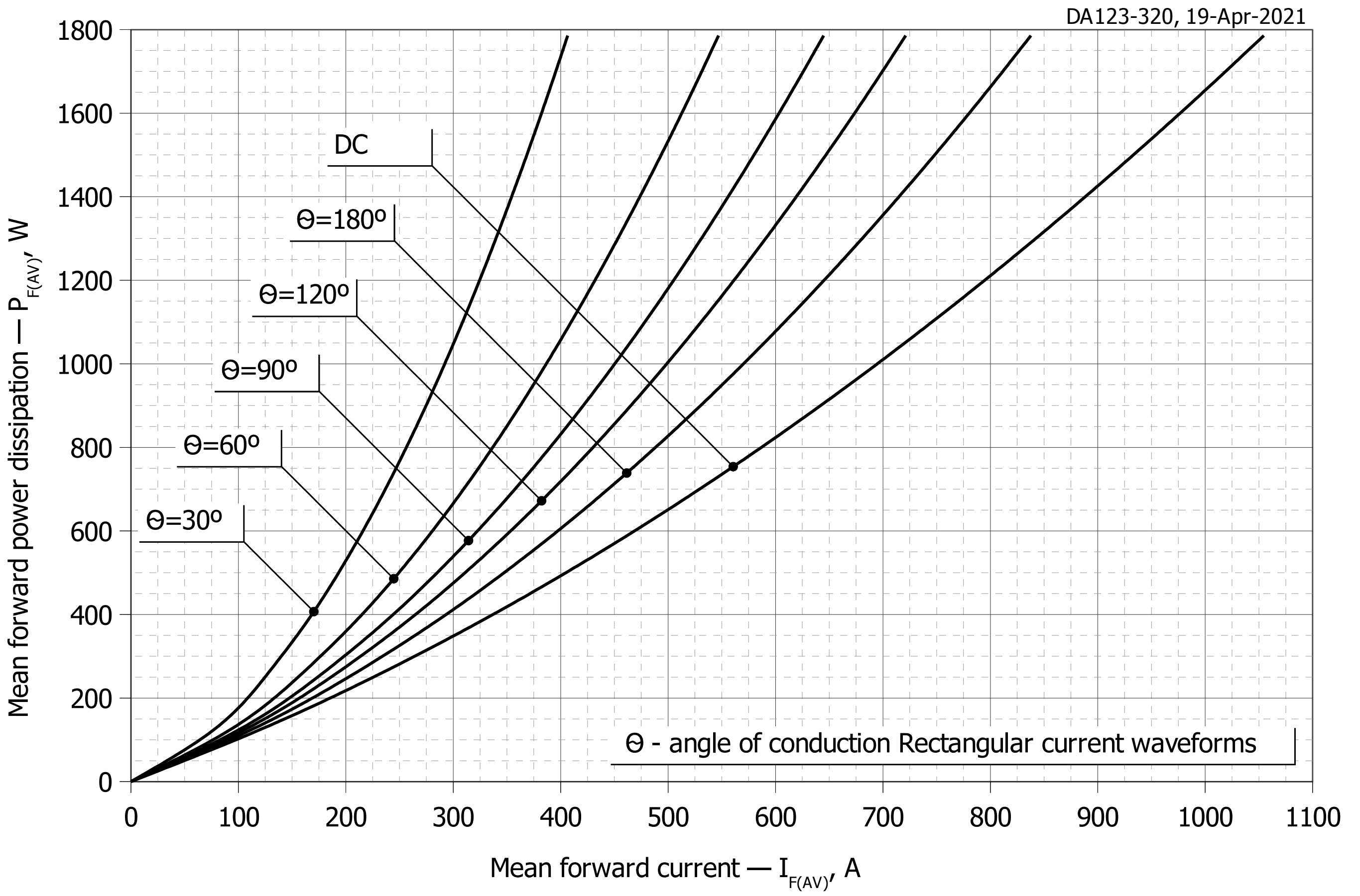


Fig. 8 – Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

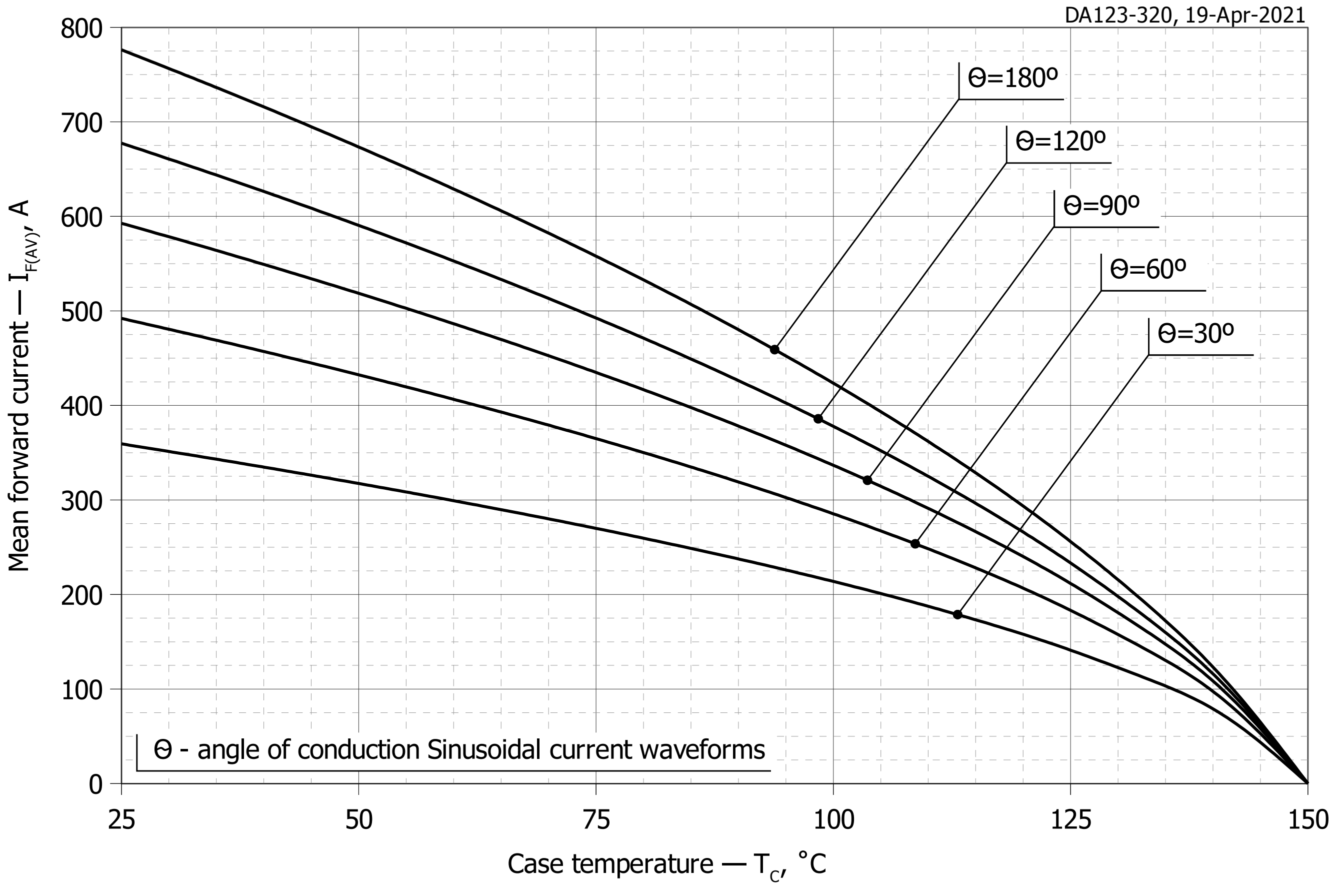


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

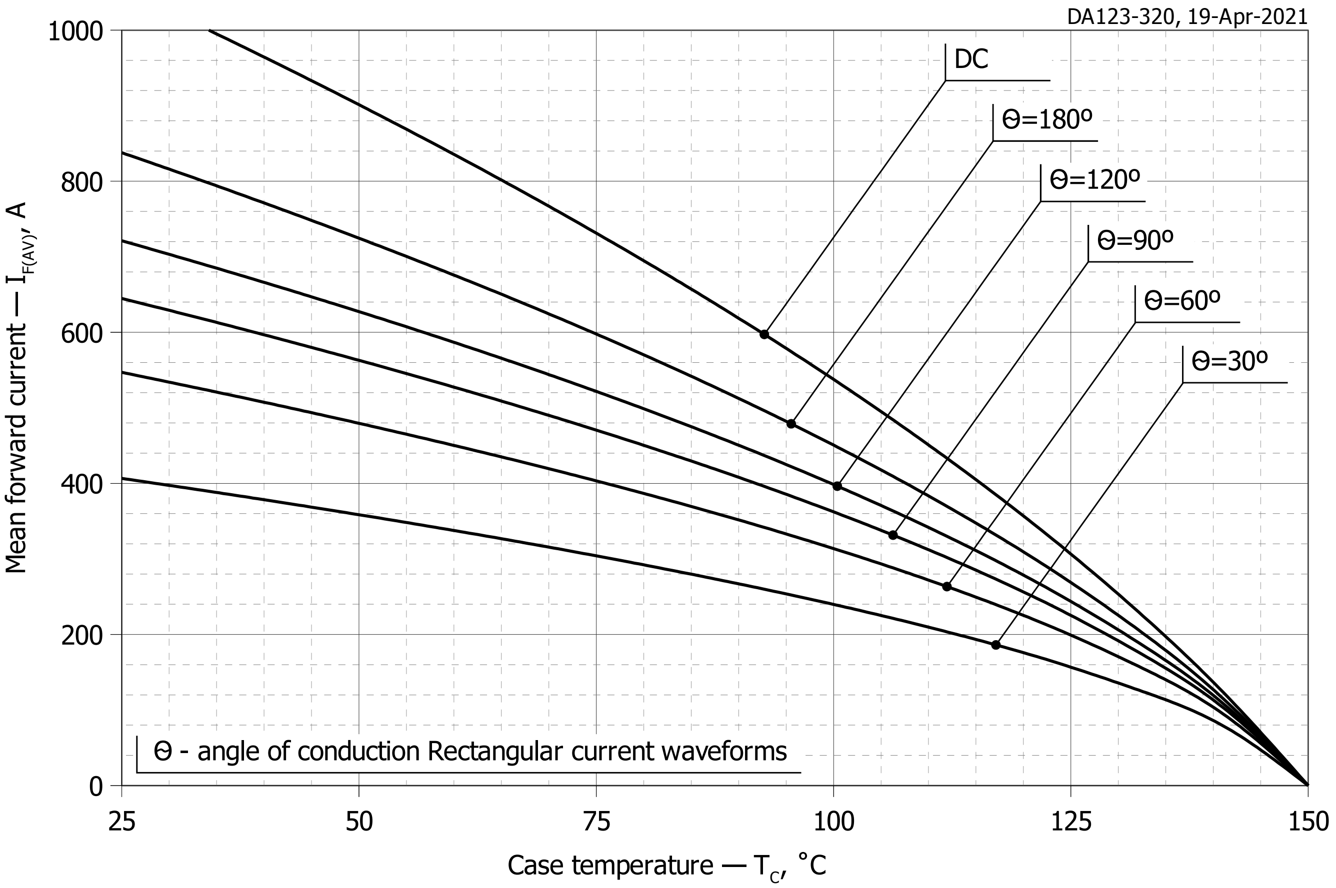


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

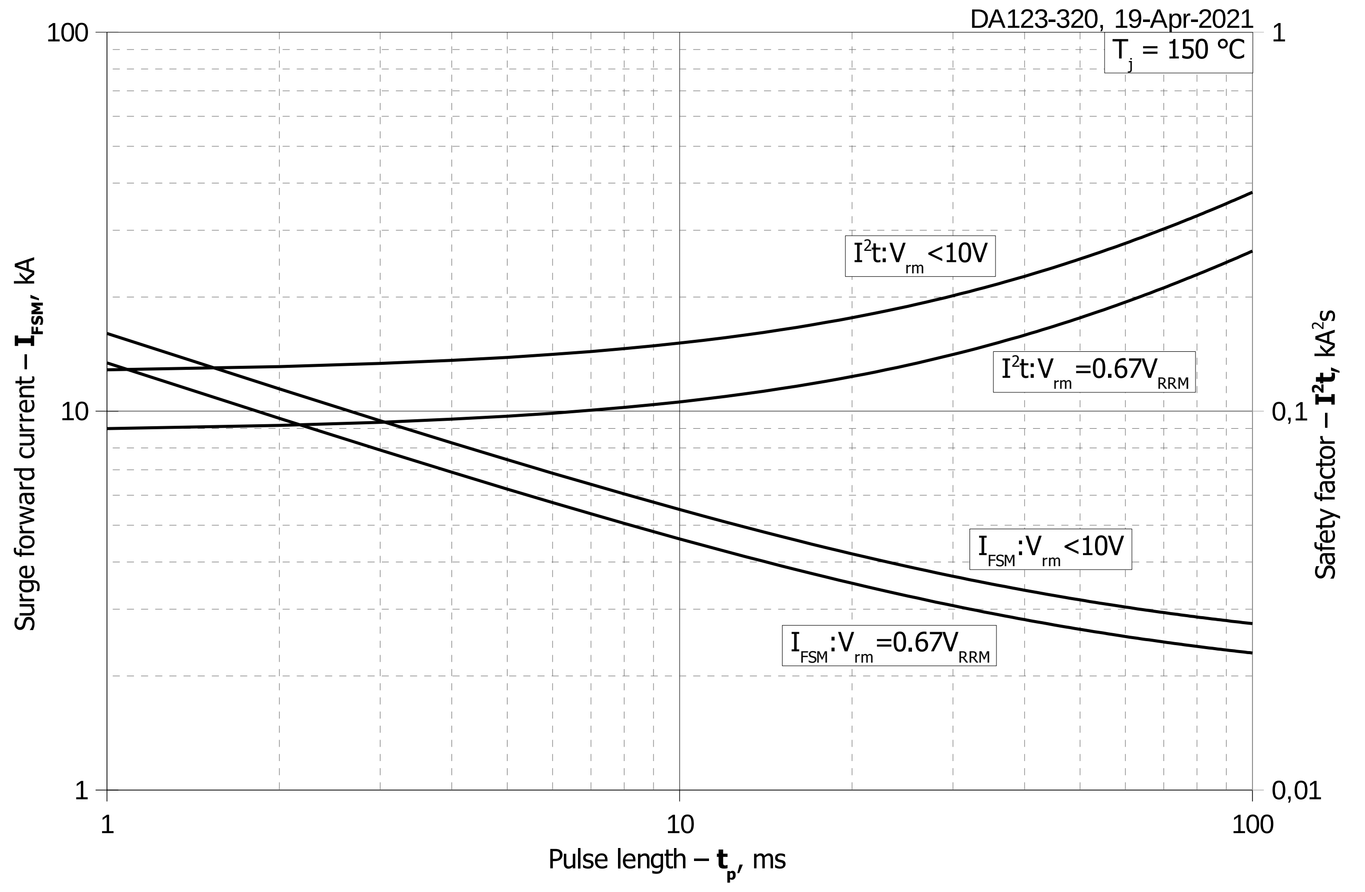


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

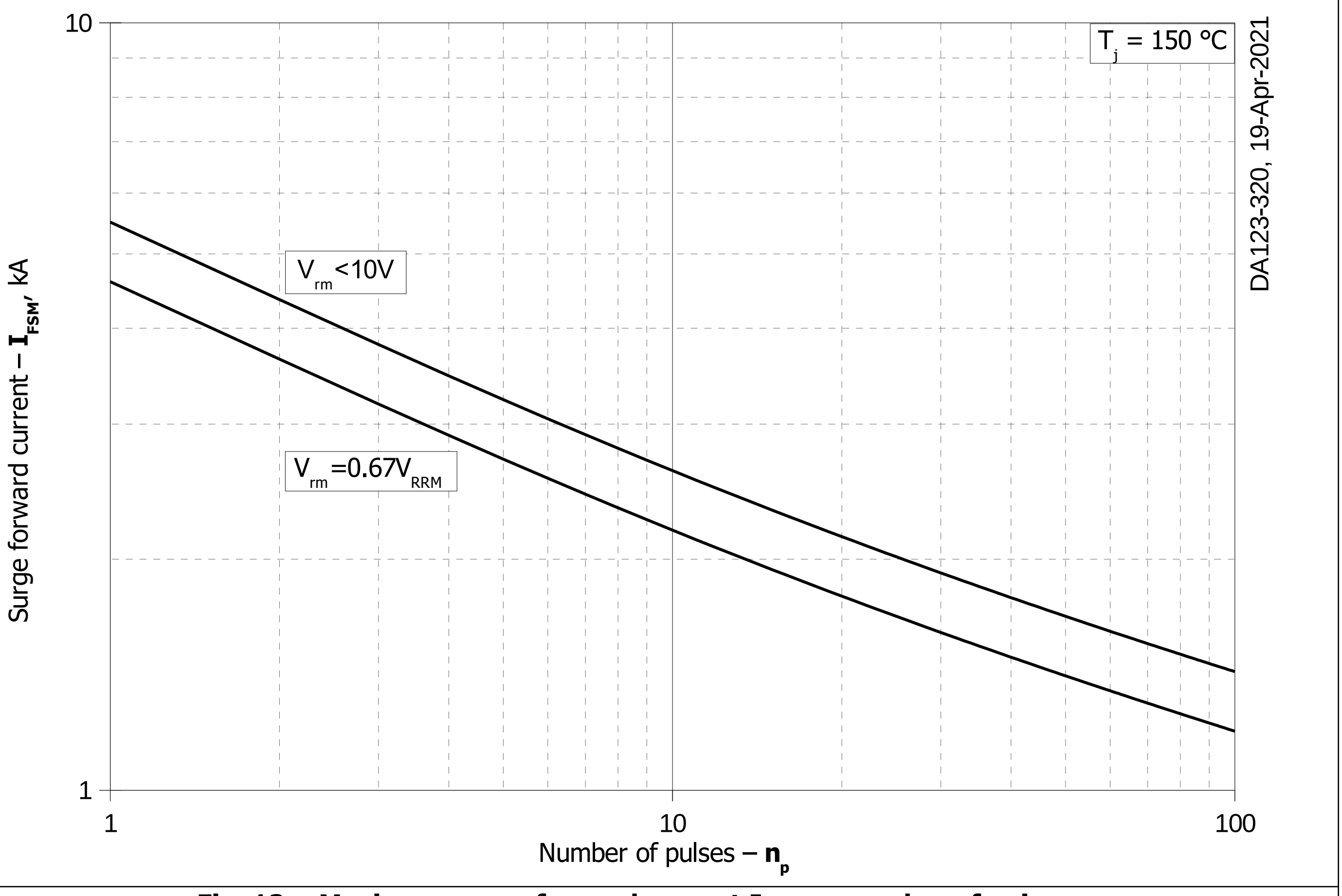


Fig. 12 - Maximum surge forward current I_{FSM} vs. number of pulses n_p