



Double Diode Module
For Phase Control
MDx-215-22-F

Electrically isolated base plate
Industrial standard package
Simplified mechanical design, rapid assembly
Pressure contact

Average forward current	I_{FAV}	215 A
Repetitive peak reverse voltage	V_{RRM}	2000...2200 V
V_{RRM}, V	2000	2200
Voltage code	20	22
$T_j, ^\circ C$	-40...+150	

MD3	MD4	MD5
plug 2,8x0,8 23(0,905) 23(0,905) 17(0,669) 9,8(0,385) 5(0,197) 28,2 (1,110) 30(1,181) 94(3,7) $\phi 6,5(0,256) DIA$ 2 aperture 80(3,15) 5(0,197) 13(0,511) 24(0,994) 34(1,338) M6		

All dimensions in millimeters (inches)

MAXIMUM ALLOWABLE RATINGS

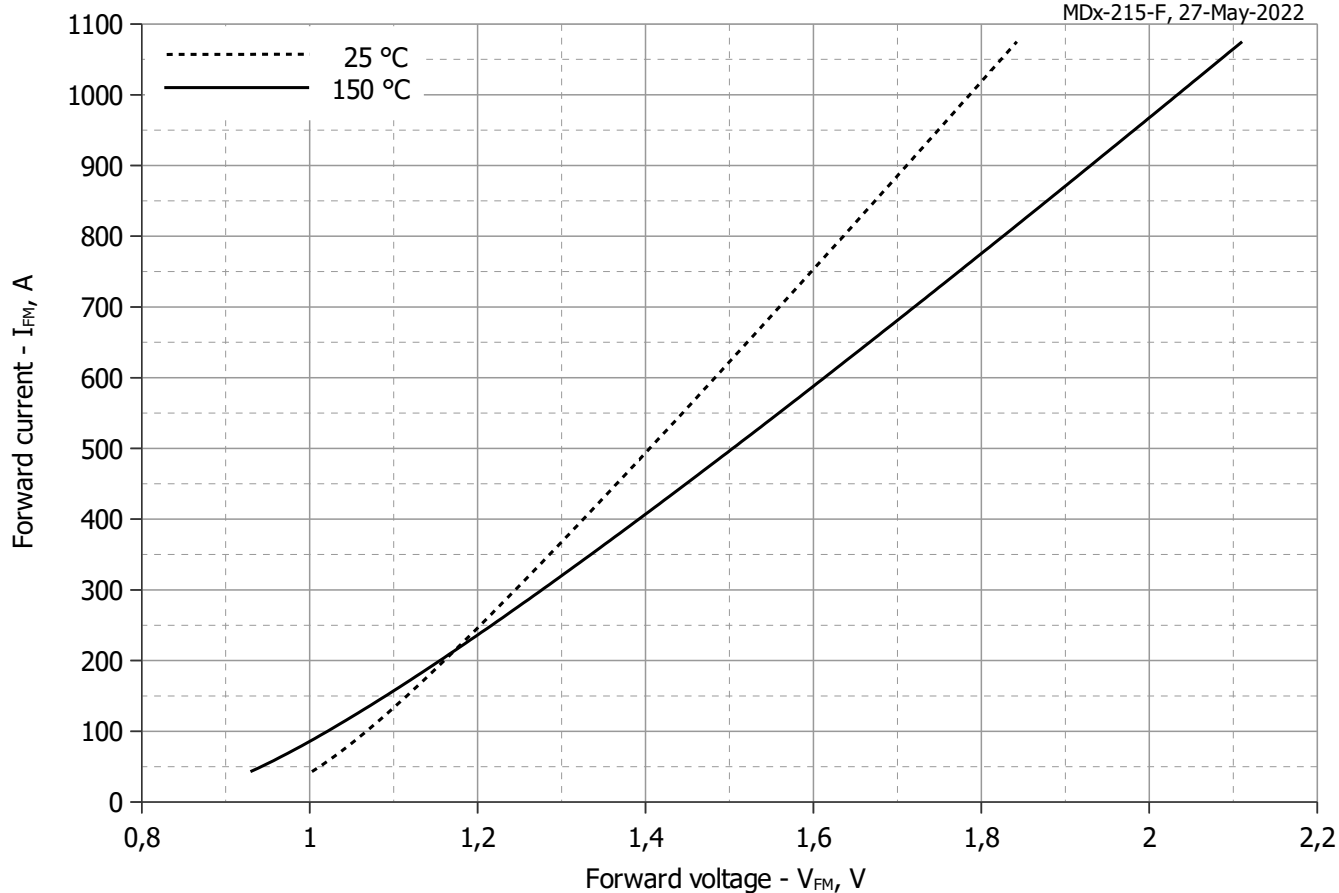
Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I _{FAV}	Maximum allowable average forward current	A	215 198	T _c =94 °C; T _c =100 °C; 180° half-sine wave; 50 Hz	
I _{FRMS}	RMS forward current	A	337	T _c =94 °C; 180° half-sine wave; 50 Hz	
I _{FSM}	Surge forward current	kA	6.4 7.5	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V
			6.5 7.5	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	200 280	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V
			170 230	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	2000...2200	T _{j min} < T _j < T _{j max} ; 180° half-sine wave; 50 Hz	
V _{RSM}	Non-repetitive peak reverse voltages	V	2100...2300	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	−40...+50		
T _j	Operating junction temperature	°C	−40...+150		
T _{c op}	Operating temperature	°C	−40...+125		
MECHANICAL					
a	Acceleration under vibration	m/s ²	50		

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.40	$T_j=25\text{ }^{\circ}\text{C}$; $I_{FM}=500\text{ A}$	
$V_{F(TO)}$	Forward threshold voltage, max	V	0.958	$T_j=T_{j\text{ max}}$;	
r_T	Forward slope resistance, max	mΩ	1.076	$0.5\pi I_{FAV} < I_T < 1.5\pi I_{FAV}$	
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	20 2.50	$T_j=T_{j\text{ max}}$ $T_j=25\text{ }^{\circ}\text{C}$	$V_R=V_{RRM}$
SWITCHING					
Q_r	Recovered charge, max	μC	1350	$T_j=T_{j\text{ max}}$; $I_{FM}=I_{FAV}$;	
t_{rr}	Reverse recovery time, max	μs	25	$di_R/dt=-10\text{ A}/\mu\text{s}$;	
I_{rr}	Reverse recovery current, max	A	108	$V_R=100\text{ V}$	
THERMAL					
R_{thjc}	Thermal resistance, junction to case				
	per module	°C/W	0.0850	180° half-sine wave, 50 Hz	
	per arm	°C/W	0.1700		
	per module	°C/W	0.0800	DC	
	per arm	°C/W	0.1600		
R_{thch}	Thermal resistance, case to heatsink				
	per module	°C/W	0.0300		
	per arm	°C/W	0.0600		

INSULATION					
V _{ISOL}	Insulation test voltage	kV	3.00	Sine wave, 50 Hz; RMS	t=60 sec
			3.60		t=1 sec
MECHANICAL					
M ₁	Mounting torque (M6) ¹⁾	Nm	6.00	Tolerance ± 15%	
M ₂	Terminal connection torque (M6) ¹⁾	Nm	6.00	Tolerance ± 15%	
m	Weight, max	g	360		

PART NUMBERING GUIDE			NOTES
MD	3	-	¹⁾ The screws must be lubricated
1	2		
		215	
		-	
		22	
		-	
		F	
		-	
		N	
		6	
1. MD - Rectifier Diode 2. Circuit Schematic 3. Average Forward Current, A 4. Voltage Code 5. Package Type (M.F) 6. Ambient Conditions: N – Normal			

**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	0.87407359	0.78795905
B	0.00069914	0.00086624
C	0.02312669	0.01091874
D	0.00167861	0.00960920

Forward characteristic model (see Fig. 1).

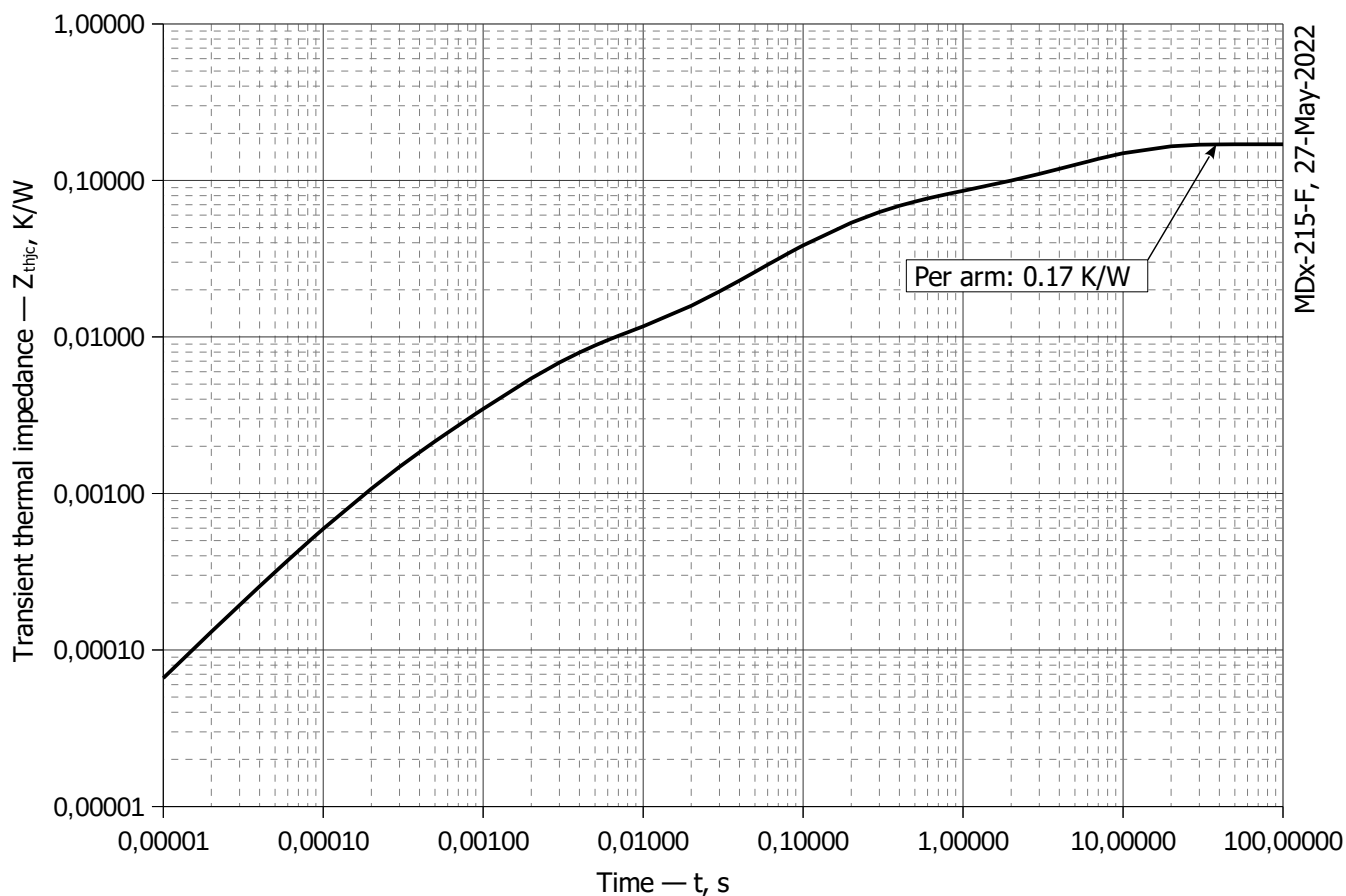


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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.

i	1	2	3	4	5	6
R_i , K/W	0.0007228424	0.006639986	0.0153862565	0.0389709604	0.0142906115	0.09398934
τ_i , s	0.0002111	0.002366	0.06905	0.1909	0.6646	6.64

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

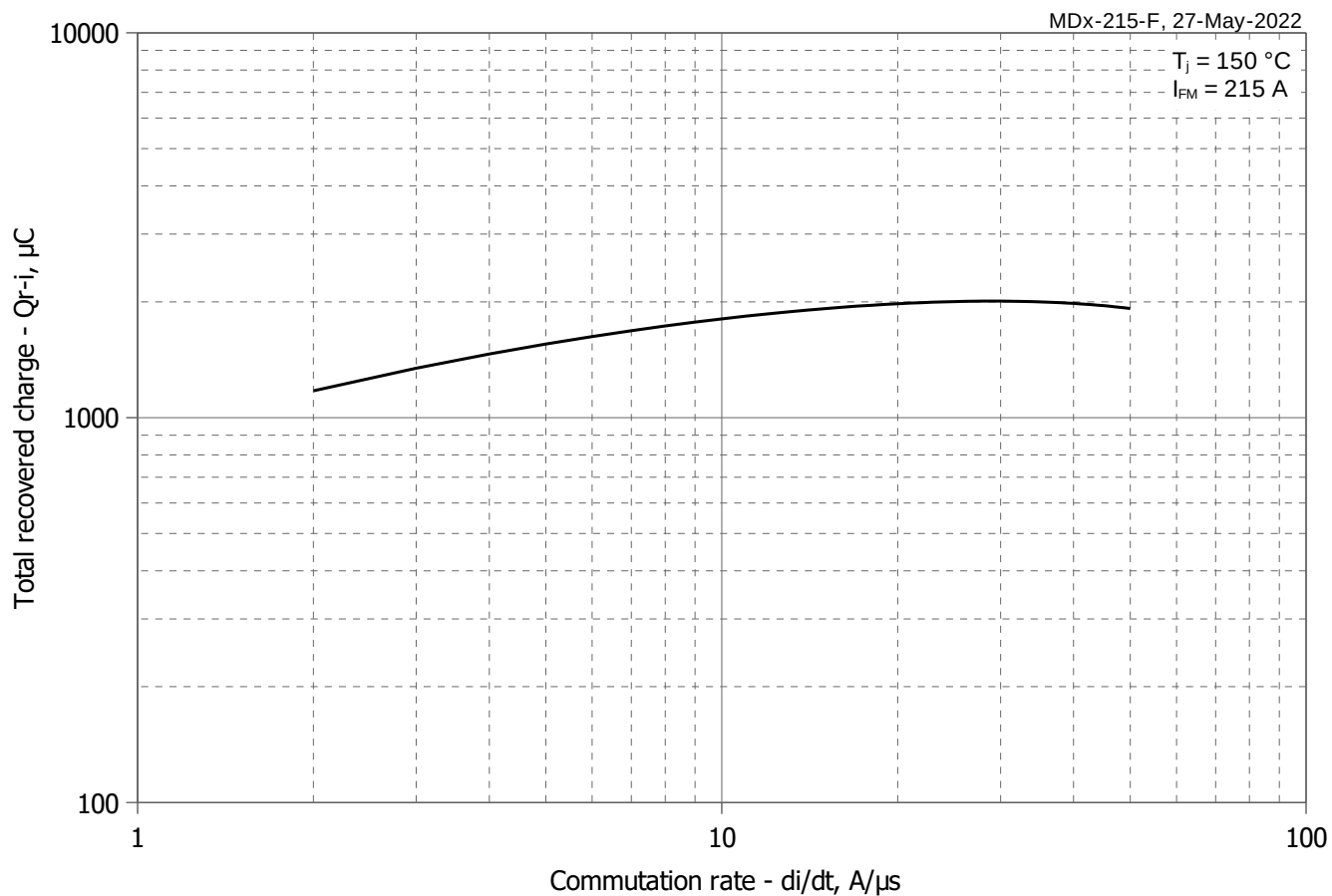


Fig 3 - Maximum recovered charge Q_{r-i} (integral) vs. commutation rate di_R/dt

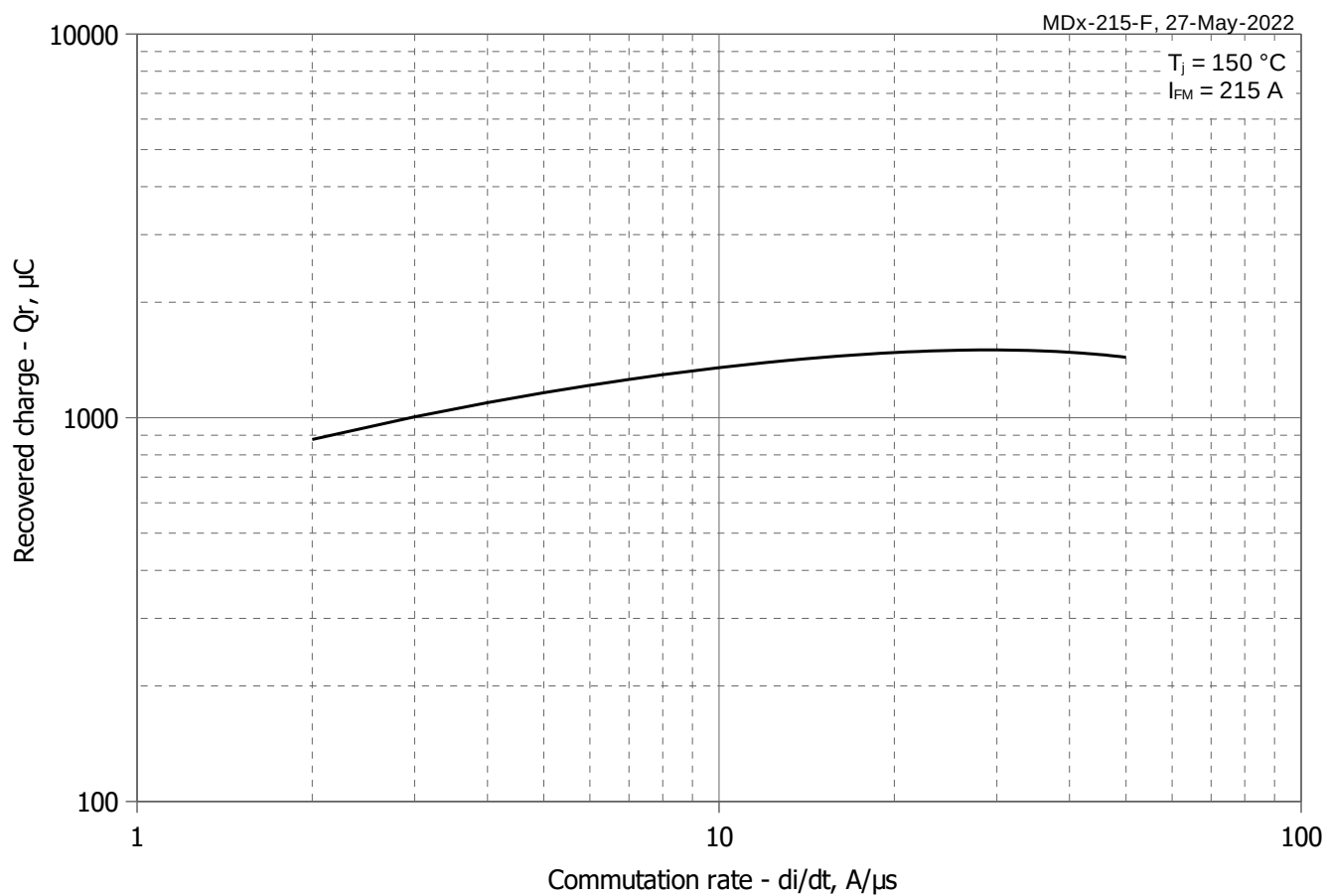


Fig 4 - Maximum recovered charge Q_r vs. commutation rate di_R/dt (25% chord)

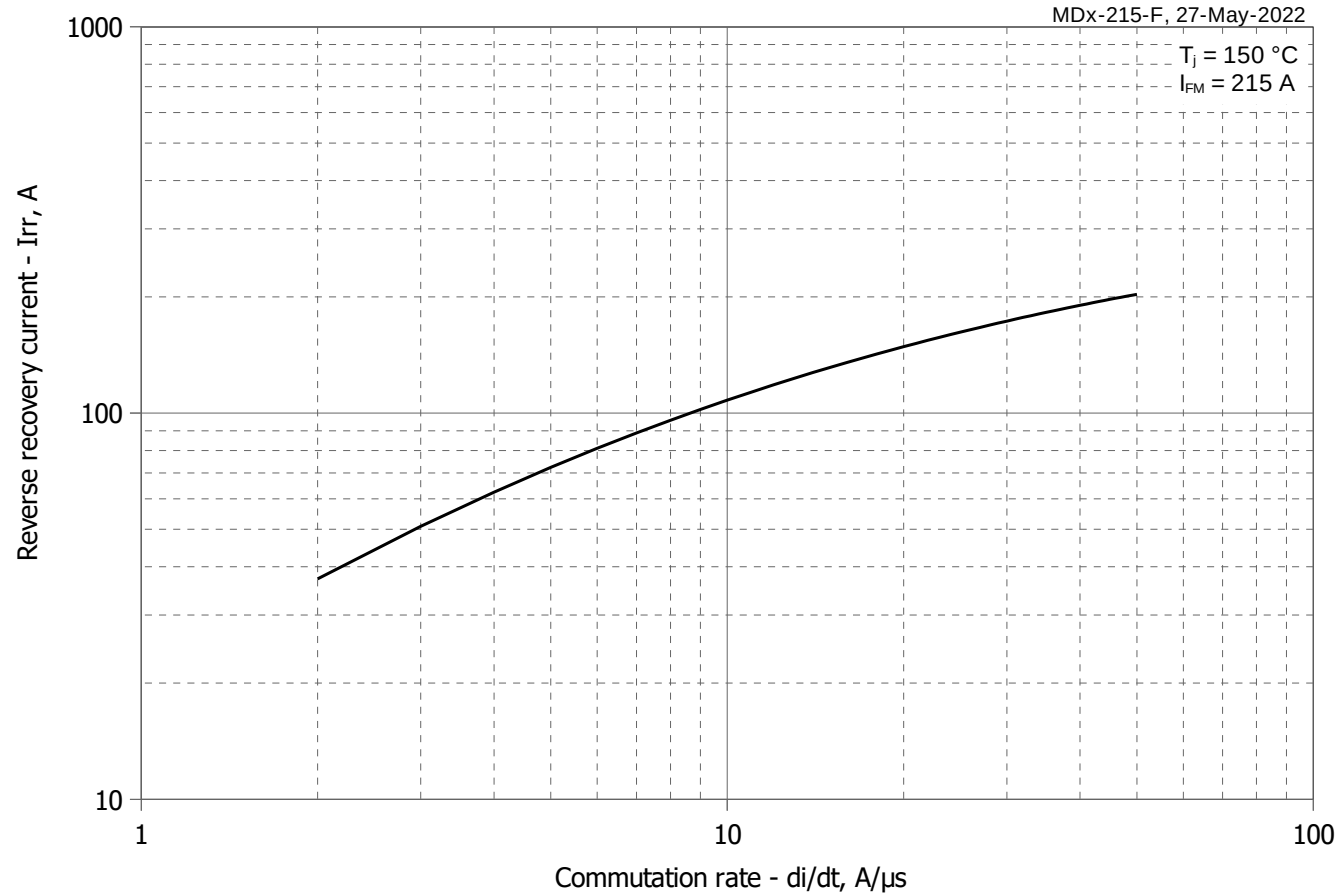


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

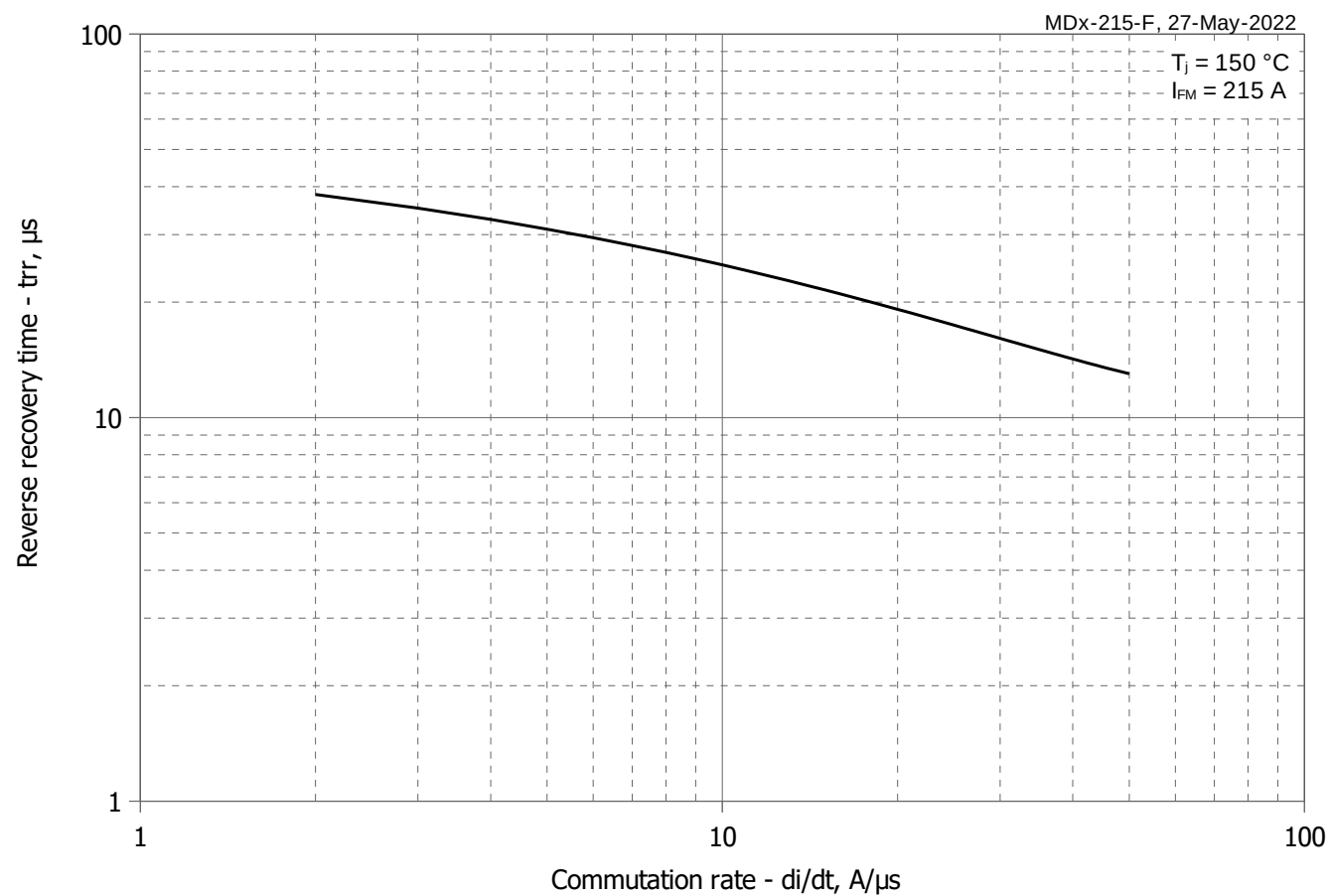


Fig 6 - Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

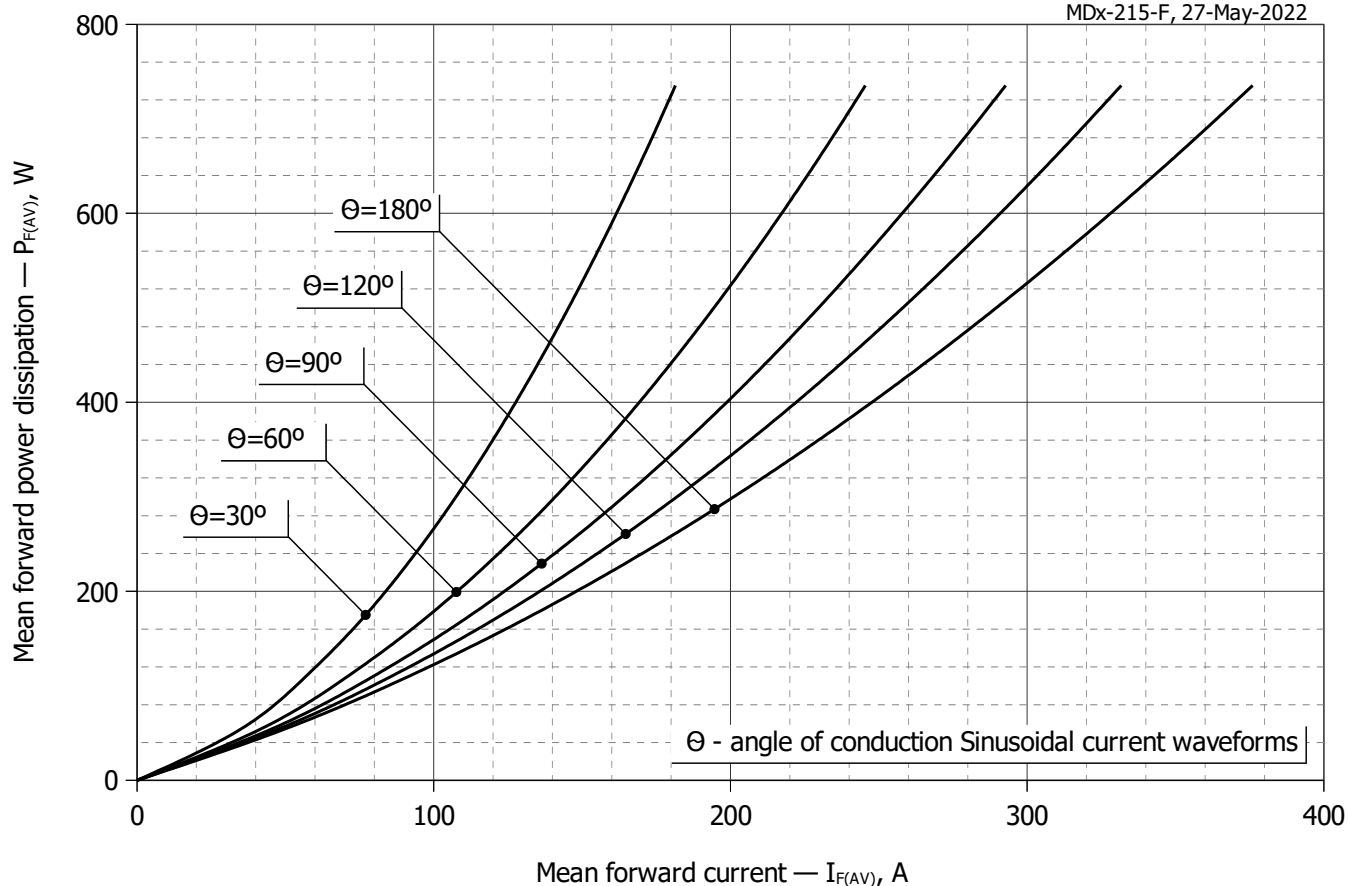


Fig. 7 - Mean forward power dissipation $P_{F(AV)}$ vs. mean forward current $I_{F(AV)}$ for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

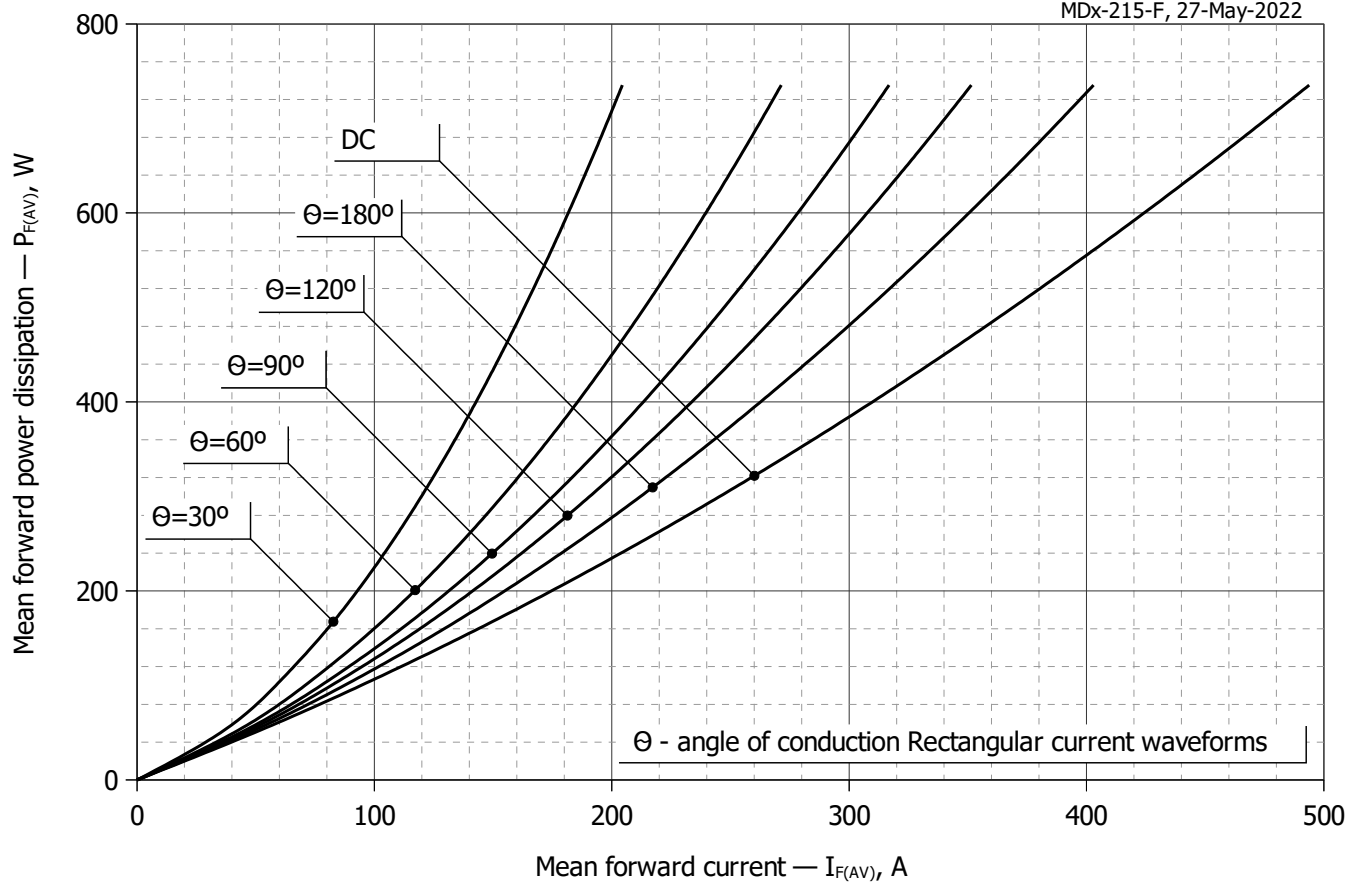


Fig. 8 - Mean forward power dissipation $P_{F(AV)}$ vs. mean forward current $I_{F(AV)}$ for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

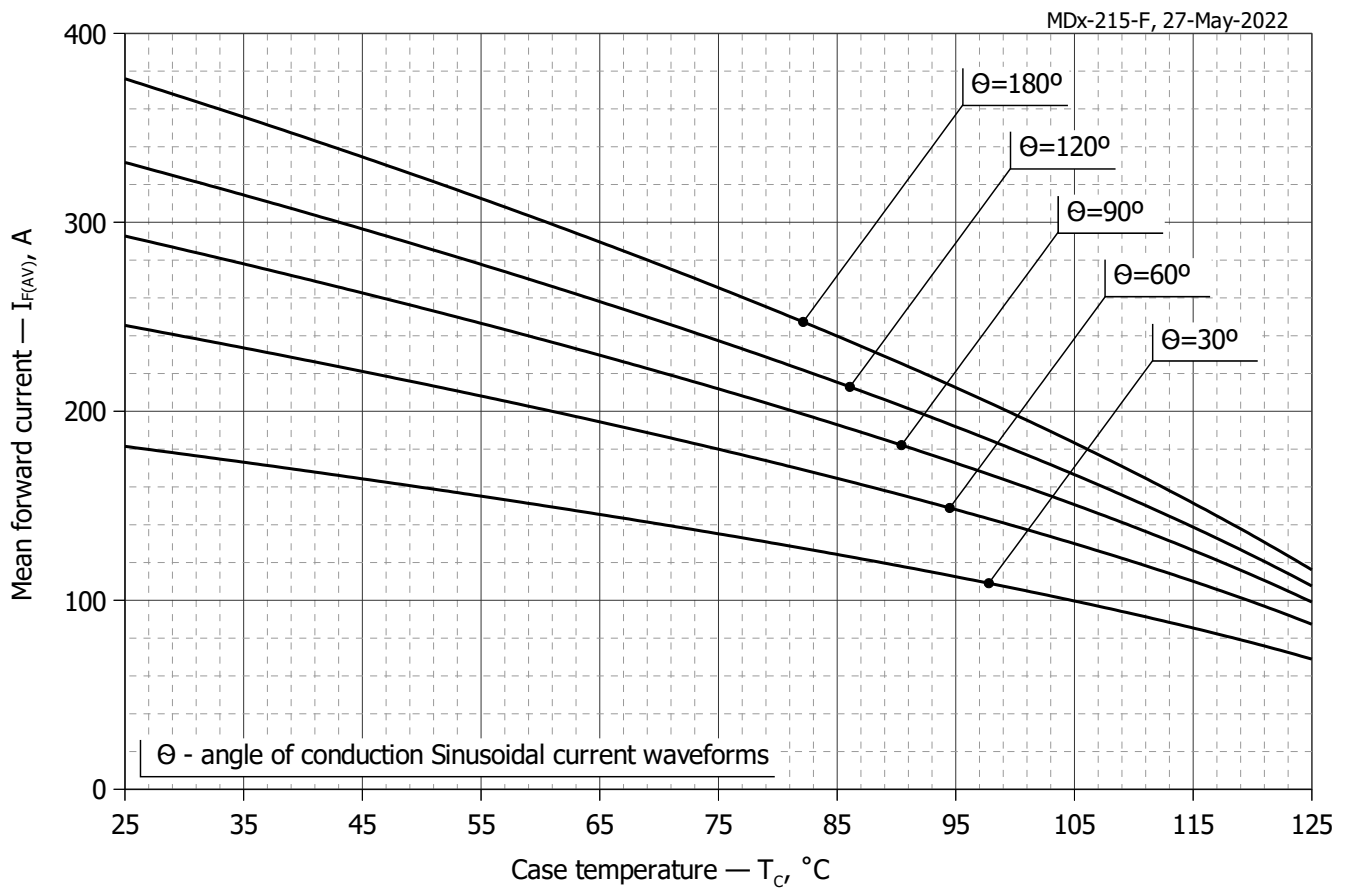


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

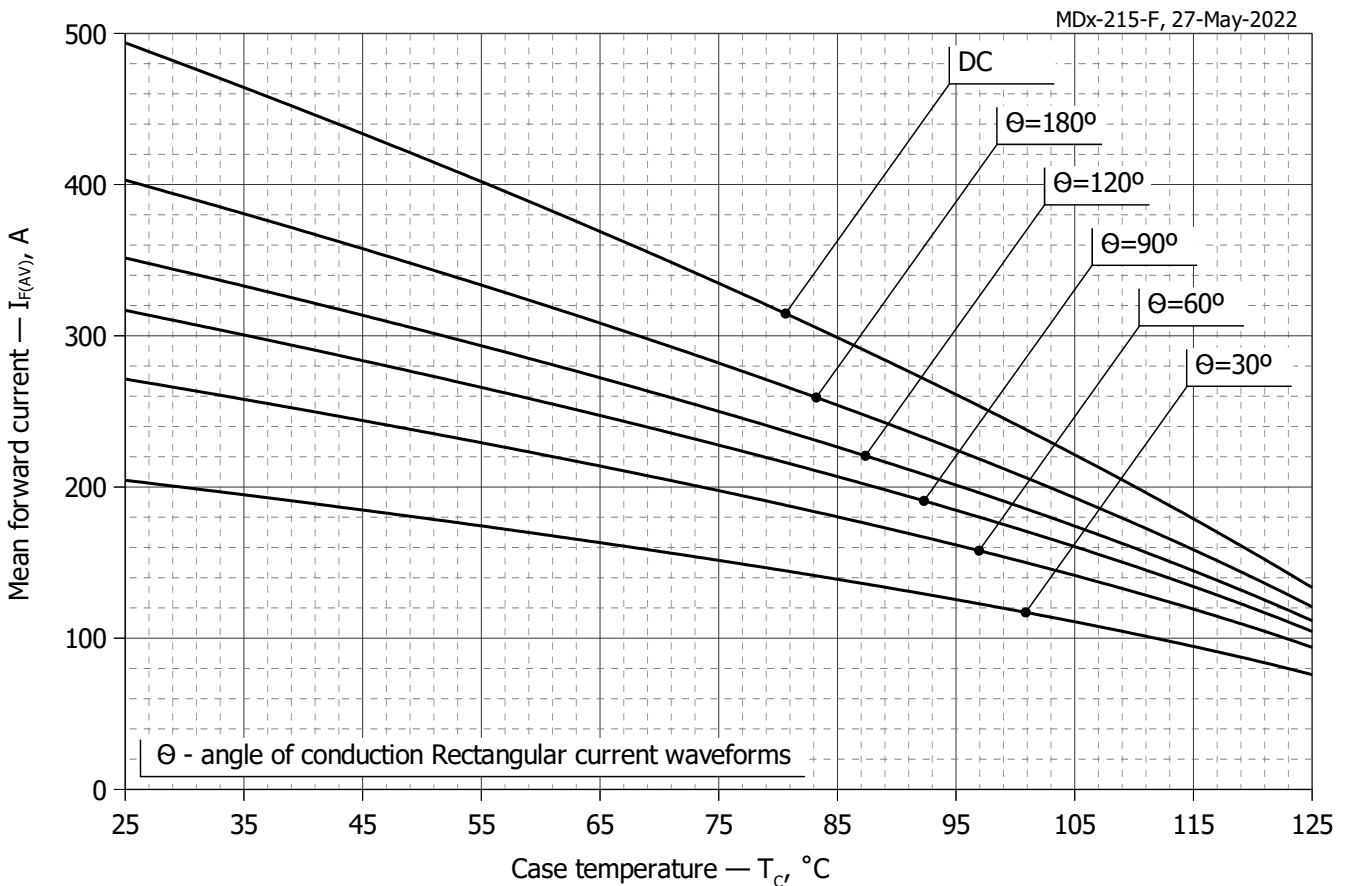


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

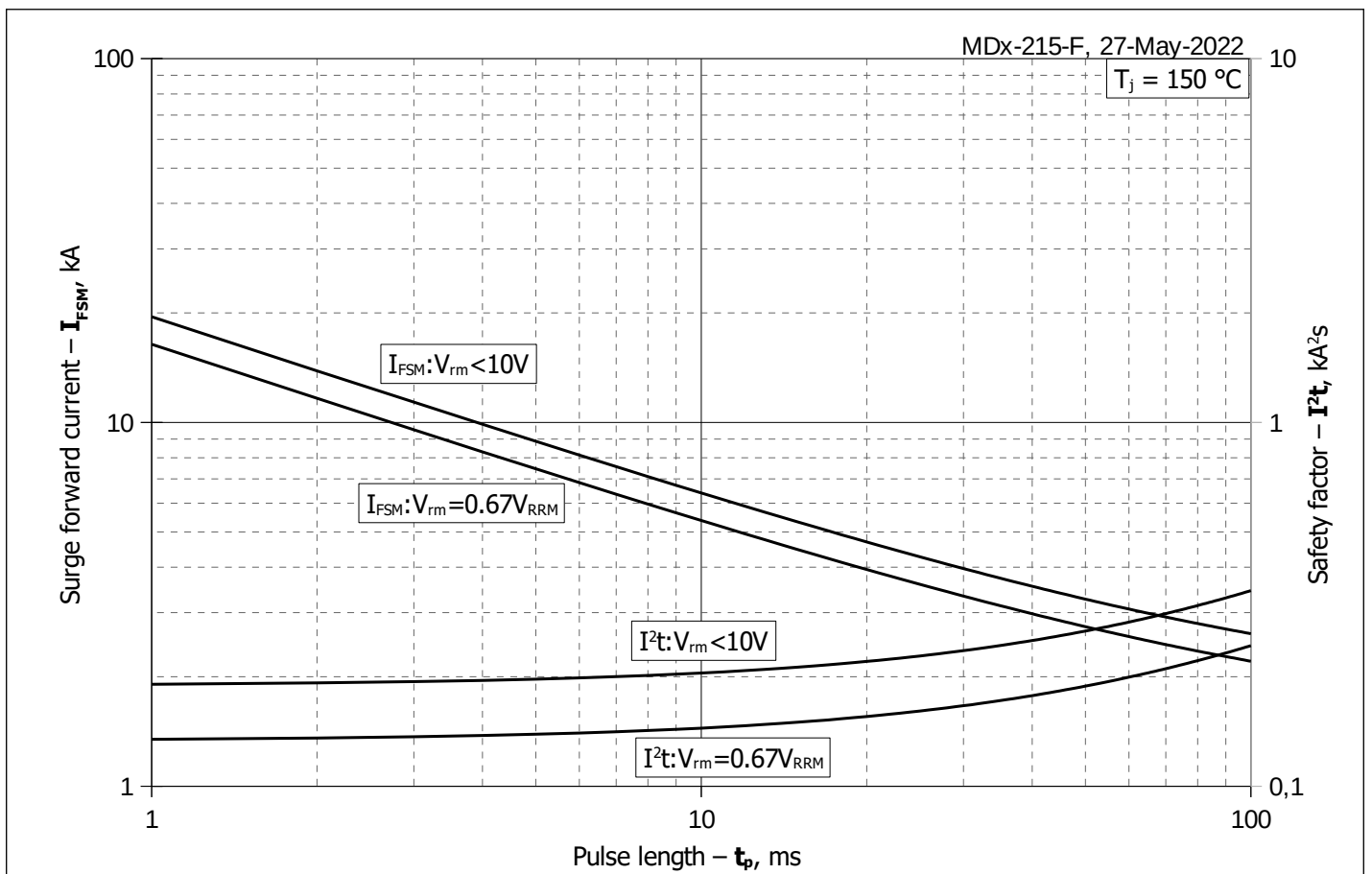


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

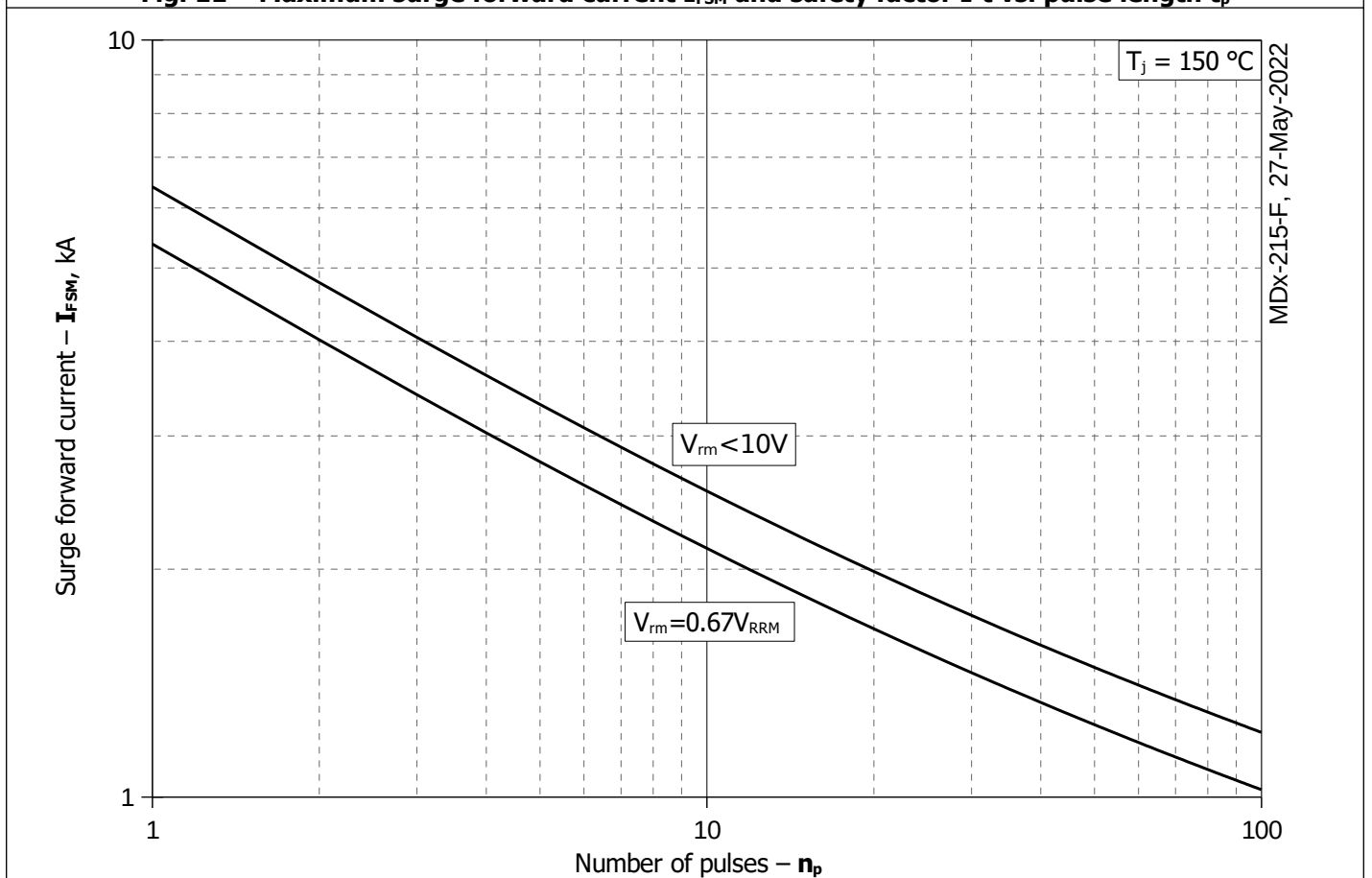


Fig. 12 – Maximum surge forward current I_{FSM} vs. number of pulses n_p