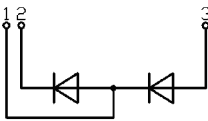
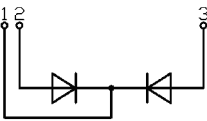
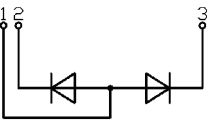
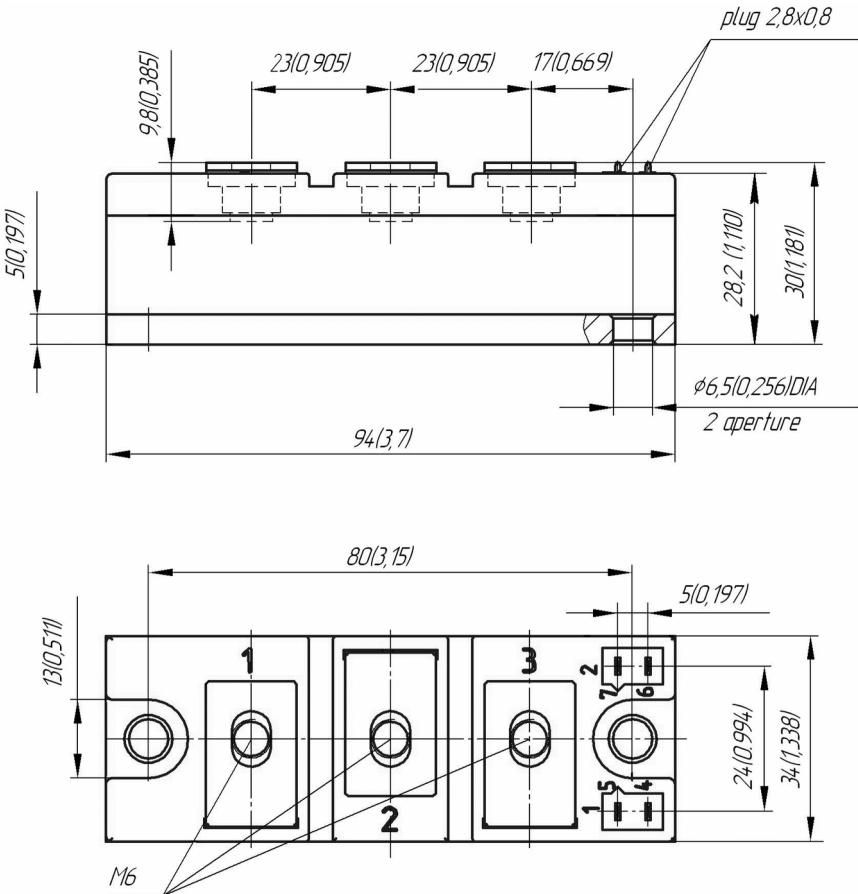




Electrically isolated base plate
Industrial standard package
Simplified mechanical design, rapid assembly
Pressure contact

Double Diode Module
For Phase Control
MDx-160-36-F

Average forward current		I_{FAV}	160 A	
Repetitive peak reverse voltage		V_{RRM}	3000...3600 V	
V_{RRM}, V	3000	3200	3400	3600
Voltage code	30	32	34	36
$T_j, ^\circ C$	-40...+150			

MD3		MD4		MD5	
					
					

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	179 160	T _c = 100 °C; T _c = 107 °C; 180° half-sine wave; 50 Hz	
I _{FRMS}	RMS forward current	A	251	T _c = 107 °C; 180° half-sine wave; 50 Hz	
I _{FSM}	Surge forward current	kA	4.5 5.0	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V
			4.5 5.0	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	100 120	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _R =0 V
			80 100	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	3000...3600	$T_{j\min} < T_j < T_{j\max};$ 180° half-sine wave; 50 Hz	
V_{RSM}	Non-repetitive peak reverse voltages	V	3100...3700	$T_{j\min} < T_j < T_{j\max};$ 180° half-sine wave; single pulse	
V_R	Reverse continuous voltages	V	$0.6 \cdot V_{RRM}$	$T_j = T_{j\max}$	

THERMAL

T_{stg}	Storage temperature	$^{\circ}\text{C}$	-40...+50	
T_j	Operating junction temperature	$^{\circ}\text{C}$	-40...+150	
$T_{c\text{ op}}$	Operating temperature	$^{\circ}\text{C}$	-40...+125	

MECHANICAL

a	Acceleration under vibration	m/s^2	50	
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CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V _{FM}	Peak forward voltage, max	V	1.70	T _j =25 °C; I _{FM} =500 A	
V _{F(TO)}	Forward threshold voltage, max	V	0.886	T _j =T _{j max} ;	
r _T	Forward slope resistance, max	mΩ	1.709	0.5 π I _{FAV} < I _T < 1.5 π I _{FAV}	
BLOCKING					
I _{RRM}	Repetitive peak reverse current, max	mA	50 2.50	T _j =T _{j max} T _j =25 °C	V _R =V _{RRM}
SWITCHING					
Q _r	Recovered charge, max	μC	2150	T _j =T _{j max} ; I _{FM} =I _{FAV} ;	
t _{rr}	Reverse recovery time, max	μs	65	di _R /dt=-5 A/μs;	
I _{rr}	Reverse recovery current, max	A	66	V _R =100 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	-	160	-	36	-	F	-	N	1) The screws must be lubricated
1	2		3		4		5		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										

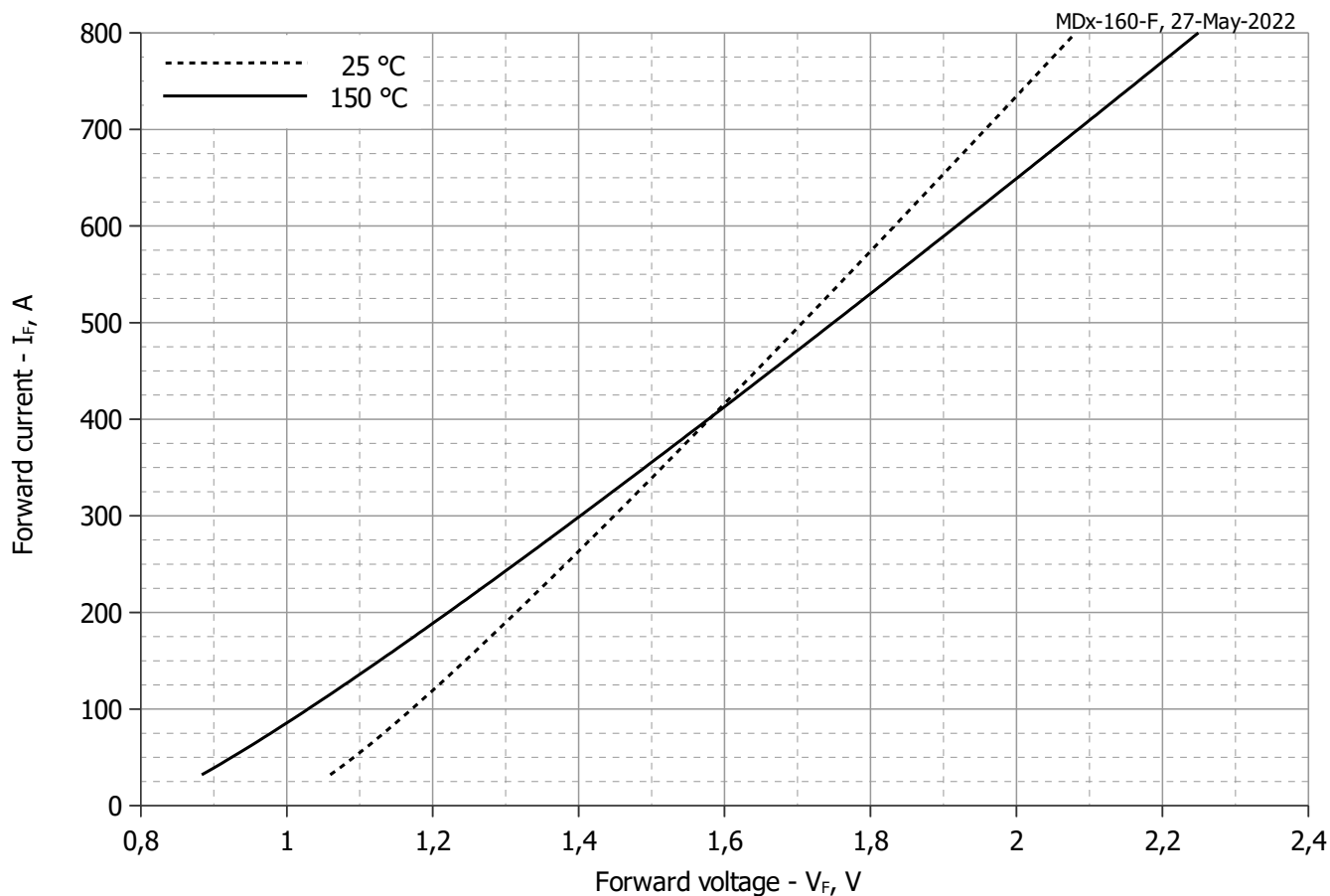


Fig 1 – Forward characteristics of Limit device

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	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j \max}$
A	0.96264779	0.79328135
B	0.00110372	0.00140620
C	0.00670937	-0.00967186
D	0.00673239	0.01398987

Forward characteristic model (see Fig. 1).

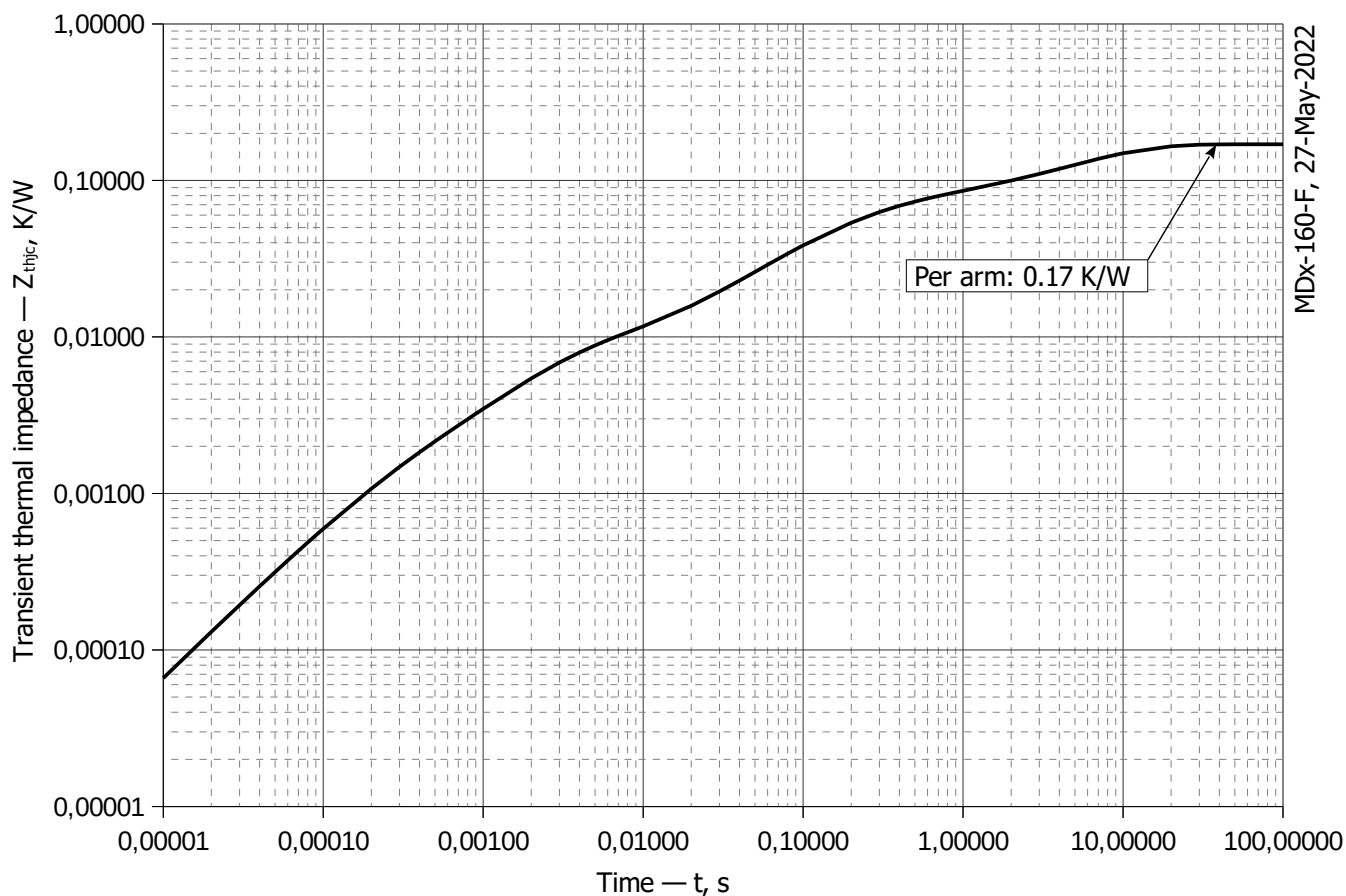


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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)

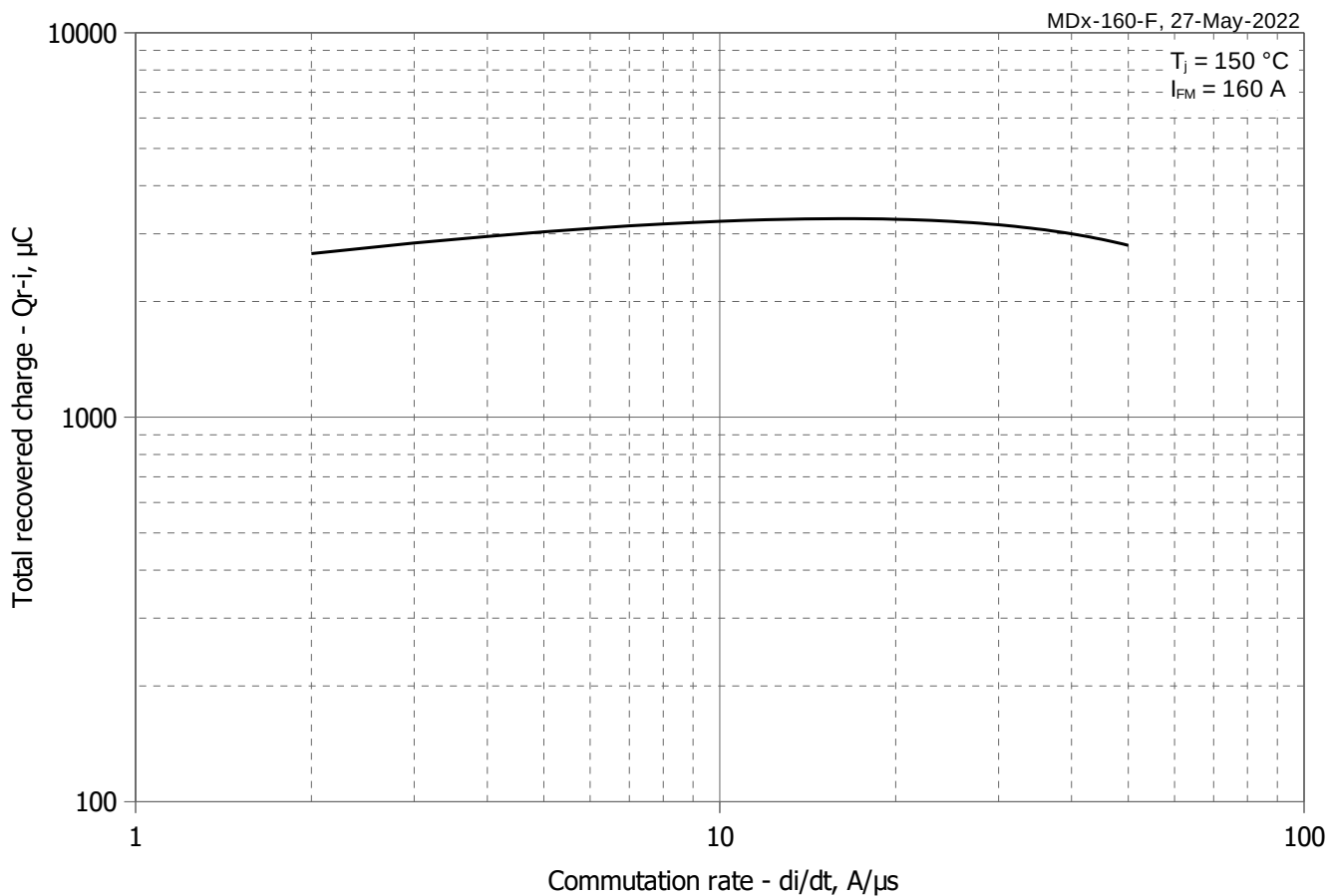


Fig 3 - Maximum recovered charge Q_{r-i} (integral) vs. commutation rate di_R/dt

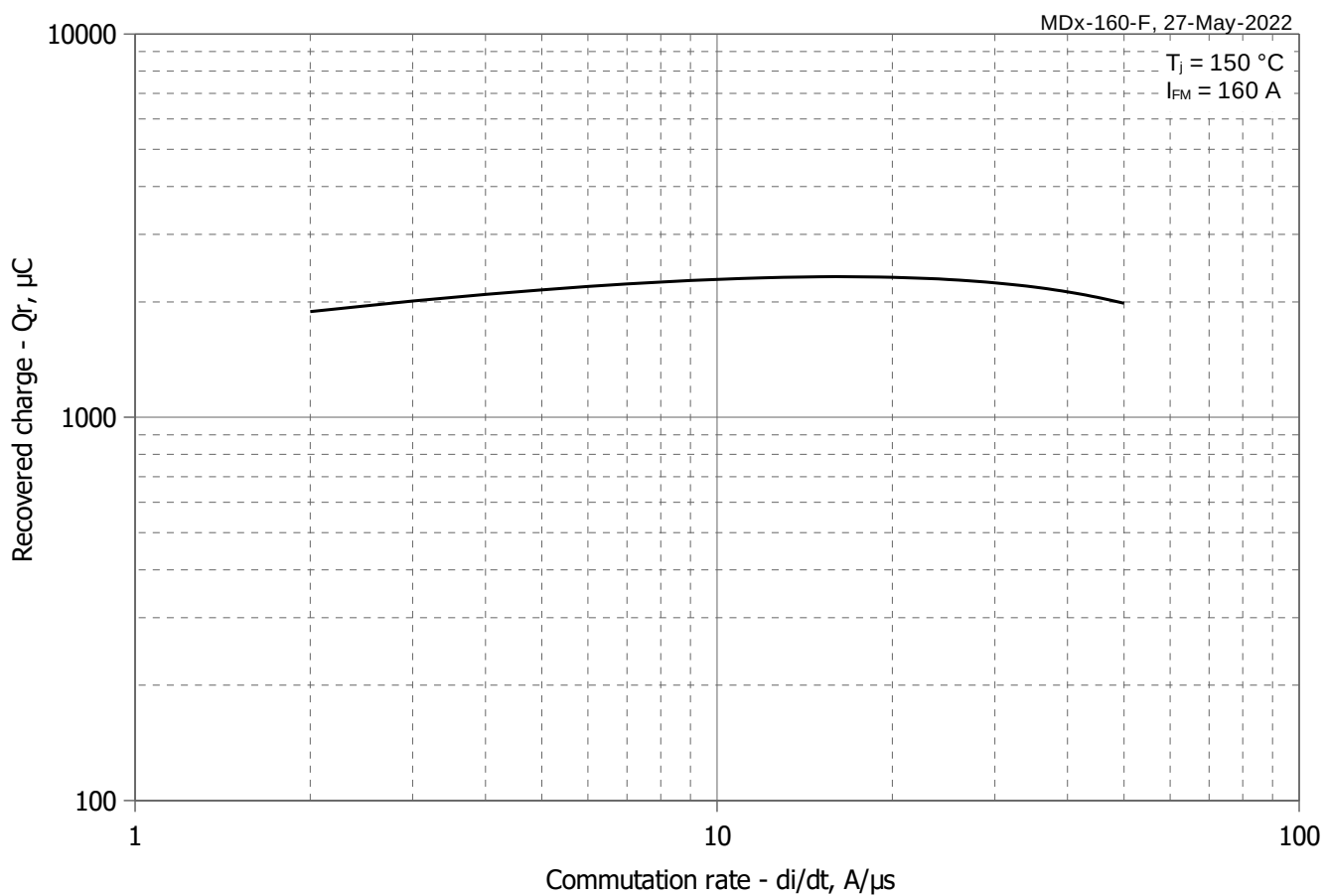


Fig 4 - Maximum recovered charge Q_r vs. commutation rate di_R/dt (25% chord)

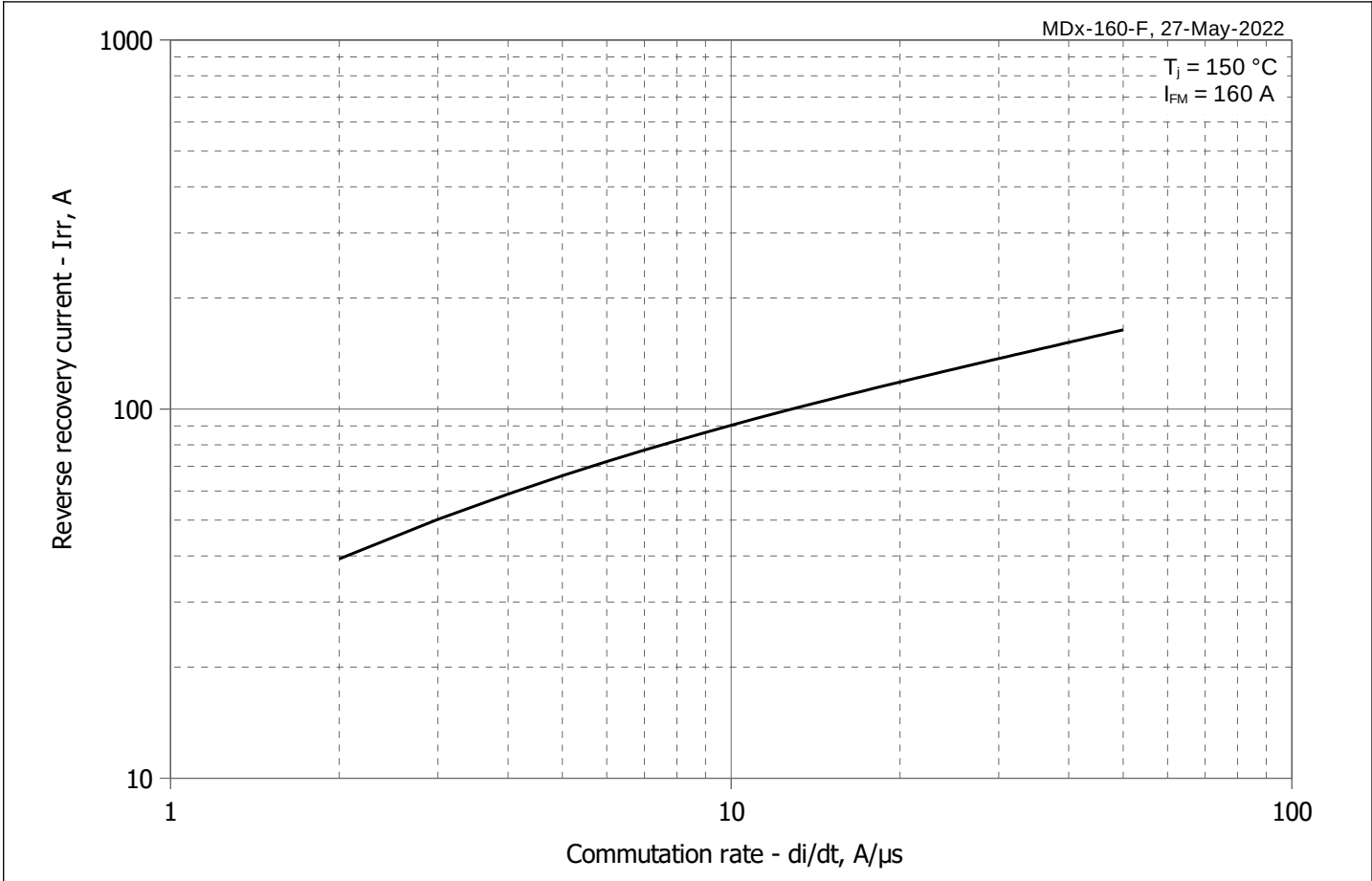


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

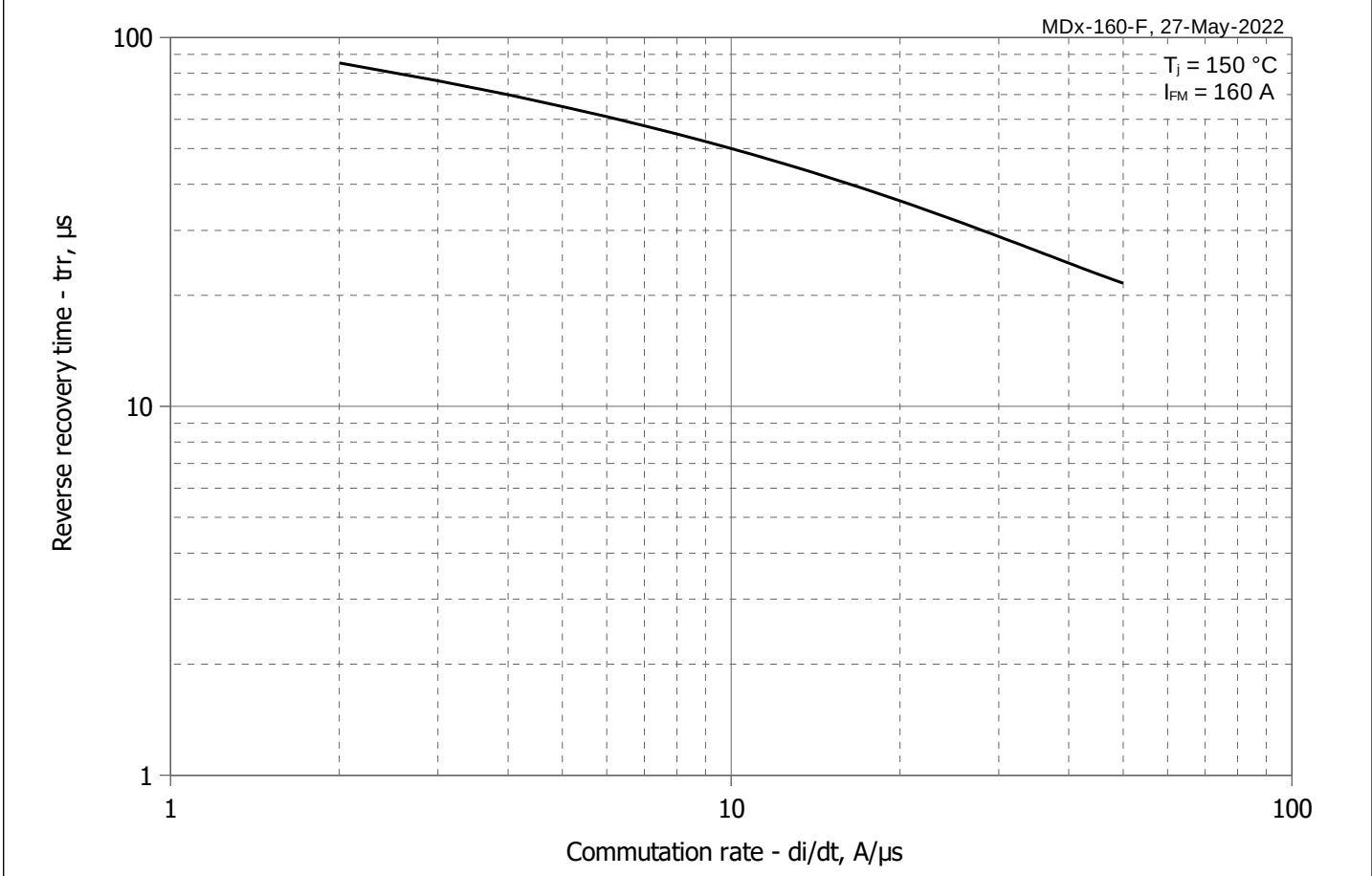


Fig 6 - Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

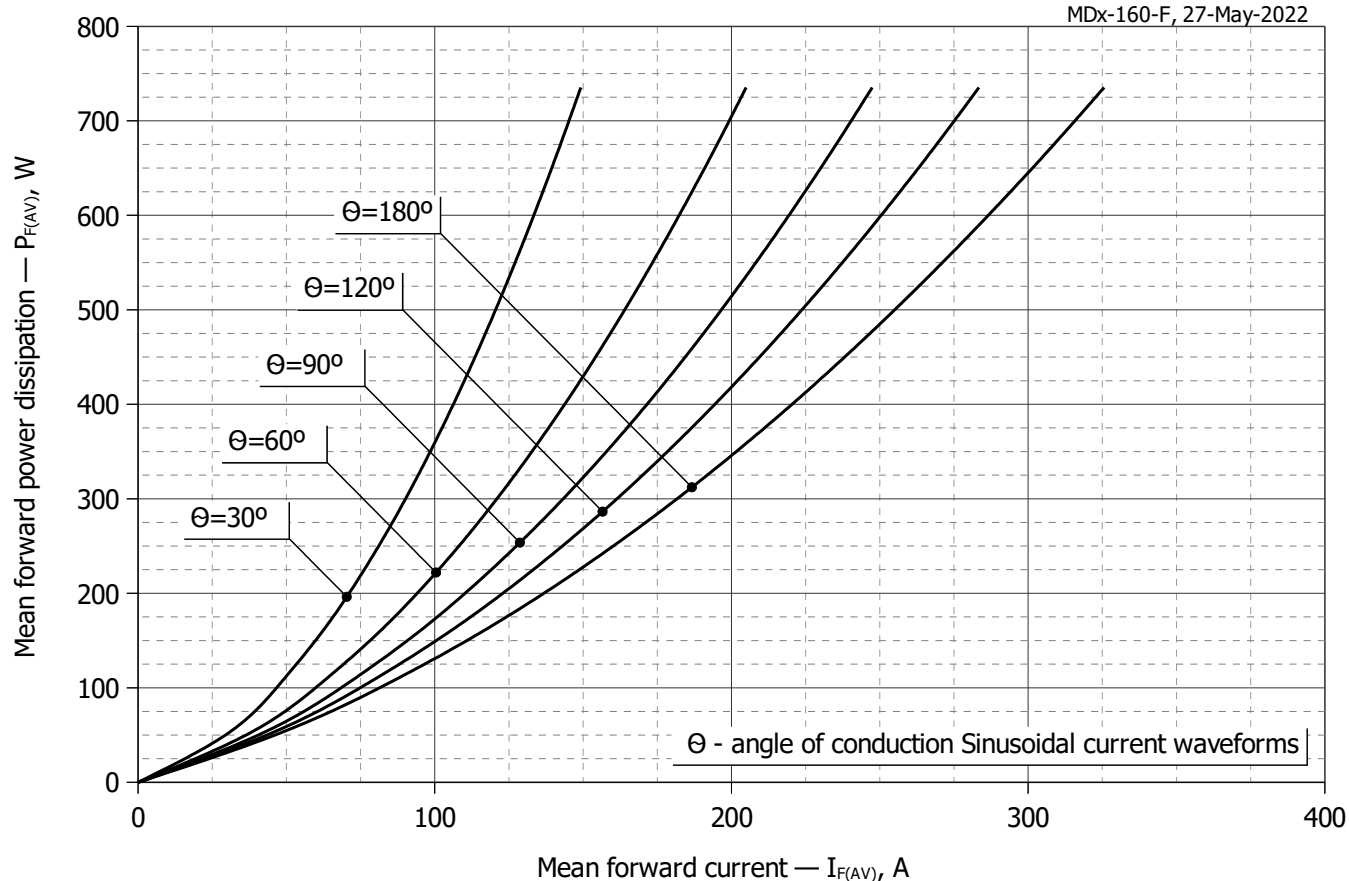


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

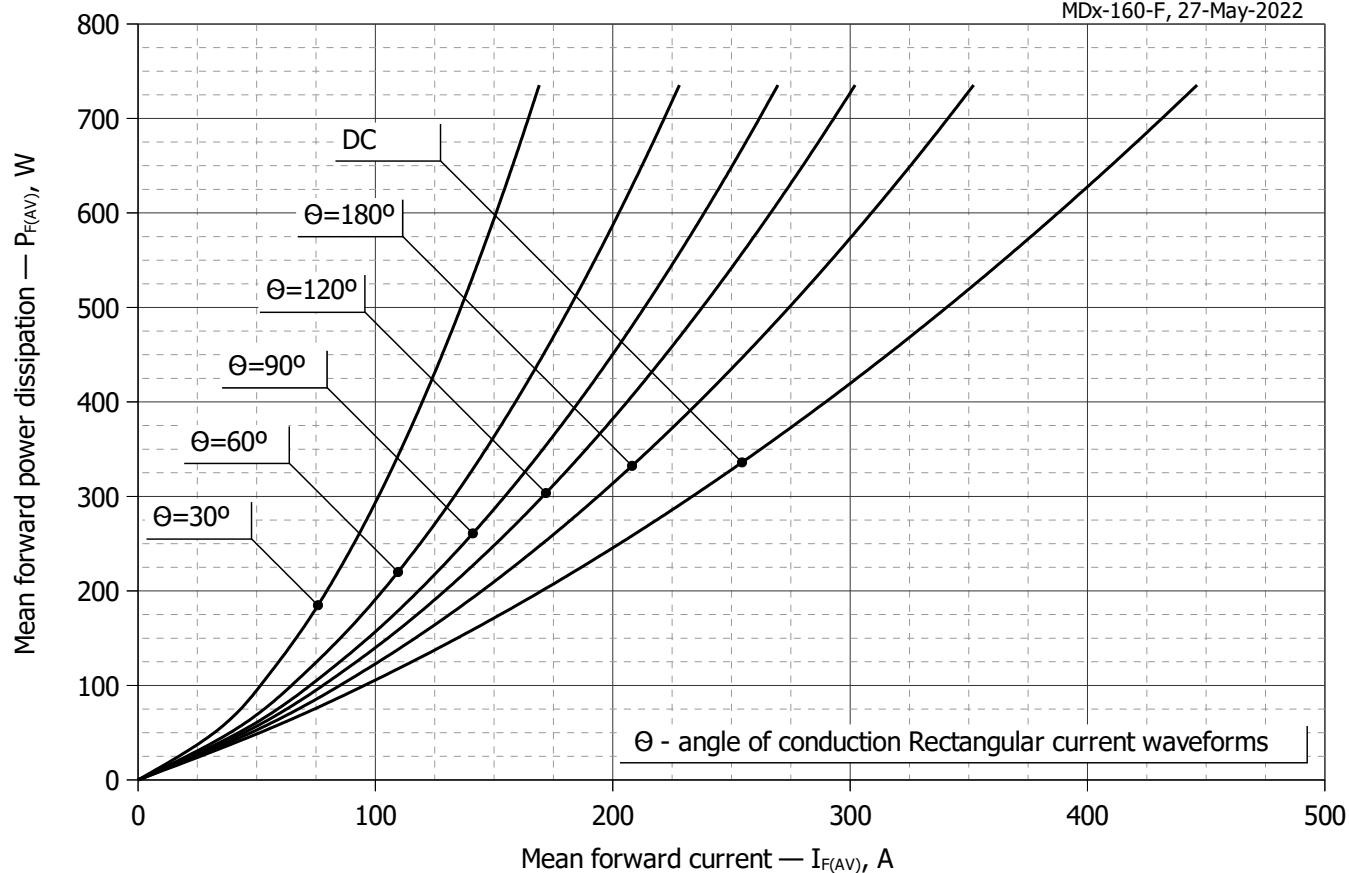


Fig. 8 – Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

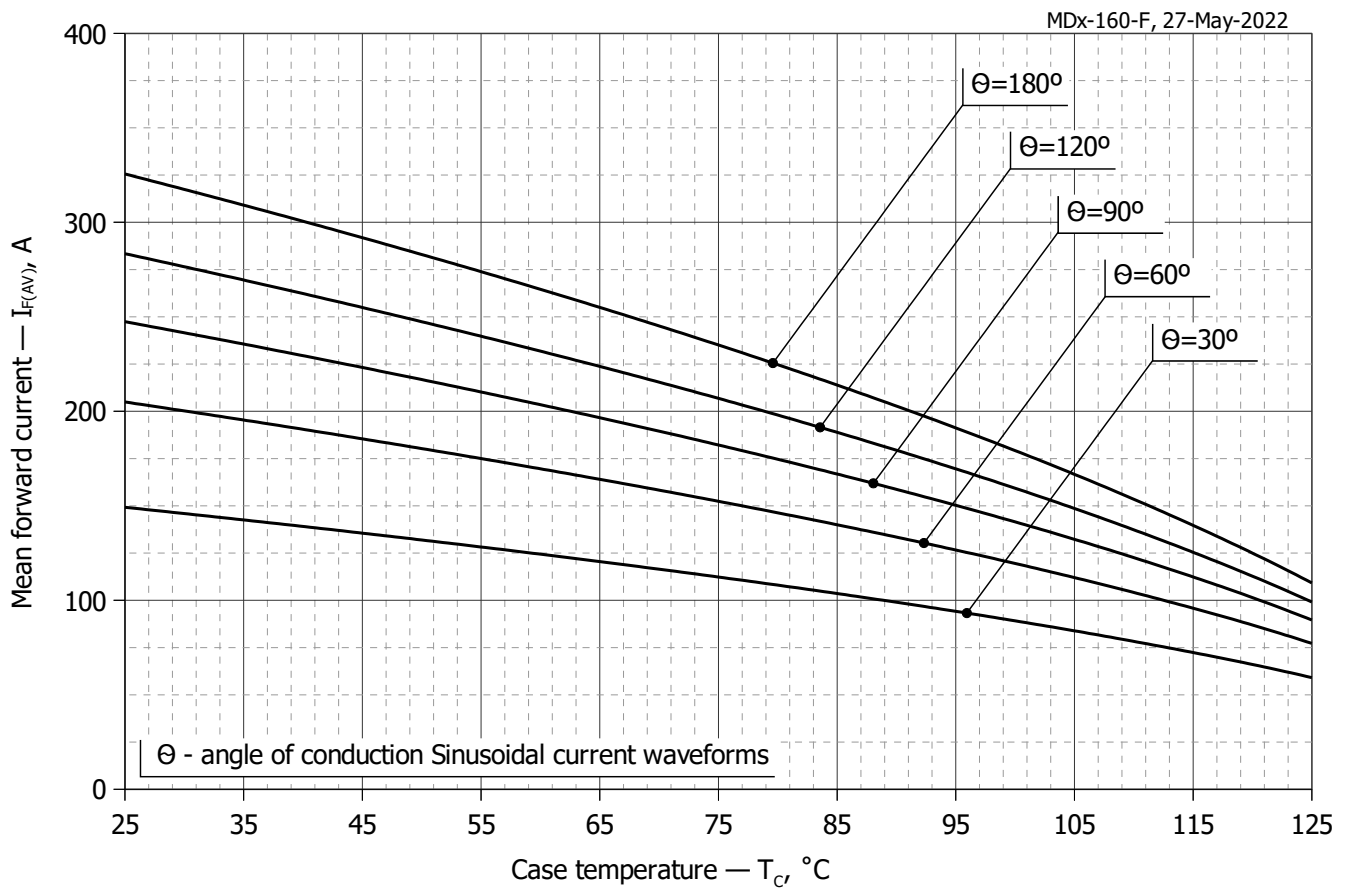


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

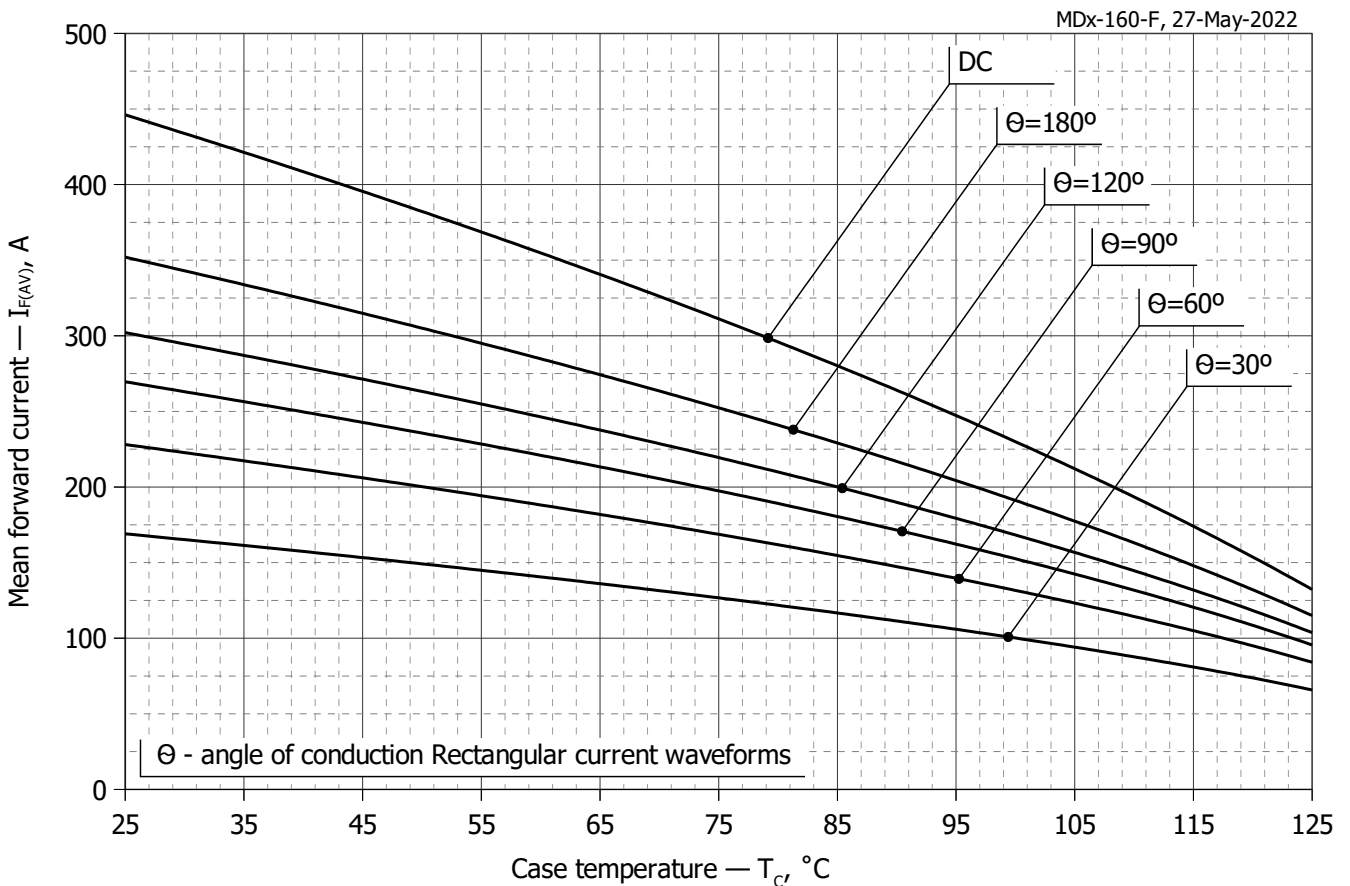


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

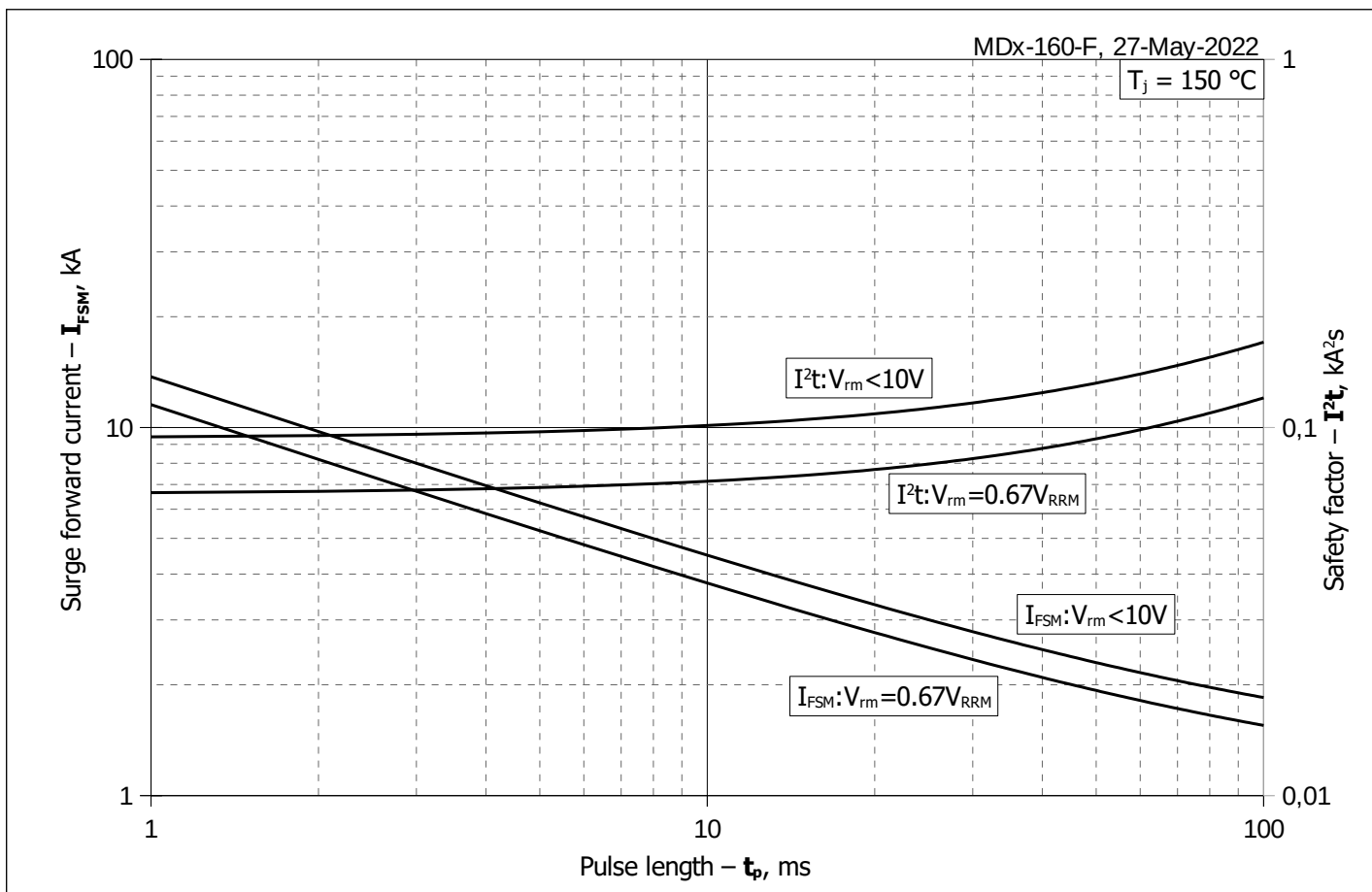


Fig. 11 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

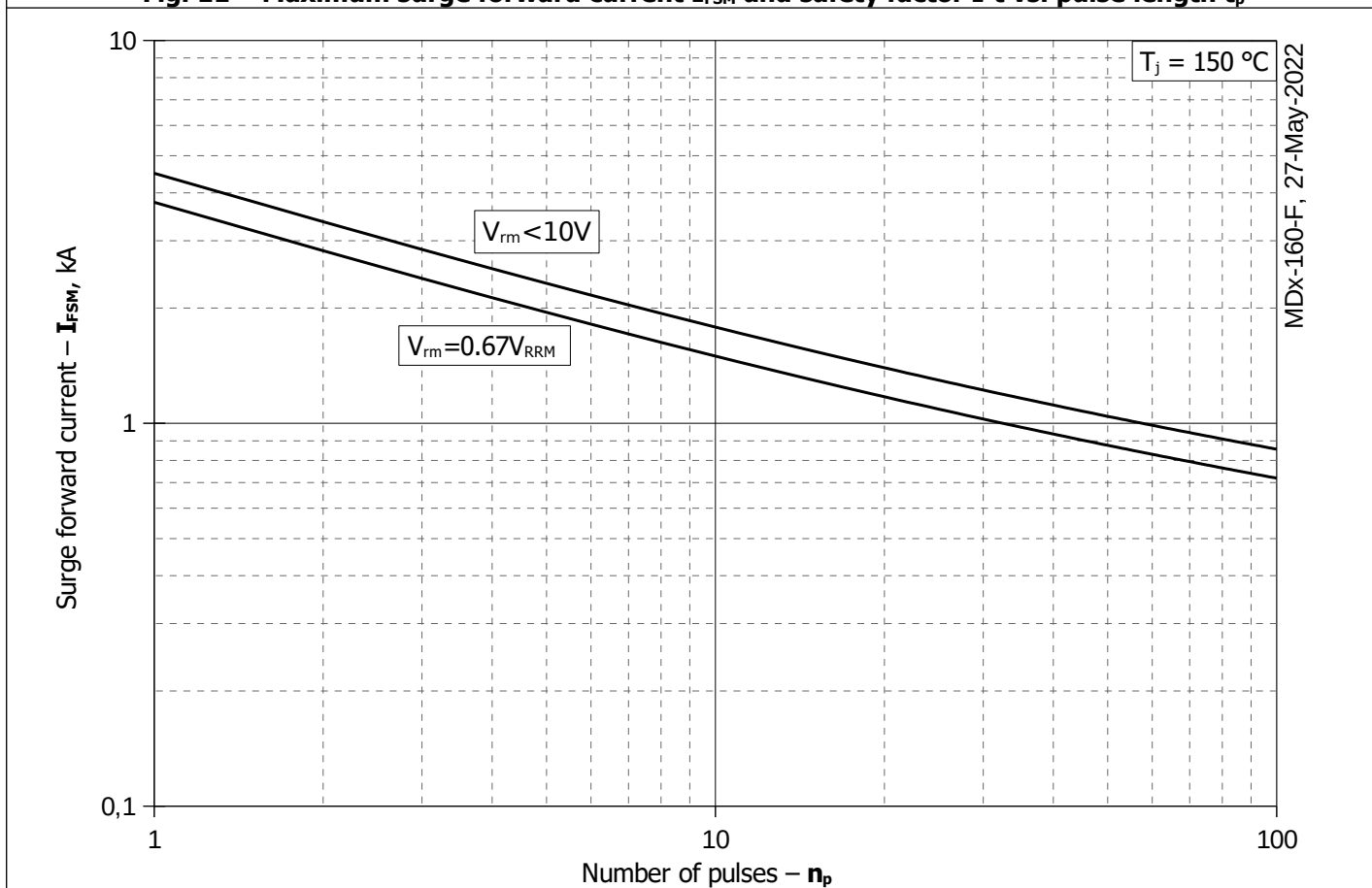


Fig. 12 – Maximum surge forward current I_{FSM} vs. number of pulses n_p