



PROTON-ELECTROTEX RUSSIA

Double Diode Module For Phase Control MDx-175-28-F

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

Average forward current		I_{FAV}	175 A
Repetitive peak reverse voltage		V_{RRM}	2400...2800 V
V_{RRM}, V	2400	2600	2800
Voltage code	24	26	28
$T_j, ^\circ C$	-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	193 175	$T_c=100\text{ }^{\circ}\text{C};$ $T_c=106\text{ }^{\circ}\text{C};$ 180° half-sine wave; 50 Hz	
I_{FRMS}	RMS forward current	A	275	$T_c=106\text{ }^{\circ}\text{C};$ 180° half-sine wave; 50 Hz	
I_{FSM}	Surge forward current	kA	6.0 7.0	$T_j=T_{j\text{ max}}$ $T_j=25\text{ }^{\circ}\text{C}$	180° half-sine wave; $t_p=10\text{ ms}$; single pulse; $V_R=0\text{ V}$
			6.5 7.5	$T_j=T_{j\text{ max}}$ $T_j=25\text{ }^{\circ}\text{C}$	180° half-sine wave; $t_p=8.3\text{ ms}$; single pulse; $V_R=0\text{ V}$
I^2t	Safety factor	$A^2s\cdot 10^3$	180 240	$T_j=T_{j\text{ max}}$ $T_j=25\text{ }^{\circ}\text{C}$	180° half-sine wave; $t_p=10\text{ ms}$; single pulse; $V_R=0\text{ V}$
			170 230	$T_j=T_{j\text{ max}}$ $T_j=25\text{ }^{\circ}\text{C}$	180° half-sine wave; $t_p=8.3\text{ ms}$; single pulse; $V_R=0\text{ V}$
BLOCKING					
V_{RRM}	Repetitive peak reverse voltages	V	2400...2800	$T_{j\text{ min}}<T_j<T_{j\text{ max}};$ 180° half-sine wave; 50 Hz	
V_{RSM}	Non-repetitive peak reverse voltages	V	2500...2900	$T_{j\text{ min}}<T_j<T_{j\text{ max}};$ 180° half-sine wave; single pulse	
V_R	Reverse continuous voltages	V	$0.6\cdot V_{RRM}$	$T_j=T_{j\text{ max}}$	
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		

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.50	$T_j=25\text{ }^{\circ}\text{C}; I_{FM}=500\text{ A}$	
$V_{F(TO)}$	Forward threshold voltage, max	V	0.968	$T_j=T_{j\text{ max}};$	
r_T	Forward slope resistance, max	mΩ	1.163	$0.5\pi I_{FAV} < I_T < 1.5\pi I_{FAV}$	
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	35 2.50	$T_j=T_{j\text{ max}}$ $T_j=25\text{ }^{\circ}\text{C}$	$V_R=V_{RRM}$
SWITCHING					
Q_r	Total 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	350	

PART NUMBERING GUIDE										NOTES
MD	3	-	175	-	28	-	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										

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2. Circuit Schematic
3. Average Forward Current, A
4. Voltage Code
5. Package Type (M.F)
6. Ambient Conditions:
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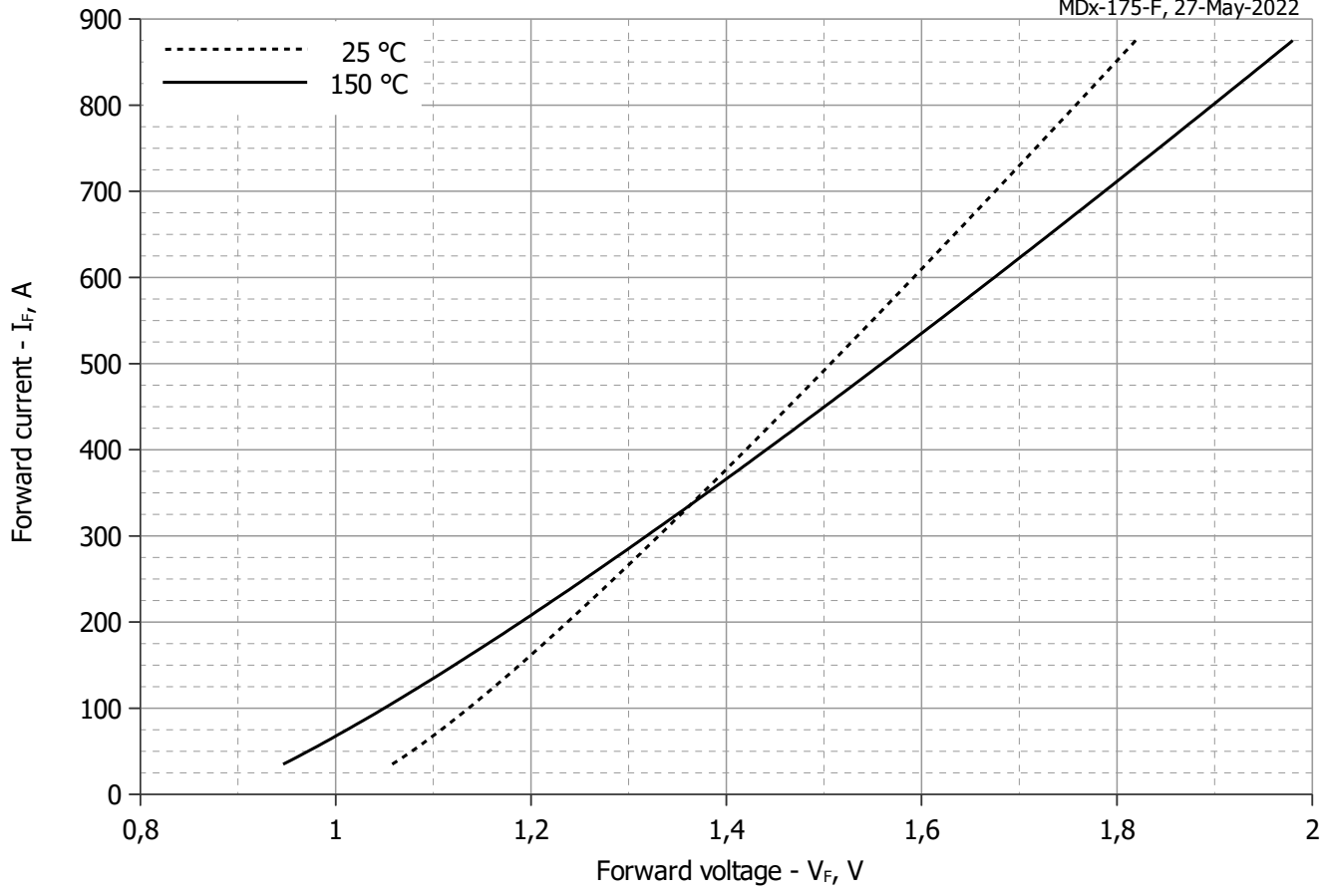


Fig 1 – Forward characteristics of Limit device

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	0.97888587	0.88742377
B	0.00068576	0.00081679
C	0.00314887	-0.02032268
D	0.00739979	0.01742982

Forward characteristic model (see Fig. 1).

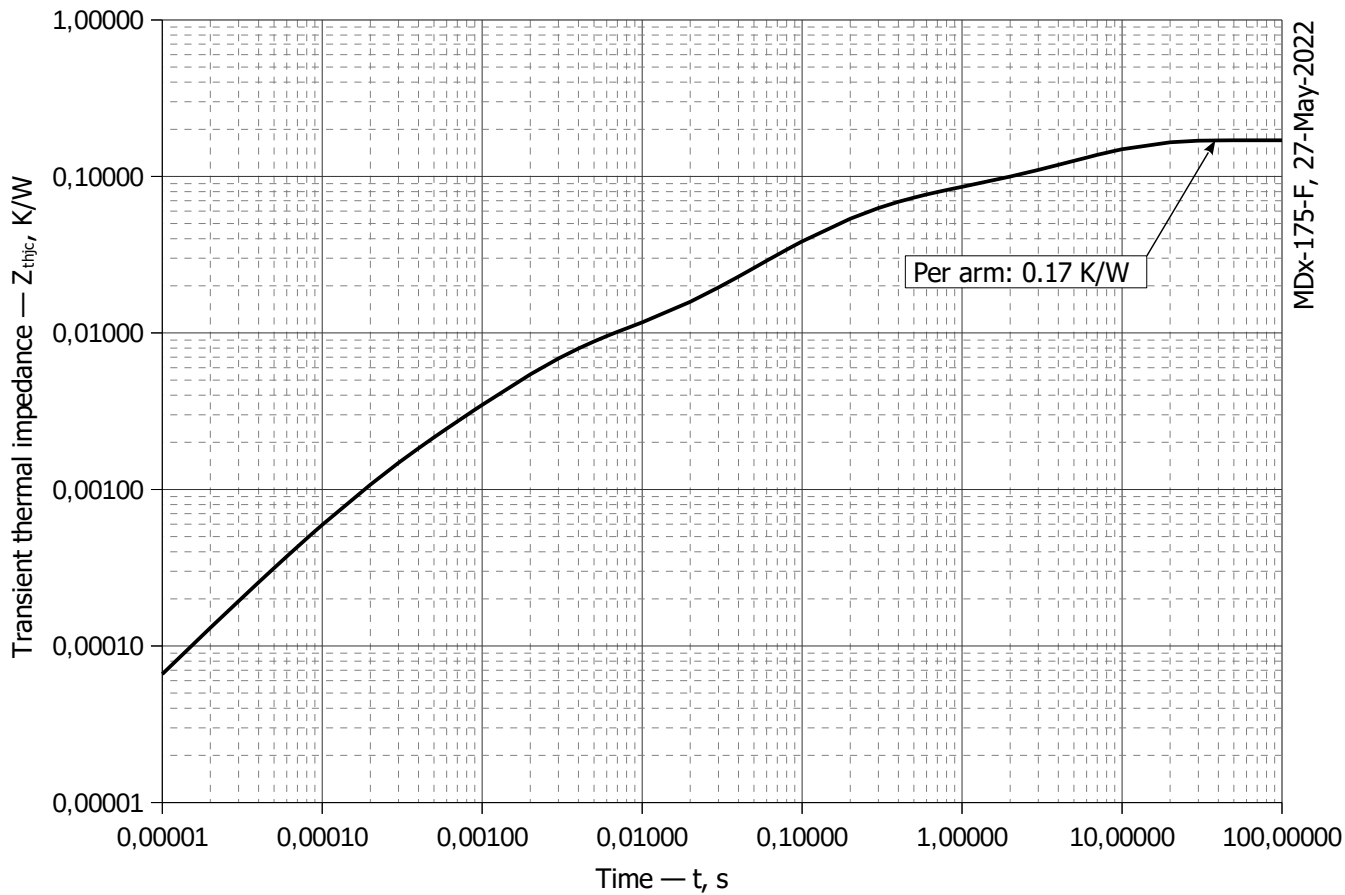


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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)

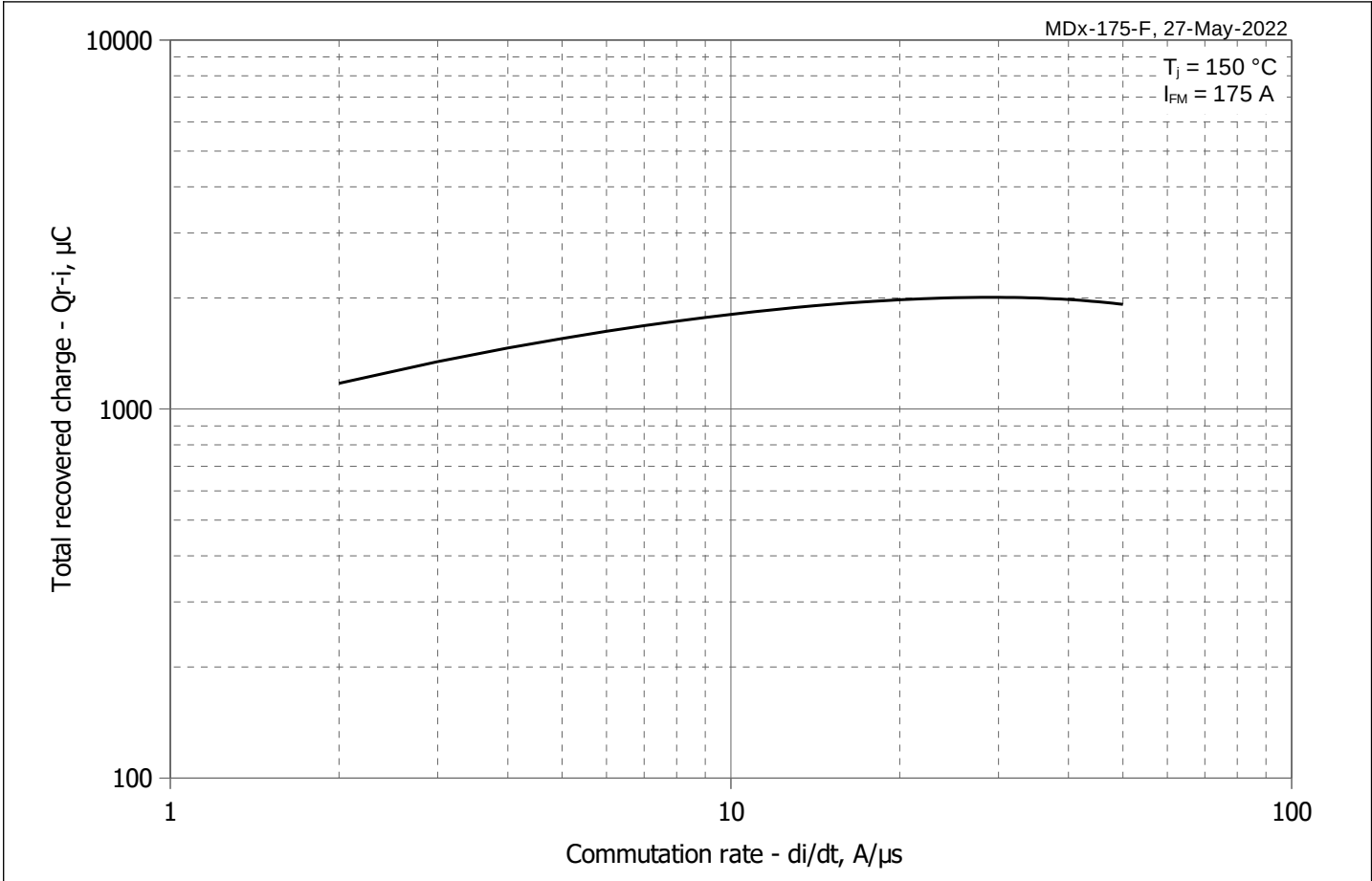


Fig 3 - Maximum recovered charge Q_{r-i} (integral) vs. commutation rate di_R/dt

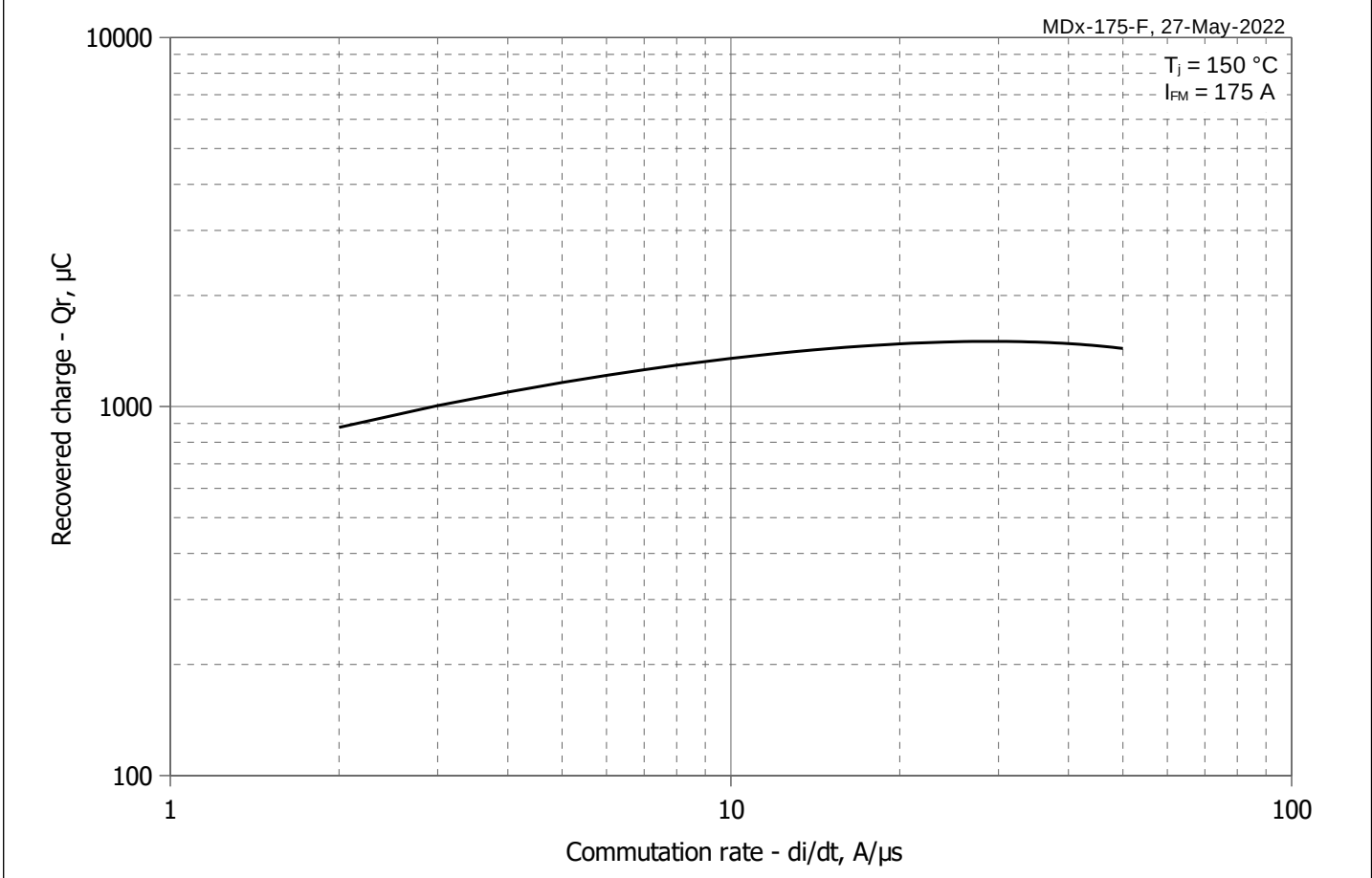


Fig 4 - Maximum recovered charge Q_r vs. commutation rate di_R/dt (25% chord)

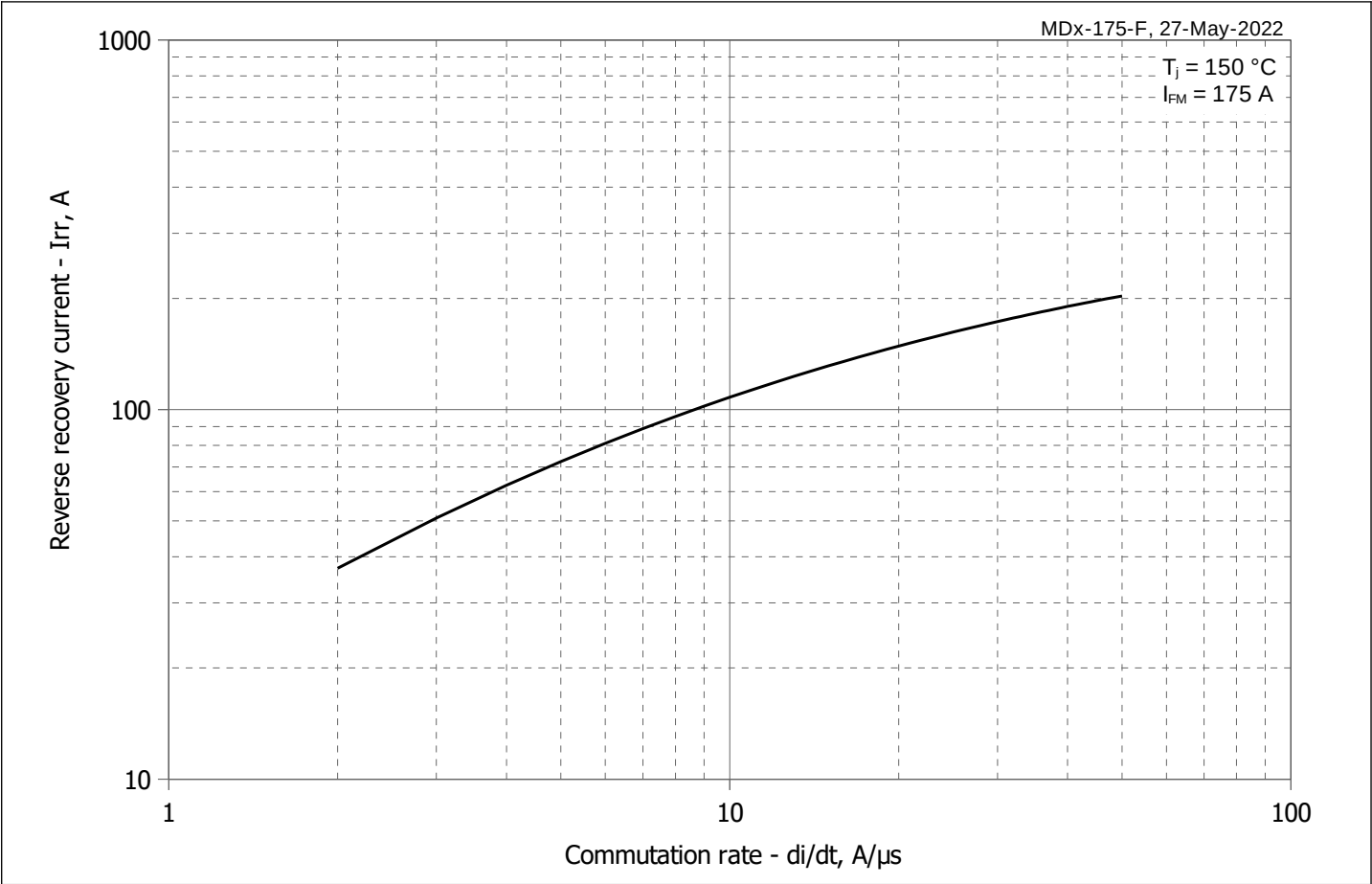


Fig 5 - Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

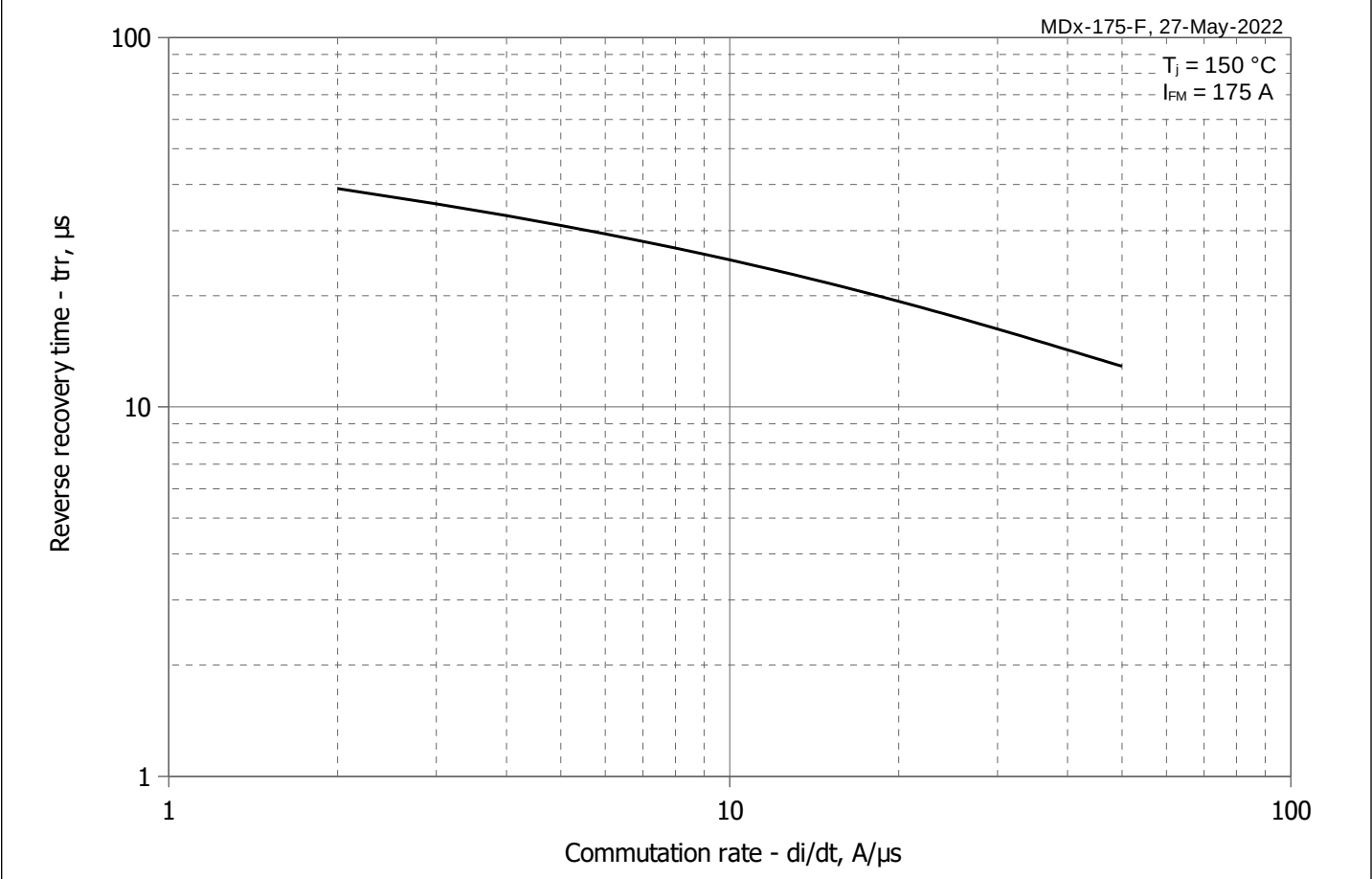


Fig 6 - Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

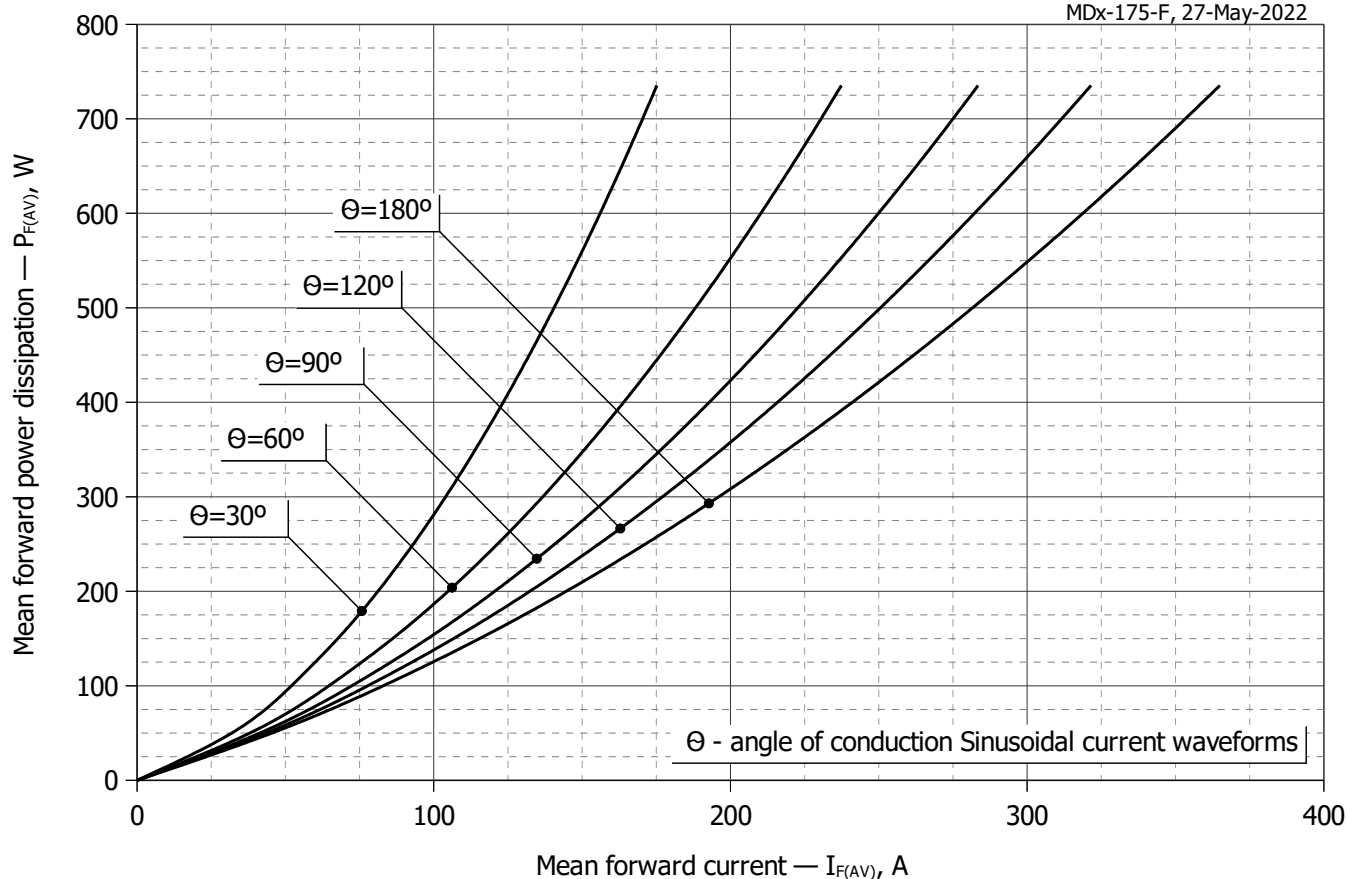


Fig. 7 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

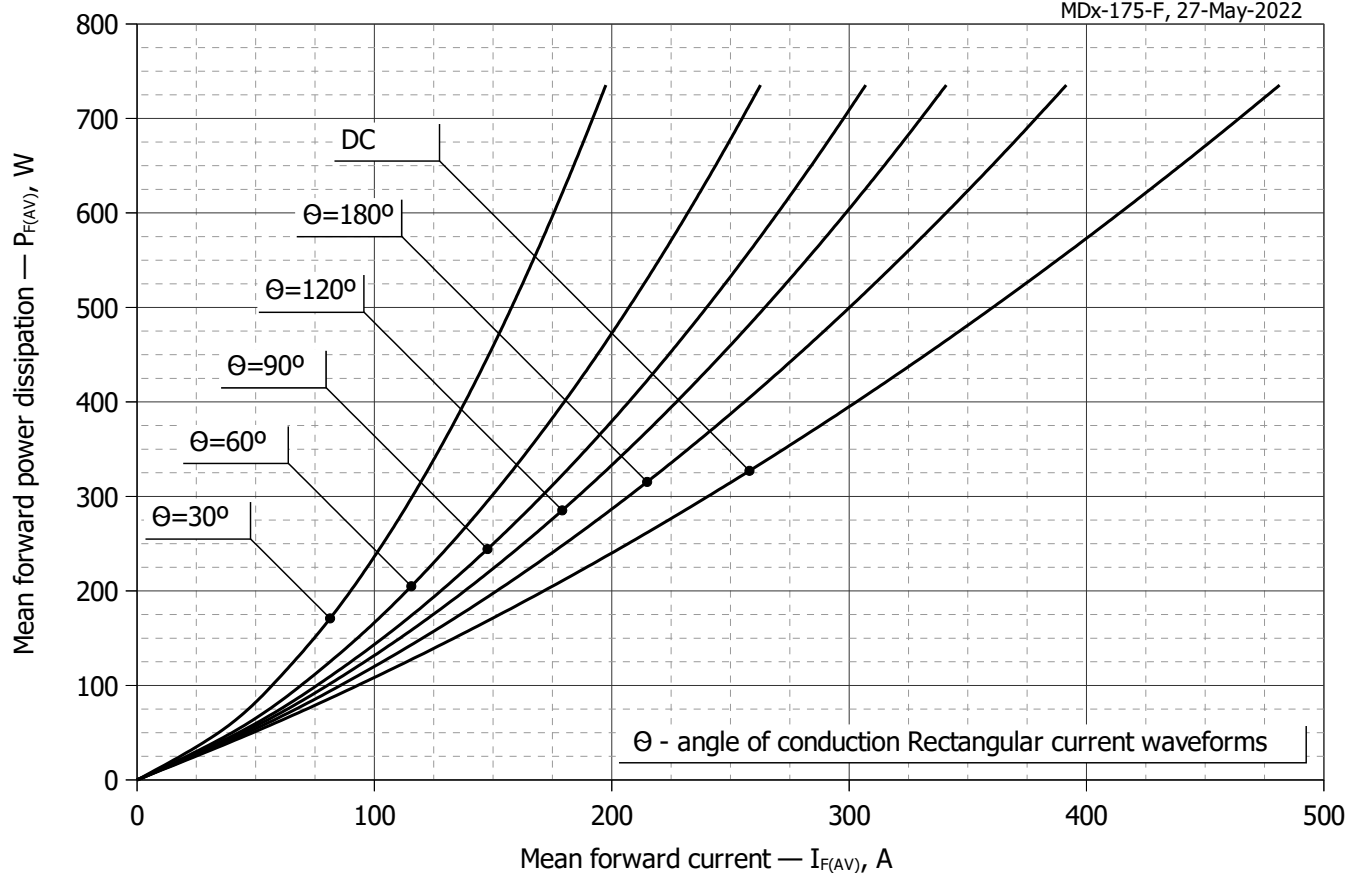


Fig. 8 – Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

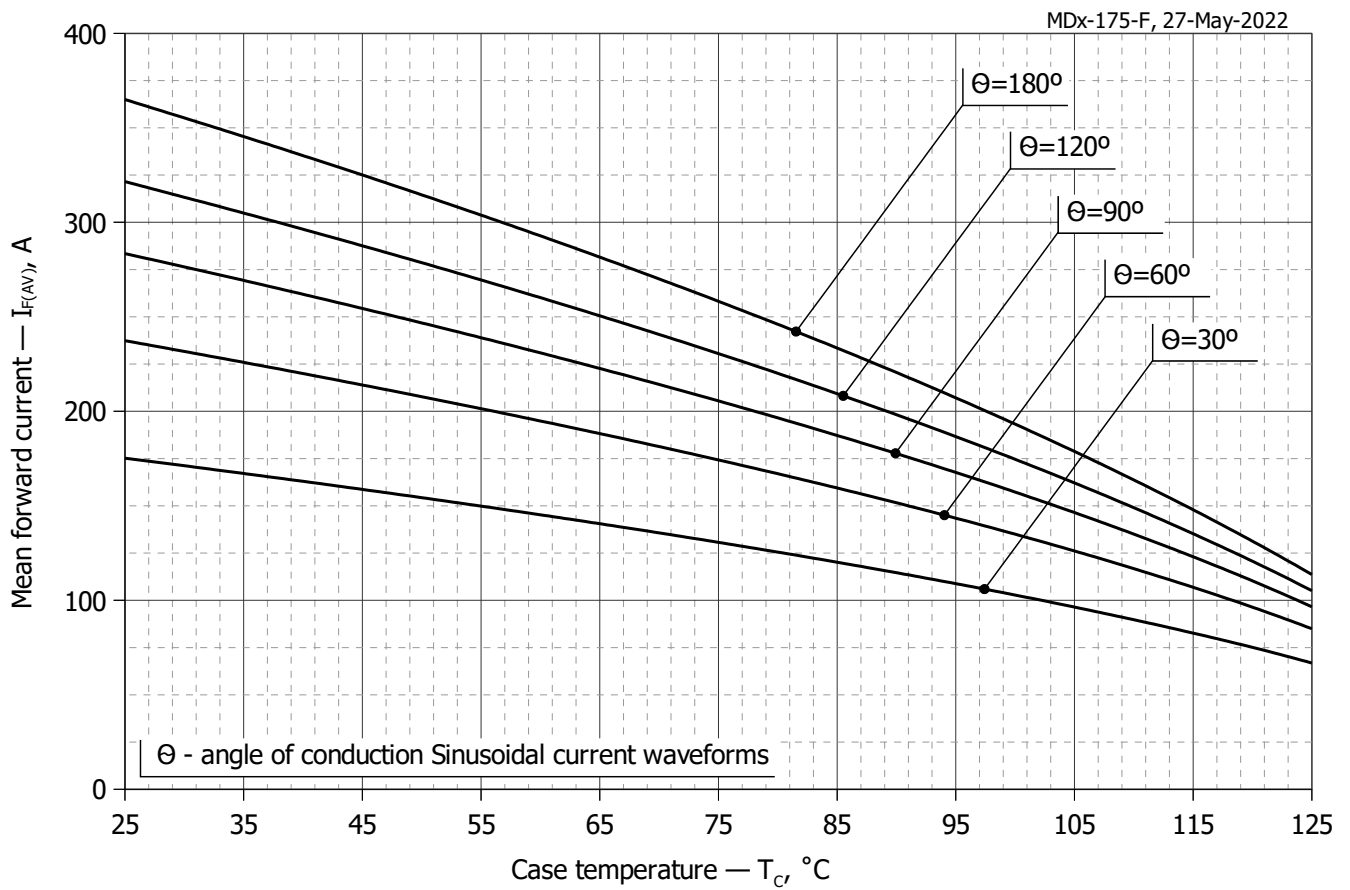


Fig. 9 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

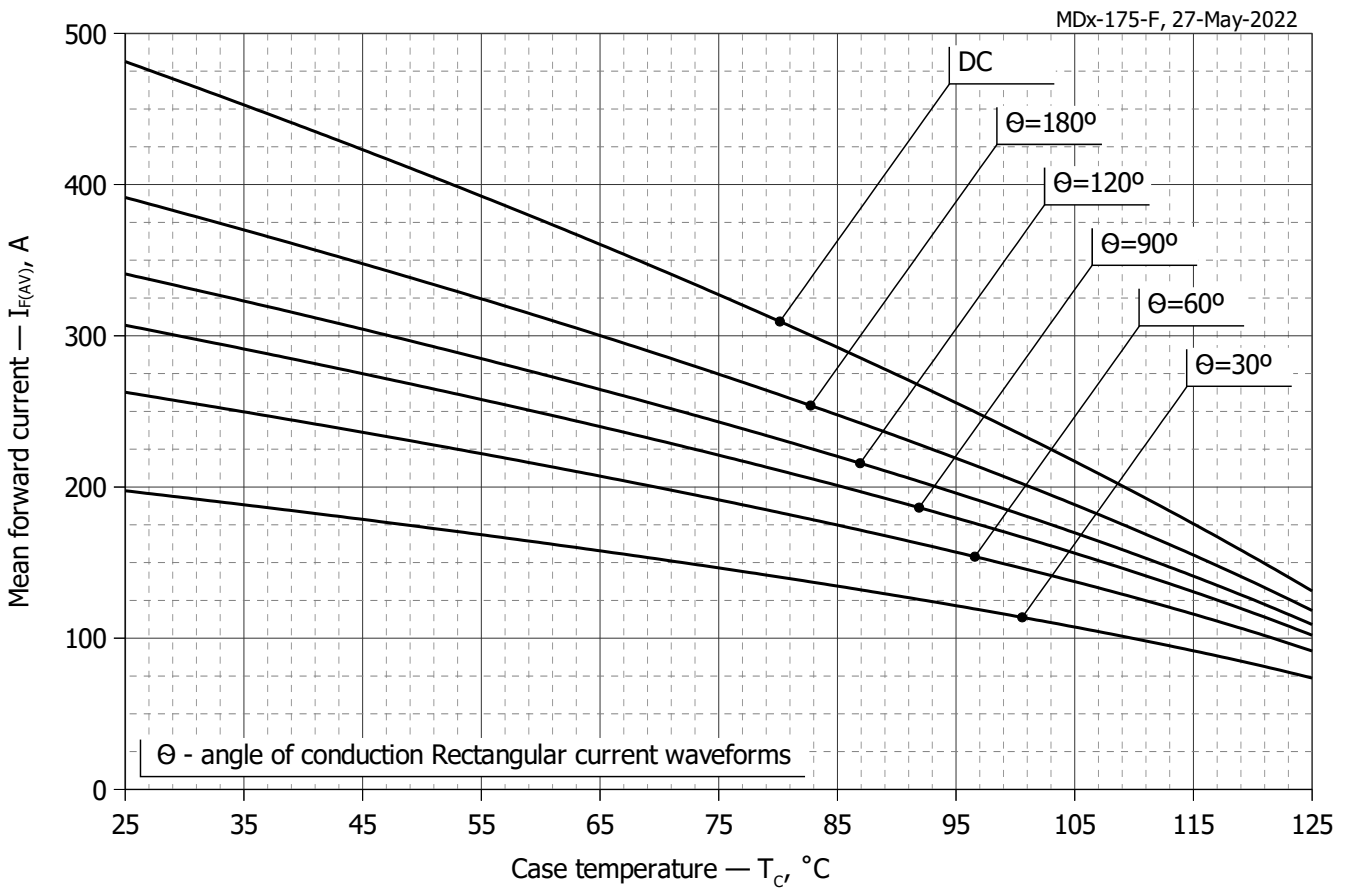


Fig. 10 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

