



Double Thyristor Module For Phase Control MTx-115-36-F

					
MT/D3	MD/T3			MT/D5	

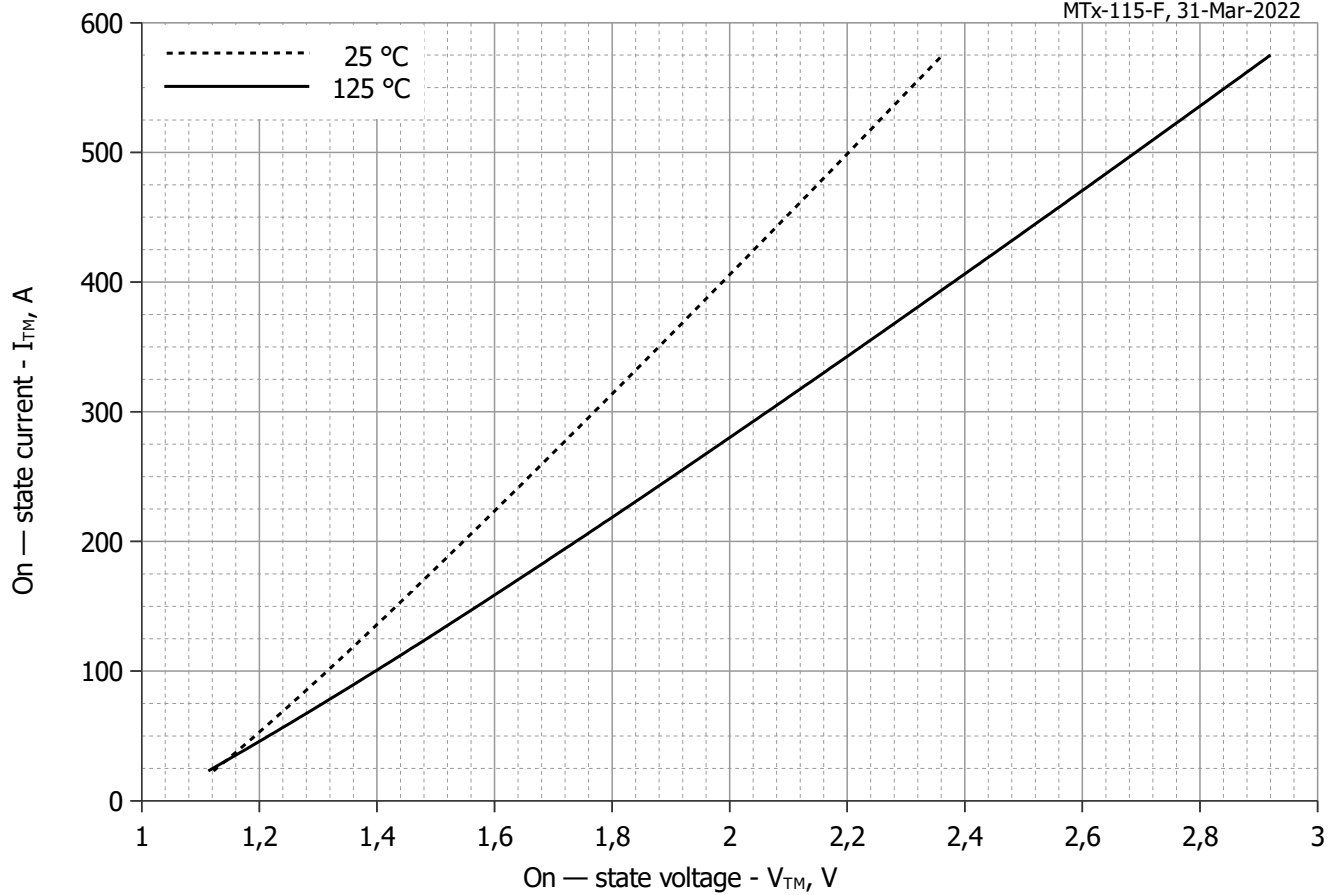
MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I _{TAV}	Maximum allowable mean on-state current	A	115	T _c = 85 °C; 180° half-sine wave; 50 Hz	
I _{TRMS}	RMS on-state current	A	180		
I _{TSM}	Surge on-state current	kA	2.8 3.0	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _D =V _R =0 V; Gate pulse: I _G =2 A; t _{GP} =50 μs; di _G /dt≥1 A/μs
			3.0 3.5	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =8.3 ms; single pulse; V _D =V _R =0 V; Gate pulse: I _G =2 A; t _{GP} =50 μs; di _G /dt≥1 A/μs
I ² t	Safety factor	A ² s·10 ³	30 40	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =10 ms; single pulse; V _D =V _R =0 V; Gate pulse: I _G =2 A; t _{GP} =50 μs; di _G /dt≥1 A/μs
			30 50	T _j =T _{j max} T _j =25 °C	180° half-sine wave; t _p =8.3 ms; single pulse; V _D =V _R =0 V; Gate pulse: I _G =2 A; t _{GP} =50 μs; di _G /dt≥1 A/μs
BLOCKING					
V _{DRM} , V _{RRM}	Repetitive peak off-state and Repetitive peak reverse voltages	V	3000...3600	T _{j min} < T _j < T _{j max} ; 180° half-sine wave; 50 Hz; Gate open	
V _{DSM} , V _{RSM}	Non-repetitive peak off-state and Non-repetitive peak reverse voltages	V	3100...3700	T _{j min} < T _j < T _{j max} ; 180° half-sine wave; single pulse; Gate open	
V _D , V _R	Direct off-state and Direct reverse voltages	V	0.6·V _{DRM} 0.6·V _{RRM}	T _j =T _{j max} ; Gate open	
TRIGGERING					
I _{FGM}	Peak forward gate current	A	5	T _j =T _{j max}	
V _{RGM}	Peak reverse gate voltage	V	5		
P _G	Gate power dissipation	W	3	T _j =T _{j max} for DC gate current	
SWITCHING					
(di _T /dt) _{crit}	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/μs	200	T _j =T _{j max} ; V _D =0.67·V _{DRM} ; I _{TM} =230 A; Gate pulse: I _G =2 A; V _G =20 V; t _{GP} =50 μs; di _G /dt=2 A/μs	
THERMAL					
T _{stg}	Storage temperature	°C	−40...+50		
T _j	Operating junction temperature	°C	−40...+125		
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 _{TM}	Peak on-state voltage, max	V	2.20	T _j =25 °C; I _{TM} = 500 A	
V _{T(TO)}	On-state threshold voltage, max	V	1.102	T _j =T _{j max} ;	
r _T	On-state slope resistance, max	mΩ	3.172	0.5 π I _{TAV} < I _T < 1.5 π I _{TAV}	
I _L	Latching current, max	mA	500	T _j =25 °C; V _D =12 V; Gate pulse: I _G =2 A; t _{GP} =50 μs; di _G /dt≥1 A/μs	
I _H	Holding current, max	mA	250	T _j =25 °C; V _D =12 V; Gate open	
BLOCKING					
I _{DRM} , I _{RRM}	Repetitive peak off-state and Repetitive peak reverse currents, max	mA	70 2.50	T _j =T _{j max} T _j = 25 °C	V _D =V _{DRM} ; V _R =V _{RRM}
(dv _D /dt) _{crit}	Critical rate of rise of off-state voltage ¹⁾ , min	V/μs	200, 320, 500, 1000, 1600, 2000, 2500	T _j =T _{j max} ; V _D =0.67·V _{DRM} ; Gate open	
TRIGGERING					
V _{GT}	Gate trigger direct voltage, max	V	3.00 2.50 1.50	T _j = T _{j min} T _j =25 °C T _j = T _{j max}	V _D =12 V; I _D =3 A; Direct gate current
I _{GT}	Gate trigger direct current, max	mA	400 250 150	T _j = T _{j min} T _j = 25 °C T _j = T _{j max}	
V _{GD}	Gate non-trigger direct voltage, min	V	0.60	T _j =T _{j max} ; V _D =0.67·V _{DRM} ;	
I _{GD}	Gate non-trigger direct current, min	mA	40.00	Direct gate current	
SWITCHING					
t _{gd}	Delay time, max	μs	1.10	T _j =25 °C; V _D =1500 V; I _{TM} =I _{TAV} ; di/dt=200 A/μs;	
t _{gt}	Turn-on time, max	μs	4.00	Gate pulse: I _G =2 A; V _G =20 V; t _{GP} =50 μs; di _G /dt=2 A/μs	
t _q	Turn-off time ²⁾ , max	μs	400	dv _D /dt=50 V/μs; T _j =T _{j max} ; I _{TM} =200 A; di _R /dt=-10 A/μs; V _R =100V; V _D =0.67 V _{DRM} ;	
Q _{rr}	Recovered charge, max	μC	920	T _j =T _{j max} ; I _{TM} =I _{TAV} ;	
t _{rr}	Reverse recovery time, max	μs	31	di _R /dt=-5 A/μs;	
I _{rr}	Reverse recovery current, max	A	59	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 3.60	Sine wave, 50 Hz; RMS	t=60 sec t=1 sec
MECHANICAL					
M ₁	Mounting torque (M6) ³⁾	Nm	6.00	Tolerance ± 15%	
M ₂	Terminal connection torque (M6) ³⁾	Nm	6.00	Tolerance ± 15%	
m	Weight, max	g	350		

PART NUMBERING GUIDE													NOTES																							
MT	3	-	115	-	36	-	A2	H2	-	F	-	N	1) Critical rate of rise of off-state voltage <table><tr><td>Symbol of Group</td><td>P2</td><td>K2</td><td>E2</td><td>A2</td><td>T1</td><td>P1</td><td>M1</td></tr><tr><td>(dv_D/dt)_{crit}, V/μs</td><td>200</td><td>320</td><td>500</td><td>1000</td><td>1600</td><td>2000</td><td>2500</td></tr></table>								Symbol of Group	P2	K2	E2	A2	T1	P1	M1	(dv _D /dt) _{crit} , V/μs	200	320	500	1000	1600	2000	2500
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(dv _D /dt) _{crit} , V/μs	200	320	500	1000	1600	2000	2500																													
1	2		3		4		5	6		7		8																								
1. Thyristor module (MT) Thyristor – Diode module (MT/D) Diode – Thyristor module (MD/T)													2) Turn-off time (dv _D /dt=50 V/μs) <table><tr><td>Symbol of group</td><td colspan="7">H2</td></tr><tr><td>t_q, μS</td><td colspan="7">400</td></tr></table>								Symbol of group	H2							t _q , μS	400						
Symbol of group	H2																																			
t _q , μS	400																																			
2. Circuit Schematic:																																				
3. Average On-state Current, A													3) The screws must be lubricated																							
4. Voltage Code																																				
5. Critical rate of rise of off-state voltage																																				
6. Group of turn-off time (dv _D /dt=50 V/μs)																																				
7. Package Type (M.F)																																				
8. Ambient Conditions:																																				
N – Normal																																				

**Fig 1 – On-state characteristics of Limit device**

Analytical function for On-state characteristic:

$$V_T = A + B \cdot i_T + C \cdot \ln(i_T + 1) + D \cdot \sqrt{i_T}$$

	Coefficients for max curves	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\max}$
A	1.05551609	1.04275622
B	0.00187338	0.00253738
C	-0.01178378	-0.03749362
D	0.01267796	0.02737256

On-state characteristic model (see Fig. 1)

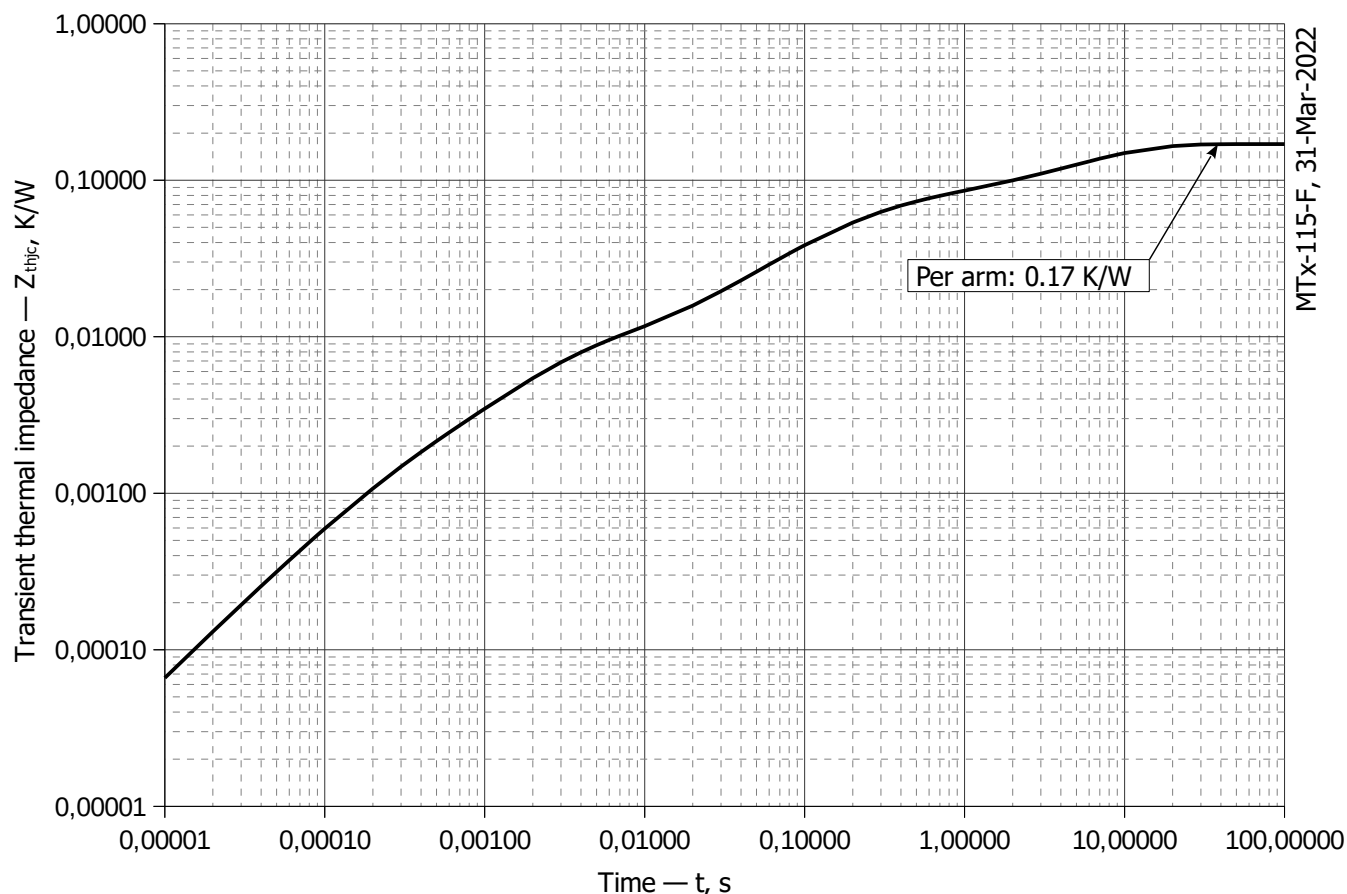


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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	0.0066399867	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)

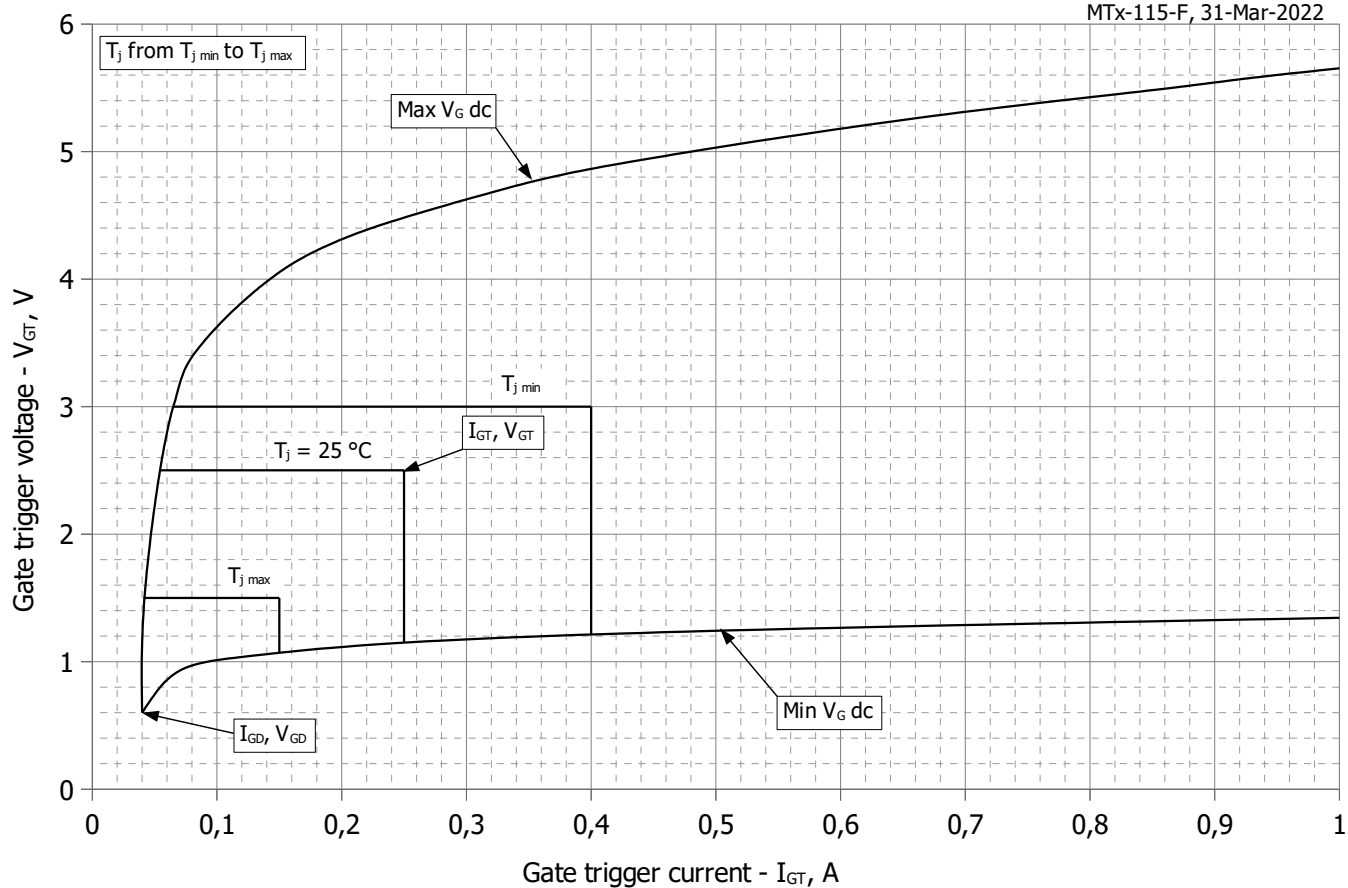


Fig 3 – Gate characteristics – Trigger limits

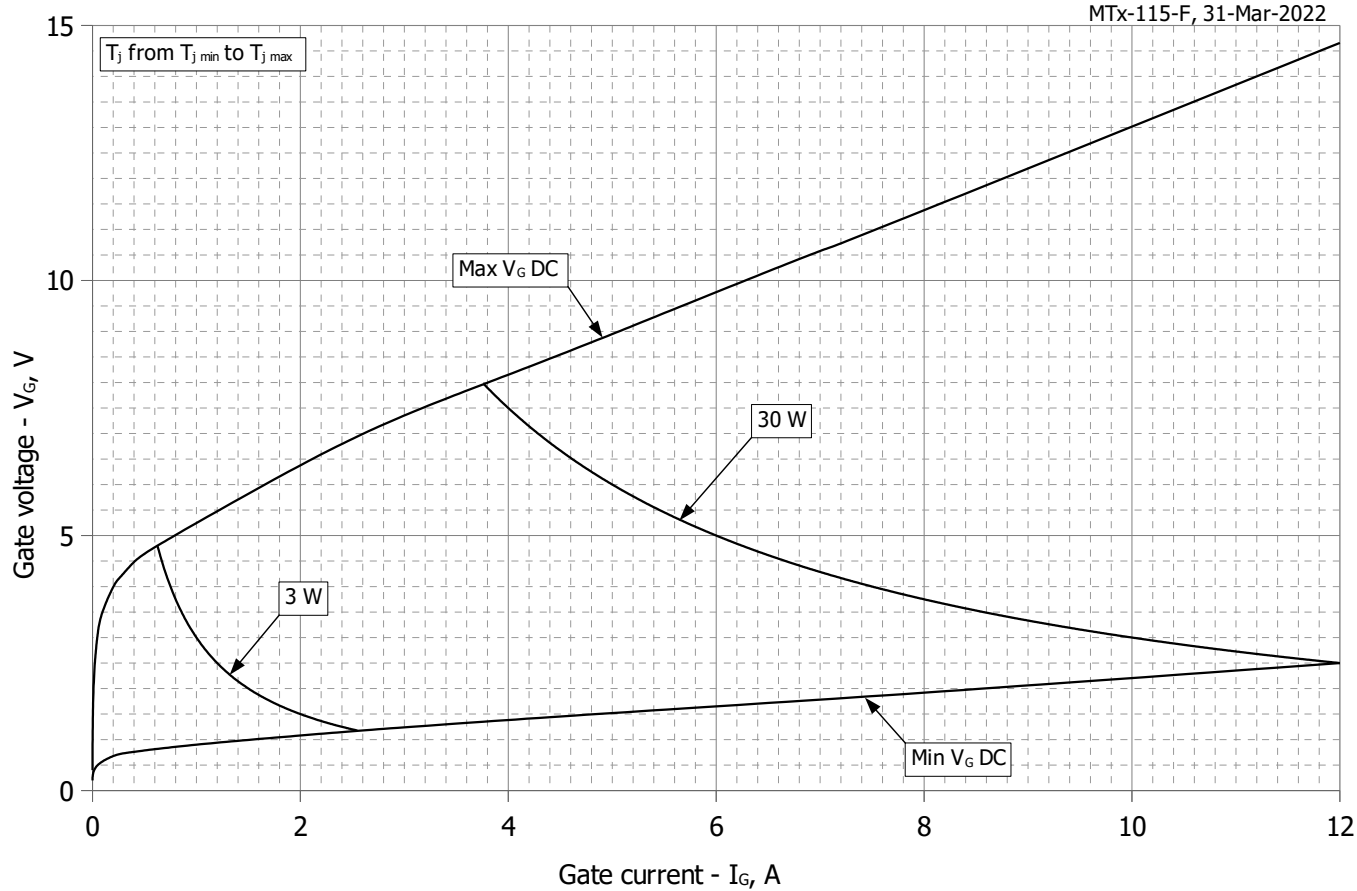


Fig 4 - Gate characteristics – Power curves

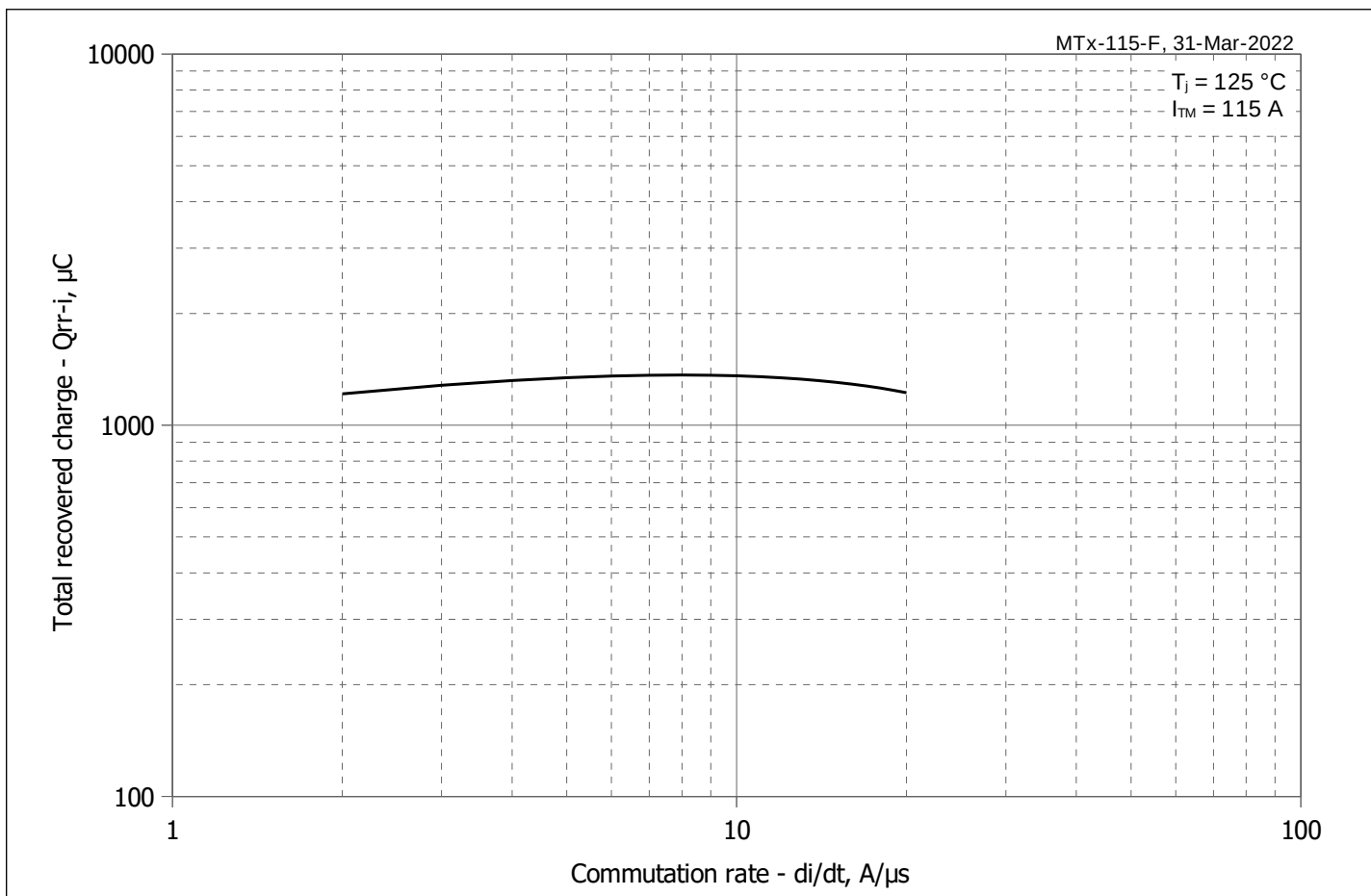


Fig 5 – Maximum recovered charge Q_{rr-i} (integral) vs. commutation rate di_R/dt

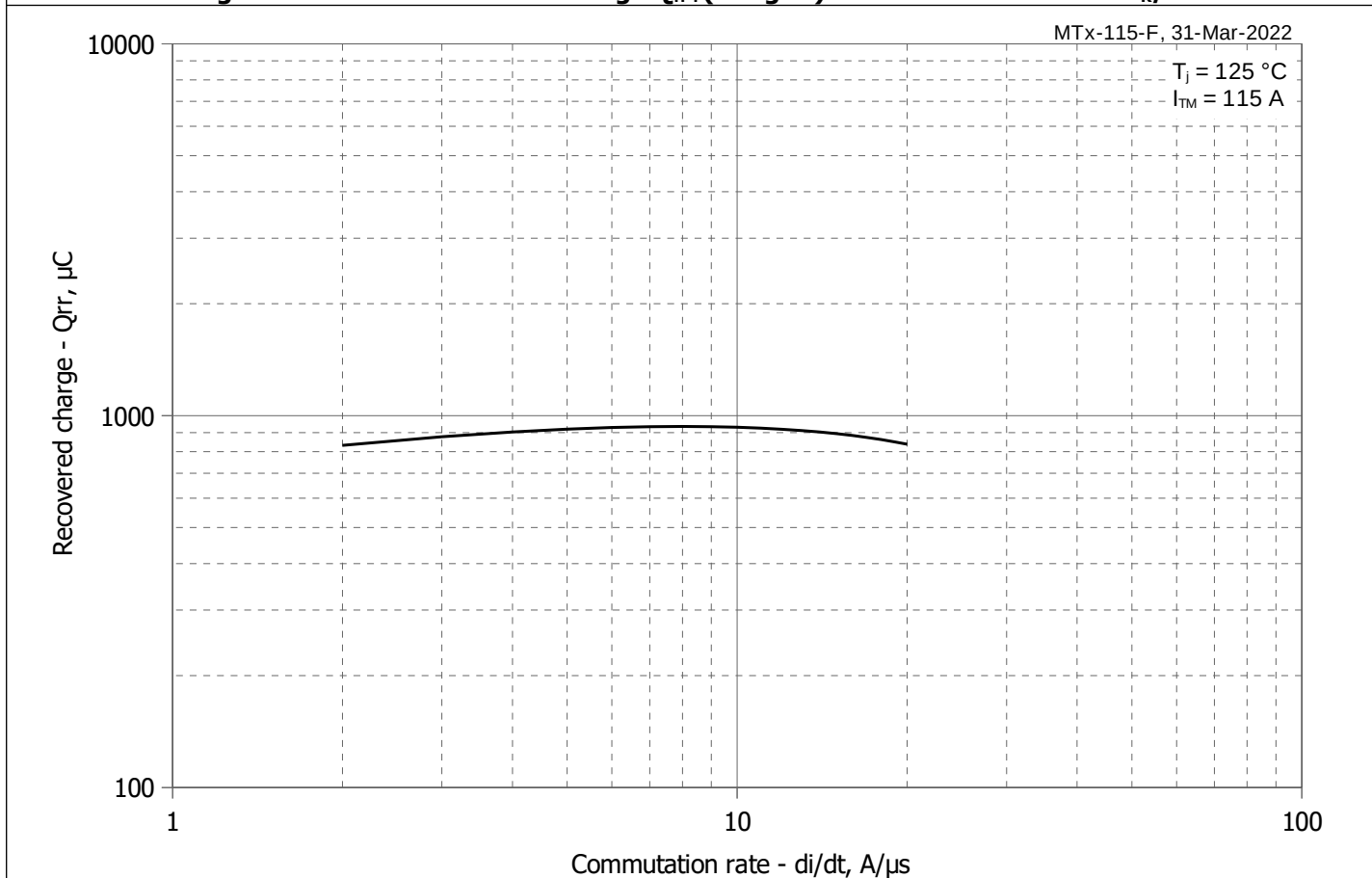


Fig 6 – Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

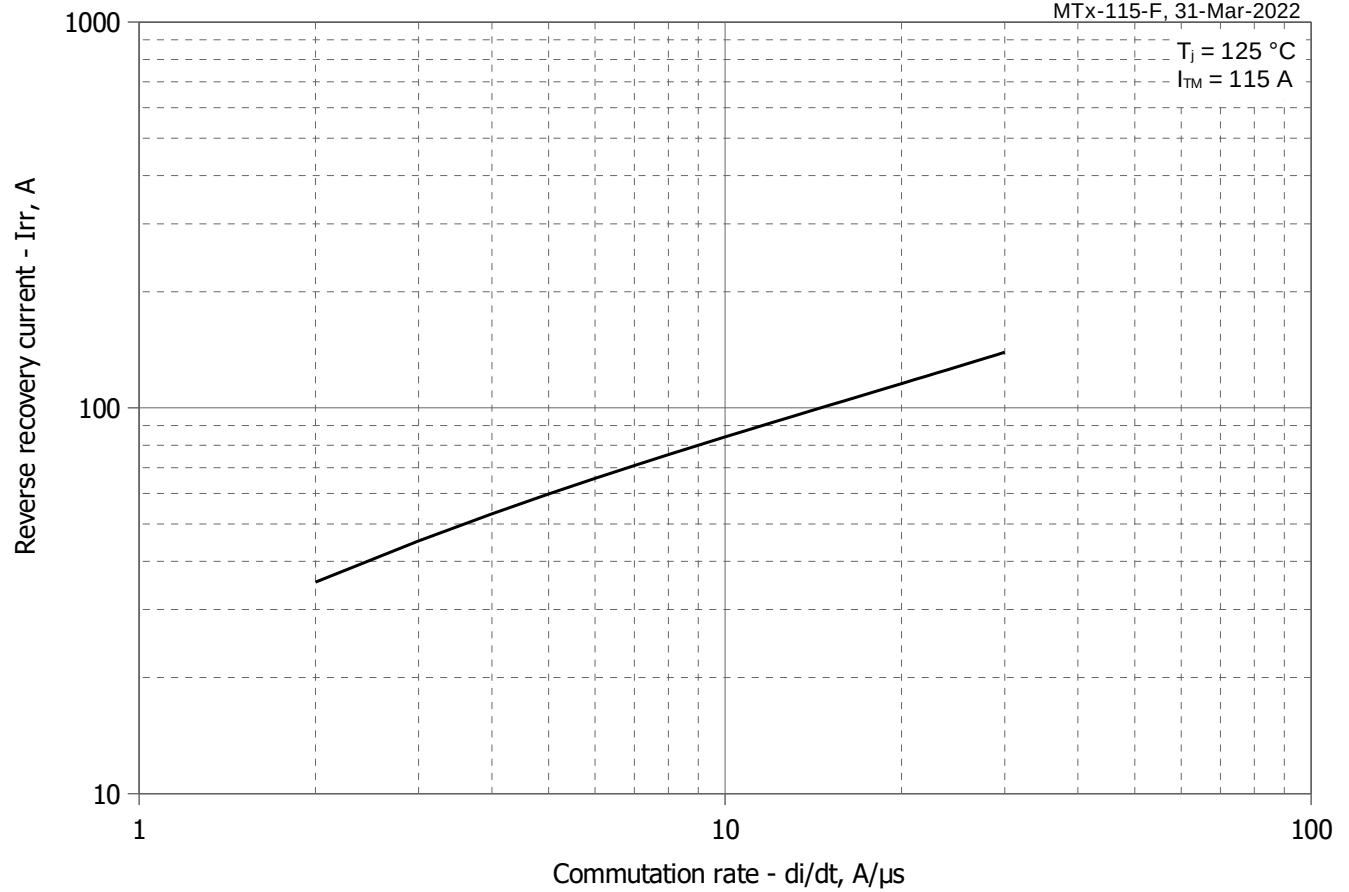


Fig 7 – Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

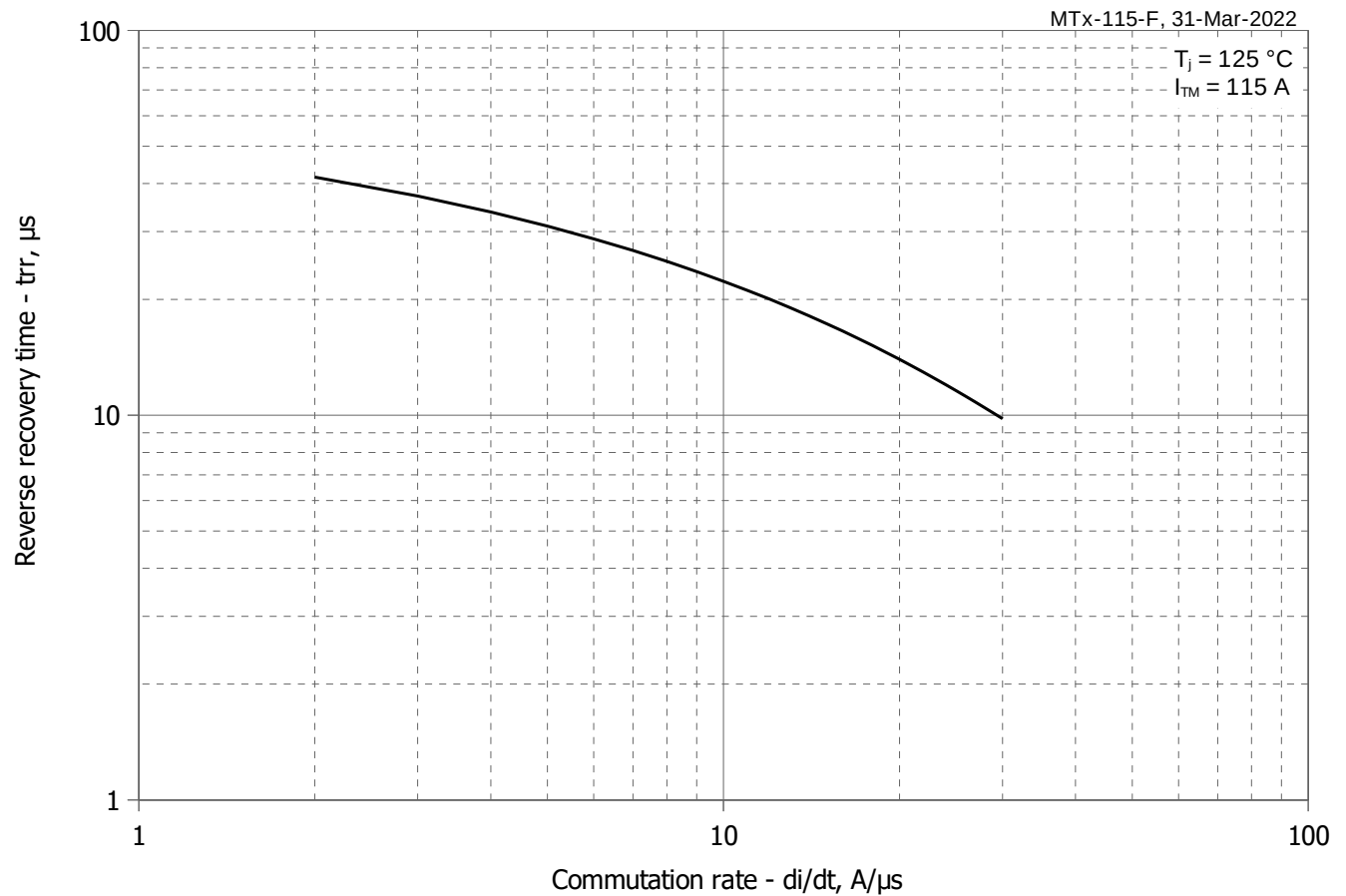


Fig 8 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

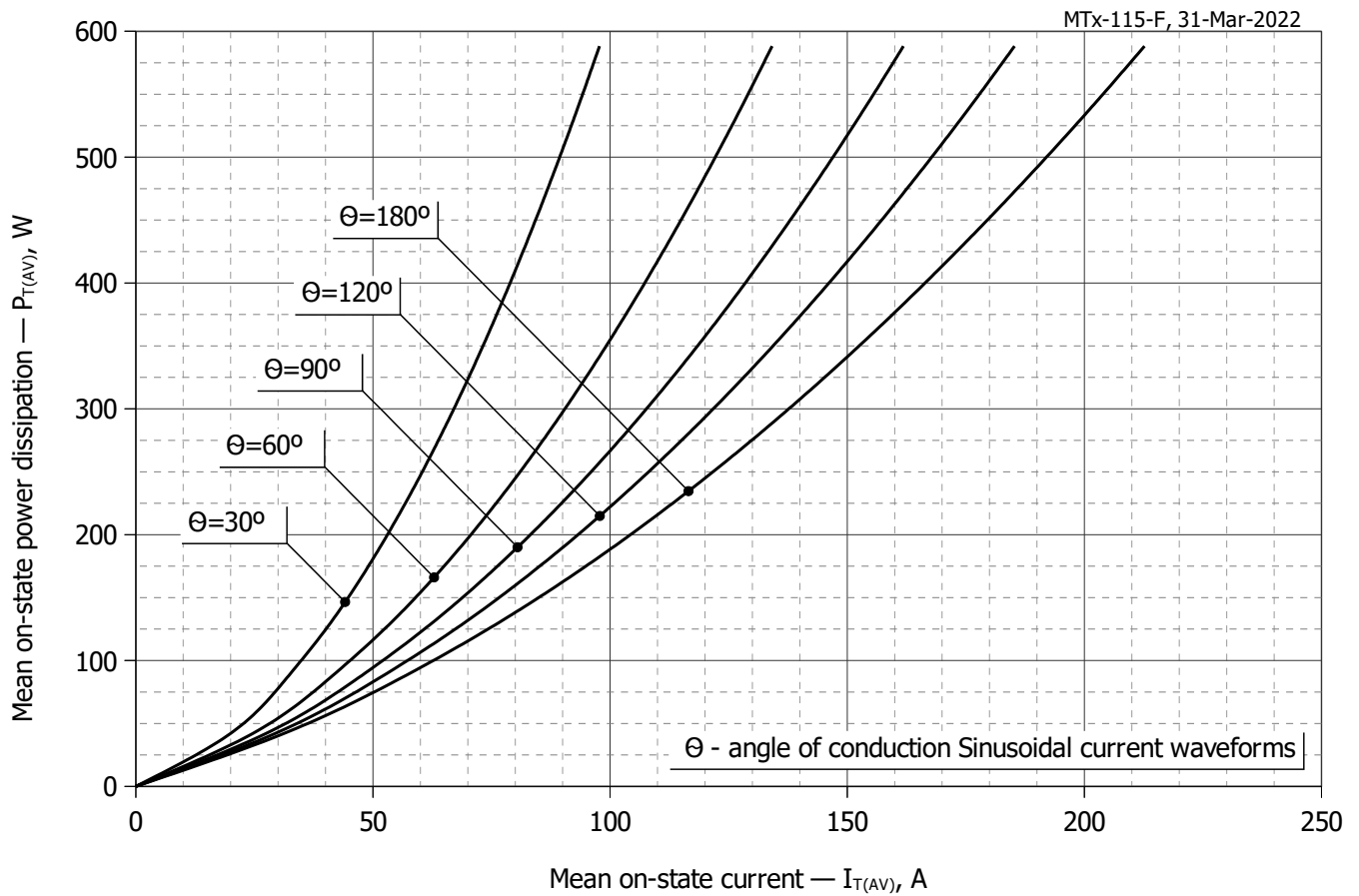


Fig. 9 - Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

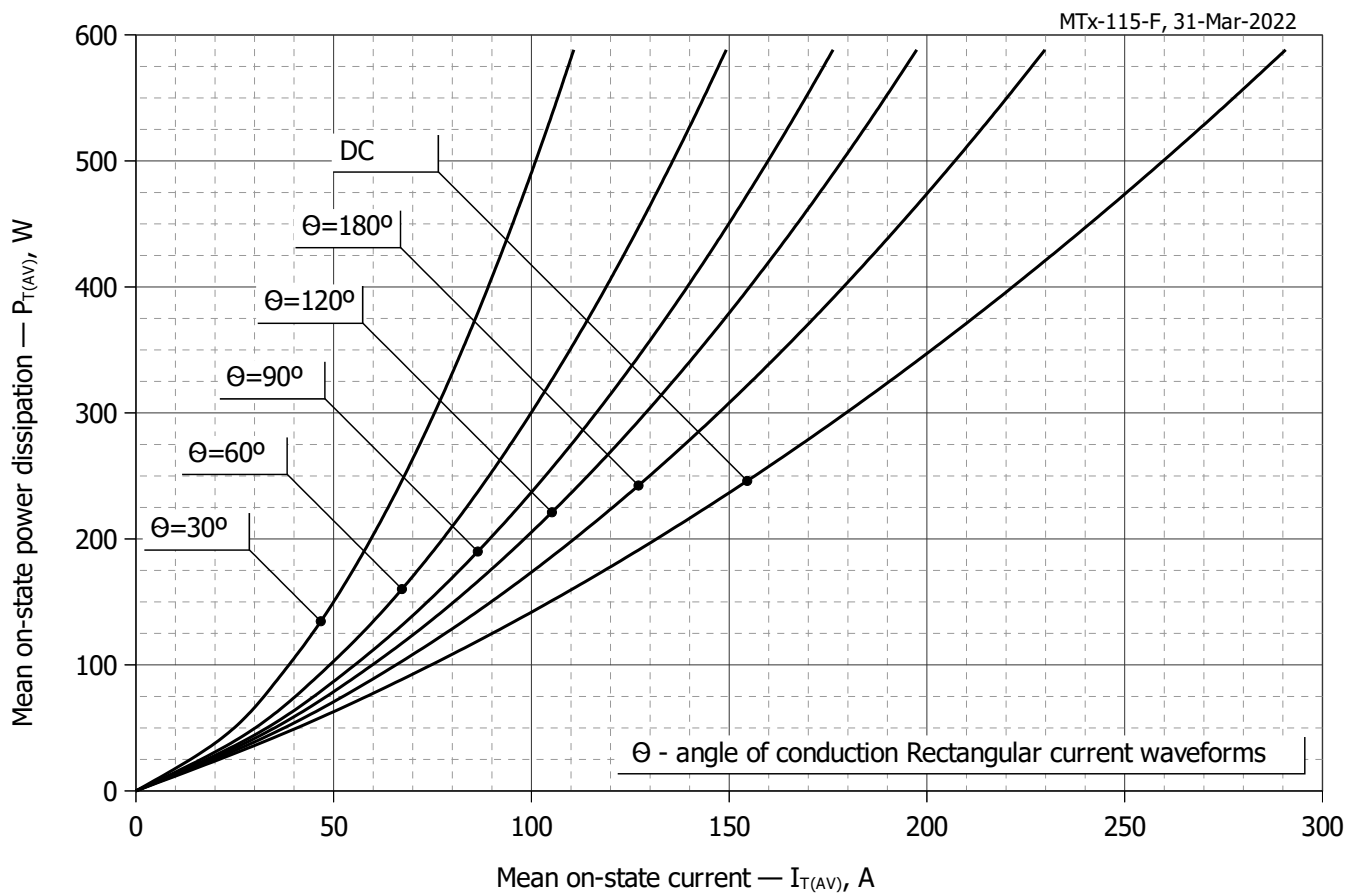


Fig. 10 – Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

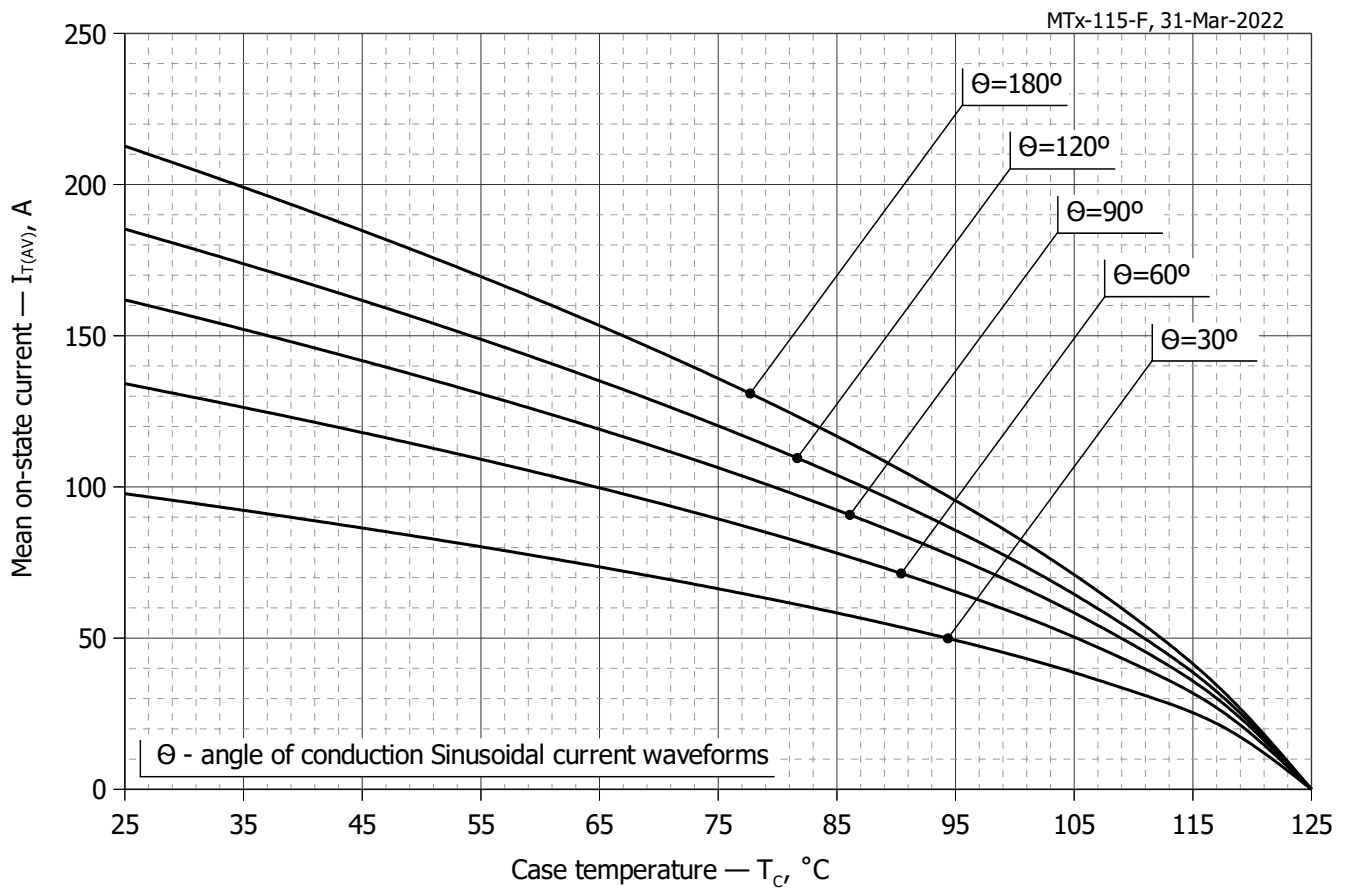


Fig. 11 – Mean on-state current I_{TAV} vs. case temperature T_c for sinusoidal current waveforms at different conduction angles ($f=50\text{Hz}$)

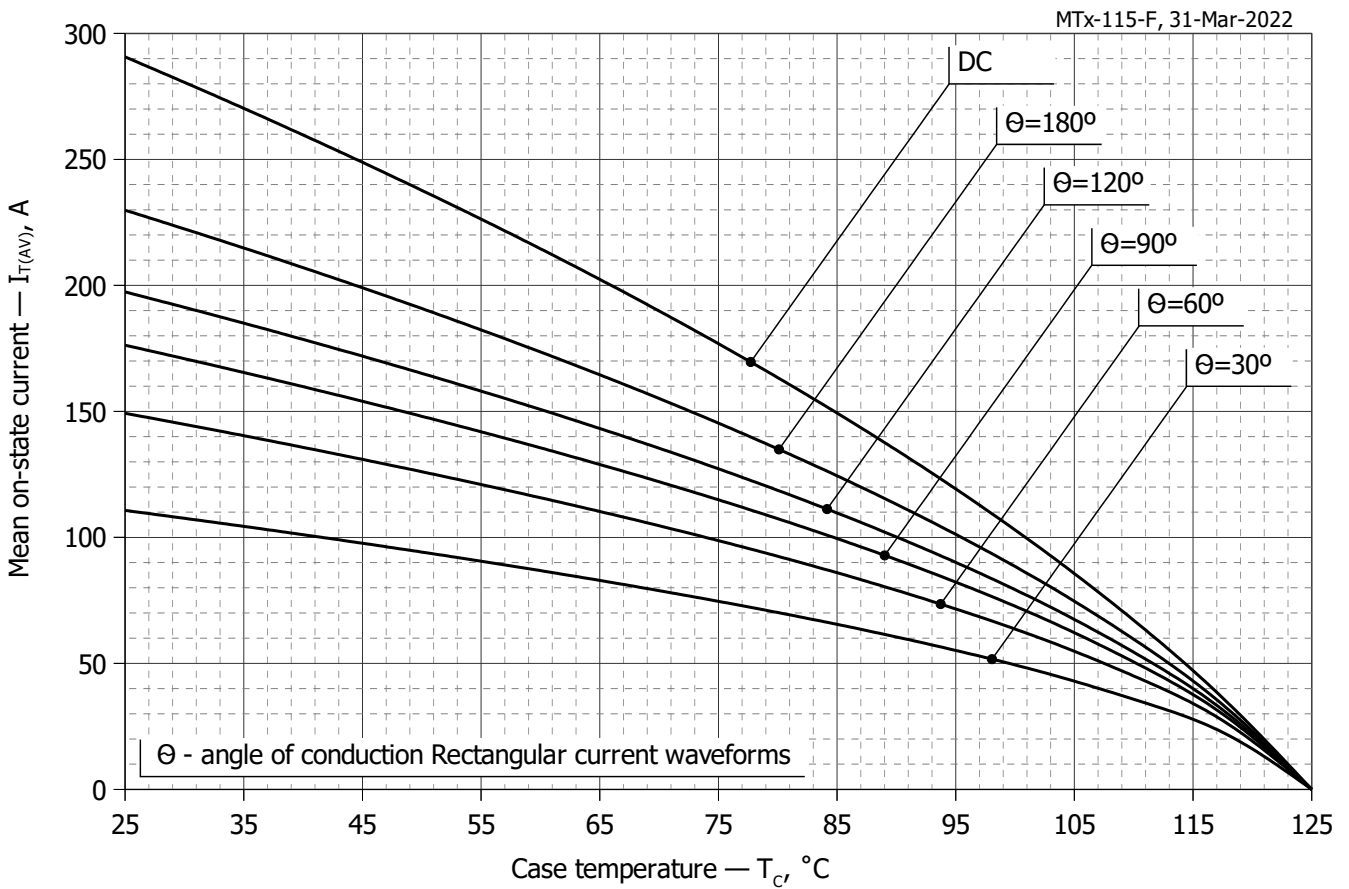


Fig. 12 - Mean on-state current I_{TAV} vs. case temperature T_c for rectangular current waveforms at different conduction angles and for DC ($f=50\text{Hz}$)

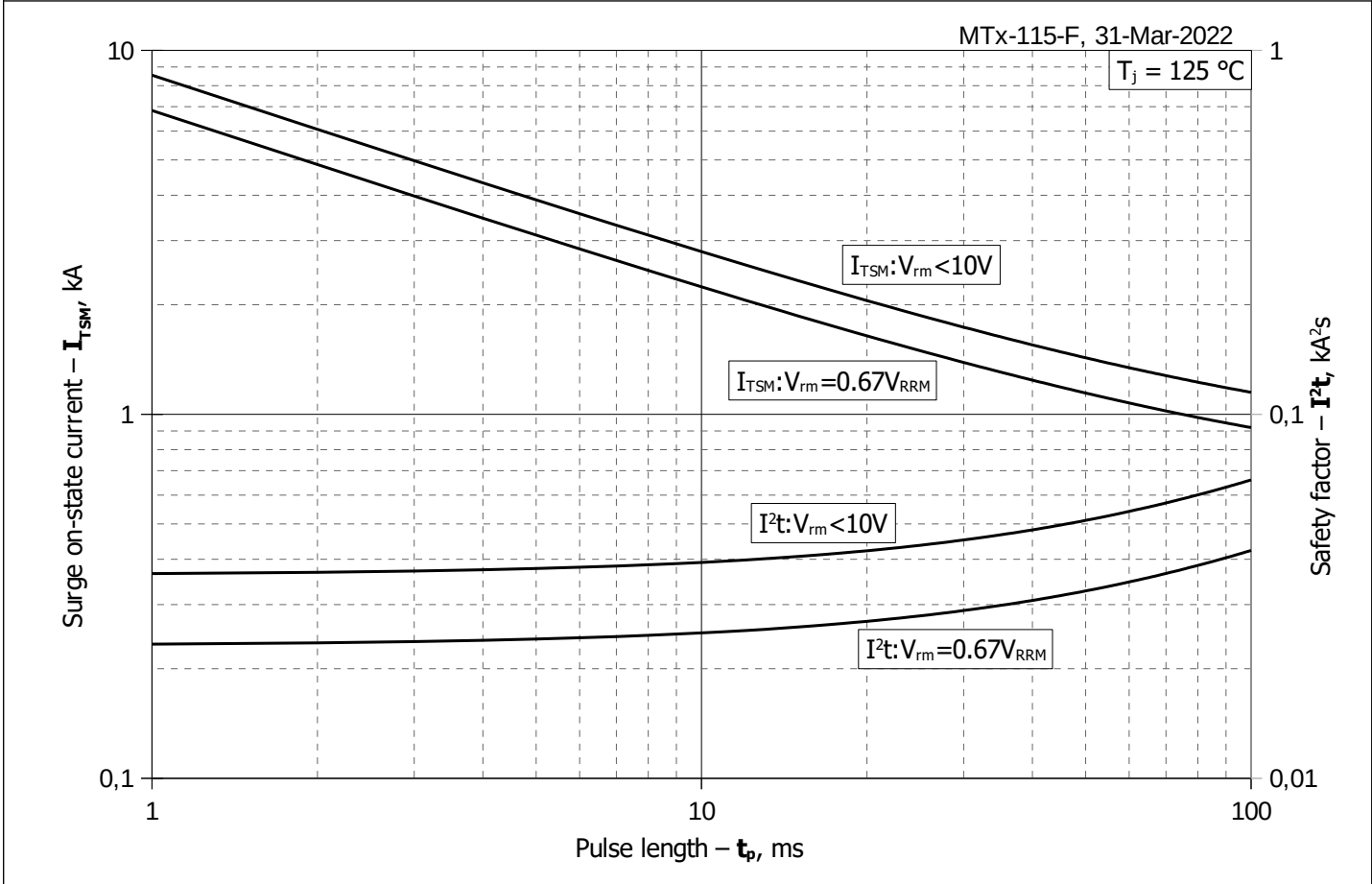


Fig. 13 – Maximum surge on-state current I_{TSM} and safety factor I^2t vs. pulse length t_p

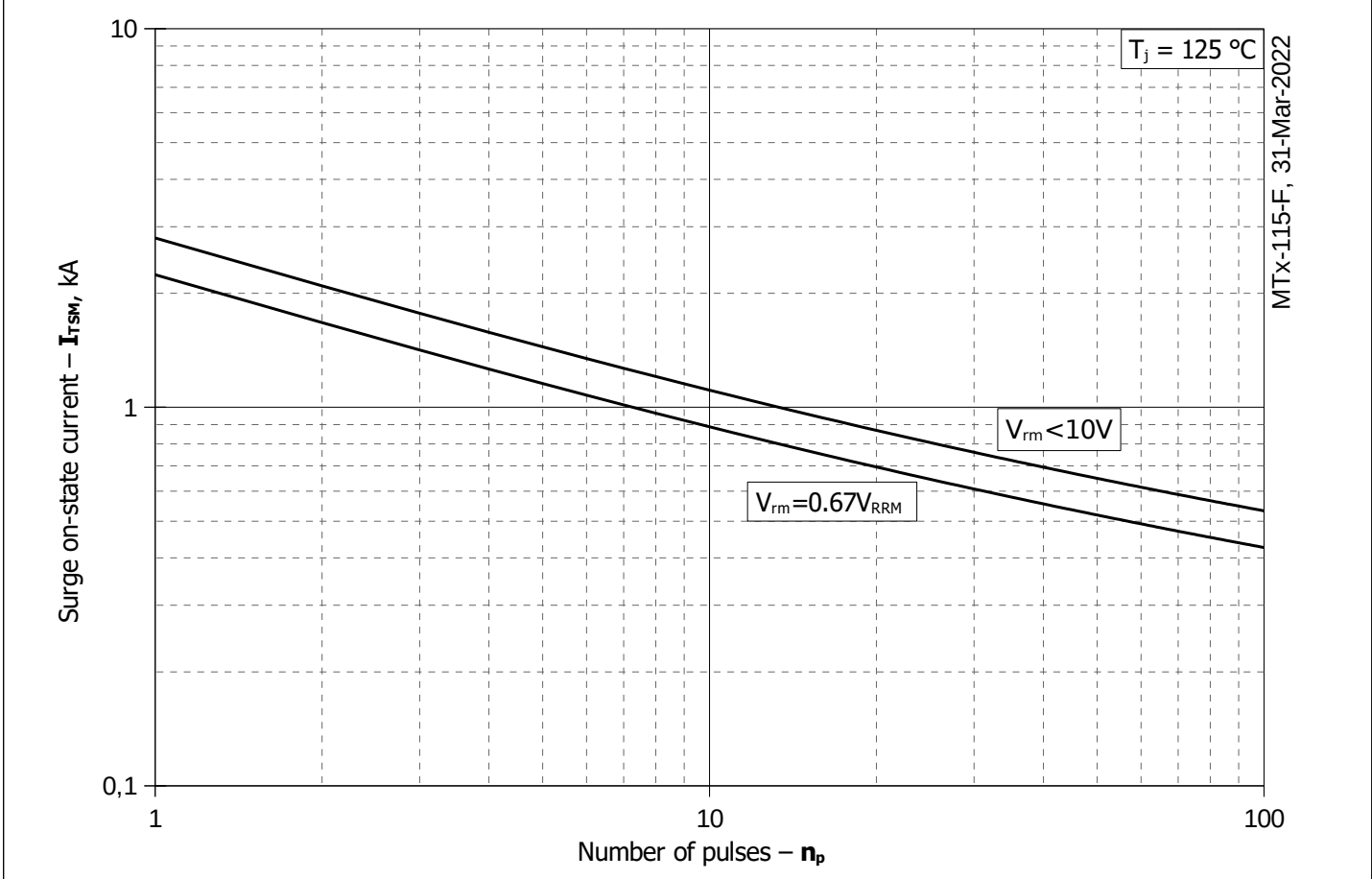


Fig. 14 - Maximum surge on-state current I_{TSM} vs. number of pulses n_p