Low switching losses
Low reverse recovery charge
Distributed amplified gate for high di_T/dt

Fast Thyristor
Type TFI253-1250-22

Maximum allowable mean on-state current		I_{TAV}	1250 A
Repetitive peak off-state voltage		V_{DRM}	1800...2200 V
Repetitive peak reverse voltage		V_{RRM}	
Turn-off time		t_q	32.0, 40.0, 50.0, 63.0 µs
V_{DRM}, V_{RRM}, V	1800	2000	2200
Voltage code	18	20	22
T_j, °C	–60...+125		

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{TAV}	Maximum allowable mean on-state current	A	1024 1250 1540	T_c= 85 °C; Double side cooled; T_c= 72 °C; Double side cooled; T_c= 55 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	1963	T_c= 72 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	24.0 28.0	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
			25.0 29.0	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^2t	Safety factor	$A^2s{\cdot}10^3$	2800 3900	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
			2500 3400	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	1800...2200	$T_{j\,min}$< 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	1900...2300	$T_{j\,min}$< 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	8	$T_j=T_{j\,max}$
V_{RGM}	Peak reverse gate voltage	V	5	
P_G	Gate power dissipation	W	8	$T_j=T_{j\,max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/µs	2000	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; I_{TM}= 2800 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	–60...+50	
T_j	Operating junction temperature	°C	–60...+125	
MECHANICAL				
F	Mounting force	kN	24.0...28.0	
a	Acceleration	m/s^2	50	Device clamped

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{TM}	Peak on-state voltage, max	V	2.10	T_j=25 °C; I_{TM}=3140 A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.255	$T_j=T_{j\,max}$;	
r_T	On-state slope resistance, max	mΩ	0.241	0.5 π I_{TAV} < I_T < 1.5 π I_{TAV}	
I_H	Holding current, max	mA	500	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	150	$T_j=T_{j\,max}$; $V_D=V_{DRM}$; $V_R=V_{RRM}$	
$(dv_D/dt)_{crit}$	Critical rate of rise of off-state voltage[1)], min	V/µs	200, 320, 500, 1000, 1600, 2000, 2500	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; 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	500 300 150	T_j= $T_{j\,min}$ T_j= 25 °C T_j= $T_{j\,max}$	
V_{GD}	Gate non-trigger direct voltage, min	V	0.40	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	55.00		
SWITCHING					
t_{gd}	Delay time, max	µs	1.00	T_j=25 °C; V_D=1000 V; $I_{TM}=I_{TAV}$; di/dt=200 A/µs; Gate pulse: I_G=2 A; V_G=20 V; t_{GP}=50 µs; di_G/dt=2 A/µs	
t_{gt}	Turn-on time[2)], max	µs	2.00, 2.50, 3.20, 4.00		
t_q	Turn-off time[3)], max	µs	32.0, 40.0, 50.0, 63.0	dv_D/dt=50 V/µs;	$T_j=T_{j\,max}$; I_{TM}= I_{TAV}; di_R/dt=-10 A/µs; V_R=100V; $V_D=0.67\cdot V_{DRM}$;
			40.0, 50.0, 63.0, 80.0	dv_D/dt=200 V/µs;	
Q_{rr}	Recovered charge, max	µC	900	$T_j=T_{j\,max}$; I_{TM}=1000 A; di_R/dt=-50 A/µs; V_R=100 V;	
t_{rr}	Reverse recovery time, max	µs	8.2		
I_{rr}	Reverse recovery current, max	A	220		

THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0210	Direct current	Double side cooled
R_{thjc-A}			0.0440		Anode side cooled
R_{thjc-K}			0.0360		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0040	Direct current	
MECHANICAL					
m	Weight, max	g	490		
D_s	Surface creepage distance	mm (inch)	31.60 (1.244)		
D_a	Air strike distance	mm (inch)	16.50 (0.649)		

PART NUMBERING GUIDE

TFI	253	1250	22	A2	C3	H4	N
1	2	3	4	5	6	7	8

1. TFI — fast inverter thyristor
2. Design version
3. Mean on-state current, A
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. Group of turn-on time
8. Ambient conditions: N – normal; T – tropical

NOTES

[1] Critical rate of rise of off-state voltage

Symbol of Group	P2	K2	E2	A2	T1	P1	M1
$(dv_D/dt)_{crit}$, V/μs	200	320	500	1000	1600	2000	2500

[2] Turn-on time

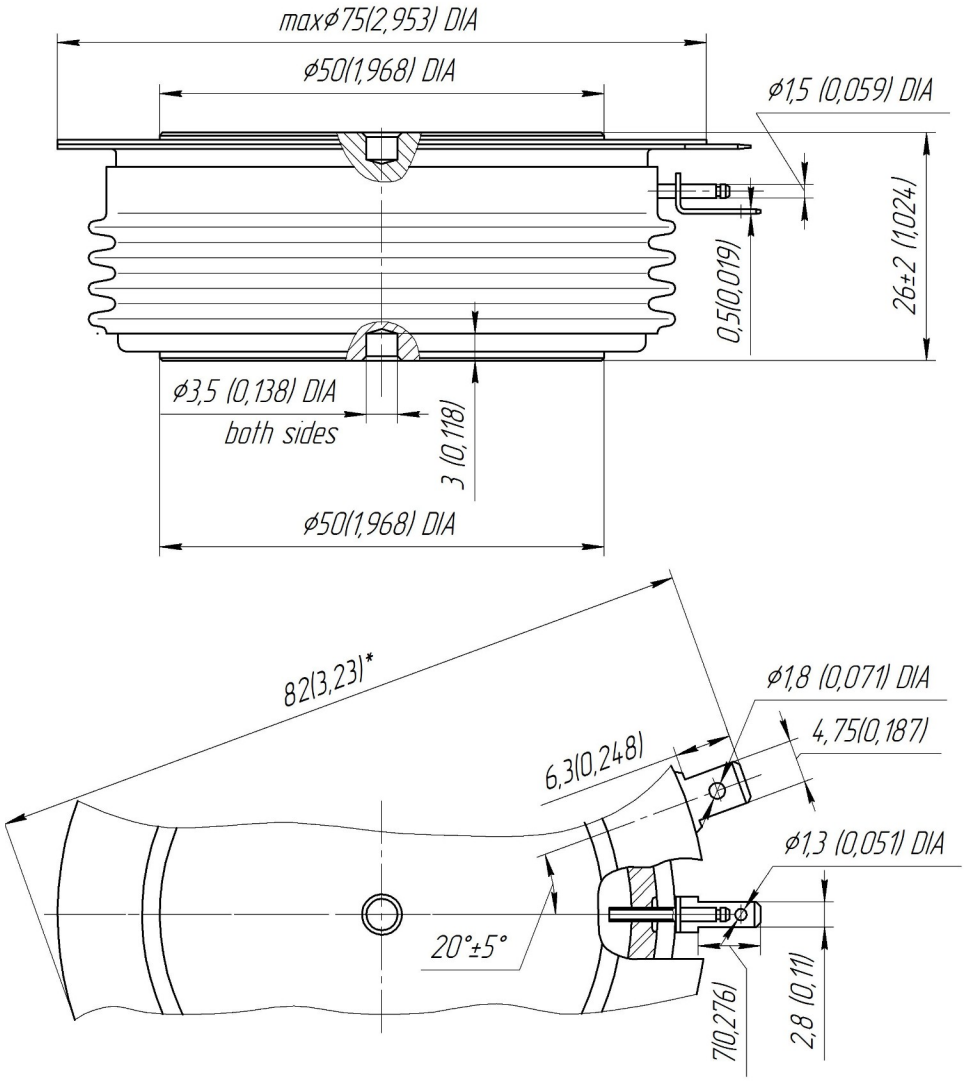
Symbol of group	P4	M4	K4	H4
t_{gt}, μs	2.00	2.50	3.20	4.00

[3] Turn-off time (dv_D/dt=50 V/μs)

Symbol of group	K3	H3	E3	C3
t_q, μs	32.0	40.0	50.0	63.0

OVERALL DIMENSIONS

Package type: T.D5



All dimensions in millimeters (inches)

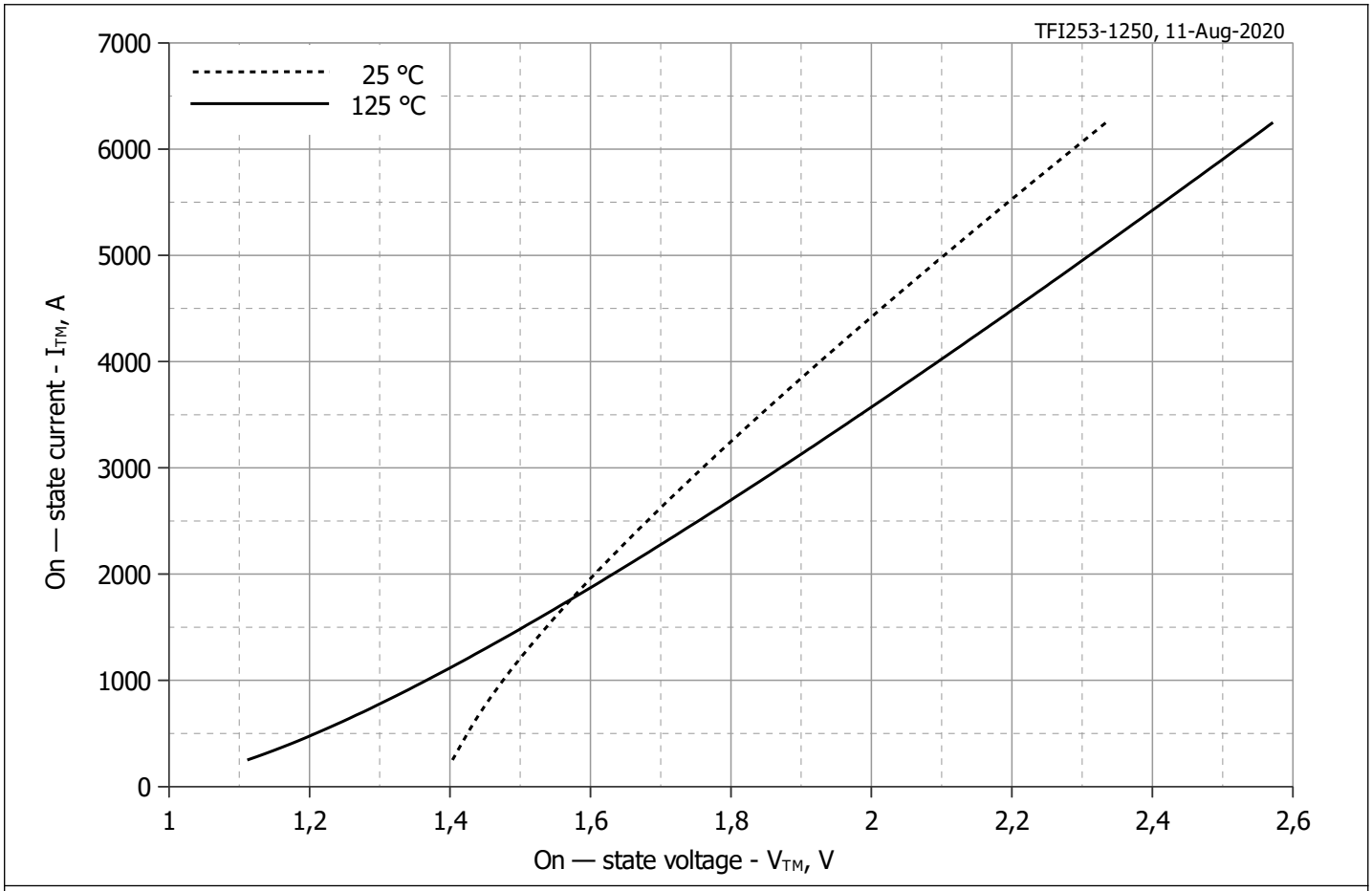


Fig 1 – On-state characteristics of typical device

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°C	$T_j = T_{j\,max}$
A	1.20098590	0.90040445
B	0.00026293	0.00015262
C	0.06322506	0.00778160
D	-0.01344407	0.00821207

On-state characteristic model (see Fig. 1)

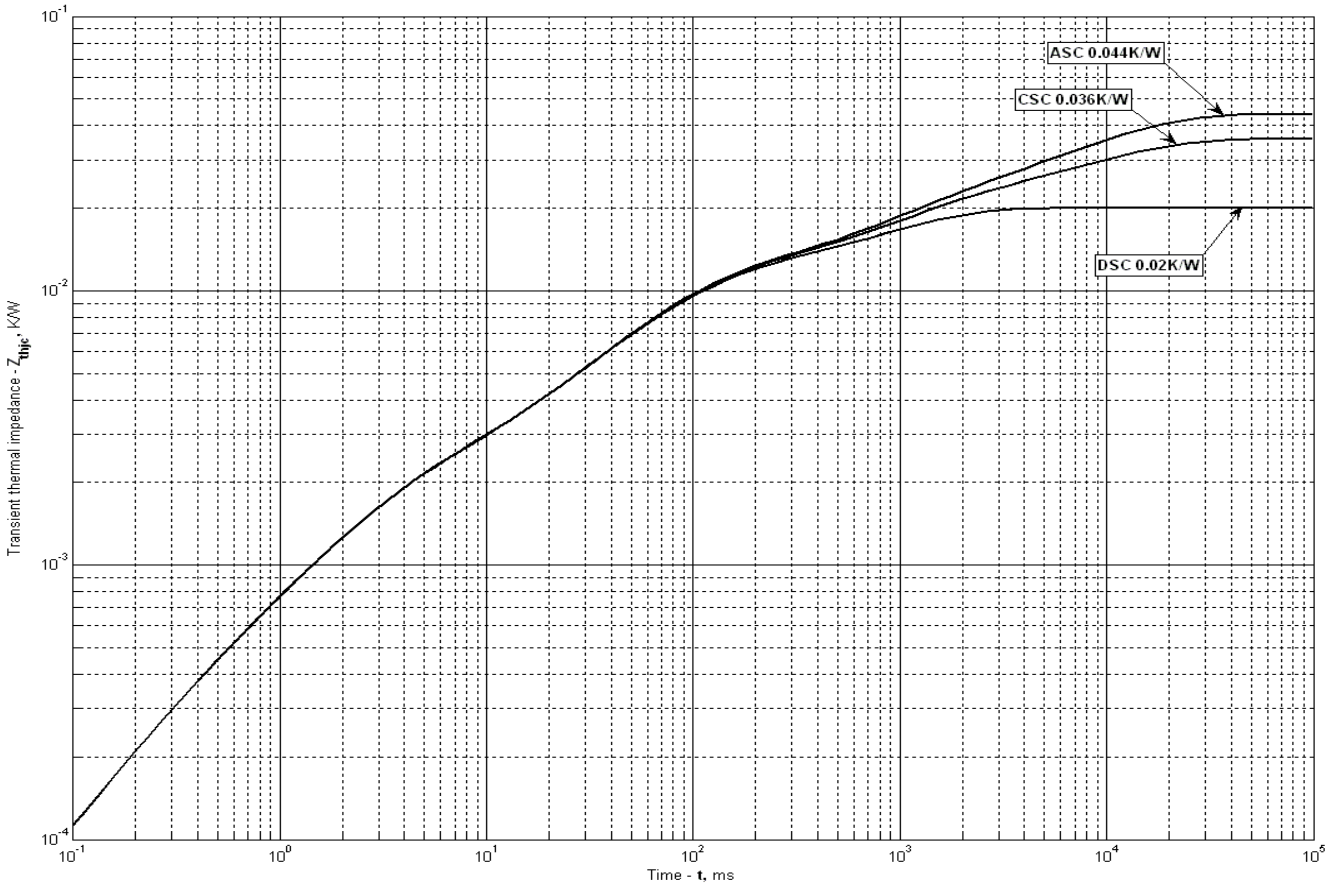


Fig 2 – Transient thermal impedance

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
$\mathbf{R_i}$, **K/W**	0.009168	0.002899	0.001522	0.006297	0.00003033	0.00008163
τ_i, **s**	0.9681	0.05144	0.002417	0.07706	0.0004122	0.0002166

DC Cathode side cooled

i	1	2	3	4	5	6
$\mathbf{R_i}$, **K/W**	0.01568	0.00922	0.009098	0.00006319	0.001526	0.000116
τ_i, **s**	9.755	1.039	0.06857	0.01397	0.002449	0.0002632

DC Anode side cooled

i	1	2	3	4	5	6
$\mathbf{R_i}$, **K/W**	0.02398	0.009274	0.009094	-0.00003741	0.00155	0.0001282
τ_i, **s**	9.752	1.065	0.06762	0.01374	0.002533	0.0002841

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

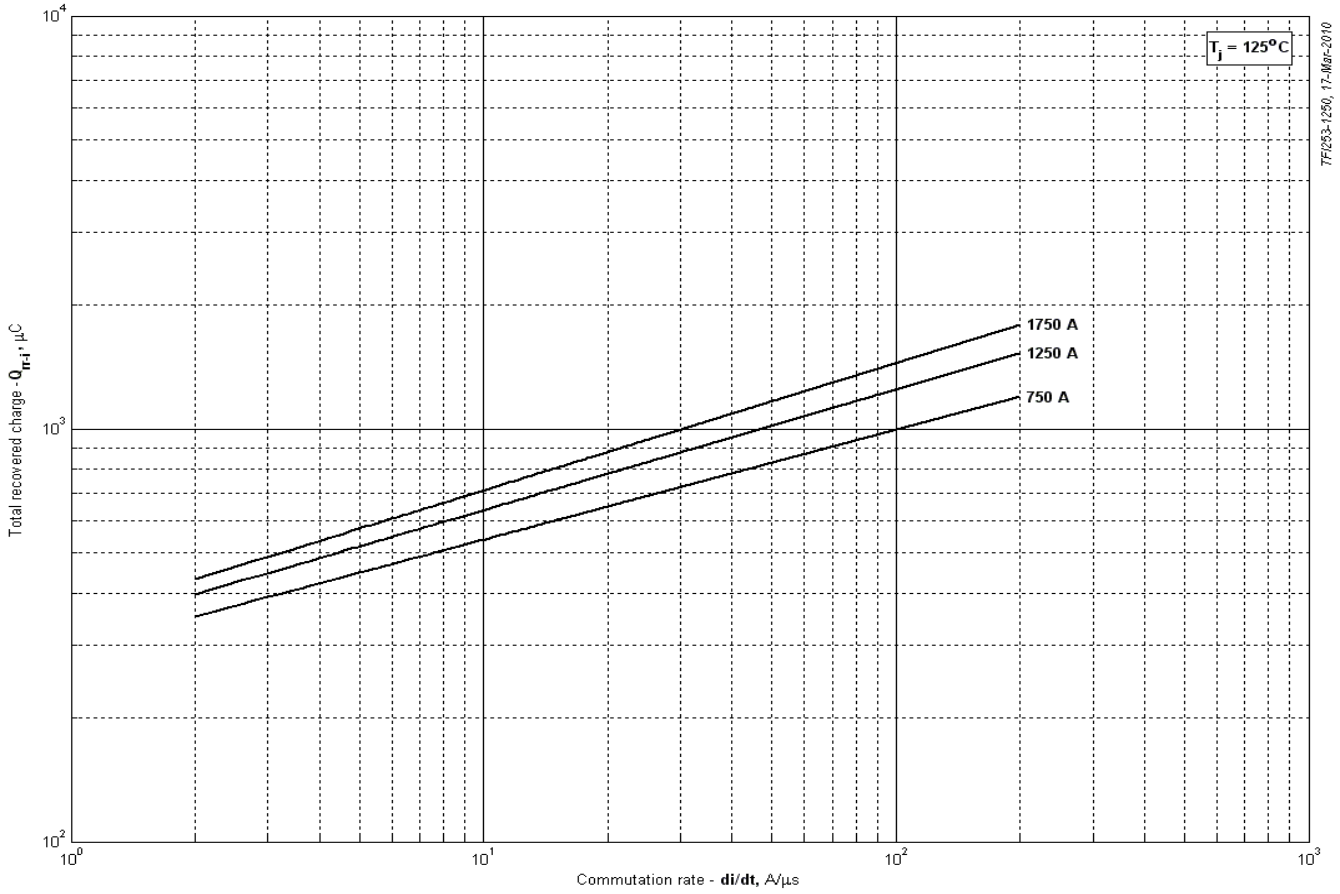


Fig 3 - Total recovered charge, Q_{rr-i} (integral)

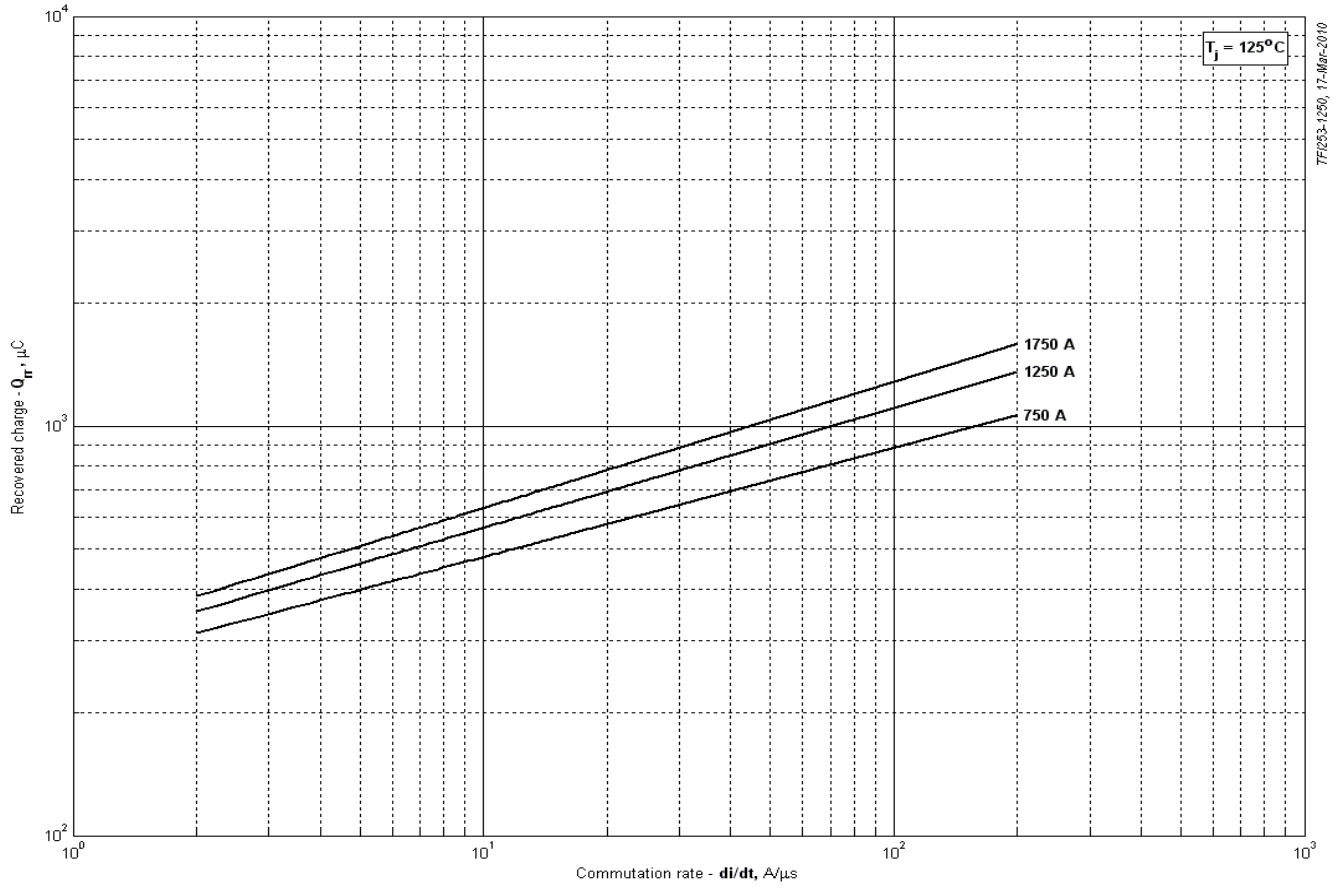


Fig 4 - Recovered charge, Q_{rr} (linear)

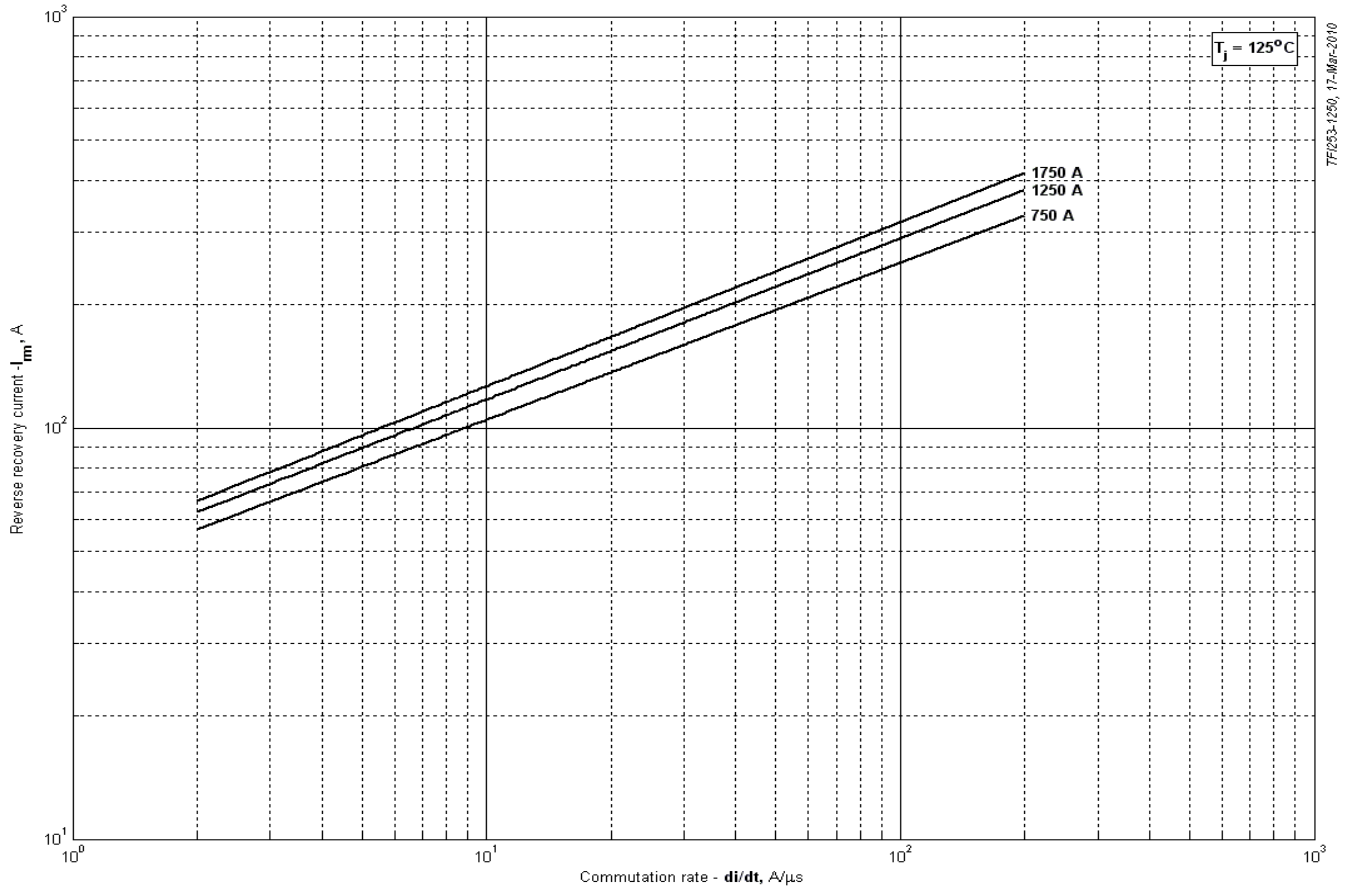


Fig 5 - Peak reverse recovery current, I_{rr}

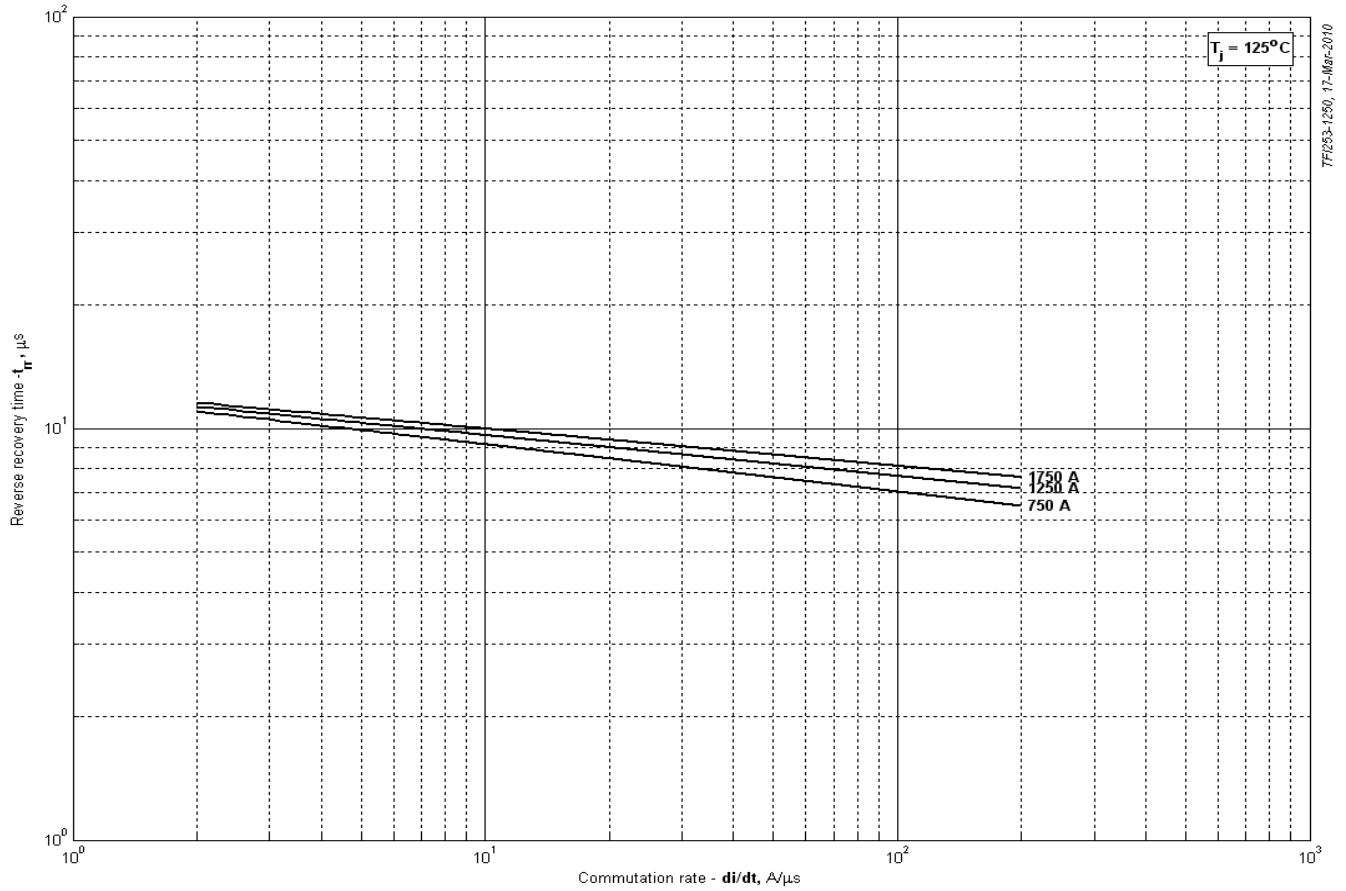


Fig 6 - Recovery time, t_{rr} (50% chord)

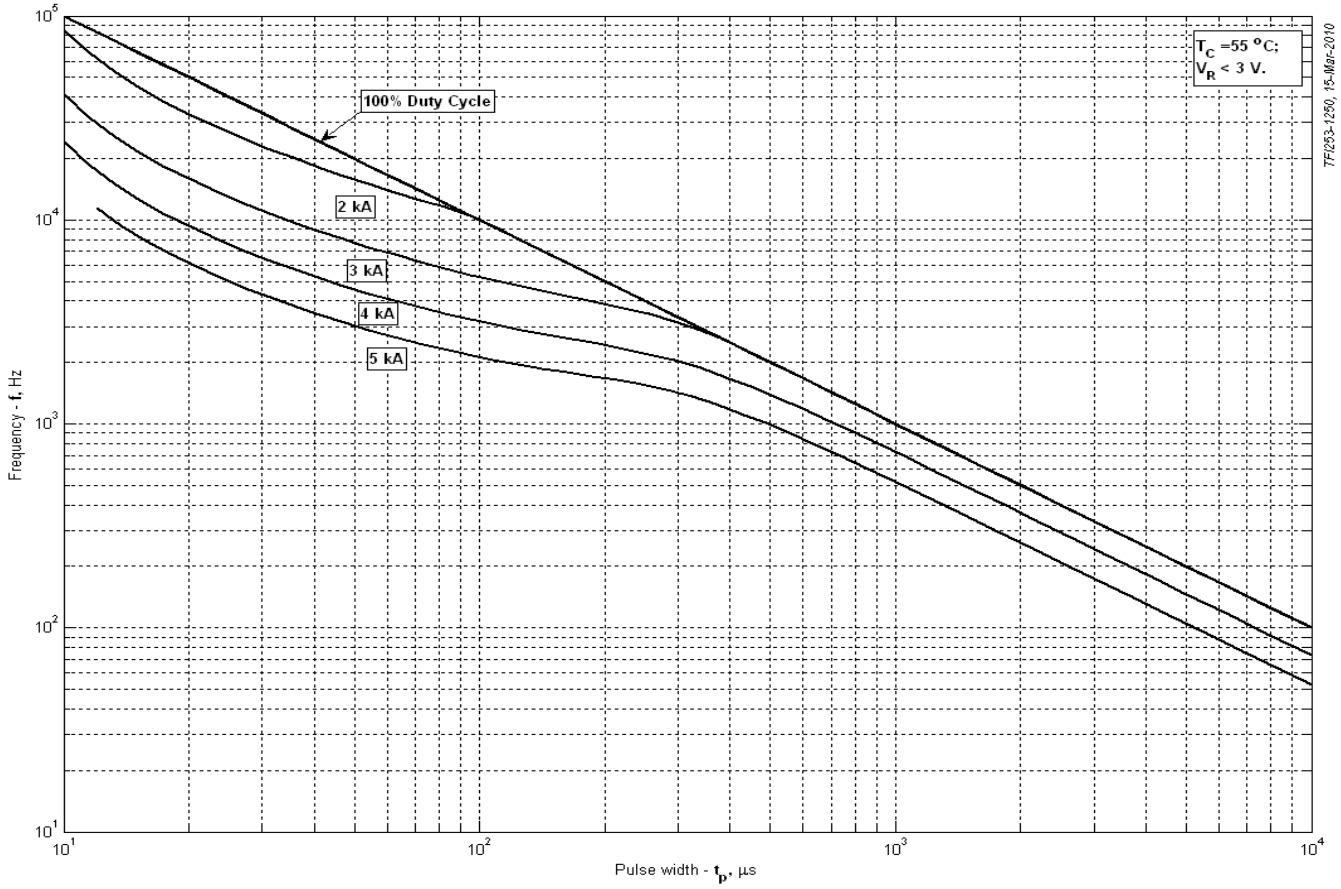


Fig 7 - Sine wave frequency ratings

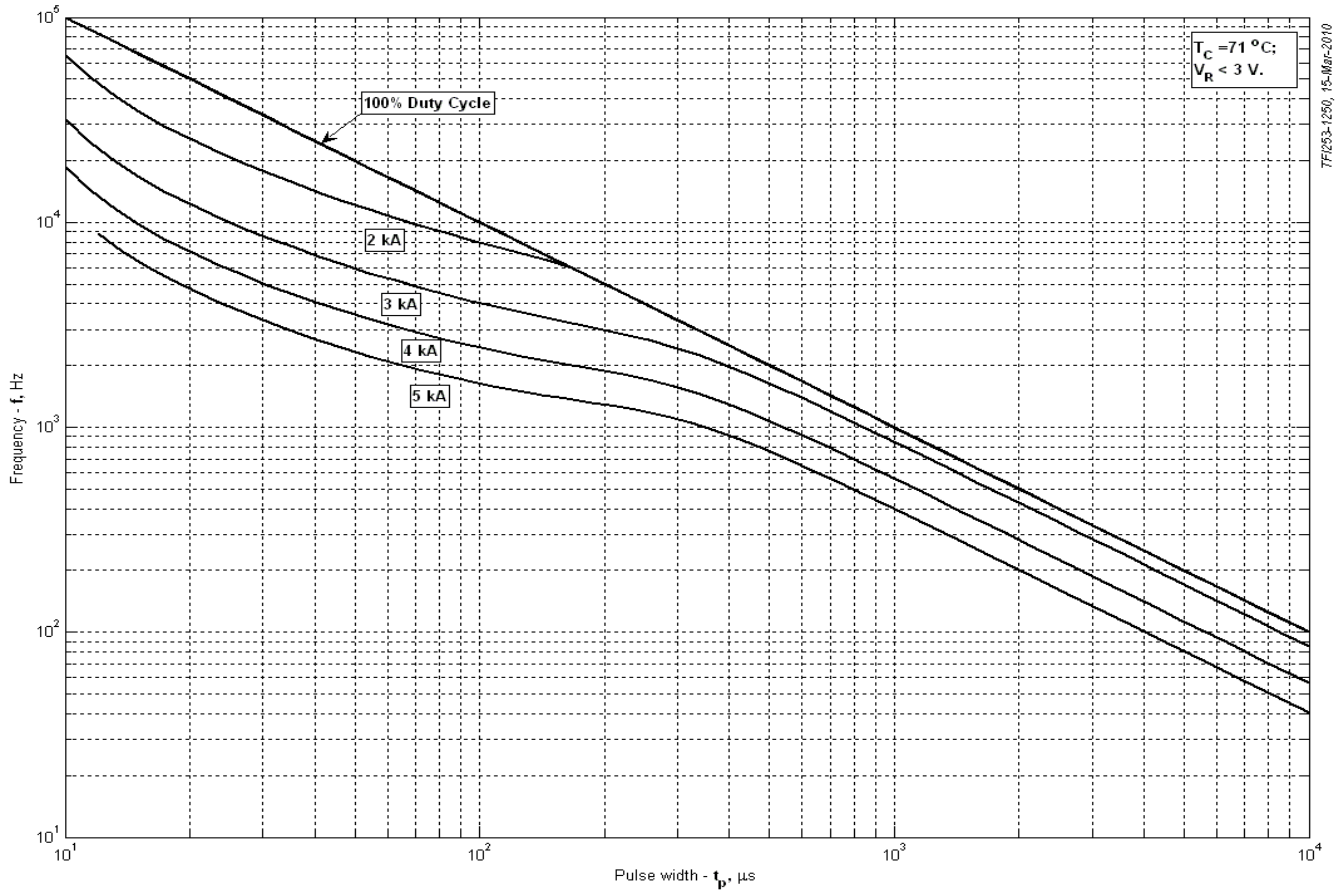


Fig 8 - Sine wave frequency ratings

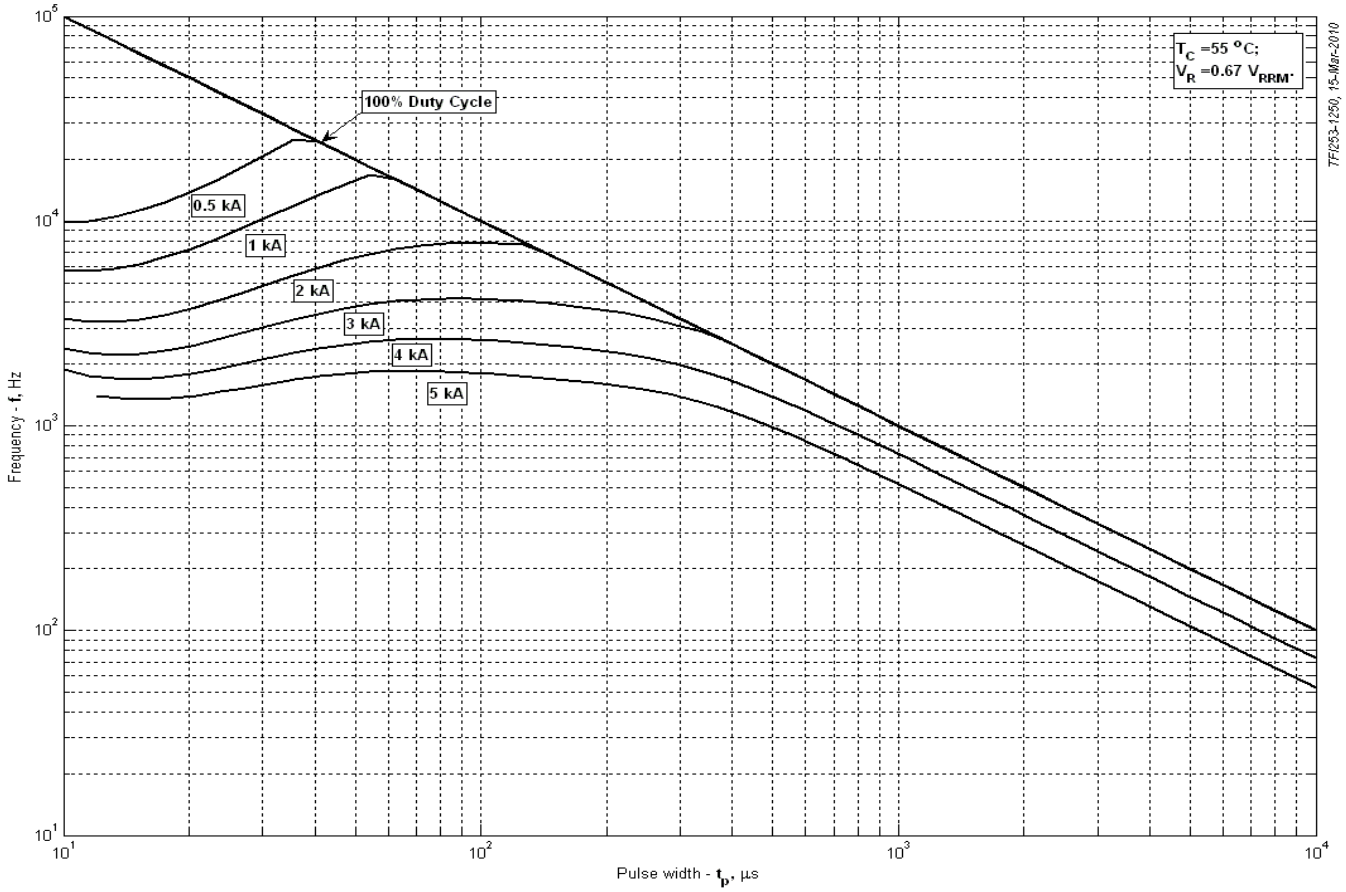


Fig 9 - Sine wave frequency ratings

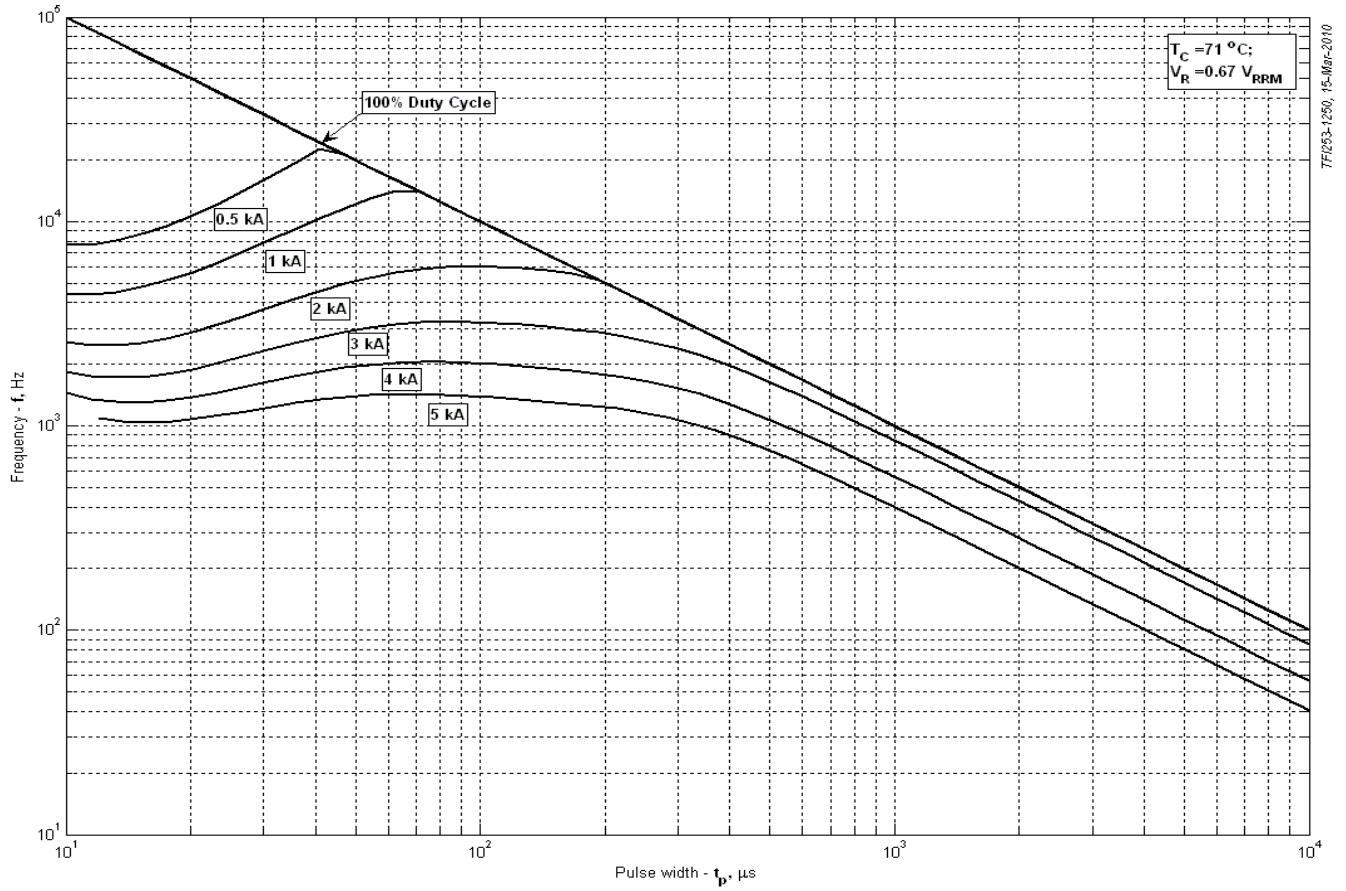


Fig 10 - Sine wave frequency ratings

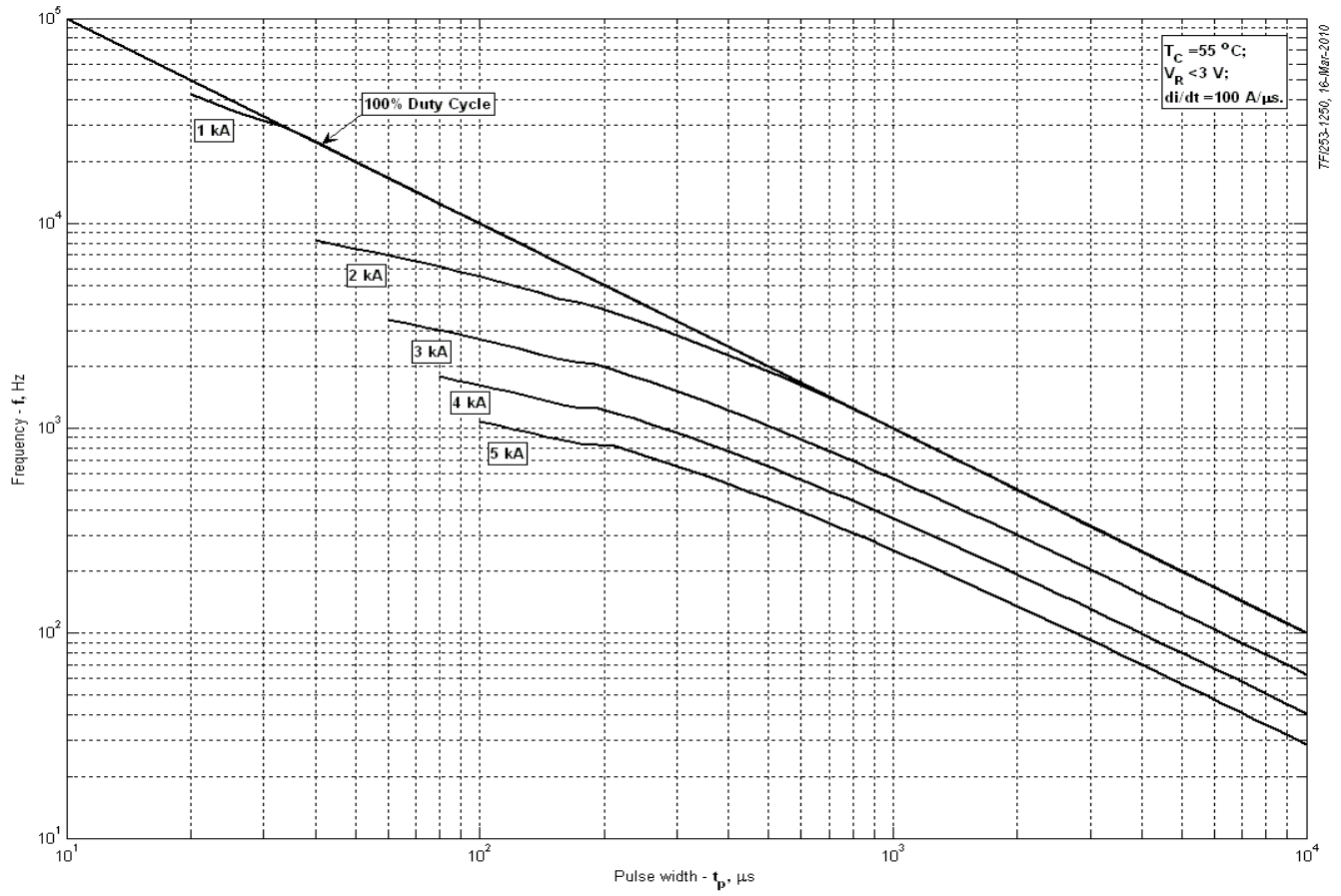


Fig 11 - Square wave frequency ratings

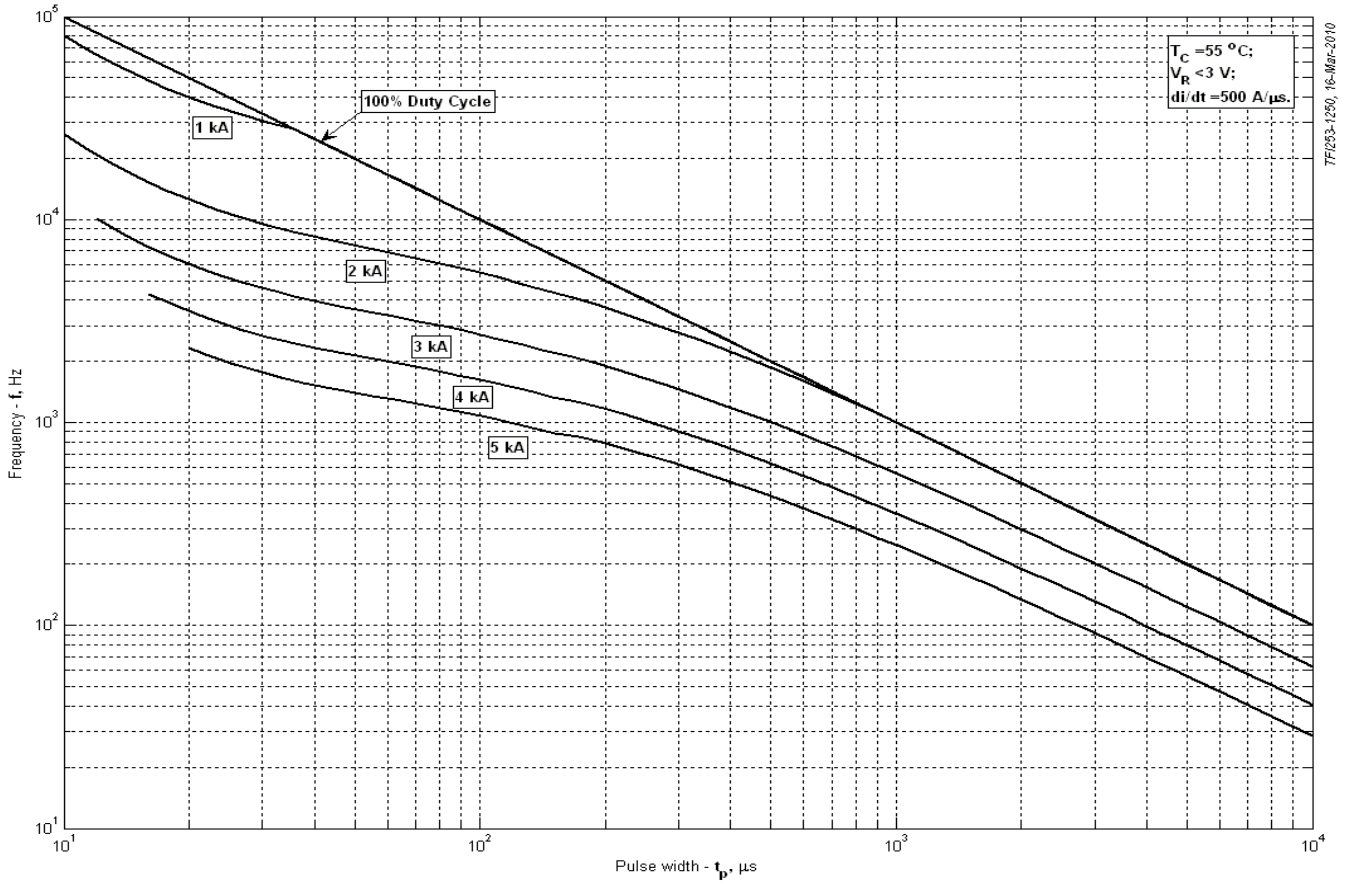


Fig 12 - Square wave frequency ratings

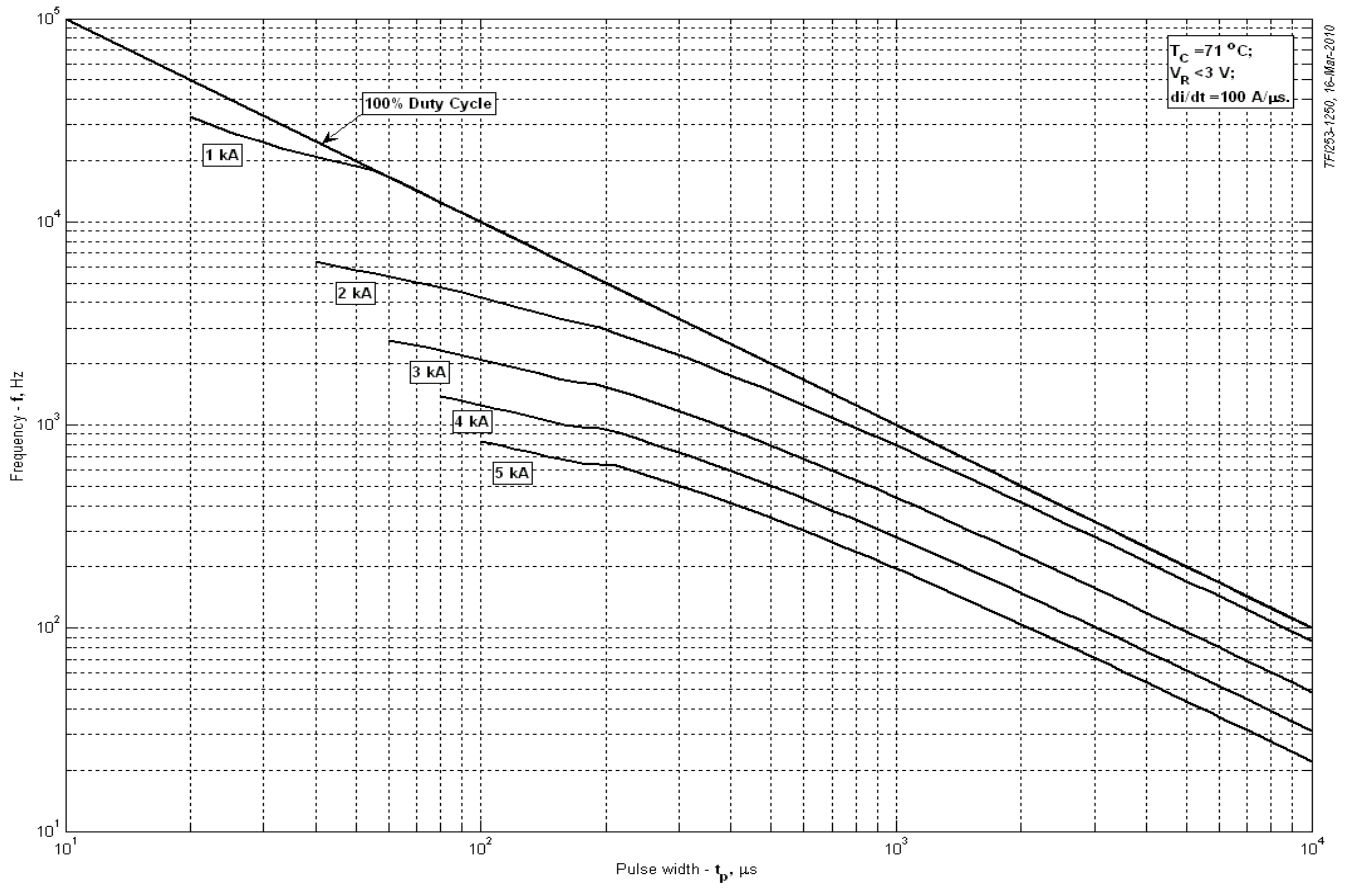


Fig 13 - Square wave frequency ratings

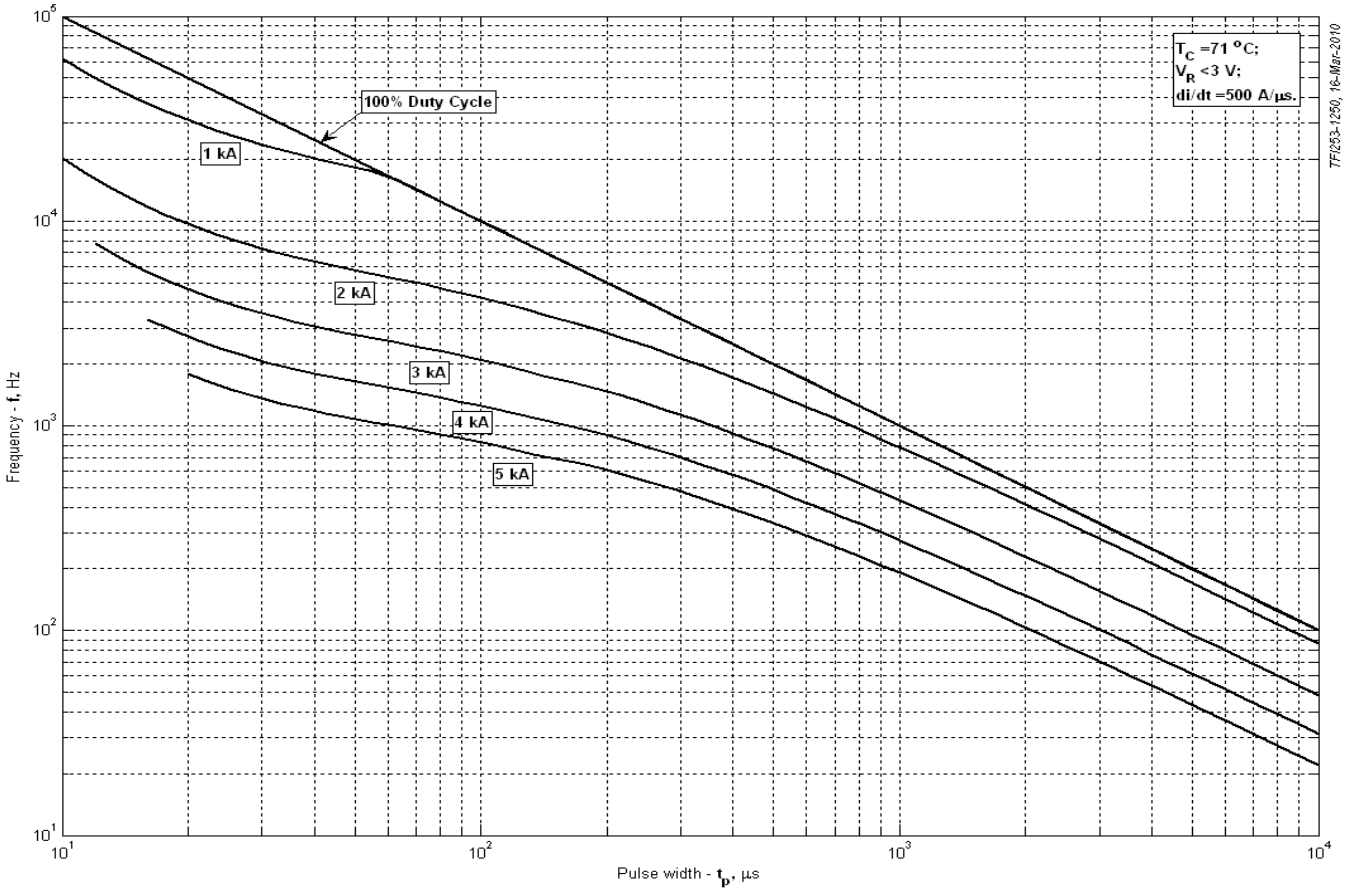


Fig 14 - Square wave frequency ratings

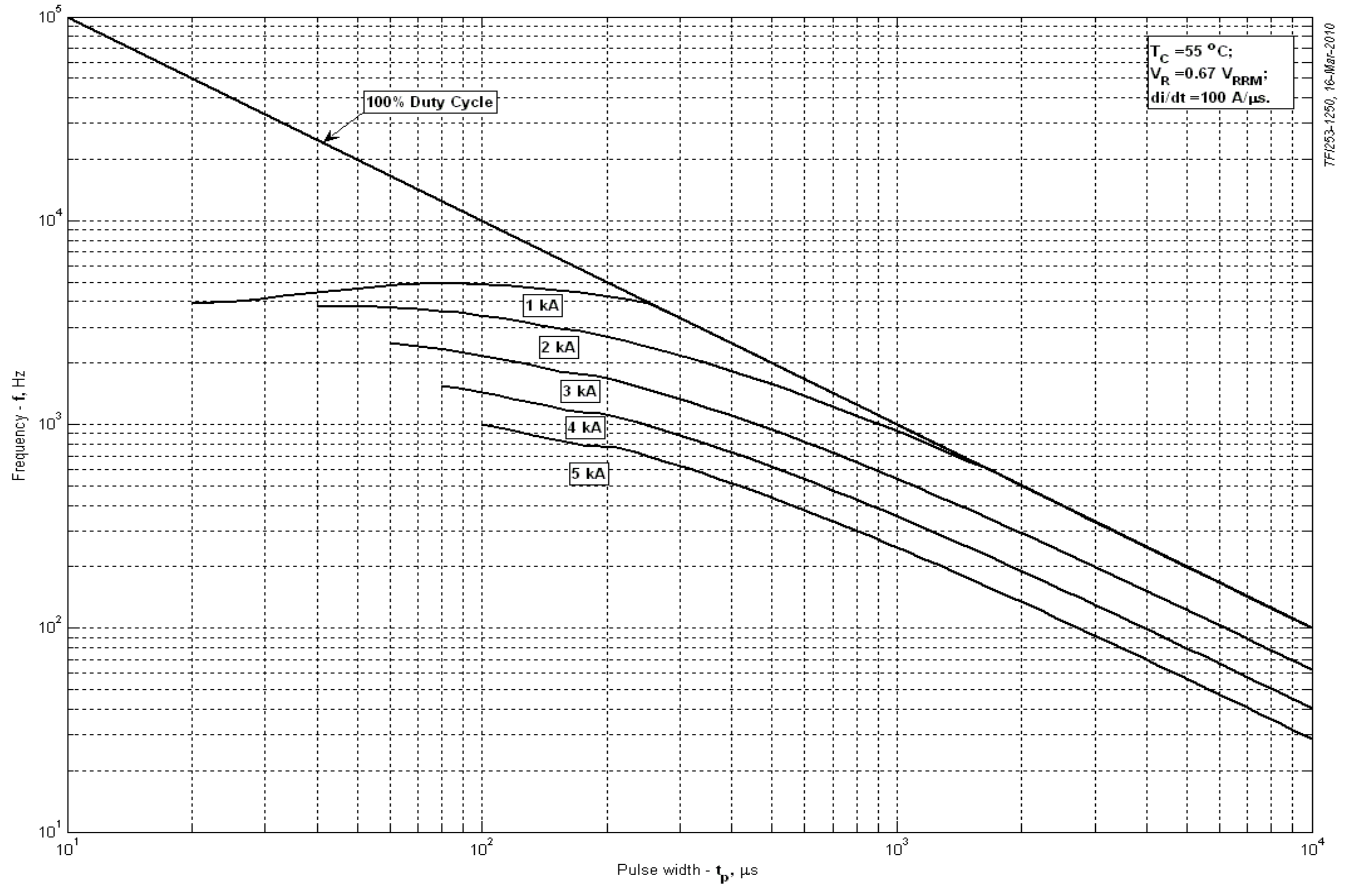


Fig 15 - Square wave frequency ratings

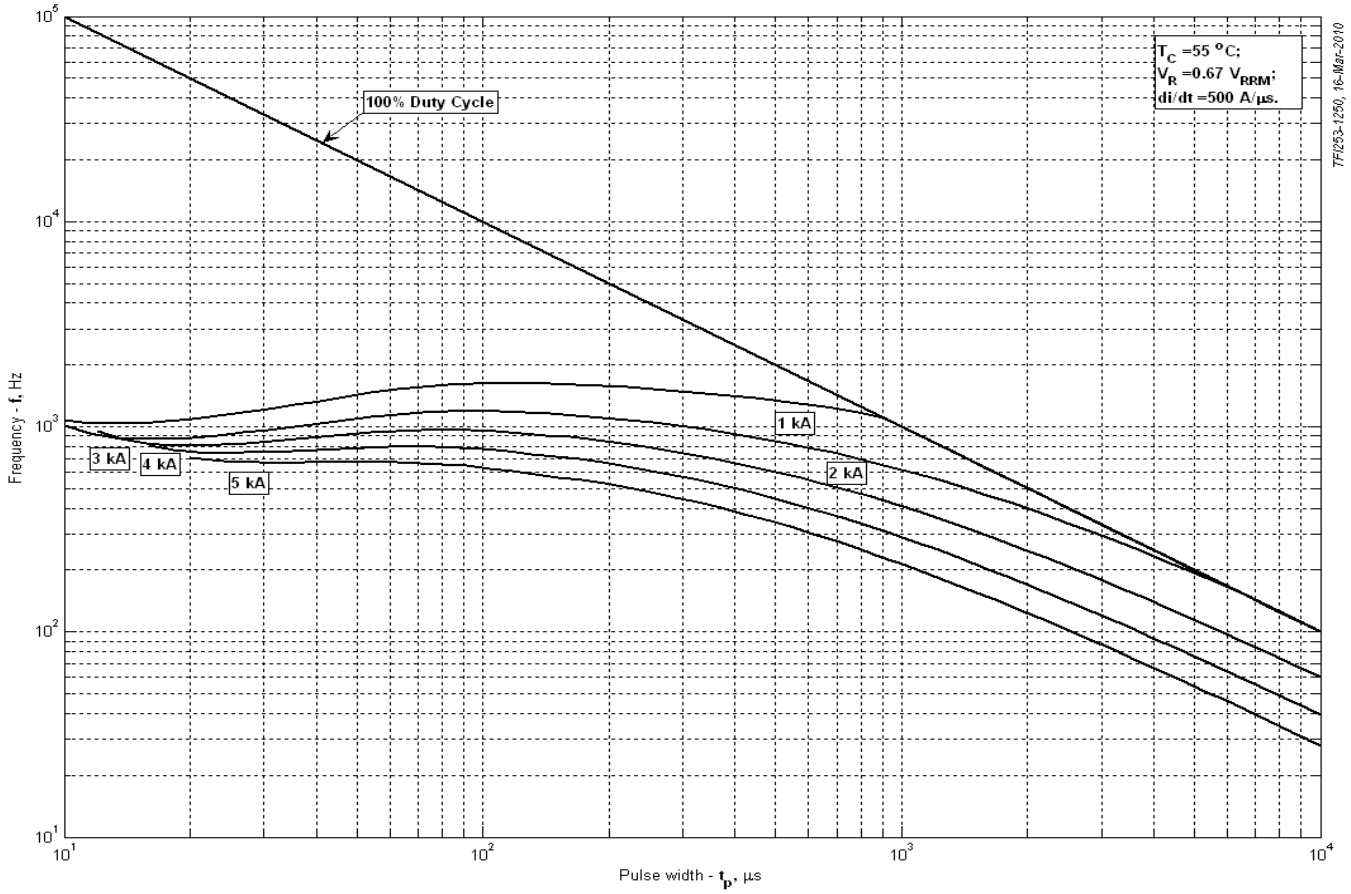


Fig 16 - Square wave frequency ratings

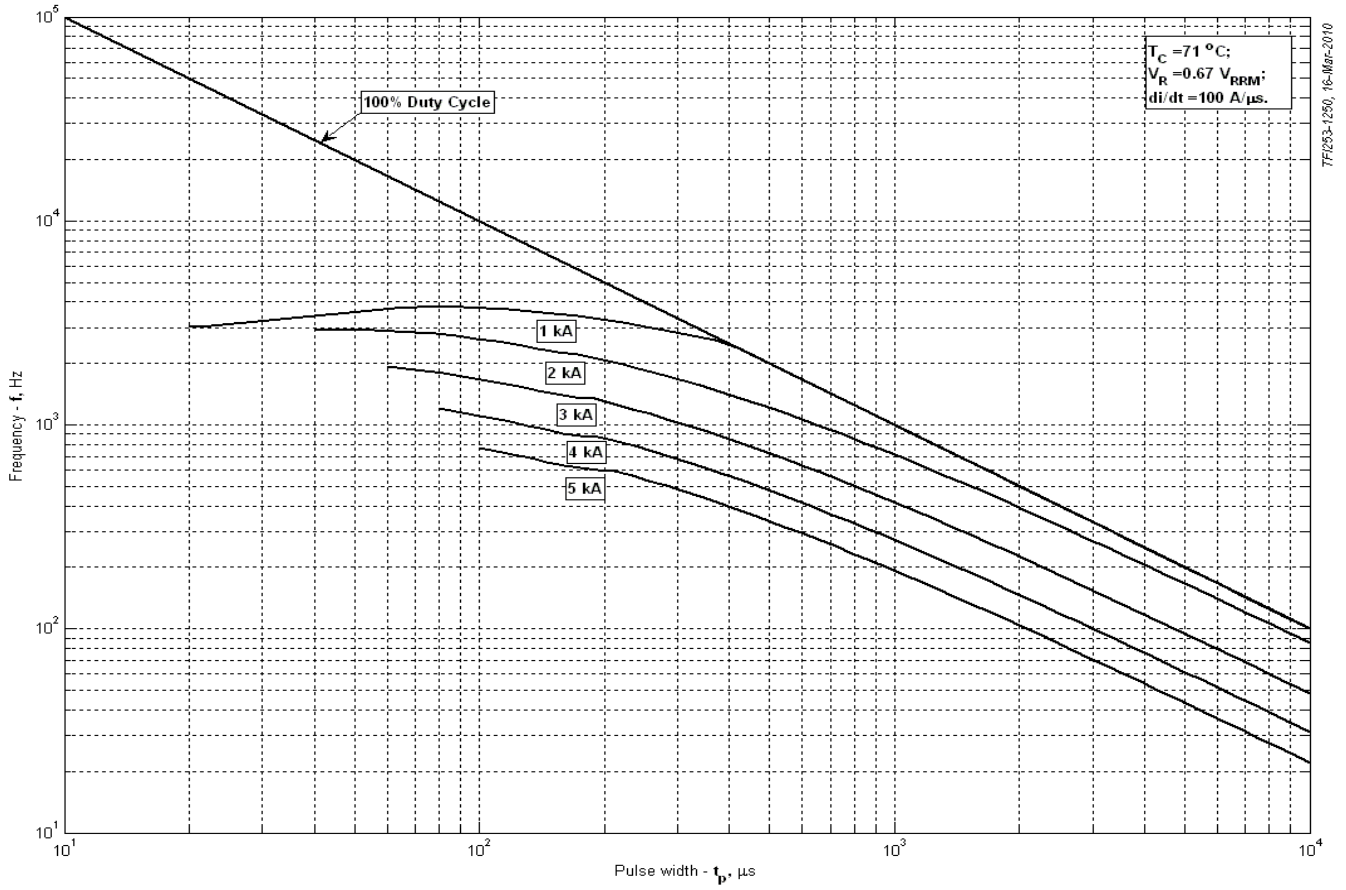


Fig 17 - Square wave frequency ratings

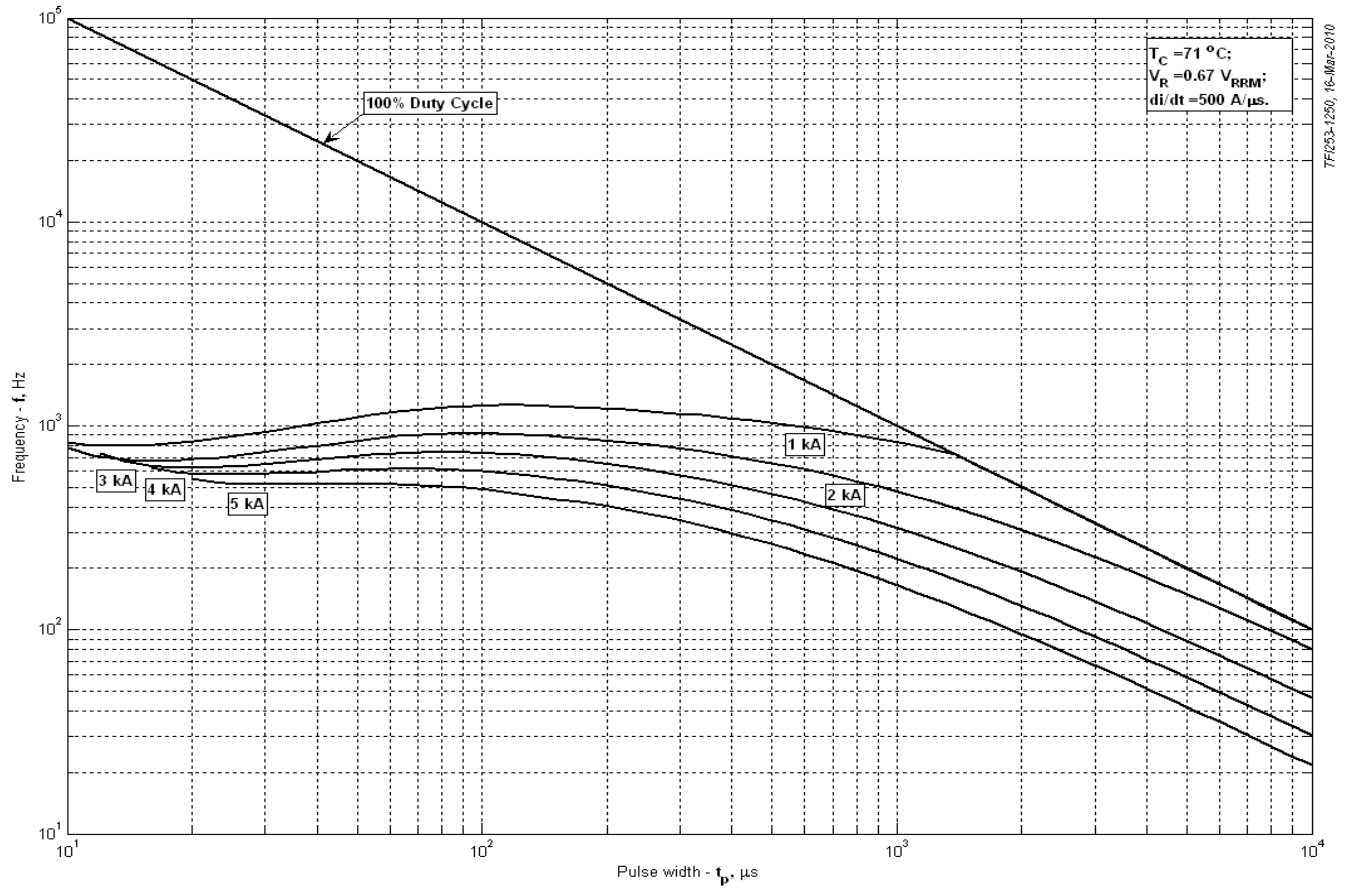


Fig 18 - Square wave frequency ratings

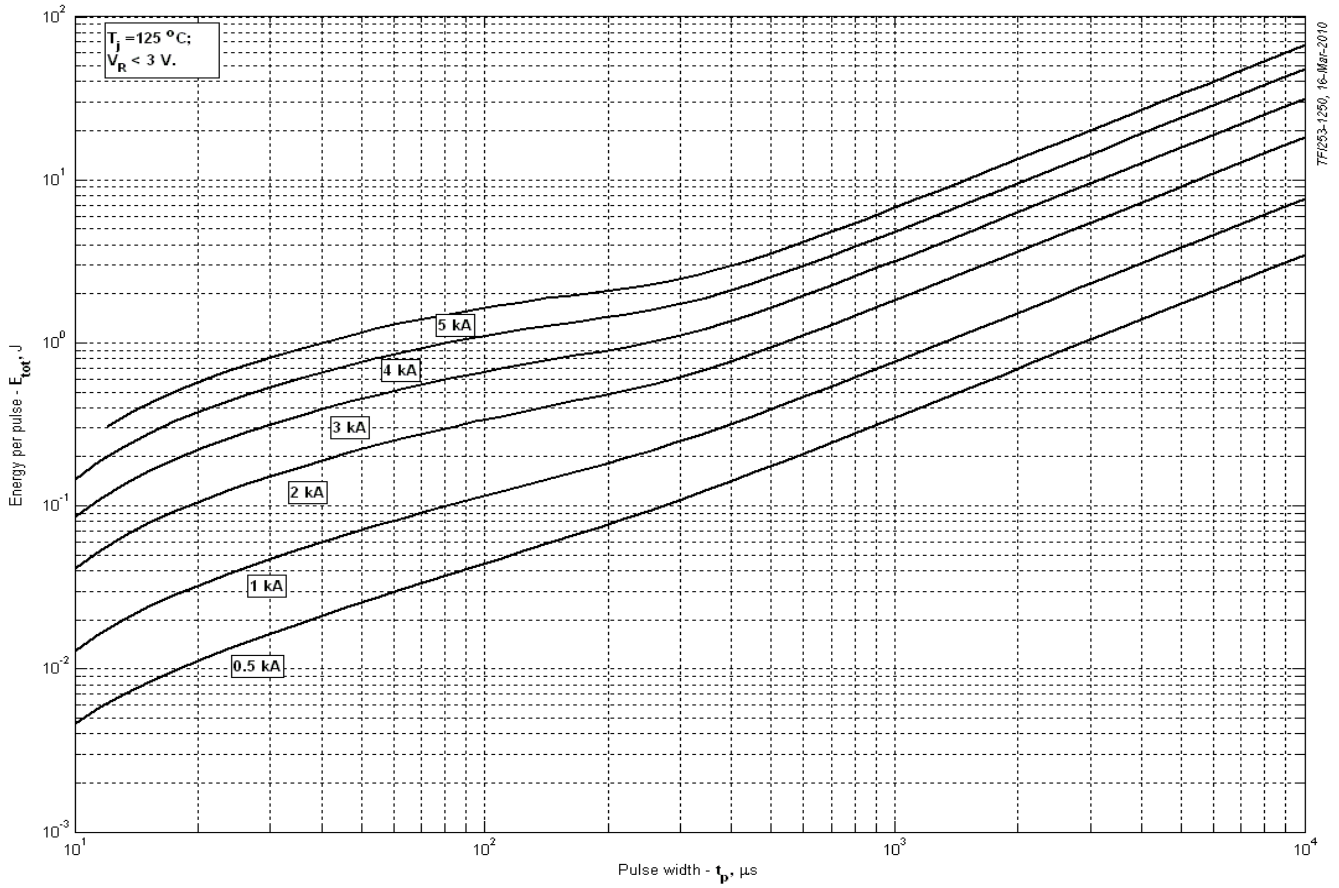


Fig 19 - Sine wave loss energy per pulse

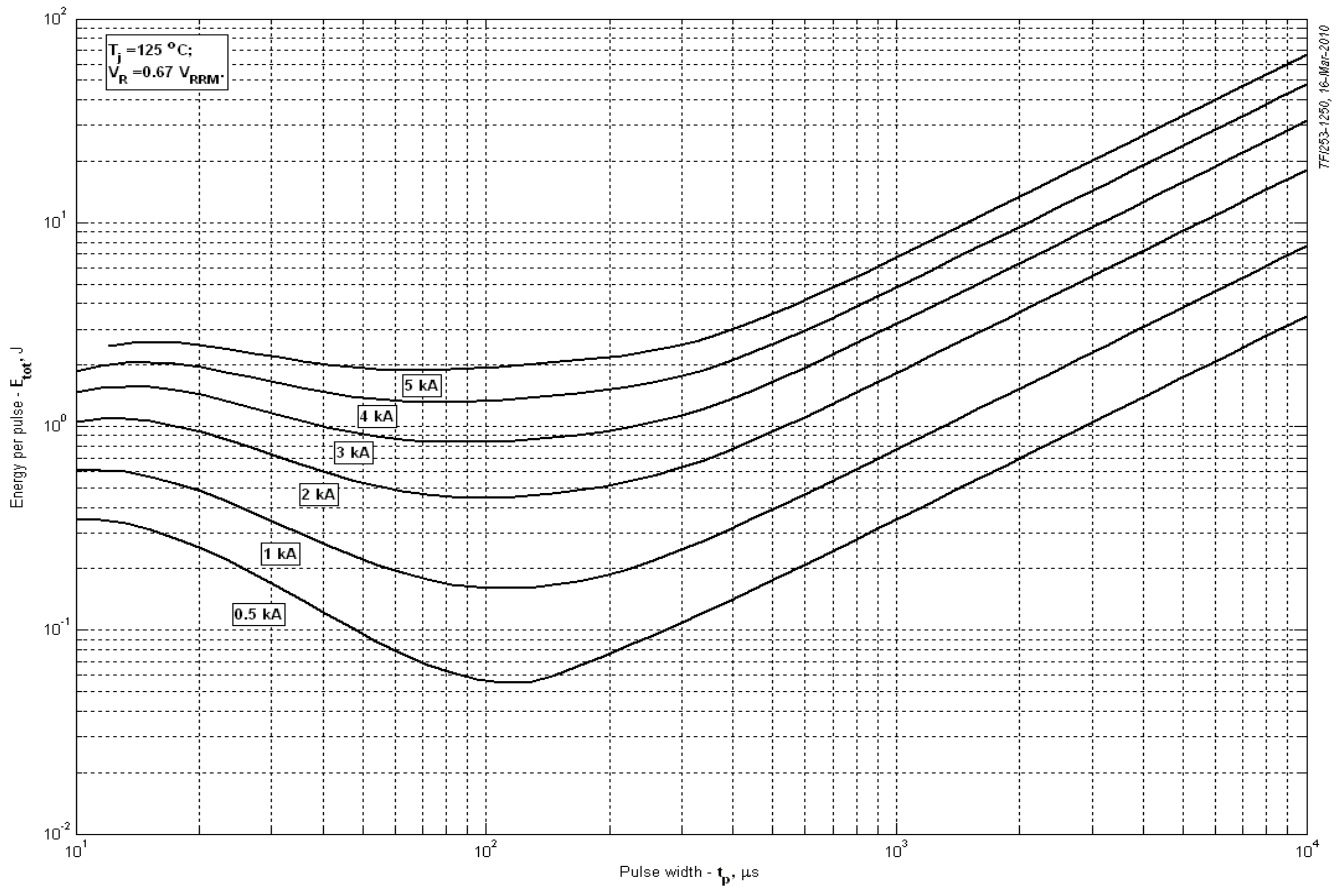


Fig 20 - Sine wave loss energy per pulse

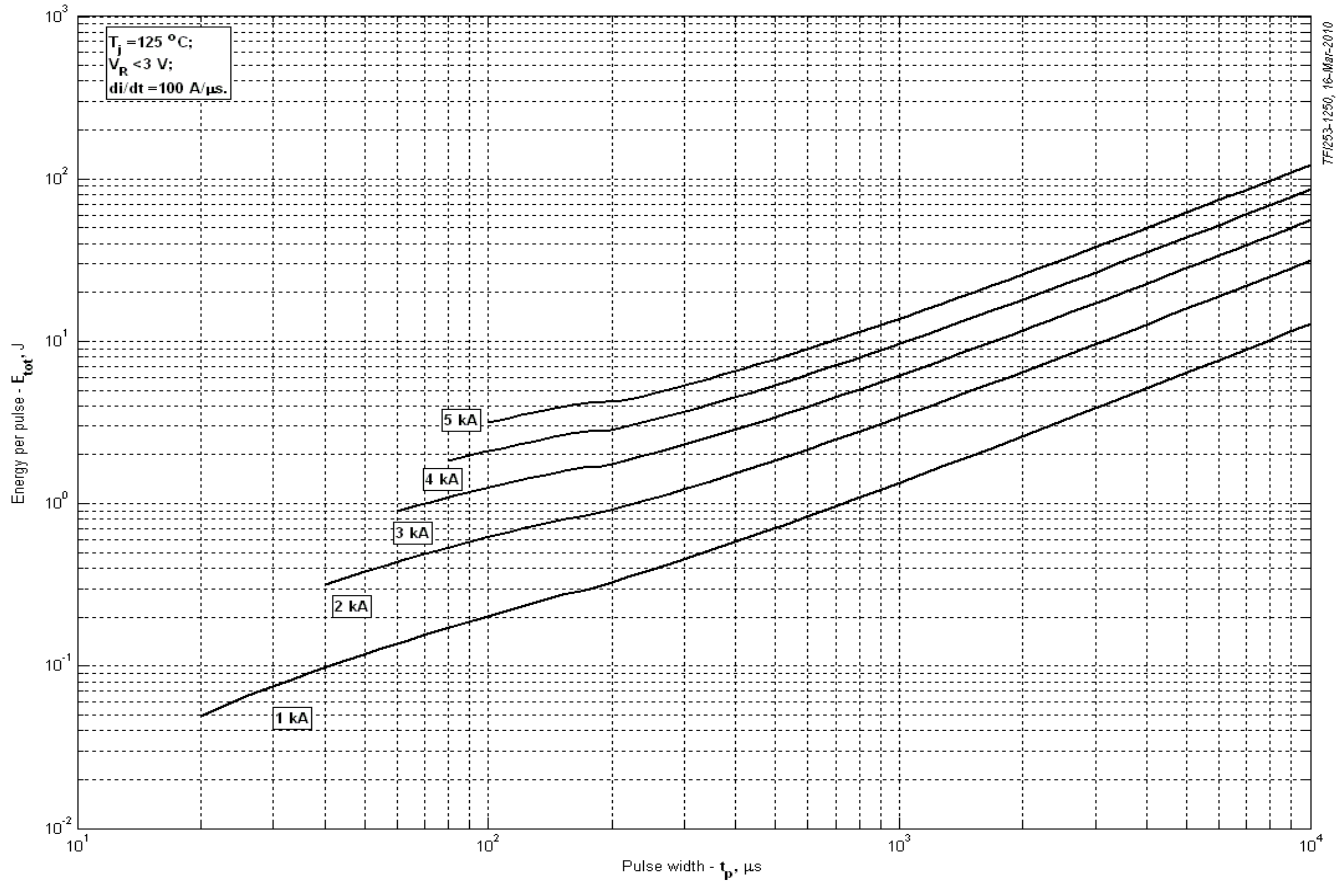


Fig 21 - Square wave loss energy per pulse

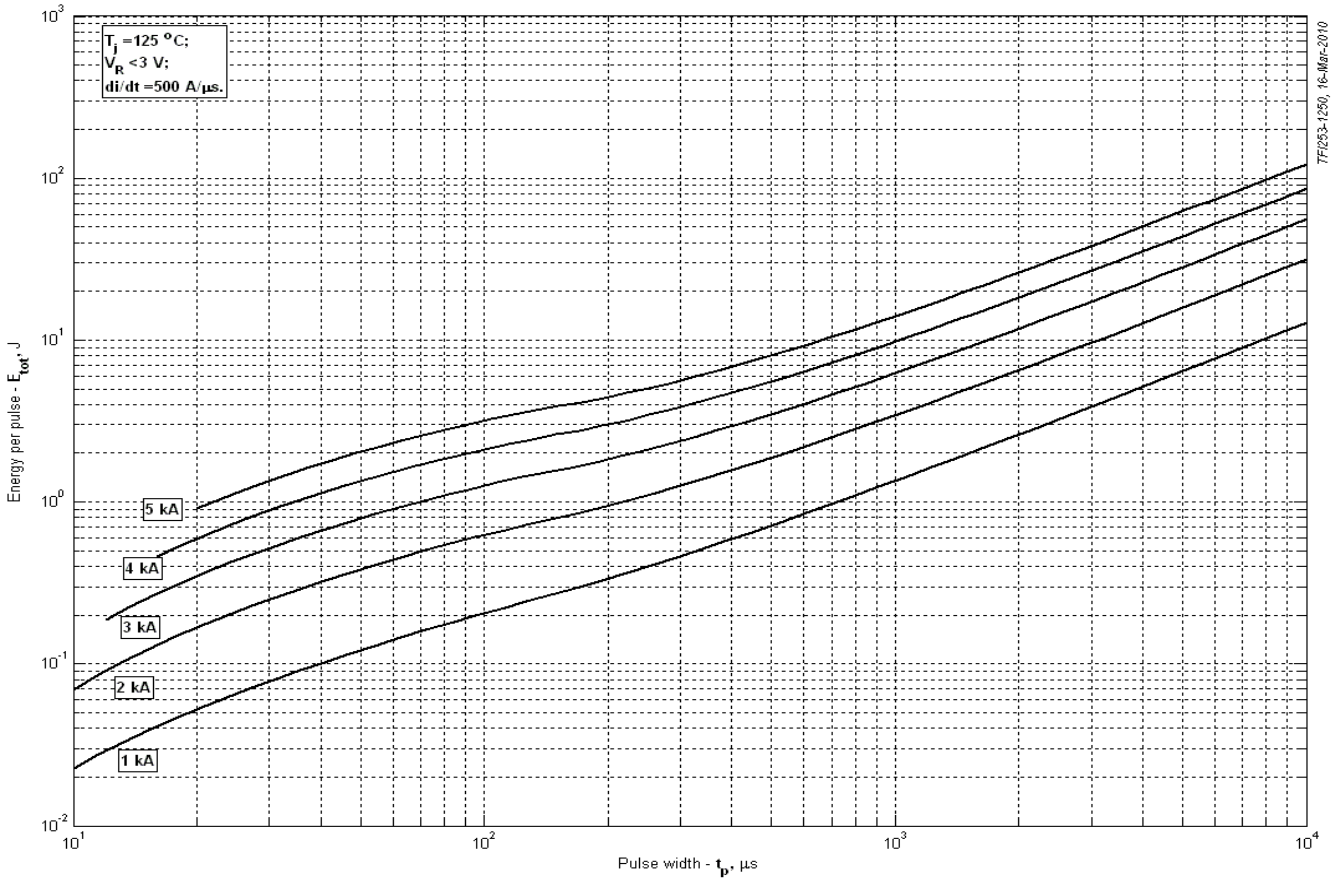


Fig 22 - Square wave loss energy per pulse

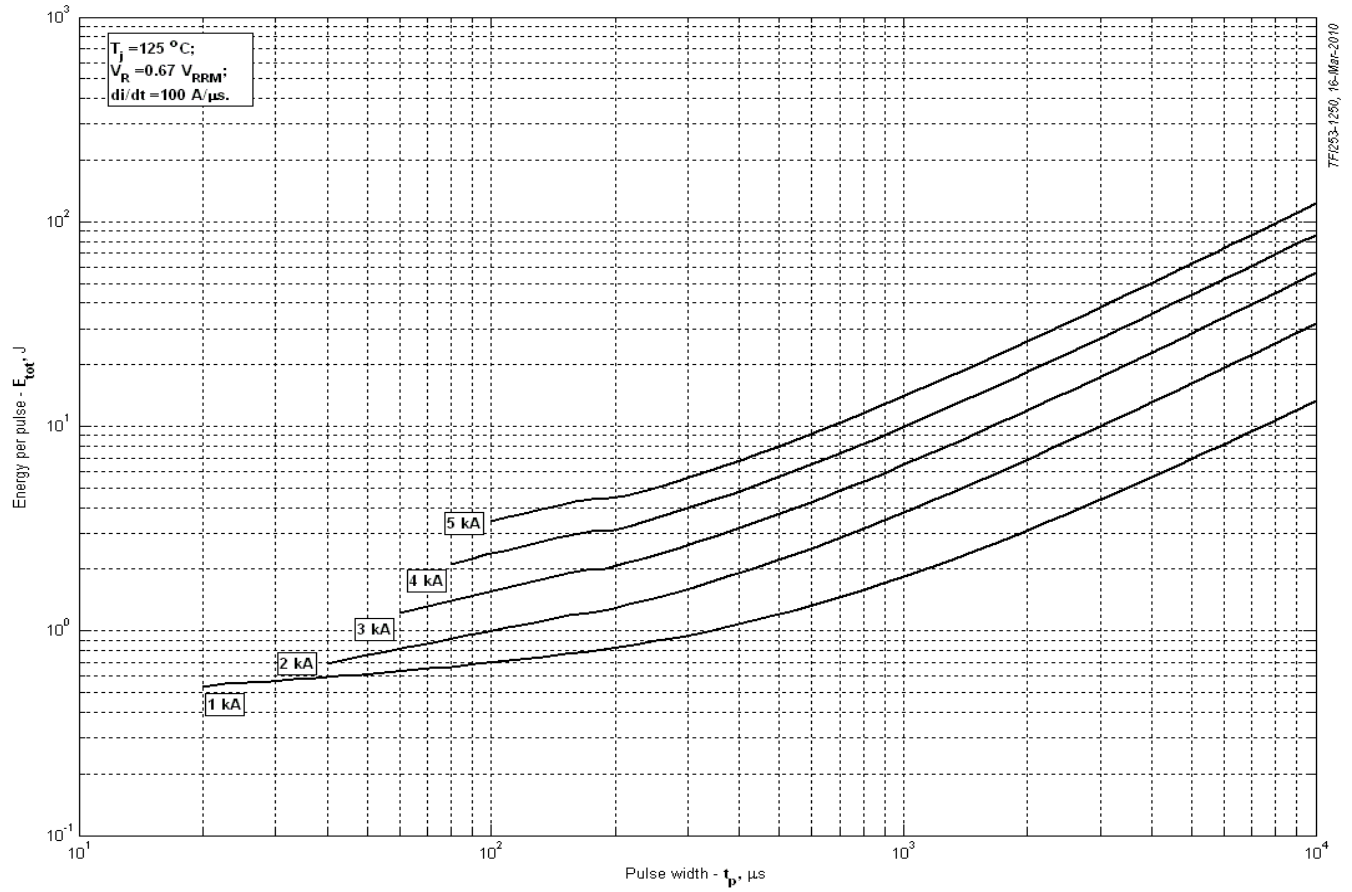


Fig 23 - Square wave loss energy per pulse

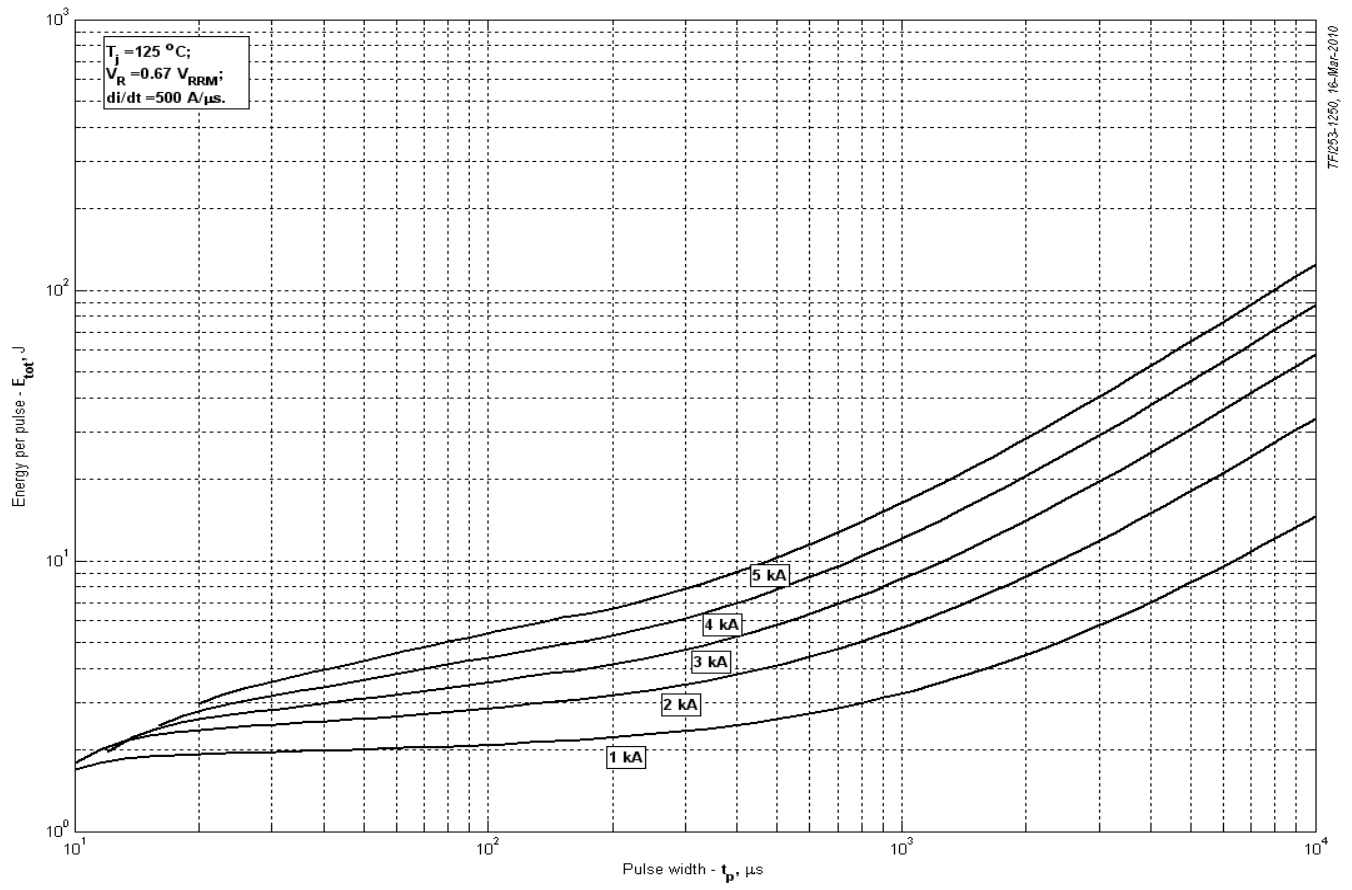


Fig 24 - Square wave loss energy per pulse

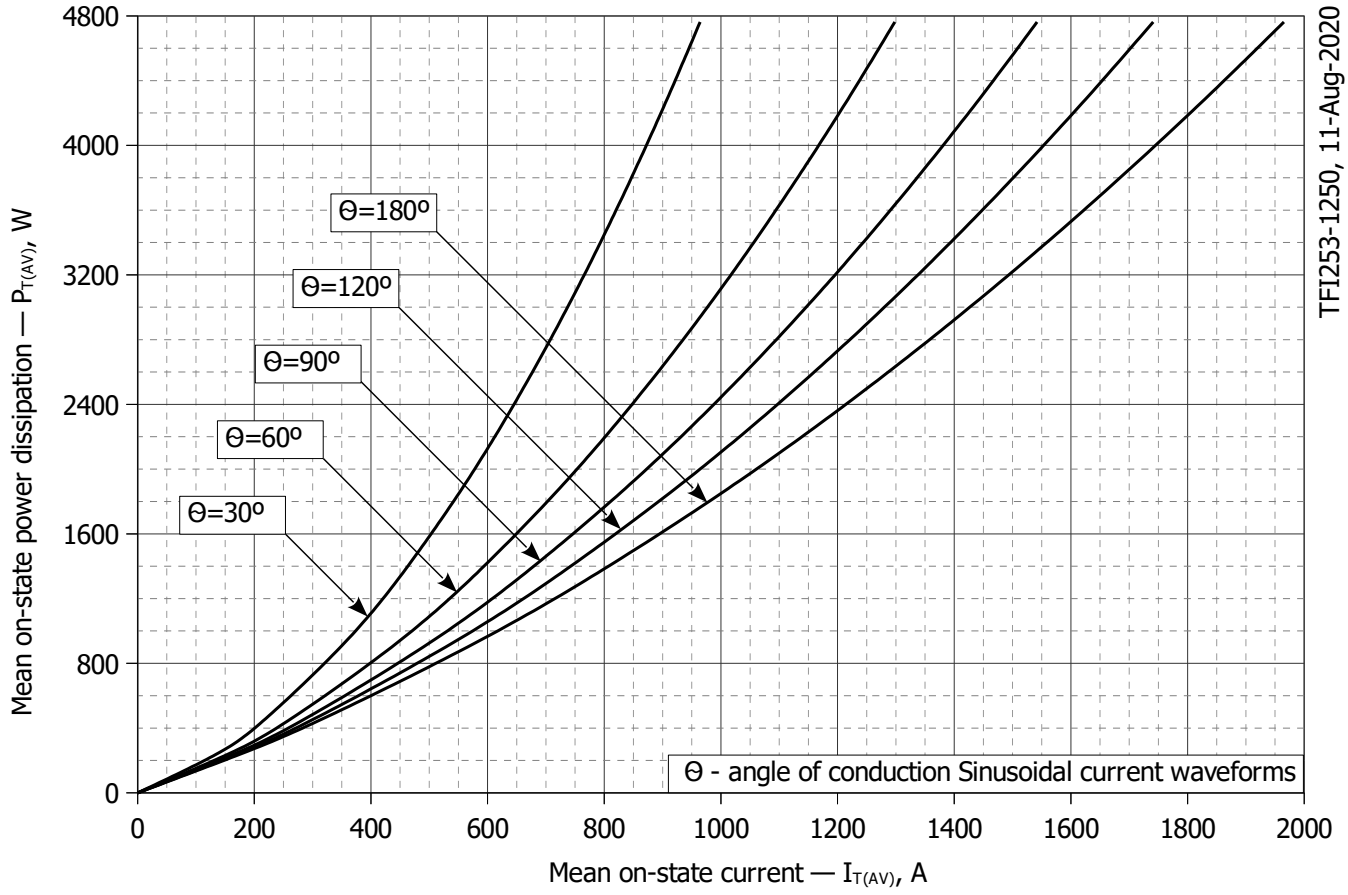


Fig 25 – Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

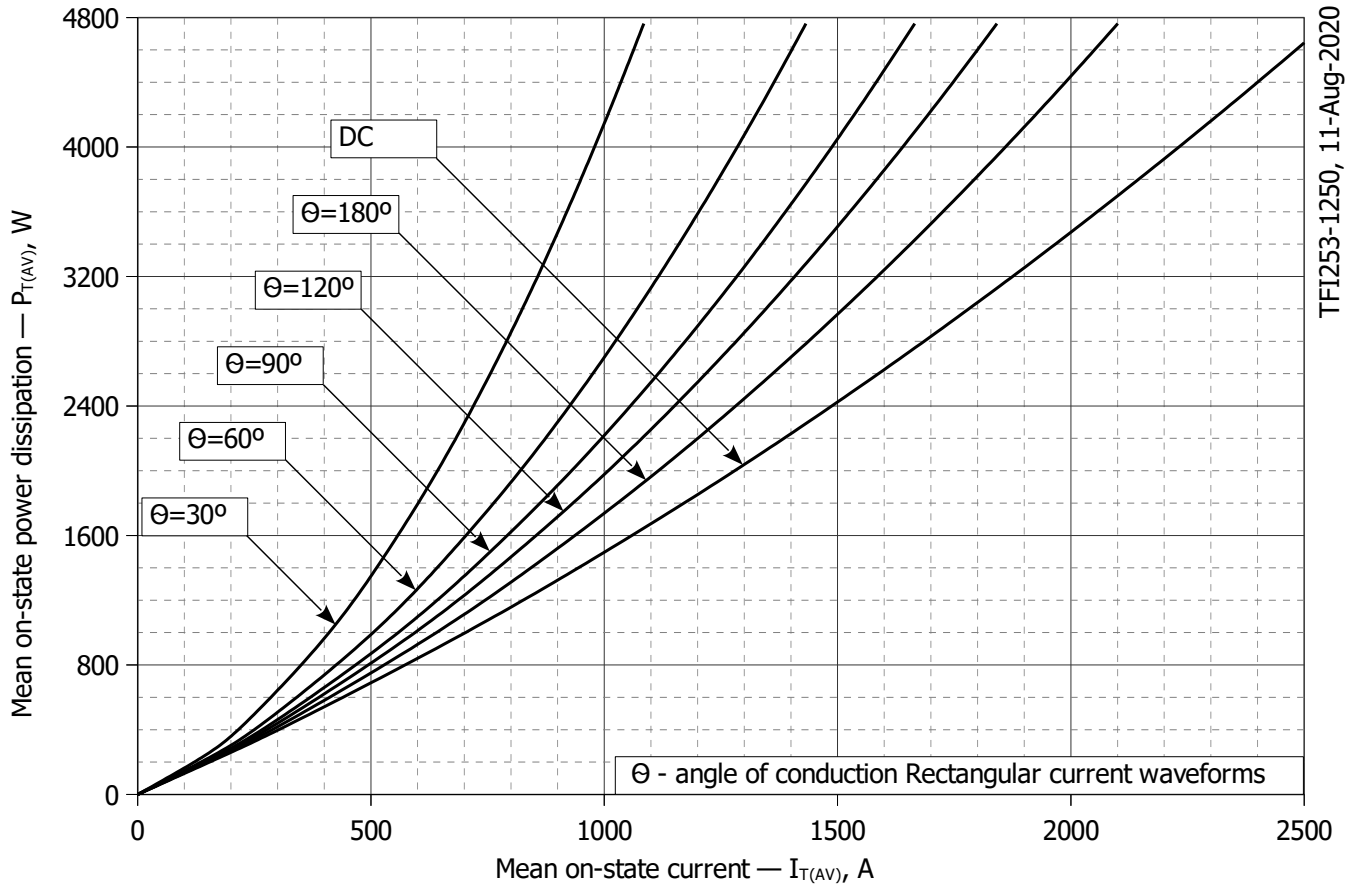


Fig 26 - Mean on-state power dissipation P_{TAV} vs. mean on-state current I_{TAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

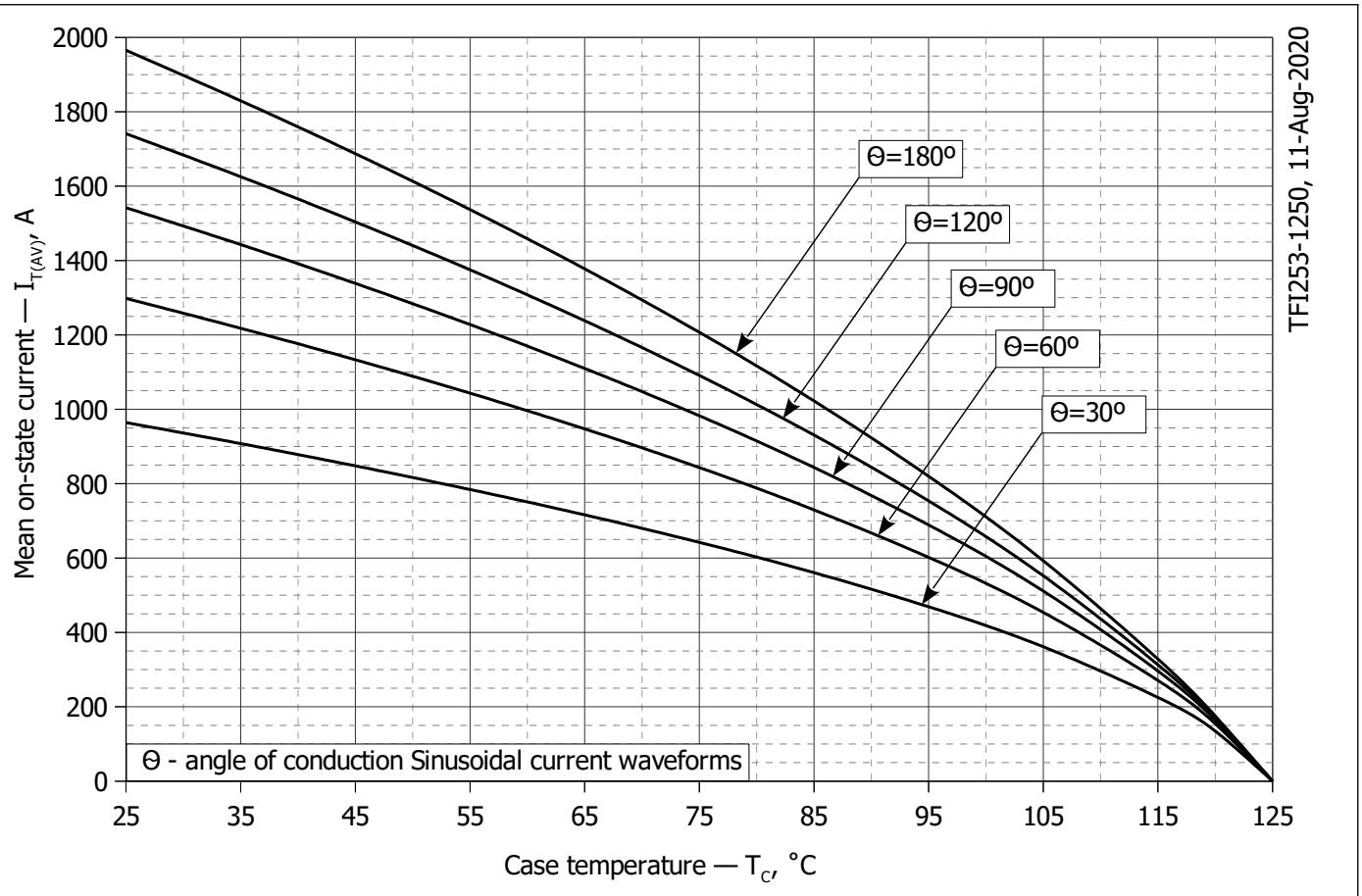


Fig 27 – Mean on-state current I_{TAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

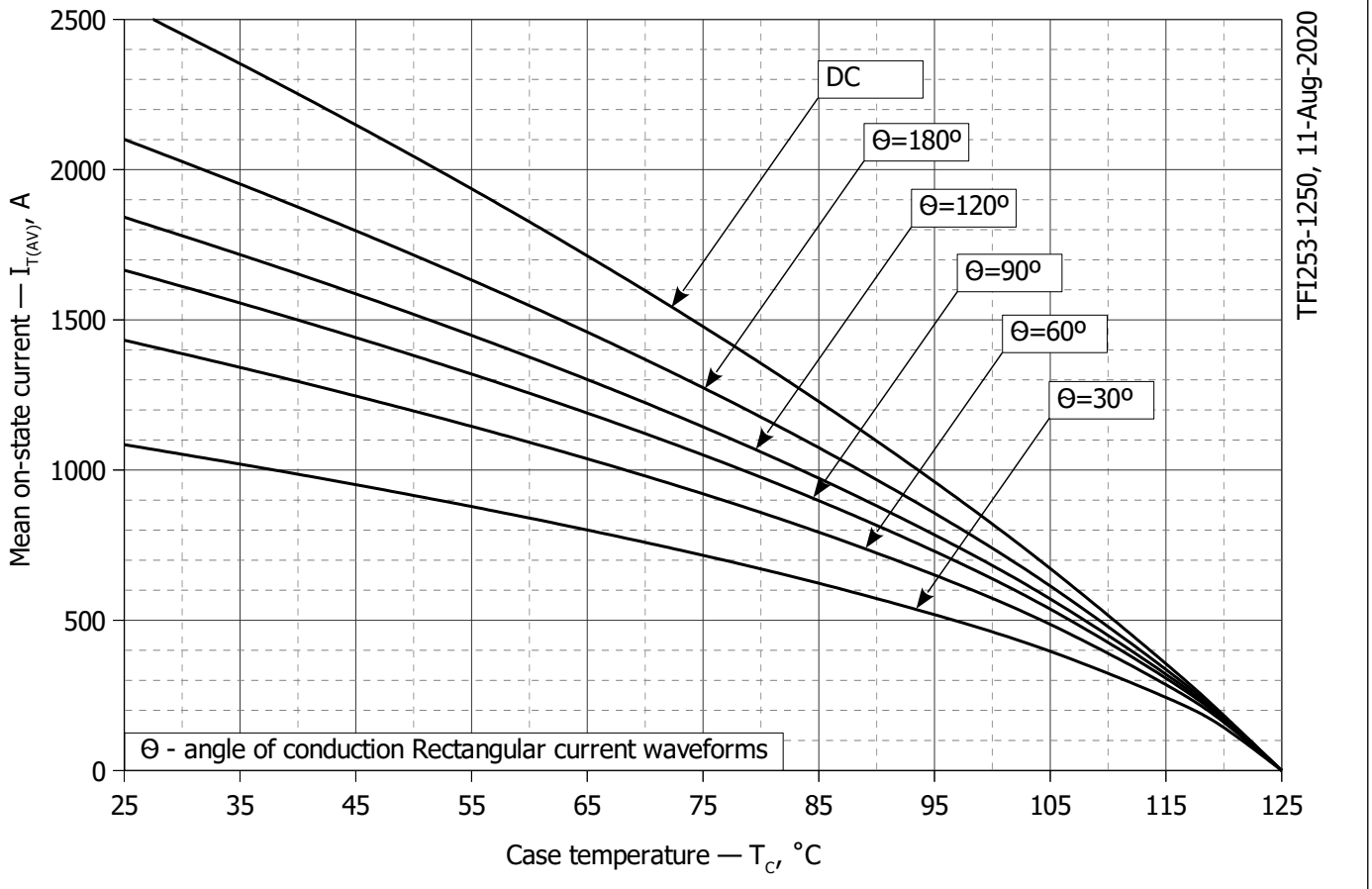


Fig 28 - Mean on-state current I_{TAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

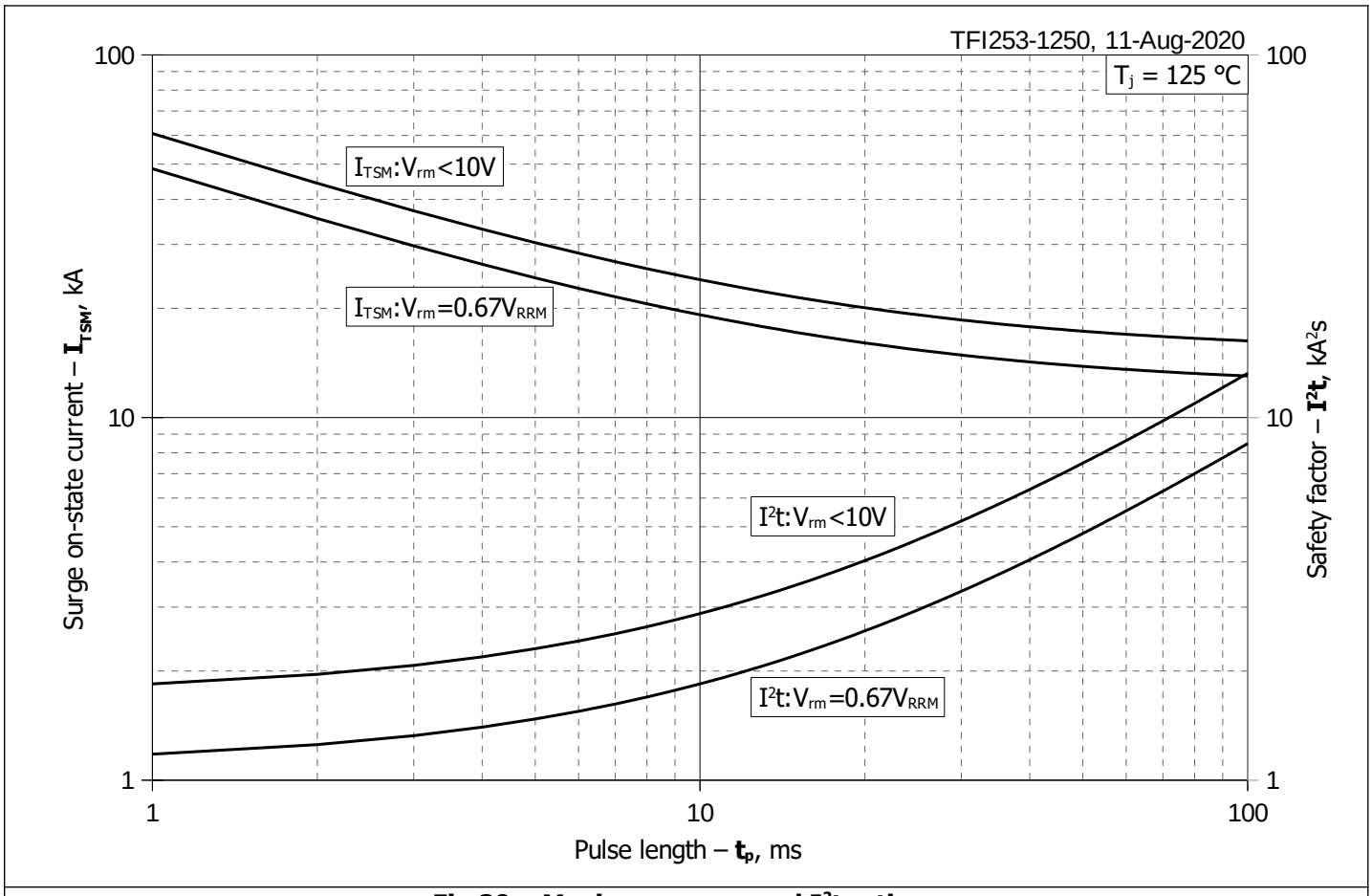


Fig 29 – Maximum surge and I^2t ratings

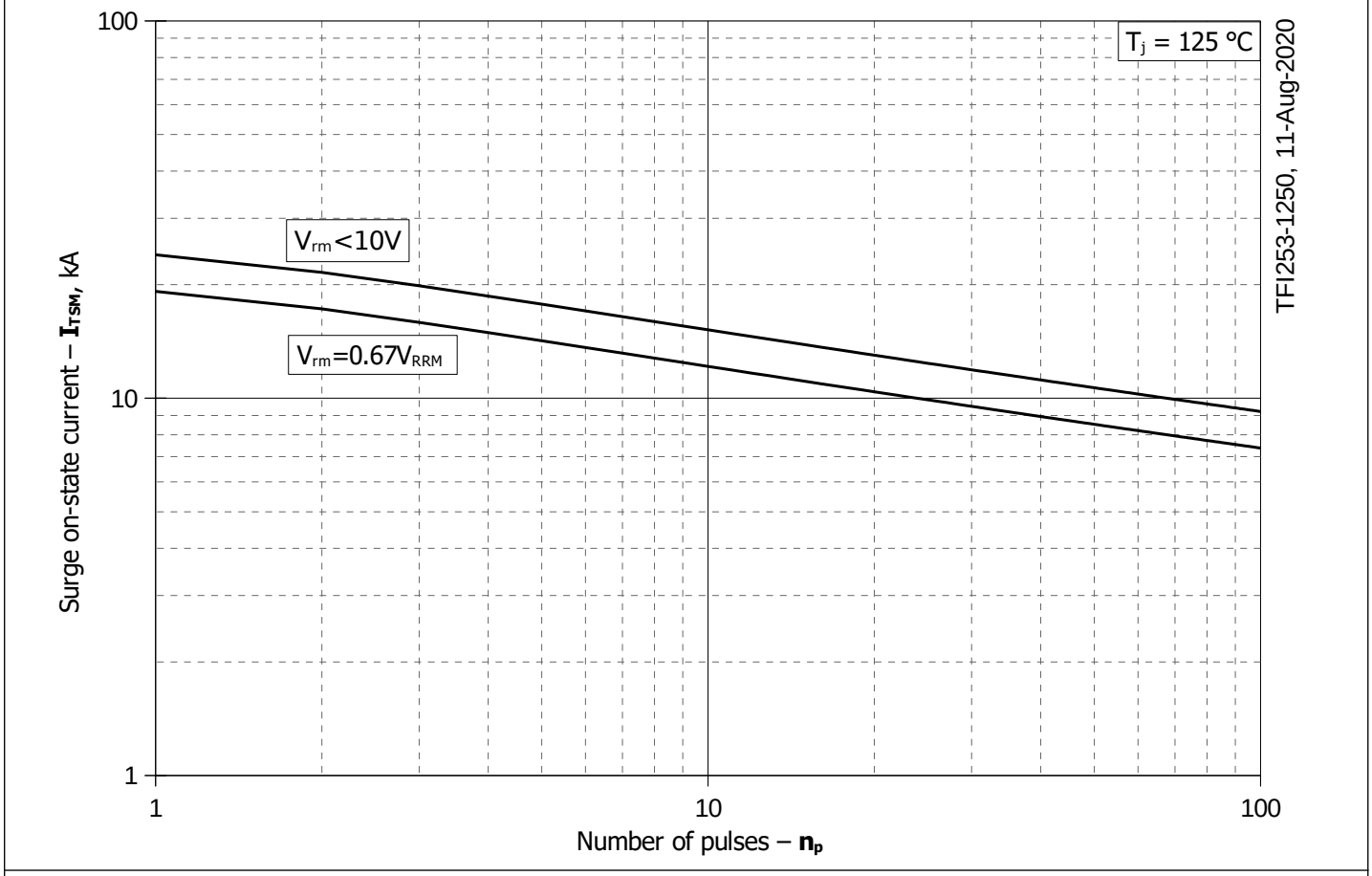


Fig 30 - Maximum surge ratings