ChunZheng

High-end Power Semiconductor Manufacturer

KK1000A 2000-2800V

Fast Switching Thyristor

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

Mean on-state current			I_{TAV}	1000 A	
Repetitive peak off-state voltage			V_{DRM}	2000 – 2800 V	
Repetitive peak reverse voltage			V_{RRM}		
Turn-off time			t_q	50.0 μs	
V_{DRM}, V_{RRM}, V	2000	2200	2400	2600	2800
Voltage code	20	22	24	26	28
T_j, °C	– 60 – 125				

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{TAV}	Mean on-state current	A	1000 1500	T_c= 85°C; Double side cooled; T_c= 55°C;180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	1570	T_c= 85°C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	19.0 22.0	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; 50 Hz (t_p=10 ms); single pulse; V_D=V_R=0 V; Gate pulse:I_G=I_{FGM}; V_G=20 V; t_{GP}=50 μs; di_G/dt=1 A/μs
			20.0 23.0	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; 60 Hz (t_p=8.3 ms); single pulse; V_D=V_R=0 V; Gate pulse:I_G=I_{FGM}; V_G=20 V; t_{GP}=50 μs; di_G/dt=1 A/μs
I^2t	Safety factor	$A^2s{\cdot}10^3$	1805 2420	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; 50 Hz (t_p=10 ms); single pulse; V_D=V_R=0 V; Gate pulse:I_G=I_{FGM}; V_G=20 V; t_{GP}=50 μs; di_G/dt=1 A/μs
			1660 2195	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; 60 Hz (t_p=8.3 ms); single pulse; V_D=V_R=0 V; Gate pulse:I_G=I_{FGM}; V_G=20 V; 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	2000–2800	$T_{j\,min}$< 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	2100–2900	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; 50 Hz;single pulse; Gate open	
V_D, V_R	Direct off-state and Direct reverse voltages	V	0.75·V_{DRM} 0.75·V_{RRM}	T_j=$T_{j\,max}$; Gate open	

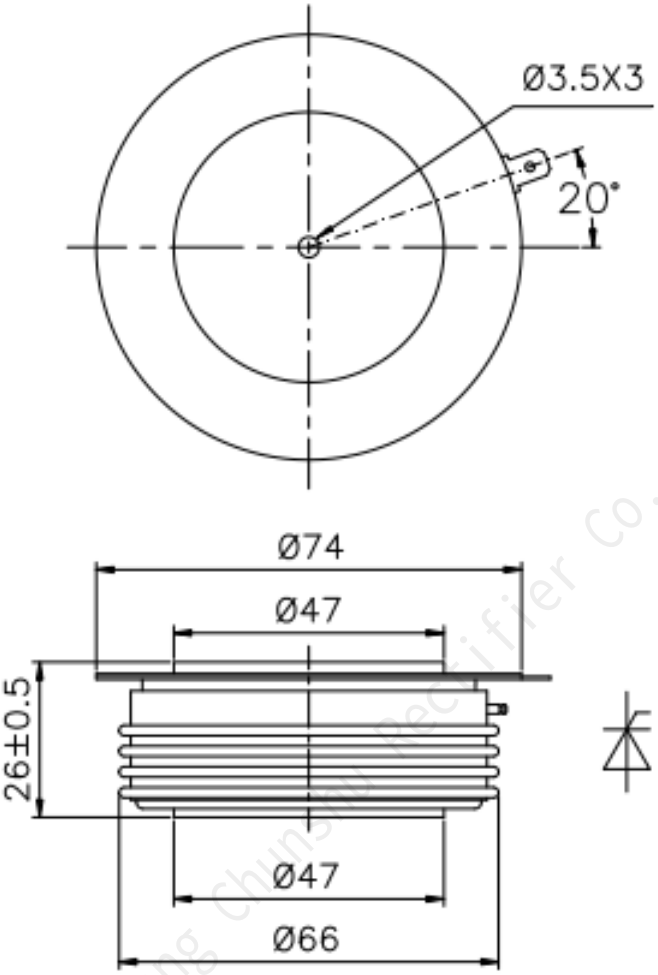
TRIGGERING				
I_{FGM}	Peak forward gate current	A	8	$T_j=T_{j\,max}$
V_{RGM}	Peak reverse gate voltage	V	5	
P_G	Gate power dissipation	W	8	$T_j=T_{j\,max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/μs	2000	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; $I_{TM}=2\ I_{TAV}$; Gate pulse: $I_G=I_{FGM}$; $V_G=20$ V; $t_{GP}=50$ μs; $di_G/dt=1$ A/μs
THERMAL				
T_{stg}	Storage temperature	°C	– 60 – 125	
T_j	Operating junction temperature	°C	– 60 – 125	
MECHANICAL				
F	Mounting force	kN	24.0 – 28.0	
a	Acceleration	m/s^2	50 100	Device unclamped Device clamped

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{TM}	Peak on-state voltage, max	V	2.25	$T_j=25$ °C; $I_{TM}=3140$ A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.35	$T_j=T_{j\,max}$; $0.5\ \pi\ I_{TAV} < I_T < 1.5\ \pi\ I_{TAV}$	
r_T	On-state slope resistance, max	mΩ	0.35		
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	1000	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; Gate open	
TRIGGERING					
V_{GT}	Gate trigger direct voltage, max	V	4.00 2.50 2.00	$T_j=T_{j\,min}$ $T_j=25$ °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	500 300 200	$T_j=T_{j\,min}$ $T_j=25$ °C $T_j=T_{j\,max}$	
V_{GD}	Gate non-trigger direct voltage, min	V	0.25	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	10.00		
SWITCHING					
t_{gd}	Delay time	μs	2.5	$T_j=25$ °C; $V_D=0.4\cdot V_{DRM}$; $I_{TM}=I_{TAV}$; Gate pulse: $I_G=I_{FGM}$; $V_G=20$ V; $t_{GP}=50$ μs; $di_G/dt=1$ A/μs	
t_q	Turn-off time[2], max	μs	50.0	$dv_D/dt=50$ V/μs;	$T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $di_R/dt=-10$ A/μs; $V_R=100$V; $V_D=0.67\cdot V_{DRM}$
			63.0	$dv_D/dt=200$ V/μs;	
Q_{rr}	Total recovered charge, max	μC	1000	$T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $di_R/dt=-50$ A/μs; $V_R=100$ V	
t_{rr}	Reverse recovery time, max	μs	8.7		
I_{rrM}	Peak reverse recovery current, max	A	230		

THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0200	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					
w	Weight, typ	g	510		
D_s	Surface creepage distance	mm (inch)	31.6 (1.244)		
D_a	Air strike distance	mm (inch)	16.5 (0.649)		

OVERALL DIMENSIONS



KT55

All dimensions in millimeters

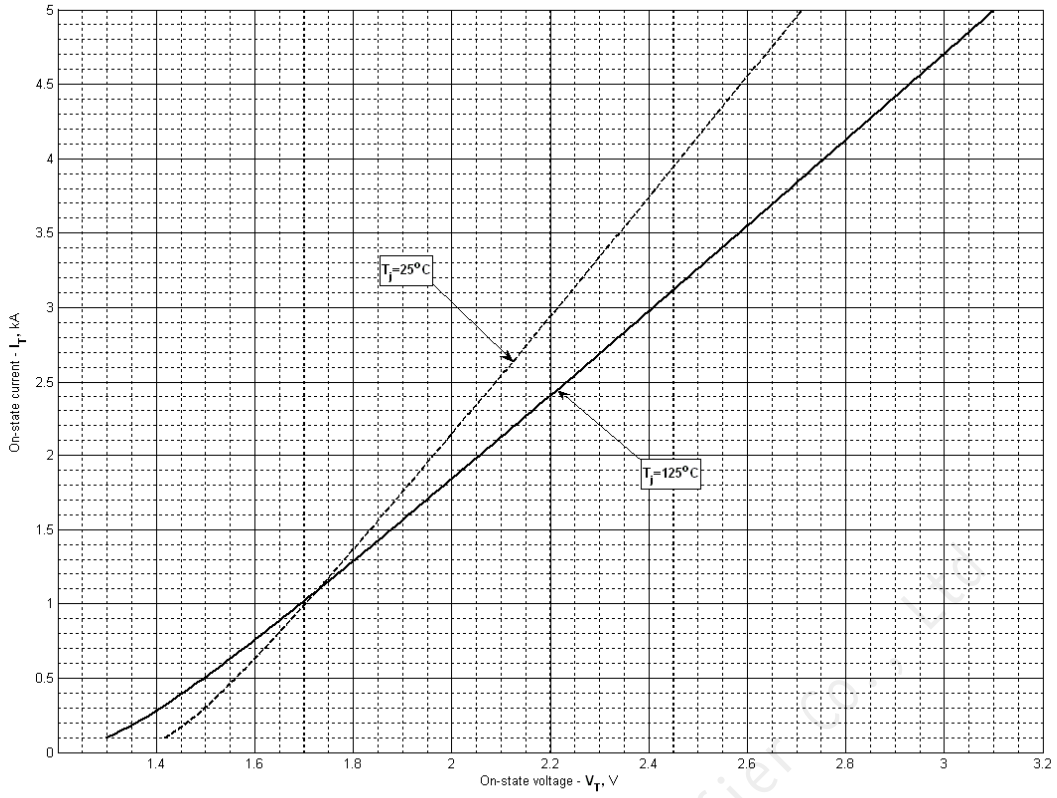


Fig 1 – On-state characteristics of Limit device

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°C	T_j = $T_{j\,max}$
A	1.324142	1.172344
B	0.209424	0.295163
C	-0.158239	-0.211339
D	0.278291	0.371677

On-state characteristic model (see Fig. 1)

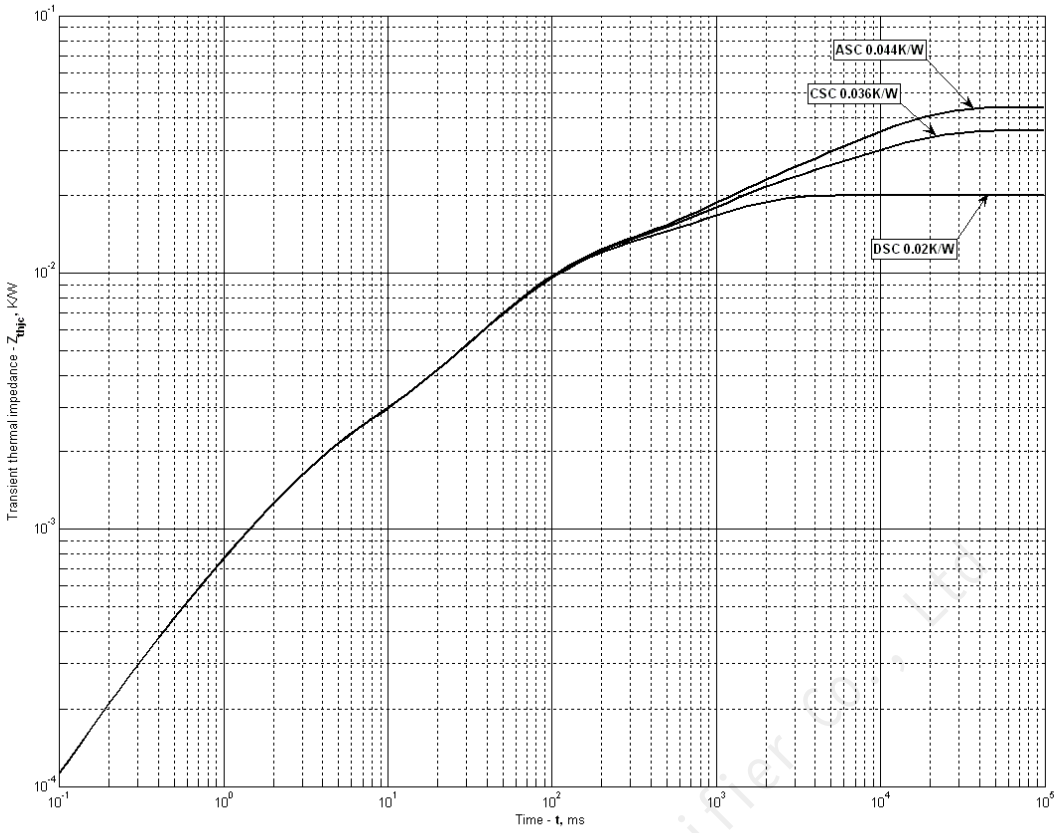


Fig 2 – Transient thermal impedance

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)

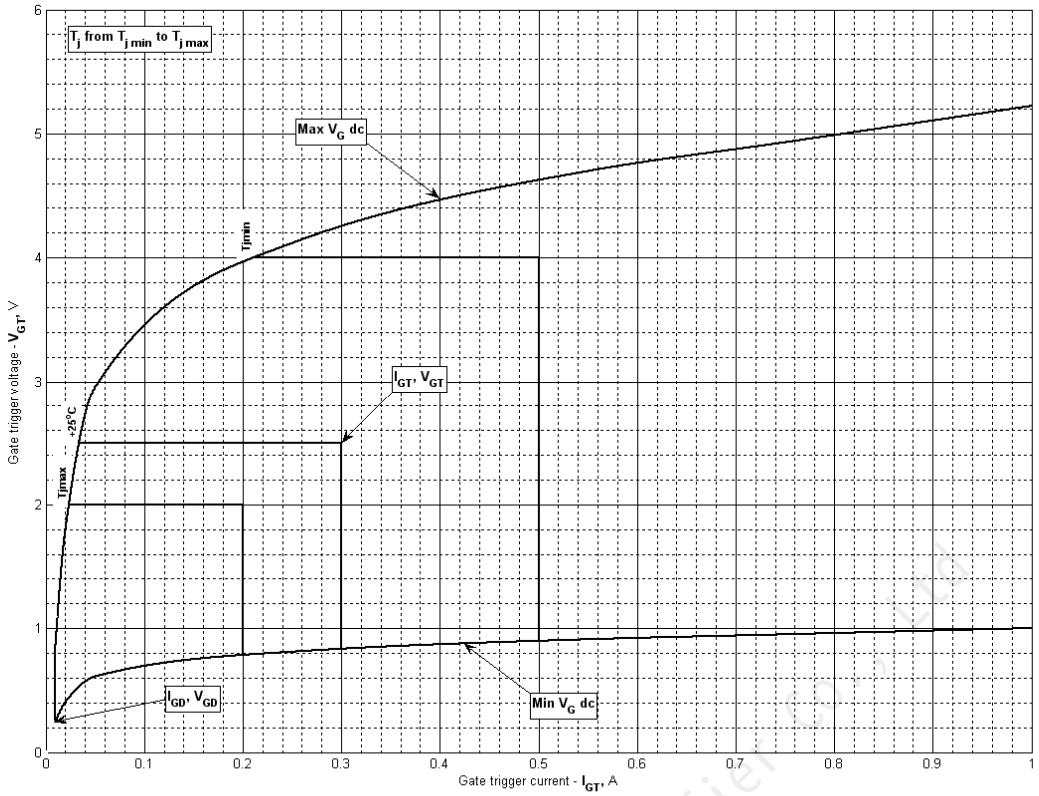


Fig 3 – Gate characteristics – Trigger limits

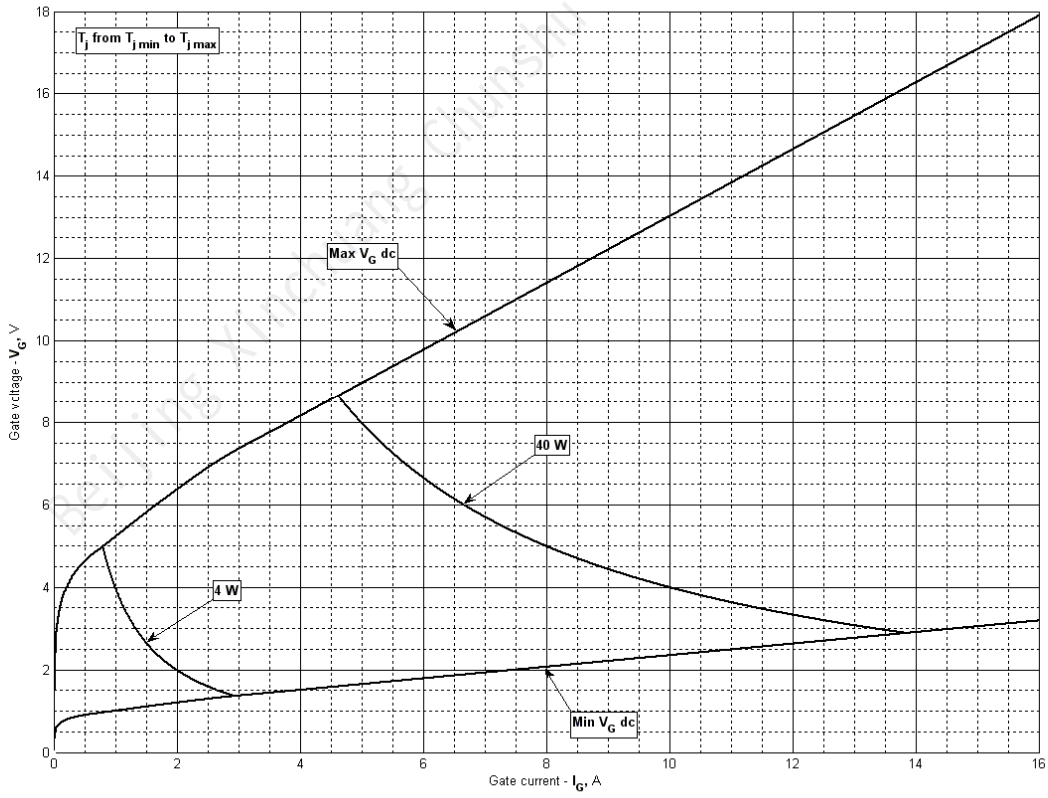


Fig 4 - Gate characteristics – Power curves

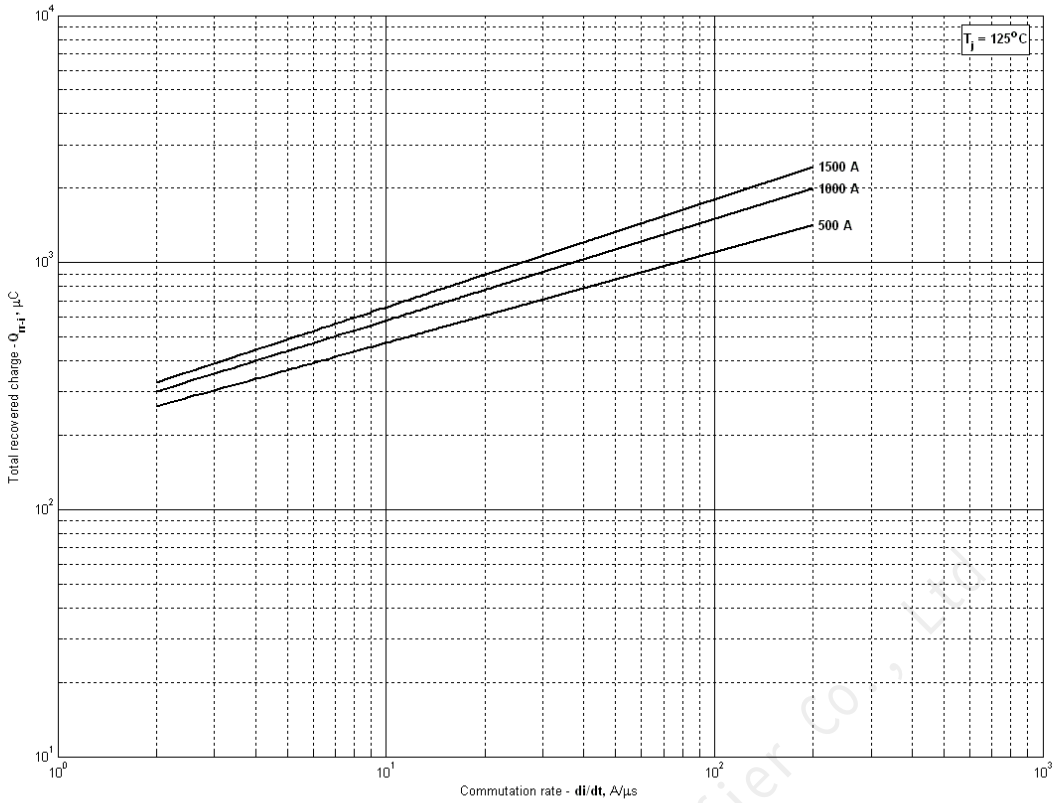


Fig 5 - Total recovered charge, Q_{rr-i} (integral)

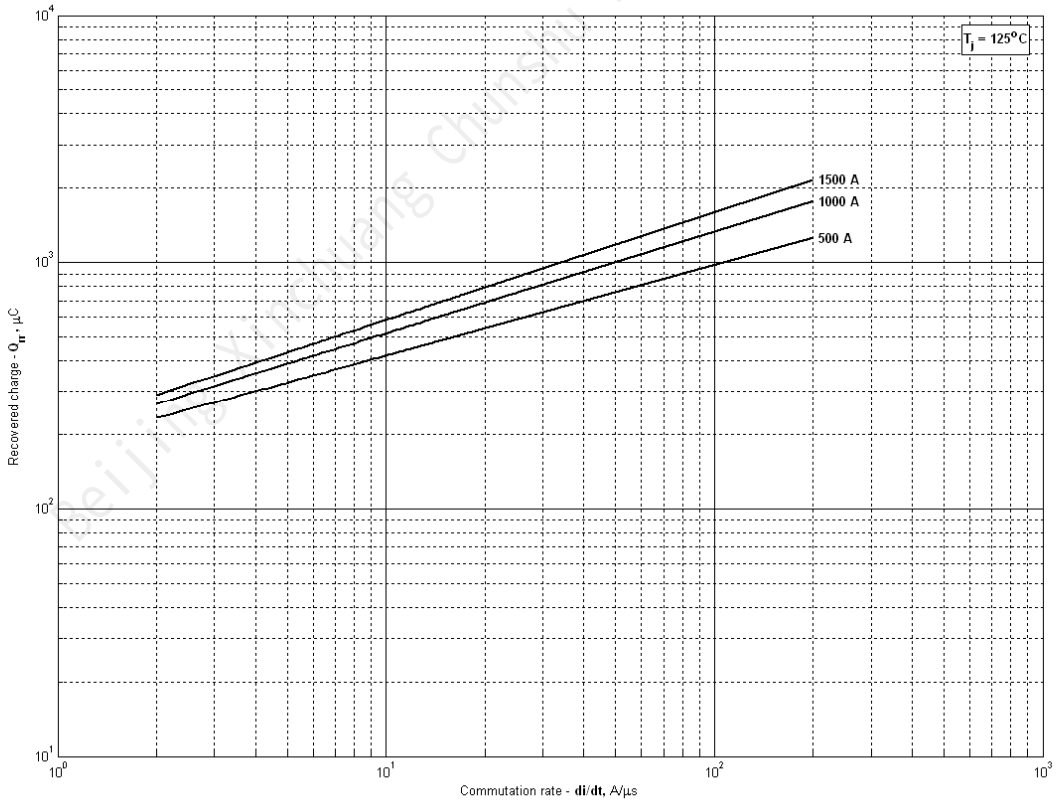


Fig 6 - Recovered charge, Q_{rr} (linear)

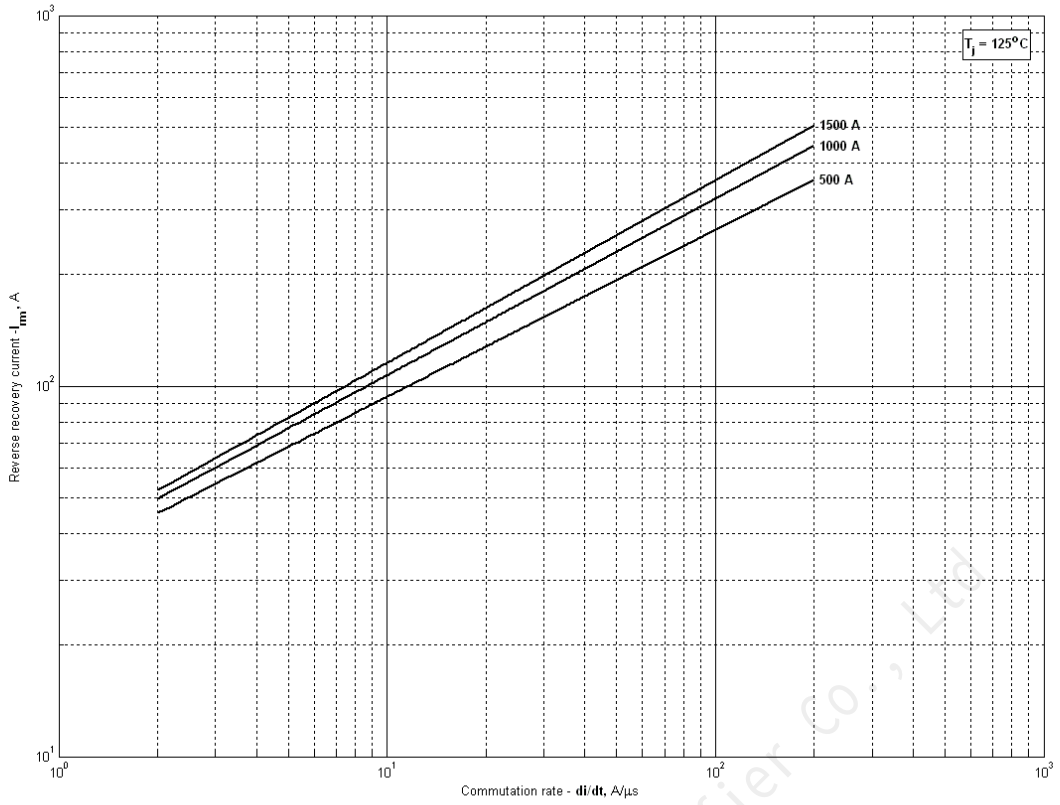


Fig 7 - Peak reverse recovery current, I_{rm}

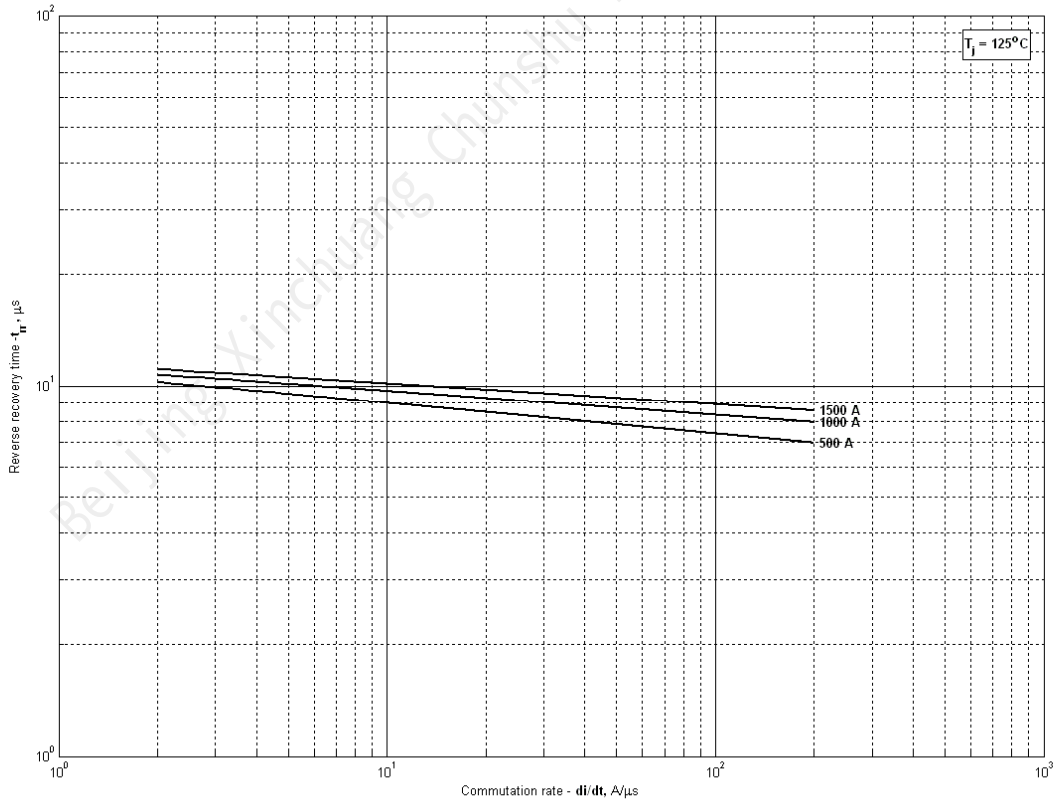


Fig 8 - Recovery time, t_{rr} (50% chord)

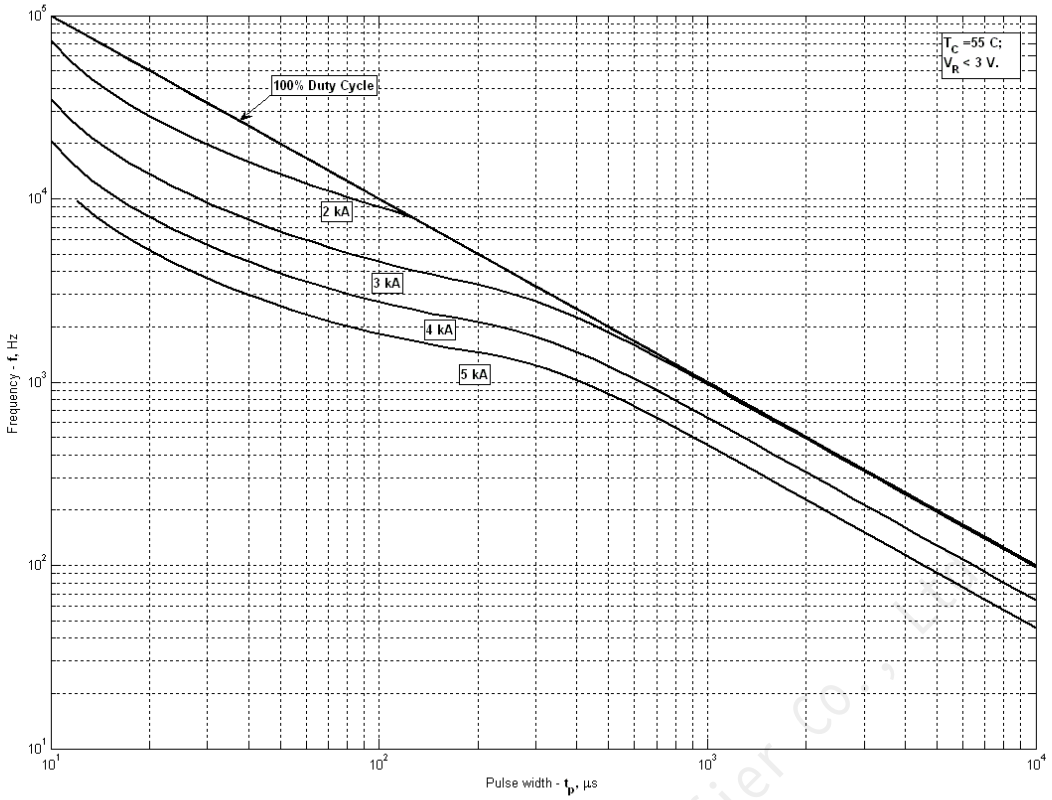


Fig 9 - Sine wave frequency ratings

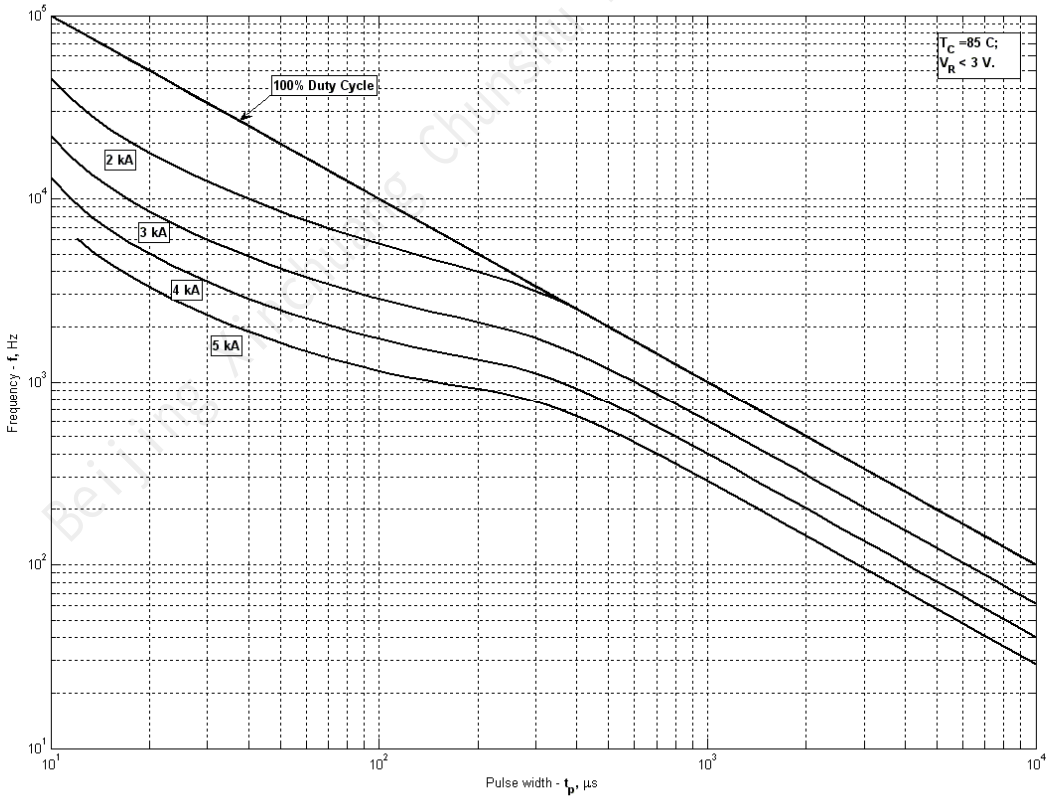


Fig 10 - Sine wave frequency ratings

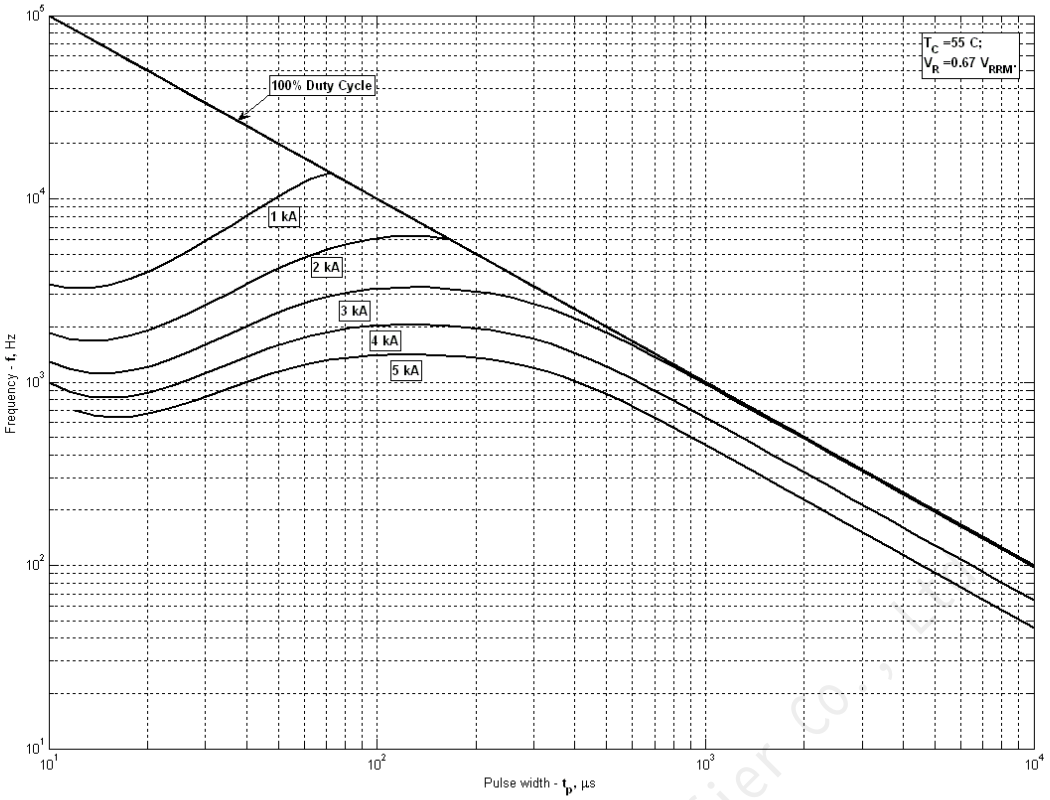


Fig 11 - Sine wave frequency ratings

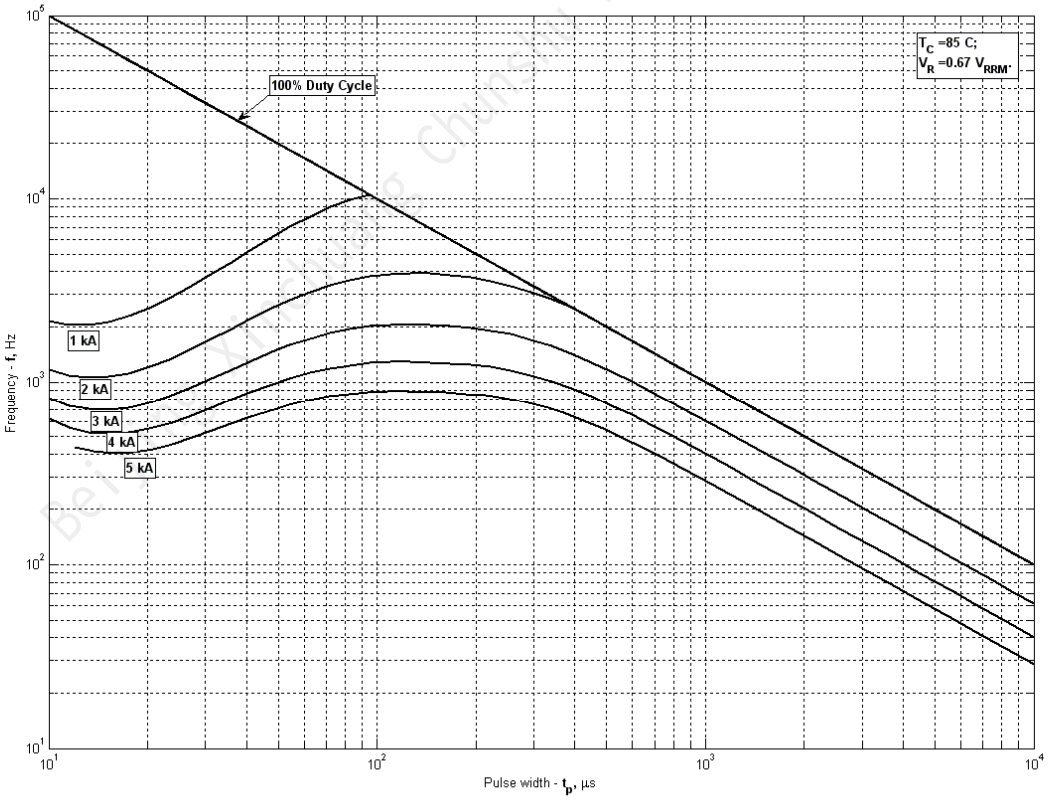


Fig 12 - Sine wave frequency ratings

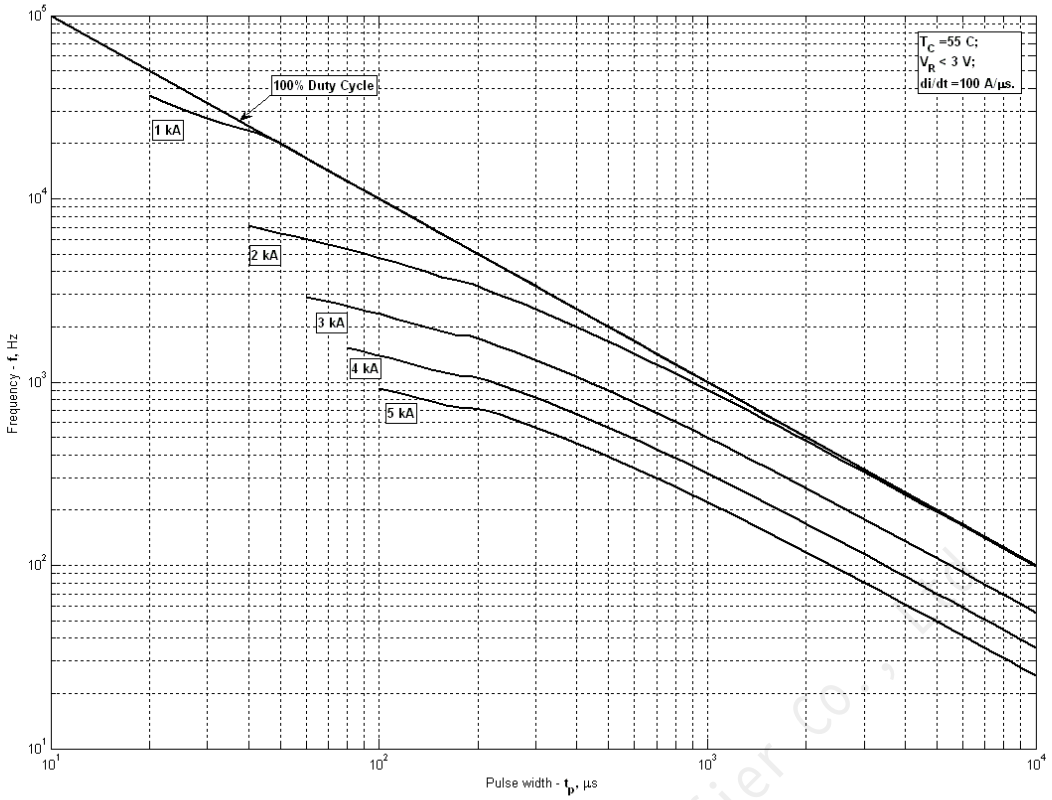


Fig 13 - Square wave frequency ratings

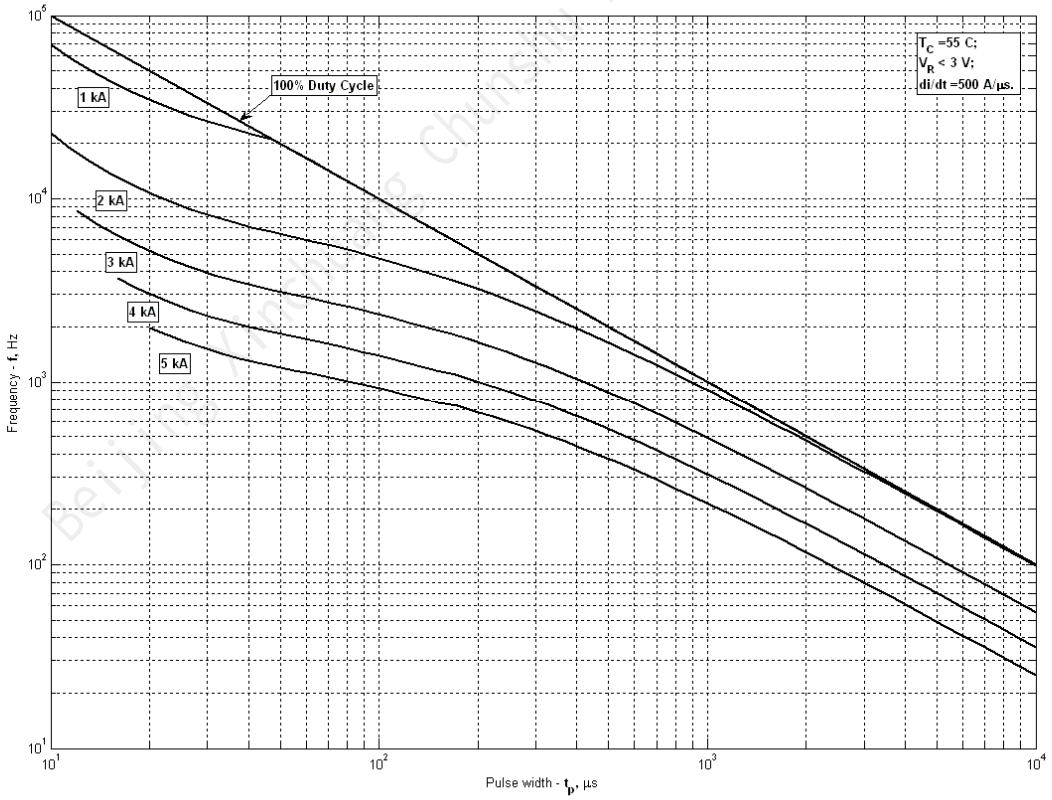


Fig 14 - Square wave frequency ratings

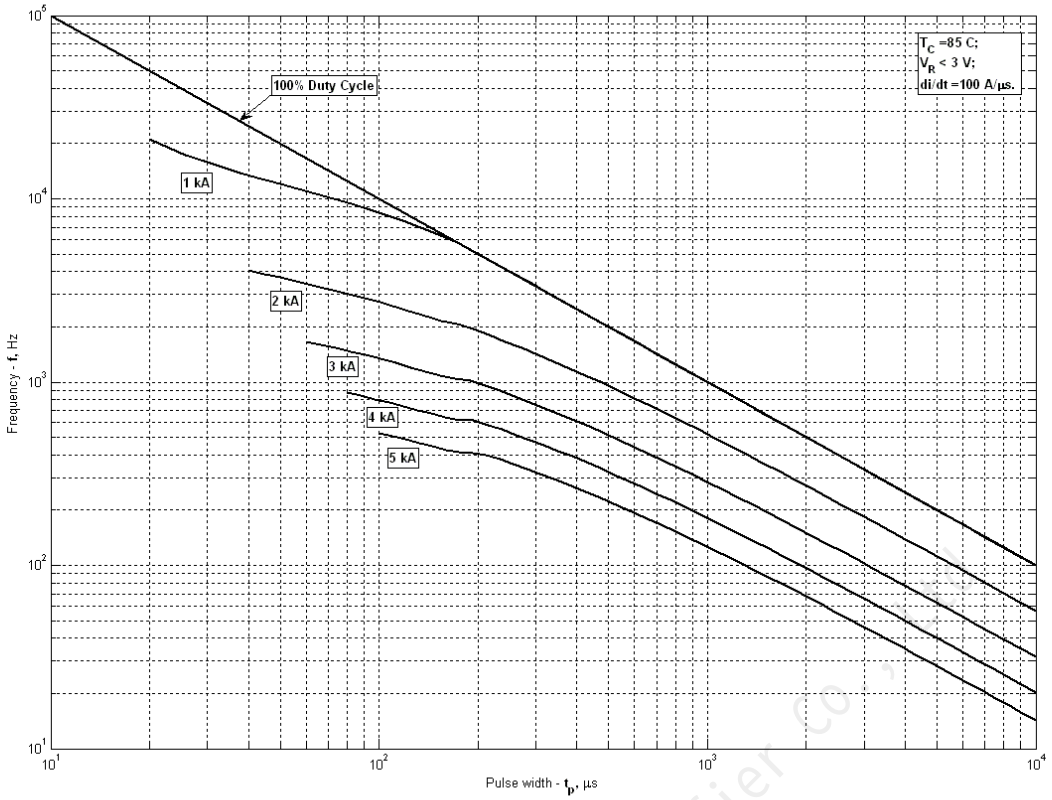


Fig 15 - Square wave frequency ratings

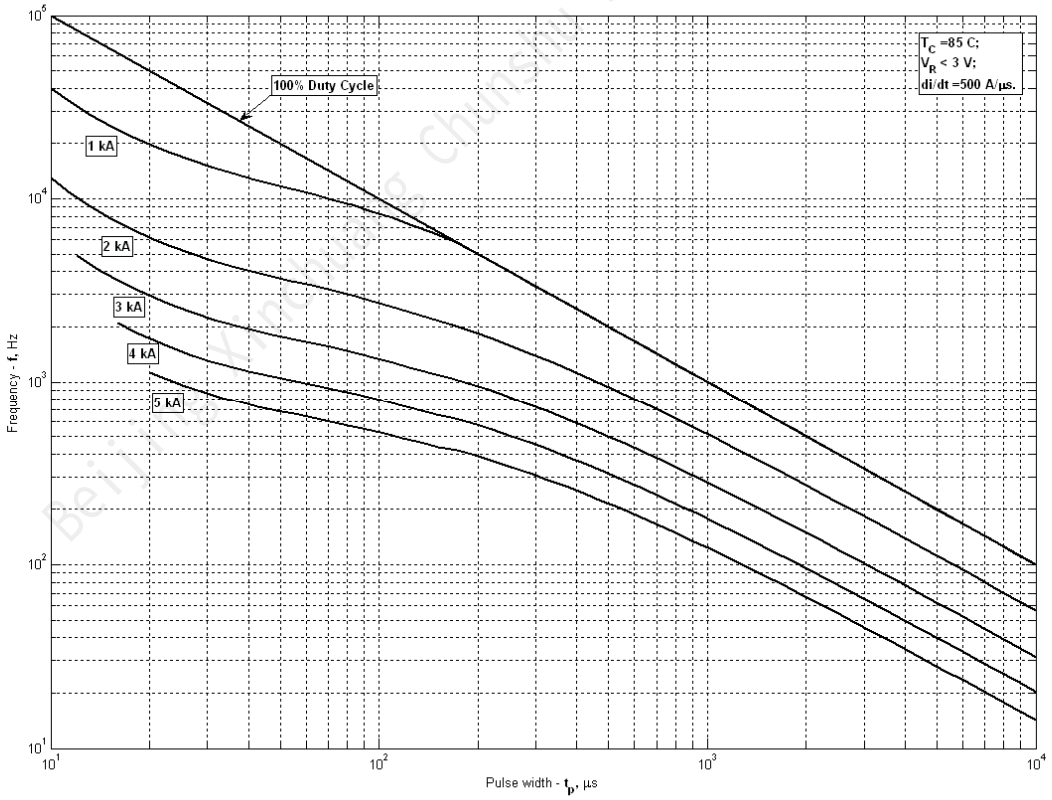


Fig 16 - Square wave frequency ratings

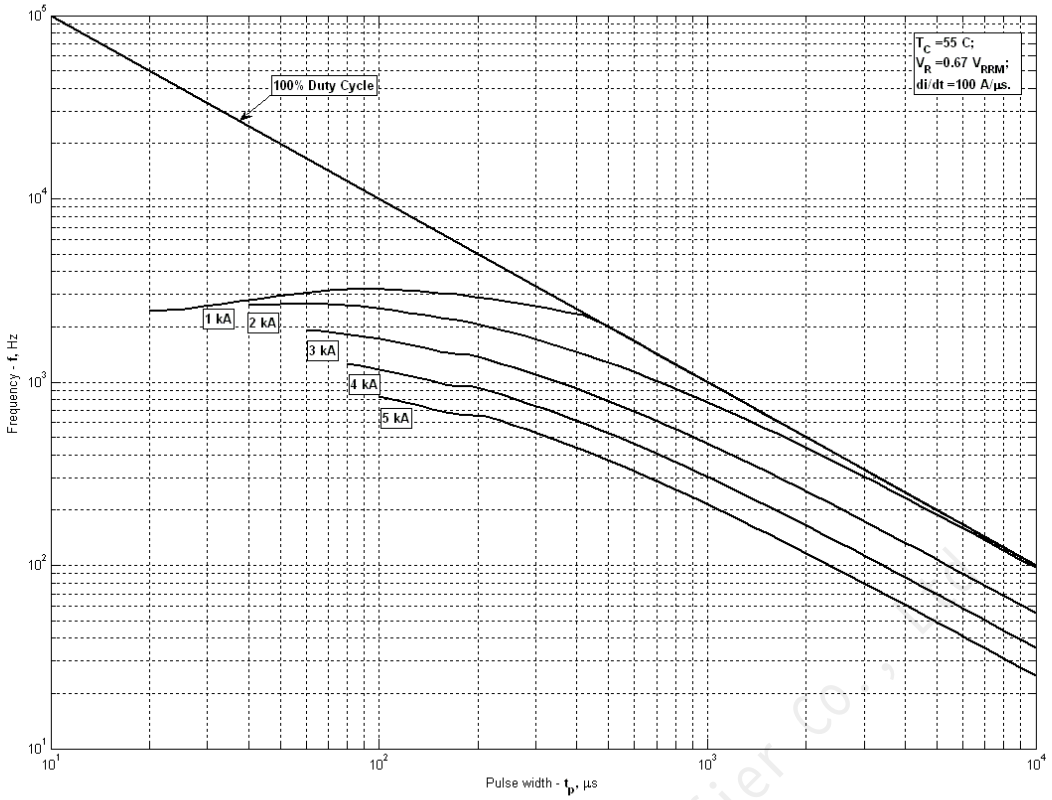


Fig 17 - Square wave frequency ratings

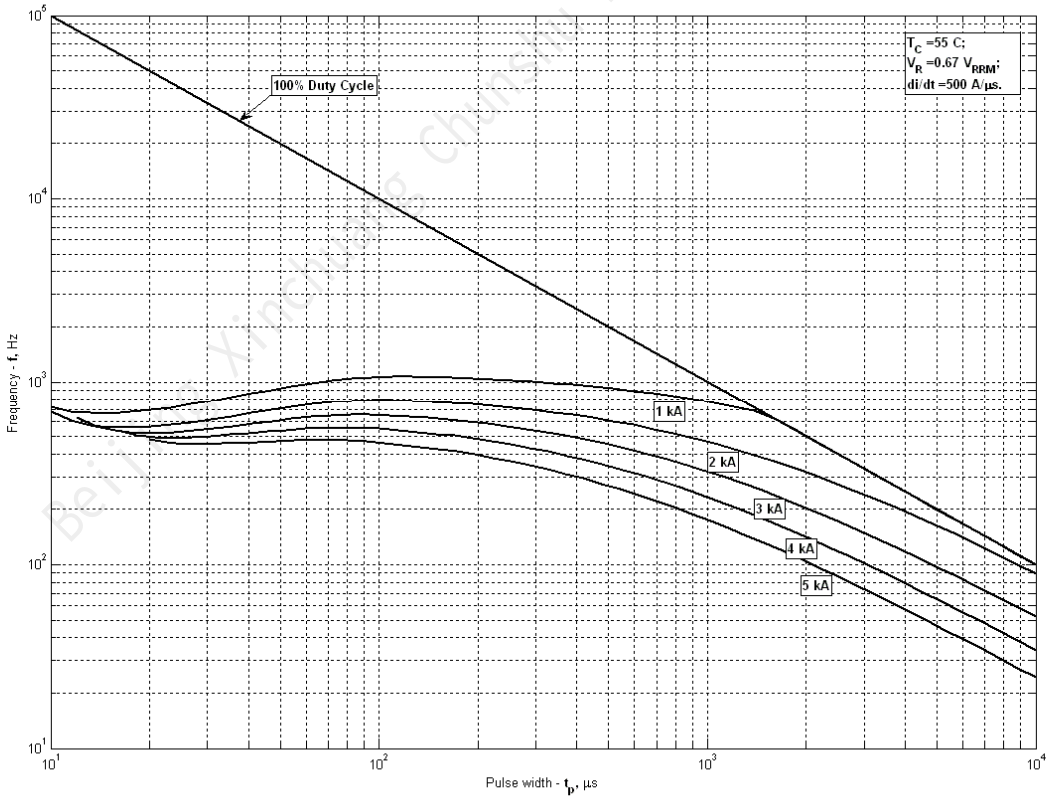


Fig 18 - Square wave frequency ratings

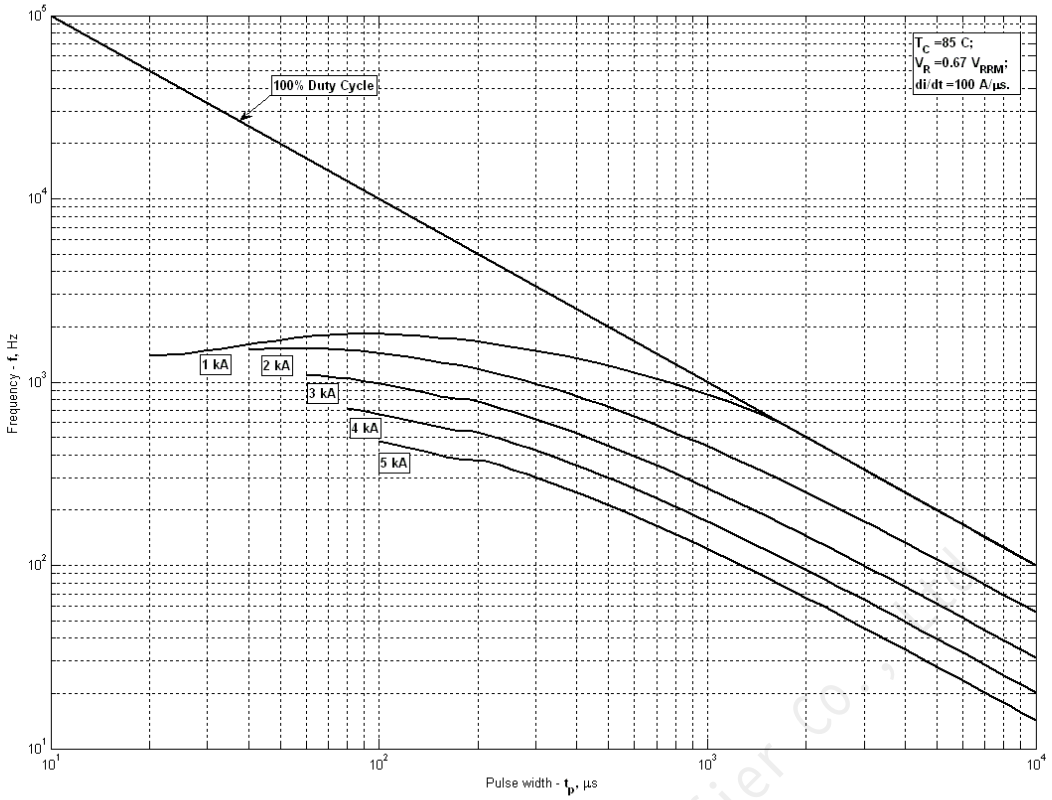


Fig 19 - Square wave frequency ratings

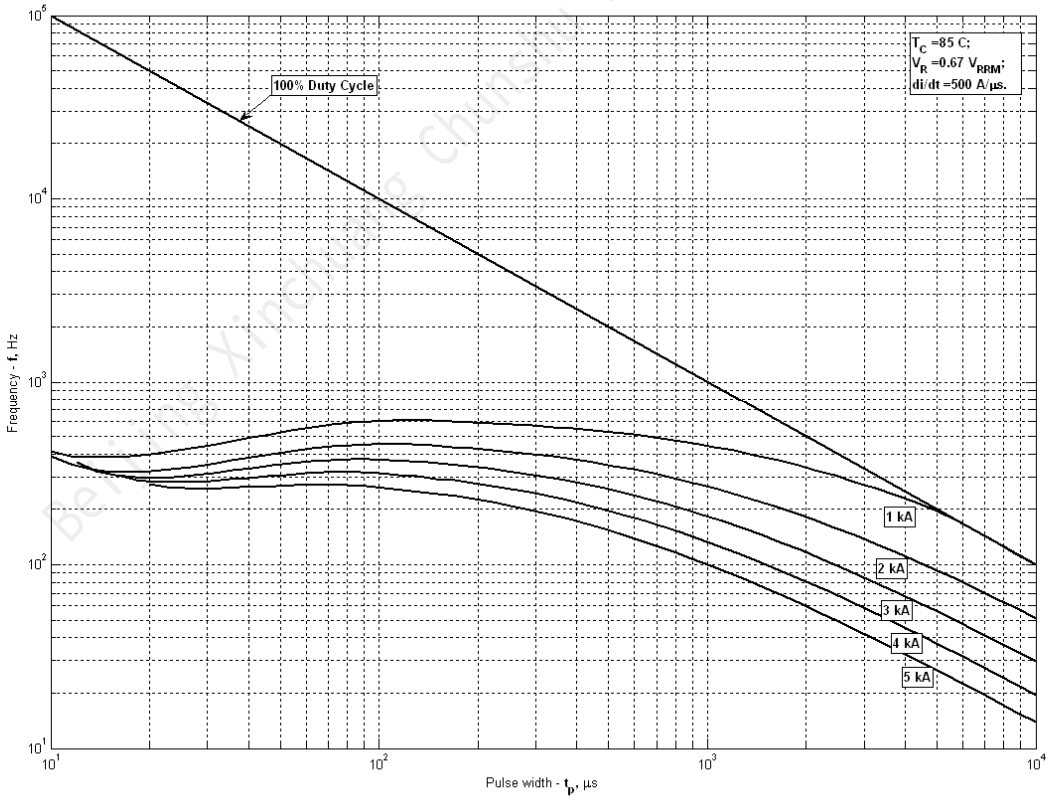


Fig 20 - Square wave frequency ratings

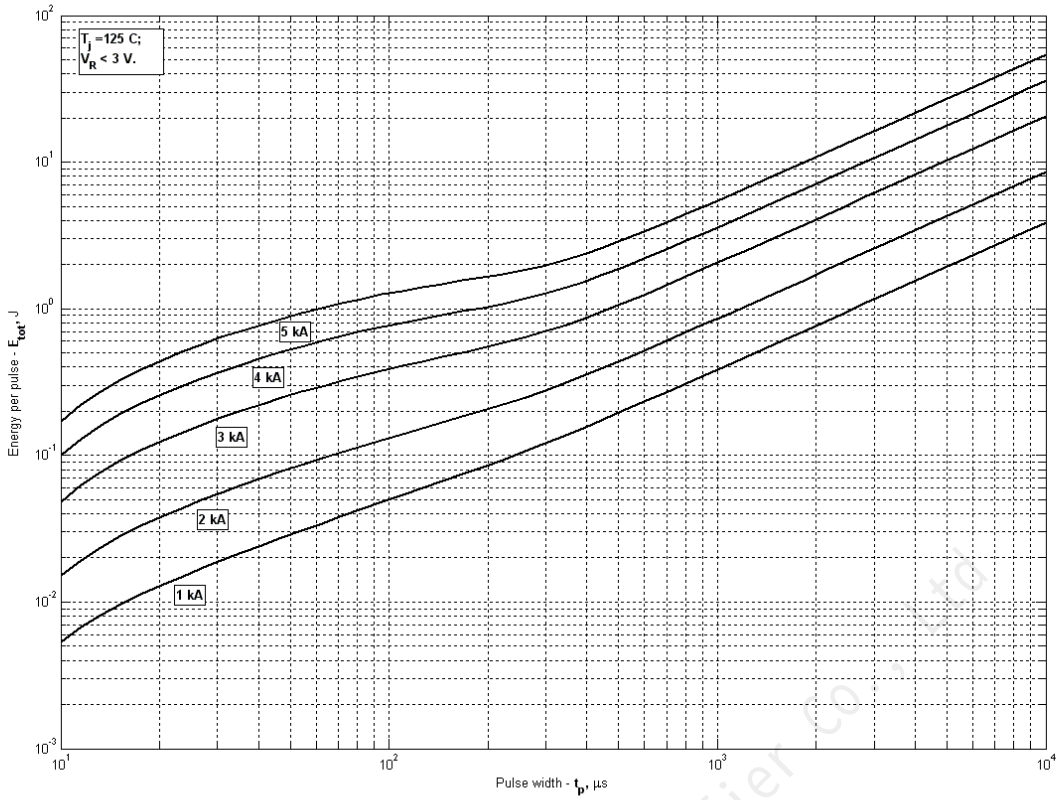


Fig 21 - Sine wave loss energy per pulse

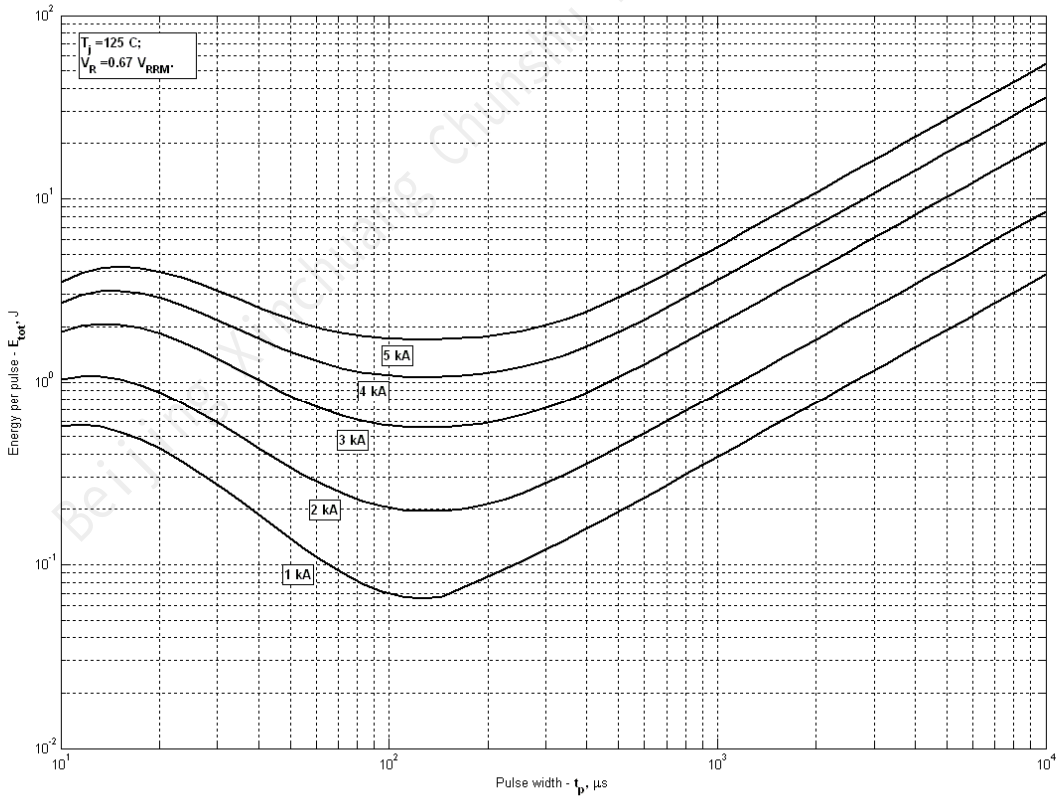


Fig 22 - Sine wave loss energy per pulse

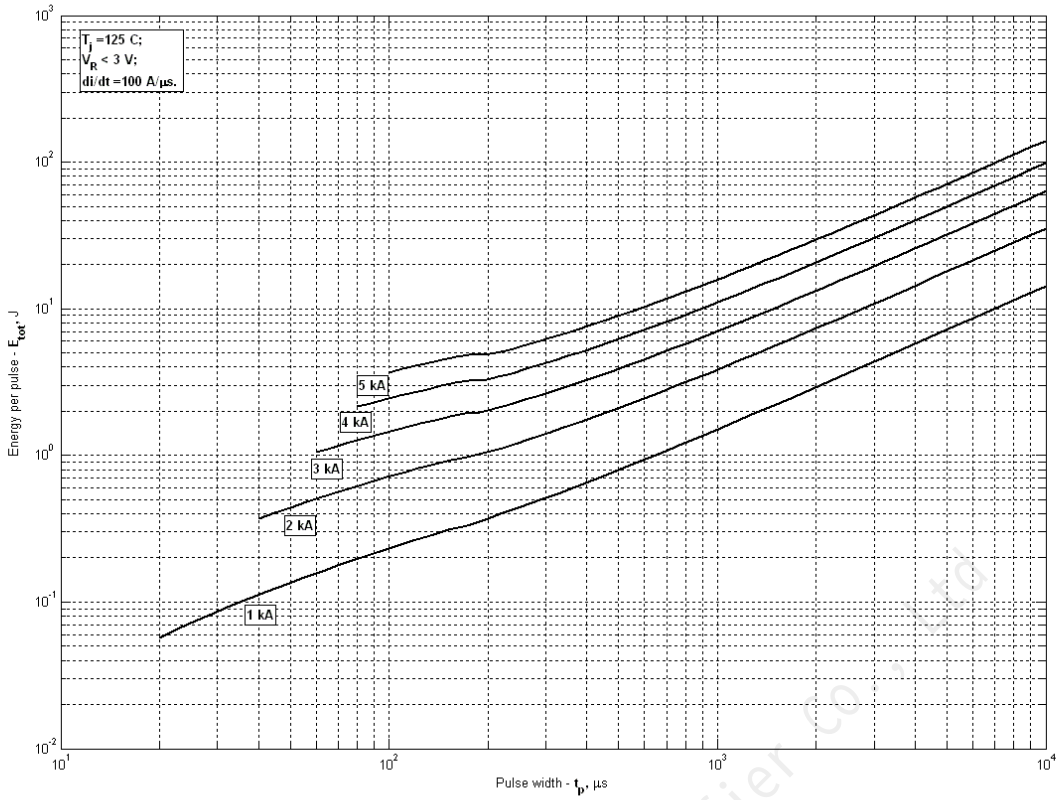


Fig 23 - Square wave loss energy per pulse

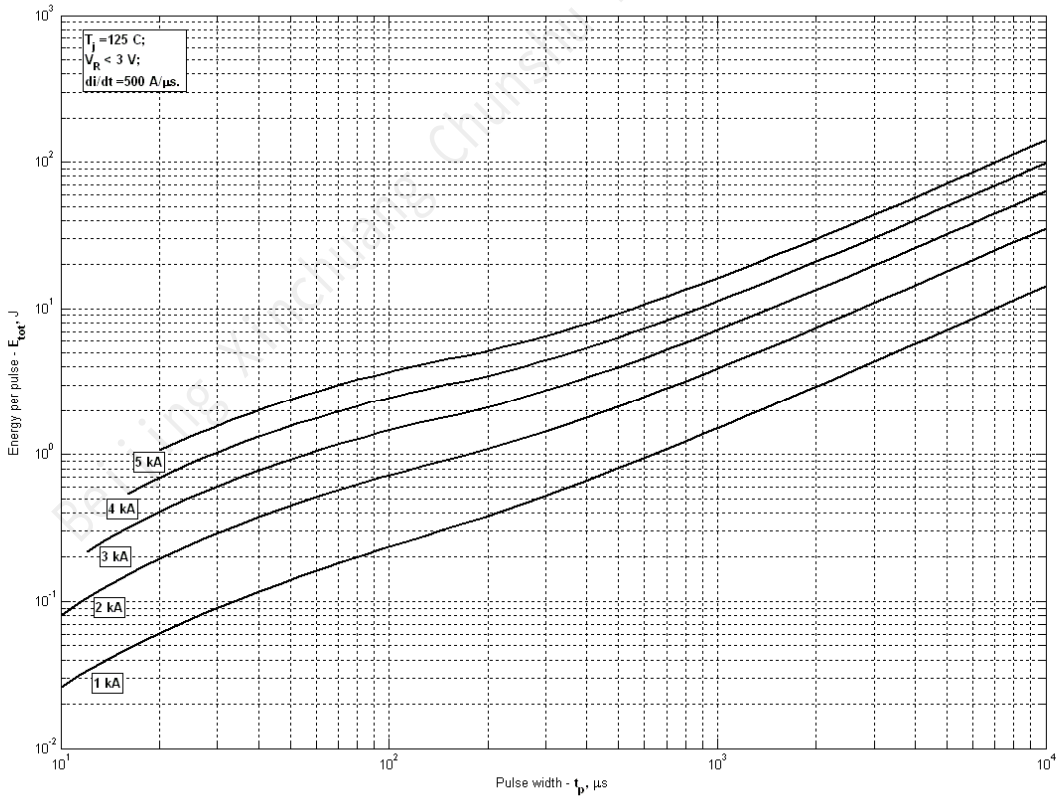


Fig 24 - Square wave loss energy per pulse

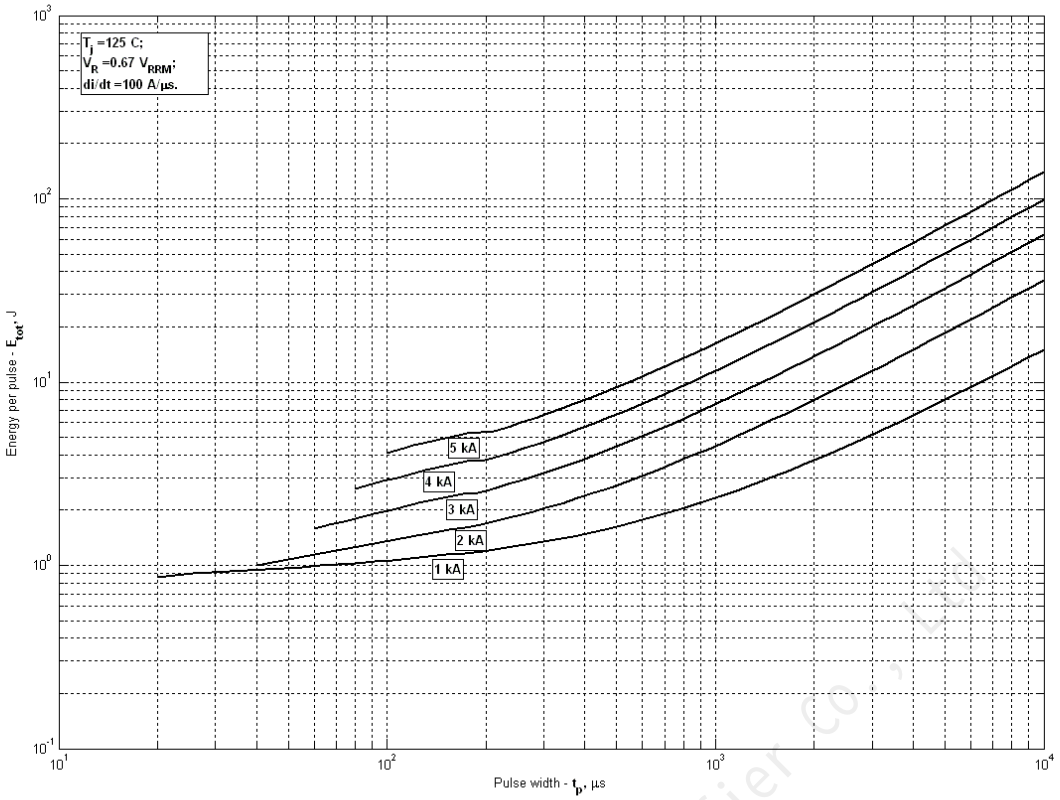


Fig 25 - Square wave loss energy per pulse

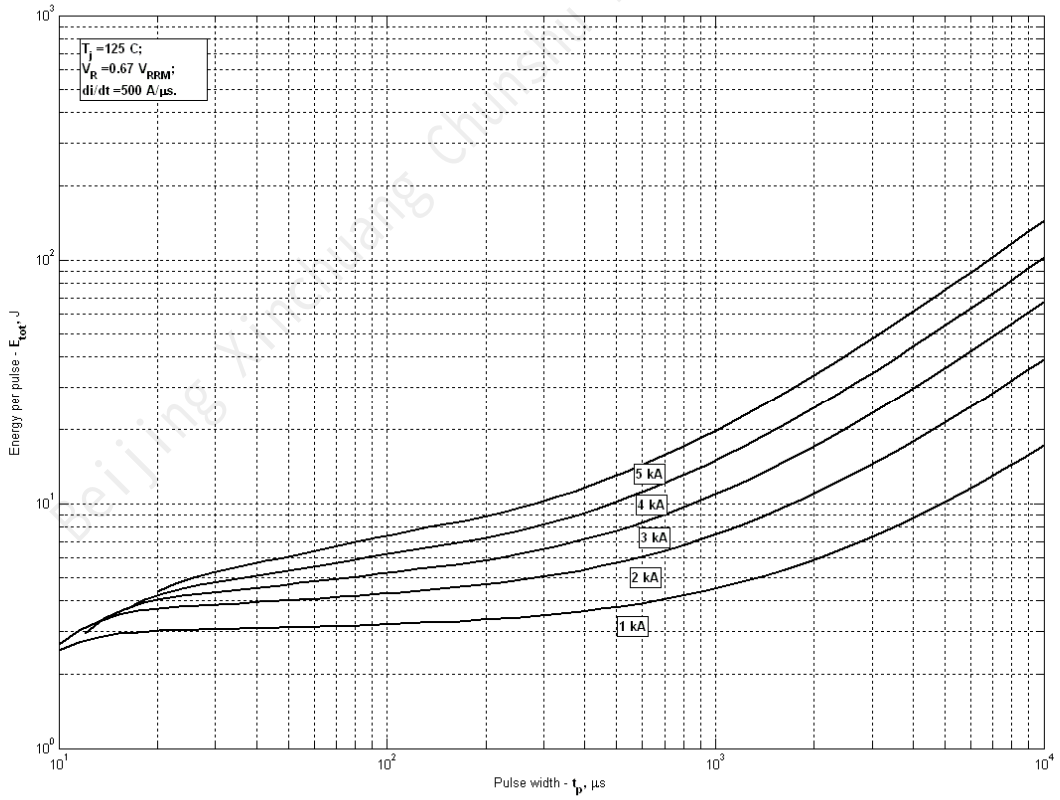


Fig 26 - Square wave loss energy per pulse

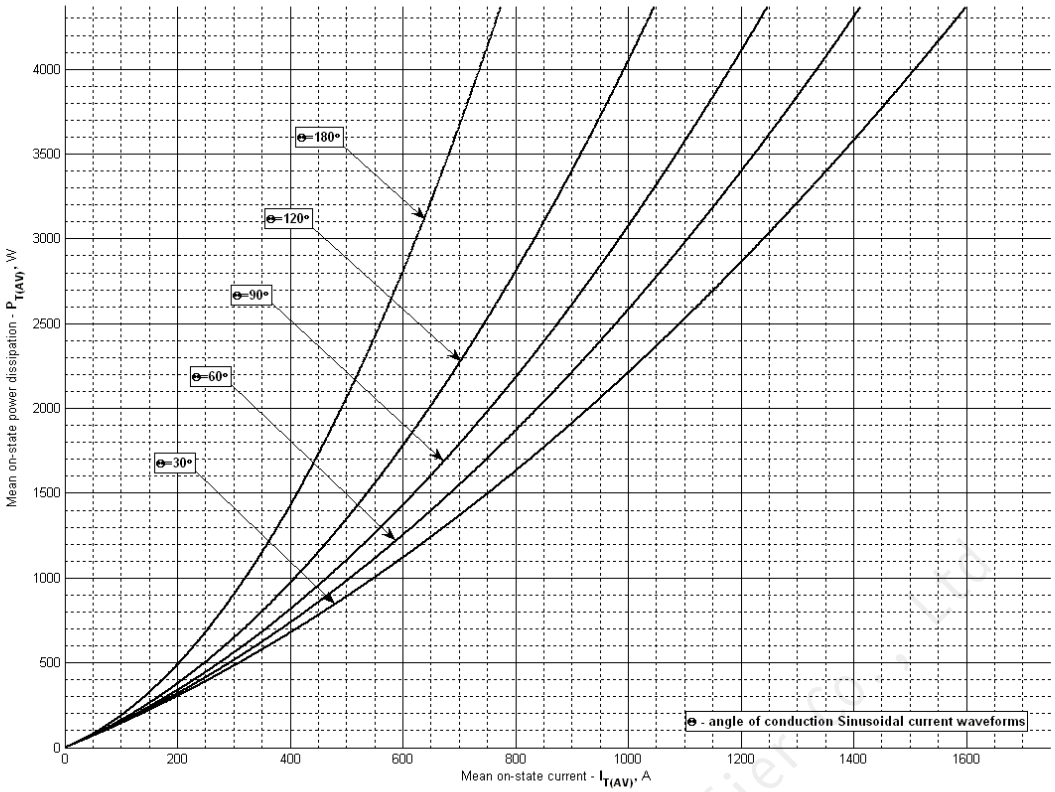


Fig 27 – On-state power loss (sinusoidal current waveforms)

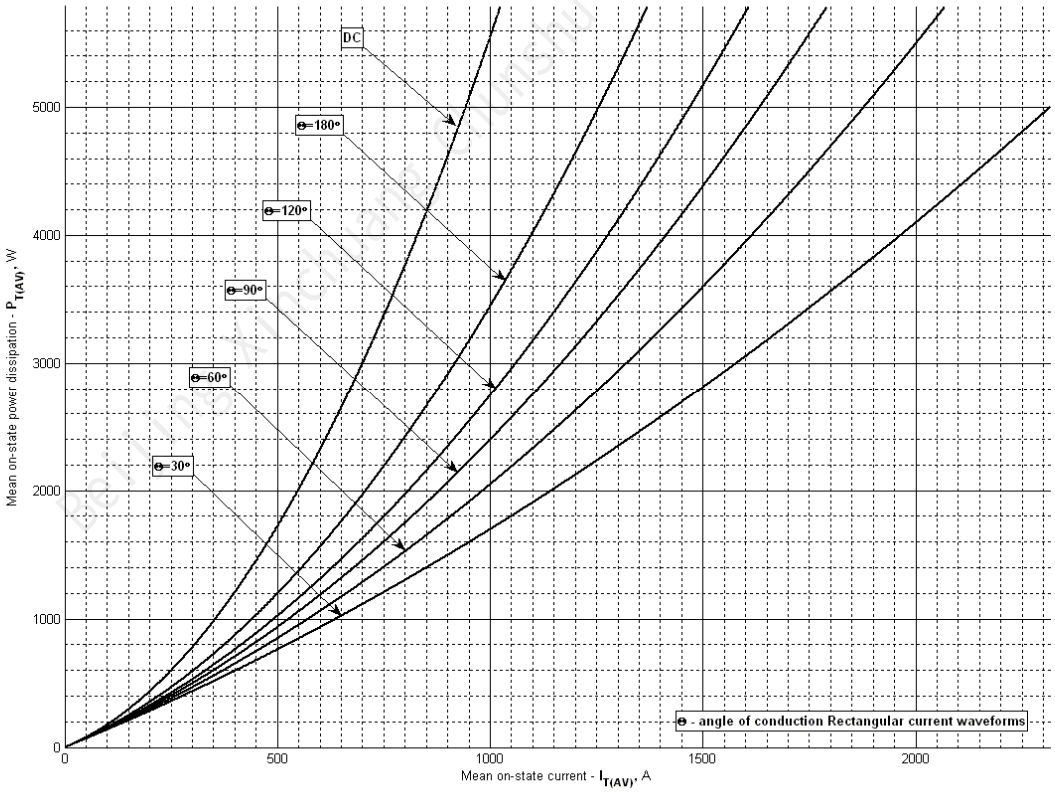


Fig 28 - On-state power loss (rectangular current waveforms)

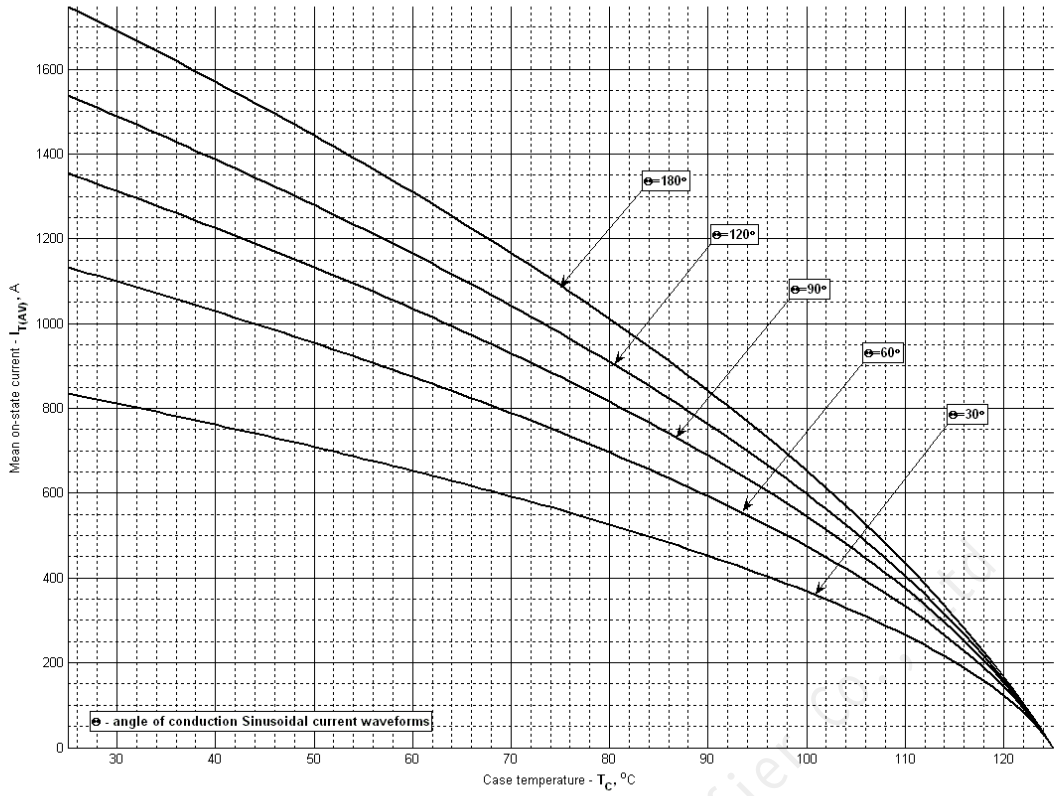


Fig 29 – Maximum case temperature (sinusoidal current waveforms)

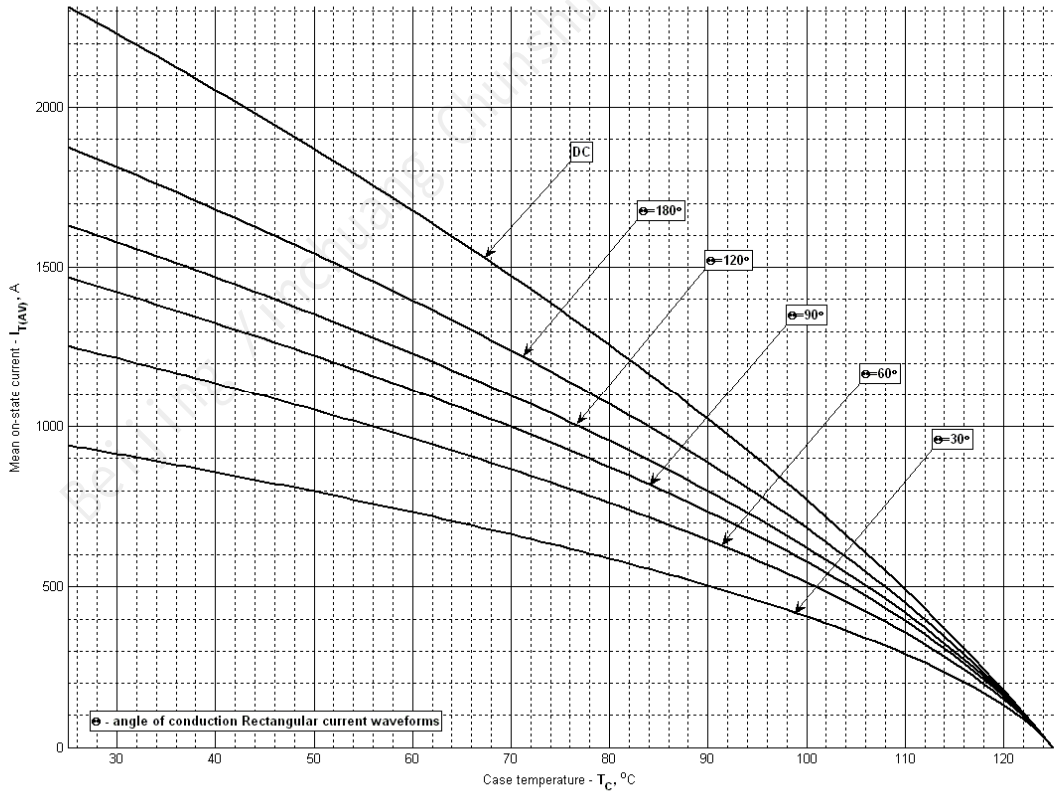


Fig 30 - Maximum case temperature (rectangular current waveforms)

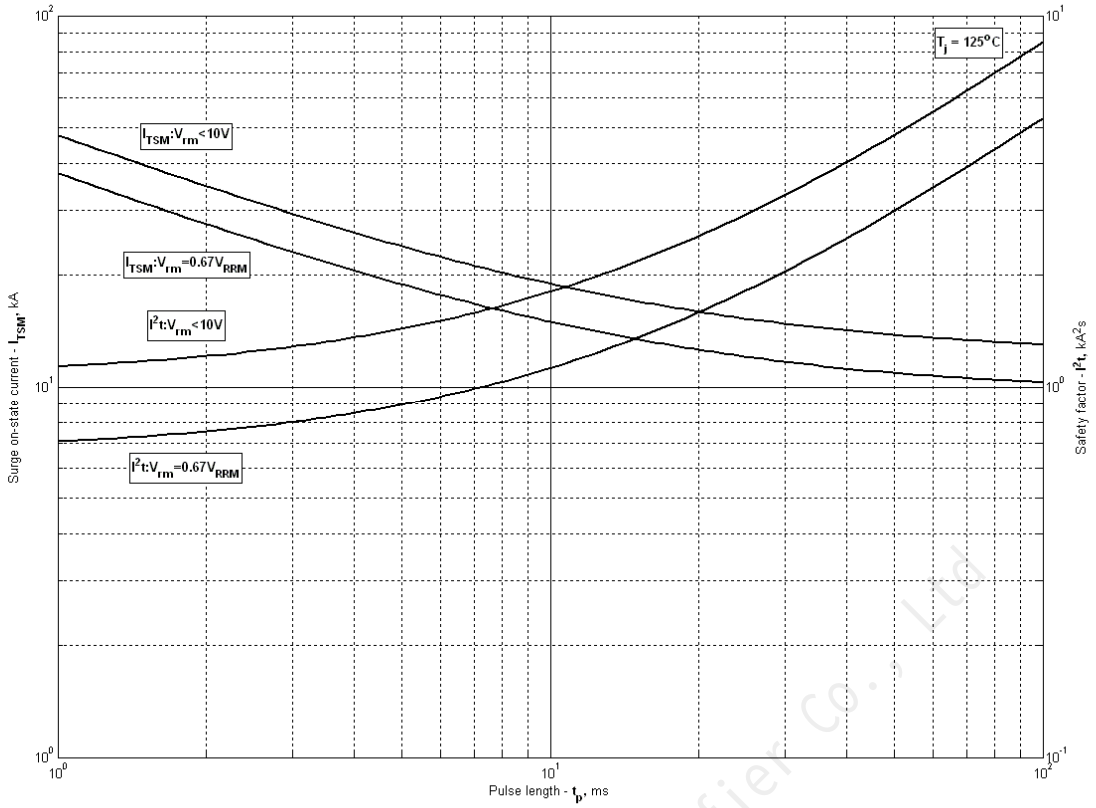


Fig 31 – Maximum surge and I^2t ratings

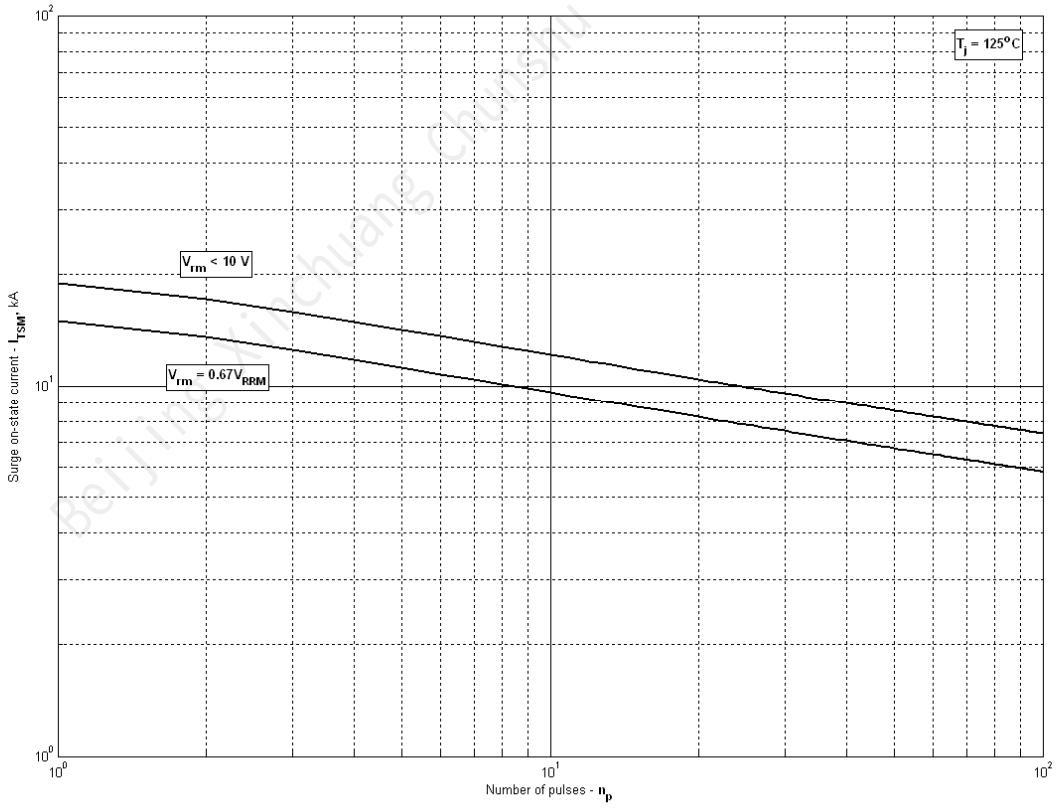


Fig 32 - Maximum surge ratings

