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

Fast Thyristor
Type TFI473-1600-40

Mean on-state current		I_{TAV}	1600 A
Repetitive peak off-state voltage		V_{DRM}	3800 ÷ 4000 V
Repetitive peak reverse voltage		V_{RRM}	
Turn-off time		t_q	125; 160 µs
V_{DRM}, V_{RRM}, V	3800		4000
Voltage code	38		40
T_j, °C	– 60 ÷ 125		

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{TAV}	Mean on-state current	A	1600 2340	T_c=85 °C; Double side cooled; T_c=55 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{TRMS}	RMS on-state current	A	2512	T_c=85 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	30.0 35.0	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=2 A/µs
			32.0 37.0	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=2 A/µs
I^2t	Safety factor	$A^2s{\cdot}10^3$	4500 6125	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=2 A/µs
			4245 5680	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=2 A/µs
BLOCKING					
V_{DRM}, V_{RRM}	Repetitive peak off-state and Repetitive peak reverse voltages	V	3800÷4000	$T_{j\,min}$< 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	3900÷4100	$T_{j\,min}$< 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	10	$T_j=T_{j\,max}$
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; $di_G/dt=2$ A/μs
THERMAL				
T_{stg}	Storage temperature	°C	-60 ÷ 125	
T_j	Operating junction temperature	°C	-60 ÷ 125	
MECHANICAL				
F	Mounting force	kN	40.0 ÷ 50.0	
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	2.40 2.70	$T_j=T_{j\,max}$; $I_{TM}=4000$ A $T_j=25$ °C; $I_{TM}=5024$ A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.44	$T_j=T_{j\,max}$; $0.5\ \pi\ I_{TAV} < I_T < 1.5\ \pi\ I_{TAV}$	
r_T	On-state slope resistance, max	mΩ	0.270		
I_H	Holding current, max	mA	1000	$T_j=25$ °C; $V_D=12$ V; Gate open	
BLOCKING					
I_{DRM}, I_{RRM}	Repetitive peak off-state and Repetitive peak reverse currents, max	mA	300	$T_j=T_{j\,max}$; $V_D=V_{DRM}$; $V_R=V_{RRM}$	
$(dv_D/dt)_{crit}$	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	5.00 3.00 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	0.35	$T_j=T_{j\,max}$; $V_D=0.67\cdot V_{DRM}$; Direct gate current	
I_{GD}	Gate non-trigger direct current, min	mA	15.00		
SWITCHING					
t_{gd}	Delay time	μs	3.5	$T_j=25$ °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; $di_G/dt=2$ A/μs	
t_q	Turn-off time[2], max	μs	125; 160	$dv_D/dt=50$ V/μs;	$T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $di_R/dt=-10$ A/μs; $V_R=100$V; $V_D=0.67\ V_{DRM}$
			160; 200	$dv_D/dt=200$ V/μs;	
Q_{rr}	Total recovered charge(linear), max	μC	3000	$T_j=T_{j\,max}$; $I_{TM}=2000$ A; $di_R/dt=-50$ A/μs; $V_R=100$ V	
t_{rr}	Reverse recovery time, max	μs	14		
I_{rrM}	Peak reverse recovery current, max	A	430		

THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0100	Direct current	Double side cooled
R_{thjc-A}			0.0220		Anode side cooled
R_{thjc-K}			0.0180		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0020	Direct current	
MECHANICAL					
w	Weight, typ	g	1600		
D_s	Surface creepage distance	mm (inch)	55.13 (2.170)		
D_a	Air strike distance	mm (inch)	25.10 (0.988)		

NOTES

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

Symbol of group	A2
$(dv_D/dt)_{crit}$, V/μs	1000

[2] Turn-off time (dv_D/dt=50 V/μs)

Symbol of group	X2	T2
t_q, μs	125	160

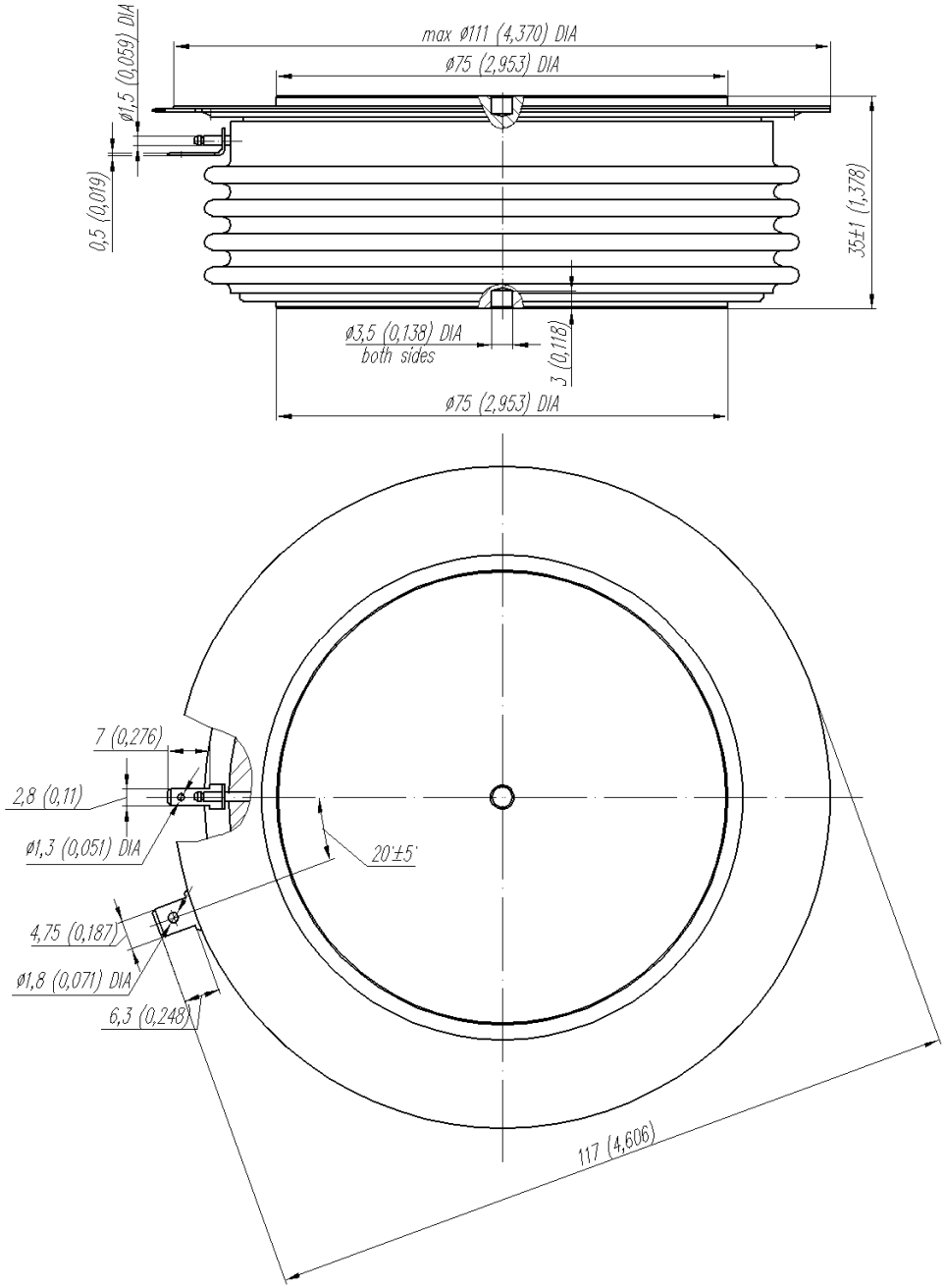
PART NUMBERING GUIDE

TFI	473	1600	40	A2	X2	N
1	2	3	4	5	6	7

1. TFI — Fast Thyristor
   TFIS — Fast Thyristor with Distributed Amplified Gate
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. Ambient conditions: N – normal; T – tropical

OVERALL DIMENSIONS

Package type: T.F5



All dimensions in millimeters (inches)

On-state characteristic model (see Fig. 1).

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	
	$T_j = 25^oC$	$T_j = T_{j\,max}$
A	1.799223	1.165741
B	0.106392	0.195115
C	-0.227901	-0.304378
D	0.350140	0.467637

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

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.
$\boldsymbol{\tau_i}$ = Time constatnt of r_{th} term.

DC Double side cooled

i	1	2	3	4	5	6
$\mathbf{R_i}$, **K/W**	0.002785	0.003537	0.0005787	0.0006418	0.00009446	0.002362
$\boldsymbol{\tau_i}$, **s**	2.061	0.07354	0.002615	0.1375	0.0004601	1.210

DC Anode side cooled

i	1	2	3	4	5	6
$\mathbf{R_i}$, **K/W**	0.01246	0.00478	0.0006333	0.003716	0.0005969	0.00006119
$\boldsymbol{\tau_i}$, **s**	13.310	1.871	0.2261	0.07337	0.002363	0.0003248

DC Cathode side cooled

i	1	2	3	4	5	6
$\mathbf{R_i}$, **K/W**	0.008256	0.004771	0.0006239	0.003744	0.0005969	0.00006164
$\boldsymbol{\tau_i}$, **s**	13.250	1.783	0.2371	0.07347	0.002367	0.000327

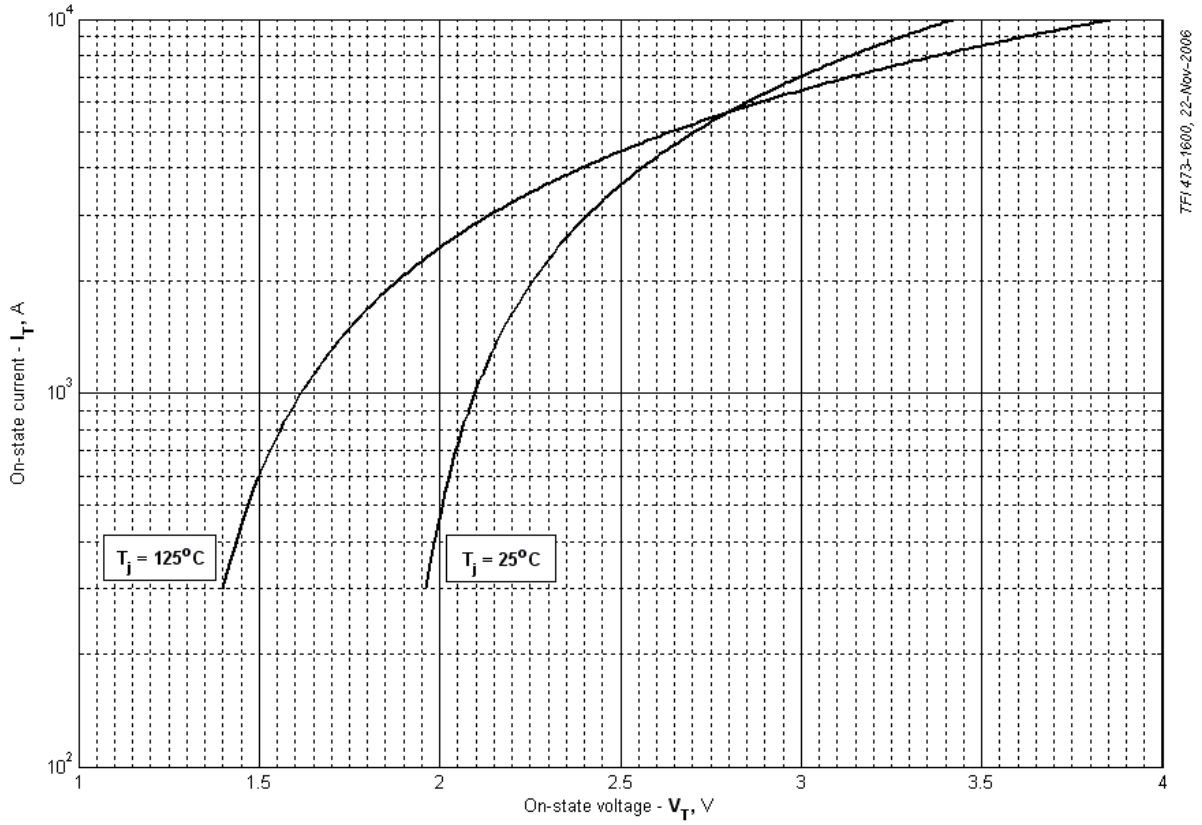


Fig 1 – On-state characteristics of Limit device

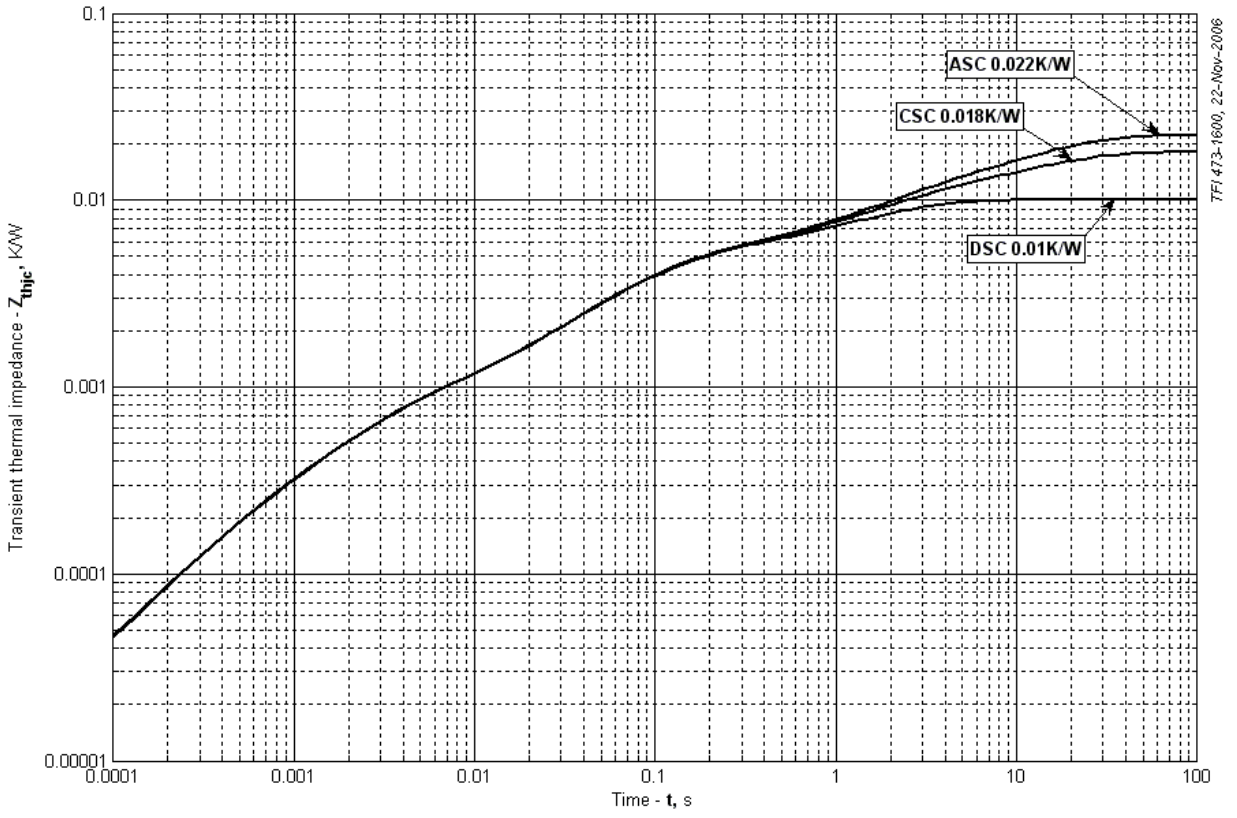


Fig 2 – Transient thermal impedance

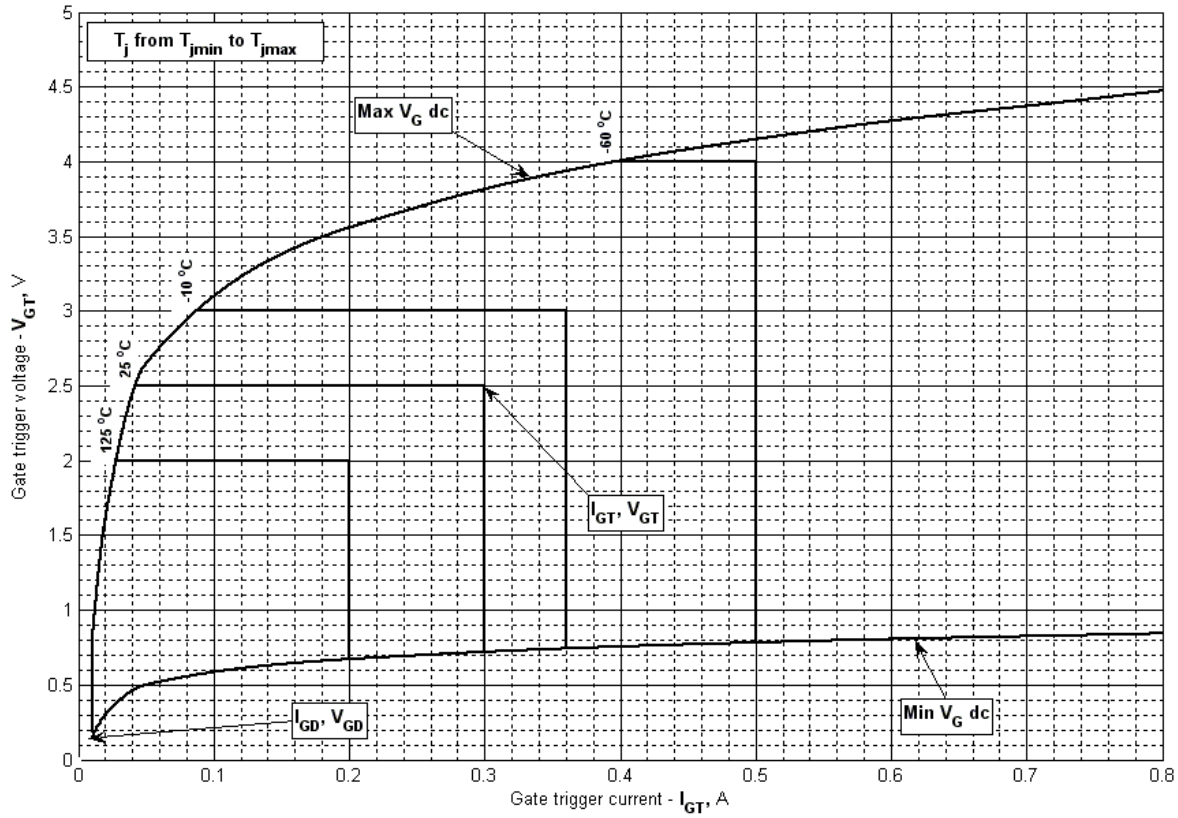


Fig 3 – Gate characteristics – Trigger limits

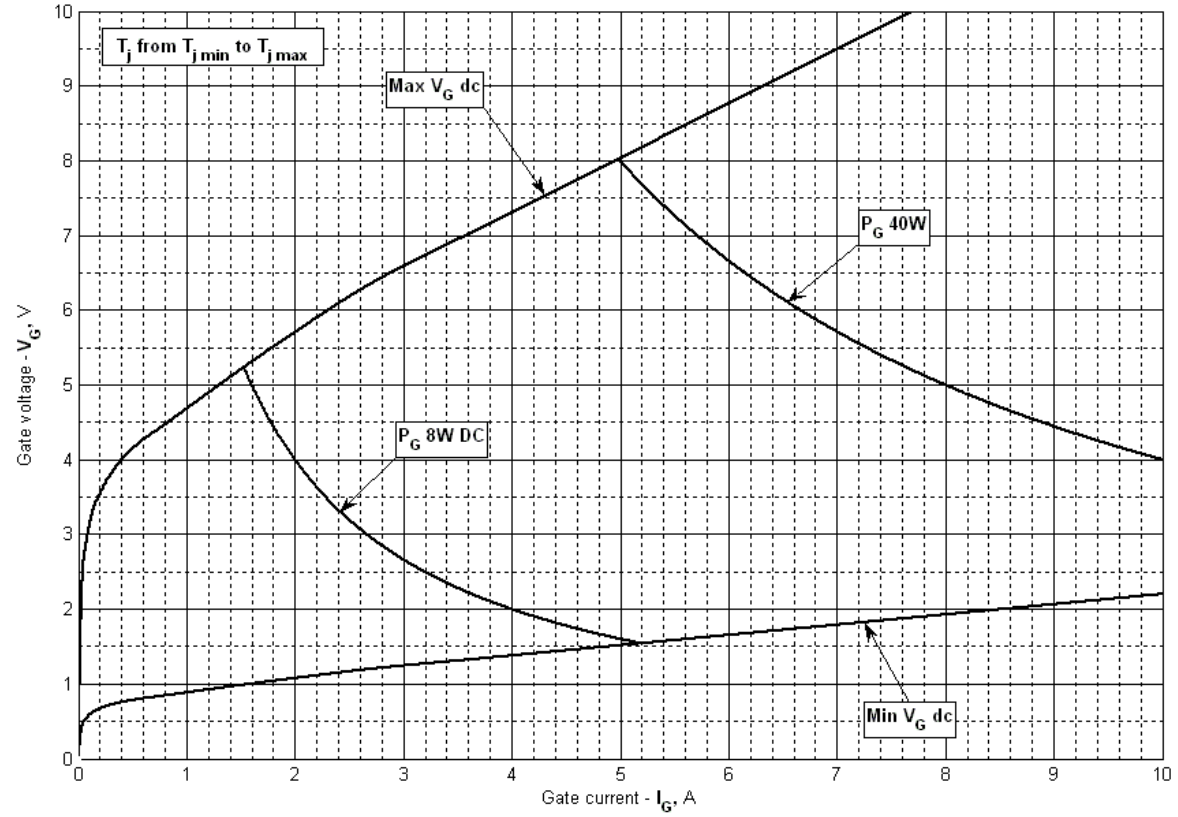


Fig 4 - Gate characteristics –Power curves

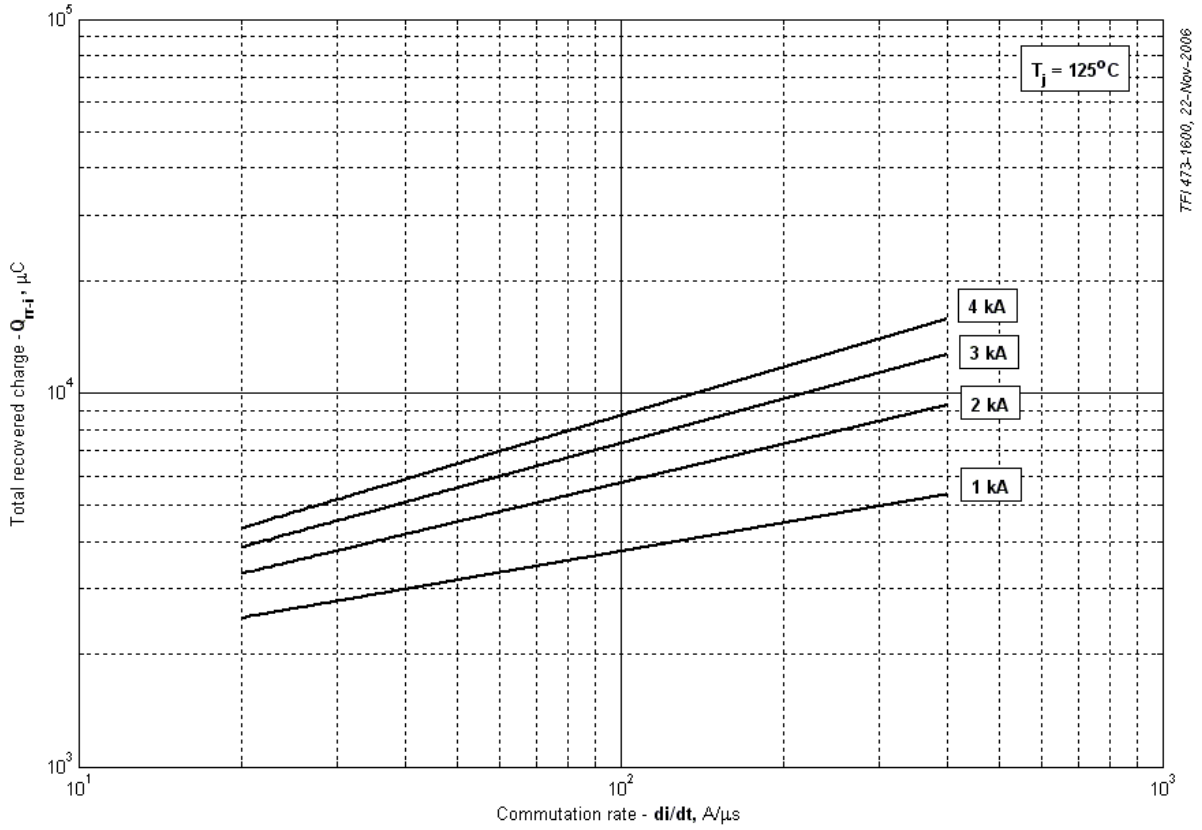


Fig 5 – Total recovered charge, Q_{rr-i} (integral)

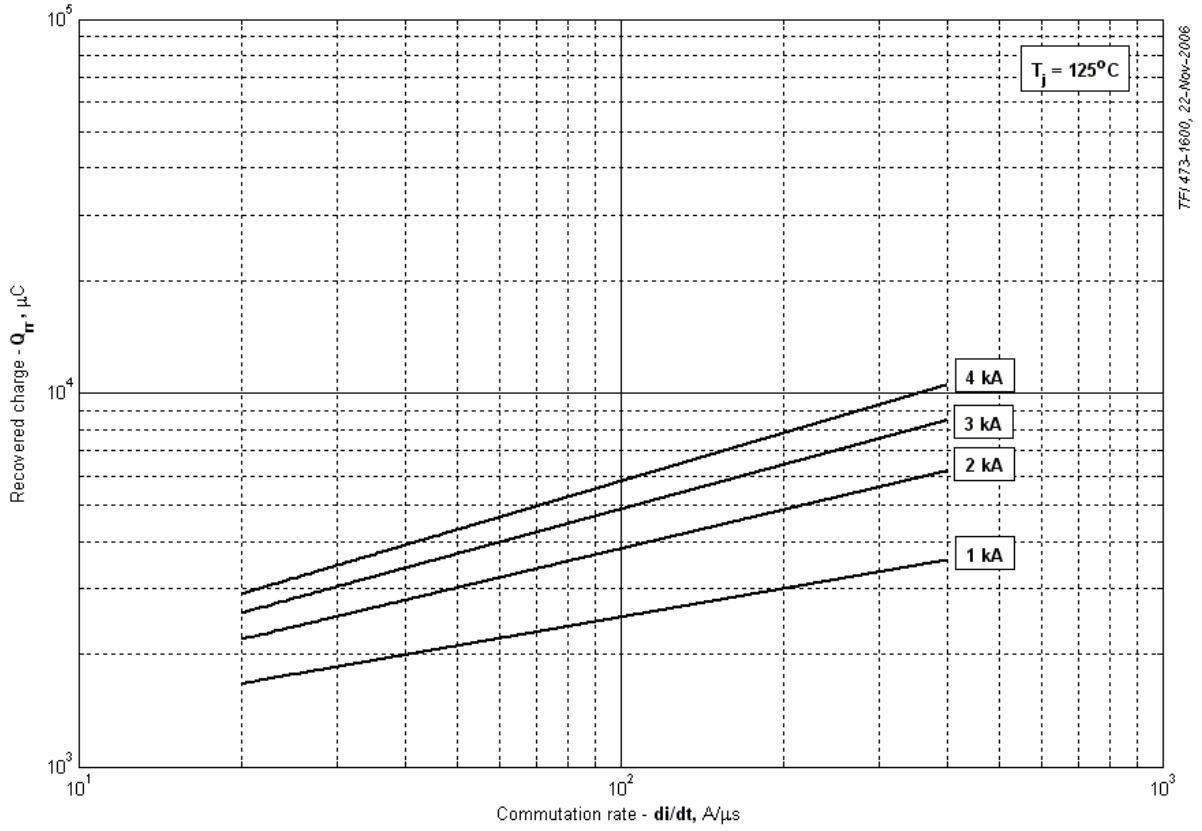


Fig 6 - Recovered charge, Q_{rr} (linear)

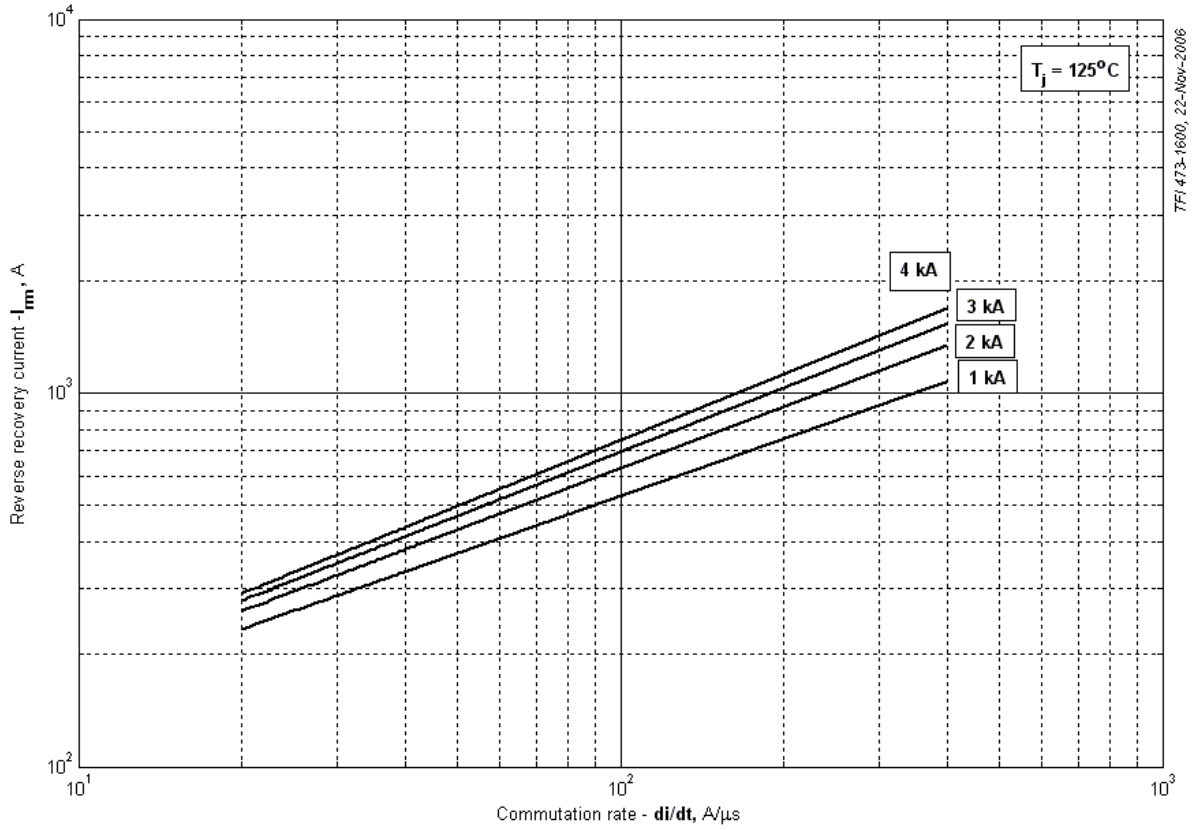


Fig 7 – Peak reverse recovery current, I_{rm}

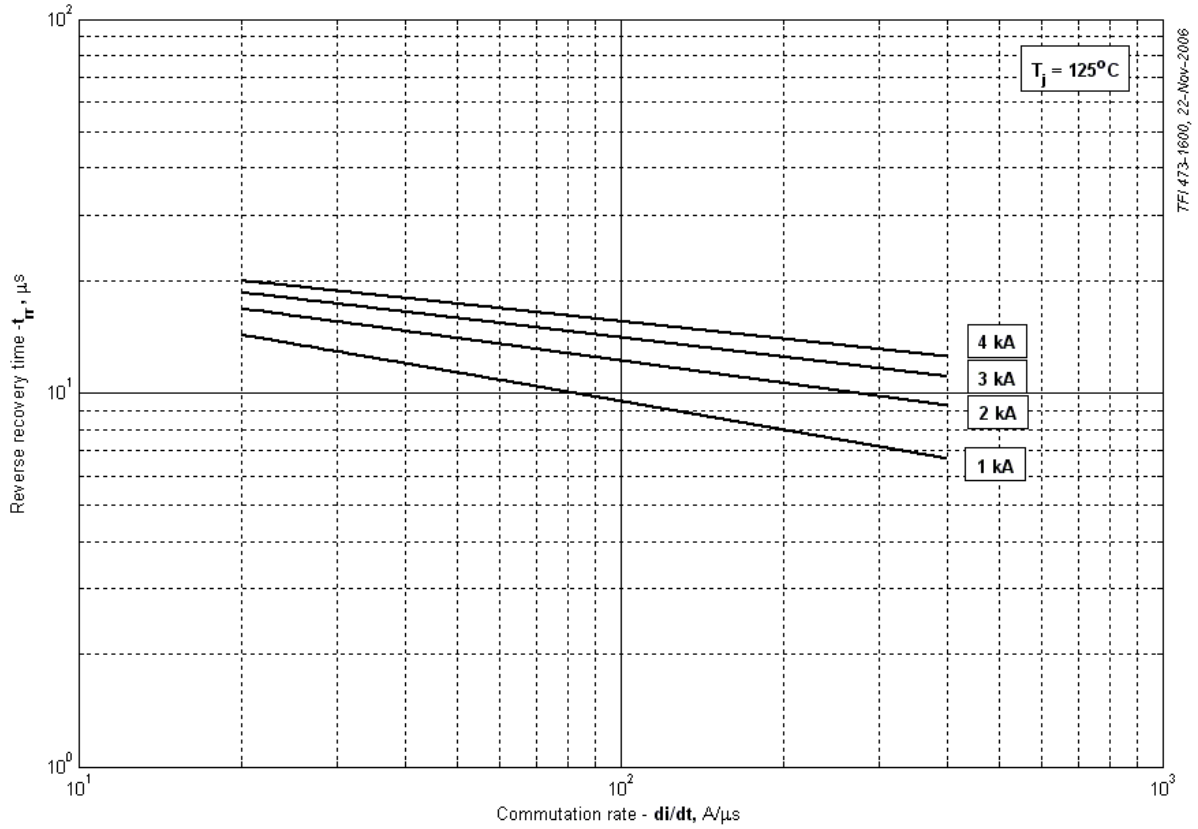


Fig 8 – Maximum recovery time, t_{rr} (linear)

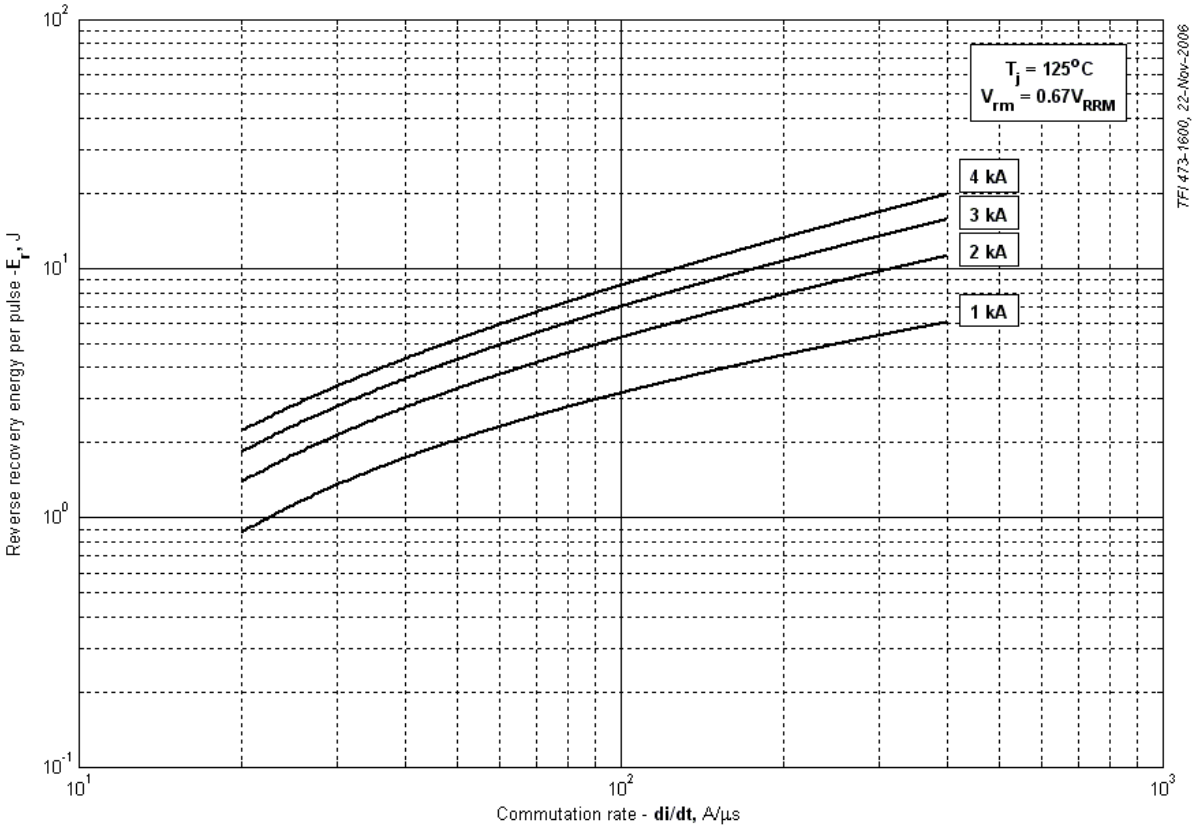


Fig 9 – Reverse recovery energy per pulse

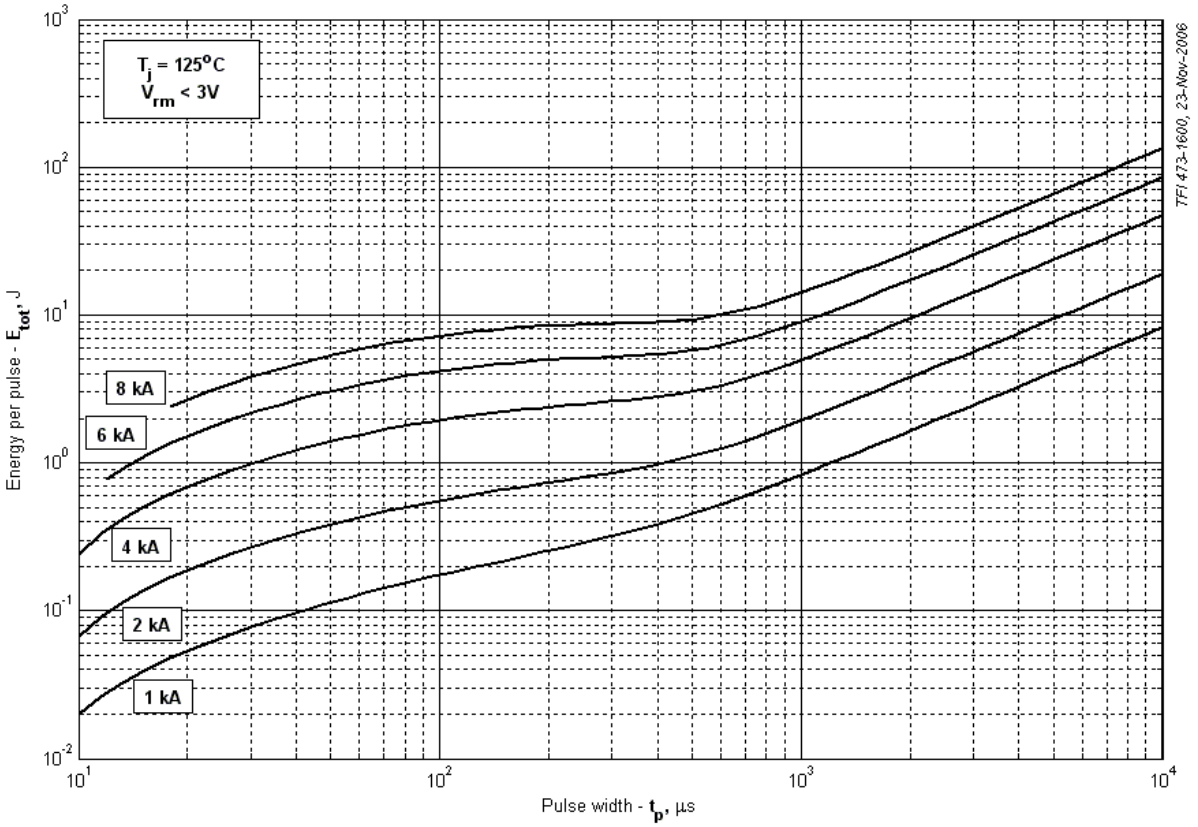


Fig 10 – Sine wave energy per pulse

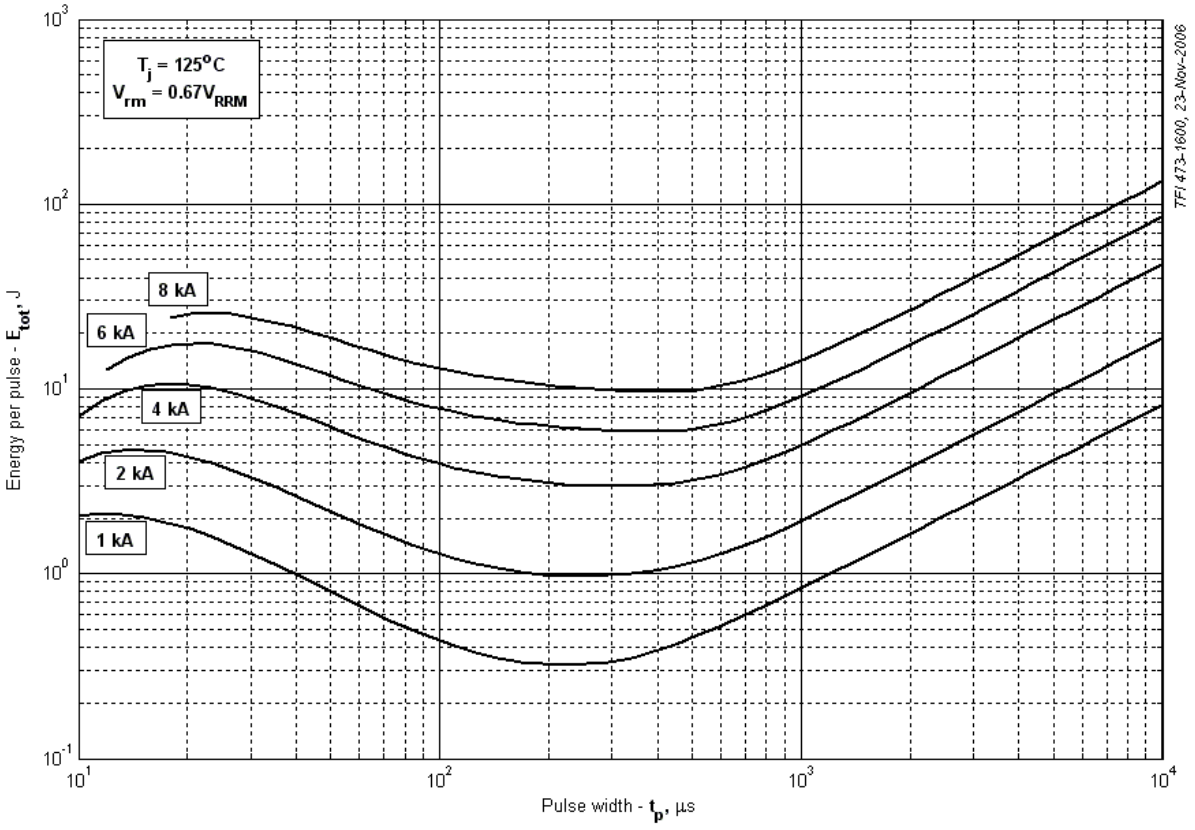


Fig 11 – Sine wave energy per pulse

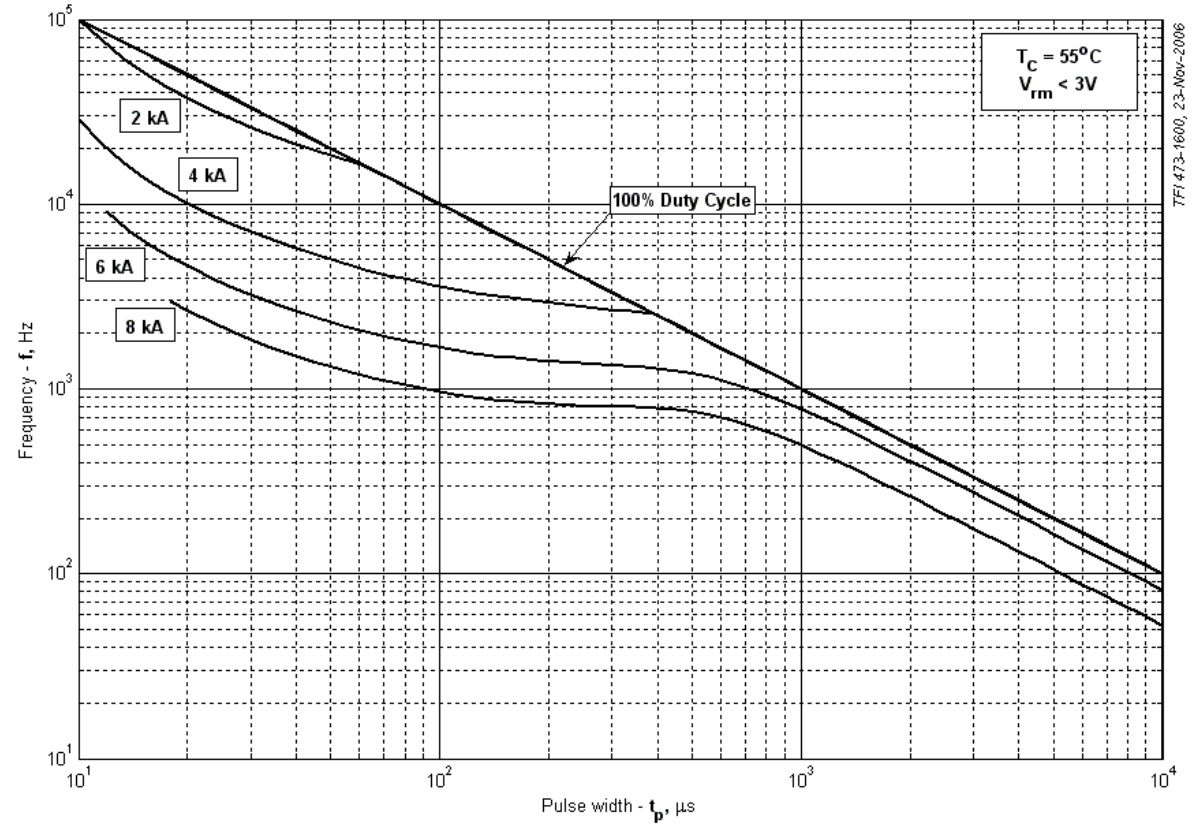


Fig 12 – Sine wave frequency ratings

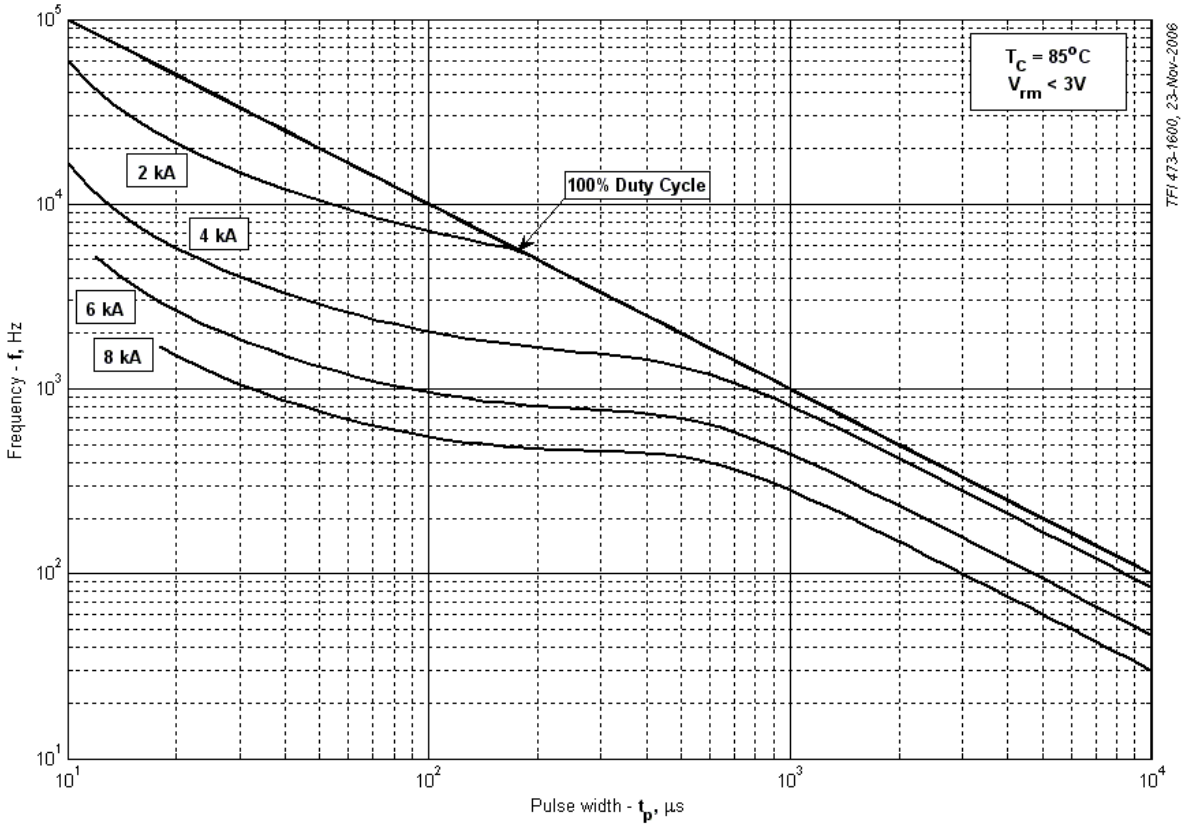


Fig 13 – Sine wave frequency ratings

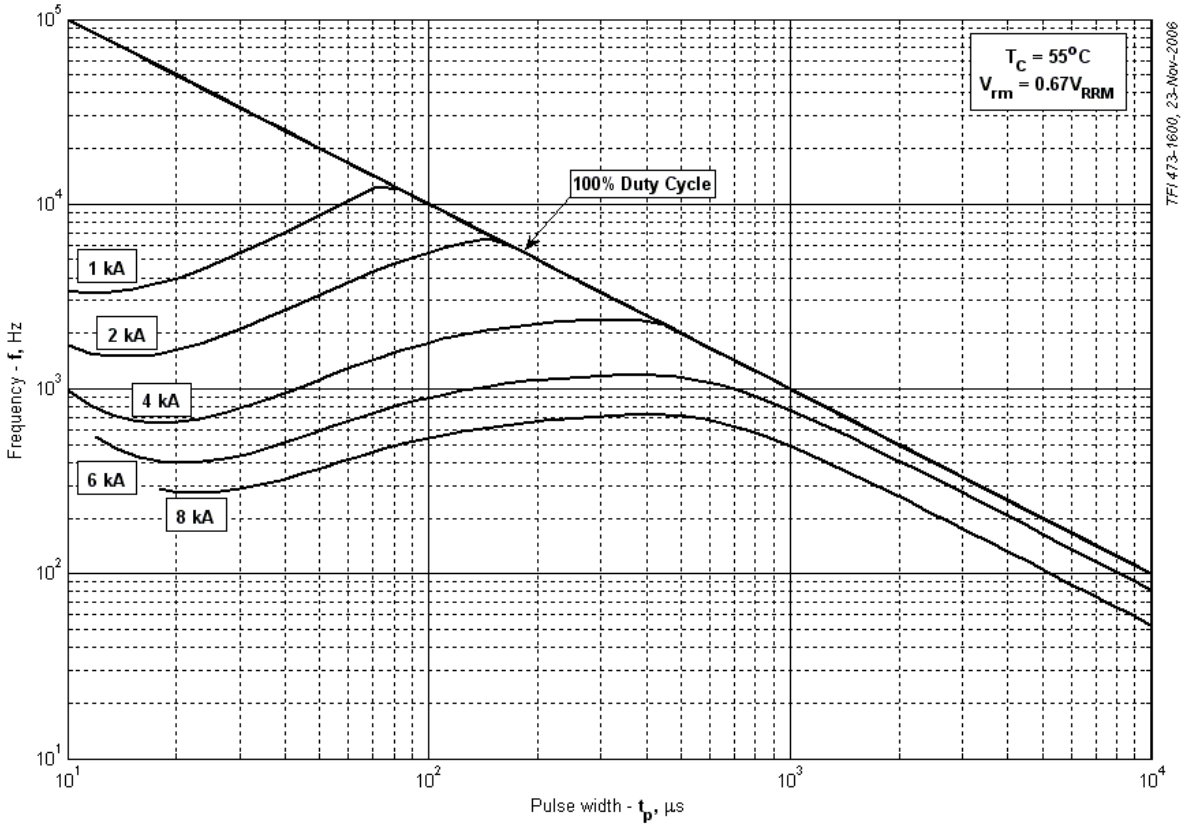


Fig 14 – Sine wave frequency ratings

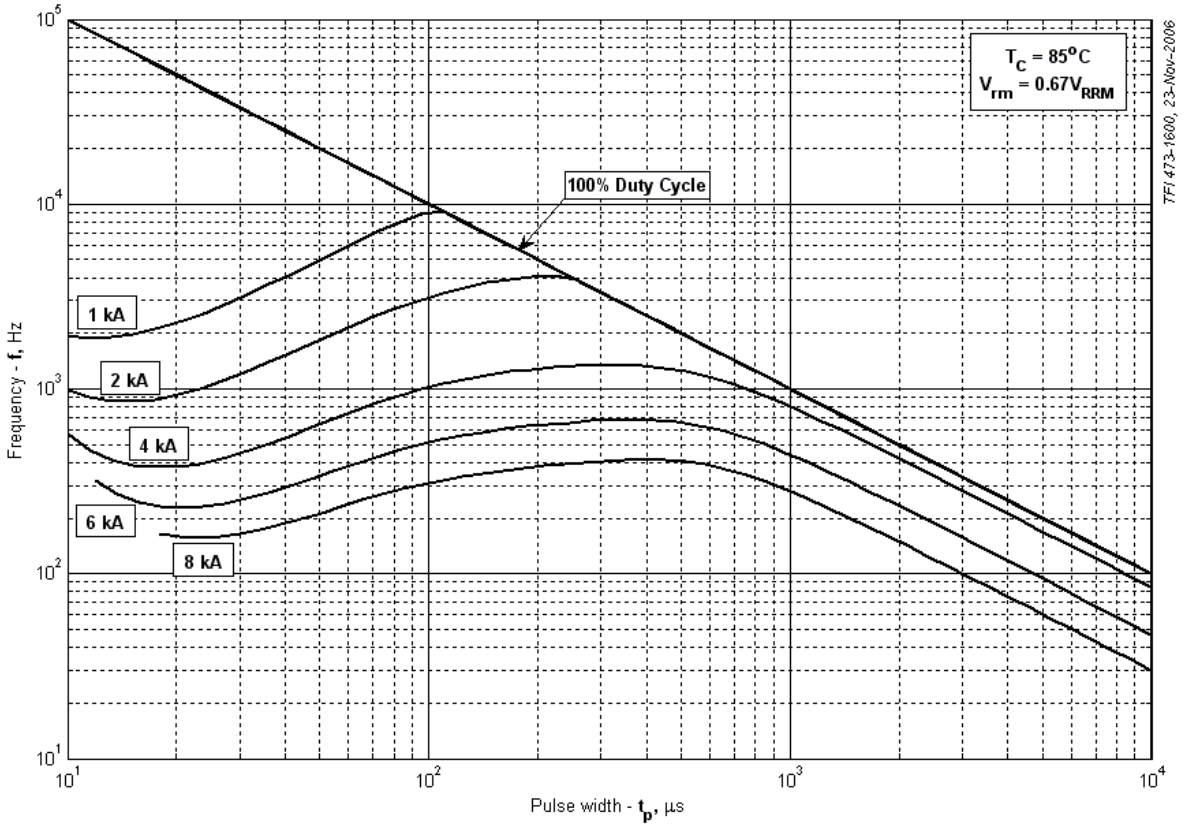


Fig 15 – Sine wave frequency ratings

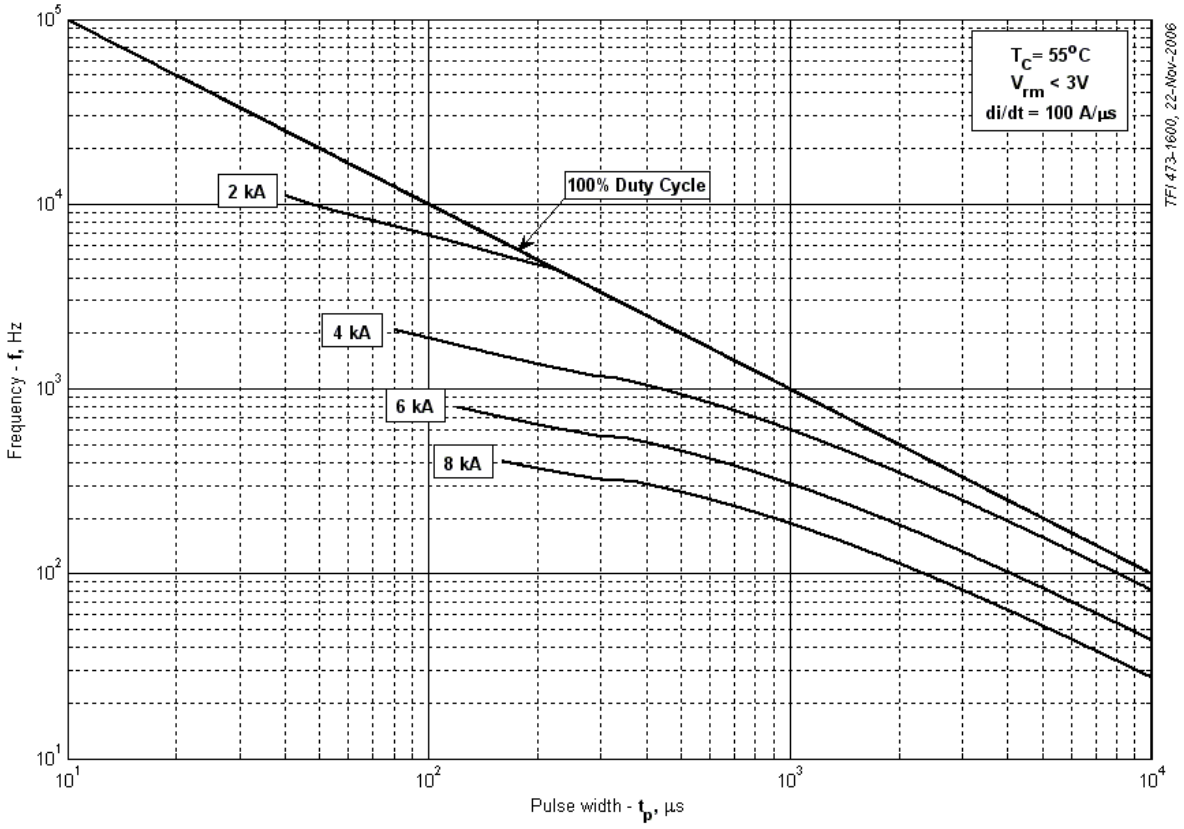


Fig 16 – Square wave frequency ratings

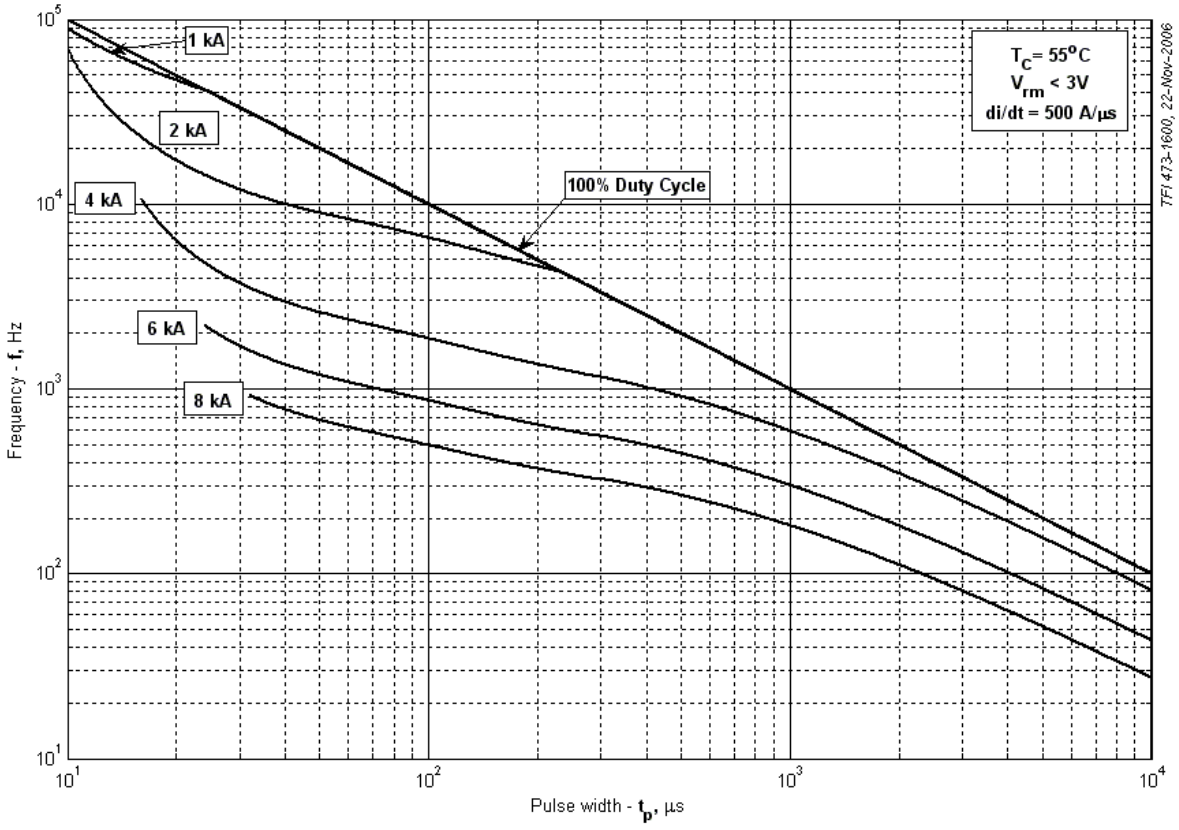


Fig 17 – Square wave frequency ratings

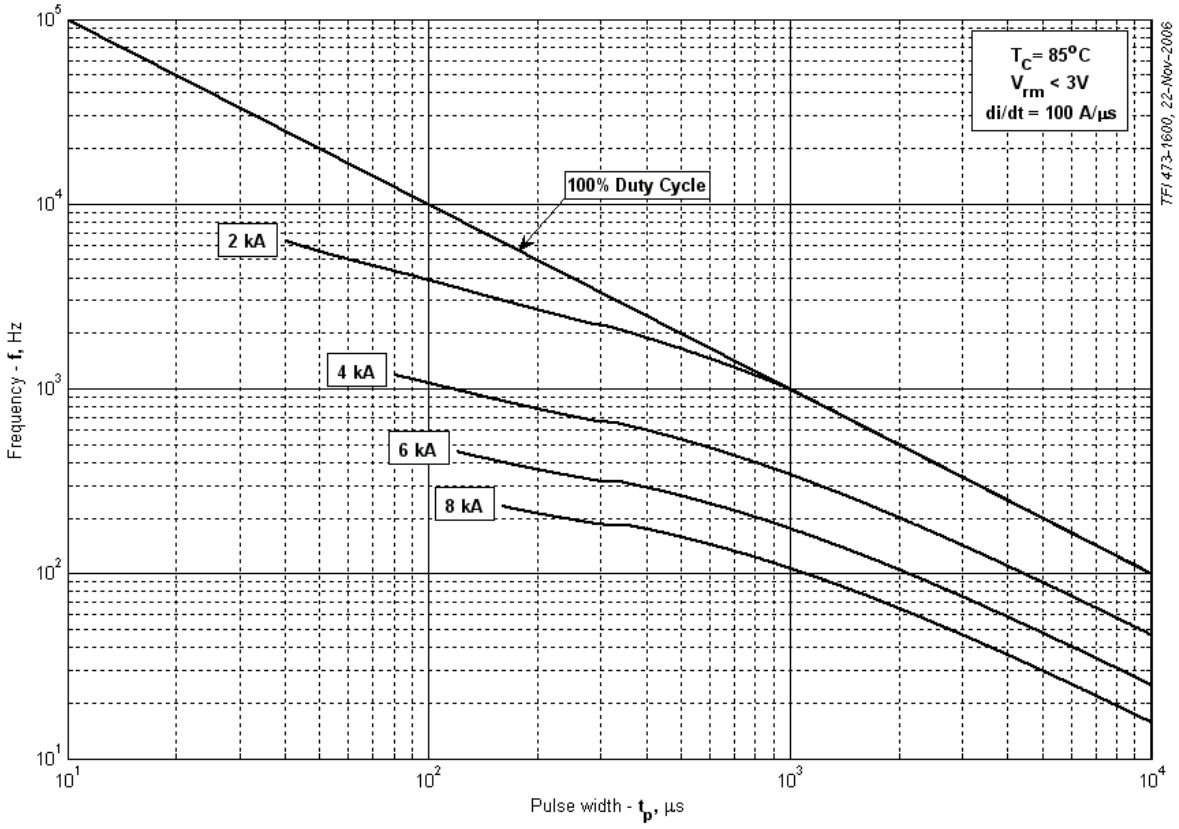


Fig 18 – Square wave frequency ratings

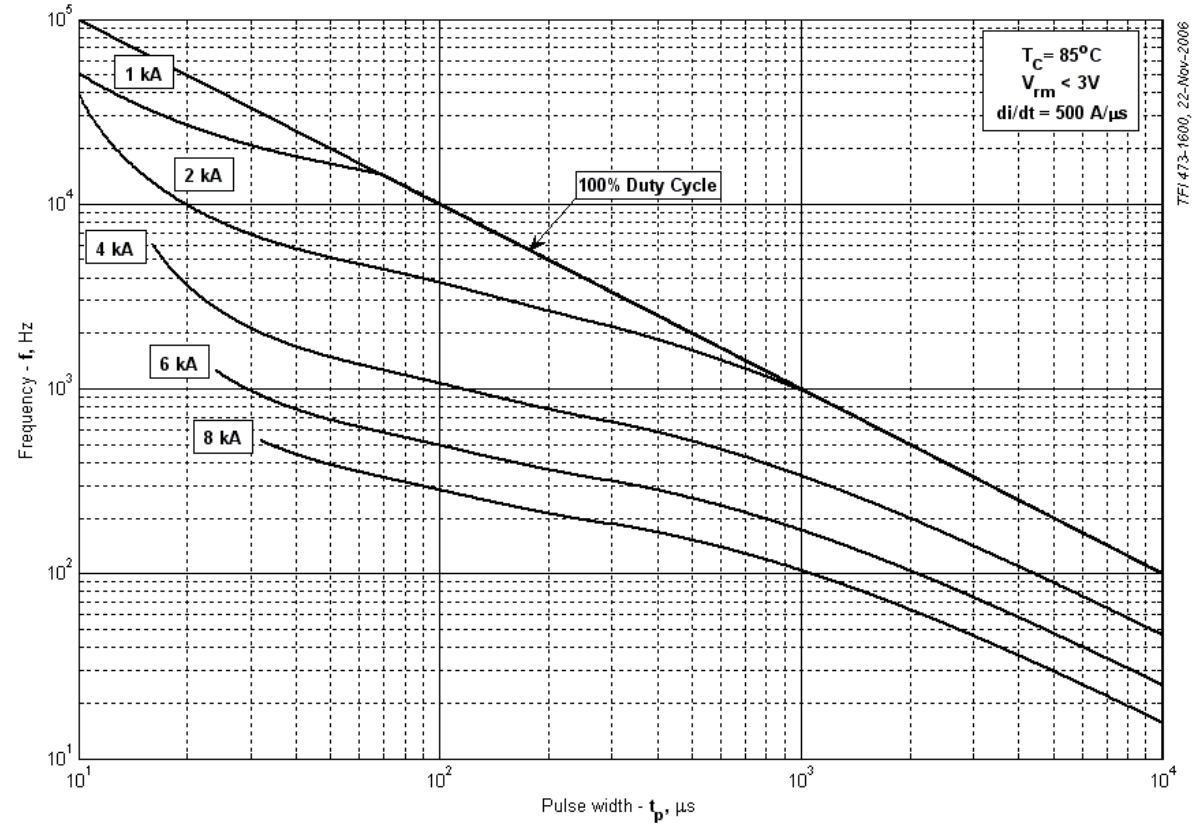


Fig 19 – Square wave frequency ratings

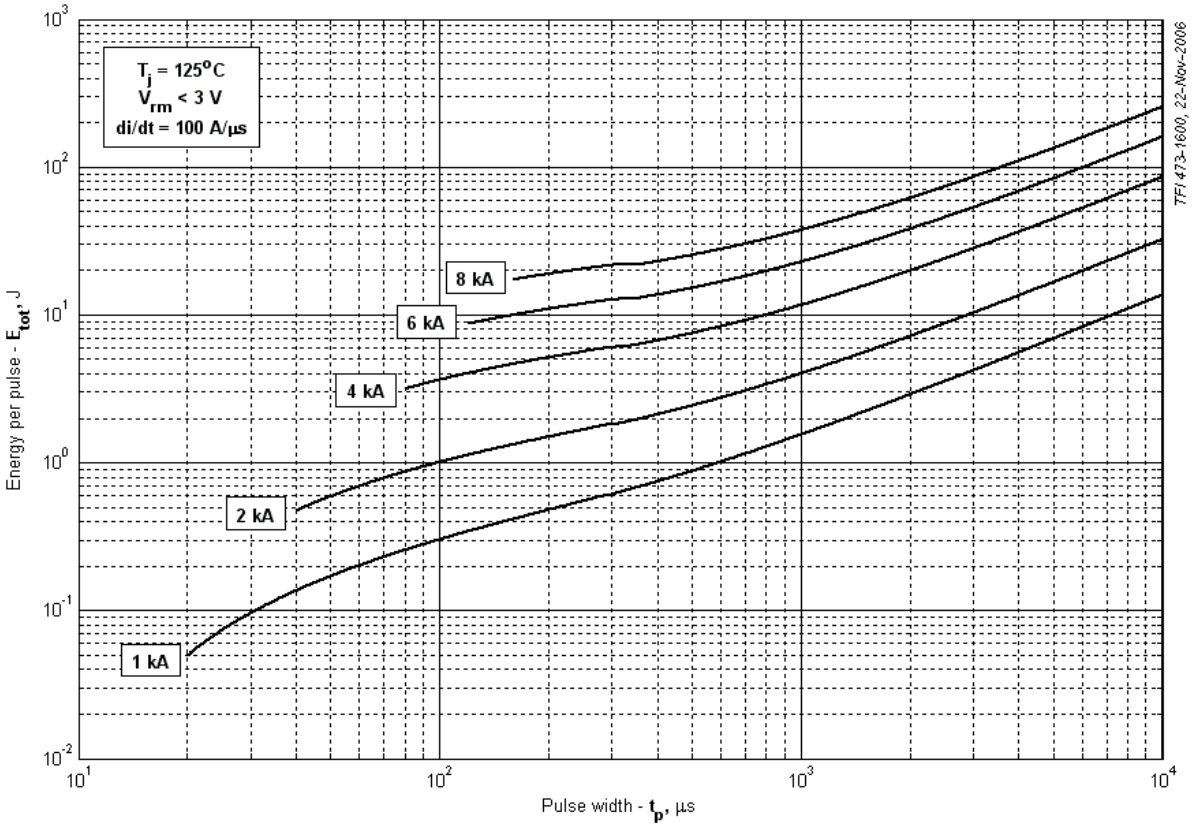


Fig 20 – Square wave energy per pulse

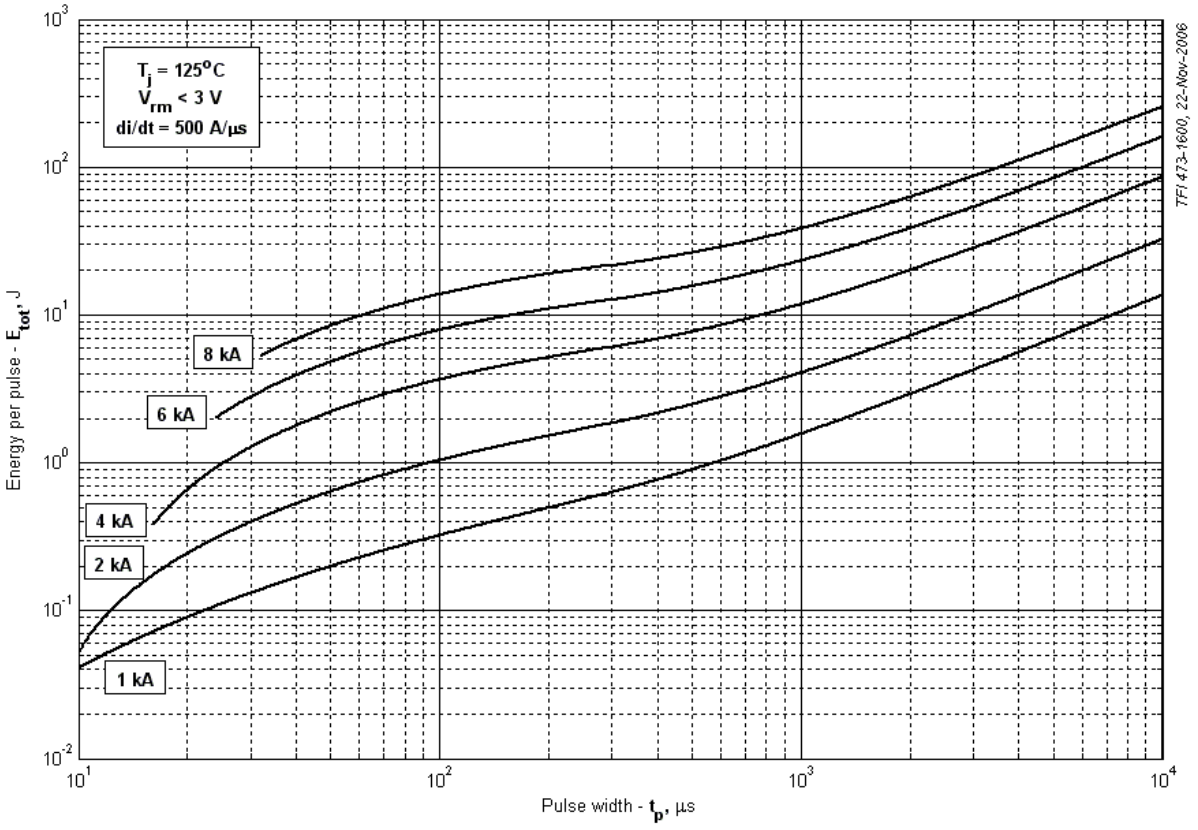


Fig 21 – Square wave energy per pulse

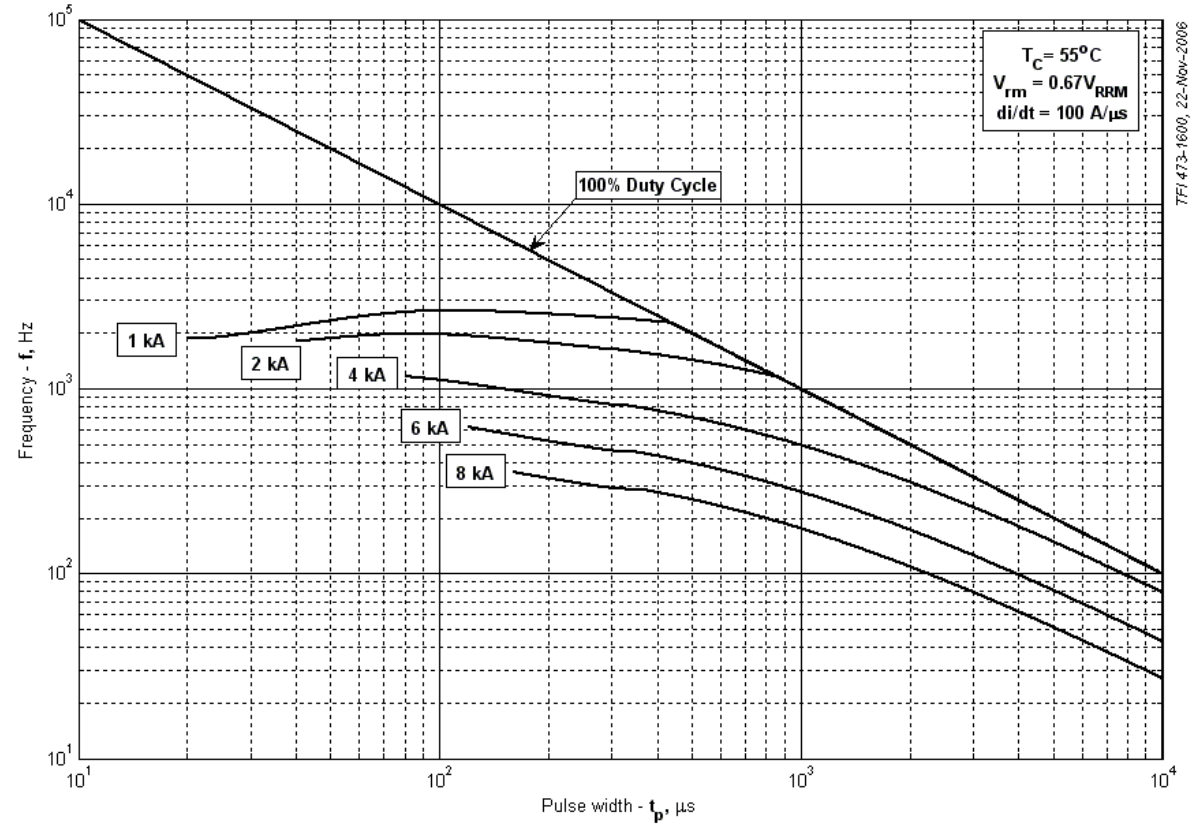


Fig 22 – Square wave frequency ratings

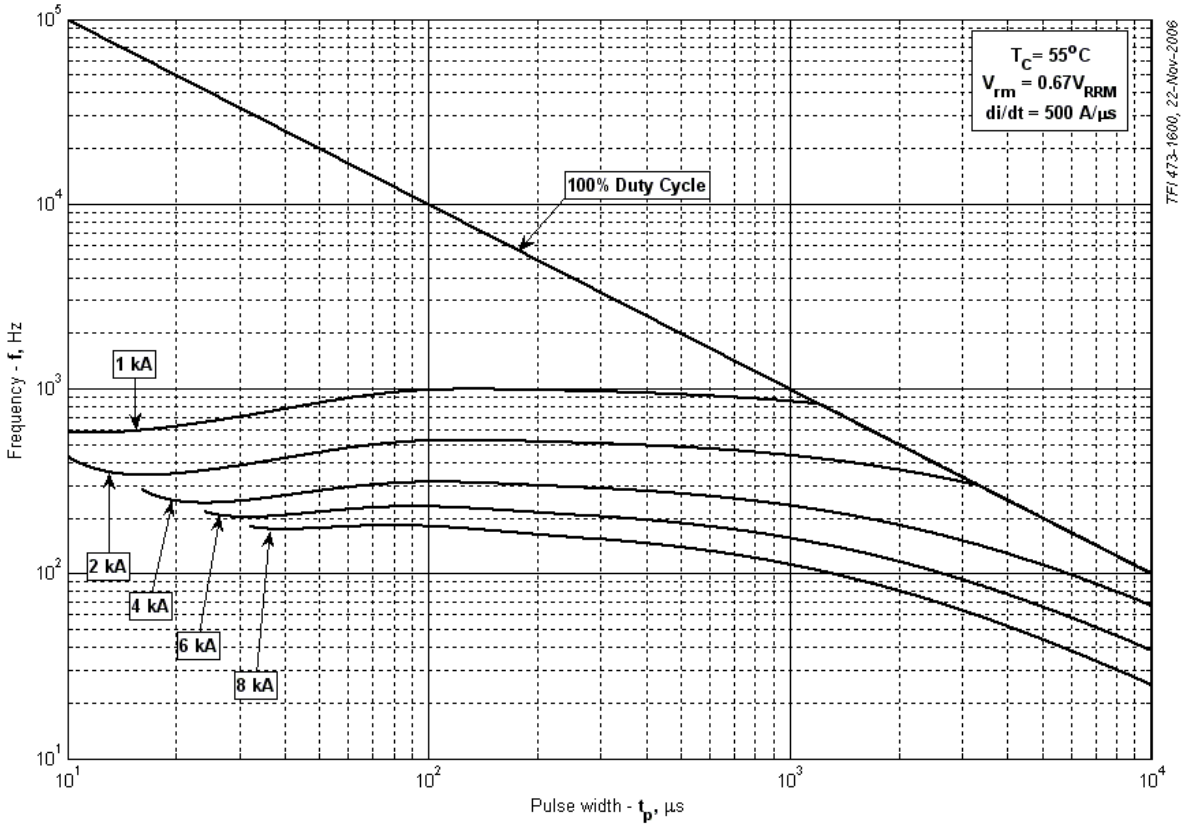


Fig 23 – Square wave frequency ratings

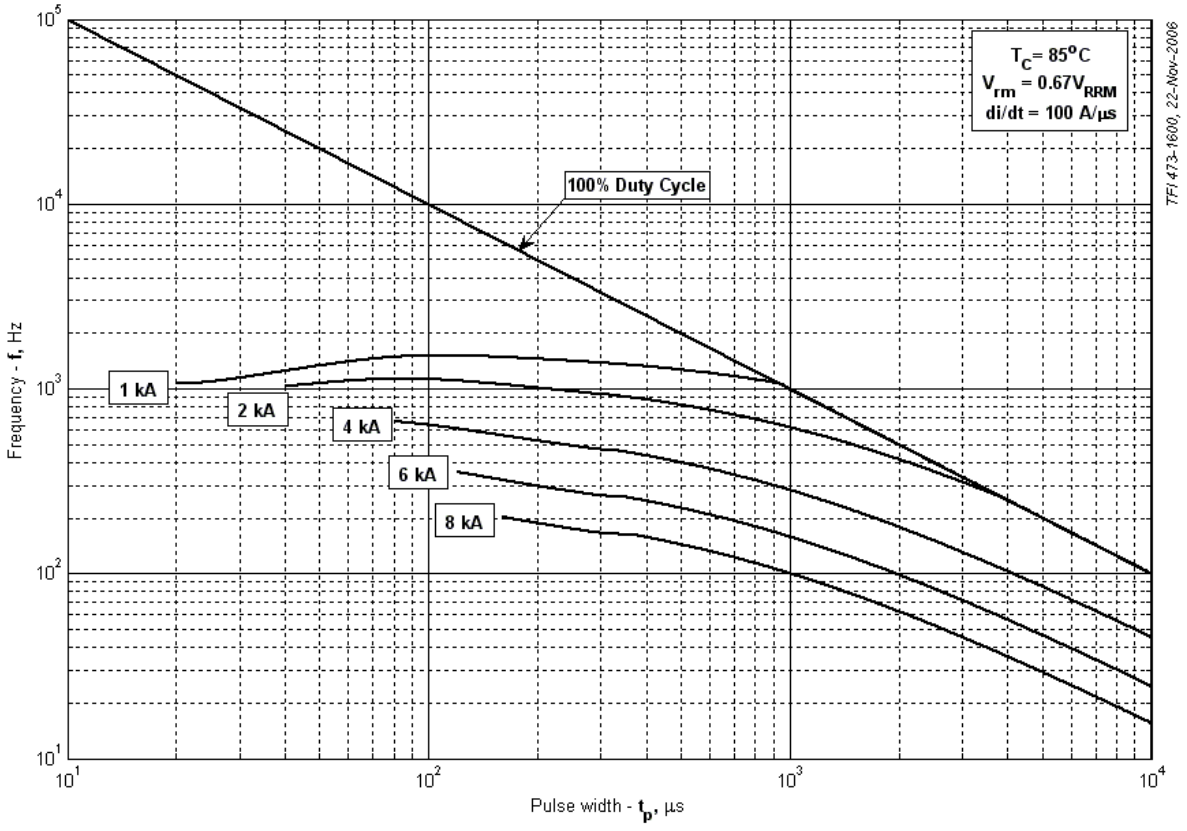


Fig 24 – Square wave frequency ratings

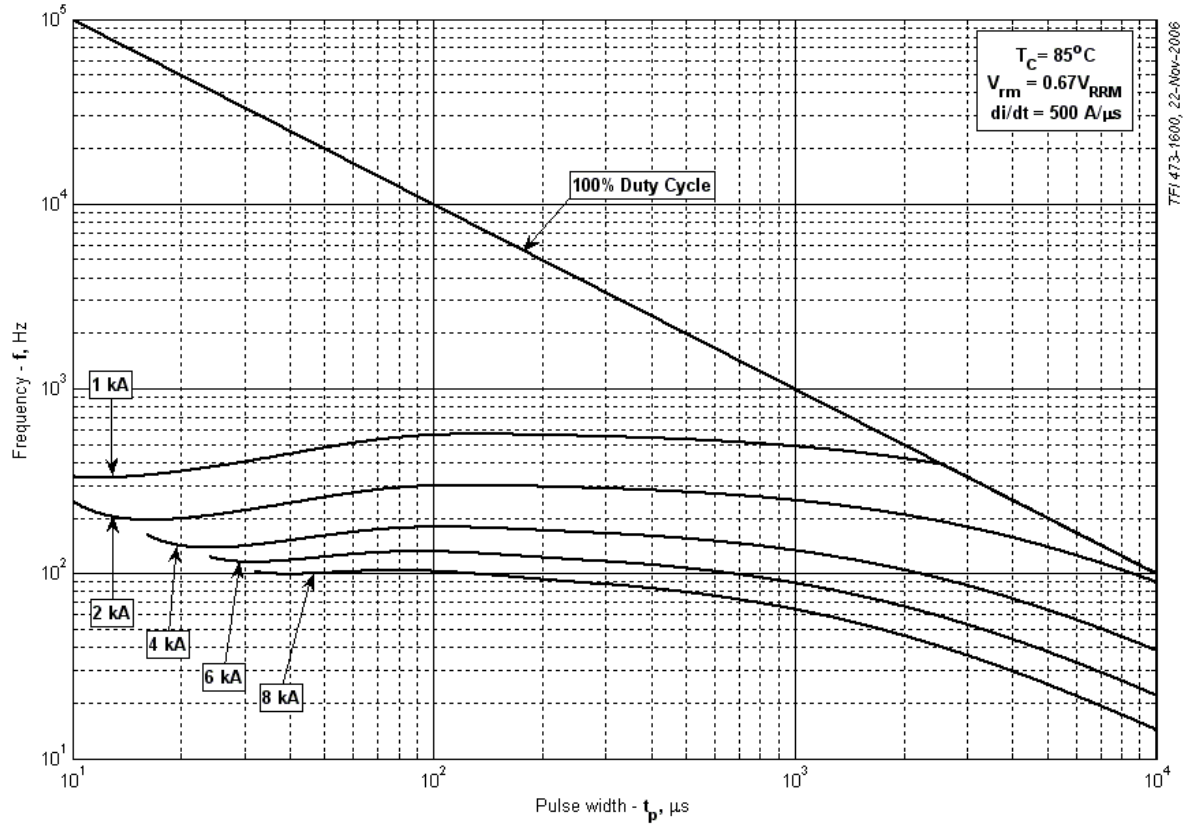


Fig 25 – Square wave frequency ratings

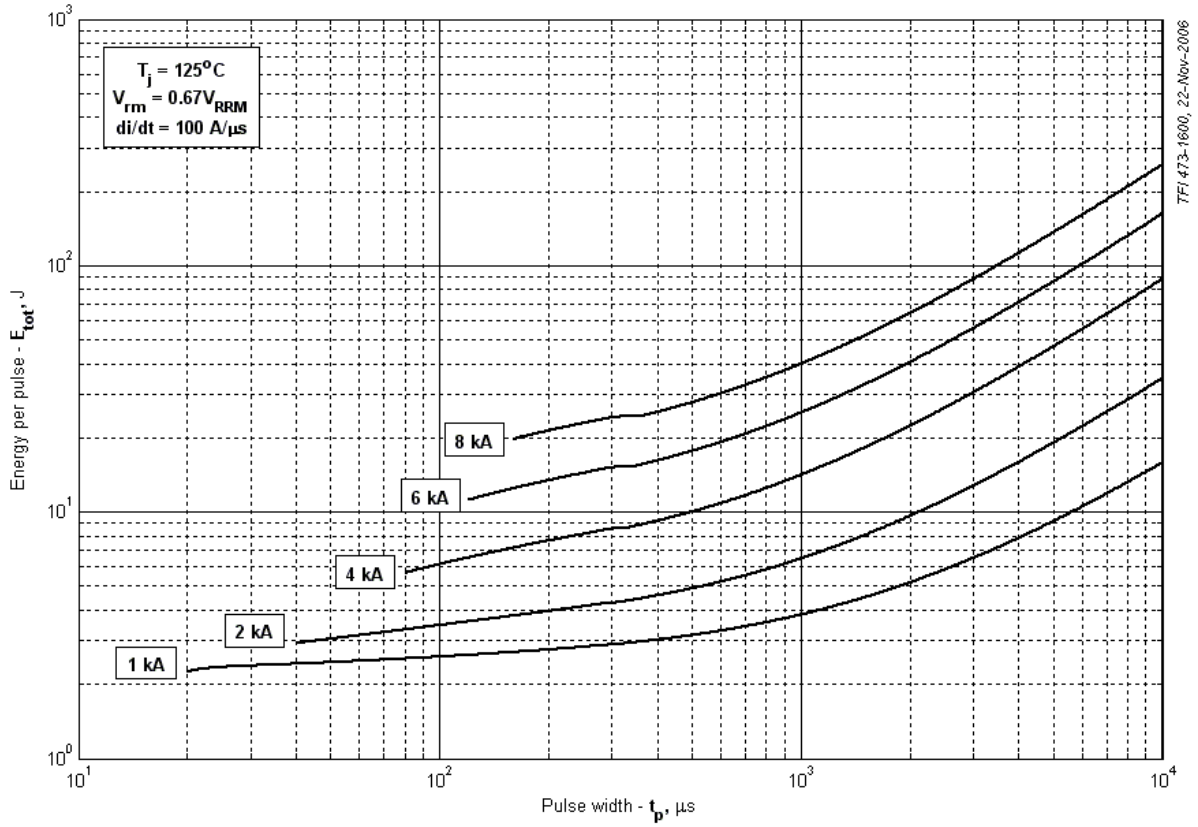


Fig 26 – Square wave energy per pulse

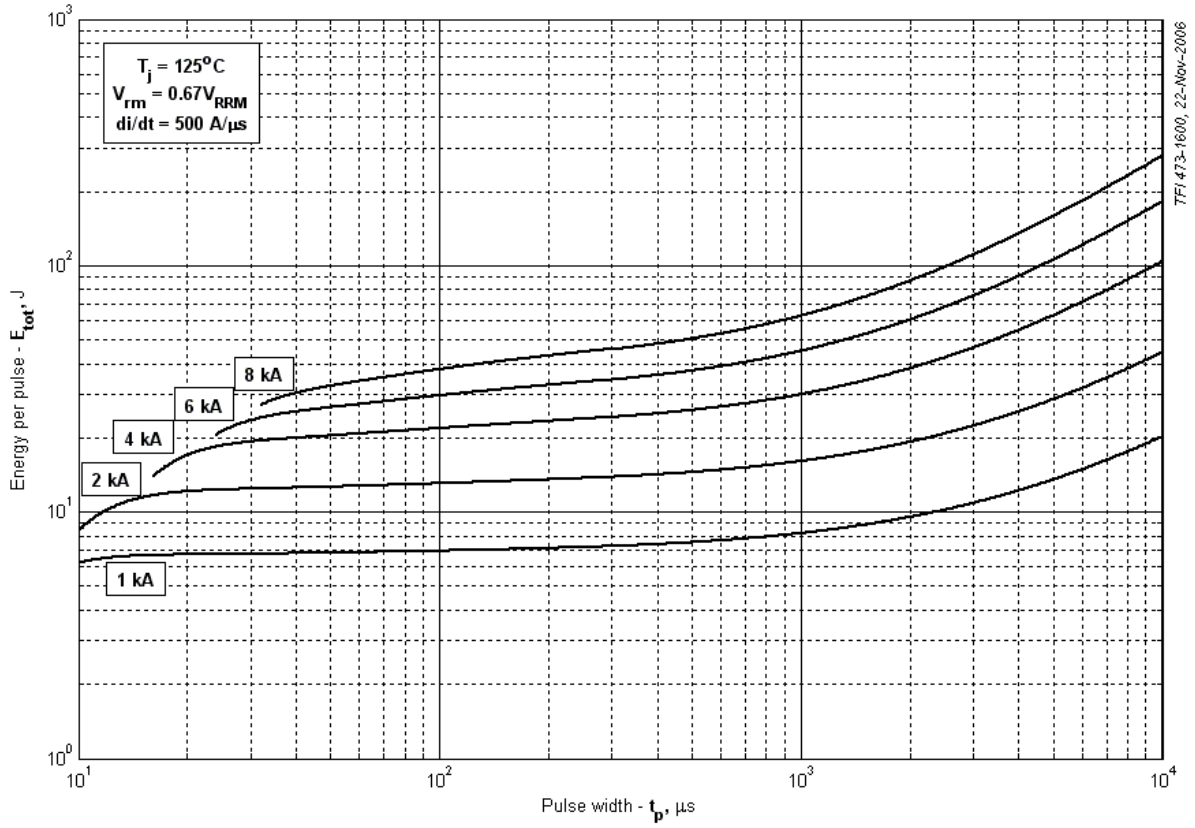


Fig 27 – Square wave energy per pulse

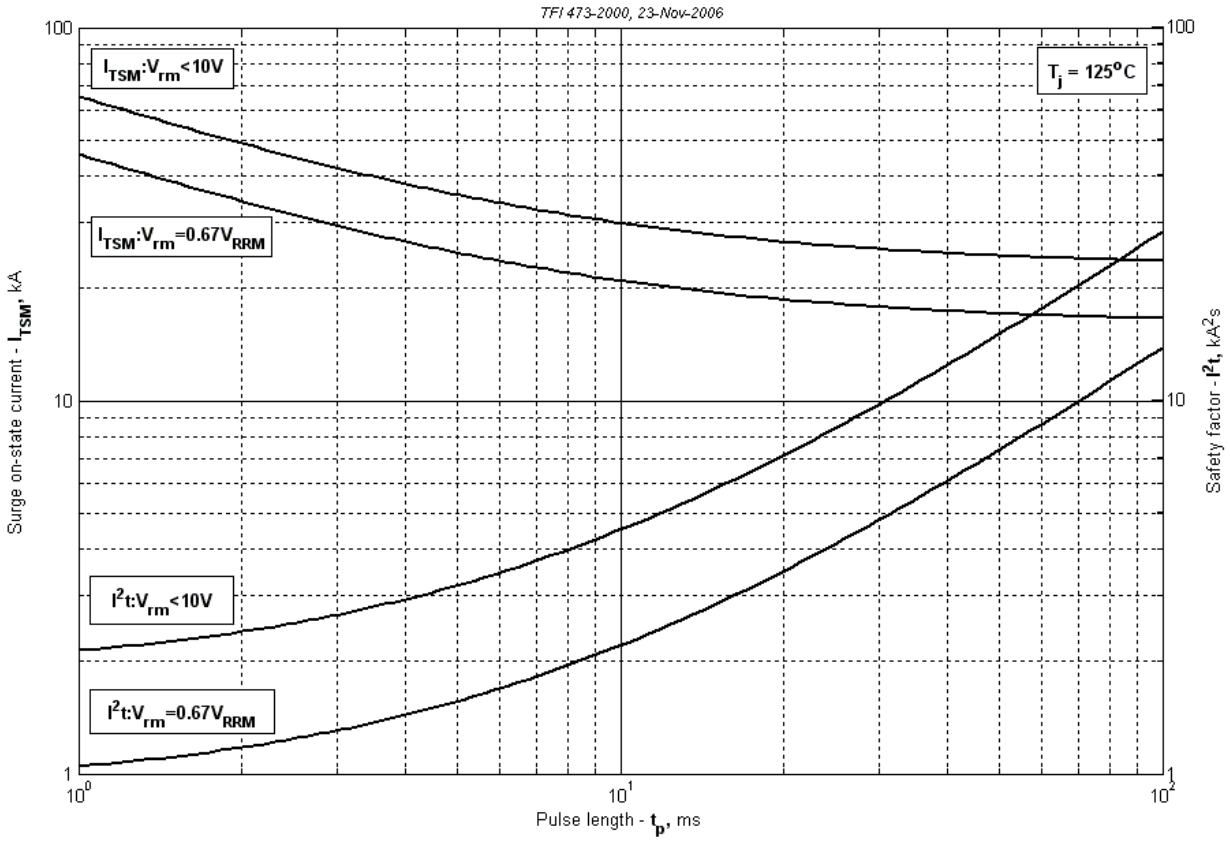


Fig 29 – Maximum surge and I^2t ratings

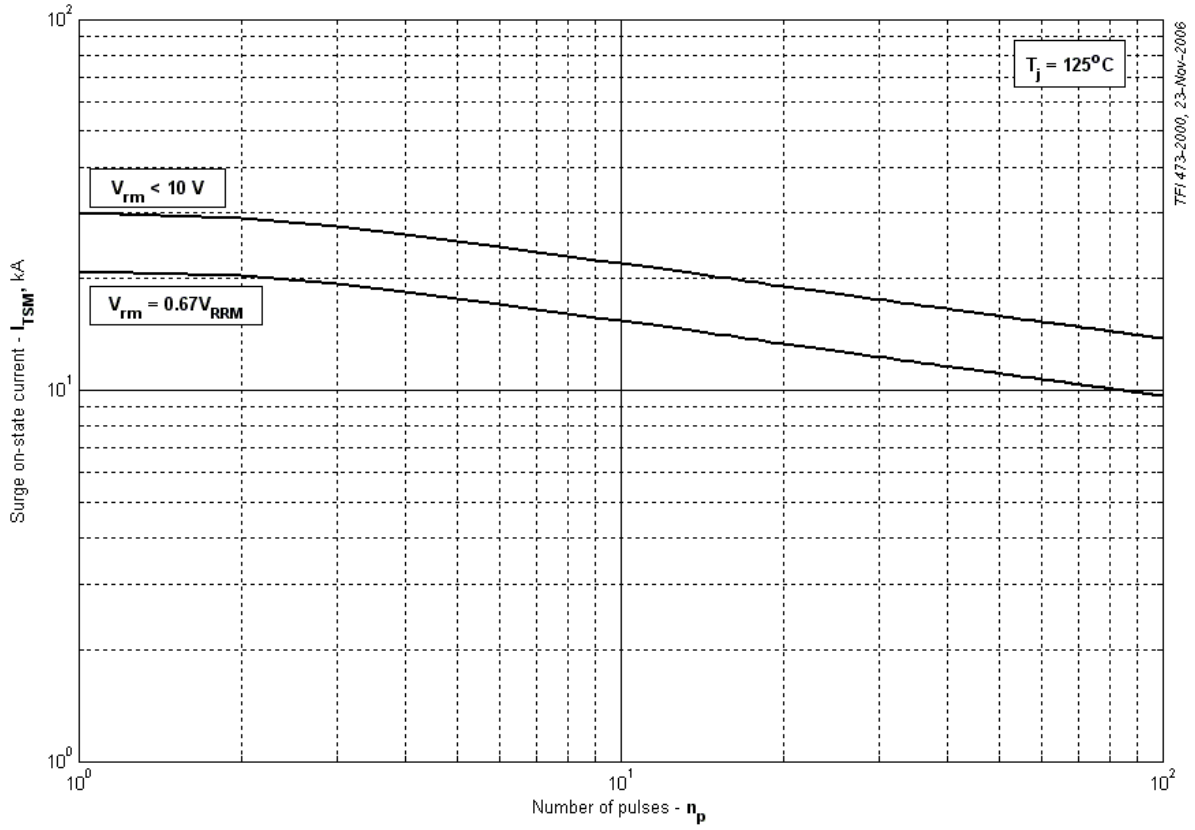


Fig 30 – Maximum surge ratings