estel	**ESTEL ELEKTROONIKA** ESTONIA	**November 2004**

Series
TFI143S-500

High Frequency Inverter grade Capsule Thyristor Type TFI143S-500

Strong distributed amplified gate and low turn-off time thyristor for high frequency applications to 20 kHz

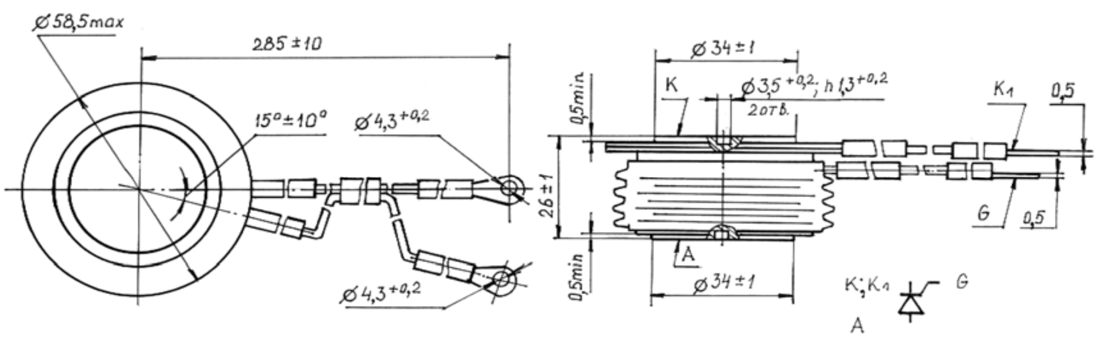
Maximum mean on-state current	ITAV		**500 A**						
Maximum repetitive peak off-state and reverse voltage	UDRM URRM		**300 ÷1100 V**						
Turn-off time	tq		**5; 6,3 µs**						
UDRM , URRM , V	300	400	500	600	700	800	900	1000	1100
Voltage code	3	4	5	6	7	8	9	10	11
Tvj, °C	- 60 ÷ 125								

MAXIMUM ALLOWABLE RATINGS					
Symbols and parameters		Units	TFI143S-500	Conditions	
ITAV	Mean on-state current	A	500 778	Tc=85 °C, Tc=55 °C, 180° half-sine wave, 50 Hz	
ITRMS	RMS on-state current	A	785	Tc=85 °C	
ITSM	Surge on-state current	kA	9,0 10,0	Tvj=125°C Tvj=25°C	tp=10 ms UR=0
I^2t	Limiting load integral	kA^2s	405 500	Tvj=125°C Tvj=25°C	
UDRM,URRM	Repetitive peak off-state and reverse voltage	V	300÷1100	Tj min≤Tvj≤TjM 180° half-sine wave, 50 Hz Gate open	
UDSM,URSM	Non-repetitive peak off-state and reverse voltage	V	330÷1210	Tj min≤Tvj≤TjM 180° half-sine wave tp=10 ms, Single pulse Gate open	
(diT/dt) crit	Critical rate of rise of on-state current : non - repetitive repetitive	A/µs	2000 1250	Tvj=125°C ; UD=0,67 UDRM, Gate pulse : 10V,5 Ω, 1µs rise time, 10 µs	
URGM	Peak reverse gate voltage	V	5	Tj min≤Tvj≤TjM	
Tstg	Storage temperature	°C	-60÷80		
Tvj	Junction temperature	°C	-60÷125		
CHARACTERISTICS					
UTM	Peak on-state voltage	V	2,4	Tvj=25°C, ITM=3,14 ITAV	
UT(TO)	Threshold voltage	V	1,45	Tvj=125°C 1,57 ITAV< IT <4,71 ITAV	
RT	On-state slope resistance	mΩ	0,71		
IDRM IRRM	Repetitive peak off-state and reverse current	mA	70 70	Tvj=125°C, UD = UDRM UR= URRM	

CHARACTERISTICS					
Symbols and parameters		Units	TFI143S-500	Conditions	
I_L	Latching current	A	16	T_{vj}=25°C,U_D=12V Gate pulse : 10V, 5Ω, 1 µs rise time, 10µs	
I_H	Holding current	A	0,5	T_{vj}=25°C,U_D=12V, Gate open	
U_{GT}	Gate trigger direct voltage	V	2,5 5,0	T_{vj}=25°C, T_{vj}=-60°C	U_D=12V
I_{GT}	Gate trigger direct current	A	0,3 0,85	T_{vj}=25°C, T_{vj}=-60°C	
U_{GD}	Gate non-trigger direct voltage	V	0,25	T_{vj}=125°C, U_D = 0,67 U_{DRM} Direct gate current	
I_{GD}	Gate non-trigger direct current	mA	10		
t_{gd}	Delay time	µs	1,6	T_{vj}=25°C,U_D=500V I_{TM} = 500 A Gate pulse : 10V, 5Ω, 1 µs rise time, 10µs	
t_{gt}	Turn-on time	µs	2,5		
t_q	Turn-off time	µs	5,0 ; 6,3 6,3 ; 8,0	T_{vj}=125°C, I_{TM}=500 A di_R/dt =10 A/µs, U_R=100V U_D = 0,67 U_{DRM} du_D/dt=50 V/µs du_D/dt=200 V/µs	
Q_{rr}	Recovered charge	µC	70	T_{vj}=125°C, I_{TM}=500 A di_R/dt =50 A/µs, U_R=100V	
t_{rr}	Reverse recovery time	µs	2,0		
I_{rrM}	Peak reverse recovery current	A	70		
$(du_D/dt)_{crit}$	Critical rate of rise of off-state voltage	V/µs	500 1000	T_{vj}=125°C, U_D = 0,67 U_{DRM} Gate open	
R_{thjc}	Thermal resistance junction to case	°C/W	0,032	Direct current, double side cooled	

ORDERING									
	TFI	**143**	**S**	**500**	**10**	**7**	**C4**	**3**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	

1. Fast thyristor with interdigitated gate structure.
2. Design version.
3. Strong distributed amplified gate
4. Mean on-state current, A.
5. Voltage code (10=1000V).
6. Critical rate of rise of off-state voltage (6 ≥ 500 V/µs, 7 ≥1000 V/µs)
7. Group of turn-off time (du_D/dt=50 V/µs, C4≤ 6,3 µs , E4 ≤ 5µs)
8. Group of turn-on time (3 ≤ 2,5 µs).



Mouting force : 13÷19 kN
Weight : 340 grams

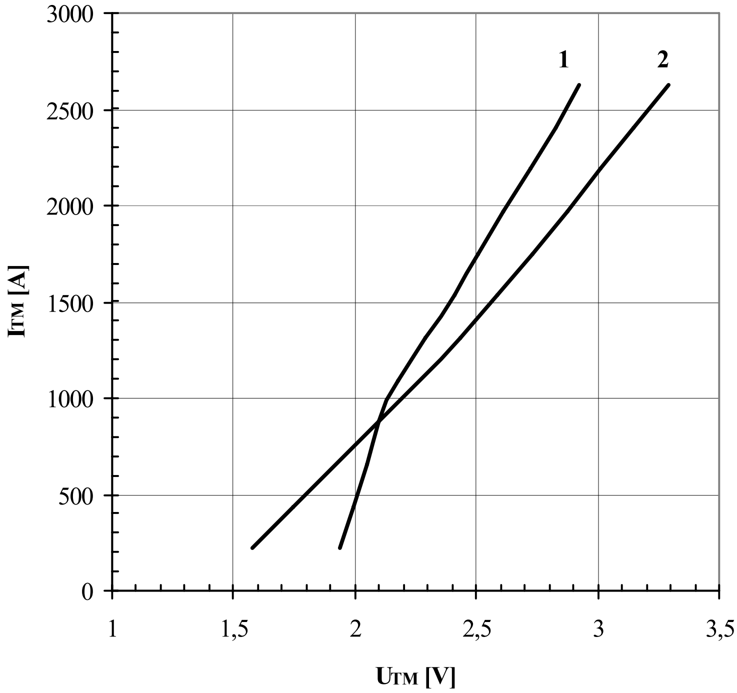
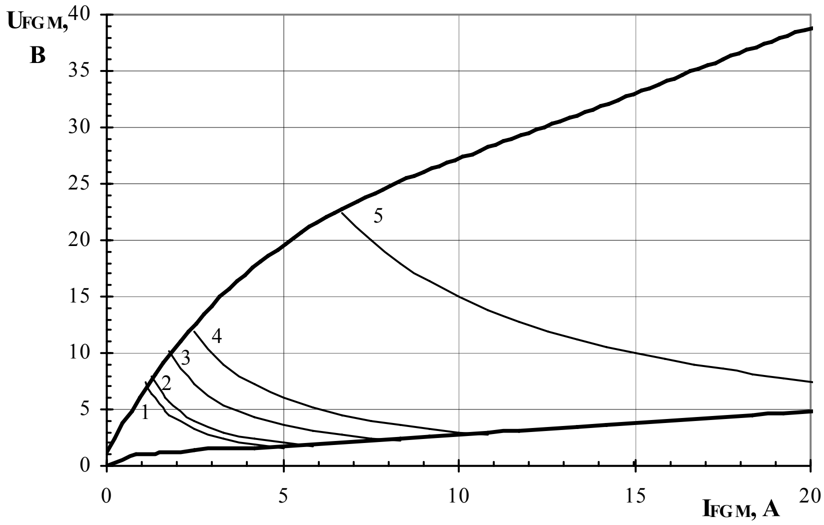


Fig. 1 On-state characteristics of Limit device
1 – T_j=25 °C
2 – T_j=125 °C



Maximum peak gate power loss

Position	On-Off time ratio	Gate pulse length, ms	Gate Pulse Power, W
1	1	DC	8
2	2	10	10
3	20	1	18
4	40	0.5	30
5	200	0.1	150

Fig. 2 Gate characteristics

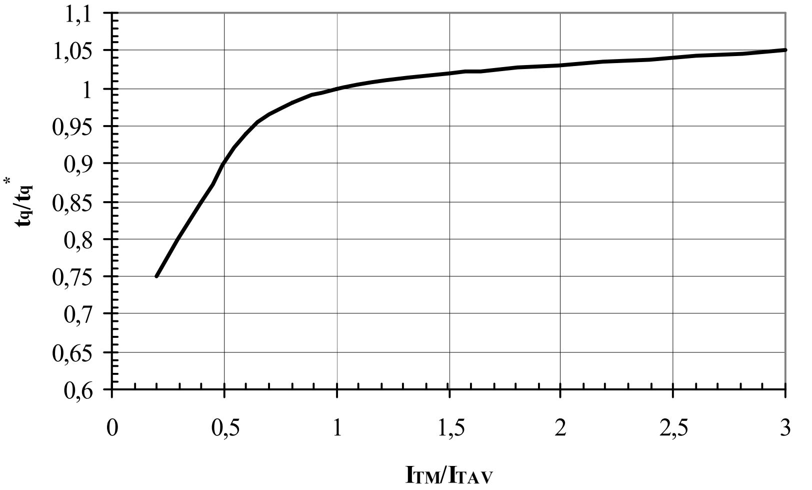


Fig. 3 Turn-off time t_q vs. On-state peak current I_{TM}

Conditions: $T_j=T_{j\,max}$; $di_R/dt=10$ A/µs; $V_R=100$ V; $dv_D/dt=50$ V/µs; $V_D=0.67·V_{DRM}$
Typical changes of t_q are normalized to the t_q^* (t_q^* – see data sheet, $dv_D/dt=50$ V/µs)

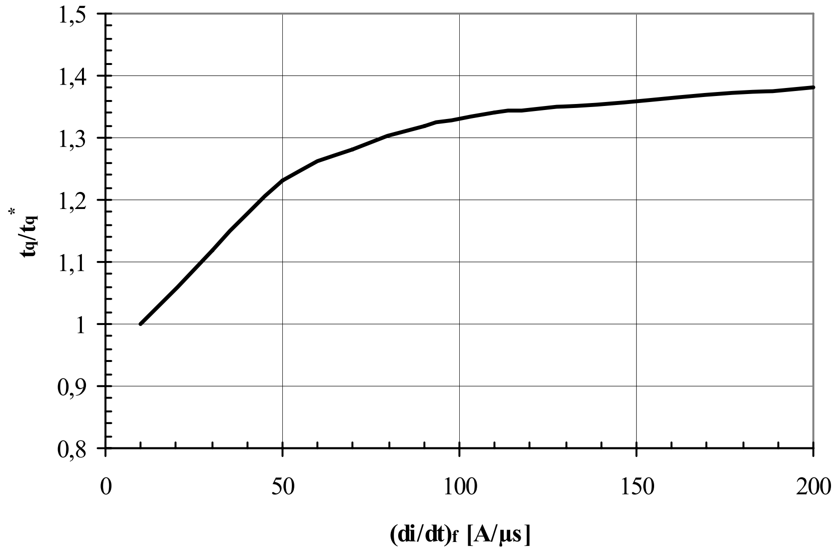


Fig. 4 Turn-off time t_q vs. Rate of fall of on-state current di_R/dt

Conditions: $T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $V_R=100$ V; $dv_D/dt=50$ V/µs; $V_D=0.67·V_{DRM}$
Typical changes of t_q are normalized to the t_q^* (t_q^* – see data sheet, $dv_D/dt=50$ V/µs)

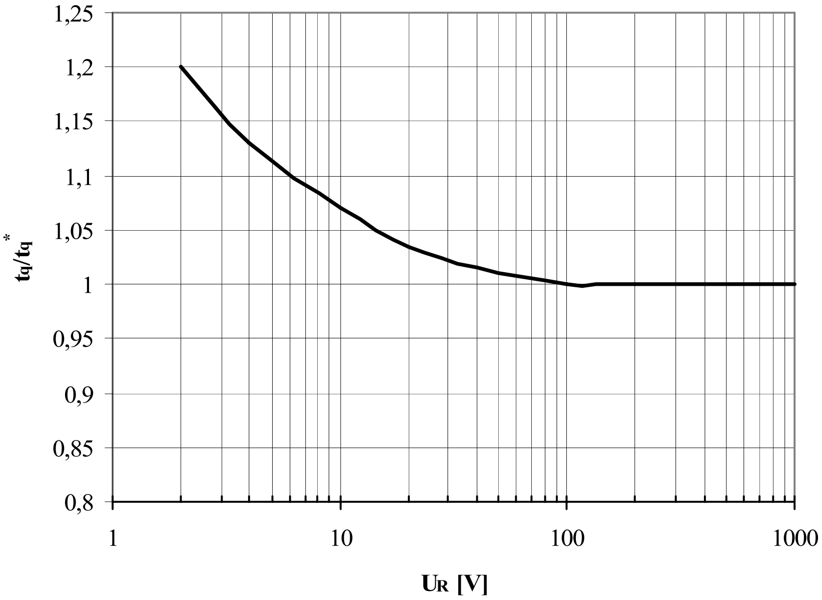


Fig. 5 Turn-off time t_q vs. Reverse voltage V_R

Conditions: $T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $di_R/dt=10$ A/µs; $dv_D/dt=50$ V/µs; $V_D=0.67 \cdot V_{DRM}$
Typical changes of t_q are normalized to the t_q^* (t_q^* – see data sheet, $dv_D/dt=50$ V/µs)

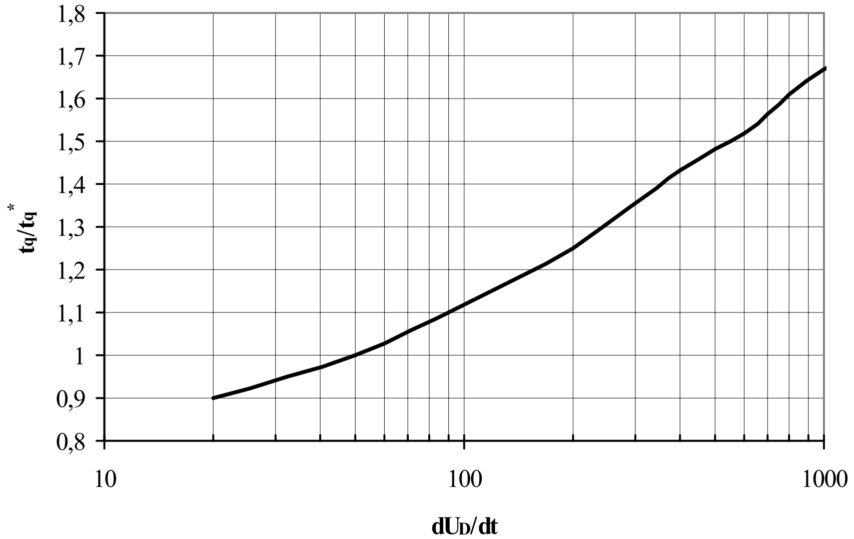


Fig. 6 Turn-off time t_q vs. Rate of rise of commutating voltage dv_D/dt

Conditions: $T_j=T_{j\,max}$; $I_{TM}=I_{TAV}$; $di_R/dt=10$ A/µs; $V_R=100$ V; $V_D=0.67 \cdot V_{DRM}$
Typical changes of t_q are normalized to the t_q^* (t_q^* – see data sheet, $dv_D/dt=50$ V/µs)

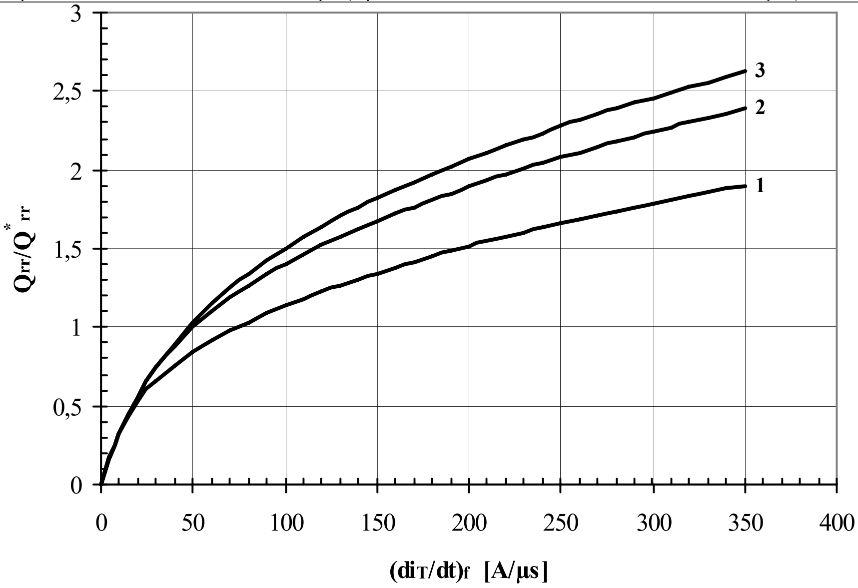


Fig. 7 Reverse recovery charge Q_{rr}, vs. Rate of fall of on-state current di_R/dt

1 – $I_{TM} = 0.5 \cdot I_{TAV}$
2 – $I_{TM} = I_{TAV}$,
3 – $I_{TM} = 1.5 \cdot I_{TAV}$

Conditions: $T_j=T_{j\,max}$; $V_R=100$ V
Typical changes of Q_{rr} are normalized to the Q_{rr}^* (Q_{rr}^* – see data sheet)

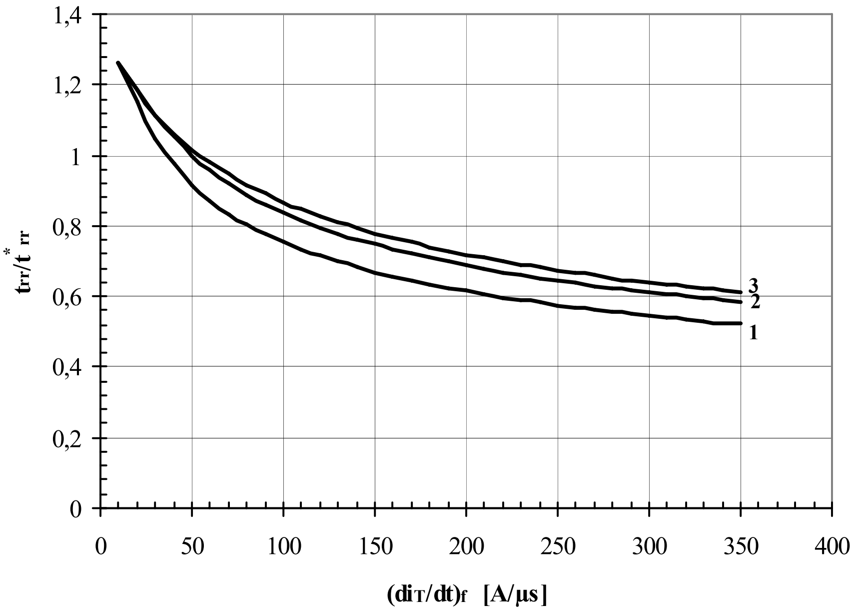


Fig. 8 Reverse recovery time t_{rr} vs. Rate of fall of on-state current di_R/dt

1 – $I_{TM} = 0.5 \cdot I_{TAV}$

2 – $I_{TM} = I_{TAV}$,

3 – $I_{TM} = 1.5 \cdot I_{TAV}$

Conditions: $T_j = T_{j\ max}$; V_R=100 V

Typical changes of t_{rr} are normalized to the t_{rr}^* (t_{rr}^* – see data sheet)

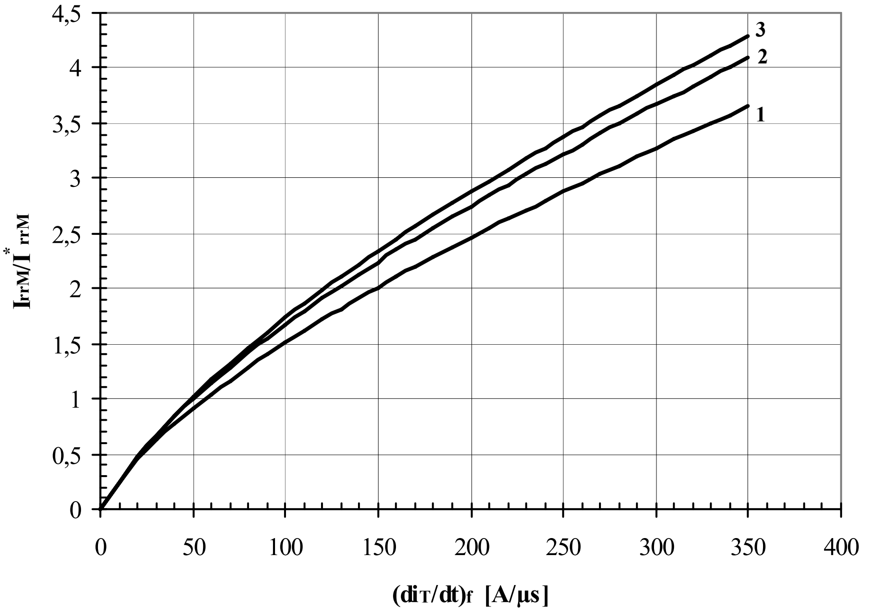


Fig. 9 Peak reverse recovery current I_{rrM} vs. Rate of fall of on-state current di_R/dt

1 – $I_{TM} = 0.5 \cdot I_{TAV}$

2 – $I_{TM} = I_{TAV}$,

3 – $I_{TM} = 1.5 \cdot I_{TAV}$

Conditions: $T_j = T_{j\ max}$; V_R=100 V

Typical changes of I_{rrM} are normalized to the I_{rrM}^* (I_{rrM}^* – see data sheet)

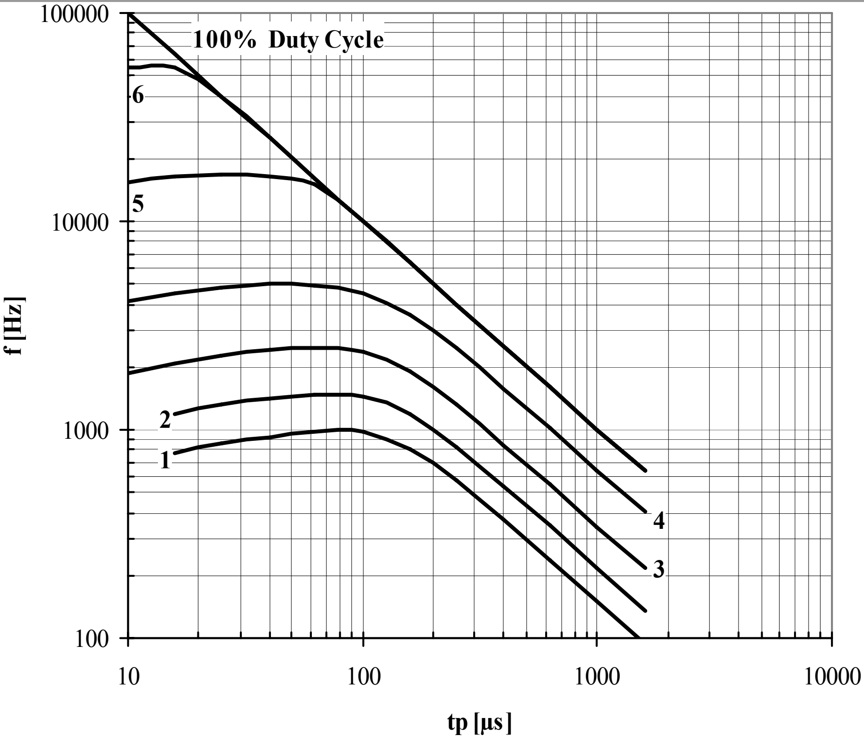


Fig. 10 Sine wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A

Conditions: $V_R \leq 3$ V; $T_C = 55$ °C

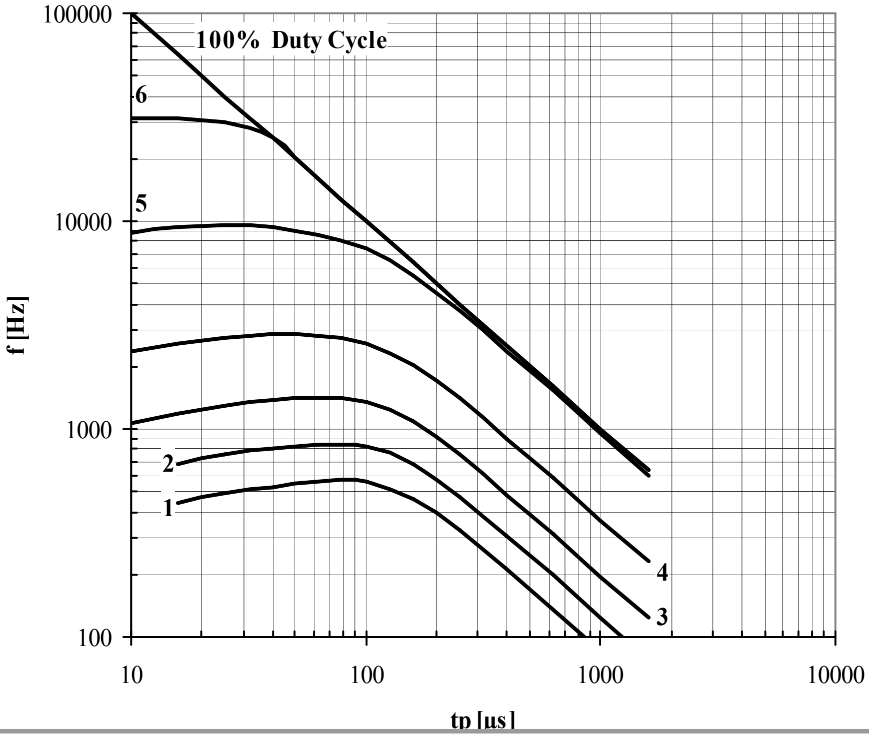


Fig. 11 Sine wave frequency ratings
1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V; T_C=85 °C

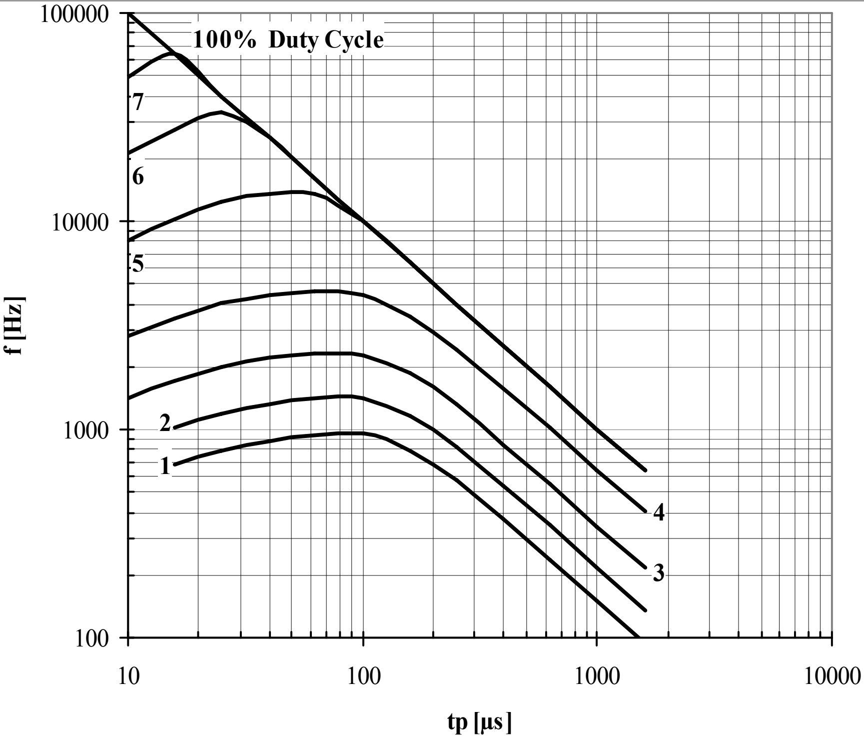


Fig. 12 Sine wave frequency ratings
1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R=0.67 \cdot V_{RRM}$; T_C=55 °C

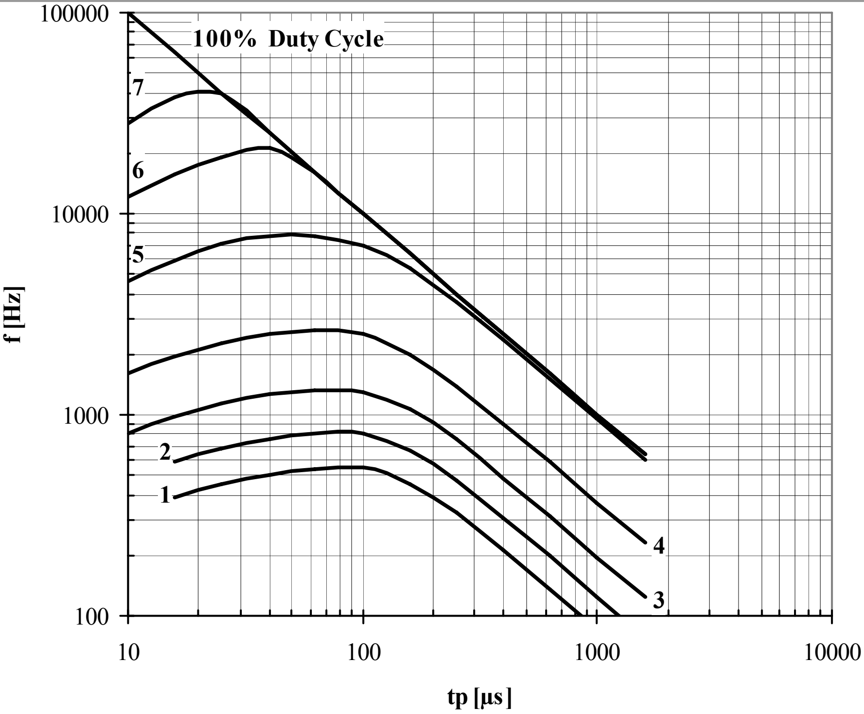


Fig. 13 Sine wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; T_C=85 °C

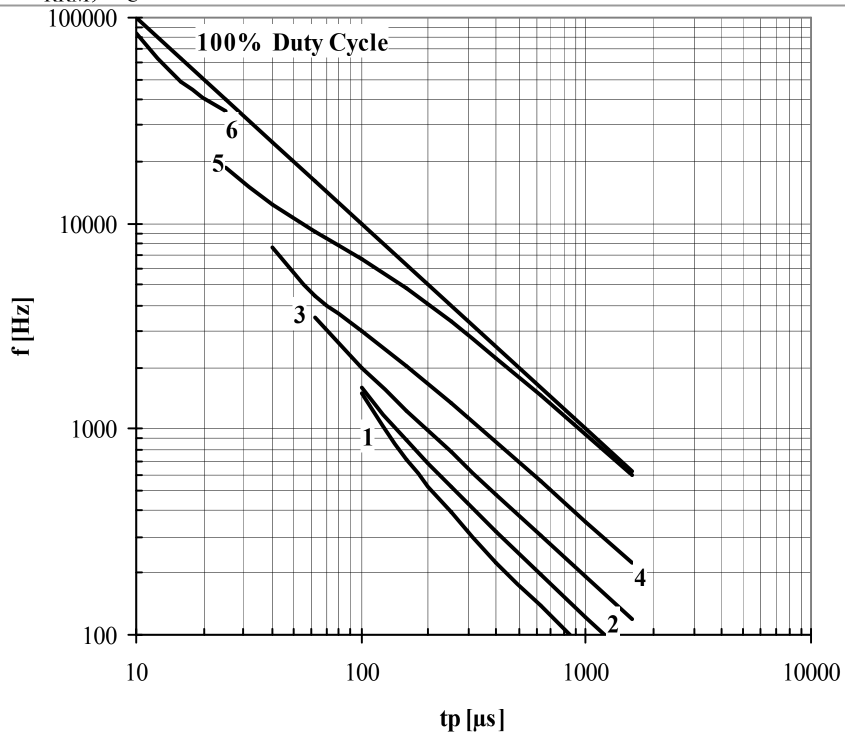


Fig. 14 Square wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A

Conditions: $V_R \leq 3$ V; $T_C=55\ ^oC$; $di_F/dt=di_R/dt=100$ A/µs

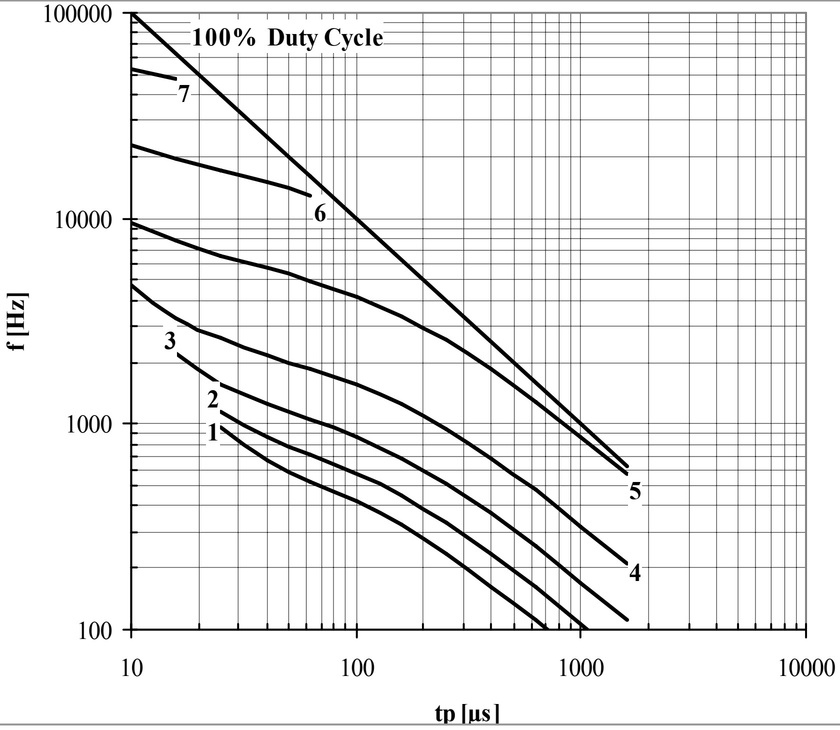


Fig. 15 Square wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V; $T_C=55\ ^oC$; $di_F/dt=di_R/dt=500$ A/µs

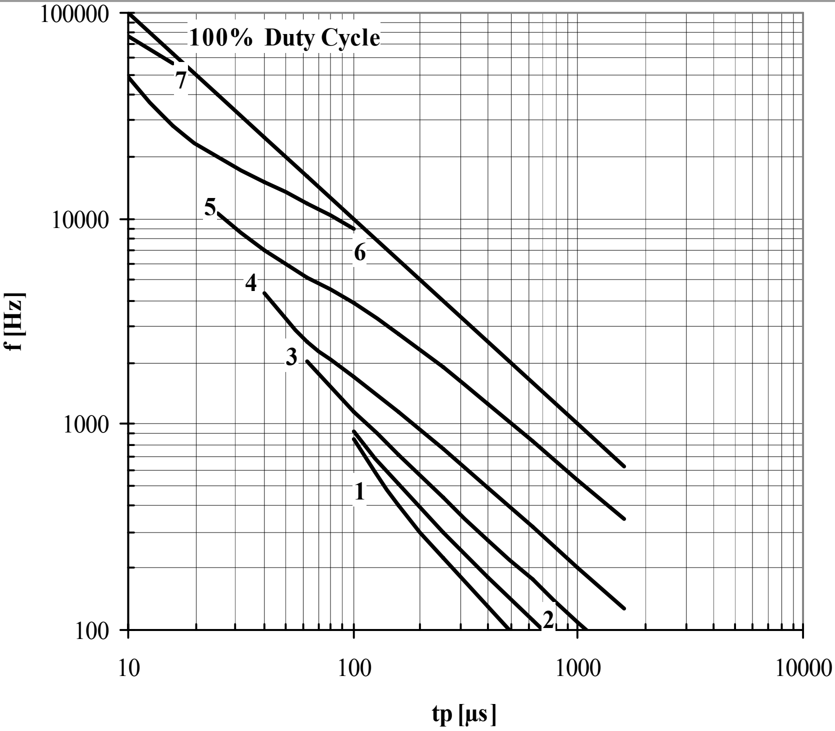


Fig. 16 Square wave frequency ratings
1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V; $T_C = 85\ ^oC$; $di_F/dt = di_R/dt = 100$ A/µs

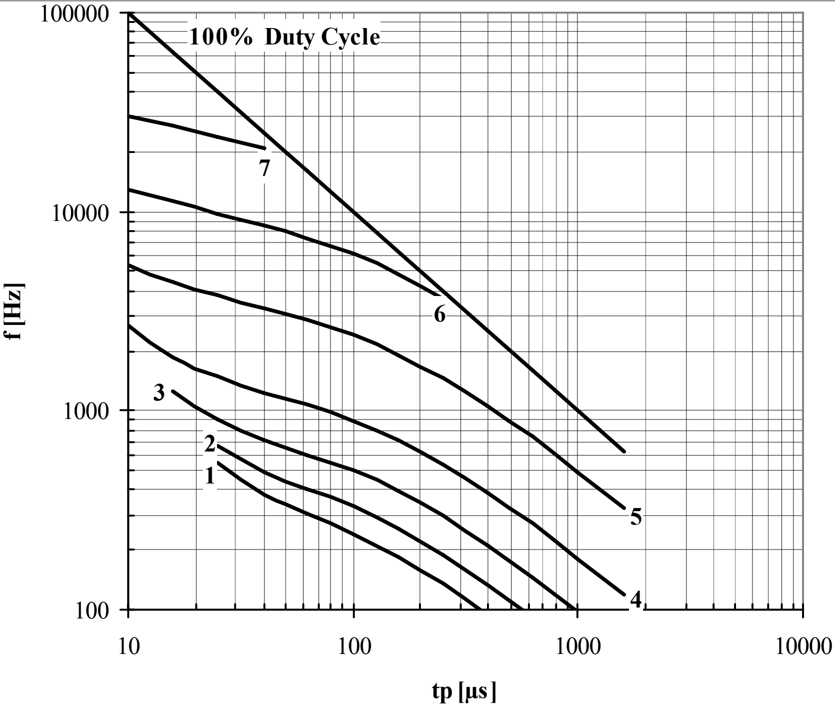


Fig. 17 Square wave frequency ratings
1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V; $T_C = 85\ ^oC$; $di_F/dt = di_R/dt = 500$ A/µs

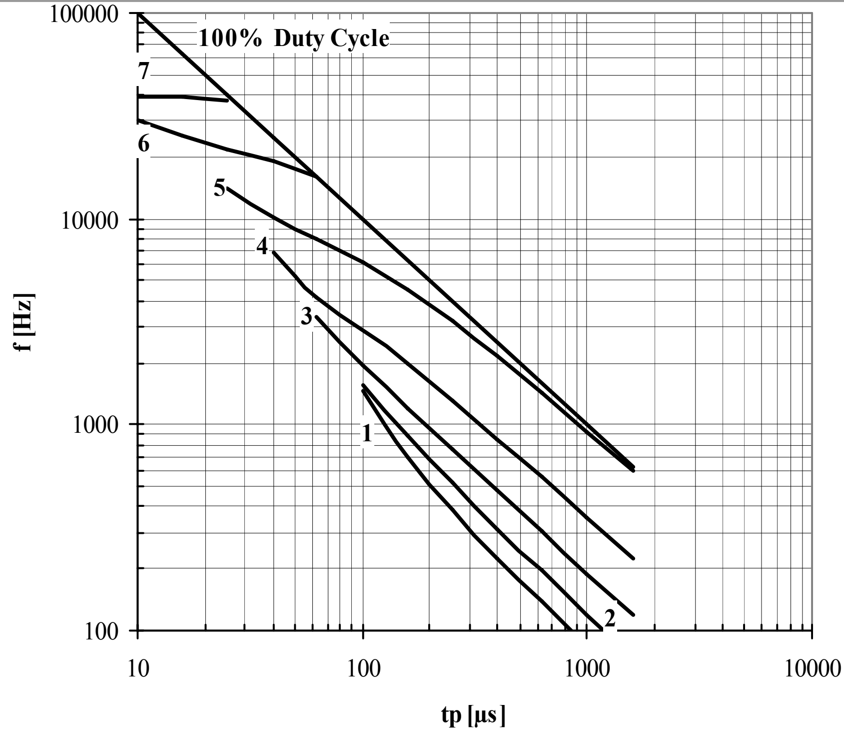


Fig. 18 Square wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; T_C=55 °C; di_F/dt=di_R/dt=100 A/µs

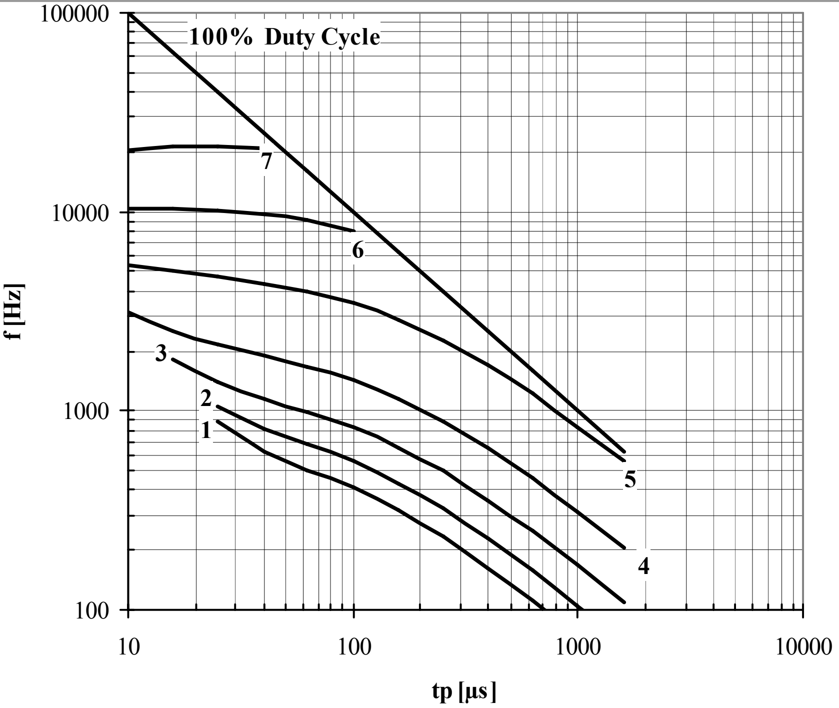


Fig. 19 Square wave frequency ratings
1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; T_C=55 °C; di_F/dt=di_R/dt=500 A/μs

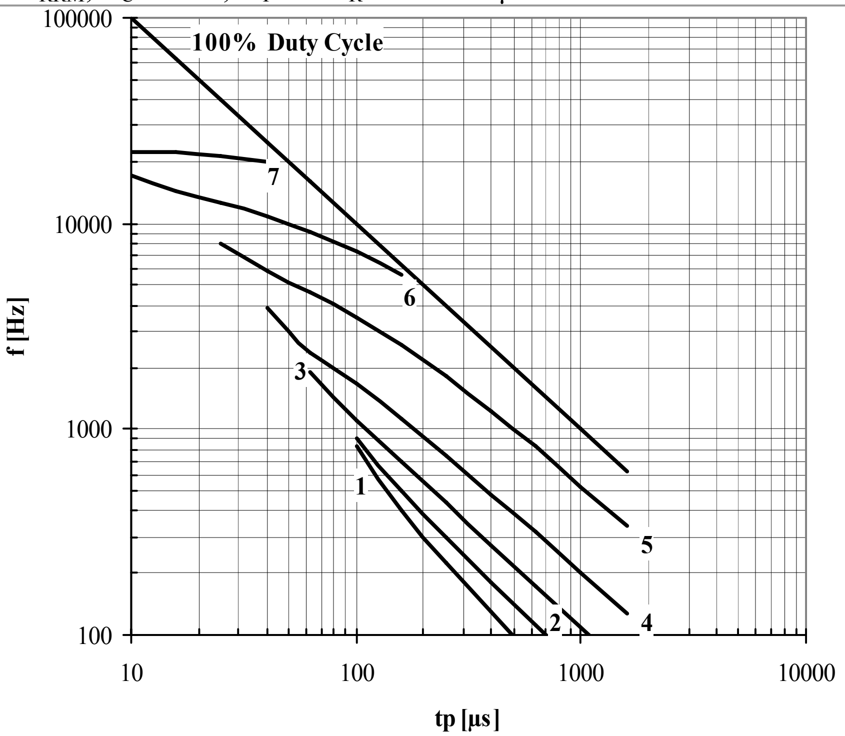


Fig. 20 Square wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; T_C=85 °C; di_F/dt=di_R/dt=100 A/µs

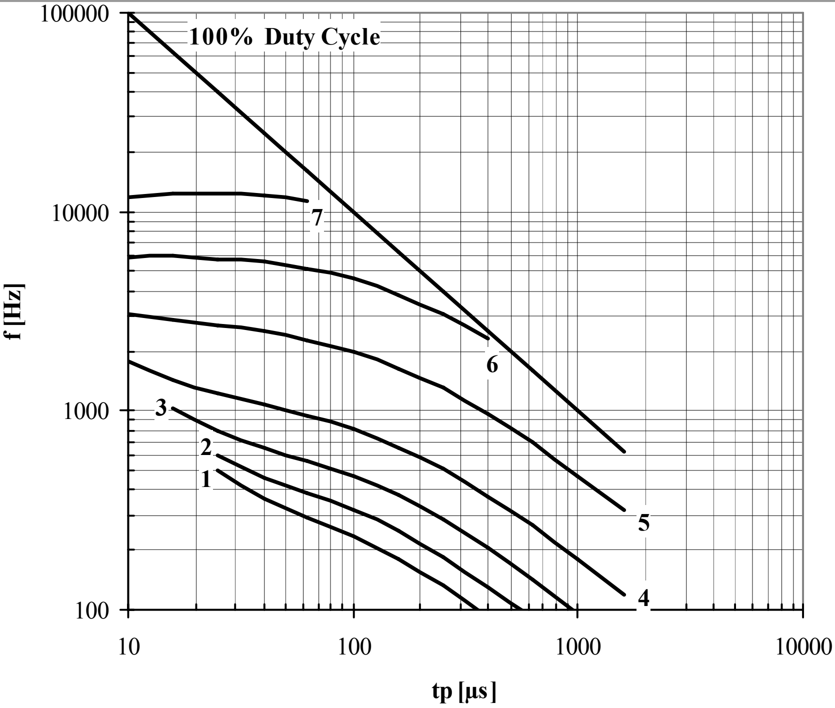


Fig. 21 Square wave frequency ratings

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; T_C=85 °C; di_F/dt=di_R/dt=500 A/µs

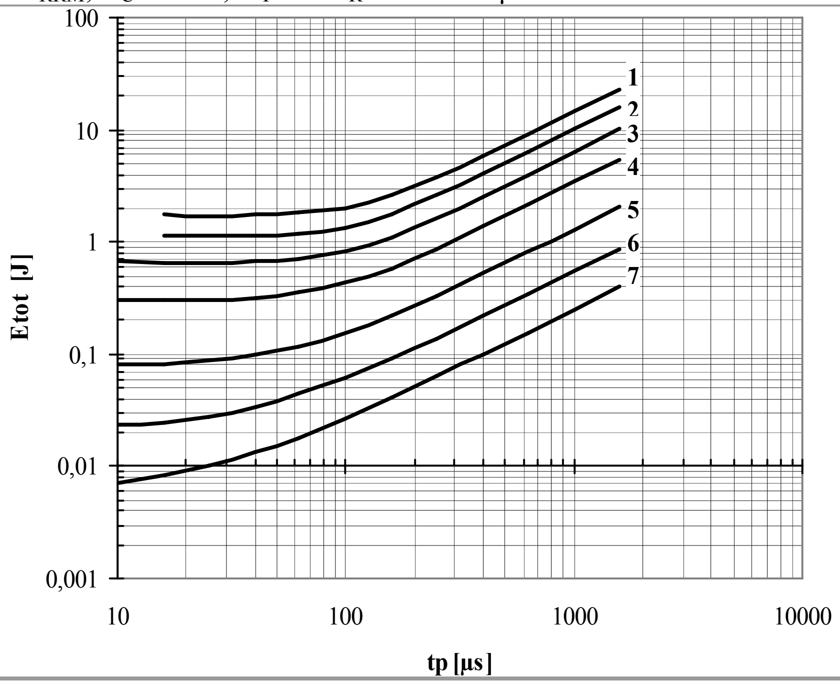


Fig. 22 Sine wave loss energy per pulse

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V

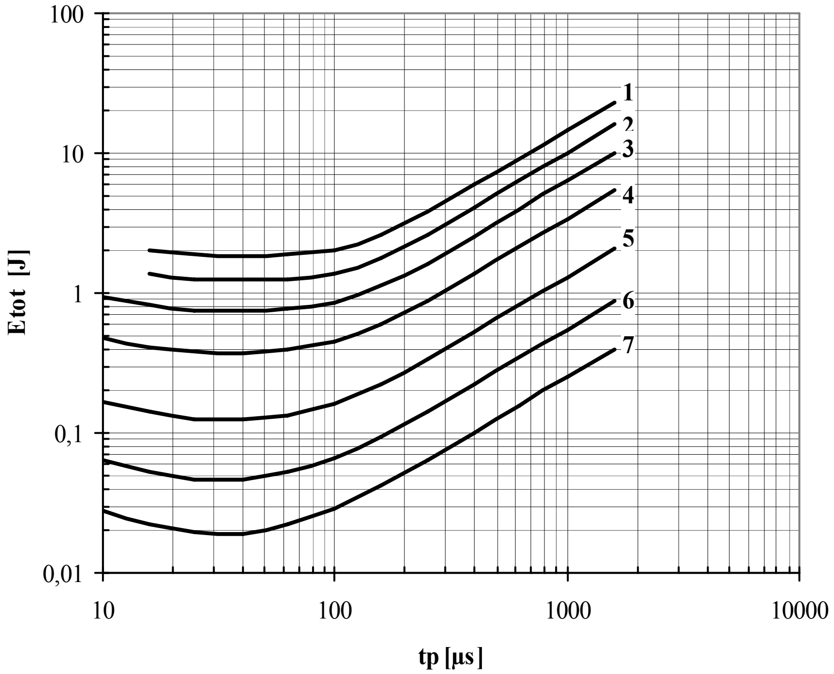


Fig. 23 Sine wave loss energy per pulse

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R = 0.67 \cdot V_{RRM}$

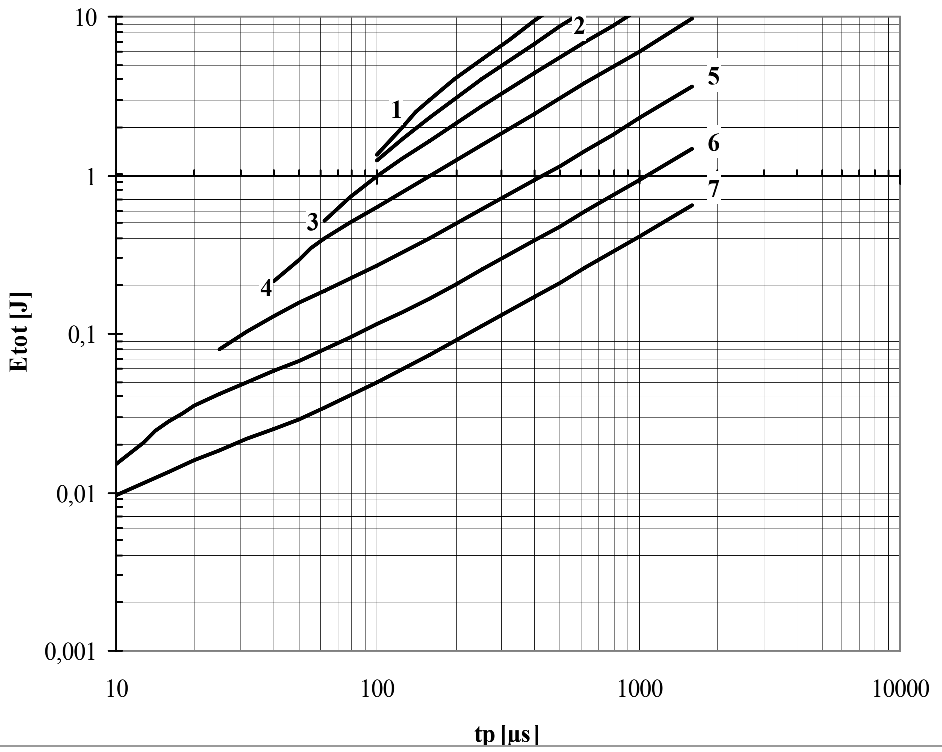


Fig. 24 Square wave loss energy per pulse

1 – I_{TM} = 5000 A

2 – I_{TM} = 4000 A

3 – I_{TM} = 3000 A

4 – I_{TM} = 2000 A

5 – I_{TM} = 1000 A

6 – I_{TM} = 500 A

7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V; $di_F/dt = di_R/dt = 100$ A/µs

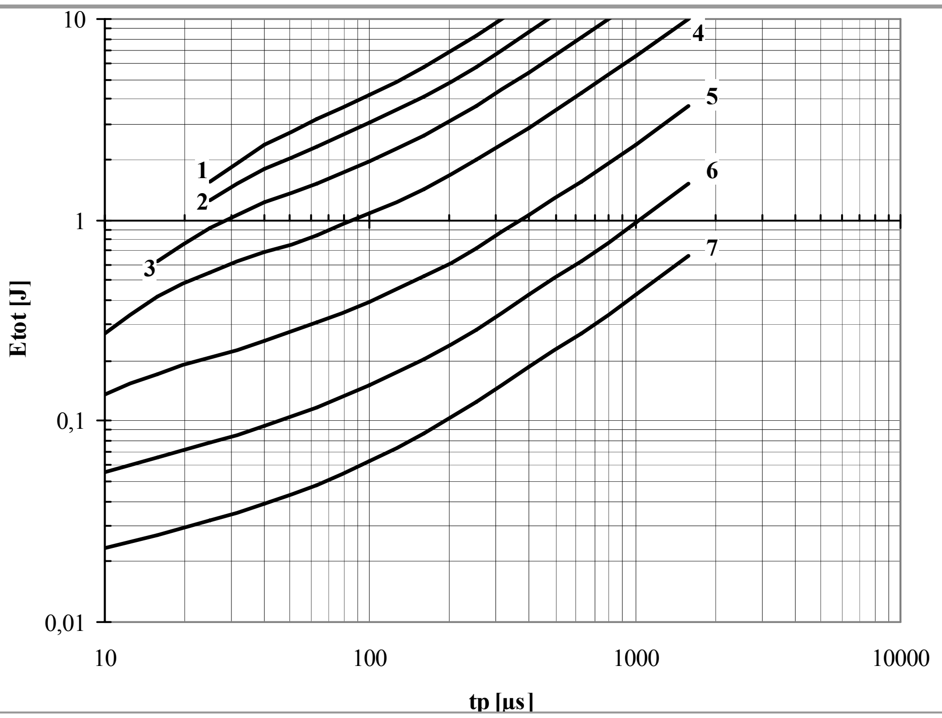


Fig. 25 Square wave loss energy per pulse

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: $V_R \leq 3$ V; $di_F/dt = di_R/dt = 500$ A/µs

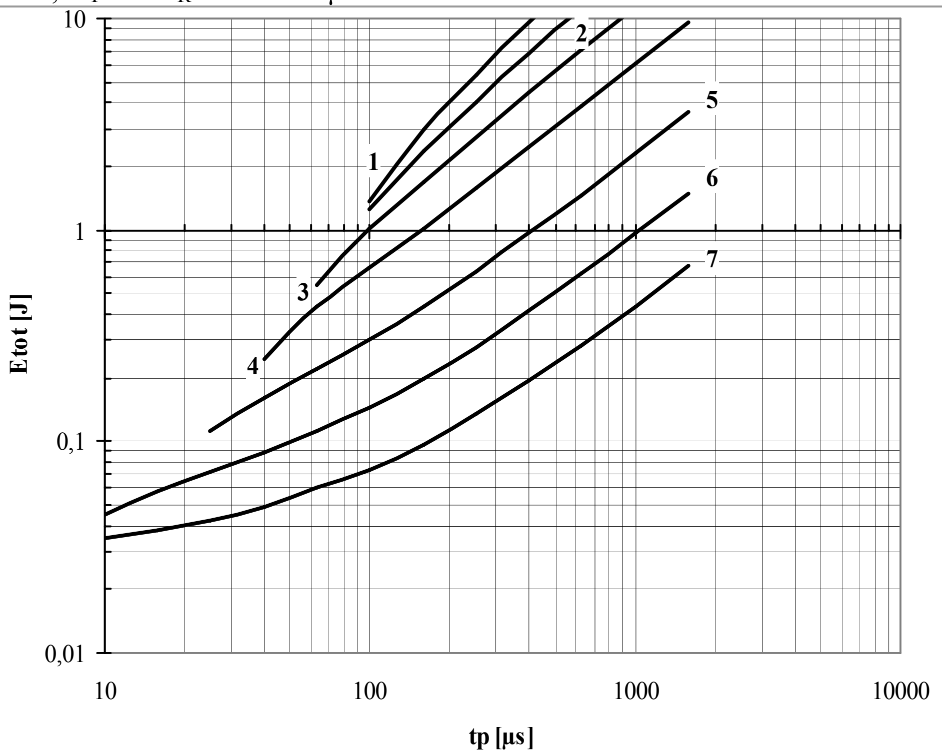


Fig. 26 Square wave loss energy per pulse

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; $di_F/dt=di_R/dt$=100 A/µs

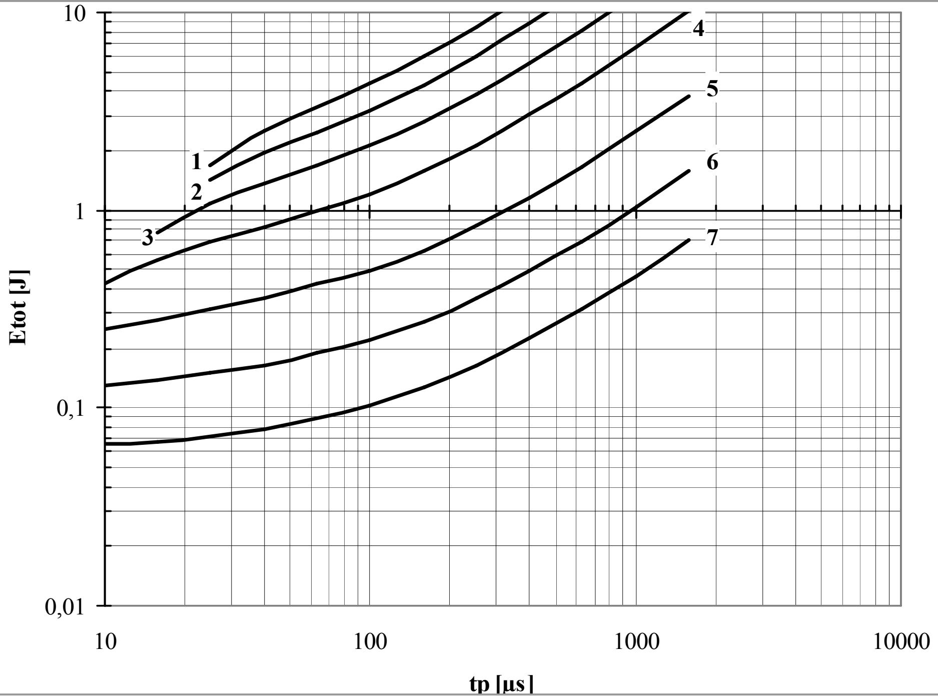


Fig. 27 Square wave loss energy per pulse

1 – I_{TM} = 5000 A
2 – I_{TM} = 4000 A
3 – I_{TM} = 3000 A
4 – I_{TM} = 2000 A
5 – I_{TM} = 1000 A
6 – I_{TM} = 500 A
7 – I_{TM} = 250 A

Conditions: V_R=0.67·V_{RRM}; $di_F/dt=di_R/dt$=500 A/µs

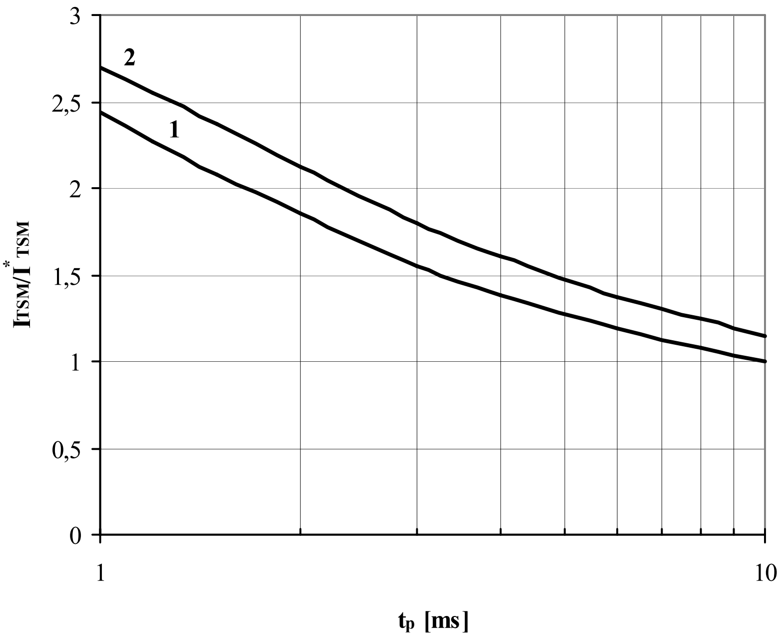


Fig. 28 The surge current I_{TSM} vs. Duration of surge t_p for a half-sine wave
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: V_R=0 V – the peak value of reverse voltage which is applied immediately after the surge current
Typical changes of I_{TSM} are normalized to the I_{TSM}^* (I_{TSM}^* – see data sheet, $T_j=T_{j\,max}$)

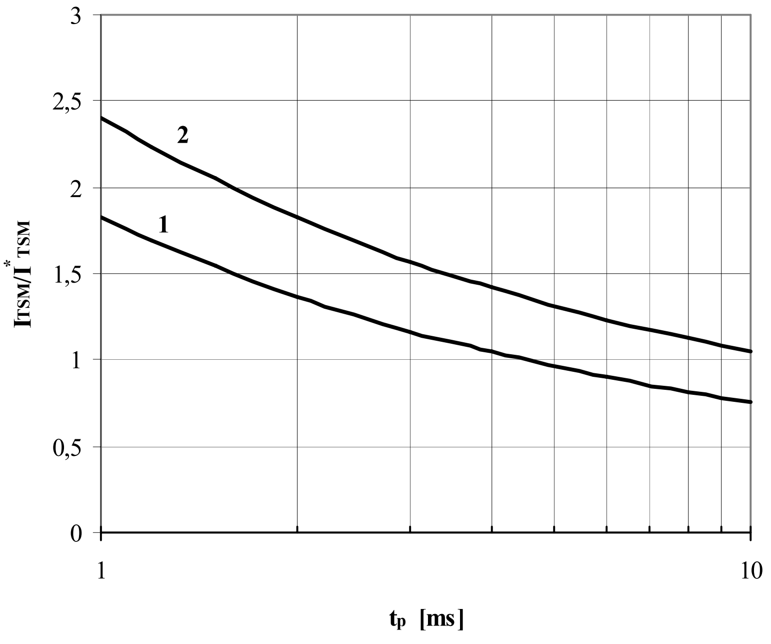


Fig. 29 The surge current I_{TSM} vs. Duration of surge t_p for a half-sine wave
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: $V_R=0.8 \cdot V_{RRM}$ – the peak value of reverse voltage which is applied immediately after the surge current
Typical changes of I_{TSM} are normalized to the I_{TSM}^* (I_{TSM}^* – see data sheet, $T_j=T_{j\,max}$)

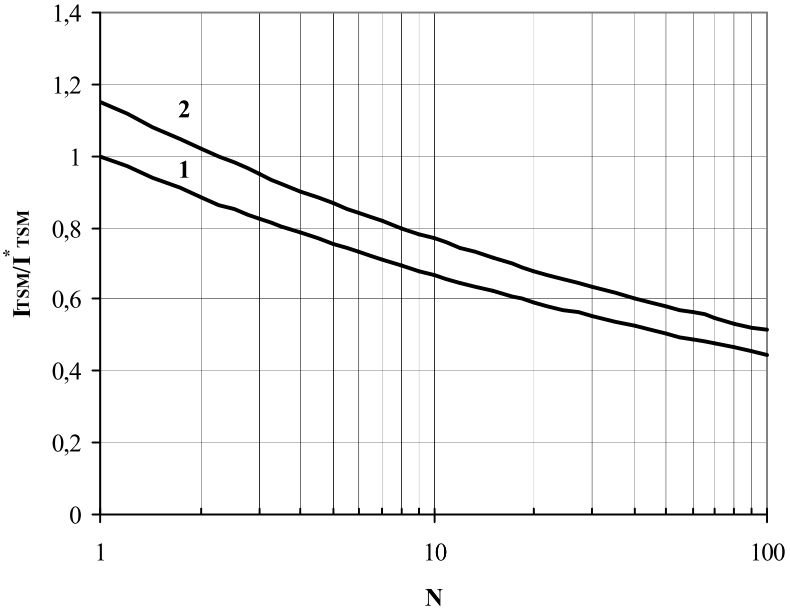


Fig. 30 The surge current I_{TSM} vs. Number of half-sine waves at 50 Hz
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: V_R=0 V – the peak value of reverse voltage which is applied immediately after the surge current
Typical changes of I_{TSM} are normalized to the I_{TSM}^* (I_{TSM}^* – see data sheet, T_j=$T_{j\,max}$)

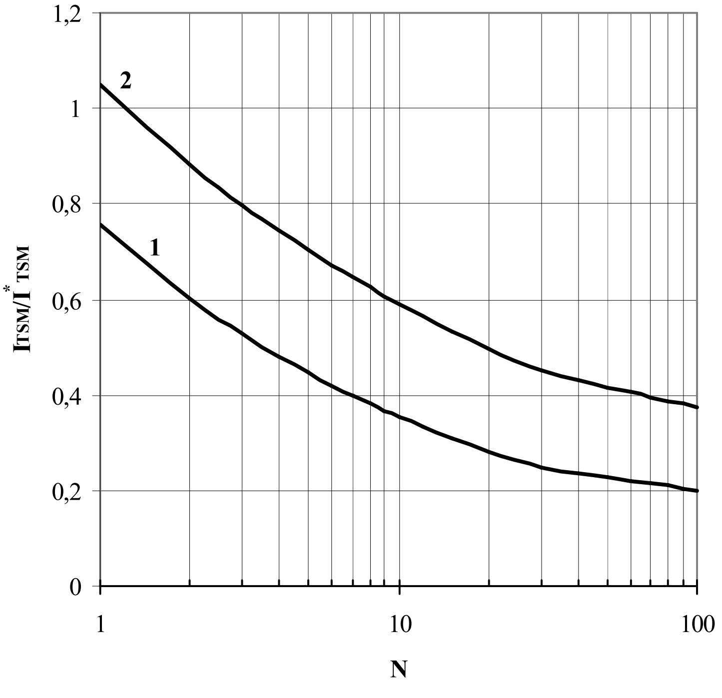


Fig. 31 The surge current I_{TSM} vs. Number of half-sine waves at 50 Hz
1 – T_j=125°C
2 – T_j=25°C

Conditions: V_R=0.8$\cdot V_{RRM}$ – the peak value of reverse voltage which is applied immediately after the surge current
Typical changes of I_{TSM} are normalized to the I_{TSM}^* (I_{TSM}^* – see data sheet, T_j=$T_{j\,max}$)