estel®	**ESTEL ELEKTROONIKA** ESTONIA	**March** **2005**

Series
TFI133S-400

High Frequency Inverter grade Capsule Thyristor Type TFI133S-400

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

Maximum mean on-state current				ITAV		**400 A**	
Maximum repetitive peak off-state and reverse voltage				UDRM URRM		**600 ÷1200 V**	
Turn-off time				**tq**		**5; 6,3 µs**	
UDRM , URRM , V	600	700	800	900	1000	1100	1200
Voltage code	6	7	8	9	10	11	12
Tvj, °C	- 60 ÷ 125						

MAXIMUM ALLOWABLE RATINGS					
Symbols and parameters		Units	TFI133S-400	Conditions	
ITAV	Mean on-state current	A	400 560	Tc=81 °C, Tc=55 °C, 180° half-sine wave, 50 Hz	
ITRMS	RMS on-state current	A	628	Tc=81 °C	
ITSM	Surge on-state current	kA	6,5 7,0	Tvj=125°C Tvj=25°C	tp=10 ms UR=0
I^2t	Limiting load integral	kA^2s	211 245	Tvj=125°C Tvj=25°C	
UDRM,URRM	Repetitive peak off-state and reverse voltage	V	600÷1200	Tj min≤Tvj≤TjM 180° half-sine wave, 50 Hz Gate open	
UDSM,URSM	Non-repetitive peak off-state and reverse voltage	V	660÷1300	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	 1600 1000	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	3,0	Tvj=25°C, ITM=3,14 ITAV	
UT(TO)	Threshold voltage	V	1,8	Tvj=125°C 1,57 ITAV< IT <4,71 ITAV	
RT	On-state slope resistance	mΩ	0,95		
IDRM IRRM	Repetitive peak off-state and reverse current	mA	50 50	Tvj=125°C, UD = UDRM UR= URRM	

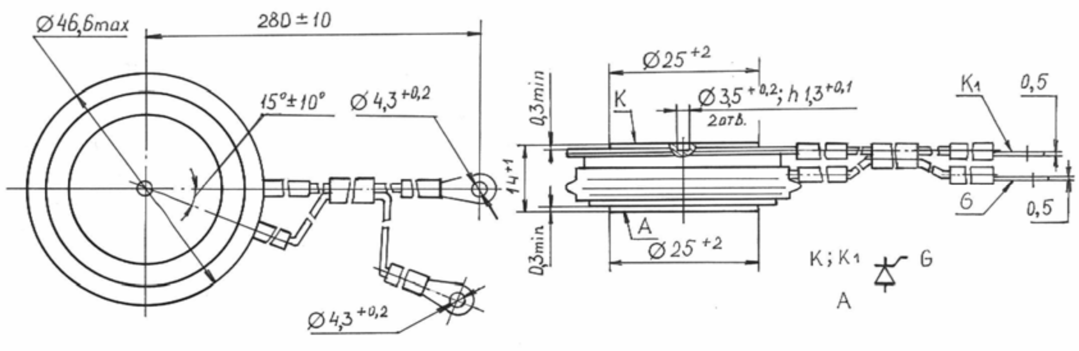
CHARACTERISTICS

Symbols and parameters		Units	TFI133S-400	Conditions
I_L	Latching current	A	12	Tvj=25°C,U_D=12V Gate pulse : 10V, 5Ω, 1 µs rise time, 10µs
I_H	Holding current	A	0,5	Tvj=25°C,U_D=12V, Gate open
U_{GT}	Gate trigger direct voltage	V	2,5 5,0	Tvj=25°C, Tvj=-60°C; U_D=12V
I_{GT}	Gate trigger direct current	A	0,4 0,9	Tvj=25°C, Tvj=-60°C; U_D=12V
U_{GD}	Gate non-trigger direct voltage	V	0,25	Tvj=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	Tvj=25°C,U_D=500V I_{TM} = 400 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	Tvj=125°C, I_{TM} =400 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	60	Tvj=125°C, I_{TM} =400 A di_R/dt =50 A/µs, U_R=100V
t_{rr}	Reverse recovery time	µs	1,85	
I_{rrM}	Peak reverse recovery current	A	65	
$(du_D/dt)_{crit}$	Critical rate of rise of off-state voltage	V/µs	500 1000	Tvj=125°C, U_D = 0,67 U_{DRM} Gate open
R_{thjc}	Thermal resistance junction to case	°C/W	0,04	Direct current, double side cooled

ORDERING

	TFI	**133**	**S**	**400**	**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 : 9÷12 kN
Weight : 120 grams

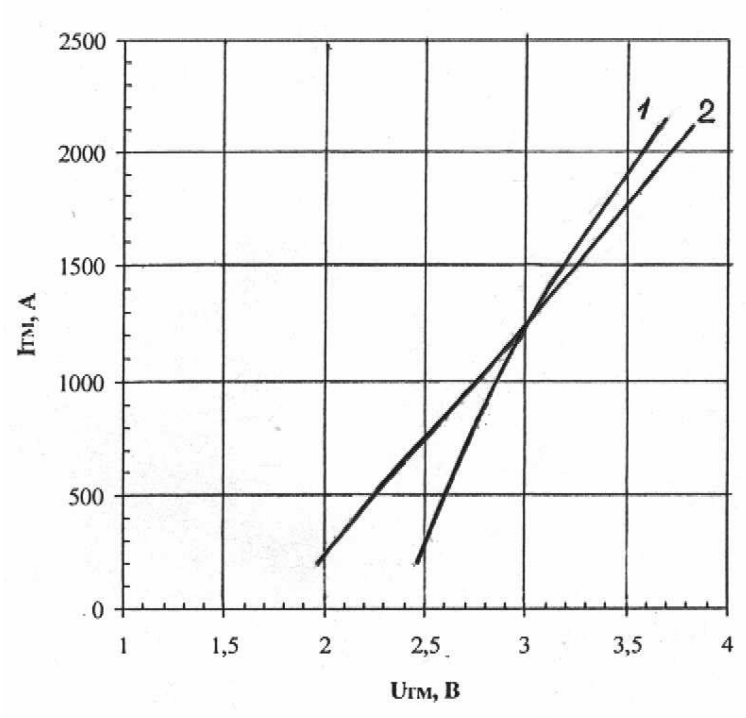
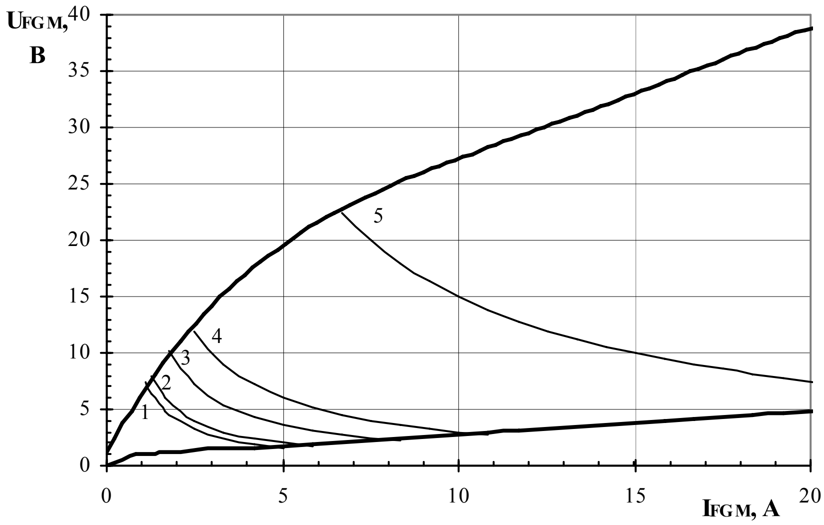


Fig. 1 On-state characteristics of Limit device
1 – T_j=25 °C
2 – T_j=125 °C



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

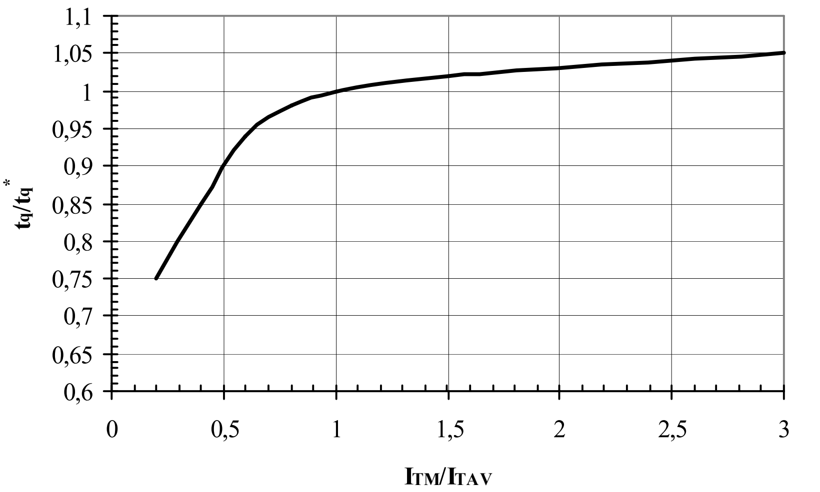


Fig. 3 Turn-off time t_q vs. On-state peak current I_{TM}

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

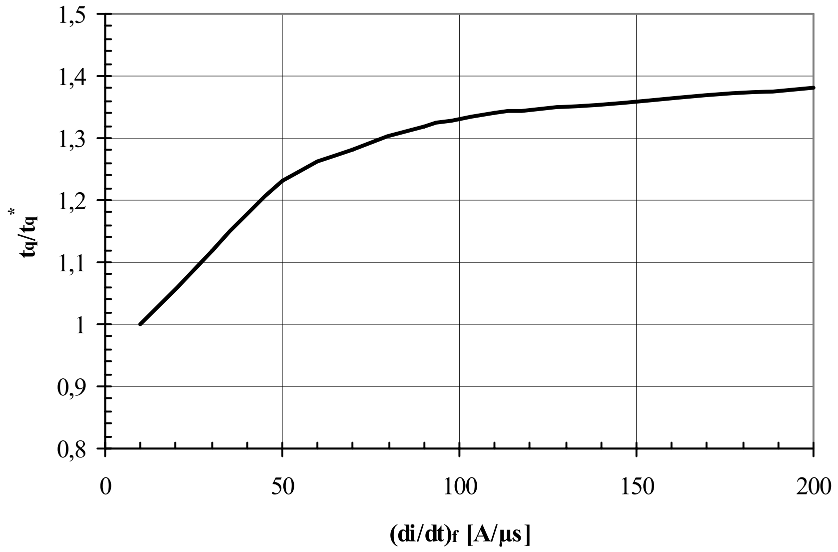


Fig. 4 Turn-off time t_q vs. Rate of fall of on-state current di_R/dt

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

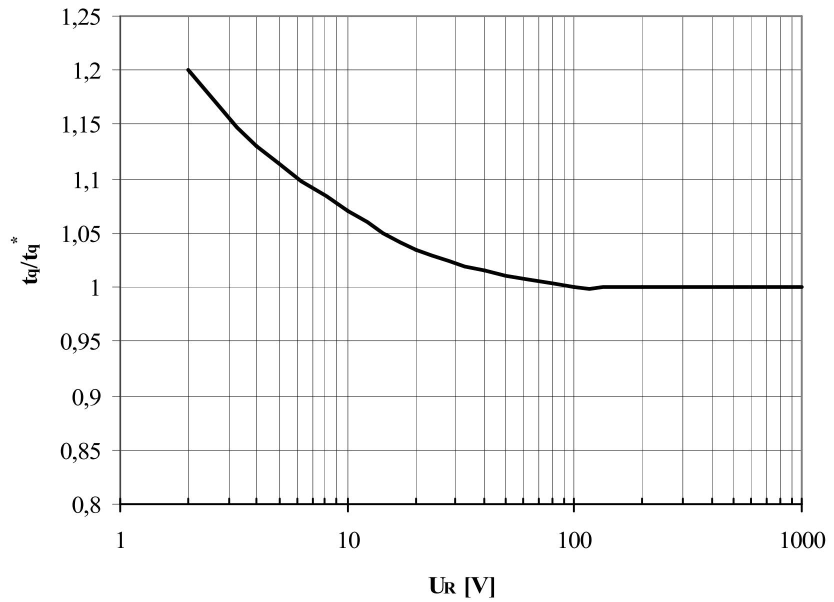


Fig. 5 Turn-off time t_q vs. Reverse voltage V_R

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)

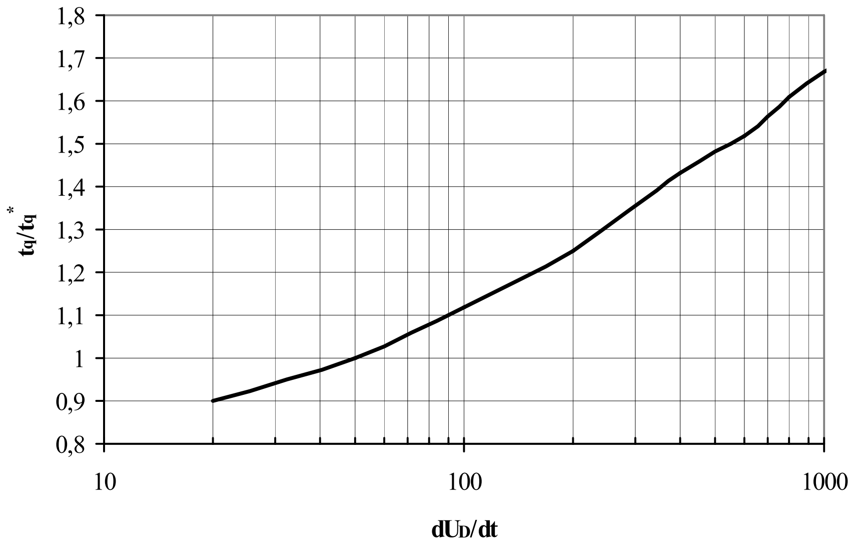


Fig. 6 Turn-off time t_q vs. Rate of rise of commutating voltage dv_D/dt

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)

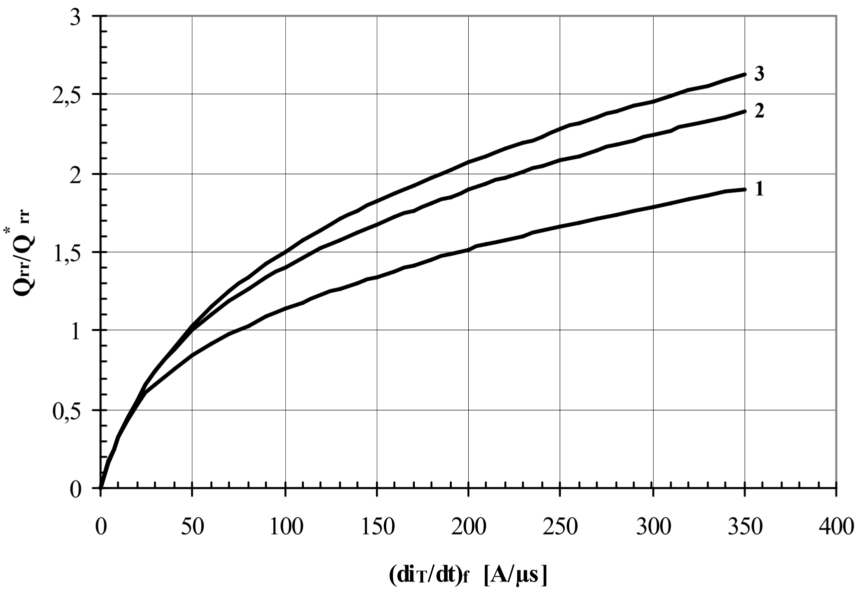


Fig. 7 Reverse recovery charge Q_{rr}, vs. Rate of fall of on-state current di_R/dt
1 – $I_{TM} = 0.5 \cdot I_{TAV}$
2 – $I_{TM} = I_{TAV}$,
3 – $I_{TM} = 1.5 \cdot I_{TAV}$

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)

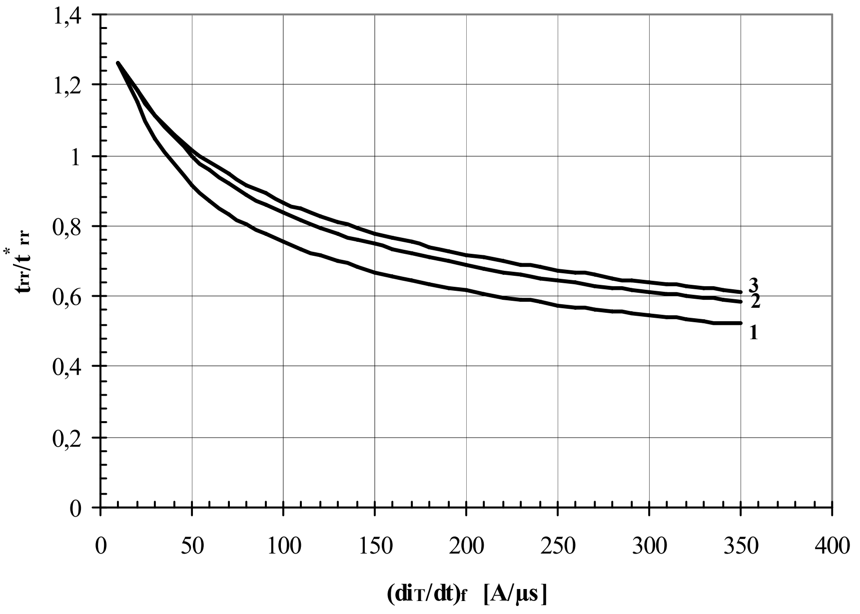


Fig. 8 Reverse recovery time t_{rr} vs. Rate of fall of on-state current di_R/dt

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)

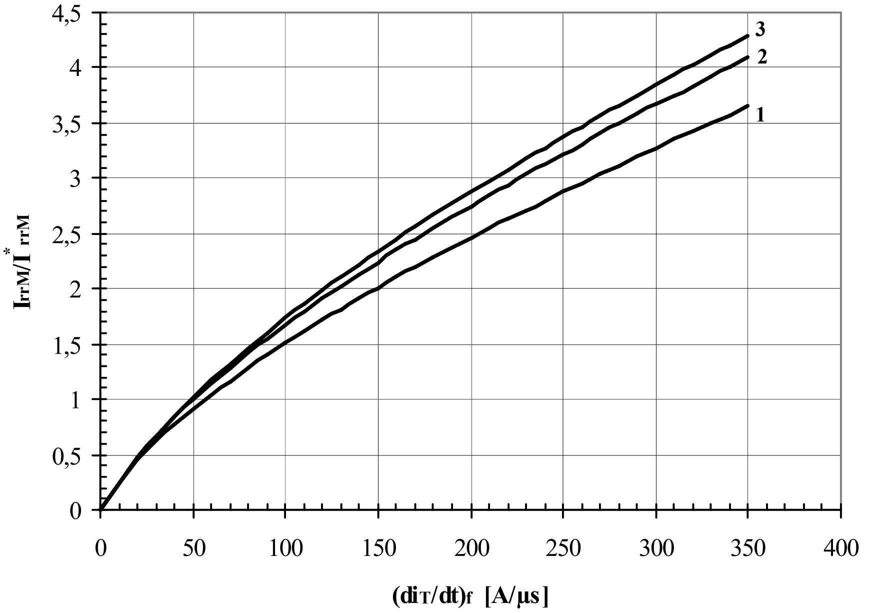


Fig. 9 Peak reverse recovery current I_{rrM} vs. Rate of fall of on-state current di_R/dt

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)

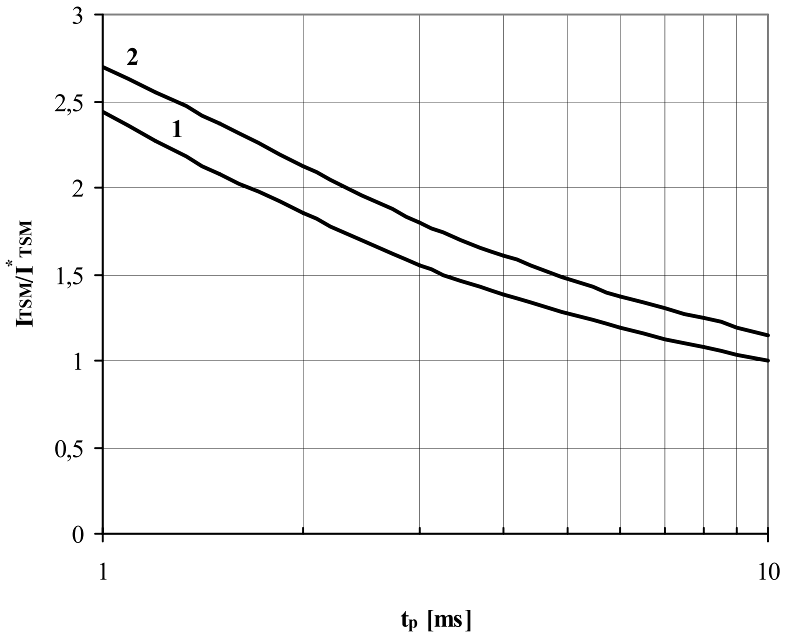


Fig. 10 The surge current I_{TSM} vs. Duration of surge t_p for a half-sine wave
1 – T_j=125 °C
2 – T_j=25 °C

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, $T_j=T_{j\,max}$)

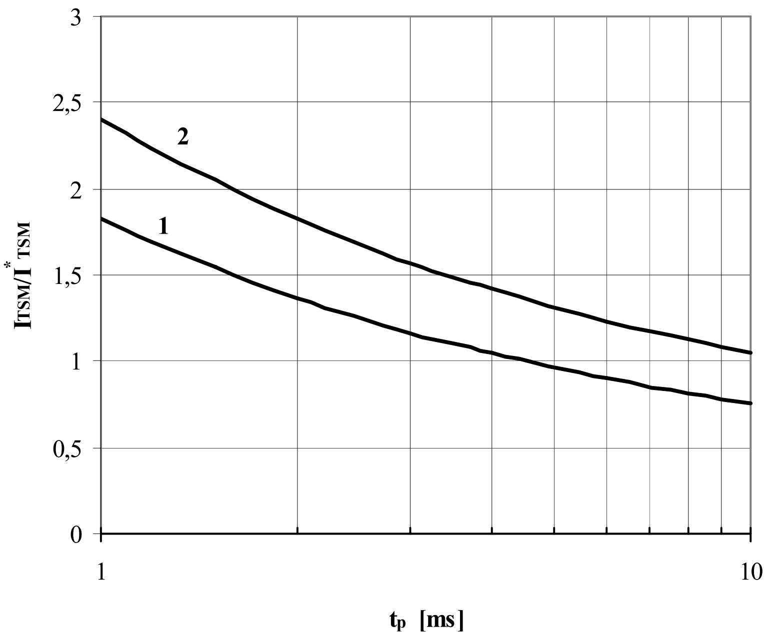


Fig. 11 The surge current I_{TSM} vs. Duration of surge t_p for a half-sine wave
1 – T_j=125 °C
2 – T_j=25 °C

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, $T_j=T_{j\,max}$)

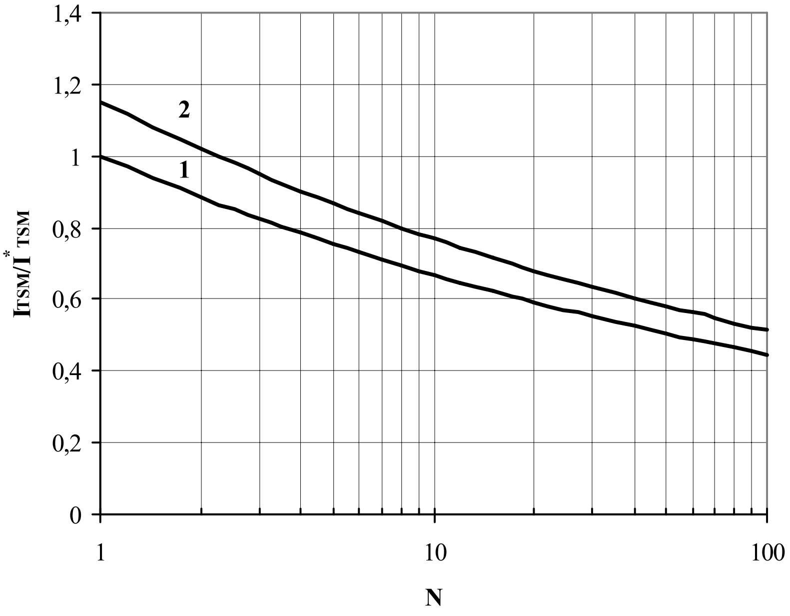


Fig. 12 The surge current I_{TSM} vs. Number of half-sine waves at 50 Hz
1 – T_j=125 °C
2 – T_j=25 °C

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=$T_{j\ max}$)

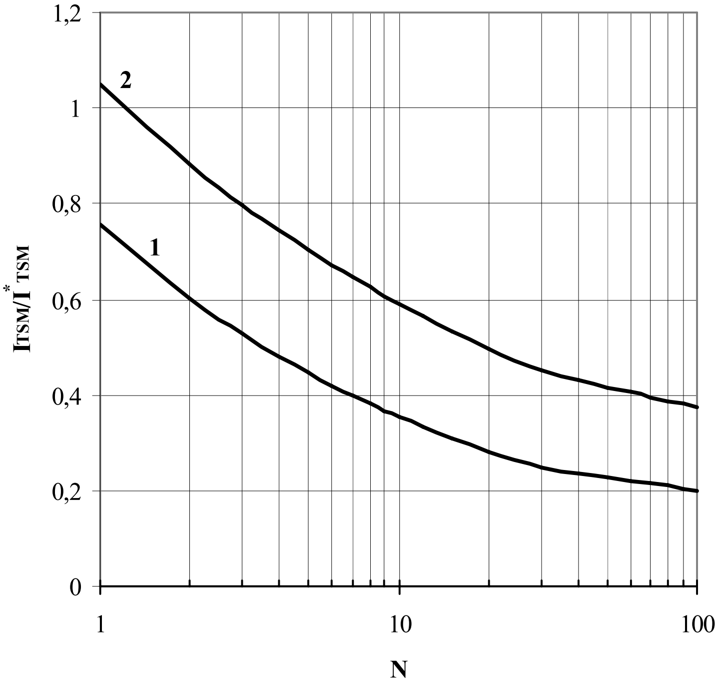


Fig. 13 The surge current I_{TSM} vs. Number of half-sine waves at 50 Hz
1 – T_j=125°C
2 – T_j=25°C

Conditions: V_R=0.8·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=$T_{j\ max}$)