Fast Thyristor
Type TFI233-320-24

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

Mean on-state current	I_{TAV}	320 A
Repetitive peak off-state voltage	V_{DRM}	2000...2400 V
Repetitive peak reverse voltage	V_{RRM}	
Turn-off time	t_q	25.0, 32.0, 40.0, 50.0 µs

V_{DRM}, V_{RRM}, V	2000	2200	2400
Voltage code	20	22	24
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	320 470	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	502	T_c= 85 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{TSM}	Surge on-state current	kA	6.3 7.0	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=I_{FGM}; V_G=20 V; t_{GP}=50 µs; di_G/dt=1 A/µs
			6.5 7.5	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=I_{FGM}; V_G=20 V; t_{GP}=50 µs; di_G/dt=1 A/µs
I^2t	Safety factor	$A^2s \cdot 10^3$	190 240	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=I_{FGM}; V_G=20 V; t_{GP}=50 µs; di_G/dt=1 A/µs
			170 230	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=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...2400	$T_{j\,min}$< 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...2500	$T_{j\,min}$< 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	$0.6 \cdot V_{DRM}$ $0.6 \cdot V_{RRM}$	T_j=$T_{j\,max}$; Gate open	

TRIGGERING				
I_{FGM}	Peak forward gate current	A	6	$T_j=T_{j\,max}$
V_{RGM}	Peak reverse gate voltage	V	5	
P_G	Gate power dissipation	W	3	$T_j=T_{j\,max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/μs	1600	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; $I_{TM}=2\ I_{TAV}$; 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	9.0...11.0	
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	2.80	$T_j=25$ °C; $I_{TM}=1005$ A	
$V_{T(TO)}$	On-state threshold voltage, max	V	1.50	$T_j=T_{j\,max}$; $0.5\ \pi\ I_{TAV} < I_T < 1.5\ \pi\ I_{TAV}$	
r_T	On-state slope resistance, max	mΩ	1.250		
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	$T_j=T_{j\,max}$; $V_D=0.67 \cdot V_{DRM}$; 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, max	μs	0.60	$T_j=25$ °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	1.60, 2.00, 2.50, 3.20		
t_q	Turn-off time[3] max	μs	25.0, 32.0, 40.0, 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; $V_D=0.67\ V_{DRM}$
			32.0, 40.0, 50.0, 63.0	$dv_D/dt=200$ V/μs	
Q_{rr}	Recovered charge, max	μC	250	$T_j=T_{j\,max}$; $I_{TM}=320$ A; $di_R/dt=-50$ A/μs; $V_R=100$ V	
t_{rr}	Reverse recovery time, max	μs	4.0		
I_{rr}	Reverse recovery current, max	A	130		

THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0500	Direct current	Double side cooled
R_{thjc-A}			0.1100		Anode side cooled
R_{thjc-K}			0.0900		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0060	Direct current	
MECHANICAL					
m	Weight, max	g	176		
D_s	Surface creepage distance	mm (inch)	19.44 (0.765)		
D_a	Air strike distance	mm (inch)	12.10 (0.476)		

PART NUMBERING GUIDE

TFI	233	320	24	A2	M3	T4	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
$(dv_D/dt)_{crit}$, V/μs	200	320	500	1000

[2]Turn-on time

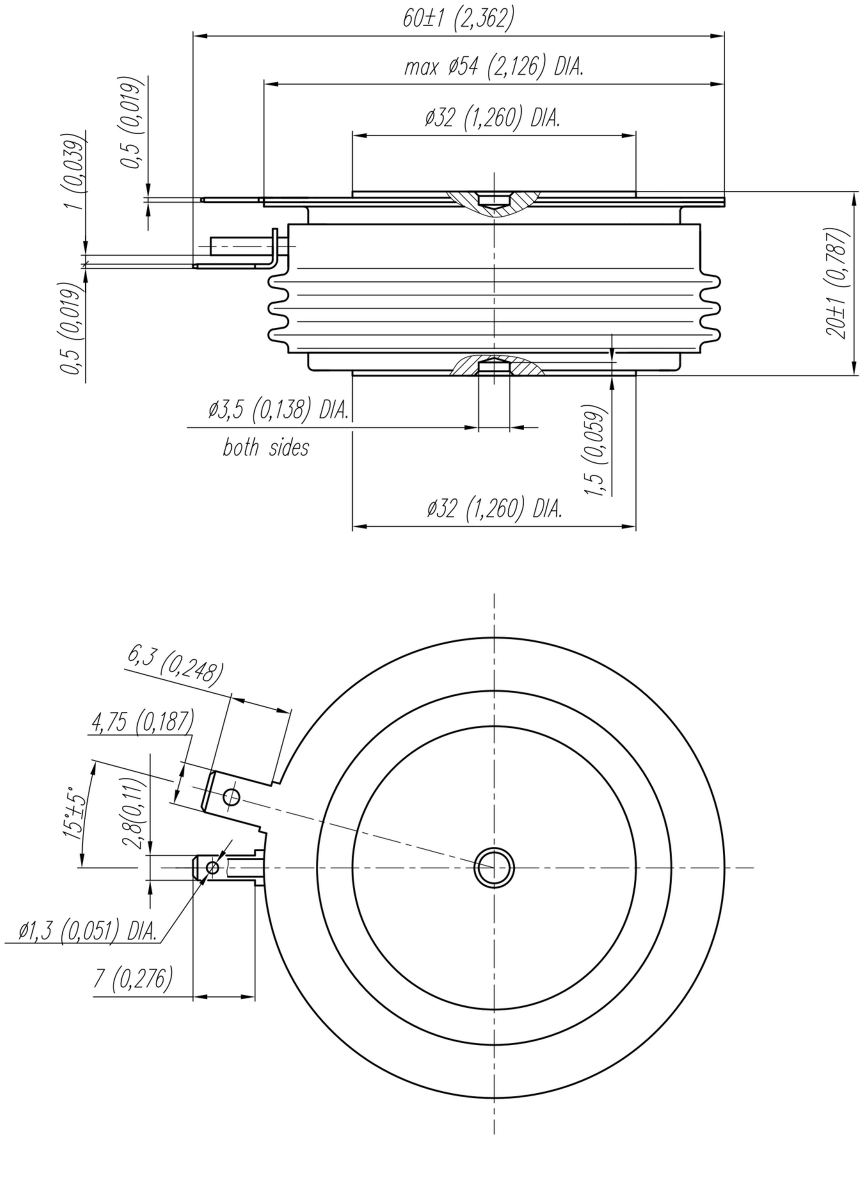
Symbol of group	T4	P4	M4	K4
t_{gt}, μs	1.60	2.00	2.50	3.20

[3]Turn-off time (dv_D/dt=50 V/μs)

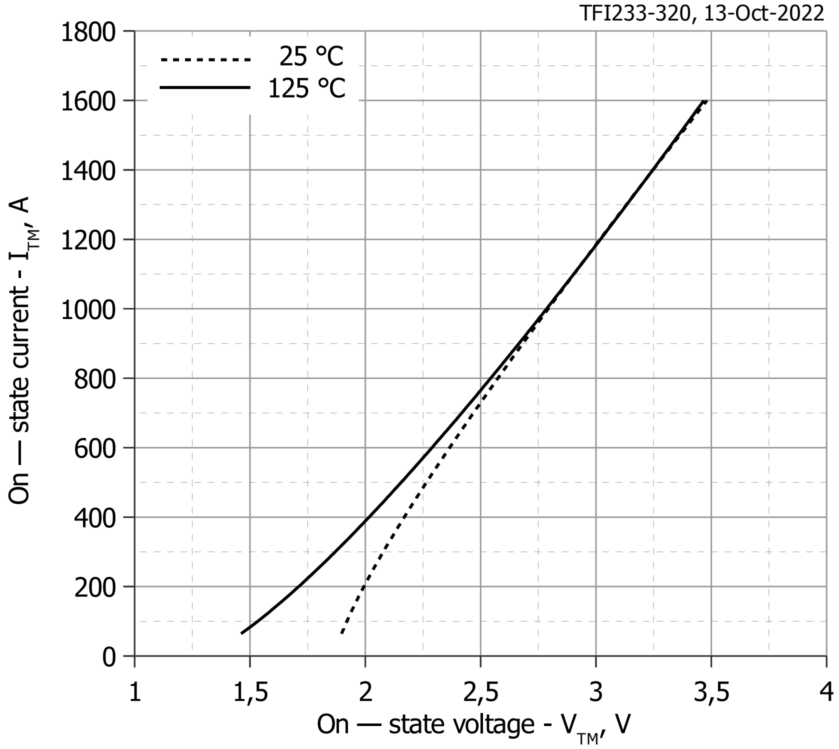
Symbol of group	M3	K3	H3	E3
t_q, μs	25.0	32.0	40.0	50.0

OVERALL DIMENSIONS

Package type: T.B3



All dimensions in millimeters (inches)



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	1.78462222	1.33243844
B	0.00148771	0.00071068
C	0.05693261	-0.04317084
D	-0.02759593	0.03292219

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

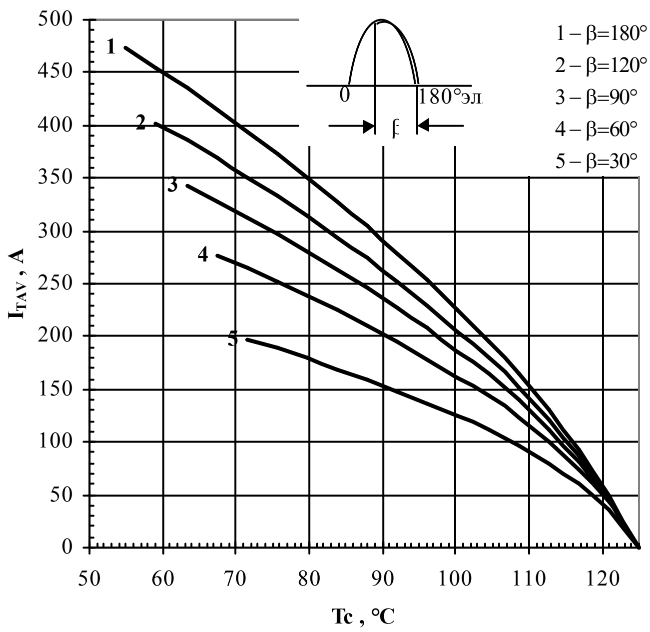


Fig. 2. Maximum allowable mean on-state current I_{TAV} vs. case temperature T_C for sinusoidal current waveforms, f=50 Hz

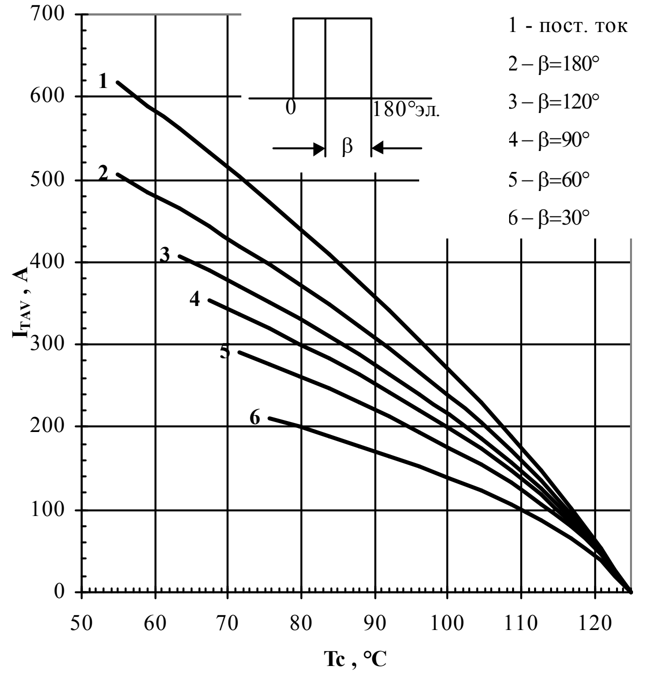


Fig. 3 Maximum allowable mean on-state current I_{TAV} vs. case temperature T_C for rectangular current waveforms and for DC, f=50Hz

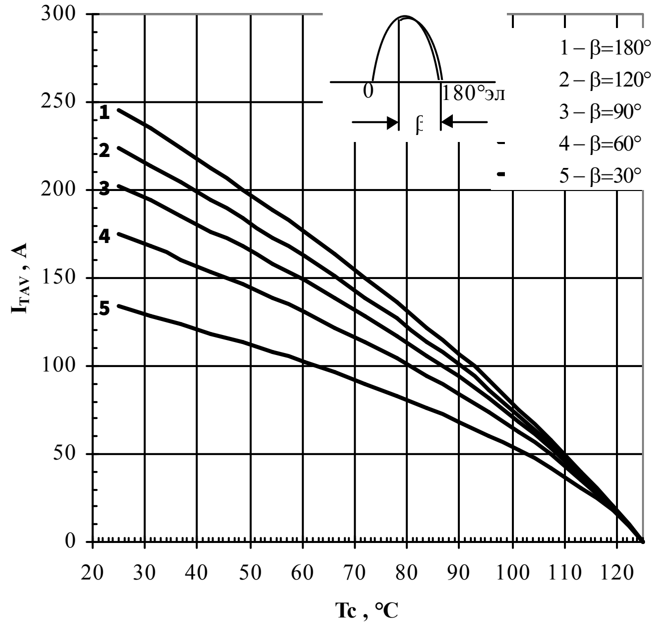


Fig. 4 Maximum allowable mean on-state current I_{TAV} vs. cooling temperature T_a for cooling air force 6 m/s, heatsink O143 and sinusoidal current waveforms at different conduction angles, f=50Hz

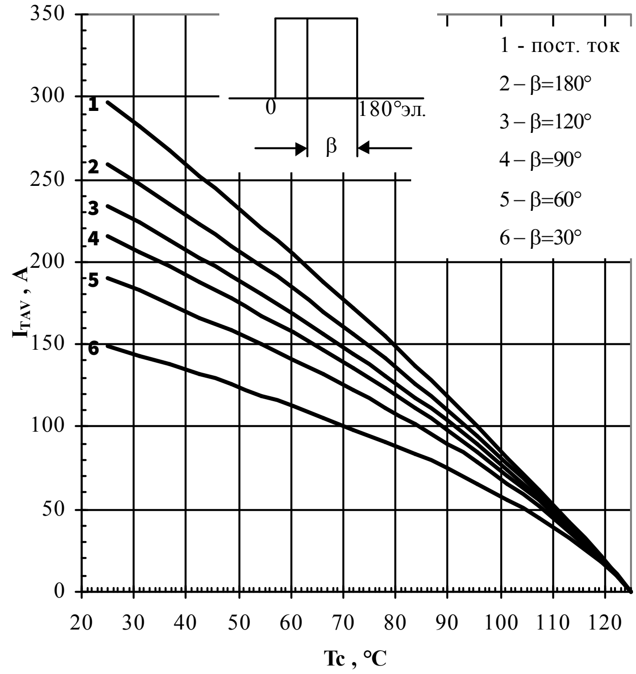


Fig. 5 Maximum allowable mean on-state current I_{TAV} vs. cooling temperature T_a for cooling air force 6 m/s, heatsink O143 and rectangular current waveforms at different conduction angles, f=50Hz

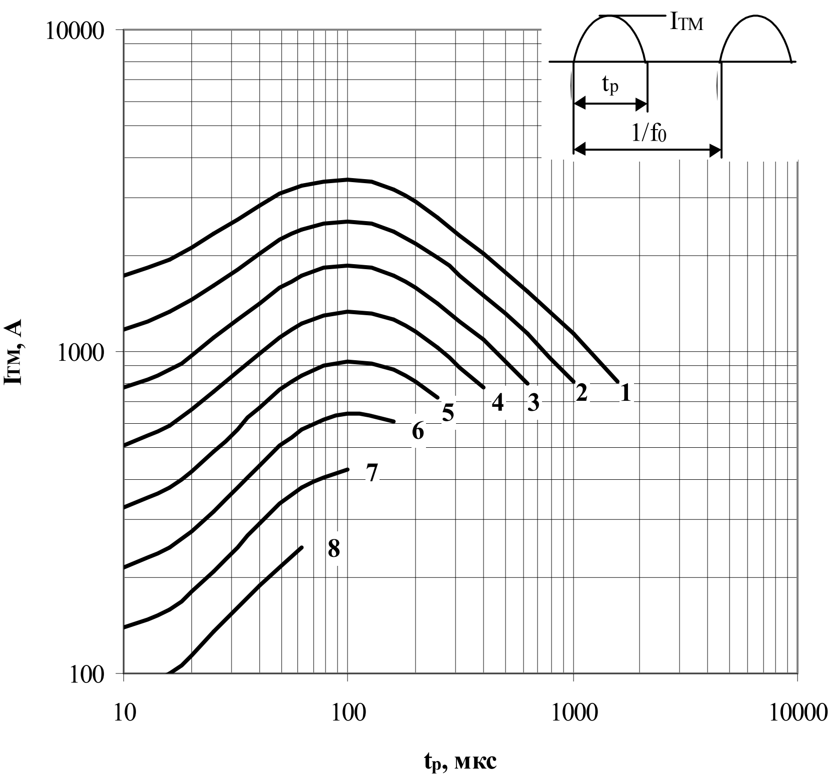


Fig. 6 Maximum allowable mean on-state current I_{TAV} of sinusoidal current waveform vs. pulse duration t_p for case temperature T_c=65 °C at high frequency.
1 – 630 Hz;
2 – 1000 Hz;
3 – 1600 Hz;
4 – 2500 Hz;
5 – 4000 Hz;
6 – 6300 Hz;
7 – 10000 Hz;
8 – 16000 Hz.

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$.

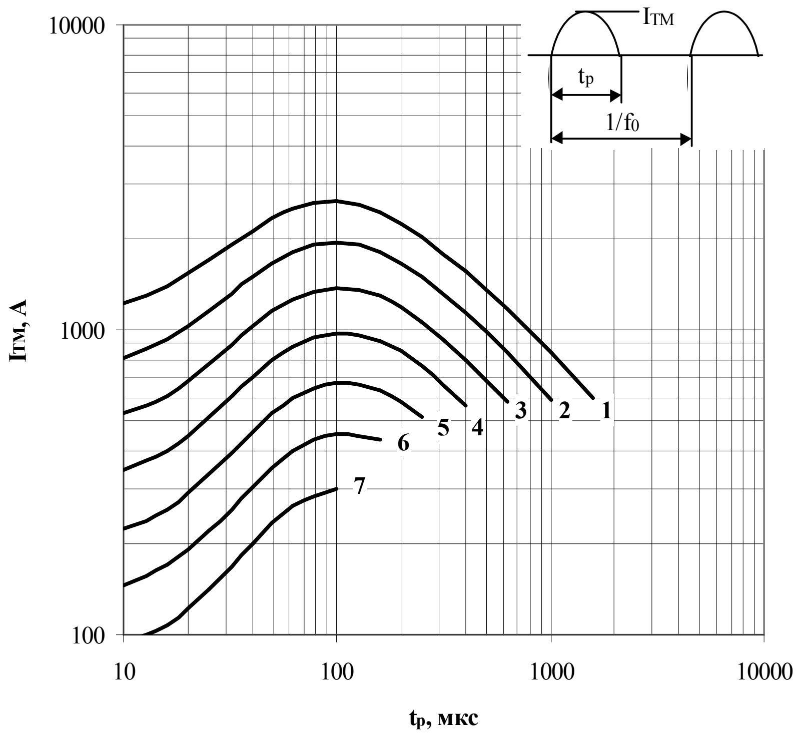


Fig. 7 Maximum allowable mean on-state current I_{TAV} of sinusoidal current waveform vs. pulse duration t_p for case temperature T_c=85 °C at high frequency.

1 – 630 Hz;	5 – 4000 Hz;
2 – 1000 Hz;	6 – 6300 Hz;
3 – 1600 Hz;	7 – 10000 Hz.
4 – 2500 Hz;	

Conditions: V_D=0,67·V_{DRM}; V_R=0,67·V_{RRM}.

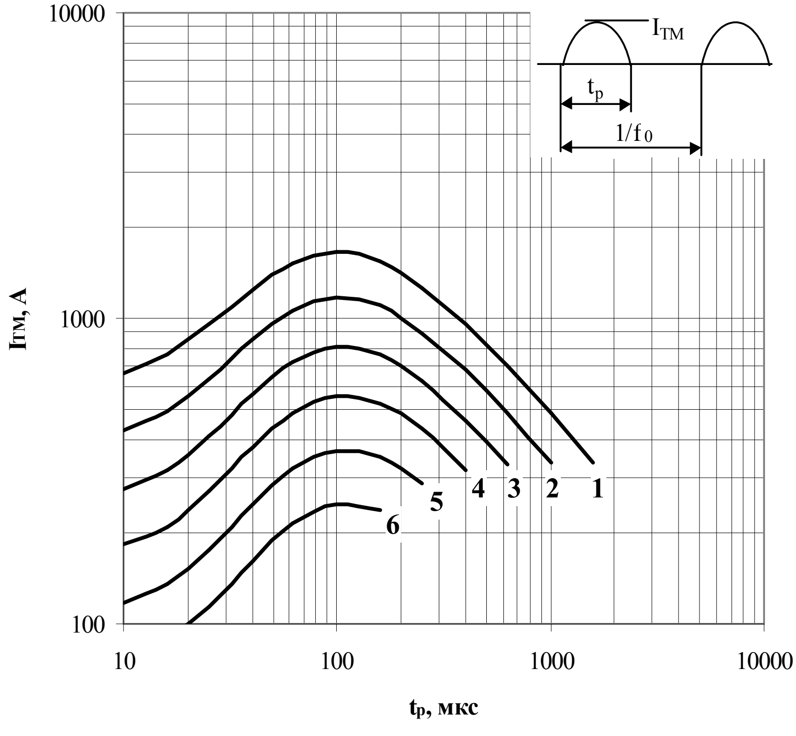


Fig. 8 Maximum allowable mean on-state current I_{TAV} of sinusoidal current waveform vs. pulse duration t_p for case temperature T_c=105 °C at high frequency

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz;
3 – 1600 Hz;	6 – 6300 Hz.

Conditions: V_D=0,67·V_{DRM}; V_R=0,67·V_{RRM}.

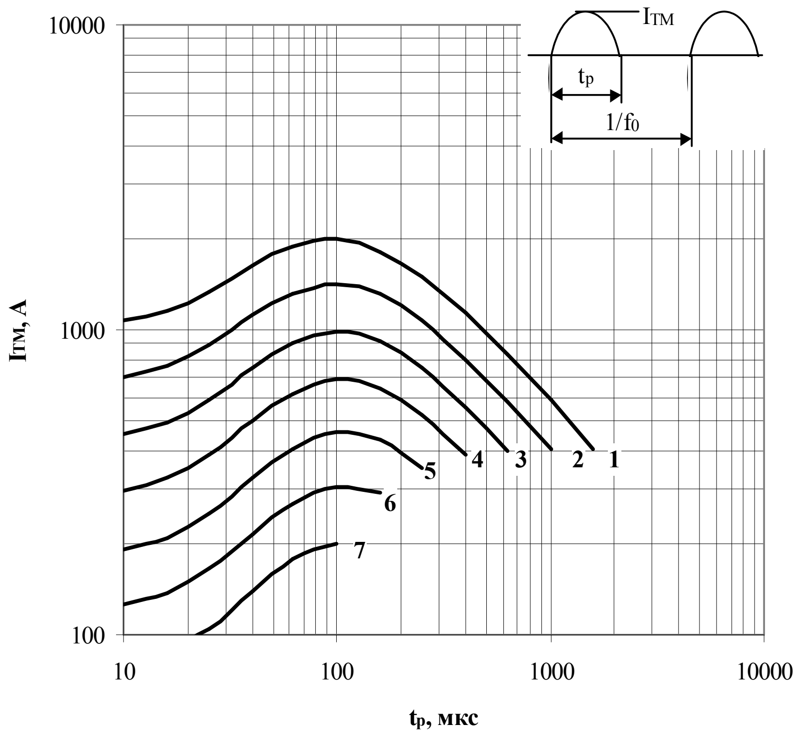


Fig. 9 Maximum allowable mean on-state current I_{TAV} of sinusoidal current waveform vs. pulse duration t_p for cooling temperature T_a=40 °C, cooling air force6 m/s, heat sink 0143 at high frequency.

1 – 630 Hz;	5 – 4000 Hz;
2 – 1000 Hz;	6 – 6300 Hz;
3 – 1600 Hz;	7 – 10000 Hz.
4 – 2500 Hz;	

Conditions: V_D=0,67·V_{DRM}; V_R=0,67·V_{RRM}.

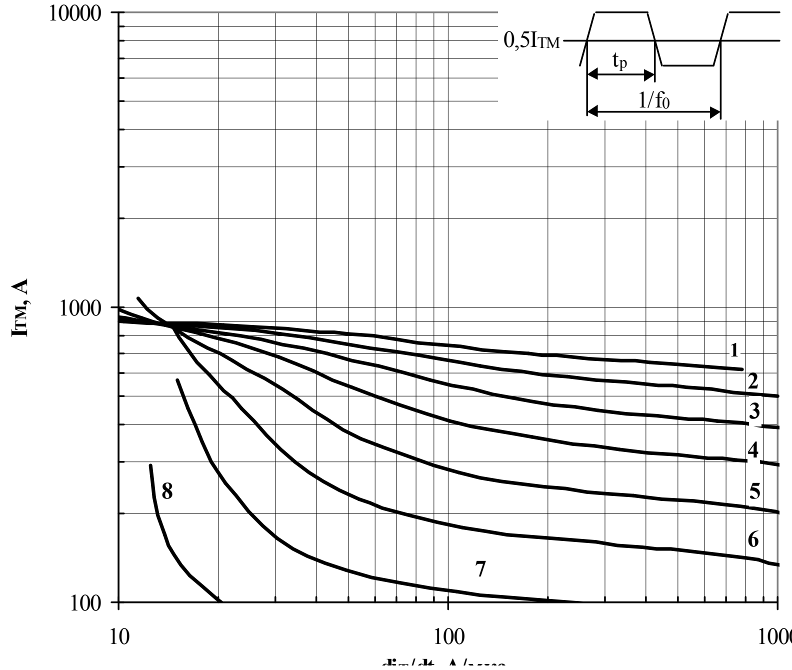


Fig. 10 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. mean on-state current di_T/dt, pulse duration t_p=1/2f_0 and case temperature T_c=65 °C.

1 – 630 Hz;	5 – 4000 Hz;
2 – 1000 Hz;	6 – 6300 Hz;
3 – 1600 Hz;	7 – 10000 Hz;
4 – 2500 Hz;	8 – 16000 Hz

Conditions: V_D=0,67·V_{DRM}; V_R=0,67·V_{RRM}

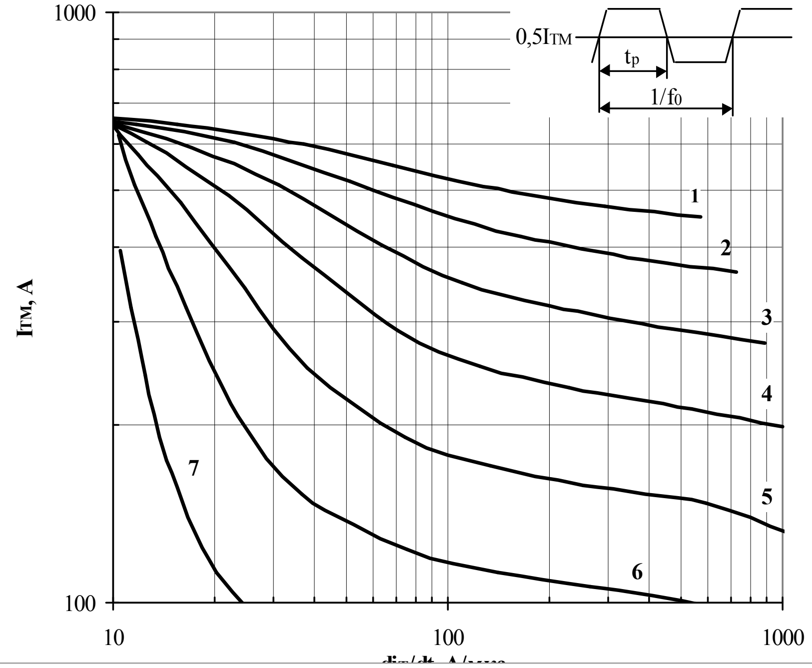


Fig. 11 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/2f_0$ and case temperature $T_c=85$ °C at high frequency.

1 – 630 Hz;	5 – 4000 Hz;
2 – 1000 HZ;	6 – 6300 Hz;
3 – 1600 Hz;	7 – 10000 Hz.
4 – 2500 Hz;	

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $VC_R=0{,}67 \cdot V_{RRM}$

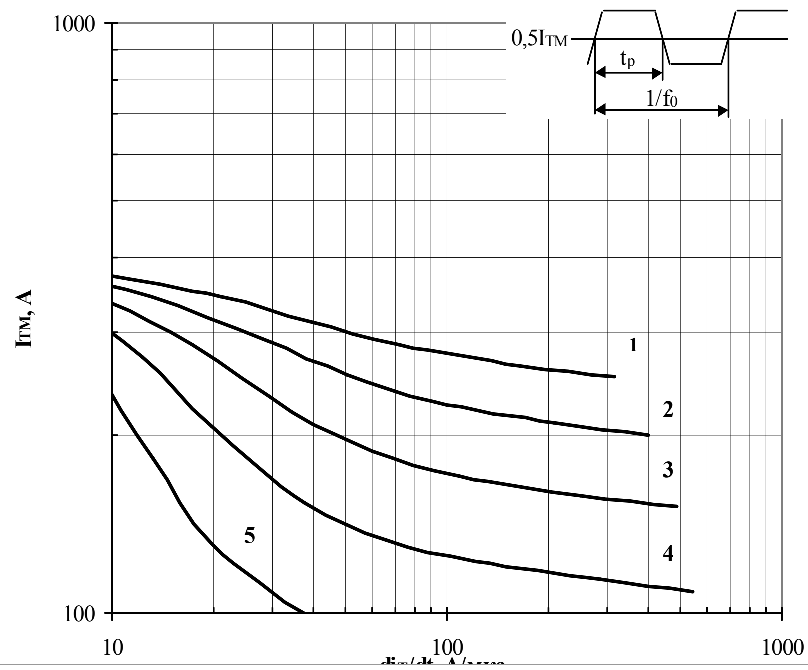


Fig. 12 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/2f_0$ and case temperature $T_c=105$ °C at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz.
3 – 1600 Hz;	

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

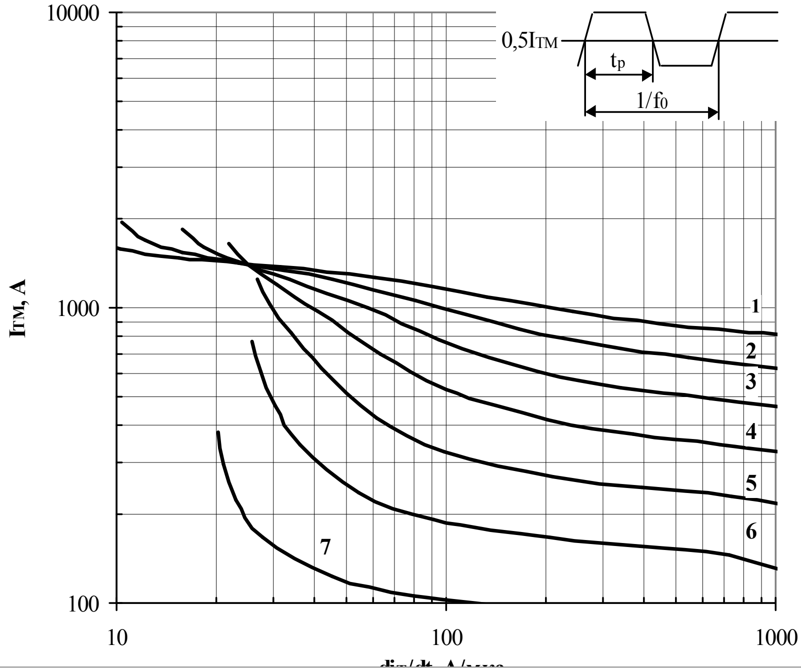


Fig. 13 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/4f_0$ and case temperature $T_c=65$ °C at high frequency.

1 – 630 Hz; 5 – 4000 Hz;
2 – 1000 Hz; 6 – 6300 Hz;
3 – 1600 Hz; 7 – 10000 Hz.
4 – 2500 Hz;

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

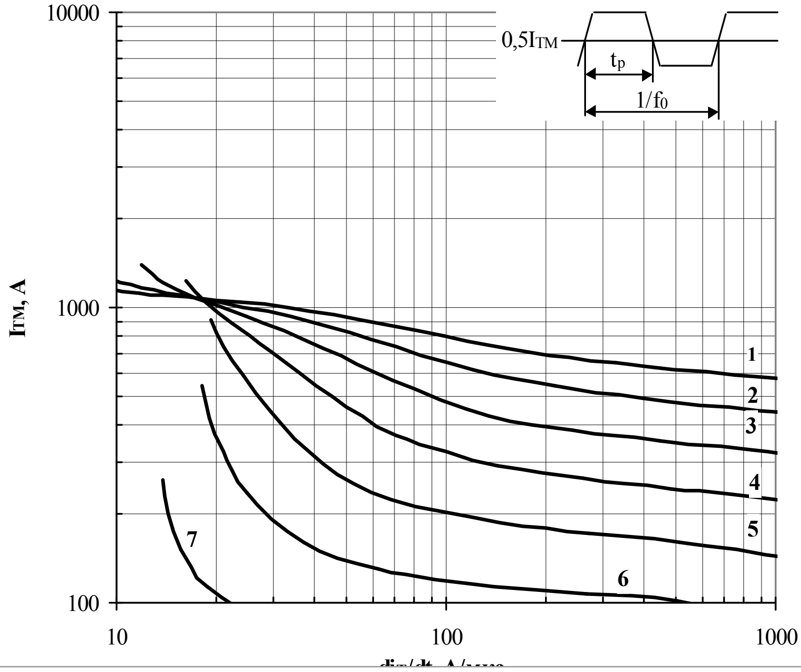


Fig. 14 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/4f_0$ and case temperature $T_c=85$ °C at high frequency.

1 – 630 Hz; 5 – 4000 Hz;
2 – 1000 Hz; 6 – 6300 Hz;
3 – 1600 Hz; 7 – 10000 Hz.
4 – 2500 Hz;

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

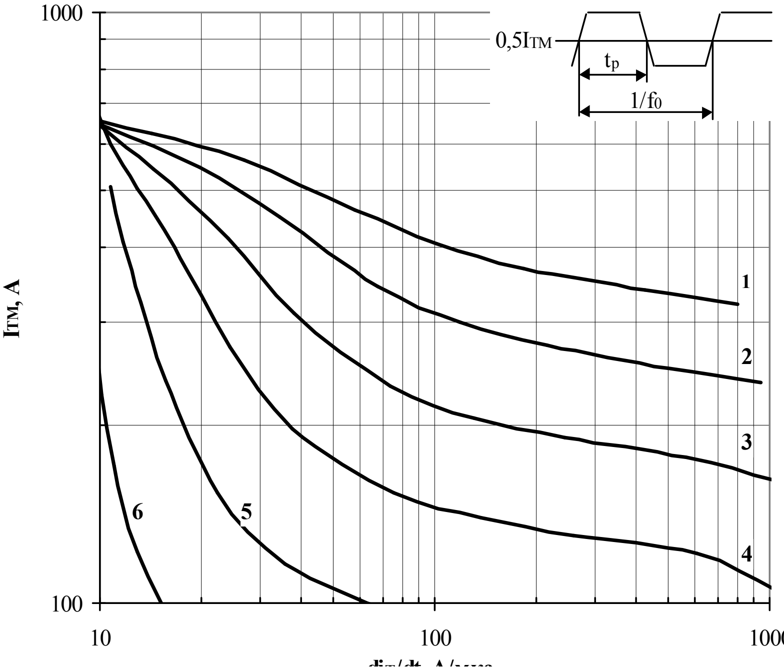


Fig. 15 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/4f_0$ and case temperature $T_c=105$ °C at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz;
3 – 1600 Hz;	6 – 6300 Hz.

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

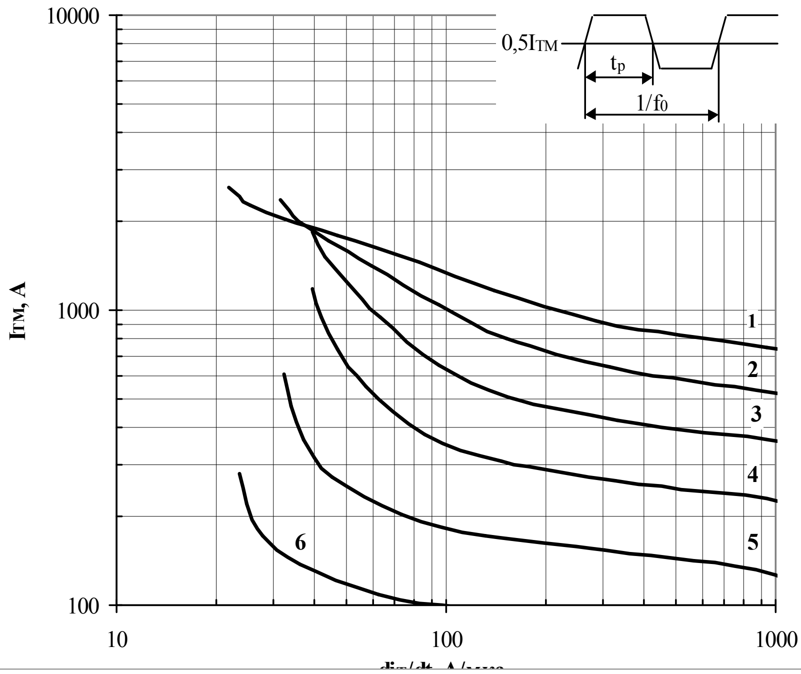


Fig. 16 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/10f_0$ and case temperature $T_c=85$ °C at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz;
3 – 1600 Hz;	6 – 6300 Hz.

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

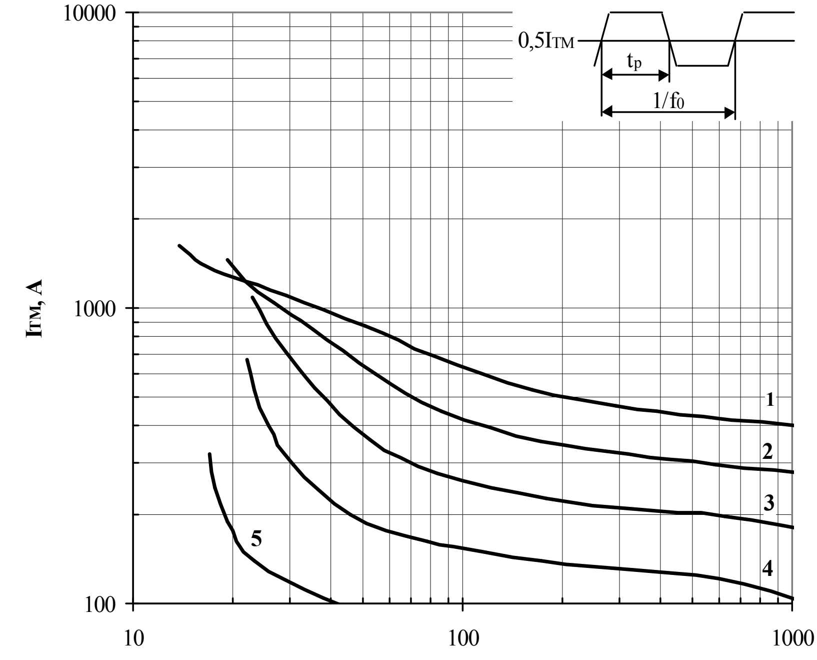


Fig. 17 Maximum allowable mean on-state current I_{TM} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/10f_0$ and case temperature $T_c=105$ °C at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz.
3 – 1600 Hz;	

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

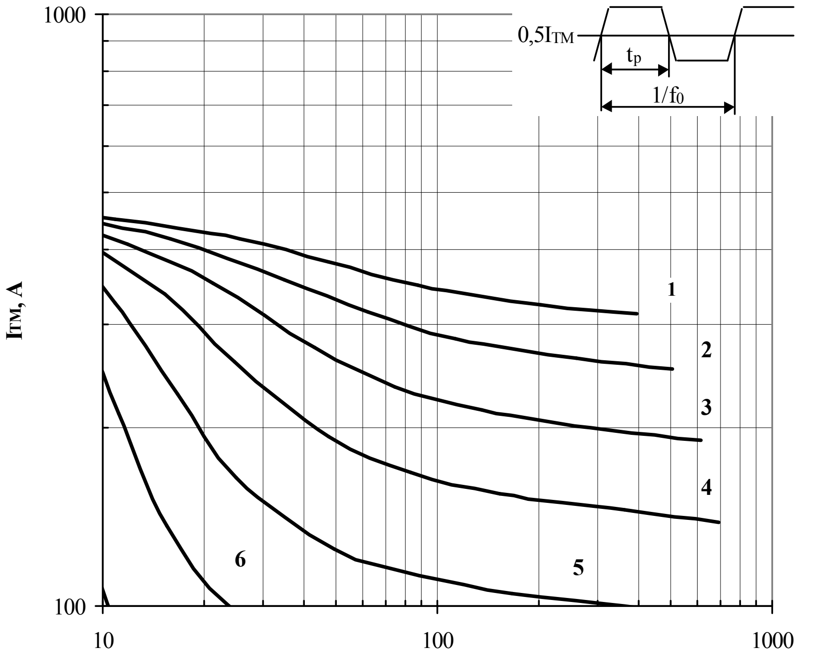


Fig.18 Maximum allowable mean on-state current I_{TAV} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/2f_0$, cooling temperature $T_a=40$ °C, cooling air force 6 m/s, heat sink 0143 at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz;
3 – 1600 Hz;	6 – 6300 Hz.

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

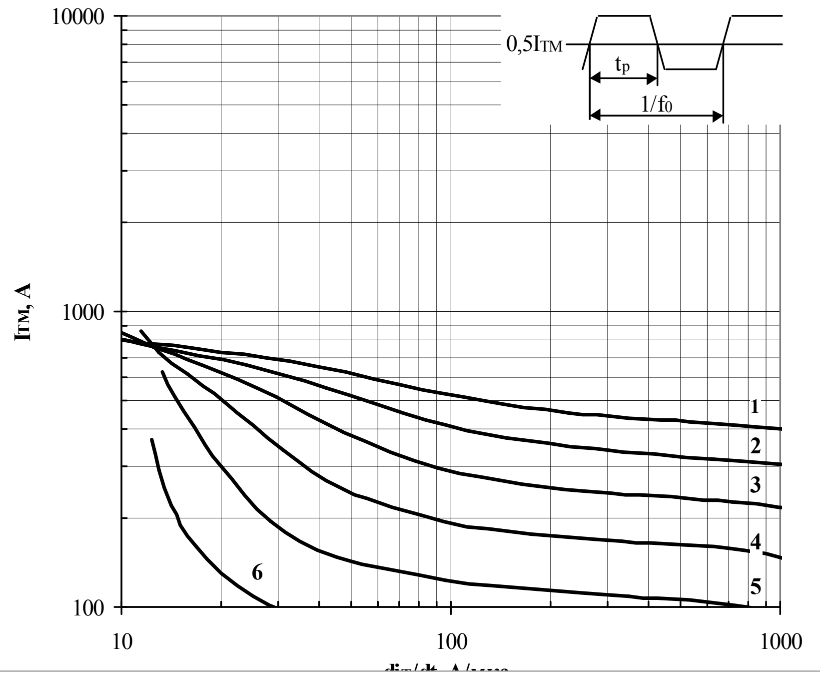


Fig. 19 Maximum allowable mean on-state current I_{TAV} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/4f_0$, cooling temperature T_a=40 °C, cooling air force 6 m/s, heatsink 0143 at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz;
3 – 1600 Hz;	6 – 6300 Hz.

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

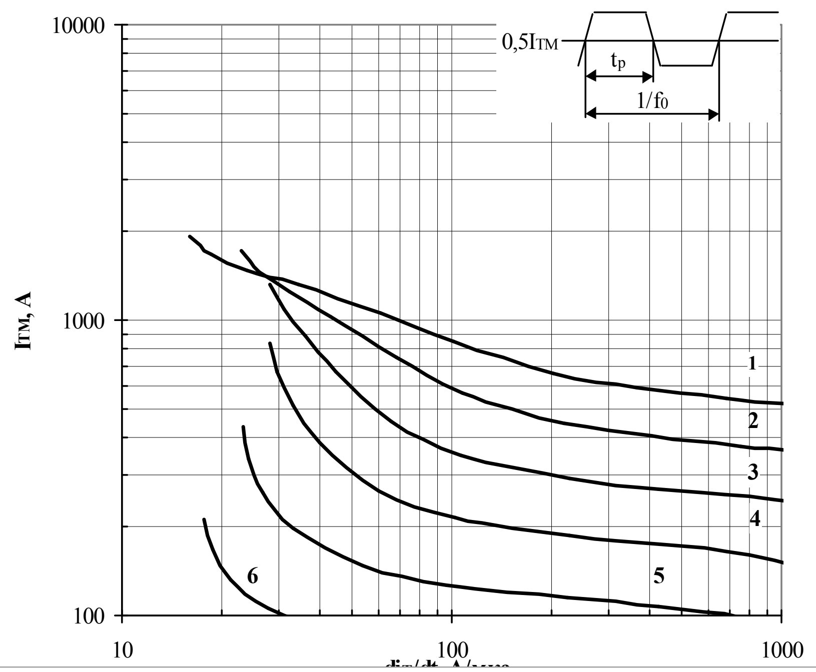


Fig. 20 Maximum allowable mean on-state current I_{TAV} of trapeze current waveform vs. on-state current rise rate di_T/dt for pulse duration $t_p=1/10f_0$, cooling temperature T_a=40 °C, cooling air force 6 m/s, heatsink 0143 at high frequency.

1 – 630 Hz;	4 – 2500 Hz;
2 – 1000 Hz;	5 – 4000 Hz;
3 – 1600 Hz;	6 – 6300 Hz.

Conditions: $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$

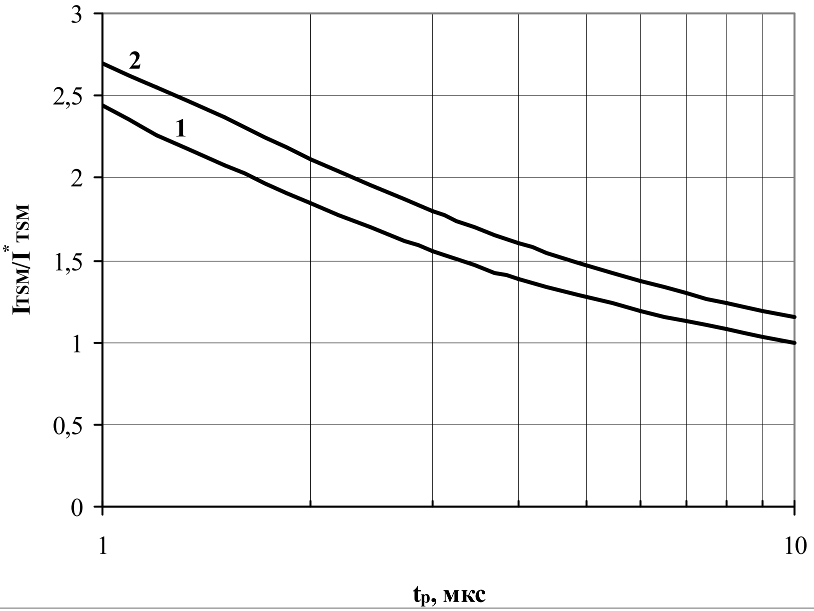


Fig. 21 Maximum allowable surge on-state current I_{TM} vs. pulse duration t_p.
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: V_R=0.
Typical changes are normalized to I^*_{TSM} – maximum allowable surge on-state current for t_p = 10 ms, V_R = 0, junction temperature 125 °C.

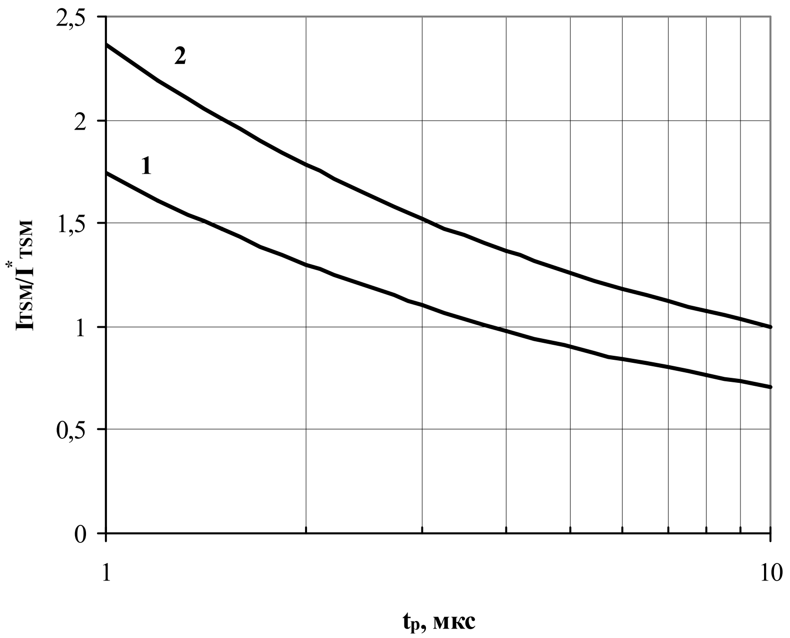


Fig. 22 Maximum allowable surge on-state current I_{TM} vs. pulse duration t_p for initial junction temperature:
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: $V_R=0{,}8 \cdot V_{RRM}$
Typical changes are normalized to I^*_{TSM} – maximum allowable surge on-state current for t_p = 10 ms, V_R = 0, junction temperature 125 °C.

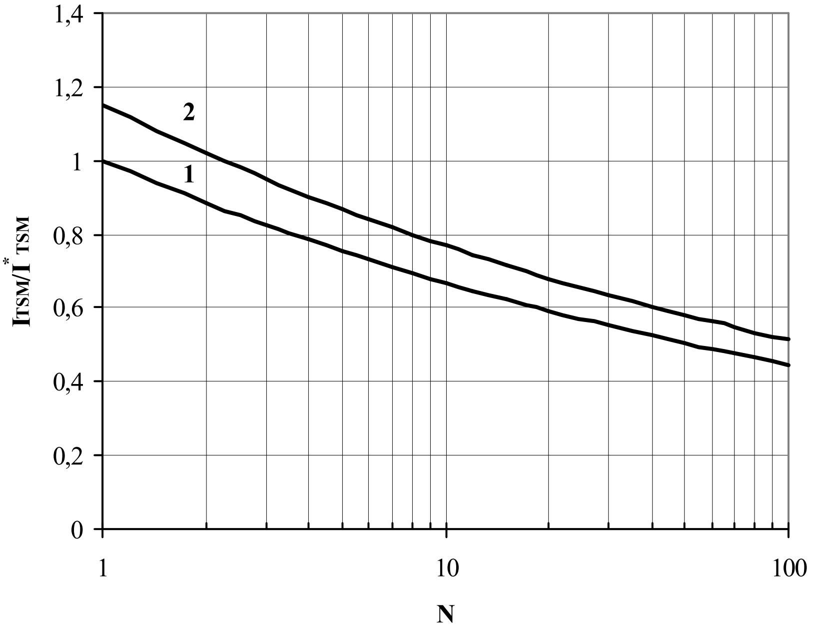


Fig. 23 Maximum allowable surge on-state current I_{TM} vs. pulse quantity of overload current N
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: sinusoidal pulse waveform, duration t_p = 10 ms, f= 50 Hz, on-off time ratio V_R=0.
Typical changes are normalized to I^{*}_{TSM} – maximum allowable single pulse surge on-state current for t_p = 10 ms, V_R = 0, junction temperature 125 °C.

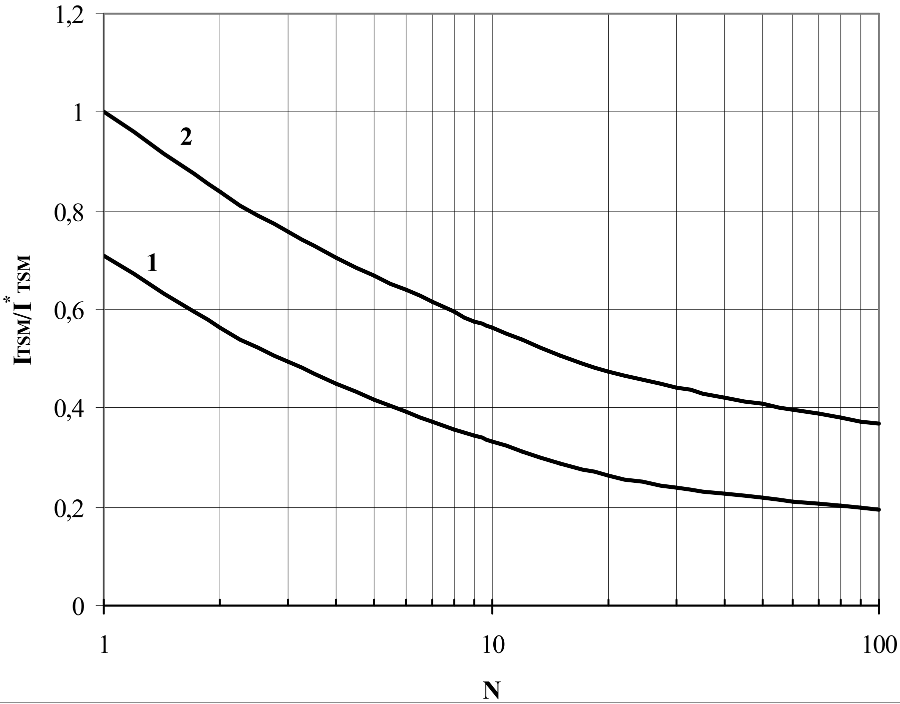
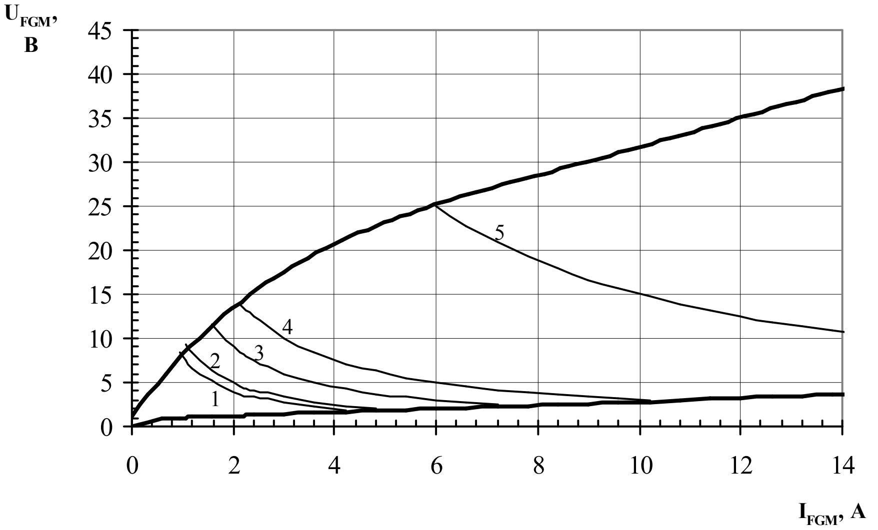


Fig. 24 Maximum allowable surge on-state current I_{TM} vs. pulse quantity of overload current N.
1 – T_j=125 °C
2 – T_j=25 °C

Conditions: sinusoidal pulse waveform, duration t_p = 10 ms, f= 50 Hz, on-off time ratio 2, $V_R=0{,}8\cdot V_{RRM}$.

Typical changes are normalized to I^{*}_{TSM} – maximum allowable surge on-state current for t_p = 10 ms, V_R = 0, junction temperature 125 °C.



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. 25 Gate characteristics.

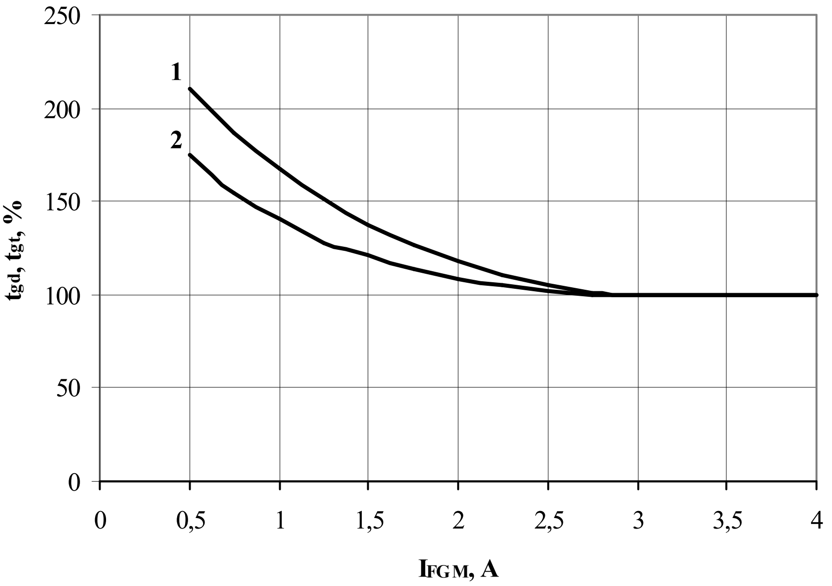


Fig. 26 Delay time t_{gd} (1) and turn-off time t_{gt} (2) vs. gate puls current I_{FGM}

Conditions: T_j=25 °C, V_D=500 V, di_G/dt=1 A/μs, t_G= 10 μs, I_T=I_{TAV}.

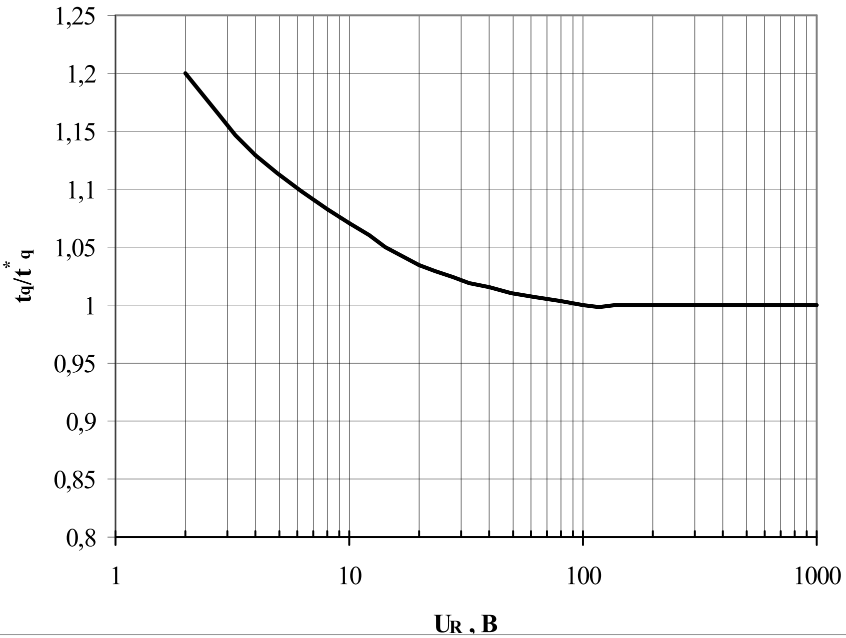


Fig. 27 Turn-on time t_q vs. reverse voltage V_R.

Conditions: T_j=125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=10 A/μs, dU_D/dt=50 V/μs, $V_D=0{,}67 \cdot V_{DRM}$.
Typical changes are normalized to the turn-off time t^*_q for T_j = 125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=10A/μs, V_R=100 V, dV_D/dt=50 v/μs, $V_D=0{,}67 \cdot V_{DRM}$

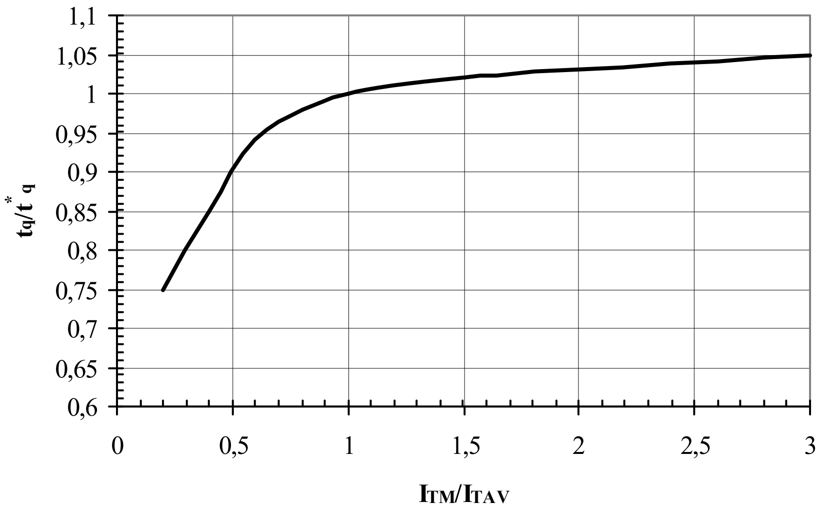


Fig. 28 Turn-off time t_q vs. mean on-state current I_T/I_{TAV}.

Conditions: T_j=125 °C, $(di_T/dt)_f$=10A/μs, V_R=100 B, dV_D/dt=50 V/μs, $V_D=0{,}67 \cdot V_{DRM}$.
Typical changes are normalized to the turn-off time t^*_q for T_j = 125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=10A/μs, V_R=100 V, dV_D/dt=50 v/μs, $V_D=0{,}67 \cdot V_{DRM}$

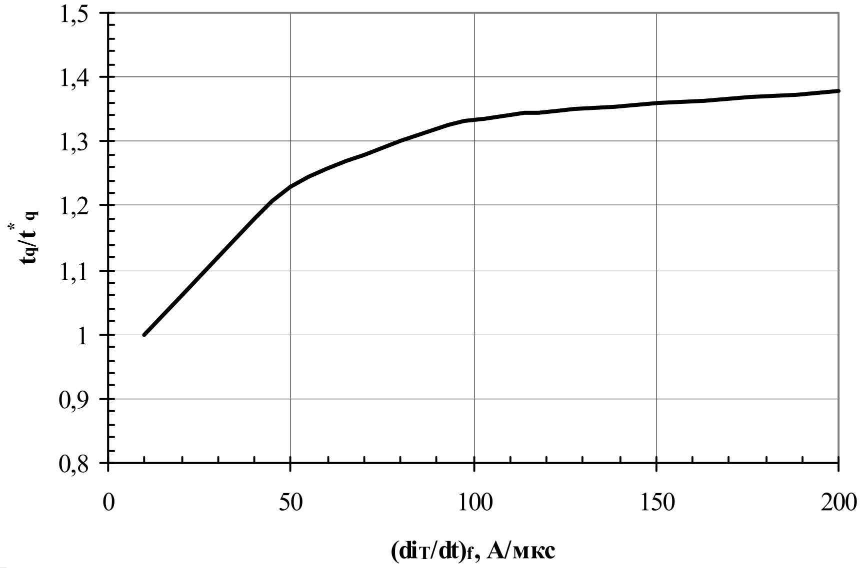


Fig. 29 Turn-on time t_q vs. rate of fall of on-state current$(di_T/dt)_f$.

Conditions: T_j=125 °C, $I_T=I_{TAV}$, V_R=100 V, dV_D/dt=50 V/мкс, $U_D=0{,}67 \cdot U_{DRM}$.
Typical changes are normalized to the turn-off time t^*_q for T_j = 125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=10 A/μs, V_R=100 V, dV_D/dt=50 V/μs, $V_D=0{,}67 \cdot V_{DRM}$.

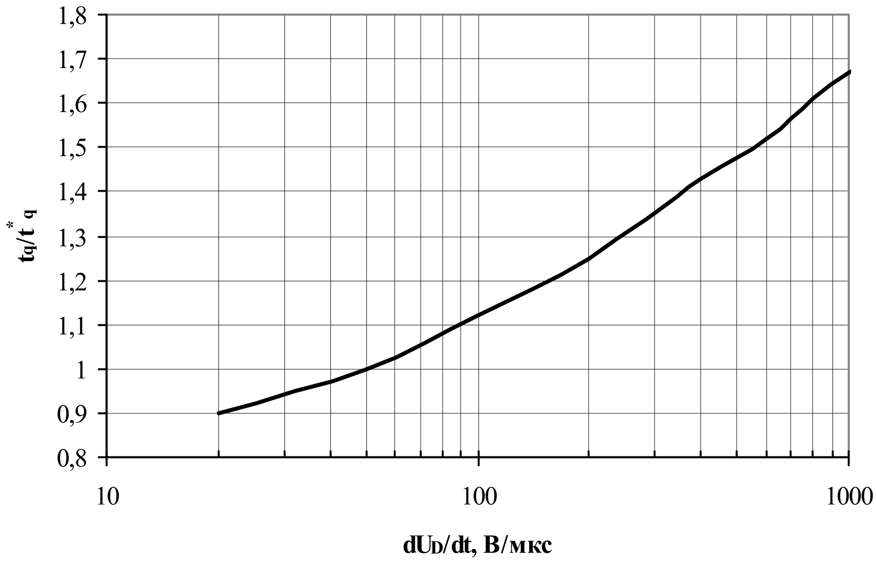


Fig. 30 Turn-on time t_q vs. rate of rise of off-state voltage$(di_T/dt)_f$.

Conditions: T_j=125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=10 A/μs, V_R=100 V, $V_D=0{,}67 \cdot V_{DRM}$.
Typical changes are normalized to the turn-off time t^*_q for T_j = 125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=10 A/μs, V_R=100 V, dV_D/dt=50 V/μs, $V_D=0{,}67 \cdot V_{DRM}$.

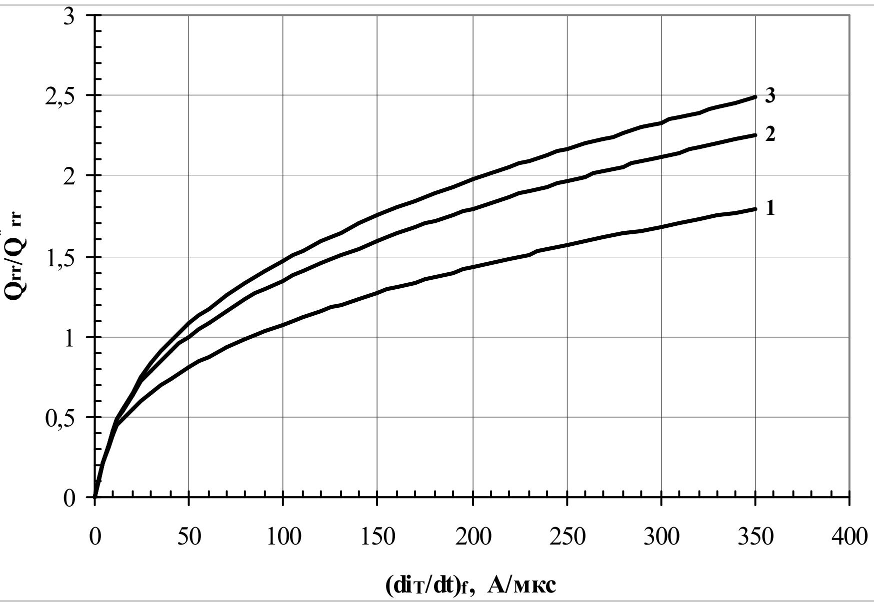


Fig. 31 Reverse recovery charge Q_{rr} vs. rate of fall of on-state current$(di_T/dt)_f$.

1 - $I_T=0{,}5 \cdot I_{TAV}$;

2 - $I_T=I_{TAV}$;

3 - $I_T=1{,}5 \cdot I_{TAV}$.

Conditions: T_j = 125 °C, V_R=100 V.
Typical changes are normalized to the reverse recovery charge Q^*_{rr} for T_j = 125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=50 A/μs, V_R=100 V.

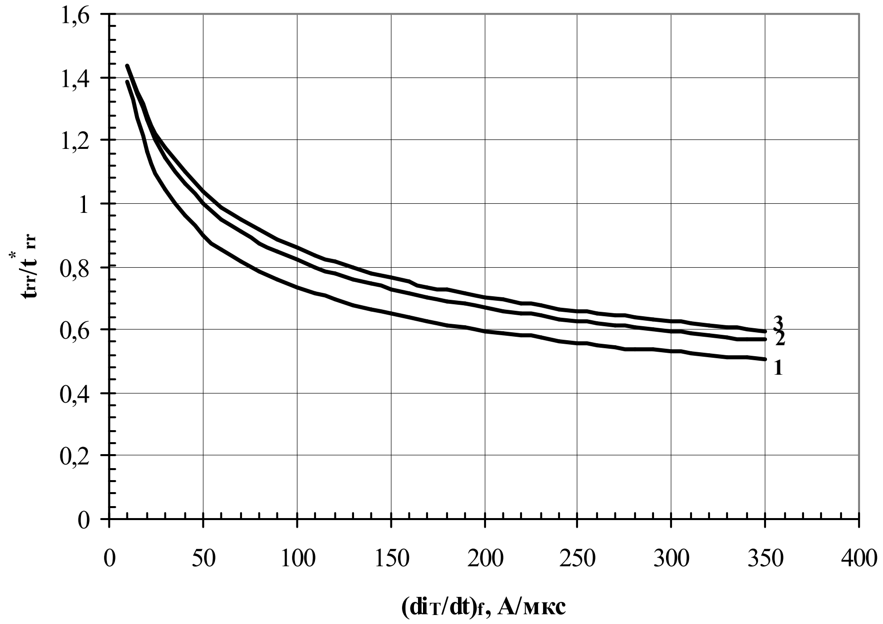


Fig. 32 Typical reverse recovery charge t_{rr} vs. rate of fall of on-state current$(di_T/dt)_f$.

1 - $I_T=0{,}5 \cdot I_{TAV}$;

2 - $I_T=I_{TAV}$;

3 - $I_T=1{,}5 \cdot I_{TAV}$.

Conditions: T_j = 125 °C, V_R=100 V.
Typical changes are normalized to the reverse recovery charge t^*_{rr} for T_j = 125 °C, $I_T=I_{TAV}$, $(di_T/dt)_f$=50 A/μs, V_R=100 V.

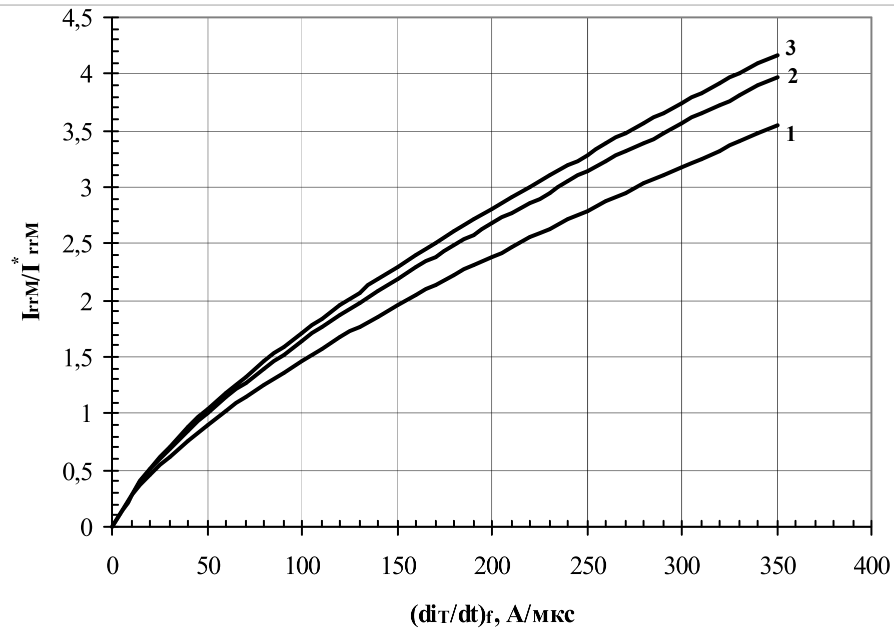


Fig. 33 Typical reverse recovery current I_{rrM} vs. rate of fall of on-state current$(di_T/dt)_f$.

1 - I_T=0,5·I_{TAV} ;

2 - I_T=I_{TAV} ;

3 - I_T=1,5·I_{TAV} .

Conditions: T_j = 125 °C, V_R=100 V.

Typical changes are normalized to the reverse recovery current I_{rrM} for T_j = 125 °C, I_T=I_{TAV}, $(di_T/dt)_f$=50 A/μs, V_R=100 V.

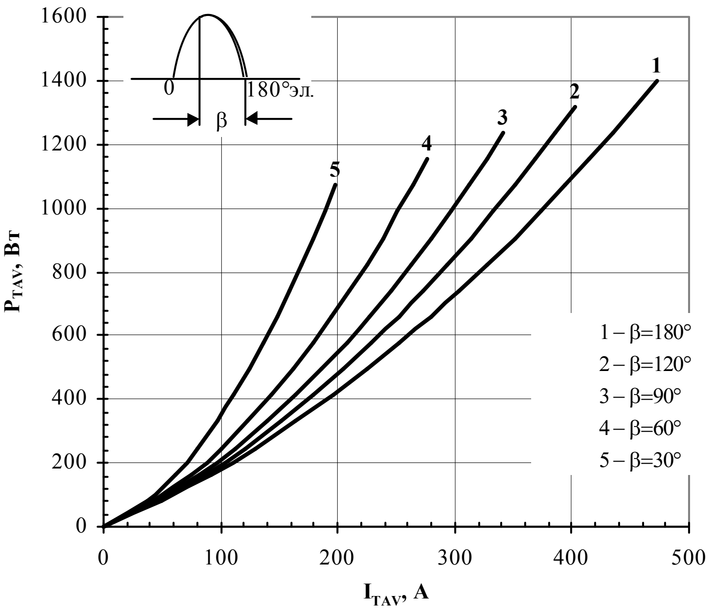


Fig. 34 Mean on-state power dissipation P_{TAV} vs. mean on-state current for sinusoidal current waveforms at different conduction angles, f=50Hz

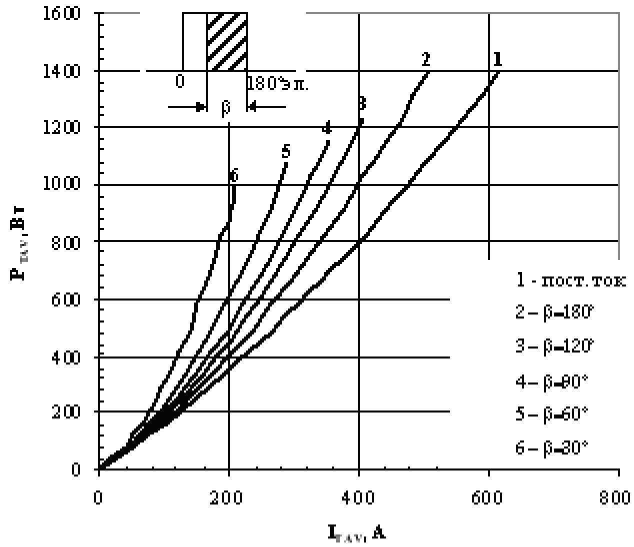


Fig. 35 Mean on-state power dissipation P_{TAV} vs. mean on-state current for rectangular current waveforms at different conduction angles, f=50Hz and DC.

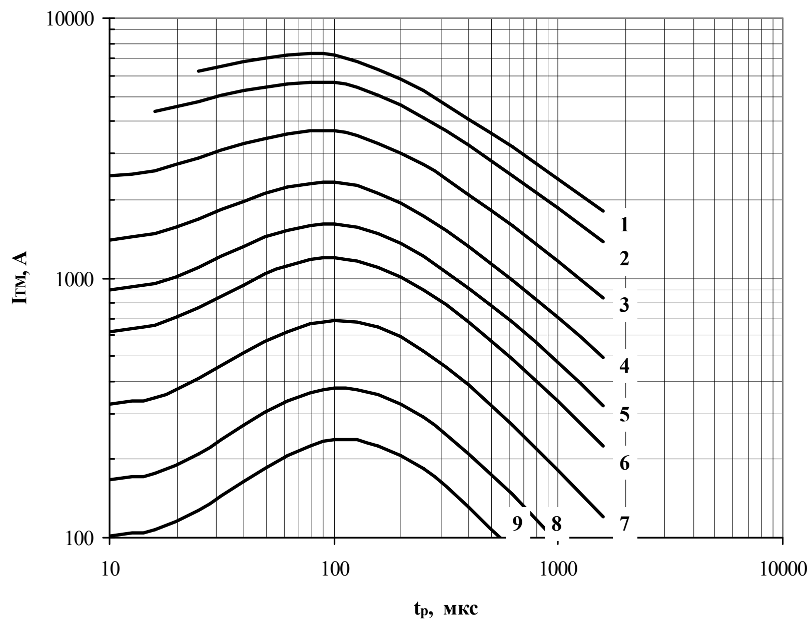


Fig. 36 Total power loss of one sinusoidal on-state current pulse vs. pulse duration t_p and current I_{TM}

Total power loss:

1 – 6 G;
2 – 4 G;
3 – 2 G;
4 – 1 G;
5 – 0,6 G;
6 – 0,4 G;
7 – 0,2 G;
8 – 0,1 G;
9 – 0,06 G.

Conditions: V_D=0,67·V_{DRM}; V_R=0,67·V_{RRM}.

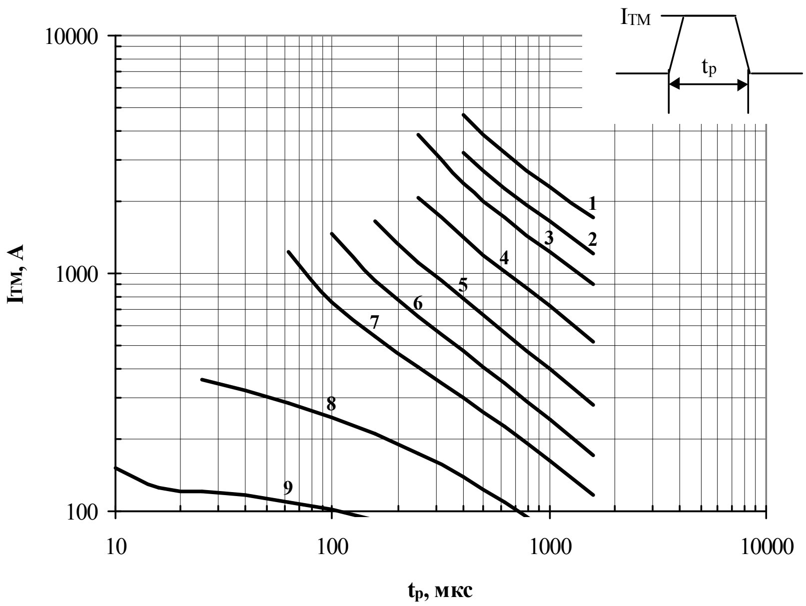


Fig. 37 Total power loss of one trapeze on-state current pulse vs. pulse duration t_p and current I_{TM}

Total power loss:

1 – 10 G;	6 – 0,6 G;
2 – 6 G;	7 – 0,4 G;
3 – 4 G;	8 – 0,2 G;
4 – 2 G;	9 – 0,1 G.
5 – 1 G;	

Conditions: di_T/dt = 50 A/μs; $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$.

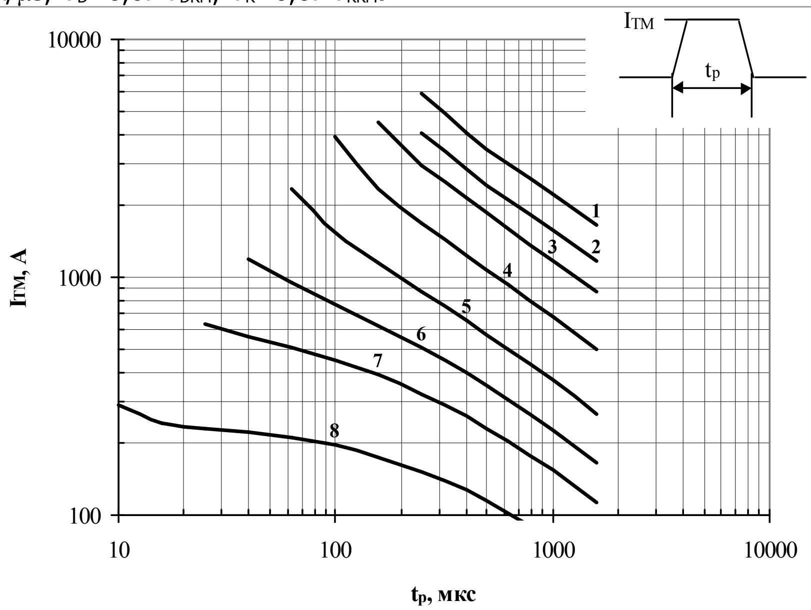


Fig. 38

Total power loss of one trapeze on-state current pulse vs. pulse duration t_p and current I_{TM}

Total power loss:

1 – 10 G;
2 – 6 G;
3 – 4 G;
4 – 2 G;
5 – 1 G;
6 – 0,6 G;
7 – 0,4 G;
8 – 0,2 G.

Conditions: di_T/dt = 100 A/ μs; $V_D=0{,}67 \cdot V_{DRM}$; $V_R=0{,}67 \cdot V_{RRM}$.

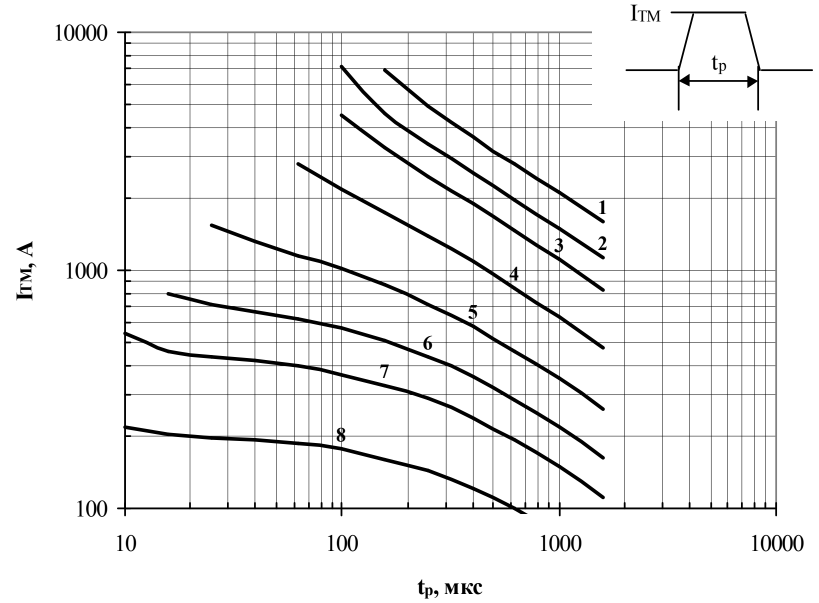


Fig. 39 Total power loss of one trapeze on-state current pulse vs. pulse duration t_p and current I_{TM} Total power loss: 1 – 10 G; 2 – 6 G; 3 – 4 G; 4 – 2 G; 5 – 1 G; 6 – 0,6 G; 7 – 0,4 G; 8 – 0,2 G.
Conditions: di_T/dt = 200 A/μs; V_D=0,67·V_{DRM}; V_R=0,67·V_{RRM}.