



Optimum power handling  
Low on-state and switching losses  
Designed for traction and industrial applications

## Phase Control Stud Thyristor Type T171-320-16

Mean on-state current							I <sub>TAV</sub>			320 A						
Repetitive peak off-state voltage*							V <sub>DRM</sub>			100÷1600 V						
Repetitive peak reverse voltage*							V <sub>RRM</sub>									
Turn-off time							t <sub>q</sub>			125 μs						
V <sub>DRM</sub> , V <sub>RRM</sub> , V	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Voltage code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
T <sub>j</sub> , °C	-60÷125															

\* **1800 V** – Voltage class on demand

### MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I <sub>TAV</sub>	Mean on-state current	A	320 355	T <sub>c</sub> = 90 °C; T <sub>c</sub> = 85 °C; 180° half-sine wave; 50 Hz	
I <sub>TRMS</sub>	RMS on-state current	A	502	T <sub>c</sub> = 90 °C; 180° half-sine wave; 50 Hz	
I <sub>TSM</sub>	Surge on-state current	kA	10.0 12.0	T <sub>j</sub> =T <sub>j max</sub> T <sub>j</sub> =25 °C	180° half-sine wave; 50 Hz (t <sub>p</sub> =10 ms); single pulse; V <sub>D</sub> =V <sub>R</sub> =0 V; Gate pulse: I <sub>G</sub> =2 A; t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs
			11.0 13.0	T <sub>j</sub> =T <sub>j max</sub> T <sub>j</sub> =25 °C	180° half-sine wave; 60 Hz (t <sub>p</sub> =8.3 ms); single pulse; V <sub>D</sub> =V <sub>R</sub> =0 V; Gate pulse: I <sub>G</sub> =2 A; t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs
I <sup>2</sup> t	Safety factor	A <sup>2</sup> s·10 <sup>3</sup>	500 720	T <sub>j</sub> =T <sub>j max</sub> T <sub>j</sub> =25 °C	180° half-sine wave; 50 Hz (t <sub>p</sub> =10 ms); single pulse; V <sub>D</sub> =V <sub>R</sub> =0 V; Gate pulse: I <sub>G</sub> =2 A; t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs
			500 700	T <sub>j</sub> =T <sub>j max</sub> T <sub>j</sub> =25 °C	180° half-sine wave; 60 Hz (t <sub>p</sub> =8.3 ms); single pulse; V <sub>D</sub> =V <sub>R</sub> =0 V; Gate pulse: I <sub>G</sub> =2 A; t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs
BLOCKING					
V <sub>DRM</sub> , V <sub>RRM</sub>	Repetitive peak off-state and Repetitive peak reverse voltages	V	100÷1600	T <sub>j min</sub> < T <sub>j</sub> <T <sub>j max</sub> ; 180° half-sine wave; 50 Hz; Gate open	
V <sub>DSM</sub> , V <sub>RSM</sub>	Non-repetitive peak off-state and Non-repetitive peak reverse voltages	V	110÷1700	T <sub>j min</sub> < T <sub>j</sub> <T <sub>j max</sub> ; 180° half-sine wave; 50 Hz;single pulse; Gate open	
V <sub>D</sub> , V <sub>R</sub>	Direct off-state and Direct reverse voltages	V	0.75·V <sub>DRM</sub> 0.75·V <sub>RRM</sub>	T <sub>j</sub> =T <sub>j max</sub> ; Gate open	

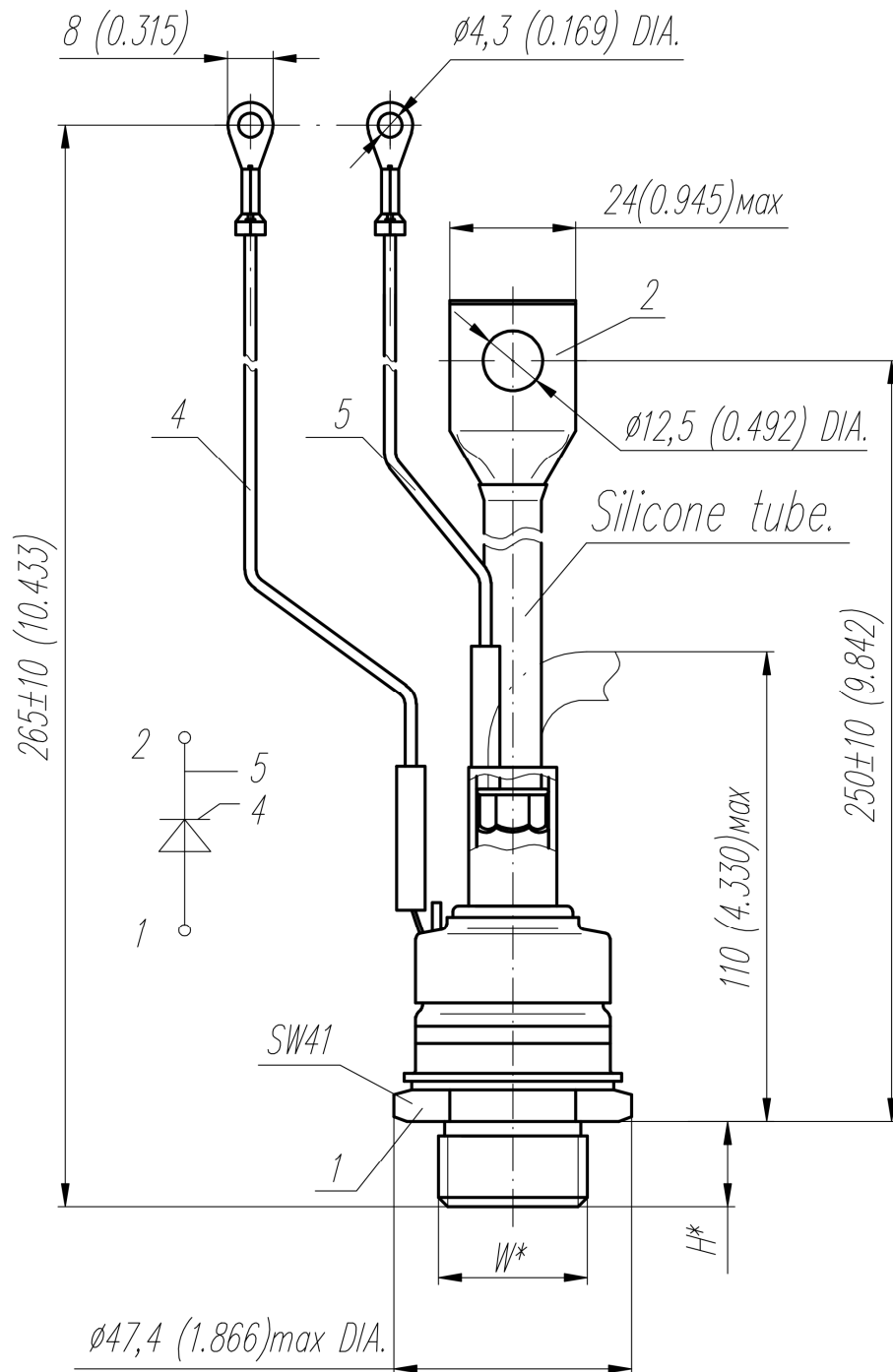
TRIGGERING				
$I_{FGM}$	Peak forward gate current	A	6	$T_j = T_{j\max}$
$V_{RGM}$	Peak reverse gate voltage	V	5	
$P_G$	Gate power dissipation	W	3	$T_j = T_{j\max}$ for DC gate current
SWITCHING				
$(di_T/dt)_{crit}$	Critical rate of rise of on-state current non-repetitive (f=1 Hz)	A/ $\mu$ s	320	$T_j = T_{j\max}$ ; $V_D = 0.67 \cdot V_{DRM}$ ; $I_{TM} = 2 I_{TAV}$ ; Gate pulse: $I_G = 2$ A; $t_{GP} = 50 \mu$ s; $di_G/dt \geq 1$ A/ $\mu$ s
THERMAL				
$T_{stg}$	Storage temperature	$^{\circ}$ C	-60÷125	
$T_j$	Operating junction temperature	$^{\circ}$ C	-60÷125	
MECHANICAL				
M	Tightening torque	Nm	25÷35	
a	Acceleration	m/s <sup>2</sup>	100	

## CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V <sub>TM</sub>	Peak on-state voltage, max	V	1.60	T <sub>j</sub> =25 °C; I <sub>TM</sub> = 1005 A	
V <sub>T(TO)</sub>	On-state threshold voltage, max	V	0.95	T <sub>j</sub> =T <sub>j max</sub> ;	
r <sub>T</sub>	On-state slope resistance, max	mΩ	0.510	0.5 π I <sub>TAV</sub> < I <sub>T</sub> < 1.5 π I <sub>TAV</sub>	
I <sub>L</sub>	Latching current, max	mA	700	T <sub>j</sub> =25 °C; V <sub>D</sub> =12 V; Gate pulse: I <sub>G</sub> =2 A; t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs	
I <sub>H</sub>	Holding current, max	mA	300	T <sub>j</sub> =25 °C; V <sub>D</sub> =12 V; Gate open	
BLOCKING					
I <sub>DRM</sub> , I <sub>RRM</sub>	Repetitive peak off-state and Repetitive peak reverse currents, max	mA	70	T <sub>j</sub> =T <sub>j max</sub> ; V <sub>D</sub> =V <sub>DRM</sub> ; V <sub>R</sub> =V <sub>RRM</sub>	
(dv <sub>D</sub> /dt) <sub>crit</sub>	Critical rate of rise of off-state voltage <sup>1)</sup> , min	V/μs	1000	T <sub>j</sub> =T <sub>j max</sub> ; V <sub>D</sub> =0.67·V <sub>DRM</sub> ; Gate open	
TRIGGERING					
V <sub>GT</sub>	Gate trigger direct voltage, max	V	4.00 2.50 2.00	T <sub>j</sub> = T <sub>j min</sub> T <sub>j</sub> =25 °C T <sub>j</sub> = T <sub>j max</sub>	V <sub>D</sub> =12 V; I <sub>D</sub> =3 A; Direct gate current
I <sub>GT</sub>	Gate trigger direct current, max	mA	400 250 200	T <sub>j</sub> = T <sub>j min</sub> T <sub>j</sub> = 25 °C T <sub>j</sub> = T <sub>j max</sub>	
V <sub>GD</sub>	Gate non-trigger direct voltage, min	V	0.25	T <sub>j</sub> =T <sub>j max</sub> ; V <sub>D</sub> =0.67·V <sub>DRM</sub> ;	
I <sub>GD</sub>	Gate non-trigger direct current, min	mA	10.00	Direct gate current	
SWITCHING					
t <sub>gd</sub>	Delay time	μs	2.00	T <sub>j</sub> =25 °C; V <sub>D</sub> =0.4·V <sub>DRM</sub> ; I <sub>TM</sub> =I <sub>TAV</sub> ; Gate pulse: I <sub>G</sub> =2 A; t <sub>GP</sub> =50 μs; di <sub>G</sub> /dt≥1 A/μs	
t <sub>q</sub>	Turn-off time <sup>2)</sup> , max	μs	125	dv <sub>D</sub> /dt=50 V/μs; T <sub>j</sub> =T <sub>j max</sub> ; I <sub>TM</sub> = I <sub>TAV</sub> ; di <sub>R</sub> /dt=-10 A/μs; V <sub>R</sub> =100V; V <sub>D</sub> = 0.67·V <sub>DRM</sub> ;	

THERMAL				
R <sub>thjc</sub>	Thermal resistance, junction to case, max	°C/W	0.0800	Direct current
MECHANICAL				
w	Weight, typ	g	440	
D <sub>s</sub>	Surface creepage distance	mm (inch)	12.40 (4.882)	
D <sub>a</sub>	Air strike distance	mm (inch)	12.40 (4.882)	

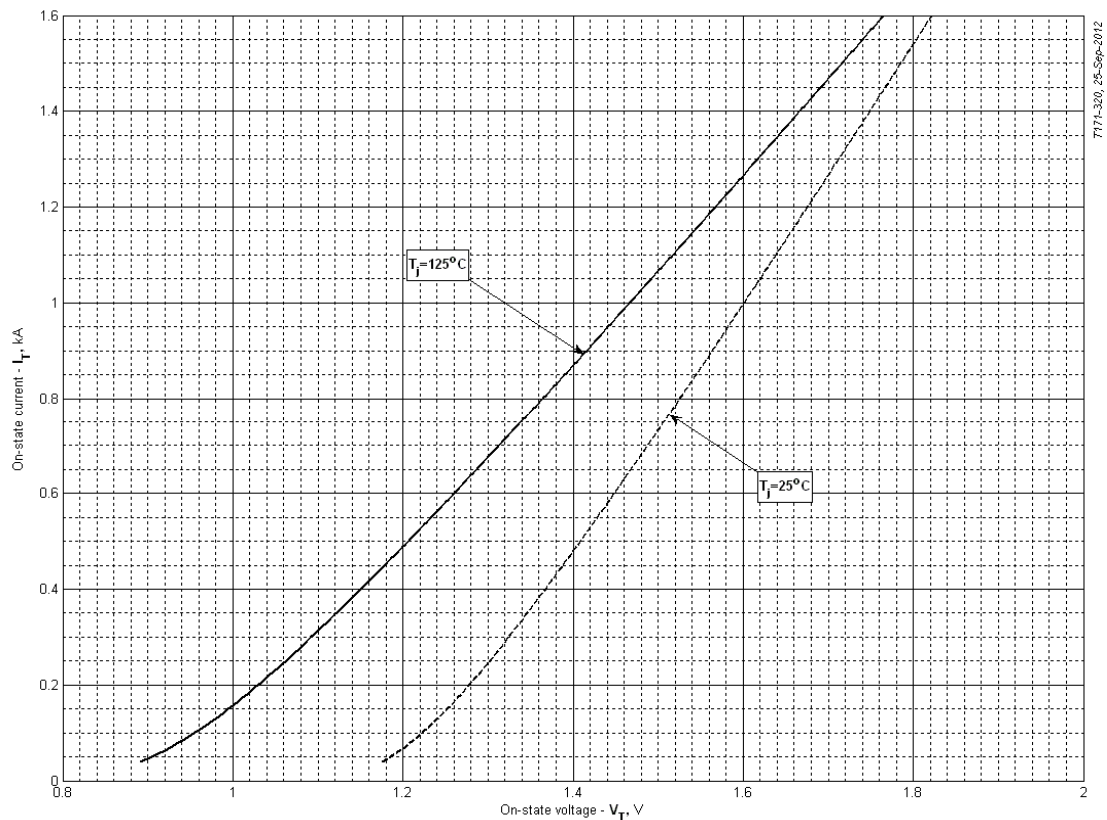
PART NUMBERING GUIDE				
T	171	320	16	N
1	2	3	4	5
1. Phase Control Thyristor 2. Design version 3. Mean on-state current, A 4. Voltage code 5. Ambient conditions: N – normal; T – tropical				



Type of screw	W	H
Metric Screw Type C	M24x1,5 – 8g	19
Metric Screw Type B (upon request)	M20x1,5 – 8g	15

Polarity	Example of code designation	Reference designation	Colors		
			Anode	Cathode	Gate
Anode to stud	T171-320-16		-	Red tube	White

**All dimensions in millimeters (inches)**



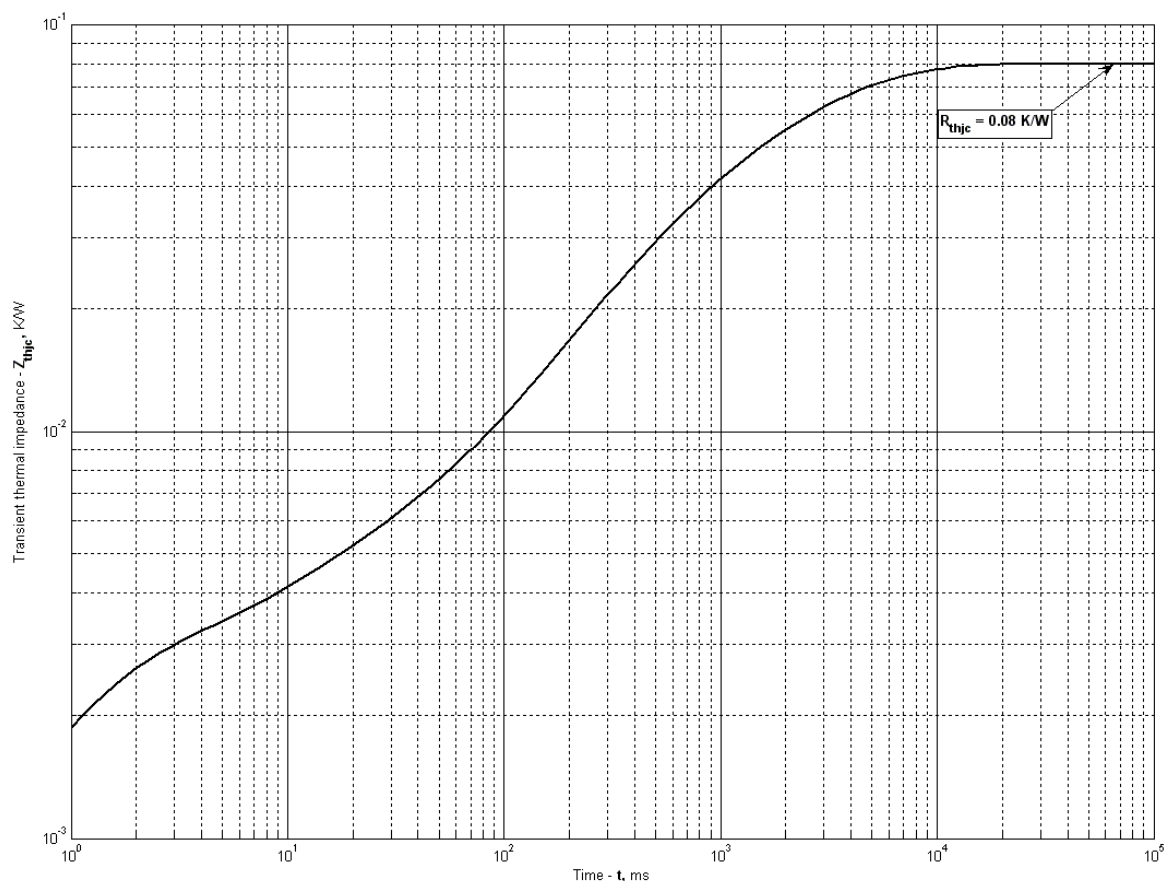
**Fig 1 – On-state characteristics of Limit device**

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	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\text{max}}$
<b>A</b>	1.108422	0.802026
<b>B</b>	0.323295	0.438347
<b>C</b>	-0.224382	-0.299678
<b>D</b>	0.324688	0.433643

**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.

$Z_{thjc}$  = Thermal resistance at time  $t$ .

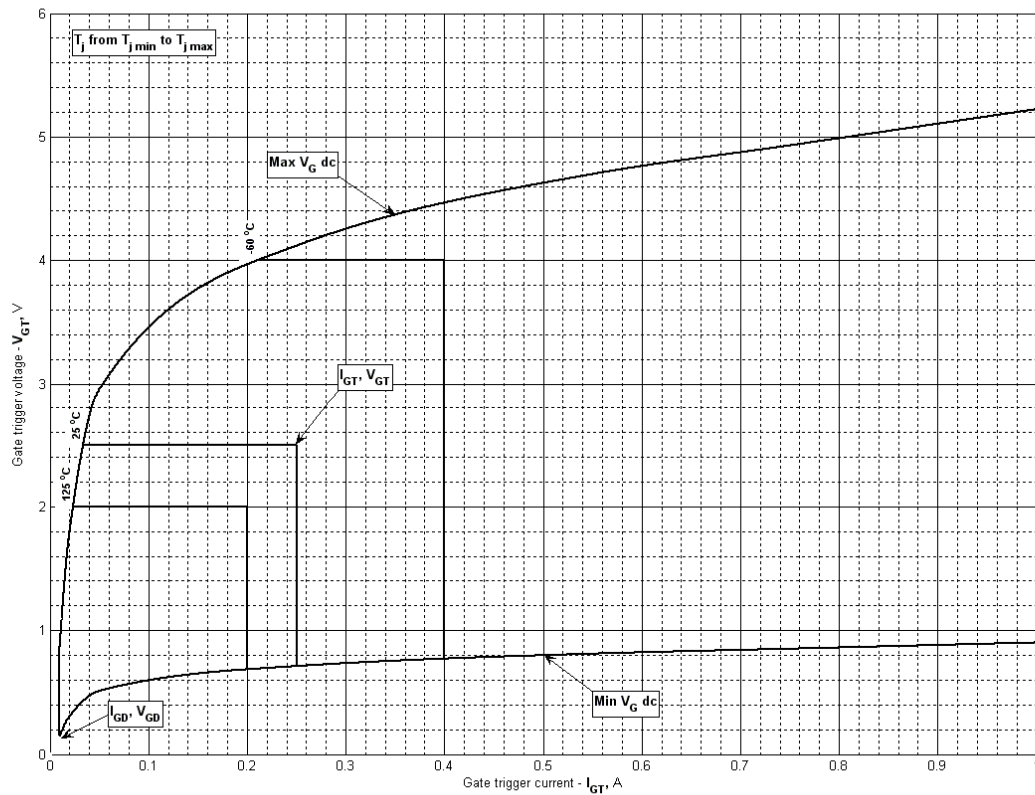
$R_i$  = Amplitude of  $p_{th}$  term.

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

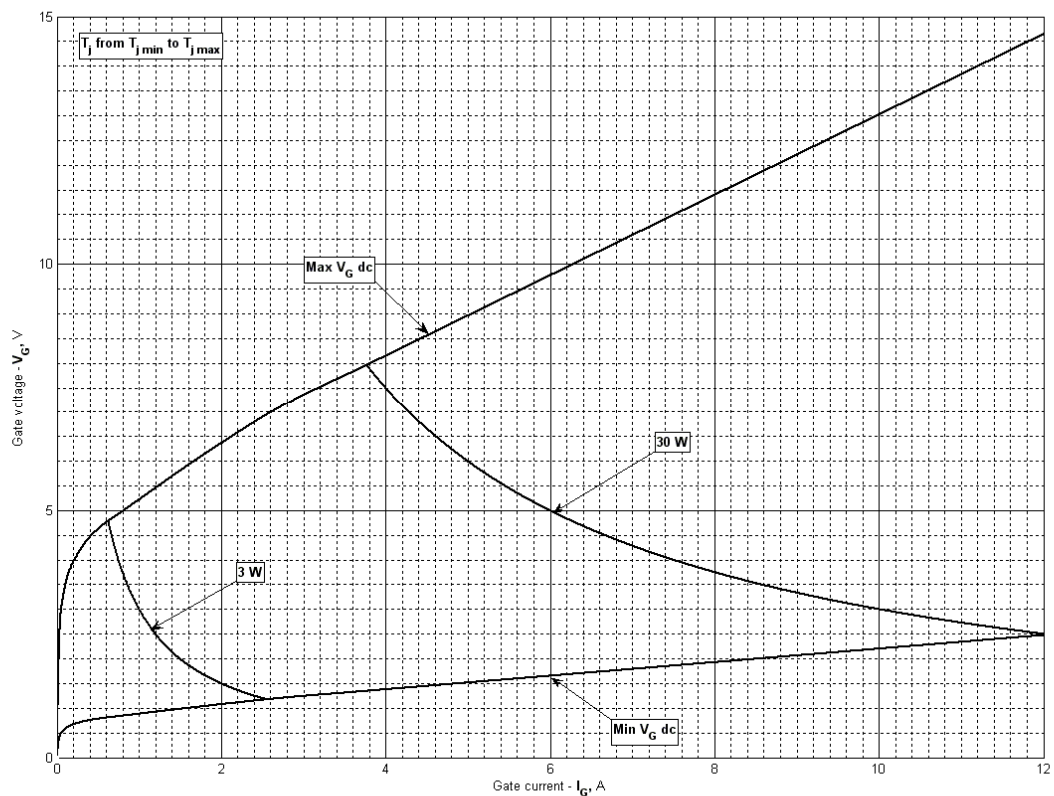
DC

$i$	1	2	3	4	5	6
$R_i$ , K/W	0.01836	0.02733	0.01495	0.001445	0.002488	0.01543
$\tau_i$ , s	4.627	2.249	0.3406	0.01043	0.0009112	0.9081

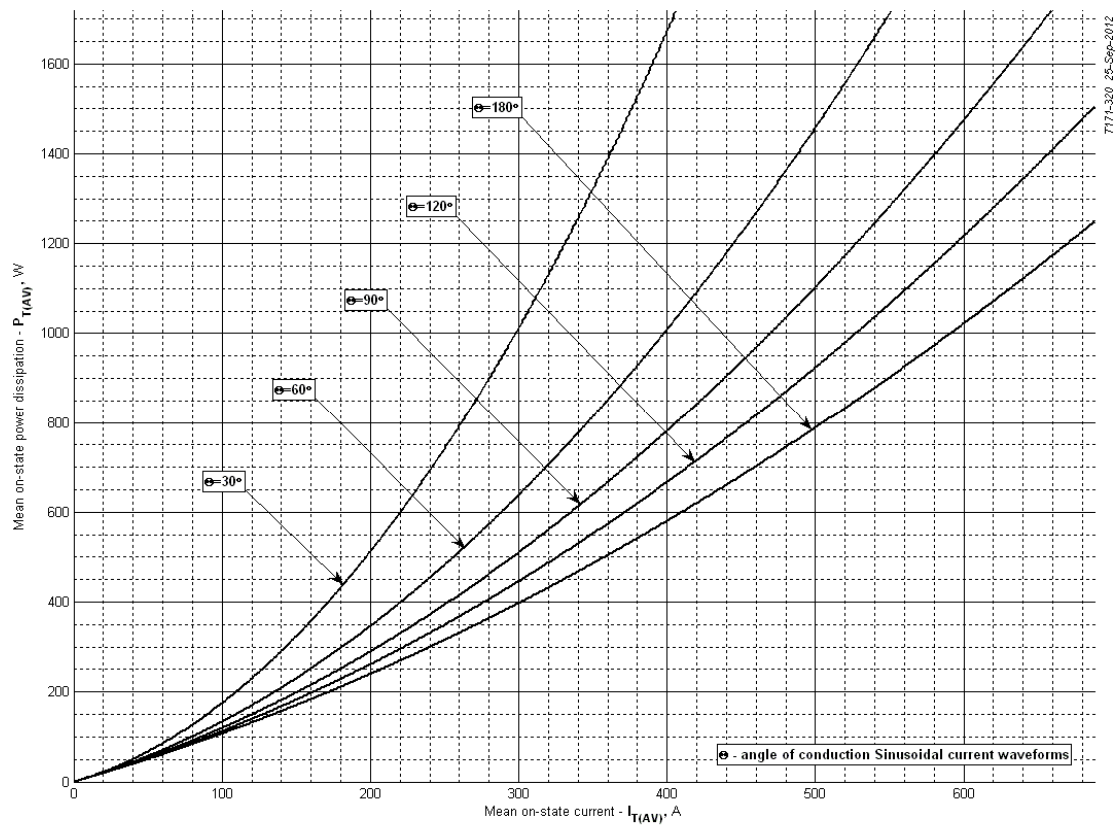
**Transient thermal impedance junction to case  $Z_{thjc}$  model (see Fig. 2)**



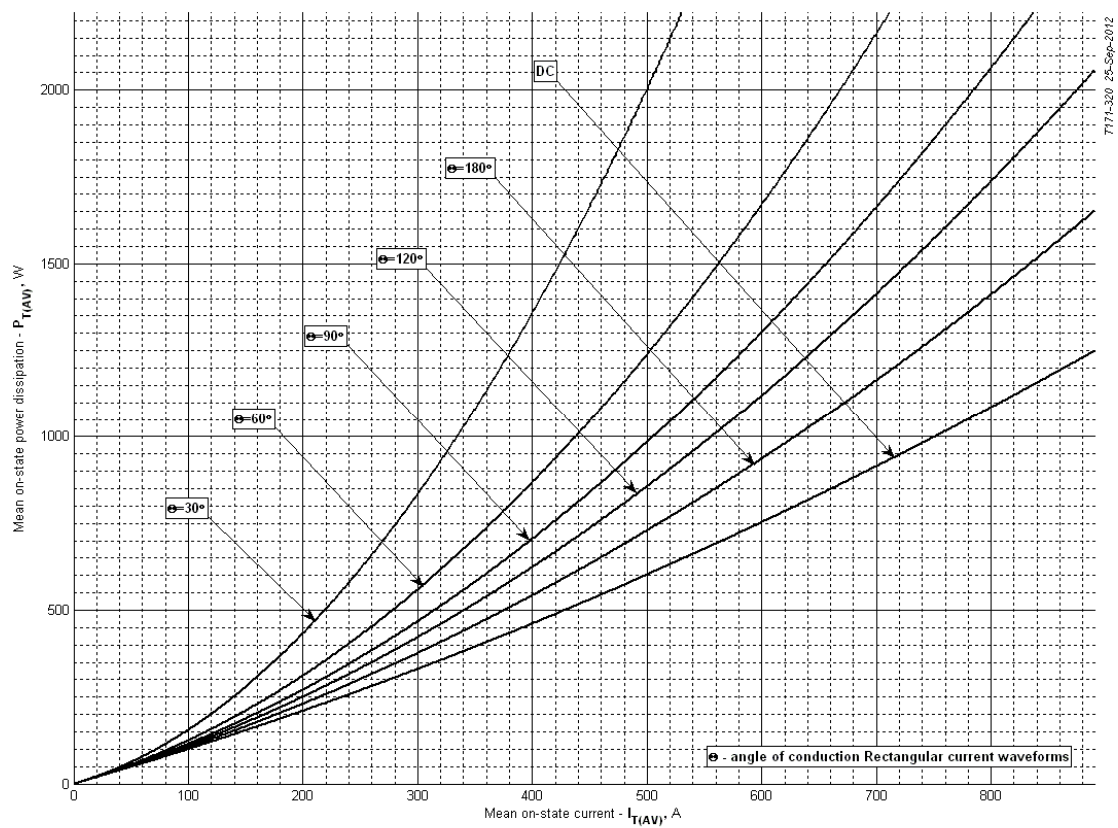
**Fig 3 – Gate characteristics – Trigger limits**



**Fig 4 - Gate characteristics –Power curves**

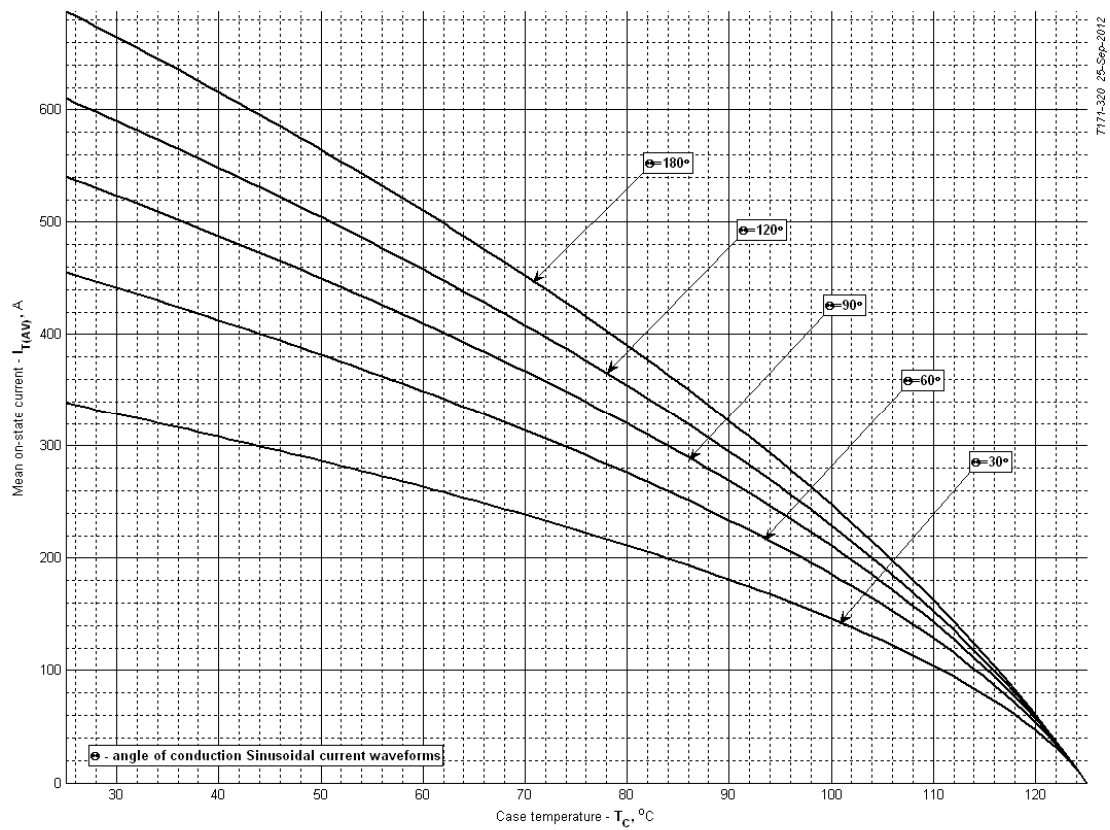


**Fig 5 – On-state power loss (sinusoidal current waveforms)**

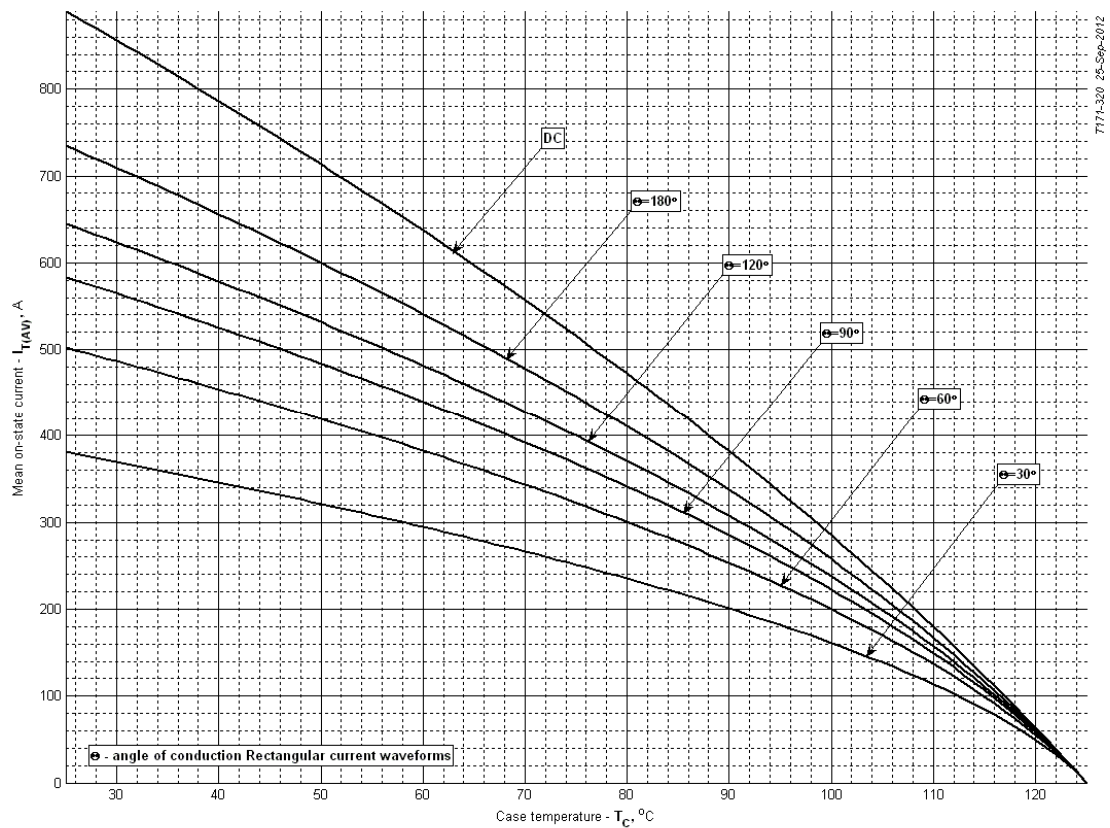


**Fig 6 – On-state power loss (rectangular current waveforms)**

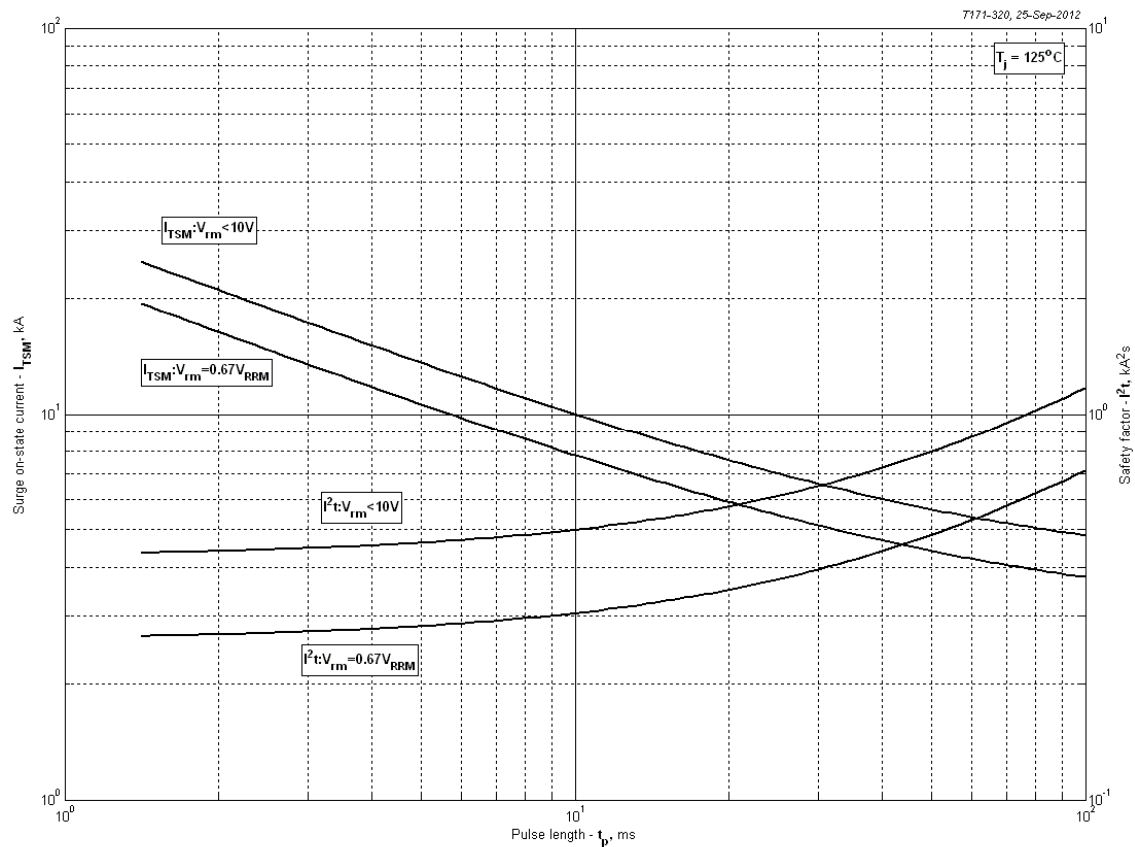




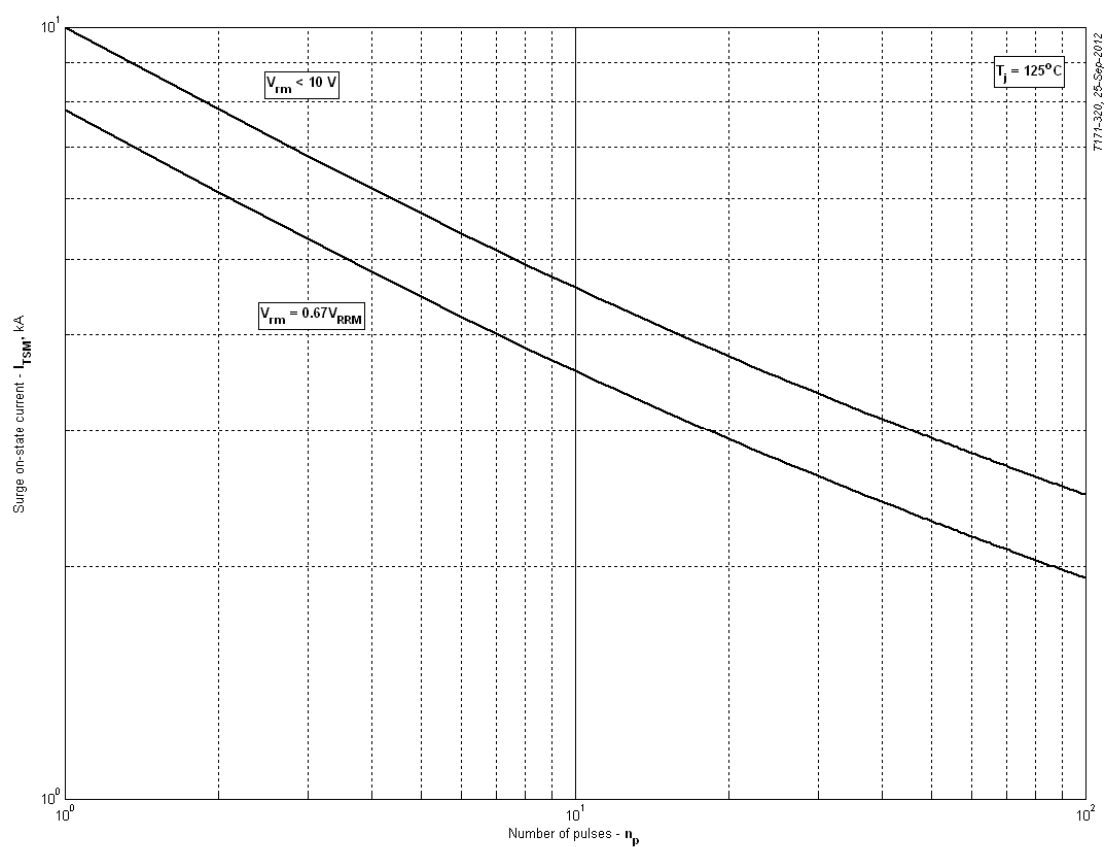
**Fig 7 – Maximum case temperature DSC (sinusoidal current waveforms)**



**Fig 8 – Maximum case temperature DSC (rectangular current waveforms)**



**Fig 9 – Maximum surge and  $I^2t$  ratings**



**Fig 10 – Maximum surge ratings**