

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

## Rectifier Stud Diode Type D171-500-12

Mean on-state current				$I_{FAV}$	500 A			
Repetitive peak reverse voltage				$V_{RRM}$	600 ÷ 1200V			
$V_{RRM}, V$	600	700	800	900	1000	1100	1200	
Voltage code	6	7	8	9	10	11	12	
$T_j, °C$	- 60 ÷ 190							

### MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions
<b>ON-STATE</b>				
$I_{FAV}$	Average forward current	A	500 603	$T_c=136 °C$ ; $T_c=120 °C$ ; 180° half-sine wave; 50 Hz
$I_{FRMS}$	RMS forward current	A	785	$T_c=136 °C$ ; 180° half-sine wave; 50 Hz
$I_{FSM}$	Surge forward current	kA	16.0 19.0	$T_j=T_{jmax}$ $T_j=25 °C$ 180° half-sine wave; $t_p=10$ ms; single pulse; $V_R=0$ V;
			17.0 20.0	$T_j=T_{jmax}$ $T_j=25 °C$ 180° half-sine wave; $t_p=8.3$ ms; single pulse; $V_R=0$ V;
$I^2t$	Safety factor	$A^2s \cdot 10^3$	1200 1800	$T_j=T_{jmax}$ $T_j=25 °C$ 180° half-sine wave; $t_p=10$ ms; single pulse; $V_R=0$ V;
			1100 1600	$T_j=T_{jmax}$ $T_j=25 °C$ 180° half-sine wave; $t_p=8.3$ ms; single pulse; $V_R=0$ V;
<b>BLOCKING</b>				
$V_{RRM}$	Repetitive peak reverse voltages	V	600÷1200	$T_{jmin} < T_j < T_{jmax}$ ; 180° half-sine wave; 50 Hz;
$V_{RSM}$	Non-repetitive peak reverse voltages	V	700÷1400	$T_{jmin} < T_j < T_{jmax}$ ; 180° half-sine wave; single pulse;
$V_R$	Reverse continuous voltages	V	$0.6 \cdot V_{RRM}$	$T_j=T_{jmax}$ ;
<b>THERMAL</b>				
$T_{stg}$	Storage temperature	°C	- 60 ÷ 50	
$T_j$	Operating junction temperature	°C	- 60 ÷ 190	
<b>MECHANICAL</b>				
M	Tightening torque	Nm	25 ÷ 35	
a	Acceleration	$m/s^2$	100	

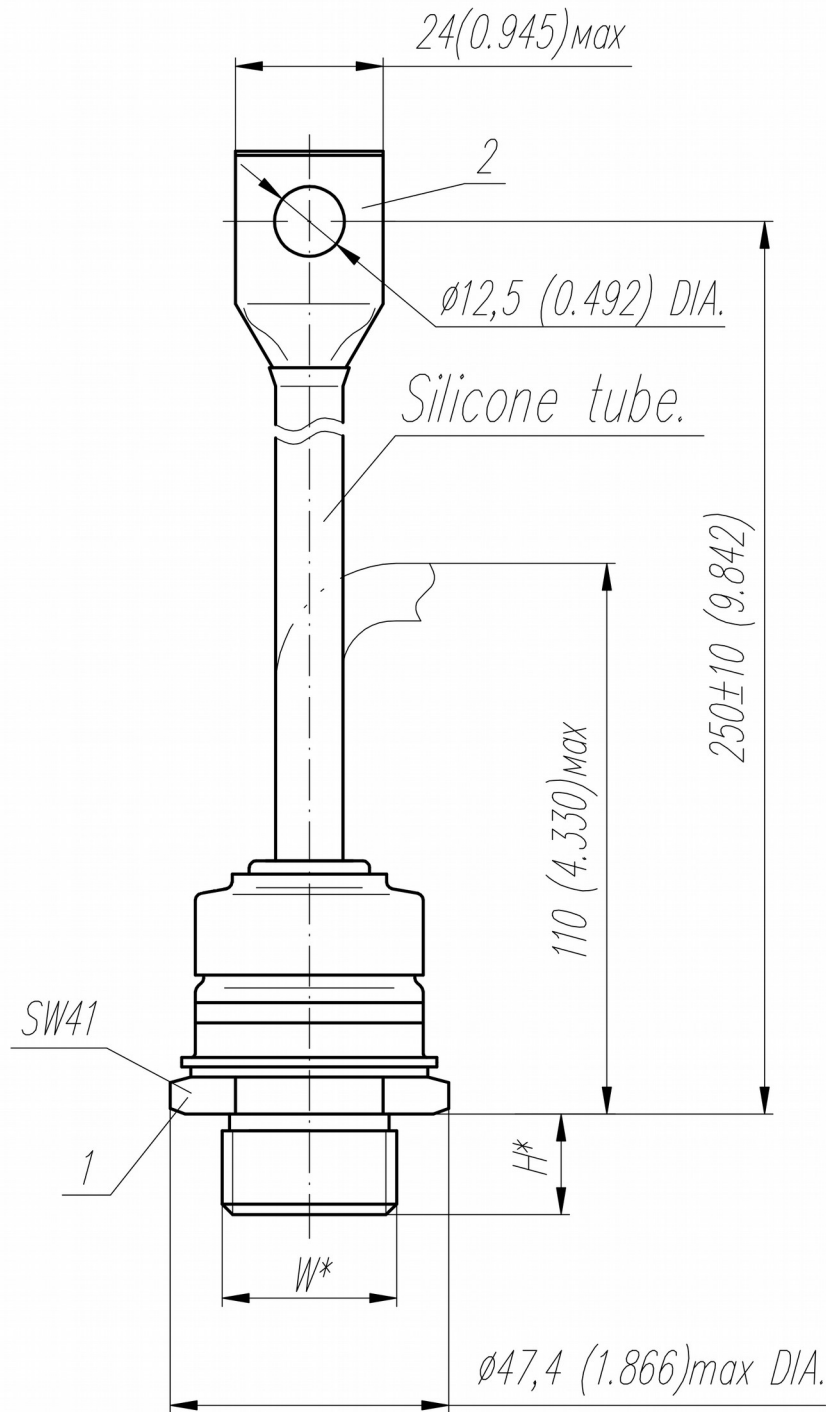
## CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions
<b>ON-STATE</b>				
$V_{FM}$	Peak forward voltage, max	V	1.40	$T_j=25\text{ }^\circ\text{C}; I_{FM}=1570\text{ A}$
$V_{F(TO)}$	Forward threshold voltage, max	V	0.809	$T_j=T_{j,max};$ $0.5\pi I_{FAV} < I_T < 1.5\pi I_{FAV}$
$r_T$	Forward slope resistance, max	m $\Omega$	0.376	
<b>BLOCKING</b>				
$I_{RRM}$	Repetitive peak reverse current, max	mA	40	$T_j=T_{j,max};$ $V_R=V_{RRM}$
<b>SWITCHING</b>				
$Q_{rr}$	Total recovered charge, max	$\mu\text{C}$	830	$T_j=T_{j,max}; I_{TM}=500\text{ A};$ $di_R/dt=-10\text{ A}/\mu\text{s};$ $V_R=100\text{ V};$
$t_{rr}$	Reverse recovery time, max	$\mu\text{s}$	15	
$I_{rrM}$	Peak reverse recovery current, max	A	110	
<b>THERMAL</b>				
$R_{thjc}$	Thermal resistance, junction to case, max	$^\circ\text{C}/\text{W}$	0.085	Direct current
<b>MECHANICAL</b>				
w	Weight, max	g	440	
$D_s$	Surface creepage distance	mm (inch)	12.4 (4.882)	
$D_a$	Air strike distance	mm (inch)	12.4 (4.882)	

### PART NUMBERING GUIDE

D	171	500		12	N
1	2	3	4	5	6

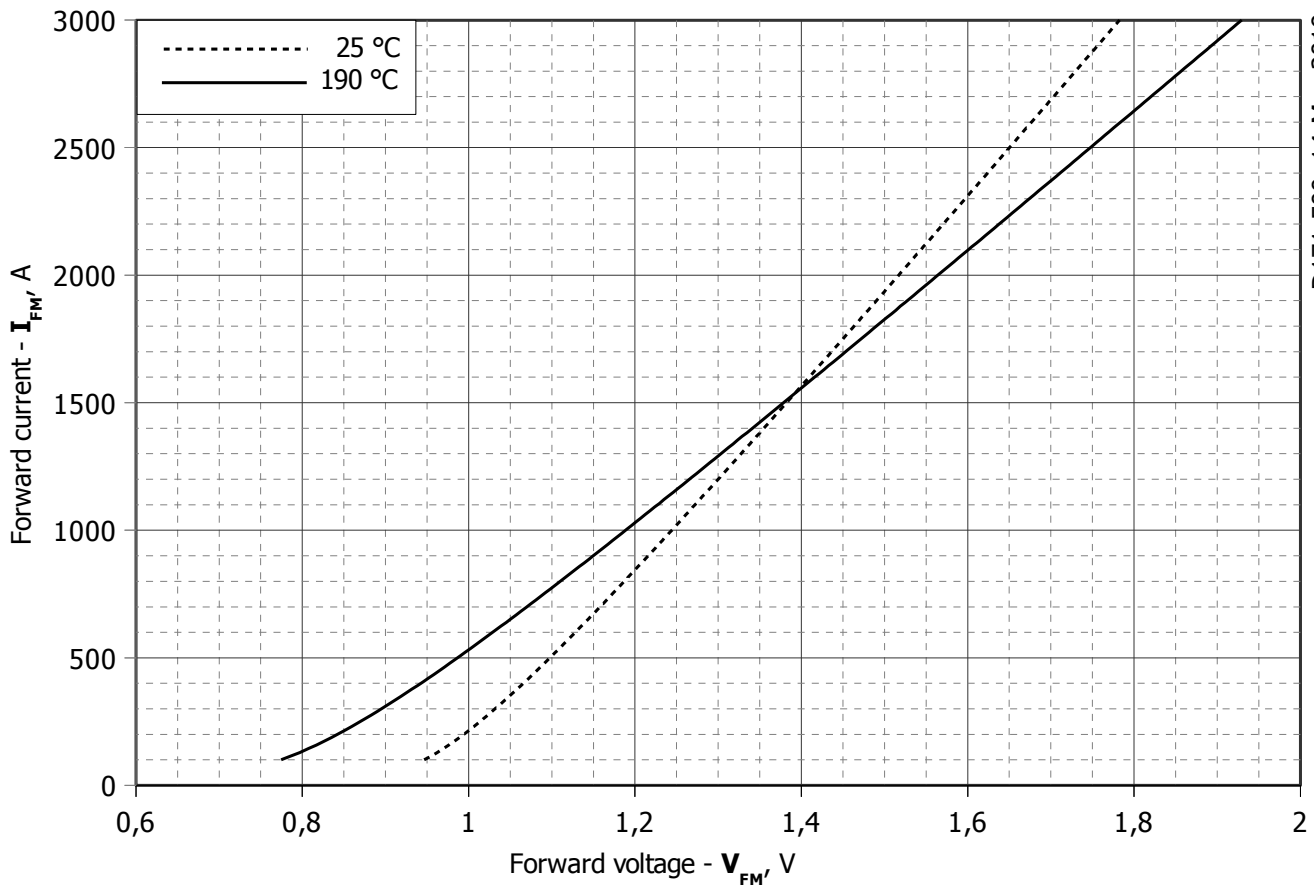
1. D — Rectifier Diode
2. Design version
3. Average forward current, A
4. Polarity: X – Cathode to Stud; Anode to Stud – no symbol
5. Voltage code
6. Ambient conditions: N – normal; T – tropical



Type of screw	W	H
Metric Screw Type C	M24x1,5 – 8g	19

Polarity		Example of code designation	Reference designation	Colors	
				Anode	Cathode
Normal	Anode to stud	D171-500-12		-	Red tube

All dimensions in millimeters (inches)

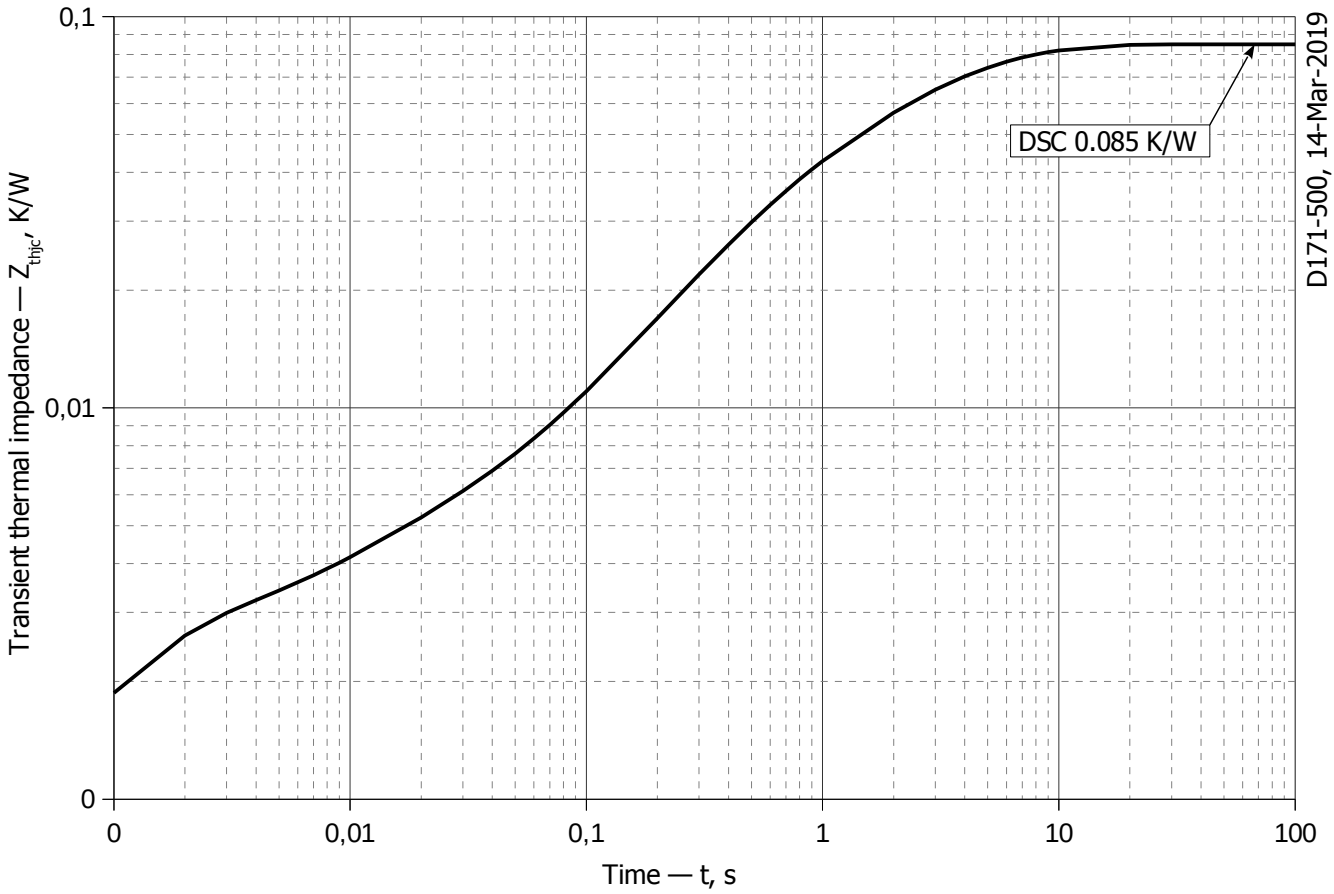


**Fig 1 – Forward characteristics of Limit device**

$$V_F = A + B \cdot i_F + C \cdot \ln(i_F + 1) + D \cdot \sqrt{i_F}$$

	Coefficients for max curves	
	T <sub>j</sub> = 25°C	T <sub>j</sub> = T <sub>j max</sub>
<b>A</b>	0,75818000	0,49236000
<b>B</b>	0,00026115	0,00036297
<b>C</b>	0,03751000	0,05786700
<b>D</b>	-0,00108460	-0,00210100

**Forward characteristic model (see Fig. 1).**



**Fig 2 – Transient thermal impedance  $Z_{thjc}$  vs. time t**

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  $t$ .

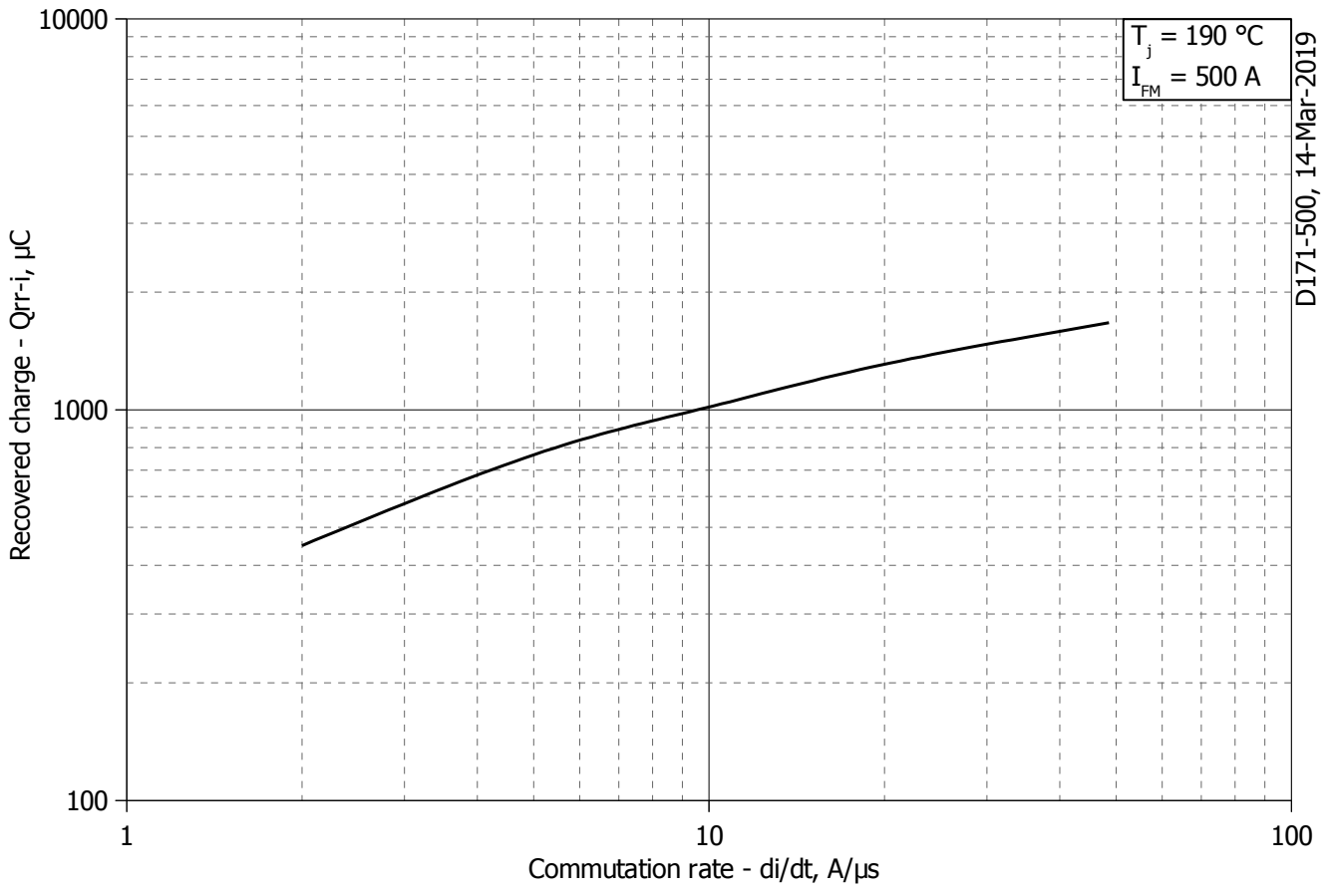
$R_i$  = Amplitude of  $p_{th}$  term.

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

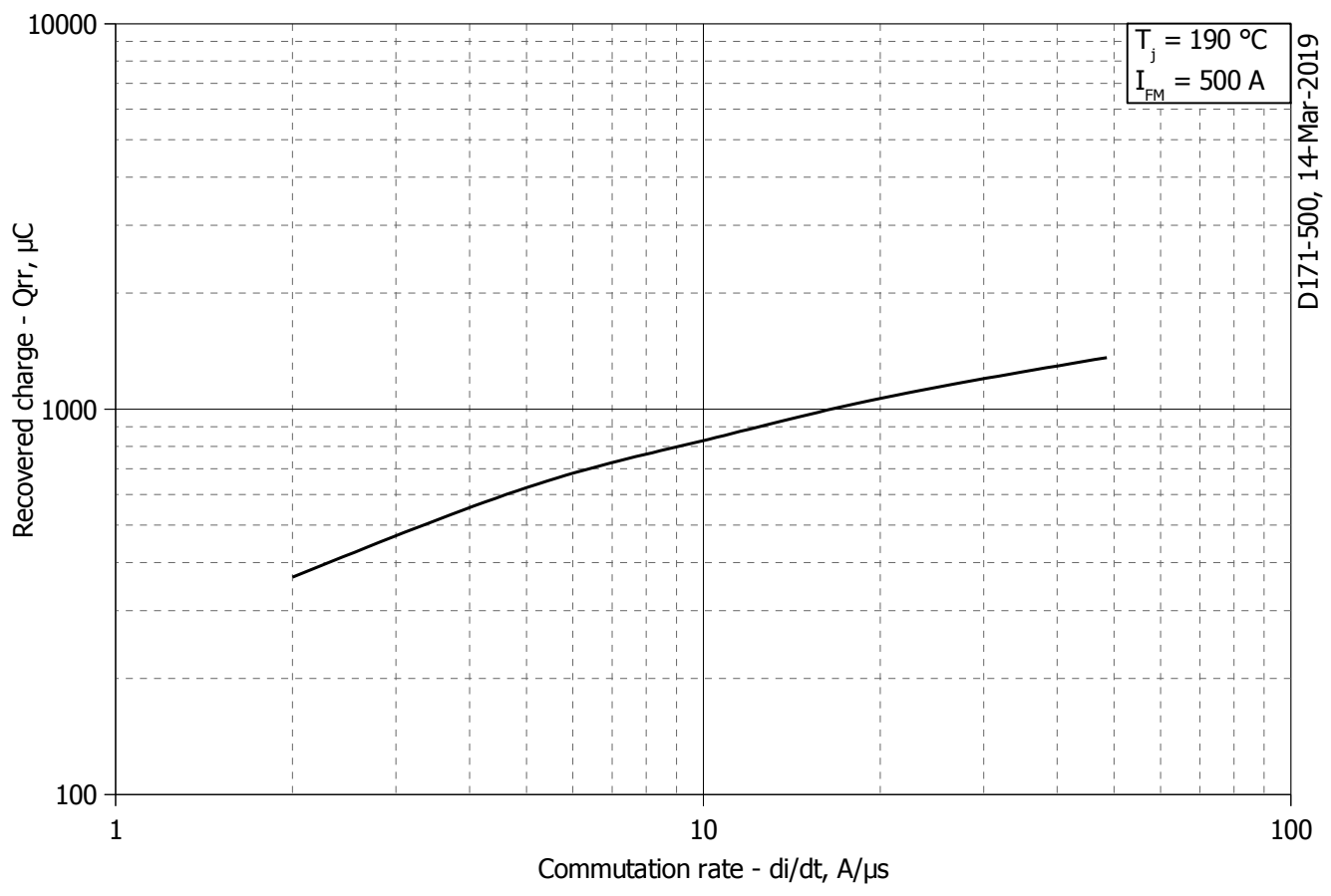
DC

<b>i</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b><math>R_i</math>, K/W</b>	0.023357	0.02733	0.01495	0.001445	0.002488	0.01543
<b><math>\tau_i</math>, s</b>	4.627	2.249	0.3406	0.01043	0.0009112	0.9081

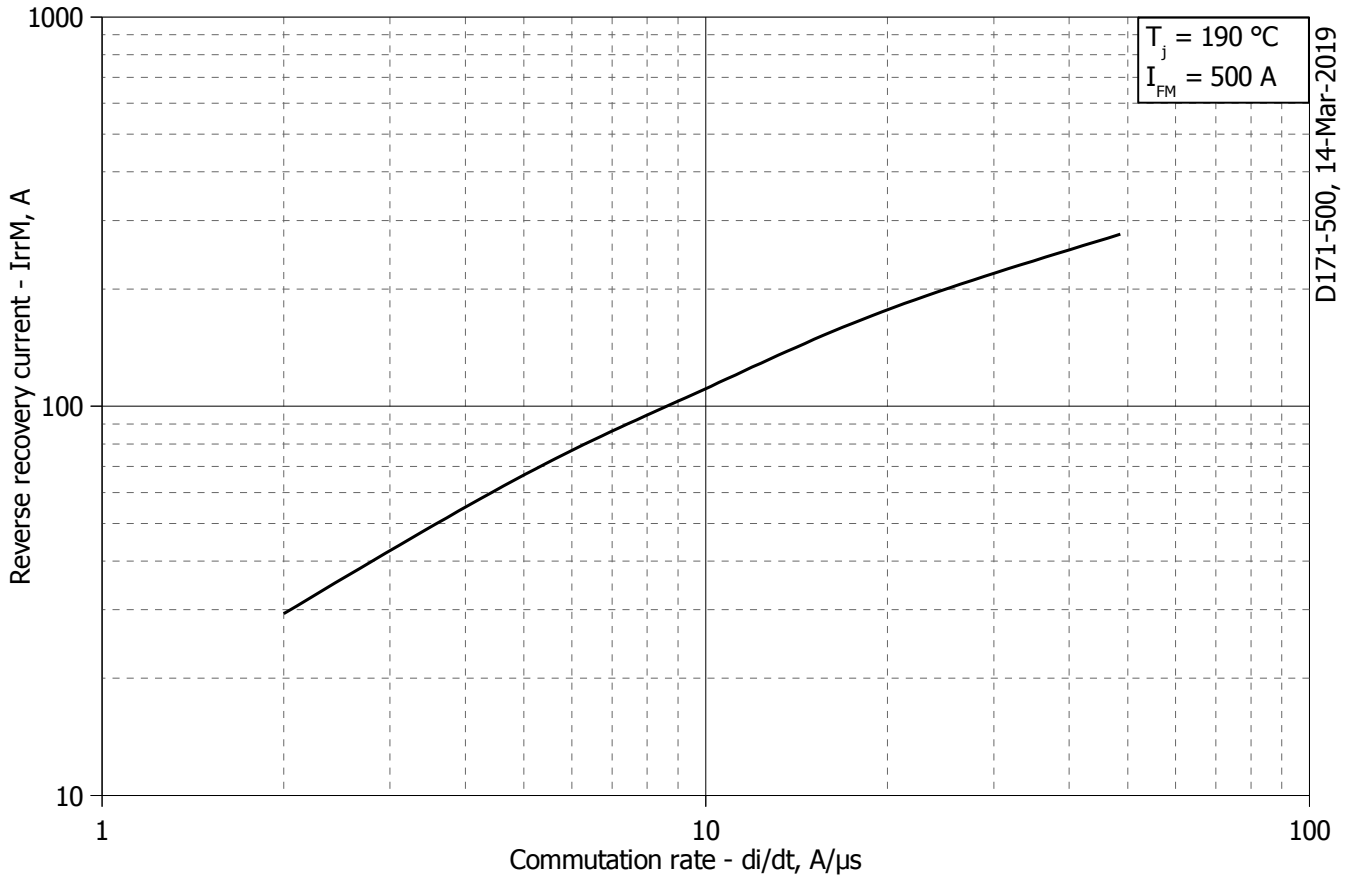
**Transient thermal impedance junction to case  $Z_{thjc}$  model (see Fig. 2)**



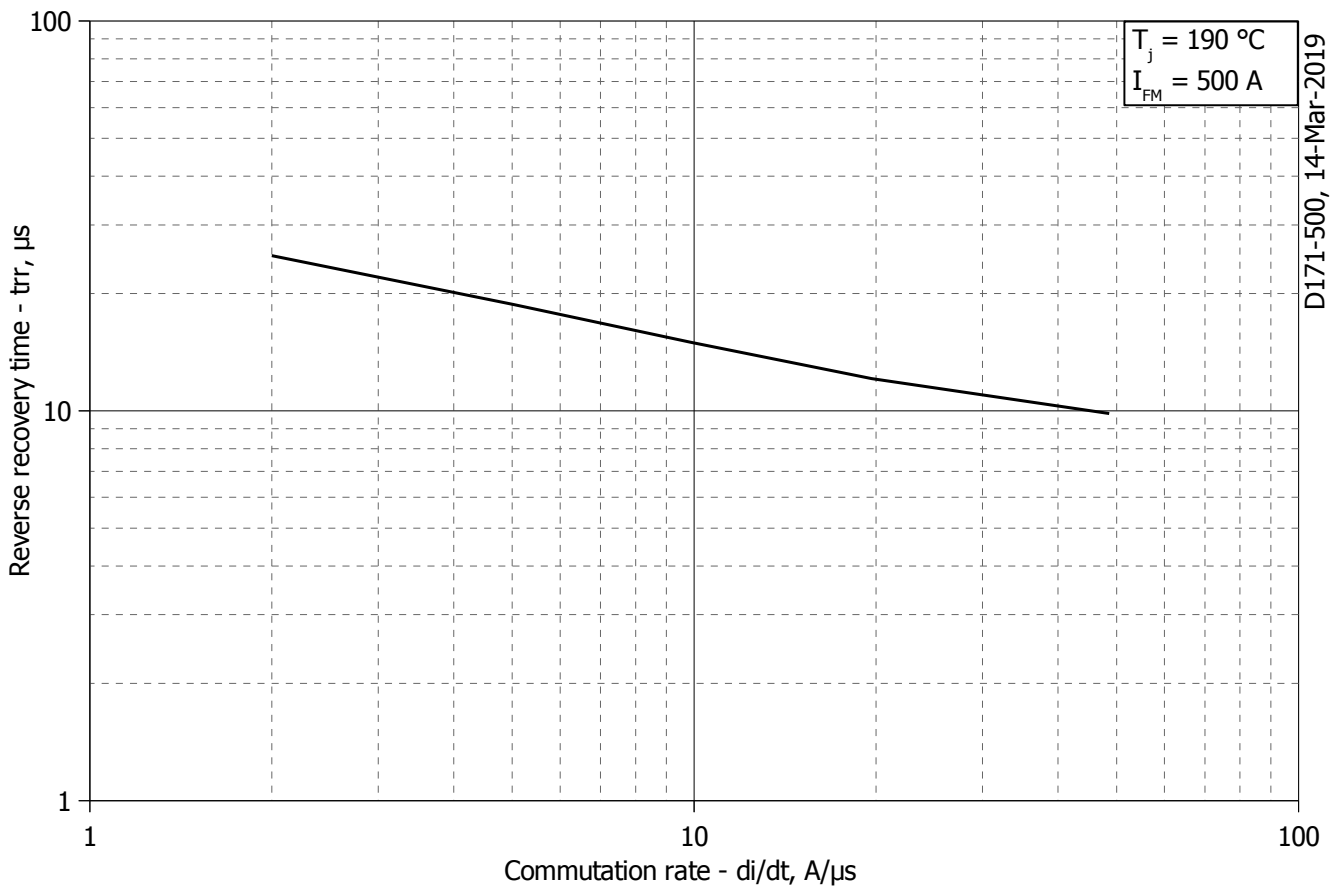
**Fig 3 – Maximum recovered charge  $Q_{rr-i}$  (integral) vs. commutation rate  $di_R/dt$**



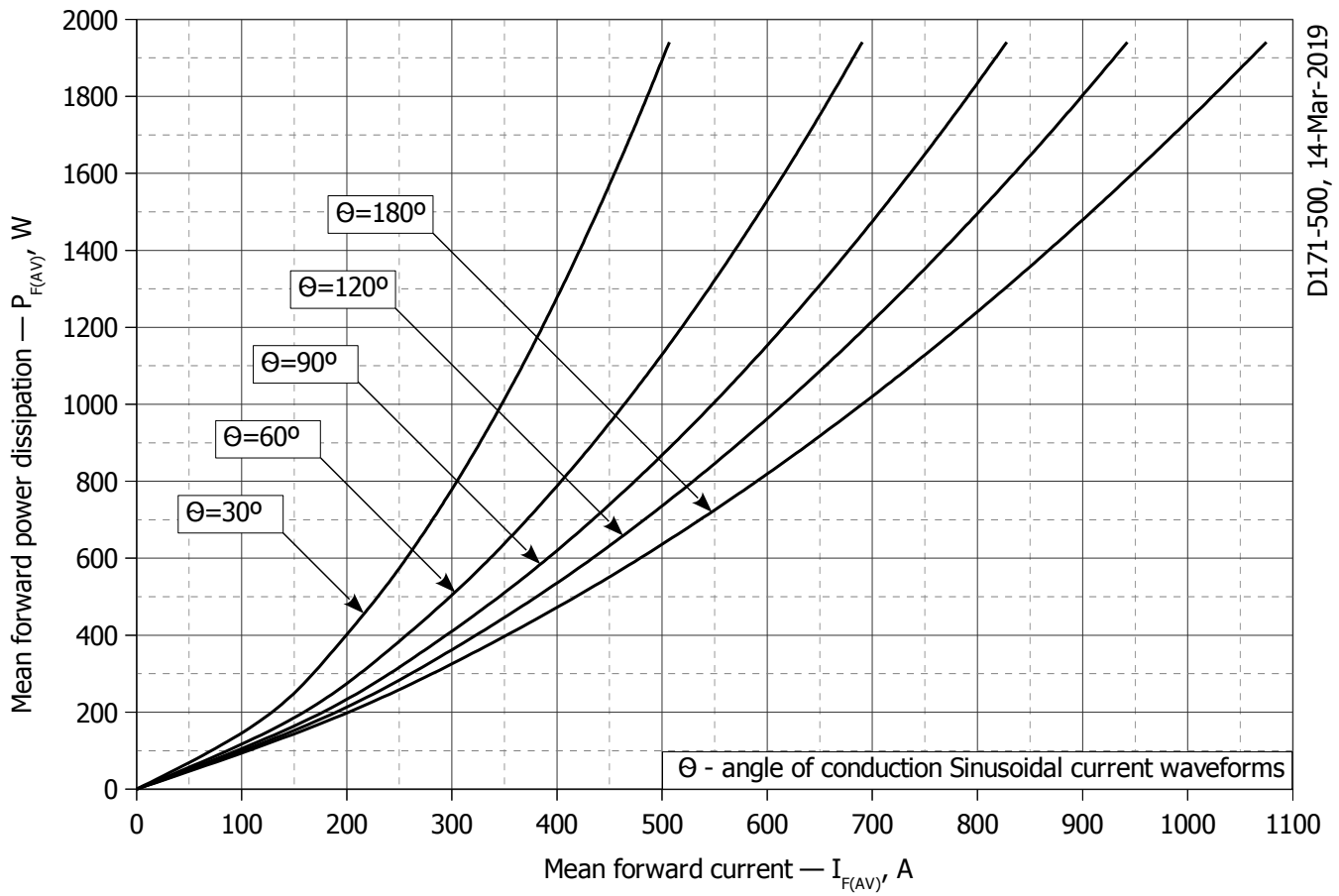
**Fig 4 – Maximum recovered charge  $Q_{rr}$  vs. commutation rate  $di_R/dt$  (25% chord)**



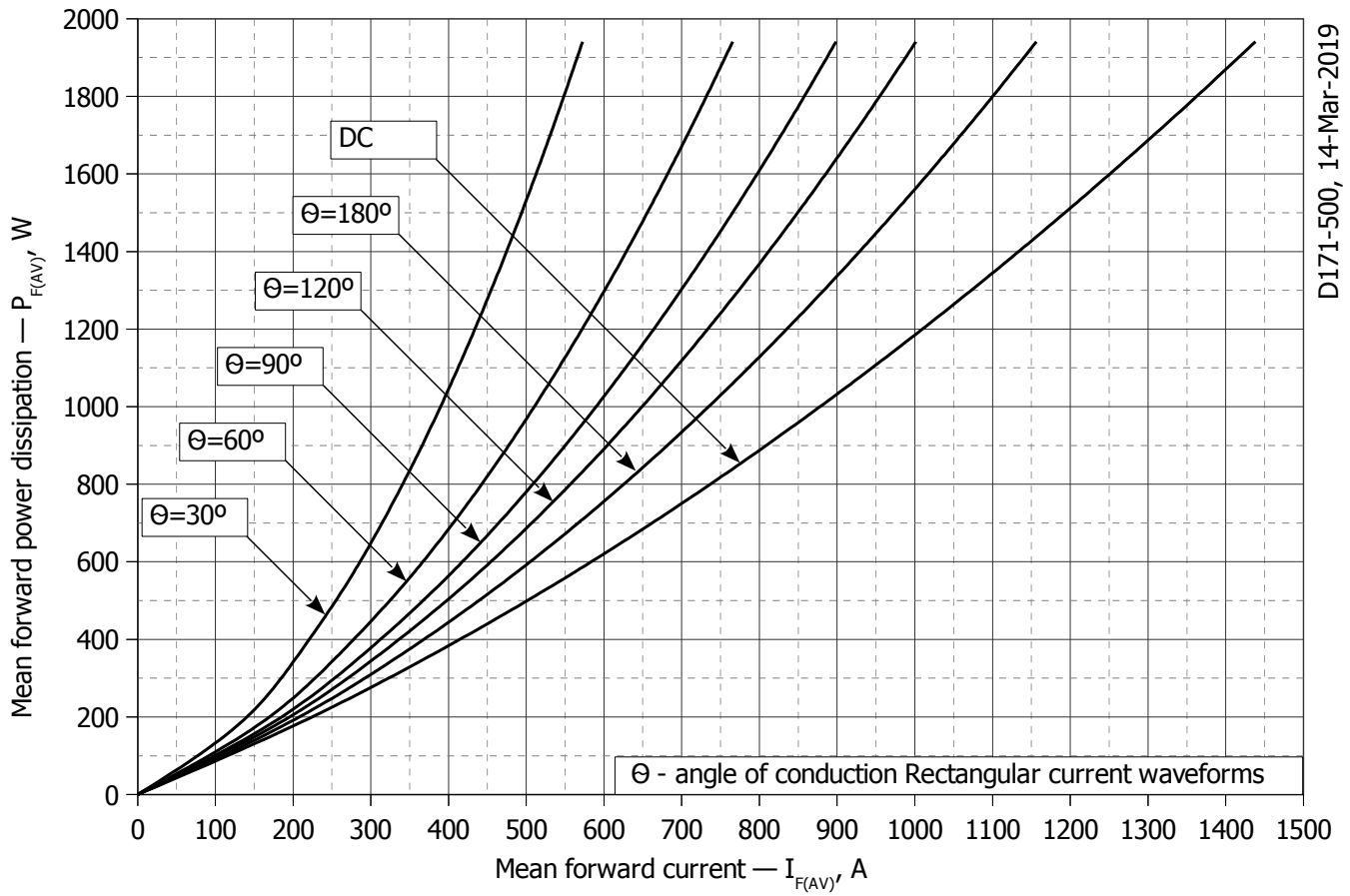
**Fig 5 – Maximum reverse recovery current  $I_{rRM}$  vs. commutation rate  $di_R/dt$**



**Fig 6 – Maximum recovery time  $t_{tr}$  vs. commutation rate  $di_R/dt$  (25% chord)**

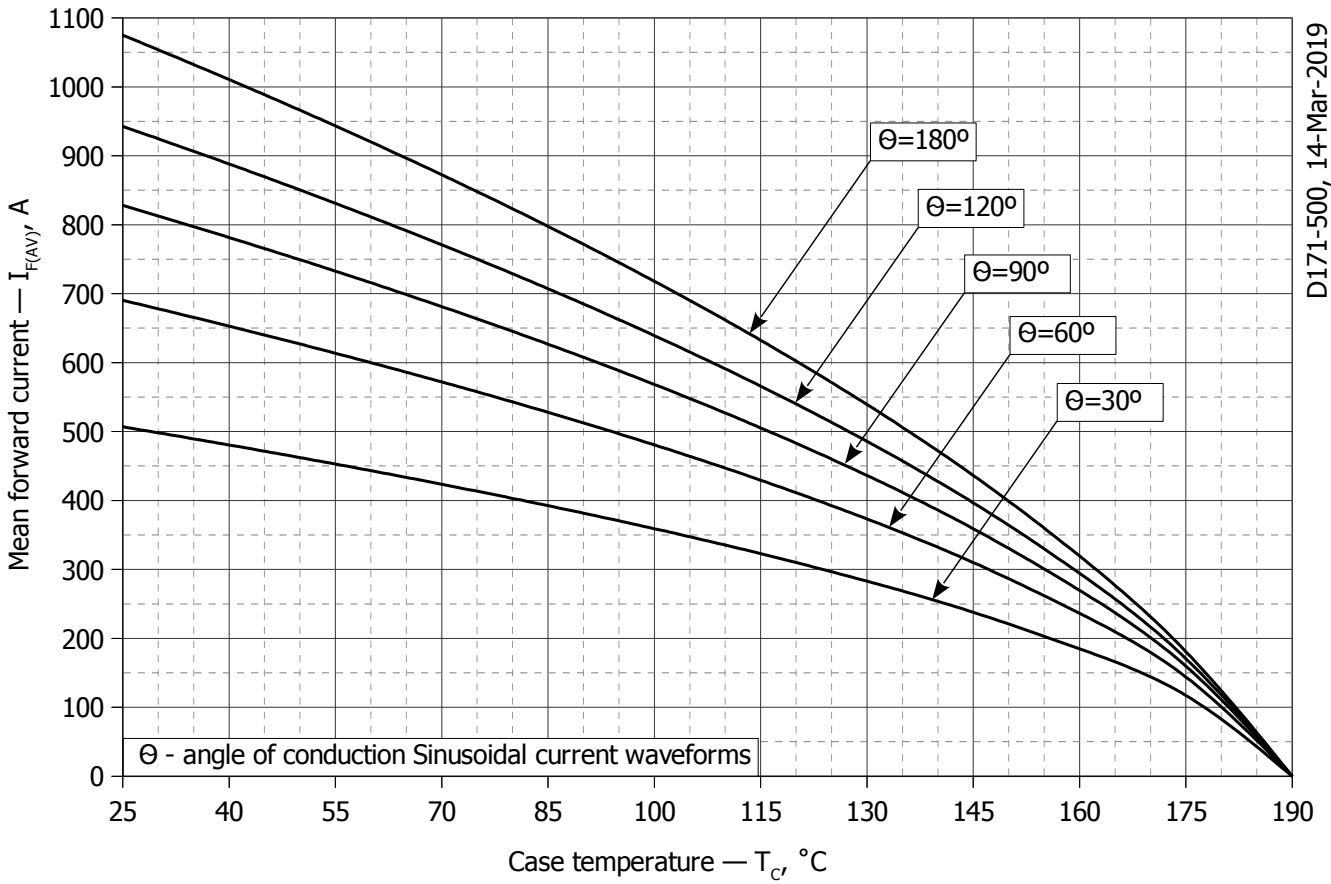


**Fig. 7 - Mean forward power dissipation  $P_{FAV}$  vs. mean forward current  $I_{FAV}$  for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)**

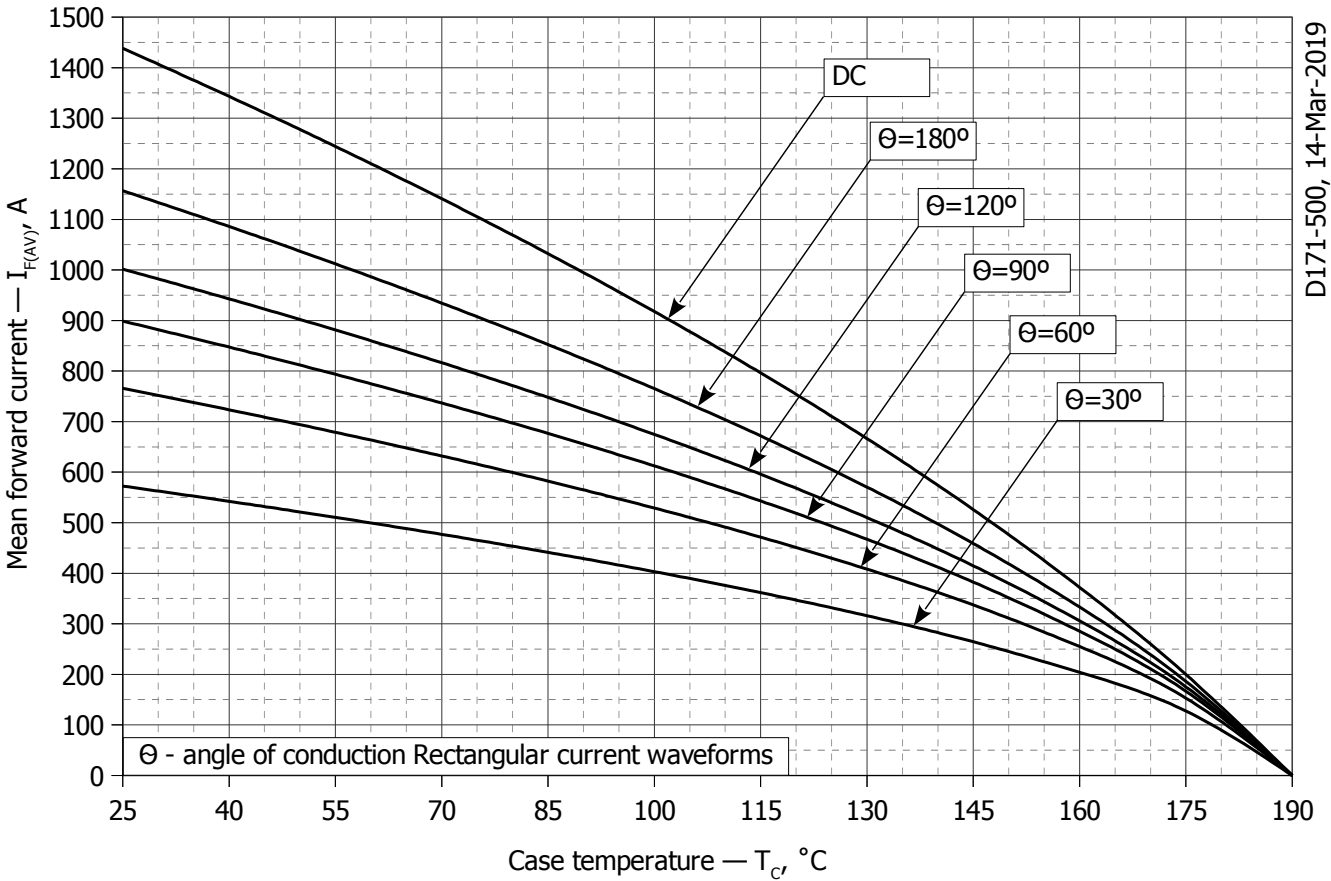


**Fig. 8 - Mean forward power dissipation  $P_{FAV}$  vs. mean forward current  $I_{FAV}$  for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)**

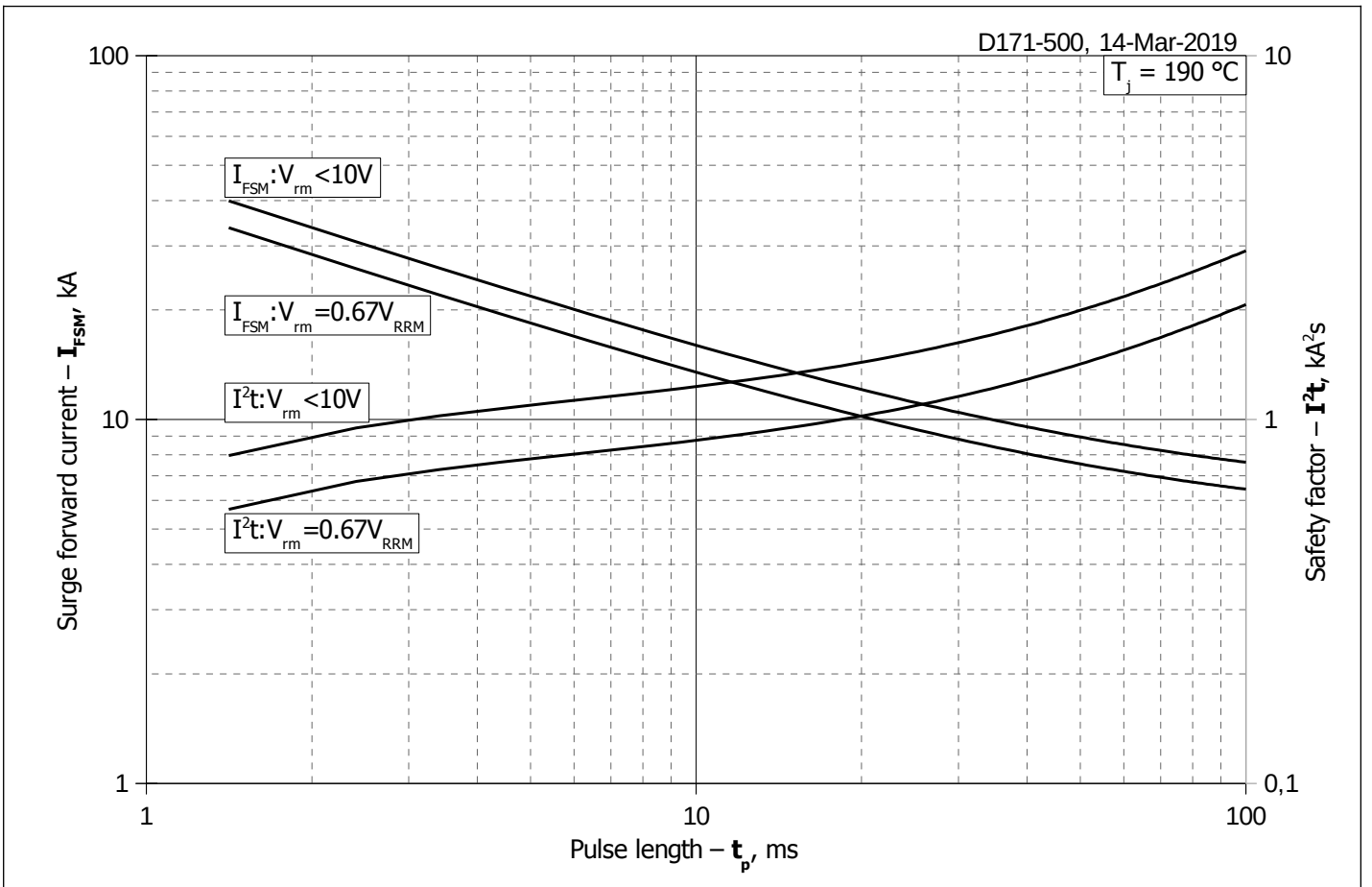




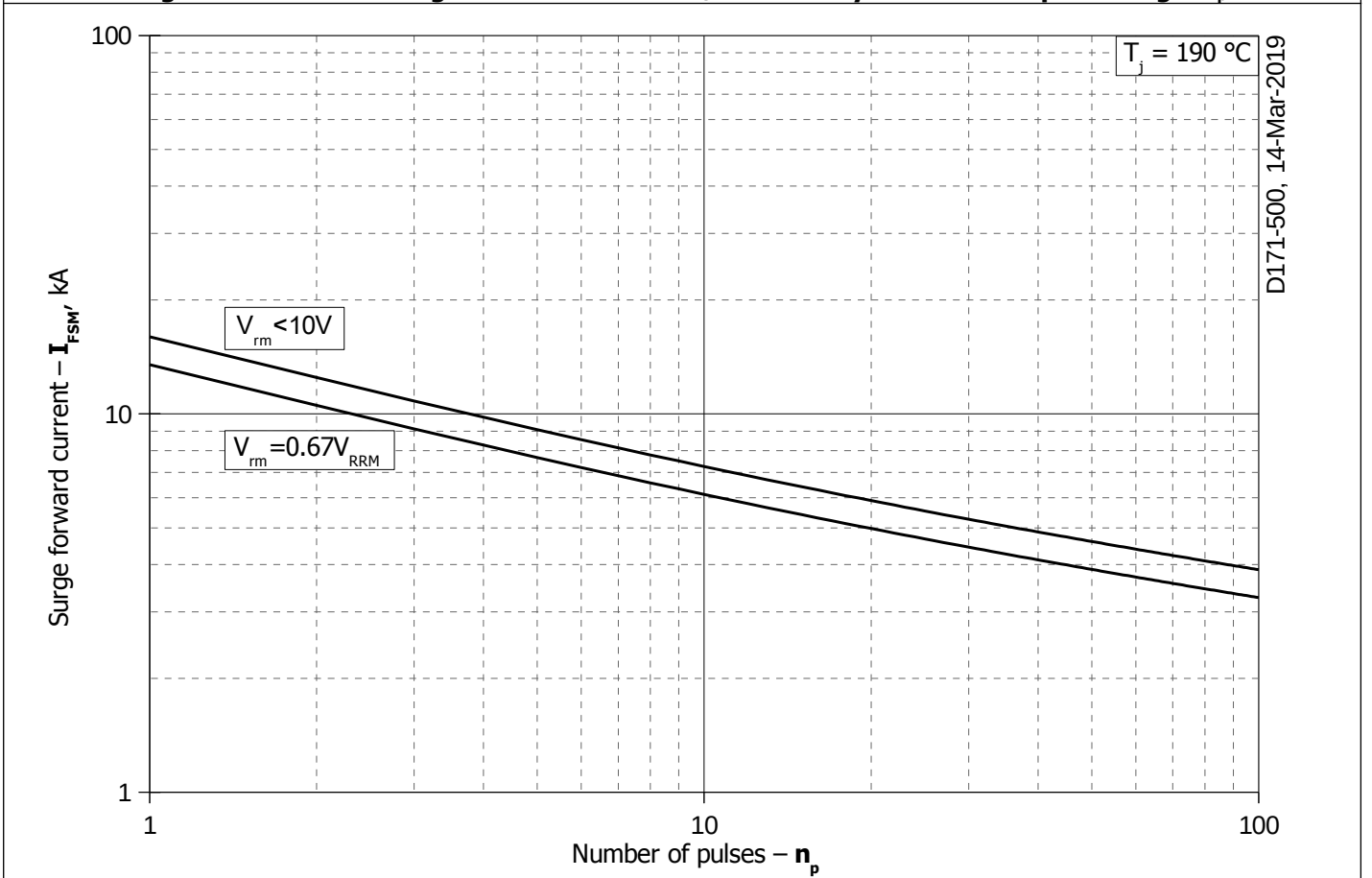
**Fig. 9 – Mean forward current  $I_{FAV}$  vs. case temperature  $T_c$  for sinusoidal current waveforms at different conduction angles ( $f=50\text{Hz}$ , DSC)**



**Fig. 10 - Mean forward current  $I_{FAV}$  vs. case temperature  $T_c$  for rectangular current waveforms at different conduction angles and for DC ( $f=50\text{Hz}$ , DSC)**



**Fig. 11 – Maximum surge forward current  $I_{FSM}$  and safety factor  $I^2t$  vs. pulse length  $t_p$**



**Fig. 12 - Maximum surge forward current  $I_{FSM}$  vs. number of pulses  $n_p$**