

High power cycling capability  
 Low on-state and switching losses  
 Optimized for line frequency rectifiers  
 Designed for traction and industrial applications

## Rectifier Diode Type D253-1600-24

Average forward current		$I_{FAV}$	1600 A	
Repetitive peak reverse voltage		$V_{RRM}$	1800 ÷ 2400 V	
$V_{RRM}, V$	1800	2000	2200	2400
Voltage code	18	20	22	24
$T_j, °C$	-60 ÷ 190			

### MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions
<b>ON-STATE</b>				
$I_{FAV}$	Average forward current	A	1600 2760	$T_c=147 °C$ ; Double side cooled; $T_c=100 °C$ ; Double side cooled; 180° half-sine wave; 50 Hz
$I_{FRMS}$	RMS forward current	A	2512	$T_c=147 °C$ ; Double side cooled; 180° half-sine wave; 50 Hz
$I_{FSM}$	Surge forward current	kA	35.0 40.0	$T_j=T_{j\ max}$ $T_j=25 °C$ 180° half-sine wave; 50 Hz ( $t_p=10\ ms$ ); single pulse; $V_R=0\ V$ ;
			37.0 43.0	$T_j=T_{j\ max}$ $T_j=25 °C$ 180° half-sine wave; 60 Hz ( $t_p=8.3\ ms$ ); single pulse; $V_R=0\ V$ ;
$I^2t$	Safety factor	$A^2s \cdot 10^3$	6125 8000	$T_j=T_{j\ max}$ $T_j=25 °C$ 180° half-sine wave; 50 Hz ( $t_p=10\ ms$ ); single pulse; $V_R=0\ V$ ;
			5680 7670	$T_j=T_{j\ max}$ $T_j=25 °C$ 180° half-sine wave; 60 Hz ( $t_p=8.3\ ms$ ); single pulse; $V_R=0\ V$ ;
<b>BLOCKING</b>				
$V_{RRM}$	Repetitive peak reverse voltages	V	1800 ÷ 2400	$T_{j\ min} < T_j < T_{j\ max}$ ; 180° half-sine wave; 50 Hz;
$V_{RSM}$	Non-repetitive peak reverse voltages	V	1900 ÷ 2500	$T_{j\ min} < T_j < T_{j\ max}$ ; 180° half-sine wave; 50 Hz; single pulse;
$V_R$	Reverse continuous voltages	V	$0.75 \cdot V_{RRM}$	$T_j = T_{j\ max}$ ;
<b>THERMAL</b>				
$T_{stg}$	Storage temperature	°C	-60 ÷ 50	
$T_j$	Operating junction temperature	°C	-60 ÷ 190	
<b>MECHANICAL</b>				
F	Mounting force	kN	24.0 ÷ 28.0	
a	Acceleration	$m/s^2$	50	Device unclamped
			100	Device clamped

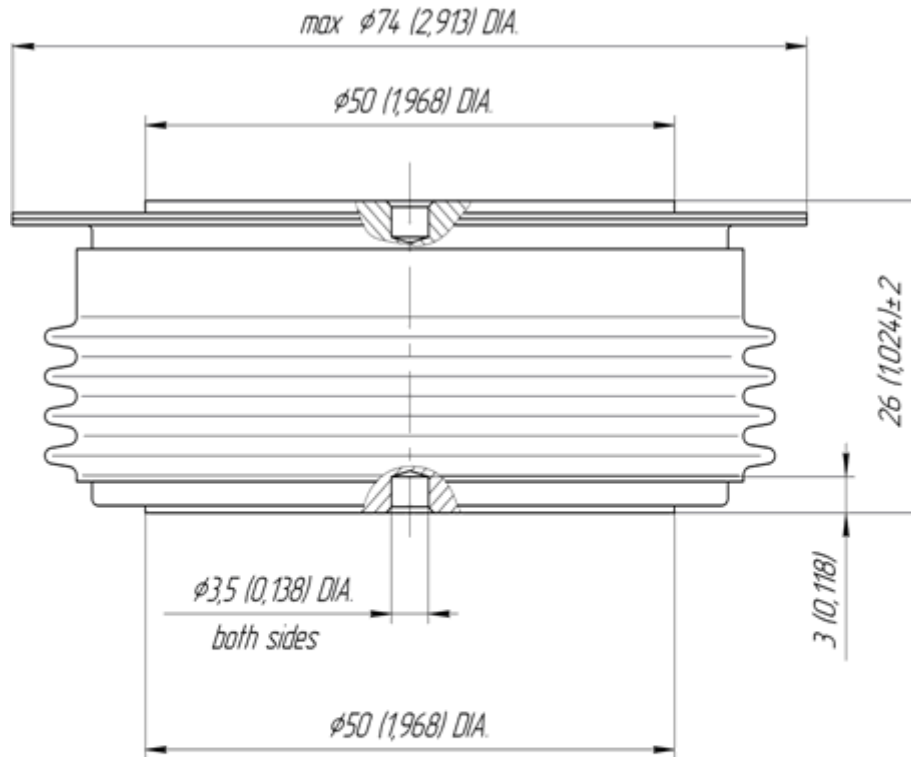
## CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
<b>ON-STATE</b>					
$V_{FM}$	Peak forward voltage, max	V	1.50	$T_j=25\text{ }^\circ\text{C}; I_{FM}=5024\text{ A}$	
$V_{F(TO)}$	Forward threshold voltage, max	V	1.00	$T_j=T_{j\text{ max}}$ ;	
$r_T$	Forward slope resistance, max	m $\Omega$	0.120	$0.5\pi I_{FAV} < I_T < 1.5\pi I_{FAV}$	
<b>BLOCKING</b>					
$I_{RRM}$	Repetitive peak reverse current, max	mA	100	$T_j=T_{j\text{ max}}$ ; $V_R=V_{RRM}$	
<b>SWITCHING</b>					
$Q_{rr}$	Total recovered charge, max	$\mu\text{C}$	3700	$T_j=T_{j\text{ max}}; I_{FM}=I_{FAV};$	
$t_{rr}$	Reverse recovery time, max	$\mu\text{s}$	35.0	$di_R/dt=-10\text{ A}/\mu\text{s};$	
$I_{rrM}$	Peak reverse recovery current, max	A	210	$V_R=100\text{ V}$	
<b>THERMAL</b>					
$R_{thjc}$	Thermal resistance, junction to case, max	$^\circ\text{C}/\text{W}$	0.0180	Direct current	Double side cooled
$R_{thjc-A}$			0.0396		Anode side cooled
$R_{thjc-K}$			0.0324		Cathode side cooled
$R_{thck}$	Thermal resistance, case to heatsink, max	$^\circ\text{C}/\text{W}$	0.0040	Direct current	
<b>MECHANICAL</b>					
w	Weight, typ	g	510		
$D_s$	Surface creepage distance	mm (inch)	38.84 (1.529)		
$D_a$	Air strike distance	mm (inch)	22.50 (0.886)		

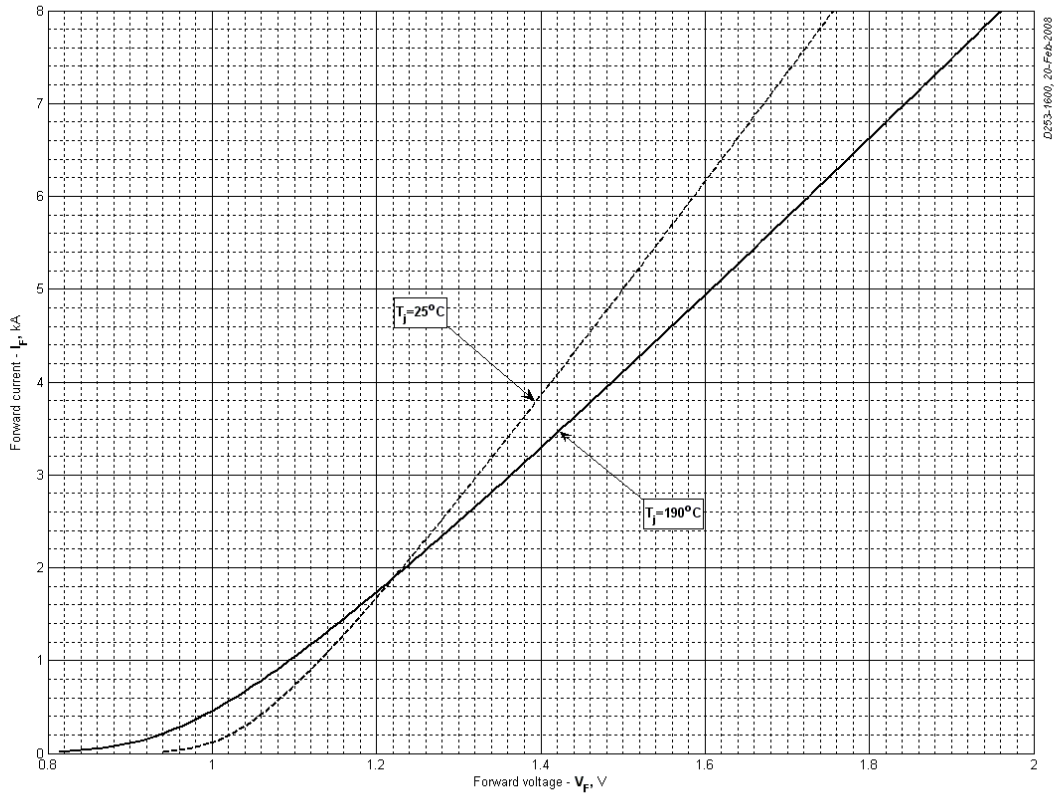
### PART NUMBERING GUIDE

D	253	1600	24	N
1	2	3	4	5

1. D — Rectifier Diode
2. Design version
3. Average forward current, A
4. Voltage code
5. Ambient conditions: N – normal; T – tropical



All dimensions in millimeters (inches)



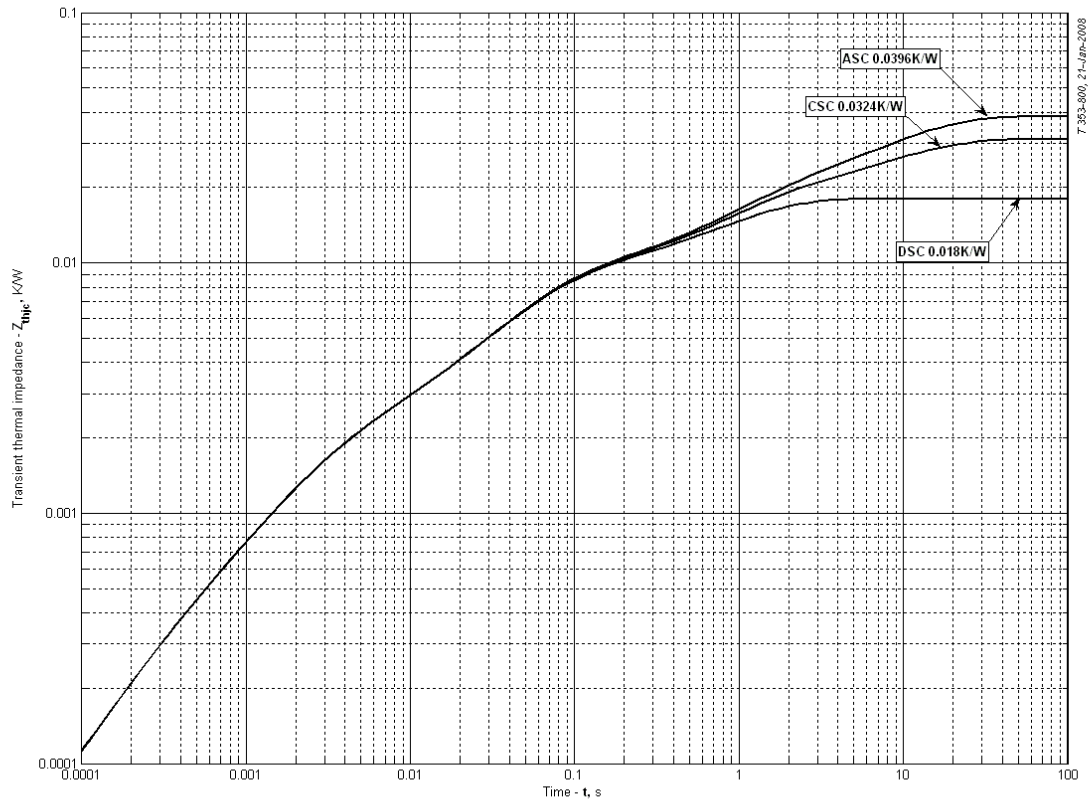
**Fig 1 – On-state characteristics of Limit device**

Analytical function for On-state characteristic:

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

	Coefficients for max curves	
	$T_j = 25^\circ\text{C}$	$T_j = T_{j\text{max}}$
<b>A</b>	0.906021	0.760163
<b>B</b>	0.050049	0.062656
<b>C</b>	-0.197637	-0.307066
<b>D</b>	0.312236	0.485119

**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 Double side cooled

$i$	1	2	3	4	5	6
$R_i, K/W$	0.009241	0.006037	0.001231	0.001054	0.0003396	0.00009575
$\tau_i, s$	0.9673	0.04967	0.002733	0.07734	0.001638	0.0002248

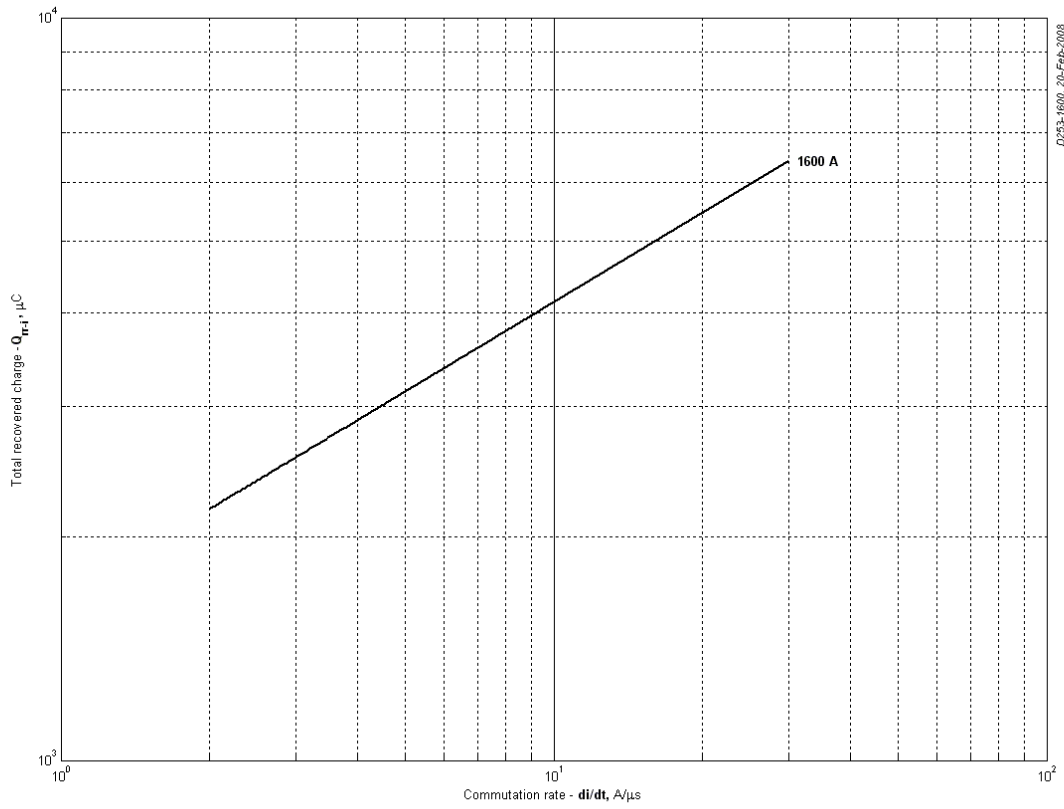
### DC Cathode side cooled

$i$	1	2	3	4	5	6
$R_i, K/W$	0.01318	0.009281	0.006055	0.001018	0.001535	0.0001182
$\tau_i, s$	9.745	1.028	0.05591	0.03732	0.002468	0.0002687

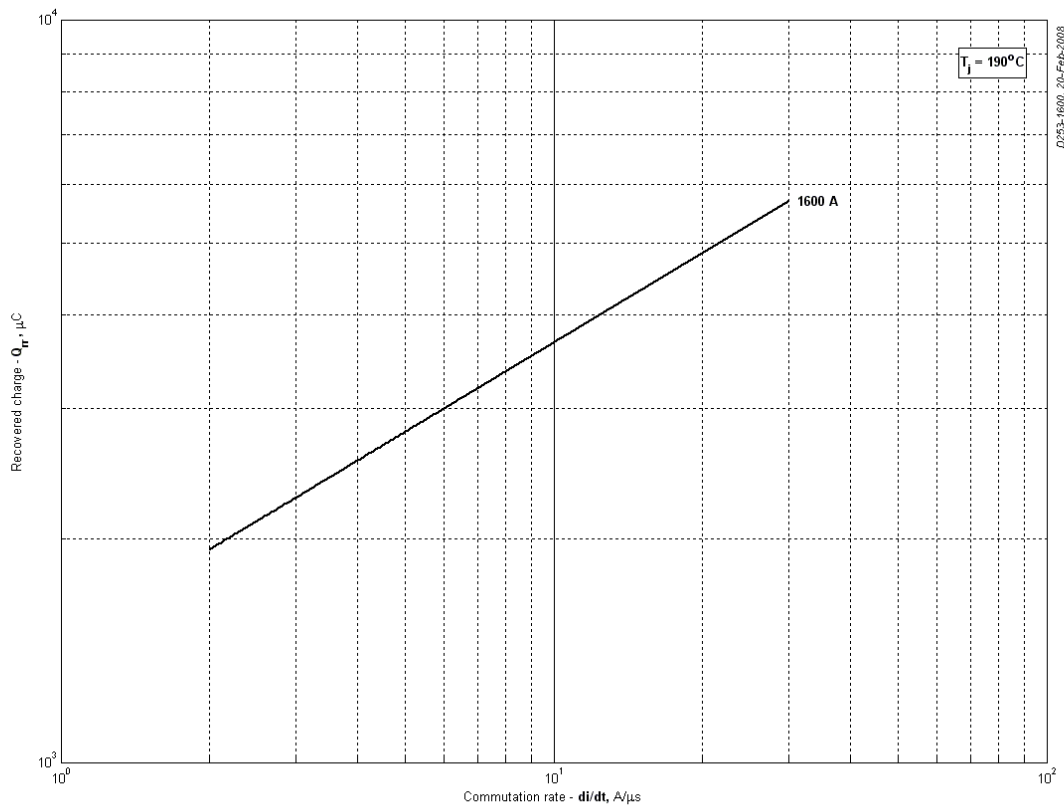
### DC Anode side cooled

$i$	1	2	3	4	5	6
$R_i, K/W$	0.02041	0.009325	0.006949	0.0001252	0.001516	0.0001119
$\tau_i, s$	9.752	1.065	0.05344	0.01407	0.002421	0.0002554

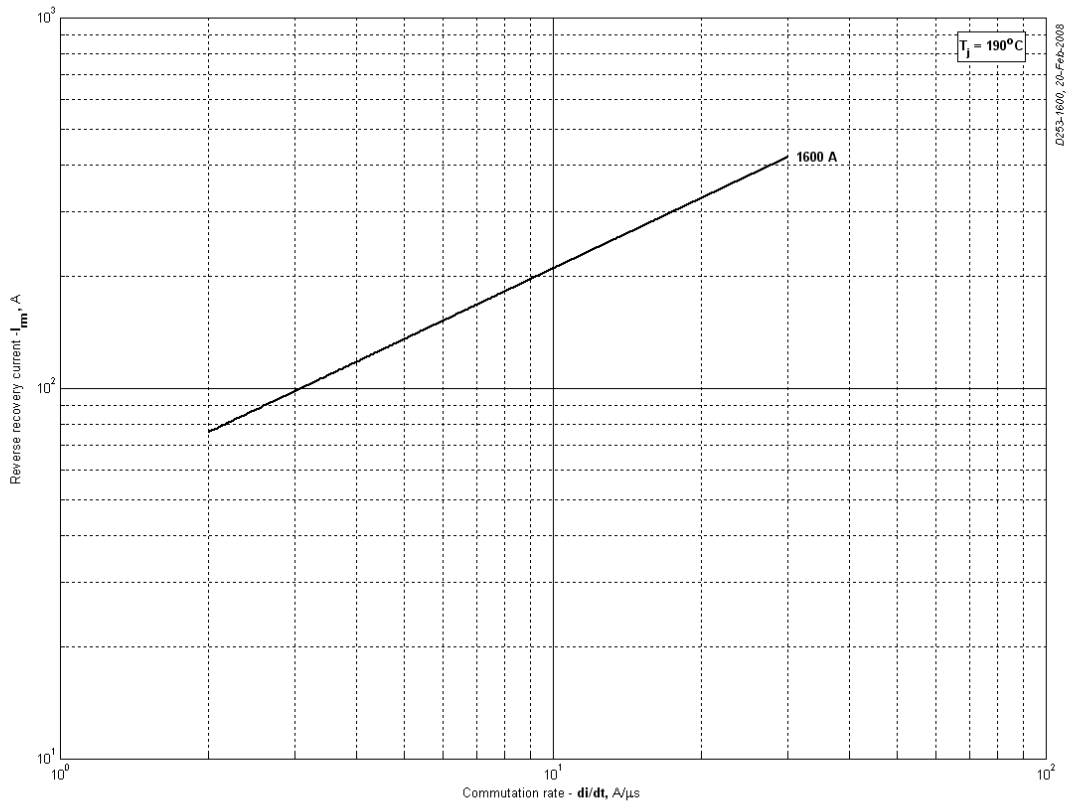
**Transient thermal impedance junction to case  $Z_{thjc}$  model (see Fig. 2)**



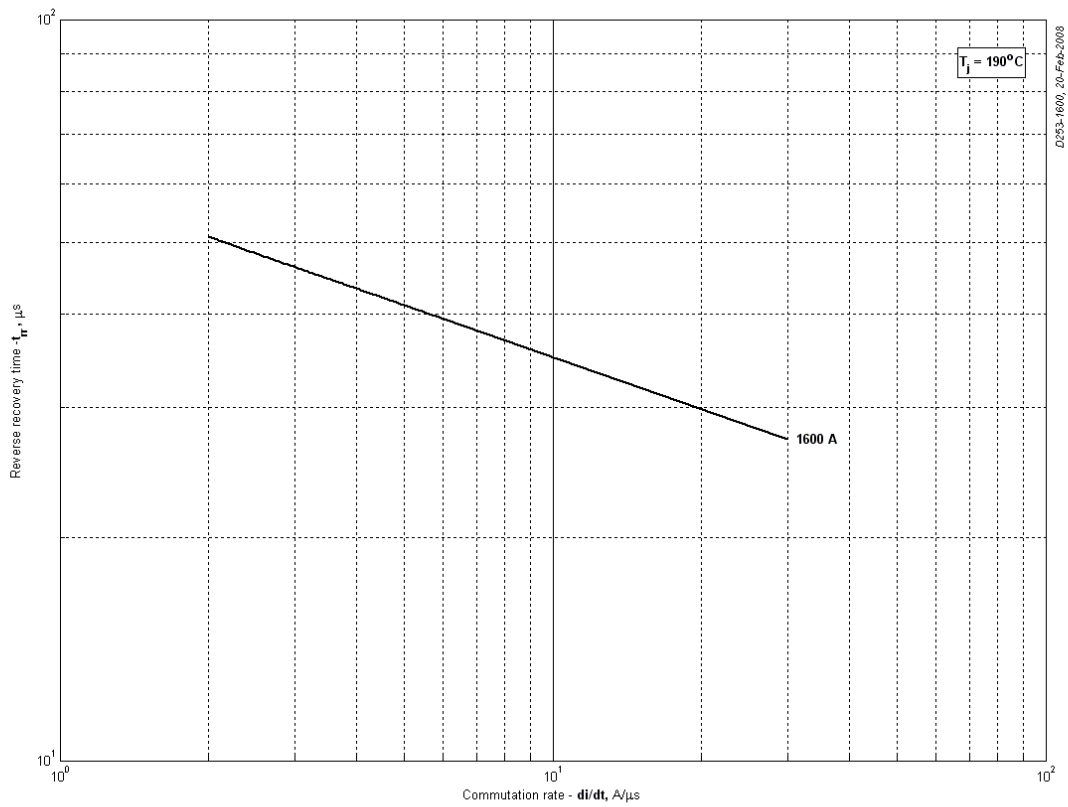
**Fig 3 – Total recovered charge,  $Q_{rr-i}$  (integral)**



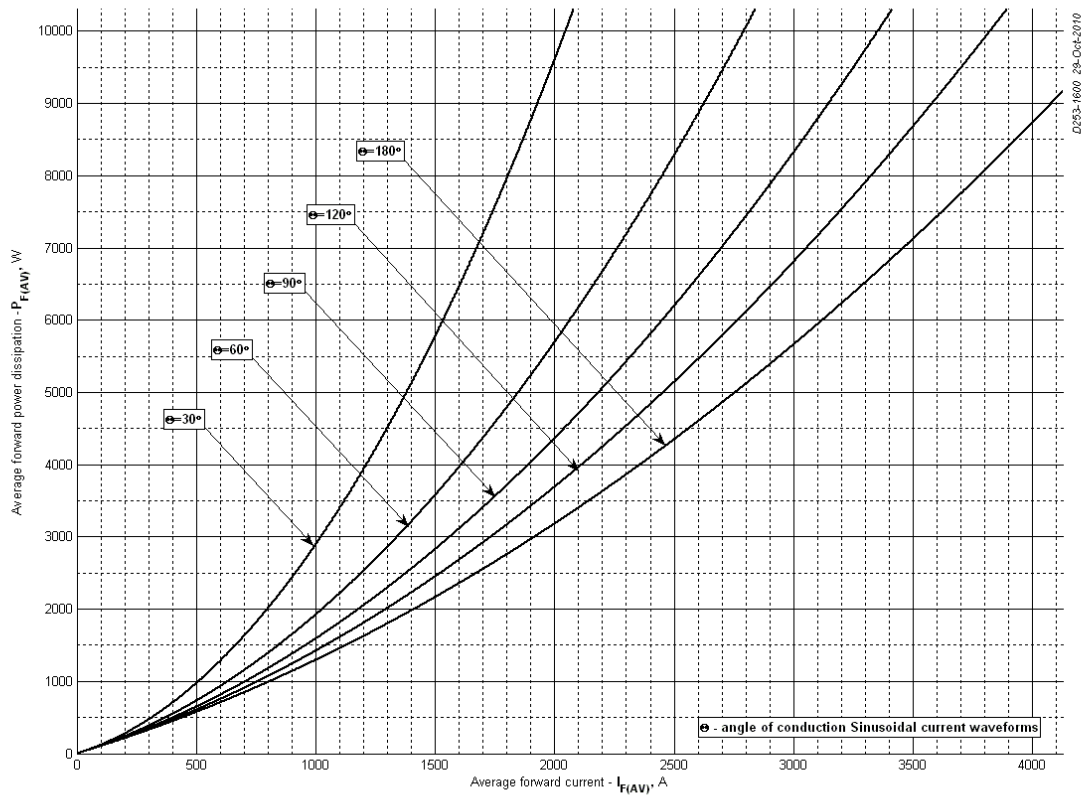
**Fig 4 - Recovered charge,  $Q_{rr}$  (linear)**



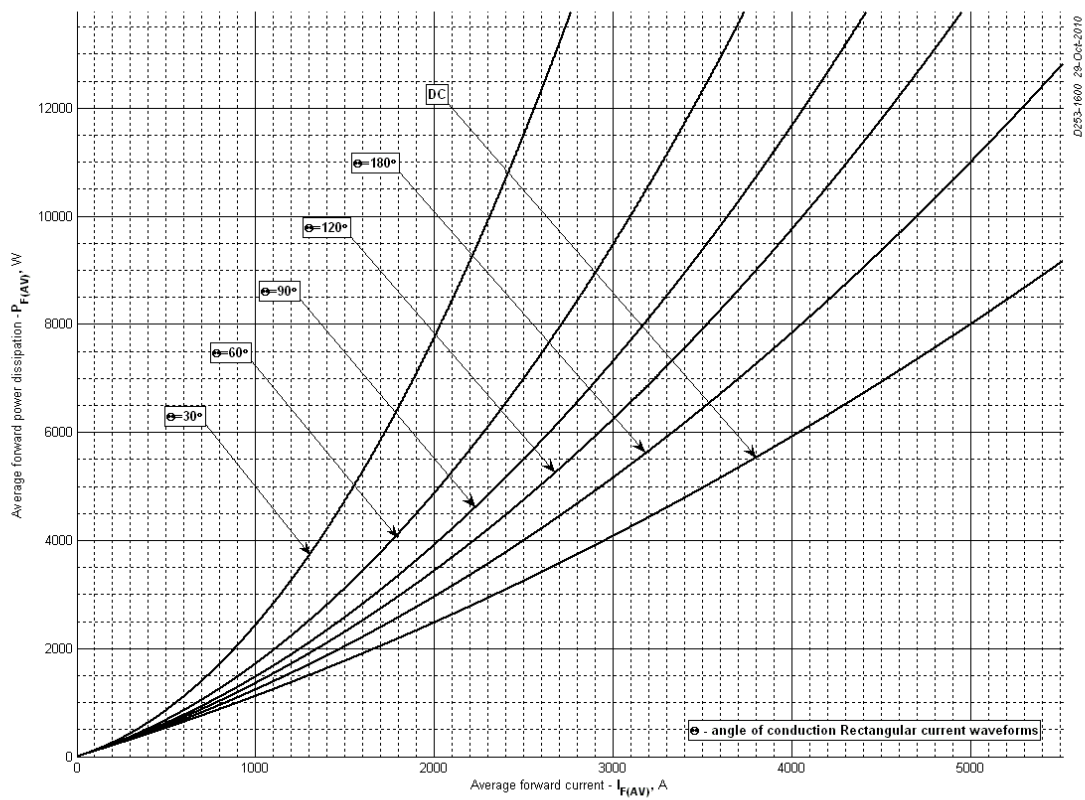
**Fig 5 – Peak reverse recovery current,  $I_{rm}$**



**Fig 6 – Maximum recovery time,  $t_{rr}$  (linear)**

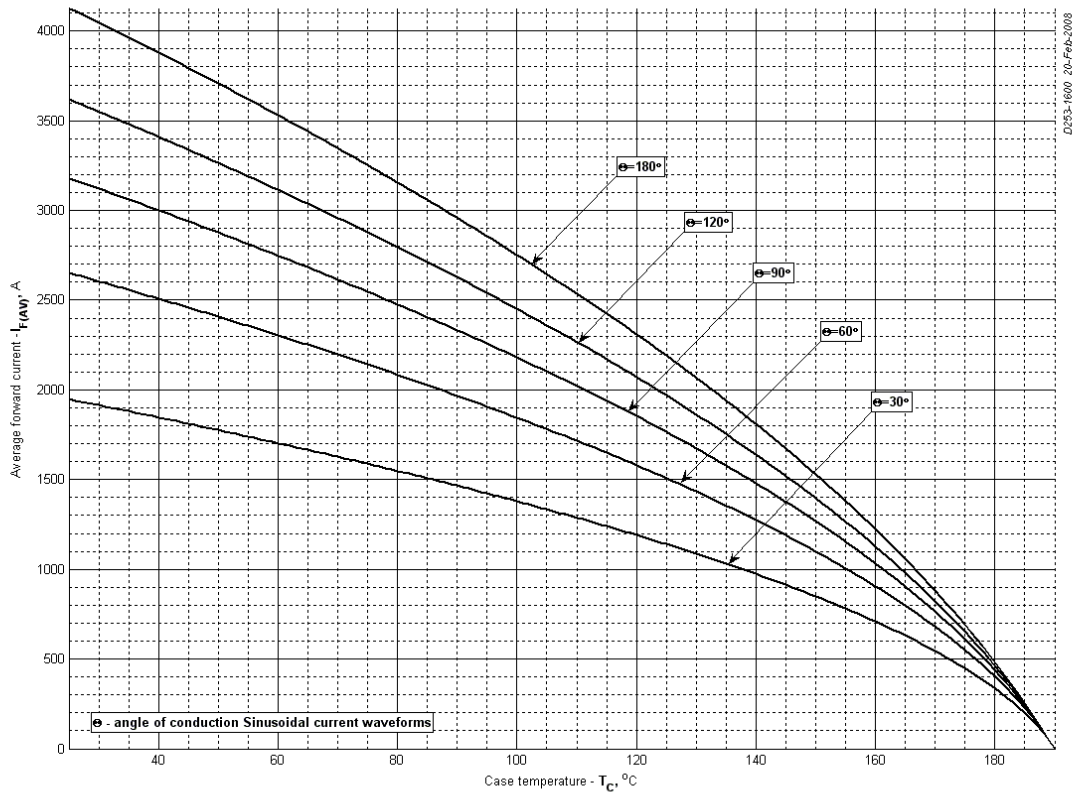


**Fig 7 – On-state power loss (sinusoidal current waveforms)**

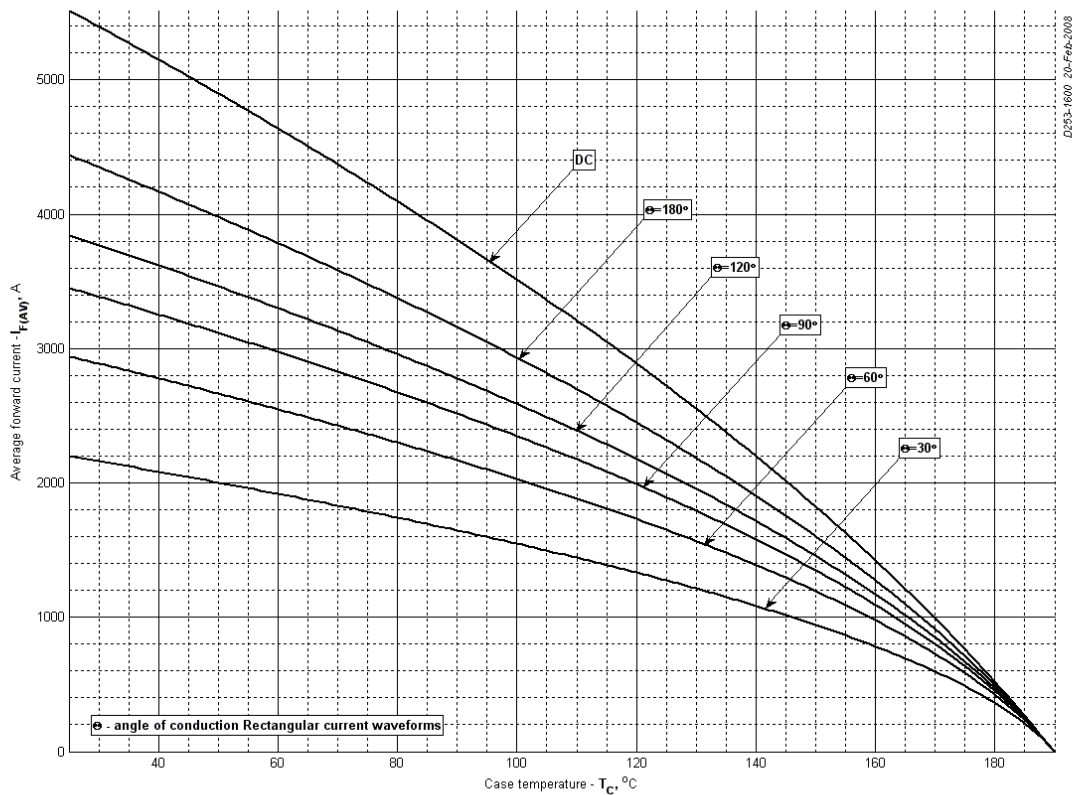


**Fig 8 – On-state power loss (rectangular current waveforms)**

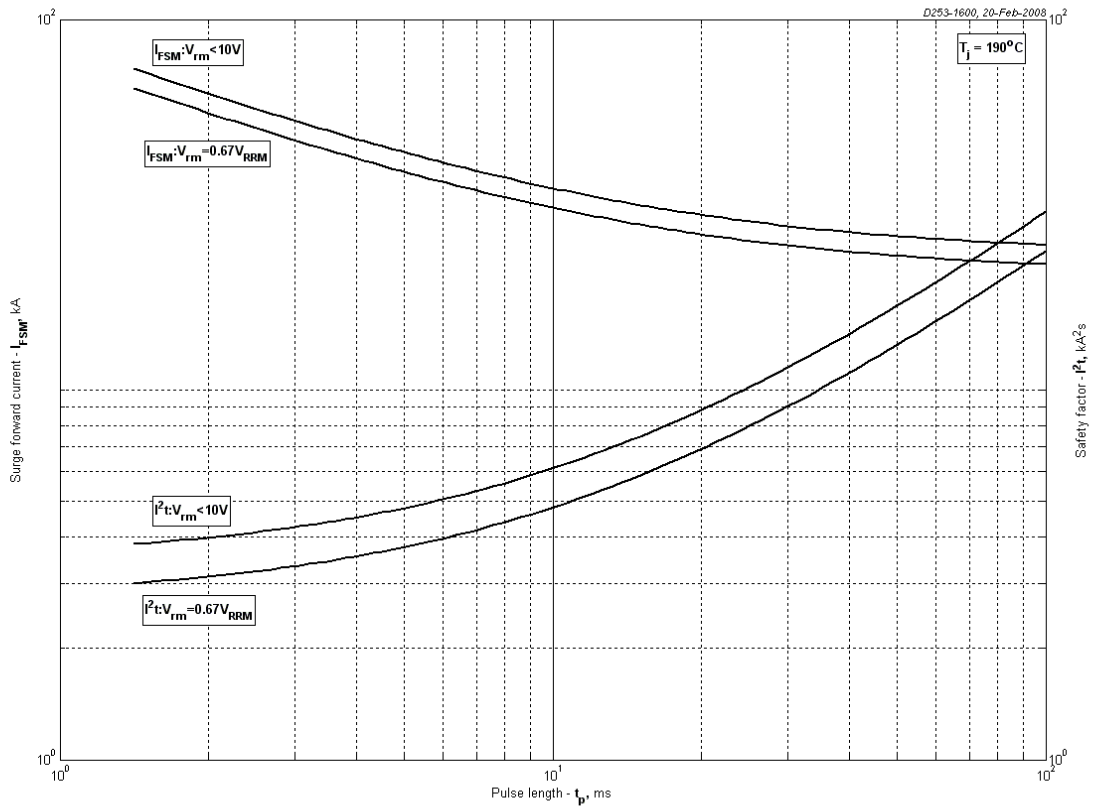




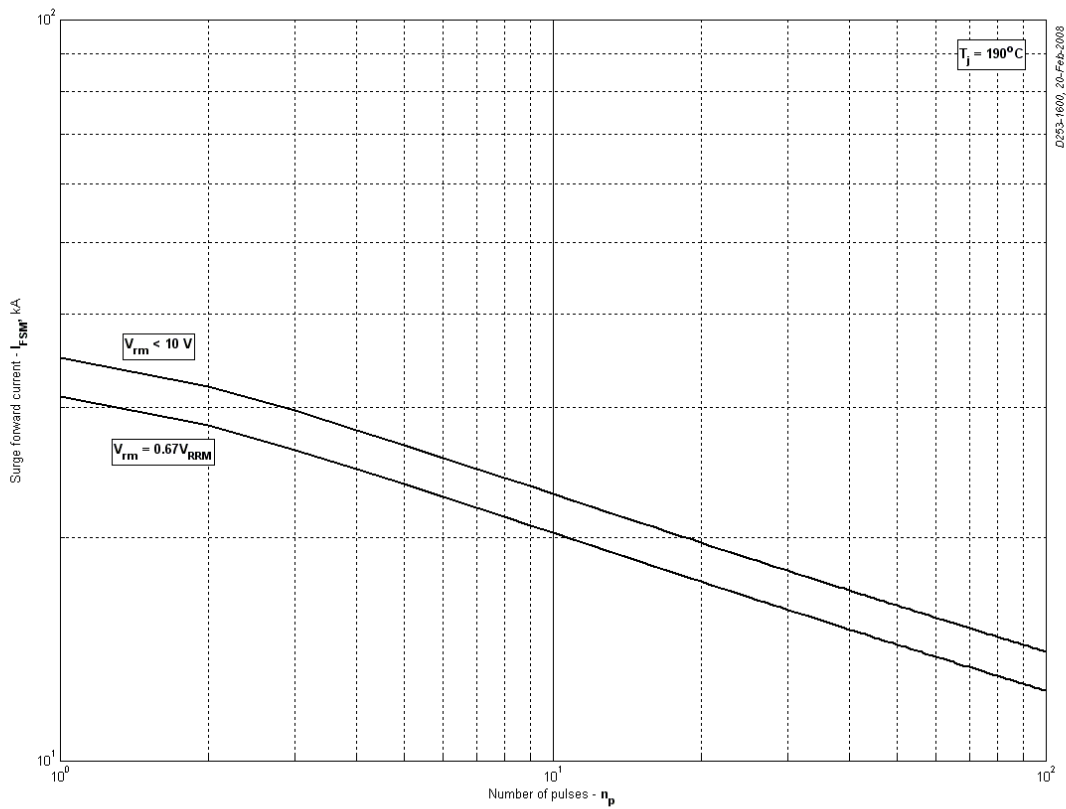
**Fig 9 – Maximum case temperature DSC (sinusoidal current waveforms)**



**Fig 10 – Maximum case temperature DSC (rectangular current waveforms)**



**Fig 11 – Maximum surge and  $I^2t$  ratings**



**Fig 12 – Maximum surge ratings**