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

Rectifier Diode
Type D193-3200-65

Average forward current	I_{FAV}	3200 A	
Repetitive peak reverse voltage	V_{RRM}	$6200 \div 6500$ V	
V_{RRM}, V	6200	6400	6500
Voltage code	62	64	65
T_j, °C	$-60 \div 150$		

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions
ON-STATE				
I_{FAV}	Average forward current	A	3200 3750	T_c=111 °C; Double side cooled; T_c=100 °C; Double side cooled; 180° half-sine wave; 50 Hz
I_{FRMS}	RMS forward current	A	5024	T_c=111 °C; Double side cooled; 180° half-sine wave; 50 Hz
I_{FSM}	Surge forward current	kA	64.0 73.6	$T_j=T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V;
			67.2 77.3	$T_j=T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=8.3 ms; single pulse; V_R=0 V;
I^2t	Safety factor	$A^2s \cdot 10^3$	20480 27085	$T_j=T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V;
			18741 24785	$T_j=T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=8.3 ms; single pulse; V_R=0 V;
BLOCKING				
V_{RRM}	Repetitive peak reverse voltages	V	$6200 \div 6500$	$T_{j\,min} < T_j < T_{j\,max}$; 180° half-sine wave; 50 Hz;
V_{RSM}	Non-repetitive peak reverse voltages	V	$6300 \div 6600$	$T_{j\,min} < T_j < T_{j\,max}$; 180° half-sine wave; single pulse;
V_R	Reverse continuous voltages	V	$0.75 \cdot V_{RRM}$	$T_j=T_{j\,max}$;
THERMAL				
T_{stg}	Storage temperature	°C	$-60 \div 55$	
T_j	Operating junction temperature	°C	$-60 \div 150$	
MECHANICAL				
F	Mounting force	kN	$70.0 \div 90.0$	
a	Acceleration	m/s^2	50 100	Device unclamped Device clamped

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.85	T_j=25 °C; I_{FM}=6300 A	
$V_{F(TO)}$	Forward threshold voltage, max	V	0.90	T_j=$T_{j\,max}$; 0.5 π I_{FAV} < I_T < 1.5 π I_{FAV}	
r_T	Forward slope resistance, max	mΩ	0.190		
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	300	T_j=$T_{j\,max}$; V_R=V_{RRM}	
SWITCHING					
Q_{rr}	Total recovered charge, max	μC	17000	T_j=$T_{j\,max}$; I_{TM}=2000 A ; di_R/dt=-5 A/μs ; V_R=100 V;	
t_{rr}	Reverse recovery time, max	μs	140		
I_{rrM}	Peak reverse recovery current, max	A	240		
THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0050	Direct current	Double side cooled
R_{thjc-A}			0.0150		Anode side cooled
R_{thjc-K}			0.0075		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max	°C/W	0.0010	Direct current	
MECHANICAL					
w	Weight, typ	g	2200		
D_s	Surface creepage distance	mm (inch)	49.5 (1.949)		
D_a	Air strike distance	mm (inch)	22.4 (0.882)		

PART NUMBERING GUIDE

| D	193	3200	65	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

max ⌀150(5,905) DIA
⌀100(3,937) DIA
26(1,024)±2
⌀3,5(0,138) DIA both sides
3(0,118)
⌀100(3,937) DIA
⌀140(5,512) DIA
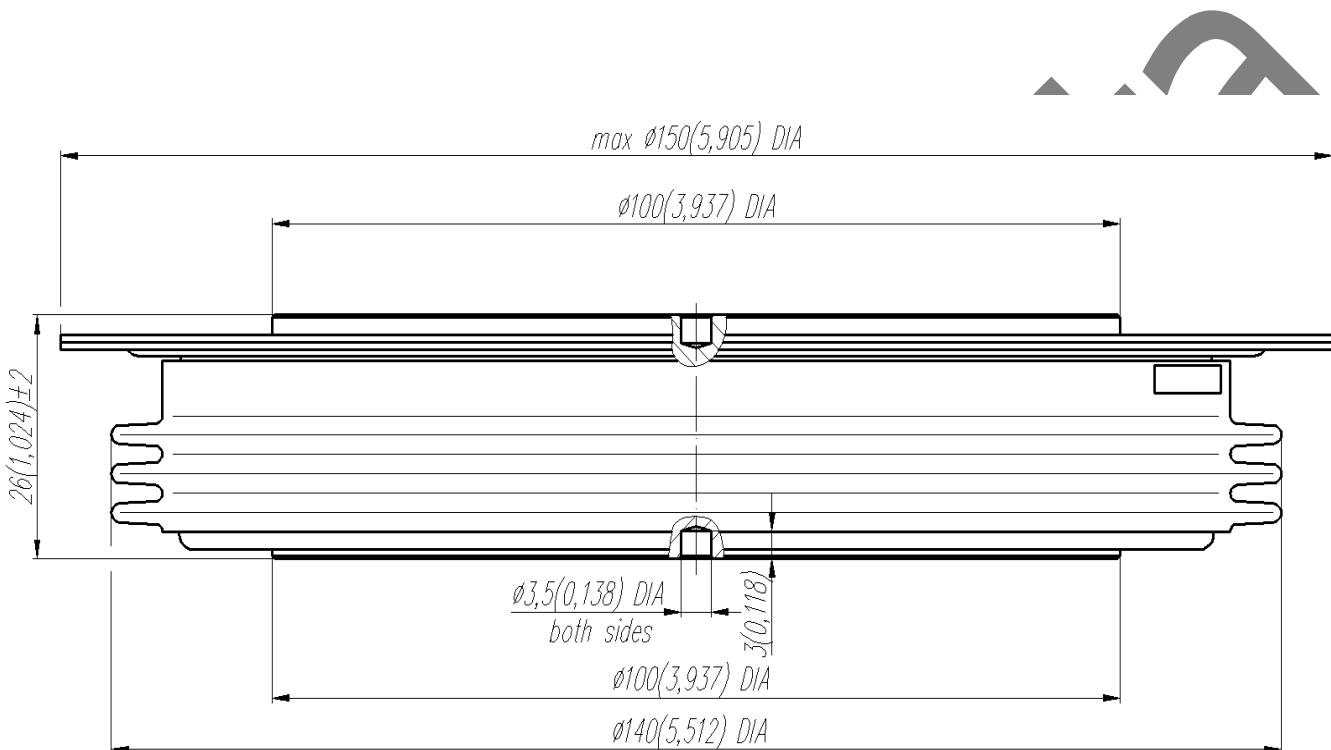
All dimensions in millimeters (inches)
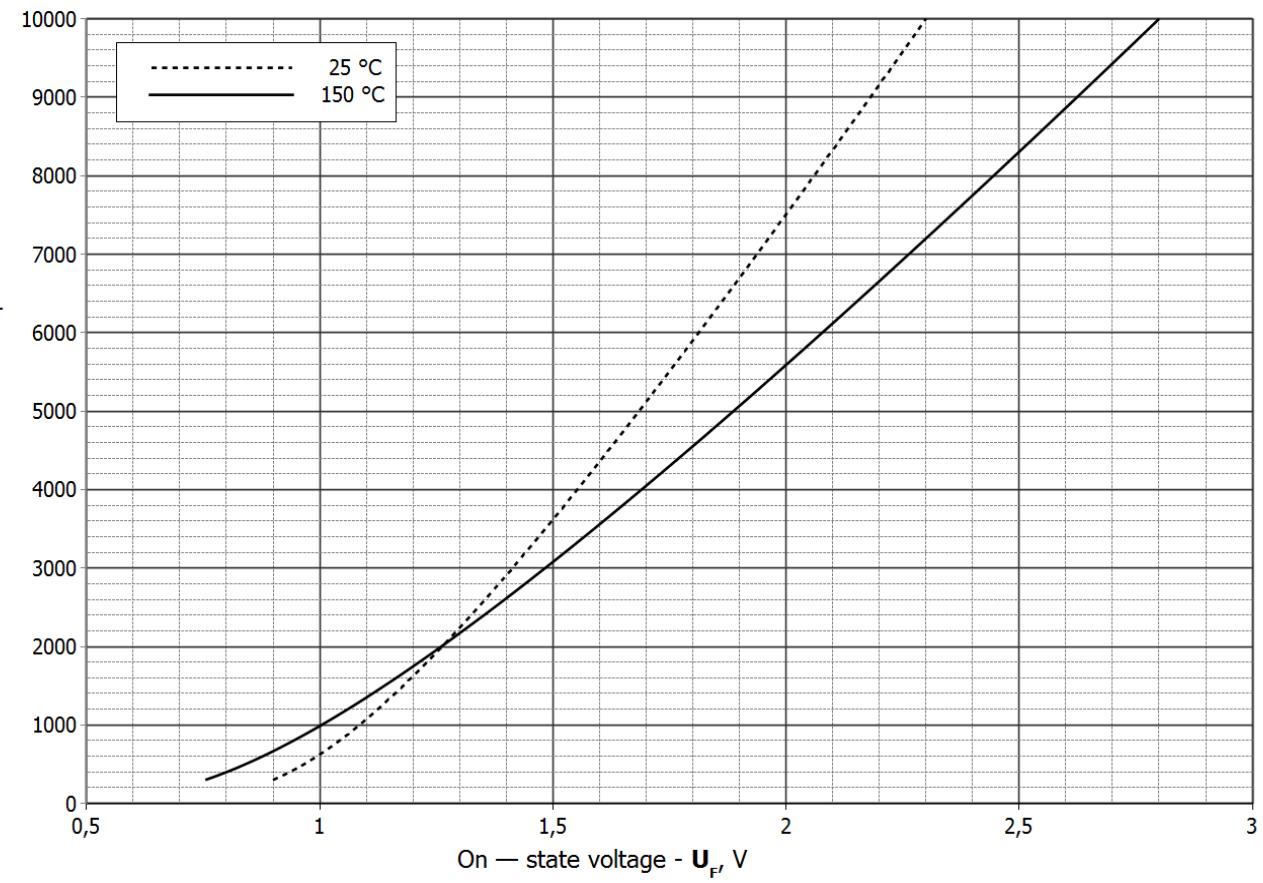
$$V_F = A + B \cdot i_F + C \cdot \ln(i_F + 1) + D \cdot \sqrt{i_F}$$

	Coefficients for max curves	
	$T_j = 25°C$	$T_j = T_{j\,max}$
A	0,43226000	0,31016000
B	0,00010089	0,00013849
C	0,07015300	0,05148900
D	0,00212680	0,00630740

Forward characteristic model (see Fig. 1).

Chart labels:
- DSC 0.00150 K/W
- CSC 0.0075 K/W
- DSC 0.0050 K/W
- D193-3200, 22-May-2018
- Y-axis: Transient thermal impedance — Z_{thjc}, K/W
- X-axis: Time — t, c
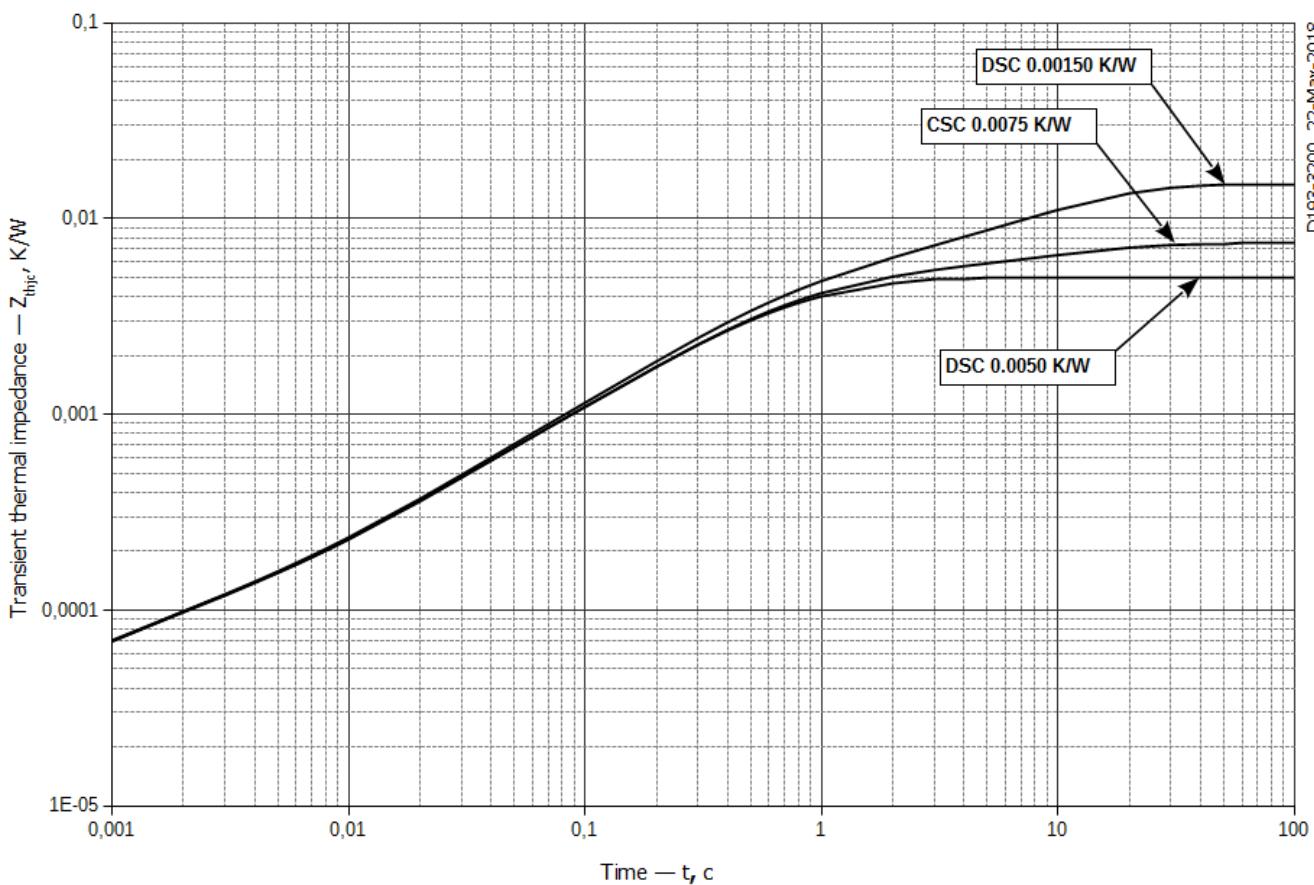
$$Z_{thjc} = \sum_{i=1}^{n} R_i \left(1 - e^{-\frac{t}{\tau_i}} \right)$$

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.

　　　τ_i = Time constatnt of r_{th} term.

DC Double side cooled

i	1	2	3	4	5	6
R_i, K/W	0.002027	0.0001166	0.002627	0.0001539	3.237e-005	4.335e-005
τ_i, s	1.059	0.080	0.3836	0.02289	0.0003559	0.001397

DC Cathode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.002502	0.002188	0.002508	0.0002154	3.854e-005	4.646e-005
τ_i, s	10.6	1.090	0.3745	0.03207	0.002565	0.0004383

DC Anode side cooled

i	1	2	3	4	5	6
R_i, K/W	0.01	0.002218	0.00248	0.0002153	3.862e-005	4.604e-005
τ_i, s	10.6	1.120	0.3786	0.03196	0.002513	0.0004352

Transient thermal impedance junction to case Z_{thjc} model (see Fig. 2)
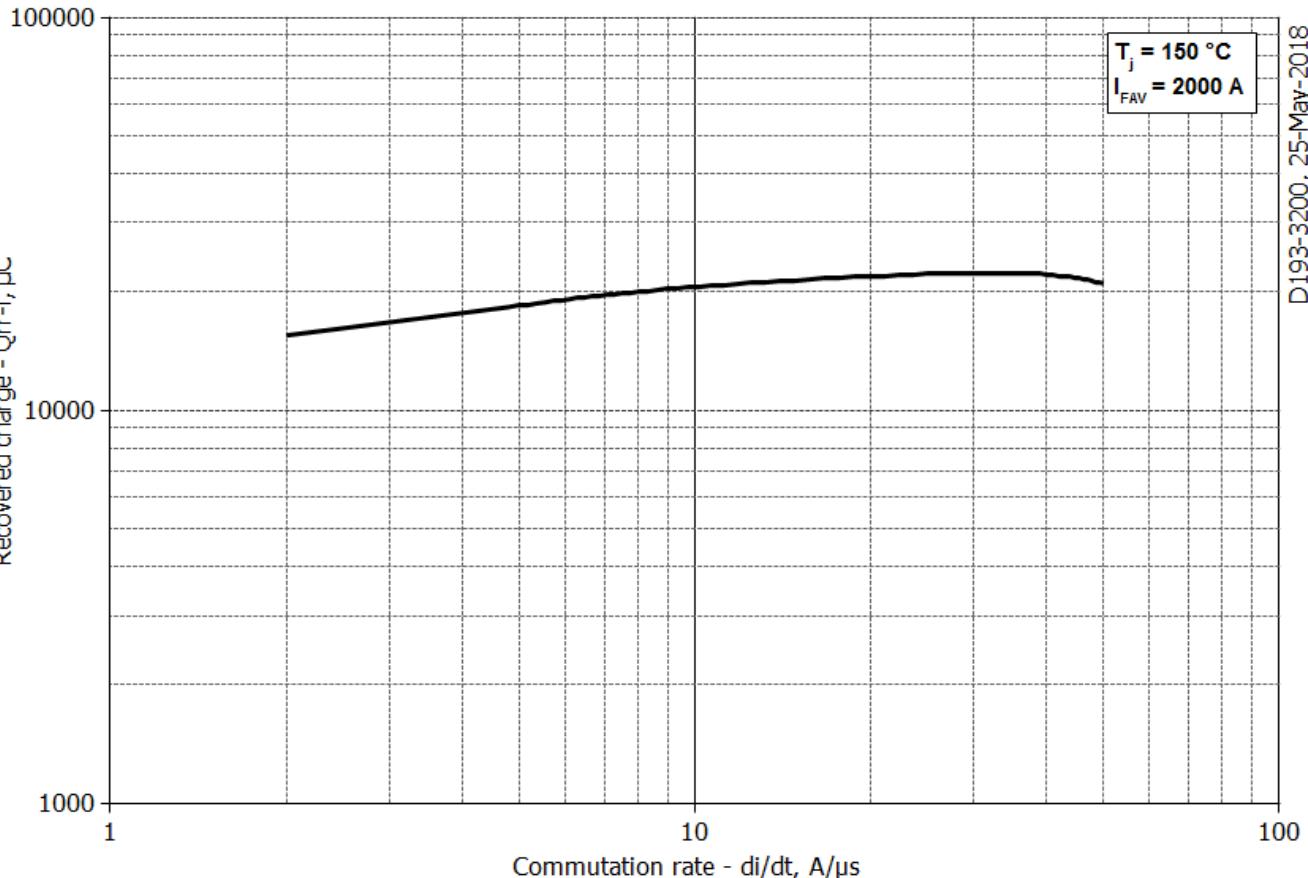
Fig 3 – Total recovered charge, Q_{rr-i} (integral)

Graph axes: Recovered charge - Q_{rr-i}, μC (vertical, 1000 to 100000); Commutation rate - di/dt, A/μs (horizontal, 1 to 100).

Legend: T_j = 150 °C, I_{FAV} = 2000 A

D193-3200, 25-May-2018
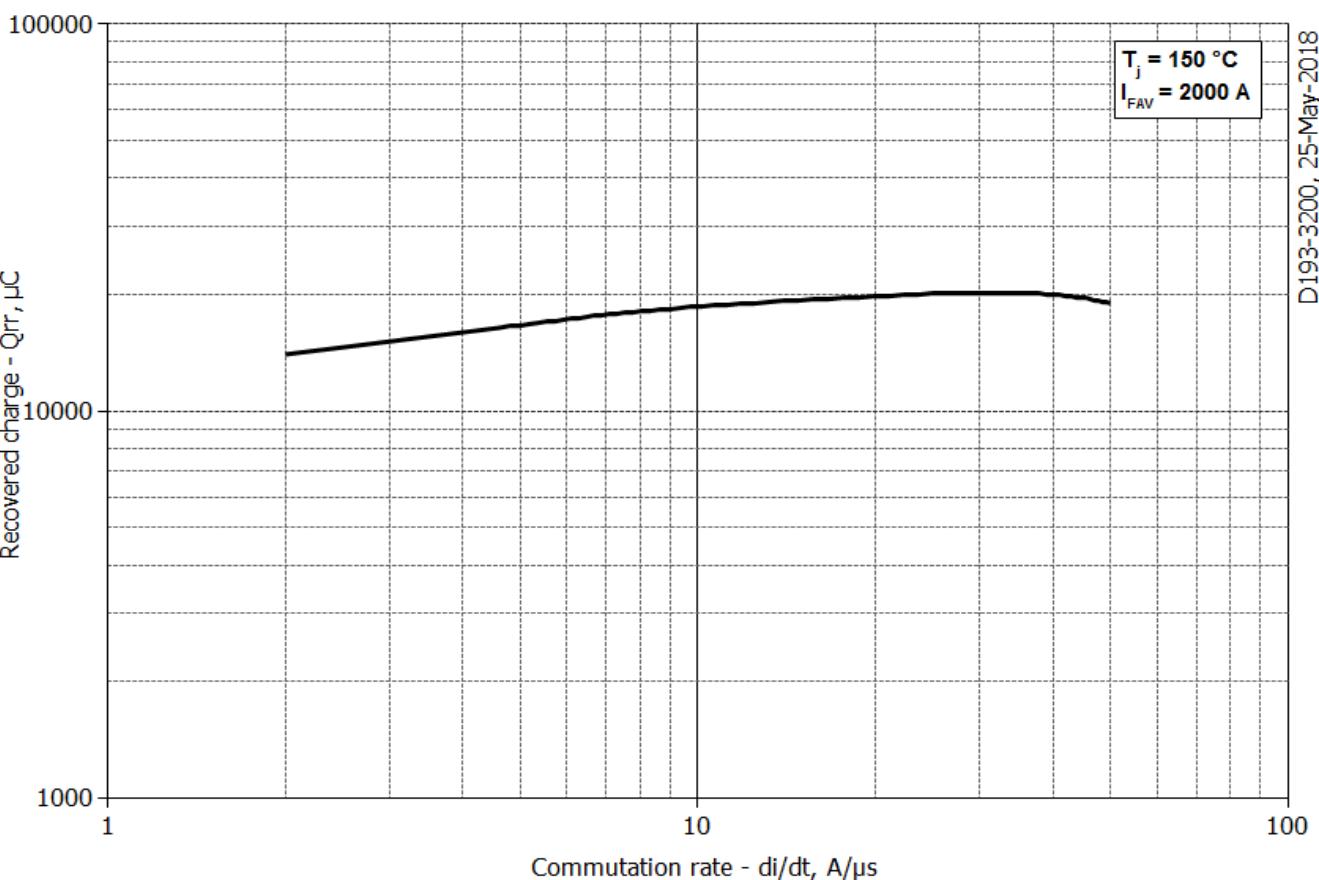
Fig 4 - Recovered charge, Q_{rr} (25% chord)

Graph axes: Recovered charge - Q_{rr}, μC (vertical, 1000 to 100000); Commutation rate - di/dt, A/μs (horizontal, 1 to 100).

Legend: T_j = 150 °C, I_{FAV} = 2000 A

D193-3200, 25-May-2018

Data Sheet D193-3200-65

Fig 5 − Peak reverse recovery current, I$_{rm}$

Graph axes:
- Y-axis: Reverse recovery current - IrrM, A (10 to 1000)
- X-axis: Commutation rate - di/dt, A/µs (1 to 100)
- Conditions: T$_j$ = 150 °C, I$_{FAV}$ = 2000 A
- D193-3200, 25-May-2018
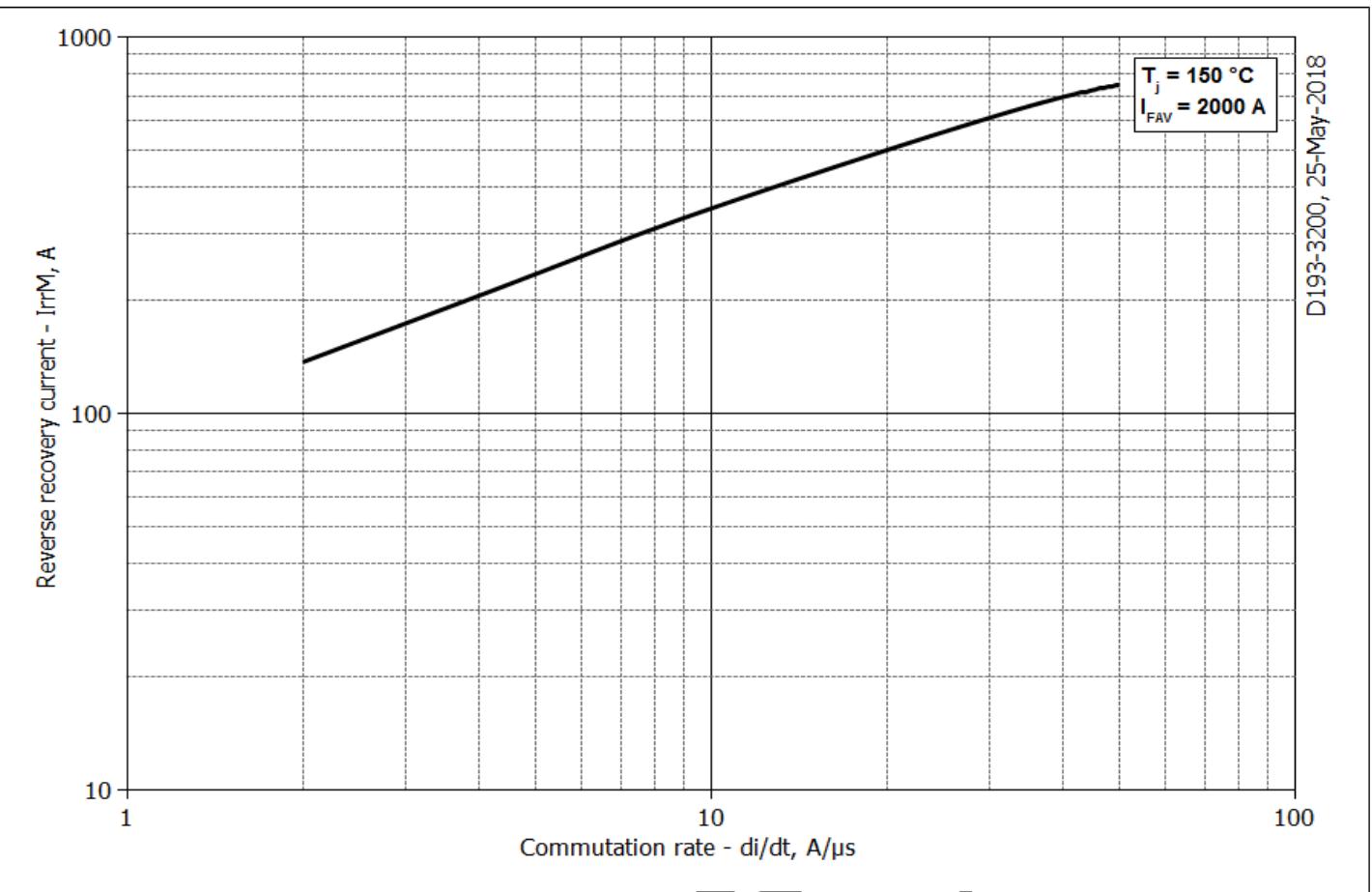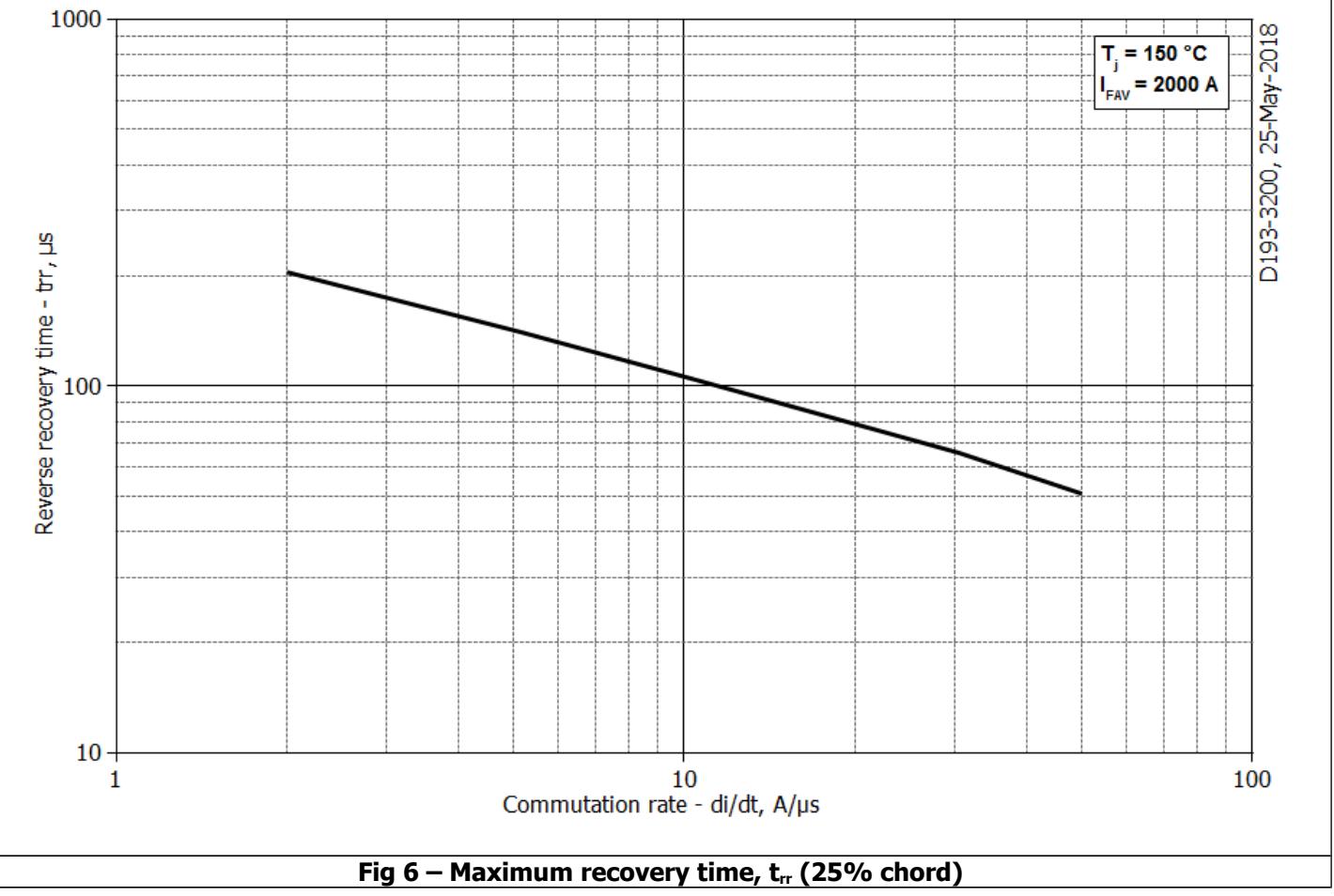
Fig 6 − Maximum recovery time, t$_{rr}$ (25% chord)

Graph axes:
- Y-axis: Reverse recovery time - trr, µs (10 to 1000)
- X-axis: Commutation rate - di/dt, A/µs (1 to 100)
- Conditions: T$_j$ = 150 °C, I$_{FAV}$ = 2000 A
- D193-3200, 25-May-2018
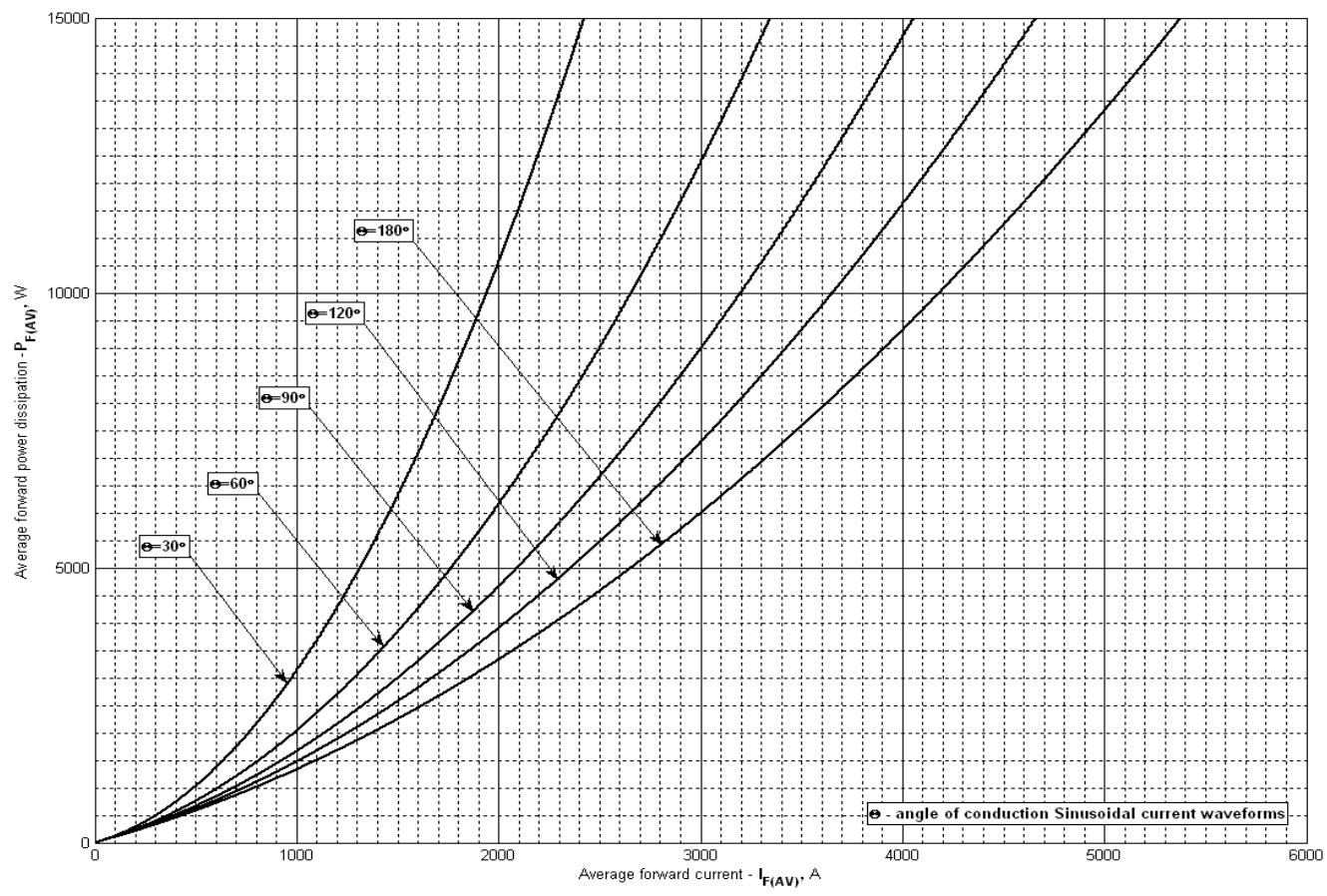
Fig 7 - Mean forward power dissipation P$_{FAV}$ vs. Mean forward current I$_{FAV}$ for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)
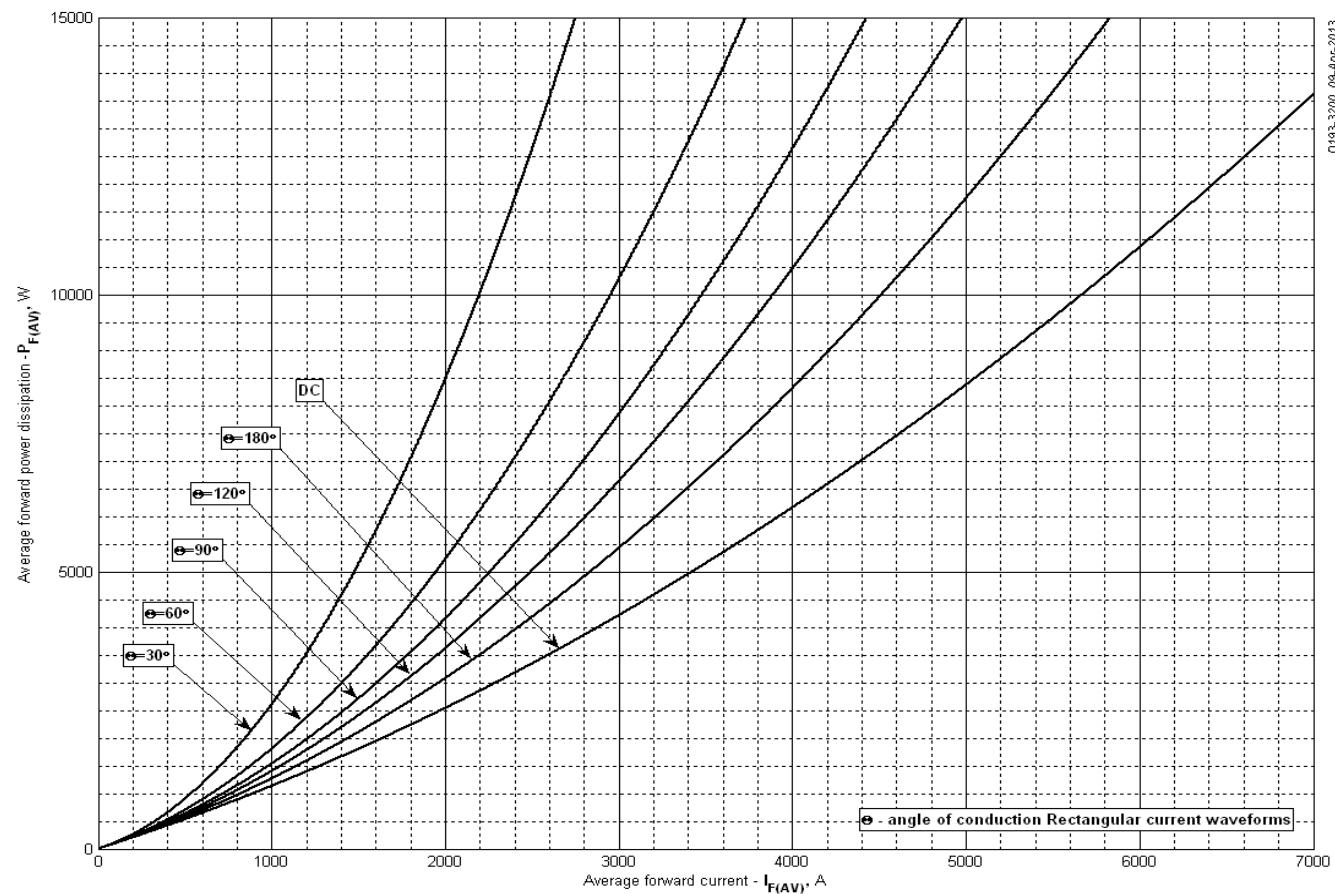
Fig 8 – Mean forward power dissipation P$_{FAV}$ vs. Mean forward current I$_{FAV}$ for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)
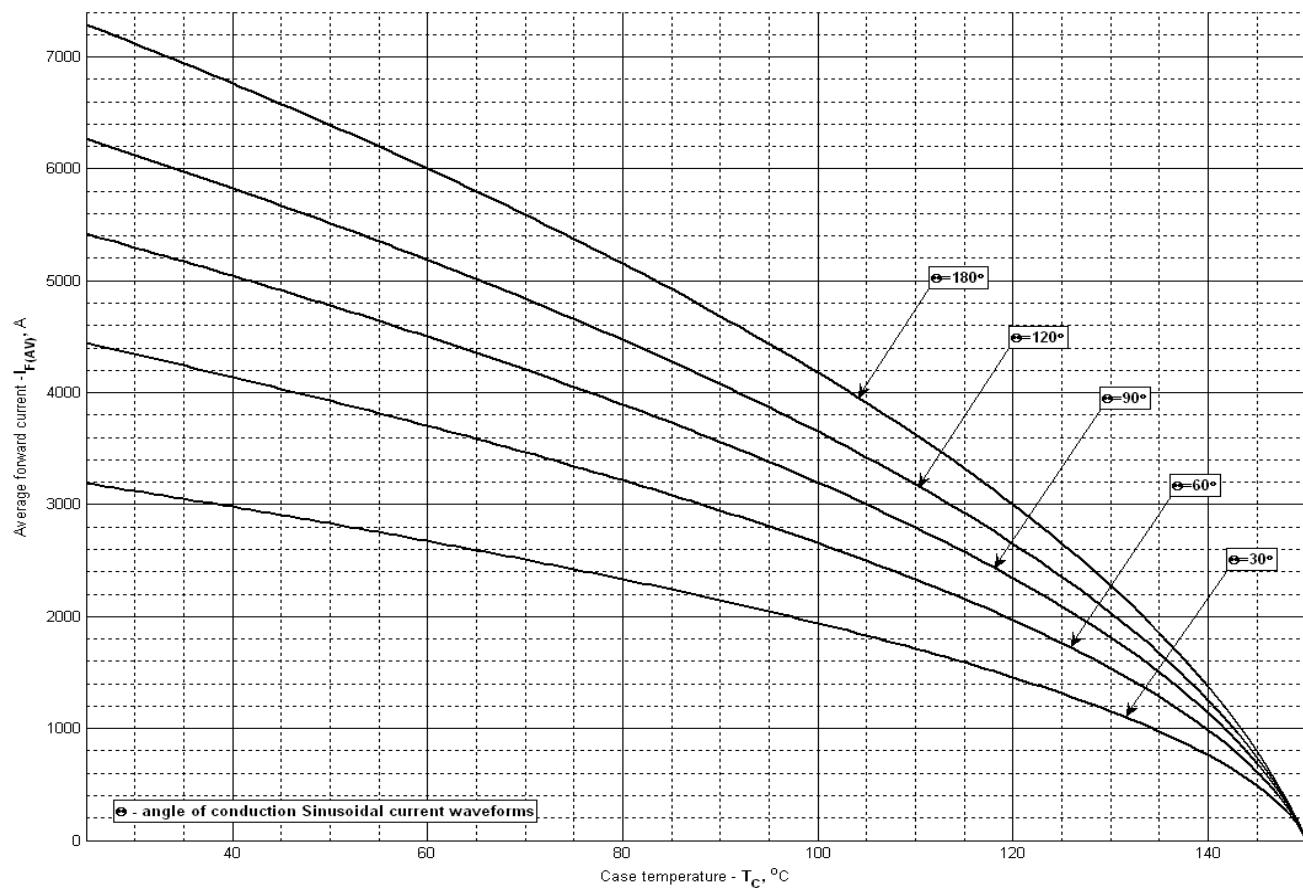
Fig 9 – Mean forward current I$_{FAV}$ vs. Case temperature T$_C$ for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)
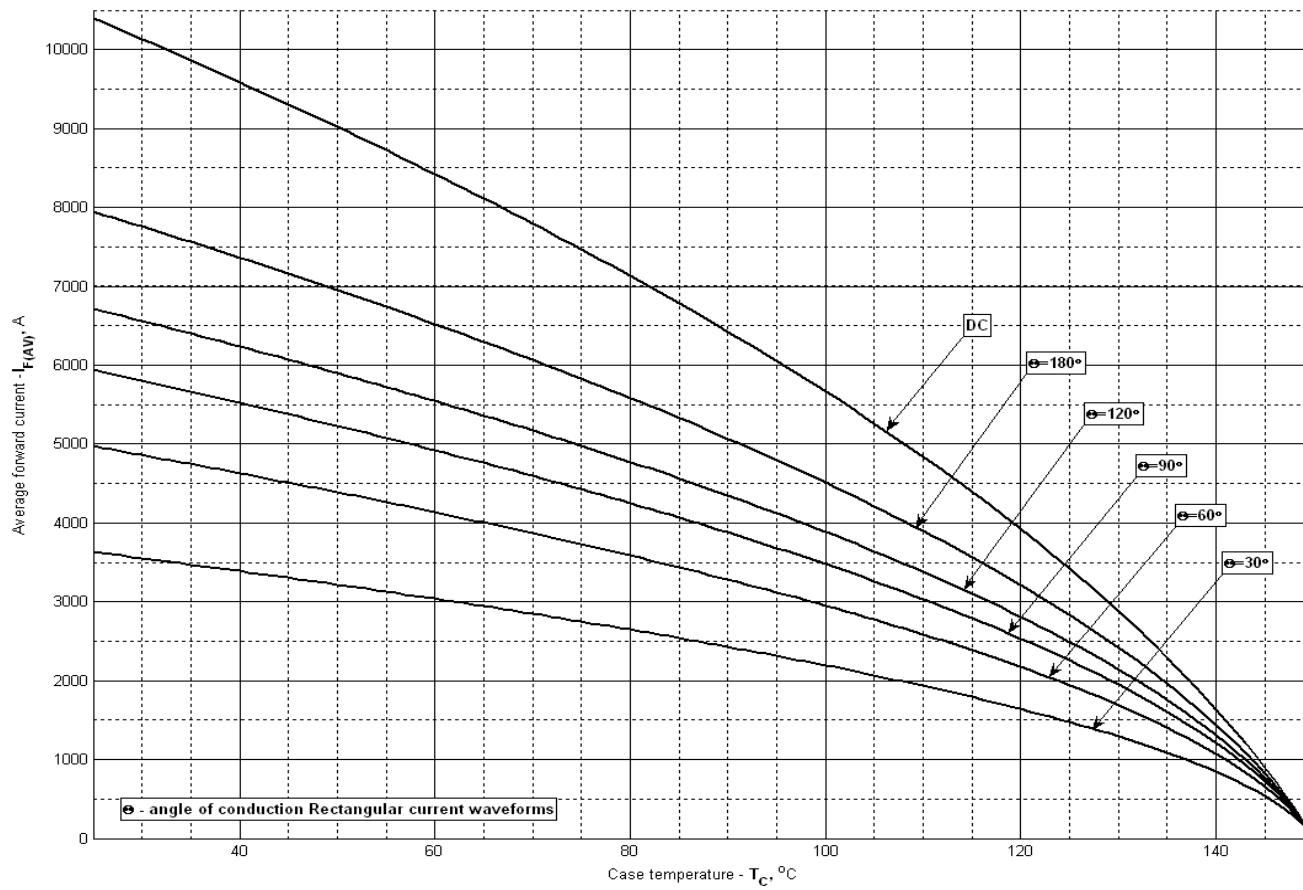

Fig 10 - Mean forward current I$_{FAV}$ vs. Case temperature T$_C$ for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

T_j = 125 °C

I²t:V_m <10V

I²t:V_m=0.67V_{RRM}

I_{TSM}:V_m<10V

I_{TSM}:V_m=0.67V_{RRM}

Surge on-state current – I_{FSM}, kA

Safety factor – I²t, kA²s

Pulse length – t_p, ms
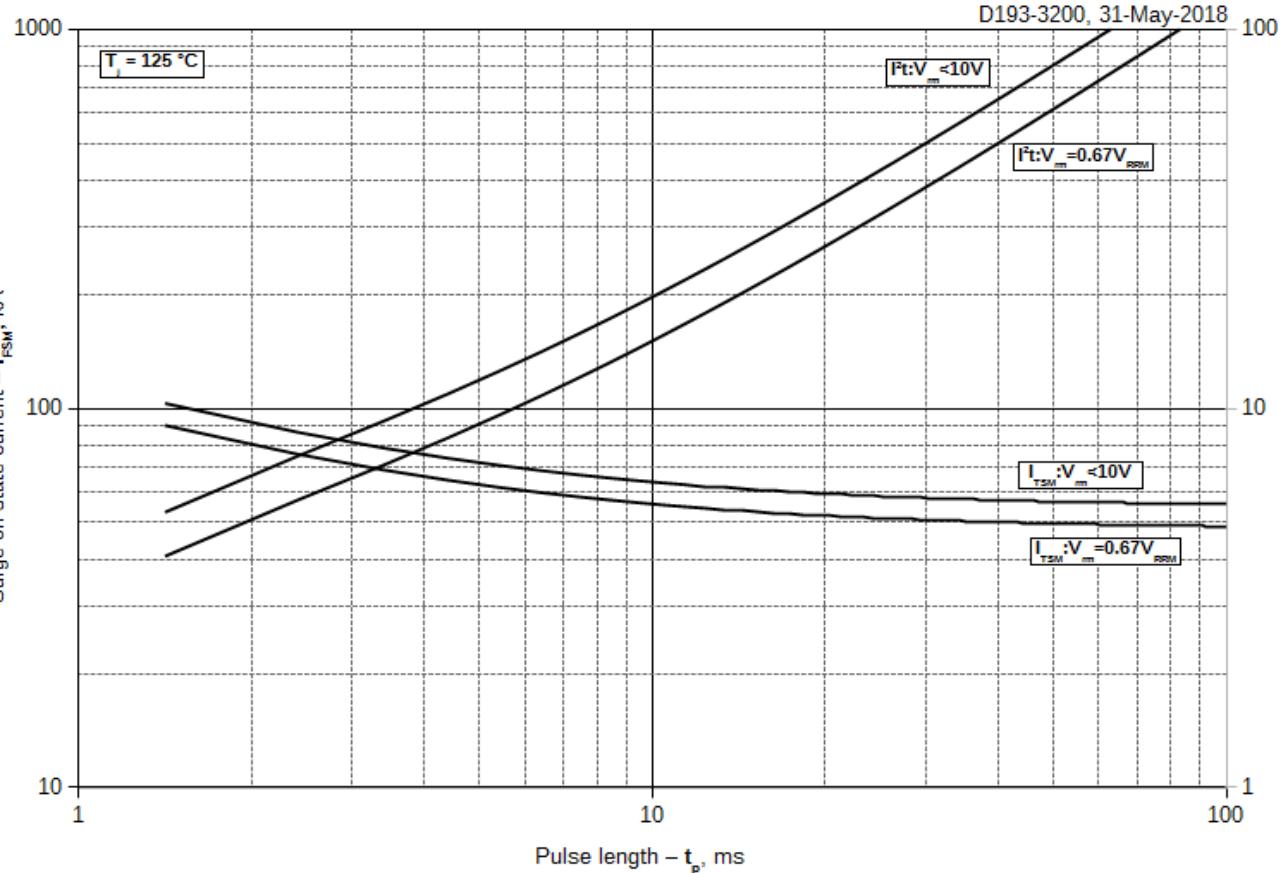
Fig 11 – Maximum surge and I²t ratings

V_m<10V

V_m=0.67V_{RRM}

T_j = 125 °C

D193-3200, 31-May-2018

Surge on-state current – I_{FSM}, kA

Nomber pulse – n_p
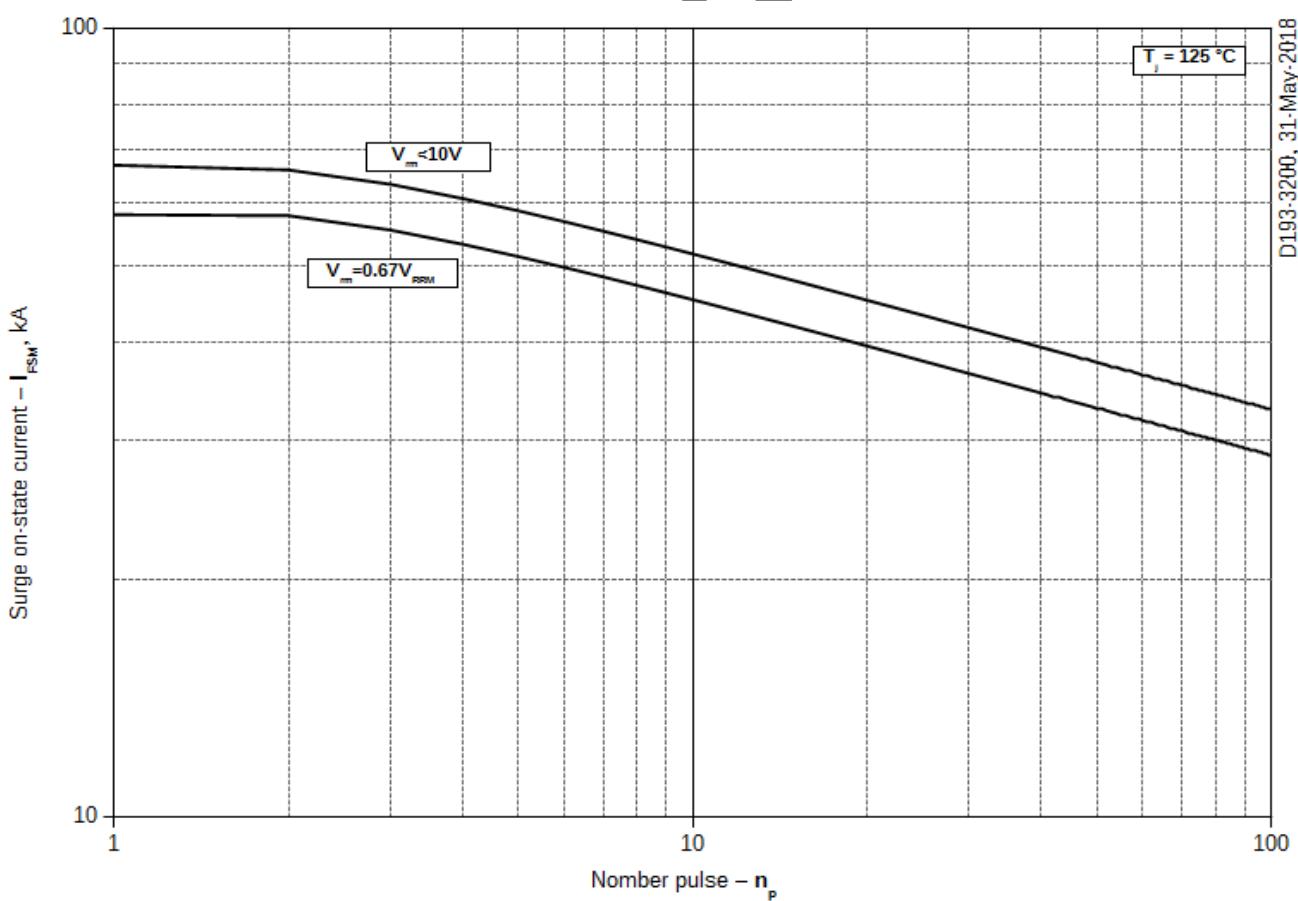
Fig 12 - Maximum surge ratings