PROTON-ELECTROTEX
RUSSIA

High forward current capability
Low forward losses
Low thermal resistance
High load cycle capability

Rectifier Diode For Welding
Type D256-9500-4

Average forward current		I_{FAV}	9500 A
Repetitive peak reverse voltage		V_{RRM}	200...400 V
V_{RRM}, V	200		400
Voltage code	2		4
T_j, °C	–45...+180		

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{FAV}	Average forward current	A	9500 11429 12905	T_c= 118 °C; Double side cooled; T_c= 100 °C; Double side cooled; T_c= 85 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{FRMS}	RMS forward current	A	14915	T_c= 118 °C; Double side cooled; 180° half-sine wave; 50 Hz	
I_{FSM}	Surge forward current	kA	70.0 84.0	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V
			74.0 89.0	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	$A^2s \cdot 10^3$	24500 35200	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V
			22700 32800	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	200...400	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; 50 Hz	
V_{RSM}	Non-repetitive peak reverse voltages	V	300...500	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; single pulse	
V_R	Reverse continuous voltages	V	0.6·V_{RRM}	T_j=$T_{j\,max}$	
THERMAL					
T_{stg}	Storage temperature	°C	–45...+40		
T_j	Operating junction temperature	°C	–45...+180		
MECHANICAL					
F	Mounting force	kN	30.0...50.0		
a	Acceleration	m/s^2	50	Device clamped	

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.08 0.98	T_j=25 °C; I_{FM} = 6300 A T_j=$T_{j\,max}$; I_{FM} = 8000 A	
$V_{F(TO)}$	Forward threshold voltage, max	V	0.84	T_j=$T_{j\,max}$	14900 A < I_T < 44700 A
			0.80		10000 A < I_T < 30000 A
r_T	Forward slope resistance, max	mΩ	0.020		14900 A < I_T < 44700 A
			0.022		10000 A < I_T < 30000 A
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	50	T_j=$T_{j\,max}$; V_R=V_{RRM}	
SWITCHING					
Q_{rr}	Total recovered charge, max	µC	1150	T_j=$T_{j\,max}$; I_{FM}=1000 A; dI_{FM}/dt=-30 A/µs;	
			720	T_j=$T_{j\,max}$; I_{FM}=1000 A; dI_{FM}/dt=-10 A/µs;	
THERMAL					
R_{thjc}	Thermal resistance, junction to case, max	°C/W	0.0050	Direct Current	Double side cooled
R_{thjc-A}			0.0066		Anode side cooled
R_{thjc-K}			0.0200		Cathode side cooled
R_{thck}	Thermal resistance, case to heatsink, max		0.0035	Direct Current	
MECHANICAL					
m	Weight, max	g	110		
D_s	Surface creepage distance	mm (inch)	2.00 (0.079)		
D_a	Air strike distance	mm (inch)	2.00 (0.079)		

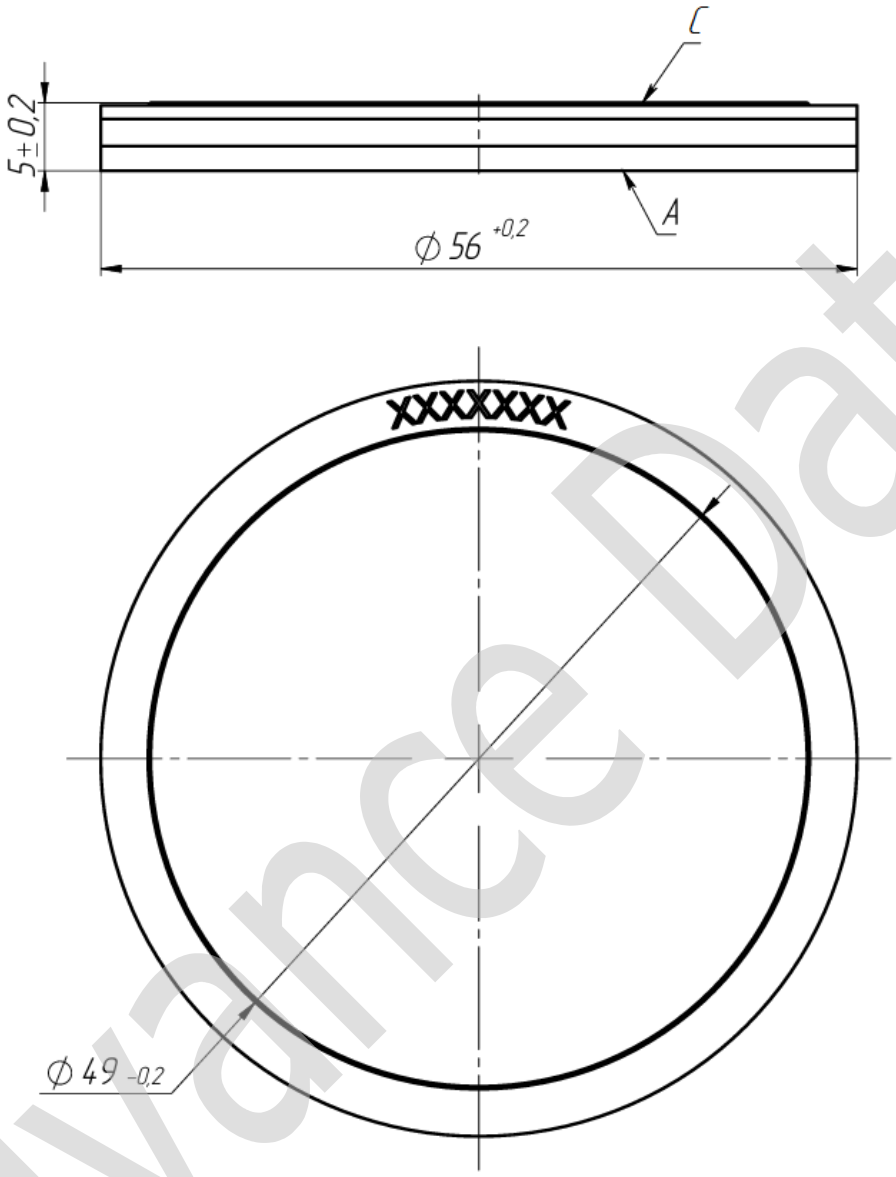
PART NUMBERING GUIDE

D	256	9500	4	N
1		2	3	4

1. Design version
2. Average forward current, A
3. Voltage code
4. Ambient conditions: N – normal

OVERALL DIMENSIONS

Package type: HOUSINGLESS



All dimensions in millimeters

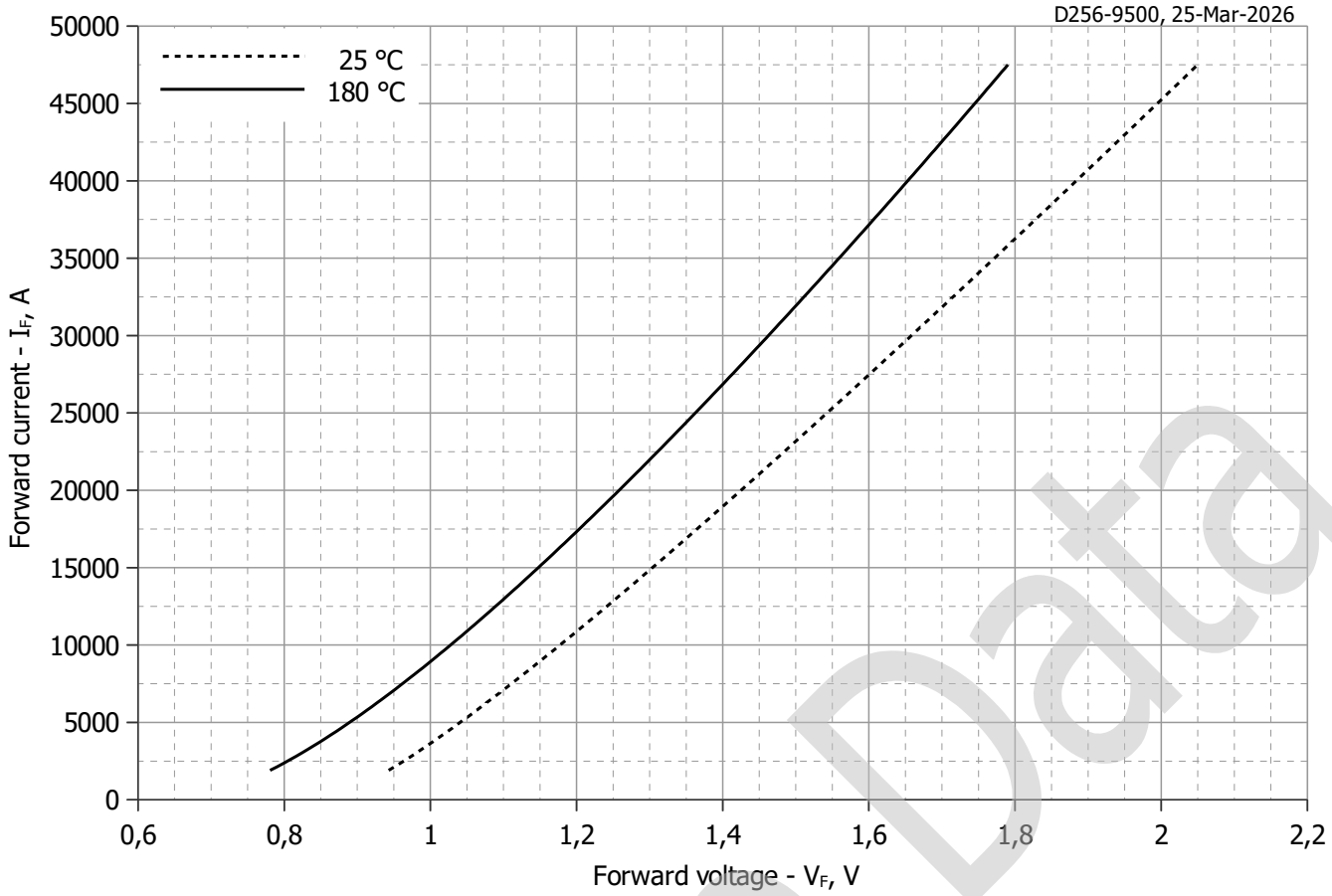


Fig 1 – Forward characteristics of Limit device

Analytical function for Forward 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°C	$T_j = T_{j\,max}$
A	0.84946283	0.67131348
B	0.00001848	0.00001151
C	-0.00115320	-0.00499173
D	0.00153712	0.00287089

Forward characteristic model (see Fig. 1).

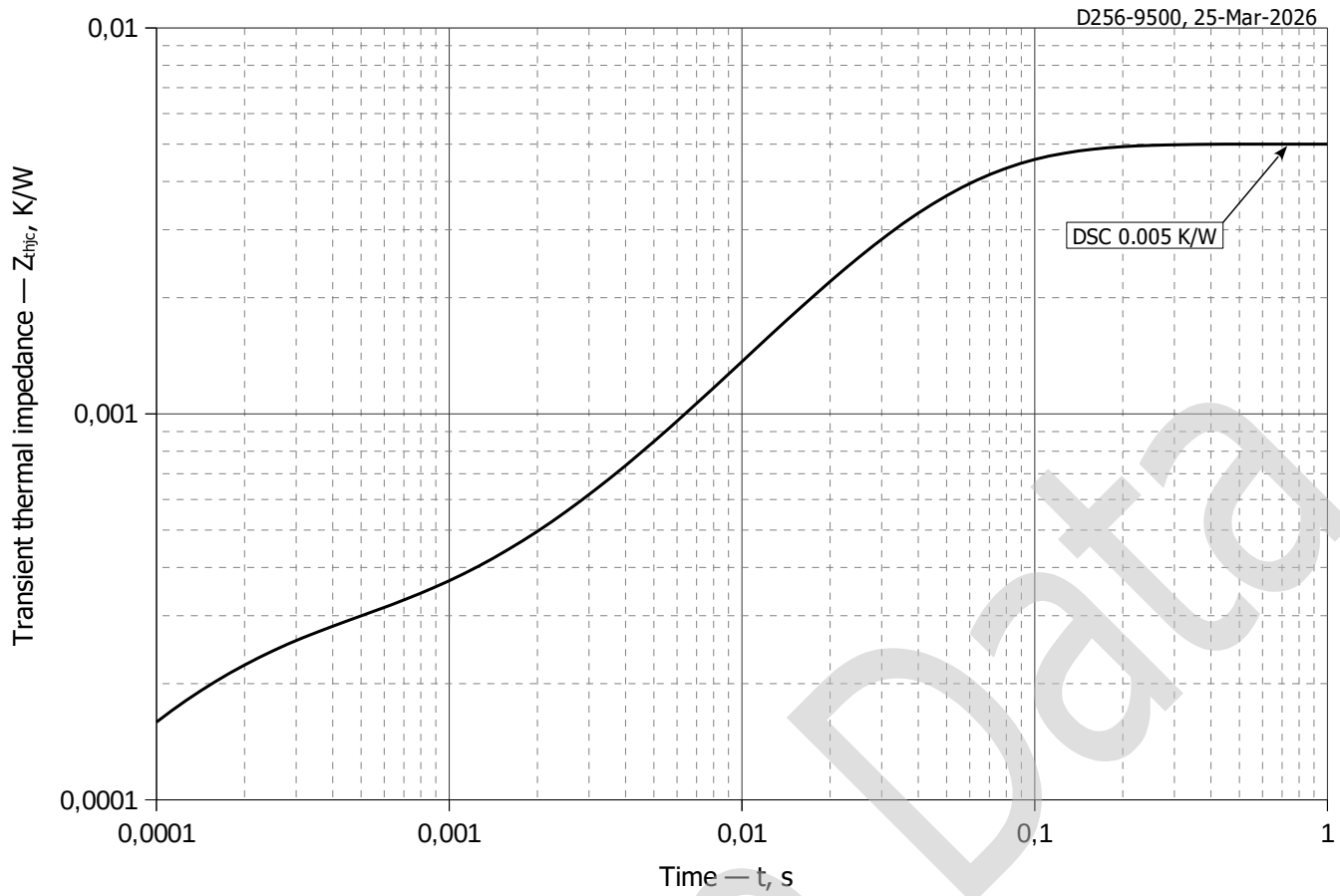


Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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.

τ_i = Time constatnt of r_{th} term.

DC Double side cooled

i	1	2	3	4	5	6
R_i, K/W	0.0009858	0.003751	0.00001625	0.00001224	0.0001735	0.00006128
τ_i, s	0.07476	0.03287	0.007701	0.001065	0.0001313	0.00005139

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

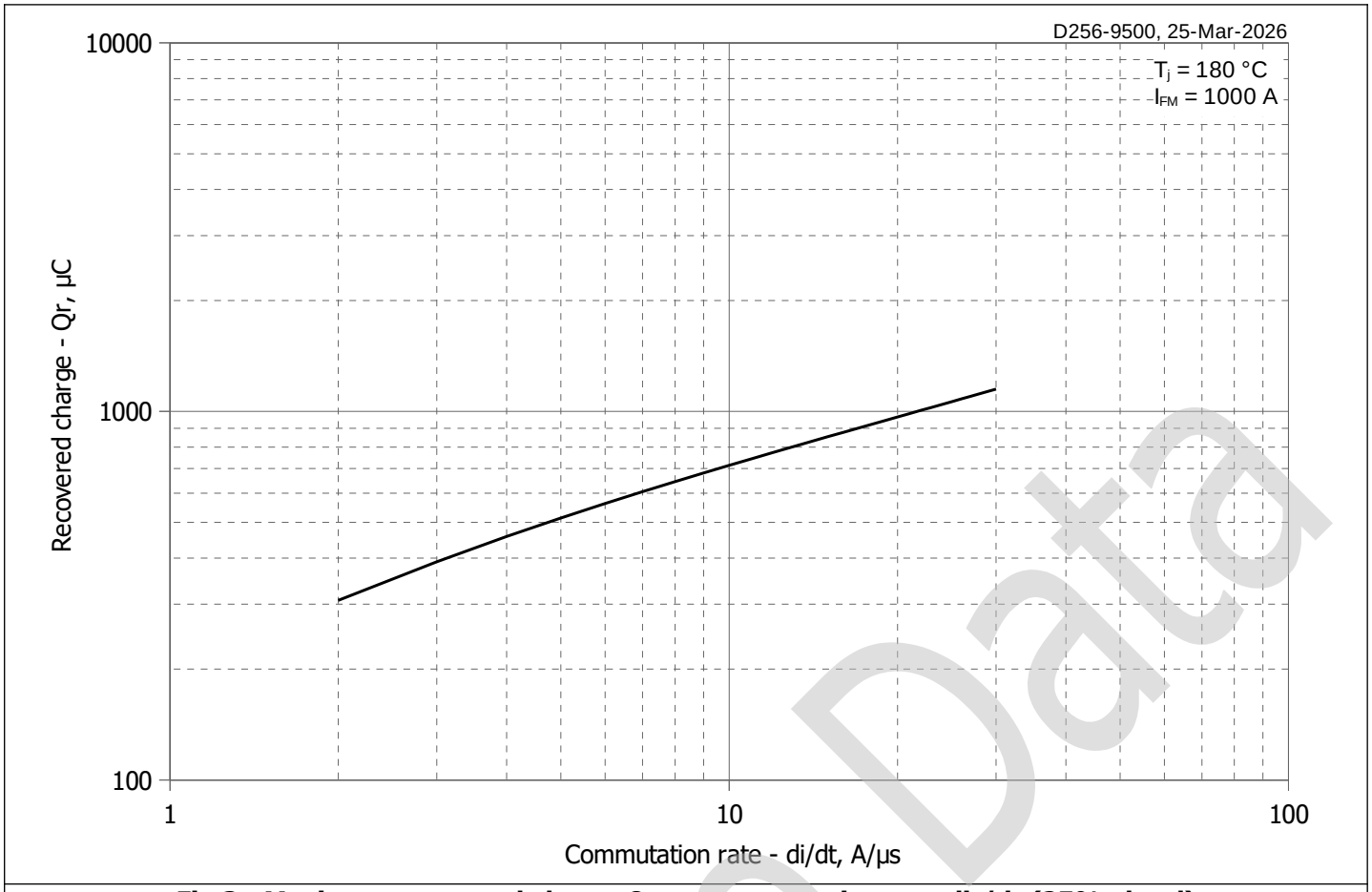


Fig 3 - Maximum recovered charge Q_{rr} vs. commutation rate di_R/dt (25% chord)

Fig 4 – Maximum reverse recovery current I_{rr} vs. commutation rate di_R/dt

Fig 5 – Maximum recovery time t_{rr} vs. commutation rate di_R/dt (25% chord)

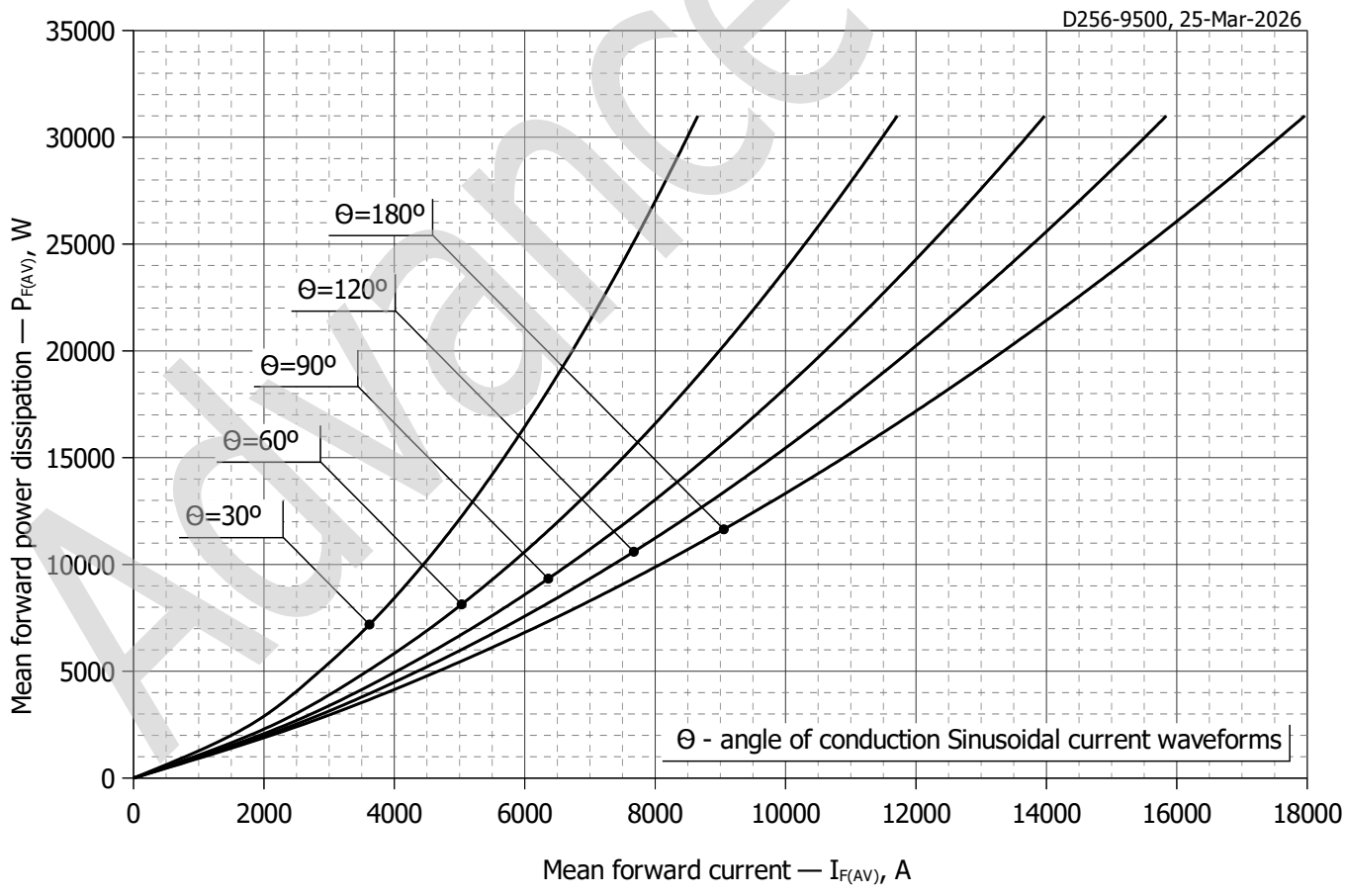


Fig 6 – Mean forward power dissipation P_{FAV} vs. Mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

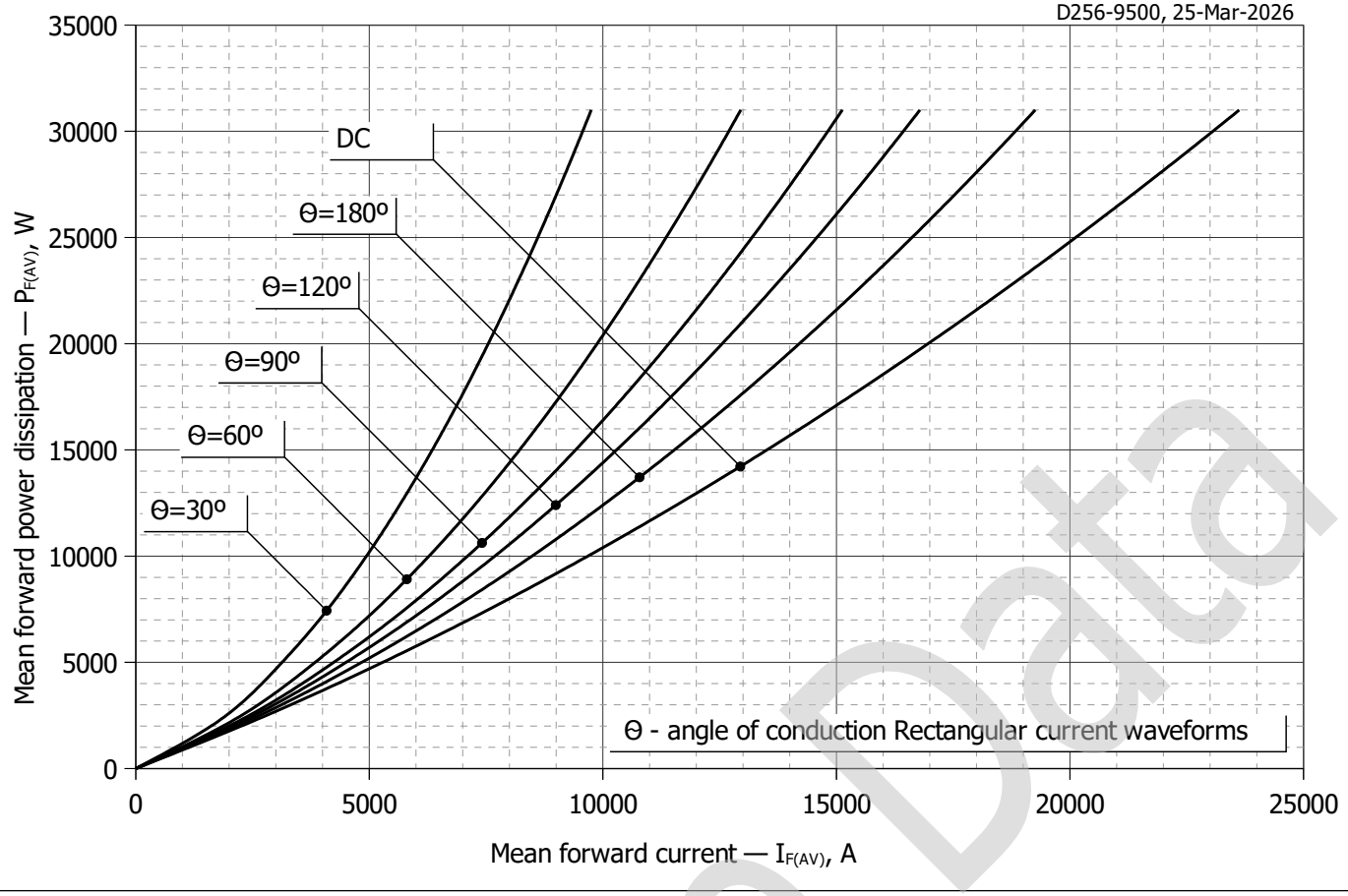


Fig 7 – Mean forward power dissipation P_{FAV} vs. Mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

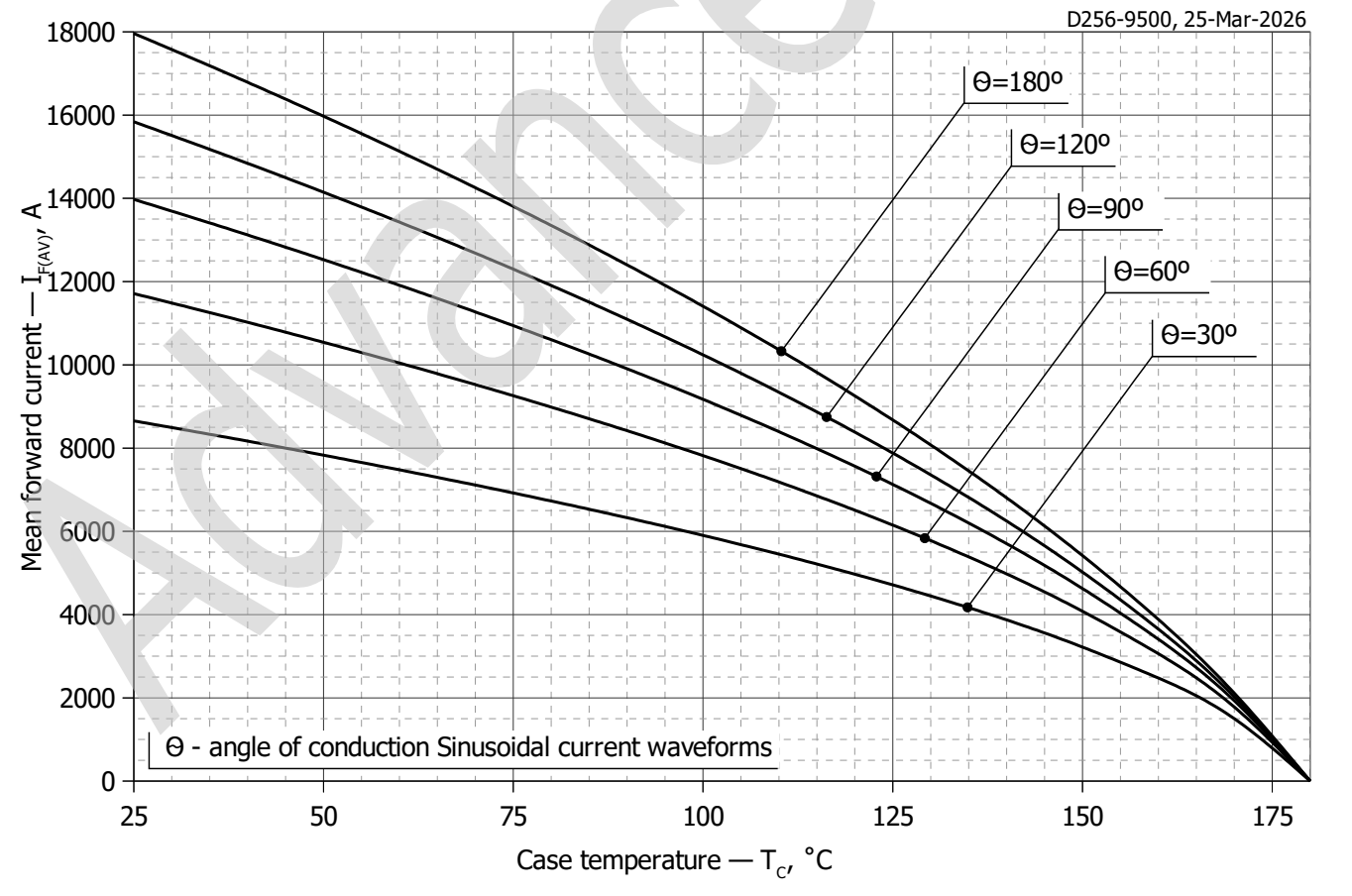


Fig 8 - Mean forward current I_{FAV} vs. Case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

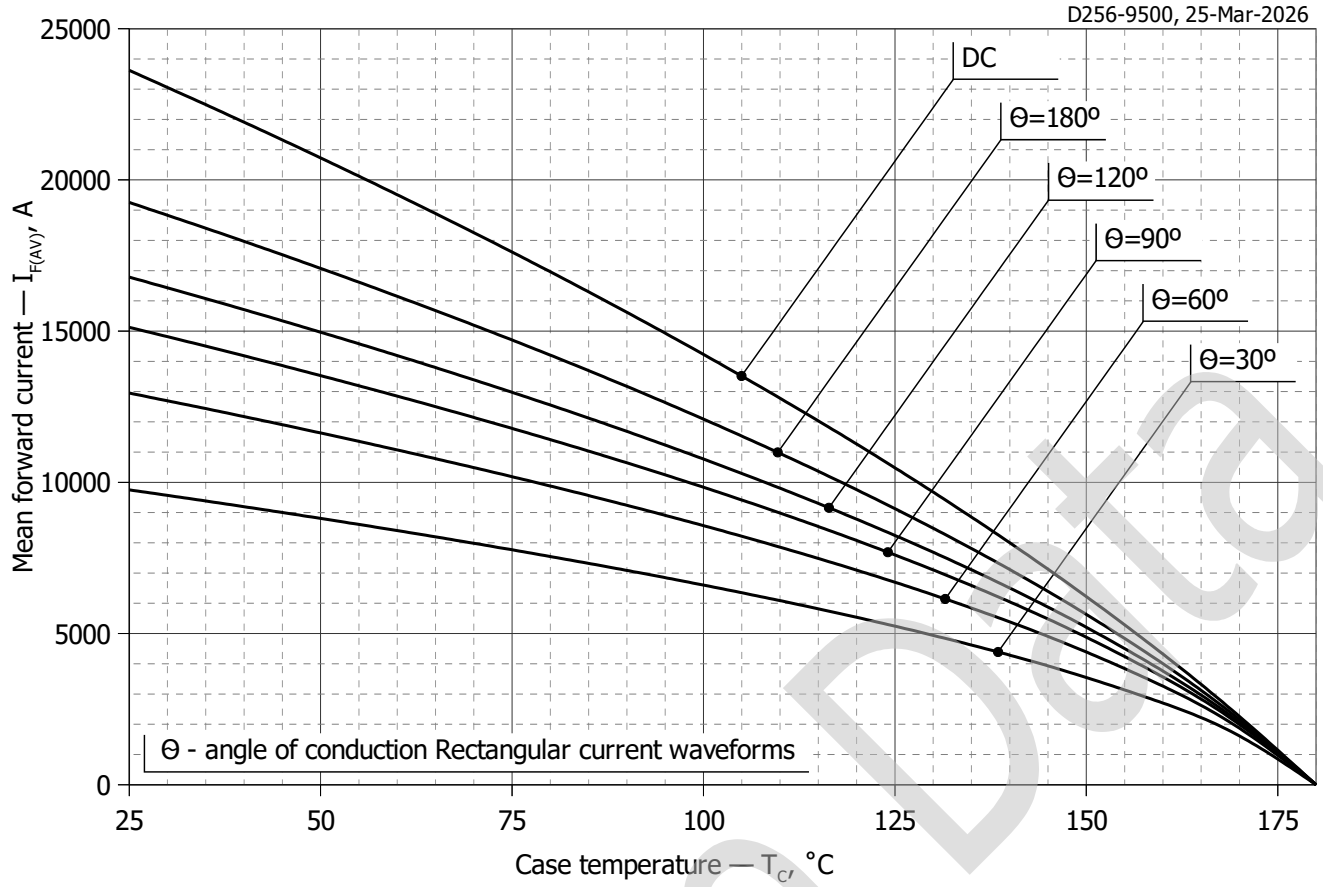


Fig 9 – Mean forward current I_{FAV} vs. Case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

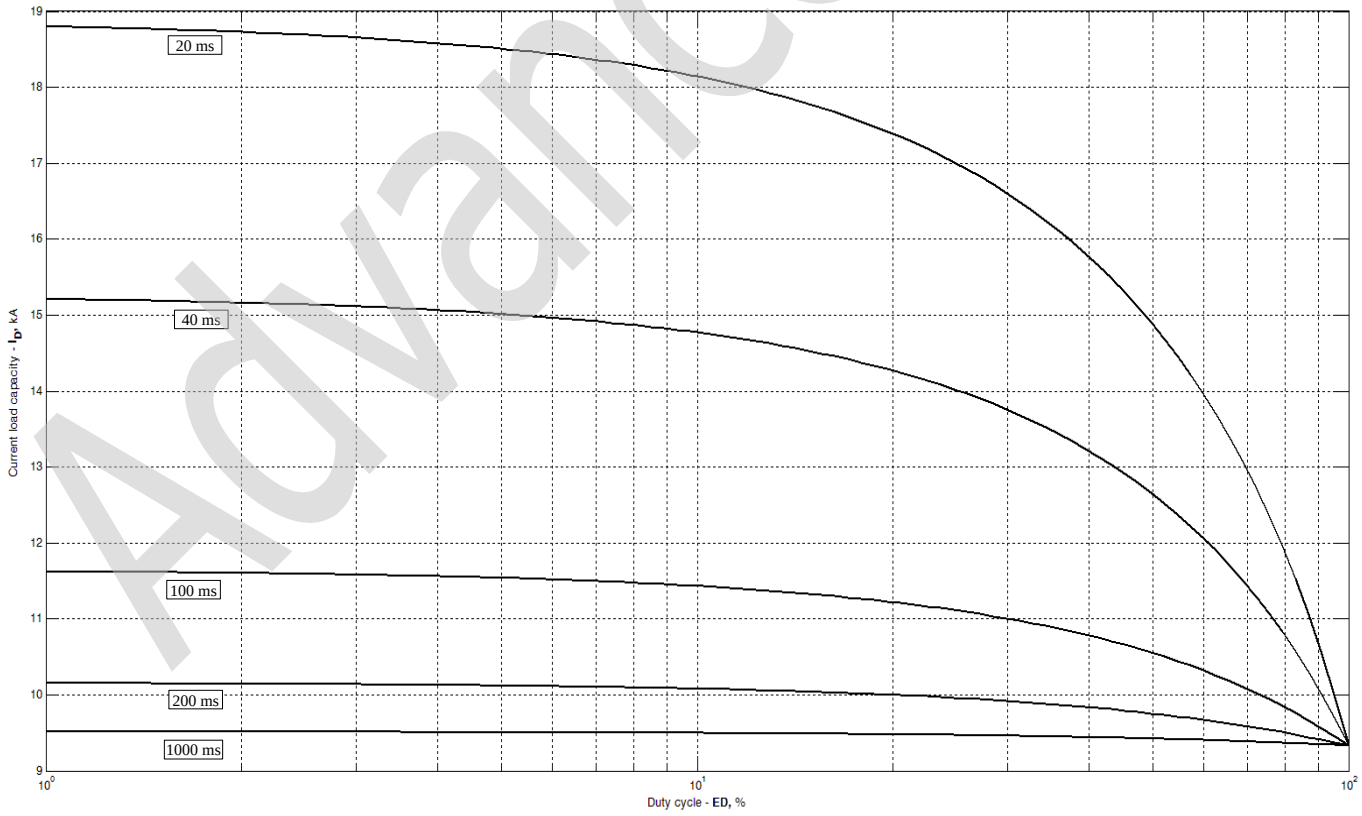


Fig 10 – Current load capability (f=1000 Hz, square wave, ΔT_j = 40 °C)

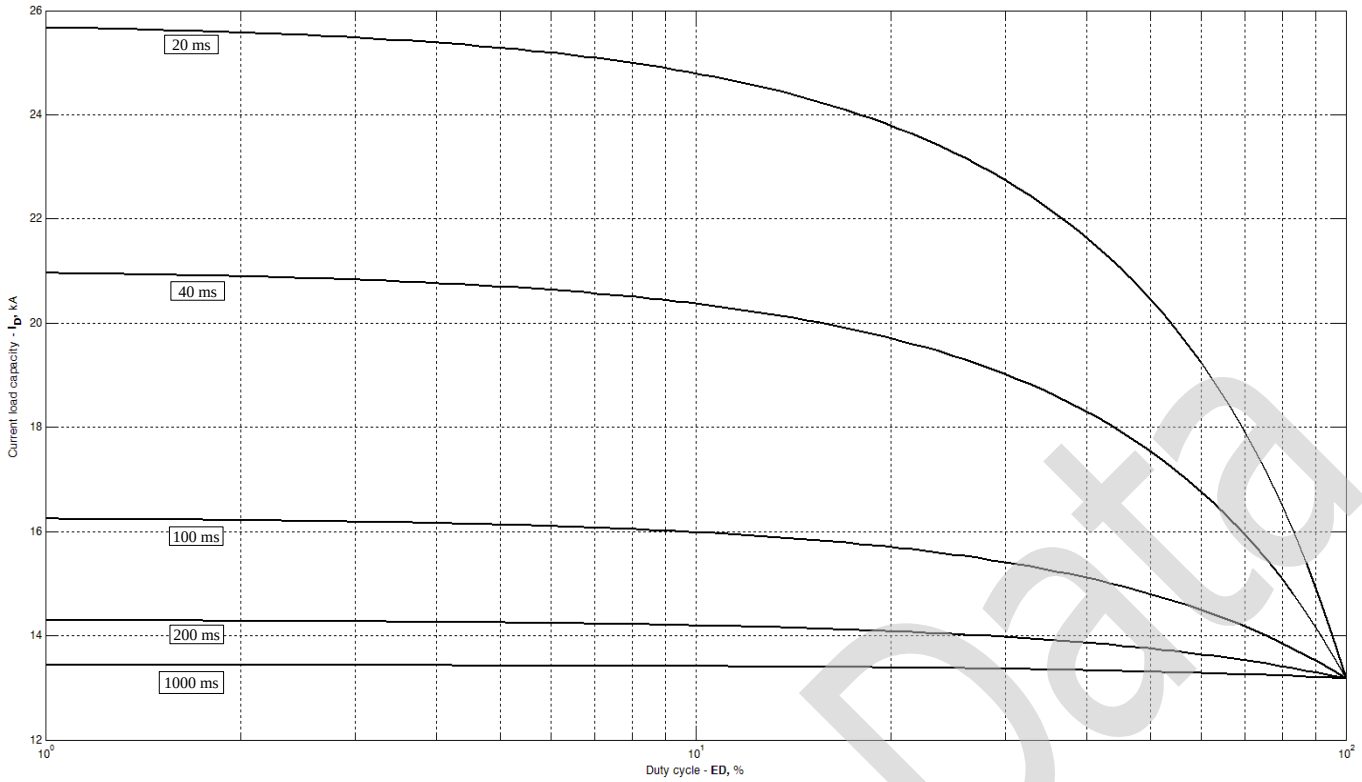


Fig 11 – Current load capability (f=1000 Hz, square wave, ΔT_j = 60 °C)

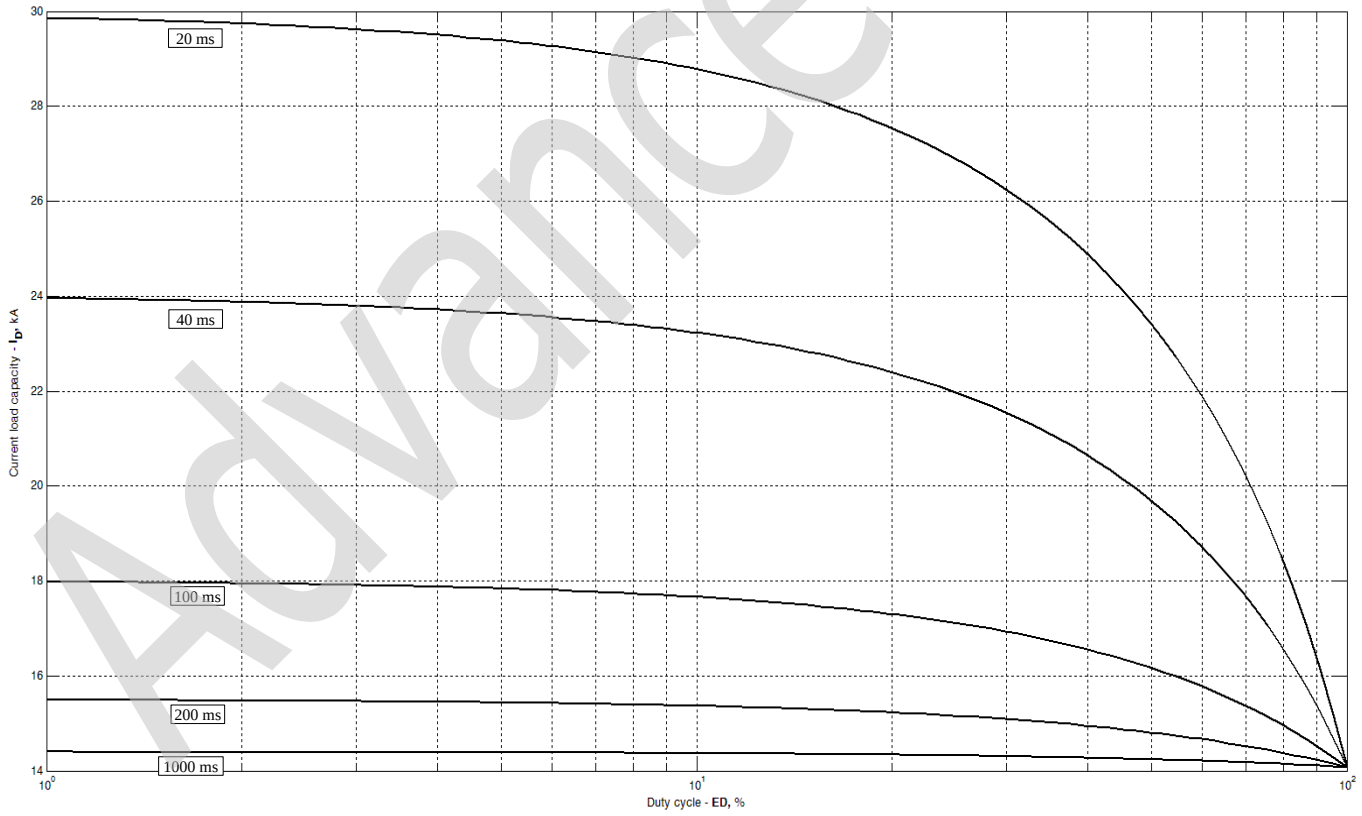


Fig 12 – Current load capability (f=1000 Hz, square wave, ΔT_j = 70 °C)

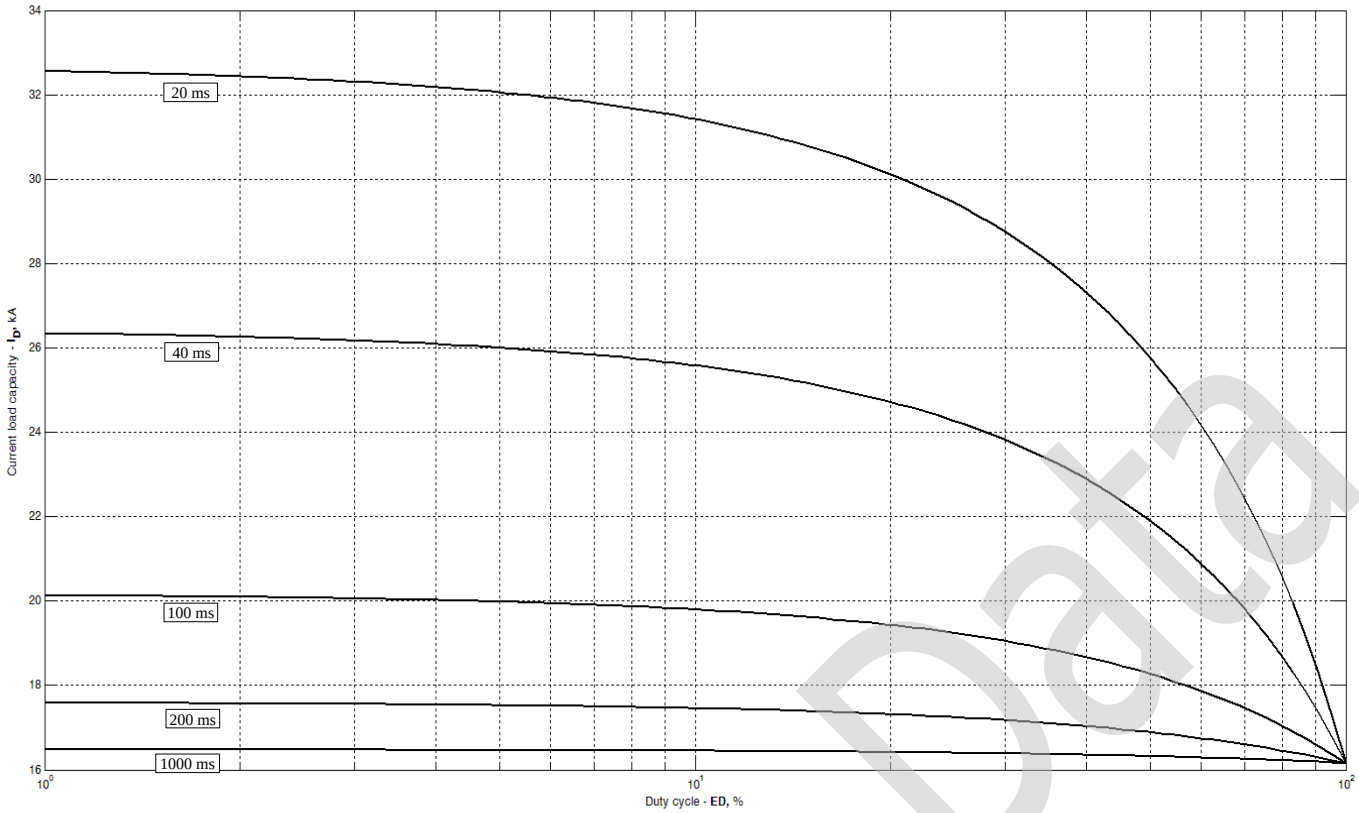


Fig 13 – Current load capability (f=1000 Hz, square wave, ΔT_j = 80 °C)

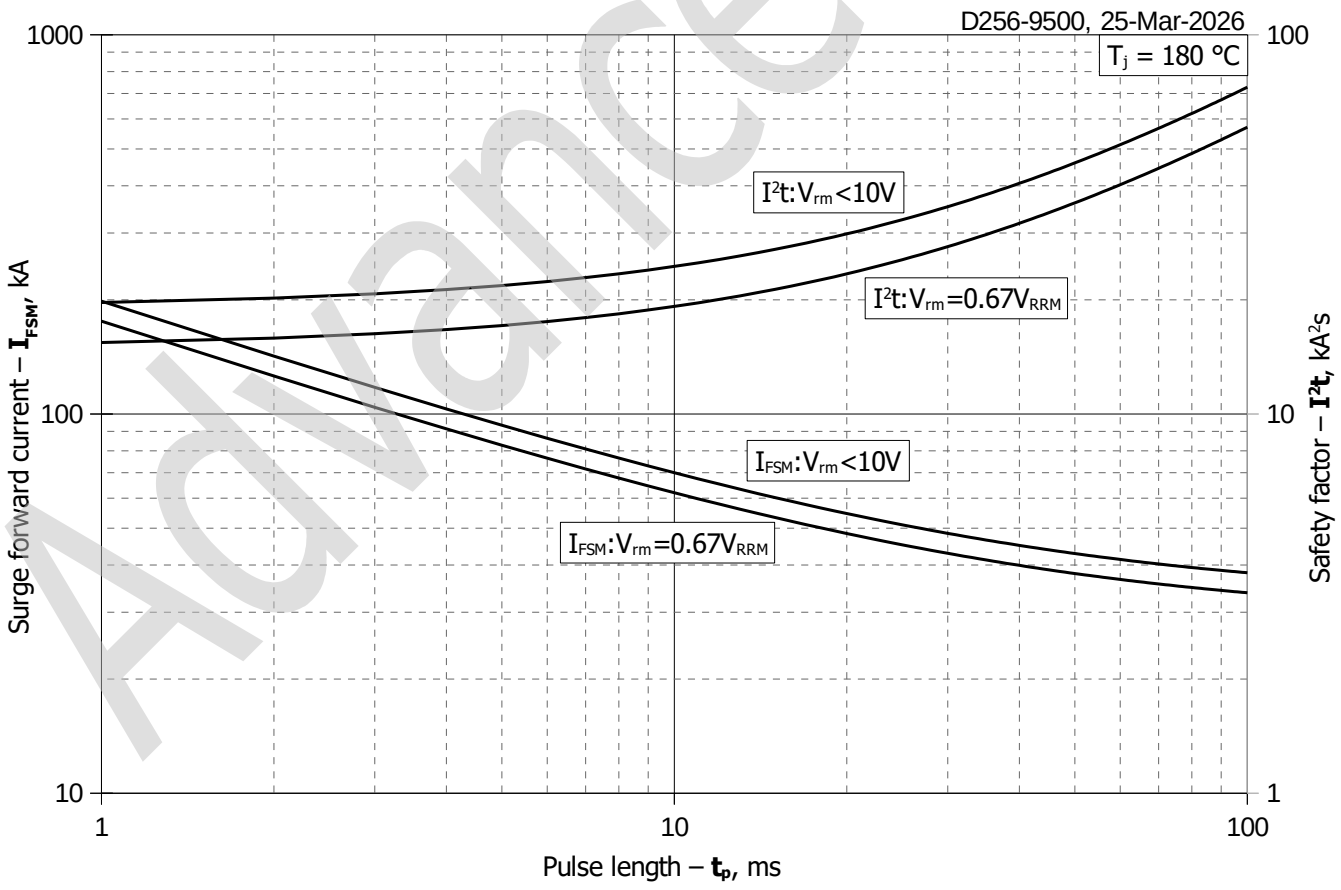


Fig 14 – Maximum surge and I^2t ratings

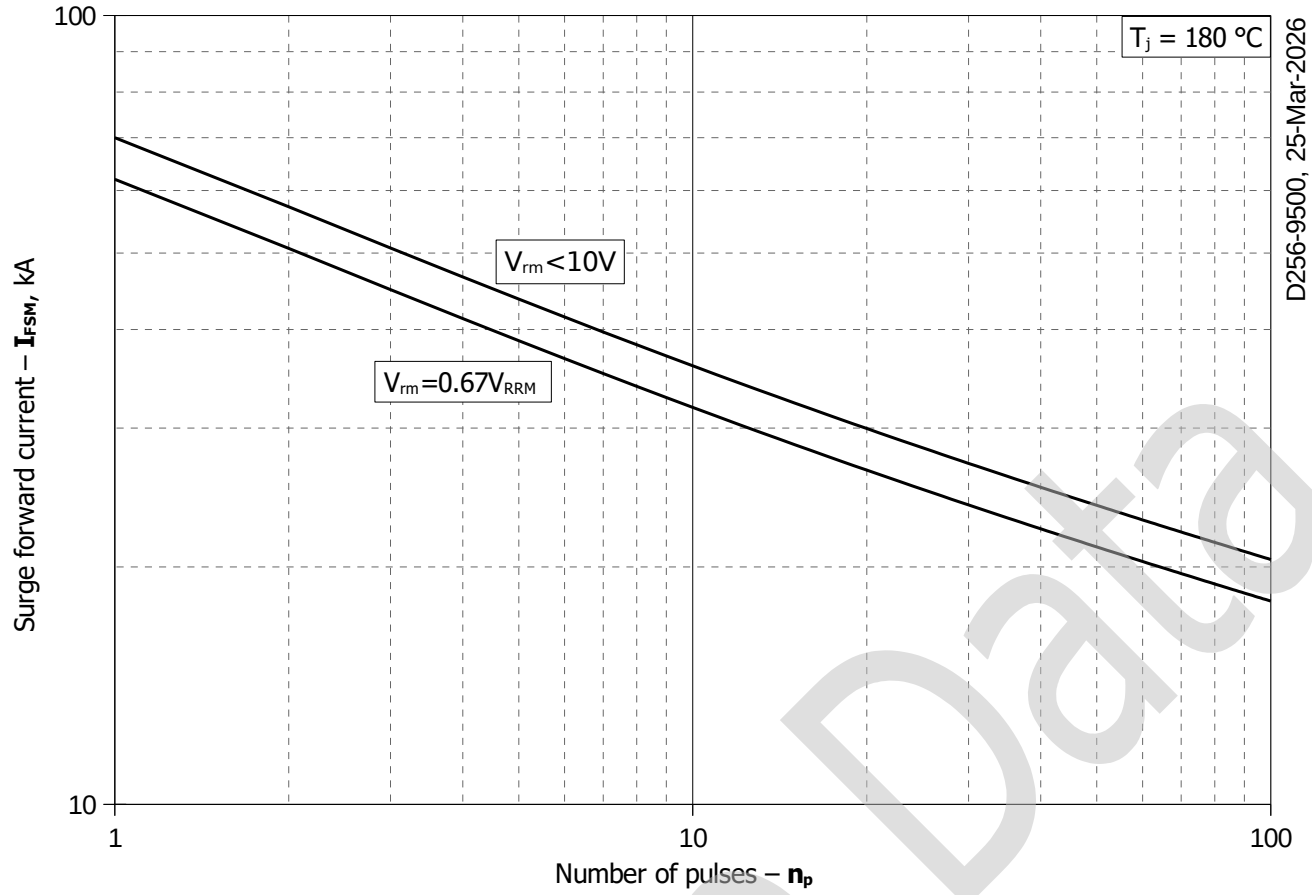


Fig 15 – Maximum surge ratings

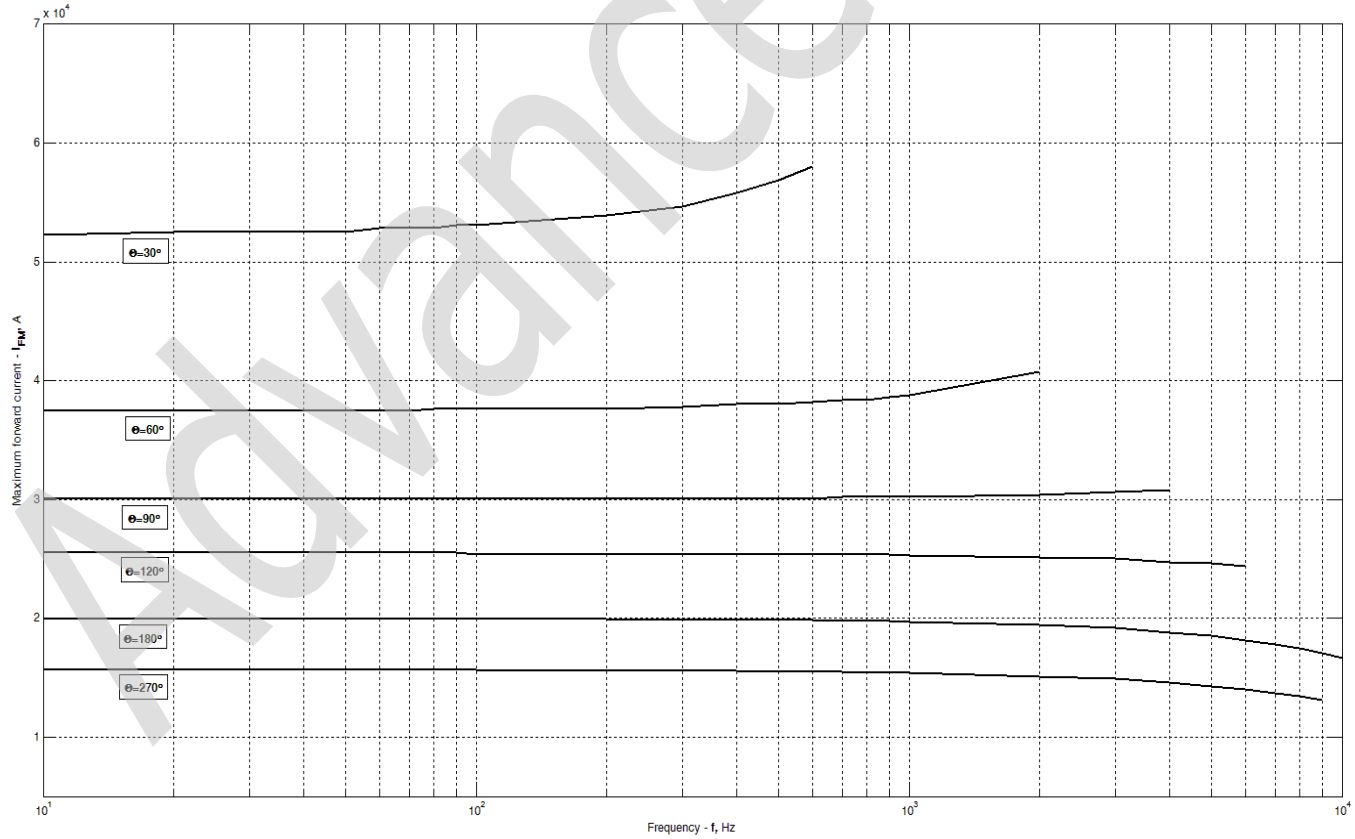


Fig 16 –Maximum forward current vs. frequency, trapezoidal waveform, T_C=85 °C, di_F/dt=±500 A/µs, V_R=100 V

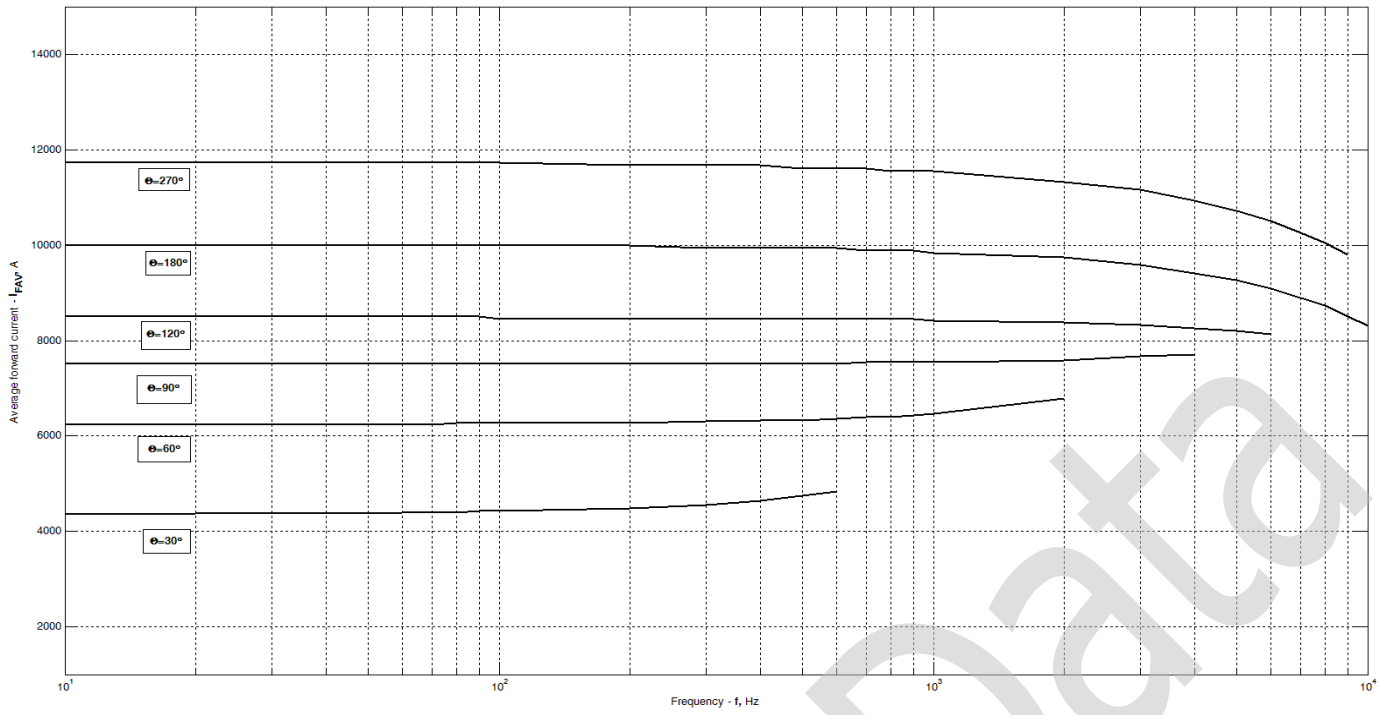


Fig 17 –Average forward current vs. frequency, trapezoidal waveform, T_C=85 °C, di_F/dt=±500 A/µs, V_R=100 V