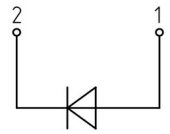
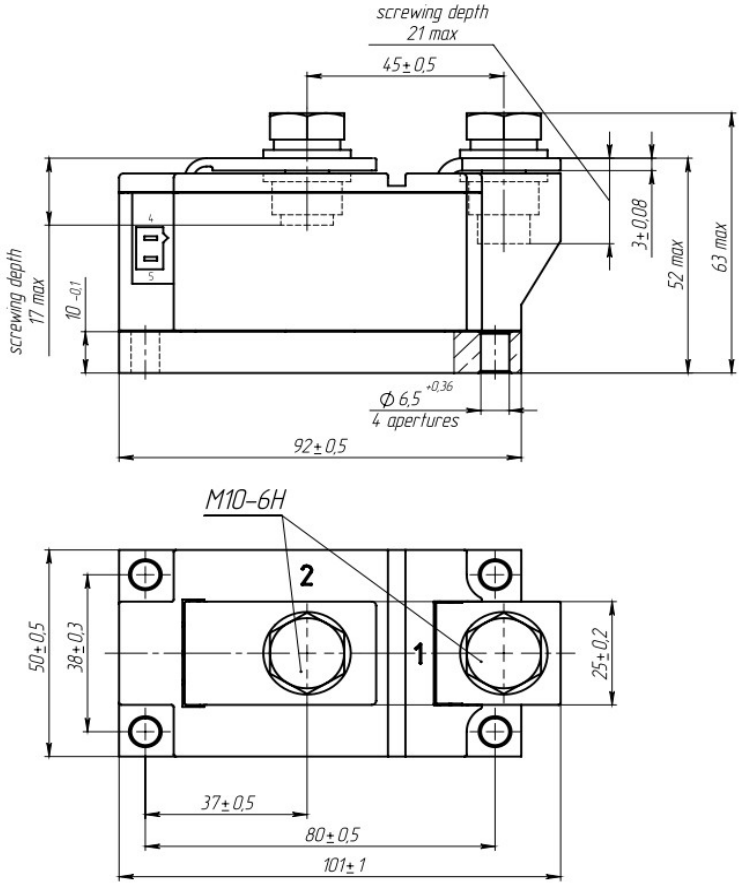
Electrically isolated base plate
Industrial standard package
Simplified mechanical design, rapid assembly
Pressure contact

Single Diode Module For Phase Control
MD1-400-52-B0

Average forward current		I_{FAV}	400 A	
Repetitive peak reverse voltage		V_{RRM}	4600...5200 V	
V_{RRM}, V	4600	4800	5000	5200
Voltage code	46	48	50	52
T_j, °C	–40...+140			

MD1





All dimensions in millimeters (inches)

MAXIMUM ALLOWABLE RATINGS

Symbols and parameters		Units	Values	Test conditions	
ON-STATE					
I_{FAV}	Maximum allowable average forward current	A	400 409	T_c=101 °C; T_c=100 °C; 180° half-sine wave; 50 Hz	
I_{FRMS}	RMS forward current	A	628	T_c=101 °C; 180° half-sine wave; 50 Hz	
I_{FSM}	Surge forward current	kA	11.0 13.0	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V;
			12.0 14.0	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	$A^2s{\cdot}10^3$	600 840	T_j=$T_{j\,max}$ T_j=25 °C	180° half-sine wave; t_p=10 ms; single pulse; V_R=0 V;
			590 810	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	4600...5200	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; 50 Hz;	
V_{RSM}	Non-repetitive peak reverse voltages	V	4700...5300	$T_{j\,min}$< T_j <$T_{j\,max}$; 180° half-sine wave; single pulse;	
V_R	Reverse continuous voltages	V	$0.6{\cdot}V_{RRM}$	T_j=$T_{j\,max}$;	
THERMAL					
T_{stg}	Storage temperature	°C	–40...+50		
T_j	Operating junction temperature	°C	–40...+140		
$T_{c\,op}$	Operating temperature	°C	–40...+125		
MECHANICAL					
a	Acceleration under vibration	m/s^2	50		

CHARACTERISTICS

Symbols and parameters		Units	Values	Conditions	
ON-STATE					
V_{FM}	Peak forward voltage, max	V	1.75	T_j=25 °C; I_{FM}=1256 A	
$V_{F(TO)}$	Forward threshold voltage, max	V	0.977	T_j=$T_{j\,max}$; $0.5\ \pi\ I_{FAV} < I_T < 1.5\ \pi\ I_{FAV}$	
r_T	Forward slope resistance, max	mΩ	0.795		
BLOCKING					
I_{RRM}	Repetitive peak reverse current, max	mA	100	T_j=$T_{j\,max}$; V_R=V_{RRM}	
THERMAL					
R_{thjc}	Thermal resistance, junction to case			180° half-sine wave, 50 Hz	
	per module	°C/W	0.0550		
R_{thch}	Thermal resistance, case to heatsink				
	per module	°C/W	0.0100		
INSULATION					
V_{ISOL}	Insulation test voltage	kV	7.00	Sine wave, 50 Hz; RMS	t=1 min
			8.40		t=1 sec
MECHANICAL					
M_1	Mounting torque (M6)[1)]	Nm	6.00	Tolerance ± 15%	
M_2	Terminal connection torque (M10)[1)]	Nm	12.00	Tolerance ± 15%	
m	Weight, max	g	900		

PART NUMBERING GUIDE	NOTES
MD 1 - 400 - 52 - B0 - N 1 2 3 4 5 6 1. MD - Rectifier Diode 2. Circuit Schematic 3. Average Forward Current, A 4. Voltage Code 5. Package Type (M.B0) 6. Ambient Conditions: N – Normal	[1)] The screws must be lubricated

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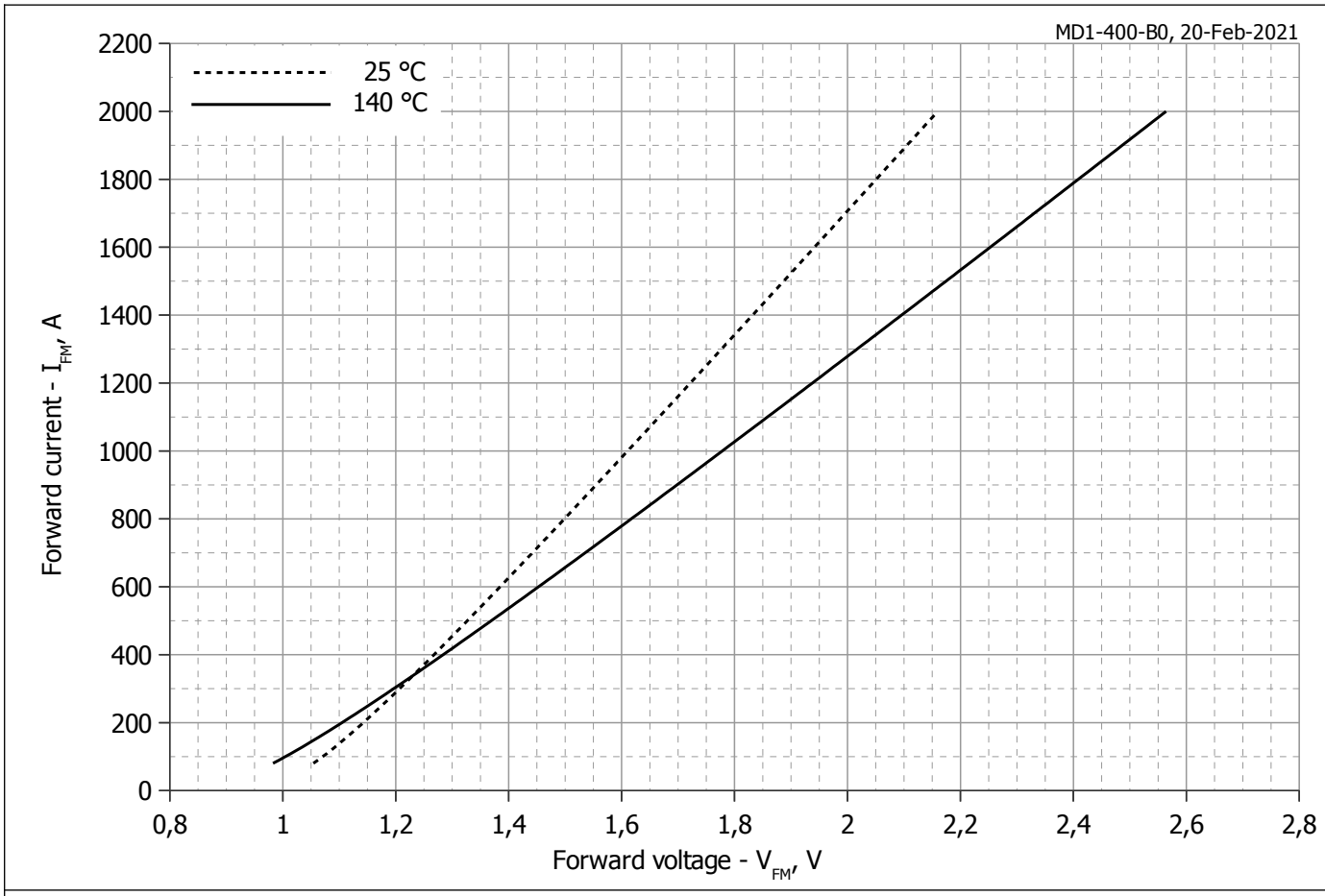

Fig 1 – Forward characteristics of Limit device

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	0.89128220	0.81526545
B	0.00052984	0.00072329
C	0.02738415	0.01704333
D	0.00001383	0.00386074

Forward characteristic model (see Fig. 1).

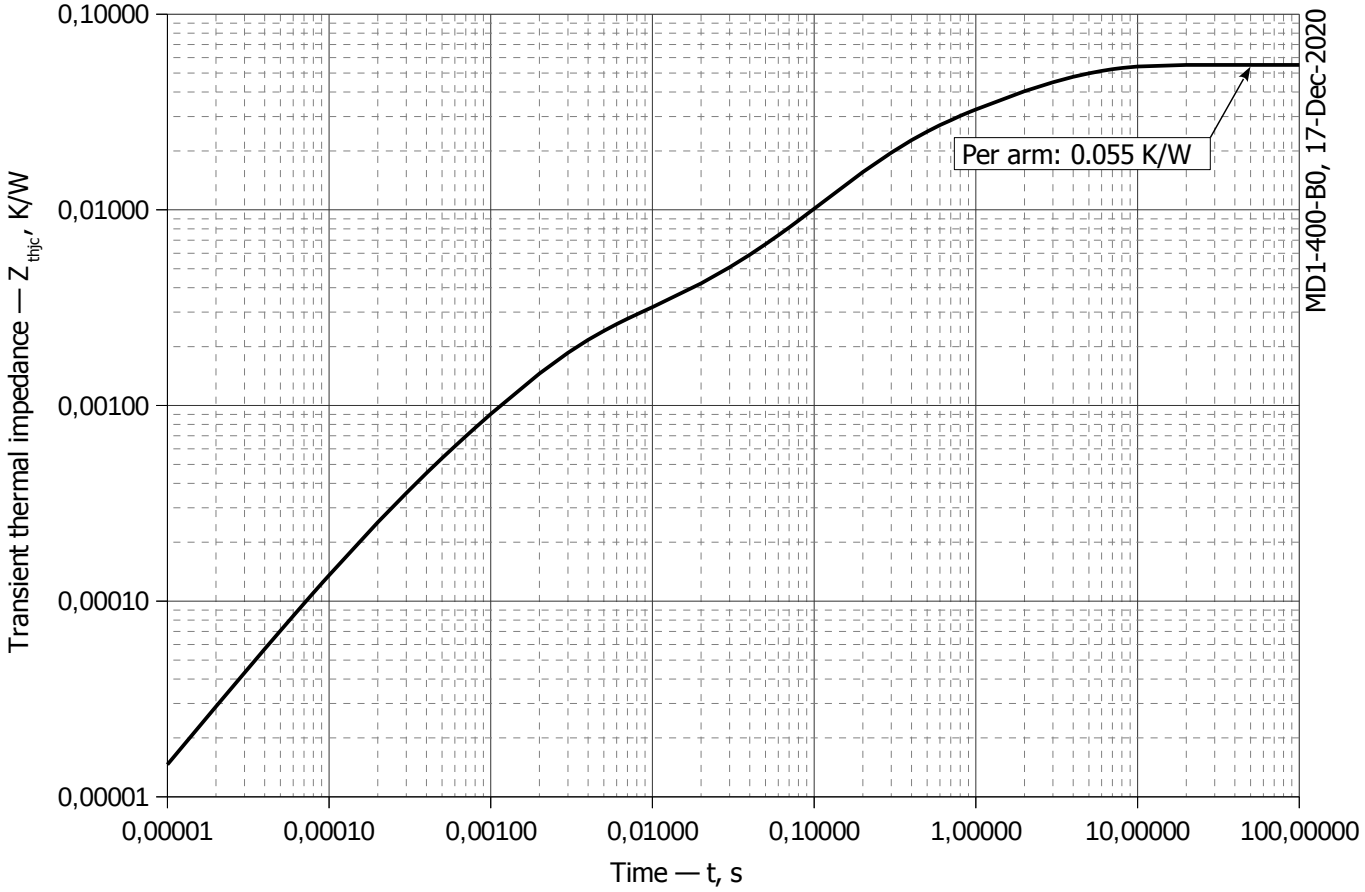

Fig 2 – Transient thermal impedance Z_{thjc} vs. time t

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

i	1	2	3	4	5	6
R_i, K/W	0.0249	0.0112	0.01635	0.0006528	0.001791	0.0001363
τ_i, s	3.132	1.000	0.2335	0.01038	0.002348	0.0002448

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

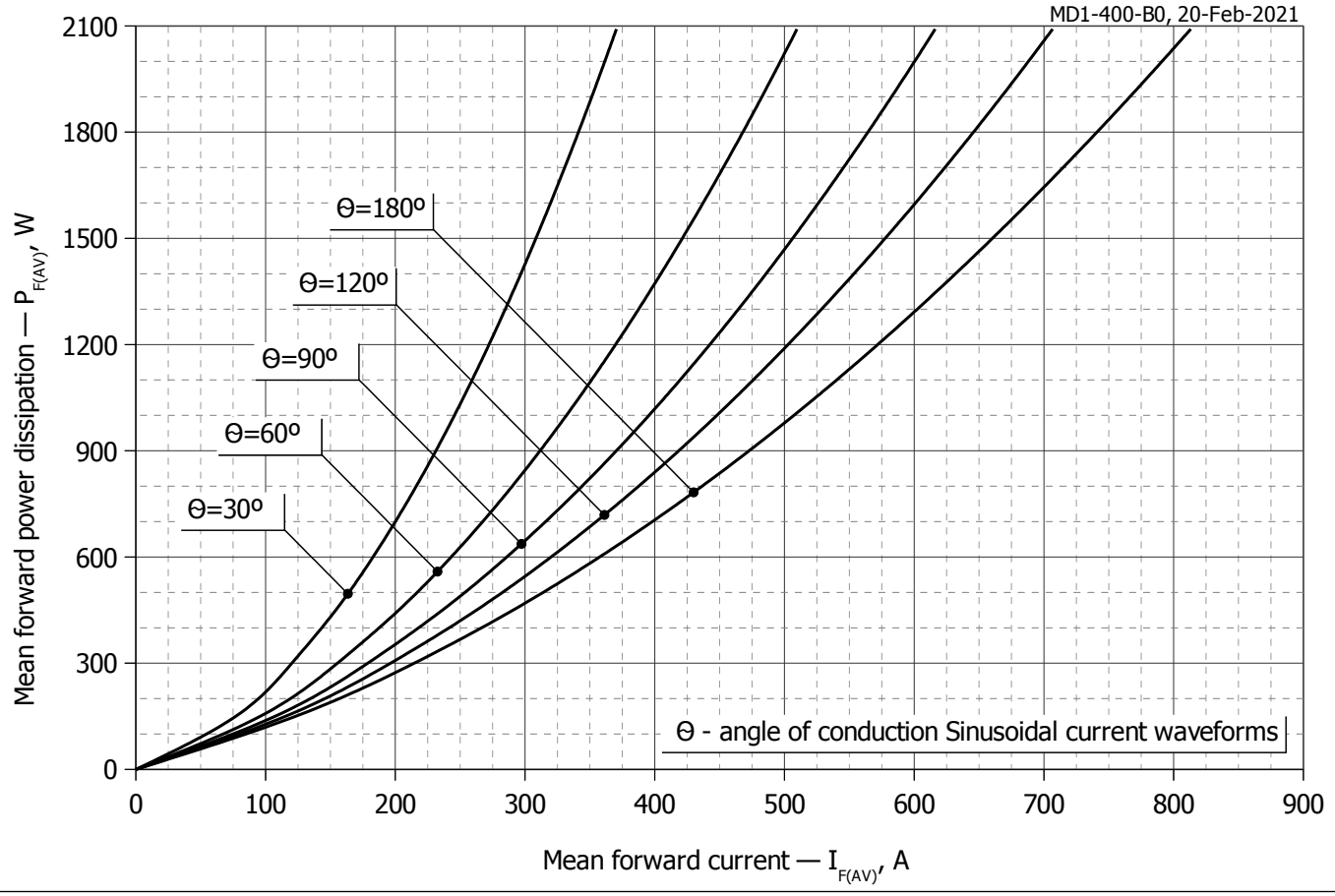

Fig. 3 - Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

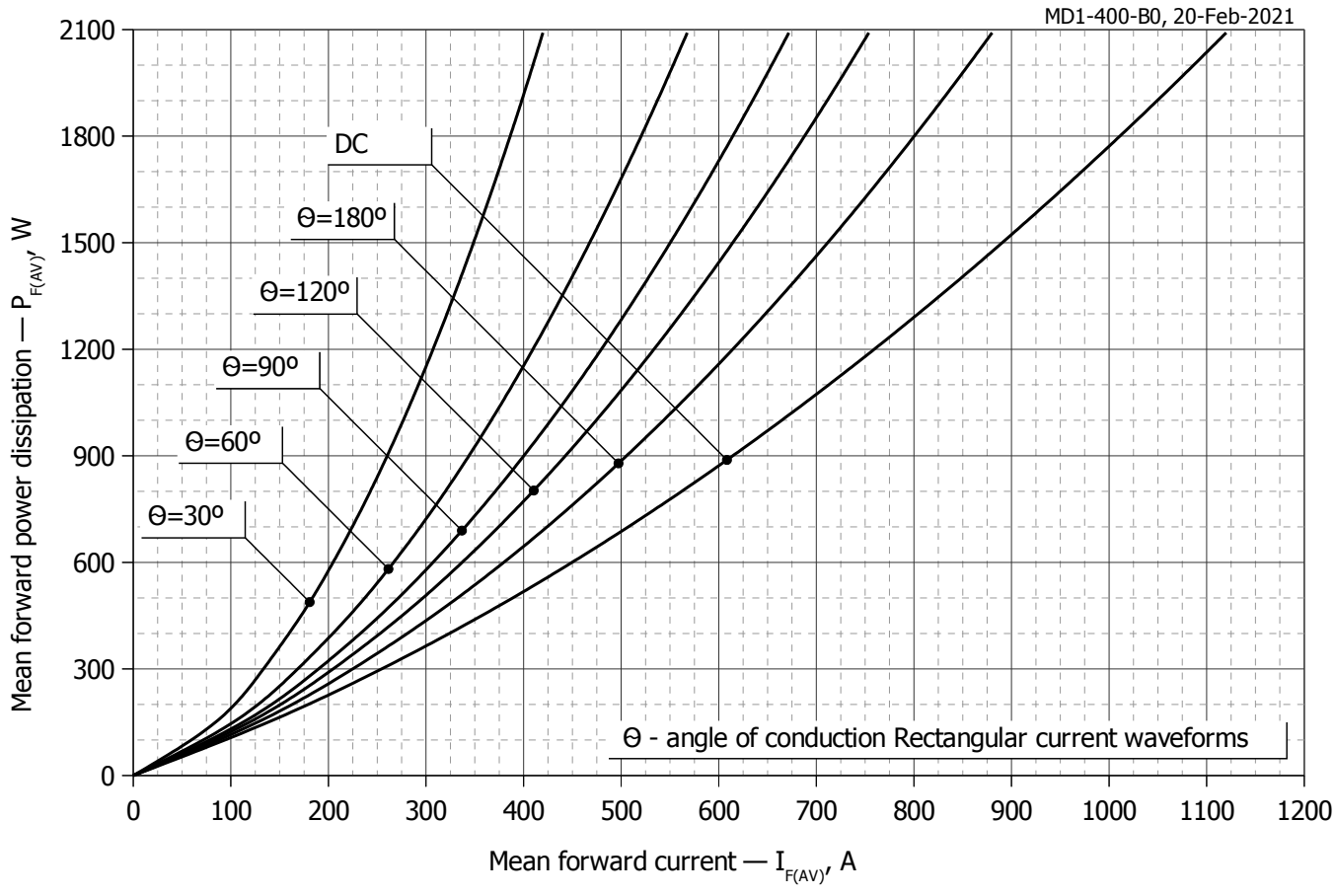

Fig. 4 – Mean forward power dissipation P_{FAV} vs. mean forward current I_{FAV} for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

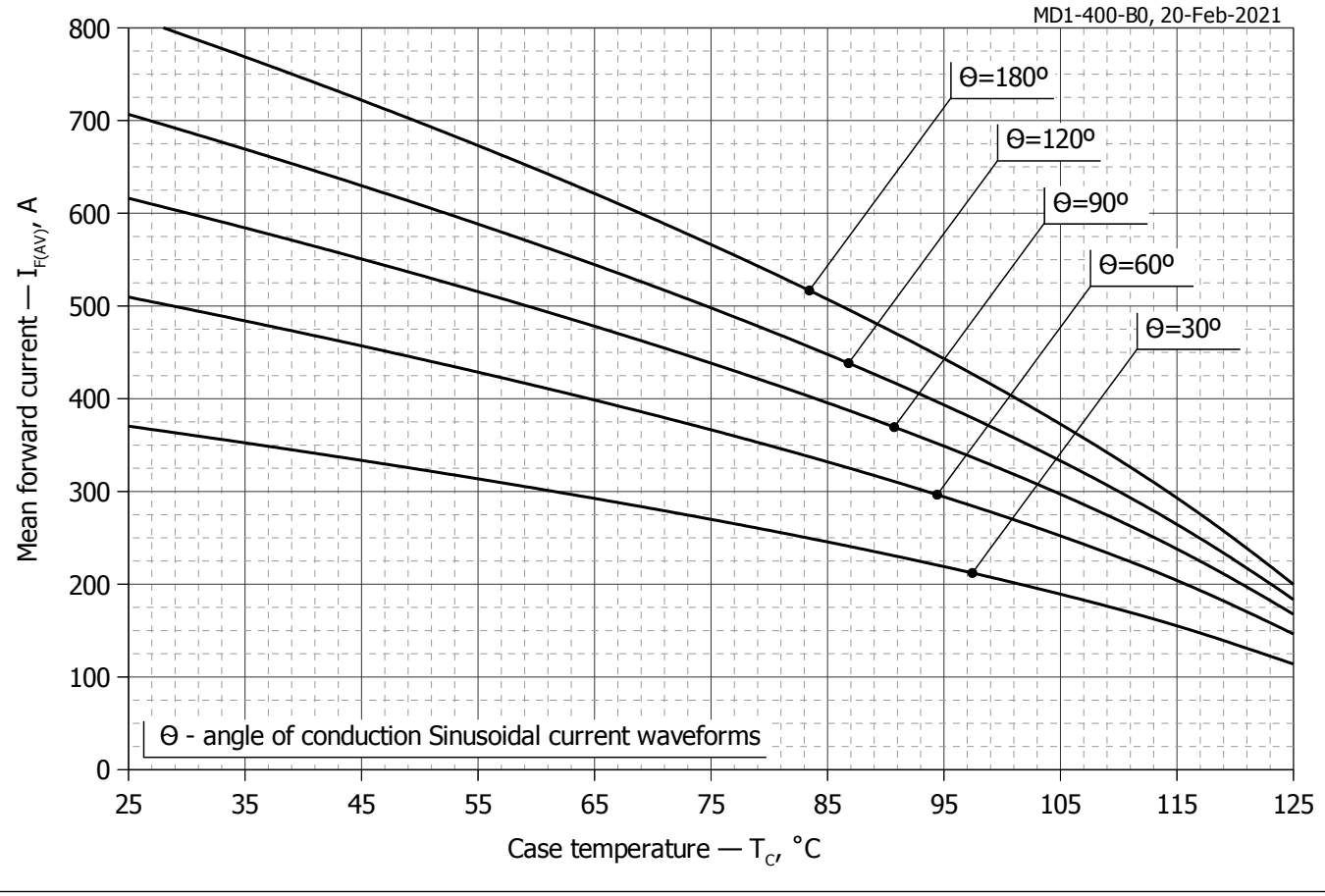

Fig. 5 – Mean forward current I_{FAV} vs. case temperature T_C for sinusoidal current waveforms at different conduction angles (f=50Hz, DSC)

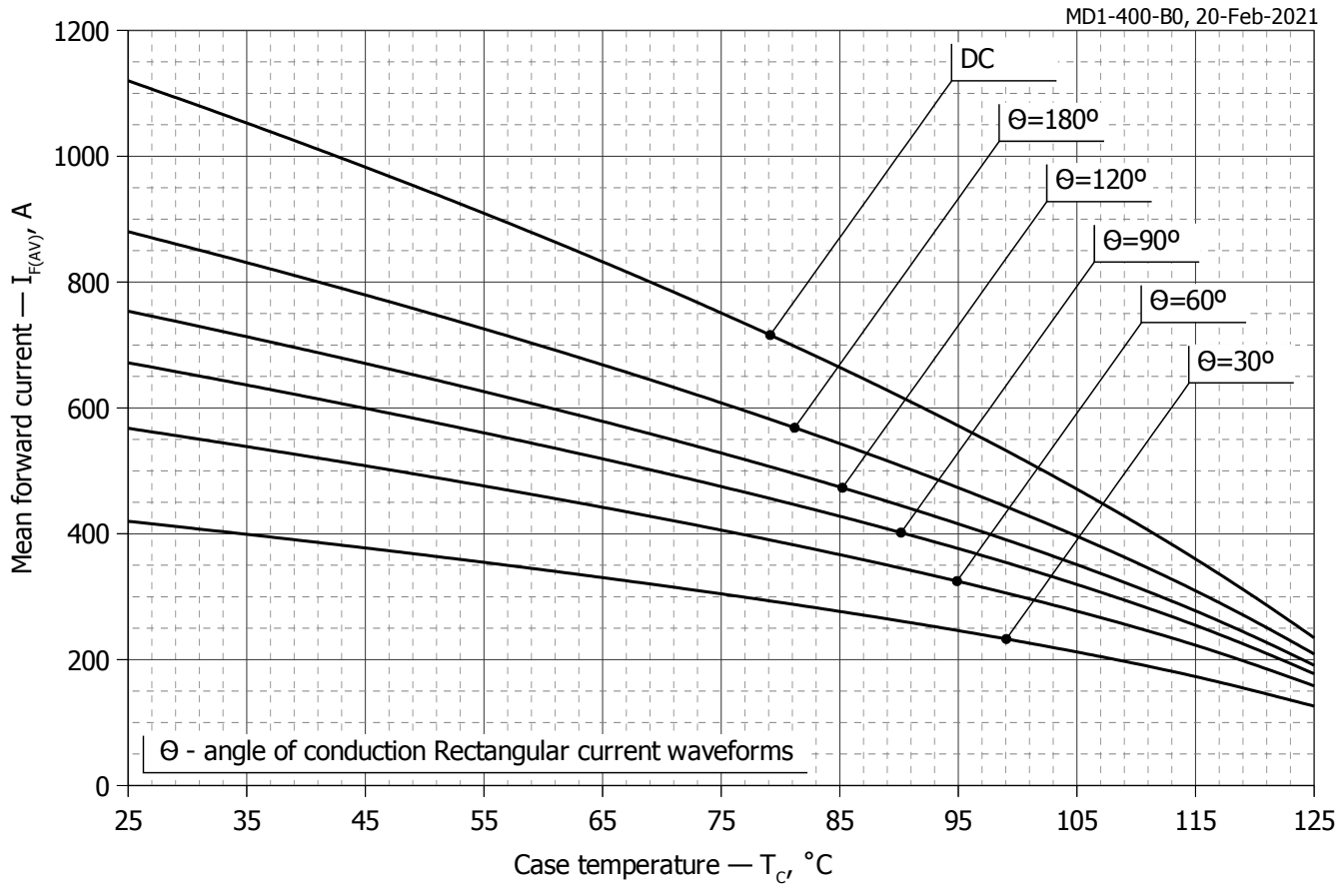

Fig. 6 - Mean forward current I_{FAV} vs. case temperature T_C for rectangular current waveforms at different conduction angles and for DC (f=50Hz, DSC)

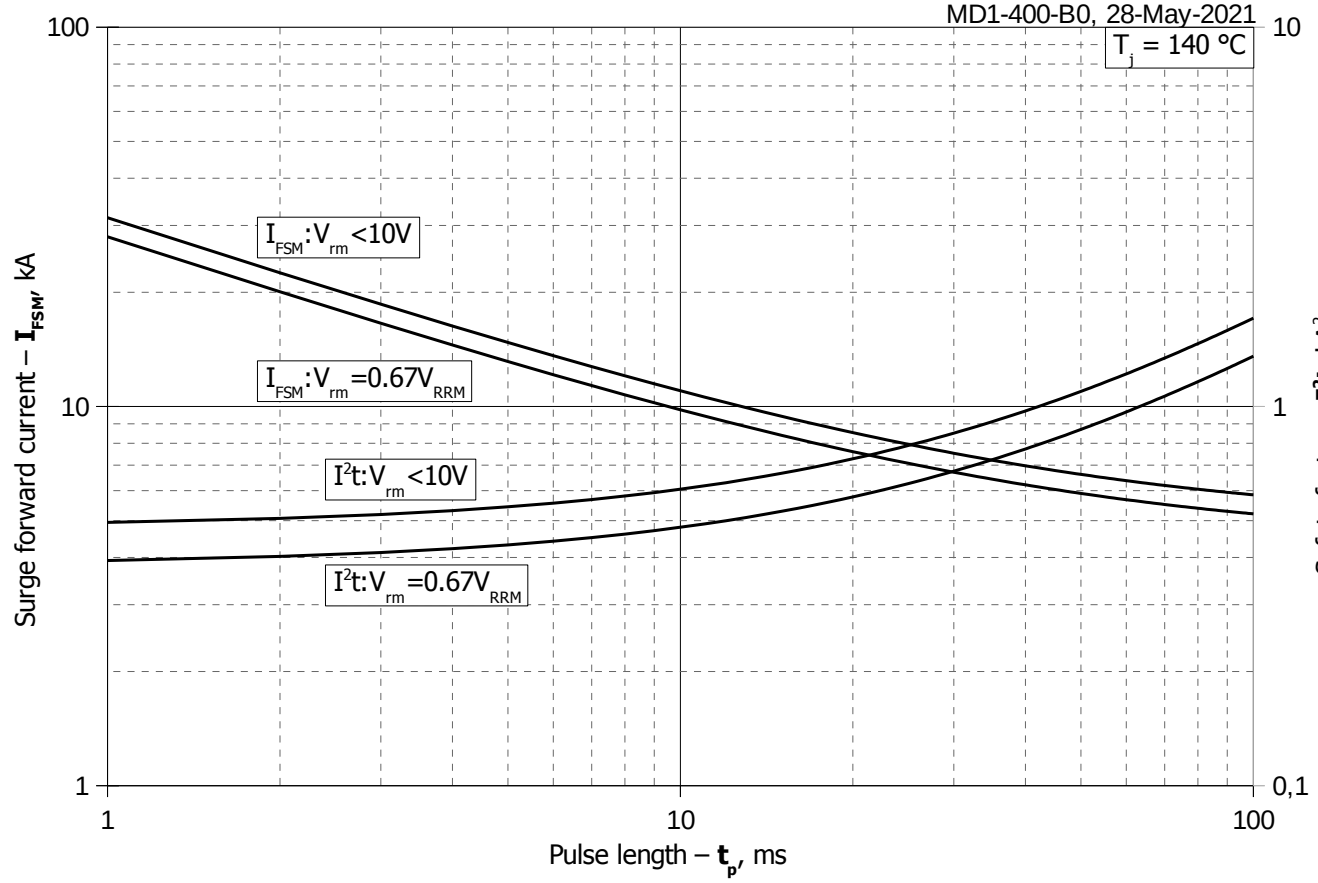

Fig. 7 – Maximum surge forward current I_{FSM} and safety factor I^2t vs. pulse length t_p

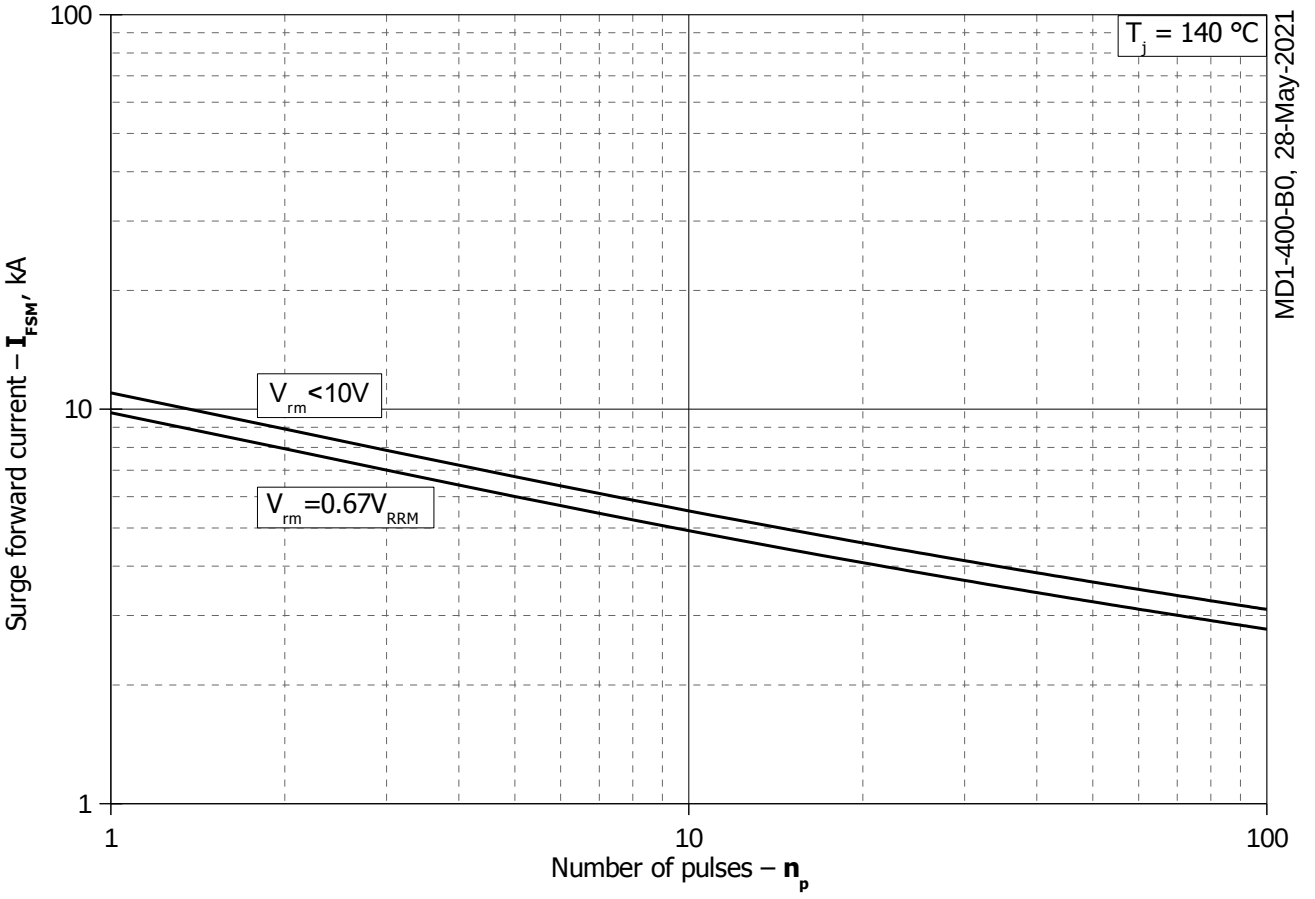

Fig. 8 - Maximum surge forward current I_{FSM} vs. number of pulses n_p