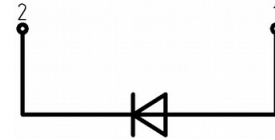


Rectifier Diode Module

MDO1120-24N1-28N1

Absolute Maximum Ratings

V_{RRM} V_{DRM} [V]	Type
2400	MDO1120-24N1
2800	MDO1120-28N1



VOLTAGE RATINGS		MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage ¹⁾	2400-2800	V
V_{RSM}	Non-repetitive peak reverse voltage ¹⁾	2500-2900	V

OTHER RATINGS		MAXIMUM LIMITS	UNITS
$I_{T(AV)M}$	Maximum average on-state current, $T_C = 85^\circ\text{C}$ ²⁾	1320	A
$I_{T(AV)M}$	Maximum average on-state current, $T_C = 100^\circ\text{C}$ ²⁾	1125	A
$I_{T(RMS)M}$	Nominal RMS on-state current, $T_C = 100^\circ\text{C}$ ²⁾	1766	A
$I_{T(d.c.)}$	D.C. on-state current, $T_C = 55^\circ\text{C}$	2146	A
I_{TSM2}	Peak non-repetitive surge $t_p = 10$ ms, $V_{RM} \leq 10$ V ³⁾	36	kA
I^2t	I^2t capacity for fusing $t_p = 10$ ms, $V_{RM} \leq 10$ V ³⁾	6.48×10^6	A^2s
V_{ISOL}	Isolation Voltage ⁴⁾	3000	V
$T_{vj\text{ op}}$	Operating temperature range	-40 to +160	$^\circ\text{C}$
T_{stg}	Storage temperature range	-40 to +50	$^\circ\text{C}$

Notes:

- 1) De-rating factor of 0.13% per $^\circ\text{C}$ is applicable for T_{vj} below 25°C .
- 2) Single phase; 50 Hz, 180° half-sinewave.
- 3) Half-sinewave, 160°C T_{vj} initial.
- 4) AC RMS voltage, 50 Hz, 1min test

Diode Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS ¹⁾	UNITS
V _{FM}	Maximum peak on-state voltage	-	-	1.05	I _{TM} = 1500 A	V
V _{T0}	Threshold voltage	-	-	0.8		V
r _T	Slope resistance	-	-	0.17		mΩ
I _{RRM}	Peak reverse current	-	-	70	Rated V _{RRM}	mA
R _{thJC}	Thermal resistance, junction to case	-	-	0.042		K/W
R _{thCH}	Thermal resistance, case to heatsink	-	-	0.010		K/W
F ₁	Mounting torque (to heatsink) ²⁾	5.1	-	6.9		Nm
F ₂	Mounting torque (to terminals) ²⁾	16.2	-	19.8		Nm
W _t	Weight	-	2.55	-		kg

Notes:

- 1) Unless otherwise indicated T_{vj}=160°C.
- 2) Screws must be lubricated.

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	V _{RRM} V	V _{RSM} V	V _R DC V
24	2400	2500	1440
28	2800	2900	1680

2.0 Extension of Voltage Grades

This report is applicable to other voltage grades when supply has been agreed by Sales/Production.

3.0 De-rating Factor

A blocking voltage de-rating factor of 0.13%/°C is applicable to this device for T_{vj} below 25°C.

4.0 Repetitive dv/dt

Standard dv/dt is 1000V/μs.

5.0 Snubber Components

When selecting snubber components, care must be taken not to use excessively large values of snubber capacitor or excessively small values of snubber resistor. Such excessive component values may lead to device damage due to the large resultant values of snubber discharge current. If required, please consult the factory for assistance.

6.0 Computer Modelling Parameters

6.1 Diode dissipation calculations

$$I_{AV} = \frac{-V_{T0} + \sqrt{V_{T0}^2 + 4 \cdot ff^2 \cdot r_T \cdot W_{AV}}}{2 \cdot ff^2 \cdot r_T} \quad \text{and:} \quad W_{AV} = \frac{\Delta T}{R_{th}}$$

$$\Delta T = T_{j\max} - T_C$$

Where V_{T0} = 0.80V, r_T = 0.17mΩ.

R_{th} = Supplementary thermal impedance, see table below and

ff = Form factor, see table below.

Supplementary Thermal Impedance				
Conduction Angle	6 phase (60°)	3 phase (120°)	½ wave (180°)	d.c.
Square wave	0.0460	0.0448	0.0439	0.0420
Sine wave	0.0453	0.0442	0.0428	

Form Factors				
Conduction Angle	6 phase (60°)	3 phase (120°)	½ wave (180°)	d.c.
Square wave	2.449	1.732	1.414	1
Sine wave	2.778	1.879	1.57	

6.2 Calculating diode V_F using ABCD coefficients – For loss calculations

The forward characteristic, I_F vs. V_F , is represented in two ways;

- (i) the well-established V_{T0} and r_T tangent used for rating purposes and
- (ii) a set of constants A, B, C, D, forming the coefficients of the equation for V_F in terms of I_T given below:

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

The ABCD constants are given below for both hot and cold characteristics. The resulting values for V_F agree with the true device characteristic over a current range, which is limited to that plotted.

25°C Coefficients		160°C Coefficients	
A	1.015039	A	0.609956
B	0.034063	B	0.112227
C	-0.152271	C	-0.221253
D	0.267739	D	0.389031

6.3 D.C. Thermal Impedance Calculation

$$r_t = \sum_{p=1}^{p=n} r_p \cdot \left(1 - e^{-\frac{t}{\tau_p}} \right)$$

n = number of terms in the series and
 t = duration of heating pulse in seconds.
 r_t = thermal resistance at time t .

r_p = Amplitude of p_{th} term.
 τ_p = Time Constant of r_{th} term.

The coefficients for this device are shown in the tables below:

D.C. Junction to Case						
Term	1	2	3	4	5	6
r_p	0.02105	0.005931	0.009502	0.004252	0.001006	0.0003132
τ_p	5.887	0.7389	0.1616	0.08215	0.1267	0.0002712

Curves

Figure 1 – Forward characteristics of Limit device

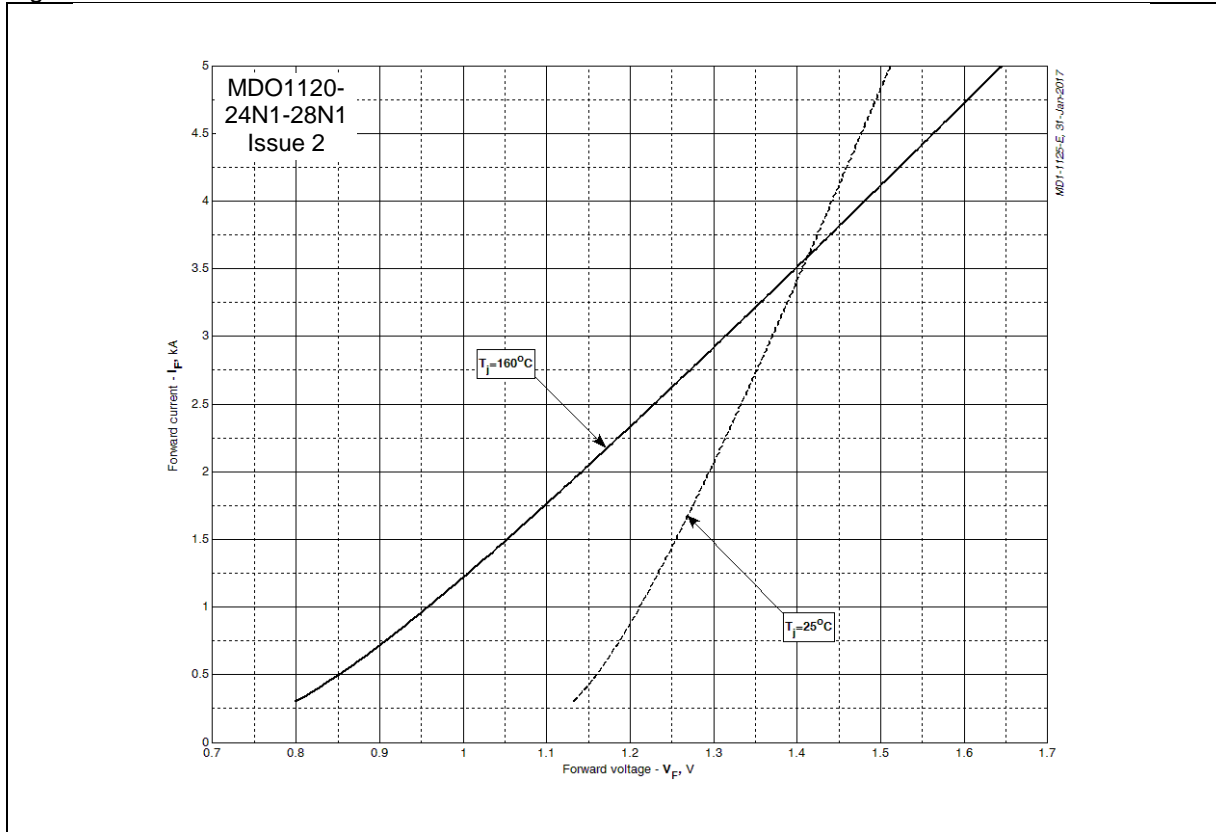


Figure 2 – Transient thermal impedance

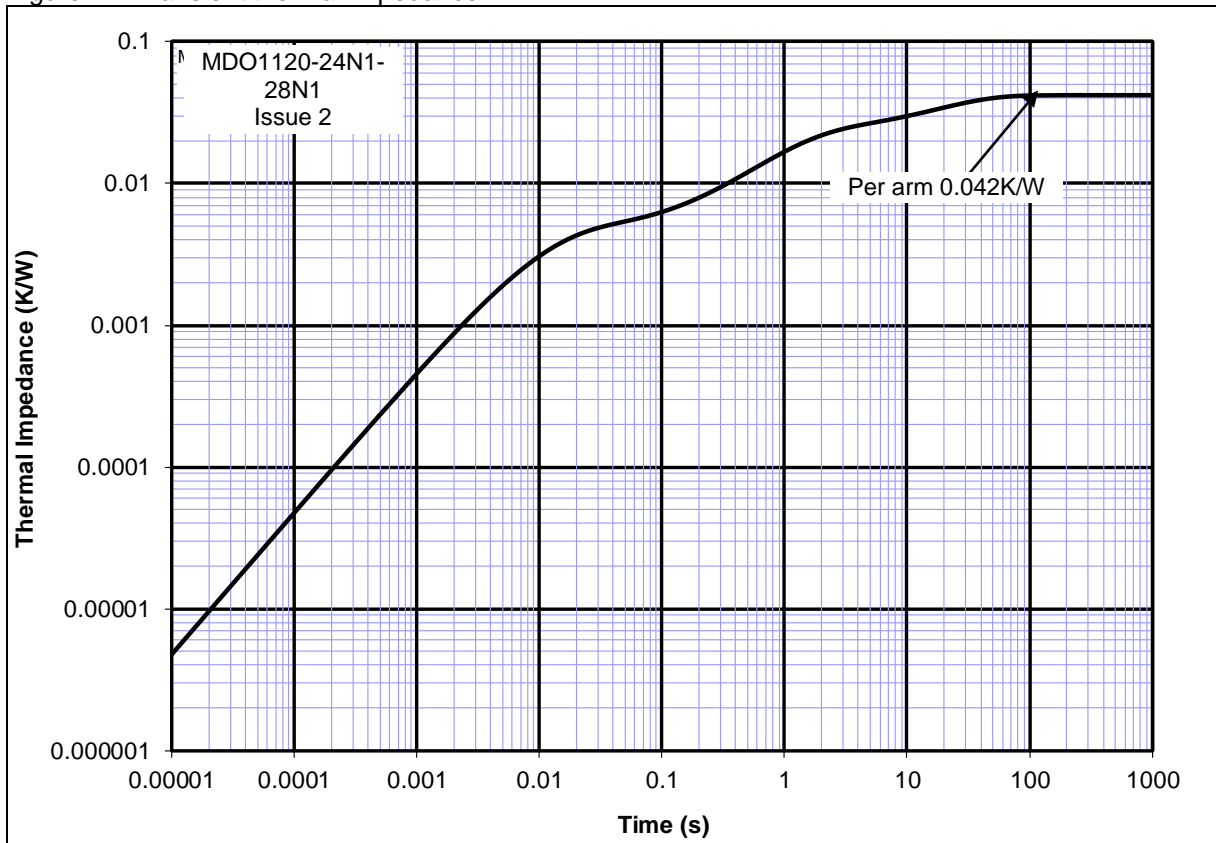


Figure 3 – Maximum surge and I²t Ratings

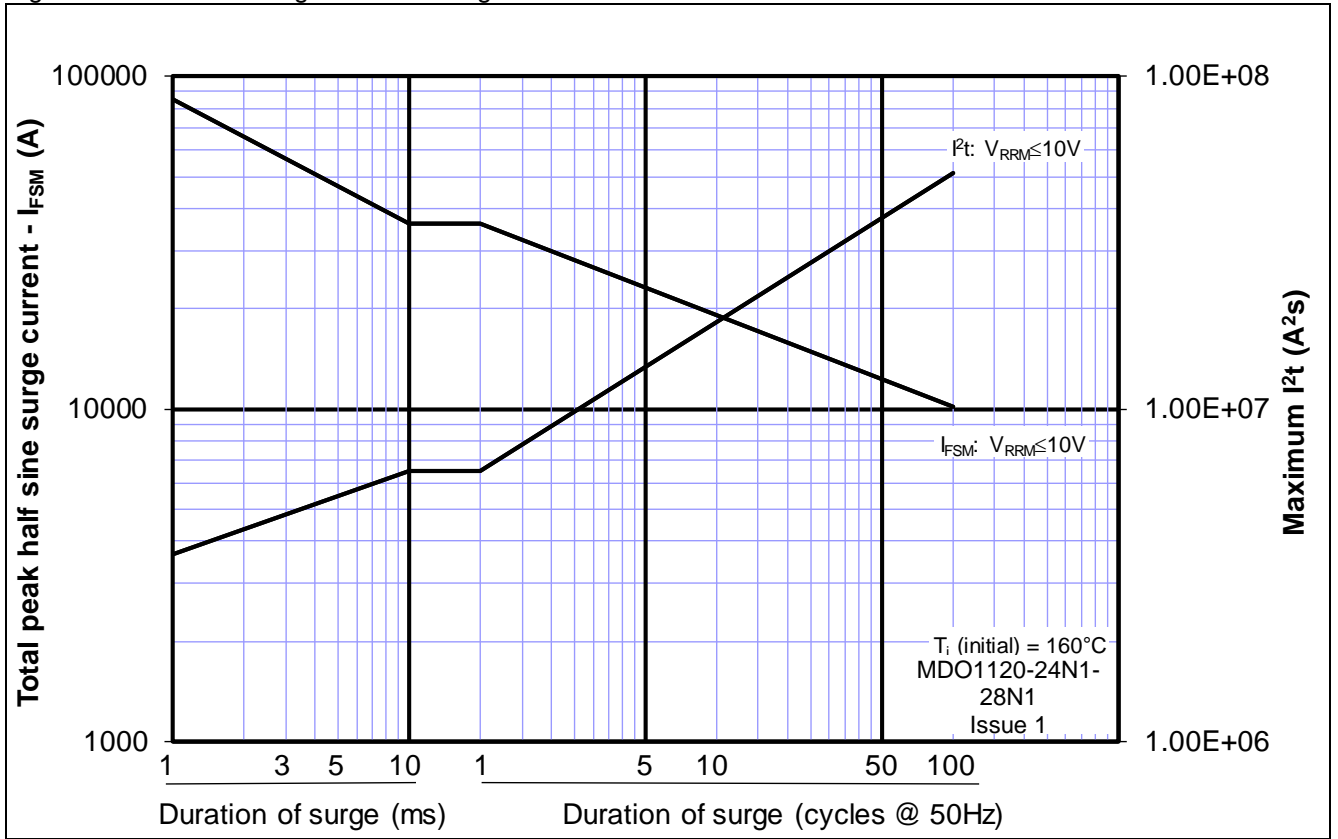


Figure 4 – On-State power loss (Sinusoidal current waveforms)

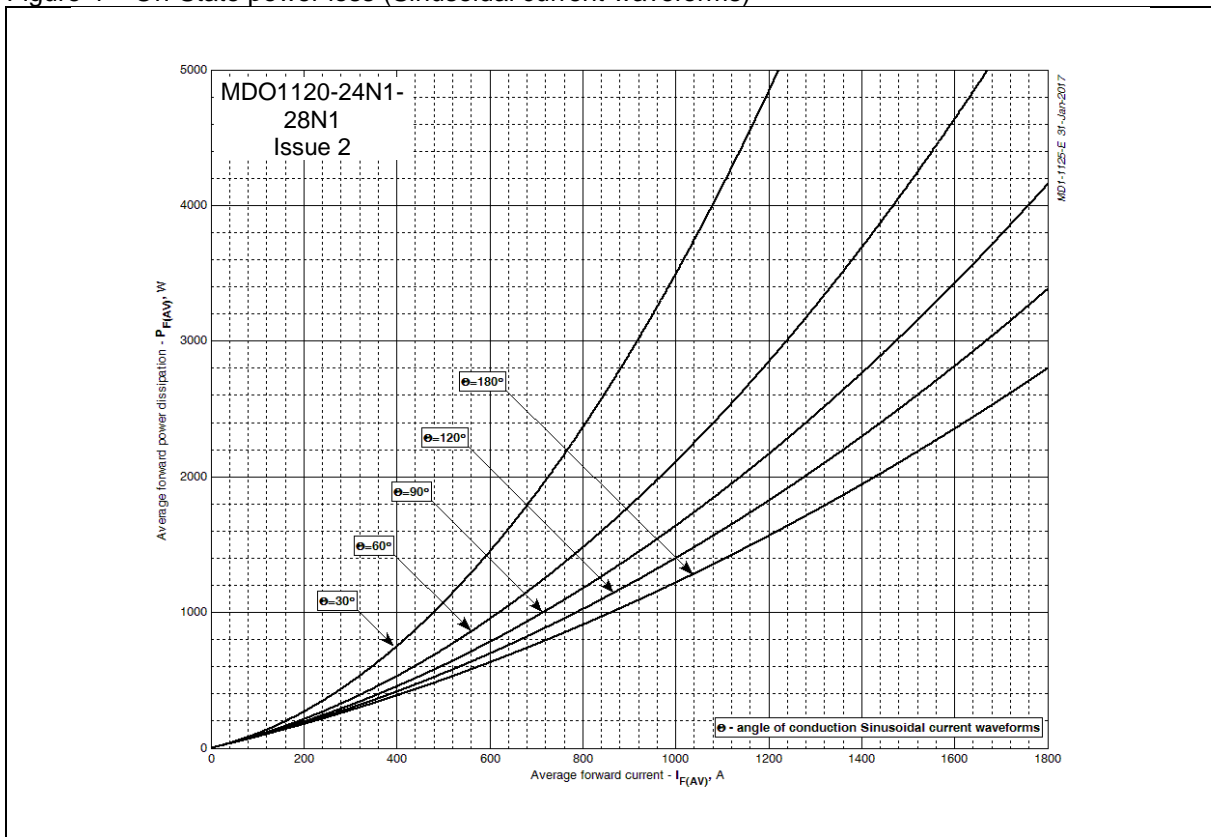


Figure 5 – On-State power loss (Rectangular current waveforms)

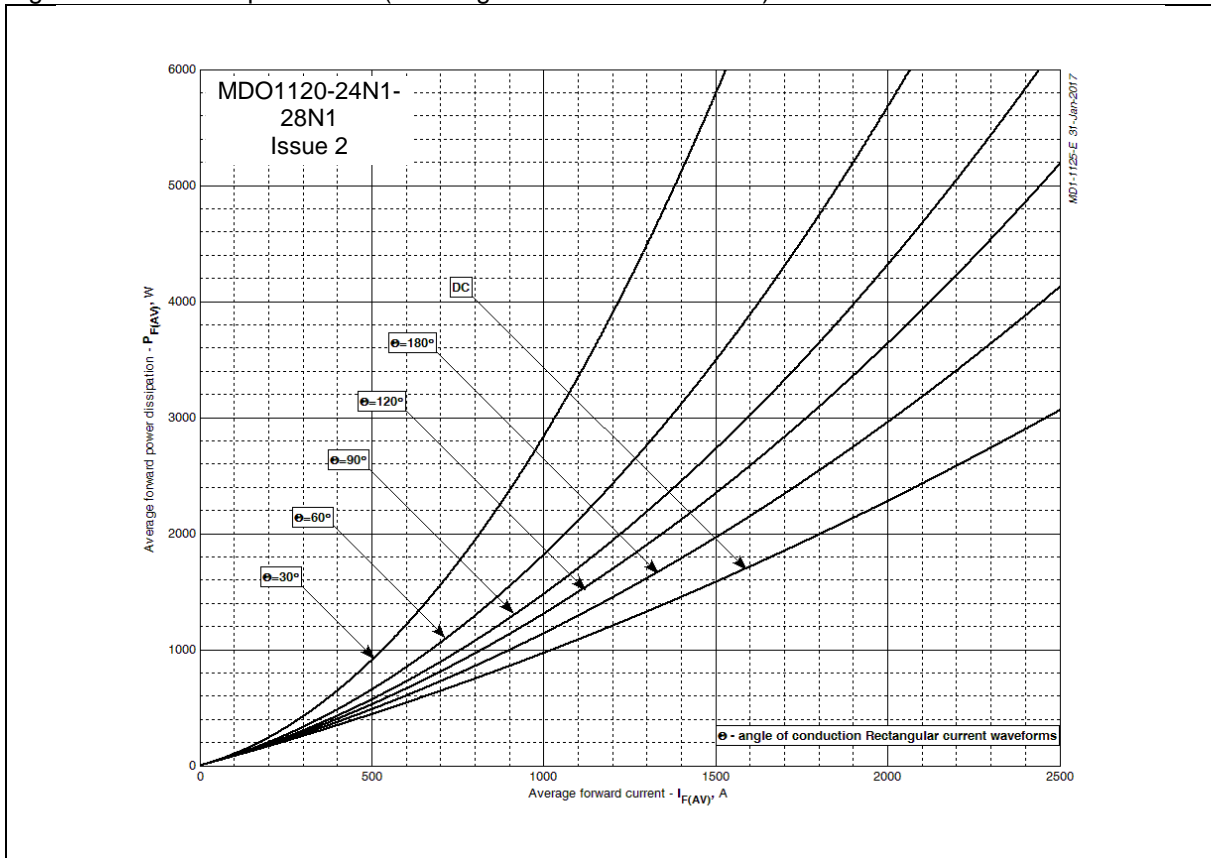


Figure 6 – Maximum case temperature DSC (Sinusoidal current waveforms)

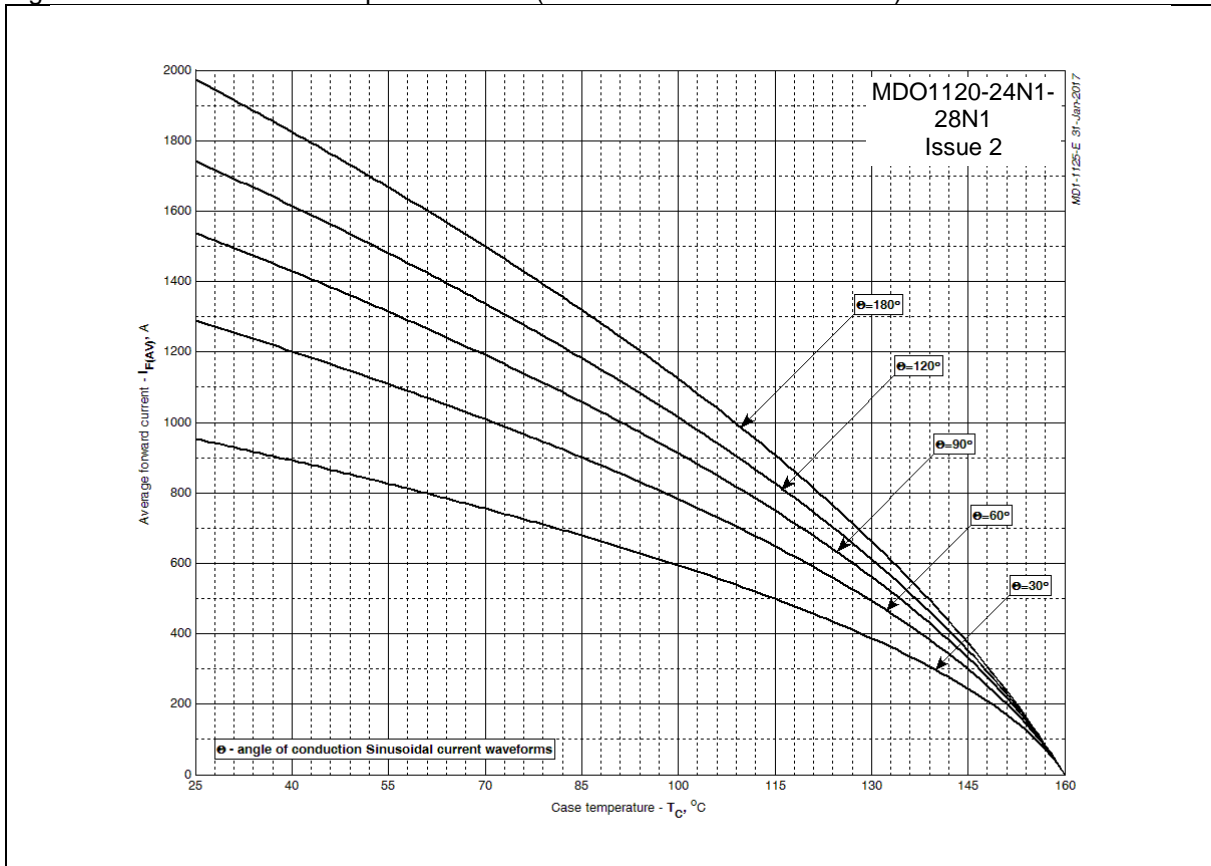
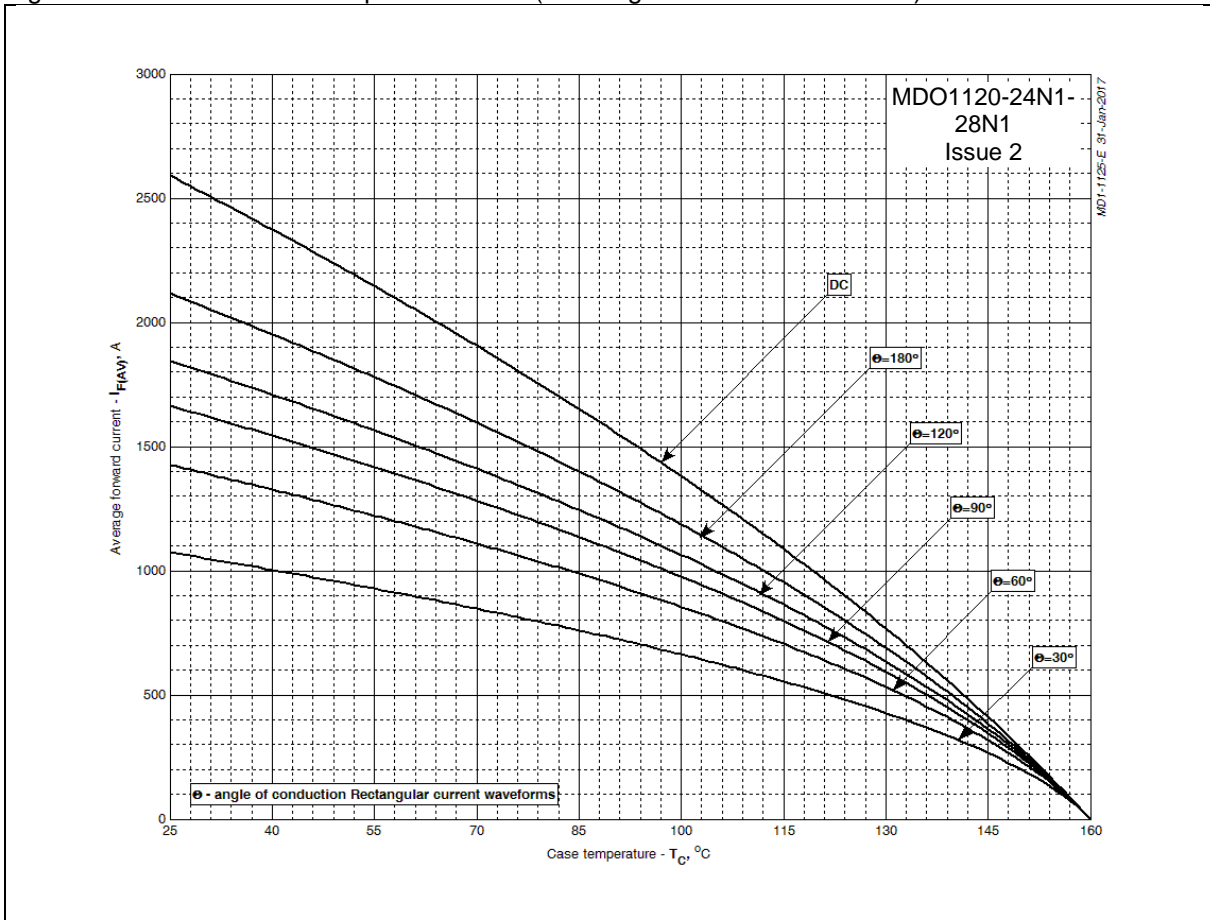
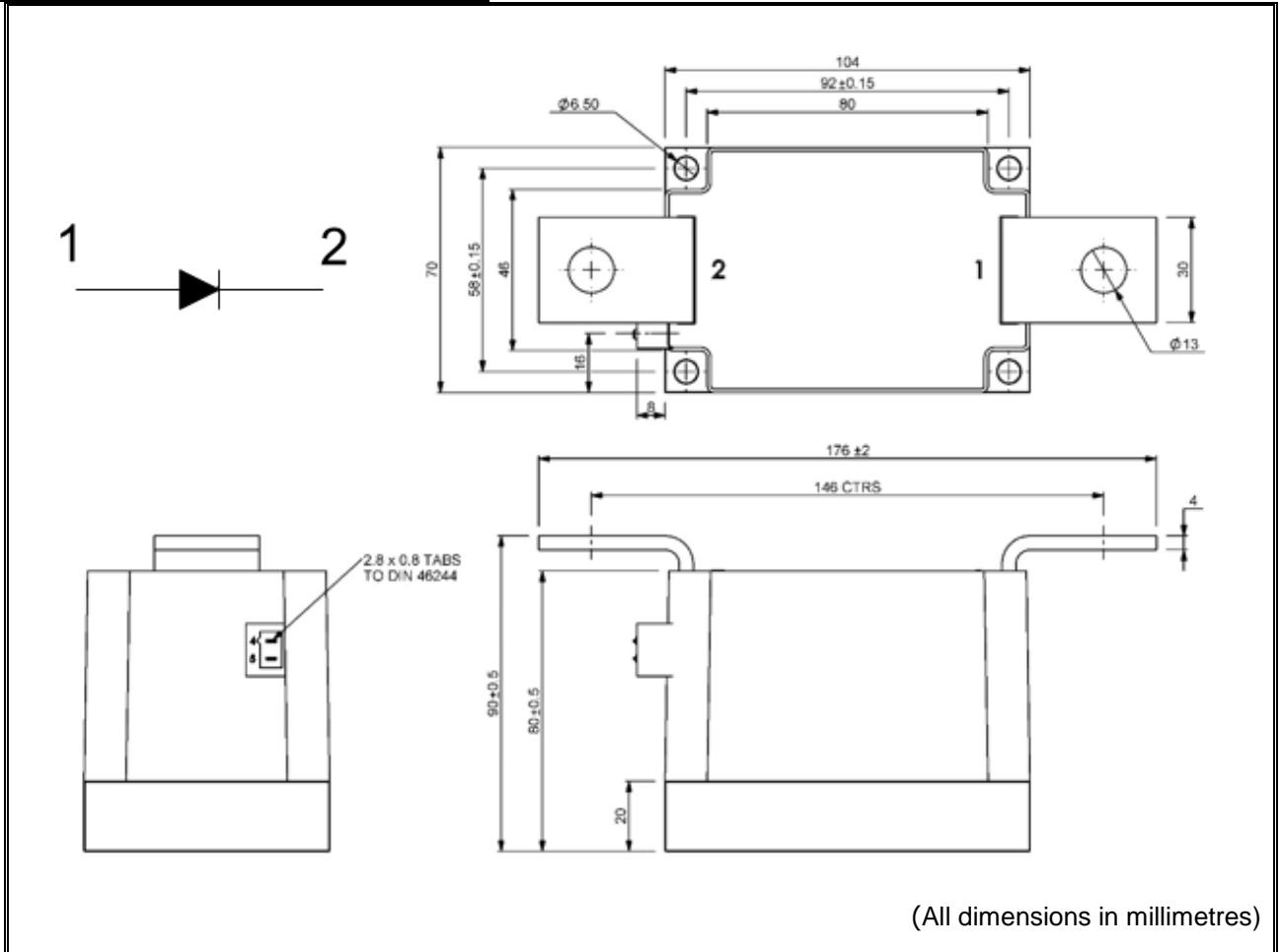


Figure 7 – Maximum case temperature DSC (Rectangular current waveforms)



Outline Drawing & Ordering Information


ORDERING INFORMATION					
(Please quote 11-digit code as below)					
M	DO	1120	◆◆	N	1
Fixed Type Code	Fixed configuration code	Fixed Type Code	Voltage code $V_{RRM}/100$ 24	Standard diode	Fixed Version Code

 Typical order code: MDO1120-24N1- MDO configuration, 2400V V_{RRM}

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