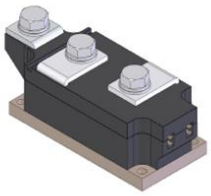
IXYS
A Littelfuse Technology



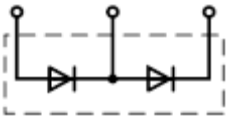
Date: 23rd sFebruary 2021

Data Sheet Issue: 1

Dual Diode Module Types

MDD320-60N2 to MDD320-65N2

Absolute Maximum Ratings

V_{RRM} [V]	 MDD
6000 6500	320-60N2 320-65N2

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage [1]	6000-6500	V
V_{RSM}	Non-repetitive peak reverse voltage [1]	6100-6600	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average on-state current, T_C = 85°C [2]	395	A
$I_{F(AV)M}$	Maximum average on-state current. T_C = 100°C [2]	320	A
$I_{F(RMS)M}$	Nominal RMS on-state current, T_C = 85°C [2]	625	A
$I_{F(RMS)M}$	Nominal RMS on-state current, T_C = 100°C [2]	505	A
$I_{F(d.c.)}$	D.C. on-state current, T_C = 55°C	715	A
I_{FSM}	Peak non-repetitive surge t_p = 10 ms, V_{RM} = 60%V_{RRM} [3]	5.4	kA
I_{FSM2}	Peak non-repetitive surge t_p = 10 ms, $V_{RM} \leq$ 10V [3]	6.0	kA
I^2t	I^2t capacity for fusing t_p = 10 ms, V_{RM} = 60%V_{RRM} [3]	146	kA^2s
I^2t	I^2t capacity for fusing t_p = 10 ms, $V_{RM} \leq$ 10 V [3]	180	kA^2s
V_{ISOL}	Isolation Voltage [4]	3000	V
$T_{vj\ op}$	Operating temperature range	-40 to +140	°C
T_{stg}	Storage temperature range	-40 to +50	°C

Notes:

1) De-rating factor of 0.13% per °C is applicable for T_{vj} below 25°C.
2) Single phase; 50 Hz, 180° half-sinewave.
3) Half-sinewave, 140°C T_{vj} initial.
4) AC RMS voltage, 50 Hz, 1min test

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS [1]	UNITS
V_{FM}	Maximum peak on-state voltage	-	-	2.40	I_{FM} = 1570 A, T_{vj} = 25°C	V
V_{F0}	Threshold voltage	-	-	0.95		V
r_T	Slope resistance	-	-	1.10		mΩ
I_{RRM}	Peak reverse current	-	-	100	Rated V_{RRM}	mA
Q_{rr}	Recovered Charge	-	-	3600	I_{FM} = 500 A, t_p = 1 ms, di/dt = 5A/µs, V_R = 100 V	µC
Q_{ra}	Recovered Charge, 25% chord	-	-	3300		µC
I_{rm}	Reverse recovery current	-	-	110		A
t_{rr}	Reverse recovery time, 25% chord	-	-	60		µs
R_{thJC}	Thermal resistance, junction to case	-	-	0.0650	Single Arm	K/W
		-	-	0.0325	Whole Module	K/W
R_{thCH}	Thermal resistance, case to heatsink	-	-	0.020	Single Arm	K/W
		-	-	0.010	Whole Module	K/W
F_1	Mounting force (to heatsink)	-	6.00	-		Nm
F_2	Mounting force (to terminals)	-	12.00	-	[2]	Nm
W_t	Weight	-	1500	-		g

Notes:

1) Unless otherwise indicated T_j=140°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
60	6000	6100	3600
65	6500	6600	3900

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 Computer Modelling Parameters

4.1 Diode Dissipation Calculations

$$I_{AV} = \frac{-V_{F0} + \sqrt{V_{F0}{}^2 + 4 \cdot ff^2 \cdot r_T \cdot W_{AV}}}{2 \cdot ff^2 \cdot r_T}$$

and:

$$W_{AV} = \frac{\Delta T}{R_{th}}$$

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

Where V_{F0} = 0.95 V, r_T = 1.10 mΩ.

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

ff = Form factor, see table below.

Supplementary Thermal Impedance							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave	0.0810	0.0768	0.0742	0.0725	0.0705	0.0690	0.0650
Sine wave	0.0766	0.0724	0.0706	0.0694	0.0680		

Form Factors							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave	3.464	2.449	2.000	1.732	1.414	1.149	1.000
Sine wave	4.025	2.778	2.220	1.879	1.568		

4.2 Calculating diode V_F using ABCD Coefficients

The on-state characteristic I_F vs. V_F, on page 6 is represented by a set of constants A, B, C, D, forming the coefficients of the representative equation for V_F in terms of I_F given below:

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

The constants, derived by curve fitting software, 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		140°C Coefficients	
A	0.97127313	A	0.9566156
B	2.360709×10^{-3}	B	-0.0404543
C	7.656939×10^{-4}	C	8.818386×10^{-4}
D	5.242400×10^{-3}	D	0.0158072

4.3 D.C. Thermal Impedance Calculation

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

Where *p = 1* to *n and:*

n = number of terms in the series
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 table below:

D.C.						
Term	1	2	3	4	5	6
r_p	0.0385	0.01253	0.0144	0.007273	0.001871	0.0001367
τ_p	3.124	0.8558	0.1999	0.009185	0.002295	0.000238

5.0 Reverse recovery ratings

(i) Q_{ra} is based on 25% I_{RM} chord as shown in Fig. 1

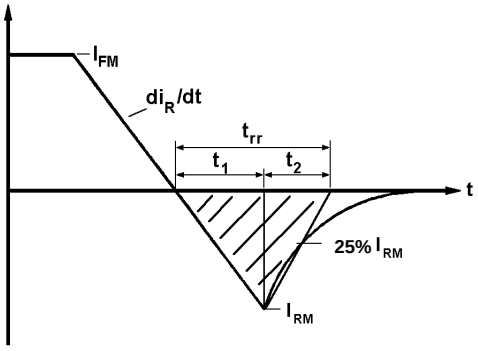


Fig. 1

(ii)
$$K\ Factor = \frac{t_1}{t_2}$$

Curves

Figure 1 – On-state characteristics of Limit device

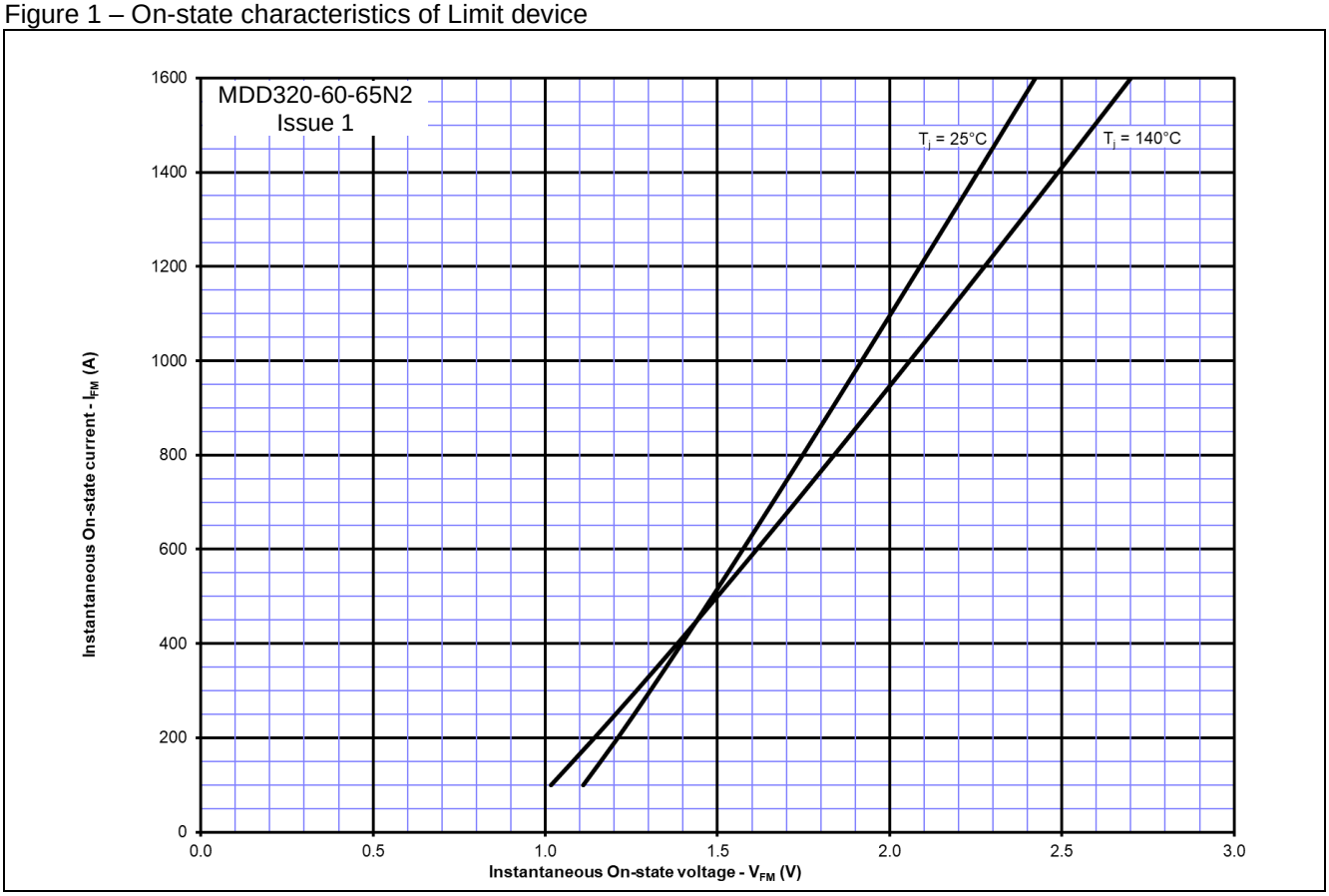


Figure 2 – Transient thermal impedance

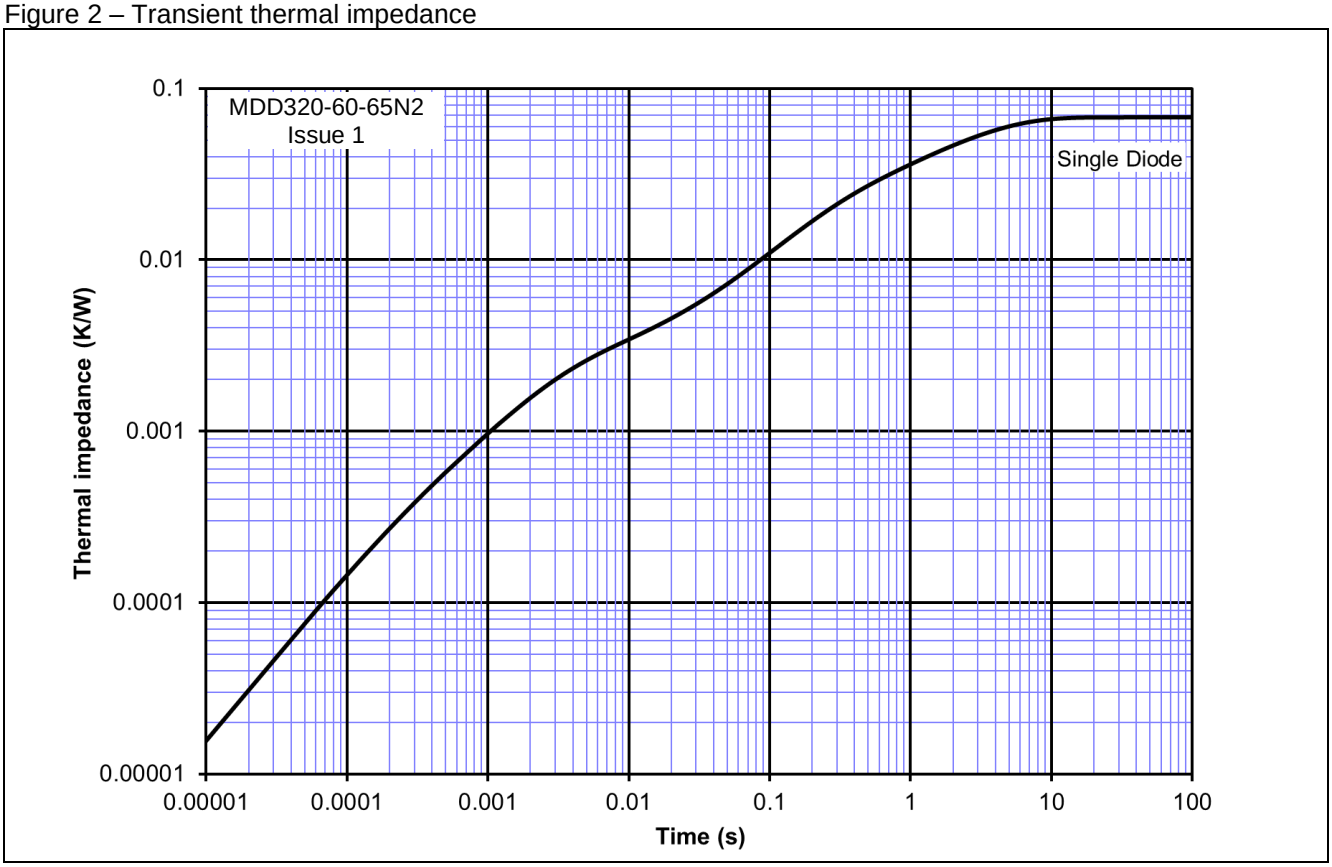


Figure 5 - Total recovered charge, Q_{rr}

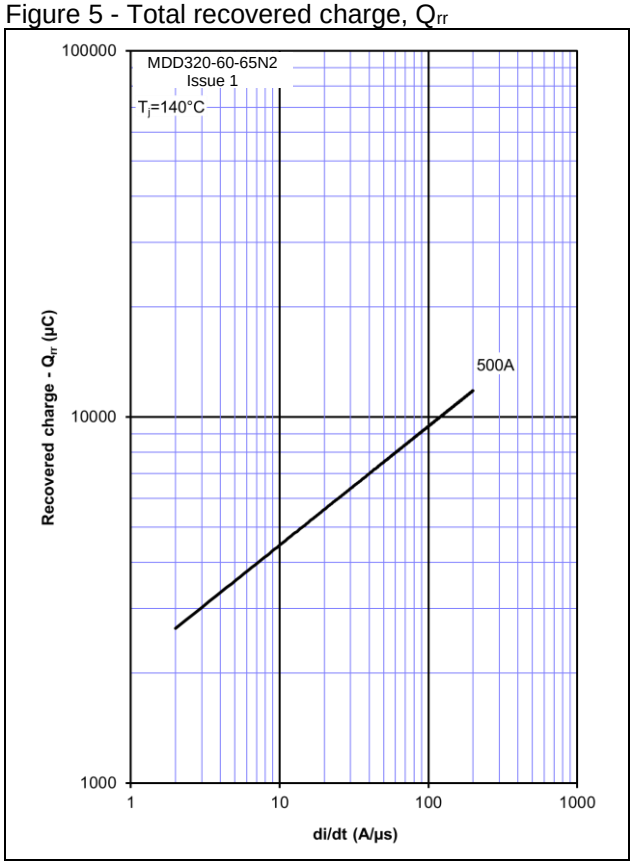


Figure 6 - Recovered charge, Q_{ra} (25% chord)

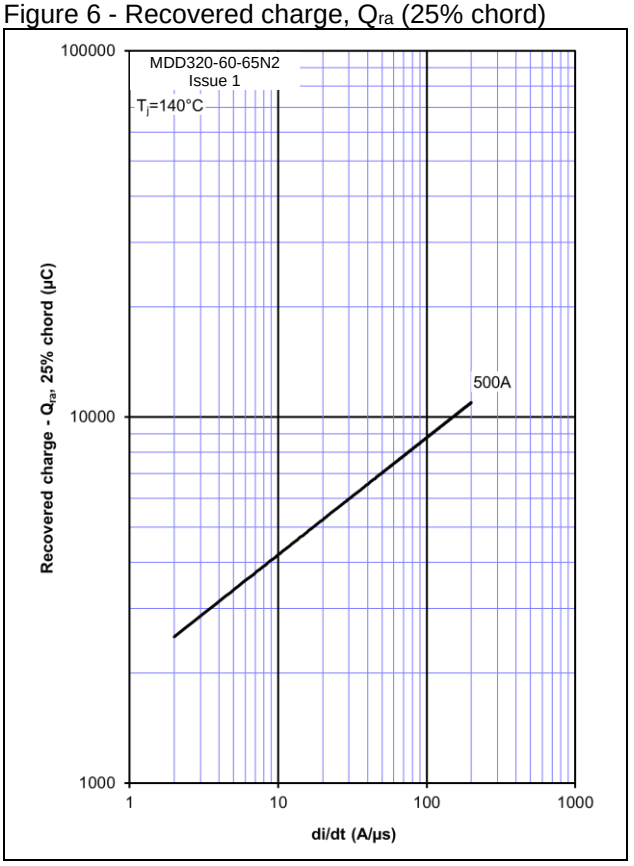


Figure 7 - Peak reverse recovery current, I_{rm}

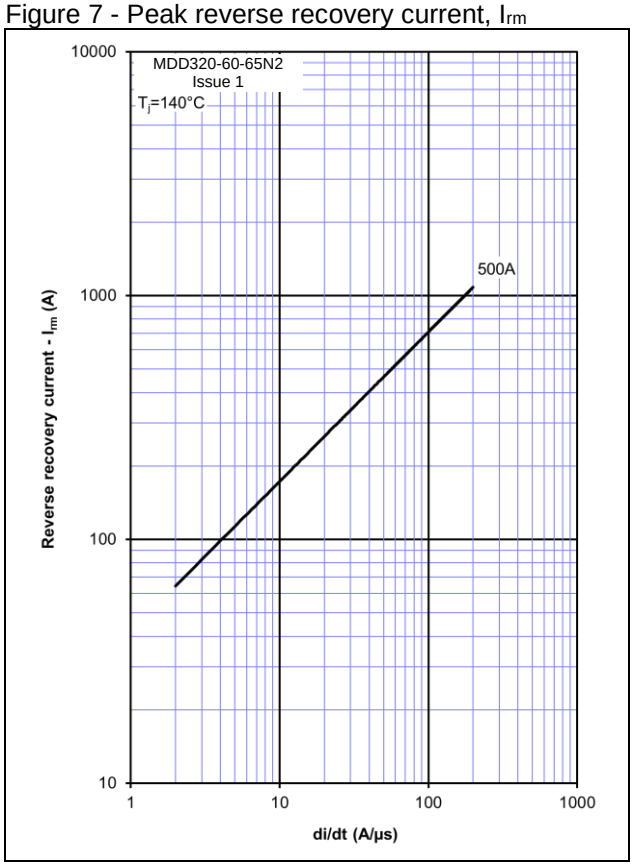


Figure 8 - Maximum recovery time, t_{rr} (25% chord)

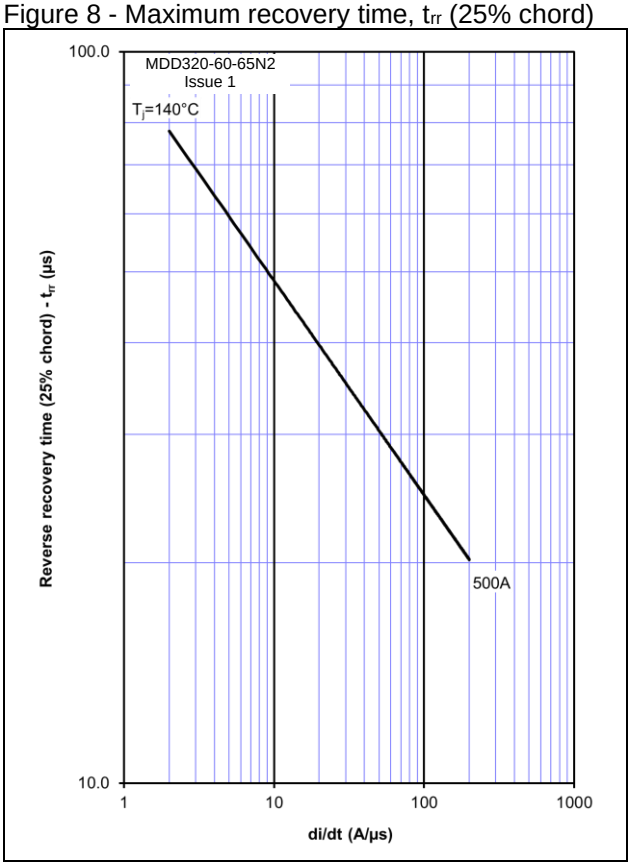


Figure 9 – On-state current vs. Power dissipation – Sine wave

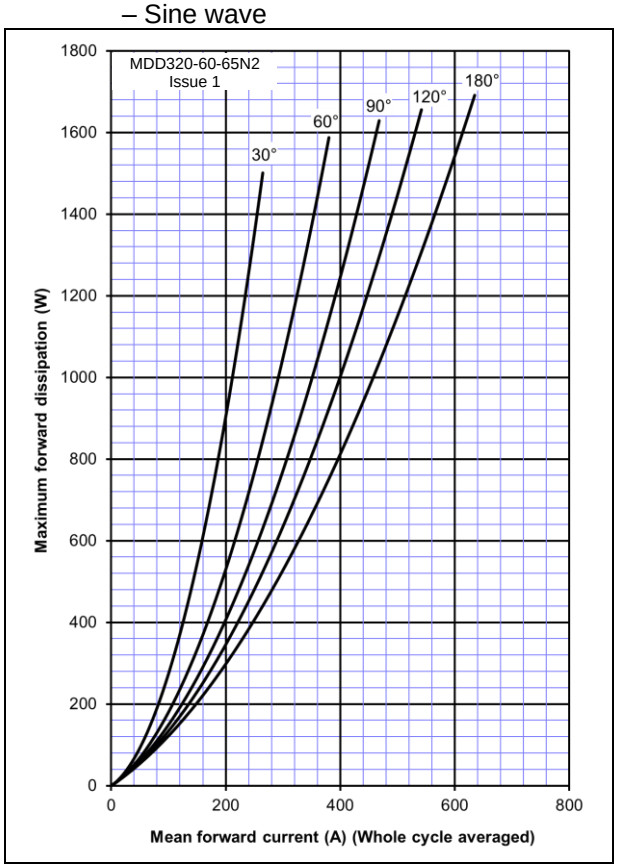


Figure 10 – On-state current vs. Heatsink temperature – Sine wave

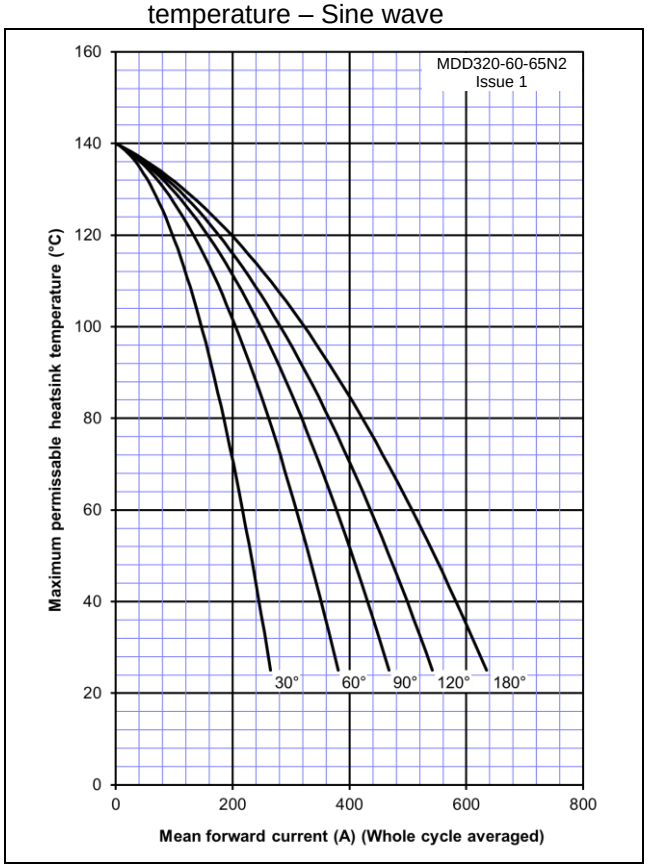


Figure 11 – On-state current vs. Power dissipation – Square wave

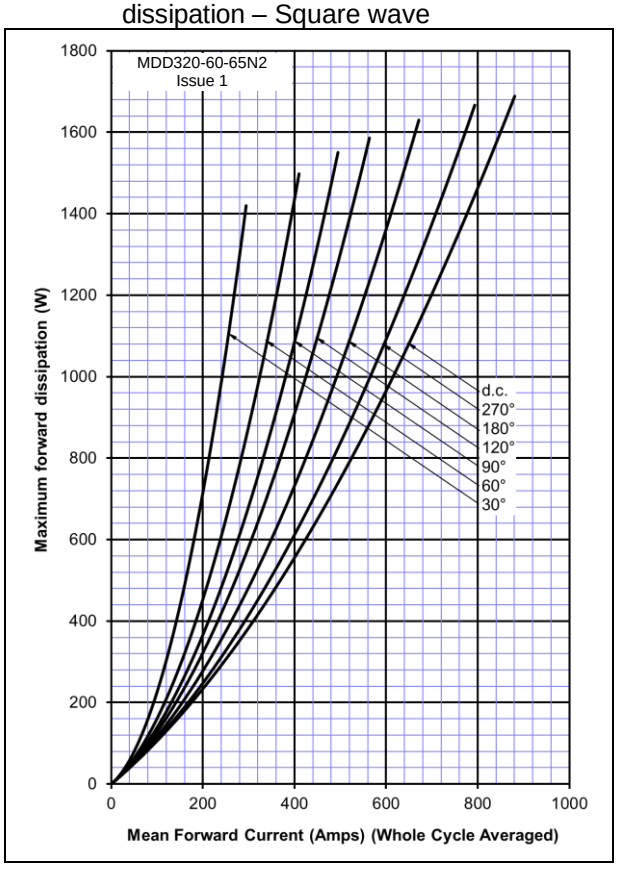


Figure 12 – On-state current vs. Heatsink temperature – Square wave

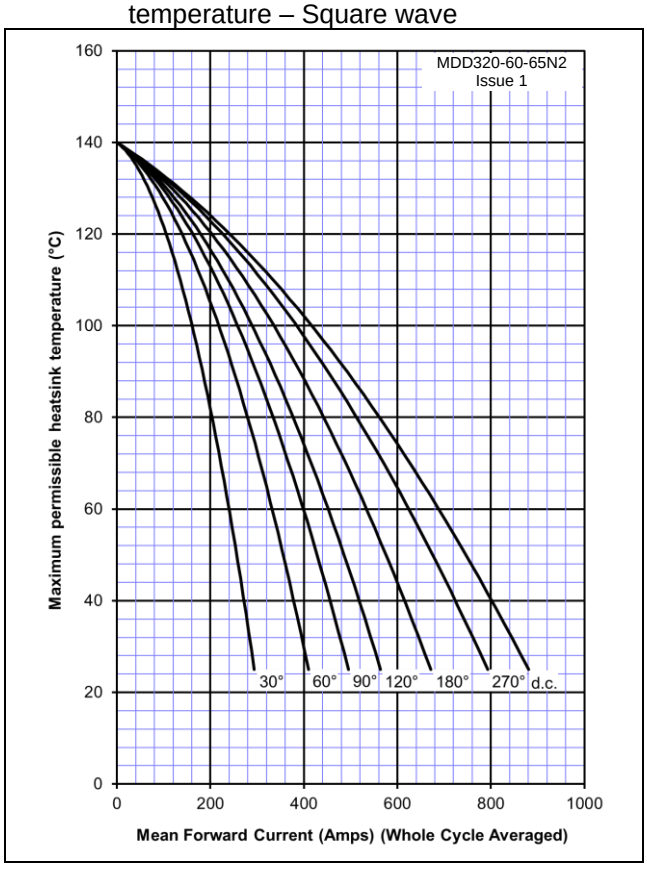
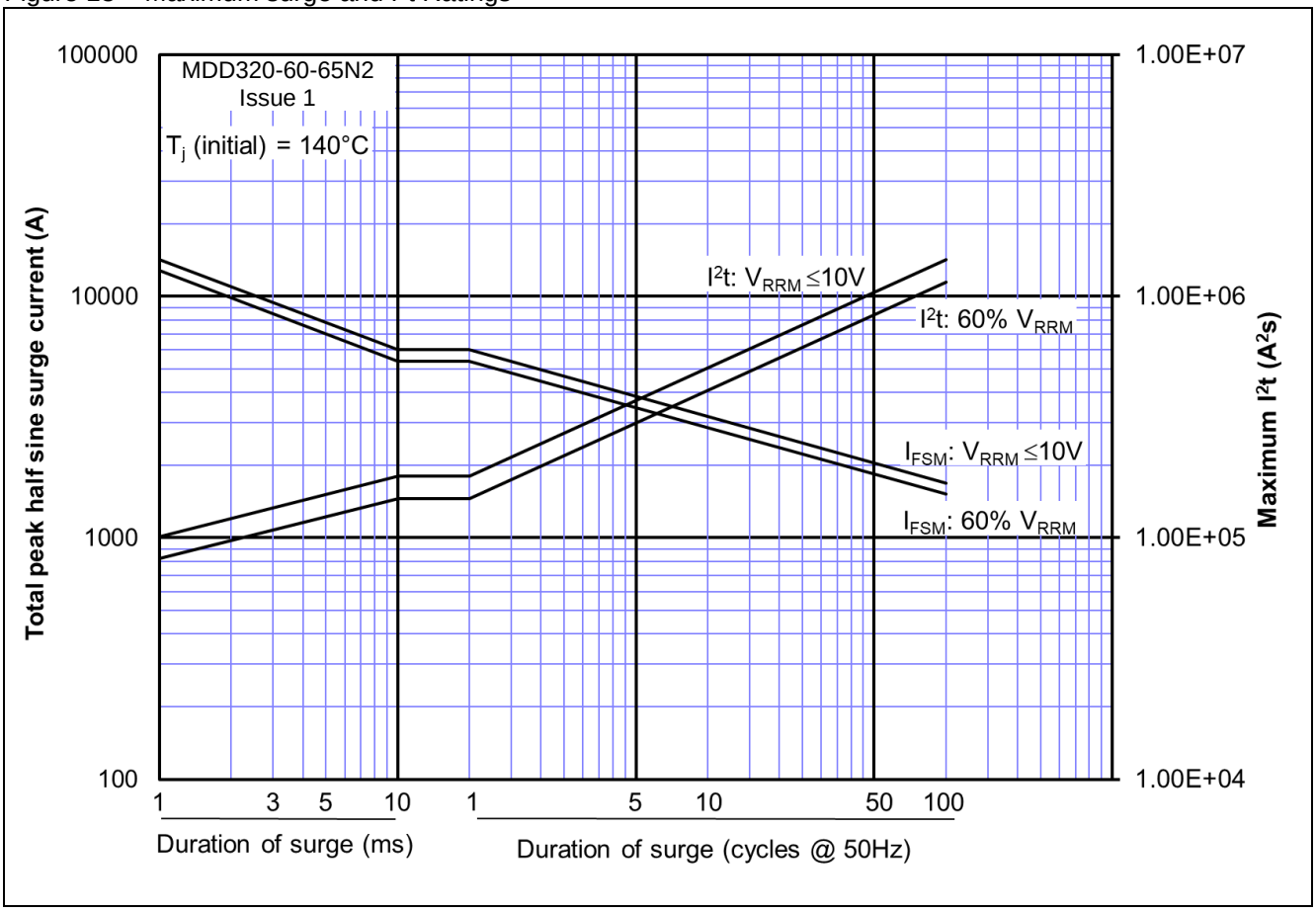
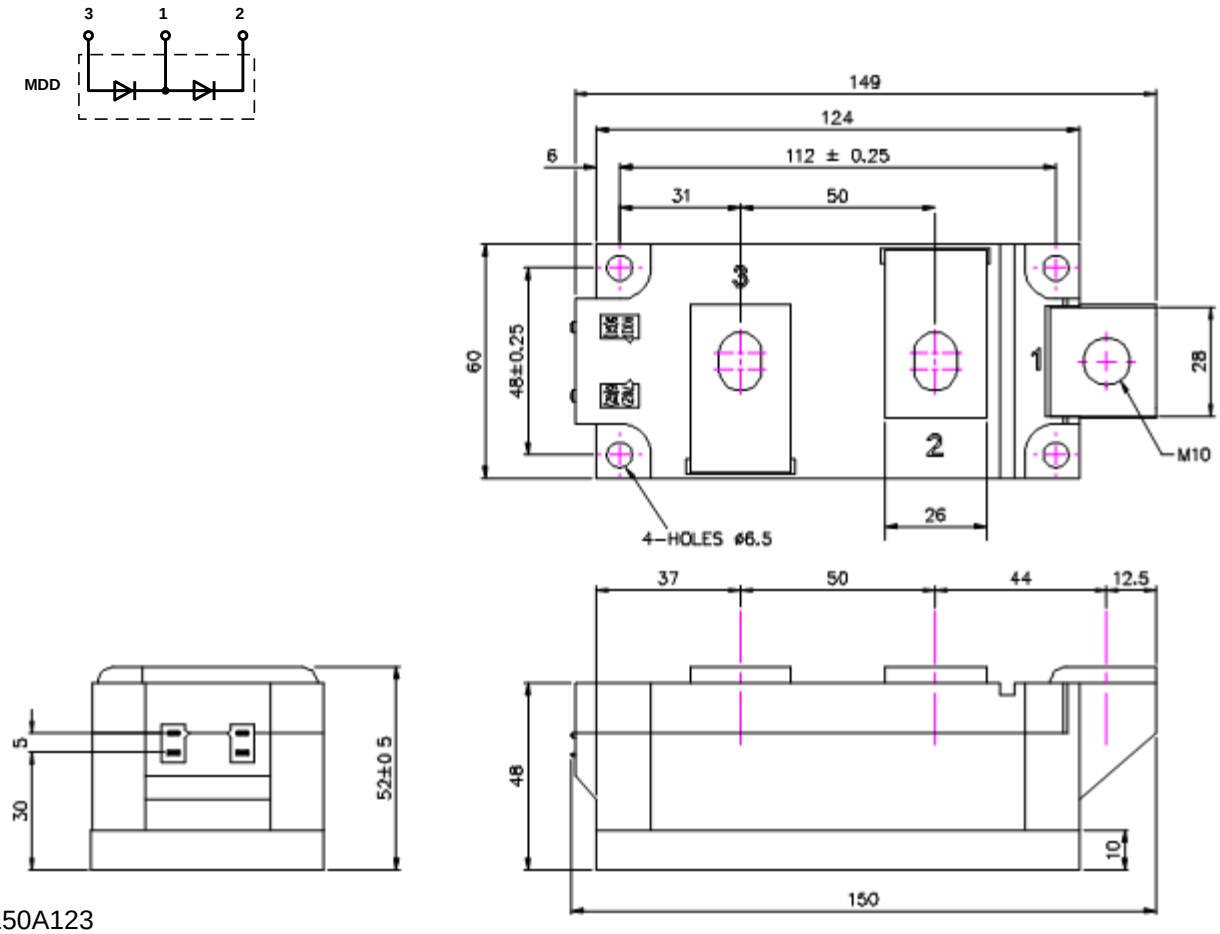


Figure 13 – Maximum surge and I^2t Ratings



Outline Drawing & Ordering Information



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ORDERING INFORMATION			(Please quote 11 digit code as below)		
M	**DD**	**320**	**♦♦**	**N**	**2**
Fixed Type Code	Configuration code DD	Fixed Type Code	Voltage code V_{RRM}/100 60-65	Standard Diode	Fixed Version Code
Typical order code: MDD320-65N2– MDD configuration, 6500V V_{RRM}					

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