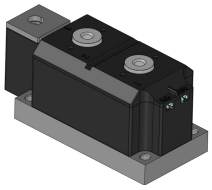
IXYS

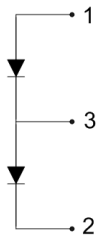
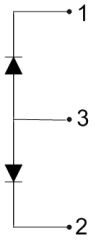
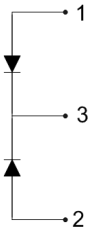


Date: 13th Mar 2013

Data Sheet Issue: 1

Diode Modules MD#1080

Absolute Maximum Ratings

V_{RRM} V_{DRM} [V]	 MDD	 MDA	 MDK
1800	1080-18N7	1080-18N7	1080-18N7
2400	1080-24N7	1080-24N7	1080-24N7
2800	1080-28N7	1080-28N7	1080-28N7

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage [1]	1800-2800	V
V_{RSM}	Non-repetitive peak reverse voltage [1]	1900-2900	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_C = 85°C [2]	1080	A
$I_{F(AV)M}$	Maximum average forward current. T_C = 100°C [2]	887	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_C = 55°C [2]	2235	A
$I_{F(d.c.)}$	D.C. forward current, T_C = 55°C	1788	A
I_{FSM}	Peak non-repetitive surge t_p = 10 ms, V_{RM} = 60%V_{RRM} [3]	29.1	kA
I_{FSM2}	Peak non-repetitive surge t_p = 10 ms, $V_{RM} \leq$ 10V [3]	32.0	kA
I^2t	I^2t capacity for fusing t_p = 10 ms, V_{RM} = 60%V_{RRM} [3]	4.23×10^3	kA^2s
I^2t	I^2t capacity for fusing t_p = 10 ms, $V_{RM} \leq$ 10 V [3]	5.12×10^3	kA^2s
$(di/dt)_{cr}$	Critical rate of rise of on-state current (repetitive) [4]	200	A/µs
	Critical rate of rise of on-state current (non-repetitive) [4]	400	A/µs
V_{ISOL}	Isolation Voltage [5]	3000	V
$T_{vj\ op}$	Operating temperature range	-40 - +150	°C
T_{stg}	Storage temperature range	-40 - +130	°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, 150°C T_{vj} initial.
4) V_D = 67% V_{DRM}, I_{FG} = 2 A, $t_r \leq$ 0.5µs, T_C = 150°C.
5) AC RMS voltage, 50 Hz, 1min test

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS [1]	UNITS
V_{FM}	Maximum peak forward voltage	-	-	0.95	I_{FM} = 1080A, $T_{vj} = T_{vjMAX}$	V
V_{FM}	Maximum peak forward voltage	-	-	1.29	I_{FM} = 3240A, $T_{vj} = T_{vjMAX}$	V
V_{T0}	Threshold voltage	-	-	0.782		V
r_T	Slope resistance	-	-	0.157		mΩ
I_{RRM}	Peak reverse current	-	-	70	Rated V_{RRM}	mA
Q_{rr}	Recovered Charge	-	-	4000	I_{FM} = 1000A, di/dt = 10A/µs, V_R = 100 V	µC
Q_{ra}	Recovered Charge, 50% chord	-	-	3300		µC
I_{rm}	Reverse recovery current	-	-	205		A
t_{rr}	Reverse recovery time, 50% chord	-	-	32		µs
R_{thJC}	Thermal resistance, junction to case	-	-	0.050	Single Diode	K/W
		-	-	0.025	Whole Module	K/W
R_{thCH}	Thermal resistance, case to heatsink	-	-	0.016	Single Diode	K/W
		-	-	0.008	Whole Module	K/W
F_1	Mounting force (to heatsink)		-	9.00		Nm
F_2	Mounting force (to terminals)		-	18.00	[2]	Nm
W_t	Weight	-	3.5	-		kg

Notes:

1) Unless otherwise indicated T_{vj}=150°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
18	1800	1900	1350
24	2400	2500	1800
28	2800	2900	2100

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 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.

5.0 Computer Modelling Parameters

5.1 Diode Dissipation Calculations

$$I_{AV} = \frac{-V_{T0} + \sqrt{V_{T0}^{\ 2} + 4 \cdot ff^2 \cdot r_T \cdot W_{AV}}}{2 \cdot ff^2 \cdot r_T}$$

and:

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

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

Where V_{T0} = 0.782 V, r_T = 0.157 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	0.0595	0.0561	0.0547	0.0537	0.0525	0.0511	0.0500
Sine wave	0.0536	0.0527	0.0522	0.0518	0.0500		

Form Factors							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave	3.464	2.449	2	1.732	1.414	1.149	1
Sine wave	3.98	2.778	2.22	1.879	1.57		

5.2 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		150°C Coefficients	
A	7.498609E-01	A	4.871119E-01
B	4.491977E-02	B	4.816888E-02
C	1.266823E-04	C	1.411432E-04
D	-2.353395E-03	D	-7.437492E-04

5.3 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	0.02506	0.009643	0.00348	0.009712	0.001719	0.0004399
τ_p	8.474	1.110	0.2289	0.04529	0.009524	0.0002414

6.0 Reverse recovery ratings

(i) Q_{ra} is based on 50% I_{RM} chord as shown in Fig. 1

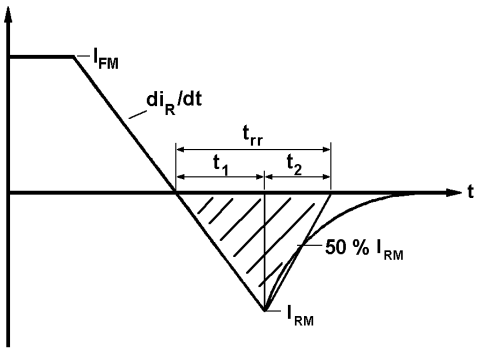


Fig. 1

(ii) Q_{rr} is based on a 150 µs integration time i.e.

$$Q_{rr} = \int_0^{150\,\mu s} i_{rr}.dt$$

(iii)

$$K\ Factor = \frac{t_1}{t_2}$$

Curves

Figure 1 – Forward characteristics of Limit device

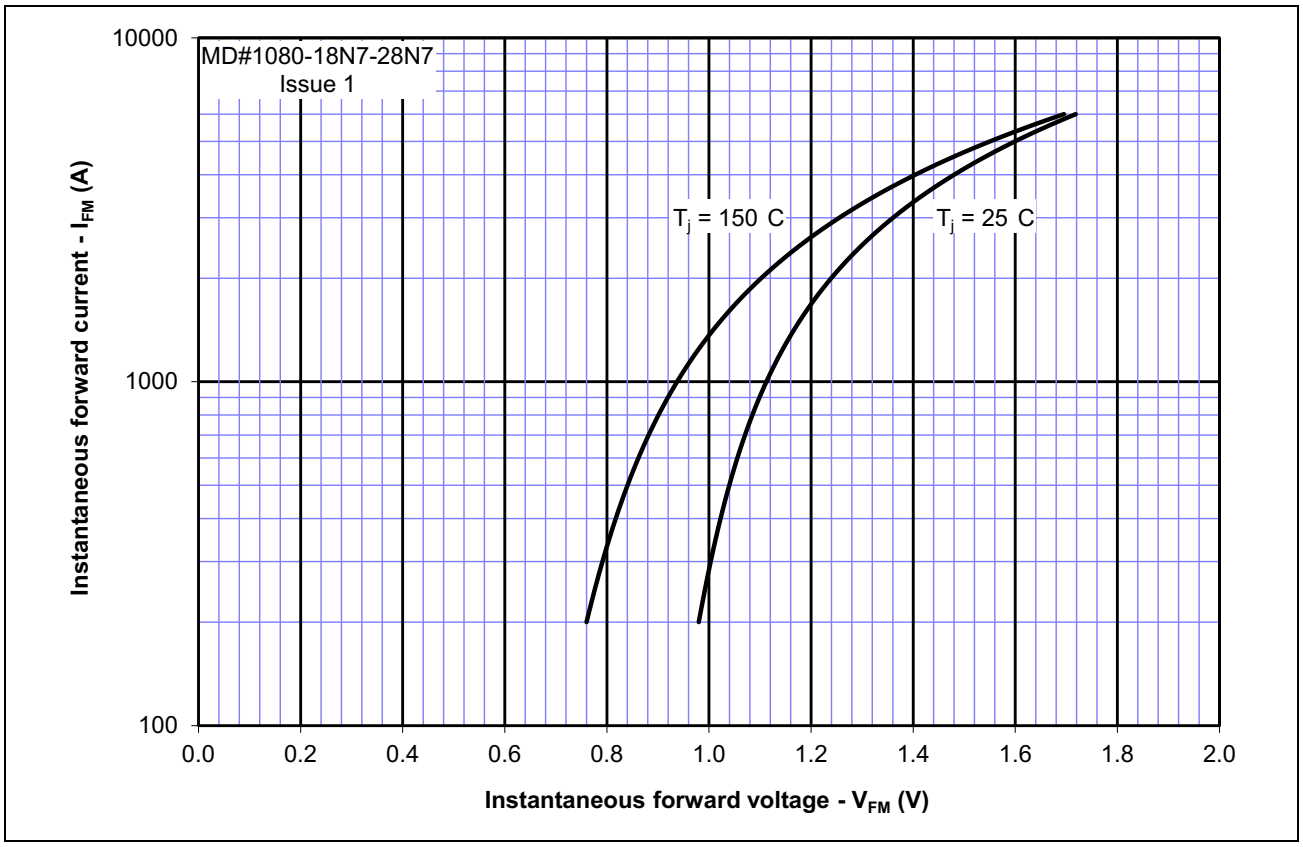


Figure 2 – Maximum surge and I^2t Ratings

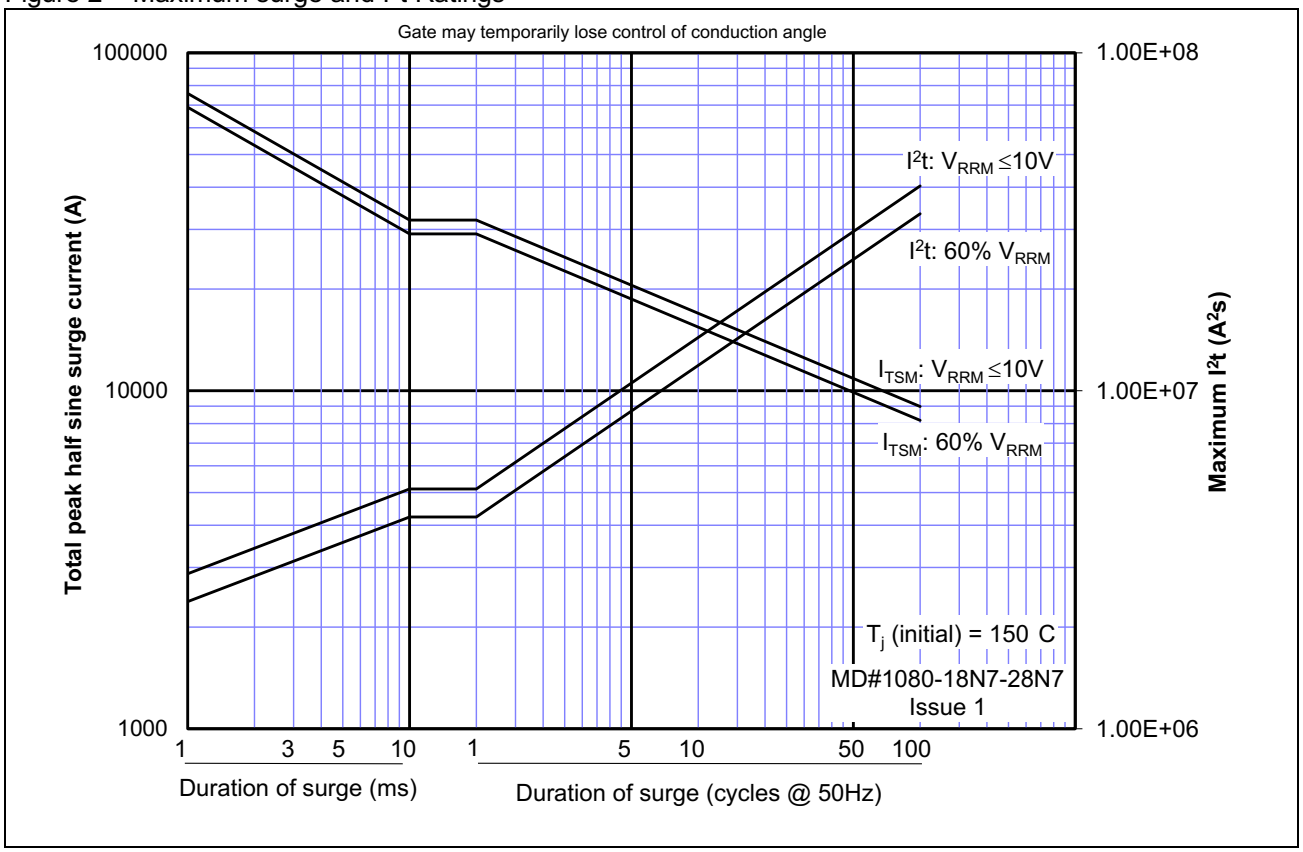


Figure 3 – Recovered charge, Q_{rr}

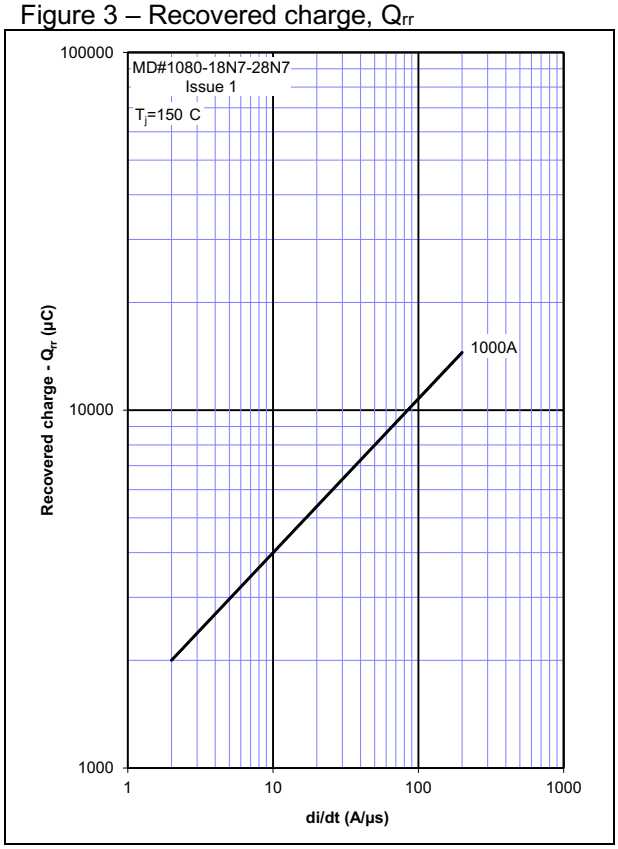


Figure 4 – Recovered charge, Q_{ra} (50% Chord)

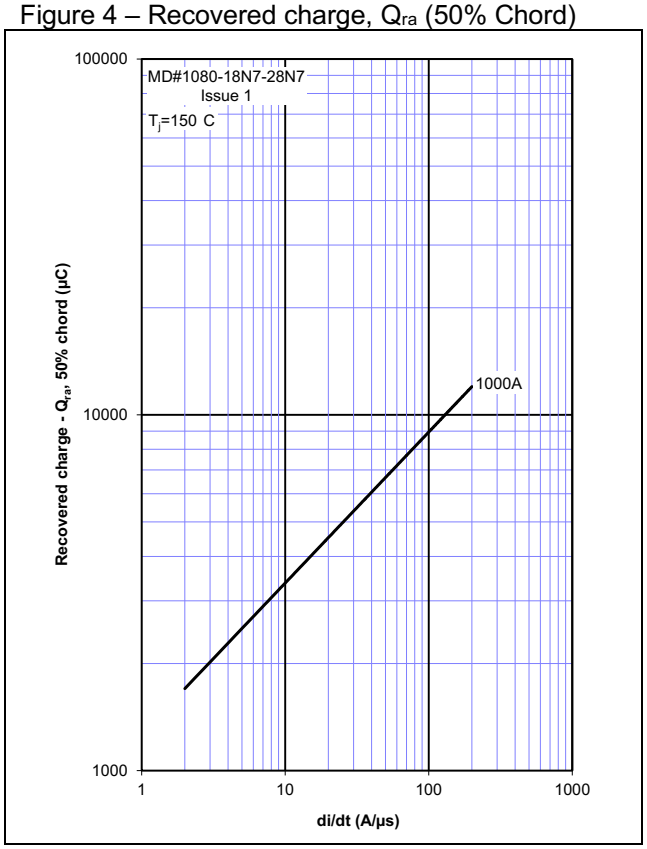


Figure 5 – Reverse recovery current, I_{rm}

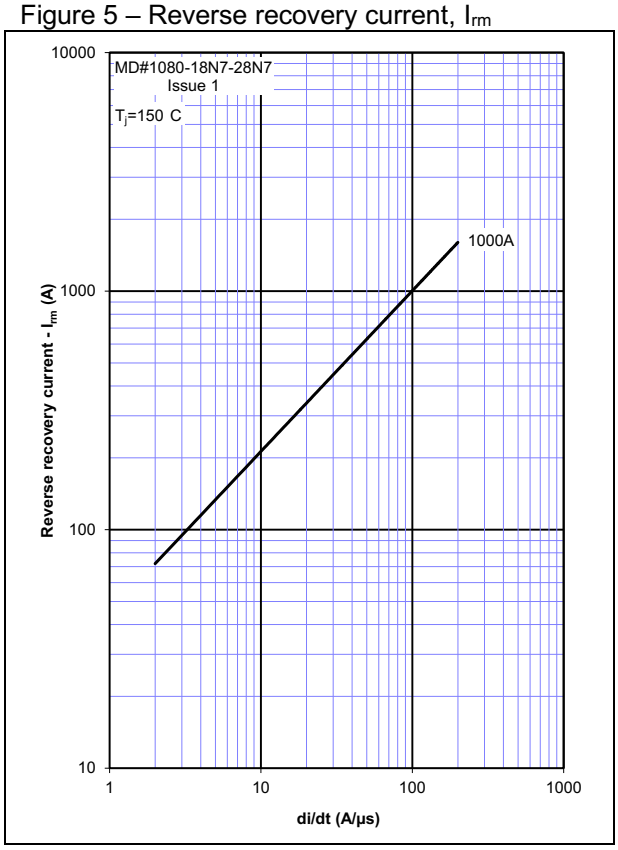


Figure 6 – Reverse recovery time, t_{rr}

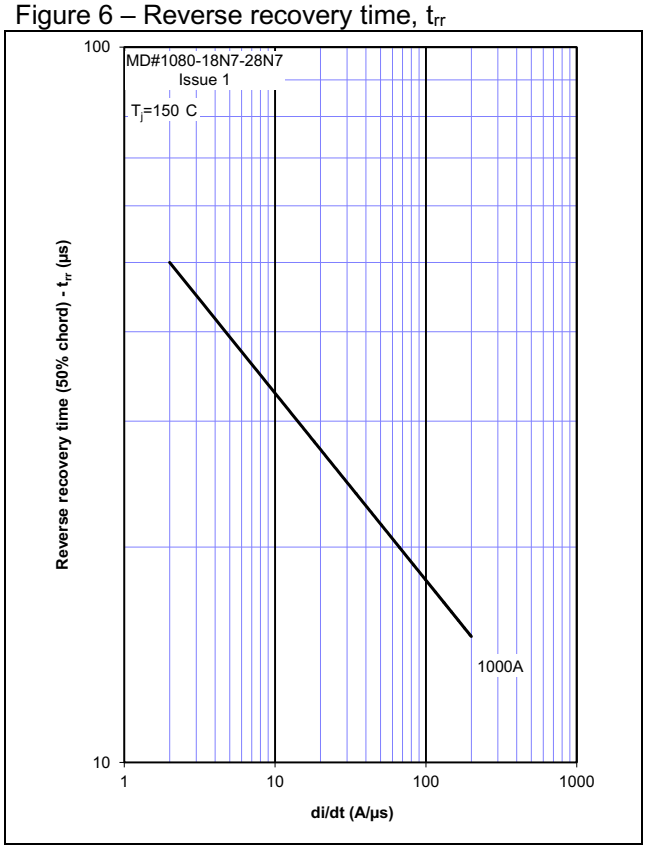


Figure 7 – On-state current vs. Power dissipation – Sine wave

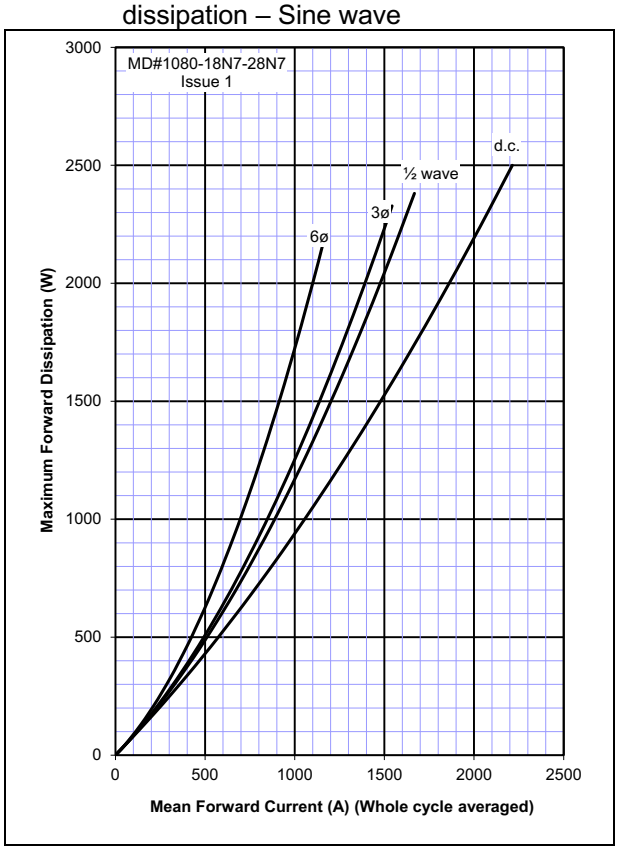


Figure 8 – On-state current vs. case temperature – Sine wave

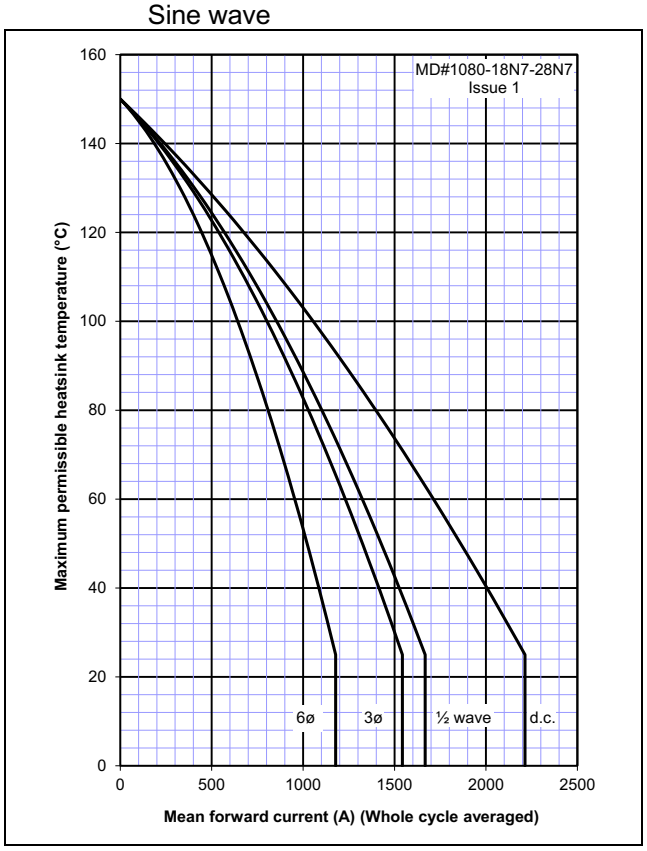
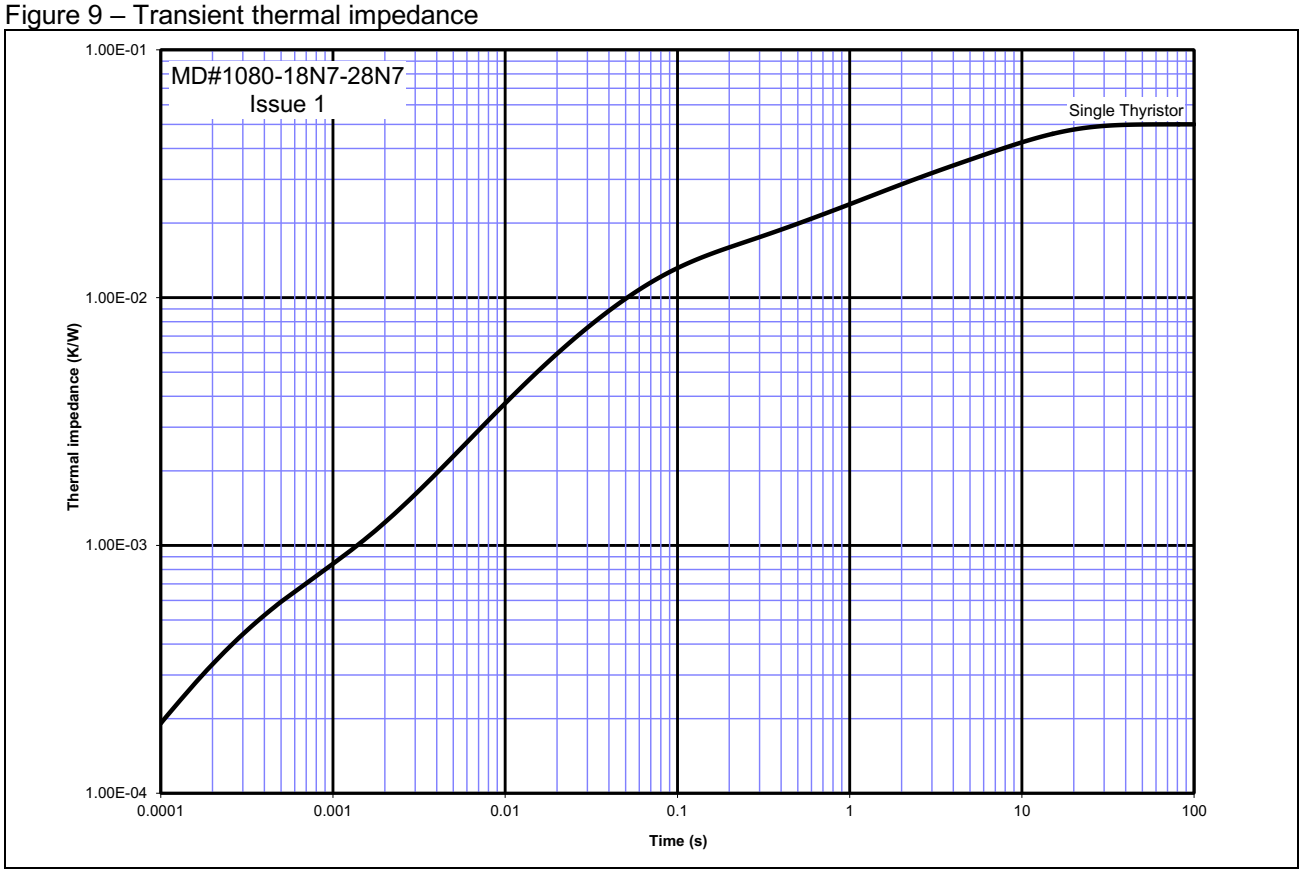
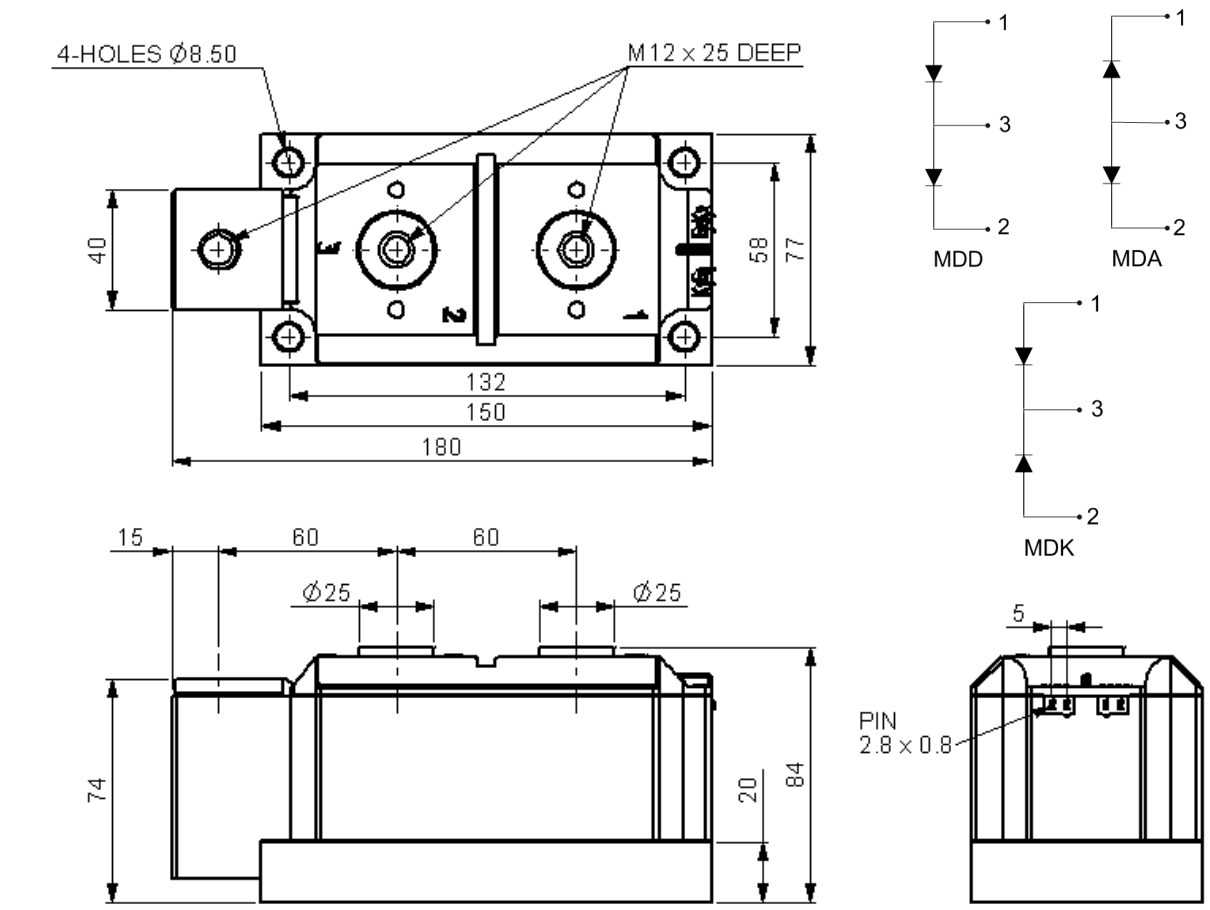


Figure 9 – Transient thermal impedance



Outline Drawing & Ordering Information



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ORDERING INFORMATION (Please quote 11 digit code as below)

M	D#	1080	♦♦	N	7
Fixed Type Code	Configuration code DD, DA or DK	Fixed Type Code	Voltage code V_{RRM}/100 18-28	Standard Diode	Fixed Version Code

Typical order code: MDD1080-18N7– MDD configuration, 1800V V_{RRM}

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