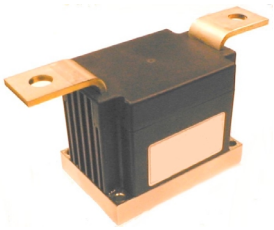
IXYS



Date: 12.01.2006

Data Sheet Issue: 1

Rectifier Diode Module
Types MDO1200-20N1 to MDO1200-22N1

Absolute Maximum Ratings

V_{RRM} [V]	Type
2000	MDO1200-20N1
2200	MDO1200-22N1

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage [1]	2000-2200	V
V_{RSM}	Non-repetitive peak reverse voltage [1]	2100-2300	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_c=55°C [2]	1888	
$I_{F(AV)M}$	Maximum average forward current, T_c=102°C [2]	1200	
$I_{F(AV)M}$	Maximum average forward current. T_c=85°C [2]	1468	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_c=25°C [2]	3557	
$I_{T(d.c.)}$	D.C. forward current, T_c=25°C [2]	2836	
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{rm}=60%V_{RRM} [3]	36.4	kA
I_{FSM2}	Peak non-repetitive surge t_p=10ms, V_{rm}≤10V [3]	40.0	kA
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}=60%V_{RRM} [3]	6.62×10^6	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}≤10V [3]	8.00×10^6	A^2s
V_{ISOL}	Isolation Voltage [4]	3500	V
$T_{vj\ op}$	Operating temperature range	-40 to +160	°C
T_{stg}	Storage temperature range	-55 to +160	°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, 160°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 forward voltage	-	-	1.35	I_{FM}=3000A	V
		-	-	1.44	I_{FM}=3600A	V
V_{T0}	Threshold voltage	-	-	0.872		V
r_T	Slope resistance	-	-	0.107		mΩ
I_{RRM}	Peak reverse current	-	-	2	Rated V_{RRM}, T_j=25°C	
		-	-	100	Rated V_{RRM}	
Q_{rr}	Recovered Charge	-	4000	-	I_{FM}=1000A, t_p=1000µs, di/dt=10A/µs, V_r=50V	µC
Q_{ra}	Recovered Charge, 50% chord	-	3300	3800		µC
I_{rm}	Reverse recovery current	-	200	-		A
t_{rr}	Reverse recovery time, 50% chord	-	33	-		µs
R_{thJC}	Thermal resistance, junction to case	-	-	0.0405		K/W
R_{thCH}	Thermal resistance, case to heatsink	-	-	0.0100		K/W
F_1	Mounting torque (to heatsink)	5.1	-	6.9		Nm
F_2	Mounting torque (to terminals)	16.2	-	19.8		Nm
W_t	Weight	-	2.2	-		kg

Notes:

1) Unless otherwise indicated T_{vj}=160°C.

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	V_{RRM} V	V_{RSM} V	V_R DC V
20	2000	2100	1250
22	2200	2300	1350

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

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

and:

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

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

Where V_{T0} = 0.872 V, r_T = 0.107 mΩ.

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	0.0449	0.0433	0.0423	0.0405
Sine wave	0.0439	0.0421	0.0409	

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	0.8219376	A	0.6177319
B	0.02800357	B	0.02398102
C	4.58252×10^{-5}	C	4.93957×10^{-5}
D	2.125018×10^{-3}	D	4.419761×10^{-3}

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	1.0×10^{-5}	0.016708	0.018317	4.346771×10^{-3}	1.004820×10^{-3}	1.0×10^{-5}
τ_p	2.460066	0.999836	21.998376	9.793053×10^{-3}	2.003674	5.007343

7.0 Reverse recovery ratings

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

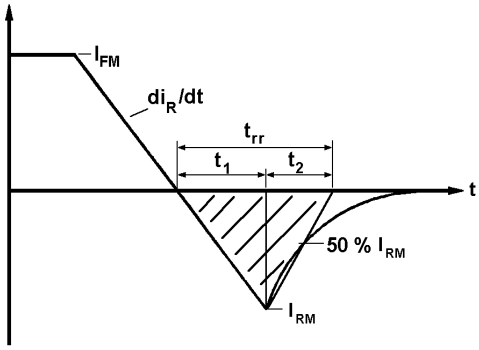


Fig. 1

(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

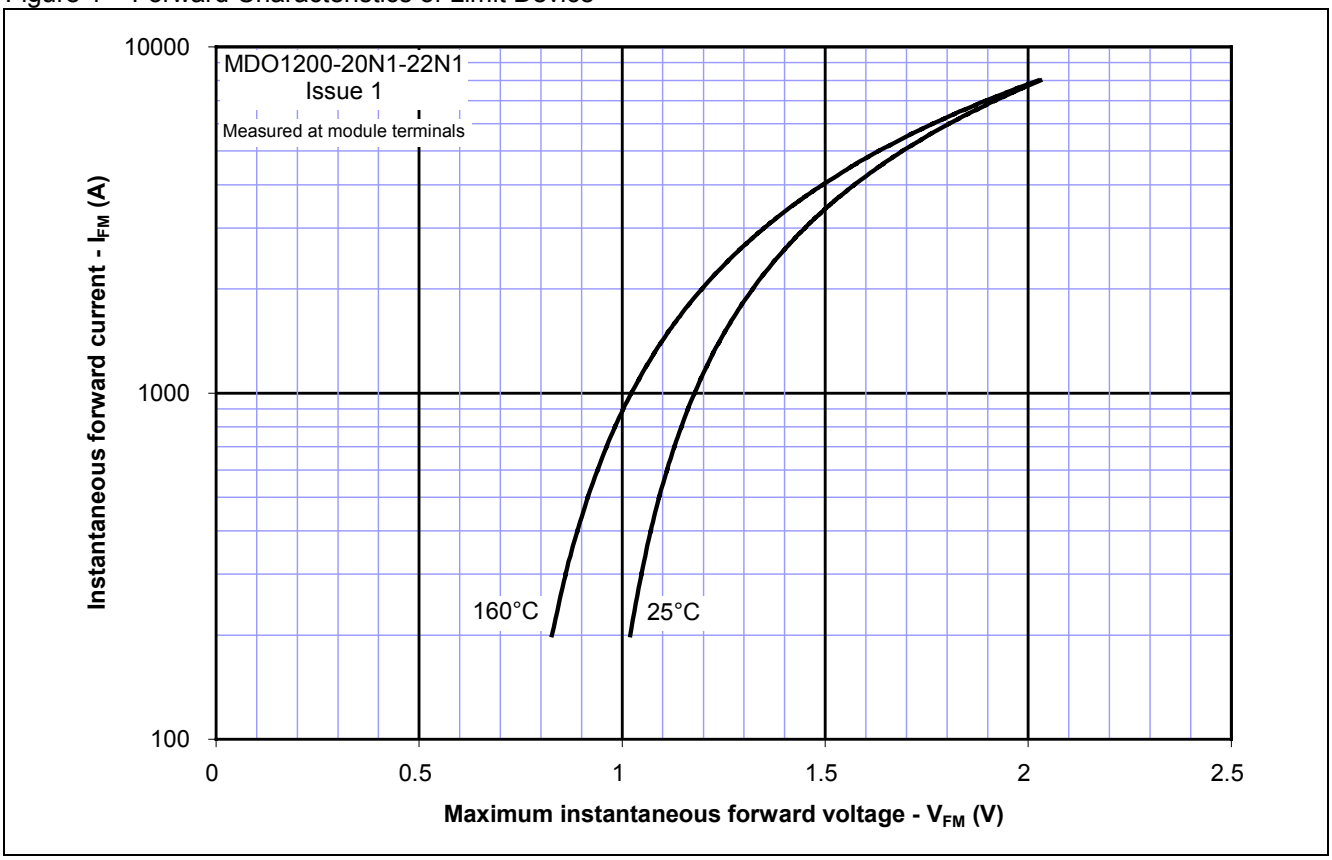


Figure 2 – Transient Thermal Impedance

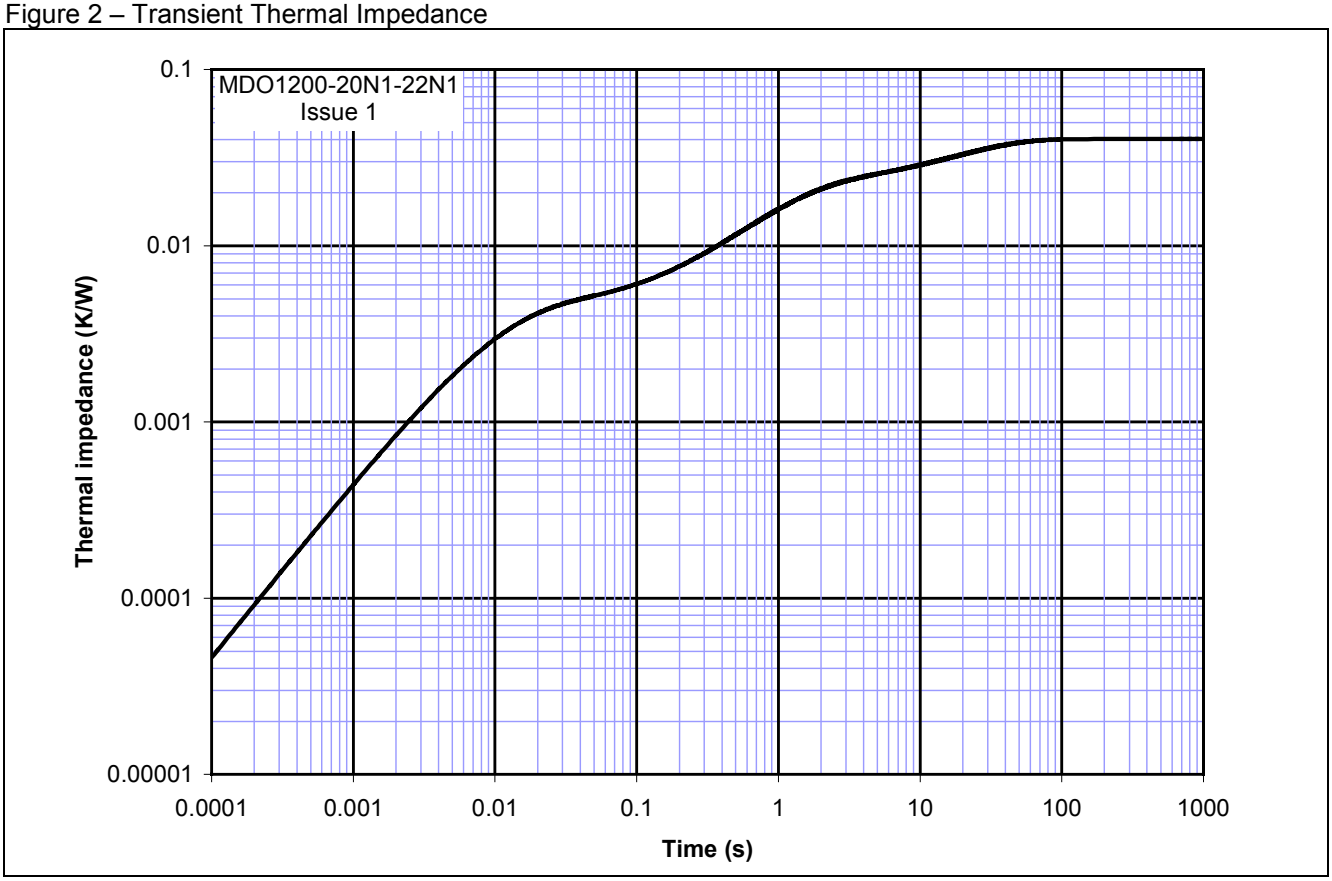


Figure 3 – Total recovered charge, Q_{rr}

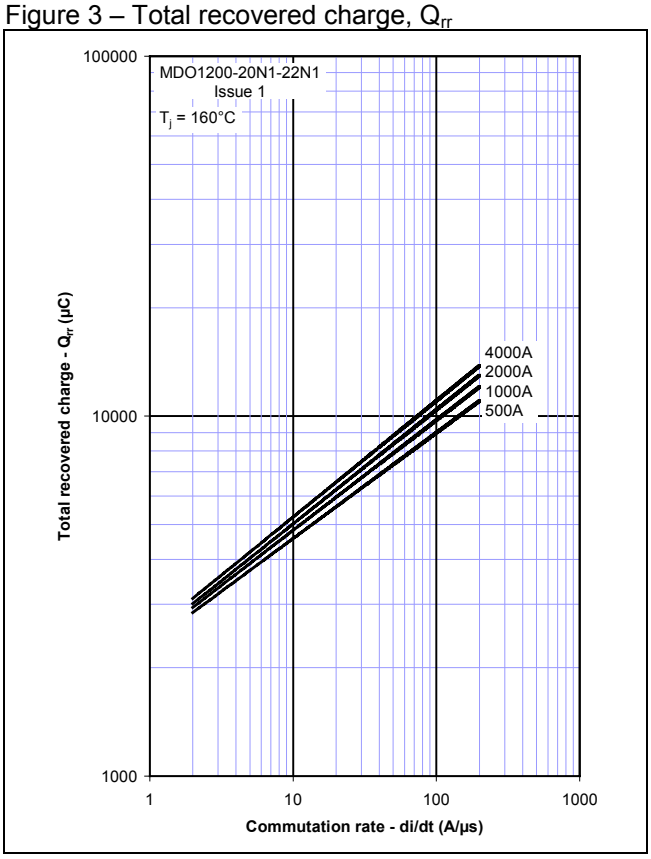


Figure 4 – Recovered charge, Q_{ra} (50% chord)

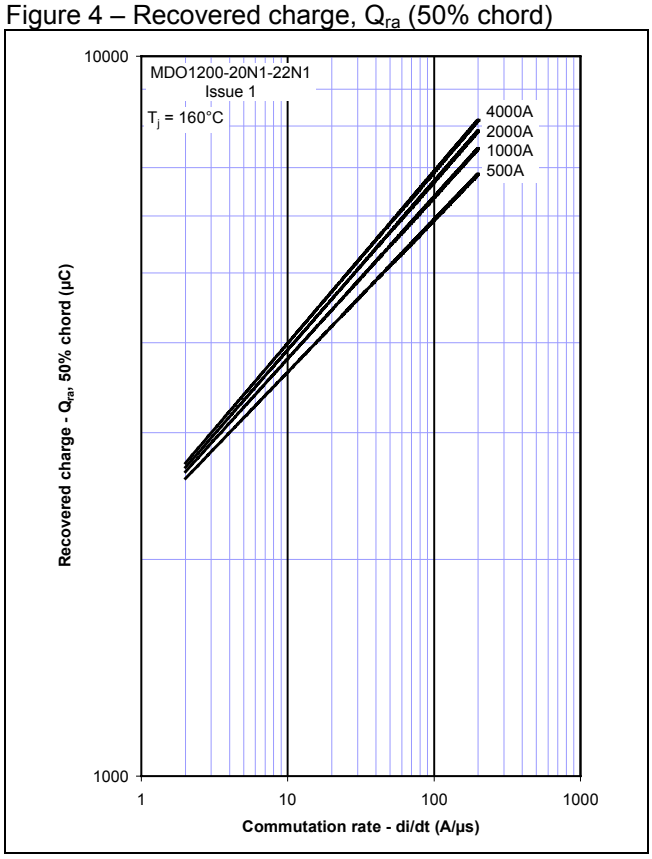


Figure 5 – Peak reverse recovery current, I_{rm}

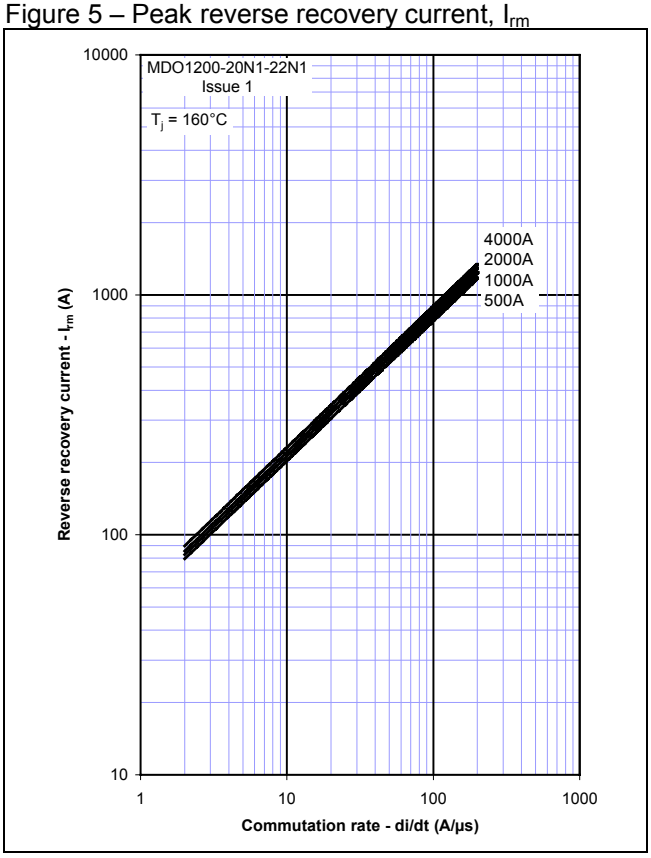


Figure 6 – Maximum recovery time, t_{rr} (50% chord)

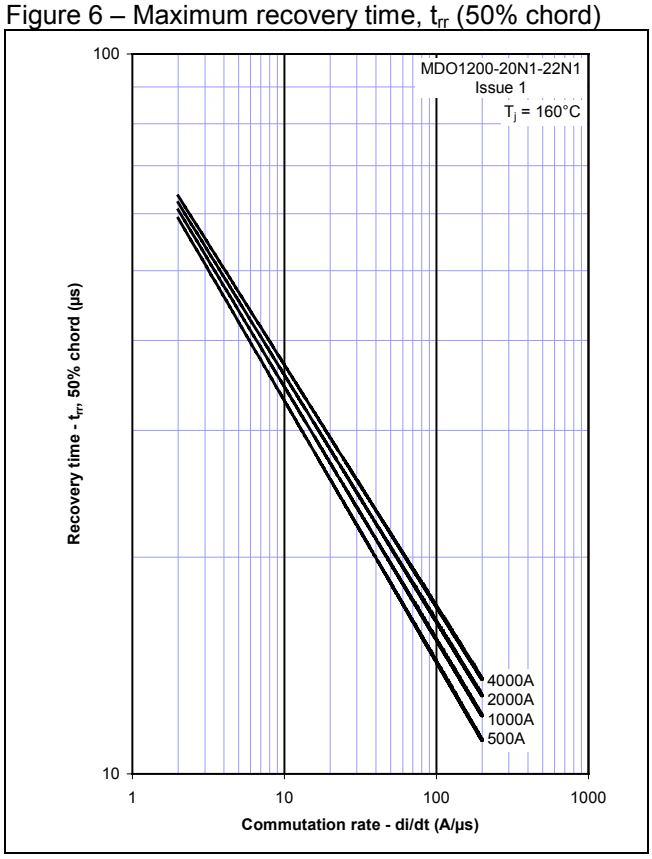


Figure 7 – Forward current vs. Power dissipation

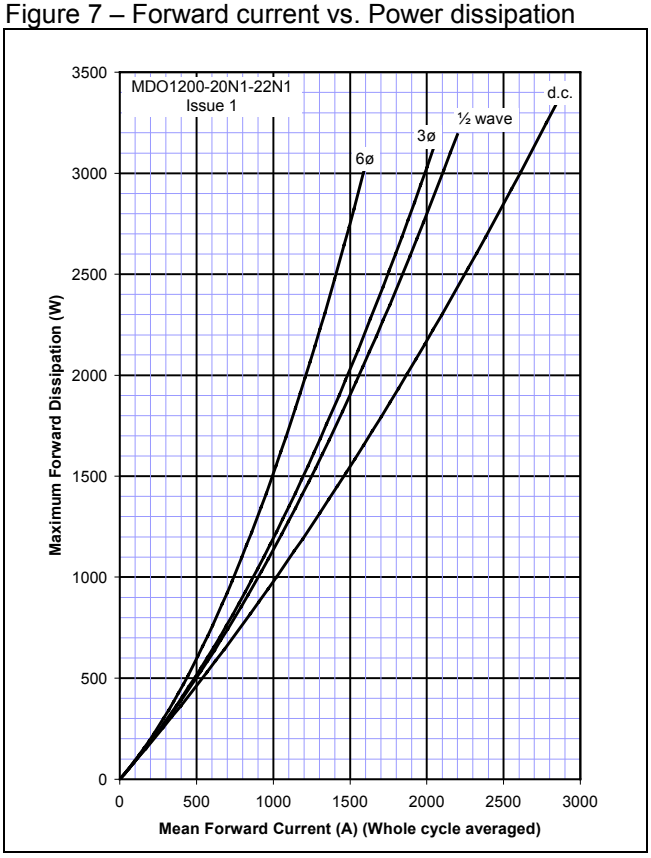


Figure 8 – Forward current vs. Heatsink temperature

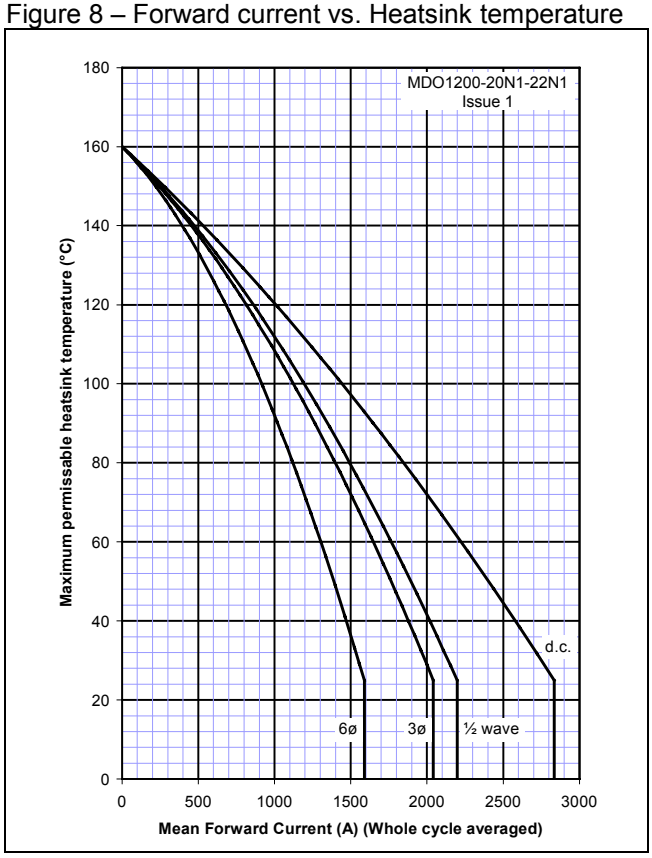
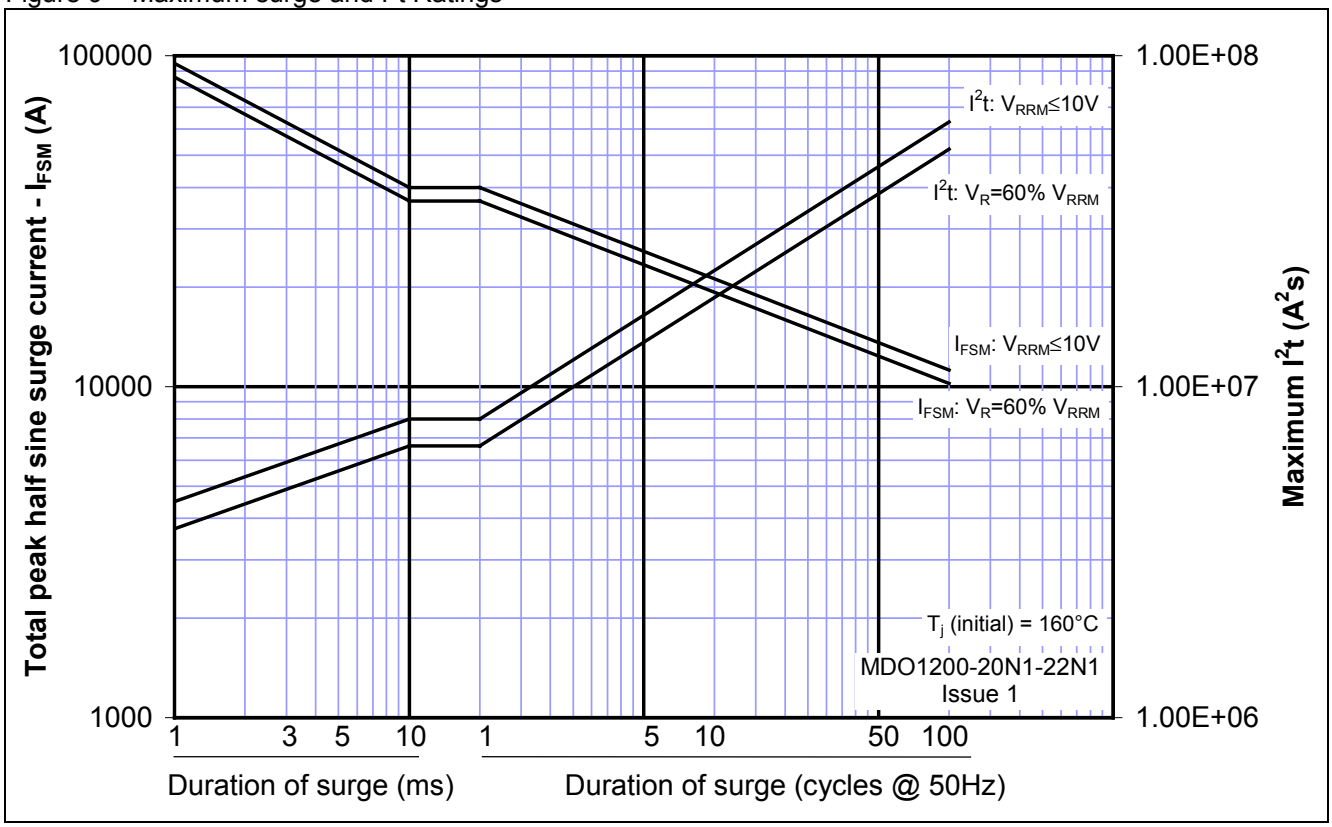
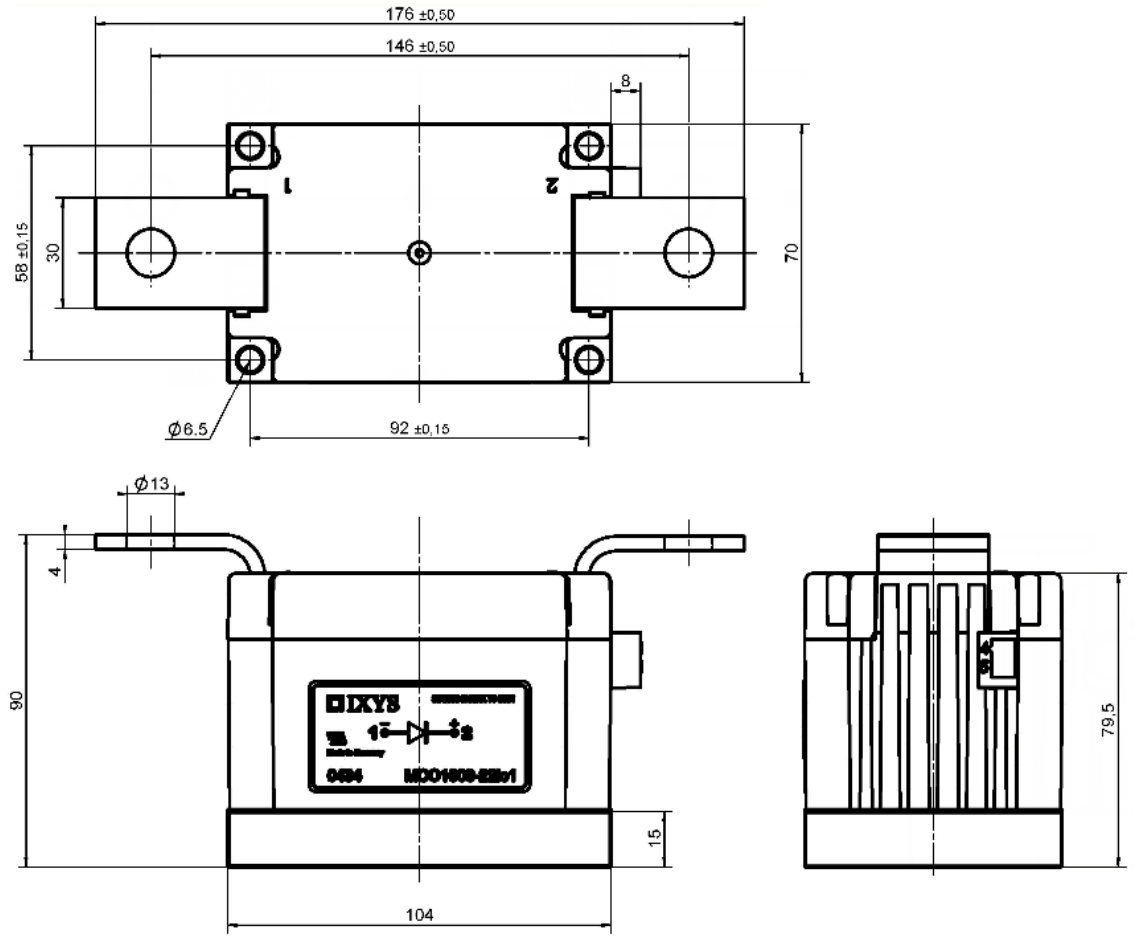


Figure 9 – Maximum surge and I^2t Ratings



Outline Drawing & Ordering Information



ORDERING INFORMATION (Please quote 11 digit code as below)

M	DO	1200	♦♦	N	1
Fixed Type Code	Fixed Configuration code	Nominal Current Rating	Voltage code V_{RRM}/100 20-22	Standard diode	Fixed Version Code

Typical order code: MDO1200-22N1, 1600V V_{RRM} Rectifier Diode Module

IXYS Semiconductor GmbH
Edisonstraße 15
D-68623 Lampertheim
Tel: +49 6206 503-0
Fax: +49 6206 503-627
E-mail: marcom@ixys.de

IXYS Corporation
3540 Bassett Street
Santa Clara CA 95054 USA
Tel: +1 (408) 982 0700
Fax: +1 (408) 496 0670
E-mail: sales@ixys.net

IXYS
www.ixys.com

WESTCODE
An IXYS Company
www.westcode.com

Westcode Semiconductors Ltd
Langley Park Way, Langley Park,
Chippenham, Wiltshire, SN15 1GE.
Tel: +44 (0)1249 444524
Fax: +44 (0)1249 659448
E-mail: WSL.sales@westcode.com

Westcode Semiconductors Inc
3270 Cherry Avenue
Long Beach CA 90807 USA
Tel: +1 (562) 595 6971
Fax: +1 (562) 595 8182
E-mail: WSI.sales@westcode.com