Rectifier Diode Module
Types MDO1201-16N1 to MDO1201-22N1

Absolute Maximum Ratings

V_{RRM} [V]	Type
1600	MDO1201-16N1
1800	MDO1201-18N1
2000	MDO1201-20N1
2200	MDO1201-22N1

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage [1]	1600-2200	V
V_{RSM}	Non-repetitive peak reverse voltage [1]	1700-2300	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_c=55℃ [2]	1950	
$I_{F(AV)M}$	Maximum average forward current, T_c=100℃ [2]	1280	
$I_{F(AV)M}$	Maximum average forward current. T_c=85℃ [2]	1520	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_c=25℃ [2]	3665	
$I_{T(d.c.)}$	D.C. forward current, T_c=25℃	2940	
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{rm}=60%V_{RRM} [3]	36	kA
I_{FSM2}	Peak non-repetitive surge t_p=10ms, V_{rm}≤10V [3]	40	kA
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}=60%V_{RRM} [3]	$6.48×10^6$	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]	3000	V
$T_{vj\,op}$	Operating temperature range	-40 to +160	℃
T_{stg}	Storage temperature range	-55 to +160	℃

Notes:
1) De-rating factor of 0.13% per ℃ is applicable for T_{vj} below 25℃.
2) Single phase; 50 Hz, 180° half-sinewave.
3) Half-sinewave, 160℃ 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	-	-	0.97	I_{FM}=1700A	V
		-	-	1.15	I_{FM}=3400A	V
V_{T0}	Threshold voltage	-	-	0.80		V
r_T	Slope resistance	-	-	0.10		mΩ
I_{RRM}	Peak reverse current	-	-	5	Rated V_{RRM}, T_j=25℃	mA
		-	-	70	Rated V_{RRM}	
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)	5.1	-	6.9		Nm
F_2	Mounting torque (to terminals)	16.2	-	19.8		Nm
W_t	Weight	-	2.8	-		kg

Notes:

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

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	V_{RRM} V	V_{RSM} V	V_R DC V
16	1600	1700	900
18	1800	1900	1000
20	2000	2100	1100
22	2200	2300	1200

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 = 0.10mΩ.

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	0.7455207	A	0.4701738
B	0.04542294	B	0.05180998
C	7.02344×10^{-5}	C	8.913584×10^{-5}
D	-1.458635×10^{-3}	D	-8.375765×10^{-4}

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
r_p	0.01904887	0.01751398	5.364393×10^{-3}
τ_p	21.99824	1.079638	0.0132514

Curves

Figure 1 – Forward Characteristics of Limit Device
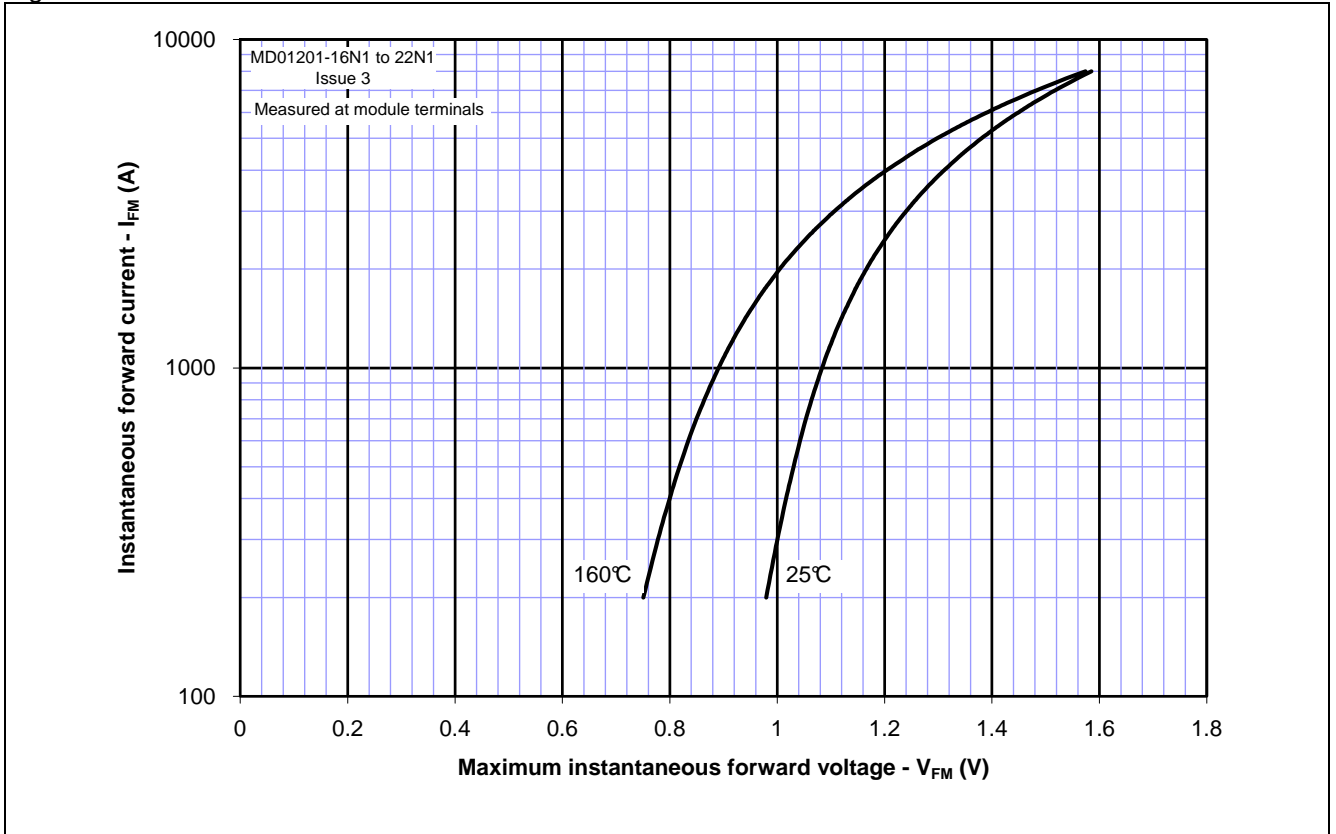
Figure 2 – Transient Thermal Impedance
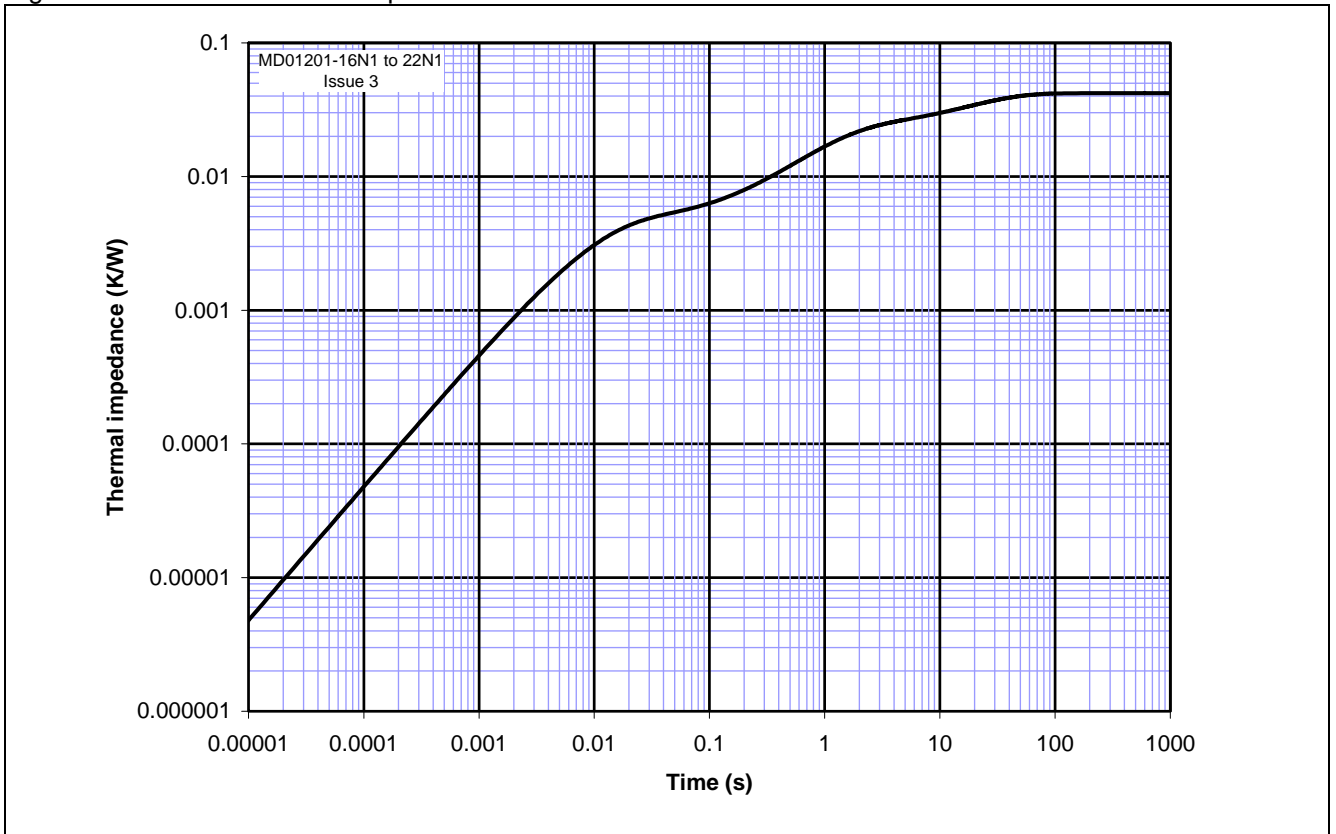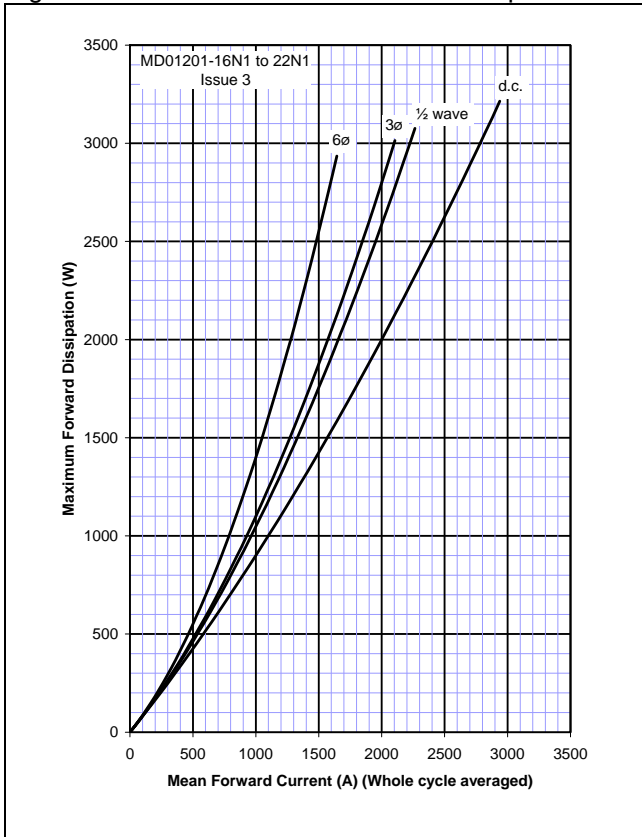
Figure 3 – Forward current vs. Power dissipation
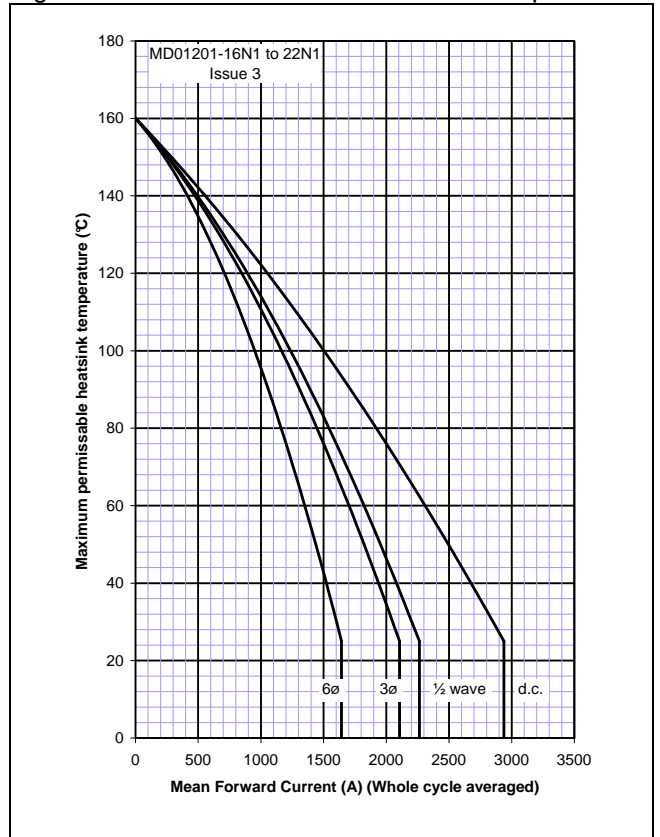

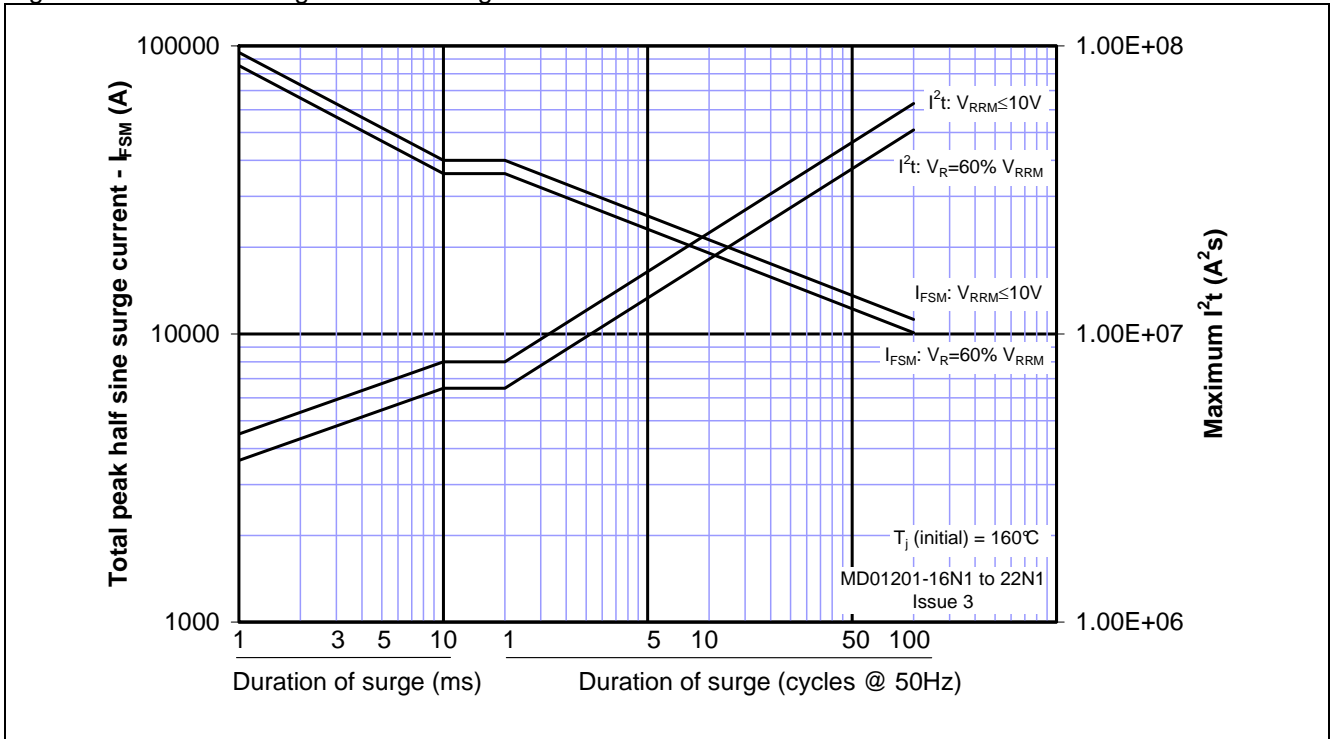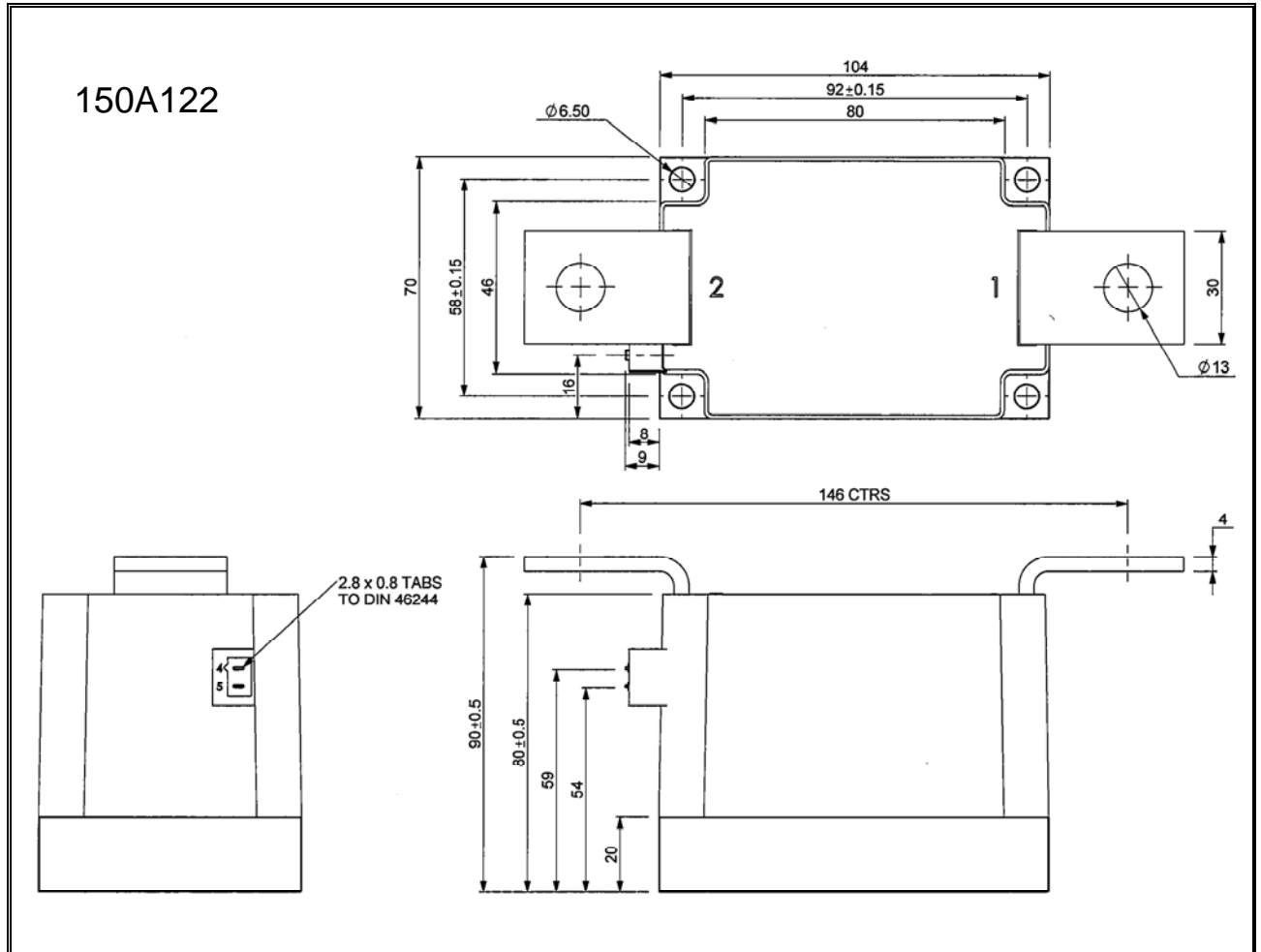Figure 4 – Forward current vs. Heatsink temperature

Figure 5 – Maximum surge and I²t Ratings

Outline Drawing & Ordering Information

150A122

ORDERING INFORMATION   (Please quote 11 digit code as below)

M	DO	1201	◆◆	N	1
Fixed Type Code	Fixed Configuration code	Nominal Current Rating	Voltage code V_{RRM}/100 16-22	Standard diode	Fixed Version Code

Typical order code: MDO1201-22N1, 2200V V_{RRM} Rectifier Diode Module