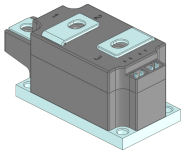
IXYS

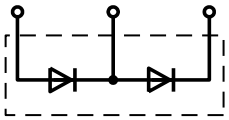
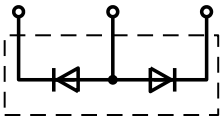
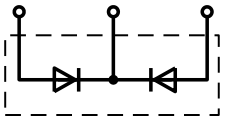


**Date: 20.08.2015**

**Data Sheet Issue: 1**

# Diode Modules MD#510

## Absolute Maximum Ratings

| $V_{RRM}$ $V_{DRM}$ [V] |  MDD |  MDA |  MDK |
|---|---|---|---|
| 1800 | 510-18N3 | 510-18N3 | 510-18N3 |

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

| | OTHER RATINGS | MAXIMUM LIMITS | UNITS |
|---|---|---|---|
| $I_{F(AV)M}$ | Maximum average forward current, $T_C$ = 85°C [2] | 545 | A |
| $I_{F(AV)M}$ | Maximum average forward current. $T_C$ = 100°C [2] | 445 | A |
| $I_{F(RMS)M}$ | Nominal RMS forward current, $T_C$ = 55°C [2] | 1135 | A |
| $I_{F(d.c.)}$ | D.C. forward current, $T_C$ = 55°C | 890 | A |
| $I_{FSM}$ | Peak non-repetitive surge $t_p$ = 10 ms, $V_{RM}$ = 60%$V_{RRM}$ [3] | 10.9 | kA |
| $I_{FSM2}$ | Peak non-repetitive surge $t_p$ = 10 ms, $V_{RM} \leq$ 10V [3] | 12.0 | kA |
| $I^2t$ | $I^2t$ capacity for fusing $t_p$ = 10 ms, $V_{RM}$ = 60%$V_{RRM}$ [3] | 594 | $kA^2s$ |
| $I^2t$ | $I^2t$ capacity for fusing $t_p$ = 10 ms, $V_{RM} \leq$ 10 V [3] | 720 | $kA^2s$ |
| $V_{ISOL}$ | Isolation Voltage [4] | 3000 | V |
| $T_{vj\ op}$ | Operating temperature range | -40 to +150 | °C |
| $T_{stg}$ | Storage temperature range | -40 to +150 | °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) AC RMS voltage, 50 Hz, 1min test

## Characteristics

| | PARAMETER | MIN. | TYP. | MAX. | TEST CONDITIONS [1] | UNITS |
|---|---|---|---|---|---|---|
| $V_{FM}$ | Maximum peak forward voltage | - | - | 1.20 | $I_{TM}$ = 785 A, $T_{VJ}$ = 25°C | V |
| $V_{T0}$ | Threshold voltage | - | - | 0.75 | | V |
| $r_T$ | Slope resistance | - | - | 0.25 | | mΩ |
| $I_{RRM}$ | Peak reverse current | - | - | 30 | Rated $V_{RRM}$ | mA |
| $R_{thJC}$ | Thermal resistance, junction to case | - | 0.1100 | - | Single Arm | K/W |
| | | - | 0.0550 | - | Whole Module | K/W |
| $R_{thCH}$ | Thermal resistance, case to heatsink | - | 0.040 | - | Single Arm | K/W |
| | | - | 0.020 | - | Whole Module | K/W |
| $F_1$ | Mounting force (to heatsink) | - | 6.00 | - | | Nm |
| $F_2$ | Mounting force (to terminals) | - | 9.00 | - | [2] | Nm |
| $W_t$ | Weight | - | 800 | - | | g |

**Notes:**

1) Unless otherwise indicated $T_{vj}$=125°C.
2) Screws must be lubricated.

## Notes on Ratings and Characteristics

1.0 Voltage Grade Table

| Voltage Grade | $V_{DRM}$ $V_{RRM}$ V | $V_{DSM}$ $V_{RSM}$ V | $V_D$ $V_R$ DC V |
|---|---|---|---|
| 18 | 1800 | 1900 | 1150 |

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 Thyristor 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 $V_{T0}$ = 0.75 V, $r_T$ = 0.25 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 | 3.46 | 2.45 | 2 | 1.73 | 1.41 | 1.15 | 1 |
| Sine wave | 3.98 | 2.78 | 2.22 | 1.88 | 1.57 | | |

| 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 | | |

6.2 D.C. Thermal Impedance Calculation

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

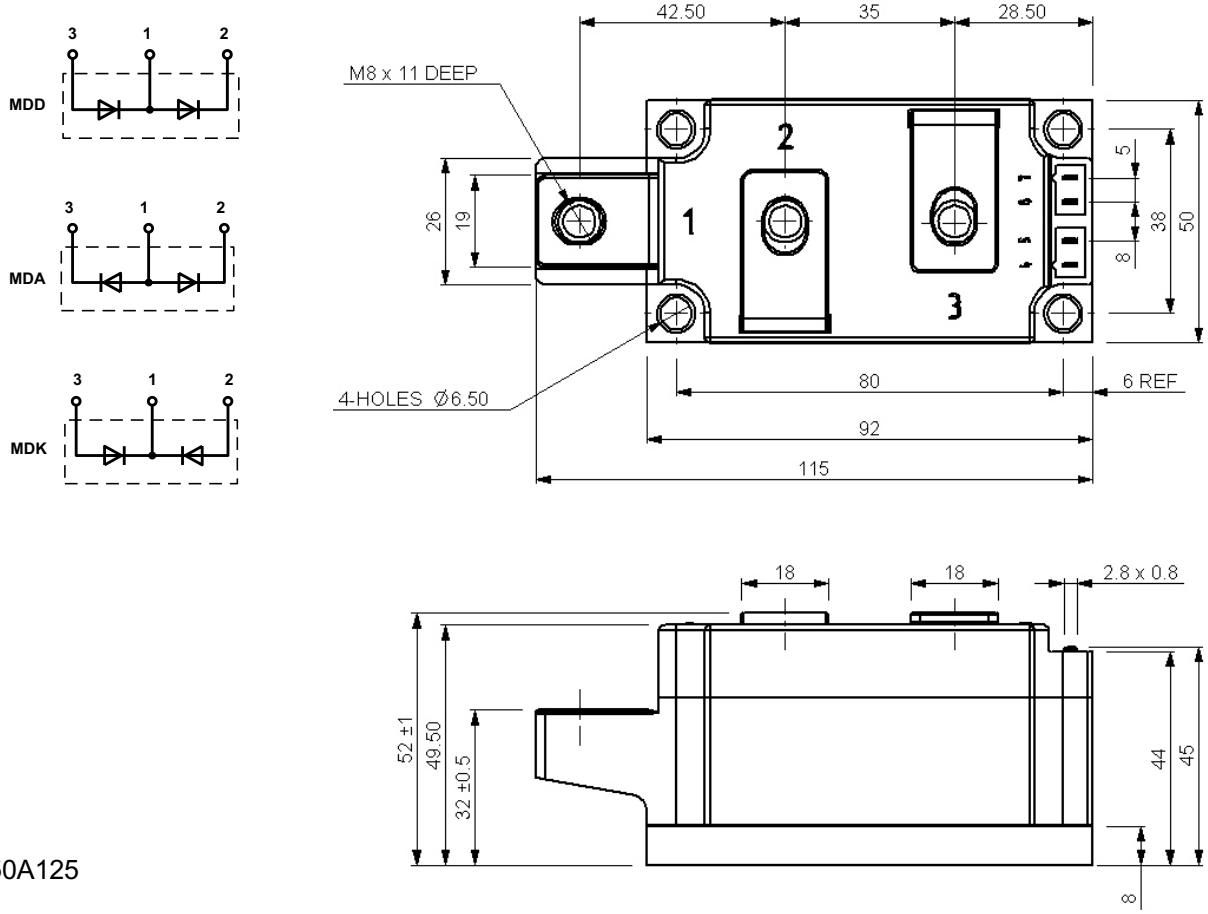
Where *p = 1* to *n and:*

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
$\tau_p$ = 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 |
| $r_p$ | 0.1293 | 0.01314 | 0.02771 | -0.05535 | 0.0528 | 0.002749 |
| $\tau_p$ | 2.823 | 1.393 | 0.3322 | 0.0611 | 0.05731 | 0.002713 |

## Outline Drawing & Ordering Information




| ORDERING INFORMATION | | | (Please quote 11 digit code as below) | | |
|---|---|---|---|---|---|
| **M** | **D#** | **510** | **♦♦** | **N** | **3** |
| Fixed Type Code | Configuration code DD, DA or DK | Fixed Type Code | Voltage code $V_{RRM}$/100 18 | Standard Diode | Fixed Version Code |

Typical order code: MDD510-18N3– MDD configuration, 1800V $V_{RRM}$

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