



Date: 20.08.2015

Data Sheet Issue: 1

Thyristor/Diode Modules M##160

Absolute Maximum Ratings

V _{RRM} V _{DRM} [V]				
	MCC	MCD	MDC	
3000	160-30io3	160-30io3	160-30io3	
3600	160-36io3	160-36io3	160-36io3	

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{DRM}	Repetitive peak off-state voltage 1)	3000-3600	V
V _{DSM}	Non-repetitive peak off-state voltage 1)	3100-3700	V
V_{RRM}	Repetitive peak reverse voltage 1)	3000-3600	V
Vrsm	Non-repetitive peak reverse voltage 1)	3100-3700	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
I _{T(AV)M}	Maximum average on-state current, T _C = 85°C ²⁾	170	Α
I _{T(AV)M}	Maximum average on-state current. T _C = 100°C ²⁾	120	Α
I _{T(RMS)M}	Nominal RMS on-state current, T _C = 55°C ²⁾	385	А
I _{T(d.c.)}	D.C. on-state current, T _C = 55°C	325	Α
I _{TSM}	Peak non-repetitive surge t _p = 10 ms, V _{RM} = 60%V _{RRM} ³⁾	3.65	kA
I _{TSM2}	Peak non-repetitive surge $t_p = 10$ ms, $V_{RM} \le 10V^{3}$	4.00	kA
l ² t	$I^{2}t$ capacity for fusing $t_p = 10$ ms, $V_{RM} = 60\%V_{RRM}$ 3)	66.6	kA ² s
l ² t	$I^{2}t$ capacity for fusing t_{p} = 10 ms, $V_{RM} \le 10 \text{ V}^{3}$	80.0	kA ² s
(11/10)	Critical rate of rise of on-state current (repetitive) 4)	100	• /
(di/dt) _{cr}	Critical rate of rise of on-state current (non-repetitive) 4)	200	A/µs
V _{RGM}	Peak reverse gate voltage	5	V
Р _{GМ}	Peak forward gate power	3	W
Visol	Isolation Voltage ⁵⁾	3000	V
T _{vj op}	Operating temperature range	-40 to +125	°C
T _{stg}	Storage temperature range	-40 to +125	°C

- 1) De-rating factor of 0.13% per °C is applicable for $T_{\nu j}$ below 25°C.
- 2) Single phase; 50 Hz, 180° half-sinewave.
- 3) Half-sinewave, 125°C $T_{\nu j}$ initial.
- 4) $V_D=67\%$ V_{DRM} , $I_{FG}=2$ Å, $di_g/dt=1$ A/ μ s, $T_C=125$ °C. 5) AC RMS voltage, 50 Hz, 1min test



Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS 1)	UNITS
Vтм	Maximum peak on-state voltage	-	-	2.50	I _{TM} = 785 A, T _{VJ} = 25°C	V
V_{T0}	Threshold voltage	-	-	1.20		V
r⊤	Slope resistance	-	-	2.30		mΩ
(dv/dt)cr	Critical rate of rise of off-state voltage	-	-	1000	V _D = 80% V _{DRM} , linear ramp, Gate o/c	V/μs
I _{DRM}	Peak off-state current	-	-	50	Rated V _{DRM}	mA
I _{RRM}	Peak reverse current	-	-	50	Rated V _{RRM}	mA
V_{GT}	Gate trigger voltage	-	2.0	-	$T_{vi} = 25^{\circ}\text{C}, V_D = 12 \text{ V}, I_T = 3 \text{ A}$	V
lgт	Gate trigger current	-	150	-	$ V_{V_{j}} = 25 \text{ C}, V_{D} = 12 \text{ V}, T = 3 \text{ A}$	mA
V _{GD}	Gate non-trigger voltage	-	0.25	-	67% V _{DRM}	V
IL	Latching current	-	-	700	V _D = 12 V, T _{vj} = 25°C	mA
lн	Holding current	-	-	300	V _D = 12 V, T _{vj} = 25°C	mA
t _{gd}	Gate controlled turn-on delay time	-	-	3.00	$\begin{split} I_{FG} &= 2 \text{ A, } t_r = 500 \mu\text{s, } V_D = 40\% V_{DRM}, \\ I_{TM} &= I_{TAV}, di/dt = 1\text{A}/\mu\text{s, } T_{vj} = 25^{\circ}\text{C} \end{split}$	μs
tq	Turn-off time	-	-	300	$I_{TM} = 150 A, t_p = 1 \text{ ms, di/dt} = 10 \text{ A/}\mu\text{s,} \ V_R = 100 \text{ V, } V_{DR} = 67\% V_{DRM}, dv_{DR}/dt = 50 \text{ V/}\mu\text{s}$	μs
R _{thJC}	Thermal registence, junction to con-	-	0.1100	-	Single Arm	K/W
KthJC	Thermal resistance, junction to case	-	0.0550	-	Whole Module	K/W
D	Thermal registeres ages to best ink	-	0.040	-	Single Arm	K/W
R _{thCH}	Thermal resistance, case to heatsink	-	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
Wt	Weight	-	800	-		g

- Unless otherwise indicated T_{vj}=125°C.
 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
30	3000	3100	1750
36	3600	3700	1900

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_{vi} below 25°C.

4.0 Repetitive dv/dt

Standard dv/dt is 1000V/µs.

5.0 Snubber Components

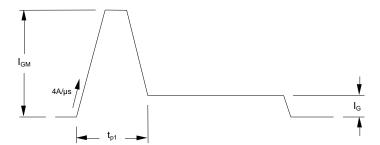
When selecting snubber components, care must be taken not to use excessively large values of snubber capacitor or excessively small values of snubber resistor. Such excessive component values may lead to device damage due to the large resultant values of snubber discharge current. If required, please consult the factory for assistance.

6.0 Rate of rise of on-state current

The maximum un-primed rate of rise of on-state current must not exceed 400A/µs at any time during turn-on on a non-repetitive basis. For repetitive performance, the on-state rate of rise of current must not exceed 200A/µs at any time during turn-on. Note that these values of rate of rise of current apply to the total device current including that from any local snubber network.

7.0 Gate Drive

The nominal requirement for a typical gate drive is illustrated below. An open circuit voltage of at least 30V is assumed. This gate drive must be applied when using the full di/dt capability of the device.



The magnitude of I_{GM} should be between five and ten times I_{GT} , which is shown on page 2. Its duration (t_{p1}) should be $20\mu s$ or sufficient to allow the anode current to reach ten times I_L , whichever is greater. Otherwise, an increase in pulse current could be needed to supply the necessary charge to trigger. The 'back-porch' current I_G should remain flowing for the same duration as the anode current and have a magnitude in the order of 1.5 times I_{GT} .



8.0 Computer Modelling Parameters

8.1 Thyristor Dissipation Calculations

$$I_{AV} = \frac{-V_{T0} + \sqrt{{V_{T0}}^2 + 4 \cdot \mathit{ff}^2 \cdot \mathit{r}_T \cdot W_{AV}}}{2 \cdot \mathit{ff}^2 \cdot \mathit{r}_T} \qquad \qquad W_{AV} = \frac{\Delta T}{R_{\mathit{th}}}$$
 and:
$$\Delta T = T_{\mathit{j\,max}} - T_C$$

Where $V_{T0} = 1.2 \text{ V}$, $r_T = 2.30 \text{ m}\Omega$.

 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.							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.							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			

8.2 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

rt = Thermal resistance at time t

 r_p = Amplitude of p_{th} term

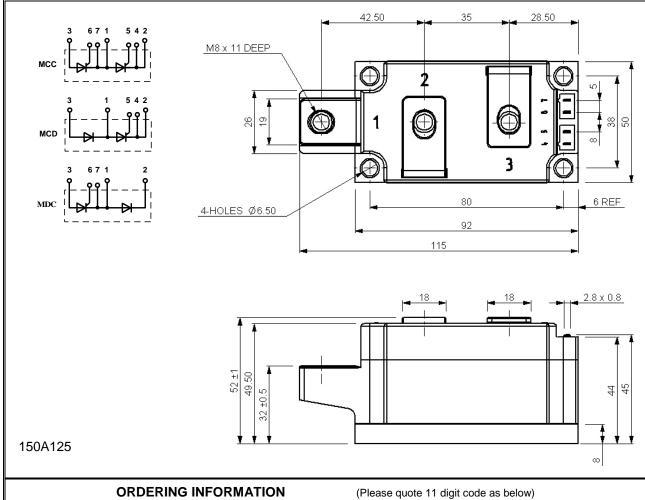
 τ_p = Time Constant of r_{th} term

The coefficients for this device are shown in the table below:

D.C.								
Term	1	2	3	4	5	6		
r_p	0.1293	0.01314	0.02771	-0.05535	0.0528	0.002749		
$ au_{\mathcal{P}}$	2.823	1.393	0.3322	0.0611	0.05731	0.002713		



Outline Drawing & Ordering Information



	ORDERING INFO	RMATION	(Please quote 11 digit code as below)			
M	##	160	**	io	3	
Fixed Type Code	Configuration code CC, CD or DC	Fixed Type Code	Voltage code V _{RRM} /100 30-36	i = Critical dv/dt 1000 V/µs o = Typical turn-off time	Fixed Version Code	

Typical order code: MCD160-30io2– MCD configuration, 3000V V_{RRM}

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

1590 Buckeye Drive Milpitas CA 95035-7418 Tel: +1 (408) 547 9000 Fax: +1 (408) 496 0670 E-mail: sales@ixys.net



www.ixysuk.com

www.ixys.com

IXYS UK Westcode Ltd

Langley Park Way, Langley Park, Chippenham, Wiltshire, SN15 1GE. Tel: +44 (0)1249 444524 Fax: +44 (0)1249 659448

E-mail: sales@ixysuk.com

IXYS Long Beach, Inc

IXYS Long Beach, Inc 2500 Mira Mar Ave, Long Beach CA 90815

Tel: +1 (562) 296 6584 Fax: +1 (562) 296 6585

E-mail: service@ixyslongbeach.com

The information contained herein is confidential and is protected by Copyright. The information may not be used or disclosed except with the written permission of and in the manner permitted by the proprietors IXYS UK Westcode Ltd.

In the interest of product improvement, IXYS UK Westcode Ltd reserves the right to change specifications at any time without

Devices with a suffix code (2-letter, 3-letter or letter/digit/letter combination) added to their generic code are not necessarily subject to the conditions and limits contained in this report.

© IXYS UK Westcode Ltd.