

Date: - 10th March, 2015

Data Sheet Issue:- 1

Rectifier Diode Types W4767MC180 & W4767MC220

Development Type No.: WX250MC#220

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	1800-2200	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	1900-2300	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
I _{F(AV)M}	Maximum average forward current, T _{sink} =55°C, (note 2)	4755	Α
I _{F(AV)M}	Maximum average forward current. T _{sink} =100°C, (note 2)	3475	Α
I _{F(AV)M}	Maximum average forward current. T _{sink} =100°C, (note 3)	2015	Α
I _{F(RMS)M}	Nominal RMS forward current, T _{sink} =25°C, (note 2)	8615	Α
I _{F(d.c.)}	D.C. forward current, T _{sink} =25°C, (note 4)	7425	Α
I _{FSM}	Peak non-repetitive surge t _p =10ms, V _m =60%V _{RRM} , (note 5)	38.0	kA
I _{FSM2}	Peak non-repetitive surge t _p =10ms, V _m ≤10V, (note 5)	41.8	kA
l²t	I ² t capacity for fusing t _p =10ms, V _m =60%V _{RRM} , (note 5)	7.22×10^6	A ² s
I ² t	I²t capacity for fusing t _p =10ms, V _m ≤10V, (note 5)	8.74 x 10 ⁶	A^2s
T _{j op}	Operating temperature range	-40 to +175	°C
T _{stg}	Storage temperature range	-55 to +175	°C

Notes:-

- 1) De-rating factor of 0.13% per °C is applicable for T_i below 25°C.
- 2) Double side cooled, single phase; 50Hz, 180° half-sinewave.
- 3) Cathode side cooled, single phase; 50Hz, 180° half-sinewave.
- 4) Double side cooled.
- 5) Half-sinewave, 175°C T_i initial.



Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
\ /	Maximum pool forward voltage	-	-	1.05	I _{TM} =3000A	V
V_{FM}	Maximum peak forward voltage	-	-	1.50	I _{TM} = 8000A	V
V _{T0}	Threshold voltage	-	-	0.827		V
r _T	Slope resistance	-	-	0.083		mΩ
	Darly manager of	-	-	5	Rated V _{RRM} , T _j =25°C	mA
I _{RRM}	Peak reverse current	-	-	50	Rated V _{RRM} , T _j = T _{jmax}	mA
Q _{rr}	Recovered charge	-	3800	4100		μC
Q_{ra}	Recovered charge, 50% Chord	-	2250	-	 I _{TM} =1000A, t _p =1000μs, di/dt=10A/μs,	μC
Irr	Reverse recovery current	-	172	-	V _r =100V	Α
t _{rr}	Reverse recovery time, 50% Chord	-	26	-		μs
		-	-	0.0140	Double side cooled	K/W
R_{thJK}	Thermal resistance, junction to heatsink	-	-	0.0265	Anode side cooled	K/W
		-	-	0.0300	Cathode side cooled	K/W
F	Mounting force	25	-	31	Note 2	kN
		-	530	-		

Notes:-

- 1) Unless otherwise indicated T_j=175°C.
- 2) For other clamp forces, please consult factory.



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	1125
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_j 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 Device Dissipation Calculations

$$I_{AV} = \frac{-V_{T0} + \sqrt{{V_{T0}}^2 + 4 \cdot f\!f^2 \cdot r_T \cdot W_{AV}}}{2 \cdot f\!f^2 \cdot r_T} \qquad \qquad W_{AV} = \frac{\Delta T}{R_{th}}$$
 and:
$$\Delta T = T_{j\,\mathrm{max}} - T_K$$

Where $V_{T0}=0.827V$, $r_T=0.083m\Omega$,

 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°)						
Square wave Double Side Cooled	0.01665	0.01581	0.01516	0.0140		
Square wave Single Side Cooled	0.03217	0.03147	0.03090	0.0297		
Sine wave Double Side Cooled	0.01612	0.01531	0.01436			
Sine wave Single Side Cooled	0.03174	0.03105	0.03022			

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			



5.2 Calculating V_F using ABCD Coefficients

The on-state characteristic I_F vs. V_F, on page 6 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 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		175°C Coefficients	
Α	0.7125574	Α	0.3416283
В	2.1505470 x 10 ⁻²	В	4.7594410 x 10 ⁻²
С	4.2526320 x 10 ⁻⁵	С	6.3862610 x 10 ⁻⁵
D	3.1809190 x 10 ⁻³	D	2.4763940 x 10 ⁻³



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, n is the 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. Double Side Cooled						
Term 1 2 3 4						
r_{ρ}	8.594785×10 ⁻³	3.308247×10 ⁻³	1.039072×10 ⁻³	7.916582×10 ⁻⁴		
$ au_{\mathcal{P}}$	0.7185764	0.09970181	0.02165834	5.266433×10 ⁻³		

Term	1	2	3
r_p	0.02196926	5.845724×10 ⁻³	1.904897×10 ⁻³
$ au_{ ho}$	4.127141	0.1629998	8.832583×10 ⁻³

6.0 Reverse recovery ratings

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

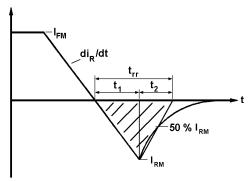


Fig. 1

(ii)
$$Q_{\text{rr}}$$
 is based on a $150\mu s$ 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

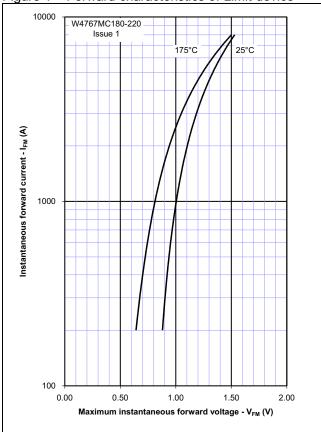


Figure 2 – Transient thermal impedance

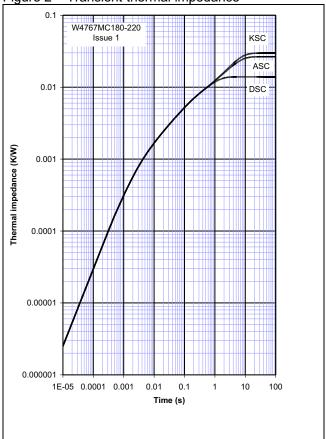
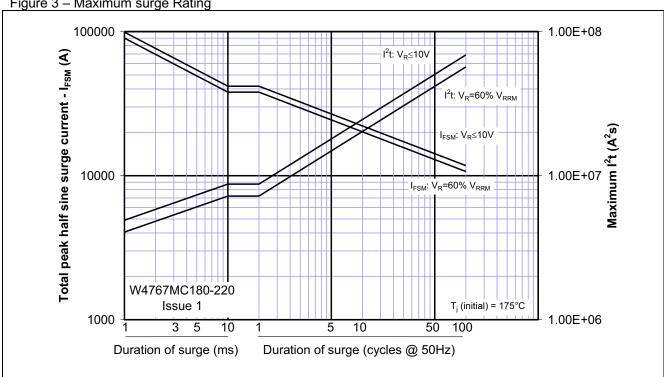
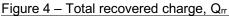


Figure 3 - Maximum surge Rating







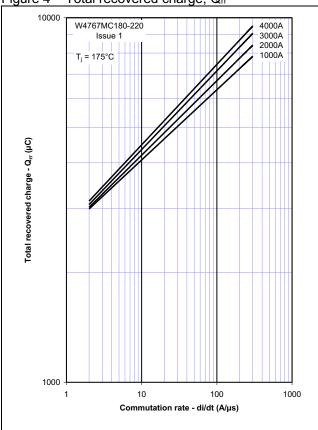
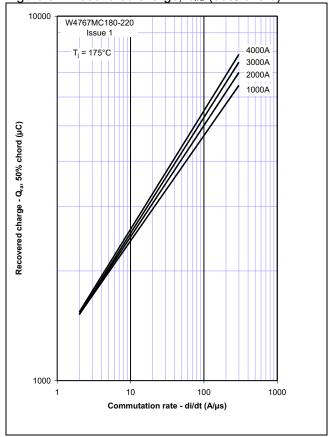


Figure 5 – Recovered charge, Q_{ra} (50% chord)



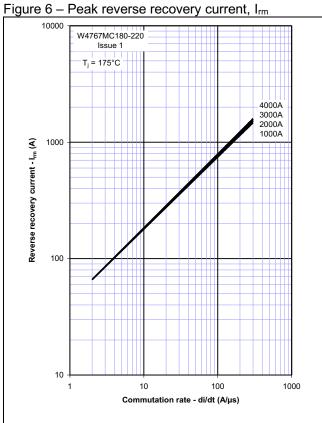


Figure 7 – Maximum recovery time, t_{rr} (50% chord)

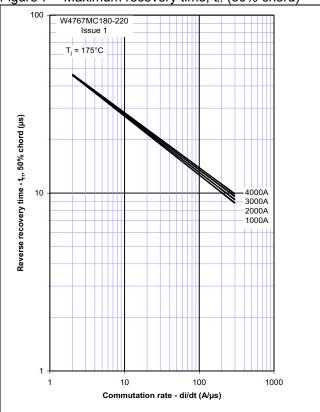




Figure 8 – Forward current vs. Power dissipation – Double Side Cooled

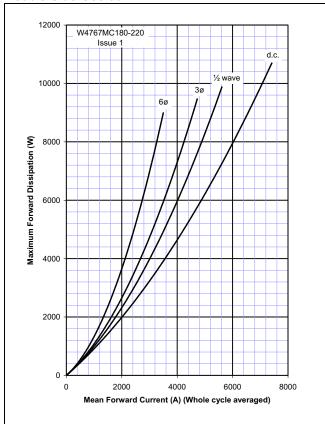


Figure 10 – Forward current vs. Power dissipation – Single Side Cooled

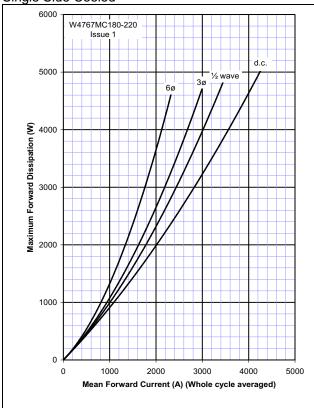


Figure 9 – Forward current vs. Heatsink temperature – Double Side Cooled

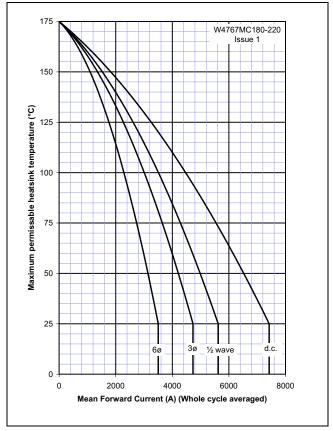
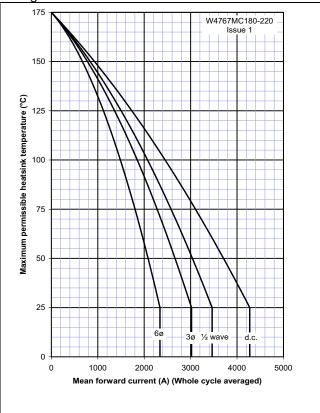
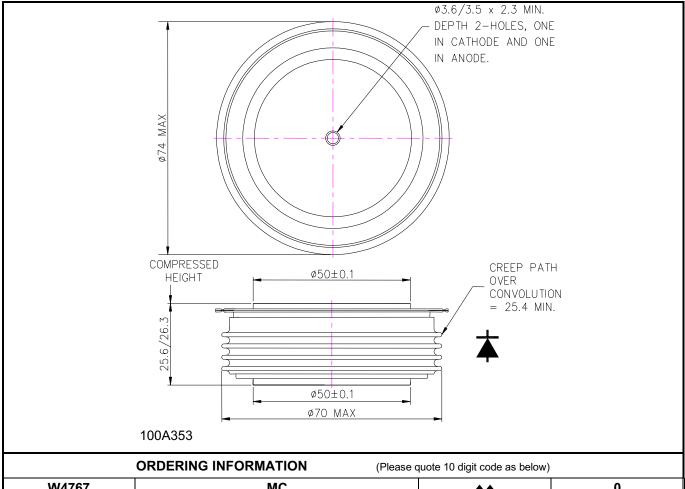


Figure 11 – Forward current vs. Heatsink temperature – Single Side Cooled





Outline Drawing & Ordering Information



	ORDERING INFORMATION (Please of	quote 10 digit code as below)	
W4767	MC	* *	0
Fixed Type Code	Fixed Outline Code	Voltage code V _{RRM} /100 18 & 22	Fixed Code

Typical Order code: W4767MC180 -1800V VRRM, 26.3mm clamp height capsule.

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: <u>sales@ixys.net</u>



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: WSL.sales@westcode,com

IXYS Long Beach, Inc

2500 Mira Mar Avenue Long Beach CA 90815 USA Tel: +1 (562) 296 6584

Fax: +1 (562) 296 6585 E-mail: service@ixyslongbeach.com

-mail. <u>service@ixysiongbeach.com</u>

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