

Data Sheet Issue: - 7

Rectifier Diode Types W3270N#200 and W3270N#220

Old Type No.: SW20-22CXC14C

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	2000-2200	V
V _{RSM}	Non-repetitive peak reverse voltage, (note 1)	2100-2300	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
I _{F(AV)M}	Maximum average forward current, T _{sink} =55°C, (note 2)	3270	Α
I _{F(AV)M}	Maximum average forward current. T _{sink} =85°C, (note 2)	2693	Α
I _{F(AV)M}	Maximum average forward current. T _{sink} =85°C, (note 3)	1638	Α
I _{F(RMS)M}	Nominal RMS forward current, T _{sink} =25°C, (note 2)	5949	Α
I _{F(d.c.)}	D.C. forward current, T _{sink} =25°C, (note 4)	5047	Α
I _{FSM}	Peak non-repetitive surge t _p =10ms, V _{rm} =60%V _{RRM} , (note 5)	28	kA
I _{FSM2}	Peak non-repetitive surge t _p =10ms, V _{rm} ≤10V, (note 5)	31	kA
l ² t	I ² t capacity for fusing t _p =10ms, V _{rm} =60%V _{RRM} , (note 5)	3.92×10 ⁶	A ² s
l ² t	l²t capacity for fusing t _p =10ms, V _{rm} ≤10V, (note 5)	4.81×10 ⁶	A ² s
T _{j op}	Operating temperature range	-55 to +175	°C
T _{stg}	Storage temperature range	-55 to +200	°C

Notes:-

- 1) De-rating factor of 0.13% per °C is applicable for T_j below 25°C.
- 2) Double side cooled, single phase; 50Hz, 180° half-sinewave.
- 3) Single 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
V _{FM}	Maximum peak forward voltage	-	-	1.47	I _{TM} =6400A	V
V_{FM}	Maximum peak forward voltage	-	-	1.76	I _{TM} =9800A	V
V_{T0}	Threshold voltage	-	-	0.826		V
r⊤	Slope resistance	-	-	0.104		mΩ
I _{RRM}	Peak reverse current	-	-	50	Rated V _{RRM}	mA
I _{RRM}	Peak reverse current	-	-	2	Rated V _{RRM} , T _j =25°C	mA
Qrr	Recovered charge	-	2400	-		μC
Qra	Recovered charge, 50% Chord	-	1900	2350	I _{TM} =1000A, t _p =1000μs, di/dt=10A/μs,	μC
Irr	Reverse recovery current	-	150	-	V _r =50V	Α
t _{rr}	Reverse recovery time	-	25	-		μs
0	The survey resistance is unotice to be establish	-	-	0.022	Double side cooled	K/W
R_{thJK}	Thermal resistance, junction to heatsink	-	-	0.044	Single side cooled	K/W
F	Mounting force	19	-	26		kN
W_t	Weight	-	510	-		g

Notes:-

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

Notes on rupture rated packages.
This product is available with a non-rupture rated package.
For additional details on these products, please consult factory.



Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	Vdrm Vdsm Vrrm V	V _{RSM} V	V _D 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_i 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

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

Where V_{T0} =0.826V, r_T =0.104 $m\Omega$,

 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°)	d.c.		
Square wave Double Side Cooled	0.0285	0.0255	0.0240	0.02 20		
Square wave Single Side Cooled	0.0513	0.0484	0.0469	0.04 40		
Sine wave Double Side Cooled	0.0257	0.0233	0.022			
Sine wave Single Side Cooled	0.0482	0.0463	0.044			

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	0.7890858	0.650014635
В	0.01705306	1.432598×10 ⁻³
С	4.17×10 ⁻⁵	5.04342×10 ⁻⁵
D	3.38225 ×10 ⁻³	6.058139×10 ⁻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_{\star} = Thermal resistance at time t.

 r_p = Amplitude of p_{th} term.

 τ_p = Time Constant of r_{th} term.

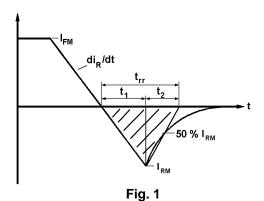
The coefficients for this device are shown in the tables below:

D.C. Single Side Cooled						
Term	1	2	3	4	5	
r_{p}	0.0291698	4.295845×10 ⁻³	7.57109×10 ⁻³	2.195801×10 ⁻³	1.628753×10 ⁻³	
$ au_{ ho}$	5.67822	1.123602	0.1407857	0.014381914	1.272749×10 ⁻³	

D.C. Double Side Cooled						
Term	Term 1 2 3 4					
r_{p}	0.01177146	6.485814×10 ⁻³	2.471007×10 ⁻³	1.607109×10 ⁻³		
$ au_{p}$	0.9495346	0.1337950	0.01636628	1.255571×10 ⁻³		

6.0 Reverse recovery ratings

(i) Qra is based on 50% Irm chord as shown in Fig. 1



(ii) Q_{rr} is based on a 150μs 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

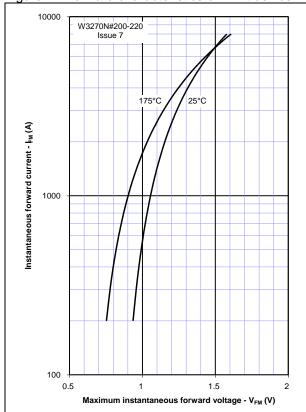


Figure 2 - Transient thermal impedance

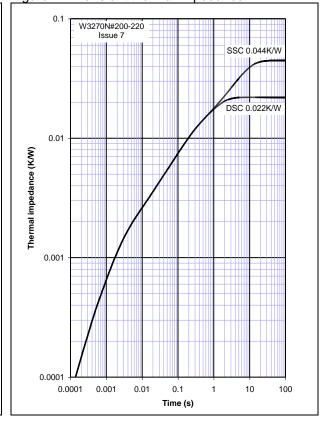


Figure 3 - Maximum surge Rating

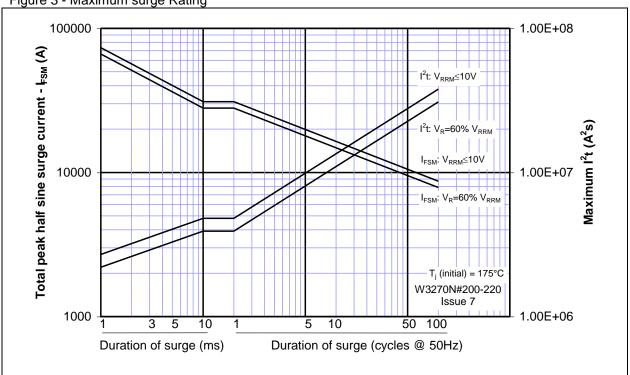




Figure 4 - Total recovered charge, Q_{rr}

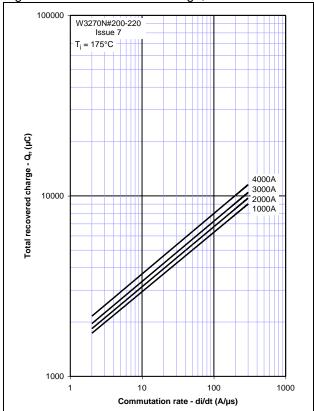


Figure 5 - Recovered charge, Qra (50% chord)

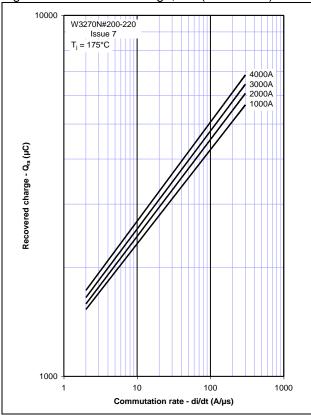


Figure 6 - Peak reverse recovery current, Irm

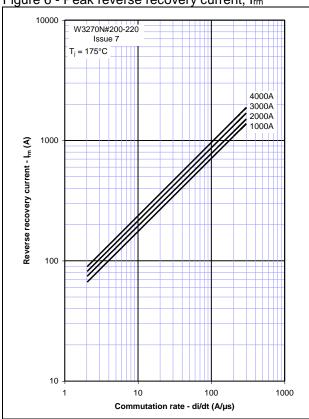


Figure 7 - Maximum recovery time, t_{rr} (50% chord)

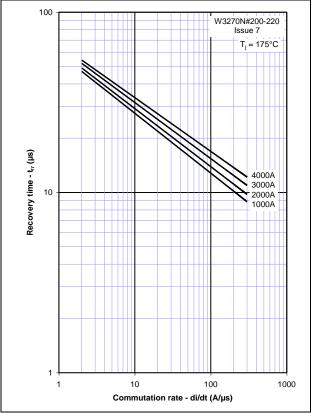




Figure 8 – Forward current vs. Power dissipation – Double Side Cooled

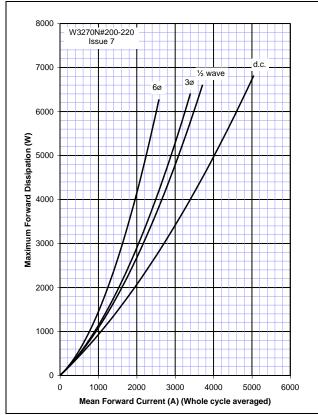


Figure 10 – Forward current vs. Power dissipation – Single Side Cooled

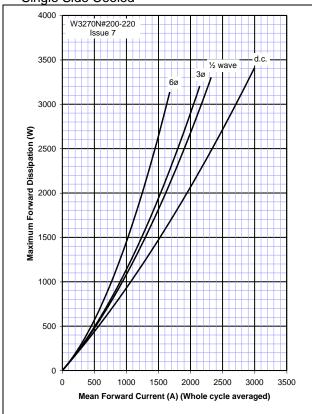


Figure 9 – Forward current vs. Heatsink temperature - Double Side Cooled

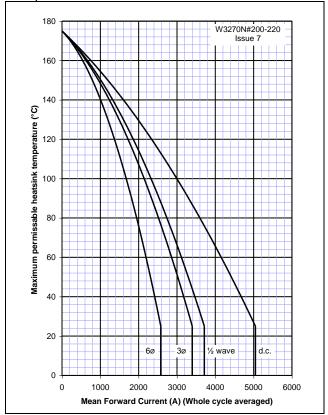
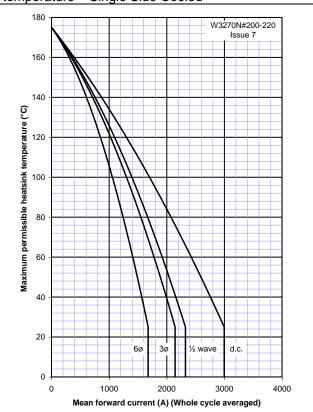
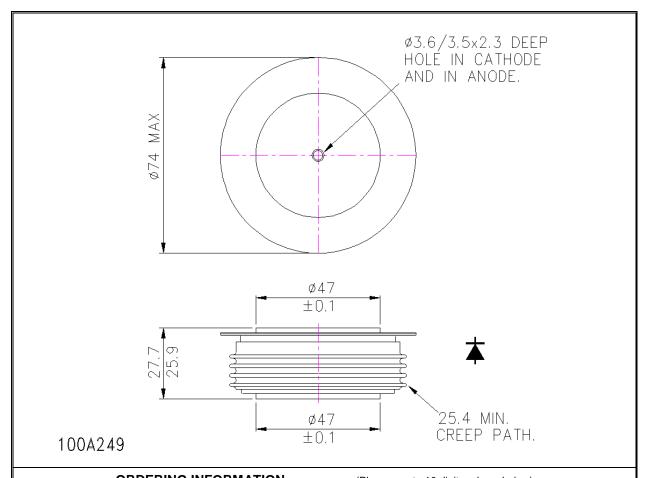


Figure 11 – Forward current vs. Heatsink temperature – Single Side Cooled





Outline Drawing & Ordering Information



ORDERII	NG INFORMATION	(Please quote 10 digit code as below)		
W3270	N#	* *	0	
Fixed Type Code	Outline code NC = Normal capsule NT = Rupture-rated capsule	Voltage code V _{DRM} /100 20 & 22	Fixed turn-off time code	

Typical order code: W3270NT200 - 2000V V_{DRM}, V_{RRM}, 27.7mm clamp height, rupture rated capsule.

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