Date: 10th January 2023

Data Sheet Issue: 4

Rectifier Diode

Types W1975MC620 to W1975MC680

Development part number WX362MC720

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	6200-6800	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	6300-6900	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_{sink}=55°C, (note 2)	1975	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 2)	1350	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 3)	840	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_{sink}=25°C, (note 2)	3630	A
$I_{F(d.c.)}$	D.C. forward current, T_{sink}=25°C, (note 4)	2310	A
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{rm}=60%V_{RRM}, (note 5)	18000	A
I_{FSM2}	Peak non-repetitive surge t_p=10ms, $V_{rm} \leq$10V, (note 5)	20000	A
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}=60%V_{RRM}, (note 5)	1.62×10^6	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, $V_{rm} \leq$10V, (note 5)	2.00×10^6	A^2s
$T_{j\ op}$	Operating temperature range	-40 to +150	°C
T_{stg}	Storage temperature range	-55 to +150	°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) Cathode side cooled, single phase; 50Hz, 180° half-sinewave.
4) Double side cooled.
5) Half-sinewave, 150°C T_j initial.

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V_{FM}	Maximum peak forward voltage	-	-	2.25	I_{FM}=2500A	V
V_{FM}	Maximum peak forward voltage	-	-	3.95	I_{FM}=4200A	V
V_{T0}	Threshold voltage	-	-	0.95		V
r_T	Slope resistance	-	-	0.51		mΩ
I_{RRM}	Peak reverse current	-	-	100	Rated V_{RRM}	mA
Q_{rr}	Recovered charge	-	8700	9500	I_{TM}=1000A, t_p=1000µs, di/dt=10A/µs, V_r=100V	µC
Q_{ra}	Recovered charge, 50% Chord	-	4160	-		µC
I_{rm}	Reverse recovery current	-	185	-		A
t_{rr}	Reverse recovery time, 50% chord	-	45	-		µs
R_{thJK}	Thermal resistance, junction to heatsink	-	-	0.0140	Double side cooled	K/W
		-	-	0.0265	Anode side cooled	K/W
		-	-	0.0297	Cathode side cooled	K/W
F	Mounting force	25	-	31	Note 2	kN
W_t	Weight		530			g

Notes:-
1) Unless otherwise indicated T_j=150°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
62	6200	6300	4150
65	6500	6600	4350
68	6800	6900	4550

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

$$I_{AV} = \frac{-V_{T0} + \sqrt{V_{T0}^{2} + 4 \cdot ff^{2} \cdot r_T \cdot W_{AV}}}{2 \cdot ff^{2} \cdot r_T}$$

and:

$$W_{AV} = \frac{\Delta T}{R_{th}}$$

$$\Delta T = T_{j\max} - T_K$$

Where V_{T0}=0.95 V, r_T=0.51 mΩ,

R_{th} = Supplementary thermal impedance, see table below and

ff = Form factor, see table below.

Supplementary Thermal Impedance (at 50Hz operating frequency)				
Conduction Angle	6 phase (60°)	3 phase (120°)	Half wave (180°)	d.c.
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°)	Half 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	150°C Coefficients
A	0.5160004	0.1568668
B	0.07006873	0.1159272
C	2.54996×10^{-4}	4.47058×10^{-4}
D	3.010536×10^{-3}	1.376798×10^{-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_p	8.594785×10^{-3}	3.308247×10^{-3}	1.039072×10^{-3}	7.916582×10^{-4}
τ_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}
τ_p	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

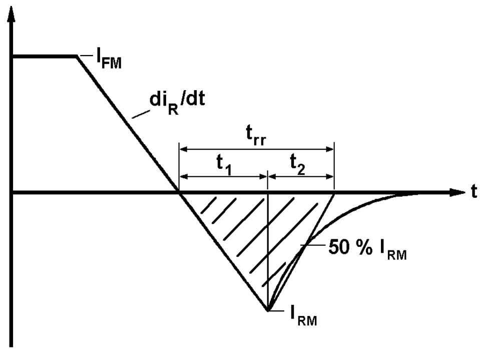


Fig. 1

(ii) Q_{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

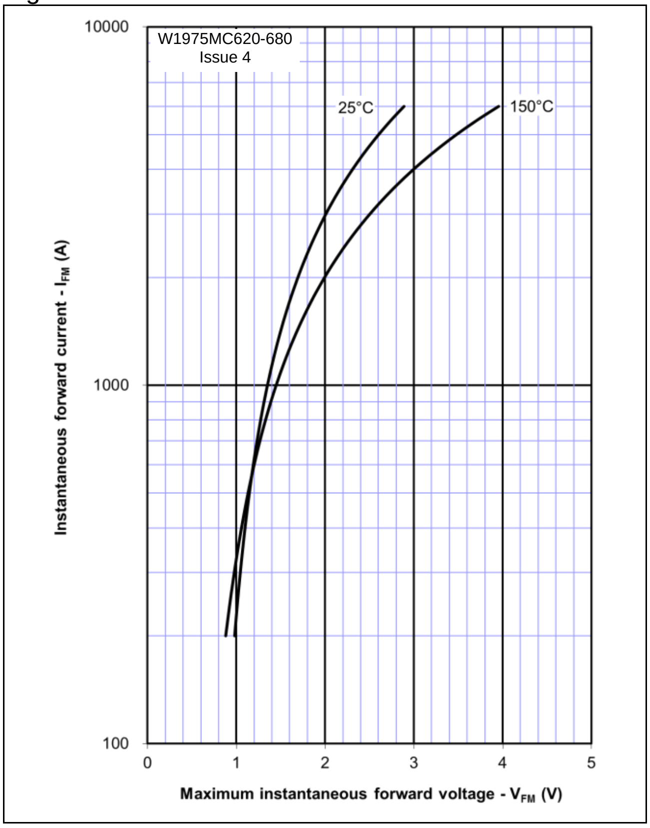


Figure 2 – Transient thermal impedance

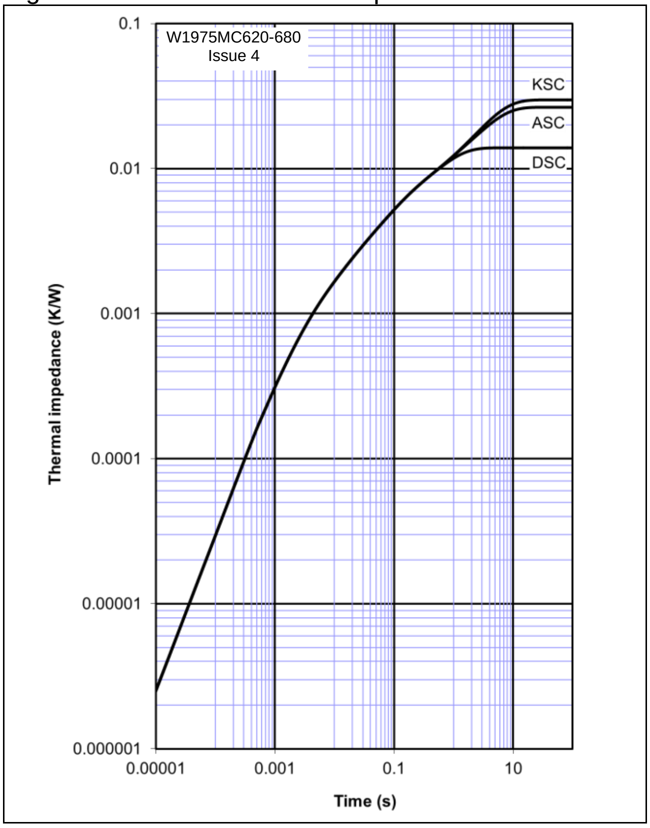


Figure 3 – Maximum Surge Rating

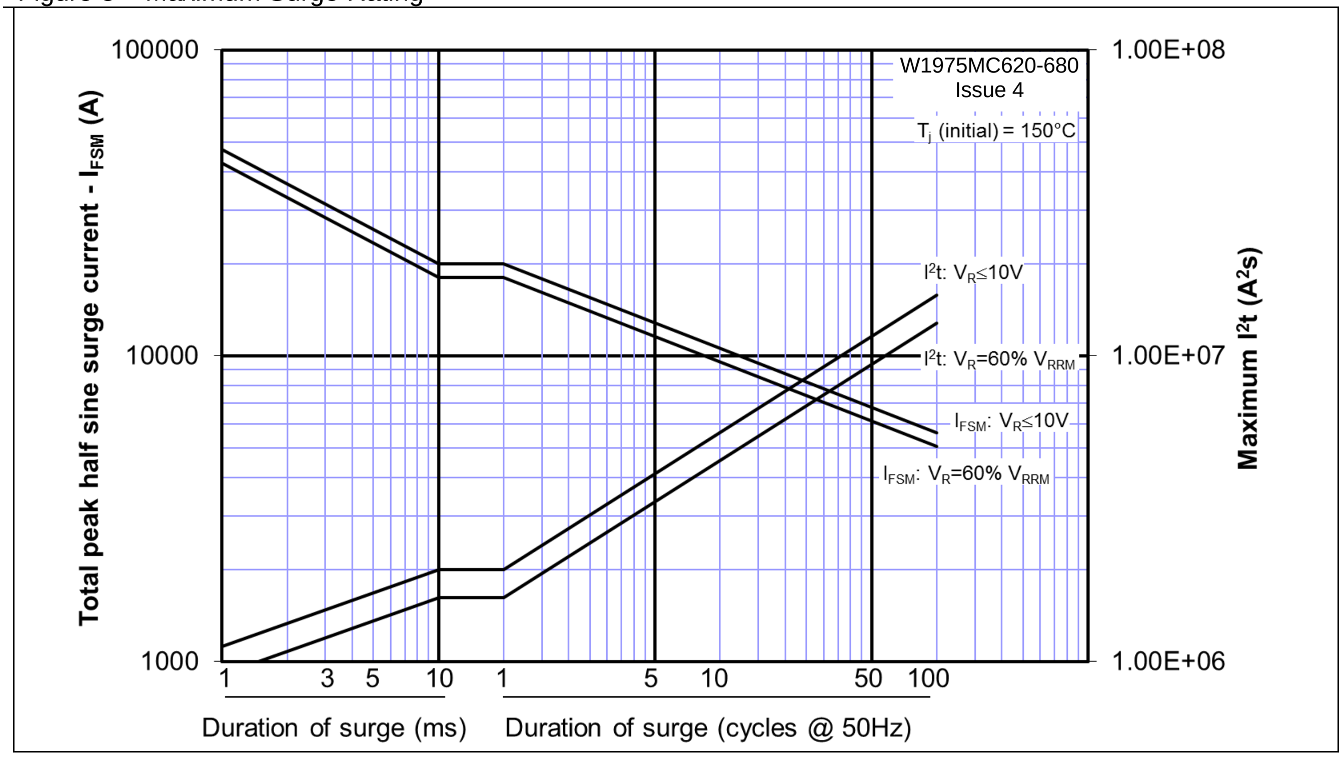


Figure 4 – Total recovered charge, Q_{rr}

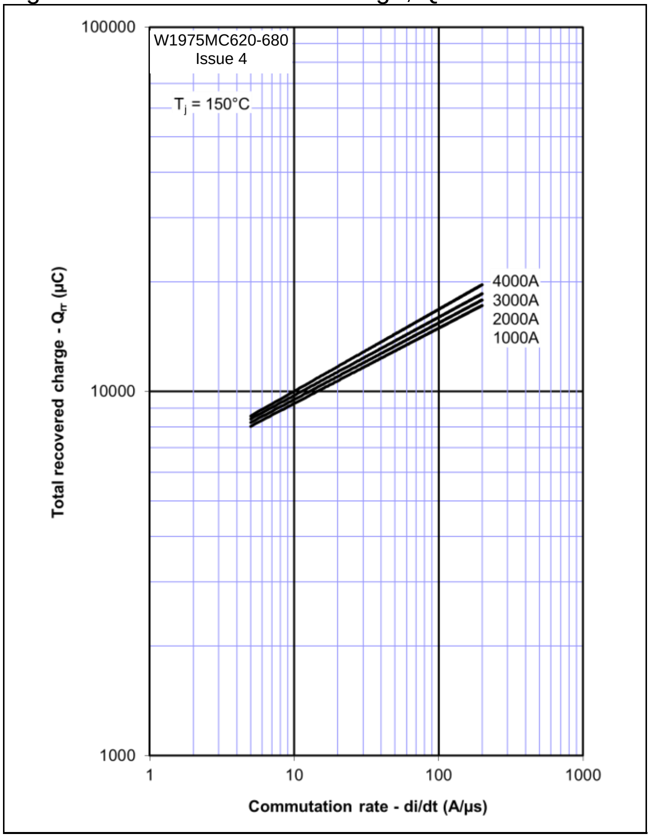


Figure 5 – Recovered charge, Q_{ra} (50% chord)

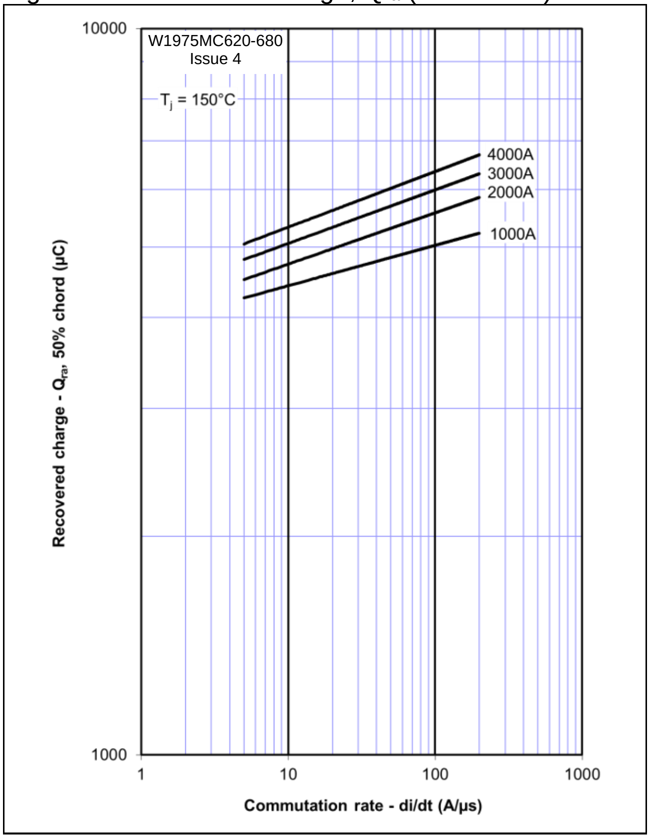


Figure 6 – Peak reverse recovery current, I_{rm}

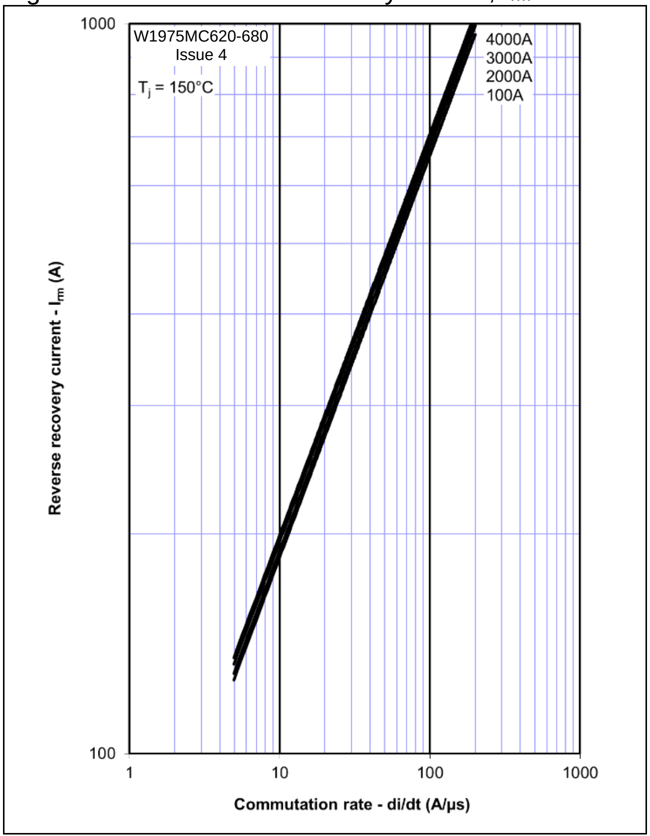


Figure 7 – Maximum recovery time, t_{rr} (50% chord)

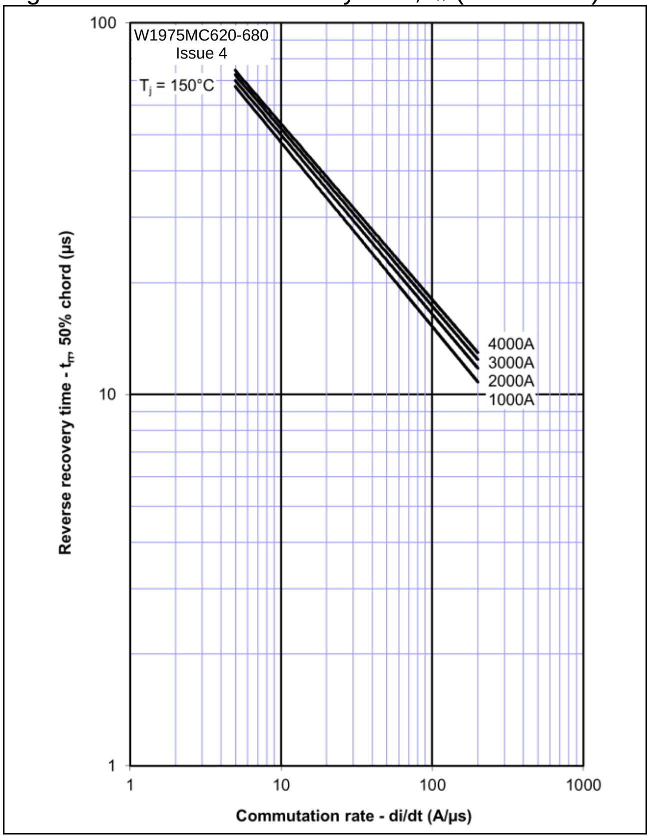


Figure 8 – Forward current vs. Power dissipation – Double Side Cooled

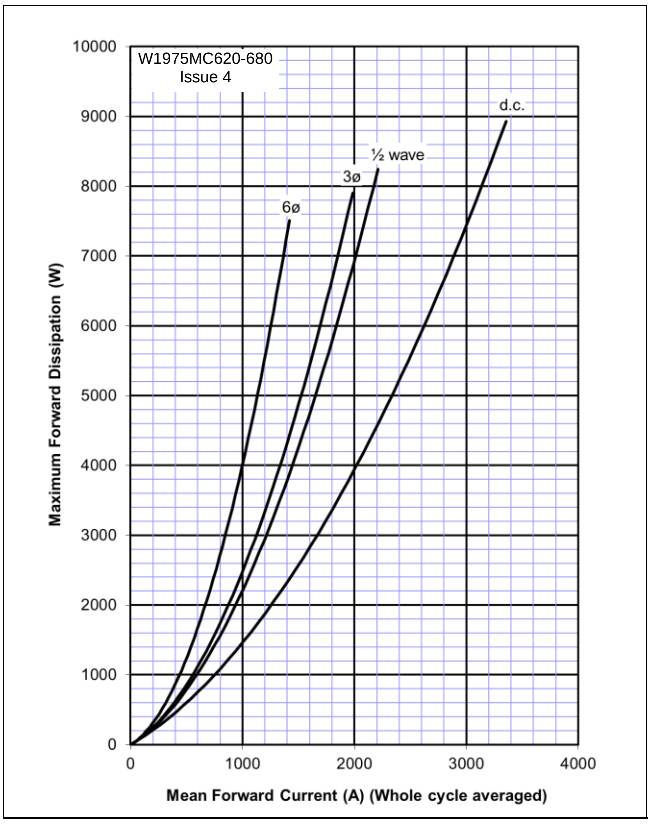


Figure 9 – Forward current vs. Heatsink temperature – Double Side Cooled

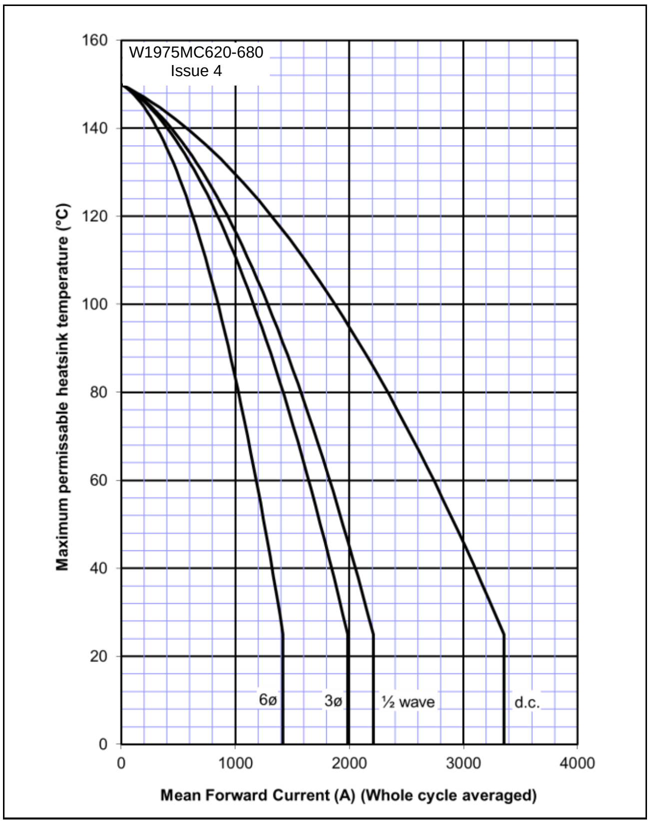


Figure 10 – Forward current vs. Power dissipation – Cathode Side Cooled

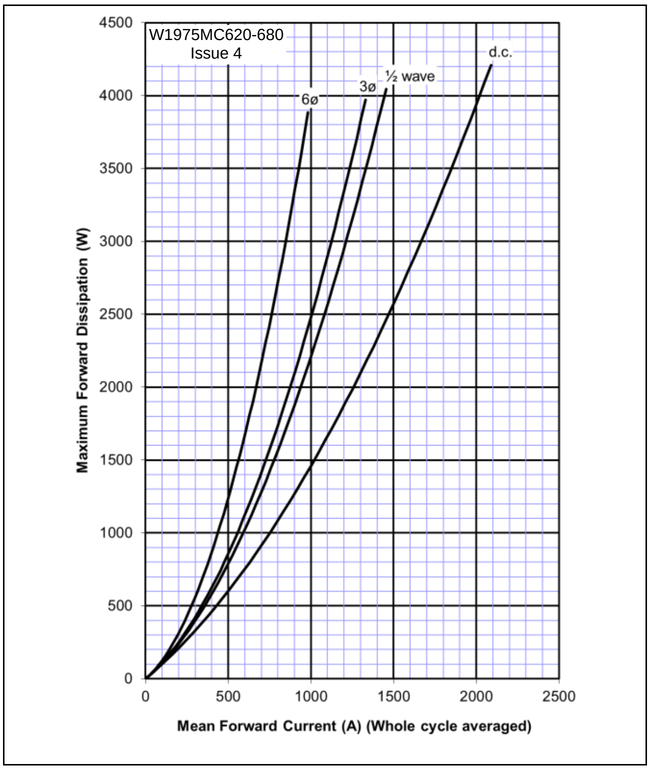
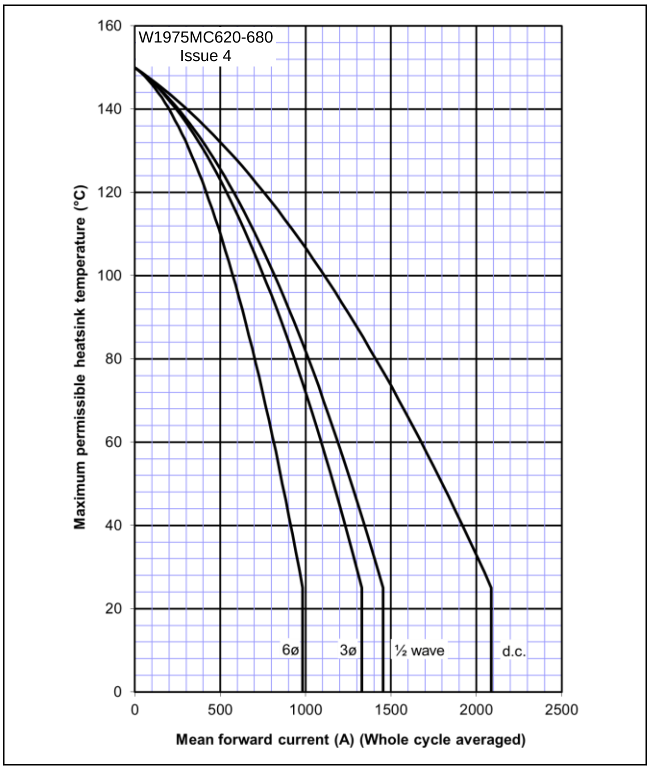
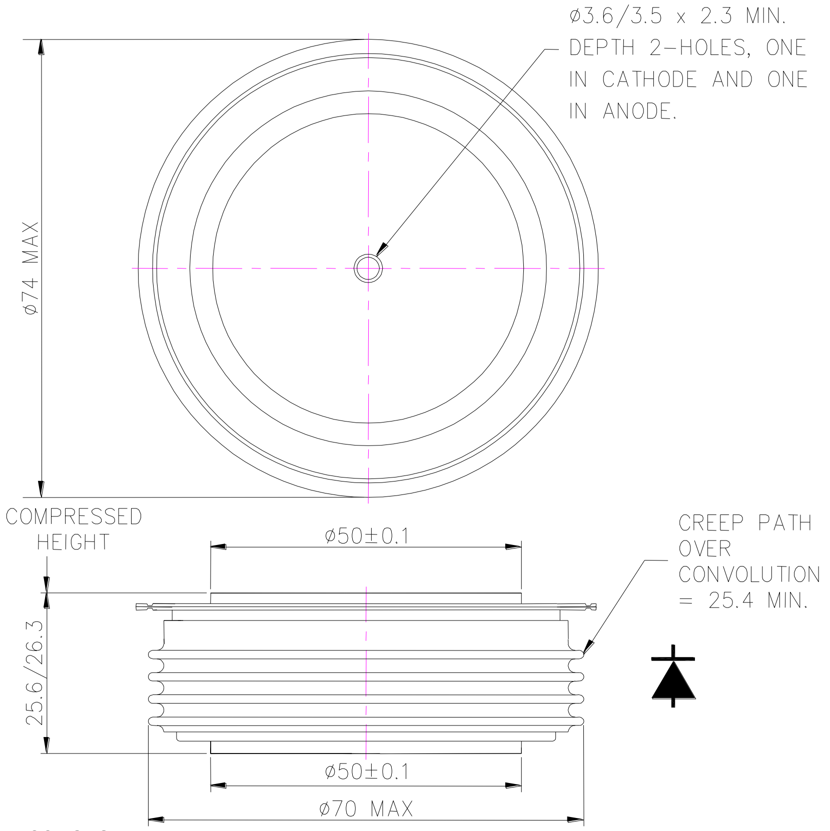


Figure 11 – Forward current vs. Heatsink temperature – Cathode Side Cooled



Outline Drawing & Ordering Information



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ORDERING INFORMATION		(Please quote 10 digit code as below)	
W1975	**MC**	**♦♦**	**0**
Fixed Type Code	Fixed Outline Code	Voltage code V_{RRM}/100 62-68	Fixed code

Order code: W1975MC680– 6800V V_{RRM}, 26.3mm clamp height capsule.

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