



# Rectifier Diode

## Types W0880LC620 to W0880LC680

### Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V <sub>RRM</sub>	Repetitive peak reverse voltage, (note 1)	6200-6800	V
V <sub>RSM</sub>	Non-repetitive peak reverse voltage, (note 1)	6300-6900	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
I <sub>F(AV)M</sub>	Maximum average forward current, T <sub>sink</sub> =55°C, (note 2)	880	A
I <sub>F(AV)M</sub>	Maximum average forward current, T <sub>sink</sub> =100°C, (note 2)	595	A
I <sub>F(AV)M</sub>	Maximum average forward current, T <sub>sink</sub> =100°C, (note 3)	380	A
I <sub>F(RMS)M</sub>	Nominal RMS forward current, T <sub>sink</sub> =25°C, (note 2)	1615	A
I <sub>F(d.c.)</sub>	D.C. forward current, T <sub>sink</sub> =25°C, (note 4)	1480	A
I <sub>FSM</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>rm</sub> =0.6V <sub>RRM</sub> , (note 5)	7000	A
I <sub>FSM2</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>rm</sub> ≤10V, (note 5)	7700	A
I <sup>2</sup> t	I <sup>2</sup> t capacity for fusing t <sub>p</sub> =10ms, V <sub>rm</sub> =0.6V <sub>RRM</sub> , (note 5)	245×10 <sup>3</sup>	A <sup>2</sup> s
I <sup>2</sup> t	I <sup>2</sup> t capacity for fusing t <sub>p</sub> =10ms, V <sub>rm</sub> ≤10V, (note 5)	296×10 <sup>3</sup>	A <sup>2</sup> s
T <sub>j op</sub>	Operating temperature range	-40 to +150	°C
T <sub>stg</sub>	Storage temperature range	-55 to +150	°C

#### Notes:-

- 1) De-rating factor of 0.13% per °C is applicable for T<sub>j</sub> 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, 150°C T<sub>j</sub> initial.

**Characteristics**

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V <sub>FM</sub>	Maximum peak forward voltage	-	-	3.8	I <sub>TM</sub> =2625A	V
V <sub>T0</sub>	Threshold voltage	-	-	0.98		V
r <sub>T</sub>	Slope resistance	-	-	1.06		mΩ
I <sub>RRM</sub>	Peak reverse current	-	-	50	Rated V <sub>RRM</sub>	mA
I <sub>RRM</sub>	Peak reverse current	-	-	2	Rated V <sub>RRM</sub> , T <sub>j</sub> =25°C	mA
Q <sub>rr</sub>	Total recovered charge	-	5815	6450		μC
Q <sub>ra</sub>	Reverse recovery charge (50% chord)	-	2211	-		μC
I <sub>rm</sub>	Reverse recovery current	-	137	-	I <sub>FM</sub> =1000A, t <sub>p</sub> =1ms, di/dt=10A/μs, V <sub>r</sub> =100V	A
t <sub>rr</sub>	Reverse recovery time (50% chord)	-	33	-		μs
R <sub>thJK</sub>	Thermal resistance, junction to heatsink	-	-	0.033	Double side cooled	K/W
		-	-	0.066	Single side cooled	K/W
F	Mounting force	10	-	20		kN
W <sub>t</sub>	Weight	-	250	-		g

Notes:-

 1) Unless otherwise indicated T<sub>j</sub>=150°C.

## **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 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 Device Dissipation Calculations

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

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

and:  $\Delta T = T_{jmax} - T_C$

Where  $V_{T0}=0.98V$ ,  $r_T=1.06m\Omega$ ,

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

$ff$  = 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	0.045	0.040	0.036	0.033
Square wave Single Side Cooled	0.081	0.075	0.070	0.066
Sine wave Double Side Cooled	0.042	0.038	0.034	
Sine wave Single Side Cooled	0.079	0.072	0.067	

Form Factors				
Conduction Angle	6 phase (60°)	3 phase (120°)	Half wave (180°)	d.c.
Square wave	2.45	1.73	1.41	1
Sine wave	2.78	1.88	1.57	

## 6.2 Calculating $V_F$ using ABCD Coefficients

The on-state characteristic  $I_F$  vs.  $V_F$ , on page 6 is represented by 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	0.110406435	A	0.101875316
B	0.200243555	B	0.168859960
C	$7.131702 \times 10^{-4}$	C	$1.068433 \times 10^{-3}$
D	$-1.513197 \times 10^{-2}$	D	$-9.060147 \times 10^{-3}$

### 6.3 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  $n$  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  $p^{\text{th}}$  term
- $\tau_p$  = Time Constant of  $r^{\text{th}}$  term

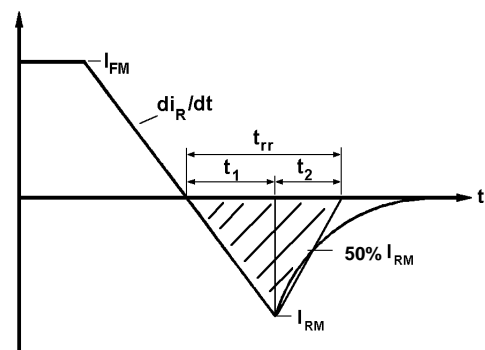
The coefficients for this device are shown in the table below:

D.C. Double Side Cooled				
Term	1	2	3	4
$r_p$	0.01771901	$4.240625 \times 10^{-3}$	$6.963806 \times 10^{-3}$	$3.043661 \times 10^{-3}$
$\tau_p$	0.7085781	0.1435833	0.03615196	$2.130842 \times 10^{-3}$

D.C. Single Side Cooled					
Term	1	2	3	4	5
$r_p$	0.04013371	$8.832199 \times 10^{-3}$	$9.210899 \times 10^{-3}$	$3.73647 \times 10^{-3}$	$2.594797 \times 10^{-3}$
$\tau_p$	4.073105	1.196877	0.09882439	0.01585017	$2.077263 \times 10^{-3}$

### 7.0 Reverse recovery ratings

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



**Fig. 1**

- (ii)  $K \text{ Factor} = \frac{t_1}{t_2}$

**Curves**

Figure 1 – Forward characteristics of Limit device

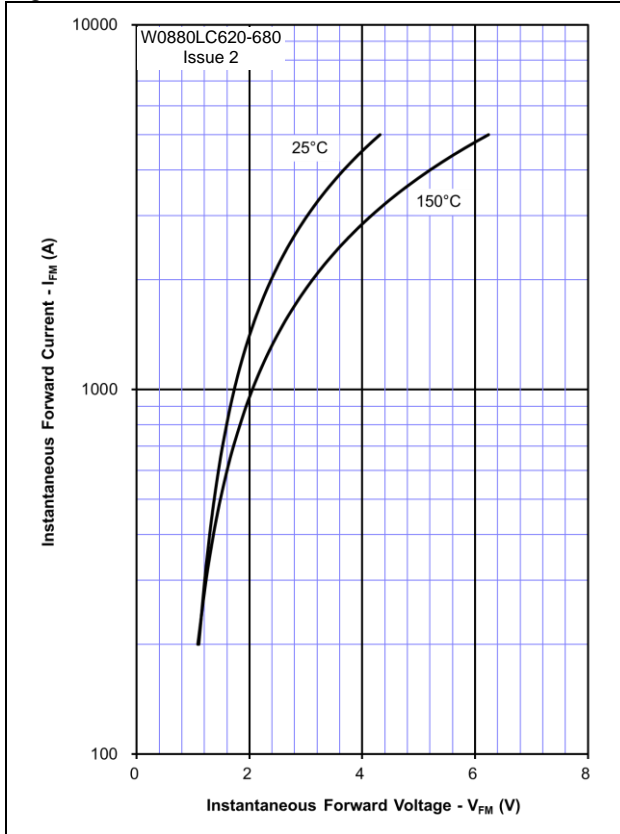


Figure 2 – Transient Thermal Impedance

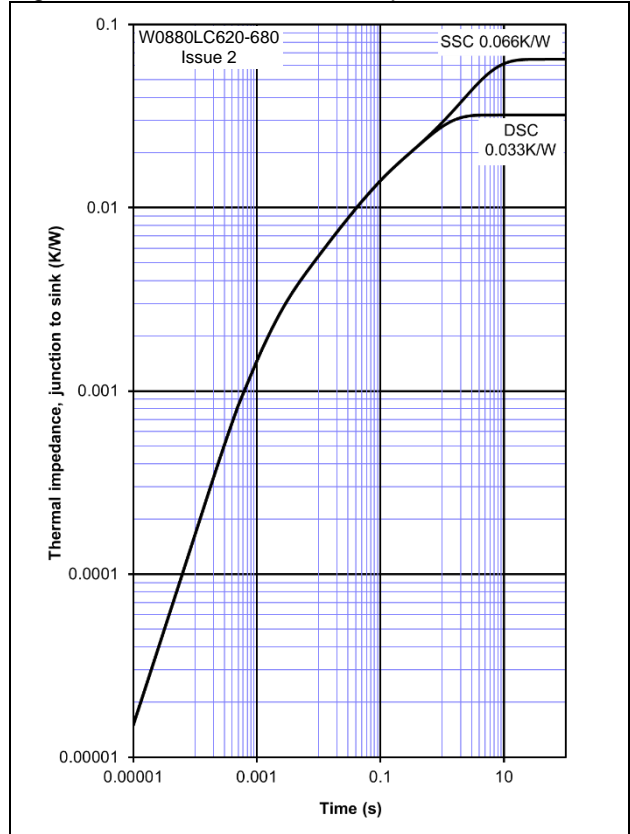


Figure 3 – Maximum surge and I<sup>2</sup>t Ratings

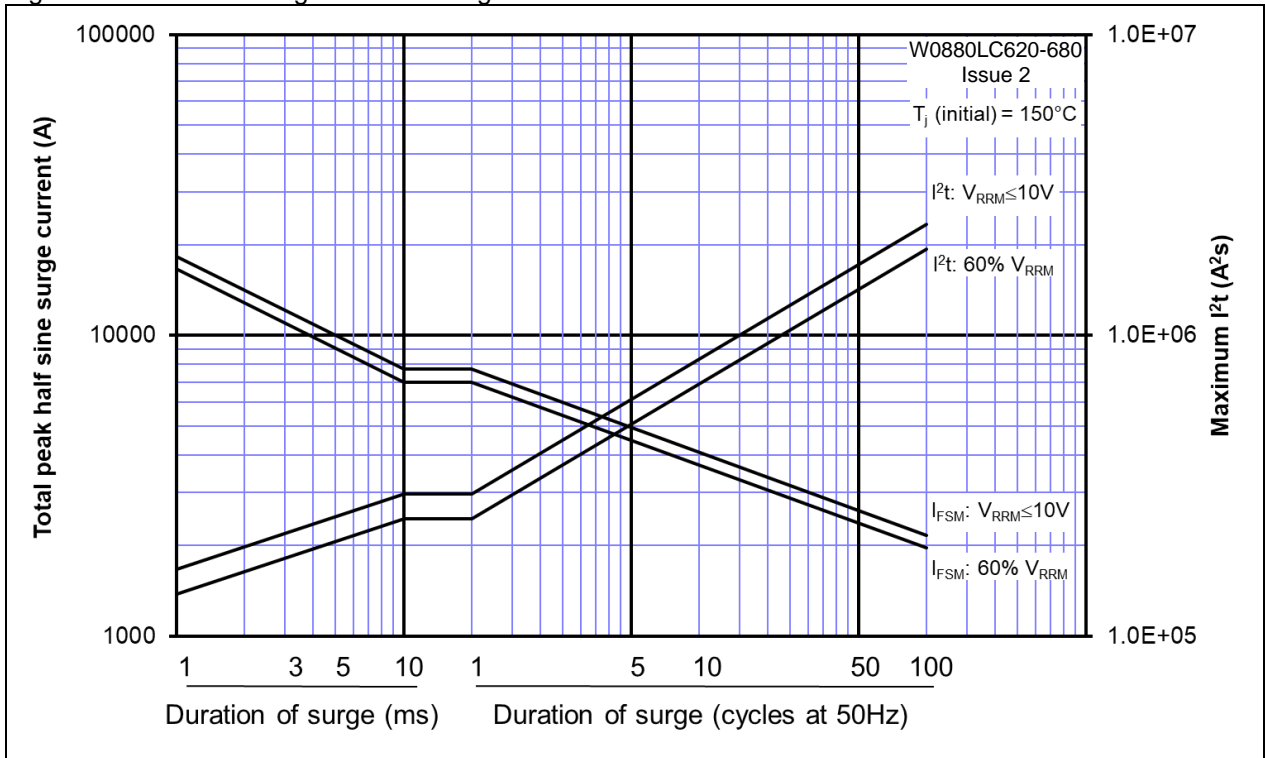


Figure 4 – Total recovered charge,  $Q_{rr}$

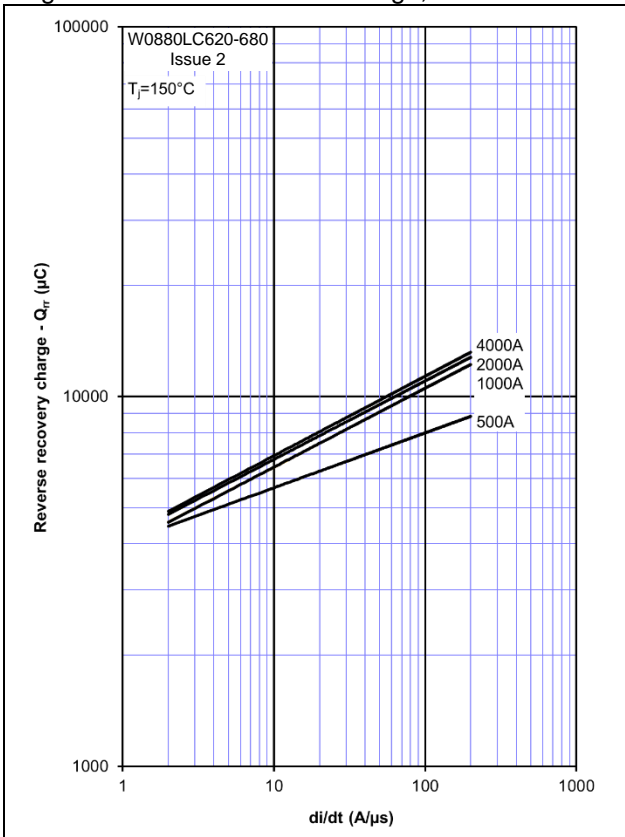


Figure 5 – Recovered charge (50% chord),  $Q_{ra}$

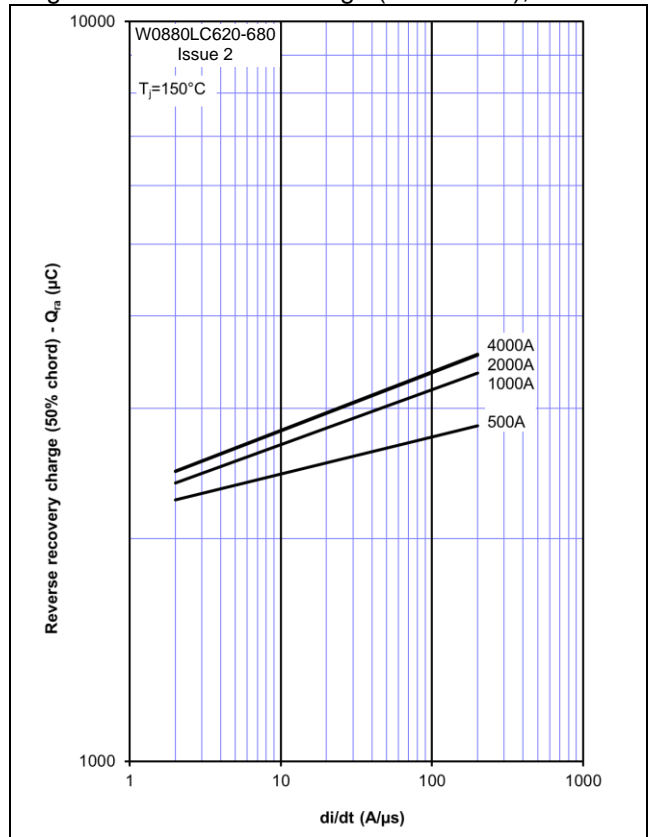


Figure 6 – Peak reverse recovery current,  $I_{rm}$

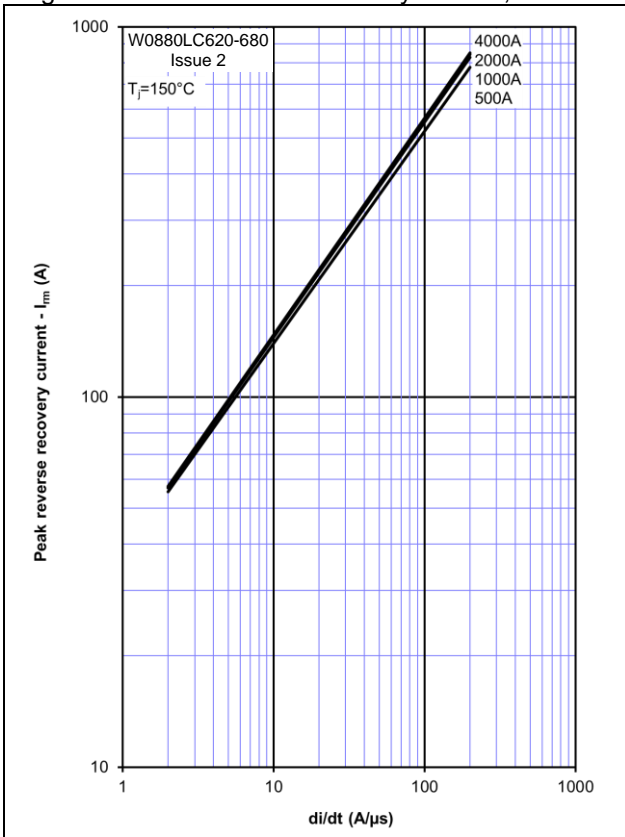


Figure 7 – Reverse recovery time (50% chord),  $t_{rr}$

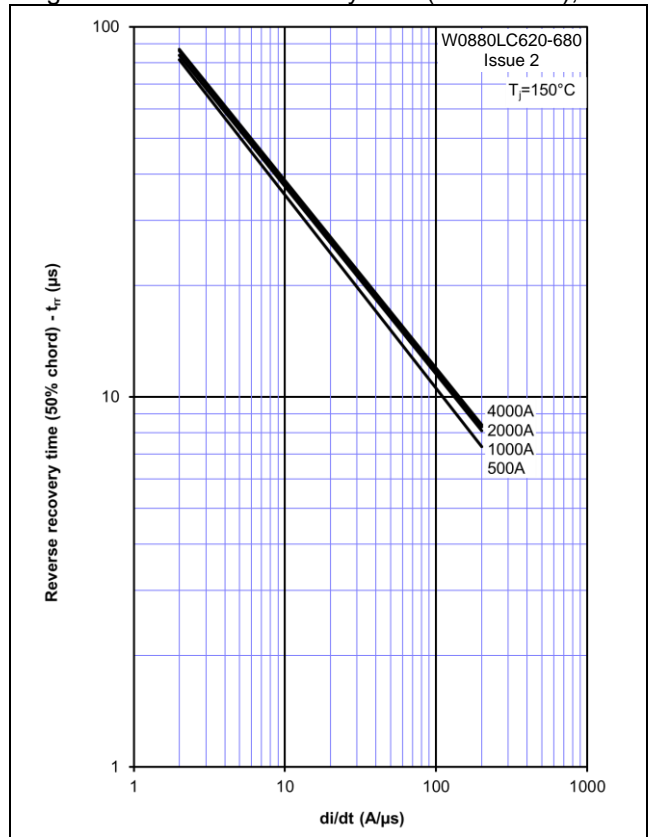




Figure 8 – Forward current vs. Power dissipation – Double Side Cooled

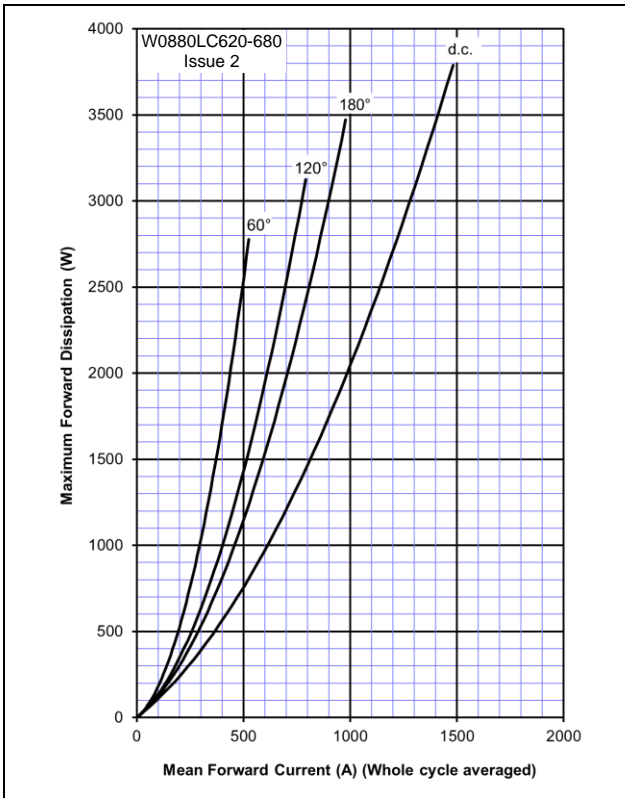


Figure 9 – Forward current vs. Heatsink temperature - Double Side Cooled

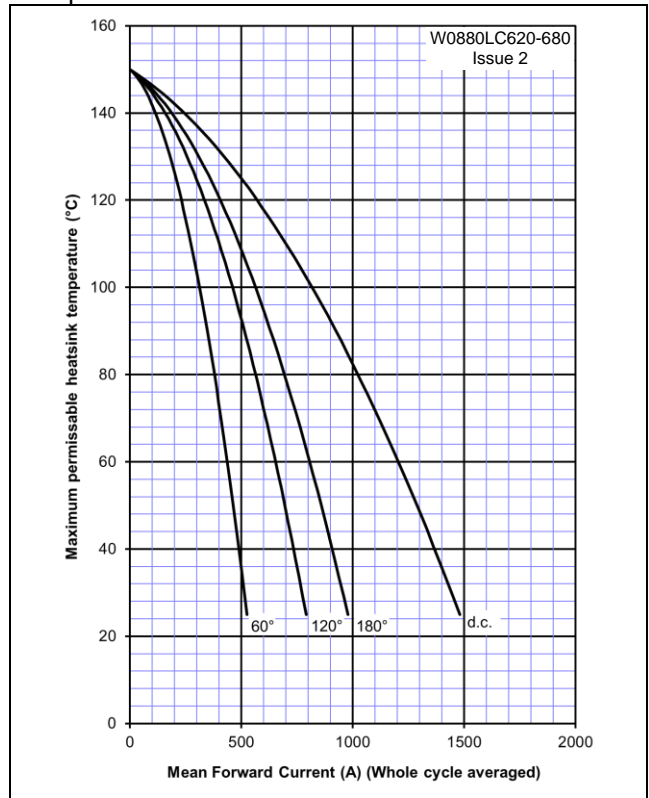


Figure 10 – Forward current vs. Power dissipation – Single Side Cooled

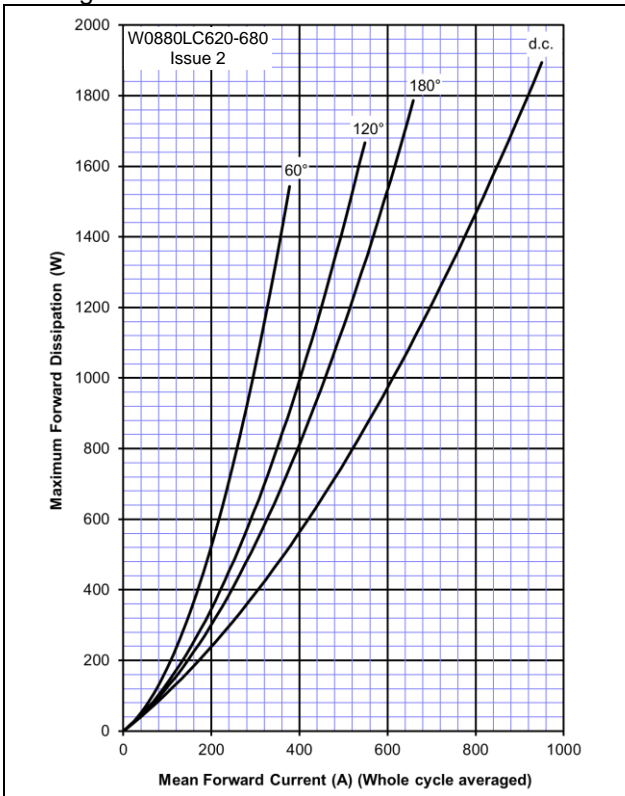
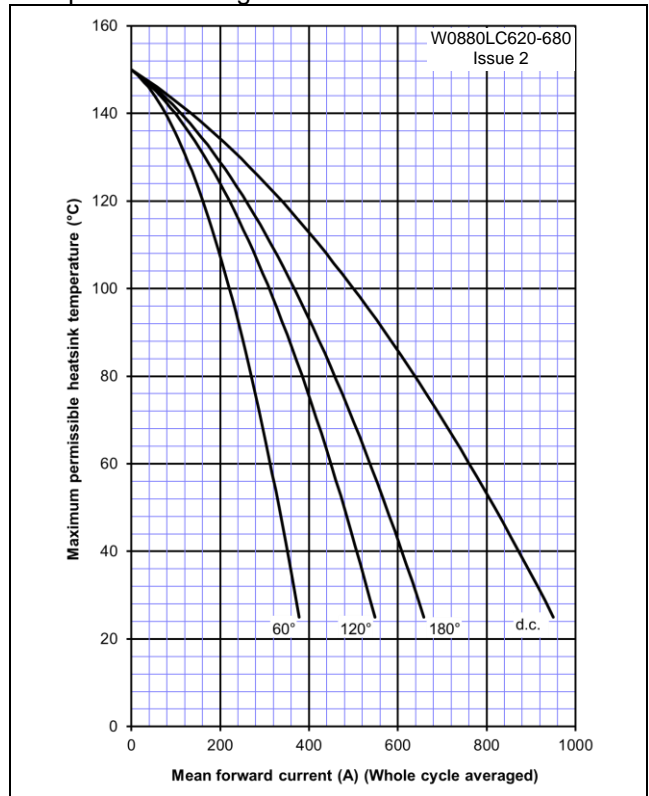
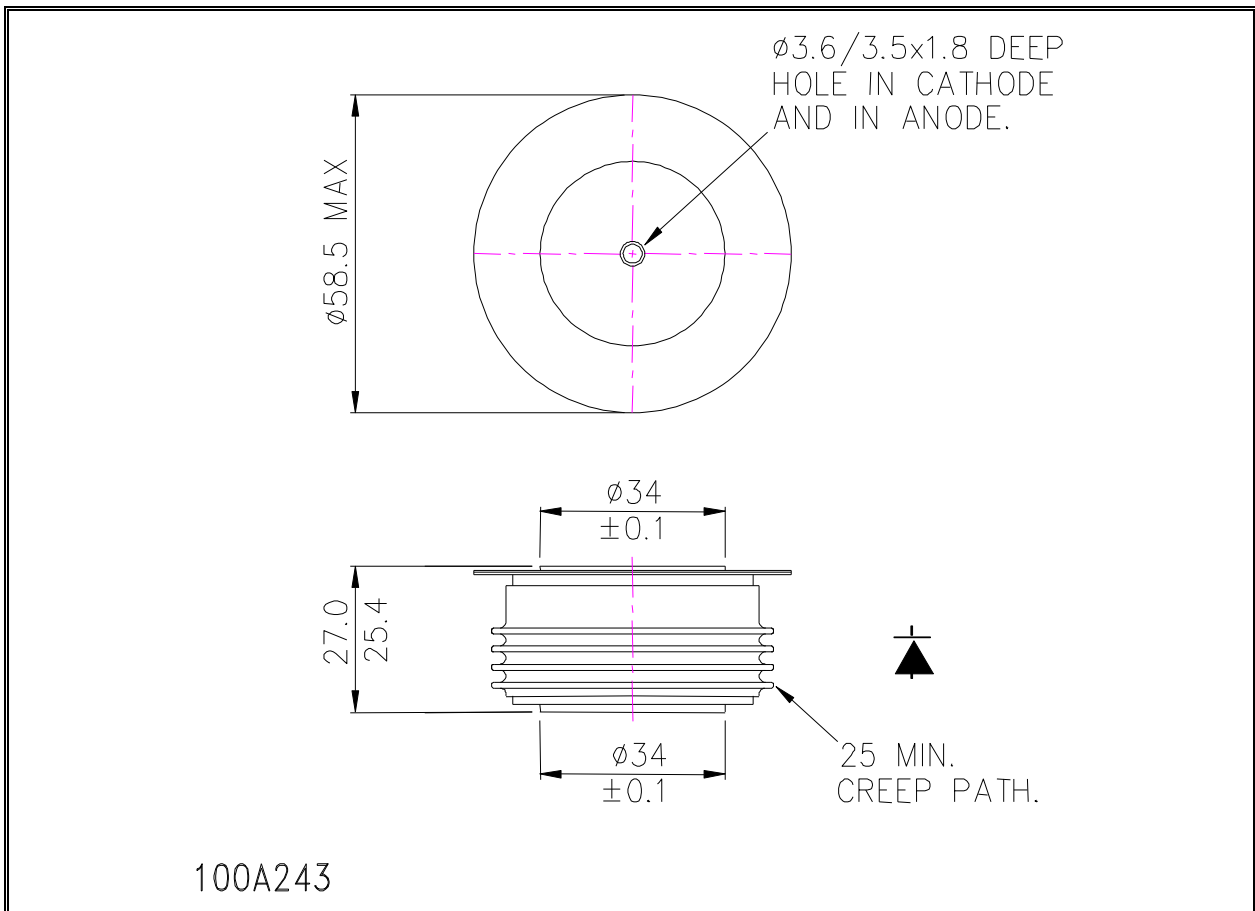


Figure 11 – Forward current vs. Heatsink temperature – Single Side Cooled



**Outline Drawing & Ordering Information**

**ORDERING INFORMATION**

(Please quote 10 digit code as below)

<b>W0880</b>	<b>LC</b>	<b>◆◆</b>	<b>0</b>
Fixed Type Code	Fixed Outline Code	Voltage code V <sub>DRM</sub> /100 62-68	Fixed turn-off time code

 Order code: W0880LC680 – 6800V V<sub>RRM</sub>, 27mm clamp height capsule

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