IXYS UK WESTCODE

Date:- 4th March, 2014

Data Sheet Issue:- 3

Rectifier Diode

Types W1185LC300 to W1185LC450

Previous Type No.: SW38-45CXC515

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	3000-4500	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	3100-4600	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_{sink}=55°C, (note 2)	1185	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 2)	833	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_{sink}=25°C, (note 2)	2171	A
$I_{F(d.c.)}$	D.C. forward current, T_{sink}=25°C, (note 3)	1936	A
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{rm}=60%V_{RRM}, (note 4)	9.2	kA
I_{FSM2}	Peak non-repetitive surge t_p=10ms, V_{rm}≤10V, (note 4)	10.58	kA
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}=60%V_{RRM}, (note 4)	0.423×10^6	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}≤10V, (note 4)	0.559×10^6	A^2s
$T_{j\,op}$	Operating temperature range	-55 to +160	°C
T_{stg}	Storage temperature range	-55 to +185	°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) Double side cooled.
4) Half-sinewave, 160°C T_j initial.

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V_{FM}	Maximum peak forward voltage	-	-	2.4	I_{FM}=2420A	V
V_{T0}	Threshold voltage	-	-	1.00		V
r_T	Slope resistance	-	-	0.575		mΩ
I_{RRM}	Peak reverse current	-	-	30	Rated V_{RRM}	mA
R_{thJK}	Thermal resistance, junction to heatsink	-	-	0.033	Double side cooled	K/W
		-	-	0.065	Single side cooled	K/W
F	Mounting force	10	-	20	Note 2	kN
W_t	Weight		340			g

Notes:-
1) Unless otherwise indicated T_j=160°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
30	3000	3100	1750
38	3800	3900	1950
45	4500	4600	2120

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}=1.00V, r_T=0.575mΩ,

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	0.0455	0.0393	0.0362	0.0319
Square wave Cathode Side Cooled	0.0753	0.0711	0.0687	0.0646
Sine wave Double Side Cooled	0.0397	0.0350	0.0313	
Sine wave Cathode Side Cooled	0.0699	0.0677	0.0653	

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 8 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.

160°C Coefficients	
A	0.5748073
B	0.04333389
C	0.4645497×10^{-3}
D	7.867421×10^{-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	0.017719	4.2406×10^{-3}	6.9638×10^{-3}	3.04366×10^{-3}
τ_p	0.708578	0.1435833	0.036152	2.1308×10^{-3}

D.C. Single Side Cooled					
Term	1	2	3	4	5
r_p	0.04013	6.3388×10^{-3}	0.011408	6.0275×10^{-3}	7.2098×10^{-4}
τ_p	4.07311	2.15774	0.19931	9.0689×10^{-3}	4.66345×10^{-4}

6.0 Reverse recovery ratings

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

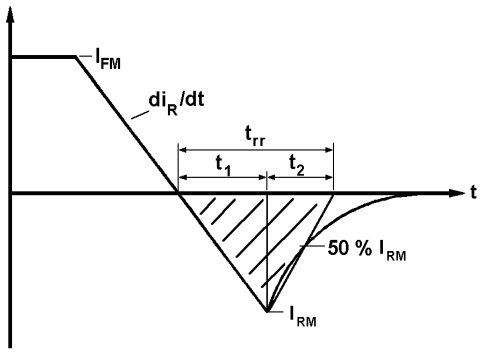


Fig. 1

(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 – Mean forward current vs. power dissipation– Double side cooled

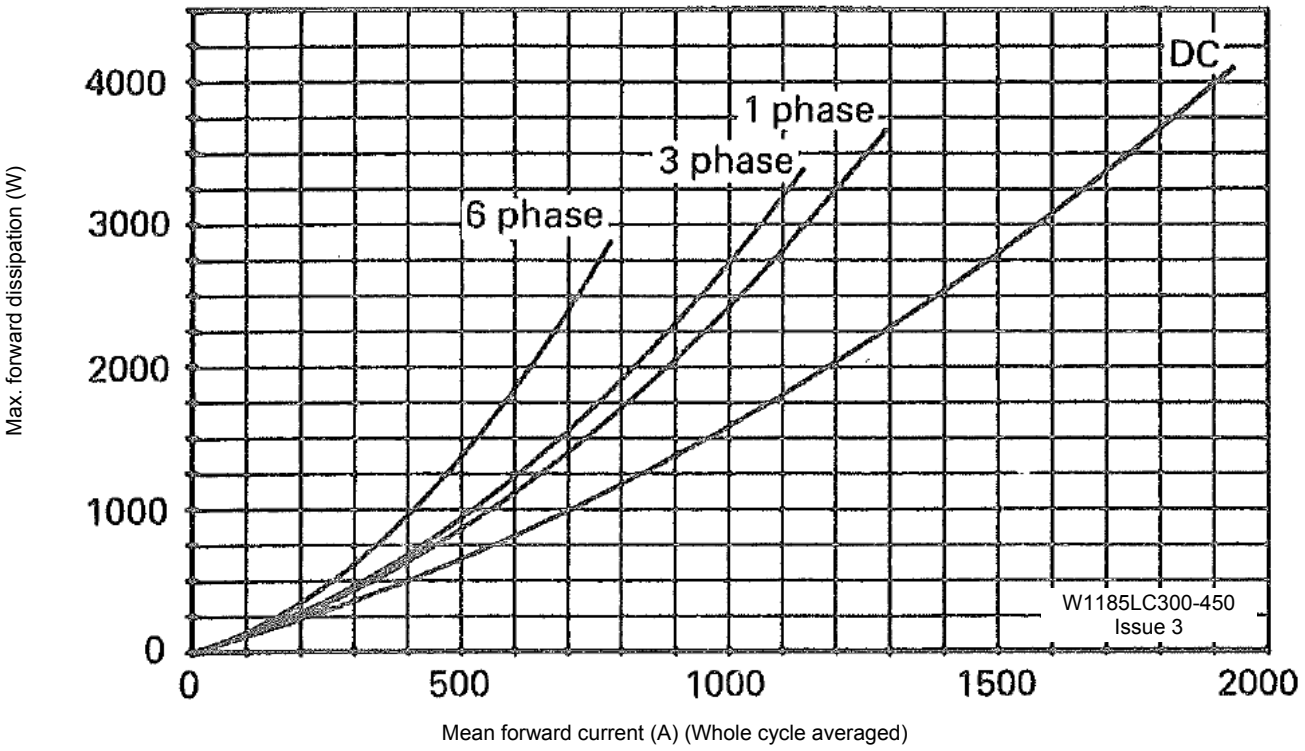


Figure 2 – Mean forward current vs. power dissipation – Single side cooled

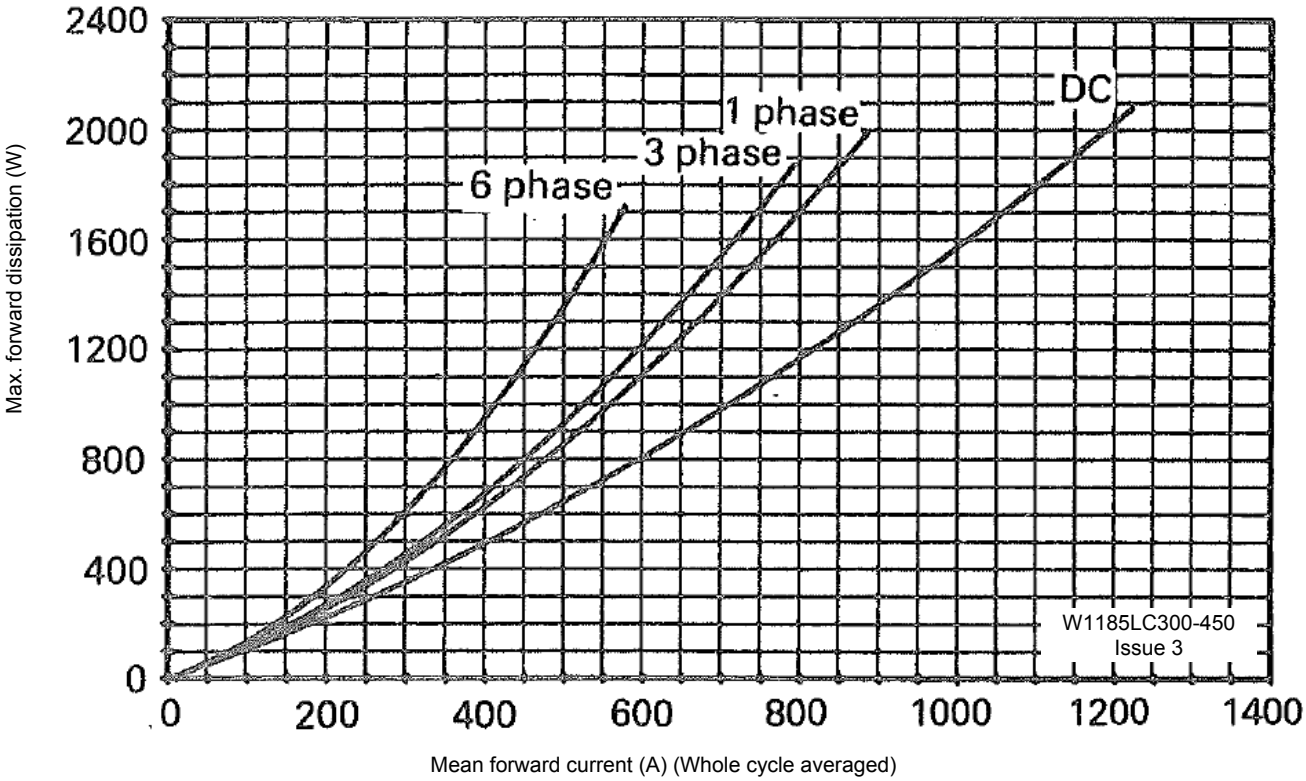


Figure 3 – Max. heatsink temperature vs. mean forward current – Double side cooled

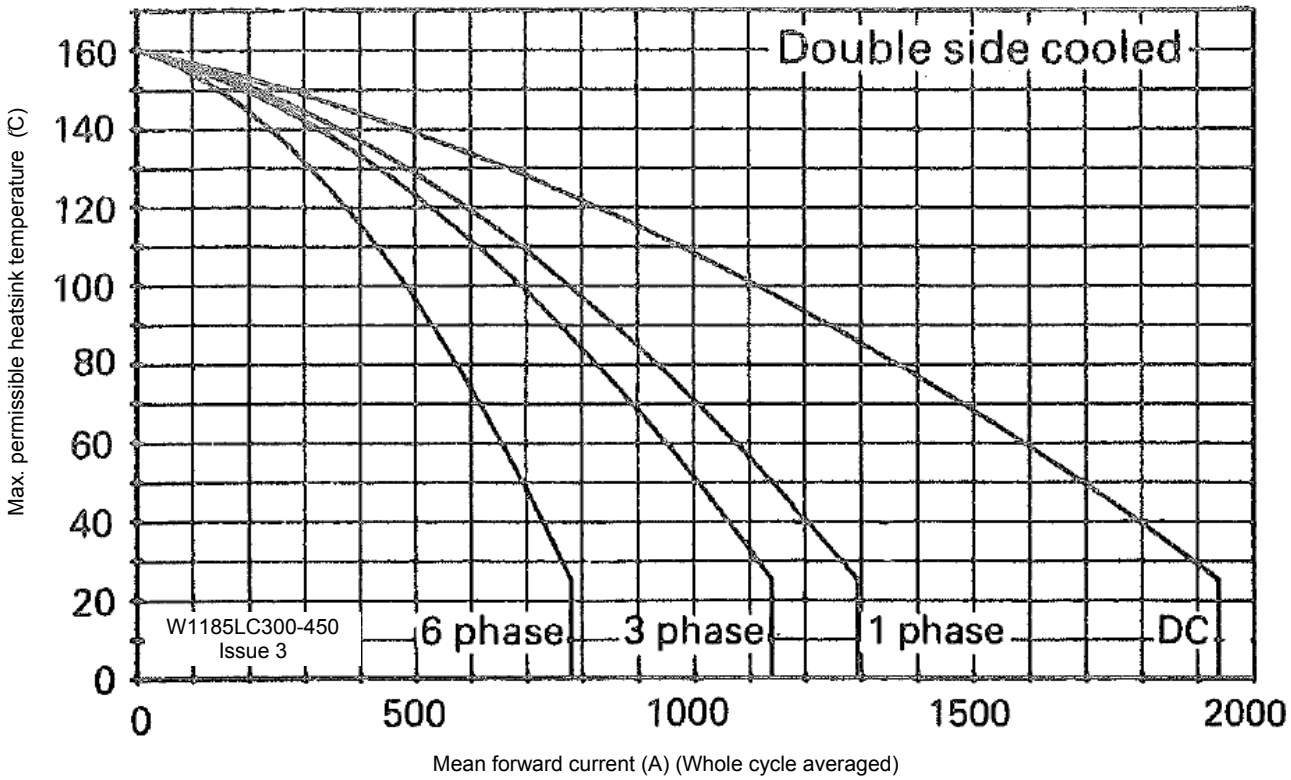


Figure 4 – Max. heatsink temperature vs. mean forward current – Single side cooled

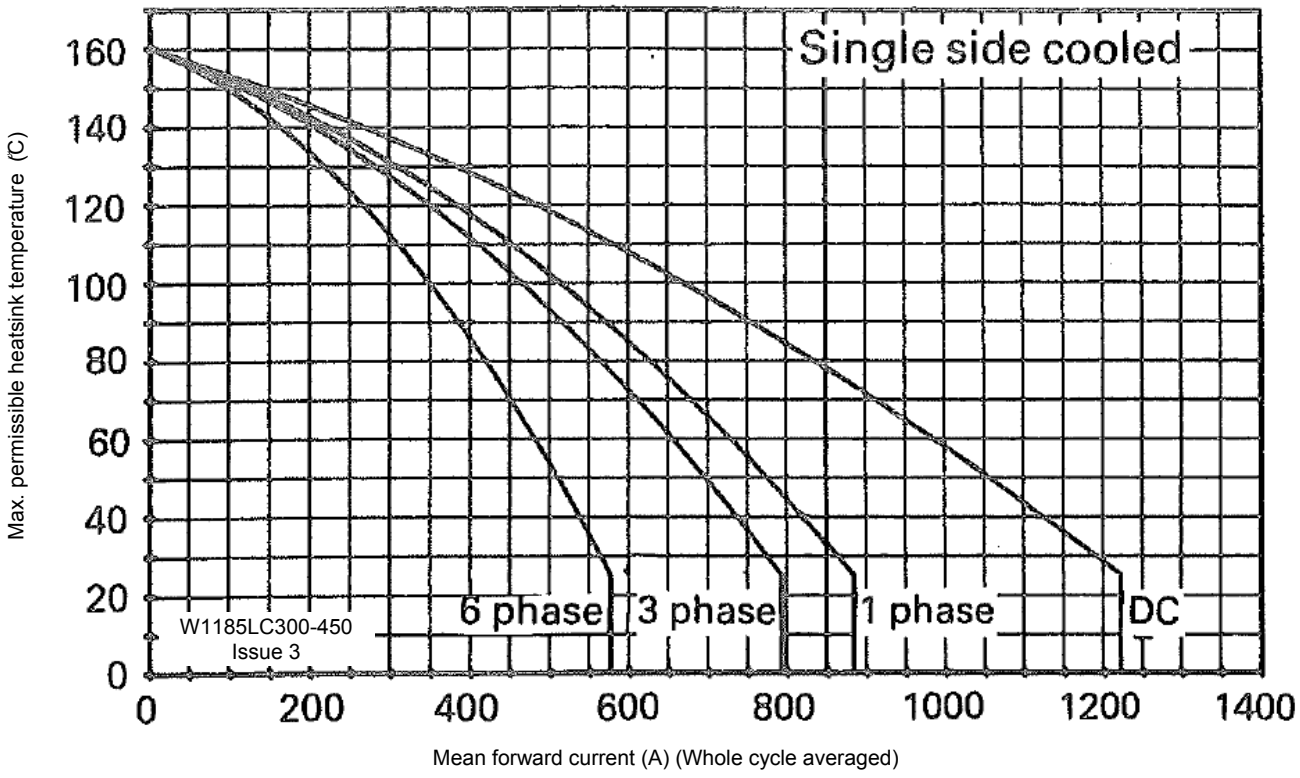


Figure 5 – Forward characteristics of limit device

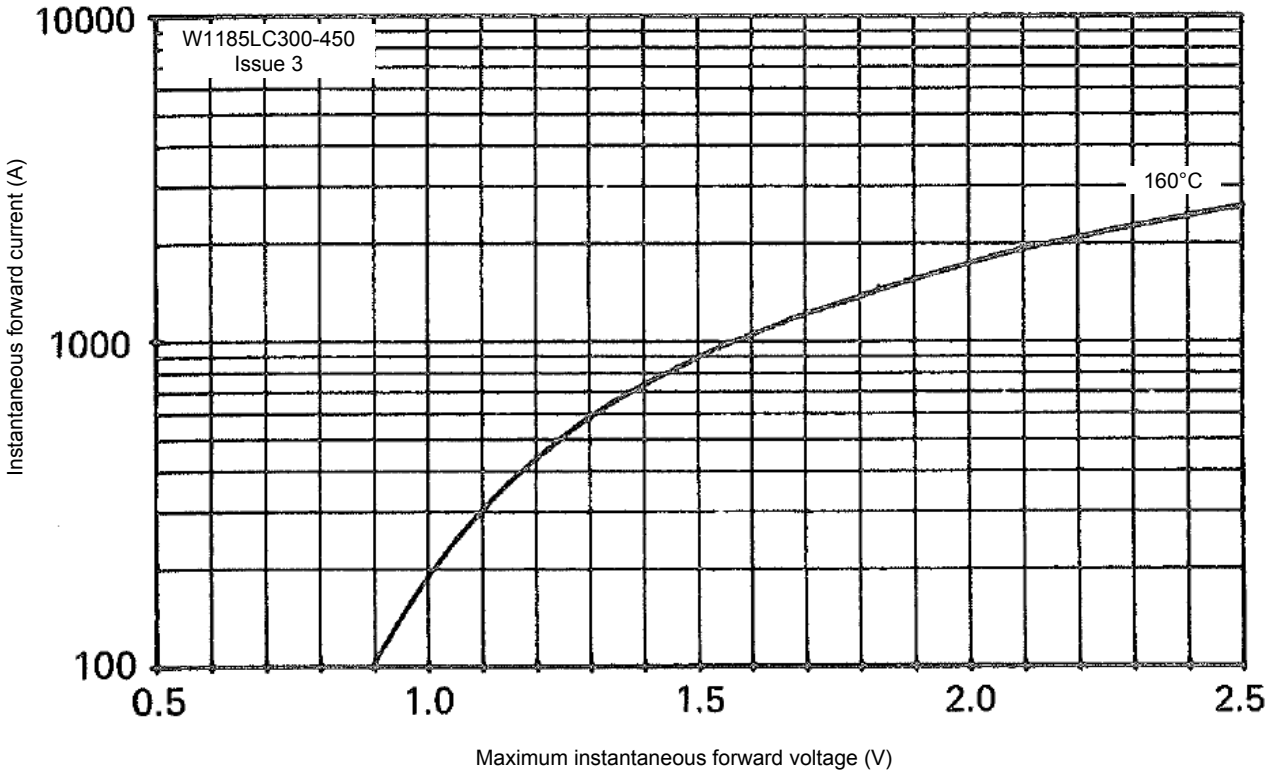


Figure 6 – Transient thermal impedance

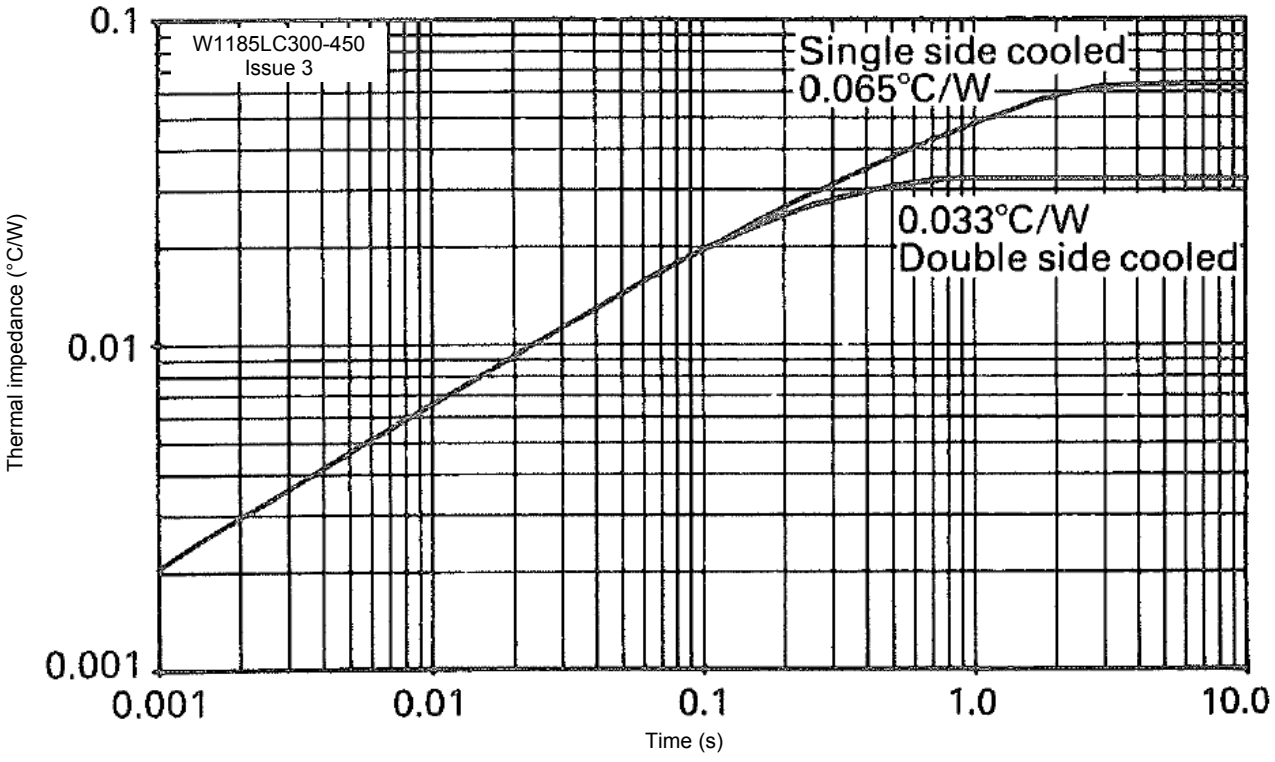
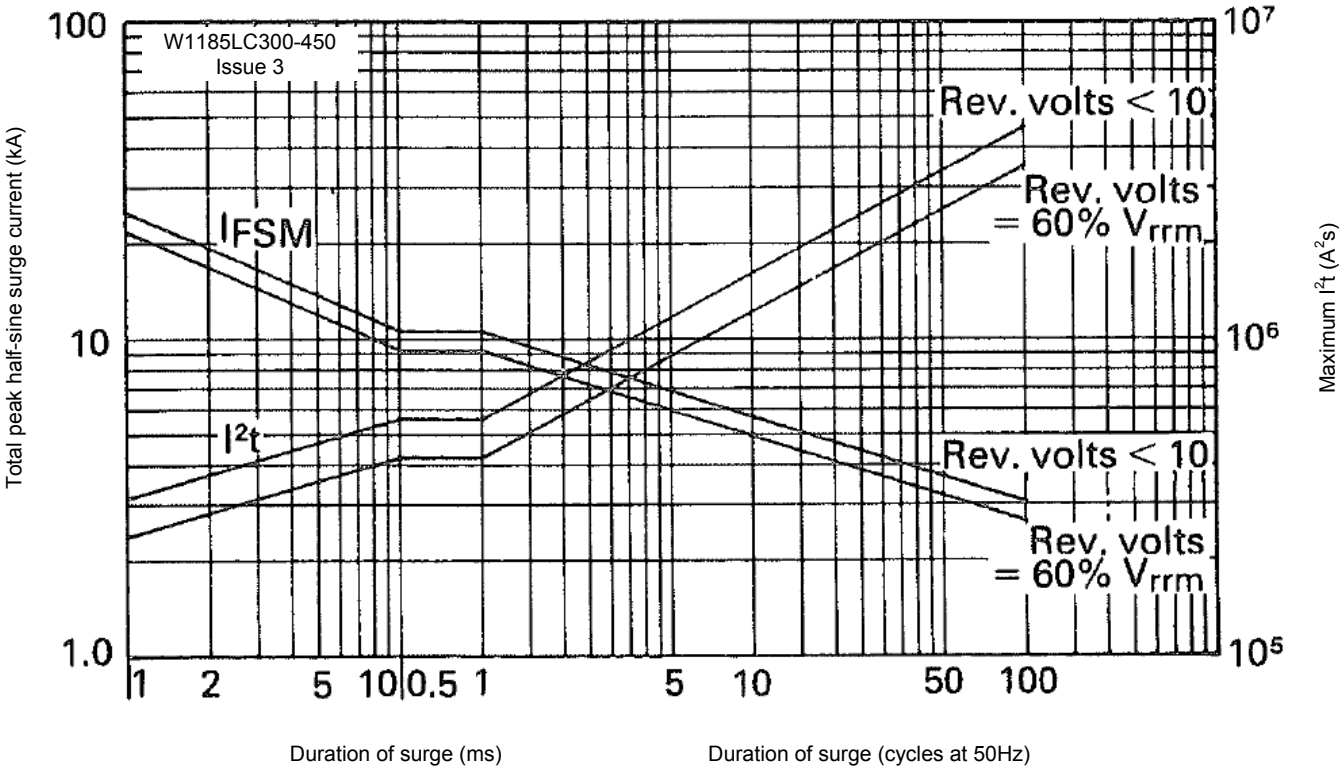
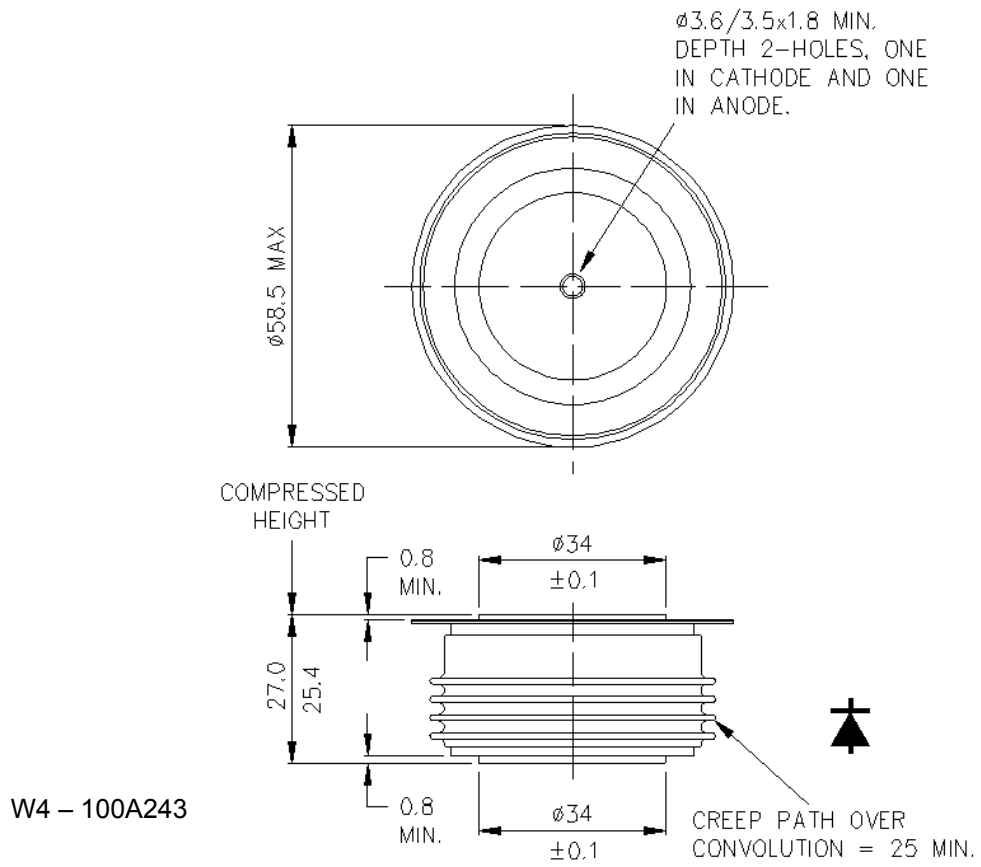


Figure 7 – Maximum non-repetitive surge current at initial junction temperature 160°C



Outline Drawing & Ordering Information



W4 – 100A243

ORDERING INFORMATION		(Please quote 10 digit code as below)	
W1185	**LC**	**♦♦**	**0**
Fixed Type Code	Fixed Outline Code	Voltage code V_{RRM}/100 30-45	Fixed code

Order code: W1185LC450 – 4500V V_{RRM}, 27mm clamp height capsule.

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