WESTCODE

An **IXYS** Company

Provisional Data

Rectifier Diode
Type W4713H#300 to W4713H#350
(Development Part No. Wx207H#300-350)

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	3000-3500	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	3100-3600	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_{sink}=55°C, (note 2)	4713	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 2)	3261	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 3)	1996	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_{sink}=25°C, (note 2)	8678	A
$I_{F(d.c.)}$	D.C. forward current, T_{sink}=25°C, (note 4)	7562	A
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{rm}=60%V_{RRM}, (note 5)	56.0	kA
I_{FSM2}	Peak non-repetitive surge t_p=10ms, V_{rm}≤10V, (note 5)	61.6	kA
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}=60%V_{RRM}, (note 5)	15.7×10^6	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}≤10V, (note 5)	19.0×10^6	A^2s
$T_{j\ op}$	Operating temperature range	-40 to +160	°C
T_{stg}	Storage temperature range	-40 to +160	°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. 160°C T_j initial.

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V_{FM}	Maximum peak forward voltage	-	-	1.35	I_{TM}=6000A	V
		-	-	1.50	I_{TM}=8000A	
V_{T0}	Threshold voltage	-	-	0.807	Range 2000A – 6000A	V
r_T	Slope resistance	-	-	0.09		mΩ
I_{RRM}	Peak reverse current	-	-	150	Rated V_{RRM}	mA
		-	-	150	Rated V_{RRM}, T_j=25°C	
Q_{rr}	Recovered charge	-	7500	8600	I_{TM}=2000A, t_p=2000µs, di/dt=10A/µs, V_r=100V	µC
Q_{ra}	Recovered charge, 50% chord	-	6000	-		µC
I_{rm}	Reverse recovery current	-	250	-		A
t_{rr}	Reverse recovery time, 50% chord	-	47	-		µs
R_{thJK}	Thermal resistance, junction to heatsink	-	-	0.012	Double side cooled	K/W
		-	-	0.024	Single side cooled	
F	Mounting force	36	-	44		kN
W_t	Weight	-	1.2	-	Outline option HL	kg
		-	1.5	-	Outline option HM	

Notes:-
1)   Unless otherwise indicated T_j=160°C.

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	1700
32	3200	3300	1800
34	3400	3500	1850
35	3500	3600	1875

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_0=0.807V, r_s=0.09mΩ,

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	0.0138	0.0132	0.0128	0.012
Square wave Single Side Cooled	0.0262	0.0255	0.0250	0.024
Sine wave Double Side Cooled	0.0134	0.0129	0.0123	
Sine wave Single Side Cooled	0.0257	0.0251	0.0244	

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 5 is represented in two ways;
(i)   the well established V_0 and r_s 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		160°C Coefficients
A	0.691735365	A	0.489564365
B	0.029196	B	0.025175
C	$3.500000E^{-05}$	C	$4.300000E^{-05}$
D	$2.664000E^{-03}$	D	$4.950000E^{-03}$

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	5.70694×10^{-3}	4.354047×10^{-3}	1.146543×10^{-3}	8.138617^{-4}
τ_p	1.486448	0.2518236	0.07993583	5.569284×10^{-3}

D.C. Single Side Cooled				
Term	1	2	3	4
r_p	0.0162195	5.732856×10^{-3}	1.48536×10^{-3}	7.633434×10^{-4}
τ_p	8.431941	0.3637194	0.0701921	4.56943×10^{-3}

Curves

Figure 1 – Forward characteristics of Limit device
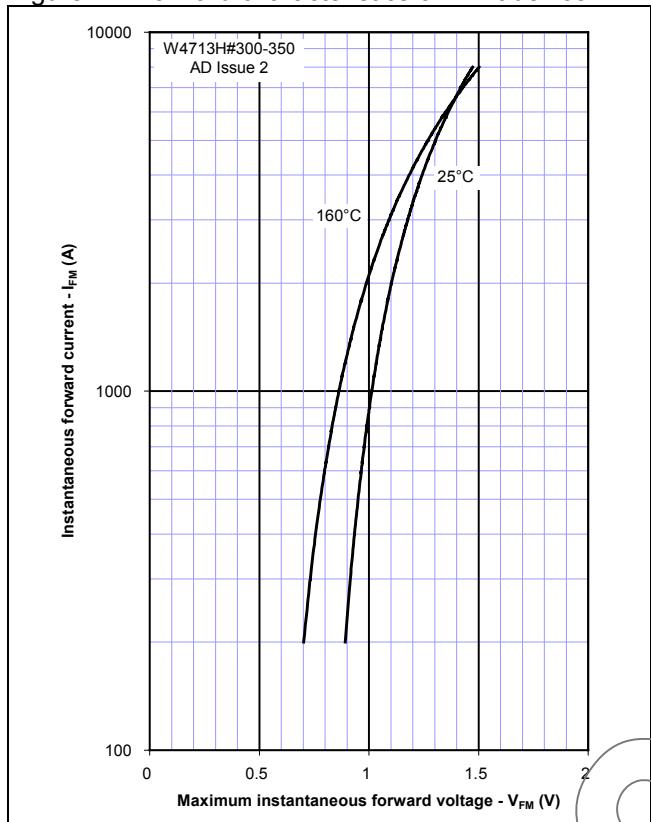
Figure 2 – Transient thermal impedance
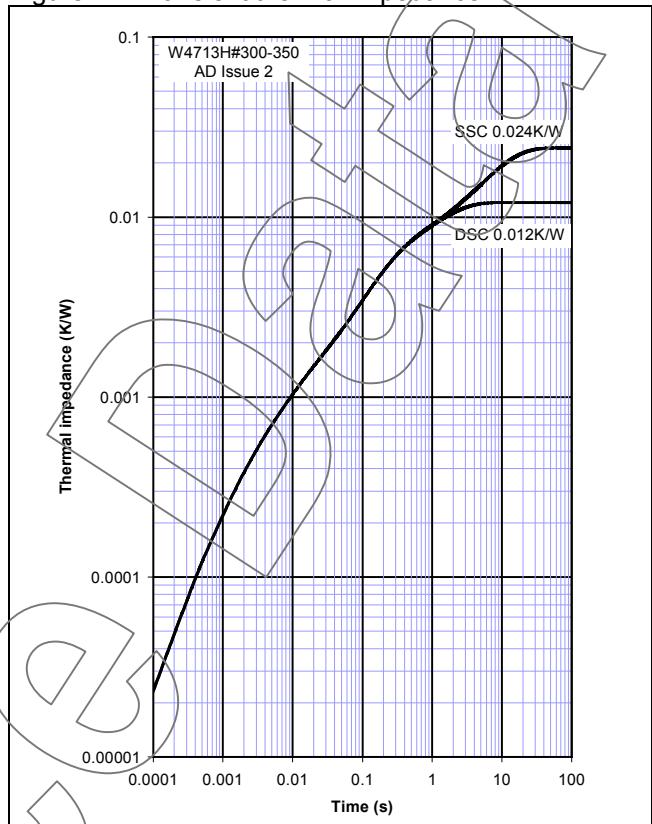

Figure 3 – Maximum surge Rating
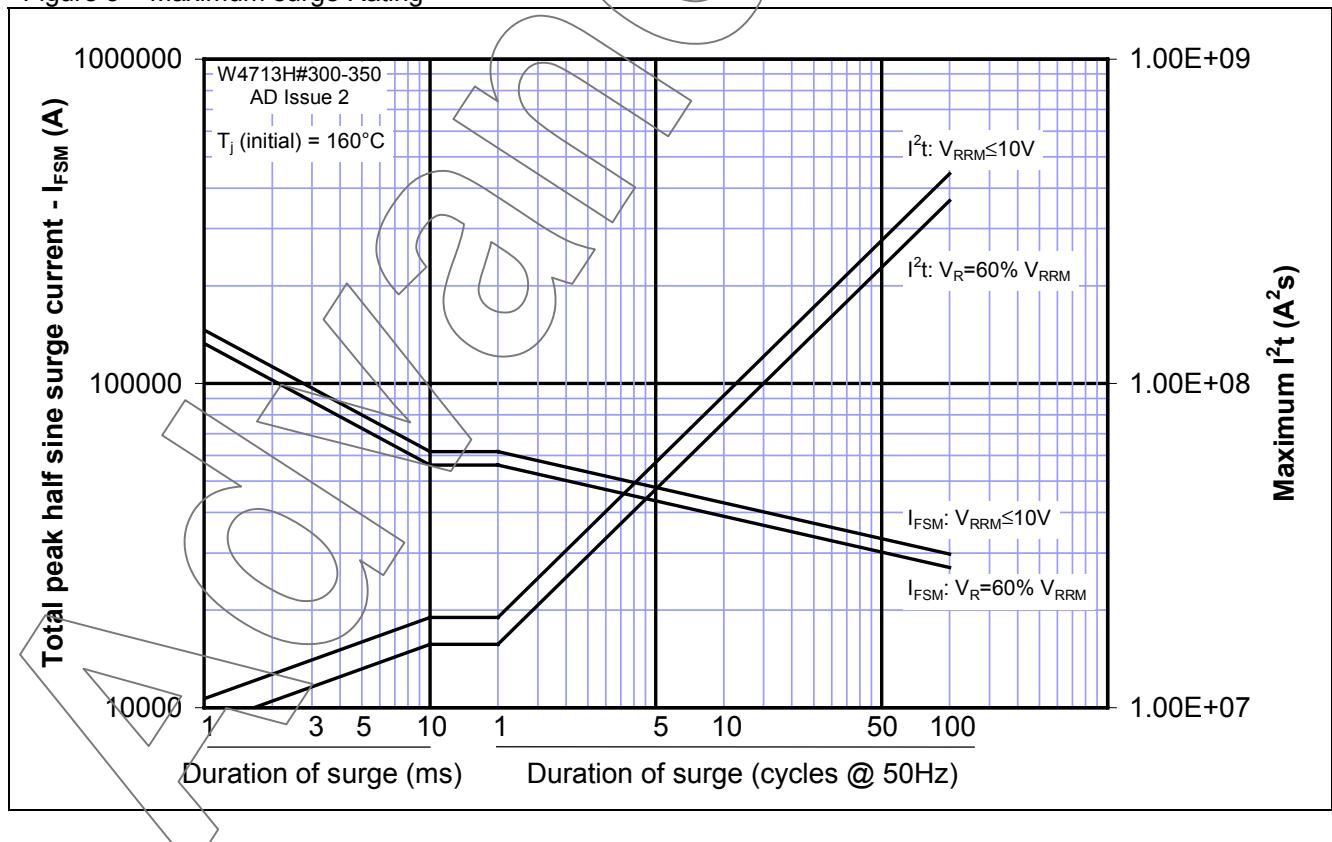
Figure 4 –Total recovered charge, Qrr
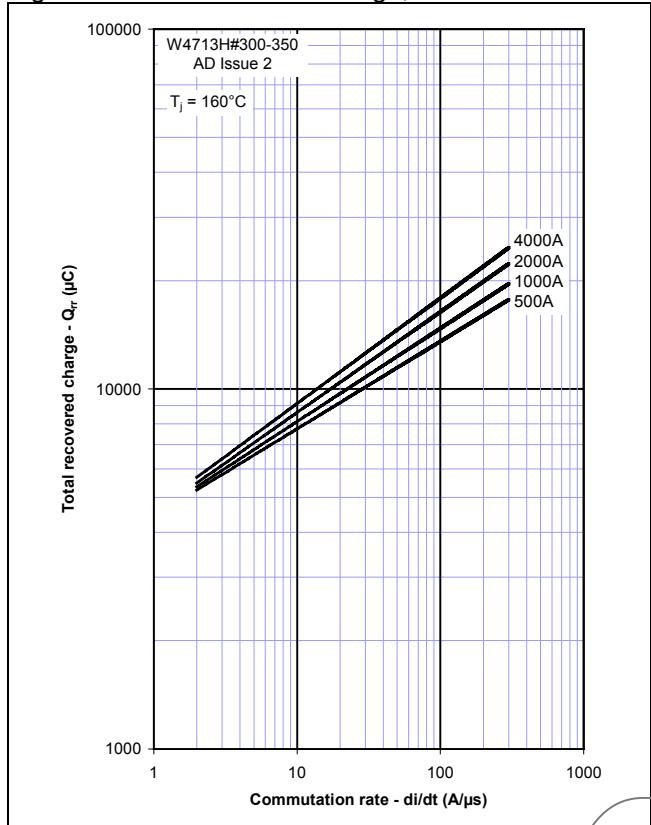
Figure 5 – Recovered charge, Qra (50% Chord)
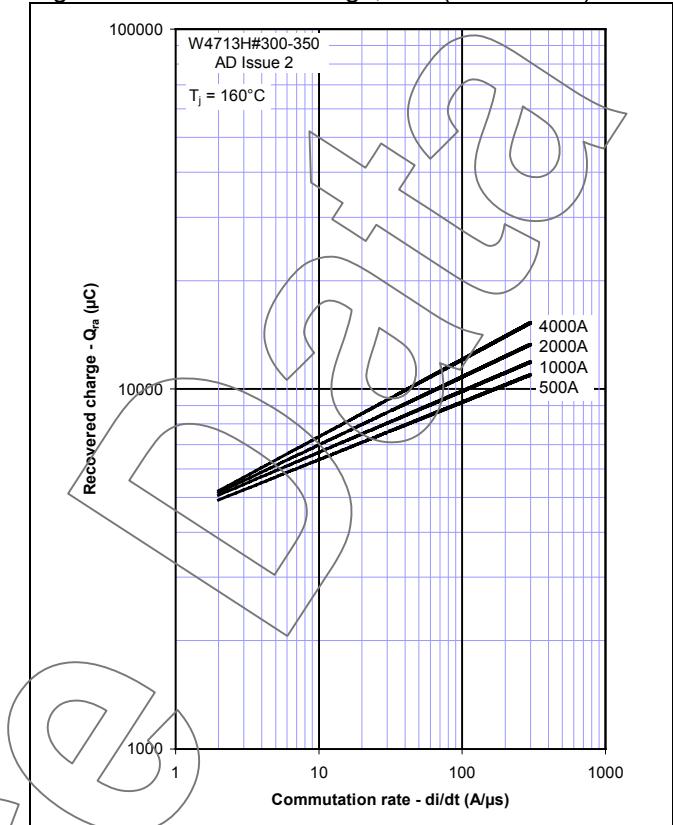

Figure 6 – Peak recovery current, Irr
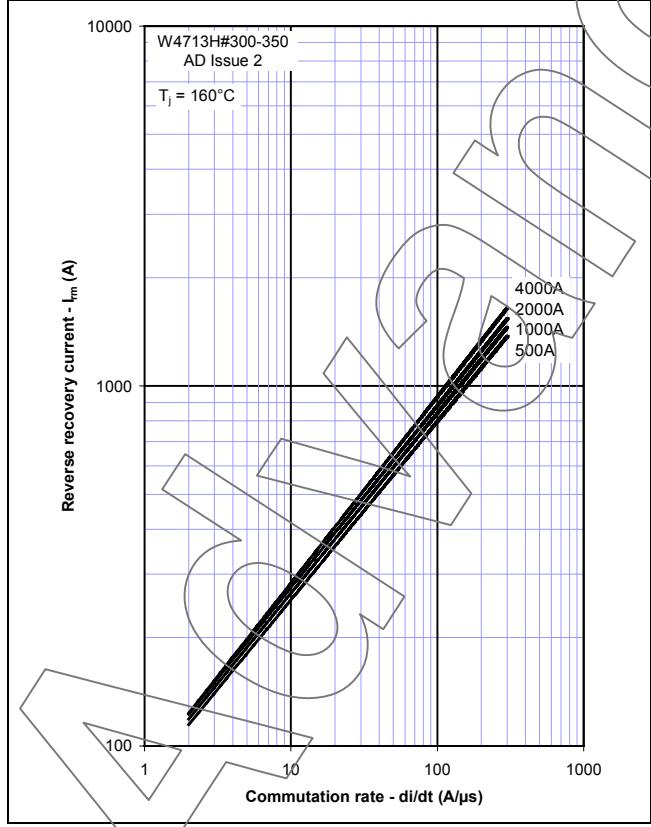

Figure 7 – Maximum recovery time, trr (50% Chord)
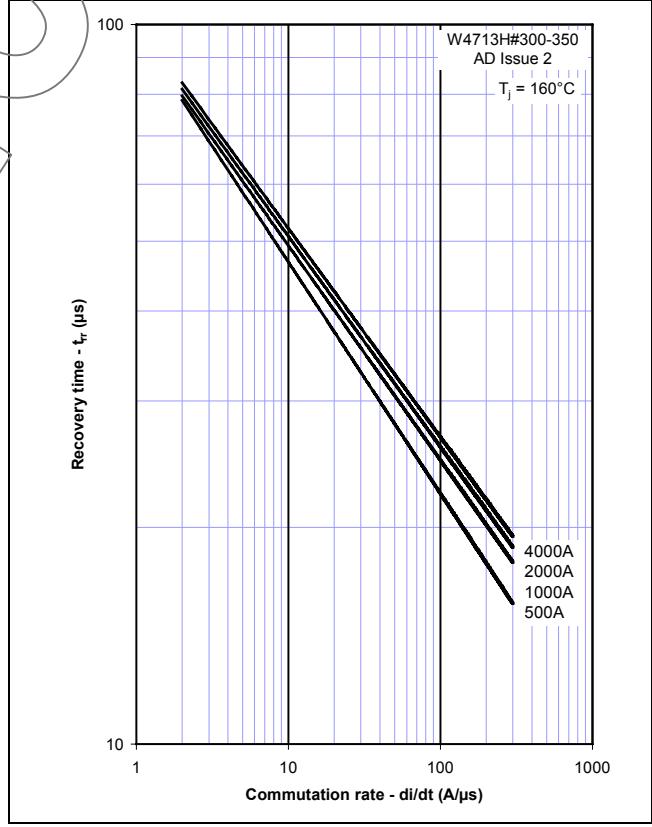
Figure 8 – Forward current vs. Power dissipation – Double Side Cooled
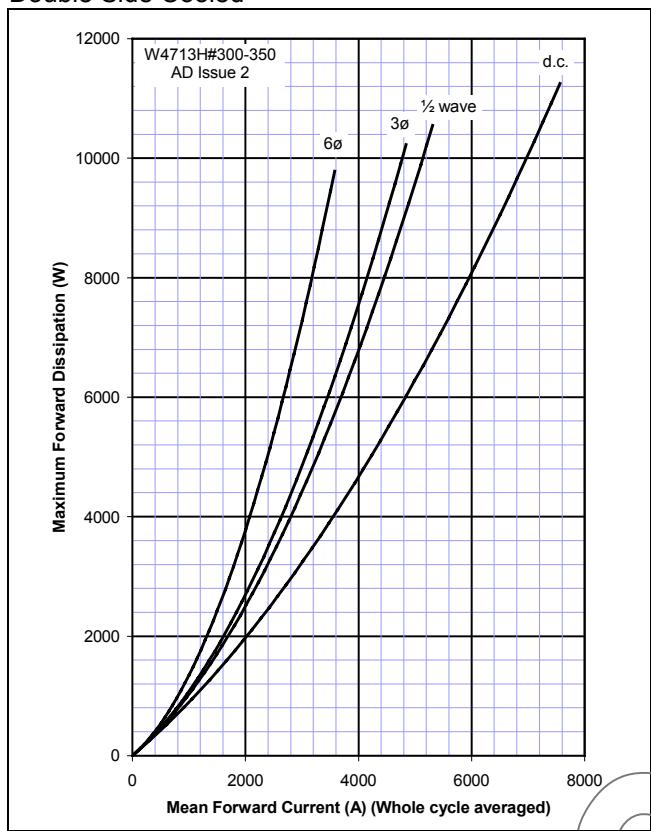
Figure 9 – Forward current vs. Heatsink temperature - Double Side Cooled
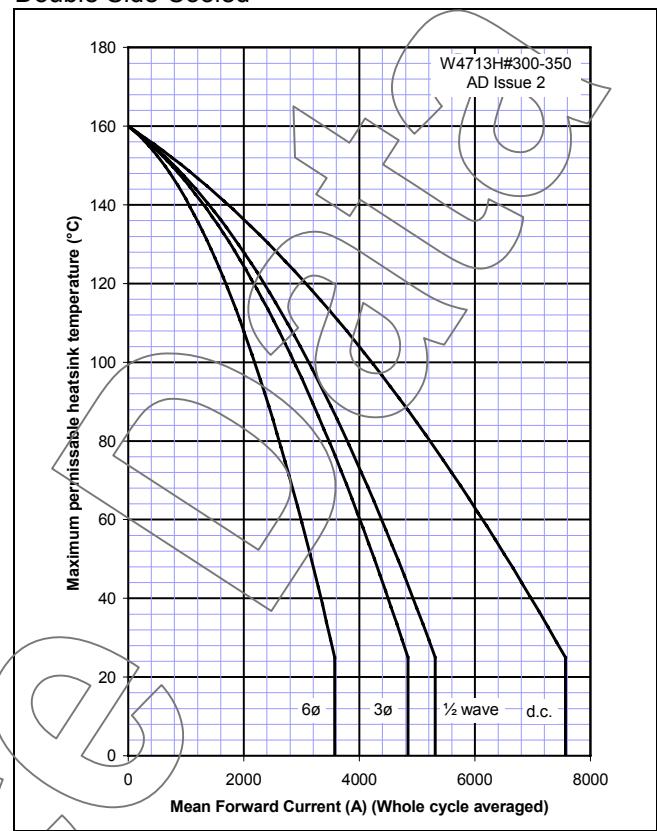
Figure 10 – Forward current vs. Power dissipation – Single Side Cooled
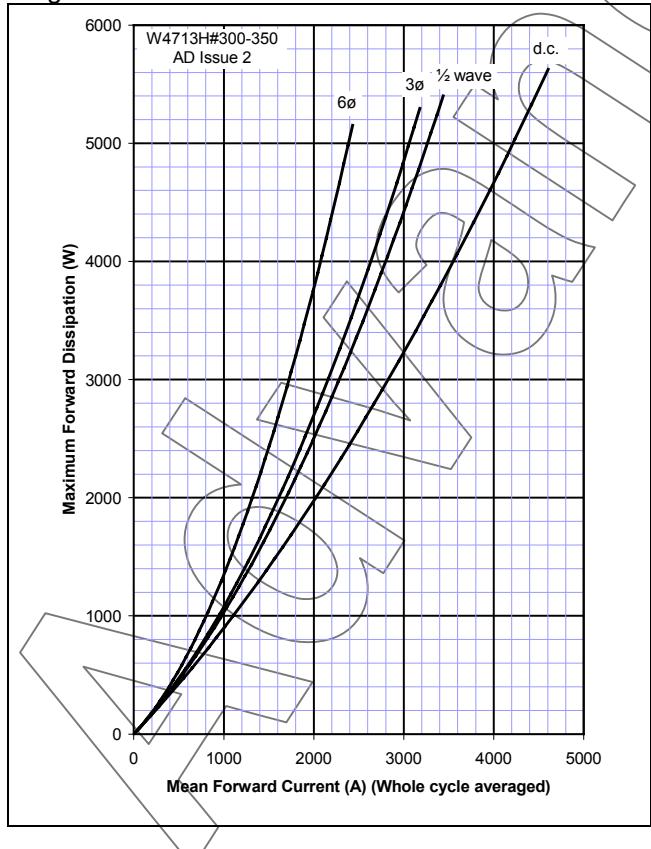
Figure 11 – Forward current vs. Heatsink temperature – Single Side Cooled
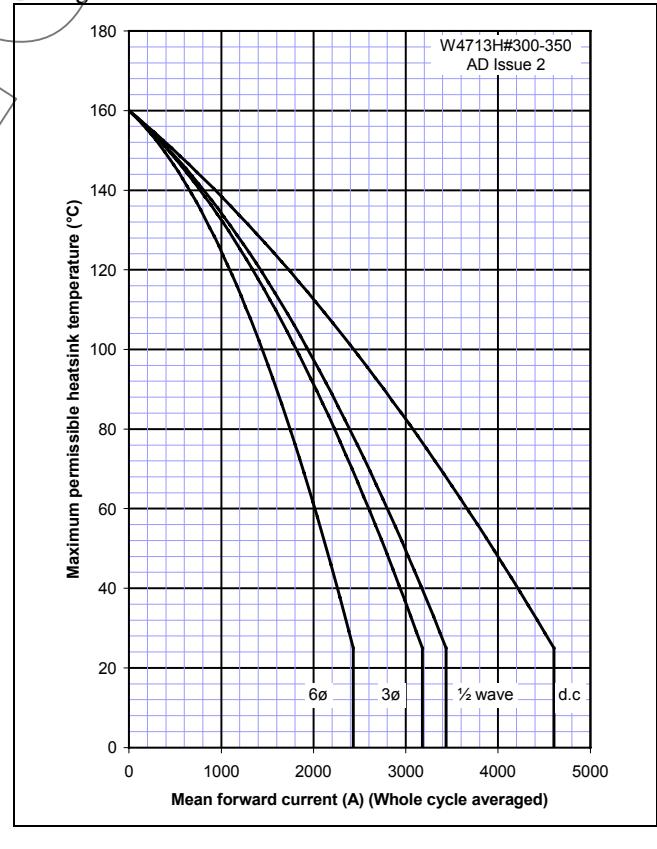
Outline Drawing & Ordering Information

Ø3.6/3.5x1.8 MIN.
DEPTH 2-HOLES, ONE
IN CATHODE AND ONE
IN ANODE.

Ø100 MAX

CREEP PATH OVER
CERAMIC = 18.5 MIN.

COMPRESSED
HEIGHT

0.8 MIN

26±0.5

Ø68 ± 0.1

0.8 MIN

Ø68 ± 0.1

100A361

Outline option HL

Ø3.6/3.5x1.8 MIN.
DEPTH 2-HOLES, ONE
IN CATHODE AND ONE
IN ANODE.

Ø100 MAX

COMPRESSED
HEIGHT

CREEP PATH OVER
CERAMIC = 25.4 MIN.

0.8 MIN

Ø68 ± 0.1

33±0.5

0.8 MIN

Ø68 ± 0.1

100A360

Outline option HM
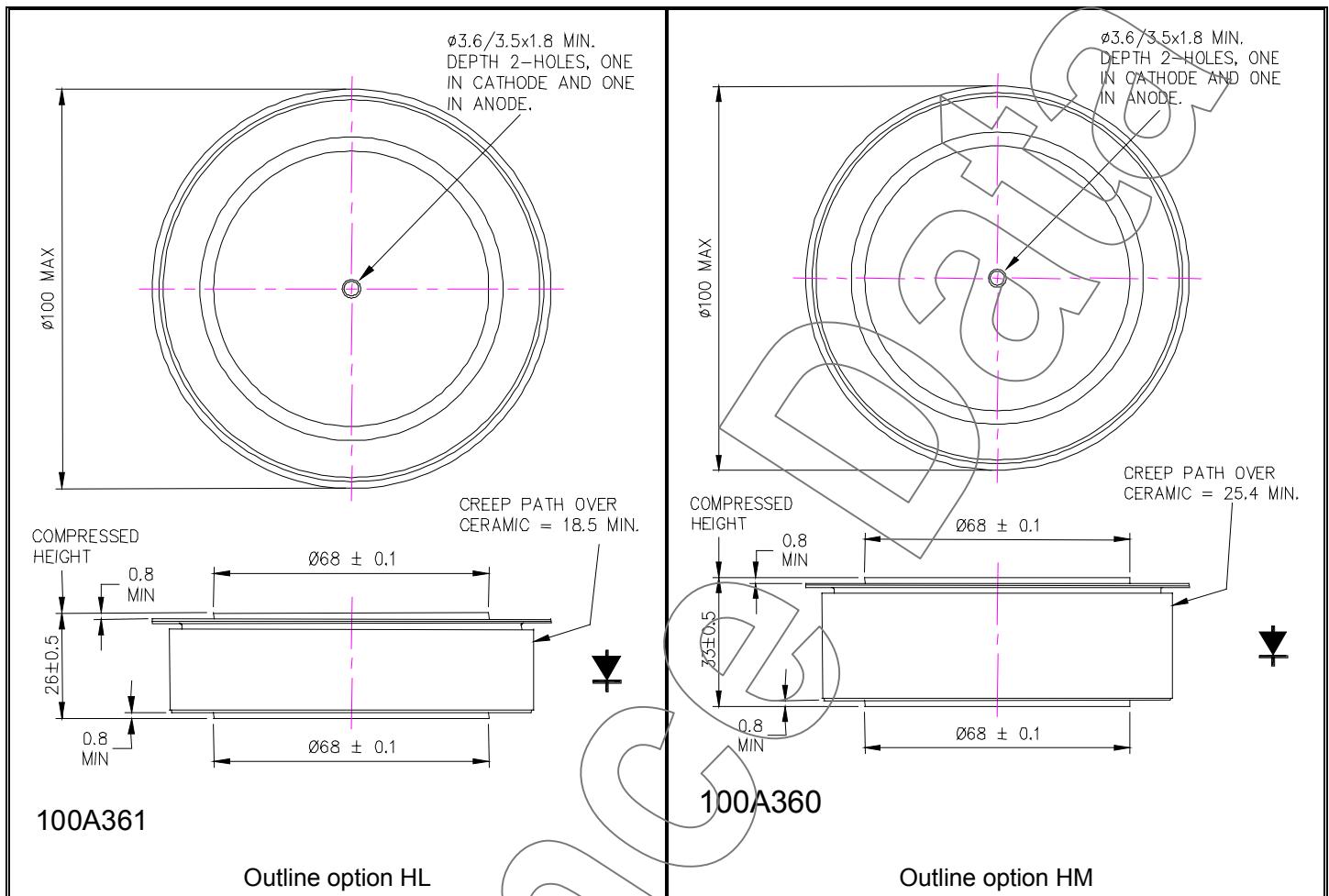
ORDERING INFORMATION		(Please quote 10 digit code as below)	
W4713	**H#**	**♦ ♦**	**0**
Fixed Type Code	Fixed outline code HL = 26mm Clamp height HM = 33mm Clamp height	Voltage code $V_{RRM}/100$ 30-35	Fixed code
Typical order code: W4713HL340 – 3400V V_{RRM}, 26mm clamp height capsule.			