Date:- 07 August 2012

Data Sheet Issue:- 2

Rectifier Diode

Types W2058LC100 to W2058LC140

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	1000-1400	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	1100-1500	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{F(AV)M}$	Maximum average forward current, T_{sink}=55°C, (note 2)	2058	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 2)	1508	A
$I_{F(AV)M}$	Maximum average forward current. T_{sink}=100°C, (note 3)	924	A
$I_{F(RMS)M}$	Nominal RMS forward current, T_{sink}=25°C, (note 2)	3726	A
$I_{F(d.c.)}$	D.C. forward current, T_{sink}=25°C, (note 4)	3225	A
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{rm}=60%V_{RRM}, (note 5)	19.5	kA
I_{FSM2}	Peak non-repetitive surge t_p=10ms, $V_{rm}\leq$10V, (note 5)	21.5	kA
I^2t	I^2t capacity for fusing t_p=10ms, V_{rm}=60%V_{RRM}, (note 5)	1.9×10^6	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, $V_{rm}\leq$10V, (note 5)	2.3×10^6	A^2s
$T_{j\ op}$	Operating temperature range	-40 to +175	°C
T_{stg}	Storage temperature range	-40 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_j initial.

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V_{FM}	Maximum peak forward voltage	-	-	1.63	I_{TM}=4400A	V
V_{FM}	Maximum peak forward voltage	-	-	1.8	I_{TM}=6175A	V
V_{T0}	Threshold voltage	-	-	0.79		V
r_T	Slope resistance	-	-	0.192		mΩ
I_{RRM}	Peak reverse current	-	-	30	Rated V_{RRM}	mA
I_{RRM}	Peak reverse current	-	-	30	Rated V_{RRM}, T_j=25°C	mA
Q_{rr}	Recovered charge	-	850	-	I_{TM}=1000A, t_p=1000µs, di/dt=10A/µs, V_r=50V	µC
Q_{ra}	Recovered charge, 50% Chord	-	600	850		µC
I_{rr}	Reverse recovery current	-	100	-		A
t_{rr}	Reverse recovery time	-	12	-		µs
R_{thJK}	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_t	Weight	-	340	-		g

Notes:-
1) Unless otherwise indicated T_j=175°C.

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	V_{DRM} V_{DSM} V_{RRM} V	V_{RSM} V	V_D V_R DC V
10	1000	1100	700
12	1200	1300	810
14	1400	1500	930

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}=0.79V, r_T=0.192mΩ,

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 Single Side Cooled	0.0753	0.0711	0.0687	0.0646
Sine wave Double Side Cooled	0.0397	0.0350	0.0313	
Sine wave Single 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 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
A	1.09345181	0.890075253
B	0.03122052	0.02367562
C	4.872×10^{-5}	5.14774×10^{-5}
D	1.8884×10^{-3}	4.745804×10^{-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. 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}

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}

6.0 Reverse recovery ratings

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

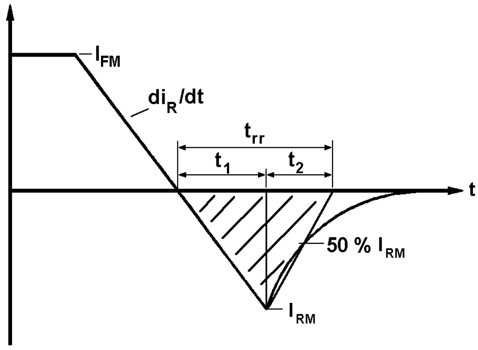


Fig. 1

(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

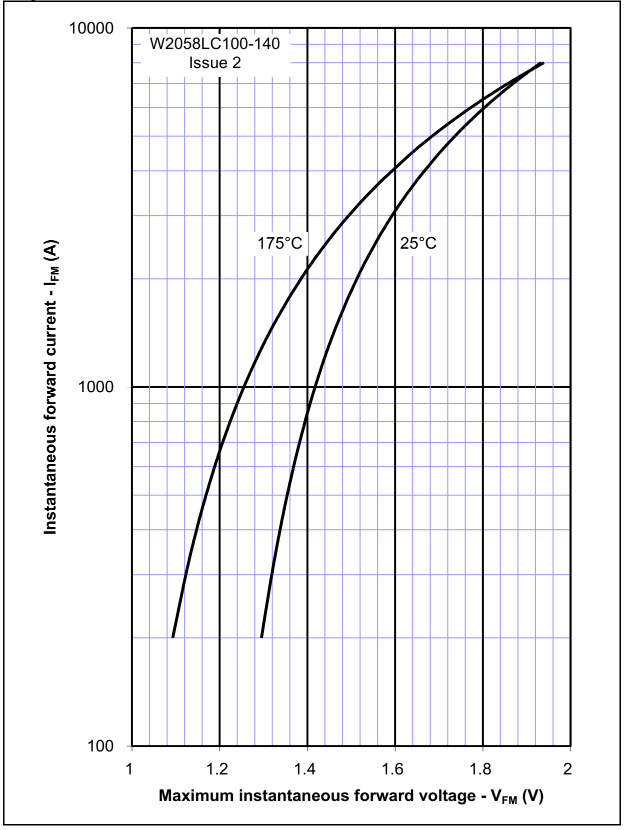


Figure 2 - Transient thermal impedance

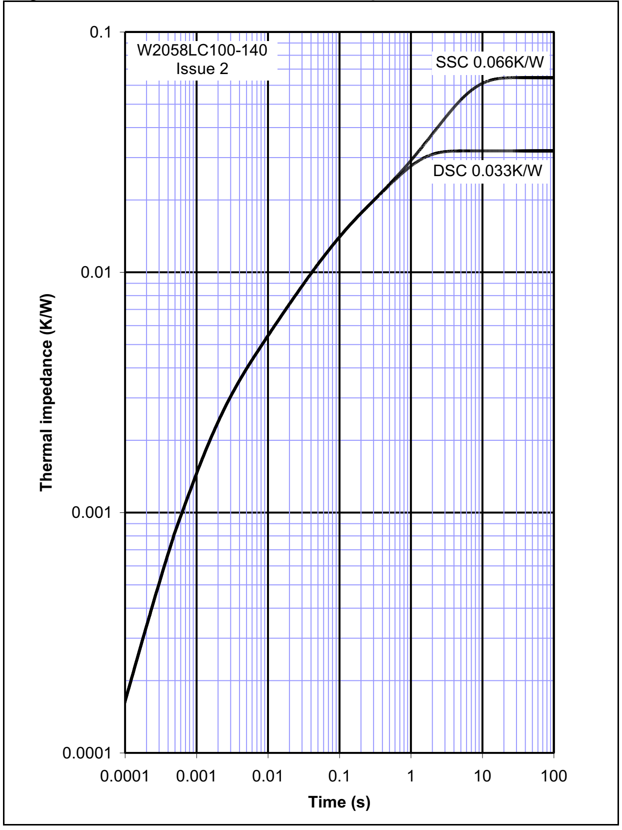


Figure 3 - Maximum surge Rating

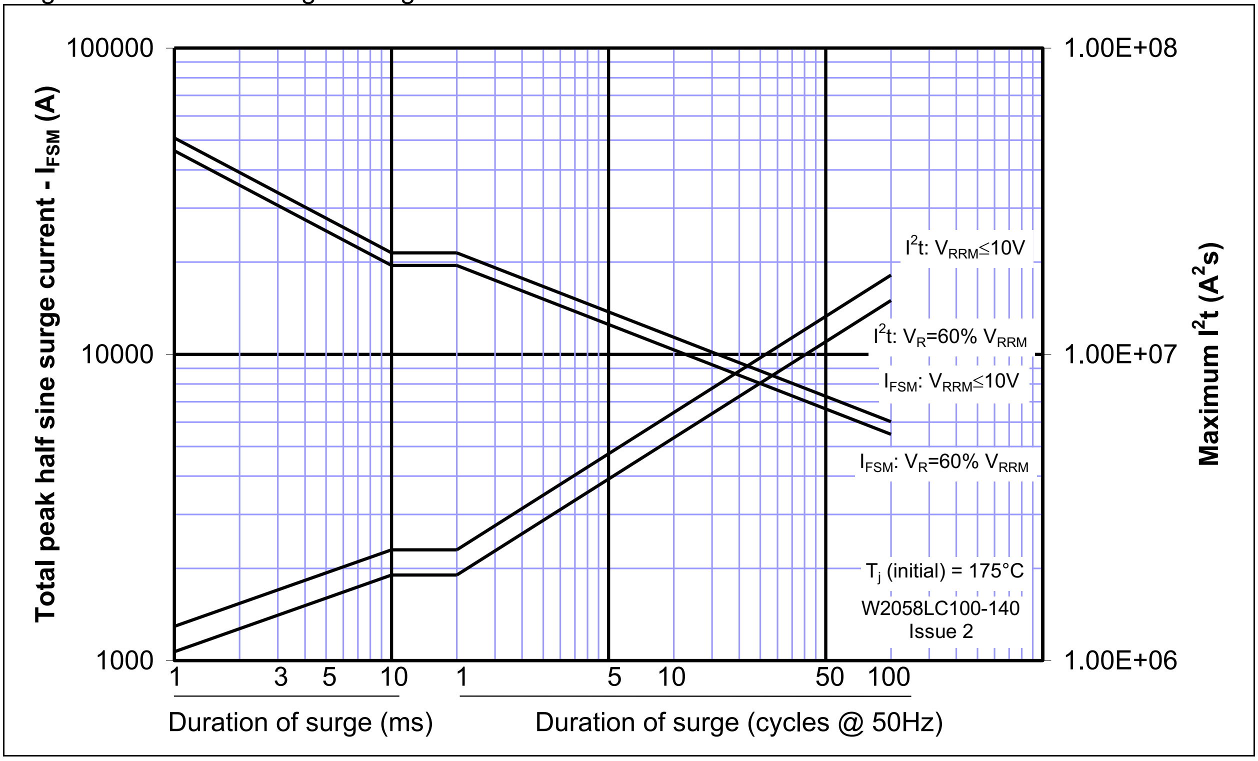


Figure 4 - Total recovered charge, Q_{rr}

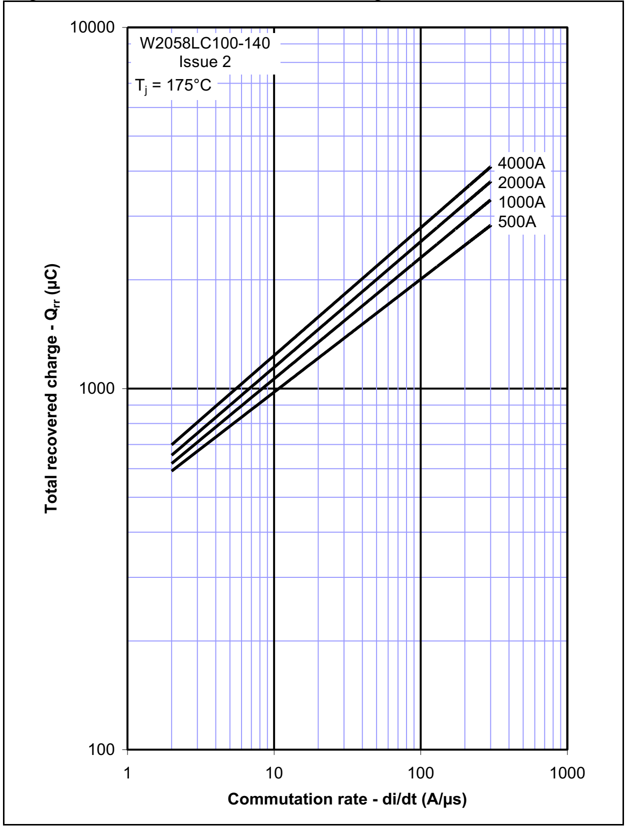


Figure 5 - Recovered charge, Q_{ra} (50% chord)

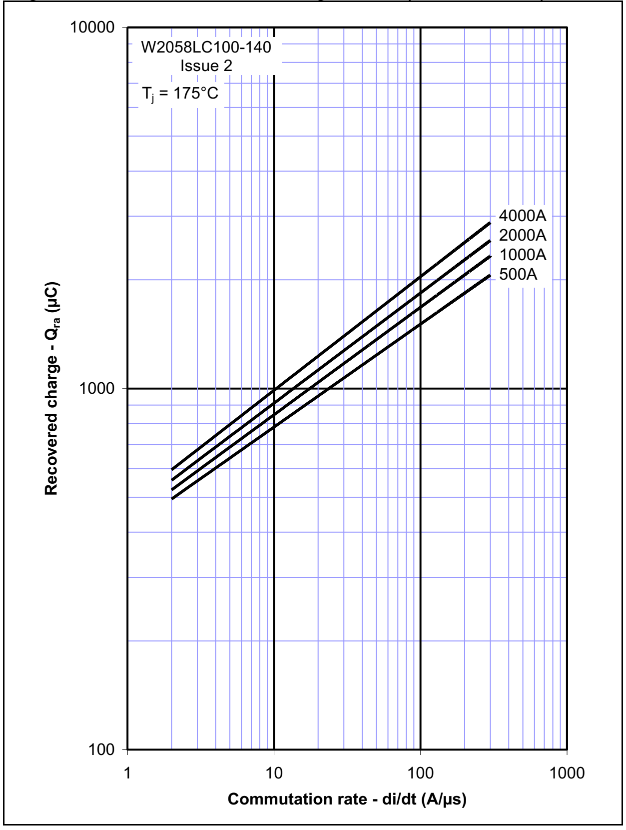


Figure 6 - Peak reverse recovery current, I_{rm}

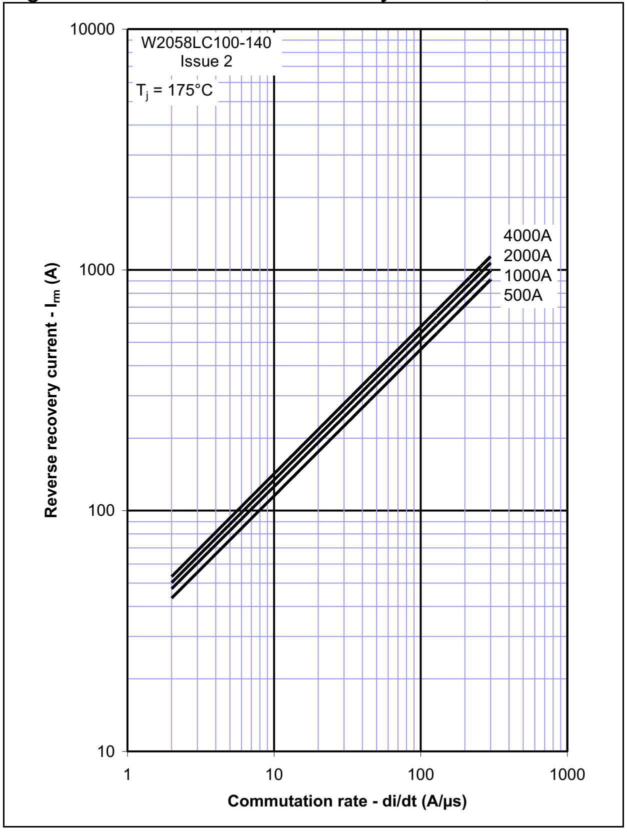


Figure 7 - Maximum recovery time, t_{rr} (50% chord)

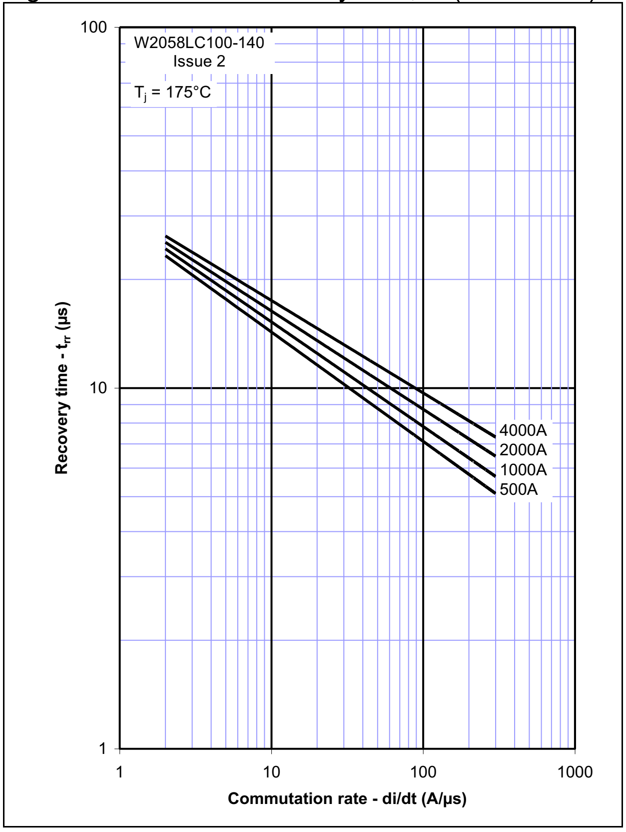


Figure 8 – Forward current vs. Power dissipation – Double Side Cooled

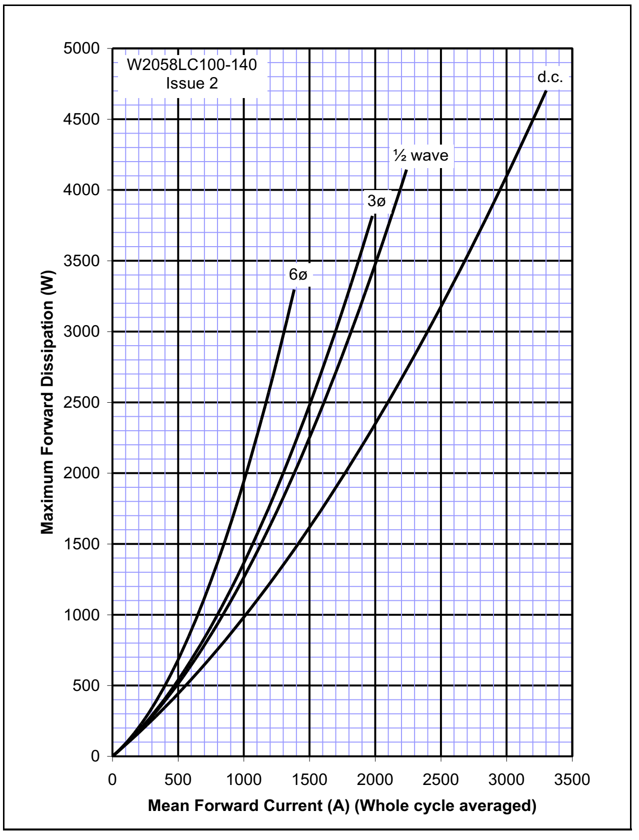


Figure 9 – Forward current vs. Heatsink temperature - Double Side Cooled

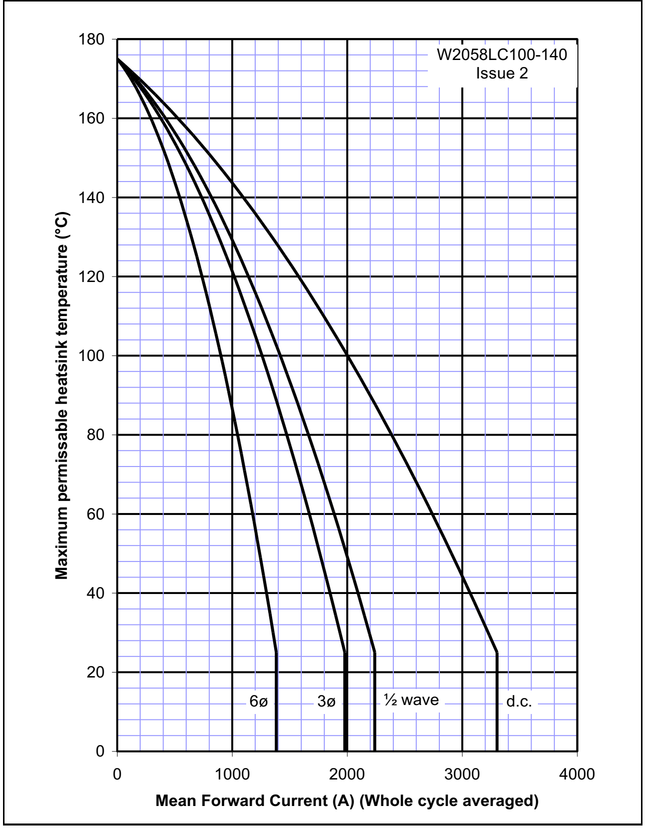


Figure 10 – Forward current vs. Power dissipation – Single Side Cooled

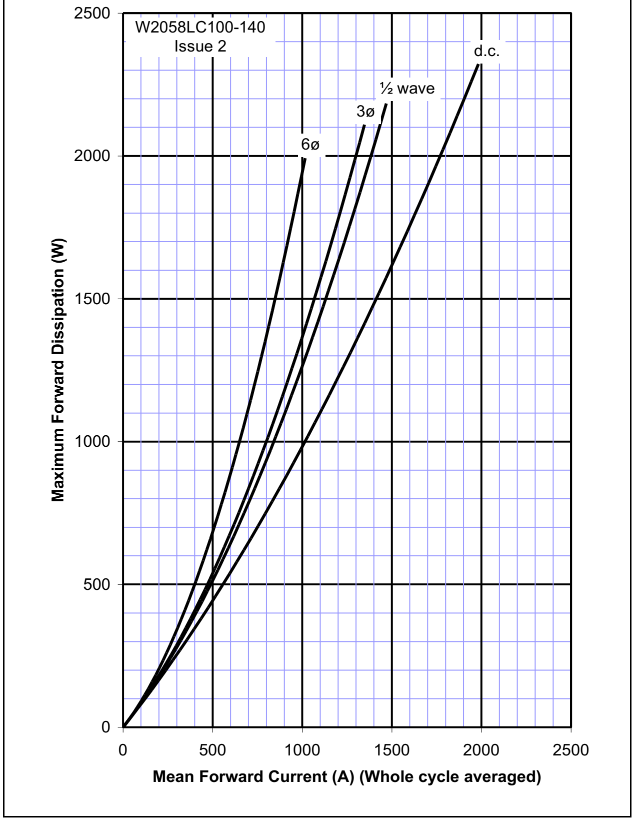
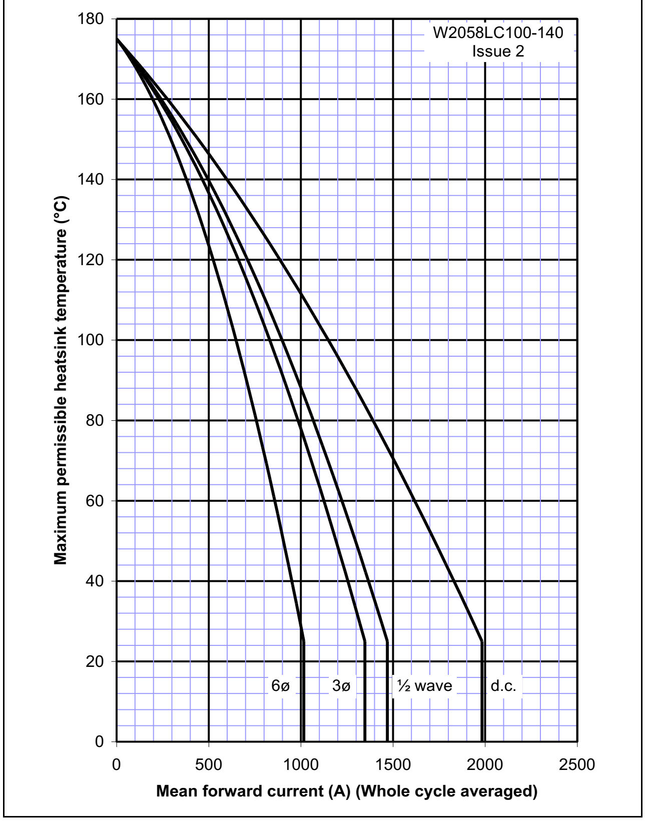
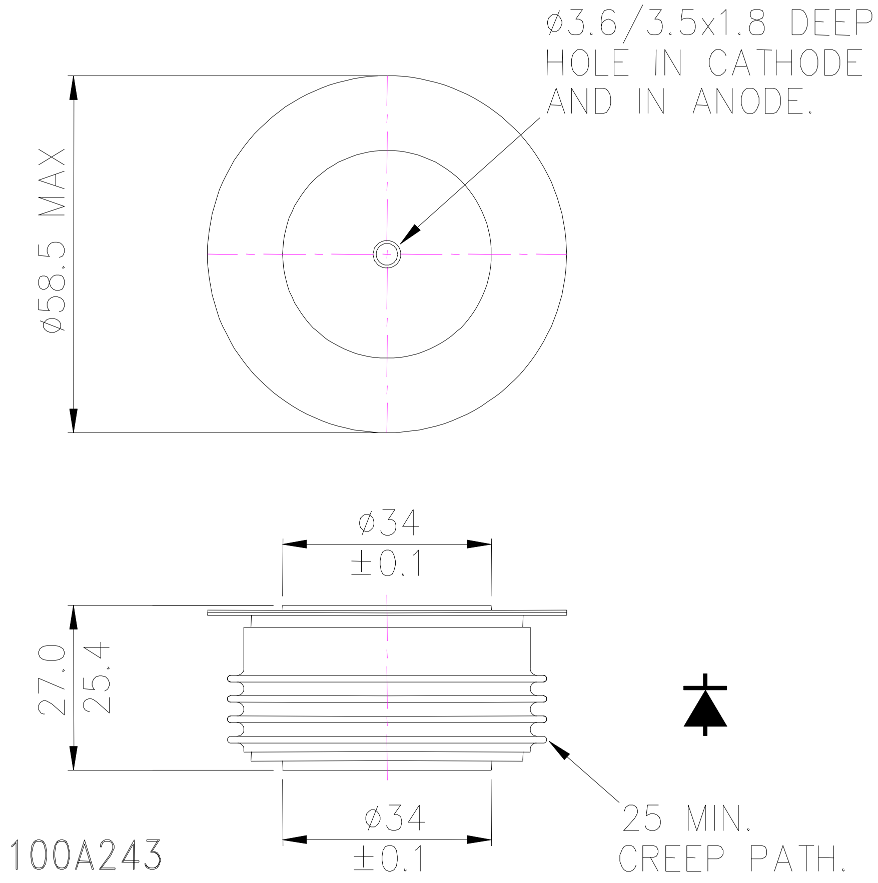


Figure 11 – Forward current vs. Heatsink temperature – Single Side Cooled



Outline Drawing & Ordering Information



ORDERING INFORMATION (Please quote 10 digit code as below)

W2058	LC	♦♦	0
Fixed Type Code	Fixed outline code	Voltage code V_{DRM}/100 10-14	Fixed turn-off time code

Order code: W2058LC140 – 1400V V_{DRM}, V_{RRM}, 27mm clamp height capsule.

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