

Date:- 12th August, 2014

Data Sheet Issue:- 2

# **Rectifier Diode**

# Types W5282Z#240 to W5282Z#300

Previous Type No.: SW20-30#XC21C

#### **Absolute Maximum Ratings**

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
$V_{RRM}$	Repetitive peak reverse voltage, (note 1)	2400-3000	V
V <sub>RSM</sub>	Non-repetitive peak reverse voltage, (note 1)	2500-3100	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
I <sub>F(AV)M</sub>	Maximum average forward current, T <sub>sink</sub> =55°C, (note 2)	5282	А
I <sub>F(AV)M</sub>	Maximum average forward current. T <sub>sink</sub> =100°C, (note 2)	3556	Α
I <sub>F(RMS)M</sub>	Nominal RMS forward current, T <sub>sink</sub> =25°C, (note 2)	9830	Α
I <sub>F(d.c.)</sub>	D.C. forward current, T <sub>sink</sub> =25°C, (note 3)	8207	Α
I <sub>FSM</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>rm</sub> =60%V <sub>RRM</sub> , (note 4)	60	kA
I <sub>FSM2</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>rm</sub> ≤10V, (note 4)	67	kA
l <sup>2</sup> t	I <sup>2</sup> t capacity for fusing t <sub>p</sub> =10ms, V <sub>rm</sub> =60%V <sub>RRM</sub> , (note 4)	18.0×10 <sup>6</sup>	A <sup>2</sup> s
l <sup>2</sup> t	I²t capacity for fusing t <sub>p</sub> =10ms, V <sub>rm</sub> ≤10V, (note 4)	22.4×10 <sup>6</sup>	A <sup>2</sup> s
T <sub>j op</sub>	Operating temperature range	-55 to +160	°C
T <sub>stg</sub>	Storage temperature range	-55 to +190	°C

#### Notes:-

- 1) De-rating factor of 0.13% per  $^{\circ}$ C is applicable for  $T_{j}$  below 25 $^{\circ}$ C.
- 2) Double side cooled, single phase; 50Hz, 180° half-sinewave.
- 3) Double side cooled.
- 4) Half-sinewave, 160°C T<sub>j</sub> initial.



## **Characteristics**

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V <sub>FM</sub>	Maximum peak forward voltage	-	-	1.35	I <sub>FM</sub> =6000A	V
V <sub>T0</sub>	Threshold voltage	-	-	0.97		V
r⊤	Slope resistance	-	-	0.064		mΩ
I <sub>RRM</sub>	Peak reverse current	-	-	100	Rated V <sub>RRM</sub>	mA
D	Thermal registeres impetion to be tainly	-	-	0.011	Double side cooled	K/W
R <sub>thJK</sub>	Thermal resistance, junction to heatsink	-	-	0.022	Single side cooled	K/W
F	Mounting force	27	-	47	Note 2	kN
$W_t$	Weight		1.7			kg

#### Notes:-

- 1) Unless otherwise indicated T<sub>j</sub>=160°C.
- 2) For other clamp forces, please consult factory.



#### Notes on Ratings and Characteristics

#### 1.0 Voltage Grade Table

Voltage Grade	V <sub>RRM</sub> V	Vrsm V	V <sub>R</sub> DC V
24	2400	2500	1450
30	3000	3100	1750

#### 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<sub>i</sub> 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

$$I_{AV} = \frac{-V_{T0} + \sqrt{{V_{T0}}^2 + 4 \cdot \textit{ff}}^2 \cdot \textit{r}_T \cdot W_{AV}}{2 \cdot \textit{ff}}^2 \cdot \textit{r}_T} \qquad \text{and:} \qquad W_{AV} = \frac{\Delta T}{R_{\textit{th}}} \\ \Delta T = T_{\textit{j} \max} - T_{\textit{K}}$$

Where  $V_{T0}$ =0.97V,  $r_T$ =0.064 $m\Omega$ ,

 $R_{th}$  = 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	0.0144	0.0132	0.0126	0.0116		
Square wave Cathode Side Cooled	0.0262	0.0251	0.0244	0.0235		
Sine wave Double Side Cooled	0.0133	0.0124	0.0115			
Sine wave Cathode Side Cooled	0.0253	0.0244	0.0234			

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<sub>F</sub> using ABCD Coefficients

The forward characteristic I<sub>F</sub> vs. V<sub>F</sub>, 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						
Α	0.4889186					
В	0.08510914					
С	0.07490114×10 <sup>-3</sup>					
D	-4.150444×10 <sup>-3</sup>					



#### 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.

 $\tau_p$  = 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			
$r_{\rho}$	0.01551	2.7827×10 <sup>-3</sup>	4.2105×10 <sup>-3</sup>	0.9443×10 <sup>-3</sup>			
$ au_{ ho}$	10.04275	1.783567	0.2231307	3.428×10 <sup>-3</sup>			

D.C. Double Side Cooled						
Term	1	2	3	4	5	
$r_p$	6.4176×10 <sup>-3</sup>	2.7472×10 <sup>-3</sup>	1.2515×10 <sup>-3</sup>	0.6336×10 <sup>-3</sup>	0.59597×10 <sup>-3</sup>	
$ au_{\mathcal{P}}$	1.785337	0.34595	0.099651	0.014214	2.298151×10 <sup>-3</sup>	



#### Curves

Figure 1 – Mean forward current vs. power dissipation– Double side cooled

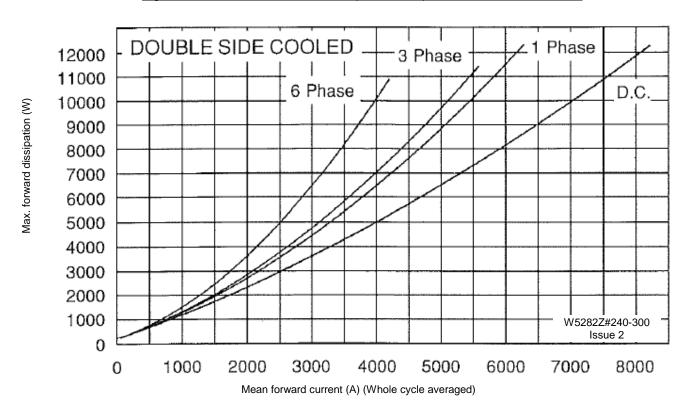
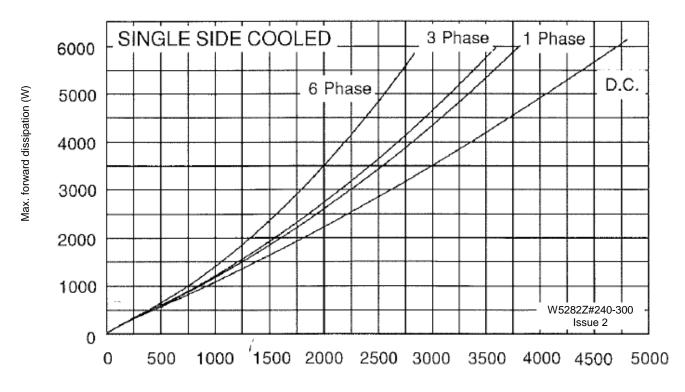


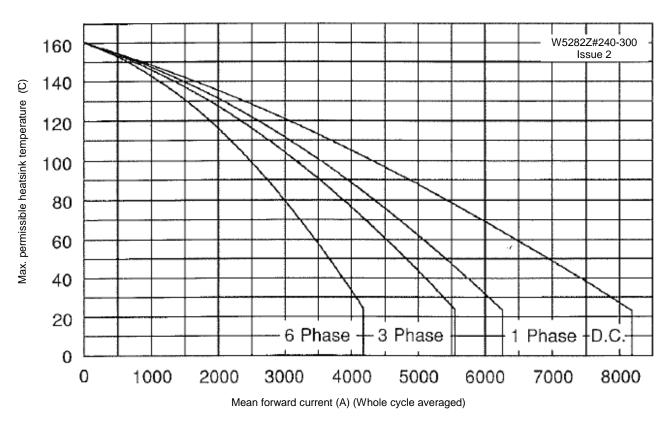
Figure 2 – Mean forward current vs. power dissipation – Single side cooled

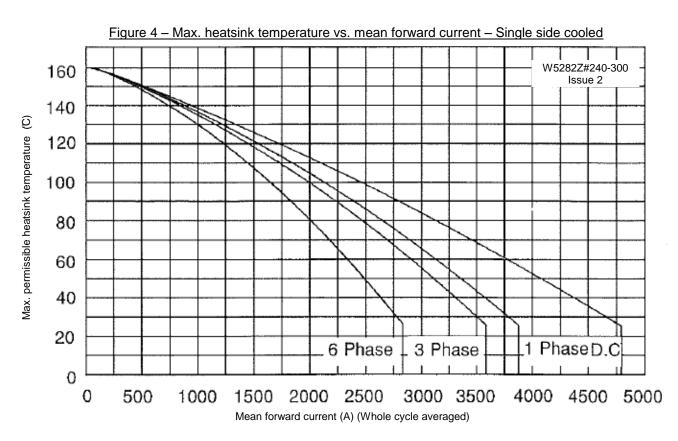


Mean forward current (A) (Whole cycle averaged)



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







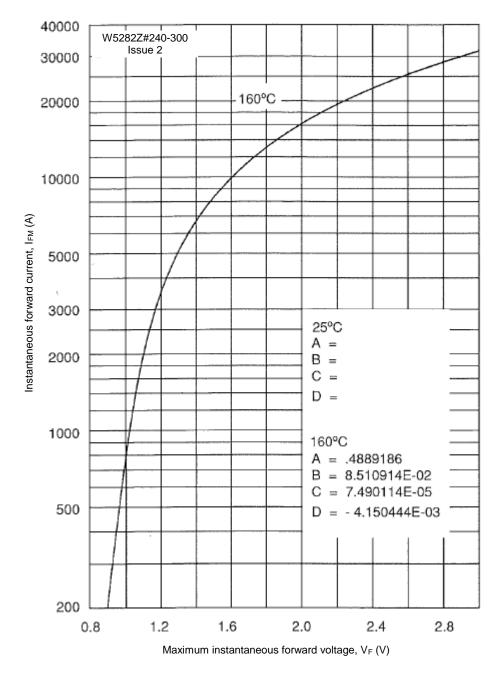


Figure 5 – Forward characteristics of limit device

Figure 6 - Transient thermal impedance

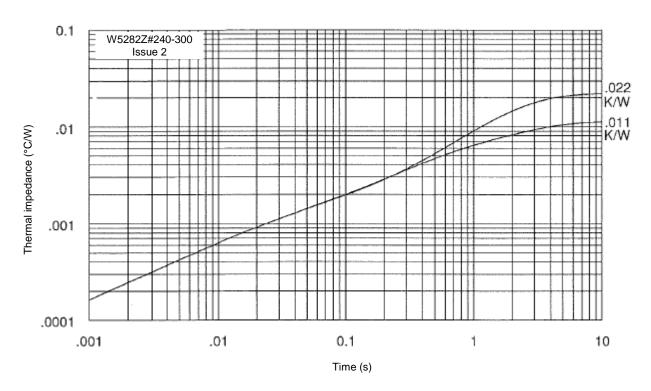
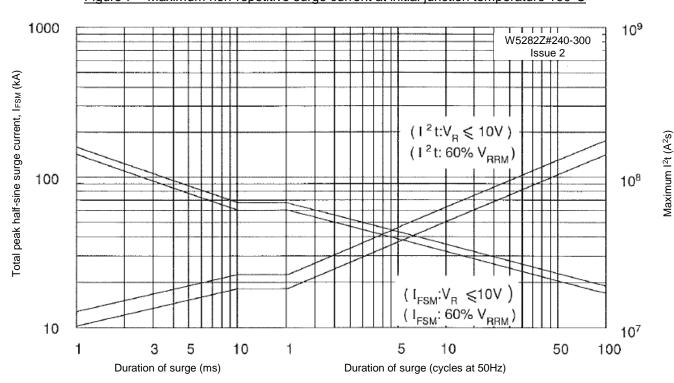
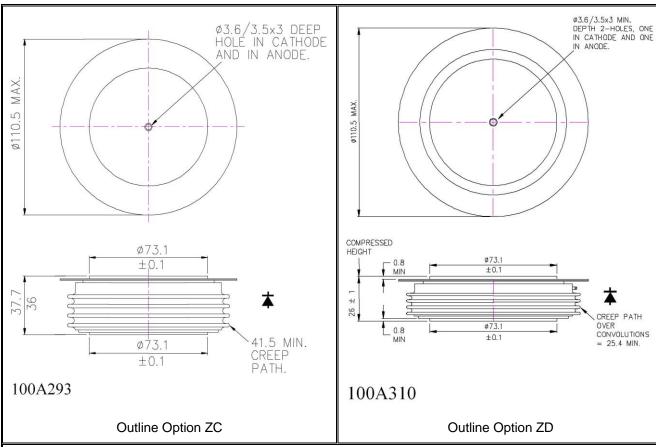


Figure 7 – Maximum non-repetitive surge current at initial junction temperature 190°C





#### **Outline Drawing & Ordering Information**



	ORDERING INFORMATION	(Please quote 10 digit code as below	)
W5282	Z#	**	0
Fixed Type Code	Fixed outline code ZC = 37.7mm Clamp height, ZD = 26mm	Voltage code V <sub>RRM</sub> /100 24-30	Fixed code

Order code: W5282ZD240 – 2400V V<sub>RRM</sub>, 26mm clamp height capsule.

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