

Date:- 11th January 2023

Data Sheet Issue:- A3

Rectifier Diode Types W3630T#620 to W3630T#680

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{RRM}	Repetitive peak reverse voltage, (note 1)	6200-6800	V
V _{RSM}	Non-repetitive peak reverse voltage, (note 1)	6300-6900	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
I _{F(AV)M}	Maximum average forward current, T _{sink} =55°C, (note 2)	3910	Α
I _{F(AV)M}	Maximum average forward current. T _{sink} =100°C, (note 2)	2630	Α
I _{F(AV)M}	Maximum average forward current. T _{sink} =100°C, (note 3)	1425	Α
I _{F(RMS)M}	Nominal RMS forward current, T _{sink} =25°C, (note 2)	7235	Α
I _{F(d.c.)}	D.C. forward current, T _{sink} =25°C, (note 4)	6555	Α
I _{FSM}	Peak non-repetitive surge t _p =10ms, V _{rm} =60%V _{RRM} , (note 5)	35	kA
I _{FSM2}	Peak non-repetitive surge t _p =10ms, V _{rm} ≤10V, (note 5)	38.5	kA
l ² t	$I^{2}t$ capacity for fusing $t_p=10$ ms, $V_{rm}=60\%V_{RRM}$, (note 5)	6.125×10 ⁶	A ² s
l ² t	I²t capacity for fusing t _p =10ms, V _{rm} ≤10V, (note 5)	7.411×10 ⁶	A ² s
T _{j op}	Operating temperature range	-40 to +150	°C
T _{stg}	Storage temperature range	-55 to +150	°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) Cathode side cooled, single phase; 50Hz, 180° half-sinewave.
- 4) Double side cooled.
- 5) Half-sinewave, 150°C T_j initial.



Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS	
V _{FM}	Maximum peak forward voltage	-	-	1.85	I _{FM} =4000A	V	
V_{FM}	Maximum peak forward voltage	-	-	2.50	I _{FM} =7000A	V	
V _{T0}	Threshold voltage	-	-	1.015		V	
r _T	Slope resistance	-	-	0.209		mΩ	
I _{RRM}	Peak reverse current	-	-	100	Rated V _{RRM}	mA	
Qrr	Recovered charge	-	15500	-		μC	
Qra	Recovered charge, 50% Chord	-	8100		I _{TM} =4000A, t _p =1000μs, di/dt=10A/μs,	μC	
I _{rm}	Reverse recovery current	-	270	-	V _r =100V	Α	
t _{rr}	Reverse recovery time, 50% chord	-	60	-		μs	
		-	-	0.008	Double side cooled	K/W	
RthJK	Thermal resistance, junction to heatsink	-	-	0.013	Anode side cooled	K/W	
		-	-	0.020	Cathode side cooled	K/W	
F	Mounting force	60	-	70	Note 2	kN	
107	NA/-:		1.15		Outline option TJ	1	
Wt	Weight		1.70		Outline option TE	kg	

Notes:-

- 1) Unless otherwise indicated $T_j=150^{\circ}C$.
- 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
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_i 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

$$I_{AV} = \frac{-V_0 + \sqrt{{V_0}^2 + 4 \cdot ff^2 \cdot r_{\scriptscriptstyle S} \cdot W_{\scriptscriptstyle AV}}}{2 \cdot ff^2 \cdot r_{\scriptscriptstyle S}} \qquad \text{and:} \qquad W_{\scriptscriptstyle AV} = \frac{\Delta T}{R_{\scriptscriptstyle th}} \\ \Delta T = T_{j\,{\rm max}} - T_{\scriptscriptstyle K}$$

Where $V_{T0}=1.015V$, $r_{T}=0.209m\Omega$,

 $R_{\it th}$ = 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	0.00866	0.00847	0.00832	0.00800		
Square wave Cathode Side Cooled	0.02118	0.02101	0.02086	0.02000		
Sine wave Double Side Cooled	0.00855	0.00837	0.00813			
Sine wave Cathode Side Cooled	0.02108	0.02091	0.02068			

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		150°C Coefficients
Α	0.6957377	Α	0.33738
В	0.01759211	В	0.054205
С	8.445811×10 ⁻⁵	С	1.63×10 ⁻⁴
D	6.703562×10 ⁻³	D	6.521×10 ⁻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_{\star} = 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			
r_p	3.81150×10 ⁻³	1.89558×10 ⁻³	1.71360×10 ⁻³	5.24282×10 ⁻⁴		
$ au_{\mathcal{P}}$	1.01434	0.34872	0.08992	0.01065		

	D.C. Cathode Side Cooled					
Term	Term 1 2 3					
r_p	0.01653	3.37618×10 ⁻³	5.93598×10 ⁻⁴			
$ au_{ m p}$	5.31595	0.15120	0.01207			



6.0 Reverse recovery ratings

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

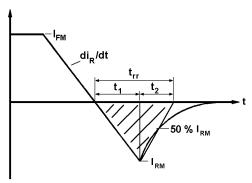


Fig. 1

(ii) Q_{rr} is based on a 150 μs 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

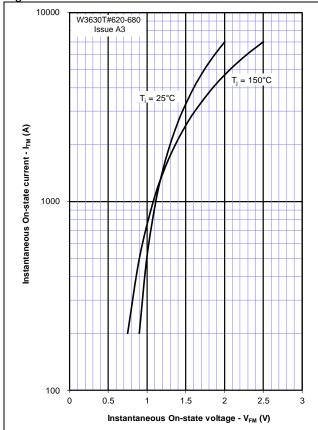


Figure 2 – Transient thermal impedance

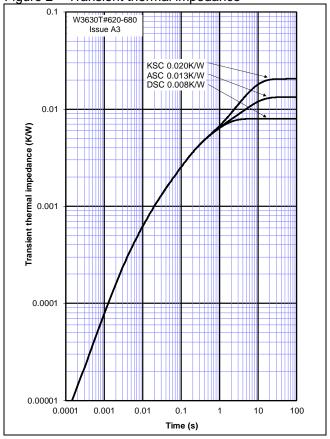


Figure 3 – Maximum Surge Rating

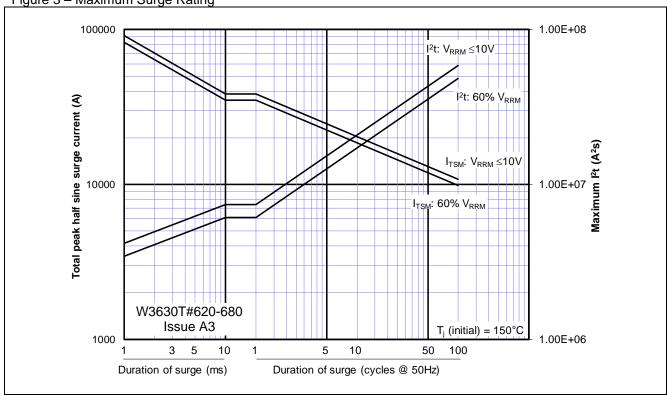




Figure 4 - Total recovered charge, Q_{rr}

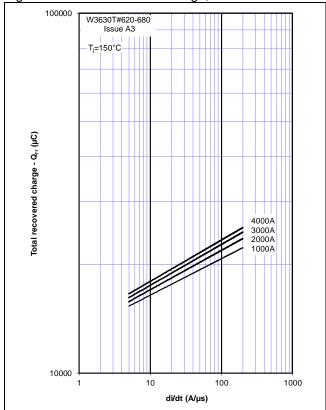


Figure 5 – Recovered charge, Qra (50% chord)

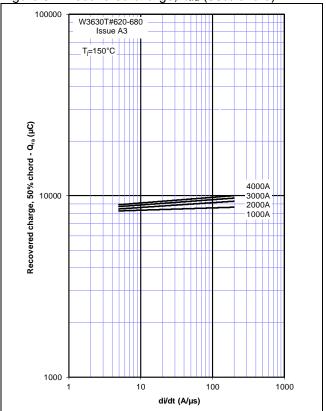


Figure 6 - Peak reverse recovery current, Irm

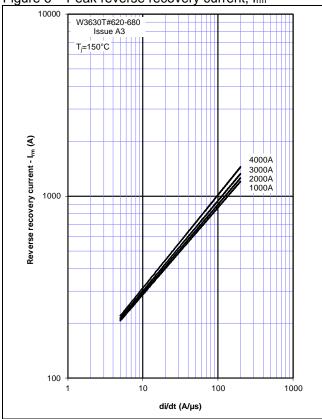


Figure 7 – Maximum recovery time, t_{rr} (50% chord)

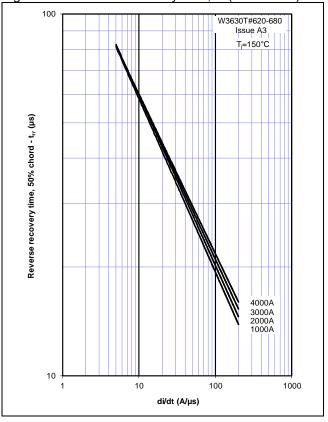




Figure 8 – Forward current vs. Power dissipation – Double Side Cooled

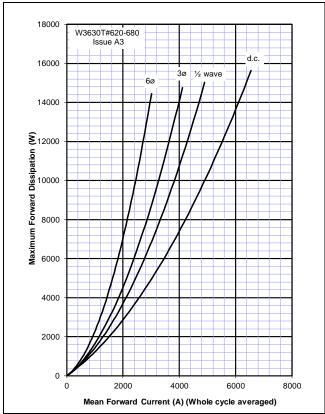


Figure 10 – Forward current vs. Power dissipation – Cathode Side Cooled

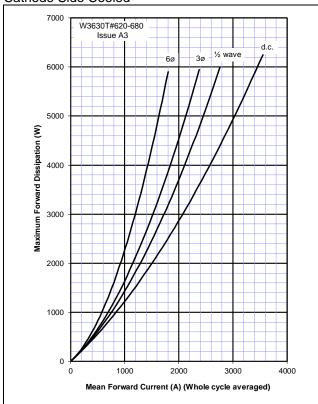


Figure 9 – Forward current vs. Heatsink temperature – Double Side Cooled

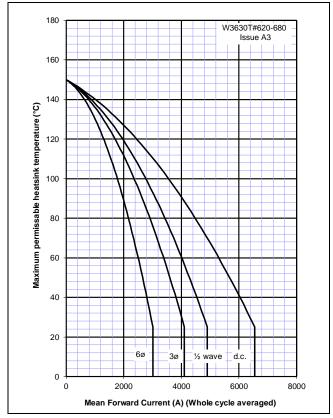
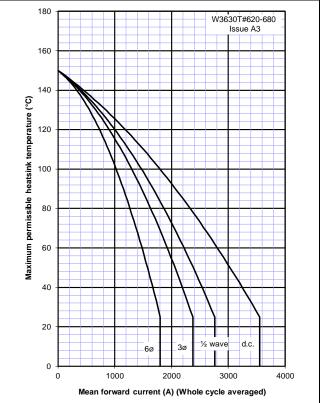
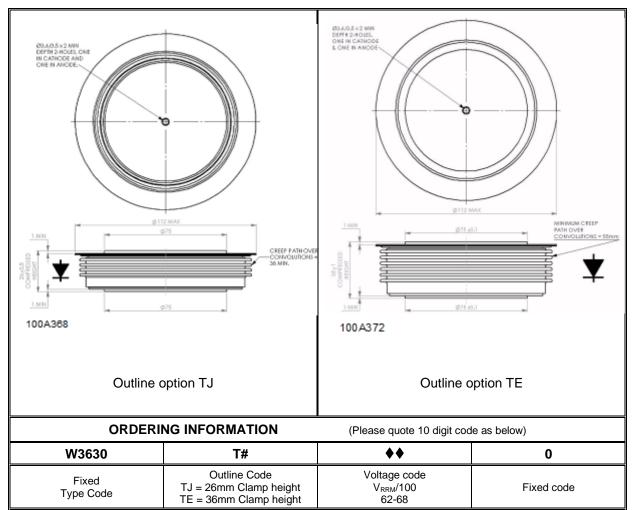


Figure 11 – Forward current vs. Heatsink temperature – Cathode Side Cooled





Outline Drawing & Ordering Information



Order code: W3630TE680 – 6800V V_{RRM}, 36mm clamp height capsule.

IXYS UK Westcode Ltd

Langley Park Way, Langley Park, Chippenham, Wiltshire, SN15 1GE Tel: +44 (0)1249 444524 Fax: +44 (0)1249 659448

E-mail:

www.littelfuse.com/contactus.aspx



IXYS Long Beach

IXYS Long Beach, Inc 2500 Mira Mar Ave, Long Beach CA 90815

Tel: +1 (562) 296 6584 Fax: +1 (562) 296 6585 E-mail:

powerstacksus@littelfuse.com

www.littelfuse.com

https://www.littelfuse.com/products/power-semiconductors/high-power.aspx

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