WESTCODE

Date:- 6 Feb, 2001

Data Sheet Issue: 1

Phase Control Thyristor

Types N0782YS120 to N0782YS160

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{DRM}	Repetitive peak off-state voltage, (note 1)	1200-1600	V
V_{DSM}	Non-repetitive peak off-state voltage, (note 1)	1200-1600	V
V_{RRM}	Repetitive peak reverse voltage, (note 1)	1200-1600	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	1300-1700	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS
$I_{T(AV)}$	Mean on-state current, T_{sink}=55°C, (note 2)	782	A
$I_{T(AV)}$	Mean on-state current. T_{sink}=85°C, (note 2)	530	A
$I_{T(AV)}$	Mean on-state current. T_{sink}=85°C, (note 3)	315	A
$I_{T(RMS)}$	Nominal RMS on-state current, 25°C, (note 2)	1554	A
$I_{T(d.c.)}$	D.C. on-state current, 25°C, (note 4)	1321	A
I_{TSM}	Peak non-repetitive surge t_p=10ms, V_{RM}=0.6V_{RRM}, (note 5)	9420	A
I_{TSM2}	Peak non-repetitive surge t_p=10ms, $V_{RM}\leq$10V, (note 5)	10400	A
I^2t	I^2t capacity for fusing t_p=10ms, V_{RM}=0.6V_{RRM}, (note 5)	444×10^3	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, $V_{RM}\leq$10V, (note 5)	541×10^3	A^2s
di_T/dt	Maximum rate of rise of on-state current (repetitive), (Note 6)	500	A/µs
	Maximum rate of rise of on-state current (non-repetitive), (Note 6)	1000	A/µs
V_{RGM}	Peak reverse gate voltage	5	V
$P_{G(AV)}$	Mean forward gate power	2	W
P_{GM}	Peak forward gate power	30	W
V_{GD}	Non-trigger gate voltage, (Note 7)	0.25	V
T_{HS}	Operating temperature range	-40 to +125	°C
T_{stg}	Storage temperature range	-40 to +150	°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, 125°C T_j initial.
6) V_D=67% V_{DRM}, I_{TM}=1000A, I_{FG}=2A, $t_r\leq$0.5µs, T_{case}=125°C.
7) Rated V_{DRM}.

Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V_{TM}	Maximum peak on-state voltage	-	-	1.62	I_{TM}=1550A	V
V_0	Threshold voltage	-	-	0.92		V
r_S	Slope resistance	-	-	0.45		mΩ
dv/dt	Critical rate of rise of off-state voltage	1000	-	-	V_D=80% V_{DRM}	V/µs
I_{DRM}	Peak off-state current	-	-	40	Rated V_{DRM}	mA
I_{RRM}	Peak reverse current	-	-	40	Rated V_{RRM}	mA
V_{GT}	Gate trigger voltage	-	-	3.0	T_j=25°C	V
I_{GT}	Gate trigger current	-	-	150	T_j=25°C. V_D=10V, I_T=3A	mA
I_H	Holding current	-	-	500	T_j=25°C	mA
R_θ	Thermal resistance, junction to heatsink	-	-	0.05	Double side cooled	K/W
		-	-	0.1	Single side cooled	K/W
F	Mounting force	5.3	-	10		kN
W_t	Weight	-	90	-		g

Notes:-

1) Unless otherwise indicated T_j=125°C.

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade 'H'	V_{DRM} V_{DSM} V_{RRM} V	V_{RSM} V	V_D V_R DC V
12	1200	1300	810
14	1400	1500	930
16	1600	1700	1040

2.0 Extension of Voltage Grades

This report is applicable to other and higher 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 Repetitive dv/dt

Standard dv/dt is 1000V/µs.

5.0 Computer Modelling Parameters

5.1 Device Dissipation Calculations

$$I_{AV} = \frac{-V_0 + \sqrt{V_0^{\,2} + 4 \cdot ff^{\,2} \cdot r_s \cdot W_{AV}}}{2 \cdot ff^{\,2} \cdot r_s}$$

and:

$$W_{AV} = \frac{\Delta T}{R_{th}}$$

$$\Delta T = T_{j\max} - T_{Hs}$$

Where V_0=0.92V, r_s=0.45mΩ,

R_{th} = Supplementary thermal impedance, see table below.

ff = Form factor, see table below.

Supplementary Thermal Impedance							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave Double Side Cooled	0.071	0.069	0.065	0.061	0.057	0.053	0.05
Square wave Single Side Cooled	0.12	0.119	0.115	0.111	0.107	0.103	0.1
Sine wave Double Side Cooled	0.053	0.052	0.0516	0.0513	0.0505		
Sine wave Single Side Cooled	0.103	0.102	0.1017	0.1013	0.1005		

Form Factors							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave	3.46	2.45	2	1.73	1.41	1.15	1
Sine wave	3.98	2.78	2.22	1.88	1.57		

5.2 Calculating V_T using ABCD Coefficients

The on-state characteristic I_T vs. V_T, on page 7 is represented in two ways;
(i) the well established V_o 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_T in terms of I_T given below:

$$V_T = A + B \cdot \ln(I_T) + C \cdot I_T + D \cdot \sqrt{I_T}$$

The constants, derived by curve fitting software, are given below for both hot and cold characteristics. The resulting values for V_T agree with the true device characteristic over a current range, which is limited to that plotted.

125°C Coefficients	
A	0.384599
B	0.08692693
C	3.688322×10^{-4}
D	3.584×10^{-6}

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.

D.C. Double Side Cooled				
Term	1	2	3	4
r_p	0.12000552	0.01609235	8.812673×10^{-3}	3.659765×10^{-3}
τ_p	0.3391689	0.09405764	0.12195269	2.196197×10^{-3}

D.C. Single Side Cooled					
Term	1	2	3	4	5
r_p	0.06157697	8.431182×10^{-3}	0.01031315	0.01613806	5.181088×10^{-3}
τ_p	2.136132	1.212898	0.1512408	0.04244	2.889595×10^{-3}

Curves

Figure 1 - On-state current vs. Power dissipation – Double Side Cooled (Sine wave)

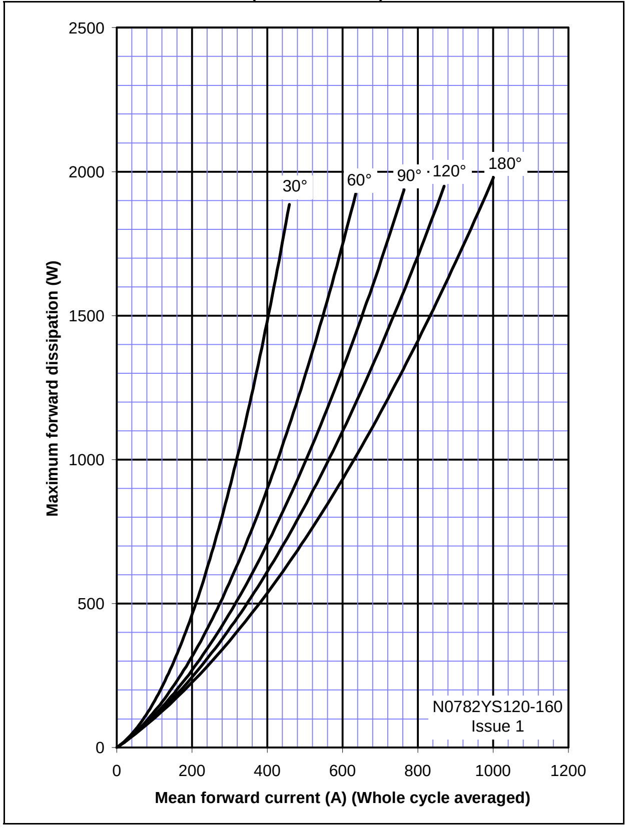


Figure 2 - On-state current vs. Heatsink temperature - Double Side Cooled (Sine wave)

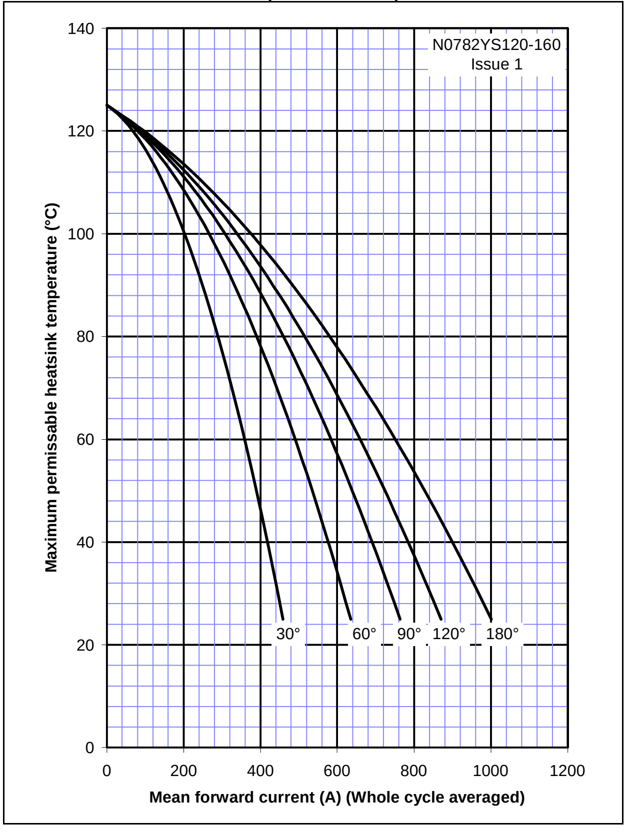


Figure 3 - On-state current vs. Power dissipation – Double Side Cooled (Square wave)

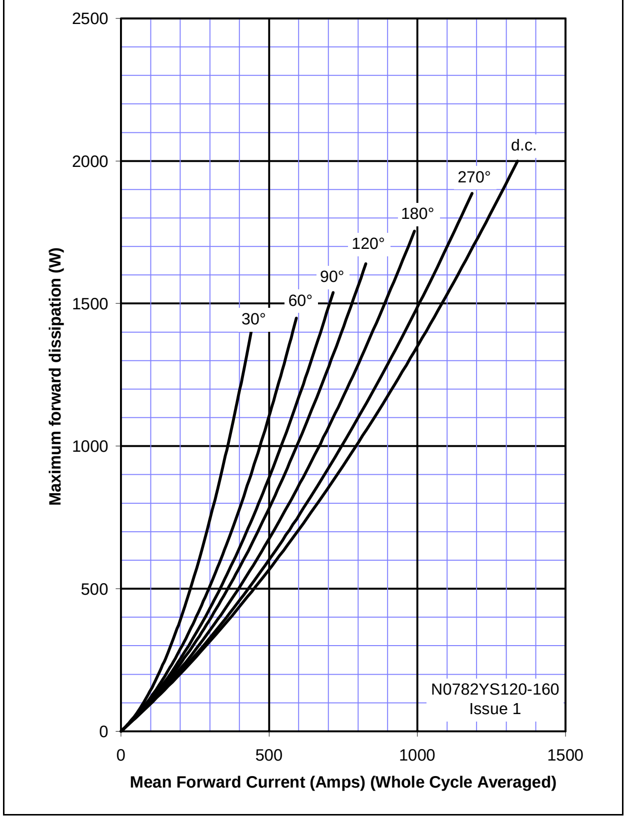


Figure 4 - On-state current vs. Heatsink temperature - Double Side Cooled (Square wave)

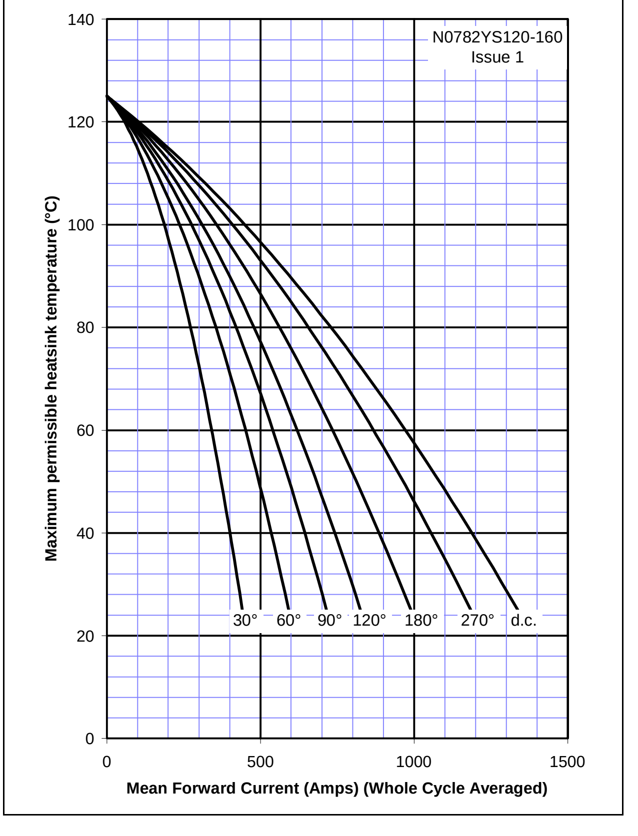


Figure 5 - On-state current vs. Power dissipation – Single Side Cooled (Sine wave)

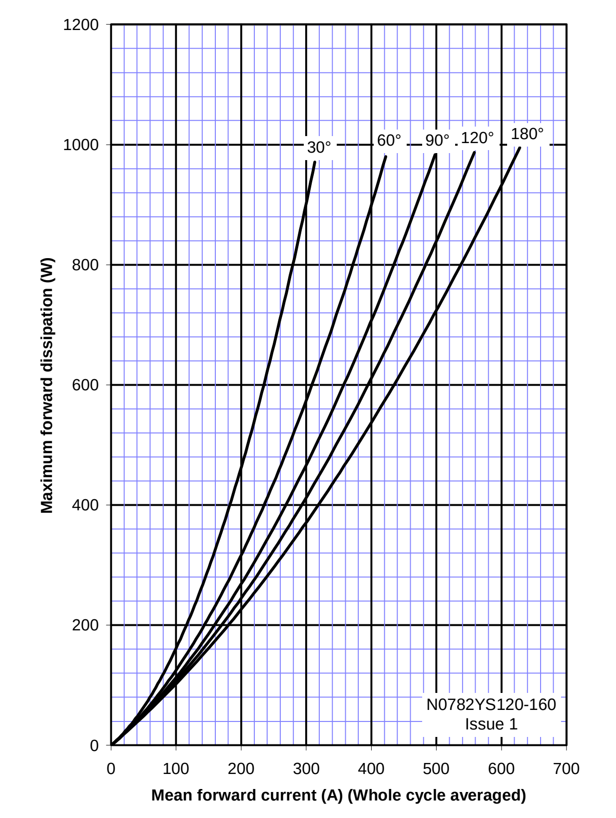


Figure 6 - On-state current vs. Heatsink temperature - Single Side Cooled (Sine wave)

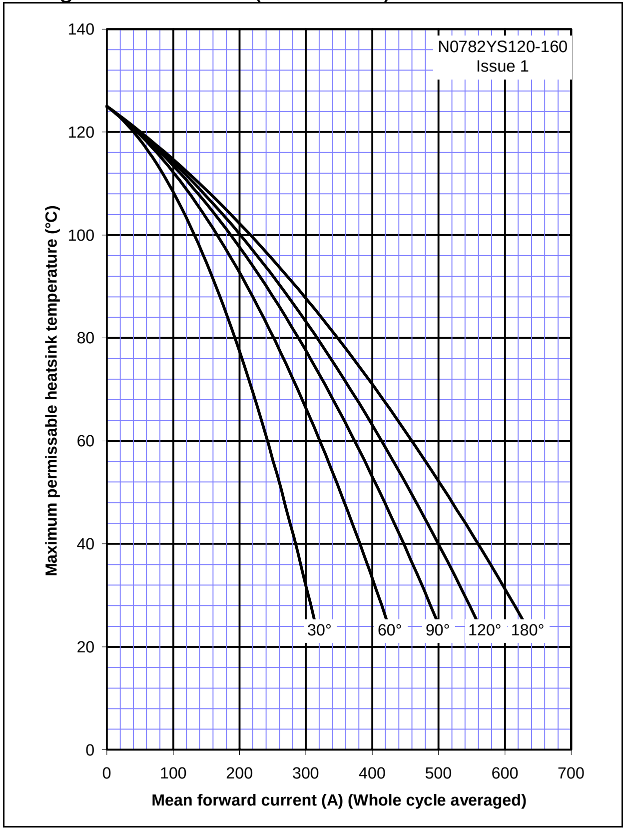


Figure 7 - On-state current vs. Power dissipation – Single Side Cooled (Square wave)

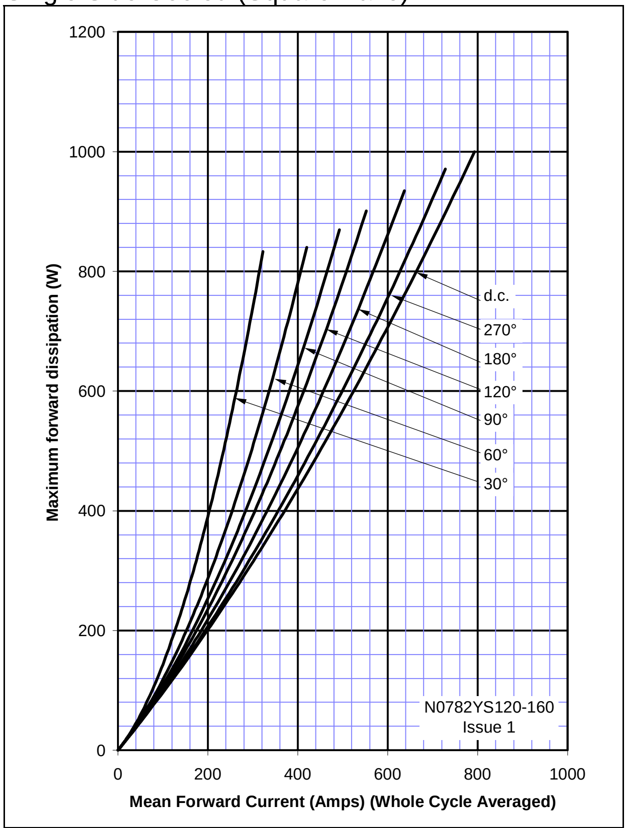


Figure 8 - On-state current vs. Heatsink temperature - Single Side Cooled (Square wave)

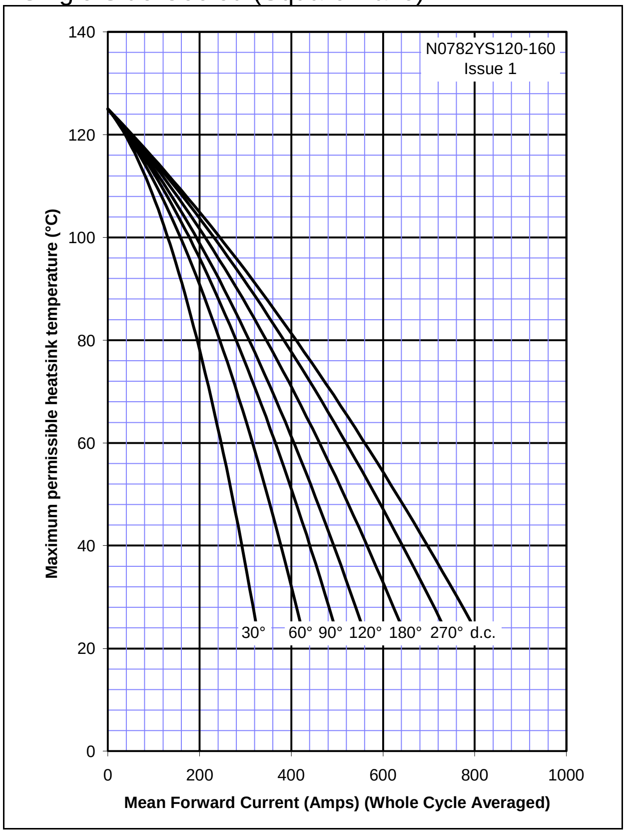


Figure 9 - On-state characteristics of Limit device

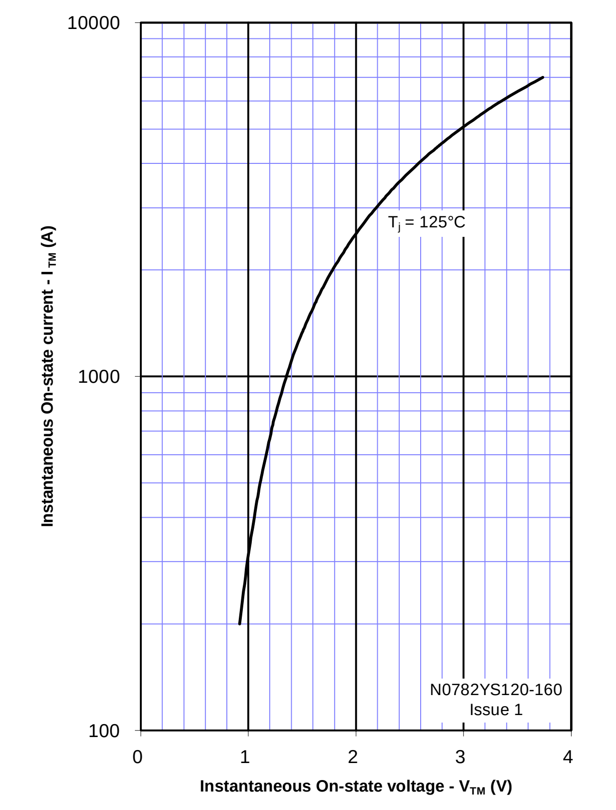


Figure 10 - Transient Thermal Impedance

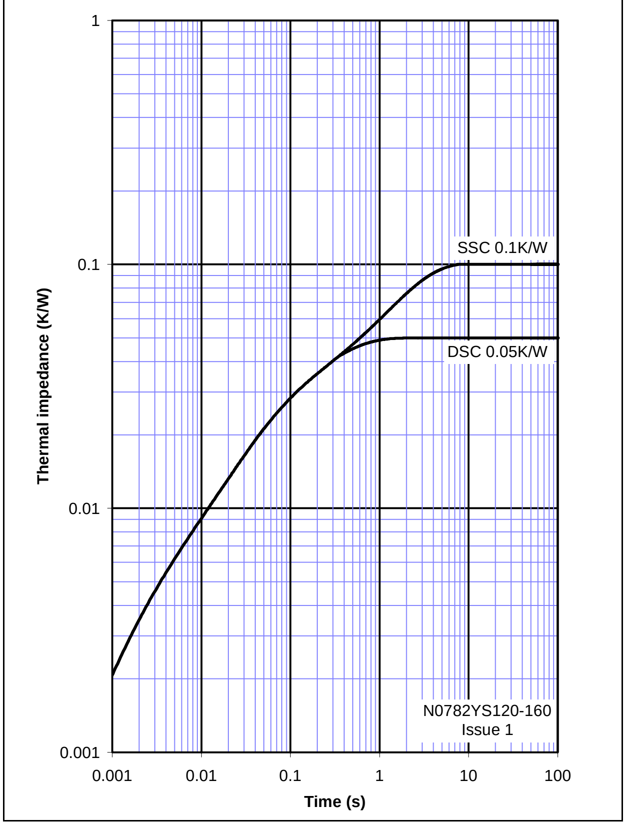


Figure 11 - Gate Characteristics - Trigger Limits

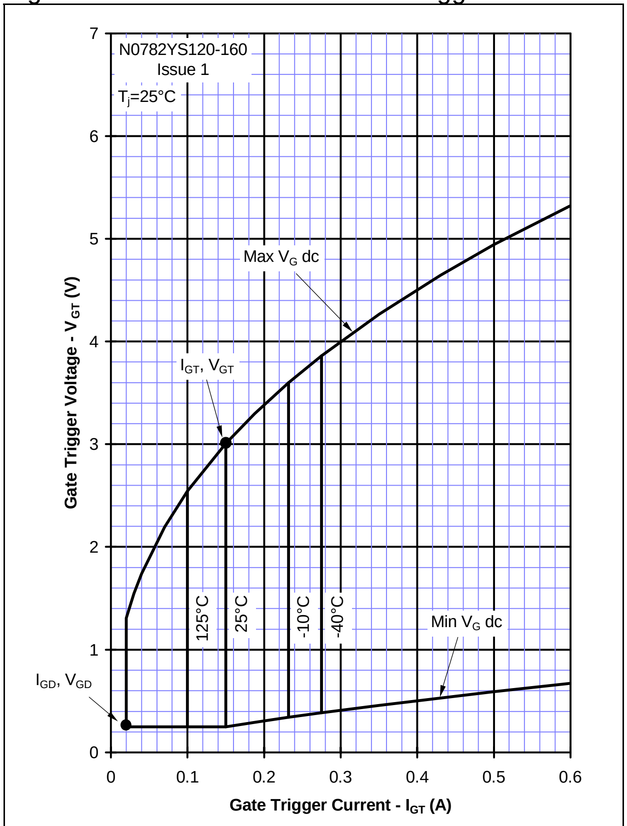


Figure 12 - Gate Characteristics - Power Curves

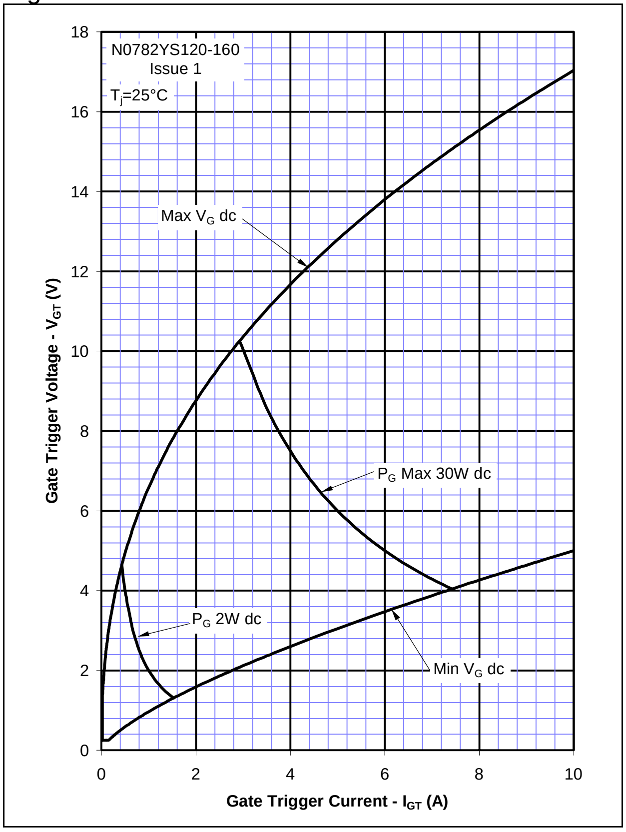
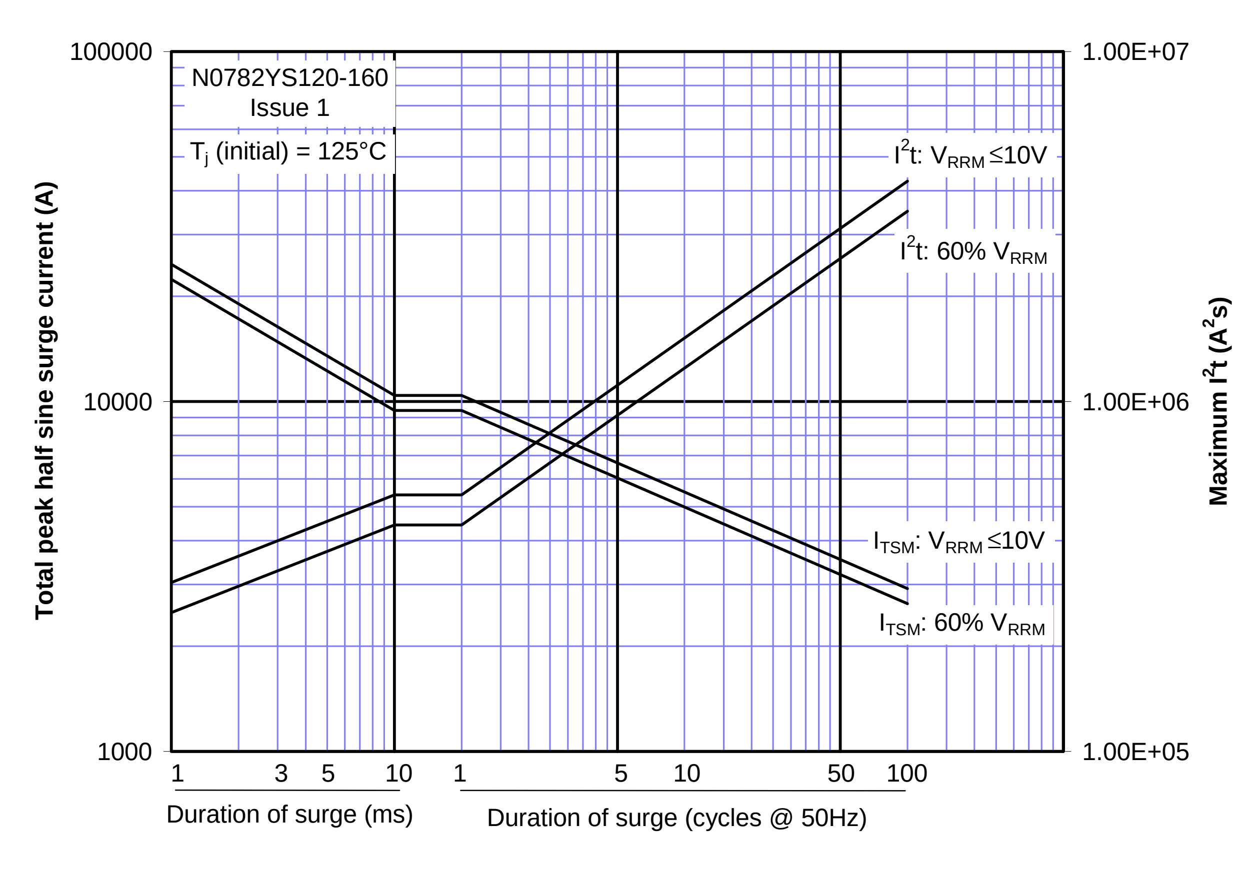
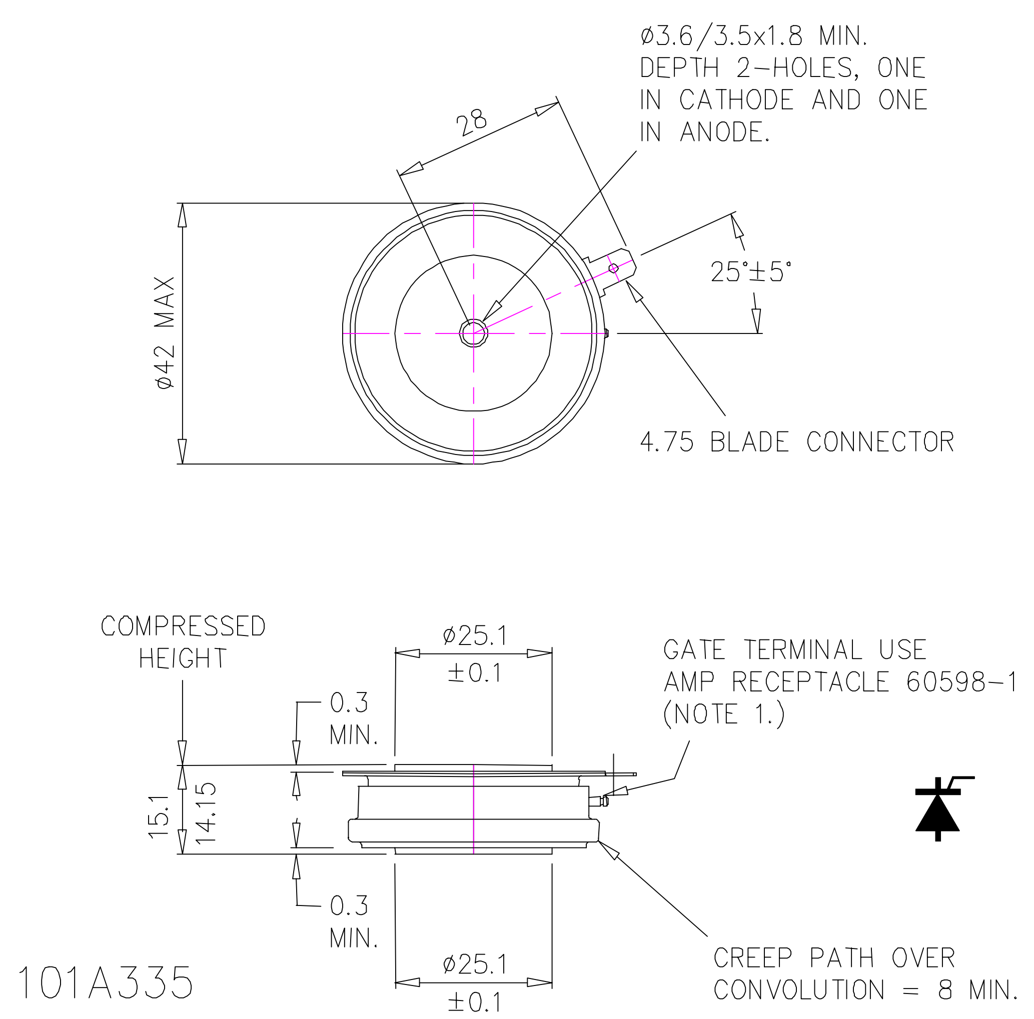


Figure 13 - Maximum surge and I^2t Ratings



Outline Drawing & Ordering Information



ORDERING INFORMATION (Please quote 10 digit code as below)			
N0782	**YS**	**♦ ♦**	**0**
Fixed Type Code	Fixed Outline Code	Voltage Code 12-16	Fixed turn-off time code
Typical order code : N0782YS120 – 1200V V_{DRM}, V_{RRM}, 1000V/µs dv/dt, 15.1mm clamp height capsule.			

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