WESTCODE

Date: November, 2000
Data Sheet: 99T03
Issue: 3

Provisional Data

Phase Control Thyristor

Types N1283CH43 to N1283CH52

Absolute maximum ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{DRM}	Repetitive peak off-state voltage (note 1)	4300-5200	V
V_{DSM}	Non-repetitive peak off-state voltage (note 1)	4300-5200	V
V_{RRM}	Repetitive peak reverse voltage (note 1)	4300-5200	V
V_{RSM}	Non-repetitive peak reverse voltage (note 1)	4400-5300	V

	RATINGS	MAXIMUM LIMITS	UNITS
$I_{T(AV)}$	Mean on-state current, T_{sink}=55°C (note 2)	3764	A
$I_{T(AV)}$	Mean on-state current. T_{sink}=85°C (note 2)	2658	A
$I_{T(AV)}$	Mean on-state current. T_{sink}=85°C (note 3)	1680	A
$I_{T(RMS)}$	Nominal RMS on-state current, T_{sink}=25°C (note 2)	7317	A
$I_{T(d.c.)}$	D.C. on-state current, T_{sink}=25°C (note 4)	6620	A
I_{TSM}	Peak non-repetitive surge t_p=10ms, V_{RM}=0.6V_{RRM} (note 5)	49.5	kA
I_{TSM2}	Peak non-repetitive surge t_p=10ms, V_{RM}≤10V (note 5)	55	kA
I^2t	I^2t capacity for fusing t_p=10ms, V_{RM}=0.4V_{RRM} (note 5)	$12.25x10^6$	A^2s
I^2t	I^2t capacity for fusing t_p=10ms, V_{RM}≤10V (note 5)	$15.13x10^6$	A^2s
di/dt	Critical rate of rise of on-state current, repetitive (note 6)	150	A/µs
	Critical rate of rise of on-state current, non-repetitive (note 6)	300	A/µs
I_{FGM}	Peak forward gate current	10	A
V_{RGM}	Peak reverse gate voltage	5	V
$P_{G(AV)}$	Mean forward gate power	5	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_T=5000A, I_{FG}=2A, t_r=500ns.
7) Rated V_{DRM}.

Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
V_{TM}	Maximum peak on-state voltage	-	-	2.00	I_T=5000A	V
V_0	Threshold voltage	-	-	1.0		V
r_s	Slope resistance	-	-	0.2		mΩ
dv/dt	Critical rate of rise of off-state voltage	200	1000	2000	V_D=80% V_{DRM}	V/µs
I_{DRM}	Peak off-state current	-	-	300	Rated V_{DRM}	mA
I_{RRM}	Peak reverse current	-	-	300	Rated V_{RRM}	mA
V_{GT}	Gate trigger voltage	-	-	3.0	T_j=25°C	V
I_{GT}	Gate trigger current	-	-	300	T_j=25°C V_D=10V, I_A=3A	mA
I_H	Holding current	-	-	1000	T_j=25°C	mA
$R_{th(j-hs)}$	Thermal resistance, junction to sink	-	-	0.0065	DC, Double side cooled	K/W
		-	-	0.013	DC, Single side cooled	
F	Mounting force	81	-	98		kN
W_t	Weight	-	2.80	-		kg

Notes:-
1) Unless otherwise indicated T_j=125°C.

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	V_{DSM} V_{DRM} V_{RRM} V	V_{RSM} V	V_D V_R (dc) V
44	4400	4500	2200
46	4600	4700	2300
48	4800	4900	2400
50	5000	5100	2500
52	5200	5300	2600

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% per °C is applicable to this device for T_j below 25°C.

4.0 Repetitive dv/dt
Higher dv/dt selections are available up to 2000V/µs on request.

5.0 Computer Modelling Parameters

5.1 Device dissipation calculations

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

Where V_0 = 1.0V, r_s = 0.2mΩ

$$W_{AV} = \frac{\Delta T}{R_{th}} \qquad \Delta T = T_{jMax} - T_{Hs}$$

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

Supplementary Thermal Impedance (at 50Hz operating frequency)							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave Double Side Cooled	0.00717	0.00707	0.00698	0.00689	0.00673	0.00652	0.0065
Square wave Single Side Cooled	0.0137	0.01359	0.01349	0.0134	0.01323	0.01301	0.013
Sine wave Double Side Cooled	0.00709	0.00697	0.00687	0.00678	0.00654		
Sine wave Single Side Cooled	0.0136	0.01348	0.01337	0.01328	0.01303		

Form Factors							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave	3.464	2.449	2	1.732	1.414	1.149	1
Sine wave	3.98	2.778	2.22	1.879	1.57		

5.2 Calculating V_T using ABCD coefficients

The on-state characteristic I_T vs. V_T, on Fig. 9, is represented in two ways;
(i) the well established V_0 and r_S tangent 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:

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

The constants, derived by curve fitting software, are given in this report for both hot and cold characteristics where possible. 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		25°C Coefficients	
A	0.545447122	A	0.8560119
B	0.06095875	B	0.06109782
C	1.872716×10^{-4}	C	1.922791×10^{-4}
D	-1.417852×10^{-5}	D	-4.777063×10^{-3}

5.3 D.C. Thermal impedance calculation

$$r_t = \sum_{p=1}^{p=n} r_p \left(1 - e^{\frac{-t}{\tau_p}}\right)$$

Where p = 1 to n, n is the number of terms in the series.
where:
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	3.424745×10^{-3}	1.745273×10^{-3}	8.532017×10^{-4}	3.457329×10^{-4}
τ_p	1.125391	0.1878348	0.02788979	8.430889×10^{-3}

D.C. Single Side Cooled				
Term	1	2	3	4
r_p	8.375269×10^{-3}	2.518437×10^{-3}	1.193758×10^{-3}	7.45432×10^{-4}
τ_p	8.929845	0.4711304	0.08221244	0.01221961

Curves

Figure 1 – Maximum on-state characteristic

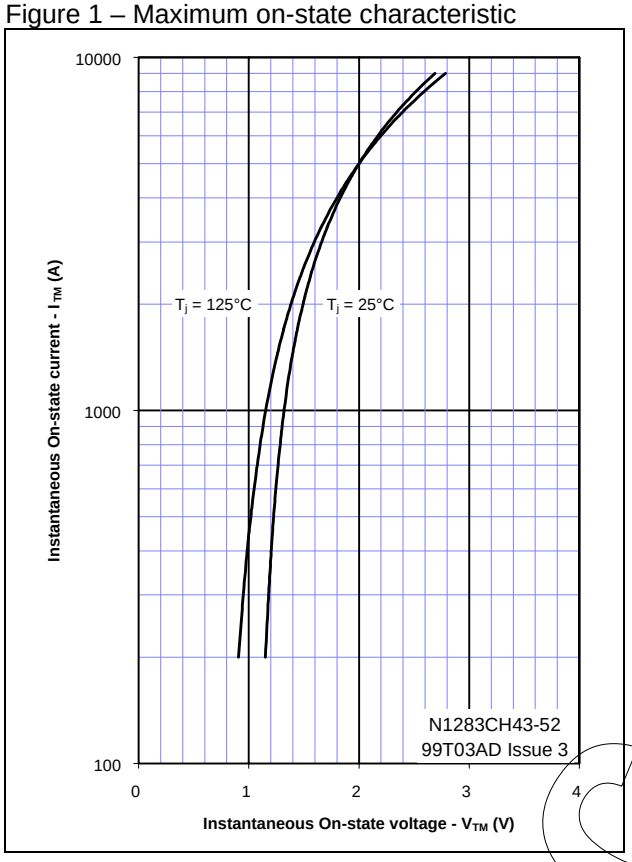


Figure 2 – Transient thermal impedance

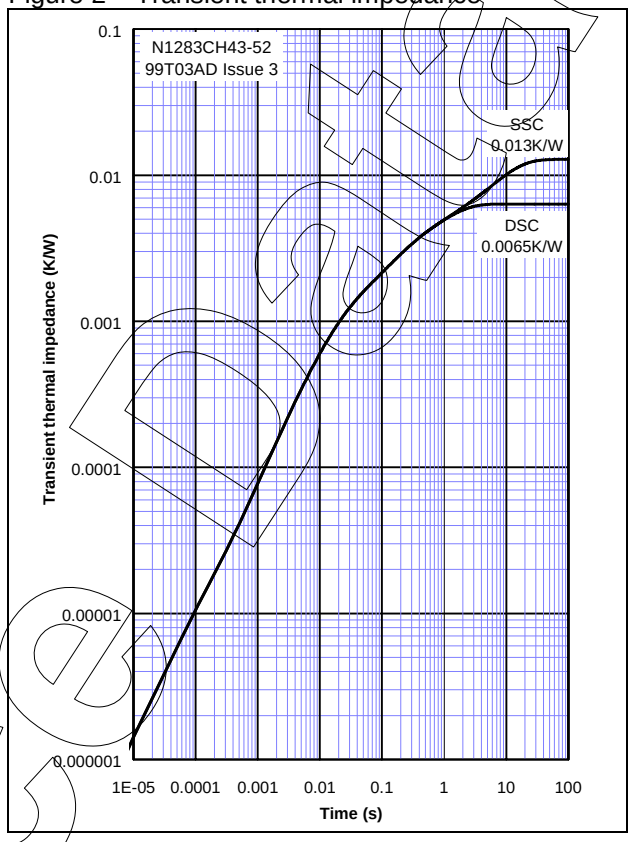


Figure 3 – Gate characteristics

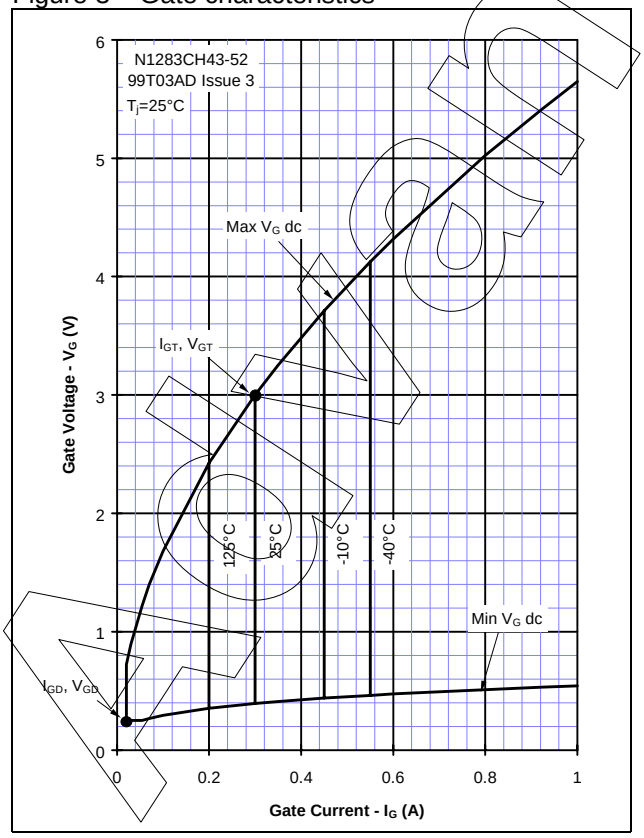


Figure 4 – Gate characteristics

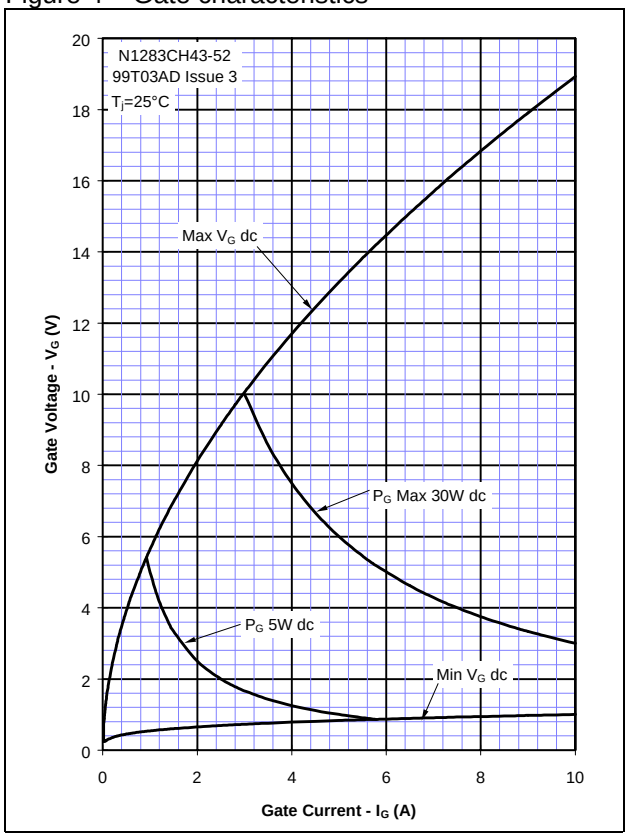


Figure 5 – On-state current vs. Power dissipation – Double Side Cooled (Sine wave)

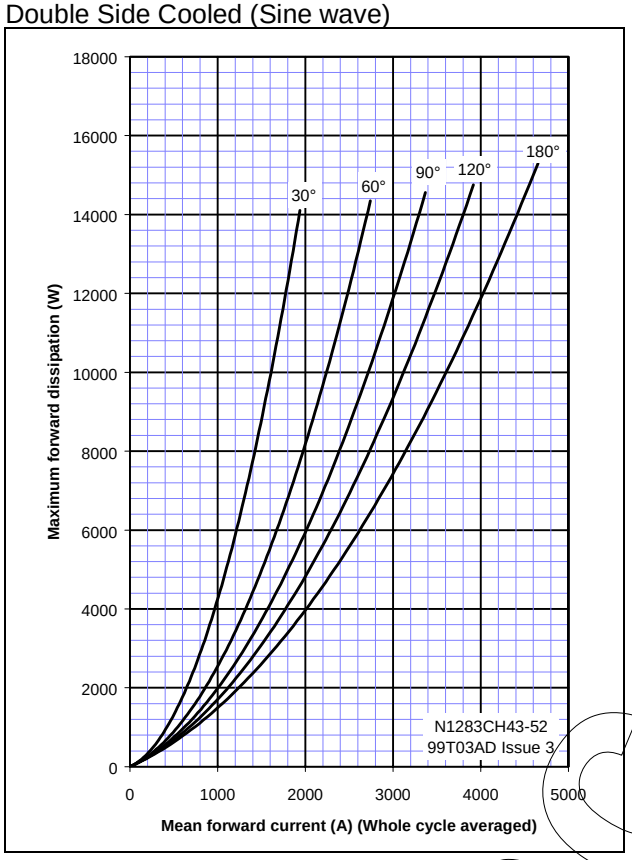


Figure 6 – On-state current vs. Heatsink temperature - Double Side Cooled (Sine wave)

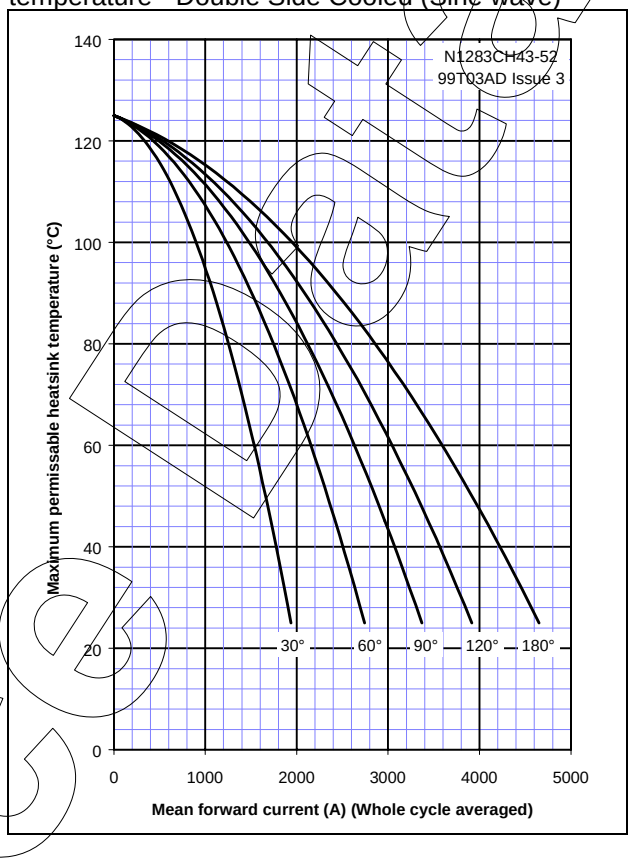


Figure 7 – On-state current vs. Power dissipation - Double Side Cooled (Square wave)

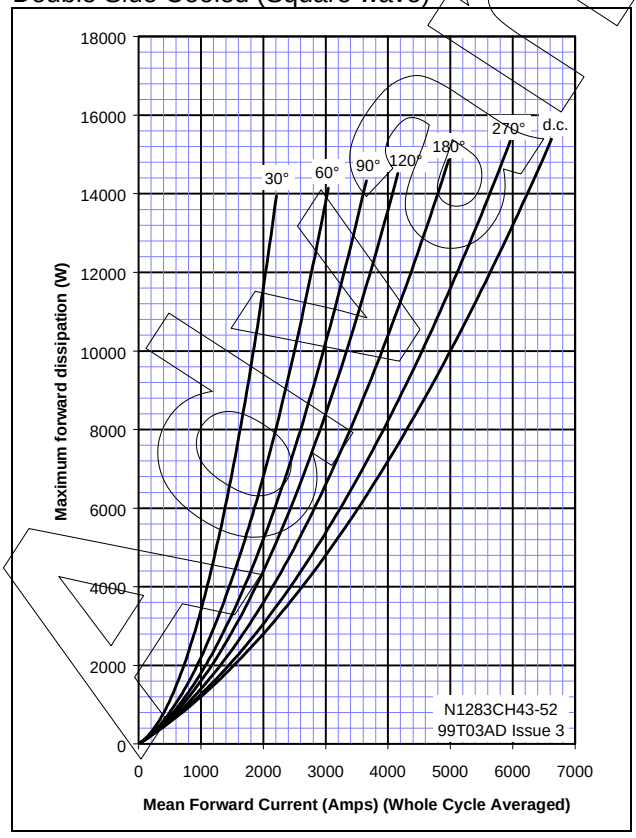


Figure 8 – On-state current vs. Heatsink temperature - Double Side Cooled (Square wave)

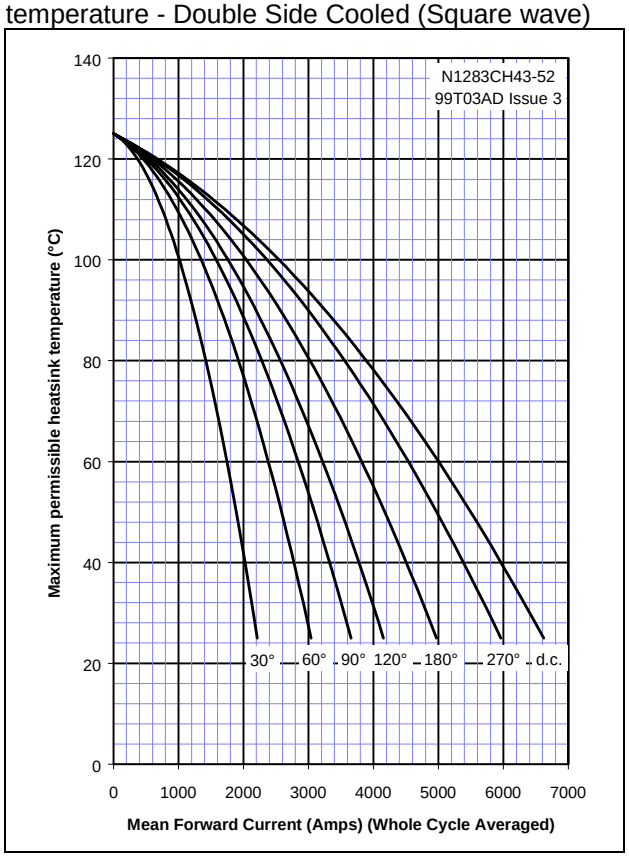


Figure 9 – On-state current vs. Power dissipation – Single Side Cooled (Sine wave)

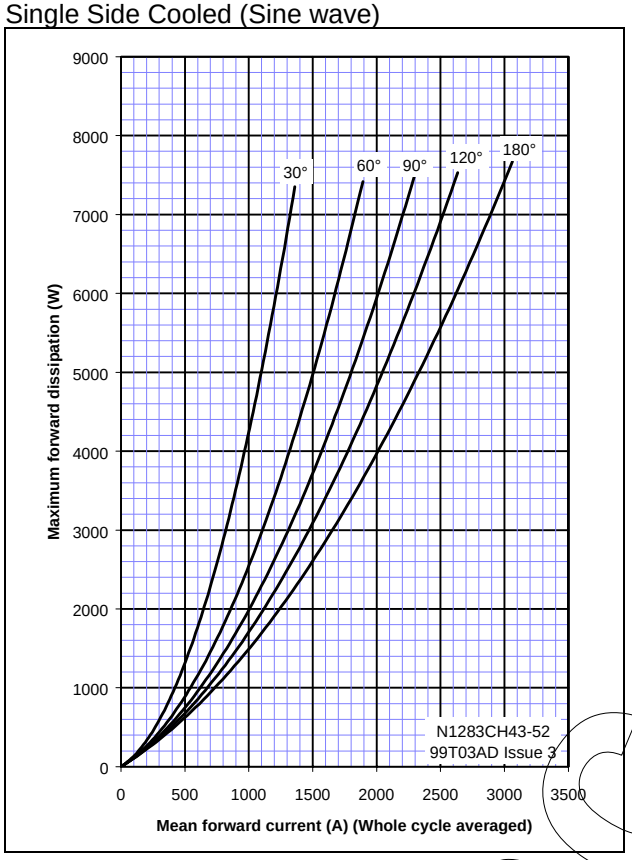


Figure 10 – On-state current vs. Heatsink temperature - Single Side Cooled (Sine wave)

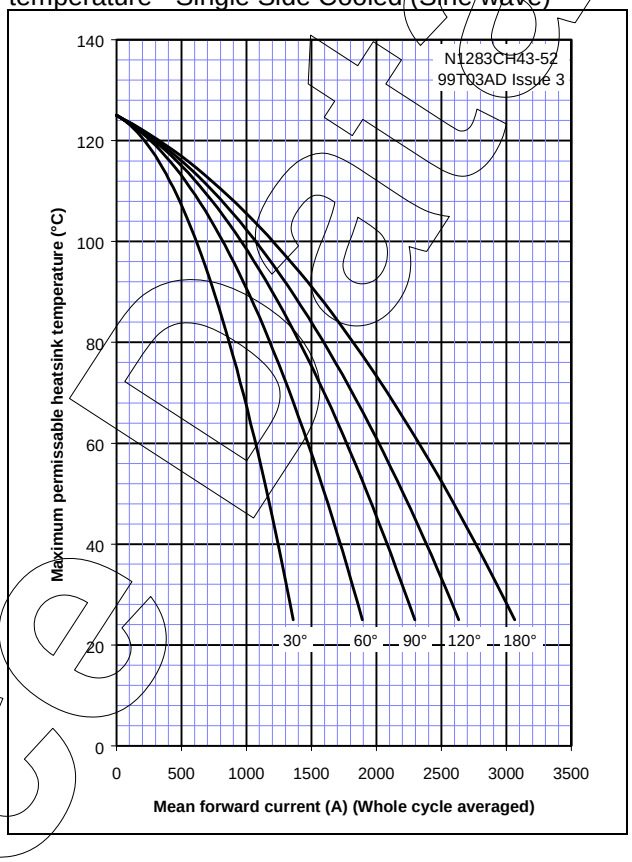


Figure 11 – On-state current vs. Power dissipation – Single Side Cooled (Square wave)

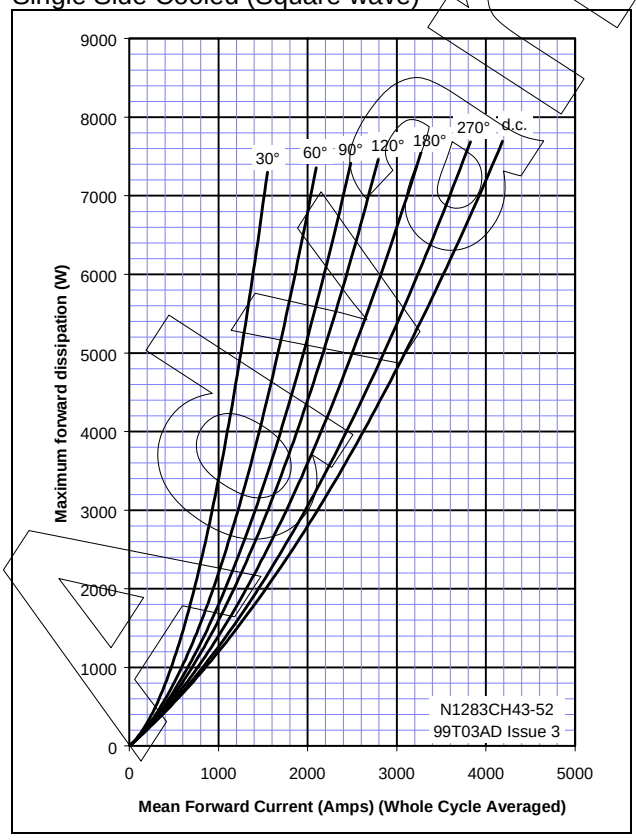


Figure 12 – On-state current vs. Heatsink temperature - Single Side Cooled (Square wave)

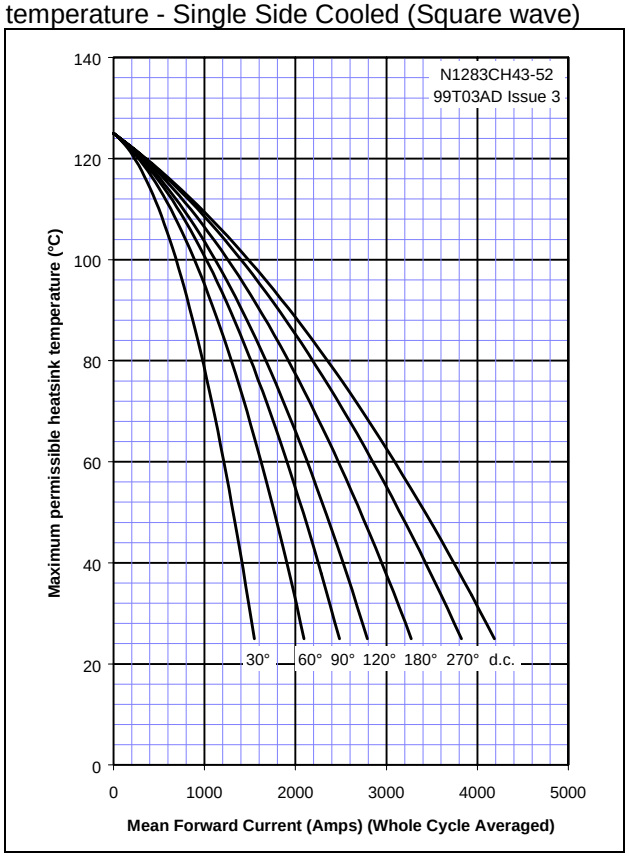
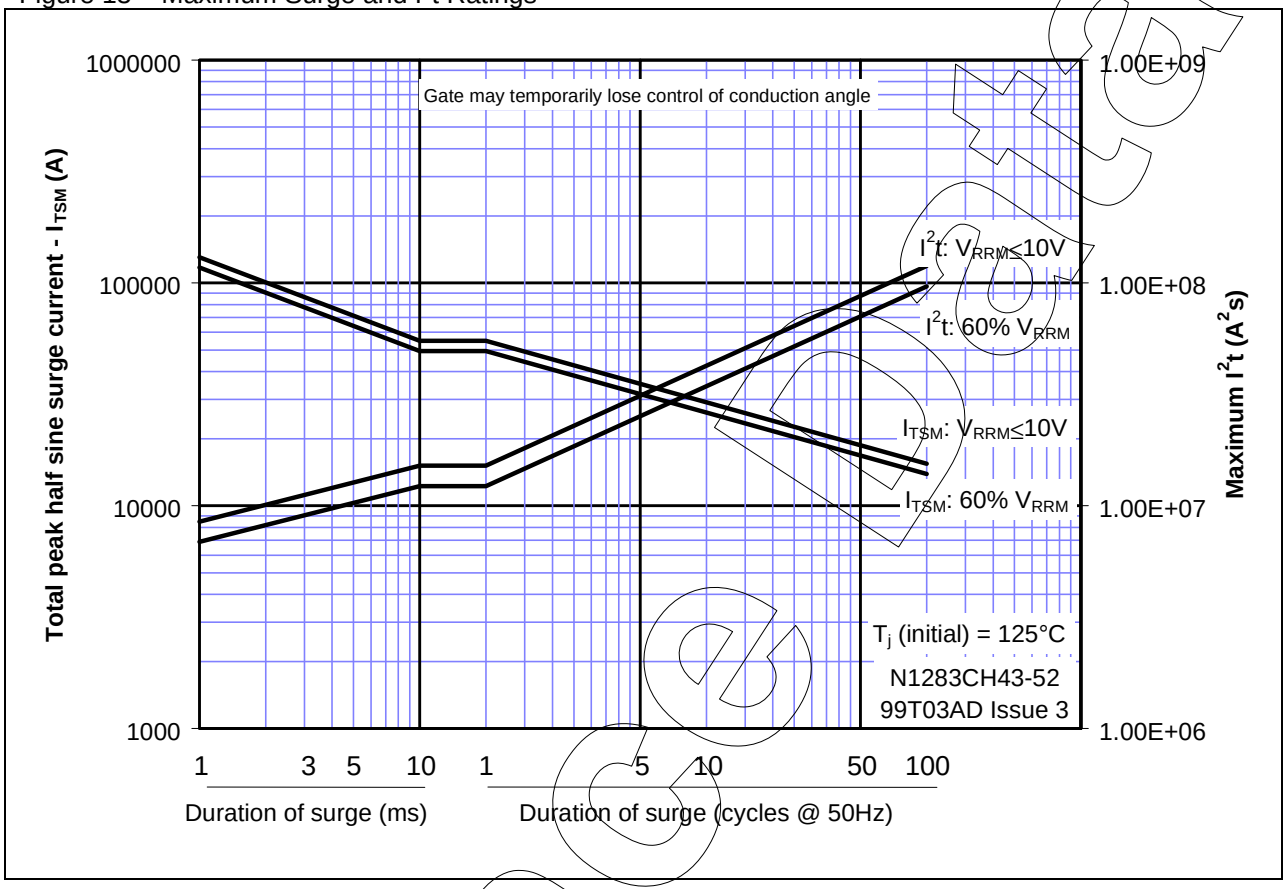
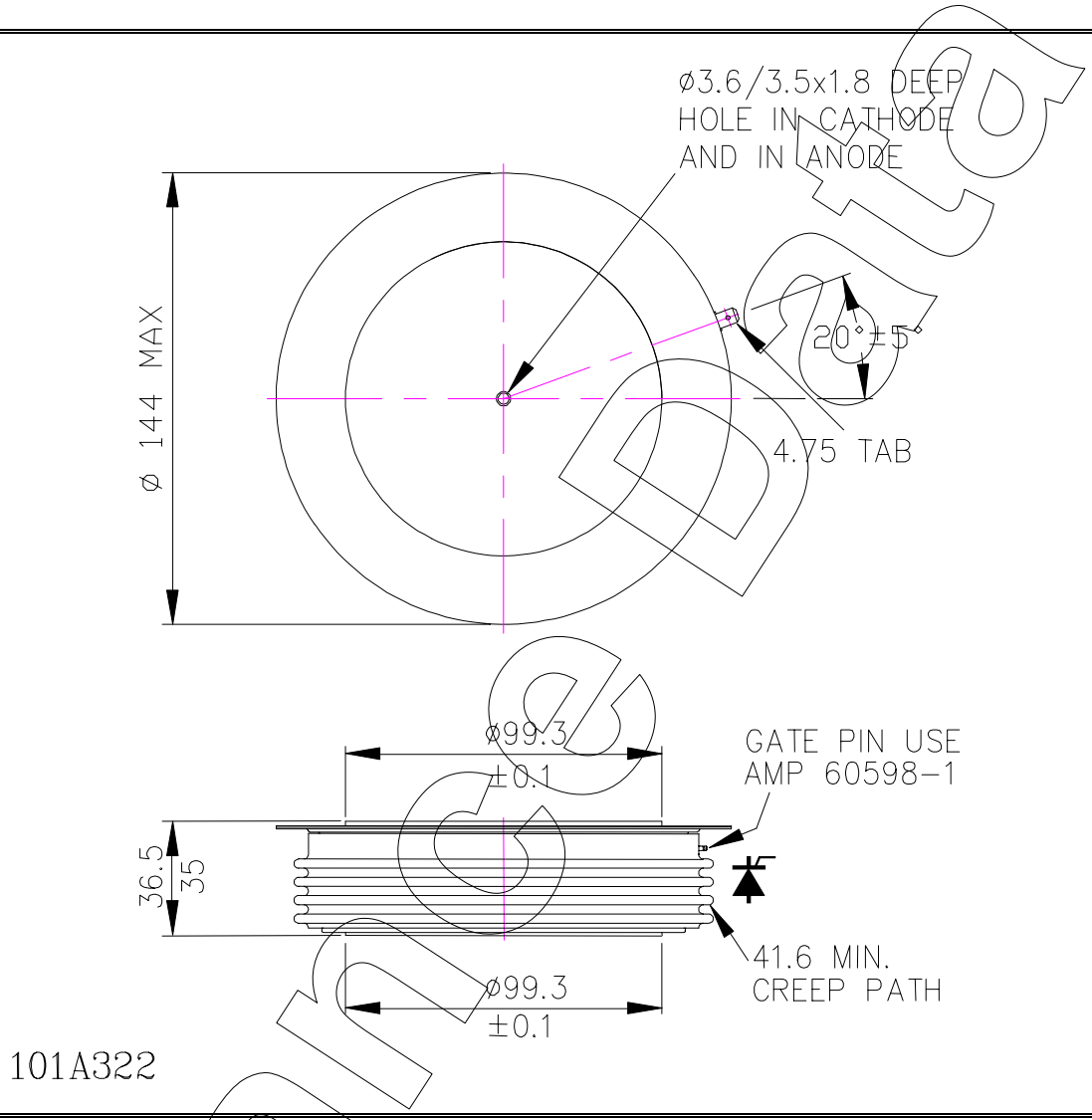


Figure 13 – Maximum Surge and I^2t Ratings



Outline drawing & ordering information



ORDERING INFORMATION			(Please quote 12 digit code as below)
N1283	**CH**	♦ ♦	♦ ♦ ♦
Fixed Type Code	Fixed Outline Code	Voltage Code V_{DRM} / 100	Critical dv/dt Code Blank=200V/µs, G00=300V/µs, H00=400V/µs, J00=500V/µs, K00=750V/µs, L00=1000V/µs

Typical order code : N1283CH50K00 – 5kV V_{DRM}, 750V/µs critical dv/dt, 36.5mm clamp height capsule

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