

Date: - 18th Jan 2019

Data Sheet Issue: - A2

Phase Control Thyristor Types N2055MC260 and N2055MC280

Development Type No.: NX454MC260 and NX454MC280

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{DRM}	Repetitive peak off-state voltage, (note 1)	2600-2800	V
V_{DSM}	Non-repetitive peak off-state voltage, (note 1)	2600-2800	V
V_{RRM}	Repetitive peak reverse voltage, (note 1)	2600-2800	V
V_{RSM}	Non-repetitive peak reverse voltage, (note 1)	2700-2900	V

	OTHER RATINGS	MAXIMUM LIMITS	UNITS	
$I_{T(AV)M}$	Maximum average on-state current, T _{sink} =55°C, (n	2105	Α	
$I_{T(AV)M}$	Maximum average on-state current. T _{sink} =85°C, (n	ote 2)	1455	Α
$I_{T(AV)M}$	Maximum average on-state current. T _{sink} =85°C, (n	ote 3)	890	Α
$I_{T(RMS)M}$	Nominal RMS on-state current, T _{sink} =25°C, (note 2	2)	4135	Α
$I_{T(d.c.)}$	D.C. on-state current, T _{sink} =25°C, (note 4)		3625	Α
I _{TSM}	Peak non-repetitive surge t _p =10ms, V _{rm} =60%V _{RRM}	25.8	kA	
I _{TSM2}	Peak non-repetitive surge t _p =10ms, V _{rm} ≤10V, (note	28.4	kA	
l ² t	$I^{2}t$ capacity for fusing t_{p} =10ms, V_{rm} =60% V_{RRM} , (not	3.33×10 ⁶	A^2s	
l ² t	l²t capacity for fusing t _p =10ms, V _{rm} ≤10V, (note 5)		4.03×10 ⁶	A^2s
		(continuous, 50Hz)	75	
(di/dt) _{cr}	Critical rate of rise of on-state current (note 6)	(repetitive, 50Hz, 60s)	150	A/μs
		(non-repetitive)	300	
V_{RGM}	Peak reverse gate voltage		5	V
$P_{G(AV)}$	Mean forward gate power	4	W	
P_GM	Peak forward gate power	30	W	
T _{j op}	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_i below 25°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, 125°C T_i initial.
- 6) V_D =67% V_{DRM} , I_{TM} =2000A, I_{FG} =2A, t_r ≤0.5 μ s, T_{case} =125°C.



Characteristics

	PARAMETER	MIN.	TYP.	MAX.	TEST CONDITIONS (Note 1)	UNITS
V_{TM}	Maximum peak on-state voltage	-	-	1.45	I _{TM} =2000A	V
V_{TM}	Maximum peak on-state voltage	-	-	2.47	I _{TM} =7800A	V
V_{T0}	Threshold voltage	-	-	0.97		V
r _T	Slope resistance	-	-	0.24		mΩ
(dv/dt) _{cr}	Critical rate of rise of off-state voltage	1000	-	-	V _D =80% V _{DRM} , linear ramp, gate o/c	V/μs
I _{DRM}	Peak off-state current	-	-	120	Rated V _{DRM}	mA
I _{RRM}	Peak reverse current	-	-	120	Rated V _{RRM}	mA
V_{GT}	Gate trigger voltage	-	-	3.0	T-25°C	V
I _{GT}	Gate trigger current	-	-	300	T_j =25°C V_D =10V, I_T =3A	mA
$V_{\sf GD}$	Gate non-trigger voltage	-	-	0.25	Rated V _{DRM}	V
I _H	Holding current	-	-	1000	T _j =25°C	mA
t _{gd}	Gate-controlled turn-on delay time	-	0.6	1.2	V _D =67% V _{DRM} , I _T =1000A, di/dt=10A/μs,	μs
t _{gt}	Turn-on time	-	1.2	2.4	I_{FG} =2A, t_r =0.5 μ s, T_j =25°C	μs
Q _{rr}	Recovered charge	-	4800	5400		μC
Q _{ra}	Recovered charge, 50% Chord	-	2650	-	 I _{TM} =1000A, t _p =2000μs, di/dt=10A/μs,	μC
Irr	Reverse recovery current	-	165	-	V _r =50V	Α
t _{rr}	Reverse recovery time	-	32	-		μs
t	Turn-off time	-	170	-	I _{TM} =1000A, t _p =2000μs, di/dt=10A/μs, V _r =50V, V _{dr} =80%V _{DRM} , dV _{dr} /dt=20V/μs	μs
t _q	Turr-on unie	-	250	-	I_{TM} =1000A, t_p =2000 μ s, di/dt=10A/ μ s, V_r =50V, V_{dr} =80% V_{DRM} , dV_{dr} /dt=200V/ μ s	μδ
R_{thJK}	Thermal resistance, junction to heatsink	-	-	0.015	Double side cooled	K/W
\tnJK	Thermal resistance, junction to fleatsink	-	-	0.030	Single side cooled	K/W
F	Mounting force	24	-	32	Note 2.	kN
W_t	Weight	-	540	-		g

Notes:-

- 1) Unless otherwise indicated T_j =125°C.
- 2) For other clamp forces, please consult factory.



Notes on Ratings and Characteristics

1.0 Voltage Grade Table

Voltage Grade	Vdrm Vdsm Vrrm V	V _{RSM} V	V _D V _R DC V
26	2600	2700	1750
28	2800	2900	1850

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 Repetitive dv/dt

Standard dv/dt is 1000V/µs.

5.0 Snubber Components

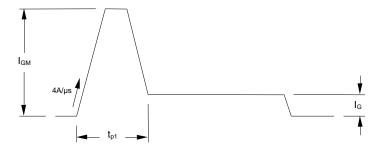
When selecting snubber components, care must be taken not to use excessively large values of snubber capacitor or excessively small values of snubber resistor. Such excessive component values may lead to device damage due to the large resultant values of snubber discharge current. If required, please consult the factory for assistance.

6.0 Rate of rise of on-state current

The maximum un-primed rate of rise of on-state current must not exceed 300A/µs at any time during turnon on a non-repetitive basis. For repetitive performance, the on-state rate of rise of current must not exceed 150A/µs at any time during turn-on. Note that these values of rate of rise of current apply to the total device current including that from any local snubber network.

7.0 Gate Drive

The nominal requirement for a typical gate drive is illustrated below. An open circuit voltage of at least 30V is assumed. This gate drive must be applied when using the full di/dt capability of the device.



The magnitude of I_{GM} should be between five and ten times I_{GT} , which is shown on page 2. Its duration (t_{p1}) should be 20µs or sufficient to allow the anode current to reach ten times I_L , whichever is greater. Otherwise, an increase in pulse current could be needed to supply the necessary charge to trigger. The 'back-porch' current I_G should remain flowing for the same duration as the anode current and have a magnitude in the order of 1.5 times I_{GT} .



8.0 Computer Modelling Parameters

8.1 Device Dissipation Calculations

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

Where V_{T0} =0.97V, r_T =0.24m Ω ,

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

ff = Form factor, see table below.

Supplementary Thermal Impedance							
Conduction Angle	30°	60°	90°	120°	180°	270°	d.c.
Square wave Double Side Cooled	0.0187	0.0180	0.0172	0.0165	0.0161	0.0154	0.0150
Square wave Cathode Side Cooled	0.0336	0.0330	0.0322	0.0316	0.0311	0.0304	0.0300
Sine wave Double Side Cooled	0.0181	0.0173	0.0167	0.0163	0.0150		
Sine wave Cathode Side Cooled	0.0331	0.0323	0.0318	0.0313	0.0300		

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		

8.2 Calculating V_T using ABCD Coefficients

The on-state characteristic I_T vs. V_T, 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_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.

25°C Coefficients			125°C Coefficients
Α	1.404857	Α	0.6396285
В	-0.09213455	В	0.02143101
С	1.13813×10 ⁻⁴	С	1.81584×10 ⁻⁴
D	0.01130301	D	6.311056×10 ⁻³



8.3 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.

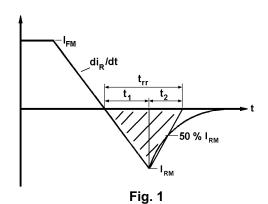
The coefficients for this device are shown in the tables below:

D.C. Double Side Cooled					
Term	erm 1 2 3 4 5				
r_p	9.101252×10 ⁻³	3.72631×10 ⁻³	9.932217×10 ⁻⁴	8.144717×10 ⁻⁴	2.83815×10 ⁻⁴
τρ	0.7551424	0.1079169	0.02507952	6.228595×10 ⁻³	1.76976×10 ⁻³

D.C. Single Side Cooled						
Term	Term 1 2 3 4					
r_p	0.02113833	4.699747×10 ⁻³	3.039341×10 ⁻³	1.342022×10 ⁻³		
$ au_{\mathcal{P}}$	4.35453	0.3471467	0.06385472	6.339516×10 ⁻³		

9.0 Reverse recovery ratings

(i) Qra is based on 50% Irm chord as shown in Fig. 1



$$Q_{rr} = \int_{0}^{150 \,\mu s} i_{rr}.dt$$

(iii)
$$K Factor = \frac{t_1}{t_2}$$



Curves

Figure 1 – On-state characteristics of Limit device

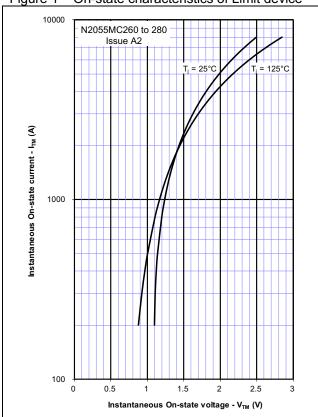


Figure 2 – Transient thermal impedance

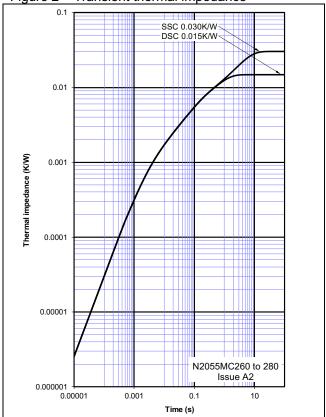


Figure 3 - Gate Characteristics - Trigger limits

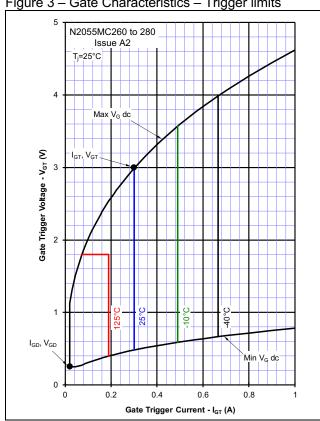


Figure 4 – Gate Characteristics – Power Curves

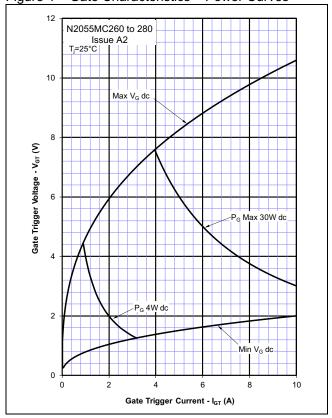




Figure 5 - Total Recovered Charge, Qrr

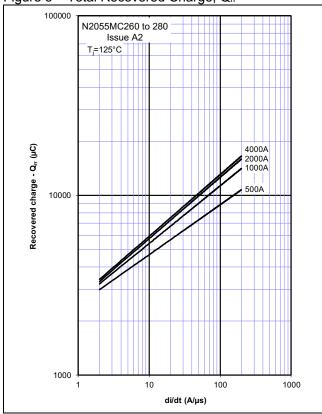


Figure 6 – Recovered Charge, Qra (50% chord)

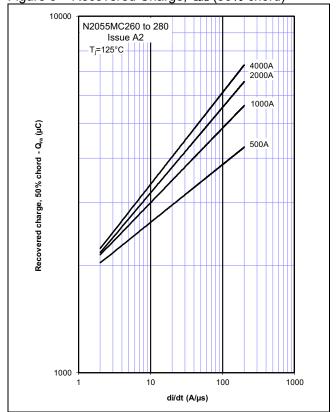


Figure 7 - Peak Reverse Recovery Current, Irm

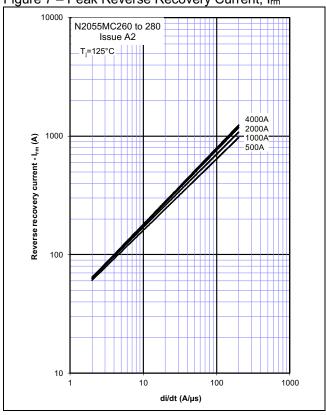


Figure 8 – Maximum Recovery Time, t_{rr} (50% chord)

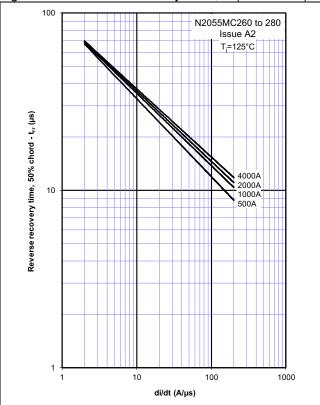




Figure 9 – On-state current vs. Power dissipation – Double Side Cooled (Sine wave)

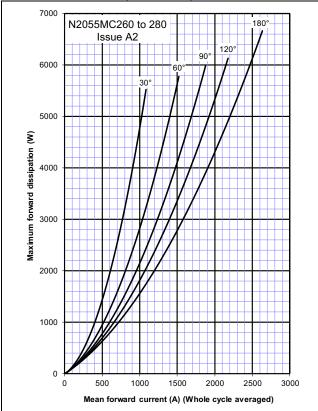


Figure 11 – On-state current vs. Power dissipation – Double Side Cooled (Square wave)

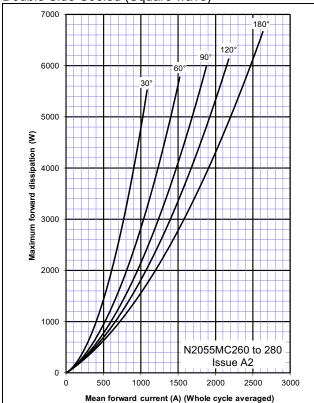


Figure 10 – On-state current vs. Heatsink temperature – Double Side Cooled (Sine wave)

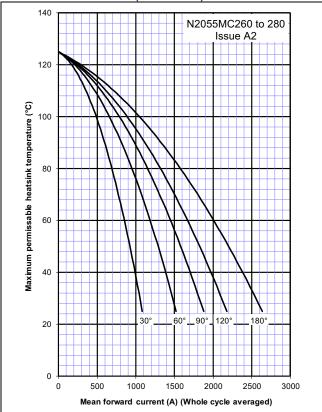


Figure 12 – On-state current vs. Heatsink temperature – Double Side Cooled (Square wave)

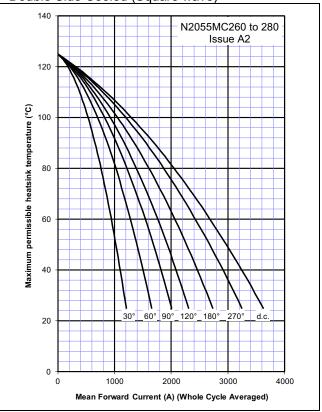




Figure 13 – On-state current vs. Power dissipation – Cathode Side Cooled (Sine wave)

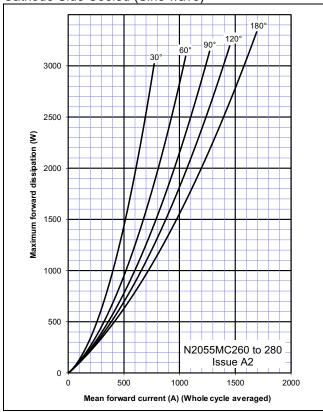


Figure 15 – On-state current vs. Power dissipation – Cathode Side Cooled (Square wave)

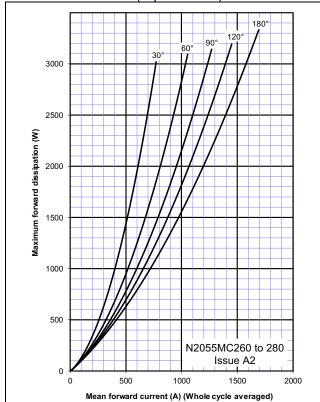


Figure 14 – On-state current vs. Heatsink temperature – Cathode Side Cooled (Sine wave)

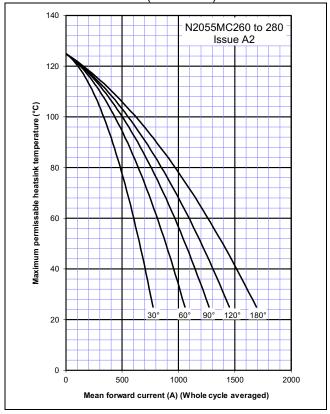
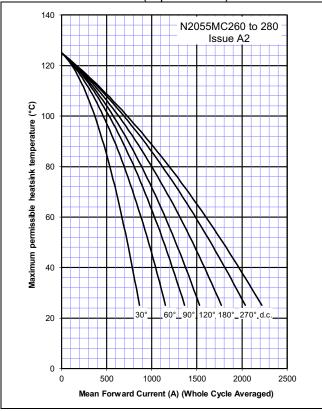
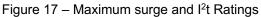
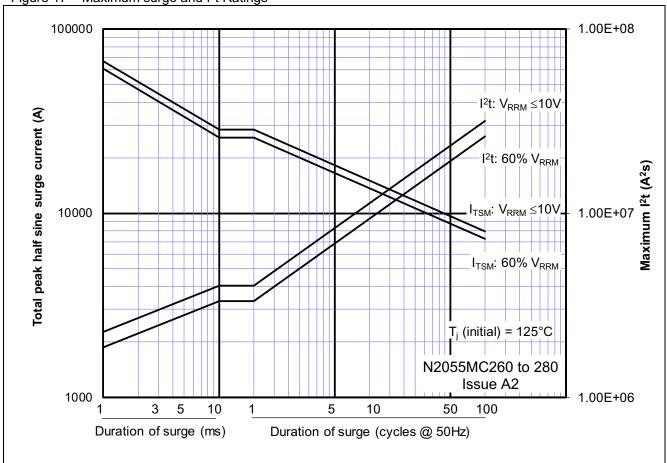


Figure 16 – On-state current vs. Heatsink temperature – Cathode Side Cooled (Square wave)



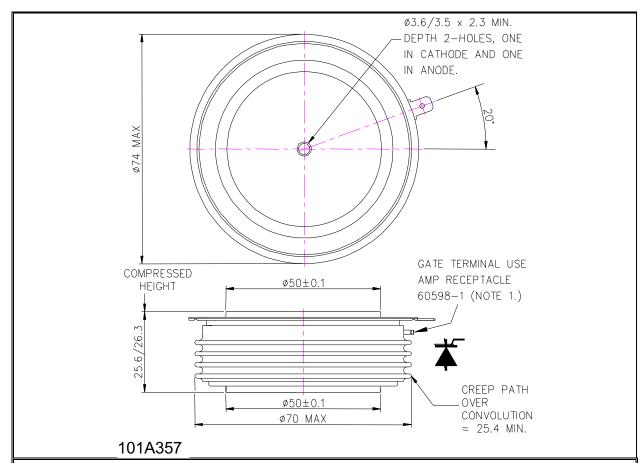








Outline Drawing & Ordering Information



ORDERI	NG INFORMATION	(Please quote 10 digit code as below)		
N2055	MC	**	0	
Fixed Type Code	Fixed MC = 26mm clamp height	Voltage code V _{DRM} /100 26 and 28	Fixed turn-off time code	

Order code: N2055MC280 - 2800V VDRM, VRRM, 26mm clamp height capsule.

IXYS Semiconductor GmbH

Edisonstraße 15 D-68623 Lampertheim Tel: +49 6206 503-0 Fax: +49 6206 503-627

E-mail: marcom@ixys.de



IXYS UK Westcode Ltd

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

E-mail: sales@ixysuk.com

IXYS Corporation

1590 Buckeye Drive Milpitas CA 95035-7418 Tel: +1 (408) 457 9000 Fax: +1 (408) 496 0670 E-mail: sales@ixys.net

www.littelfuse.com

www.ixysuk.com

www.ixys.com

IXYS Long Beach

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

Tel: +1 (562) 296 6584 Fax: +1 (562) 296 6585

E-mail: service@ixyslongbeach.com

The information contained herein is confidential and is protected by Copyright. The information may not be used or disclosed except with the written permission of and in the manner permitted by the proprietors IXYS UK Westcode Ltd

In the interest of product improvement, IXYS UK Westcode Ltd reserves the right to change specifications at any time without

Devices with a suffix code (2-letter, 3-letter or letter/digit/letter combination) added to their generic code are not necessarily subject to the conditions and limits contained in this report.

© IXYS UK Westcode Ltd.

