DCR4330M52

Phase Control Thyristor

DS5941-3 April 2013 (LN30251)

FEATURES

- Double Side Cooling
- High Surge Capability

APPLICATIONS

- High Power Drives
- High Voltage Power Supplies
- Static Switches

VOLTAGE RATINGS

Part and Ordering Number	Repetitive Peak Voltages V_{DRM} and V_{RRM} V	Conditions
DCR4330M52* DCR4330M50 DCR4330M45	5200 5000 4500	T_{vj} = -40°C to 125°C, I_{DRM} = I_{RRM} = 300mA, V_{DRM}, V_{RRM} t_p = 10ms, V_{DSM} & V_{RSM} = V_{DRM} & V_{RRM} + 100V respectively

Lower voltage grades available.
*5000V @ -40°C, 5200V @ 0°C

ORDERING INFORMATION

When ordering, select the required part number shown in the Voltage Ratings selection table.

For example:

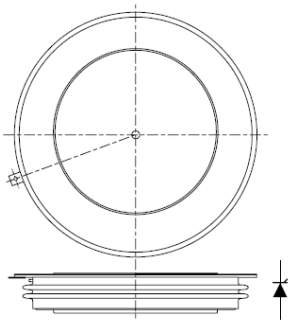
DCR4330M52

Note: Please use the complete part number when ordering and quote this number in any future correspondence relating to your order.

KEY PARAMETERS

V_{DRM}	**5200V**
$I_{T(AV)}$	**4325A**
I_{TSM}	**53400A**
dV/dt*	**2000V/µs**
dI/dt	**400A/µs**

*** Higher dV/dt selections available**



Outline type code: M.

(See Package Details for further information)

Fig. 1 Package outline

CURRENT RATINGS

T_{case} = 60°C unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
Double Side Cooled				
$I_{T(AV)}$	Mean on-state current	Half wave resistive load	4325	A
$I_{T(RMS)}$	RMS value	-	6790	A
I_T	Continuous (direct) on-state current	-	6250	A

SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine, T_{case} = 125°C	53.4	kA
I^2t	I^2t for fusing	V_R = 0	14.25	MA^2s

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Test Conditions		Min.	Max.	Units
$R_{th(j-c)}$	Thermal resistance – junction to case	Double side cooled	DC	-	0.00518	°C/W
		Single side cooled	Anode DC	-	0.01012	°C/W
			Cathode DC	-	0.01080	°C/W
$R_{th(c-h)}$	Thermal resistance – case to heatsink	Clamping force 83.0kN	Double side	-	0.001	°C/W
		(with mounting compound)	Single side	-	0.002	°C/W
T_{vj}	Virtual junction temperature	Blocking V_{DRM} / V_{RRM}		-	125	°C
T_{stg}	Storage temperature range			-55	125	°C
F_m	Clamping force			74.0	91.0	kN

DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions		Min.	Max.	Units
I_{RRM}/I_{DRM}	Peak reverse and off-state current	At V_{RRM}/V_{DRM}, T_{case} = 125°C		-	300	mA
dV/dt	Max. linear rate of rise of off-state voltage	To 67% V_{DRM}, T_j = 125°C, gate open		-	2000	V/µs
dI/dt	Rate of rise of on-state current	From 67% V_{DRM} to 2x $I_{T(AV)}$	Repetitive 50Hz	-	400	A/µs
		Gate source 30V, 10Ω, t_r < 0.5µs, T_j = 125°C	Non-repetitive	-	1000	A/µs
$V_{T(TO)}$	Threshold voltage – Low level	1000 to 2600A at T_{case} = 125°C		-	0.85	V
	Threshold voltage – High level	2600 to 9000A at T_{case} = 125°C		-	0.99	V
r_T	On-state slope resistance – Low level	1000 to 2600A at T_{case} = 125°C		-	0.2115	mΩ
	On-state slope resistance – High level	2600 to 9000A at T_{case} = 125°C		-	0.1578	mΩ
t_{gd}	Delay time	V_D = 67% V_{DRM}, gate source 30V, 10Ω, t_r = 0.5µs, T_j = 25°C		-	3	µs
t_q	Turn-off time	T_j = 125°C, V_R = 200V, dI/dt = 1A/µs, dV_{DR}/dt = 20V/µs linear			750	µs
Q_S	Stored charge	I_T = 3000A, T_j = 125°C, dI/dt – 1A/µs, V_{Rpeak} ~3100V, V_R ~ 2100V		4030	5420	µC
I_{RR}	Reverse recovery current			49	59	A
I_L	Latching current	T_j = 25°C, V_D = 5V		-	3	A
I_H	Holding current	T_j = 25°C, R_{G-K} = ∞, I_{TM} = 500A, I_T = 5A		-	300	mA

GATE TRIGGER CHARACTERISTICS AND RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
V_{GT}	Gate trigger voltage	V_{DRM} = 5V, T_{case} = 25°C	1.5	V
V_{GD}	Gate non-trigger voltage	At 50% V_{DRM}, T_{case} = 125°C	0.4	V
I_{GT}	Gate trigger current	V_{DRM} = 5V, T_{case} = 25°C	400	mA
I_{GD}	Gate non-trigger current	At 50% V_{DRM}, T_{case} = 125°C	10	mA

CURVES

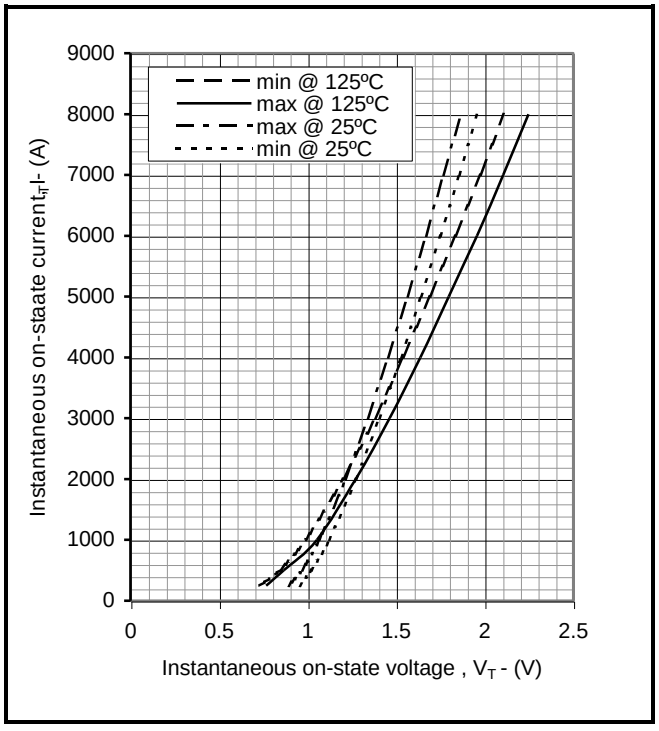


Fig.2 Maximum & minimum on-state characteristics

V_{TM} EQUATION

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

Where A = 0.061592
B = 0.115333
C = 0.000119
D = 0.002394

these values are valid for T_j = 125°C for I_T 250A to 9000A

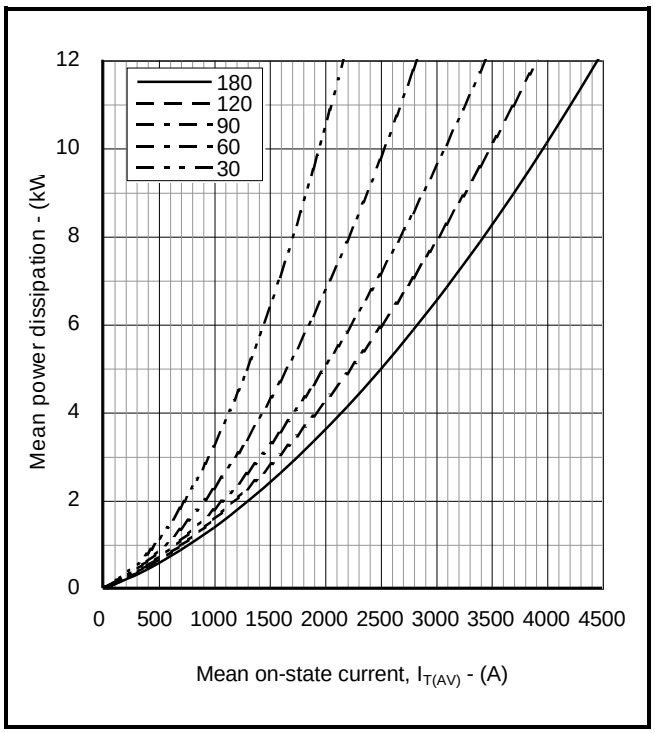


Fig.3 On-state power dissipation – sine wave

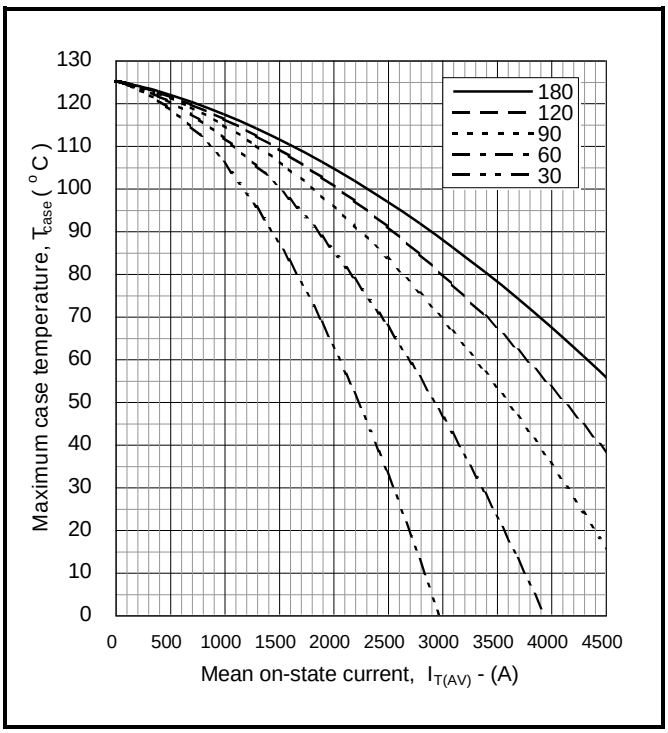


Fig.4 Maximum permissible case temperature, double side cooled – sine wave

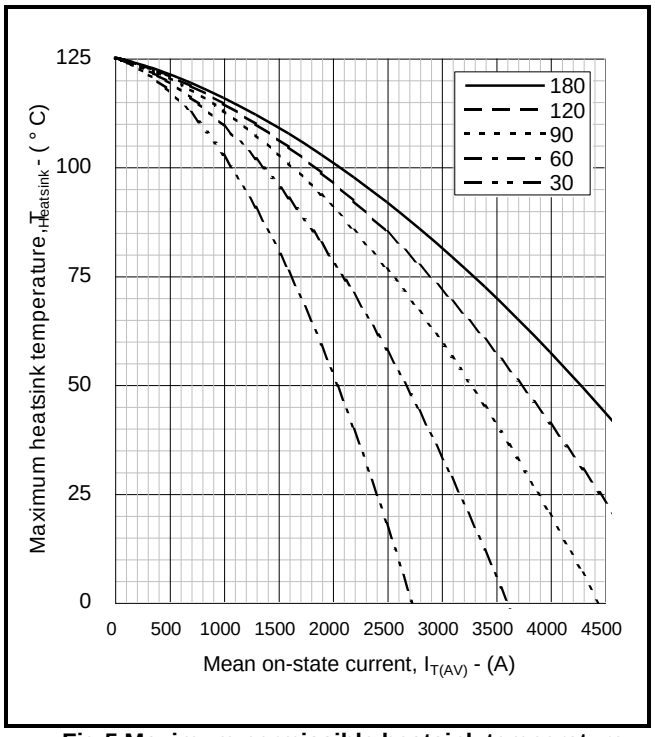


Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave

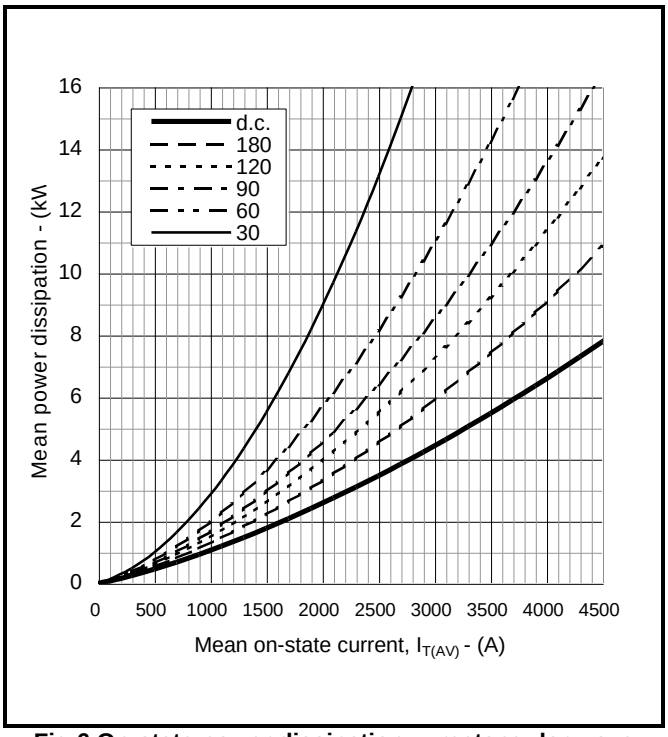


Fig.6 On-state power dissipation – rectangular wave

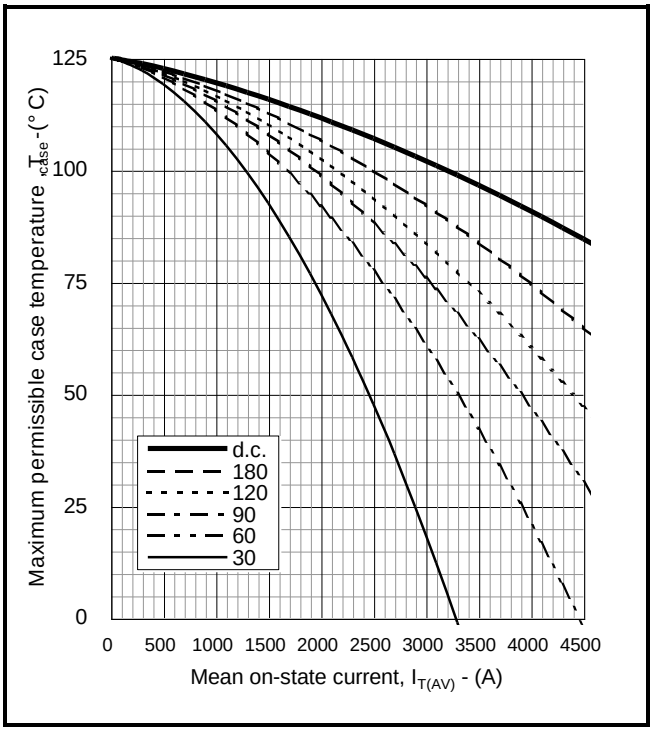


Fig.7 Maximum permissible case temperature, double side cooled – rectangular wave

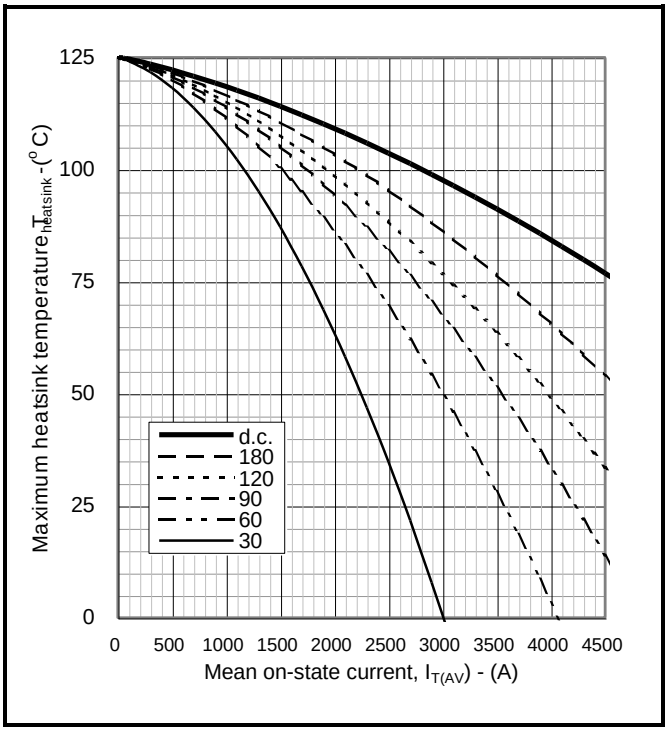
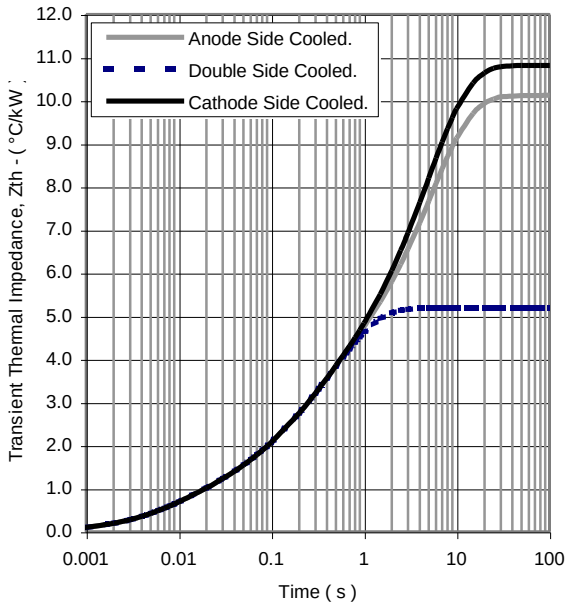


Fig.8 Maximum permissible heatsink temperature, double side cooled – rectangular wave



		1	2	3	4
Double side cooled	R_i (°C/kW)	1.995338	1.242784	1.9448	0.005
	T_i (s)	0.05	0.592935	0.592385	110.5108
Anode side cooled	R_i (°C/kW)	6.092995	1.957372	2.042252	0.035908
	T_i (s)	5.459764	0.510898	0.05	110.1735
Cathode side cooled	R_i (°C/kW)	6.856845	1.876401	2.062845	0.025343
	T_i (s)	5.181139	0.557321	0.05	110.1546

$$Z_{th} = \sum_{i=1}^{i=4} [R_i \times (1 - \exp(T / T_i))]$$

$\Delta R_{th(j-c)}$ Conduction

Tables show the increments of thermal resistance $R_{th(j-c)}$ when the device operates at conduction angles other than d.c.

Double side cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	0.51	0.36
120	0.57	0.49
90	0.64	0.56
60	0.70	0.63
30	0.74	0.71
15	0.76	0.74

Anode Side Cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	0.51	0.36
120	0.58	0.50
90	0.65	0.57
60	0.71	0.64
30	0.75	0.71
15	0.77	0.75

Cathode Sided Cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	0.51	0.36
120	0.58	0.50
90	0.65	0.57
60	0.71	0.64
30	0.75	0.71
15	0.77	0.75

Fig.9 Maximum (limit) transient thermal impedance – junction to case (°C/kW)

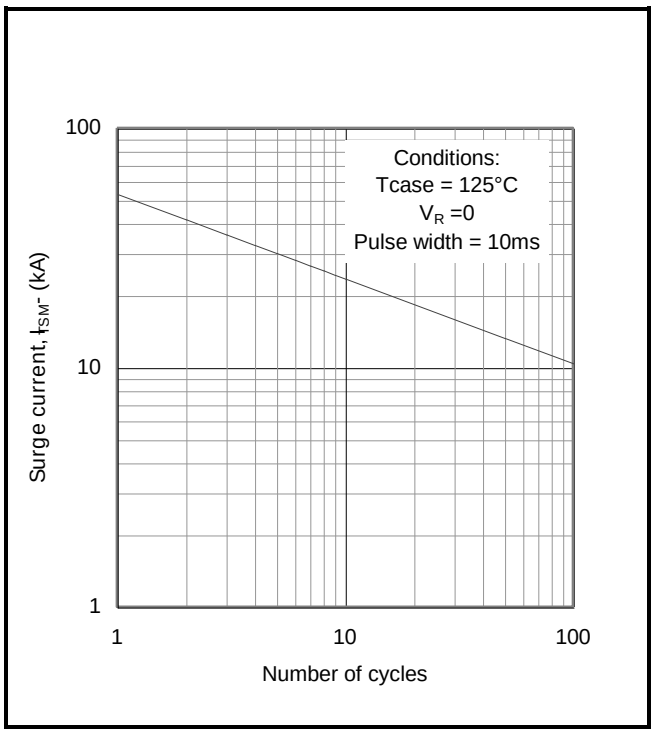


Fig.10 Multi-cycle surge current

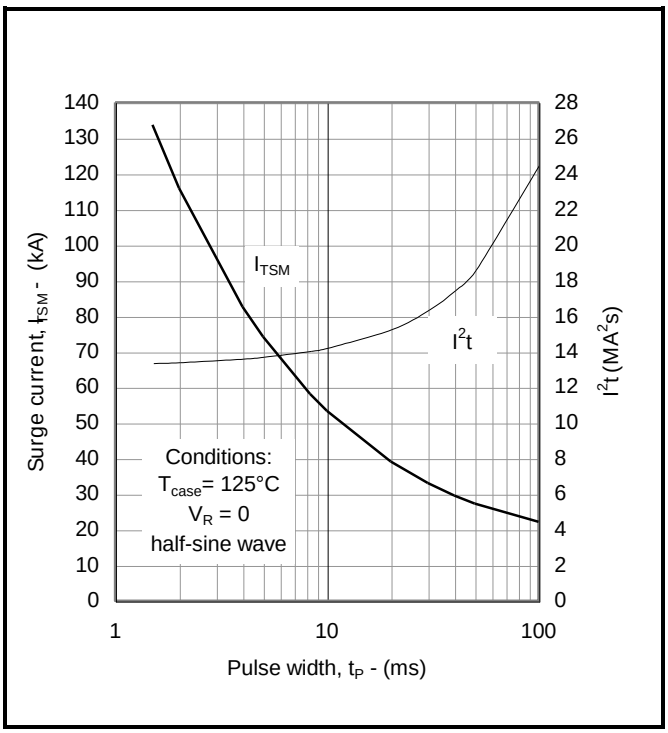


Fig.11 Single-cycle surge current

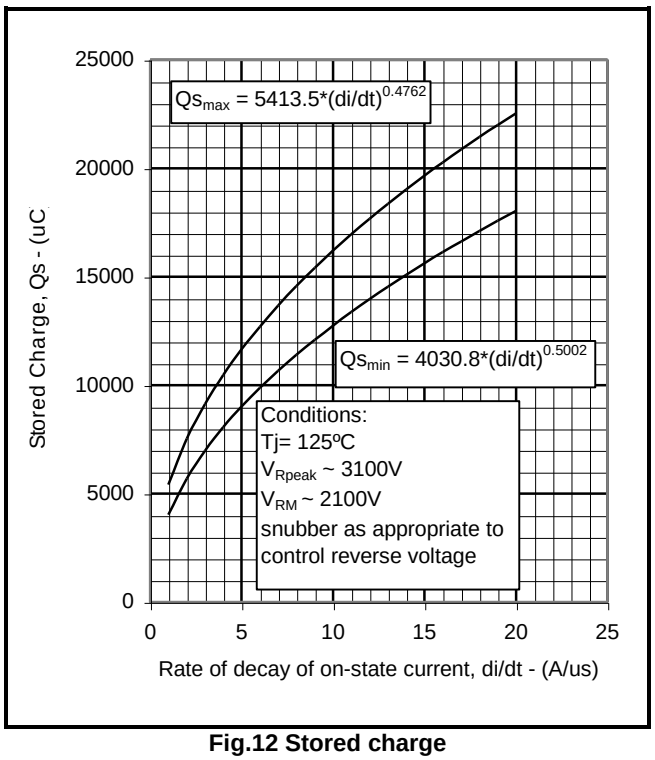


Fig.12 Stored charge

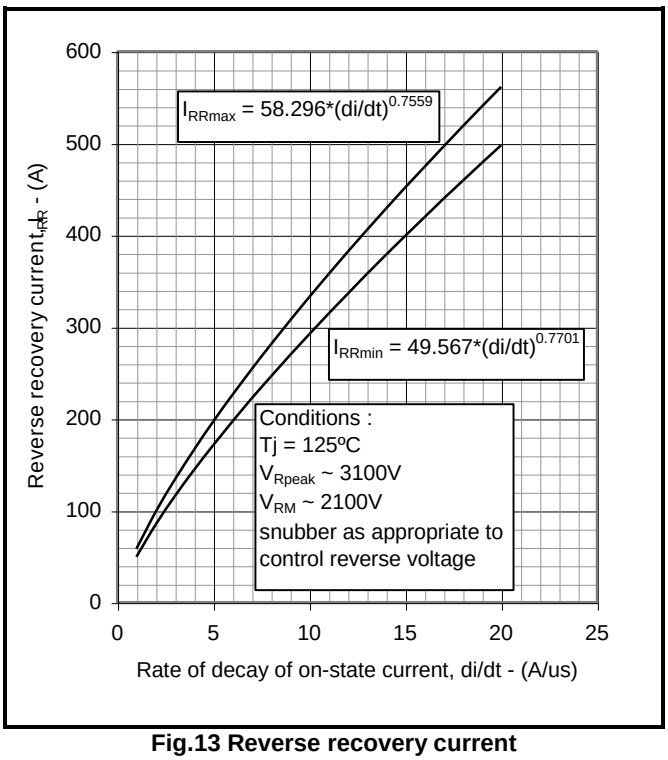


Fig.13 Reverse recovery current

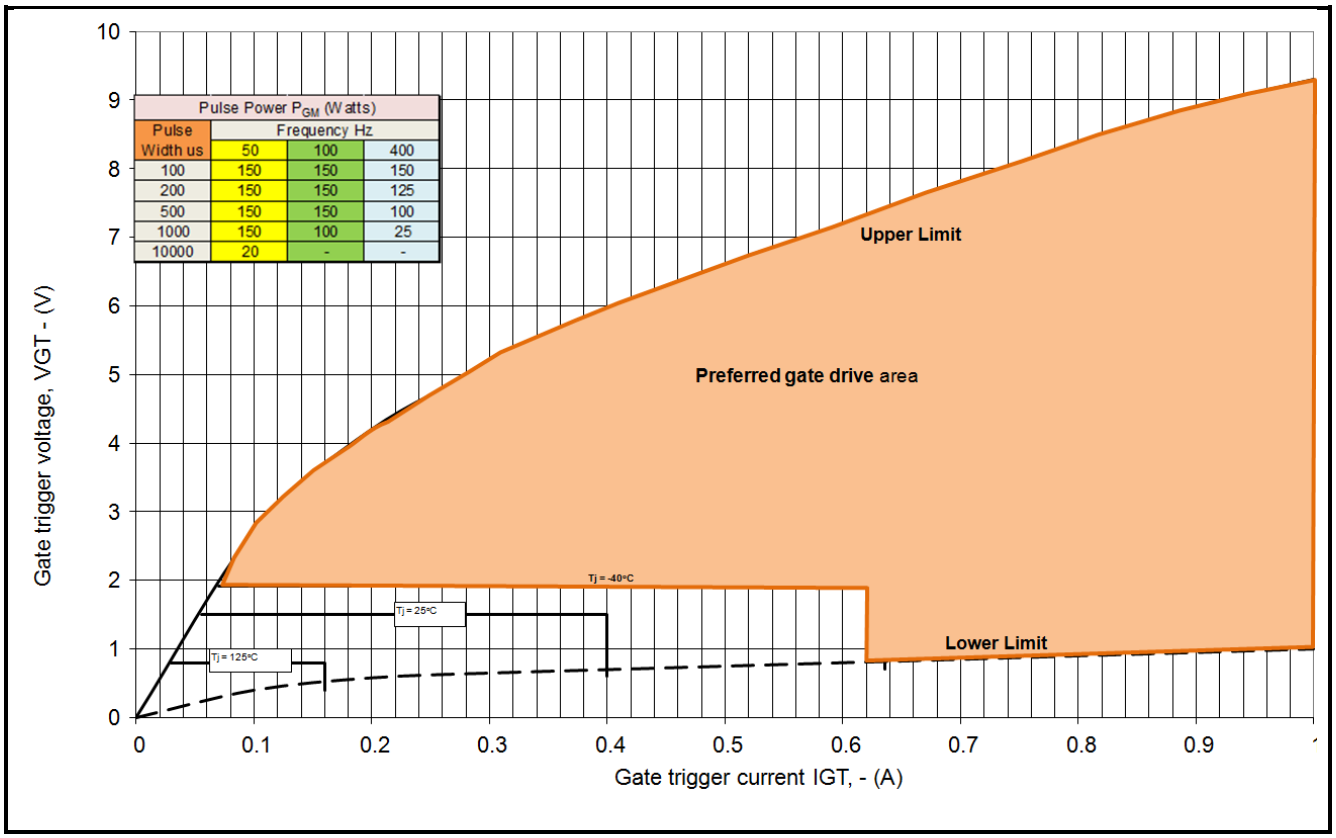


Fig14 Gate Characteristics

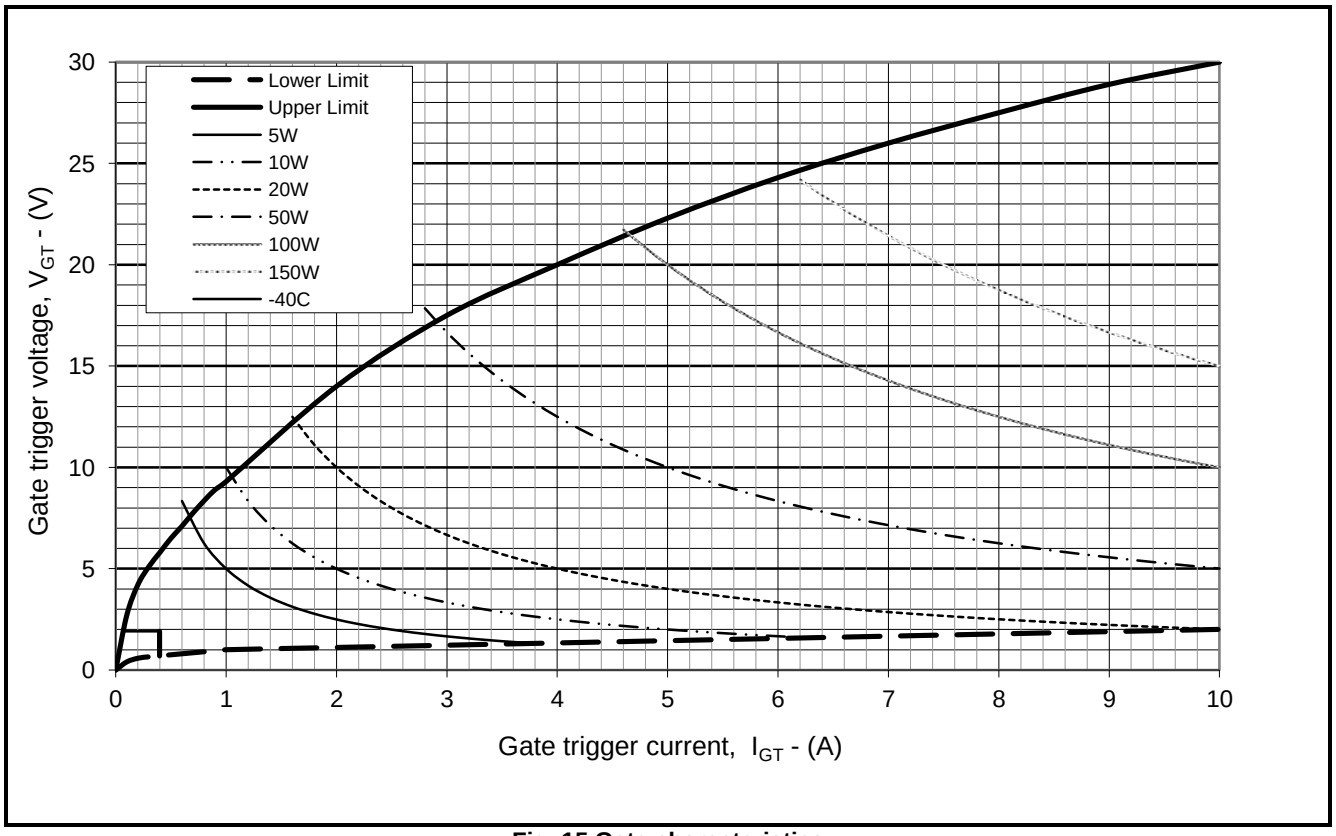
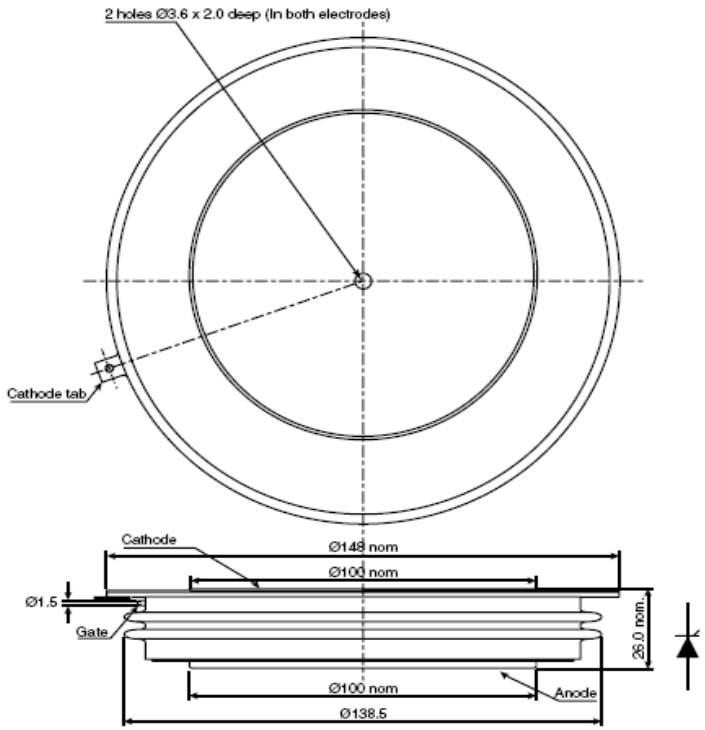


Fig. 15 Gate characteristics

PACKAGE DETAILS

For further package information, please contact Customer Services. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



Device	Maximum Thickness (mm)	Minimum Thickness (mm)
22CT93M	25.815	25.305
28CT93M	25.89	25.38
42CT93M	26.12	25.61
DCR4330M52	**26.26**	**25.75**
DCR3480M65	26.5	25.99
DCR2760M85	26.84	26.33

Nominal weight: 1950g
Lead length: 420mm
Lead terminal connector: M4 ring

Package outline type code: M

Fig.16 Package outline

IMPORTANT INFORMATION:

The products and data in this publication are intended for use by appropriately trained technical personnel.

Due to the diversity of product applications, the information contained herein is provided as a guide only and does not constitute any guarantee of suitability for use in a specific application.The user must evaluate the suitability of the product and the completeness of the product data for the application. The user is responsible for product selection and ensuring all safety and any warning requirements are met. Should additional product information be needed please contact Customer Service.

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The products must not be touched when operating because there is a danger of electrocution or severe burning. Always use protective safety equipment such as appropriate shields for the product and wear safety glasses. Even when disconnected any electric charge remaining in the product must be discharged and allowed to cool before safe handling using protective gloves.

Extended exposure outside the product ratings may affect reliability leading to premature product failure. Use outside the product ratings is likely to cause permanent damage to the product. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture, a large current to flow or high voltage arcing, resulting in fire or explosion. Appropriate application design and safety precautions should always be followed to protect persons and property.

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Preliminary Information: The product design is complete and final characterisation for volume production is in progress. The datasheet represents the product as it is now understood but details may change.
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