

**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
DCR4500A42*	4200	$T_{vj} = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$ , $I_{DRM} = I_{RRM} = 300\text{mA}$ , $V_{DRM}, V_{RRM} t_p = 10\text{ms}$ , $V_{DSM} \& V_{RSM} =$ $V_{DRM} \& V_{RRM} + 100\text{V}$ respectively
DCR4500A40	4000	
DCR4500A36	3600	

Lower voltage grades available.  
 \*4100V @  $-40^{\circ}\text{C}$ , 4200V @  $0^{\circ}\text{C}$

**ORDERING INFORMATION**

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

For example:

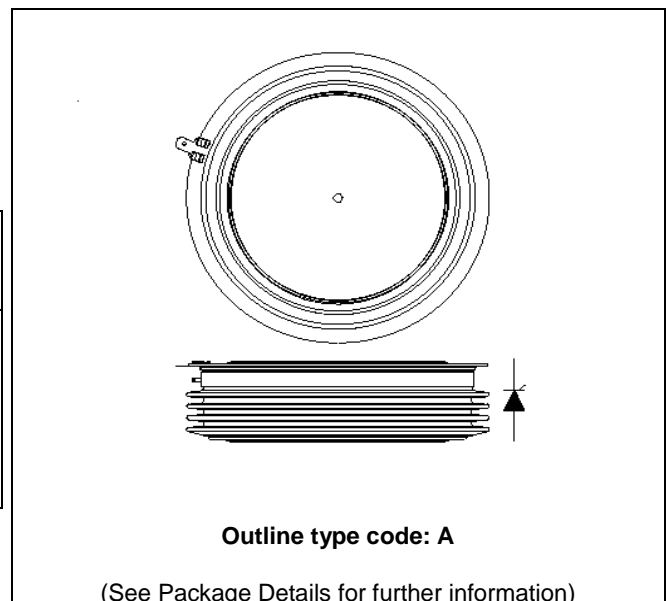
**DCR4500A42**

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

**KEY PARAMETERS**

$V_{DRM}$	<b>4200V</b>
$I_{T(AV)}$	<b>4500A</b>
$I_{TSM}$	<b>60800A</b>
$dV/dt^*$	<b>2000V/<math>\mu\text{s}</math></b>
$di/dt$	<b>200A/<math>\mu\text{s}</math></b>

\* Higher  $dV/dt$  selections available



**Fig. 1 Package outline**

## CURRENT RATINGS

$T_{case} = 60^{\circ}\text{C}$  unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
<b>Double Side Cooled</b>				
$I_{T(AV)}$	Mean on-state current	Half wave resistive load	4500	A
$I_{T(RMS)}$	RMS value	-	7068	A
$I_T$	Continuous (direct) on-state current	-	6330	A

## SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
$I_{TSM}$	Surge (non-repetitive) on-state current	10ms half sine, $T_{case} = 125^{\circ}\text{C}$	60.8	kA
$I^2t$	$I^2t$ for fusing	$V_R = 0$	18.48	$\text{MA}^2\text{s}$

## THERMAL AND MECHANICAL RATINGS

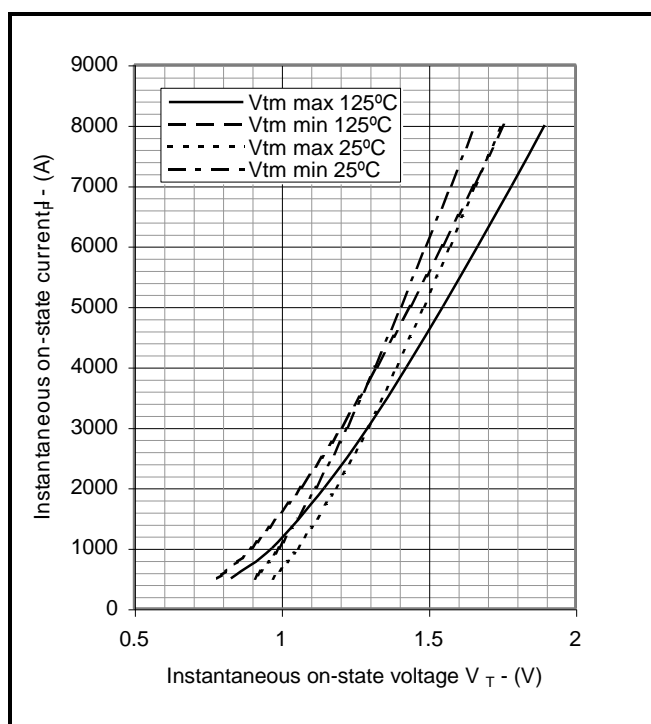
Symbol	Parameter	Test Conditions	Min.	Max.	Units	
$R_{th(j-c)}$	Thermal resistance – junction to case	Double side cooled	DC	-	0.00603	$^{\circ}\text{C/W}$
		Single side cooled	Anode DC	-	0.01024	$^{\circ}\text{C/W}$
			Cathode DC	-	0.01467	$^{\circ}\text{C/W}$
$R_{th(c-h)}$	Thermal resistance – case to heatsink	Clamping force 83.0kN (with mounting compound)	Double side	-	0.001	$^{\circ}\text{C/W}$
			Single side	-	0.002	$^{\circ}\text{C/W}$
$T_{vj}$	Virtual junction temperature	Blocking $V_{DRM} / V_{RRM}$	-	125	$^{\circ}\text{C}$	
$T_{stg}$	Storage temperature range		-55	125	$^{\circ}\text{C}$	
$F_m$	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 $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$	-	300	mA	
$dV/dt$	Max. linear rate of rise of off-state voltage	To 67% $V_{DRM}$ , $T_j = 125^{\circ}C$ , gate open	-	2000	V/ $\mu s$	
$dI/dt$	Rate of rise of on-state current	From 67% $V_{DRM}$ to $2x I_{T(AV)}$	Repetitive 50Hz	-	200	A/ $\mu s$
		Gate source 30V, 10 $\Omega$ , $t_r < 0.5\mu s$ , $T_j = 125^{\circ}C$	Non-repetitive	-	500	A/ $\mu s$
$V_{T(TO)}$	Threshold voltage – Low level	500 to 2200A at $T_{case} = 125^{\circ}C$	-	0.75	V	
	Threshold voltage – High level	2200 to 8000A at $T_{case} = 125^{\circ}C$	-	0.92	V	
$r_T$	On-state slope resistance – Low level	500A to 2200A at $T_{case} = 125^{\circ}C$	-	0.205	m $\Omega$	
	On-state slope resistance – High level	2200A to 8000A at $T_{case} = 125^{\circ}C$	-	0.122	m $\Omega$	
$t_{gd}$	Delay time	$V_D = 67\% V_{DRM}$ , gate source 30V, 10 $\Omega$ $t_r = 0.5\mu s$ , $T_j = 25^{\circ}C$	-	3	$\mu s$	
$t_q$	Turn-off time	$I_T = 5000A$ , $T_j = 125^{\circ}C$ , $V_R = 200V$ , $dI/dt = 5A/\mu s$ , $dV_{DR}/dt = 20V/\mu s$ linear		900	$\mu s$	
$Q_S$	Stored charge	$I_T = 3000A$ , $T_j = 125^{\circ}C$ , $dI/dt = 1A/\mu s$ , $V_{Rpeak} \sim 2500V$ , $V_R \sim 1700V$	2920	4875	$\mu C$	
$I_{RR}$	Reverse recovery current		42	57	A	
$I_L$	Latching current	$T_j = 25^{\circ}C$ , $V_D = 5V$	-	3	A	
$I_H$	Holding current	$T_j = 25^{\circ}C$ , $R_{G-K} = \infty$ , $I_{TM} = 500A$ , $I_T = 5A$	-	300	mA	

**GATE TRIGGER CHARACTERISTICS AND RATINGS**

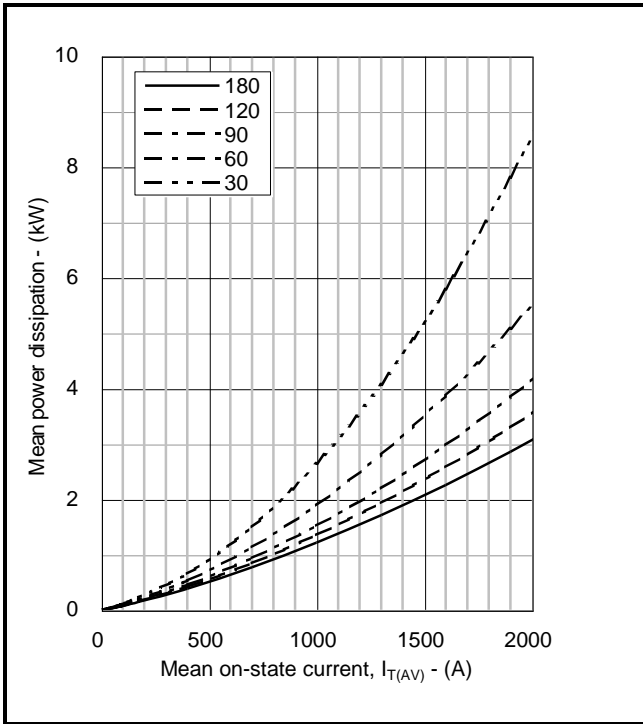
Symbol	Parameter	Test Conditions	Max.	Units
V <sub>GT</sub>	Gate trigger voltage	V <sub>DRM</sub> = 5V, T <sub>case</sub> = 25°C	1.5	V
V <sub>GD</sub>	Gate non-trigger voltage	At 50% V <sub>DRM</sub> , T <sub>case</sub> = 125°C	0.4	V
I <sub>GT</sub>	Gate trigger current	V <sub>DRM</sub> = 5V, T <sub>case</sub> = 25°C	400	mA
I <sub>GD</sub>	Gate non-trigger current	At 50% V <sub>DRM</sub> , T <sub>case</sub> = 125°C	10	mA

**CURVES**

**Fig.2 Maximum & minimum on-state characteristics**
**V<sub>TM</sub> EQUATION**

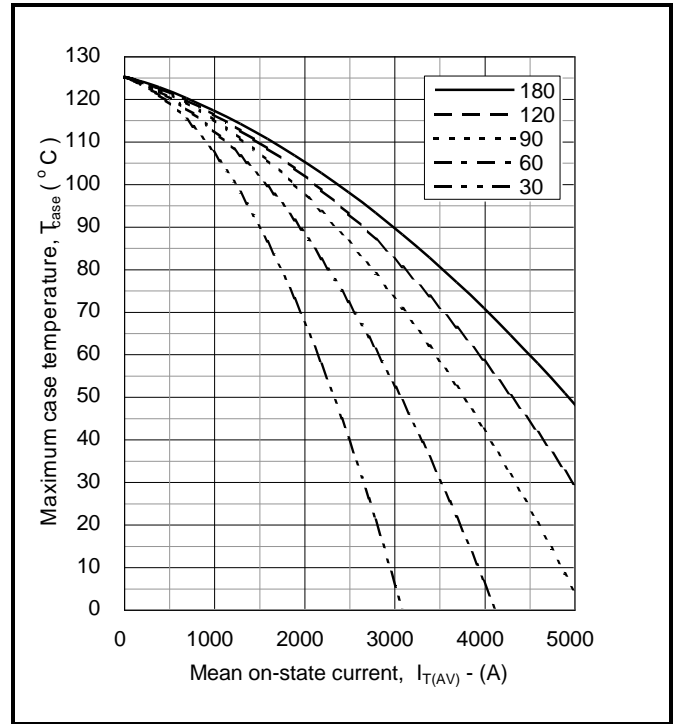
$$V_{TM} = A + B \ln(I_T) + C \cdot I_T + D \cdot \sqrt{I_T}$$

Where A = -0.208640  
 B = 0.171688  
 C = 0.000113  
 D = -0.003842

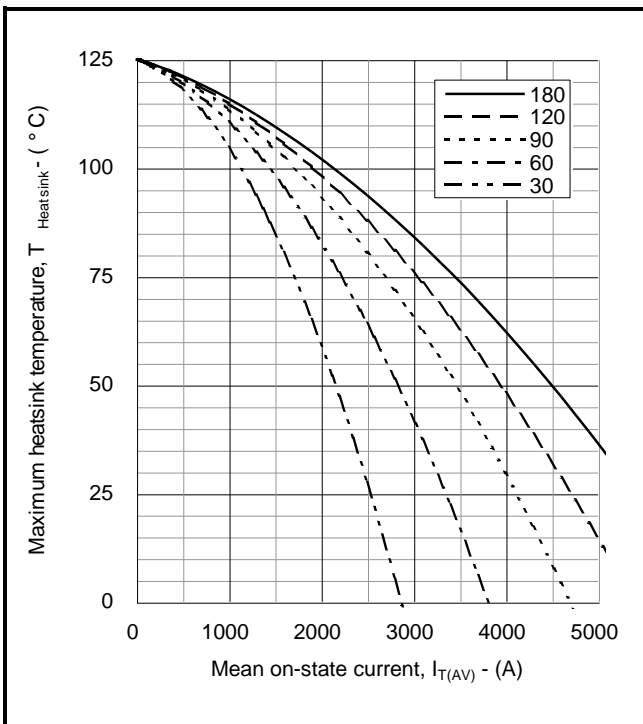
these values are valid for T<sub>j</sub> = 125°C for I<sub>T</sub> 500A to 8000A



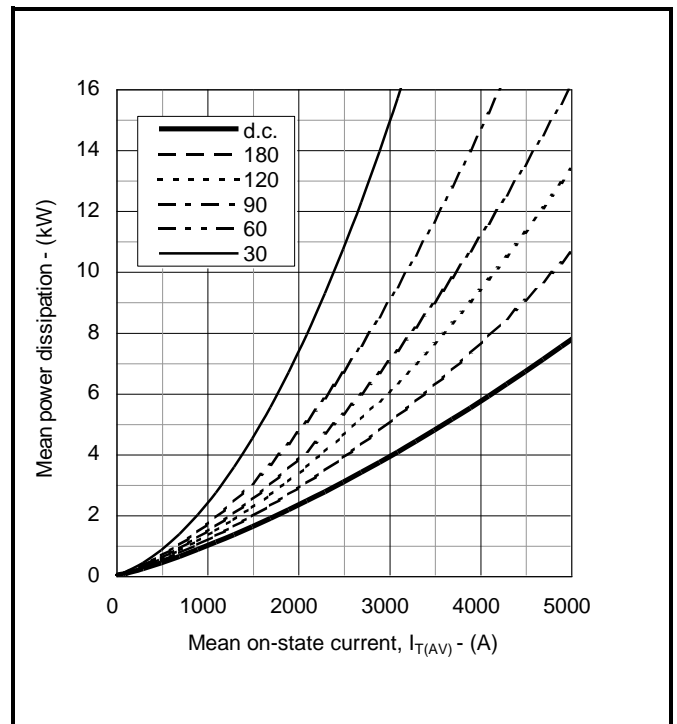
**Fig.3 On-state power dissipation – sine wave**



**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**

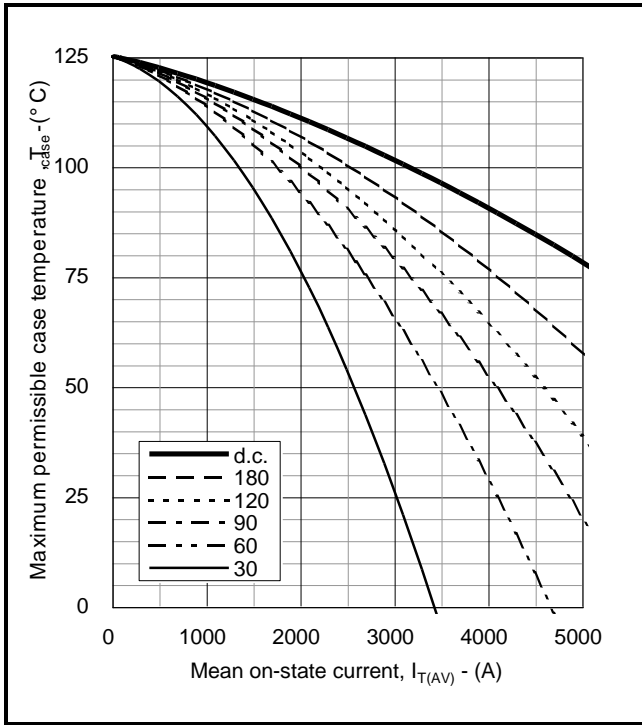


Fig.7 Maximum permissible case temperature, double side cooled – rectangular wave

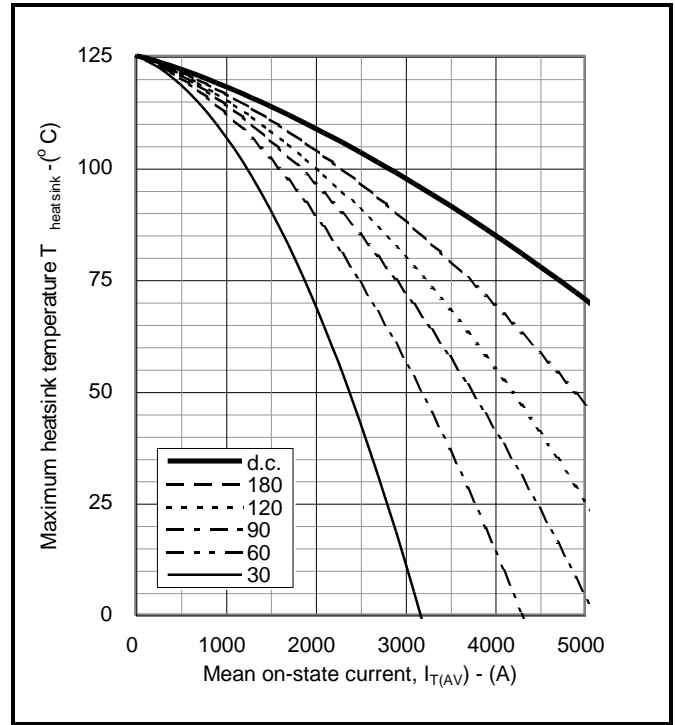


Fig.8 Maximum permissible heatsink temperature, double side cooled – rectangular wave

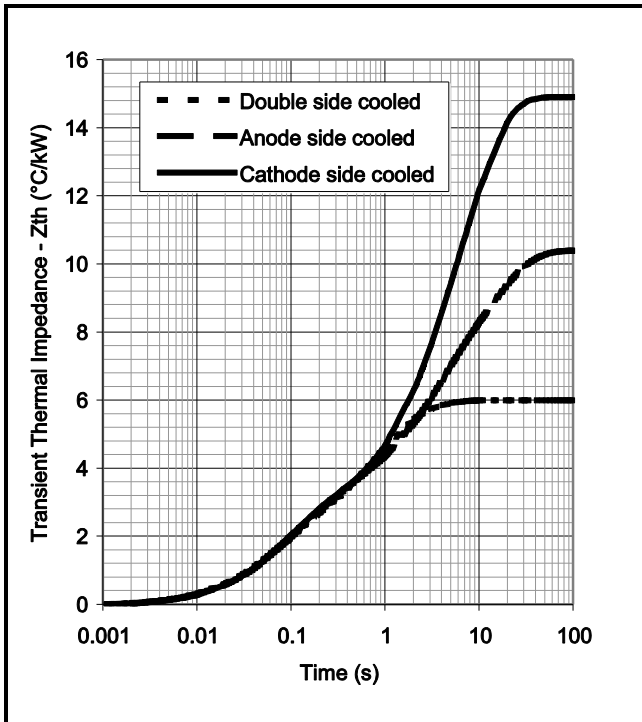


Fig.9 Maximum (limit) transient thermal impedance – junction to case (°C/kW)

		1	2	3	4
Double side cooled	R <sub>i</sub> (°C/kW)	3.01541	1.048955	0.983519	0.983519
	T <sub>i</sub> (s)	0.703874	1.904794	0.059	0.059
Anode side cooled	R <sub>i</sub> (°C/kW)	3.156003	4.092806	1.556555	1.623962
	T <sub>i</sub> (s)	2.69023	13.79162	0.059	0.205916
Cathode side cooled	R <sub>i</sub> (°C/kW)	7.077369	3.483481	1.745839	2.634274
	T <sub>i</sub> (s)	6.648601	8.436484	1.762119	0.08069

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

**ΔR<sub>th(j-c)</sub> Conduction**

Tables show the increments of thermal resistance R<sub>th(j-c)</sub> when the device operates at conduction angles other than d.c.

θ°	Double side cooling	
	sine.	rect.
180	0.44	0.31
120	0.49	0.43
90	0.55	0.49
60	0.60	0.55
30	0.64	0.61
15	0.66	0.64

θ°	Anode Side Cooling	
	sine.	rect.
180	0.42	0.30
120	0.47	0.41
90	0.52	0.46
60	0.57	0.52
30	0.61	0.58
15	0.62	0.61

θ°	Cathode Sided Cooling	
	sine.	rect.
180	0.42	0.30
120	0.47	0.41
90	0.52	0.46
60	0.57	0.52
30	0.60	0.58
15	0.62	0.60

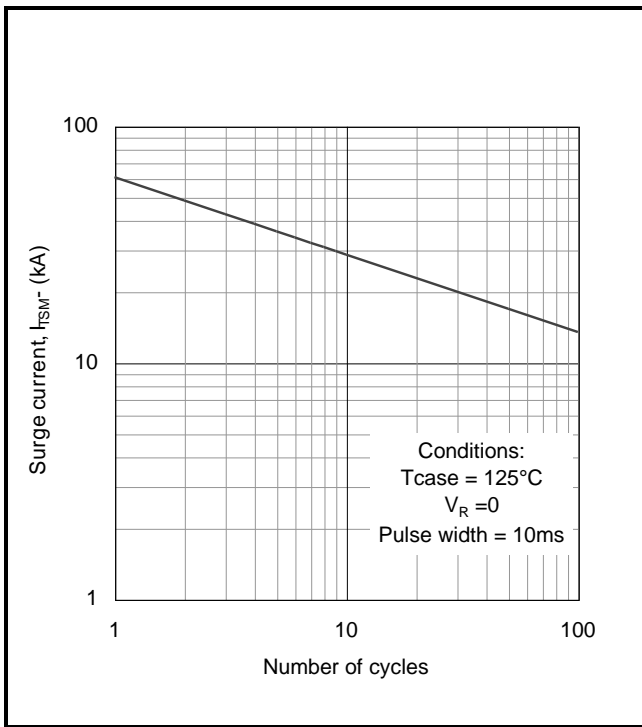


Fig.10 Multi-cycle surge current

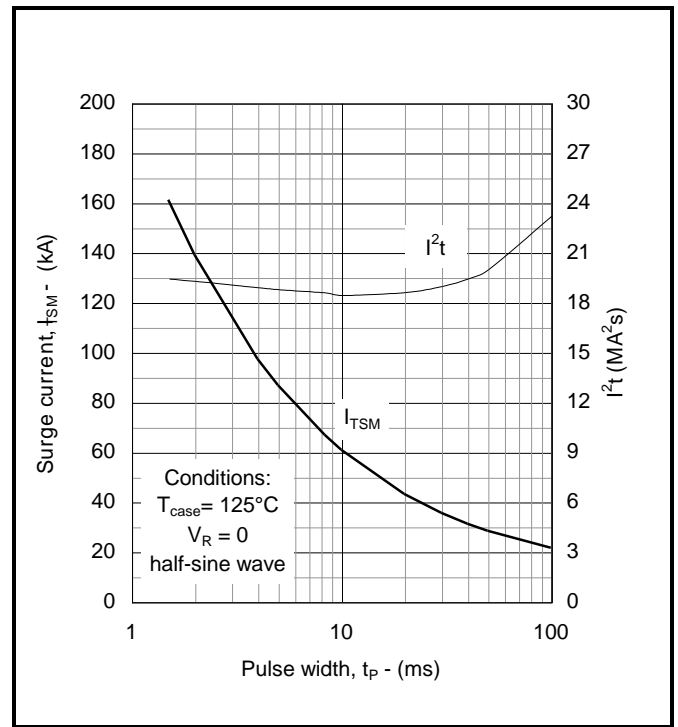


Fig.11 Single-cycle surge current

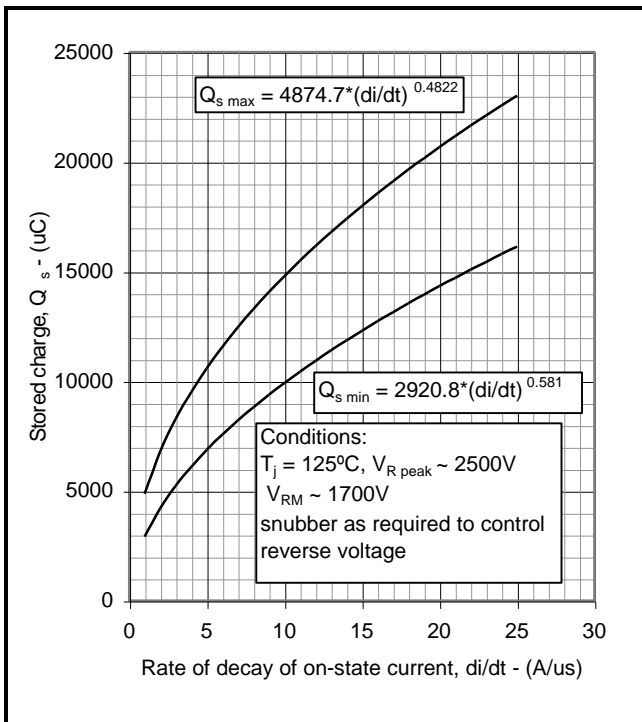


Fig.12 Stored charge

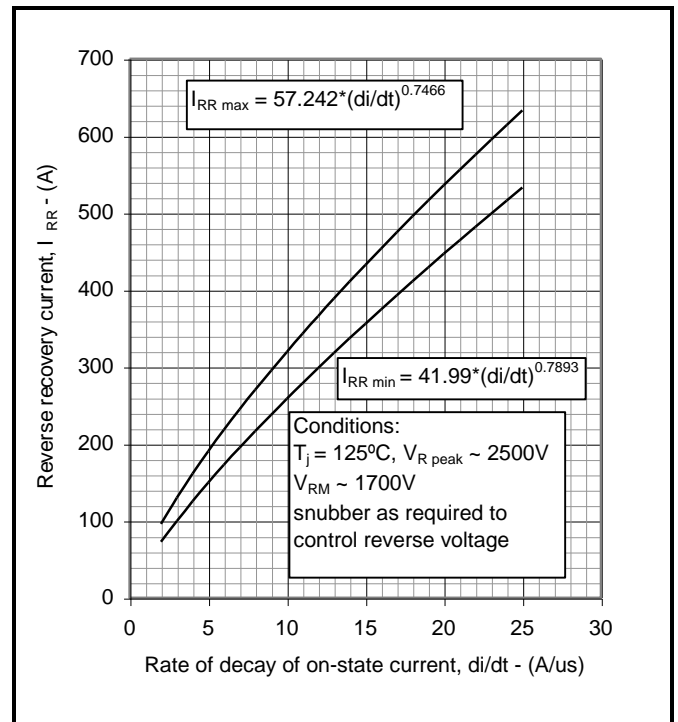
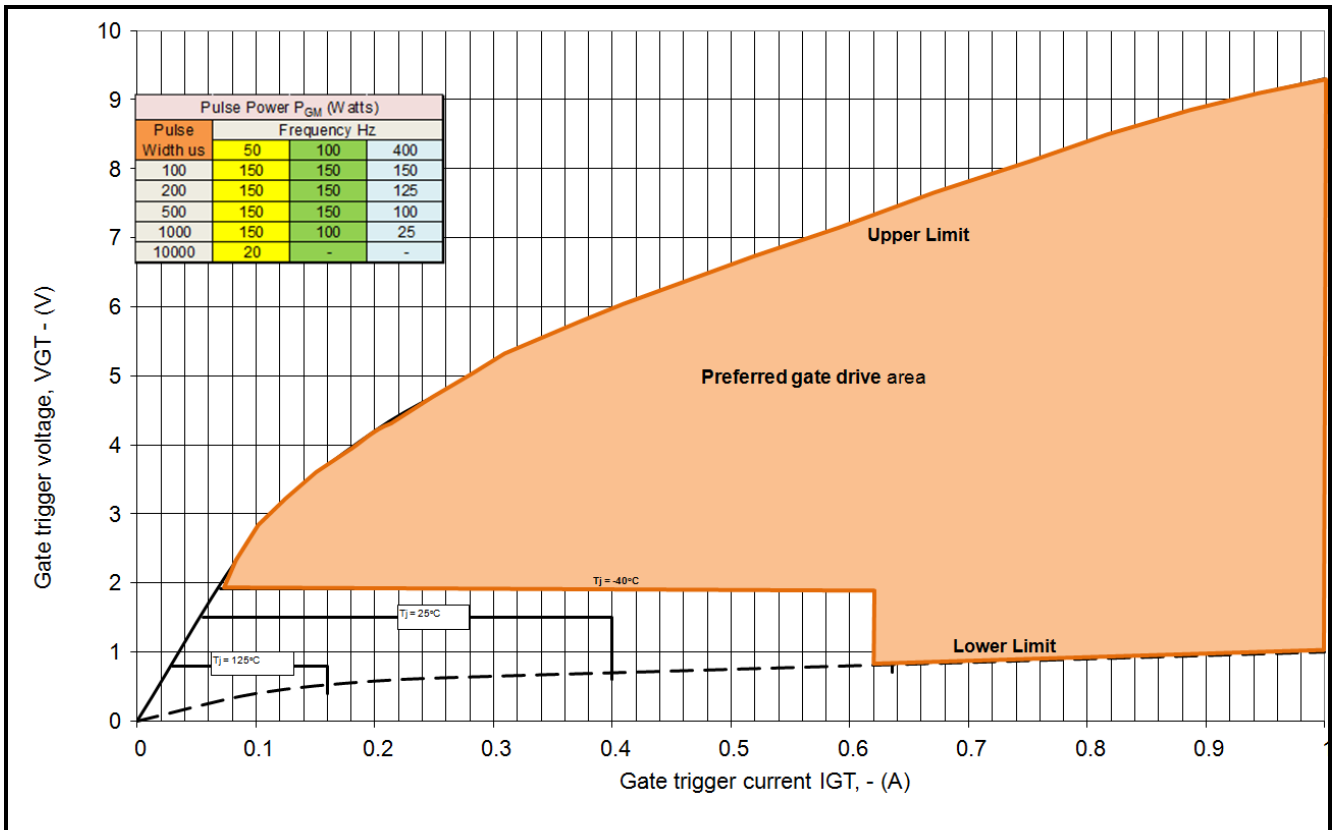
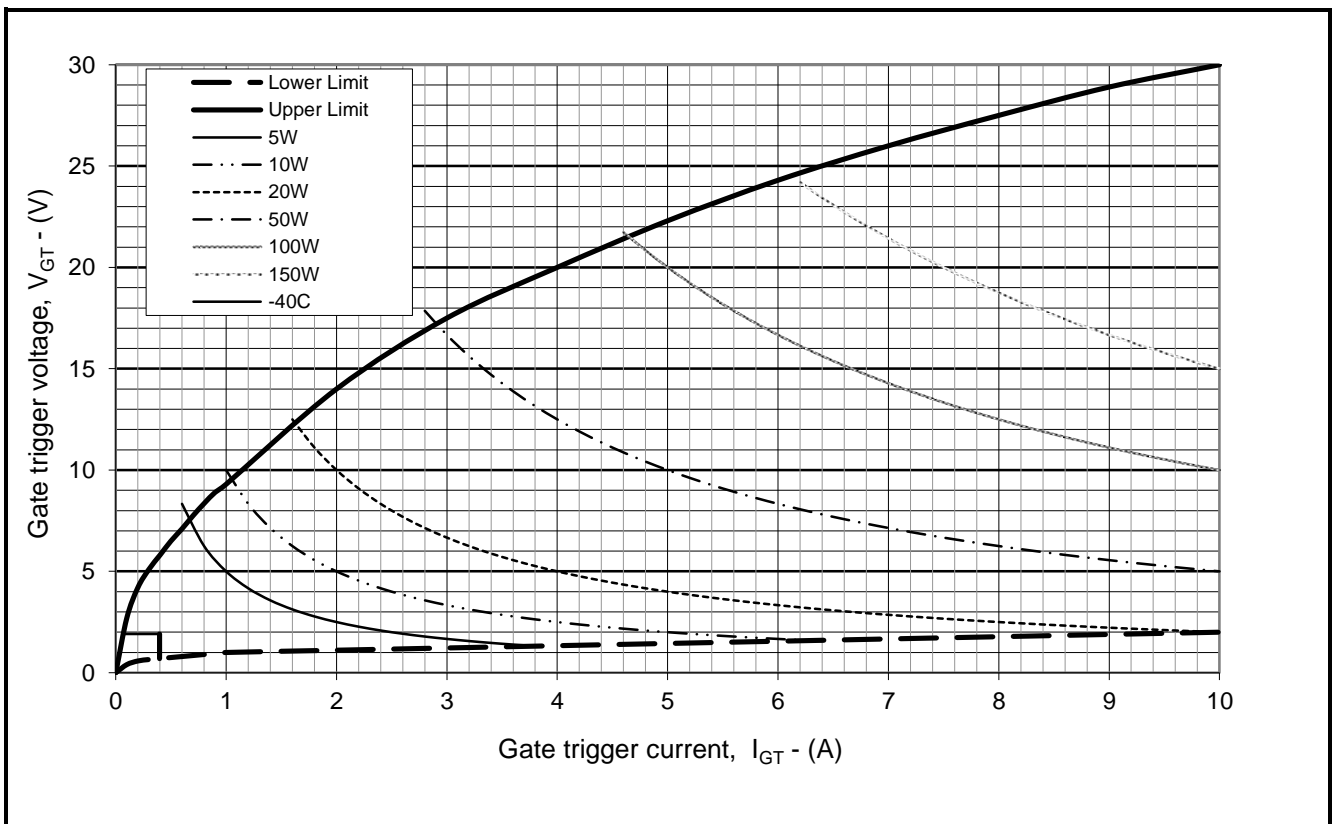


Fig.13 Reverse recovery current



**Fig14 Gate Characteristics**



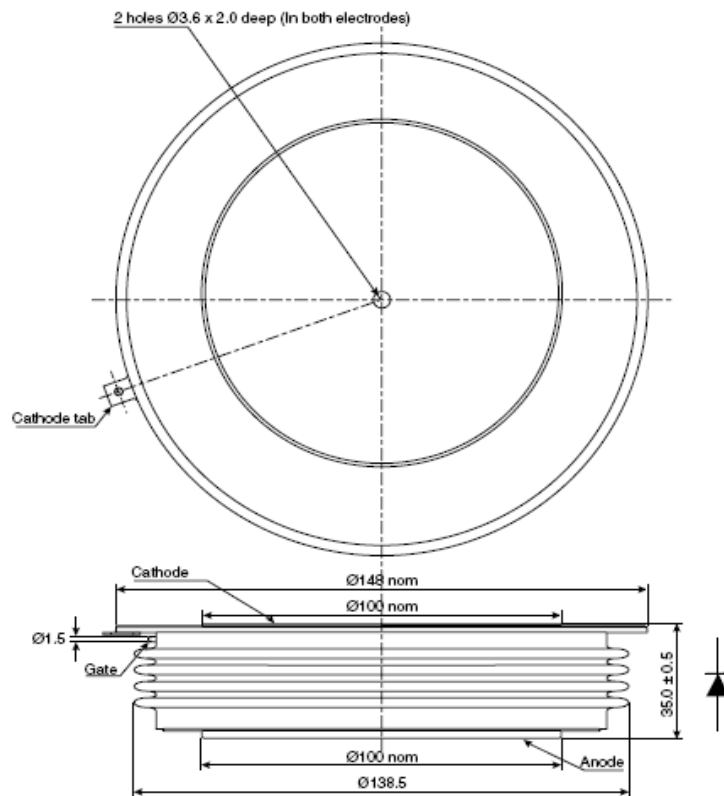
**Fig. 15 Gate characteristics**



**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)
<b>DCR4500A42</b>	<b>35.47</b>	<b>34.86</b>
DCR3990A52	35.61	35
DCR3220A65	35.85	35.24
DCR2560A85	36.19	35.58



Lead length: 420mm  
 Lead terminal connector: M4 ring  
 Weight: 2.6kg  
**Package outline type code: A**

**Fig.16 Package outline**

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Due to the diversity of product applications, the information contained herein is provided as a general 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 to conditions 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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