

### FEATURES

- Double Side Cooling
- High Surge Capability

### APPLICATIONS

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

### KEY PARAMETERS

$V_{DRM}$	<b>6500V</b>
$I_{T(AV)}$	<b>3230A</b>
$I_{TSM}$	<b>43000A</b>
$dV/dt^*$	<b>2000V/<math>\mu</math>s</b>
$dI/dt$	<b>500A/<math>\mu</math>s</b>

\* Higher  $dV/dt$  selections are available on request

### VOLTAGE RATINGS

Part and Ordering Number	Repetitive Peak Voltages $V_{DRM}$ and $V_{RRM}$ (V)	Conditions
DCR3220A65*	6500	$T_{vj} = -40^{\circ}\text{C}$ 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
DCR3220A60	6000	
DCR3220A55	5500	

Lower voltage grades available.

\*6200V @  $-40^{\circ}\text{C}$ , 6500V @  $0^{\circ}\text{C}$

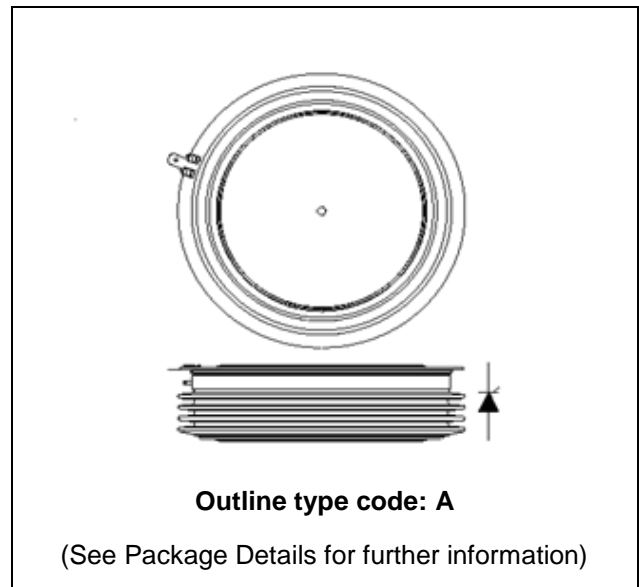


Fig. 1 Package outline

### ORDERING INFORMATION

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

For example:

#### DCR3220A65

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

## CURRENT RATINGS

$T_{case} = 60^{\circ}C$  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	3230	A
$I_{T(RMS)}$	RMS value	-	5070	A
$I_r$	Continuous (direct) on-state current	-	4640	A

## SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
$I_{TSM}$	Surge (non-repetitive) on-state current	10ms half sine, $T_{case} = 125^{\circ}C$ , $V_R = 0$	43.0	kA
$I^2t$	$I^2t$ for fusing		9.25	MA <sup>2</sup> 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	-	6.0	$^{\circ}C/kW$
		Single side cooled	Anode DC	-	10.4	$^{\circ}C/kW$
			Cathode DC	-	14.9	$^{\circ}C/kW$
$R_{th(c-h)}$	Thermal resistance - case to heatsink	Clamping force 83kN (with mounting compound)	Double side	-	1.0	$^{\circ}C/kW$
			Single side	-	2.0	$^{\circ}C/kW$
$T_{vj}$	Virtual junction temperature	Blocking $V_{DRM} / V_{RRM}$	-	125	$^{\circ}C$	
$T_{stg}$	Storage temperature range		-55	125	$^{\circ}C$	
$F_m$	Clamping force		74	91	kN	

**DYNAMIC CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Typ.	Max.	Units
<b>I<sub>RRM</sub>/I<sub>DRM</sub></b>	Peak reverse and off-state current	At $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$	-	300	mA
		At 50% $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$	20	-	mA

Symbol	Parameter	Test Conditions	Min.	Max.	Units	
<b>V<sub>TM</sub></b>	Instantaneous forward voltage	At 4000A peak, $T_j = 125^{\circ}C$	1.85	2.17	V	
<b>dV/dt</b>	Max. linear rate of rise of off-state voltage	To 67% $V_{DRM}$ , $T_j = 125^{\circ}C$ , gate open	-	2000	V/ $\mu$ s	
<b>dI/dt</b>	Rate of rise of on-state current	From 67% $V_{DRM}$ to $2x I_{T(AV)}$ Gate source 30V, $10\Omega$ $t_r < 0.5\mu$ s, $T_j = 125^{\circ}C$	Repetitive 50Hz	-	200	A/ $\mu$ s
			Non-repetitive	-	500	A/ $\mu$ s
<b>V<sub>T(ro)</sub></b>	Threshold voltage - Low level	500A to 2900A at $T_{case} = 125^{\circ}C$	-	0.96	V	
	Threshold voltage - High level	2900A to 7000A at $T_{case} = 125^{\circ}C$	-	1.16	V	
<b>r<sub>T</sub></b>	On-state slope resistance - Low level	500A to 2900A at $T_{case} = 125^{\circ}C$	-	0.32	m $\Omega$	
	On-state slope resistance - High level	2900A to 7000A at $T_{case} = 125^{\circ}C$	-	0.25	m $\Omega$	
<b>t<sub>gd</sub></b>	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	
<b>t<sub>q</sub></b>	Turn-off time	$I_T = 3000A$ , $T_j = 125^{\circ}C$ , $V_R = 200V$ , $dI/dt = 1A/\mu$ s, $dV_{DR}/dt = 20V/\mu$ s linear	-	500	$\mu$ s	
<b>Q<sub>s</sub></b>	Stored charge	$I_T = 1500A$ , $T_j = 125^{\circ}C$ , $dI/dt = 1A/\mu$ s	3730	7270	$\mu$ C	
<b>I<sub>RR</sub></b>	Reverse recovery current	$V_R \sim 2600V$ , $C_s = 1\mu$ F, $R_s = 63\Omega$	50	72	A	
<b>I<sub>L</sub></b>	Latching current	$T_j = 25^{\circ}C$ , $V_D = 5V$	-	3	A	
<b>I<sub>H</sub></b>	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
$V_{GT}$	Gate trigger voltage	$V_{DRM} = 5V, T_{case} = 25^{\circ}C$	1.5	V
$V_{GD}$	Gate non-trigger voltage	At 50% $V_{DRM}, T_{case} = 125^{\circ}C$	0.4	V
$I_{GT}$	Gate trigger current	$V_{DRM} = 5V, T_{case} = 25^{\circ}C$	400	mA
$I_{GD}$	Gate non-trigger current	At 50% $V_{DRM}, T_{case} = 125^{\circ}C$	10	mA

## CURVES

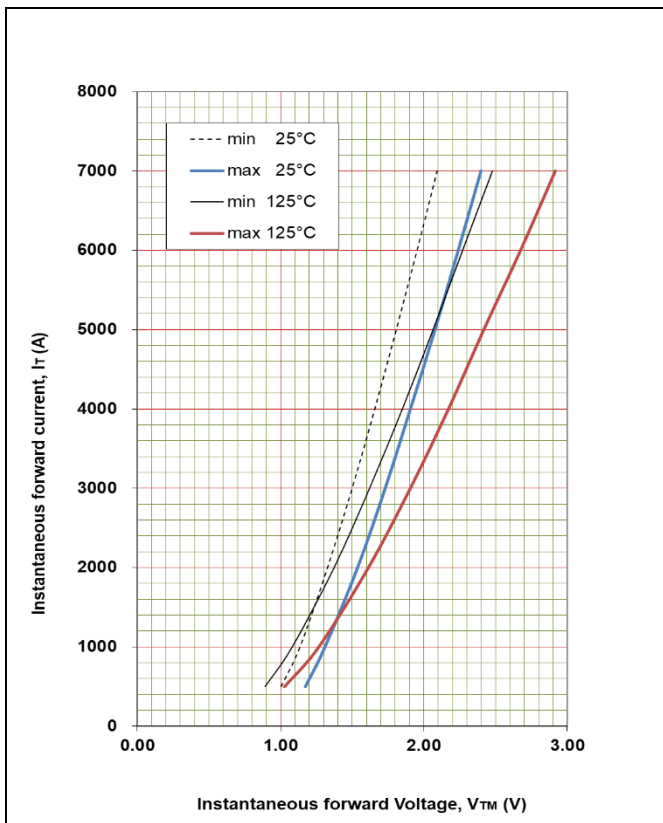


Fig. 2 Maximum & minimum on-state characteristics

## $V_{TM}$ EQUATION

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

Where  $A = -0.219311$

$B = 0.180566$

$C = 0.000207$

$D = 0.001008$

These values are valid for  $T_j = 125^{\circ}C$  for  $I_T$  500A to 7000A

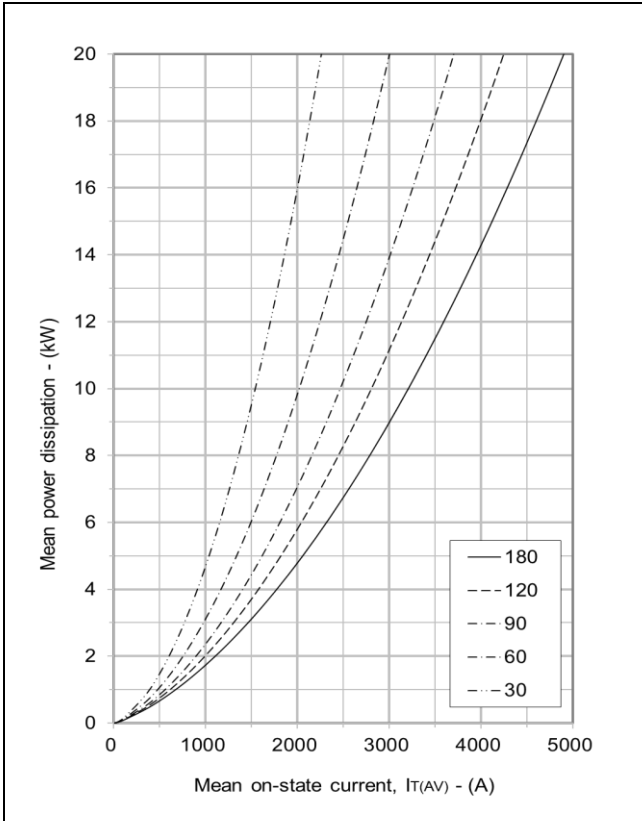


Fig. 3 On-state power dissipation - sine wave

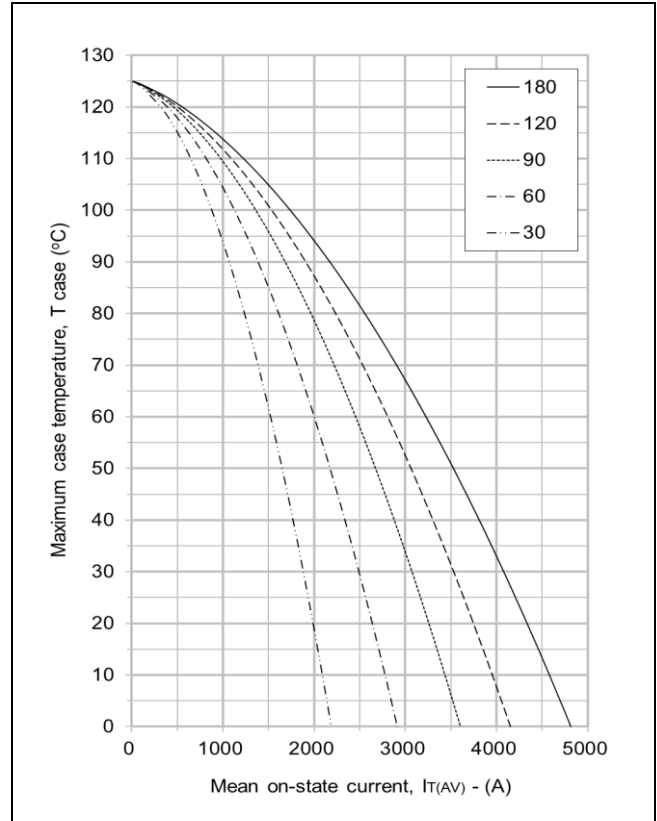


Fig. 4 Maximum permissible case temperature, double side cooled - sine wave

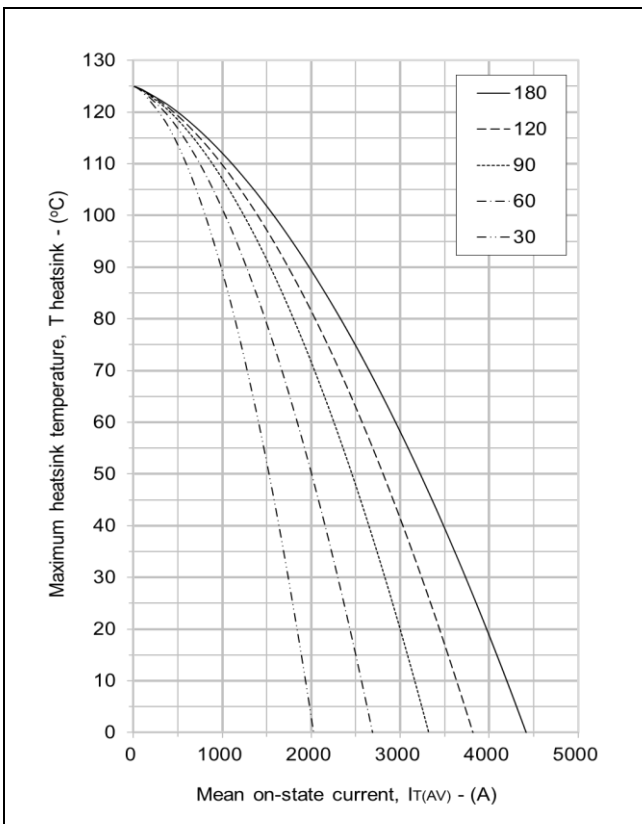


Fig. 5 Maximum permissible heatsink temperature, double side cooled - sine wave

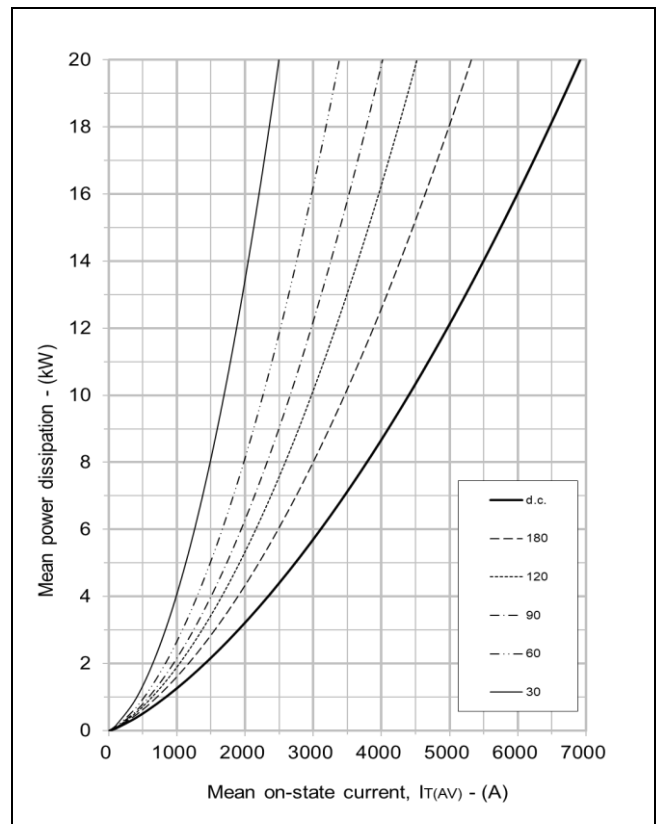


Fig. 6 On-state power dissipation - rectangular wave

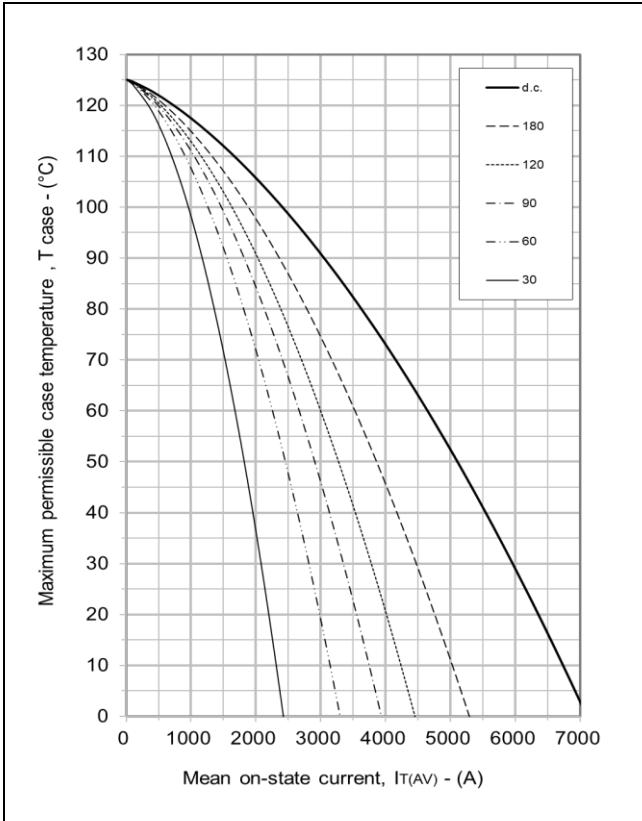


Fig. 7 Maximum permissible case temperature, double side cooled - rectangular wave

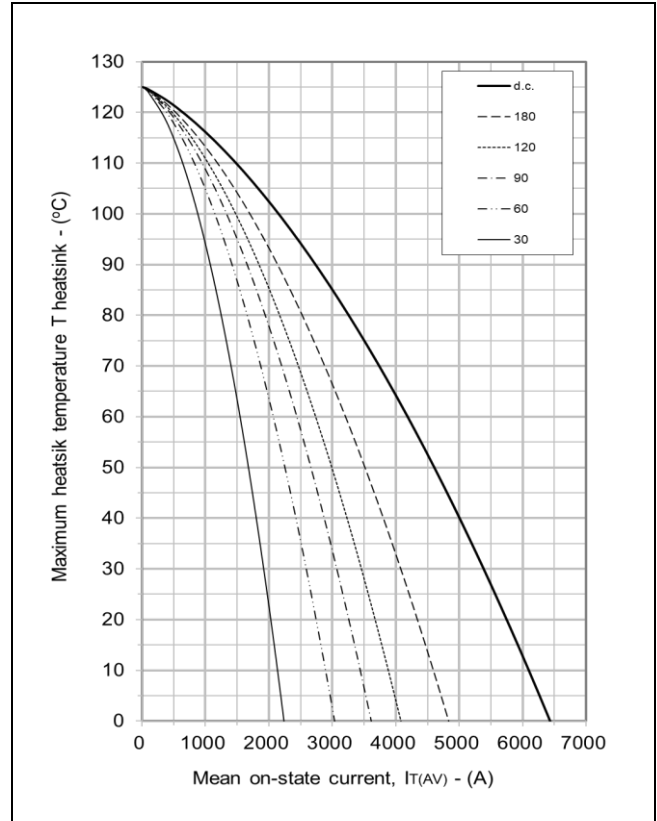


Fig. 8 Maximum permissible heatsink temperature, double side cooled - rectangular wave

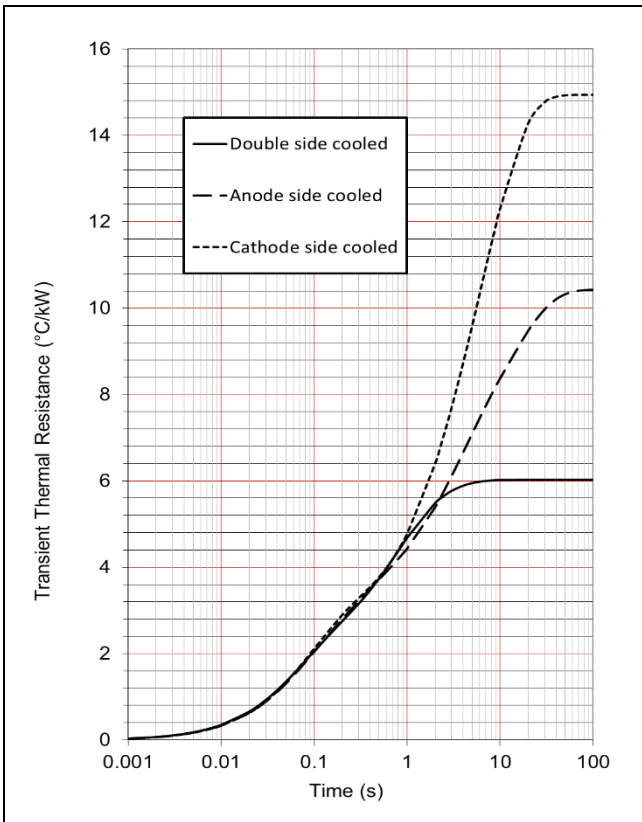


Fig.9 Maximum (limit) transient thermal impedance – junction to case (degC/kW)

		1	2	3	4
Double side cooled	Ri(°C/kW)	3.015	1.049	0.984	0.984
	Ti(s)	0.704	1.905	0.059	0.059
Anode side cooled	Ri(°C/kW)	3.156	4.093	1.557	1.624
	Ti(s)	2.690	13.792	0.059	0.206
Cathode side cooled	Ri(°C/kW)	7.077	3.483	1.746	2.634
	Ti(s)	6.649	8.436	1.762	0.081

$$Z_{th} = \sum_{i=1}^{i=4} R_i \cdot \left(1 - \exp\left(-\frac{T}{T_i}\right)\right)$$

$\Delta R_{th(j-c)}$  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			Anode Side Cooling			Cathode Sided Cooling		
$\theta^\circ$	$\Delta Z_{th} (z)$		$\theta^\circ$	$\Delta Z_{th} (z)$		$\theta^\circ$	$\Delta Z_{th} (z)$	
	sine.	rect.		sine.	rect.		sine.	rect.
180	0.44	0.31	180	0.42	0.30	180	0.42	0.30
120	0.49	0.43	120	0.47	0.41	120	0.47	0.41
90	0.55	0.49	90	0.52	0.46	90	0.52	0.46
60	0.60	0.55	60	0.57	0.52	60	0.57	0.52
30	0.64	0.61	30	0.61	0.58	30	0.60	0.58
15	0.66	0.64	15	0.62	0.61	15	0.62	0.60

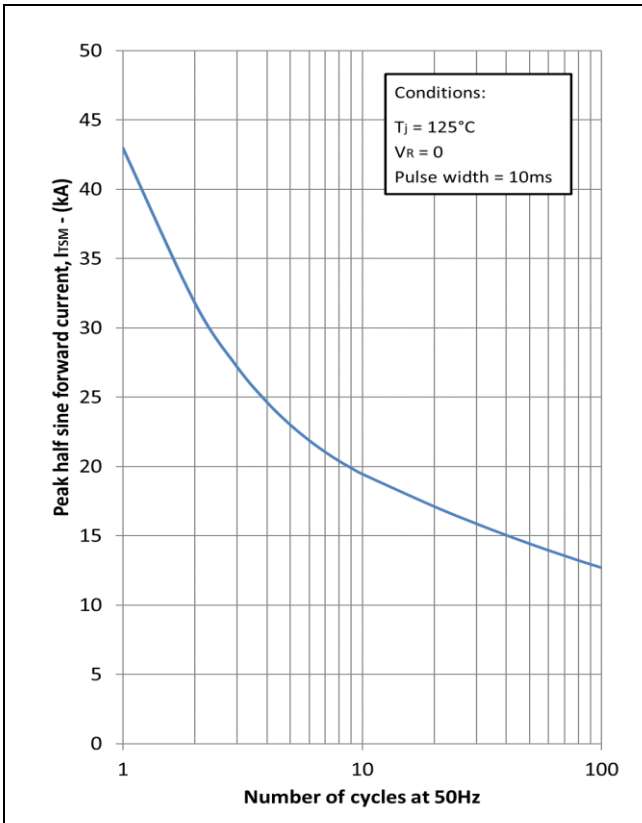


Fig. 10 Multi-cycle surge current

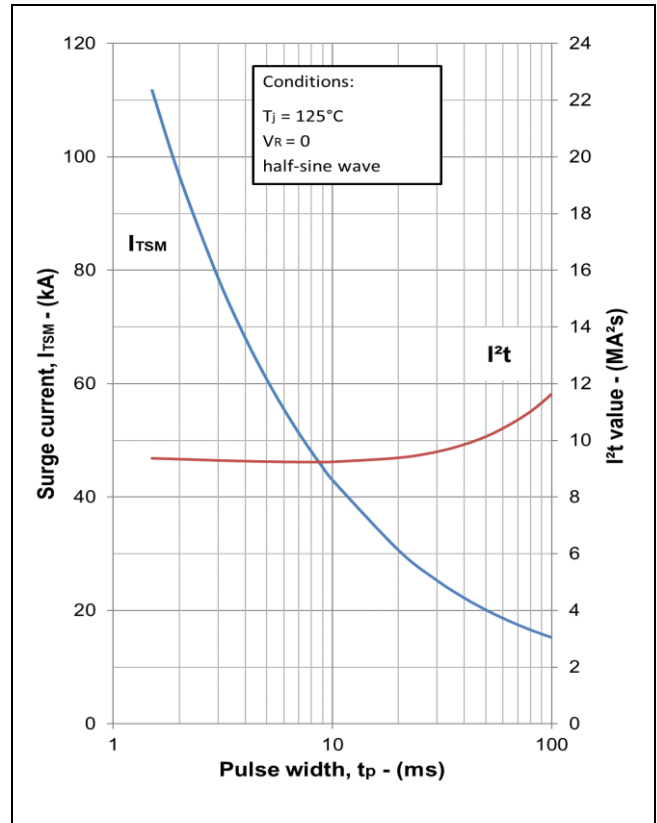


Fig. 11 Single-cycle surge current

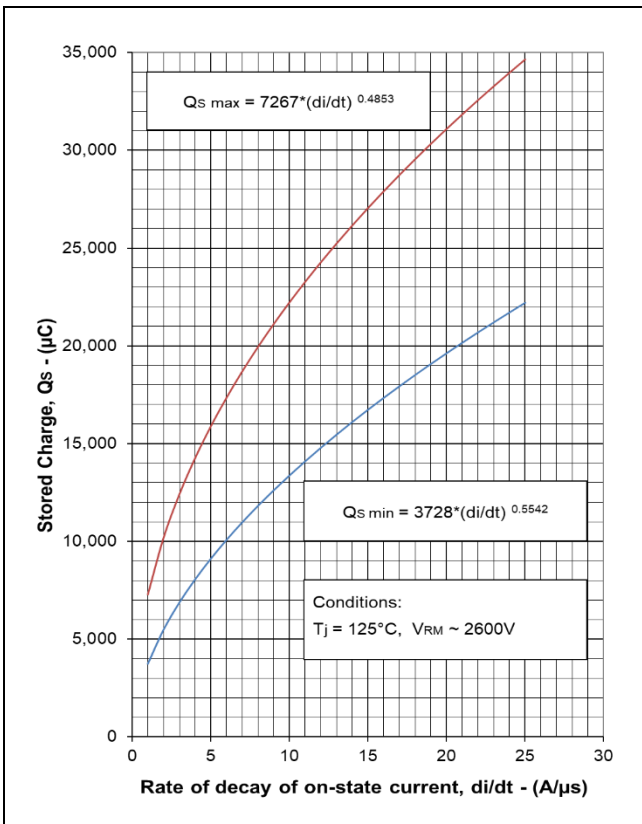


Fig. 12 Stored charge

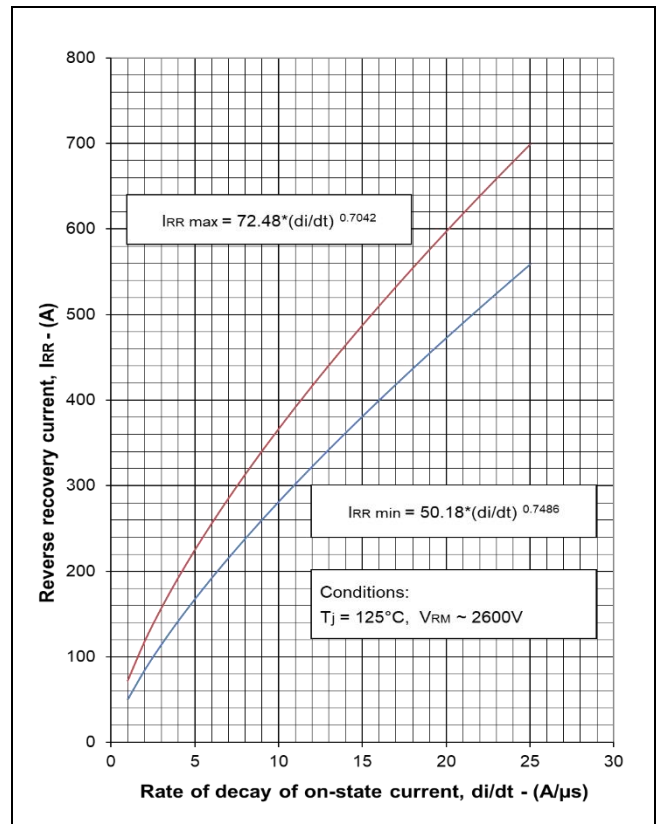


Fig. 13 Reverse recovery current

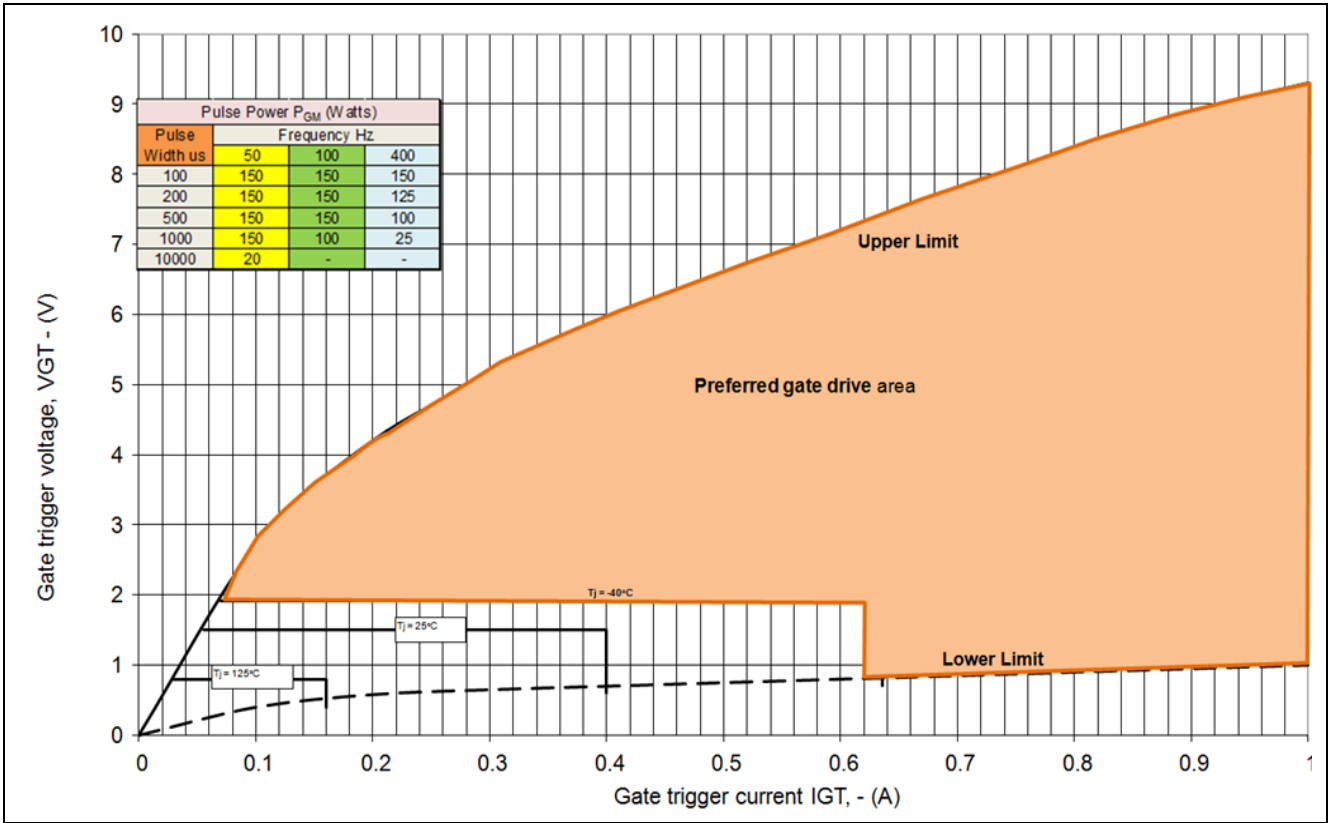


Fig.14 Gate characteristics

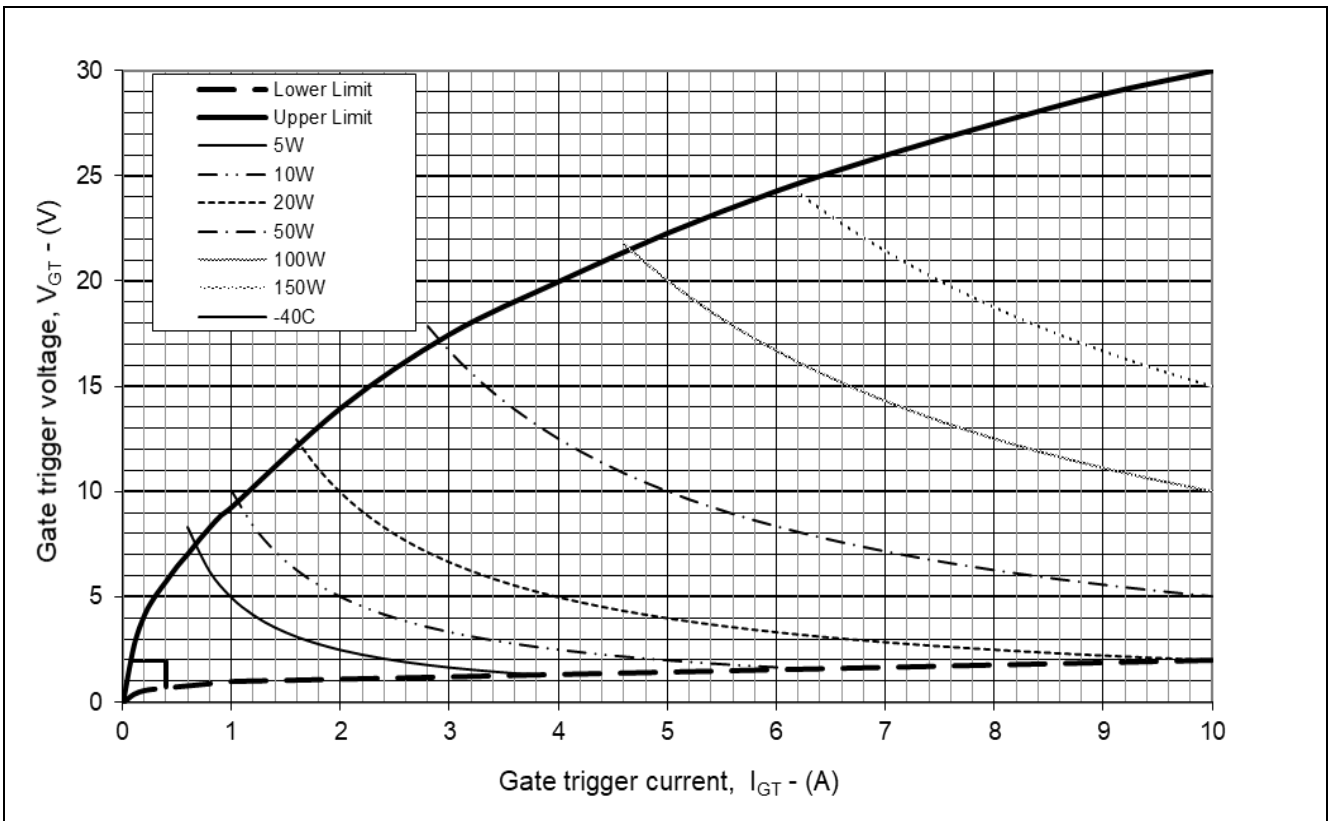


Fig. 15 Gate characteristics



**PACKAGE DETAILS**

For further package information, please contact Customer services.

All dimensions in mm, unless stated otherwise.

DO NOT SCALE

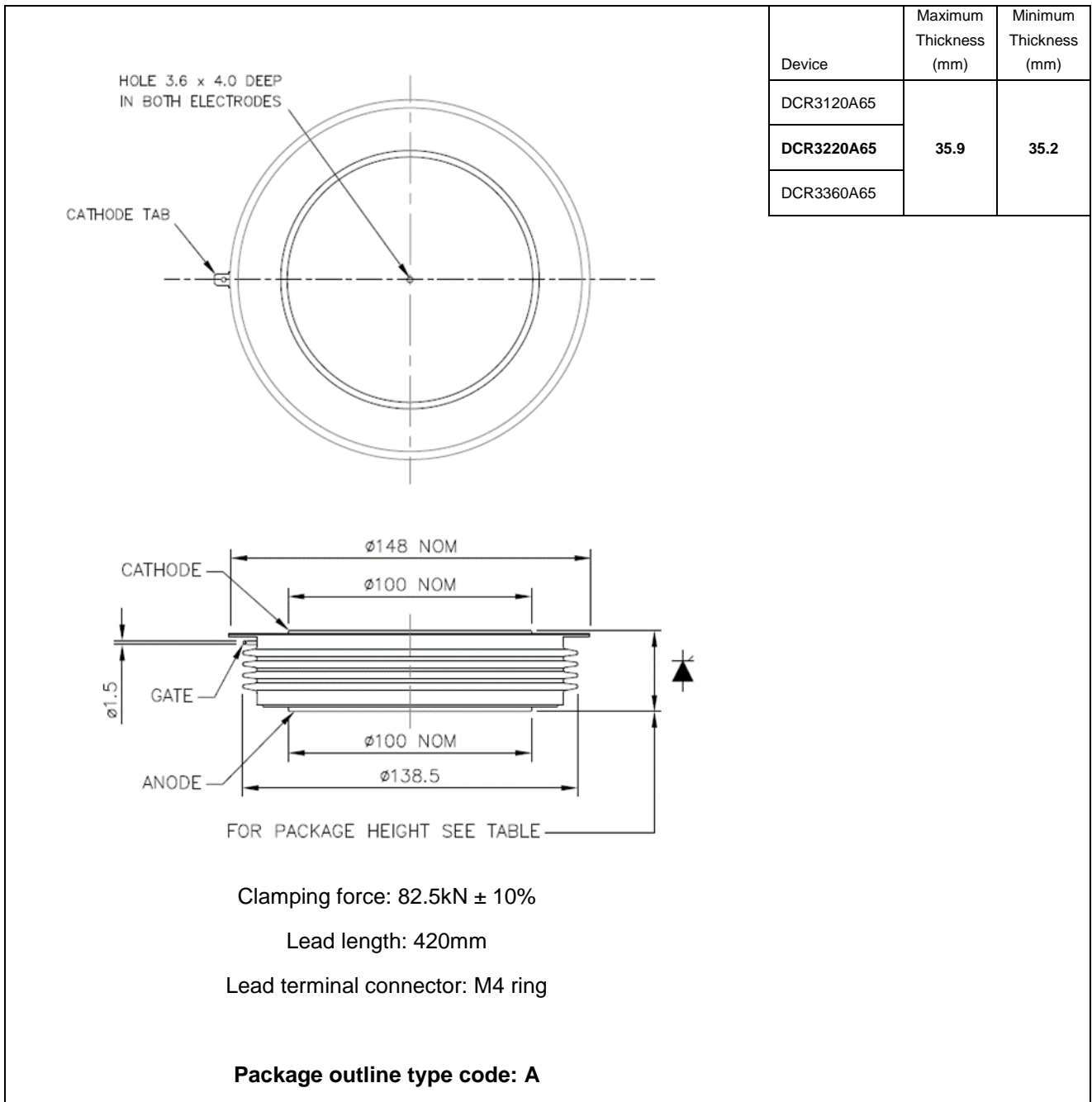


Fig. 16 Package outline

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