

### FEATURES

- Double Side Cooling
- High Surge Capability

### APPLICATIONS

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

### KEY PARAMETERS

|                          |                 |
|--------------------------|-----------------|
| <b>V<sub>DRM</sub></b>   | <b>6500V</b>    |
| <b>I<sub>T(AV)</sub></b> | <b>4350A</b>    |
| <b>I<sub>TSM</sub></b>   | <b>64600A</b>   |
| <b>dV/dt*</b>            | <b>2000V/μs</b> |
| <b>dI/dt</b>             | <b>500A/μs</b>  |

\* Higher dV/dt selections are available on request

### VOLTAGE RATINGS

| Part and Ordering Number | Repetitive Peak Voltages V <sub>DRM</sub> and V <sub>RRM</sub> (V) | Conditions  |
|--------------------------|--|---|
| DCR4420H65*              | 6500   | T <sub>vj</sub> = -40°C to 125°C,<br>I <sub>DRM</sub> = I <sub>RRM</sub> = 600mA,<br>V <sub>DRM</sub> , V <sub>RRM</sub> t <sub>p</sub> = 10ms<br>V <sub>DSM</sub> & V <sub>RSM</sub> =<br>V <sub>DRM</sub> & V <sub>RRM</sub> + 100V<br>respectively |
| DCR4420H60               | 6000   |   |
| DCR4420H55               | 5500   |   |

Lower voltage grades available.

\*6200V @ -40°C, 6500V @ 0°C

### ORDERING INFORMATION

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

For example:

#### DCR4420H65

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

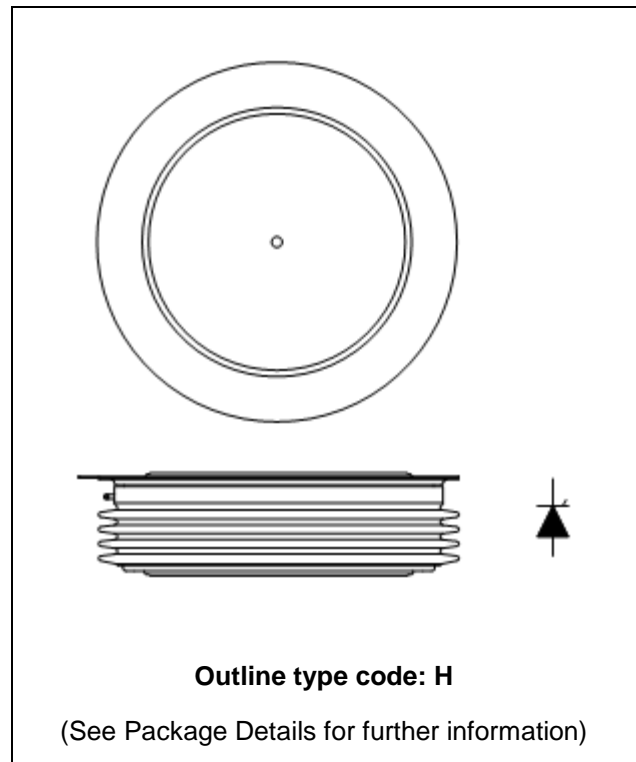


Fig. 1 Package outline

## 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 | 4350 | A     |
| $I_{T(RMS)}$              | RMS value                            | -                        | 6830 | A     |
| $I_r$                     | Continuous (direct) on-state current | -                        | 6260 | A     |

## SURGE RATINGS

| Symbol    | Parameter                               | Test Conditions                                  | Max. | Units             |
|-----------|---|--|------|-------------------|
| $I_{TSM}$ | Surge (non-repetitive) on-state current | 10ms half sine, $T_{case} = 125^{\circ}\text{C}$ | 64.6 | kA                |
| $I^2t$    | $I^2t$ for fusing                       | $V_R = 0$  | 20.9 | 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          | -    | 4.3                | $^{\circ}\text{C}/\text{kW}$ |
|               |                                       | Single side cooled                               | Anode DC    | -    | 8.0                | $^{\circ}\text{C}/\text{kW}$ |
|               |                                       |  | Cathode DC  | -    | 9.5                | $^{\circ}\text{C}/\text{kW}$ |
| $R_{th(c-h)}$ | Thermal resistance - case to heatsink | Clamping force 135kN<br>(with mounting compound) | Double side | -    | 0.9                | $^{\circ}\text{C}/\text{kW}$ |
|               |                                       |  | Single side | -    | 1.8                | $^{\circ}\text{C}/\text{kW}$ |
| $T_{vj}$      | 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                        |  | 120         | 155  | kN                 |                              |

**DYNAMIC CHARACTERISTICS**

| Symbol                                 | Parameter                                     | Test Conditions   | Min.               | Max. | Units |      |
|--|---|---|--------------------|------|-------|------|
| <b>I<sub>RRM</sub>/I<sub>DRM</sub></b> | Peak reverse and off-state current            | At V <sub>RRM</sub> /V <sub>DRM</sub> , T <sub>case</sub> = 125°C   | -                  | 600  | mA    |      |
| <b>V<sub>TM</sub></b>                  | Instantaneous forward voltage                 | At 4000A peak, T <sub>j</sub> = 125°C   | 1.75               | 2.00 | V     |      |
| <b>dV/dt</b>                           | Max. linear rate of rise of off-state voltage | To 67% V <sub>DRM</sub> , T <sub>j</sub> = 125°C, gate open   | -                  | 2000 | V/μs  |      |
| <b>di/dt</b>                           | Rate of rise of on-state current              | From 67% V <sub>DRM</sub> to 2x I <sub>T(AV)</sub><br>Gate source 30V, 10Ω<br>tr < 0.5μs, T <sub>j</sub> = 125°C              | Repetitive<br>50Hz | -    | 200   | A/μs |
|  |   |   | Non-repetitive     | -    | 500   | A/μs |
| <b>V<sub>T(TO)</sub></b>               | Threshold voltage - Low level                 | 1000A to 5000A at T <sub>case</sub> = 125°C   | -                  | 1.19 | V     |      |
|  | Threshold voltage - High level                | 5000A to 8000A at T <sub>case</sub> = 125°C   | -                  | 1.29 | V     |      |
| <b>r<sub>T</sub></b>                   | On-state slope resistance - low level         | 1000A to 5000A at T <sub>case</sub> = 125°C   | -                  | 0.20 | mΩ    |      |
|  | On-state slope resistance - High level        | 5000A to 8000A at T <sub>case</sub> = 125°C   | -                  | 0.18 | mΩ    |      |
| <b>t<sub>gd</sub></b>                  | Delay time                                    | V <sub>D</sub> = 67% V <sub>DRM</sub> , gate source 30V, 10Ω<br>tr = 0.5μs, T <sub>j</sub> = 25°C                             | -                  | 3    | μs    |      |
| <b>t<sub>q</sub></b>                   | Turn-off time                                 | I <sub>T</sub> = 3000A, T <sub>j</sub> = 125°C, V <sub>R</sub> = 200V,<br>di/dt = 1A/μs, dV <sub>DR</sub> /dt = 20V/μs linear | -                  | 400  | μs    |      |
| <b>Q<sub>s</sub></b>                   | Stored charge                                 | I <sub>T</sub> = 3000A, T <sub>j</sub> = 125°C, di/dt = 1A/μs   | 2300               | 5000 | μC    |      |
| <b>I<sub>RR</sub></b>                  | Reverse recovery current                      | V <sub>R(peak)</sub> ~ 3900V, V <sub>RM</sub> ~ 2600V   | 37                 | 52   | A     |      |
| <b>I<sub>L</sub></b>                   | Latching current                              | T <sub>j</sub> = 25°C, V <sub>D</sub> = 5V  | -                  | 3    | A     |      |
| <b>I<sub>H</sub></b>                   | Holding current                               | T <sub>j</sub> = 25°C, R <sub>G-K</sub> = ∞, I <sub>TM</sub> = 500A, I <sub>T</sub> = 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     | $V_{DRM} = 5V, T_{case} = 25^{\circ}C$    | 350  | mA    |
| $I_{GD}$ | Gate non-trigger current | At 50% $V_{DRM}, T_{case} = 125^{\circ}C$ | 10   | mA    |

## CURVES

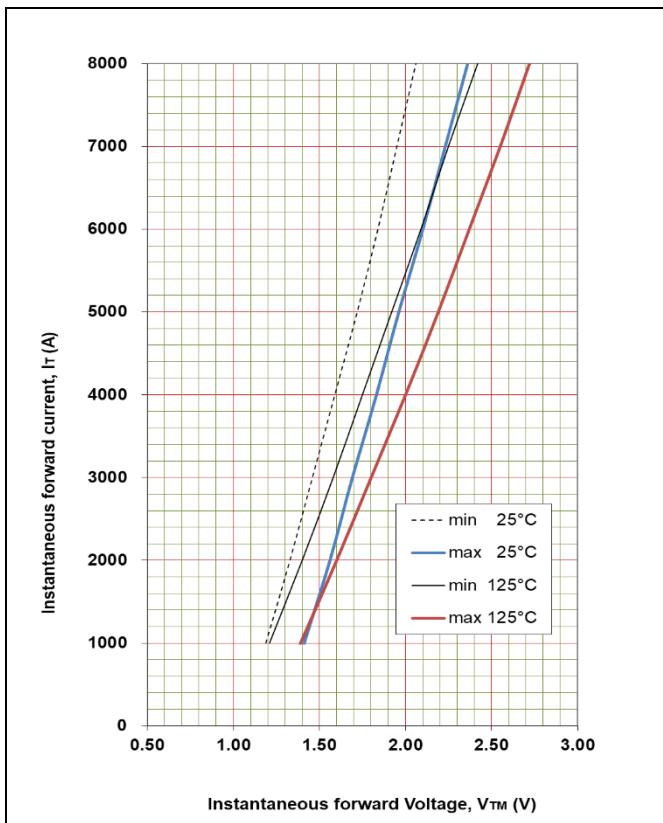


Fig. 2 Maximum & minimum on-state characteristics

## $V_{TM}$ EQUATION

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

Where  $A = 0.904719$

$B = 0.034296$

$C = 0.000157$

$D = 0.002862$

These values are valid for  $T_j = 125^{\circ}C$  for  $I_T$  1000A to 8000A

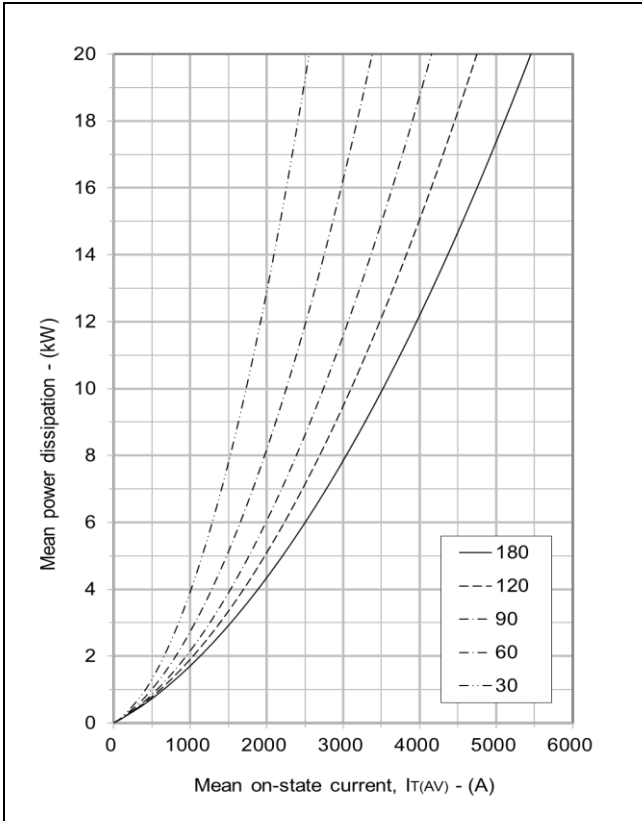


Fig. 3 On-state power dissipation - sine wave

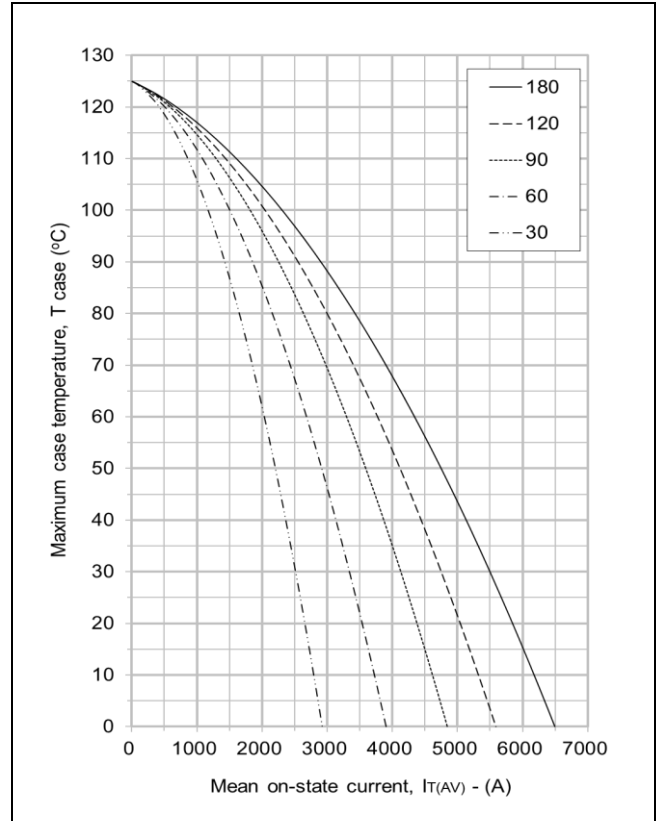


Fig. 4 Maximum permissible case temperature, double side cooled - sine wave

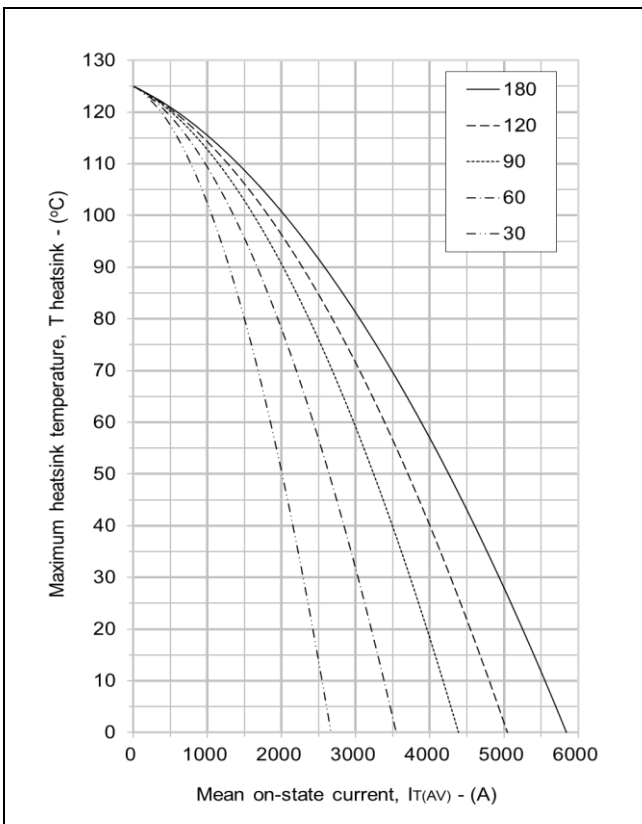


Fig. 5 Maximum permissible heatsink temperature, double side cooled - sine wave

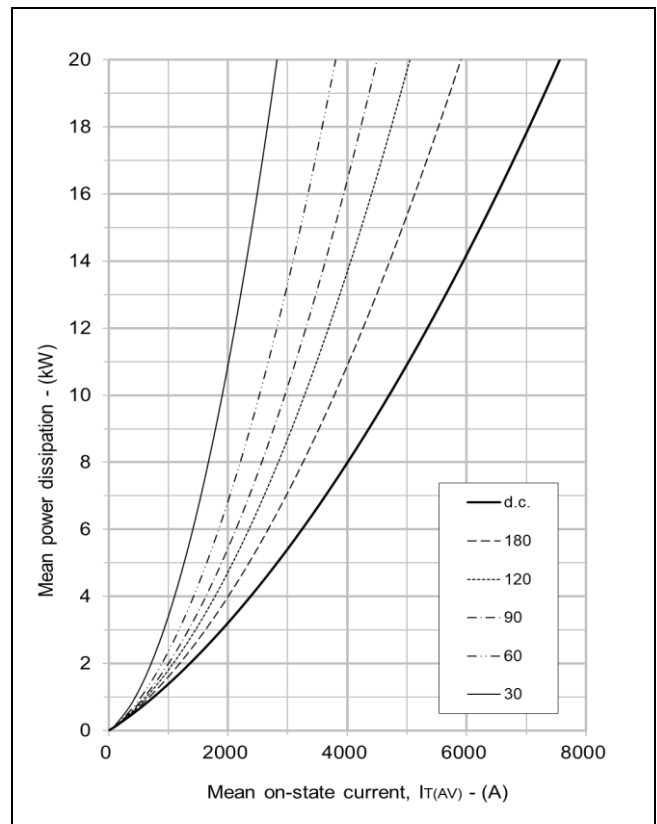


Fig. 6 On-state power dissipation - rectangular wave

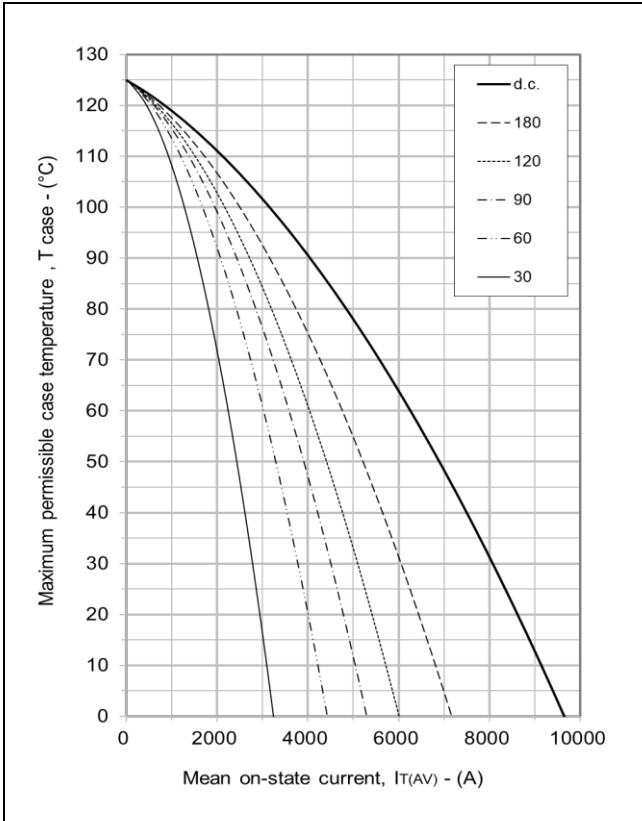


Fig. 7 Maximum permissible case temperature, double side cooled - rectangular wave

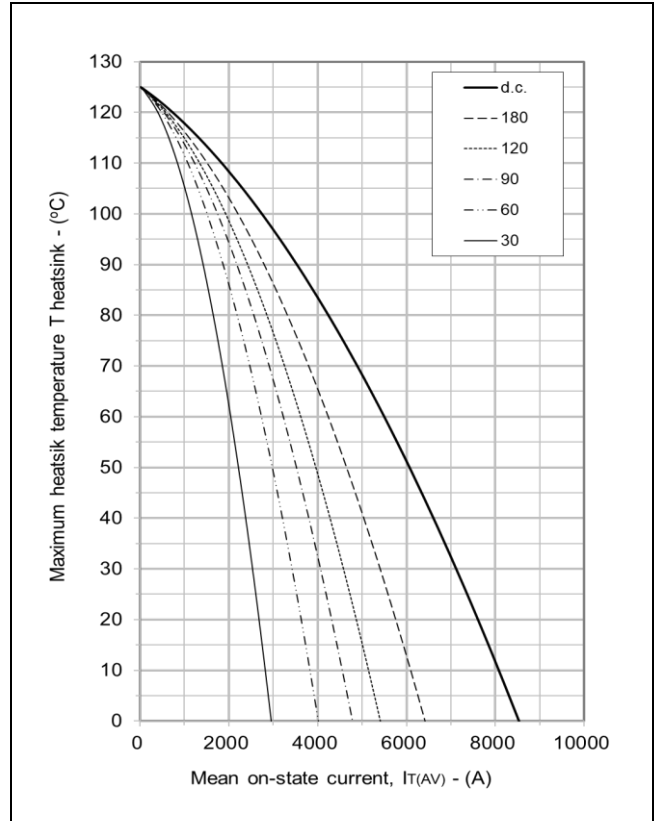


Fig. 8 Maximum permissible heatsink temperature, double side cooled - rectangular wave

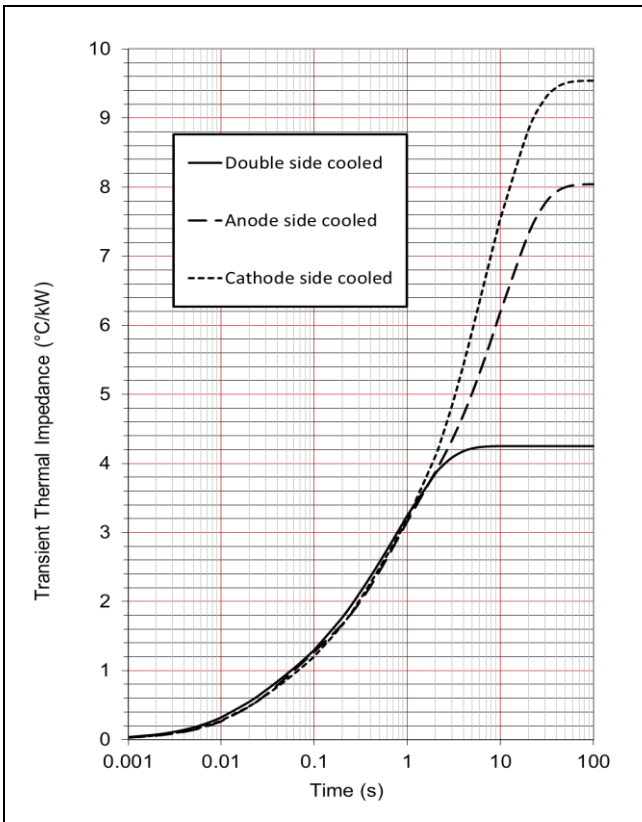


Fig. 9 Maximum (limit) transient thermal impedance – junction to case (degC/kW)

|                     |           |       |       |       |        |
|---------------------|-----------|-------|-------|-------|--------|
|                     |           | 1     | 2     | 3     | 4      |
| Double side cooled  | Ri(°C/kW) | 1.248 | 0.833 | 0.606 | 1.568  |
|                     | Ti(s)     | 0.670 | 0.146 | 0.020 | 1.287  |
| Anode side cooled   | Ri(°C/kW) | 0.512 | 1.946 | 0.920 | 4.666  |
|                     | Ti(s)     | 2.898 | 0.505 | 0.036 | 10.647 |
| Cathode side cooled | Ri(°C/kW) | 2.417 | 1.537 | 0.626 | 4.959  |
|                     | Ti(s)     | 3.441 | 0.269 | 0.024 | 10.172 |

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

$\Delta R_{th(j-c)}$  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                 | 0.38                | 0.26  | 180                | 0.32                | 0.23  | 180                   | 0.33                | 0.23  |
| 120                 | 0.44                | 0.37  | 120                | 0.36                | 0.31  | 120                   | 0.38                | 0.33  |
| 90                  | 0.49                | 0.43  | 90                 | 0.41                | 0.36  | 90                    | 0.43                | 0.37  |
| 60                  | 0.54                | 0.49  | 60                 | 0.45                | 0.40  | 60                    | 0.47                | 0.43  |
| 30                  | 0.58                | 0.55  | 30                 | 0.48                | 0.45  | 30                    | 0.51                | 0.48  |
| 15                  | 0.60                | 0.58  | 15                 | 0.49                | 0.48  | 15                    | 0.52                | 0.51  |

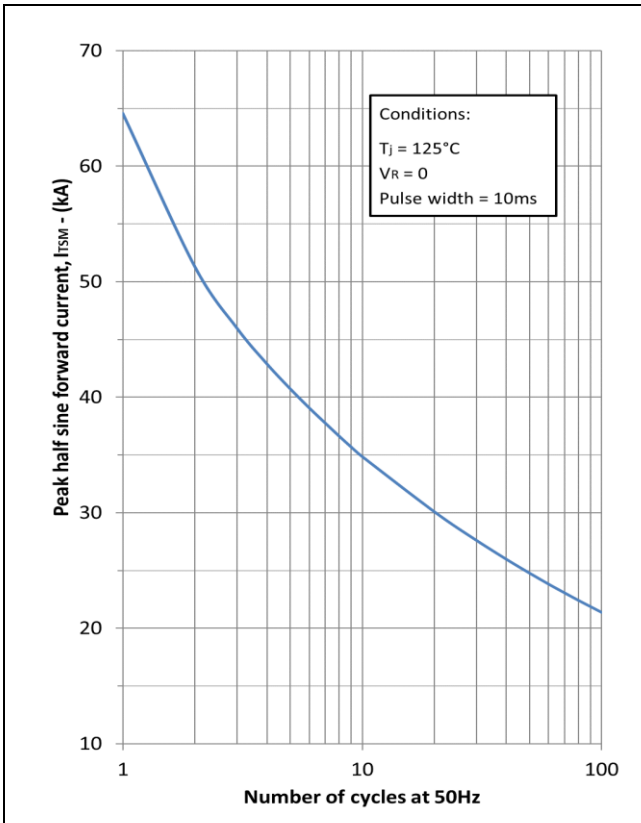


Fig. 10 Multi-cycle surge current

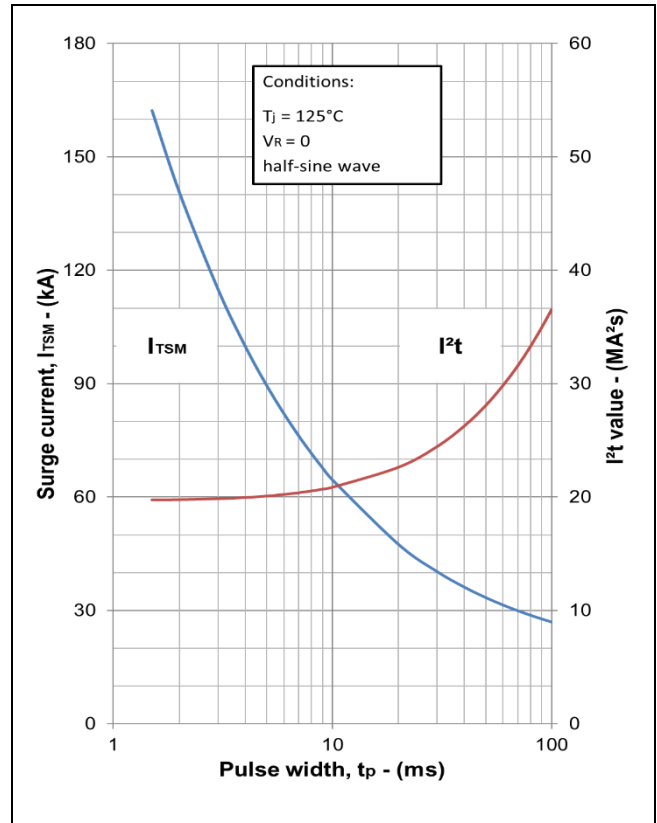


Fig. 11 Single-cycle surge current

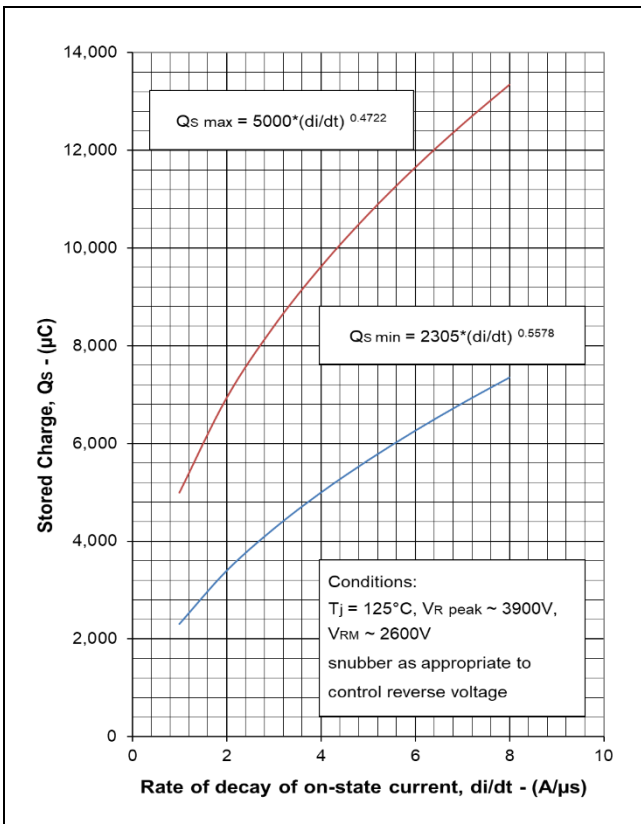


Fig. 12 Reverse recovery charge

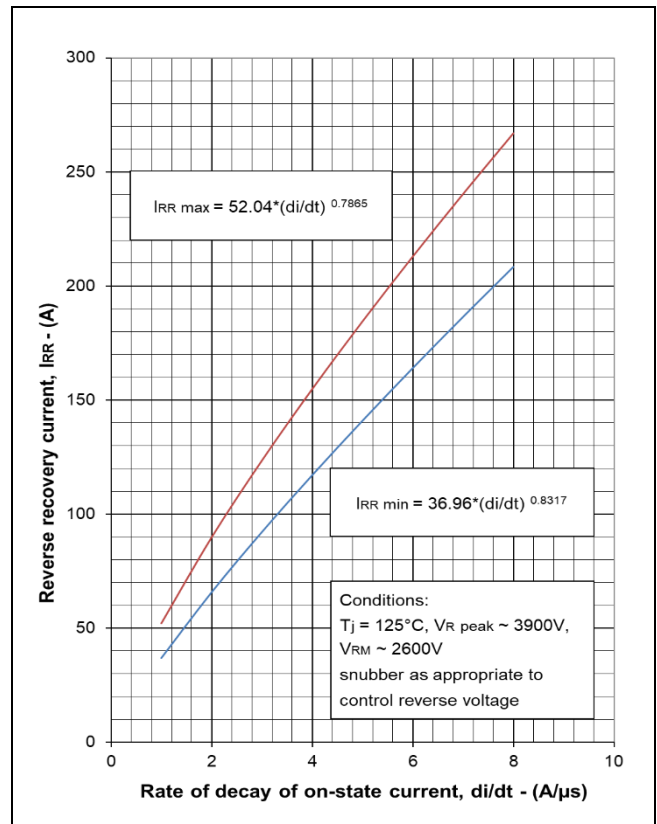


Fig. 13 Reverse recovery current

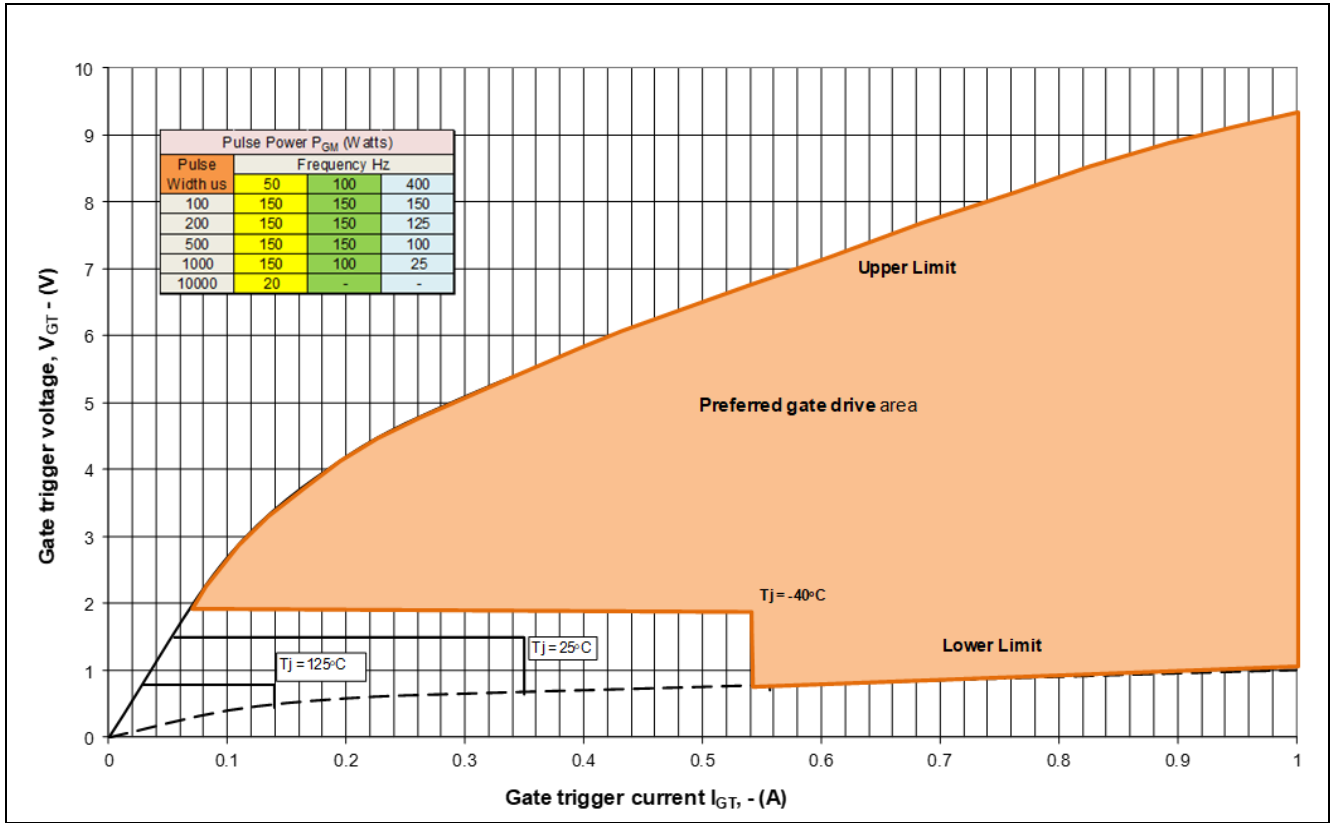


Fig. 14 Gate characteristics

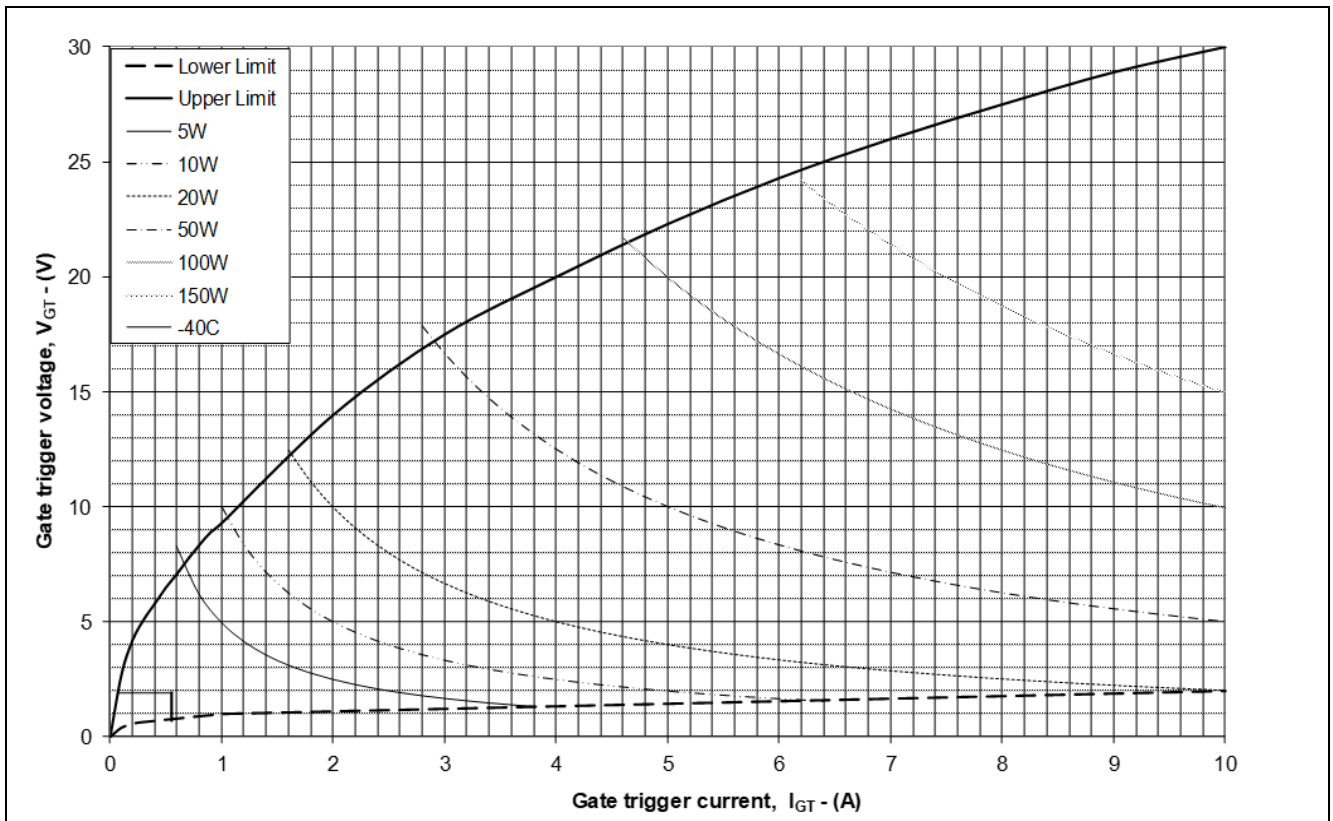


Fig. 15 Gate characteristics



**PACKAGE DETAILS**

For further package information, please contact Customer services.

All dimensions in mm, unless stated otherwise.

DO NOT SCALE

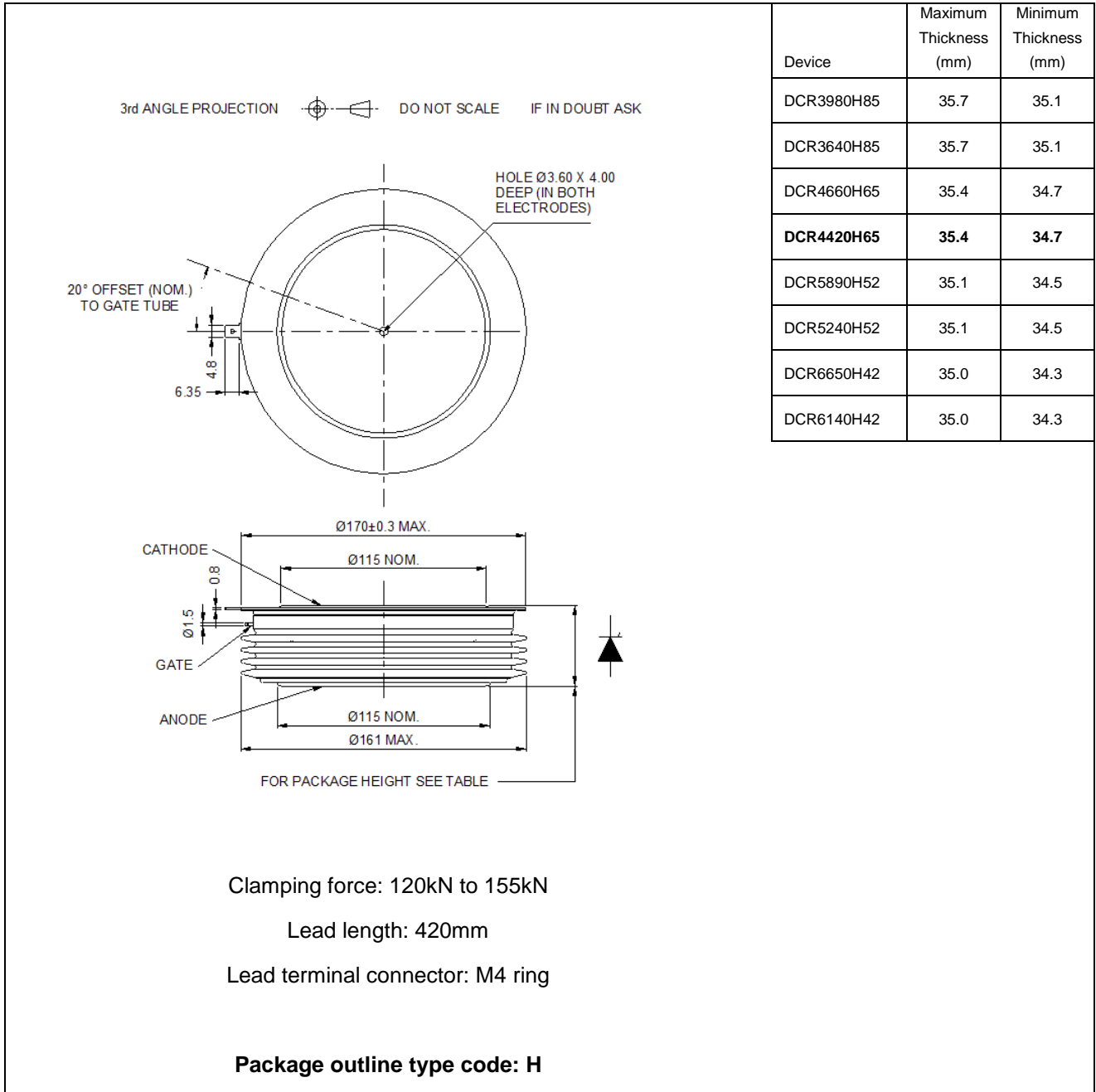


Fig. 16 Package outline

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|                                 |   |
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**HEADQUARTERS OPERATIONS**

DYNEX SEMICONDUCTOR LIMITED  
 Doddington Road, Lincoln, Lincolnshire. LN6 3LF  
 United Kingdom.  
 Phone: +44 (0) 1522 500500  
 Fax: +44 (0) 1522 500550  
 Web: <http://www.dynexsemi.com>

**CUSTOMER SERVICE**

Phone: +44 (0) 1522 502753 / 502901  
 e-mail: [powersolutions@dynexsemi.com](mailto:powersolutions@dynexsemi.com)