

### 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 $V_{RRM}$<br>V | Conditions  |
|--------------------------|---|---|
| DCR3030V42               | 4200  | $T_{vj} = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$ ,<br>$I_{DRM} = I_{RRM} = 200\text{mA}$ ,<br>$V_{DRM}, V_{RRM} t_p = 10\text{ms}$ ,<br>$V_{DSM} \& V_{RSM} =$<br>$V_{DRM} \& V_{RRM} + 100\text{V}$<br>respectively |
| DCR3030V40               | 4000  |   |
| DCR3030V35               | 3500  |   |
| DCR3030V30               | 3000  |   |

Lower voltage grades available.

### ORDERING INFORMATION

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

For example:

### DCR3030V42

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>3030A</b>                          |
| $I_{TSM}$   | <b>40600A</b>                         |
| $dV/dt^*$   | <b>1500V/<math>\mu\text{s}</math></b> |
| $dI/dt$     | <b>400A/<math>\mu\text{s}</math></b>  |

\* Higher  $dV/dt$  selections available

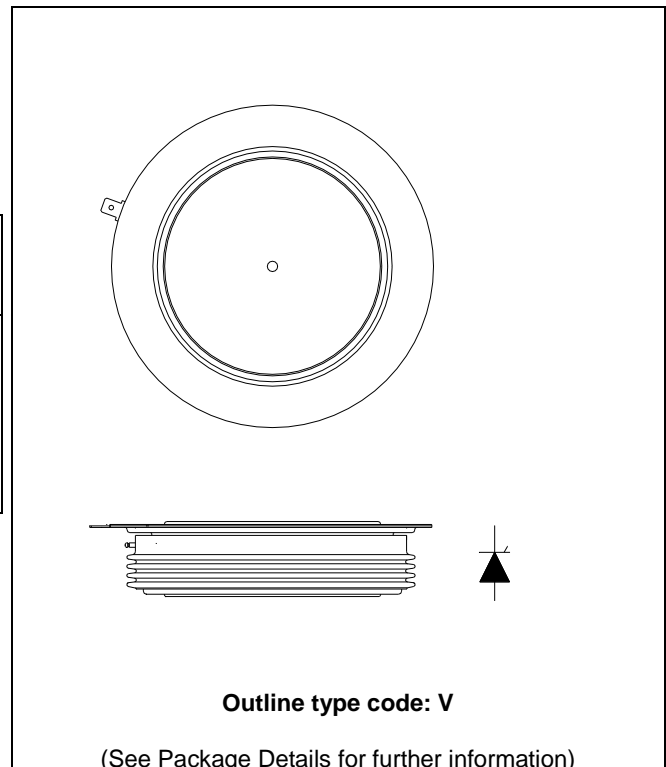


Fig. 1 Package outline

## 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 | 3030 | A     |
| $I_{T(RMS)}$              | RMS value                            | -                        | 4760 | A     |
| $I_T$                     | Continuous (direct) on-state current | -                        | 4550 | A     |

## SURGE RATINGS

| Symbol    | Parameter                               | Test Conditions                                  | Max. | Units                 |
|-----------|---|--|------|-----------------------|
| $I_{TSM}$ | Surge (non-repetitive) on-state current | 10ms half sine, $T_{case} = 125^{\circ}\text{C}$ | 40.6 | kA                    |
| $I^2t$    | $I^2t$ for fusing                       | $V_R = 0$  | 8.24 | $\text{MA}^2\text{s}$ |

## THERMAL AND MECHANICAL RATINGS

| Symbol        | Parameter                             | Test Conditions                                 | Min.        | Max. | Units              |                      |
|---------------|---------------------------------------|---|-------------|------|--------------------|----------------------|
| $R_{th(j-c)}$ | Thermal resistance – junction to case | Double side cooled                              | DC          | -    | 0.00746            | $^{\circ}\text{C/W}$ |
|               |                                       | Single side cooled                              | Anode DC    | -    | 0.0130             | $^{\circ}\text{C/W}$ |
|               |                                       |   | Cathode DC  | -    | 0.0178             | $^{\circ}\text{C/W}$ |
| $R_{th(c-h)}$ | Thermal resistance – case to heatsink | Clamping force 54kN<br>(with mounting compound) | Double side | -    | 0.002              | $^{\circ}\text{C/W}$ |
|               |                                       |   | Single side | -    | 0.004              | $^{\circ}\text{C/W}$ |
| $T_{vj}$      | 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                        |   | 48.0        | 59.0 | kN                 |                      |

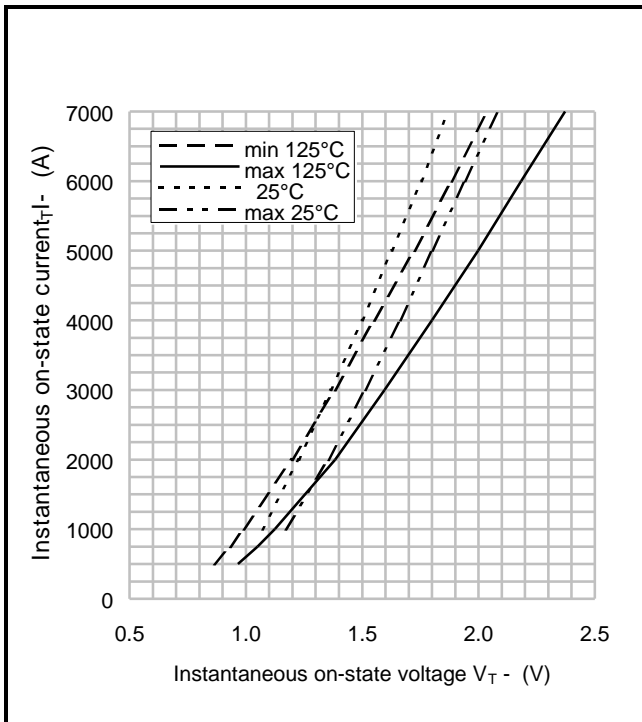
**DYNAMIC CHARACTERISTICS**

| Symbol            | Parameter                                     | Test Conditions   | Min.            | Max.  | Units      |            |
|-------------------|---|---|-----------------|-------|------------|------------|
| $I_{RRM}/I_{DRM}$ | Peak reverse and off-state current            | At $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$  | -               | 200   | mA         |            |
| $dV/dt$           | Max. linear rate of rise of off-state voltage | To 67% $V_{DRM}$ , $T_j = 125^{\circ}C$ , gate open   | -               | 1500  | 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 $\Omega$ ,<br>$t_r < 0.5\mu s$ , $T_j = 125^{\circ}C$                     | Non-repetitive  | -     | 400        | A/ $\mu s$ |
| $V_{T(TO)}$       | Threshold voltage – Low level                 | 200A to 1700A at $T_{case} = 125^{\circ}C$  | -               | 0.82  | V          |            |
|                   | Threshold voltage – High level                | 1700A to 7000A at $T_{case} = 125^{\circ}C$   | -               | 0.98  | V          |            |
| $r_T$             | On-state slope resistance – Low level         | 200A to 1700A at $T_{case} = 125^{\circ}C$  | -               | 0.292 | m $\Omega$ |            |
|                   | On-state slope resistance – High level        | 1700A to 7000A at $T_{case} = 125^{\circ}C$   | -               | 0.198 | m $\Omega$ |            |
| $t_{gd}$          | Delay time                                    | $V_D = 67\% V_{DRM}$ , gate source 30V, 10 $\Omega$<br>$t_r = 0.5\mu s$ , $T_j = 25^{\circ}C$ | TBD             | TBD   | $\mu s$    |            |
| $t_q$             | Turn-off time                                 | $T_j = 125^{\circ}C$ , $V_R = 200V$ , $di/dt = 1A/\mu s$ ,<br>$dV_{DR}/dt = 20V/\mu s$ linear | 250             | 500   | $\mu s$    |            |
| $Q_S$             | Stored charge                                 | $T_j = 125^{\circ}C$ , $di/dt = 1A/\mu s$ , $V_{Rpk} = 3000V$ ,<br>$V_{RM} = 1700V$           | 1600            | 3500  | $\mu C$    |            |
| $I_L$             | 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 V <sub>DRM</sub> , T <sub>case</sub> = 125°C | TBD  | V     |
| I <sub>GT</sub> | Gate trigger current     | V <sub>DRM</sub> = 5V, T <sub>case</sub> = 25°C | 350  | mA    |
| I <sub>GD</sub> | Gate non-trigger current | V <sub>DRM</sub> = 5V, T <sub>case</sub> = 25°C | TBD  | mA    |

**CURVES**



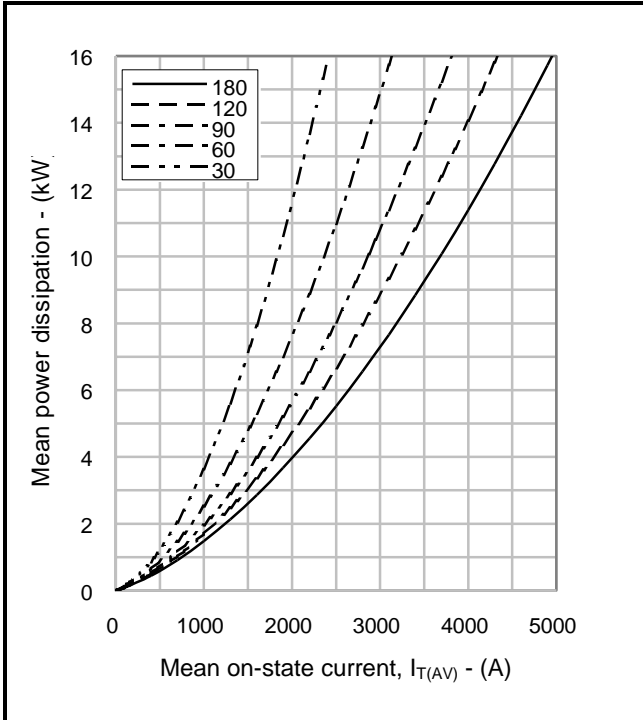
**Fig.2 Maximum & minimum on-state characteristics**

**V<sub>TM</sub> EQUATION**

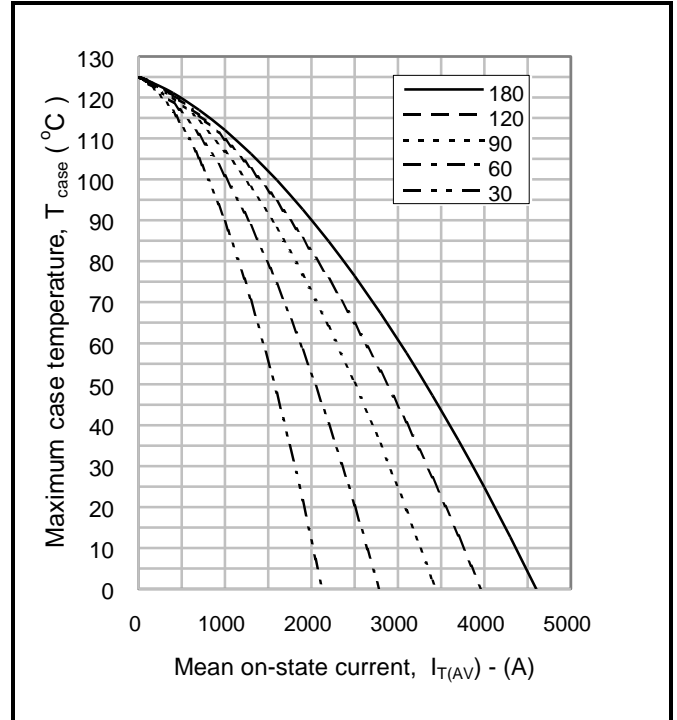
$$V_{TM} = A + B \ln(I_T) + C \cdot I_T + D \cdot \sqrt{I_T}$$

Where A = 0.866995  
 B = -0.042053  
 C = 0.000100  
 D = 0.014062

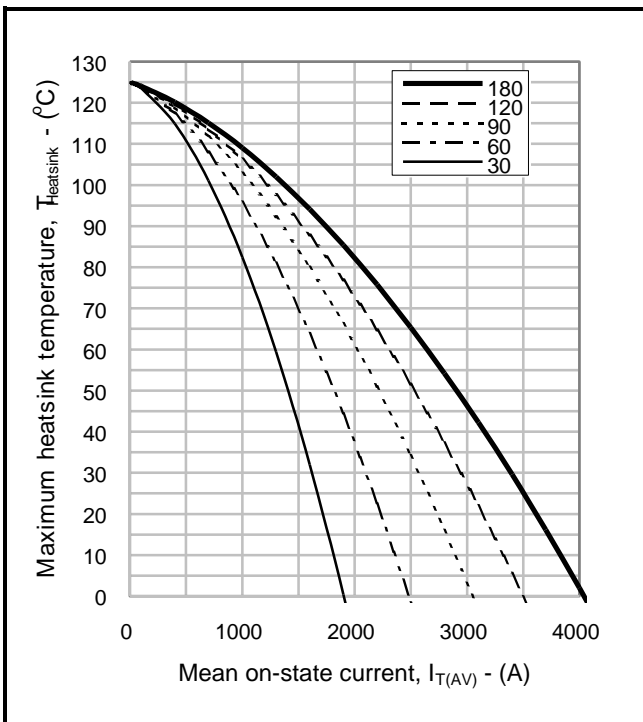
these values are valid for T<sub>j</sub> = 125°C for I<sub>T</sub> 500A to 10000A



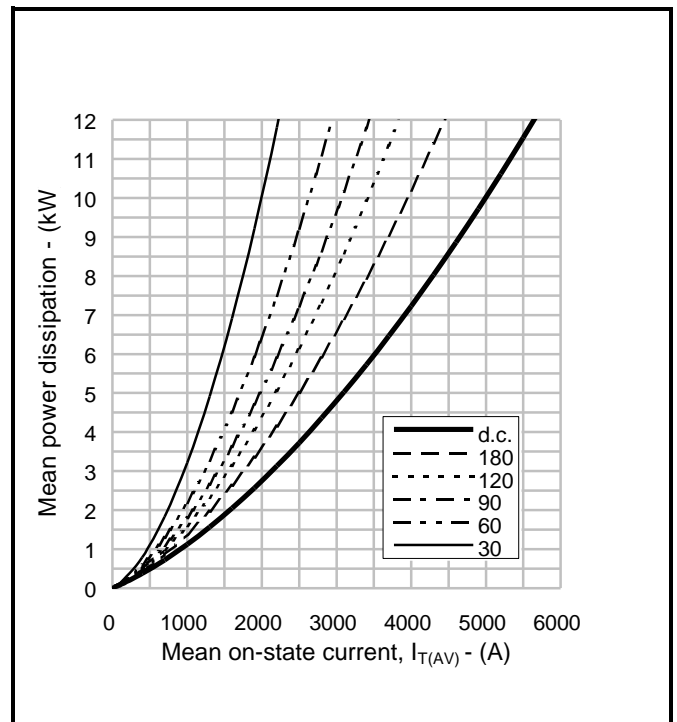
**Fig.3 On-state power dissipation – sine wave**



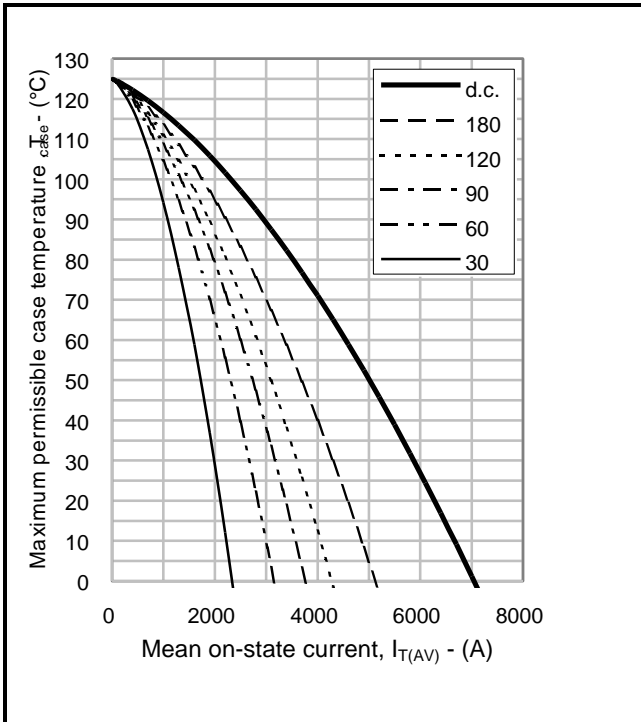
**Fig.4 Maximum permissible case temperature, double side cooled – sine wave**



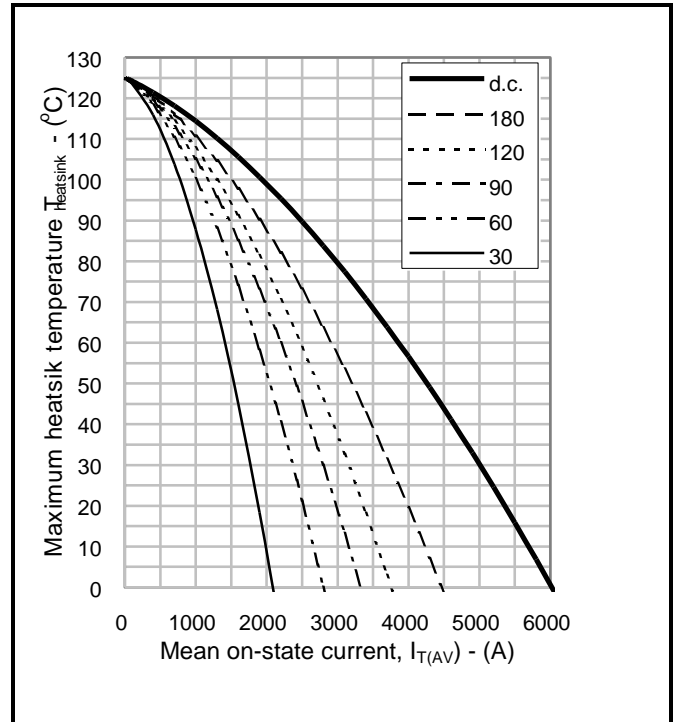
**Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave**



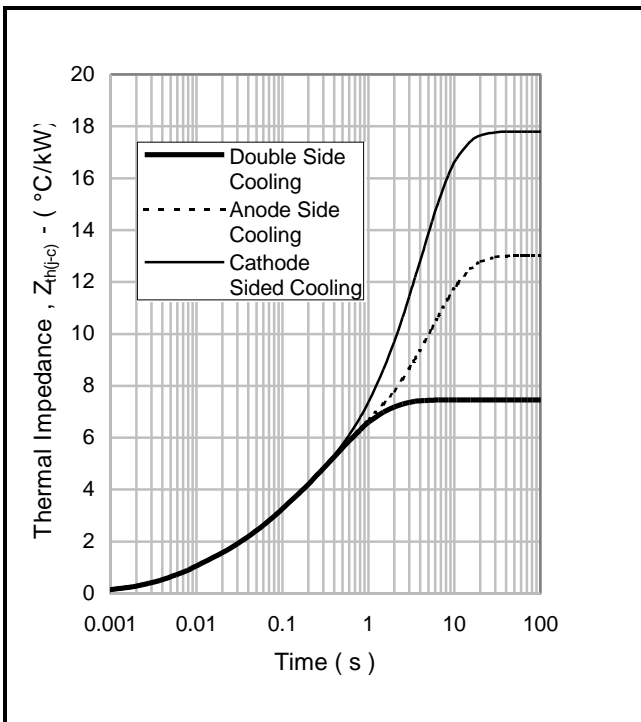
**Fig.6 On-state power dissipation – rectangular wave**



**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) | 0.9206    | 1.8299    | 3.4022    | 1.3044  |
|                     | T <sub>i</sub> (s)     | 0.0076807 | 0.0579454 | 0.4078613 | 1.2085  |
| Anode side cooled   | R <sub>i</sub> (°C/kW) | 0.9032    | 1.6719    | 3.0101    | 7.4269  |
|                     | T <sub>i</sub> (s)     | 0.0075871 | 0.0536531 | 0.3144537 | 5.624   |
| Cathode side cooled | R <sub>i</sub> (°C/kW) | 0.9478    | 2.0661    | 1.6884    | 13.0847 |
|                     | T <sub>i</sub> (s)     | 0.0078442 | 0.0645541 | 0.3894389 | 4.1447  |

$$Z_{th} = \sum [R_i \times (1 - \exp. (t/t_i))] \quad [1]$$

$\Delta R_{th(j-c)}$  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                 | 1.34                | 0.88  | 180                | 1.34                | 0.88  | 180                   | 1.33                | 0.88  |
| 120                 | 1.57                | 1.30  | 120                | 1.57                | 1.30  | 120                   | 1.57                | 1.29  |
| 90                  | 1.83                | 1.54  | 90                 | 1.84                | 1.54  | 90                    | 1.83                | 1.53  |
| 60                  | 2.08                | 1.81  | 60                 | 2.08                | 1.81  | 60                    | 2.07                | 1.80  |
| 30                  | 2.27                | 2.11  | 30                 | 2.28                | 2.11  | 30                    | 2.26                | 2.10  |
| 15                  | 2.36                | 2.28  | 15                 | 2.37                | 2.28  | 15                    | 2.35                | 2.26  |

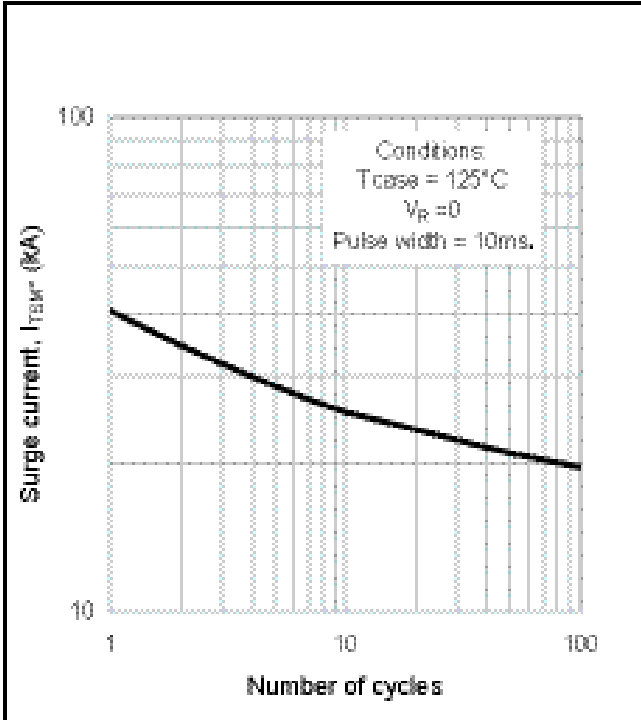


Fig.10 Multi-cycle surge current

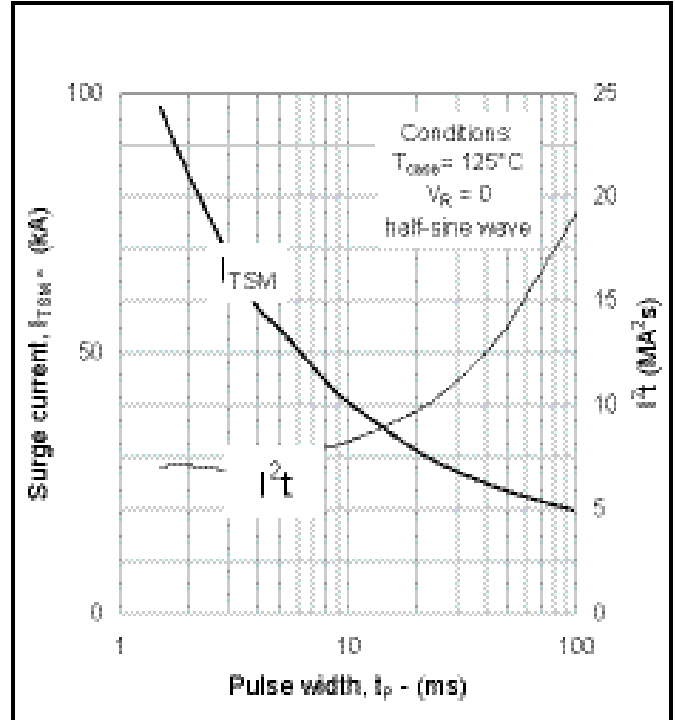


Fig.11 Single-cycle surge current

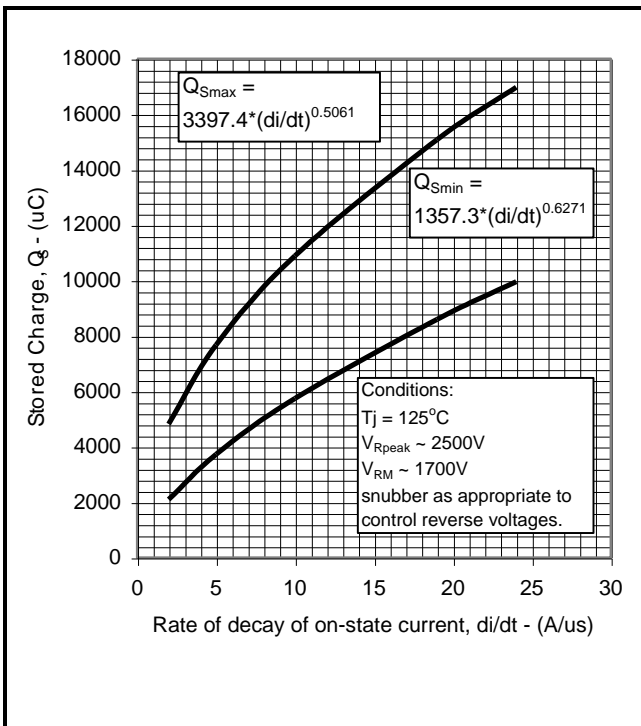


Fig. 12 Stored Charge

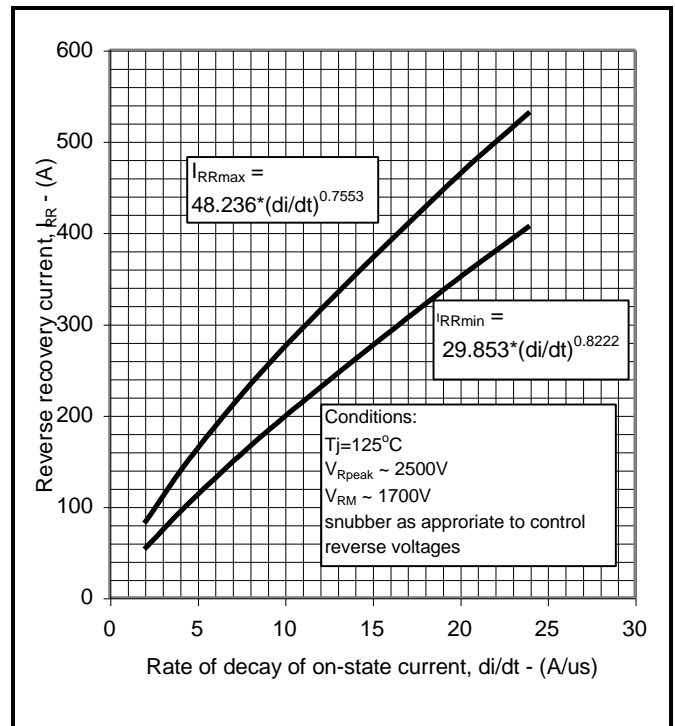


Fig. 13 Reverse Recovery Current

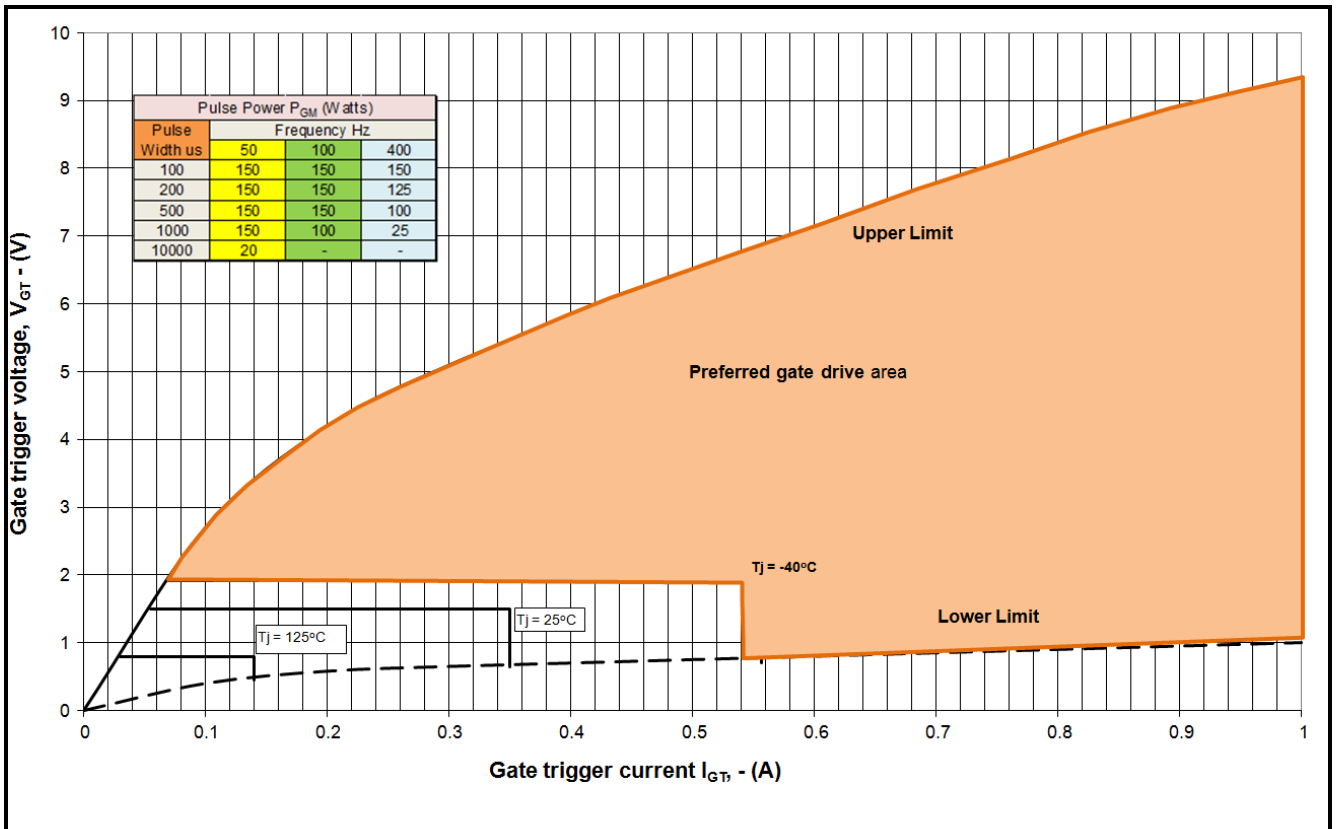


Fig14 Gate Characteristics

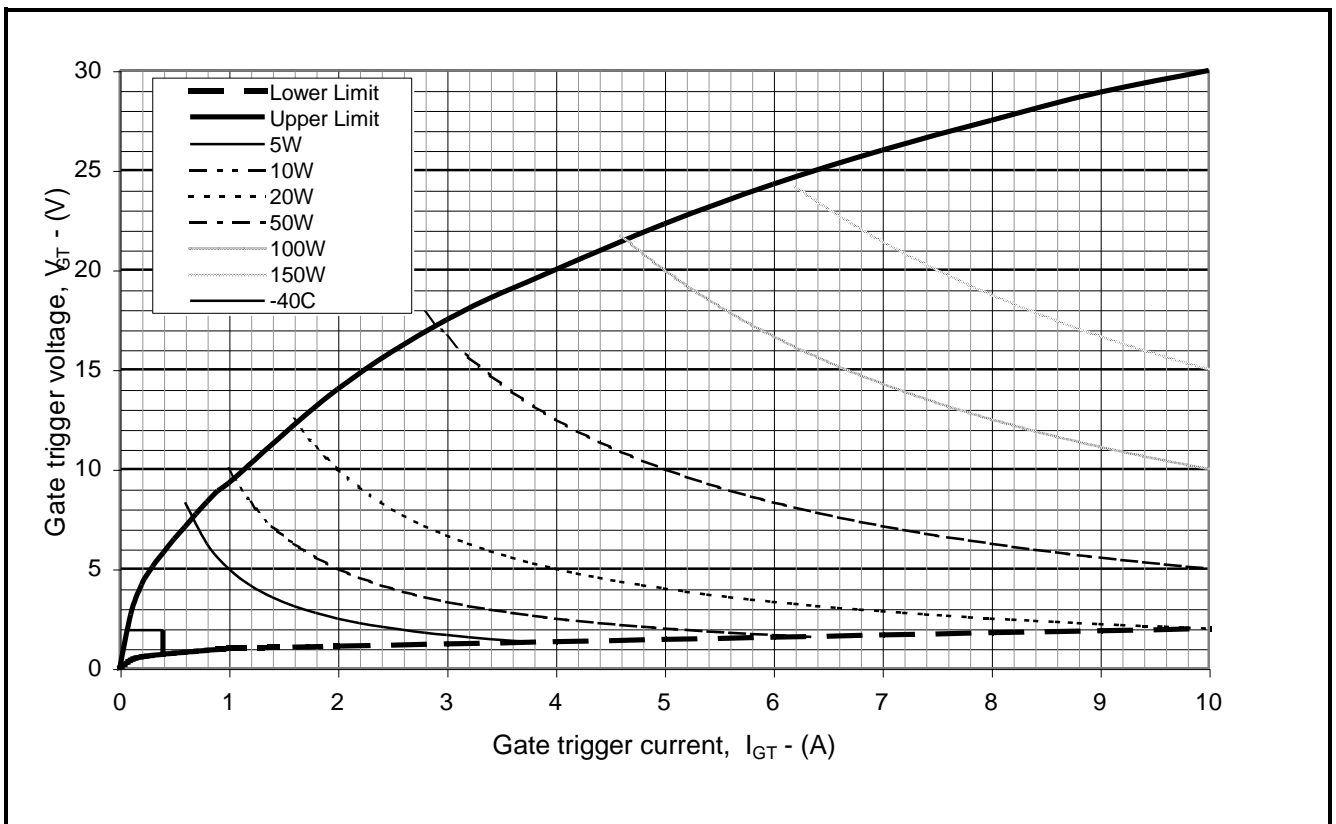
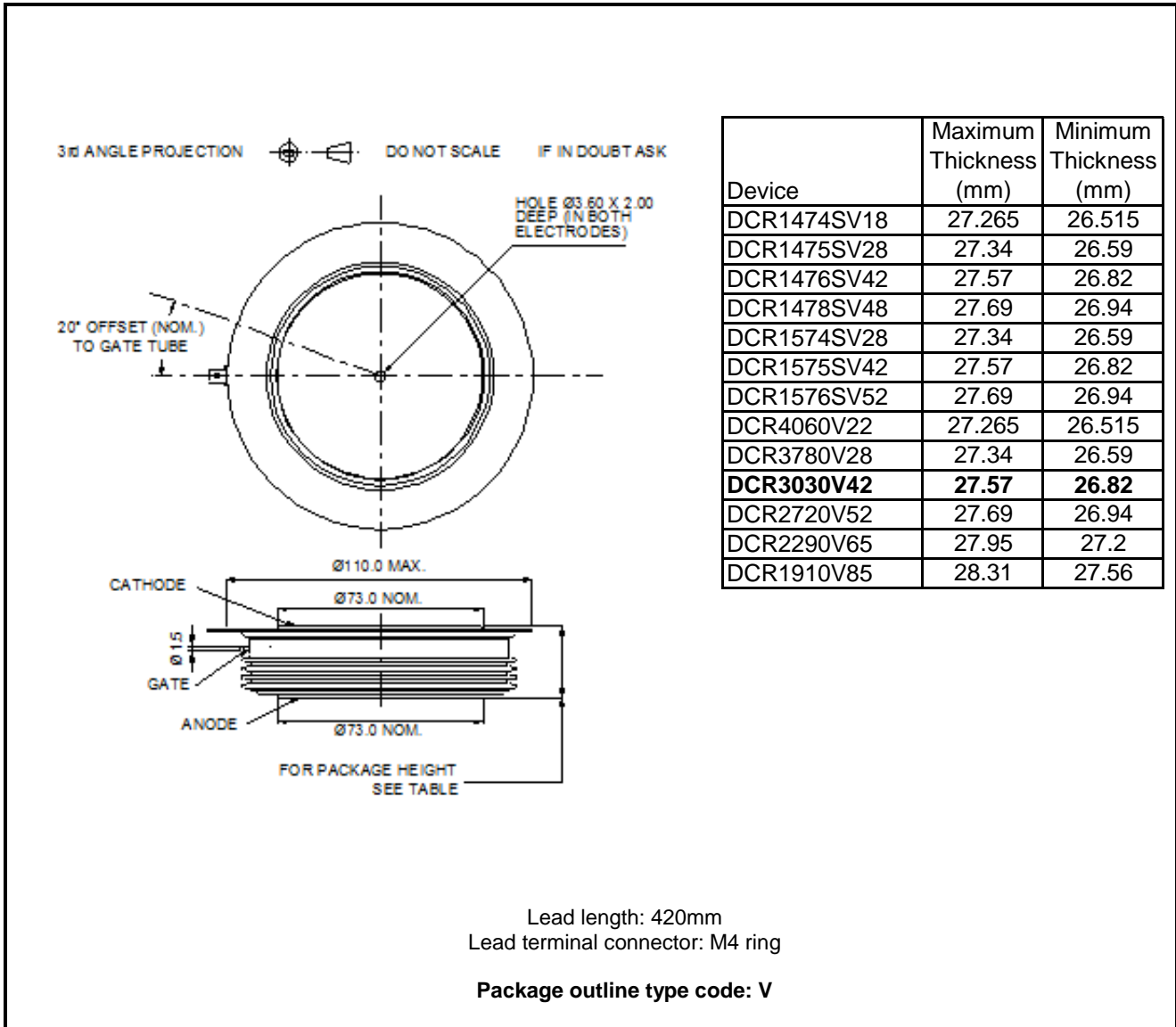


Fig. 15 Gate characteristics



**PACKAGE DETAILS**

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



**Fig.16 Package outline**

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