# DCR2150C42

## Phase Control Thyristor

DS5811-3 January 2014 (LN31255)

### 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 |
|---|---|---|
| DCR2150C42<br>DCR2150C40<br>DCR2150C35<br>DCR2150C30 | 4200<br>4000<br>3500<br>3000 | $T_{vj}$ = -40°C to 125°C, $I_{DRM}$ = $I_{RRM}$ = 200mA, $V_{DRM}$, $V_{RRM}$ $t_p$ = 10ms, $V_{DSM}$ & $V_{RSM}$ = $V_{DRM}$ & $V_{RRM}$ + 100V respectively |

Lower voltage grades available.

### ORDERING INFORMATION

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

For example:

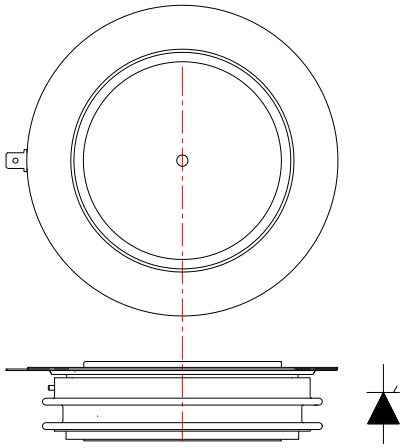
**DCR2150C42**

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

### KEY PARAMETERS

| | |
|---|---|
| $V_{DRM}$ | **4200V** |
| $I_{T(AV)}$ | **2150A** |
| $I_{TSM}$ | **29000A** |
| **dV/dt*** | **1500V/µs** |
| **dI/dt** | **400A/µs** |

* **Higher dV/dt selections available**



**Outline type code: C**

(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 | 2150 | A |
| $I_{T(RMS)}$ | RMS value | - | 3377 | A |
| $I_T$ | Continuous (direct) on-state current | - | 3280 | A |

## SURGE RATINGS

| Symbol | Parameter | Test Conditions | Max. | Units |
|---|---|---|---|---|
| $I_{TSM}$ | Surge (non-repetitive) on-state current | 10ms half sine, $T_{case}$ = 125°C | 29.0 | kA |
| $I^2t$ | $I^2t$ for fusing | $V_R$ = 0 | 4.2 | $MA^2s$ |

## THERMAL AND MECHANICAL RATINGS

| Symbol | Parameter | Test Conditions | | Min. | Max. | Units |
|---|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Thermal resistance – junction to case | Double side cooled | DC | - | 0.0101 | °C/W |
| | | Single side cooled | Anode DC | - | 0.0176 | °C/W |
| | | | Cathode DC | - | 0.0239 | °C/W |
| $R_{th(c-h)}$ | Thermal resistance – case to heatsink | Clamping force 37kN | Double side | - | 0.0025 | °C/W |
| | | (with mounting compound) | Single side | - | 0.005 | °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 | | | 33.0 | 41.0 | 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 | | - | 200 | mA |
| dV/dt | Max. linear rate of rise of off-state voltage | To 67% $V_{DRM}$, $T_j$ = 125°C, gate open | | - | 1500 | V/µs |
| dI/dt | Rate of rise of on-state current | From 67% $V_{DRM}$ to 2x $I_{T(AV)}$ | Repetitive 50Hz | - | 200 | A/µs |
| | | Gate source 30V, 10Ω, $t_r$ < 0.5µs, $T_j$ = 125°C | Non-repetitive | - | 400 | A/µs |
| $V_{T(TO)}$ | Threshold voltage – Low level | 500A to 2000A at $T_{case}$ = 125°C | | - | 0.9 | V |
| | Threshold voltage – High level | 2000A to 7000A at $T_{case}$ = 125°C | | - | 1.08 | V |
| $r_T$ | On-state slope resistance – Low level | 500A to 2000A at $T_{case}$ = 125°C | | - | 0.36 | mΩ |
| | On-state slope resistance – High level | 2000A to 7000A at $T_{case}$ = 125°C | | - | 0.265 | 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 | | 250 | 500 | µs |
| $Q_S$ | Stored charge | $I_T$ = 2000A, $T_j$ = 125°C, dI/dt – 1A/µs, | | 1000 | 3000 | µC |
| $I_L$ | 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 | 350 | mA |
| $I_{GD}$ | Gate non-trigger current | At 50% $V_{DRM}$, $T_{case}$ = 125°C | 10 | mA |

## CURVES

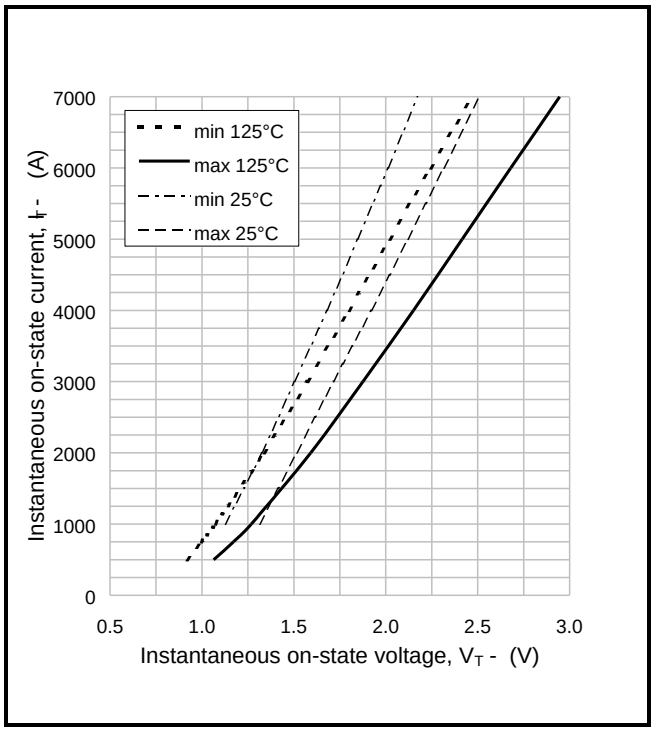



**Fig.2 Maximum & minimum on-state characteristics**

### $V_{TM}$ EQUATION

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

Where A = 0.137154
B = 0.132631
C = 0.000248
D = -0.001126

these values are valid for $T_j$ = 125°C for $I_T$ 100A to 7000A

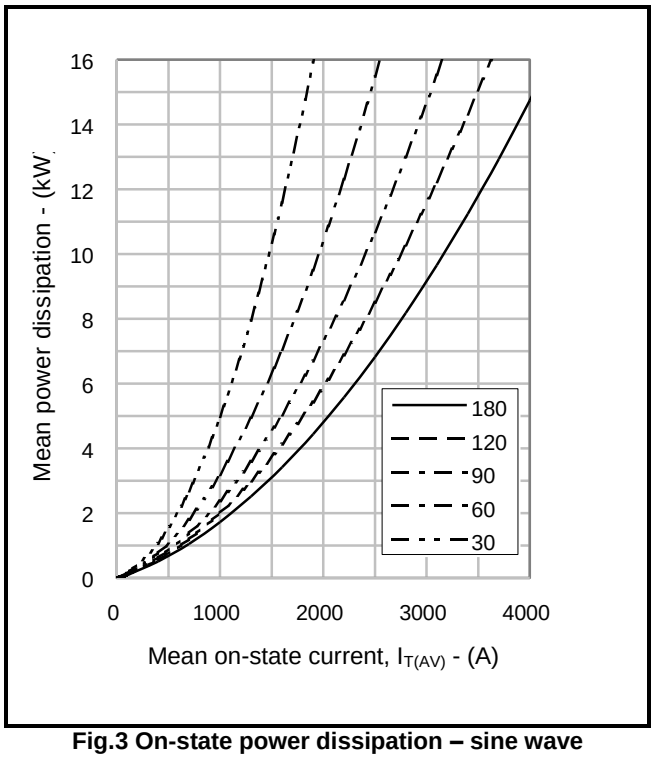



**Fig.3 On-state power dissipation – sine wave**

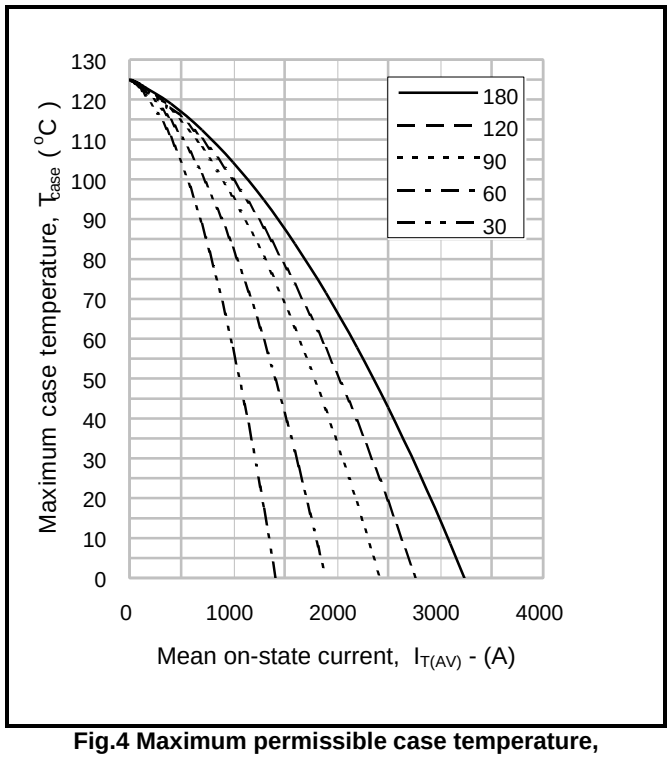



**Fig.4 Maximum permissible case temperature, double side cooled – sine wave**

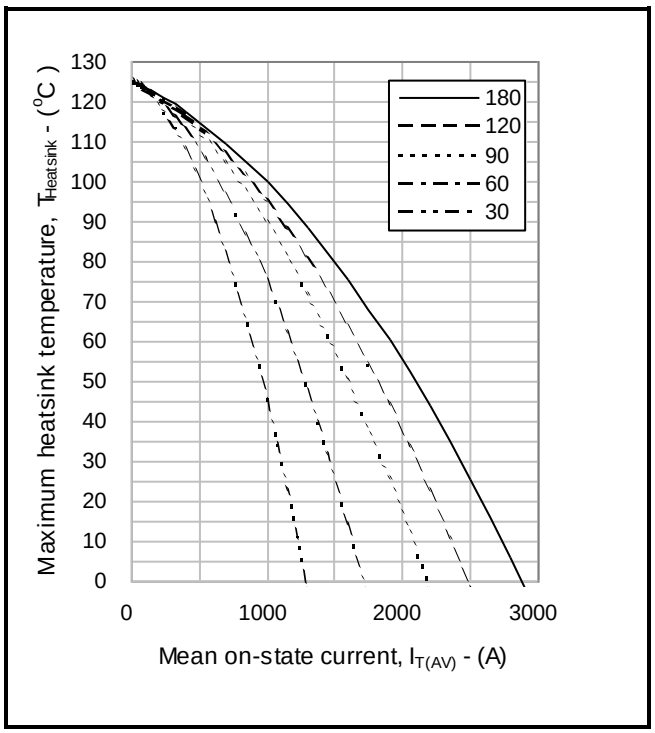



**Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave**

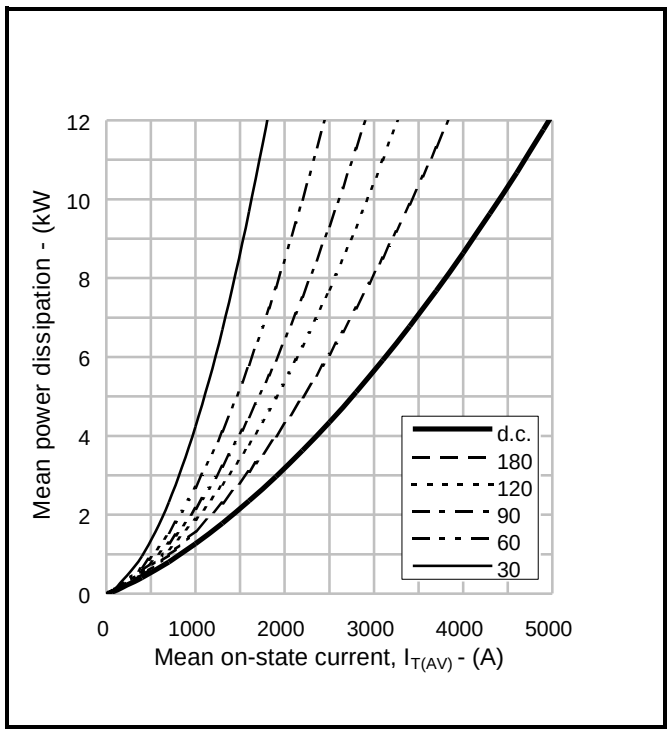



**Fig.6 On-state power dissipation – rectangular wave**

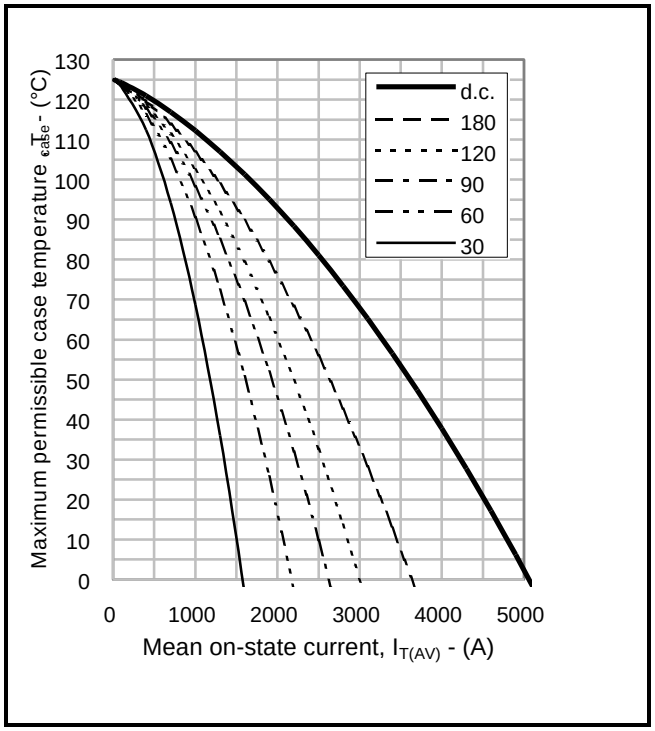



**Fig.7 Maximum permissible case temperature, double side cooled – rectangular wave**

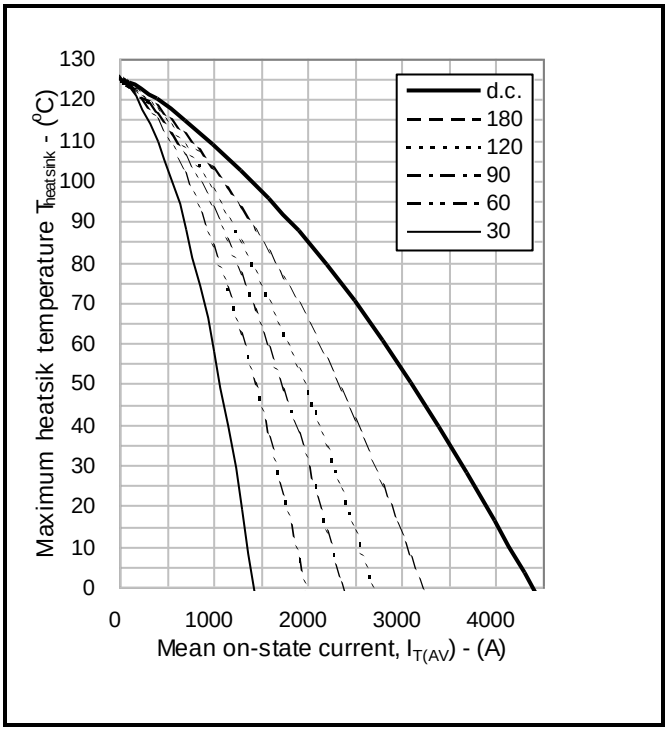
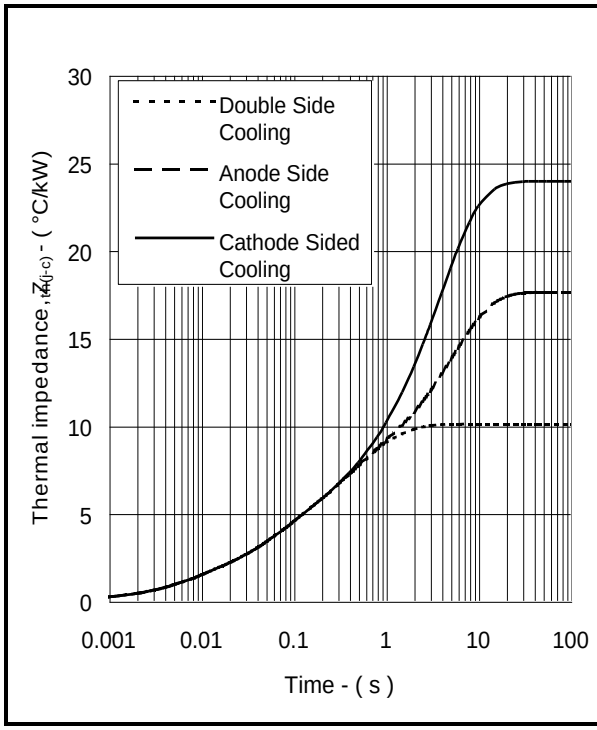



**Fig.8 Maximum permissible heatsink temperature, double side cooled – rectangular wave**




| | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Double side cooled | $R_i$ (°C/kW) | 1.1043 | 2.576 | 4.5096 | 1.9009 |
| | $T_i$ (s) | 0.006176 | 0.0517916 | 0.3820376 | 1.06 |
| Anode side cooled | $R_i$ (°C/kW) | 1.0977 | 2.4566 | 4.0469 | 9.9994 |
| | $T_i$ (s) | 0.006153 | 0.050142 | 0.3129407 | 5.27 |
| Cathode side cooled | $R_i$ (°C/kW) | 1.1519 | 2.8926 | 2.4064 | 17.4793 |
| | $T_i$ (s) | 0.006389 | 0.0582953 | 0.3775516 | 3.97 |

$Z_{th} = \Sigma [R_i \times ( 1\text{-exp. } (t/t_i))]$ **[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 | | |
|---|---|---|
| | $\Delta Z_{th}$ (z) | |
| θ° | sine. | rect. |
| 180 | 1.95 | 1.26 |
| 120 | 2.32 | 1.89 |
| 90 | 2.74 | 2.27 |
| 60 | 3.14 | 2.70 |
| 30 | 3.46 | 3.19 |
| 15 | 3.61 | 3.47 |

| Anode Side Cooling | | |
|---|---|---|
| | $\Delta Z_{th}$ (z) | |
| θ° | sine. | rect. |
| 180 | 1.95 | 1.26 |
| 120 | 2.32 | 1.89 |
| 90 | 2.74 | 2.27 |
| 60 | 3.14 | 2.70 |
| 30 | 3.46 | 3.19 |
| 15 | 3.62 | 3.47 |

| Cathode Sided Cooling | | |
|---|---|---|
| | $\Delta Z_{th}$ (z) | |
| θ° | sine. | rect. |
| 180 | 1.95 | 1.26 |
| 120 | 2.31 | 1.88 |
| 90 | 2.72 | 2.26 |
| 60 | 3.12 | 2.68 |
| 30 | 3.43 | 3.17 |
| 15 | 3.58 | 3.44 |

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

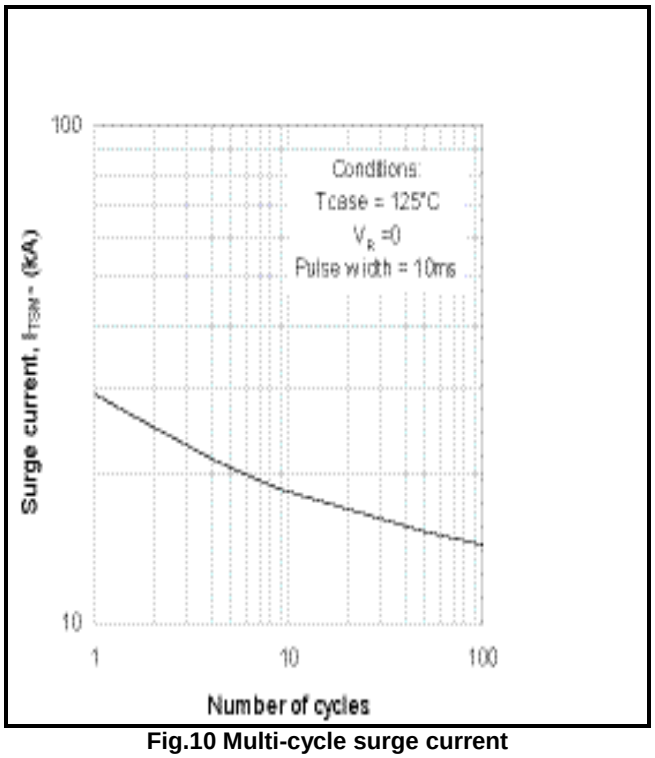



**Fig.10 Multi-cycle surge current**

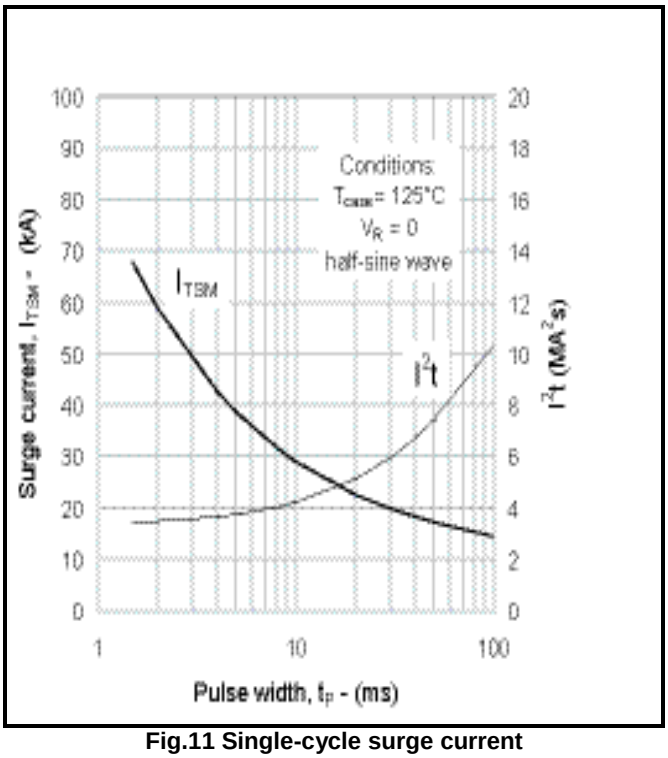



**Fig.11 Single-cycle surge current**

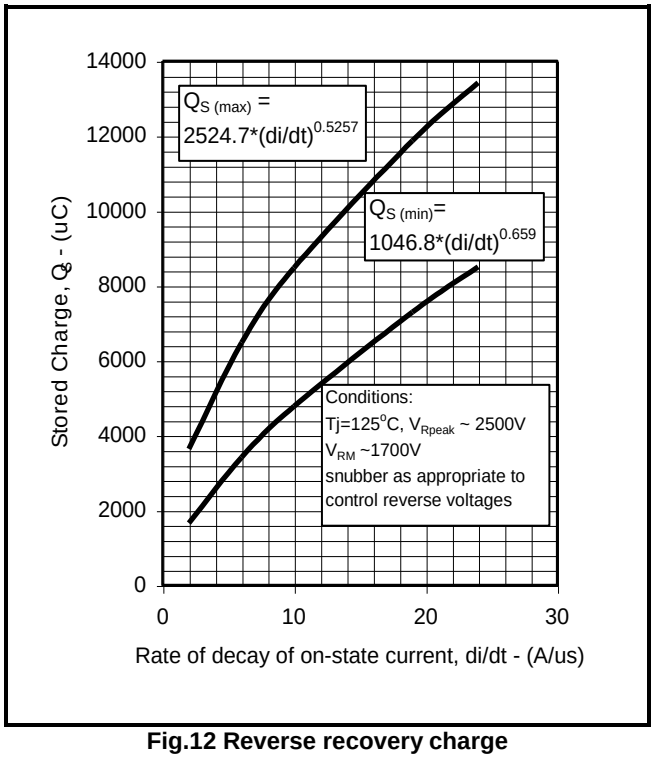



**Fig.12 Reverse recovery charge**

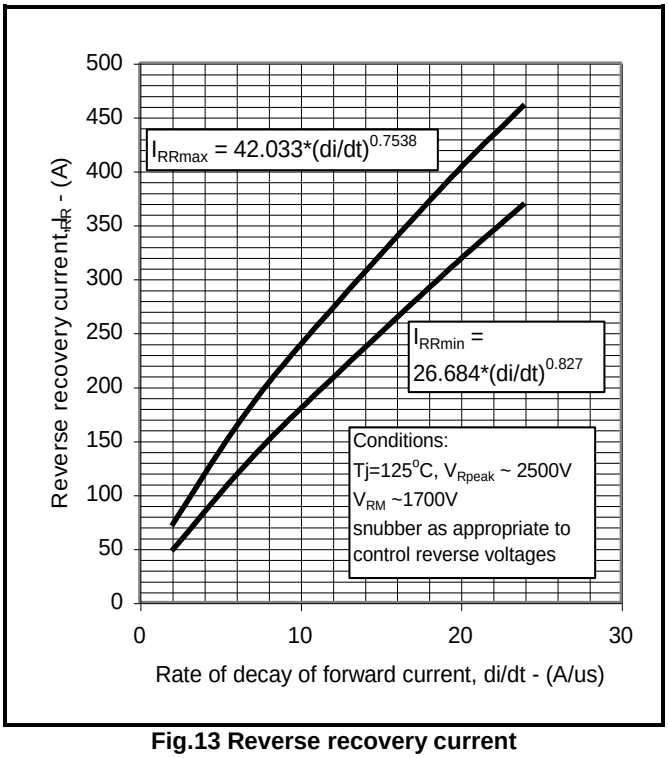



**Fig.13 Reverse recovery current**

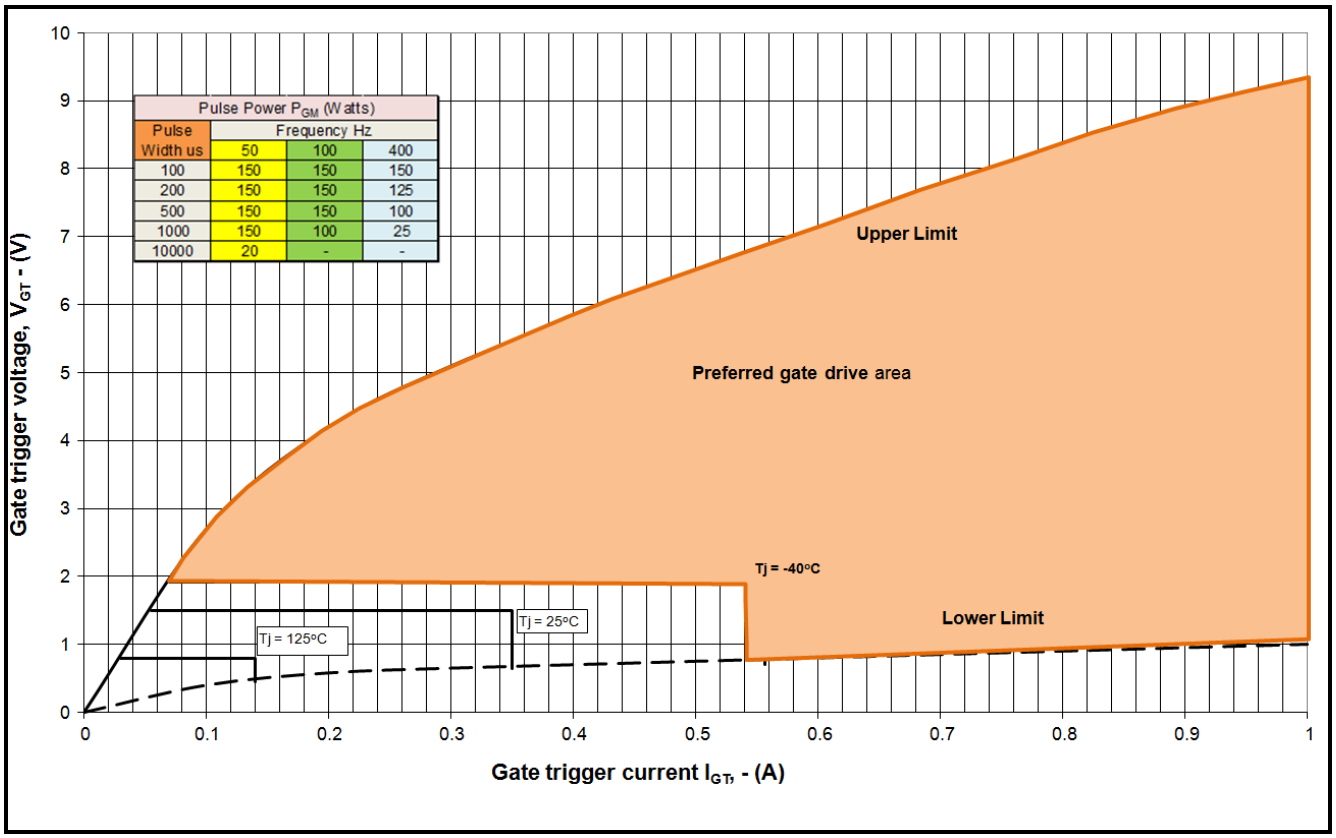



**Fig14 Gate Characteristics**

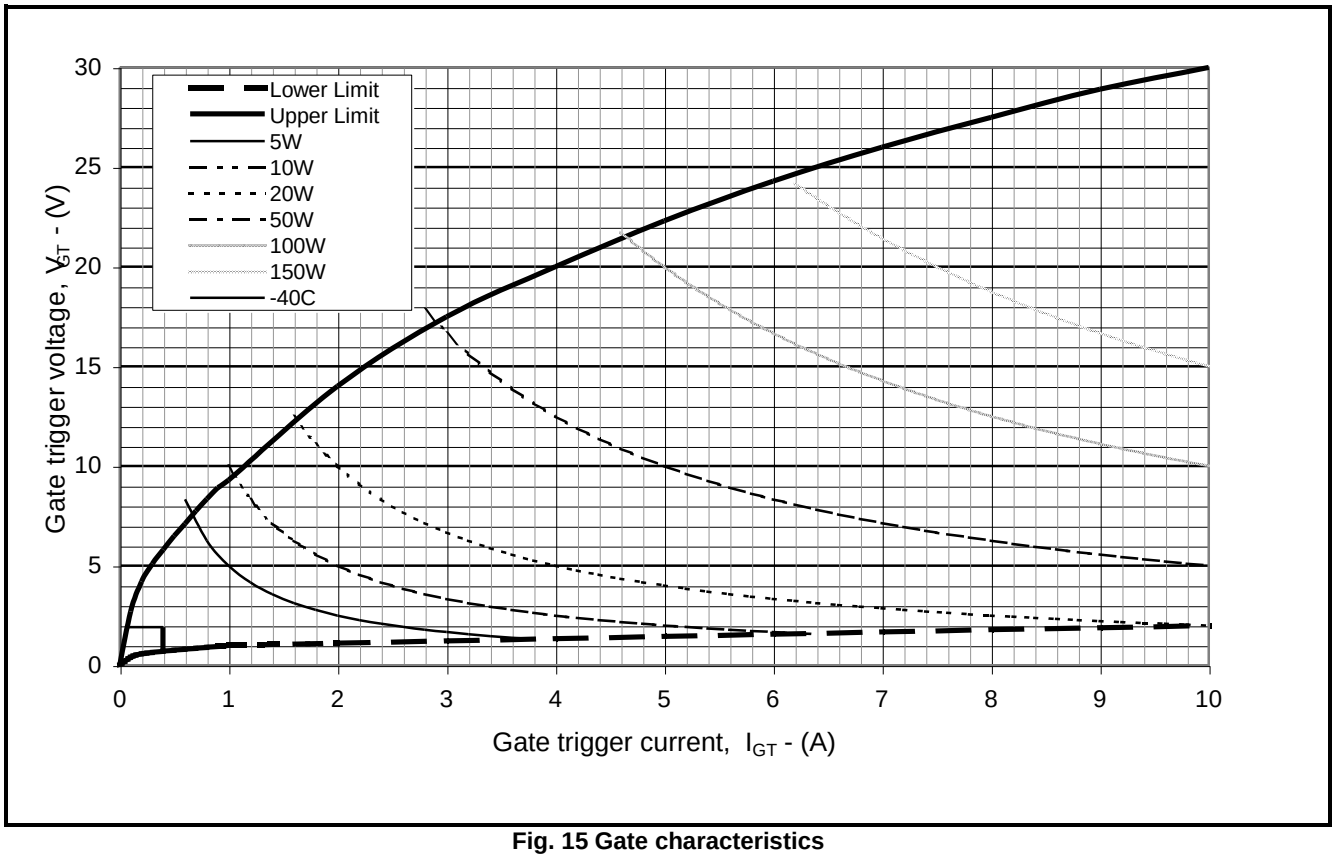
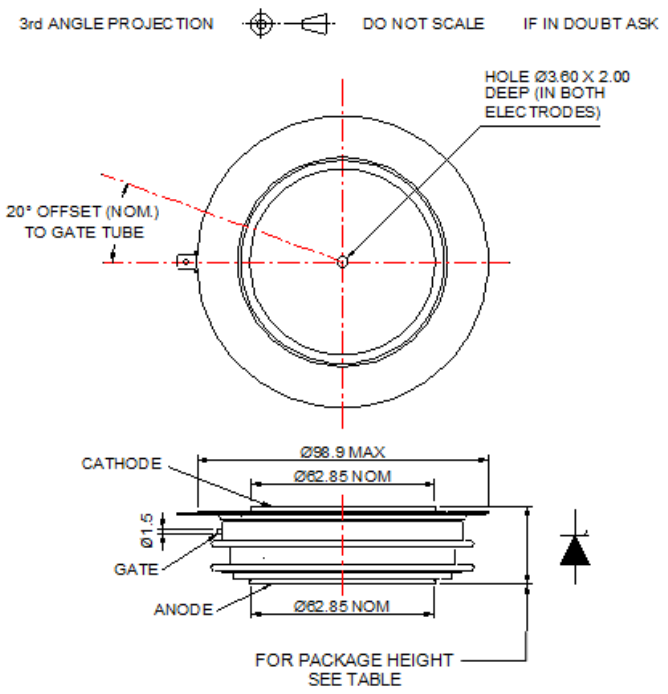



**Fig. 15 Gate characteristics**

## 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) |
|---|---|---|
| DCR2860C22 | 26.415 | 25.865 |
| DCR2630C28 | 26.49 | 25.94 |
| **DCR2150C42** | **26.76** | **26.17** |
| DCR1950C52 | 26.84 | 26.29 |
| DCR1650C65 | 27.1 | 26.55 |
| DCR1370C85 | 27.46 | 26.91 |

Lead length: 420mm
Lead terminal connector: M4 ring

**Package outline type code: C**

**Fig.16 Package outline**

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| | |
|---|---|
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