# DCR604SE

## Phase Control Thyristor

Supersedes January 2000 version, DS4450-4.0

DS4450-5.0 July 2001

### FEATURES

- Double Side Cooling
- High Surge Capability
- High Mean Current
- Fatigue Free

### APPLICATIONS

- High Power Drives
- High Voltage Power Supplies
- DC Motor Control

### VOLTAGE RATINGS

| Type Number | Repetitive Peak Voltages $V_{DRM}$ $V_{RRM}$ V | Conditions |
|---|---|---|
| DCR604SE21 | 2100 | $T_{vj}$ = 0˚ to 125˚C, $I_{DRM}$ = $I_{RRM}$ = 30mA, $V_{DRM}$, $V_{RRM}$ $t_p$ = 10ms, $V_{DSM}$ & $V_{RSM}$ = $V_{DRM}$ & $V_{RRM}$ + 100V respectively |
| DCR604SE20 | 2000 | |
| DCR604SE19 | 1900 | |
| DCR604SE18 | 1800 | |
| DCR604SE17 | 1700 | |

Lower voltage grades available.

### ORDERING INFORMATION

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

For example:

**DCR604SE20**

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

### KEY PARAMETERS

**$V_{DRM}$ 2100V**

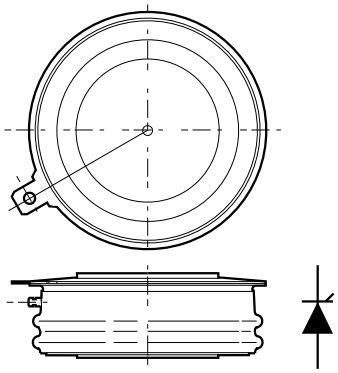
**$I_{T(AV)}$ 706A**

**$I_{TSM}$ 8100A**

**dVdt* 1000V/μs**

**dI/dt 700A/μs**

***Higher dV/dt selections available**



**Outline type code: E**

See Package Details for further information.

**Fig. 1 Package outline**

## CURRENT RATINGS

**$T_{case}$ = 60˚C unless stated otherwise.**

| Symbol | Parameter | Conditions | Max. | Units |
|---|---|---|---|---|
| **Double Side Cooled** | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 706 | A |
| $I_{T(RMS)}$ | RMS value | - | 1109 | A |
| $I_T$ | Continuous (direct) on-state current | - | 995 | A |
| **Single Side Cooled (Anode side)** | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 487 | A |
| $I_{T(RMS)}$ | RMS value | - | 766 | A |
| $I_T$ | Continuous (direct) on-state current | - | 646 | A |

## CURRENT RATINGS

**$T_{case}$ = 80˚C unless stated otherwise.**

| Symbol | Parameter | Conditions | Max. | Units |
|---|---|---|---|---|
| **Double Side Cooled** | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 562 | A |
| $I_{T(RMS)}$ | RMS value | - | 882 | A |
| $I_T$ | Continuous (direct) on-state current | - | 770 | A |
| **Single Side Cooled (Anode side)** | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 380 | A |
| $I_{T(RMS)}$ | RMS value | - | 595 | A |
| $I_T$ | Continuous (direct) on-state current | - | 480 | A |

## SURGE RATINGS

| Symbol | Parameter | Conditions | Max. | Units |
|---|---|---|---|---|
| $I_{TSM}$ | Surge (non-repetitive) on-state current | 10ms half sine; $T_{case}$ = 125°C | 6.5 | kA |
| $I^2t$ | $I^2t$ for fusing | $V_R$ = 50% $V_{RRM}$ - 1/4 sine | 0.21 x $10^6$ | $A^2s$ |
| $I_{TSM}$ | Surge (non-repetitive) on-state current | 10ms half sine; $T_{case}$ = 125°C | 8.1 | kA |
| $I^2t$ | $I^2t$ for fusing | $V_R$ = 0 | 0.33 x $10^6$ | $A^2s$ |

## THERMAL AND MECHANICAL DATA

| Symbol | Parameter | Conditions | | Min. | Max. | Units |
|---|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Thermal resistance - junction to case | Double side cooled | dc | - | 0.041 | °C/W |
| | | Single side cooled | Anode dc | - | 0.074 | °C/W |
| | | | Cathode dc | - | 0.092 | °C/W |
| $R_{th(c-h)}$ | Thermal resistance - case to heatsink | Clamping force 8.0kN with mounting compound | Double side | - | 0.018 | °C/W |
| | | | Single side | - | 0.036 | °C/W |
| $T_{vj}$ | Virtual junction temperature | On-state (conducting) | | - | 135 | °C |
| | | Reverse (blocking) | | - | 125 | °C |
| $T_{stg}$ | Storage temperature range | | | –55 | 125 | °C |
| - | Clamping force | | | 7.2 | 8.8 | kN |

## DYNAMIC CHARACTERISTICS

| Symbol | Parameter | Conditions | | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_{RRM}/I_{DRM}$ | Peak reverse and off-state current | At $V_{RRM}/V_{DRM}$, $T_{case}$ = 125°C | | - | 30 | mA |
| dV/dt | Maximum linear rate of rise of off-state voltage | To 67% $V_{DRM}$ $T_j$ = 125°C. Gate open circuit. | | - | 1000 | V/µs |
| dI/dt | Rate of rise of on-state current | From 67% $V_{DRM}$ to 1100A<br>Gate source 20V, 20Ω<br>$t_r \leq 0.5\mu s$, $T_j$ = 125°C | Repetitive 50Hz | - | 350 | A/µs |
| | | | Non-repetitive | - | 700 | A/µs |
| $V_{T(TO)}$ | Threshold voltage | At $T_{vj}$ = 125°C | | - | 0.93 | V |
| $r_T$ | On-state slope resistance | At $T_{vj}$ = 125°C | | - | 0.667 | mΩ |
| $t_{gd}$ | Delay time | $V_D$ = 67% $V_{DRM}$, Gate source 10V, 5Ω<br>$t_r$ = 0.5µs, $T_j$ = 25°C | | - | 1.5 | µs |
| $I_L$ | Latching current | $T_j$ = 25°C, $V_D$ = 5V | | - | 500 | mA |
| $I_H$ | Holding current | $T_j$ = 25°C, $V_D$ = 5V | | - | 70 | mA |
| $t_q$ | Turn-off time | $I_T$ = 500A, $t_p$ = 1ms, $T_j$ = 125°C,<br>$V_R$ = 50V, $dI_{RR}/dt$ = 20A/µs,<br>$V_{DR}$ = 67% $V_{DRM}$, $dV_{DR}/dt$ = 20V/µs linear | | 300 | 400 | µs |

## GATE TRIGGER CHARACTERISTICS AND RATINGS

| Symbol | Parameter | Conditions | Max. | Units |
|---|---|---|---|---|
| $V_{GT}$ | Gate trigger voltage | $V_{DRM}$ = 5V, $T_{case}$ = 25°C | 3.0 | V |
| $I_{GT}$ | Gate trigger current | $V_{DRM}$ = 5V, $T_{case}$ = 25°C | 150 | mA |
| $V_{GD}$ | Gate non-trigger voltage | At 67% $V_{DRM}$ $T_{case}$ = 125°C | 0.25 | V |
| $V_{FGM}$ | Peak forward gate voltage | Anode positive with respect to cathode | 30 | V |
| $V_{FGN}$ | Peak forward gate voltage | Anode negative with respect to cathode | 0.25 | V |
| $V_{RGM}$ | Peak reverse gate voltage | | 5 | V |
| $I_{FGM}$ | Peak forward gate current | Anode positive with respect to cathode | 10 | A |
| $P_{GM}$ | Peak gate power | See table, gate characteristics curve | 100 | W |
| $P_{G(AV)}$ | Mean gate power | | 5 | W |

## CURVES

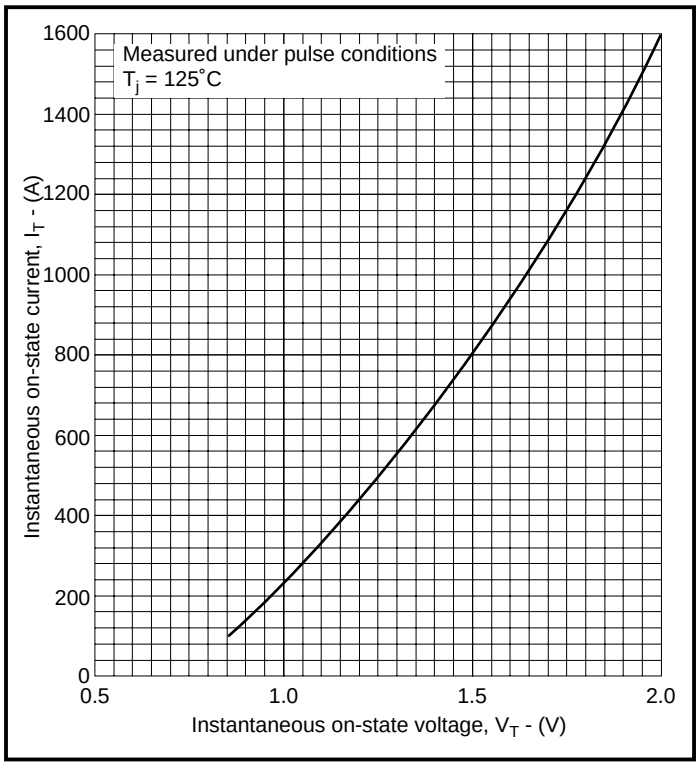



**Fig.2 Maximum (limit) on-state characteristics**

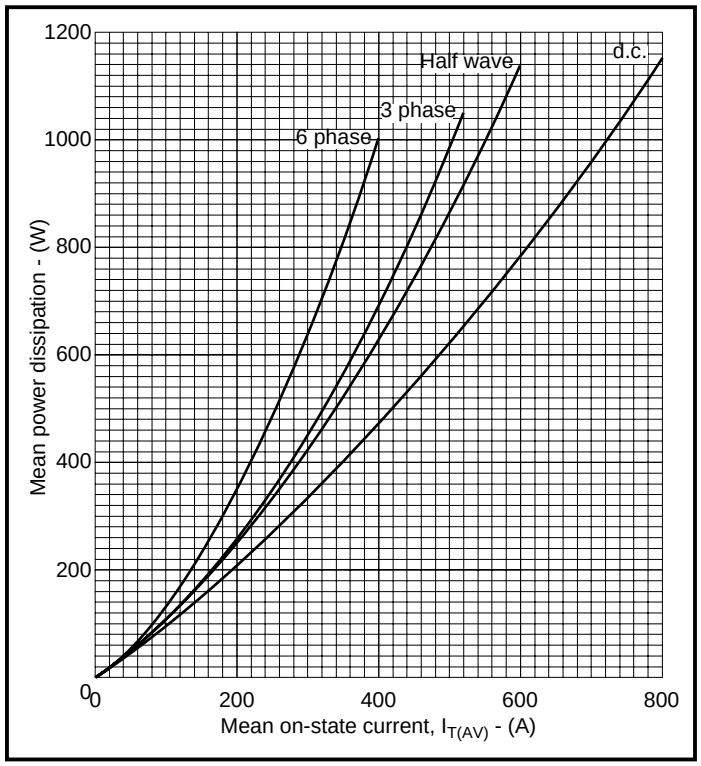



**Fig.3 Dissipation curves**

$V_{TM}$ Equation:-

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

Where A = 1.086551
B = –0.173031
C = $–3.307461 \times 10^{–5}$
D = 0.056345

these values are valid for $T_j$ = 125˚C for $I_T$ 500A to 1600A

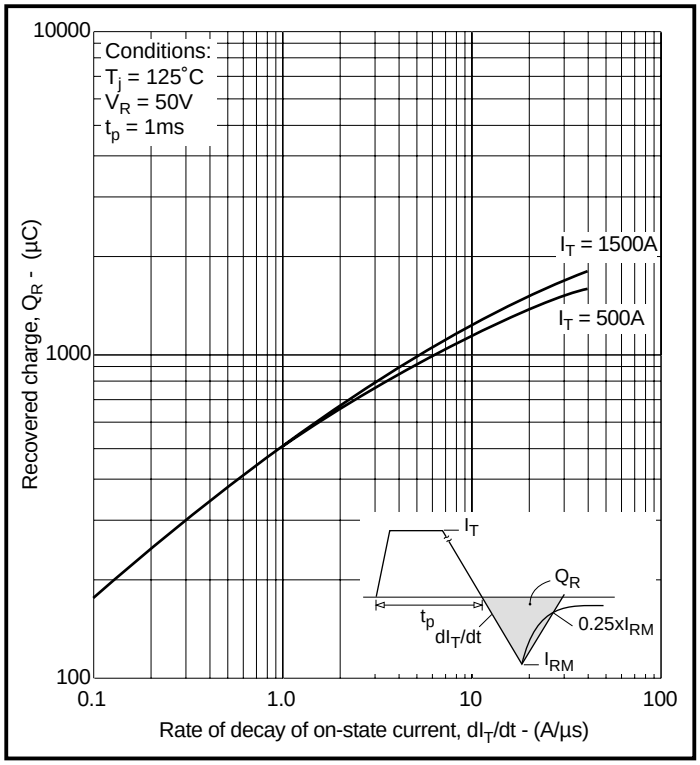



**Fig.4 Recovered charge**

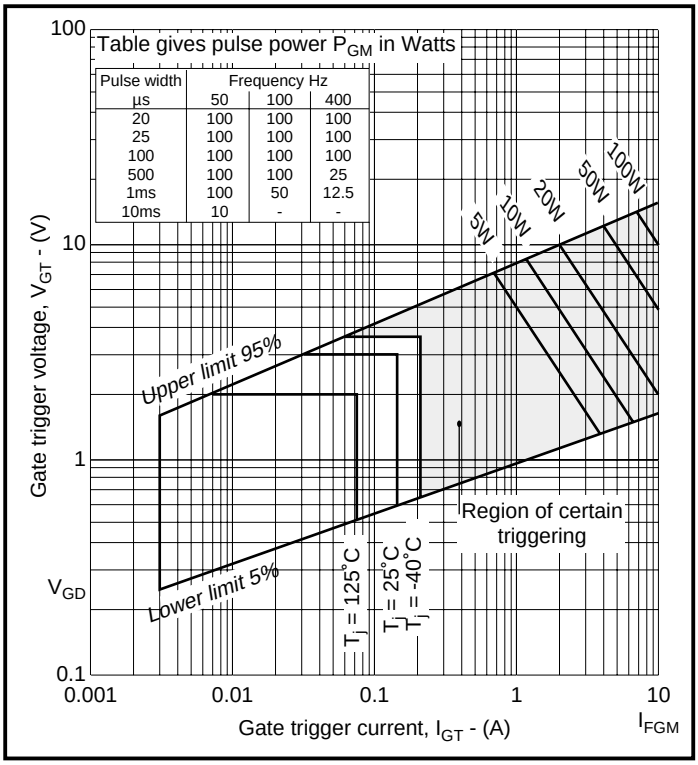



**Fig.5 Gate characteristics**

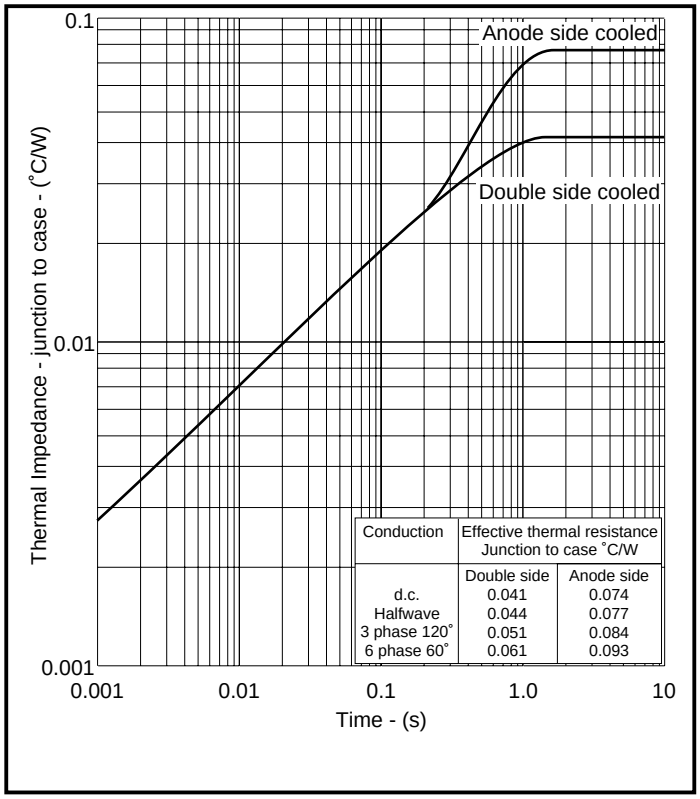



**Fig.6 Maximum (limit) transient thermal impedance - junction to case**

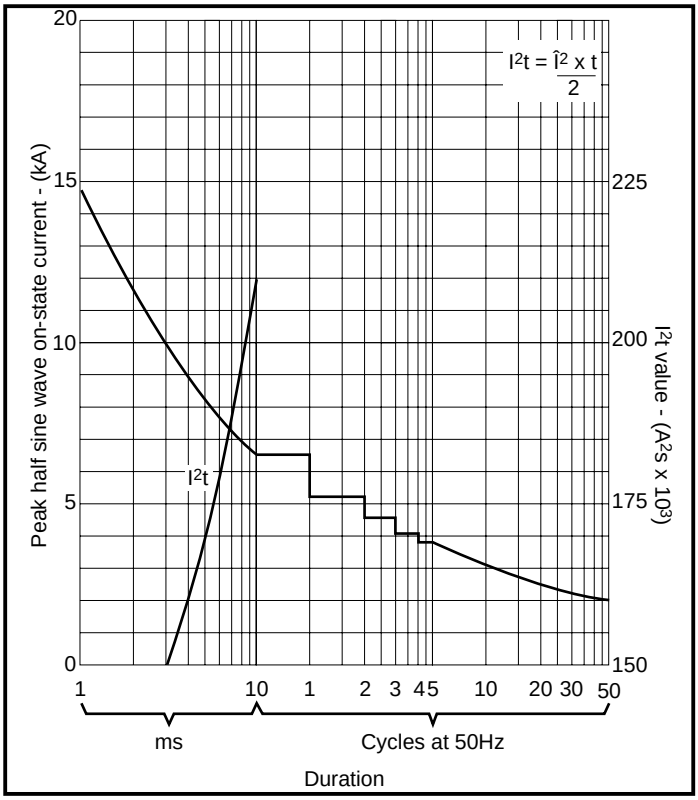
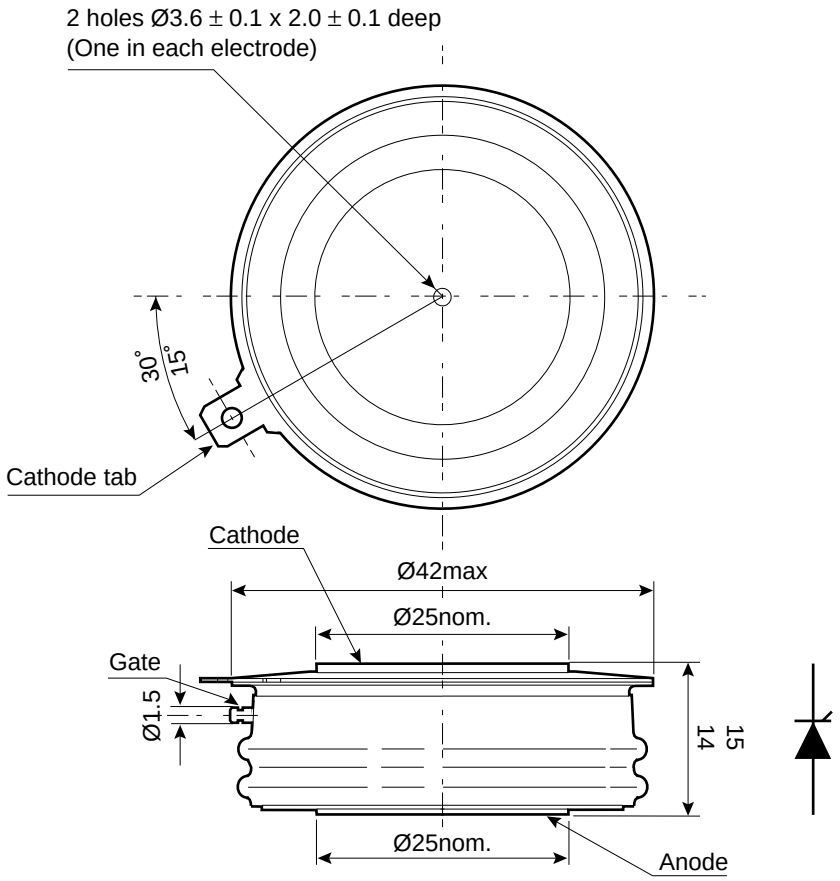



**Fig.7 Surge (non-repetitive) on-state current vs time (with 50% $V_{RRM}$ at $T_{case}$ 125˚C)**

## PACKAGE DETAILS

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.




Nominal weight: 82g
Clamping force: 8kN ±10%
Lead length: 420mm
Lead terminal connector: M4 ring

**Package outine type code: E**

## POWER ASSEMBLY CAPABILITY

The Power Assembly group was set up to provide a support service for those customers requiring more than the basic semiconductor, and has developed a flexible range of heatsink / clamping systems in line with advances in device types and the voltage and current capability of our semiconductors.

We offer an extensive range of air and liquid cooled assemblies covering the full range of circuit designs in general use today. The Assembly group continues to offer high quality engineering support dedicated to designing new units to satisfy the growing needs of our customers.

Using the up to date CAD methods our team of design and applications engineers aim to provide the Power Assembly Complete solution (PACs).

## DEVICE CLAMPS

Disc devices require the correct clamping force to ensure their safe operation. The PACs range offers a varied selection of pre-loaded clamps to suit all of our manufactured devices. This include cube clamps for single side cooling of 'T' 22mm

Clamps are available for single or double side cooling, with high insulation versions for high voltage assemblies.

Please refer to our application note on device clamping, AN4839

## HEATSINKS

Power Assembly has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance or our semiconductors. Data with respect to air natural, forced air and liquid cooling (with flow rates) is available on request.

For further information on device clamps, heatsinks and assemblies, please contact your nearest Sales Representative or Customer Services.

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**Preliminary Information:** The product is in design and development. The datasheet represents the product as it is understood but details may change.

**Advance Information:** The product design is complete and final characterisation for volume production is well in hand.

**No Annotation:** The product parameters are fixed and the product is available to datasheet specification.