



DCR720E

Phase Control Thyristor

Preliminary Information

DS5485-1.2 February 2002

FEATURES

- Double Side Cooling
- High Surge Capability
- Low Inductance Internal Construction

APPLICATIONS

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

VOLTAGE RATINGS

| Part and Ordering Number | Repetitive Peak Voltages V_{DRM} and V_{DRM} V | Conditions |
|--------------------------|--|--|
| DCR720E18 | 1800 | $T_{vj} = 0^\circ$ to 125°C , |
| DCR720E16 | 1600 | $I_{DRM} = I_{RRM} = 30\text{mA}$, |
| DCR720E14 | 1400 | V_{DRM}, V_{RRM} $t_p = 10\text{ms}$, |
| DCR720E12 | 1200 | V_{DSM} & $V_{RSM} =$ V_{DRM} & $V_{RRM} + 100\text{V}$ respectively |

Lower voltage grades available.

ORDERING INFORMATION

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

For example:

DCR720E16

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} | 1800V |
| $I_{T(AV)}$ | 724A |
| I_{TSM} | 9800A |
| dV/dt^* | 1000V/ μs |
| dl/dt | 700A/ μs |

*Higher dV/dt selections available

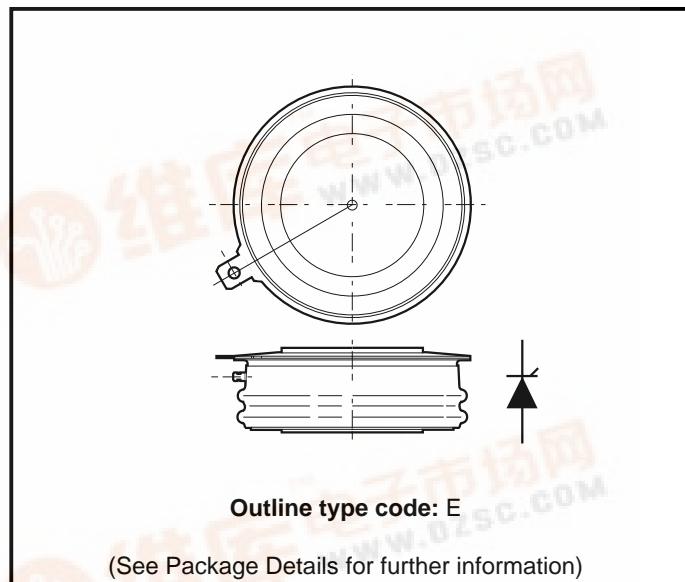


Fig. 1 Package outline

CURRENT RATINGS $T_{case} = 60^\circ\text{C}$ unless stated otherwise.

| Symbol | Parameter | Test Conditions | Max. | Units |
|---------------------------|--------------------------------------|--------------------------|------|-------|
| Double Side Cooled | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 724 | A |
| $I_{T(RMS)}$ | RMS value | - | 1140 | A |
| I_T | Continuous (direct) on-state current | - | 1025 | A |
| Single Side Cooled | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 500 | A |
| $I_{T(RMS)}$ | RMS value | - | 790 | A |
| I_T | Continuous (direct) on-state current | - | 670 | A |

 $T_{case} = 80^\circ\text{C}$ unless stated otherwise.

| Symbol | Parameter | Test Conditions | Max. | Units |
|---------------------------|--------------------------------------|--------------------------|------|-------|
| Double Side Cooled | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 570 | A |
| $I_{T(RMS)}$ | RMS value | - | 895 | A |
| I_T | Continuous (direct) on-state current | - | 790 | A |
| Single Side Cooled | | | | |
| $I_{T(AV)}$ | Mean on-state current | Half wave resistive load | 390 | A |
| $I_{T(RMS)}$ | RMS value | - | 610 | A |
| I_T | Continuous (direct) on-state current | - | 505 | A |

SURGE RATINGS

| Symbol | Parameter | Test Conditions | Max. | Units |
|-----------|---|---|--------------------|--------|
| I_{TSM} | Surge (non-repetitive) on-state current | 10ms half sine, $T_{case} = 125^\circ C$ $V_R = 50\% V_{RRM} - 1/4 \sin$ | 7.8 | kA |
| I^2t | I^2t for fusing | | 0.3×10^6 | A^2s |
| I_{TSM} | Surge (non-repetitive) on-state current | 10ms half sine, $T_{case} = 125^\circ C$ $V_R = 0$ | 9.8 | kA |
| I^2t | I^2t for fusing | | 0.48×10^6 | A^2s |

DYNAMIC CHARACTERISTICS

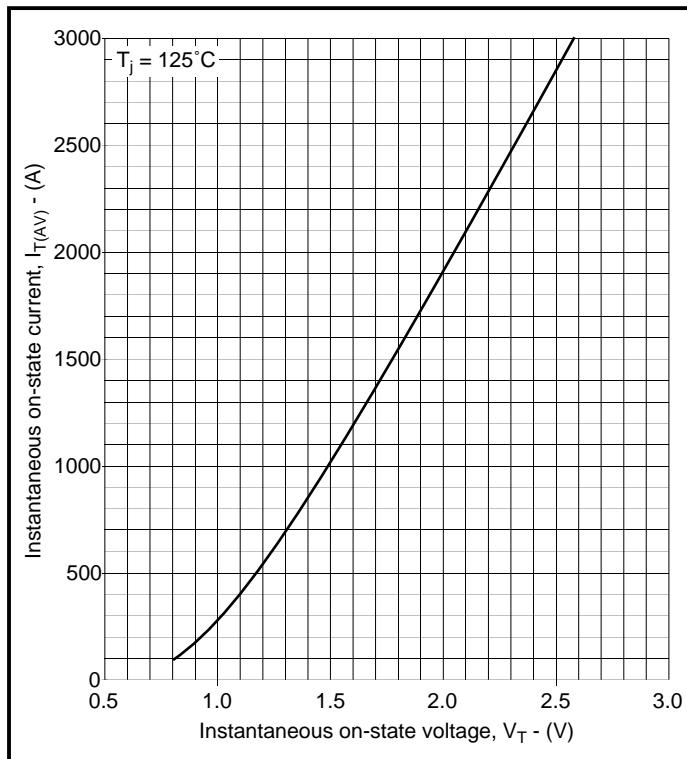
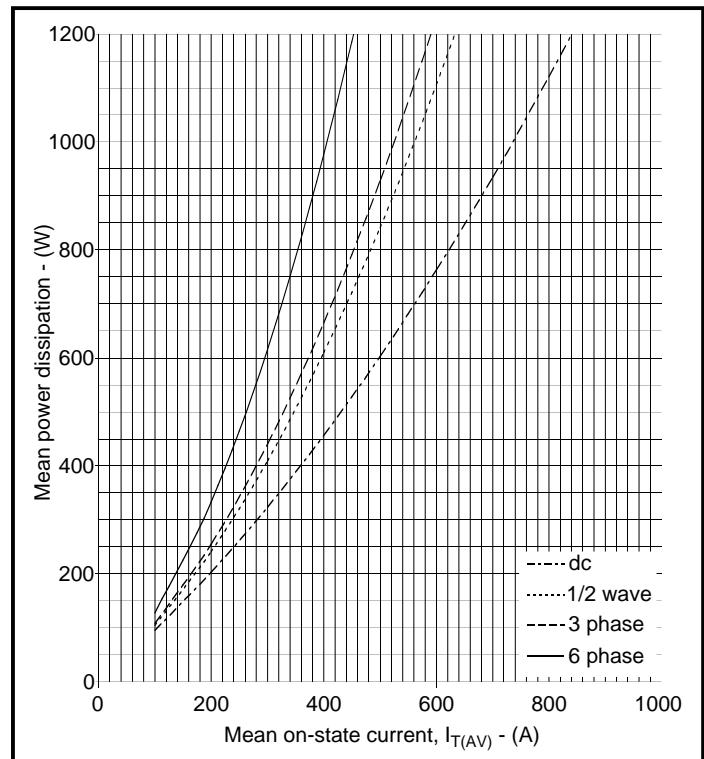
| Symbol | Parameter | Test Conditions | Min. | Max. | Units | |
|-------------------|---|--|-----------------|------|-----------|-----------|
| I_{RRM}/I_{RRM} | Peak reverse and off-state current | At V_{RRM}/V_{DRM} , $T_{case} = 125^\circ C$ | - | 30 | mA | |
| dV/dt | Max. linear rate of rise of off-state voltage | To 67% V_{DRM} , $T_j = 125^\circ C$ | - | 1000 | $V/\mu s$ | |
| dl/dt | Rate of rise of on-state current | From 67% V_{DRM} to 1100A | Repetitive 50Hz | - | 350 | $A/\mu s$ |
| | | Gate source 20V, 10Ω , $t_r \leq 0.5\mu s$, $T_j = 125^\circ C$ | Non-repetitive | - | 700 | $A/\mu s$ |
| $V_{T(TO)}$ | Threshold voltage | At $T_{vj} = 125^\circ C$ | - | 0.88 | V | |
| r_T | On-state slope resistance | At $T_{vj} = 125^\circ C$ | - | 0.65 | $m\Omega$ | |
| t_{gd} | Delay time | $V_D = 67\% V_{DRM}$, gate source 10V, 5Ω $t_r = 0.5\mu s$, $T_j = 25^\circ C$ | - | 1.5 | μs | |
| t_q | Turn-off time | $I_T = 500A$, $t_p = 1ms$, $T_j = 125^\circ C$, $V_R = 50V$, $dl_{RR}/dt = 20A/\mu s$, $V_{DR} = 67\% V_{DRM}$, $dV_{DR}/dt = 20V/\mu s$ linear | 300 | 400 | μs | |
| I_L | Latching current | $T_j = 25^\circ C$, $V_D = 5V$ | - | 500 | mA | |
| I_H | Holding current | $T_j = 25^\circ C$, $V_D = 5V$ | - | 70 | mA | |

THERMAL AND MECHANICAL RATINGS

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

GATE TRIGGER CHARACTERISTICS AND RATINGS

| Symbol | Parameter | Test Conditions | Max. | Units |
|-------------|---------------------------|--|------|-------|
| V_{GT} | Gate trigger voltage | $V_{DRM} = 5V, T_{case} = 25°C$ | 3 | V |
| I_{GT} | Gate trigger current | $V_{DRM} = 5V, T_{case} = 25°C$ | 150 | mA |
| V_{GD} | Gate non-trigger voltage | At $V_{DRM} T_{case} = 125°C$ | 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 Power dissipation

V_{TM} Equation:-

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

Where $A = 0.2366$
 $B = 0.1182$
 $C = 0.0005$
 $D = -0.0019$

these values are valid for $T_j = 125^\circ\text{C}$ for I_T 100A to 3000A

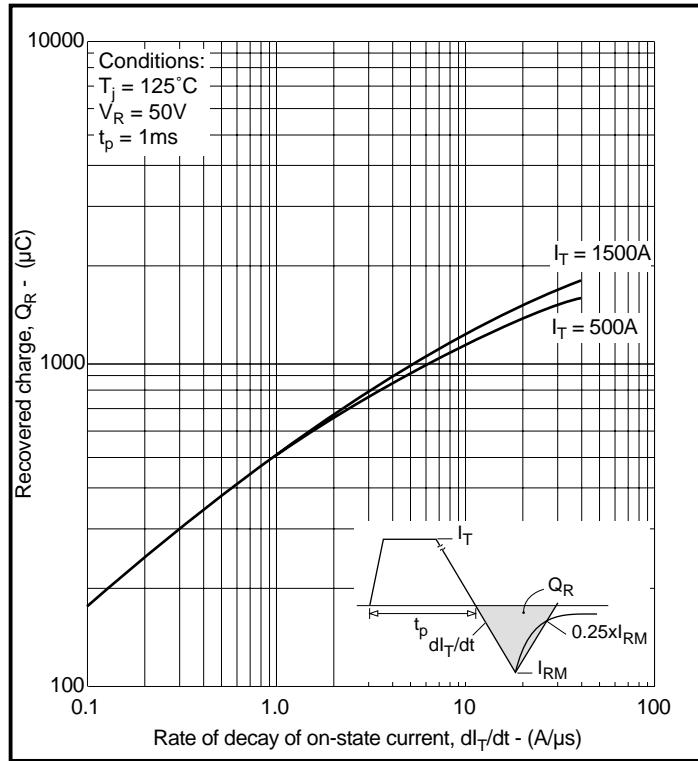


Fig.4 Stored charge

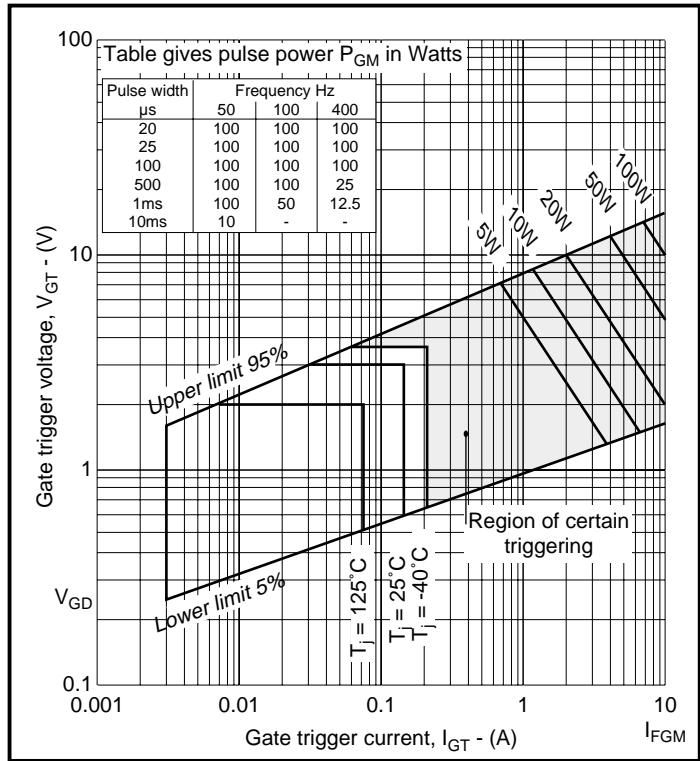


Fig.5 Gate characteristics

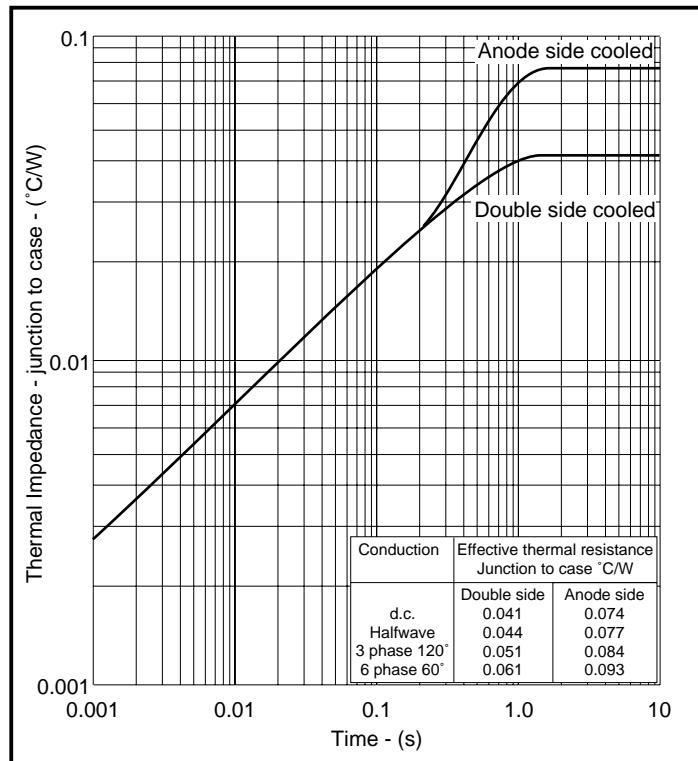
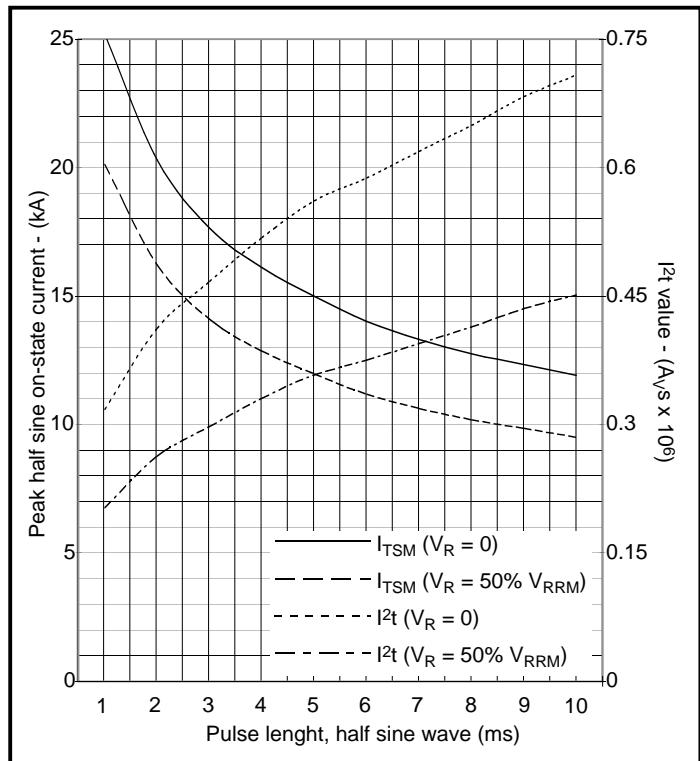
Fig.6 Maximum (limit) transient thermal impedance - junction to case ($^\circ\text{C}/\text{W}$)

Fig.7 Sub-cycle surge currents

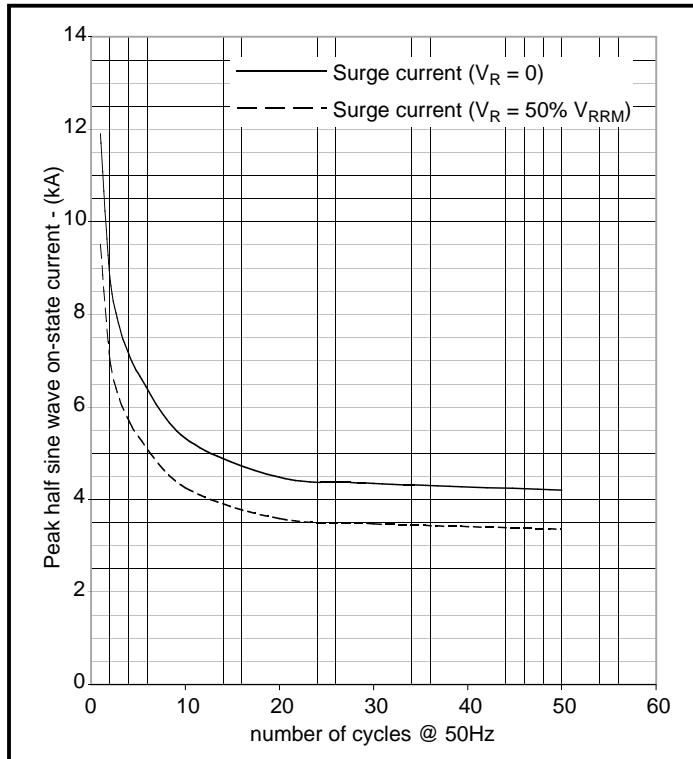
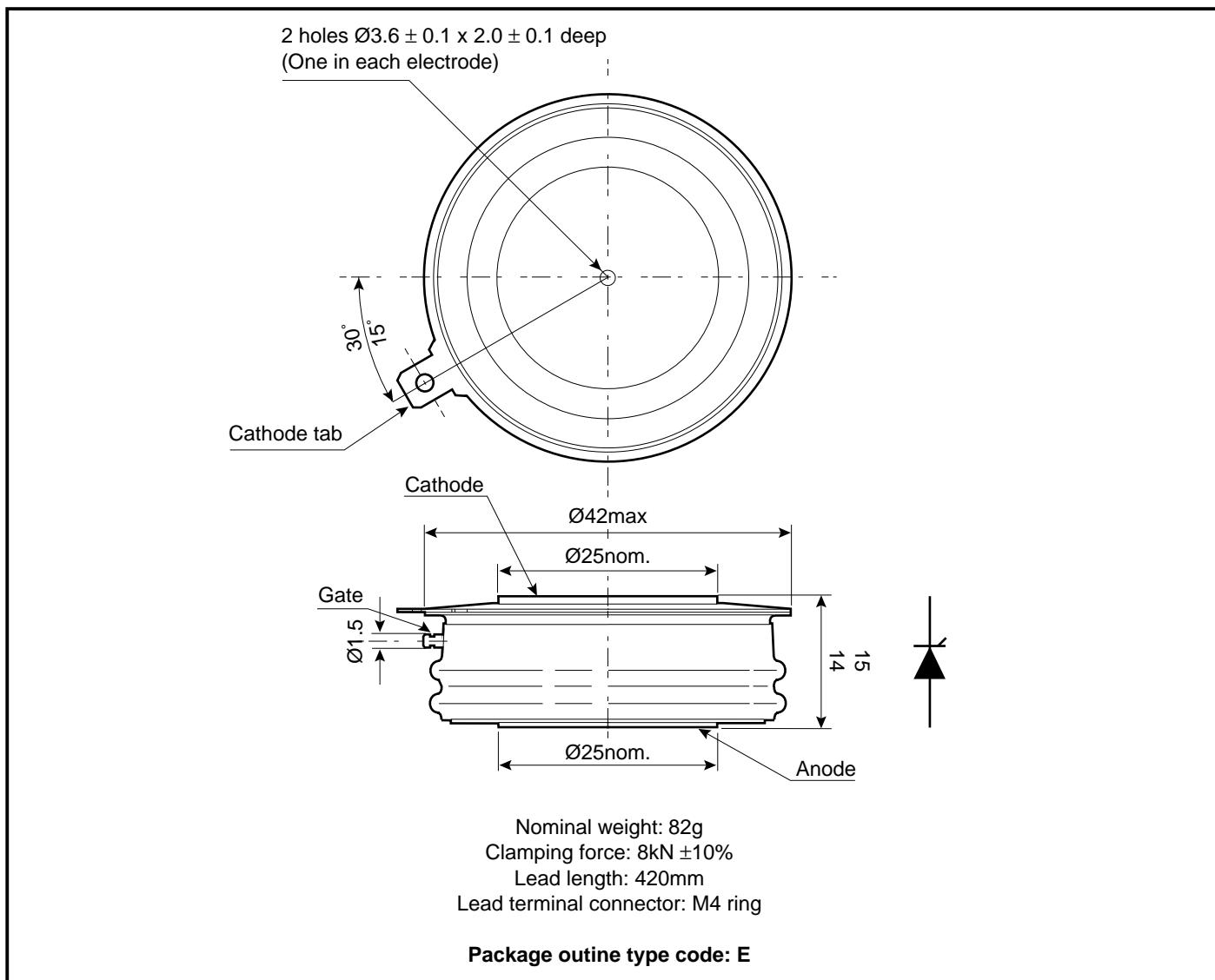


Fig.8 Multi-cycle surge currents

PACKAGE DETAILS

For further package information, please visit our website or contact your nearest Customer Service Centre. All dimensions in mm, unless stated otherwise. DO NOT SCALE.



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 and clamping systems in line with advances in device voltages 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 latest 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 includes a varied selection of pre-loaded clamps to suit all of our manufactured devices. Types available include cube clamps for single side cooling of 'T' 23mm and 'E' 30mm discs, and bar clamps right up to 83kN for our 'Z' 100mm thyristors and diodes.

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

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks. They have been designed to optimise the performance of Dynex 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 service office.

Datasheet Annotations:

Dynex Semiconductor annotate datasheets in the top right hard corner of the front page, to indicate product status. The annotations are as follows:-

Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

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.

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