

### 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	$T_{vj} = 0^{\circ} \text{ to } 125^{\circ}\text{C}$ , $I_{DRM} = I_{RRM} = 30\text{mA}$ , $V_{DRM}, V_{RRM} t_p = 10\text{ms}$ , $V_{DSM} \text{ \& } V_{RSM} =$ $V_{DRM} \text{ \& } V_{RRM} + 100\text{V}$ 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 correspondence relating to your order.

### KEY PARAMETERS

$V_{DRM}$	2100V
$I_{T(AV)}$	706A
$I_{TSM}$	8100A
dVdt*	1000V/ $\mu\text{s}$
dI/dt	700A/ $\mu\text{s}$

\*Higher dV/dt selections available

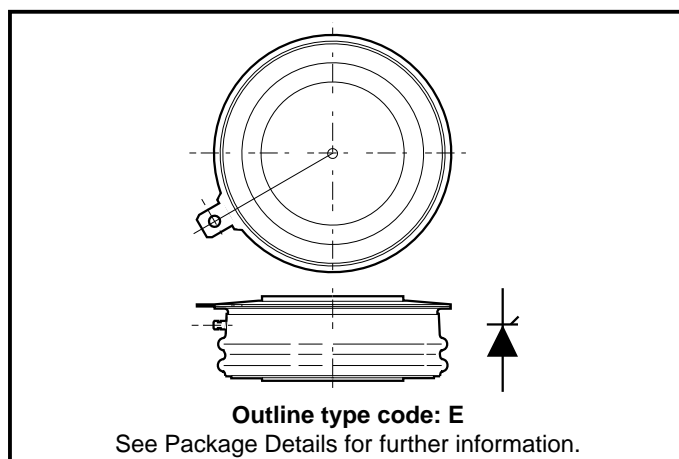


Fig. 1 Package outline

**CURRENT RATINGS****T<sub>case</sub> = 60°C unless stated otherwise.**

Symbol	Parameter	Conditions	Max.	Units
<b>Double Side Cooled</b>				
$I_{T(AV)}$	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
<b>Single Side Cooled (Anode side)</b>				
$I_{T(AV)}$	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<sub>case</sub> = 80°C unless stated otherwise.**

Symbol	Parameter	Conditions	Max.	Units
<b>Double Side Cooled</b>				
$I_{T(AV)}$	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
<b>Single Side Cooled (Anode side)</b>				
$I_{T(AV)}$	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; $T_{case} = 125^{\circ}C$	6.5	kA
$I^2t$	$I^2t$ for fusing	$V_R = 50\% V_{RRM}$ - 1/4 sine	$0.21 \times 10^6$	A <sup>2</sup> s
$I_{TSM}$	Surge (non-repetitive) on-state current	10ms half sine; $T_{case} = 125^{\circ}C$	8.1	kA
$I^2t$	$I^2t$ for fusing	$V_R = 0$	$0.33 \times 10^6$	A <sup>2</sup> s

**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

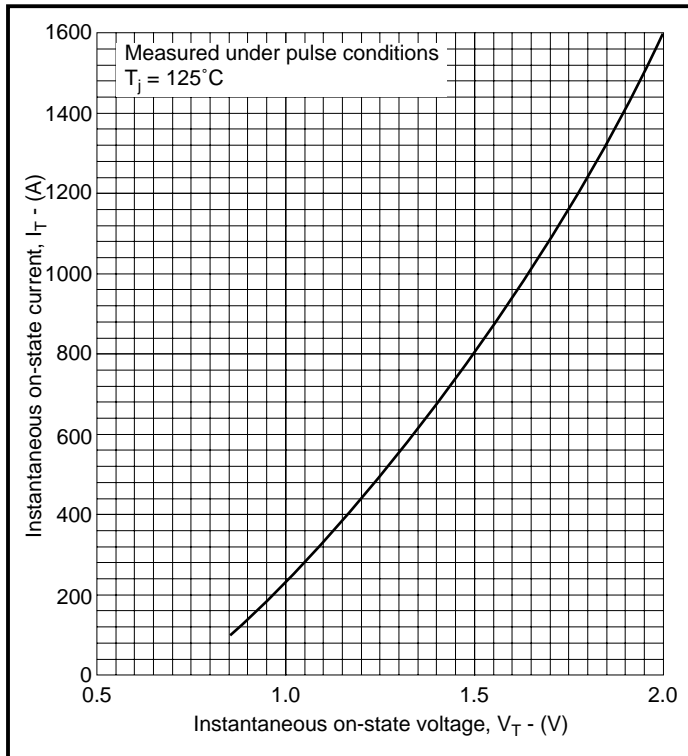
## DYNAMIC CHARACTERISTICS

Symbol	Parameter	Conditions		Typ.	Max.	Units
I <sub>RRM</sub> /I <sub>DRM</sub>	Peak reverse and off-state current	At V <sub>RRM</sub> /V <sub>DRM</sub> , T <sub>case</sub> = 125°C		-	30	mA
dV/dt	Maximum linear rate of rise of off-state voltage	To 67% V <sub>DRM</sub> T <sub>j</sub> = 125°C. Gate open circuit.		-	1000	V/μs
dI/dt	Rate of rise of on-state current	From 67% V <sub>DRM</sub> to 1100A Gate source 20V, 20Ω t <sub>r</sub> ≤ 0.5μs, T <sub>j</sub> = 125°C	Repetitive 50Hz	-	350	A/μs
			Non-repetitive	-	700	A/μs
V <sub>T(TO)</sub>	Threshold voltage	At T <sub>vj</sub> = 125°C		-	0.93	V
r <sub>T</sub>	On-state slope resistance	At T <sub>vj</sub> = 125°C		-	0.667	mΩ
t <sub>gd</sub>	Delay time	V <sub>D</sub> = 67% V <sub>DRM</sub> , Gate source 10V, 5Ω t <sub>r</sub> = 0.5μs, T <sub>j</sub> = 25°C		-	1.5	μs
I <sub>L</sub>	Latching current	T <sub>j</sub> = 25°C, V <sub>D</sub> = 5V		-	500	mA
I <sub>H</sub>	Holding current	T <sub>j</sub> = 25°C, V <sub>D</sub> = 5V		-	70	mA
t <sub>q</sub>	Turn-off time	I <sub>T</sub> = 500A, t <sub>p</sub> = 1ms, T <sub>j</sub> = 125°C, V <sub>R</sub> = 50V, dI <sub>RR</sub> /dt = 20A/μs, V <sub>DR</sub> = 67% V <sub>DRM</sub> , dV <sub>DR</sub> /dt = 20V/μs linear		300	400	μs

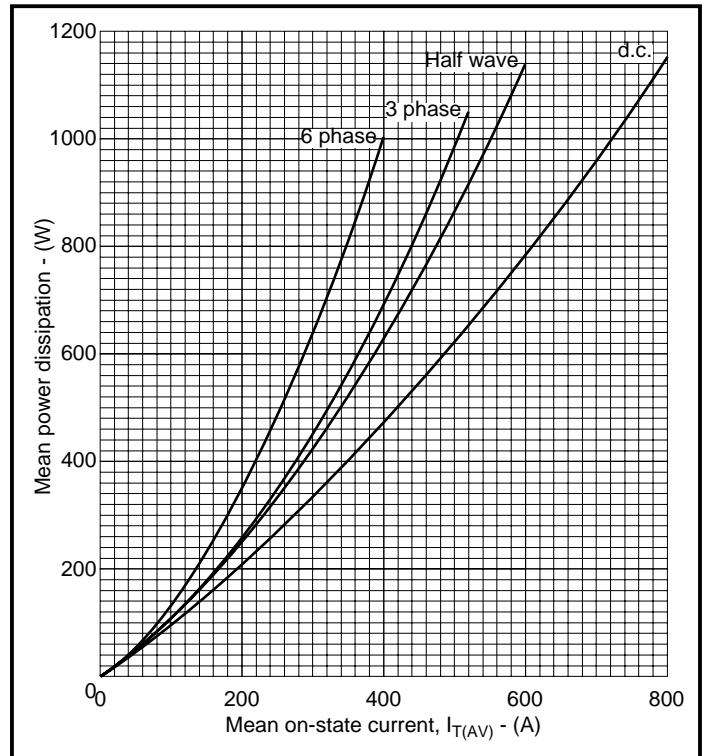
## GATE TRIGGER CHARACTERISTICS AND RATINGS

Symbol	Parameter	Conditions	Max.	Units
$V_{GT}$	Gate trigger voltage	$V_{DRM} = 5V$ , $T_{case} = 25^{\circ}C$	3.0	V
$I_{GT}$	Gate trigger current	$V_{DRM} = 5V$ , $T_{case} = 25^{\circ}C$	150	mA
$V_{GD}$	Gate non-trigger voltage	At 67% $V_{DRM}$ , $T_{case} = 125^{\circ}C$	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:-

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

Where

$$A = 1.086551$$

$$B = -0.173031$$

$$C = -3.307461 \times 10^{-5}$$

$$D = 0.056345$$

these values are valid for  $T_j = 125^\circ\text{C}$  for  $I_T$  500A to 1600A

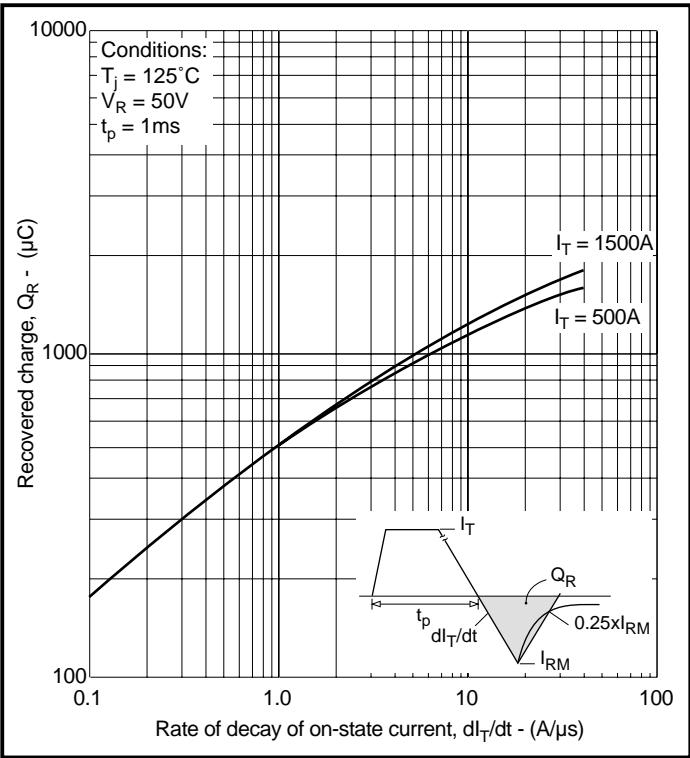


Fig.4 Recovered charge

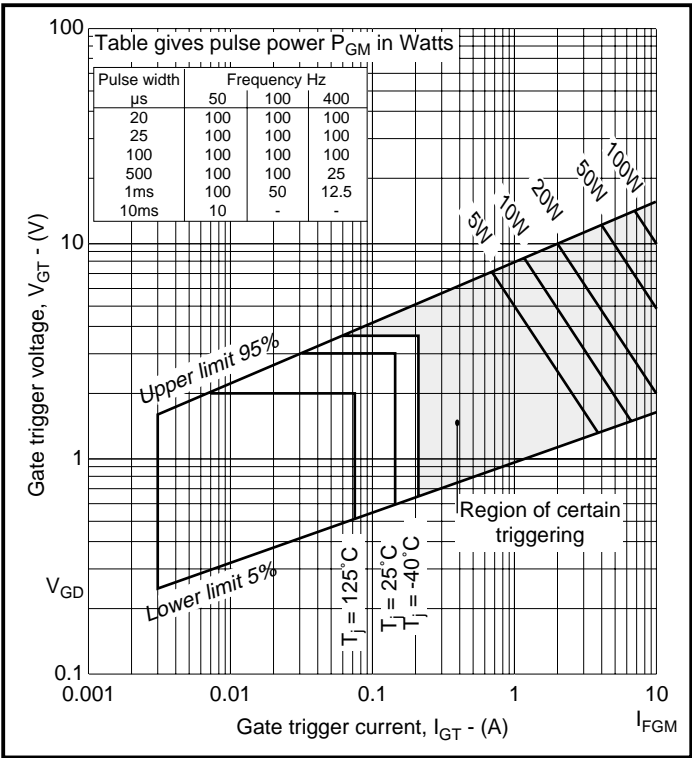


Fig.5 Gate characteristics

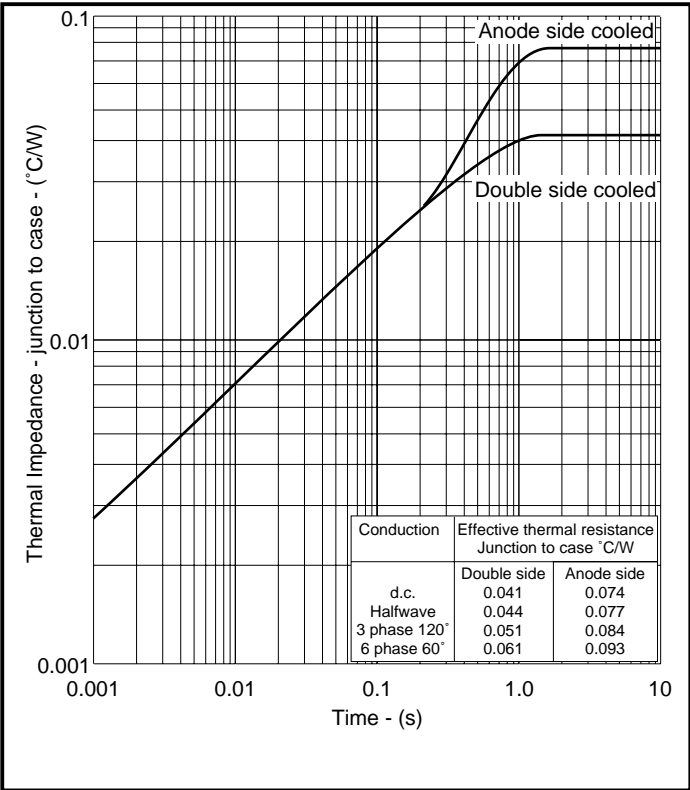


Fig.6 Maximum (limit) transient thermal impedance - junction to case

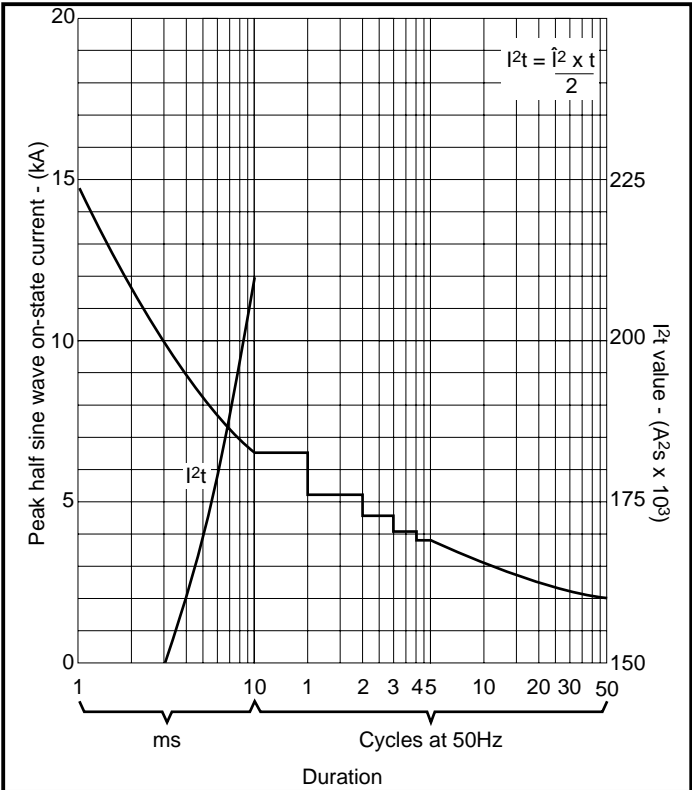
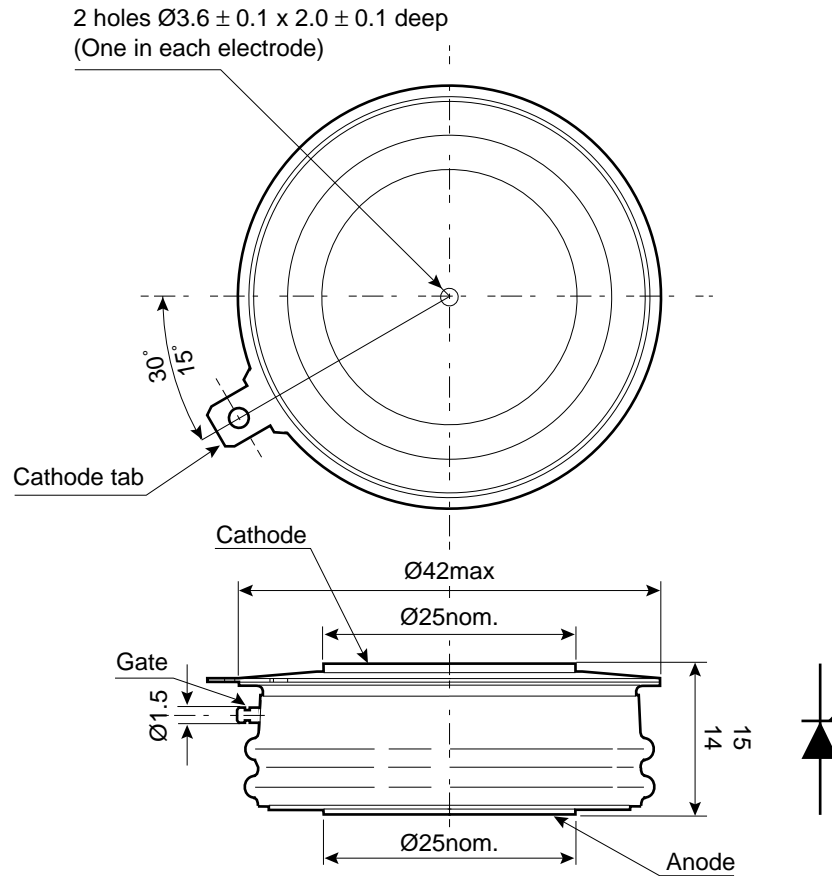


Fig.7 Surge (non-repetitive) on-state current vs time (with 50%  $V_{RRM}$  at  $T_{case} 125^\circ\text{C}$ )

## 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:  $8\text{kN} \pm 10\%$   
Lead length: 420mm  
Lead terminal connector: M4 ring

**Package outline 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 of 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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**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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