DCR5450W22

Phase Control Thyristor

DS5752-2.3 September 2007 (LN25537)

FEATURES

- Double Side Cooling
- High Surge Capability

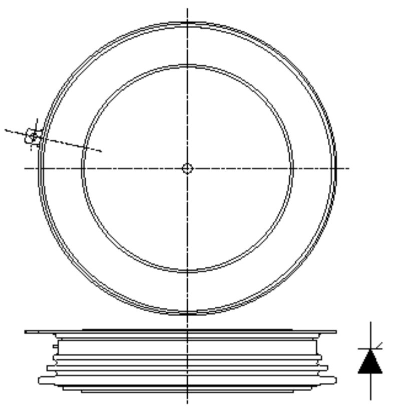
APPLICATIONS

- High Power Drives
- High Voltage Power Supplies
- Static Switches

KEY PARAMETERS

V_{DRM}	**2200V**
$I_{T(AV)}$	**5240A**
I_{TSM}	**72500A**
dV/dt*	**2000V/µs**
dI/dt	**500A/µs**

*** Higher dV/dt selections available**



Outline type code: W

(See Package Details for further information)

Fig. 1 Package outline

VOLTAGE RATINGS

Part and Ordering Number	Repetitive Peak Voltages V_{DRM} and V_{RRM} V	Conditions
DCR5450W22 DCR5450W20 DCR5450W18	2200 2000 1800	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:

DCR5450W22

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

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	5240	A
$I_{T(RMS)}$	RMS value	-	8230	A
I_T	Continuous (direct) on-state current	-	7340	A

SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine, T_{case} = 125°C	72.5	kA
I^2t	I^2t for fusing	V_R = 0	26.3	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	-	0.00631	°C/W
		Single side cooled	Anode DC	-	0.01115	°C/W
			Cathode DC	-	0.01453	°C/W
$R_{th(c-h)}$	Thermal resistance – case to heatsink	Clamping force 76kN	Double side	-	0.0014	°C/W
		(with mounting compound)	Single side	-	0.0028	°C/W
T_{vj}	Virtual junction temperature	Blocking V_{DRM} / $_{VRRM}$		-	125	°C
T_{stg}	Storage temperature range			-55	125	°C
F_m	Clamping force			68.0	84.0	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		-	2000	V/µs
dI/dt	Rate of rise of on-state current	From 67% V_{DRM} to 2x $I_{T(AV)}$ Gate source 30V, 10Ω, t_r < 0.5µs, T_j = 125°C	Repetitive 50Hz	-	250	A/µs
			Non-repetitive	-	500	A/µs
$V_{T(TO)}$	Threshold voltage – Low level	500A to 3000A at T_{case} = 125°C		-	0.72	V
	Threshold voltage – High level	3000A to 10000A at T_{case} = 125°C		-	0.84	V
r_T	On-state slope resistance – Low level	500A to 3000A at T_{case} = 125°C		-	0.1134	mΩ
	On-state slope resistance – High level	3000A to 10000A at T_{case} = 125°C		-	0.0734	mΩ
t_{gd}	Delay time	V_D = 67% V_{DRM}, gate source 30V, 10Ω t_r = 0.5µs, T_j = 25°C		0.5	1.5	µs
t_q	Turn-off time	T_j = 125°C, V_R = 200V, dI/dt = 1A/µs, dV_{DR}/dt = 20V/µs linear		50	150	µs
Q_S	Stored charge	I_T = 2000A, T_j = 125°C, dI/dt – 1A/µs,		460	1600	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 $V_{DRM,}$ T_{case} = 125°C	TBD	V
I_{GT}	Gate trigger current	V_{DRM} = 5V, T_{case} = 25°C	250	mA
I_{GD}	Gate non-trigger current	V_{DRM} = 5V, T_{case} = 25°C	TBD	mA

CURVES

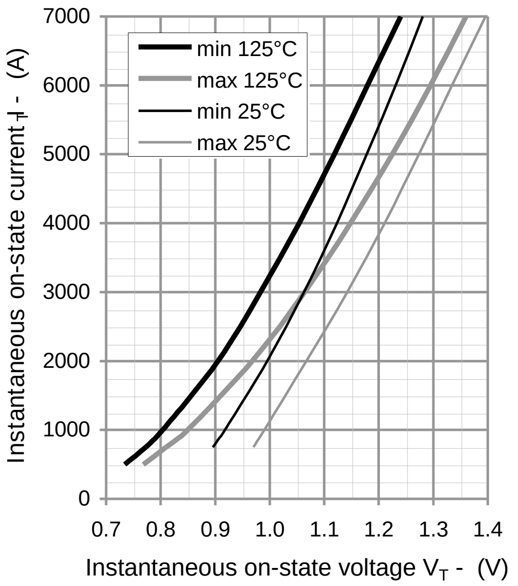


Fig.2 Maximum & minimum on-state characteristics

V_{TM} EQUATION

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

Where A = 0.7793769
B = - 0.04481
C = -3.68×10^{-6}
D = 0.0119692
these values are valid for T_j = 125°C for I_T 500A to10000A

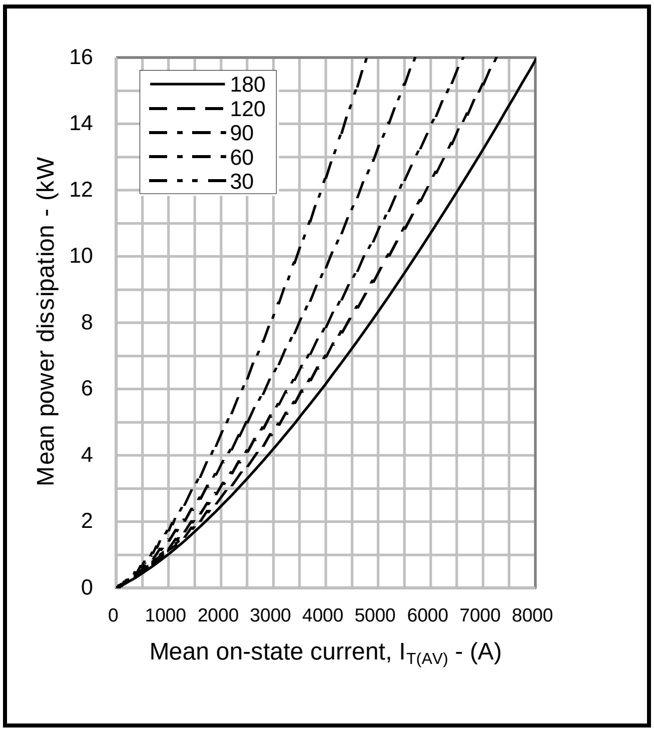


Fig.3 On-state power dissipation – sine wave

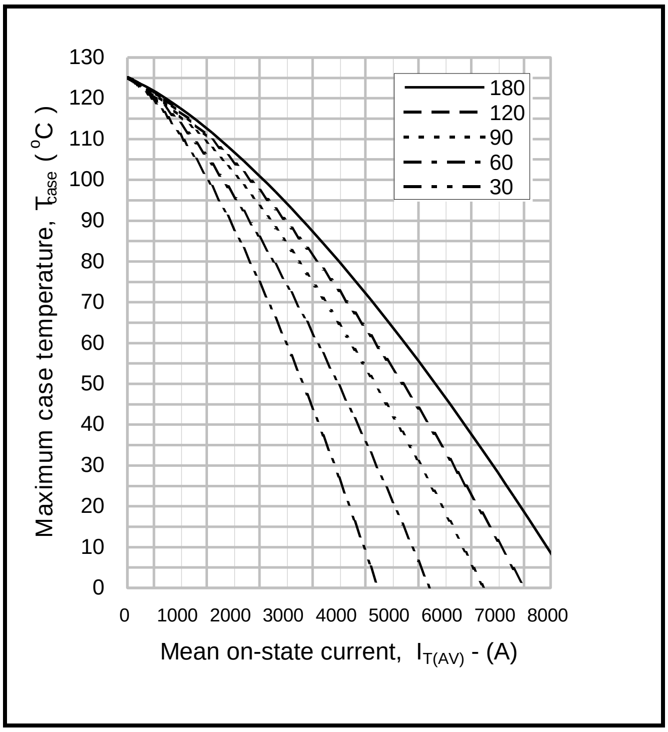


Fig.4 Maximum permissible case temperature, double side cooled – sine wave

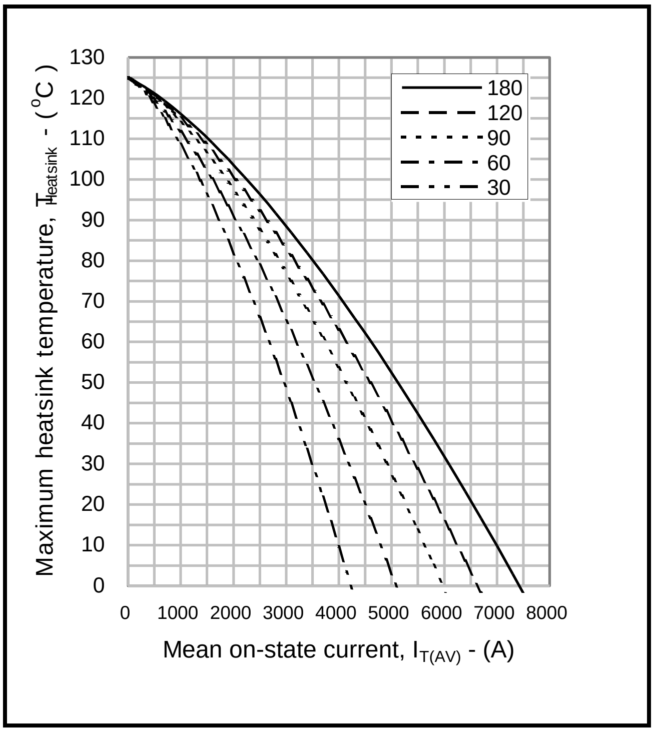


Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave

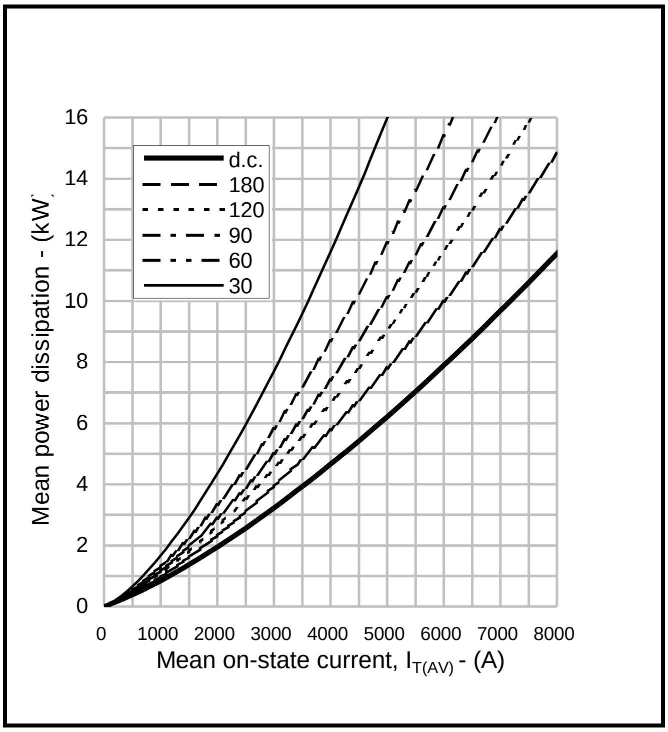


Fig.6 On-state power dissipation – rectangular wave

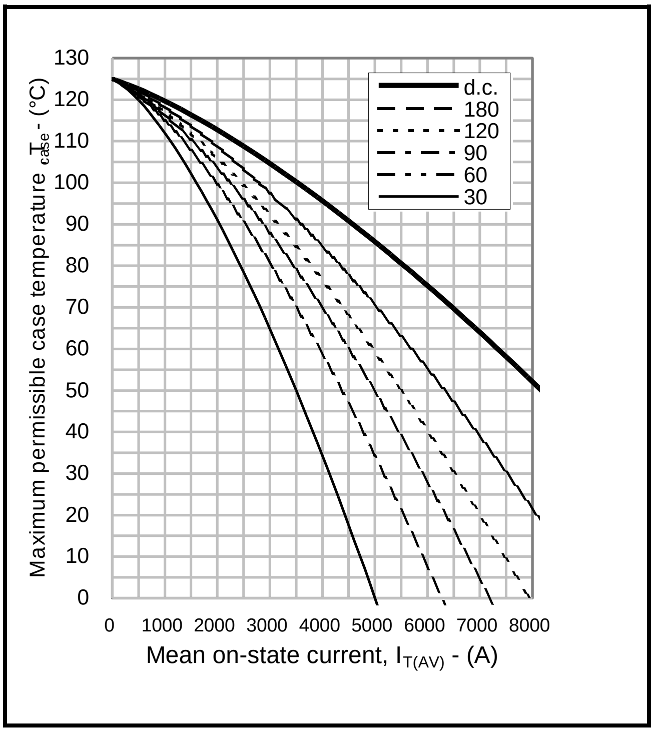


Fig.7 Maximum permissible case temperature, double side cooled – rectangular wave

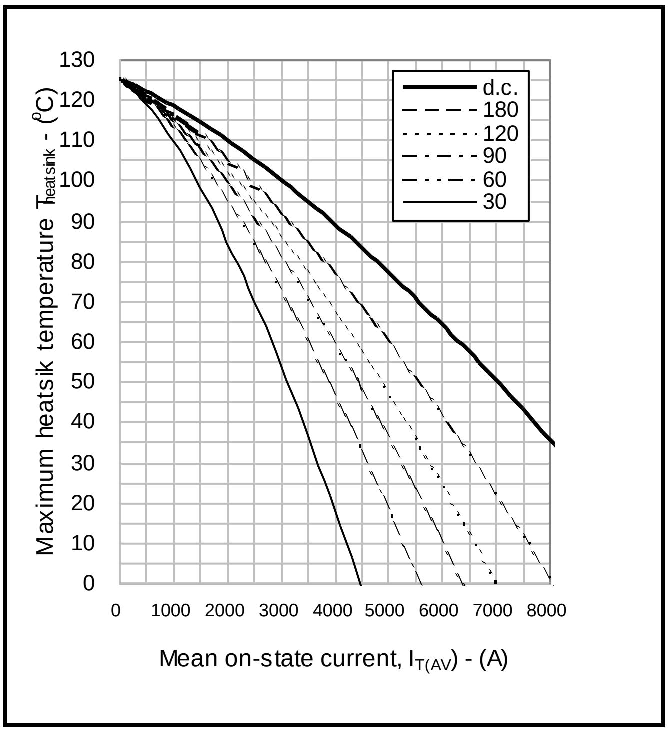
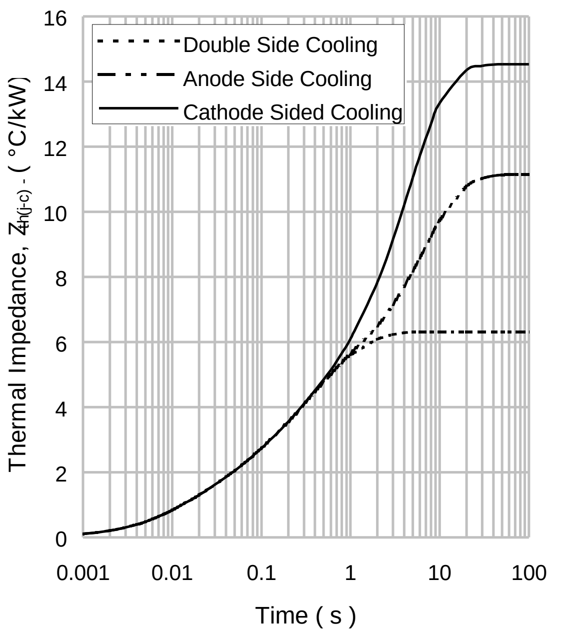


Fig.8 Maximum permissible heatsink temperature, double side cooled – rectangular wave



		1	2	3	4
Double side cooled	R_i (°C/kW)	0.8816	1.2993	2.8048	1.3305
	T_i (s)	0.0106818	0.058404	0.3584979	1.1285
Anode side cooled	R_i (°C/kW)	1.5197	3.2398	5.7622	0.6312
	T_i (s)	0.0170581	0.2424644	6.013	15.364
Cathode side cooled	R_i (°C/kW)	1.4106	2.4667	6.7451	3.9054
	T_i (s)	0.0158344	0.1786951	3.6201	6.196

$Z_{th} = \Sigma\ [R_i \times (\ 1\text{-exp.}\ (t/t_i))]$ **[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		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	1.00	0.67
120	1.16	0.97
90	1.33	1.13
60	1.48	1.31
30	1.61	1.51
15	1.66	1.61

Anode Side Cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	0.94	0.64
120	1.08	0.91
90	1.23	1.06
60	1.37	1.22
30	1.47	1.38
15	1.52	1.47

Cathode Sided Cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	0.95	0.65
120	1.09	0.92
90	1.25	1.07
60	1.38	1.23
30	1.49	1.40
15	1.54	1.49

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

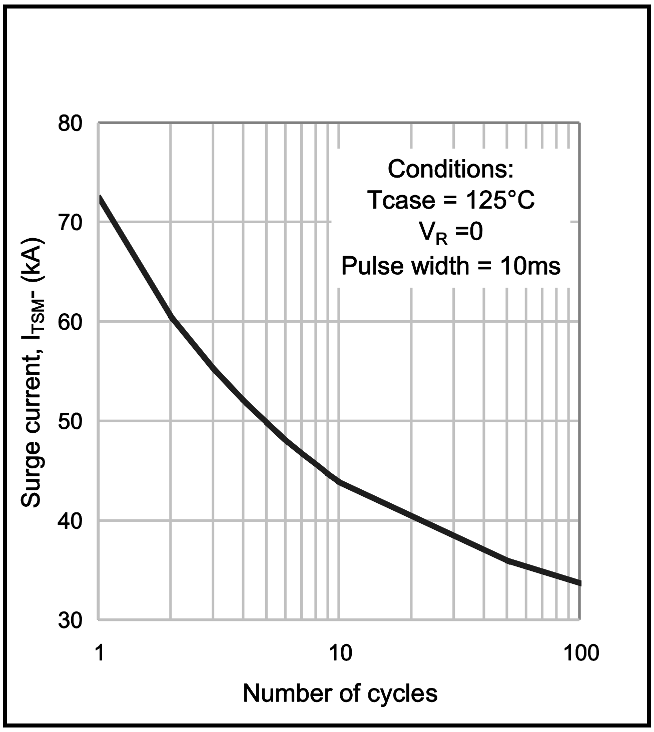


Fig.10 Multi-cycle surge current

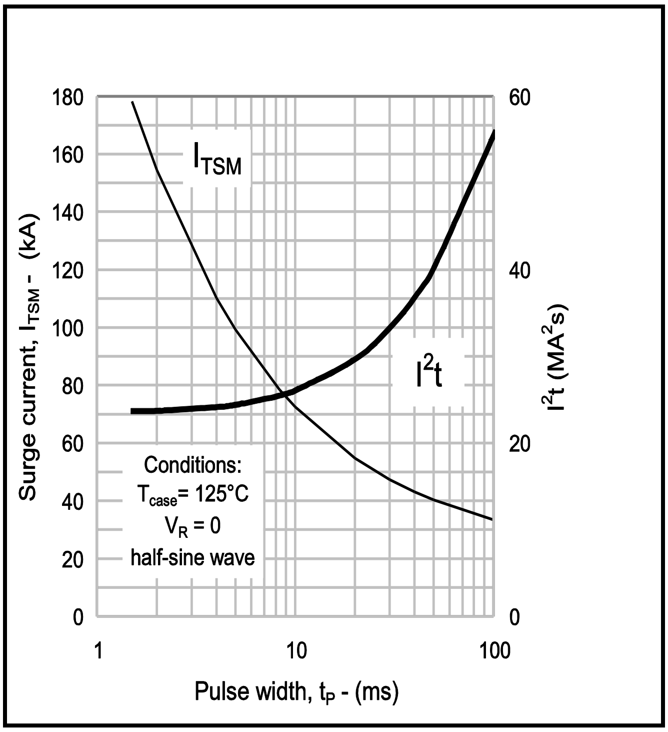


Fig.11 Single-cycle surge current

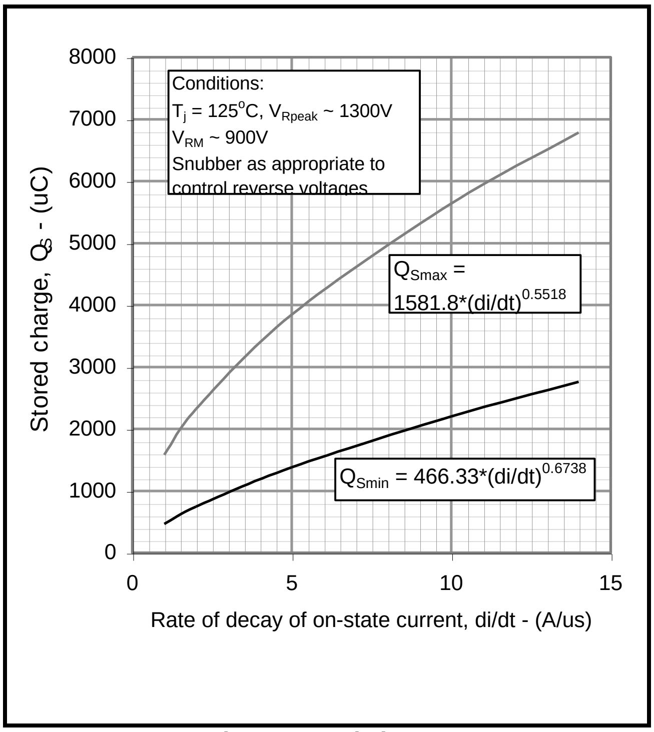


Fig.12 Stored charge

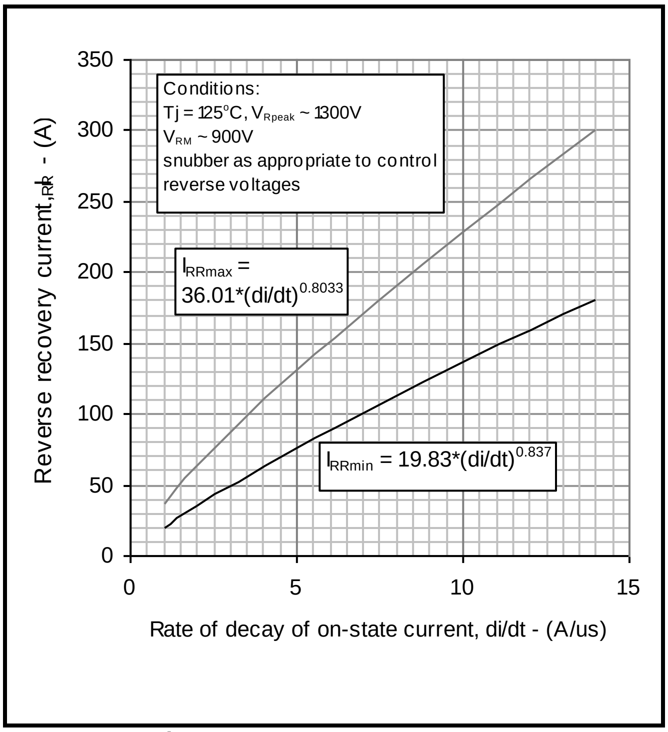
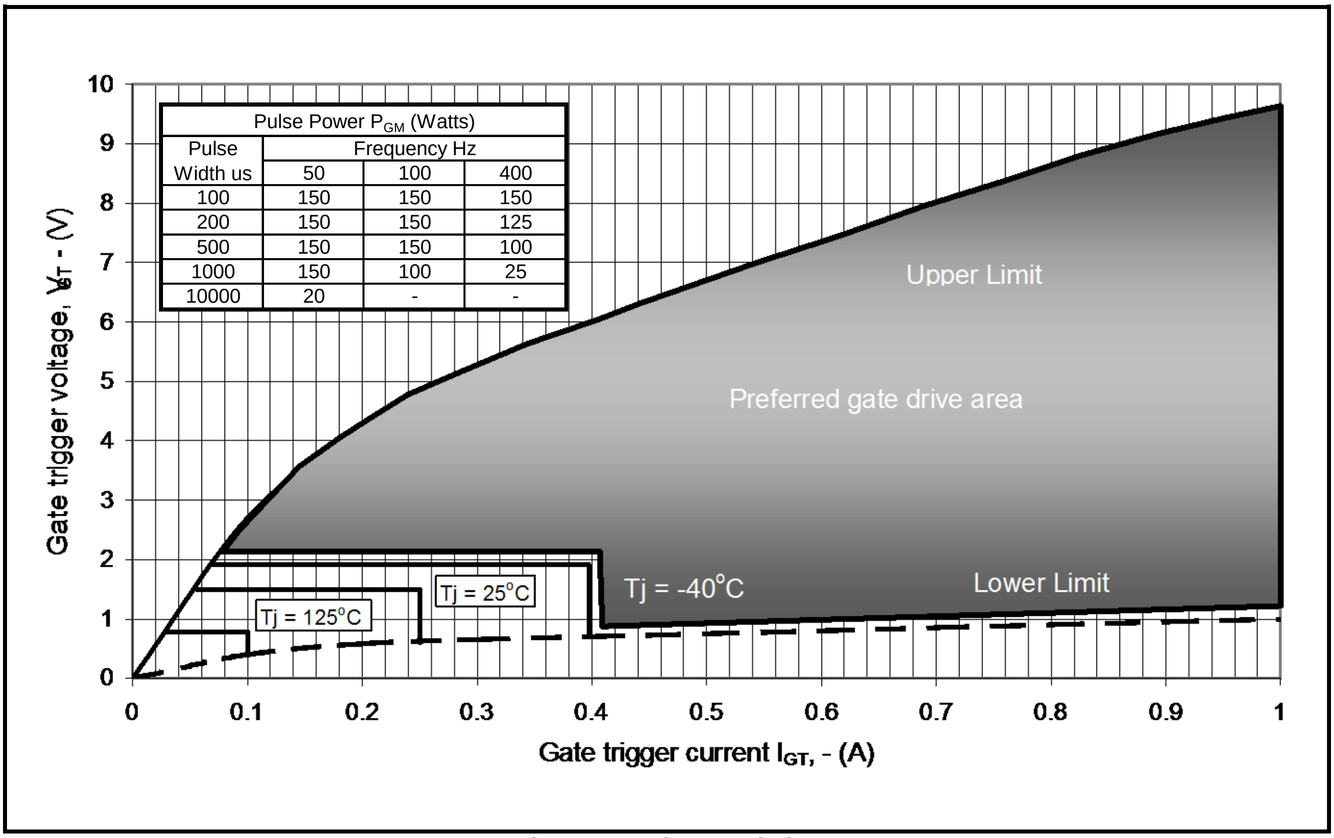


Fig.13 Reverse recovery current



Pulse Width us	Frequency Hz 50	100	400
100	150	150	150
200	150	150	125
500	150	150	100
1000	150	100	25
10000	20	-	-

Fig14 Gate Characteristics

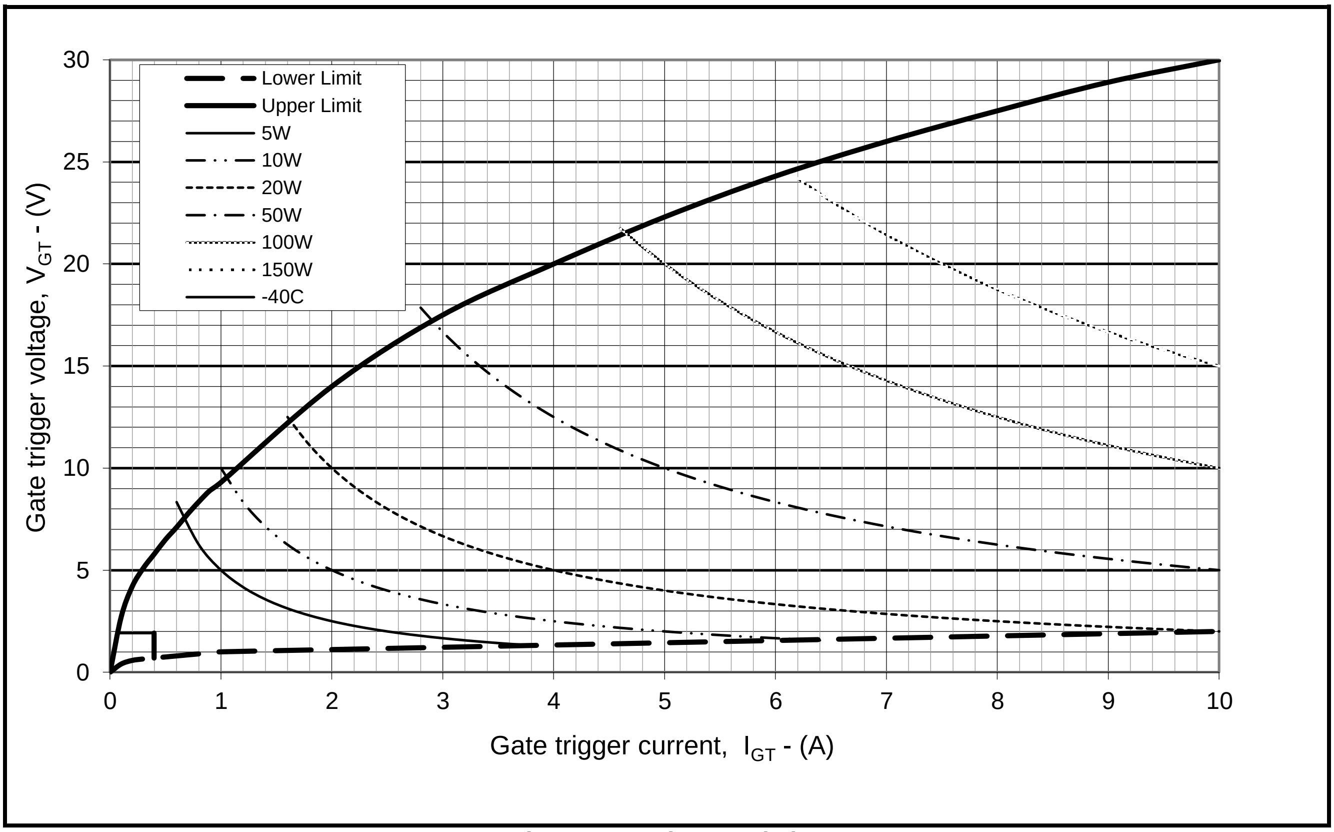
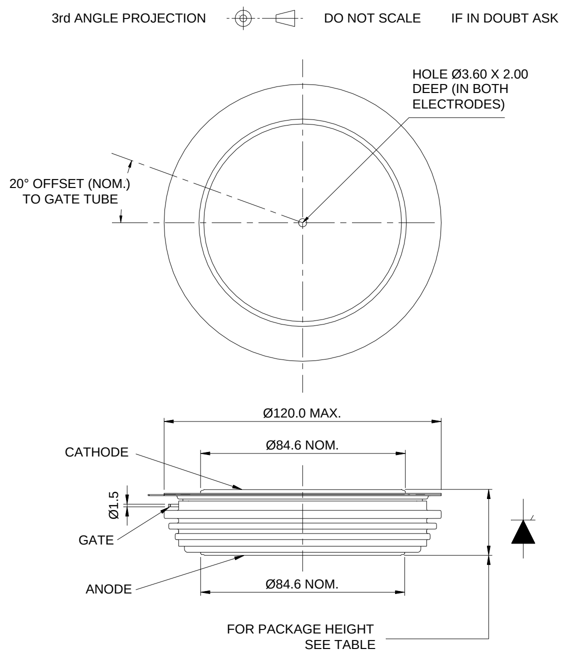


Fig. 15 Gate characteristics

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)
DCR1594SW28	27.34	26.79
DCR1595SW42	27.57	27.02
DCR1596SW52	27.69	27.14
DCR5450W22	**27.265**	**26.715**
DCR4910W28	27.34	26.79
DCR4100W42	27.57	27.02
DCR3640W52	27.69	27.14
DCR3020W65	27.95	27.4
DCR2510W85	28.31	27.76

Lead length: 420mm
Lead terminal connector: M4 ring

Package outline type code: W

Fig.16 Package outline

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 offers 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).

HEATSINKS

The Power Assembly group has its own proprietary range of extruded aluminium heatsinks which 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 Services.

Stresses above those listed in this data sheet may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed.

http://www.dynexsemi.com

e-mail: power_solutions@dynexsemi.com

HEADQUARTERS OPERATIONS
DYNEX SEMICONDUCTOR LTD
Doddington Road, Lincoln
Lincolnshire, LN6 3LF. United Kingdom.
Tel: +44(0)1522 500500
Fax: +44(0)1522 500550

CUSTOMER SERVICE
Tel: +44(0)1522 502753 / 502901. Fax: +44(0)1522 500020