DCR2040L42

Phase Control Thyristor

Preliminary Information

DS5960-1 February 2010 (LN27056)

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
DCR2040L42 DCR2040L40 DCR2040L35	4200 4000 3500	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:

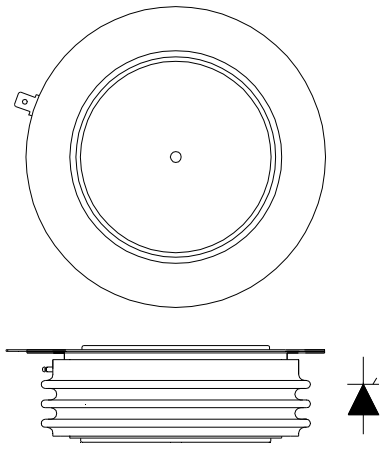
DCR2040L42

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**
$I_{T(AV)}$	**2040A**
I_{TSM}	**29000A**
dV/dt*	**1500V/µs**
dI/dt	**400A/µs**

* **Higher dV/dt selections available**



Outline type code: L

(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	2040	A
$I_{T(RMS)}$	RMS value	-	3204	A
I_T	Continuous (direct) on-state current	-	2965	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	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	-	0.0117	°C/W
		Single side cooled	Anode DC	-	0.0187	°C/W
			Cathode DC	-	0.0329	°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 $I_{T(AV)}$	-	200	200	A/µs
		Gate source 30V, 10Ω, t_r < 0.5µs, T_j = 125°C	-	400	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 V_{DRM}, T_{case} = 125°C	0.4	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	10	mA

CURVES

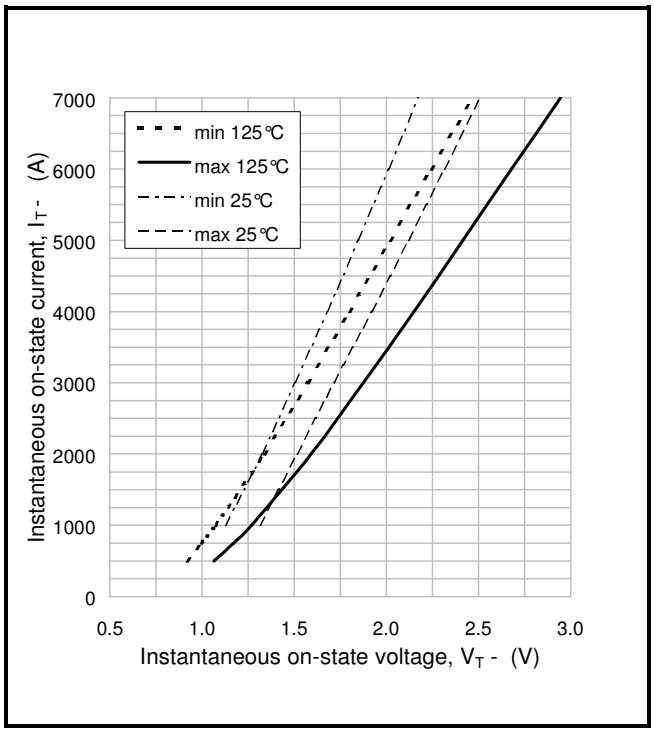


Fig.2 Maximum & minimum on-state characteristics

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

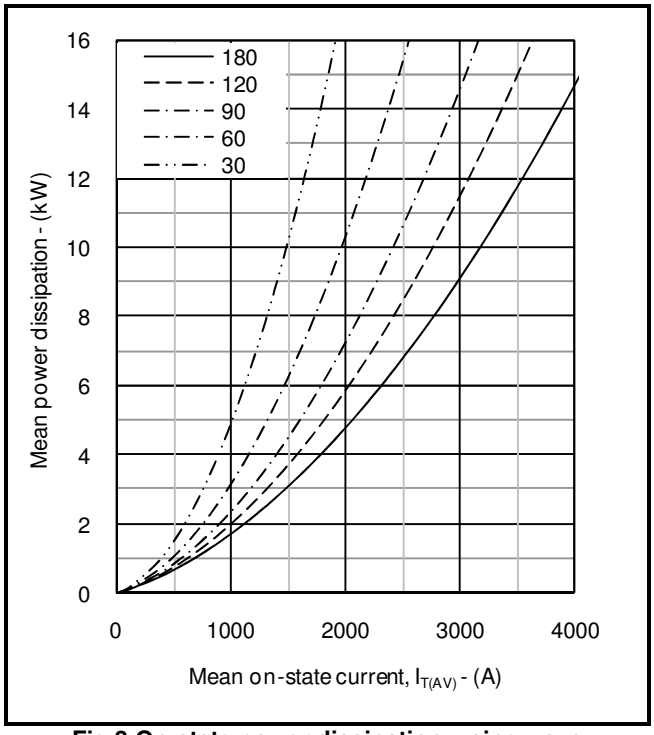


Fig.3 On-state power dissipation – sine wave

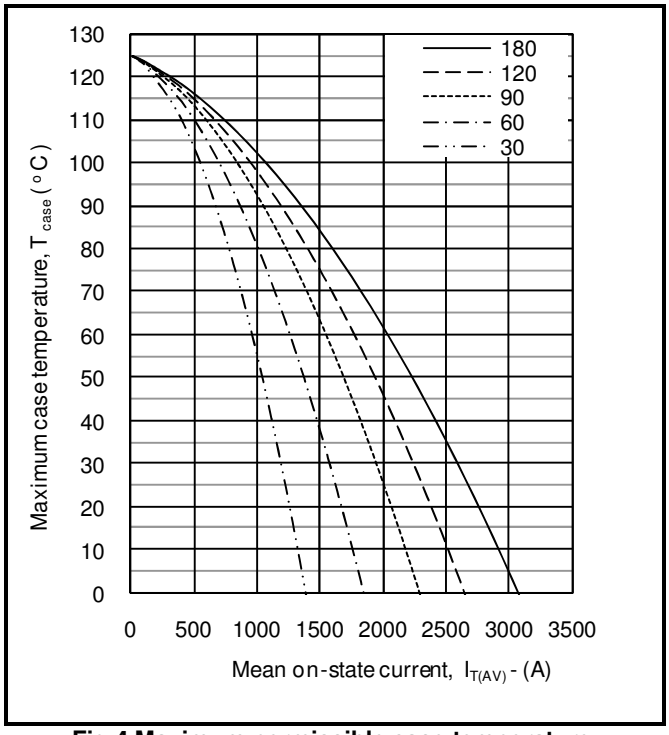


Fig.4 Maximum permissible case temperature, double side cooled – sine wave

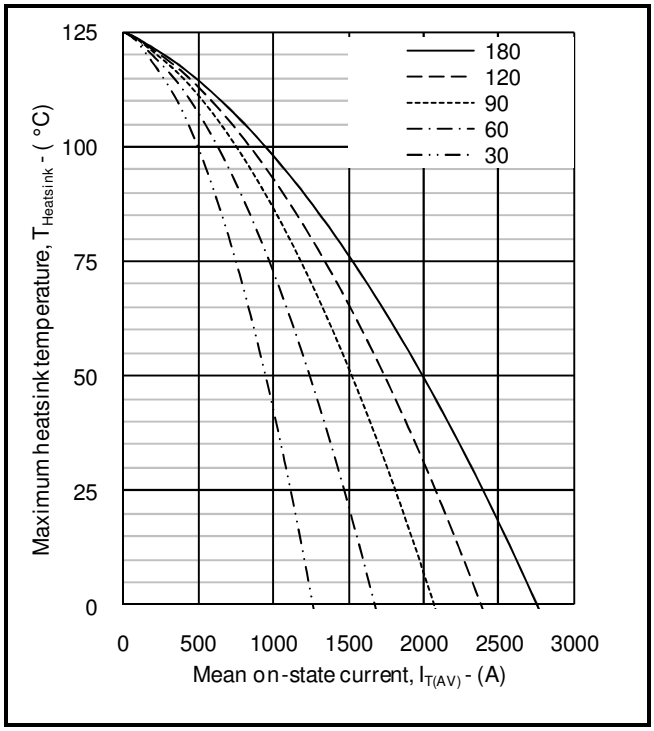


Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave

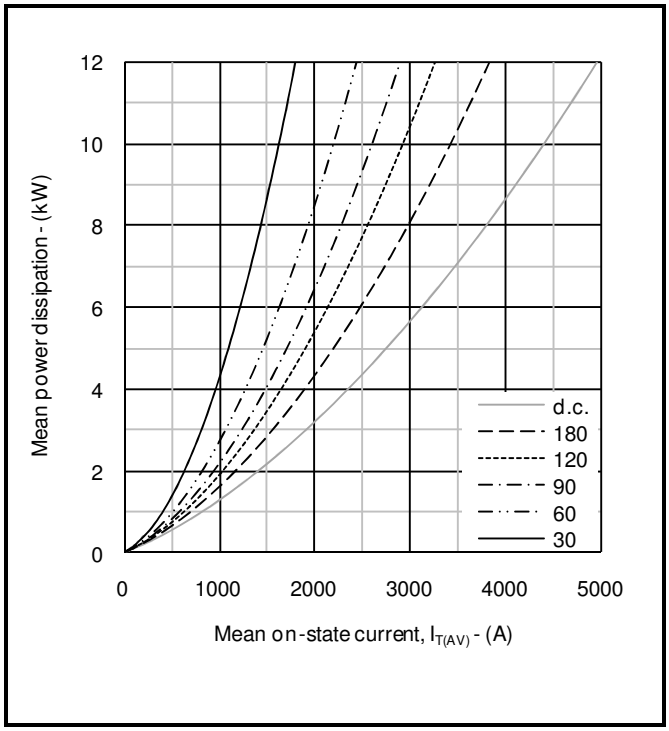


Fig.6 On-state power dissipation – rectangular wave

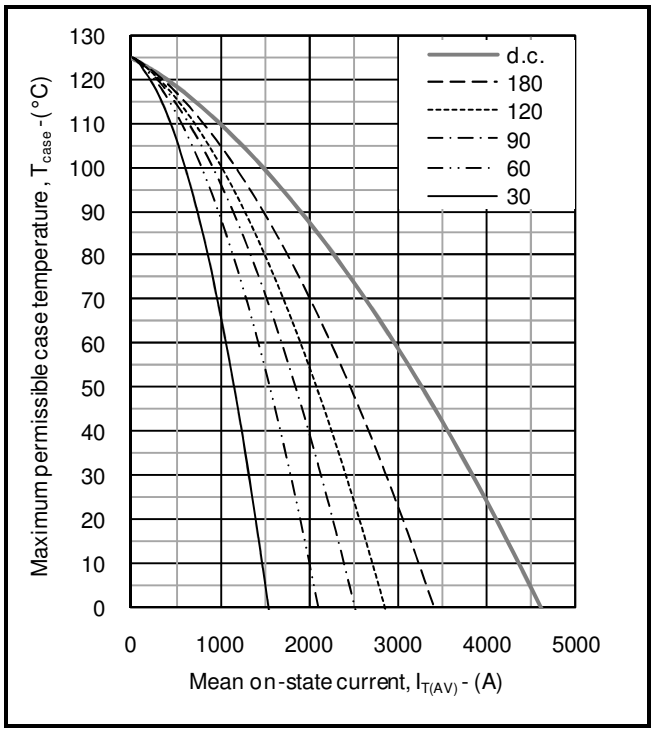


Fig.7 Maximum permissible case temperature, double side cooled – rectangular wave

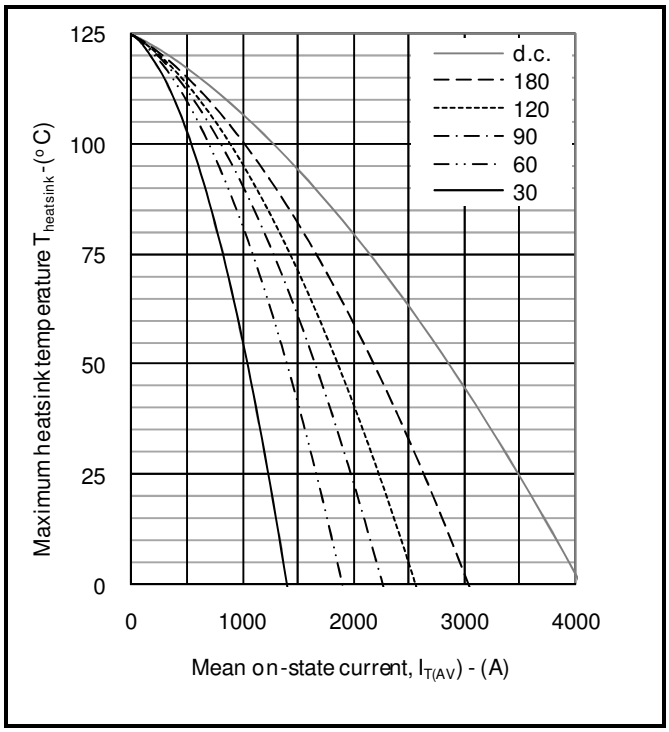
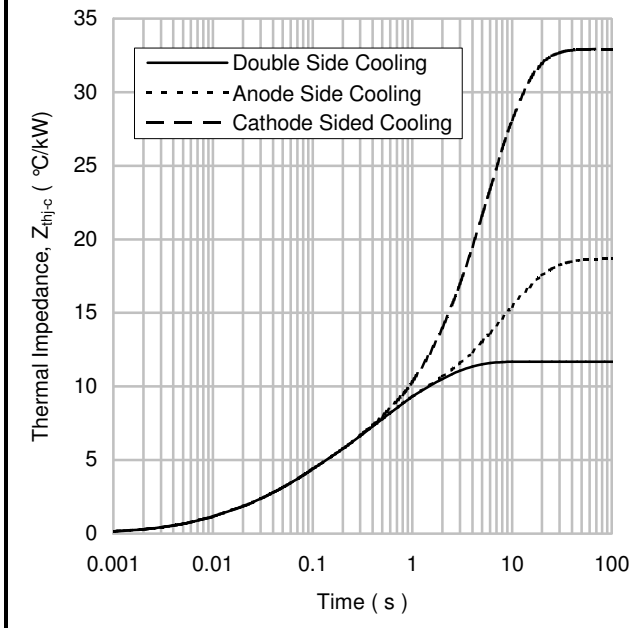


Fig.8 Maximum permissible heatsink temperature, double side cooled – rectangular wave



		1	2	3	4
Double side cooled	R_i (°C/kW)	0.8342	2.6074	4.2073	4.041
	T_i (s)	0.008639	0.0533503	0.3309504	1.612
Anode side cooled	R_i (°C/kW)	0.9647	2.8312	4.9433	9.909
	T_i (s)	0.0096096	0.0627037	0.4198958	8.908
Cathode side cooled	R_i (°C/kW)	0.9285	2.9366	2.3581	26.683
	T_i (s)	0.0093033	0.0621535	0.3092235	5.835

$$Z_{th} = \Sigma [R_i \times (1\text{-}exp. (t/t_i))]$$

$\Delta R_{th(j-c)}$ 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	1.45	0.98
120	1.68	1.40
90	1.93	1.64
60	2.16	1.90
30	2.34	2.19
15	2.42	2.34

Anode Side Cooling		
	ΔZ_{th} (z)	
θ °	sine.	rect.
180	1.43	0.97
120	1.66	1.39
90	1.90	1.62
60	2.12	1.88
30	2.30	2.15
15	2.37	2.30

Cathode Sided Cooling		
	ΔZ_{th} (z)	
θ °	sine.	rect.
180	1.44	0.97
120	1.66	1.39
90	1.91	1.63
60	2.14	1.89
30	2.31	2.17
15	2.39	2.31

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

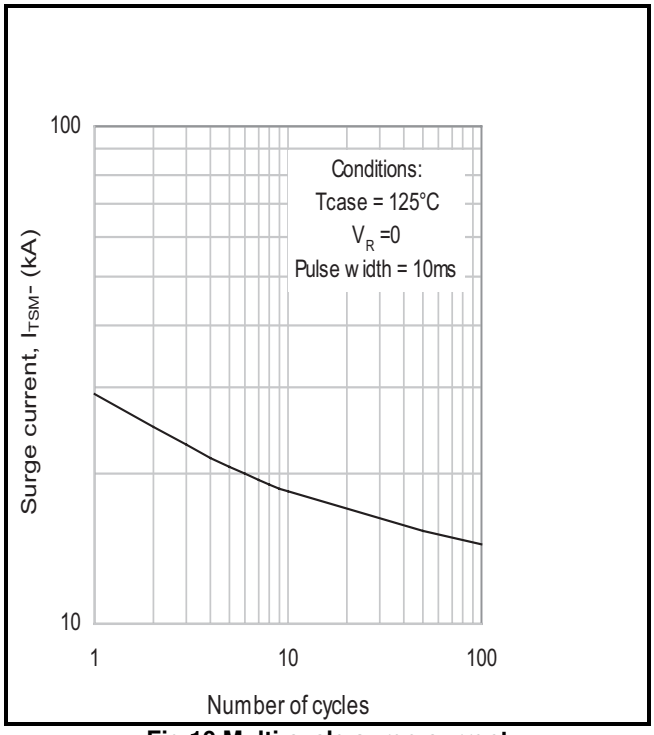


Fig.10 Multi-cycle surge current

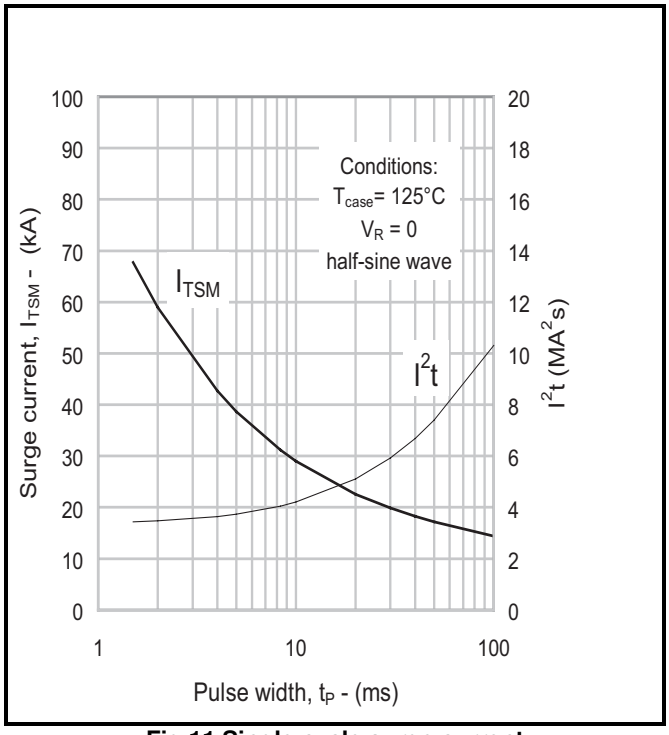


Fig.11 Single-cycle surge current

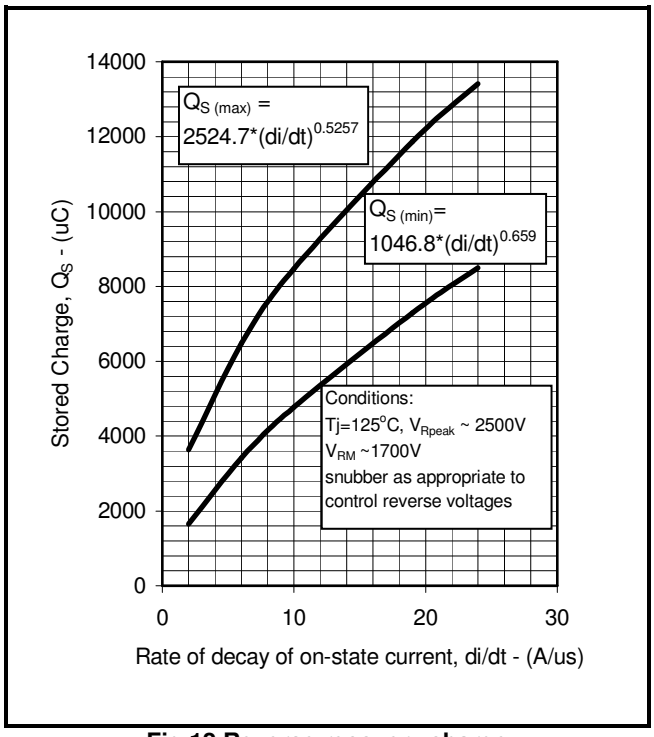


Fig.12 Reverse recovery charge

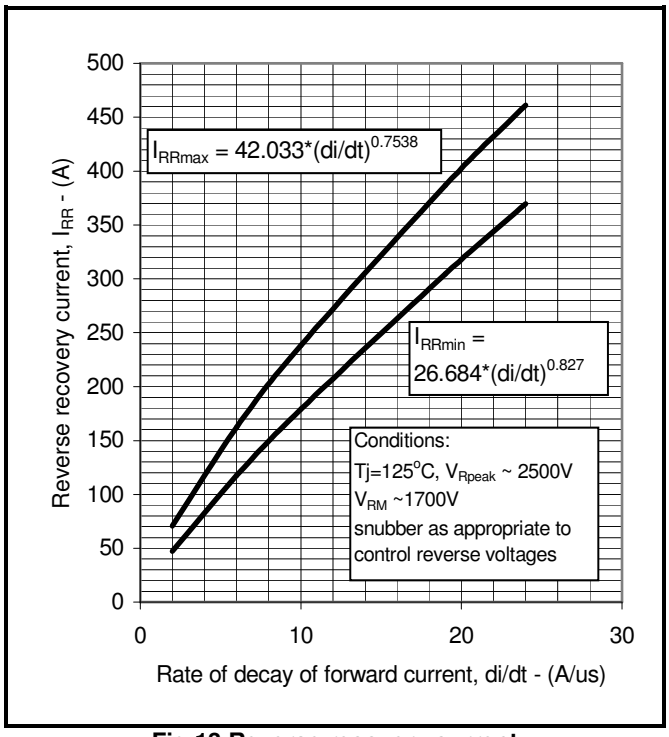


Fig.13 Reverse recovery current

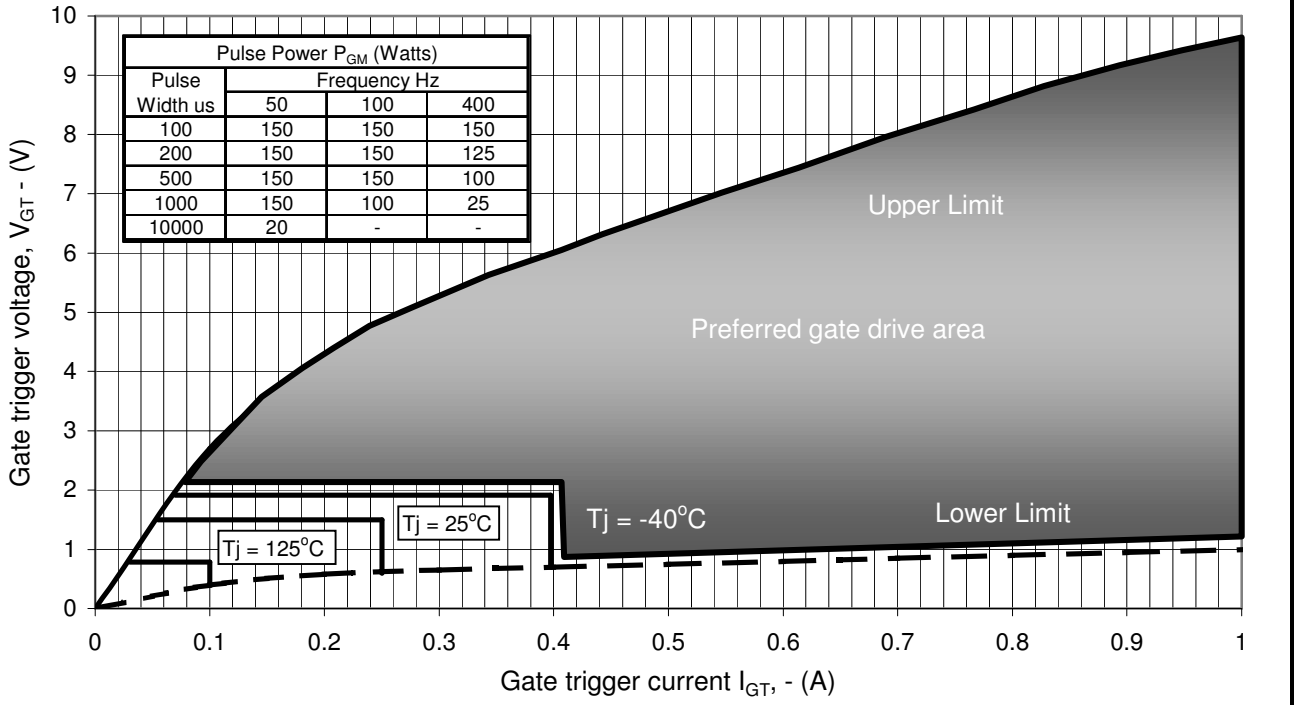


Fig14 Gate Characteristics

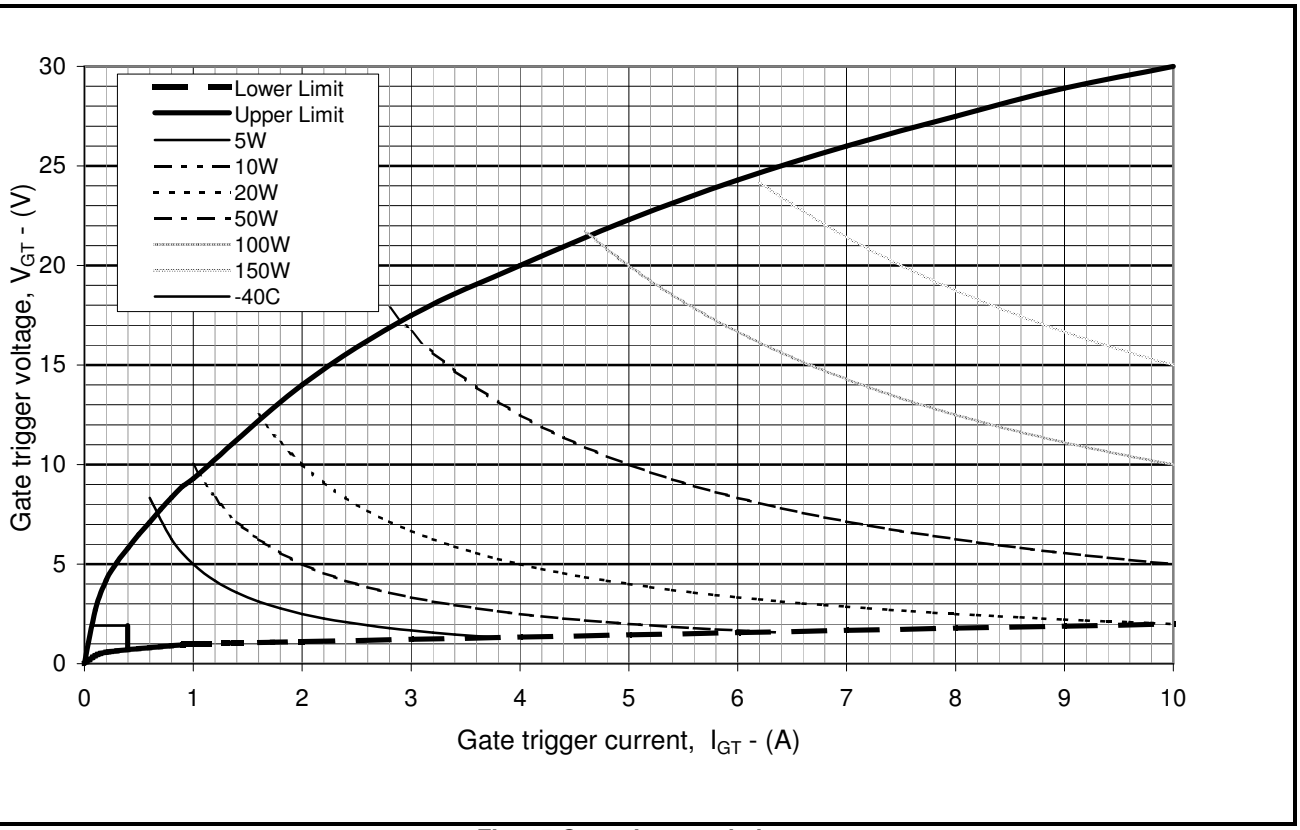
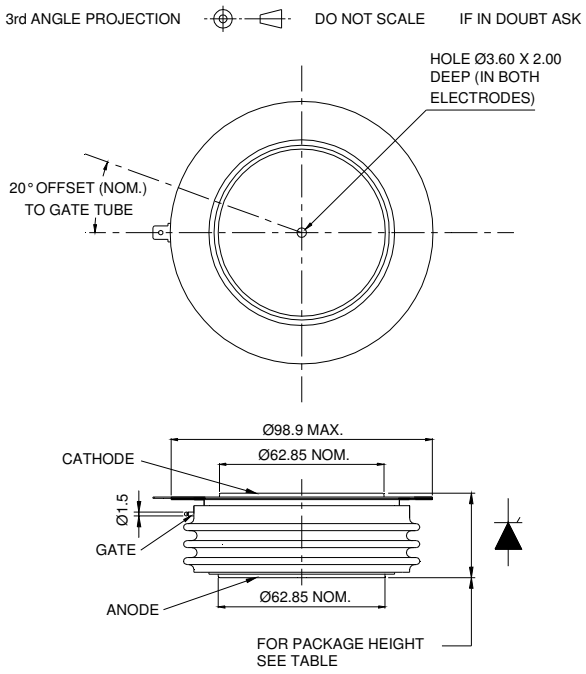


Fig. 15 Gate characteristics

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)
DCR1374SBA18	34.515	33.965
DCR1375SBA28	34.59	34.04
DCR1376SBA36	34.82	34.27
DCR2690L22	34.515	33.965
DCR2480L28	34.59	34.04
DCR2040L42	**34.82**	**34.27**
DCR1850L52	34.94	34.39
DCR1570L65	35.2	34.65
DCR1300L85	35.56	35.01

Lead length: 420mm
Lead terminal connector: M4 ring

Package outline type code: L

Fig.16 Package outline

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.

HEADQUARTERS OPERATIONS

DYNEX SEMICONDUCTOR LIMITED
Doddington Road, Lincoln, Lincolnshire, LN6 3LF
United Kingdom.
Phone: +44 (0) 1522 500500
Fax: +44 (0) 1522 500550
Web: http://www.dynexsemi.com

CUSTOMER SERVICE

Phone: +(0) 1522 502753 / 502901
Fax: +(0) 1522 500020
e-mail: power_solutions@dynexsemi.com