

### FEATURES

- Double Side Cooling
- High Surge Capability

### APPLICATIONS

- Bridge Rectifiers
- High Voltage Power Supplies
- Motor Drives

### VOLTAGE RATINGS

Part and Ordering Number	Repetitive Peak Voltages $V_{DRM}$ and $V_{RRM}$ V	Conditions
DCR3640H85*	8500	$T_{vj} = -40^{\circ}\text{C}$ to $125^{\circ}\text{C}$ , $I_{DRM} = I_{RRM} = 600\text{mA}$ , $V_{DRM}, V_{RRM} t_p = 10\text{ms}$ , $V_{DSM} \& V_{RSM} =$ $V_{DRM} \& V_{RRM} + 100\text{V}$ respectively
DCR3640H80	8000	
DCR3640H75	7500	

Lower voltage grades available.  
 \*8200V @  $-40^{\circ}\text{C}$ , 8500V @  $0^{\circ}\text{C}$

### ORDERING INFORMATION

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

For example:

#### DCR3640H85

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

### KEY PARAMETERS

$V_{DRM}$	<b>8500V</b>
$I_{T(AV)}$	<b>3640A</b>
$I_{TSM}$	<b>54000A</b>
$dV/dt^*$	<b>2000V/<math>\mu\text{s}</math></b>
$di/dt$	<b>200A/<math>\mu\text{s}</math></b>

\* Higher  $dV/dt$  selections available

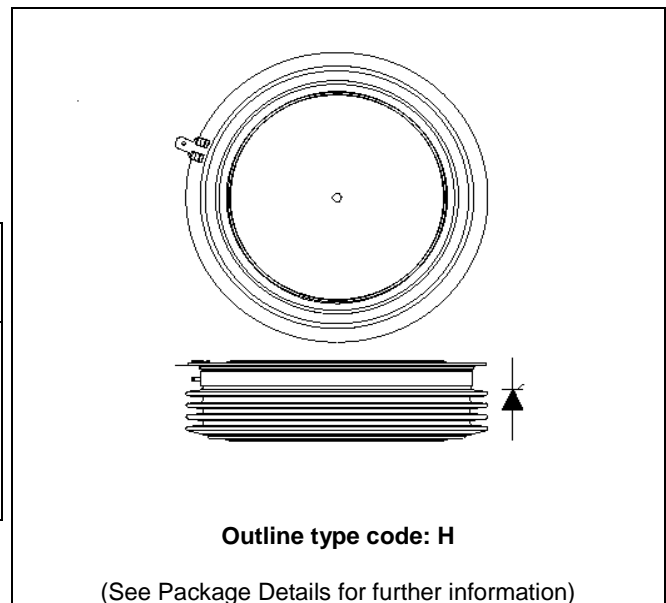


Fig. 1 Package outline

## CURRENT RATINGS

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

Symbol	Parameter	Test Conditions	Max.	Units
<b>Double Side Cooled</b>				
$I_{T(AV)}$	Mean on-state current	Half wave resistive load	3640	A
$I_{T(RMS)}$	RMS value	-	5718	A
$I_T$	Continuous (direct) on-state current	-	5306	A

## SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
$I_{TSM}$	Surge (non-repetitive) on-state current	10ms half sine, $T_{case} = 125^{\circ}\text{C}$	54.0	kA
$I^2t$	$I^2t$ for fusing	$V_R = 0$	14.58	$\text{MA}^2\text{s}$

## THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Test Conditions	Min.	Max.	Units	
$R_{th(j-c)}$	Thermal resistance – junction to case	Double side cooled	DC	-	0.004255	$^{\circ}\text{C/W}$
		Single side cooled	Anode DC	-	0.008	$^{\circ}\text{C/W}$
			Cathode DC	-	0.0093	$^{\circ}\text{C/W}$
$R_{th(c-h)}$	Thermal resistance – case to heatsink	Clamping force 135.0kN (with mounting compound)	Double side	-	0.0009	$^{\circ}\text{C/W}$
			Single side	-	0.0018	$^{\circ}\text{C/W}$
$T_{vj}$	Virtual junction temperature	Blocking $V_{DRM} / V_{RRM}$	-	125	$^{\circ}\text{C}$	
$T_{stg}$	Storage temperature range		-55	125	$^{\circ}\text{C}$	
$F_m$	Clamping force		120	155	kN	

**DYNAMIC CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Min.	Max.	Units	
$I_{RRM}/I_{DRM}$	Peak reverse and off-state current	At $V_{RRM}/V_{DRM}$ , $T_{case} = 125^{\circ}C$	-	600	mA	
$dV/dt$	Max. linear rate of rise of off-state voltage	To 67% $V_{DRM}$ , $T_j = 125^{\circ}C$ , gate open	-	2000	V/ $\mu s$	
$dI/dt$	Rate of rise of on-state current	From 67% $V_{DRM}$ to $2x I_{T(AV)}$	Repetitive 50Hz	-	200	A/ $\mu s$
		Gate source 30V, 10 $\Omega$ , $t_r < 0.5\mu s$ , $T_j = 125^{\circ}C$	Non-repetitive	-	500	A/ $\mu s$
$V_{T(TO)}$	Threshold voltage – Low level	500 to 4000A at $T_{case} = 125^{\circ}C$	-	1.21	V	
	Threshold voltage – High level	4000 to 8000A at $T_{case} = 125^{\circ}C$	-	1.4067	V	
$r_T$	On-state slope resistance – Low level	500A to 4000A at $T_{case} = 125^{\circ}C$	-	0.33	m $\Omega$	
	On-state slope resistance – High level	4000A to 8000A at $T_{case} = 125^{\circ}C$	-	0.2767	m $\Omega$	
$t_{gd}$	Delay time	$V_D = 67\% V_{DRM}$ , gate source 30V, 10 $\Omega$ $t_r = 0.5\mu s$ , $T_j = 25^{\circ}C$	-	3	$\mu s$	
$t_q$	Turn-off time	$I_T = 3000A$ , $T_j = 125^{\circ}C$ , $V_R = 200V$ , $dI/dt = 1A/\mu s$ , $dV_{DR}/dt = 20V/\mu s$ linear		1000	$\mu s$	
$Q_S$	Stored charge	$I_T = 3000A$ , $T_j = 125^{\circ}C$ , $dI/dt = 1A/\mu s$ , $V_{Rpeak} \sim 5100V$ , $V_R \sim 3400V$	3400	6700	$\mu C$	
$I_{RR}$	Reverse recovery current		63	46	A	
$I_L$	Latching current	$T_j = 25^{\circ}C$ , $V_D = 5V$	-	3	A	
$I_H$	Holding current	$T_j = 25^{\circ}C$ , $R_{G-K} = \infty$ , $I_{TM} = 500A$ , $I_T = 5A$	-	300	mA	

**GATE TRIGGER CHARACTERISTICS AND RATINGS**

Symbol	Parameter	Test Conditions	Max.	Units
V <sub>GT</sub>	Gate trigger voltage	V <sub>DRM</sub> = 5V, T <sub>case</sub> = 25°C	1.5	V
V <sub>GD</sub>	Gate non-trigger voltage	At 50% V <sub>DRM</sub> , T <sub>case</sub> = 125°C	0.4	V
I <sub>GT</sub>	Gate trigger current	V <sub>DRM</sub> = 5V, T <sub>case</sub> = 25°C	350	mA
I <sub>GD</sub>	Gate non-trigger current	At 50% V <sub>DRM</sub> , T <sub>case</sub> = 125°C	10	mA

**CURVES**

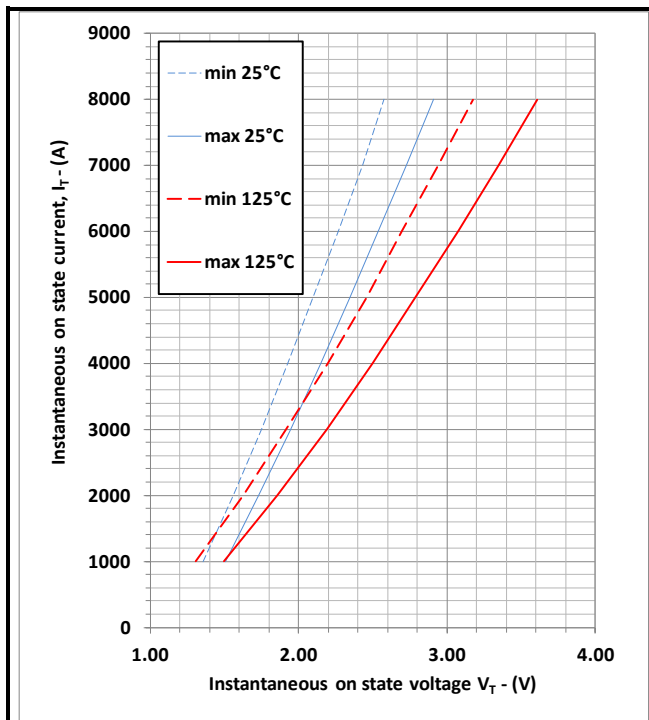


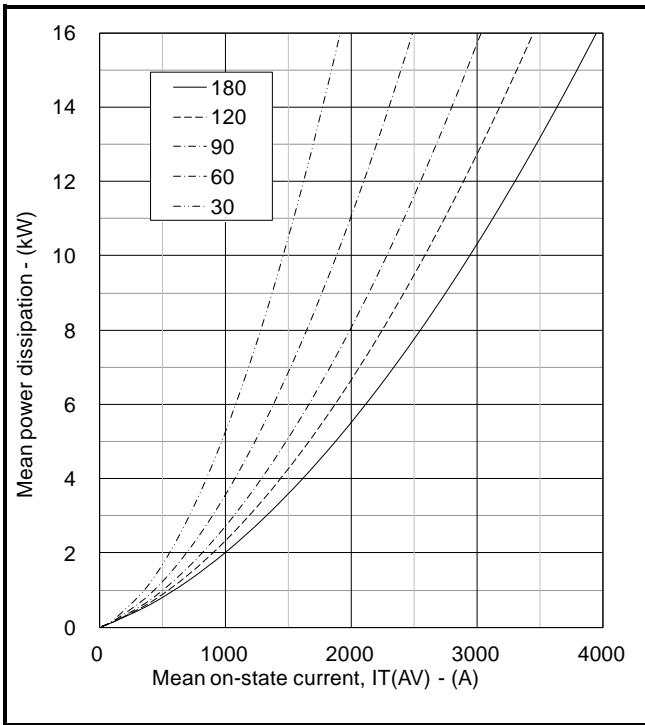
Fig.2 Maximum & minimum on-state characteristics

**V<sub>TM</sub> EQUATION**

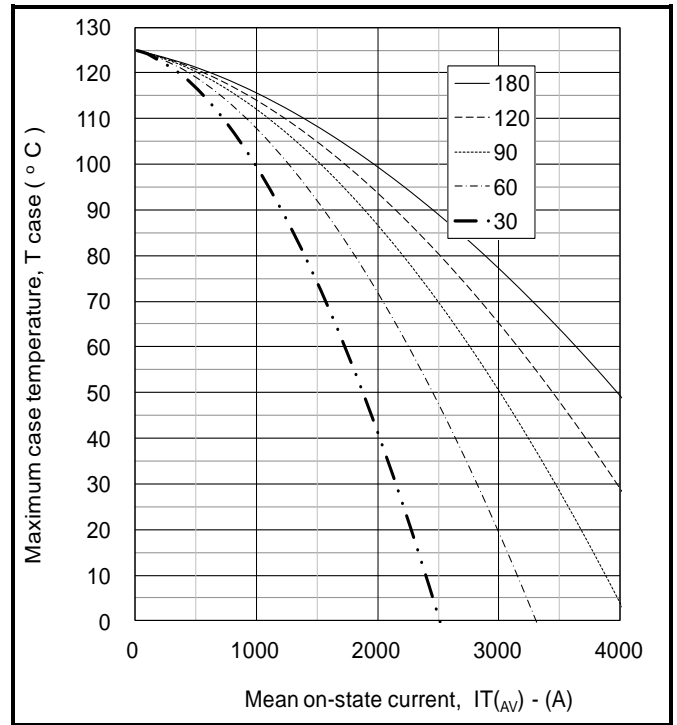
$$V_{TM} = A + B \ln(I_T) + C \cdot I_T + D \cdot \sqrt{I_T}$$

Where A = 2.035252  
 B = -0.20854  
 C = 0.000150  
 D = 0.02514

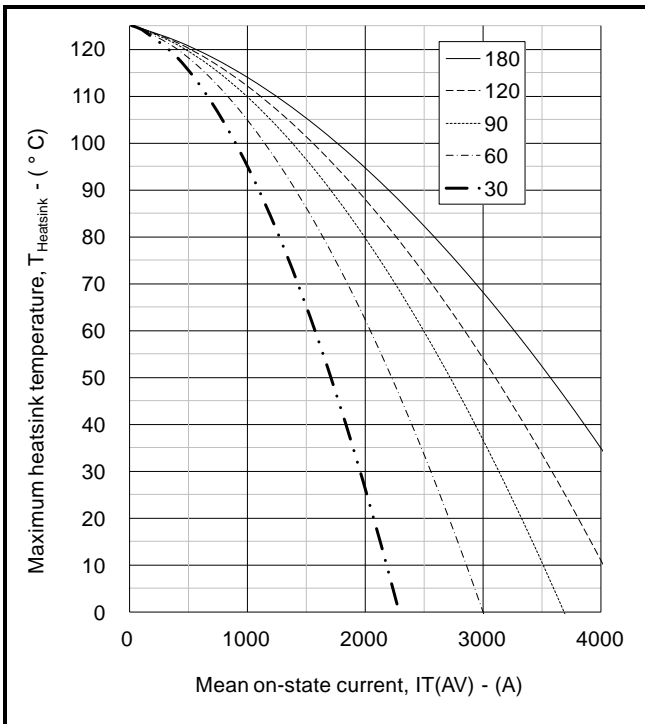
these values are valid for T<sub>j</sub> = 125°C for I<sub>T</sub> 500A to 8000A



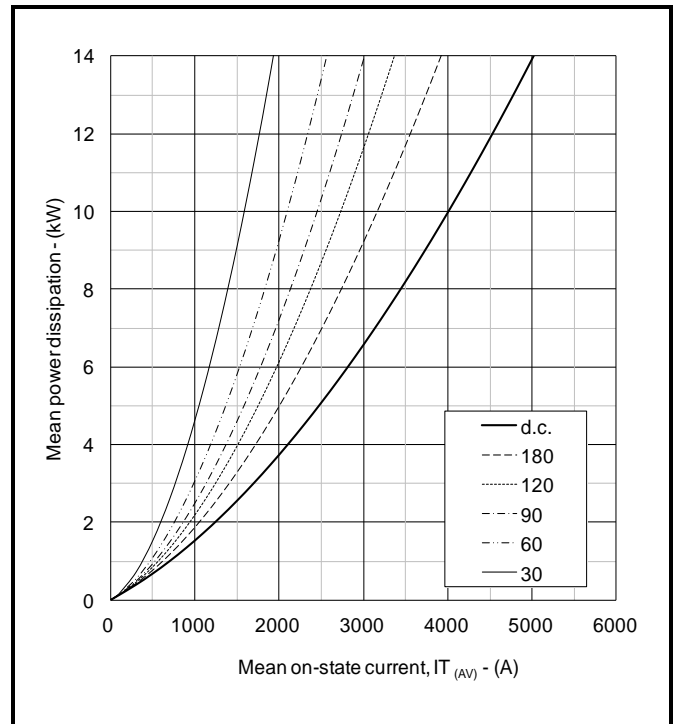
**Fig.3 On-state power dissipation – sine wave**



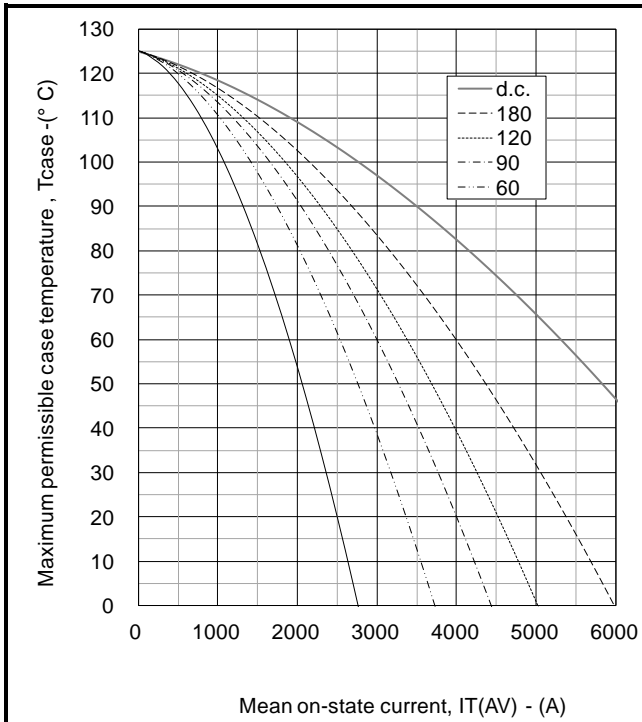
**Fig.4 Maximum permissible case temperature, double side cooled – sine wave**



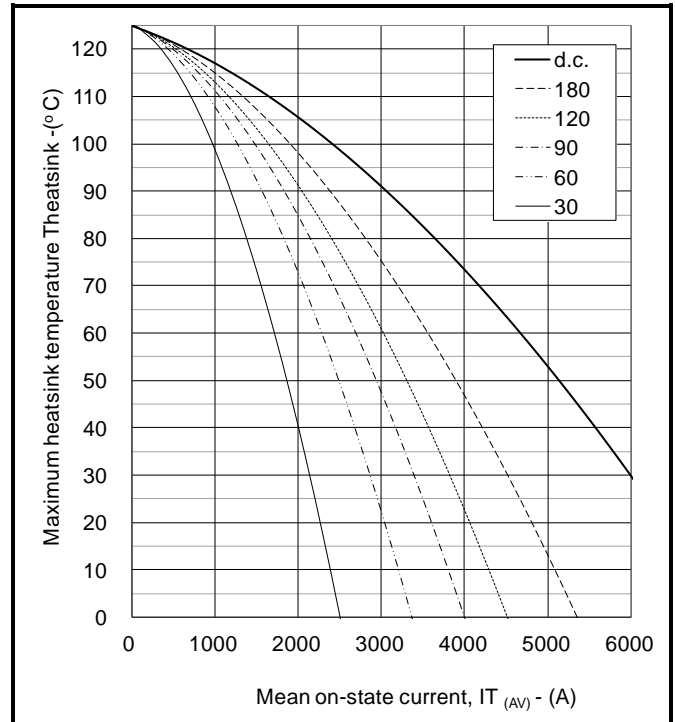
**Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave**



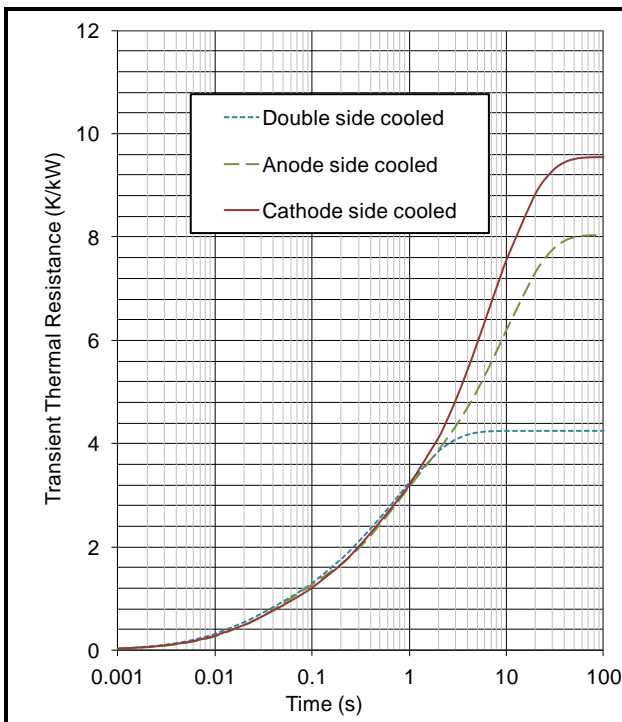
**Fig.6 On-state power dissipation – rectangular wave**



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



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



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

		1	2	3	4
Double side cooled	R <sub>i</sub> (°C/kW)	1.24786361	0.8334561	0.60621847	1.56769894
	T <sub>i</sub> (s)	0.67007122	0.14563223	0.01981569	1.28702484
Anode side cooled	R <sub>i</sub> (°C/kW)	0.51177271	1.94595762	0.91956601	4.66635596
	T <sub>i</sub> (s)	2.89822124	0.50524092	0.0358286	10.6466908
Cathode side cooled	R <sub>i</sub> (°C/kW)	2.41723953	1.53684913	0.62607497	4.9592331
	T <sub>i</sub> (s)	3.44130269	0.26943359	0.02350127	10.172444

$$Z_{th} = \sum_{i=1}^{i=4} [R_i \times (1 - \exp(-T / T_i))]$$

$\Delta R_{th(j-c)}$  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			Anode Side Cooling			Cathode Sided Cooling		
$\theta^\circ$	$\Delta Z_{th} (z)$		$\theta^\circ$	$\Delta Z_{th} (z)$		$\theta^\circ$	$\Delta Z_{th} (z)$	
	sine.	rect.		sine.	rect.		sine.	rect.
180	0.38	0.26	180	0.32	0.23	180	0.33	0.23
120	0.44	0.37	120	0.36	0.31	120	0.38	0.33
90	0.49	0.43	90	0.41	0.36	90	0.43	0.37
60	0.54	0.49	60	0.45	0.40	60	0.47	0.43
30	0.58	0.55	30	0.48	0.45	30	0.51	0.48
15	0.60	0.58	15	0.49	0.48	15	0.52	0.51

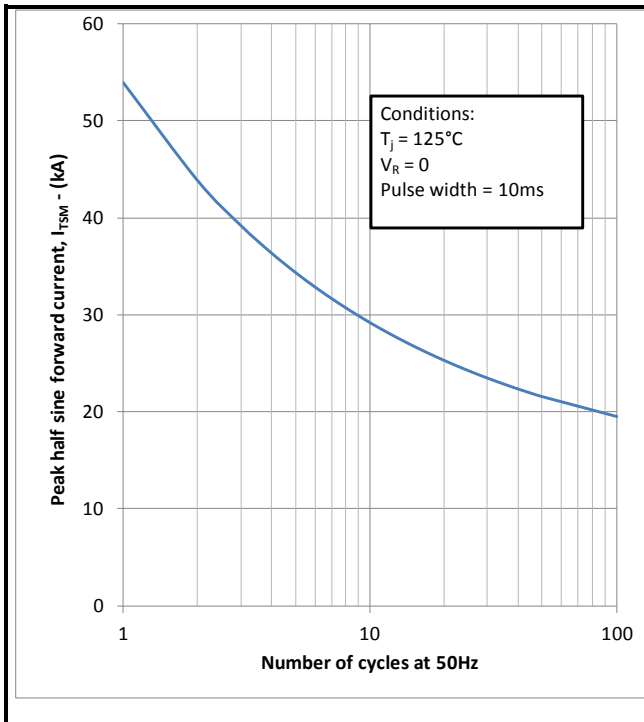


Fig.10 Multi-cycle surge current

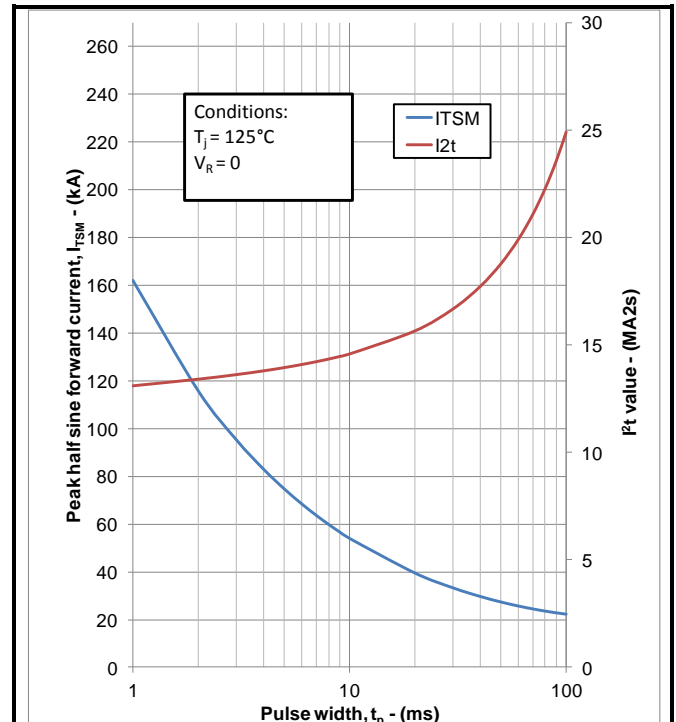


Fig.11 Single-cycle surge current

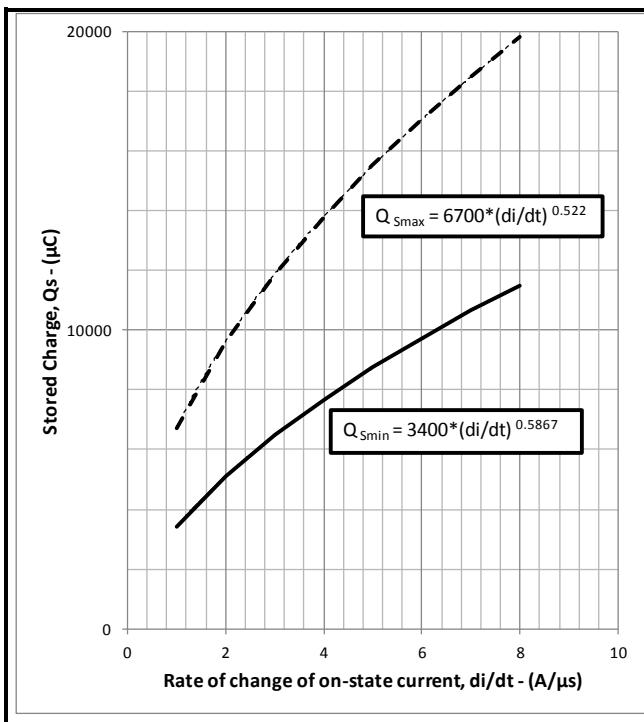


Fig.12 Stored charge

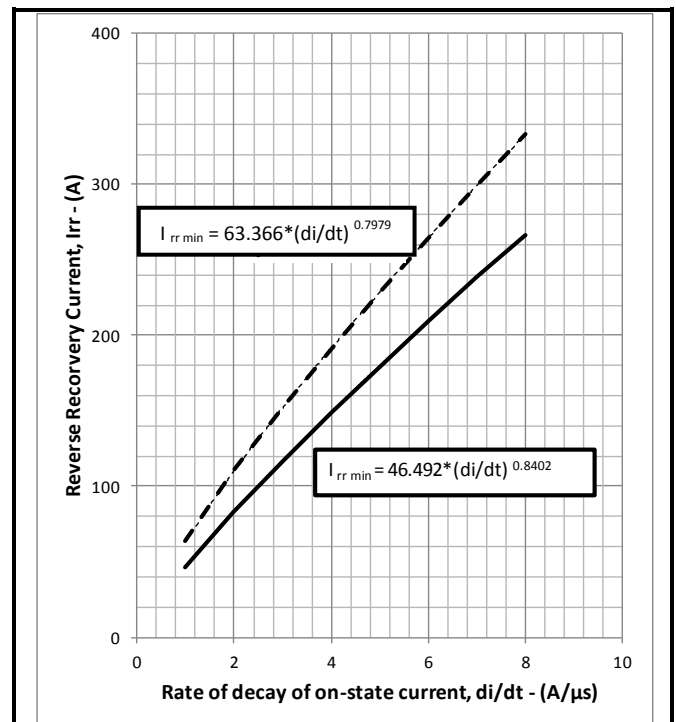


Fig.13 Reverse recovery current

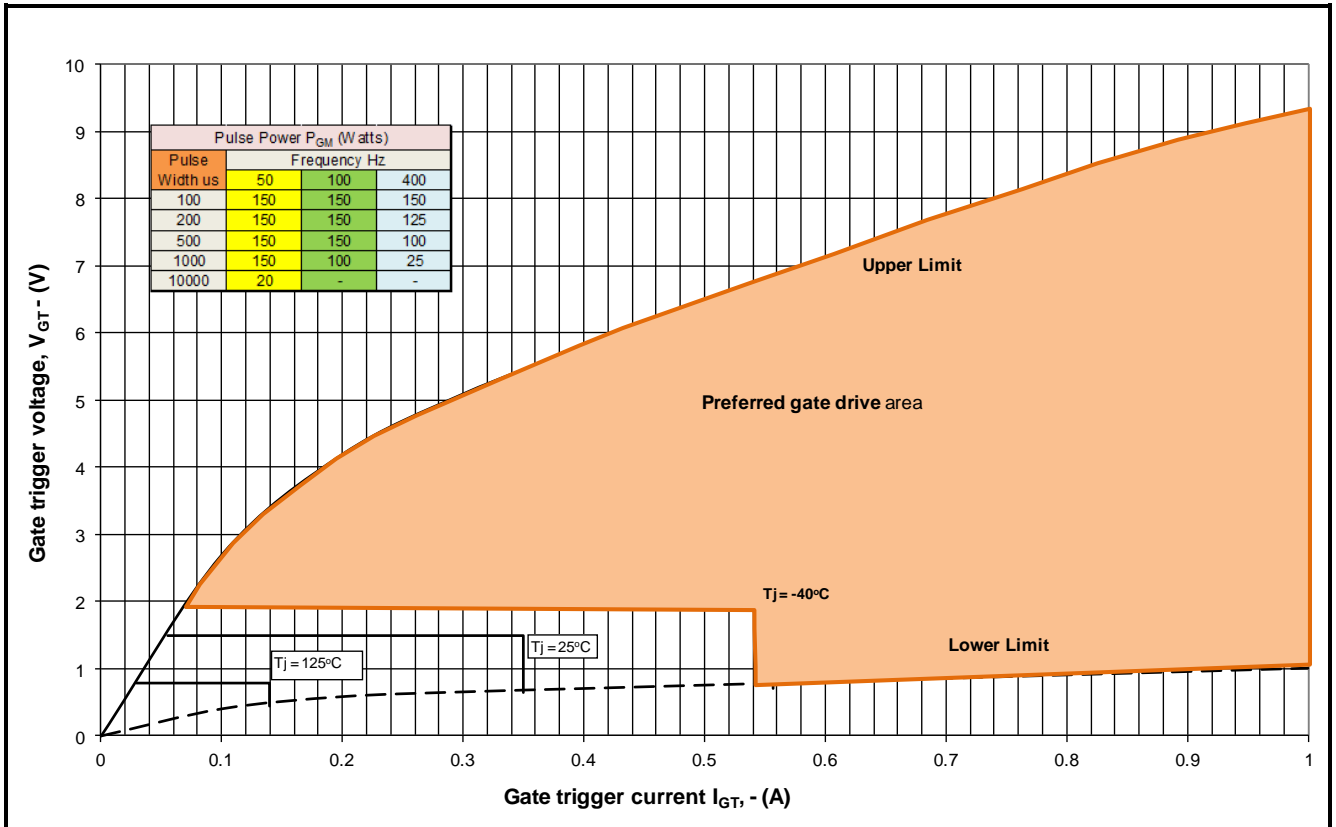


Fig14 Gate Characteristics

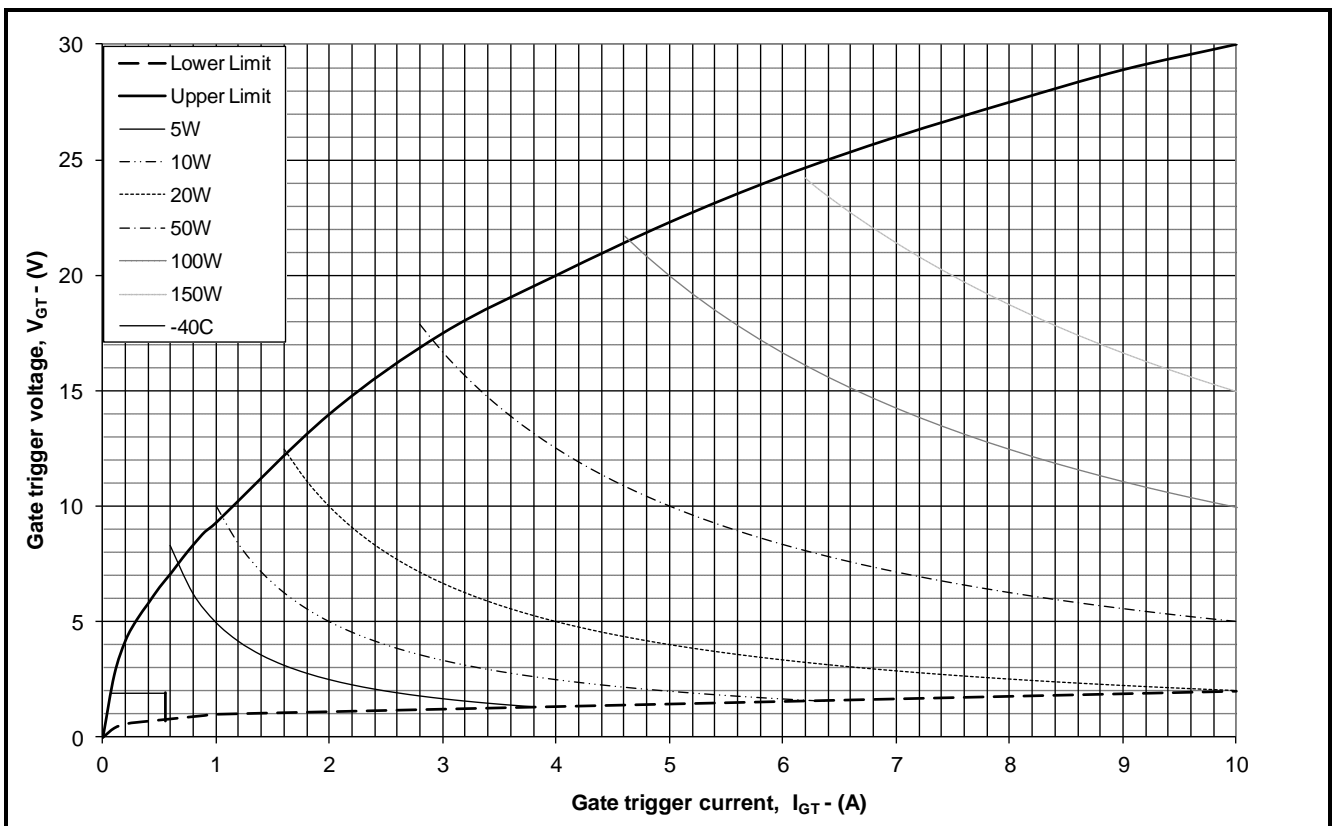


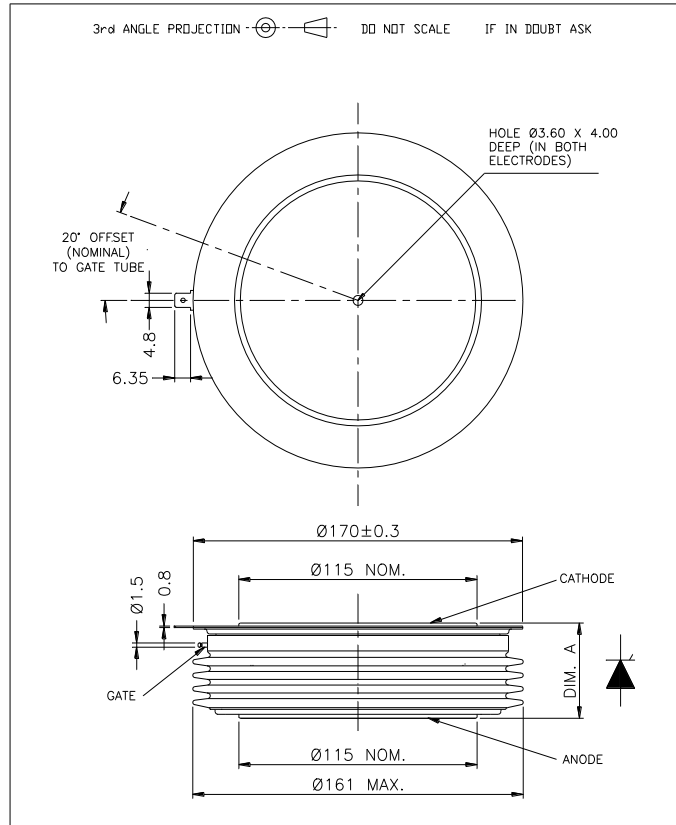
Fig. 15 Gate characteristics



**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)
DCRxxxxH42	35.15	34.28
DCRxxxxH52	35.27	34.4
DCR4420H65	35.3	34.7
DCR4660H65	35.3	34.7
<b>DCR3640H85</b>	<b>35.65</b>	<b>35.05</b>
DCR3980H85	35.65	35.05



Lead length: 420mm  
Lead terminal connector: M4 ring

**Package outline type code:H**

**Fig.16 Package outline**

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