

Phase Control Thyristor
Preliminary Information

DS5928-1.1 July 2009 (LN26822)

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
DCR1610F28	2800	$T_{vj} = -40^{\circ}\text{C}$ to 125°C , $I_{DRM} = I_{RRM} = 100\text{mA}$, $V_{DRM}, V_{RRM} t_p = 10\text{ms}$, $V_{DSM} \& V_{RSM} =$ $V_{DRM} \& V_{RRM} + 100\text{V}$ respectively
DCR1610F26	2600	
DCR1610F24	2400	

Lower voltage grades available.

KEY PARAMETERS

V_{DRM}	2800V
$I_{T(AV)}$	1610A
I_{TSM}	21500A
dV/dt^*	1500V/ μs
dI/dt	1000A/ μs

* Higher dV/dt selections available

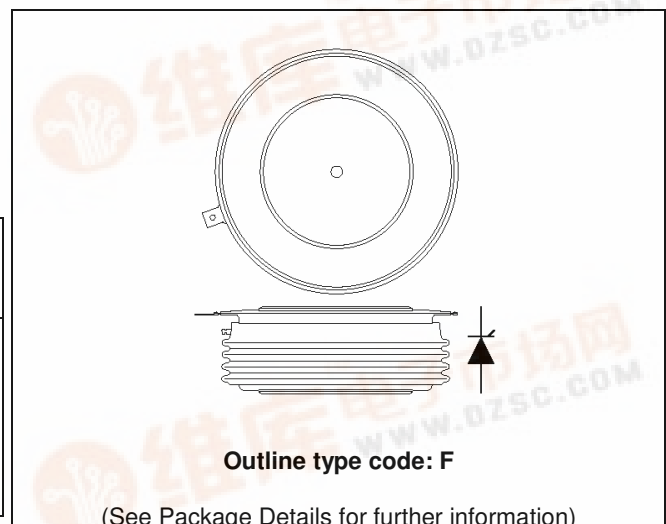


Fig. 1 Package outline

ORDERING INFORMATION

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

For example:

DCR1610F28

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

CURRENT RATINGS

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

Symbol	Parameter	Test Conditions	Max.	Units
Double Side Cooled				
$I_{T(AV)}$	Mean on-state current	Half wave resistive load	1607	A
$I_{T(RMS)}$	RMS value	-	2524	A
I_T	Continuous (direct) on-state current	-	2353	A

SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine, $T_{case} = 125^{\circ}\text{C}$	21.5	kA
I^2t	I^2t for fusing	$V_R = 0$	2.3	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	-	0.0184	$^{\circ}\text{C/W}$
		Single side cooled	Anode DC	-	0.0333	$^{\circ}\text{C/W}$
			Cathode DC	-	0.0418	$^{\circ}\text{C/W}$
$R_{th(c-h)}$	Thermal resistance – case to heatsink	Clamping force 23kN (with mounting compound)	Double side	-	0.004	$^{\circ}\text{C/W}$
			Single side	-	0.008	$^{\circ}\text{C/W}$
T_{vj}	Virtual junction temperature	On-state (conducting)		-	135	$^{\circ}\text{C}$
		Reverse (blocking)		-	125	$^{\circ}\text{C}$
T_{stg}	Storage temperature range			-55	125	$^{\circ}\text{C}$
F_m	Clamping force			22.0	25.0	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		-	100	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)}	Repetitive 50Hz	-	250	A/μs
		Gate source 30V, 10Ω, t _r < 0.5μs, T _j = 125 °C	Non-repetitive	-	1000	A/μs
V _{T(TO)}	Threshold voltage – Low level	100A to 1000A at T _{case} = 125 °C		-	0.8	V
	Threshold voltage – High level	1000A to 4000A at T _{case} = 125 °C		-	0.91	V
r _T	On-state slope resistance – Low level	100A to 1000A at T _{case} = 125 °C		-	0.35	mΩ
	On-state slope resistance – High level	1000A to 4000A at T _{case} = 125 °C		-	0.245	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 = 100V, dI/dt = 5A/μs, dV _{DR} /dt = 20V/μs linear to 2500V		-	600	μs
Q _S	Stored charge	I _T = 1000A, t _p = 1000us, T _j = 125 °C, dI/dt = 5A/μs,		2500	3500	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	$V_{DRM} = 5V, T_{case} = 25^{\circ}C$	1.5	V
V_{GD}	Gate non-trigger voltage	At 50% $V_{DRM}, T_{case} = 125^{\circ}C$	0.4	V
I_{GT}	Gate trigger current	$V_{DRM} = 5V, T_{case} = 25^{\circ}C$	250	mA
I_{GD}	Gate non-trigger current	At 50% $V_{DRM}, T_{case} = 125^{\circ}C$	10	mA

CURVES

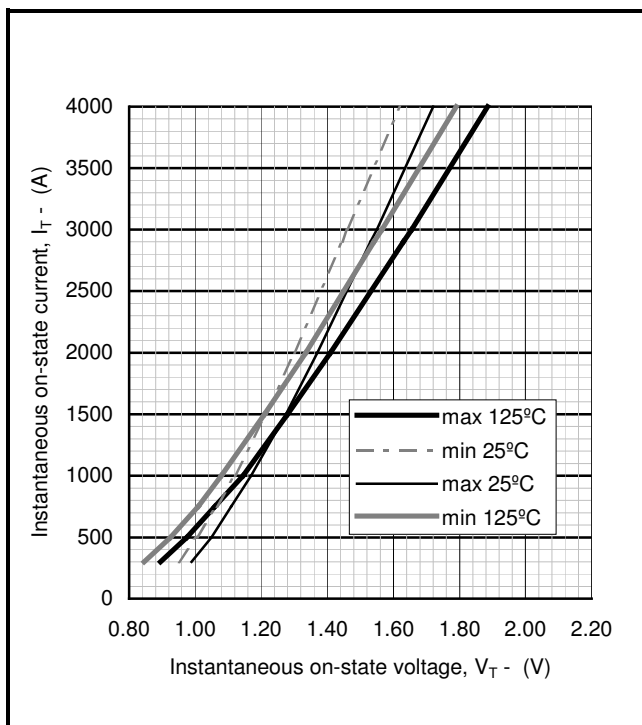


Fig.2 Maximum & minimum on-state characteristics

V_{TM} EQUATION

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

Where $A = 0.746516$
 $B = -0.012797$
 $C = 0.000146$
 $D = 0.010555$

these values are valid for $T_j = 125^{\circ}C$ for I_T 100A to 4000A

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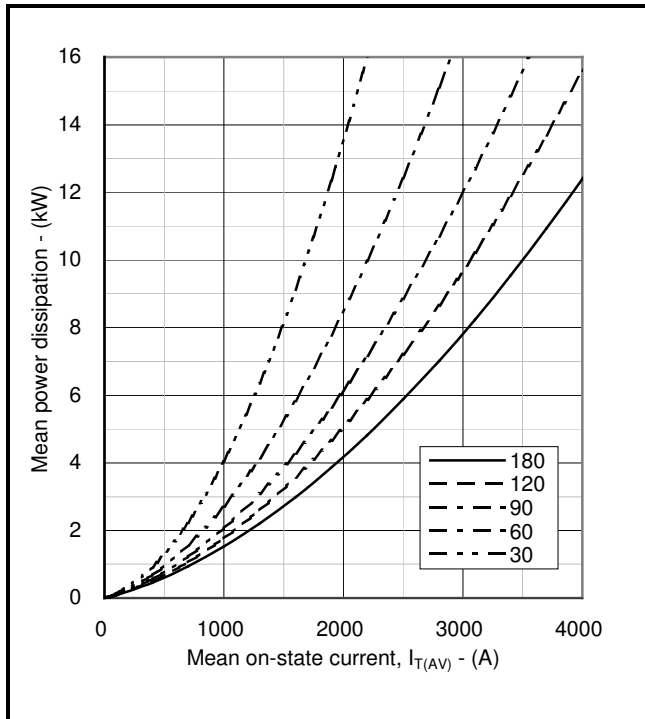


Fig.3 On-state power dissipation – sine wave

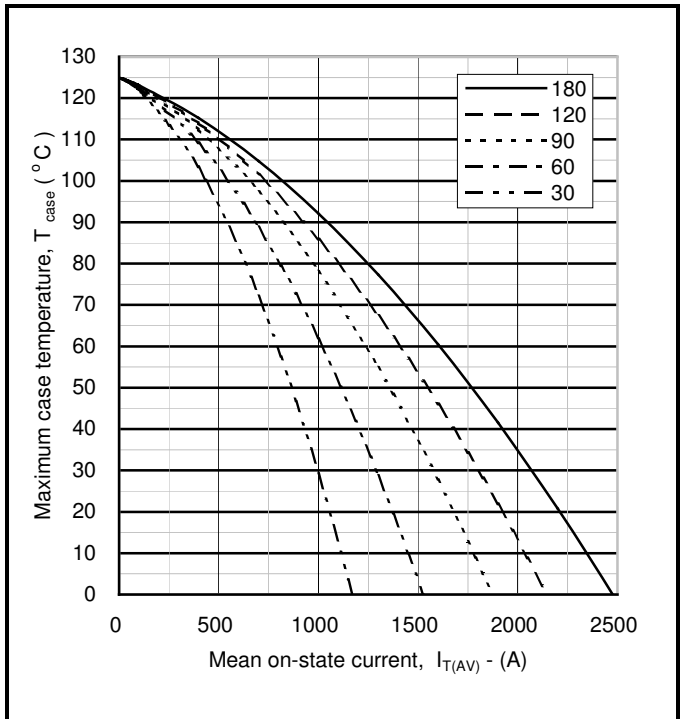


Fig.4 Maximum permissible case temperature, double side cooled – sine wave

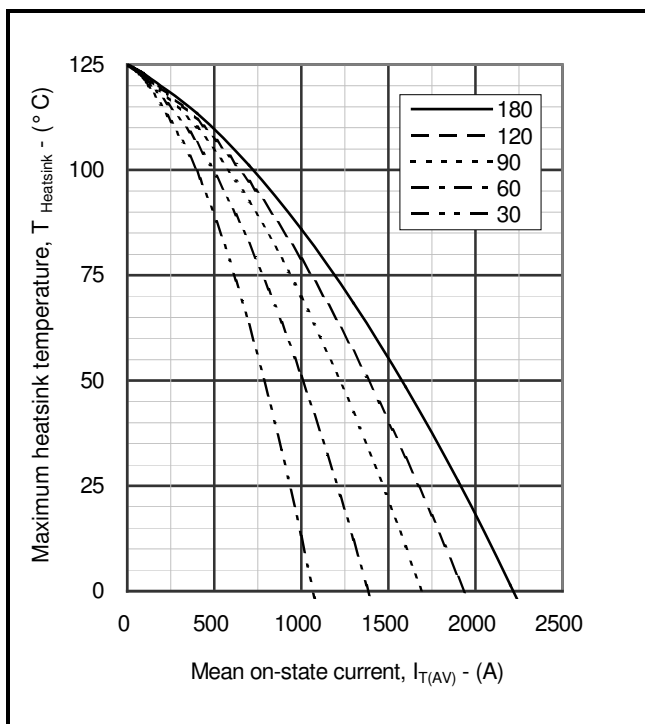


Fig.5 Maximum permissible heatsink temperature, double side cooled – sine wave

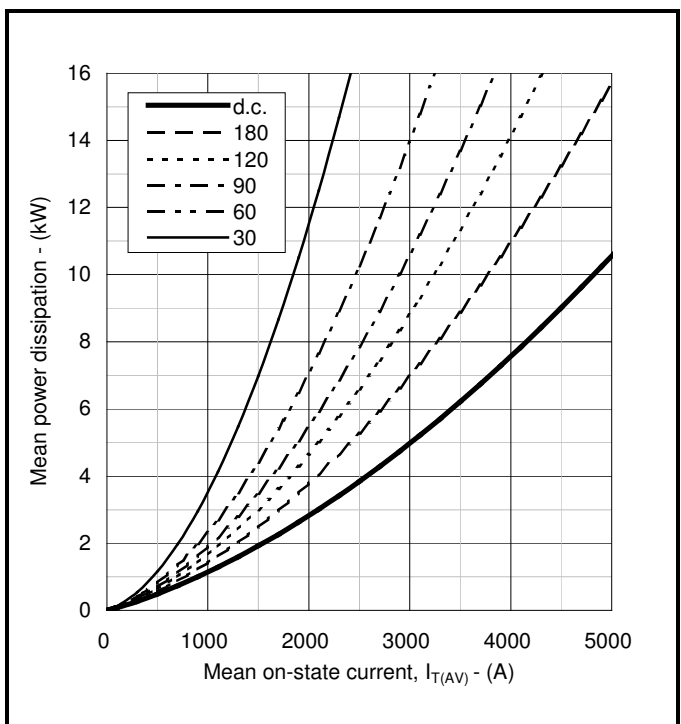


Fig.6 On-state power dissipation – rectangular wave

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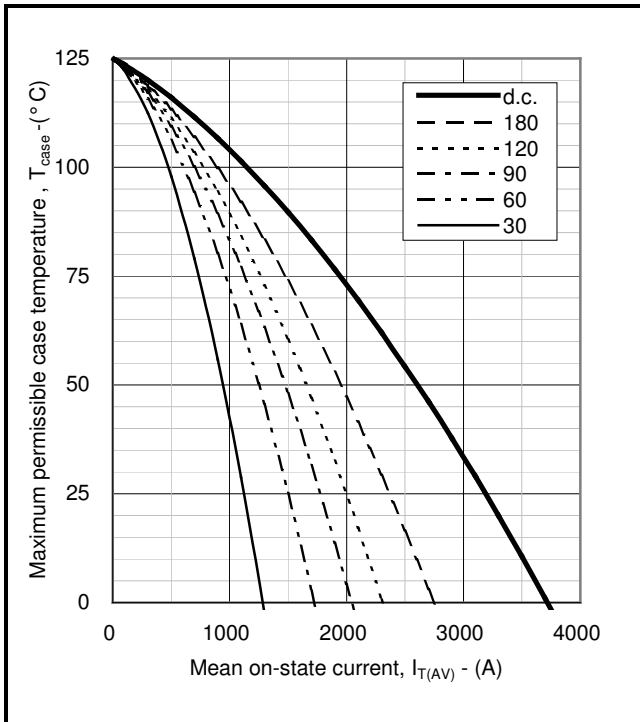


Fig.7 Maximum permissible case temperature, double side cooled – rectangular wave

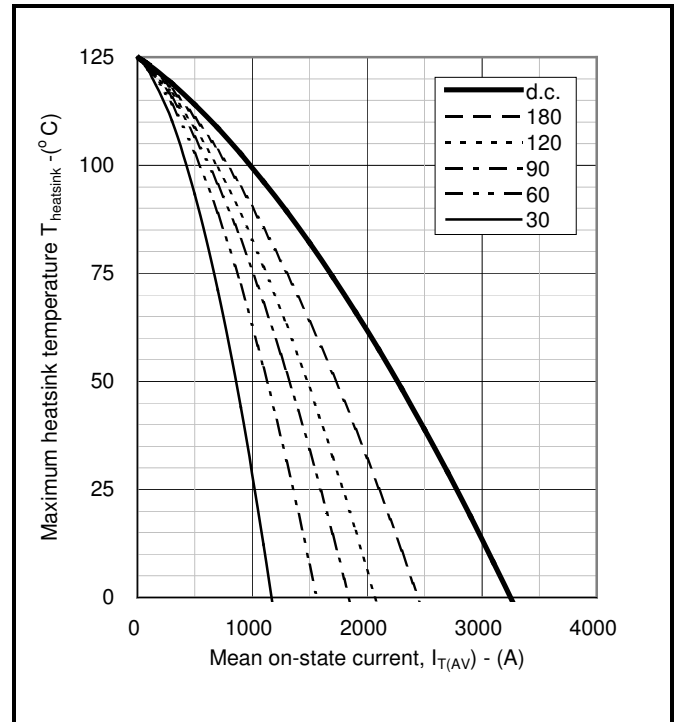


Fig.8 Maximum permissible heatsink temperature, double side cooled – rectangular wave

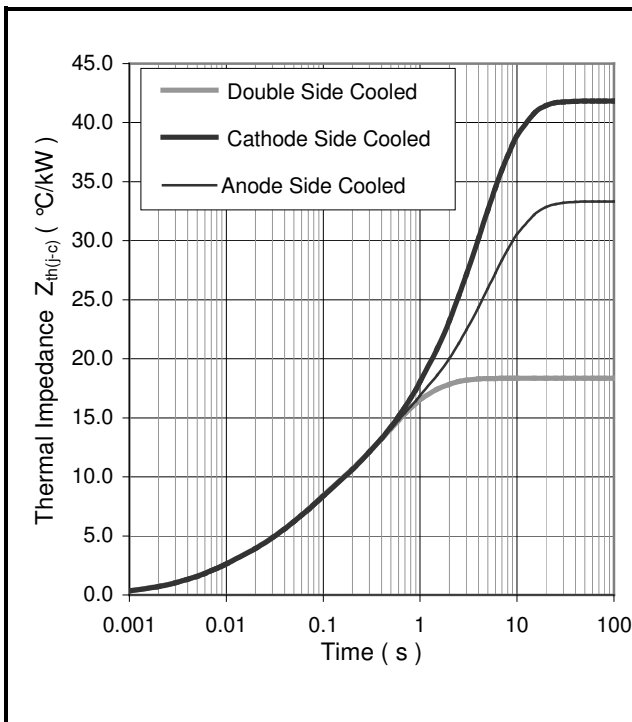


Fig.9 Maximum (limit) transient thermal impedance – junction to case (°C/kW)

		1	2	3	4
Double side cooled	R_i (°C/kW)	7.5608	4.0772	3.8420	2.8671
	T_i (s)	0.6877	0.2537	0.0614	0.0101
Anode side cooled	R_i (°C/kW)	6.7211	4.6219	15.5387	14.8631
	T_i (s)	0.1910	0.0158	5.0011	3.3169
Cathode side cooled	R_i (°C/kW)	11.5564	8.5810	4.7942	8.3643
	T_i (s)	4.2216	6.0269	0.0166	0.2255

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

$\Delta R_{th(j-c)}$ 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		
θ°	$\Delta Z_{th} (z)$		θ°	$\Delta Z_{th} (z)$		θ°	$\Delta Z_{th} (z)$	
	sine.	rect.		sine.	rect.		sine.	rect.
180	3.19	2.14	180	2.97	2.03	180	2.95	2.02
120	3.72	3.10	120	3.43	2.89	120	3.40	2.87
90	4.29	3.64	90	3.92	3.36	90	3.88	3.34
60	4.81	4.23	60	4.36	3.87	60	4.31	3.84
30	5.22	4.88	30	4.69	4.41	30	4.64	4.37
15	5.40	5.22	15	4.84	4.70	15	4.79	4.65

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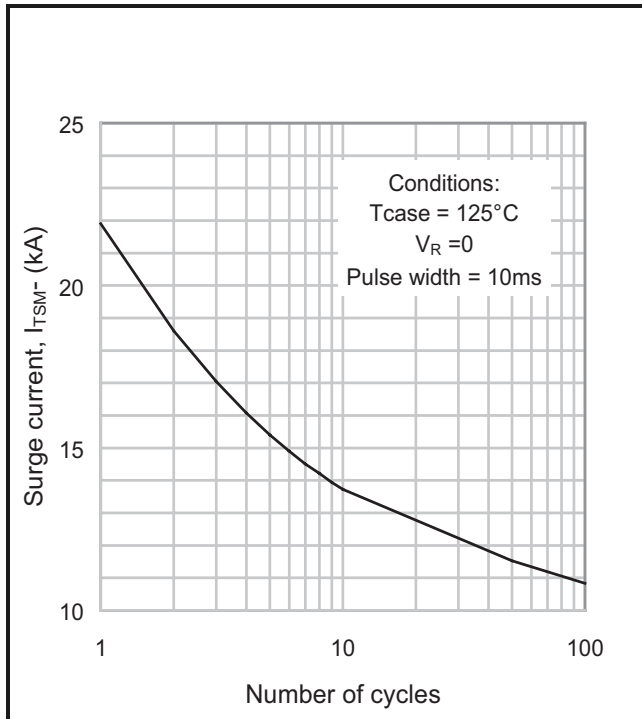


Fig.10 Multi-cycle surge current

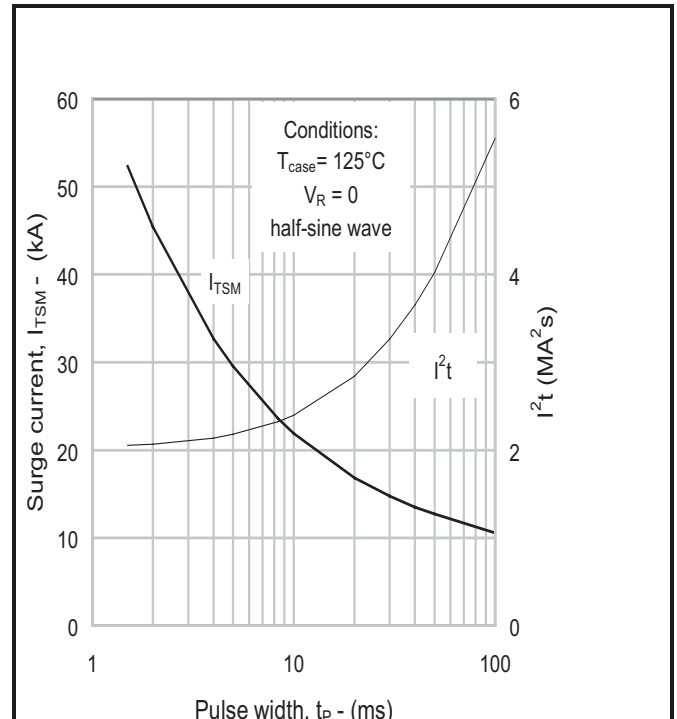


Fig.11 Single-cycle surge current

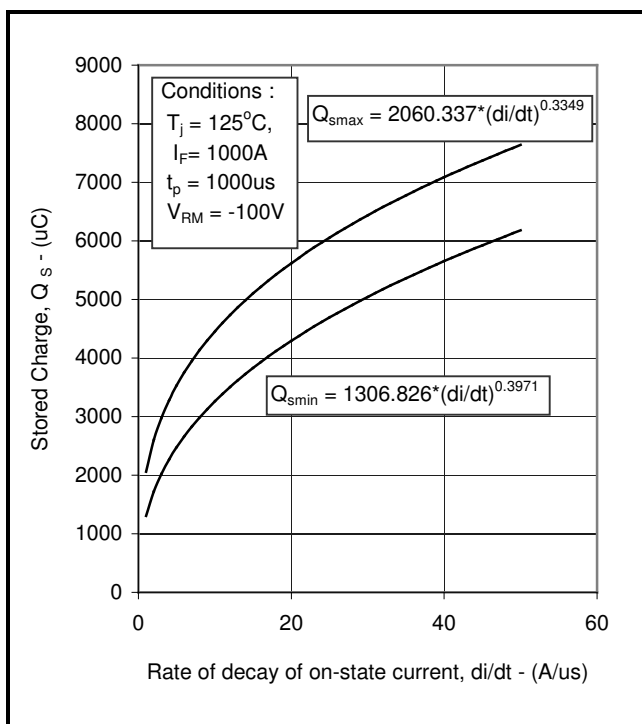


Fig.12 Stored charge vs di/dt

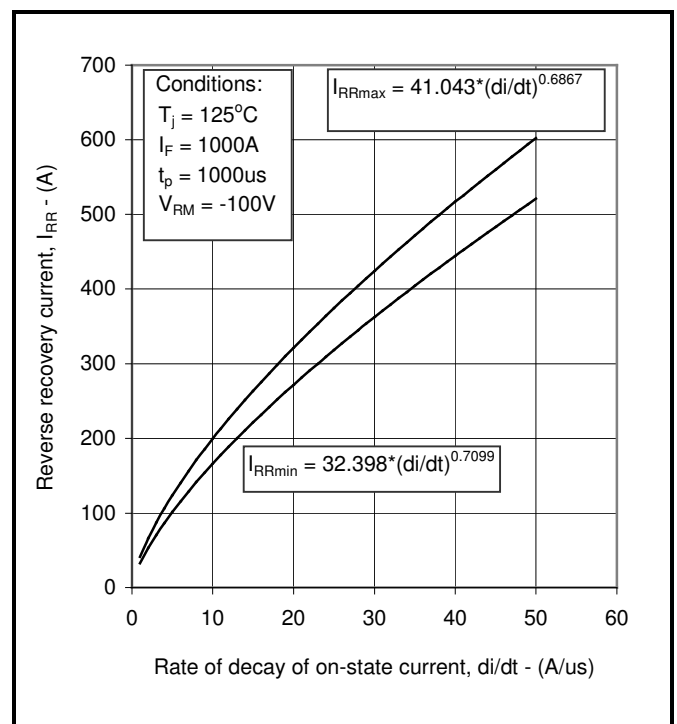


Fig.13 Reverse recovery current vs di/dt

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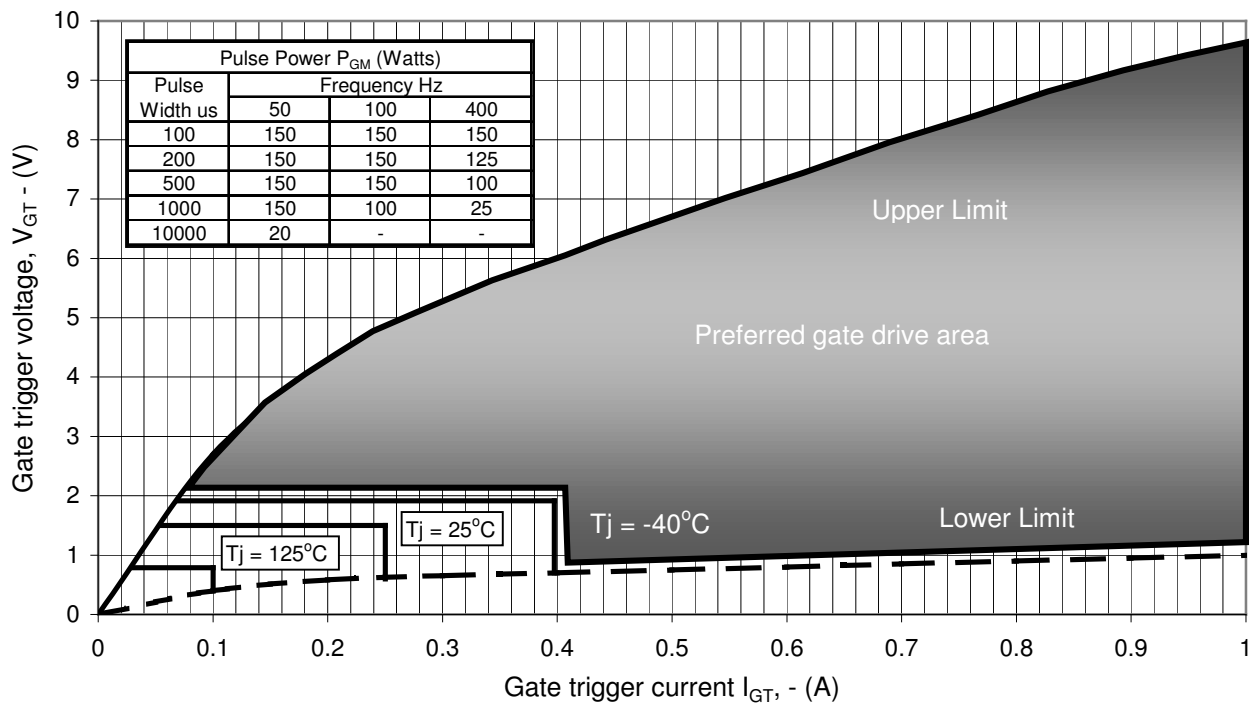


Fig14 Gate Characteristics

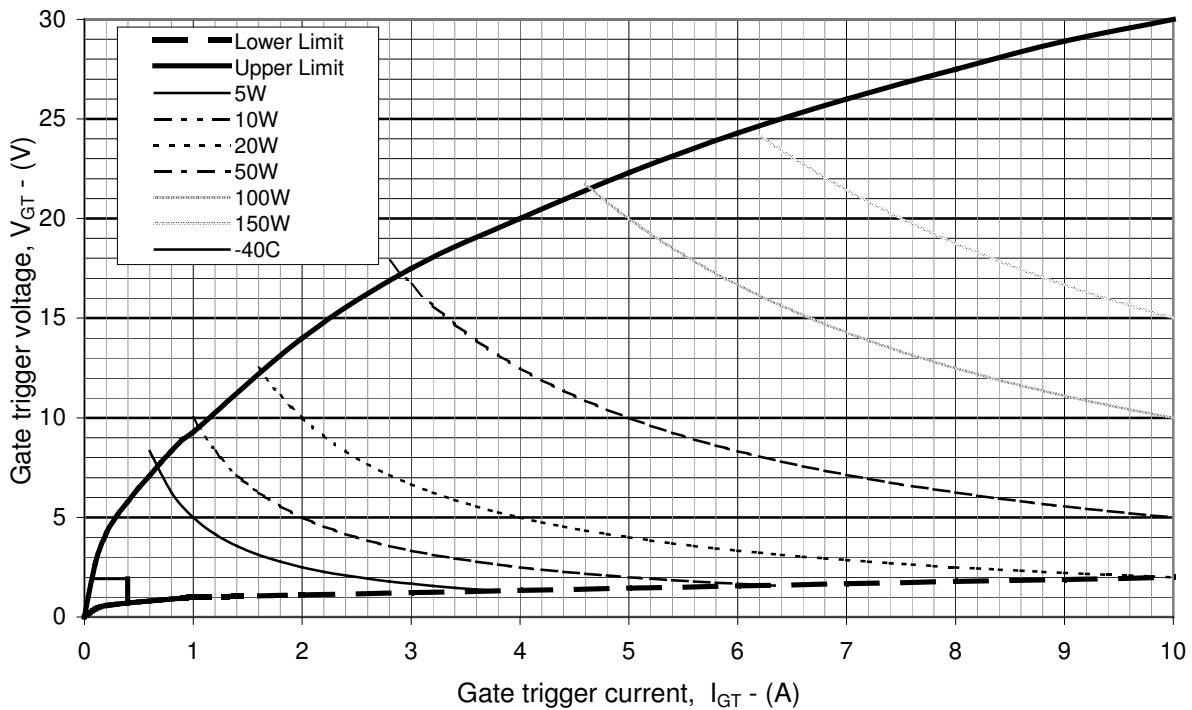
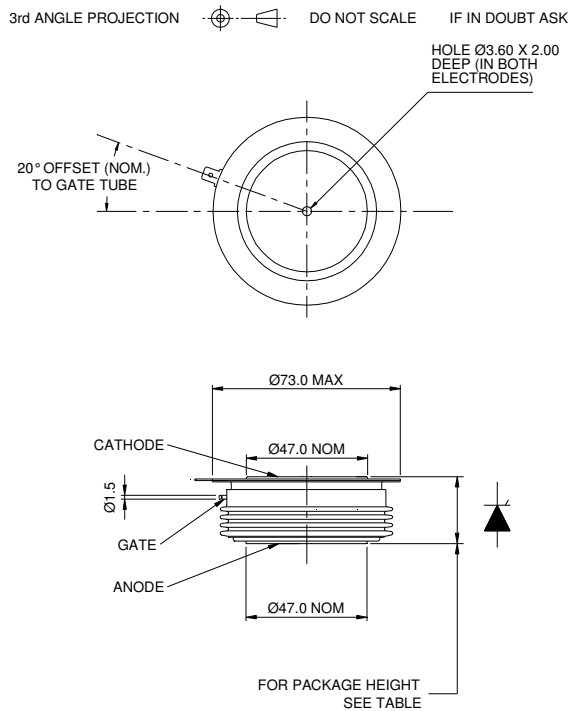


Fig. 15 Gate characteristics

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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)
DCR1003SF18	26.415	25.865
DCR1006SF28	26.49	25.94
DCR1008SF36	26.72	26.17
DCR1020F65	27.1	26.55
DCR1050SF42	26.72	26.17
DCR1180F52	26.84	26.29
DCR1274SF18	26.415	25.865
DCR1275SF28	26.49	25.94
DCR1277SF36	26.72	26.17
DCR1279SF48	26.84	26.29
DCR1350F42	26.72	26.17
DCR1610F28	26.49	25.94
DCR1640F28	26.49	25.94
DCR1830F22	26.415	25.865
DCR810F85	27.46	26.91
DCR840F48	26.84	26.29
DCR890F65	27.1	26.5
DCR950F65	27.1	26.5

Lead length: 420mm
Lead terminal connector: M4 ring

Package outline type code: F

Fig.16 Package outline

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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.



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