ACR3200VR33

Bypass Thyristor

DS6189-2 August 2016 (LN33711)

FEATURES

- Double Side Cooling
- High Surge Capability
- Very Low Cosmic Ray FIT Rating
- High dv/dt Rating

KEY PARAMETERS

V_{DRM}	1000V
V_{RRM}	3300V
$I_{T(AV)}$	3200A
I_{TSM}	43000A
dV/dt	10kV/µs
dI/dt	400A/µs

APPLICATIONS

- Multi-level VSC By-pass thyristor for HVDC

VOLTAGE RATINGS

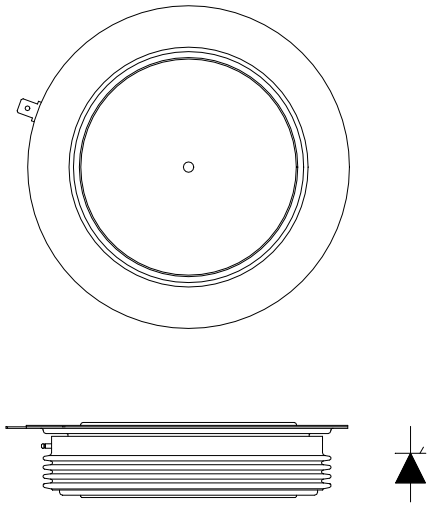
Part and Ordering Number	Repetitive Peak Voltages V_{DRM} and V_{RRM} V	Conditions
ACR3200VR33	1000 / 3300	T_{vj} = -40°C to 125°C, I_{DRM} = I_{RRM} = 400mA, V_{DRM}, V_{RRM} t_p = 10ms,

ORDERING INFORMATION

For example:

ACR3200VR33

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



Outline type code: V

(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	3200	A
$I_{T(RMS)}$	RMS value	-	5026	A
I_T	Continuous (direct) on-state current	-	4900	A

SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Units
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine, T_{case} = 125°C	43	kA
I^2t	I^2t for fusing	V_R = 0	9.24	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	-	0.00746	°C/W
		Single side cooled	Anode DC	-	0.0130	°C/W
			Cathode DC	-	0.0178	°C/W
$R_{th(c-h)}$	Thermal resistance – case to heatsink	Clamping force 54kN	Double side	-	0.002	°C/W
		(with mounting compound)	Single side	-	0.004	°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			48.0	59.0	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		-	400	mA
dV/dt	Max. linear rate of rise of off-state voltage	To 67% V_{DRM}, T_j = 60°C, gate open circuit		-	10000	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	Non-repetitive	-	400	A/µs
$V_{T(TO)}$	Threshold voltage – Low level	300A to 2400A at T_{case} = 125°C		-	0.8383	V
	Threshold voltage – High level	2400A to 9000A at T_{case} = 125°C		-	1.0419	V
r_T	On-state slope resistance – Low level	300A to 2400A at T_{case} = 125°C		-	0.2374	mΩ
	On-state slope resistance – High level	2400A to 9000A at T_{case} = 125°C		-	0.1490	mΩ
t_{gd}	Delay time	V_D = 67% V_{DRM}, I_g=3A, t_r = 0.5µs, T_j = 25°C, t_p = 40µs		3	3	µs
DC FITs	DC Cosmic Ray FIT Rating	T_j = 25°C, V_R = 50% V_{RRM} ,sea level			24	Per 10^9 hours
		T_j = 25°C, V_R = 67% V_{RRM} ,sea level			743	
Vpu	Pick-up Voltage	I_g=3A, t_r = 0.5µs, T_j = 25°C, t_p = 40µs			2	V
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	350	mA
I_{GD}	Gate non-trigger current	V_{DRM} = 5V, T_{case} = 25°C	TBD	mA

CURVES

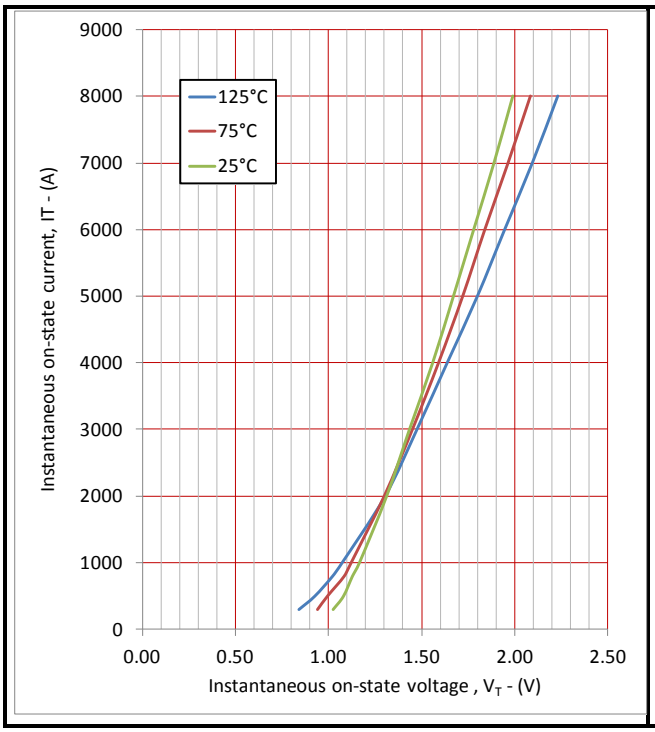


Fig.2 Maximum & minimum on-state characteristics

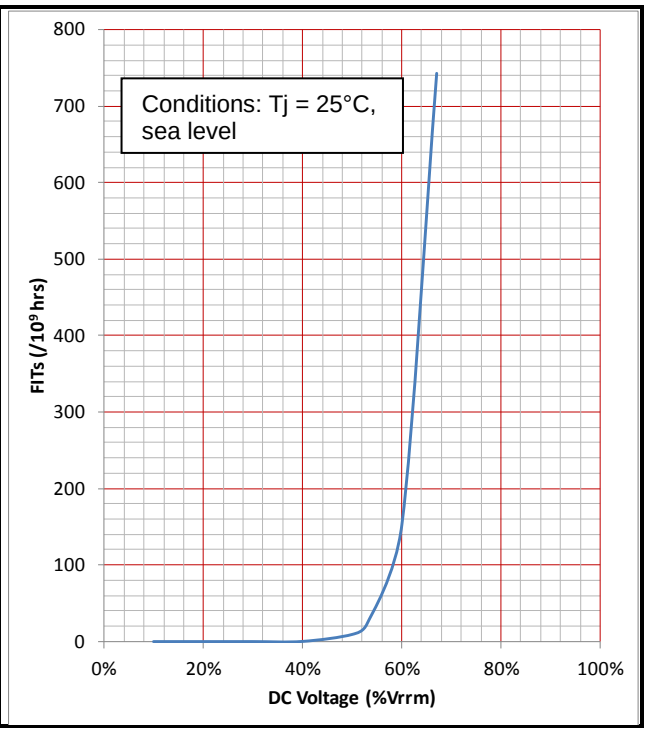


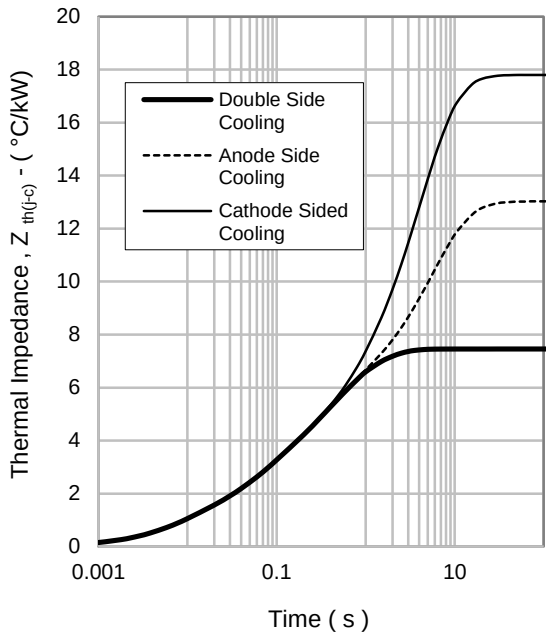
Fig.3 Cosmic Ray DC FIT Rating

V_{TM} EQUATION

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

Where A = -0.303672
B = 0.216168
C = 0.000164
D = -0.007999

these values are valid for T_j = 125°C for I_T 300A to 9000



		1	2	3	4
Double side cooled	R_i (°C/kW)	0.9206	1.8299	3.4022	1.3044
	T_i (s)	0.0076807	0.0579454	0.4078613	1.2085
Anode side cooled	R_i (°C/kW)	0.9032	1.6719	3.0101	7.4269
	T_i (s)	0.0075871	0.0536531	0.3144537	5.624
Cathode side cooled	R_i (°C/kW)	0.9478	2.0661	1.6884	13.0847
	T_i (s)	0.0078442	0.0645541	0.3894389	4.1447

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

$\Delta R_{th(j-c)}$ 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	1.34	0.88
120	1.57	1.30
90	1.83	1.54
60	2.08	1.81
30	2.27	2.11
15	2.36	2.28

Anode Side Cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	1.34	0.88
120	1.57	1.30
90	1.84	1.54
60	2.08	1.81
30	2.28	2.11
15	2.37	2.28

Cathode Sided Cooling		
	ΔZ_{th} (z)	
θ°	sine.	rect.
180	1.33	0.88
120	1.57	1.29
90	1.83	1.53
60	2.07	1.80
30	2.26	2.10
15	2.35	2.26

Fig.4
Maximum (limit) transient thermal impedance – junction to case (°C/kW)

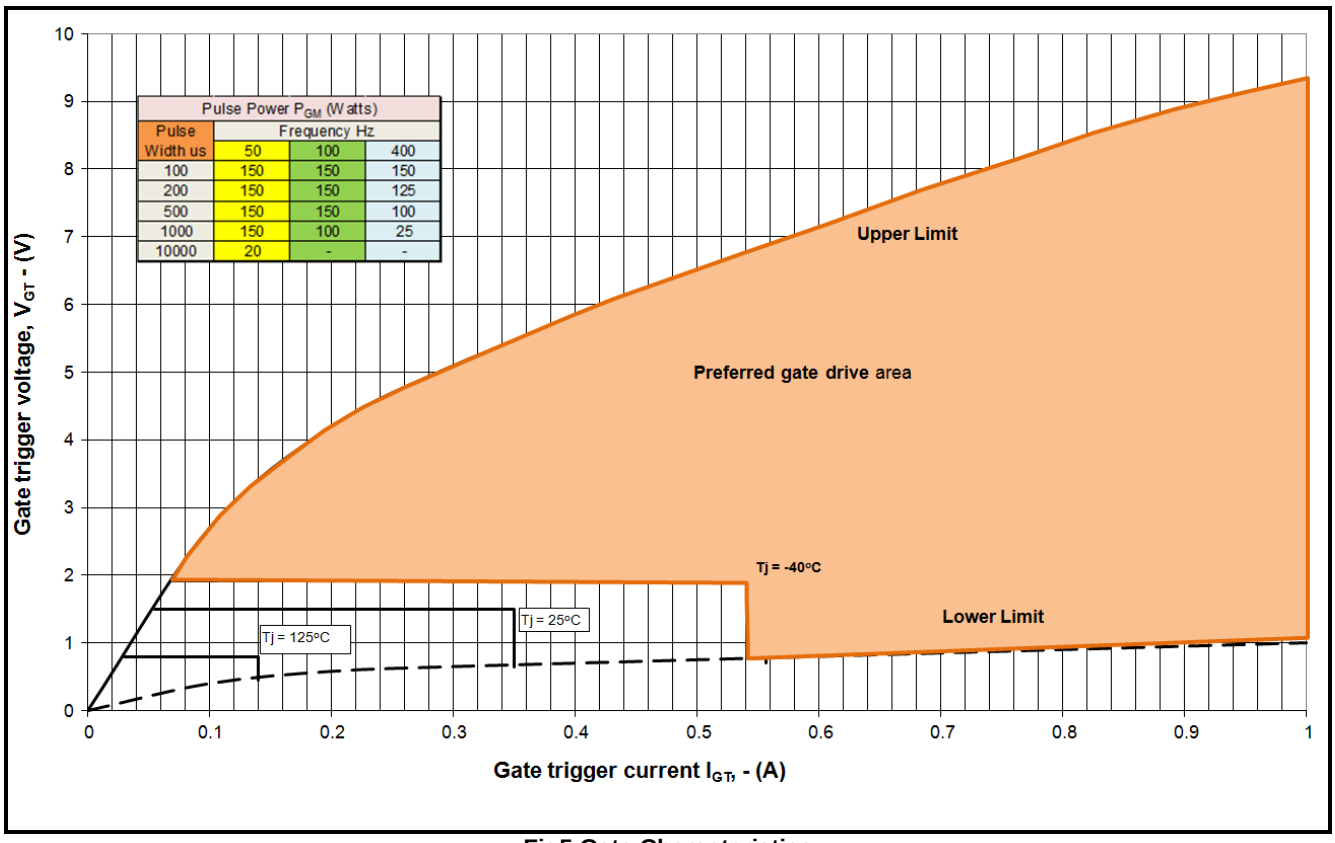


Fig5 Gate Characteristics

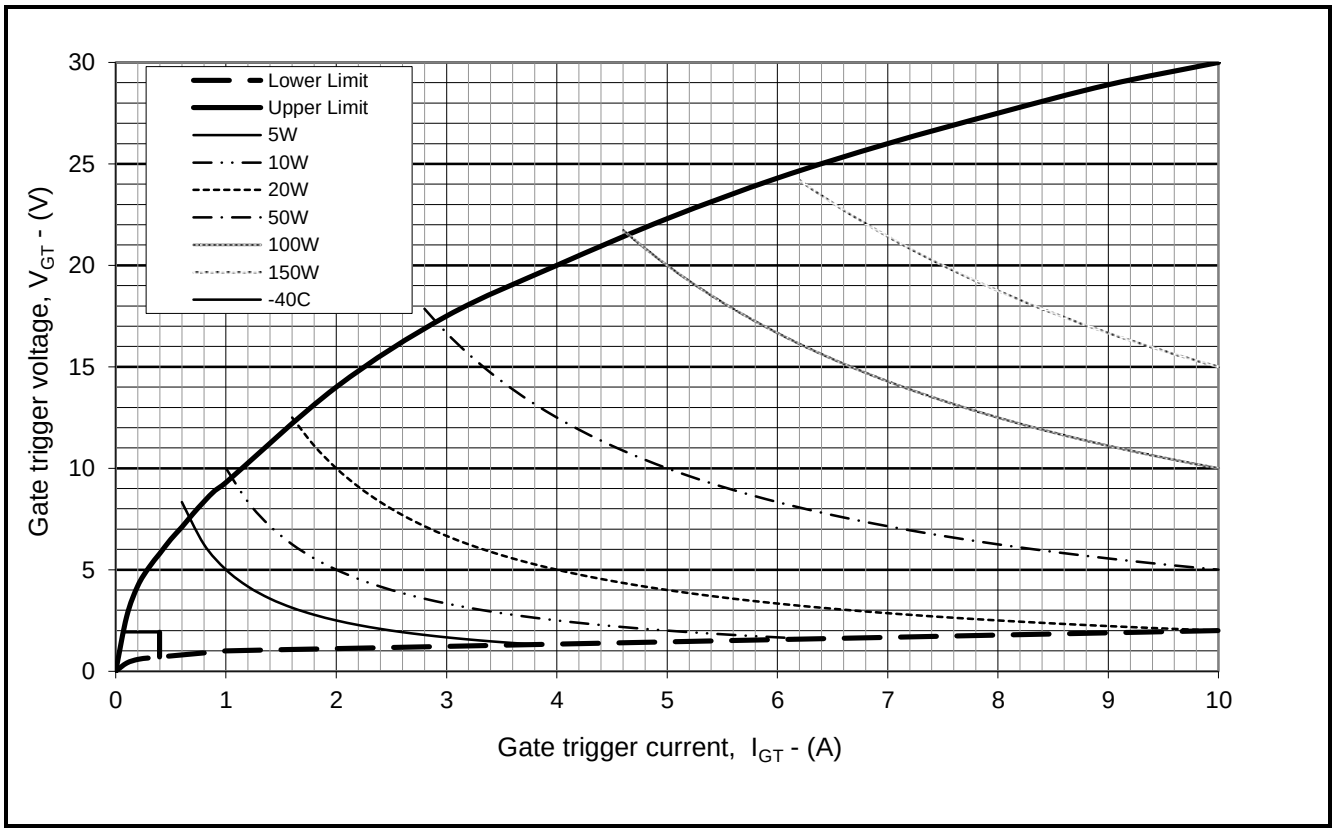
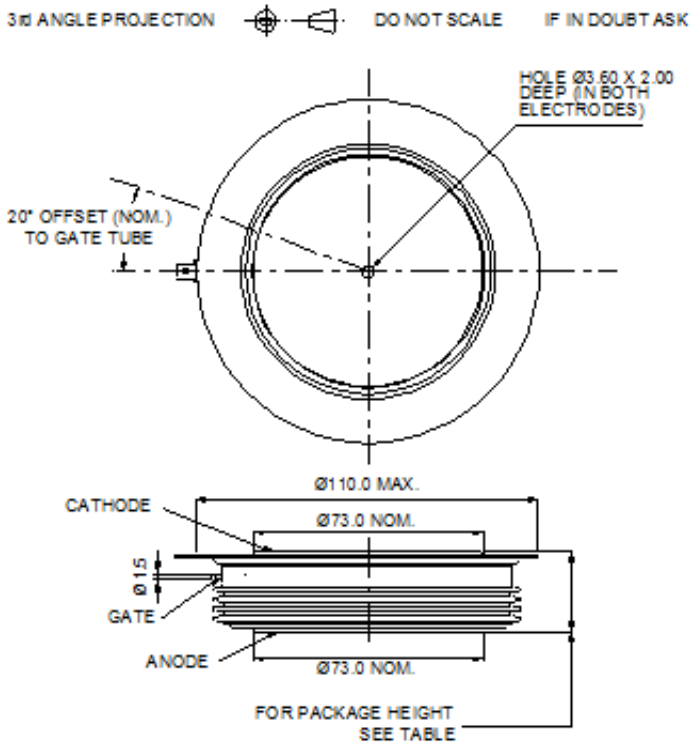


Fig. 6 Gate characteristics

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)
ACR2900VR45	27.67	26.92
ACR3200VR33	27.48	26.73
ACR3350VR45	27.44	26.69
ACR3775VR33	27.34	26.59

Lead length: 420mm
Lead terminal connector: M4 ring

Package outline type code: V
Weight 1100g

Fig.7 Package outline

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