

$V_{\text{DRM}} = 2500 \text{ V}$   
 $I_{\text{TGDM}} = 3000 \text{ A}$   
 $I_{\text{TSM}} = 30 \text{ kA}$   
 $V_{\text{T0}} = 1.5 \text{ V}$   
 $r_{\text{T}} = 0.33 \text{ m}\Omega$   
 $V_{\text{DClink}} = 1400 \text{ V}$

# Gate turn-off Thyristor

## 5SGA 30J2501

Doc. No. 5SYA1213-02 Jan. 05

- Patented free-floating silicon technology
- Low on-state and switching losses
- Annular gate electrode
- Industry standard housing
- Cosmic radiation withstand rating

### Blocking

$V_{\text{DRM}}$	Repetitive peak off-state voltage	2500 V	$V_{\text{GR}} \geq 2V$
$V_{\text{RRM}}$	Repetitive peak reverse voltage	17 V	
$I_{\text{DRM}}$	Repetitive peak off-state current	$\leq 100 \text{ mA}$	$V_{\text{D}} = V_{\text{DRM}} \quad V_{\text{GR}} \geq 2V$
$I_{\text{RRM}}$	Repetitive peak reverse current	$\leq 50 \text{ mA}$	$V_{\text{R}} = V_{\text{RRM}} \quad R_{\text{GK}} = \infty$
$V_{\text{DClink}}$	Permanent DC voltage for 100 FIT failure rate	1400 V	Ambient cosmic radiation at sea level in open air.

### Mechanical data (see Fig. 3)

$F_{\text{m}}$	Mounting force	min.	36	kN
		max.	44	kN
A	Acceleration:			
	Device unclamped		50	$\text{m/s}^2$
	Device clamped		200	$\text{m/s}^2$
M	Weight		1.3	kg
$D_{\text{S}}$	Surface creepage distance	$\geq$	33	mm
$D_{\text{a}}$	Air strike distance	$\geq$	15	mm

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**GTO Data****On-state**

$I_{TAVM}$	Max. average on-state current	1300 A	Half sine wave, $T_C = 85\text{ °C}$	
$I_{TRMS}$	Max. RMS on-state current	2040 A		
$I_{TSM}$	Max. peak non-repetitive surge current	30 kA	$t_p = 10\text{ ms}$	$T_j = 125\text{ °C}$ After surge: $V_D = V_R = 0V$
		51 kA	$t_p = 1\text{ ms}$	
$I^2t$	Limiting load integral	$4.5 \times 10^6\text{ A}^2\text{s}$	$t_p = 10\text{ ms}$	
		$1.3 \times 10^6\text{ A}^2\text{s}$	$t_p = 1\text{ ms}$	
$V_T$	On-state voltage	2.5 V	$I_T = 3000\text{ A}$	$T_j = 125\text{ °C}$
$V_{T0}$	Threshold voltage	1.5 V	$I_T = 400 - 4000\text{ A}$	
$r_T$	Slope resistance	0.33 m $\Omega$		
$I_H$	Holding current	100 A	$T_j = 25\text{ °C}$	

**Gate**

$V_{GT}$	Gate trigger voltage	1.2 V	$V_D = 24\text{ V}$	$T_j = 25\text{ °C}$
$I_{GT}$	Gate trigger current	4 A	$R_A = 0.1\text{ W}$	
$V_{GRM}$	Repetitive peak reverse voltage	17 V		
$I_{GRM}$	Repetitive peak reverse current	50 mA	$V_{GR} = V_{GRM}$	

**Turn-on switching**

$di/dt_{crit}$	Max. rate of rise of on-state current	500 A/ $\mu\text{s}$	$f = 200\text{ Hz}$	$I_T = 3000\text{ A}, T_j = 125\text{ °C}$ $I_{GM} = 30\text{ A}, di_G/dt = 20\text{ A}/\mu\text{s}$
		1000 A/ $\mu\text{s}$	$f = 1\text{ Hz}$	
$t_d$	Delay time	2.5 $\mu\text{s}$	$V_D = 0.5 V_{DRM}$	$T_j = 125\text{ °C}$
$t_r$	Rise time	5 $\mu\text{s}$	$I_T = 3000\text{ A}$	$di/dt = 300\text{ A}/\mu\text{s}$
$t_{on(min)}$	Min. on-time	100 $\mu\text{s}$	$I_{GM} = 30\text{ A}$	$di_G/dt = 20\text{ A}/\mu\text{s}$
$E_{on}$	Turn-on energy per pulse	2 Ws	$C_S = 5\text{ }\mu\text{F}$	$R_S = 5\text{ }\Omega$

**Turn-off switching**

$I_{TGQM}$	Max controllable turn-off current	3000 A	$V_{DM} = V_{DRM}$	$di_{GQ}/dt = 40\text{ A}/\mu\text{s}$
$t_s$	Storage time	25 $\mu\text{s}$	$C_S = 5\text{ }\mu\text{F}$	$L_S \leq 0.3\text{ }\mu\text{H}$
$t_f$	Fall time	3 $\mu\text{s}$	$V_D = \frac{1}{2} V_{DRM}$	$V_{DM} = V_{DRM}$
$t_{off(min)}$	Min. off-time	100 $\mu\text{s}$	$T_j = 125\text{ °C}$	$di_{GQ}/dt = 40\text{ A}/\mu\text{s}$
$E_{off}$	Turn-off energy per pulse	4.7 Ws	$I_{TGQ} = I_{TGQM}$	
$I_{GQM}$	Peak turn-off gate current	1000 A	$C_S = 5\text{ }\mu\text{F}$	$R_S = 5\text{ W}$
			$L_S \leq 0.3\text{ }\mu\text{H}$	

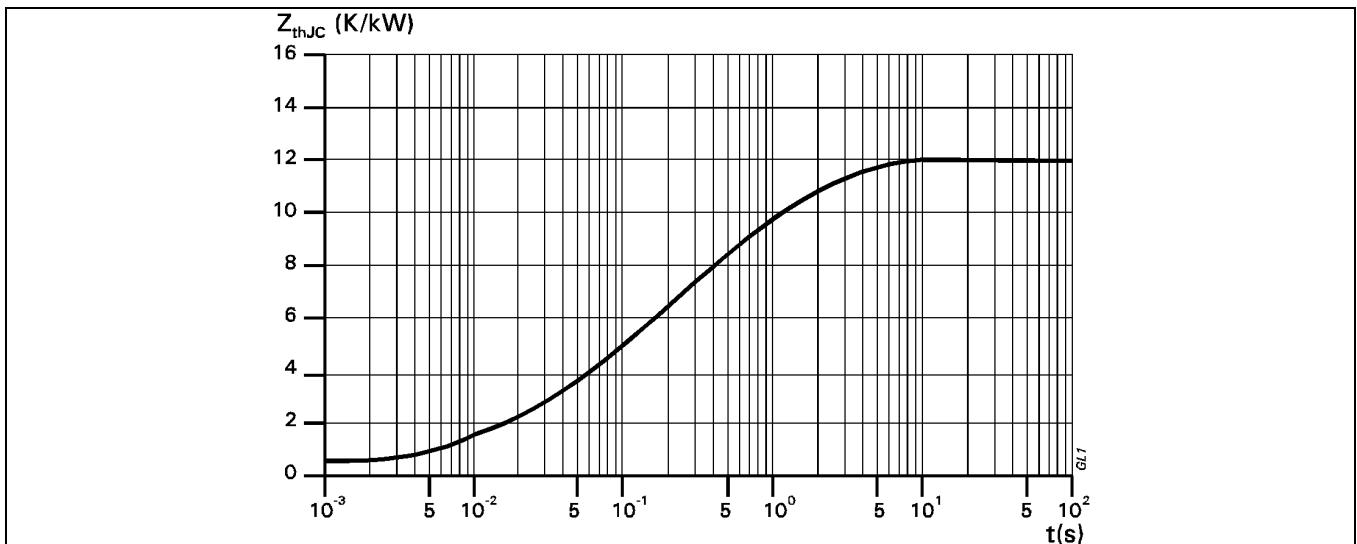
## Thermal

$T_j$	Storage and operating junction temperature range	-40...125°C	
$R_{thJC}$	Thermal resistance junction to case	22 K/kW	Anode side cooled
		27 K/kW	Cathode side cooled
		12 K/kW	Double side cooled
$R_{thCH}$	Thermal resistance case to heat sink	6 K/kW	Single side cooled
		3 K/kW	Double side cooled

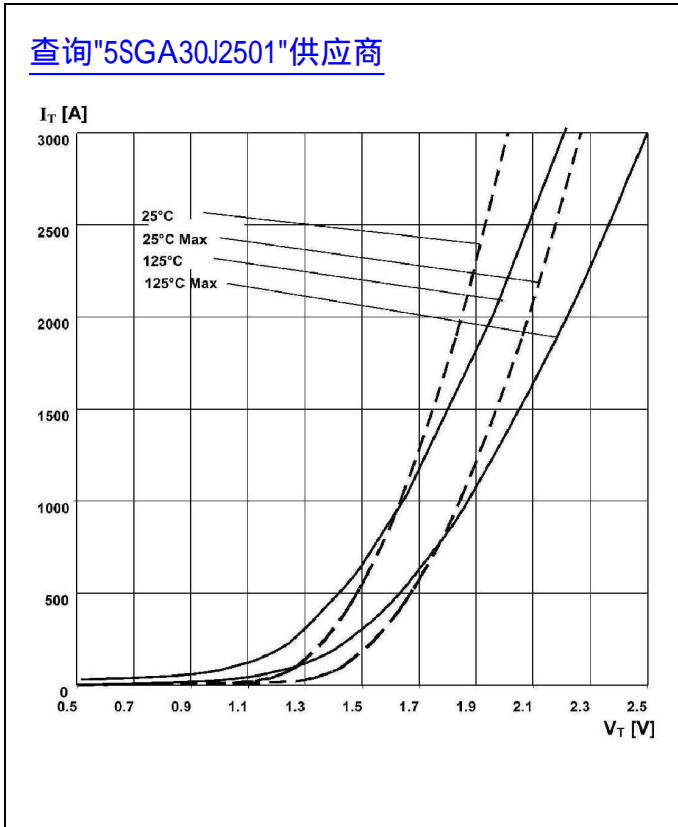
Analytical function for transient thermal impedance:

$$Z_{thJC}(t) = \sum_{i=1}^4 R_i (1 - e^{-t/\tau_i})$$

i	1	2	3	4
$R_i$ (K/kW)	5.4	4.5	1.7	0.4
$\tau_i$ (s)	1.2	0.17	0.01	0.001



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**Fig. 1** On-state characteristics

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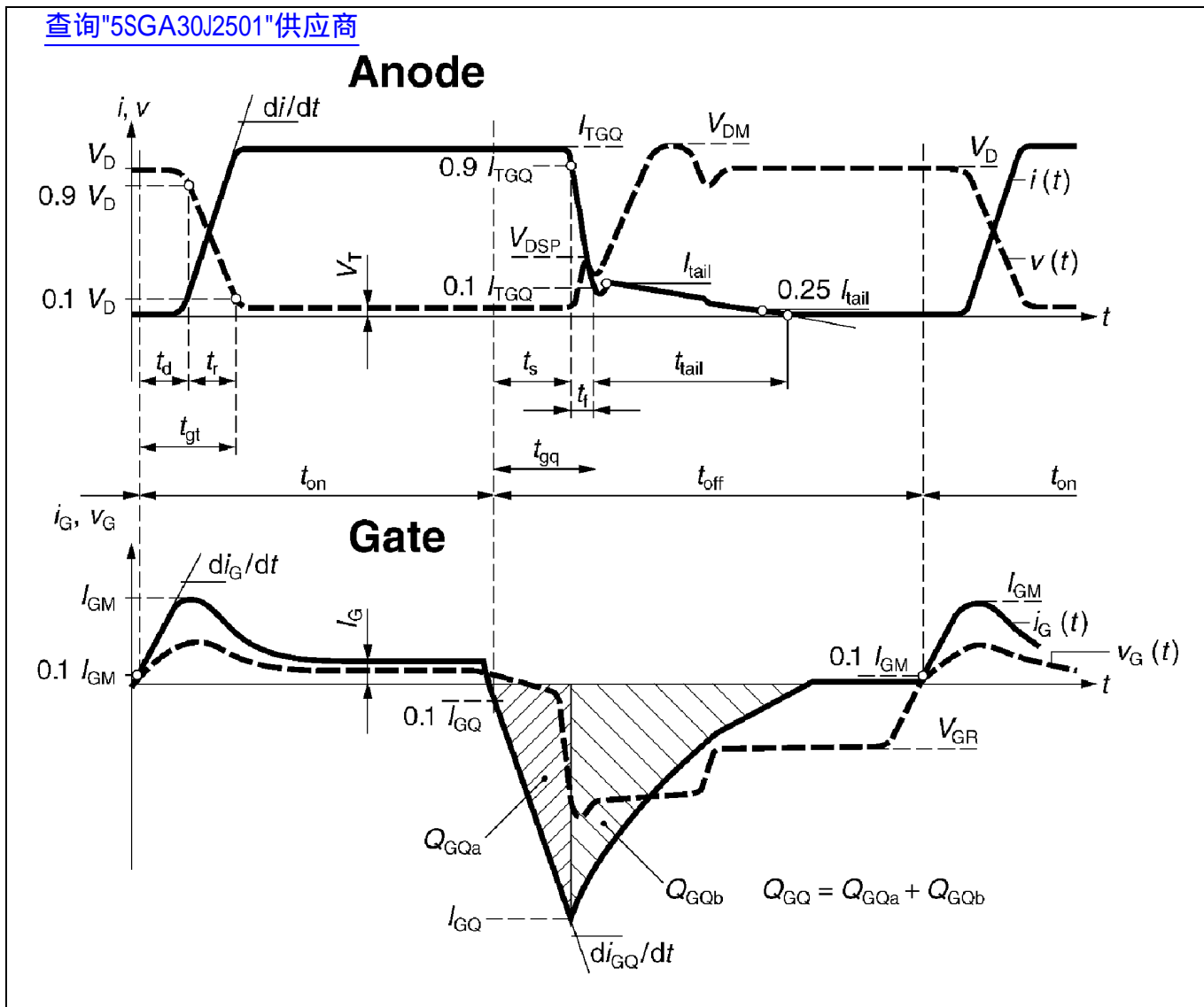


Fig. 2 General current and voltage waveforms with GTO-specific symbols

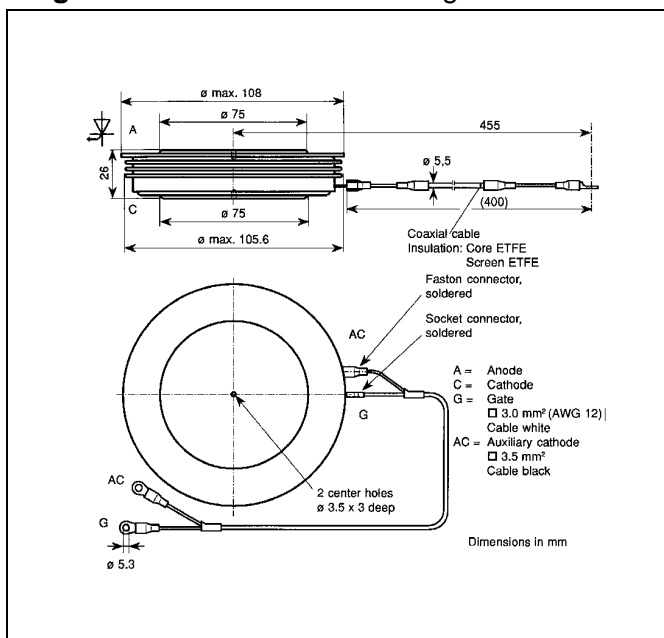


Fig. 3 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

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## Reverse avalanche capability

In operation with an antiparallel freewheeling diode, the GTO reverse voltage  $V_R$  may exceed the rate value  $V_{RRM}$  due to stray inductance and diode turn-on voltage spike at high  $di/dt$ . The GTO is then driven into reverse avalanche. This condition is not dangerous for the GTO provided avalanche time and current are below 10  $\mu s$  and 1000 A respectively. However, gate voltage must remain negative during this time. Recommendation :  $V_{GR} = 10... 15 V$ .

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