

$V_{DRM} = 4500 \text{ V}$   
 $I_{TGQM} = 3000 \text{ A}$   
 $I_{TSM} = 30 \text{ kA}$   
 $V_{T0} = 1.17 \text{ V}$   
 $r_T = 0.31 \text{ m}\Omega$   
 $V_{DClin} = 2800 \text{ V}$

# Gate turn-off Thyristor

# 5SGT 30J4502

## PRELIMINARY

Doc. No. 5SYA 1215-03 Aug. 2000

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

The 5SGT 30J4502 is an 85 mm buffered layer, Transparent Emitter (non-shortcd anode) GTO with exceptionally low dynamic and static losses and gate drive requirements. Housed in an industry-standard 108 mm wide housing, it is ideally suited for high reliability applications such as Transportation and Medium Voltage Drives.

### Blocking

$V_{DRM}$	Repetitive peak off-state voltage	4500 V	$V_{GR} \geq 2V$
$V_{RRM}$	Repetitive peak reverse voltage	17 V	
$I_{DRM}$	Repetitive peak off-state current	$\leq 100 \text{ mA}$	$V_D = V_{DRM}$ $V_{GR} \geq 2V$
$I_{RRM}$	Repetitive peak reverse current	$\leq 50 \text{ mA}$	$V_R = V_{RRM}$ $R_{GK} = \infty$
$V_{DClink}$	Permanent DC voltage for 100 FIT failure rate	2800 V	$-40 \leq T_j \leq 125 \text{ }^\circ\text{C}$ . Ambient cosmic radiation at sea level in open air.

### Mechanical data (see Fig. 4)

$F_m$	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
$D_s$	Surface creepage distance	$\geq$	33	mm
$D_a$	Air strike distance	$\geq$	15	mm

ABB Semiconductors AG reserves the right to change specifications without notice.



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

$I_{TAVM}$	Max. average on-state current	1450 A	Half sine wave, $T_C = 85\text{ }^\circ\text{C}$	
$I_{TRMS}$	Max. RMS on-state current	2280 A		
$I_{TSM}$	Max. peak non-repetitive surge current	30 kA	$t_P = 10\text{ ms}$	$T_j = 125\text{ }^\circ\text{C}$ After surge: $V_D = V_R = 0V$
		50 kA	$t_P = 1\text{ ms}$	
$I^2t$	Limiting load integral	$2.88 \cdot 10^6\text{ A}^2\text{s}$	$t_P = 10\text{ ms}$	
		$0.80 \cdot 10^6\text{ A}^2\text{s}$	$t_P = 1\text{ ms}$	
$V_T$	On-state voltage	2.10 V	$I_T = 3000\text{ A}$	$T_j = 125\text{ }^\circ\text{C}$
$V_{T0}$	Threshold voltage	1.17 V	$I_T = 400 - 4000\text{ A}$	
$r_T$	Slope resistance	0.31 m $\Omega$		
$I_H$	Holding current	100 A	$T_j = 25\text{ }^\circ\text{C}$	

**Gate**

$V_{GT}$	Gate trigger voltage	1.2 V	$V_D = 24\text{ V}$	$T_j = 25\text{ }^\circ\text{C}$
$I_{GT}$	Gate trigger current	1.0 A	$R_A = 0.1\text{ }\Omega$	
$V_{GRM}$	Repetitive peak reverse voltage	17 V		
$I_{GRM}$	Repetitive peak reverse current	20 mA	$V_{GR} = V_{GRM}$	

**Turn-on switching**

$di/dt_{crit}$	Max. rate of rise of on-state current	400 A/ $\mu\text{s}$	$f = 200\text{ Hz}$	$I_T = 2500\text{ A}, T_j = 125\text{ }^\circ\text{C}$ $I_{GM} = 25\text{ A}, di_G/dt = 20\text{ A}/\mu\text{s}$
		800 A/ $\mu\text{s}$	$f = 1\text{ Hz}$	
$t_d$	Delay time	2.0 $\mu\text{s}$	$V_D = 0.5 V_{DRM}$	$T_j = 125\text{ }^\circ\text{C}$
$t_r$	Rise time	4.5 $\mu\text{s}$	$I_T = 2500\text{ A}$	$di/dt = 300\text{ A}/\mu\text{s}$
$t_{on(min)}$	Min. on-time	100 $\mu\text{s}$	$I_{GM} = 25\text{ A}$	$di_G/dt = 20\text{ A}/\mu\text{s}$
$E_{on}$	Turn-on energy per pulse	2.00 Ws	$C_S = 6\text{ }\mu\text{F}$	$R_S = 5\text{ }\Omega$

**Turn-off switching**

$I_{TGQM}$	Max controllable turn-off current	3000 A	$V_{DM} = V_{DRM}$	$di_{GQ}/dt = 40\text{ A}/\mu\text{s}$
			$C_S = 6\text{ }\mu\text{F}$	$L_S \leq 0.2\text{ }\mu\text{H}$
$t_s$	Storage time	25.0 $\mu\text{s}$	$V_D = \frac{1}{2} V_{DRM}$	$V_{DM} = V_{DRM}$
$t_f$	Fall time	3.0 $\mu\text{s}$	$T_j = 125\text{ }^\circ\text{C}$	$di_{GQ}/dt = 40\text{ A}/\mu\text{s}$
$t_{off(min)}$	Min. off-time	100 $\mu\text{s}$	$I_{TGQ} = I_{TGQM}$	
$E_{off}$	Turn-off energy per pulse	6.5 Ws	$C_S = 6\text{ }\mu\text{F}$	$R_S = 5\text{ }\Omega$
$I_{GQM}$	Peak turn-off gate current	1000 A	$L_S \leq 0.2\text{ }\mu\text{H}$	

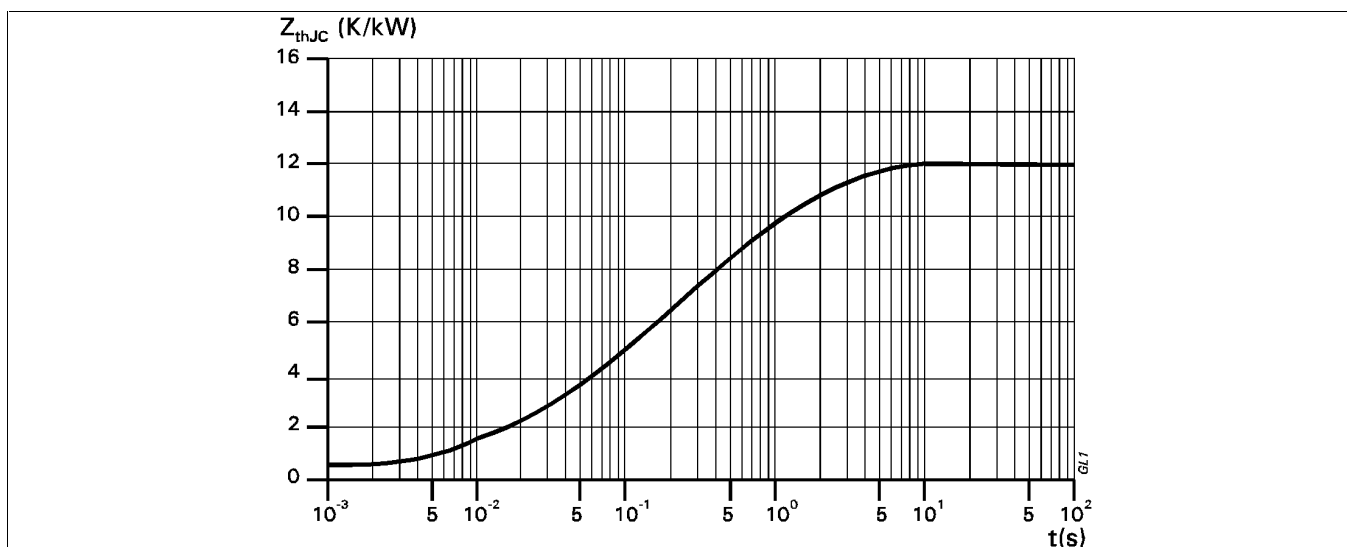
**Thermal**

$T_j$	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

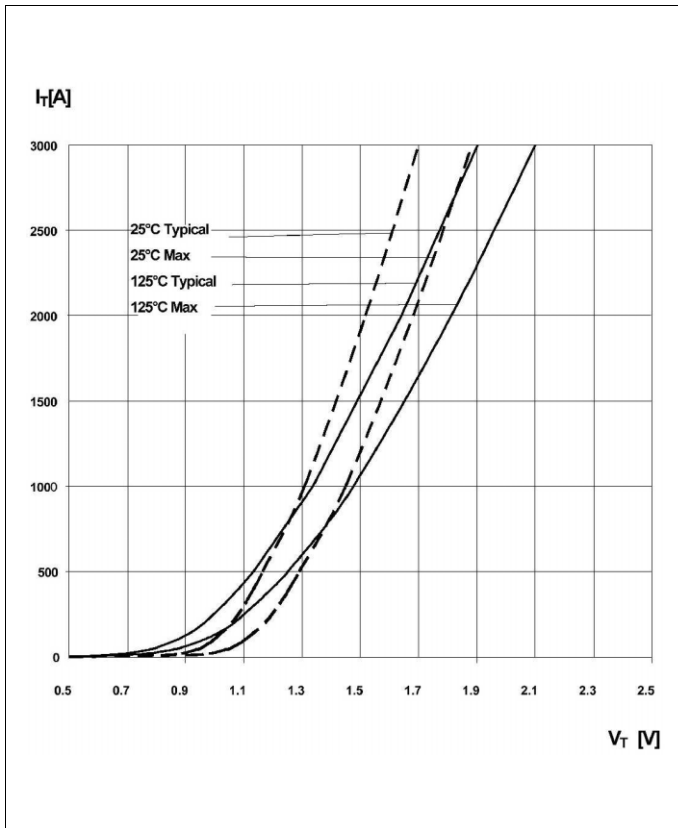
**Analytical function for transient thermal impedance:**

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

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



**Fig. 1** Transient thermal impedance, junction to case.



**Fig. 2** On-state characteristics

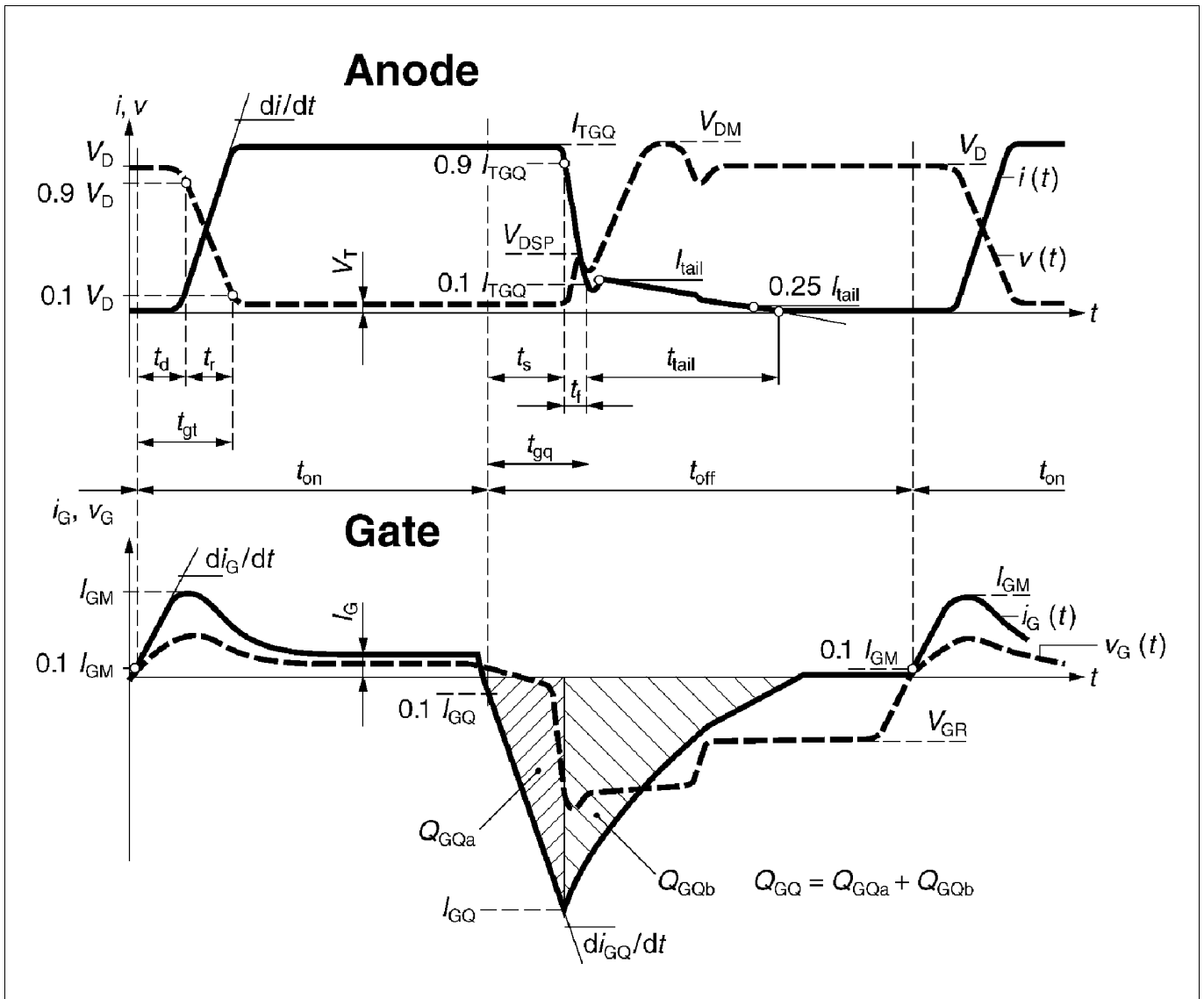


Fig. 3 General current and voltage waveforms with GTO-specific symbols

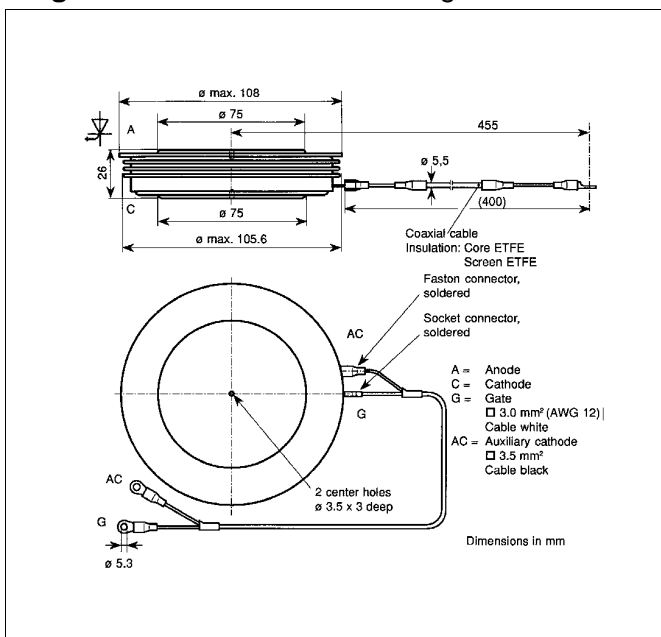


Fig. 4 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

ABB Semiconductors AG reserves the right to change specifications without notice.

**Reverse avalanche capability**

In operation with an antiparallel freewheeling diode, the GTO reverse voltage  $V_R$  may exceed the rated 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.

**ABB Semiconductors AG reserves the right to change specifications without notice.**



**ABB Semiconductors AG**  
Fabrikstrasse 2  
CH-5600 Lenzburg, Switzerland

Doc. No. 5SYA 1215-03 Aug. 2000

Tel: +41 (0)62 888 6419  
Fax: +41 (0)62 888 6306  
E-mail [info@ch.abb.com](mailto:info@ch.abb.com)  
Internet [www.abbsem.com](http://www.abbsem.com)