CSG20H2500

Gate Turn-off Thyristor

FEATURES

- Patent Free-floating Silicon Technology
- Low On-state and Switching Loss
- Ring Gate Electrode
- Industry Standard Case
- Tolerance Rating of Cosmic Radiation

KEY PARAMETERS

V_{DRM}	2500 V
I_{TGQM}	2000 A
I_{TSM}	16 kA
V_{T0}	1.66 V
r_T	0.57 mΩ
V_{DClin}	1400 V

BLOCKING

V_{DRM}	Repetitive peak off-state voltage		2500	V	$V_{GR} \geq 2V$
V_{RRM}	Repetitive peak reverse voltage		17	V	
I_{DRM}	Repetitive peak off-state current	≤	30	mA	$V_D = V_{DRM}$ $V_{GR} \geq 2V$
I_{RRM}	Repetitive peak reverse current	≤	50	mA	$V_R = V_{RRM}$ $R_{GK} \geq \infty$
V_{DClink}	Permanent DC voltage for 100 FIT failure rate		1400	V	$-40 \leq T_j \leq 125$ °C. Ambient cosmic radiation at sea level in open air.

MECHANICAL RATINGS (Refer to **Fig.19**)

F_m	Mounting force	min.	17	kN
		max.	24	kN
A	Acceleration: Device unclamped Device clamped		50 200	m/s^2 m/s^2
M	Weight		0.8	kg
D_S	Surface creepage distance		≥ 22	mm
D_a	Air strike distance		≥ 13	mm

ON-STATE RATING

I_{TAVM}	Max. average on-state current	830	A	Half sine wave, T_C = 85 °C	
I_{TRMS}	Max. RMS on-state current	1300	A		
I_{TSM}	Max. peak non-repetitive surge current	16	kA	t_P = 10 ms	T_j = 125°C
		32	kA	t_P = 1 ms	After surge:
I^2t	Limiting load integral	$1.28 \bullet 10^6$	A^2s	t_P = 10 ms	$V_D = V_R$ = 0V
		$0.51 \bullet 10^6$	A^2s	t_P = 1 ms	
V_T	On-state voltage	2.80	V	I_T = 2000 A	
V_{T0}	Threshold voltage	1.66	V	I_T = 200 - 2500 A	T_j = 125 °C
r_T	Slope resistance	0.57	mΩ		
I_H	Holding current	50	A	T_j = 25 °C	

GATING

V_{GT}	Gate trigger voltage	1.0	V	V_D = 24 V, T_j = 25 °C
I_{GT}	Gate trigger current	2.5	A	R_A = 0.1 Ω
V_{GRM}	Repetitive peak reverse voltage	17	V	
I_{GRM}	Repetitive peak reverse current	50	mA	V_G = V_{GRM}

TURN-ON

di/dt_{crit}	Max. rate of rise of on-state current	400 A/µs	f = 200Hz	I_T = 2000 A, T_j = 125 °C
		700 A/µs	f = 1Hz	I_{GM} = 30 A, di_G/dt = 20 A/µs
t_d	Delay time	1.5 µs	V_D = 0.5 V_{DRM}	T_j = 125 °C
t_r	Rise time	3.5 µs	I_T = 2000 A	di/dt = 200 A/µs
$t_{on(min)}$	Min. on-time	80 µs	I_{GM} = 30 A	di_G/dt = 20 A/µs
E_{on}	Turn-on energy per pulse	0.75 Ws	C_S = 4 µF	R_S = 5 Ω

TURN-OFF

I_{TGQM}	Max controllable turn-off current	2000	A	V_{DM} = V_{DRM} C_S = 4 µF	di_{GQ}/dt = 30 A/µs L_S ≤ 0.3 µH
t_s	Storage time	22.0	µs	V_D = ½ V_{DRM}	V_{DM} = V_{DRM}
t_f	Fall time	2.0	µs	T_j = 125 °C	di_{GQ}/dt = 30 A/µs
$t_{off(min)}$	Min. off-time	80	µs	I_{TGQ} = I_{TGQM}	
E_{off}	Turn-off energy per pulse	3.5	Ws	C_S = 4 µF	R_S = 5 Ω
I_{GQM}	Peak turn-off gate current	700	A	L_S ≤ 0.3 µH	

THERMAL RATINGS

T_j	Storage and operating junction temperature range	-40...125°C	
R_{thJC}	Thermal resistance junction to case	30 K/kW	Anode side cooled
		39 K/kW	Cathode side cooled
		17 K/kW	Double side cooled
R_{thCH}	Thermal resistance case to heat sink	10 K/kW	Sin gle side cooled
		5 K/kW	Double side cooled

Analytical function for transient thermal impedance:

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

i	1	2	3	4
R_i (K/kW)	11.7	4.7	0.64	0.0001
τ_i (s)	0.9	0.26	0.002	0.001

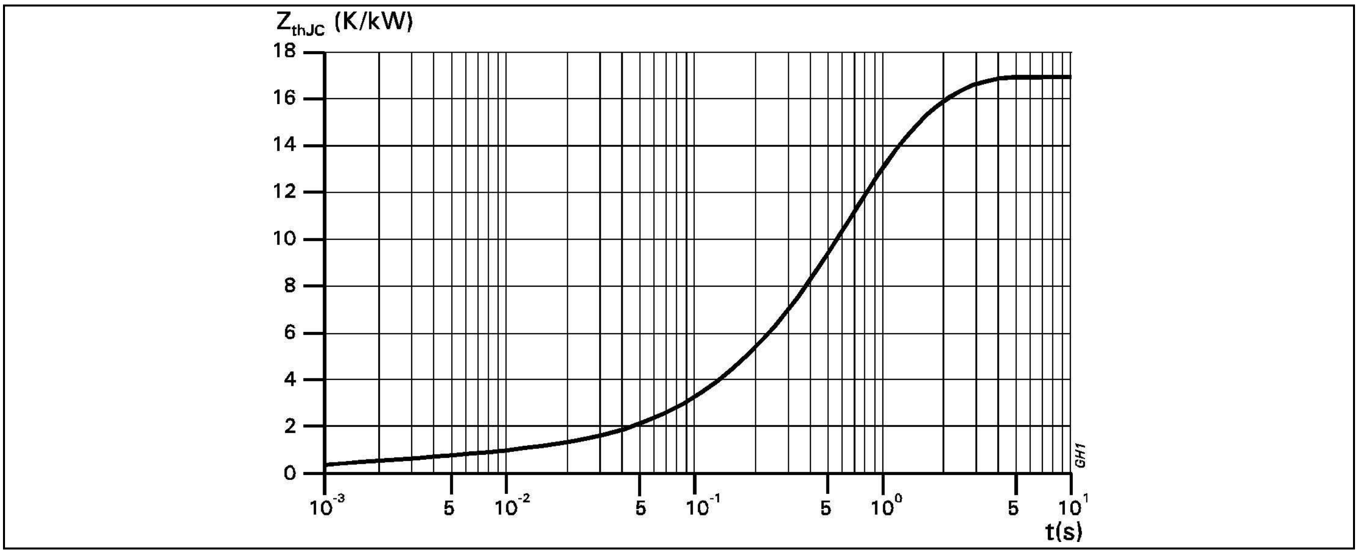

Fig. 1 Transient thermal impedance, junction to case.

CURVE

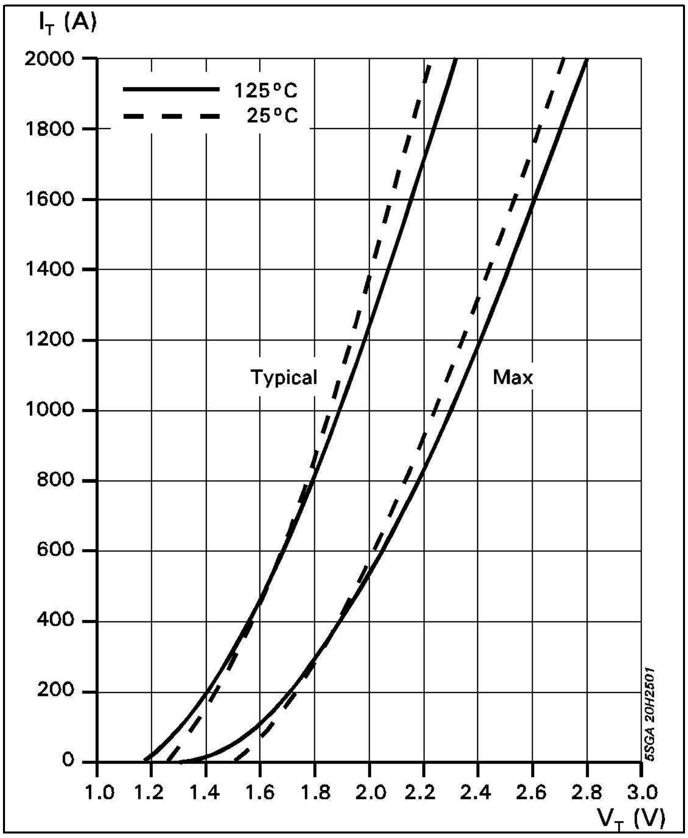

Fig. 2 On-state characteristics

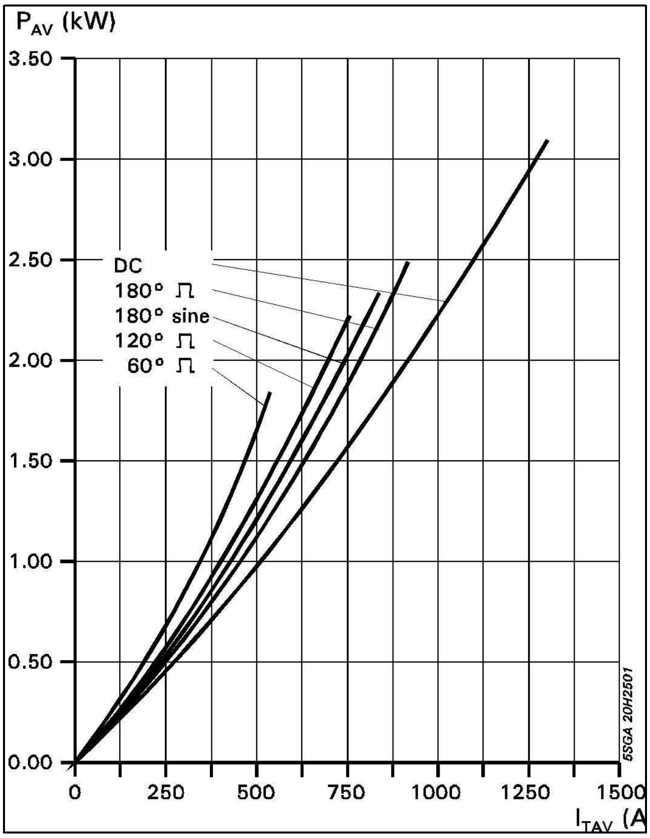

Fig. 3 Average on-state power dissipation vs. average on-state current.

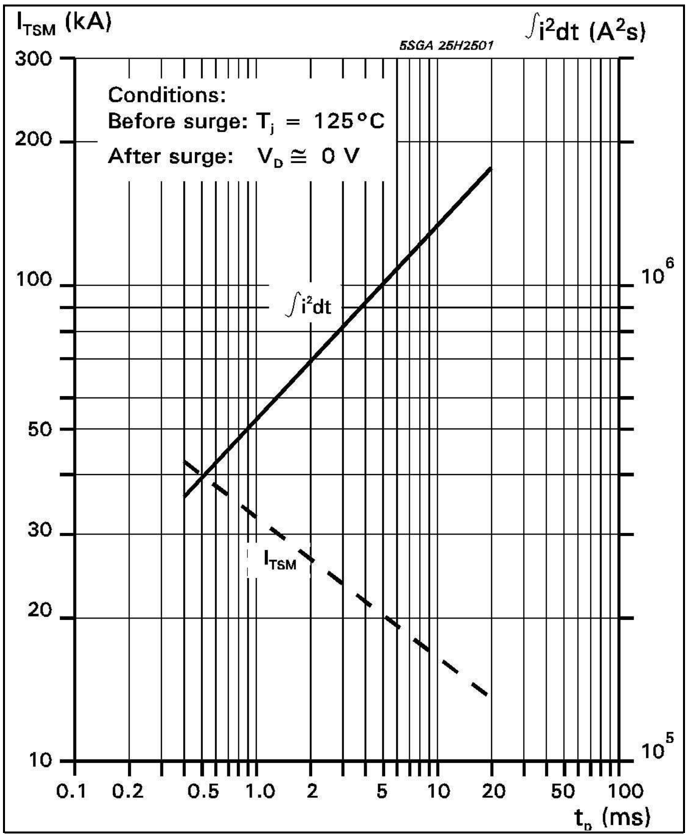

Fig. 4 Surge current and fusing integral vs. pulse width

CURVE

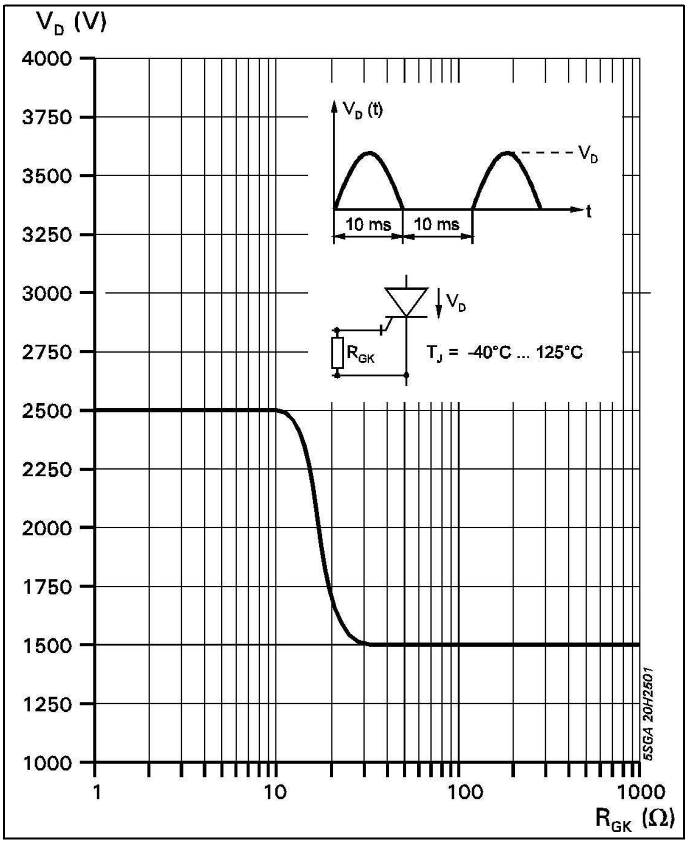

Fig. 5 Forward blocking voltage vs. gate-cathode resistance.

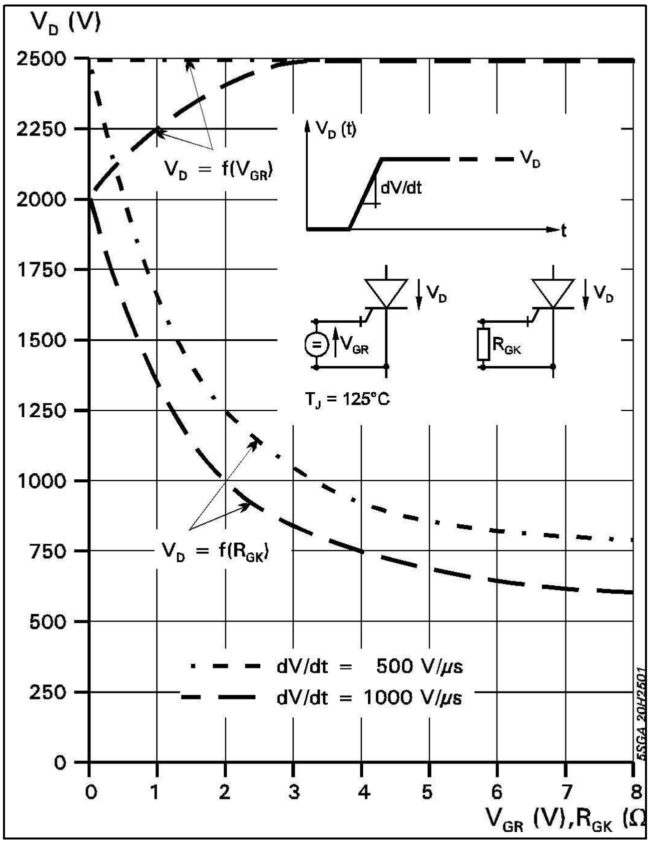

Fig. 6 Static dv/dt capability: Forward blocking voltage vs. neg. gate voltage or gate cathode resistance.

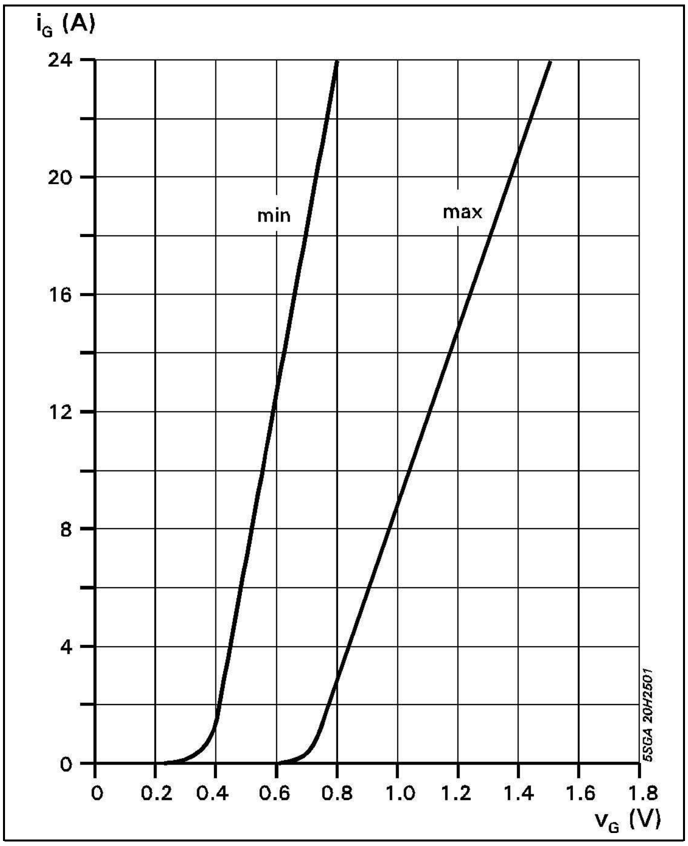

Fig. 7 Forwarde gate current vs. forard gate voltage.

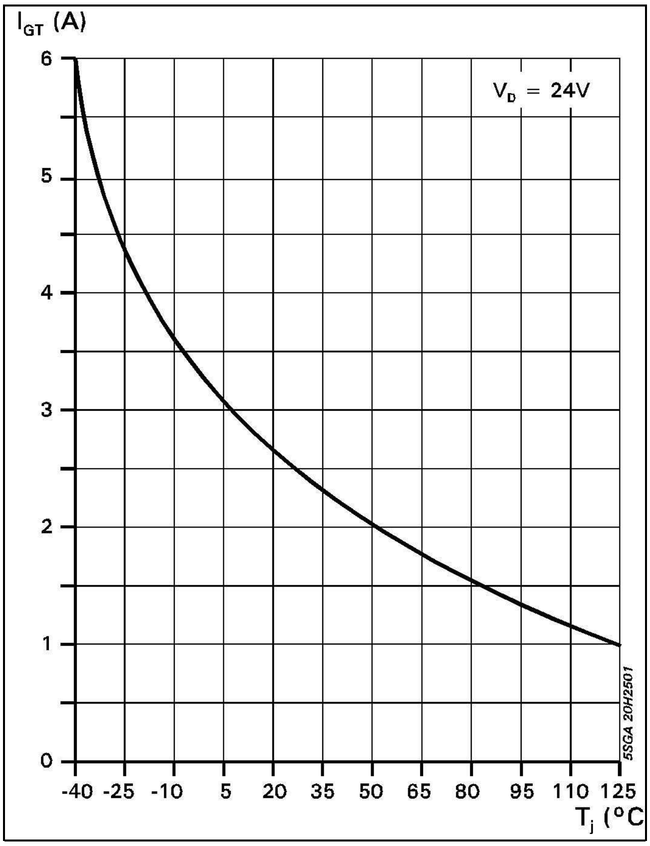

Fig. 8 Gate trigger current vs. junction temperature

CURVE

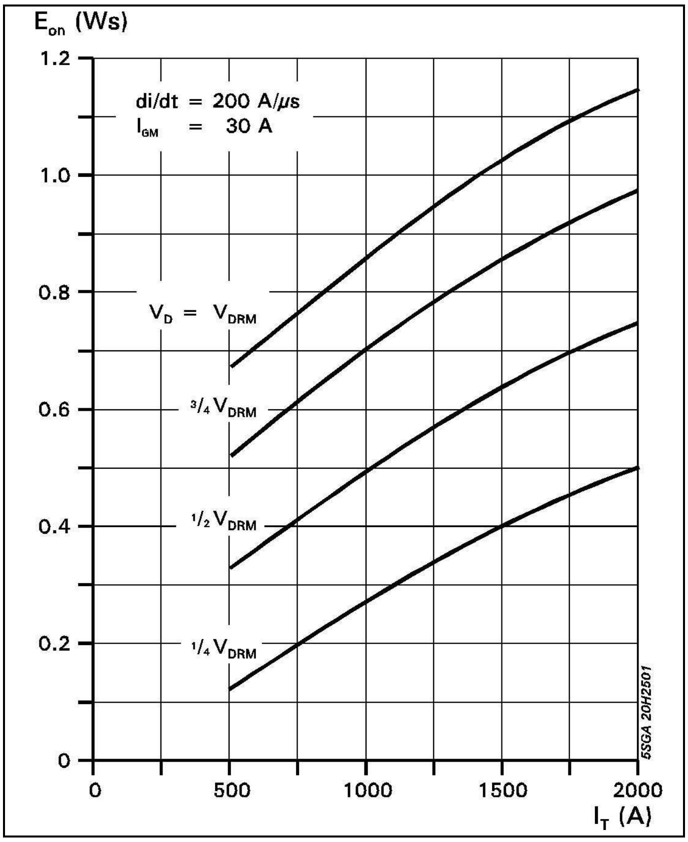

Fig. 9 Turn-on energy per pulse vs. on-state current and turn-on voltage.

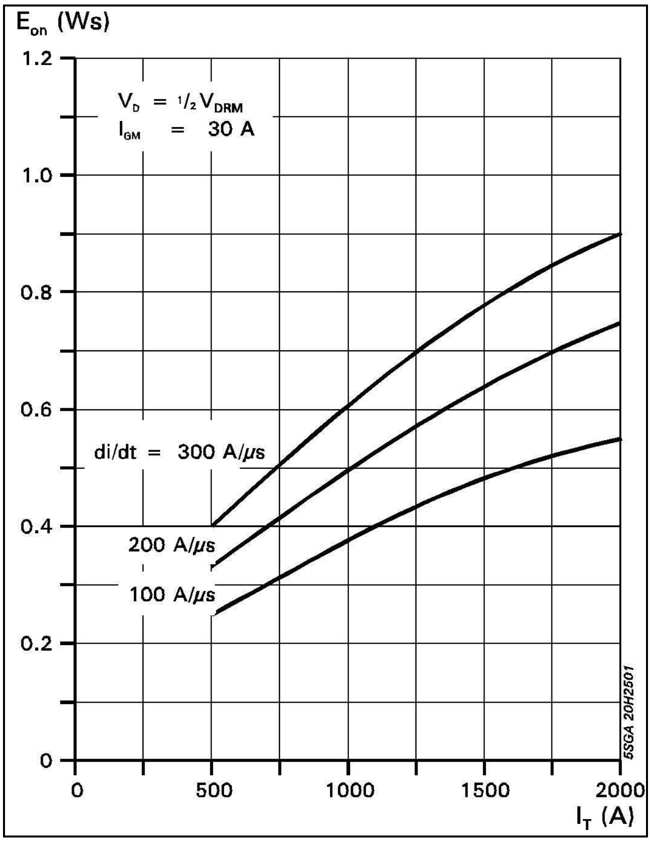

Fig. 10 Turn-on energy per pulse vs. on.-state current and current rise rate

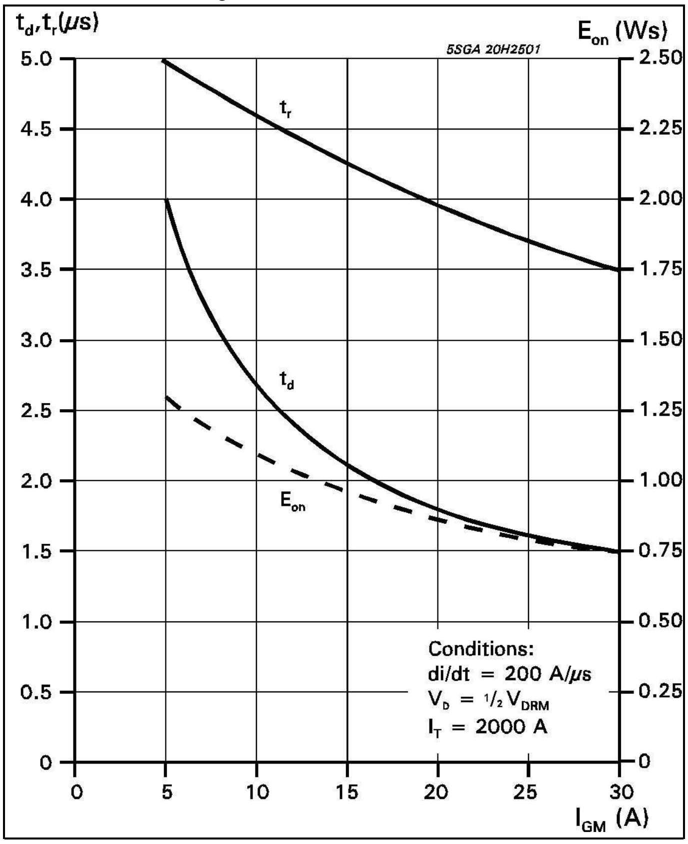

Fig. 11 Turn-on energy per pulse vs. on-state current and turn-on voltage.

Common Test conditions for figures 9, 10 and 11:

di_G/dt = 20 A/μs C_S = 4 μF

R_S = 5 ϕι

Tj = 125 °C

Definition of Turn-on energy:

$$E_{on} = \int_0^{20\,\mu s} V_D \bullet I_T dt \quad (t = 0, I_G = 0.1 \bullet I_{GM})$$

Common Test conditions for figures 12, 13 and 15:

Definition of Turn-off energy:

$$E_{off} = \int_0^{40\,\mu s} V_D \bullet I_T dt \quad (t = 0, I_T = 0.9 \bullet I_{TGQ})$$

CURVE

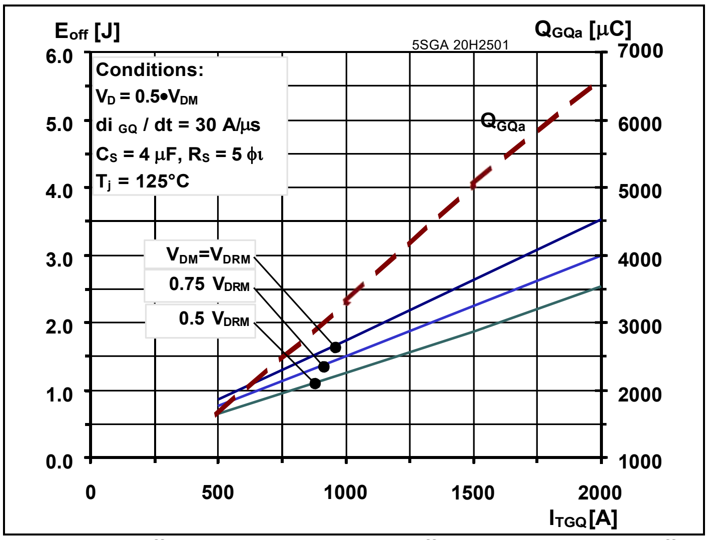

Fig. 12 Turn-off energy per pulse vs. turn-off current and peak turn-off voltage. Extracted gate charge vs. turn-off current.

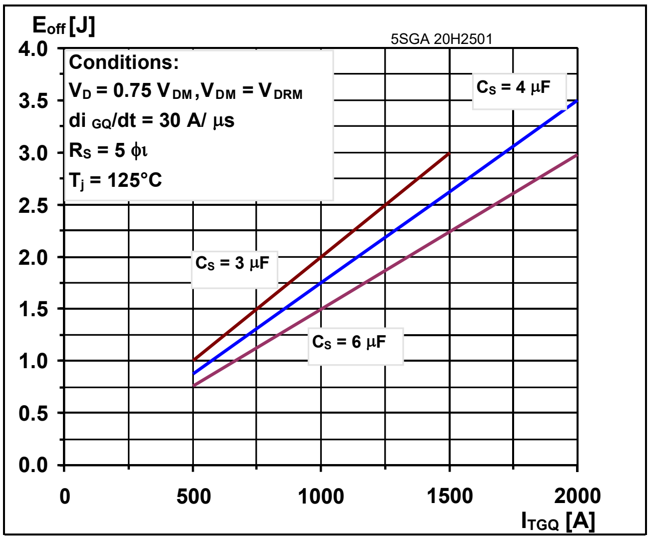

Fig. 13 Turn-off energy per pulse vs. turn-off current and snubber capacitance.

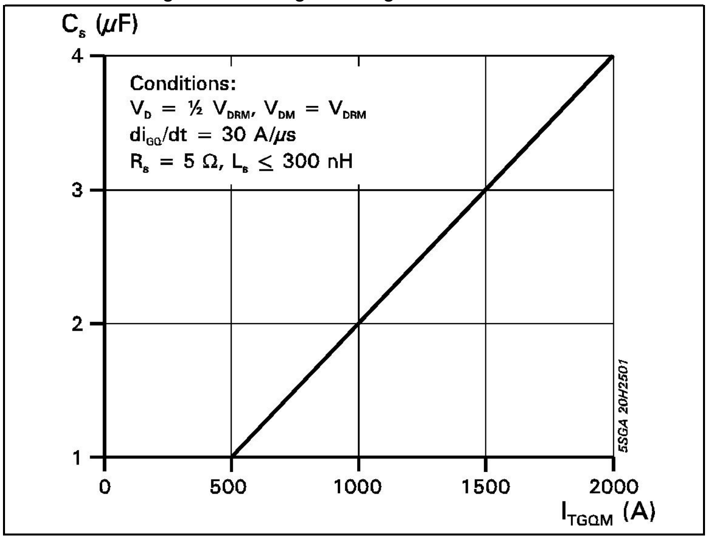

Fig. 14 Required snubber capacitor vs. max allowable turn-off current.

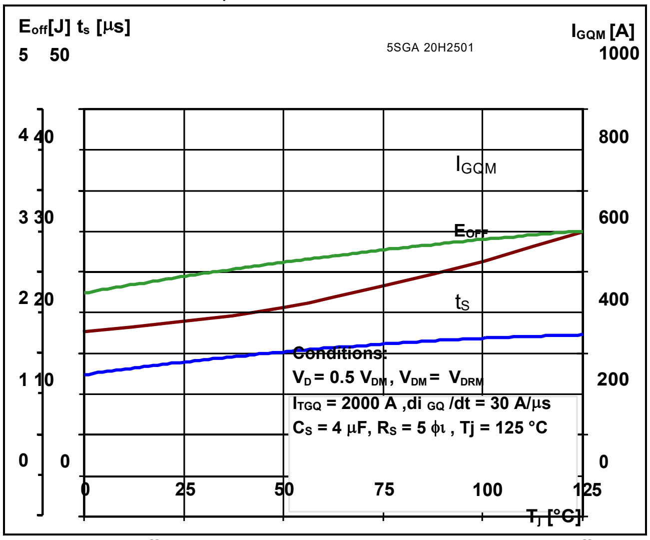

Fig. 15 Turn-off energy per pulse, storage time and peak turn-off gate current vs. junction temperature

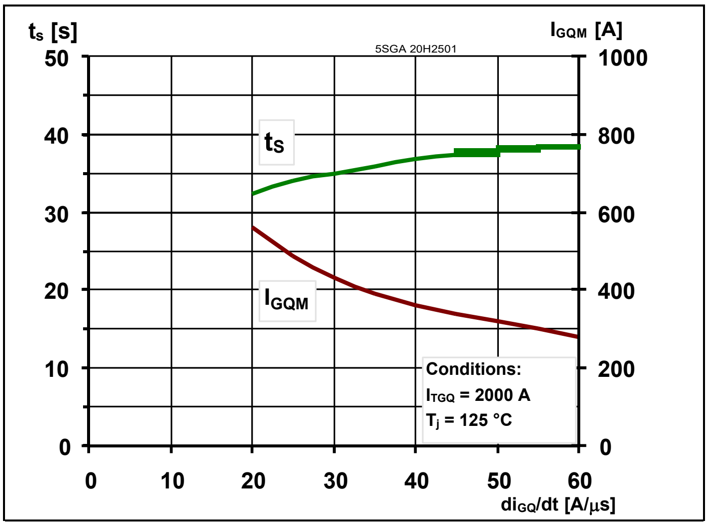

Fig. 16 Storage time and peak turn-off gate current vs. neg. gate current rise rate.

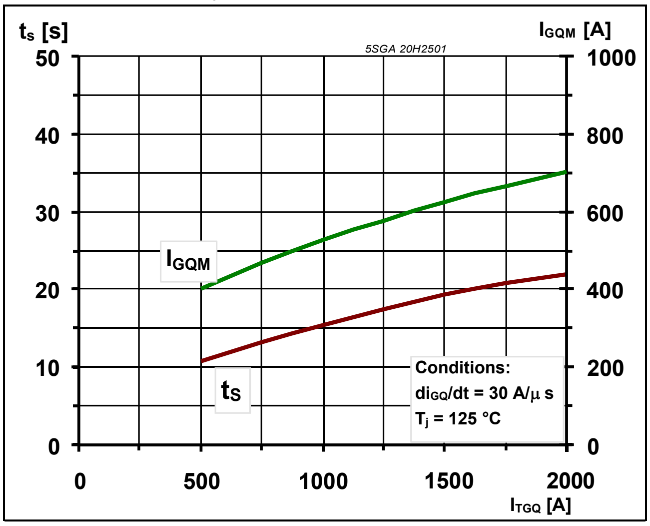

Fig. 17 Storage time and peak turn-off gate current vs. turn-off current

CURVE AND PACKAGE

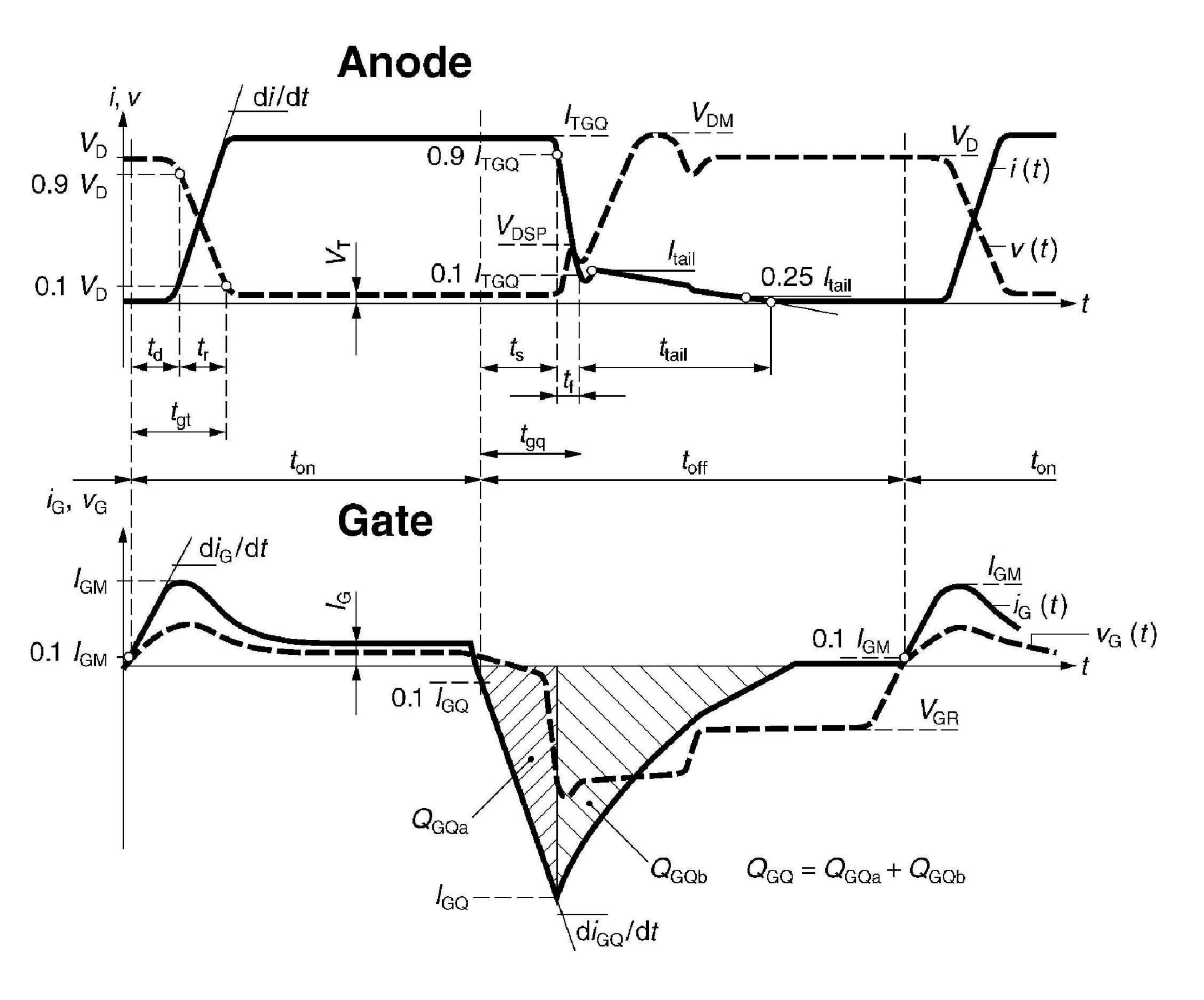

Fig. 18 General current and voltage waveforms with GTO-specific symbols

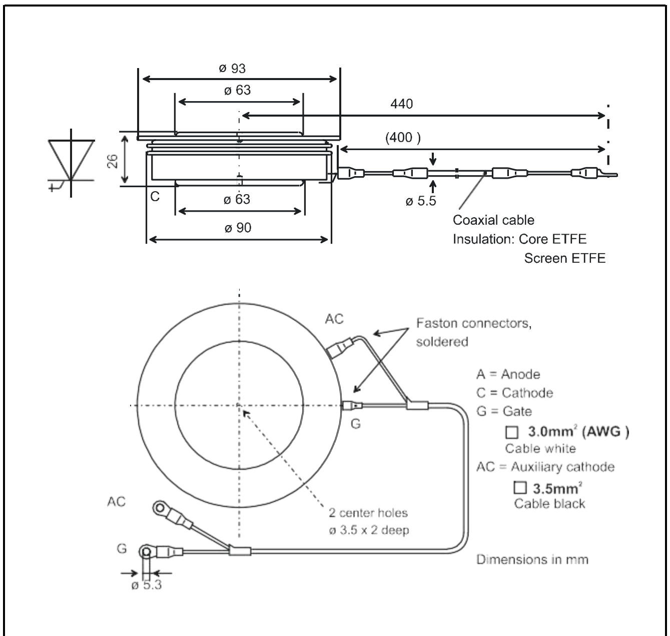

Fig. 19 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise

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 μs and 1000 A respectively. However, gate voltage must remain negative during this time. Recommendation : V_{GR} = 10… 15 V.