

$V_{DRM} = 4500 \text{ V}$
 $I_{TGQM} = 3000 \text{ A}$
 $I_{TSM} = 24 \times 10^3 \text{ A}$
 $V_{T0} = 2.2 \text{ V}$
 $r_T = 0.6 \text{ m}\Omega$
 $V_{Dclink} = 2800 \text{ V}$

Asymmetric Gate turn-off Thyristor

5SGA 30J4502

Doc. No. 5SYA1202-03 Jan. 03

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

Blocking

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Repetitive peak off-state voltage	V_{DRM}	$V_{GR} \geq 2 \text{ V}$			4500	V
Repetitive peak reverse voltage	V_{RRM}				17	V
Permanent DC voltage for 100 FIT failure rate	V_{Dclink}	Ambient cosmic radiation at sea level in open air.			2800	V

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Repetitive peak off-state current	I_{DRM}	$V_D = V_{DRM}, V_{GR} \geq 2 \text{ V}$			60	mA
Repetitive peak reverse current	I_{RRM}	$V_R = V_{RRM}, R_{GK} = \infty \Omega$			20	mA

Mechanical data

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_m		36	40	44	kN

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Pole-piece diameter	D_p	$\pm 0.1 \text{ mm}$		75		mm
Housing thickness	H	$\pm 0.5 \text{ mm}$		26		mm
Weight	m			1.3		kg
Surface creepage distance	D_s	Anode to Gate	33			mm
Air strike distance	D_a	Anode to Gate	15			mm

1) Maximum rated values indicate limits beyond which damage to the device may occur

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GTO Data

On-state A30J4502" 供应商

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. average on-state current	I_{TAVM}	Half sine wave, $T_C = 85^\circ\text{C}$			930	A
Max. RMS on-state current	I_{TRMS}				1460	A
Max. peak non-repetitive surge current	I_{TSM}	$t_p = 10\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, sine wave After Surge: $V_D = V_R = 0\text{ V}$			24×10^3	A
Limiting load integral	I^2t				2.88×10^6	A^2s
Max. peak non-repetitive surge current	I_{TSM}	$t_p = 1\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, sine wave After Surge: $V_D = V_R = 0\text{ V}$			40×10^3	A
Limiting load integral	I^2t				800×10^3	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	$I_T = 3000\text{ A}$, $T_{vj} = 125^\circ\text{C}$			4	V
Threshold voltage	$V_{(T0)}$	$T_{vj} = 125^\circ\text{C}$			2.2	V
Slope resistance	r_T	$I_T = 300 \dots 4000\text{ A}$			0.6	$\text{m}\Omega$
Holding current	I_H	$T_{vj} = 25^\circ\text{C}$			50	A

Turn-on switching

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Critical rate of rise of on-state current	di_T/dt_{cr}	$T_{vj} = 125^\circ\text{C}$, $f = 200\text{ Hz}$			400	$\text{A}/\mu\text{s}$
Critical rate of rise of on-state current	di_T/dt_{cr}	$I_T = 3000\text{ A}$, $I_{GM} = 30\text{ A}$, $di_G/dt = 20\text{ A}/\mu\text{s}$, $f = 1\text{ Hz}$			800	$\text{A}/\mu\text{s}$
Min. on-time	t_{on}		100			μs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Turn-on delay time	t_d	$V_D = 0.5 V_{DRM}$, $T_{vj} = 125^\circ\text{C}$			3	μs
Rise time	t_r	$I_T = 3000\text{ A}$, $di/dt = 200\text{ A}/\mu\text{s}$, $I_{GM} = 30\text{ A}$, $di_G/dt = 20\text{ A}/\mu\text{s}$, $C_S = 6\text{ }\mu\text{F}$			6	μs
Turn-on energy per pulse	E_{on}	μF , $R_S = 5\text{ }\Omega$			3.6	J

Turn-off switching

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. controllable turn-off current	I_{TGQM}	$V_{DM} \leq V_{DRM}$, $di_{GQ}/dt = 40\text{ A}/\mu\text{s}$, $C_S = 6\text{ }\mu\text{F}$, $L_S \leq 0.3\text{ }\mu\text{H}$			3000	A
Min. off-time	t_{off}		80			μs

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Storage time	t_s	$V_D = 0.5 V_{DRM}$, $T_{vj} = 125^\circ\text{C}$			25	μs
Fall time	t_f	$V_{DM} \leq V_{DRM}$, $di_{GQ}/dt = 40\text{ A}/\mu\text{s}$, $I_{TGQ} = I_{TGQM}$			3	μs
Turn-on energy per pulse	E_{off}	$R_S = 5\text{ }\Omega$, $C_S = 6\text{ }\mu\text{F}$, $L_S = 0.3\text{ }\mu\text{H}$			13	J
Peak turn-off gate current	I_{GQM}				900	A

Gate

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Maximum rated values

Parameter	Symbol	Conditions	min	typ	max	Unit
Repetitive peak reverse voltage	V_{GRM}				17	V
Repetitive peak reverse current	I_{GRM}	$V_{GR} = V_{GRM}$			20	mA

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Gate trigger voltage	V_{GT}	$T_{vj} = 25^{\circ}C,$		1		V
Gate trigger current	I_{GT}	$V_D = 24 V, R_A = 0.1 \Omega$		3		A

Thermal

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Junction operating temperature	T_{vj}		-40		125	$^{\circ}C$
Storage temperature range	T_{stg}		-40		125	$^{\circ}C$

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	$R_{th(jc)}$	Double side cooled			12	K/kW
	$R_{th(jc)A}$	Anode side cooled			22	K/kW
	$R_{th(jc)C}$	Cathode side cooled			27	K/kW
Thermal resistance case to heatsink (Double side cooled)	$R_{th(ch)}$	Single side cooled			6	K/kW
	$R_{th(ch)}$	Double side cooled			3	K/kW

Analytical function for transient thermal impedance:

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

i	1	2	3	4
$R_i(K/kW)$	5.400	4.500	1.700	0.400
$\tau_i(s)$	1.2000	0.1700	0.0100	0.0010

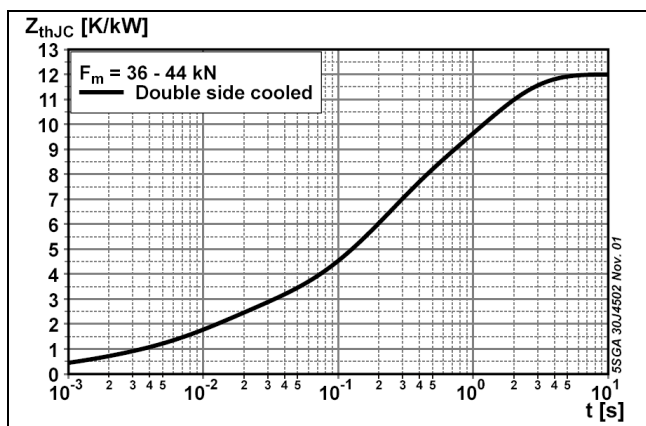


Fig. 1 Transient thermal impedance, junction to case.

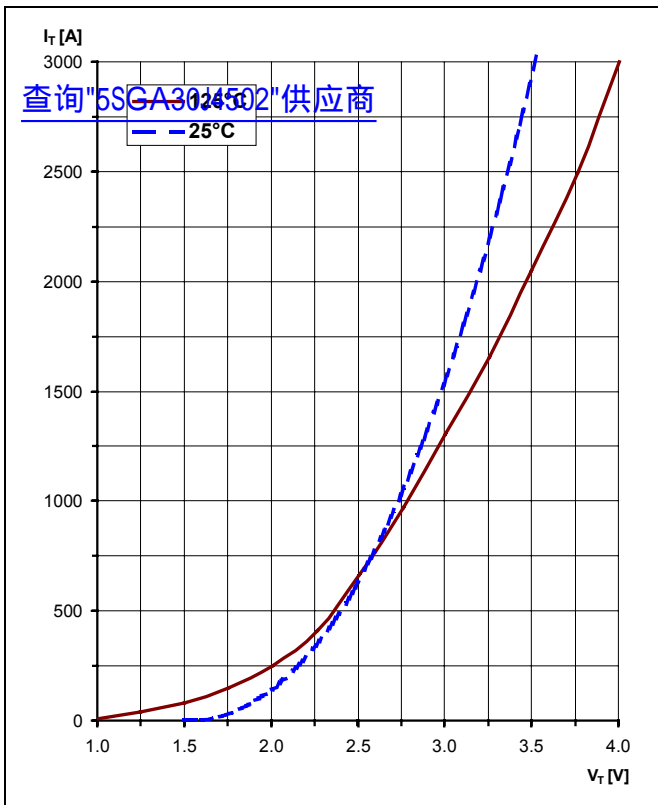


Fig. 2 On-state characteristics.

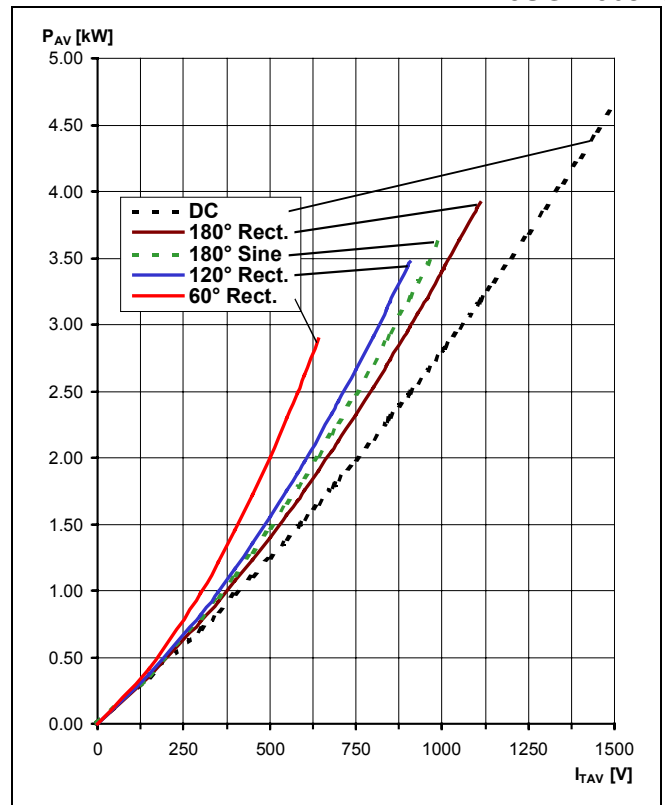


Fig. 3 Average on-state power dissipation vs. average on-state current..

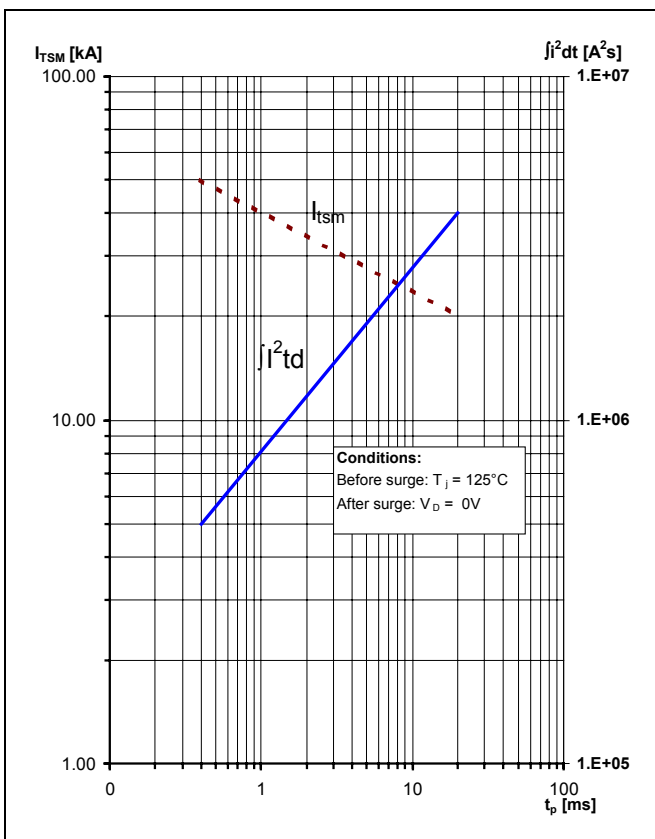


Fig. 4 Surge current and fusing integral vs. pulse width.

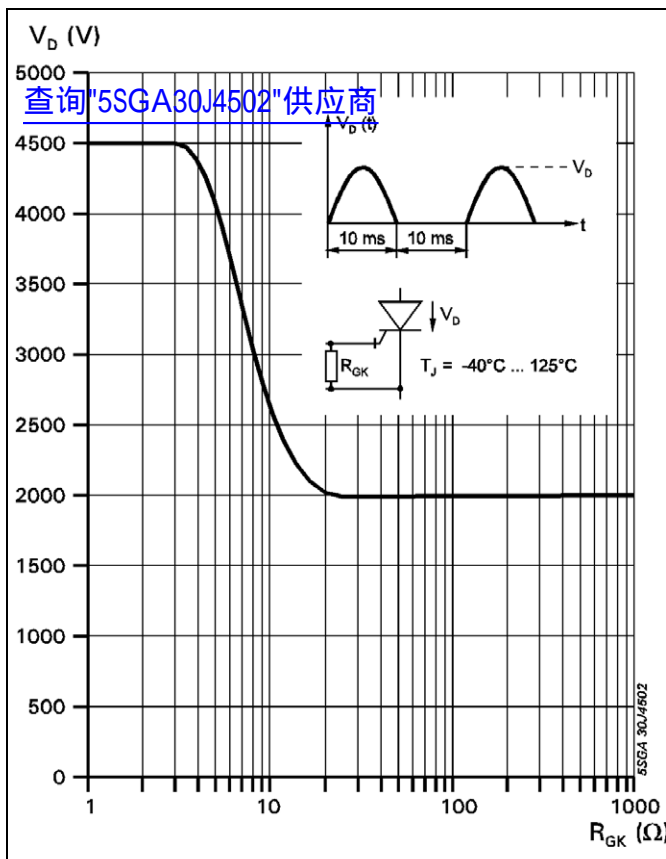


Fig. 5 Forward blocking voltage vs. gate-cathode resistance..

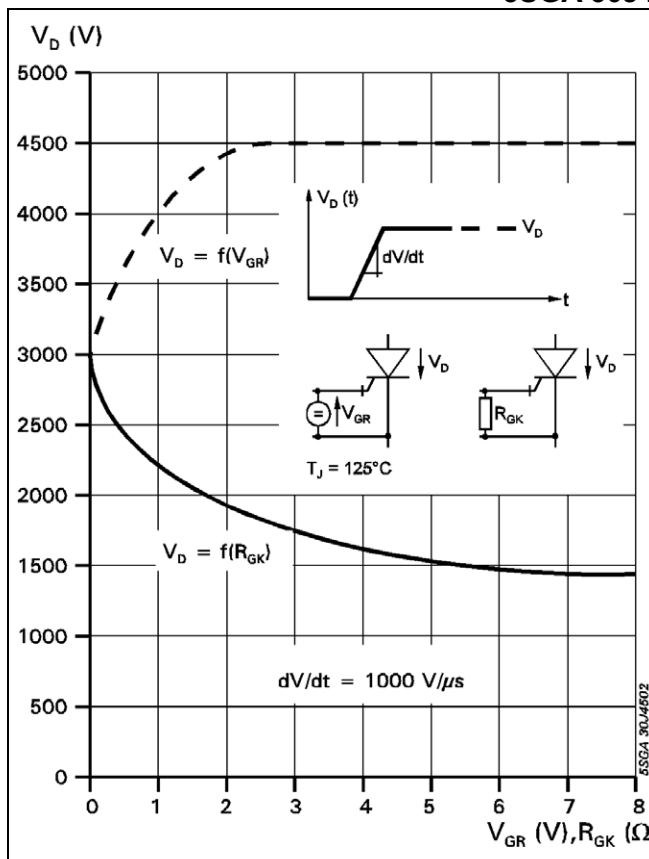


Fig. 6 Static dv/dt capability: Forward blocking voltage vs. neg. gate voltage or gate cathode resistance.

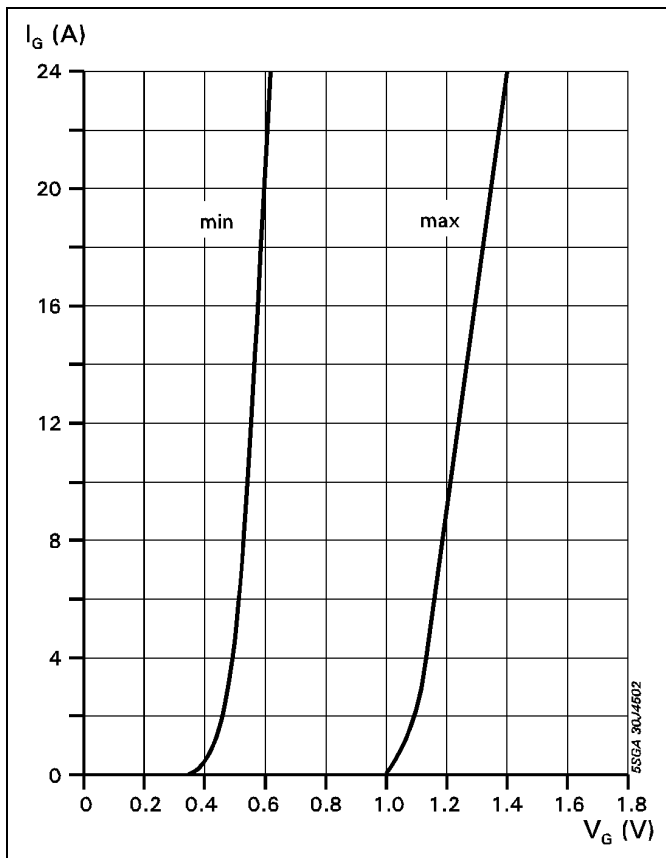


Fig. 7 Forward gate current vs. forward gate voltage.

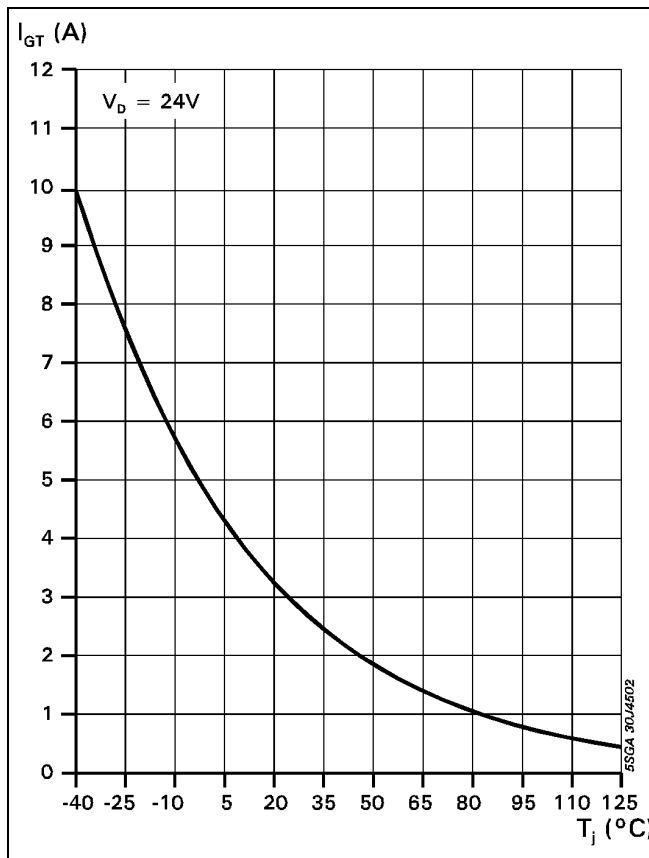


Fig. 8 Gate trigger current vs. junction temperature

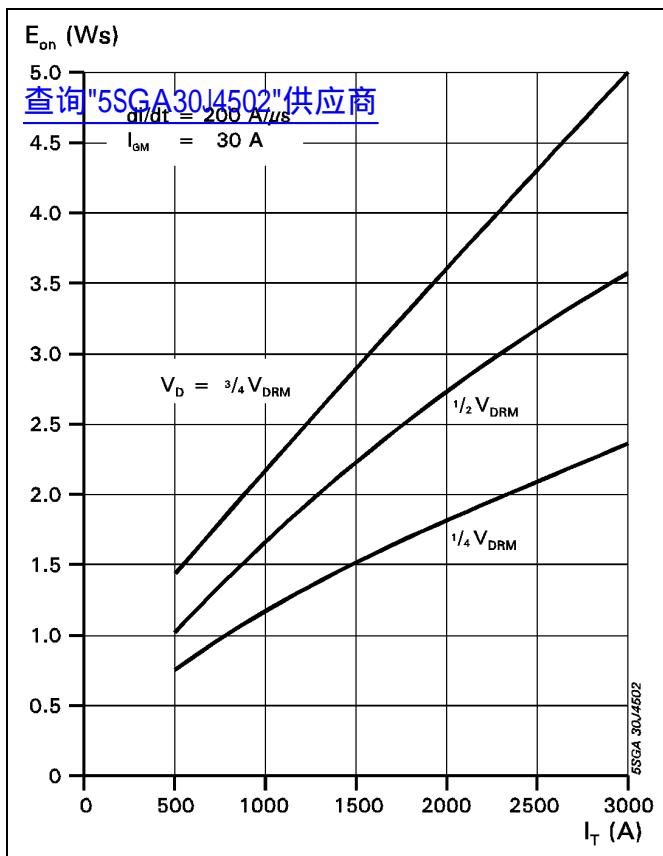


Fig. 9 Turn-on energy per pulse vs. on-state current and turn-on voltage.

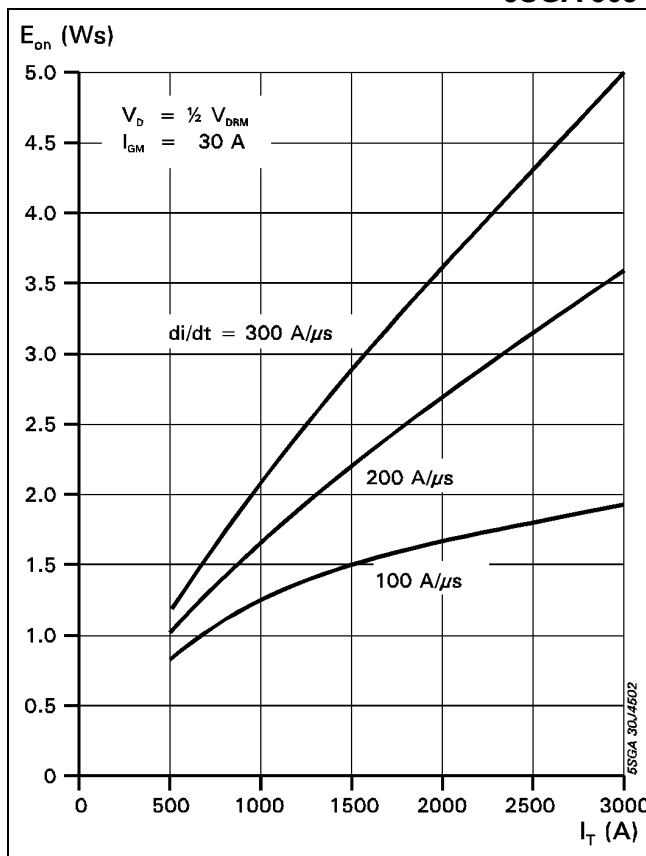


Fig. 10 Turn-on energy per pulse vs. on-state current and current rise rate

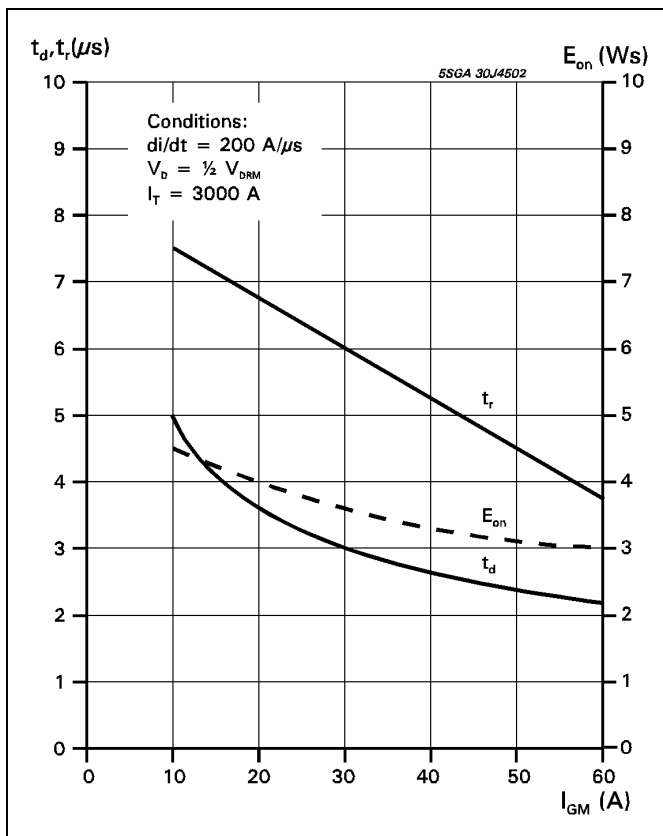


Fig. 11 Turn-on energy per pulse vs. on-state current and turn-on voltage.

Common Test conditions for figures 9, 10 and 11:

- $di_G/dt = 20 \text{ A}/\mu\text{s}$
- $C_S = 6 \mu\text{F}$
- $R_S = 5 \Omega$
- $T_j = 125 \text{ }^\circ\text{C}$

Definition of Turn-on energy:

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

Common Test conditions for figures 12, 13 and 15:

Definition of Turn-off energy:

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

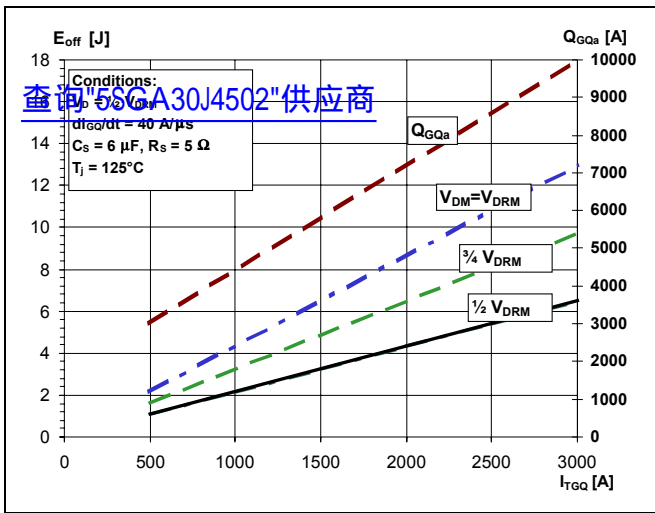


Fig. 12 Turn-off energy per pulse vs. turn-off current and peak turn-off voltage. Extracted gate charge vs. turn-off current.

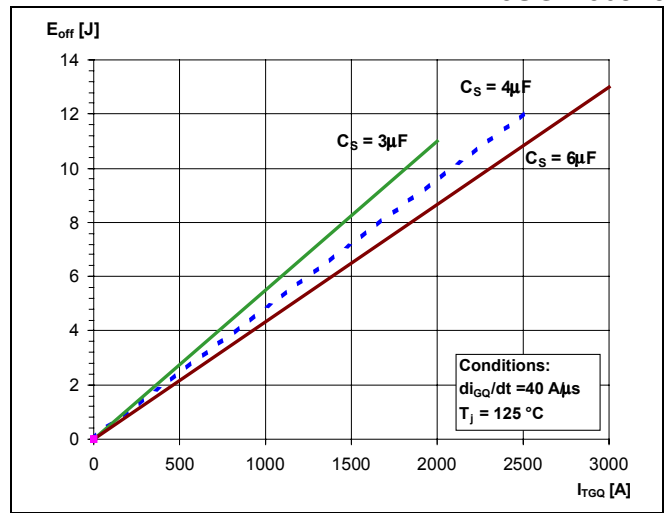


Fig. 13 Turn-off energy per pulse vs. turn-off current and snubber capacitance.

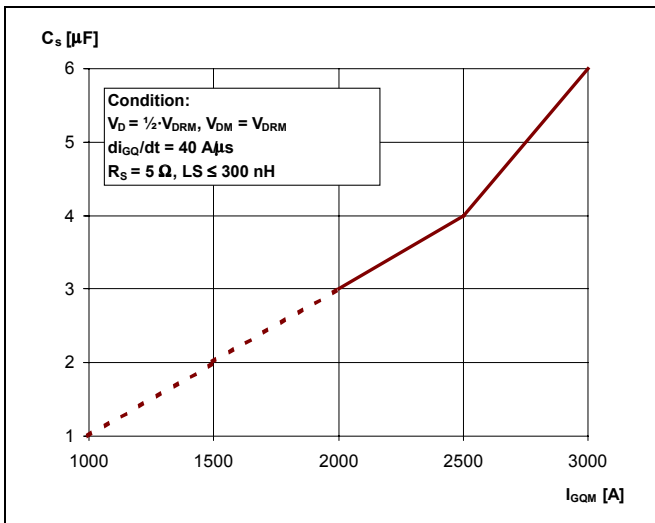


Fig. 14 Required snubber capacitor vs. max allowable turn-off current.

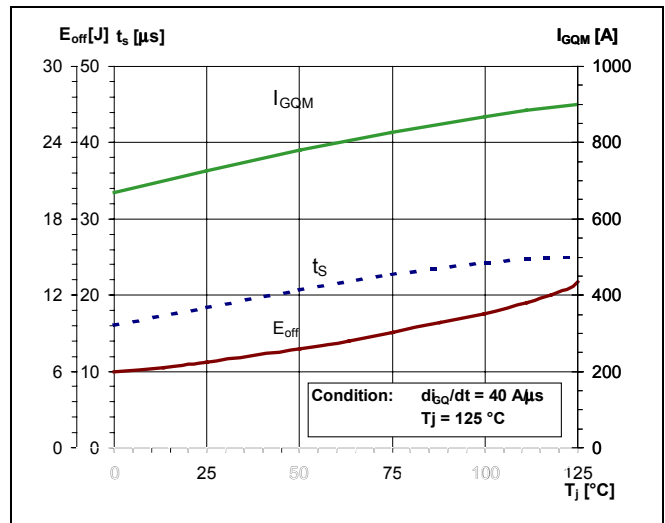


Fig. 15 Turn-off energy per pulse, storage time and peak turn-off gate current vs. junction temperature.

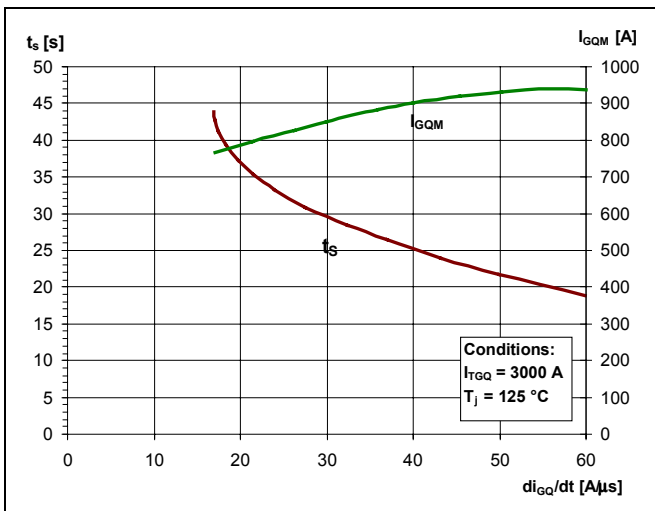


Fig. 16 Storage time and peak turn-off gate current vs. neg. gate current rise rate.

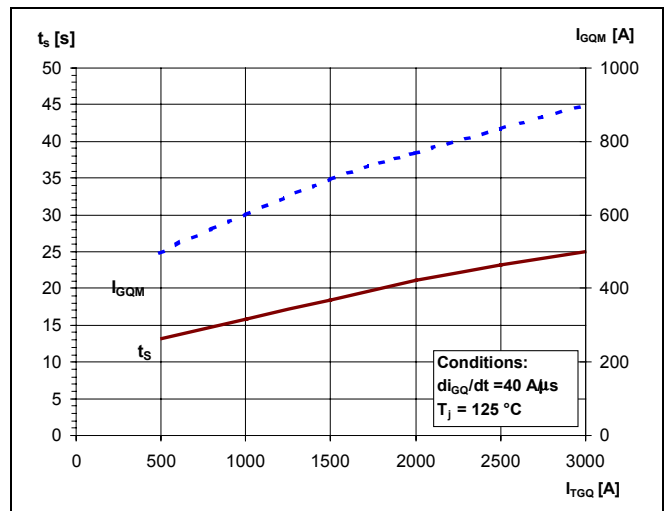


Fig. 17 Storage time and peak turn-off gate current vs. turn-off current.

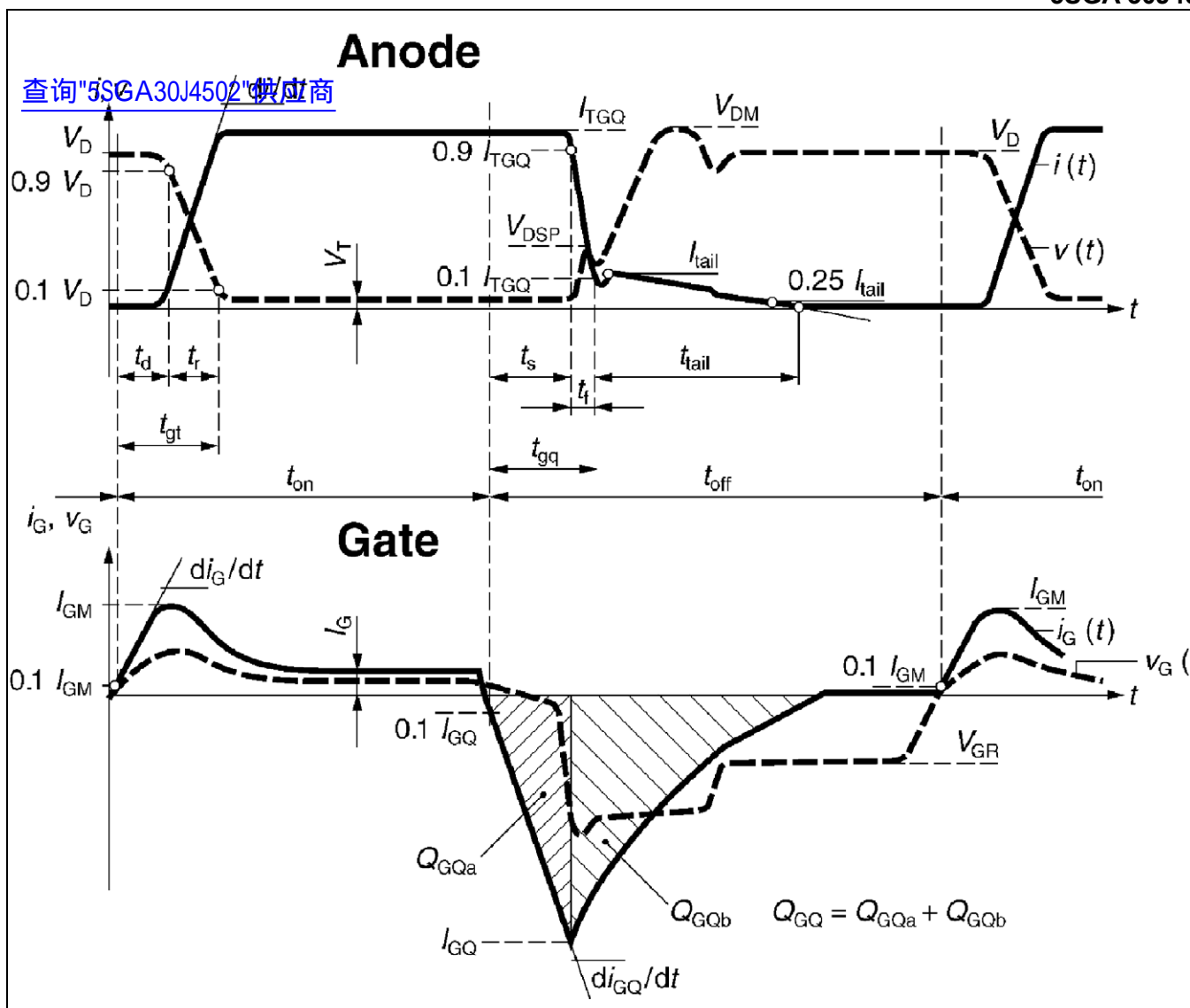


Fig. 18 General current and voltage waveforms with GTO-specific symbols.

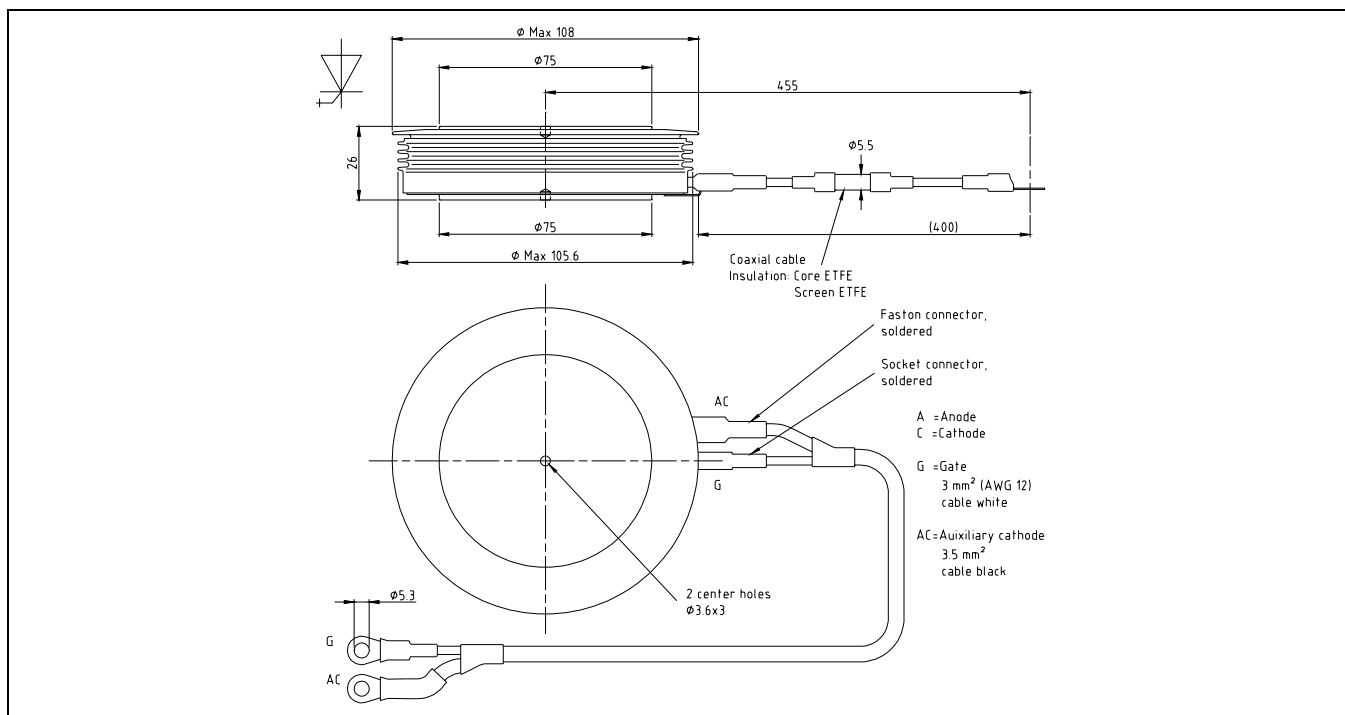


Fig. 19 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

Reverse avalanche capability

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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 : $V_{GR} = 10... 15 V$.

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Doc. No. 5SYA1202-03 Jan. 03

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