V_{DRM}	=	4500 V
I_{TGQM}	=	600 A
I_{TSM}	=	3×10^3 A
V_{T0}	=	1.9 V
r_T	=	3.5 mΩ
V_{Dclink}	=	2800 V

Asymmetric Gate turn-off Thyristor

5SGA 06D4502

PRELIMINARY

Doc. No. 5SYA1236-00 Jun. 04

- **Patented free-floating silicon technology**
- **Low on-state and switching losses**
- **Central 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}	$V_{GR} \geq 2$ 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}	$V_D = V_{DRM}$, $V_{GR} \geq 2$ V			20	mA
Repetitive peak reverse current	I_{RRM}	$V_R = V_{RRM}$, $R_{GK} = \infty\ \Omega$			50	mA

Mechanical data

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_m		10	11	12	kN

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Pole-piece diameter	D_p	± 0.1 mm		34		mm
Housing thickness	H			26		mm
Weight	m				0.25	kg
Surface creepage distance	D_s	Anode to Gate	30			mm
Air strike distance	D_a	Anode to Gate	20.5			mm

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

GTO Data

On-state

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. average on-state current	$I_{T(AV)M}$	Half sine wave, T_C = 85 °C			210	A
Max. RMS on-state current	$I_{T(RMS)}$				330	A
Max. peak non-repetitive surge current	I_{TSM}	t_p = 8.3 ms, T_{vj} = 125°C, sine wave After Surge: $V_D = V_R$ = 0 V			3.1×10^3	A
Limiting load integral	I^2t				40×10^3	A^2s
Max. peak non-repetitive surge current	I_{TSM}	t_p = 10 ms, T_{vj} = 125°C, sine wave After Surge: $V_D = V_R$ = 0 V			3×10^3	A
Limiting load integral	I^2t				45×10^3	A^2s
Max. peak non-repetitive surge current	I_{TSM}	t_p = 1 ms, T_{vj} = 125°C, sine wave After Surge: $V_D = V_R$ = 0 V			6×10^3	A
Limiting load integral	I^2t				18×10^3	A^2s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_T	I_T = 600 A, T_{vj} = 125°C			4	V
Threshold voltage	$V_{(T0)}$	T_{vj} = 125°C I_T = 200...600 A			1.9	V
Slope resistance	r_T				3.5	mΩ
Holding current	I_H	T_{vj} = 25°C			20	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°C, I_T = 600 A, I_{GM} = 20 A, di_G/dt = 20 A/µs	f = 200 Hz			400	A/µs
Critical rate of rise of on-state current	di_T/dt_{cr}		f = 1 Hz			600	A/µs
Min. on-time	t_{on}			80			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 °C I_T = 600 A, di/dt = 200 A/µs, I_{GM} = 20 A, di_G/dt = 20 A/µs, C_S = 1 µF, R_S = 10 Ω			1.5	µs
Rise time	t_r				3	µs
Turn-on energy per pulse	E_{on}				0.8	J

Turn-off switching

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. controllable turn-off current	I_{TGQM}	$V_{DM} \le V_{DRM}$, V_D = 0.5 V_{DRM} di_{GQ}/dt = 20 A/µs, C_S = 1 µF, $L_S \le$ 0.15 µH, RCD Snubber			600	A
Spike Voltage	V_{DSP}				≤ 650	V
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 °C $V_{DM} \le V_{DRM}$, di_{GQ}/dt = 20 A/µs, $I_{TGQ} = I_{TGQM}$, R_S = 10 Ω, C_S = 1 µF, L_S = 0.15 µH RCD Snubber			15	µs
Fall time	t_f				5	µs
Turn-on energy per pulse	E_{off}				1.9	J
Peak turn-off gate current	I_{GQM}				300	A

Gate

Maximum rated values [1)]

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°C, V_D = 24 V, R_A = 0.1 Ω		1		V
Gate trigger current	I_{GT}			2		A

Thermal

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	typ	max	Unit
Junction operating temperature	T_{vj}		0		125	°C
Storage temperature range	T_{stg}		0		125	°C

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	$R_{th(jc)}$	Double side cooled			50	K/kW
	$R_{th(jc)A}$	Anode side cooled			85	K/kW
	$R_{th(jc)C}$	Cathode side cooled			122	K/kW
Thermal resistance case to heatsink (Double side cooled)	$R_{th(ch)}$	Single side cooled			16	K/kW
	$R_{th(ch)}$	Double side cooled			8	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)	15.000	5.200	7.500	0.100
τ_i(s)	0.4610	0.0950	0.0120	0.0010

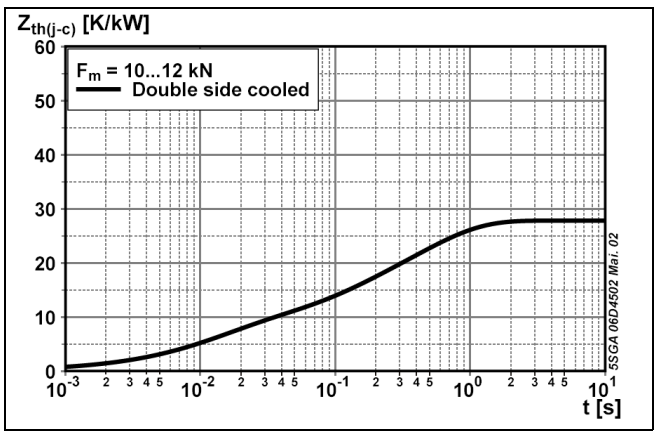

Fig. 1 Transient thermal impedance, junction to case.

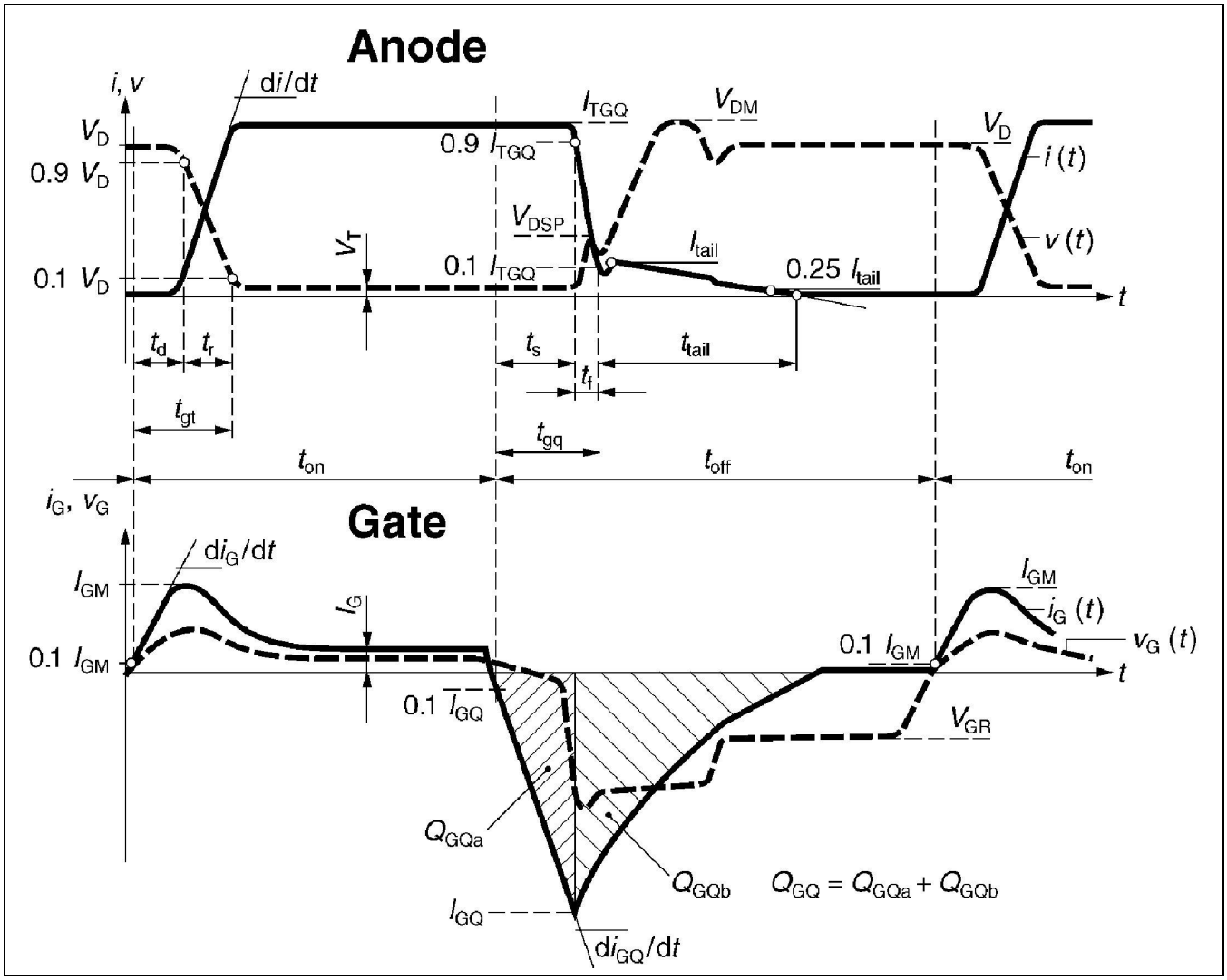

Fig. 2 General current and voltage waveforms with GTO-specific symbols.

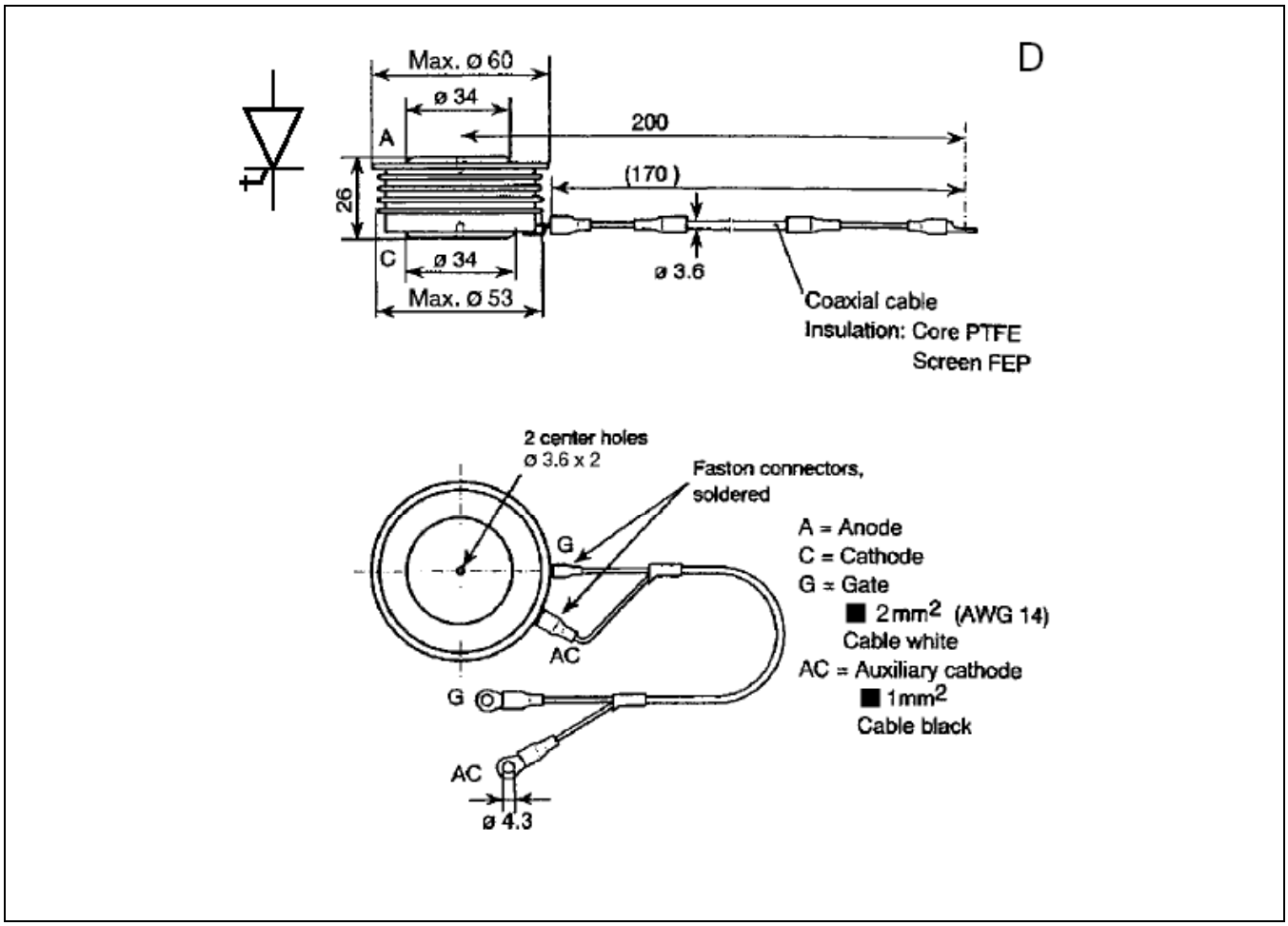

Fig. 3 Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

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.

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