JIANGSU YANGJIE RUNAU SEMICONDUCTOR CO.,LTD

CSG15F2500

Gate Turn-off Thyristor

FEATURES

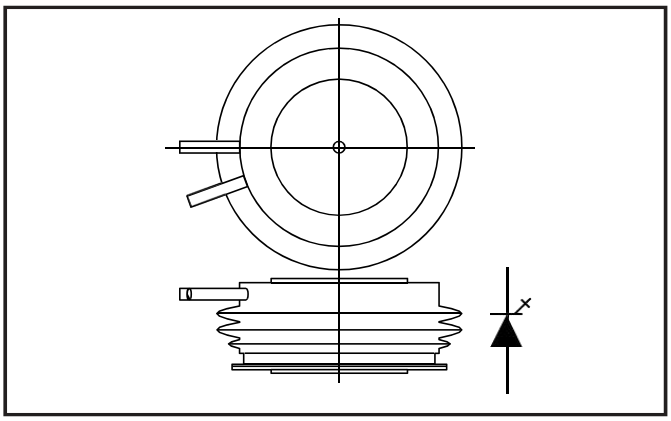
- Double side cooling
- High reliability
- High voltage property
- Fault protection without fast fuse
- Large surge current resistance
- Excellent switching performance

KEY PARAMETERS

I_{TGQM}	1500A
V_{DRM}	2500V
$I_{T(AV)}$	570A
di_T/dt	400A/μs

APPLICATION

- Variable speed AC motor drive inverter (VSD-AC)
- UPS
- High voltage converter
- Chopper
- Welder
- DC-DC converter



Outline type code: F.
See Package Details for further information.

VOLTAGE RATINGS

MODE	Off-state Repetitive Peak Voltage V_{DRM} V	Reverse Repetitive Peak Voltage V_{RRM} V	TEST CONDITION
CSG15F2500	2500	17	$V_R = V_{RRM}$, $R_{GK} = \infty\ \Omega$

CURRENT RATINGS

SYMBOL	PARAMETER	TEST CONDITION	Max.	UNIT
I_{TGQM}	Repetitive peak controllable on-state current	$V_{DM} \le V_{DRM}$, di_{GQ}/dt = 30 A/μs, C_S = 3 μF, $L_S \le$ 0.3 μH	1500	A
$I_{T(AV)}$	Mean on-state current	T_{HS} = 80°C. Double side cooled, half sine 50Hz	570	A
$I_{T(RMS)}$	RMS on-state current	T_{HS} = 80°C. Double side cooled, half sine 50Hz	900	A

SURGE RATINGS

SYMBOL	PARAMETER	TEST CONDITION	Max.	UNIT
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine. T = 125°C	10	kA
I^2t	I^2t for fusing	10ms half sine. T =125°C	500 x 10^3	A^2s
di_T/dt	Critical rate of rise of on-state current	I_T= 1500A, T_j= 125°C,di_G/dt = 20 A/μs	400	A/μs
L_S	Peak stray inductance in snubber circuit	I_T = 3000A, V_D = V_{DRM},-T_j = 125°C, $dI/_{GQ}$ = 40A/μs, Cs = 3.0μF	200	nH

GATE RATINGS

SYMBOL	PARAMETER	TEST CONDITION	Min.	Max.	UNIT
V_{RGM}	Peak reverse gate voltage	This value maybe exceeded during turn-off	-	17	V
I_{RGM}	Repetitive peak reverse current		-	20	mA
V_{GT}	Gate trigger voltage		-	1.5	V
I_{GT}	Gate trigger current		-	1.5	A
$t_{ON(min)}$	Minimum permissable on time		80	-	μs
$t_{OFF(min)}$	Minimum permissable off time		80	-	μs

THERMAL & MECHANICAL RATINGS

SYMBOL	PARAMETER	TEST CONDITION		Min.	Max.	UNIT
$R_{th(j-c)}$	DC thermal resistance - junction to case	Double side cooled		-	0.027	°C/W
		Anode side cooled		-	0.049	°C/W
		Cathode side cooled		-	0.06	°C/W
$R_{th(c-hs)}$	Contact thermal resistance	Clamping force 40.0kN With mounting compound	per contact	-	0.016	°C/W
T_{vj}	Virtual junction temperature			-40	125	°C
T_{OP}/T_{stg}	Operating junction/storage temperature range			-40	125	°C
-	Clamping force			14.0	16.0	kN

GTO CHARACTERISTICS

T_j = 125 °C unless stated otherwise

SYMBOL	PARAMETER	TEST CONDITION	Min.	Max.	UNIT
V_{TM}	On-state voltage	I_T = 1500 A, T_j = 125°C	-	2.8	V
I_{DM}	Peak off-state current	V_{DRM} = 2500V, V_{RG} = 2V	-	100	mA
I_{RRM}	Peak reverse current	At V_{RRM}	-	50	mA
V_{GT}	Gate trigger voltage	V_D = 24V, T_j = 25 °C	-	1.5	V
I_{GT}	Gate trigger current	V_D = 24V, T_j = 25 °C	-	1.5	A
I_{RGM}	Reverse gate cathode current	V_{RGM} = 17V, No gate/cathode resistor	-	20	mA
E_{ON}	Turn-on energy	V_D = 0.5V_{DRM}	-	500	mJ
t_d	Delay time	I_T =1500A, dI_T/dt = 100A/μs	-	2.0	μs
t_r	Rise time	I_{GM} = 30A,	-	4.0	μs
E_{OFF}	Turn-off energy		-	2000	mJ
t_{gs}	Storage time		-	15.0	μs
t_{gf}	Fall time	I_T = 1500A, V_{DM} = V_{DRM}	-	2.0	μs
t_{gq}	Gate controlled turn-off time	Snubber Cap Cs = 3μF,	-	27.5	μs
I_{GQM}	Peak reverse gate current	di_{GQ}/dt = 30A/μs	-	480	A

Analytical function for transient thermal impedance:

$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_i(1 - e^{-t/t_i})$$

i	1	2	3	4
R_i(K/kW)	14.570	5.051	7.285	0.097
τ_i(s)	0.4610	0.0950	0.0120	0.0010

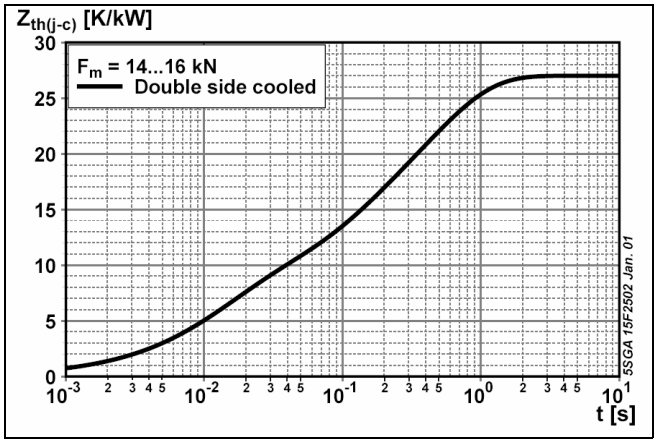


Fig. 1 Transient thermal impedance, junction to case

Max. on-state characteristic model:

$$V_{T25} = A_{Tvj} + B_{Tvj} \cdot I_T + C_{Tvj} \cdot \ln(I_T + 1) + D_{Tvj} \cdot \sqrt{I_T}$$

Valid for i_T = 300 – 2000 A

A_{25}	B_{25}	C_{25}	D_{25}
178.9×10^{-3}	816.7×10^{-6}	356.4×10^{-3}	-41.7×10^{-3}

Max. on-state characteristic model:

$$V_{T125} = A_{Tvj} + B_{Tvj} \cdot I_T + C_{Tvj} \cdot \ln(I_T + 1) + D_{Tvj} \cdot \sqrt{I_T}$$

Valid for i_T = 300 – 2000 A

A_{125}	B_{125}	C_{125}	D_{125}
11.7×10^{-3}	630.8×10^{-6}	340.2×10^{-3}	-22.0×10^{-3}

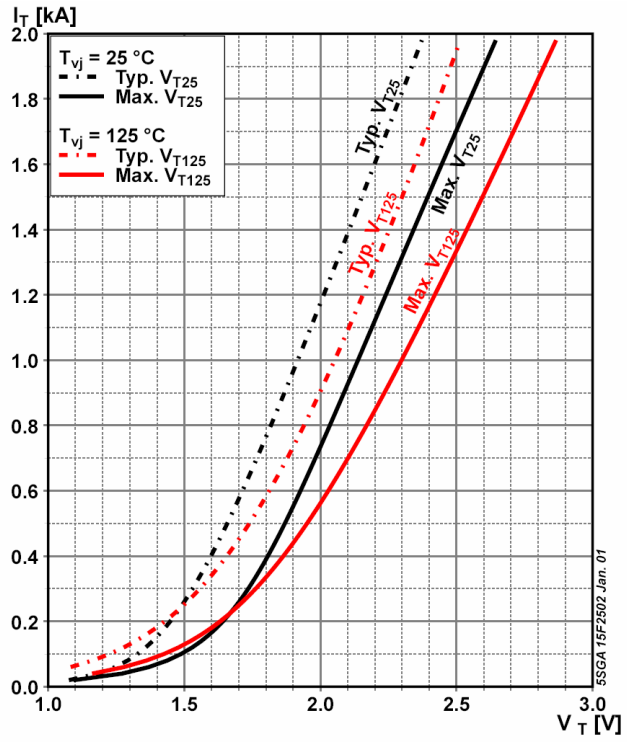


Fig. 2 On-state characteristics

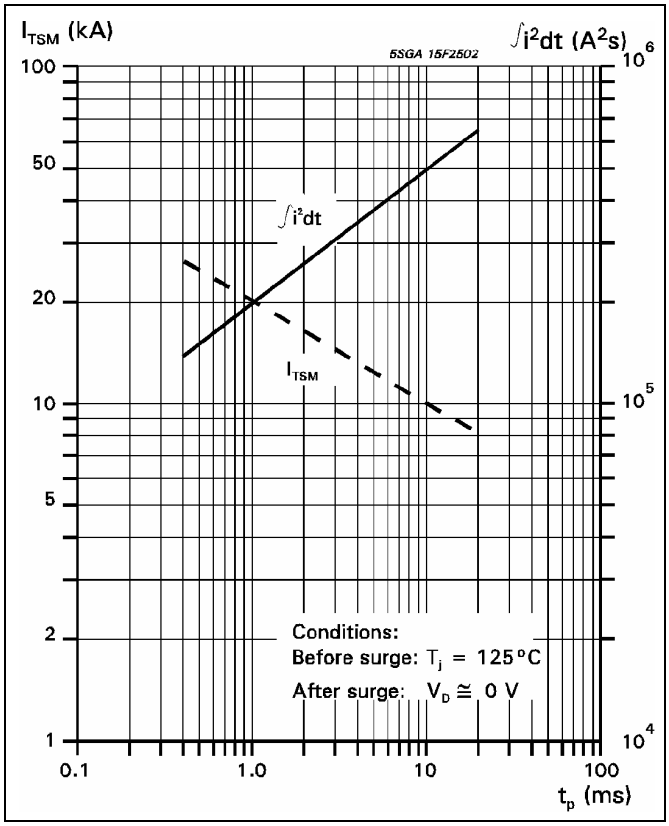


Fig. 3 Surge current and fusing integral vs. pulse width

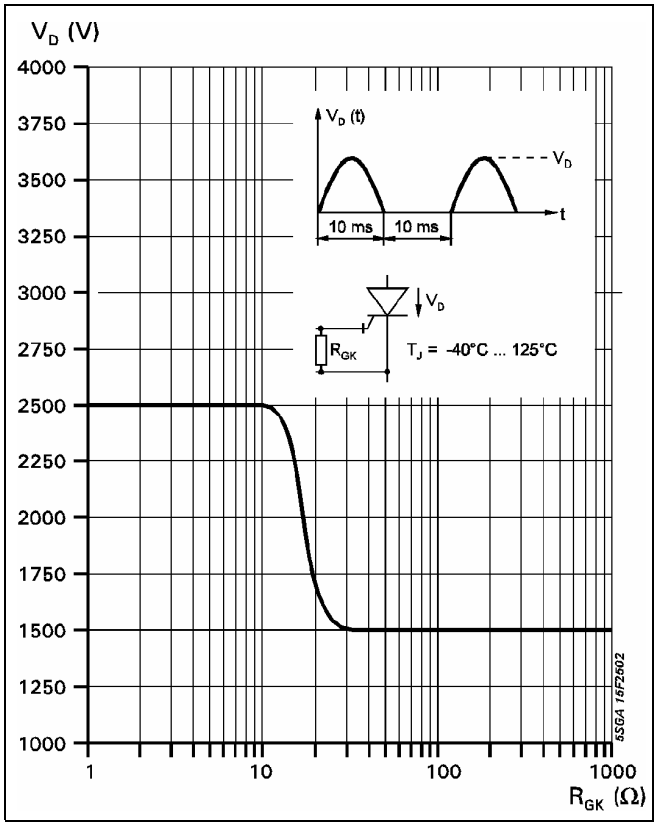


Fig. 4 Forward blocking voltage vs. gate-cathode resistance

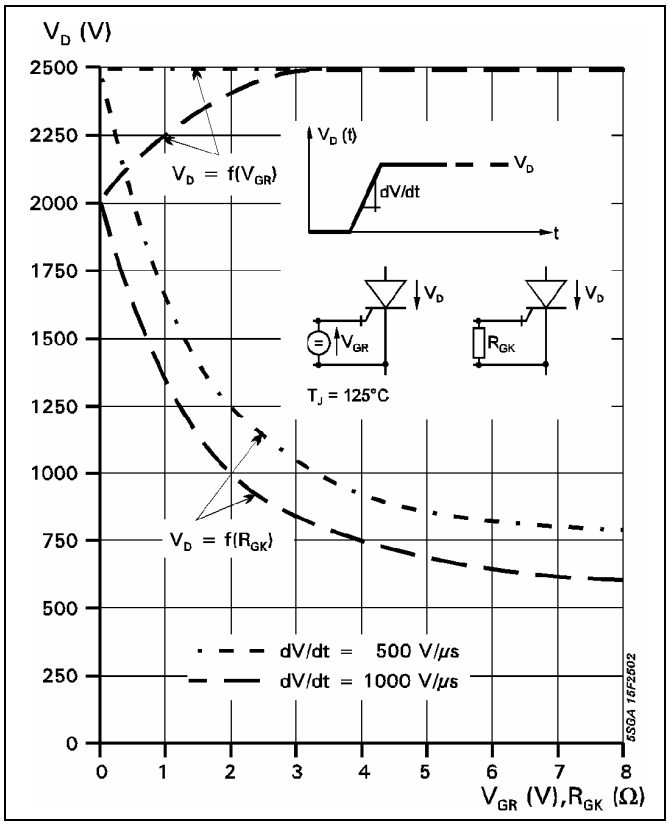


Fig. 5 Static dv/dt capability; forward blocking voltage vs. neg. gate voltage or gate cathode resistance

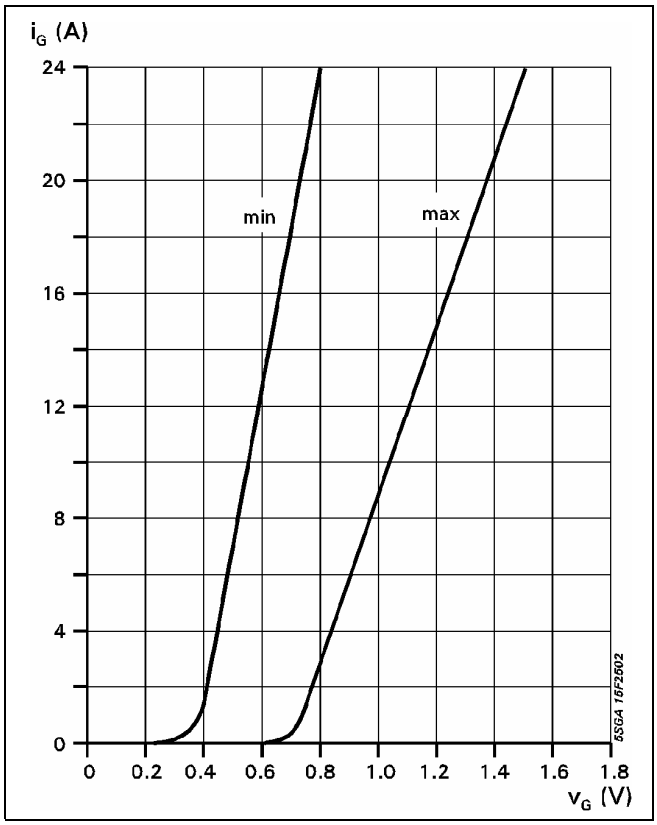


Fig. 6 Forward gate current vs. forward gate voltage

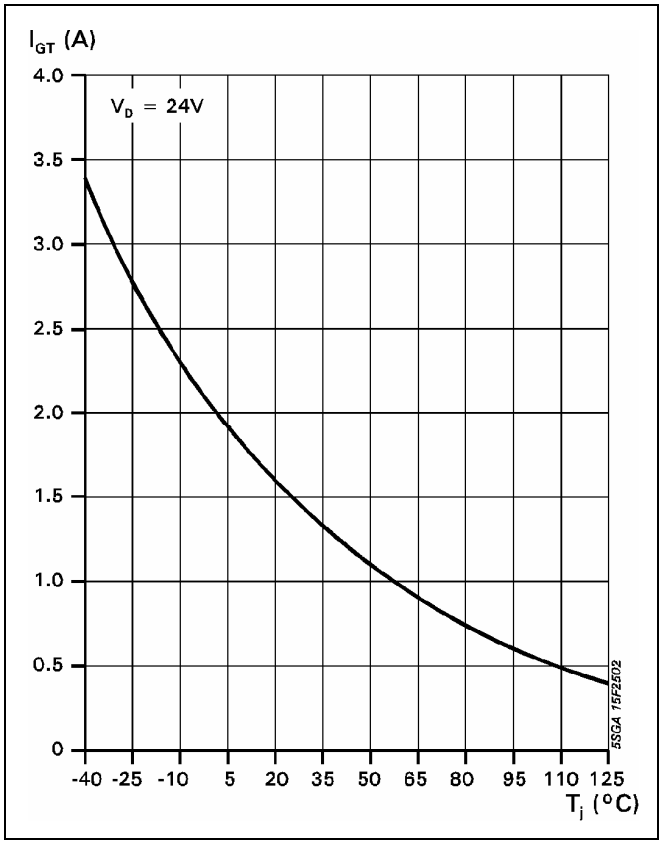


Fig. 7 Gate trigger current vs. junction temperature

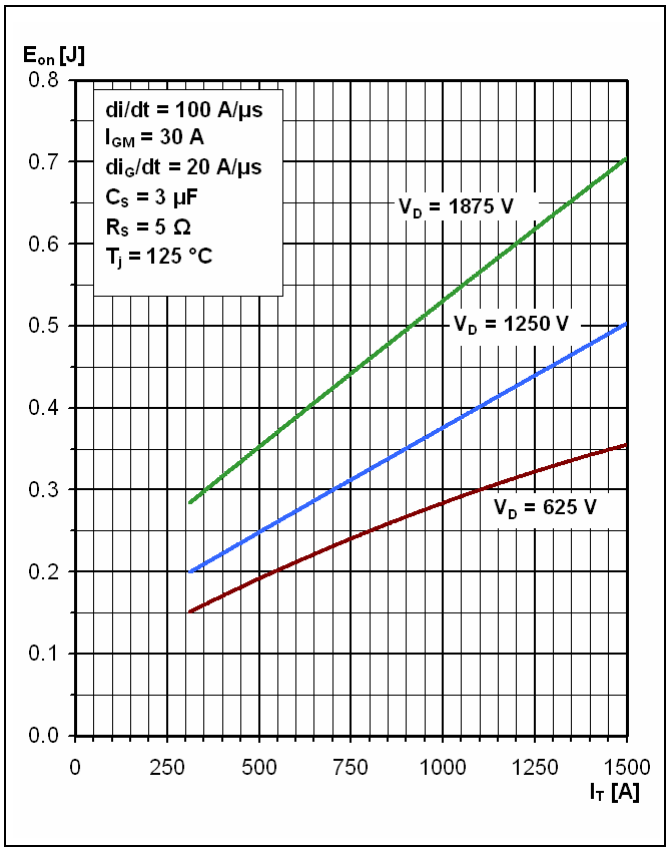


Fig. 8 Turn-on energy per pulse vs. on-state current and turn-on voltage

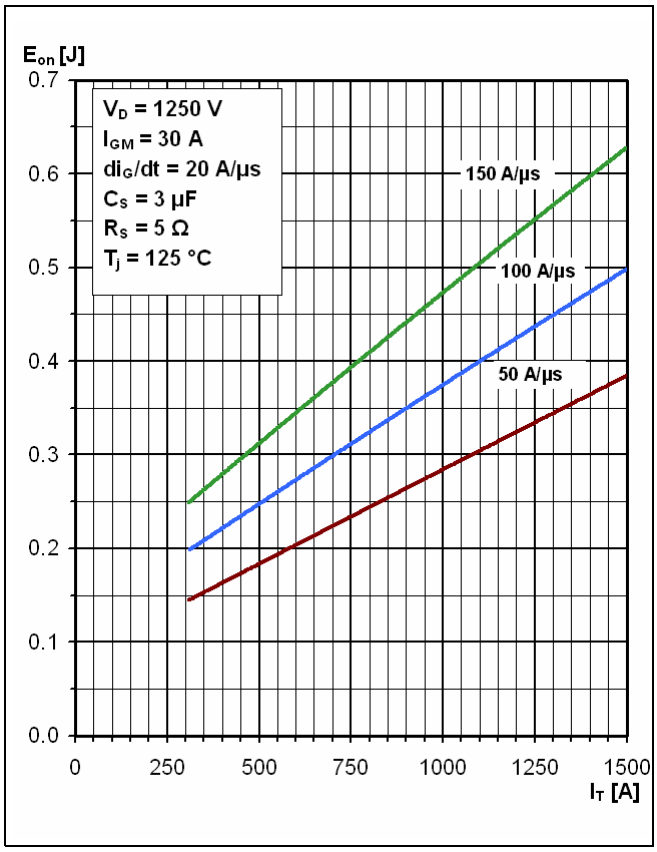


Fig. 9 Turn-on energy per pulse vs. on-state current and current rise rate

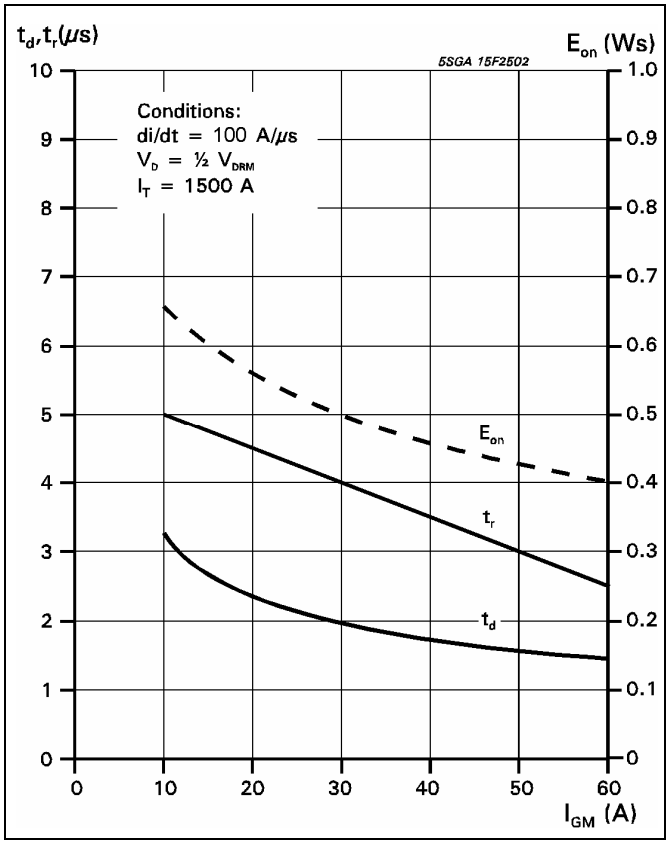


Fig. 10 Turn-on energy per pulse vs. on-state current and turn-on voltage

Common Test conditions:

di_G/dt	= 20 A/µs
C_S	= 3 µF
R_S	= 5 Ω
Tj	= 125 °C

Definition of Turn-on energy:

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

Definition of Turn-off energy:

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

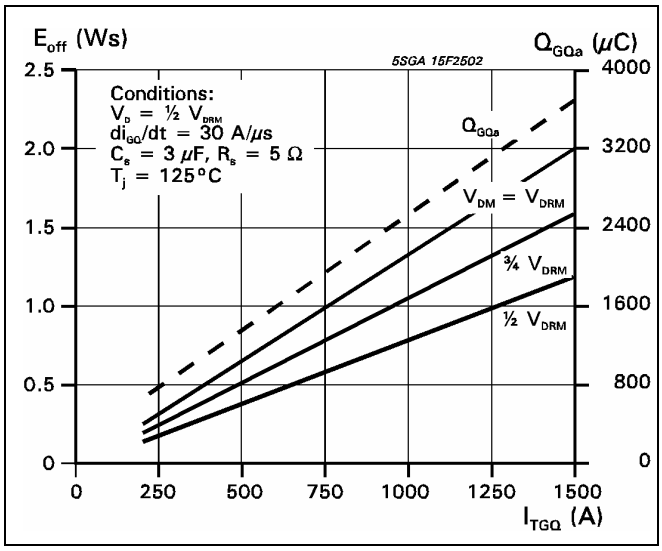


Fig. 11 Turn-off energy per pulse vs. turn-off current and peak turn-off voltage, extracted gate charge vs. turn-off current

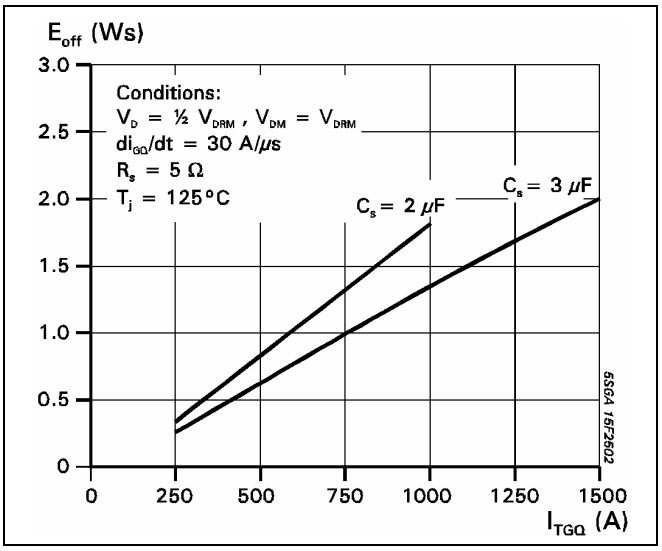


Fig. 12 Turn-off energy per pulse vs. turn-off current and snubber capacitance

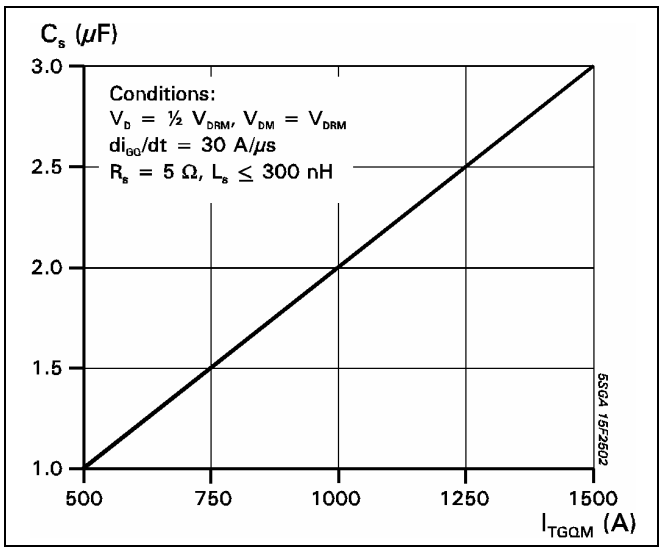


Fig. 13 Required snubber capacitor vs. max allowable turn-off current

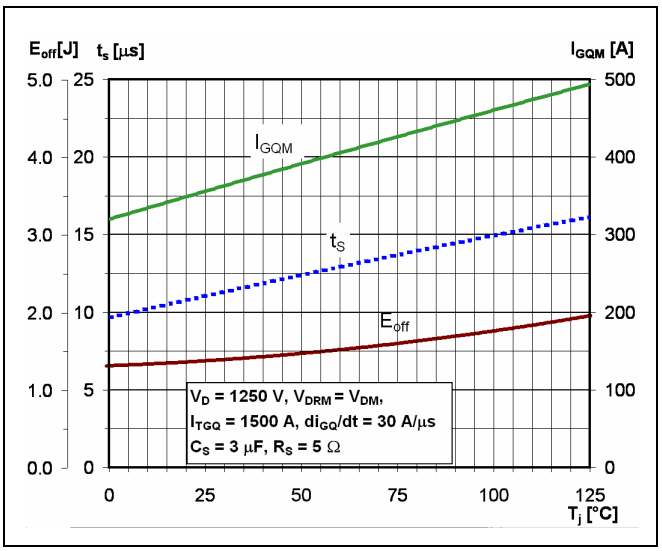


Fig. 14 Turn-off energy per pulse, storage time and peak turn-off gate current vs. junction temperature

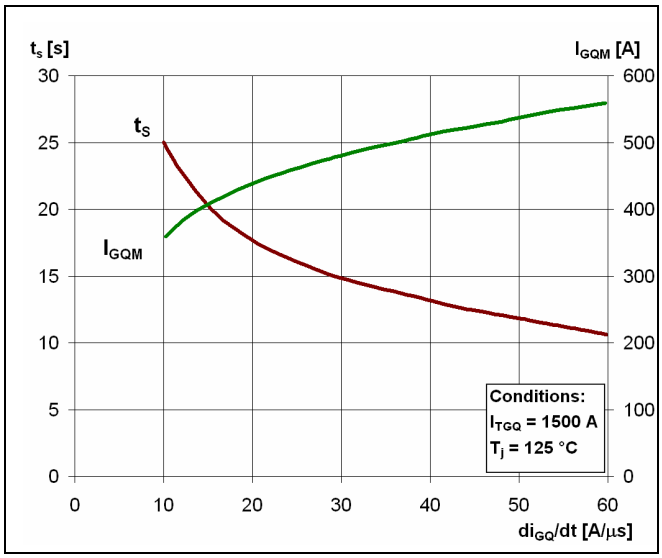


Fig. 15 Storage time and peak turn-off gate current vs. neg. gate current rise rate

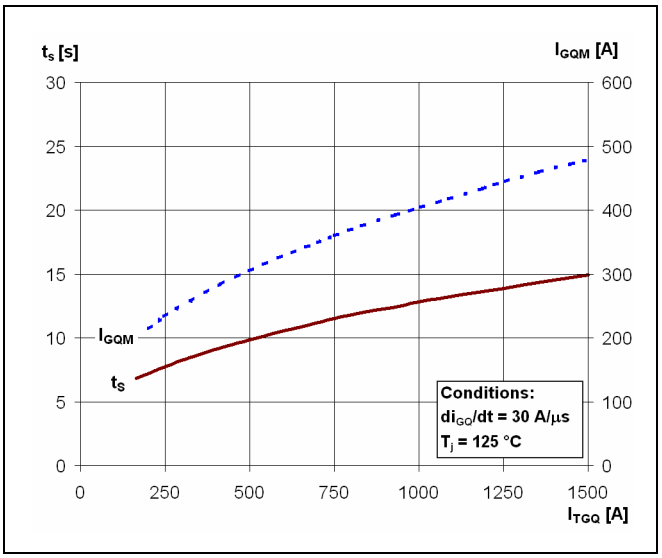


Fig. 16 Storage time and peak turn-off gate current vs. neg. gate current rise rate

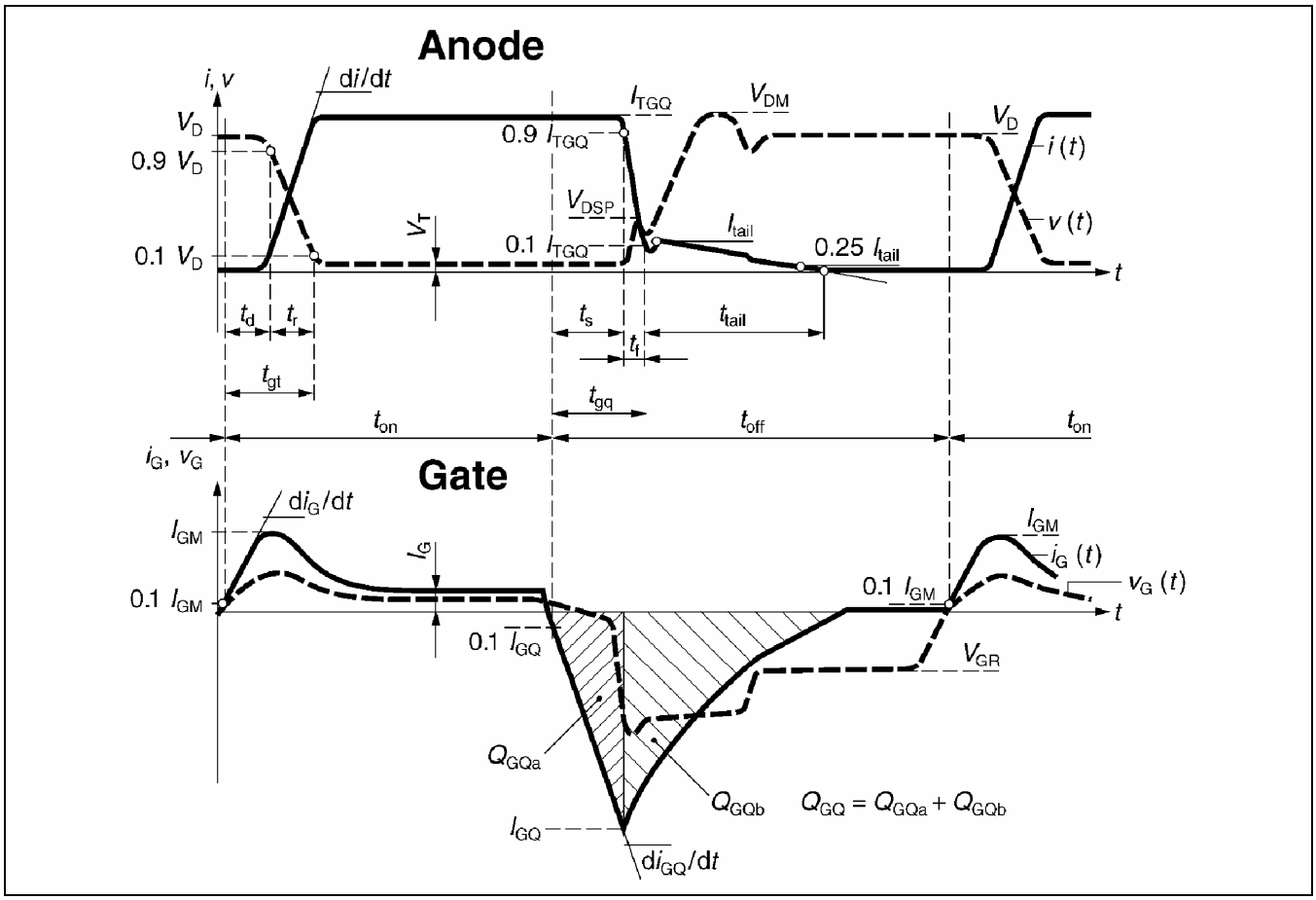
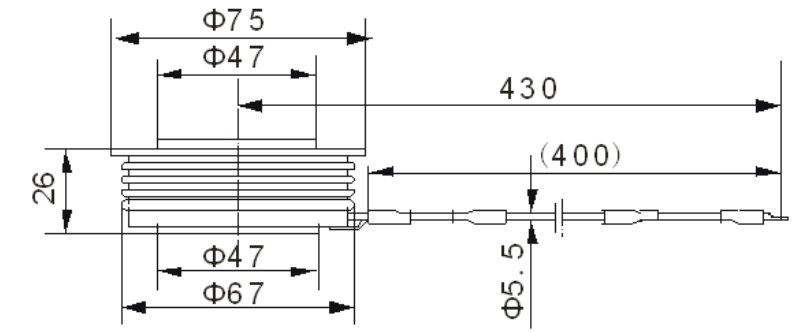
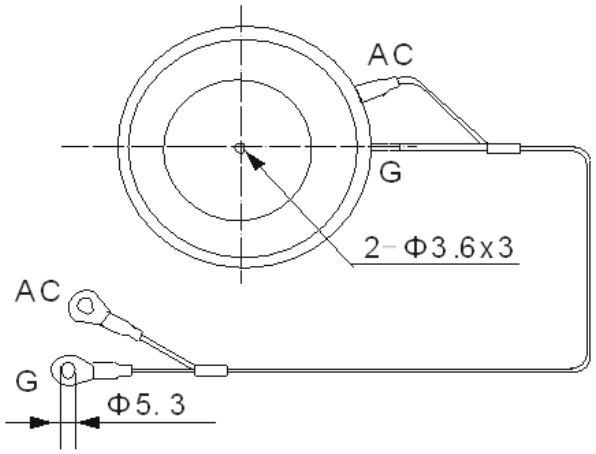


Fig. 17 General current and voltage waveforms with GTO-specific symbols

DIMENSION AND OUTLINE

For further package information, please contact your local Customer Service Centre. All dimensions in mm, unless stated otherwise.
DO NOT SCALE.





Package outline type code: F