



CSG15F2500

Gate Turn-off Thyristor

FEATURES

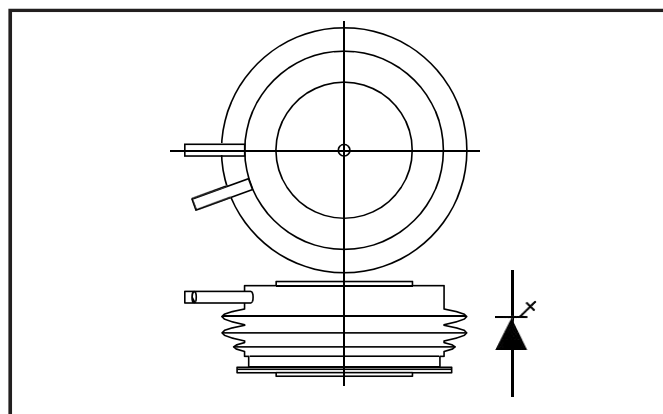
- Double side cooling
- High reliability
- High voltage property
- Fault protection without fast fuse
- Large surge current resistance
- Excellent switching performance

KEY PARAMETERS

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

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	$V_{DM} \leq V_{DRM}$, $di_{GQ}/dt = 30 \text{ A}/\mu\text{s}$, $C_s = 3 \mu\text{F}$, $L_s \leq 0.3 \mu\text{H}$	1500	A
$I_{T(AV)}$	Mean on-state current	$T_{HS} = 80^\circ\text{C}$. Double side cooled, half sine 50Hz	570	A
$I_{T(RMS)}$	RMS on-state current	$T_{HS} = 80^\circ\text{C}$. 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. $T = 125^{\circ}\text{C}$	10	kA
I^2t	I^2t for fusing	10ms half sine. $T = 125^{\circ}\text{C}$	500×10^3	A^2s
di/dt	Critical rate of rise of on-state current	$I_T = 1500\text{A}$, $T_j = 125^{\circ}\text{C}$, $di/dt = 20 \text{ A}/\mu\text{s}$	400	$\text{A}/\mu\text{s}$
L_s	Peak stray inductance in snubber circuit	$I_T = 3000\text{A}$, $V_D = V_{DRM}$, $T_j = 125^{\circ}\text{C}$, $dI/dt = 40\text{A}/\mu\text{s}$, $C_s = 3.0\mu\text{F}$	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	$^{\circ}\text{C}/\text{W}$
		Anode side cooled		-	0.049	$^{\circ}\text{C}/\text{W}$
		Cathode side cooled		-	0.06	$^{\circ}\text{C}/\text{W}$
$R_{th(c-hs)}$	Contact thermal resistance	Clamping force 40.0kN With mounting compound	per contact	-	0.016	$^{\circ}\text{C}/\text{W}$
T_{vj}	Virtual junction temperature			-40	125	$^{\circ}\text{C}$
T_{OP}/T_{stg}	Operating junction/storage temperature range			-40	125	$^{\circ}\text{C}$
-	Clamping force			14.0	16.0	kN

GTO CHARACTERISTICS

$T_j = 125^\circ\text{C}$ unless stated otherwise

SYMBOL	PARAMETER	TEST CONDITION	Min.	Max.	UNIT
V_{TM}	On-state voltage	$I_T = 1500\text{ A}$, $T_j = 125^\circ\text{C}$	-	2.8	V
I_{DM}	Peak off-state current	$V_{DRM} = 2500\text{V}$, $V_{RG} = 2\text{V}$	-	100	mA
I_{RRM}	Peak reverse current	At V_{RRM}	-	50	mA
V_{GT}	Gate trigger voltage	$V_D = 24\text{V}$, $T_j = 25^\circ\text{C}$	-	1.5	V
I_{GT}	Gate trigger current	$V_D = 24\text{V}$, $T_j = 25^\circ\text{C}$	-	1.5	A
I_{RGM}	Reverse gate cathode current	$V_{RGM} = 17\text{V}$, No gate/cathode resistor	-	20	mA
E_{ON}	Turn-on energy	$V_D = 0.5V_{DRM}$	-	500	mJ
t_d	Delay time	$I_T = 1500\text{A}$, $di_T/dt = 100\text{A}/\mu\text{s}$	-	2.0	μs
t_r	Rise time	$I_{GM} = 30\text{A}$,	-	4.0	μs
E_{OFF}	Turn-off energy	$I_T = 1500\text{A}$, $V_{DM} = V_{DRM}$ Snubber Cap $C_s = 3\mu\text{F}$, $di_{GQ}/dt = 30\text{A}/\mu\text{s}$	-	2000	mJ
t_{gs}	Storage time		-	15.0	μs
t_{gf}	Fall time		-	2.0	μs
t_{gq}	Gate controlled turn-off time		-	27.5	μs
I_{GQM}	Peak reverse gate current		-	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
$R_i(\text{K/kW})$	14.570	5.051	7.285	0.097
$\tau_i(\text{s})$	0.4610	0.0950	0.0120	0.0010

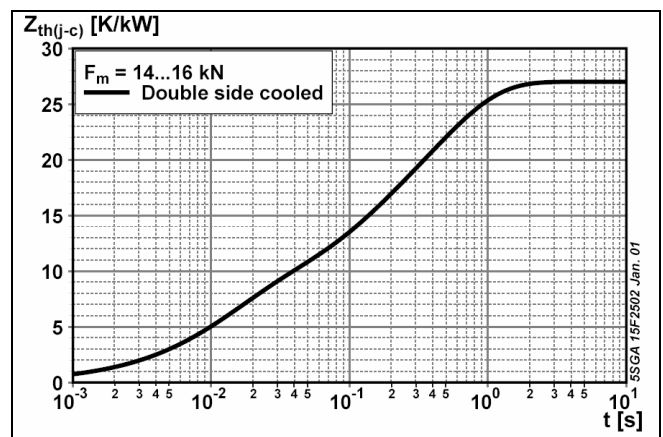


Fig. 1 Transient thermal impedance, junction to case

Max. on-state characteristic model:

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

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}

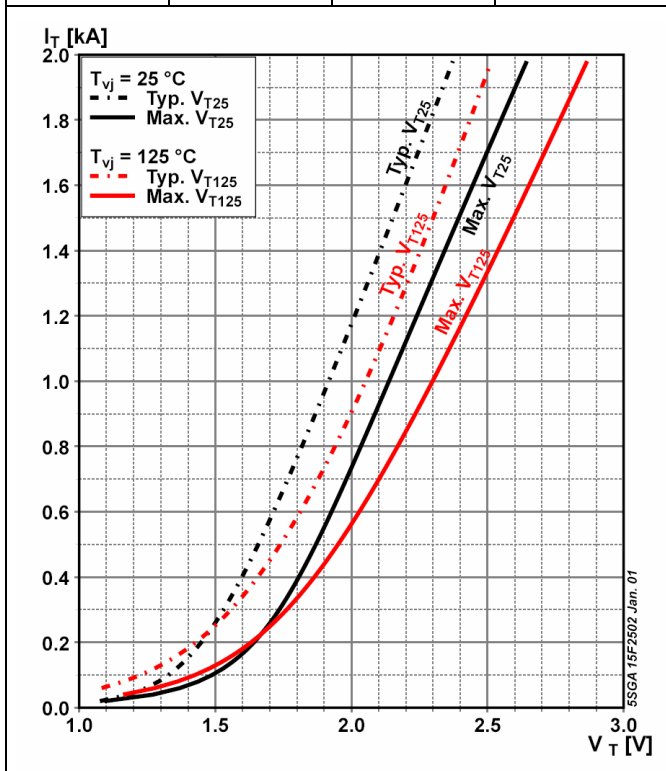


Fig. 2 On-state characteristics

Max. on-state characteristic model:

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

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}

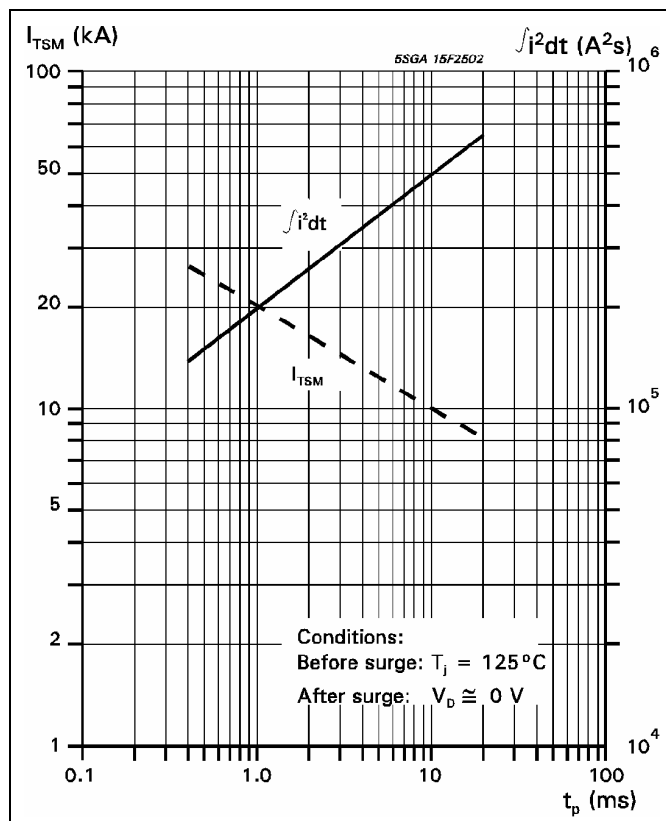


Fig. 3 Surge current and fusing integral vs. pulse width

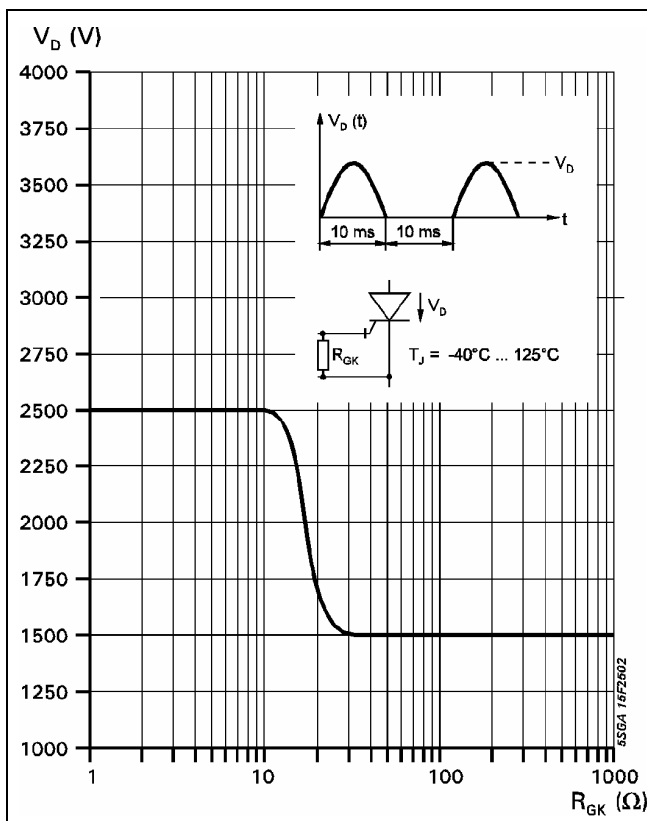


Fig. 4 Forward blocking voltage vs. gate-cathode resistance

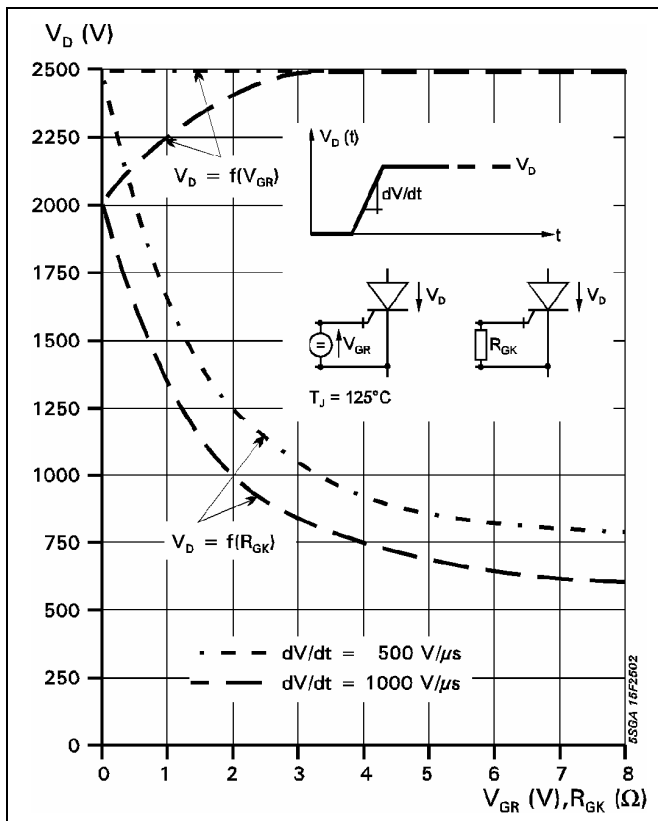


Fig. 5 Static dv/dt capability; forward blocking voltage vs. neg. gate voltage or gate cathode resistance

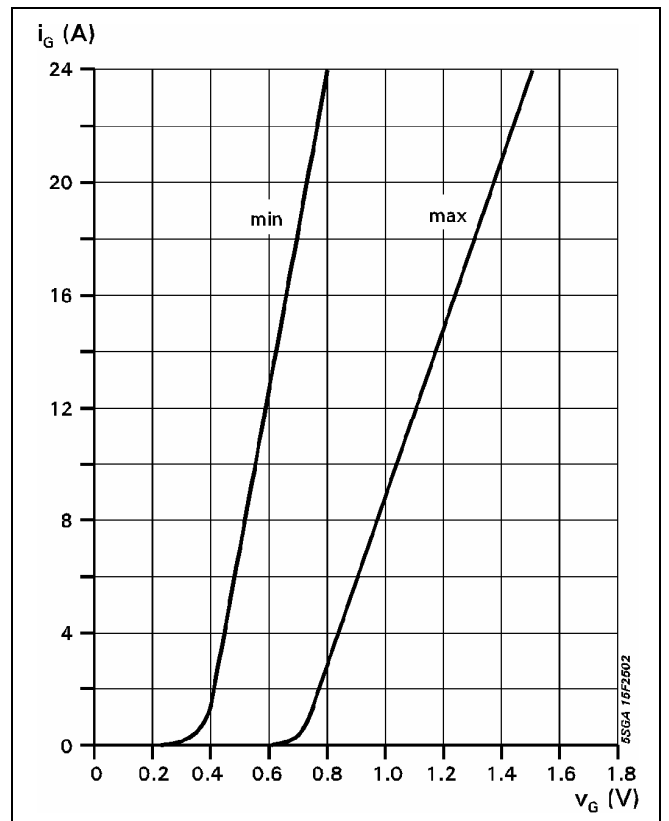


Fig. 6 Forward gate current vs. forward gate voltage

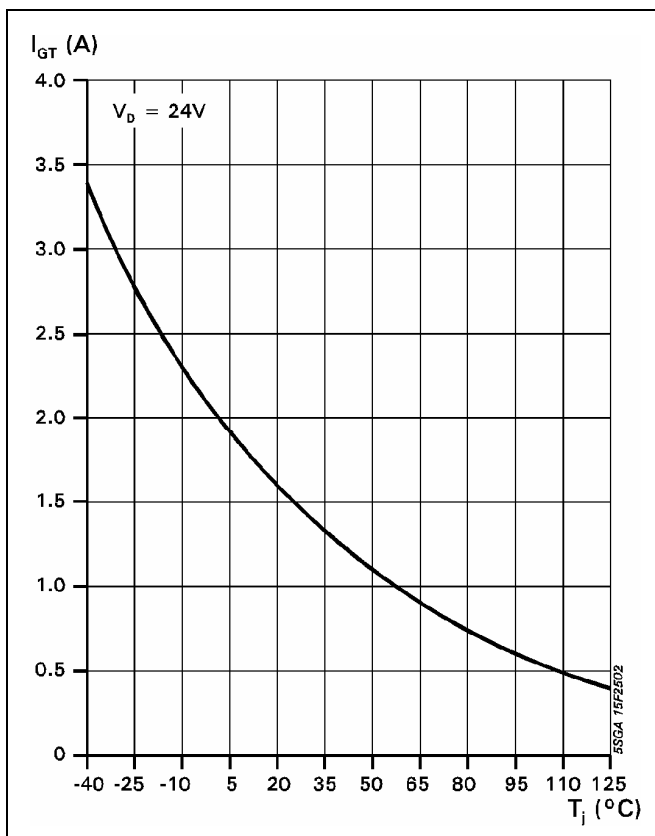


Fig. 7 Gate trigger current vs. junction temperature

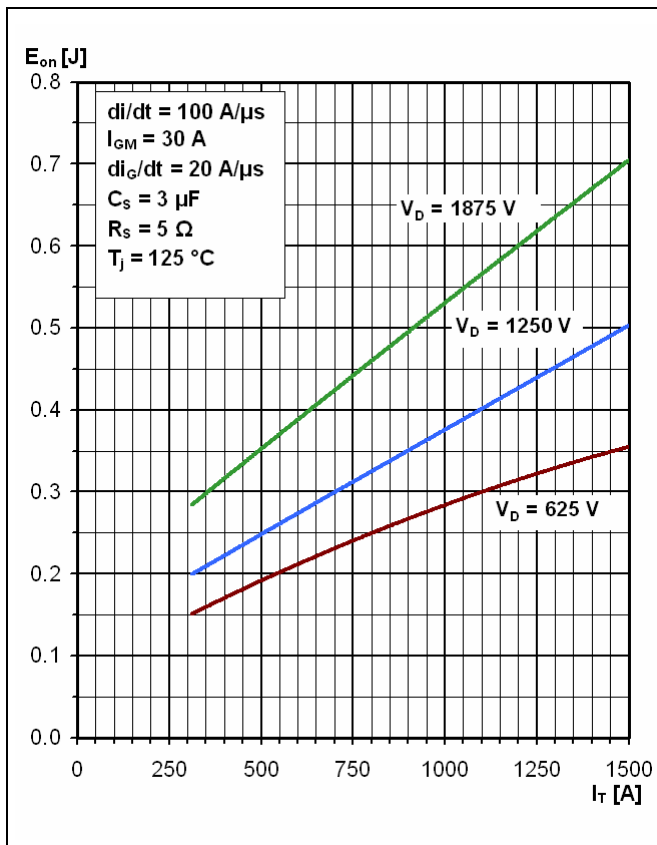


Fig. 8 Turn-on energy per pulse vs. on-state current and turn-on voltage

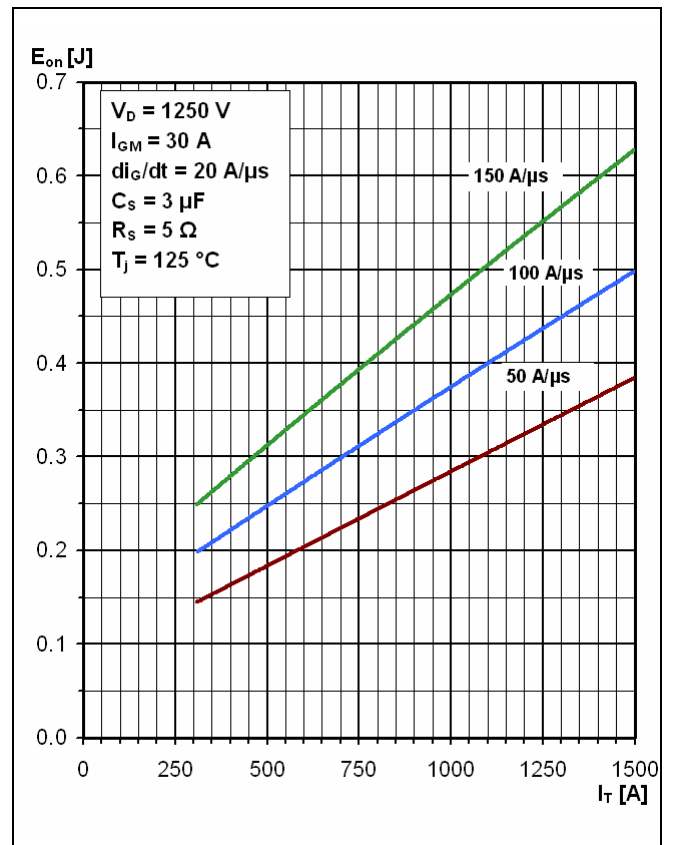


Fig. 9 Turn-on energy per pulse vs. on-state current and current rise rate

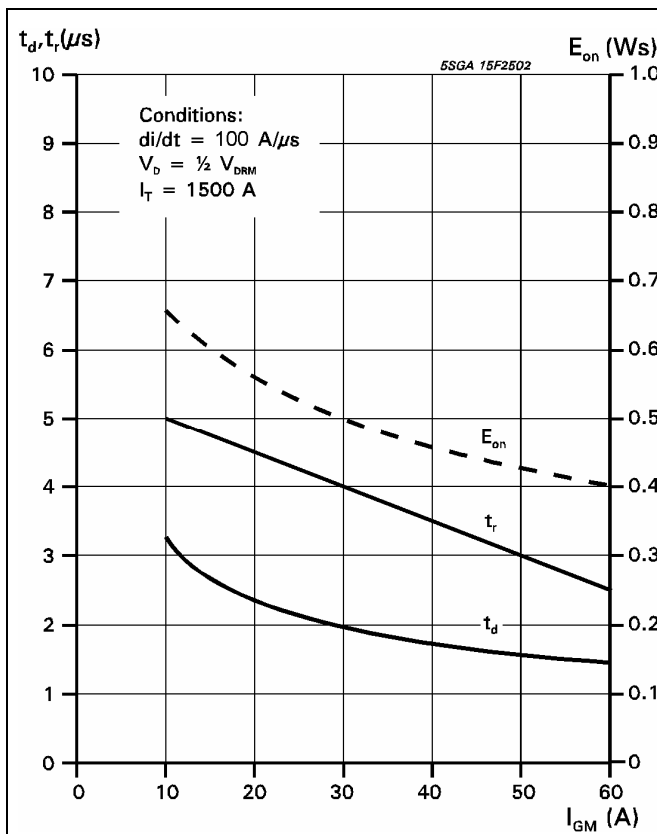


Fig. 10 Turn-on energy per pulse vs. on-state current and turn-on voltage

Common Test conditions:

$$\begin{aligned} di_G/dt &= 20 \text{ A}/\mu\text{s} \\ C_S &= 3 \text{ } \mu\text{F} \\ R_S &= 5 \text{ } \Omega \\ T_J &= 125 \text{ } ^\circ\text{C} \end{aligned}$$

Definition of Turn-on energy:

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

Definition of Turn-off energy:

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

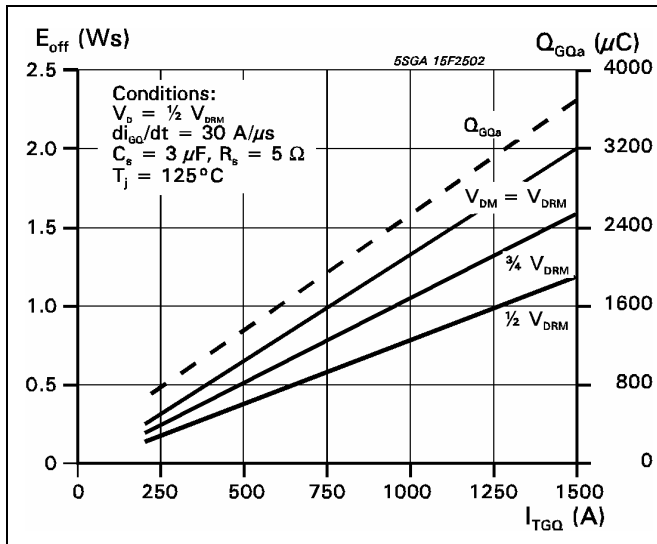


Fig. 11 Turn-off energy per pulse vs. turn-off current and peak turn-off voltage, extracted gate charge vs. turn-off current

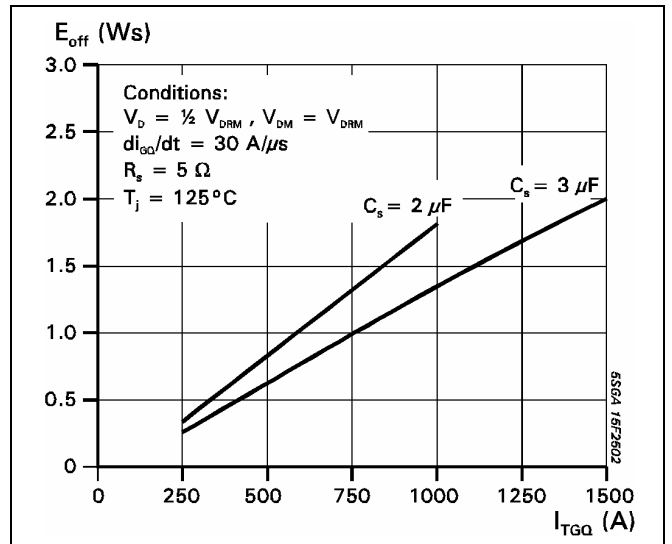


Fig. 12 Turn-off energy per pulse vs. turn-off current and snubber capacitance

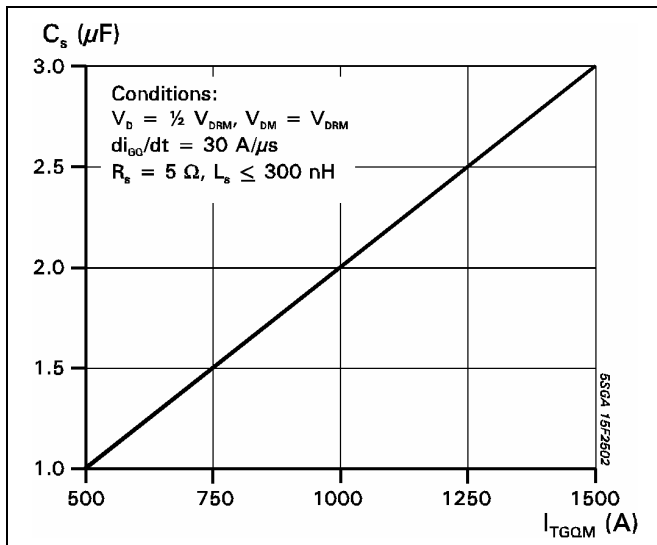


Fig. 13 Required snubber capacitor vs. max allowable turn-off current

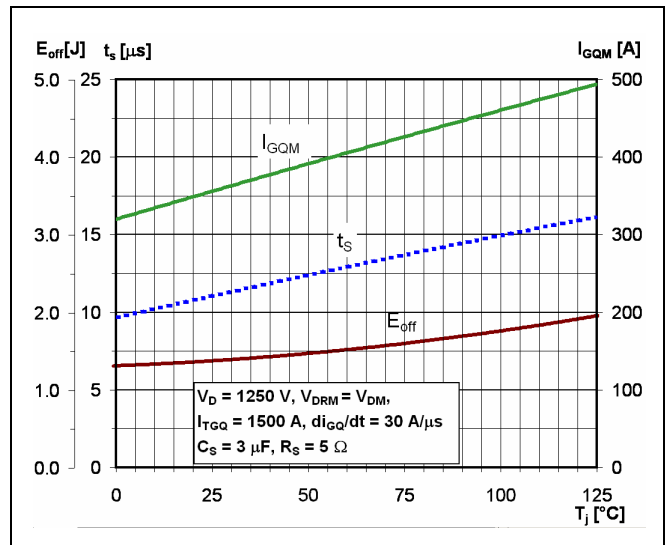


Fig. 14 Turn-off energy per pulse, storage time and peak turn-off gate current vs. junction temperature

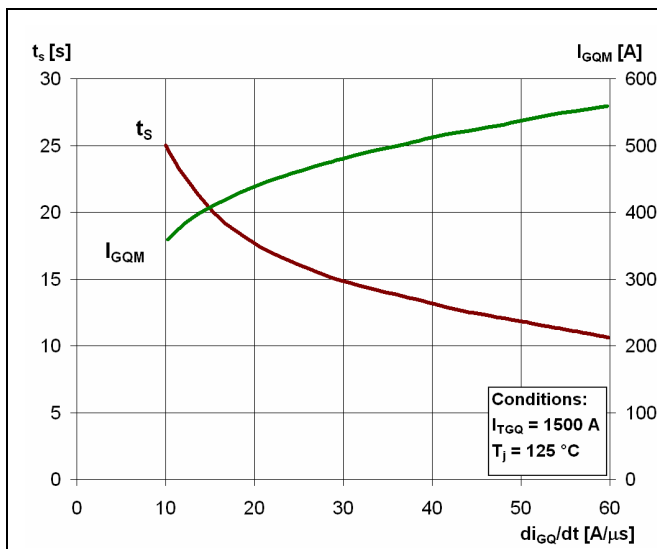


Fig. 15 Storage time and peak turn-off gate current vs. neg. gate current rise rate

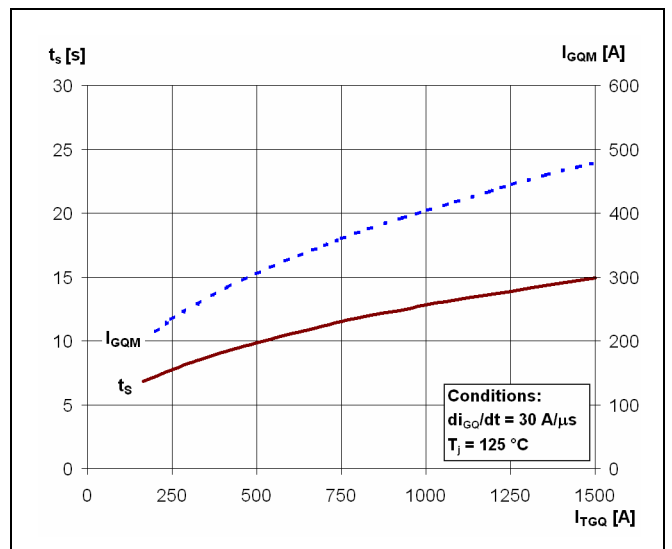


Fig. 16 Storage time and peak turn-off gate current vs. neg. gate current rise rate

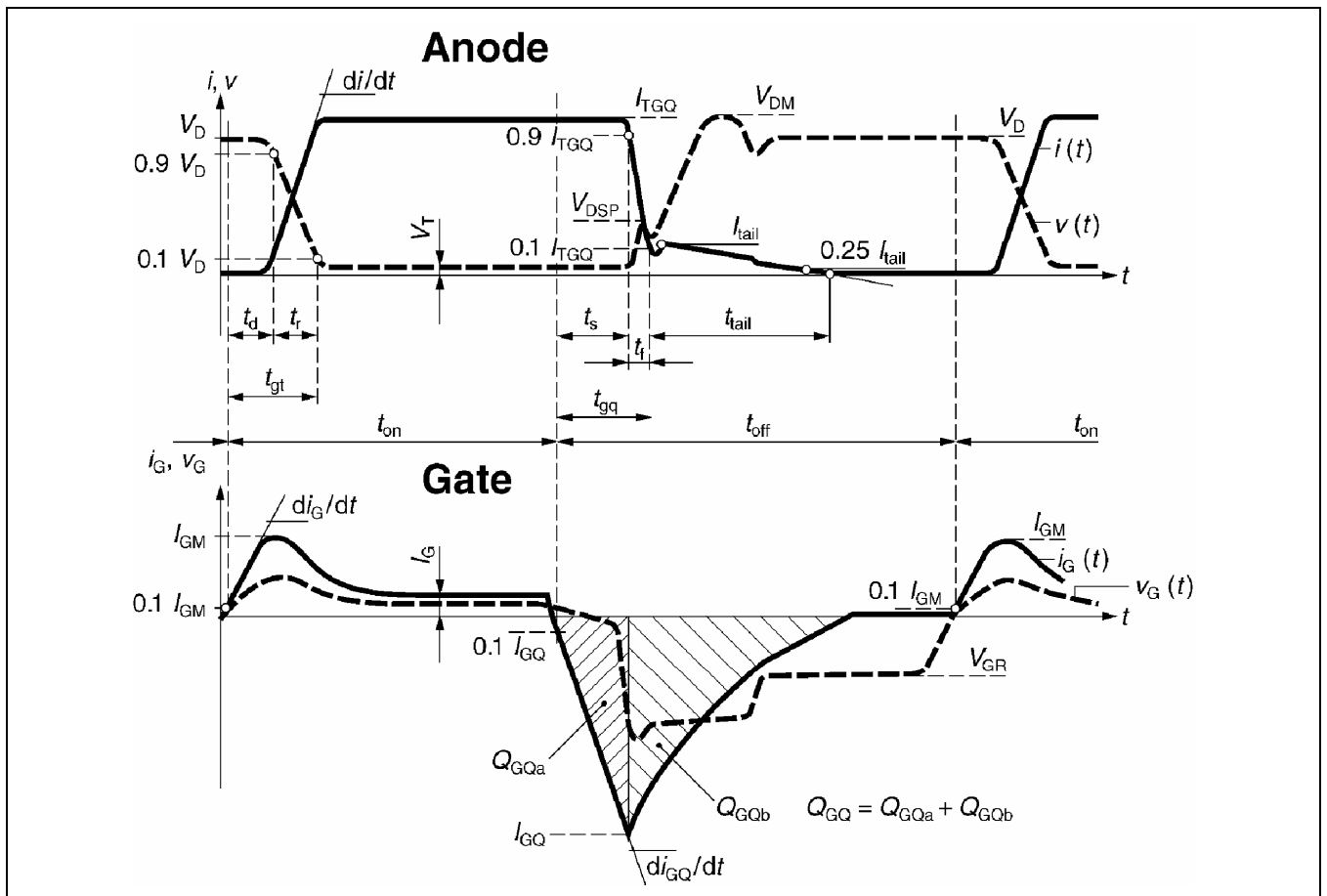
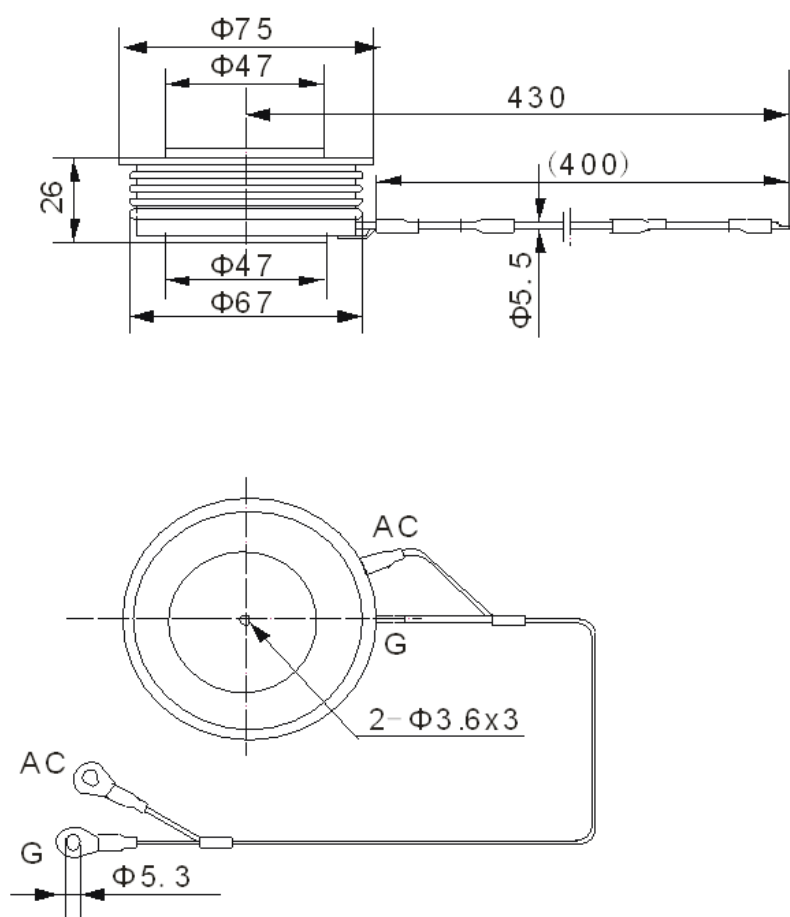


Fig. 17 General current and voltage waveforms with GTO-specific symbols



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