



CSG20H4500

Gate Turn-off Thyristor

High-end Power Semiconductor Manufacturer

APPLICATION

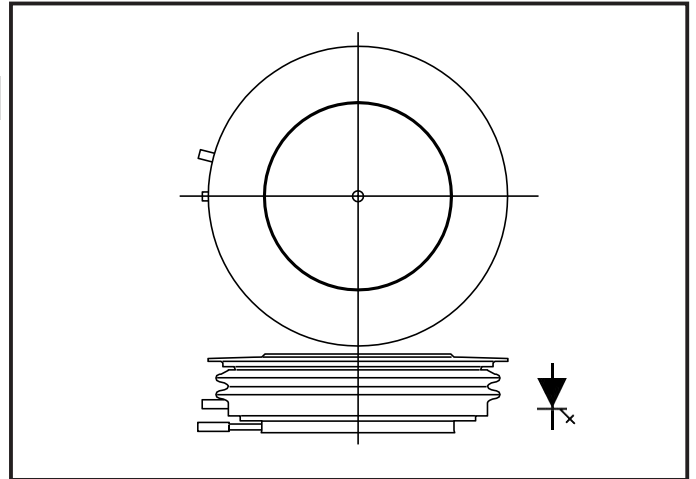
- Variable Speed AC Motor Drive Inverter (VSD-AC)
- UPS
- High Voltage Converter
- Chopper
- Welder
- Induction Heating
- DC / DC Converter

KEY PARAMETERS

I_{TCM}	2000A
V_{DRM}	4500V
$I_{T(AV)}$	745A
dV_D/dt	1000V/ μ s
di_T/dt	300A/ μ s

FEATURES

- Double Sides Cooled
- High Reliability
- High Voltage Capability
- Fast Fuse Protection Not Required
- High Surge Current Capacity
- Excellent Turn-off performance
- Reduce Equipment Size and Weight, Low noise



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

VOLTAGE RATINGS

Mode	Repetitive Peak Off-state Voltage V_{DRM}	Repetitive Peak Reverse Voltage V_{RRM}	Test Conditions
CSG20H4500	4500	16	$T_{vj} = 125^{\circ}\text{C}$, $I_{DM} = 50\text{mA}$, $I_{RRM} = 50\text{mA}$

CURRENT RATINGS

Symbol	Parameter	Test Conditions	Max.	Unit
I_{TCM}	Repetitive peak controllable on-state current	$V_D = V_{DRM}$, $T_j = 125^{\circ}\text{C}$, $di_T/dt = 40\text{A}/\mu\text{s}$, $C_s = 2.0\mu\text{F}$	2000	A
$I_{T(AV)}$	Mean on-state current	$T_{HS} = 80^{\circ}\text{C}$. Double side cooled. Half sine 50Hz.	745	A
$I_{T(RMS)}$	RMS on-state current	$T_{HS} = 80^{\circ}\text{C}$. Double side cooled. Half sine 50Hz.	1170	A



SURGE RATINGS

Symbol	Parameter	Test Conditions	Max.	Unit
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine. $T_j = 125^{\circ}\text{C}$	16.0	kA
I^2t	I^2t for fusing	10ms half sine. $T_j = 125^{\circ}\text{C}$	1.28×10^6	A^2s
di_T/dt	Critical rate of rise of on-state current	$V_D = 4500\text{V}$, $I_T = 2000\text{A}$, $T_j = 125^{\circ}\text{C}$, $I_{FG} \geq 30\text{A}$, Rise time $> 1.0\mu\text{s}$	300	$\text{A}/\mu\text{s}$
dV_D/dt	Rate of rise of off-state voltage	To 66% V_{DRM} ; $R_{GK} \leq 1.5\Omega$, $T_j = 125^{\circ}\text{C}$	175	$\text{V}/\mu\text{s}$
		To 66% V_{DRM} ; $V_{RG} = -2\text{V}$, $T_j = 125^{\circ}\text{C}$	1000	$\text{V}/\mu\text{s}$
L_s	Peak stray inductance in snubber circuit	$I_T = 2000\text{A}$, $V_{DM} = 4500\text{V}$, $T_j = 125^{\circ}\text{C}$, $di_{GQ}/dt = 40\text{A}/\mu\text{s}$, $C_s = 2.0\mu\text{F}$	200	nH

GATE RATINGS

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{RGM}	Peak reverse gate voltage	This value maybe exceeded during turn-off	-	16	V
I_{FGM}	Peak forward gate current		20	100	A
$P_{FG(AV)}$	Average forward gate power		-	15	W
P_{RGM}	Peak reverse gate power		-	19	kW
di_{GQ}/dt	Rate of rise of reverse gate current		30	60	$\text{A}/\mu\text{s}$
$t_{ON(min)}$	Minimum permissible on time		50	-	μs
$t_{OFF(min)}$	Minimum permissible off time		100	-	μs

THERMAL AND MECHANICAL RATINGS

Symbol	Parameter	Test Conditions		Min.	Max.	Unit
$R_{th(j-hs)}$	DC thermal resistance - junction to heatsink surface	Double side cooled		-	0.018	$^{\circ}\text{C}/\text{W}$
		Anode side cooled		-	0.03	$^{\circ}\text{C}/\text{W}$
		Cathode side cooled		-	0.045	$^{\circ}\text{C}/\text{W}$
$R_{th(c-hs)}$	Contact thermal resistance	Clamping force 20.0kN With mounting compound	per contact	-	0.006	$^{\circ}\text{C}/\text{W}$
T_{vj}	Virtual junction temperature			-	125	$^{\circ}\text{C}$
T_{OP}/T_{stg}	Operating junction/storage temperature range			-40	125	$^{\circ}\text{C}$
-	Clamping force			18.0	22.0	kN



GTO CHARACTERISTICS

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

Symbol	Parameters	Test Conditions	Min.	Max.	Unit
V_{TM}	On-state voltage	At 2000A peak, $I_{G(ON)} = 7\text{A d.c.}$	-	3.2	V
I_{DM}	Peak off-state current	$V_{DRM} = 4500\text{V}$, $V_{RG} = 0\text{V}$	-	100	mA
I_{RRM}	Peak reverse current	At V_{RRM}	-	50	mA
V_{GT}	Gate trigger voltage	$V_D = 24\text{V}$, $I_T = 100\text{A}$, $T_j = 25^\circ\text{C}$	-	1.0	V
I_{GT}	Gate trigger current	$V_D = 24\text{V}$, $I_T = 100\text{A}$, $T_j = 25^\circ\text{C}$	-	3.0	A
I_{RGM}	Reverse gate cathode current	$V_{RGM} = 16\text{V}$, No gate/cathode resistor	-	50	mA
E_{ON}	Turn-on energy	$V_D = 3000\text{V}$ $I_T = 2000\text{A}$, $di_T/dt = 300\text{A}/\mu\text{s}$ $I_{FG} = 30\text{A}$, rise time $< 1.0\mu\text{s}$	-	3170	mJ
t_d	Delay time		-	1.35	μs
t_r	Rise time		-	3.2	μs
E_{OFF}	Turn-off energy	$I_T = 2000\text{A}$, $V_{DM} = V_{DRM}$ Snubber Cap $C_s = 2.0\mu\text{F}$, $di_{GQ}/dt = 40\text{A}/\mu\text{s}$	-	10000	mJ
t_{gs}	Storage time		-	20.0	μs
t_{gf}	Fall time		-	2.0	μs
t_{gq}	Gate controlled turn-off time		-	22.0	μs
Q_{GQ}	Turn-off gate charge		-	6000	μC
Q_{GQT}	Total turn-off gate charge		-	12000	μC
I_{GQM}	Peak reverse gate current		-	690	A



CURVES

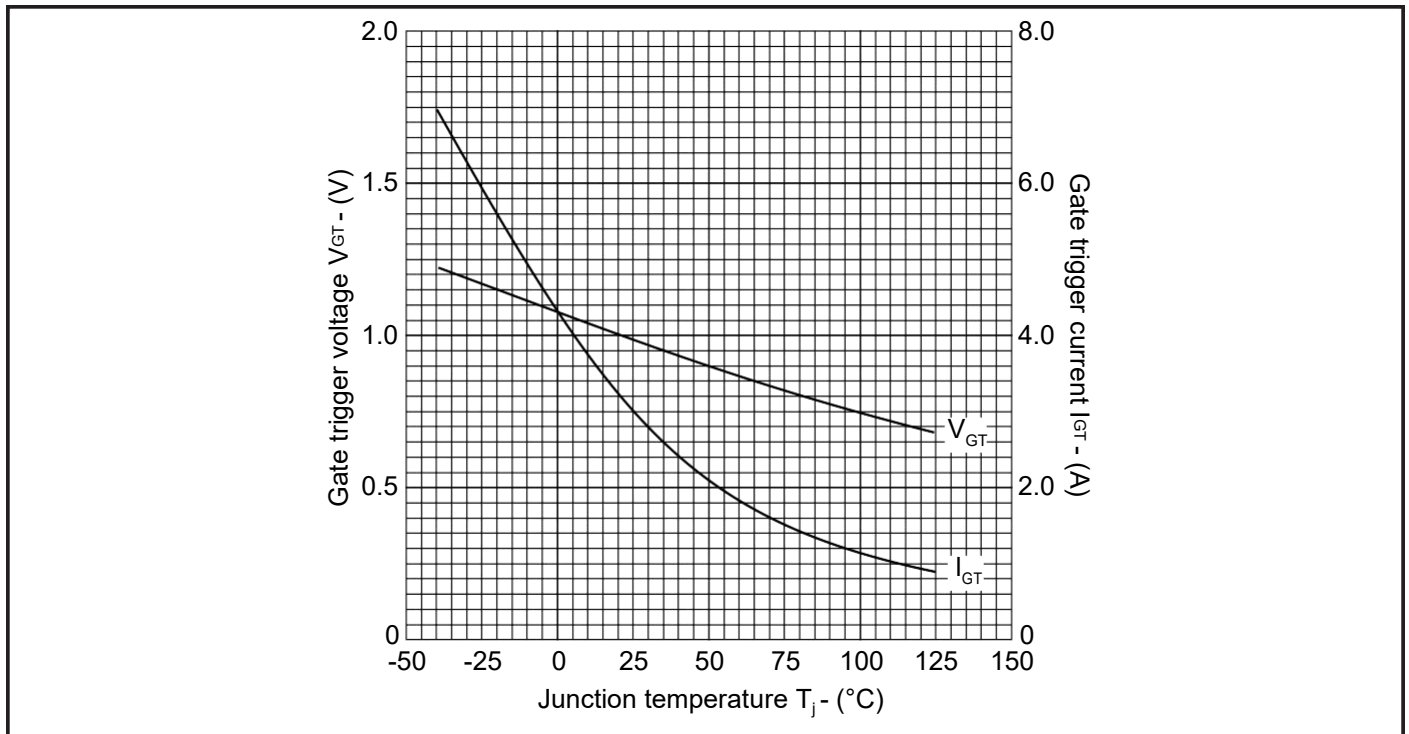


Fig.1 Maximum gate trigger voltage/current vs junction temperature

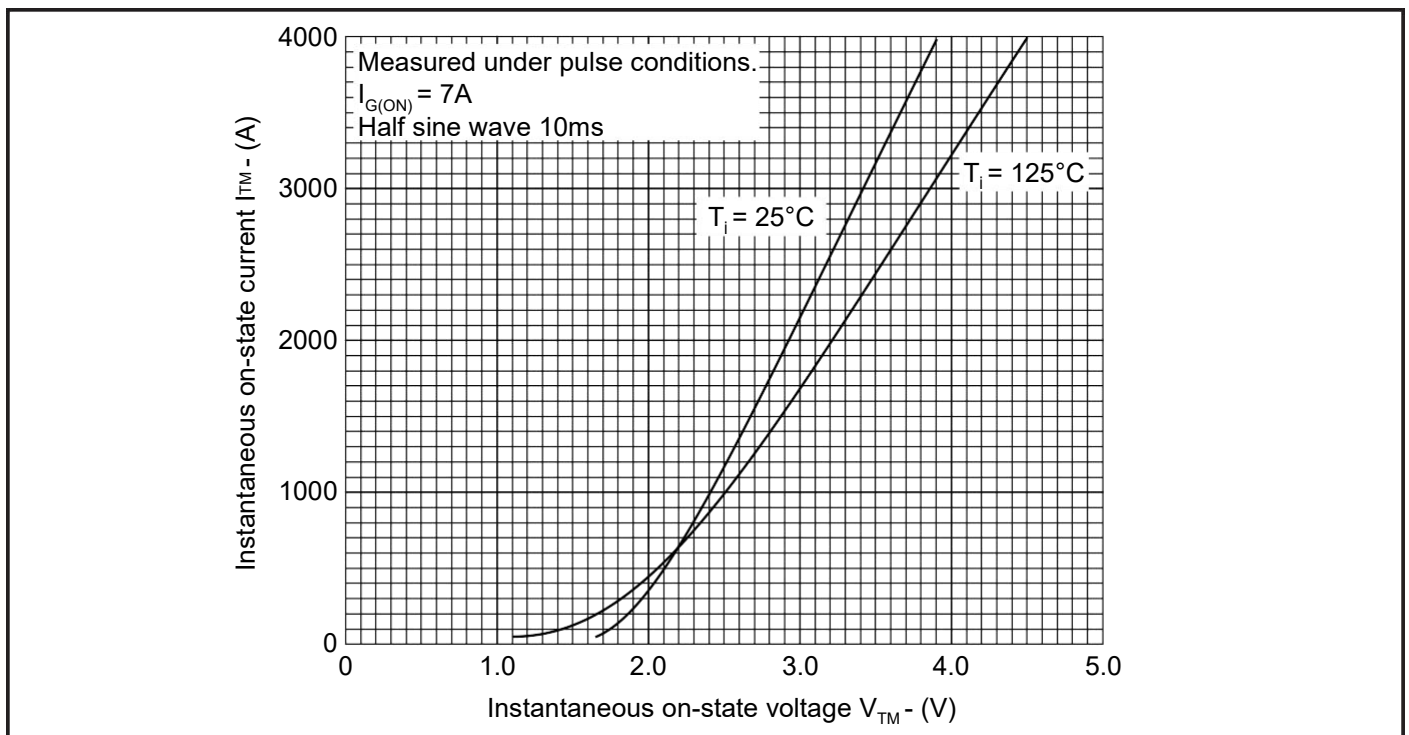


Fig.2 On-state characteristics

CURVES

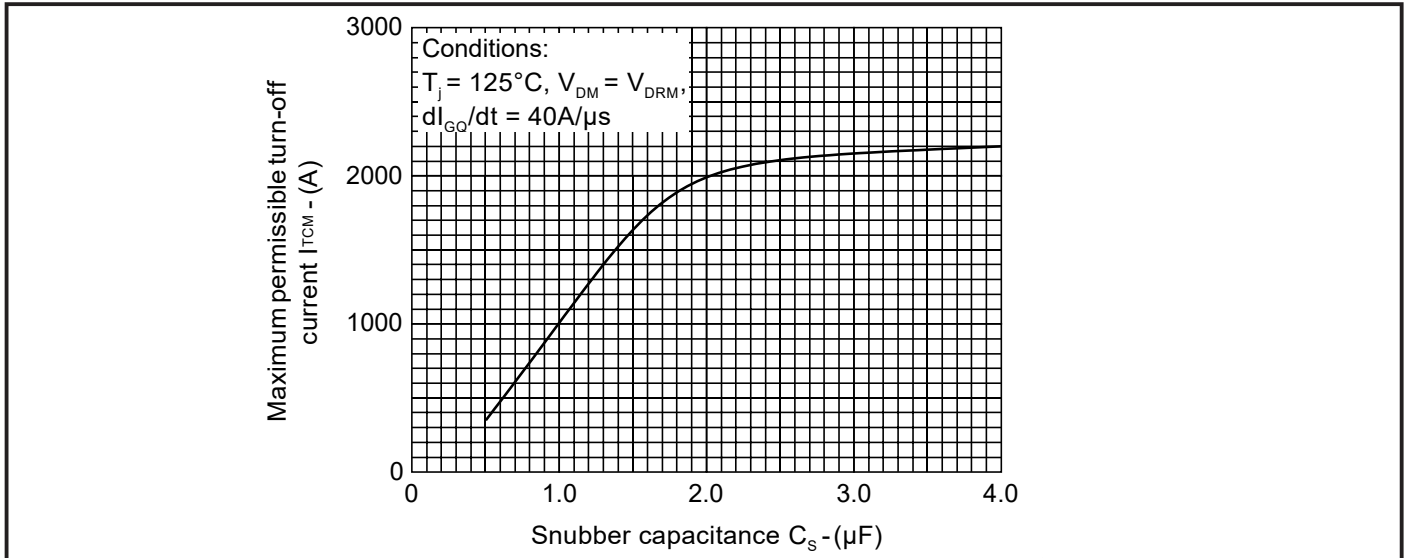


Fig.3 Maximum dependence of I_{TCM} on C_s

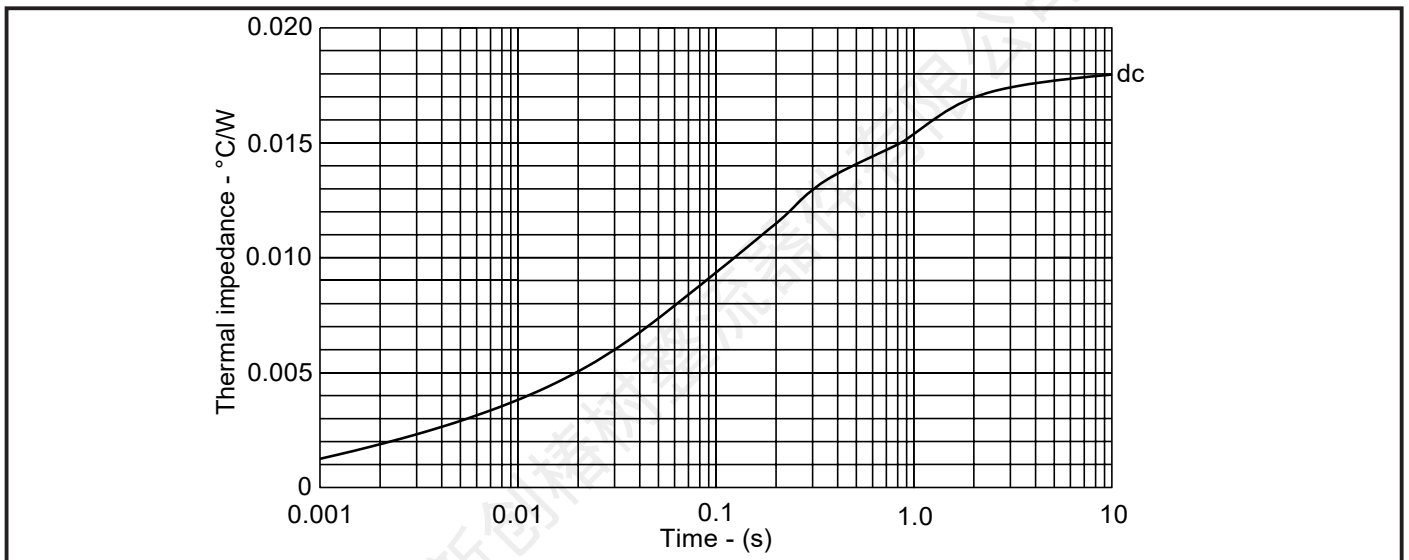


Fig.4 Maximum (limit) transient thermal impedance - double side cooled

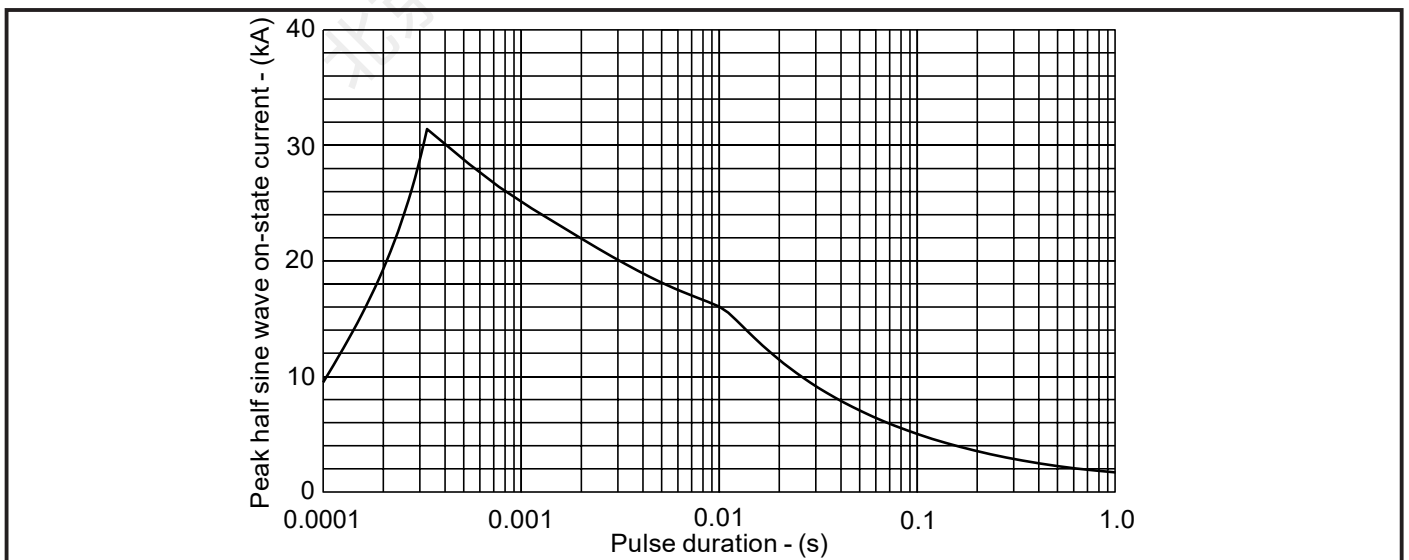


Fig.5 Surge (non-repetitive) on-state current vs time

CURVES

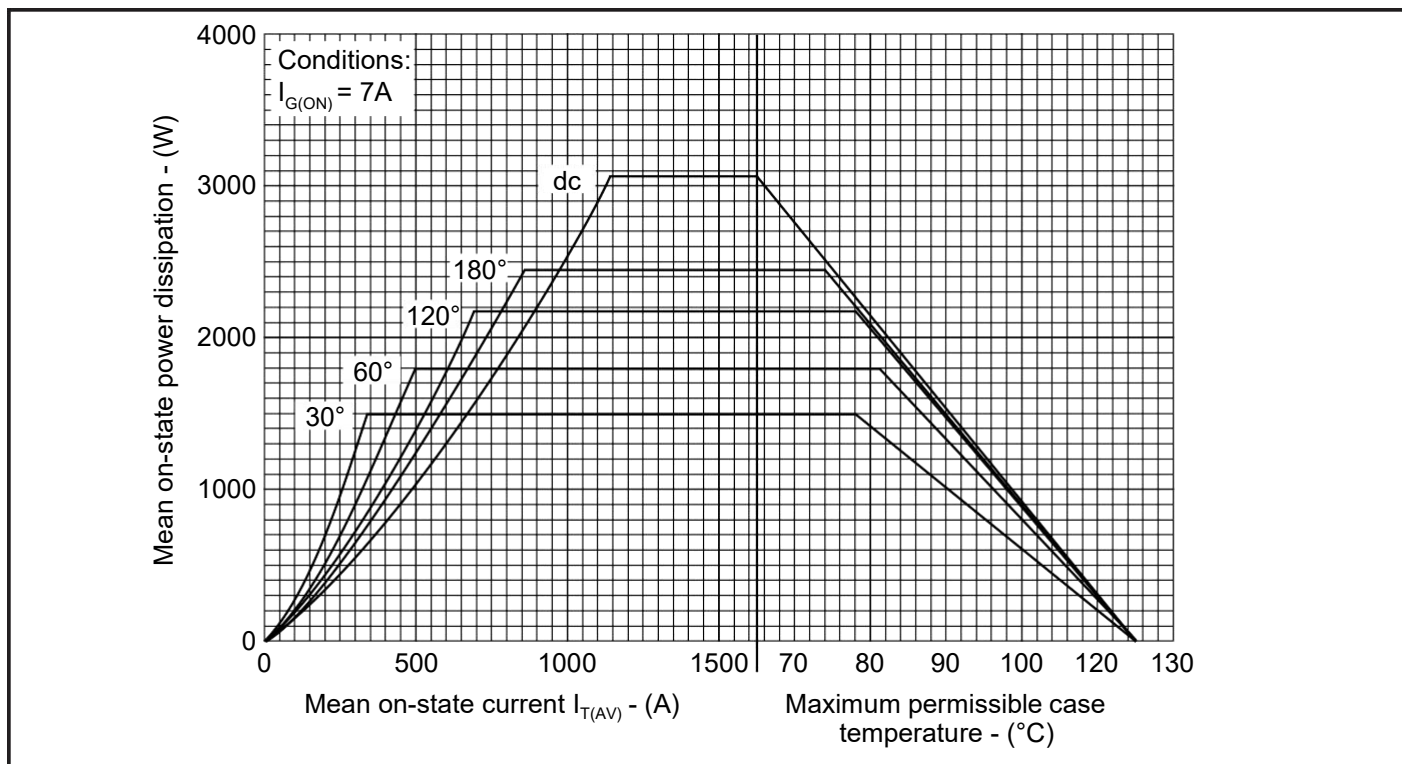


Fig.6 Steady state rectangular wave conduction loss - double side cooled

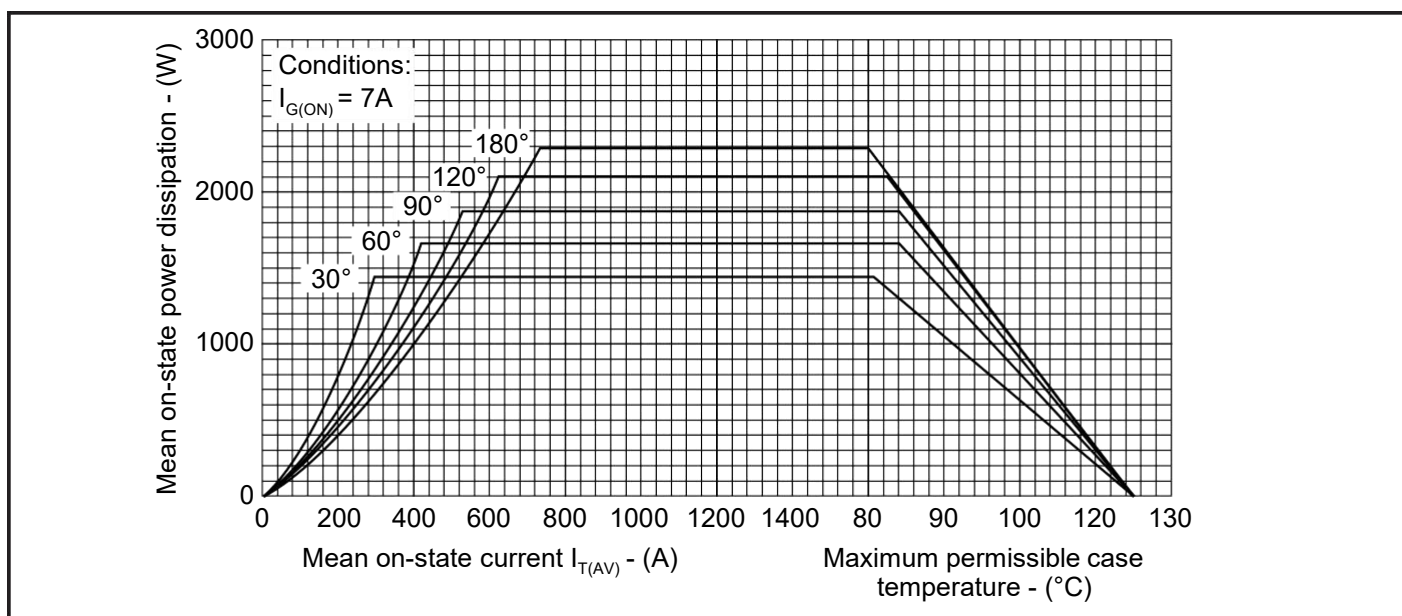


Fig.7 Steady state sinusoidal wave conduction loss - double side cooled

CURVES

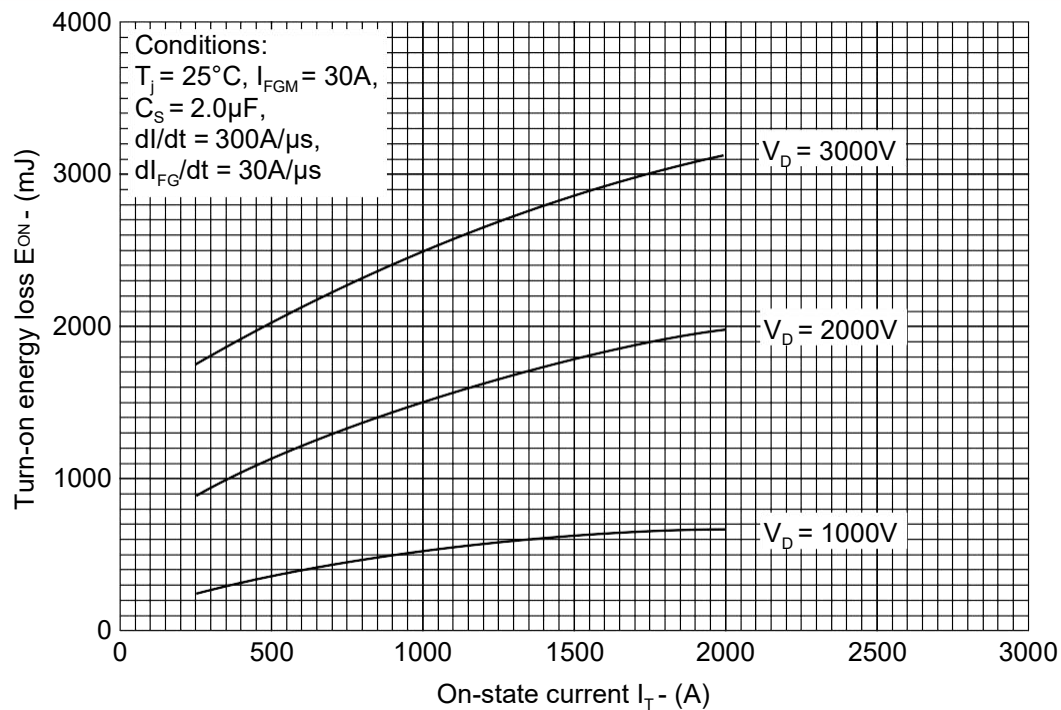


Fig.8 Turn-on energy vs on-state current

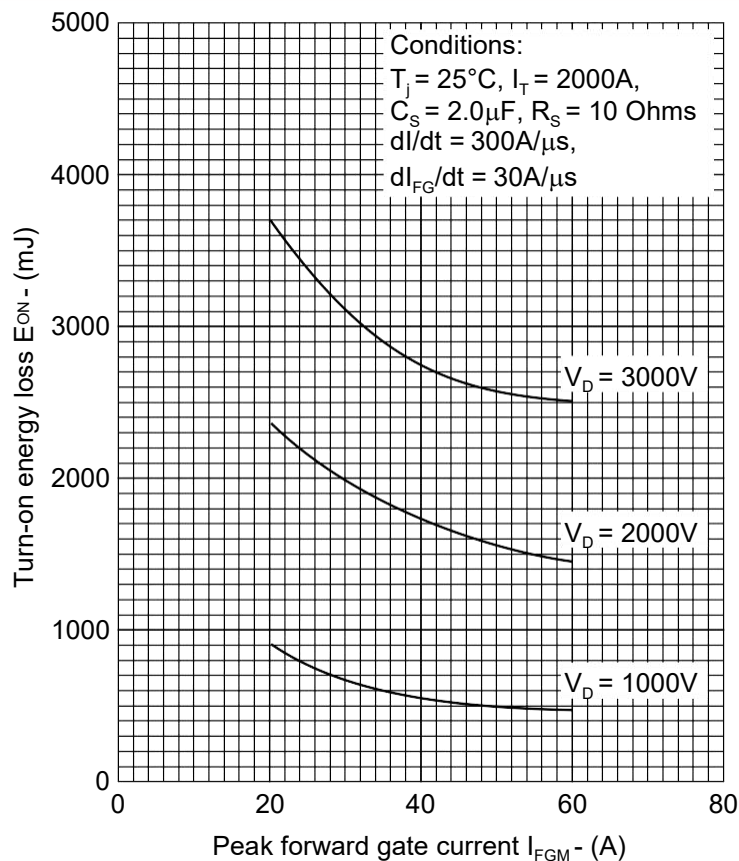


Fig.9 Turn-on energy vs peak forward gate current

CURVES

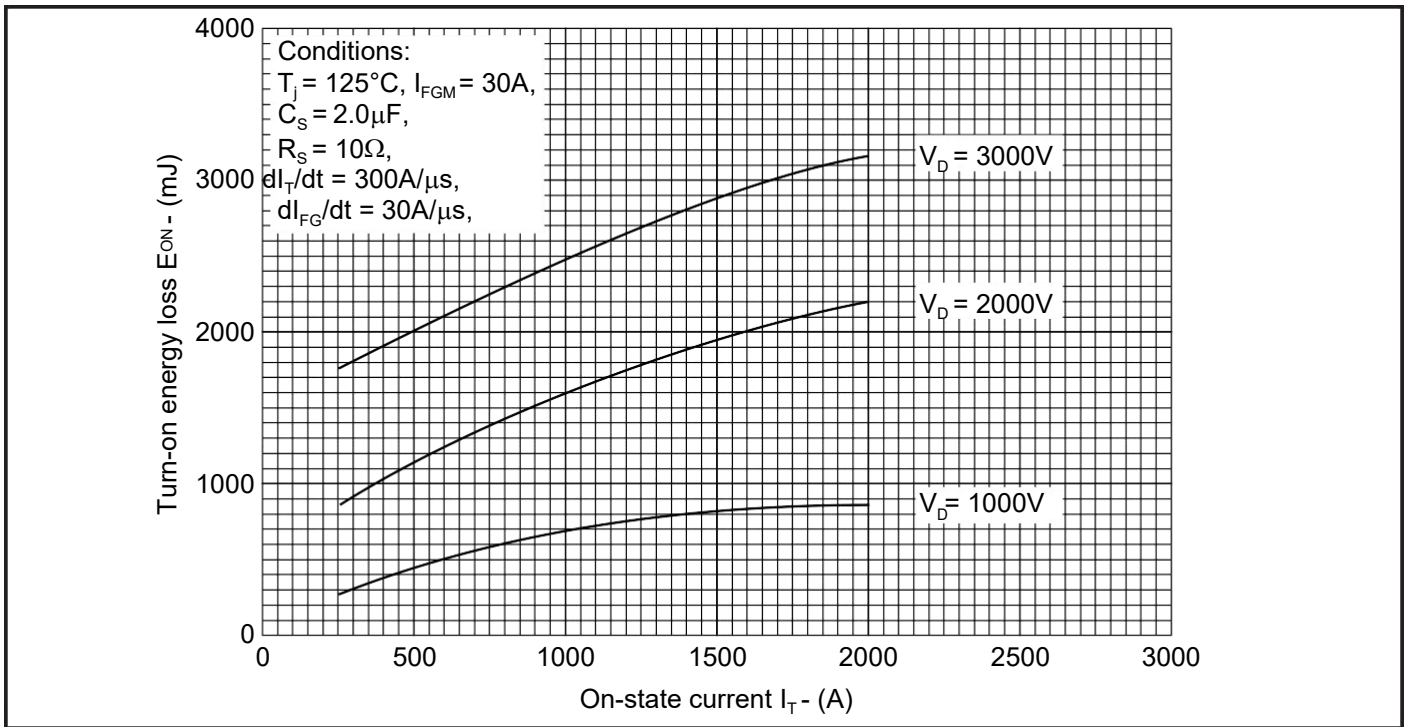


Fig.10 Turn-on energy vs on-state current

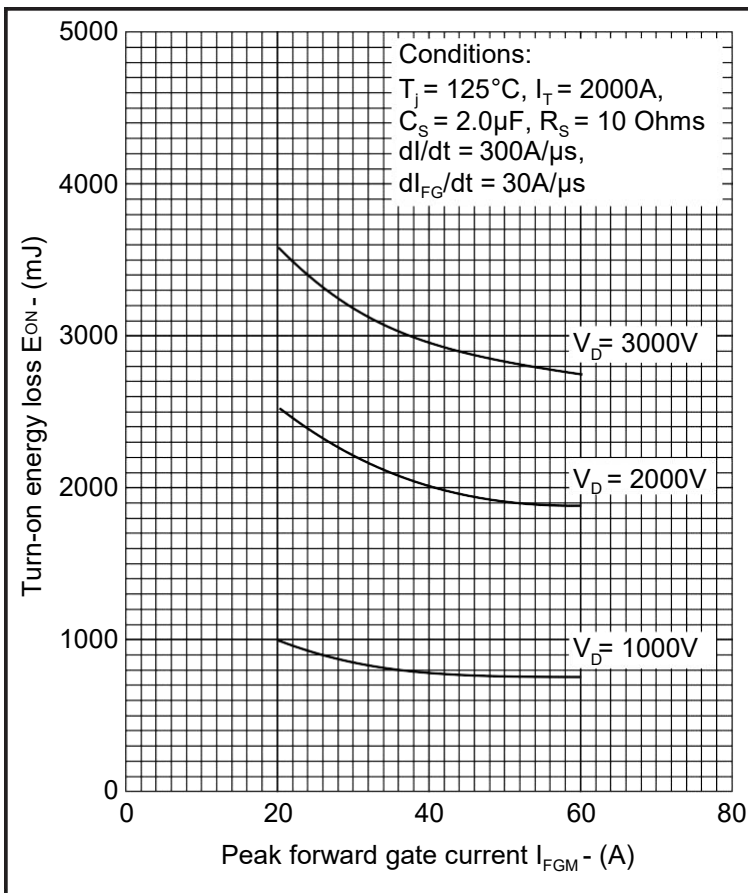


Fig.11 Turn-on energy vs peak forward gate current

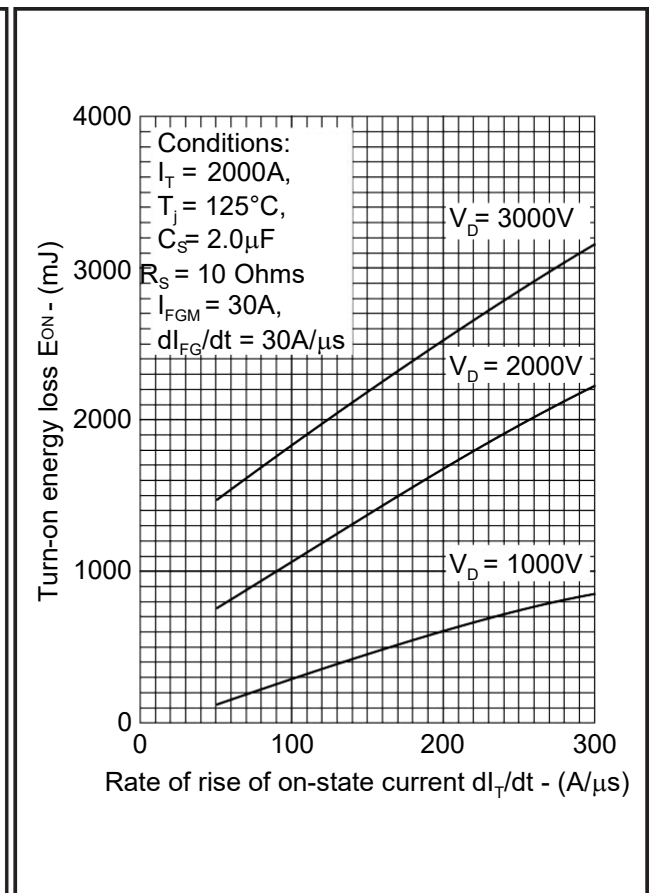


Fig.12 Turn-on energy vs rate of rise of on-state current

CURVES

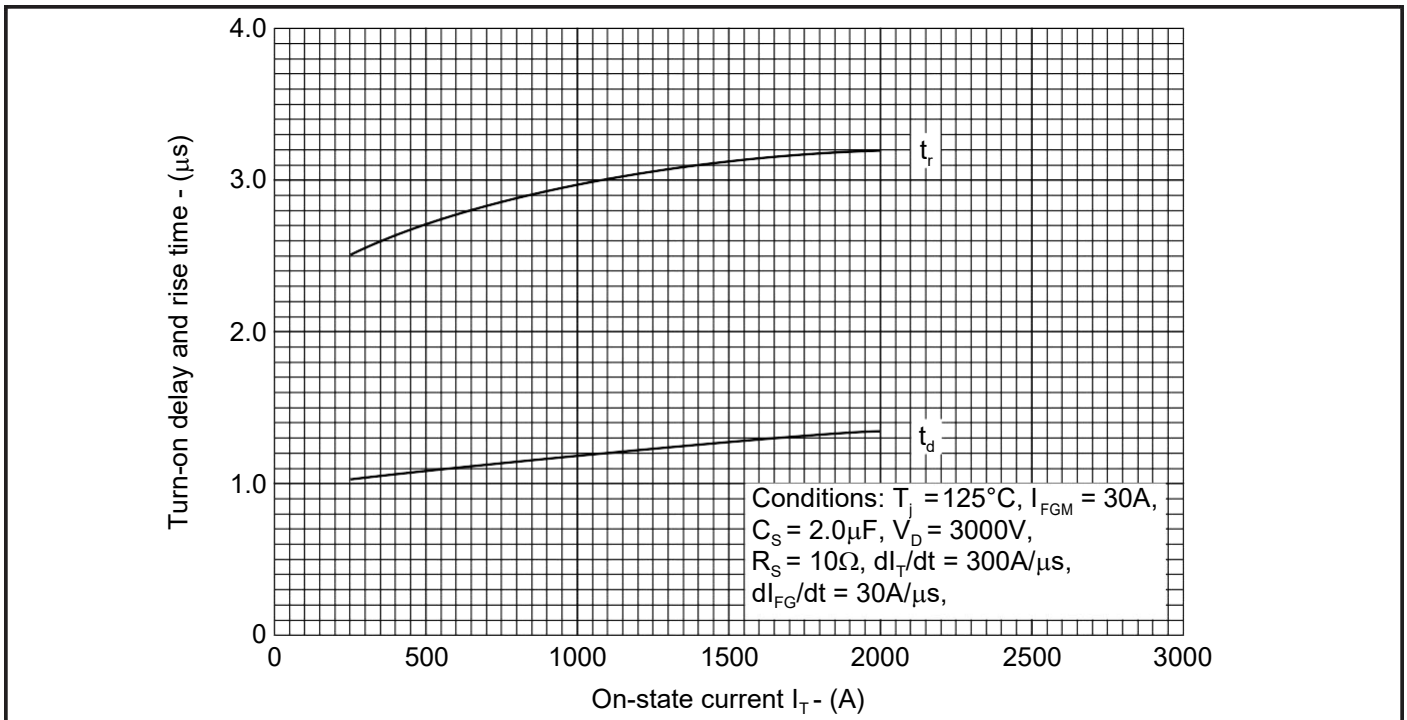


Fig.13 Delay time & rise time vs turn-on current

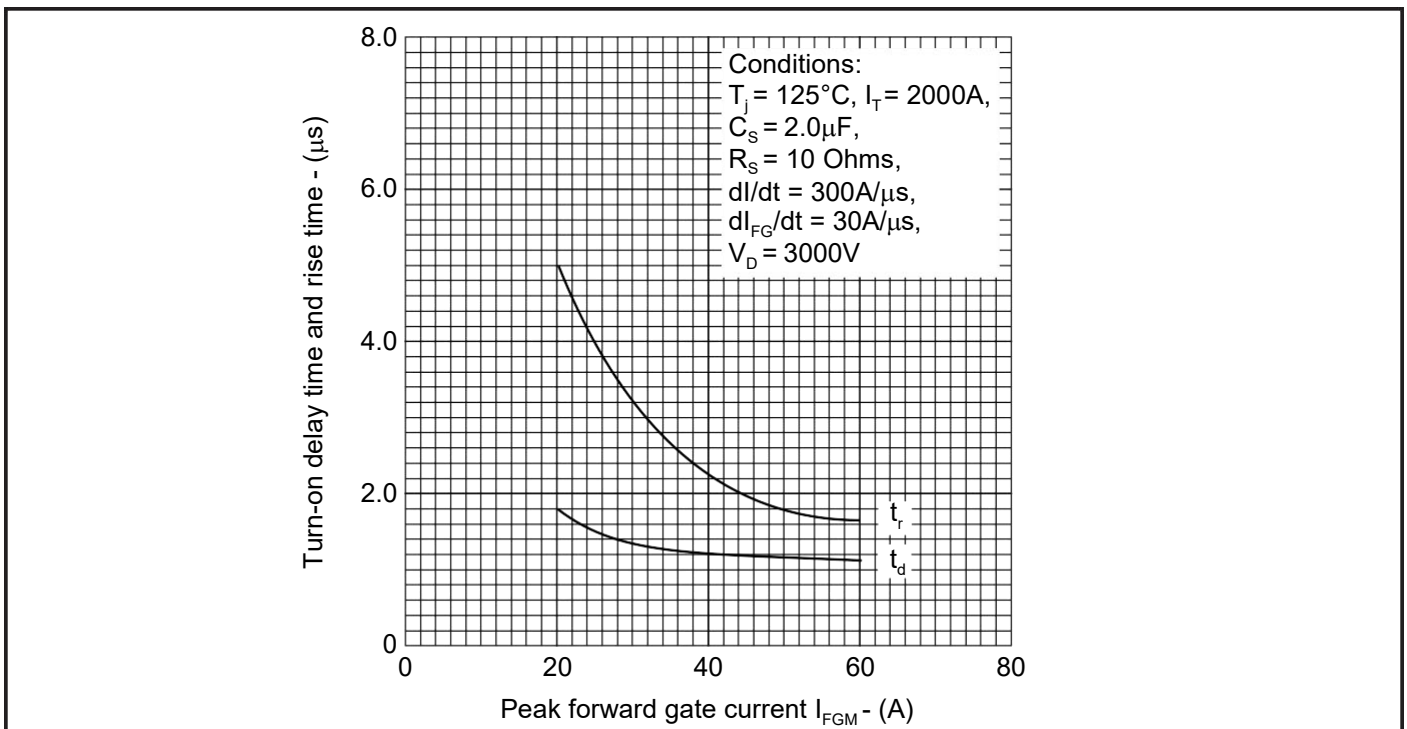


Fig.14 Delay time & rise time vs peak forward gate current

CURVES

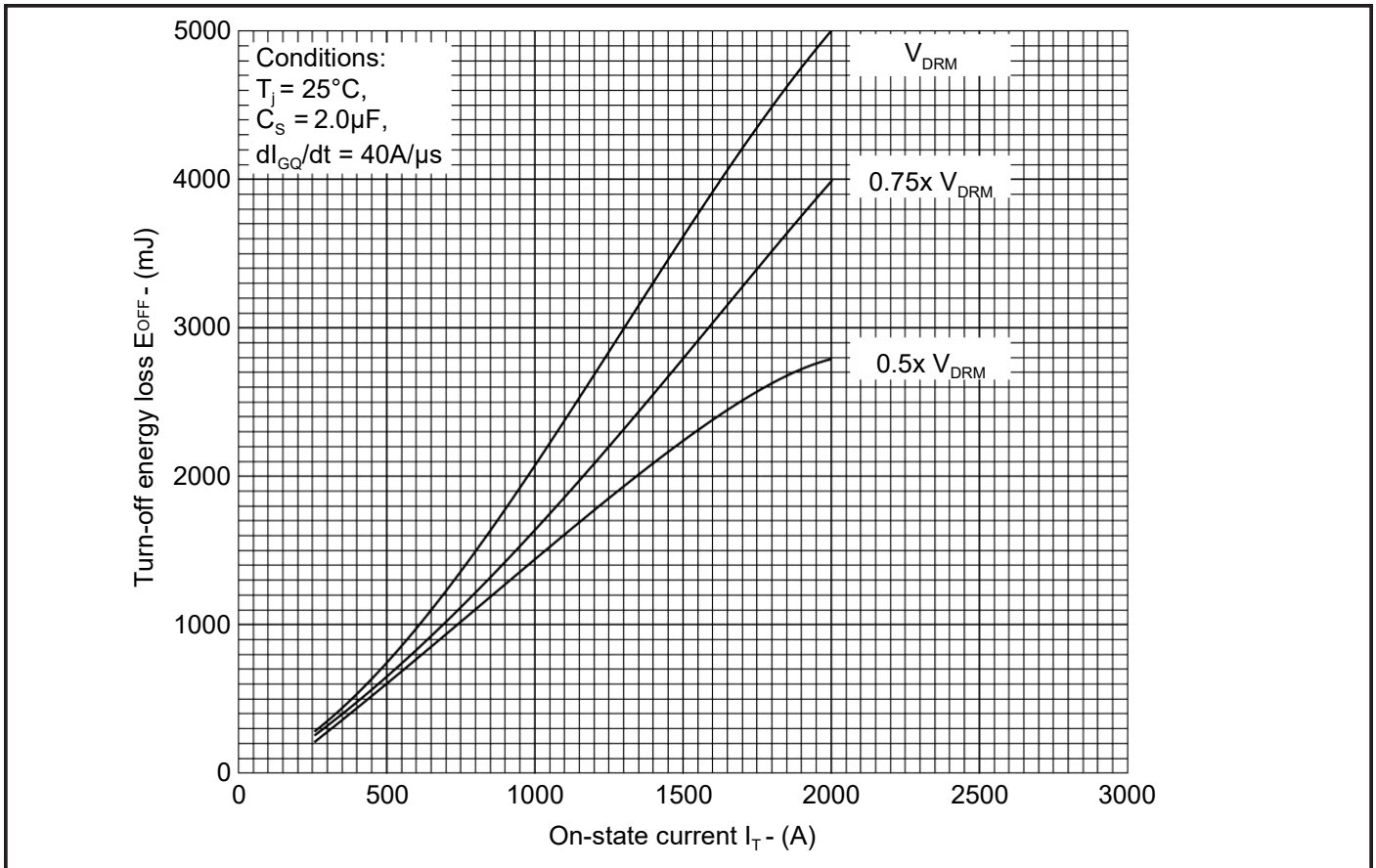


Fig.15 Turn-off energy vs on-state current

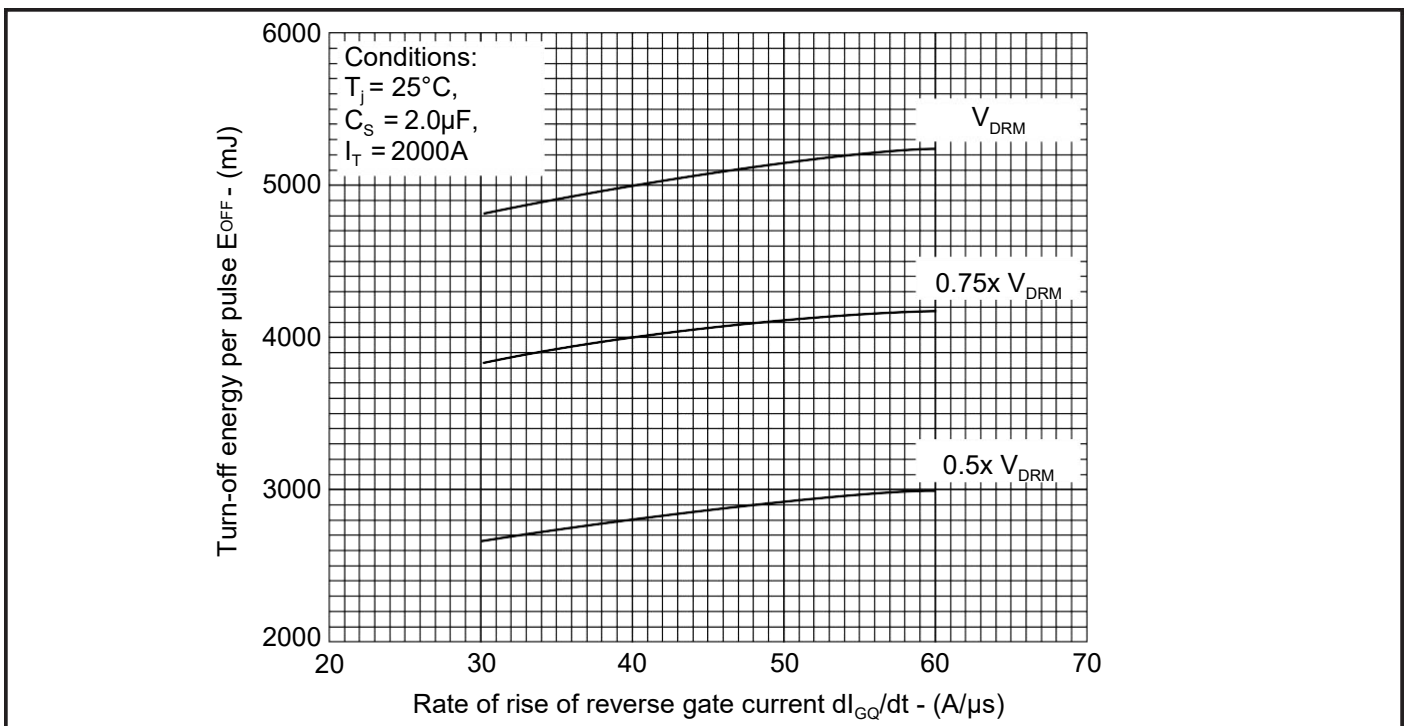


Fig.16 Turn-off energy vs rate of rise of reverse gate current

CURVES

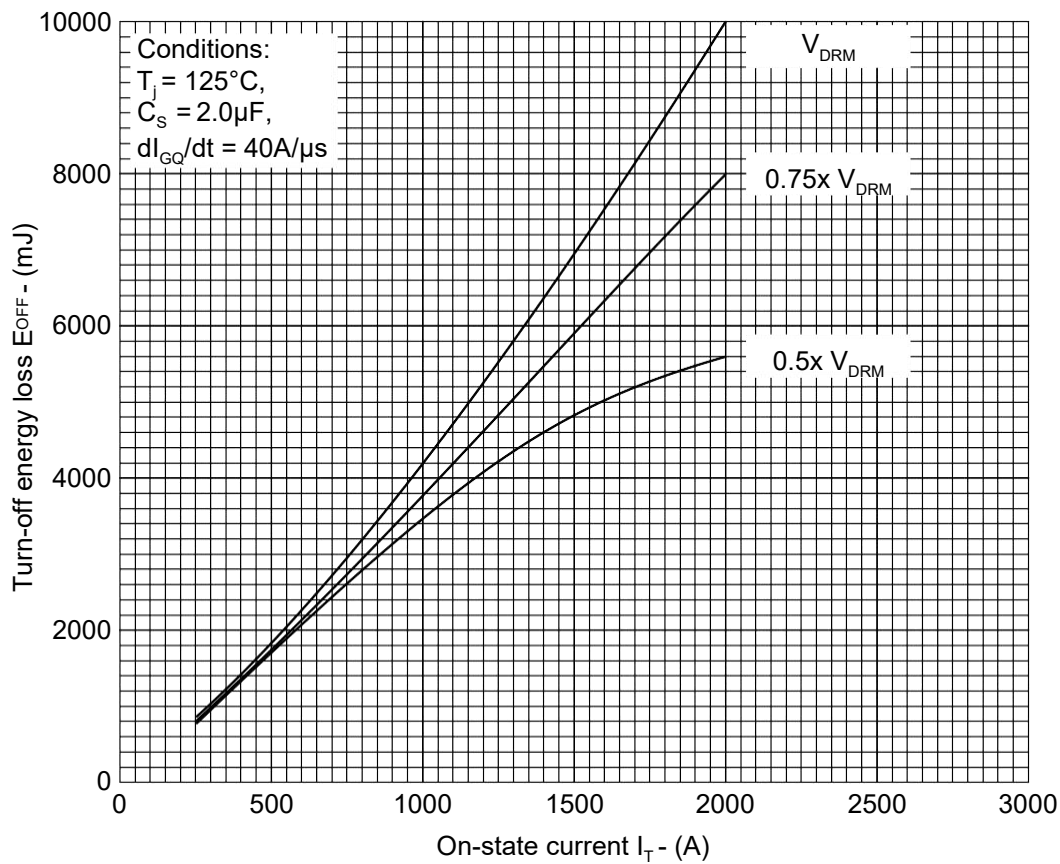


Fig.17 Turn-off energy vs on-state current

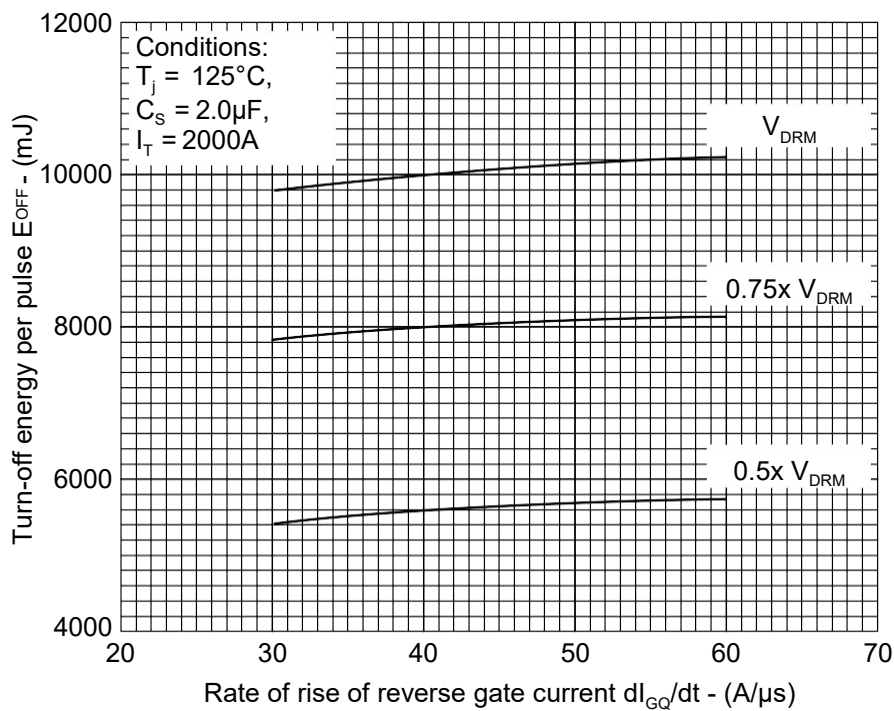


Fig.18 Turn-off energy loss vs rate of rise of reverse gate current

CURVES

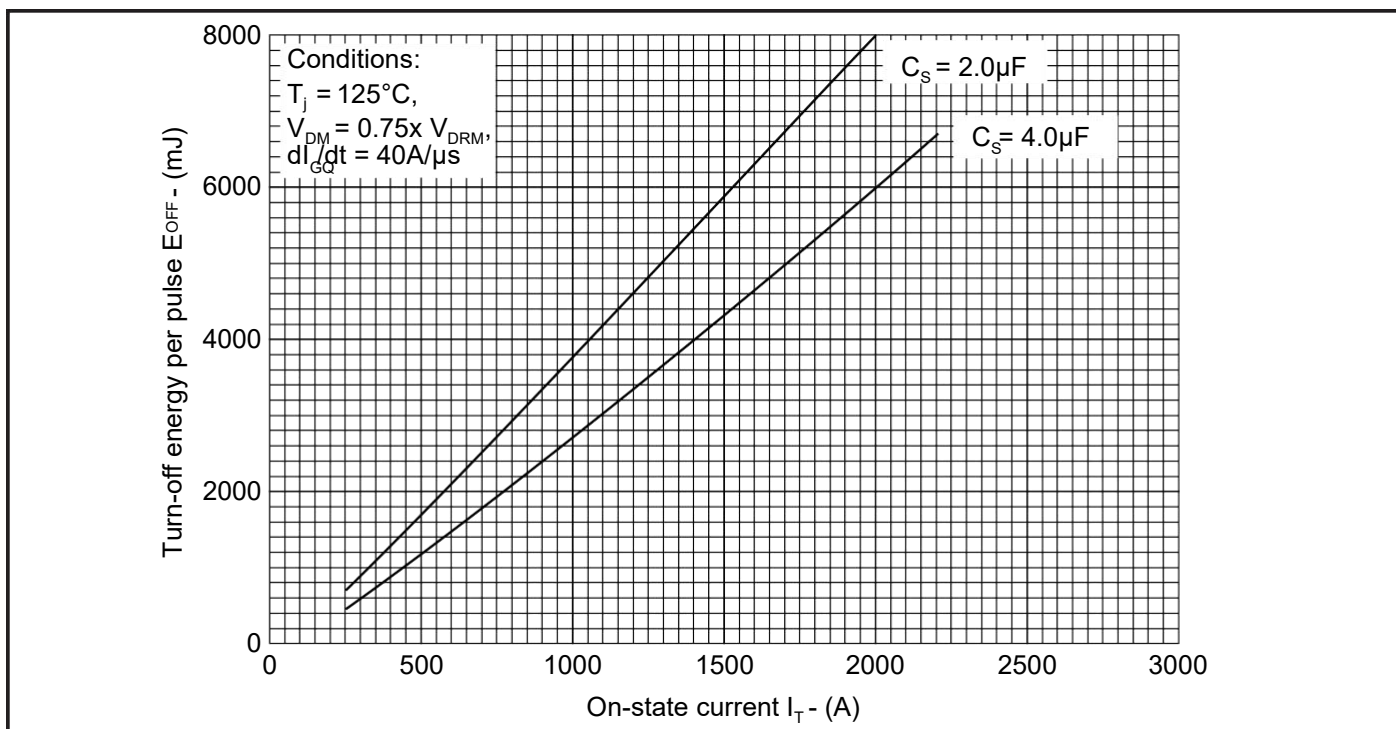


Fig.19 Turn-off energy vs on-state current

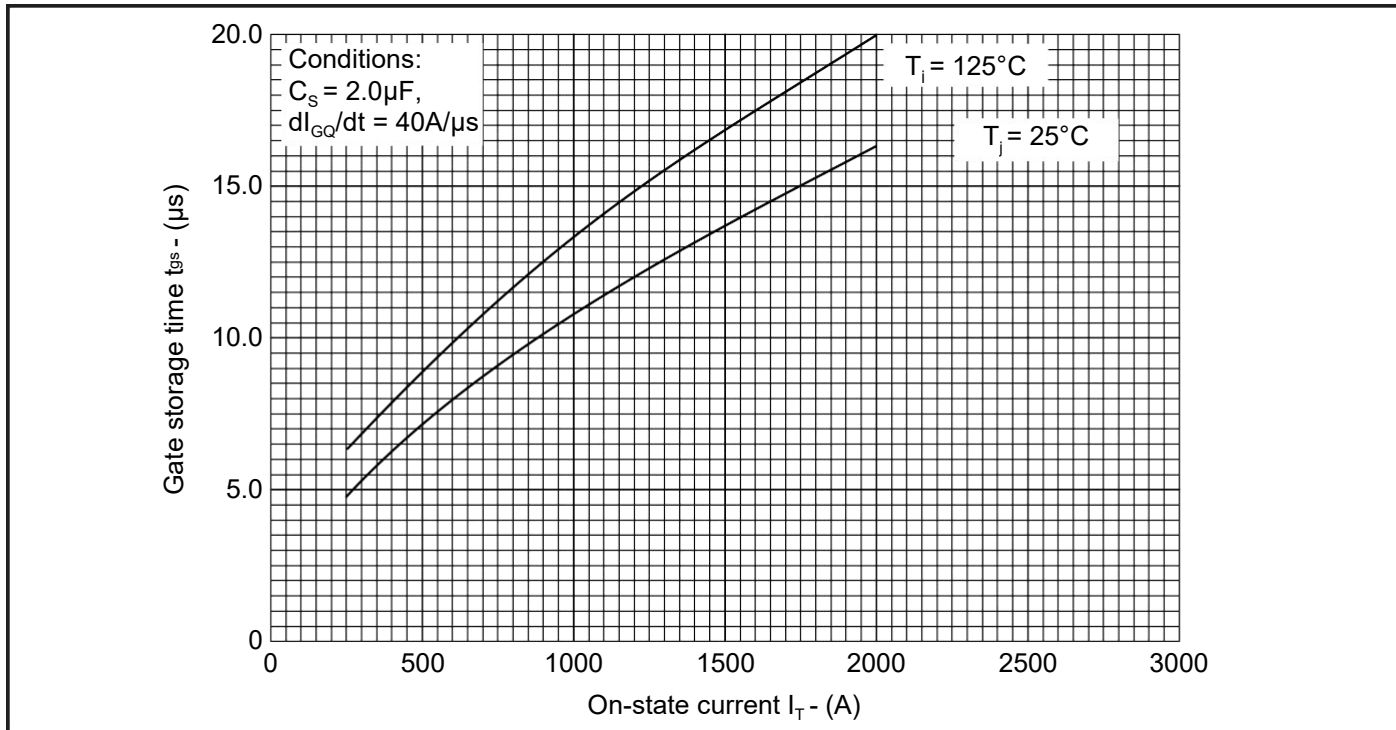


Fig.20 Gate storage time vs on-state current

CURVES

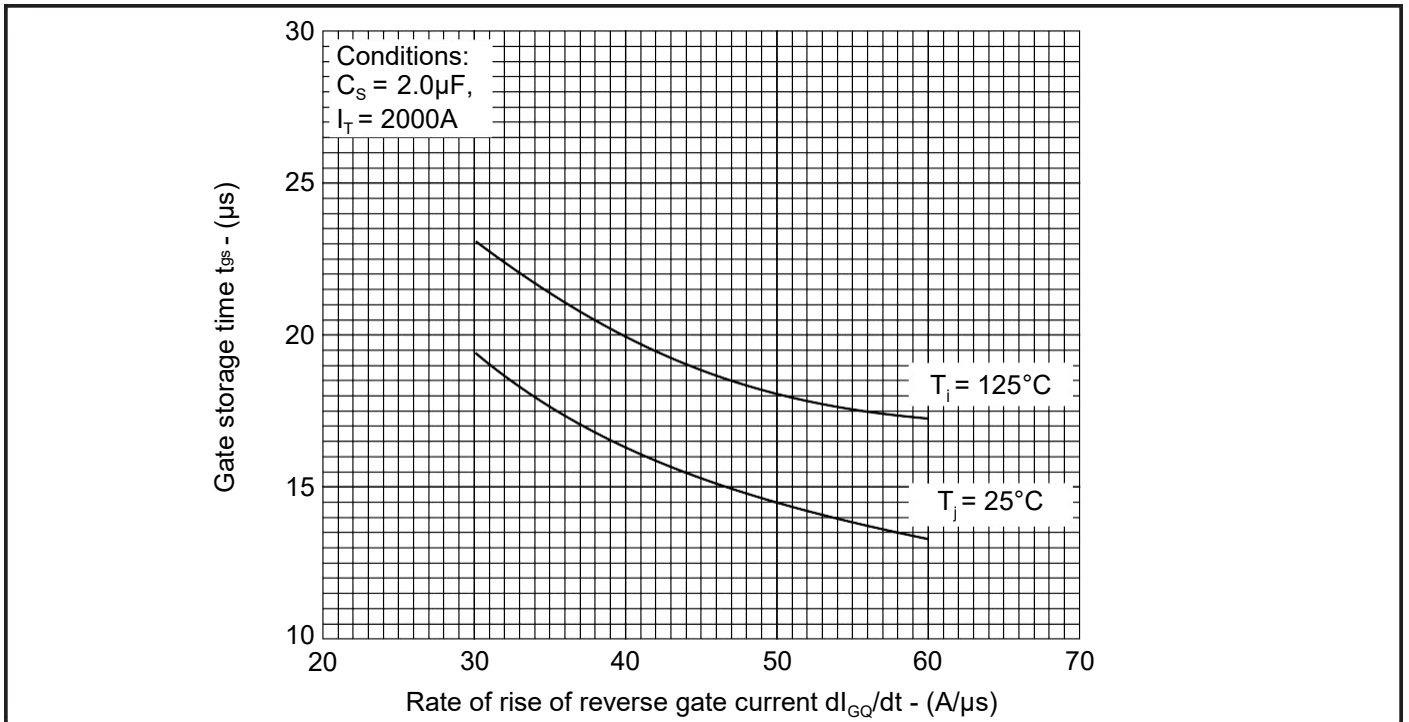


Fig.21 Gate storage time vs rate of rise of reverse gate current

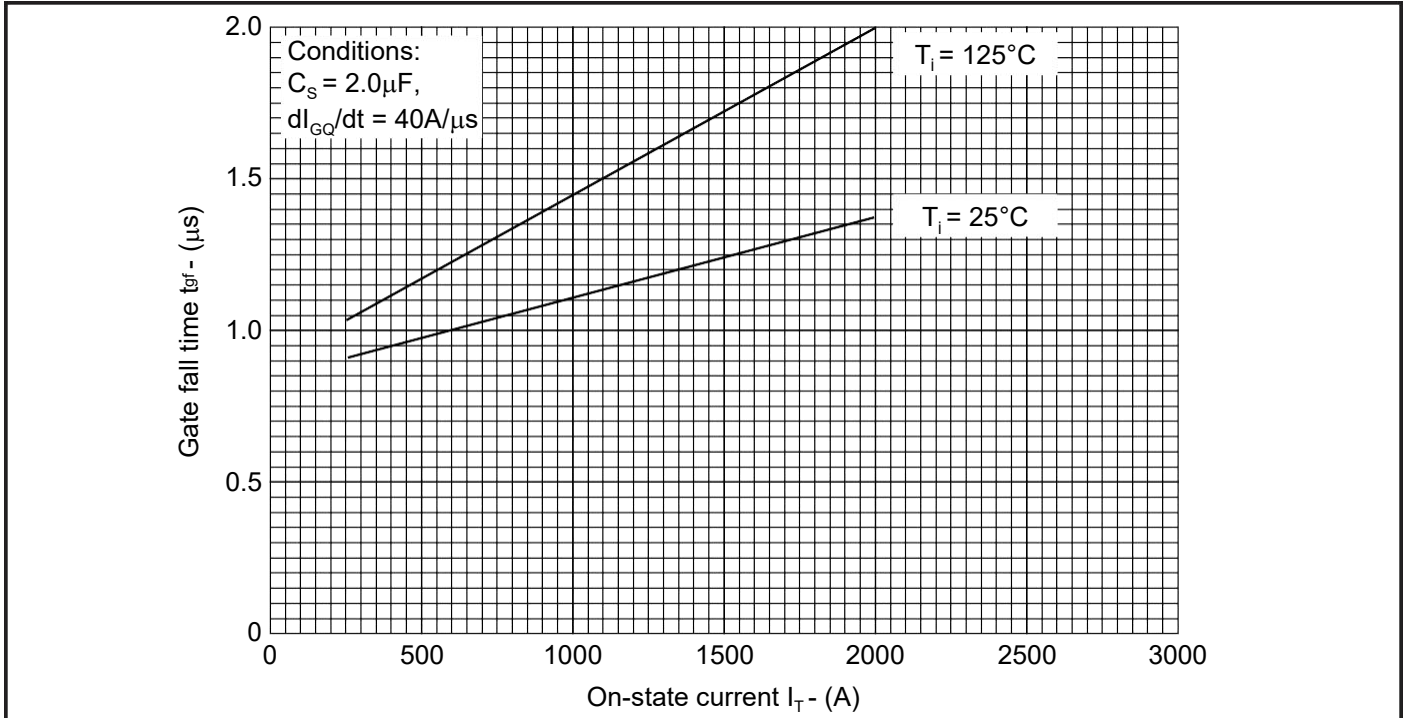


Fig.22 Gate fall time vs on-state current

CURVES

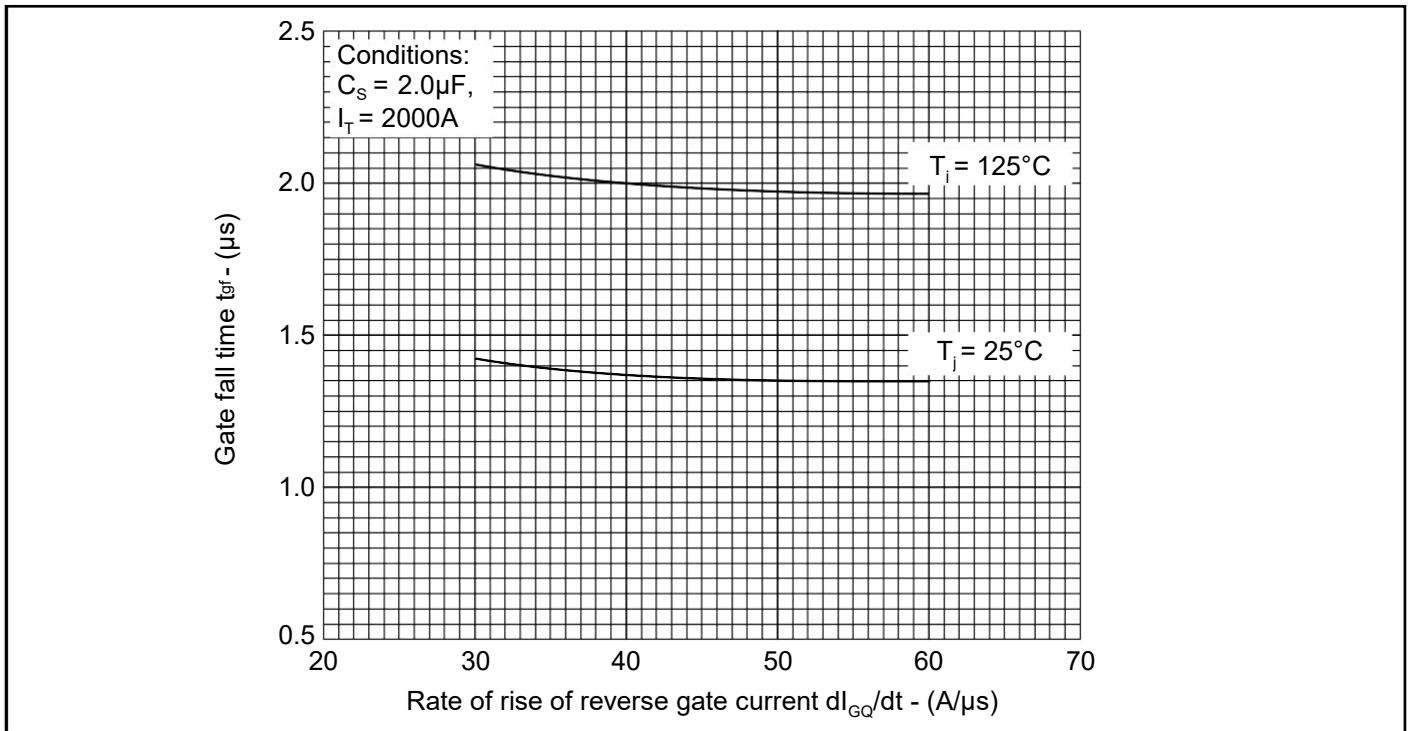


Fig.23 Gate fall time vs rate of rise of reverse gate current

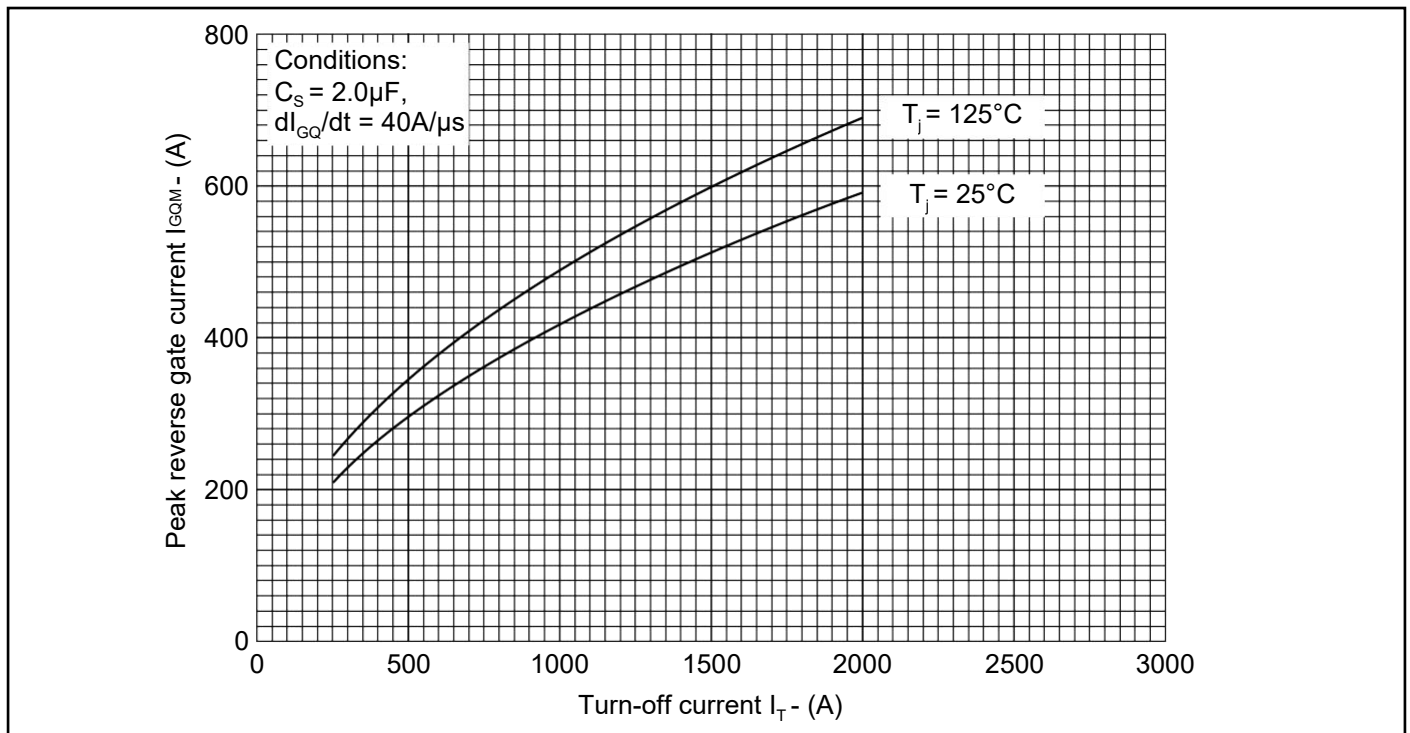


Fig.24 Peak reverse gate current vs turn-off current

CURVES

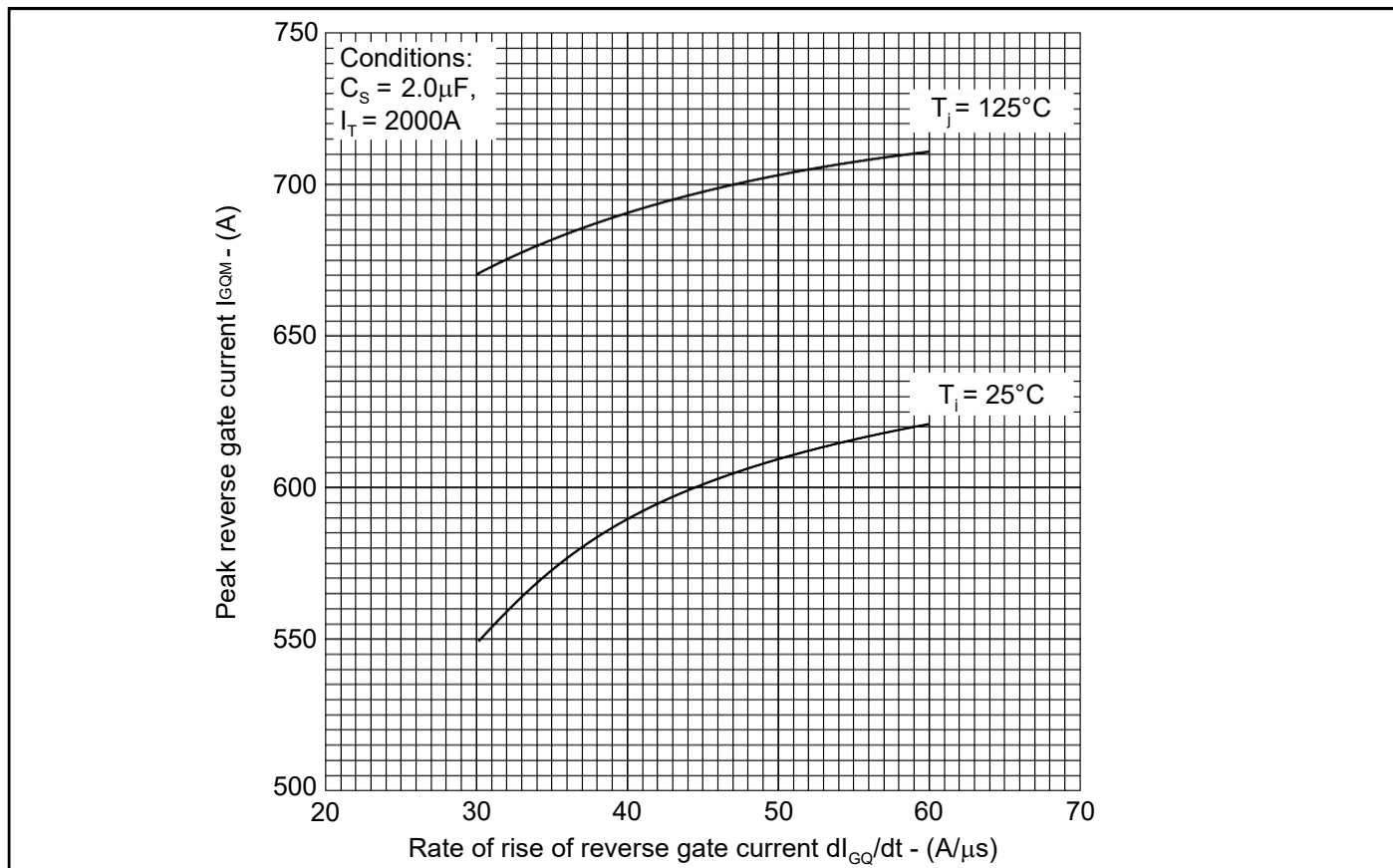


Fig.25 Peak reverse gate current vs rate of rise of reverse gate current

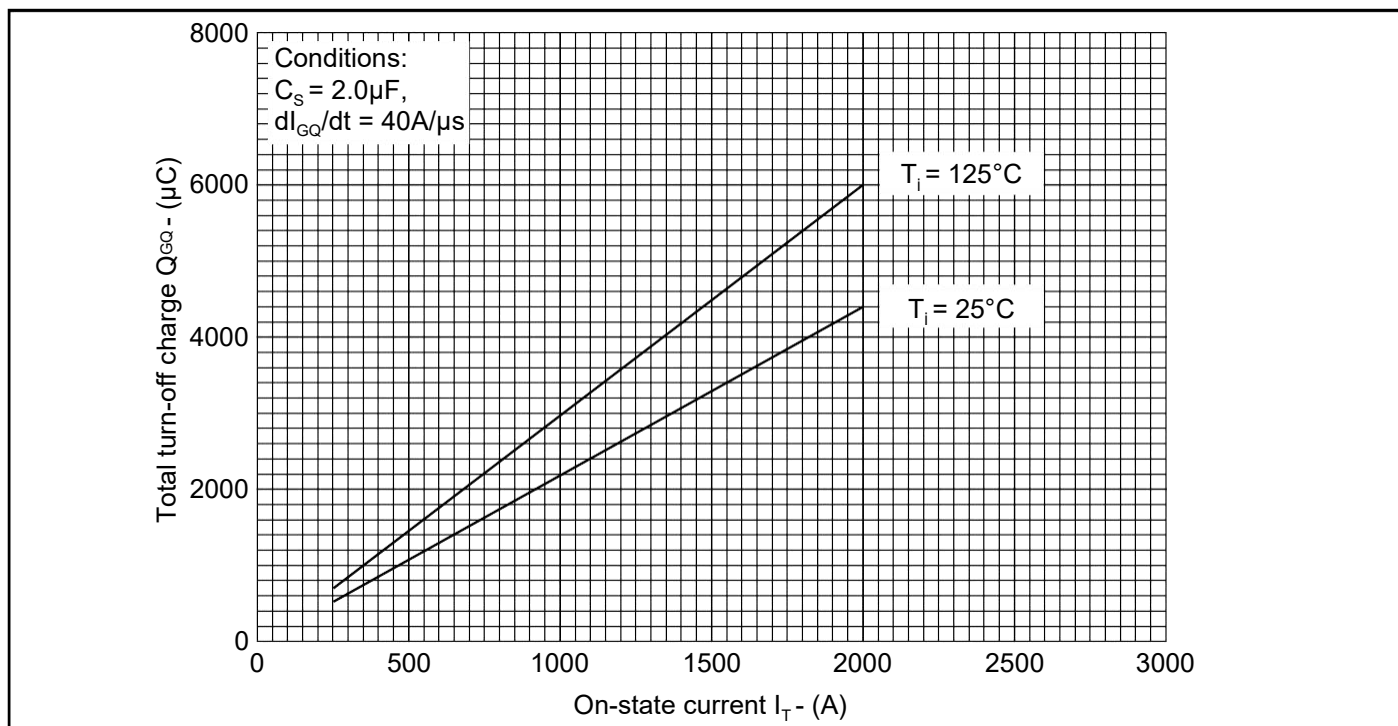


Fig.26 Turn-off gate charge vs on-state current

CURVES

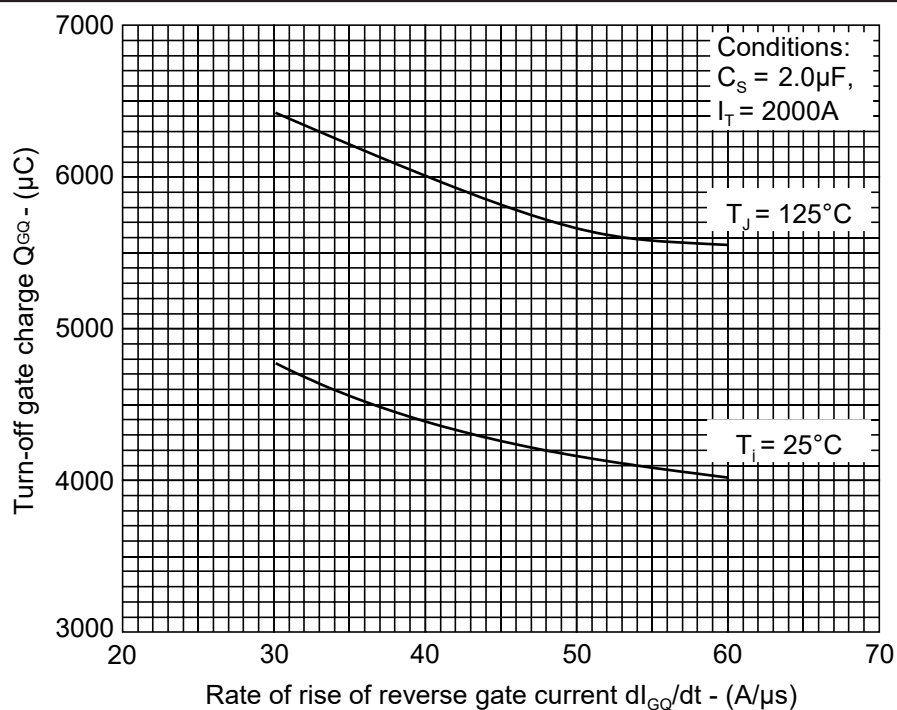


Fig.27 Turn-off gate charge vs rate of rise of reverse gate current

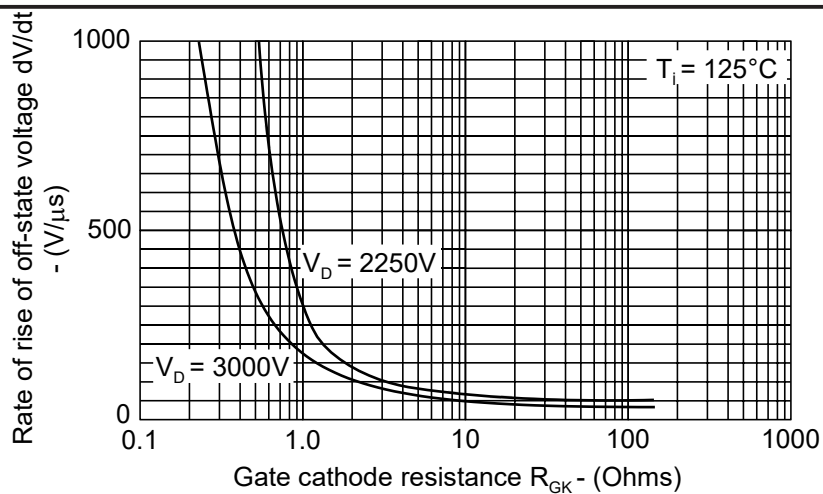
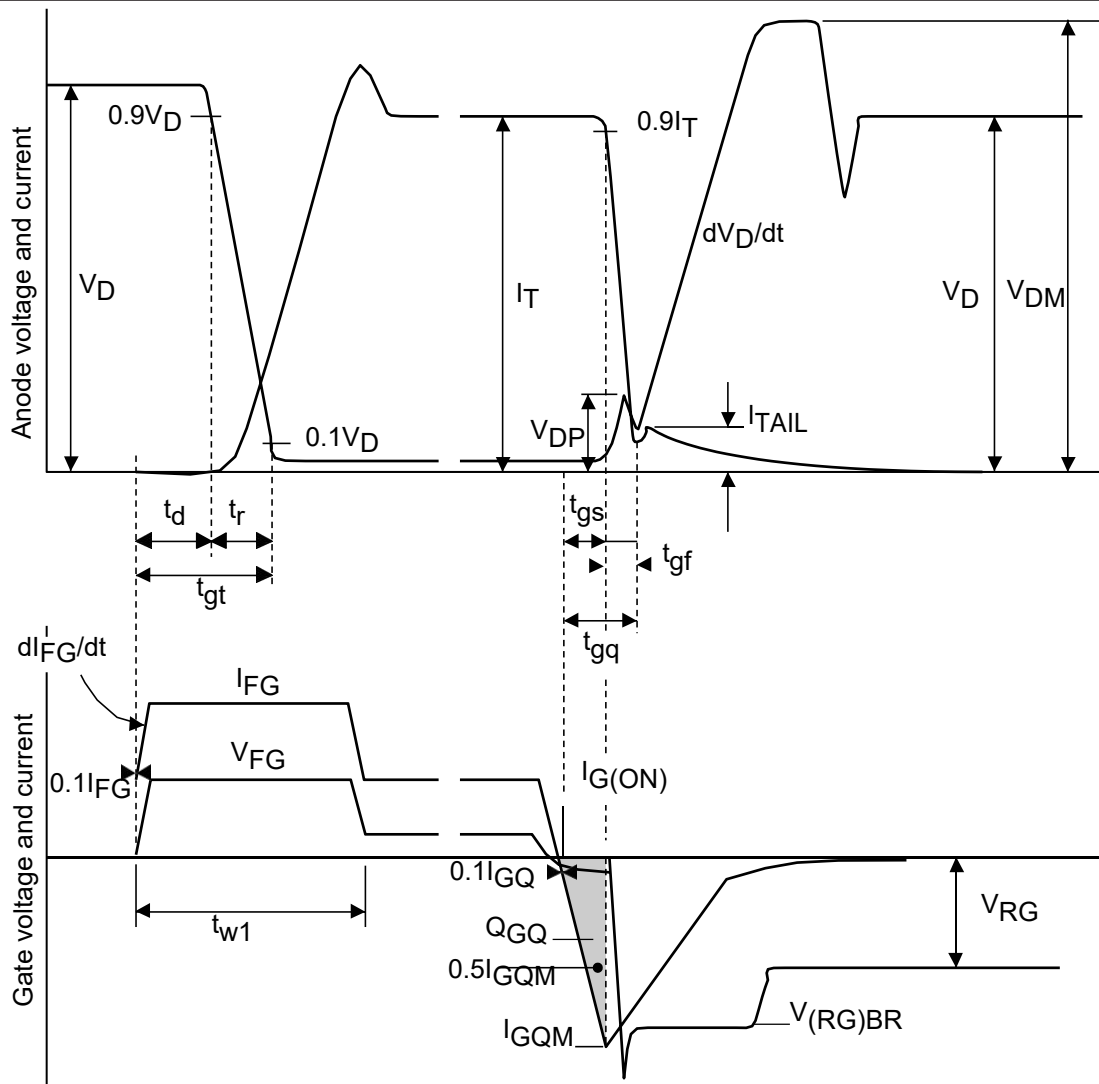


Fig.28 Rate of rise of off-state voltage vs gate cathode resistance

CURVES



Recommended gate conditions:

$$I_{TCM} = 2000A$$

$$I_{FG} = 30A$$

$$I_{G(ON)} = 7A \text{ d.c.}$$

$$t_{w1(min)} = 20\mu s$$

$$I_{GQM} = 690A$$

$$di_{GQ}/dt = 40A/\mu s$$

$$Q_{GQ} = 6000\mu C$$

$$V_{RG(min)} = 2V$$

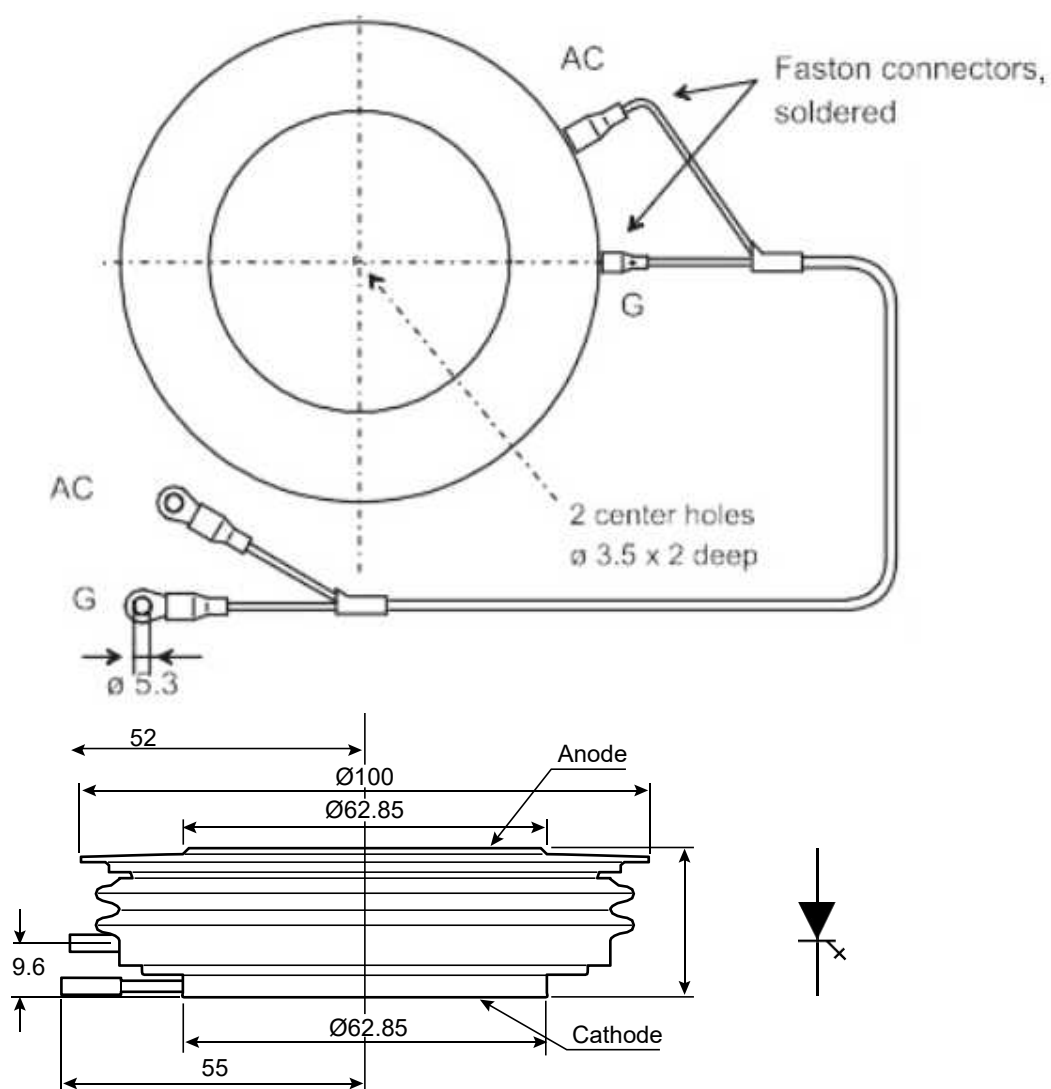
$$V_{RG(max)} = 16V$$

Fig.29 General switching waveforms



OUTLINE AND DIMENSION

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



Nominal weight: 820g
Clamping force: $20\text{kN} \pm 10\%$
Lead coaxial length: 600mm

Package outline type code: H