

APPLICATIONS

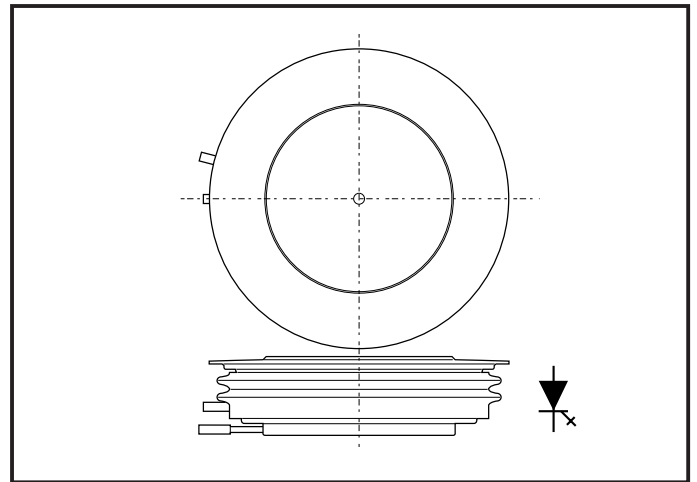
- Variable speed A.C. motor drive inverters (VSD-AC)
- Uninterruptable Power Supplies
- High Voltage Converters
- Choppers
- Welding
- Induction Heating
- DC/DC Converters

KEY PARAMETERS

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

FEATURES

- Double Side Cooling
- High Reliability In Service
- High Voltage Capability
- Fault Protection Without Fuses
- High Surge Current Capability
- Turn-off Capability Allows Reduction In Equipment Size And Weight. Low Noise Emission Reduces Acoustic Cladding Necessary For Environmental Requirements



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

VOLTAGE RATINGS

Type Number	Repetitive Peak Off-state Voltage V_{DRM} V	Repetitive Peak Reverse Voltage V_{RRM} V	Conditions
DG648BH45	4500	16	$T_{vj} = 125^{\circ}C, I_{DM} = 50mA,$ $I_{RRM} = 50mA$

CURRENT RATINGS

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

DG648BH45

SURGE RATINGS

Symbol	Parameter	Conditions	Max.	Units
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	$V_D = 4500\text{V}$, $I_T = 2000\text{A}$, $T_j = 125^\circ\text{C}$, $I_{FG} > 30\text{A}$, 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	Conditions	Min.	Max.	Units
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 RATINGS AND MECHANICAL DATA

Symbol	Parameter	Conditions	Min.	Max.	Units
$R_{th(j-hs)}$	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		0.006	$^\circ\text{C}/\text{W}$
		per contact	-		
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

CHARACTERISTICS

T _j = 125°C unless stated otherwise					
Symbol	Parameter	Conditions	Min.	Max.	Units
V _{TM}	On-state voltage	At 2000A peak, I _{G(ON)} = 7A d.c.	-	3.2	V
I _{DM}	Peak off-state current	V _{DRM} = 4500V, V _{RG} = 0V	-	100	mA
I _{RRM}	Peak reverse current	At V _{RRM}	-	50	mA
V _{GT}	Gate trigger voltage	V _D = 24V, I _T = 100A, T _j = 25°C	-	1.0	V
I _{GT}	Gate trigger current	V _D = 24V, I _T = 100A, T _j = 25°C	-	3.0	A
I _{RGM}	Reverse gate cathode current	V _{RGM} = 16V, No gate/cathode resistor	-	50	mA
E _{ON}	Turn-on energy	V _D = 3000V	-	3170	mJ
t _d	Delay time	I _T = 2000A, di _T /dt = 300A/μs	-	1.35	μs
t _r	Rise time	I _{FG} = 30A, rise time < 1.0μs	-	3.2	μs
E _{OFF}	Turn-off energy		-	10000	mJ
t _{gs}	Storage time		-	20.0	μs
t _{gf}	Fall time	I _T = 2000A, V _{DM} = V _{DRM}	-	2.0	μs
t _{gq}	Gate controlled turn-off time	Snubber Cap Cs = 2.0μF,	-	22.0	μs
Q _{GQ}	Turn-off gate charge	di _{GQ} /dt = 40A/μs	-	6000	μC
Q _{GQT}	Total turn-off gate charge		-	12000	μC
I _{GQM}	Peak reverse gate current		-	690	A

CURVES

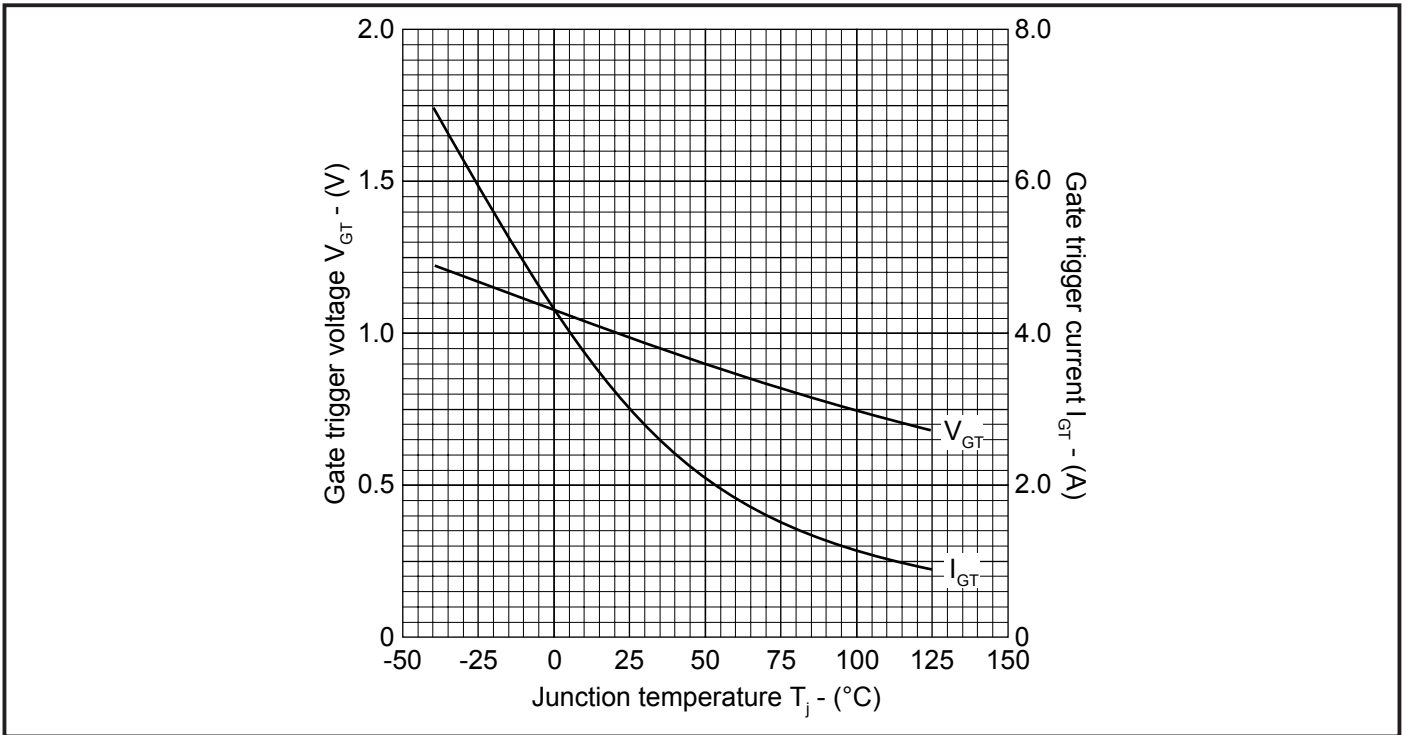


Fig.1 Maximum gate trigger voltage/current vs junction temperature

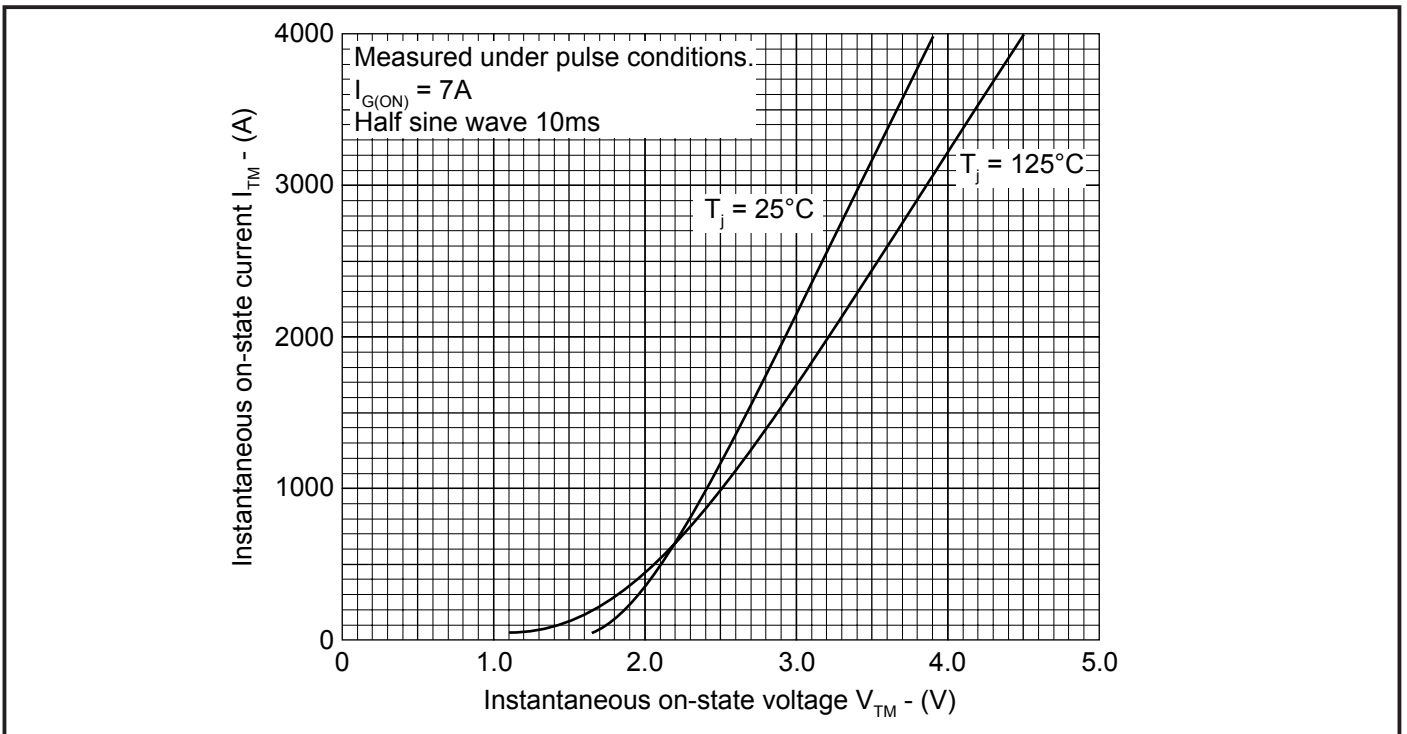


Fig.2 On-state characteristics

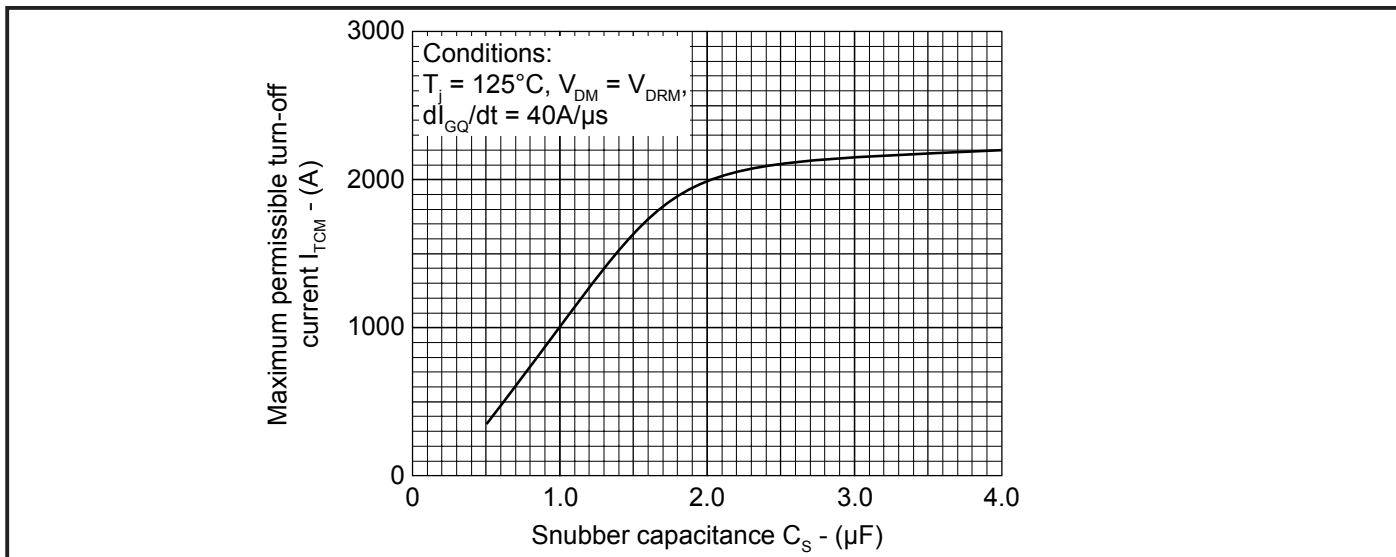


Fig.3 Maximum dependence of I_{TCM} on C_s

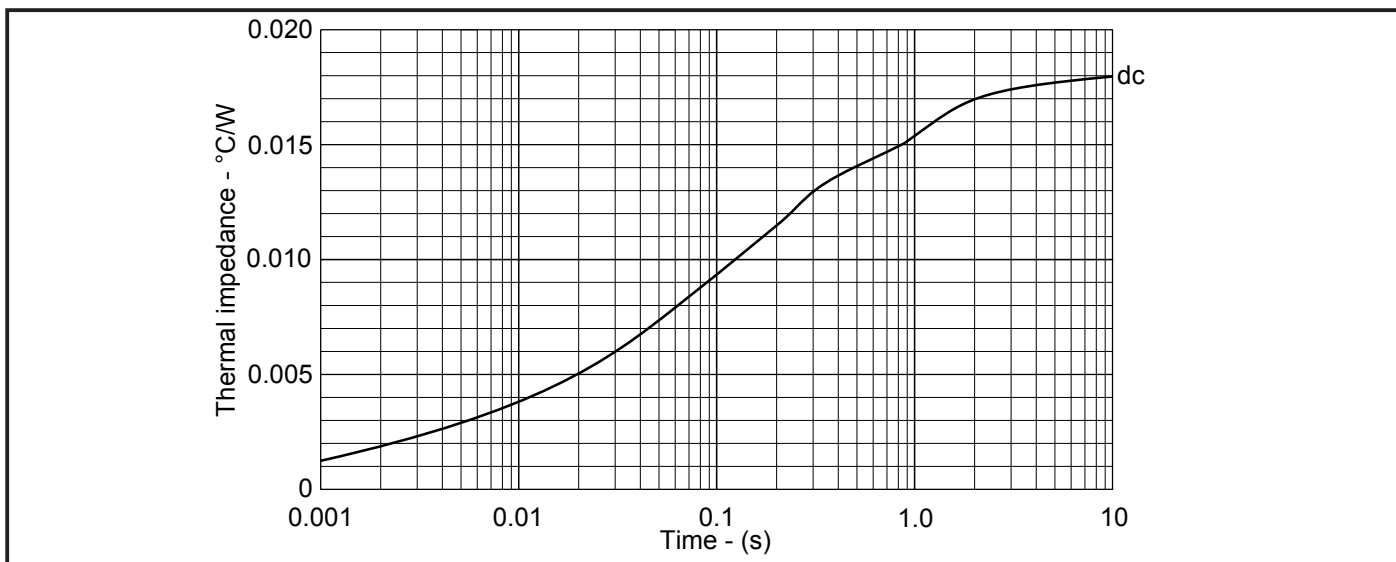


Fig.4 Maximum (limit) transient thermal impedance - double side cooled

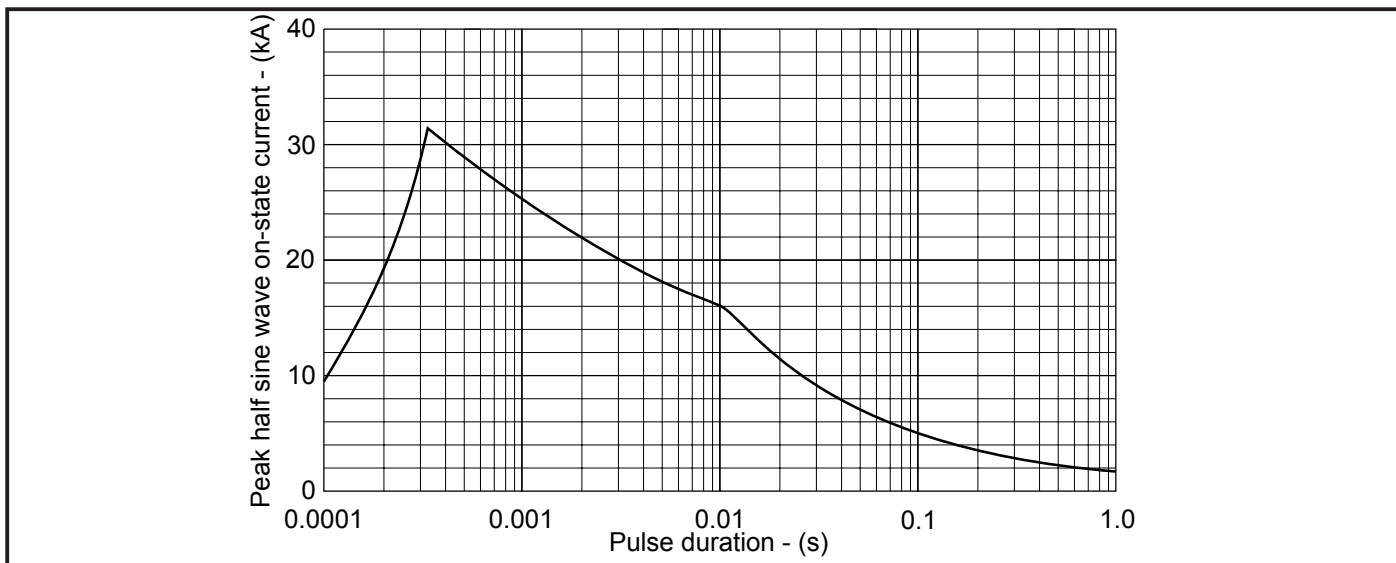


Fig.5 Surge (non-repetitive) on-state current vs time

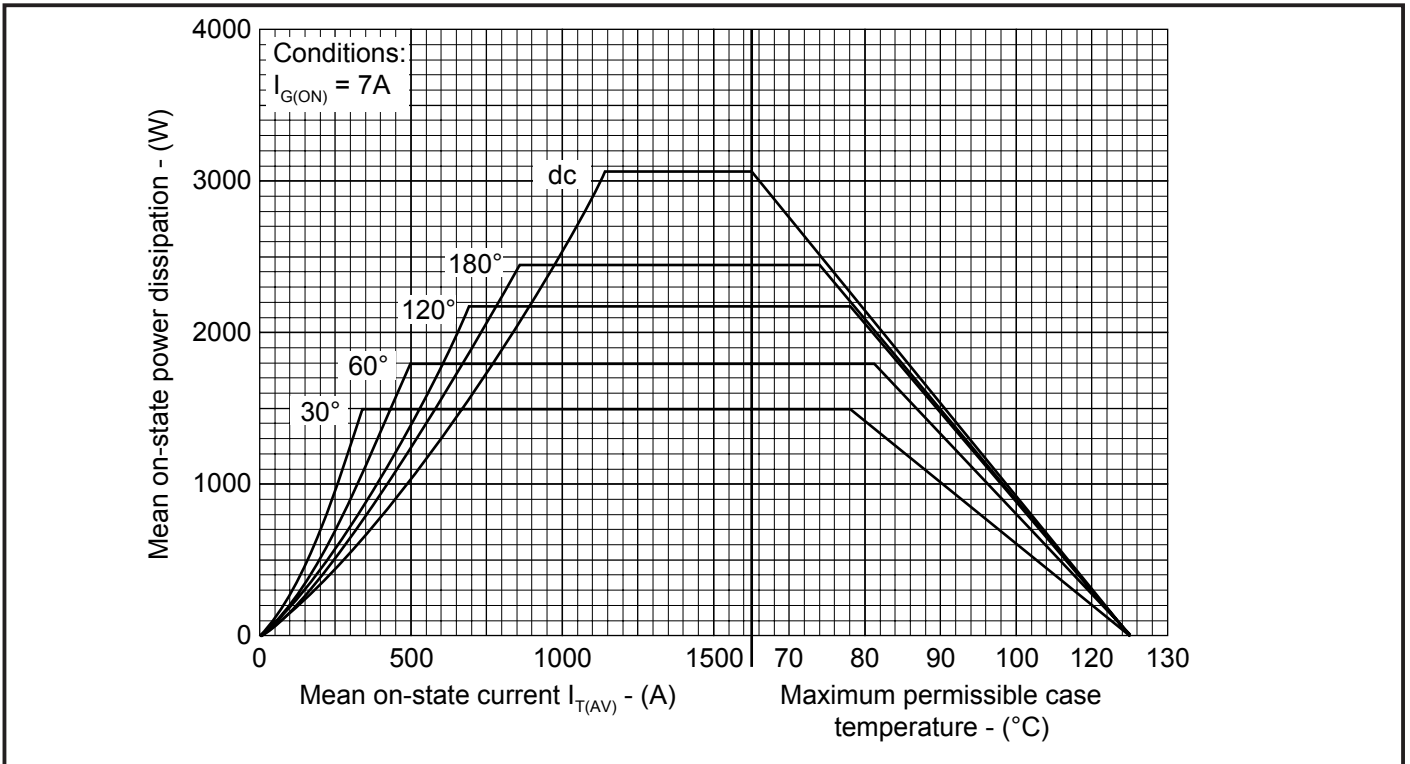


Fig.6 Steady state rectangular wave conduction loss - double side cooled

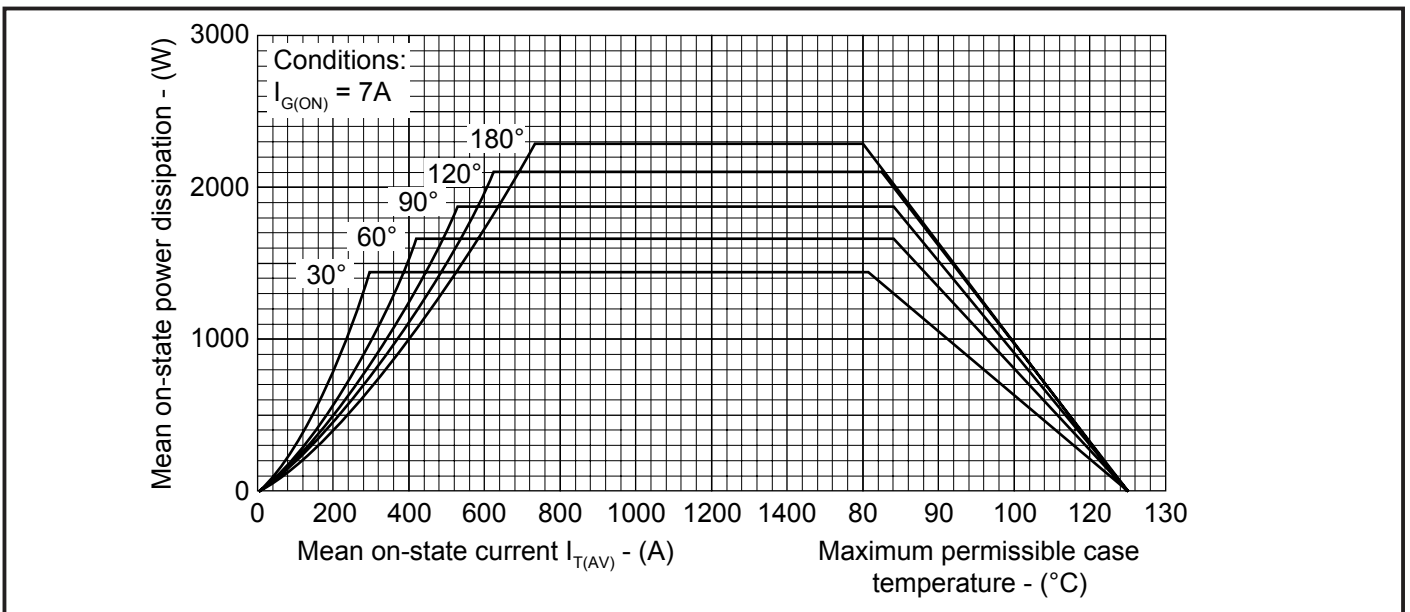


Fig.7 Steady state sinusoidal wave conduction loss - double side cooled

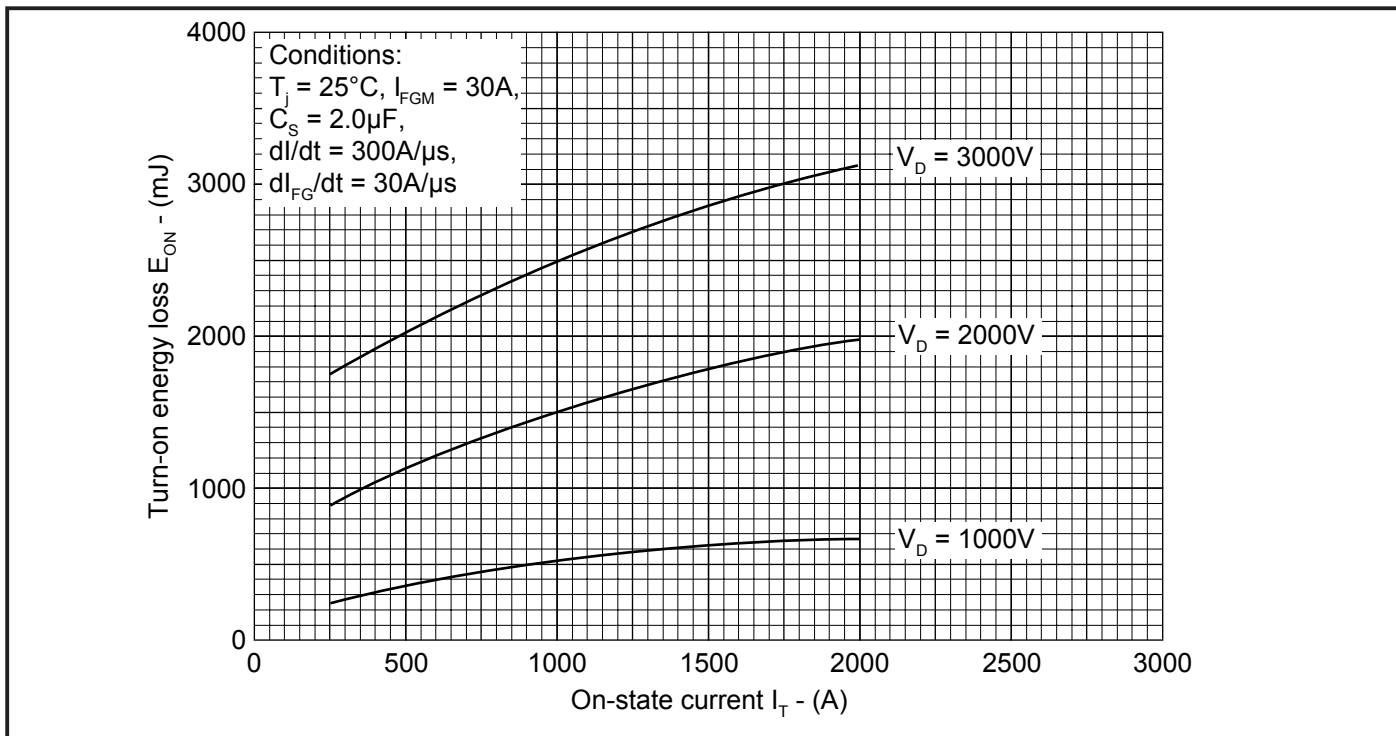


Fig.8 Turn-on energy vs on-state current

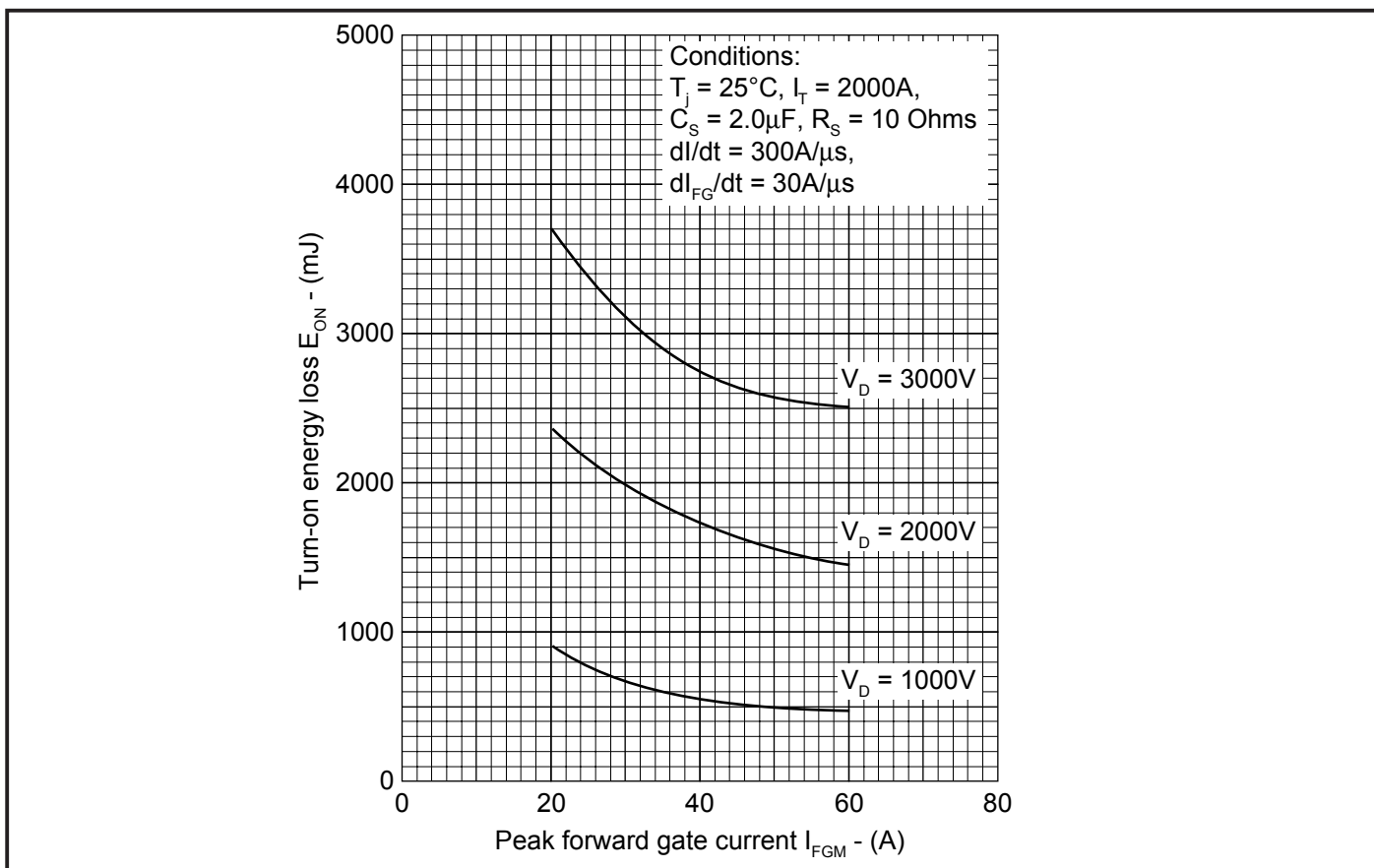


Fig.9 Turn-on energy vs peak forward gate current

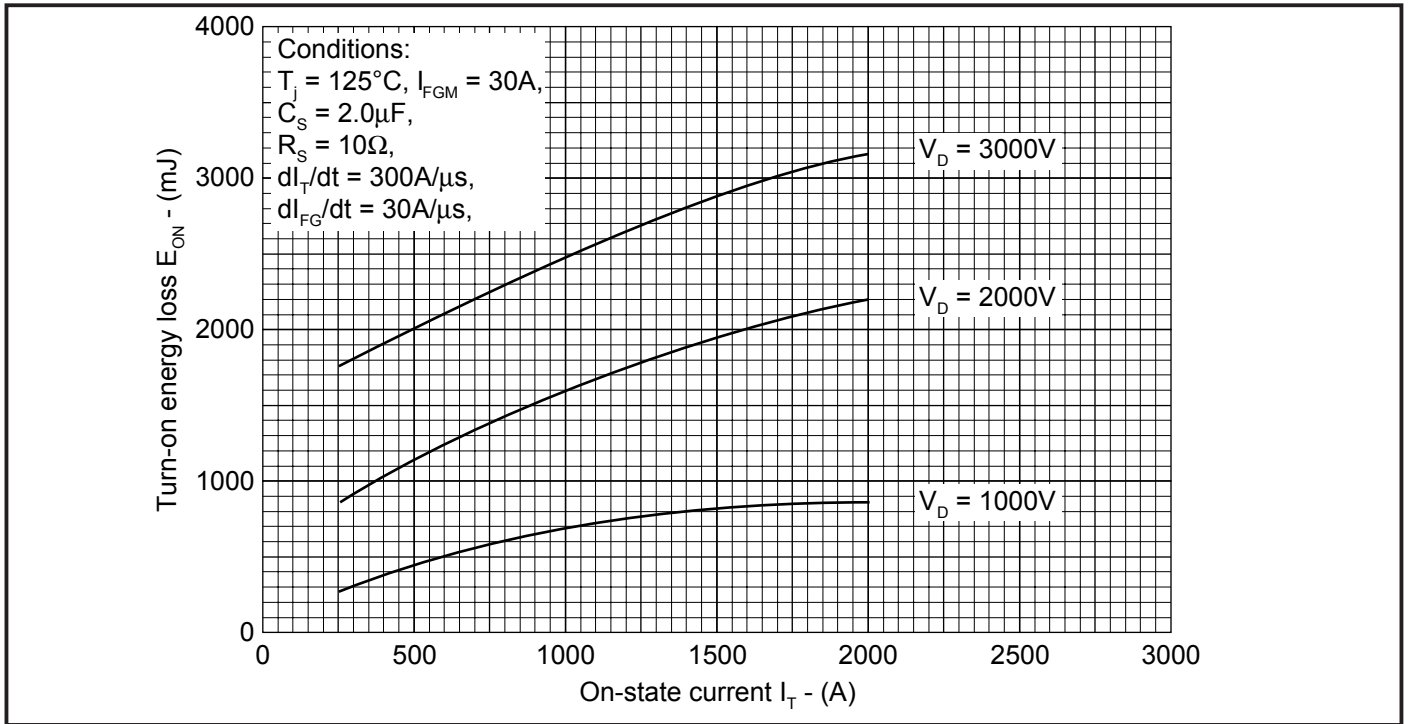


Fig.10 Turn-on energy vs on-state current

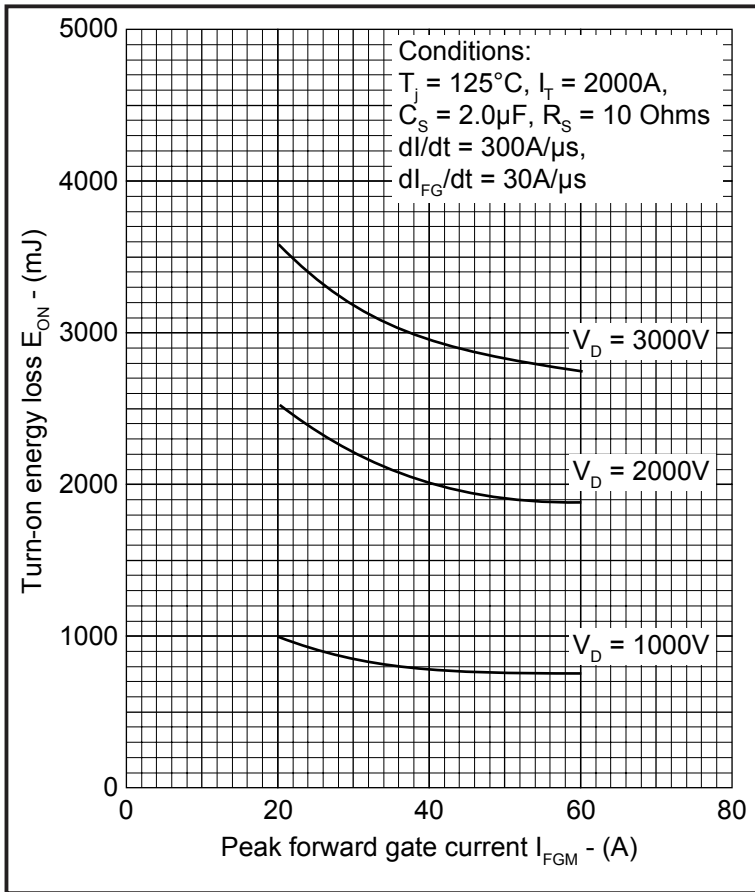


Fig.11 Turn-on energy vs peak forward gate current

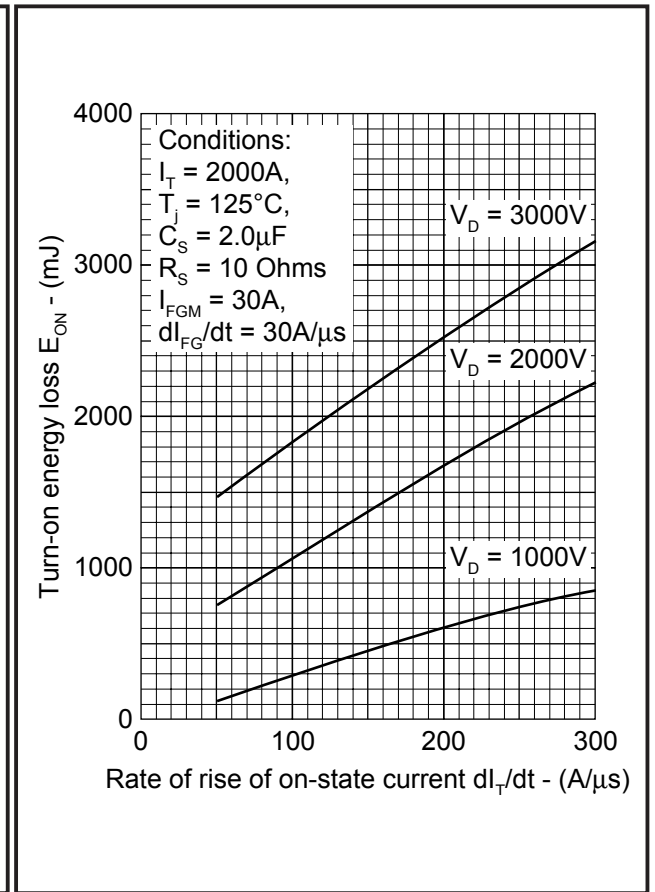


Fig.12 Turn-on energy vs rate of rise of on-state current

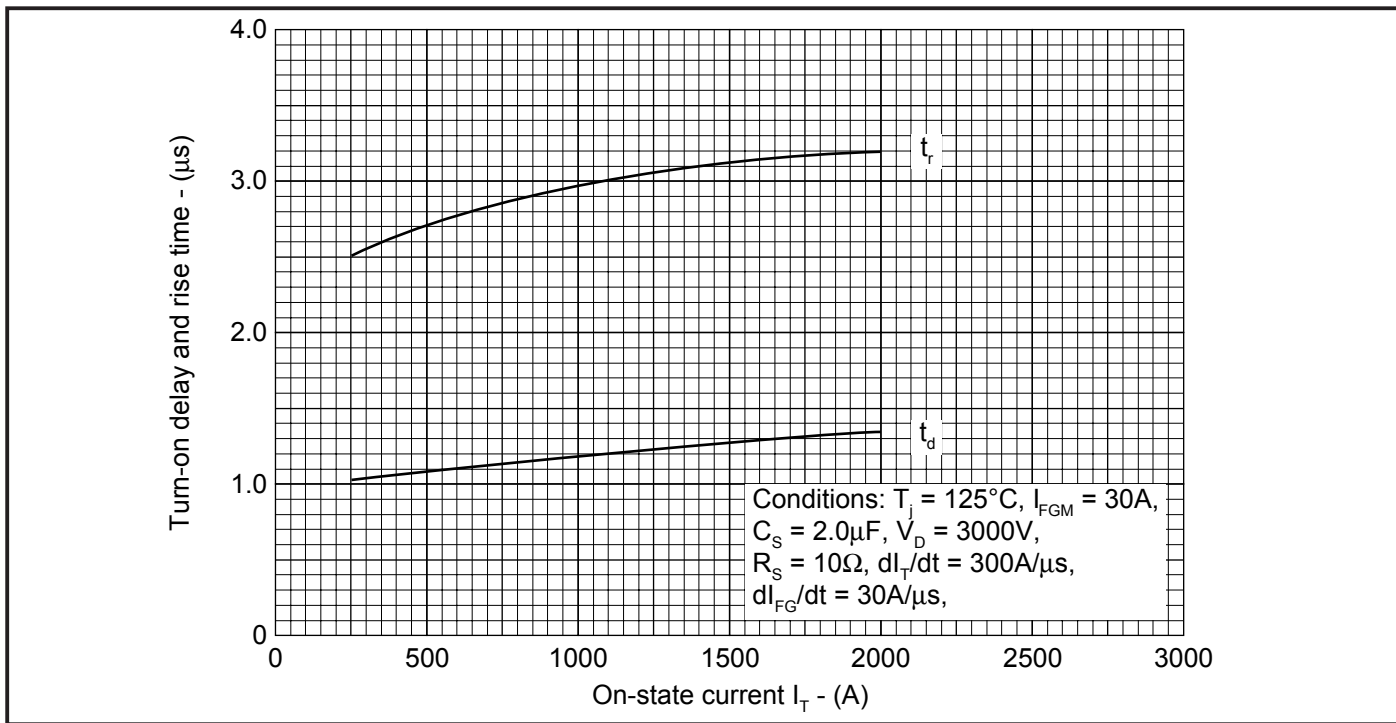


Fig.13 Delay time & rise time vs turn-on current

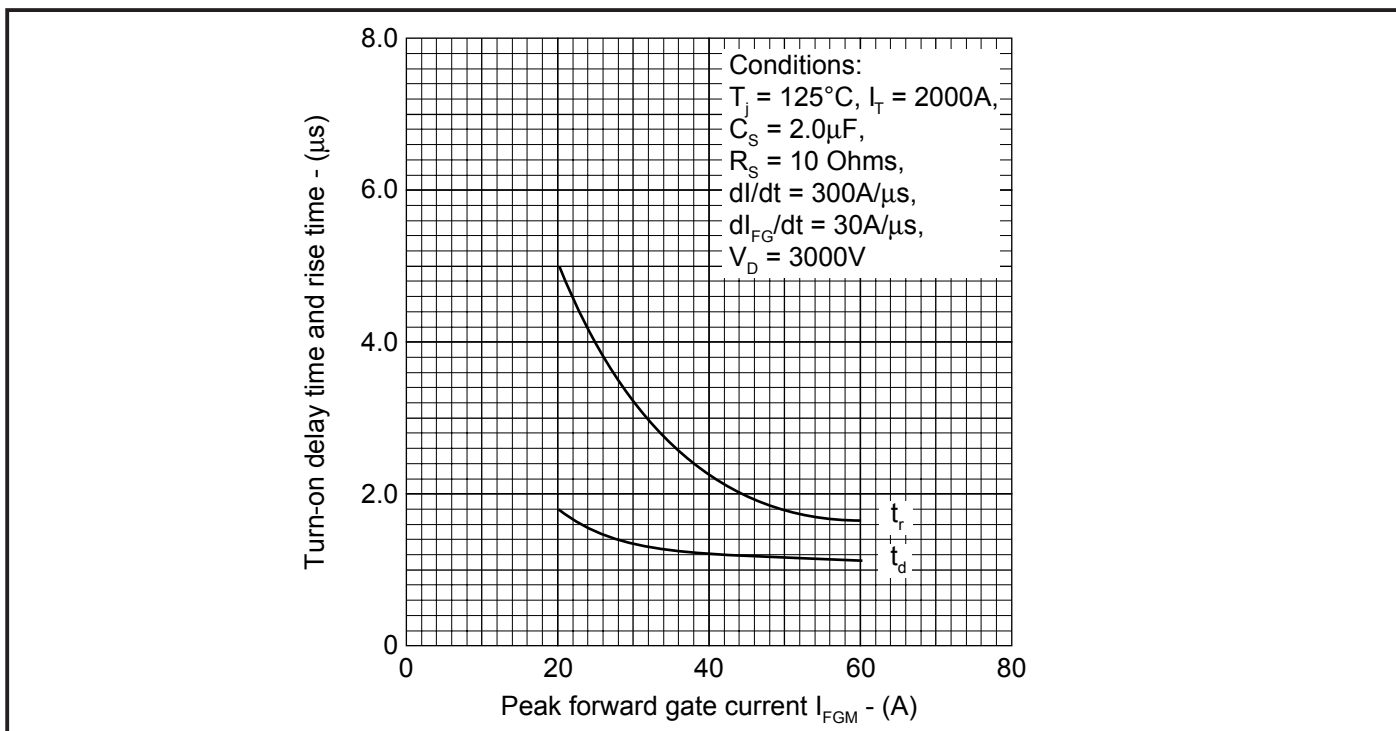


Fig.14 Delay time & rise time vs peak forward gate current

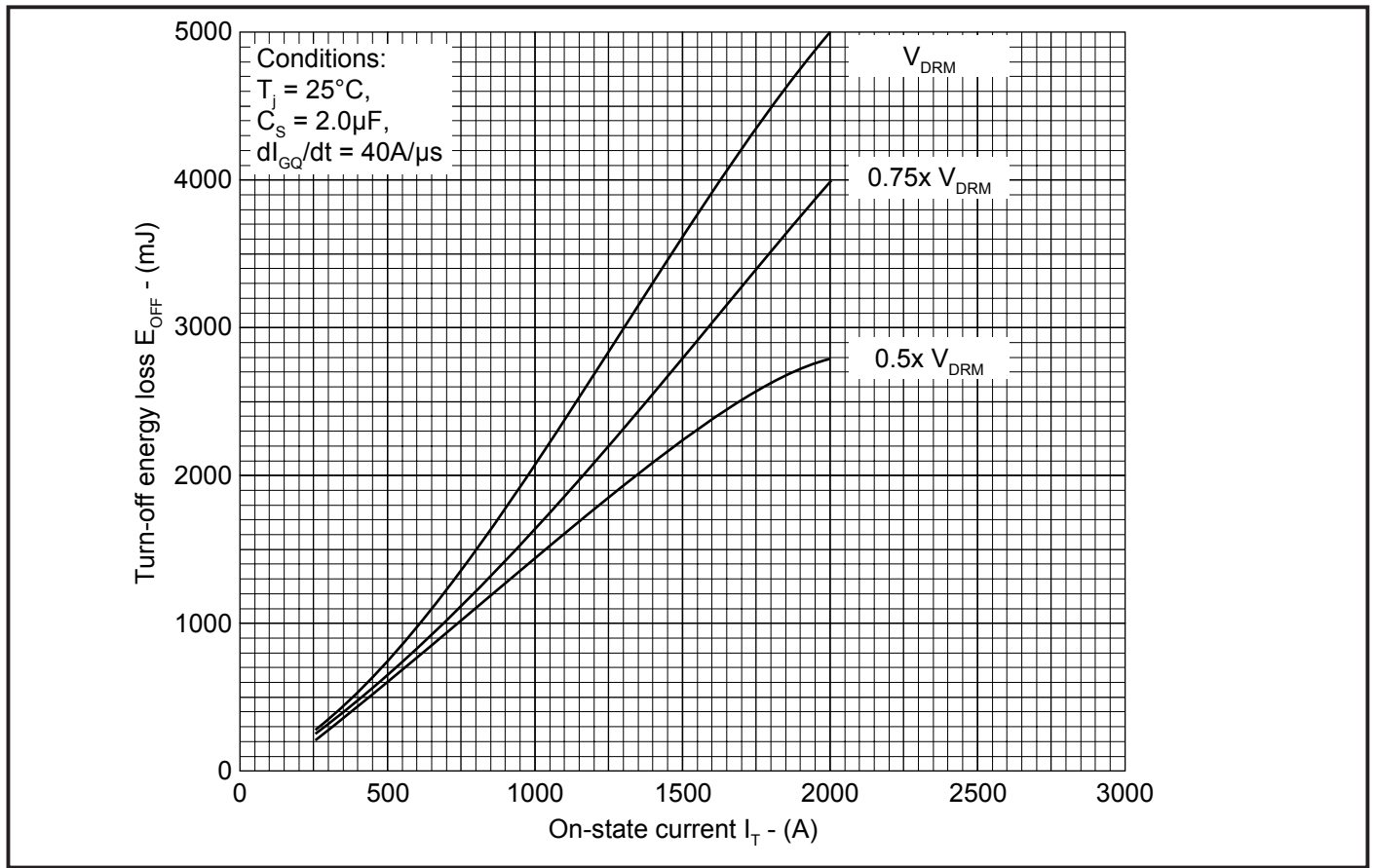


Fig.15 Turn-off energy vs on-state current

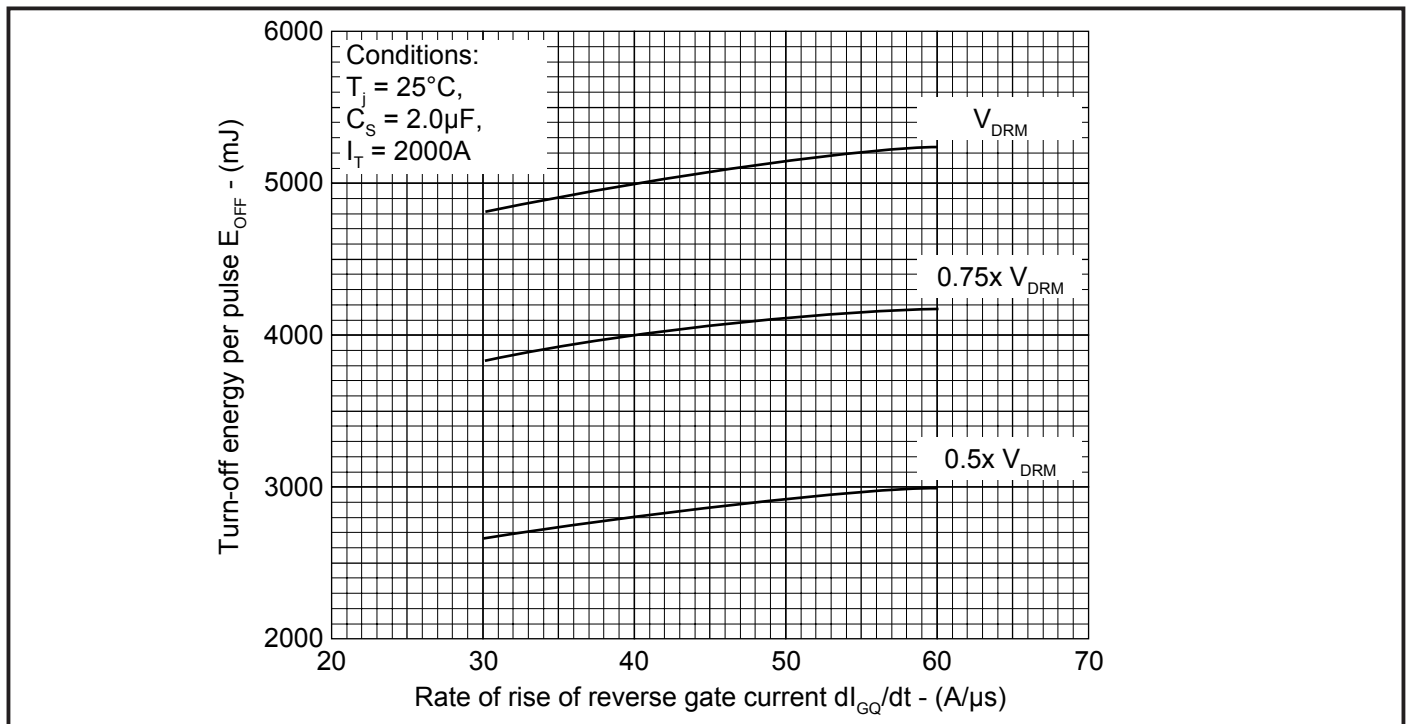


Fig.16 Turn-off energy vs rate of rise of reverse gate current

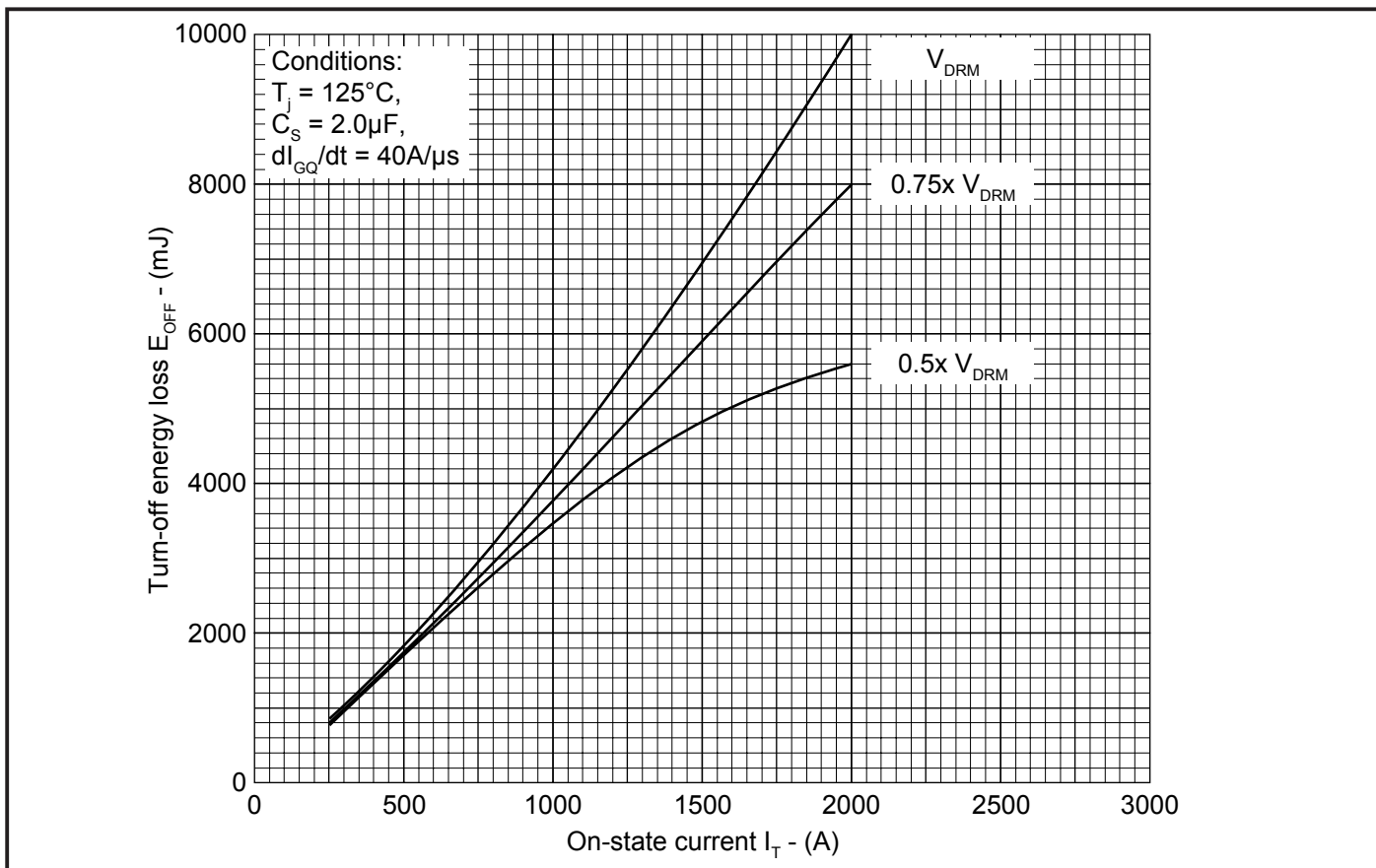


Fig.17 Turn-off energy vs on-state current

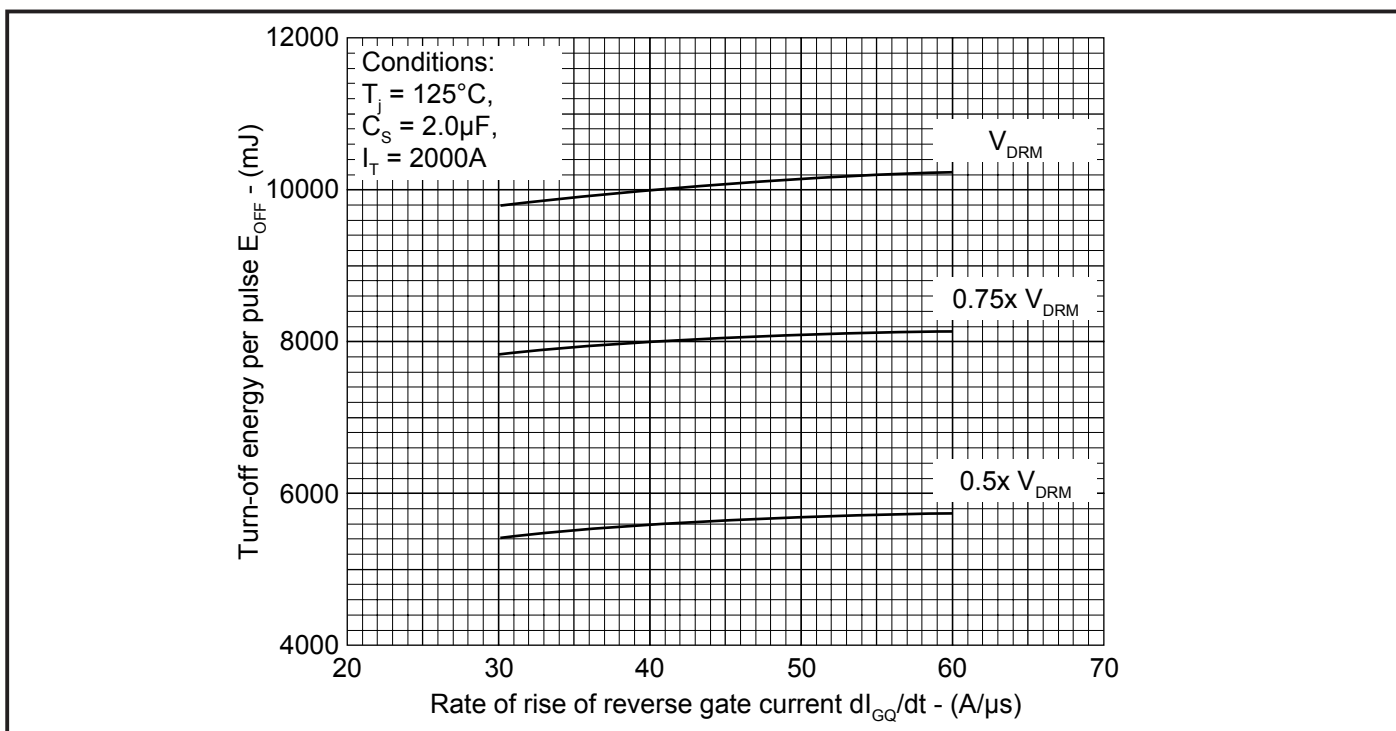


Fig.18 Turn-off energy loss vs rate of rise of reverse gate current

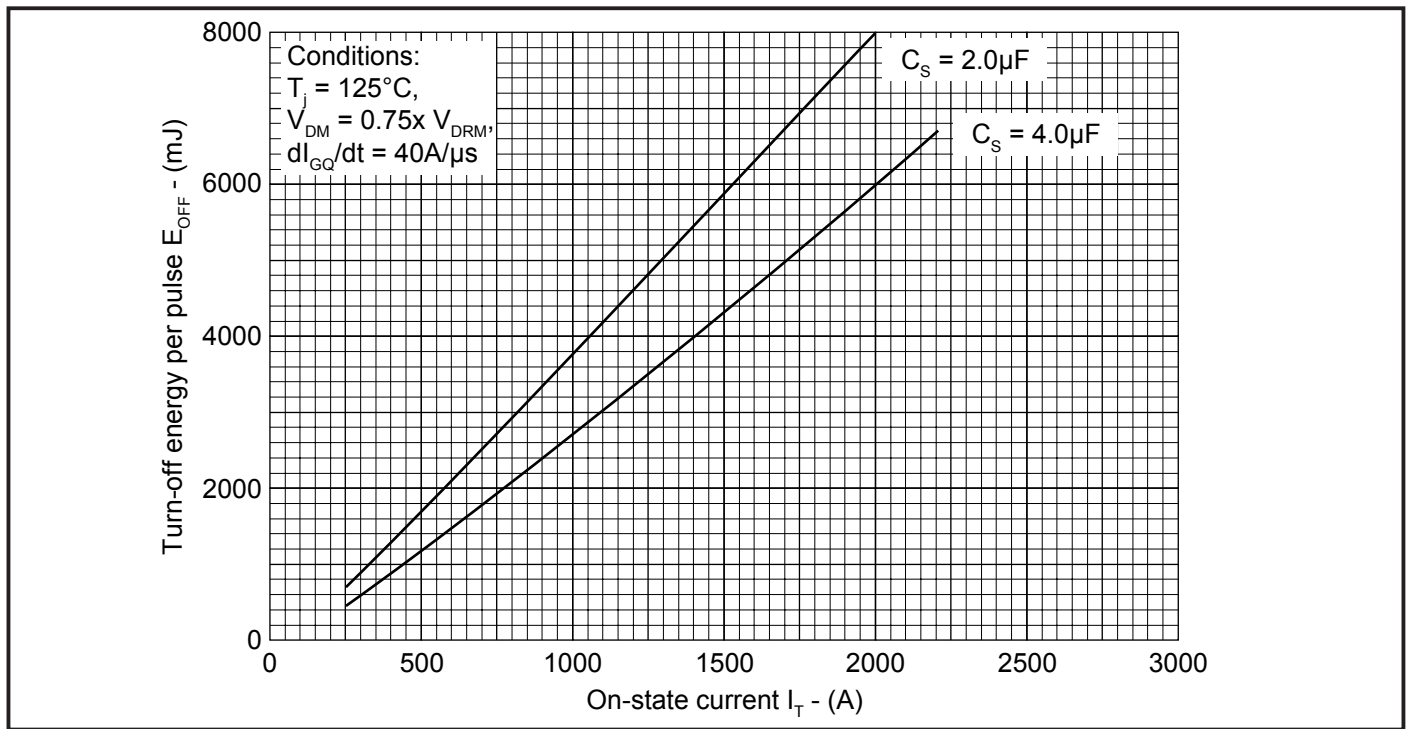


Fig.19 Turn-off energy vs on-state current

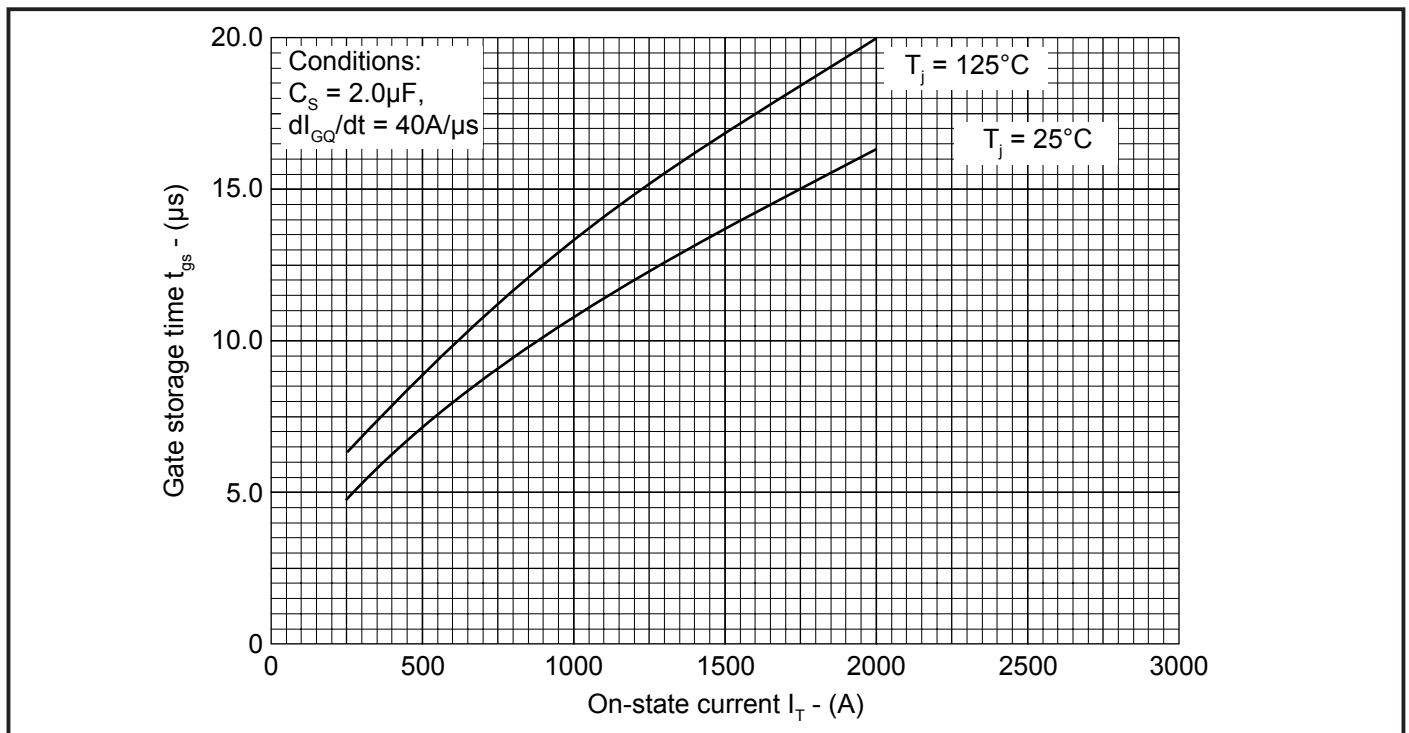


Fig.20 Gate storage time vs on-state current

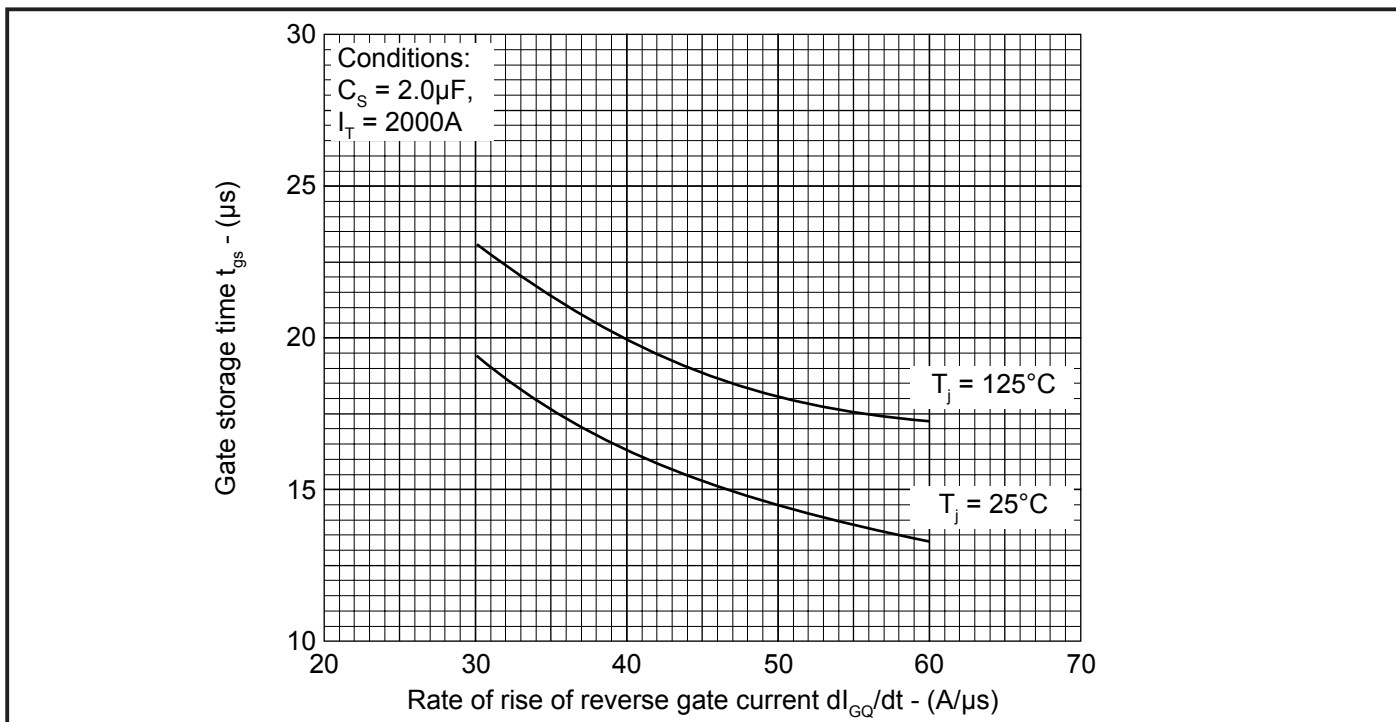


Fig.21 Gate storage time vs rate of rise of reverse gate current

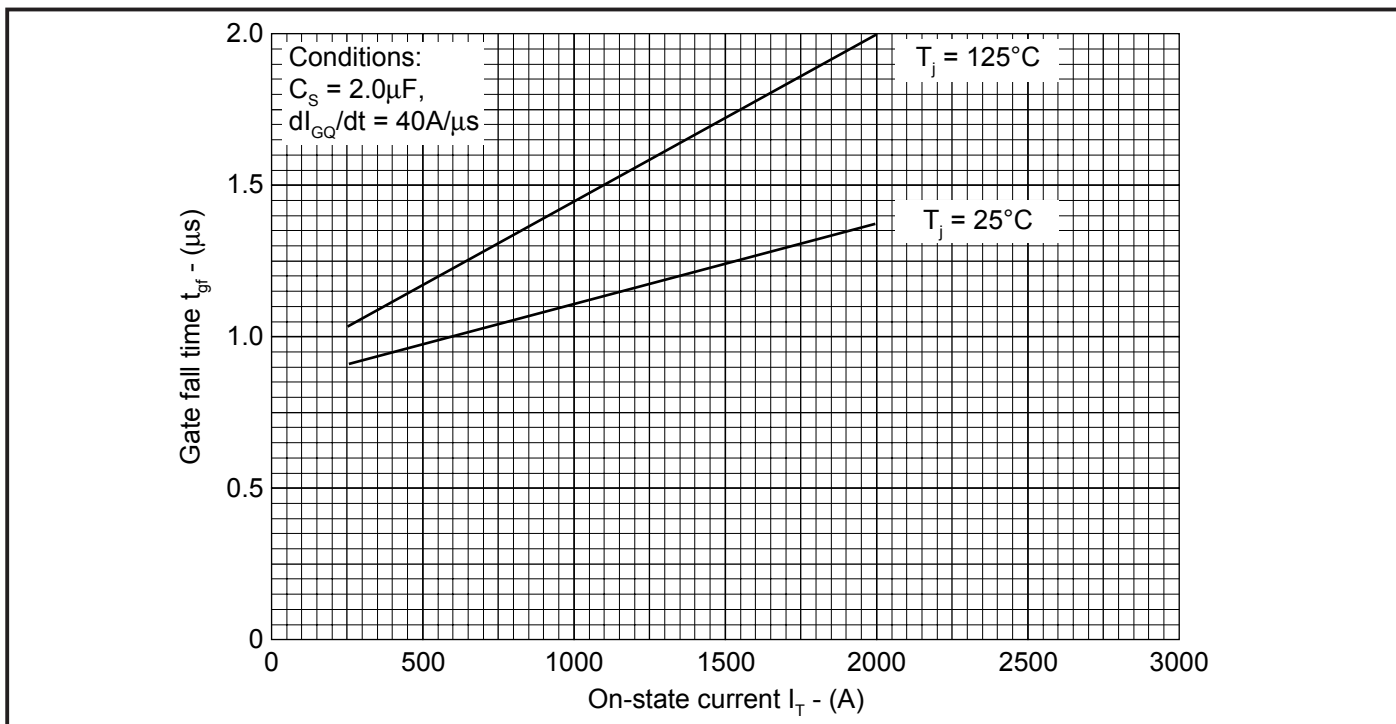


Fig.22 Gate fall time vs on-state current

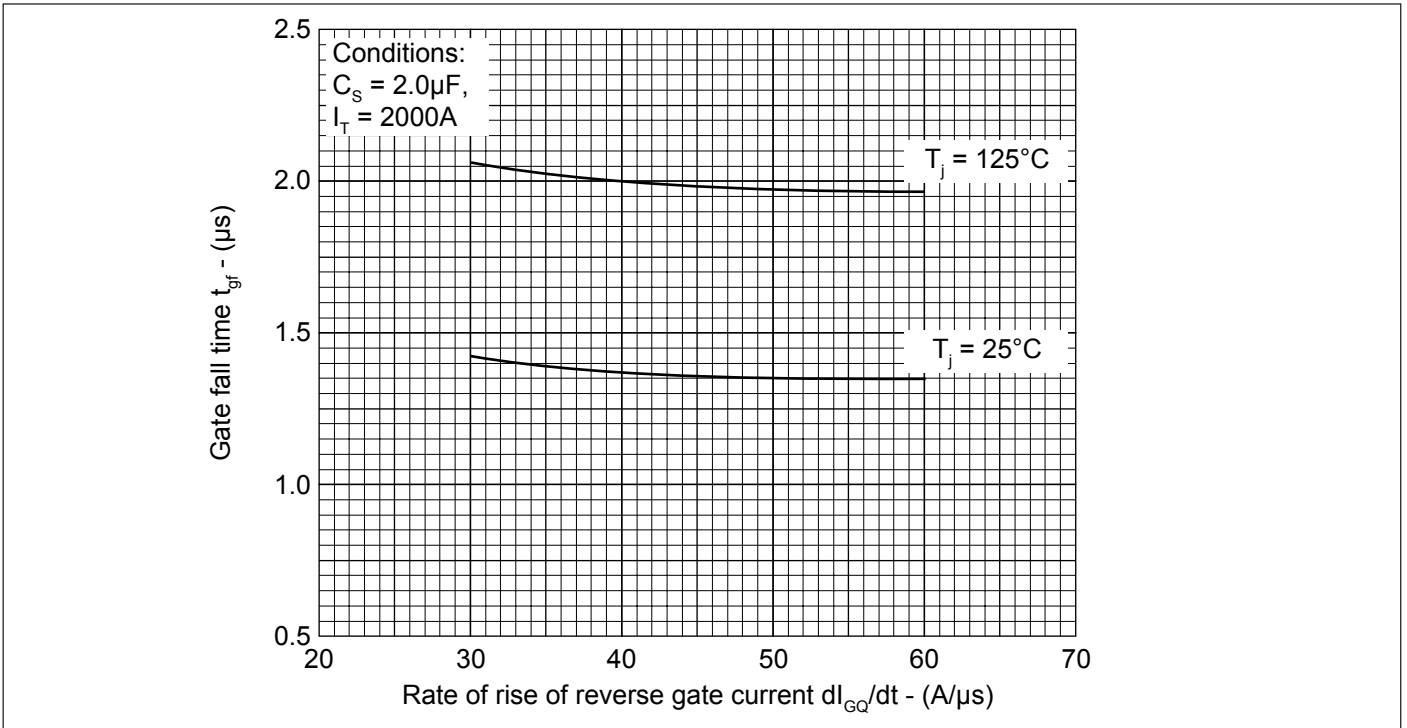


Fig.23 Gate fall time vs rate of rise of reverse gate current

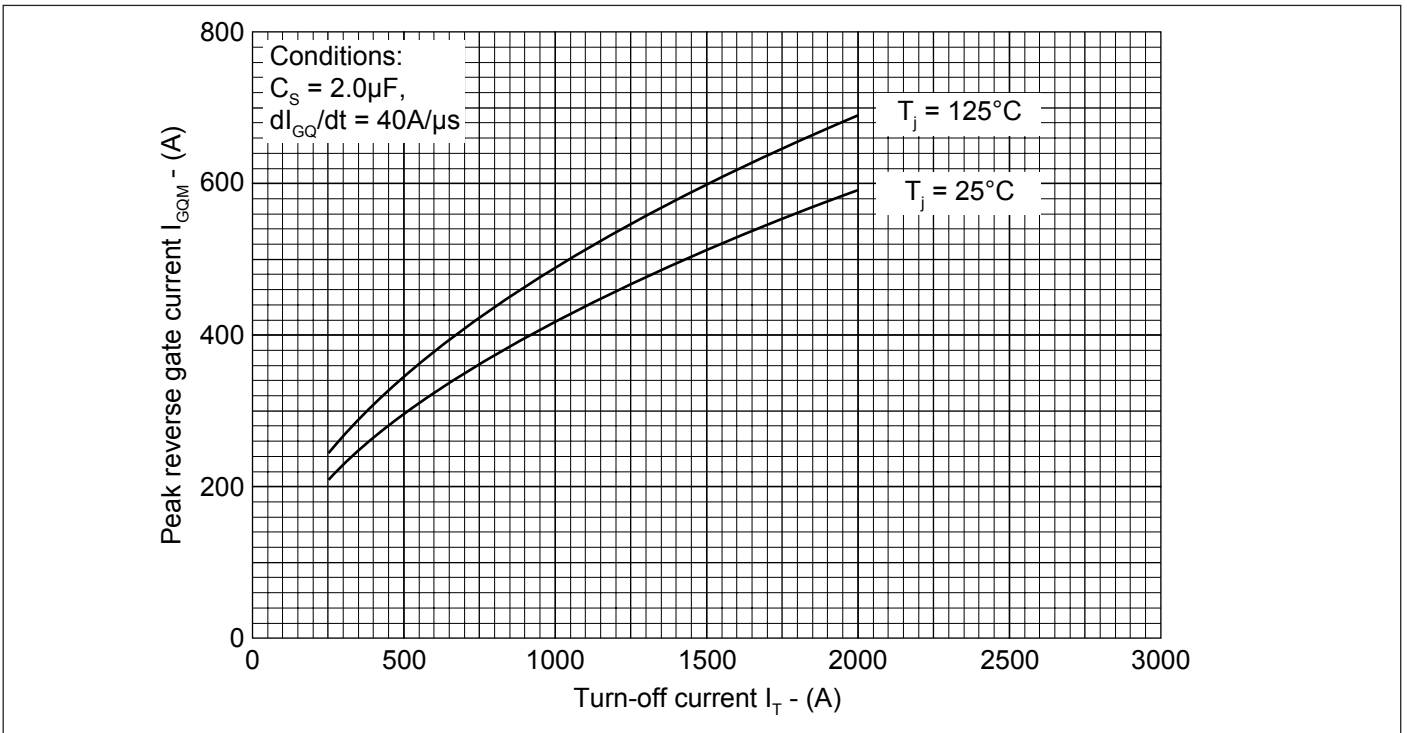


Fig.24 Peak reverse gate current vs turn-off current

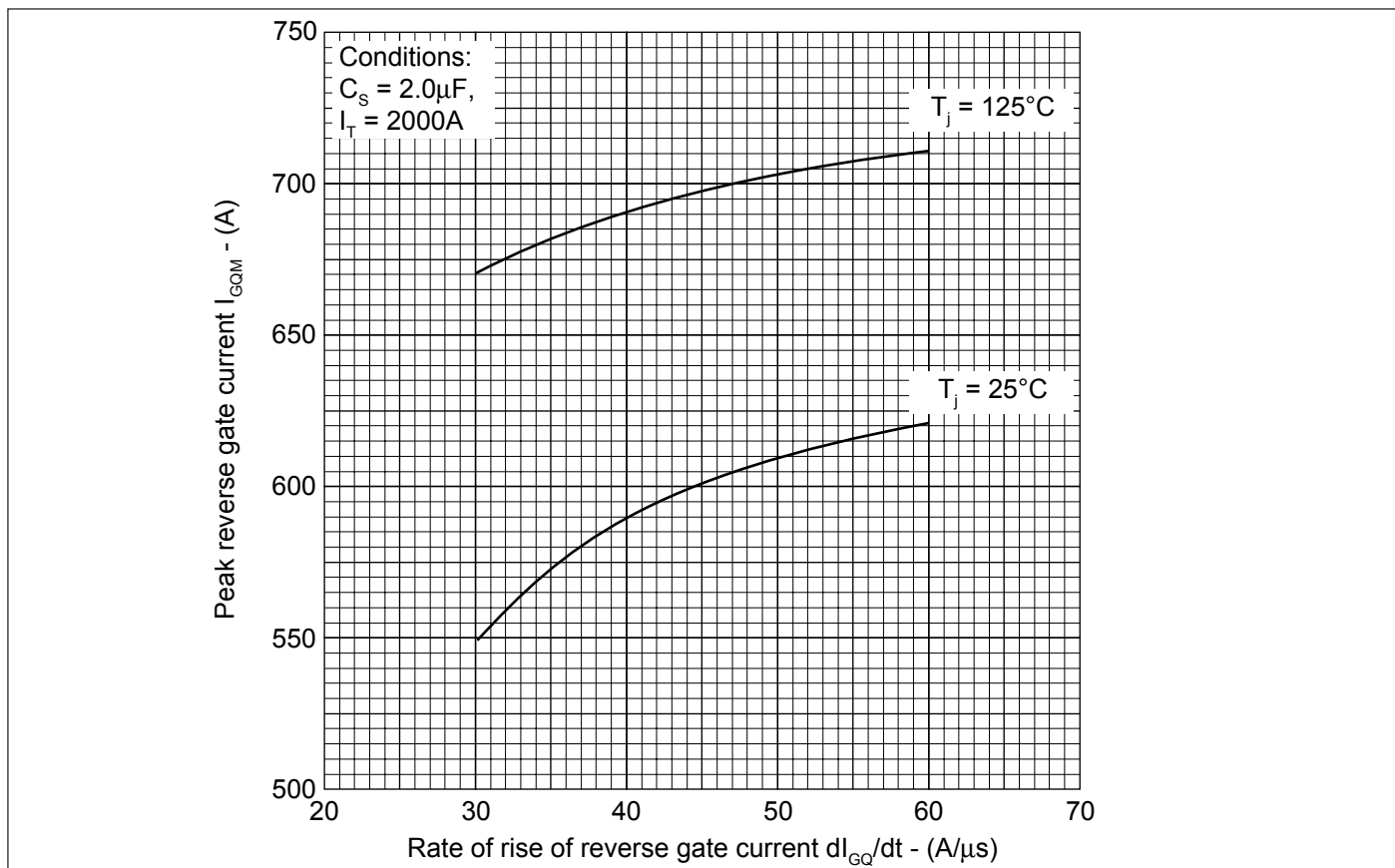


Fig.25 Peak reverse gate current vs rate of rise of reversegate current

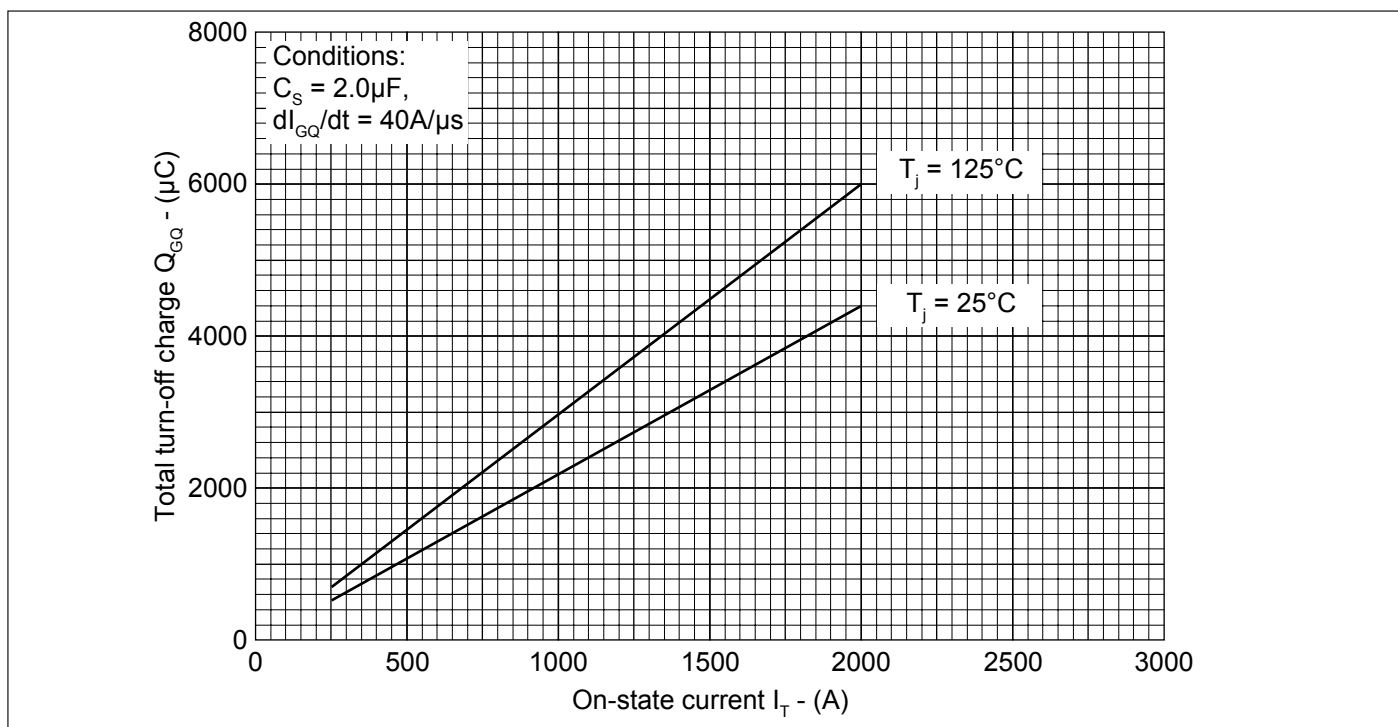


Fig.26 Turn-off gate charge vs on-state current

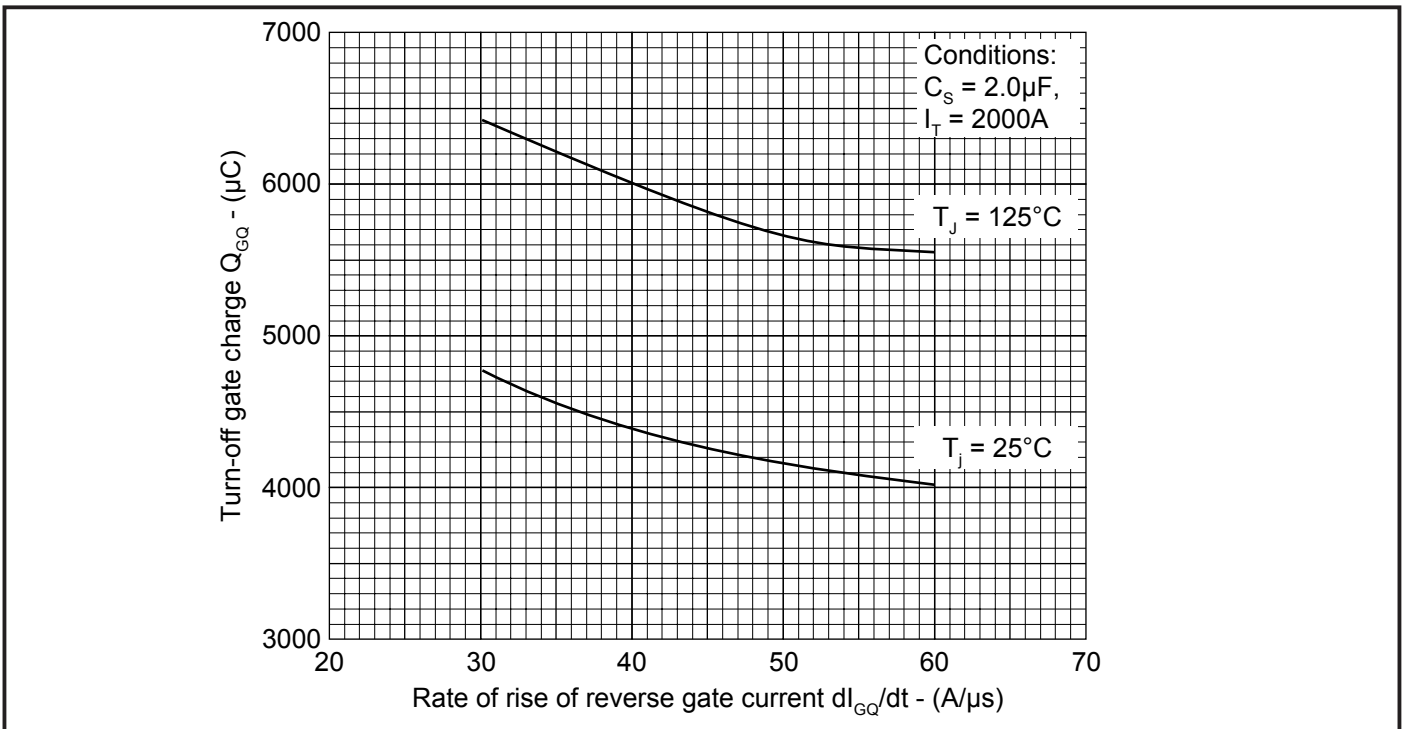


Fig.27 Turn-off gate charge vs rate of rise of reverse gate current

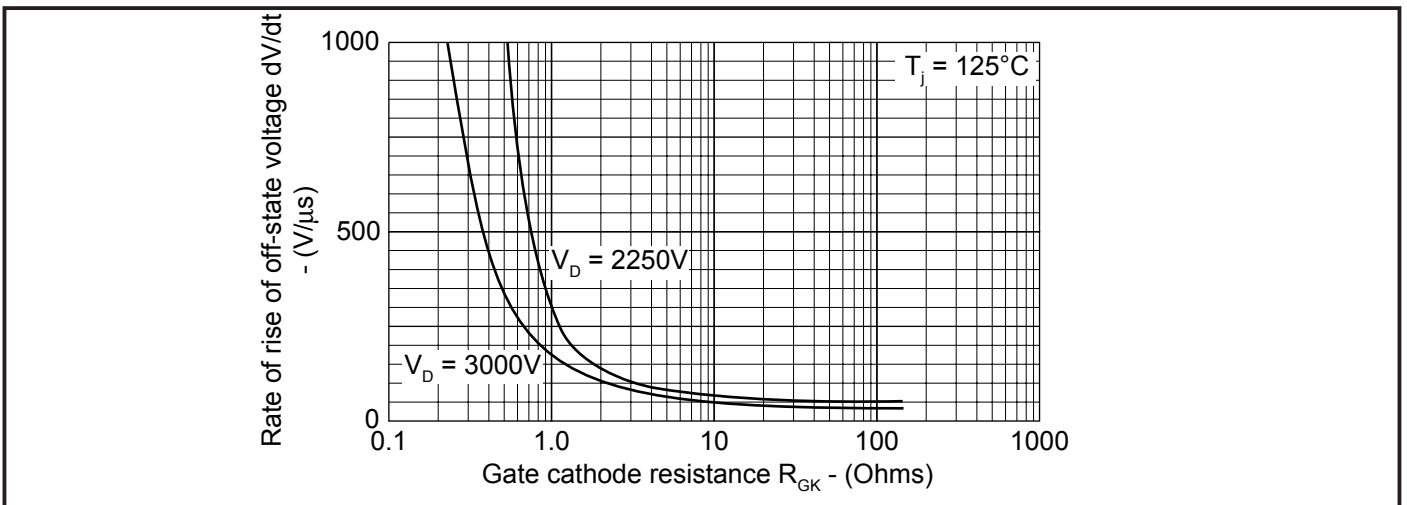
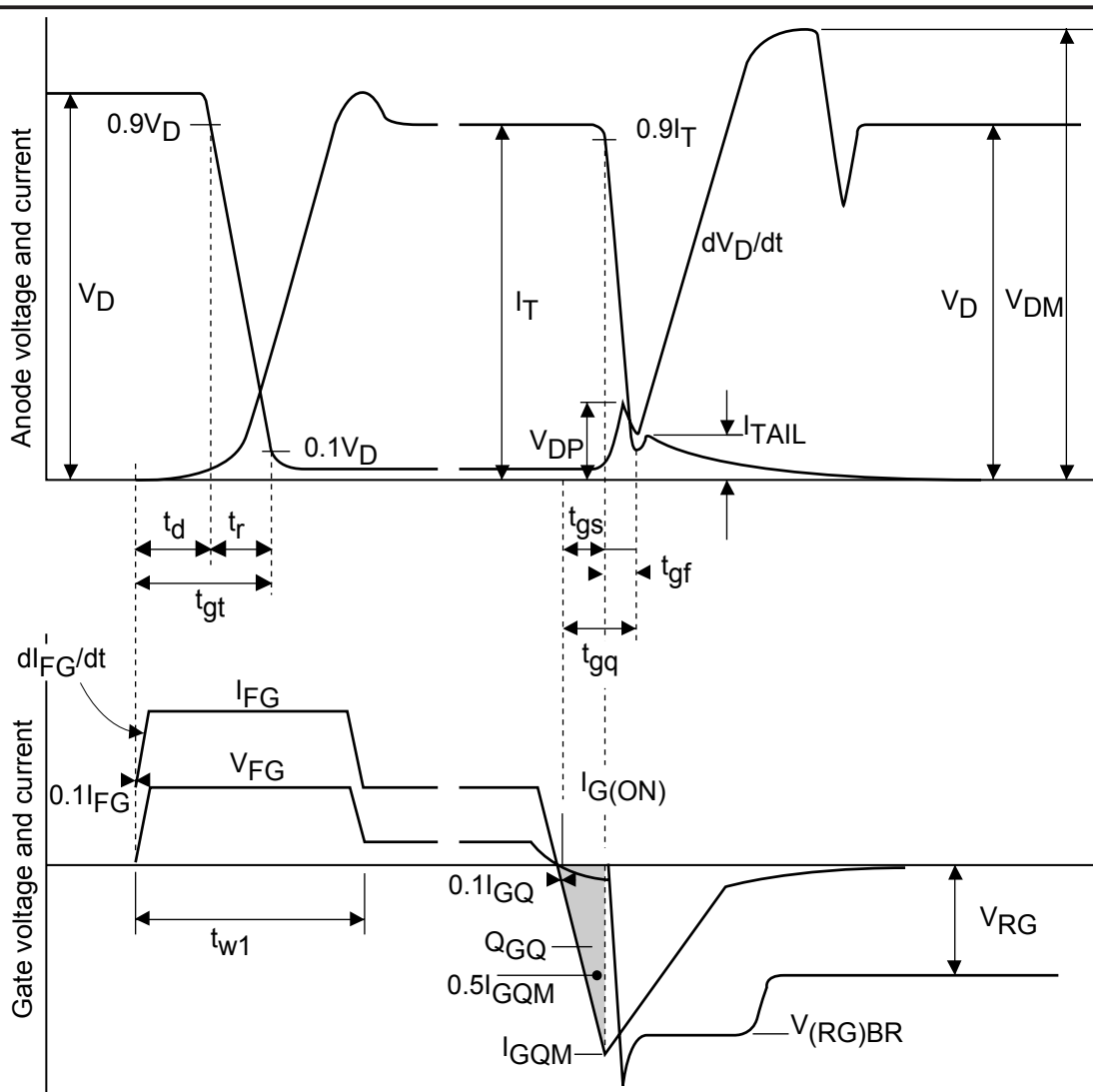


Fig.28 Rate of rise of off-state voltage vs gate cathode resistance



Recommended gate conditions:

- $I_{TCM} = 2000A$
- $I_{FG} = 30A$
- $I_{G(ON)} = 7A$ d.c.
- $t_{w1(min)} = 20\mu s$
- $I_{GQM} = 690A$
- $di_{GQ}/dt = 40A/\mu s$
- $Q_{GQ} = 6000\mu C$
- $V_{RG(min)} = 2V$
- $V_{RG(max)} = 16V$

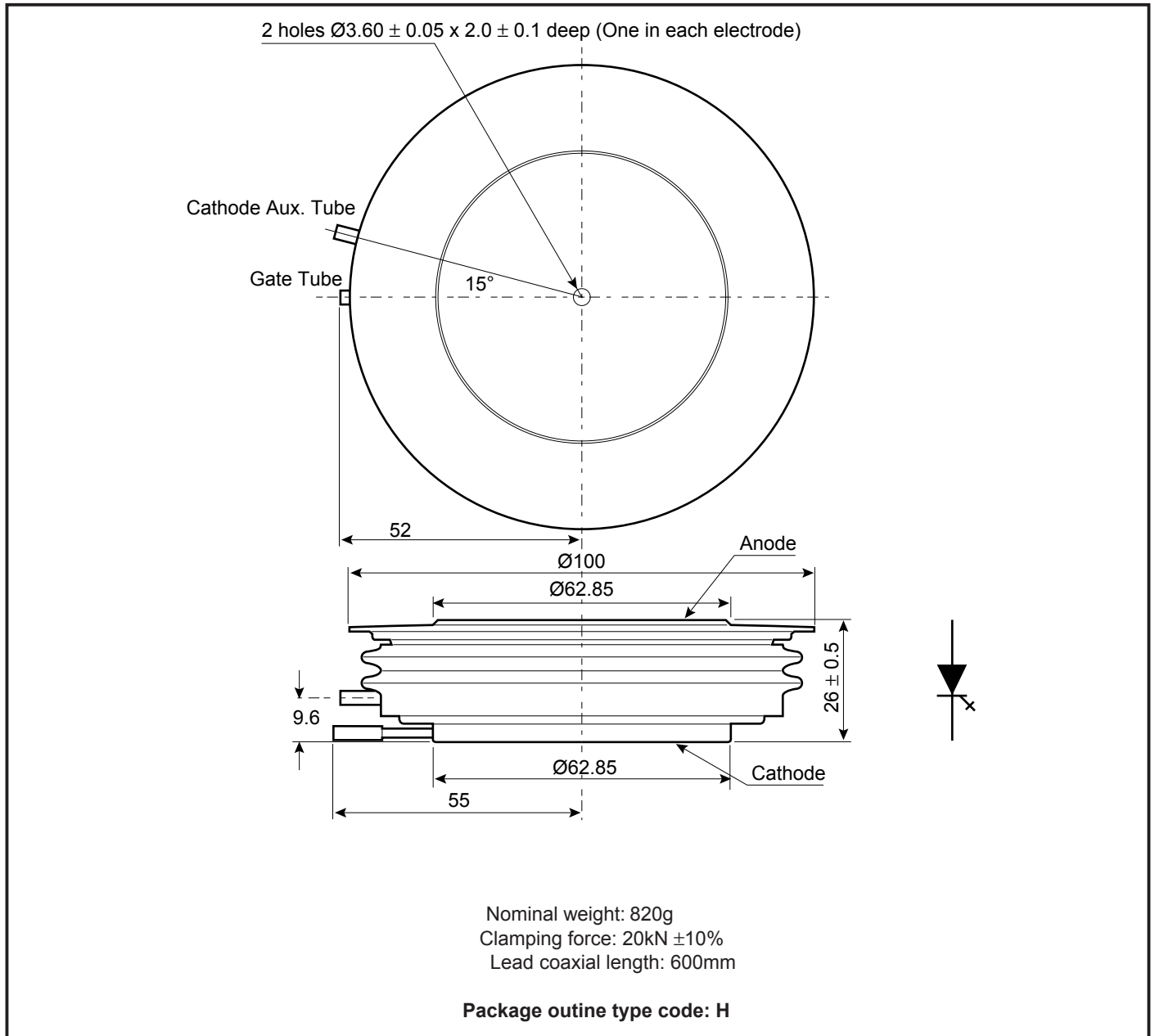
These are recommended Dynex Semiconductor conditions. Other conditions are permitted according to users gate drive specifications.

Fig.29 General switching waveforms

DG648BH45

PACKAGE DETAILS

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



ASSOCIATED PUBLICATIONS

Title	Application Note
	Number
Calculating the junction temperature or power semiconductors	AN4506
GTO gate drive units	AN4571
Recommendations for clamping power semiconductors	AN4839
Use of V_{TO} , r_T on-state characteristic	AN5001
Improved gate drive for GTO series connections	AN5177