



CSG40L4500

Gate Turn-off Thyristor

High-end Power Semiconductor Manufacturer

APPLICATION

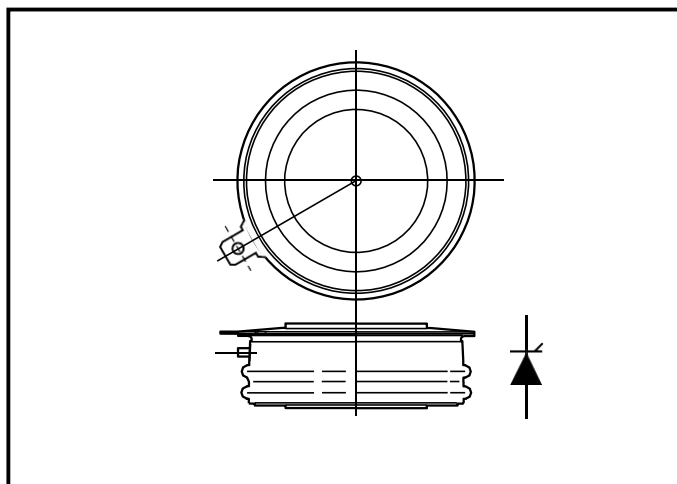
- Variable Speed AC Motor Drive Inverter (VSD-AC)
- High Voltage Converter
- Chopper
- DC / DC Converter

KEY PARAMETERS

I_{TCM}	4000A
V_{DRM}	4500V
$I_{T(AV)}$	1180A
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: L.
See Package Details for further information.

VOLTAGE RATINGS

Mode	Repetitive Peak Off-state Voltage V_{DRM}	Repetitive Peak Reverse Voltage V_{RRM}	Test Conditions
CSG40L4500	4500	16	$T_{vj} = 125^{\circ}\text{C}$, $I_{DM} = 100\text{mA}$, $I_{RRM} = 50\text{mA}$

CURRENT RATINGS

Symbol	Parameter	Test Conditions	Max.	Unit
I_{TGQM}	Peak controllable off-state current	$V = 66\% V_{DRM}$, $T_j = 125^{\circ}\text{C}$, $dI_{GQ}/dt = 40\text{A}/\mu\text{s}$, $C_s = 3\mu\text{F}$	4000	A
$I_{T(AV)}$	Mean on-state current	$T_{HS} = 80^{\circ}\text{C}$. Double side cooled, half sine 50Hz	1180	A
$I_{T(RMS)}$	RMS on-state current		1850	A



SURGE RATINGS

Symbol	Parameters	Test Conditions	Max.	Unit
I_{TSM}	Surge (non-repetitive) on-state current	10ms half sine. $T_j = 125^\circ\text{C}$	20.0	kA
I^2t	I^2t for fusing	10ms half sine. $T_j = 125^\circ\text{C}$	2.0×10^6	A^2s
di_T/dt	Critical rate of rise of on-state current	$V_D = 3000\text{V}$, $I_T = 3000\text{A}$, $T_j = 125^\circ\text{C}$, $I_{FG} > 40\text{A}$, 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} ; $R_{GK} \leq 1.5\Omega$, $T_j = 125^\circ\text{C}$	130	$\text{V}/\mu\text{s}$
		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	$I_T = 3000\text{A}$, $V_D = V_{DRM}$, $T_j = 125^\circ\text{C}$, $dI_{GQ} = 40\text{A}/\mu\text{s}$, $C_s = 3.0\mu\text{F}$	200	nH

GATE RATINGS

Symbol	Parameters	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		-	20	W
P_{RGM}	Peak reverse gate power		-	24	kW
di_{GQ}/dt	Rate of rise of reverse gate current		20	60	$\text{A}/\mu\text{s}$
$t_{ON(min)}$	Minimum permissable on time		50	-	μs
$t_{OFF(min)}$	Minimum permissable off time		100	-	μs

THERMAL AND MECHANICAL RATINGS

Symbol	Parameters	Test Conditions		Min.	Max.	Unit
R_{thJC}	DC thermal resistance - junction to heatsink surface	Double side cooled		-	0.011	$^\circ\text{C}/\text{W}$
		Anode side cooled		-	0.017	$^\circ\text{C}/\text{W}$
		Cathode side cooled		-	0.03	$^\circ\text{C}/\text{W}$
R_{thCH}	Contact thermal resistance	Clamping force 40.0kN With mounting compound	per contact	-	0.0021	$^\circ\text{C}/\text{W}$
T_{VJM}	Virtual junction temperature			-40	125	$^\circ\text{C}$
T_{OP}/T_{stg}	Operating junction/storage temperature range			-40	125	$^\circ\text{C}$
F	Clamping force			36.0	44.0	kN



GTO CHARACTERISTICS

Symbol	Parameters	Test Conditions	Max.	Unit
V_{TM}	On-state voltage	At 4000A peak, $I_{G(ON)} = 10A$ d.c.	4.0	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	$V_D = 24V$, $I_T = 110A$, $T_j = 25^\circ C$	1.2	V
I_{GT}	Gate trigger current	$V_D = 24V$, $I_T = 110A$, $T_j = 25^\circ C$	4.0	A
I_{RGM}	Reverse gate cathode current	$V_{RGM} = 16V$, No gate/cathode resistor	50	mA
E_{ON}	Turn-on energy	$V_D = 2000V$ $I_T = 3000A$, $dI_T/dt = 300A/\mu s$ $I_{FG} = 40A$, rise time $< 1.0\mu s$ $I_T = 3000A$, $V_{DM} = V_{DRM}$ Snubber Cap $C_s = 3.0\mu F$, $di_{GQ}/dt = 40A/\mu s$	2700	mJ
t_d	Delay time		2.0	μs
t_r	Rise time		6.0	μs
E_{OFF}	Turn-off energy		13500	mJ
t_{gs}	Storage time		25.0	μs
t_{gf}	Fall time		2.5	μs
t_{gq}	Gate controlled turn-off time		27.5	μs
Q_{GQ}	Turn-off gate charge		12000	μC
Q_{GQT}	Total turn-off gate charge		24000	μC
I_{GQM}	Peak reverse gate current		950	A

CURVES

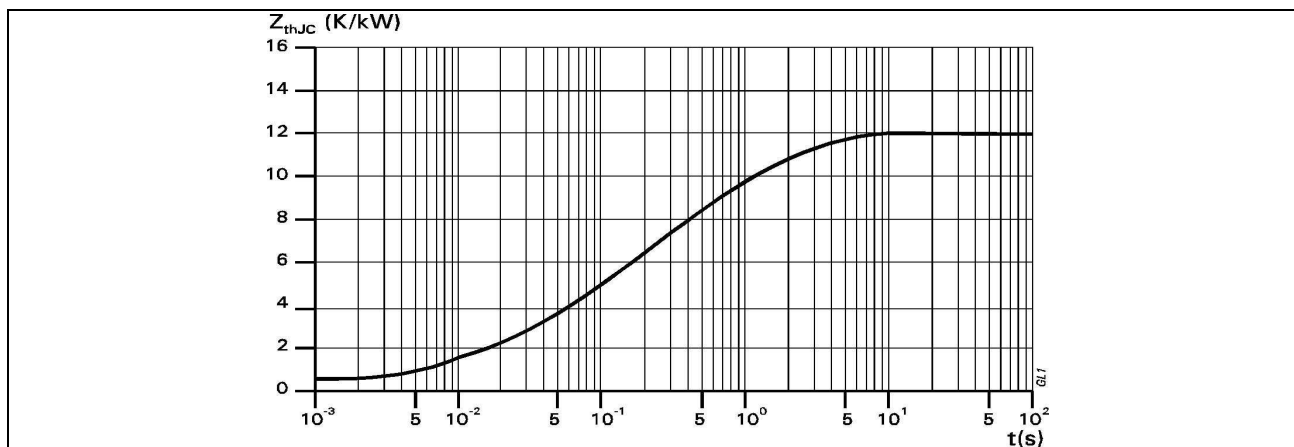


Fig. 1 Transient thermal impedance, junction to case.



CURVES

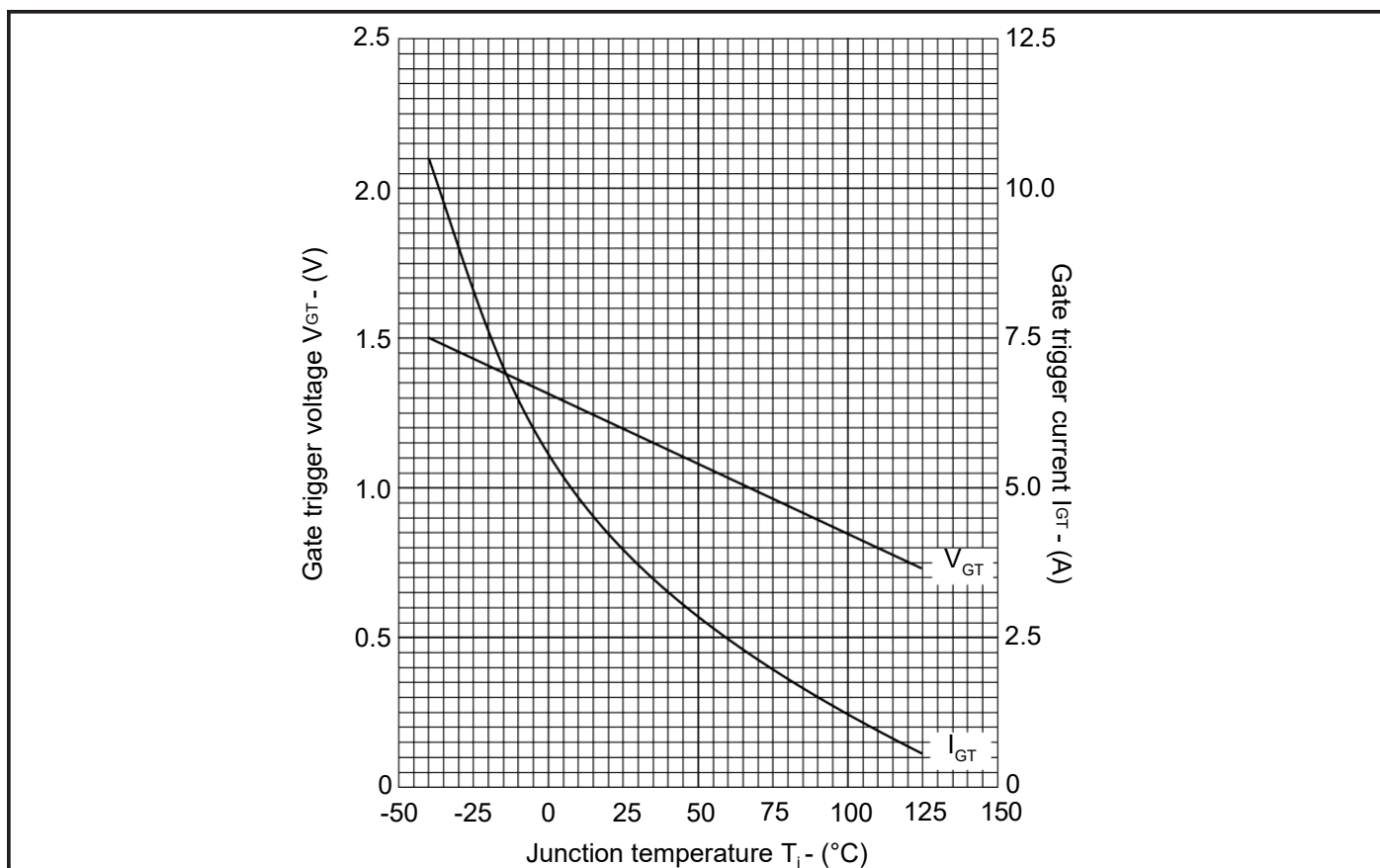


Figure 2. Maximum gate trigger voltage/current vs junction temperature

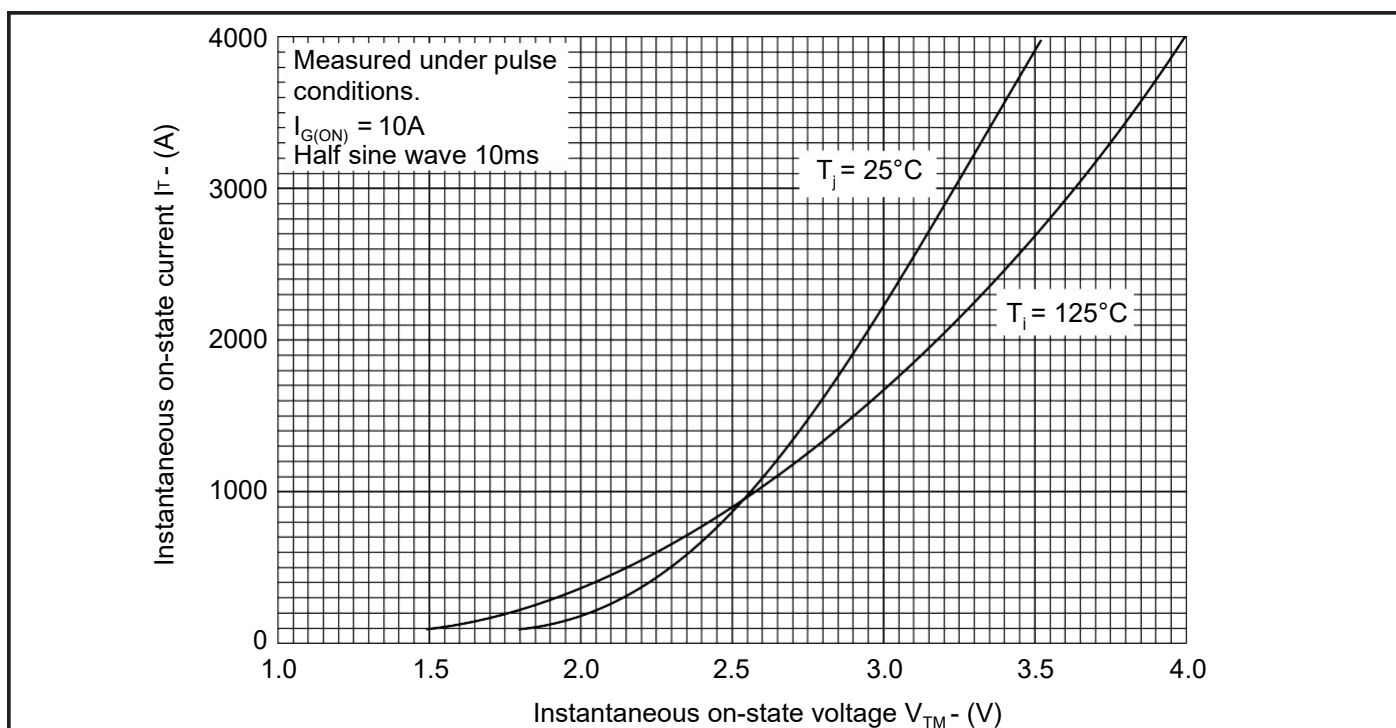


Figure 3. On-state characteristics



CURVES

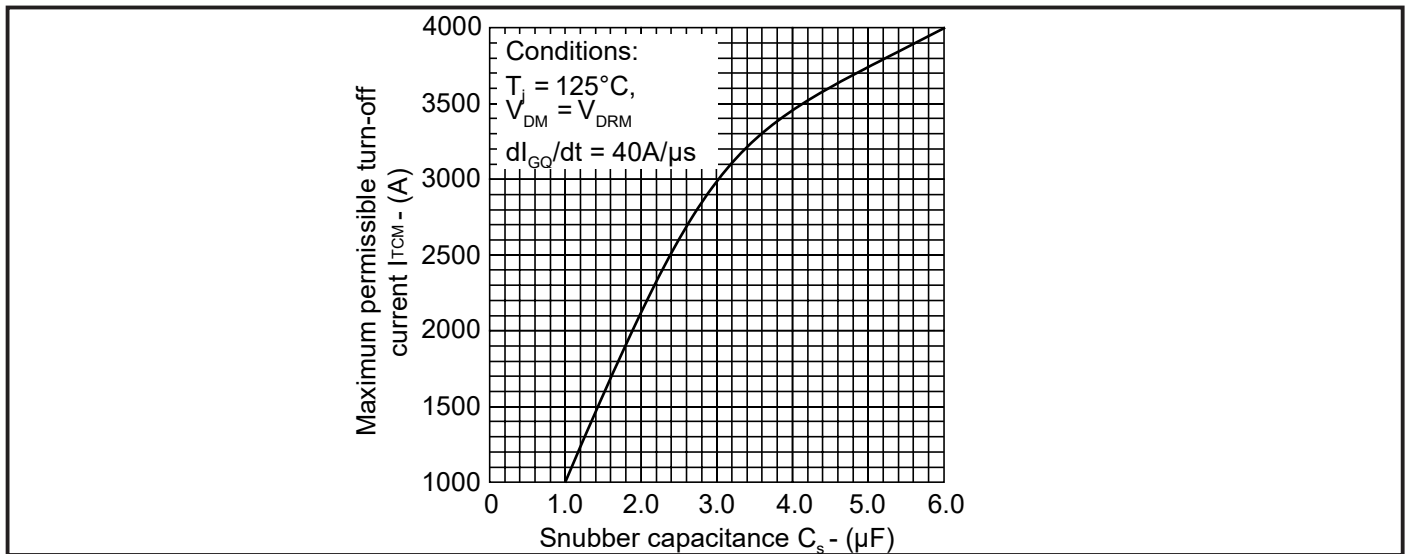


Figure 4. Maximum dependence of I_{TCM} on C_s

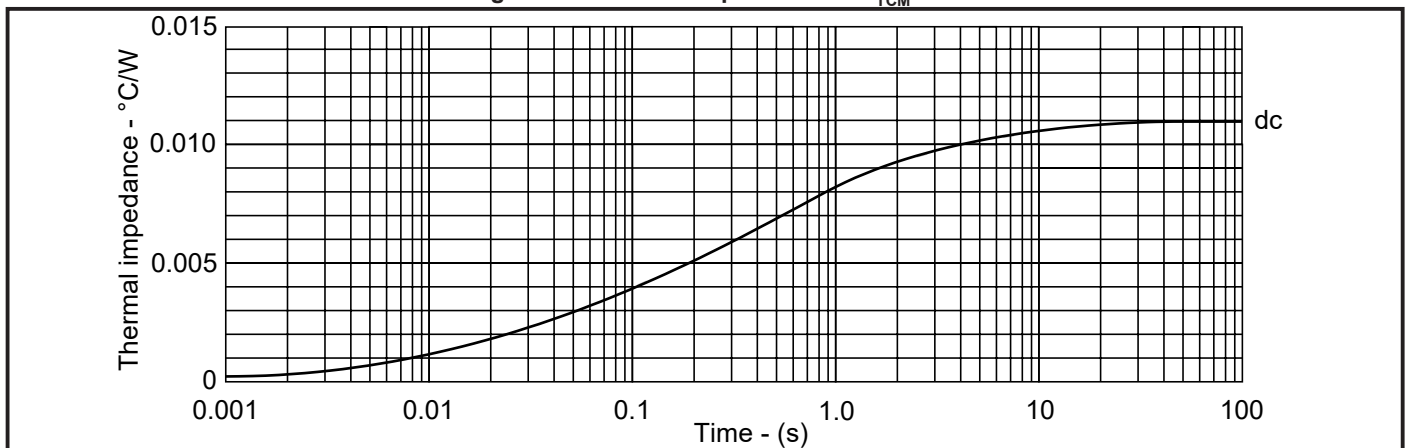


Figure 5. Maximum (limit) transient thermal impedance - double side cooled

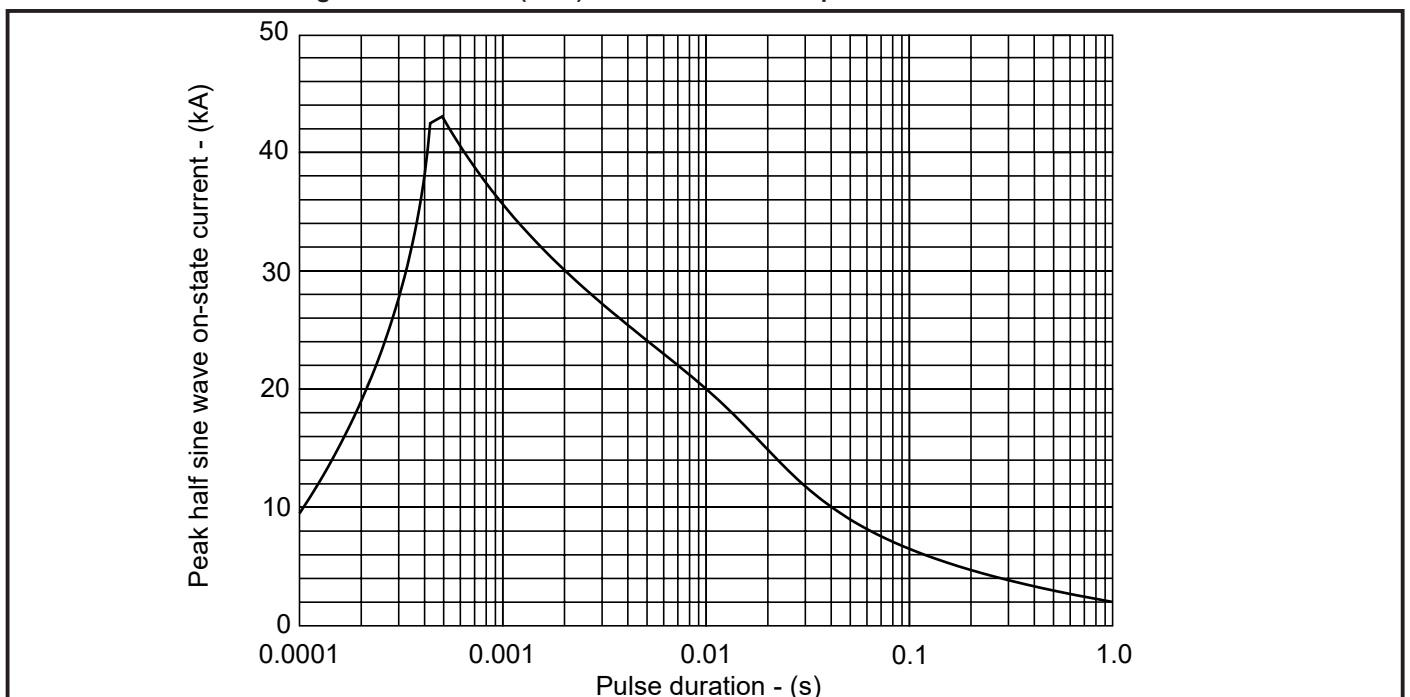


Figure 6. Surge (non-repetitive) on-state current vs time



CURVES

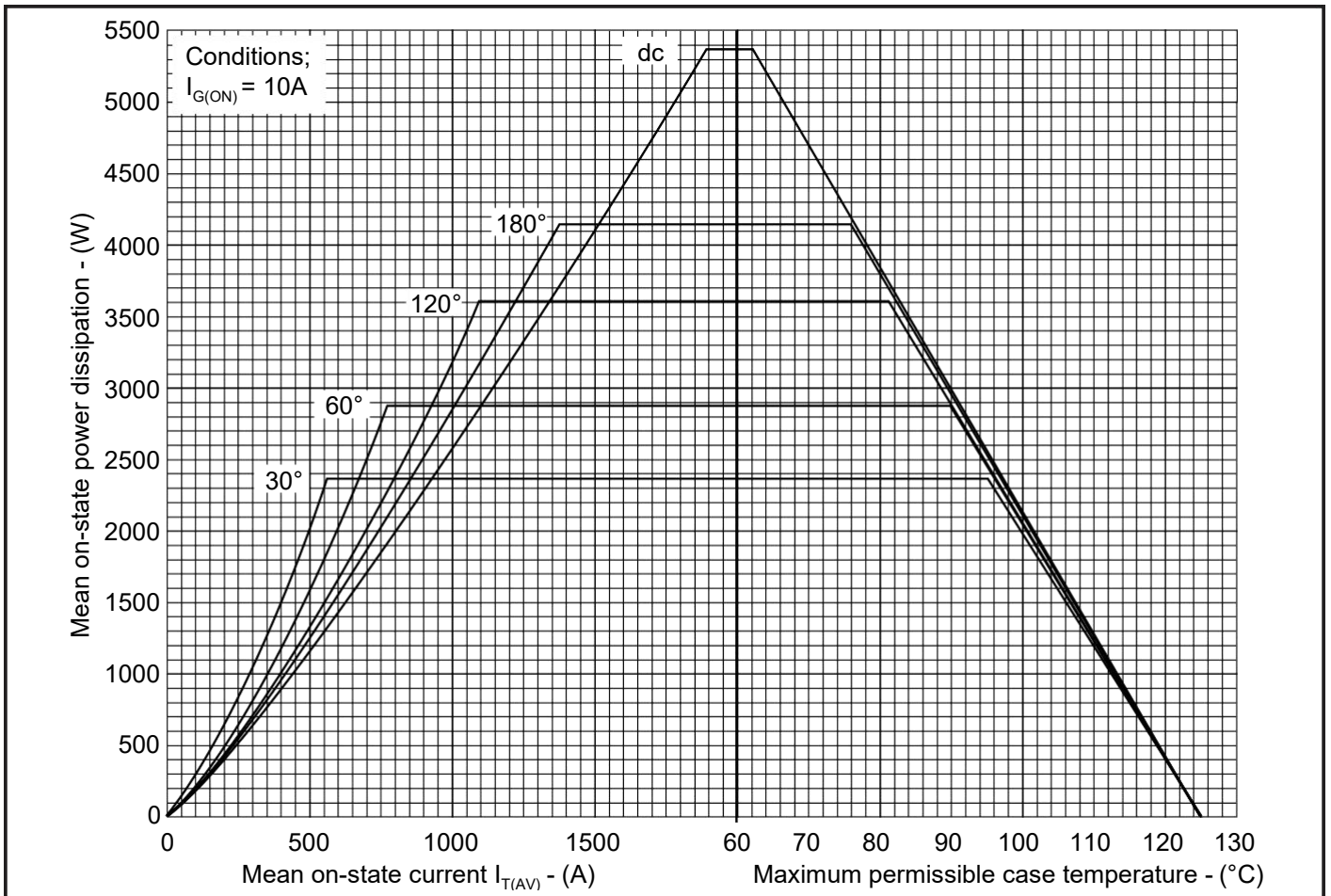


Figure 7. Steady state rectangular wave conduction loss - double side cooled

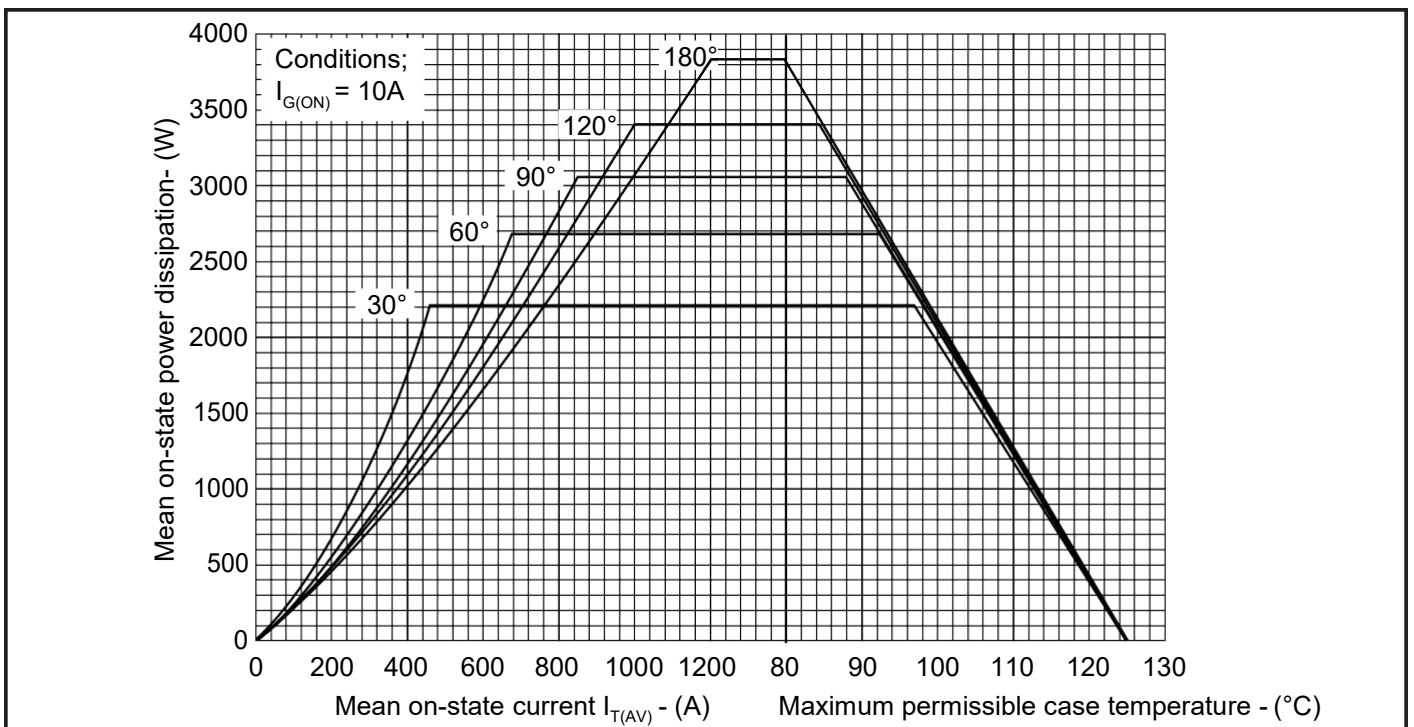


Figure 8. Steady state sinusoidal wave conduction loss - double side cooled



CURVES

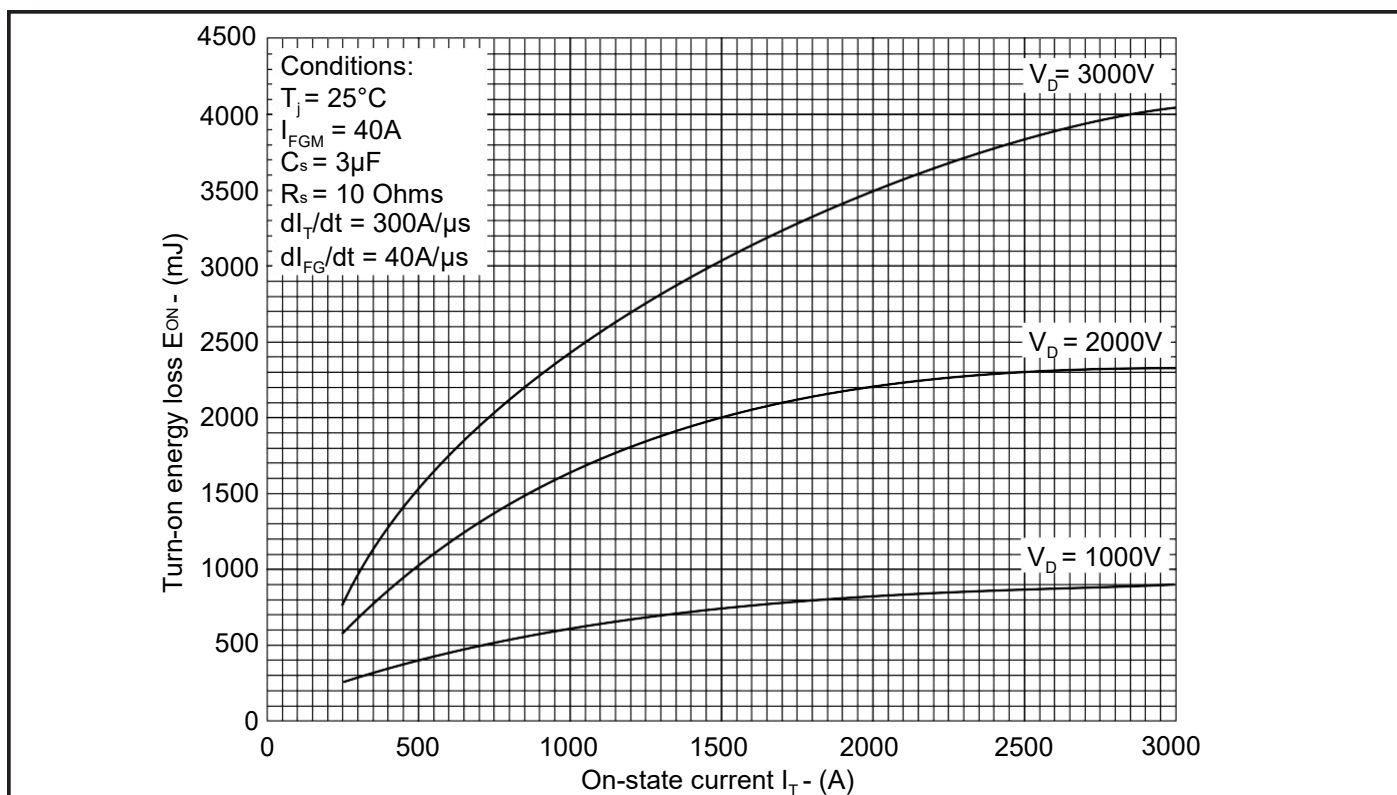


Figure 9. Turn-on energy vs on-state current

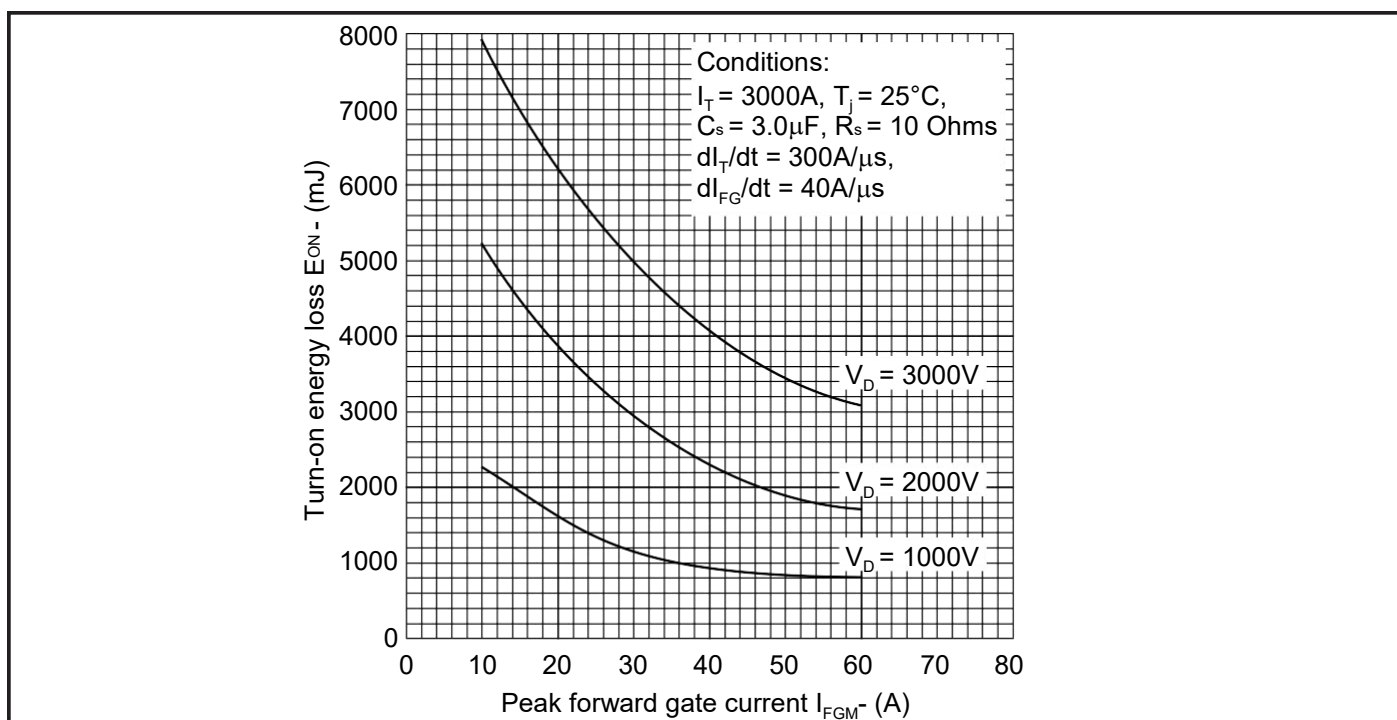


Figure 10. Turn-on energy vs peak forward gate current



CURVES

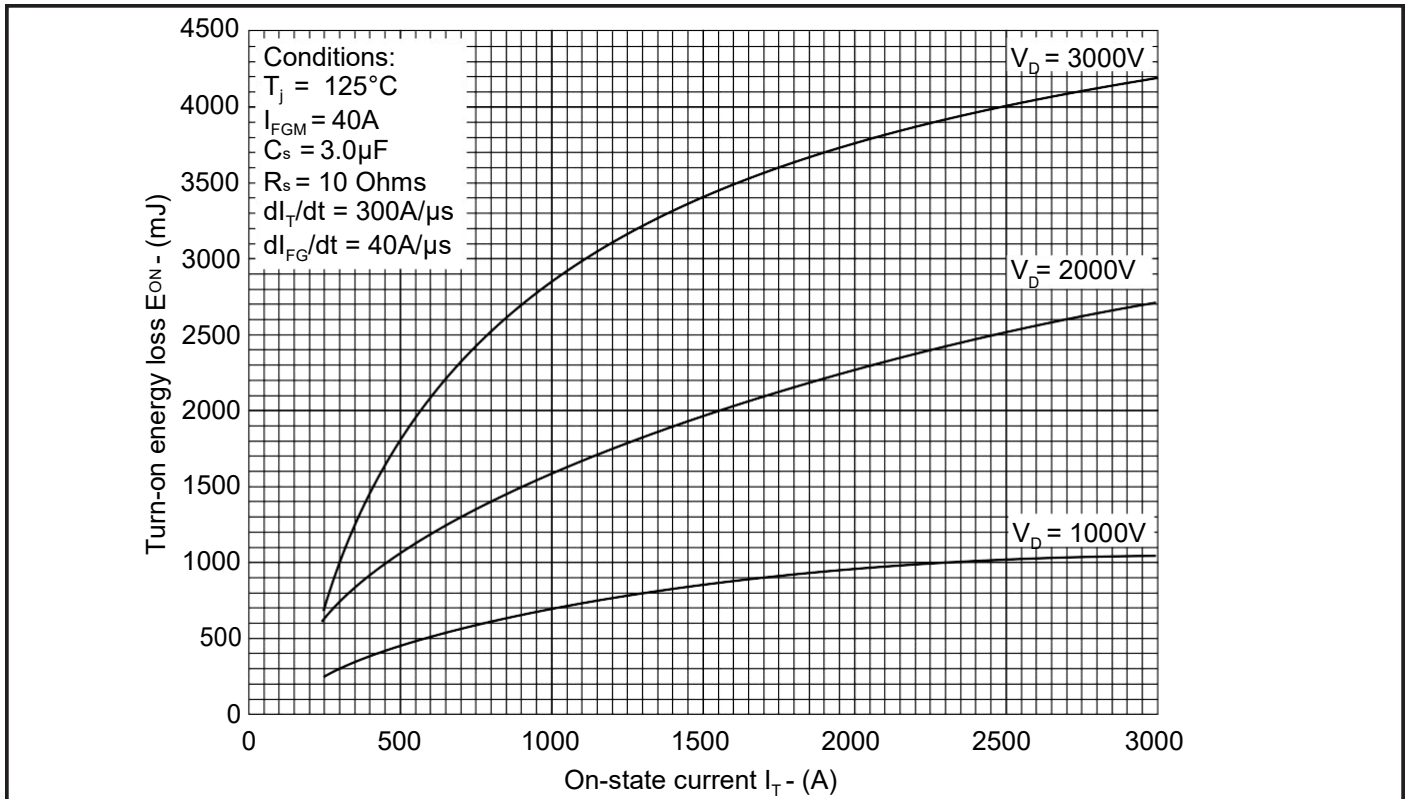


Figure 11. Turn-on energy vs on-state current

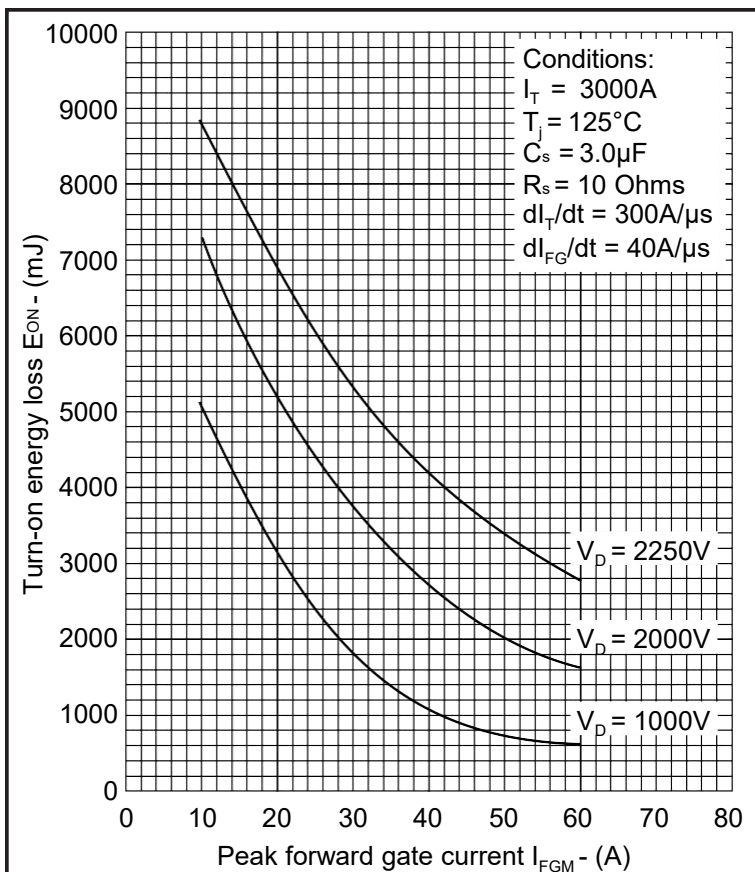


Figure 12. Turn-on energy vs peak forward gate current

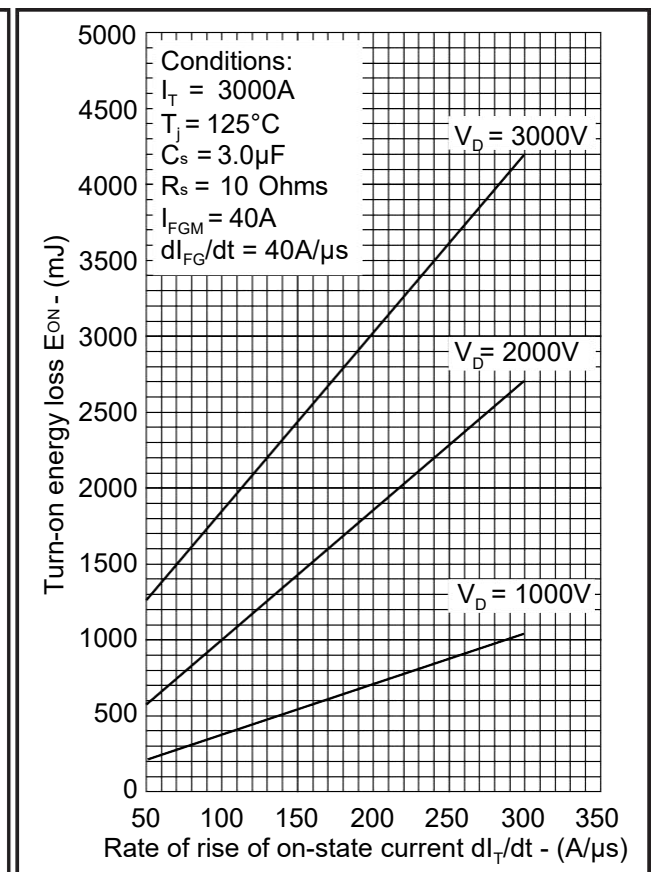


Figure 13. Turn-on energy vs rate of rise of on-state current



CURVES

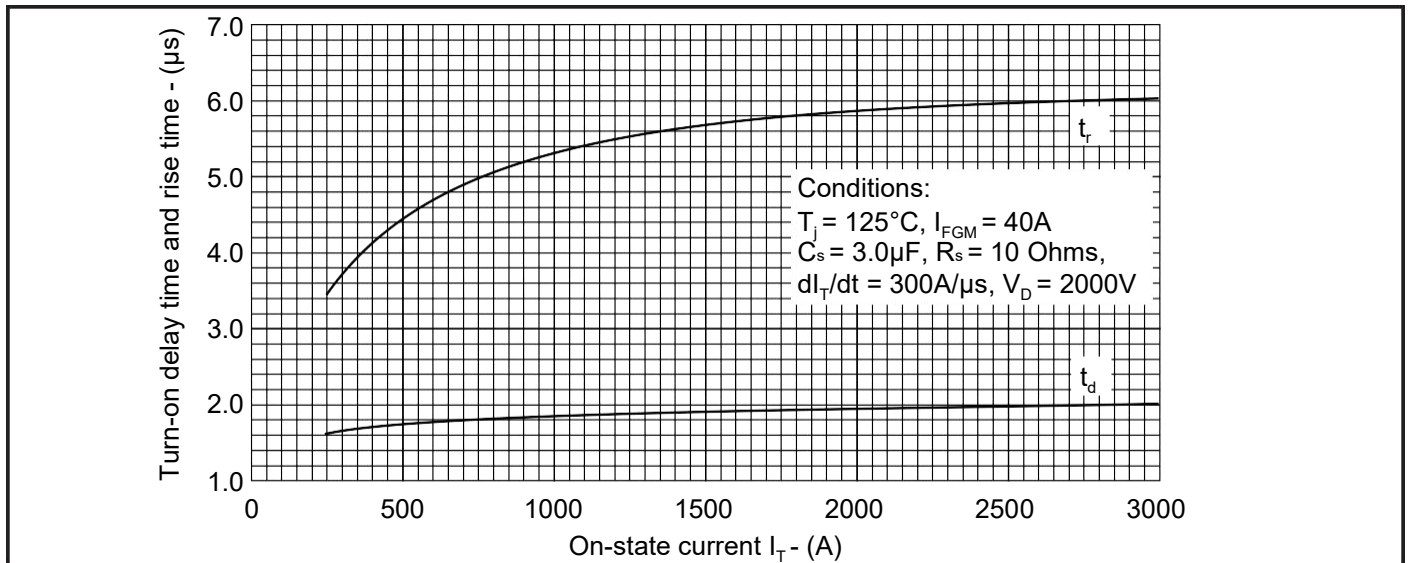


Figure 14. Delay and rise time vs on-state current

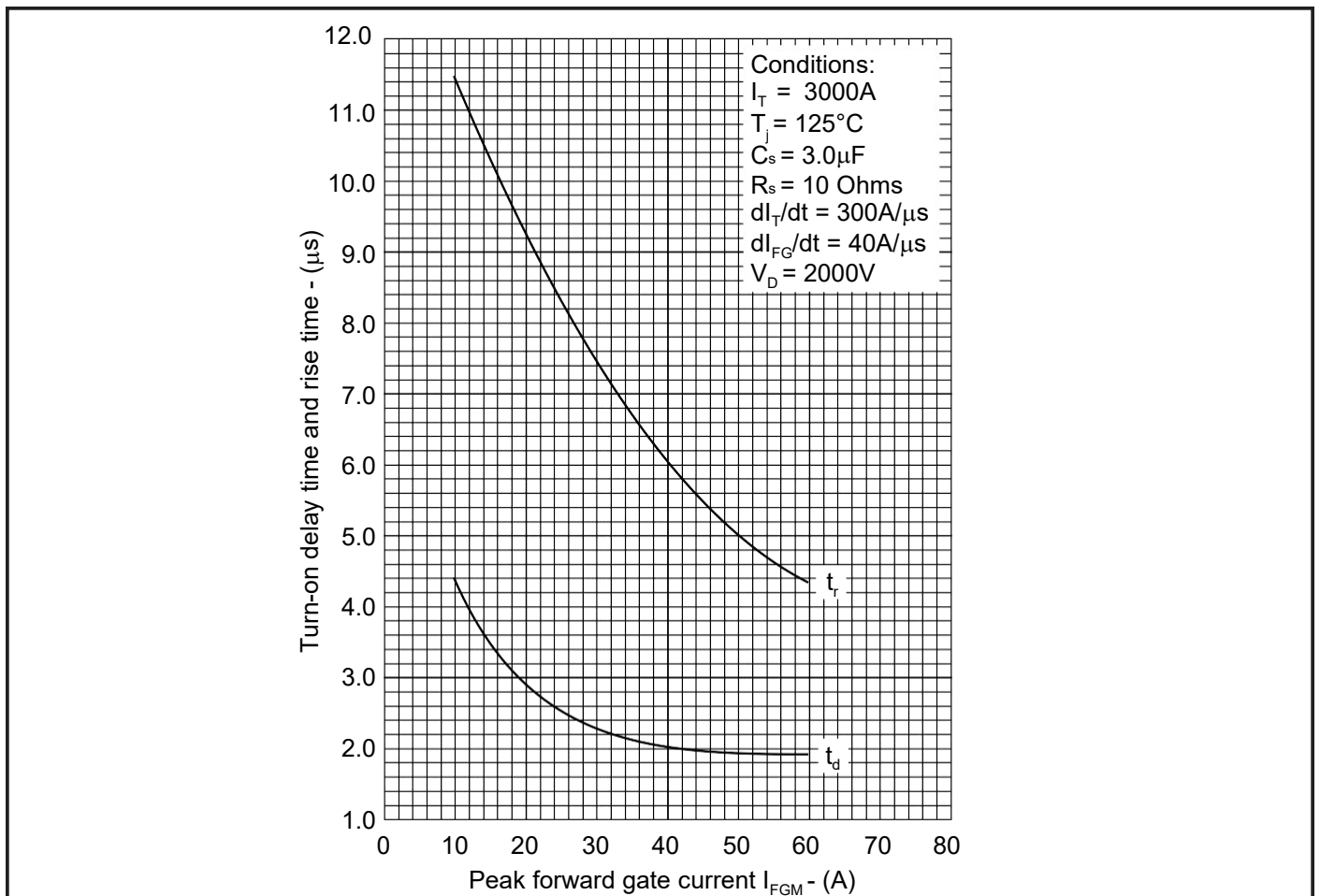


Figure 15. Delay and rise time vs peak forward gate current



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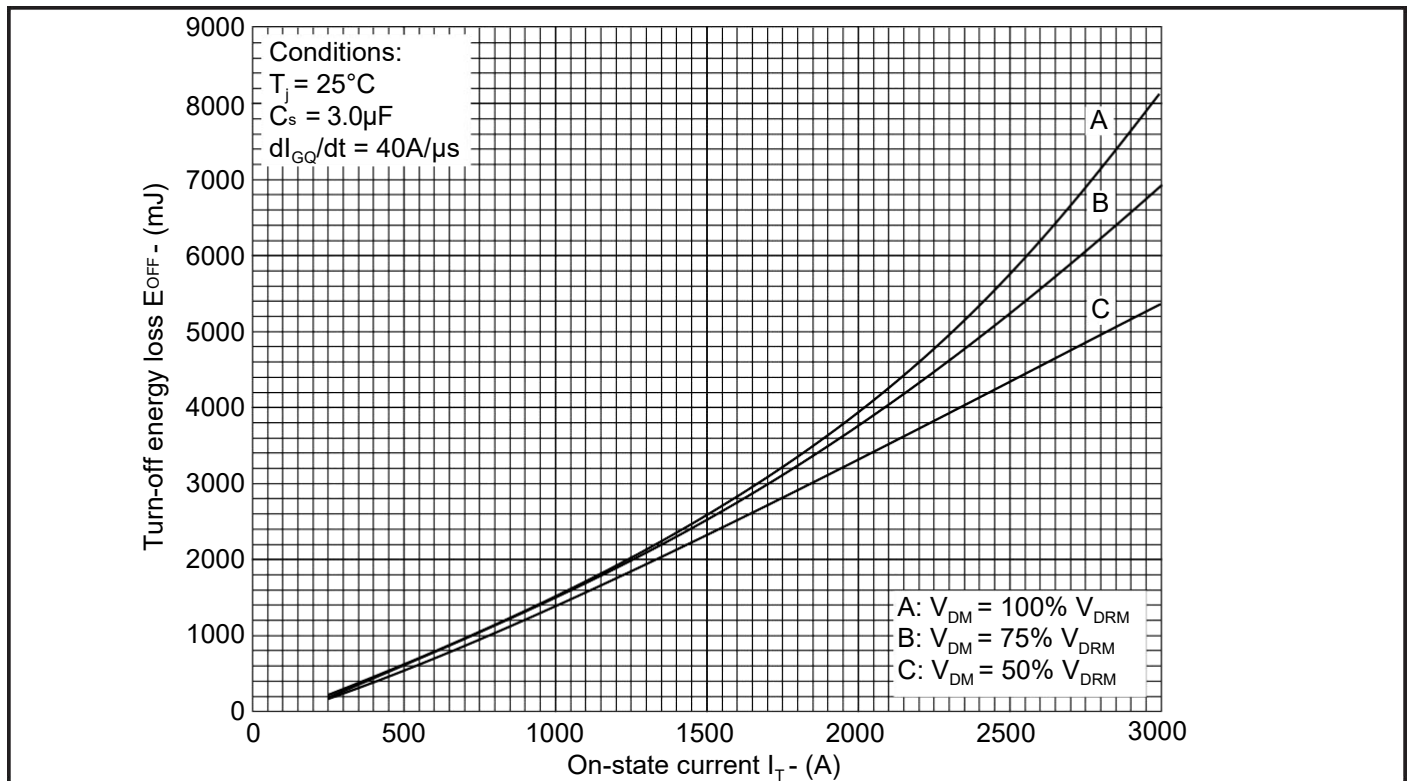


Figure 16. Turn-off energy loss vs on-state current

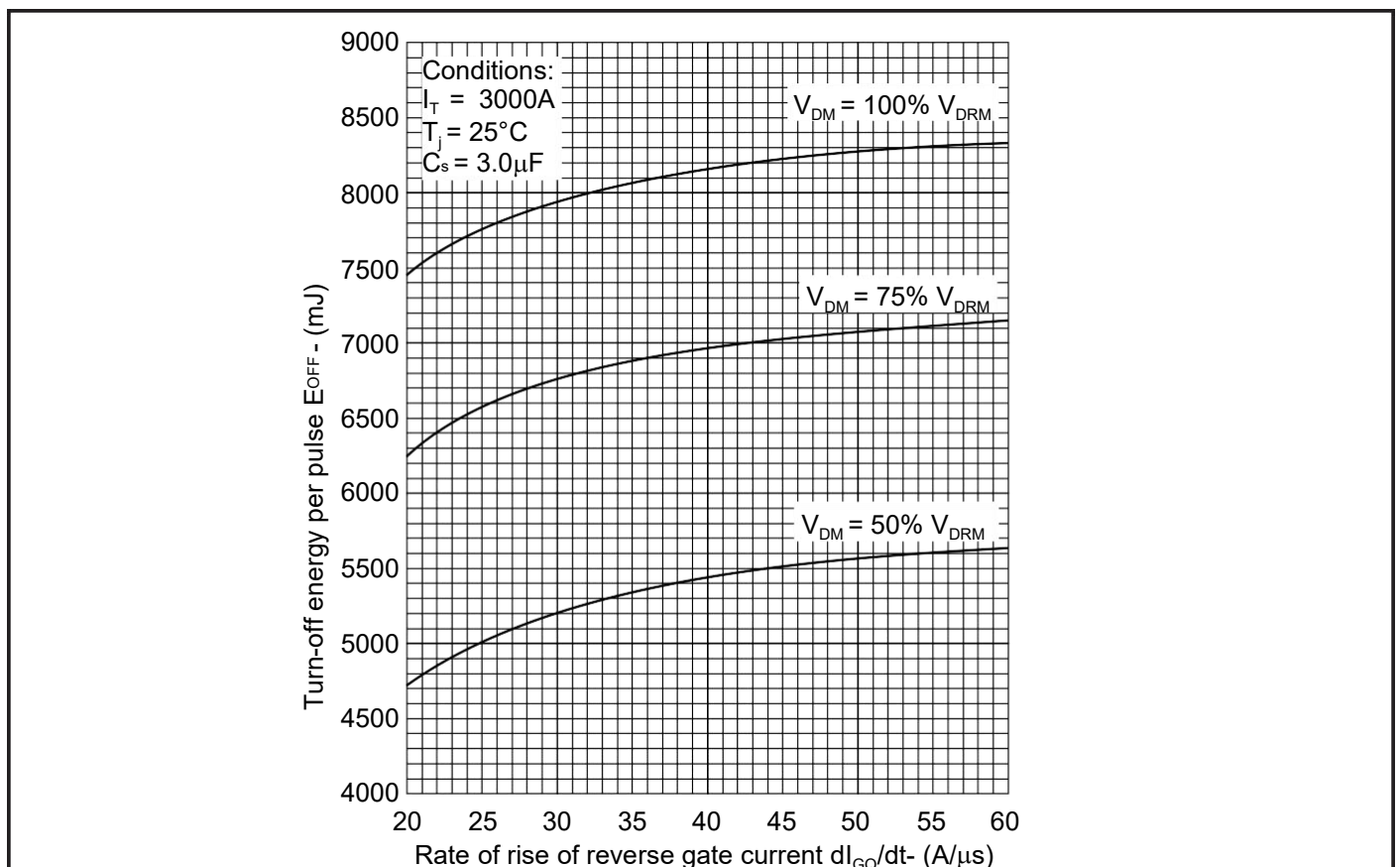


Figure 17. Turn-off energy vs rate of rise of reverse gate current



CURVES

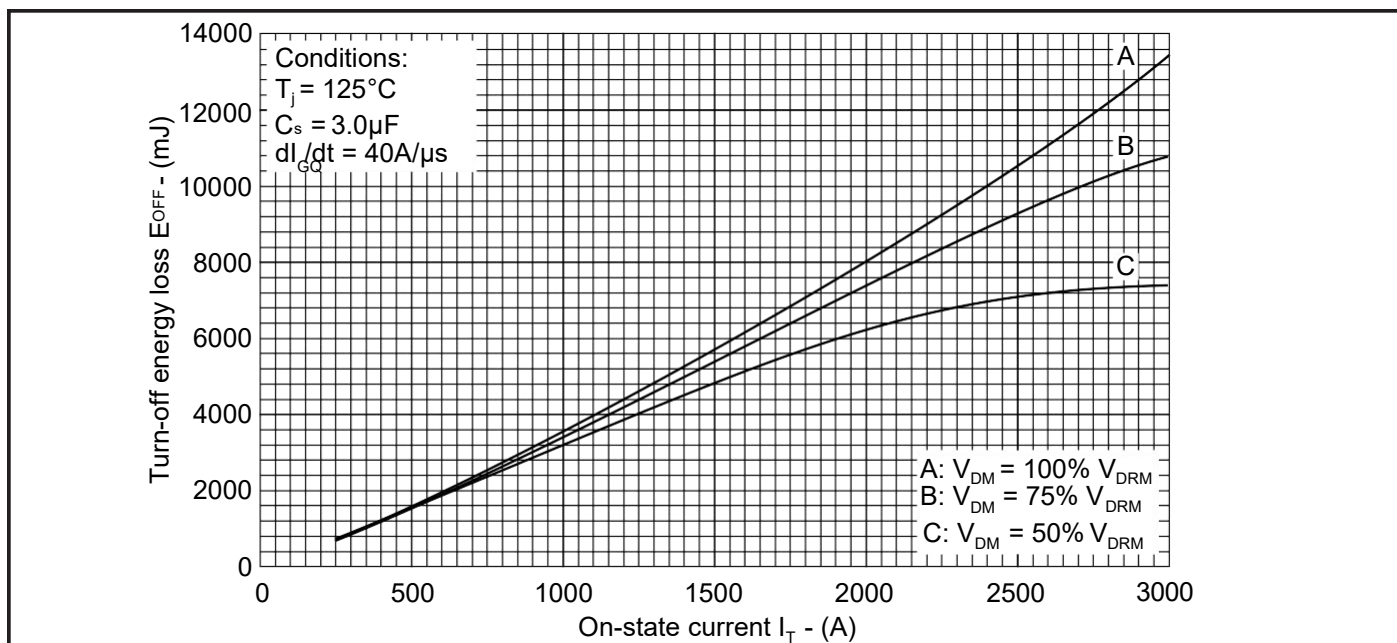


Figure 18. Turn-off energy vs on-state current

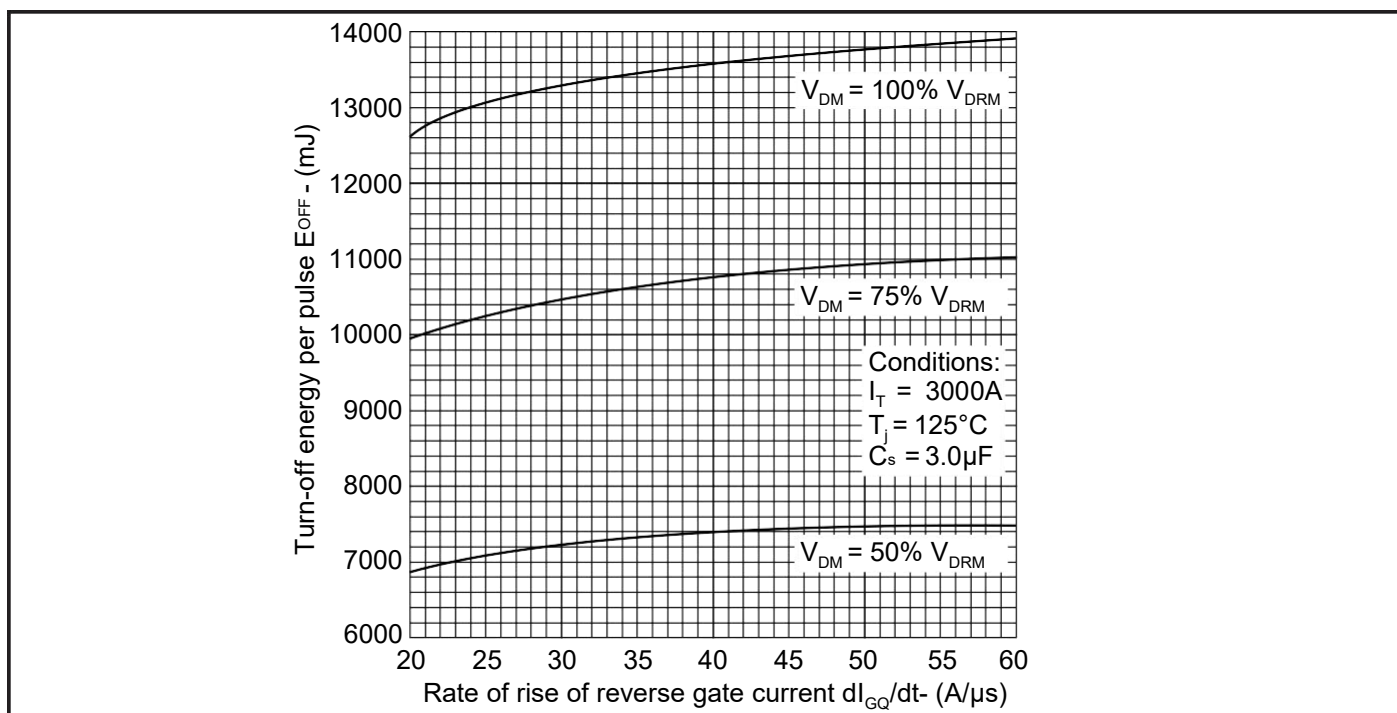


Figure 19. Turn-off energy loss vs rate of rise of reverse gate current



CURVES

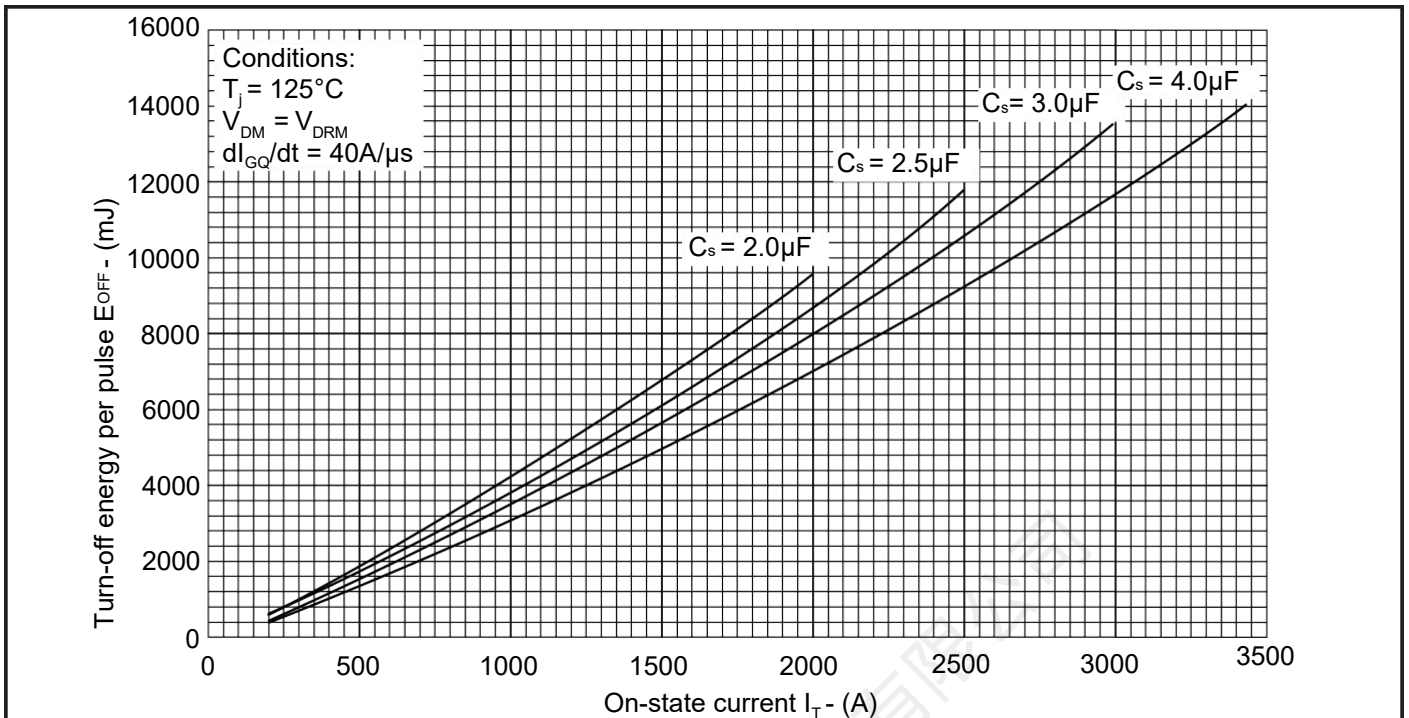


Figure 20. Turn-off energy vs on-state current

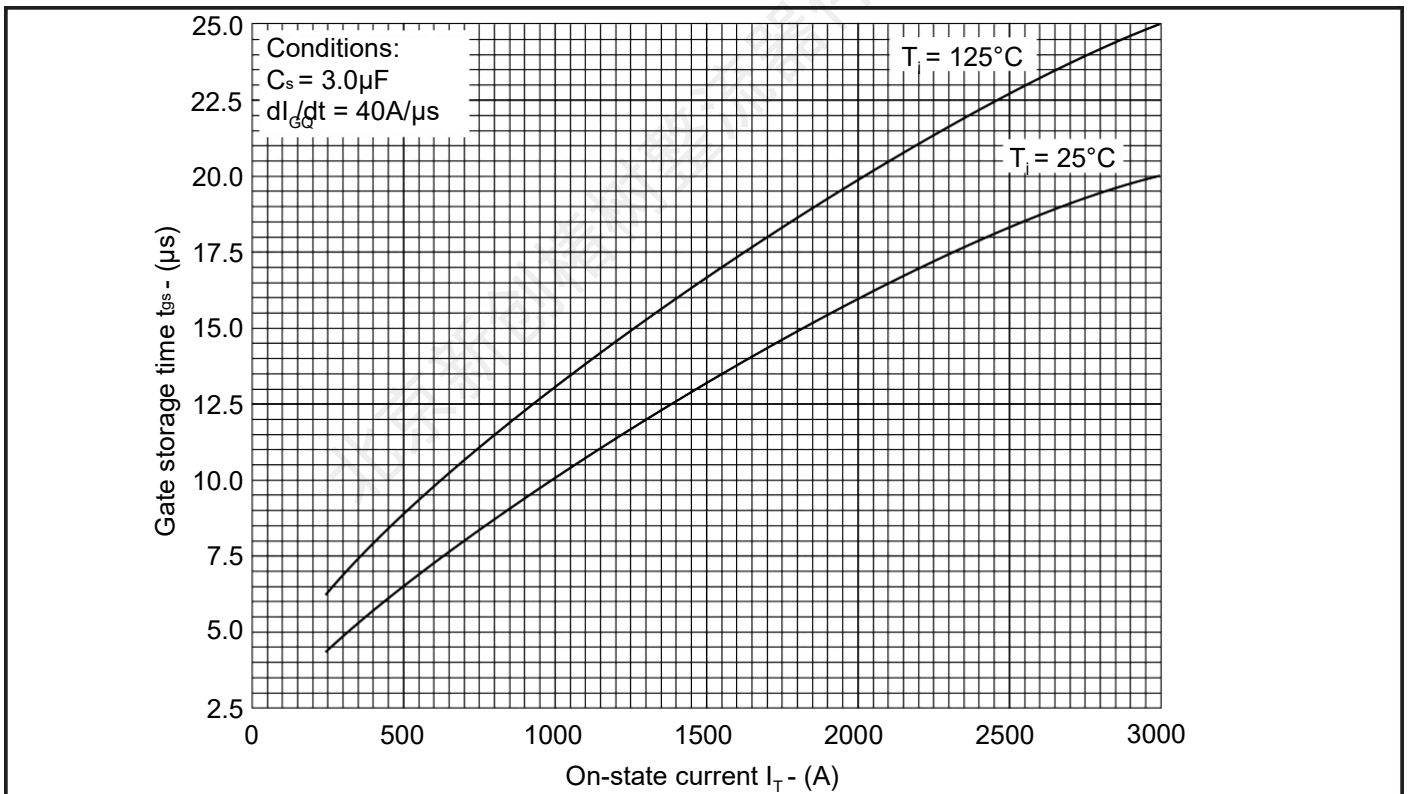


Figure 21. Gate storage time vs on-state current



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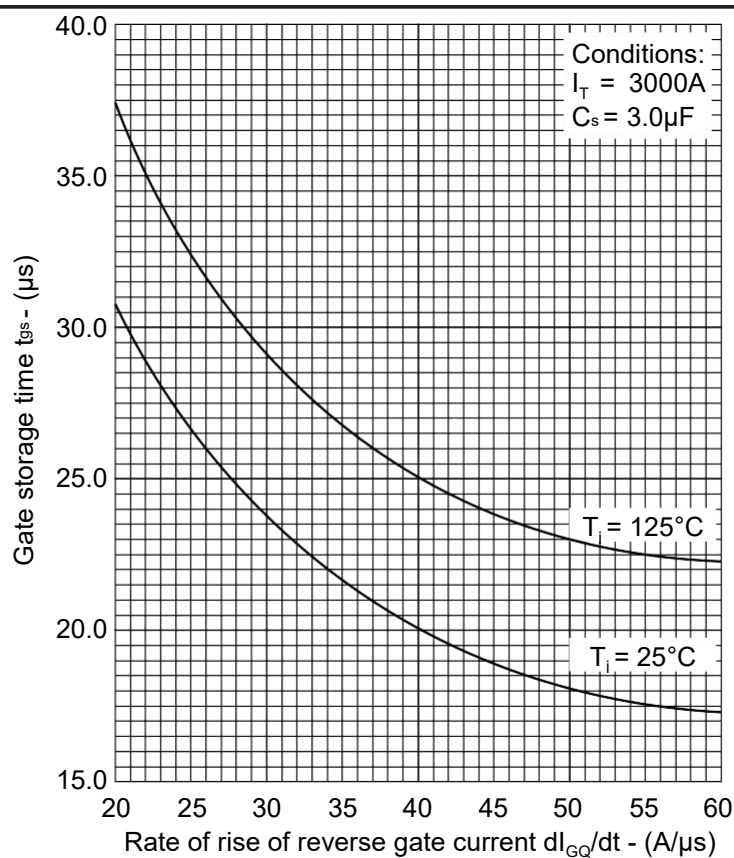


Figure 22. Gate storage time vs rate of rise of reverse gate current

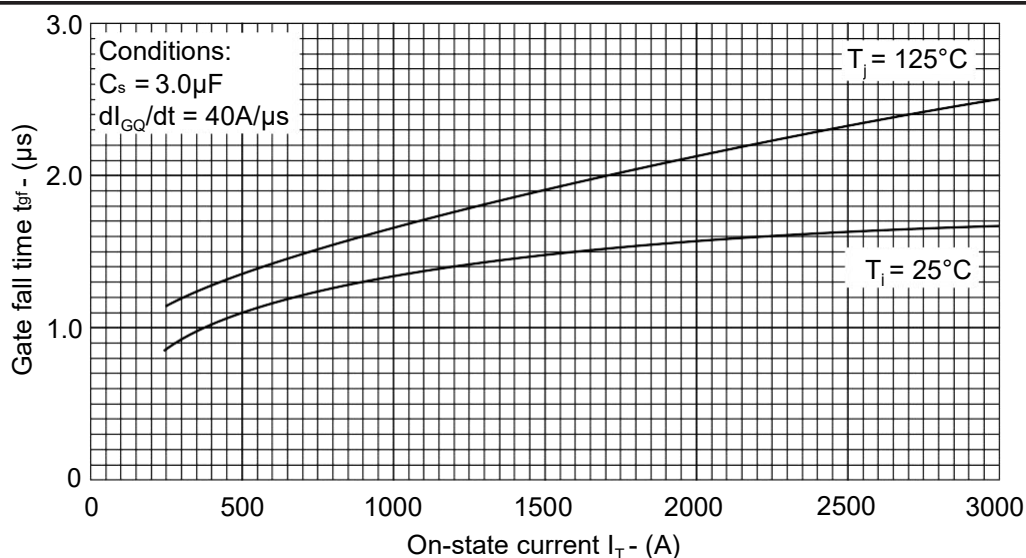


Figure 23. Gate fall time vs on-state current



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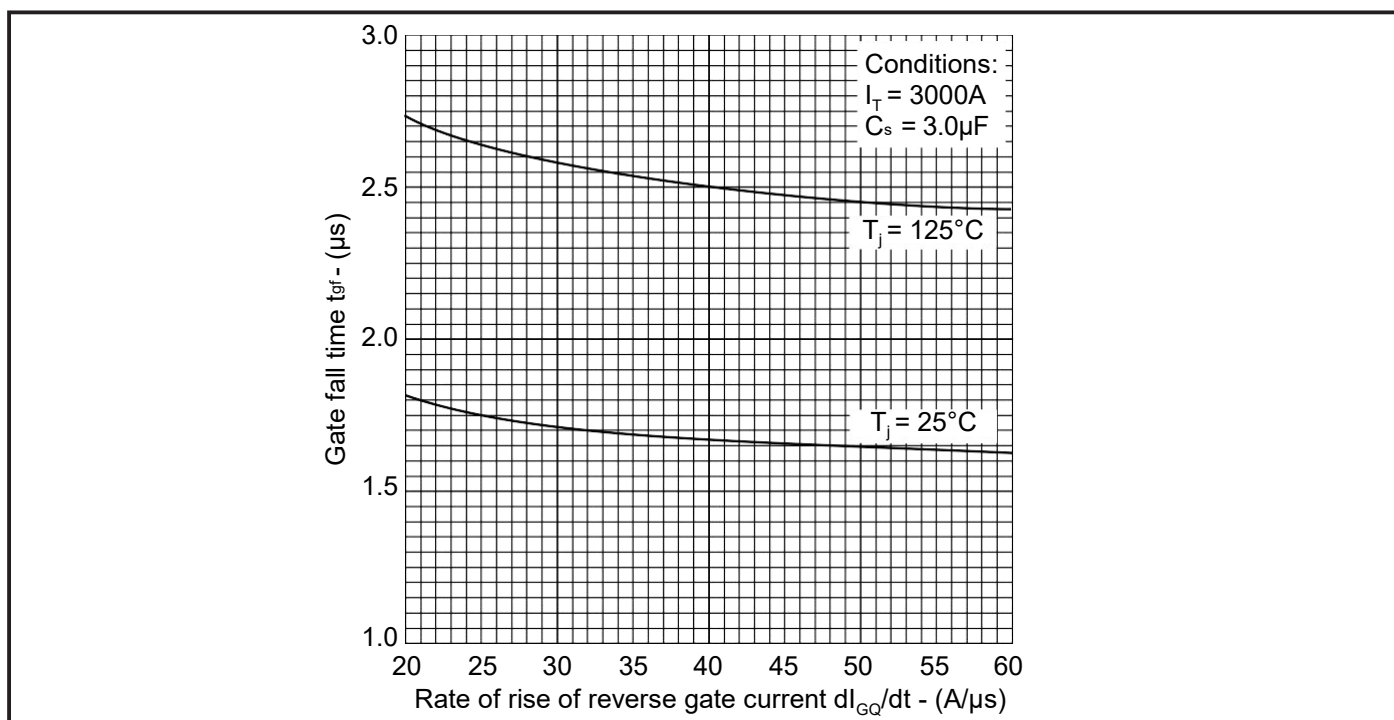


Figure 24. Gate fall time vs rate of rise of reverse gate current

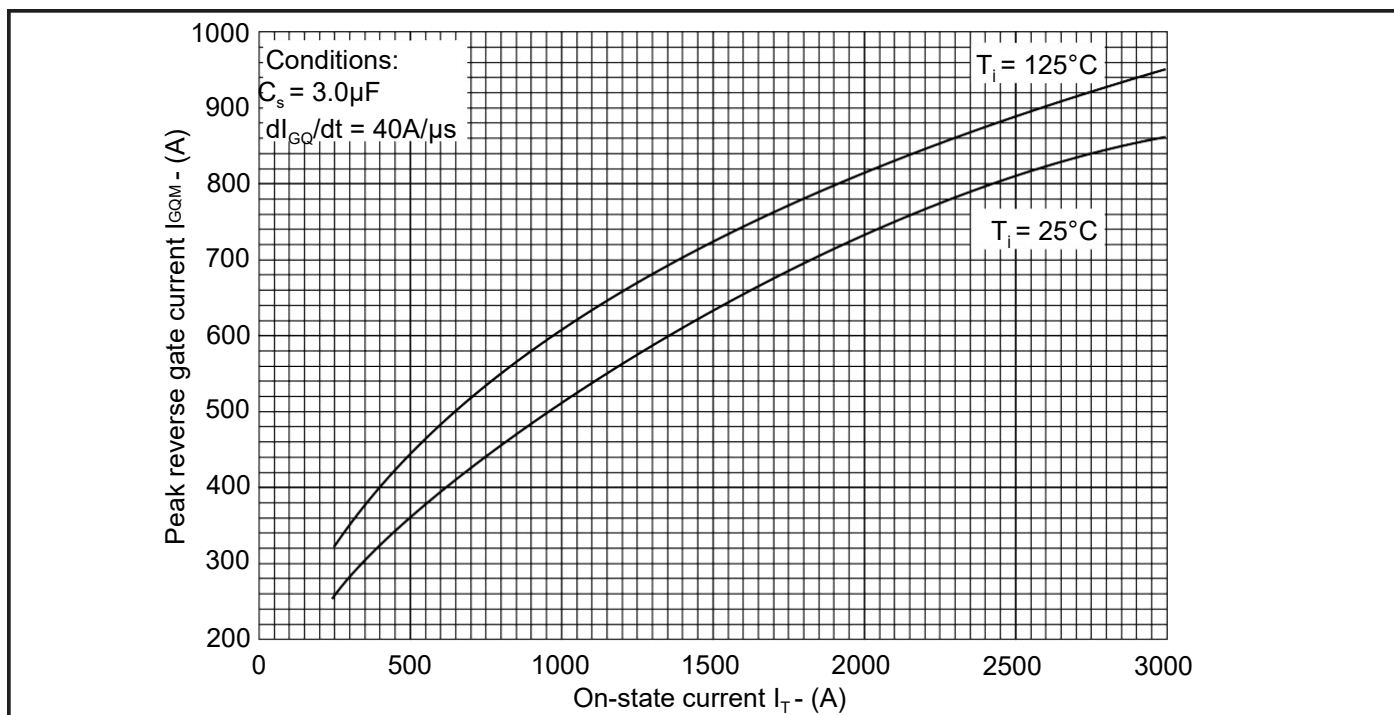


Figure 25. Peak reverse gate current vs on-state current



CURVES

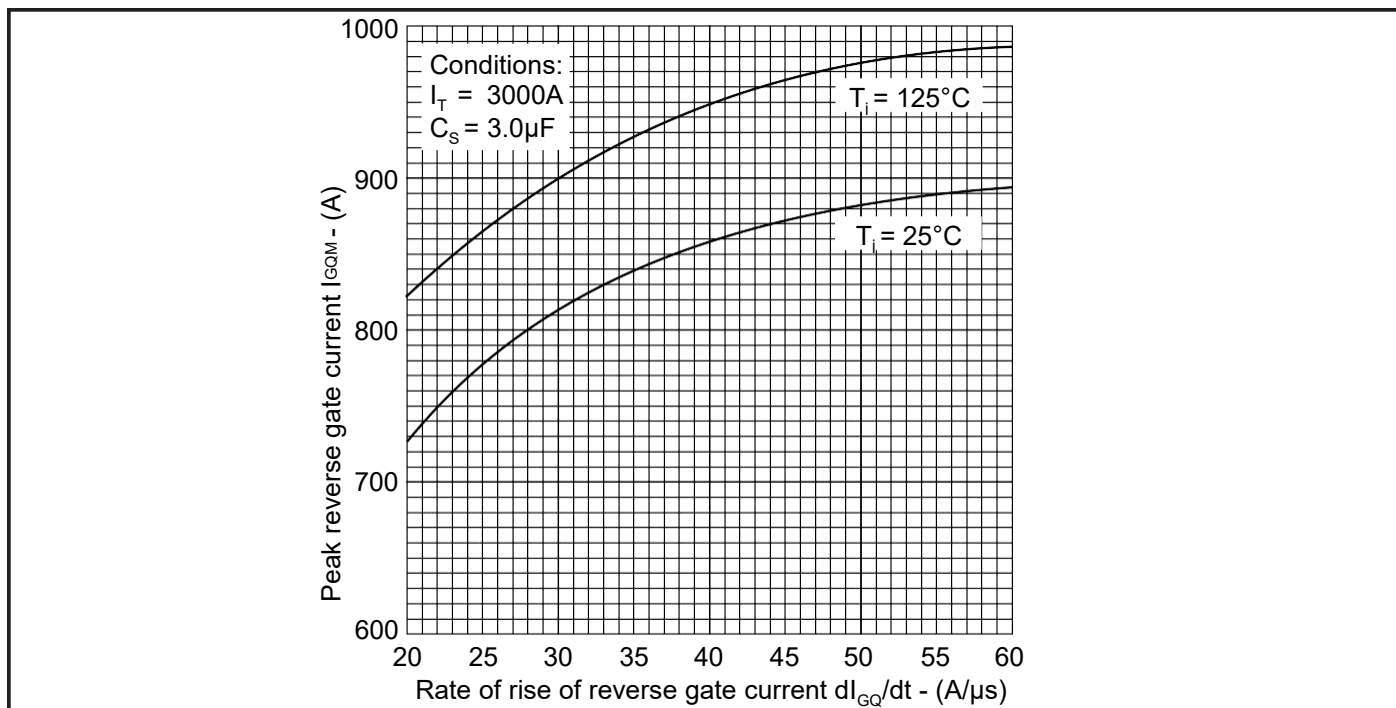


Figure 26. Reverse gate current vs rate of rise of reverse gate current

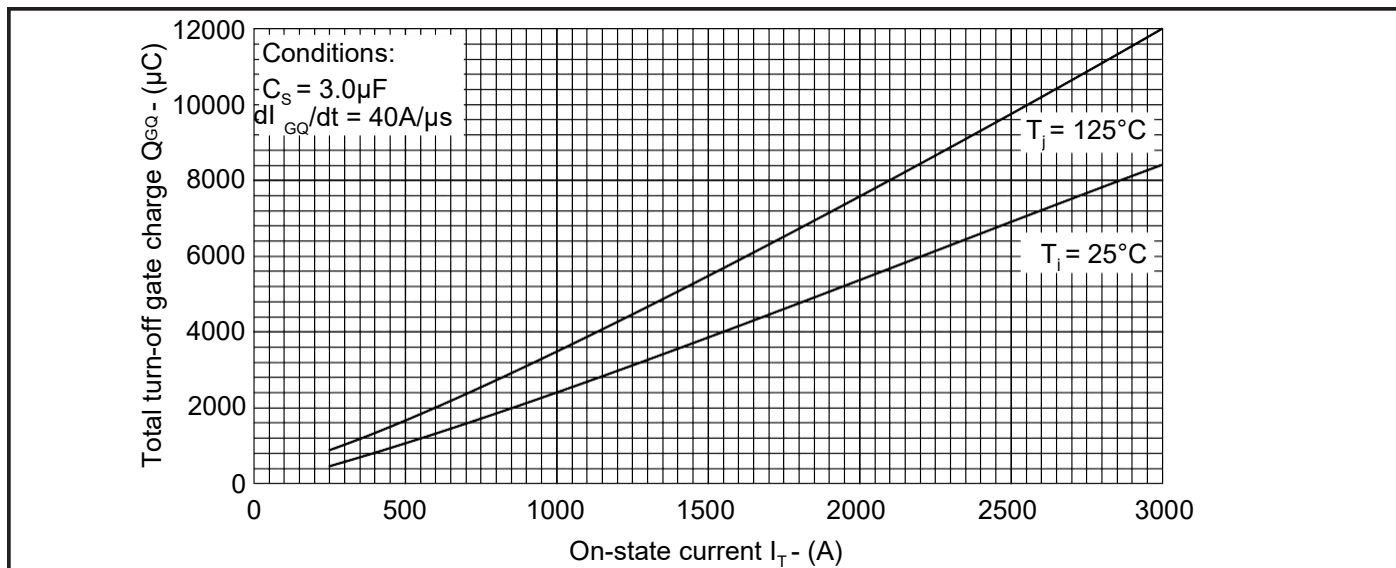


Figure 27. Turn-off gate charge vs on-state current



CURVES

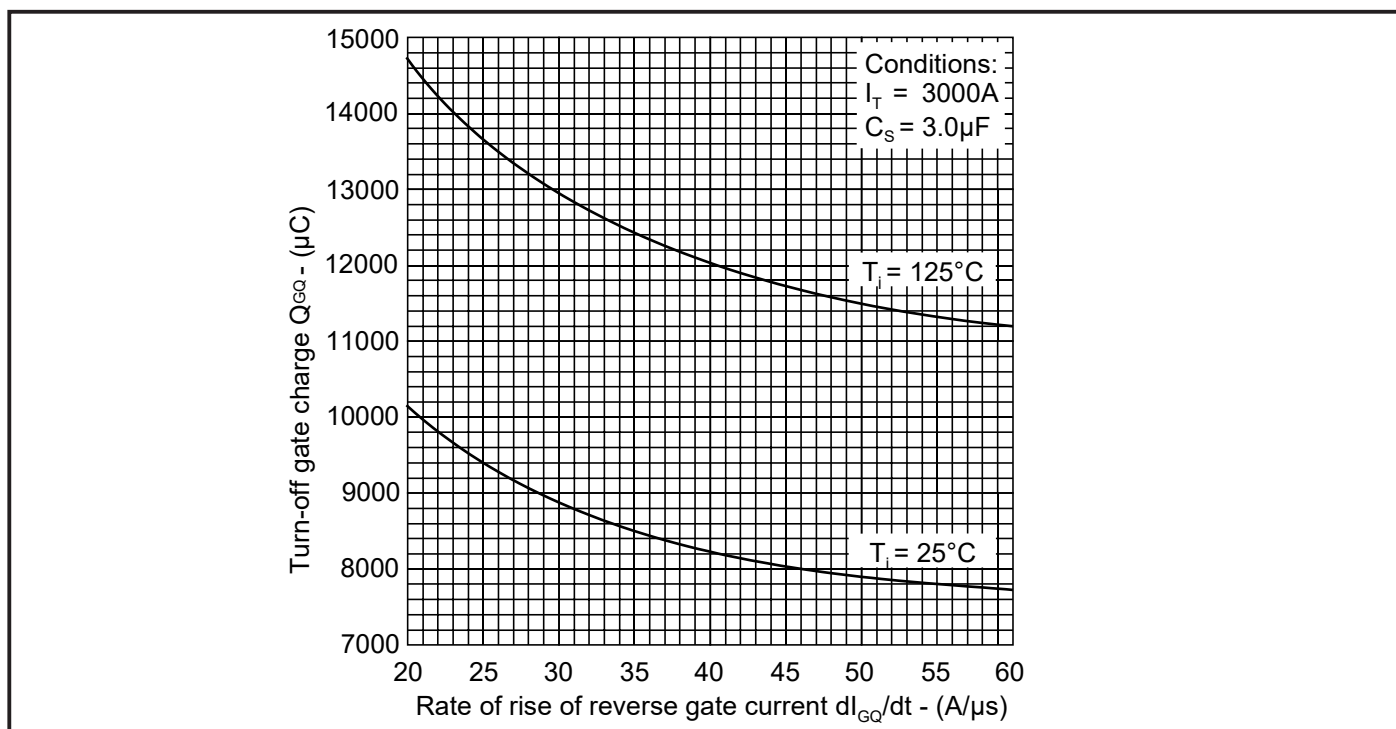


Figure 28. Turn-off gate charge vs rate of rise of reverse gate current

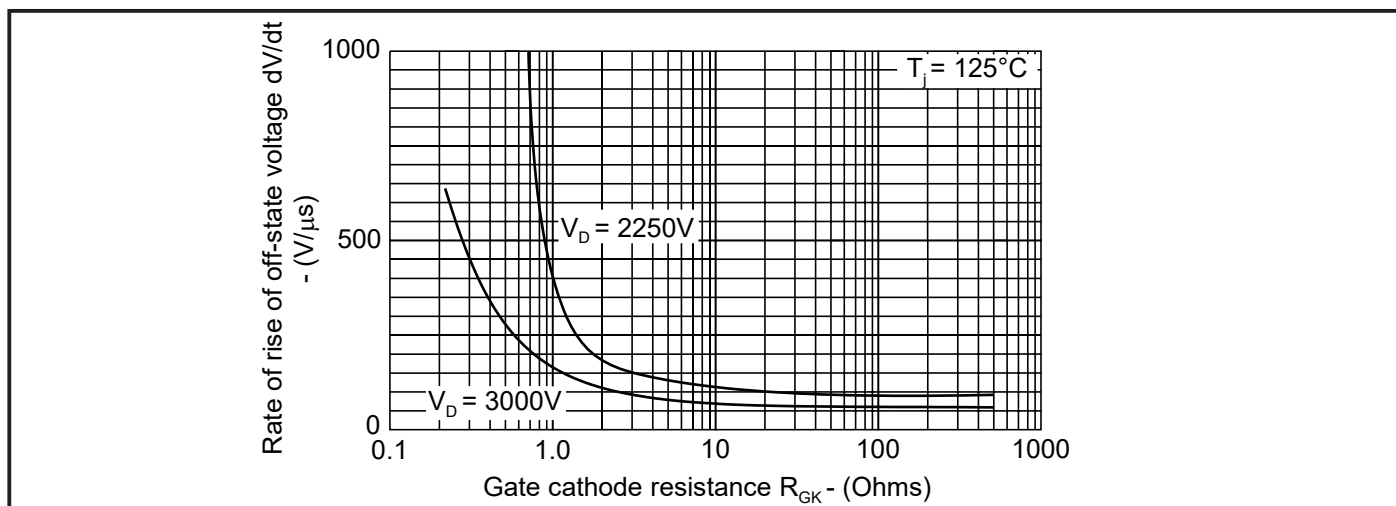
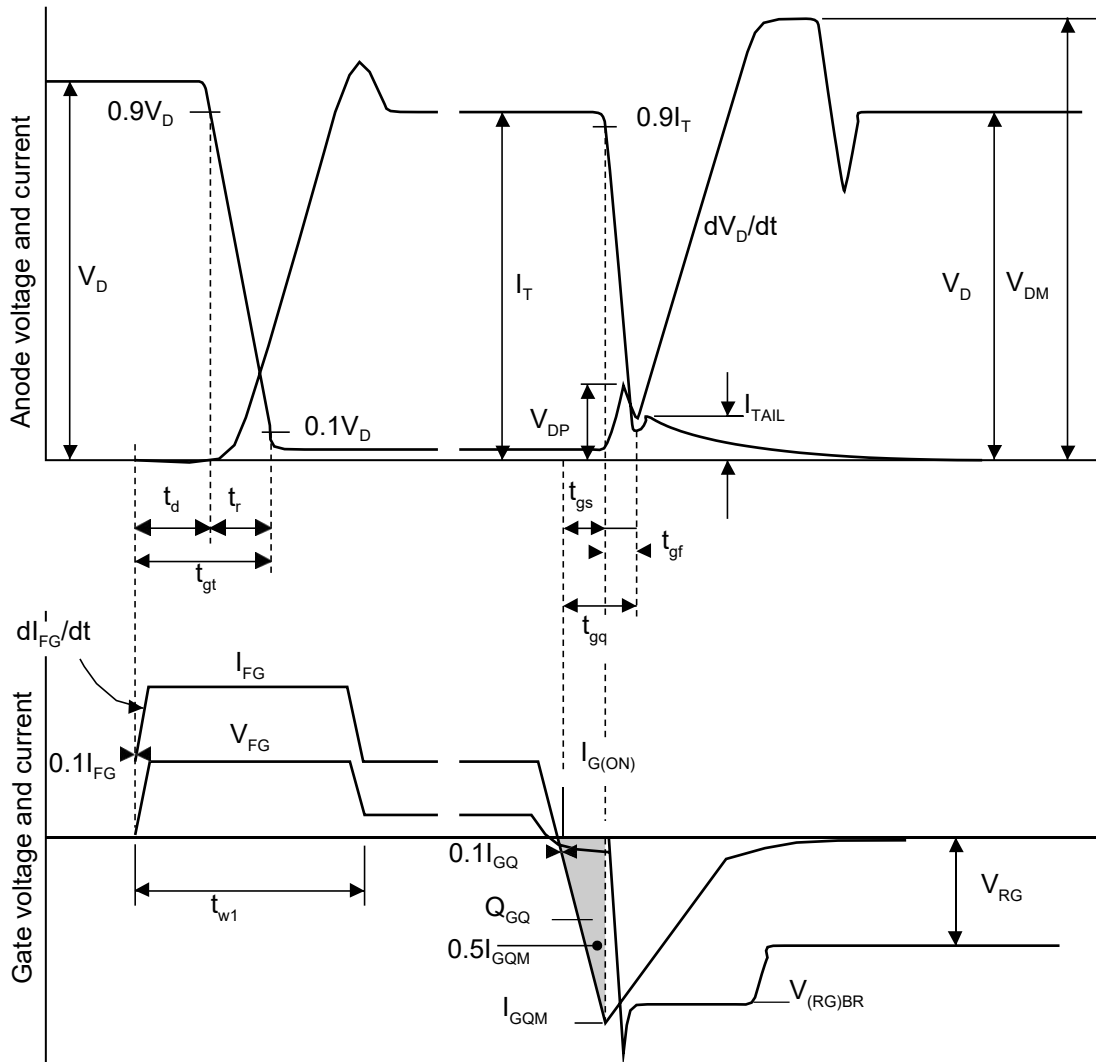


Figure 29. Rate of rise of off-state voltage vs gate cathode resistance



CURVES



Recommended gate conditions:

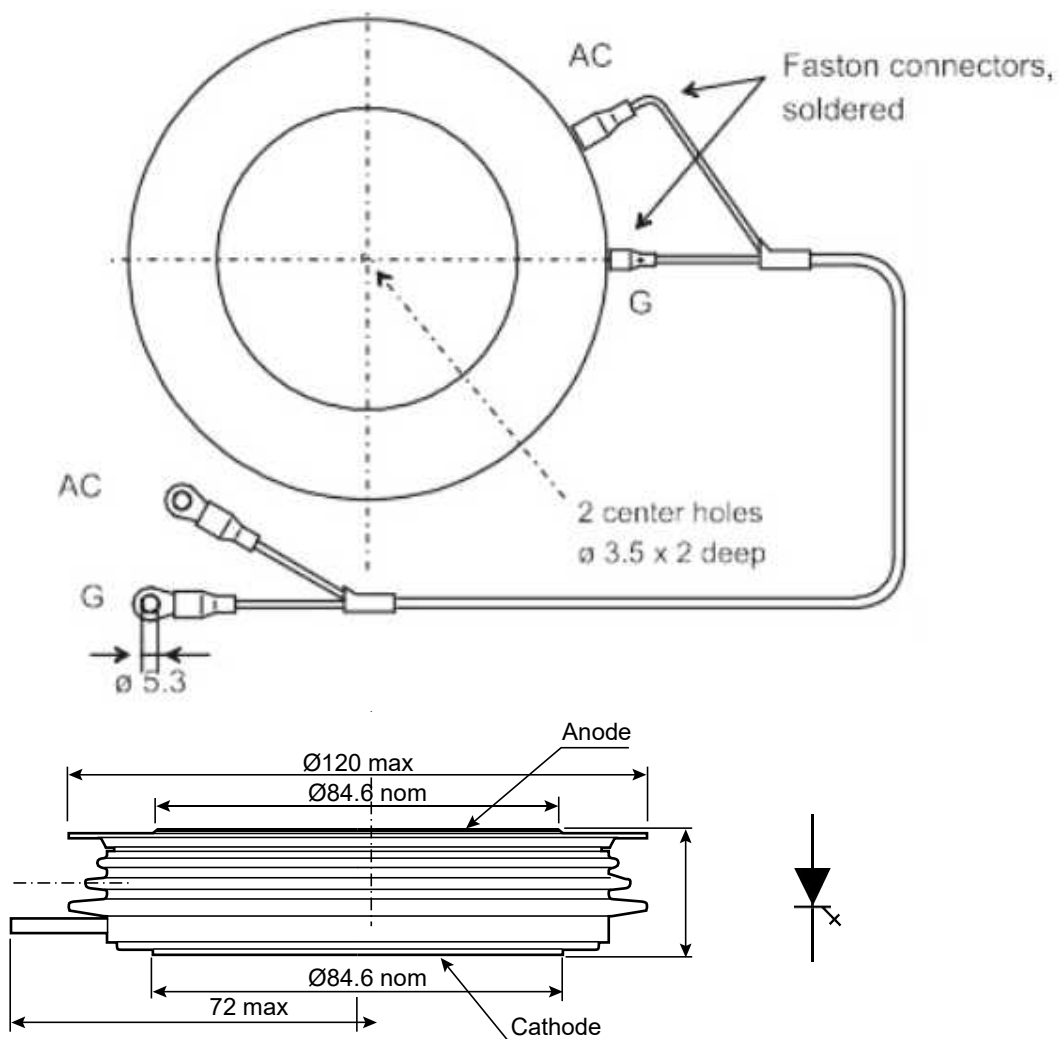
$I_{TCM} = 3000A$
 $I_{FG} = 40A$
 $I_{G(ON)} = 10A \text{ d.c.}$
 $t_{w1(min)} = 20\mu s$
 $I_{GQM} = 950A$
 $di_{GQ}/dt = 40A/\mu s$
 $Q_{GQ} = 12000\mu C$
 $V_{RG(min)} = 2V$
 $V_{RG(max)} = 16V$

Figure 30. General switching waveforms



OUTLINE AND DIMENSION

For further package information, please contact Customer Services. All dimensions in mm, unless stated otherwise.
DO NOT SCALE.



Package outline type code: L

Nominal weight: 1700g

Clamping force: 40 ± 4 kN

Lead double coax, length: 630mm

Leads and connectors can be customized by sample from user