SiC Power Module

BSM400D12P3G002

Datasheet

●Application

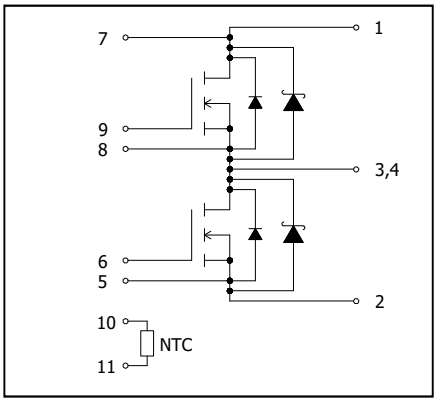
・Motor drive

・Inverter, Converter

・Photovoltaics, wind power generation.

・Induction heating equipment.

●Circuit diagram



●Features

1) Low surge, low switching loss.

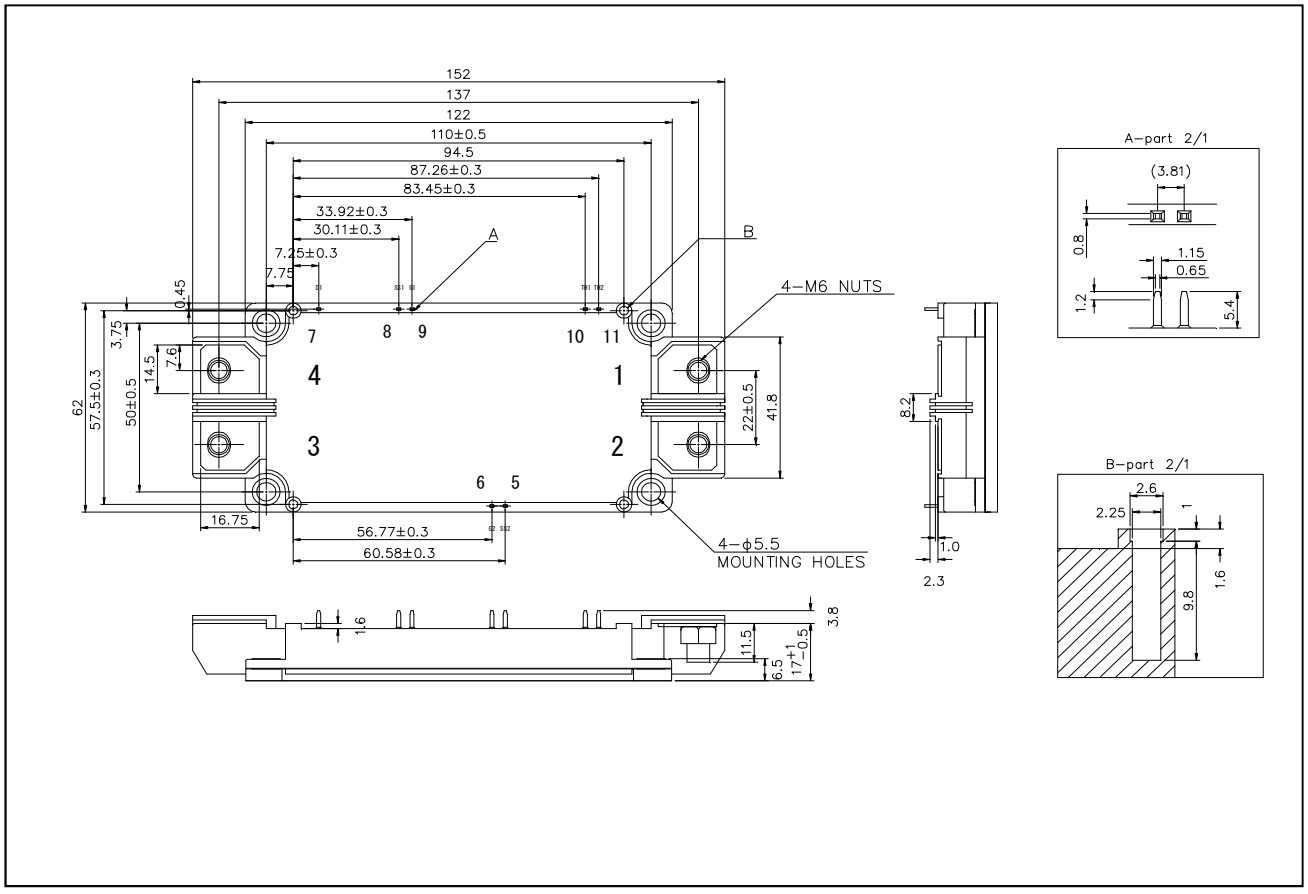
2) High-speed switching possible.

3) Reduced temperature dependence.

●Construction

This product is a half bridge module consisting of SiC-UMOSFET and SiC-SBD from ROHM.

●Dimensions & Pin layout (Unit : mm)



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●Absolute maximum ratings (T_j = 25°C)

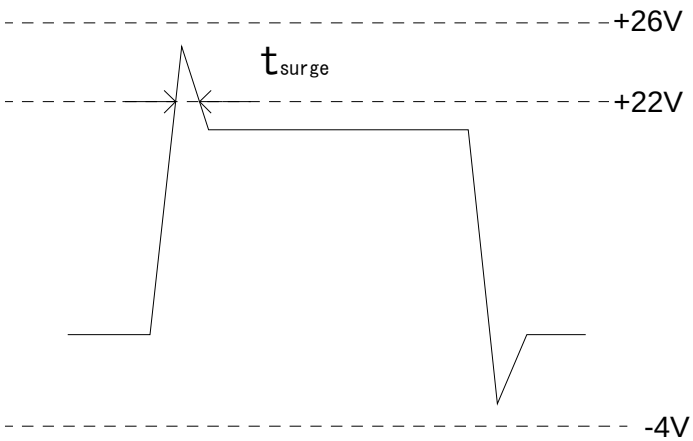
Parameter	Symbol	Conditions	Limit	Unit
Drain-source voltage	V_{DSS}	G-S short	1200	V
Gate-source voltage(+)	V_{GSS}	D-S short	22	
Gate-source voltage(–)			–4	
G - S Voltage (t_{surge}<300nsec)	$V_{GSSsurge}$		–4 to 26	
Drain current *1	I_D	DC (T_c=60°C) V_{GS}=18V	358	A
	I_D	DC (T_c=32°C) V_{GS}=18V	400	
	I_{DRM}	Pulse (T_c=60°C) 1ms V_{GS}=18V *2	800	
Source current *1	I_S	DC (T_c=60°C) V_{GS}=18V	358	
	I_S	DC (T_c=32°C) V_{GS}=18V	400	
	I_S	DC (T_c=60°C) V_{GS}=0V	260	
	I_{SRM}	Pulse (Tc=60°C) 1ms V_{GS}=18V *2	800	
	I_{SRM}	Pulse (Tc=60°C) 10μs V_{GS}=0V *2	800	
Total power disspation *3	Ptot	T_c=25°C	1570	W
Max Junction Temperature	T_{jmax}		175	°C
Junction temperature	T_{jop}		–40 to150	
Storage temperature	T_{stg}		–40 to125	
Isolation voltage	Visol	Terminals to baseplate, f=60Hz AC 1min.	2500	Vrms
Mounting torque	–	Main Terminals : M6 screw	4.5	N · m
		Mounting to heat shink : M5 screw	3.5	

(*1) Case temperature (T_c) is defined on the surface of base plate just under the chips.

(*2) Repetition rate should be kept within the range where temperature rise if die should not exceed $T_{j\,max.}$

(*3) T_j is less than 175°C

●Example of acceptable V_{GS} waveform



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●Electrical characteristics (T_j=25°C)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Static drain-source on-state voltage	$V_{DS(on)}$	I_D=400A, V_{GS}=18V	T_j=25°C	-	1.8	2.5	V
			T_j=125°C	-	2.6	-	
			T_j=150°C	-	3.0	4.5	
Drain cutoff current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V		-	-	2.4	mA
Souce-Drain Voltage	V_{SD}	V_{GS}=0V, I_S=400A	T_j=25°C	-	2.1	2.6	V
			T_j=125°C	-	2.7	-	
			T_j=150°C	-	2.8	4.8	
		V_{GS}=18V, I_S=400A	T_j=25°C	-	1.3	-	V
			T_j=125°C	-	1.8	-	
			T_j=150°C	-	1.9	-	
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS}=10V, I_D=109.2mA		2.7	-	5.6	V
Gate-source leakage current	I_{GSS}	V_{GS}=22V, V_{DS}=0V		-	-	0.5	μA
		V_{GS}= −4V, V_{DS}=0V		−0.5	-	-	
Switching characteristics	$t_{d(on)}$	$V_{GS(on)}$=18V, $V_{GS(off)}$= −2V *4		-	45	-	ns
	t_r	V_{DS}=600V		-	55	-	
	t_{rr}	I_D=400A		-	45	-	
	$t_{d(off)}$	$R_{G(on)}$=2.2Ω, $R_{G(off)}$=2.2Ω		-	240	-	
	t_f	inductive load		-	55	-	
Input capacitance	Ciss	V_{DS}=10V, V_{GS}=0V,200kHz		-	17	-	nF
Gate Registance	R_{Gint}	T_j=25°C		-	2.4	-	Ω
NTC Rated Resistance	R25			-	5.0	-	kΩ
NTC B Value	$B_{50/25}$			-	3370	-	K
Stray Inductance	Ls			-	10.5	-	nH
Creepage Distance	-	Terminal to heat sink		-	16.7	-	mm
		Terminal to terminal		-	16.7	-	mm
Clearance Distance	-	Terminal to heat sink		-	12.0	-	mm
		Terminal to terminal		-	11.0	-	mm
Junction-to-case thermal resistance	R_{th}(j-c)	UMOS (1/2 module) *5		-	-	96	°C/kW
		SBD (1/2 module) *5		-	-	127	
Case-to-heat sink Thermal resistance	R_{th}(c-f)	Case to heat sink, per 1 module, Thermal grease applied *6		-	15	-	

(*4) In order to prevent self turn-on, it is recommended to apply negative gate bias.

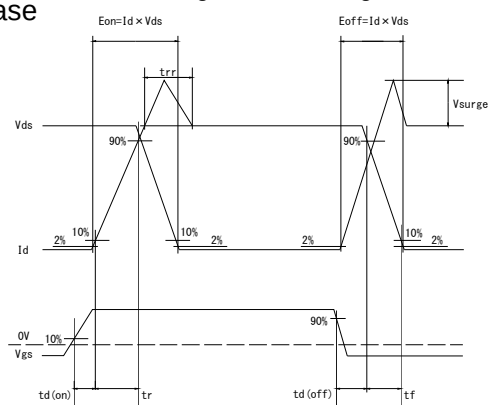
(*5) Measurement of Tc is to be done at the point just under the chip.

(*6) Typical value is measured by using thermally conductive grease of λ=0.9W/(m･K).

(*7) SiC devices have lower short cuicuit withstand capability due to high current density. Please be advised to pay careful attention to short cuicuit accident and try to adjust protection time to shutdown them as short as possible.

(*8) If the Product is used beyond absolute maximum ratings defined in the Specifications, as its internal structure may be dameged, please replace such Product with a new one.

＜Wavelength for Switching Test＞



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●**Electrical characteristic curves** (Typical)

Fig.1 Typical Output Characteristics [T_j=25ºC]

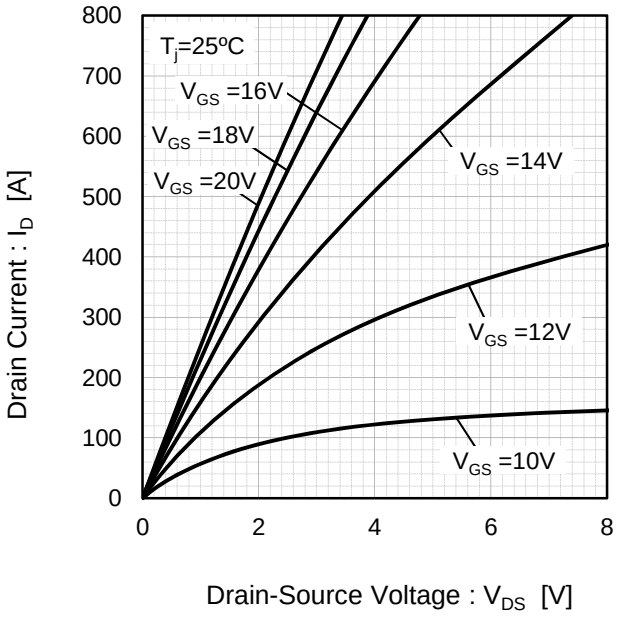


Fig.2 Drain-Source Voltage vs. Drain Current

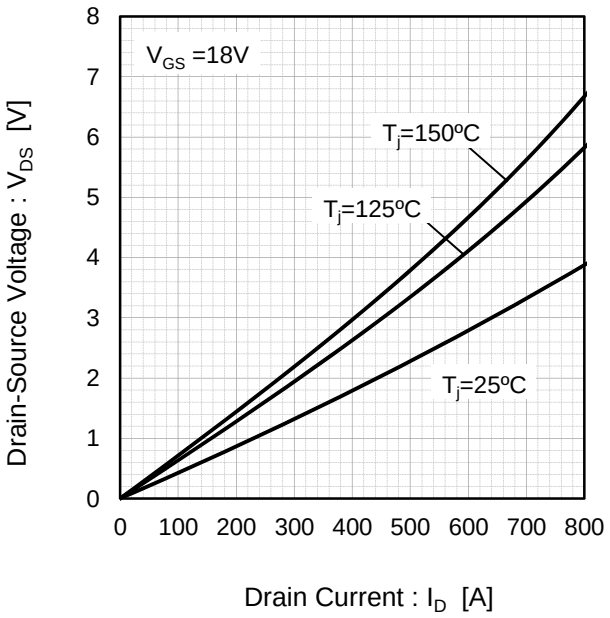


Fig.3 Drain-Source Voltage vs. Gate-Source Voltage [T_j=25ºC]

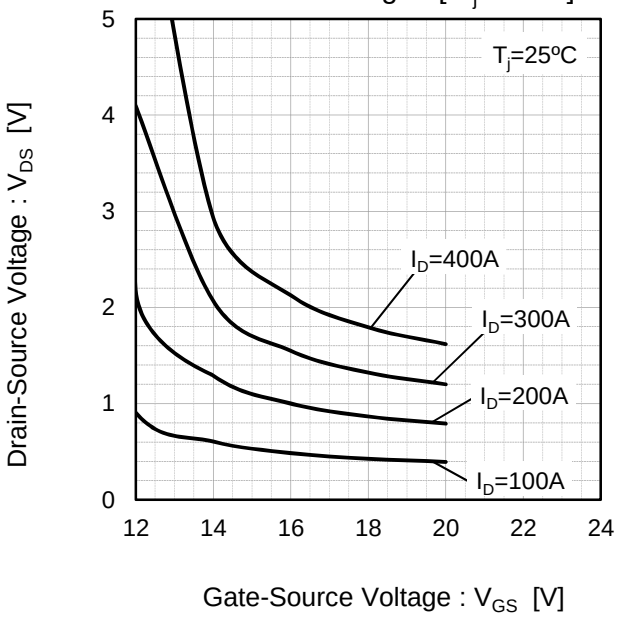
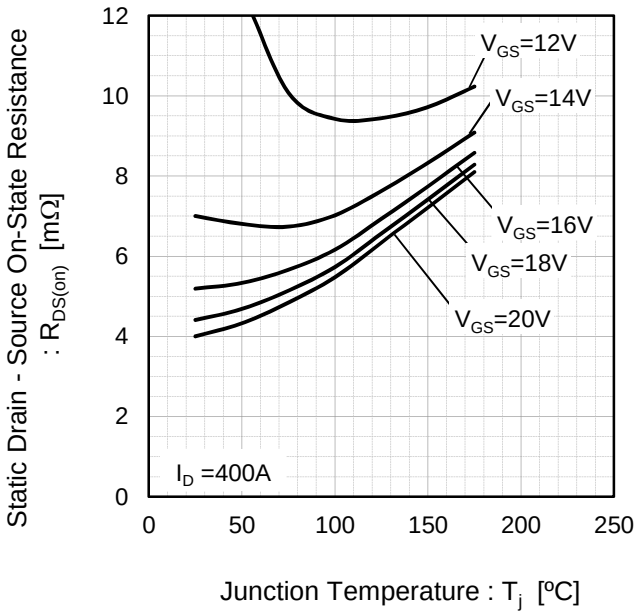


Fig.4 Static Drain - Source On-State Resistance vs. Junction Temperature



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●**Electrical characteristic curves** (Typical)

Fig.5 Forward characteristic of Diode

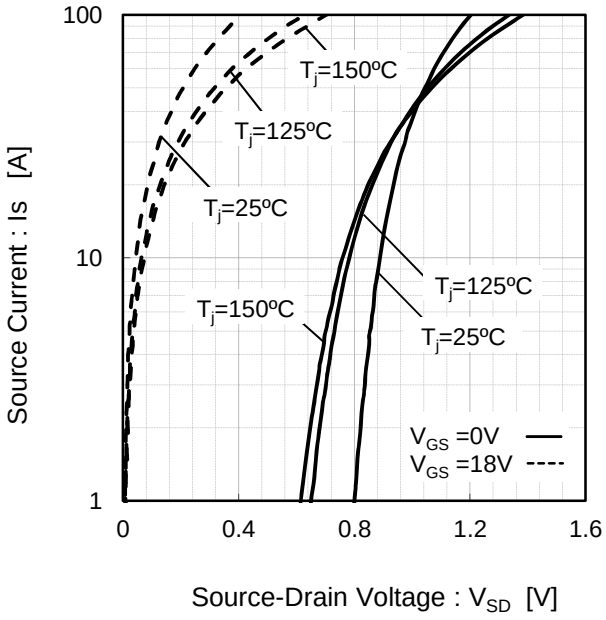


Fig.6 Forward characteristic of Diode

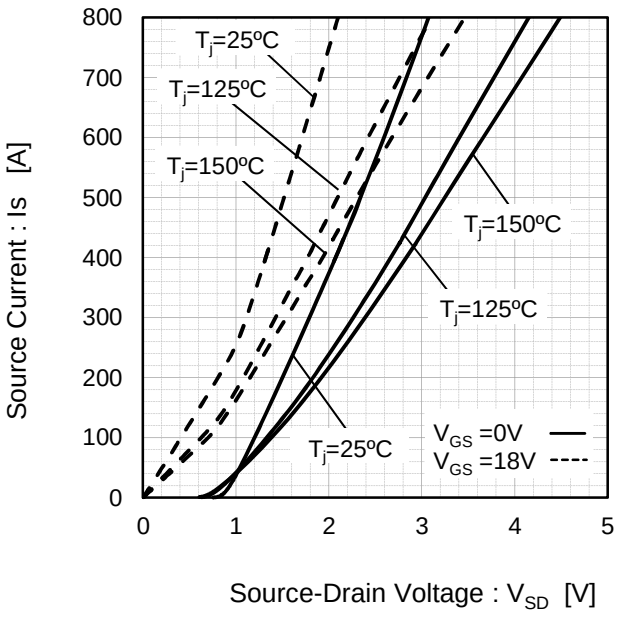


Fig.7 Drain Current vs. Gate-Source Voltage

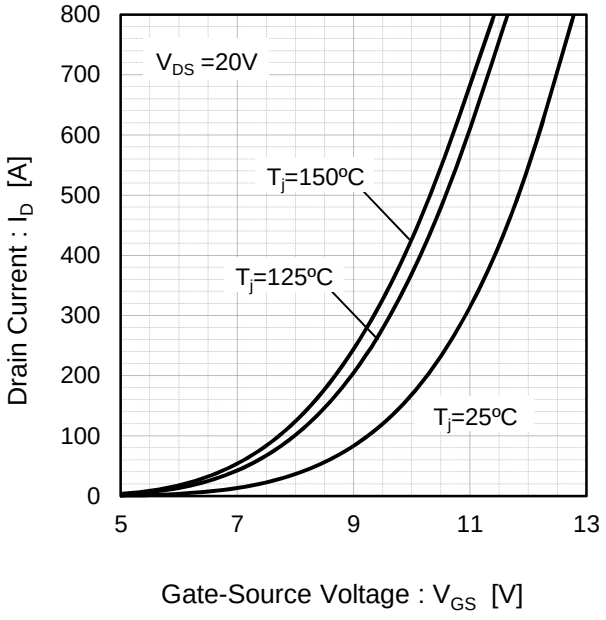
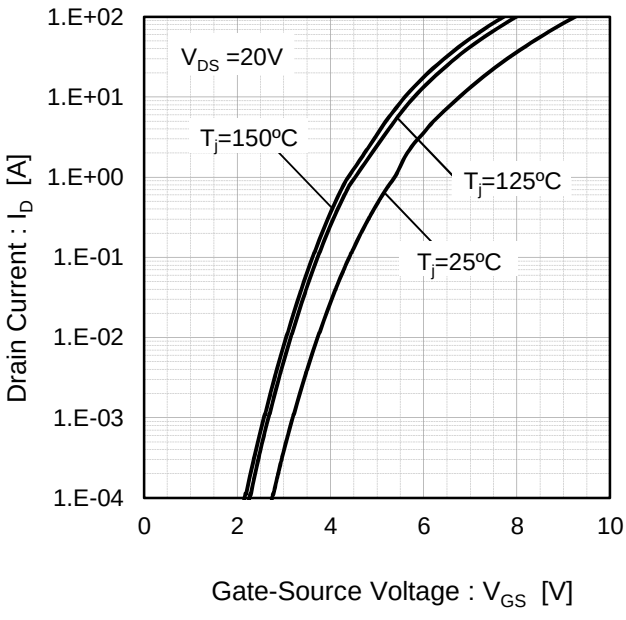


Fig.8 Drain Current vs. Gate-Source Voltage



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●**Electrical characteristic curves** (Typical)

Fig.9 Switching Characteristics [T_j=25ºC]

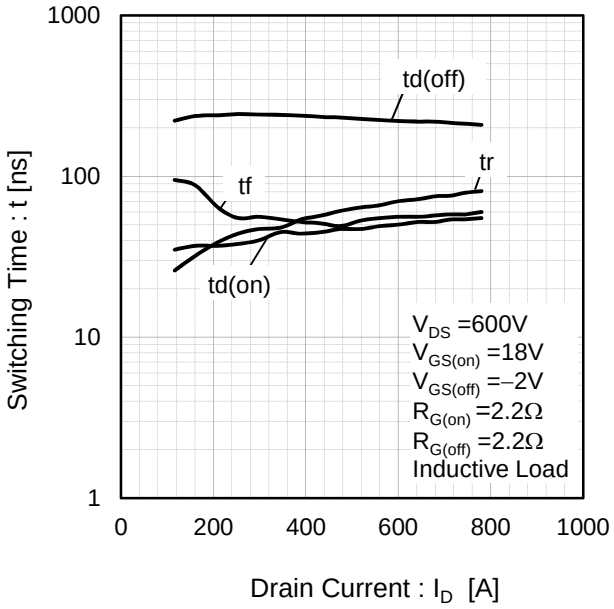


Fig.10 Switching Characteristics [T_j=125ºC]

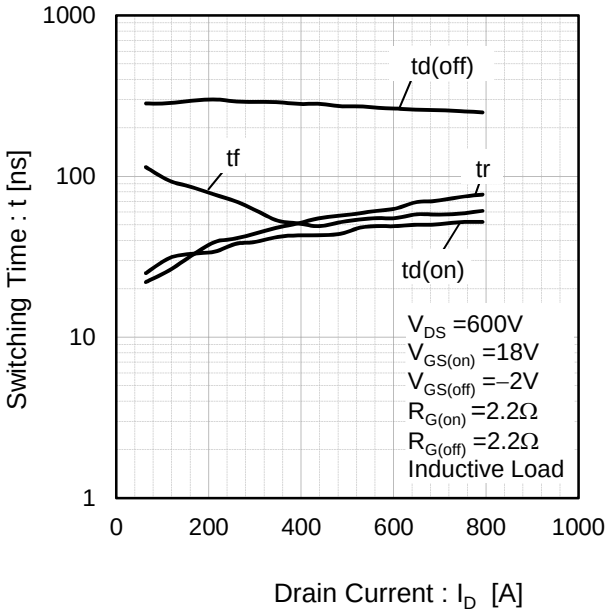


Fig.11 Switching Characteristics [T_j=150ºC]

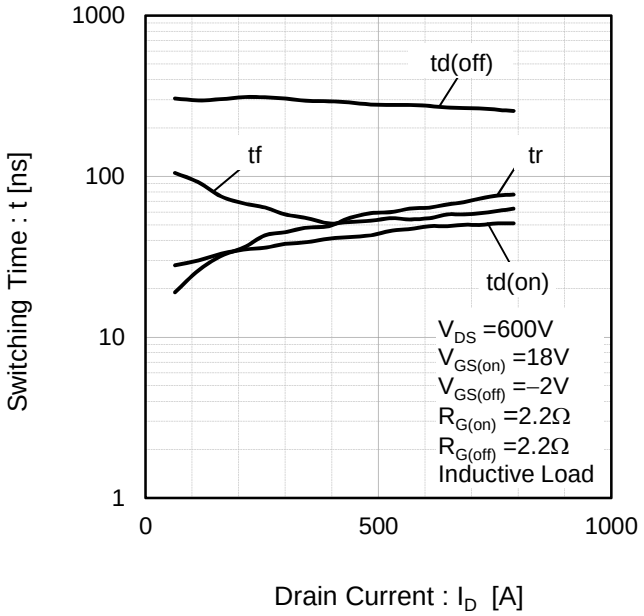
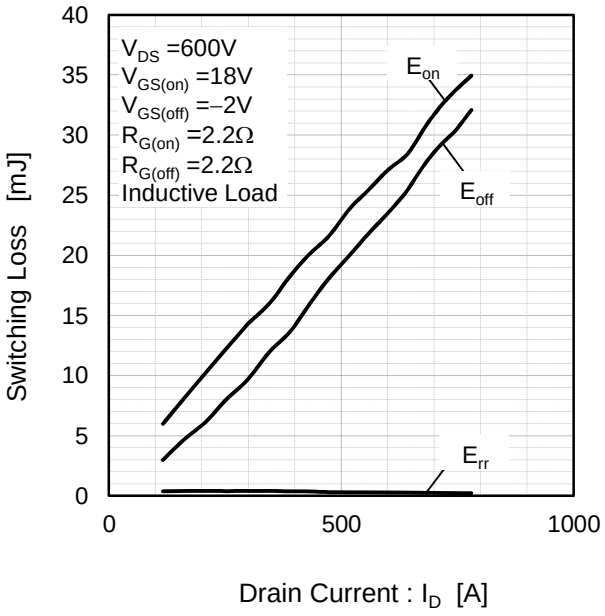


Fig.12 Switching Loss vs. Drain Current [T_j=25ºC]



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●Electrical characteristic curves (Typical)

Fig.13 Switching Loss vs. Drain Current [T_j=125ºC]

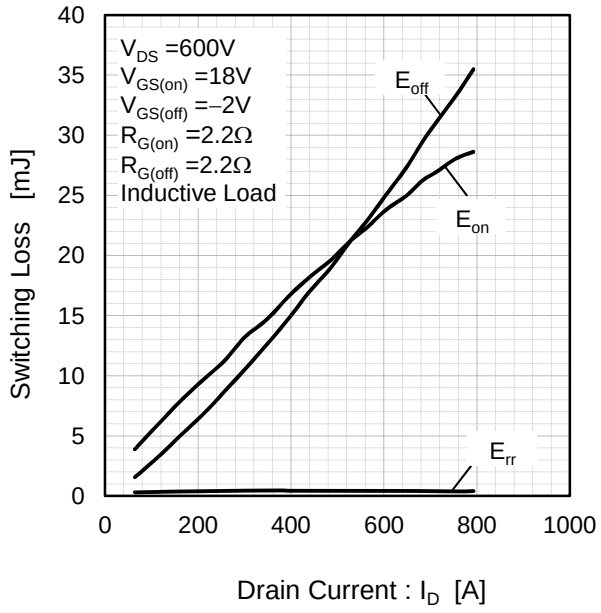


Fig.14 Switching Loss vs. Drain Current [T_j=150ºC]

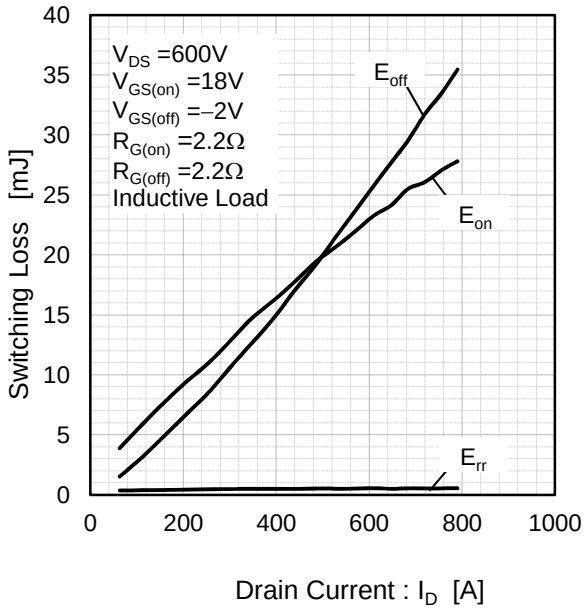


Fig.15 Recovery Characteristics vs. Drain Current [T_j=25ºC]

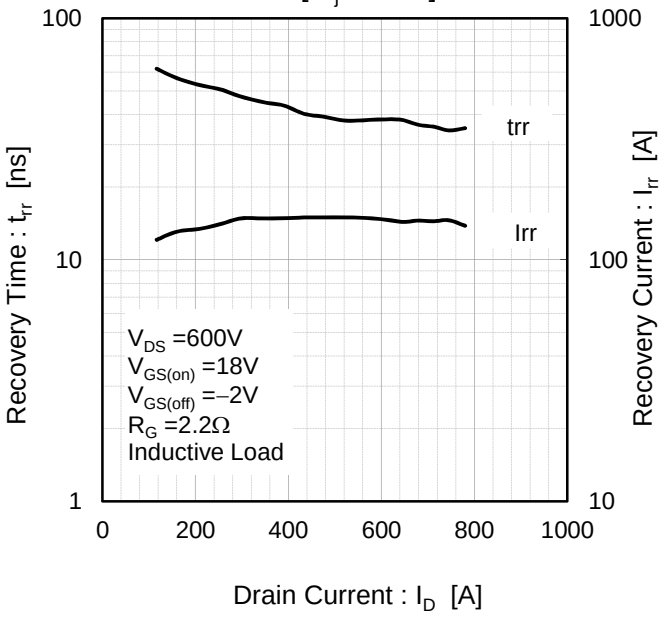
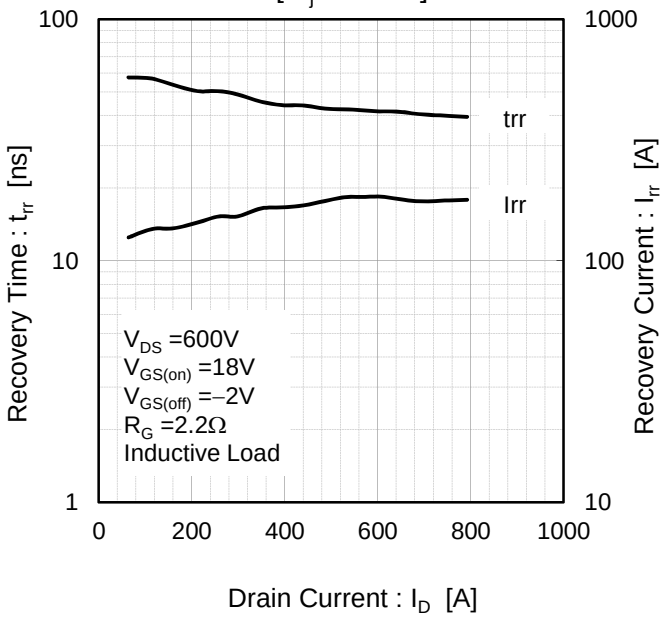


Fig.16 Recovery Characteristics vs. Drain Current [T_j=125ºC]



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●Electrical characteristic curves (Typical)

Fig.17 Recovery Characteristics vs. Drain Current [T_j=150ºC]

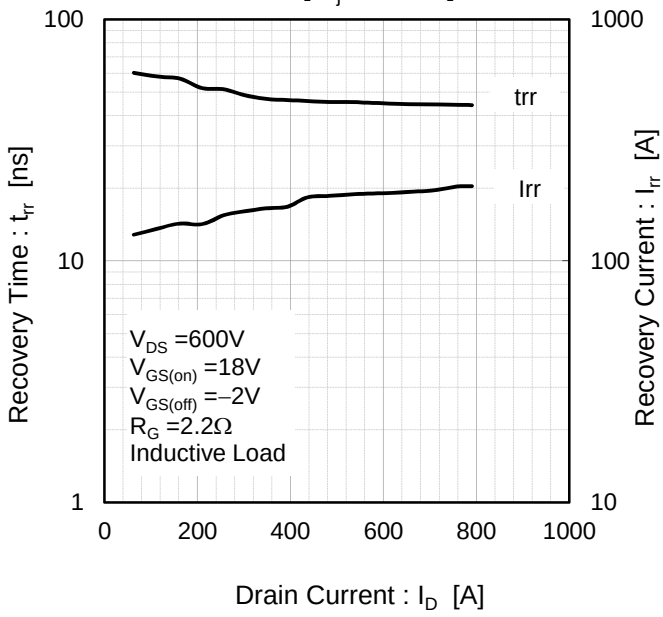


Fig.18 Switching Characteristics vs. Gate Resistance [T_j=25ºC]

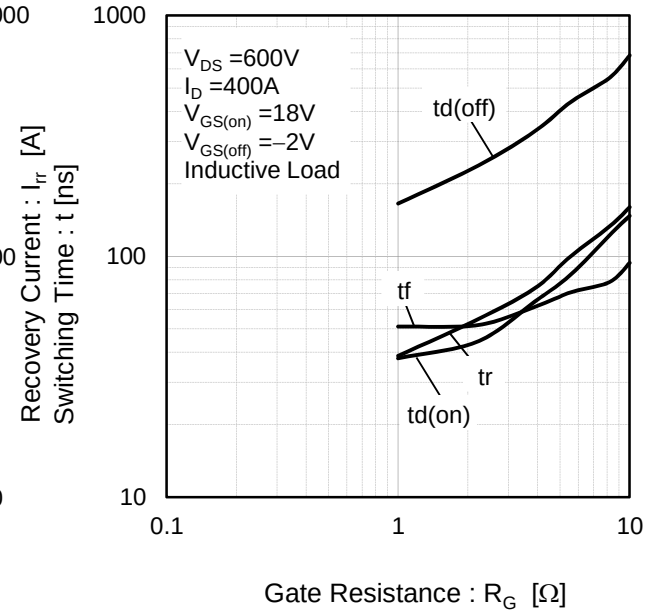


Fig.19 Switching Characteristics vs. Gate Resistance [T_j=125ºC]

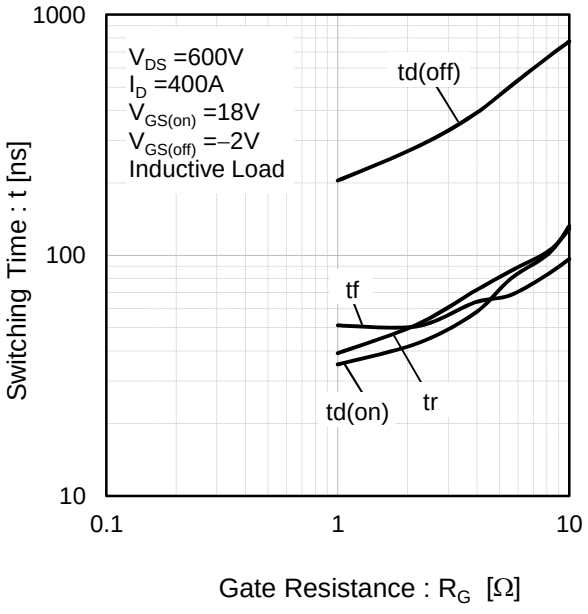
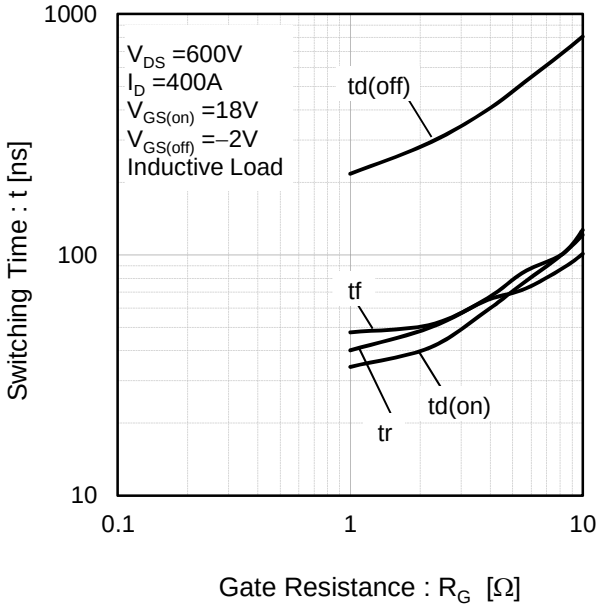


Fig.20 Switching Characteristics vs. Gate Resistance [T_j=150ºC]



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Fig.21 Switching Loss vs. Gate Resistance
[T_j=25ºC]

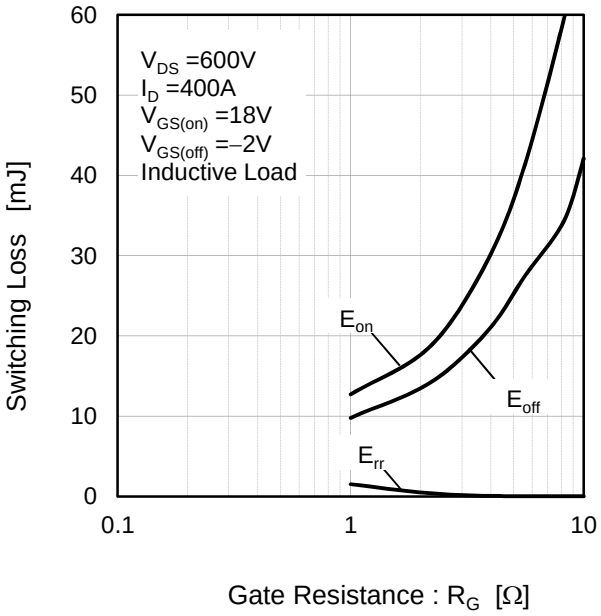


Fig.22 Switching Loss vs. Gate Resistance
[T_j=125ºC]

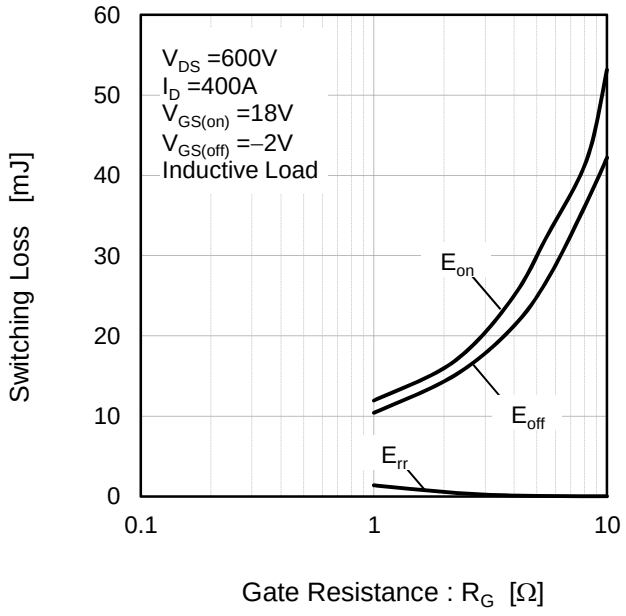


Fig.23 Switching Loss vs. Gate Resistance
[T_j=150ºC]

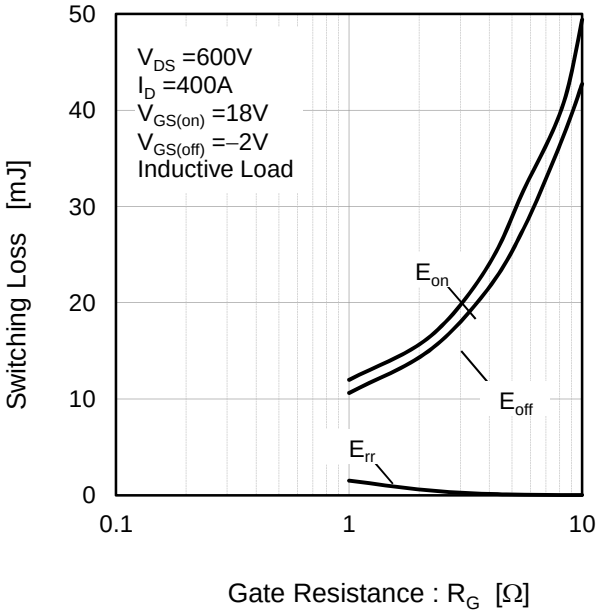
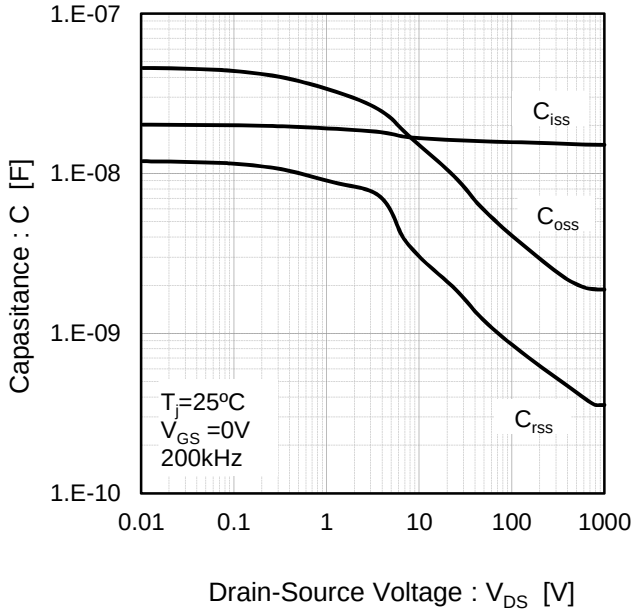


Fig.24 Typical Capacitance vs. Drain-Source Voltage



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●Electrical characteristic curves (Typical)

Fig.25 Gate Charge Characteristics

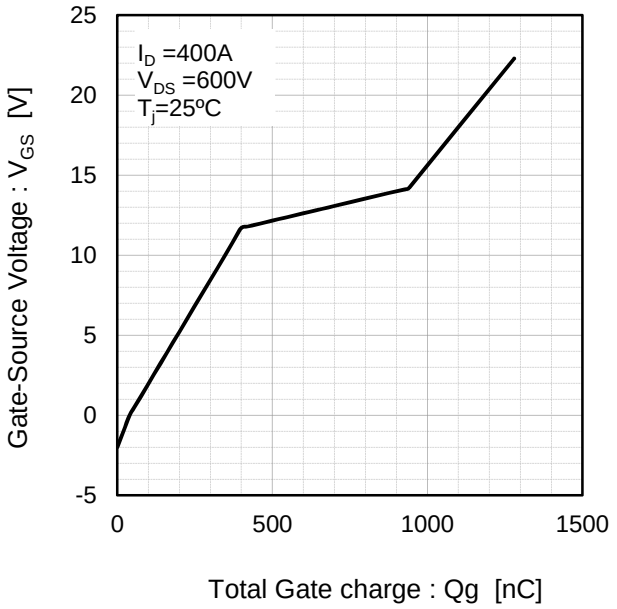
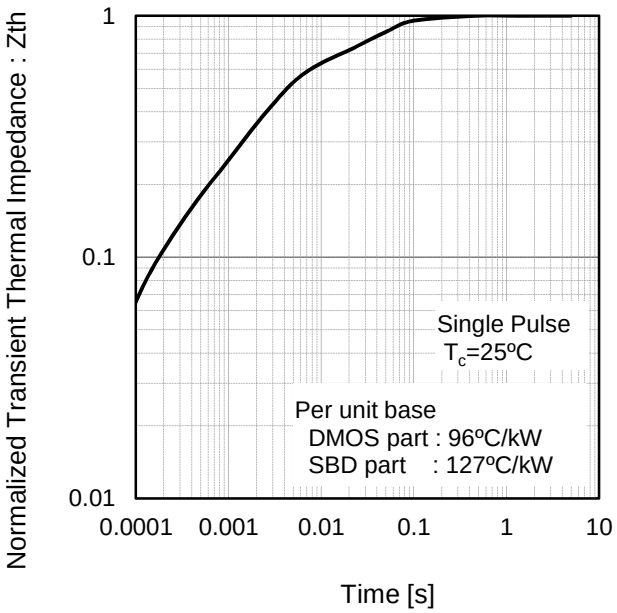


Fig.26 Normalized Transient Thermal Impedance



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