SiC Power Module

BSM180C12P2E202

Datasheet

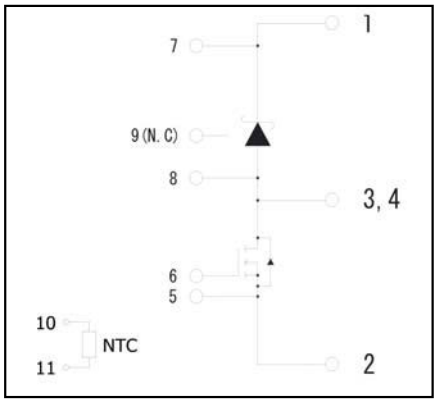
●Application

・Converter

・Photovoltaics, wind power generation.

・Induction heating equipment.

●Circuit diagram



●Features

1) Low surge, low switching loss.

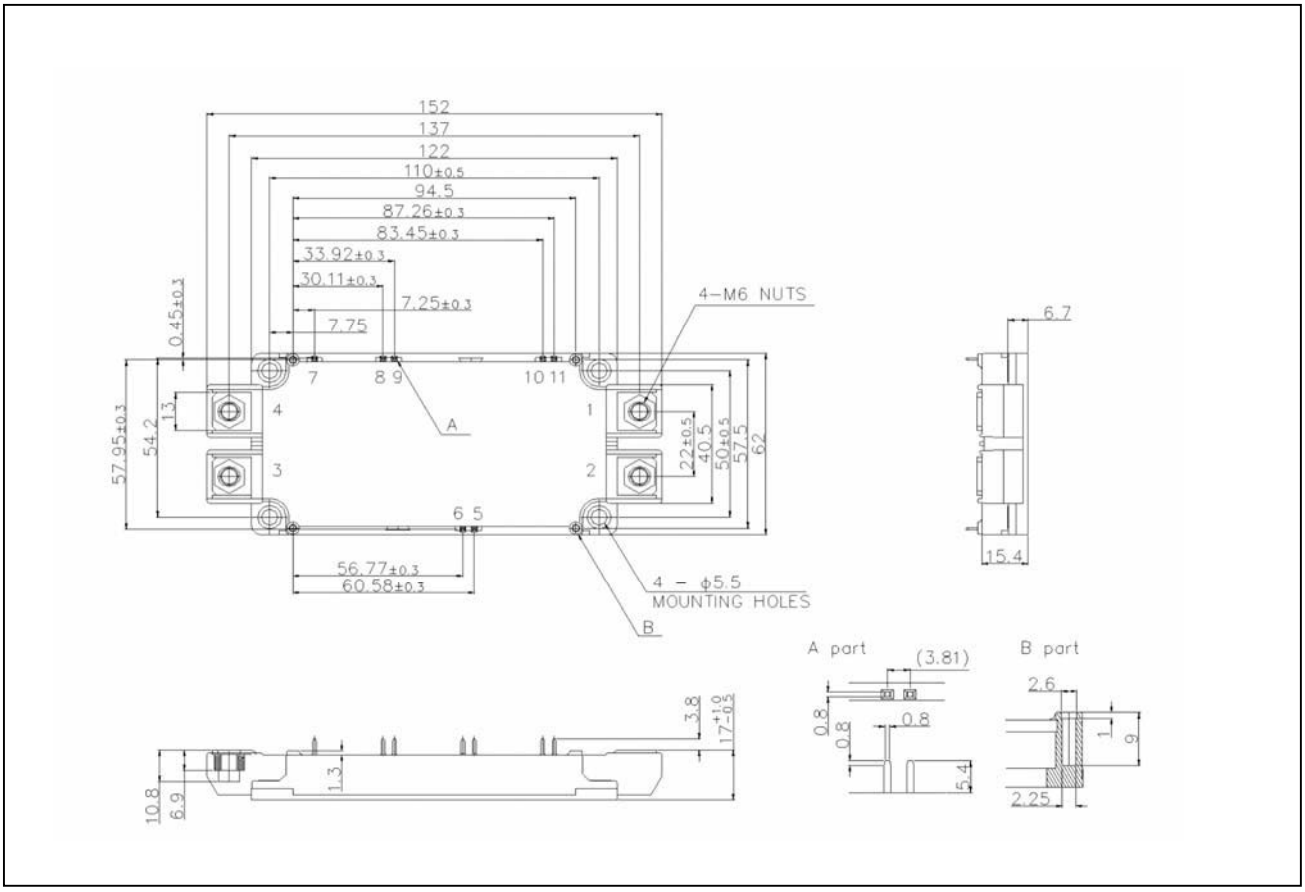
2) High-speed switching possible.

3) Reduced temperature dependence.

●Construction

This product is a chopper module consisting of SiC-DMOSFET and SiC-SBD from ROHM.

●Dimensions & Pin layout (Unit : mm)

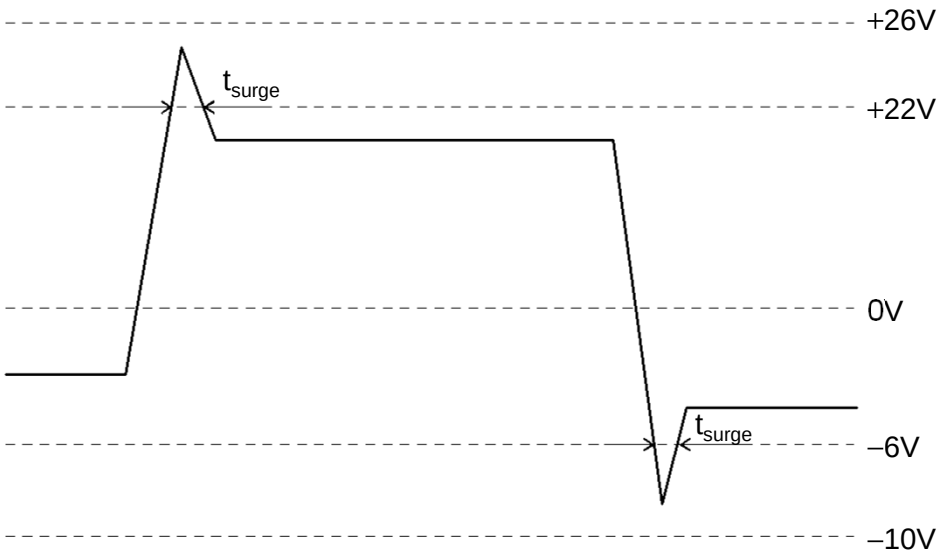


●Absolute maximum ratings (T_j = 25°C)

Parameter	Symbol	Conditions	Limit	Unit
Drain-source voltage	V_{DSS}	G-S short	1200	V
Repetitive reverse voltage	V_{DSS}	Clamp diode	1200	
Gate-source voltage(+)	V_{GSS}	D-S short	22	
Gate-source voltage(–)			–6	
G - S Voltage (t_{surge}<300nsec)	V_{GSS_surge}	D-S short	–10 to 26	
Drain current *1	I_D	DC (T_c=60°C)	204	A
	I_{DRM}	Pulse (T_c=60°C) 1ms *2	360	
	I_{DRM}	Pulse (T_c=60°C) 10us *2 *3	540	
Source current *1	I_S	DC (T_c=60°C) V_{GS}=18V	204	
	I_{SRM}	Pulse (Tc=60°C) 1ms V_{GS}=18V *2	360	
	I_{SRM}	Pulse (Tc=60°C) 10us V_{GS}=18V *2 *3	540	
Forward current (clamp diode) *1	I_F	DC (T_c=60°C)	204	
	I_{FRM}	Pulse (Tc=60°C) 1ms *2	360	
	I_{FRM}	Pulse (Tc=60°C) 10us *2 *3	540	
Total power dissipation *3	Ptot	T_c=25°C	1360	W
Max Junction Temperature	T_{jmax}		175	°C
Operating 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) Please use an appropriate external gate resistor not to exceed maximum ratings of Drain - Source Voltage.
(*4) T_j is less than 175°C

Example of acceptable V_{GS} waveform



●Electrical characteristics (T_j=25°C)

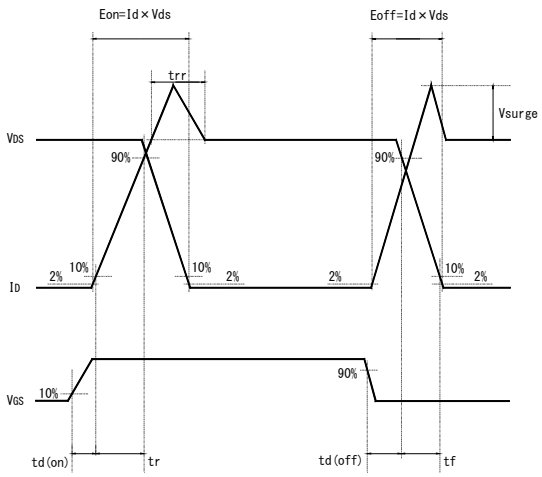
Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
On-state static Drain-Source Voltage	$V_{DS(on)}$	I_D=180A, V_{GS}=18V	T_j=25°C	-	2.2	3.2	V
			T_j=125°C	-	3.1	-	
			T_j=150°C	-	3.5	5.0	
Drain cutoff current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V		-	-	10	μA
Forward Voltage	V_F	I_F=180A	T_j=25°C	-	1.6	2.2	V
			T_j=125°C		2.0	-	
			T_j=150°C	-	2.2	3.3	
Reverse current	I_{RRM}	Clamp diode		-	-	3.2	mA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS}=10V, I_D=35.2mA		1.6	-	4	V
Gate-Source Leakage Current	I_{GSS}	V_{GS}=22V, V_{DS}=0V		-	-	0.5	μA
		V_{GS}= −6V, V_{DS}=0V		−0.5	-	-	
Switching Characteristics	$t_{d(on)}$	$V_{GS(on)}$=18V, $V_{GS(off)}$=0V		-	49	-	ns
	t_r	V_{DS}=600V		-	36	-	
	t_{rr}	I_D=180A		-	20	-	
	$t_{d(off)}$	$R_{G(on)}$=1.0Ω, $R_{G(off)}$=0.2Ω		-	139	-	
	t_f	inductive load		-	32	-	
Input Capacitance	Ciss	V_{DS}=10V, V_{GS}=0V, 200kHz		-	20	-	nF
Gate Registance	R_{Gint}	T_j=25°C		-	1.2	-	Ω
NTC Rated Resistance	R25				5.0		kΩ
NTC B Value	B50/25				3370		K
Stray Inductance	Ls				13.0	-	nH
Creepage Distance	-	Terminal to heat sink			14.5	-	mm
		Terminal to terminal			15.0	-	mm
Clearance Distance	-	Terminal to heat sink			12.0	-	mm
		Terminal to terminal			9.0	-	mm
Junction-to-Case Thermal Resistance	R_{th}(j-c)	DMOSFET (1/2 module) *5		-	-	0.11	K/W
		SBD (1/2 module) *5		-	-	0.14	
Case-to -heat sink Thermal Resistance	R_{th}(c-f)	Case to heat sink, per 1 module, Thermal grease appied *6		-	0.035	-	

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

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

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

●Waveform for switching test



●**Electrical characteristic curves** (Typical)

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

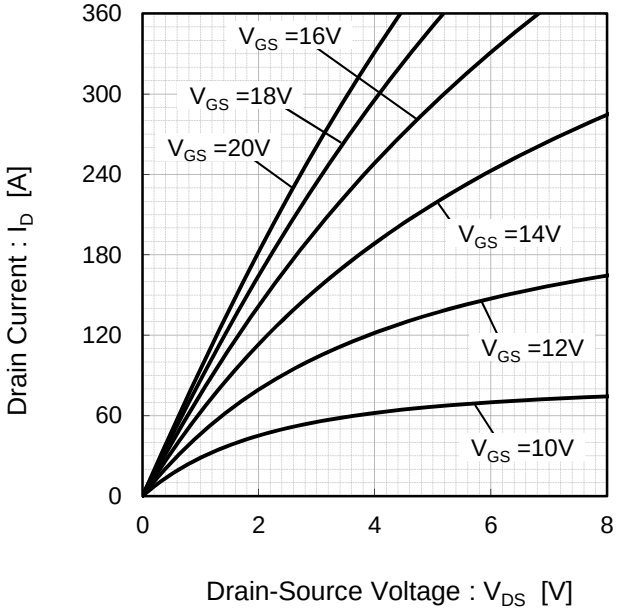


Fig.2 Drain-Source Voltage vs. Drain Current

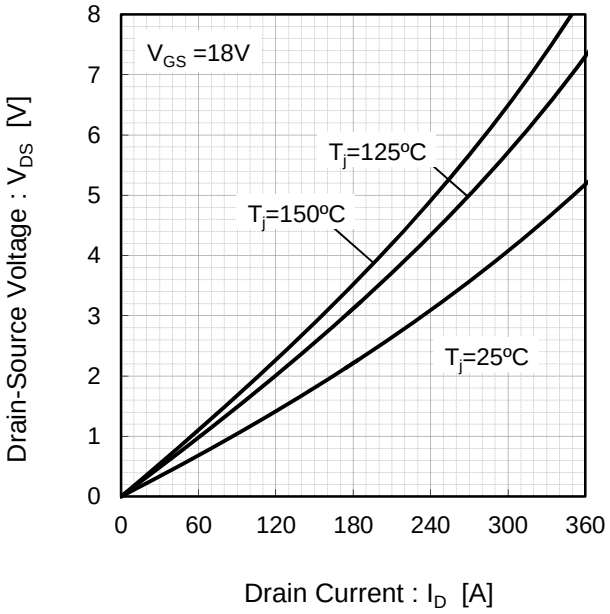


Fig.3 Drain-Source Voltage vs. Gate-Source Voltage [T_j=25ºC]

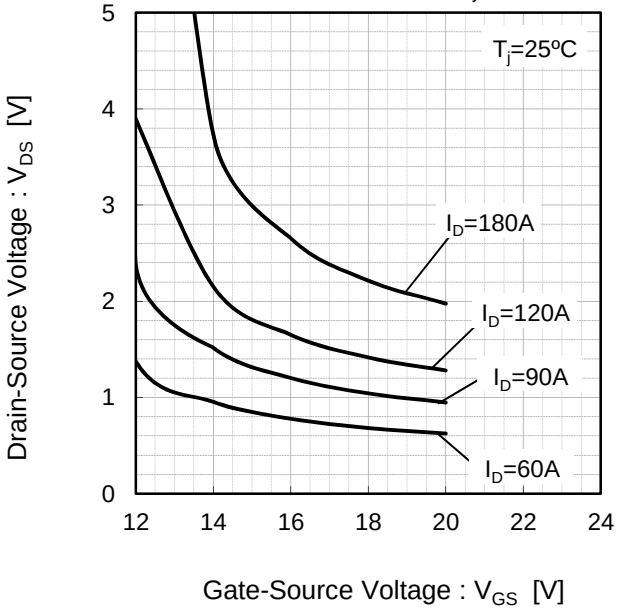
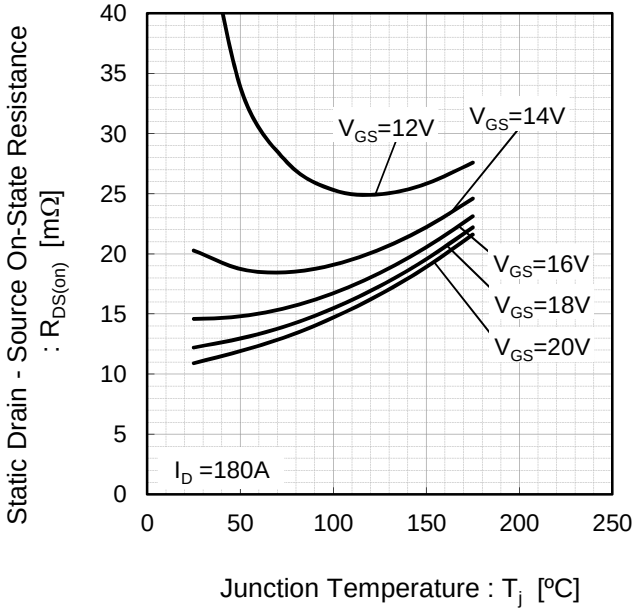


Fig.4 Static Drain - Source On-State Resistance vs. Junction Temperature



●Electrical characteristic curves (Typical)

Fig.5 Forward characteristic of Diode

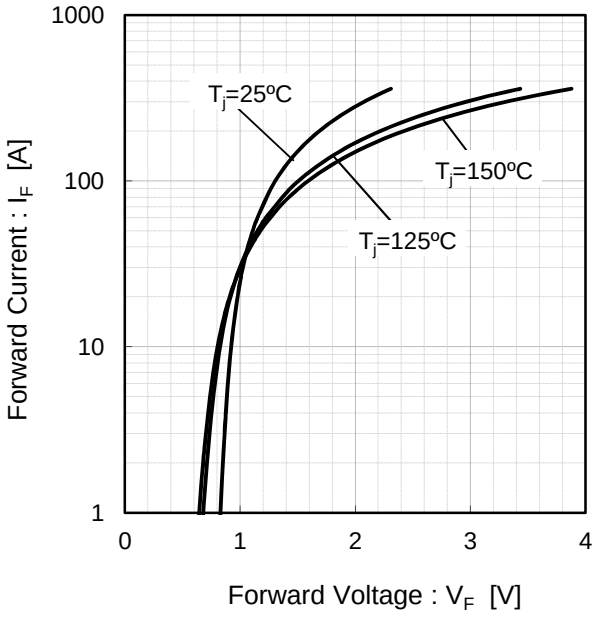


Fig.6 Forward characteristic of Diode

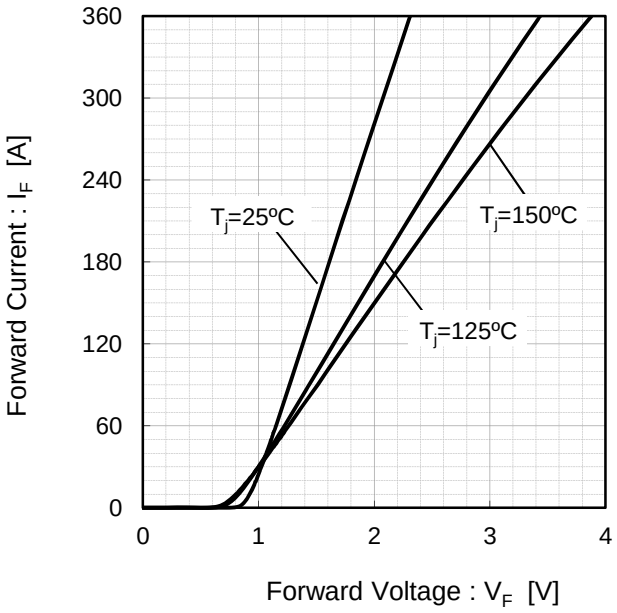


Fig.7 Drain Current vs. Gate-Source Voltage

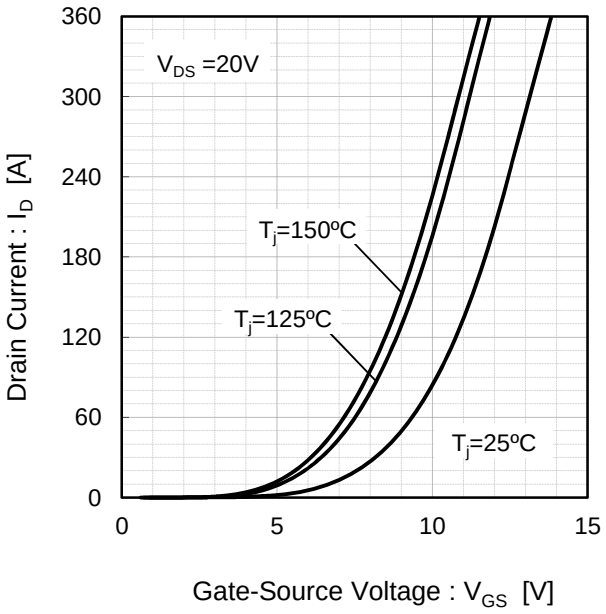
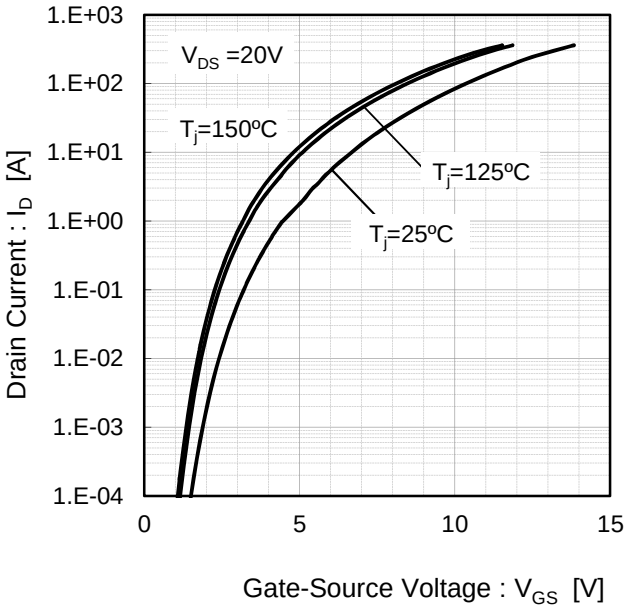


Fig.8 Drain Current vs. Gate-Source Voltage



●**Electrical characteristic curves** (Typical)

Fig.9 Switching Characteristics [T_j=25ºC]

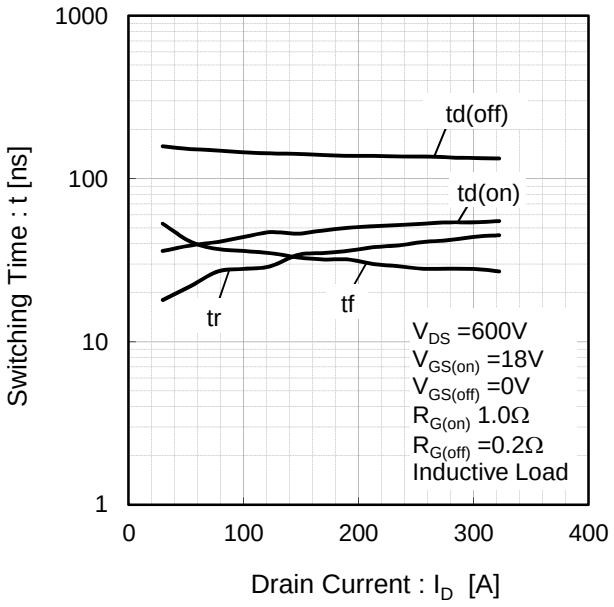


Fig.10 Switching Characteristics [T_j=125ºC]

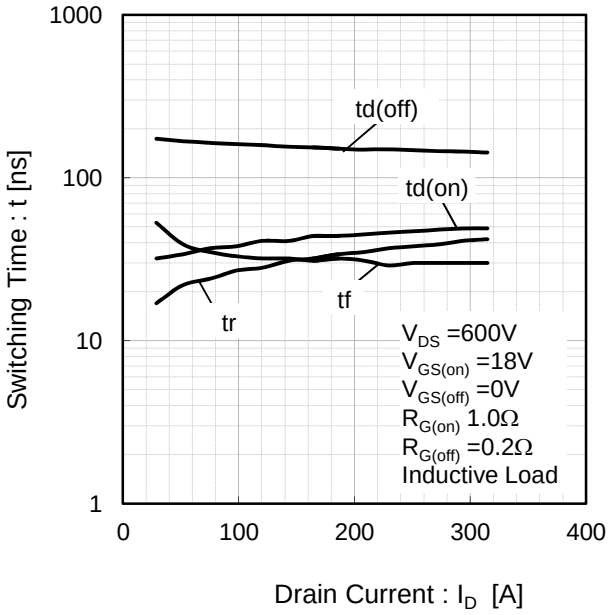


Fig.11 Switching Characteristics [T_j=150ºC]

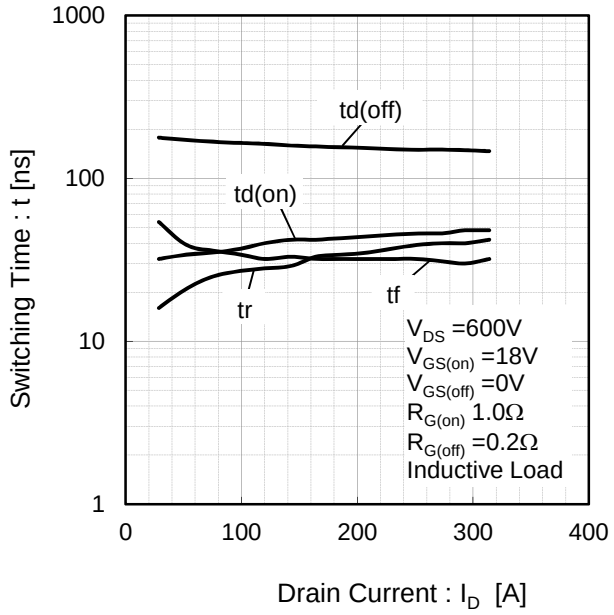
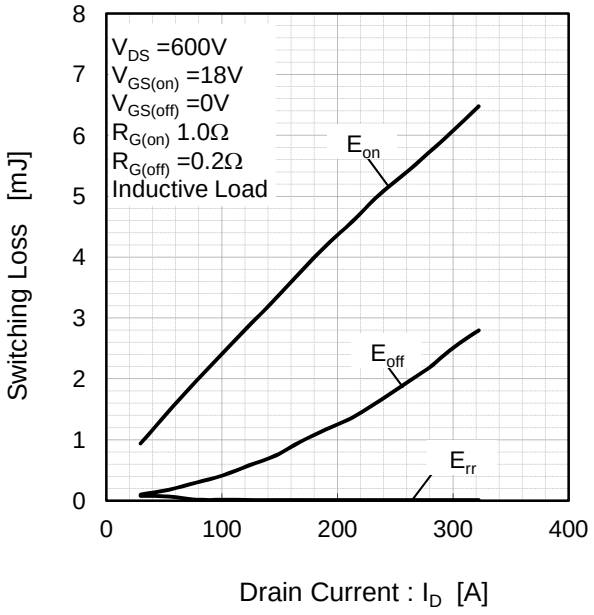


Fig.12 Switching Loss vs. Drain Current [T_j=25ºC]



●**Electrical characteristic curves** (Typical)

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

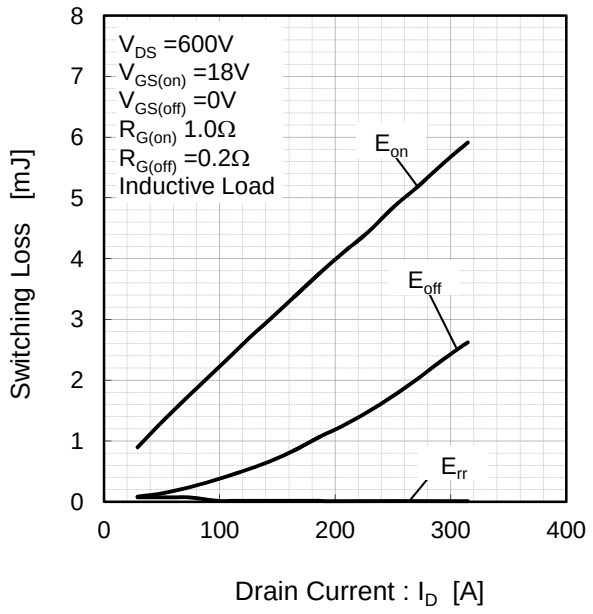


Fig.14 Switching Loss vs. Drain Current [T_j=150ºC]

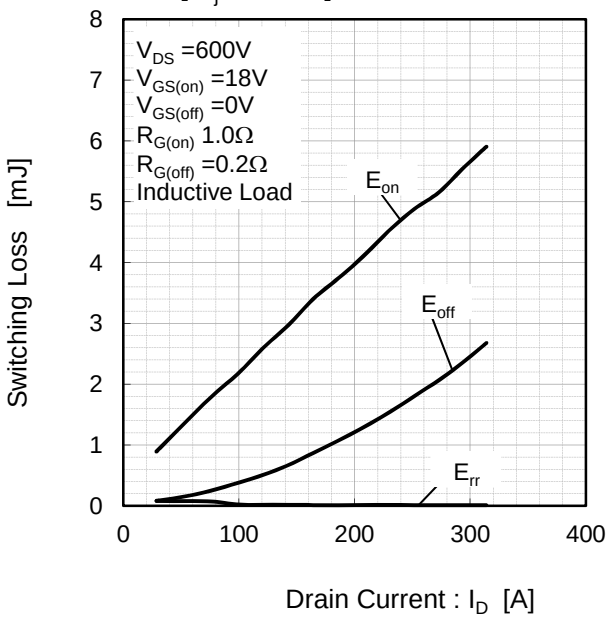


Fig.15 Recovery Characteristics vs. Drain Current [T_j=25ºC]

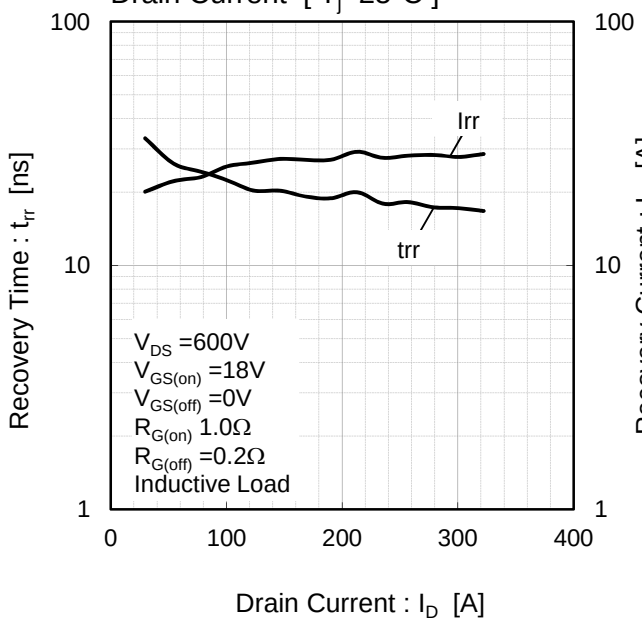
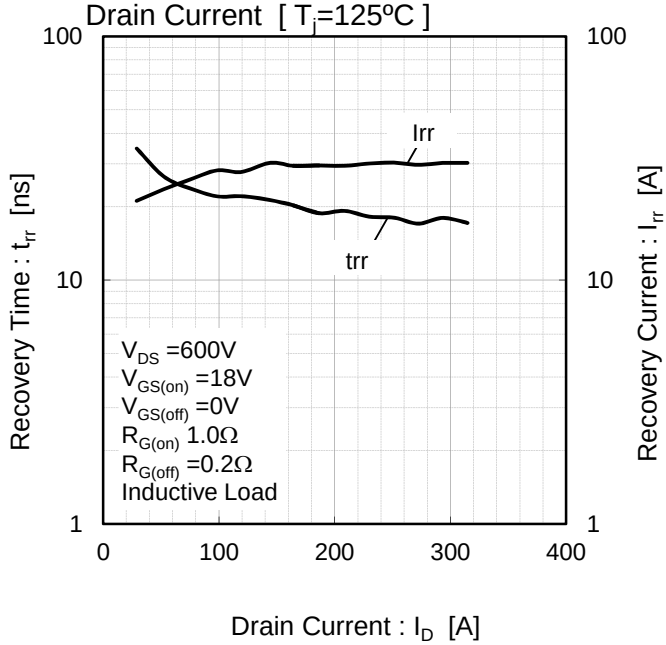


Fig.16 Recovery Characteristics vs. Drain Current [T_j=125ºC]



●Electrical characteristic curves (Typical)

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

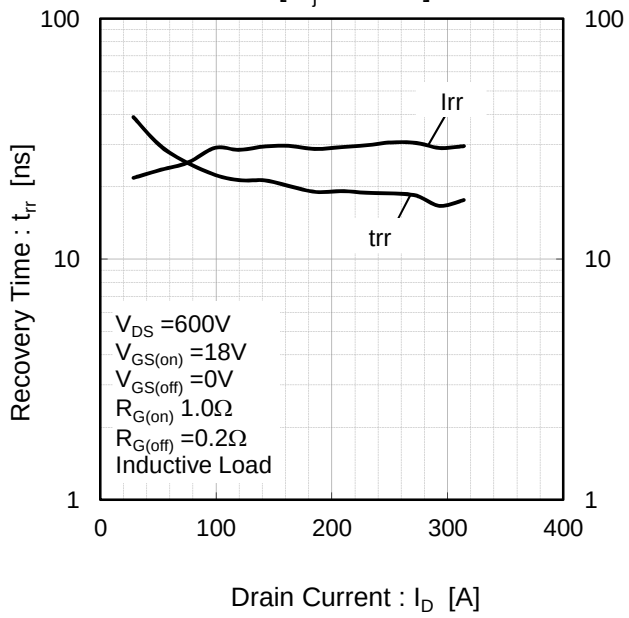


Fig.18 Switching Characteristics vs. Gate Resistance [T_j=25ºC]

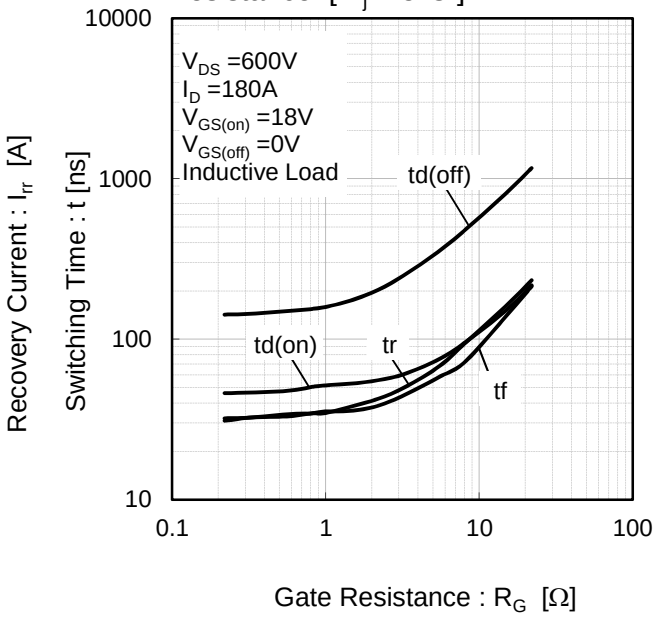


Fig.19 Switching Characteristics vs. Gate Resistance [T_j=125ºC]

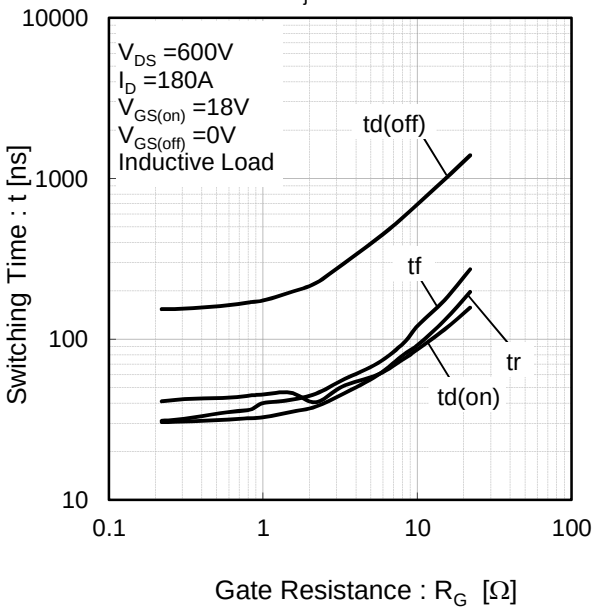
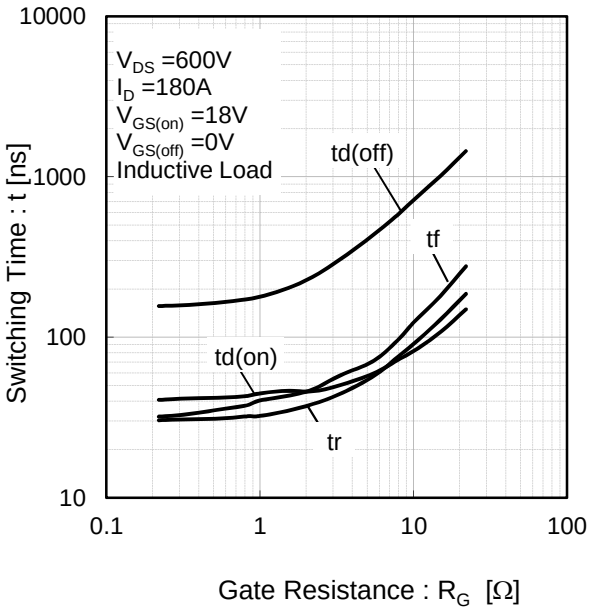


Fig.20 Switching Characteristics vs. Gate Resistance [T_j=150ºC]



●Electrical characteristic curves (Typical)

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

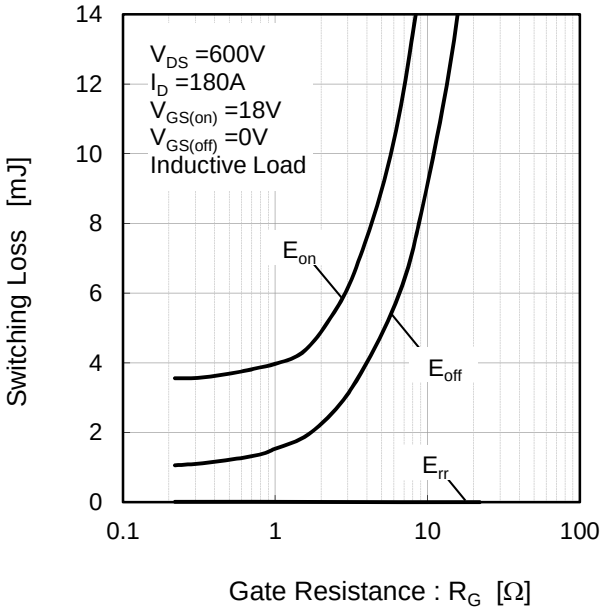


Fig.22 Switching Loss vs. Gate Resistance
[T_j=125ºC]

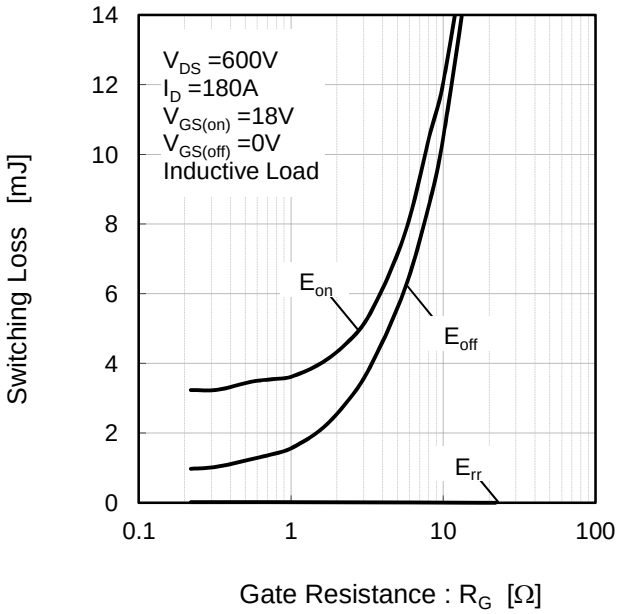


Fig.23 Switching Loss vs. Gate Resistance
[T_j=150ºC]

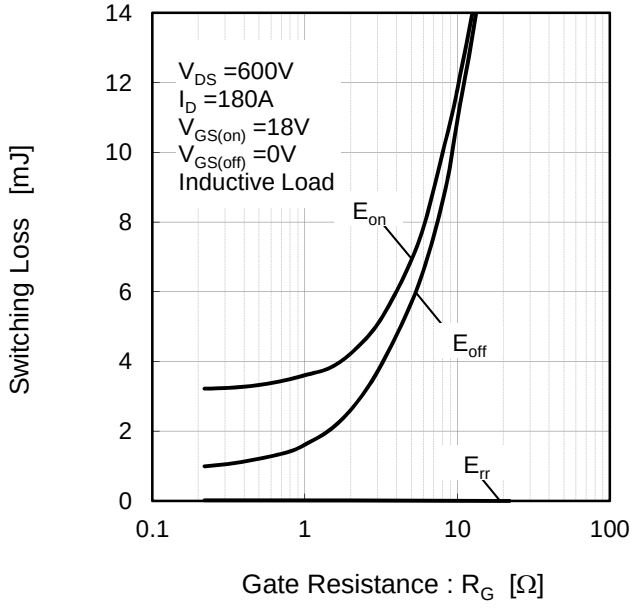
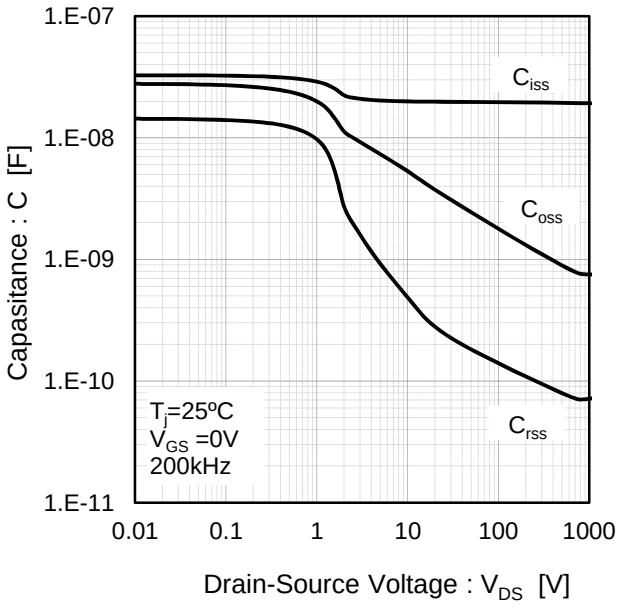


Fig.24 Typical Capacitance vs. Drain-Source Voltage



●**Electrical characteristic curves** (Typical)

Fig.25 Gate Charge Characteristics
[T_j=25ºC]

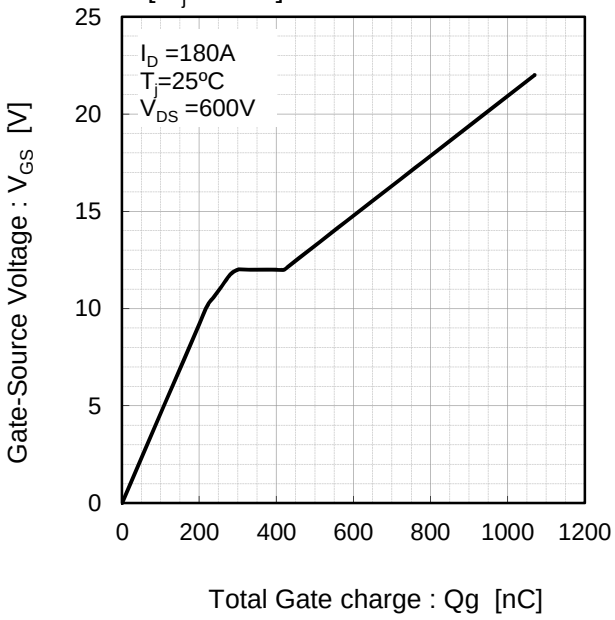
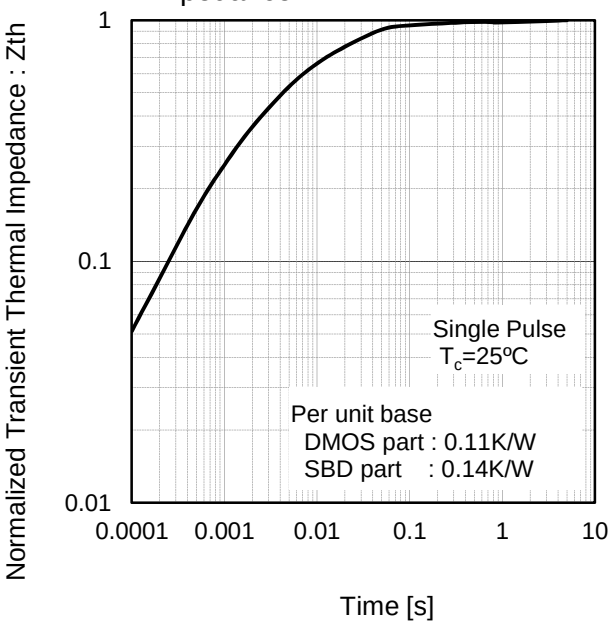


Fig.26 Normalized Transient Thermal Impedance



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