SiC Power Module

BSM600D12P3G001

Datasheet

●Application

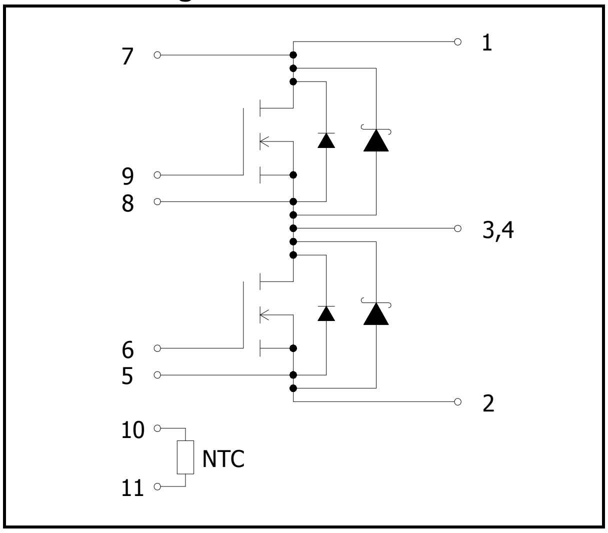
· Motor drive

· Inverter, Converter

· Photovoltaics, wind power generation.

· Induction heating equipment.

●Circuit diagram



●Features

1) Low surge, low switching loss.

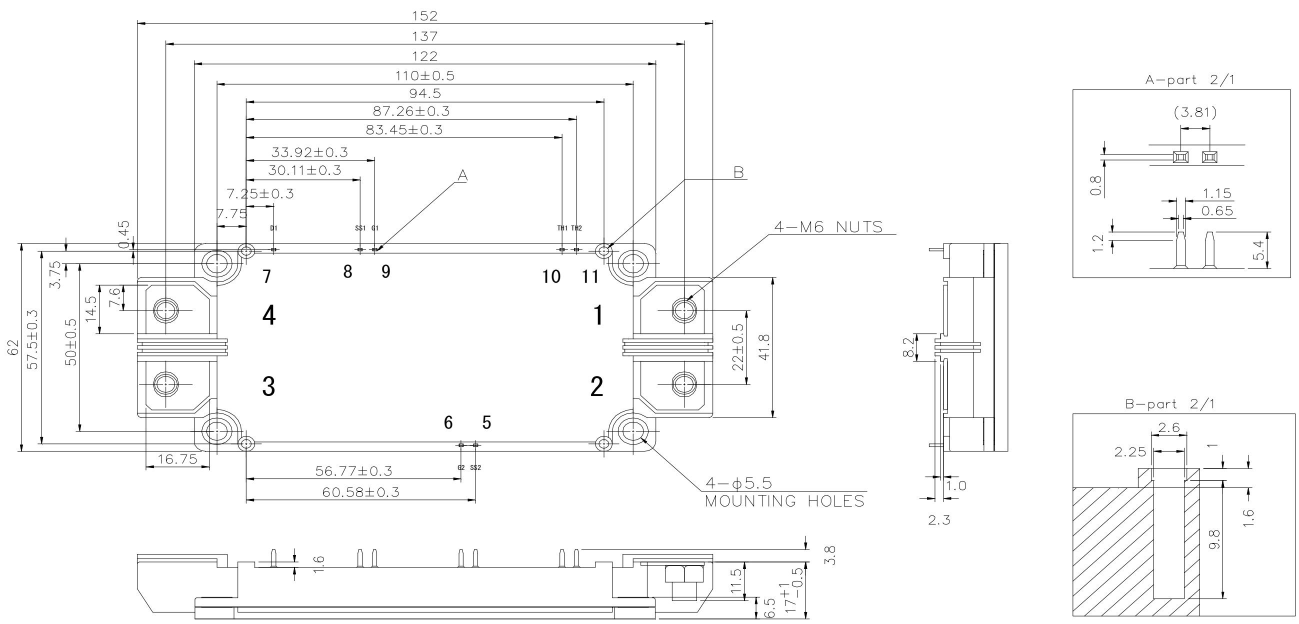
2) High-speed switching possible.

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)

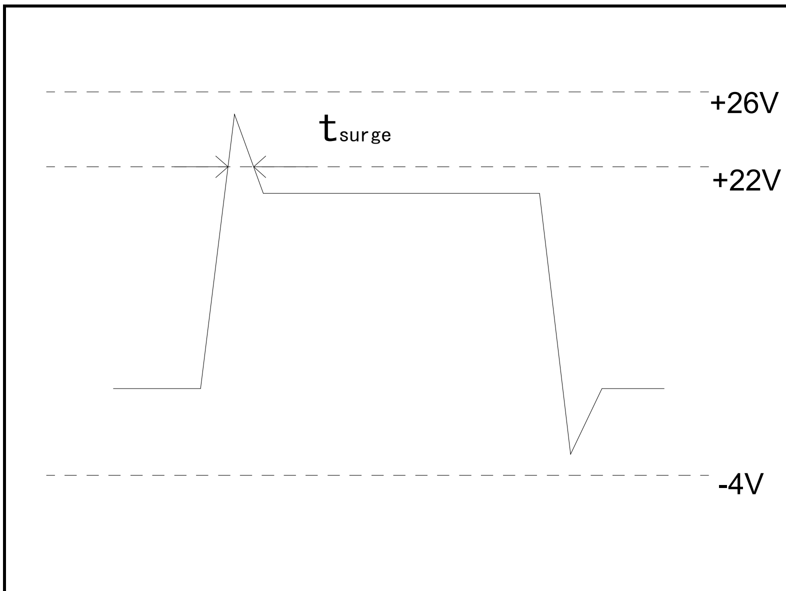


●Absolute maximum ratings (T_j = 25°C)

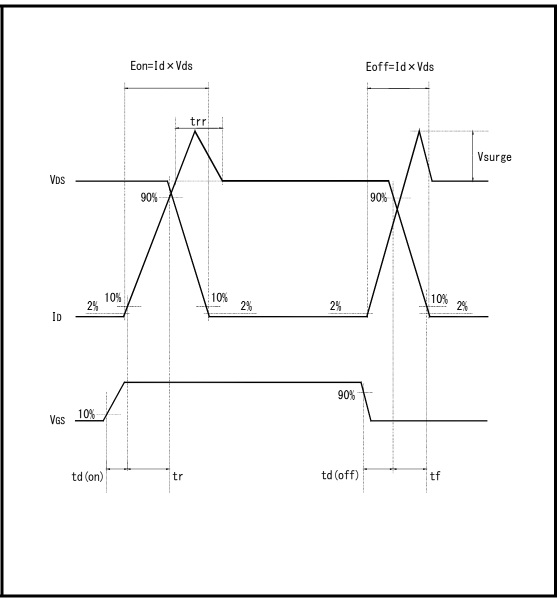
Parameter	Symbol	Conditions	Ratings	Unit
Drain - Source Voltage	V_{DSS}	G-S short	1200	V
Gate - Source Voltage (+)	V_{GSS}	D-S short	22	
Gate - Source Voltage (-)	V_{GSS}	D-S short	-4	
G - S Voltage (t_{surge}<300nsec)	$V_{GSSsurge}$	D-S short	-4 to 26	
Drain Current Note 1)	I_D	DC(Tc=60°C) VGS=18V	576	A
	I_D	DC(Tc=50℃) VGS=18V	600	
	I_{DRM}	Pulse (Tc = 60°C) 1ms VGS=18V Note 2)	1200	
Source Current Note 1)	I_S	DC(Tc=60°C) VGS=18V	576	
	I_S	DC(Tc=50℃) VGS=18V	600	
	I_S	DC(Tc=60°C) VGS=0V	418	
	I_{SRM}	Pulse (Tc = 60°C) 1ms VGS=18V Note 2)	1200	
	I_{SRM}	Pulse (Tc = 60°C) 10us VGS=0V Note 2)	1200	
Total Power Dissipation Note 3)	Ptot	Tc = 25°C	2450	W
Max Junction Temperature	Tjmax		175	°C
Junction Temperature	Tjop		-40 to 150	
Storage Temperature	Tstg		-40 to 125	
Isolation Voltage	Visol	Terminals to baseplate f = 60Hz AC 1 min.	2500	Vrms
Mounting Torque	-	Main Terminals : M6 screw	4.5	N・m
		Mounting to heat sink M5 screw	3.5	

Note 1) Case temperature (Tc) is defined on the surface of base plate just under the chips.
Note 2) Repetition rate should be kept within the range where temperature rise if die should not exceed Tjmax.
Note 3) Tj is less than 175°C.

Example of acceptable V_{GS} waveform



<Wavelength for Switching Test>



●Electrical characteristics (T_j=25°C)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
On-state static Drain-Source Voltage	$V_{DS(on)}$	I_D=600A,V_{GS}=18V	Tj=25°C	–	1.8	2.4	V
			Tj=125°C	–	2.6	–	
			Tj=150°C	–	2.9	4.1	
Drain Cutoff Current	I_{DSS}	V_{DS}=1200V,V_{GS}=0V		–	–	4	mA
Souce-Drain Voltage	V_{SD}	V_{GS}=0V,I_S=600A	Tj=25°C	–	2.0	2.9	V
			Tj=125°C	–	2.6	–	
			Tj=150°C	–	2.7	4.6	
		V_{GS}=18V,I_S=600A	Tj=25°C	–	1.4	–	
			Tj=125°C	–	1.7	–	
			Tj=150°C	–	1.9	–	
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS}=10V,I_D=182mA		2.7	–	5.6	V
Gate-Source Leak Current	I_{GSS}	V_{GS}=22V,V_{DS}=0V		–	–	0.5	μA
		V_{GS}=-6V,V_{DS}=0V		-0.5	–	–	
Switching Characteristics	td(on)	$V_{GS(on)}$=18V、$V_{GS(off)}$=-2V Note 4) V_{DS}=600V I_D=600A $R_{G(on)}$=1.8 ohm, $R_{G(off)}$=1.8 ohm Inductive load		–	60	–	ns
	tr			–	70	–	
	trr			–	45	–	
	td (off)			–	320	–	
	tf			–	65	–	
Input Capacitance	Ciss	V_{DS}=10V,V_{GS}=0V,200kHz		–	31	–	nF
Gate Registance	R_{Gint}	Tj=25°C		–	1.4	–	Ω
NTC Rated Resistance	R_{25}			–	5.0	–	kΩ
NTC B Value	$B_{50/25}$			–	3370	–	K
Stray Inductance	Ls			–	10.0	–	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	Rth(j-c)	UMOSFET(1/2 module) Note 5)		–	–	61	°C/kW
		SBD(1/2 module) Note 5)		–	–	80	
Case-to -heat sink Thermal Resistance	Rth(c-f)	Case to heat sink, per 1 module. Thermal grease applied. Note 6)		–	15	–	

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

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

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

Note 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.

Note 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.

● **Electrical characteristic curves** (Typical)

Fig.1 Output characteristic 25°C (TYP)

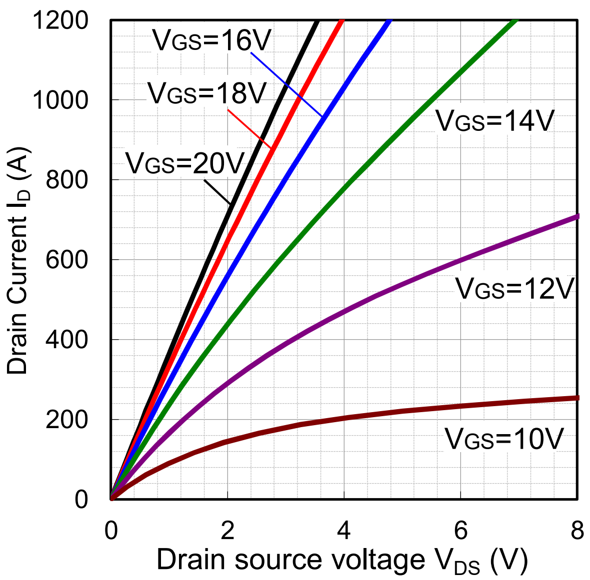


Fig.2 Drain source voltage characteristic (TYP)

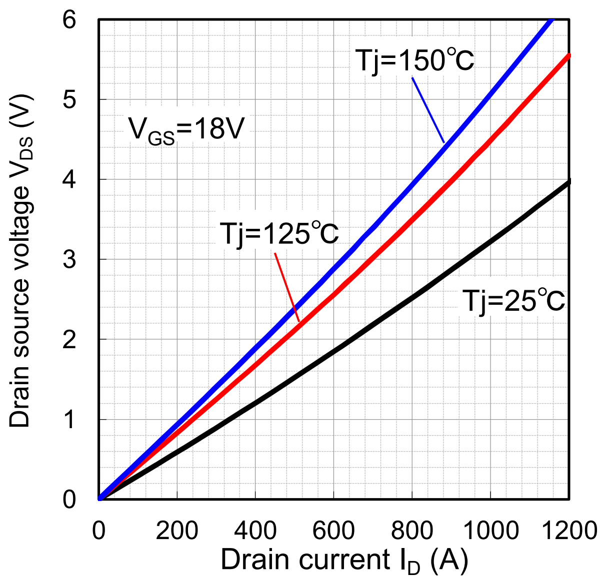


Fig.3 Drain source voltage characteristic 25°C (TYP)

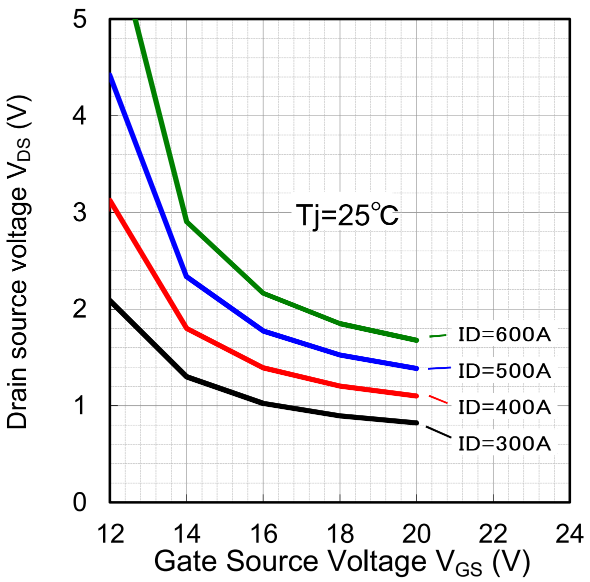
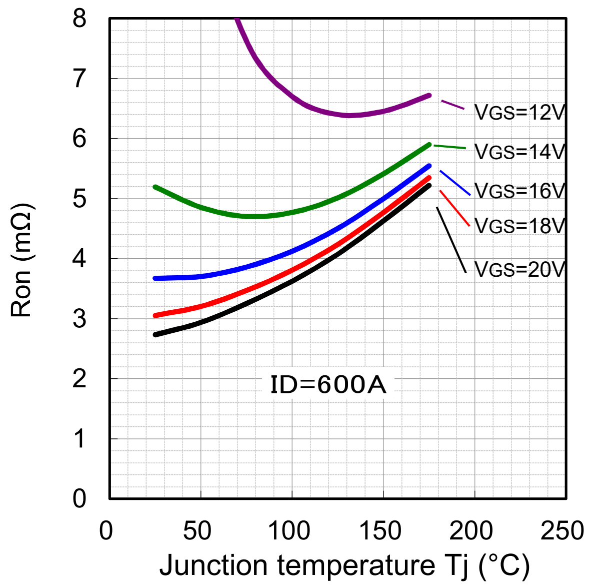


Fig.4 Ron vs Tj characteristic (TYP)



●**Electrical characteristic curves** (Typical)

Fig.5 Forward characteristic of Diode (TYP)

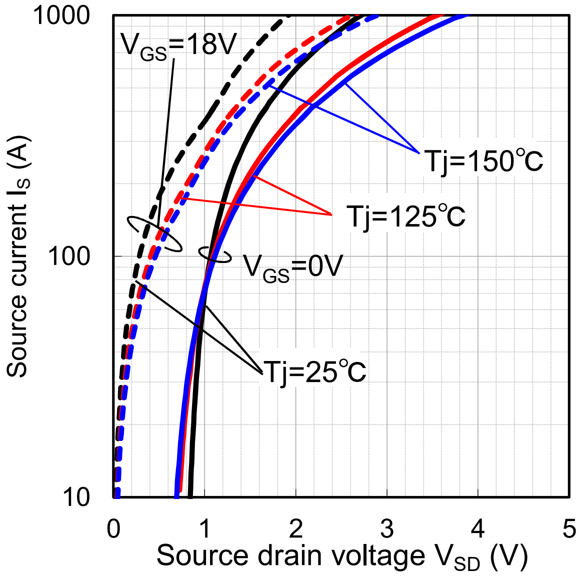


Fig.6 Forward characteristic of Diode (TYP)

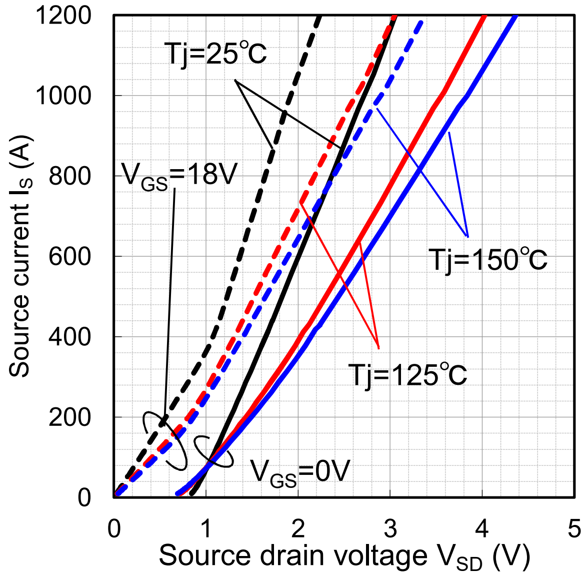


Fig.7 Drain Current vs Gate Voltage (TYP)

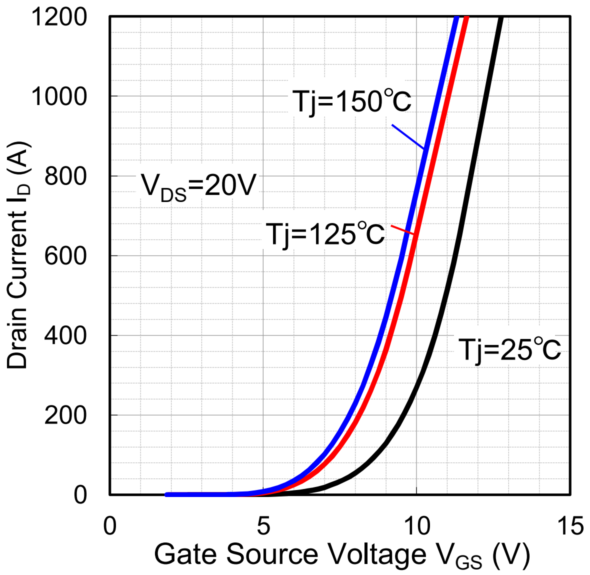
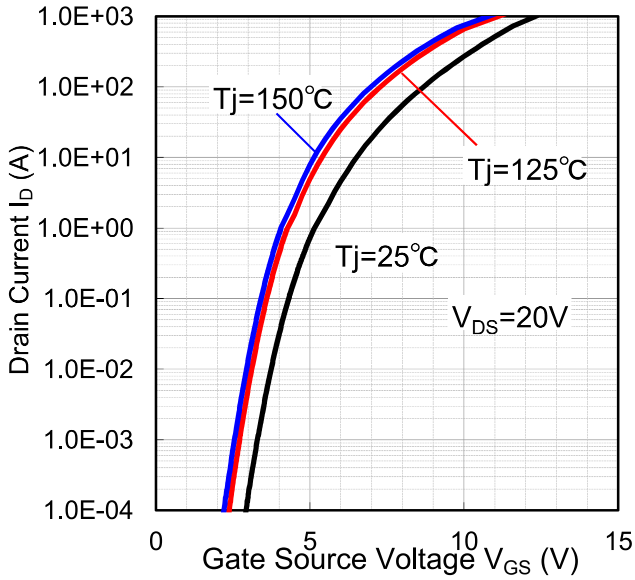


Fig.8 Drain Current vs Gate Voltage (TYP)



●Electrical characteristic curves (Typical)

Fig.9 Switching time vs drain current at 25°C (TYP)

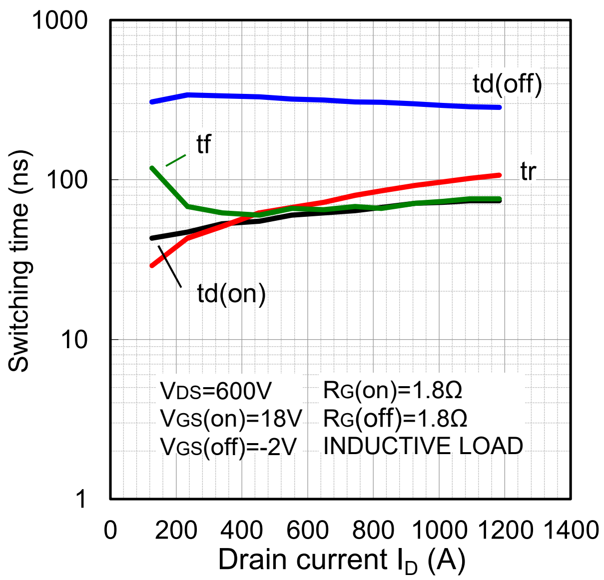


Fig.10 Switching time vs drain current at 125°C (TYP)

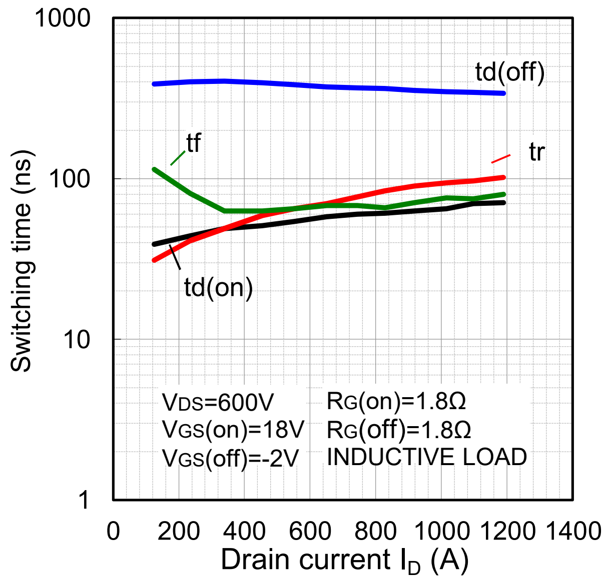


Fig.11 Switching time vs drain current at 150°C (TYP)

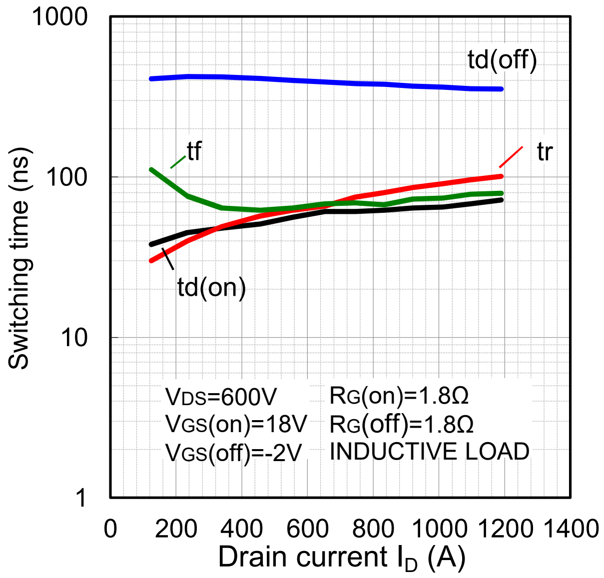
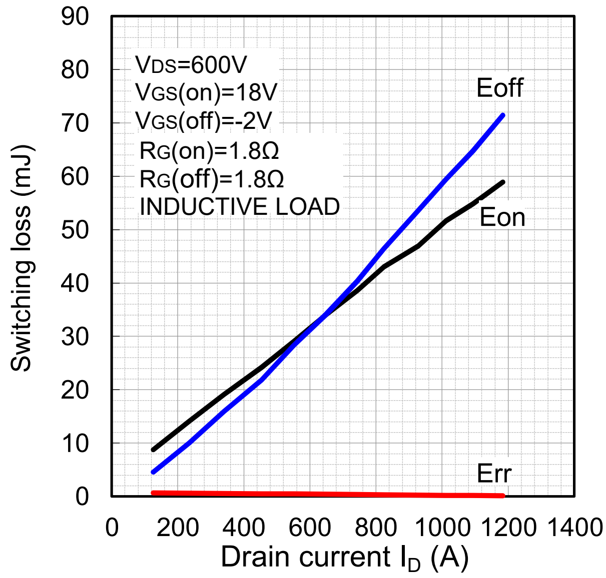


Fig.12 Switching loss vs drain current at 25°C (TYP)



●**Electrical characteristic curves** (Typical)

Fig.13 Switching loss vs drain current at 125°C (TYP)

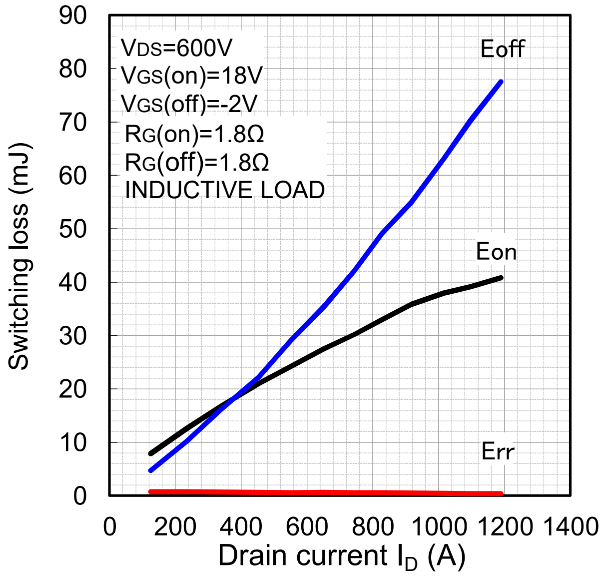


Fig.14 Switching loss vs drain current at 150°C (TYP)

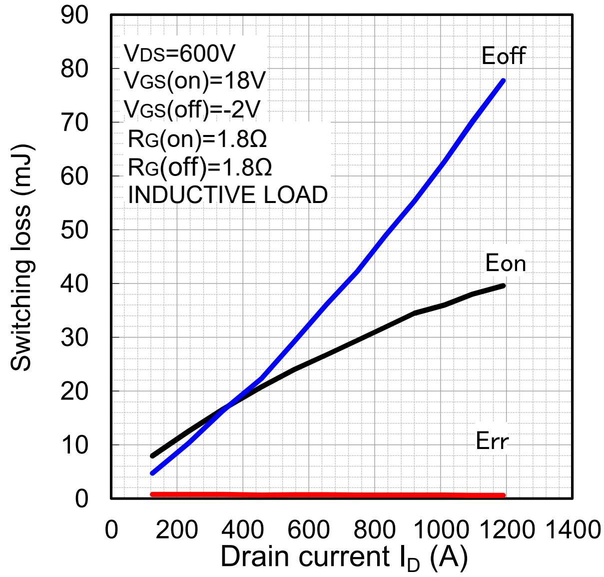


Fig.15 Recovery characteristic vs drain current at 25°C (TYP)

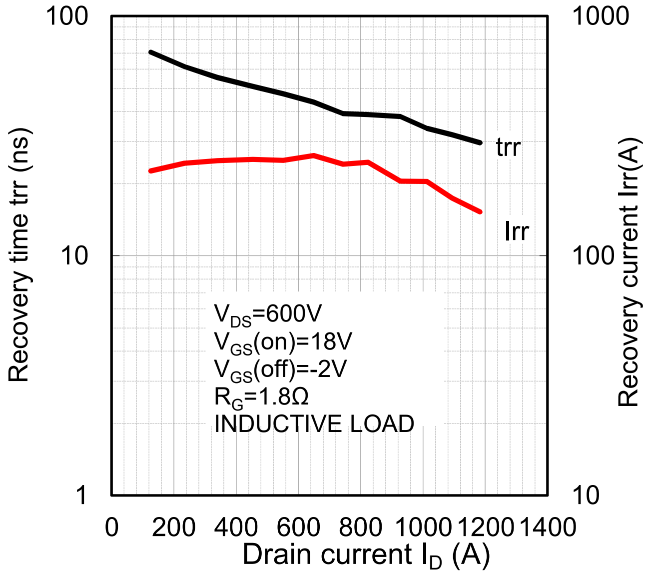
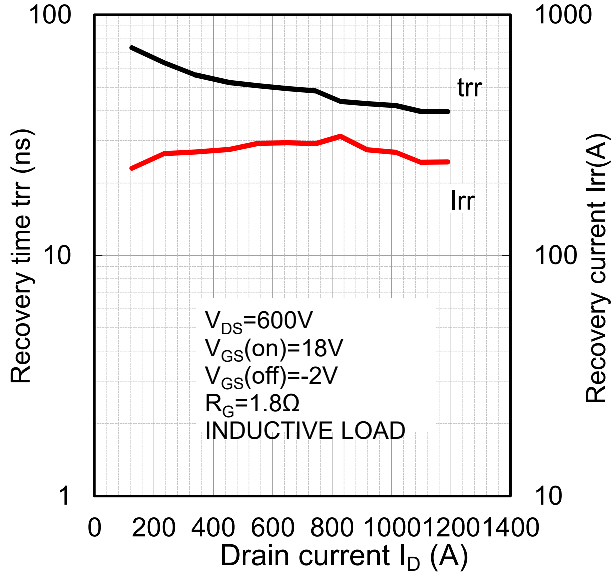


Fig.16 Recovery characteristic vs drain current at 125°C (TYP)



●**Electrical characteristic curves** (Typical)

Fig.17 Recovery characteristic vs drain current at 150°C (TYP)

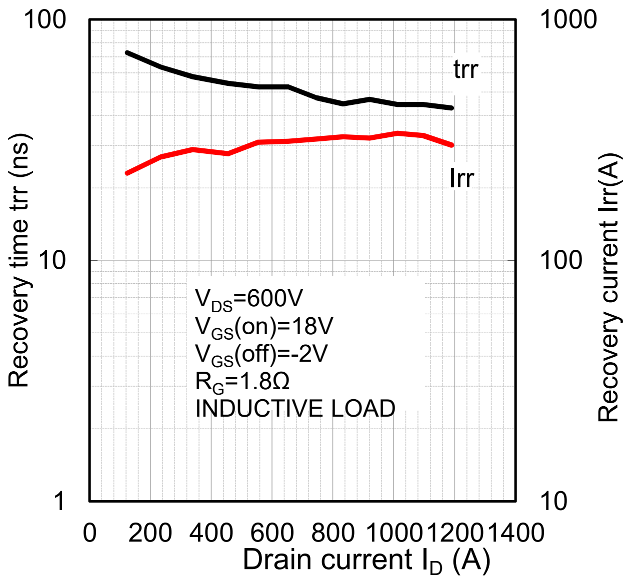


Fig.18 Switching time vs gate resistance at 25°C (TYP)

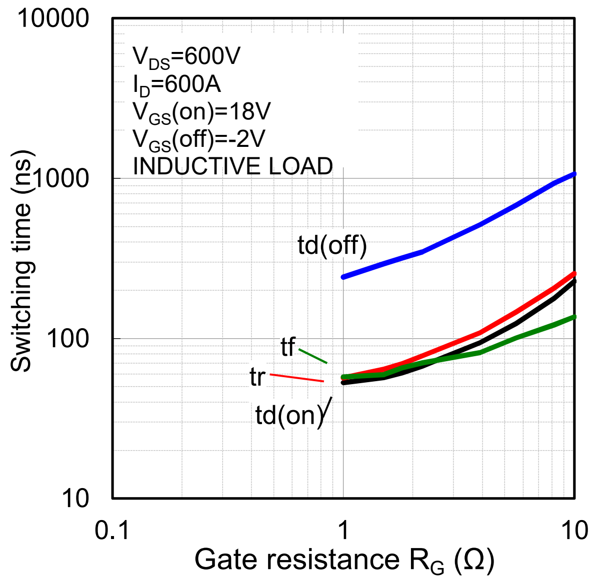


Fig.19 Switching time vs gate resistance at 125°C (TYP)

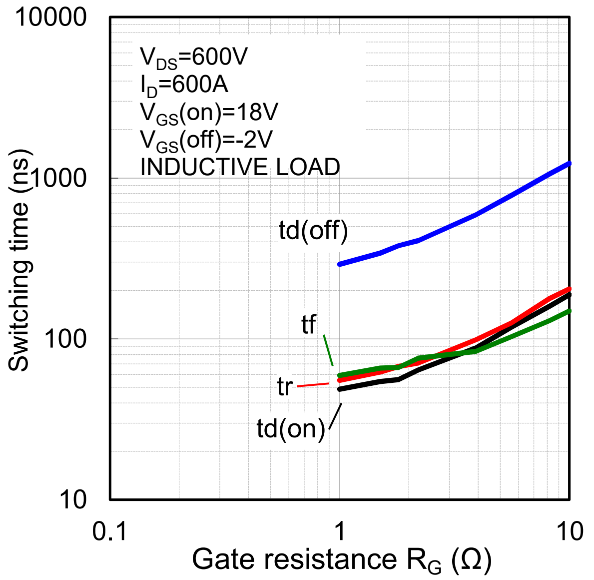
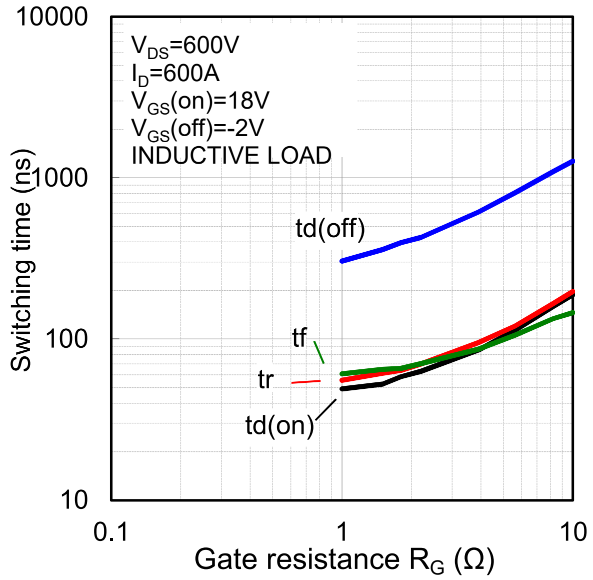


Fig.20 Switching time vs gate resistance at 150°C (TYP)



●**Electrical characteristic curves** (Typical)

Fig.21 Switching loss vs gate resistance at 25°C (TYP)

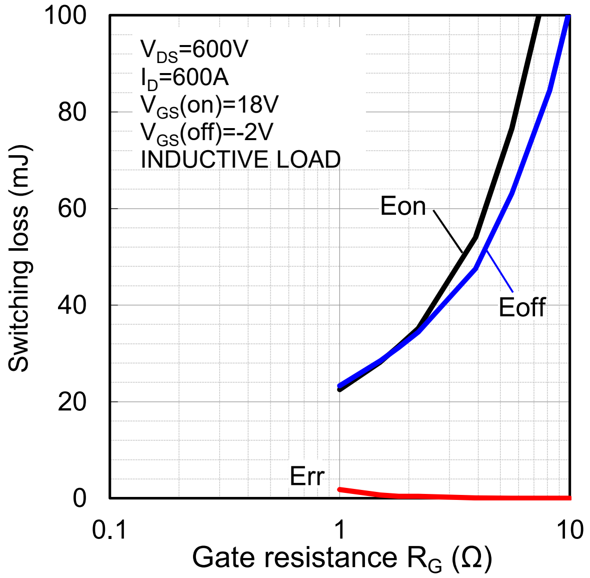


Fig.22 Switching loss vs gate resistance at 125°C (TYP)

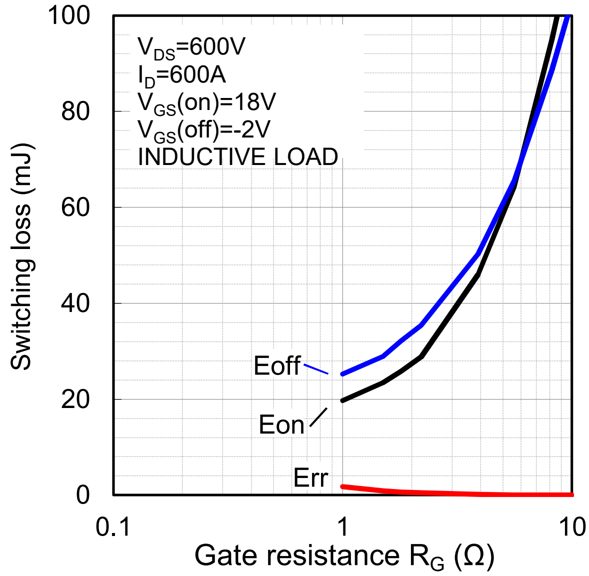
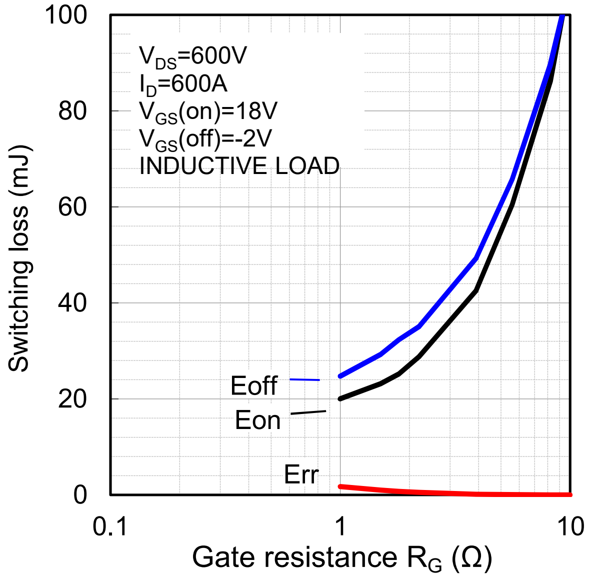


Fig.23 Switching loss vs gate resistance at 150°C (TYP)



●**Electrical characteristic curves** (Typical)

Fig.24 Capacitance vs Drain source voltage (TYP)

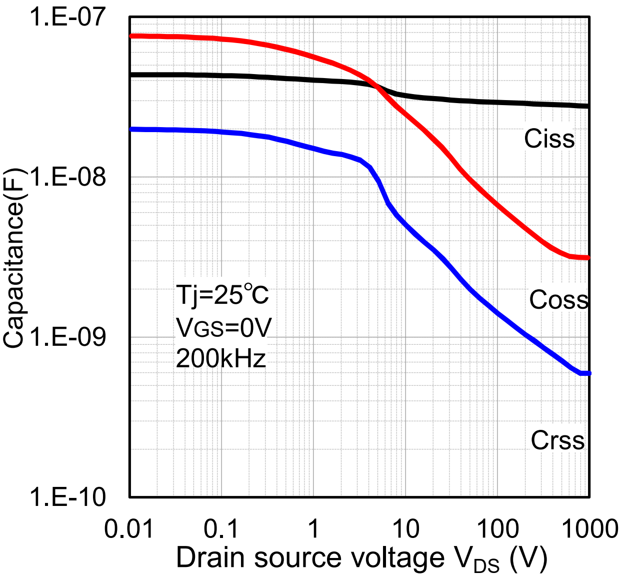


Fig.25 Gate charge characteristic (TYP)

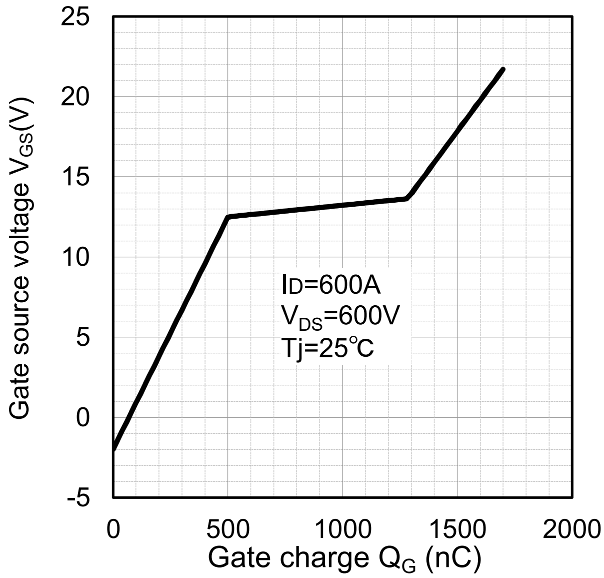
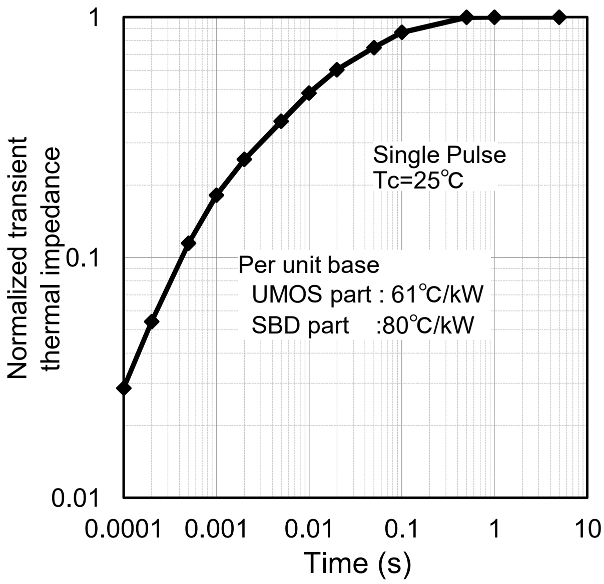


Fig.26 Transient thermal impedance (TYP)



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