# SiC Power Module

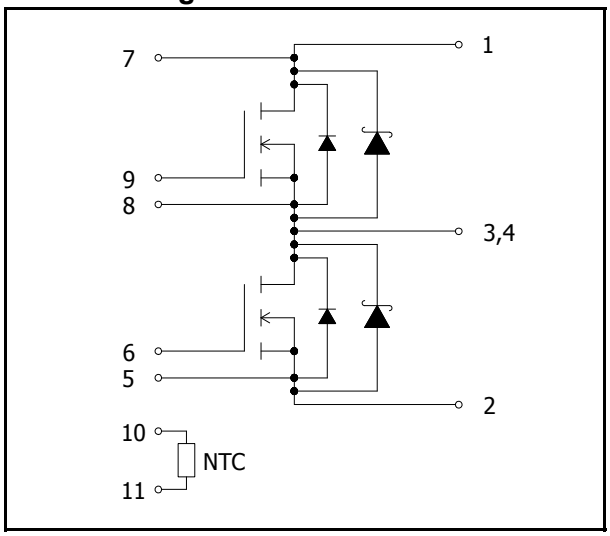
**BSM400D12P2G003**

Datasheet

## ●Application

- Motor drive
- Inverter, Converter
- Photovoltaics, wind power generation.
- Induction heating equipment.

## ●Circuit diagram




## ●Features

1) Low surge, low switching loss.

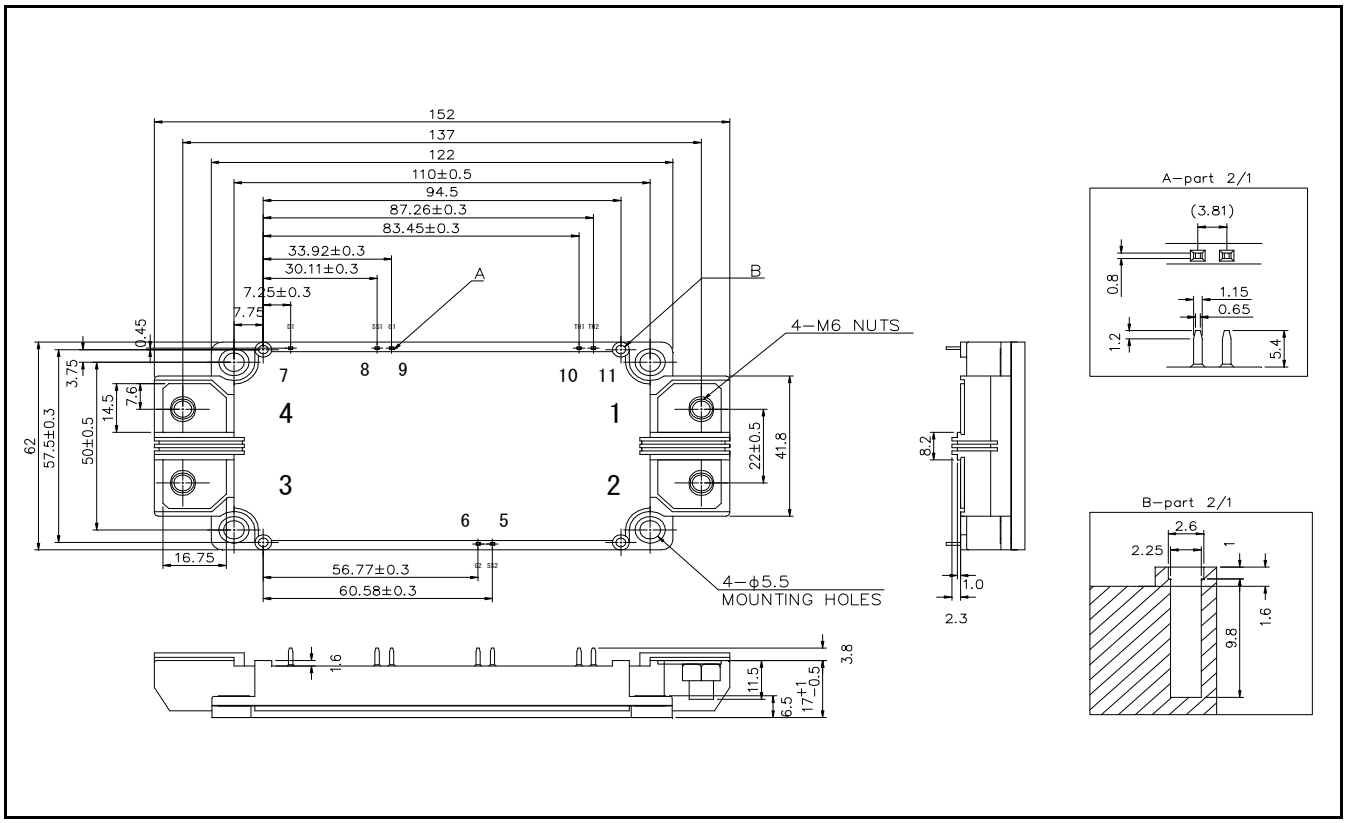
2) High-speed switching possible.

3) Reduced temperature dependence.

## ●Construction

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

## ●Dimensions & Pin layout (Unit : mm)

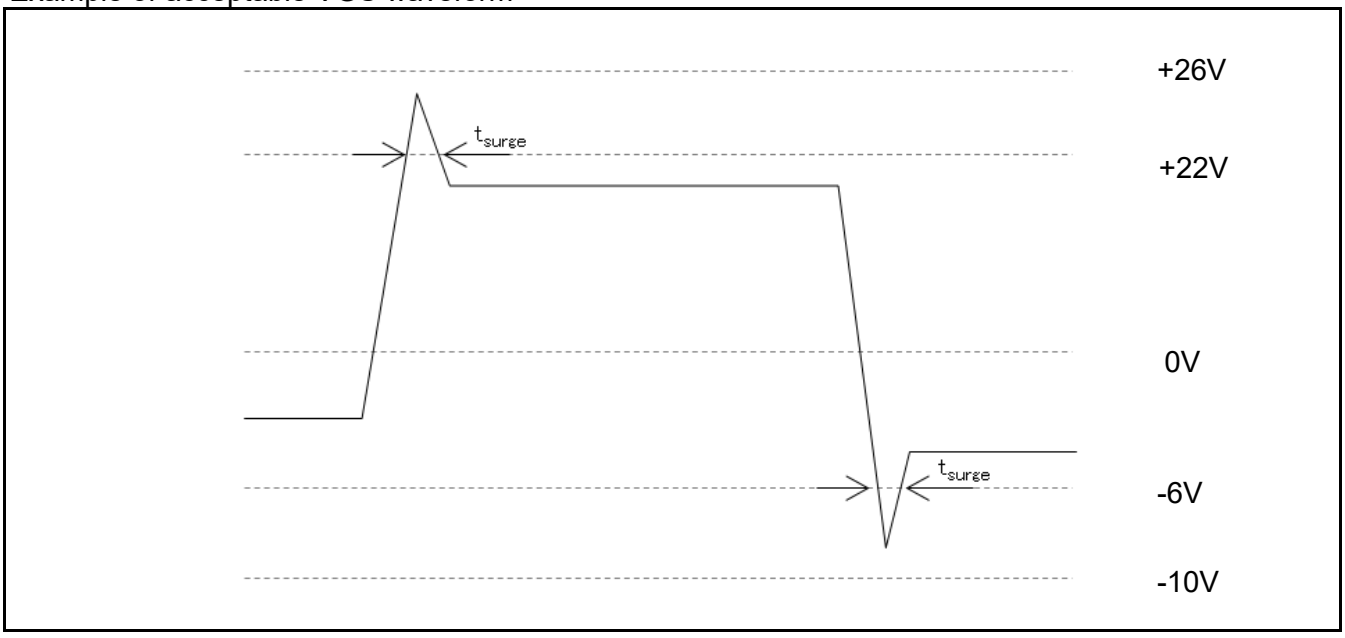


## ●Absolute maximum ratings ($T_j$ = 25°C)

| 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 | -6 | |
| G - S Voltage ($t_{surge}$<300nsec) | $V_{GSSsurge}$ | D-S short | -10 to 26 | |
| Drain Current Note 1) | $I_D$ | DC(Tc=60°C) VGS=18V | 397 | A |
| | $I_D$ | DC(Tc=59°C) VGS=18V | 400 | |
| | $I_{DRM}$ | Pulse (Tc = 60°C） 1ms VGS=18V Note 2) | 800 | |
| Source Current Note 1) | $I_S$ | DC(Tc=60°C) VGS=18V | 418 | |
| | $I_S$ | DC(Tc=60°C) VGS=0V | 418 | |
| | $I_{SRM}$ | Pulse (Tc = 60°C） 1ms VGS=18V Note 2) | 800 | |
| | $I_{SRM}$ | Pulse (Tc = 60°C） 1ms VGS=0V Note 2) | 800 | |
| 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 VGS waveform



## ●Electrical characteristics ($T_j$=25°C)

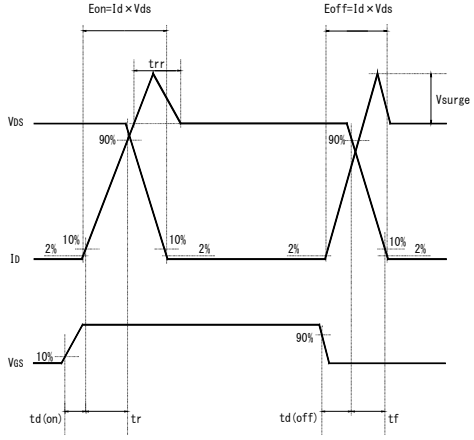
| Parameter | Symbol | Conditions | | Ratings Min. | Ratings Typ. | Ratings Max. | Unit |
|---|---|---|---|---|---|---|---|
| On-state static Drain-Source Voltage | $V_{DS}$(on) | ID=400A,VGS=18V | Tj=25°C | — | 2.3 | 3.2 | V |
| | | | Tj=125°C | — | 3.3 | — | |
| | | | Tj=150°C | — | 3.8 | 4.6 | |
| Drain Cutoff Current | $I_{DSS}$ | $V_{DS}$=1200V,$V_{GS}$=0V | | — | — | 4 | mA |
| Souce-Drain Voltage | $V_{SD}$ | VGS=0V,IS=400A | Tj=25°C | — | 1.8 | 2.1 | V |
| | | | Tj=125°C | — | 2.3 | — | |
| | | | Tj=150°C | — | 2.4 | 3.4 | |
| | | VGS=18V,IS=400A | Tj=25°C | — | 1.4 | — | |
| | | | Tj=125°C | — | 1.7 | — | |
| | | | Tj=150°C | — | 1.8 | — | |
| Gate-Source Threshold Voltage | $V_{GS}$(th) | $V_{DS}$=10V,$I_D$=85mA | | 1.6 | — | 4 | 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) | VGS(on)=18V、VGS(off)=0V VDS=600V ID=400A RG(on)=0.2 ohm, RG(off)=0.2 ohm Inductive load | | — | 60 | — | ns |
| | tr | | | — | 50 | — | |
| | trr | | | — | 70 | — | |
| | td (off) | | | — | 240 | — | |
| | tf | | | — | 75 | — | |
| Input Capacitance | Ciss | $V_{DS}$=10V,$V_{GS}$=0V,200kHz | | — | 38 | — | 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) | DMOSFET（1/2 module） Note 4) | | — | — | 61 | °C/kW |
| | | SBD（1/2 module） Note 4) | | — | — | 80 | |
| Case-to -heat sink Thermal Resistance | Rth(c-f) | Case to heat sink, per 1 module. Thermal grease applied. Note 5） | | — | 15 | — | |

Note 4) Measurement of Tc is to be done at the point just under the chip.

Note 5) Typical value is measured by using thermally conductive grease of λ=0.9W/(m･K).

Note 6) 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＞



## ●Electrical characteristic curves (Typical)

Fig.1 Output characteristic 25°C (TYP)

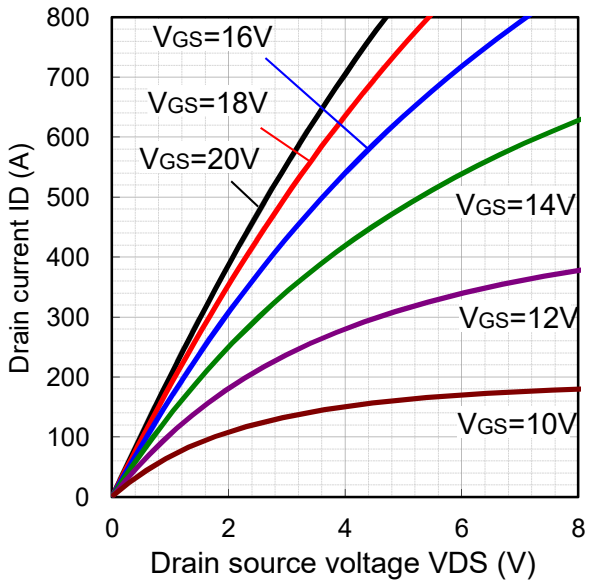



Fig.2 Drain source voltage characteristic (TYP)

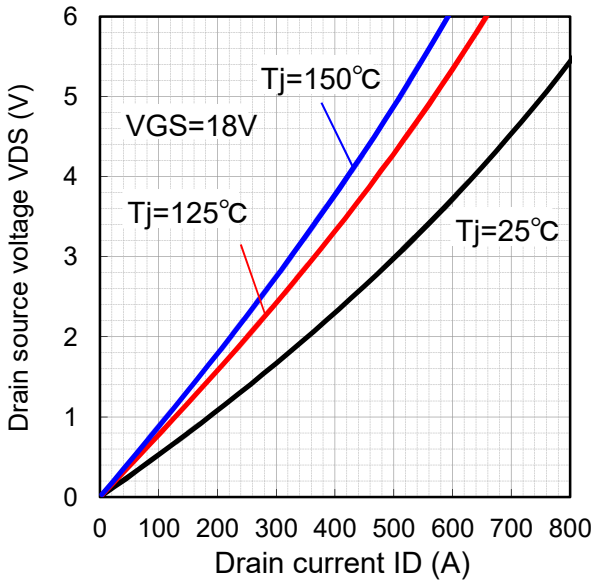



Fig.3 Drain source voltage characteristic 25°C (TYP)

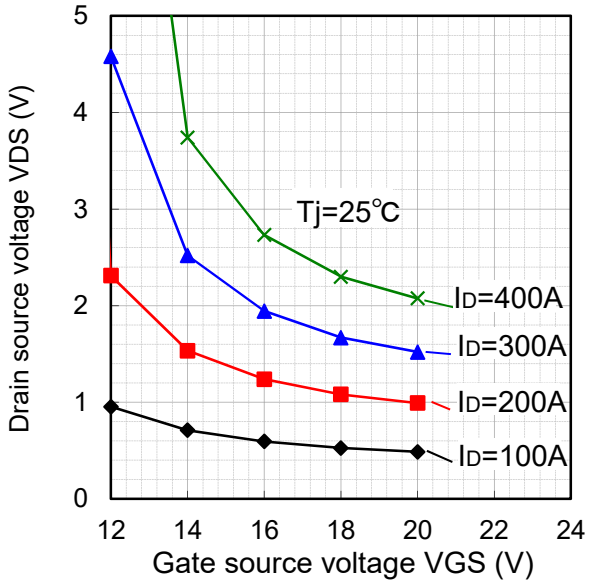
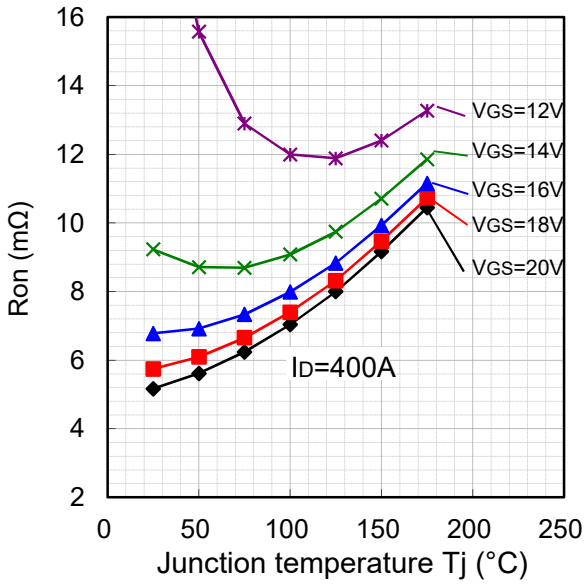



Fig.4 Ron vs Tj characteristic (TYP)



●**Electrical characteristic curves** (Typical)

Fig.5 Forward characteristic of Diode (TYP)

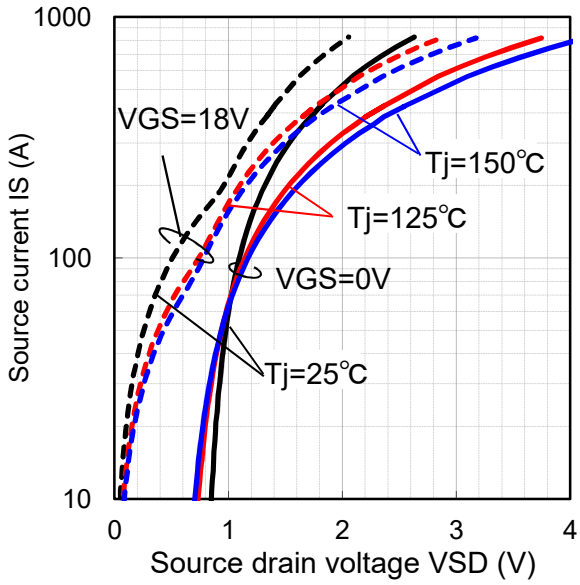



Fig.6 Forward characteristic of Diode (TYP)

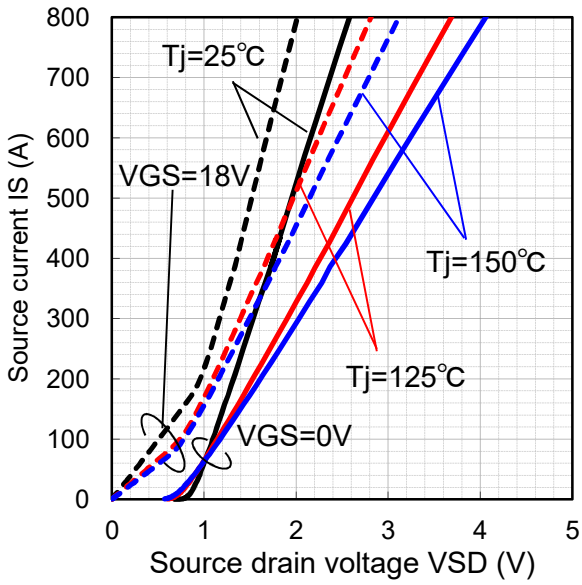



Fig.7 Drain Current vs Gate Voltage (TYP)

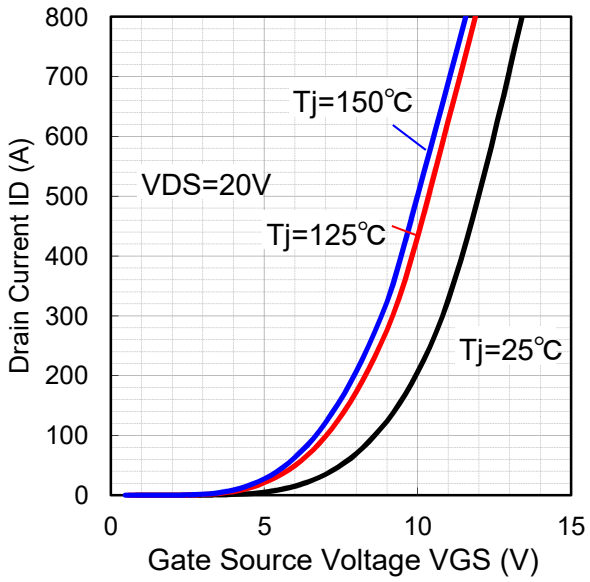
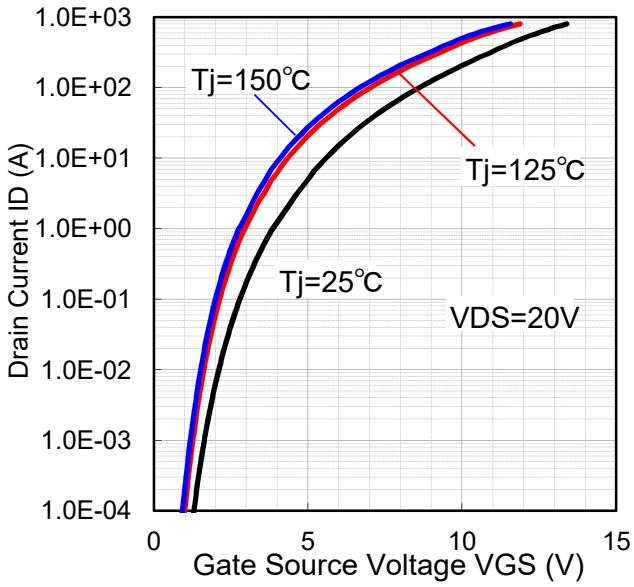



Fig.8 Drain Current vs Gate Voltage (TYP)



## ●Electrical characteristic curves (Typical)

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

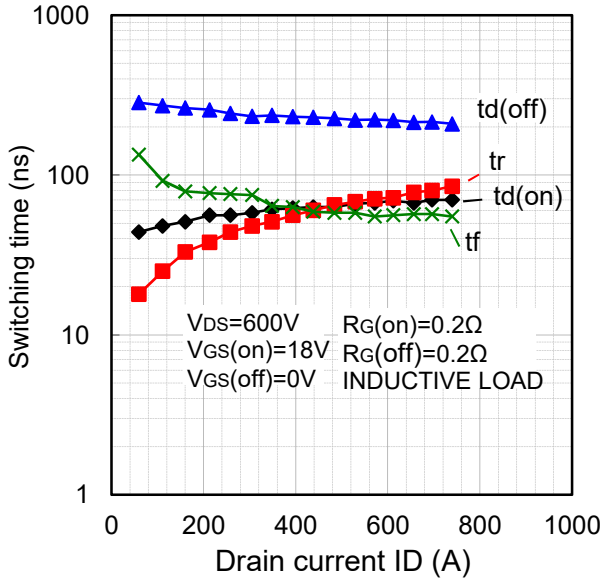



Fig.10 Switching time vs drain current at 125°C (TYP)

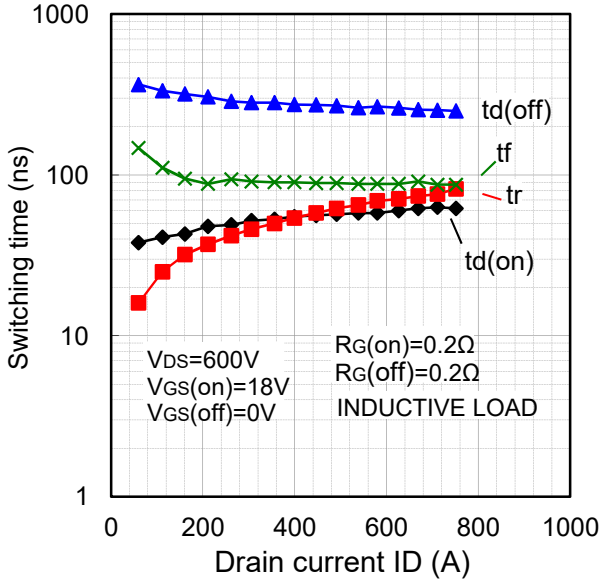



Fig.11 Switching time vs drain current at 150°C (TYP)

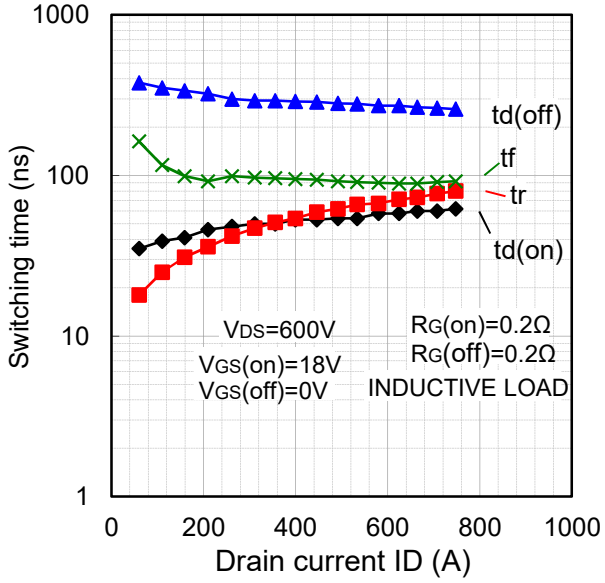
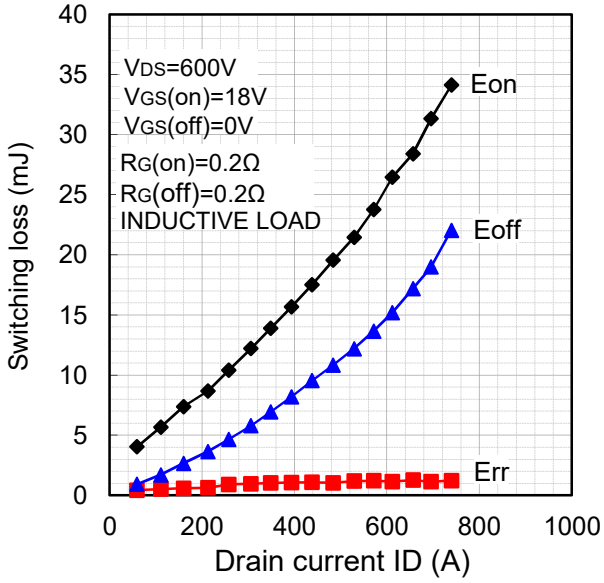



Fig.12 Switching loss vs drain current at 25°C (TYP)



## ●Electrical characteristic curves (Typical)

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

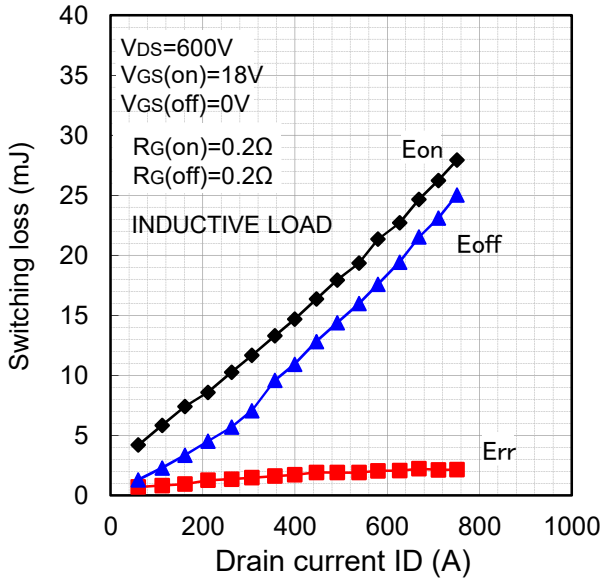



Fig.14 Switching loss vs drain current at 150°C (TYP)

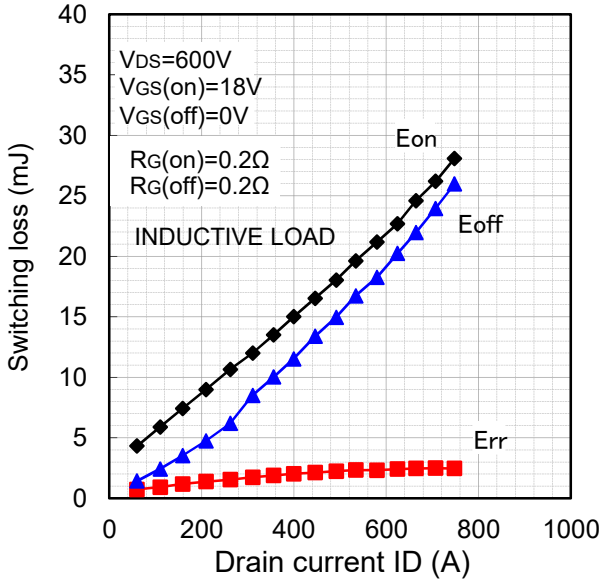



Fig.15 Recovery characteristic vs drain current at 25°C (TYP)

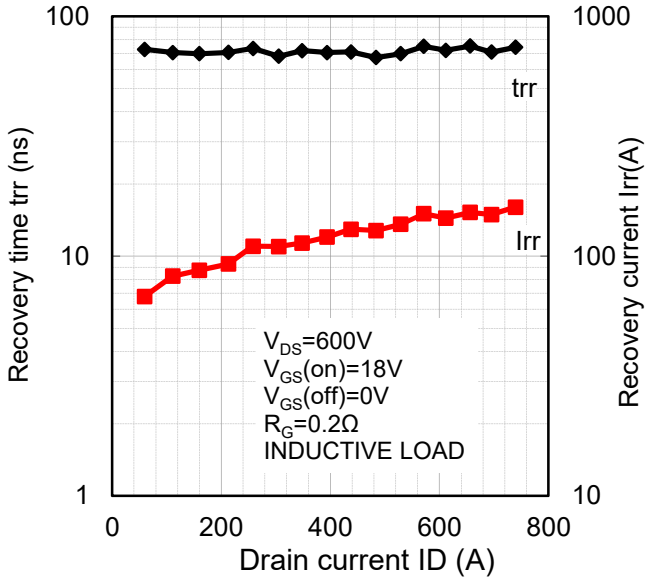
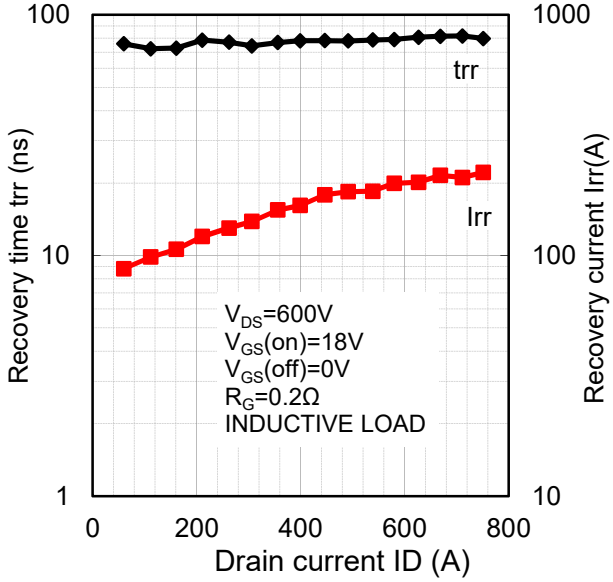



Fig.16 Recovery characteristic vs drain current at 125°C (TYP)



## ●Electrical characteristic curves (Typical)

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

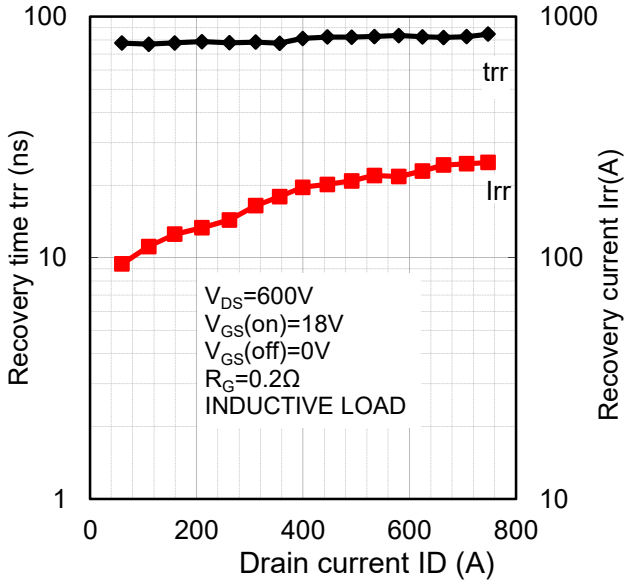



Fig.18 Switching time vs gate resistance at 25°C (TYP)

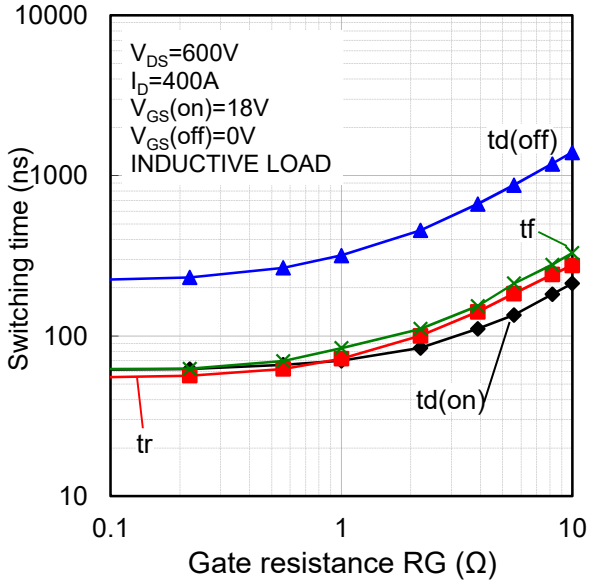



Fig.19 Switching time vs gate resistance at 125°C (TYP)

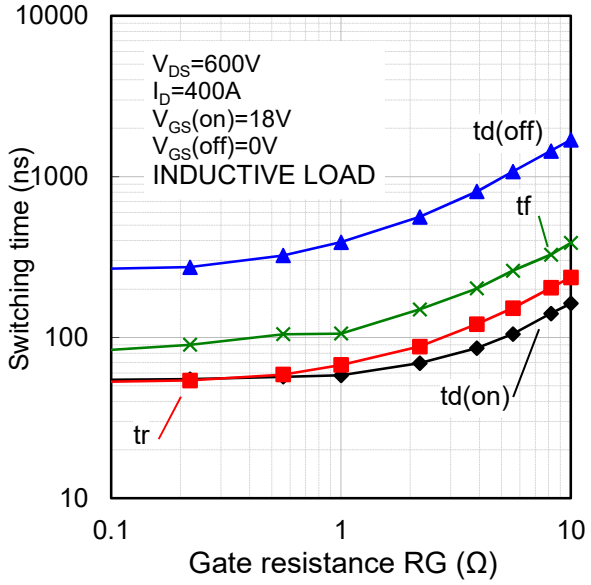
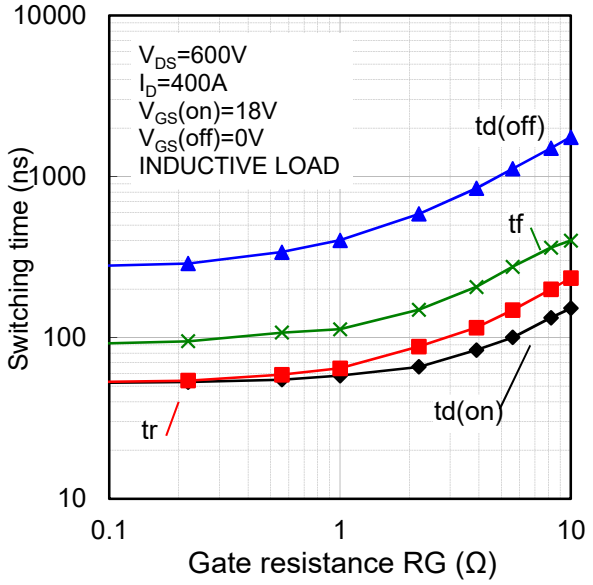



Fig.20 Switching time vs gate resistance at 150°C (TYP)



●**Electrical characteristic curves** (Typical)

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

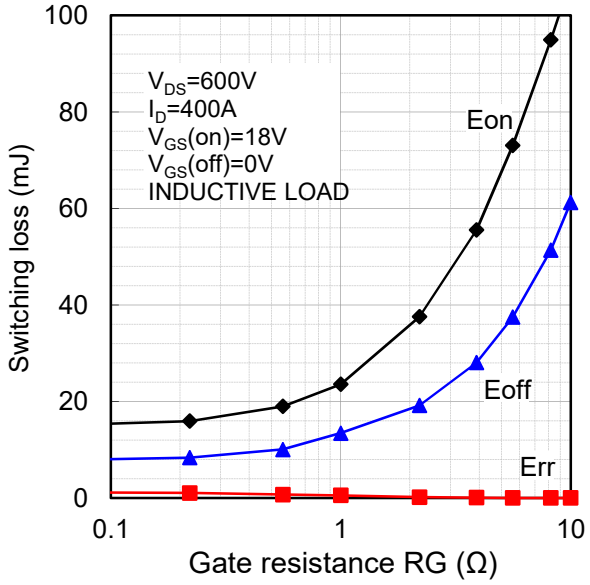



Fig.22 Switching loss vs gate resistance at 125°C (TYP)

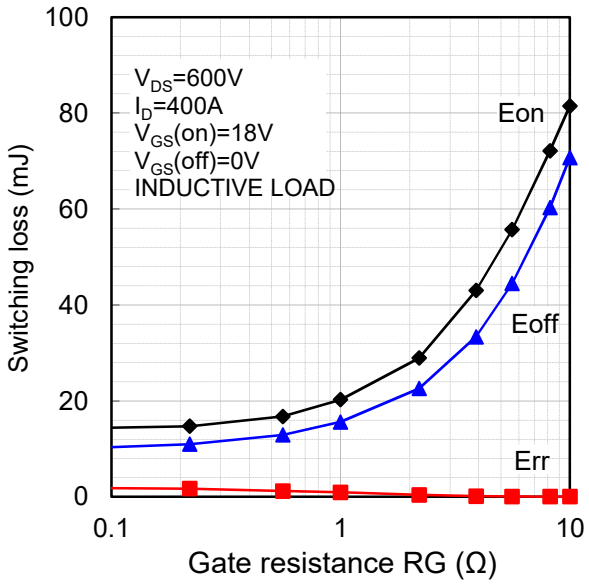
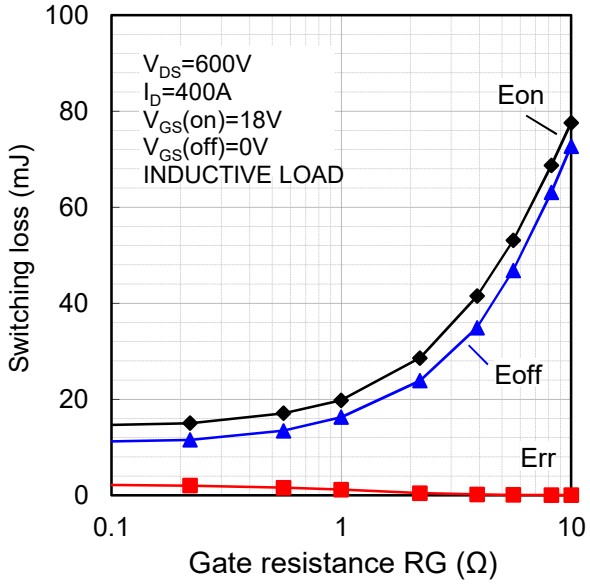



Fig.23 Switching loss vs gate resistance at 150°C (TYP)



●**Electrical characteristic curves** (Typical)

Fig.24 Capacitance vs Drain source voltage (TYP)

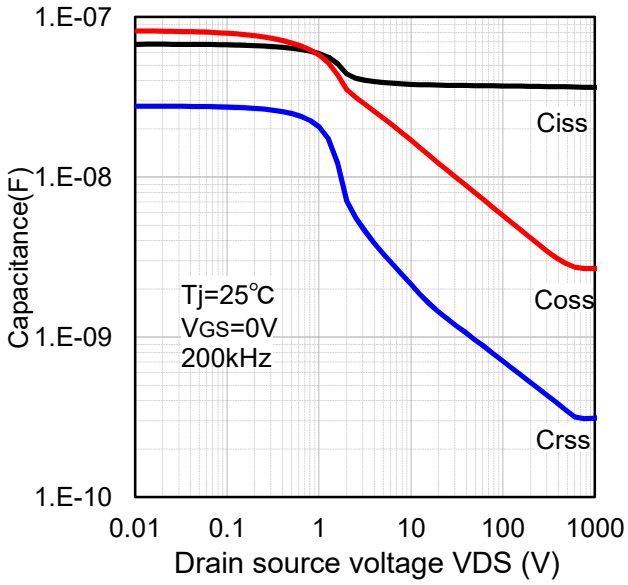



Fig.25 Gate charge characteristic (TYP)

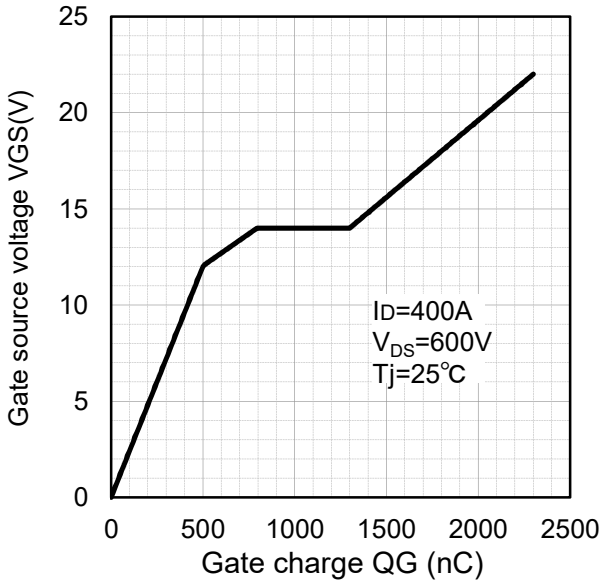
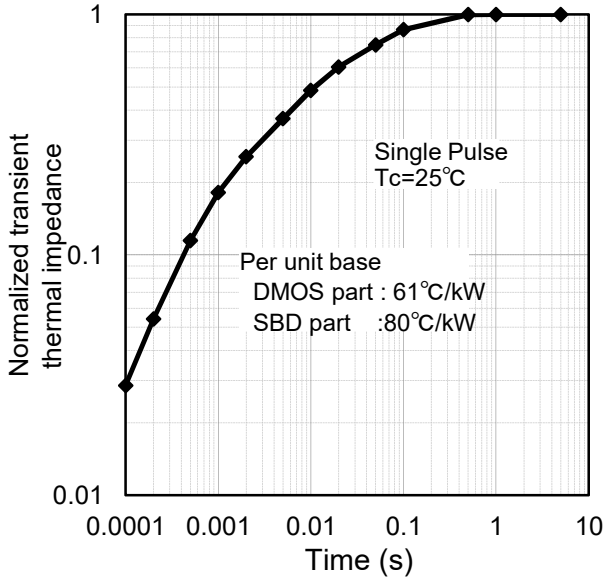



Fig.26 Transient thermal impedance (TYP)



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