

### ●Application

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

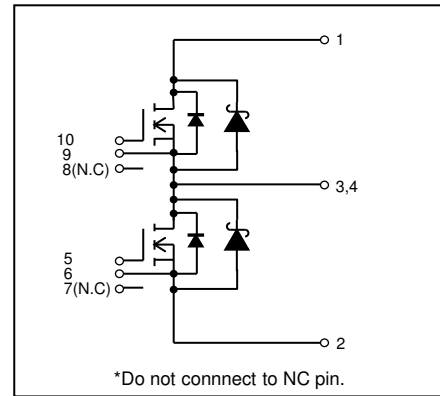
### ●Features

- 1) Low surge, low switching loss.
- 2) High-speed switching possible.
- 3) Reduced temperature dependence.

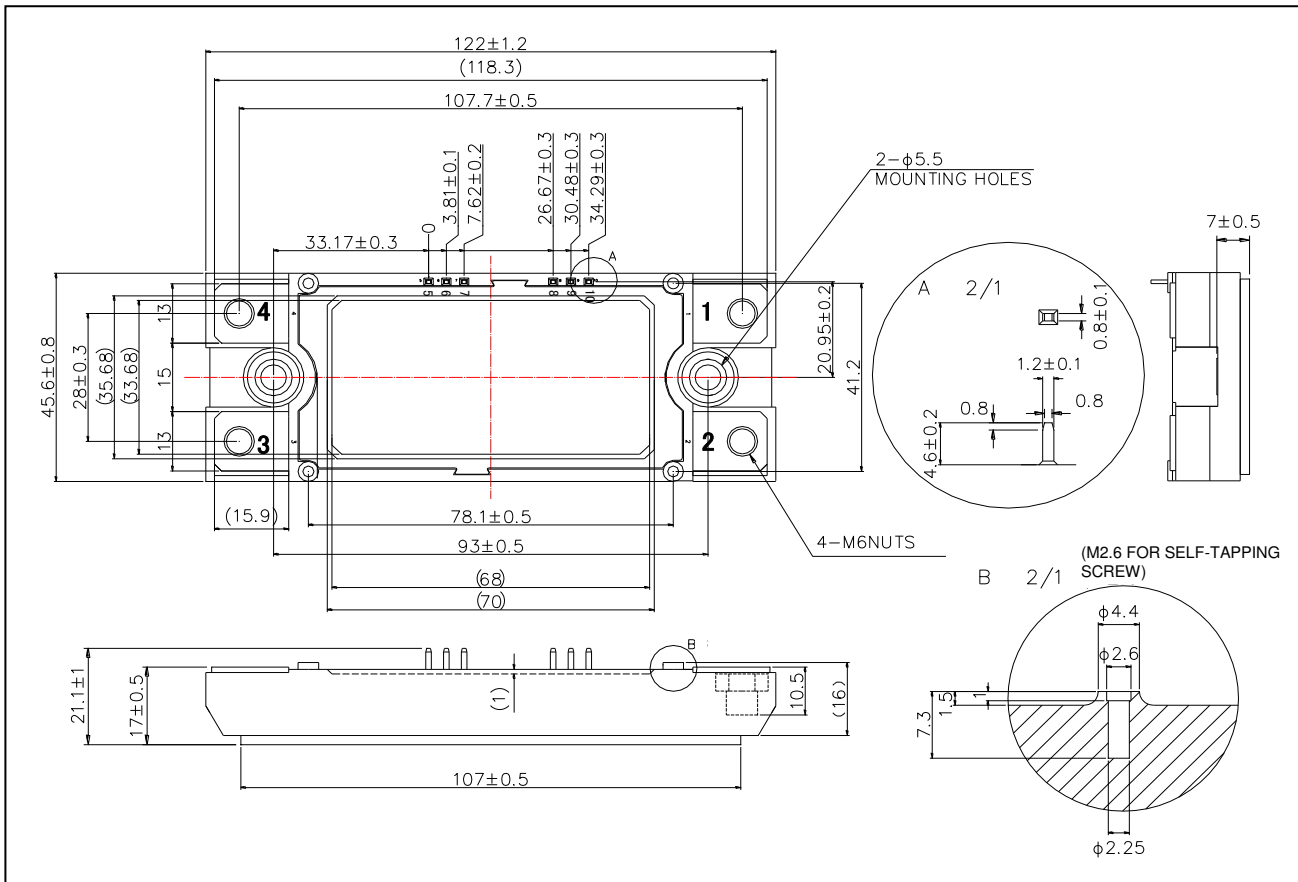
### ●Construction

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

### ●Circuit diagram



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



● Absolute maximum ratings ( $T_j = 25^\circ\text{C}$ )

| 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         |       |
| Drain current *1           | $I_D$      | DC ( $T_c=60^\circ\text{C}$ )   | 180        | A     |
|                            | $I_{DRM}$  | Pulse ( $T_c=60^\circ\text{C}$ ) 1ms *2                                 | 360        |       |
| Source current *1          | $I_S$      | DC ( $T_c=60^\circ\text{C}$ ) $V_{GS}=18\text{V}$                       | 180        |       |
|                            | $I_{SRM}$  | Pulse ( $T_c=60^\circ\text{C}$ ) 1ms $V_{GS}=18\text{V}$ *2             | 360        |       |
|                            |            | Pulse ( $T_c=60^\circ\text{C}$ ) 10 $\mu\text{s}$ $V_{GS}=0\text{V}$ *2 | 360        |       |
| Total power dissipation *3 | $P_{tot}$  | $T_c=25^\circ\text{C}$  | 880        | W     |
| Max Junction Temperature   | $T_{jmax}$ |   | 175        | °C    |
| Junction temperature       | $T_{jop}$  |   | -40 to 150 |       |
| Storage temperature        | $T_{stg}$  |   | -40 to 125 |       |
| Isolation voltage *4       | $V_{isol}$ | Terminals to baseplate,<br>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  $T_{jmax}$ .

(\*3)  $T_j$  is less than  $175^\circ\text{C}$  (\*4) Actual measurement is 3000Vrms/1sec. in accordance with UL1557.

### ●Electrical characteristics (T<sub>j</sub>=25°C)

| Parameter                            | Symbol               | Conditions   | Min.                  | Typ.  | Max. | Unit |   |
|--------------------------------------|----------------------|--|-----------------------|-------|------|------|---|
| Static drain-source on-state voltage | V <sub>DS(on)</sub>  | I <sub>C</sub> =180A, V <sub>GS</sub> =18V   | T <sub>j</sub> =25°C  | -     | 1.8  | 2.6  | V |
|                                      |                      |  | T <sub>j</sub> =125°C | -     | 2.7  | -    |   |
|                                      |                      |  | T <sub>j</sub> =150°C | -     | 3.1  | 4    |   |
| Drain cutoff current                 | I <sub>DSS</sub>     | V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V  | -                     | -     | 2    | mA   |   |
| Source-drain voltage                 | V <sub>SD</sub>      | V <sub>GS</sub> =0V, I <sub>S</sub> =180A  | T <sub>j</sub> =25°C  | -     | 2.1  | 2.6  | V |
|                                      |                      |  | T <sub>j</sub> =125°C | -     | 2.6  | -    |   |
|                                      |                      |  | T <sub>j</sub> =150°C | -     | 2.8  | 4.3  |   |
|                                      |                      | V <sub>GS</sub> =18V, I <sub>S</sub> =180A   | T <sub>j</sub> =25°C  | -     | 1.4  | -    |   |
|                                      |                      |  | T <sub>j</sub> =125°C | -     | 1.9  | -    |   |
|                                      |                      |  | T <sub>j</sub> =150°C | -     | 2    | -    |   |
| Gate-source threshold voltage        | V <sub>GS(th)</sub>  | V <sub>DS</sub> =10V, I <sub>D</sub> =50mA   | 2.7                   | -     | 5.6  | V    |   |
| Gate-source leakage current          | I <sub>GSS</sub>     | V <sub>GS</sub> =22V, V <sub>DS</sub> =0V  | -                     | -     | 0.5  | μA   |   |
|                                      |                      | V <sub>GS</sub> =-4V, V <sub>DS</sub> =0V  | -0.5                  | -     | -    |      |   |
| Switching characteristics            | t <sub>d(on)</sub>   | V <sub>GS(on)</sub> =18V, V <sub>GS(off)</sub> =-2V *5<br>V <sub>DS</sub> =600V<br>I <sub>D</sub> =180A<br>R <sub>G(on)</sub> =8.2Ω, R <sub>G(off)</sub> =4.7Ω<br>inductive load | -                     | 50    | -    | ns   |   |
|                                      | t <sub>r</sub>       |  | -                     | 70    | -    |      |   |
|                                      | t <sub>rr</sub>      |  | -                     | 35    | -    |      |   |
|                                      | t <sub>d(off)</sub>  |  | -                     | 165   | -    |      |   |
|                                      | t <sub>f</sub>       |  | -                     | 50    | -    |      |   |
| Input capacitance                    | C <sub>iss</sub>     | V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, 200kHz  | -                     | 9     | -    | nF   |   |
| Gate Registance                      | R <sub>Gint</sub>    | T <sub>j</sub> =25°C   | -                     | 1.4   | -    | Ω    |   |
| Stray Inductance                     | L <sub>s</sub>       |  |                       | 25.0  | -    | nH   |   |
| Creepage Distance                    | -                    | Terminal to heat sink  |                       | 11.5  | -    | mm   |   |
|                                      |                      | Terminal to terminal   |                       | 19.0  | -    | mm   |   |
| Clearance Distance                   | -                    | Terminal to heat sink  |                       | 9.5   | -    | mm   |   |
|                                      |                      | Terminal to terminal   |                       | 13.0  | -    | mm   |   |
| Junction-to-case thermal resistance  | R <sub>th(j-c)</sub> | UMOSFET (1/2 module) *6  | -                     | -     | 0.17 | °C/W |   |
|                                      |                      | SBD (1/2 module) *6  | -                     | -     | 0.21 |      |   |
| Case-to-heat sink Thermal resistance | R <sub>th(c-f)</sub> | Case to heat sink, per 1 module, Thermal grease applied *7   | -                     | 0.035 | -    | °C/W |   |

(\*5) In order to prevent self turn-on, it is recommended to apply negative gate bias.

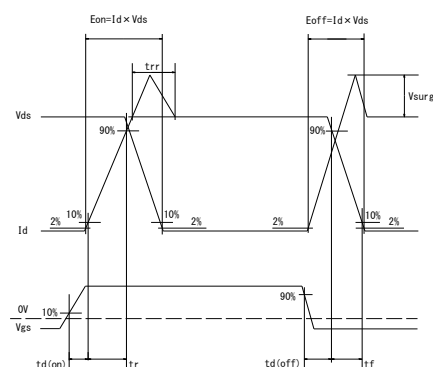
(\*6) Measurement of T<sub>c</sub> is to be done at the point just beneath the chip.

(\*7) Typical value is measured by using thermally conductive grease of λ=0.9W/(m·K).

(\*8) SiC devices have lower short circuit withstand capability due to high current density.

Please be advised to pay careful attention to short circuit accident and try to adjust protection time to shutdown them as short as possible.

### ●Waveform for switching test



●Electrical characteristic curves (Typical)

Fig.1 Typical Output Characteristics [  $T_j=25^\circ\text{C}$  ]

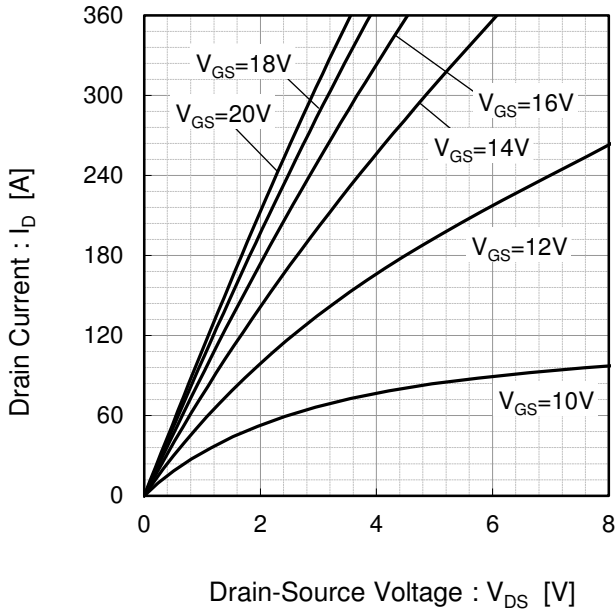


Fig.2 Drain-Source Voltage vs. Drain Current [  $T_j=25^\circ\text{C}$  ]

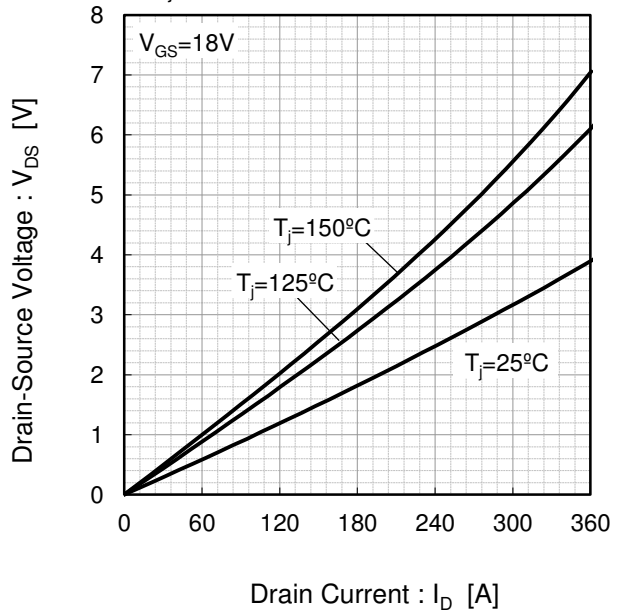


Fig.3 Drain-Source Voltage vs. Gate-Source Voltage [  $T_j=25^\circ\text{C}$  ]

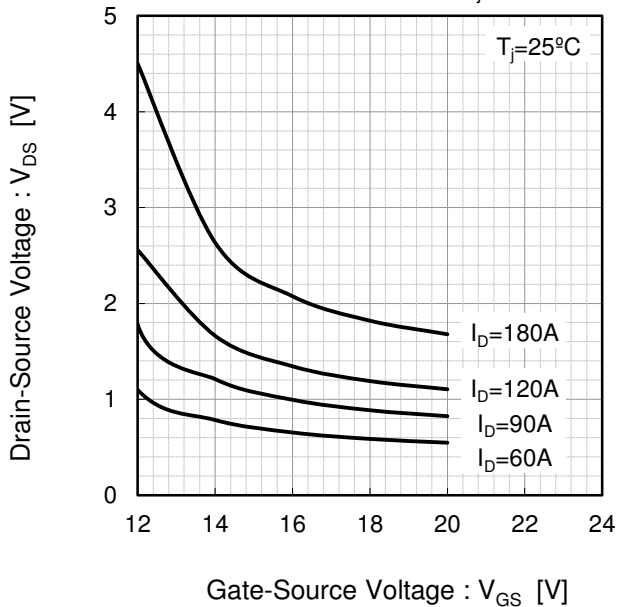
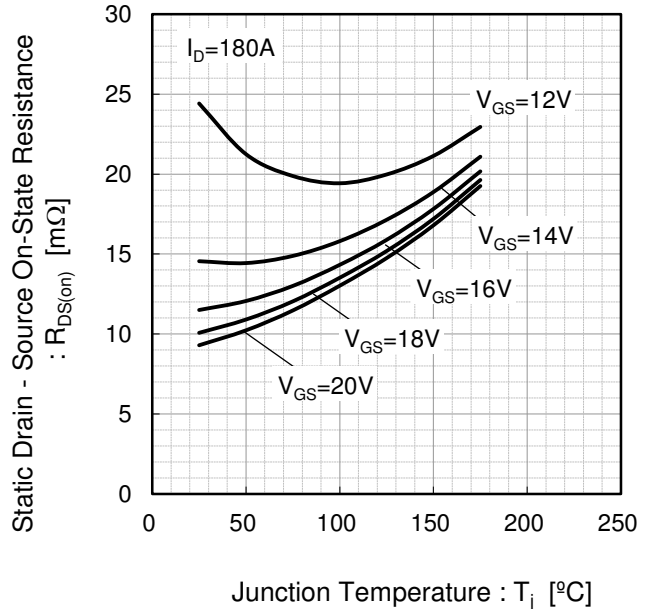


Fig.4 Static Drain - Source On-State Resistance vs. Junction Temperature



●Electrical characteristic curves (Typical)

Fig.5 Forward characteristic of Diode

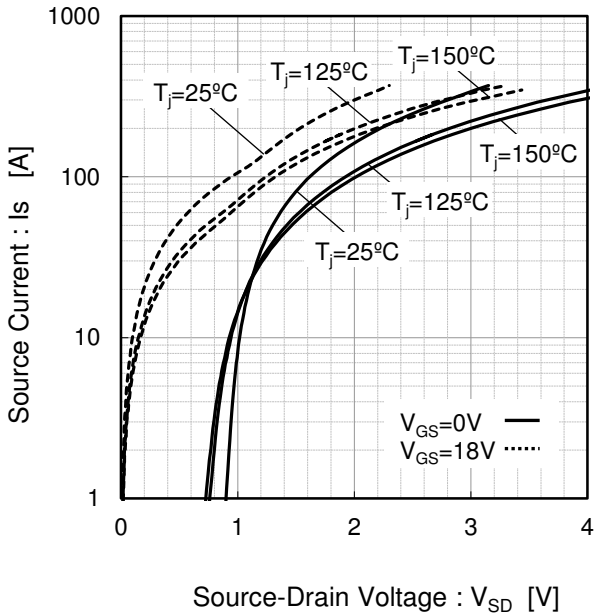


Fig.6 Forward characteristic of Diode

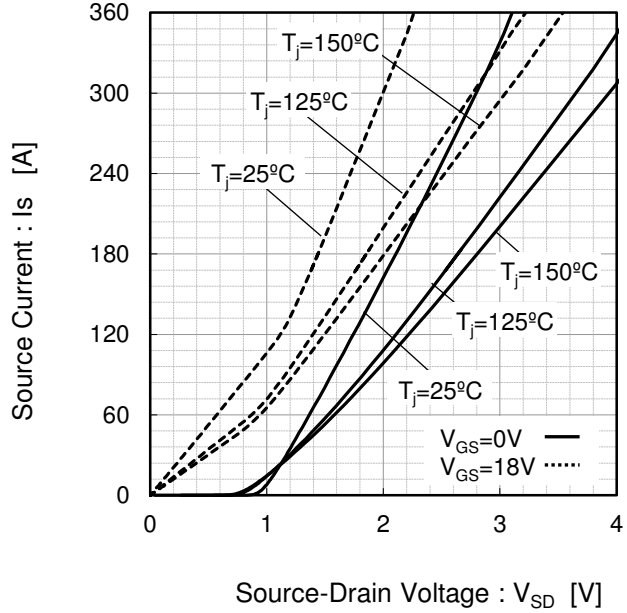


Fig.7 Drain Current vs. Gate-Source Voltage

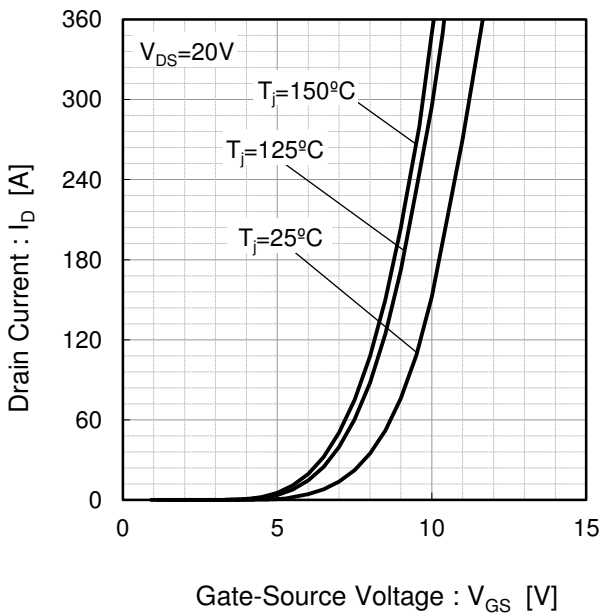
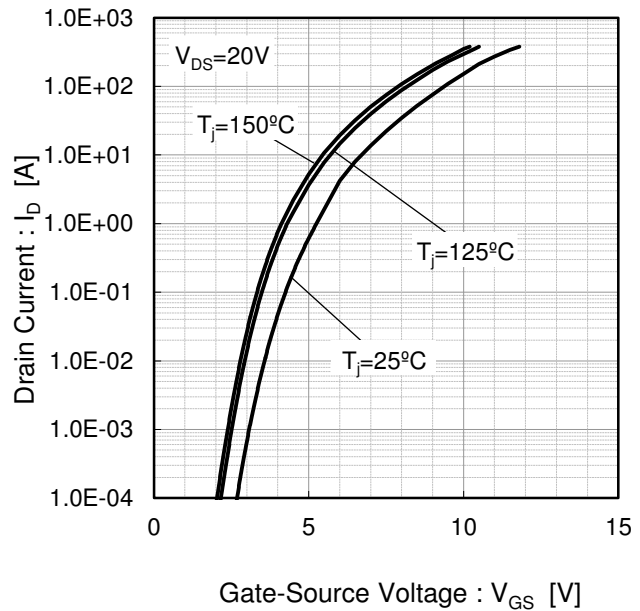


Fig.8 Drain Current vs. Gate-Source Voltage



●Electrical characteristic curves (Typical)

Fig.9 Switching Characteristics [  $T_j=25^{\circ}\text{C}$  ]

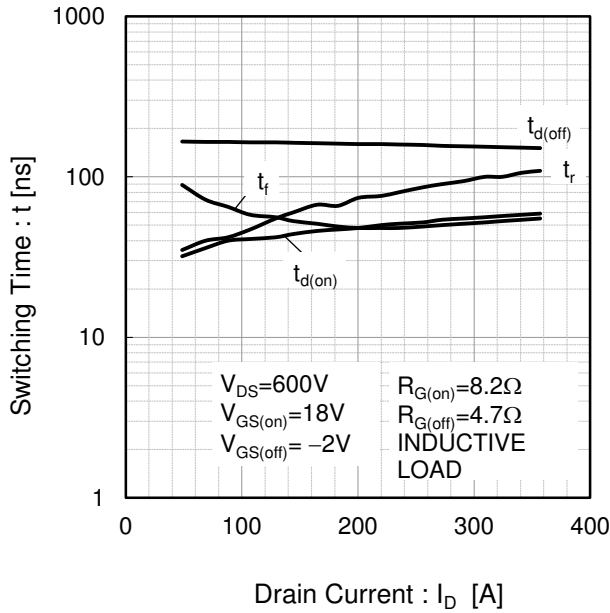


Fig.10 Switching Characteristics [  $T_j=125^{\circ}\text{C}$  ]

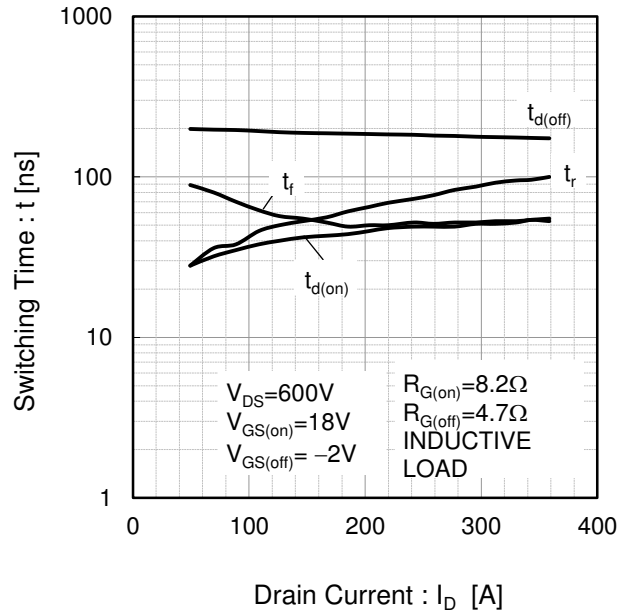


Fig.11 Switching Characteristics [  $T_j=150^{\circ}\text{C}$  ]

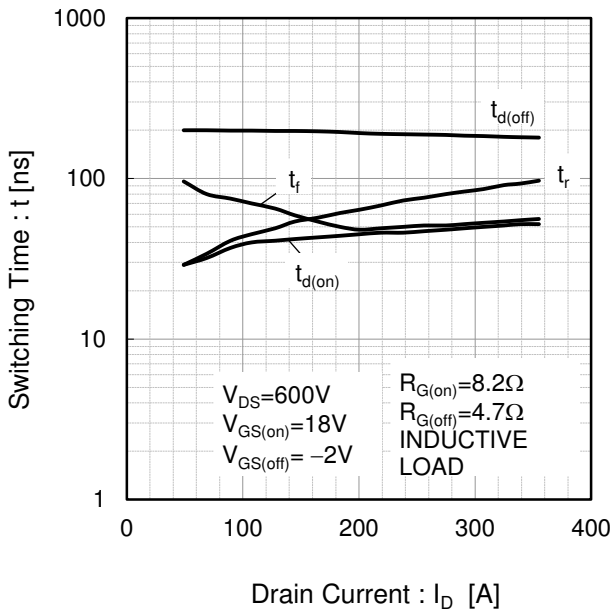
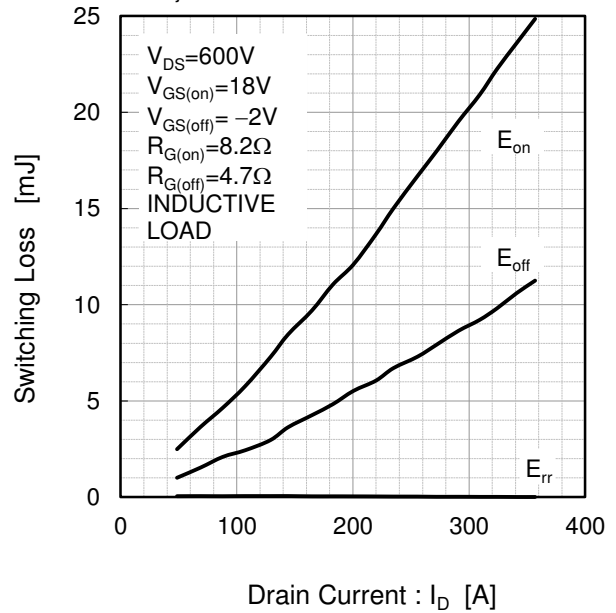


Fig.12 Switching Loss vs. Drain Current [  $T_j=25^{\circ}\text{C}$  ]



●Electrical characteristic curves (Typical)

Fig.13 Switching Loss vs. Drain Current [  $T_j=125^{\circ}\text{C}$  ]

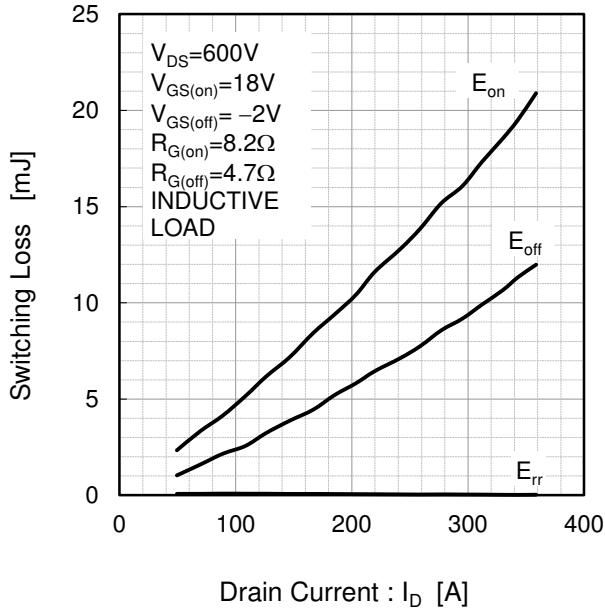


Fig.14 Switching Loss vs. Drain Current [  $T_j=150^{\circ}\text{C}$  ]

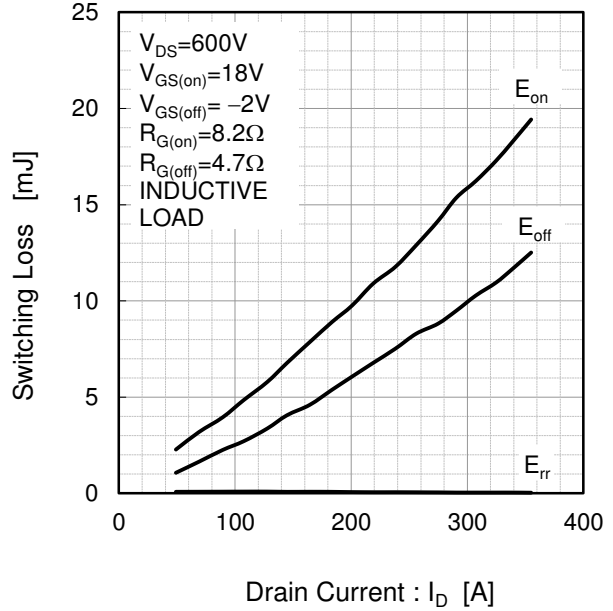


Fig.15 Recovery Characteristics vs. Drain Current [  $T_j=25^{\circ}\text{C}$  ]

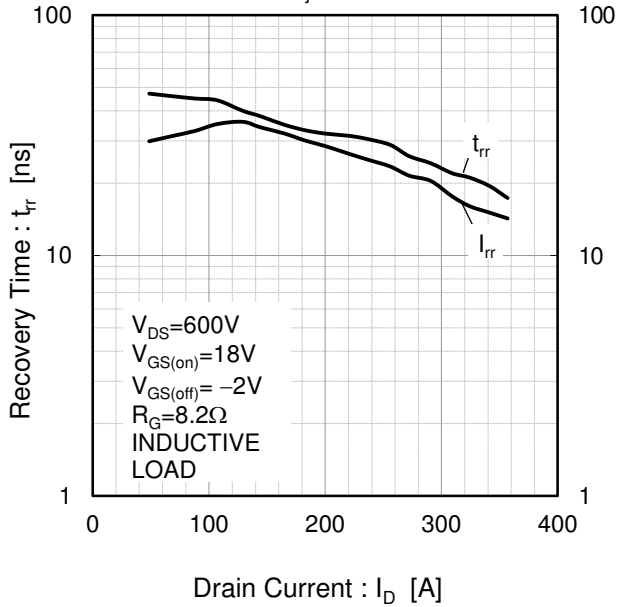
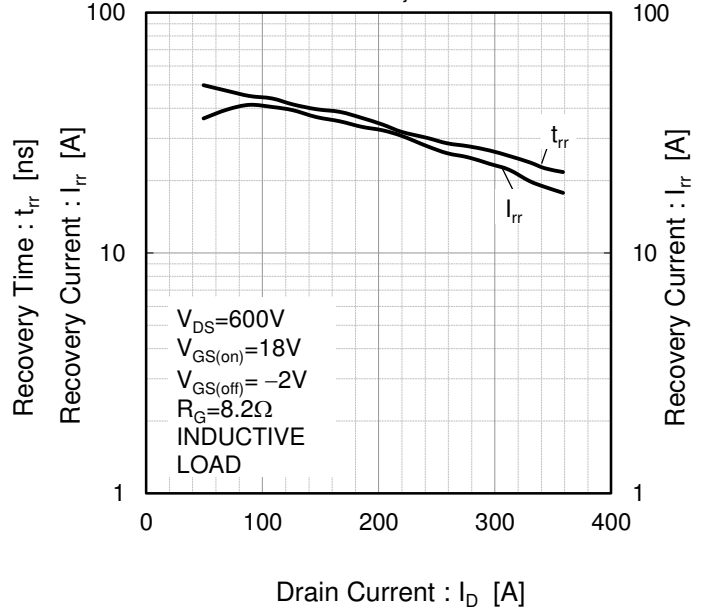


Fig.16 Recovery Characteristics vs. Drain Current [  $T_j=125^{\circ}\text{C}$  ]



●Electrical characteristic curves (Typical)

Fig.17 Recovery Characteristics vs. Drain Current [  $T_j=150^{\circ}\text{C}$  ]

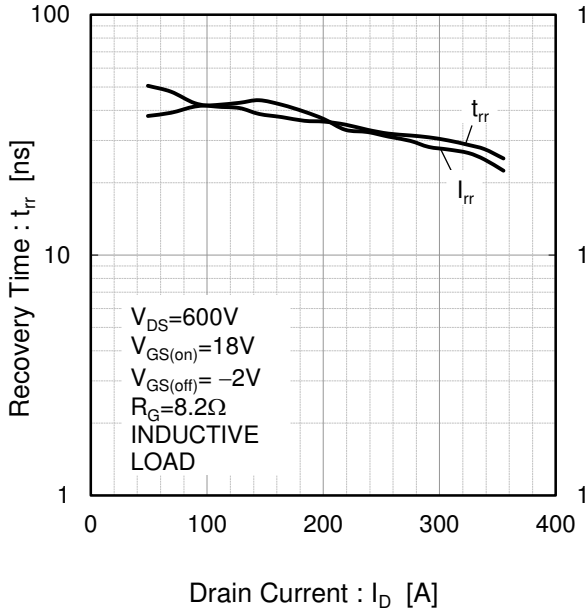


Fig.18 Switching Characteristics vs. Gate Resistance [  $T_j=25^{\circ}\text{C}$  ]

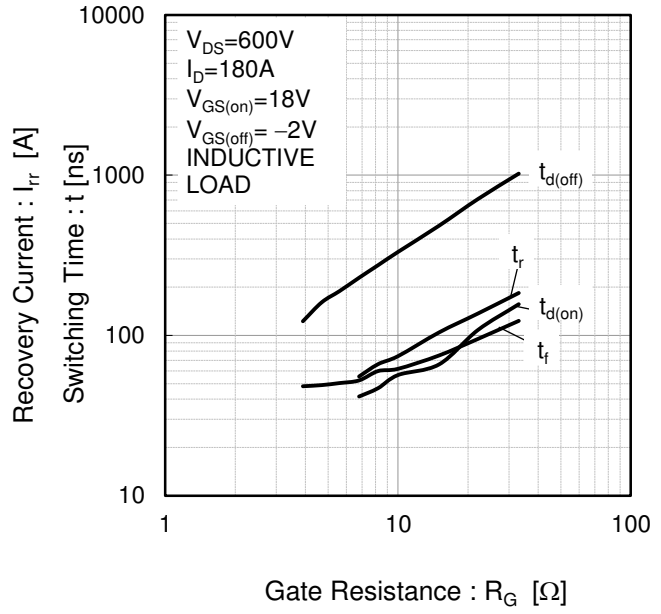


Fig.19 Switching Characteristics vs. Gate Resistance [  $T_j=125^{\circ}\text{C}$  ]

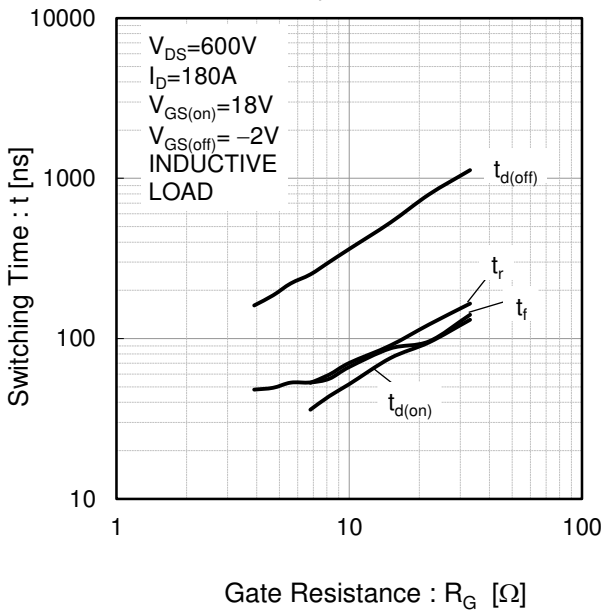
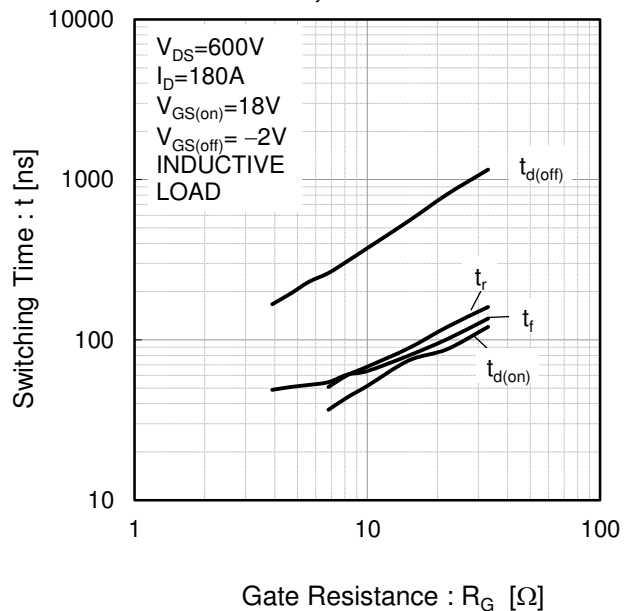


Fig.20 Switching Characteristics vs. Gate Resistance [  $T_j=150^{\circ}\text{C}$  ]





●Electrical characteristic curves (Typical)

Fig.21 Switching Loss vs. Gate Resistance [  $T_j=25^{\circ}\text{C}$  ]

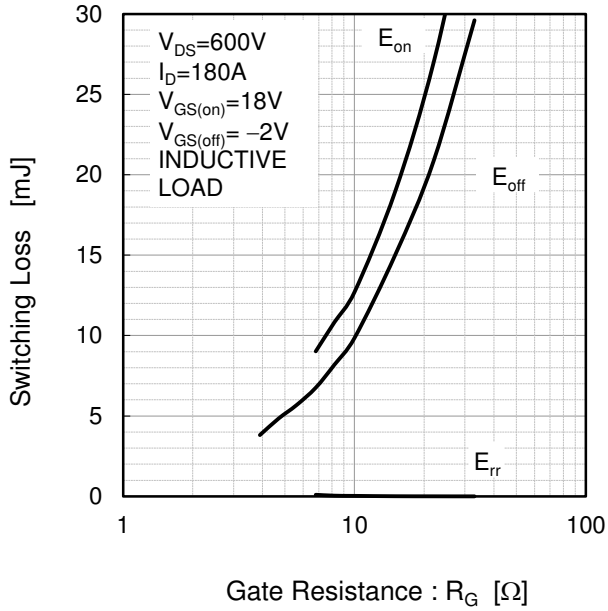


Fig.22 Switching Loss vs. Gate Resistance [  $T_j=125^{\circ}\text{C}$  ]

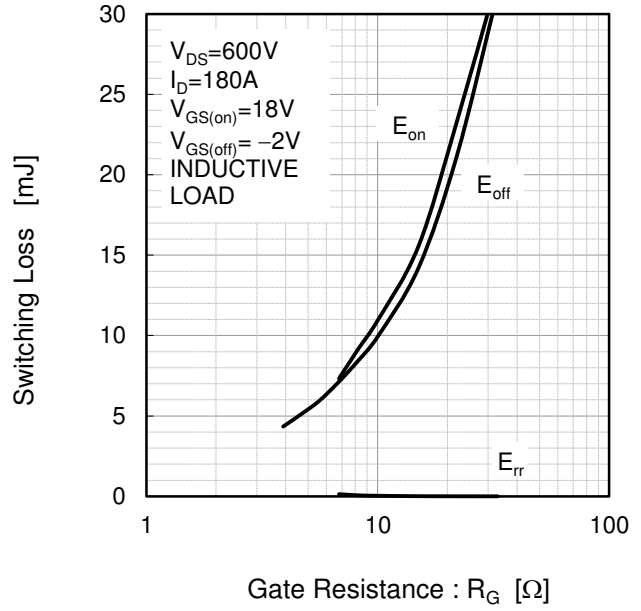


Fig.23 Switching Loss vs. Gate Resistance [  $T_j=150^{\circ}\text{C}$  ]

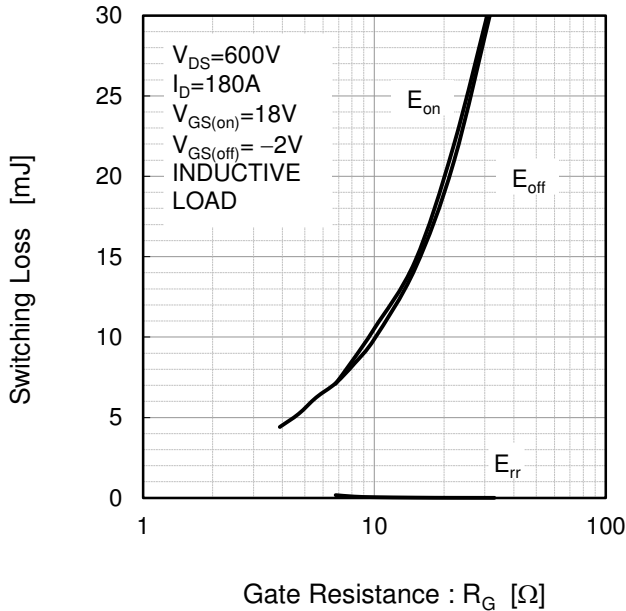
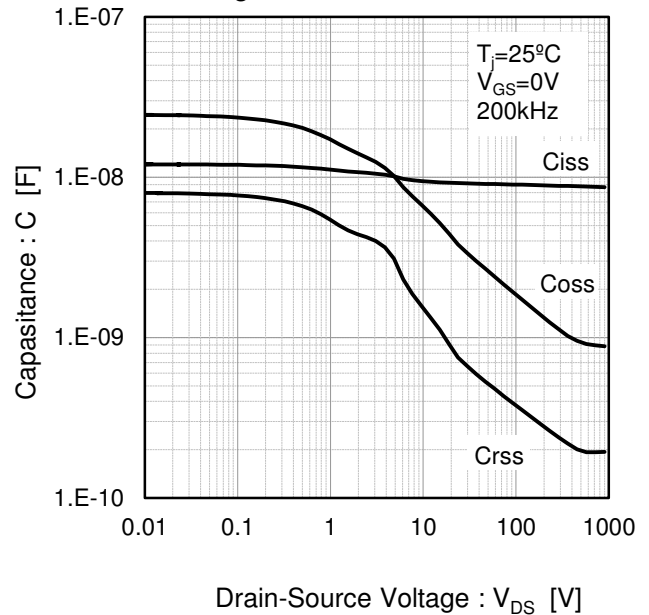


Fig.24 Typical Capacitance vs. Drain-Source Voltage



●Electrical characteristic curves (Typical)

Fig.25 Gate Charge Characteristics  
[  $T_j=25^\circ\text{C}$  ]

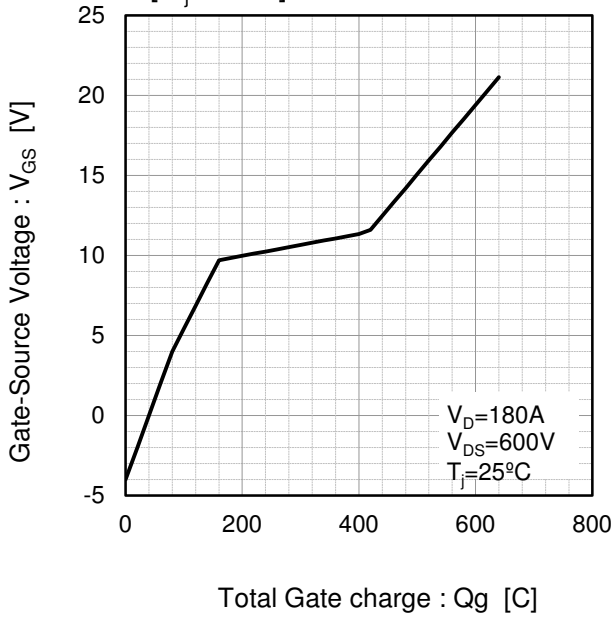
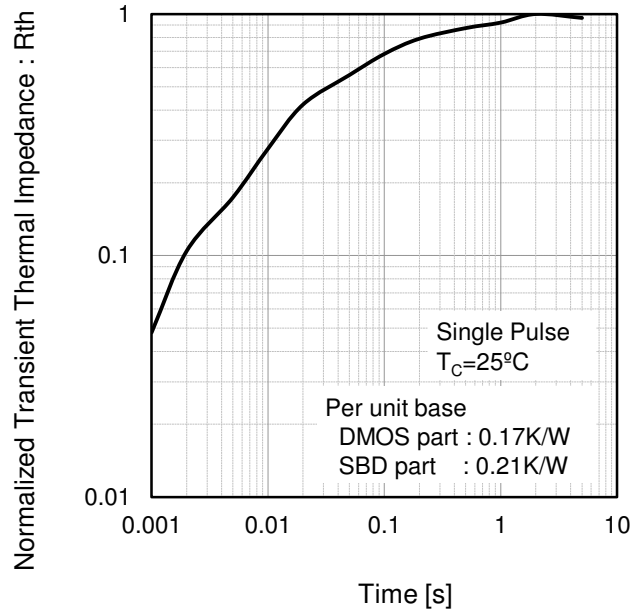


Fig.26 Normalized Transient Thermal Impedance



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