

## IGBT MODULE ( N series )

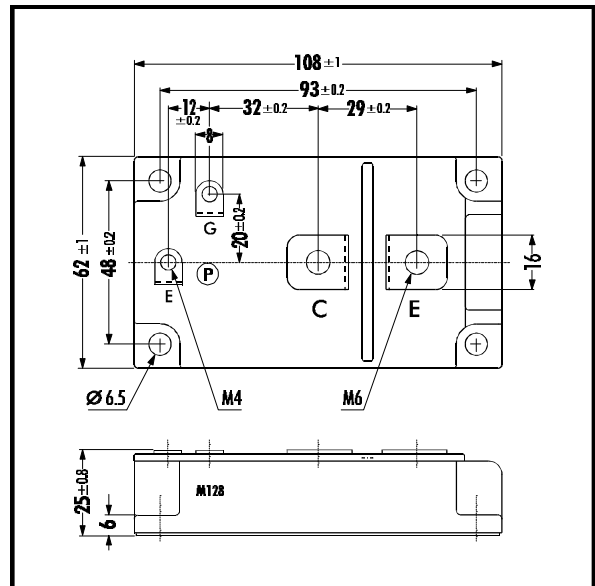
### ■ Features

- Square RBSOA
- Low Saturation Voltage
- Less Total Power Dissipation
- Improved FWD Characteristic
- Minimized Internal Stray Inductance
- Overcurrent Limiting Function (4~5 Times Rated Current)

### ■ Applications

- High Power Switching
- A.C. Motor Controls
- D.C. Motor Controls
- Uninterruptible Power Supply

### ■ Outline Drawing



### ■ Maximum Ratings and Characteristics

#### • Absolute Maximum Ratings ( T<sub>c</sub>=25°C )

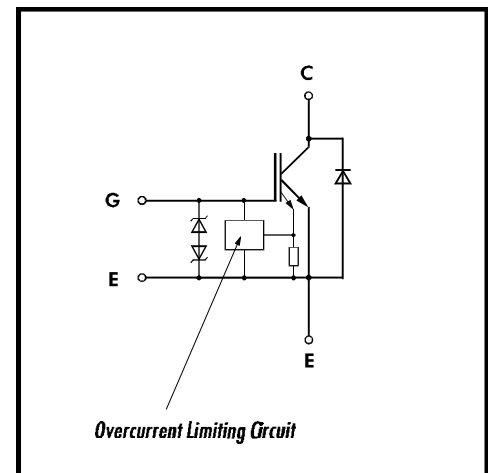
| Items                     | Symbols               | Ratings    | Units |
|---------------------------|-----------------------|------------|-------|
| Collector-Emitter Voltage | V <sub>CES</sub>      | 1200       | V     |
| Gate -Emitter Voltage     | V <sub>GES</sub>      | ± 20       | V     |
| Collector Current         | I <sub>C</sub>        | 400        | A     |
|                           | I <sub>C</sub> PULSE  | 800        |       |
|                           | -I <sub>C</sub>       | 400        |       |
|                           | -I <sub>C</sub> PULSE | 800        |       |
| Max. Power Dissipation    | P <sub>C</sub>        | 3100       | W     |
| Operating Temperature     | T <sub>J</sub>        | +150       | °C    |
| Storage Temperature       | T <sub>stg</sub>      | -40 ~ +125 | °C    |
| Isolation Voltage         | V <sub>is</sub>       | 2500       | V     |
| Screw Torque              | Mounting *1           | 3.5        | Nm    |
|                           | Terminals *2          | 4.5        |       |
|                           | Terminals *3          | 1.7        |       |

Note: \*1:Recommendable Value; 2.5 ~ 3.5 Nm (M5) or (M6)

\*2:Recommendable Value; 3.5 ~ 4.5 Nm (M6)

\*3:Recommendable Value; 1.3 ~ 1.7 Nm (M4)

### ■ Equivalent Circuit



#### • Electrical Characteristics ( at T<sub>J</sub>=25°C )

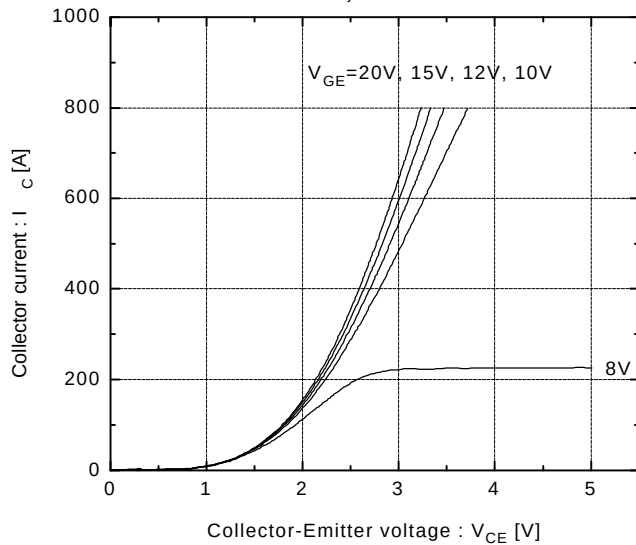
| Items                                | Symbols              | Test Conditions                            | Min. | Typ.  | Max. | Units |
|--------------------------------------|----------------------|--------------------------------------------|------|-------|------|-------|
| Zero Gate Voltage Collector Current  | I <sub>CES</sub>     | V <sub>GE</sub> =0V V <sub>CE</sub> =1200V |      |       | 4.0  | mA    |
| Gate-Emitter Leakage Current         | I <sub>GES</sub>     | V <sub>CE</sub> =0V V <sub>GE</sub> =± 20V |      |       | 60   | μA    |
| Gate-Emitter Threshold Voltage       | V <sub>GE(th)</sub>  | V <sub>GE</sub> =20V I <sub>C</sub> =400mA | 4.5  |       | 7.5  | V     |
| Collector-Emitter Saturation Voltage | V <sub>CE(sat)</sub> | V <sub>GE</sub> =15V I <sub>C</sub> =400A  |      |       | 3.3  | V     |
| Input capacitance                    | C <sub>ies</sub>     | V <sub>GE</sub> =0V                        |      | 64000 |      | pF    |
| Output capacitance                   | C <sub>oes</sub>     | V <sub>CE</sub> =10V                       |      | 23200 |      |       |
| Reverse Transfer capacitance         | C <sub>res</sub>     | f=1MHz                                     |      | 20640 |      |       |
| Turn-on Time                         | t <sub>ON</sub>      | V <sub>CC</sub> =600V                      |      | 0.75  | 1.2  | μs    |
|                                      | t <sub>r</sub>       | I <sub>C</sub> =400A                       |      | 0.25  | 0.6  |       |
| Turn-off Time                        | t <sub>OFF</sub>     | V <sub>GE</sub> =± 15V                     |      | 1.05  | 1.5  |       |
|                                      | t <sub>f</sub>       | R <sub>G</sub> =1.8Ω                       |      | 0.35  | 0.5  |       |
| Diode Forward On-Voltage             | V <sub>F</sub>       | I <sub>F</sub> =400A V <sub>GE</sub> =0V   |      |       | 3.0  | V     |
| Reverse Recovery Time                | t <sub>rr</sub>      | I <sub>F</sub> =400A                       |      |       | 350  | ns    |

#### • Thermal Characteristics

| Items              | Symbols              | Test Conditions       | Min. | Typ.   | Max. | Units |
|--------------------|----------------------|-----------------------|------|--------|------|-------|
| Thermal Resistance | R <sub>th(j-c)</sub> | IGBT                  |      |        | 0.04 | °C/W  |
|                    | R <sub>th(f-c)</sub> | Diode                 |      |        | 0.12 |       |
|                    | R <sub>th(c-f)</sub> | With Thermal Compound |      | 0.0125 |      |       |

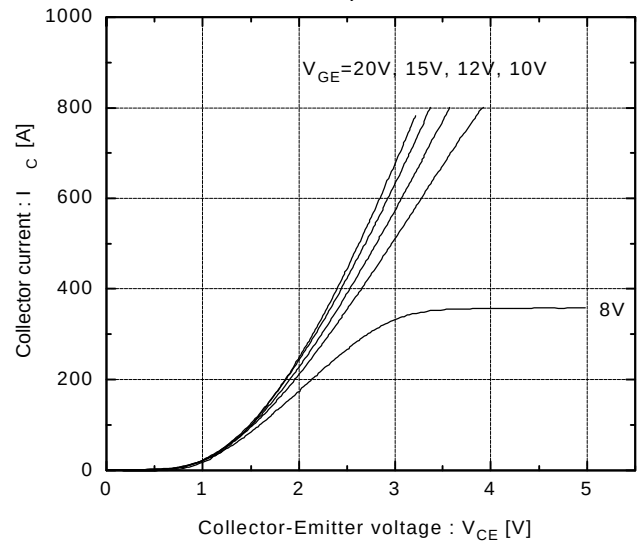
Collector current vs. Collector-Emittter voltage

$T_J=25^{\circ}\text{C}$



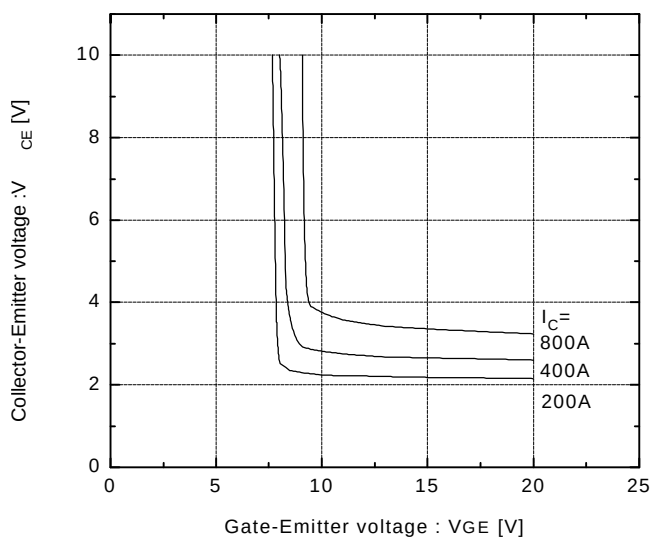
Collector current vs. Collector-Emittter voltage

$T_J=125^{\circ}\text{C}$



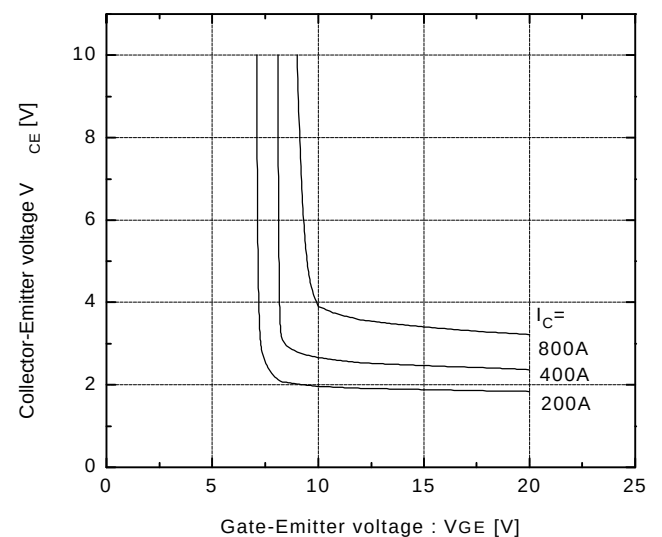
Collector-Emittter vs. Gate-Emittter voltage

$T_J=25^{\circ}\text{C}$

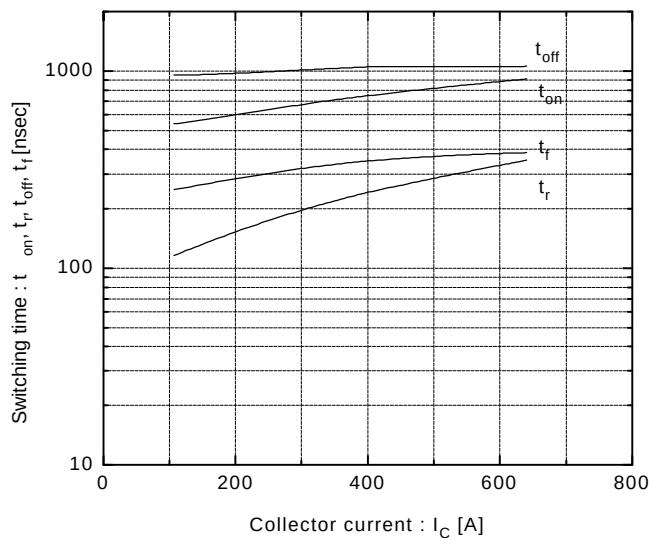


Collector-Emittter vs. Gate-Emittter voltage

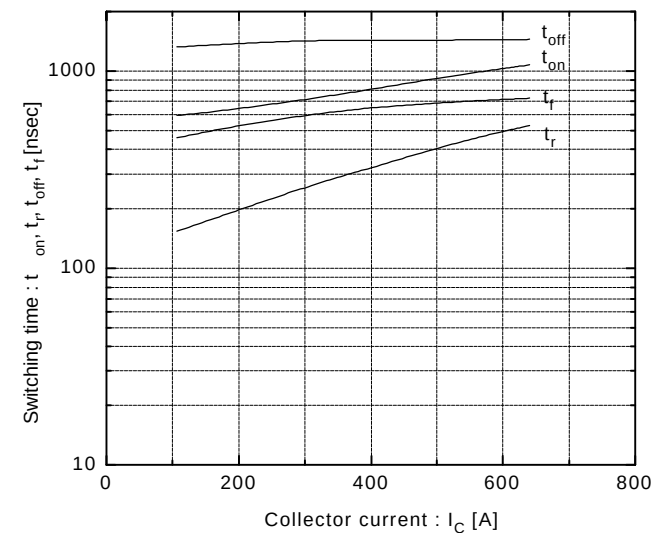
$T_J=125^{\circ}\text{C}$



Switching time vs. Collector current  
 $V_{CC}=600\text{V}, R_G=1.8\Omega, V_{GE}\pm 15\text{V}, T_J=25^{\circ}\text{C}$

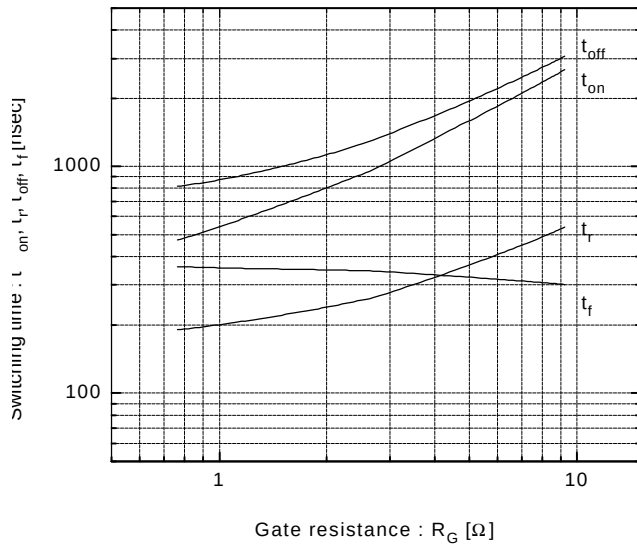


Switching time vs. Collector current  
 $V_{CC}=600\text{V}, R_G=1.8\Omega, V_{GE}\pm 15\text{V}, T_J=125^{\circ}\text{C}$



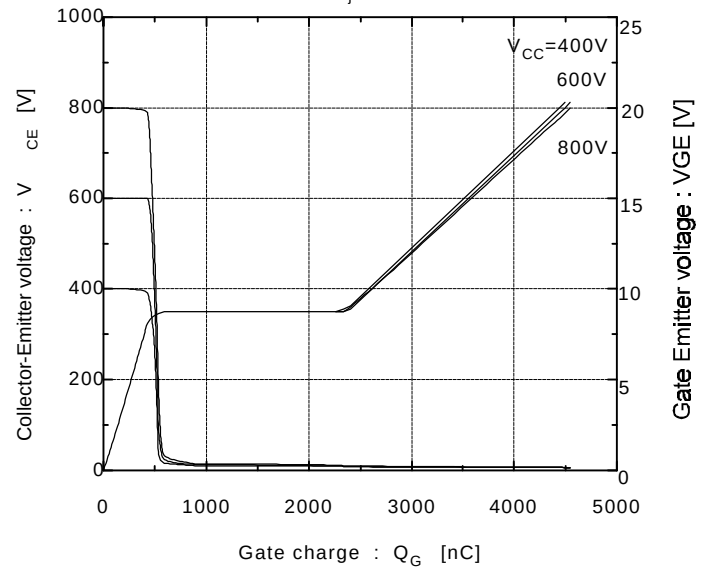
Switching time vs.  $R_G$

$V_{CC}=600V$ ,  $I_C=400A$ ,  $V_{GE}=\pm 15V$ ,  $T_J=25^\circ C$



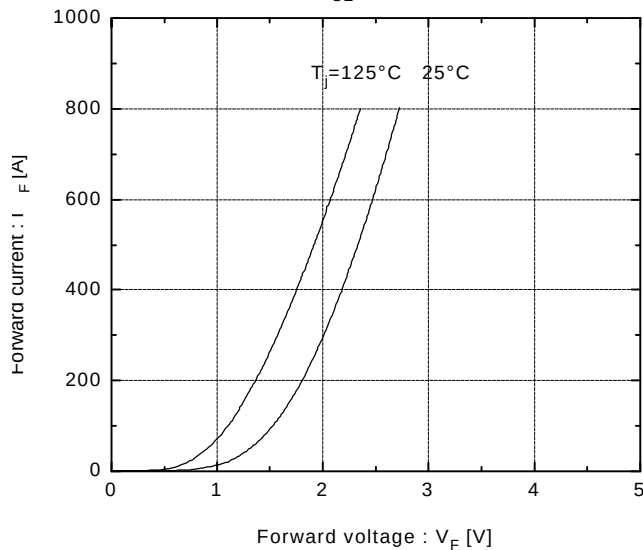
Dynamic input characteristics

$T_J=25^\circ C$



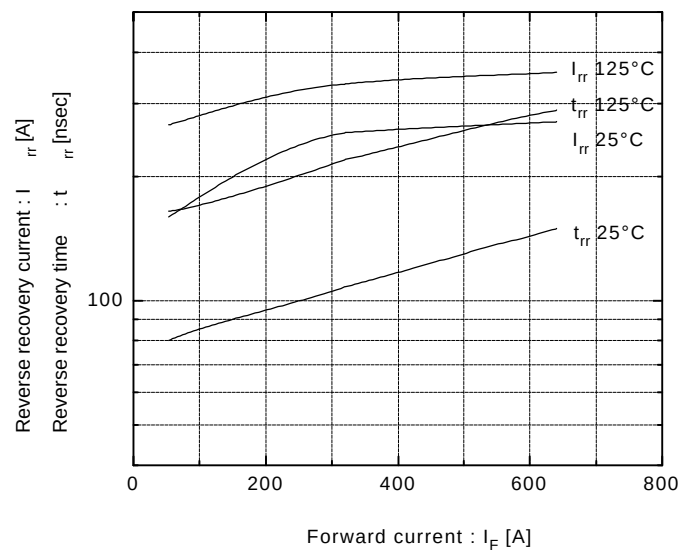
Forward current vs. Forward voltage

$V_{GE}=0V$

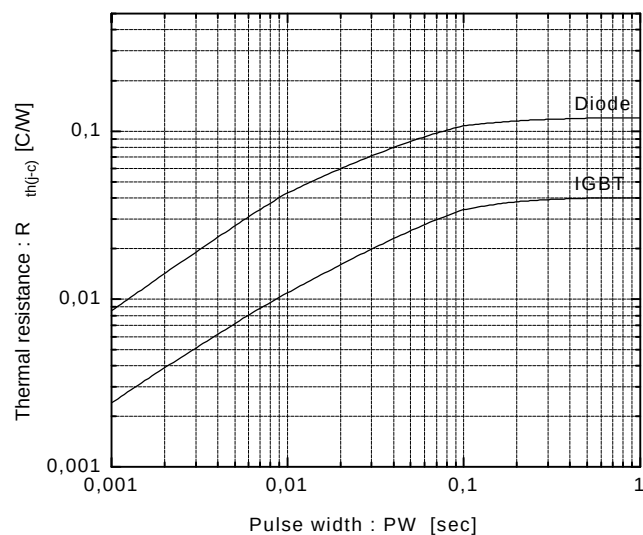


Reverse recovery characteristics

$t_{rr}$ ,  $I_{rr}$  vs.  $I_F$

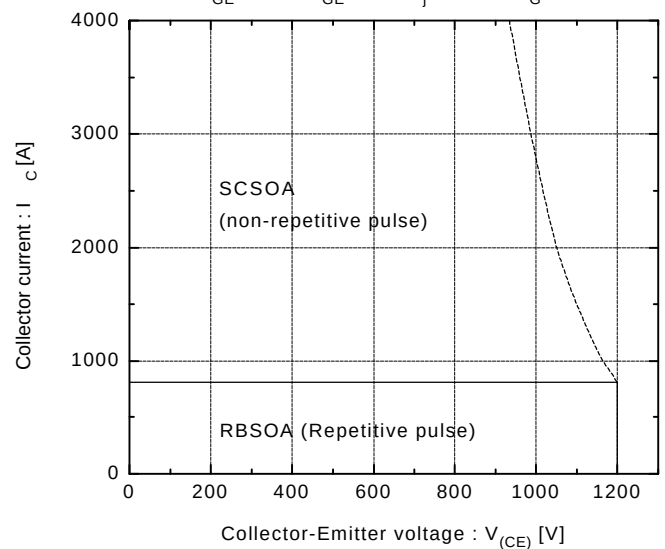


Transient thermal resistance

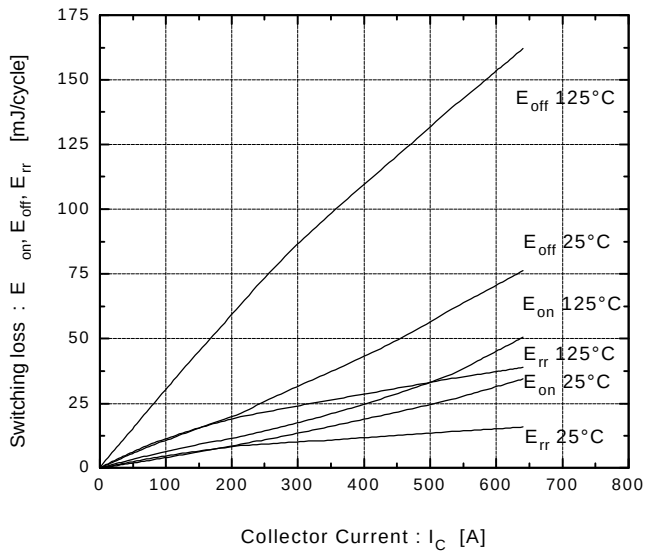


Reversed biased safe operating area

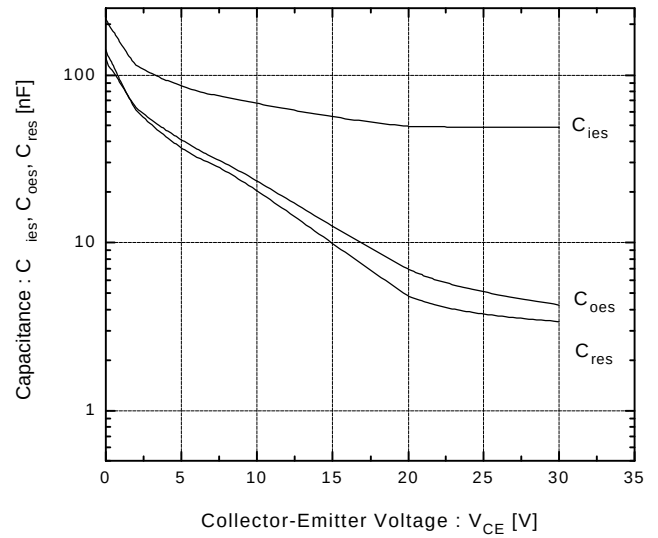
$+V_{GE}=15V$ ,  $-V_{GE}\leq 15V$ ,  $T_J\leq 125^\circ C$ ,  $R_G\geq 1.8\Omega$



Switching loss vs. Collector current

 $V_{CC}=600V, R_G=1.8\Omega, V_{GE}=\pm 15V$ 


Capacitance vs. Collector-Emitter voltage

 $T_J=25^\circ C$ 


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