

### IGBT MODULE (U series) 600V / 50A / PIM



#### ■ Features

- Low  $V_{CE(sat)}$
- Compact Package
- P.C. Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit

#### ■ Applications

- Inverter for Motoe Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply

#### ■ Maximum ratings and characteristics

● Absolute maximum ratings ( $T_c=25^{\circ}\text{C}$  unless otherwise specified)

| Item                           |                                     | Symbol                | Condition                   | Rating      | Unit             |
|--------------------------------|-------------------------------------|-----------------------|-----------------------------|-------------|------------------|
| Inverter                       | Collector-Emitter voltage           | V <sub>CES</sub>      |                             | 600         | V                |
|                                | Gate-Emitter voltage                | V <sub>GES</sub>      |                             | ±20         | V                |
|                                | Collector current                   | I <sub>C</sub>        | Continuous                  | 50          | A                |
|                                |                                     | I <sub>CP</sub>       | 1ms                         | 100         |                  |
|                                |                                     | -I <sub>C</sub>       |                             | 50          |                  |
|                                |                                     | -I <sub>C</sub> pulse | 1ms                         | 100         |                  |
| Collector power dissipation    | P <sub>C</sub>                      | 1 device              | 187                         | W           |                  |
| Brake                          | Collector-Emitter voltage           | V <sub>CES</sub>      |                             | 600         | V                |
|                                | Gate-Emitter voltage                | V <sub>GES</sub>      |                             | ±20         | V                |
|                                | Collector current                   | I <sub>C</sub>        | Continuous                  | 20          | A                |
|                                |                                     | I <sub>CP</sub>       | 1ms                         | 40          | A                |
|                                | Collector power dissipation         | P <sub>C</sub>        | 1 device                    | 104         | W                |
|                                | Repetitive peak reverse voltage     | V <sub>RRM</sub>      |                             | 600         | V                |
| Converter                      | Repetitive peak reverse voltage     | V <sub>RRM</sub>      |                             | 800         | V                |
|                                | Average output current              | I <sub>O</sub>        | 50Hz/60Hz sine wave         | 50          | A                |
|                                | Surge current (Non-Repetitive)      | I <sub>FSM</sub>      | T <sub>J</sub> =150°C, 10ms | 350         | A                |
|                                | I <sup>2</sup> t (Non-Repetitive)   | P <sub>t</sub>        | half sine wave              | 613         | A <sup>2</sup> s |
| Operating junction temperature |                                     | T <sub>J</sub>        |                             | +150        | °C               |
| Storage temperature            |                                     | T <sub>slg</sub>      |                             | -40 to +125 | °C               |
| Isolation voltage              | between terminal and copper base *2 | V <sub>iso</sub>      | AC : 1 minute               | AC 2500     | V                |
|                                | between thermistor and others *3    |                       |                             | AC 2500     |                  |
| Mounting screw torque          |                                     |                       |                             | 3.5 *1      | N·m              |

\*1 Recommendable value : 2.5 to 3.5 N·m (M5)

\*2 All terminals should be connected together when isolation test will be done.

\*3 Two thermistor terminals should be connected together, each other terminals should be connected together and shorted to base plate when isolation test will be done.

● Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified)

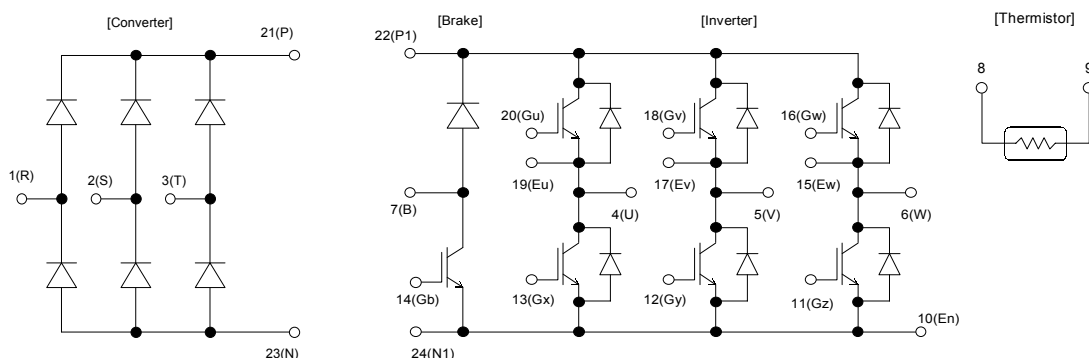
| Item                  |                                      | Symbol                 | Condition                      |          | Characteristics |      |      | Unit |
|-----------------------|--------------------------------------|------------------------|--------------------------------|----------|-----------------|------|------|------|
|                       |                                      |                        |                                |          | Min.            | Typ. | Max. |      |
| Inverter              | Zero gate voltage collector current  | ICES                   | VCE=600V, VGE=0V               |          | -               | -    | 1.0  | mA   |
|                       | Gate-Emitter leakage current         | IGES                   | VCE=0V, VGE=±20V               |          | -               | -    | 200  | nA   |
|                       | Gate-Emitter threshold voltage       | VGE(th)                | VCE=20V, Ic=50mA               |          | 6.2             | 6.7  | 7.7  | V    |
|                       | Collector-Emitter saturation voltage | VCE(sat)<br>(terminal) | VGE=15V<br>Ic=50A              | Tj=25°C  | -               | 2.25 | 2.55 | V    |
|                       |                                      |                        |                                | Tj=125°C | -               | 2.45 | -    |      |
|                       |                                      | VCE(sat)<br>(chip)     |                                | Tj=25°C  | -               | 1.85 | -    |      |
|                       |                                      |                        |                                | Tj=125°C | -               | 2.15 | -    |      |
|                       | Input capacitance                    | Cies                   | VGE=0V, VCE=10V, f=1MHz        |          | -               | 3.6  | -    | nF   |
|                       | Turn-on time                         | ton                    | VCC=300V<br>Ic=50A<br>VGE=±15V |          | -               | 0.42 | 1.20 | μs   |
|                       |                                      | tr                     |                                |          | -               | 0.24 | 0.60 |      |
|                       |                                      | tr(i)                  |                                |          | -               | 0.05 | -    |      |
|                       | Turn-off time                        | toff                   | RG=68Ω                         |          | -               | 0.42 | 1.20 |      |
|                       |                                      | tf                     |                                |          | -               | 0.03 | 0.45 |      |
|                       | Forward on voltage                   | VF<br>(terminal)       | VGE=0V<br>IF=50A               | Tj=25°C  | -               | 2.00 | 2.35 | V    |
| Tj=125°C              |                                      |                        |                                | -        | 2.05            | -    |      |      |
| VF<br>(chip)          |                                      | Tj=25°C                |                                | -        | 1.60            | -    |      |      |
|                       |                                      | Tj=125°C               |                                | -        | 1.65            | -    |      |      |
| Reverse recovery time | trr                                  | IF=50A                 |                                | -        | -               | 0.35 | μs   |      |
| Brake                 | Zero gate voltage collector current  | ICES                   | VCE=600V, VGE=0V               |          | -               | -    | 1.0  | mA   |
|                       | Gate-Emitter leakage current         | IGES                   | VCE=0V, VGE=±20V               |          | -               | -    | 200  | nA   |
|                       | Collector-Emitter saturation voltage | VCE(sat)<br>(terminal) | Ic=20A<br>VGE=15V              | Tj=25°C  | -               | 1.85 | 2.15 | V    |
|                       |                                      |                        |                                | Tj=125°C | -               | 2.15 | -    |      |
|                       |                                      | VCE(sat)<br>(chip)     |                                | Tj=25°C  | -               | 1.70 | -    |      |
|                       |                                      |                        |                                | Tj=125°C | -               | 2.00 | -    |      |
|                       | Turn-on time                         | ton                    | VCC=300V<br>Ic=20A<br>VGE=±15V |          | -               | 0.45 | 1.20 | μs   |
|                       |                                      | tr                     |                                |          | -               | 0.15 | 0.60 |      |
|                       | Turn-off time                        | toff                   | RG=270Ω                        |          | -               | 0.37 | 1.20 |      |
|                       |                                      | tf                     |                                |          | -               | 0.04 | 0.45 |      |
| Reverse current       | IRRM                                 | VR=600V                |                                | -        | -               | 1.0  | mA   |      |
| Converter             | Forward on voltage                   | VFM                    | IF=50A                         | terminal | -               | 1.20 | 1.50 | V    |
|                       |                                      |                        | VGE=0V                         | chip     | -               | 1.10 | -    |      |
|                       | Reverse current                      | IRRM                   | VR=800V                        |          | -               | -    | 1.0  | mA   |
| Thermistor            | Resistance                           | R                      | T=25°C                         |          | -               | 5000 | -    | Ω    |
|                       |                                      |                        | T=100°C                        |          | 465             | 495  | 520  |      |
|                       | B value                              | B                      | T=25/50°C                      |          | 3305            | 3375 | 3450 | K    |

● Thermal resistance Characteristics

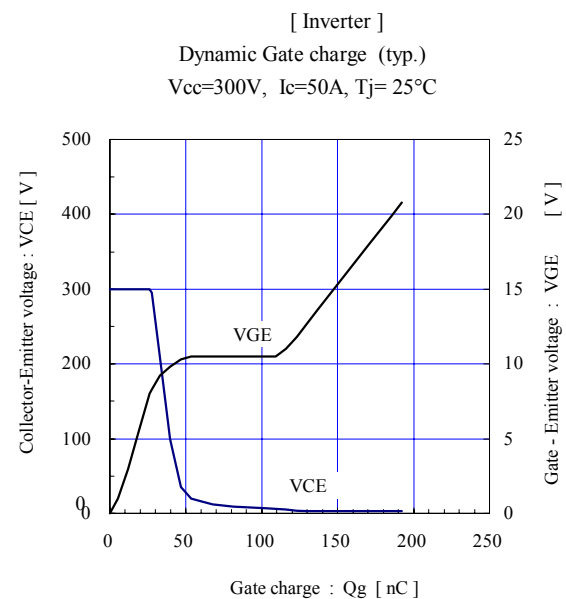
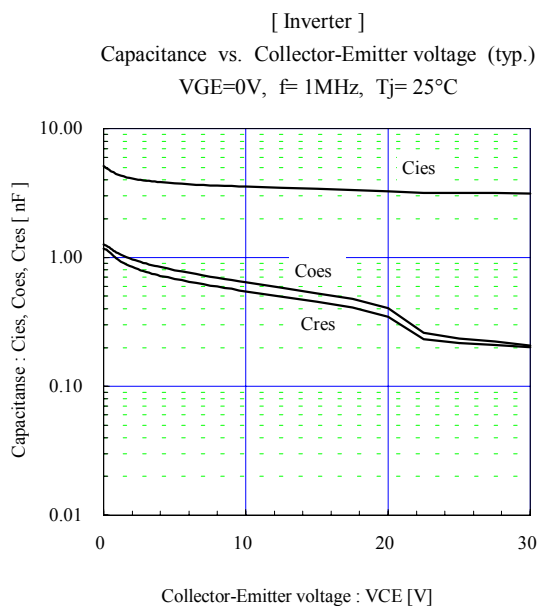
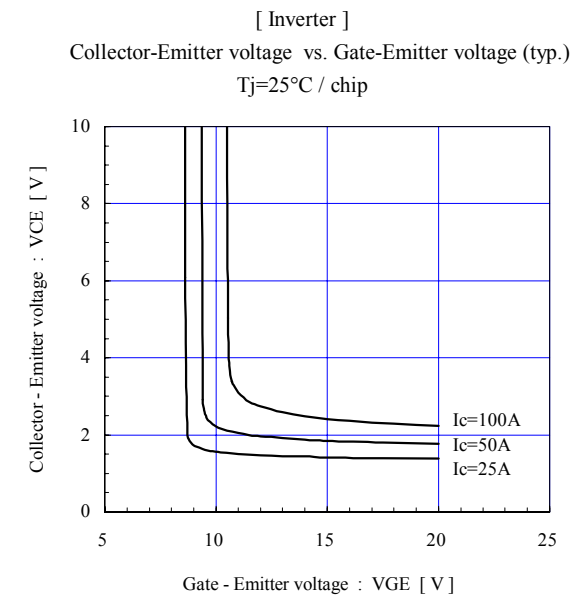
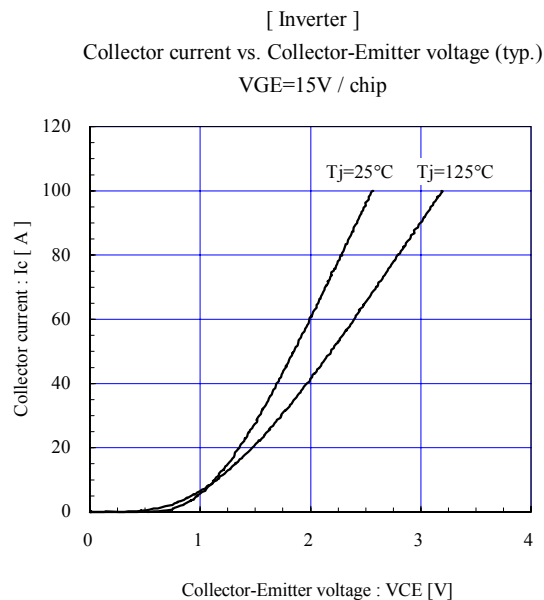
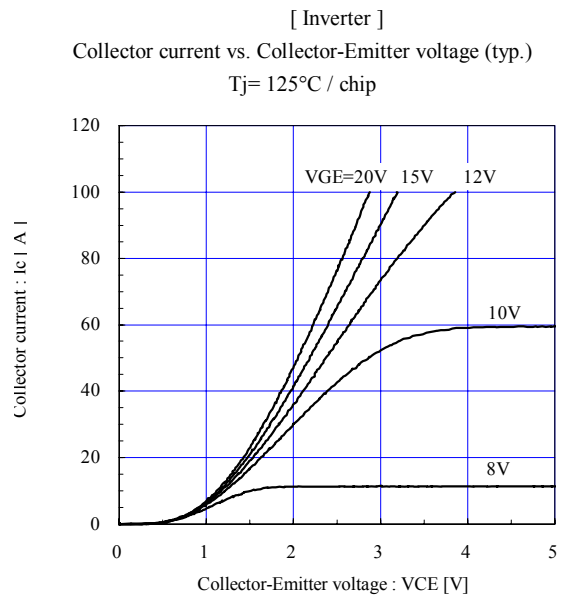
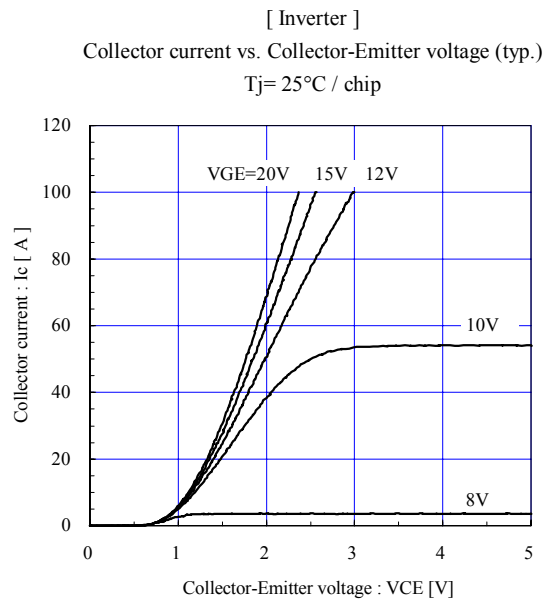
| Item                            | Symbol               | Condition             | Characteristics |      |      | Unit |
|---------------------------------|----------------------|-----------------------|-----------------|------|------|------|
|                                 |                      |                       | Min.            | Typ. | Max. |      |
| Thermal resistance ( 1 device ) | R <sub>th(j-c)</sub> | Inverter IGBT         | -               | -    | 0.67 | °C/W |
|                                 |                      | Inverter FWD          | -               | -    | 1.10 |      |
|                                 |                      | Brake IGBT            | -               | -    | 1.20 |      |
|                                 |                      | Converter Diode       | -               | -    | 0.82 |      |
| Contact thermal resistance *    | R <sub>th(c-f)</sub> | With thermal compound | -               | 0.05 |      |      |

\* This is the value which is defined mounting on the additional cooling fin with thermal compound

■ Equivalent Circuit Schematic

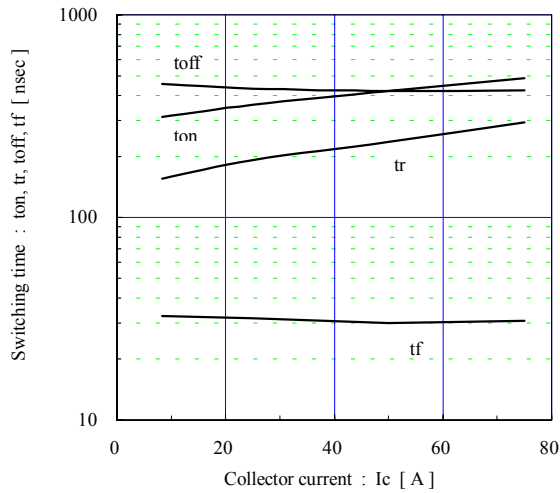


## ■ Characteristics (Representative)



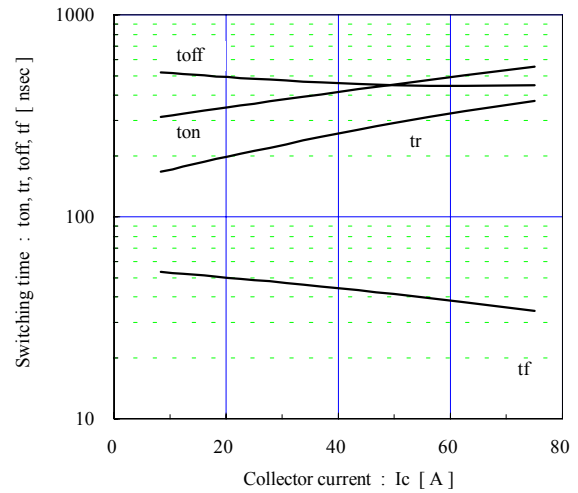
[ Inverter ]

Switching time vs. Collector current (typ.)  
 $V_{cc}=300V$ ,  $V_{GE}=\pm 15V$ ,  $R_g=68\Omega$ ,  $T_j=25^\circ C$



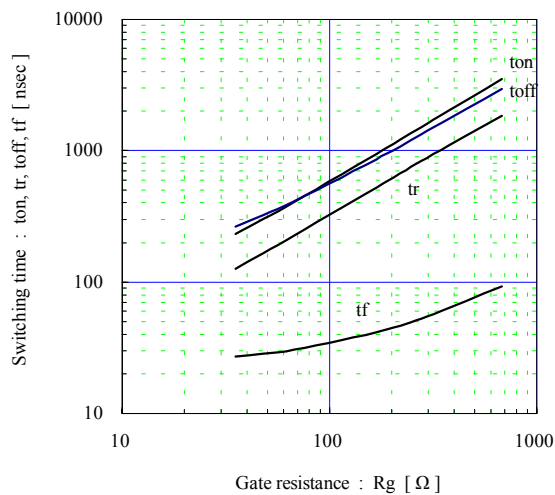
[ Inverter ]

Switching time vs. Collector current (typ.)  
 $V_{cc}=300V$ ,  $V_{GE}=\pm 15V$ ,  $R_g=68\Omega$ ,  $T_j=125^\circ C$



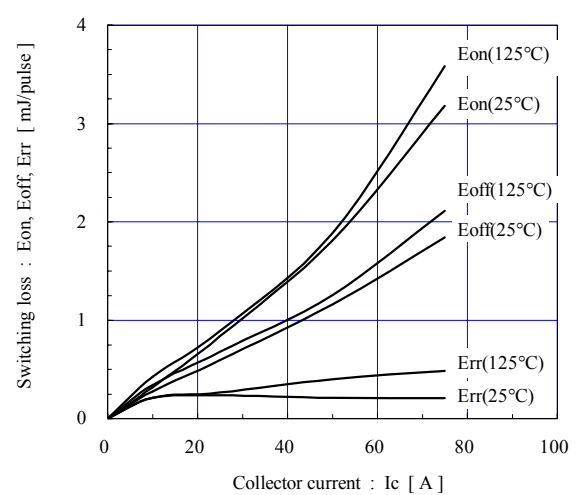
[ Inverter ]

Switching time vs. Gate resistance (typ.)  
 $V_{cc}=300V$ ,  $I_c=50A$ ,  $V_{GE}=\pm 15V$ ,  $T_j=25^\circ C$



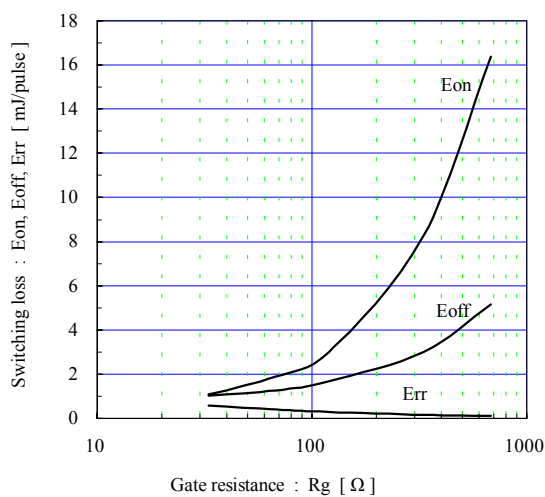
[ Inverter ]

Switching loss vs. Collector current (typ.)  
 $V_{cc}=300V$ ,  $V_{GE}=\pm 15V$ ,  $R_g=68\Omega$



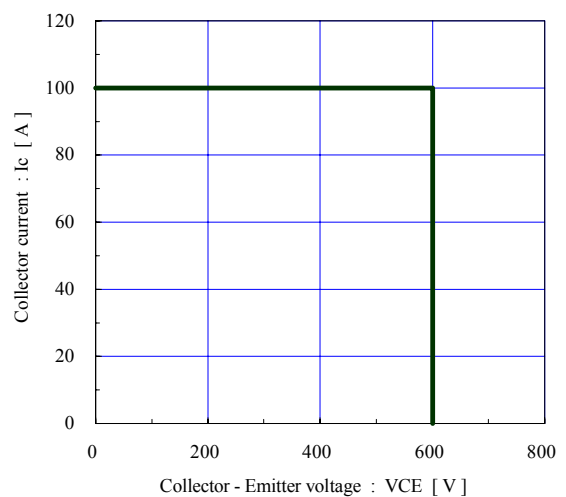
[ Inverter ]

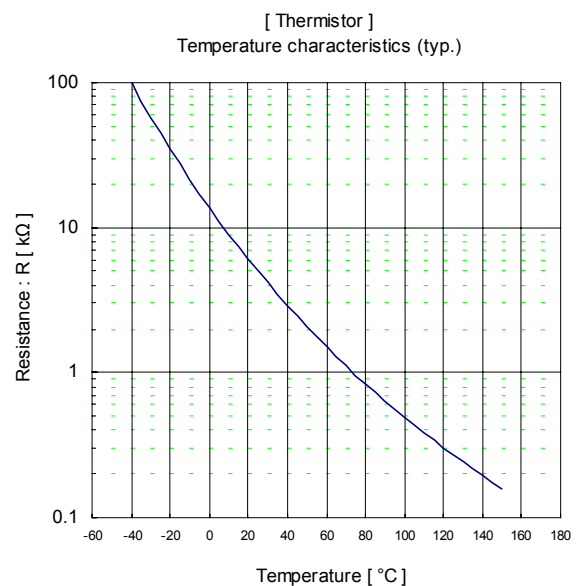
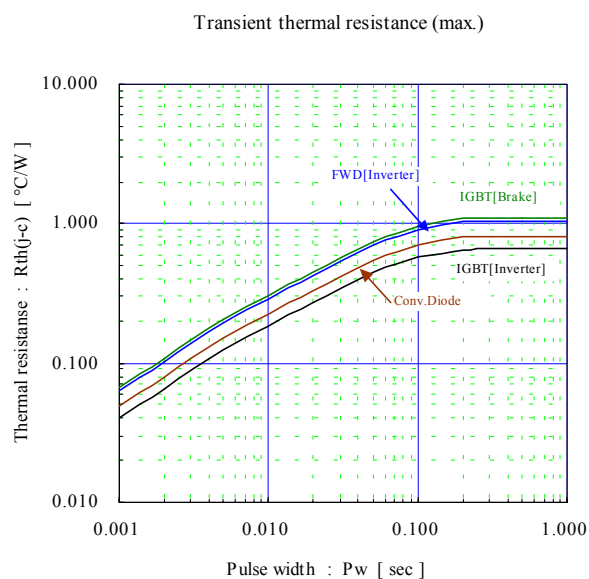
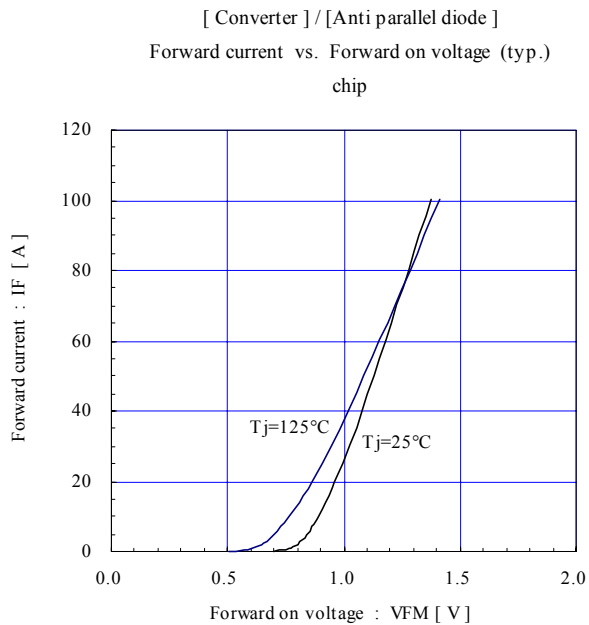
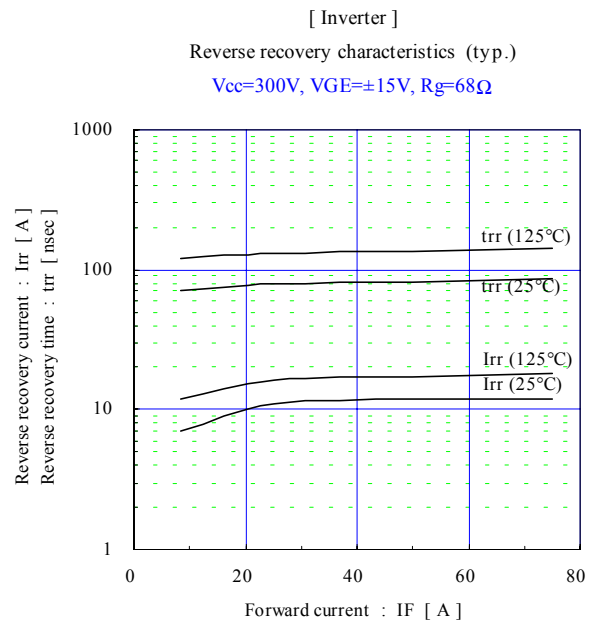
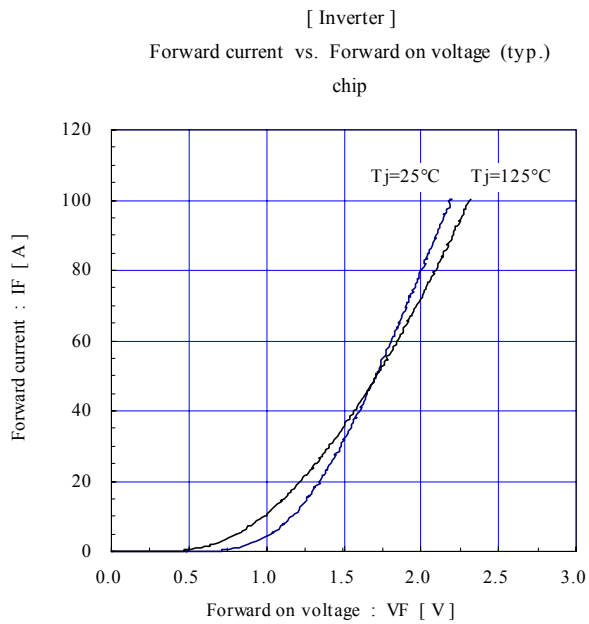
Switching loss vs. Gate resistance (typ.)  
 $V_{cc}=300V$ ,  $I_c=50A$ ,  $V_{GE}=\pm 15V$ ,  $T_j=125^\circ C$

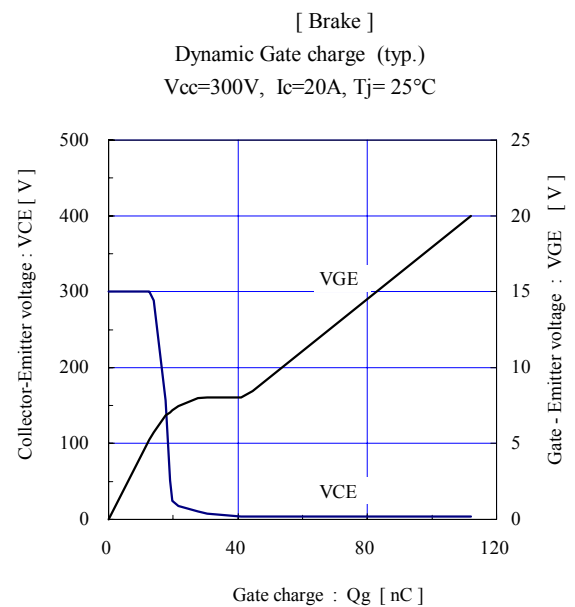
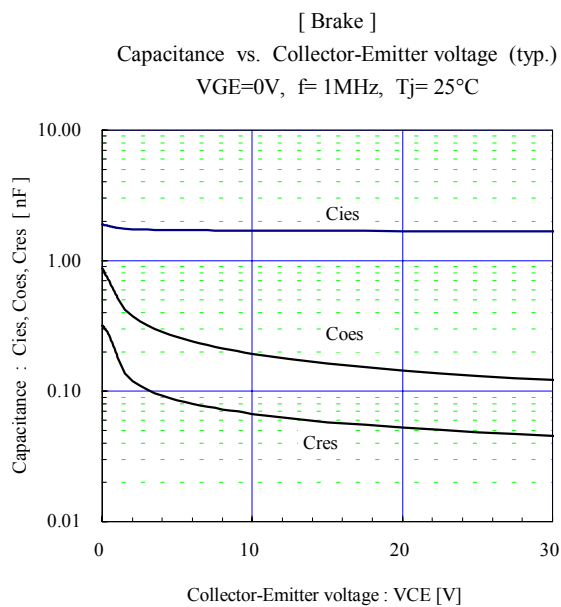
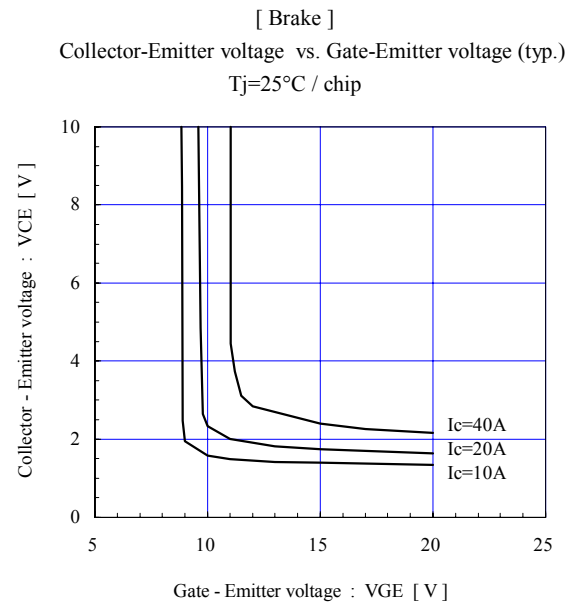
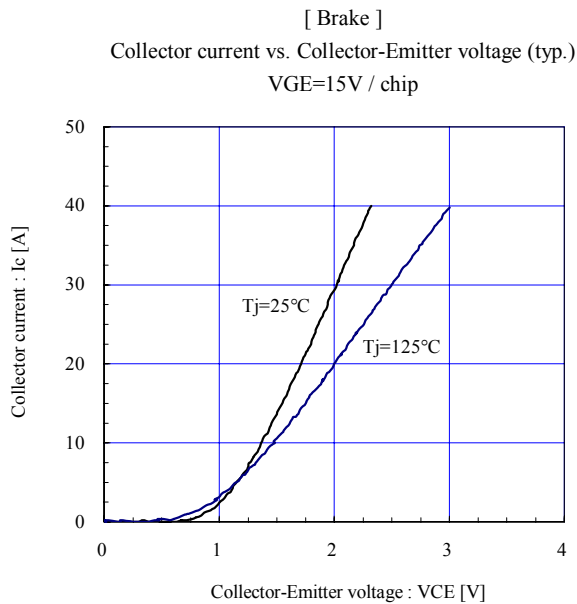
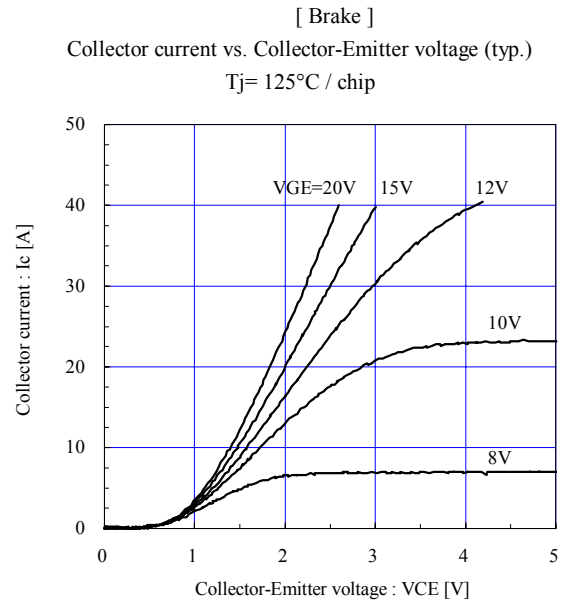
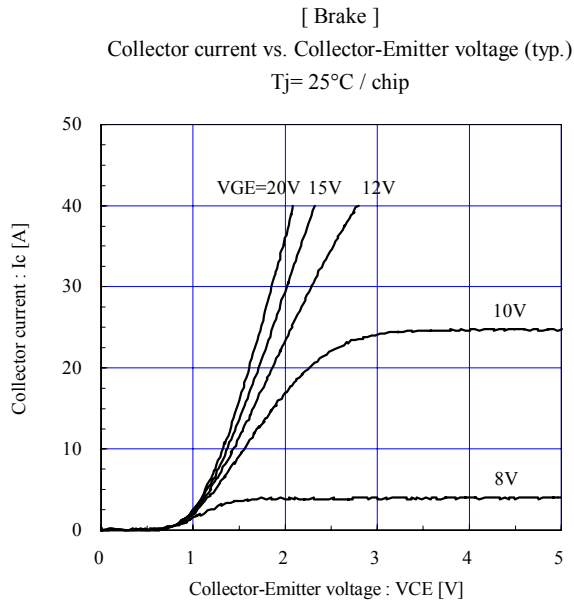


[ Inverter ]

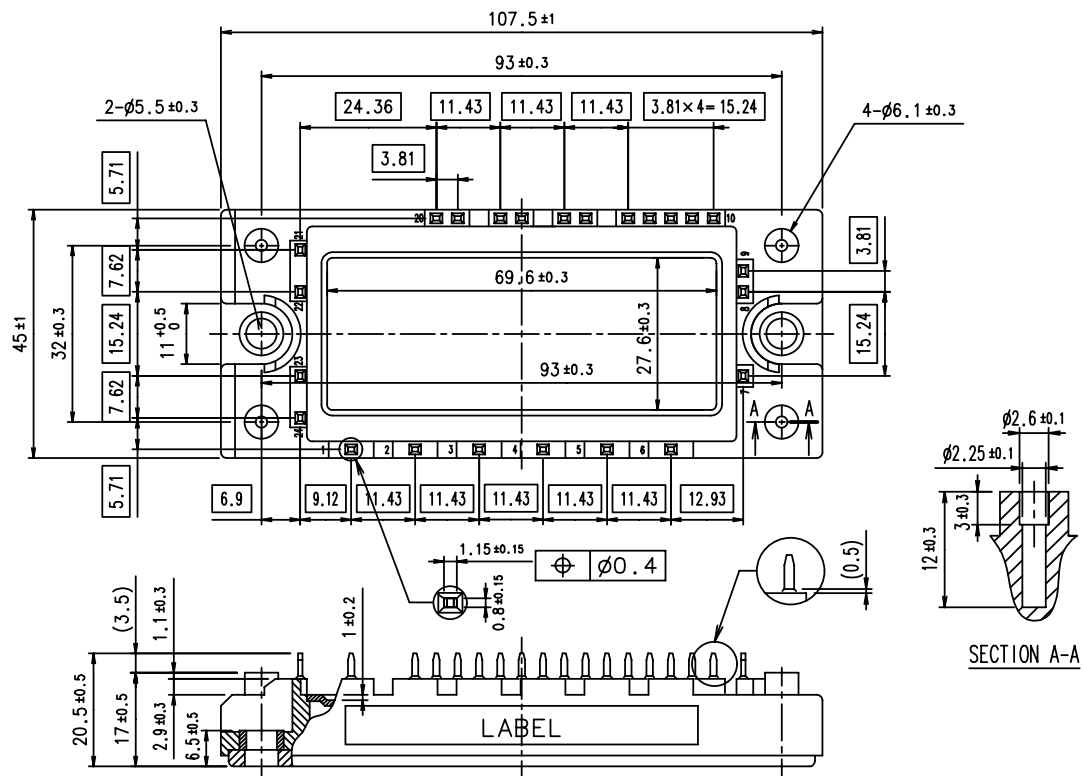
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V$ ,  $-V_{GE} \leq 15V$ ,  $R_g \geq 68\Omega$ ,  $T_j \leq 125^\circ C$







# ■ Outline Drawings, mm



□ shows theoretical dimension.  
 ( ) shows reference dimension.