# IGBT MODULE (U series)
# 600V / 75A / 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 (Tc=25°C unless otherwise specified)**

| Item | | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|---|
| Inverter | Collector-Emitter voltage | $V_{CES}$ | | 600 | V |
| | Gate-Emitter voltage | $V_{GES}$ | | ±20 | V |
| | Collector current | $I_C$ | Continuous | 75 | A |
| | | $I_{CP}$ | 1ms | 150 | |
| | | -$I_C$ | | 75 | |
| | | -$I_C$ pulse | 1ms | 150 | |
| | Collector power disspation | $P_C$ | 1 device | 255 | W |
| Brake | Collector-Emitter voltage | $V_{CES}$ | | 600 | V |
| | Gate-Emitter voltage | $V_{GES}$ | | ±20 | V |
| | Collector current | $I_C$ | Continuous | 30 | A |
| | | $I_{CP}$ | 1ms | 60 | A |
| | Collector power disspation | $P_C$ | 1 device | 133 | W |
| | Repetitive peak reverse voltage | $V_{RRM}$ | | 600 | V |
| Converter | Repetitive peak reverse voltage | $V_{RRM}$ | | 800 | V |
| | Average output current | $I_O$ | 50Hz/60Hz sine wave | 75 | A |
| | Surge current (Non-Repetitive) | $I_{FSM}$ | Tj=150°C, 10ms | 525 | A |
| | $I^2t$ (Non-Repetitive) | $I^2t$ | half sine wave | 1378 | $A^2s$ |
| Operating junction temperature | | $T_j$ | | +150 | ℃ |
| Storage temperature | | $T_{stg}$ | | -40 to +125 | ℃ |
| Isolation voltage | between terminal and copper base *2 | $V_{iso}$ | AC : 1 minute | AC 2500 | V |
| | between thermistor and others *3 | | | AC 2500 | V |
| 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 (Tj=25°C unless otherwise specified)**

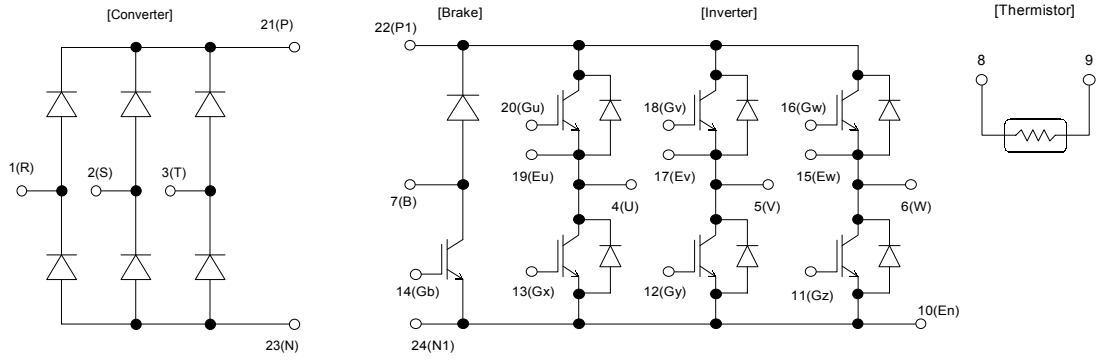
| Item | | Symbol | Condition | | Characteristics Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Inverter | Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=600V, $V_{GE}$=0V | | - | - | 1.0 | mA |
| | Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | - | - | 200 | nA |
| | Gate-Emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$=20V, $I_C$=75mA | | 6.2 | 6.7 | 7.7 | V |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE}$=15V, $I_C$=75A | Tj=25°C | - | 2.20 | 2.50 | V |
| | | | | Tj=125°C | - | 2.40 | - | |
| | | $V_{CE(sat)}$ (chip) | | Tj=25°C | - | 1.85 | - | |
| | | | | Tj=125°C | - | 2.15 | - | |
| | Input capacitance | $C_{ies}$ | $V_{GE}$=0V, $V_{CE}$=10V, f=1MHz | | - | 5.4 | - | nF |
| | Turn-on time | $t_{on}$ | $V_{CC}$=300V, $I_C$=75A, $V_{GE}$=±15V, $R_G$=47Ω | | - | 0.42 | 1.20 | µs |
| | | $t_r$ | | | - | 0.24 | 0.60 | |
| | | $t_{r(i)}$ | | | - | 0.05 | - | |
| | Turn-off time | $t_{off}$ | | | - | 0.42 | 1.20 | |
| | | $t_f$ | | | - | 0.03 | 0.45 | |
| | Forward on voltage | $V_F$ (terminal) | $V_{GE}$=0V, $I_F$=75A | Tj=25°C | - | 1.95 | 2.30 | V |
| | | | | Tj=125°C | - | 2.00 | - | |
| | | $V_F$ (chip) | | Tj=25°C | - | 1.60 | - | |
| | | | | Tj=125°C | - | 1.65 | - | |
| | Reverse recovery time | $t_{rr}$ | $I_F$=75A | | - | - | 0.35 | µs |
| Brake | Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=600V, $V_{GE}$=0V | | - | - | 1.0 | mA |
| | Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | - | - | 200 | nA |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $I_C$=30A, $V_{GE}$=15V | Tj=25°C | - | 2.00 | 2.30 | V |
| | | | | Tj=125°C | - | 2.30 | - | |
| | | $V_{CE(sat)}$ (chip) | | Tj=25°C | - | 1.85 | - | |
| | | | | Tj=125°C | - | 2.15 | - | |
| | Turn-on time | $t_{on}$ | $V_{CC}$=300V, $I_C$=30A, $V_{GE}$=±15V, $R_G$=120Ω | | - | 0.42 | 1.20 | µs |
| | | $t_r$ | | | - | 0.24 | 0.60 | |
| | Turn-off time | $t_{off}$ | | | - | 0.42 | 1.20 | |
| | | $t_f$ | | | - | 0.03 | 0.45 | |
| | Reverse current | $I_{RRM}$ | $V_R$=600V | | - | - | 1.0 | mA |
| Converter | Forward on voltage | $V_{FM}$ | $I_F$=75A | terminal | - | 1.20 | 1.50 | V |
| | | | $V_{GE}$=0V | chip | - | 1.10 | - | |
| | Reverse current | $I_{RRM}$ | $V_R$=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 Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Thermal resistance ( 1 device ) | Rth(j-c) | Inverter IGBT | - | - | 0.49 | °C/W |
| | | Inverter FWD | - | - | 0.79 | |
| | | Brake IGBT | - | - | 0.94 | |
| | | Converter Diode | - | - | 0.66 | |
| Contact thermal resistance * | Rth(c-f) | With thermal compound | - | 0.05 | - | |

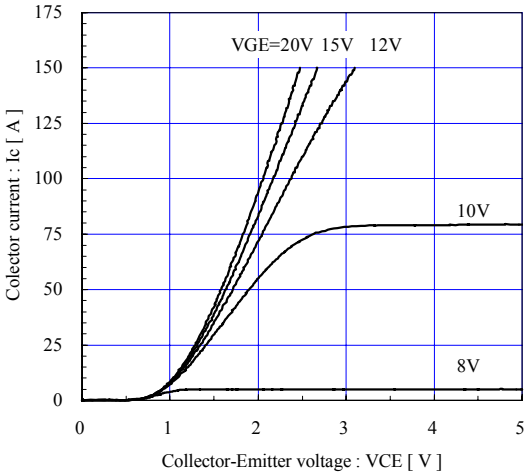
* This is the value which is defined mounting on the additional cooling fin with thermal compound

## ■ Equivalent Circuit Schematic

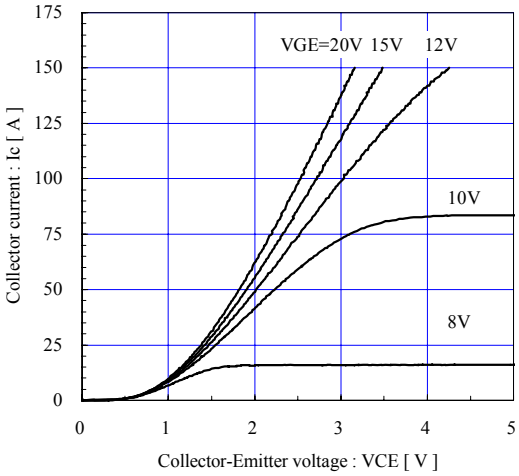


## ■ Characteristics (Representative)

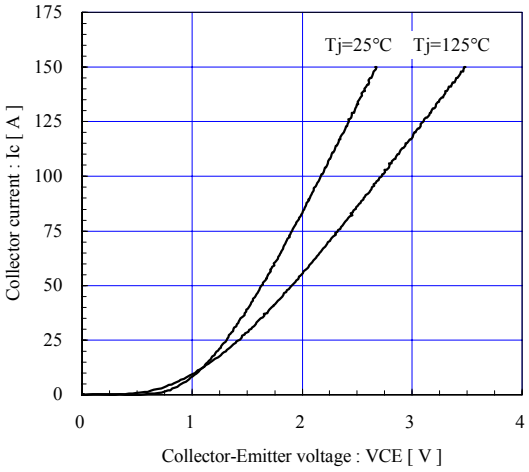
[ Inverter ]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 25°C / chip



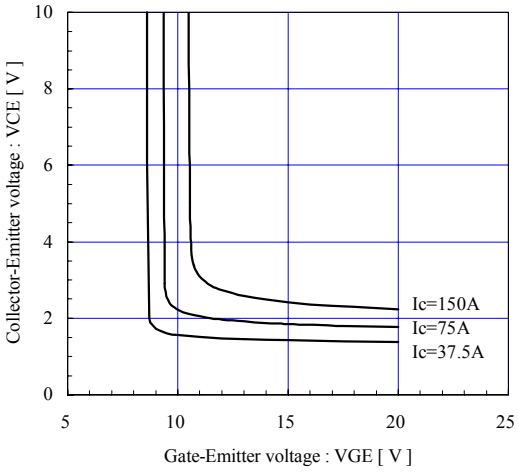

[ Inverter ]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 125°C / chip



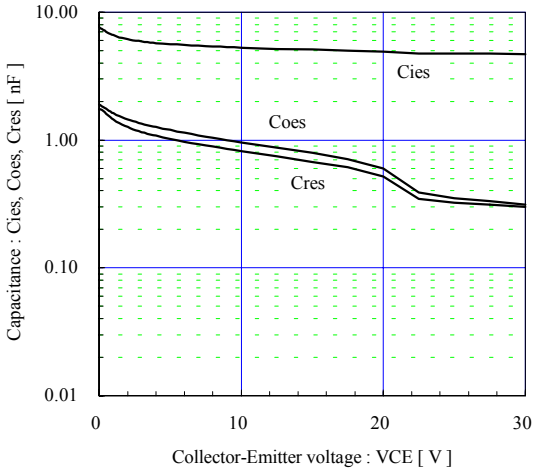

[ Inverter ]
Collector current vs. Collector-Emitter voltage (typ.)
VGE=15V / chip



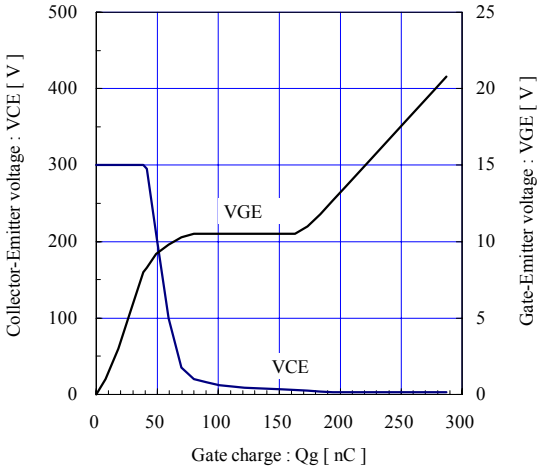

[ Inverter ]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
Tj=25°C / chip



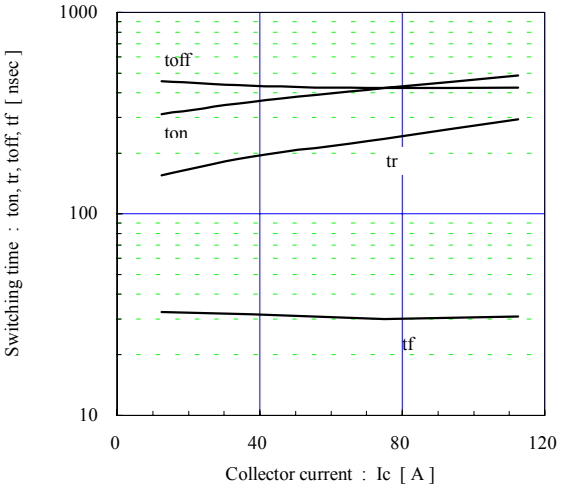

[ Inverter ]
Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f= 1MHz, Tj= 25°C



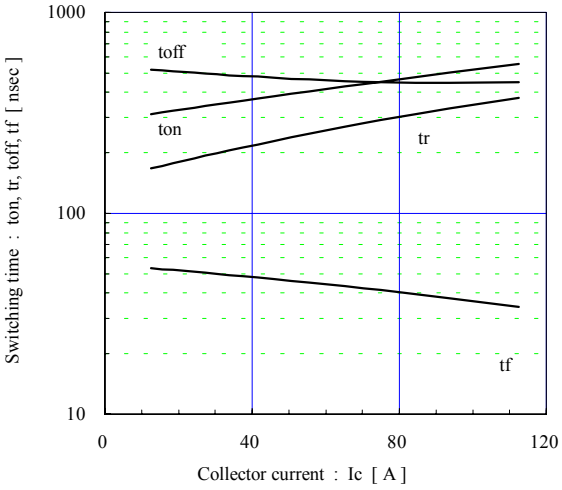

[ Inverter ]
Dynamic Gate charge (typ.)
Vcc=300V, Ic=75A, Tj= 25°C



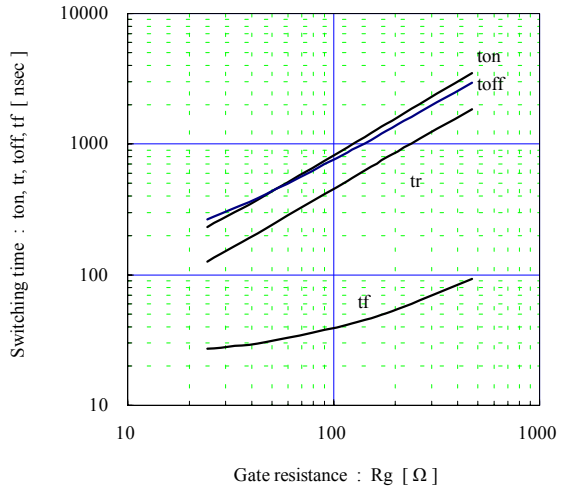
[ Inverter ]
Switching time vs. Collector current (typ.)
Vcc=300V, VGE=±15V, Rg=47Ω,, Tj= 25°C



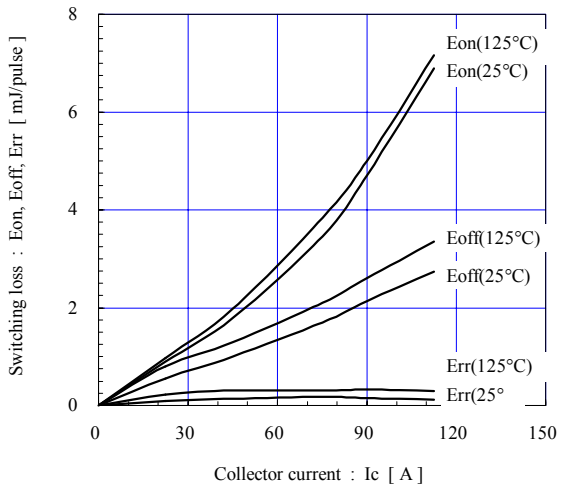

[ Inverter ]
Switching time vs. Collector current (typ.)
Vcc=300V, VGE=±15V, Rg=47Ω, Tj=125°C



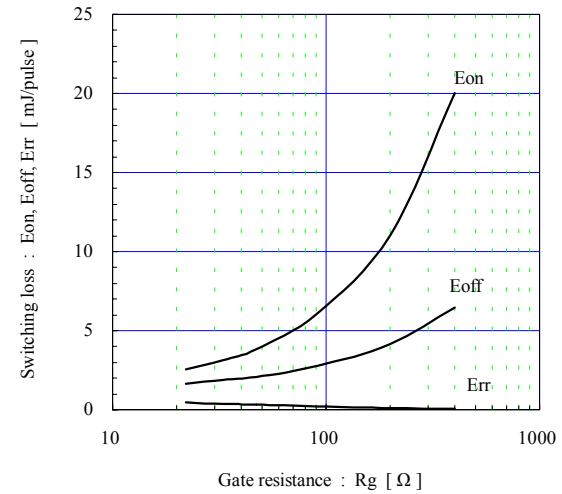

[ Inverter ]
Switching time vs. Gate resistance (typ.)
Vcc=300V, Ic=75A, VGE=±15V, Tj= 25°C



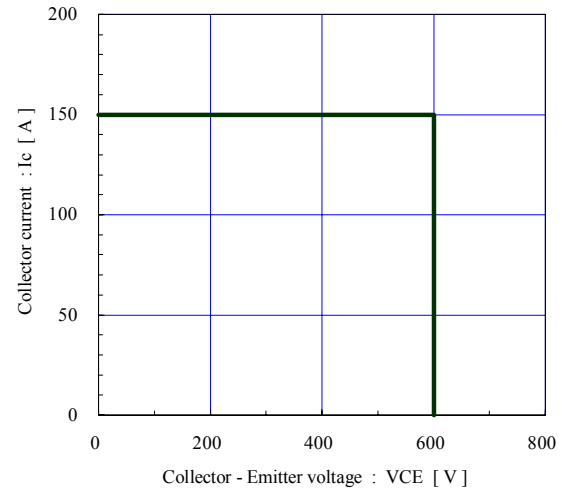

[ Inverter ]
Switching loss vs. Collector current (typ.)
Vcc=300V, VGE=±15V, Rg=47Ω




[ Inverter ]
Switching loss vs. Gate resistance (typ.)
Vcc=300V, Ic=75A, VGE=±15V, Tj= 125°C



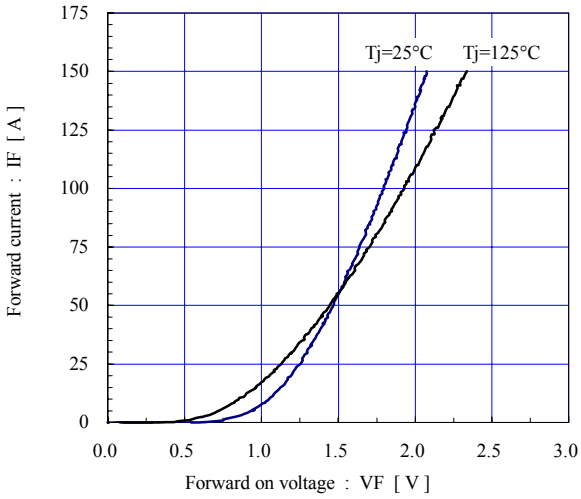

[ Inverter ]
Reverse bias safe operating area (max.)
+VGE=15V,-VGE <= 15V, RG >= 47Ω ,Tj <= 125°C



[ Inverter ]

Forward current vs. Forward on voltage (typ.)

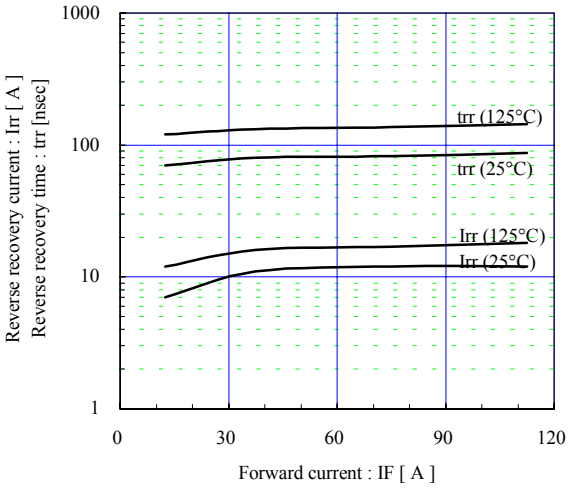
chip




[ Inverter ]

Reverse recovery characteristics (typ.)

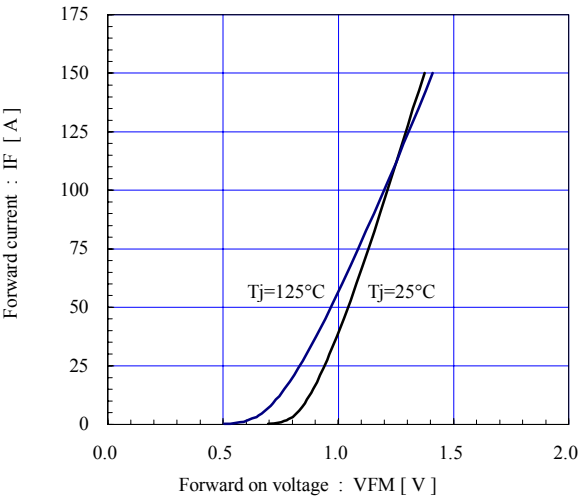
Vcc=300V, VGE=±15V, Rg=47Ω




[ Converter ]

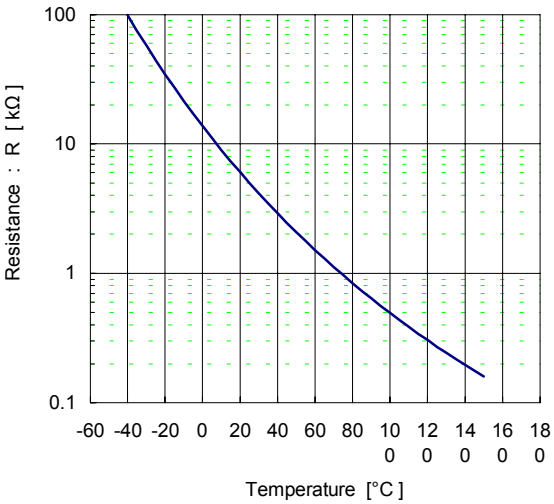
Forward current vs. Forward on voltage (typ.)

chip

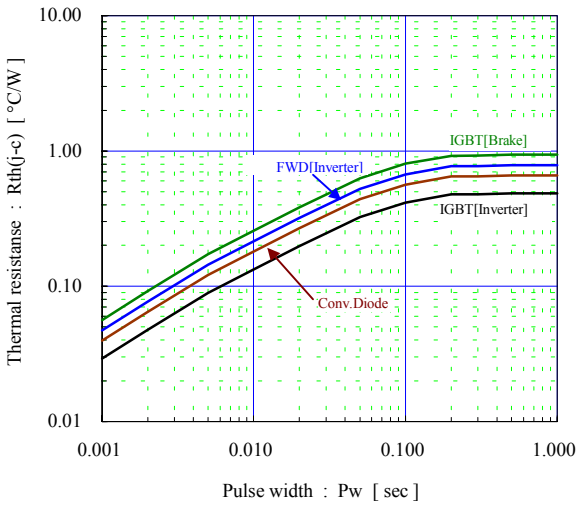



[ Thermistor ]

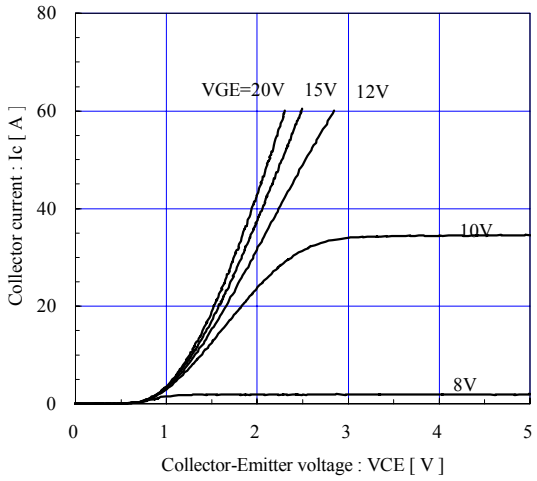
Temperature characteristic (typ.)



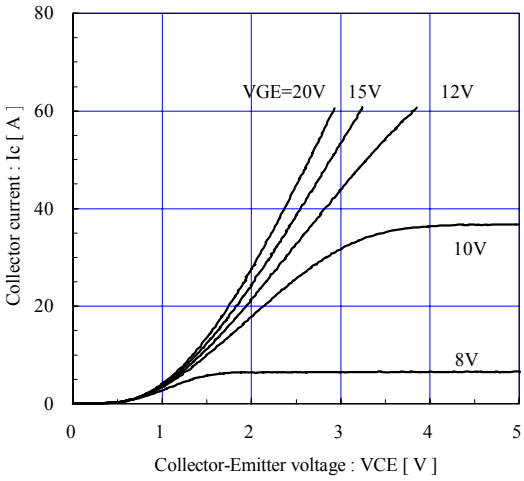

Transient thermal resistance (max.)



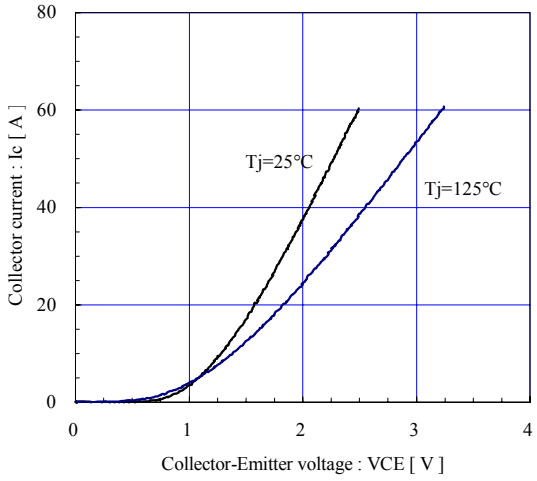
[ Brake ]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 25°C / chip



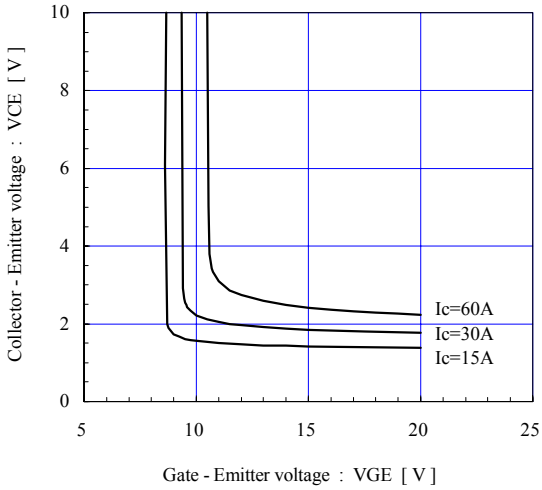

[ Brake ]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 125°C / chip



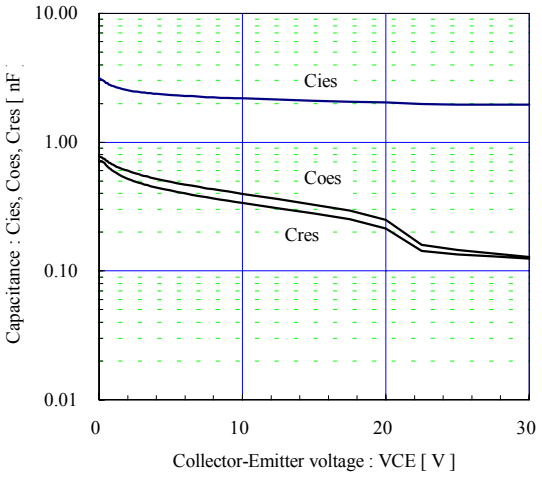

[ Brake ]
Collector current vs. Collector-Emitter voltage (typ.)
VGE=15V / chip



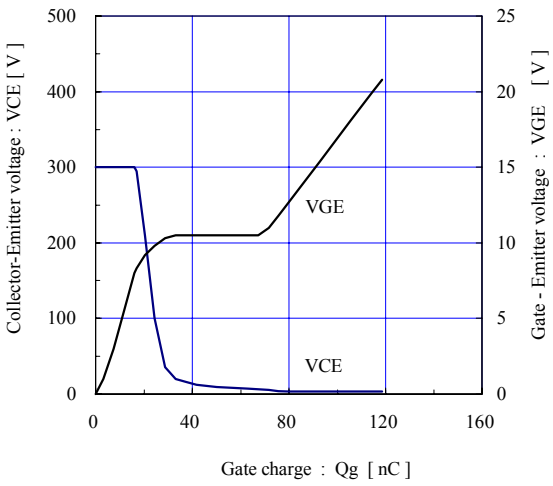

[ Brake ]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
Tj=25°C / chip




[ Brake ]
Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f= 1MHz, Tj= 25°C




[ Brake ]
Dynamic Gate charge (typ.)
Vcc=300V, Ic=30A, Tj= 25°C



## ■ Outline Drawings, mm