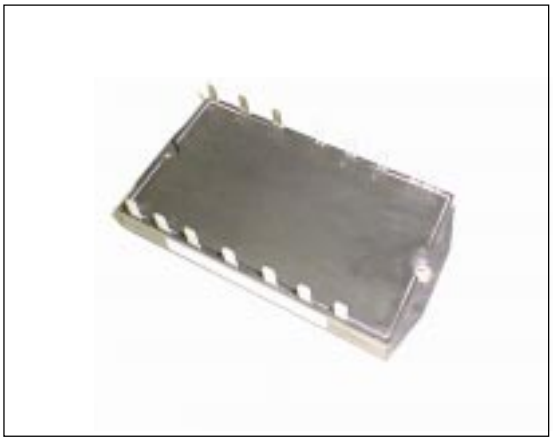
# IGBT MODULE

## 1200V / 15A / PIM



## ■ Features

· High Speed Switching
· Voltage Drive
· Low Inductance Module Structure
· 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 without specified)**

| Item | | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|---|
| Inverter | Collector-Emitter voltage | $V_{CES}$ | | 1200 | V |
| | Gate-Emitter voltage | $V_{GES}$ | | ±20 | V |
| | Collector current | $I_C$ | Continuous | 15 | A |
| | | $I_{CP}$ | 1ms | 30 | A |
| | | -$I_C$ | | 15 | A |
| | Collector power disspation | $P_C$ | 1 device | 120 | W |
| Brake | Collector-Emitter voltage | $V_{CES}$ | | 1200 | V |
| | Gate-Emitter voltage | $V_{GES}$ | | ±20 | V |
| | Collector current | $I_C$ | Continuous | 10 | A |
| | | $I_{CP}$ | 1ms | 20 | A |
| | Collector power disspation | $P_C$ | 1 device | 88 | W |
| | Repetitive peak reverse voltage | $V_{RRM}$ | | 1200 | V |
| | Average forward current | $I_{F(AV)}$ | | 1 | A |
| | Surge current | $I_{FSM}$ | 10ms | 50 | A |
| Converter | Repetitive peak reverse voltage | $V_{RRM}$ | | 1600 | V |
| | Non-Repetitive peak reverse voltage | $V_{RSM}$ | | 1700 | V |
| | Average output current | $I_O$ | 50Hz/60Hz sine wave | 25 | A |
| | Surge current (Non-Repetitive) | $I_{FSM}$ | Tj=150°C, 10ms | 320 | A |
| | $I^2t$ (Non-Repetitive) | | Tj=150°C, 10ms | 512 | $A^2s$ |
| Operating junction temperature | | $T_j$ | | +150 | °C |
| Storage temperature | | $T_{stg}$ | | -40 to +125 | °C |
| Isolation voltage | | $V_{iso}$ | AC : 1 minute | AC 2500 | V |
| Mounting screw torque | | | | 1.7 *1 | N·m |

*1 Recommendable value : 1.3 to 1.7 N·m (M4)

● **Electrical characteristics (Tj=25°C unless without specified)**

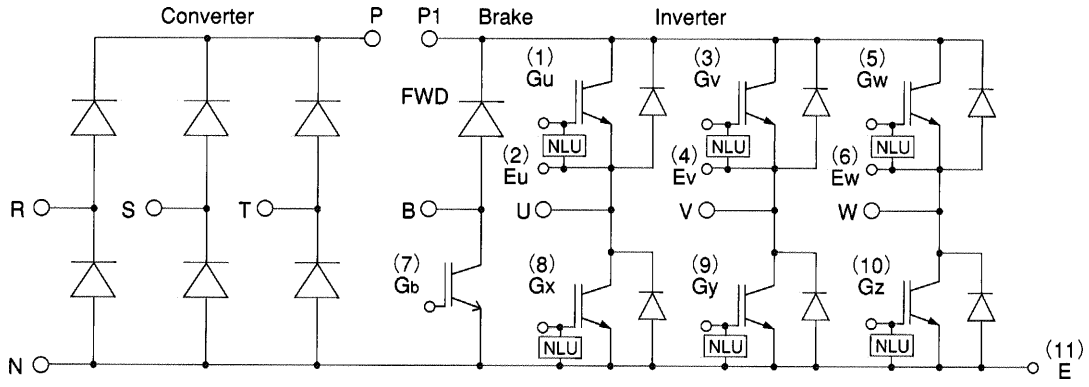
| Item | | Symbol | Condition | Characteristics | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Inverter (IGBT) | Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$=1200V, $V_{GE}$=0V | | | 1.0 | mA |
| | Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | | 20 | μA |
| | Gate-Emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$=20V, $I_C$=15mA | 4.5 | | 7.5 | V |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}$=15V, Ic=15A | | | 3.3 | V |
| | Collector-Emitter voltage | -$V_{CE}$ | -Ic=15A | | | 3.0 | V |
| | Input capacitance | $C_{ies}$ | $V_{GE}$=0V, $V_{CE}$=10V, f=1MHz | | 2400 | | pF |
| | Switching time | $t_{on}$ | $V_{CC}$=600V | | | 1.2 | μs |
| | | $t_r$ | $I_C$=15A | | | 0.6 | μs |
| | | $t_{off}$ | $V_{GE}$=±15V | | | 1.5 | μs |
| | | $t_f$ | $R_G$=82 ohm | | | 0.5 | μs |
| | Reverse recovery time of FRD | $t_{rr}$ | $I_F$=15A | | | 0.35 | μs |
| Brake (IGBT) | Zero gate voltage collector current | $I_{CES}$ | $V_{CES}$=1200V, $V_{GE}$=0V | | | 1.0 | mA |
| | Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | | 0.1 | μA |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $I_C$=10A, $V_{GE}$=15V | | | 3.3 | V |
| | Switching time | $t_{on}$ | $V_{CC}$=600V | | | 0.8 | μs |
| | | $t_r$ | $I_C$=10A | | | 0.6 | μs |
| | | $t_{off}$ | $V_{GE}$=±15V | | | 1.5 | μs |
| | | $t_f$ | $R_G$=120 ohm | | | 0.5 | μs |
| Brake (FWD) | Reverse current | $I_{RRM}$ | $V_R$=1200V | | | 1 | mA |
| | Reverse recovery time | $t_{rr}$ | | | | 0.6 | μs |
| Converter | Forward voltage | $V_{FM}$ | $I_F$=25A | | | 1.4 | V |
| | Reverse current | $I_{RRM}$ | $V_R$=1600V | | | 1.0 | mA |

● **Thermal Characteristics**

| Item | Symbol | Condition | Characteristics | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Thermal resistance ( 1 device ) | Rth(j-c) | Inverter IGBT | | | 1.04 | °C/W |
| | | Inverter FRD | | | 2.78 | |
| | | Brake IGBT | | | 1.43 | |
| | | Converter Diode | | | 3.40 | |
| 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

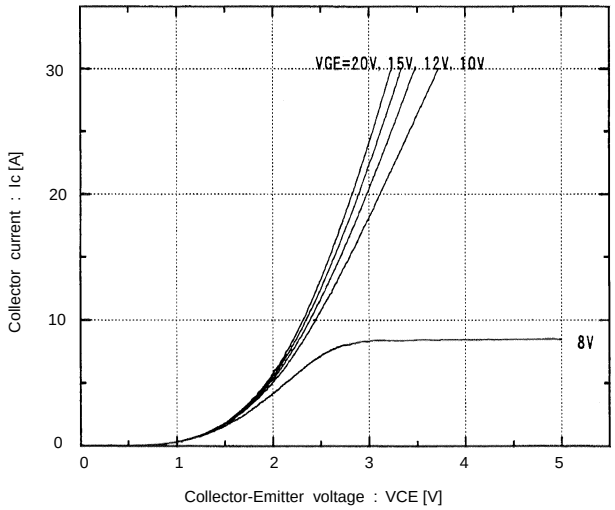



* NLU (Over current Limiting circuit)

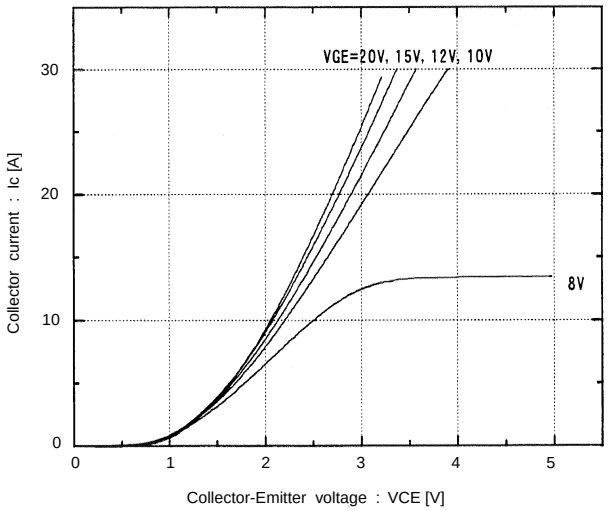
## ■ Characteristics (Representative)

### ● Inverter

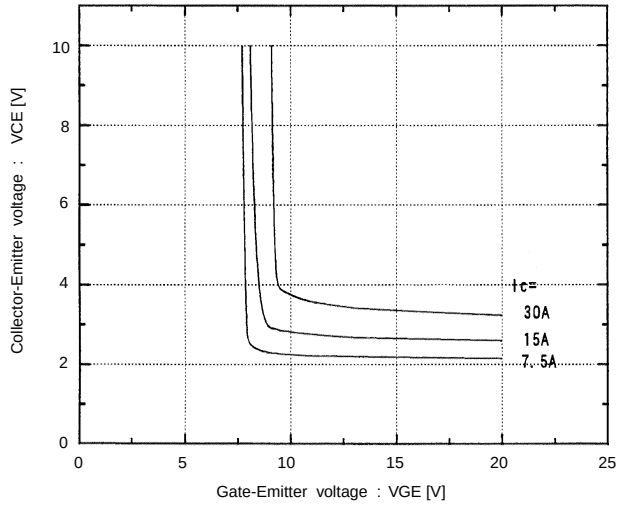
Collector current vs. Collector-Emitter voltage
Tj=25°C



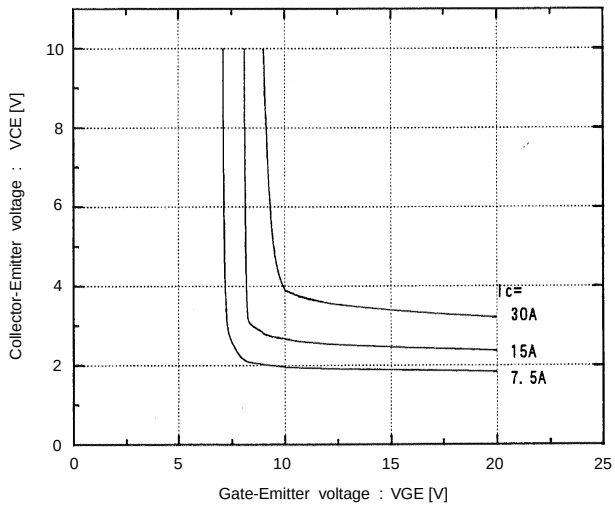

Collector current vs. Collector-Emitter voltage
Tj=125°C



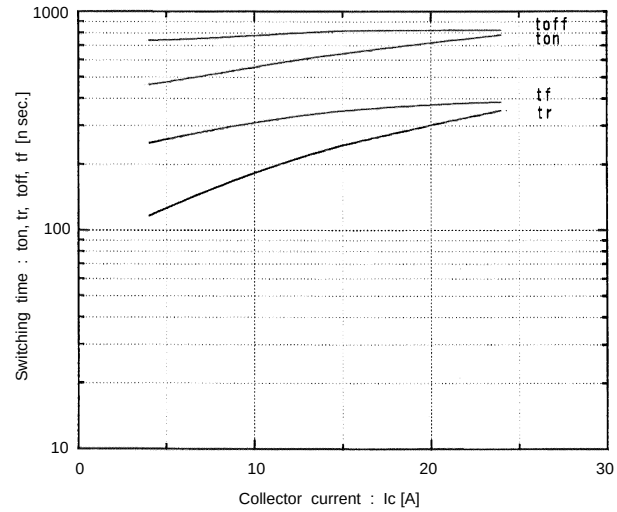

Collector-Emitter vs. Gate-Emitter voltage
Tj=25°C



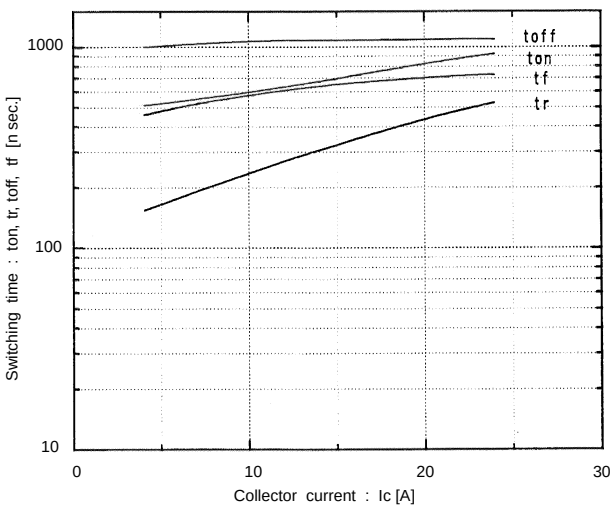

Collector-Emitter vs. Gate-Emitter voltage
Tj=125°C



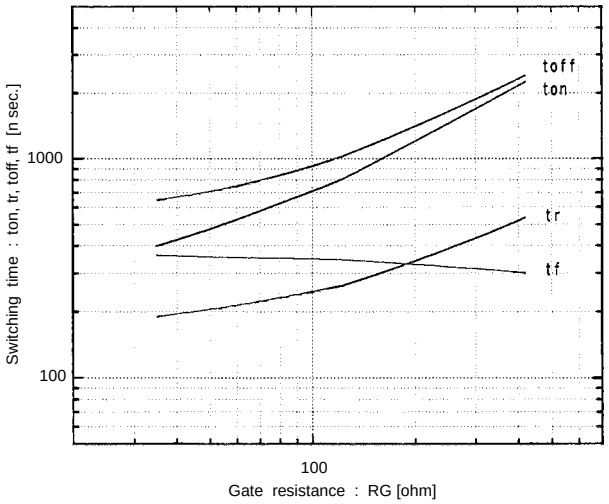

Switching time vs. Collector current
Vcc=600V, RG=82 ohm, VGE=±15V, Tj=25°C



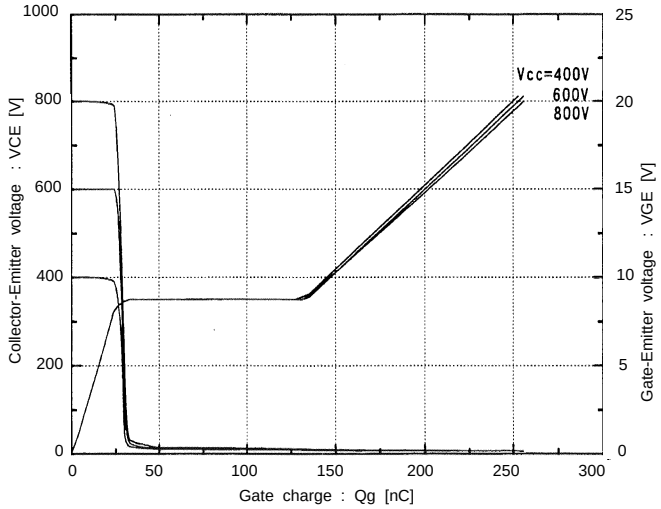

Switching time vs. Collector current
Vcc=600V, RG=82 ohm, VGE=±15V, Tj=125°C



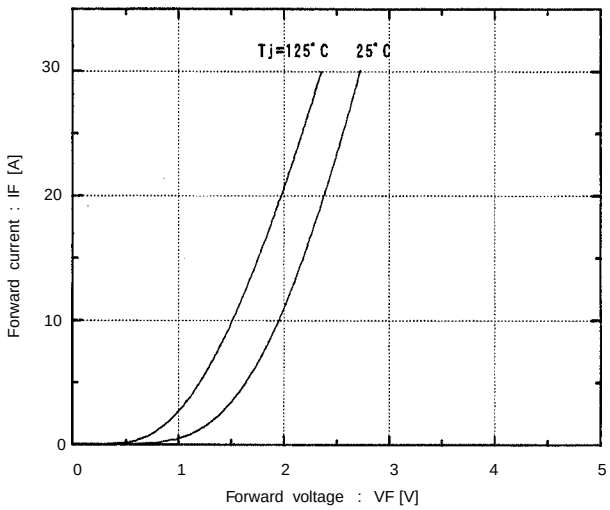
Switching time vs. RG
Vcc=600V, Ic=15A, VGE=±15V, Tj=25°C



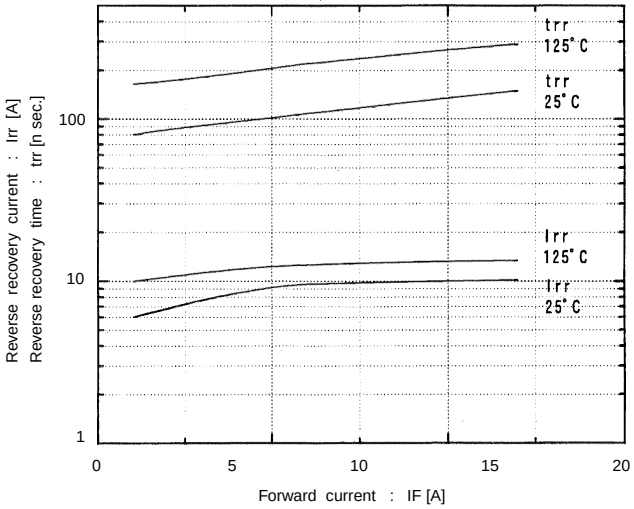

Dynamic input characteristics
Tj=25°C



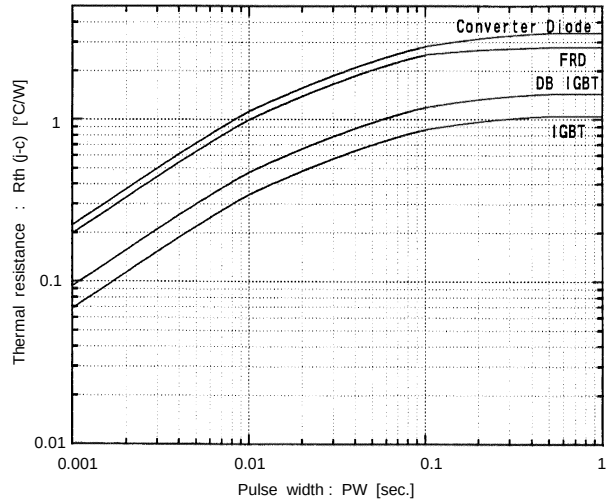

Forward current vs. Forward voltage
VGE=0V



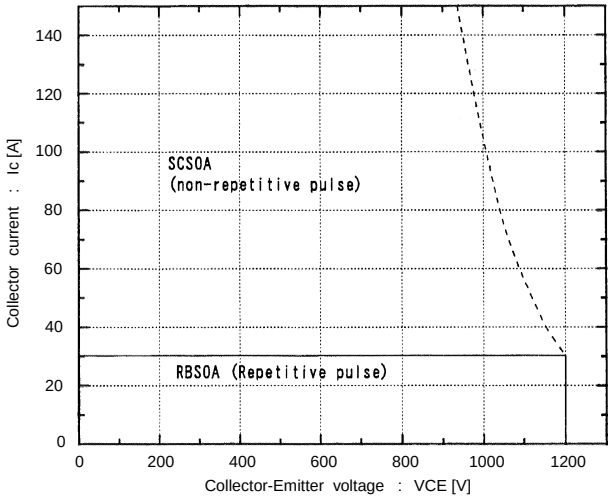

Reverse recovery characteristics
trr, Irr, vs. IF



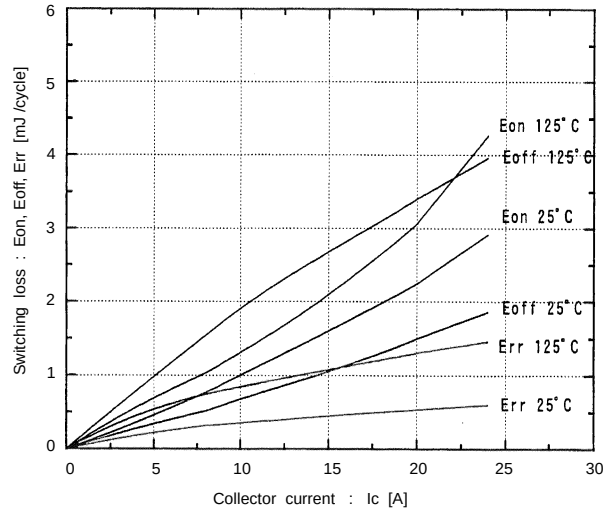

Transient thermal resistance



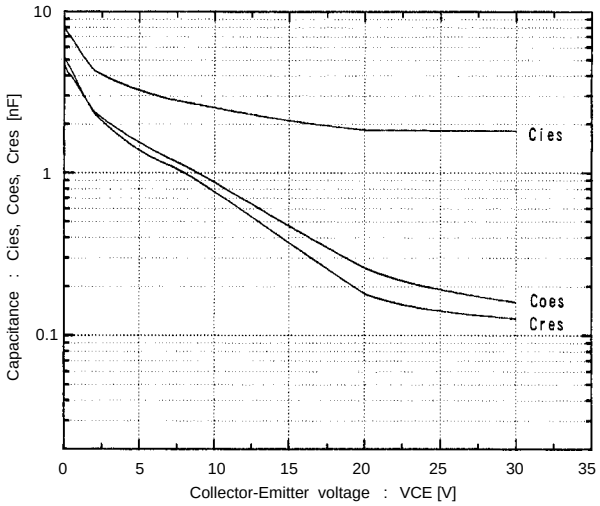

Reversed biased safe operating area
+VGE=15V, -VGE ≦ 15V, Tj ≦ 125°C, RG ≧ 82 ohm



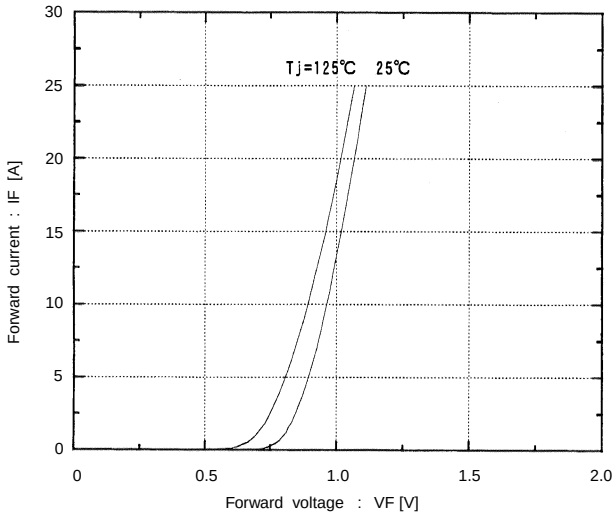
Switching loss vs. Collector current
Vcc=600V, RG=82 ohm, VGE=±15V




Capacitance vs. Collector-Emitter voltage
Tj=25°C

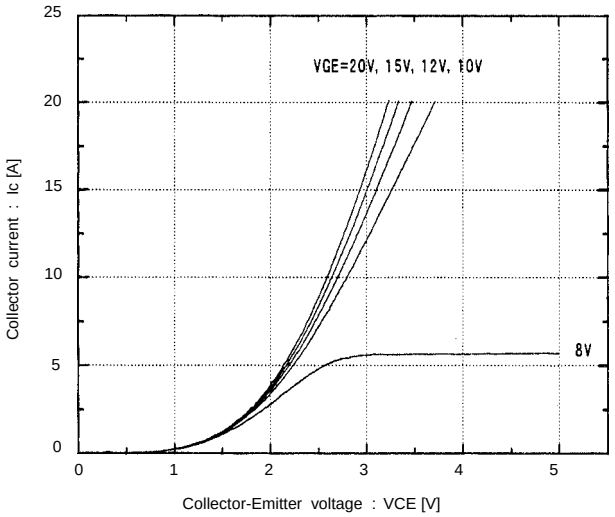



Converter Diode
Forward current vs. Forward voltage

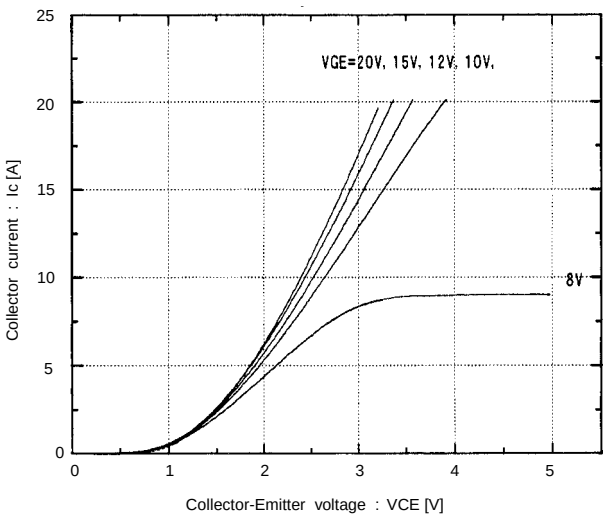


● **Brake**

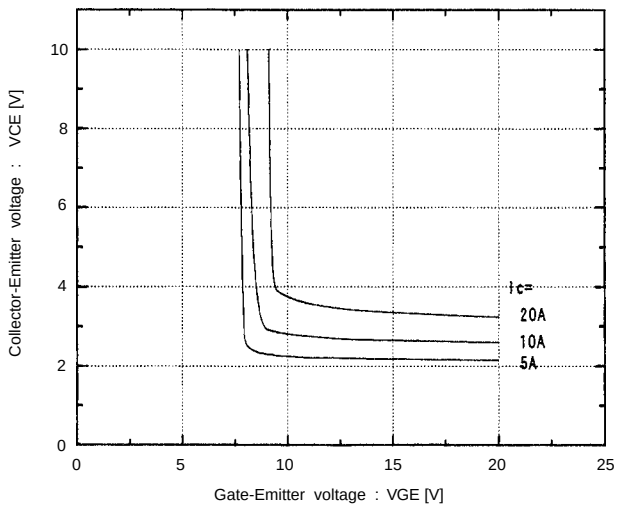
Collector current vs. Collector-Emitter voltage
Tj=25°C



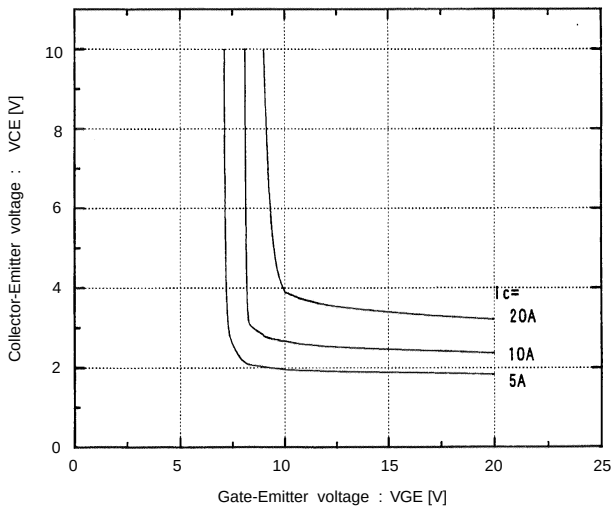

Collector current vs. Collector-Emitter voltage
Tj=125°C



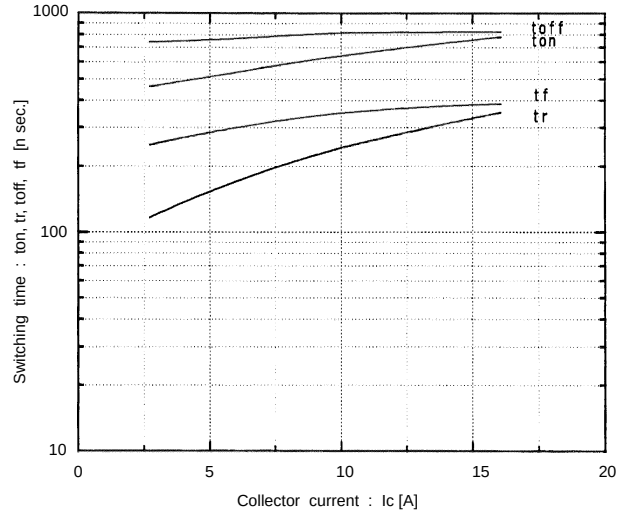

Collector-Emitter vs. Gate-Emitter voltage
Tj=25°C




Collector-Emitter vs. Gate-Emitter voltage
Tj=125°C




Switching time vs. Collector current
Vcc=600V, RG=120 ohm, VGE=±15V, Tj=25°C

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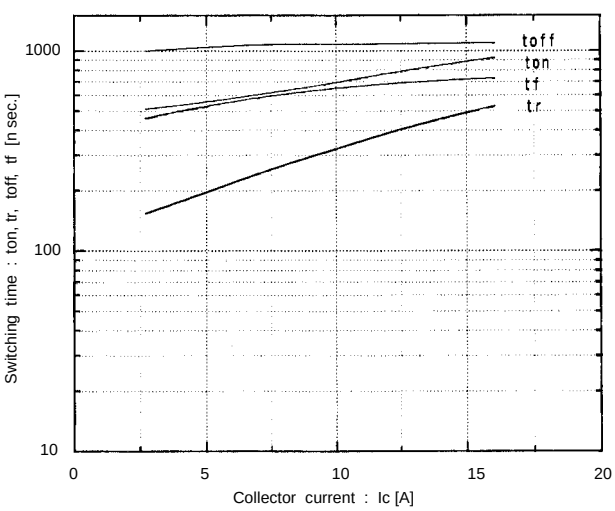
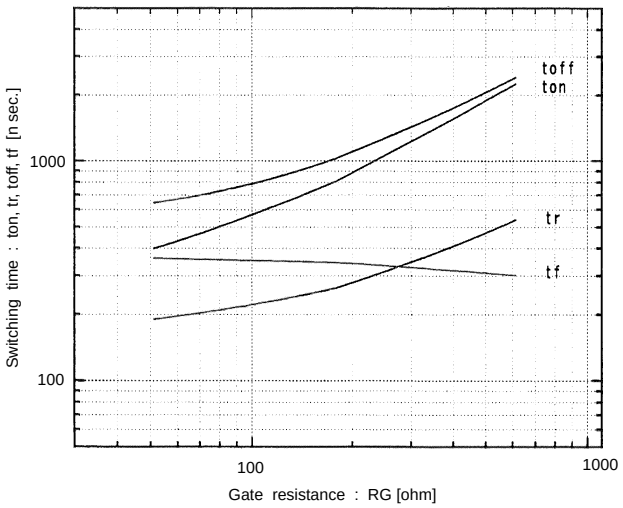
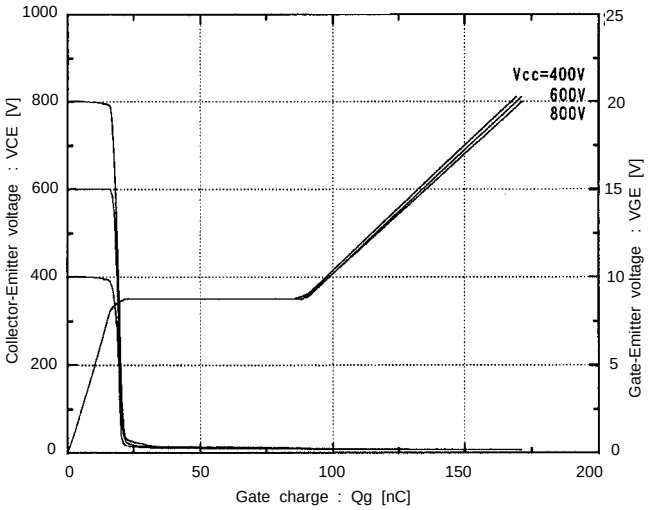
Vcc=600V, RG=120 ohm, VGE=±15V, Tj=125°C



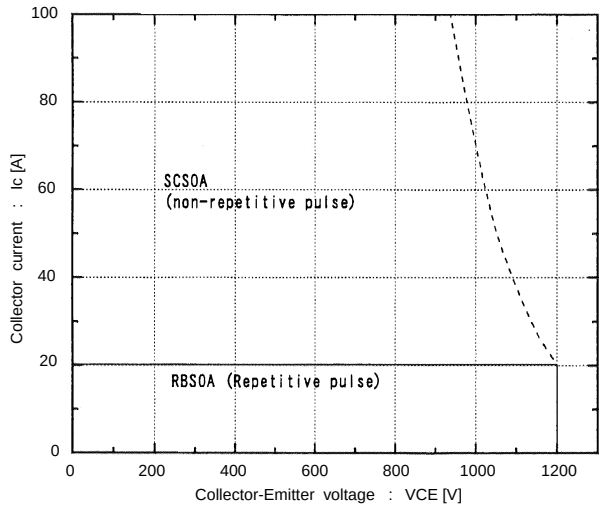
Switching time vs. RG
Vcc=600V, Ic=10A, VGE=±15V, Tj=25°C



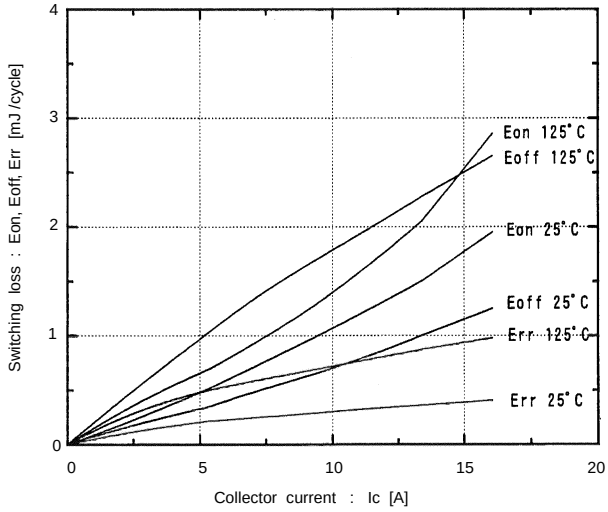

Dynamic input characteristics
Tj=25°C



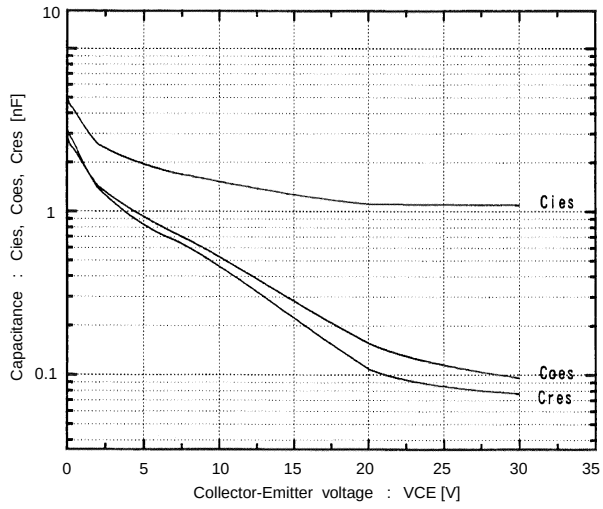

Reversed biased safe operating area
+VGE=15V, -VGE ≦ 15V, Tj ≦ 125°C, RG ≧ 120 ohm



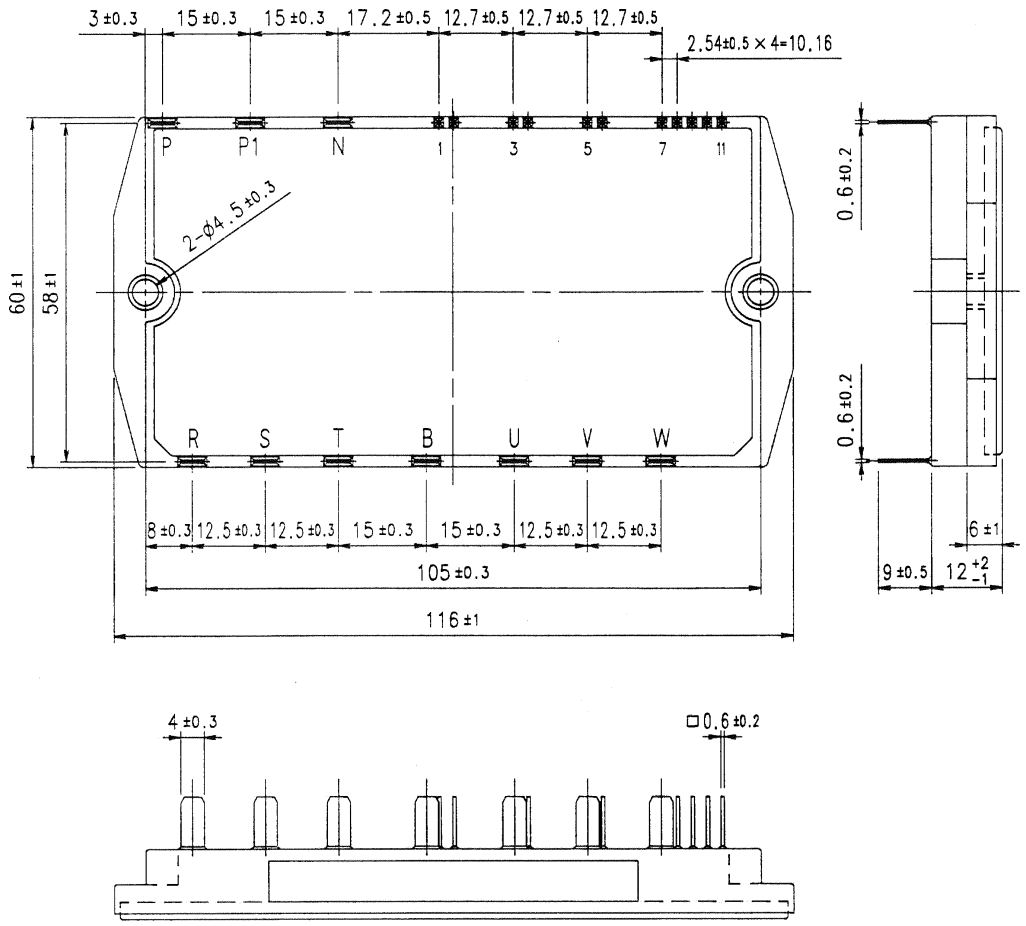

Switching loss vs. Collector current
Vcc=600V, RG=120 ohm, VGE=±15V




Capacitance vs. Collector-Emitter voltage
Tj=25°C



## ■ Outline Drawings, mm



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