FUJI ELECTRIC

# 7MBR 50NE-060

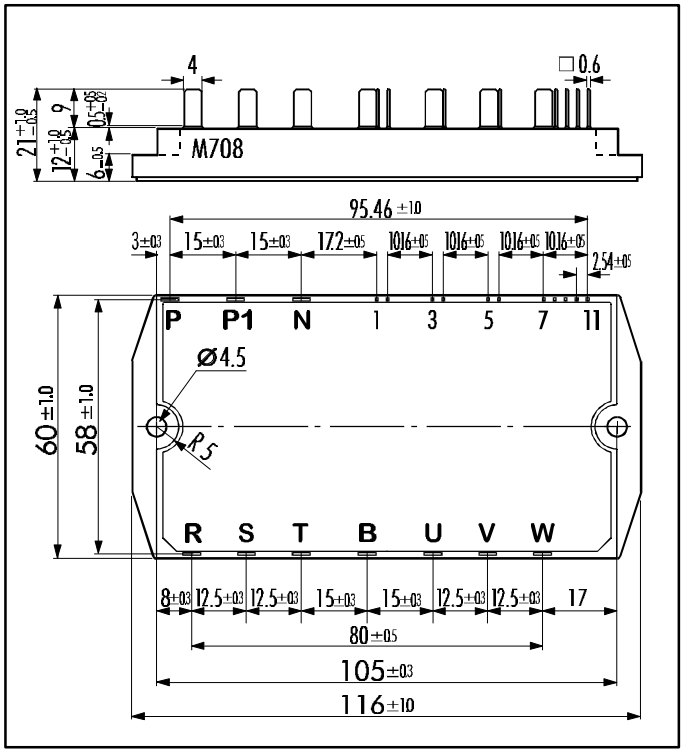
IGBT
600 V
50 A

## Power Integrated Module (PIM)

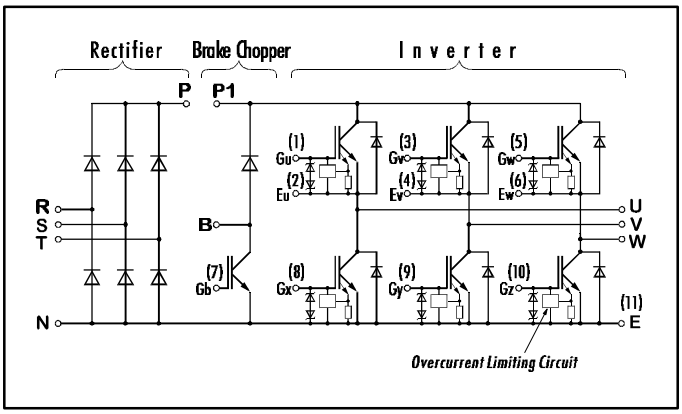
### ■ Features

- *Included Rectifier and Brake Chopper*
- *Square RBSOA*
- *Low Saturation Voltage*
- *Overcurrent Limiting Function ( ~ 3 Times Rated Current )*

### ■ Outline Drawing




### ■ Equivalent Circuit




### ■ Absolute Maximum Ratings ( $T_c$=25°C)

| | Items | Symbols | Test Conditions | Ratings | Units |
|---|---|---|---|---|---|
| Inverter | Collector-Emitter Voltage | $V_{CES}$ | | 600 | V |
| | Gate -Emitter Voltage | $V_{GES}$ | | ± 20 | |
| | Collector Current | $I_C$ | Continuous | 50 | A |
| | | $I_{C\ PULSE}$ | 1ms | 100 | |
| | | $-I_{C\ PULSE}$ | 1ms | 50 | |
| | Collector Power Dissipation | $P_C$ | 1 device | 200 | W |
| Rectifier | Repetitive Peak Reverse Voltage | $V_{RRM}$ | | 800 | V |
| | Non Repetitive Peak Reverse Voltage | $V_{RSM}$ | | 900 | |
| | Average Output Current | $I_O$ | 50Hz/60Hz sin. wave | 50 | A |
| | Surge Current (Non Repetitive) | $I_{FSM}$ | $T_j$=150°C, 10ms | 350 | |
| | $I^2t$ (Non Repetitive) | | $T_j$=150°C, 10ms | 648 | $A^2s$ |
| Brake Chopper IGBT | Collector-Emitter Voltage | $V_{CES}$ | | 600 | V |
| | Gate -Emitter Voltage | $V_{GES}$ | | ± 20 | |
| | Collector Current | $I_C$ | Continuous | 50 | A |
| | | $I_{C\ PULSE}$ | 1ms | 100 | |
| | Collector Power Dissipation | $P_C$ | 1 device | 200 | W |
| FWD | Repetitive Peak Reverse Voltage | $V_{RRM}$ | | 600 | V |
| | Average Forward Current | $I_{F(AV)}$ | | 1 | A |
| | Surge Current | $I_{FSM}$ | 10ms | 50 | |
| | Operating Junction Temperature | $T_j$ | | +150 | °C |
| | Storage Temperature | $T_{Stg}$ | | -40 ~ +125 | |
| | Isolation Voltage | $V_{ISO}$ | A.C. 1min. | 2500 | V |
| | Mounting Screw Torque *1 | | | 1.7 | Nm |

**Note:** *1:Recommendable Value; 1.3 ~ 1.7 Nm (M4)

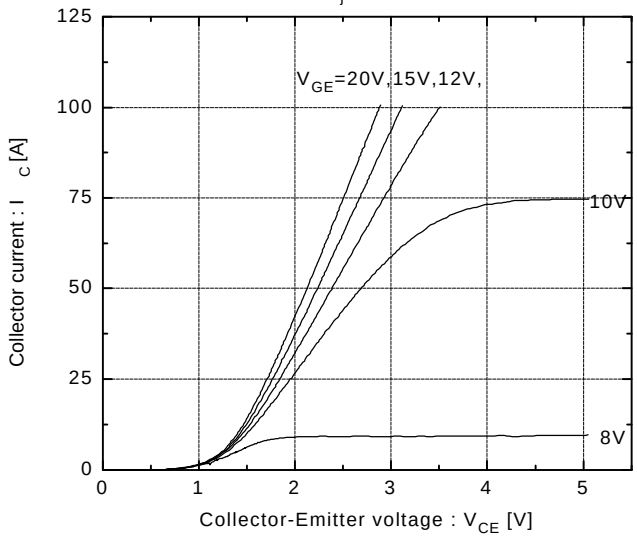
## ■ Electrical Characteristics( $T_j$=25°C )

| | | Items | Symbols | Test Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Inverter | IGBT | Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{GE}$=0V $V_{CE}$=600V | | 1.0 | mA |
| | | Gate-Emitter Leackage Current | $I_{GES}$ | $V_{CE}$=0V $V_{GE}$=± 20V | | 20 | μA |
| | | Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $V_{GE}$=20V $I_C$=50mA | 4.5 | 7.5 | V |
| | | Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}$=15V $I_C$=50A | | 2.9 | |
| | | Input capacitance | $C_{ies}$ | f=1MHz, $V_{GE}$=0V, $V_{CE}$=10V | 3300 (typ.) | | pF |
| | | Turn-on Time | $t_{on}$ | $V_{CC}$ = 300V | | 1.2 | μs |
| | | | $t_r$ | $I_C$ = 50A | | 0.6 | |
| | | Turn-off Time | $t_{off}$ | $V_{GE}$ = ±15V | | 1.0 | |
| | | | $t_f$ | $R_G$ = 51Ω | | 0.35 | |
| | FWD | Diode Forward On-Voltage | $V_F$ | $I_F$=50A $V_{GE}$=0V | | 3.1 | V |
| | | Reverse Recovery Time | $t_{rr}$ | $I_F$=50A | | 350 | ns |
| Rectif. | | Forward Voltage | $V_{FM}$ | $I_F$ = 50A | | 1.55 | V |
| | | Reverse Current | $I_{RRM}$ | $V_R$ =800V | | 1.0 | mA |
| Brake Chopper | IGBT | Zero Gate Voltage Collector Current | $I_{CES}$ | $V_{GE}$=0V $V_{CE}$=600V | | 1.0 | mA |
| | | Gate-Emitter Leackage Current | $I_{GES}$ | $V_{CE}$=0V $V_{GE}$=± 20V | | 100 | nA |
| | | Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_{GE}$=15V $I_C$=50A | | 2.8 | V |
| | | Turn-on Time | $t_{on}$ | $V_{CC}$ = 300V | | 0.8 | μs |
| | | | $t_r$ | $I_C$ = 50A | | 0.6 | |
| | | Turn-off Time | $t_{off}$ | $V_{GE}$ = ±15V | | 1.0 | |
| | | | $t_f$ | $R_G$ = 51Ω | | 0.35 | |
| | FWD | Reverse Current | $I_{RRM}$ | $V_R$=600V | | 1.0 | mA |
| | | Reverse Recovery Time | $t_{rr}$ | | | 600 | ns |

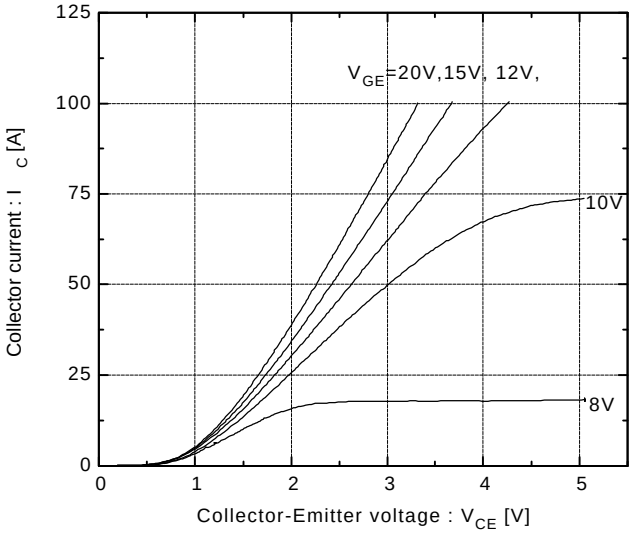
## ■ Thermal Characteristics

| Items | Symbols | Test Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|
| Thermal Resistance (1 device) | $R_{th(j-c)}$ | Inverter IGBT | | 0.63 | °C/W |
| | | Inverter FRD | | 1.60 | |
| | | Brake IGBT | | 0.63 | |
| | | Converter Diode | | 2.10 | |
| Contact Thermal Resistance | $R_{th(c-f)}$ | With Thermal Compound | 0.05 (typ.) | | |

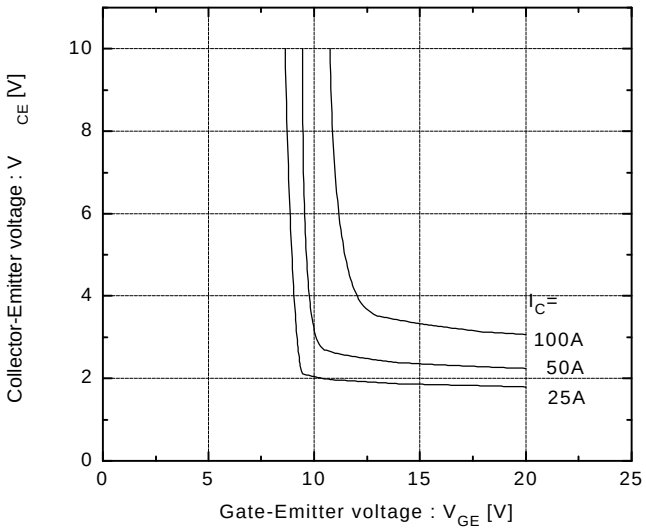
Collector current vs. Collector-Emitter voltage
$T_j$=25°C



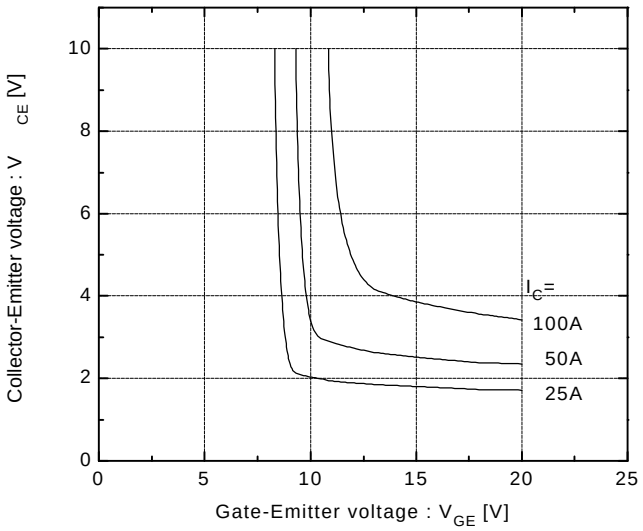

Collector current vs. Collector-Emitter voltage
$T_j$=125°C



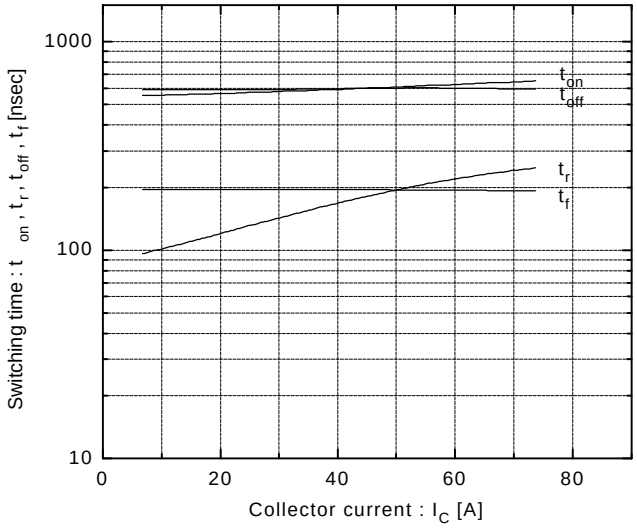

Collector-Emitter vs. Gate-Emitter voltage
$T_j$=25°C



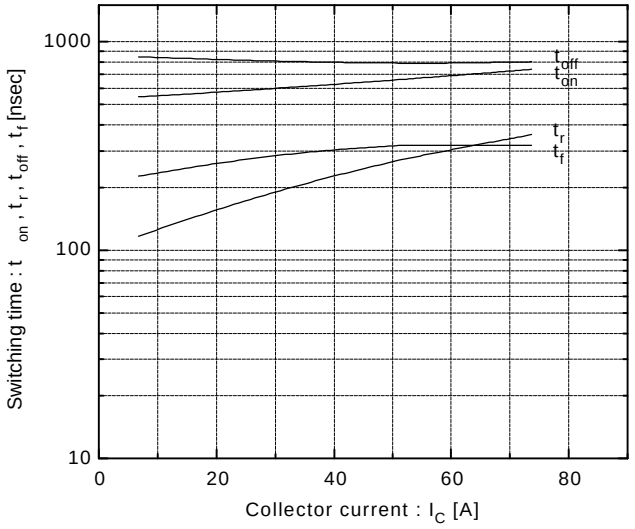

Collector-Emitter vs. Gate-Emitter voltage
$T_j$=125°C




Switching time vs. Collector current
$V_{CC}$=300V, $R_G$=51$_W$, $V_{GE}$=±15V, $T_j$=25°C

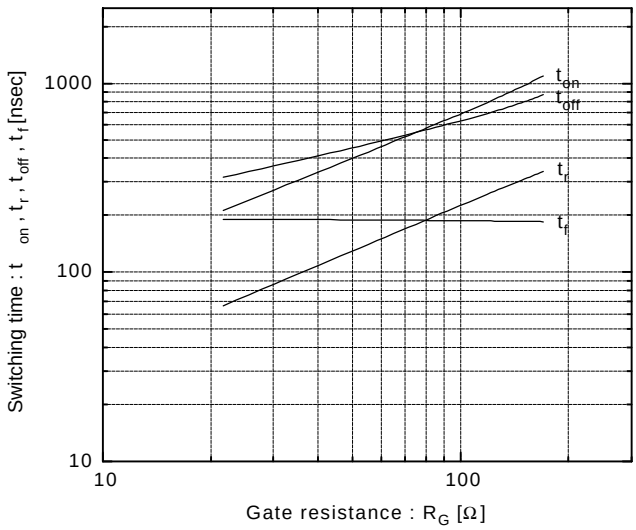



Switching time vs. Collector current
$V_{CC}$=300V, $R_G$=51Ω, $V_{GE}$=±15V, $T_j$=125°C



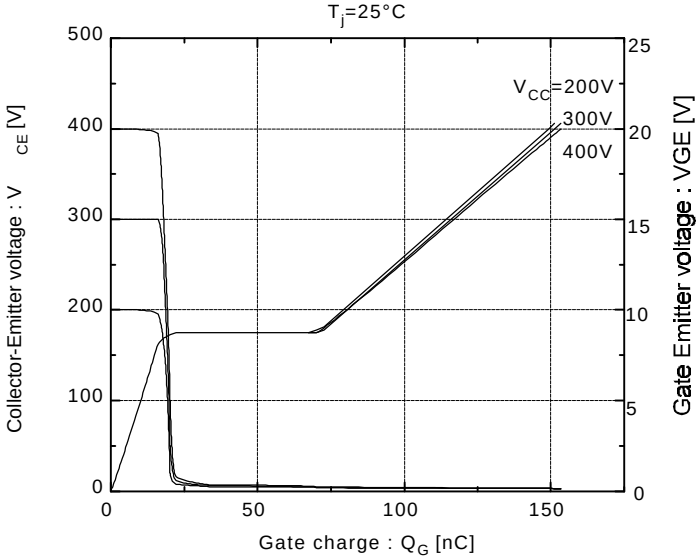
Switching time vs. $R_G$

$V_{CC}$=300V, $I_C$=30A, $V_{GE}$=±15V, $T_j$=25°C




Dynamic input characteristics

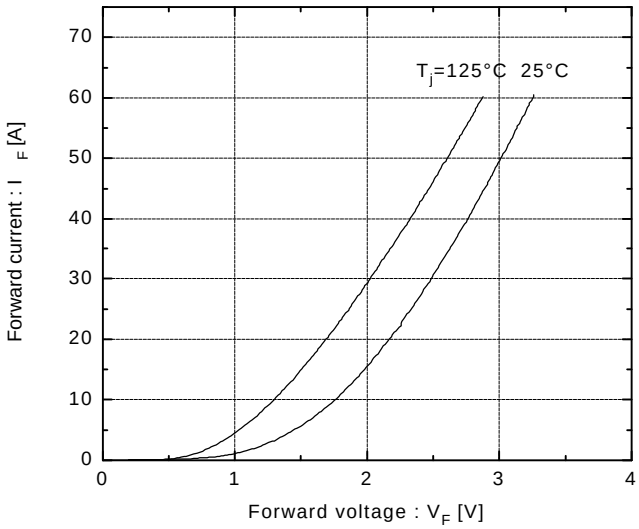
$T_j$=25°C




FRD

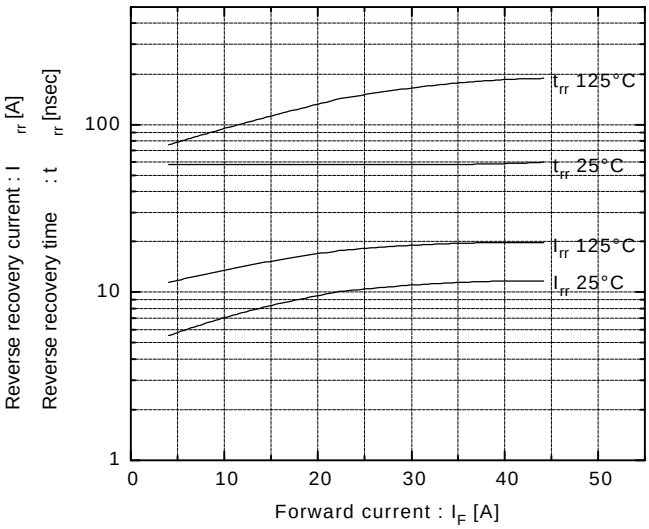
Forward current vs. Forward voltage

$V_{GE}$=OV

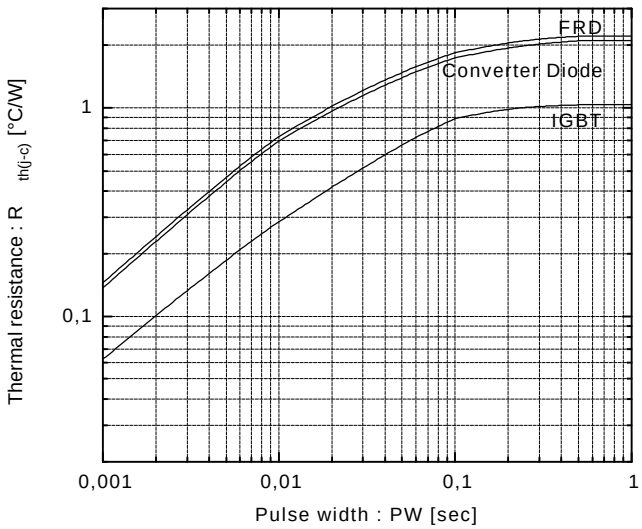



Reverse recovery characteristics

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

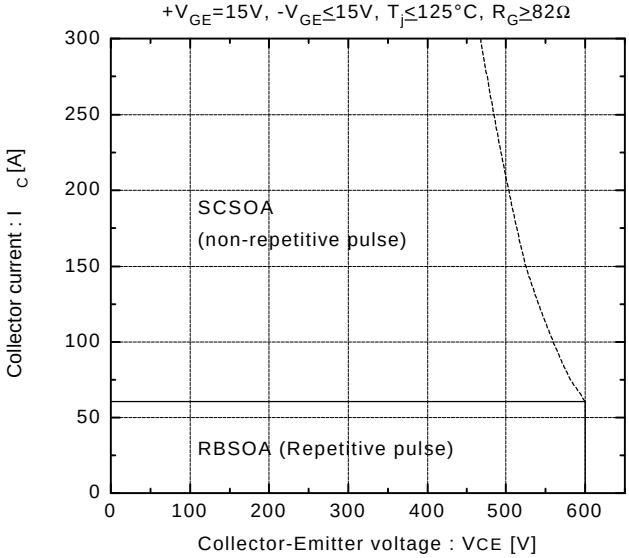



Transient thermal resistance



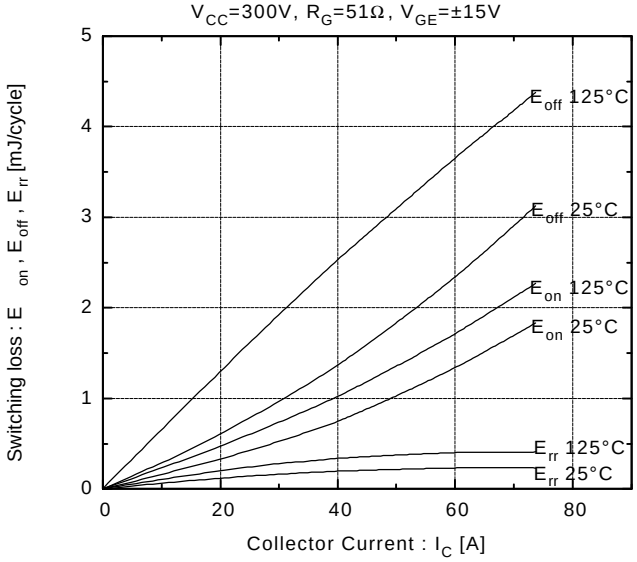

Reversed biased safe operating area

+$V_{GE}$=15V, -$V_{GE}$≤15V, $T_j$≤125°C, $R_G$≥82Ω



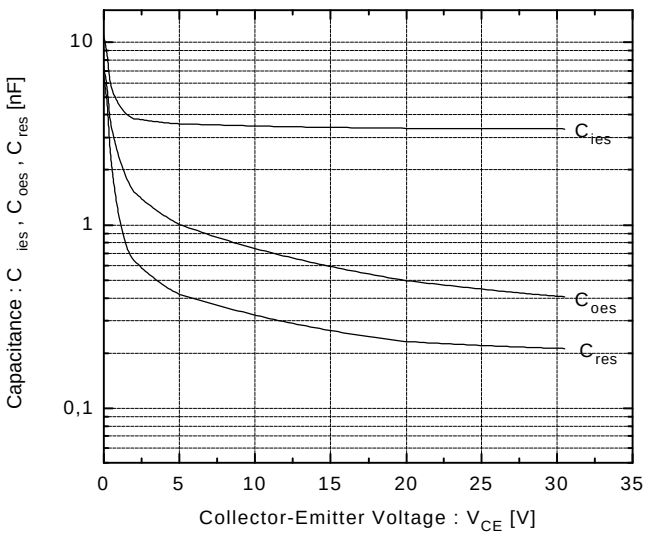
Switching loss vs. Collector current

$V_{CC}$=300V, $R_G$=51Ω, $V_{GE}$=±15V




Capacitance vs. Collector-Emitter voltage

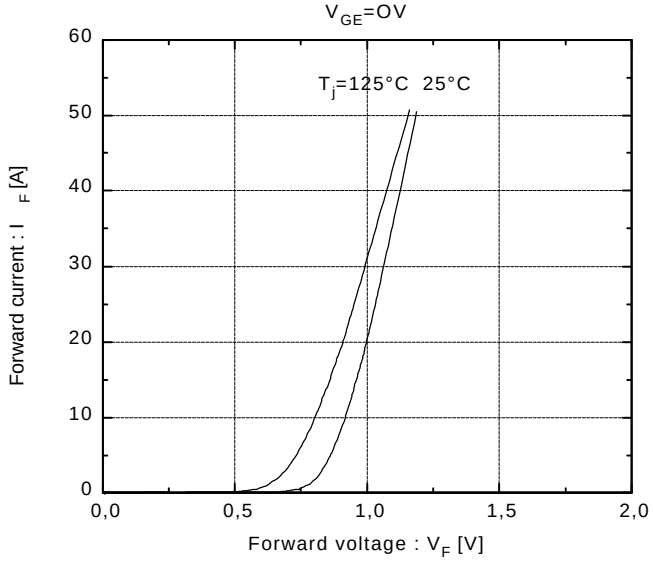
$T_j$=25°C




Converter Diode

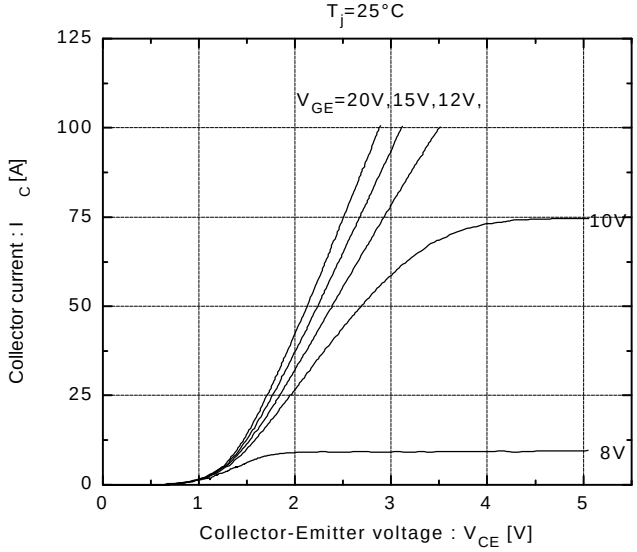
Forward current vs. Forward voltage

$V_{GE}$=OV

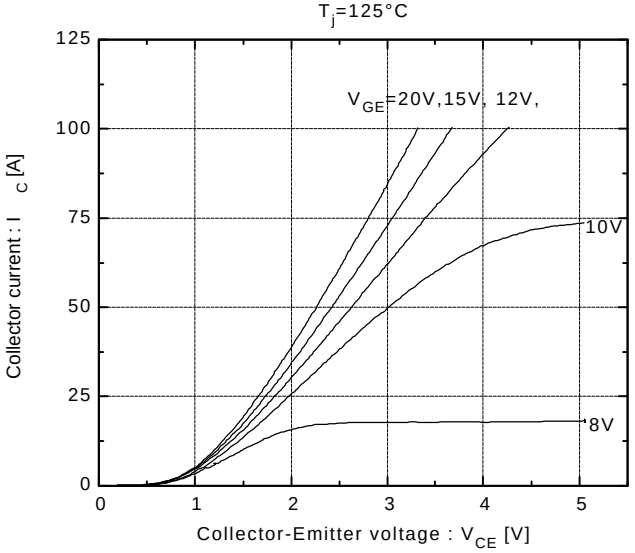


## Brake Chopper IGBT

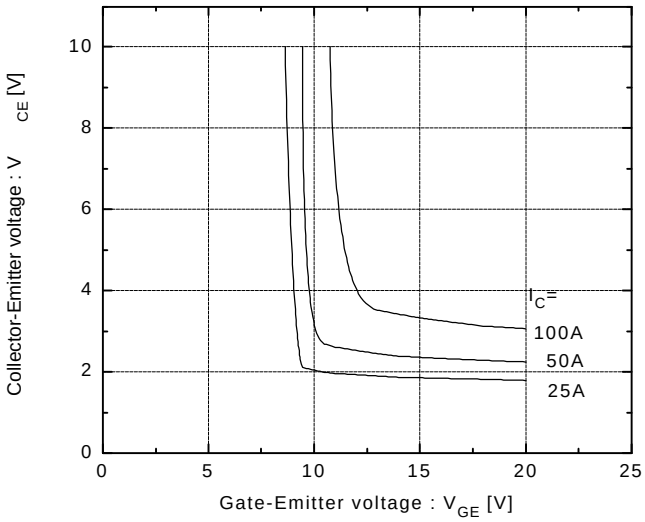
Collector current vs. Collector-Emitter voltage
$T_j$=25°C



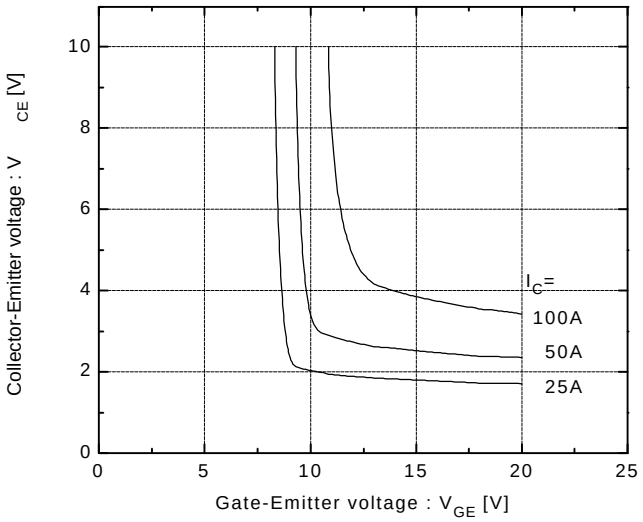

Collector current vs. Collector-Emitter voltage
$T_j$=125°C



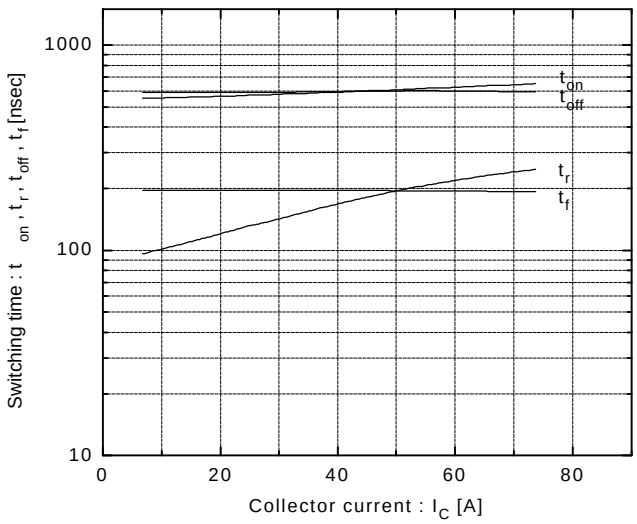

Collector-Emitter vs. Gate-Emitter voltage
$T_j$=25°C



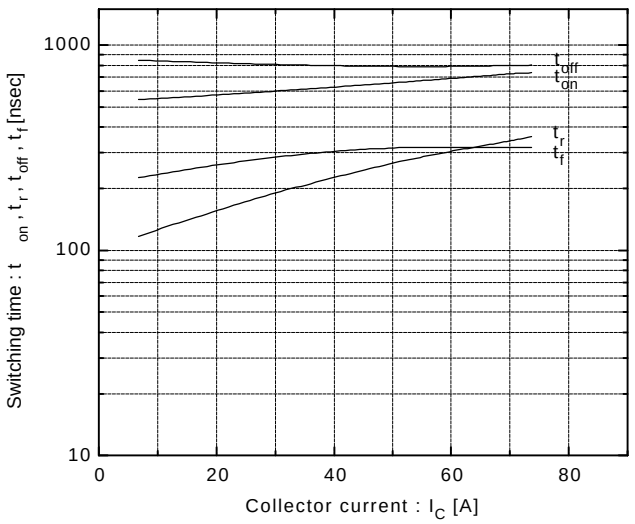

Collector-Emitter vs. Gate-Emitter voltage
$T_j$=125°C




Switching time vs. Collector current
$V_{CC}$=300V, $R_G$=51$_W$, $V_{GE}$=±15V, $T_j$=25°C



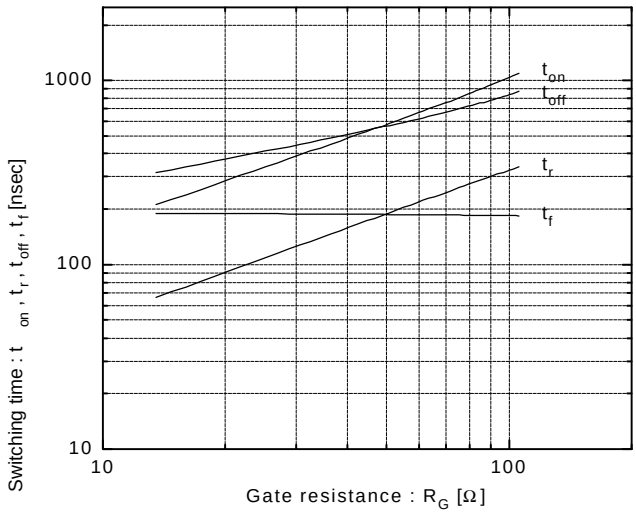

Switching time vs. Collector current
$V_{CC}$=300V, $R_G$=51Ω, $V_{GE}$=±15V, $T_j$=125°C



## Brake Chopper IGBT

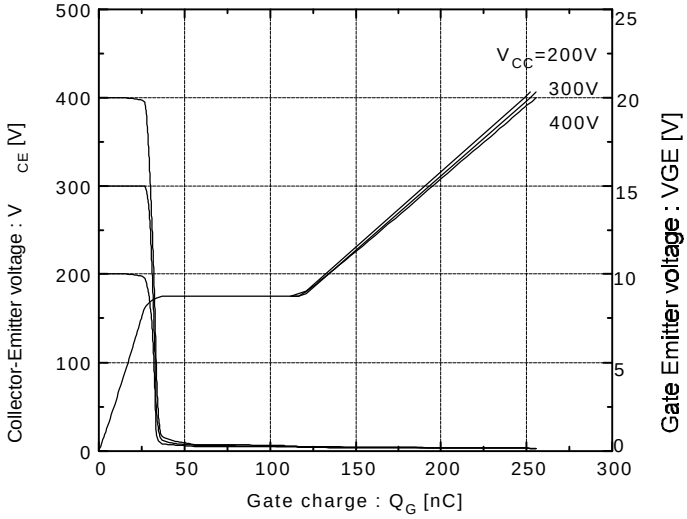
Switching time vs. $R_G$

$V_{CC}$=300V, $I_C$=50A, $V_{GE}$=±15V, $T_j$=25°C



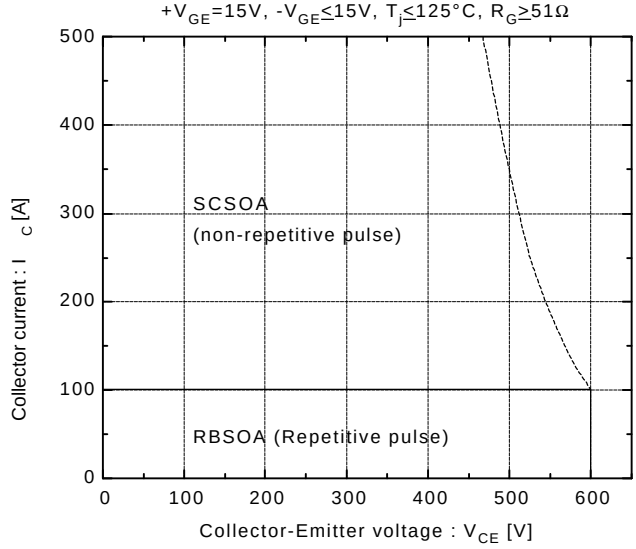

Dynamic input characteristics

$T_j$=25°C



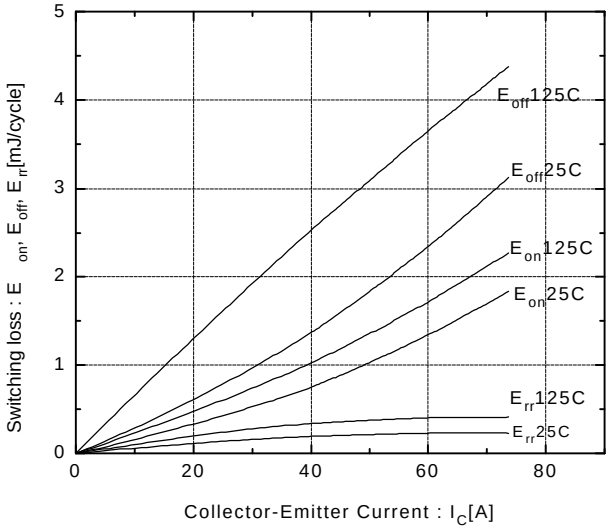

Reversed biased safe operating area

$+V_{GE}$=15V, $-V_{GE}$≤15V, $T_j$≤125°C, $R_G$≥51Ω




Switching loss vs. Collector current

$V_{CC}$=300V, $R_G$=51Ω, $V_{GE}$=±15V




Capacitance vs. Collector-Emitter Voltage

Tj=25C