

# SPECIFICATION

DEVICE NAME : IGBT

TYPE NAME : 1MBH05D-060

SPEC. No. :

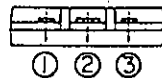
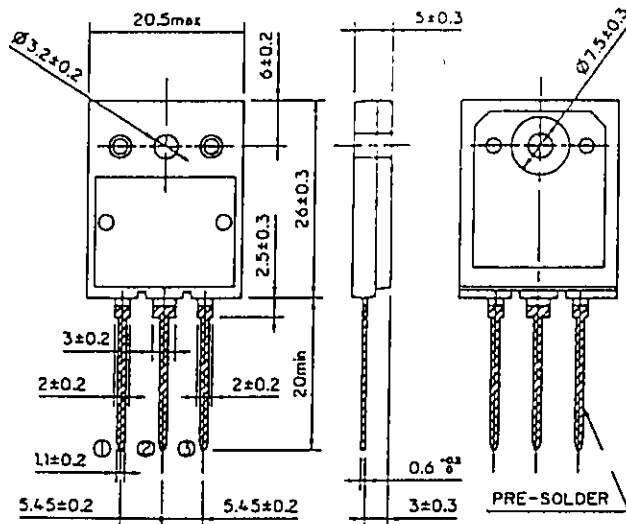
DATE :

Fuji Electric Co.,Ltd.

This Specification is subject to change without notice.

|         |      |      |          |  |                        |      |
|---------|------|------|----------|--|------------------------|------|
|         | DATE | NAME | APPROVED |  | Fuji Electric Co.,Ltd. |      |
| DRAWN   |      |      |          |  | DWG NO.                | 1/12 |
| CHECKED |      |      |          |  |                        |      |
|         |      |      |          |  |                        |      |

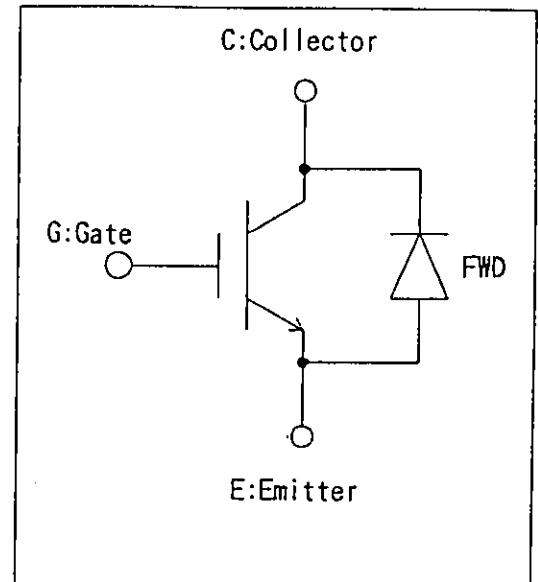
## 1. Outline Drawing



## CONNECTION

- ① GATE  
② COLLECTOR  
③ EMITTER

## 2. Equivalent circuit

3. Absolute maximum ratings (  $T_c=25^\circ\text{C}$  )

| Items                       |     |                         | Symbols    | Ratings    | Units            |
|-----------------------------|-----|-------------------------|------------|------------|------------------|
| Collector-Emitter Voltage   |     |                         | $V_{CES}$  | 600        | V                |
| Gate-Emitter Voltage        |     |                         | $V_{GES}$  | $\pm 20$   | V                |
| Collector Current           | DC  | $T_c=25^\circ\text{C}$  | $I_{C25}$  | 21         | A                |
|                             |     | $T_c=120^\circ\text{C}$ | $I_{C120}$ | 5          | A                |
|                             | 1ms | $T_c=25^\circ\text{C}$  | $I_{cp}$   | 52         | A                |
| IGBT Max. Power Dissipation |     |                         | $P_c$      | 80         | W                |
| FWD Max. Power Dissipation  |     |                         | $P_c$      | 40         | W                |
| Operating Temperature       |     |                         | $T_j$      | + 150      | $^\circ\text{C}$ |
| Storage Temperature         |     |                         | $T_{stg}$  | -40 ~ +150 | $^\circ\text{C}$ |
| Mounting Screw Torque       |     |                         | —          | 70         | N · cm           |

#### 4. Electrical Characteristics ( at Tc=25°C unless otherwise specified )

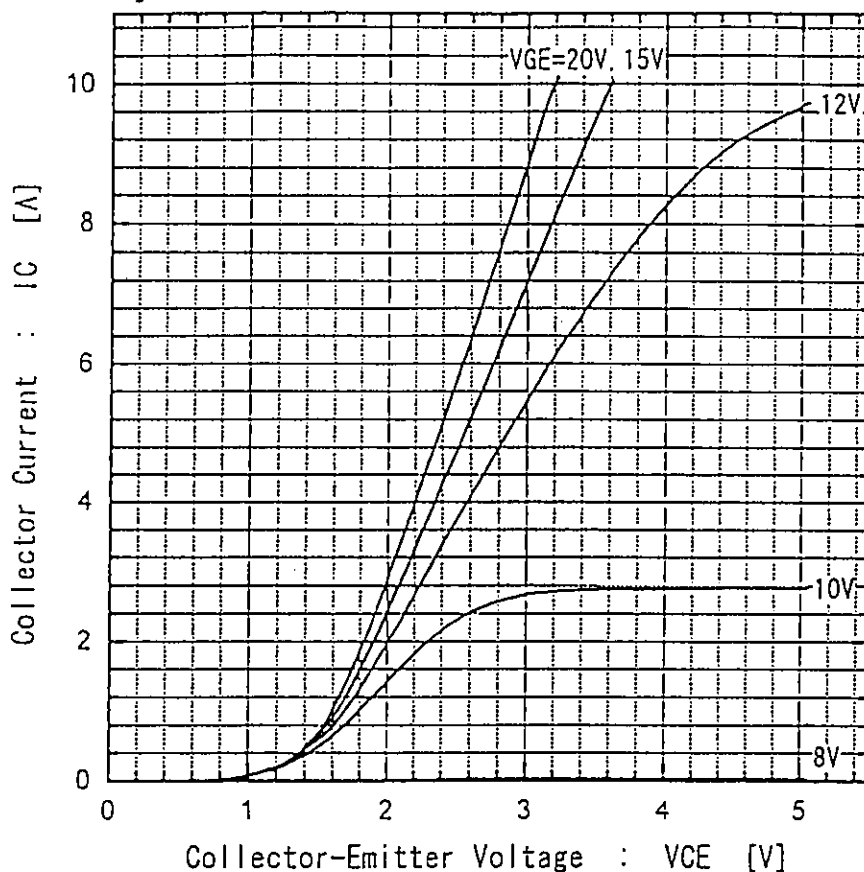
| Items                                   |                  | Symbols       | Characteristics |      |      | Conditions                                                                                | Unit    |
|-----------------------------------------|------------------|---------------|-----------------|------|------|-------------------------------------------------------------------------------------------|---------|
|                                         |                  |               | min.            | typ. | max. |                                                                                           |         |
| Zero gate voltage<br>Collector Current  |                  | $I_{CES}$     |                 |      | 1.0  | $V_{GE} = 0V$<br>$V_{CE} = 600V$                                                          | mA      |
| Gate-Emitter<br>leakage Current         |                  | $I_{GES}$     |                 |      | 20   | $V_{CE} = 0V$<br>$V_{GE} = \pm 20V$                                                       | $\mu A$ |
| Gate-Emitter<br>Threshold Voltage       |                  | $V_{GE(th)}$  | 5.5             |      | 8.5  | $V_{CE} = 20V$<br>$I_C = 5mA$                                                             | V       |
| Collector-Emitter<br>Saturation Voltage |                  | $V_{CE(sat)}$ |                 |      | 3.0  | $V_{GE} = 15V$<br>$I_C = 5A$                                                              | V       |
| Input capacitance                       |                  | $C_{ies}$     |                 | 400  |      | $V_{GE} = 0V$<br>$V_{CE} = 10V$<br>$f = 1MHz$                                             | pF      |
| Output capacitance                      |                  | $C_{oes}$     |                 | 85   |      |                                                                                           |         |
| Reverse transfer<br>capacitance         |                  | $C_{res}$     |                 | 15   |      |                                                                                           |         |
| Switching<br>Time                       | Turn-on<br>time  | $t_{on}$      |                 |      | 1.2  | $V_{CC} = 300V$<br>$I_C = 5A$<br>$V_{GE} = \pm 15V$<br>$R_G = 330\Omega$<br>(Half Bridge) | $\mu s$ |
|                                         |                  | $t_r$         |                 |      | 0.6  |                                                                                           |         |
|                                         | Turn-off<br>time | $t_{off}$     |                 |      | 1.0  |                                                                                           |         |
|                                         |                  | $t_f$         |                 |      | 0.35 |                                                                                           |         |
|                                         | Turn-on<br>time  | $t_{on}$      |                 | 0.16 |      | $V_{CC} = 300V$<br>$I_C = 5A$<br>$V_{GE} = +15V$<br>$R_G = 33\Omega$<br>(Half Bridge)     |         |
|                                         |                  | $t_r$         |                 | 0.11 |      |                                                                                           |         |
|                                         | Turn-off<br>time | $t_{off}$     |                 | 0.30 |      |                                                                                           |         |
|                                         |                  | $t_f$         |                 |      | 0.35 |                                                                                           |         |
| FWD forward voltage drop                |                  | $V_F$         |                 |      | 3.0  | $I_F = 5A$                                                                                | V       |
| Reverse recovery time                   |                  | $t_{rr}$      |                 |      | 0.3  | $I_F = 5A, V_{GE} = -10V$<br>$V_R = 200V$<br>$di/dt = 100A/\mu s$                         | $\mu s$ |

#### 5. Thermal resistance characteristics

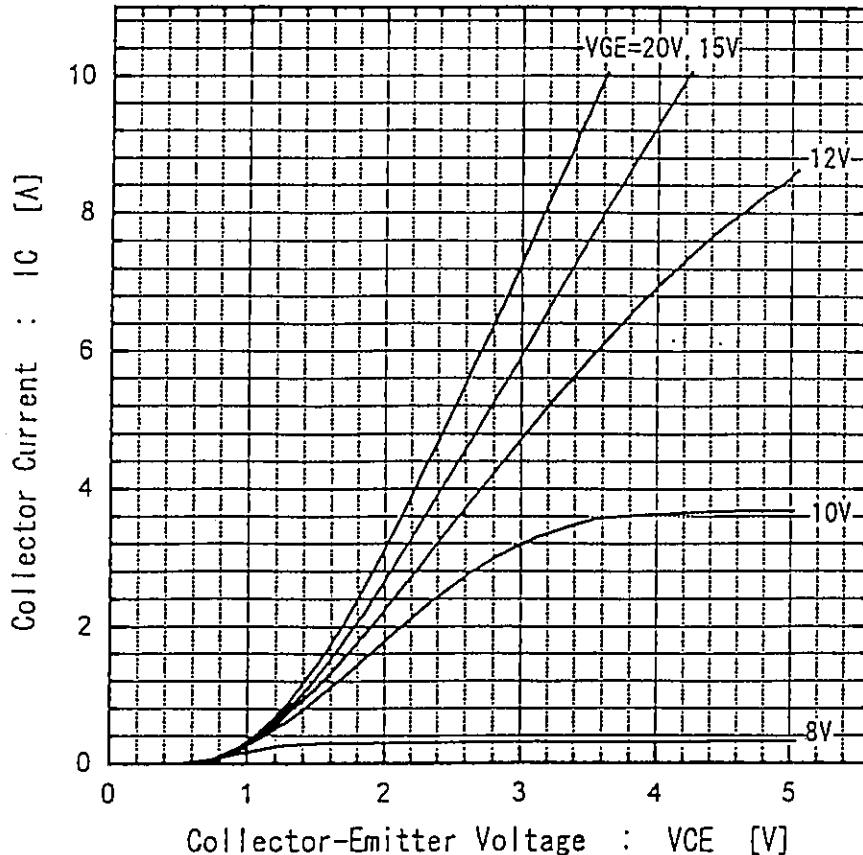
| Items              |  | Symbols       | Characteristics |      |      | Conditions | Unit          |
|--------------------|--|---------------|-----------------|------|------|------------|---------------|
|                    |  |               | min.            | typ. | max. |            |               |
| Thermal resistance |  | $R_{th(j-c)}$ |                 |      | 1.56 | IGBT       | $^{\circ}C/W$ |
|                    |  | $R_{th(j-c)}$ |                 |      | 3.12 | FWD        |               |

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Collector Current vs. Collector-Emitter Voltage  
 $T_j = 25^\circ\text{C}$

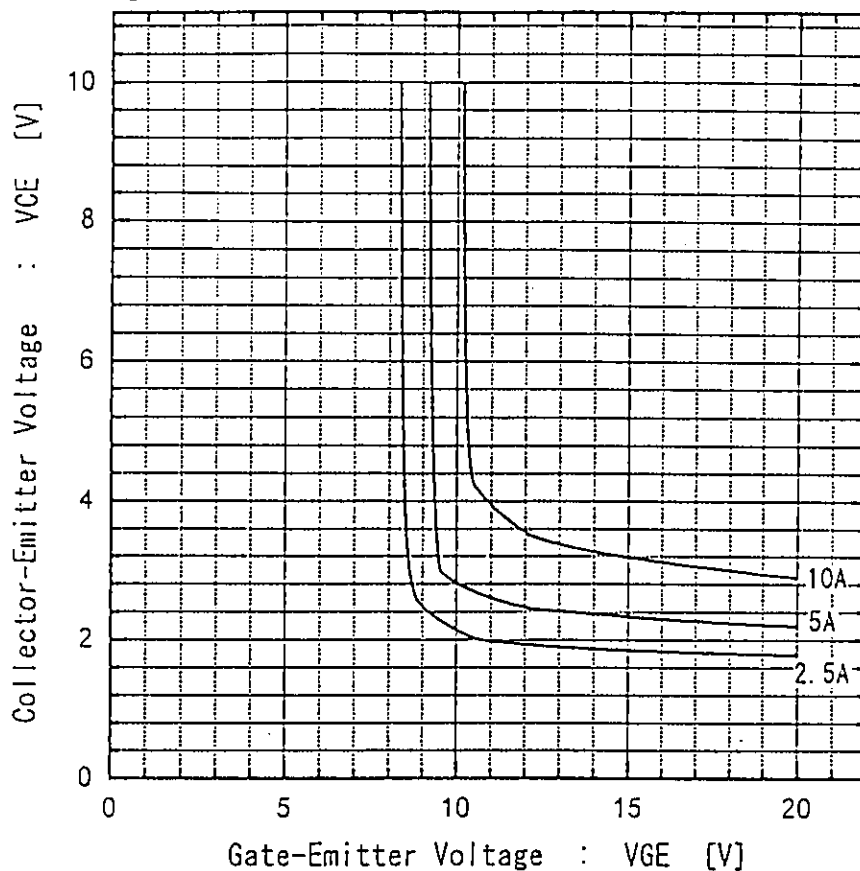


Collector Current vs. Collector-Emitter Voltage  
 $T_j = 125^\circ\text{C}$

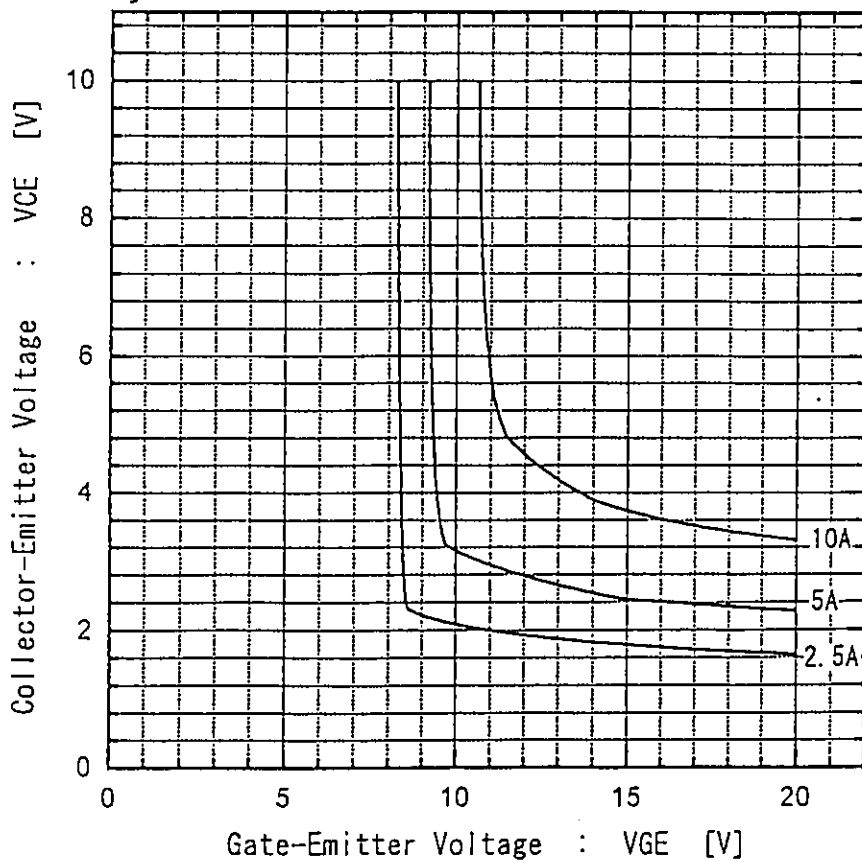


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Collector-Emitter Voltage vs Gate-Emitter Voltage  
 $T_j = 25^\circ\text{C}$



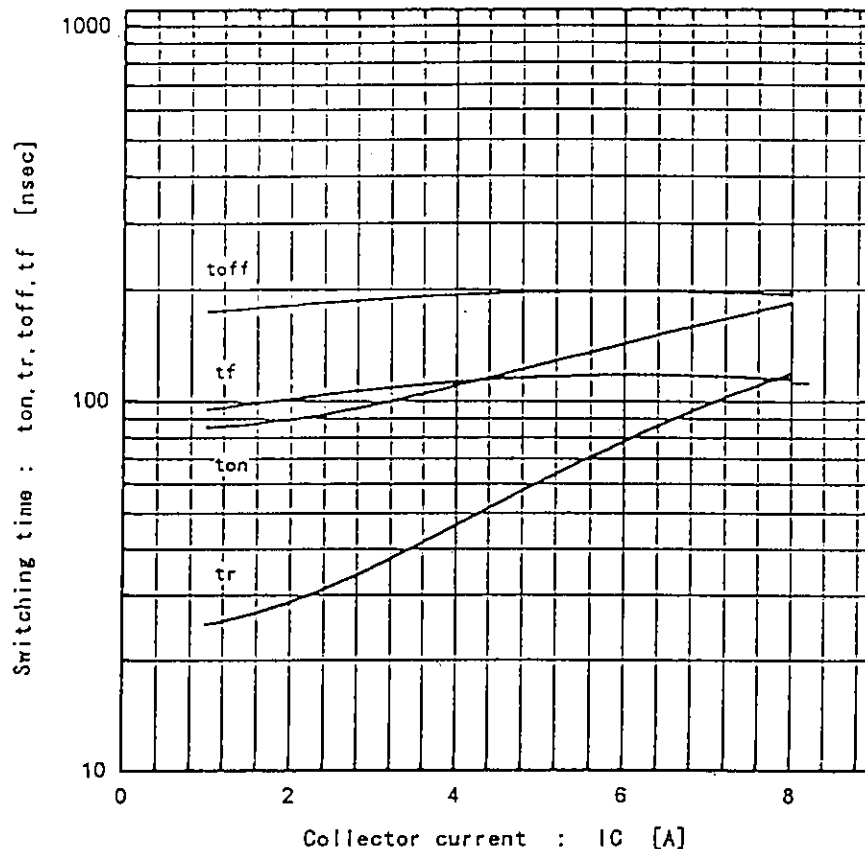
Collector-Emitter Voltage vs Gate-Emitter Voltage  
 $T_j = 125^\circ\text{C}$



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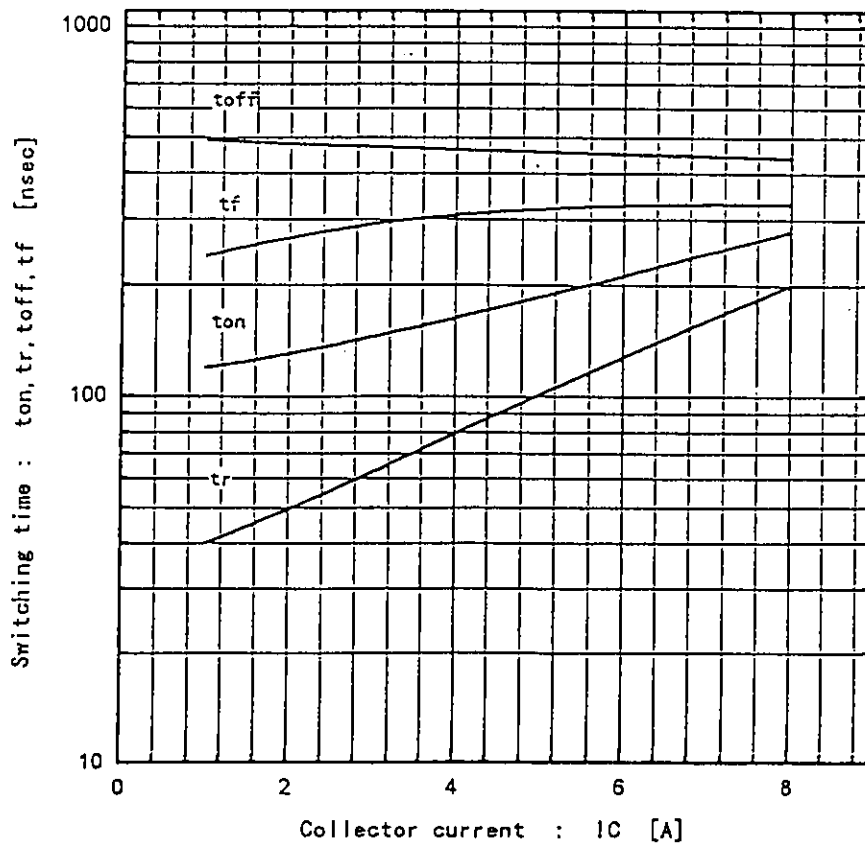
# Switching time vs. Collector current

$V_{CC}=300V$ ,  $R_G=33\Omega$ ,  $V_{GE}=\pm 15V$ ,  $T_j=25^\circ C$



# Switching time vs. Collector current

$V_{CC}=300V$ ,  $R_G=33\Omega$ ,  $V_{GE}=\pm 15V$ ,  $T_j=25^\circ C$



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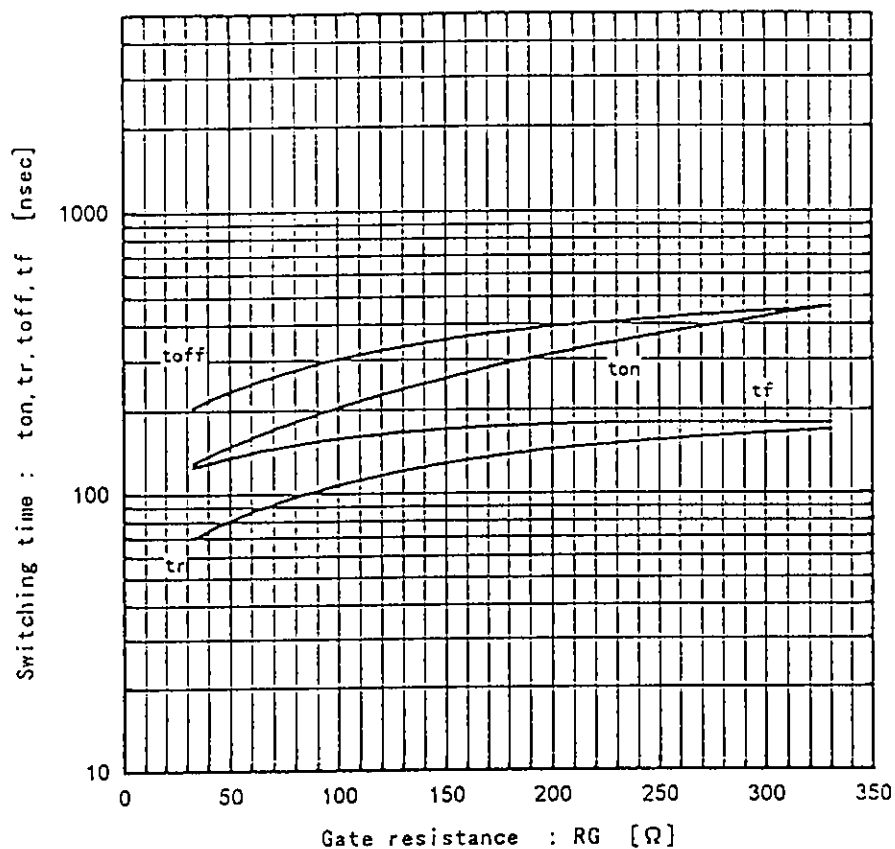
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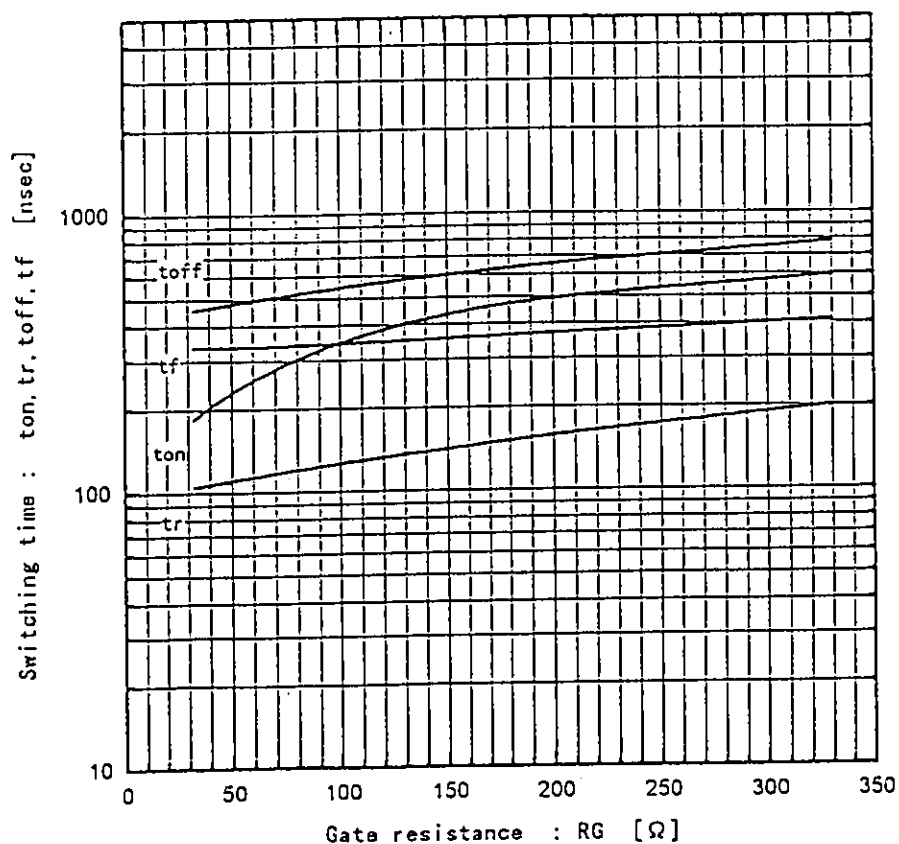
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Switching time vs.  $R_G$   
 $V_{CC}=300V, I_C=5A, V_{GE}=\pm 15V, T_j=25^\circ C$



Switching time vs.  $R_G$   
 $V_{CC}=300V, I_C=5A, V_{GE}=\pm 15V, T_j=125^\circ C$



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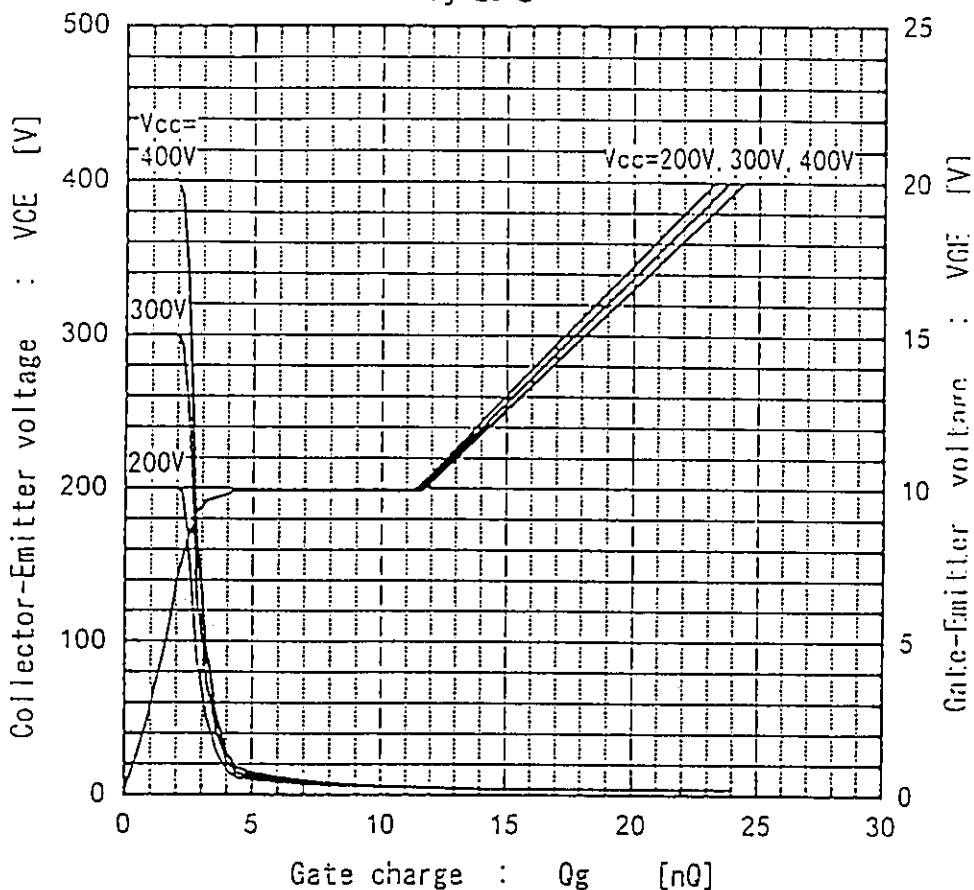
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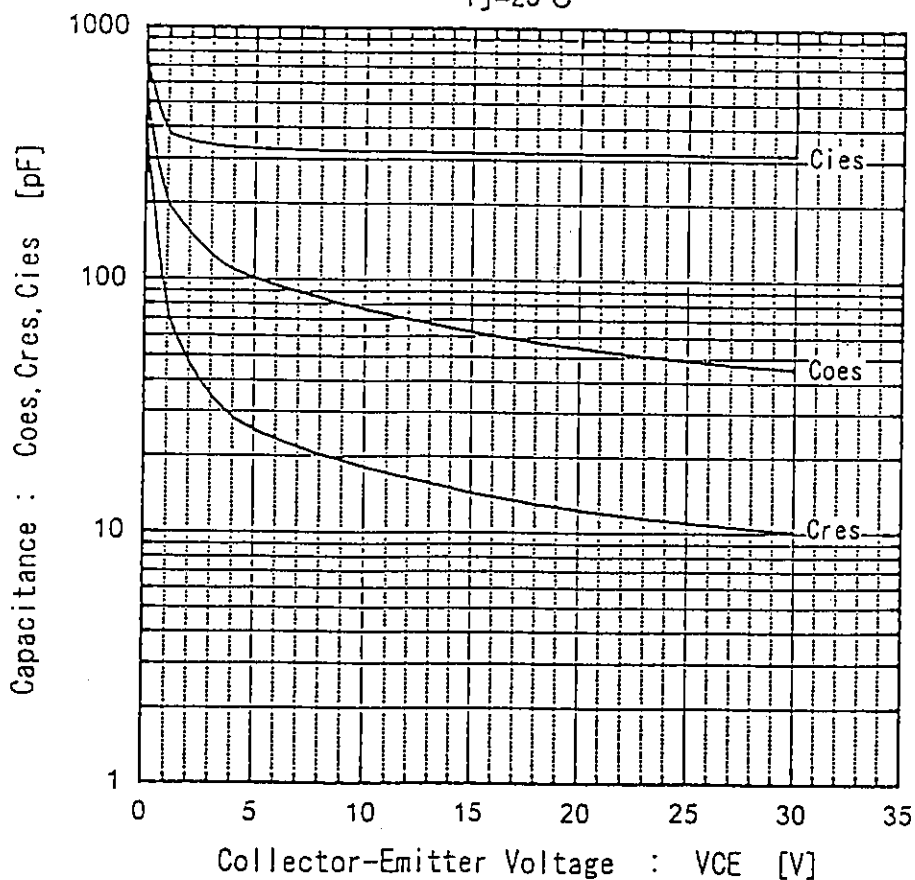
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# Dynamic input characteristics Tj=25°C



## Capacitance vs. Collector-Emittter voltage Tj=25°C



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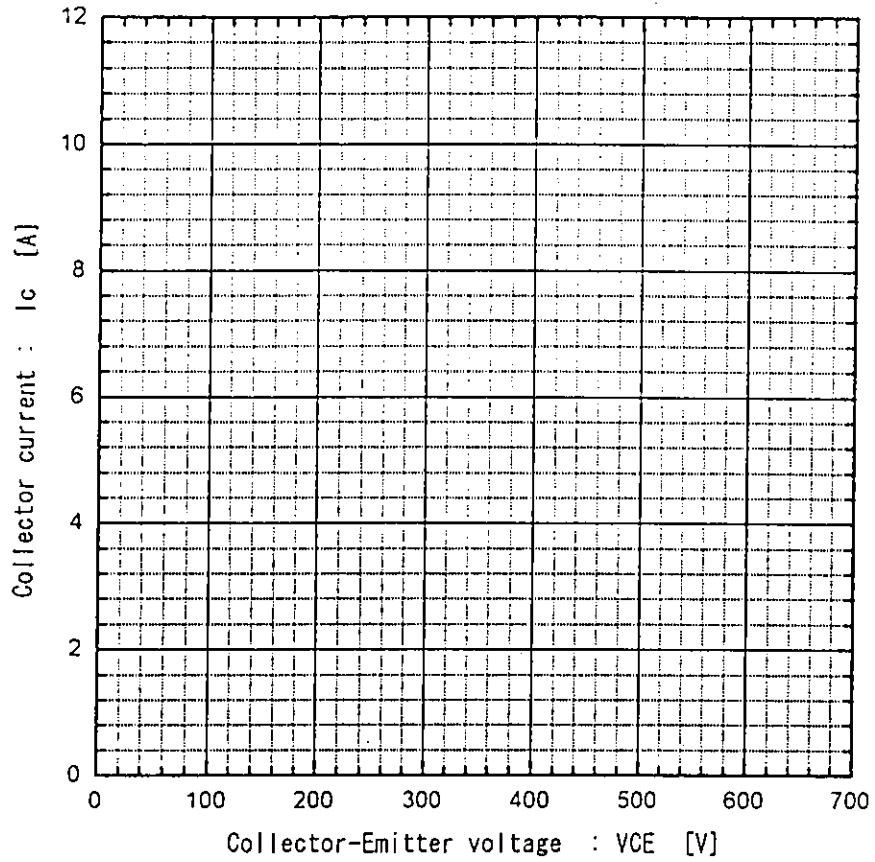
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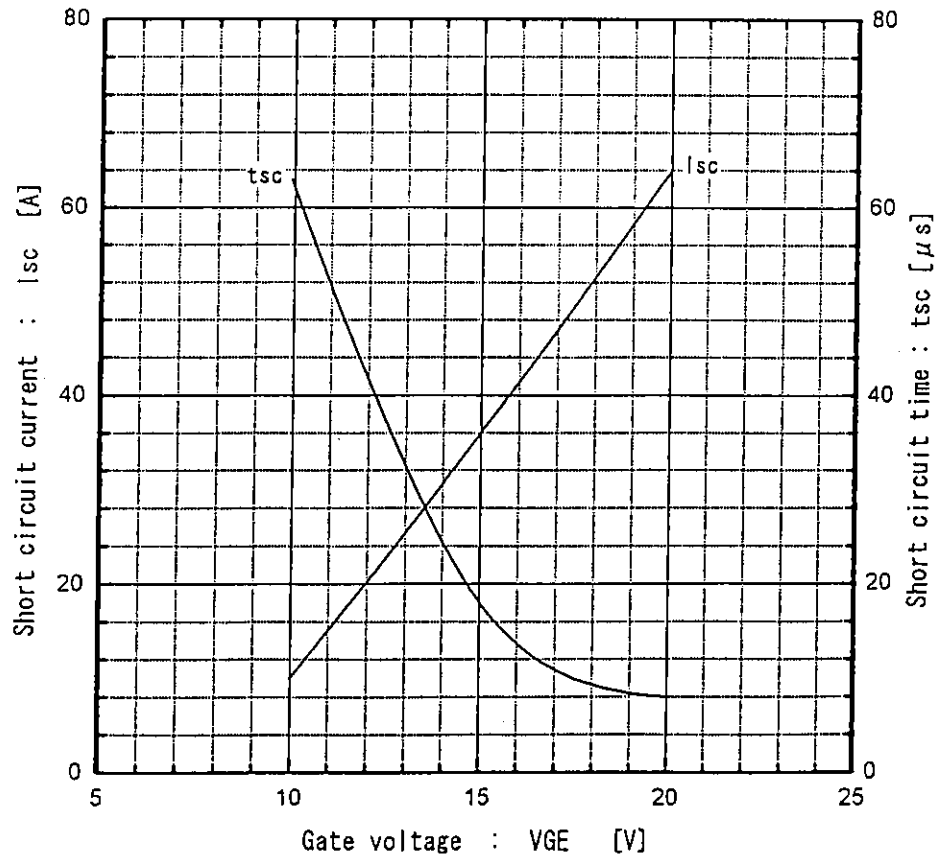


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Reverse Biased Safe Operating Area  
 $+V_{GE}=15V, -V_{GE} \leq 15V, T_j \leq 125^\circ C, R_G \geq 33\Omega$



Typical short circuit capability  
 $V_{CC}=400V, R_G=33\Omega, T_j=125^\circ C$



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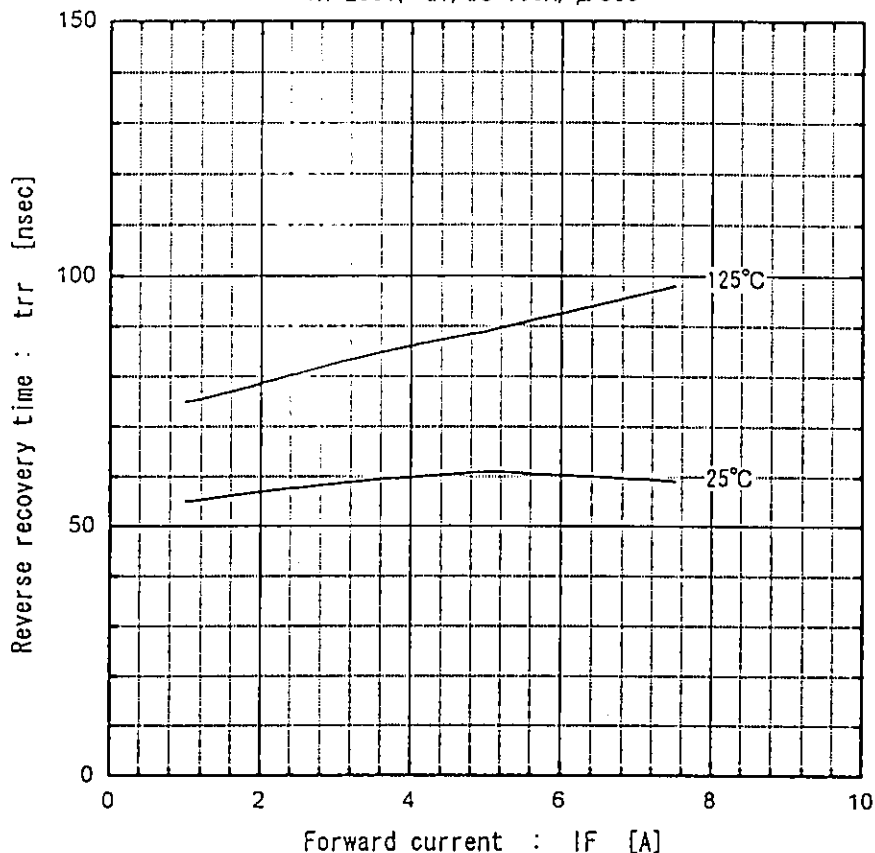
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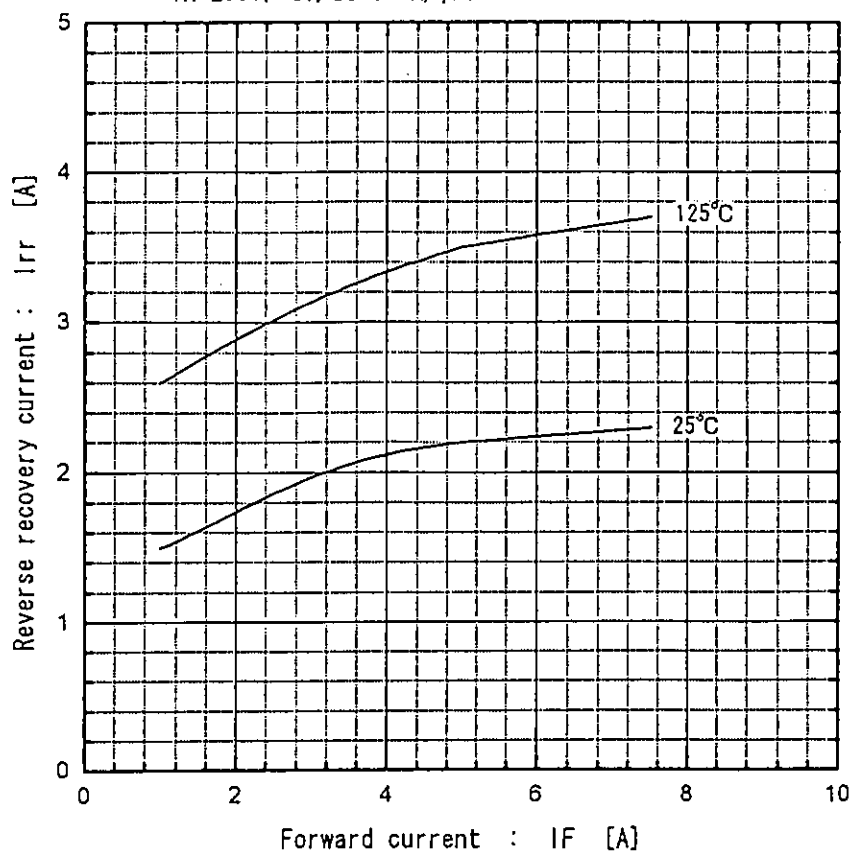
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Reverse recovery time vs. Forward current  
 $V_R=200V, -di/dt=100A/\mu sec$



Reverse recovery current vs. Forward current  
 $V_R=200V, -di/dt=100A/\mu sec$



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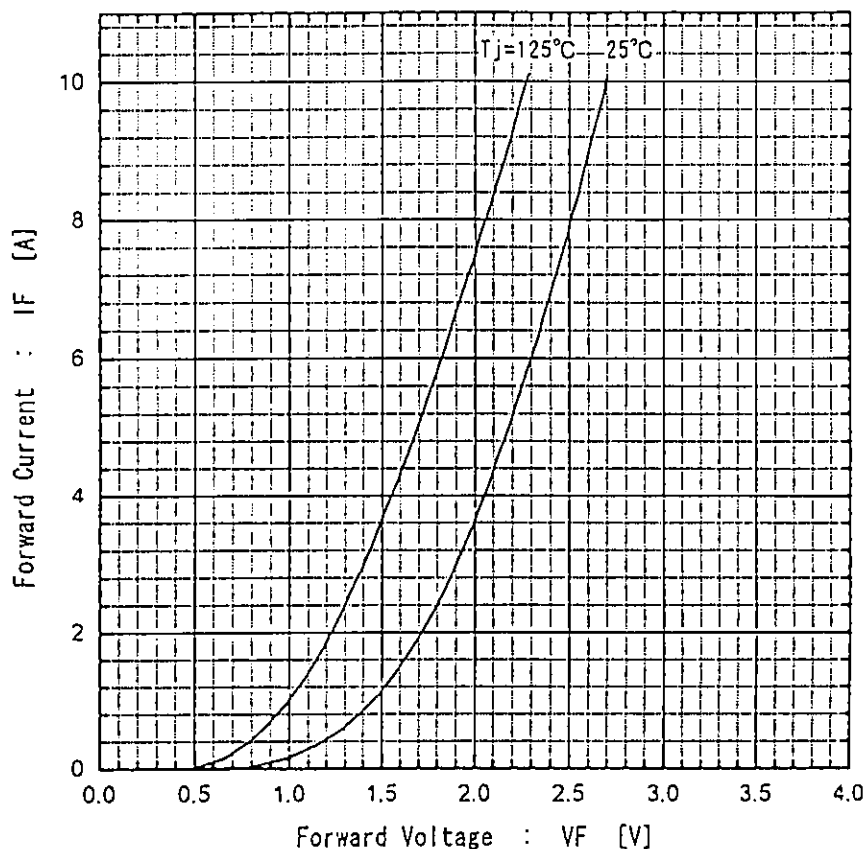
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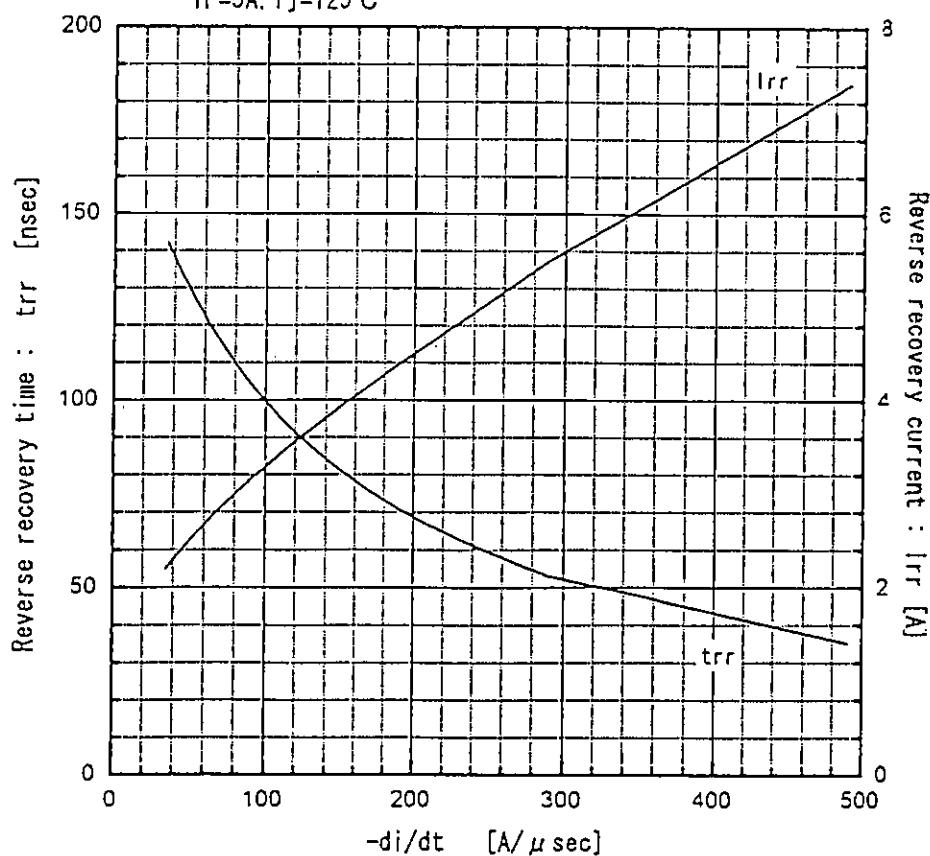
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Forward voltage vs. Forward current



Reverse recovery characteristics vs.  $-di/dt$   
 $I_F = 5\text{A}$ ,  $T_J = 125^\circ\text{C}$



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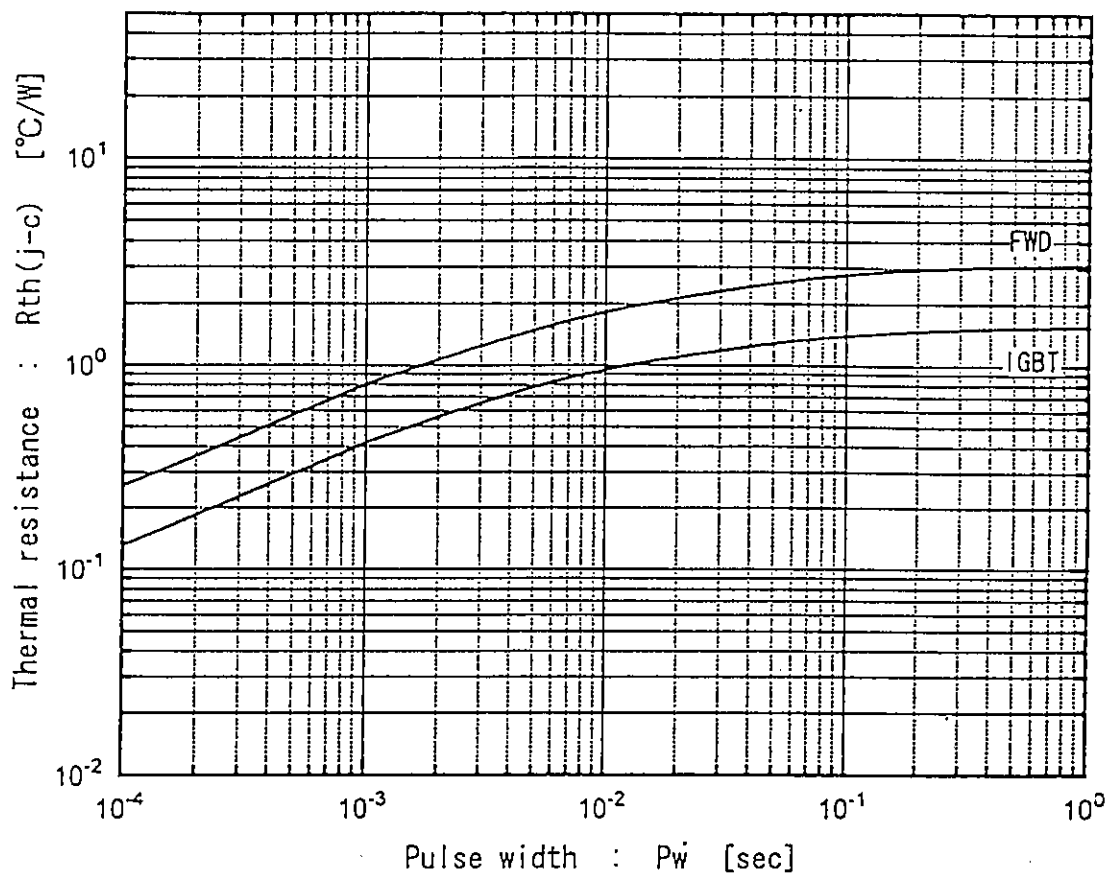
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# Transient thermal resistance



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