

600V / 50A

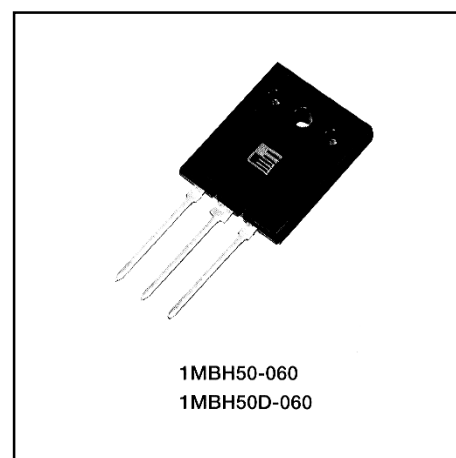
## Molded Package

## ■ Features

- Small molded package
- Low power loss
- Soft switching with low switching surge and noise
- High reliability, high ruggedness (RBSOA, SCSOA etc.)
- Comprehensive line-up

## ■ Applications

- Inverter for Motor drive
- AC and DC Servo drive amplifier
- Uninterruptible power supply



## ■ Maximum ratings and characteristics

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

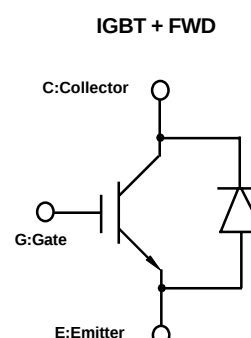
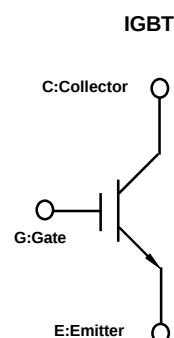
## 1MBH50-060 / IGBT

| Item                         |     |          | Symbol           | Rating      | Unit |
|------------------------------|-----|----------|------------------|-------------|------|
| Collector-Emitter voltage    |     |          | V <sub>CES</sub> | 600         | V    |
| Gate-Emitter voltaga         |     |          | V <sub>GES</sub> | ±20         | V    |
| Collector<br>current         | DC  | Tc=25°C  | Ic25             | 82          | A    |
|                              |     | Tc=100°C | Ic100            | 50          | A    |
|                              | 1ms | Tc=25°C  | Icp              | 328         | A    |
| Max. power dissipation(IGBT) |     |          | Pc               | 310         | W    |
| Operating temperature        |     |          | Tj               | +150        | °C   |
| Storage temperature          |     |          | Tstg             | -40 to +150 | °C   |
| Screw torque                 |     |          | -                | 70          | N·m  |

## 1MBH50D-060 / IGBT+FWD

| Item                          |     |          | Symbol           | Rating      | Unit |
|-------------------------------|-----|----------|------------------|-------------|------|
| Collector-Emitter voltage     |     |          | V <sub>CES</sub> | 600         | V    |
| Gate-Emitter voltage          |     |          | V <sub>GES</sub> | ±20         | V    |
| Collector current             | DC  | Tc=25°C  | Ic25             | 82          | A    |
|                               |     | Tc=100°C | Ic100            | 50          | A    |
|                               | 1ms | Tc=25°C  | Icp              | 328         | A    |
| Max. power dissipation (IGBT) |     |          | Pc               | 310         | W    |
| Max. power dissipation (FWD)  |     |          | Pc               | 140         | W    |
| Operating temperature         |     |          | Tj               | +150        | °C   |
| Storage temperature           |     |          | Tslg             | -40 to +150 | °C   |
| Screw torque                  |     |          | -                | 70          | N·m  |

## ■ Equivalent Circuit Schematic



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

1MBH50-060 / IGBT

| Item                                 | Symbol               | Characteristics |      |      | Conditions                                 | Unit |
|--------------------------------------|----------------------|-----------------|------|------|--------------------------------------------|------|
|                                      |                      | Min.            | Typ. | Max. |                                            |      |
| Zero gate voltage collector current  | I <sub>CEs</sub>     | —               | —    | 1.0  | V <sub>GE</sub> =0V, V <sub>CE</sub> =600V | mA   |
| Gate-Emitter leakage current         | I <sub>GES</sub>     | —               | —    | 20   | V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V | μA   |
| Gate-Emitter threshold voltage       | V <sub>GE(th)</sub>  | 5.5             | —    | 8.5  | V <sub>CE</sub> =20V, I <sub>C</sub> =50mA | V    |
| Collector-Emitter saturation voltage | V <sub>CE(sat)</sub> | —               | —    | 3.0  | V <sub>GE</sub> =15V, I <sub>C</sub> =50A  | V    |
| Input capacitance                    | C <sub>ies</sub>     | —               | 3000 | —    | V <sub>GE</sub> =0V                        | pF   |
| Output capacitance                   | C <sub>oes</sub>     | —               | 650  | —    | V <sub>CE</sub> =10V                       |      |
| Reverse transfer capacitance         | C <sub>res</sub>     | —               | 150  | —    | f=1MHz                                     |      |
| Turn-on time                         | t <sub>on</sub>      | —               | —    | 1.2  | V <sub>CC</sub> =300V, I <sub>C</sub> =50A | μs   |
|                                      | t <sub>r</sub>       | —               | —    | 0.6  | V <sub>GE</sub> =±15V                      |      |
| Turn-off time                        | t <sub>off</sub>     | —               | —    | 1.0  | R <sub>G</sub> =62 ohm                     |      |
|                                      | t <sub>f</sub>       | —               | —    | 0.35 | (Half Bridge)                              |      |

1MBH50D-060 / IGBT+FWD

| Item                                 | Symbol               | Characteristics |      |      | Conditions                                                | Unit |
|--------------------------------------|----------------------|-----------------|------|------|-----------------------------------------------------------|------|
|                                      |                      | Min.            | Typ. | Max. |                                                           |      |
| Zero gate voltage collector current  | I <sub>CEs</sub>     | —               | —    | 1.0  | V <sub>GE</sub> =0V, V <sub>CE</sub> =600V                | mA   |
| Gate-Emitter leakage current         | I <sub>GES</sub>     | —               | —    | 20   | V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V                | μA   |
| Gate-Emitter threshold voltage       | V <sub>GE(th)</sub>  | 5.5             | —    | 8.5  | V <sub>CE</sub> =20V, I <sub>C</sub> =50mA                | V    |
| Collector-Emitter saturation voltage | V <sub>CE(sat)</sub> | —               | —    | 3.0  | V <sub>GE</sub> =15V, I <sub>C</sub> =50A                 | V    |
| Input capacitance                    | C <sub>ies</sub>     | —               | 3000 | —    | V <sub>GE</sub> =0V                                       | pF   |
| Output capacitance                   | C <sub>oes</sub>     | —               | 650  | —    | V <sub>CE</sub> =10V                                      |      |
| Reverse transfer capacitance         | C <sub>res</sub>     | —               | 150  | —    | f=1MHz                                                    |      |
| Turn-on time                         | t <sub>on</sub>      | —               | —    | 1.2  | V <sub>CC</sub> =300V, I <sub>C</sub> =50A                | μs   |
|                                      | t <sub>r</sub>       | —               | —    | 0.6  | V <sub>GE</sub> =±15V                                     |      |
| Turn-off time                        | t <sub>off</sub>     | —               | —    | 1.0  | R <sub>G</sub> =62 ohm                                    |      |
|                                      | t <sub>f</sub>       | —               | —    | 0.35 | (Half Bridge)                                             |      |
| FWD forward on voltage               | V <sub>F</sub>       | —               | —    | 3.0  | I <sub>F</sub> =50A, V <sub>GE</sub> =0V                  | V    |
| Reverse recovery time                | t <sub>rr</sub>      | —               | —    | 0.3  | I <sub>F</sub> =50A, V <sub>GE</sub> =-10V, di/dt=100A/μs | μs   |

● Thermal resistance characteristics

1MBH50-060 / IGBT

| Item               | Symbol               | Characteristics |      |      | Conditions | Unit |
|--------------------|----------------------|-----------------|------|------|------------|------|
|                    |                      | Min.            | Typ. | Max. |            |      |
| Thermal resistance | R <sub>th(j-c)</sub> | —               | —    | 0.40 | IGBT       | °C/W |

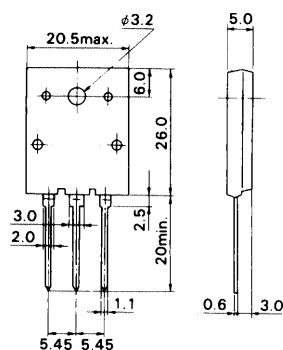
1MBH50D-060 / IGBT+FWD

| Item               | Symbol               | Characteristics |      |      | Conditions | Unit |
|--------------------|----------------------|-----------------|------|------|------------|------|
|                    |                      | Min.            | Typ. | Max. |            |      |
| Thermal resistance | R <sub>th(j-c)</sub> | —               | —    | 0.40 | IGBT       | °C/W |
|                    | R <sub>th(j-c)</sub> | —               | —    | 0.89 | FWD        | °C/W |

■ Outline drawings, mm

1MBH50-060, 1MBH50D-060

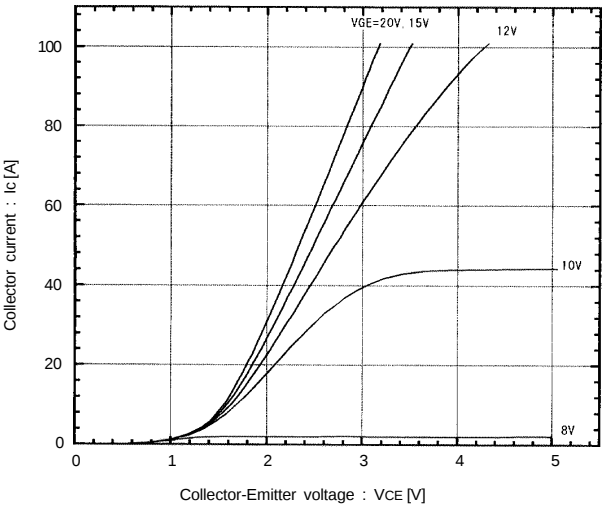
TO-3PL



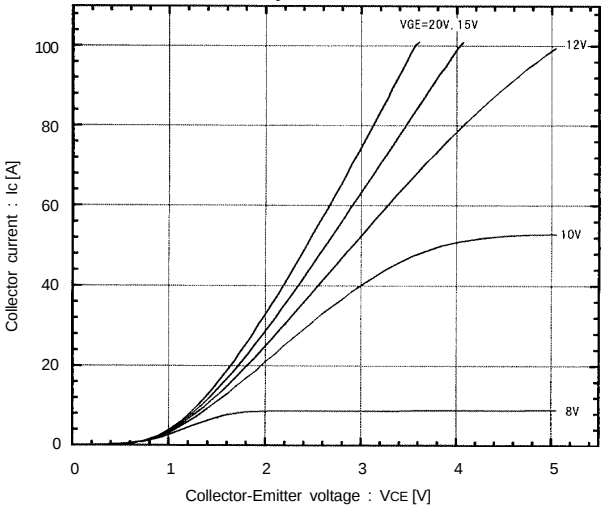
Characteristics

1MBH50-060,1MBH50D-060

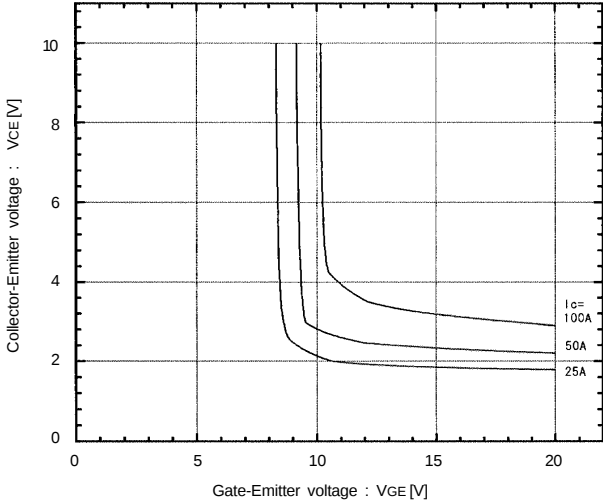
Collector current vs. Collector-Emitter voltage  
 $T_j=25^{\circ}\text{C}$



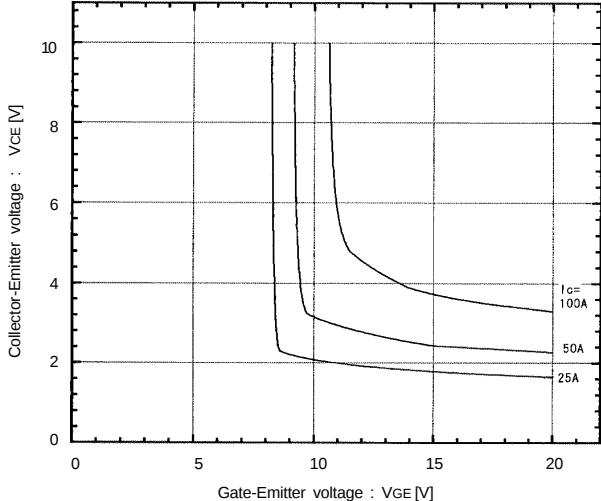
Collector current vs. Collector-Emitter voltage  
 $T_j=125^{\circ}\text{C}$



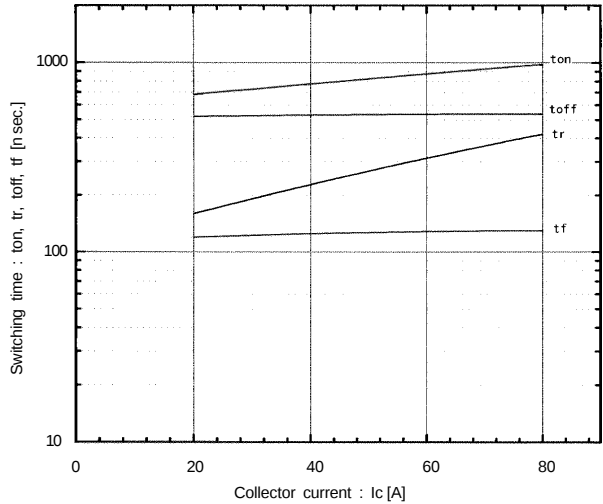
Collector-Emitter vs. Gate-Emitter voltage  
 $T_j=25^{\circ}\text{C}$



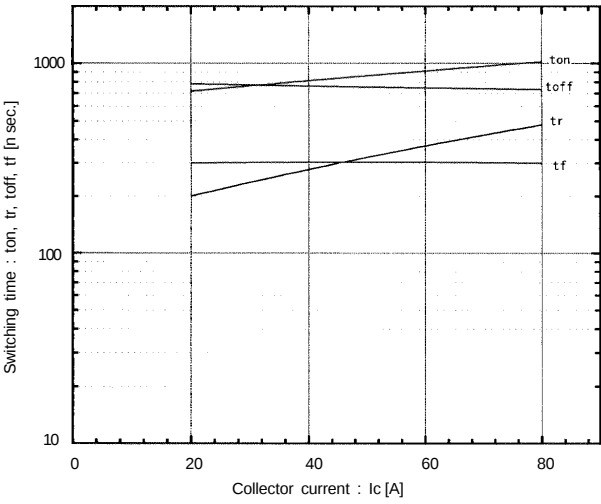
Collector-Emitter vs. Gate-Emitter voltage  
 $T_j=125^{\circ}\text{C}$



Switching time vs. Collector current  
 $V_{CC}=300\text{V}$ ,  $R_G=62\text{ ohm}$ ,  $V_{GE}=\pm 15\text{V}$ ,  $T_j=25^{\circ}\text{C}$

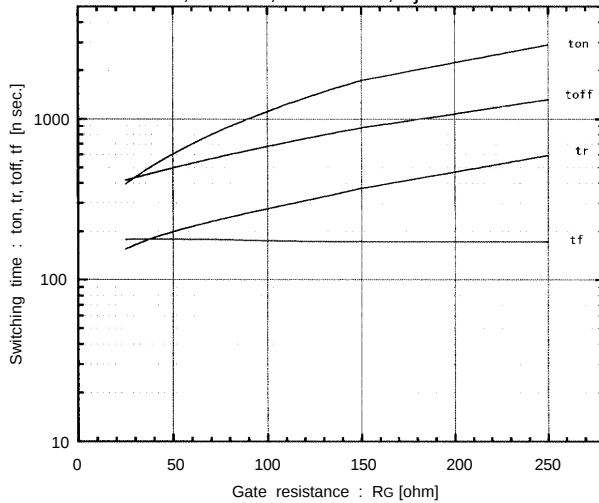
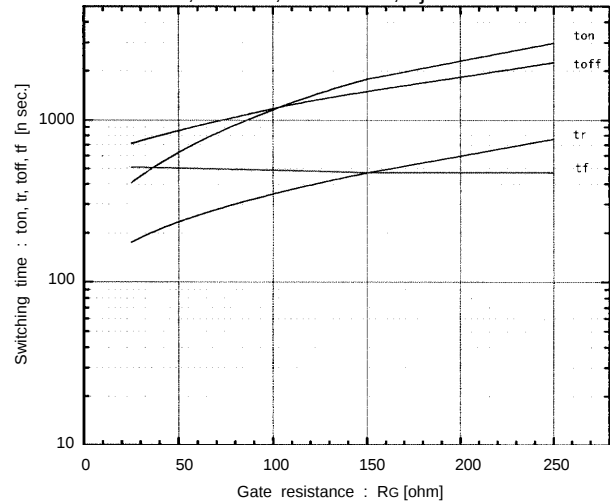


Switching time vs. Collector current  
 $V_{CC}=300\text{V}$ ,  $R_G=62\text{ ohm}$ ,  $V_{GE}=\pm 15\text{V}$ ,  $T_j=125^{\circ}\text{C}$

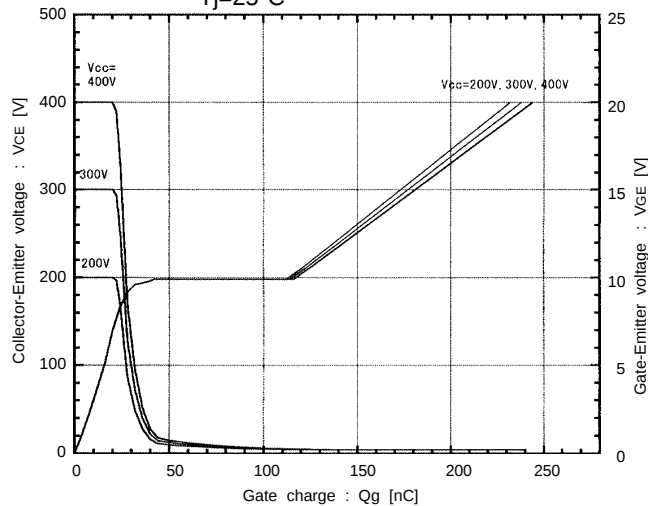


## Characteristics

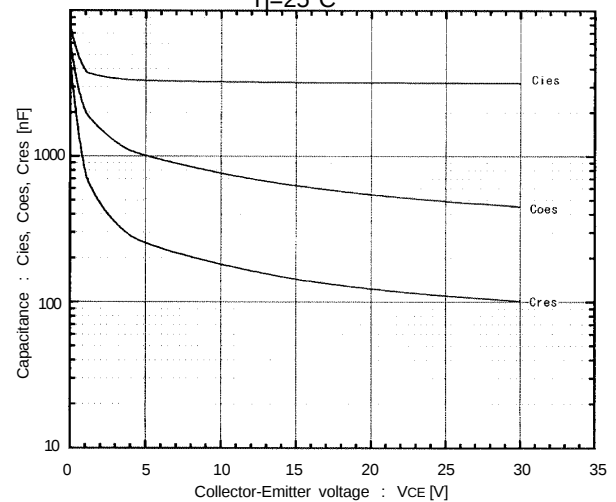
1MBH50-060, 1MBH50D-060

Switching time vs.  $R_G$  $V_{CC}=300V, I_C=50A, V_{GE}=\pm 15V, T_J=25^\circ C$ Switching time vs.  $R_G$  $V_{CC}=300V, I_C=50A, V_{GE}=\pm 15V, T_J=125^\circ C$ 

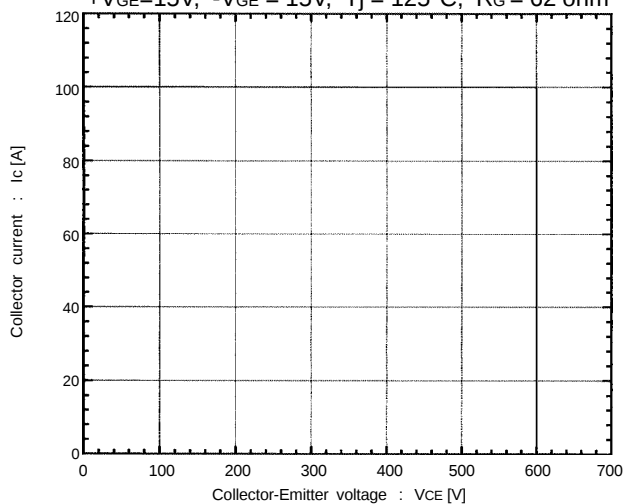
Dynamic input characteristics

 $T_J=25^\circ C$ 

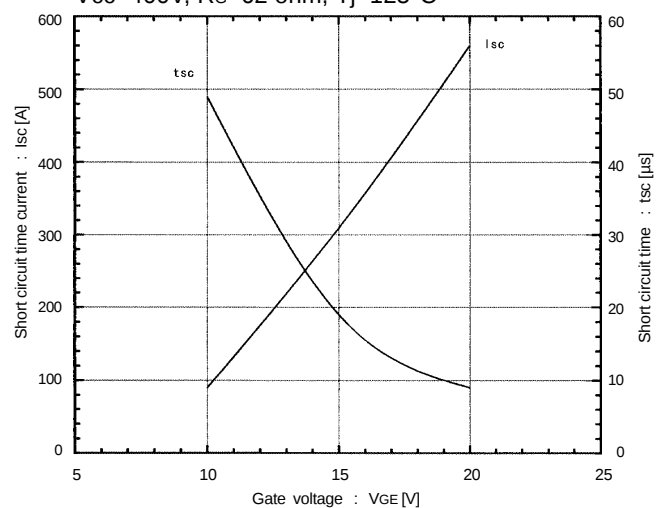
Capacitance vs. Collector-Emitter voltage

 $T_J=25^\circ C$ 

Reversed biased safe operating area

 $+V_{GE}=15V, -V_{GE} \leq 15V, T_J \leq 125^\circ C, R_G \geq 62 \text{ ohm}$ 

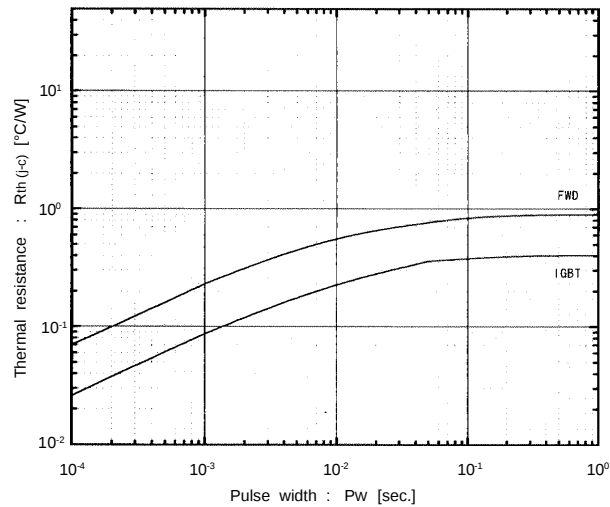
Typical short circuit capability

 $V_{CC}=400V, R_G=62 \text{ ohm}, T_J=125^\circ C$ 

Characteristics

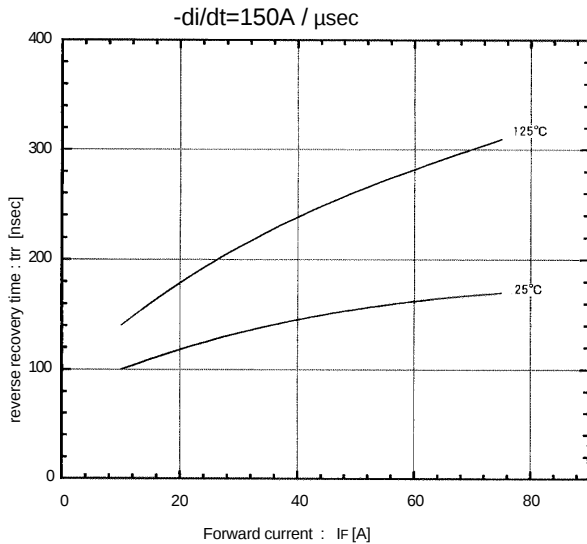
1MBH50-060,1MBH50D-060

Transient thermal resistance

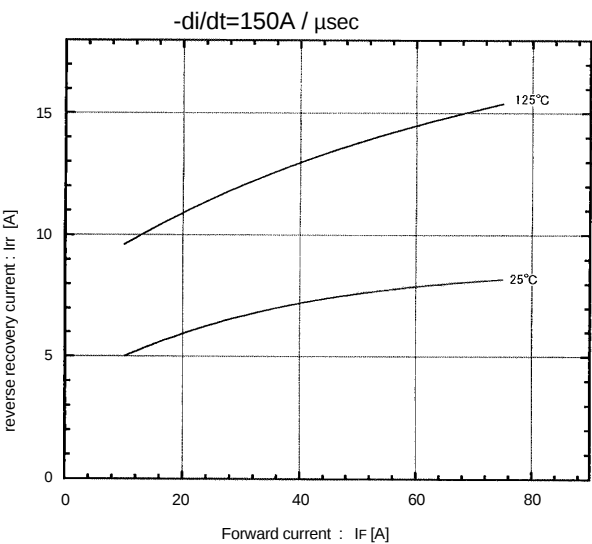


1MBH50D-060

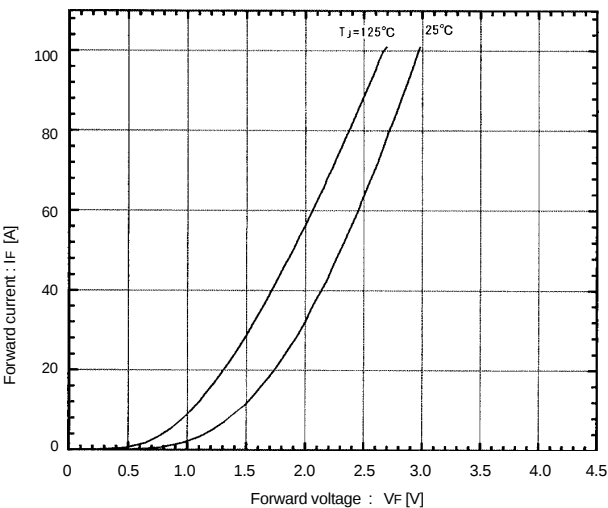
Reverse recovery time vs. Forward current



Reverse recovery current vs. Forward current



Forward current vs. Forward voltage



Reverse recovery time characteristics vs.  $-di/dt$

