

# 4MBI900VB-120RA-50

IGBT Modules

## IGBT Power Module (V series)

1200V/900A/IGBT,  $\pm 600V/900A/RB$ -IGBT, 4-in-1 package

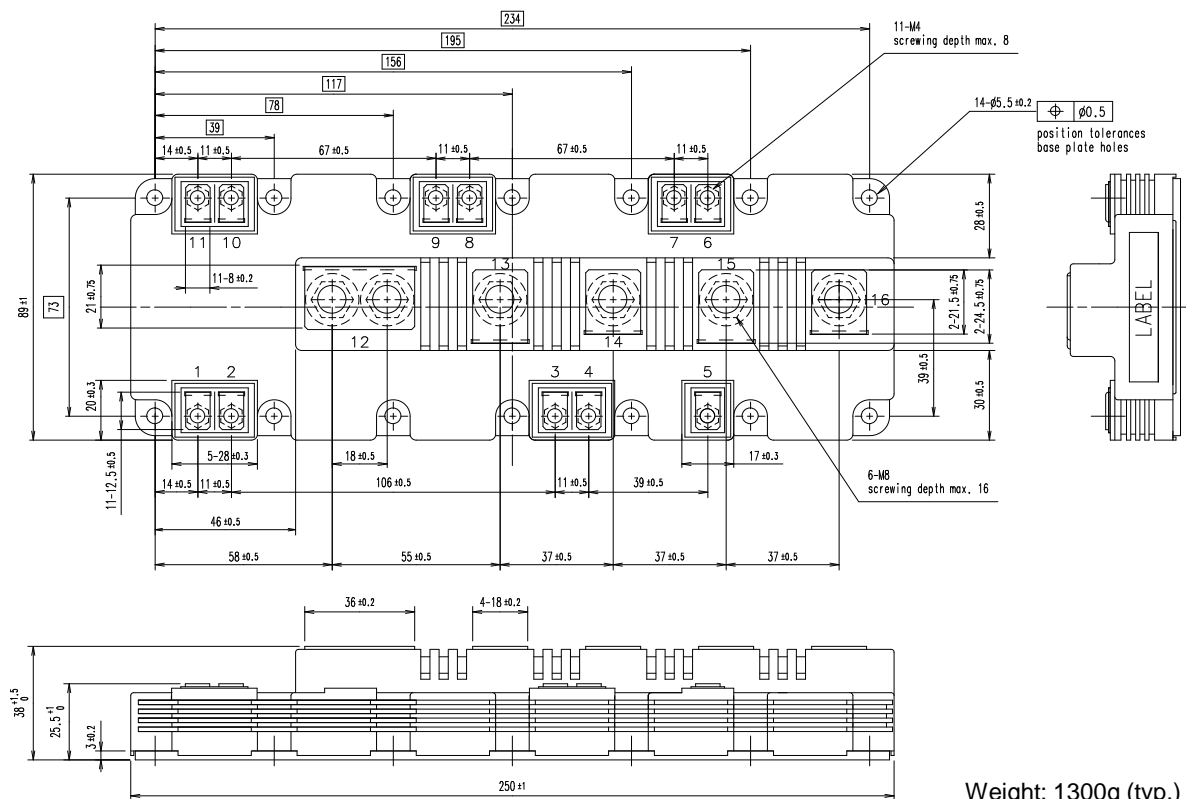
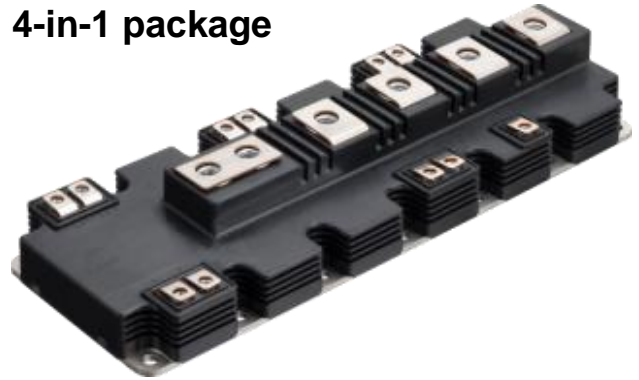
■ **Features**

- Higher efficiency
- Optimized Advanced T-type circuit
- Reverse-Blocking IGBT as for AC Switch
- Low inductance module structure

■ **Applications**

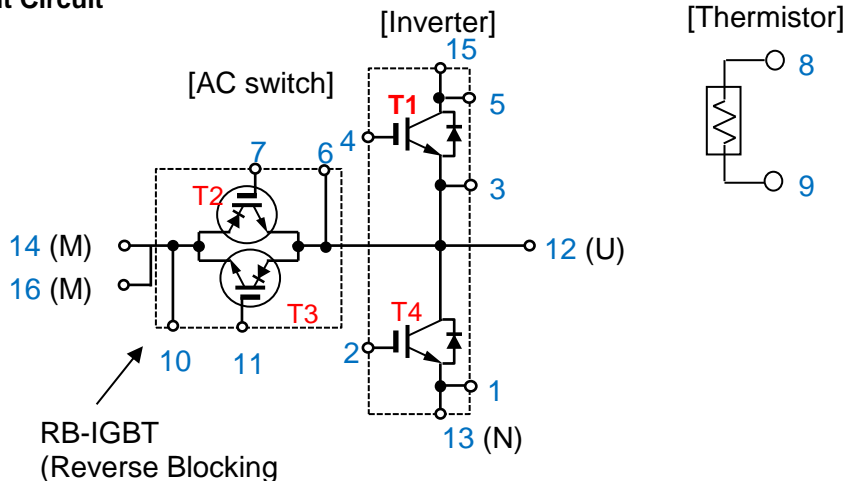
- Inverter for motor drive
- Uninterruptible powre supply
- Power conditioner for PV, Wind turbine

■ **Outline drawing**



Weight: 1300g (typ.)

■ **Equivalent Circuit**



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■ Absolute Maximum Ratings (at Tc= 25°C unless otherwise specified)

| Item                |   | Symbol    | Condition | Maximum Rating       | Unit            |   |
|---------------------|---|-----------|-----------|----------------------|-----------------|---|
| Inverter            | Collector-Emitter voltage                             | VCES      |           | 1200                 | V               |   |
|                     | Gate-Emitter voltage                                  | VGES      |           | ±20                  | V               |   |
|                     | Collector current                                     | IGBT      | Ic        | Continuous           | Tc=25°C<br>1200 | A |
|                     |   |           |           | Tc=100°C<br>Duty=88% | 900             |   |
|                     |   | FWD       | Icp       | 1ms                  | 1800            |   |
|                     |   |           | -Ic       |                      | 900             |   |
|                     |   | -Ic pulse | 1ms       | 1800                 |                 |   |
|                     | Collector power dissipation                           | Pc        | 1 device  | 3950                 | W               |   |
|                     | Junction temperature                                  | Tj        |           | 175                  | °C              |   |
|                     | Operating temperature<br>(under switching conditions) | Tjop      |           | 150                  |                 |   |
|                     |   |           |           |                      |                 |   |
| AC switch           | Collector-Emitter voltage                             | VCES      |           | ±600                 | V               |   |
|                     | Gate-Emitter voltage                                  | VGES      |           | ±20                  | V               |   |
|                     | Collector current                                     | RB-IGBT   | Ic        | Continuous           | Tc=25°C<br>1200 | A |
|                     |   |           |           | Tc=88°C<br>Duty=56%  | 900             |   |
|                     |   | Ic pulse  | 1ms       | 1800                 |                 |   |
|                     | Collector power dissipation                           | Pc        | 1 device  | 2660                 | W               |   |
|                     | Junction temperature                                  | Tj        |           | 150                  | °C              |   |
|                     | Operating temperature<br>(under switching conditions) | Tjop      |           | 125                  |                 |   |
|                     |   |           |           |                      |                 |   |
| Case temperature    | Tc  |           | 125       |                      |                 |   |
| Storage temperature | Tstg  |           | -40 ~ 125 |                      |                 |   |
| Isolation voltage   | between terminal and copper base (*1)                 | Viso      | AC: 1min. | 4000                 | VAC             |   |
|                     | between thermistor and others (*2)                    |           |           |                      |                 |   |
| Screw torque (*3)   | Mounting  | -         | M5        | 6.0                  | N m             |   |
|                     | Main terminals  | -         | M8        | 10.0                 |                 |   |
|                     | Sense terminals                                       | -         | M4        | 2.1                  |                 |   |

(\*1) All terminals should be connected together during the test.

(\*2) Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

(\*3) Recommendable value : Mounting                    3.0 ~ 6.0 Nm (M5)  
 Recommendable value : Main Terminals            8.0 ~ 10.0 Nm (M8)  
 Recommendable value : Sense Terminals         1.8 ~ 2.1 Nm (M4)

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■ Electrical characteristics (at Tj= 25°C unless otherwise specified)

| Item                  | Symbol                               | Condition  | Characteristics   |                     |      | Units   |          |          |
|-----------------------|--------------------------------------|--|---|---------------------|------|---------|----------|----------|
|                       |                                      |  | min.  | typ.                | max. |         |          |          |
| Inverter              | Zero gate voltage Collector current  | $I_{CES}$  | $V_{GE} = 0V$<br>$V_{CE} = 1200V$   | -                   | -    | 6.0     | mA       |          |
|                       | Gate-Emitter leakage current         | $I_{GES}$  | $V_{CE} = 0V$<br>$V_{GE} = \pm 20V$                                       | -                   | -    | 1200    | nA       |          |
|                       | Gate-Emitter threshold voltage       | $V_{GE(th)}$   | $V_{CE} = 20V$<br>$I_C = 900mA$   | 6.0                 | 6.5  | 7.0     | V        |          |
|                       | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (chip)   | $V_{GE} = 15V$<br>$I_C = 900A$  | $T_j = 25^\circ C$  | -    | 1.85    | 2.35     | V        |
|                       |                                      |  |   | $T_j = 125^\circ C$ | -    | 2.20    | -        |          |
|                       |                                      | $V_{CE(sat)}$ (terminal)   | $V_{GE} = 15V$<br>$I_C = 900A$  | $T_j = 150^\circ C$ | -    | 2.25    | -        |          |
|                       |                                      |  |   | $T_j = 25^\circ C$  | -    | 1.95    | 2.45     |          |
|                       | Internal gate resistance             | $Rg(int)$  | -   | $T_j = 25^\circ C$  | -    | 0.80    | -        | $\Omega$ |
|                       |                                      |  |   | $T_j = 125^\circ C$ | -    | 0.80    | -        |          |
|                       | Input capacitance                    | $Cies$   | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$                                     | -                   | 75.5 | -       | nF       |          |
|                       | Turn-on time                         | $t_{on}$   | Switching mode: A (*1)<br>$V_{CC} = 300V$<br>$I_C = 900A$<br>$L_s = 15nH$ | $t_r$               | -    | 0.60    | -        | $\mu s$  |
|                       |                                      |  |   | $t_{r(i)}$          | -    | 0.26    | -        |          |
|                       |                                      |  |   | $t_{off}$           | -    | 0.14    | -        |          |
|                       | Turn-off time                        | $t_{off}$  | $V_{GE} = \pm 15V$<br>$R_G = +3.9/-1.0\Omega$                             | $t_f$               | -    | 0.85    | -        | $\mu s$  |
| $t_r$                 |                                      |  |   | -                   | 0.09 | -       |          |          |
| Forward on voltage    | $V_F$ (chip)                         | $I_F = 900A$   | $T_j = 25^\circ C$  | -                   | 1.70 | 2.20    | V        |          |
|                       |                                      |  | $T_j = 125^\circ C$   | -                   | 1.85 | -       |          |          |
|                       | $V_F$ (terminal)                     | $I_F = 900A$   | $T_j = 150^\circ C$   | -                   | 1.80 | -       |          |          |
|                       |                                      |  | $T_j = 25^\circ C$  | -                   | 1.85 | 2.35    |          |          |
| Reverse recovery time | $t_{rr}$                             | Switching mode: B (*1)<br>$V_{CC} = 300V$<br>$I_F = 900A$<br>$V_{GE} = \pm 15V$<br>$R_G = +2.7/-15\Omega$  | $T_j = 125^\circ C$   | -                   | 0.18 | -       | $\mu s$  |          |
|                       |                                      |  | $T_j = 150^\circ C$   | -                   | 0.18 | -       |          |          |
| AC-switch             | Zero gate voltage Collector current  | $I_{CES}$  | $V_{GE} = 0V$<br>$V_{CE} = 600V$  | -                   | -    | 9.0     | mA       |          |
|                       | Gate-Emitter leakage current         | $I_{GES}$  | $V_{CE} = 0V$<br>$V_{GE} = \pm 20V$                                       | -                   | -    | 1800    | nA       |          |
|                       | Gate-Emitter threshold voltage       | $V_{GE(th)}$   | $V_{CE} = 20V$<br>$I_C = 900mA$   | 5.5                 | 6.5  | 7.5     | V        |          |
|                       | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (chip)   | $V_{GE} = 15V$<br>$I_C = 900A$  | $T_j = 25^\circ C$  | -    | 2.45    | 2.8      | V        |
|                       |                                      |  |   | $T_j = 125^\circ C$ | -    | 2.60    | -        |          |
|                       | $V_{CE(sat)}$ (terminal)             | $V_{GE} = 15V$<br>$I_C = 900A$   | $T_j = 25^\circ C$  | -                   | 2.55 | 3.20    |          |          |
|                       |                                      |  | $T_j = 125^\circ C$   | -                   | 2.70 | -       |          |          |
|                       | Internal gate resistance             | $Rg(int)$  | -   | -                   | 2.80 | -       | $\Omega$ |          |
|                       | Input capacitance                    | $Cies$   | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$                                     | -                   | 58.5 | -       | nF       |          |
|                       | Turn-on time                         | $t_{on}$   | Switching mode: B (*1)<br>$V_{CC} = 300V$<br>$I_C = 900A$<br>$L_s = 15nH$ | $t_r$               | -    | 0.75    | -        | $\mu s$  |
|                       |                                      |  |   | $t_{r(i)}$          | -    | 0.35    | -        |          |
|                       |                                      |  |   | $t_{off}$           | -    | 0.17    | -        |          |
|                       | Turn-off time                        | $t_{off}$  | $V_{GE} = \pm 15V$<br>$R_G = +2.7/-15\Omega$                              | $t_f$               | -    | 1.73    | -        | $\mu s$  |
|                       |                                      |  |   | $t_r$               | -    | 0.15    | -        |          |
| Reverse recovery time | $t_{rr}$                             | Switching mode: A (*1)<br>$V_{CC} = 300V$<br>$I_F = 900A$<br>$V_{GE} = \pm 15V$<br>$R_G = +3.9/-1.0\Omega$ | -   | 0.13                | -    | $\mu s$ |          |          |
| Thermistor            | Resistance                           | R  | $T = 25^\circ C$  | -                   | 5000 | -       | $\Omega$ |          |
|                       | B Value                              | B  | $T = 100^\circ C$   | 465                 | 495  | 520     |          |          |
|                       |                                      |  | $T = 25/50^\circ C$   | 3305                | 3375 | 3450    | K        |          |

(\*1) Please refer to page 4, there is definition of A mode and B mode.

■ Thermal resistance characteristics

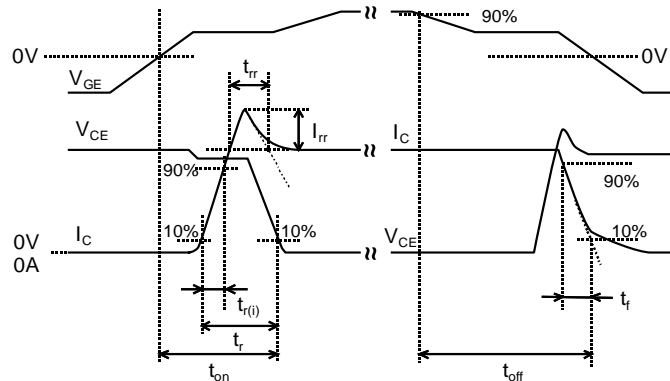
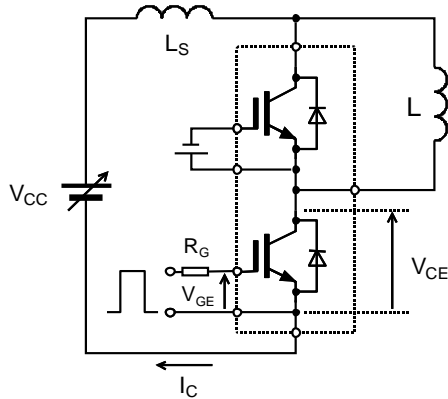
| Item                                      | Symbol        | Condition                    | Characteristics |        |       | Units        |
|---|---------------|------------------------------|-----------------|--------|-------|--------------|
|   |               |                              | min.            | typ.   | max.  |              |
| Thermal resistance (1device)              | $R_{th(j-c)}$ | T1, T4 IGBT                  | -               | -      | 0.038 | $^\circ C/W$ |
|   |               | T1, T4 FWD                   | -               | -      | 0.054 |              |
|   |               | T2, T3 RB-IGBT               | -               | -      | 0.047 |              |
| Contact thermal resistance (1device) (*2) | $R_{th(c-f)}$ | T1, T4                       | -               | 0.0083 | -     | $^\circ C/W$ |
|   |               | T2, T3 with thermal compound | -               | 0.0056 | -     |              |

(\*2) This is the value which is defined mounting on the additional cooling fin with thermal compound.

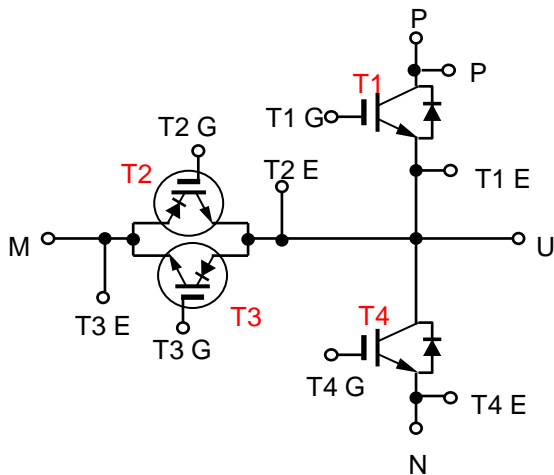
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■ Definitions of switching time



■ Definition of on-state voltage at terminal and switching characteristics



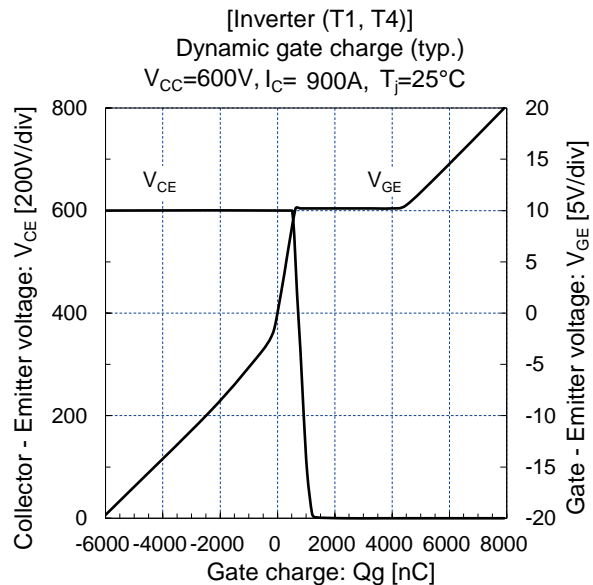
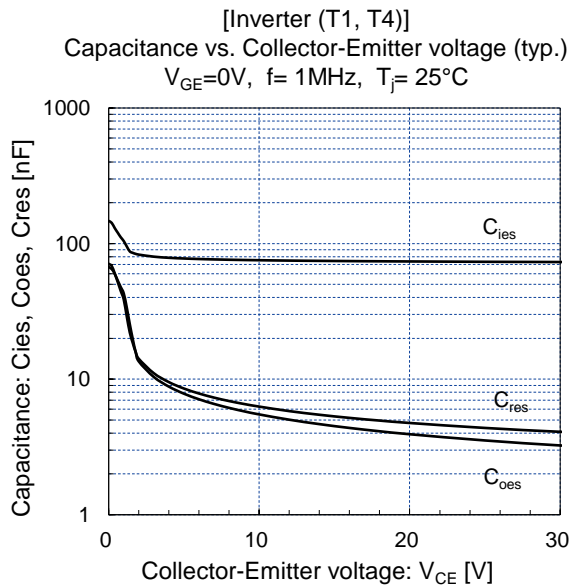
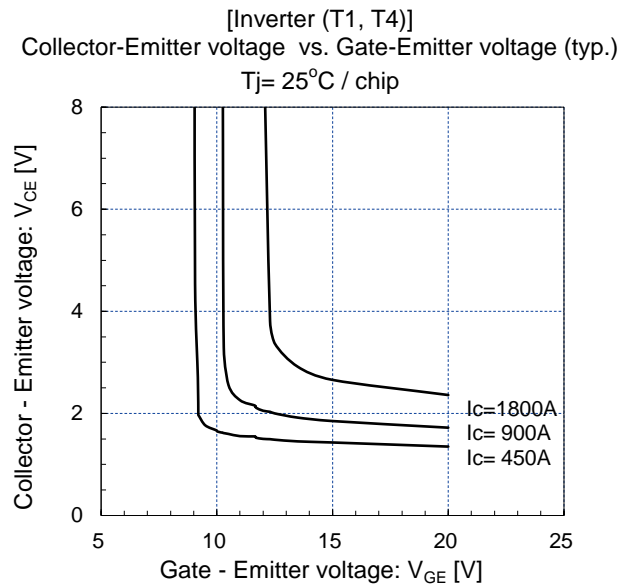
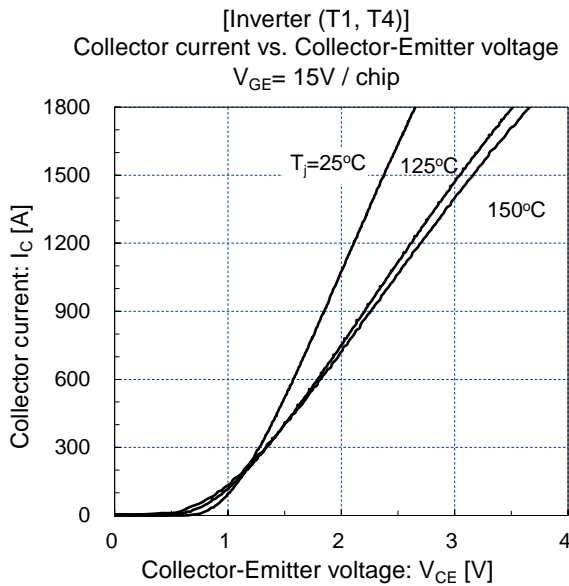
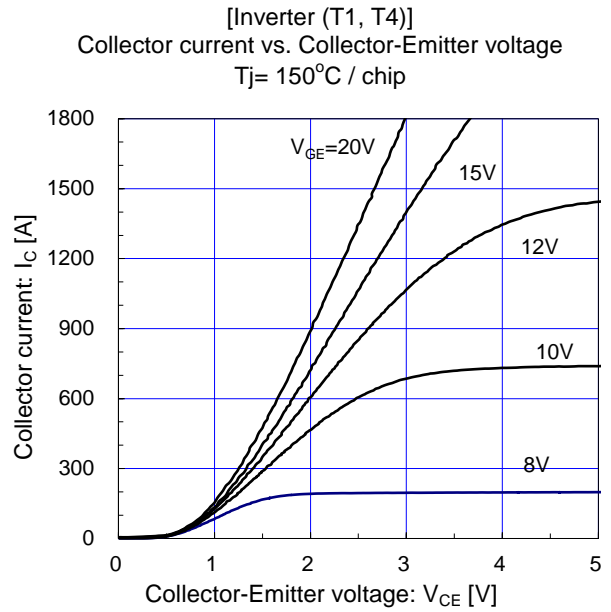
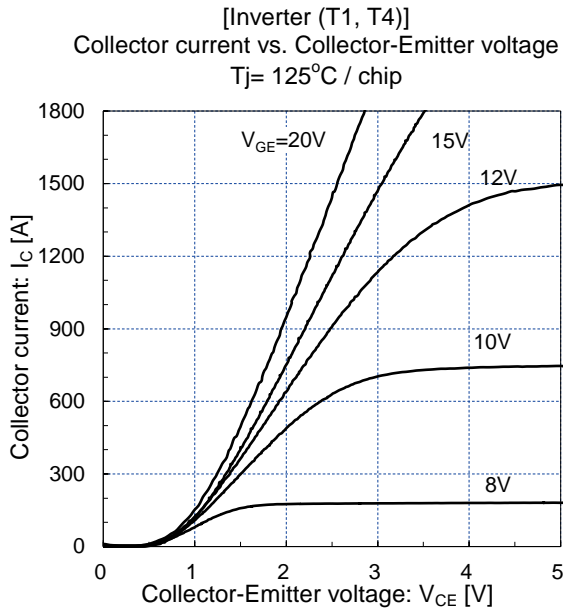
Fuji defined VCE value of terminal by using Sense P and Sense T1E for T1 arm , Sense T3E and Sense T2E for T2 arm , Sense T2E and Sense T3E for T3 arm and Sense T1E and Sense T4E for T4 arm .

Switching characteristics of VCE also is defined between Sense P and Sense T1E for T1 arm , Sense T3E and Sense T2E for T2 arm , Sense T2E and Sense T3E for T3 arm and Sense T1E and Sense T4E for T4 arm .

Please use these terminals whenever measure spike voltage and on-state voltage .

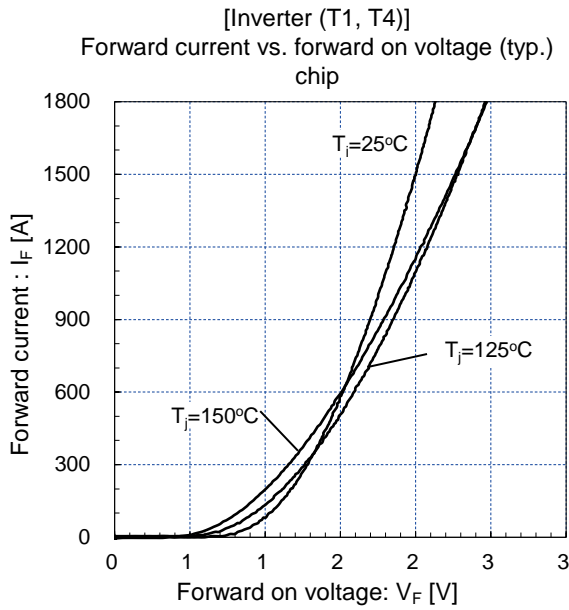
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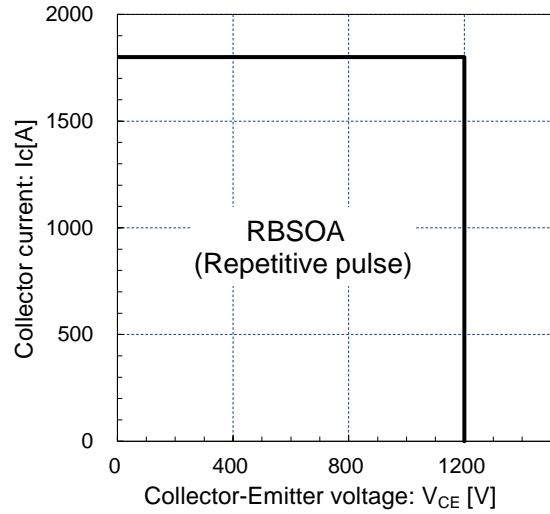


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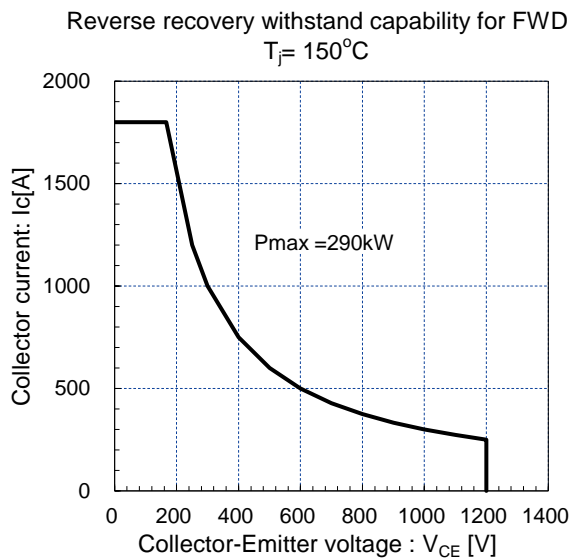
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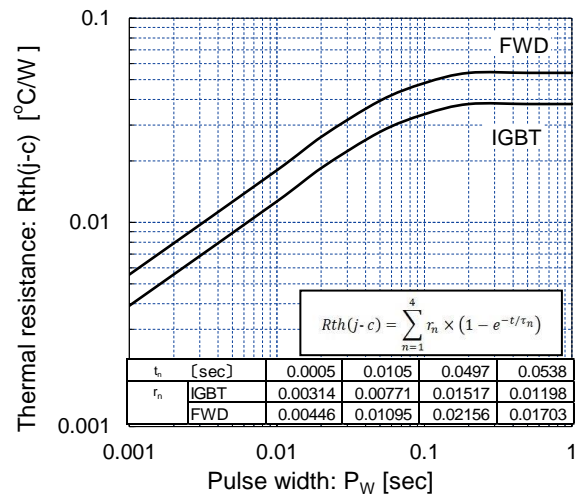
Reverse bias safe operating area (max.)  
VGE=±15V, RG ≥ Recommended, Tj=150°C (T1, T4)  
T1, T4 (Terminal)(\*1)



(\*1) Please refer to page 4, there is definition of terminal

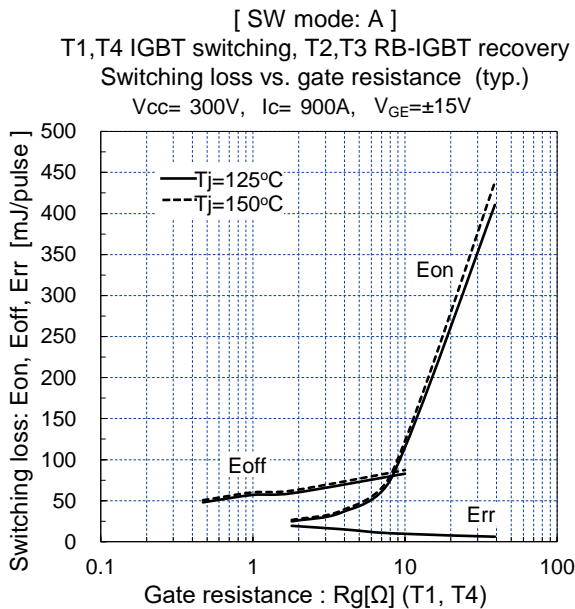
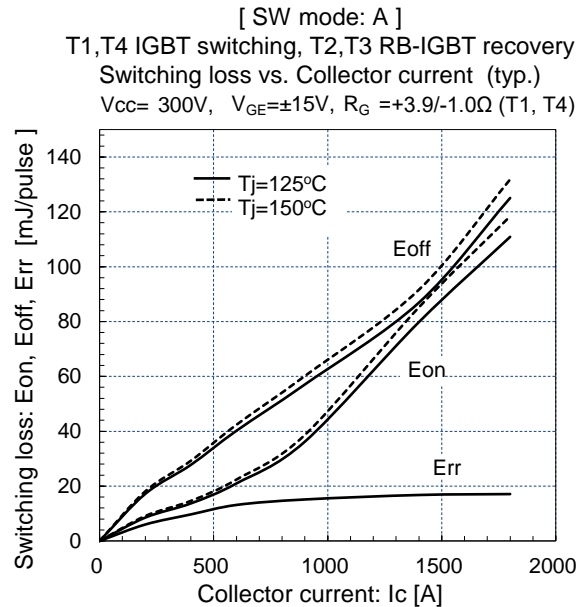
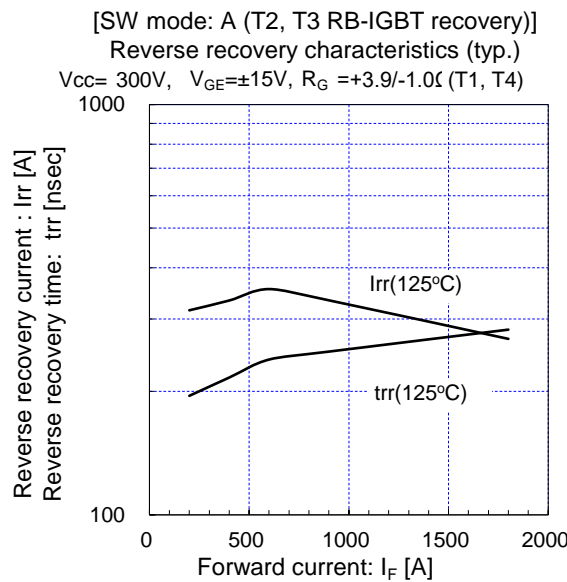
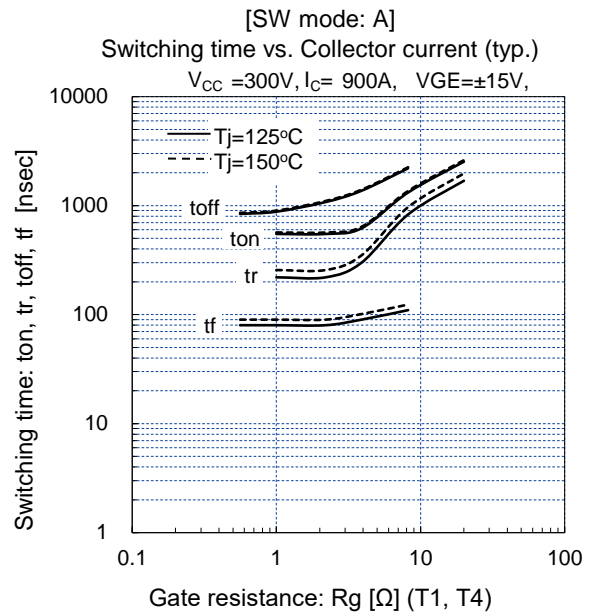
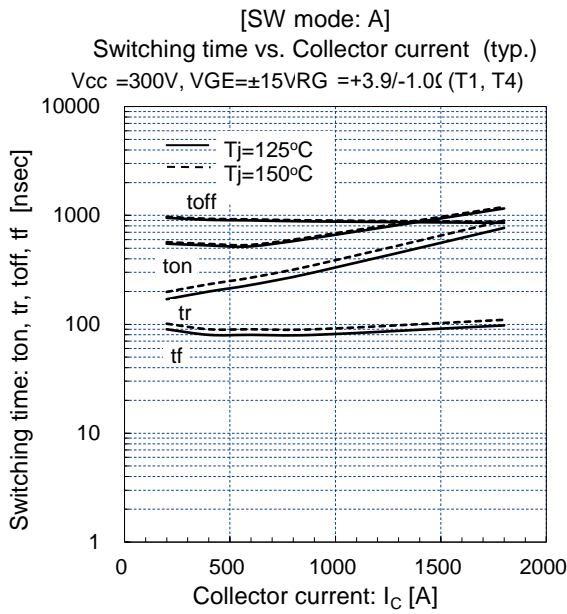


Transient thermal resistance (max.)



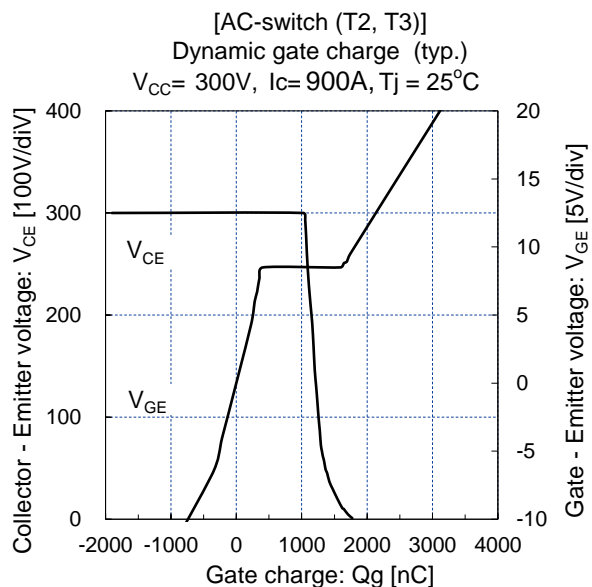
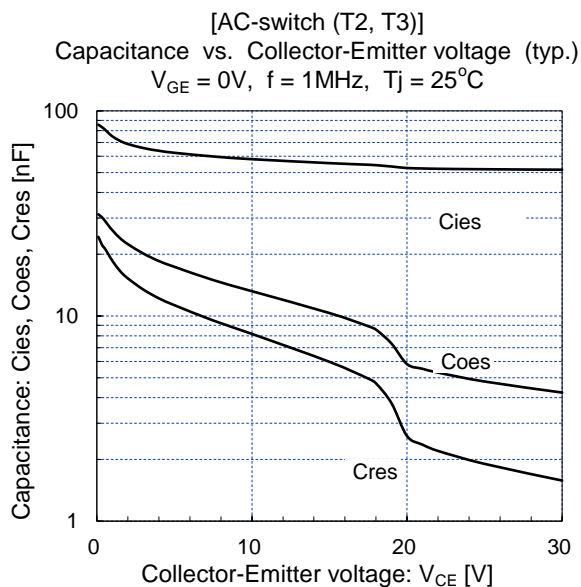
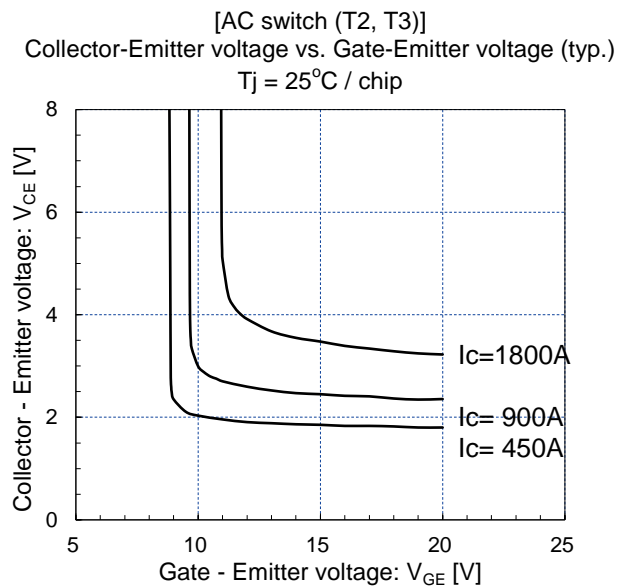
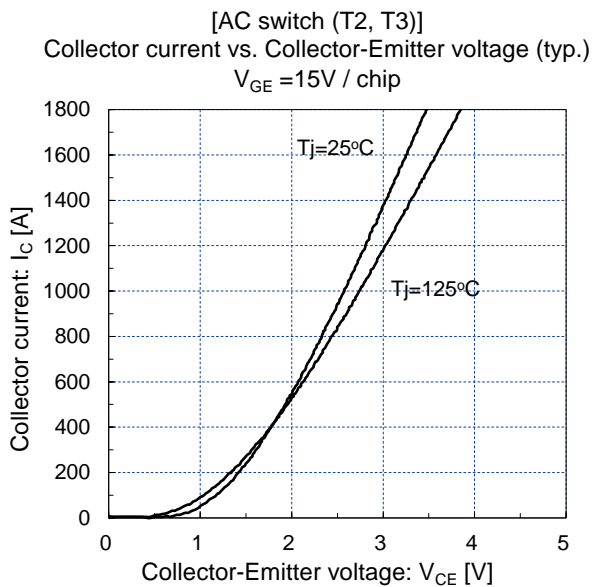
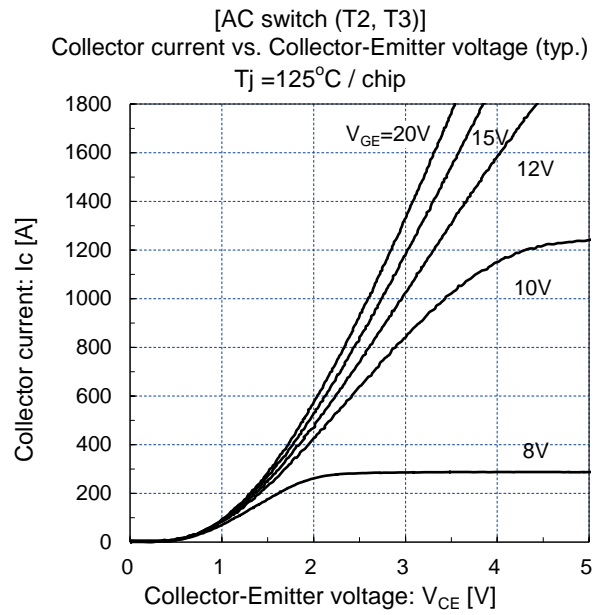
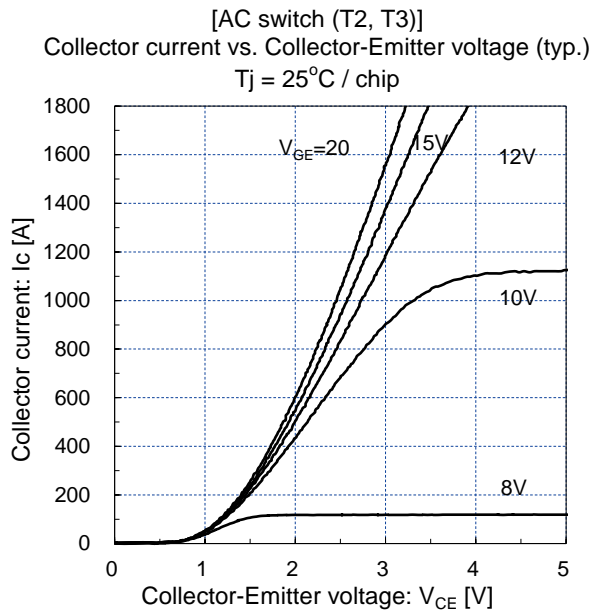
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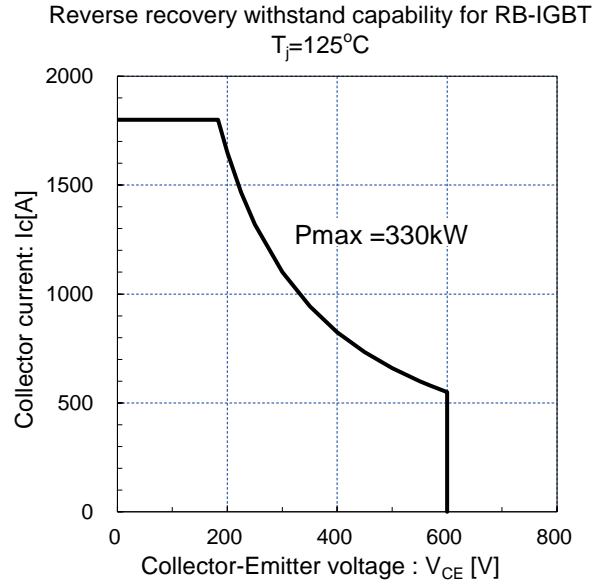
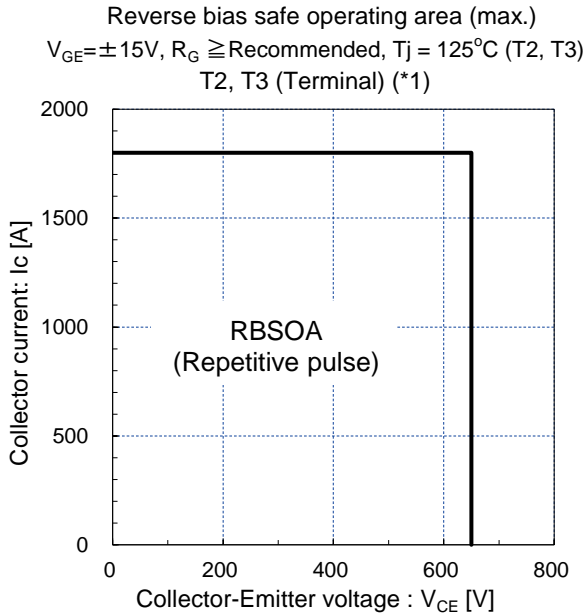
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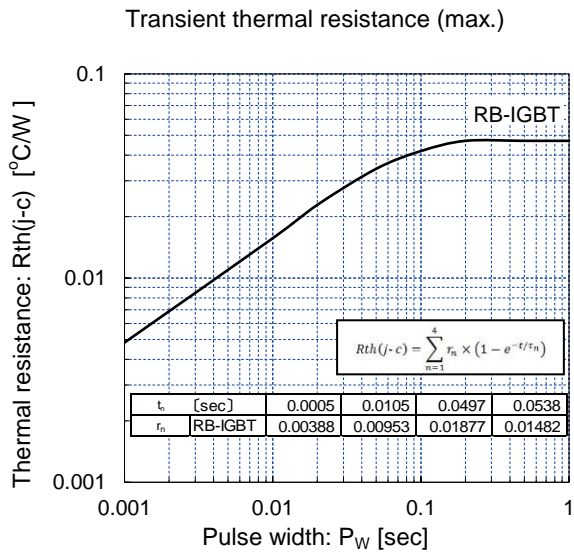


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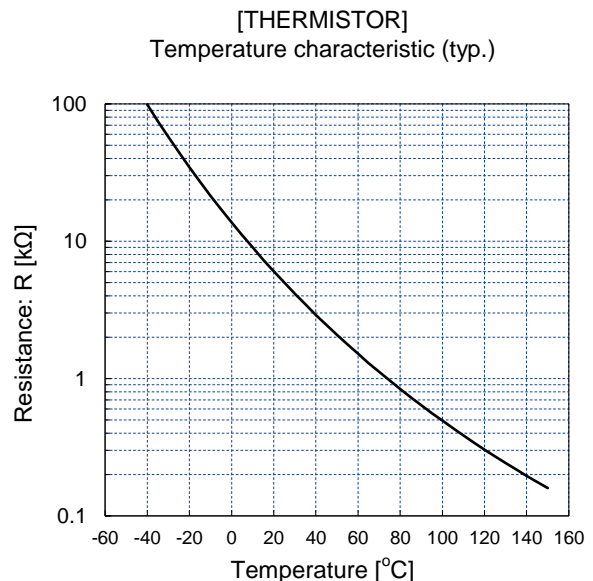
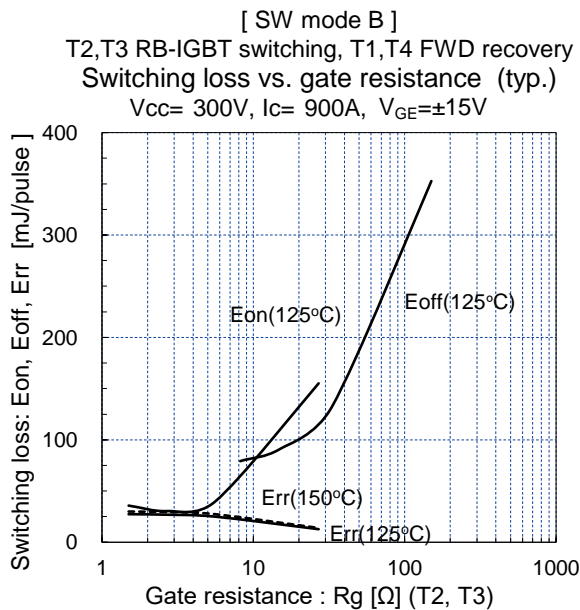
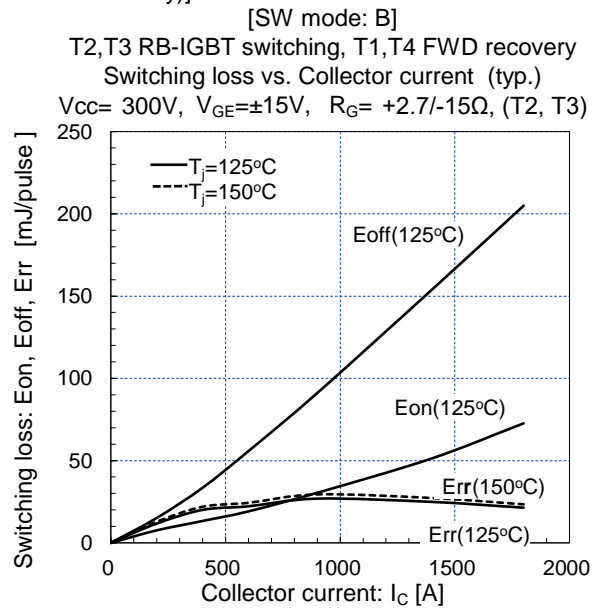
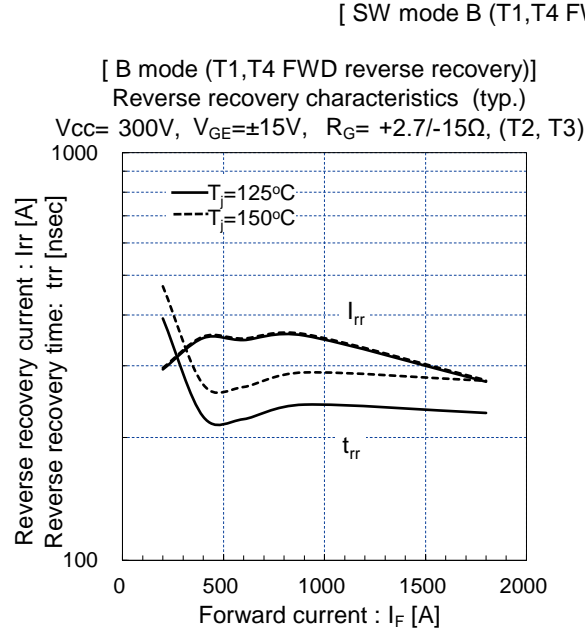
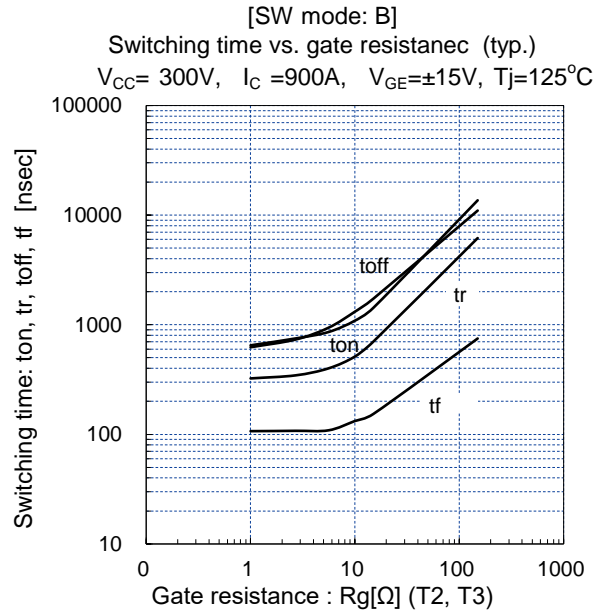
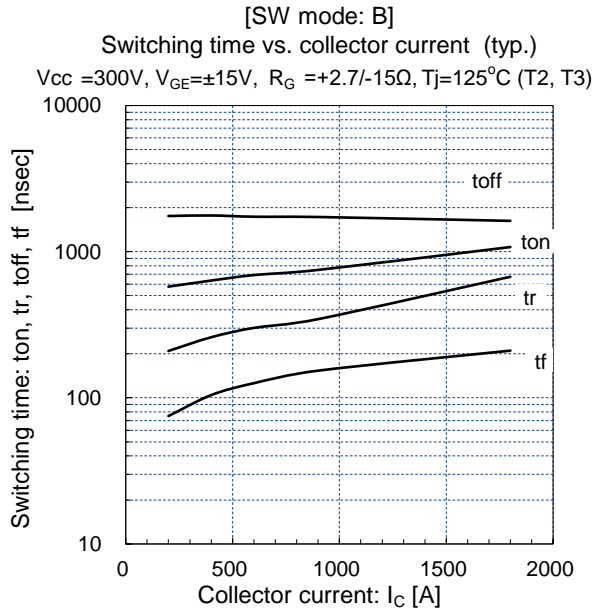


The reverse bias blocking voltage for coupled RB-IGBT can be guaranteed with 650V by applying  $V_{GE} = +15V$ .  
 (\*1) Please refer to page 4 for the terminal definition



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| 1 半導体総合カタログ          | <a href="http://www.fujielectric.co.jp/products/semiconductor/catalog/">www.fujielectric.co.jp/products/semiconductor/catalog/</a>                               |
| 2 製品情報               | <a href="http://www.fujielectric.co.jp/products/semiconductor/model/">www.fujielectric.co.jp/products/semiconductor/model/</a>                                   |
| 3 アプリケーションマニュアル      | <a href="http://www.fujielectric.co.jp/products/semiconductor/model/igbt/application/">www.fujielectric.co.jp/products/semiconductor/model/igbt/application/</a> |
| 4 デザインサポート           | <a href="http://www.fujielectric.co.jp/products/semiconductor/model/igbt/technical/">www.fujielectric.co.jp/products/semiconductor/model/igbt/technical/</a>     |
| 5 マウンティングインストラクション   | <a href="http://www.fujielectric.co.jp/products/semiconductor/model/igbt/mounting/">www.fujielectric.co.jp/products/semiconductor/model/igbt/mounting/</a>       |
| 6 IGBT 損失シミュレーションソフト | <a href="http://www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation/">www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation/</a>   |
| 7 富士電機技報             | <a href="http://www.fujielectric.co.jp/products/semiconductor/journal/">www.fujielectric.co.jp/products/semiconductor/journal/</a>                               |
| 8 製品のお問い合わせ          | <a href="http://www.fujielectric.co.jp/products/semiconductor/contact/">www.fujielectric.co.jp/products/semiconductor/contact/</a>                               |
| 9 改廃のお知らせ            | <a href="http://www.fujielectric.co.jp/products/semiconductor/discontinued/">www.fujielectric.co.jp/products/semiconductor/discontinued/</a>                     |

### Global

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| 1 Semiconductors General Catalog               | <a href="http://www.fujielectric.com/products/semiconductor/catalog/">www.fujielectric.com/products/semiconductor/catalog/</a>                               |
| 2 Product Information                          | <a href="http://www.fujielectric.com/products/semiconductor/model/">www.fujielectric.com/products/semiconductor/model/</a>                                   |
| 3 Application Manuals                          | <a href="http://www.fujielectric.com/products/semiconductor/model/igbt/application/">www.fujielectric.com/products/semiconductor/model/igbt/application/</a> |
| 4 Design Support                               | <a href="http://www.fujielectric.com/products/semiconductor/model/igbt/technical/">www.fujielectric.com/products/semiconductor/model/igbt/technical/</a>     |
| 5 Mounting Instructions                        | <a href="http://www.fujielectric.com/products/semiconductor/model/igbt/mounting/">www.fujielectric.com/products/semiconductor/model/igbt/mounting/</a>       |
| 6 IGBT Loss Simulation Software                | <a href="http://www.fujielectric.com/products/semiconductor/model/igbt/simulation/">www.fujielectric.com/products/semiconductor/model/igbt/simulation/</a>   |
| 7 Fuji Electric Journal                        | <a href="http://www.fujielectric.com/products/semiconductor/journal/">www.fujielectric.com/products/semiconductor/journal/</a>                               |
| 8 Contact                                      | <a href="http://www.fujielectric.com/contact/">www.fujielectric.com/contact/</a>   |
| 9 Revised and discontinued product information | <a href="http://www.fujielectric.com/products/semiconductor/discontinued/">www.fujielectric.com/products/semiconductor/discontinued/</a>                     |

### 中国

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| 1 半导体综合目录     | <a href="http://www.fujielectric.com.cn/products/semiconductor/catalog/">www.fujielectric.com.cn/products/semiconductor/catalog/</a>                               |
| 2 产品信息        | <a href="http://www.fujielectric.com.cn/products/semiconductor/model/">www.fujielectric.com.cn/products/semiconductor/model/</a>                                   |
| 3 应用手册        | <a href="http://www.fujielectric.com.cn/products/semiconductor/model/igbt/application/">www.fujielectric.com.cn/products/semiconductor/model/igbt/application/</a> |
| 4 技术信息        | <a href="http://www.fujielectric.com.cn/products/semiconductor/model/igbt/technical/">www.fujielectric.com.cn/products/semiconductor/model/igbt/technical/</a>     |
| 5 安装说明书       | <a href="http://www.fujielectric.com.cn/products/semiconductor/model/igbt/mounting/">www.fujielectric.com.cn/products/semiconductor/model/igbt/mounting/</a>       |
| 6 IGBT 损耗模拟软件 | <a href="http://www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation/">www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation/</a>   |
| 7 富士电机技报      | <a href="http://www.fujielectric.com.cn/products/semiconductor/journal/">www.fujielectric.com.cn/products/semiconductor/journal/</a>                               |
| 8 产品咨询        | <a href="http://www.fujielectric.com/contact/">www.fujielectric.com/contact/</a>   |
| 9 产品更改和停产信息   | <a href="http://www.fujielectric.com.cn/products/semiconductor/discontinued/">www.fujielectric.com.cn/products/semiconductor/discontinued/</a>                     |