

# 6MBI100XBA120-50

IGBT Modules

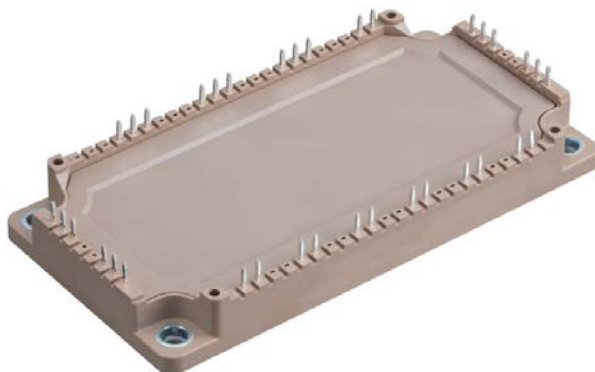
**Power Module (X series)**  
1200V / 100A / 6-in-1 package

## ■ Features

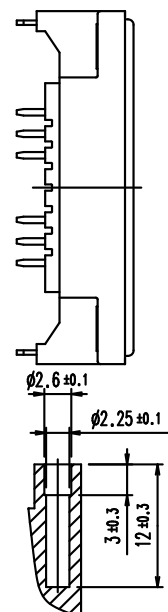
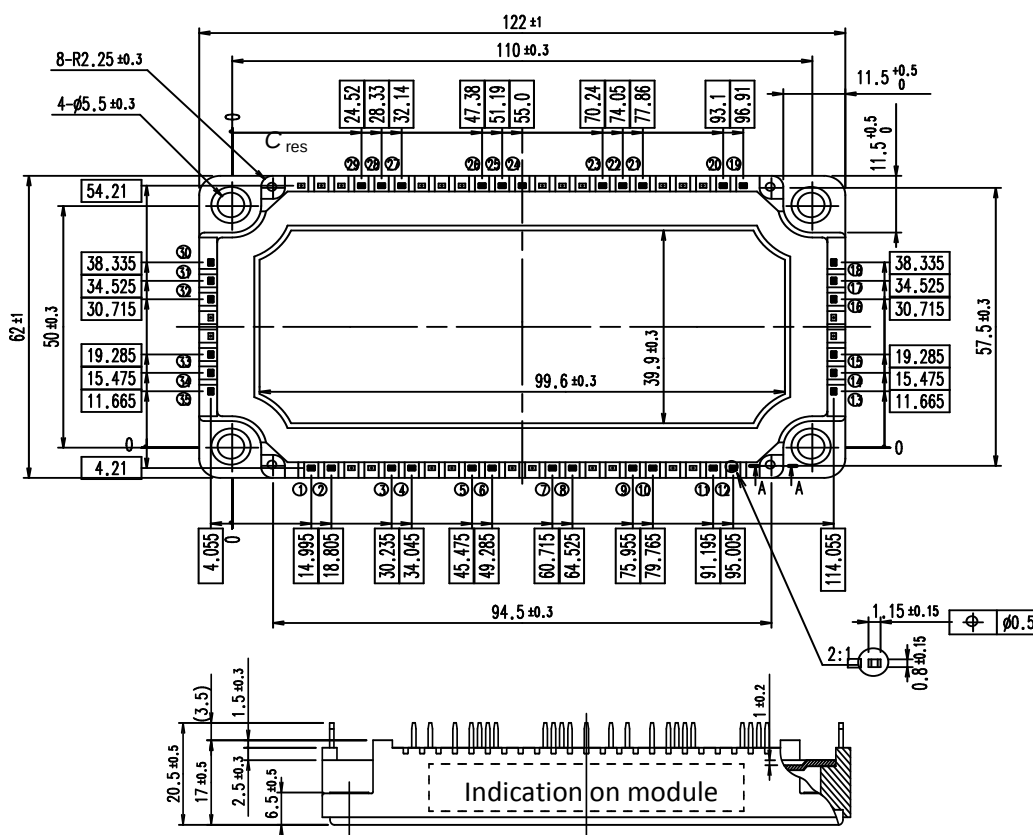
- Low  $V_{CE(sat)}$
- Compact Package
- P.C.Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit
- RoHS compliant Product

## ■ Applications

- Inverter for Motor Drives,
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply



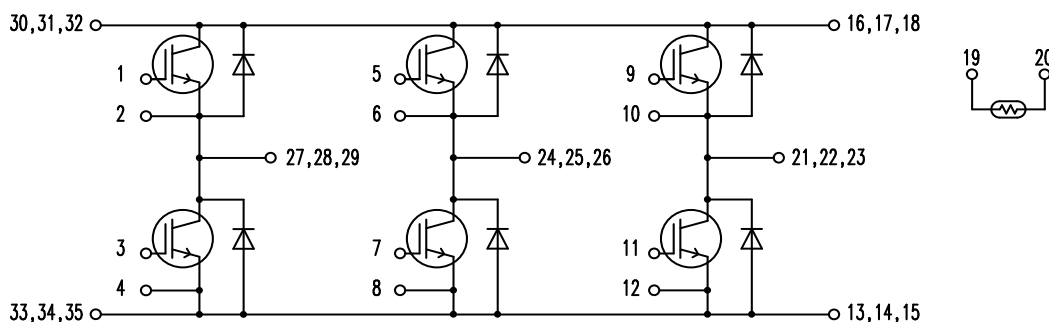
## ■ Outline drawing ( Unit : mm )



Section A-A

Weight: 310 g(typ.)

## ■ Equivalent Circuit



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## ■ Absolute Maximum Ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

| Items                                                   |                                       | Symbols    | Conditions                           | Maximum Ratings | Units            |
|---------------------------------------------------------|---------------------------------------|------------|--------------------------------------|-----------------|------------------|
| Collector-emitter voltage, gate-emitter short-circuited |                                       | $V_{CES}$  |                                      | 1200            | V                |
| Gate-emitter voltage, collector-emitter short-circuited |                                       | $V_{GES}$  |                                      | $\pm 20$        | V                |
| Collector current                                       |                                       | $I_C$      | Continuous $T_c = 100^\circ\text{C}$ | 100             | A                |
| Repetitive peak collector current                       |                                       | $I_{CRM}$  | 1ms                                  | 200             |                  |
| Forward current                                         |                                       | $I_F$      | Continuous                           | 100             |                  |
| Repetitive peak forward current                         |                                       | $I_{FRM}$  | 1ms                                  | 200             |                  |
| Total power dissipation                                 |                                       | $P_{tot}$  | 1 device                             | 440             | W                |
| Virtual junction temperature                            |                                       | $T_{vj}$   |                                      | 175             | $^\circ\text{C}$ |
| Operating virtual junction temperature                  |                                       | $T_{vjop}$ |                                      | 175             |                  |
| Case temperature                                        |                                       | $T_c$      |                                      | 125             |                  |
| Storage temperature                                     |                                       | $T_{stg}$  |                                      | -40 ~ 125       |                  |
| Isolation voltage                                       | between terminal and copper base (*1) | $V_{isol}$ | AC: 1min.                            | 4000            | Vrms             |
|                                                         | between terminal and others (*2)      |            |                                      |                 |                  |
| Mounting torque of screws to heatsink (*3)              |                                       | $M_s$      | M5                                   | 6.0             | N·m              |

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

(\*2) Two thermistors  $C_{res}$  and shorted to base plate during the test.

(\*3) Recommendable value : Mounting 2.5 ~ 6.0 N·m (M5)

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Electrical characteristics (at  $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

| Items                    |                                                                 | Symbols                     | Conditions                                                                                          |                       | Characteristics |       |      | Units    |
|--------------------------|-----------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------|-----------------------|-----------------|-------|------|----------|
|                          |                                                                 |                             |                                                                                                     |                       | min.            | typ.  | max. |          |
| Inverter                 | Collector-emitter cut-off current, gate-emitter short-circuited | $I_{CES}$                   | $V_{GE} = 0V$<br>$V_{CE} = 1200V$                                                                   |                       | -               | -     | 50   | $\mu A$  |
|                          | Gate leakage current , collector-emitter short-circuited        | $I_{GES}$                   | $V_{CE}=0V, V_{GE}=\pm 20V$                                                                         |                       | -               | -     | 100  | nA       |
|                          | Gate-Emitter threshold voltage                                  | $V_{GE(th)}$                | $V_{CE} = 20V$<br>$I_C = 100mA$                                                                     |                       | 6.0             | 6.5   | 7.0  | V        |
|                          | Collector-Emitter saturation voltage                            | $V_{CE(sat)}$<br>(terminal) | $V_{GE} = 15V$<br>$I_C = 100A$                                                                      | $T_{vj}=25^{\circ}C$  | -               | 1.95  | 2.40 | V        |
|                          |                                                                 | $V_{CE(sat)}$<br>(chip)     |                                                                                                     | $T_{vj}=25^{\circ}C$  | -               | 1.45  | 1.90 |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 1.80  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 1.85  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 1.90  | -    |          |
|                          | Internal Gate resistance                                        | $r_g$                       | -                                                                                                   |                       | -               | 5.60  | -    | $\Omega$ |
|                          | Input capacitance                                               | $C_{ies}$                   | $V_{CE}=10V, V_{GE}=0V, f=1MHz$                                                                     |                       | -               | 11.6  | -    | nF       |
|                          | Output capacitance                                              | $C_{oes}$                   |                                                                                                     |                       | -               | 0.4   | -    |          |
|                          | Reverse transfer capacitanc                                     | $C_{res}$                   |                                                                                                     |                       | -               | 0.10  | -    |          |
|                          | Gate charge                                                     | $Q_G$                       | $V_{CC} = 600V, I_C = 100A$<br>$V_{GE} = -15 \rightarrow +15V$                                      |                       | -               | 740.0 | -    | $\mu C$  |
|                          | Forward on voltage                                              | $V_F$<br>(terminal)         | $V_{GE} = 0V$<br>$I_F = 100A$                                                                       | $T_{vj}=25^{\circ}C$  | -               | 2.30  | 2.75 | V        |
|                          |                                                                 | $V_F$<br>(chip)             |                                                                                                     | $T_{vj}=25^{\circ}C$  | -               | 1.80  | 2.25 |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 1.85  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 1.80  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 1.75  | -    |          |
|                          | Turn-on delay time (*1)                                         | $t_{d(on)}$                 | $V_{CC} = 600V$<br>$I_C, I_F = 100A$<br>$V_{GE} = +15/-15 V$<br>$R_G = 5.1 \Omega$<br>$L_S = 30 nH$ | $T_{vj}=25^{\circ}C$  | -               | 0.21  | -    | $\mu s$  |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 0.25  | -    |          |
|                          | $T_{vj}=150^{\circ}C$                                           | -                           |                                                                                                     | 0.25                  | -               |       |      |          |
|                          | $T_{vj}=175^{\circ}C$                                           | -                           |                                                                                                     | 0.26                  | -               |       |      |          |
|                          | Rise time (*1)                                                  | $t_r$                       |                                                                                                     | $T_{vj}=25^{\circ}C$  | -               | 0.05  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 0.06  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 0.06  | -    |          |
|                          |                                                                 |                             |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 0.06  | -    |          |
| Turn-off delay time (*1) | $t_{d(off)}$                                                    | $T_{vj}=25^{\circ}C$        |                                                                                                     | -                     | 0.29            | -     |      |          |
|                          |                                                                 | $T_{vj}=125^{\circ}C$       |                                                                                                     | -                     | 0.32            | -     |      |          |
|                          |                                                                 | $T_{vj}=150^{\circ}C$       |                                                                                                     | -                     | 0.33            | -     |      |          |
|                          |                                                                 | $T_{vj}=175^{\circ}C$       |                                                                                                     | -                     | 0.34            | -     |      |          |
| Fall time (*1)           | $t_f$                                                           | $T_{vj}=25^{\circ}C$        |                                                                                                     | -                     | 0.10            | -     |      |          |
|                          |                                                                 | $T_{vj}=125^{\circ}C$       |                                                                                                     | -                     | 0.16            | -     |      |          |
|                          |                                                                 | $T_{vj}=150^{\circ}C$       |                                                                                                     | -                     | 0.18            | -     |      |          |
|                          |                                                                 | $T_{vj}=175^{\circ}C$       |                                                                                                     | -                     | 0.20            | -     |      |          |
| Reverse recovery time    | $t_{rr}$                                                        | $T_{vj}=25^{\circ}C$        |                                                                                                     | -                     | 0.11            | -     |      |          |
|                          |                                                                 | $T_{vj}=125^{\circ}C$       |                                                                                                     | -                     | 0.18            | -     |      |          |
|                          |                                                                 | $T_{vj}=150^{\circ}C$       |                                                                                                     | -                     | 0.22            | -     |      |          |
|                          |                                                                 | $T_{vj}=175^{\circ}C$       |                                                                                                     | -                     | 0.25            | -     |      |          |

(\*1) Turn- on time ( $t_{on}$ ) =  $t_{d(on)} + t_r$  , Turn- off time ( $t_{off}$ ) =  $t_{d(off)} + t_f$

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■ Electrical characteristics (at  $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

| Items      |                         | Symbols   | Conditions                                                                                                         |                       | Characteristics |       |          | Units |
|------------|-------------------------|-----------|--------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------|-------|----------|-------|
|            |                         |           |                                                                                                                    |                       | min.            | typ.  | max.     |       |
| Inverter   | Turn-on energy          | $E_{on}$  | $V_{CC} = 600V$<br>$I_C, I_F = 100A$<br>$V_{GE} = +15/-15\text{ V}$<br>$R_G = 5.1\ \Omega$<br>$L_S = 30\text{ nH}$ | $T_{vj}=25^{\circ}C$  | -               | 7.45  | -        | mJ    |
|            |                         |           |                                                                                                                    | $T_{vj}=125^{\circ}C$ | -               | 10.51 | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=150^{\circ}C$ | -               | 11.50 | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=175^{\circ}C$ | -               | 12.79 | -        |       |
|            | Turn-off energy         | $E_{off}$ |                                                                                                                    | $T_{vj}=25^{\circ}C$  | -               | 7.07  | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=125^{\circ}C$ | -               | 8.82  | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=150^{\circ}C$ | -               | 9.55  | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=175^{\circ}C$ | -               | 9.93  | -        |       |
|            | Reverse recovery energy | $E_{rr}$  |                                                                                                                    | $T_{vj}=25^{\circ}C$  | -               | 3.00  | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=125^{\circ}C$ | -               | 4.88  | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=150^{\circ}C$ | -               | 5.88  | -        |       |
|            |                         |           |                                                                                                                    | $T_{vj}=175^{\circ}C$ | -               | 6.51  | -        |       |
| Thermistor | Resistance              | $R$       | $T = 25^{\circ}C$                                                                                                  | -                     | 5000            | -     | $\Omega$ |       |
|            |                         |           | $T = 100^{\circ}C$                                                                                                 | 465                   | 495             | 520   |          |       |
|            | B value                 | $B$       | $T = 25/ 50^{\circ}C$                                                                                              | 3305                  | 3375            | 3450  | K        |       |

$C_{res}$

NOTICE:  
The external gate resistance ( $R_G$ ) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum  $R_G$  depends on circuit configuration and/or environment. We recommend that the  $R_G$  has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

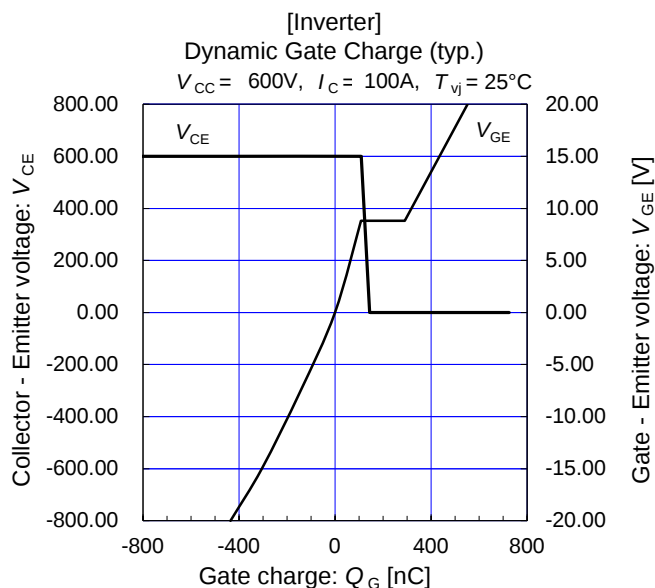
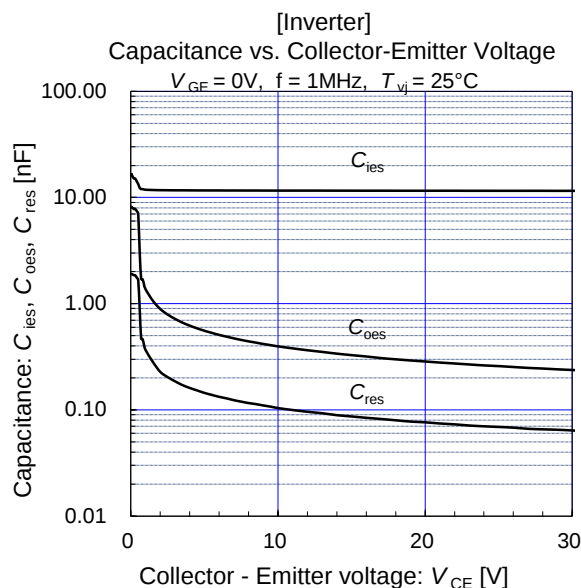
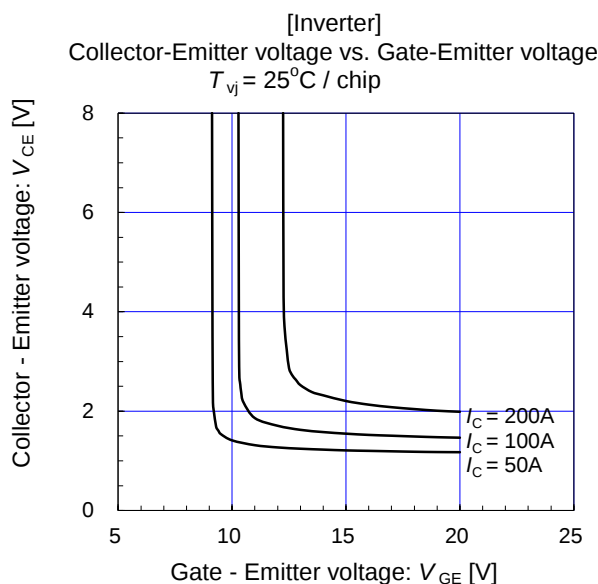
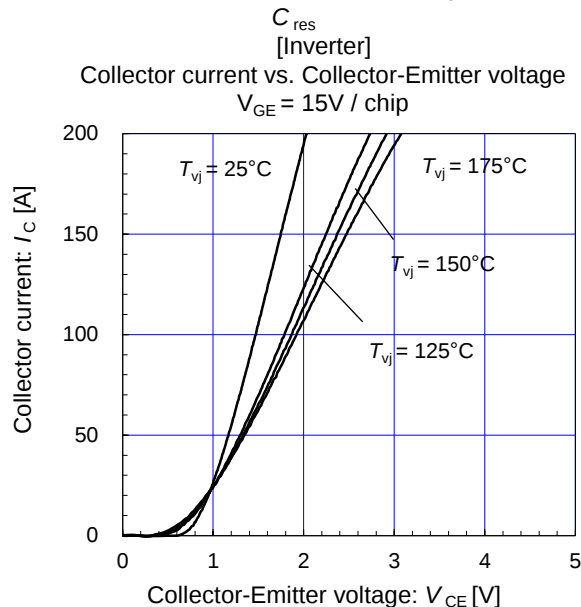
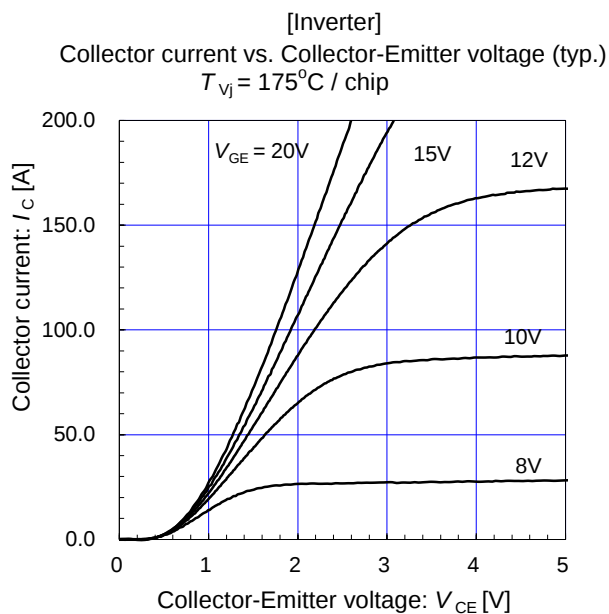
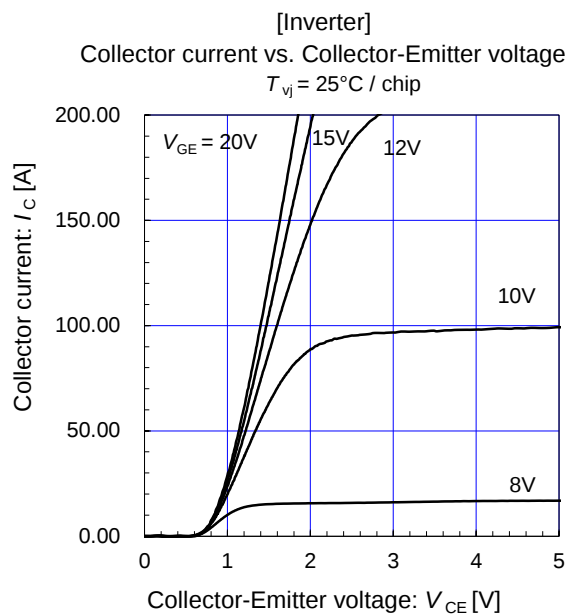
■ Thermal resistance characteristics

| Items                                                     | Symbols       | Conditions                    | Characteristics |      |      | Units                |
|-----------------------------------------------------------|---------------|-------------------------------|-----------------|------|------|----------------------|
|                                                           |               |                               | min.            | typ. | max. |                      |
| Thermal resistance junction to case (1 device)            | $R_{th(j-c)}$ | Inverter IGBT                 | -               | -    | 0.34 | $^{\circ}\text{C/W}$ |
|                                                           |               | Inverter FWD                  | -               | -    | 0.45 |                      |
| Thermal resistance case to heatsink (1 IGBT + 1 FWD) (*1) | $R_{th(c-s)}$ | with 1 W/(m·K) thermal grease | -               | 0.05 | -    |                      |

(\*1) This is the value which is defined mounting on the additional heatsink with thermal grease.

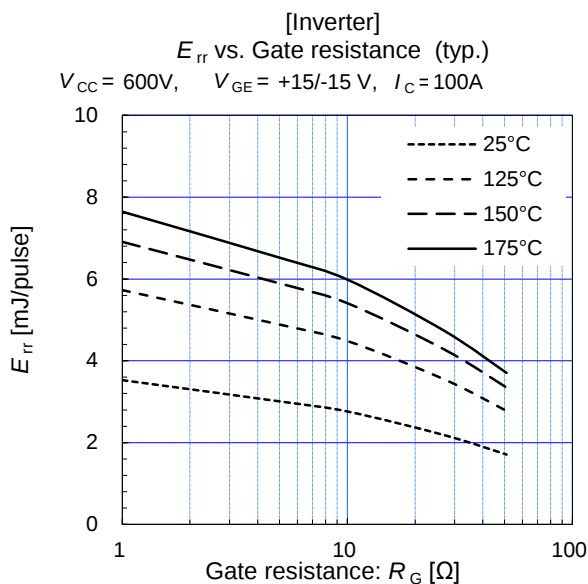
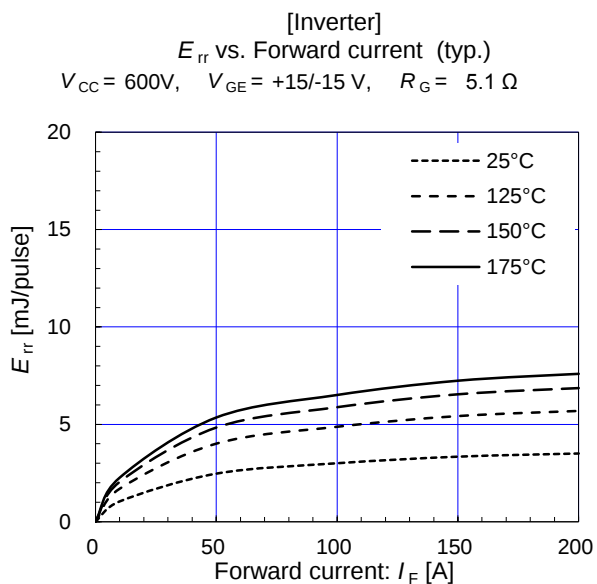
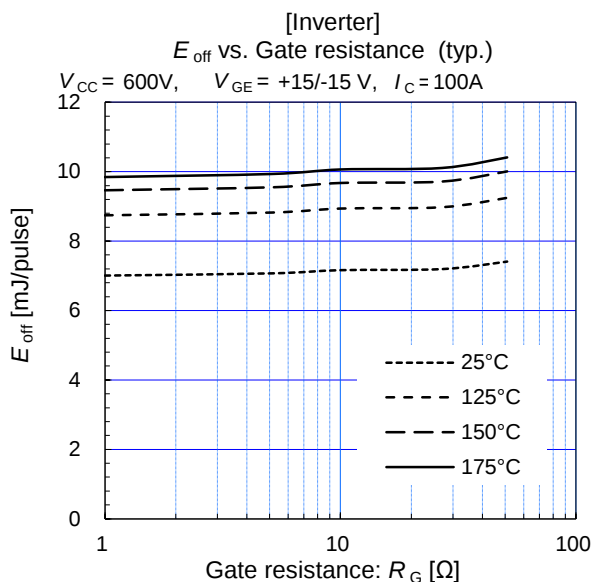
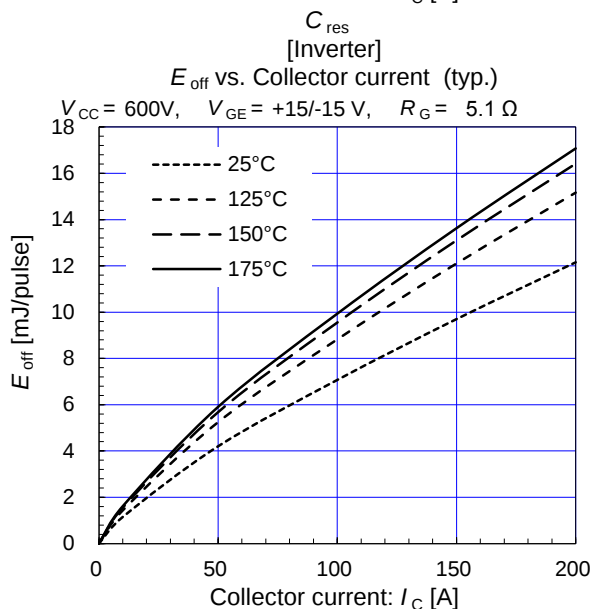
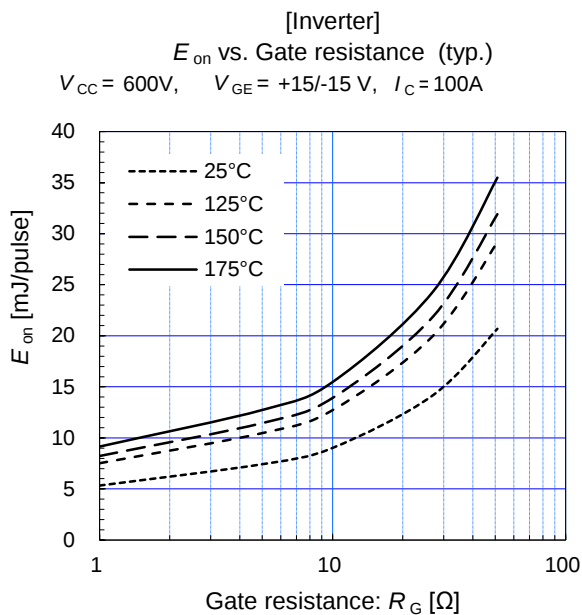
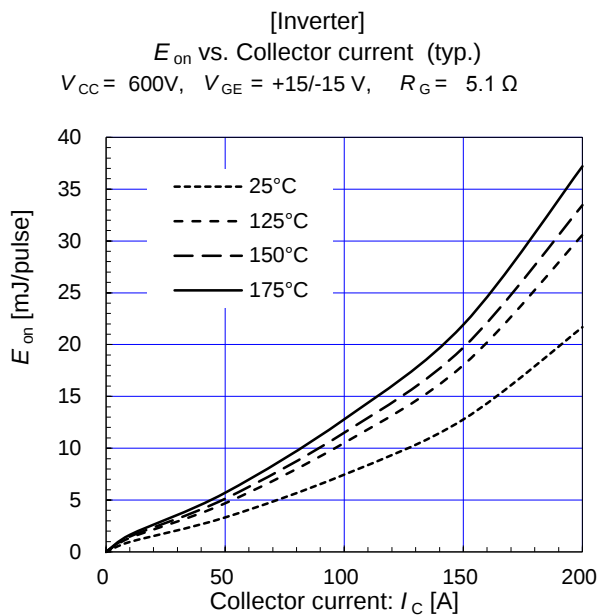
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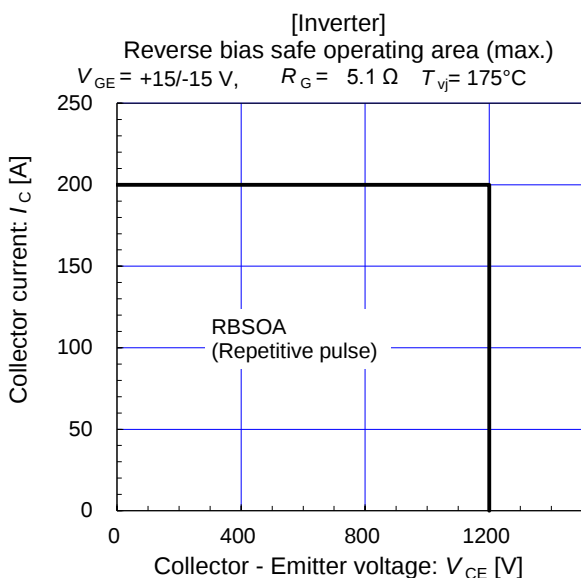
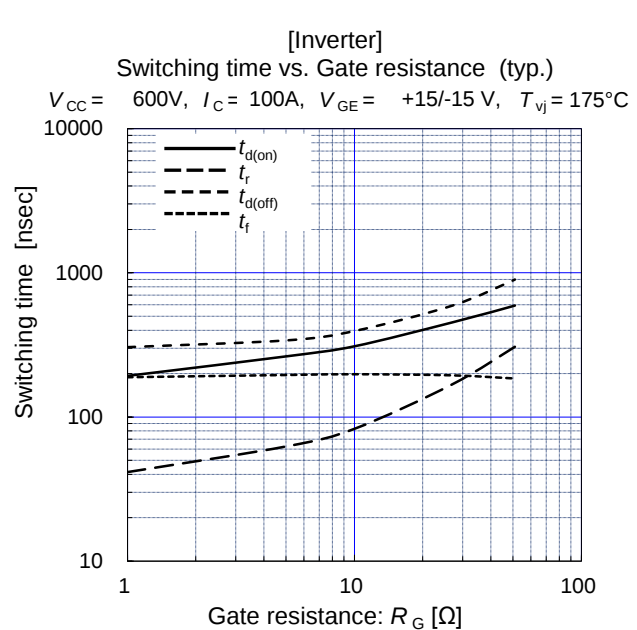
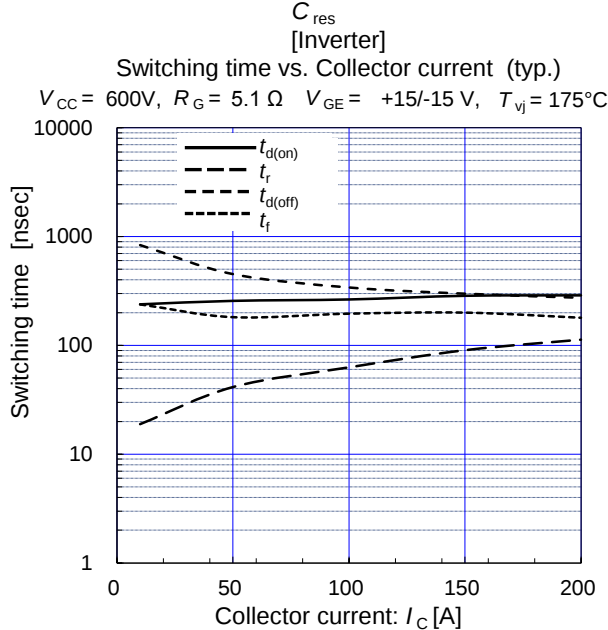
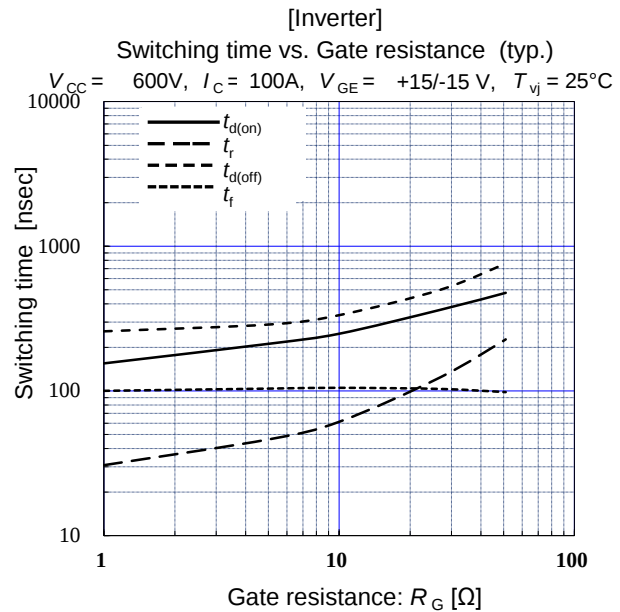
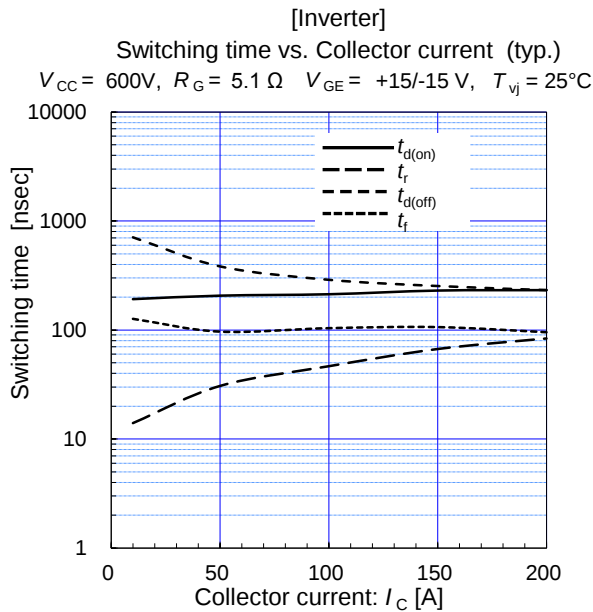
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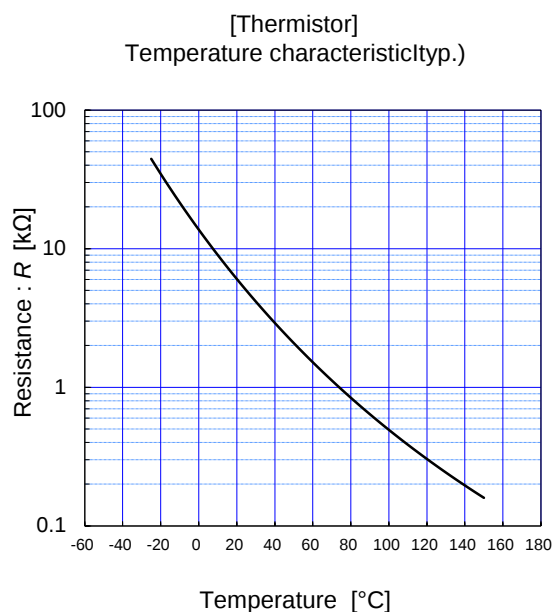
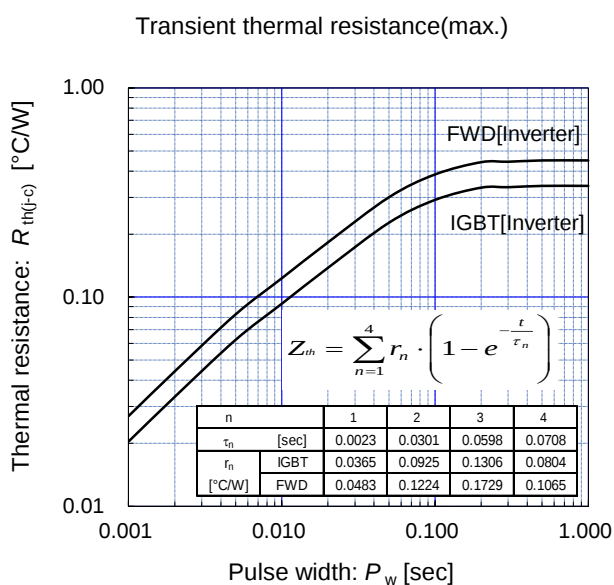
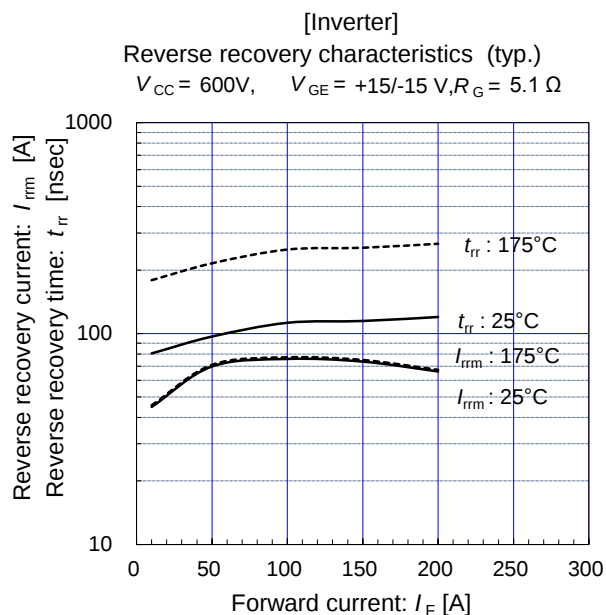
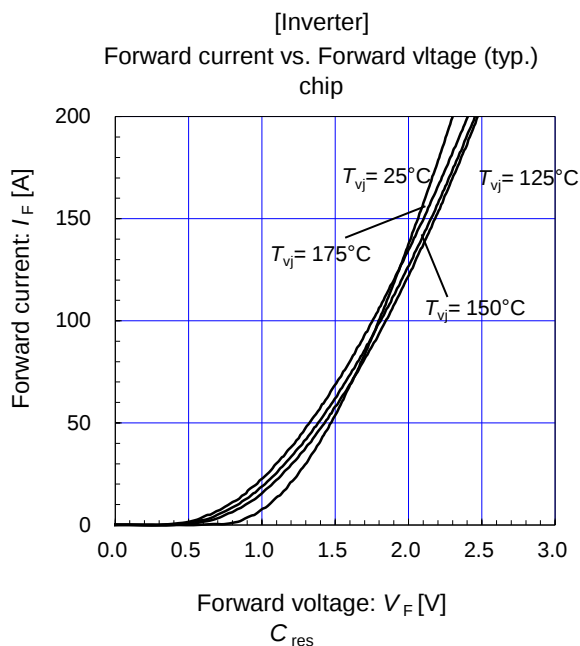
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## Warnings

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## IGBT Modules

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|               |                                                                                                                                    |
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| 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>                               |
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#### 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>                     |

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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>                     |