

# 2MBI150XAA120-50

IGBT Modules

**Power Module (X series)**  
**1200V / 150A / 2-in-1 package**

■ **Features**

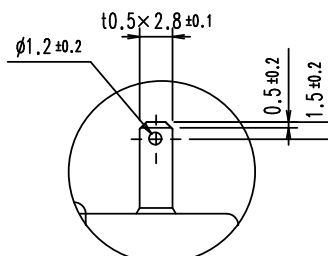
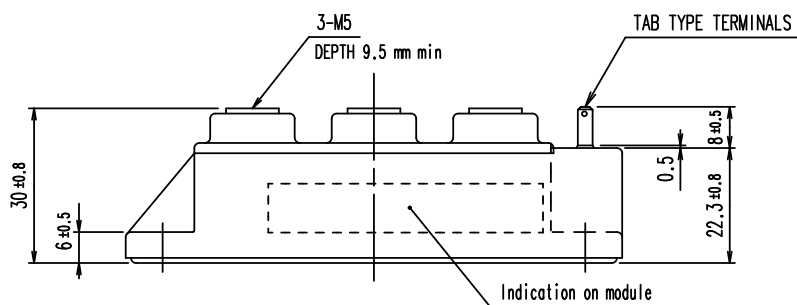
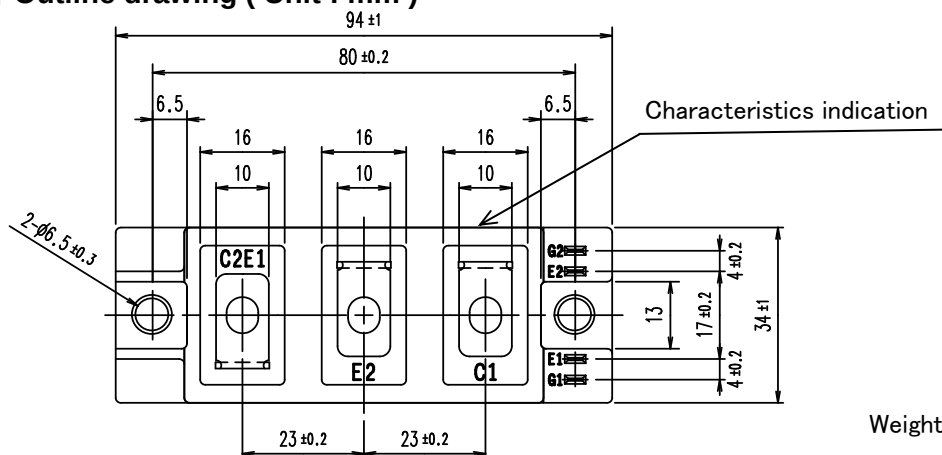
- LOW  $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ **Applications**

- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems,
- Industrial machines, such as Welding machines

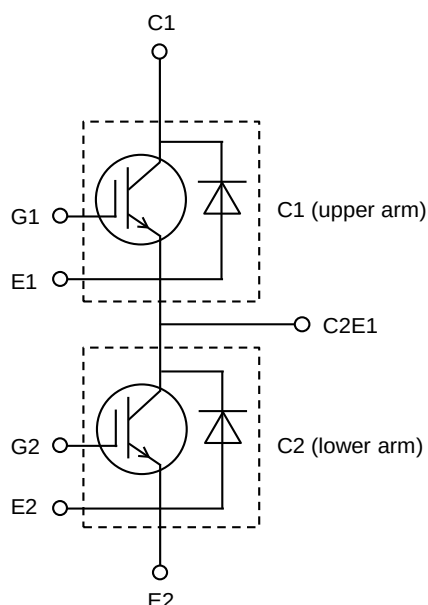


■ **Outline drawing ( Unit : mm )**



DETAIL TAB TYPE TERMINALS

■ **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            |
|--------------------------------------------|---------------------------------------------------------|------------|------------|---------------------------|-----------------|------------------|
| Inverter                                   | 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 | $T_c = 100^\circ\text{C}$ | 150             | A                |
|                                            | Repetitive peak collector current                       | $I_{CRM}$  | 1ms        |                           | 300             |                  |
|                                            | Forward current                                         | $I_F$      |            |                           | 150             |                  |
|                                            | Repetitive peak forward current                         | $I_{FRM}$  | 1ms        |                           | 300             |                  |
|                                            | Total power dissipation                                 | $P_{tot}$  | 1 device   |                           | 680             | 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 terminals and copper base (*1)                  | $V_{isol}$ | AC: 1min.  |                           | 4000            | Vrms             |
| Mounting torque of screws to heatsink(*2)  |                                                         | $M_s$      | M5         |                           | 5.0             | N·m              |
| Mounting torque of screws to terminals(*3) |                                                         | $M_t$      | M5         |                           | 5.0             |                  |

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

(\*2) Recommendable Value: 3.0 ~ 5.0 N·m (M5 or M6)

(\*3) Recommendable Value: 2.5 ~ 5.0 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>$I_C = 150mA$                                                                     |                       | 6.0             | 6.5  | 7.0  | V        |
|                       | Collector-emitter saturation voltage                           | $V_{CE(sat)}$ (terminal) | $V_{GE} = 15V$<br>$I_C = 150A$                                                                      | $T_{vj}=25^{\circ}C$  | -               | 1.75 | 2.20 | V        |
|                       |                                                                | $V_{CE(sat)}$ (chip)     |                                                                                                     | $T_{vj}=25^{\circ}C$  | -               | 1.50 | 1.95 |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 1.90 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 1.95 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 2.00 | -    |          |
|                       | Internal gate resistance                                       | $r_g$                    | -                                                                                                   |                       | -               | 3.75 | -    | $\Omega$ |
|                       | Input capacitance                                              | $C_{ies}$                | $V_{CE}=10V, V_{GE}=0V, f=1MHz$                                                                     |                       | -               | 16   | -    | nF       |
|                       | Output capacitance                                             | $C_{oes}$                |                                                                                                     |                       | -               | 0.5  | -    |          |
|                       | Reverse transfer capacitance                                   | $C_{res}$                |                                                                                                     |                       | -               | 0.14 | -    |          |
|                       | Gate charge                                                    | $Q_G$                    | $V_{CC} = 600V, I_C = 150A$<br>$V_{GE} = -15 \rightarrow +15V$                                      |                       | -               | 1.2  | -    | $\mu C$  |
|                       | Forward voltage                                                | $V_F$ (terminal)         | $V_{GE} = 0V$<br>$I_F= 150A$                                                                        | $T_{vj}=25^{\circ}C$  | -               | 1.85 | 2.30 | V        |
|                       |                                                                | $V_F$ (chip)             |                                                                                                     | $T_{vj}= 25^{\circ}C$ | -               | 1.60 | 2.05 |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 1.65 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 1.60 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 1.60 | -    |          |
|                       | Turn-on delay time(*1)                                         | $t_{d(on)}$              | $V_{CC} = 600V$<br>$I_C, I_F = 150A$<br>$V_{GE} = +15/ -15V$<br>$R_G = 3.9 \Omega$<br>$L_S = 30 nH$ | $T_{vj}= 25^{\circ}C$ | -               | 0.22 | -    | $\mu s$  |
|                       | Rise time(*1)                                                  | $t_r$                    |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 0.25 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 0.26 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 0.26 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}= 25^{\circ}C$ | -               | 0.07 | -    |          |
|                       | Turn-off delay time(*1)                                        | $t_{d(off)}$             |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 0.07 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=150^{\circ}C$ | -               | 0.08 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}=175^{\circ}C$ | -               | 0.08 | -    |          |
|                       |                                                                |                          |                                                                                                     | $T_{vj}= 25^{\circ}C$ | -               | 0.25 | -    |          |
|                       | Fall time(*1)                                                  | $t_f$                    |                                                                                                     | $T_{vj}=125^{\circ}C$ | -               | 0.29 | -    |          |
| $T_{vj}=150^{\circ}C$ |                                                                |                          |                                                                                                     | -                     | 0.30            | -    |      |          |
| $T_{vj}=175^{\circ}C$ |                                                                |                          |                                                                                                     | -                     | 0.31            | -    |      |          |
| $T_{vj}= 25^{\circ}C$ |                                                                |                          |                                                                                                     | -                     | 0.11            | -    |      |          |
| Reverse recovery time | $t_{rr}$                                                       | $T_{vj}=125^{\circ}C$    |                                                                                                     | -                     | 0.18            | -    |      |          |
|                       |                                                                | $T_{vj}=150^{\circ}C$    |                                                                                                     | -                     | 0.20            | -    |      |          |
|                       |                                                                | $T_{vj}=175^{\circ}C$    |                                                                                                     | -                     | 0.23            | -    |      |          |
|                       |                                                                | $T_{vj}= 25^{\circ}C$    |                                                                                                     | -                     | 0.44            | -    |      |          |
|                       |                                                                | $T_{vj}=125^{\circ}C$    |                                                                                                     | -                     | 0.62            | -    |      |          |
|                       |                                                                | $T_{vj}=150^{\circ}C$    |                                                                                                     | -                     | 0.67            | -    |      |          |
|                       |                                                                | $T_{vj}=175^{\circ}C$    |                                                                                                     | -                     | 0.71            | -    |      |          |

(\*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          | $E_{\text{on}}$  | $V_{\text{CC}} = 600\text{V}$<br>$I_{\text{C}}, I_{\text{F}} = 150\text{A}$<br>$V_{\text{GE}} = +15/ -15\text{V}$<br>$R_{\text{G}} = 3.9 \Omega$<br>$L_{\text{S}} = 30 \text{ nH}$ | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -               | 11.8 | -    | mJ    |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=125^{\circ}\text{C}$ | -               | 16.9 | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=150^{\circ}\text{C}$ | -               | 18.2 | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=175^{\circ}\text{C}$ | -               | 20.1 | -    |       |
|          | Turn-off energy         | $E_{\text{off}}$ |                                                                                                                                                                                    | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -               | 7.2  | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=125^{\circ}\text{C}$ | -               | 10.1 | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=150^{\circ}\text{C}$ | -               | 10.8 | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=175^{\circ}\text{C}$ | -               | 11.5 | -    |       |
|          | Reverse recovery energy | $E_{\text{rr}}$  |                                                                                                                                                                                    | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -               | 3.1  | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=125^{\circ}\text{C}$ | -               | 6.9  | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=150^{\circ}\text{C}$ | -               | 7.9  | -    |       |
|          |                         |                  |                                                                                                                                                                                    | $T_{\text{vj}}=175^{\circ}\text{C}$ | -               | 9.2  | -    |       |

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.

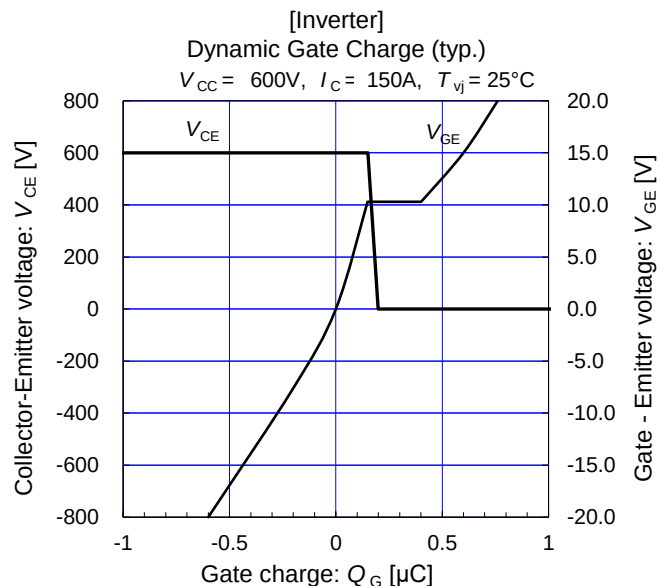
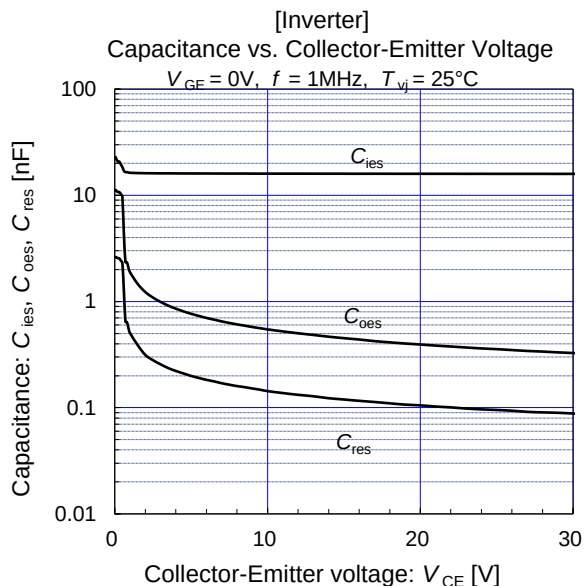
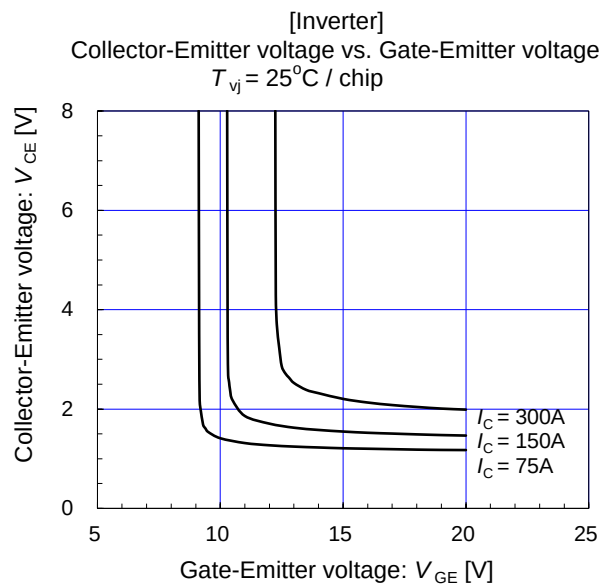
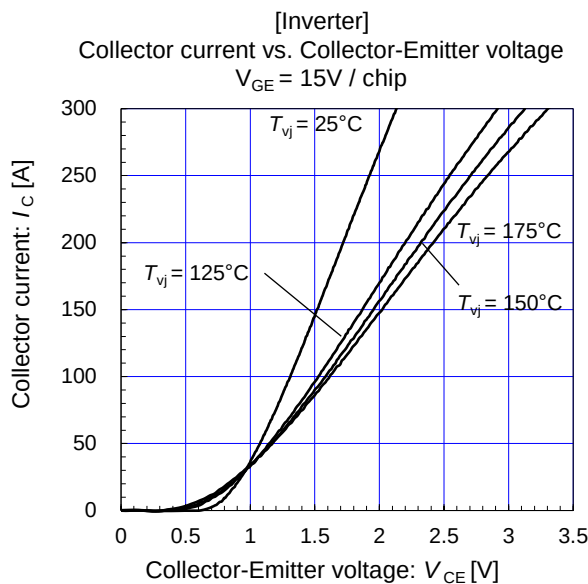
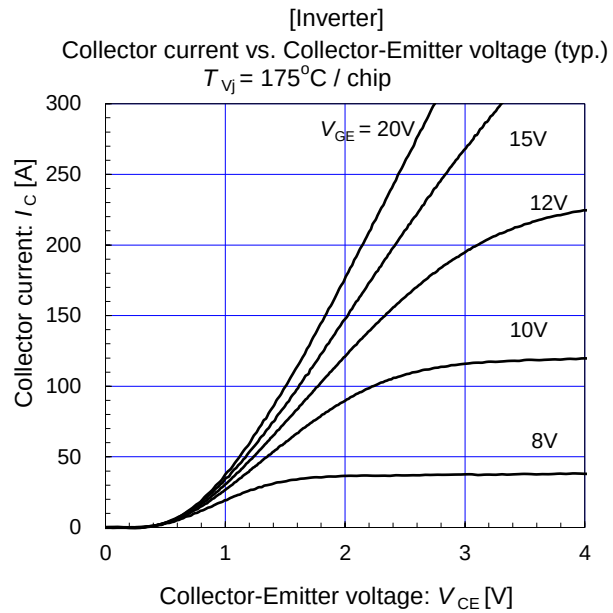
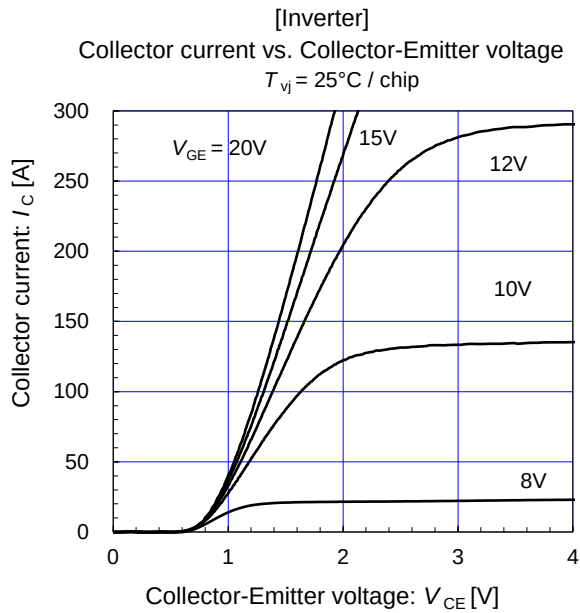
Thermal resistance characteristics

|                                                         | Symbols       | Conditions                    | Characteristics |       |       | ns  |
|---------------------------------------------------------|---------------|-------------------------------|-----------------|-------|-------|-----|
|                                                         |               |                               | min.            | typ.  | max.  |     |
| Thermal resistance junction to case (1device)           | $R_{th(j-c)}$ | IGBT                          | -               | -     | 0.220 | K/W |
|                                                         |               | FWD                           | -               | -     | 0.338 |     |
| Thermal resistance case to heatsink (1IGBT + 1FWD) (*1) | $R_{th(c-s)}$ | with 1 W/(m·K) thermal grease | -               | 0.050 | -     |     |

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

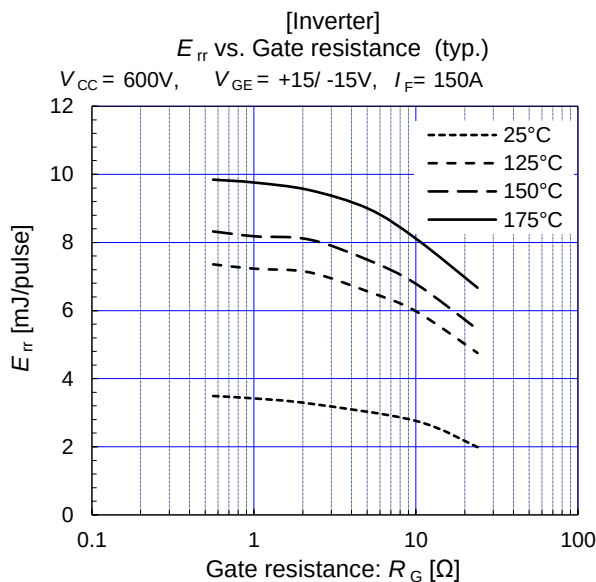
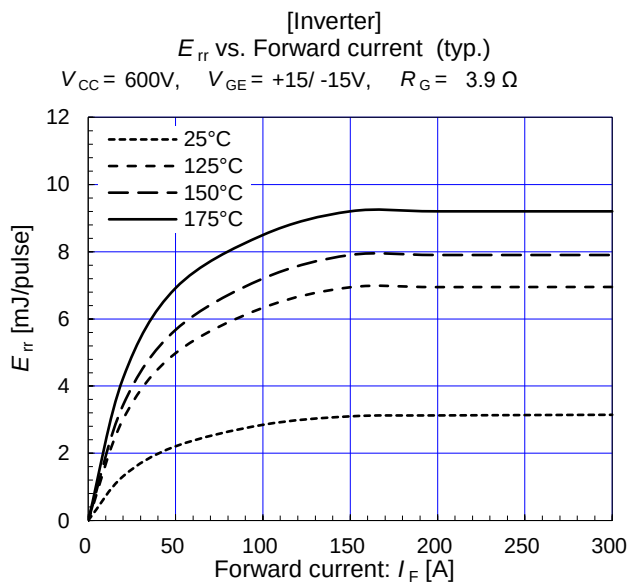
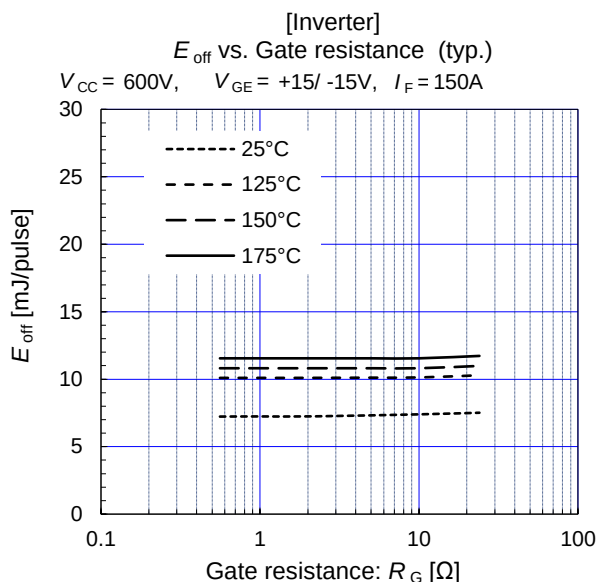
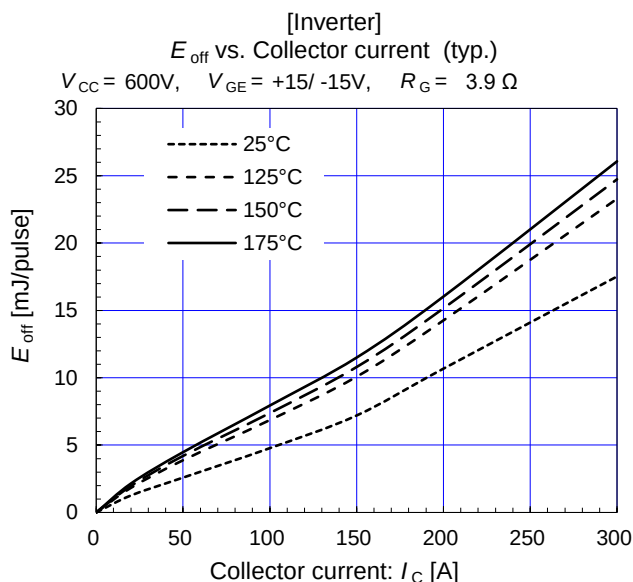
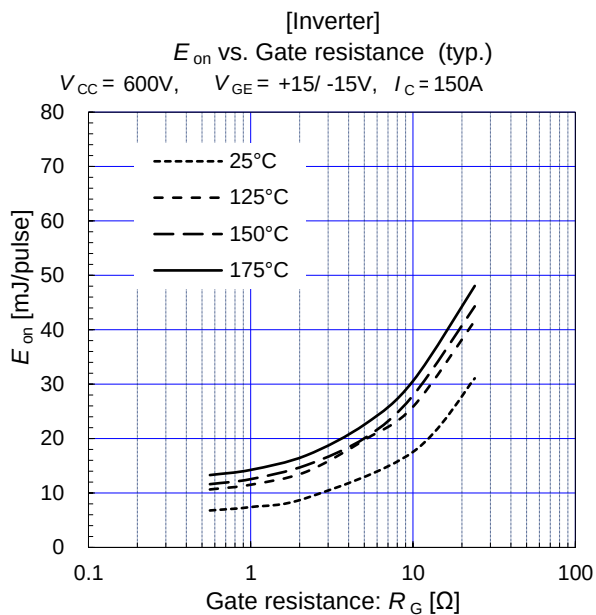
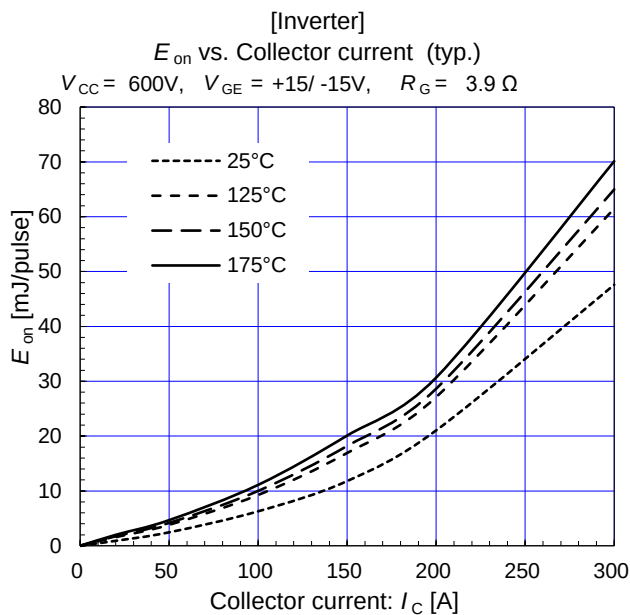
# 2MBI150XAA120-50

## IGBT Modules



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IGBT Modules



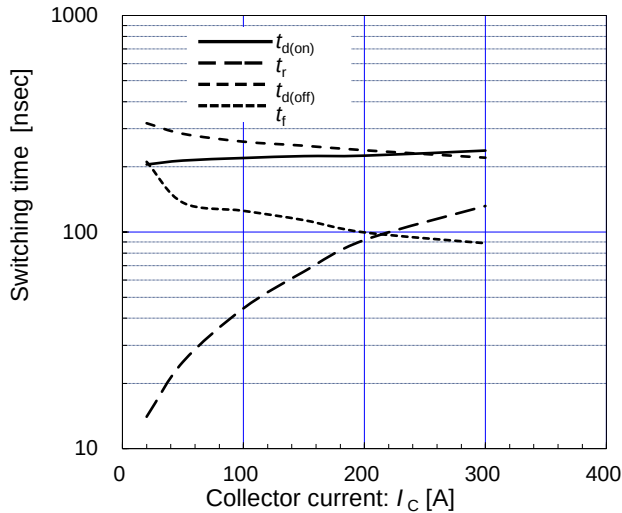
# 2MBI150XAA120-50

IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

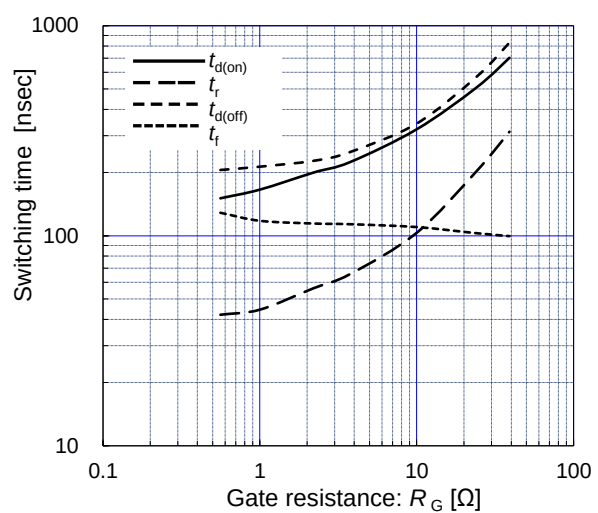
$V_{CC} = 600V$ ,  $R_G = 3.9\ \Omega$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

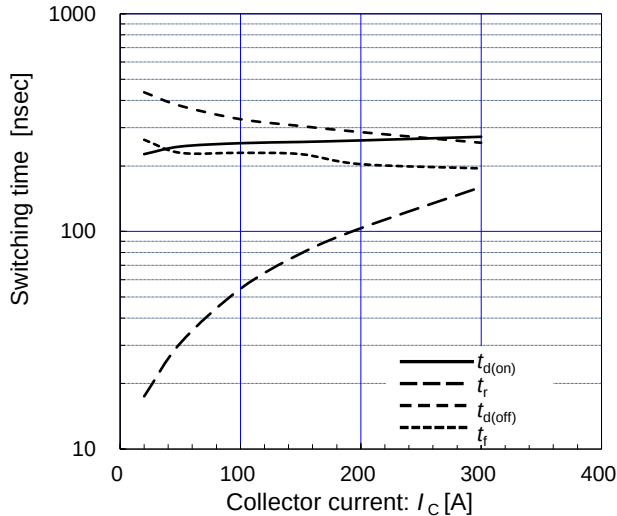
$V_{CC} = 600V$ ,  $I_C = 150A$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

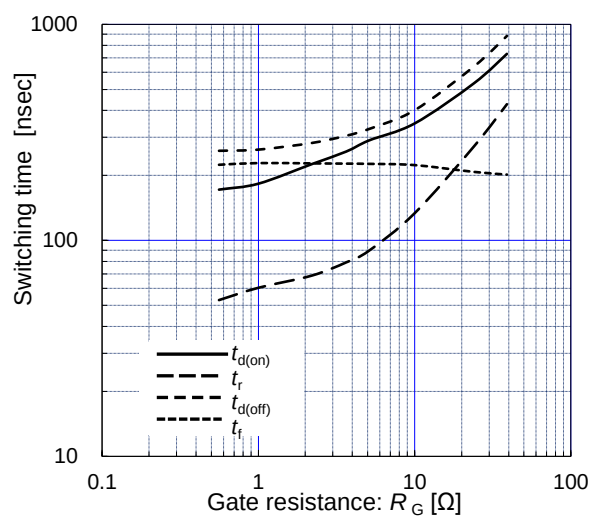
$V_{CC} = 600V$ ,  $R_G = 3.9\ \Omega$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

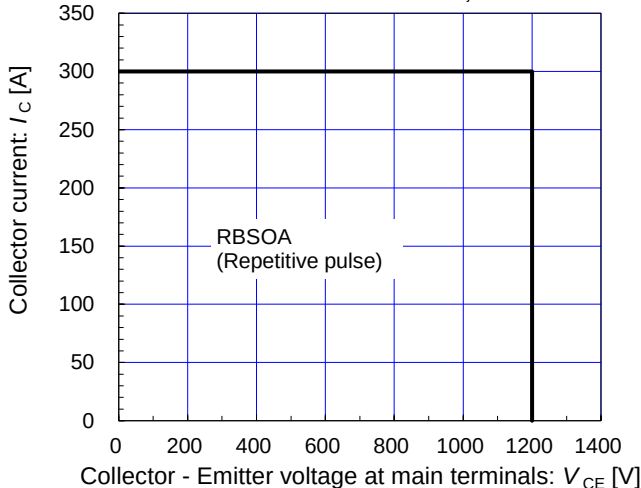
$V_{CC} = 600V$ ,  $I_C = 150A$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 175^\circ C$



[Inverter]

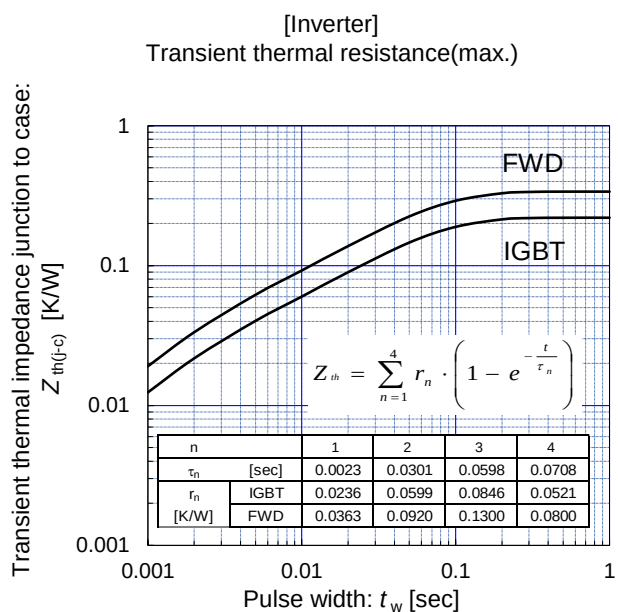
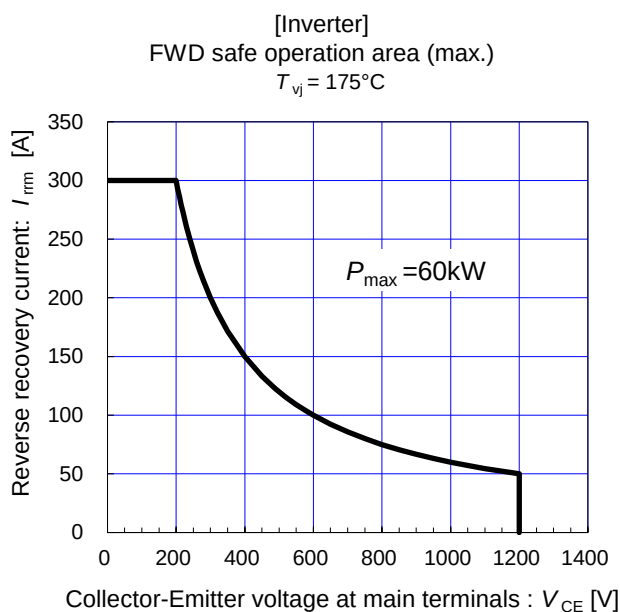
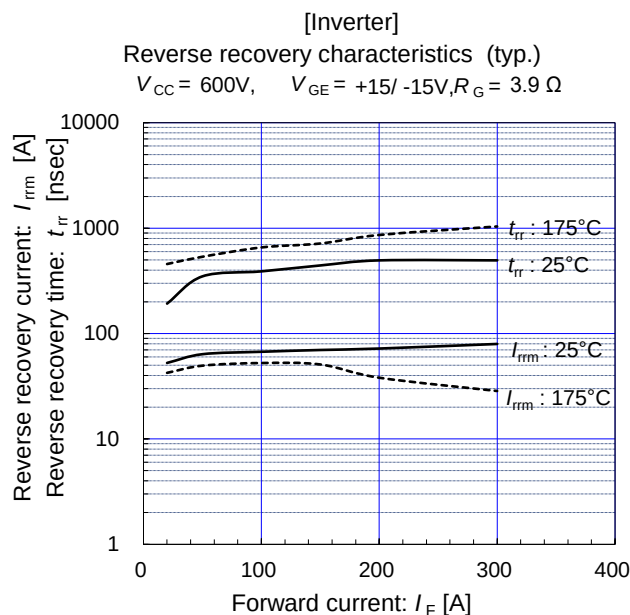
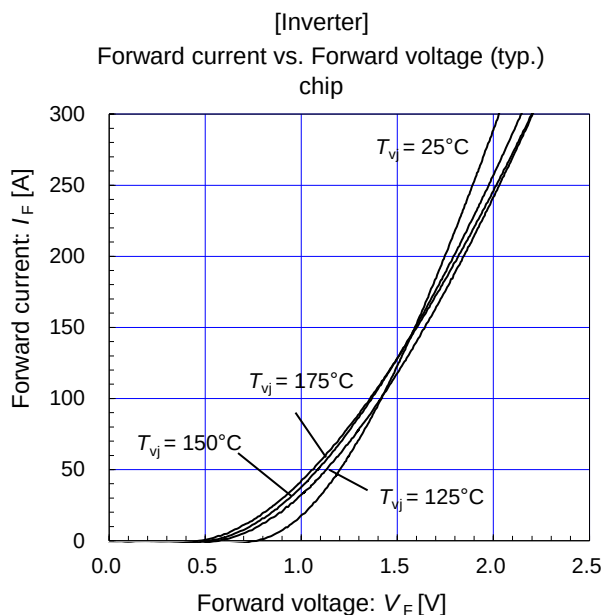
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$ ,  $R_G = 3.9\ \Omega$ ,  $T_{vj} = 175^\circ C$



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## Warnings

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## IGBT Modules

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|               |                                                                                                                                    |
|---------------|------------------------------------------------------------------------------------------------------------------------------------|
| 日本            | <a href="http://www.fujielectric.co.jp/products/semiconductor/">www.fujielectric.co.jp/products/semiconductor/</a>                 |
| Global        | <a href="http://www.fujielectric.com/products/semiconductor/">www.fujielectric.com/products/semiconductor/</a>                     |
| 中国            | <a href="http://www.fujielectric.com.cn/products/semiconductor/">www.fujielectric.com.cn/products/semiconductor/</a>               |
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#### 日本

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| 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>                     |