

# 2MBI800XNF120-50

IGBT Modules

**Power Module (X series)**  
1200V / 800A / 2-in-1 package

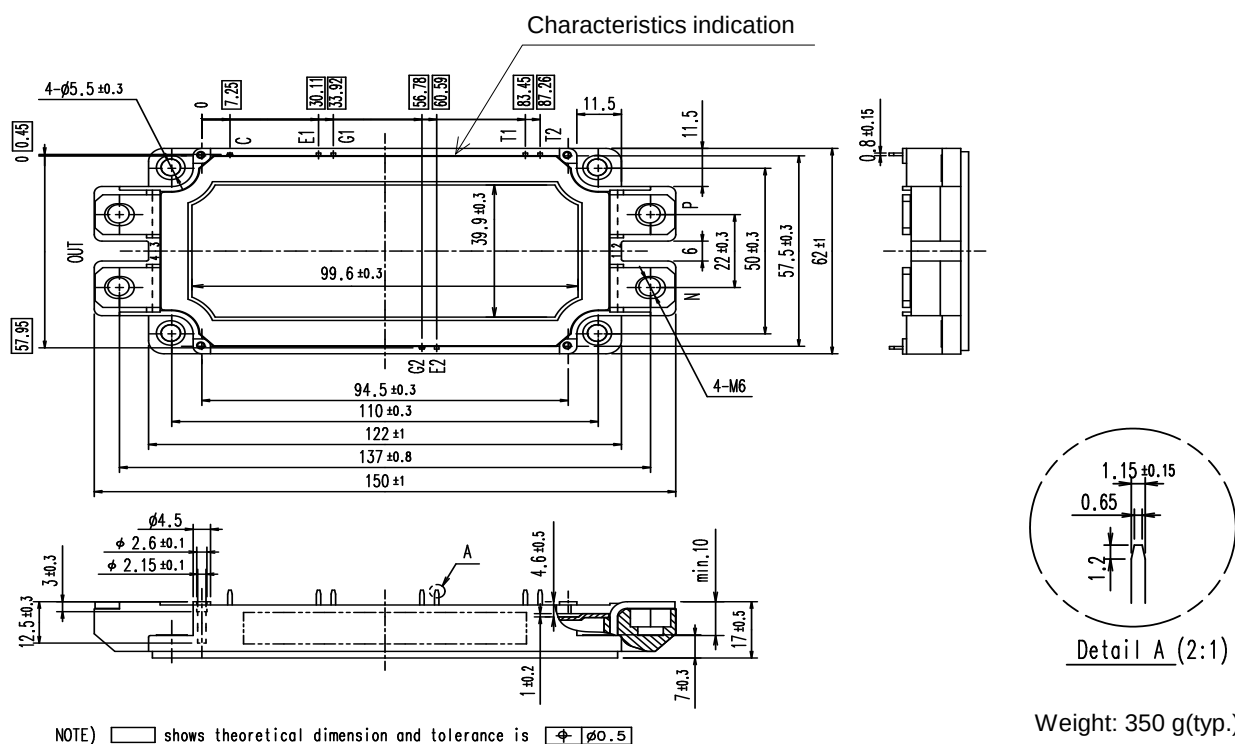
## ■ Features

- Low  $V_{CE(sat)}$
- Low Inductance Module structure
- Solderless press-fit terminals

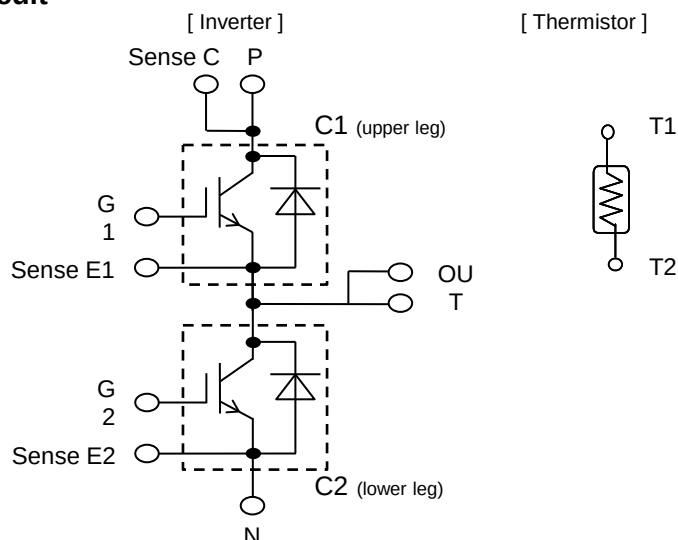
## ■ Applications

- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems

## ■ Outline drawing ( Unit : mm )



## ■ Equivalent Circuit



# 2MBI800XNF120-50

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

| Items               |                                                                |           | Symbols    | Conditions |                           | Maximum Ratings | Units |
|---------------------|----------------------------------------------------------------|-----------|------------|------------|---------------------------|-----------------|-------|
| Inverter            | Collector-Emitter voltage                                      |           | $V_{CES}$  |            |                           | 1200            | V     |
|                     | Gate-Emitter voltage                                           |           | $V_{GES}$  |            |                           | ±20             | V     |
|                     | Collector current                                              |           | $I_C$      | Continuous | $T_C=100^{\circ}\text{C}$ | 800             | A     |
|                     |                                                                |           | $I_{CRM}$  | 1ms        |                           | 1600            |       |
|                     | Forward current                                                |           | $I_F$      |            |                           | 800             |       |
|                     |                                                                |           | $I_{FRM}$  | 1ms        |                           | 1600            |       |
|                     | Collector power dissipation                                    |           | $P_C$      | 1 device   |                           | 4050            |       |
|                     | Junction temperature                                           |           | $T_{vj}$   |            |                           | 175             | W     |
|                     | Operating junction temperature<br>(under switching conditions) |           | $T_{vjop}$ |            |                           | 175             | °C    |
|                     | Case temperature                                               |           | $T_c$      |            |                           | 125             |       |
| Storage temperature |                                                                | $T_{stg}$ |            |            | -40 ~ 125                 |                 |       |
| Isolation voltage   | between terminal and copper base (*1)                          |           | $V_{iso}$  | AC: 1min.  |                           | 4000            | Vrms  |
|                     | between thermistor and others (*2)                             |           |            |            |                           |                 |       |
| Screw Torque(*3)    | Mounting                                                       |           | -          | M5         |                           | 6.0             | N m   |
|                     | Terminals                                                      |           |            | M6         |                           | 6.0             |       |

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

(\*2) Two thermistor terminals should be connected together, other terminals should be connected together

(\*3) Recommendable Value:      Mounting      2.5 ~ 6.0 N·m      (M5)  
                                          Terminals      3.5 ~ 6.0 N·m      (M6)

# 2MBI800XNF120-50

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

| Items                               |                                         | Symbols                             | Conditions                                                                                                    |                                                                                                                                                                                   | Characteristics                     |      |      | Units         |
|-------------------------------------|-----------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------|------|---------------|
|                                     |                                         |                                     |                                                                                                               |                                                                                                                                                                                   | min.                                | typ. | max. |               |
| Inverter                            | Zero gate voltage<br>Collector current  | $I_{\text{CES}}$                    | $V_{\text{GE}} = 0\text{V}$<br>$V_{\text{CE}} = 1200\text{V}$                                                 |                                                                                                                                                                                   | -                                   | -    | 150  | mA            |
|                                     | Gate-Emitter<br>leakage current         | $I_{\text{GES}}$                    | $V_{\text{CE}}=0\text{V}$ , $V_{\text{GE}}=\pm 20\text{V}$                                                    |                                                                                                                                                                                   | -                                   | -    | 300  | nA            |
|                                     | Gate-Emitter<br>threshold voltage       | $V_{\text{GE(th)}}$                 | $V_{\text{CE}} = 20\text{V}$<br>$I_{\text{C}} = 800\text{mA}$                                                 |                                                                                                                                                                                   | 6.0                                 | 6.5  | 7.0  | V             |
|                                     | Collector-Emitter<br>saturation voltage | $V_{\text{CE(sat)}}$<br>(terminal)  | $V_{\text{GE}} = 15\text{V}$<br>$I_{\text{C}} = 800\text{A}$                                                  | $T_{\text{vj}}=25^{\circ}\text{C}$                                                                                                                                                | -                                   | 2.45 | 2.90 | V             |
|                                     |                                         |                                     |                                                                                                               | $T_{\text{vj}}=25^{\circ}\text{C}$                                                                                                                                                | -                                   | 1.45 | 1.90 |               |
|                                     |                                         | $V_{\text{CE(sat)}}$<br>(chip)      |                                                                                                               | $T_{\text{vj}}=125^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.80 | -    |               |
|                                     |                                         |                                     |                                                                                                               | $T_{\text{vj}}=150^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.90 | -    |               |
|                                     |                                         |                                     |                                                                                                               | $T_{\text{vj}}=175^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.95 | -    |               |
|                                     | Internal gate                           | $R_{\text{G}}$                      | -                                                                                                             |                                                                                                                                                                                   | -                                   | 1.17 | -    | $\Omega$      |
|                                     | Capacitance                             | $C_{\text{ies}}$                    | $V_{\text{CE}}=10\text{V}$ , $V_{\text{GE}}=0\text{V}$ , $f=1\text{MHz}$                                      |                                                                                                                                                                                   | -                                   | 85   | -    | nF            |
|                                     |                                         | $C_{\text{oes}}$                    |                                                                                                               |                                                                                                                                                                                   | -                                   | 2.9  | -    |               |
|                                     |                                         | $C_{\text{res}}$                    |                                                                                                               |                                                                                                                                                                                   | -                                   | 0.76 | -    |               |
|                                     | Gate charge                             | $Q_{\text{G}}$                      | $V_{\text{CC}} = 600\text{V}$ , $I_{\text{C}} = 800\text{A}$<br>$V_{\text{GE}} = -15 \rightarrow +15\text{V}$ |                                                                                                                                                                                   | -                                   | 5.5  | -    | $\mu\text{C}$ |
|                                     | Forward on voltage                      | $V_{\text{F}}$<br>(terminal)        | $V_{\text{GE}} = 0\text{V}$<br>$I_{\text{F}}= 800\text{A}$                                                    | $T_{\text{vj}}=25^{\circ}\text{C}$                                                                                                                                                | -                                   | 2.60 | 3.05 | V             |
|                                     |                                         | $V_{\text{F}}$<br>(chip)            |                                                                                                               | $T_{\text{vj}}= 25^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.60 | 2.05 |               |
|                                     |                                         |                                     |                                                                                                               | $T_{\text{vj}}=125^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.65 | -    |               |
|                                     |                                         |                                     |                                                                                                               | $T_{\text{vj}}=150^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.60 | -    |               |
|                                     |                                         |                                     |                                                                                                               | $T_{\text{vj}}=175^{\circ}\text{C}$                                                                                                                                               | -                                   | 1.60 | -    |               |
|                                     | Switching time (*1)                     |                                     | $t_{\text{d(on)}}$                                                                                            | $V_{\text{CC}} = 600\text{V}$<br>$I_{\text{C}}, I_{\text{F}}= 800\text{A}$<br>$V_{\text{GE}} = +15/ -15\text{V}$<br>$R_{\text{G}} = 0.5 \Omega$<br>$L_{\text{S}} = 35 \text{ nH}$ | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -    | 0.47 | -             |
|                                     |                                         | $T_{\text{vj}}=125^{\circ}\text{C}$ |                                                                                                               |                                                                                                                                                                                   | -                                   | 0.48 | -    |               |
| $T_{\text{vj}}=150^{\circ}\text{C}$ |                                         | -                                   |                                                                                                               |                                                                                                                                                                                   | 0.49                                | -    |      |               |
| $T_{\text{vj}}=175^{\circ}\text{C}$ |                                         | -                                   |                                                                                                               |                                                                                                                                                                                   | 0.51                                | -    |      |               |
| $t_{\text{r}}$                      |                                         | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.10                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=125^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.11                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=150^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.12                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=175^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.12                                | -    |      |               |
| $t_{\text{d(off)}}$                 |                                         | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.45                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=125^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.49                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=150^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.50                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=175^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.52                                | -    |      |               |
| $t_{\text{f}}$                      |                                         | $T_{\text{vj}}= 25^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.08                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=125^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.10                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=150^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.10                                | -    |      |               |
|                                     |                                         | $T_{\text{vj}}=175^{\circ}\text{C}$ | -                                                                                                             |                                                                                                                                                                                   | 0.11                                | -    |      |               |
|                                     |                                         | Reverse recovery time               | $t_{\text{rr}}$                                                                                               | $T_{\text{vj}}= 25^{\circ}\text{C}$                                                                                                                                               | -                                   | 0.19 | -    |               |
| $T_{\text{vj}}=125^{\circ}\text{C}$ |                                         |                                     |                                                                                                               | -                                                                                                                                                                                 | 0.29                                | -    |      |               |
| $T_{\text{vj}}=150^{\circ}\text{C}$ |                                         |                                     |                                                                                                               | -                                                                                                                                                                                 | 0.32                                | -    |      |               |
| $T_{\text{vj}}=175^{\circ}\text{C}$ | -                                       |                                     |                                                                                                               | 0.37                                                                                                                                                                              | -                                   |      |      |               |

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

# 2MBI800XNF120-50

**IGBT Modules**

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

| Items      |                               | Symbols          | Conditions                                 |                                     | Characteristics |      |      | Units    |
|------------|-------------------------------|------------------|--------------------------------------------|-------------------------------------|-----------------|------|------|----------|
|            |                               |                  |                                            |                                     | min.            | typ. | max. |          |
| Inverter   | Switching loss<br>(per pulse) | $E_{\text{on}}$  | $V_{\text{CC}} = 600\text{V}$              | $T_{\text{vj}}=25^{\circ}\text{C}$  | -               | 41.7 | -    | mJ       |
|            |                               |                  | $I_{\text{C}}, I_{\text{F}} = 800\text{A}$ | $T_{\text{vj}}=125^{\circ}\text{C}$ | -               | 70.2 | -    |          |
|            |                               |                  | $V_{\text{GE}} = +15/ -15\text{V}$         | $T_{\text{vj}}=150^{\circ}\text{C}$ | -               | 81.1 | -    |          |
|            |                               |                  | $R_{\text{G}} = 0.5\ \Omega$               | $T_{\text{vj}}=175^{\circ}\text{C}$ | -               | 90.4 | -    |          |
|            |                               | $E_{\text{off}}$ | $L_{\text{S}} = 35\ \text{nH}$             | $T_{\text{vj}}=25^{\circ}\text{C}$  | -               | 77.6 | -    |          |
|            |                               |                  | $T_{\text{vj}}=125^{\circ}\text{C}$        | -                                   | 92.5            | -    |      |          |
|            |                               |                  | $T_{\text{vj}}=150^{\circ}\text{C}$        | -                                   | 94.9            | -    |      |          |
|            |                               |                  | $T_{\text{vj}}=175^{\circ}\text{C}$        | -                                   | 100.5           | -    |      |          |
|            |                               | $E_{\text{rr}}$  | $T_{\text{vj}}=25^{\circ}\text{C}$         | -                                   | 31.0            | -    |      |          |
|            |                               |                  | $T_{\text{vj}}=125^{\circ}\text{C}$        | -                                   | 52.9            | -    |      |          |
|            |                               |                  | $T_{\text{vj}}=150^{\circ}\text{C}$        | -                                   | 60.2            | -    |      |          |
|            |                               |                  | $T_{\text{vj}}=175^{\circ}\text{C}$        | -                                   | 67.8            | -    |      |          |
| Thermistor | Resistance                    | $R$              | $T =$                                      | $25^{\circ}\text{C}$                | -               | 5000 | -    | $\Omega$ |
|            |                               |                  | $T =$                                      | $100^{\circ}\text{C}$               | 465             | 495  | 520  |          |
|            | B value                       | $B$              | $T =$                                      | $25/ 50^{\circ}\text{C}$            | 3305            | 3375 | 3450 | K        |

### 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.

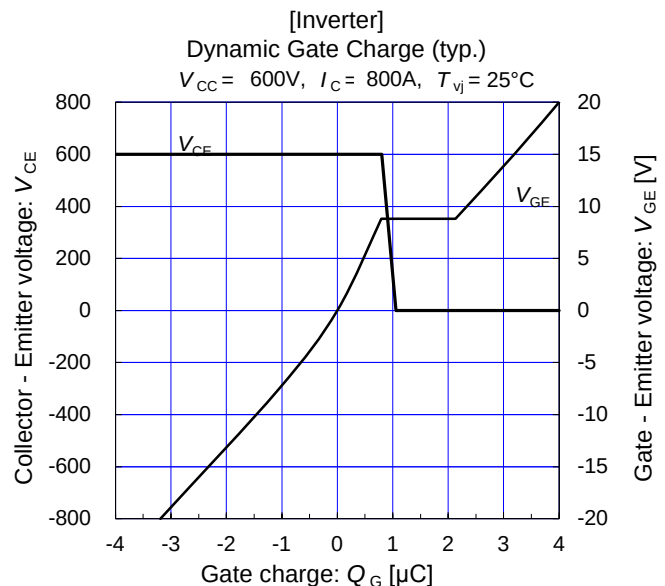
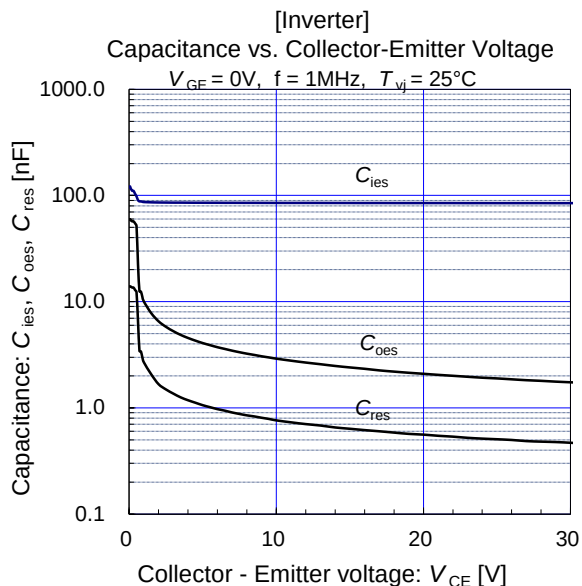
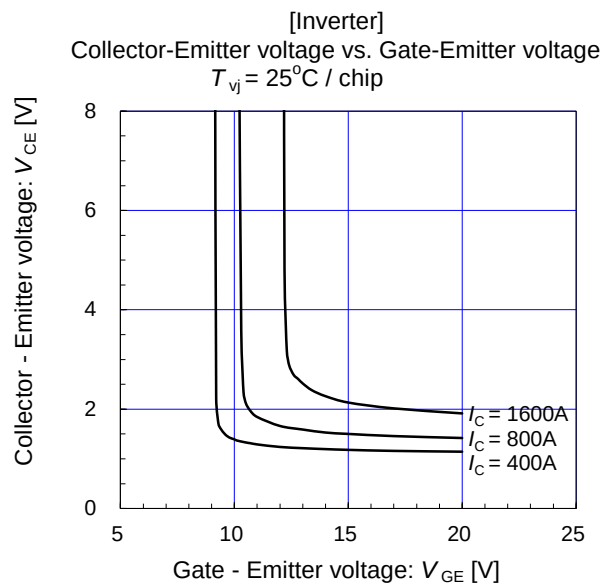
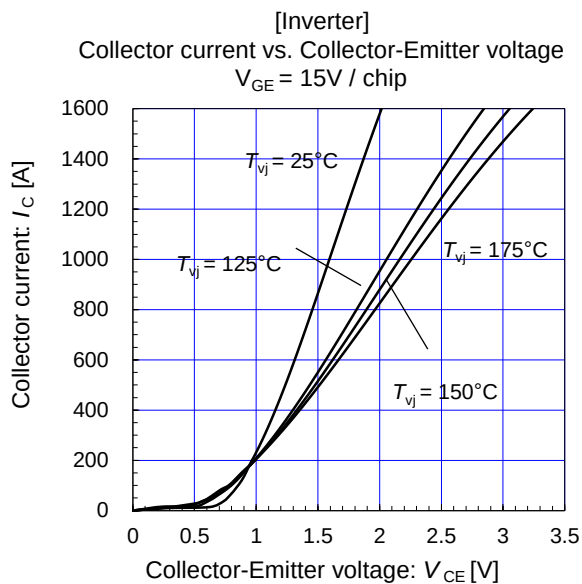
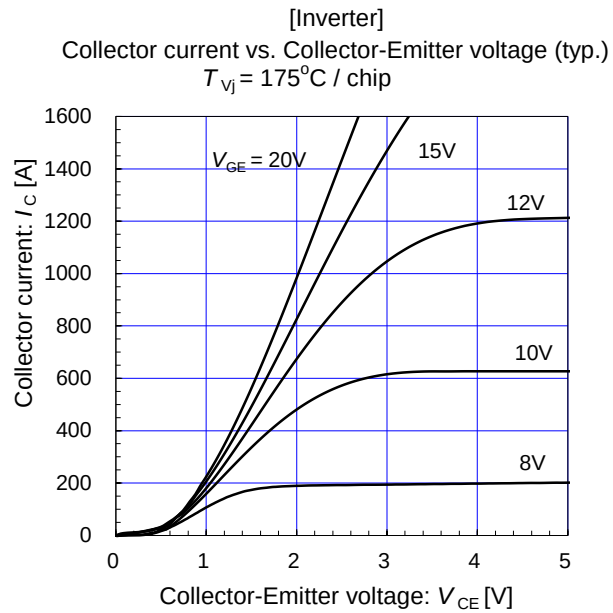
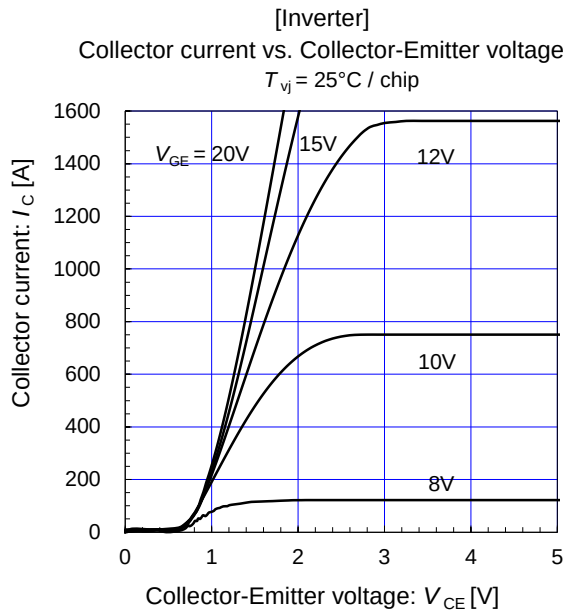
## ■ Thermal resistance characteristics

|                                              | Symbols       | Conditions                    | Characteristics |        |       | Units                |
|----------------------------------------------|---------------|-------------------------------|-----------------|--------|-------|----------------------|
|                                              |               |                               | min.            | typ.   | max.  |                      |
| Thermal resistance<br>(1device)              | $R_{th(j-c)}$ | Inverter IGBT                 | -               | -      | 0.037 | $^{\circ}\text{C/W}$ |
|                                              |               | Inverter FWD                  | -               | -      | 0.044 |                      |
| Contact thermal resistance<br>(1device) (*1) | $R_{th(c-f)}$ | with 1 W/(m·K) thermal grease | -               | 0.0167 | -     |                      |

(\*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

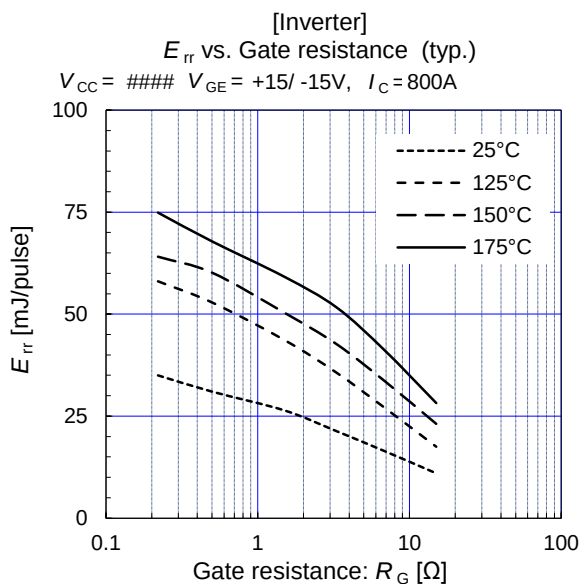
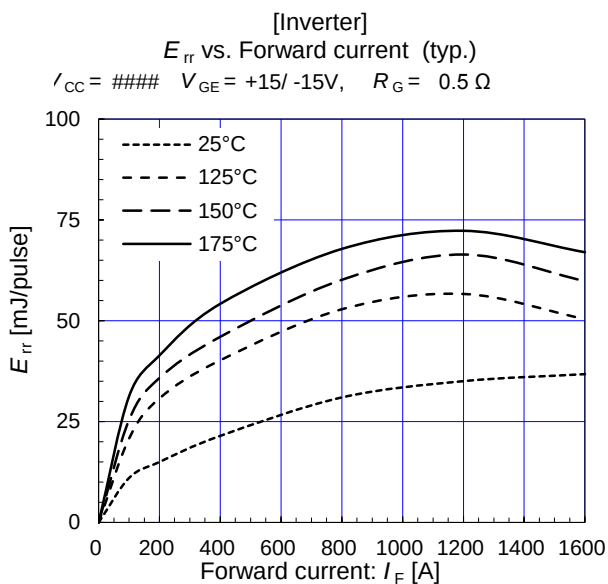
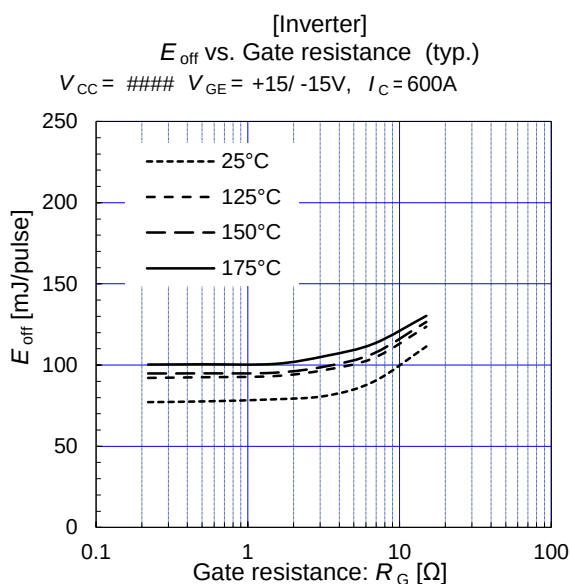
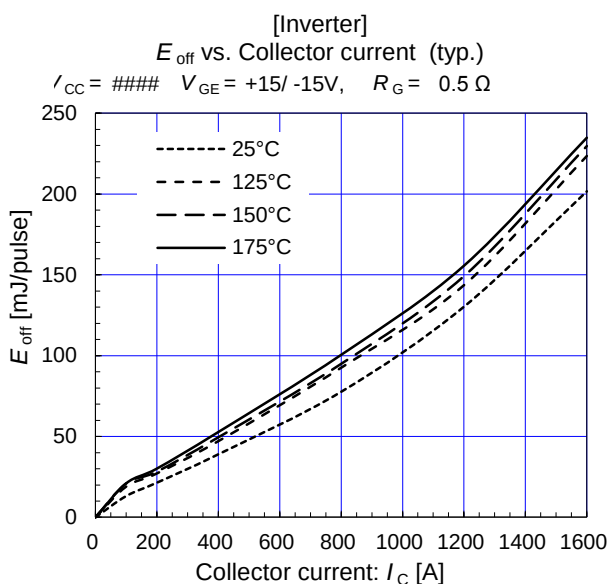
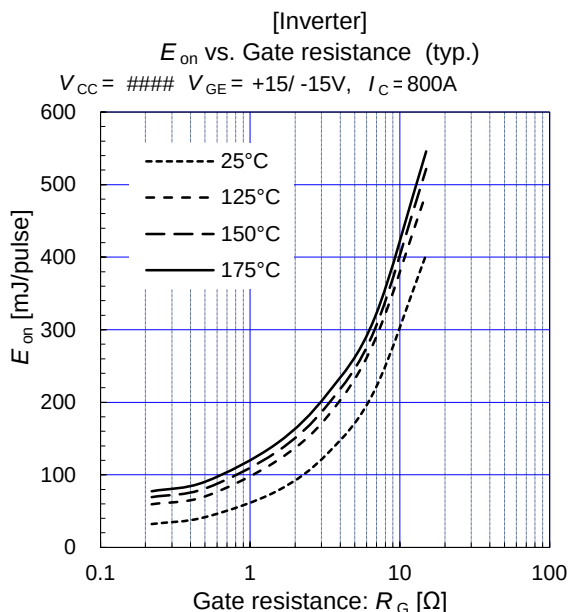
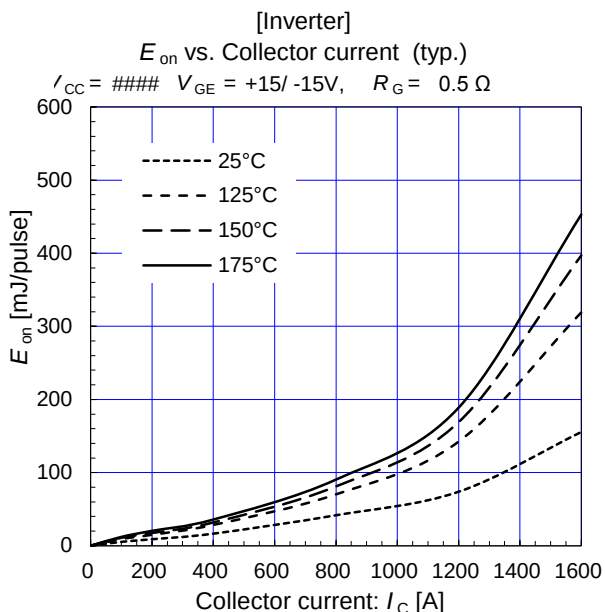
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## IGBT Modules



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IGBT Modules



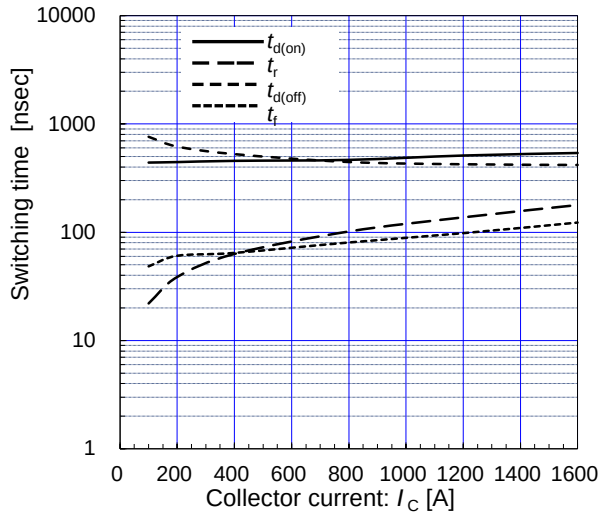
# 2MBI800XNF120-50

IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

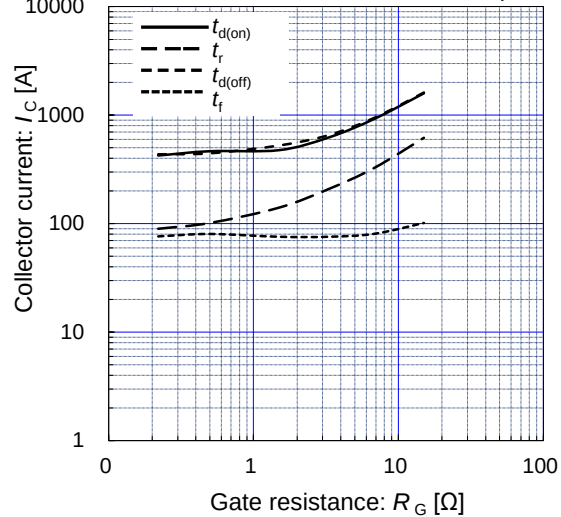
$V_{CC} = 600V$ ,  $R_G = 0.5\Omega$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

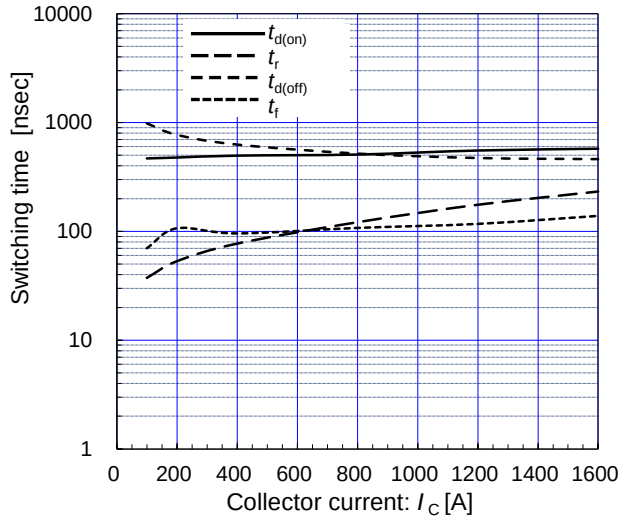
$V_{CC} = 600V$ ,  $I_C = 800A$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

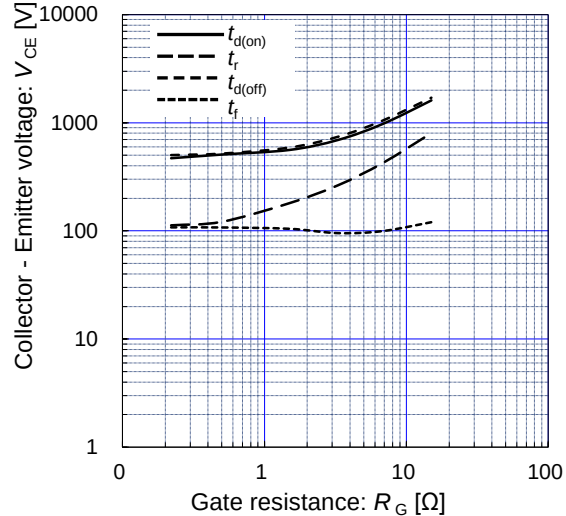
$V_{CC} = 600V$ ,  $R_G = 0.5\Omega$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

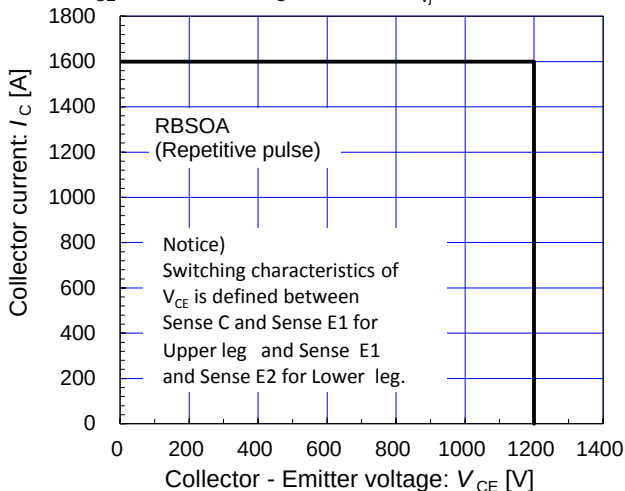
$V_{CC} = 600V$ ,  $I_C = 800A$ ,  $V_{GE} = +15/-15V$ ,  $T_{vj} = 175^\circ C$



[Inverter]

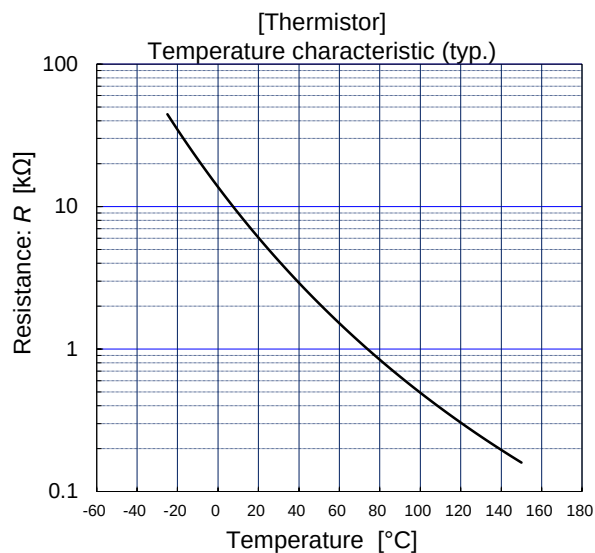
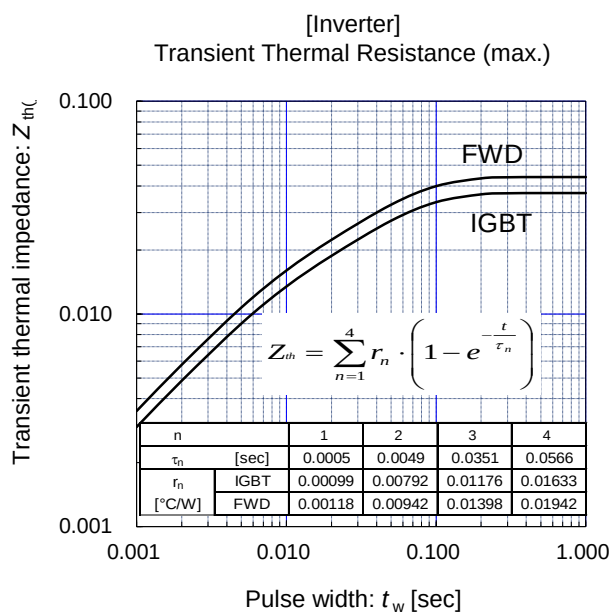
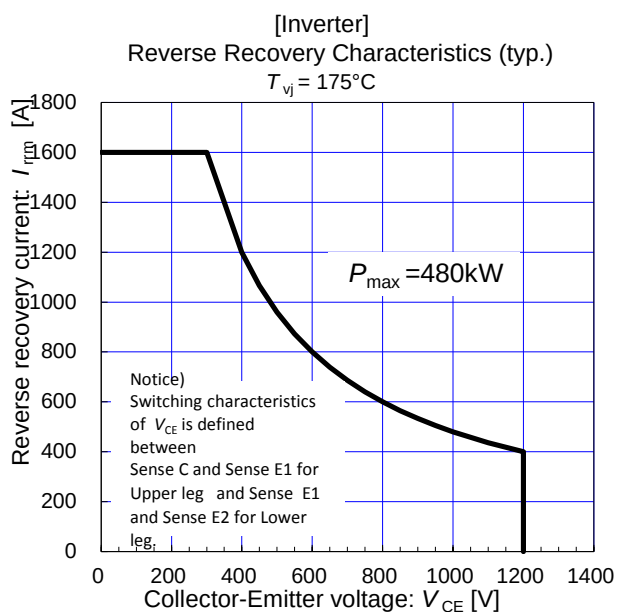
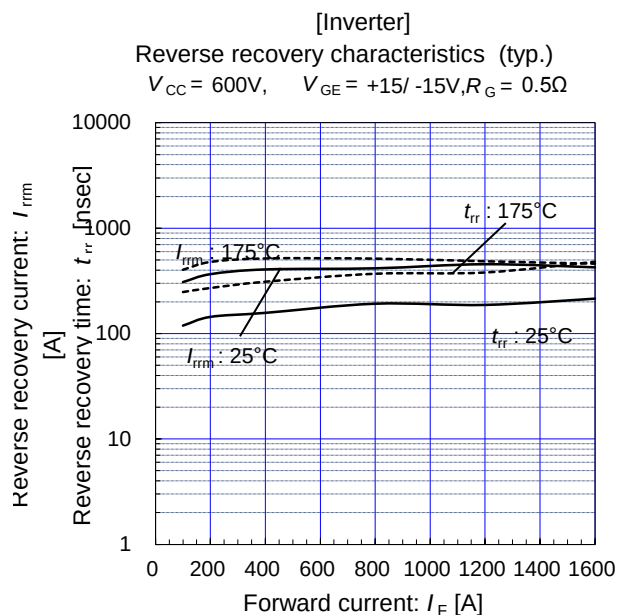
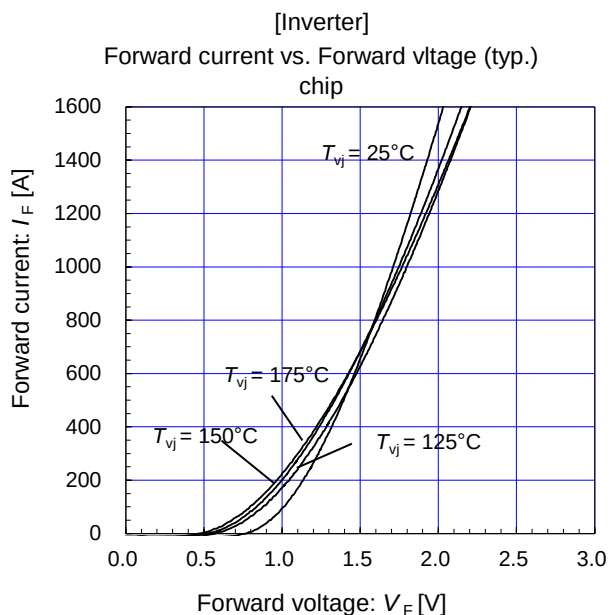
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$ ,  $R_G = 0.5\Omega$ ,  $T_{vj} = 175^\circ C$



# 2MBI800XNF120-50

IGBT Modules





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| 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>                   |
| Europe        | <a href="http://www.fujielectric-europe.com/en/power_semiconductor/">www.fujielectric-europe.com/en/power_semiconductor/</a>           |
| North America | <a href="http://www.americas.fujielectric.com/components/semiconductors/">www.americas.fujielectric.com/components/semiconductors/</a> |

### Information

#### 日本

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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/products/semiconductor/contact/">www.fujielectric.com/products/semiconductor/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.cn/products/semiconductor/contact/">www.fujielectric.com.cn/products/semiconductor/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>                     |