**MBM1000FS17G**

Silicon N-channel IGBT 1700V G version

**FEATURES**
- High current density package
- Low stray inductance & low Rth(j-c)
- Half-bridge (2in1)
- Built in temperature sensor
- Scalable large current easily handled by paralleling
- Equipped with current sensing terminals

**ABSOLUTE MAXIMUM RATINGS (Tc=25°C)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Emitter Voltage</td>
<td>VCES</td>
<td>V</td>
<td>1,700</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Emitter Voltage</td>
<td>VGES</td>
<td>V</td>
<td>±20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector Current DC, 1ms</td>
<td>IC</td>
<td>mA</td>
<td>-</td>
<td>1</td>
<td>20</td>
<td>VCES=1,700V, VGES=0V, TJ=25°C</td>
</tr>
<tr>
<td>1ms Collector Current</td>
<td>IC</td>
<td>mA</td>
<td>-</td>
<td>10</td>
<td>76</td>
<td>VCES=1,700V, VGES=0V, TJ=150°C</td>
</tr>
<tr>
<td>Forward Current DC, 1ms</td>
<td>IF</td>
<td>mA</td>
<td>-</td>
<td>1</td>
<td>2.1</td>
<td>VCES=1,000A, VGES=15V, TJ=25°C</td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>TJ</td>
<td>°C</td>
<td>-25</td>
<td></td>
<td>150</td>
<td>VCES=10V, IC=1,000mA, TJ=25°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>TSS</td>
<td>°C</td>
<td>-25</td>
<td></td>
<td>150</td>
<td>VCES=200V, VGES=0V, TJ=25°C</td>
</tr>
<tr>
<td>Isolation Voltage</td>
<td>VISO</td>
<td>V</td>
<td>4.000</td>
<td></td>
<td></td>
<td>4.000(AC 1 minute)</td>
</tr>
<tr>
<td>Screw Torque (M3/M8)</td>
<td></td>
<td></td>
<td>0.8/15</td>
<td></td>
<td>6.0</td>
<td>(1)</td>
</tr>
</tbody>
</table>

**ELECTRICAL CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Emitter Cut-Off Current</td>
<td>ICES</td>
<td>mA</td>
<td>-</td>
<td>1</td>
<td>20</td>
<td>VCES=1,700V, VGES=0V, TJ=25°C</td>
</tr>
<tr>
<td>Gate Emitter Leakage Current</td>
<td>IGE</td>
<td>nA</td>
<td>-500</td>
<td>10</td>
<td>76</td>
<td>VCES=10V, VGES=0V, IC=100kHz, TJ=25°C</td>
</tr>
<tr>
<td>Collector Emitter Saturation Voltage</td>
<td>VCESat</td>
<td>V</td>
<td>1.7</td>
<td>1.85</td>
<td>2.6</td>
<td>IC=1,000A, TJ=25°C</td>
</tr>
<tr>
<td>Gate Emitter Threshold Voltage</td>
<td>VGIES</td>
<td>V</td>
<td>5.5</td>
<td>6.5</td>
<td>7.5</td>
<td>VCES=10V, IC=1,000mA, TJ=25°C</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>Ciss</td>
<td>nF</td>
<td>-</td>
<td>1.0</td>
<td>5.0</td>
<td>VCES=10V, VGES=0V, IC=100kHz, TJ=25°C</td>
</tr>
<tr>
<td>Internal Gate Resistance</td>
<td>RG</td>
<td>Ω</td>
<td>-</td>
<td>0.2</td>
<td>0.6</td>
<td>Ls=40nH</td>
</tr>
<tr>
<td>Switching Times</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise Time</td>
<td>tR</td>
<td>µs</td>
<td>-</td>
<td>0.2</td>
<td>0.6</td>
<td>VCES=900V, IC=1,000A</td>
</tr>
<tr>
<td>Turn On Time</td>
<td>ton</td>
<td>µs</td>
<td>-</td>
<td>0.6</td>
<td>0.8</td>
<td>R(on/off)=2.7Ω/10Ω</td>
</tr>
<tr>
<td>Fall Time</td>
<td>tf</td>
<td>µs</td>
<td>-</td>
<td>0.8</td>
<td>1.9</td>
<td>VCES=15V, TJ=150°C</td>
</tr>
<tr>
<td>Turn Off Time</td>
<td>toff</td>
<td>µs</td>
<td>-</td>
<td>1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Voltage Drop</td>
<td>Vf</td>
<td>V</td>
<td>-</td>
<td>1.75</td>
<td>2.35</td>
<td>IP=1,000A, VCES=0V, TJ=25°C</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>tr</td>
<td>µs</td>
<td>-</td>
<td>0.5</td>
<td></td>
<td>VCES=900V, IP=1,000A, Ls=40nH, TJ=150°C</td>
</tr>
<tr>
<td>Turn-on Loss per Pulse</td>
<td>Eon</td>
<td>J/P</td>
<td>-</td>
<td>0.39</td>
<td>0.38</td>
<td>R(on/off)=2.7Ω/10Ω</td>
</tr>
<tr>
<td>Turn-off Loss per Pulse</td>
<td>Eoff</td>
<td>J/P</td>
<td>-</td>
<td>0.38</td>
<td>0.39</td>
<td>VCES=15V, TJ=150°C</td>
</tr>
<tr>
<td>Reverse Recovery Loss per Pulse</td>
<td>Err</td>
<td>J/P</td>
<td>-</td>
<td>0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Circuit Pulse Width</td>
<td>tsc</td>
<td>µs</td>
<td>6</td>
<td></td>
<td></td>
<td>VCES=1300V, L=40nH</td>
</tr>
<tr>
<td>Stray Inductance Module</td>
<td>Lsce</td>
<td>nH</td>
<td>-</td>
<td>9</td>
<td></td>
<td>Between C1 (main) and E2 (main)</td>
</tr>
<tr>
<td>NTC-Thermistor</td>
<td>Rss</td>
<td>Ω</td>
<td>-</td>
<td>5</td>
<td></td>
<td>TC=25°C</td>
</tr>
<tr>
<td>Deviation</td>
<td>ΔR/R</td>
<td>%</td>
<td>-5</td>
<td>5</td>
<td></td>
<td>TC=25°C</td>
</tr>
<tr>
<td>B-constant</td>
<td>B2500</td>
<td>K</td>
<td>3375</td>
<td></td>
<td></td>
<td>Between 25°C and 50°C</td>
</tr>
<tr>
<td>Thermal Impedance</td>
<td>Rth</td>
<td>K/W</td>
<td>0.032</td>
<td></td>
<td></td>
<td>Junction to case</td>
</tr>
<tr>
<td>Contact Thermal Impedance</td>
<td>Rth</td>
<td>K/W</td>
<td>0.053</td>
<td></td>
<td></td>
<td>Case to fin (per 1 arm)</td>
</tr>
</tbody>
</table>

Notes: (1) Recommended Value 5.5±0.5N·m

Notes: (2) Rth value is a test condition value for evaluation, not recommended value.

Please determine the suitable Rth value by measuring switching behavior and checking results with the respective SOA.

* Please contact our representatives at order.
* For improvement, specifications are subject to change without notice.
* For actual application, please confirm this spec sheet is the newest revision.

* ELECTRICAL CHARACTERISTIC values according to IEC 60747–2 IEC 60747–9
MBM1000FS17G

OUTLINE DRAWING

Weight: 770(g)

Unit in mm
**Collector Current vs. Collector to Emitter Voltage**

- **Typical**
  - Collector Current, $I_C (A)$
  - Collector-Emitter Voltage, $V_{CE} (V)$
  - $T_{j}=150°C$
  - $T_{j}=25°C$

- **Forward Current vs. Forward Voltage**
  - Forward Current, $I_F (A)$
  - Forward Voltage, $V_F (V)$
  - $T_{j}=150°C$
  - $T_{j}=25°C$

- **QG-VGE Curve**
  - $QG (\mu C)$
  - $V_{GE} (V)$
  - Conditions:
    - $T_{j}=25°C$
    - $V_{CC} = 900V$
    - $I_C = 1000A$
    - $V_{GE} = \pm 15V$
**MBM1000FS17G**

**IGBT MODULE**

**Spec.No.IGBT-SP-16034 R4 P 4**

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**Turn-on Loss vs. Collector Current**

- **Conditions**
  - $T_j = 150°C$
  - $L_s = 40nH$
  - $V_{CC} = 900V$
  - $R_G = 2.7Ω/10Ω$
  - $V_{GE} = ±15V$

- **Equation**
  
  $y = 1.7450E-16x^6 - 6.8290E-13x^5 + 9.2449E-10x^4 - 3.6990E-07x^3 + 3.2773E-04x + 1.7363E-02$

**Turn-off Loss vs. Collector Current**

- **Conditions**
  - $T_j = 150°C$
  - $L_s = 40nH$
  - $V_{CC} = 900V$
  - $R_G = 2.7Ω/10Ω$
  - $V_{GE} = ±15V$

- **Equation**
  
  $y = 1E-20x^6 - 2E-17x^5 - 1E-13x^4 + 4E-10x^3 - 5E-07x^2 + 0.0006x + 0.0305$

---

**Reverse Recovery Loss vs. Forward Current**

- **Equation**
  
  $y = 6E-11x^3 - 3E-07x^2 + 0.0006x + 0.0503$

---

**Switching time vs. Collector Current**

- **Equation**
  
  $y = 1E+20x^6 - 3E+17x^5 - 2E+13x^4 + 9.2449E+10x^3 - 3.6990E+07x^2 + 3.2773E+04x + 1.7363E+02$

---

**IGBT Specifications**

- **Turn-on Loss, $E_{on}$ (J/pulse)**
- **Turn-off Loss, $E_{off}$ (J/pulse)**
- **Reverse Recovery Loss, $E_{rr}$ (J/pulse)**
- **Switching time, $t_{on}$, $t_{off}$, $t_{rr}$ (us)**

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**Graphs and Equations**

- **Graphs** for Turn-on Loss, Turn-off Loss, Reverse Recovery Loss, and Switching time vs. Collector Current.

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**Note:**

- All graphs and equations are typical values under specified conditions.

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**Reference:**

- **Hitachi**
  - **Insight the Next**

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**MBM1000FS17G**

**IGBT MODULE**

*Spec.No.IGBT-SP-16034 R4 P 5*

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**Turn-on Loss vs. Gate Resistance**

Conditions:
- $V_{G}=150^\circ\text{C}$
- $L_s=40\text{nH}$
- $V_{CC}=900\text{V}$
- $I_c=1000\text{A}$
- $V_{GE}=\pm 15\text{V}$

![Graph showing Turn-on Loss vs. Gate Resistance](image)

---

**Turn-off Loss vs. Gate Resistance**

Conditions:
- $V_{G}=150^\circ\text{C}$
- $L_s=40\text{nH}$
- $V_{CC}=900\text{V}$
- $I_c=1000\text{A}$
- $V_{GE}=\pm 15\text{V}$

![Graph showing Turn-off Loss vs. Gate Resistance](image)

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**Recovery Loss vs. Gate Resistance**

Conditions:
- $V_{G}=150^\circ\text{C}$
- $L_s=40\text{nH}$
- $V_{CC}=900\text{V}$
- $I_c=1000\text{A}$
- $V_{GE}=\pm 15\text{V}$

![Graph showing Recovery Loss vs. Gate Resistance](image)

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**Switching time vs. Gate Resistance**

Conditions:
- $V_{G}=150^\circ\text{C}$
- $L_s=40\text{nH}$
- $V_{CC}=900\text{V}$
- $I_c=1000\text{A}$
- $V_{GE}=\pm 15\text{V}$

![Graph showing Switching time vs. Gate Resistance](image)
 reverse bias safe operation area (RBSOA) 

Reverse Recovery SOA

Conditions:
Ls ≤ 40nH, Vcc ≤ 1200V, IF ≤ 2000A, di/dt ≤ 8000A/us, Tj = 150°C

Definition of Recovery di/dt

\[ \Delta t = \frac{0.5I_{rm}}{I_{rm}} \]

Reverse Recovery SOA

\[ P_{max} \leq 1.2 \text{MW} \]
**MBM1000FS17G**

**IGBT MODULE**

**Transient Thermal Impedance Curve**

- **Maximum**

<table>
<thead>
<tr>
<th>n</th>
<th>t_{th}[n]</th>
<th>Z_{th}[n,IGBT]</th>
<th>Z_{th}[n,Diode]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.67E-01</td>
<td>2.36E-02</td>
<td>3.57E-02</td>
</tr>
<tr>
<td>2</td>
<td>1.20E-02</td>
<td>4.47E-03</td>
<td>1.31E-02</td>
</tr>
<tr>
<td>3</td>
<td>1.17E-03</td>
<td>3.79E-03</td>
<td>4.08E-03</td>
</tr>
<tr>
<td>4</td>
<td>1.03E-04</td>
<td>1.03E-04</td>
<td>1.06E-04</td>
</tr>
</tbody>
</table>

**Unit**
- t_{th}[n]: sec
- Z_{th}[n]: K/W

- **Time**
- **Maximum Transient Thermal Impedance Curve**

**Thermistor Resistance vs. Temperature**

**Typical**

- **Conditions**
  - Tj=25°C
  - f=100kHz

**Capacitance vs. Collector to Emitter Voltage**

- **Conditions**
  - Tj=25°C
  - f=100kHz
HITACHI POWER SEMICONDUCTORS

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