**MBM450FS33F**

Silicon N-channel IGBT 3300V F 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℃)*

<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>-</td>
<td>-</td>
<td>3.300</td>
<td>MBM450FS33F</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</td>
<td>IC</td>
<td>mA</td>
<td>-</td>
<td>15</td>
<td>50</td>
<td>VGE=3,300V, VGE=0V, Tj=25℃</td>
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<tr>
<td>Collector Current</td>
<td>ICM</td>
<td>mA</td>
<td>-500</td>
<td>+500</td>
<td>+500</td>
<td>VGE=±20V, VGE=0V, Tj=25℃</td>
</tr>
<tr>
<td>Forward Current</td>
<td>IF</td>
<td>mA</td>
<td>-</td>
<td>6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction Temperature</td>
<td>Tj</td>
<td>°C</td>
<td>-50</td>
<td>-150</td>
<td>+150</td>
<td>Vjc=450V, Vje=15V, Tj=25℃</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>Tstg</td>
<td>°C</td>
<td>-55</td>
<td>-150</td>
<td>+150</td>
<td>Vstg=10V, Tstg=150℃</td>
</tr>
<tr>
<td>Isolation Voltage</td>
<td>VISO</td>
<td>V</td>
<td>6.5</td>
<td>7.5</td>
<td>8.5</td>
<td>VCE=10V, VCE=450mA, TCE=25℃</td>
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<tr>
<td>Screw Torque</td>
<td>M</td>
<td>N·m</td>
<td>0.8</td>
<td>1.5</td>
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**ELECTRICAL CHARACTERISTICS**

<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>
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<tbody>
<tr>
<td>Collector Emitter Cut-Off Current</td>
<td>ICES</td>
<td>mA</td>
<td>-</td>
<td>0.30</td>
<td></td>
<td>Vje=3,300V, Tj=150℃</td>
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<tr>
<td>Gate Emitter Leakage Current</td>
<td>IGES</td>
<td>nA</td>
<td>-500</td>
<td>+500</td>
<td>+500</td>
<td>VGC=150V, VGE=450V, Tj=25℃</td>
</tr>
<tr>
<td>Collector Emitter Saturation Voltage</td>
<td>VCESat</td>
<td>V</td>
<td>-</td>
<td>2.25</td>
<td>3.05</td>
<td>VCE=10V, Tj=150℃</td>
</tr>
<tr>
<td>Gate Emitter Threshold Voltage</td>
<td>VGES(th)</td>
<td>V</td>
<td>5.5</td>
<td>6.5</td>
<td>7.5</td>
<td>VCE=10V, Tj=150℃</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>Ciss</td>
<td>nF</td>
<td>24</td>
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<tr>
<td>Internal Gate Resistance</td>
<td>Rges</td>
<td>Ω</td>
<td>6.2</td>
<td></td>
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<tr>
<td>Switching Times</td>
<td></td>
<td>µs</td>
<td>0.12</td>
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<tr>
<td>Rise Time</td>
<td>tRC</td>
<td>µs</td>
<td>1.10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fall Time</td>
<td>tf</td>
<td>µs</td>
<td>1.30</td>
<td></td>
<td></td>
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<tr>
<td>Turn On Time</td>
<td>t(on)</td>
<td>µs</td>
<td>2.40</td>
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<tr>
<td>Turn Off Time</td>
<td>t(off)</td>
<td>µs</td>
<td>2.25</td>
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<td></td>
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<tr>
<td>Forward Voltage Drop</td>
<td>VF</td>
<td>V</td>
<td>2.10</td>
<td>2.45</td>
<td>2.80</td>
<td>Vje=450V, Tj=150℃</td>
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<tr>
<td>Reverse Recovery Time</td>
<td>tr</td>
<td>µs</td>
<td>1.10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Turn-on Loss per Pulse</td>
<td>Eon</td>
<td>J/P</td>
<td>0.73</td>
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<tr>
<td>Turn-off Loss per Pulse</td>
<td>Eoff</td>
<td>J/P</td>
<td>0.63</td>
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<tr>
<td>Reverse Recovery Loss per Pulse</td>
<td>Rev</td>
<td>J/P</td>
<td>0.68</td>
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<tr>
<td>Short Circuit Pulse Width</td>
<td>tscc</td>
<td>µs</td>
<td>10</td>
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<tr>
<td>Stray Inductance Module</td>
<td>Lsge</td>
<td>nH</td>
<td>9</td>
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<tr>
<td>NTC-Thermistor</td>
<td>Rθq</td>
<td>kΩ</td>
<td>5</td>
<td></td>
<td></td>
<td>Tc=25℃</td>
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<tr>
<td>Thermal Impedance</td>
<td>Rth(j-c)</td>
<td>K/W</td>
<td>0.035</td>
<td></td>
<td></td>
<td>Between 25℃ and 50℃</td>
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<tr>
<td>Contact Thermal Impedance</td>
<td>Rth(c-f)</td>
<td>K/W</td>
<td>0.02</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
2. Please determine the suitable Rθq 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
OUTLINE DRAWING

Weight: 770(g)
Collector Current vs. Collector to Emitter Voltage

Typical

Collector Current, IC(A)
Collector-Emitter Voltage, VCE(V)
Tvj =25°C
VGE=15V

Collector Current, IC(A)
Collector-Emitter Voltage, VCE(V)
Tvj =150°C
VGE=15V

Forward Voltage of free-wheeling diode

Forward Voltage, VF(V)
Forward Current, IF(A)

VGE(V)
QG(µC)
【Conditions】
Tvj =25°C
Ls=25nH
VCC =1800V
IC=450A
VGE =±15V

Typical

QG-VGE curve

【Conditions】
Tvj =25°C
Ls=25nH
VCC =1800V
IC=450A
VGE =±15V

Typical
**MBM450FS33F**

**IGBT MODULE**

**Spec.No.**IGBT-SP-14035 R4

**Typical**

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

- **Conditions**
  - $T_{j}=150^\circ C$
  - $L_s=40\, \text{nH}$
  - $V_{CC}=1800\, \text{V}$
  - $R_G=6.8\, \Omega /12\, \Omega$
  - $V_{GE}=\pm 15\, \text{V}$

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

- **Conditions**
  - $T_{j}=150^\circ C$
  - $L_s=40\, \text{nH}$
  - $V_{CC}=1800\, \text{V}$
  - $R_G=6.8\, \Omega /12\, \Omega$
  - $V_{GE}=\pm 15\, \text{V}$

**Reverse Recovery Loss vs. Forward Current**

- **Conditions**
  - $T_{j}=150^\circ C$
  - $L_s=40\, \text{nH}$
  - $V_{CC}=1800\, \text{V}$
  - $R_G=6.8\, \Omega /12\, \Omega$
  - $V_{GE}=\pm 15\, \text{V}$

**Switching time vs. Collector Current**

- **Conditions**
  - $T_{j}=150^\circ C$
  - $L_s=40\, \text{nH}$
  - $V_{CC}=1800\, \text{V}$
  - $R_G=6.8\, \Omega /12\, \Omega$
  - $V_{GE}=\pm 15\, \text{V}$
**MBM450FS33F**

**IGBT MODULE**

**Spec.No.IGBT-SP-14035 R4 P5**

---

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

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

**Reverse Recovery Loss vs. Gate Resistance**

**Switching time vs. Gate Resistance**

**Conditions**

- $T_{j} = 150^\circ C$
- $L_s = 40\,nH$
- $V_{CC} = 1800\,V$
- $I_c = 450\,A$
- $V_{GE} = \pm 15\,V$

---

**Turn-on Loss $E_{on}$ (J/pulse)**

**Gate Resistance $R_g$ (Ω)**

---

**Reverse Recovery Loss $E_{rr}$ (J/pulse)**

**Gate Resistance $R_g$ (Ω)**

---

**Switching time $t_{on}, t_{off}, t_{tr}, t_{rr}$ (µs)**

**Gate Resistance $R_g$ (Ω)**

---

**Typical**

---

**Hitachi**

Inspire the Next
Reverse bias safe operation area (RBSOA)

Reverse Recovery SOA

Conditions:
\( L_s \leq 40 \)nH, \( V_{cc} \leq 2200 \)V, \( I_F \leq 900 \)A, \( \frac{dI}{dt} \leq 2500 \)A/us, \( T_j = 150^\circ \)C

Reverse Recovery SOA

Conditions:
\( L_s \leq 40 \)nH, \( V_{cc} \leq 2200 \)V, \( I_F \leq 900 \)A, \( \frac{dI}{dt} \leq 2500 \)A/us, \( T_j = 150^\circ \)C

Reverse Recovery SOA

Conditions:
\( V_{cc} \leq 2200 \)V, \( I_C \leq 900 \)A, \( R_{G(OFF)} \geq 12 \)Ω, \( V_{GE} = +15 \)V, \( T_j = 150^\circ \)C, \( L_s \leq 40 \)nH, on pulse width \( \geq 10 \)us

(\( V_{ce} \) spike voltage and \( L_s \) are defined at auxiliary terminal)
**MBM450FS33F**

**IGBT MODULE**

**Capacitance vs. Collector to Emitter Voltage**

- **Cies**
- **Coes**
- **Cres**

**Transistor Thermal Impedance Curve**

\[ \sum r_{th[n]} \times (1 - \exp(-t/\tau_{th[n]})) \]

<table>
<thead>
<tr>
<th>n</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \tau_{th[n]} )</td>
<td>( 1.80E-01 )</td>
<td>( 2.04E-02 )</td>
<td>( 7.46E-04 )</td>
<td>( 3.06E-03 )</td>
<td>sec</td>
</tr>
<tr>
<td>( r_{th[n,IGBT]} )</td>
<td>( 2.52E-02 )</td>
<td>( 4.70E-03 )</td>
<td>( 7.66E-04 )</td>
<td>( 4.36E-03 )</td>
<td>K/W</td>
</tr>
<tr>
<td>( r_{th[n,Diode]} )</td>
<td>( 3.70E-02 )</td>
<td>( 1.02E-02 )</td>
<td>( 9.42E-04 )</td>
<td>( 6.76E-03 )</td>
<td>K/W</td>
</tr>
</tbody>
</table>

**Thermistor Resistance vs. Temperature**

- Typical:

\[ T_j=25\,^\circ C \]
\[ f=100\,kHz \]

**Typical**

**Thermistor Resistance (kΩ)**

- Case Temperature, \( T_c \) (°C)

<table>
<thead>
<tr>
<th>-50</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
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</table>
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