**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°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>$V_{CES}$</td>
<td>V</td>
<td></td>
<td>0.30</td>
<td>3,300</td>
<td>$V_{GE}=3.300V, V_{GE}=0V, T_j=25°C</td>
</tr>
<tr>
<td>Gate Emitter Voltage</td>
<td>$V_{GES}$</td>
<td>V</td>
<td>15</td>
<td>50</td>
<td>55</td>
<td>$V_{GE}=3.300V, V_{GE}=0V, T_j=150°C</td>
</tr>
<tr>
<td>Collector Current</td>
<td>I_C</td>
<td>mA</td>
<td></td>
<td>2.25</td>
<td>450</td>
<td>$I_{CM}=150V, I_{CM}=15V, T_j=25°C</td>
</tr>
<tr>
<td>Collector Emitter Saturation Voltage</td>
<td>$V_{CEsat}$</td>
<td>V</td>
<td>3,05</td>
<td>3.5</td>
<td>3.50</td>
<td>$V_{CEsat}=0V, I_{CEsat}=100kHz, T_j=25°C</td>
</tr>
<tr>
<td>Gate Emitter Threshold Voltage</td>
<td>$V_{GEth}$</td>
<td>V</td>
<td>5.5</td>
<td>6.8</td>
<td>7.5</td>
<td>$V_{GEth}=10V, I_{GEth}=450mA, T_j=25°C</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>C_Ige</td>
<td>pF</td>
<td>24</td>
<td></td>
<td>30</td>
<td>$V_{Ige}=10V, I_{Ige}=0V, I=100kHz, T_j=25°C</td>
</tr>
<tr>
<td>Internal Gate Resistance</td>
<td>$R_{th(j-c)}$</td>
<td>Ω</td>
<td>6.2</td>
<td></td>
<td>8.0</td>
<td>$V_{Ige}=10V, I_{Ige}=0V, I=100kHz, T_j=25°C</td>
</tr>
<tr>
<td>Switching Times</td>
<td></td>
<td>µs</td>
<td>0.12</td>
<td></td>
<td>0.15</td>
<td>$V_{GEG}=1800V, I_{GEG}=450A</td>
</tr>
<tr>
<td>Forward Voltage Drop</td>
<td>$V_F$</td>
<td>V</td>
<td>2.25</td>
<td></td>
<td>3.05</td>
<td>$I_F=450A, V_{Ige}=0V, T_j=25°C</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>$t_r$</td>
<td>µs</td>
<td>1.10</td>
<td></td>
<td>1.57</td>
<td>$V_{Rr}=1800V, I_{Rr}=450A, I=40nH, T_j=150°C</td>
</tr>
<tr>
<td>Turn-on Loss per Pulse</td>
<td>$E_{on}$</td>
<td>J/P</td>
<td>0.73</td>
<td></td>
<td>0.87</td>
<td>$V_{Ce}=10V, I_{Ce}=450A, L=40nH, T_j=25°C</td>
</tr>
<tr>
<td>Turn-off Loss per Pulse</td>
<td>$E_{off}$</td>
<td>J/P</td>
<td>0.63</td>
<td></td>
<td>0.87</td>
<td>$R_{D(on/off)}=6.8W/12W, T_j=150°C</td>
</tr>
<tr>
<td>Reverse Recovery Loss per Pulse</td>
<td>$E_{rr}$</td>
<td>J/P</td>
<td>0.68</td>
<td></td>
<td>0.87</td>
<td>$V_{D}=15V, T_j=150°C</td>
</tr>
<tr>
<td>Short Circuit Pulse Width</td>
<td>t_sc</td>
<td>µs</td>
<td>10</td>
<td></td>
<td>12</td>
<td>$V_{CC}=2200V, L=40nH, I_{D(on/off)}=6.8W/12W, V_{GE}=±15V, T_C=150°C</td>
</tr>
<tr>
<td>Stray Inductance Module</td>
<td>$L_{SCE}$</td>
<td>nH</td>
<td>9</td>
<td></td>
<td>15</td>
<td>Between C1(main) and E2(main)</td>
</tr>
<tr>
<td>NTC-Thermistor</td>
<td>$R_{Th}$</td>
<td>kΩ</td>
<td>5</td>
<td></td>
<td>50</td>
<td>T_C=25°C</td>
</tr>
<tr>
<td>Deviation</td>
<td>$\Delta R/I$</td>
<td>%</td>
<td>-5</td>
<td></td>
<td>5</td>
<td>T_C=25°C</td>
</tr>
<tr>
<td>B-constant</td>
<td>$B_{25(50)}$</td>
<td>K</td>
<td>3375</td>
<td></td>
<td>5</td>
<td>Between 25°C and 50°C</td>
</tr>
<tr>
<td>Thermal Impedance</td>
<td>$R_{Th(j-c)}$</td>
<td>K/W</td>
<td></td>
<td>0.035</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Thermal Impedance</td>
<td>$R_{Th(j-c)}$</td>
<td>K/W</td>
<td></td>
<td>0.035</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: (1) Recommended Value 5.5±0.5N·m
(2) $R_X$ value is a test condition value for evaluation, not recommended value.
Please determine the suitable $R_X$ 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

Collector Current vs. Collector to Emitter Voltage

Forward Voltage of free-wheeling diode

QG-VGE curve
**MBM450FS33F**

**IGBT MODULE**

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

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

**Typical**

- **Conditions**
  - Tj = 150°C
  - \( L = 40 \text{nH} \)
  - \( V_{CC} = 1800 \text{V} \)
  - \( R_G = 6.8\Omega/12\Omega \)
  - \( V_{GE} = \pm 15 \text{V} \)

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

**Typical**

- **Conditions**
  - Tj = 150°C
  - \( L = 40 \text{nH} \)
  - \( V_{CC} = 1800 \text{V} \)
  - \( R_G = 6.8\Omega/12\Omega \)
  - \( V_{GE} = \pm 15 \text{V} \)

**Reverse Recovery Loss vs. Forward Current**

**Typical**

- **Conditions**
  - Tj = 150°C
  - \( L = 40 \text{nH} \)
  - \( V_{CC} = 1800 \text{V} \)
  - \( R_G = 6.8\Omega/12\Omega \)
  - \( V_{GE} = \pm 15 \text{V} \)

**Switching time vs. Collector Current**

**Typical**

- **Conditions**
  - Tj = 150°C
  - \( L = 40 \text{nH} \)
  - \( V_{CC} = 1800 \text{V} \)
  - \( R_G = 6.8\Omega/12\Omega \)
  - \( V_{GE} = \pm 15 \text{V} \)
**IGBT MODULE Spec.No.IGBT-SP-14035 R4**

**MBM450FS33F**

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

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

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

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

---

**Reverse Recovery Loss vs. Gate Resistance**

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

---

**Switching time vs. Gate Resistance**

- **Conditions**
  - $T_{j} = 150^\circ C$
  - $L_s = 40\,nH$
  - $V_{CC} = 1800\,V$
  - $I_C = 450\,A$
  - $V_{GE} = \pm 15\,V$
Reverse bias safe operation area (RBSOA)

Conditions:
- Ls ≤ 40nH, Vcc ≤ 2200V, IF ≤ 900A, di/dt ≤ 2500A/us, Tj = 150°C

Reverse Recovery SOA

Conditions:
- Vcc ≤ 2200V, Ic ≤ 900A, Rg(OFF) ≥ 12Ω,
- VGE = ±15V, Tj = 150°C,
- Ls ≤ 40nH, on pulse width ≥ 10us

(Vce spike voltage and Ls are defined at auxiliary terminal)
**MBM450FS33F**

**IGBT MODULE**

**Spec.No.IGBT-SP-14035 R4  P7**

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**IGBT Module Specifications**

- **Type:** IGBT Module
- **Model:** MBM450FS33F
- **Rated Current:** 450A
- **Rating Voltage:** 3300V
- **Operating Temperature:** 
  - **Tj=25℃**
  - **f=100kHz**

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**Thermal Impedance**

- **Maximum Transient Thermal Impedance:**
  
  \[ Z_{th(j-c)} (K/W) \]

  - **Time:** \( t(s) \)

  - **Unit:**
    - **\( \tau_{th[n]} \):** 1.80E-01, 2.04E-02, 7.46E-04, 3.06E-03 sec
    - **\( r_{th[n,IGBT]} \):** 2.52E-02, 4.70E-03, 7.66E-04, 4.36E-03 K/W
    - **\( r_{th[n,Diode]} \):** 3.70E-02, 1.02E-02, 9.42E-04, 6.76E-03 K/W

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**Capacitance vs. Collector to Emitter Voltage**

- **Typical**
  
  \[ C_{ies}, C_{oes}, C_{res} (nF) \]

- **Collector to Emitter Voltage, \( V_{CE} \):** 0.1, 1, 10, 100 V

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**Thermistor Resistance vs. Temperature**

- **Typical**
  
  \[ R_{thres} (Ω) \]

- **Case Temperature, \( T_c \):** -50, 0, 50, 100, 150 °C

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**Important Notes**

- This document contains technical specifications and performance data for the MBM450FS33F IGBT module.
- It includes details on thermal impedance, capacitance, and thermistor resistance.
- The data is provided for typical conditions at specific temperatures and frequencies.
- Users should refer to the IGBT module’s datasheet for complete and detailed information.
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