SEMITRANS ®

IGBT Modules

SKM 75 GB 123 D
SKM 75 GAL 123 D

Features
- MOS input (voltage controlled)
- N channel, Homogeneous Si
- Low inductance case
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to 6 * I_Cnom
- Latch-up free
- Fast & soft inverse CAL diodes
- Isolated copper baseplate using DCB Direct Copper Bonding Technology
- Large clearance (10 mm) and creepage distances (20 mm).

Typical Applications:
- Switching (not for linear use)

ABSOLUTE MAXIMUM RATINGS

Symbol | Conditions | Values | Units
--- | --- | --- | ---
V_CES | | 1200 | V
V_CGR | R_GE = 20 kΩ | 1200 | V
I_C | T_case = 25/80 °C | 75 / 60 | A
I_C(M) | T_case = 25/80 °C; I_L = 1 ms | 150 / 120 | A
V_CES(th) | | ± 20 | V
P_TOT | per IGBT, T_case = 25 °C | 460 | W
V_I(isol) | AC, 1 min. | 2500 | V
Humidity | DIN 40 040 | Class F
Climate | DIN IEC 68 1.1 | 40/125/56

REVERSE DIODE

Symbol | Conditions | Values | Units
--- | --- | --- | ---
I_F | = - I_C | 75 / 50 | FWD
I_F(M) | T_case = 25/80 °C | 150 / 120 | A
I_F(SM) | I_L = 10 ms; I_G = 150 °C | 550 | A
I_F(RMS) | | 1500 | A

CHARACTERISTICS

Symbol | Conditions | Values | Units
--- | --- | --- | ---
V_CE(CE)ES | V_GE = 0, I_C = 4 mA | ≥ V_CES | V
V_CE(th) | V_GE = V_CE, I_C = 2 mA | 4,5 | mA
I_CES | V_GE = 0 | 0,8 | mA
V_CE | V_GE = V_CES | 3,5 | mA
I_GES | V_GE = 20 V, V_CE = 0 | 200 | nA
V_CE(st) | I_C = 50 A | 2,5(3,1) | V
V_CE(st2) | I_C = 75 A | 3(3,8) | V
I_GS | V_GE = 20 V, I_C = 50 A | 23 | A
C_CHC | per IGBT | – | – | 350 | pF
C_Ces | V_GE = 0 | 3,3 | nF
C_Ces | V_CE = 25 V | 500 | pF
C_res | f = 1 MHz | 220 | nF
L_CE | | – | – | 30 | nH
I_AD(on) | V_CE = 600 V | – | – | 44 | 100 | ns
I_AD(off) | I_C = 50 A, ind. load | – | – | 380 | 500 | ns
I_AD(off) | | – | – | 70 | 100 | ns
E_ON | T_j = 125 °C | – | – | 8 | mWs
E_OFF | T_j = 125 °C | – | – | 5 | mWs

FWD for types "GAL" 8)

Symbol | Conditions | Values | Units
--- | --- | --- | ---
I_F | = 50 A | V_GE = 0 V; T_j = 25 (125) °C | – | 2,0(1,8) | 2,5 | V
I_F | = 50 A | V_GE = 0 V; T_j = 25 (125) °C | – | 2,25(2,1) | – | V
V_TO | T_j = 125 °C | – | – | 1,2 | V
R_T | T_j = 125 °C | – | – | 18 | 22 | mΩ
I_RRM | I_C = 50 A; T_j = 25 (125) °C | – | 23(35) | – | A
Q_RR | I_C = 50 A; T_j = 25 (125) °C | – | 2,3(7) | – | μC

THERMAL CHARACTERISTICS

Symbol | Conditions | Values | Units
--- | --- | --- | ---
R_THJC | per IGBT | – | – | 0,27 | °C/W
R_THJC | per diode / FWD "GAL" | – | – | 0,60/0,50 | °C/W
R_RHC | per module | – | – | 0,05 | °C/W
Fig. 1 Rated power dissipation \( P_{\text{tot}} = f (T_C) \)

Fig. 2 Turn-on /-off energy = \( f (I_C) \)

Fig. 3 Turn-on /-off energy = \( f (R_G) \)

Fig. 4 Maximum safe operating area (SOA) \( I_C = f (V_{CE}) \)

Fig. 5 Turn-off safe operating area (RBSOA)

Fig. 6 Safe operating area at short circuit \( I_C = f (V_{CE}) \)
\[ P_{\text{cond}(t)} = V_{\text{CEsat}(t)} \cdot I_{\text{C}(t)} \]

\[ V_{\text{CEsat}(t)} = V_{\text{CE}(TO)(T_j)} + r_{\text{CE}(T_j)} \cdot I_{\text{C}(t)} \]

\[ V_{\text{CE}(TO)(T_j)} \leq 1,5 + 0,002 \cdot (T_j - 25) \text{ [V]} \]

typ.: \[ r_{\text{CE}(T_j)} = 0,020 + 0,00008 \cdot (T_j - 25) \text{ [\Omega]} \]

max.: \[ r_{\text{CE}(T_j)} = 0,030 + 0,00010 \cdot (T_j - 25) \text{ [\Omega]} \]

valid for \[ V_{\text{GE}} = + 15^{\pm 2} \text{ [V]}; I_{\text{C}} \geq 0,3 \cdot I_{\text{Cnom}} \]

Fig. 11 Saturation characteristic (IGBT)
Calculation elements and equations
Fig. 13 Typ. gate charge characteristic

Fig. 14 Typ. capacitances vs. $V_{CE}$

Fig. 15 Typ. switching times vs. $I_C$

Fig. 16 Typ. switching times vs. gate resistor $R_G$

Fig. 17 Typ. CAL diode forward characteristic

Fig. 18 Diode turn-off energy dissipation per pulse
Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p); D = t_p / t_c = t_p \cdot f$

Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p); D = t_p / t_c = t_p \cdot f$

Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

Fig. 24 Typ. CAL diode recovered charge $Q_{tr} = f(di/dt)$

**Typical Applications**

Include
- Switched mode power supplies
- DC servo and robot drives
- Inverters
- DC choppers (versions GAL)
- AC motor speed control
- Inductive heating
- UPS Uninterruptable power supplies
- General power switching applications
- Electronic (also portable) welders
- Pulse frequencies also above 15 kHz
This is an electrostatic discharge sensitive device (ESDS). Please observe the international standard IEC 747-1, Chapter IX.

Eight devices are supplied in one SEMIBOX A without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 2)

Accessories → B 6 – 4.
SEMIBOX → C – 1.
Larger packing units of 20 or 42 pieces are used if suitable.

### Mechanical Data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M₁</td>
<td>to heatsink, SI Units (M6)</td>
<td>3 – 5 Nm</td>
<td>Nm</td>
</tr>
<tr>
<td>M₂</td>
<td>to heatsink, US Units</td>
<td>27 – 44 lb.in.</td>
<td>lb.in.</td>
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<tr>
<td>M₃</td>
<td>for terminals, SI Units (M5)</td>
<td>2.5 – 5 Nm</td>
<td>Nm</td>
</tr>
<tr>
<td>M₄</td>
<td>for terminals US Units</td>
<td>22 – 44 lb.in.</td>
<td>lb.in.</td>
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<tr>
<td>a</td>
<td>– – 5x9.81 m/s²</td>
<td>m/s²</td>
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<tr>
<td>w</td>
<td>– – 160 g</td>
<td>g</td>
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### Footnotes