

**SIEMENS**

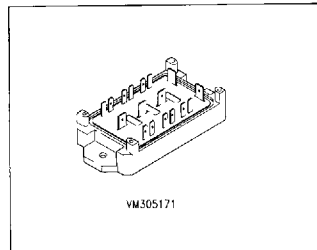
SIEMENS AKTIENGESELLSCHAFT

T-23-07

BSM 25 GD 120 D

**IGBT Module**  
Preliminary Data $V_{CE} = 1200 \text{ V}$  $I_C = 6 \times 35 \text{ A at } T_C = 25 \text{ }^\circ\text{C}$  $I_C = 6 \times 25 \text{ A at } T_C = 80 \text{ }^\circ\text{C}$ 

- Power module
- 3-phase full bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Package outlines/Circuit diagram: 3<sup>1)</sup>



| Type            | Ordering Code   |
|-----------------|-----------------|
| BSM 25 GD 120 D | C67076-A2505-A2 |

**Maximum Ratings**

| Parameter  | Symbol               | Values         | Unit             |
|--|----------------------|----------------|------------------|
| Collector-emitter voltage  | $V_{CE}$             | 1200           | V                |
| Collector-gate voltage, $R_{GE} = 20 \text{ k}\Omega$  | $V_{CGR}$            | 1200           |                  |
| Gate-emitter voltage   | $V_{GE}$             | $\pm 20$       |                  |
| Continuous collector current, $T_C = 25 \text{ }^\circ\text{C}$<br>$T_C = 80 \text{ }^\circ\text{C}$ | $I_C$                | 35<br>25       | A                |
| Pulsed collector current, $T_C = 25 \text{ }^\circ\text{C}$<br>$T_C = 80 \text{ }^\circ\text{C}$     | $I_{C \text{ puls}}$ | 70<br>50       |                  |
| Operating and storage temperature range  | $T_J, T_{stg}$       | - 55 ... + 150 | $^\circ\text{C}$ |
| Power dissipation, $T_C = 25 \text{ }^\circ\text{C}$   | $P_{tot}$            | 300            | W                |
| Thermal resistance, chip-case  | $R_{thJC}$           | $\leq 0.4$     | K/W              |
| Insulation test voltage <sup>2)</sup> , $t = 1 \text{ min.}$   | $V_{is}$             | 2500           | $V_{ac}$         |
| Creepage distance  | –                    | 16             | mm               |
| Clearance  | –                    | 11             |                  |
| DIN humidity category, DIN 40 040  | –                    | F              | –                |
| IEC climatic category, DIN IEC 68-1  | –                    | 55/150/56      |                  |

<sup>1)</sup> See chapter Package Outline and Circuit Diagrams.

<sup>2)</sup> Insulation test voltage between collector and metal base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para. 492.1.

**SIEMENS****BSM 25 GD 120 D****SIEMENS AKTIENGESELLSCHAFT****Electrical Characteristics**at  $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified.

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

**Static Characteristics**

|  |               |        |            |             |               |
|--|---------------|--------|------------|-------------|---------------|
| Collector-emitter breakdown voltage<br>$V_{GE} = 0, I_C = 0.75\text{ mA}$  | $V_{(BR)CES}$ | 1200   | —          | —           | V             |
| Gate threshold voltage<br>$V_{GE} = V_{CE}, I_C = 2\text{ mA}$   | $V_{GE(th)}$  | 4.8    | 5.5        | 6.2         |               |
| Collector-emitter saturation voltage<br>$V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$T_J = 25\text{ }^\circ\text{C}$<br>$T_J = 150\text{ }^\circ\text{C}$ | $V_{CE(sat)}$ | —<br>— | 2.8<br>4.0 | 3.3<br>4.5  |               |
| Zero gate voltage collector current<br>$V_{CE} = 1200\text{ V}, V_{GE} = 0$<br>$T_J = 25\text{ }^\circ\text{C}$<br>$T_J = 125\text{ }^\circ\text{C}$       | $I_{CES}$     | —<br>— | —<br>—     | 750<br>3000 | $\mu\text{A}$ |
| Gate-emitter leakage current<br>$V_{GE} = 20\text{ V}, V_{CE} = 0$   | $I_{GES}$     | —      | —          | 100         | nA            |

**AC Characteristics**

|  |           |     |      |   |               |
|--|-----------|-----|------|---|---------------|
| Forward transconductance<br>$V_{CE} = 20\text{ V}, I_C = 25\text{ A}$                    | $g_{fs}$  | 9.0 | —    | — | S             |
| Input capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$                | $C_{iss}$ | —   | 4000 | — | $\mu\text{F}$ |
| Output capacitance, $V_{GS} = 0$<br>$V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$ | $C_{oss}$ | —   | 320  | — |               |
| Reverse transfer capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$     | $C_{rss}$ | —   | 130  | — |               |

**Switching Characteristics**

at  $T_j = 125\text{ °C}$ , unless otherwise specified.

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

**Resistive Load**

|  |              |    |     |    |    |
|--|--------------|----|-----|----|----|
| Turn-on delay time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$  | $t_{d(on)}$  | 20 | 30  | 40 | ns |
| Rise time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$           | $t_r$        | —  | 110 | —  |    |
| Turn-off delay time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$ | $t_{d(off)}$ | —  | 200 | —  |    |
| Fall time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$           | $t_f$        | —  | 300 | —  |    |

**Inductive Load**

|  |                          |        |            |        |     |
|--|--------------------------|--------|------------|--------|-----|
| Turn-on delay time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$                                | $t_{d(on)}$              | 20     | 30         | 40     | ns  |
| Rise time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$   | $t_r$                    | 5      | 10         | 15     |     |
| Turn-off delay time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$                               | $t_{d(off)}$             | 160    | 230        | 280    |     |
| Fall time<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$   | $t_f$                    | 20     | 30         | 40     |     |
| Turn-off loss ( $E_{off} = E_{off1} + E_{off2}$ )<br>$V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}, I_C = 25\text{ A}$<br>$R_{g(on)} = 3.3\ \Omega, R_{g(off)} = 3.3\ \Omega$ | $E_{off1}$<br>$E_{off2}$ | —<br>— | 1.4<br>1.3 | —<br>— | mWs |

**SIEMENS****BSM 25 GD 120 D**

SIEMENS AKTIENGESELLSCHAFT

**Electrical Characteristics**at  $T_j = 25\text{ °C}$ , unless otherwise specified.

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

**Free-Wheel Diode**

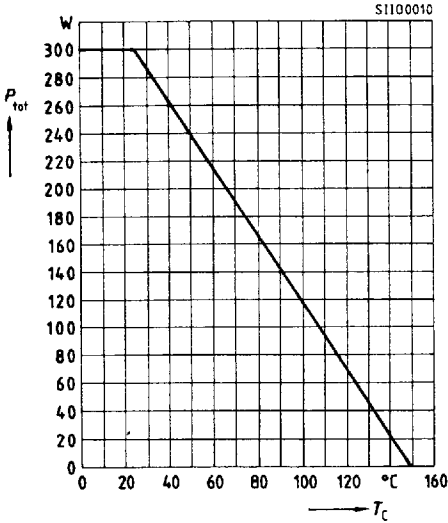
|  |            |   |              |     |               |
|--|------------|---|--------------|-----|---------------|
| Diode forward voltage<br>$I_F = 25\text{ A}$ , $V_{GE} = 0$<br>$T_j = 25\text{ °C}$<br>$T_j = 125\text{ °C}$   | $V_F$      | – | 2.15<br>1.55 | –   | V             |
| Reverse recovery time<br>$I_F = 25\text{ A}$ , $V_R = 600\text{ V}$<br>$V_{GE} = 0$ , $di_F/dt = -800\text{ A}/\mu\text{s}$<br>$T_j = 125\text{ °C}$                           | $t_{rr}$   | – | 0.13         | –   | $\mu\text{s}$ |
| Reverse recovery charge<br>$I_F = 25\text{ A}$ , $V_R = 600\text{ V}$<br>$V_{GE} = 0$ , $di_F/dt = -800\text{ A}/\mu\text{s}$<br>$T_j = 25\text{ °C}$<br>$T_j = 125\text{ °C}$ | $Q_{rr}$   | – | 2.3<br>6     | –   | $\mu\text{C}$ |
| Soft factor<br>$I_F = 25\text{ A}$ , $V_R = 600\text{ V}$<br>$V_{GE} = 0$ , $di_F/dt = -800\text{ A}/\mu\text{s}$<br>$T_j = 125\text{ °C}$                                     | $S$        | – | 1            | –   | –             |
| Thermal resistance<br>Chip-case  | $R_{thJC}$ | – | –            | 1.0 | K/W           |

**SIEMENS AKTIENGESELLSCHAFT**

Characteristics at  $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified.

**Power dissipation**  $P_{\text{tot}} = f(T_C)$

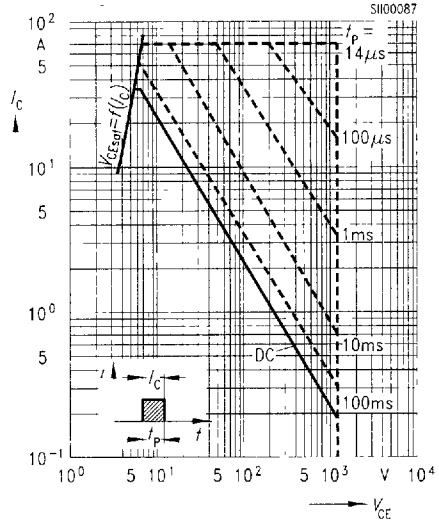
parameter:  $T_j = 150\text{ }^\circ\text{C}$



**Safe operating area**  $I_C = f(V_{CE})$

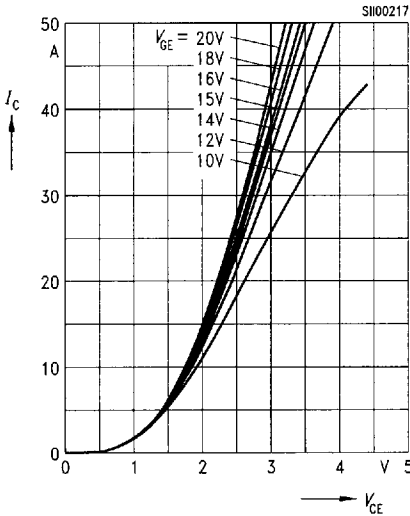
parameter: single pulse,  $T_C = 25\text{ }^\circ\text{C}$

$T_j \leq 150\text{ }^\circ\text{C}$



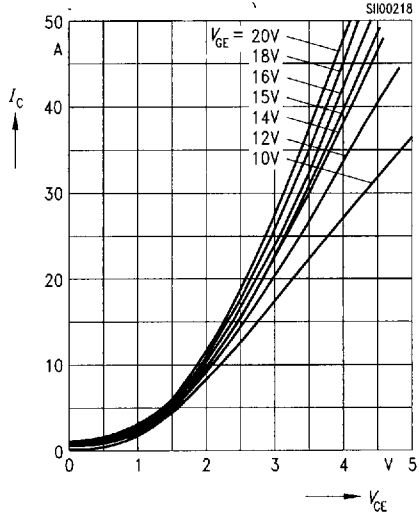
**Typ. output characteristics**  $I_C = f(V_{CE})$

parameter:  $t_p = 80\text{ }\mu\text{s}$ ,  $T_j \leq 25\text{ }^\circ\text{C}$



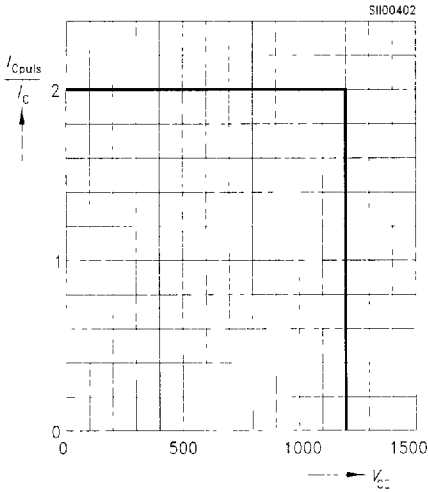
**Typ. output characteristics**  $I_C = f(V_{CE})$

parameter:  $t_p = 80\text{ }\mu\text{s}$ ,  $T_j \leq 125\text{ }^\circ\text{C}$



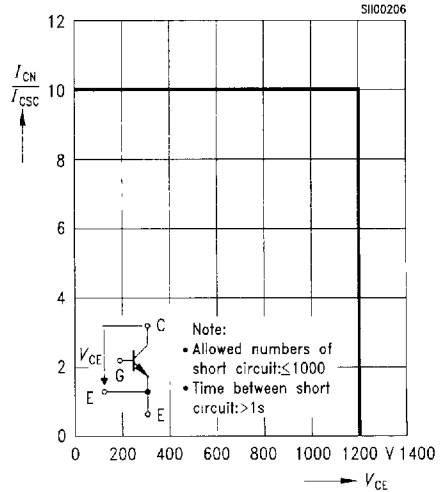
**Reverse biased safe operating area**

$I_C = f(V_{CE})$ , parameter:  $T_J = 125^\circ\text{C}$ ,  
 $V_{GE} = 15\text{ V}$ ,  $R_{g(off)} = 3.3\ \Omega$ ,  
 $L$  (parasitic inductance, module)  $< 50\text{ nH}$



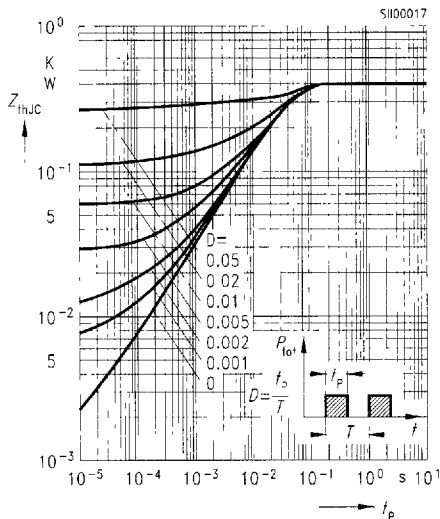
**Safe operating area, short circuit**

$I_C = f(V_{CE})$ ,  $V_{GE} = \pm 15\text{ V}$   
 $T_J \leq 150^\circ\text{C}$ ,  $t_{SC} \leq 10\ \mu\text{s}$ ,  $L < 50\text{ nH}$



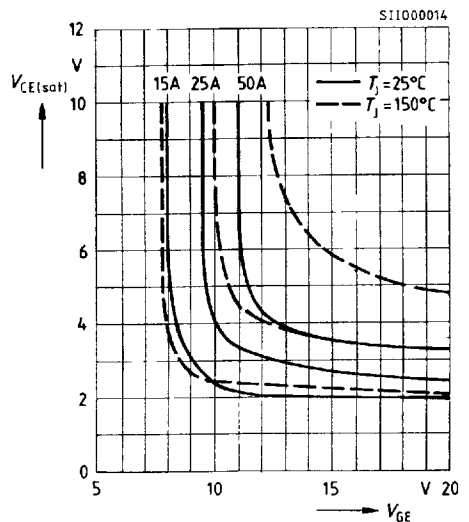
**Transient thermal impedance**

$Z_{thJC} = f(t_p)$ , parameter:  $D = t_p / T$

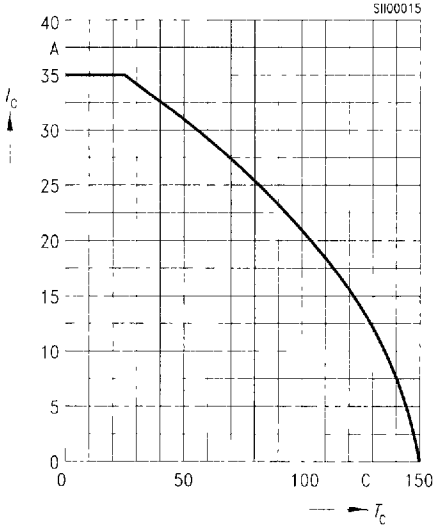


**Typ. on-state characteristics**

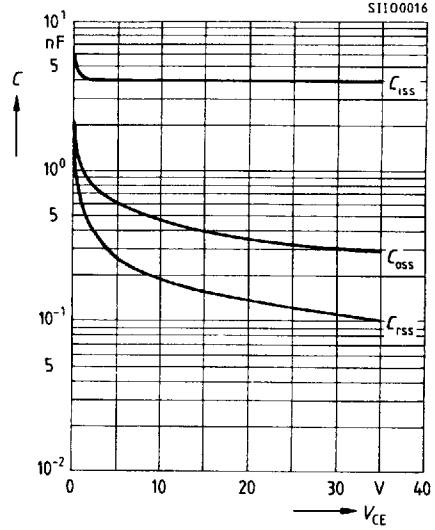
$V_{CE(sat)} = f(V_{GE})$ , parameter:  $I_C, T_J$



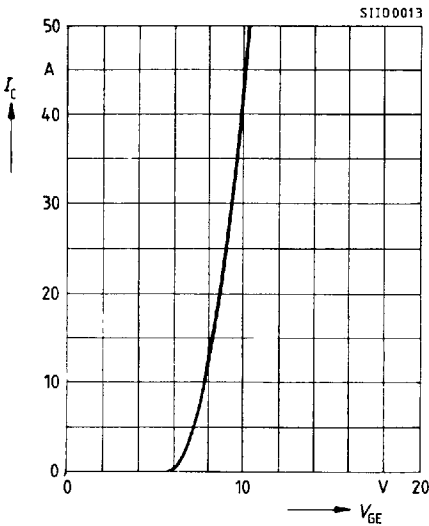
**Collector current  $I_C = f(T_C)$**   
 parameter:  $V_{GE} \geq 15 \text{ V}$ ,  $T_J = 150 \text{ }^\circ\text{C}$



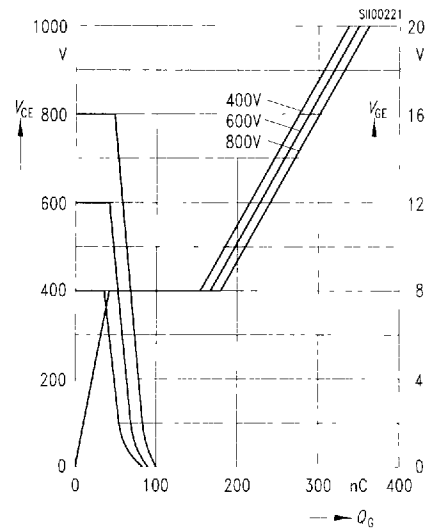
**Typ. capacitances  $C = f(V_{CE})$**   
 parameter:  $V_{GE} = 0$ ,  $f = 1 \text{ MHz}$



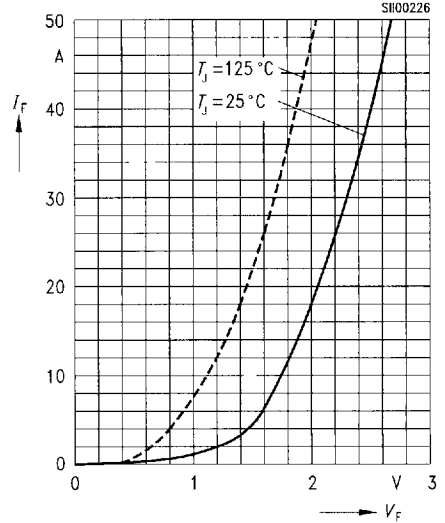
**Typ. transfer characteristics  $I_C = f(V_{GE})$**   
 parameter:  $t_p = 80 \text{ } \mu\text{s}$ ,  $V_{CE} = 20 \text{ V}$



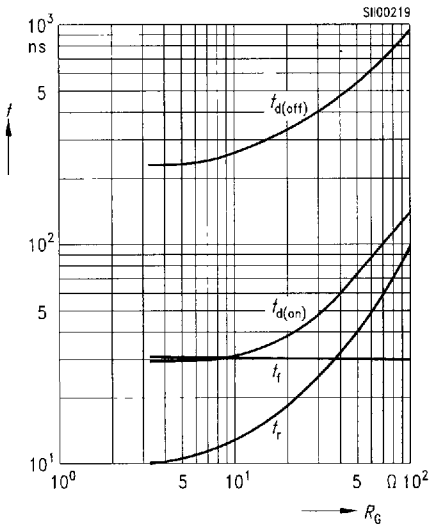
**Typ. gate charge  $V_{CE}, V_{GE} = f(Q_G)$**



**Forward characteristics of fast recovery reverse diode**  $I_F = f(V_F)$   
parameter:  $T_J$



**Typ. switching time  $t = f(R_G)$**   
Inductive load, parameter:  $T_J = 125\text{ °C}$   
 $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 25\text{ A}$



**Typ. switching time  $t = f(I_C)$**   
Inductive load, parameter:  $T_J = 125\text{ °C}$   
 $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 22\text{ Ω}$

