

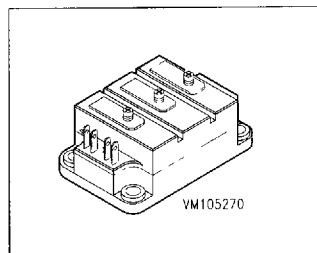
**SIEMENS**

SIEMENS AKTIENGESELLSCHAFT

T-23-09

**IGBT Module**  
Preliminary Data**BSM 150 GB 100 D**  
**BSM 150 GAL 100 D** $V_{CE} = 1000 \text{ V}$  $I_C = 2 \times 200 \text{ A at } T_C = 25 \text{ }^\circ\text{C}$  $I_C = 2 \times 150 \text{ A at } T_C = 80 \text{ }^\circ\text{C}$ 

- Power module
- Half-bridge/Chopper
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Package outlines/Circuit diagram: 5a, 5b<sup>1)</sup>



| Half-bridge      |                 | Chopper           |                 |
|------------------|-----------------|-------------------|-----------------|
| Type             | Ordering Code   | Type              | Ordering Code   |
| BSM 150 GB 100 D | C67076-A2102-A2 | BSM 150 GAL 100 D | C67076-A2005-A2 |

**Maximum Ratings**

| Parameter                                                                                            | Symbol               | Values         | Unit             |
|------------------------------------------------------------------------------------------------------|----------------------|----------------|------------------|
| Collector-emitter voltage                                                                            | $V_{CE}$             | 1000           | V                |
| Collector-gate voltage, $R_{GE} = 20 \text{ k}\Omega$                                                | $V_{CGR}$            | 1000           |                  |
| Gate-emitter voltage                                                                                 | $V_{GE}$             | $\pm 20$       |                  |
| Continuous collector current, $T_C = 25 \text{ }^\circ\text{C}$<br>$T_C = 80 \text{ }^\circ\text{C}$ | $I_C$                | 200<br>150     | A                |
| Pulsed collector current, $T_C = 25 \text{ }^\circ\text{C}$<br>$T_C = 80 \text{ }^\circ\text{C}$     | $I_{C \text{ puls}}$ | 400<br>300     |                  |
| Operating and storage temperature range                                                              | $T_J, T_{stg}$       | - 55 ... + 150 | $^\circ\text{C}$ |
| Power dissipation, $T_C = 25 \text{ }^\circ\text{C}$                                                 | $P_{tot}$            | 1250           | W                |
| Thermal resistance, chip-case                                                                        | $R_{thJC}$           | $\leq 0.1$     | 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 150 GB 100 D**  
**BSM 150 GAL 100 D**

SIEMENS AKTIENGESELLSCHAFT

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

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

**Static Characteristics**

|                                                                                                                                     |               |        |            |            |               |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|------------|------------|---------------|
| Collector-emitter breakdown voltage<br>$V_{GE} = 0, I_C = 2.8\text{ mA}$                                                            | $V_{(BR)CES}$ | 1000   | —          | —          | V             |
| Gate threshold voltage<br>$V_{GE} = V_{CE}, I_C = 10\text{ mA}$                                                                     | $V_{GE(th)}$  | 4.8    | 5.5        | 6.2        |               |
| Collector-emitter saturation voltage<br>$V_{GE} = 15\text{ V}, I_C = 150\text{ A}$<br>$T_j = 25\text{ °C}$<br>$T_j = 150\text{ °C}$ | $V_{CE(sat)}$ | —<br>— | 2.8<br>4.0 | 3.3<br>4.5 |               |
| Zero gate voltage collector current<br>$V_{CE} = 1000\text{ V}, V_{GE} = 0$<br>$T_j = 25\text{ °C}$<br>$T_j = 125\text{ °C}$        | $I_{CES}$     | —<br>— | —<br>—     | 2800<br>—  | $\mu\text{A}$ |
| Gate-emitter leakage current<br>$V_{GE} = 20\text{ V}, V_{CE} = 0$                                                                  | $I_{GES}$     | —      | —          | 100        | nA            |

**AC Characteristics**

|                                                                                          |           |    |       |   |    |
|------------------------------------------------------------------------------------------|-----------|----|-------|---|----|
| Forward transconductance<br>$V_{CE} = 20\text{ V}, I_C = 150\text{ A}$                   | $g_{fs}$  | 54 | —     | — | S  |
| Input capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$                | $C_{iss}$ | —  | 22000 | — | pF |
| Output capacitance, $V_{GS} = 0$<br>$V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$ | $C_{oss}$ | —  | 1700  | — |    |
| Reverse transfer capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$     | $C_{rss}$ | —  | 700   | — |    |

**SIEMENS**
**BSM 150 GB 100 D**  
**BSM 150 GAL 100 D**
**SIEMENS AKTIENGESELLSCHAFT**
**Switching Characteristics**

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

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

**Resistive Load**

|                                                                                                                                                                        |                     |   |      |   |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---|------|---|----|
| Turn-on delay time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$  | $t_{d(\text{on})}$  | — | 200  | — | ns |
| Rise time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$           | $t_r$               | — | 400  | — |    |
| Turn-off delay time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$ | $t_{d(\text{off})}$ | — | 1100 | — |    |
| Fall time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$           | $t_f$               | — | 500  | — |    |

**Inductive Load**

|                                                                                                                                                                                                                               |                                            |        |        |     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------|--------|-----|-----|
| Turn-on delay time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$                                                         | $t_{d(\text{on})}$                         | 120    | 200    | 250 | ns  |
| Rise time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$                                                                  | $t_r$                                      | 50     | 100    | 150 |     |
| Turn-off delay time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$                                                        | $t_{d(\text{off})}$                        | 480    | 650    | 800 |     |
| Fall time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$                                                                  | $t_f$                                      | 65     | 90     | 120 |     |
| Turn-off loss ( $E_{\text{off}} = E_{\text{off } 1} + E_{\text{off } 2}$ )<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 150\text{ A}$<br>$R_{g(\text{on})} = 3.3\ \Omega$ , $R_{g(\text{off})} = 3.3\ \Omega$ | $E_{\text{off } 1}$<br>$E_{\text{off } 2}$ | —<br>— | 9<br>7 |     | mWs |

**SIEMENS****BSM 150 GB 100 D****BSM 150 GAL 100 D**

SIEMENS AKTIENGESELLSCHAFT

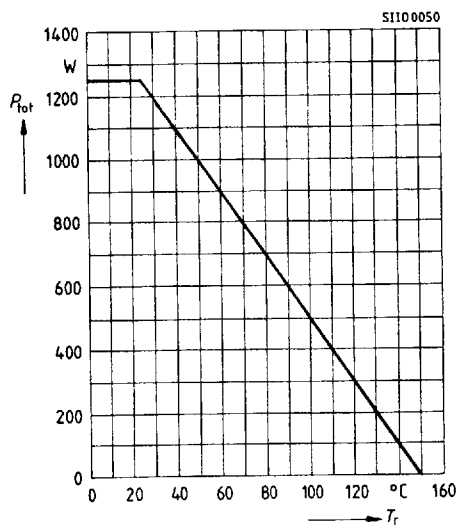
**Electrical Characteristics**at  $T_j = 25\text{ °C}$ , unless otherwise specified.

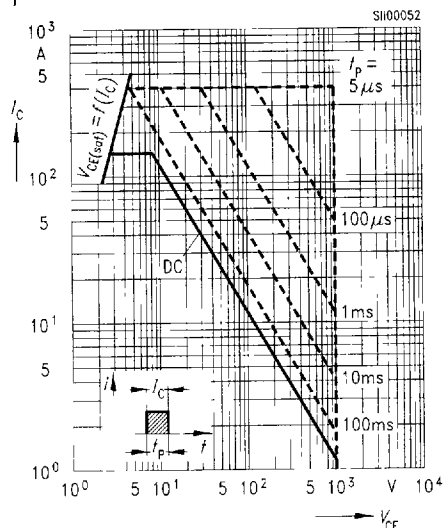
| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

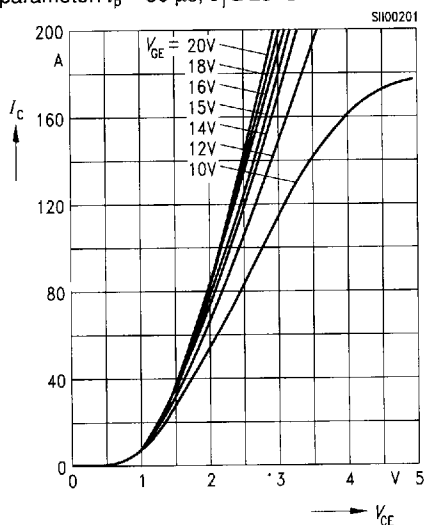
**Free-Wheel Diode**

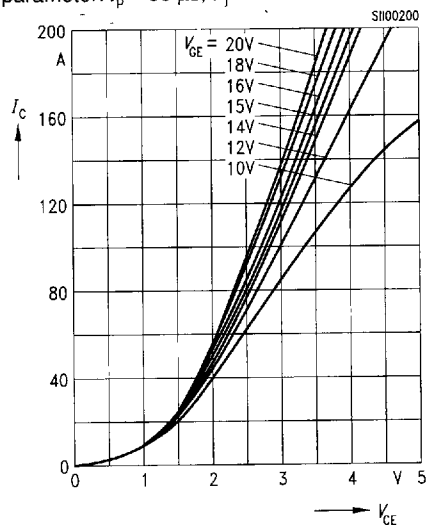
|                                                                                                                                                                                  |            |        |            |        |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|------------|--------|---------------|
| Diode forward voltage<br>$I_F = 150\text{ A}$ , $V_{GE} = 0$<br>$T_j = 25\text{ °C}$<br>$T_j = 125\text{ °C}$                                                                    | $V_F$      | —<br>— | 2.0<br>1.6 | —<br>— | V             |
| Reverse recovery time<br>$I_F = 150\text{ A}$ , $V_R = 600\text{ V}$<br>$V_{GE} = 0$ , $di_F/dt = -1500\text{ A/}\mu\text{s}$<br>$T_j = 125\text{ °C}$                           | $t_{rr}$   | —      | 0.35       | —      | $\mu\text{s}$ |
| Reverse recovery charge<br>$I_F = 150\text{ A}$ , $V_R = 600\text{ V}$<br>$V_{GE} = 0$ , $di_F/dt = -1500\text{ A/}\mu\text{s}$<br>$T_j = 25\text{ °C}$<br>$T_j = 125\text{ °C}$ | $Q_{rr}$   | —<br>— | 8<br>27    | —<br>— | $\mu\text{C}$ |
| Soft factor<br>$I_F = 150\text{ A}$ , $V_R = 600\text{ V}$<br>$V_{GE} = 0$ , $di_F/dt = -1500\text{ A/}\mu\text{s}$<br>$T_j = 125\text{ °C}$                                     | $S$        | —      | 1          | —      | —             |
| Thermal resistance<br>Chip-case                                                                                                                                                  | $R_{thJC}$ | —      | —          | 0.38   | K/W           |

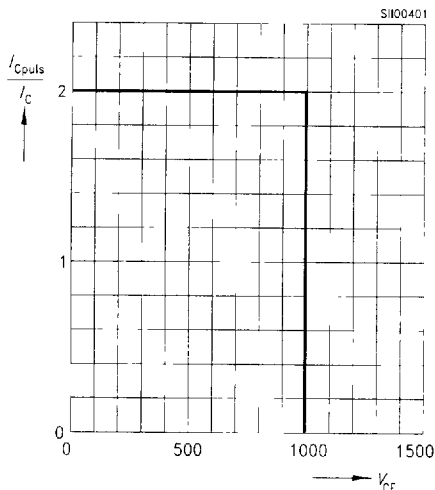
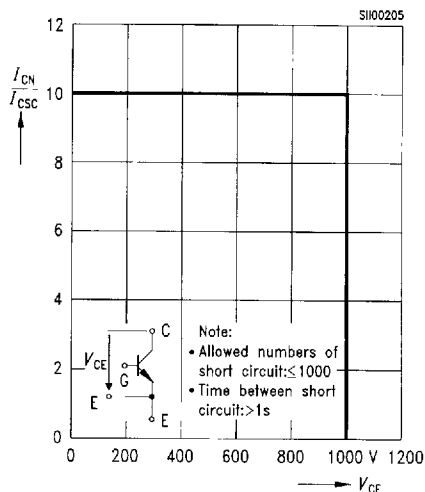
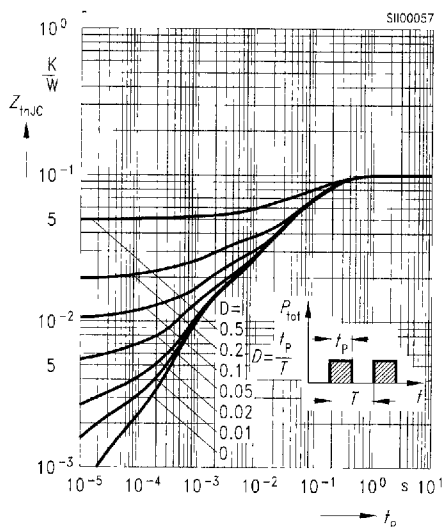
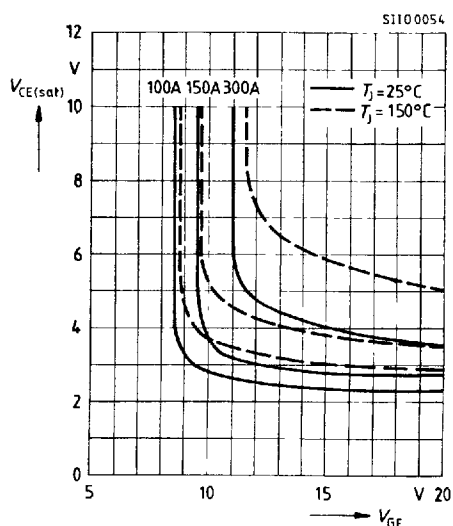
**SIEMENS**
**BSM 150 GB 100 D**  
**BSM 150 GAL 100 D**
**SIEMENS AKTIENGESELLSCHAFT**
**Characteristics at  $T_j = 25^\circ\text{C}$ , unless otherwise specified.**
**Power dissipation  $P_{\text{tot}} = f(T_c)$** 

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

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

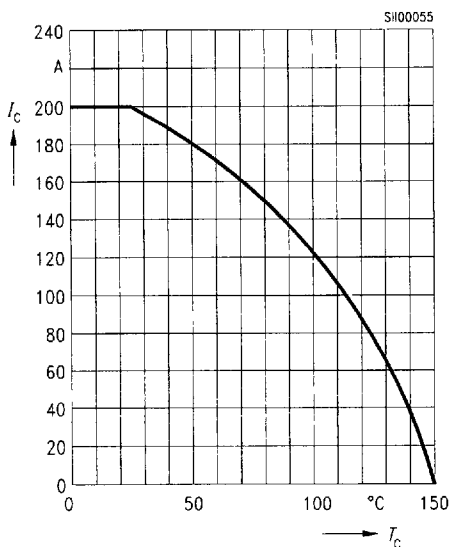
parameter: single pulse,  $T_c = 25^\circ\text{C}$ 
 $T_j \leq 150^\circ\text{C}$ 

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

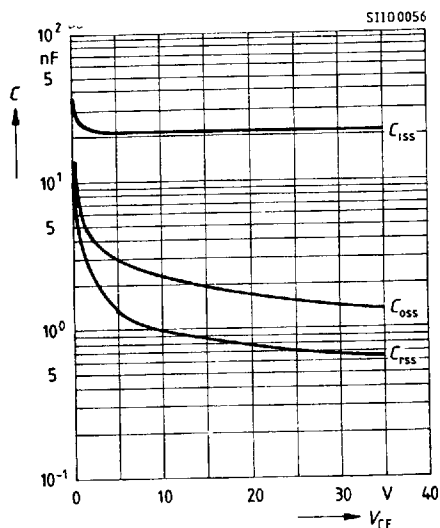
parameter:  $t_p = 80\mu\text{s}$ ,  $T_j \leq 25^\circ\text{C}$ 

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

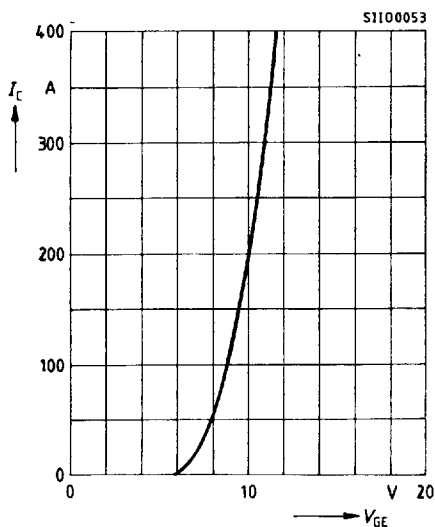
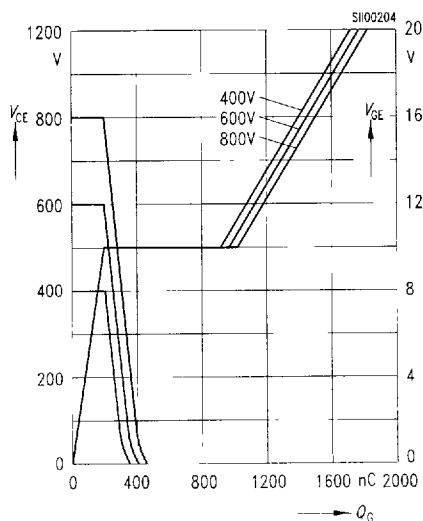
parameter:  $t_p = 80\mu\text{s}$ ,  $T_j \leq 125^\circ\text{C}$ 


**SIEMENS**
**BSM 150 GB 100 D**  
**BSM 150 GAL 100 D**
**SIEMENS AKTIENGESellschaft**
**Reverse biased safe operating area**
 $I_C = f(V_{CE})$ , parameter:  $T_J = 125^\circ\text{C}$ ,  
 $V_{GE} = 15\text{ V}$ ,  $R_{g(\text{off})} = 3.3\ \Omega$ ,  
 $L$  (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**
 $V_{CE(\text{sat})} = f(V_{GE})$ , parameter:  $I_C$ ,  $T_J$ 


**SIEMENS**
**BSM 150 GB 100 D**  
**BSM 150 GAL 100 D**
**SIEMENS AKTIENGESELLSCHAFT**
**Collector current  $I_C = f(T_C)$** 

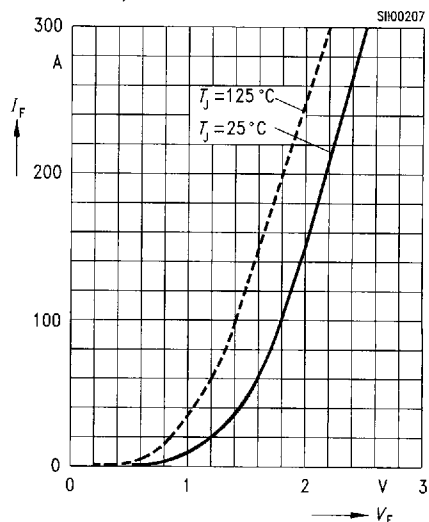
parameter:  $V_{GE} \geq 15 \text{ V}$ ,  $T_J = 150^\circ\text{C}$ 

**Typ. capacitances  $C = f(V_{CE})$** 

parameter:  $V_{GE} = 0$ ,  $f = 1 \text{ MHz}$ 

**Typ. transfer characteristics  $I_C = f(V_{GE})$** 

parameter:  $t_p = 80 \mu\text{s}$ ,  $V_{CE} = 20 \text{ V}$ 

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


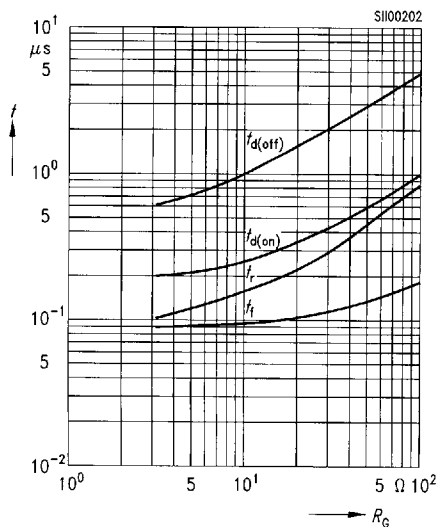
**SIEMENS**
**BSM 150 GB 100 D**  
**BSM 150 GAL 100 D**
**SIEMENS AKTIENGESELLSCHAFT**

**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:  $T_J = 125^\circ\text{C}$   
 $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 150\text{ A}$



**Typ. switching time  $t = f(I_C)$**

Inductive load, parameter:  $T_J = 125^\circ\text{C}$   
 $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 5.6\text{ }\Omega$

