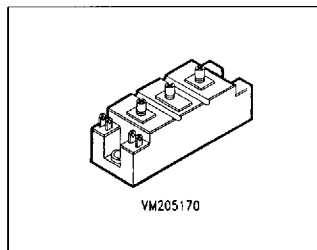


# SIEMENS

SIEMENS AKTIENGESELLSCHAFT

*T-23-07*
**SIMOPAC® Module**
**BSM 284 F**
 $V_{DS} = 800 \text{ V}$ 
 $I_D = 2 \times 20 \text{ A}$ 
 $R_{DS(on)} = 0.48 \text{ } \Omega$ 

- Power module
- Half-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Package outline/Circuit diagram: 2a<sup>1</sup>



| Type      | Ordering Code   |
|-----------|-----------------|
| BSM 284 F | C67076-A1152-A2 |

## Maximum Ratings

| Parameter                                                    | Symbol               | Values           | Unit             |
|--------------------------------------------------------------|----------------------|------------------|------------------|
| Drain-source voltage                                         | $V_{DS}$             | 800              | V                |
| Drain-gate voltage, $R_{GS} = 20 \text{ k}\Omega$            | $V_{DGR}$            | 800              |                  |
| Gate-source voltage                                          | $V_{GS}$             | $\pm 20$         |                  |
| Continuous drain current, $T_C = 25 \text{ }^\circ\text{C}$  | $I_D$                | 20               | A                |
| Pulsed drain current, $T_C = 25 \text{ }^\circ\text{C}$      | $I_{D \text{ puls}}$ | 80               |                  |
| Operating and storage temperature range                      | $T_J, T_{stg}$       | $-55 \dots +150$ | $^\circ\text{C}$ |
| Power dissipation, $T_C = 25 \text{ }^\circ\text{C}$         | $P_{tot}$            | 400              | W                |
| Thermal resistance<br>Chip-case                              | $R_{thJC}$           | $\leq 0.31$      | K/W              |
| Insulation test voltage <sup>2)</sup> , $t = 1 \text{ min.}$ | $V_{is}$             | 2500             | $V_{ac}$         |
| Creepage distance, drain-source                              | —                    | 16               | mm               |
| Clearance, drain-source                                      | —                    | 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 drain and base plate referred to standard climate 23/50 in acc. with DIN 50 014, IEC 146, para. 492.1.

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

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

**Static Characteristics**

|                                                                                                                                                        |              |        |           |             |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|-----------|-------------|---------------|
| Drain-source breakdown voltage<br>$V_{GS} = 0$ , $I_D = 0.25\text{ mA}$                                                                                | $V_{(BR)DS}$ | 800    | —         | —           | V             |
| Gate threshold voltage<br>$V_{GS} = V_{DS}$ , $I_D = 1\text{ mA}$                                                                                      | $V_{GS(th)}$ | 2.1    | 3.0       | 4.0         |               |
| Zero gate voltage drain current<br>$V_{DS} = 800\text{ V}$ , $V_{GS} = 0$<br>$T_j = 25\text{ }^{\circ}\text{C}$<br>$T_j = 125\text{ }^{\circ}\text{C}$ | $I_{DSS}$    | —<br>— | 50<br>300 | 250<br>1000 | $\mu\text{A}$ |
| Gate-source leakage current<br>$V_{GS} = 20\text{ V}$ , $V_{DS} = 0$                                                                                   | $I_{GSS}$    | —      | 10        | 100         |               |
| Drain-source on-state resistance<br>$V_{GS} = 10\text{ V}$ , $I_D = 13\text{ A}$                                                                       | $R_{DS(on)}$ | —      | 0.36      | 0.48        | $\Omega$      |

**Dynamic Characteristics**

|                                                                                                                                                                    |              |    |     |     |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----|-----|-----|----|
| Forward transconductance<br>$V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$ , $I_D = 13\text{ A}$                                                                  | $g_{fs}$     | 10 | 18  | —   | S  |
| Input capacitance<br>$V_{GS} = 0$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                                                                    | $C_{iss}$    | —  | 15  | 20  | nF |
| Output capacitance<br>$V_{GS} = 0$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                                                                   | $C_{oss}$    | —  | 0.7 | 1.5 |    |
| Reverse transfer capacitance<br>$V_{GS} = 0$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$                                                                         | $C_{rss}$    | —  | 0.3 | 1   |    |
| Turn-on time $t_{on}$ ( $t_{on} = t_{d(on)} + t_r$ )<br>$V_{CC} = 400\text{ V}$ , $V_{GS} = 10\text{ V}$<br>$I_D = 13\text{ A}$ , $R_{GS} = 3.3\text{ }\Omega$     | $t_{d(on)}$  | —  | 50  | —   | ns |
|                                                                                                                                                                    | $t_r$        | —  | 30  | —   |    |
| Turn-off time $t_{off}$ ( $t_{off} = t_{d(off)} + t_f$ )<br>$V_{CC} = 400\text{ V}$ , $V_{GS} = 10\text{ V}$<br>$I_D = 13\text{ A}$ , $R_{GS} = 3.3\text{ }\Omega$ | $t_{d(off)}$ | —  | 130 | —   |    |
|                                                                                                                                                                    | $t_f$        | —  | 35  | —   |    |

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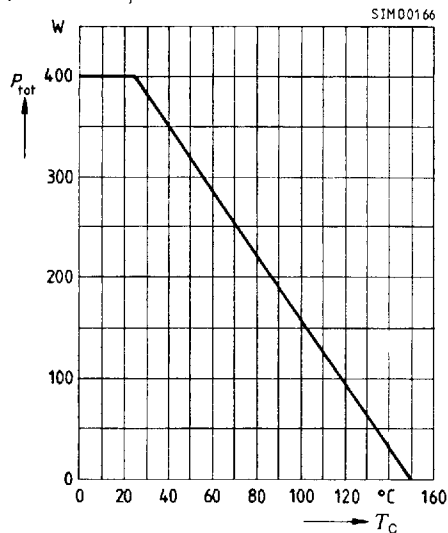
**Electrical Characteristics (cont'd)**at  $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified.

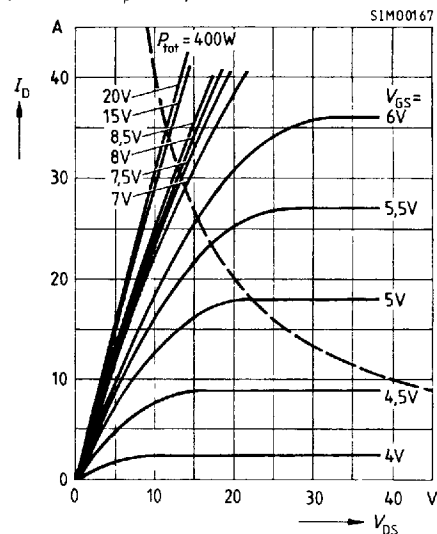
| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

**Fast-recovery reverse diode**

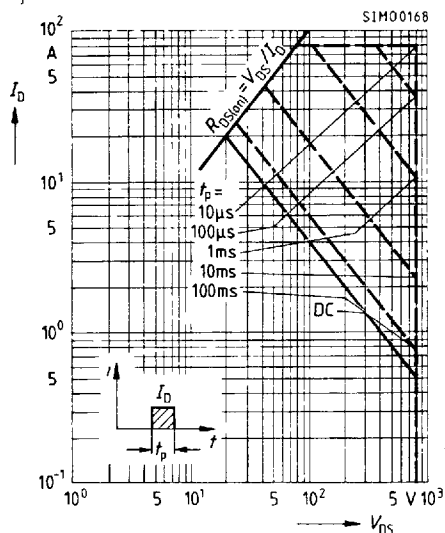
|                                                                                                                                                                                   |          |        |        |        |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|--------|--------|---------------|
| Continuous reverse drain current<br>$T_C = 25\text{ }^{\circ}\text{C}$                                                                                                            | $I_S$    | —      | —      | 20     | A             |
| Pulsed reverse drain current<br>$T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                | $I_{SM}$ | —      | —      | 80     |               |
| Diode forward on-voltage<br>$I_F = 40\text{ A}$ , $V_{GS} = 0$                                                                                                                    | $V_{SD}$ | —      | 1.2    | 1.6    | V             |
| Reverse recovery time<br>$I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 100\text{ V}$<br>$T_j = 150\text{ }^{\circ}\text{C}$                                         | $t_{rr}$ | —      | 300    | —      | ns            |
| Reverse recovery charge<br>$I_F = I_S$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 100\text{ V}$<br>$T_j = 25\text{ }^{\circ}\text{C}$<br>$T_j = 150\text{ }^{\circ}\text{C}$ | $Q_{rr}$ | —<br>— | 2<br>6 | —<br>— | $\mu\text{C}$ |

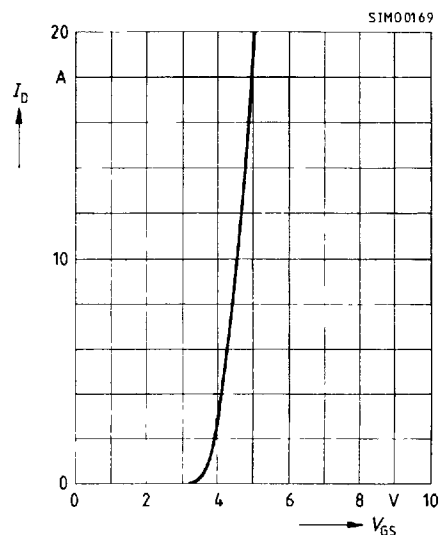
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**Characteristics at  $T_j = 25^\circ\text{C}$ , unless otherwise specified.**
**Power dissipation  $P_{\text{tot}} = f(T_c)$** 

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

**Typ. output characteristics  $I_D = f(V_{\text{DS}})$** 

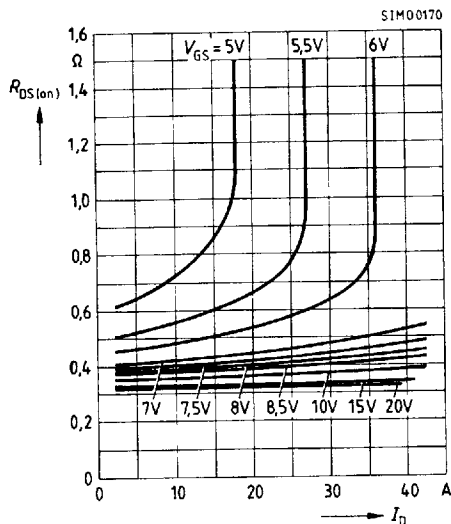
parameter:  $t_p = 80\ \mu\text{s}$ 

**Safe operating area  $I_D = f(V_{\text{DS}})$** 

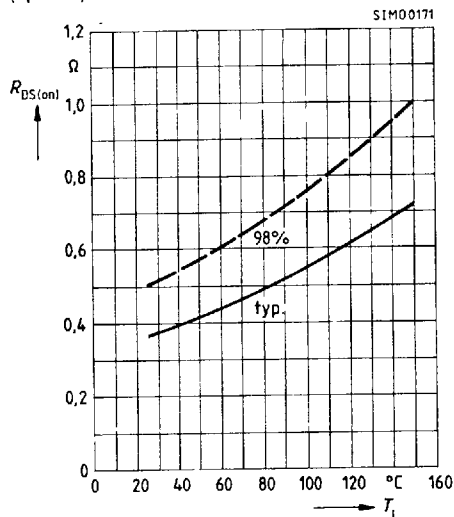
parameter: single pulse,  $T_c = 25^\circ\text{C}$ ,

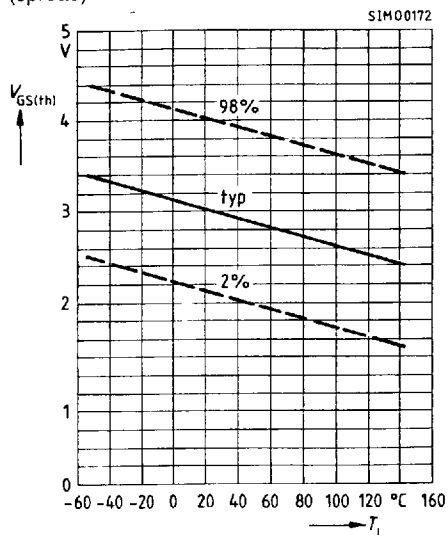
 $T_j = 150^\circ\text{C}$ 

**Typ. transfer characteristic  $I_D = f(V_{\text{GS}})$** 

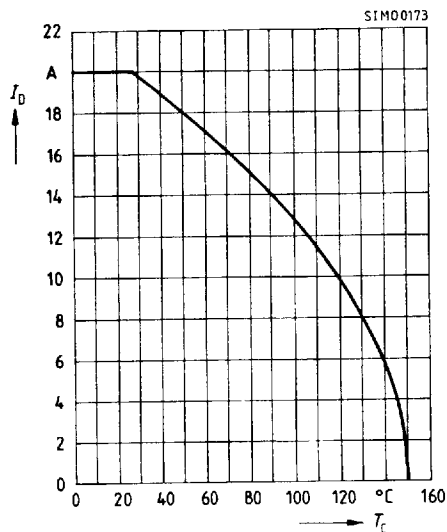
parameter:  $t_p = 80\ \mu\text{s}$ ,  $V_{\text{DS}} = 25\text{ V}$ 


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**Typ. on-state resistance**  $R_{DS(on)} = f(I_D)$ 

parameter:  $V_{GS}$ 

**On state resistance**  $R_{DS(on)} = f(T_J)$ 

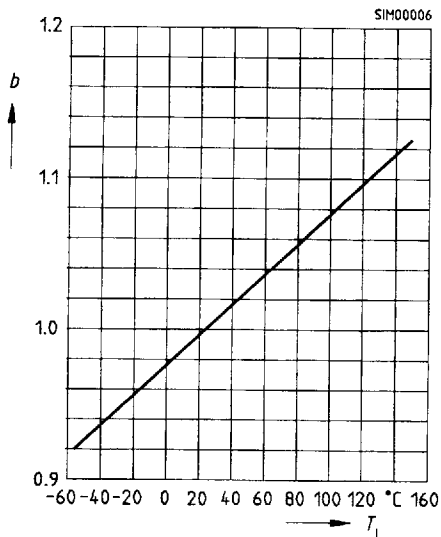
parameter:  $I_D = 13 \text{ A}$ ;  $V_{GS} = 10 \text{ V}$   
(spread)

**Gate threshold voltage**  $V_{GS(th)} = f(T_J)$ 

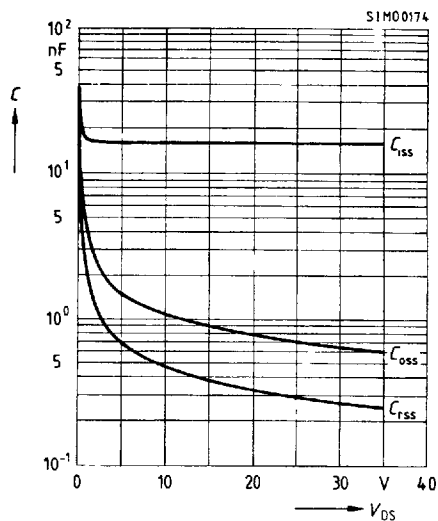
parameter:  $V_{GS} = V_{DS}$ ,  $I_D = 1 \text{ mA}$   
(spread)

**Drain current**  $I_D = f(T_C)$ 

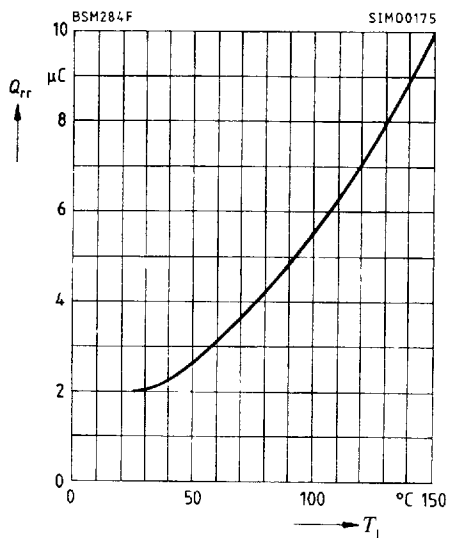
parameter:  $V_{GS} \geq 10 \text{ V}$ ,  $T_J = 150 \text{ }^{\circ}\text{C}$ 


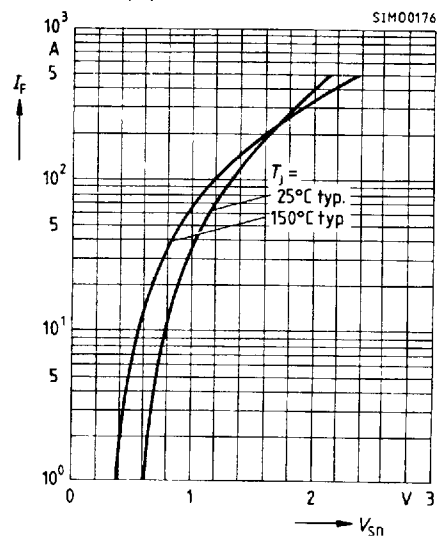
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**Drain-source breakdown voltage**

$$V_{(BR)DSS}(T_J) = b \times V_{(BR)DSS}(25^\circ\text{C})$$


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

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

**Typ. reverse recovery charge  $Q_{rr} = f(T_J)$** 

parameter:  $di_F/dt = 100\text{ A}/\mu\text{s}$ ,  $I_F = 20\text{ A}$ 
 $V_R = 100\text{ V}$ 

**Forward characteristics**
**of fast-recovery reverse diode  $I_F = f(V_{SD})$** 

parameter:  $T_J$ ,  $t_p = 80\text{ }\mu\text{s}$ , (spread)


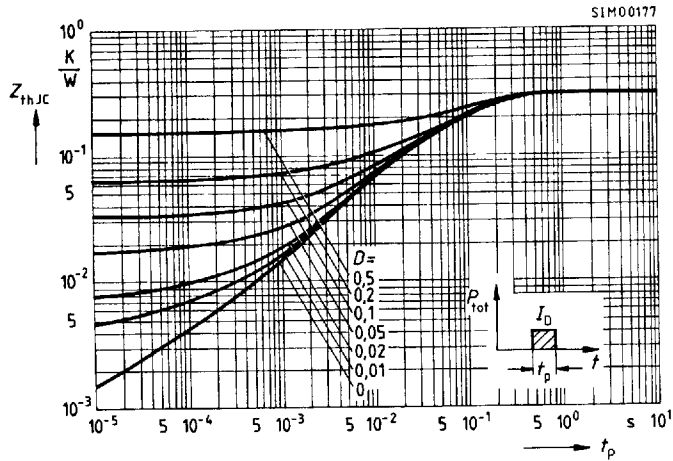
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**Transient thermal impedance**  $Z_{thJC} = f(t_p)$

parameter:  $D = t_p/T$



**Typ. gate charge**  $V_{GS} = f(Q_{Gate})$

parameter:  $I_{Dpuls} = 30$  A

