SIEMENS

SIEMENS AKTIENGESELLSCHAF

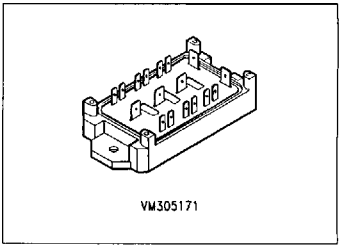
T-23-07

SIMOPAC® Module

BSM 651 F

V_{DS} = 500 V
I_D = 6 × 9 A
$R_{DS(on)}$ = 0.7 Ω

- Power module
- 3-phase full-bridge
- FREDFET
- N channel
- Enhancement mode
- Package with insulated metal base plate
- Package outline / Circuit diagram: 3a[1)]



Type	Ordering Code
BSM 651 F	C67076-A1500-A2

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	500	V
Drain-gate voltage, R_{GS} = 20 kΩ	V_{DGR}	500	
Gate-source voltage	V_{GS}	± 20	
Continuous drain current, T_C = 25 °C	I_D	9	A
Pulsed drain current, T_C = 25 °C	$I_{D\,puls}$	36	
Operating and storage temperature range	T_j T_{stg}	 – 55 ... + 150	°C
Power dissipation, T_C = 25 °C	P_{tot}	125	W
Thermal resistance Chip - case	$R_{th\,JC}$	≤ 1	K/W
Insulation test voltage[2)], t = 1 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	

1) See chapter Package Outlines and Circuit Diagrams
2) 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.

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Electrical Characteristics
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static characteristics					
Drain-source breakdown voltage V_{GS} = 0, I_D = 0.25 mA	$V_{(BR)DSS}$	500	–	–	V
Gate threshold voltage V_{GS} = V_{DS}, I_D = 1 mA	$V_{GS(th)}$	2.1	3.0	4.0	
Zero gate voltage drain current V_{DS} = 500 V, V_{GS} = 0 T_j = 25 °C T_j = 125 °C	I_{DSS}	 – –	 20 300	 250 1000	µA
Gate-source leakage current V_{GS} = 20 V, V_{DS} = 0	I_{GSS}	–	10	100	nA
Drain-source on-state resistance V_{GS} = 10 V, I_D = 6.5 A	$R_{DS(on)}$	–	0.6	0.7	Ω
Dynamic characteristics					
Forward transconductance $V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$, I_D = 6.5 A	g_{fs}	2.7	6	–	S
Input capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{iss}	–	3900	4900	pF
Output capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{oss}	–	250	400	
Reverse transfer capacitance V_{GS} = 0, V_{DS} = 25 V, f = 1 MHz	C_{rss}	–	100	170	
Turn-on time t_{on} ($t_{on} = t_{d(on)} + t_r$) V_{CC} = 250 V, V_{GS} = 10 V I_D = 6.5 A, R_{GS} = 3.3 Ω	$t_{d(on)}$	–	60	90	ns
	t_r	–	90	140	
Turn-off time t_{off} ($t_{off} = t_{d(off)} + t_f$) V_{CC} = 250 V, V_{GS} = 10 V I_D = 6.5 A, R_{GS} = 3.3 Ω	$t_{d(off)}$	–	330	430	
	t_f	–	110	140	

Electrical Characteristics (continued)
at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Fast-recovery reverse diode					
Continuous reverse drain current T_C = 25 °C	I_S	–	–	9	A
Pulsed reverse drain current T_C = 25 °C	I_{SM}	–	–	36	
Diode forward on-voltage I_F = 18 A, V_{GS} = 0	V_{SD}	–	1.5	1.9	V
Reverse recovery time $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V	t_{rr}	–	250	–	ns
Reverse recovery charge $I_F = I_S$, di_F/dt = 100 A/µs, V_R = 100 V	Q_{rr}	–	1.2	–	µC

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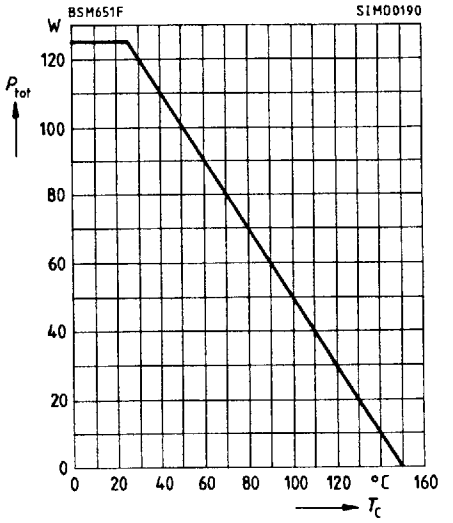
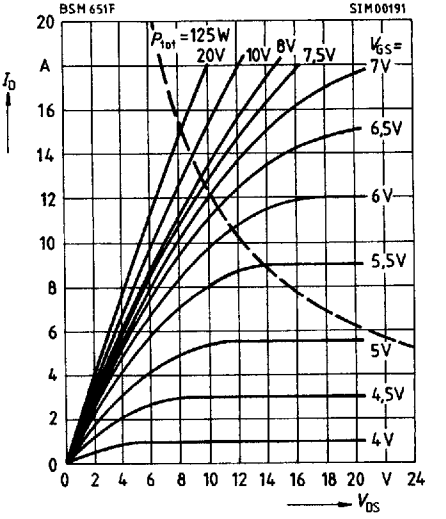
Characteristics at T_j = 25 °C, unless otherwise specified.

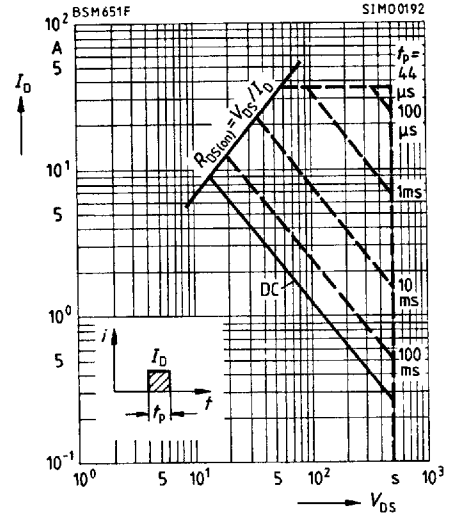
Power dissipation $P_{tot} = f(T_C)$
parameter: T_j = 150 °C



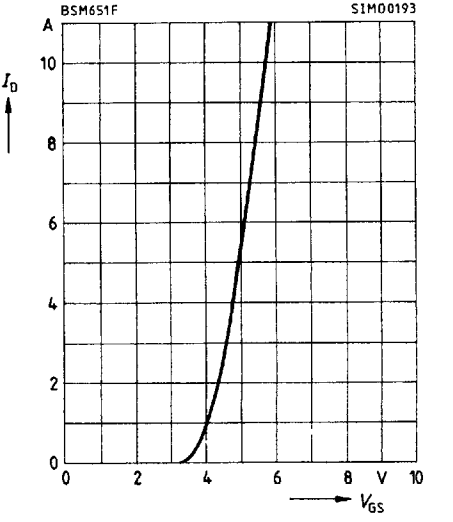
Typ. output characteristics $I_D = f(V_{DS})$
parameter: t_p = 80 µs



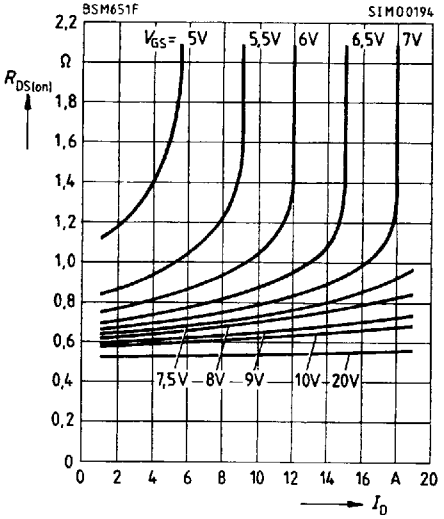
Safe operating area $I_D = f(V_{DS})$
parameter: single pulse, T_C = 25 °C
$T_j \leq 150$ °C



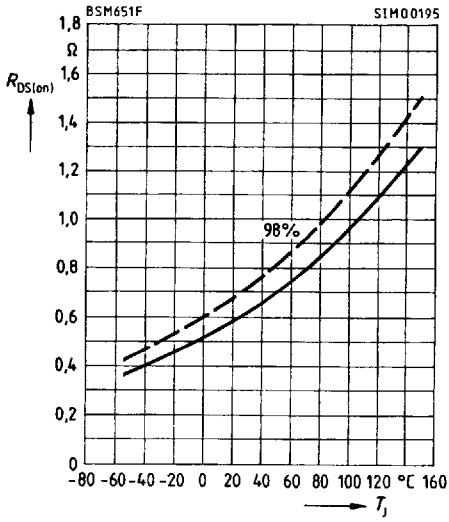
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: t_p = 80 µs , V_{DS} = 25 V



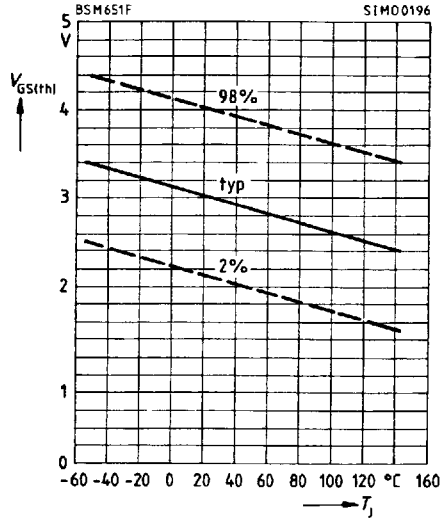
Typ. on-state resistance $R_{DS(on)} = f(I_D)$
parameter: V_{GS}



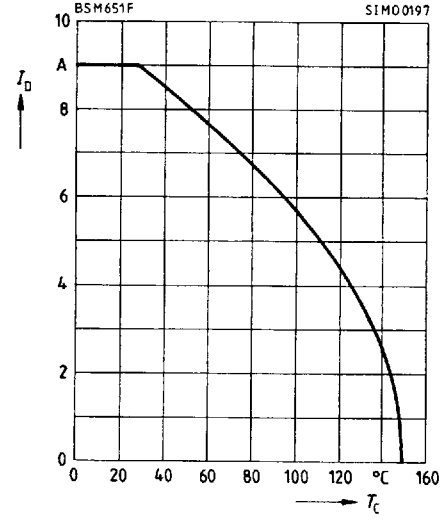
On-state resistance $R_{DS(on)} = f(T_j)$
parameter: I_D = 6.5 A; V_{GS} = 10 V
(spread)



Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, I_D = 1 mA
(spread)



Drain current $I_D = f(T_C)$
parameter: $V_{GS} \geq 10$ V, T_j = 150 °C



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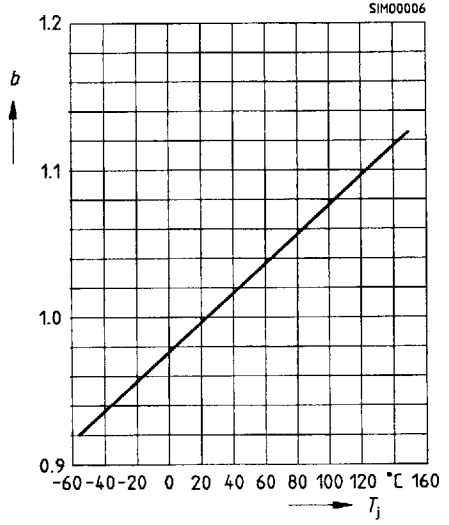
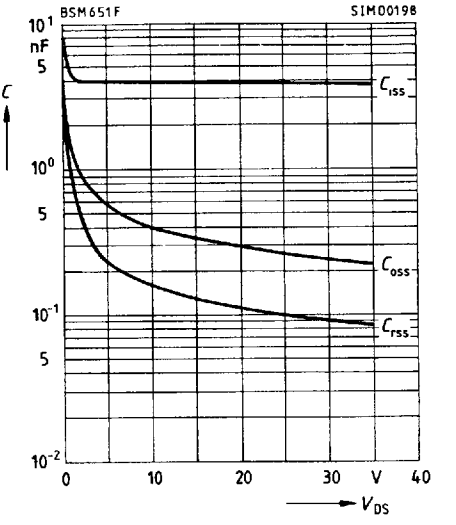
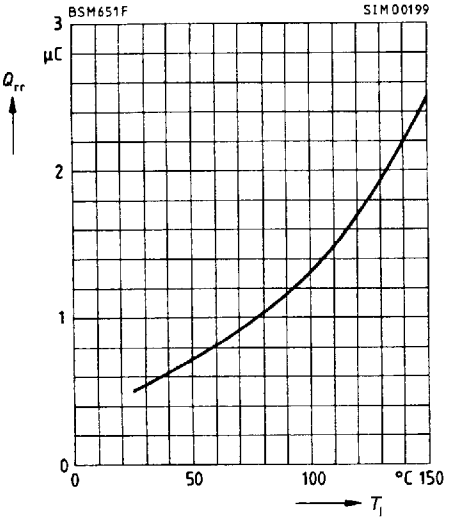
Drain-source breakdown voltage
$V_{(BR)DSS}$ $(T_j) = b \times V_{(BR)DSS}$ (25 °C)



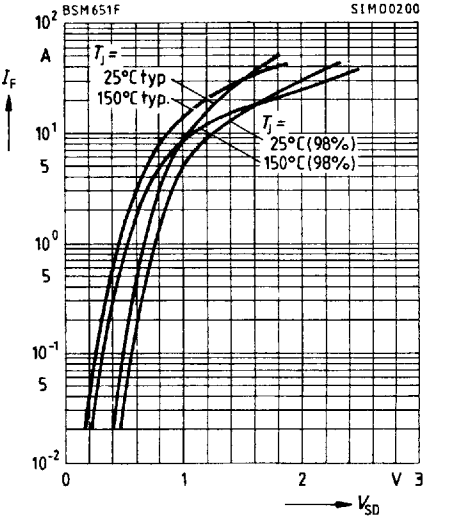
Typ. capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz
(spread)



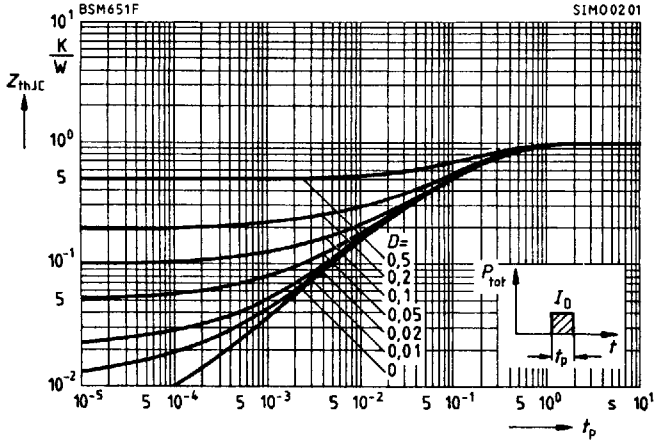
Typ. reverse recovery charge $Q_{rr} = f(T_j)$
parameter: $di_F/dt = 100$ A/µs, $I_F = 9$ A
$V_R = 100$ V



Forward characteristics
of fast-recovery reverse diode $I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs (spread)



Transient thermal impedance $Z_{thJC} = f(t_p)$
parameter: $D = t_p/T$



Typ. gate charge $V_{GS} = f(Q_{Gate})$
parameter: $I_{D\,puls}$ = 13.5 A