

IGBT Module Preliminary Data

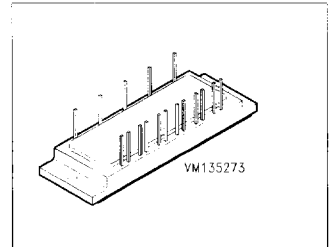
BSM 05 GD 100 D

$V_{CE} = 1000 \text{ V}$

$I_C = 6 \times 5.5 \text{ A at } T_C = 25 \text{ }^\circ\text{C}$

$I_C = 6 \times 5.0 \text{ A at } T_C = 40 \text{ }^\circ\text{C}$

- Power module
- 3-phase full bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Package outlines/Circuit diagram: 6a¹⁾



Type	Ordering Code
BSM 05 GD 100 D	C67076-A2506-A52

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}	± 20	
Continuous collector current, $T_C = 25 \text{ }^\circ\text{C}$ $T_C = 40 \text{ }^\circ\text{C}$	I_C	5.5 5.0	A
Pulsed collector current, $T_C = 25 \text{ }^\circ\text{C}$ $T_C = 40 \text{ }^\circ\text{C}$	$I_{C \text{ puls}}$	11.0 10.0	
Storage temperature range	T_{stg}	- 40 ... + 125	°C
Junction Temperature	T_j	150	
Power dissipation, $T_C = 40 \text{ }^\circ\text{C}$	P_{tot}	30	W
Thermal resistance, chip-case	$R_{th,jc}$	≤ 4.0	K/W
DIN humidity category, DIN 40 040	—	F	—
IEC climatic category, DIN IEC 68-1	—	40/125/56	—

¹⁾ See chapter Package Outline and Circuit Diagrams.

Electrical Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Static Characteristics

Collector-emitter breakdown voltage $V_{GE} = 0, I_C = 0.3\text{ mA}$	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage $V_{GE} = V_{CE}, I_C = 0.3\text{ mA}$	$V_{GE(th)}$	4.8	5.5	6.2	
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 5\text{ A}$ $T_j = 25\text{ °C}$ $T_j = 150\text{ °C}$	$V_{CE(sat)}$	– –	2.8 4.0	3.3 4.5	
Zero gate voltage collector current $V_{CE} = 1000\text{ V}, V_{GE} = 0$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	I_{CES}	– –	–	300 1000	μA
Gate-emitter leakage current $V_{GE} = 20\text{ V}, V_{CE} = 0$	I_{GES}	–	0.1	100	nA

AC Characteristics

Forward transconductance $V_{CE} = 20\text{ V}, I_C = 5\text{ A}$	g_{fs}	1.5	–	–	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$	C_{iss}	–	650	–	pF
Output capacitance, $V_{GS} = 0$ $V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$	C_{oss}	–	50	–	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0, f = 1\text{ MHz}$	C_{rss}	–	20	–	

Switching Characteristics

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Resistive Load

Turn-on delay time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	$t_{d(\text{on})}$	–	15	–	ns
Rise time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	t_r	–	100	–	
Turn-off delay time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	$t_{d(\text{off})}$	–	120	–	
Fall time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	t_f	–	150	–	

Inductive Load

Turn-on delay time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	$t_{d(\text{on})}$	5 –	12 –	20 –	ns
Rise time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	t_r	5 –	10 –	15 –	
Turn-off delay time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	$t_{d(\text{off})}$	90 –	120 –	150 –	
Fall time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	t_f	10 –	15 –	20 –	
Turn-off loss ($E_{\text{off}} = E_{\text{off}1} + E_{\text{off}2}$) $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $R_{g(\text{on})} = 3.3\text{ }\Omega$, $R_{g(\text{off})} = 3.3\text{ }\Omega$	$E_{\text{off}1}$ $E_{\text{off}2}$	– –	0.25 0.35	– –	mWs

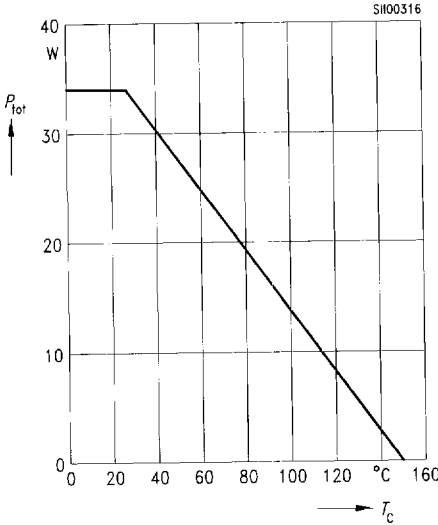
Electrical Characteristics

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

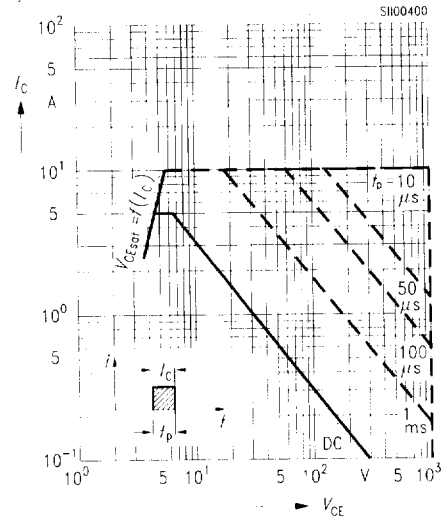
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Free-Wheel Diode Diode forward voltage $I_F = 5\text{ A}$, $V_{GE} = 0$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	V_F	–	1.8 1.6	–	V
Reverse recovery time $I_F = 5\text{ A}$, $V_R = 600\text{ V}$ $V_{GE} = 0$, $di/dt = -500\text{ A}/\mu\text{s}$ $T_j = 125\text{ °C}$	t_{rr}	–	0.05	–	μs
Reverse recovery charge $I_F = 5\text{ A}$, $V_R = 600\text{ V}$ $V_{GE} = 0$, $di/dt = -500\text{ A}/\mu\text{s}$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	Q_{rr}	–	0.5 1.0	–	μC
Soft factor $I_F = 5\text{ A}$, $V_R = 600\text{ V}$ $V_{GE} = 0$, $di/dt = -500\text{ A}/\mu\text{s}$ $T_j = 125\text{ °C}$	S	–	1	–	–
Thermal resistance Chip-case	R_{thJC}	–	–	6.0	K/W

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

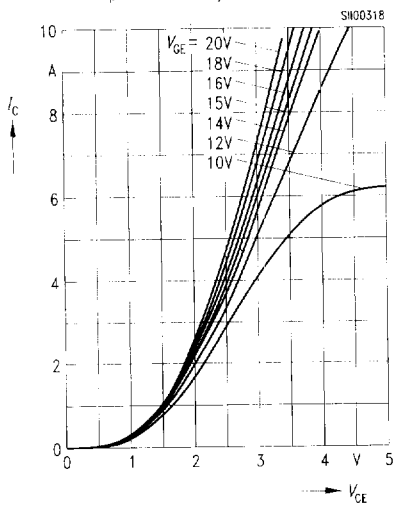
Power dissipation $P_{\text{tot}} = f(T_C)$
parameter: $T_j = 150^\circ\text{C}$



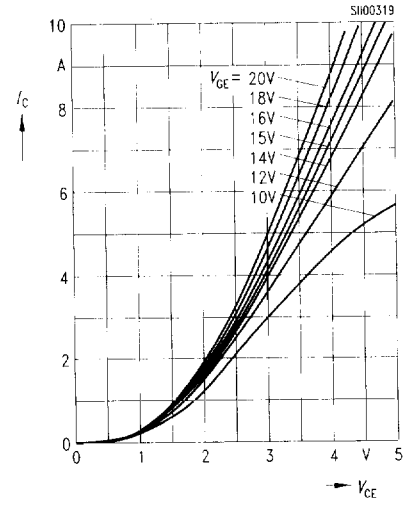
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, $T_C = 25^\circ\text{C}$
 $T_j \leq 150^\circ\text{C}$



Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80 \mu\text{s}$, $T_j \leq 25^\circ\text{C}$

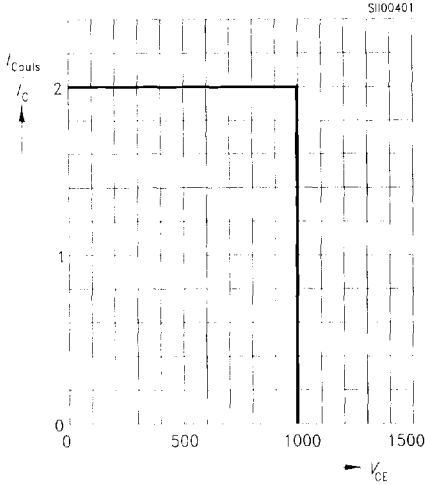


Typ. output characteristics $I_C = f(V_{CE})$
parameter: $t_p = 80 \mu\text{s}$, $T_j \leq 125^\circ\text{C}$



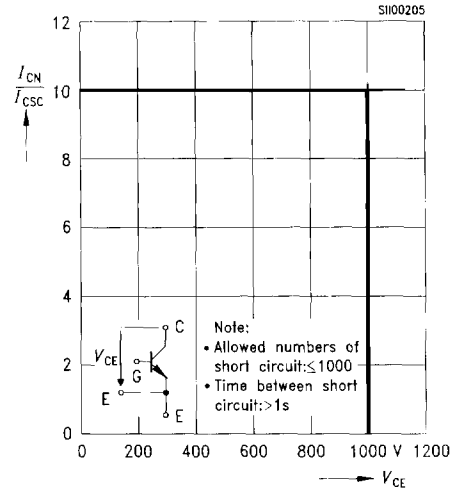
Reverse biased safe operating area

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



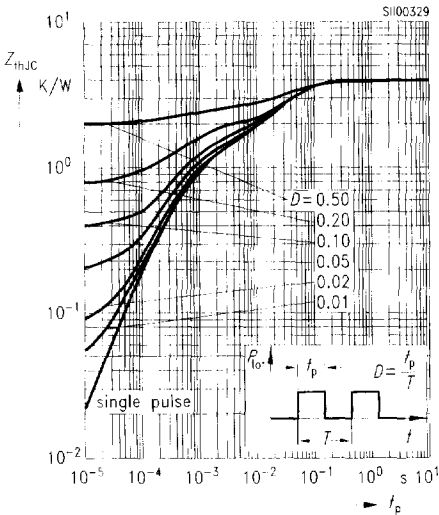
Safe operating area, short circuit

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



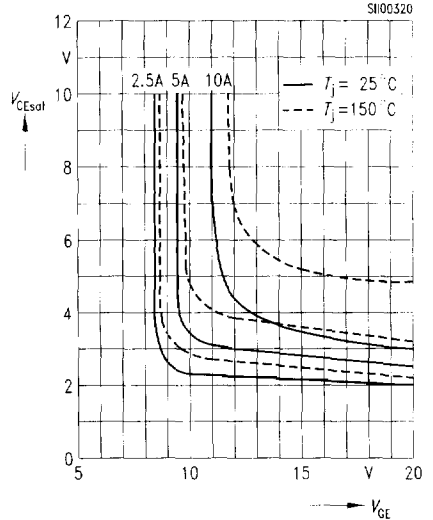
Transient thermal impedance

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



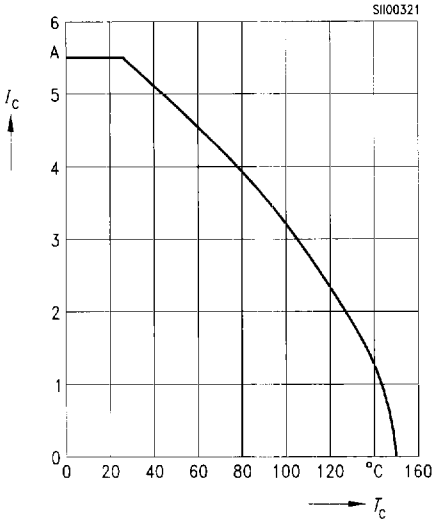
Typ. on-state characteristics

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



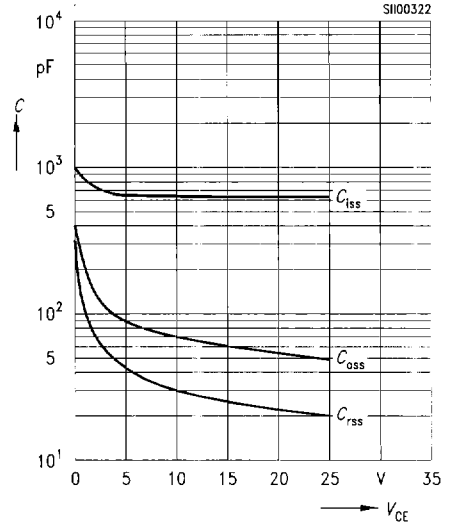
Collector current $I_C = f(T_C)$

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



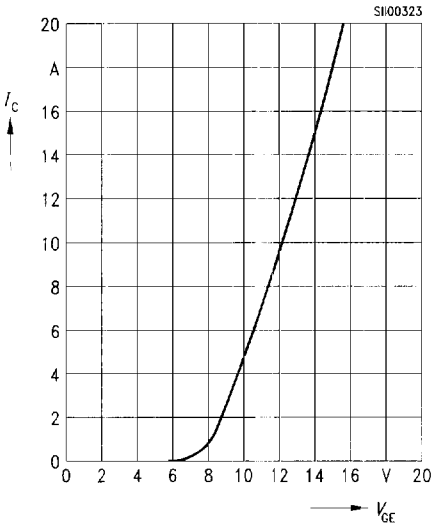
Typ. capacitances $C = f(V_{CE})$

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

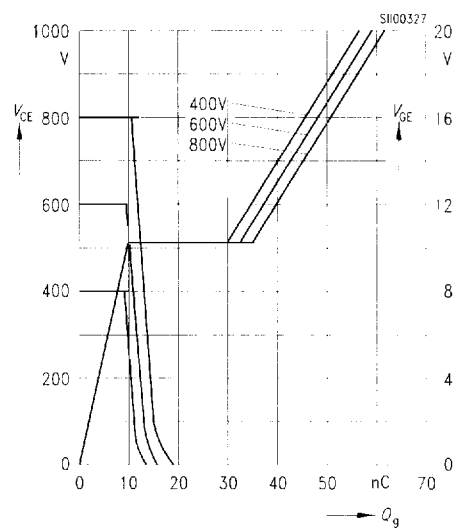


Typ. transfer characteristics $I_C = f(V_{GE})$

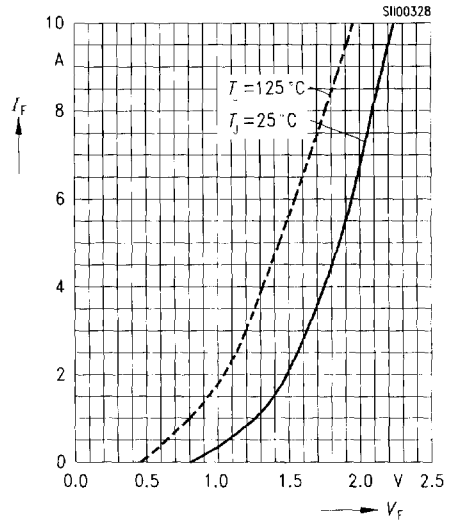
parameter: $t_p = 80 \text{ } \mu\text{s}$, $V_{CE} = 20 \text{ V}$



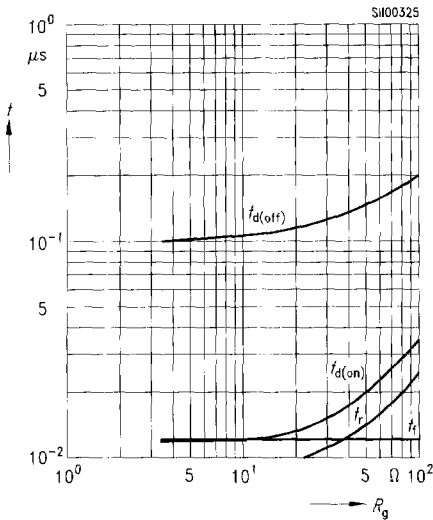
Typ. gate charge $V_{CE}, V_{GE} = f(Q_g)$



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: $T_J = 125\text{ °C}$
 $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $I_C = 5\text{ A}$



Typ. switching time $t = f(I_C)$
 Inductive load, parameter: $T_J = 125\text{ °C}$
 $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_G = 3.3\text{ Ω}$

