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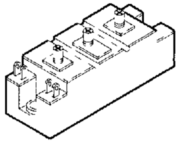
T-23-09

IGBT Module
Preliminary Data

BSM 50 GB 100 D
BSM 50 GAL 100 D

V_{CE} = 1000 V
I_C = 2 x 70 A at T_C = 25 °C
I_C = 2 x 50 A at T_C = 80 °C

- Power module
- Half-bridge/Chopper
- Including fast free-wheel diodes
- Package with insulated metal base plate
- Package outlines/Circuit diagram: 2b, 2c[1)]



Half-bridge		**Chopper**	
Type	**Ordering Code**	**Type**	**Ordering code**
BSM 50 GB 100 D	C67076-A2100-A2	BSM 50 GAL 100 D	C67076-A2002-A2

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Collector-emitter voltage	V_{CE}	1000	V
Collector-gate voltage, R_{GE} = 20 kΩ	V_{CGR}	1000	
Gate-emitter voltage	V_{GE}	± 20	
Continuous collector current, T_C = 25 °C T_C = 80 °C	I_C	70 50	A
Pulsed collector current, T_C = 25 °C T_C = 80 °C	$I_{C\ puls}$	140 100	
Operating and storage temperature range	T_j, T_{stg}	- 55 ... + 150	°C
Power dissipation, T_C = 25 °C	P_{tot}	500	W
Thermal resistance, chip-case	R_{thJC}	≤ 0.25	K/W
Insulation test voltage[2)], t = 1 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	

[1)] See chapter Package Outline and Circuit Diagrams.

[2)] 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

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Collector-emitter breakdown voltage V_{GE} = 0, I_C = 1 mA	$V_{(BR)CES}$	1000	–	–	V
Gate threshold voltage V_{GE} = V_{CE}, I_C = 4 mA	$V_{GE(th)}$	4.8	5.5	6.2	
Collector-emitter saturation voltage V_{GE} = 15 V, I_C = 50 A T_j = 25 °C T_j = 150 °C	$V_{CE(sat)}$	– –	2.8 4.0	3.3 4.5	
Zero gate voltage collector current V_{CE} = 1000 V, V_{GE} = 0 T_j = 25 °C T_j = 125 °C	I_{CES}	– –	– –	1000 4000	µA
Gate-emitter leakage current V_{GE} = 20 V, V_{CE} = 0	I_{GES}	–	–	100	nA
AC Characteristics					
Forward transconductance V_{CE} = 20 V, I_C = 50 A	g_{fs}	18	–	–	S
Input capacitance V_{CE} = 25 V, V_{GE} = 0, f = 1 MHz	C_{iss}	–	8000	–	pF
Output capacitance, V_{GS} = 0 V_{CE} = 25 V, V_{GE} = 0, f = 1 MHz	C_{oss}	–	640	–	
Reverse transfer capacitance V_{CE} = 25 V, V_{GE} = 0, f = 1 MHz	C_{rss}	–	250	–	

Switching Characteristics

at T_j = 125 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Resistive Load					
Turn-on delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	$t_{d\,(on)}$	20	30	40	ns
Rise time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	t_r	–	140	–	
Turn-off delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	$t_{d\,(off)}$	–	300	–	
Fall time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	t_f	–	300	–	
Inductive Load					
Turn-on delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	$t_{d\,(on)}$	20	30	40	ns
Rise time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	t_r	10	20	25	
Turn-off delay time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	$t_{d\,(off)}$	220	300	360	
Fall time V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	t_f	25	35	45	
Turn-off loss ($E_{off} = E_{off\,1} + E_{off\,2}$) V_{CC} = 600 V, V_{GE} = 15 V, I_C = 50 A $R_{g\,(on)}$ = 3.3 Ω, $R_{g\,(off)}$ = 3.3 Ω	$E_{off\,1}$ $E_{off\,2}$	– –	2.0 2.0	– –	mWs

Electrical Characteristics

at T_j = 25 °C, unless otherwise specified.

Parameter	**Symbol**	**Values**			**Unit**
		min.	**typ.**	**max.**	
Free-Wheel Diode					
Diode forward voltage I_F = 50 A, V_{GE} = 0 T_j = 25 °C T_j = 125 °C	V_F	 – –	 1.85 1.45	 – –	V
Reverse recovery time I_F = 50 A, V_R = 600 V V_{GE} = 0, di_F/dt = – 800 A/µs T_j = 125 °C	t_{rr}	 –	 0.2	 –	µs
Reverse recovery charge I_F = 50 A, V_R = 600 V V_{GE} = 0, di_F/dt = – 800 A/µs T_j = 25 °C T_j = 125 °C	Q_{rr}	 – –	 3.6 10	 – –	µC
Soft factor I_F = 50 A, V_R = 600 V V_{GE} = 0, di_F/dt = – 800 A/µs T_j = 125 °C	S	 –	 1	 –	–
Thermal resistance Chip-case	R_{thJC}	–	–	0.9	K/W

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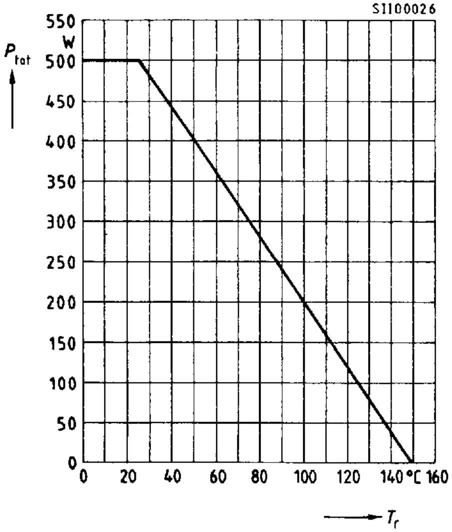
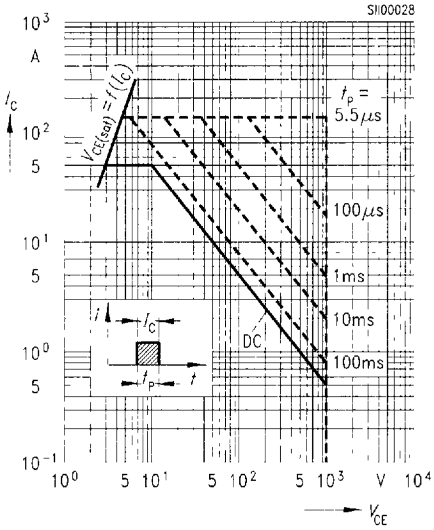
Characteristics at T_j = 25 °C, unless otherwise specified.

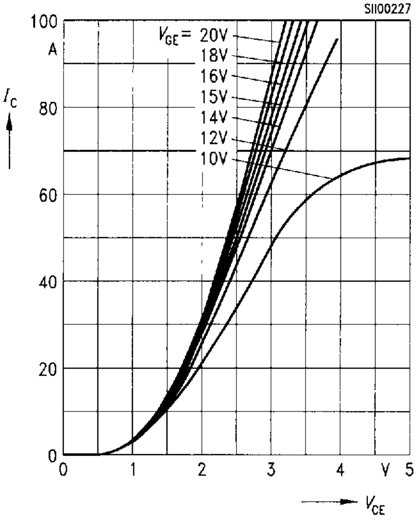
Power dissipation $P_{tot} = f(T_C)$
parameter: T_j = 150 °C



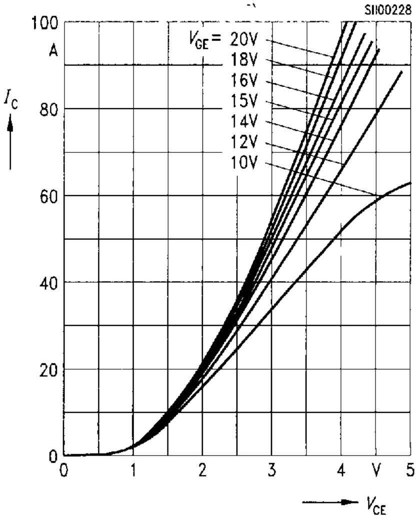
Safe operating area $I_C = f(V_{CE})$
parameter: single pulse, T_C = 25 °C
T_j ≤ 150 °C



Typ. output characteristics $I_C = f(V_{CE})$
parameter: t_p = 80 µs, T_j ≤ 25 °C

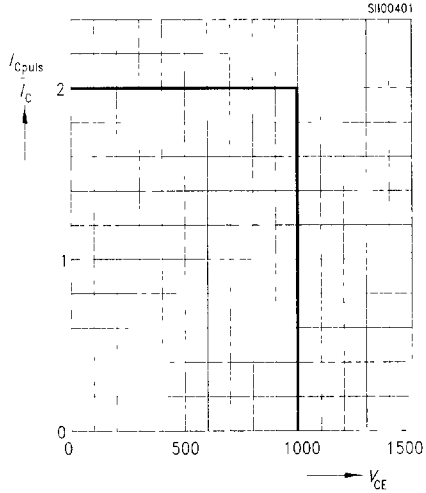


Typ. output characteristics $I_C = f(V_{CE})$
parameter: t_p = 80 µs, T_j ≤ 125 °C



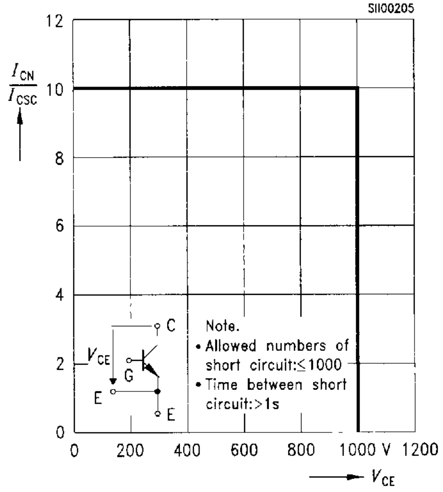
Reverse biased safe operating area

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



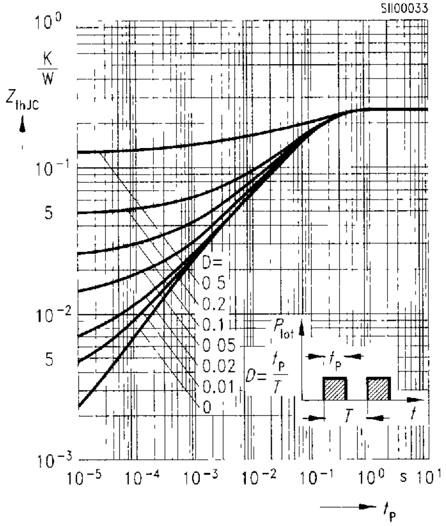
Safe operating area, short circuit $I_C = f(V_{CE})$, $V_{GE} = \pm 15$ V

$T_j \le 150$ °C, $t_{SC} \le 10$ µs, $L < 50$ nH



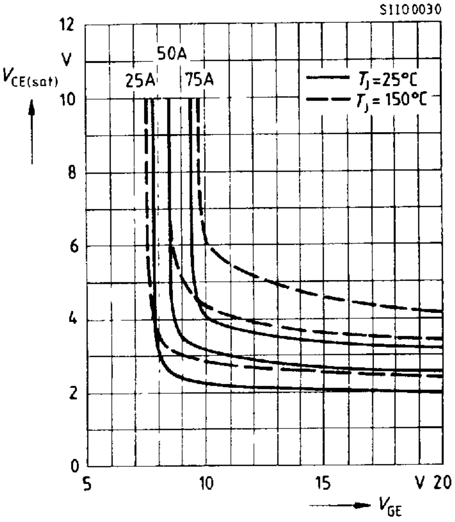
Transient thermal impedance

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

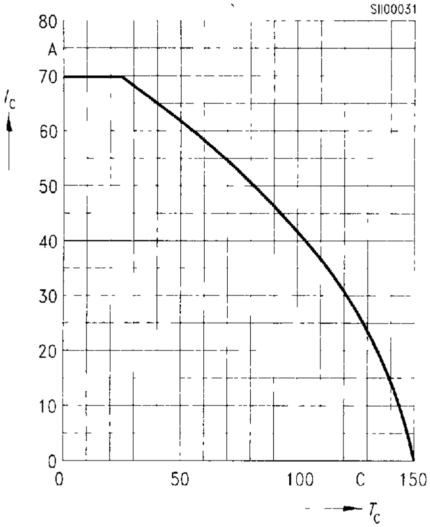


Typ. on-state characteristics

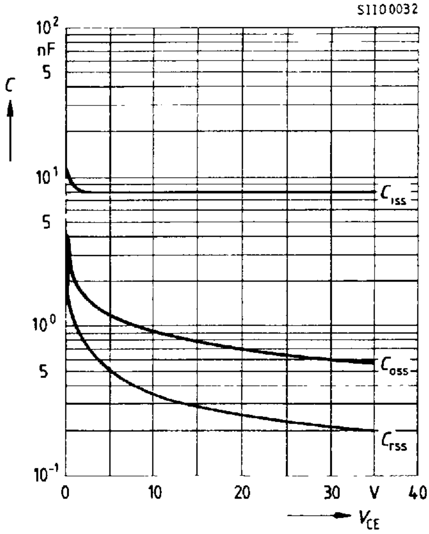
$V_{CE(sat)} = f(V_{GE})$, parameter: I_C, T_j



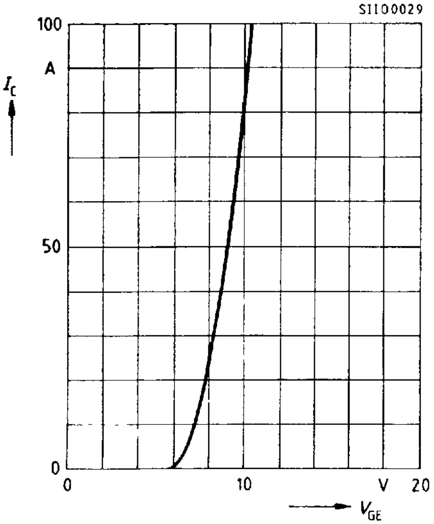
Collector current $I_C = f(T_C)$
parameter: $V_{GE} \geq 15$ V, $T_j = 150$ °C



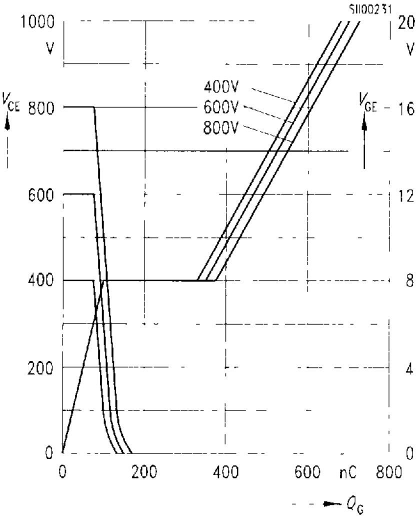
Typ. capacitances $C = f(V_{CE})$
parameter: $V_{GE} = 0$, $f = 1$ MHz



Typ. transfer characteristics $I_C = f(V_{GE})$
parameter: $t_p = 80$ µs, $V_{CE} = 20$ V



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



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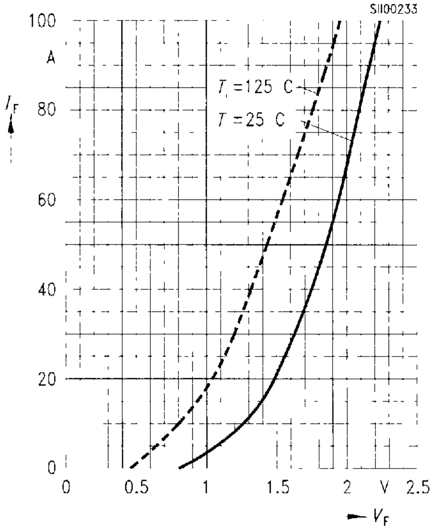
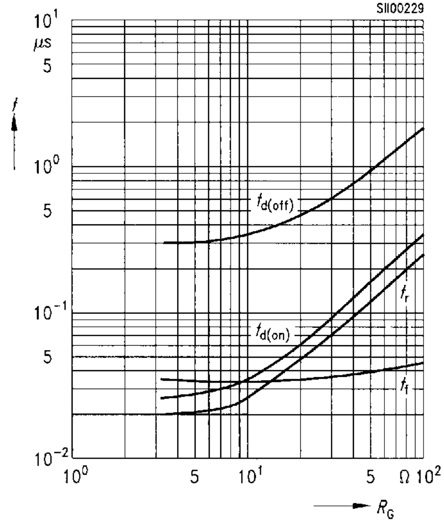
Forward characteristics of fast recovery reverse diode $I_F = f(V_F)$
parameter: T_j



Typ. switching time $t = f(R_G)$
Inductive load, parameter: T_j = 125 °C
V_{CE} = 600 V, V_{GE} = ± 15 V, I_C = 50 A



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