Technische Information / Technical Information

IGBT-Module
IGBT-Modules

BSM400GA120DLC



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Höchstzulässige Werte / Maximum rated values

Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	T_C = 80 °C T_C = 25 °C	$I_{C,nom.}$ I_C	400 625	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C = 80°C	I_{CRM}	800	A
Gesamt-Verlustleistung total power dissipation	T_C=25°C, Transistor	P_{tot}	2500	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V
Dauergleichstrom DC forward current		I_F	400	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	800	A
Grenzlastintegral der Diode I^2t - value, Diode	V_R = 0V, t_p = 10ms, T_{vj} = 125°C	I^2t	27,4	kA^2s
Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}	2,5	kV

Charakteristische Werte / Characteristic values

Transistor / Transistor			**min.**	**typ.**	**max.**	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	I_C = 400A, V_{GE} = 15V, T_{vj} = 25°C I_C = 400A, V_{GE} = 15V, T_{vj} = 125°C	$V_{CE\ sat}$	- -	2,1 2,4	2,6 t.b.d.	V V
Gate-Schwellenspannung gate threshold voltage	I_C = 16mA, V_{CE} = V_{GE}, T_{vj} = 25°C	$V_{GE(th)}$	4,5	5,5	6,5	V
Gateladung gate charge	V_{GE} = -15V...+15V	Q_G	-	4,2	-	µC
Eingangskapazität input capacitance	f = 1MHz,T_{vj} = 25°C,V_{CE} = 25V, V_{GE} = 0V	C_{ies}	-	26	-	nF
Rückwirkungskapazität reverse transfer capacitance	f = 1MHz,T_{vj} = 25°C,V_{CE} = 25V, V_{GE} = 0V	C_{res}	-	t.b.d.	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 25°C V_{CE} = 1200V, V_{GE} = 0V, T_{vj} = 125°C	I_{CES}	- -	20 500	500 -	µA µA
Gate-Emitter Reststrom gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25°C	I_{GES}	-	-	400	nA

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Charakteristische Werte / Characteristic values

Transistor / Transistor			**min.**	**typ.**	**max.**	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	I_C = 400A, V_{CC} = 600V					
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 25°C	$t_{d,on}$	-	0,09	-	µs
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 125°C		-	0,09	-	µs
Anstiegszeit (induktive Last) rise time (inductive load)	I_C = 400A, V_{CC} = 600V					
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 25°C	t_r	-	0,09	-	µs
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 125°C		-	0,1	-	µs
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	I_C = 400A, V_{CC} = 600V					
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 25°C	$t_{d,off}$	-	0,54	-	µs
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 125°C		-	0,59	-	µs
Fallzeit (induktive Last) fall time (inductive load)	I_C = 400A, V_{CC} = 600V					
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 25°C	t_f	-	0,06	-	µs
	V_{GE} = ±15V, R_G = 2,2Ω, T_{vj} = 125°C		-	0,09	-	µs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	I_C = 400A, V_{CC} = 600V, V_{GE} = 15V					
	R_G = 2,2Ω, T_{vj} = 125°C, L_S = 90nH	E_{on}	-	38	-	mWs
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	I_C = 400A, V_{CC} = 600V, V_{GE} = 15V					
	R_G = 2,2Ω, T_{vj} = 125°C, L_S = 90nH	E_{off}	-	51	-	mWs
Kurzschlußverhalten SC Data	$t_p \leq$ 10µsec, $V_{GE} \leq$ 15V, R_G = 2,2Ω					
	$T_{Vj} \leq$125°C, V_{CC}=900V, $V_{CEmax}=V_{CES}-L_{sCE} \cdot dI/dt$	I_{SC}	-	2350	-	A
Modulinduktivität stray inductance module		L_{sCE}	-	16	-	nH
Modul Leitungswiderstand, Anschlüsse – Chip module lead resistance, terminals – chip	T_C=25°C	$R_{CC'+EE'}$	-	0,5	-	mΩ

Charakteristische Werte / Characteristic values

Diode / Diode			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	I_F = 400A, V_{GE} = 0V, T_{vj} = 25°C	V_F	-	1,8	2,3	V
	I_F = 400A, V_{GE} = 0V, T_{vj} = 125°C		-	1,7	t.b.d.	V
Rückstromspitze peak reverse recovery current	I_F = 400A, - di_F/dt = 4100A/µsec					
	V_R = 600V, VGE = -15V, T_{vj} = 25°C	I_{RM}	-	325	-	A
	V_R = 600V, VGE = -15V, T_{vj} = 125°C		-	430	-	A
Sperrverzögerungsladung recovered charge	I_F = 400A, - di_F/dt = 4100A/µsec					
	V_R = 600V, VGE = -15V, T_{vj} = 25°C	Q_r	-	41	-	µAs
	V_R = 600V, VGE = -15V, T_{vj} = 125°C		-	80	-	µAs
Abschaltenergie pro Puls reverse recovery energy	I_F = 400A, - di_F/dt = 4100A/µsec					
	V_R = 600V, VGE = -15V, T_{vj} = 25°C	E_{rec}	-	16	-	mWs
	V_R = 600V, VGE = -15V, T_{vj} = 125°C		-	33	-	mWs



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Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC Diode/Diode, DC	R_{thJC}	- -	- -	0,05 0,09	K/W K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module λ_{Paste} = 1 W/m * K / λ_{grease} = 1 W/m * K	R_{thCK}	-	0,010	-	K/W
Höchstzulässige Sperrschichttemperatur maximum junction temperature		T_{vj}	-	-	150	°C
Betriebstemperatur operation temperature		T_{op}	-40	-	125	°C
Lagertemperatur storage temperature		T_{stg}	-40	-	150	°C

Mechanische Eigenschaften / Mechanical properties

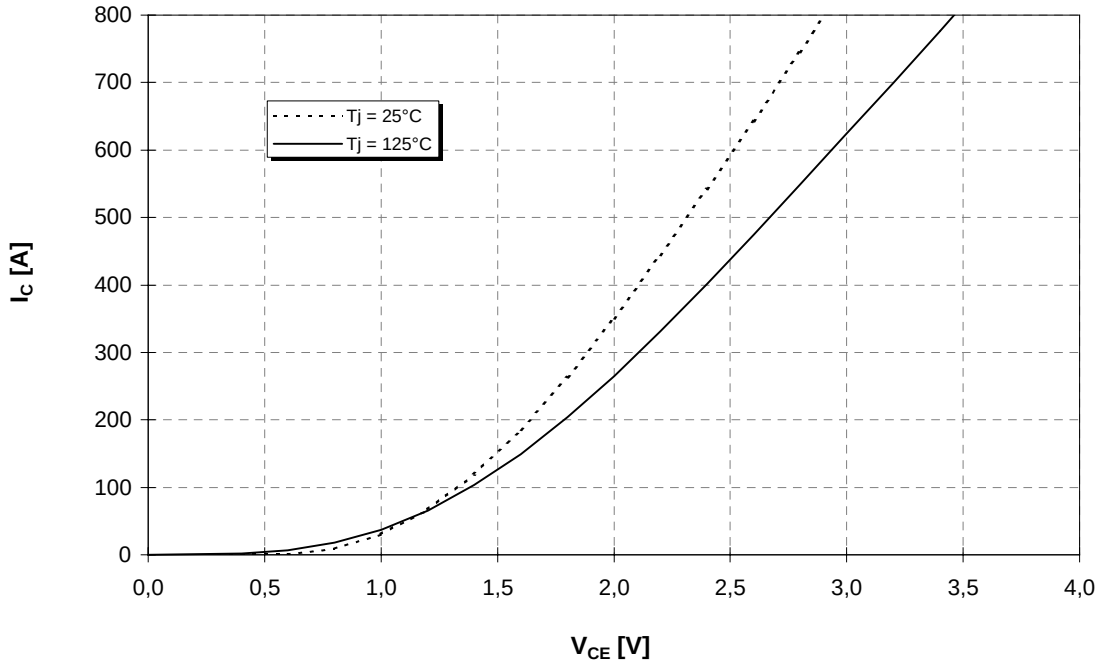
Gehäuse, siehe Anlage case, see appendix						
Innere Isolation internal insulation				AL_2O_3		
Kriechstrecke creepage distance				20		mm
Luftstrecke clearance				11		mm
CTI comperative tracking index				225		
Anzugsdrehmoment f. mech. Befestigung mounting torque	screw M5	M1	3		6	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	terminals M6 terminals M4		2,5 1,1		5,0 2,0	Nm Nm
Gewicht weight		G		300		g

Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

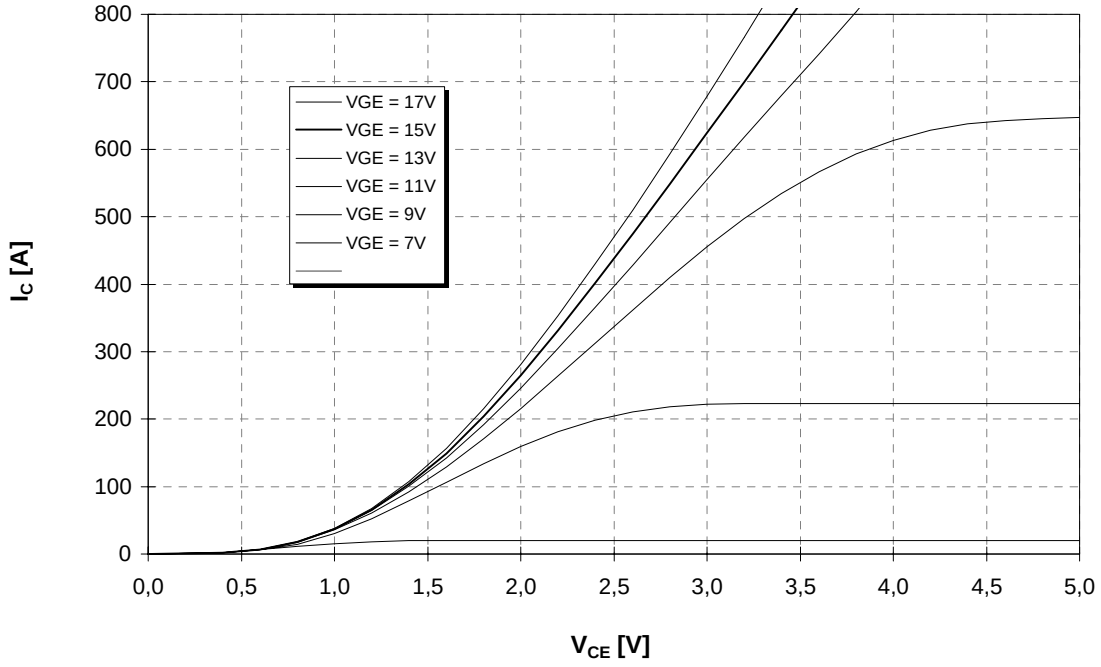
This technical information specifies semiconductor devices but promises no characteristics. It is valid in combination with the belonging technical notes.

Ausgangskennlinie (typisch) $I_C = f(V_{CE})$
Output characteristic (typical) $V_{GE} = 15V$

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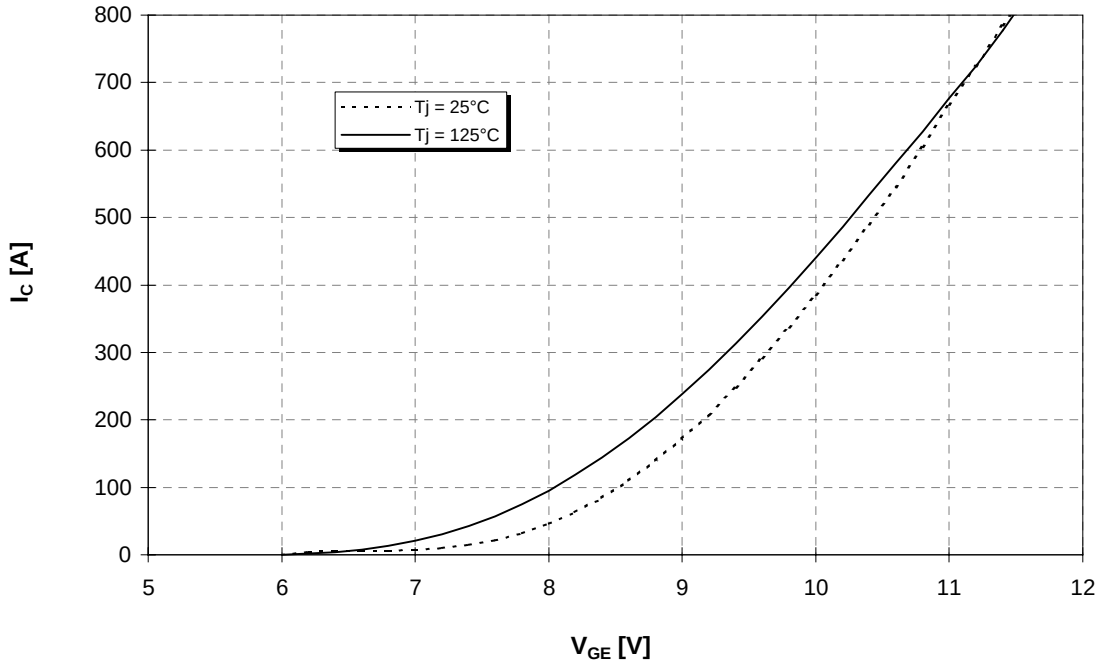


Ausgangskennlinienfeld (typisch) $I_C = f(V_{CE})$
Output characteristic (typical) $T_{vj} = 125°C$

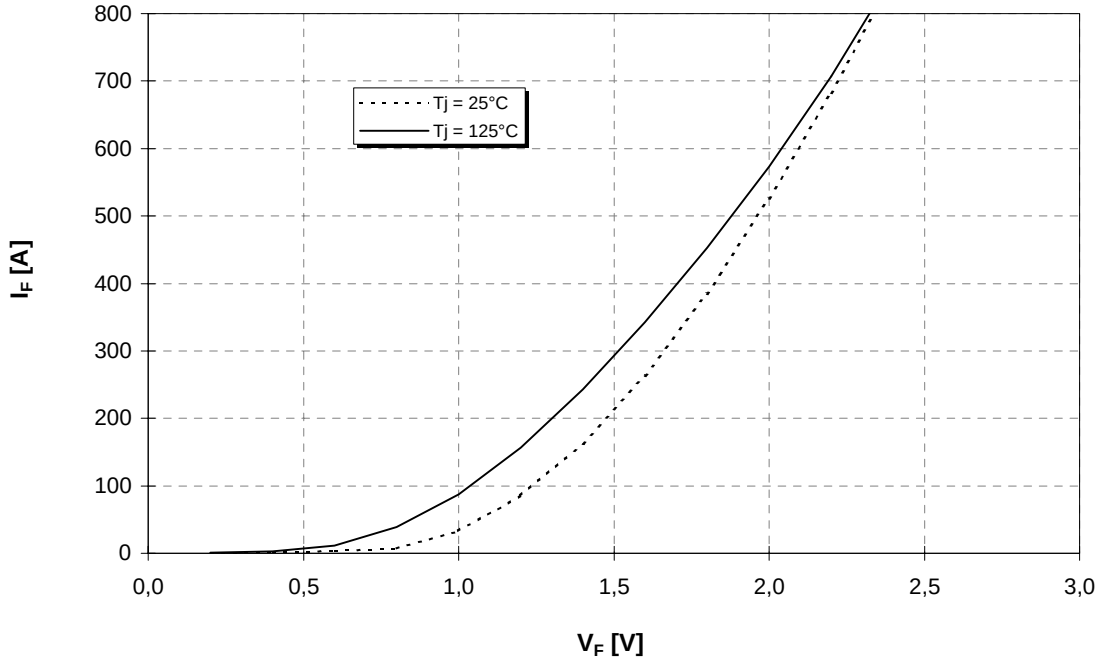


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Übertragungscharakteristik (typisch) $I_C = f(V_{GE})$
Transfer characteristic (typical) $V_{CE} = 20V$

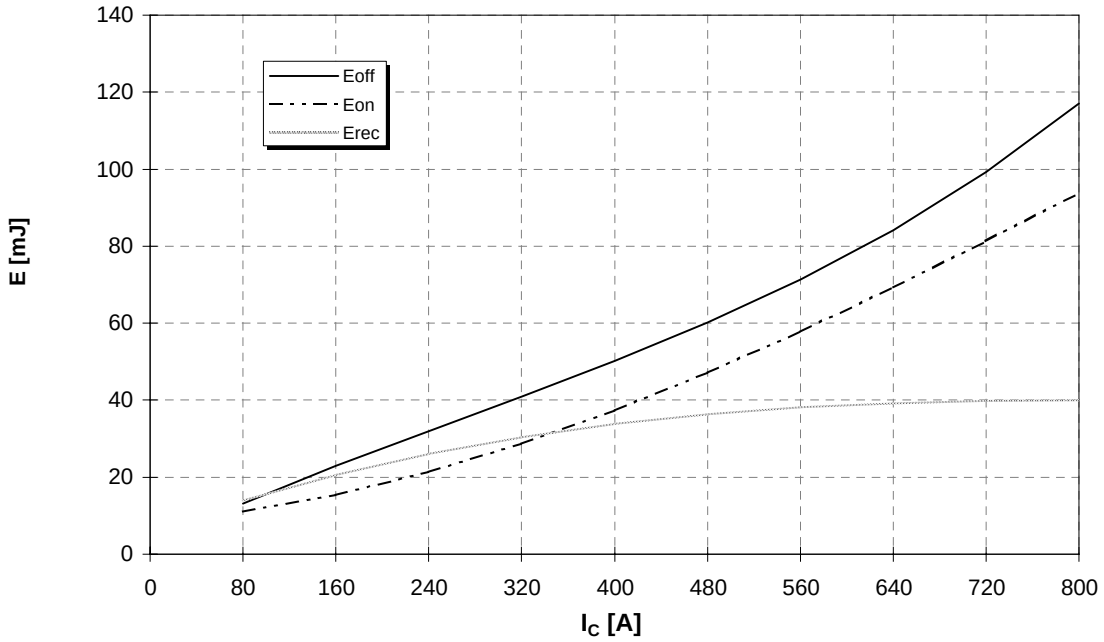


Durchlaßkennlinie der Inversdiode (typisch) $I_F = f(V_F)$
Forward characteristic of inverse diode (typical)

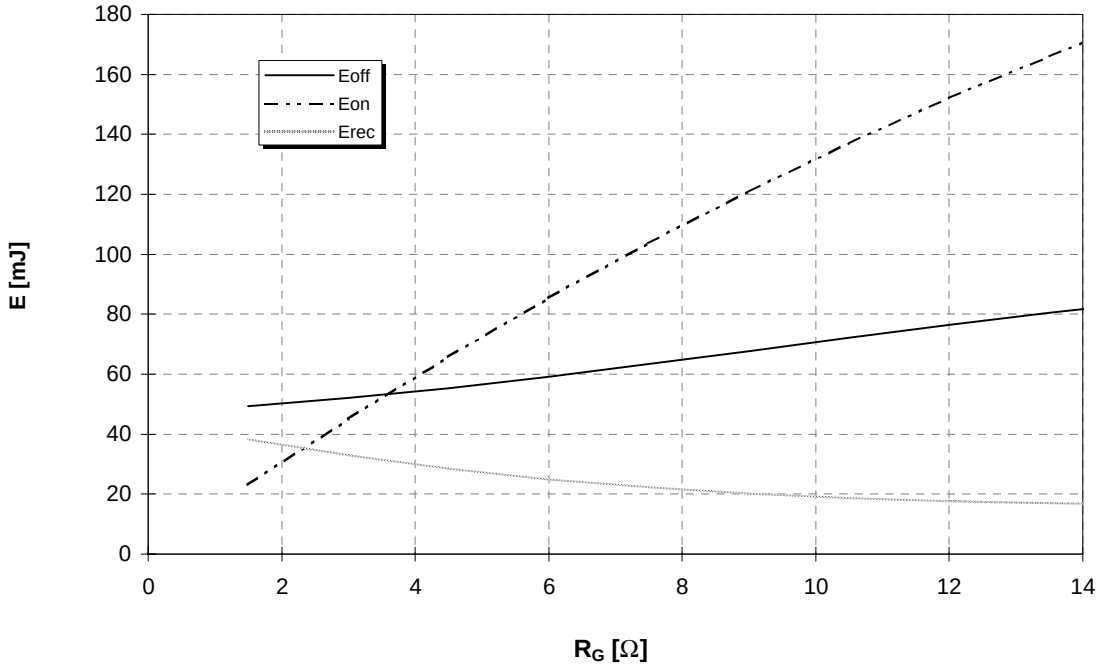


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Schaltverluste (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$
Switching losses (typical) V_{GE}=15V, $R_{gon} = R_{goff}$ = 2,2 Ω, V_{CE} = 600V, T_j = 125°C



Schaltverluste (typisch) $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
Switching losses (typical) V_{GE}=15V , I_C = 400A , V_{CE} = 600V , T_j = 125°C

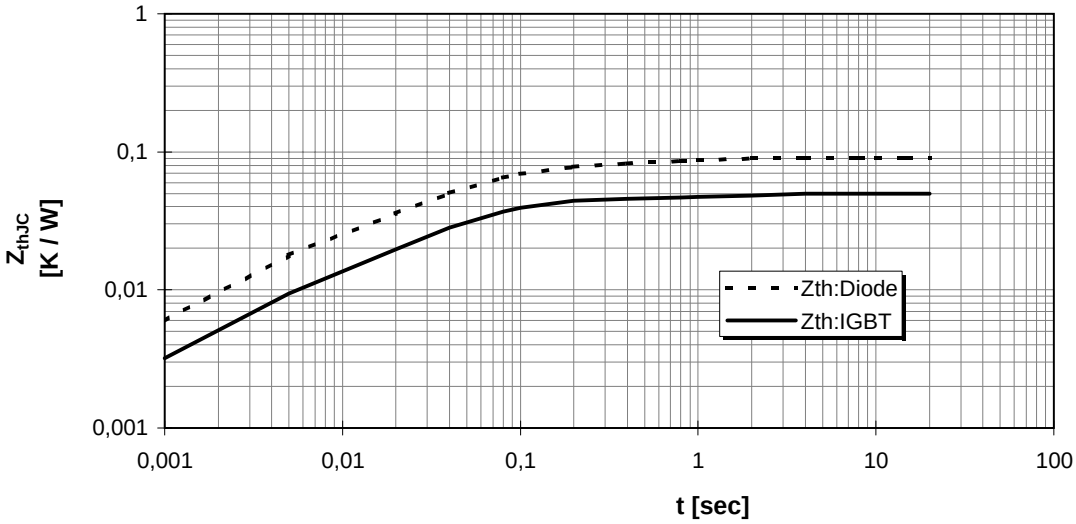


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Transienter Wärmewiderstand $Z_{thJC} = f(t)$

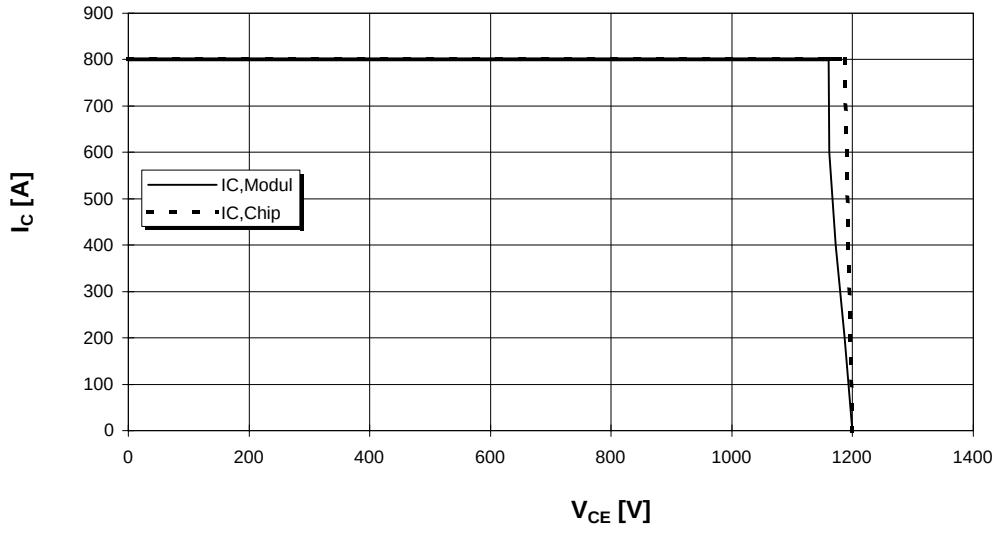
Transient thermal impedance



i		1	2	3	4
r_i [K/kW]	: IGBT	5,59	16,93	22,06	5,43
τ_i [sec]	: IGBT	0,002	0,03	0,066	1,655
r_i [K/kW]	: Diode	11,78	31,20	34,04	12,99
τ_i [sec]	: Diode	0,002	0,03	0,072	0,682

Sicherer Arbeitsbereich (RBSOA)

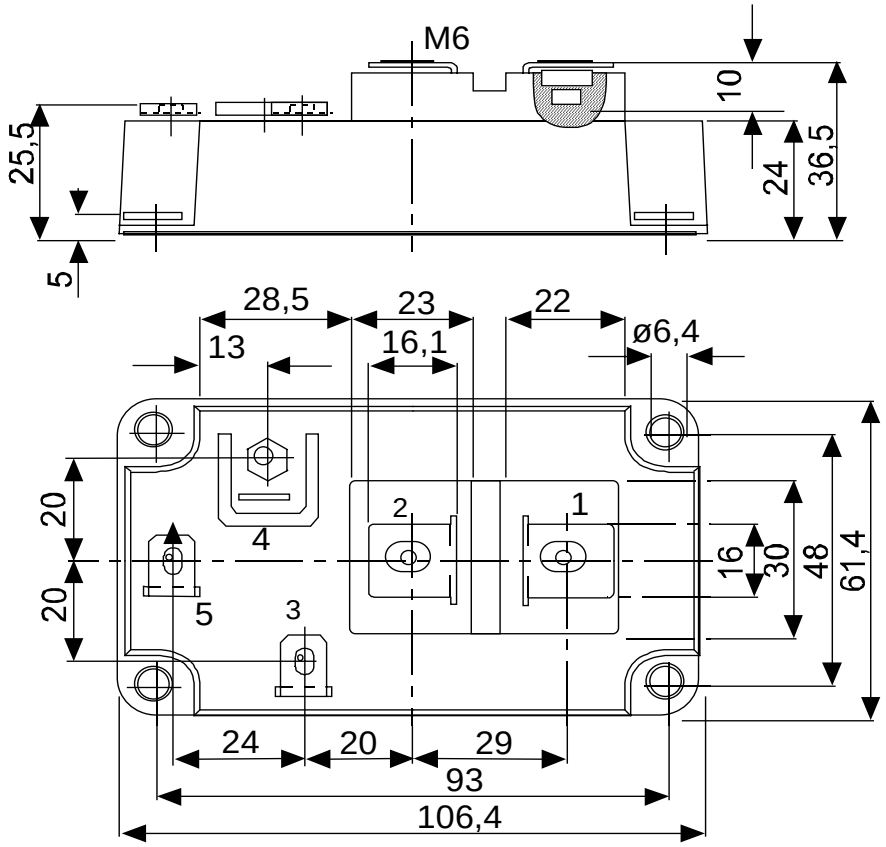
Reverse bias safe operation area (RBSOA) V_{GE} = 15V, R_g = 2,2 Ohm, T_{vj} = 125°C

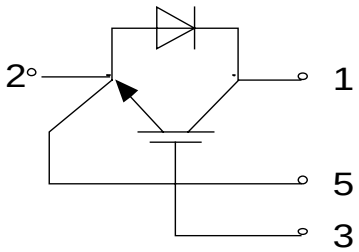


Single Switch 62

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