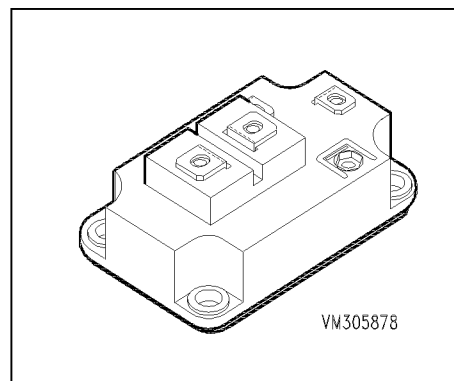


IGBT Power Module

Preliminary data

- Low Loss IGBT
- Single switch
- Including fast free-wheeling diodes
- Package with insulated metal base plate



Type	V_{CE}	I_C	Package	Ordering Code
BSM 400 GA 120 DL	1200V	650A	SINGLE SWITCH	C67076-A2302-A70

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE}	1200	V
Collector-gate voltage	V_{CGR}	1200	
$R_{GE} = 20\text{ k}\Omega$			
Gate-emitter voltage	V_{GE}	± 20	
DC collector current	I_C		A
$T_C = 25\text{ }^{\circ}\text{C}$		650	
$T_C = 90\text{ }^{\circ}\text{C}$		400	
Pulsed collector current, $t_p = 1\text{ ms}$	I_{Cpuls}		
$T_C = 25\text{ }^{\circ}\text{C}$		1300	
$T_C = 90\text{ }^{\circ}\text{C}$		800	
Power dissipation per IGBT	P_{tot}		W
$T_C = 25\text{ }^{\circ}\text{C}$		2700	
Chip temperature	T_j	+ 150	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-40 ... + 125	
Thermal resistance, chip case	R_{thJC}	≤ 0.045	K/W
Diode thermal resistance, chip case	R_{thJCD}	≤ 0.09	
Insulation test voltage, $t = 1\text{ min.}$	V_{is}	2500	Vac
Creepage distance	-	20	mm
Clearance	-	11	
DIN humidity category, DIN 40 040	-	F	sec
IEC climatic category, DIN IEC 68-1	-	40 / 125 / 56	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Static Characteristics

Gate threshold voltage $V_{GE} = V_{CE}, I_C = 16\text{ mA}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 400\text{ A}, T_j = 25\text{ °C}$ $V_{GE} = 15\text{ V}, I_C = 400\text{ A}, T_j = 125\text{ °C}$	$V_{CE(sat)}$	- -	2.2 2.5	2.6 3	
Zero gate voltage collector current $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ °C}$ $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 125\text{ °C}$	I_{CES}	- -	- -	15 -	mA
Gate-emitter leakage current $V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	I_{GES}	-	-	400	

AC Characteristics

Transconductance $V_{CE} = 20\text{ V}, I_C = 400\text{ A}$	g_{fs}	-	-	-	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{iss}	-	26	-	nF
Output capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{oss}	-	4	-	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{rss}	-	2	-	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

Switching Characteristics, Inductive Load at $T_j = 125\text{ °C}$

Turn-on delay time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 400\text{ A}$ $R_{Gon} = 2.7\text{ }\Omega$	$t_{d(on)}$	-	300	-	ns
Rise time $V_{CC} = 600\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 400\text{ A}$ $R_{Gon} = 2.7\text{ }\Omega$	t_r	-	170	-	
Turn-off delay time $V_{CC} = 600\text{ V}$, $V_{GE} = -15\text{ V}$, $I_C = 400\text{ A}$ $R_{Goff} = 2.7\text{ }\Omega$	$t_{d(off)}$	-	900	-	
Fall time $V_{CC} = 600\text{ V}$, $V_{GE} = -15\text{ V}$, $I_C = 400\text{ A}$ $R_{Goff} = 2.7\text{ }\Omega$	t_f	-	100	-	

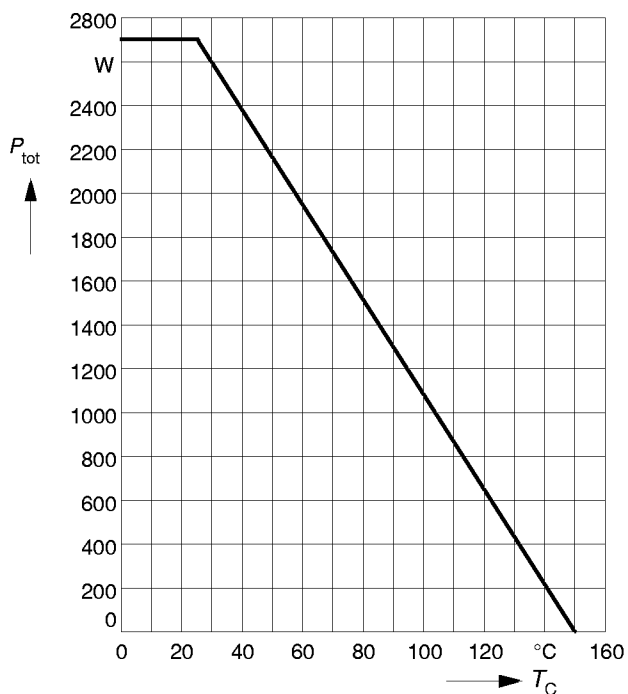
Free-Wheel Diode

Diode forward voltage $I_F = 400\text{ A}$, $V_{GE} = 0\text{ V}$, $T_j = 25\text{ °C}$ $I_F = 400\text{ A}$, $V_{GE} = 0\text{ V}$, $T_j = 125\text{ °C}$	V_F	-	2.3 1.8	2.8 -	V
Reverse recovery time $I_F = 400\text{ A}$, $V_R = -600\text{ V}$, $V_{GE} = 0\text{ V}$ $di_F/dt = -3000\text{ A}/\mu\text{s}$, $T_j = 125\text{ °C}$	t_{rr}	-	0.6	-	
Reverse recovery charge $I_F = 400\text{ A}$, $V_R = -600\text{ V}$, $V_{GE} = 0\text{ V}$ $di_F/dt = -3000\text{ A}/\mu\text{s}$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	Q_{rr}	-	16 45	- -	μC
		-			

Power dissipation

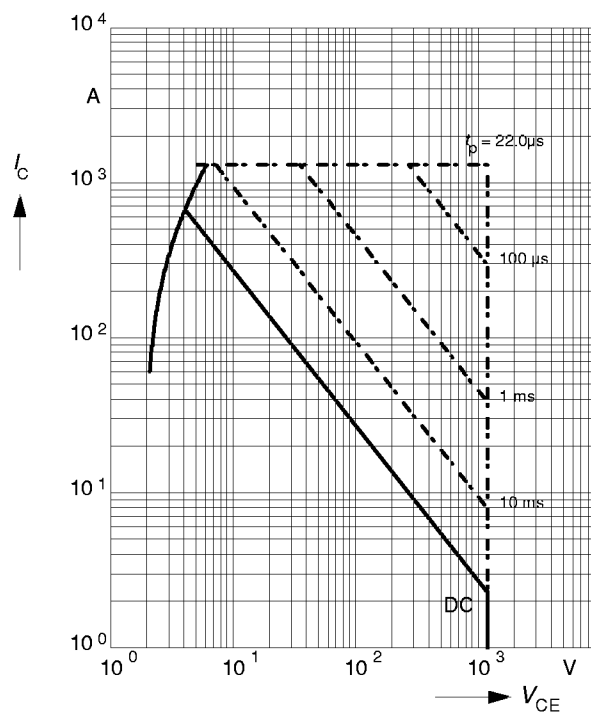
$$P_{\text{tot}} = f(T_C)$$

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

**Safe operating area**

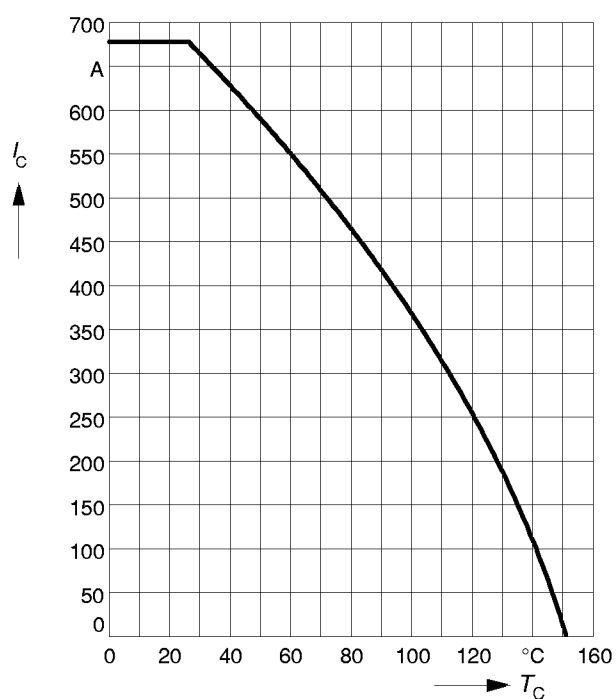
$$I_C = f(V_{CE})$$

parameter: $D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 150^\circ\text{C}$

**Collector current**

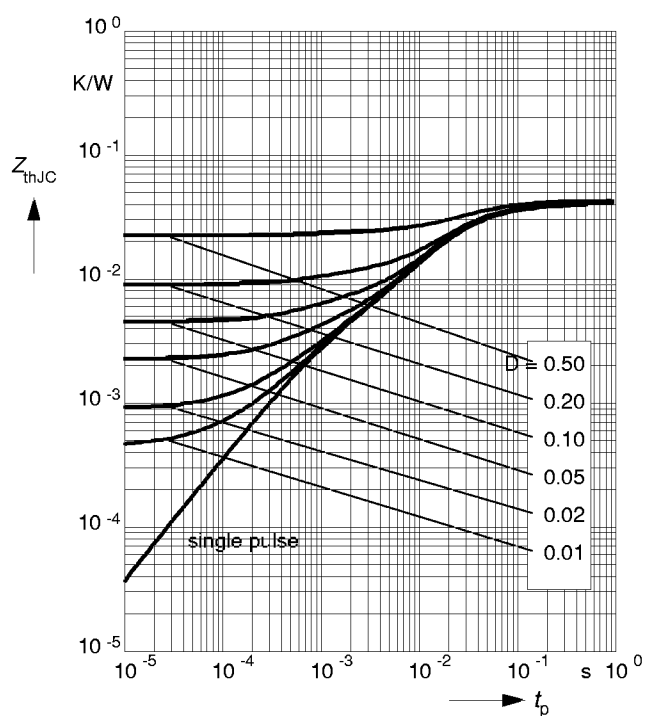
$$I_C = f(T_C)$$

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

**Transient thermal impedance IGBT**

$$Z_{\text{thJC}} = f(t_p)$$

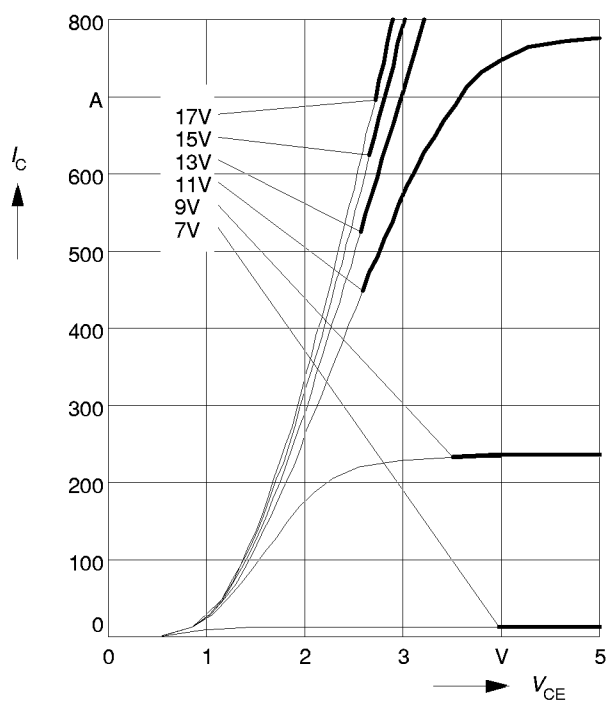
parameter: $D = t_p / T$



Typ. output characteristics

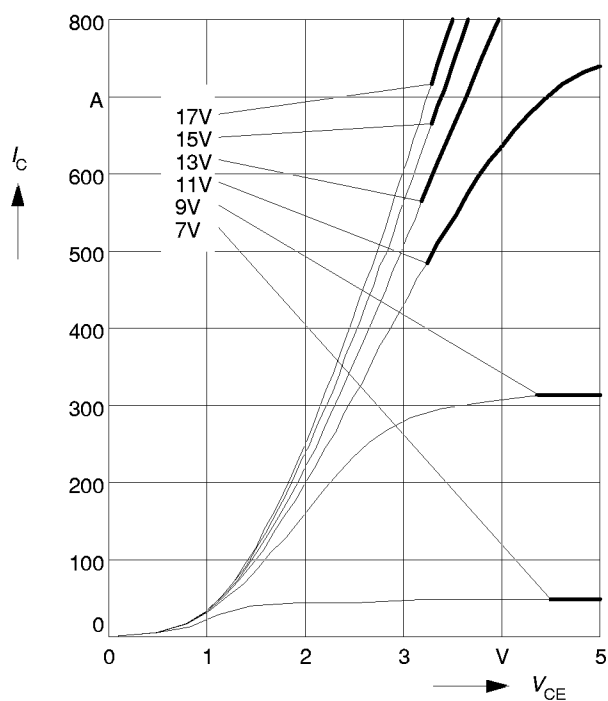
$$I_C = f(V_{CE})$$

parameter: $t_p = 250 \mu s$, $T_j = 25^\circ C$

**Typ. output characteristics**

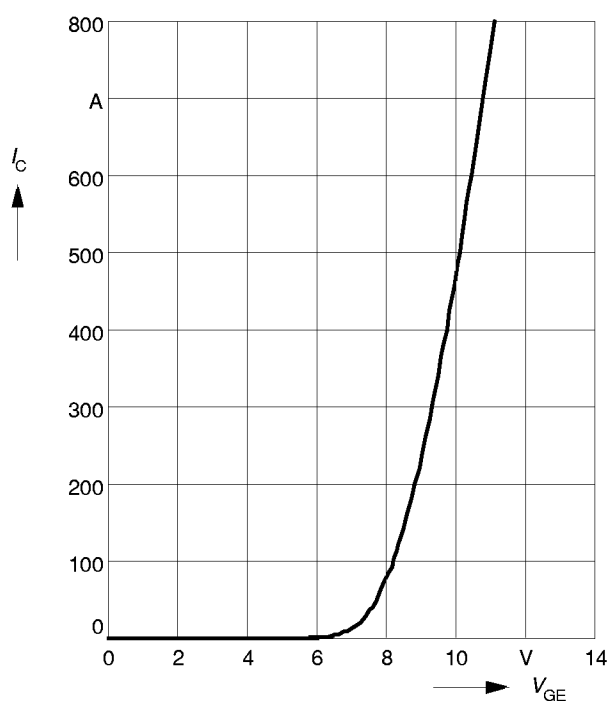
$$I_C = f(V_{CE})$$

parameter: $t_p = 250 \mu s$, $T_j = 125^\circ C$

**Typ. transfer characteristics**

$$I_C = f(V_{GE})$$

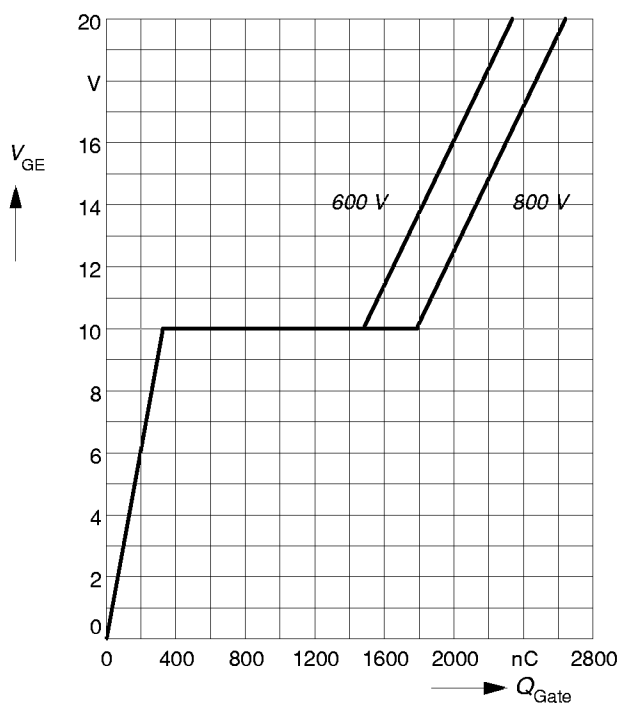
parameter: $t_p = 250 \mu s$, $V_{CE} = 20 V$



Typ. gate charge

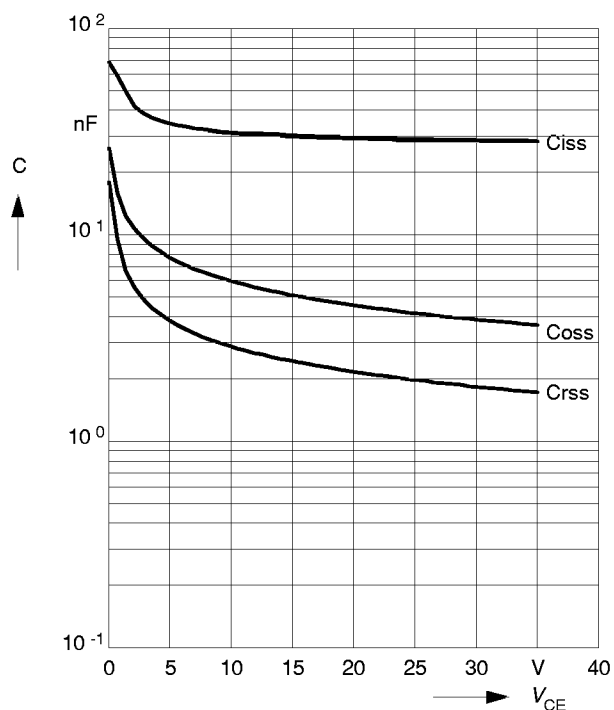
$$V_{GE} = f(Q_{Gate})$$

parameter: $I_{C\ puls} = 400\ A$

**Typ. capacitances**

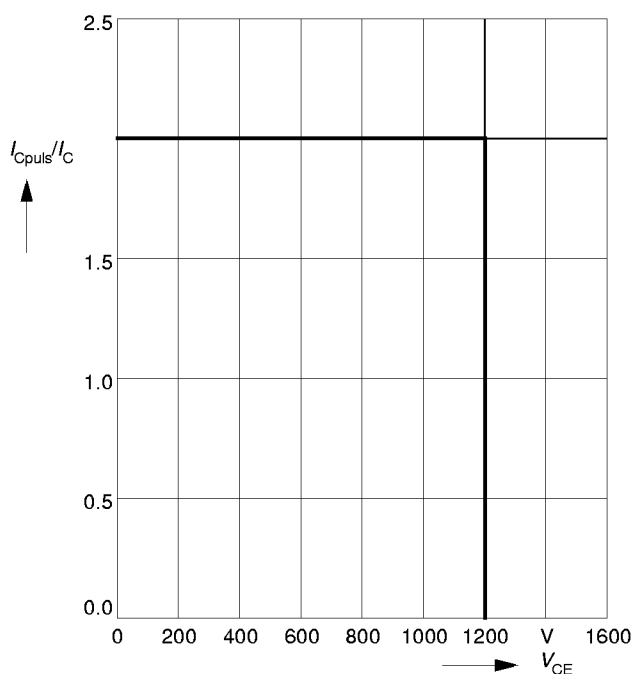
$$C = f(V_{CE})$$

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

**Reverse biased safe operating area**

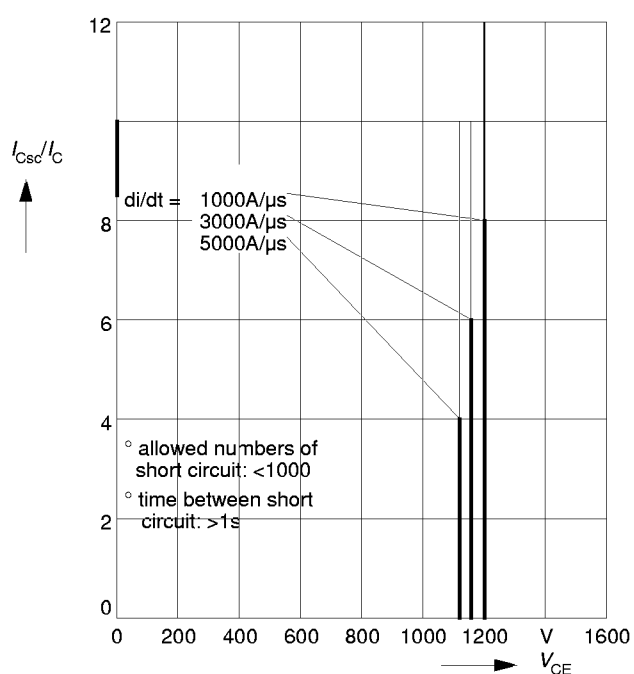
$$I_{C\ puls} = f(V_{CE}), T_j = 150^\circ C$$

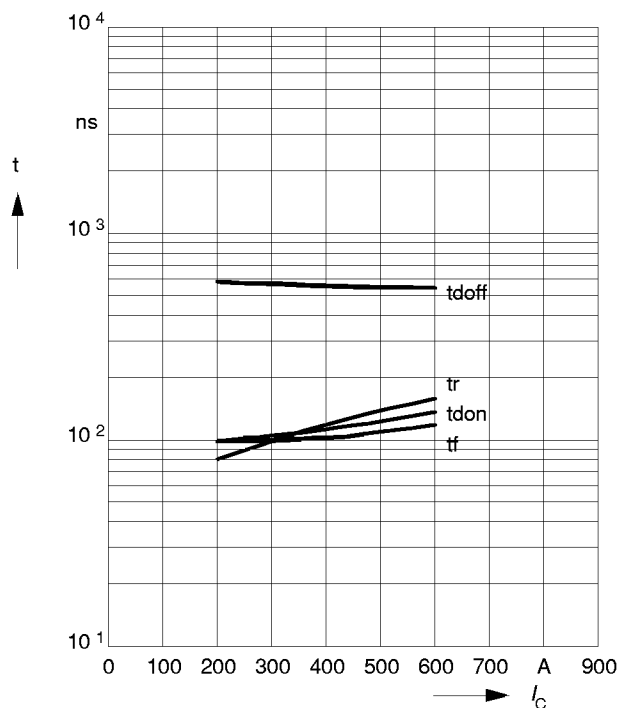
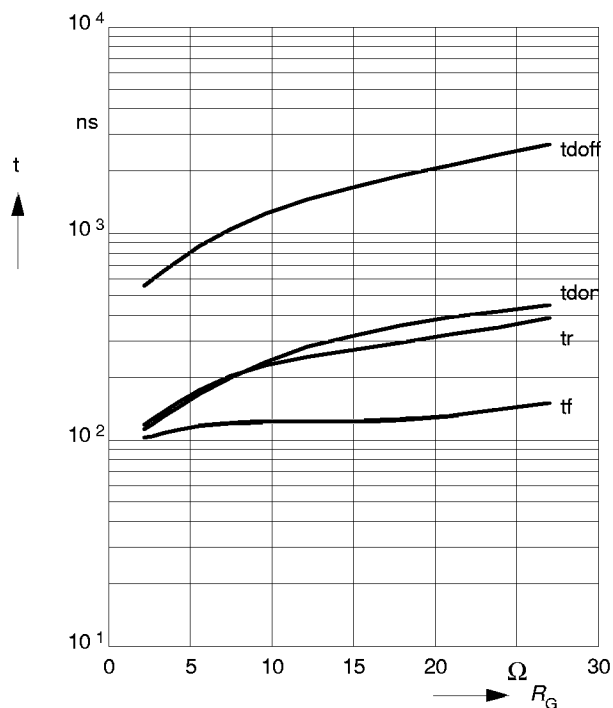
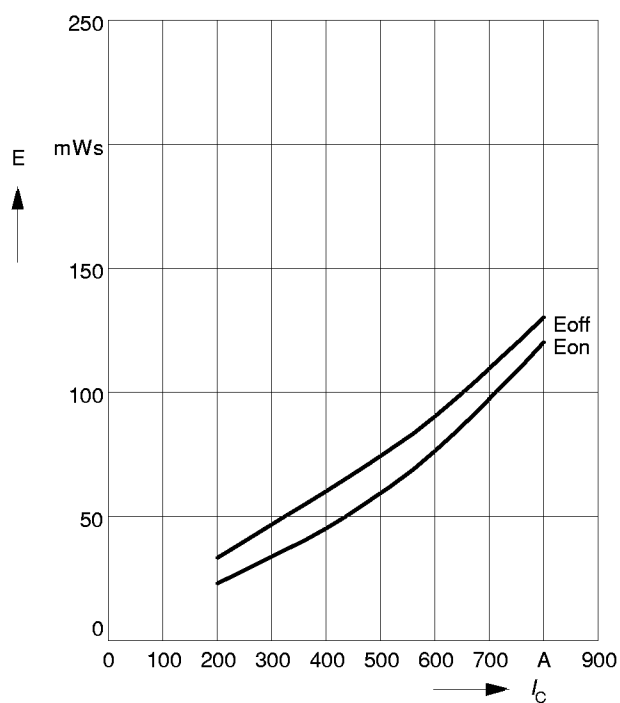
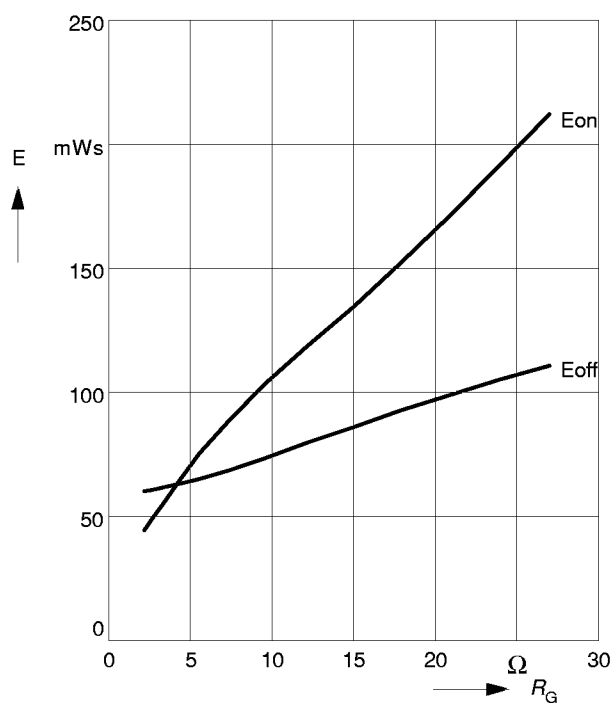
parameter: $V_{GE} = 15\ V$

**Short circuit safe operating area**

$$I_{C\ sc} = f(V_{CE}), T_j = 150^\circ C$$

parameter: $V_{GE} = \pm 15\ V$, $t_{SC} \leq 10\ \mu s$, $L < 20\ nH$

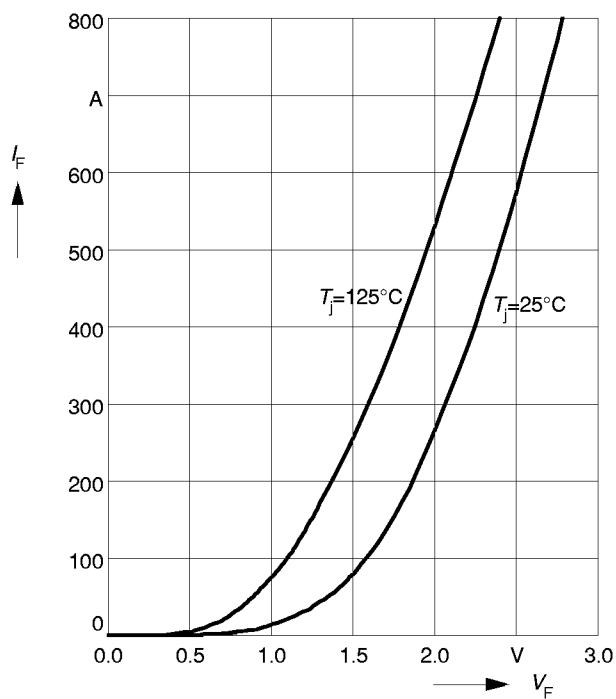


Typ. switching time $t = f(I_C)$, inductive load, $T_j = 125^\circ\text{C}$ par.: $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_G = 2.2\ \Omega$ **Typ. switching time** $t = f(R_G)$, inductive load, $T_j = 125^\circ\text{C}$ par.: $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $I_C = 400\text{ A}$ **Typ. switching losses** $E = f(I_C)$, inductive load, $T_j = 125^\circ\text{C}$ par.: $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_G = 2.2\ \Omega$ **Typ. switching losses** $E = f(R_G)$, inductive load, $T_j = 125^\circ\text{C}$ par.: $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $I_C = 400\text{ A}$ 

Forward characteristics of fast recovery reverse diode

$$I_F = f(V_F)$$

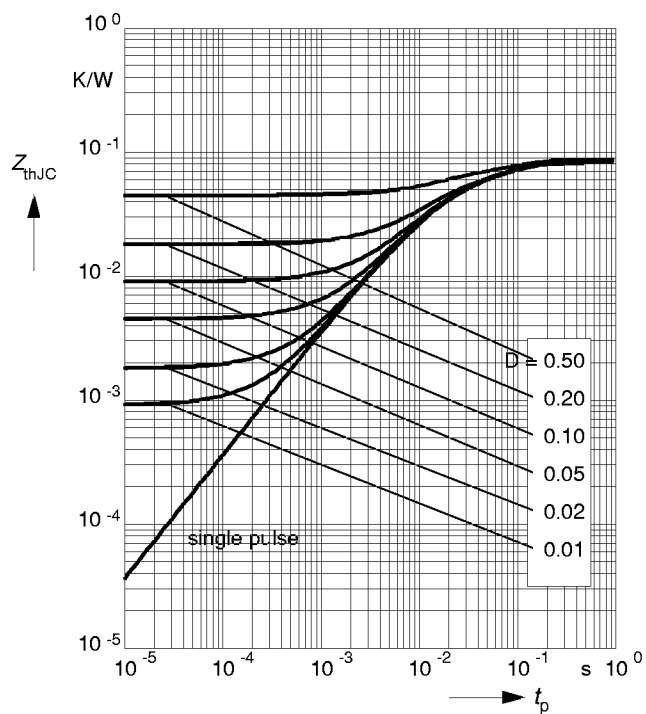
parameter: T_j



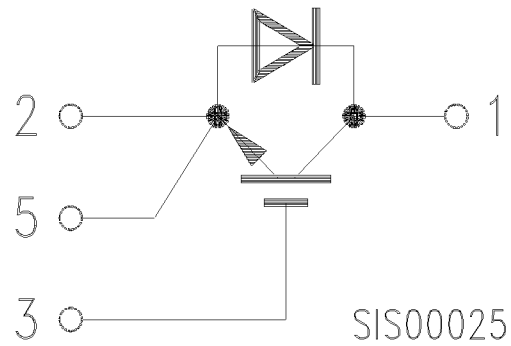
Transient thermal impedance Diode

$$Z_{thJC} = f(t_p)$$

parameter: $D = t_p / T$



Circuit Diagram



Package Outlines

Dimensions in mm

Weight: 420 g

