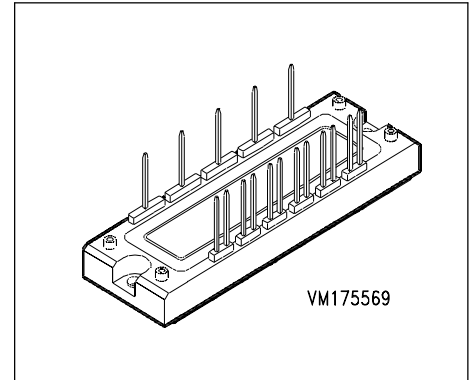


**IGBT Power Module**

- Power module
- 3-phase full-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate



Type	$V_{CE}$	$I_C$	Package	Ordering Code
BSM 35 GD 120 DN2	1200V	50A	ECONOPACK 2	C67076-A2506-A67
BSM35GD120DN2E3224	1200V	50A	ECONOPACK 2K	C67070-A2506-A67

**Maximum Ratings**

Parameter	Symbol	Values	Unit
Collector-emitter voltage	$V_{CE}$	1200	V
Collector-gate voltage $R_{GE} = 20 \text{ k}\Omega$	$V_{CGR}$	1200	
Gate-emitter voltage	$V_{GE}$	$\pm 20$	
DC collector current $T_C = 25 \text{ }^\circ\text{C}$ $T_C = 80 \text{ }^\circ\text{C}$	$I_C$	50 35	A
Pulsed collector current, $t_p = 1 \text{ ms}$ $T_C = 25 \text{ }^\circ\text{C}$ $T_C = 80 \text{ }^\circ\text{C}$	$I_{Cpuls}$	100 70	
Power dissipation per IGBT $T_C = 25 \text{ }^\circ\text{C}$	$P_{tot}$	280	W
Chip temperature	$T_j$	+ 150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-40 ... + 125	
Thermal resistance, chip case	$R_{thJC}$	$\leq 0.44$	K/W
Diode thermal resistance, chip case	$R_{thJCD}$	$\leq 0.8$	
Insulation test voltage, $t = 1 \text{ min.}$	$V_{is}$	2500	Vac
Creepage distance	-	16	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 $V_{GE} = V_{CE}, I_C = 1.2\text{ mA}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 35\text{ A}, T_j = 25\text{ °C}$ $V_{GE} = 15\text{ V}, I_C = 35\text{ A}, T_j = 125\text{ °C}$	$V_{CE(sat)}$	-	2.7 3.3	3.2 3.9	
Zero gate voltage collector current $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ °C}$ $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 125\text{ °C}$	$I_{CES}$	-	0.6 2.4	1 -	mA
Gate-emitter leakage current $V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	150	nA

### AC Characteristics

Transconductance $V_{CE} = 20\text{ V}, I_C = 35\text{ A}$	$g_{fs}$	11	-	-	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{iss}$	-	2	-	nF
Output capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{oss}$	-	0.3	-	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{rss}$	-	0.14	-	

**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 $V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 35\text{ A}$ $R_{Gon} = 39\ \Omega$	$t_{d(on)}$	-	60	120	ns
Rise time $V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 35\text{ A}$ $R_{Gon} = 39\ \Omega$	$t_r$	-	60	120	
Turn-off delay time $V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 35\text{ A}$ $R_{Goff} = 39\ \Omega$	$t_{d(off)}$	-	400	600	
Fall time $V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 35\text{ A}$ $R_{Goff} = 39\ \Omega$	$t_f$	-	50	75	

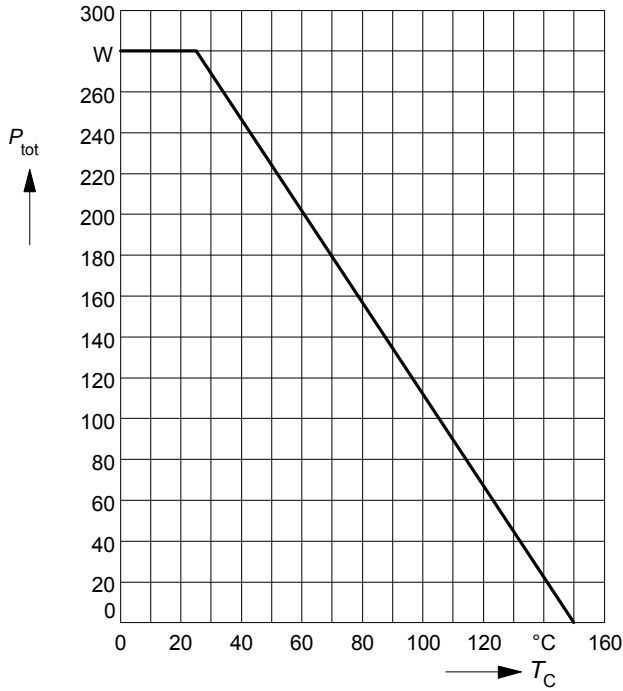
**Free-Wheel Diode**

Diode forward voltage $I_F = 35\text{ A}$ , $V_{GE} = 0\text{ V}$ , $T_j = 25\text{ °C}$ $I_F = 35\text{ A}$ , $V_{GE} = 0\text{ V}$ , $T_j = 125\text{ °C}$	$V_F$	-	2.3 1.9	2.9 -	V
Reverse recovery time $I_F = 35\text{ A}$ , $V_R = -600\text{ V}$ , $V_{GE} = 0\text{ V}$ $di_F/dt = -800\text{ A}/\mu\text{s}$ , $T_j = 125\text{ °C}$	$t_{rr}$	-	0.25	-	$\mu\text{s}$
Reverse recovery charge $I_F = 35\text{ A}$ , $V_R = -600\text{ V}$ , $V_{GE} = 0\text{ V}$ $di_F/dt = -800\text{ A}/\mu\text{s}$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	$Q_{rr}$	-	2 5	- -	$\mu\text{C}$

Power dissipation

$P_{tot} = f(T_C)$

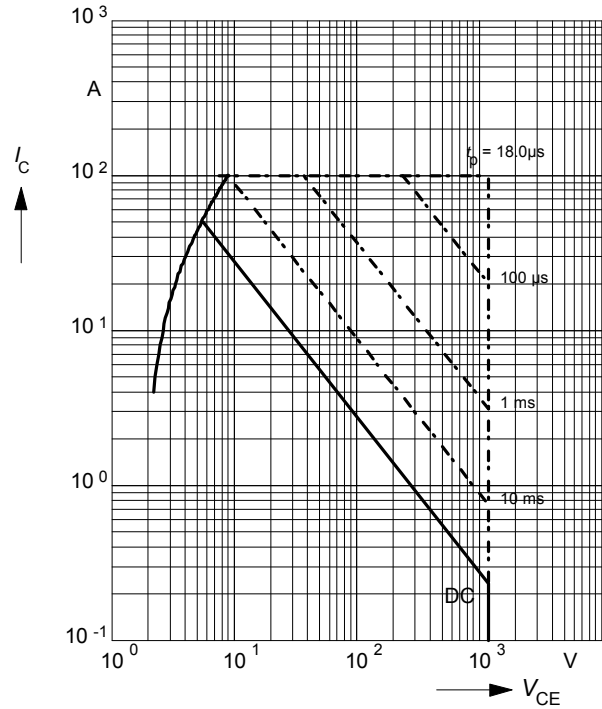
parameter:  $T_j \leq 150\text{ }^\circ\text{C}$



Safe operating area

$I_C = f(V_{CE})$

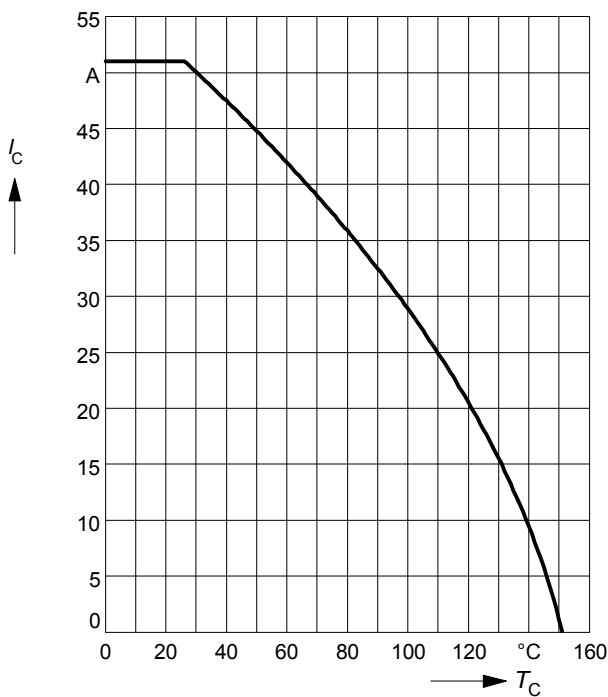
parameter:  $D = 0, T_C = 25\text{ }^\circ\text{C}, T_j \leq 150\text{ }^\circ\text{C}$



Collector current

$I_C = f(T_C)$

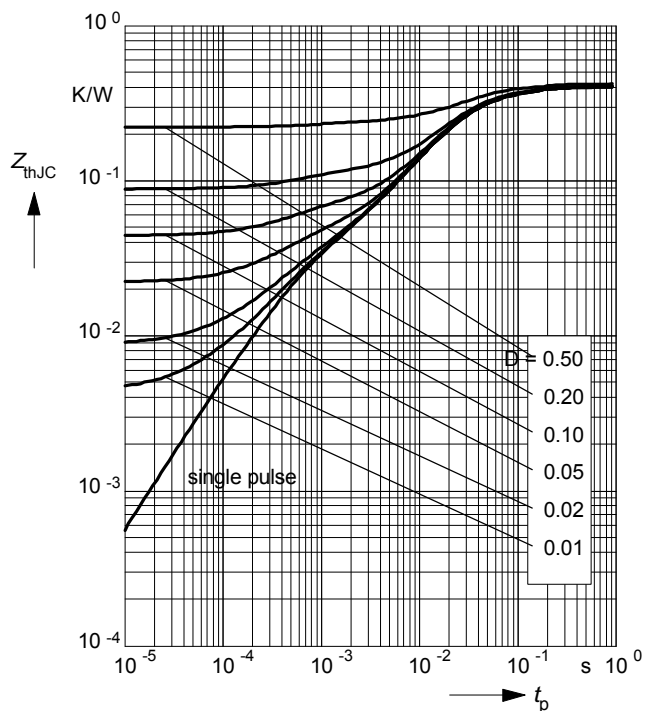
parameter:  $V_{GE} \geq 15\text{ V}, T_j \leq 150\text{ }^\circ\text{C}$



Transient thermal impedance IGBT

$Z_{thJC} = f(t_p)$

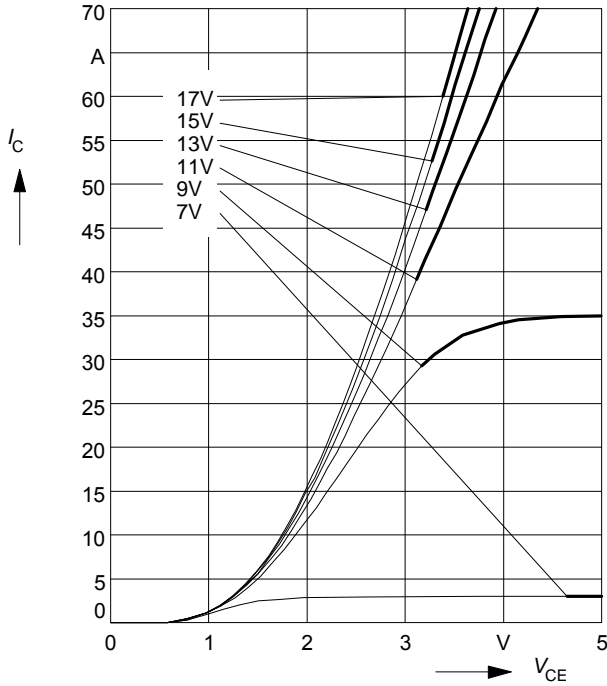
parameter:  $D = t_p / T$



**Typ. output characteristics**

$I_C = f(V_{CE})$

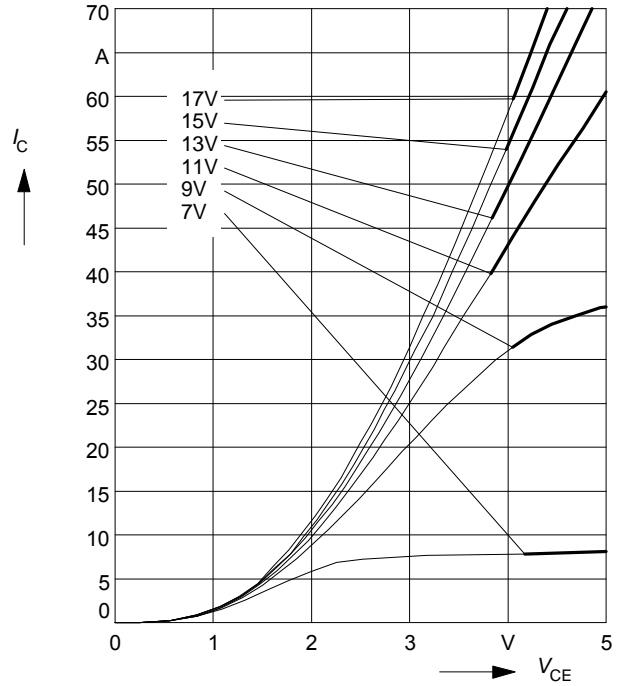
parameter:  $t_p = 80 \mu s, T_j = 25 \text{ }^\circ\text{C}$



**Typ. output characteristics**

$I_C = f(V_{CE})$

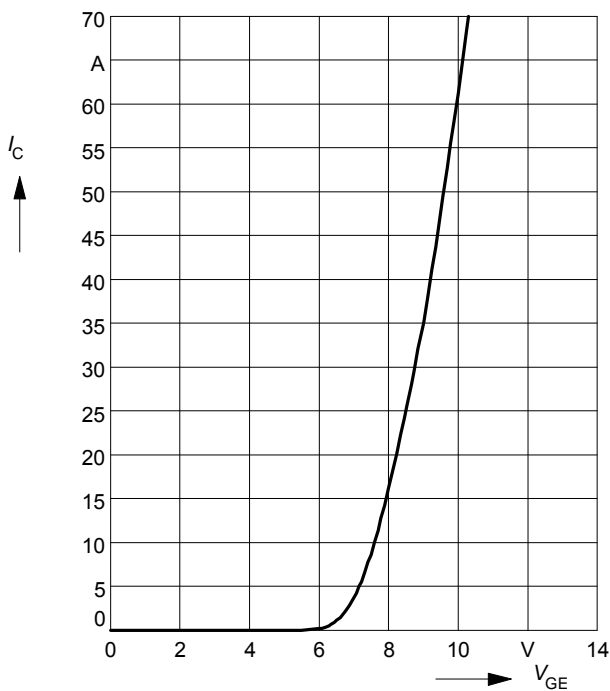
parameter:  $t_p = 80 \mu s, T_j = 125 \text{ }^\circ\text{C}$



**Typ. transfer characteristics**

$I_C = f(V_{GE})$

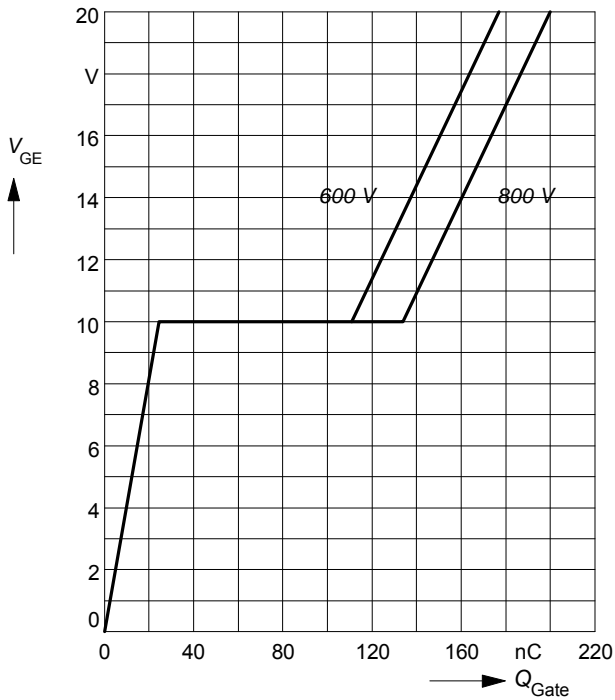
parameter:  $t_p = 80 \mu s, V_{CE} = 20 \text{ V}$



Typ. gate charge

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

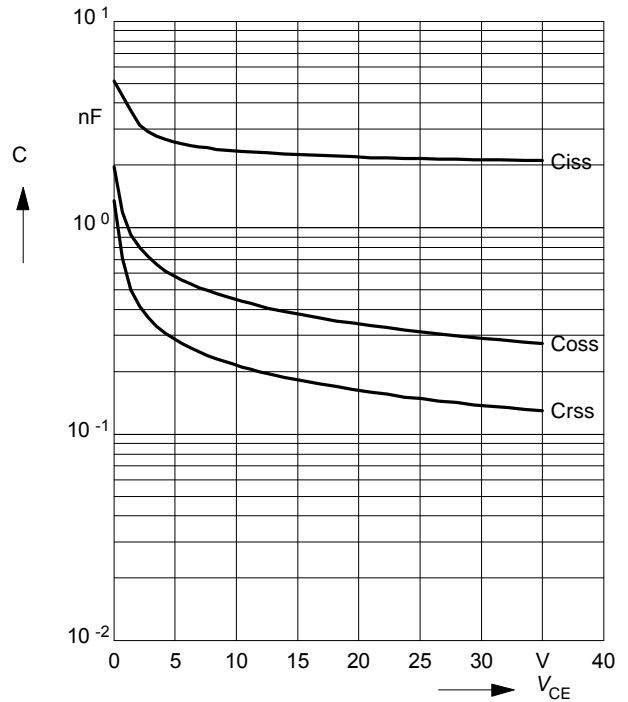
parameter:  $I_{C\ puls} = 35\ A$



Typ. capacitances

$C = f(V_{CE})$

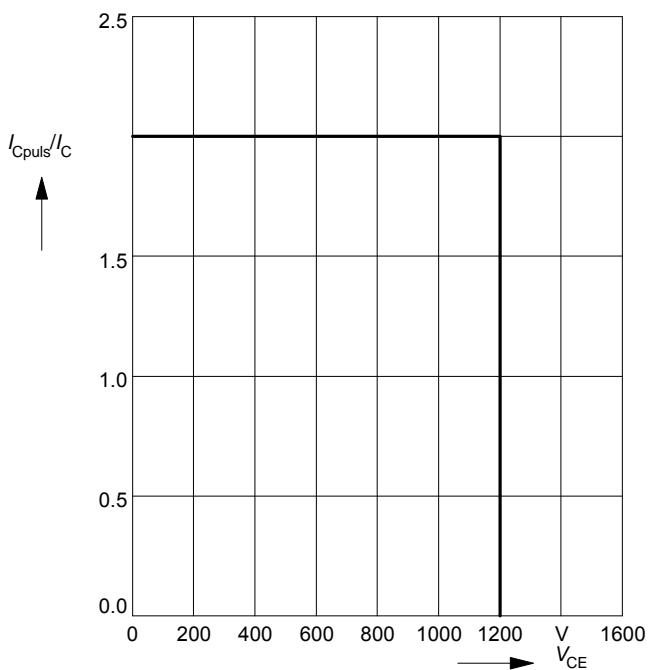
parameter:  $V_{GE} = 0\ V, f = 1\ MHz$



Reverse biased safe operating area

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

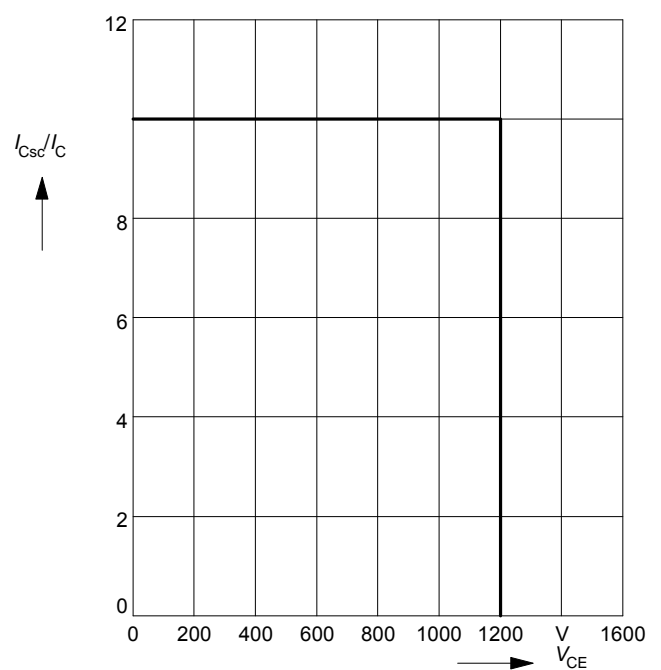
parameter:  $V_{GE} = 15\ V$



Short circuit safe operating area

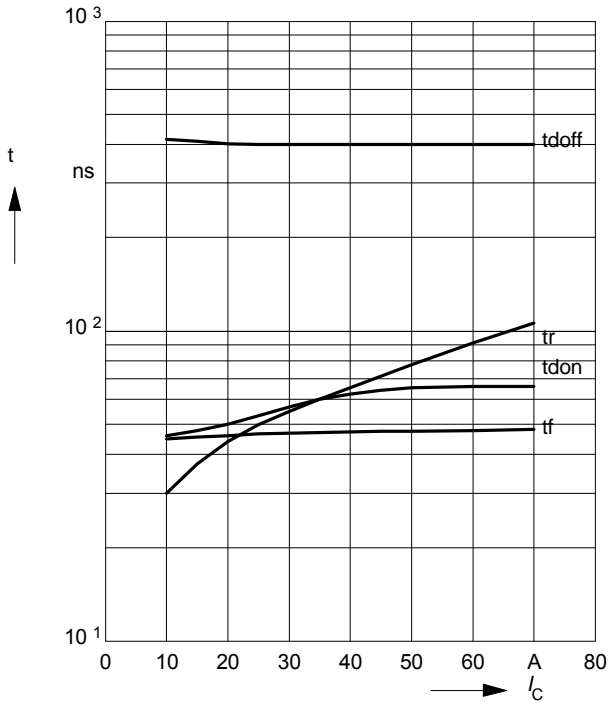
$I_{C\ sc} = f(V_{CE}), T_j = 150^\circ C$

parameter:  $V_{GE} = \pm 15\ V, t_{sc} \le 10\ \mu s, L < 50\ nH$



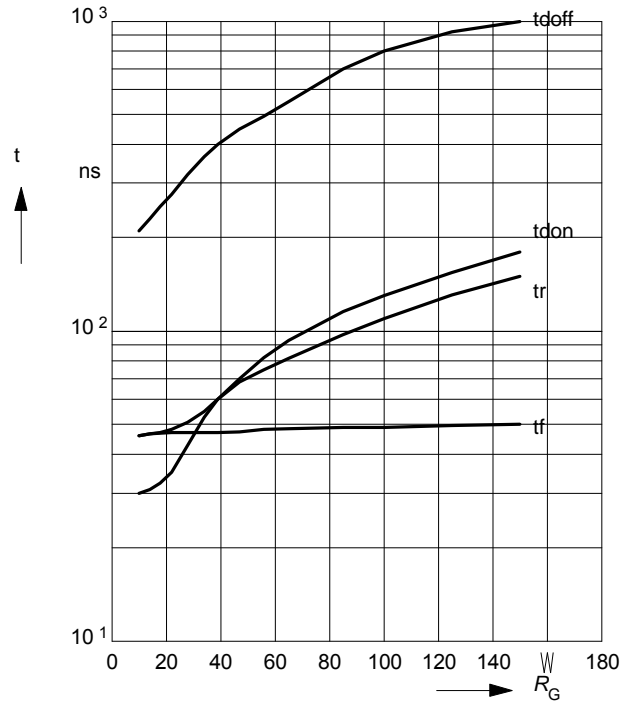
**Typ. switching time**

$t = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 39\ \Omega$



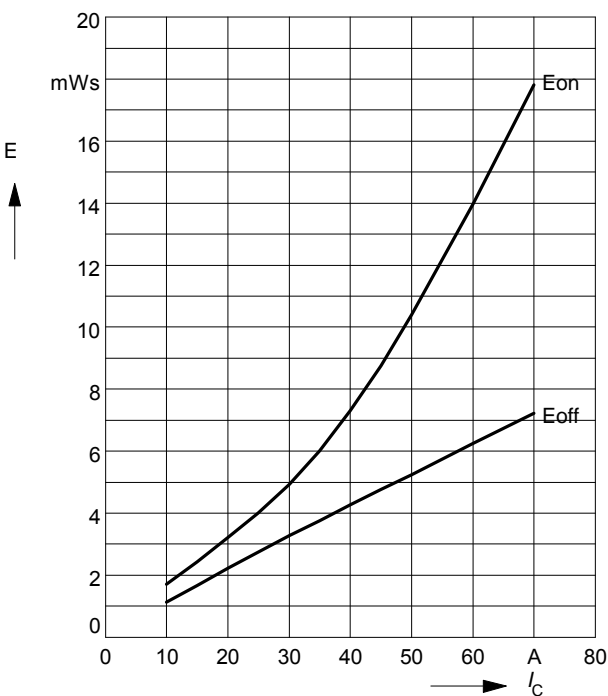
**Typ. switching time**

$t = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 35\text{ A}$



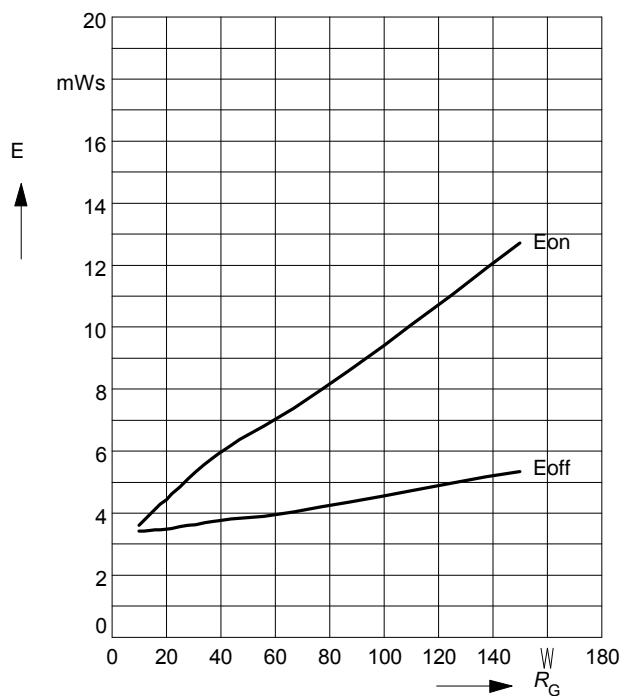
**Typ. switching losses**

$E = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 39\ \Omega$



**Typ. switching losses**

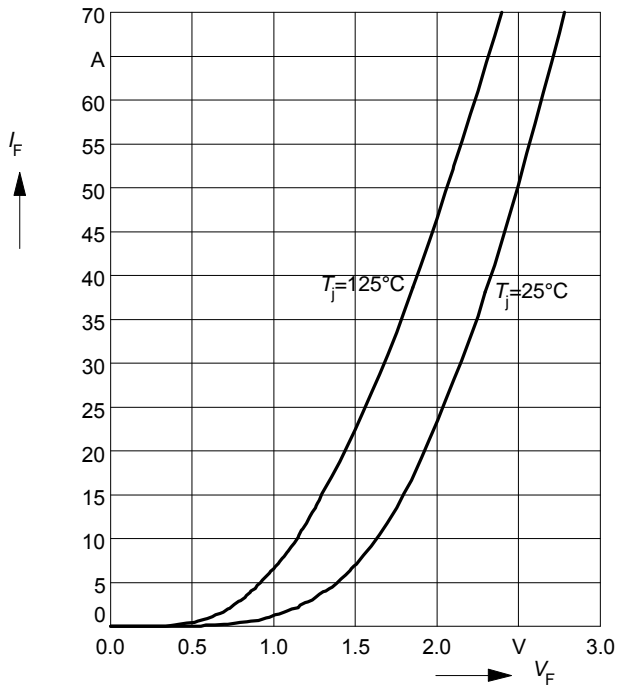
$E = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 35\text{ A}$



**Forward characteristics of fast recovery**

**reverse diode**  $I_F = f(V_F)$

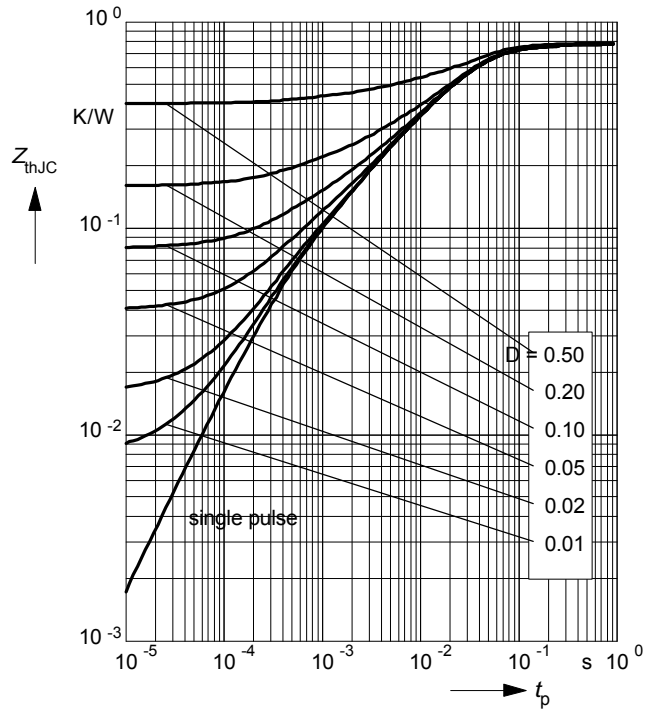
parameter:  $T_j$



**Transient thermal impedance Diode**

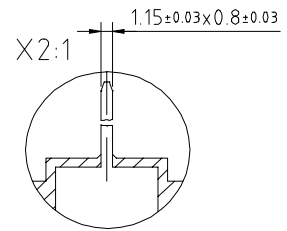
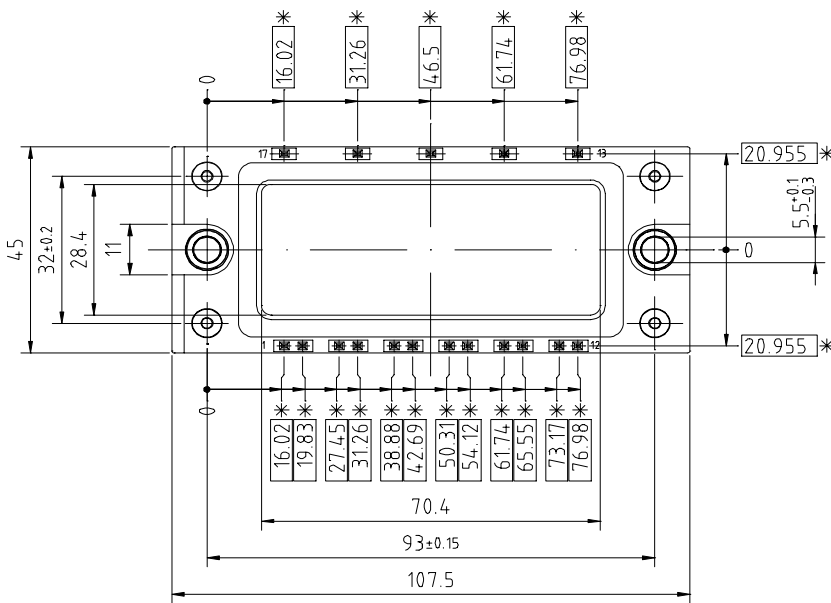
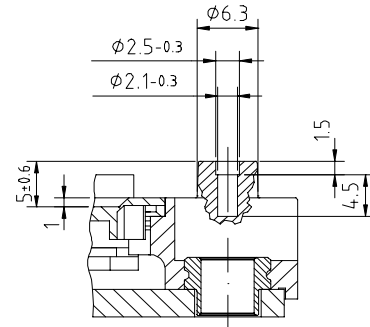
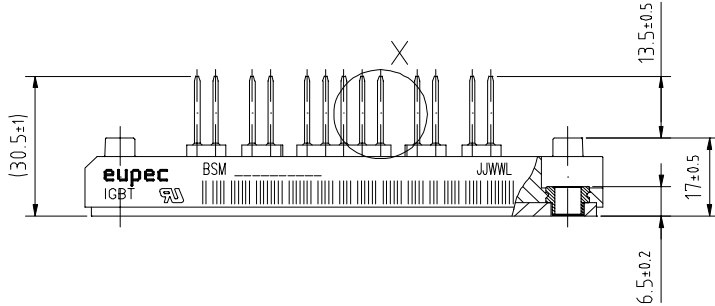
$$Z_{thJC} = f(t_p)$$

parameter:  $D = t_p / T$

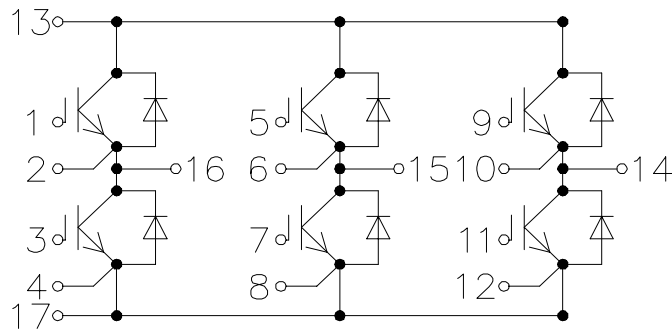




Gehäusemaße / Schaltbild  
 Package outline / Circuit diagram



\* = alle Maße mit einer Toleranz von  $\pm 0.4$   
 \* = all dimensions with a tolerance of  $\pm 0.4$



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