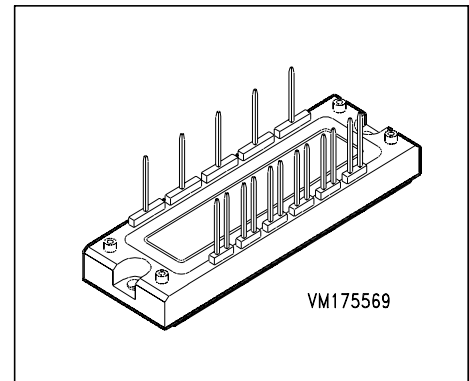


### IGBT Power Module

- Power module
- 3-phase full-bridge
- Including fast free-wheel diodes
- Package with insulated metal base plate
- E3226: long terminals, limited current per terminal



Type	$V_{CE}$	$I_C$	Package	Ordering Code
BSM50GD60DN2E3226	600V	50A	ECONOPACK 2	C67070-A2515-A67

### Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	$V_{CE}$	600	V
Collector-gate voltage	$V_{CGR}$	600	
$R_{GE} = 20 \text{ k}\Omega$			
Gate-emitter voltage	$V_{GE}$	$\pm 20$	
DC collector current	$I_C$	50	A
$T_C = 25 \text{ }^\circ\text{C}$			
Pulsed collector current, $t_p = 1 \text{ ms}$	$I_{Cpuls}$	100	
$T_C = 25 \text{ }^\circ\text{C}$			
Power dissipation per IGBT	$P_{tot}$	200	W
$T_C = 25 \text{ }^\circ\text{C}$			
Chip temperature	$T_j$	+ 150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 ... + 150	
Thermal resistance, chip case	$R_{thJC}$	$\leq 0.6$	K/W
Diode thermal resistance, chip case	$R_{thJCD}$	$\leq 1.5$	
Insulation test voltage, $t = 1 \text{ min.}$	$V_{is}$	2500	V <sub>ac</sub>
Creepage distance	-	16	mm
Clearance	-	11	
DIN humidity category, DIN 40 040	-	F	sec
IEC climatic category, DIN IEC 68-1	-	55 / 150 / 56	

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

**Static Characteristics**

Gate threshold voltage $V_{GE} = V_{CE}, I_C = 1\text{ mA}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_j = 25\text{ °C}$	$V_{CE(sat)}$	-	2.1	2.7	
$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_j = 125\text{ °C}$		-	2.2	2.8	
Zero gate voltage collector current $V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ °C}$	$I_{CES}$	-	-	1.5	mA
Gate-emitter leakage current $V_{GE} = 25\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	100	nA

**AC Characteristics**

Transconductance $V_{CE} = 20\text{ V}, I_C = 50\text{ A}$	$g_{fs}$	10	-	-	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{iss}$	-	2.8	-	nF
Output capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{oss}$	-	0.3	-	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{rss}$	-	0.2	-	

### 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 $V_{CC} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Gon} = 22\ \Omega$	$t_{d(on)}$	-	60	-	ns
Rise time $V_{CC} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Gon} = 22\ \Omega$	$t_r$	-	80	-	
Turn-off delay time $V_{CC} = 300\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Goff} = 22\ \Omega$	$t_{d(off)}$	-	330	-	
Fall time $V_{CC} = 300\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Goff} = 22\ \Omega$	$t_f$	-	550	-	

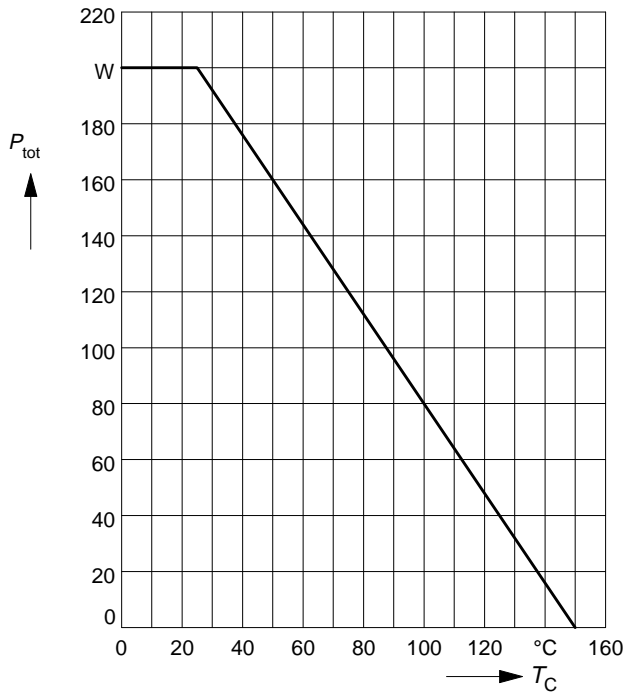
### Free-Wheel Diode

Diode forward voltage $I_F = 50\text{ A}$ , $V_{GE} = 0\text{ V}$ , $T_j = 25\text{ °C}$ $I_F = 50\text{ A}$ , $V_{GE} = 0\text{ V}$ , $T_j = 125\text{ °C}$	$V_F$	-	2 1.8	-	V
Reverse recovery time $I_F = 50\text{ A}$ , $V_R = -300\text{ V}$ , $V_{GE} = 0\text{ V}$ $di_F/dt = -500\text{ A}/\mu\text{s}$ , $T_j = 125\text{ °C}$	$t_{rr}$	-	0.2	-	
Reverse recovery charge $I_F = 50\text{ A}$ , $V_R = -300\text{ V}$ , $V_{GE} = 0\text{ V}$ $di_F/dt = -500\text{ A}/\mu\text{s}$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	$Q_{rr}$	-	2.8 5	-	$\mu\text{C}$
		-		-	

### Power dissipation

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

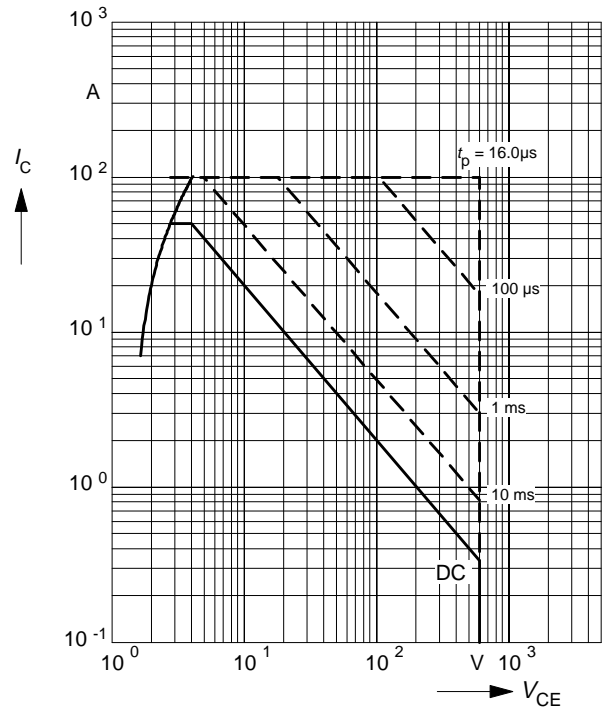
parameter:  $T_j \leq 150^\circ\text{C}$



### Safe operating area

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

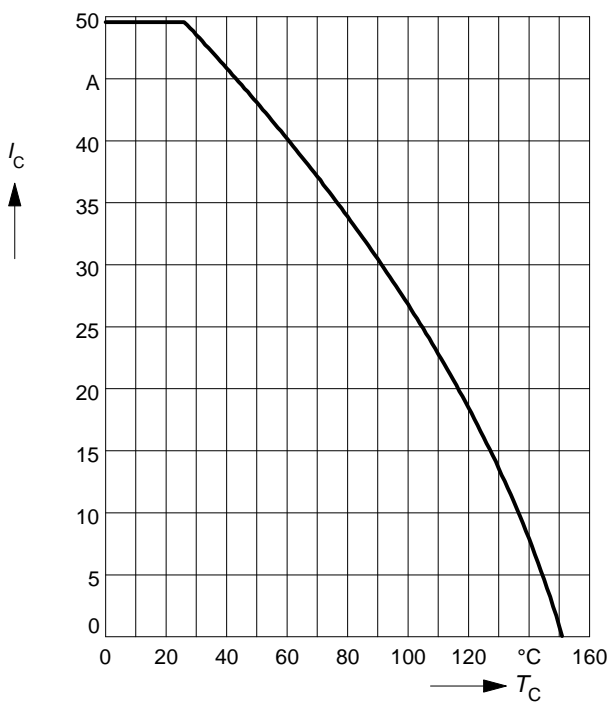
parameter:  $D = 0, T_C = 25^\circ\text{C}, T_j \leq 150^\circ\text{C}$



### Collector current

$$I_C = f(T_C)$$

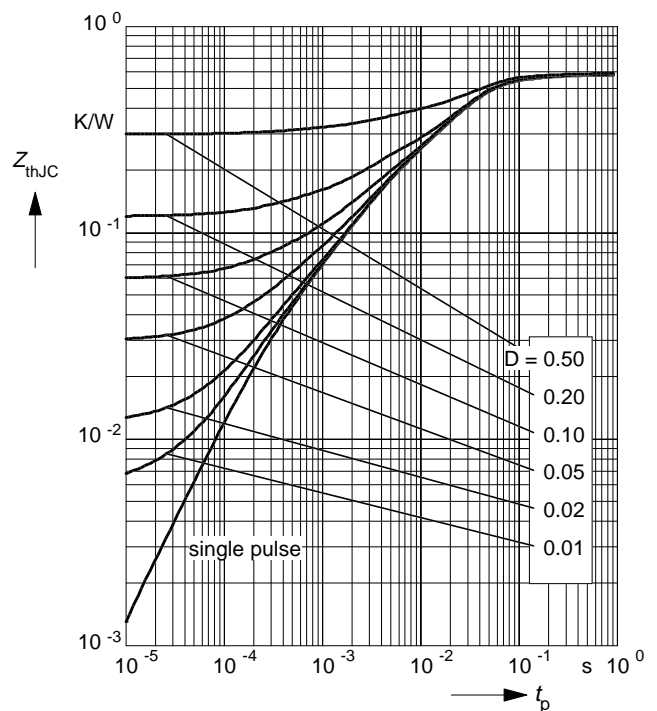
parameter:  $V_{\text{GE}} \geq 15\text{ V}, T_j \leq 150^\circ\text{C}$



### Transient thermal impedance IGBT

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

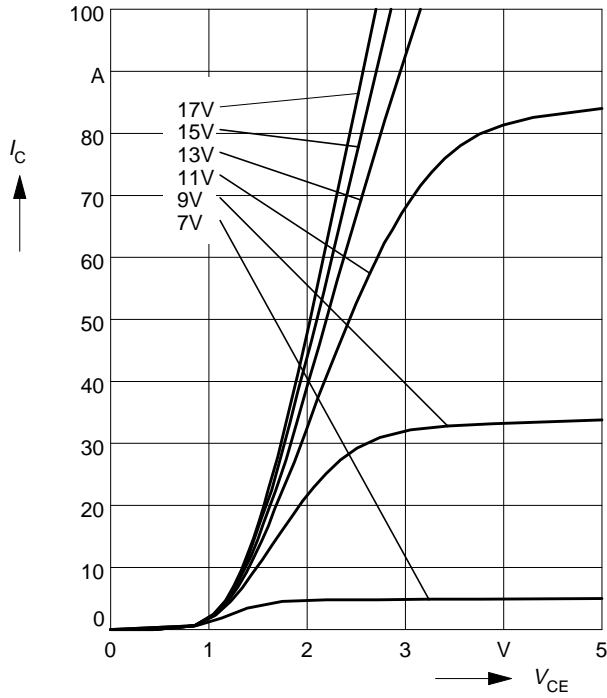
parameter:  $D = t_p / T$



### Typ. output characteristics

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

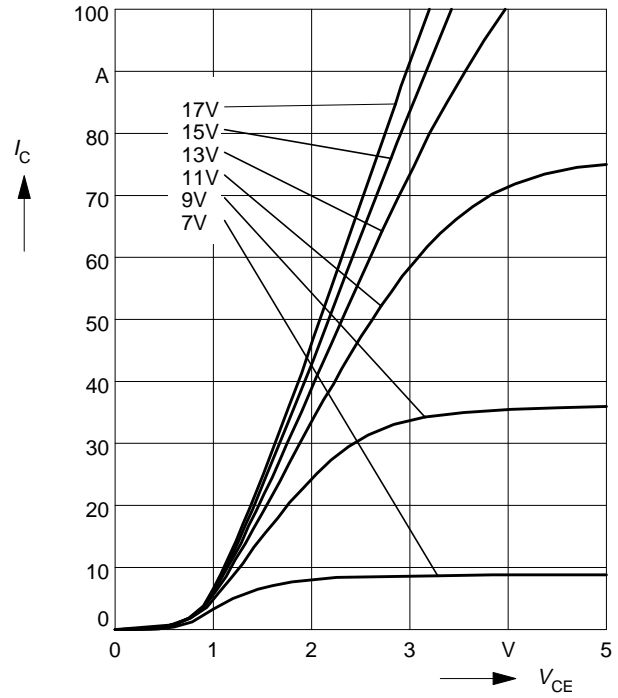
parameter:  $t_p = 80 \mu s$ ,  $T_j = 25 \text{ }^\circ\text{C}$



### Typ. output characteristics

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

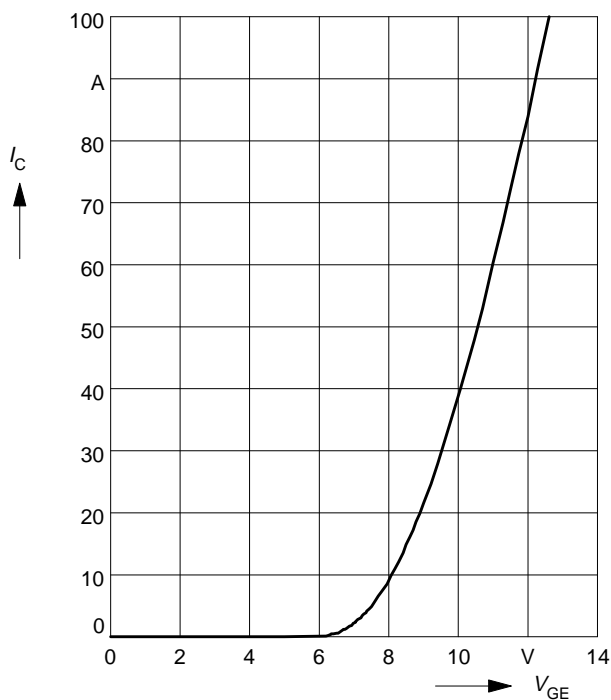
parameter:  $t_p = 80 \mu s$ ,  $T_j = 125 \text{ }^\circ\text{C}$



### Typ. transfer characteristics

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

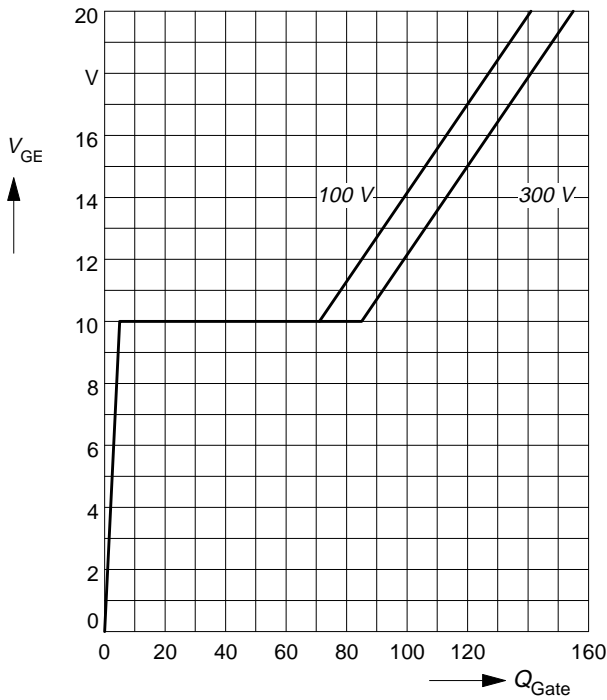
parameter:  $t_p = 80 \mu s$ ,  $V_{CE} = 20 \text{ V}$



### Typ. gate charge

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

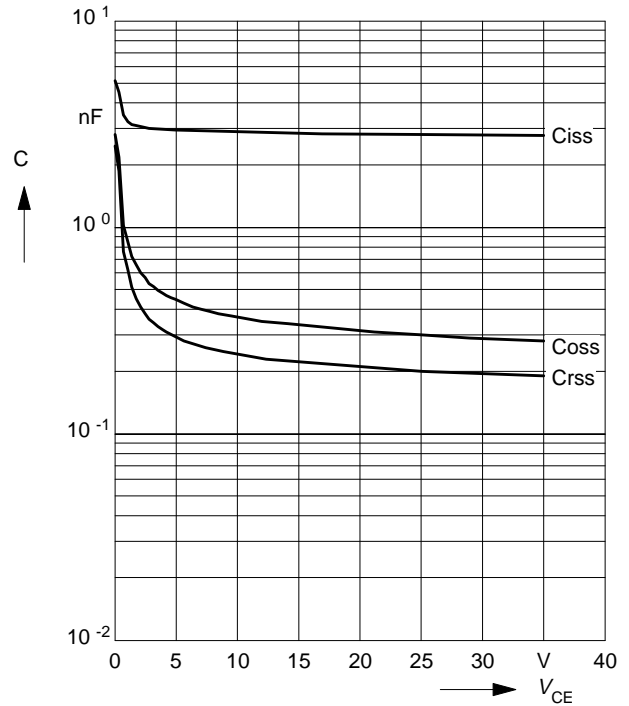
parameter:  $I_{C\ puls} = 50\ A$



### Typ. capacitances

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

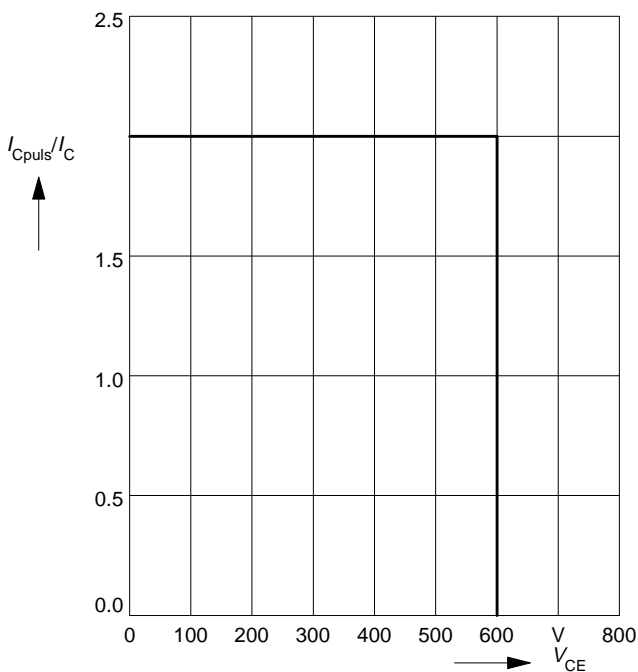
parameter:  $V_{GE} = 0\ V, f = 1\ MHz$



### Reverse biased safe operating area

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

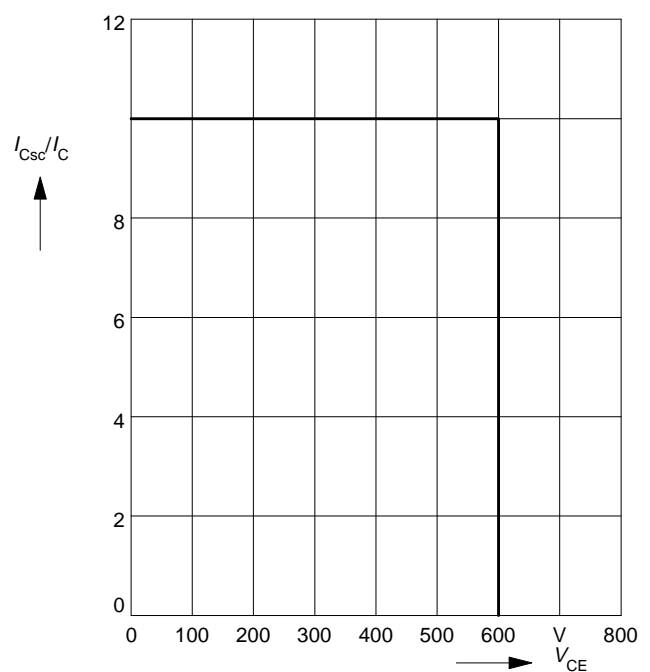
parameter:  $V_{GE} = 15\ V$



### Short circuit safe operating area

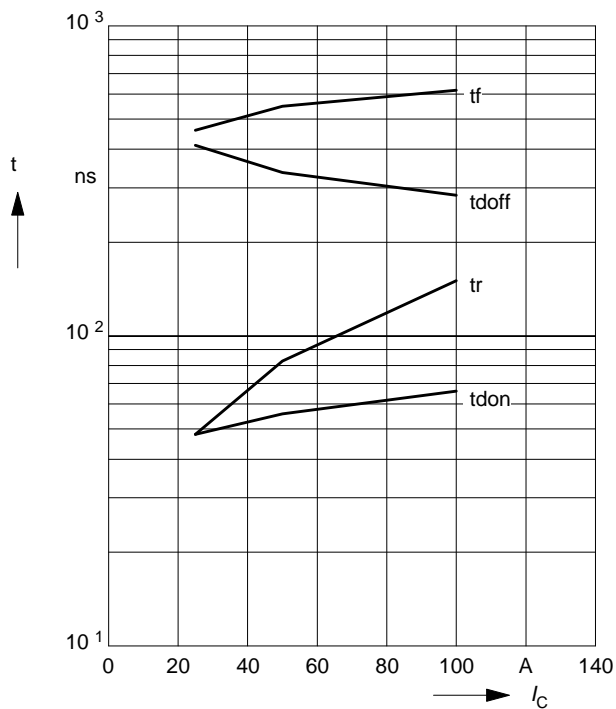
$$I_{C\ sc} = f(V_{CE}), T_j = 150^\circ C$$

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



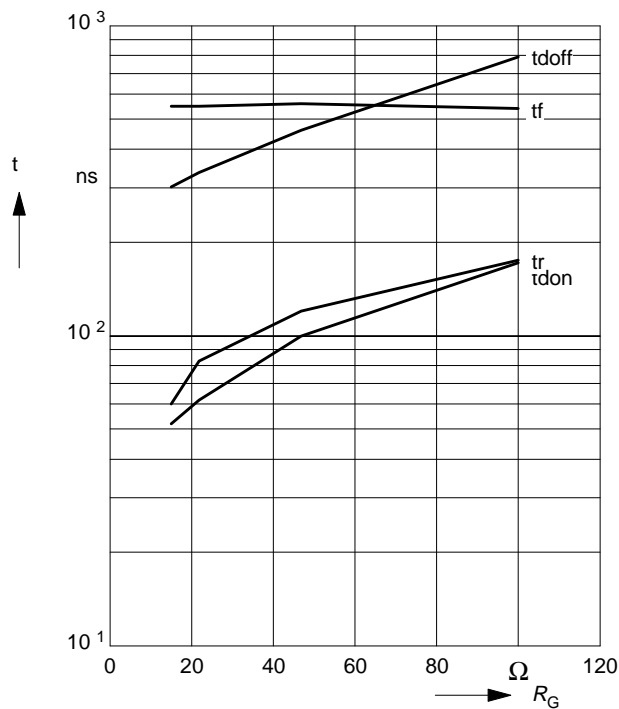
### Typ. switching time

$t = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 22\ \Omega$



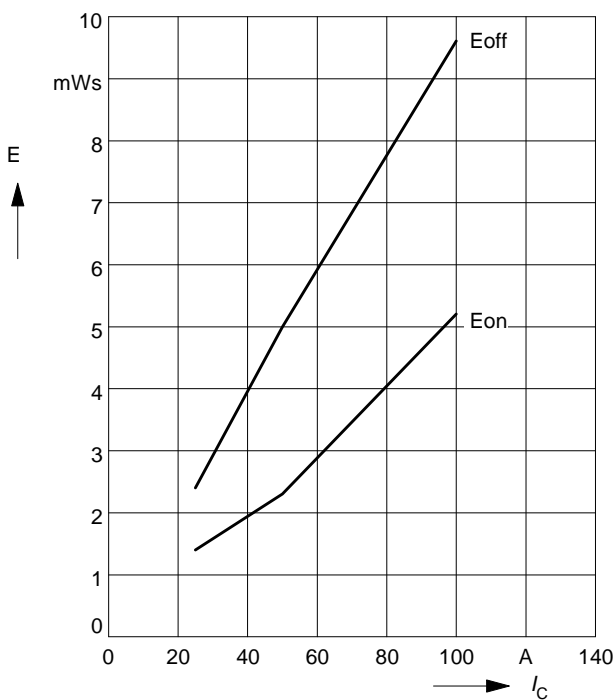
### Typ. switching time

$t = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 50\text{ A}$



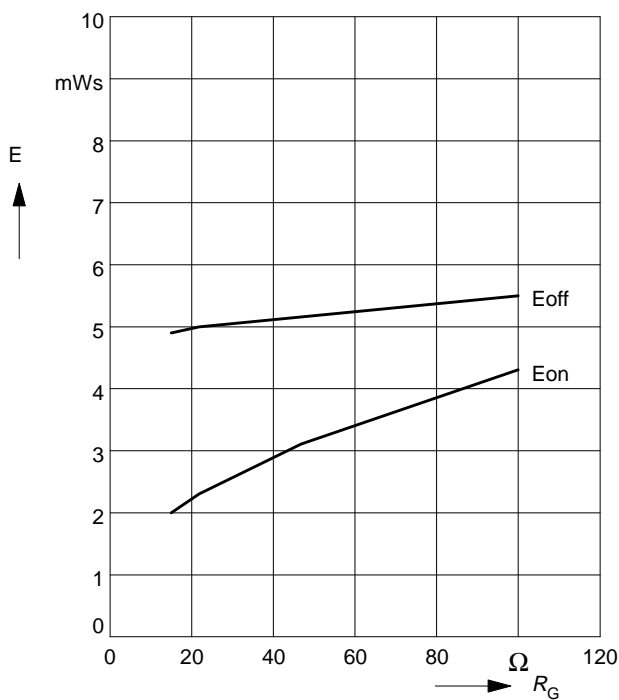
### Typ. switching losses

$E = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 22\ \Omega$



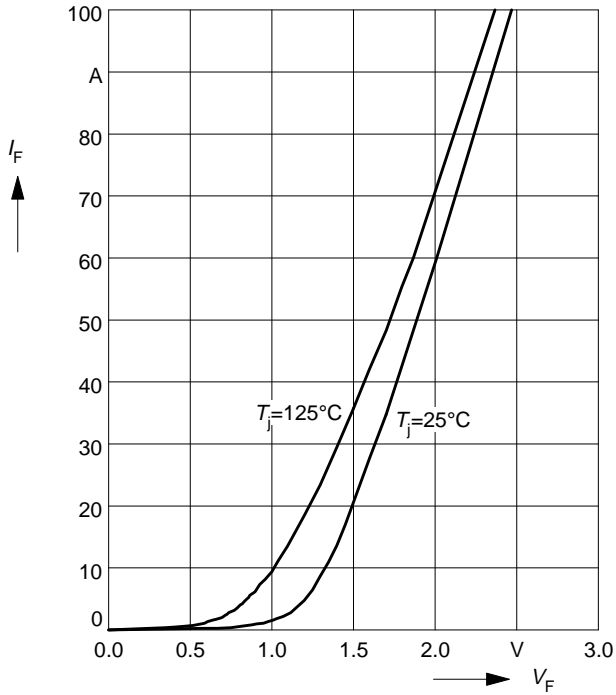
### Typ. switching losses

$E = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 300\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 50\text{ A}$



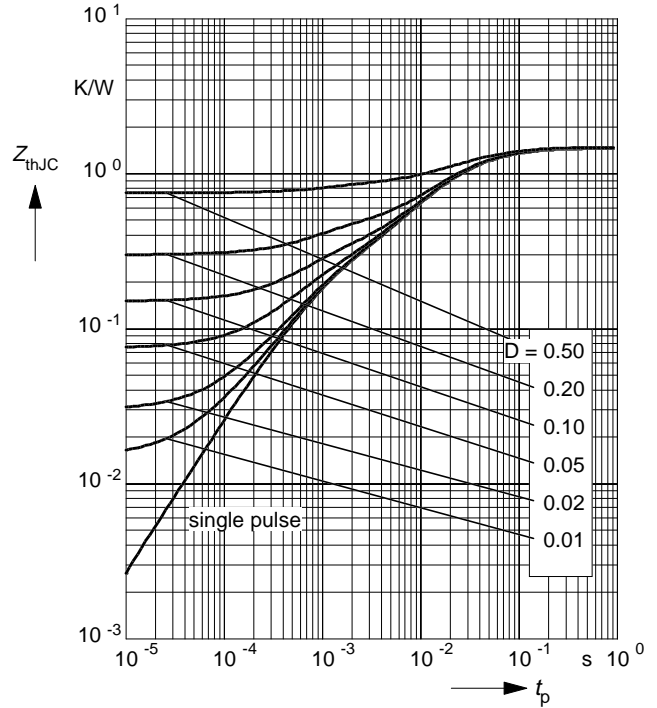
### Forward characteristics of fast recovery reverse diode $I_F = f(V_F)$

parameter:  $T_j$



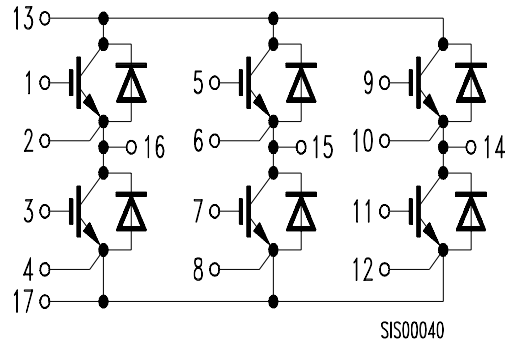
### Transient thermal impedance Diode $Z_{thJC} = f(t_p)$

parameter:  $D = t_p / T$





### Circuit Diagram



### Package Outlines

Dimensions in mm

Weight: 180 g

