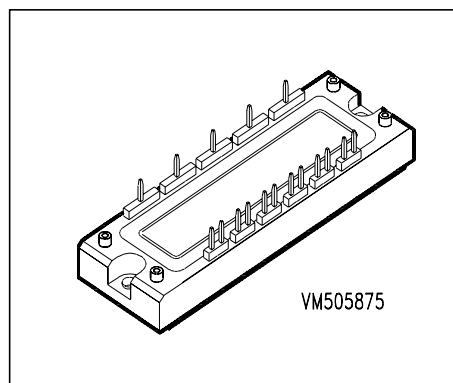


### IGBT Power Module

- 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 50 GD 120 DN2	1200V	72A	ECONOPACK 2K	C67076-A2514-A67

### Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	$V_{CE}$	1200	V
Collector-gate voltage	$V_{CGR}$		
$R_{GE} = 20\text{ k}\Omega$		1200	
Gate-emitter voltage	$V_{GE}$	$\pm 20$	
DC collector current	$I_C$		A
$T_C = 25\text{ }^{\circ}\text{C}$		72	
$T_C = 80\text{ }^{\circ}\text{C}$		50	
Pulsed collector current, $t_p = 1\text{ ms}$	$I_{Cpuls}$		
$T_C = 25\text{ }^{\circ}\text{C}$		144	
$T_C = 80\text{ }^{\circ}\text{C}$		100	
Power dissipation per IGBT	$P_{tot}$		W
$T_C = 25\text{ }^{\circ}\text{C}$		350	
Chip temperature	$T_j$	+ 150	$^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55 ... + 150	
Thermal resistance, chip case	$R_{thJC}$	$\leq 0.35$	K/W
Diode thermal resistance, chip case	$R_{thJCD}$	$\leq 0.7$	
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	-	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 $V_{GE} = V_{CE}, I_C = 2\text{ mA}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_j = 25\text{ °C}$ $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_j = 125\text{ °C}$	$V_{CE(sat)}$	- -	2.5 3.1	3 3.7	
Zero gate voltage collector current $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ °C}$ $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 125\text{ °C}$	$I_{CES}$	- -	0.8 4	1 -	mA
Gate-emitter leakage current $V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	200	

#### AC Characteristics

Transconductance $V_{CE} = 20\text{ V}, I_C = 50\text{ A}$	$g_{fs}$	23	-	-	S
Input capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{iss}$	-	3300	-	pF
Output capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{oss}$	-	500	-	
Reverse transfer capacitance $V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{rss}$	-	220	-	

### 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 $V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Gon} = 22\text{ }\Omega$	$t_{d(on)}$	-	44	100	ns
Rise time $V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Gon} = 22\text{ }\Omega$	$t_r$	-	56	100	
Turn-off delay time $V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Goff} = 22\text{ }\Omega$	$t_{d(off)}$	-	380	500	
Fall time $V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 50\text{ A}$ $R_{Goff} = 22\text{ }\Omega$	$t_f$	-	70	100	

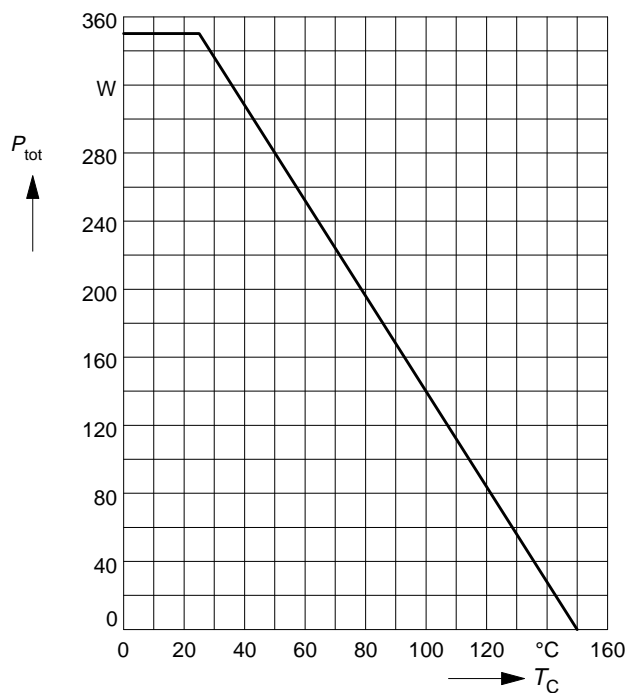
### Free-Wheel Diode

Diode forward voltage $I_F = 50\text{ A}$ , $V_{GE} = 0\text{ V}$ , $T_j = 25\text{ °C}$ $I_F = 50\text{ A}$ , $V_{GE} = 0\text{ V}$ , $T_j = 125\text{ °C}$	$V_F$	-	2.3 1.8	2.8 -	V
Reverse recovery time $I_F = 50\text{ A}$ , $V_R = -600\text{ V}$ , $V_{GE} = 0\text{ V}$ $dI_F/dt = -800\text{ A}/\mu\text{s}$ , $T_j = 125\text{ °C}$	$t_{rr}$	-	0.2	-	
Reverse recovery charge $I_F = 50\text{ A}$ , $V_R = -600\text{ V}$ , $V_{GE} = 0\text{ V}$ $dI_F/dt = -800\text{ A}/\mu\text{s}$ $T_j = 25\text{ °C}$ $T_j = 125\text{ °C}$	$Q_{rr}$	-	2.8 8	- -	$\mu\text{C}$
		-			

## Power dissipation

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

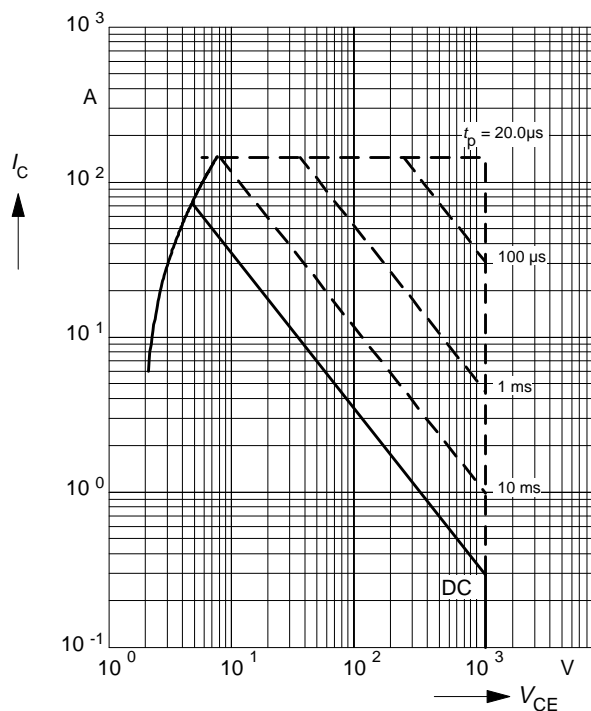
parameter:  $T_j \leq 150^\circ\text{C}$



## Safe operating area

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

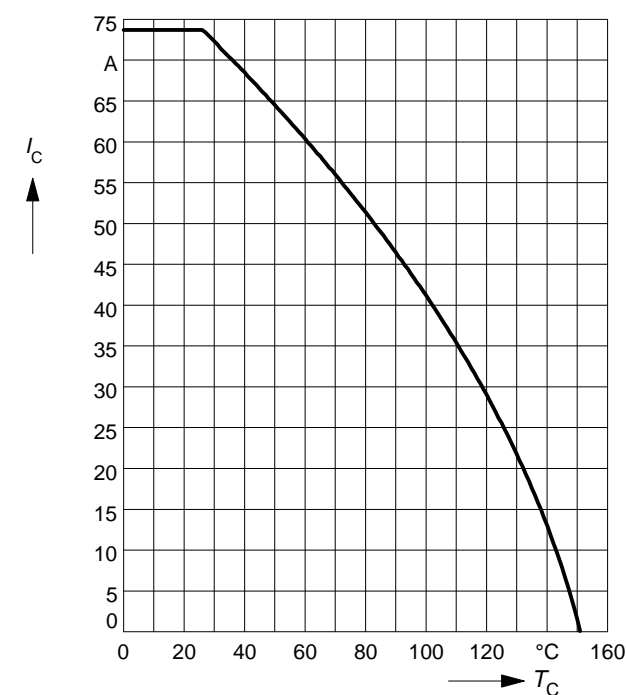
parameter:  $D = 0$ ,  $T_C = 25^\circ\text{C}$ ,  $T_j \leq 150^\circ\text{C}$



## Collector current

$$I_C = f(T_C)$$

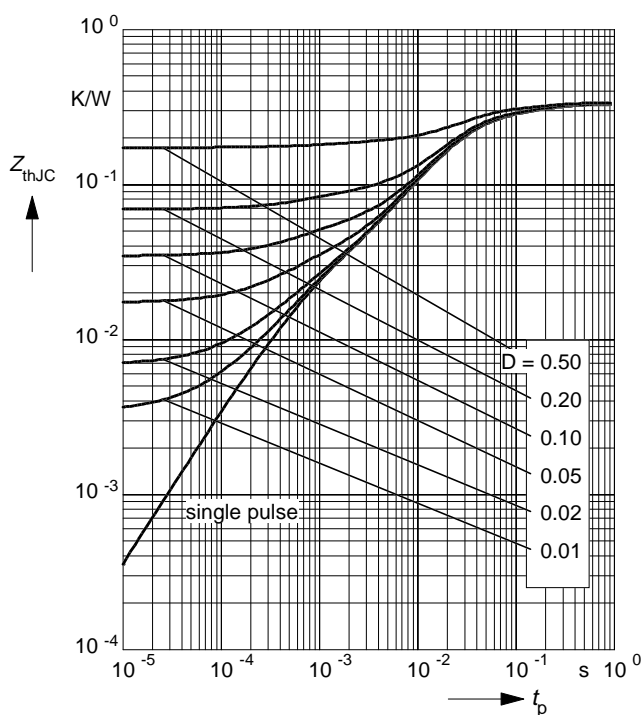
parameter:  $V_{GE} \geq 15\text{ V}$ ,  $T_j \leq 150^\circ\text{C}$



## Transient thermal impedance IGBT

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

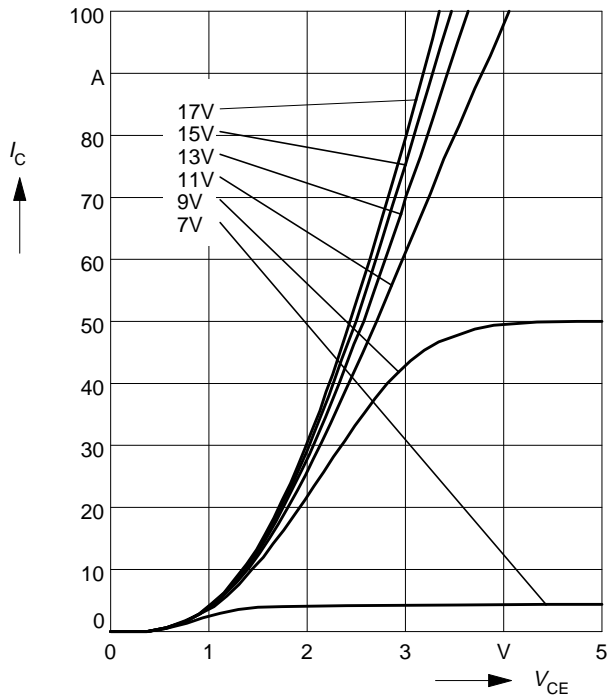
parameter:  $D = t_p / T$



## Typ. output characteristics

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

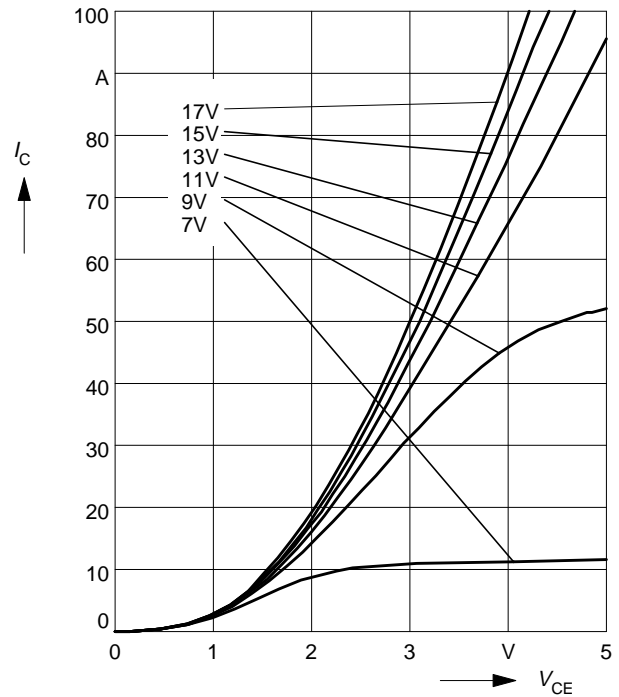
parameter:  $t_p = 80 \mu s$ ,  $T_j = 25^\circ C$



## Typ. output characteristics

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

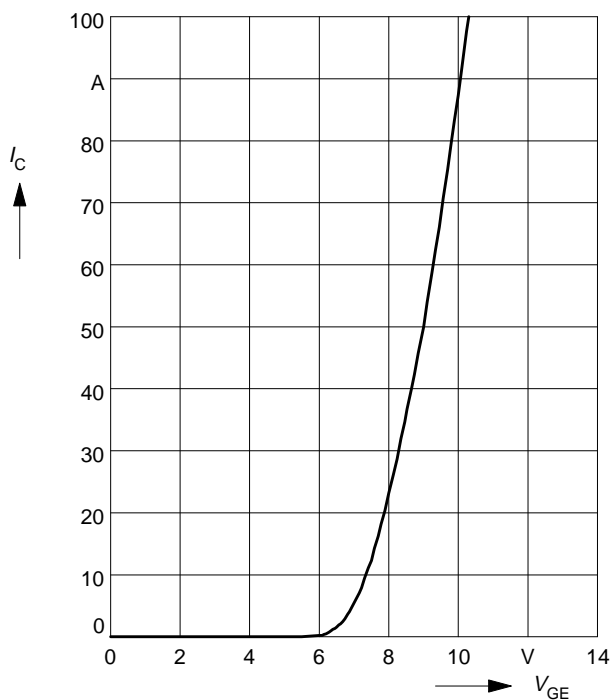
parameter:  $t_p = 80 \mu s$ ,  $T_j = 125^\circ C$



## Typ. transfer characteristics

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

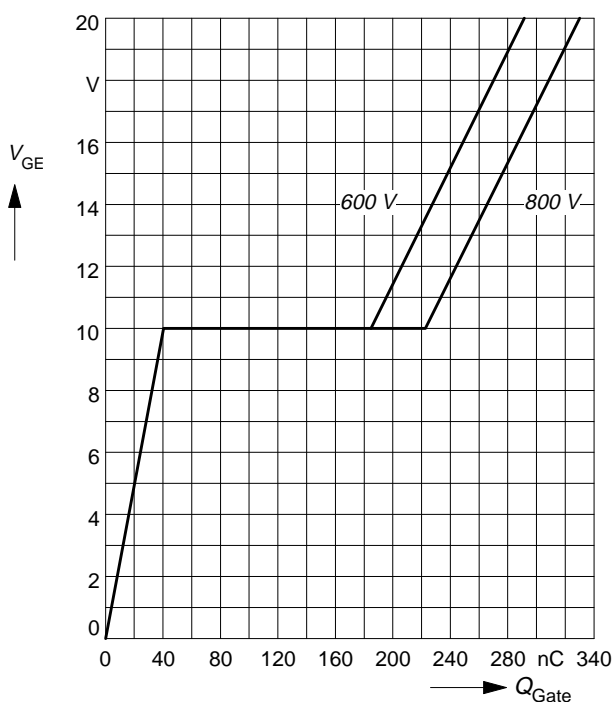
parameter:  $t_p = 80 \mu s$ ,  $V_{CE} = 20 V$



## Typ. gate charge

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

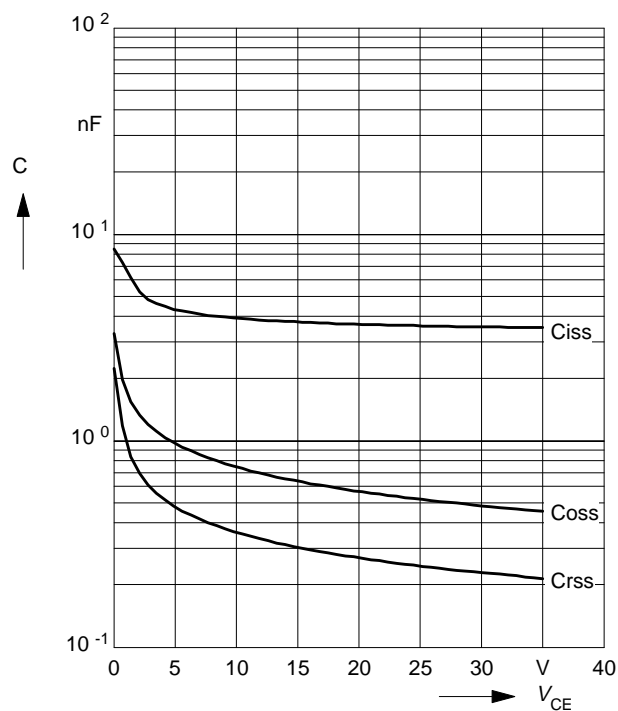
parameter:  $I_{C\ puls} = 50\ A$



## Typ. capacitances

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

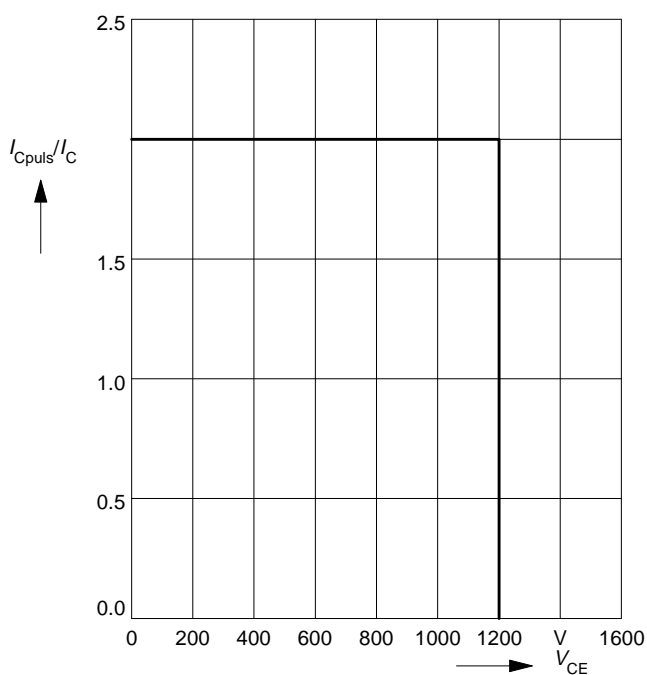
parameter:  $V_{GE} = 0\ V, f = 1\ MHz$



## Reverse biased safe operating area

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

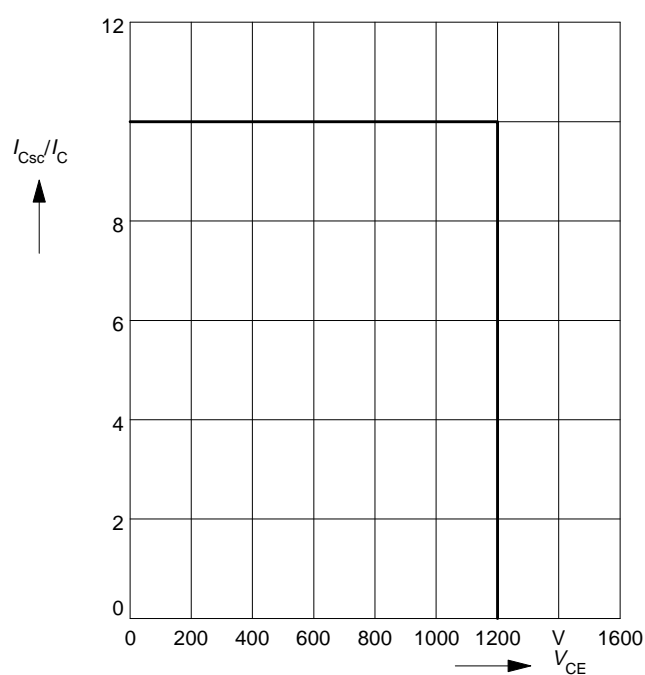
parameter:  $V_{GE} = 15\ V$



## Short circuit safe operating area

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

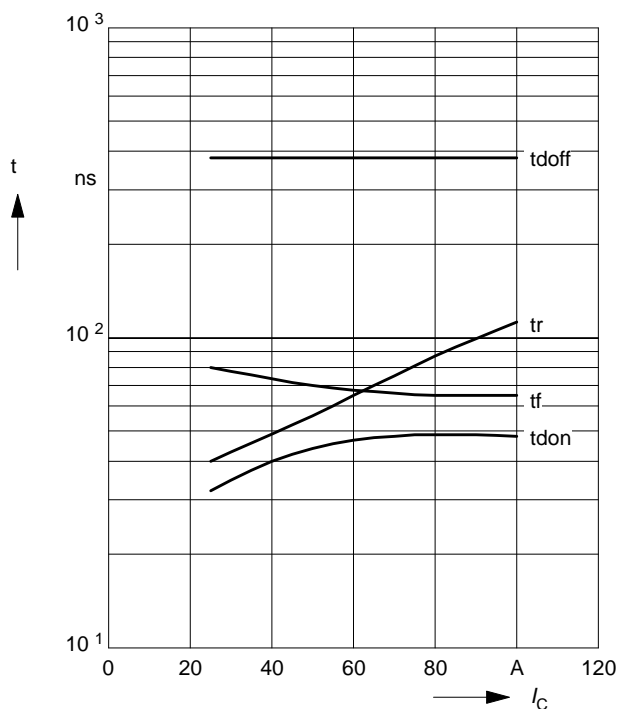
parameter:  $V_{GE} = \pm 15\ V, t_{SC} \leq 10\ \mu s, L < 50\ nH$



### Typ. switching time

$t = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$

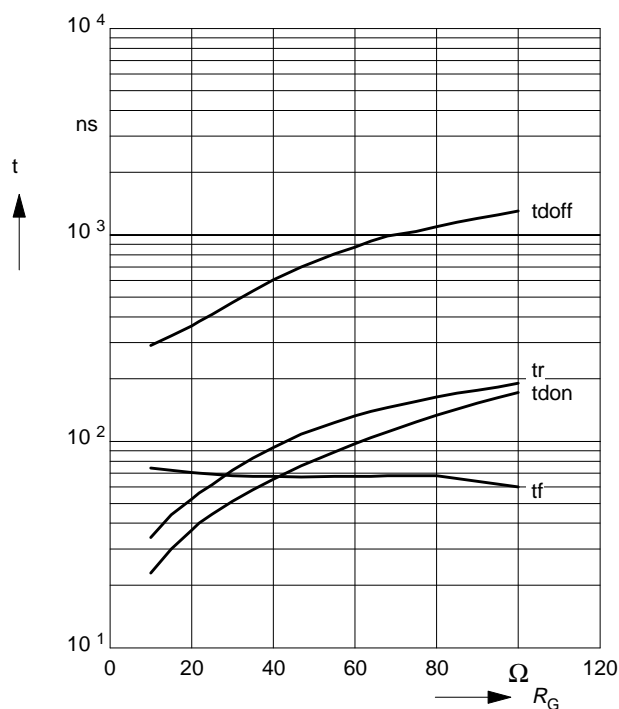
par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 22\ \Omega$



### Typ. switching time

$t = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$

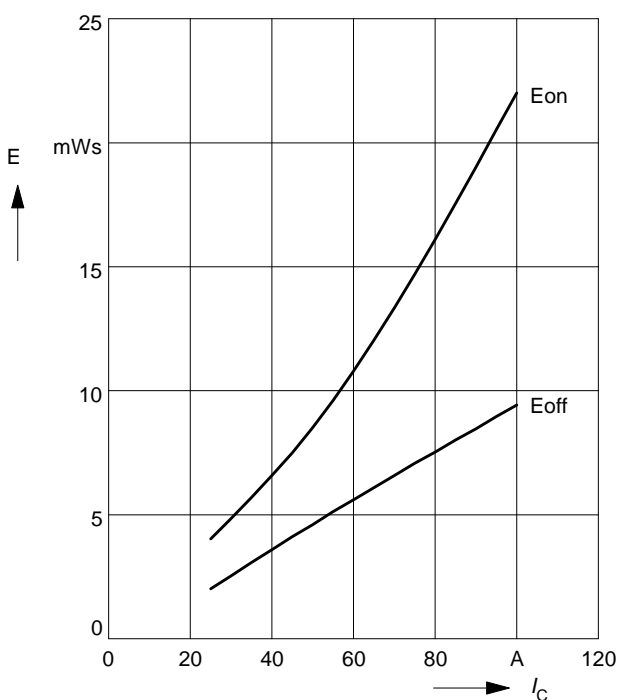
par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 50\text{ A}$



### Typ. switching losses

$E = f(I_C)$ , inductive load,  $T_j = 125^\circ\text{C}$

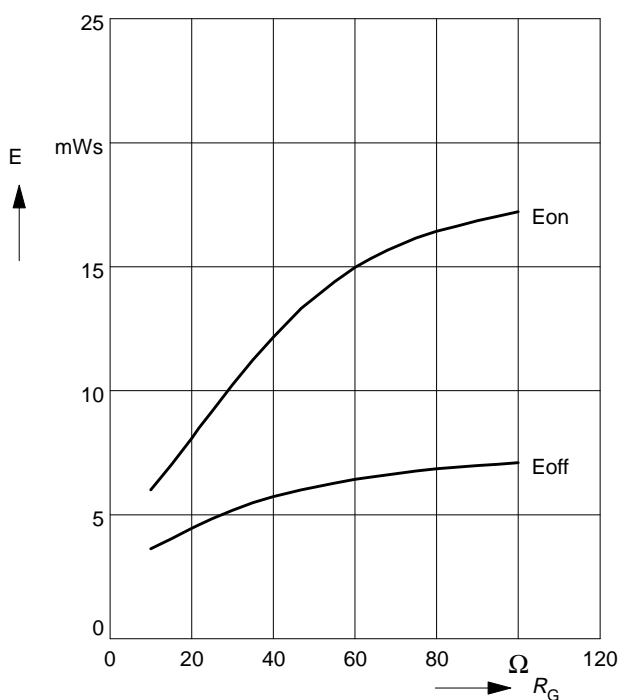
par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 22\ \Omega$



### Typ. switching losses

$E = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$

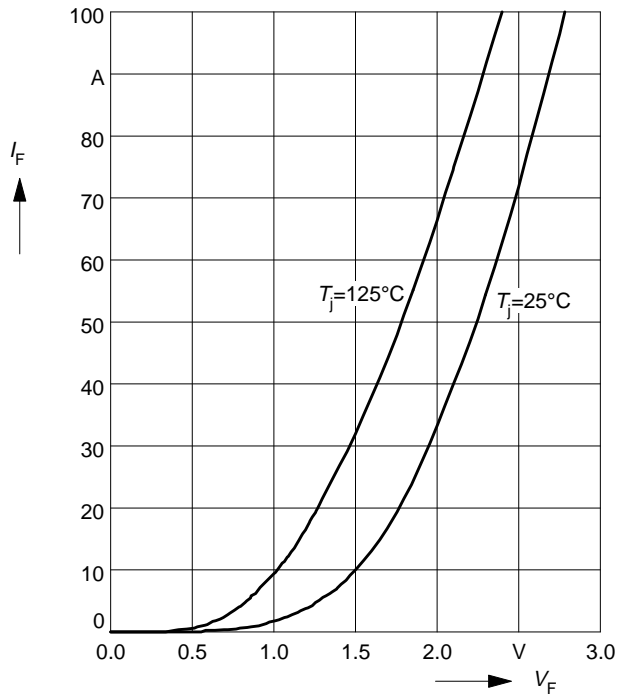
par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 50\text{ A}$



### 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:  $D = t_p / T$

