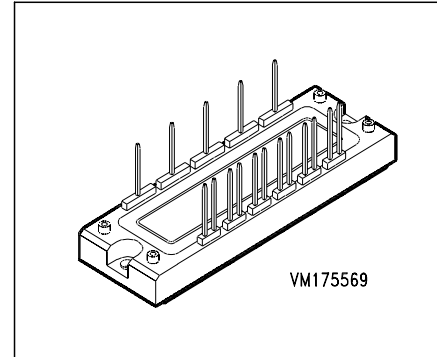


IGBT Power Module

- 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	
$R_{GE} = 20 \text{ k}\Omega$		600	
Gate-emitter voltage	V_{GE}	± 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}	≤ 0.6	K/W
Diode thermal resistance, chip case	R_{thJCD}	≤ 1.5	
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 $V_{GE} = V_{CE}, I_C = 1\text{ mA}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter saturation voltage $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_j = 25\text{ °C}$ $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_j = 125\text{ °C}$	$V_{CE(sat)}$	-	2.1 2.2	2.7 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 $T_j = 125\text{ °C}$

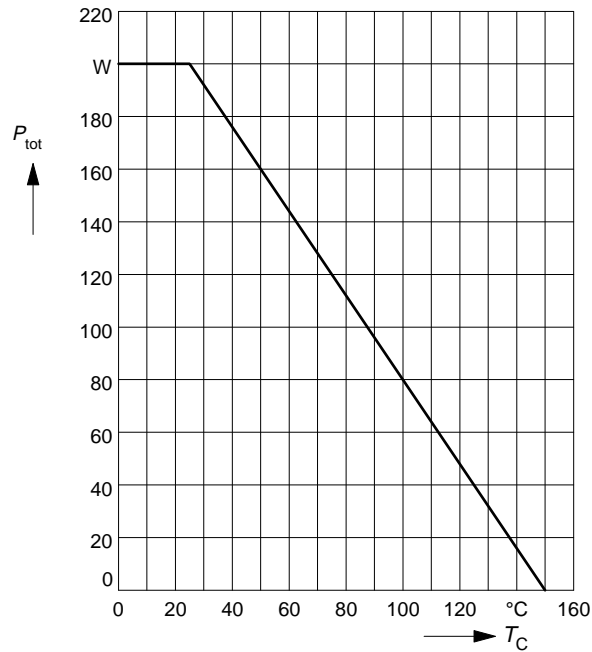
Turn-on delay time $V_{CC} = 300\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$ $R_{Gon} = 22\ \Omega$	$t_{d(on)}$	-	60	-	ns
Rise time $V_{CC} = 300\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 50\text{ A}$ $R_{Gon} = 22\ \Omega$	t_r	-	80	-	
Turn-off delay time $V_{CC} = 300\text{ V}$, $V_{GE} =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

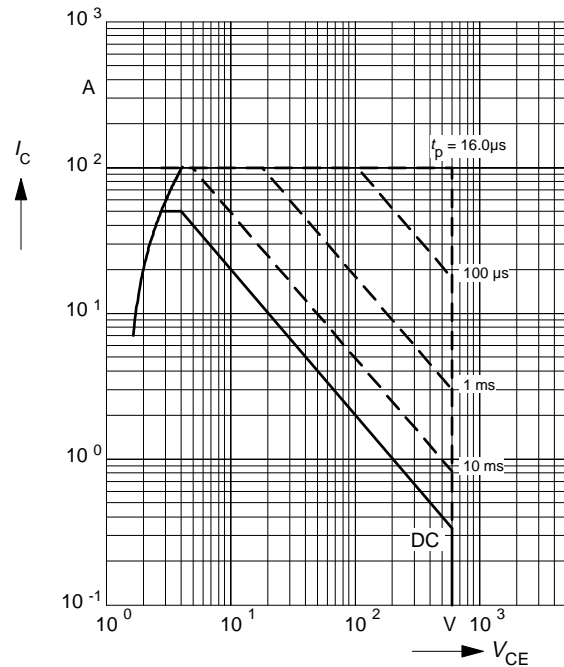
Power dissipation

$P_{tot} = f(T_C)$
parameter: $T_j \leq 150\text{ °C}$



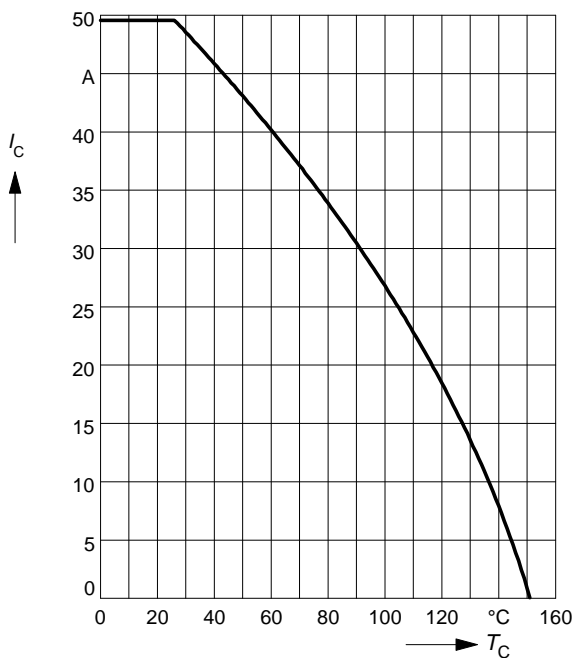
Safe operating area

$I_C = f(V_{CE})$
parameter: $D = 0, T_C = 25\text{ °C}, T_j \leq 150\text{ °C}$



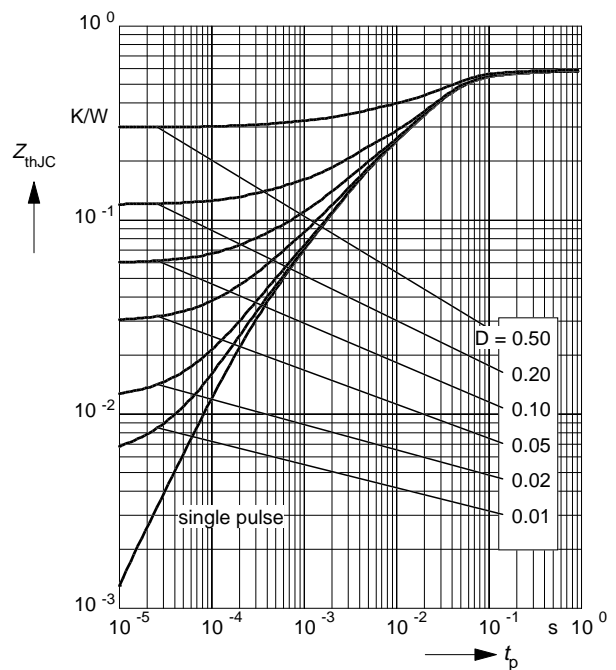
Collector current

$I_C = f(T_C)$
parameter: $V_{GE} \geq 15\text{ V}, T_j \leq 150\text{ °C}$



Transient thermal impedance IGBT

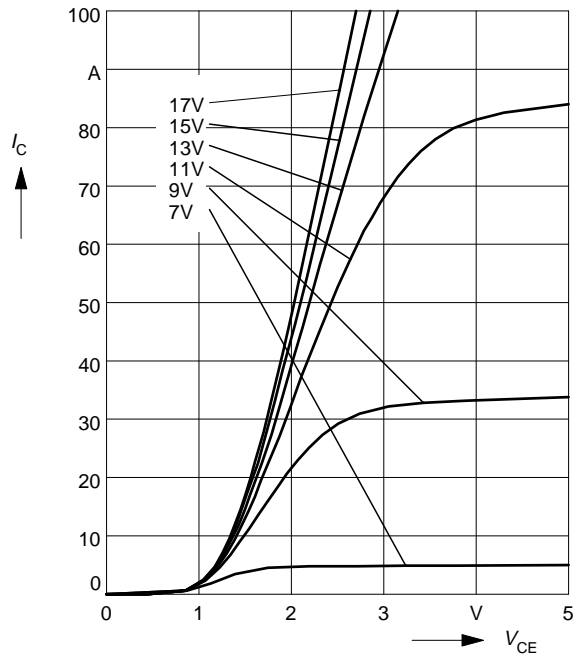
$Z_{thJC} = f(t_p)$
parameter: $D = t_p / T$



Typ. output characteristics

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

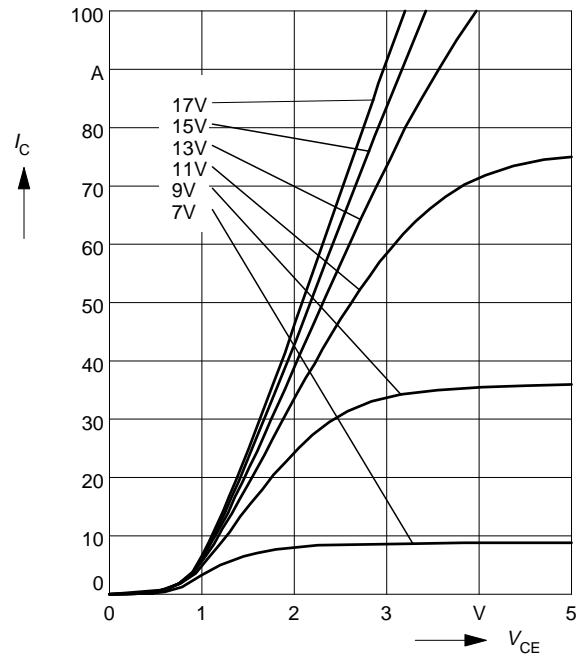
parameter: $t_p = 80 \mu s$, $T_j = 25 \text{ }^\circ\text{C}$



Typ. output characteristics

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

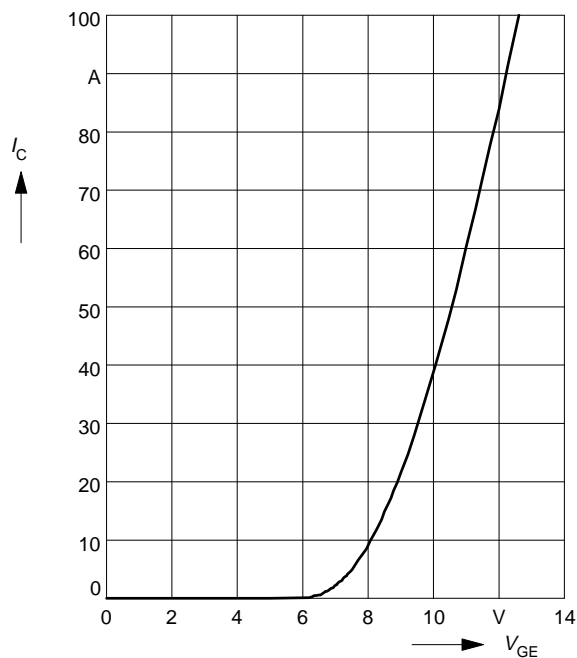
parameter: $t_p = 80 \mu s$, $T_j = 125 \text{ }^\circ\text{C}$



Typ. transfer characteristics

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

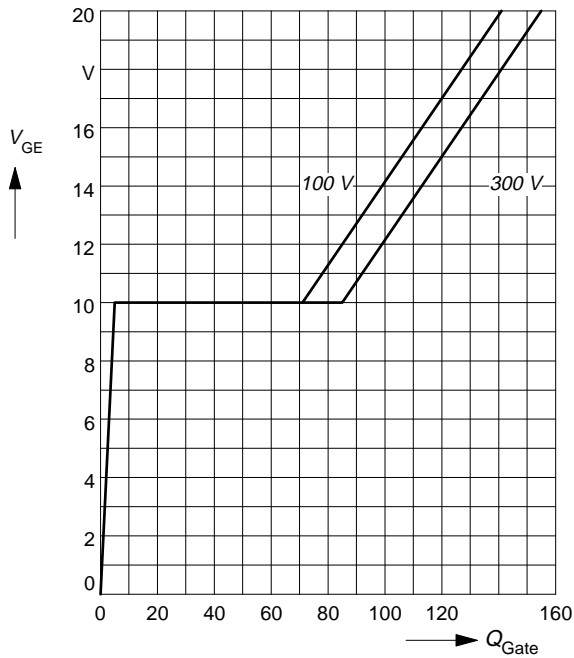
parameter: $t_p = 80 \mu s$, $V_{CE} = 20 \text{ V}$



Typ. gate charge

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

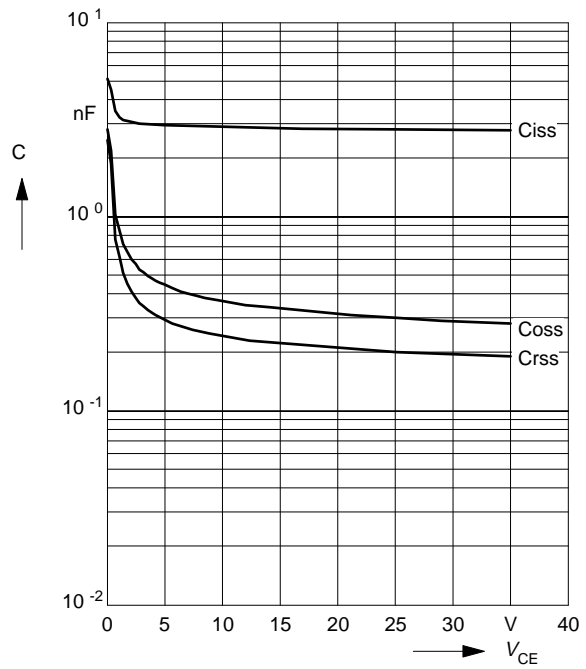
parameter: $I_{C\ puls} = 50\ A$



Typ. capacitances

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

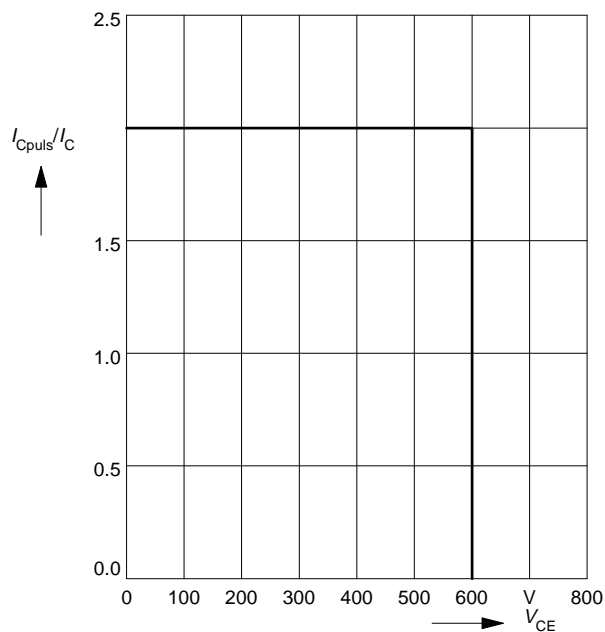
parameter: $V_{GE} = 0\ V, f = 1\ MHz$



Reverse biased safe operating area

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

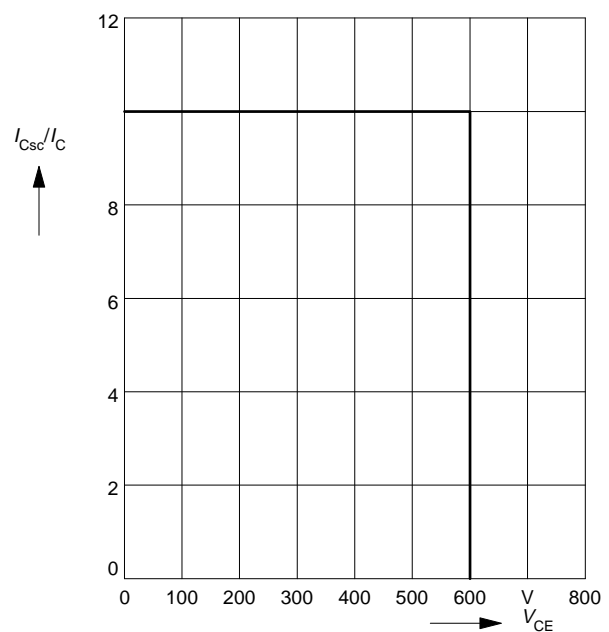
parameter: $V_{GE} = 15\ V$



Short circuit safe operating area

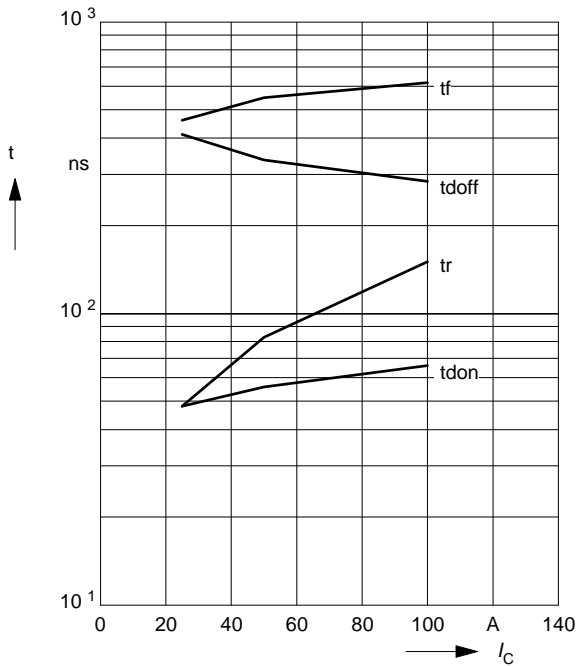
$$I_{C\ sc} = f(V_{CE}), T_j = 150^\circ C$$

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



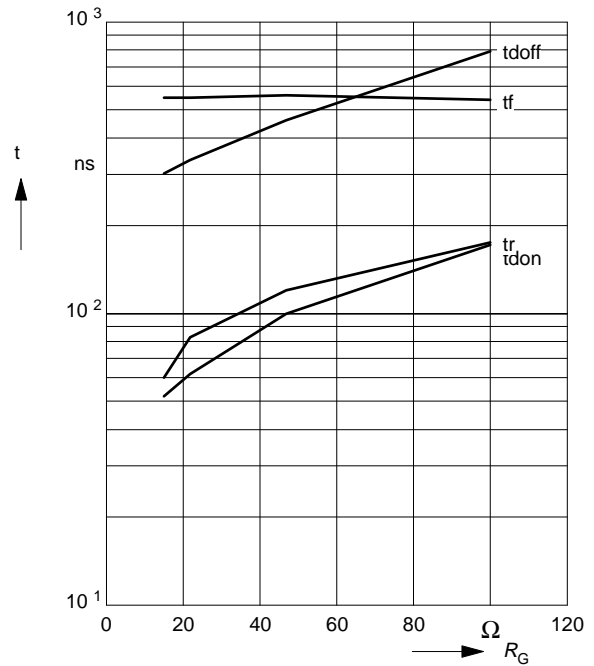
Typ. switching time

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



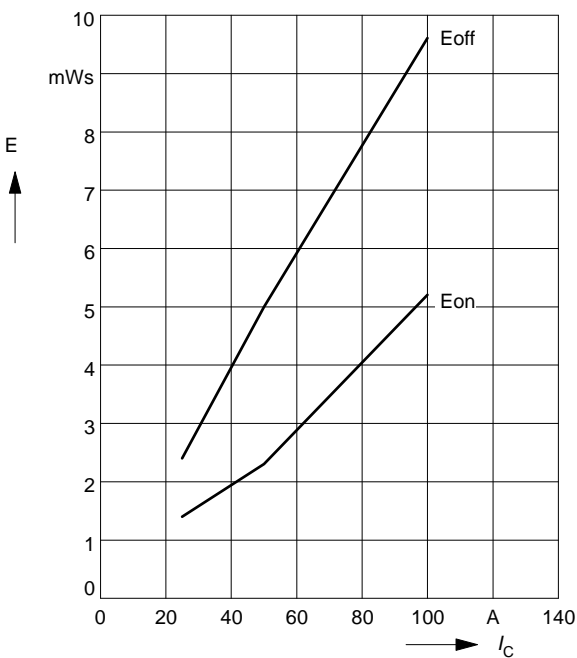
Typ. switching time

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



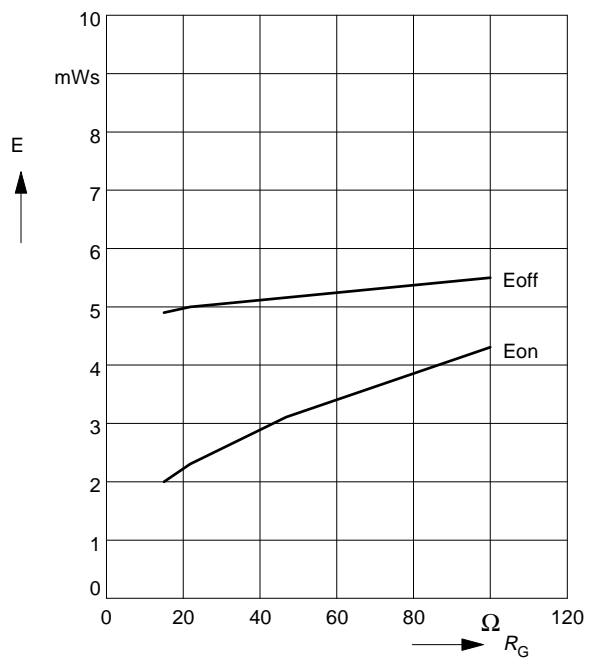
Typ. switching losses

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



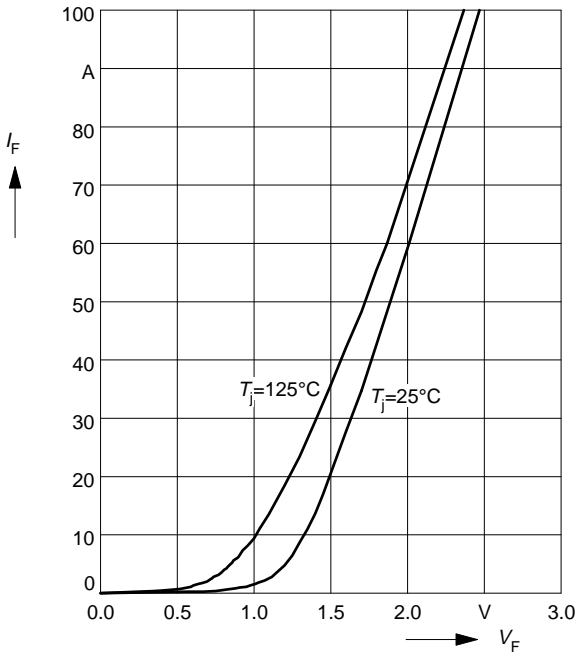
Typ. switching losses

$E = f(R_G)$, 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 $Z_{th\,JC} = f(t_p)$

parameter: $D = t_p / T$

