

## IGBT Module (2 in one-package)

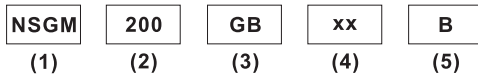
### Features

1. High frequency operation
2. Low losses and soft switching
3. Isolated baseplate for easy heat sinking
4. Discrete super-fast recovery free-wheel diode
5. Small temperature dependence of the turn-off switching loss

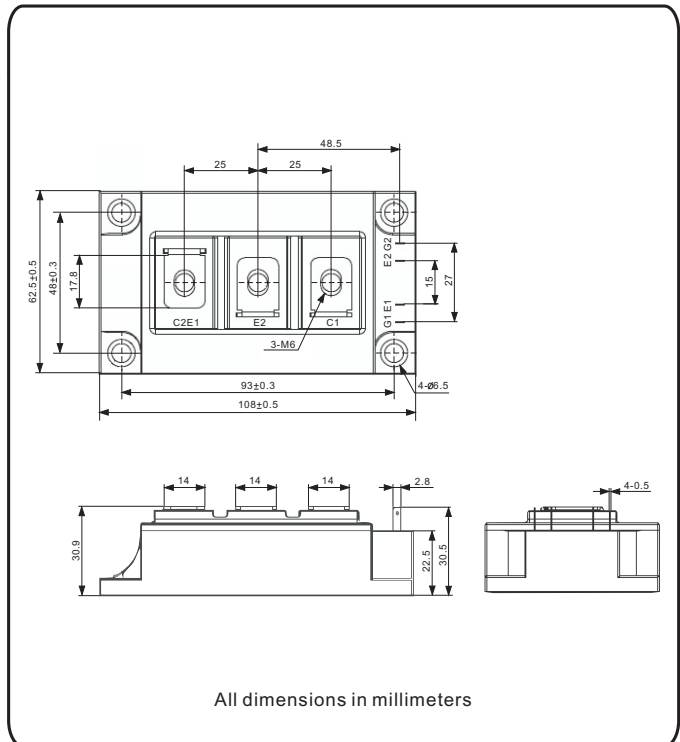
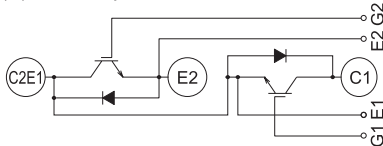
### Typical Applications

- AC Motor Control
- DC Motor Control
- UPS
- Welding Power Supplies
- Inverter
- Electronic welders at  $f_{SW}$  up to 20kHz

Ordering code



- (1) For IGBT module
- (2) Maximum average forward current, A
- (3) 2 in one-package
- (4) Voltage code, V (code x 10 =  $V_{RRM}$ )
- (5) Case style



### Electrical Characteristics

Absolute maximum ratings,  $T_j=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Condition	Max. Value	Unit
$I_C$	Collector current	$T_C=80^\circ\text{C}$	200	A
$I_{CM}$	Peak collector current	$T_C=25^\circ\text{C}$	400	A
$P_c$	Maximum collector dissipation	$T_C=25^\circ\text{C}, T_j \leq 150^\circ\text{C}$	1400	W
$V_{CES}$	Collector-emitter voltage	G-E Short	1200	V
$V_{GES}$	Gate-emitter voltage	C-E Short	$\pm 20$	V
$V_{iso}$	Isolation voltage	Main terminal to baseplate, AC 1 min	3000	V
$T_j$	Junction temperature		-40 to 150	$^\circ\text{C}$
$T_{stg}$	Storage temperature		-40 to 125	$^\circ\text{C}$
$T$	Mounting torque, M6 main terminal		3 to 5	N.m
	Mounting torque, M6 mounting		3 to 5	
$W_t$	Approximate weight		370	g

Static electrical characteristics,  $T_j=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
$I_{CES}$	Collector-cutoff current	$V_{CE}=V_{CES}, V_{GE}=0V$			1.0	mA
$I_{GES}$	Gate leakage current	$V_{GE}=\pm 20V, V_{CE}=0V, T_j=125^\circ\text{C}$			200	$\mu\text{A}$
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=6mA, V_{CE}=V_{GE}$	5	6.2	7	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$I_C=200A, V_{GE}=15V, T_j=25^\circ\text{C}$		1.9		V
		$I_C=200A, V_{GE}=15V, T_j=125^\circ\text{C}$		2.1		
$Q_G$	Total gate charge			2100		nC
$V_{EC}$	Emitter-collector voltage	$I_C=-130A, V_{GE}=0V$			2.2	V

Dynamic electrical characteristics ,  $T_j=25^{\circ}\text{C}$  unless otherwise specified

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{GE}=0\text{V}, V_{CE}=25\text{V}$ $f=1\text{MHz}$		20		nF
$C_{oes}$	Output capacitance			1.6		
$C_{res}$	Reverse transfer capacitance			1		
$t_{d(on)}$	Turn-on delay time , Resistive	$V_{CC}=600\text{V}, I_C=200\text{A}$ $V_{GE1}=V_{GE2}=\pm 15\text{V}, R_G=8\Omega$		135		ns
$t_r$	Rise time , Load			60		
$t_{d(off)}$	Turn-off delay time , Switching			490		
$t_f$	Fall time , Times			75		
$t_{rr}$	Diode reverse recovery time	$I_C=-130\text{A}, d_i/d_t=-150\text{A}/\mu\text{s}$			250	ns
$Q_{rr}$	Diode reverse recovery charge	$I_C=-130\text{A}, d_i/d_t=-150\text{A}/\mu\text{s}$		12		$\mu\text{C}$

Thermal and mechanical characteristics ,  $T_j=25^{\circ}\text{C}$  unless otherwise specified

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
$R_{th(j-c)}$	Thermal resistance , junction to case	Per IGBT			0.11	$^{\circ}\text{C}/\text{W}$
		Per FWDi			0.32	
$R_{th(c-f)}$	Contact thermal resistance	Per module , thermal grease applied			0.05	$^{\circ}\text{C}/\text{W}$

Fig.1 Power dissipation

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

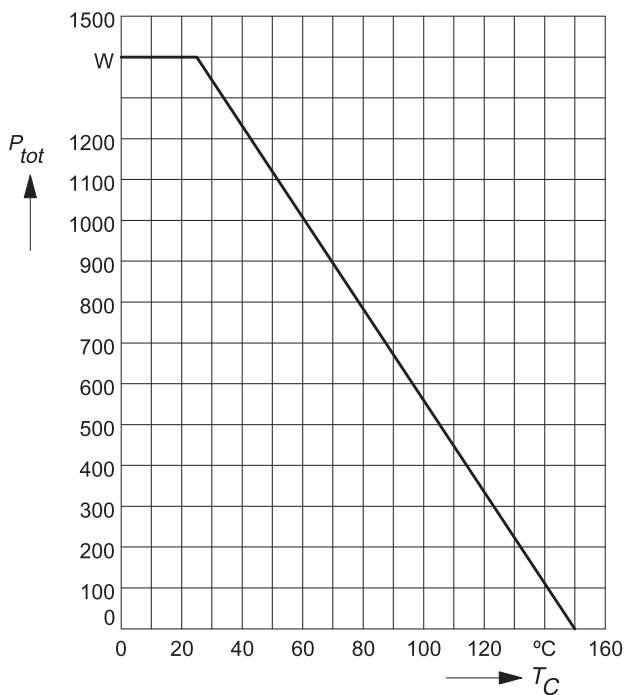


Fig.2 Safe operating area

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

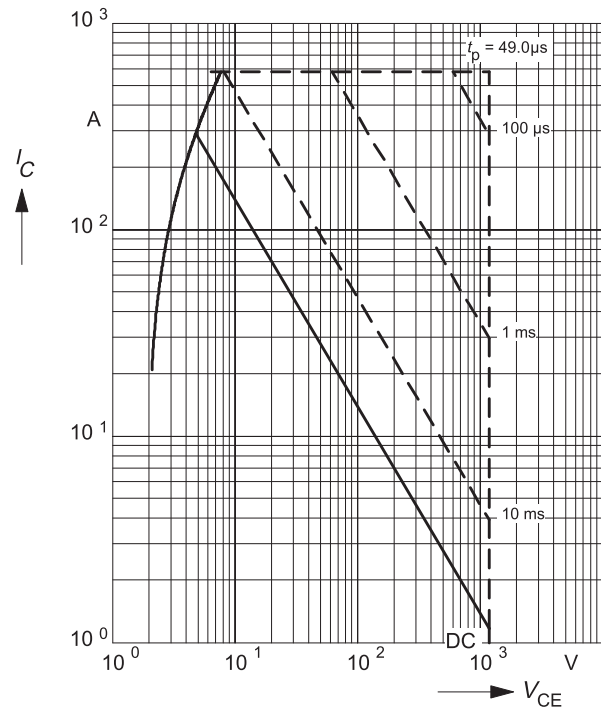


Fig.3 Collector current

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

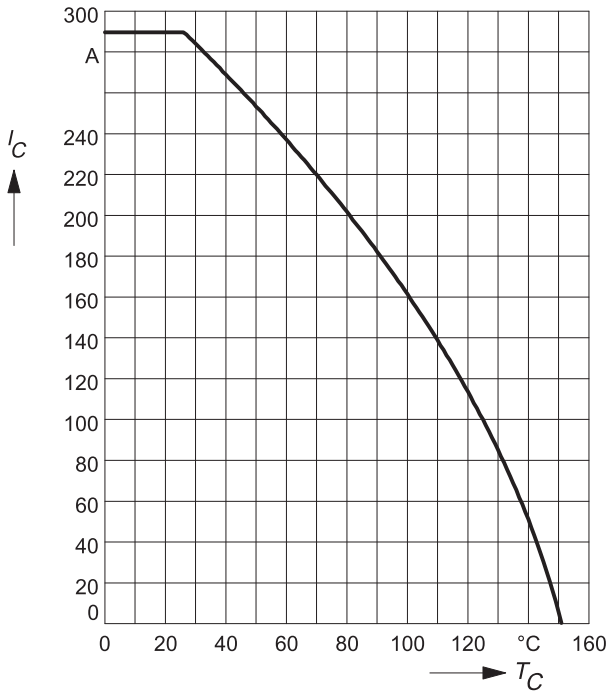


Fig 4. Transient thermal impedance IGBT

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

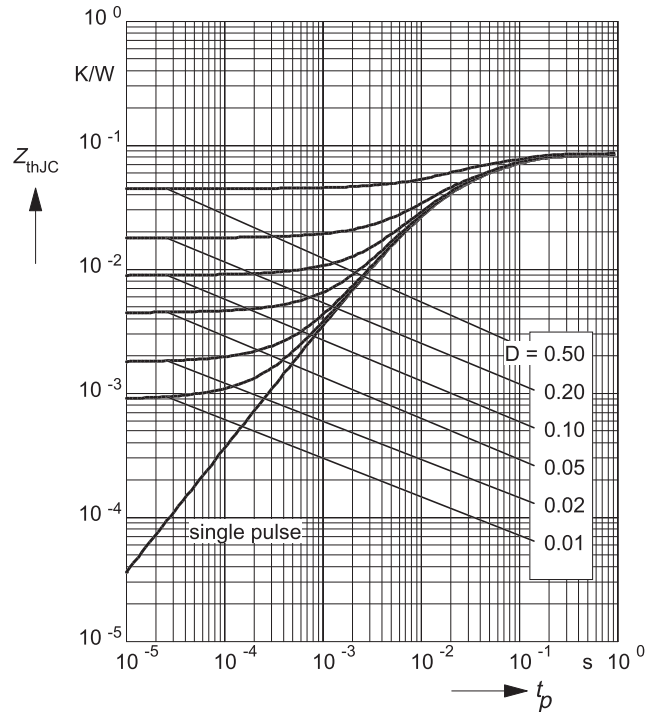


Fig 5. Typ. output characteristics

$I_C = f(V_{CE})$ , parameter:  $t_p = 80 \mu s, T_j = 25^\circ C$

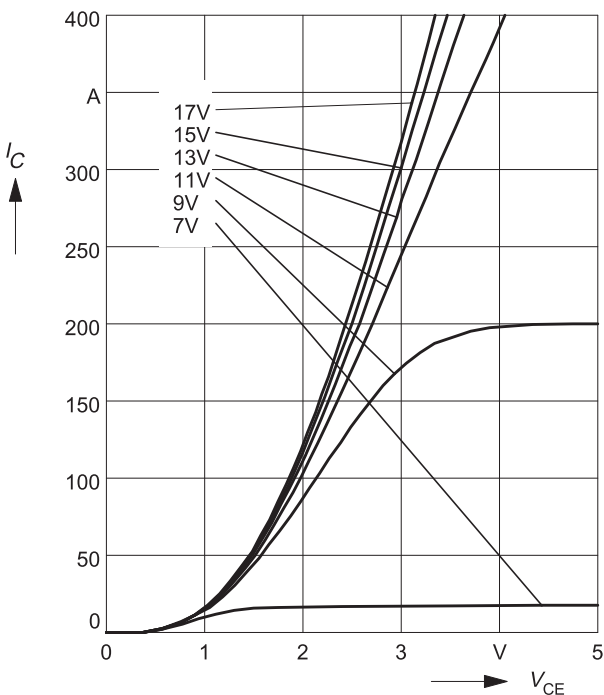


Fig 6. Typ. output characteristics

$I_C = f(V_{CE})$ , parameter:  $t_p = 80 \mu s, T_j = 125^\circ C$

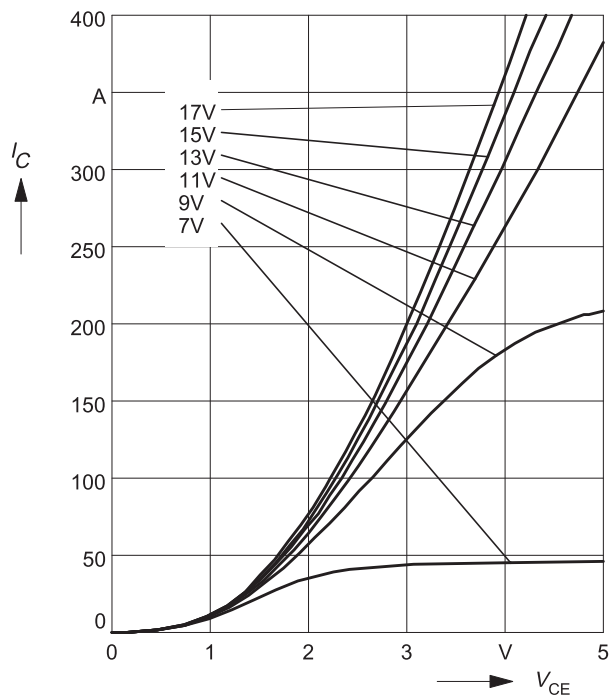


Fig 7. Typ. transfer characteristics

$I_C = f(V_{GE})$ , parameter:  $t_p = 80 \mu s, V_{CE} = 20 V$

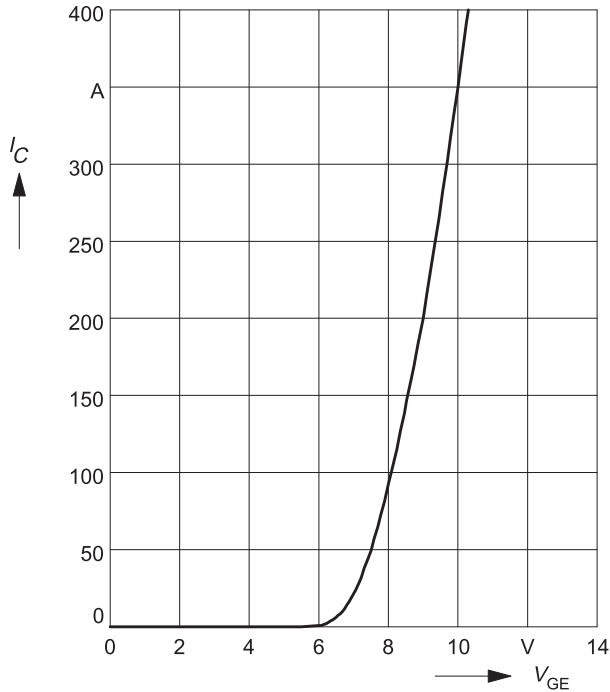


Fig 8. Typ. gate charge

$V_{GE} = f(Q_{Gate})$ , parameter:  $I_{C\ puls} = 200 A$

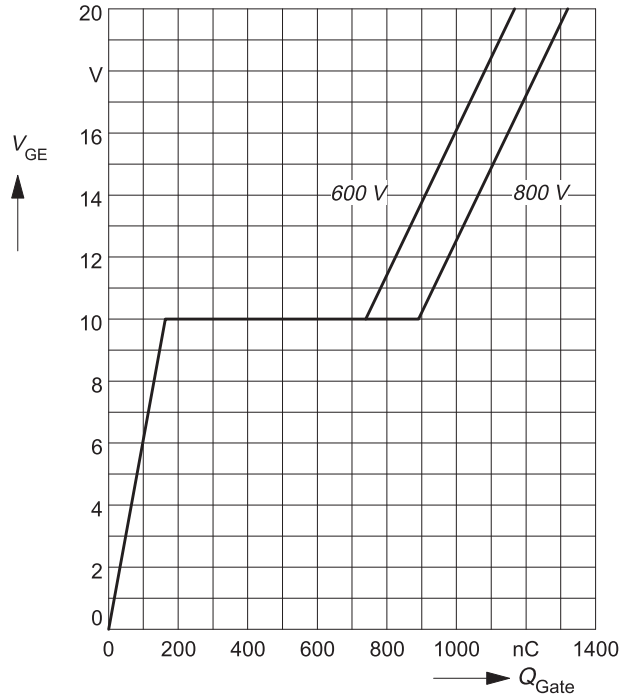


Fig 9. Typ. capacitances

$C = f(V_{CE})$ , parameter:  $V_{GE} = 0 V, f = 1 MHz$

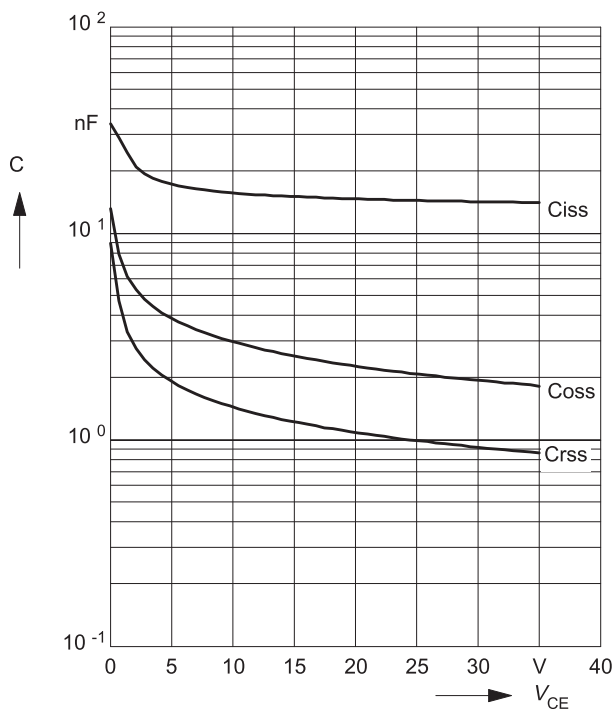


Fig 10. Reverse biased safe operating area

$I_{C\ puls} = f(V_{CE})$ ,  $T_j = 150 \text{ }^\circ C$ , parameter:  $V_{GE} = 15 V$

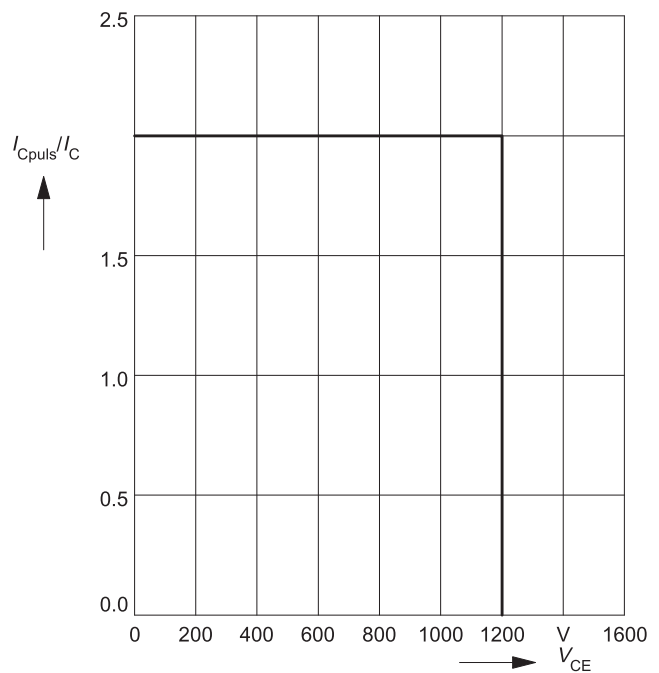


Fig 11. Short circuit safe operating area

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

parameter :  $V_{GE} = \pm 15\text{ V}$ ,  $t_{SC} \leq 10\text{ }\mu\text{s}$ ,  $L < 25\text{ nH}$

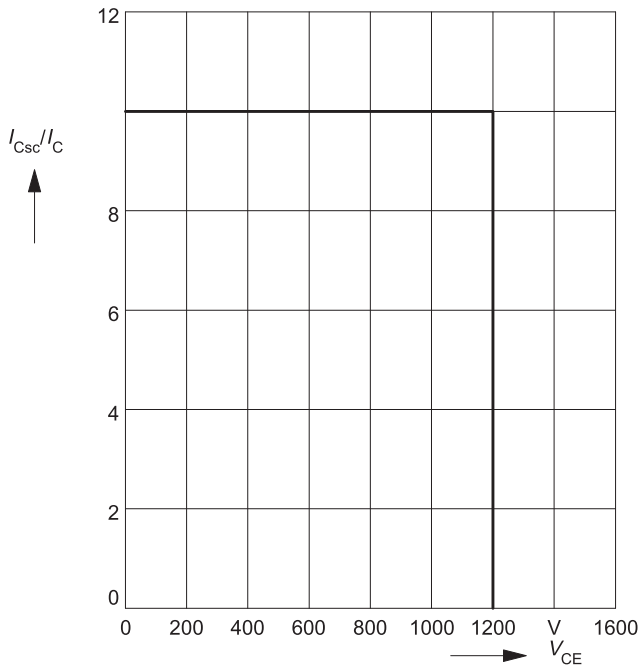


Fig 12. Typ. switching time

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

par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 4.7\text{ }\Omega$

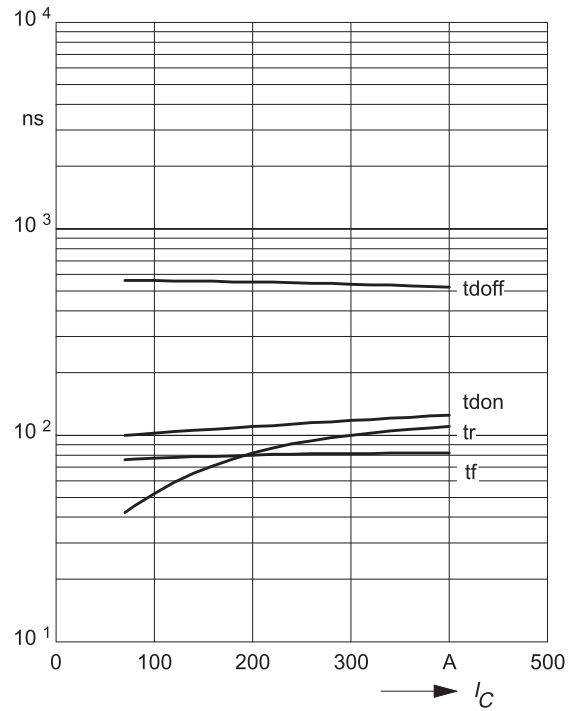


Fig 13. Typ. switching time

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

par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 200\text{ A}$

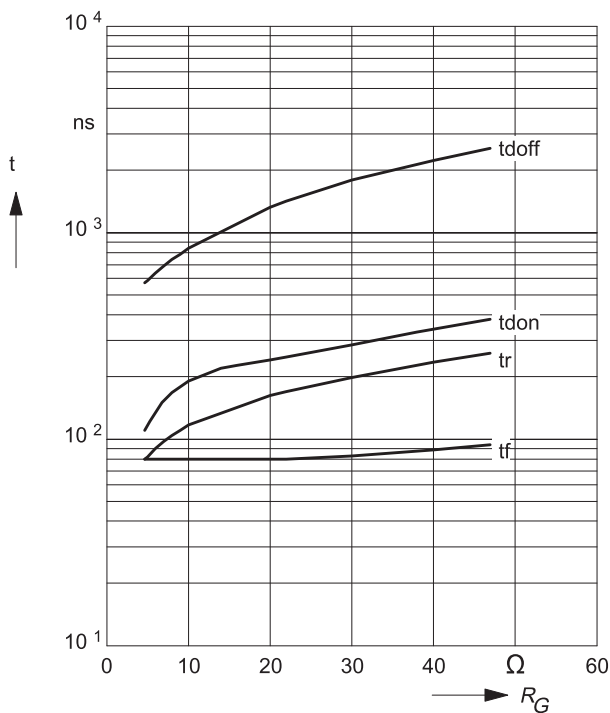


Fig 14. Typ. switching losses

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

par.:  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $R_G = 4.7\text{ }\Omega$

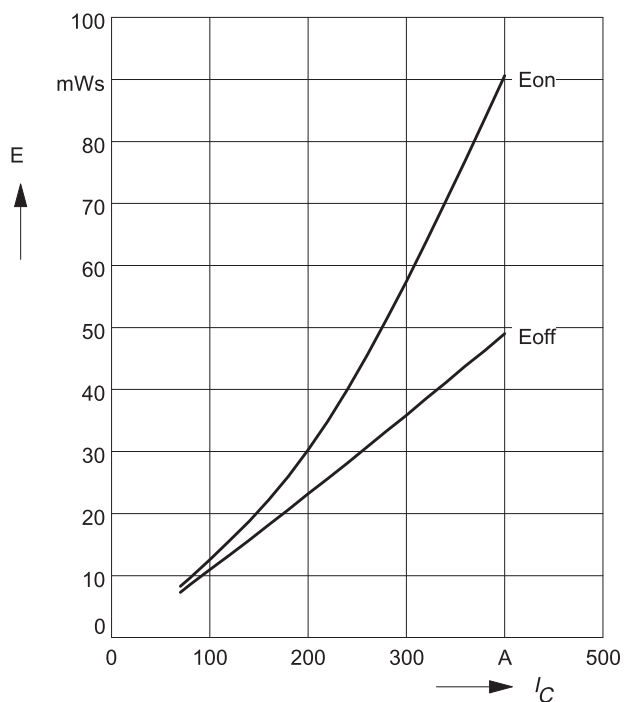


Fig 15. Typ. switching losses

$E = f(R_G)$ , inductive load,  $T_j = 125^\circ\text{C}$   
 par.:  $V_{CE} = 600\text{V}$ ,  $V_{GE} = \pm 15\text{V}$ ,  $I_C = 200\text{A}$

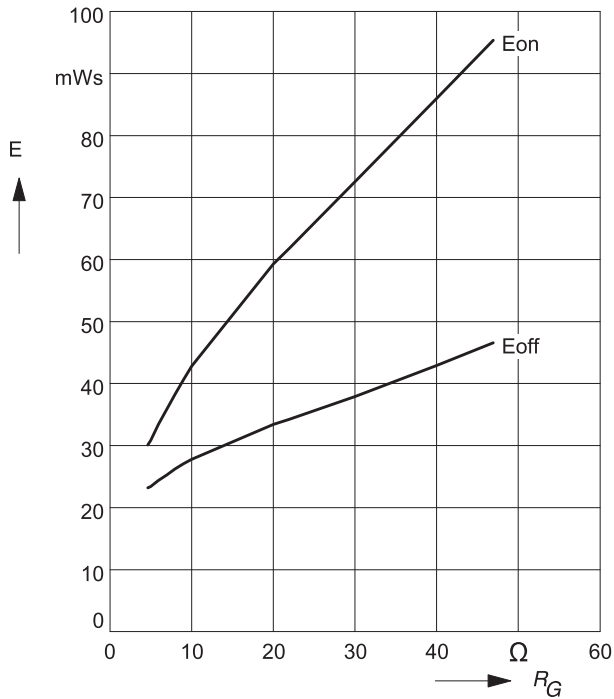


Fig 16. Forward characteristics of fast recovery reverse diode  $I_F = f(V_F)$ , parameter:  $T_j$

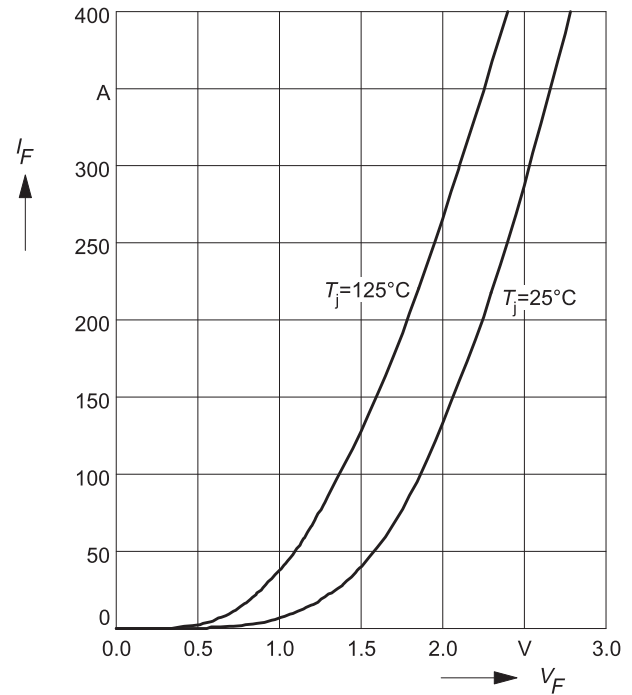


Fig 17. Transient thermal impedance Diode

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

