

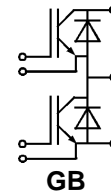
Absolute Maximum Ratings		Values	Units
Symbol	Conditions <sup>1)</sup>		
V <sub>CES</sub>		600	V
V <sub>CGR</sub>	R <sub>GE</sub> = 20 kΩ	600	V
I <sub>C</sub>	T <sub>case</sub> = 25/75 °C	70 / 50	A
I <sub>CM</sub>	T <sub>case</sub> = 25/75 °C; t <sub>p</sub> = 1 ms	140 / 100	A
V <sub>GES</sub>		± 20	V
P <sub>tot</sub>	per IGBT, T <sub>case</sub> = 25 °C	250	W
T <sub>J</sub> , (T <sub>stg</sub> )		-40 ... +150 (125)	°C
V <sub>isol</sub>	AC, 1 min.	2500	V
humidity	DIN 40040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
I <sub>F</sub> = -I <sub>C</sub>	T <sub>case</sub> = 25/80 °C	75 / 50	A
I <sub>FM</sub> = -I <sub>CM</sub>	T <sub>case</sub> = 25/80 °C; t <sub>p</sub> = 1 ms	140 / 100	A
I <sub>FSM</sub>	t <sub>p</sub> = 10 ms; sin.; T <sub>J</sub> = 150 °C	440	A
I <sup>2</sup> t	t <sub>p</sub> = 10 ms; T <sub>J</sub> = 150 °C	970	A <sup>2</sup> s

## SEMITRANS® M Superfast NPT-IGBT Modules

### SKM 50 GB 063 D



### SEMITRANS 2



### Features

- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
  - Low tail current with low temperature dependence
  - High short circuit capability, self limiting if term. G is clamped to E
  - Pos. temp.-coeff. of V<sub>CESat</sub>
  - 50 % less turn off losses <sup>9)</sup>
  - 30 % less short circuit current <sup>9)</sup>
  - Very low C<sub>ies</sub>, C<sub>oes</sub>, C<sub>res</sub> <sup>9)</sup>
  - Latch-up free
  - Fast & soft inverse CAL diodes <sup>8)</sup>
  - Isolated copper baseplate using DCB Direct Copper Bonding Technology without hard mould
  - Large clearance (10 mm) and creepage distances (20 mm)
- ### Typical Applications
- Switching (not for linear use)
  - Switched mode power supplies
  - UPS
  - Three phase inverters for servo / AC motor speed control
  - Pulse frequencies also above 10 kHz

Characteristics		min.	typ.	max.	Units
Symbol	Conditions <sup>1)</sup>				
V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0, I <sub>C</sub> = 1,5 mA	≥ V <sub>CES</sub>	–	–	V
V <sub>GE(th)</sub>	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 1 mA	4,5	5,5	6,5	V
I <sub>CES</sub>	V <sub>GE</sub> = 0 } T <sub>J</sub> = 25 °C	–	0,1	1,5	mA
	V <sub>CE</sub> = V <sub>CES</sub> } T <sub>J</sub> = 125 °C	–	3	–	mA
I <sub>GES</sub>	V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0	–	–	100	nA
V <sub>CESat</sub>	I <sub>C</sub> = 30 A } V <sub>GE</sub> = 15 V;	–	1,8(2,0)	–	V
V <sub>CESat</sub>	I <sub>C</sub> = 50 A } T <sub>J</sub> = 25 (125) °C }	–	2,1(2,4)	2,5(2,8)	V
g <sub>fs</sub>	V <sub>CE</sub> = 20 V, I <sub>C</sub> = 50 A	20	–	–	S
C <sub>CHC</sub>	per IGBT	–	–	350	pF
C <sub>ies</sub>	V <sub>GE</sub> = 0	–	2800	–	pF
C <sub>oes</sub>	V <sub>CE</sub> = 25 V	–	300	–	pF
C <sub>res</sub>	f = 1 MHz	–	200	–	pF
L <sub>CE</sub>		–	–	30	nH
t <sub>d(on)</sub>	V <sub>CC</sub> = 300 V	–	50	–	ns
t <sub>r</sub>	V <sub>GE</sub> = -15 V / +15 V <sup>3)</sup>	–	40	–	ns
t <sub>d(off)</sub>	I <sub>C</sub> = 50 A, ind. load	–	300	–	ns
t <sub>f</sub>	R <sub>Gon</sub> = R <sub>Goff</sub> = 22 Ω	–	30	–	ns
E <sub>on</sub>	T <sub>J</sub> = 125 °C	–	2,5	–	mWs
E <sub>off</sub>		–	1,8	–	mWs
Inverse Diode <sup>8)</sup>					
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 50 A } V <sub>GE</sub> = 0 V;	–	1,45(1,35)	1,7	V
	T <sub>J</sub> = 25 (125 °C) }				
V <sub>TO</sub>	T <sub>J</sub> = 125 °C	–	–	0,9	V
r <sub>t</sub>	T <sub>J</sub> = 125 °C	–	10	15	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 50 A; T <sub>J</sub> = 125 °C <sup>2)</sup>	–	31	–	A
Q <sub>rr</sub>	I <sub>F</sub> = 50 A; T <sub>J</sub> = 125 °C <sup>2)</sup>	–	3,2	–	μC
Thermal characteristics					
R <sub>thjc</sub>	per IGBT	–	–	0,5	°C/W
R <sub>thjc</sub>	per diode	–	–	1,0	°C/W
R <sub>thch</sub>	per module	–	–	0,05	°C/W

<sup>1)</sup> T<sub>case</sub> = 25 °C, unless otherwise specified

<sup>2)</sup> I<sub>F</sub> = -I<sub>C</sub>, V<sub>R</sub> = 300 V, -di<sub>F</sub>/dt = 800 A/μs, V<sub>GE</sub> = 0 V

<sup>3)</sup> Use V<sub>GEoff</sub> = -5... -15 V

<sup>8)</sup> CAL = Controlled Axial Lifetime Technology

<sup>9)</sup> Compared to PT-IGBT

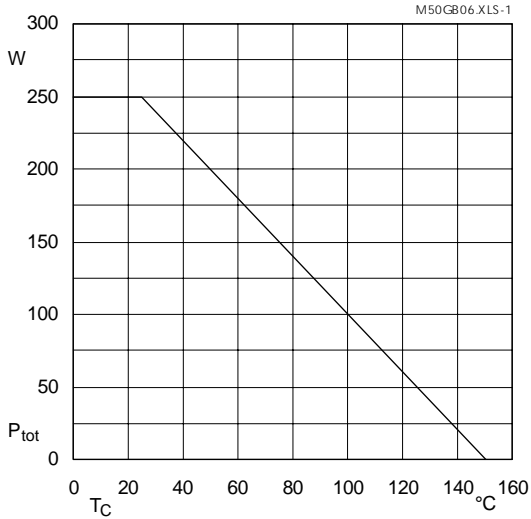


Fig. 1 Rated power dissipation  $P_{tot} = f(T_C)$

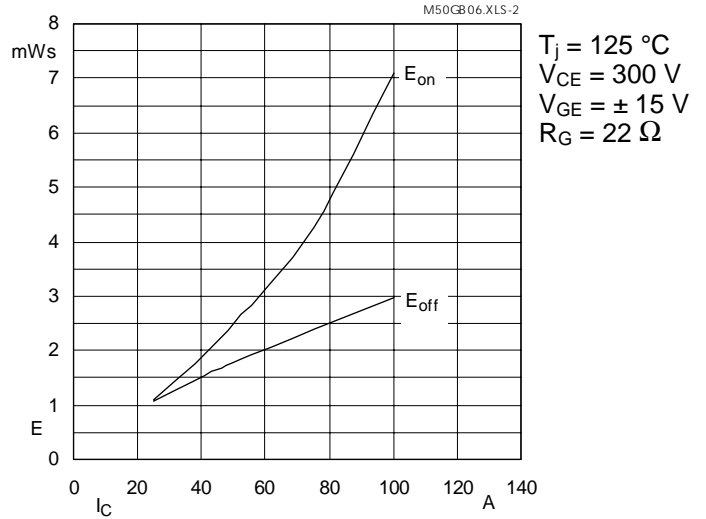


Fig. 2 Turn-on /-off energy  $= f(I_C)$

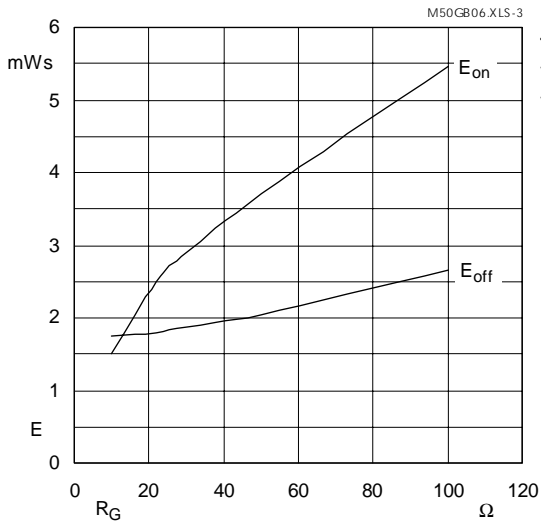


Fig. 3 Turn-on /-off energy  $= f(R_G)$

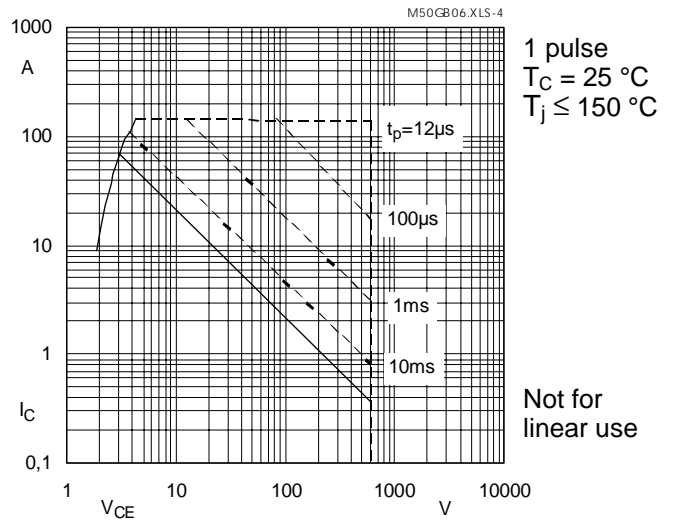


Fig. 4 Maximum safe operating area (SOA)  $I_C = f(V_{CE})$

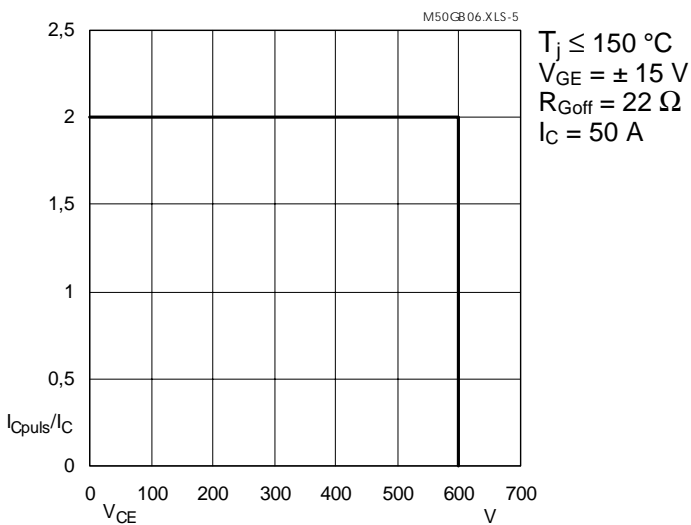


Fig. 5 Turn-off safe operating area (RBSOA)

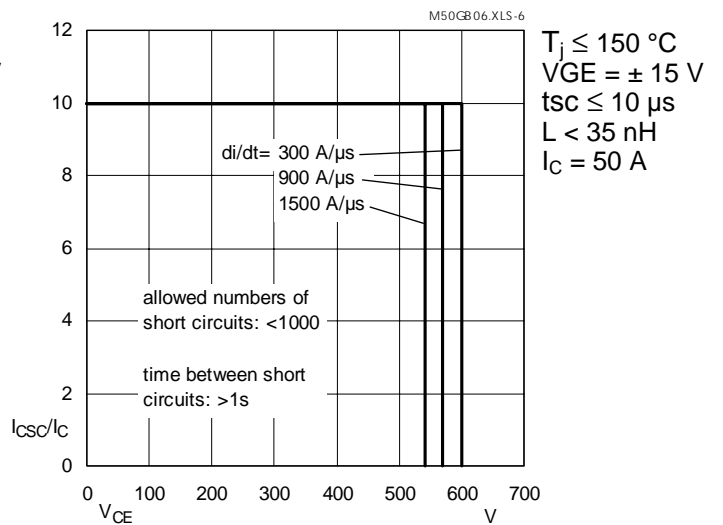


Fig. 6 Safe operating area at short circuit  $I_C = f(V_{CE})$

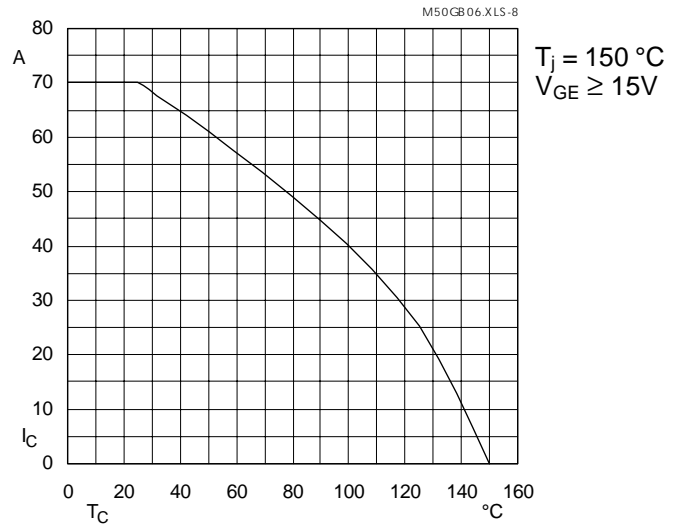


Fig. 8 Rated current vs. temperature  $I_C = f(T_C)$

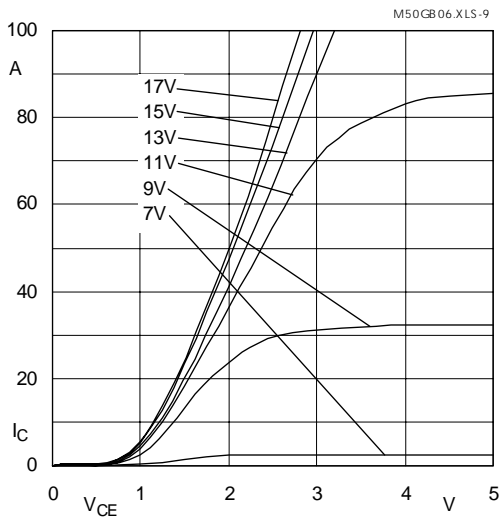


Fig. 9 Typ. output characteristic,  $t_p = 250\text{ }\mu\text{s}$ ;  $T_j = 25\text{ }^\circ\text{C}$

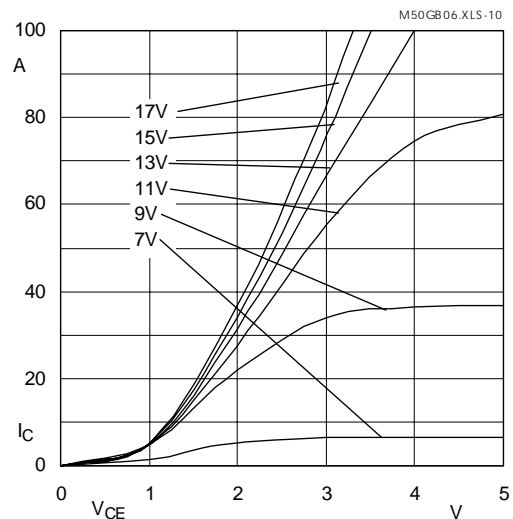


Fig. 10 Typ. output characteristic,  $t_p = 250\text{ }\mu\text{s}$ ;  $T_j = 125\text{ }^\circ\text{C}$

$$P_{\text{cond}(t)} = V_{\text{CEsat}(t)} \cdot I_{\text{C}(t)}$$

$$V_{\text{CEsat}(t)} = V_{\text{CE(TO)(Tj)}} + r_{\text{CE(Tj)}} \cdot I_{\text{C}(t)}$$

$$V_{\text{CE(TO)(Tj)}} \leq 1,2 - 0,001 (T_j - 25) \text{ [V]}$$

$$\text{typ.: } r_{\text{CE(Tj)}} = 0,018 + 0,00008 (T_j - 25) \text{ [\Omega]}$$

$$\text{max.: } r_{\text{CE(Tj)}} = 0,026 + 0,00008 (T_j - 25) \text{ [\Omega]}$$

$$\text{valid for } V_{\text{GE}} = +15 \begin{matrix} +2 \\ -1 \end{matrix} \text{ [V]; } I_{\text{C}} \geq 0,3 I_{\text{Cnom}}$$

Fig. 11 Saturation characteristic (IGBT)  
Calculation elements and equations

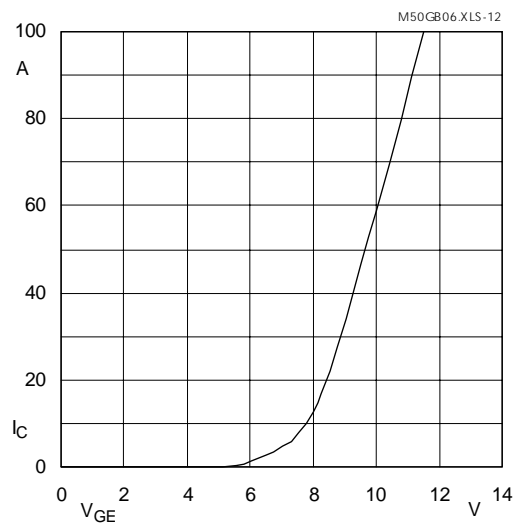


Fig. 12 Typ. transfer characteristic,  $t_p = 80\text{ }\mu\text{s}$ ;  $V_{CE} = 20\text{ V}$

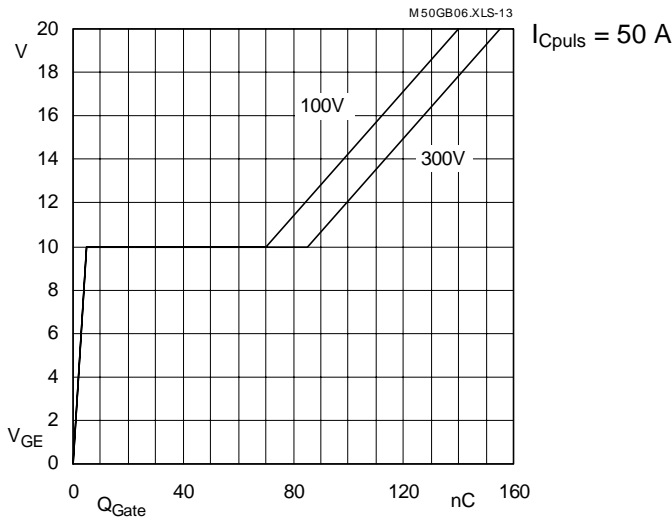


Fig. 13 Typ. gate charge characteristic

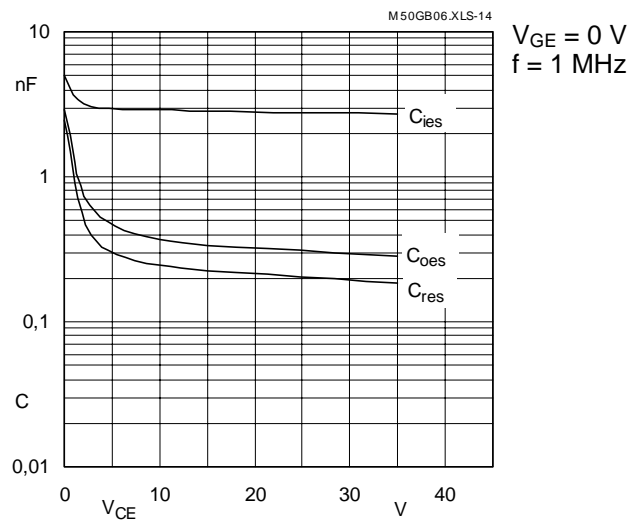


Fig. 14 Typ. capacitances vs.  $V_{CE}$

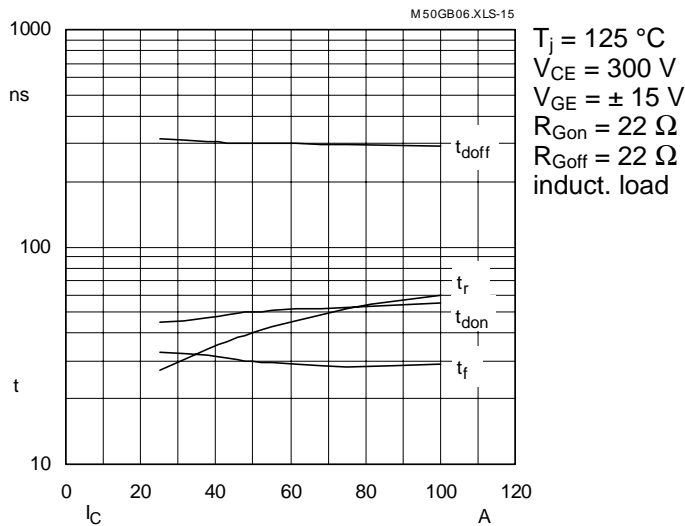


Fig. 15 Typ. switching times vs.  $I_C$

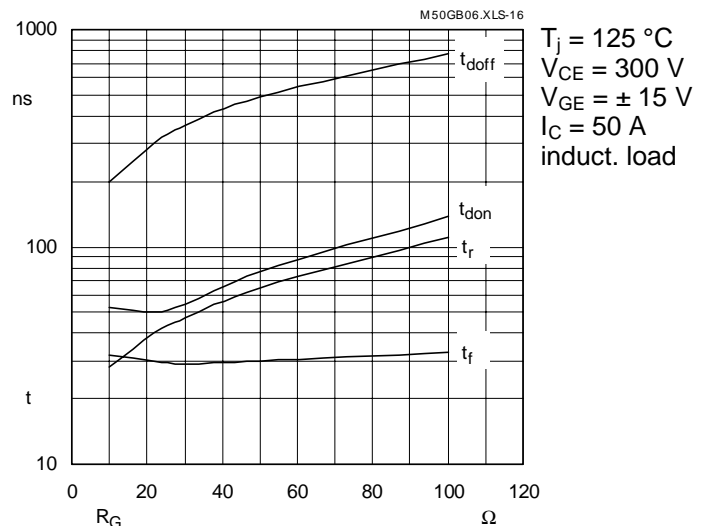


Fig. 16 Typ. switching times vs. gate resistor  $R_G$

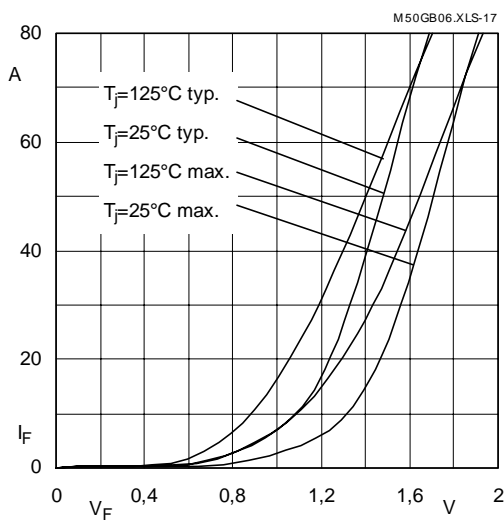


Fig. 17 Typ. CAL diode forward characteristic

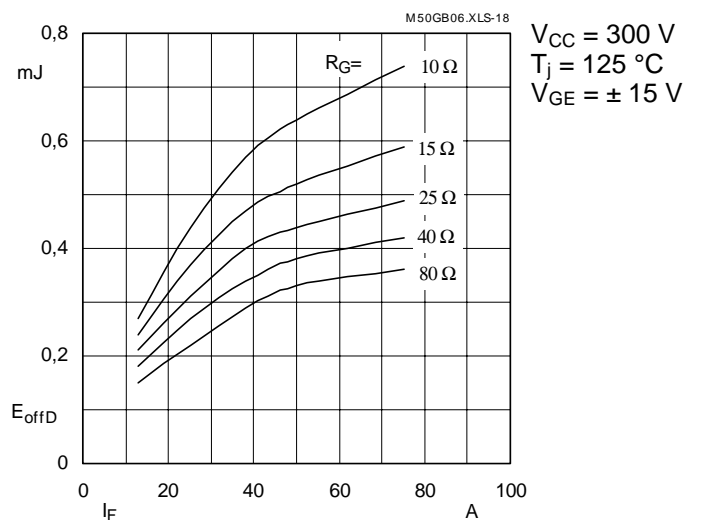


Fig. 18 Diode turn-off energy dissipation per pulse

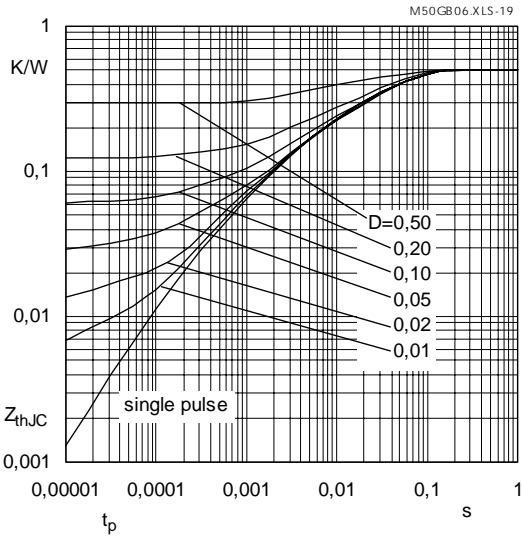


Fig. 19 Transient thermal impedance of IGBT  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

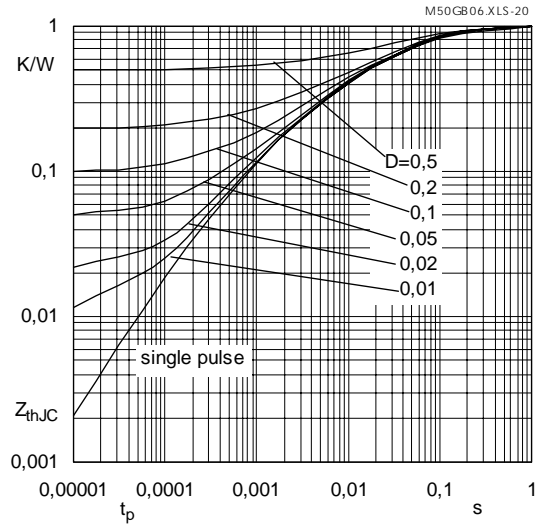


Fig. 20 Transient thermal impedance of inverse CAL diodes  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

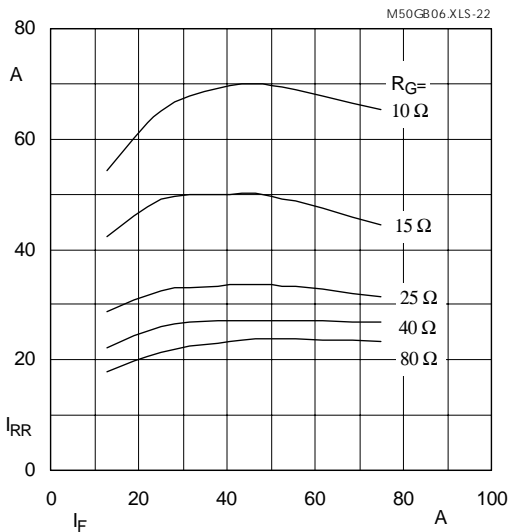


Fig. 22 Typ. CAL diode peak reverse recovery current  $I_{RR} = f(I_F; R_G)$

$V_{CC} = 300\text{ V}$   
 $T_j = 125\text{ °C}$   
 $V_{GE} = \pm 15\text{ V}$

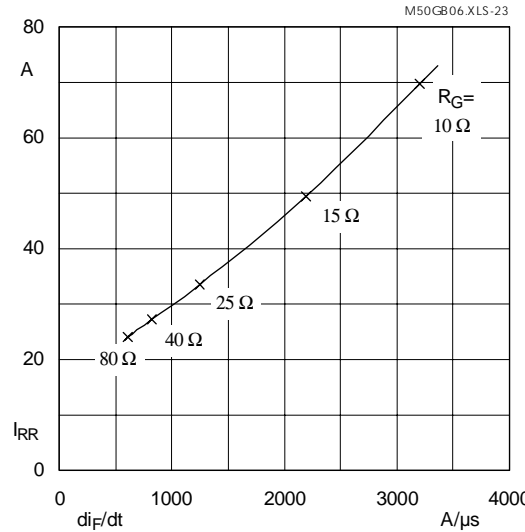


Fig. 23 Typ. CAL diode peak reverse recovery current  $I_{RR} = f(di_F/dt)$

$V_{CC} = 300\text{ V}$   
 $T_j = 125\text{ °C}$   
 $V_{GE} = \pm 15\text{ V}$   
 $I_F = 50\text{ A}$

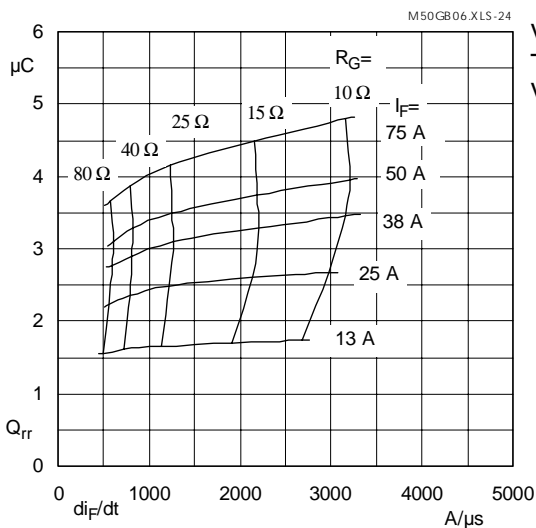


Fig. 24 Typ. CAL diode recovered charge

$V_{CC} = 300\text{ V}$   
 $T_j = 125\text{ °C}$   
 $V_{GE} = \pm 15\text{ V}$

