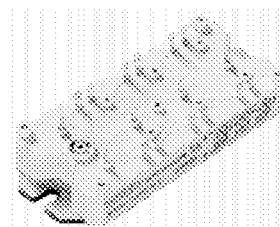
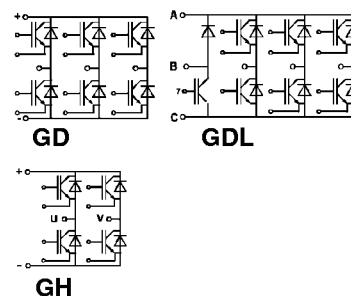


SEMITRANS® Superfast NPT-IGBT Modules

SKM 50 GD 063 DL
SKM 50 GDL 063 D)**
SKM 50 GH 063 DL *)**



SIXPACK / 7-Pack)/ 4-Pack***)**



Features

- Nchannel, 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_{CEsat}
- 50 % less turn off losses ⁹⁾
- 30 % less short circuit current ⁹⁾
- Very low C_{ies} , C_{oes} , C_{res} ⁹⁾
- Latch-up free
- Fast & soft inverse CAL diodes ⁸⁾
- Isolated copper baseplate using DCB Direct Copper Bonding Technology without hard mould
- Large clearance (9 mm) and creepage distances (13 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 > 10 kHz

Cases and mech. data → B 6 – 14

Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V_{CES}		600	V
V_{CGR}	$R_{GE} = 20 \text{ k}\Omega$	600	V
I_C	$T_{case} = 25/75 \text{ }^\circ\text{C}$	70 / 50	A
I_{CM}	$T_{case} = 25/75 \text{ }^\circ\text{C}; t_p = 1 \text{ ms}$	140 / 100	A
V_{GES}		± 20	V
P_{tot}	per IGBT, $T_{case} = 25 \text{ }^\circ\text{C}$	250	W
$T_j, (T_{stg})$		-40 ... +150 (125)	$^\circ\text{C}$
V_{isol}	AC, 1 min.	2500	V
humidity	DIN 40040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
$I_F = -I_C$	$T_{case} = 25/80 \text{ }^\circ\text{C}$	75 / 50	A
$I_{FM} = -I_{CM}$	$T_{case} = 25/80 \text{ }^\circ\text{C}; t_p = 1 \text{ ms}$	140 / 100	A
I_{FSM}	$t_p = 10 \text{ ms}; \sin.; T_j = 150 \text{ }^\circ\text{C}$	440	A
I^2t	$t_p = 10 \text{ ms}; T_j = 150 \text{ }^\circ\text{C}$	970	A^2s

Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
$V_{(BR)CES}$	$V_{GE} = 0, I_C = 1,5 \text{ mA}$	$\geq V_{CES}$	—	—	V
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 1 \text{ mA}$	4,5	5,5	6,5	V
I_{CES}	$V_{GE} = 0 \quad \left. \begin{matrix} T_j = 25 \text{ }^\circ\text{C} \\ T_j = 125 \text{ }^\circ\text{C} \end{matrix} \right\}$	—	0,1	1,5	mA
	$V_{CE} = V_{CES}$	—	3	—	mA
I_{GES}	$V_{GE} = 20 \text{ V}, V_{CE} = 0$	—	—	100	nA
V_{CEsat}	$I_C = 30 \text{ A} \quad \left. \begin{matrix} V_{GE} = 15 \text{ V}; \\ T_j = 25 (125) \text{ }^\circ\text{C} \end{matrix} \right\}$	—	1,8(2,0)	—	V
V_{CEsat}	$I_C = 50 \text{ A} \quad \left. \begin{matrix} V_{GE} = 15 \text{ V}; \\ T_j = 25 (125) \text{ }^\circ\text{C} \end{matrix} \right\}$	—	2,1(2,4)	2,5(2,8)	V
g_{fs}	$V_{CE} = 20 \text{ V}, I_C = 50 \text{ A}$	20	—	—	S
C_{CHC}	per IGBT	—	—	350	pF
C_{ies}	$V_{GE} = 0$	—	2800	—	pF
C_{oes}	$V_{CE} = 25 \text{ V}$	—	300	—	pF
C_{res}	$f = 1 \text{ MHz}$	—	200	—	pF
L_{CE}		—	—	60	nH
$t_{d(on)}$	$V_{CC} = 300 \text{ V}$	—	50	—	ns
t_r	$V_{GE} = -15 \text{ V} / +15 \text{ V}^{3)}$	—	40	—	ns
$t_{d(off)}$	$I_C = 50 \text{ A, ind. load}$	—	300	—	ns
t_f	$R_{Gon} = R_{Goff} = 22 \text{ } \Omega$	—	30	—	ns
E_{on}	$T_j = 125 \text{ }^\circ\text{C}$	—	2,5	—	mWs
E_{off}		—	1,8	—	mWs
Inverse Diode ⁸⁾					
$V_F = V_{EC}$	$I_F = 50 \text{ A} \quad \left. \begin{matrix} V_{GE} = 0 \text{ V}; \\ T_j = 25 (125 \text{ }^\circ\text{C}) \end{matrix} \right\}$	—	1,45(1,35)	1,7	V
V_{TO}	$T_j = 125 \text{ }^\circ\text{C}$	—	—	0,9	V
r_t	$T_j = 125 \text{ }^\circ\text{C}$	—	10	15	$\text{m}\Omega$
I_{RRM}	$I_F = 50 \text{ A}; T_j = 125 \text{ }^\circ\text{C}^{2)}$	—	31	—	A
Q_{rr}	$I_F = 50 \text{ A}; T_j = 125 \text{ }^\circ\text{C}^{2)}$	—	3,2	—	μC
Thermal characteristics					
R_{thjc}	per IGBT	—	—	0,5	$^\circ\text{C/W}$
R_{thjc}	per diode	—	—	1,0	$^\circ\text{C/W}$
R_{thch}	per module	—	—	0,05	$^\circ\text{C/W}$

Diagrams Fig. 1 to 24 of type SKM 50GB063D apply

**) 7-pack = three phase inverter plus brake chopper

***) 4-pack, branch W left off

¹⁾ $T_{case} = 25 \text{ }^\circ\text{C}$, unless otherwise specified

²⁾ $I_F = -I_C, V_R = 300 \text{ V}, -di_F/dt = 800 \text{ A}/\mu\text{s}, V_{GE} = 0 \text{ V}$

³⁾ Use $V_{GEOff} = -5 \dots -15 \text{ V}$

⁸⁾ CAL = Controlled Axial Lifetime Technology

⁹⁾ Compared to PT-IGBT

SKM 50 GD 063 DL...

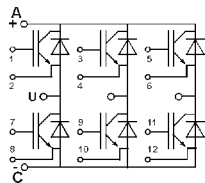
SEMITRANS® Sixpack

Case D 68

UL Recognized

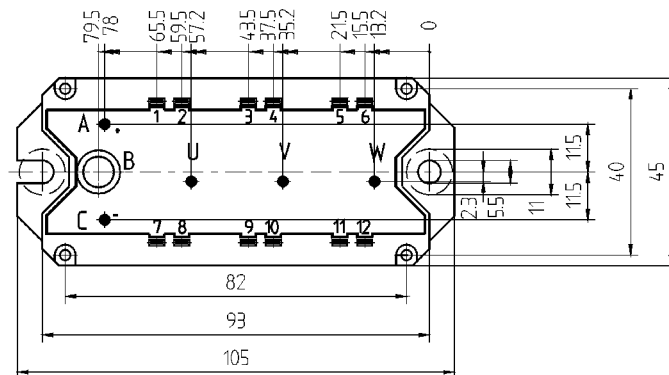
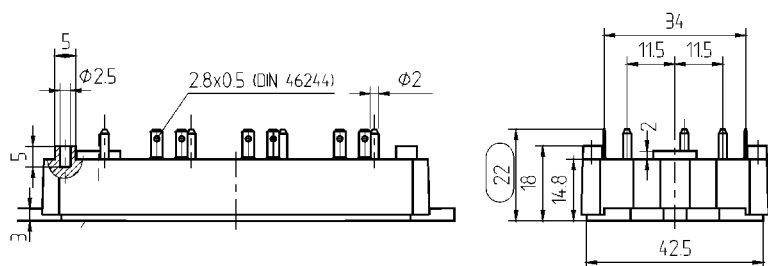
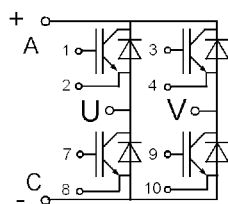
File no. E 63 532

SKM 50 GD 063 DL



SKM 50 GH 063 DL

Case D77 (= D68 without terminal W)



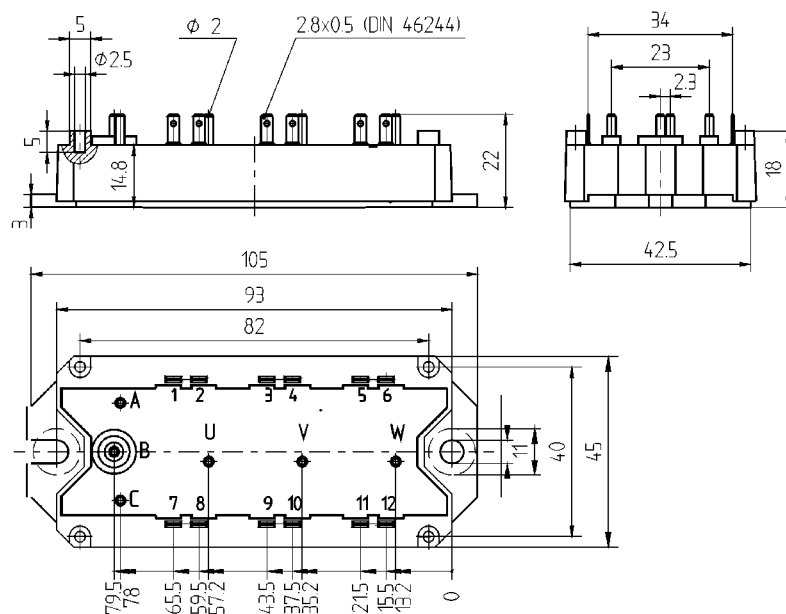
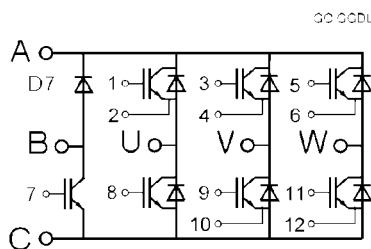
SEMITRANS® Sevenpack

Case D 73

UL Recognized

File no. E 63 532

SKM 50 GDL 063 D



Dimensions in mm

Case outlines and circuit diagrams

Mechanical Data		Values			Units
Symbol	Conditions	min.	typ.	max.	
M ₁	to heatsink, SI Units (M5)	4	—	5	Nm
a	to heatsink, US Units	35	—	44	lb.in.
w		—	—	5x9,81	m/s ²
		—	—	175	g

This is an electrostatic discharge sensitive device (ESDS). Please observe the international standard IEC 747-1, Chapter IX.

Two devices are supplied in one SEMIBOX A.

Larger packing units (10 or 20 pieces) are used if suitable SEMIBOX → page C - 1.

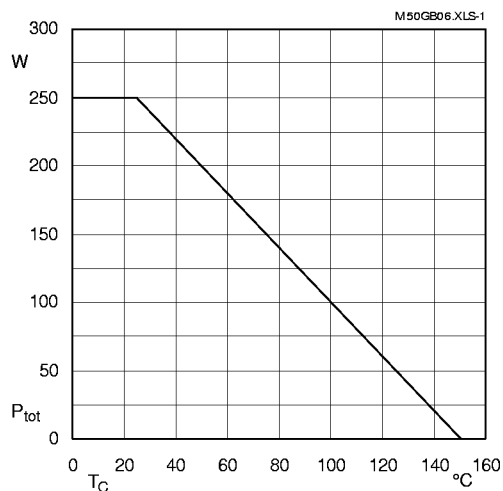


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

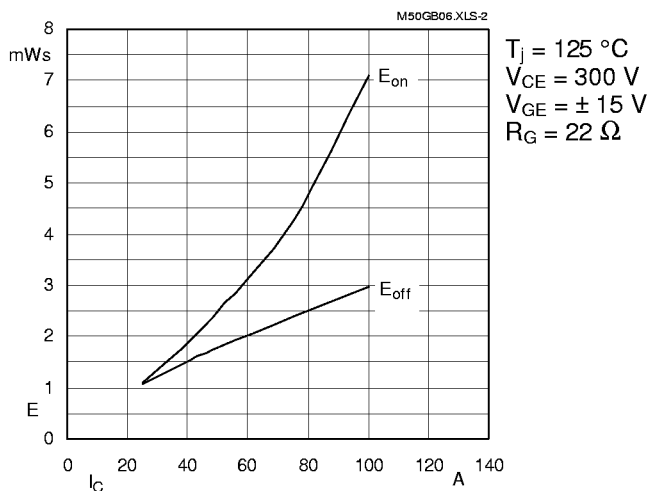


Fig. 2 Turn-on /-off energy $= f(I_C)$

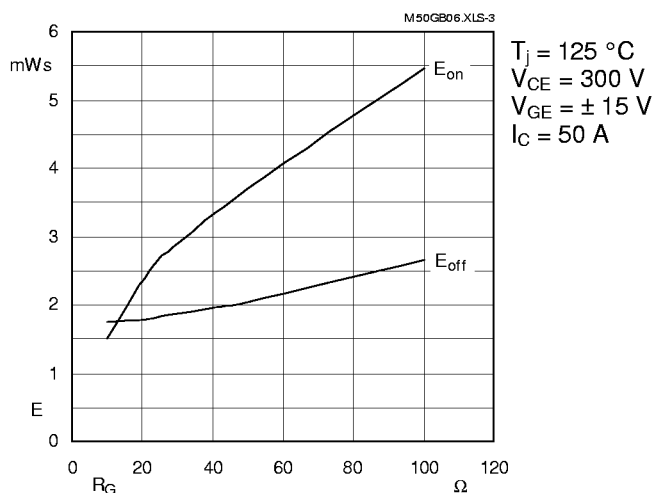


Fig. 3 Turn-on /-off energy $= f(R_G)$

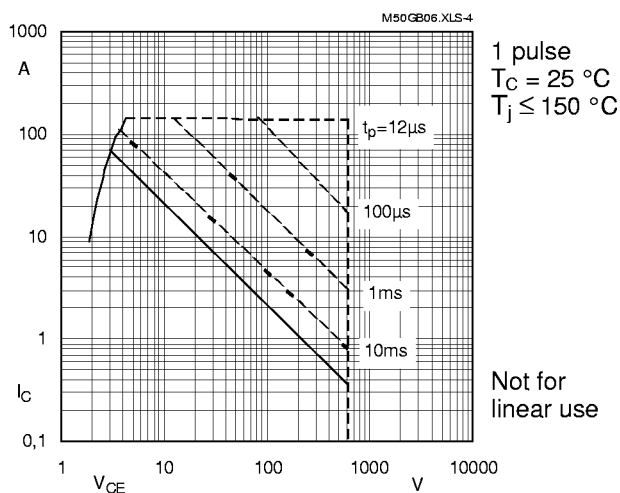


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

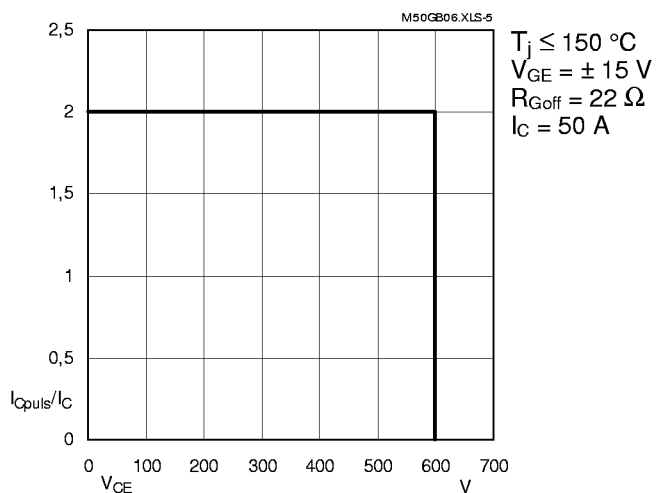


Fig. 5 Turn-off safe operating area (RBSOA)

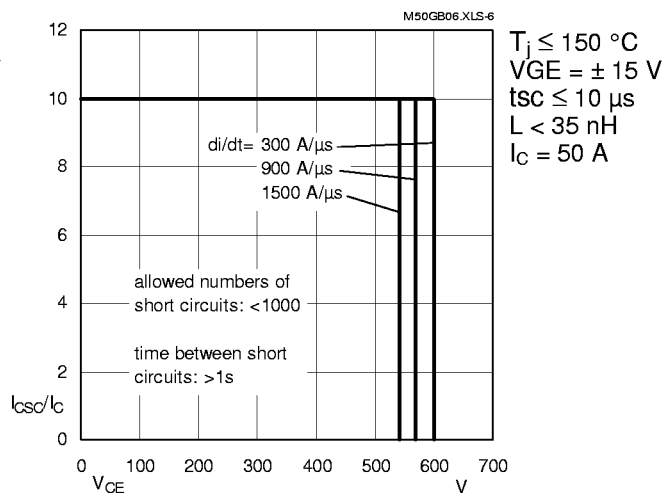


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

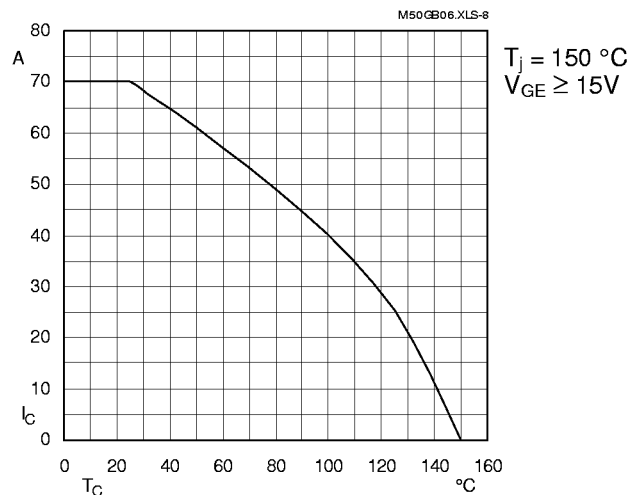


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

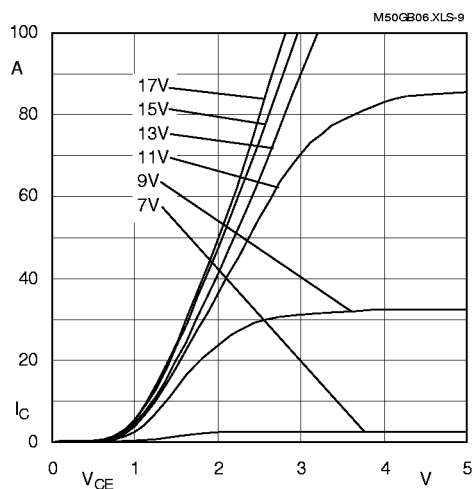


Fig. 9 Typ. output characteristic, $t_p = 250\text{ μs}$; $T_J = 25\text{ °C}$

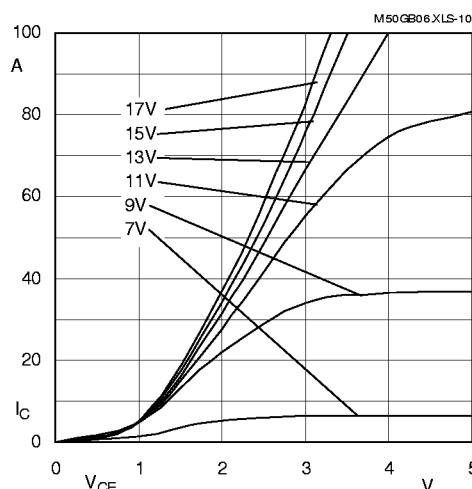


Fig. 10 Typ. output characteristic, $t_p = 250\text{ μs}$; $T_J = 125\text{ °C}$

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

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

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

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

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

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

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

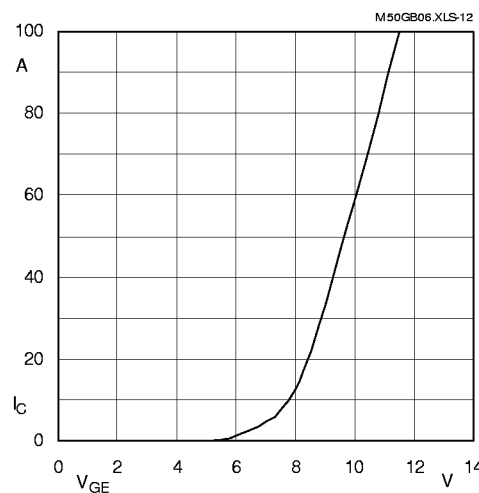


Fig. 12 Typ. transfer characteristic, $t_p = 80\text{ μs}$; $V_{\text{CE}} = 20\text{ V}$

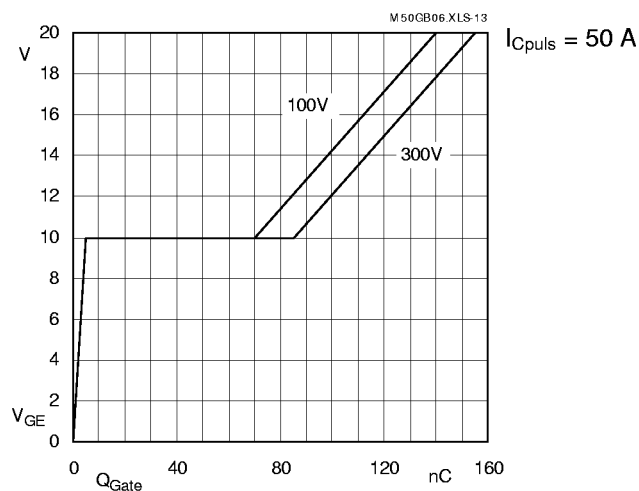


Fig. 13 Typ. gate charge characteristic

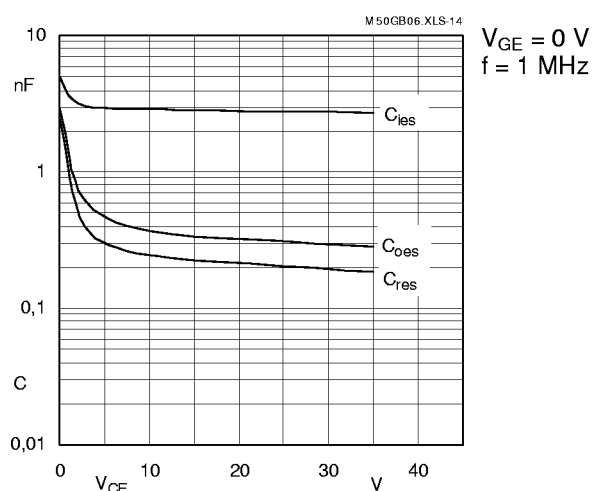


Fig. 14 Typ. capacitances vs. V_{CE}

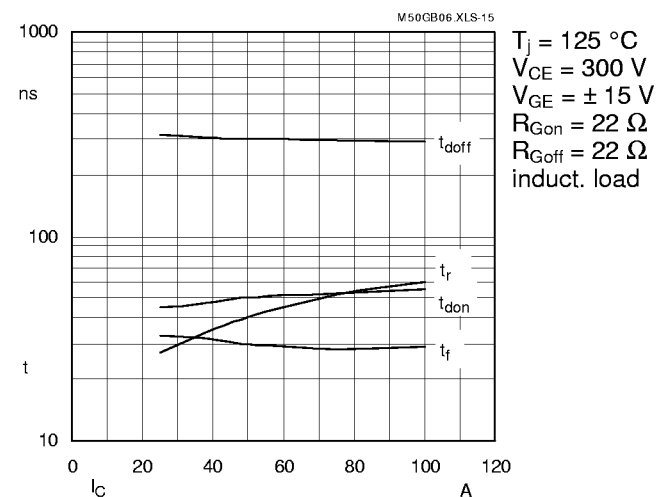


Fig. 15 Typ. switching times vs. I_C

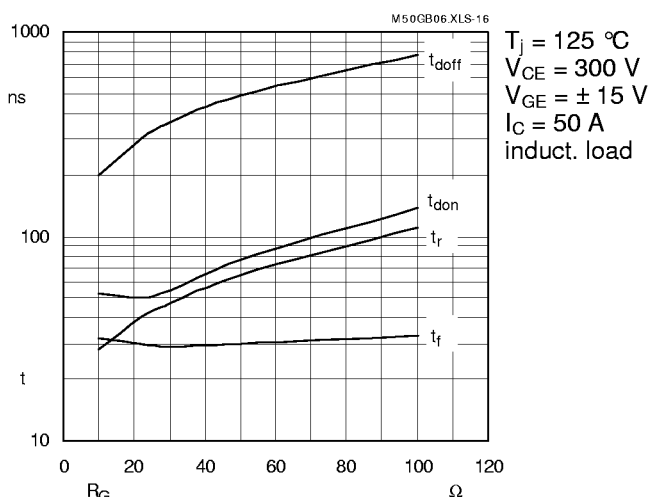


Fig. 16 Typ. switching times vs. gate resistor R_G

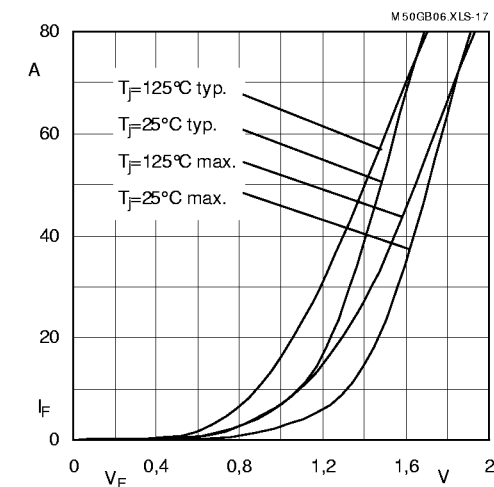


Fig. 17 Typ. CAL diode forward characteristic

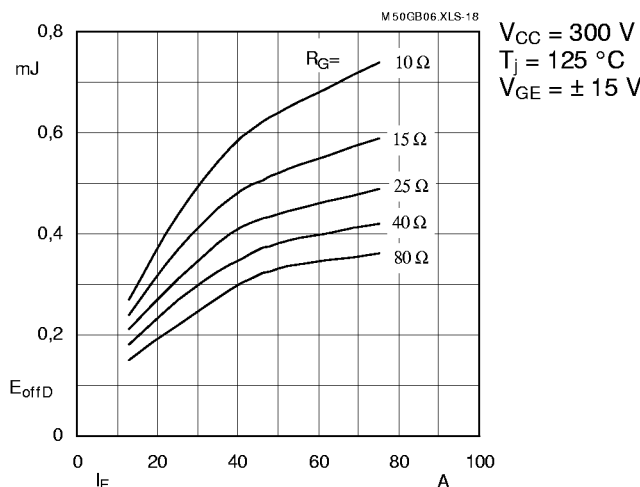


Fig. 18 Diode turn-off energy dissipation per pulse

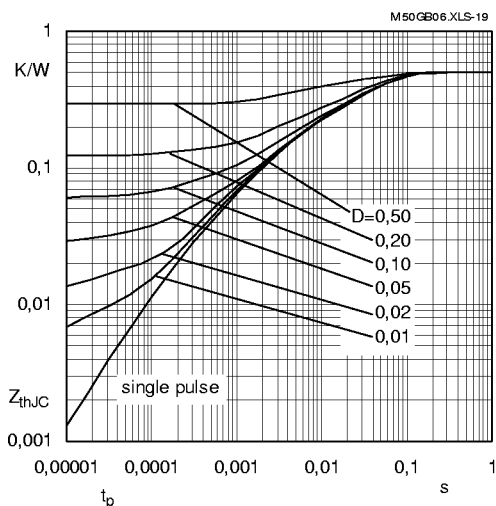


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

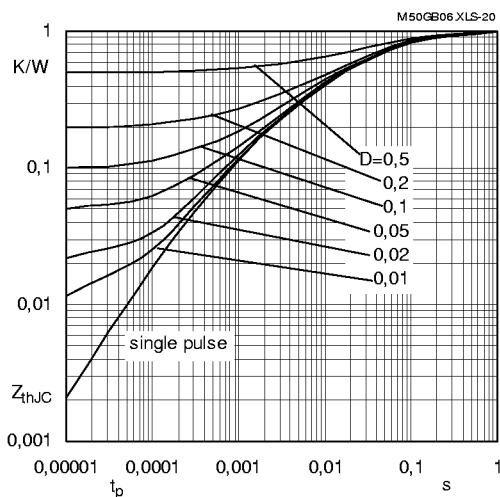
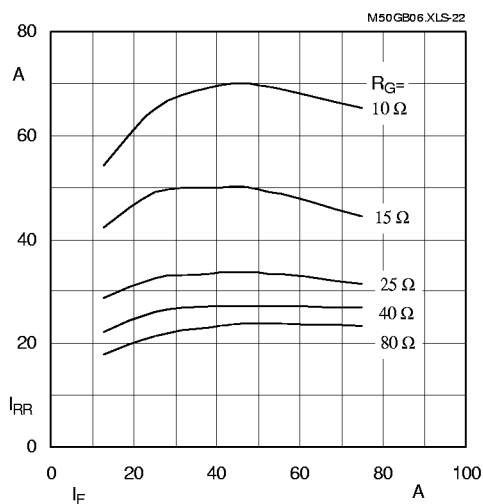
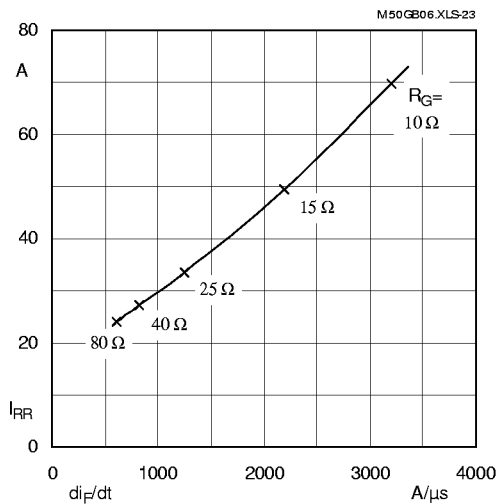


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$



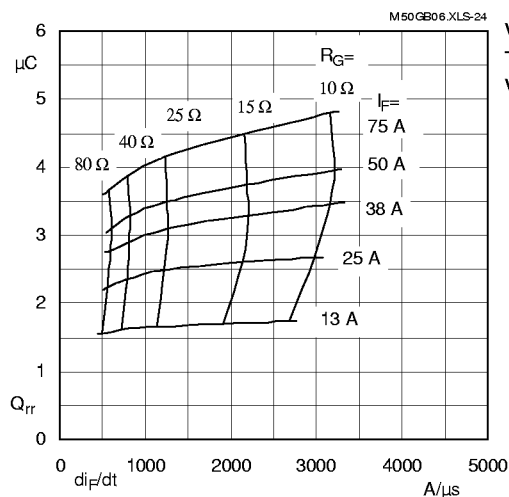
$V_{CC} = 300 \text{ V}$
 $T_j = 125 \text{ }^\circ\text{C}$
 $V_{GE} = \pm 15 \text{ V}$

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



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

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



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

Fig. 24 Typ. CAL diode recovered charge