SEMITRANS® Superfast NPT-IGBT Modules

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

Absolute Maximum Ratings Symbol	Conditions [1]	Values	Units
V_{CES}		600	V
V_{CGR}	R_{GE} = 20 kΩ	600	V
I_C	T_{case} = 25/75 °C	70 / 50	A
I_{CM}	T_{case} = 25/75 °C; t_p = 1 ms	140 / 100	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	250	W
T_j, (T_{stg})		–40 ... +150 (125)	°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 °C	75 / 50	A
$I_{FM} = -I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	140 / 100	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	440	A
I^2t	t_p = 10 ms; T_j = 150 °C	970	A^2s

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

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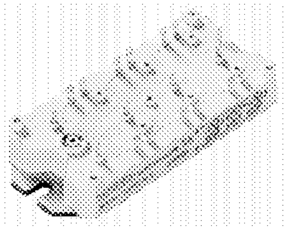
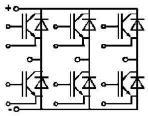
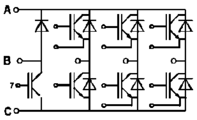
[1] T_{case} = 25 °C, unless otherwise specified
[2] $I_F = -I_C$, V_R = 300 V, $-di_F/dt$ = 800 A/µs, V_{GE} = 0 V
[3] Use V_{GEoff} = –5... –15 V
[8] CAL = Controlled Axial Lifetime Technology
[9] Compared to PT-IGBT



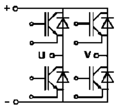
SIXPACK / 7-Pack**) / 4-Pack***)



GD



GDL



GH

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_{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

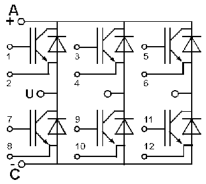
SEMITRANS® Sixpack

Case D 68

UL Recognized

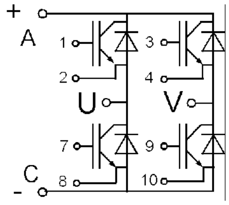
File no. E 63 532

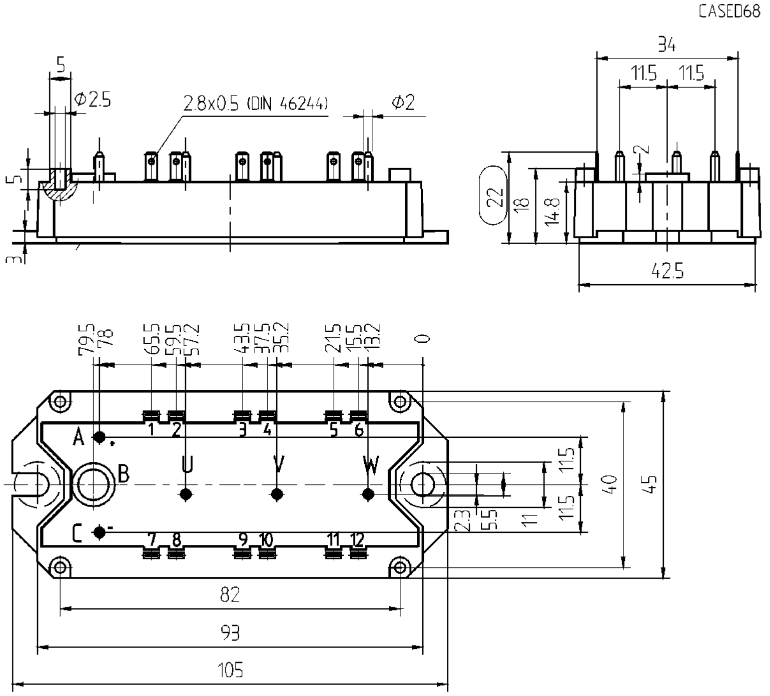
SKM 50 GD 063 DL



SKM 50 GH 063 DL

Case D77 (= D68 without terminal W)





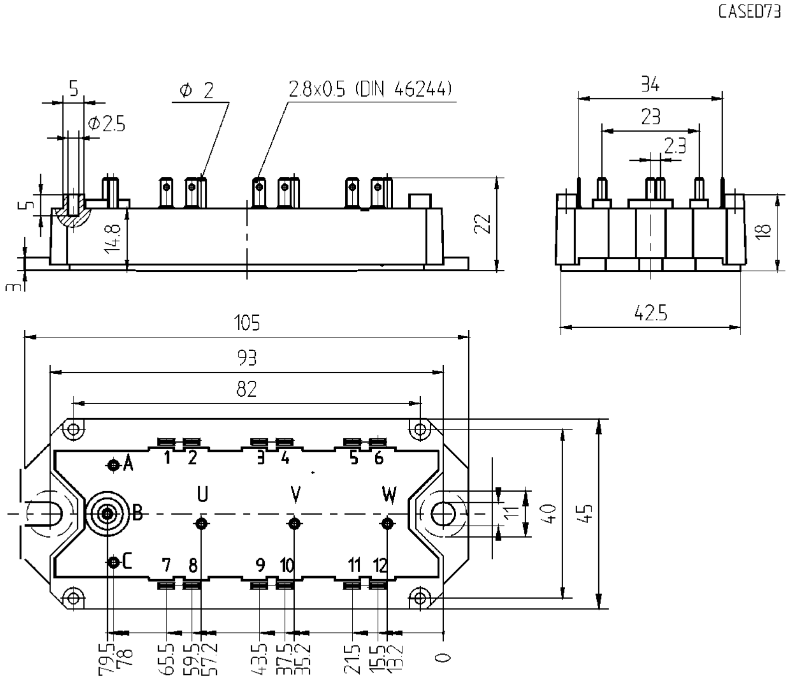
SEMITRANS® Sevenpack

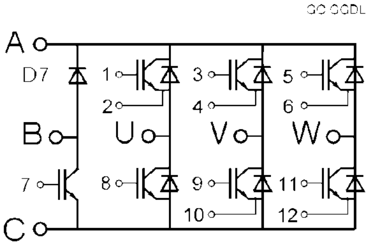
Case D 73

UL Recognized

File no. E 63 532

SKM 50 GDL 063 D





Dimensions in mm

Case outlines and circuit diagrams

Mechanical Data

Symbol	Conditions		Values			Units
			min.	typ.	max.	
M_1	to heatsink, SI Units	(M5)	4	–	5	Nm
	to heatsink, US Units		35	–	44	lb.in.
a			–	–	5x9,81	m/s^2
w			–	–	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.

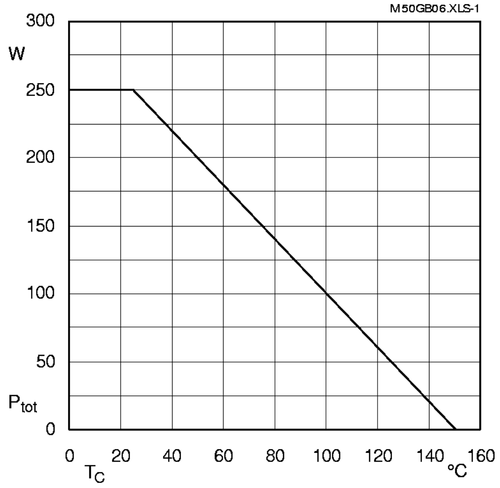
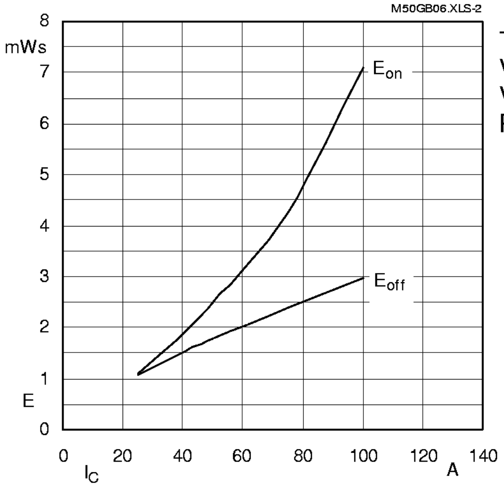
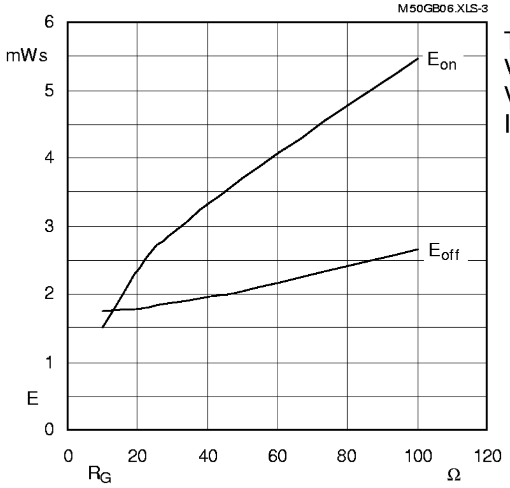


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



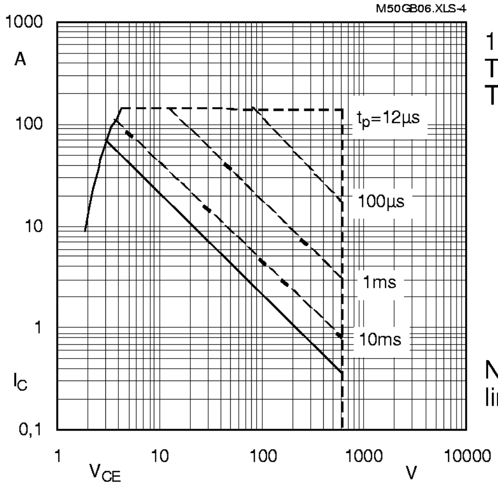
T_j = 125 °C
V_{CE} = 300 V
V_{GE} = ± 15 V
R_G = 22 Ω

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



T_j = 125 °C
V_{CE} = 300 V
V_{GE} = ± 15 V
I_C = 50 A

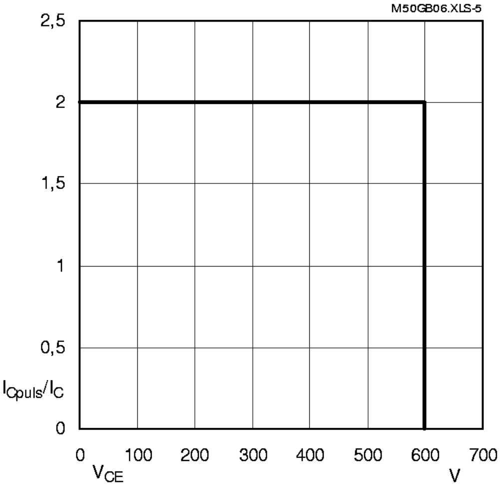
Fig. 3 Turn-on /-off energy = f (R_G)



1 pulse
T_C = 25 °C
$T_j \leq$ 150 °C

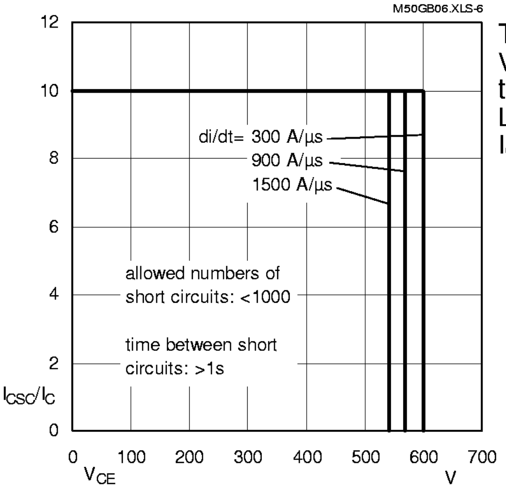
Not for
linear use

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



$T_j \leq$ 150 °C
V_{GE} = ± 15 V
R_{Goff} = 22 Ω
I_C = 50 A

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



$T_j \leq$ 150 °C
VGE = ± 15 V
tsc ≤ 10 µs
L < 35 nH
I_C = 50 A

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

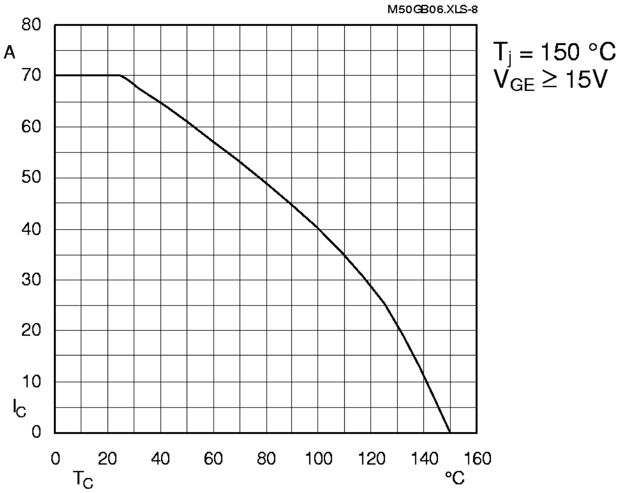


Fig. 8 Rated current vs. temperature $I_C = f\,(T_C)$

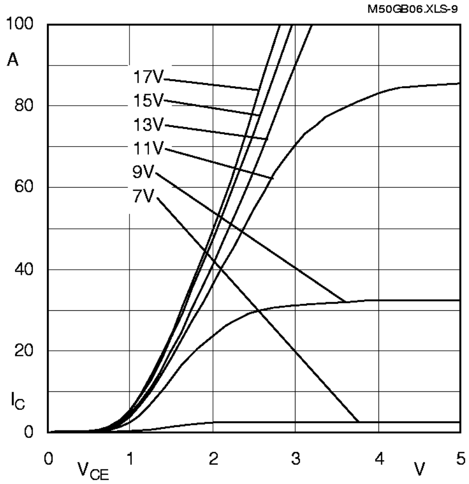


Fig. 9 Typ. output characteristic, t_p = 250 µs; T_j = 25 °C

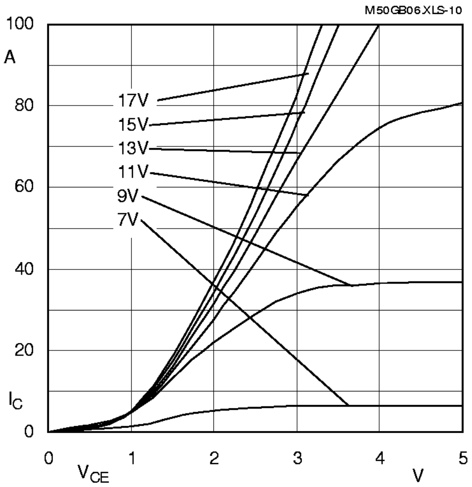


Fig. 10 Typ. output characteristic, t_p = 250 µs; T_j = 125 °C

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

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

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

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

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

valid for $V_{GE} = +\,15\,^{+2}_{-1}$ [V]; $I_C \ge 0{,}3\,I_{Cnom}$

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

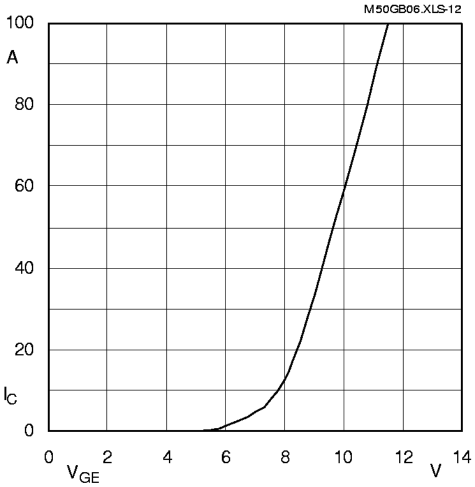


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

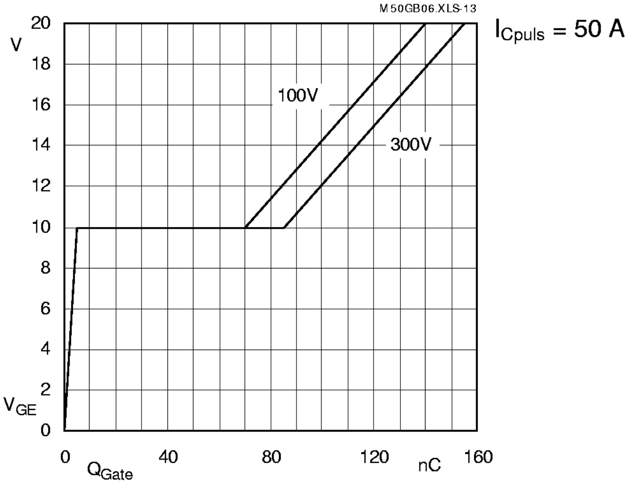


Fig. 13 Typ. gate charge characteristic

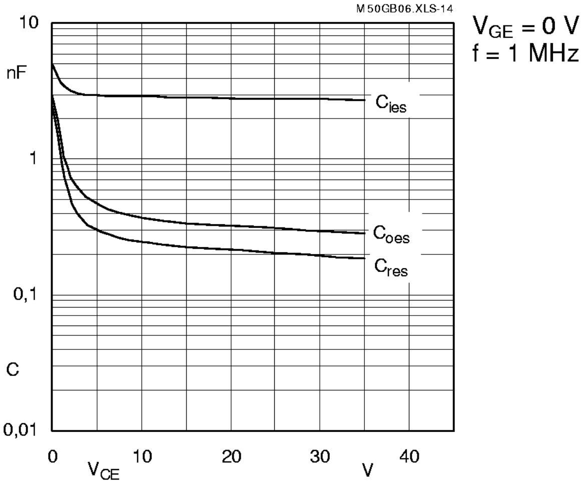


Fig. 14 Typ. capacitances vs.V_{CE}

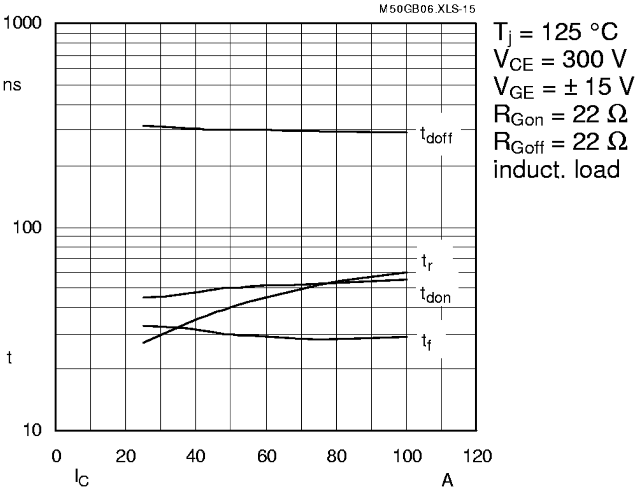


Fig. 15 Typ. switching times vs. I_C

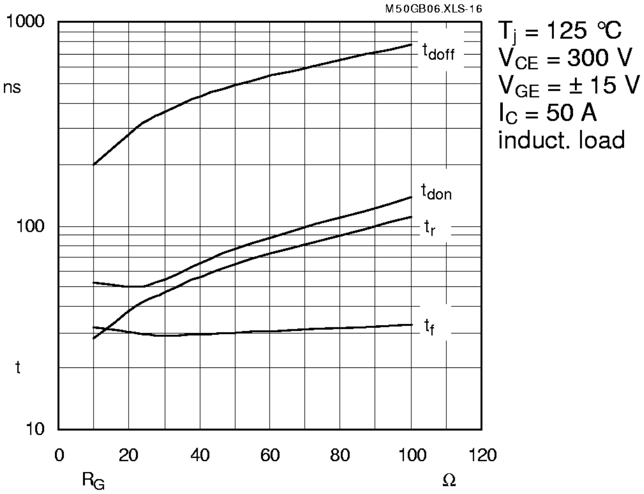


Fig. 16 Typ. switching times vs. gate resistor R_G

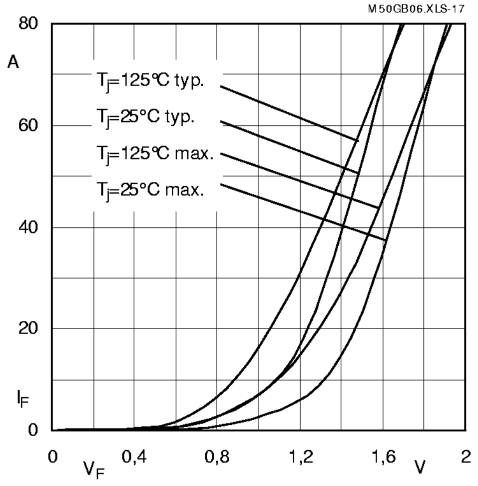


Fig. 17 Typ. CAL diode forward characteristic

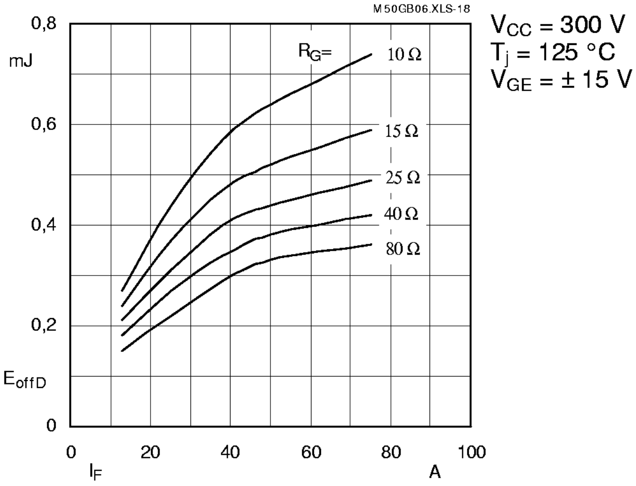
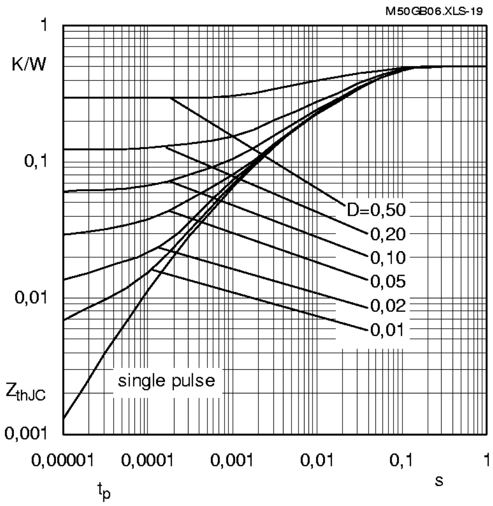


Fig. 18 Diode turn-off energy dissipation per pulse



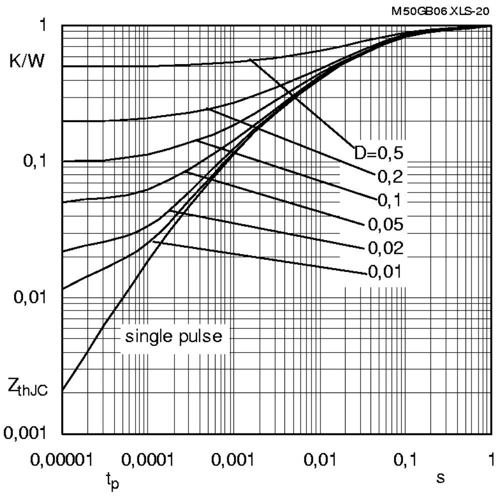
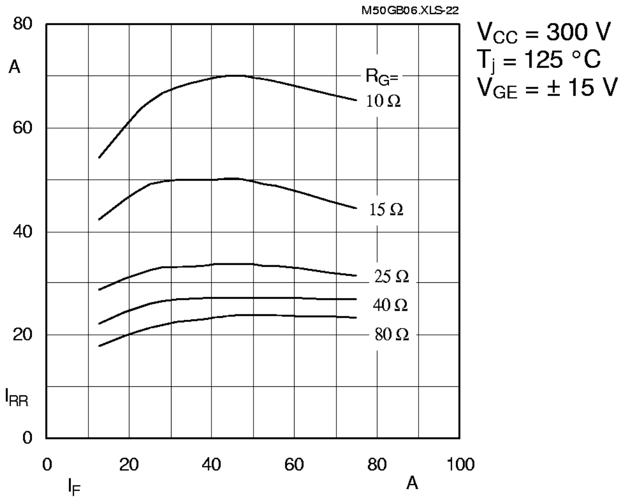


Fig. 19 Transient thermal impedance of IGBT $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

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



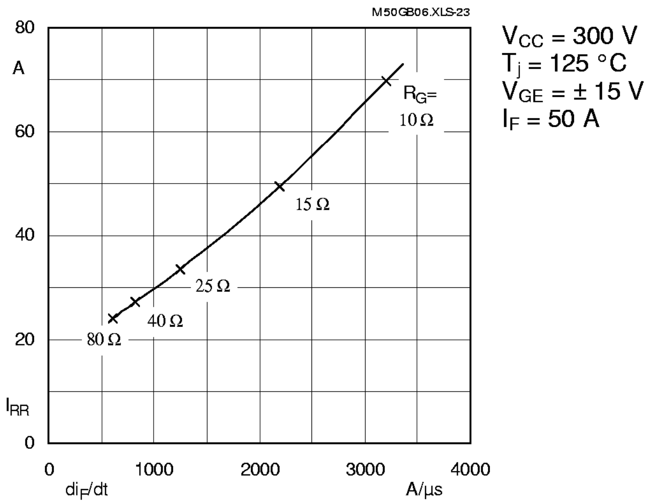


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

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

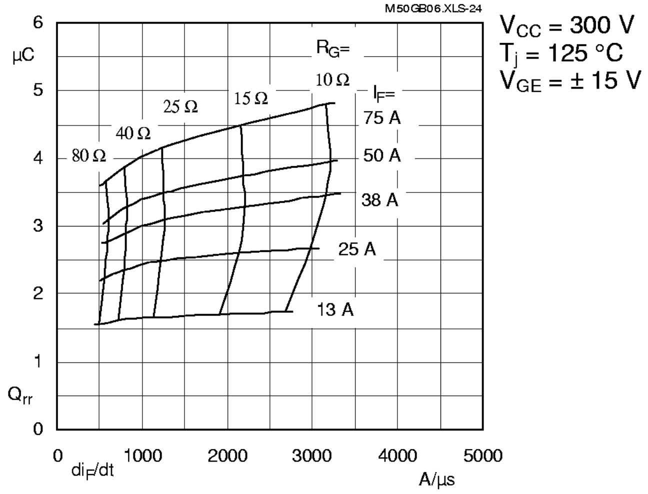


Fig. 24 Typ. CAL diode recovered charge