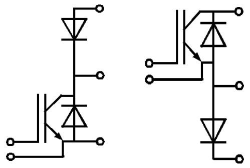
SEMITRANS® M
IGBT Modules

SKM 100 GAX 173 D 6)
SKM 100 GAY 173 D 6)

SEMITRANS 2



Absolute Maximum Ratings **Symbol**	**Conditions** 1)	**Values**	**Units**
V_{CES}		1700	V
V_{CGR}	R_{GE} = 20 kΩ	1700	V
I_C	T_{case} = 25/80 °C	110 / 75	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	220 / 150	A
V_{GES}		± 20	V
P_{tot}	per IGBT/Diode, T_{case} = 25 °C	625 / 310	W
T_j, (T_{stg})		–40 ... +150 (125)	°C
V_{isol}	AC, 1 min.	4000	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	

Diode 8)		Inverse	Series6)	
$I_F = -I_C$	T_{case} = 25/80 °C	80 / 50	125 / 80	A
$I_{FM} = -I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	200 / 150	250 / 160	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	720	1100	A
I^2t	t_p = 10 ms; T_j = 150 °C	2600	6000	A^2s

Characteristics **Symbol**	**Conditions** 1)	**min.**	**typ.**	**max.**	**Units**
$V_{(BR)CES}$	V_{GE} = 0, I_C = 1,4 mA	≥ V_{CES}	–	–	V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 6 mA	4,8	5,5	6,2	V
I_{CES}	V_{GE} = 0 } T_j = 25 °C	–	0,1	1	mA
	$V_{CE} = V_{CES}$ } T_j = 125 °C	–	–	15	mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0	–	–	400	nA
V_{CEsat}	I_C = 75 A { V_{GE} = 15 V; }	–	3,4(4,4)	3,9(5)	V
V_{CEsat}	I_C = 100 A { T_j = 25 (125) °C }	–	3,8(5,5)	–	V
g_{fs}	V_{CE} = 20 V, I_C = 75 A	27	–	–	S
C_{CHC}	per IGBT	–	–	200	pF
C_{ies}	} V_{GE} = 0	–	11	–	nF
C_{oes}	} V_{CE} = 25 V	–	1	–	nF
C_{res}	} f = 1 MHz	–	0,28	–	nF
L_{CE}		–	–	30	nH
$t_{d(on)}$	} V_{CC} = 1200 V	–	40	–	ns
t_r	} V_{GE} = +15 V / –15 V	–	45	–	ns
$t_{d(off)}$	} I_C = 75 A, ind. load	–	400	–	ns
t_f	} $R_{Gon} = R_{Goff}$ = 10 Ω	–	56	–	ns
E_{on}	} T_j = 125 °C	–	35	–	mWs
E_{off}		–	21	–	mWs
Inverse Diode 8)					
$V_F = V_{EC}$	I_F = 75 A { V_{GE} = 0 V; }	–	2,2(2,0)	2,7(2,3)	V
$V_F = V_{EC}$	I_F = 100 A { T_j = 25 (125) °C }	–	2,45(2,25)	–	V
V_{TO}	T_j = 125 °C	–	1,3	1,5	V
r_T	T_j = 125 °C	–	9	13	mΩ
I_{RRM}	I_F = 75 A; T_j = 25 (125) °C 2)	–	38(51)	–	A
Q_{rr}	I_F = 75 A; T_j = 25 (125) °C 2)	–	8(19)	–	µC
Series Diode 6), 8)					
$V_F = V_{EC}$	I_F = 100 A { V_{GE} = 0 V; }	–	2,2(1,9)	2,7(2,4)	V
$V_F = V_{EC}$	I_F = 150 A { T_j = 25 (125) °C }	–	2,4(2,2)	–	V
V_{TO}	T_j = 125 °C	–	1,2	1,5	V
r_T	T_j = 125 °C	–	7	9	mΩ
I_{RR}	I_F = 100 A; T_j = 25 (125) °C 2)		50(70)	–	A
Q_{rr}	I_F = 100 A; T_j = 25 (125) °C 2)	–	10(27)	–	µC
Thermal characteristics					
R_{thjc}	per IGBT	–	–	0,2	°C/W
R_{thjc}	per inverse/series diode	–	–	0,63/0,40	°C/W
R_{thch}	per module	–	–	0,05	°C/W

Features

- N channel, Homogeneous Silicon structure (NPT-IGBT)
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to 6 * I_{cnom}
- Latch-up free
- Fast & soft inverse CAL diodes 8)
- Isolated copper baseplate using DCB Direct Copper Bonding
- Large clearance (10 mm) and creepage distances (20 mm).

Typical Applications

- Bidirectional switches as “reverse blocking” IGBT
- Regenerative Braking
- Quasi resonant inverters
- DC bus voltage 750 - 1200 V_{DC}
- Public transport (auxiliary syst.)
- Switching (not for linear use)

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1) T_{case} = 25 °C, unless otherwise specified

2) $I_F = -I_C$, V_R = 1200 V, $-di_F/dt$ = 800 A/µs, V_{GE} = 0 V

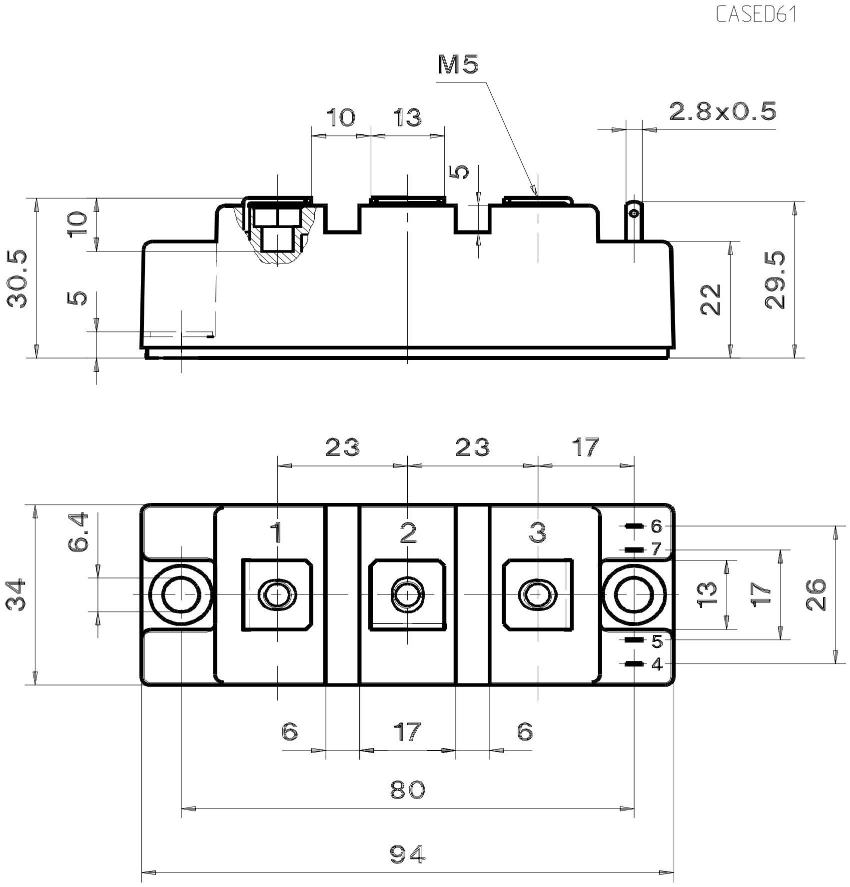
6) The series diodes have the data of the inverse diodes of SKM 150 GB 173 D

8) CAL = Controlled Axial Lifetime Technology.

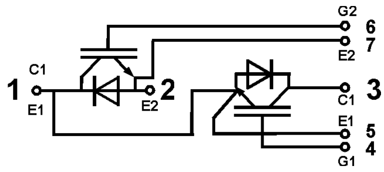
Cases and mech. data
→ B6 – 246
Diagrams of IGBT
→ B 6 – 240...
of series diode → B 6 – 250
fig. 17, 18, 20 to 24.

SEMITRANS 2

Case D 61
UL Recognized
File no. E 63 532



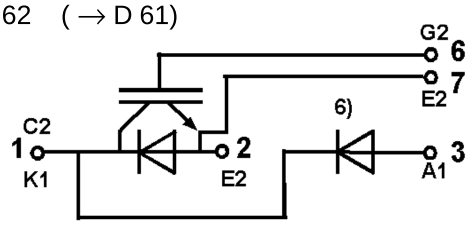
SKM 100 GB 173 D



Dimensions in mm

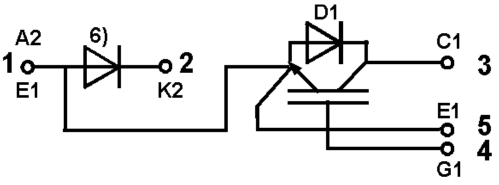
SKM 100 GAX 173 D

Case D 62 (→ D 61)



SKM 100 GAY 173 D

Case D 63 (→ D 61)



Case outline and circuit diagrams

Mechanical Data Symbol	Conditions	Values min.	 typ.	 max.	Units
M_1	to heatsink, SI Units (M6)	3	–	5	Nm
	to heatsink, US Units	27	–	44	lb.in.
M_2	for terminals, SI Units (M5)	2,5	–	5	Nm
	for terminals, US Units	22	–	44	lb.in.
a		–	–	5x9,81	m/s^2
w		–	–	160	g

[6] Series diode → B 6 – 245, remark 6.

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

Eight devices are supplied in one SEMIBOX A without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 2). Larger packing units of 20 and 42 pieces are used if suitable
Accessories → B 6 – 4.
SEMIBOX → C – 1.

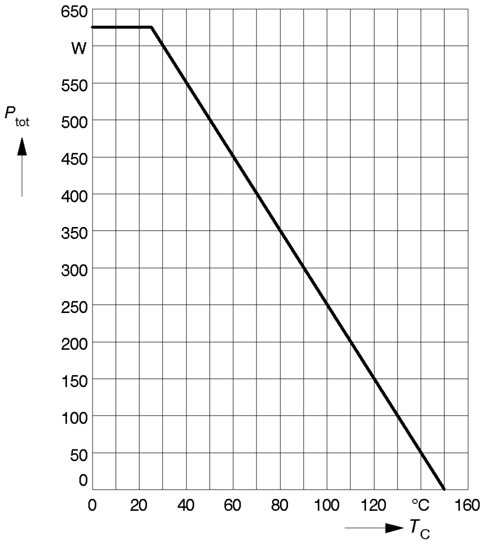
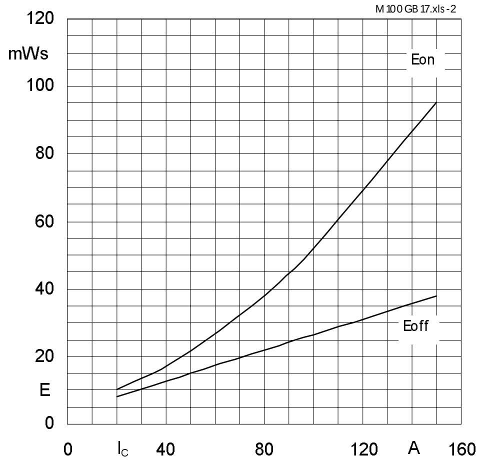


Fig. 1 Rated power dissipation P_{tot} = f (T_C)



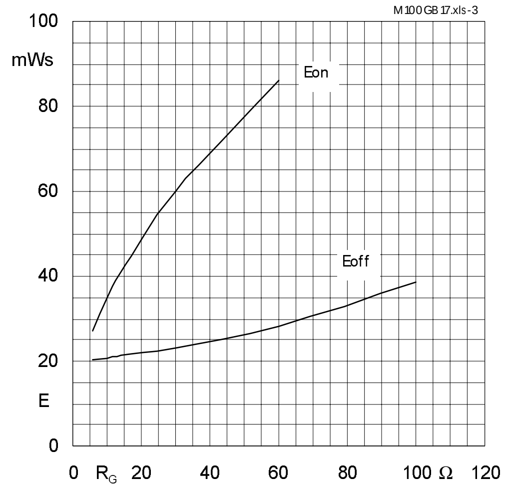
T_j = 125 °C

V_{CE} = 1200 V

V_{GE} = ± 15 V

R_G = 10Ω

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



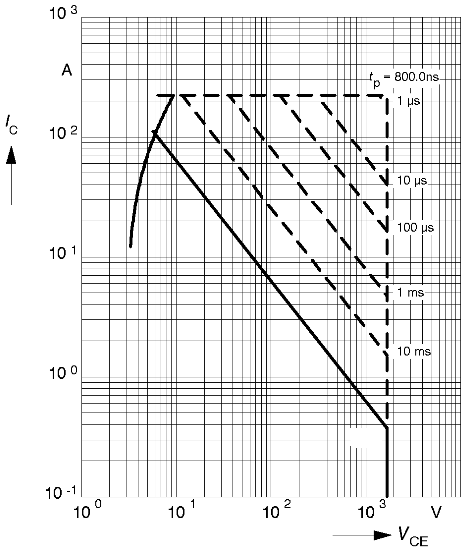
T_j = 125 °C

V_{CE} = 1200 V

V_{GE} = ± 15 V

I_C = 75 A

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



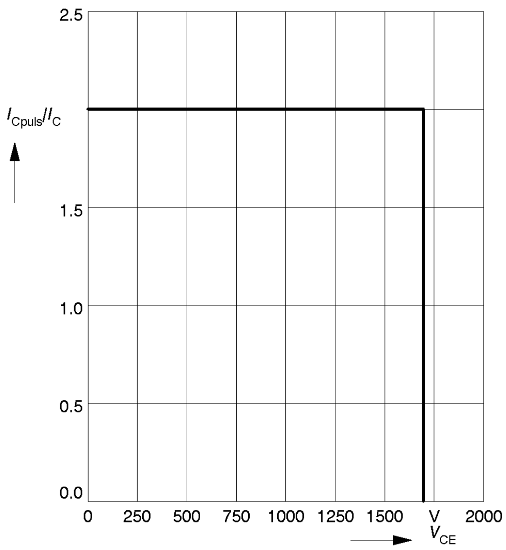
1 pulse

T_C = 25 °C

T_j ≤ 150 °C

Not recommended for linear duty

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



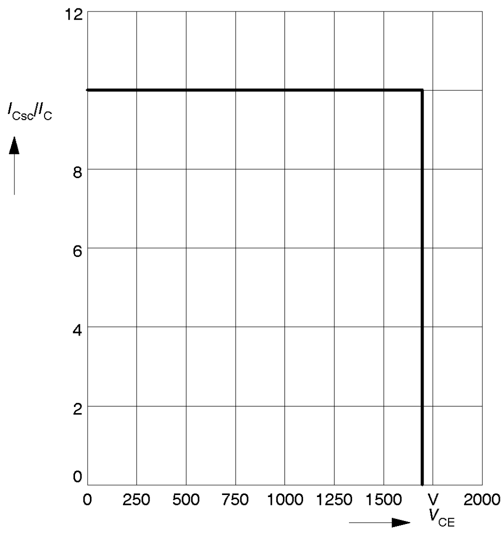
T_j ≤ 150 °C

V_{GE} = ± 15 V

R_{Goff} = 10 Ω

I_C = 75 A

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



T_j ≤ 150 °C

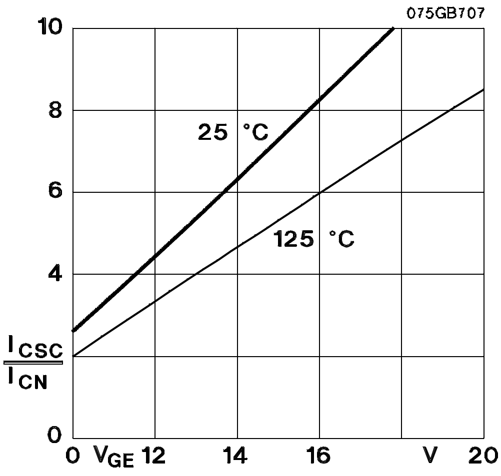
V_{GE} = ± 15 V

t_{sc} ≤ 10 µs

L_{ext} < 50 nH

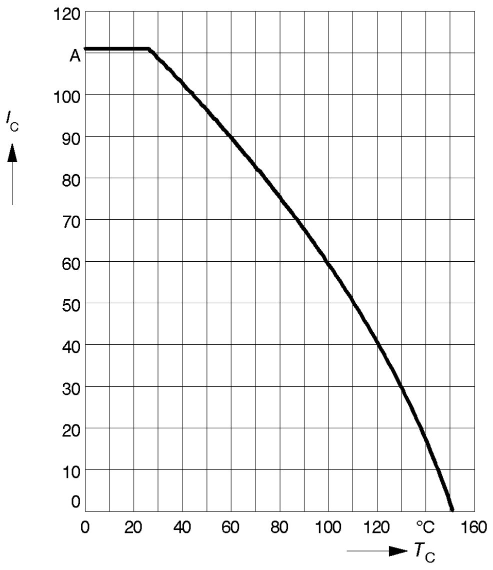
I_C = 75 A

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



$V_C = 1200$ V
$I_C = I_{CN} = 75$ A
$t_p = 10$ µs
$L_{ext} \le 25$ nH
$R_{Gon} = 10\ \Omega$
$R_{Goff} = 10\ \Omega$

Fig. 7 Short circuit current vs. turn-on gate voltage



$T_j = 150$ °C
$V_{GE} \ge 15$ V

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

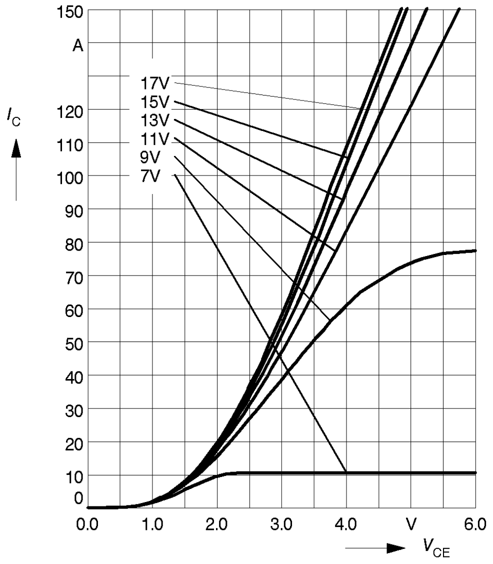


Fig. 9 Typ. output characteristic, $t_p = 80$ µs; $T_j = 25$ °C

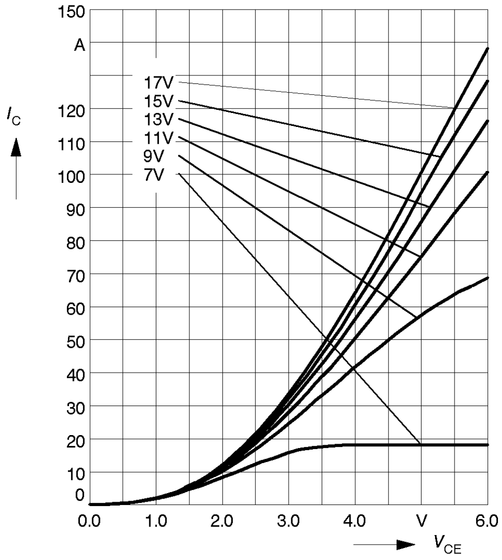


Fig. 10 Typ. output characteristic, $t_p = 80$ µs; $T_j = 125$ °C

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

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

$V_{CE(TO)(Tj)} \le 1{,}9 + 0{,}003\,(T_j - 25)$ [V]

$r_{CE(Tj)} = 0{,}023 + 0{,}00007\,(T_j - 25)$ [Ω]

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

Fig. 11 Typ. saturation characteristic (IGBT)
Calculation elements and equations

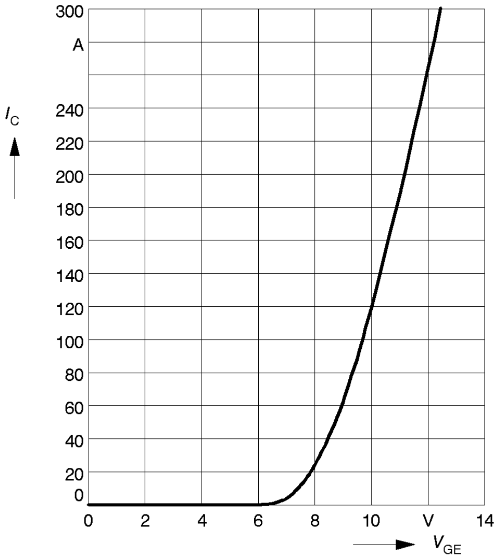
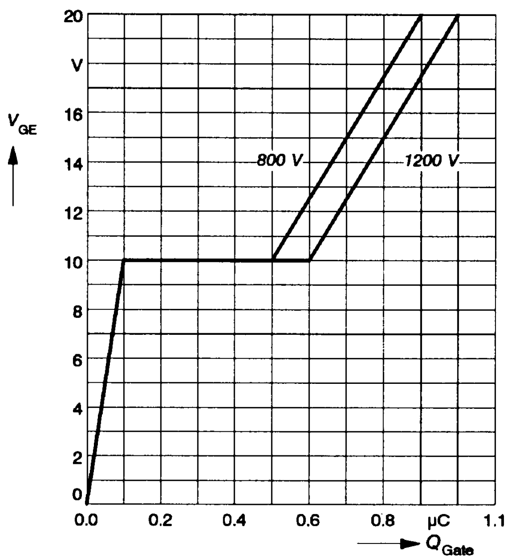
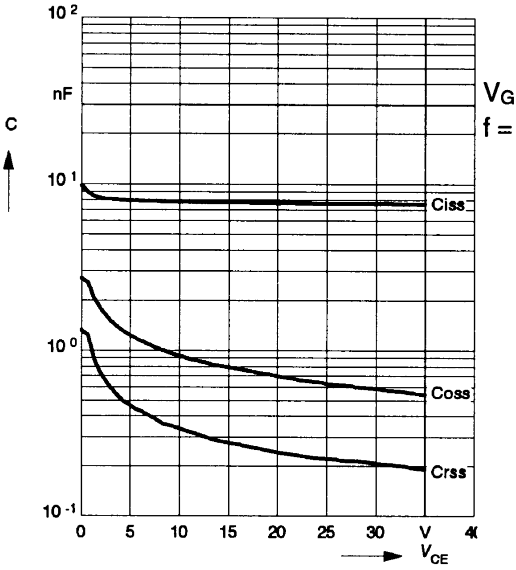


Fig. 12 Typ. transfer characteristic, $t_p = 80$ µs; $V_{CE} = 20$ V



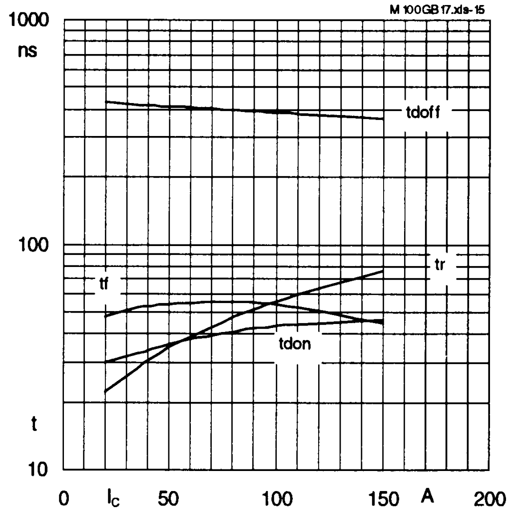
I_{Cpuls} = 75 A

Fig. 13 Typ. gate charge characteristic



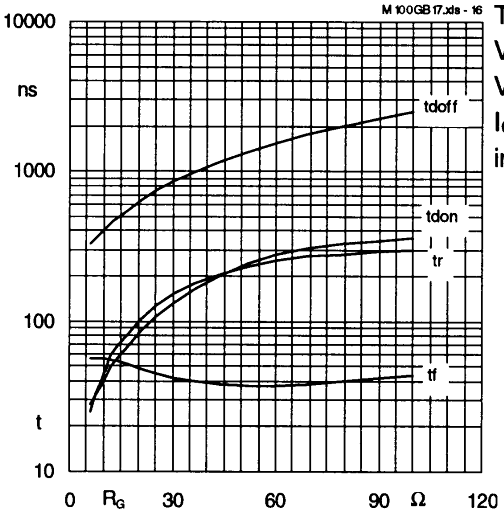
V_{GE} = 0 V
f = 1 MHZ

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



T_j = 125 °C
V_{CE} = 1200 V
V_{GE} = ± 15 V
R_G = 10 Ω
ind. load

Fig. 15 Typ. switching times vs. I_C



T_j = 125 °C
V_{CE} = 1200 V
V_{GE} = ± 15 V
I_C = 75 A
ind. load

Fig. 16 Typ. switching times vs. R_G

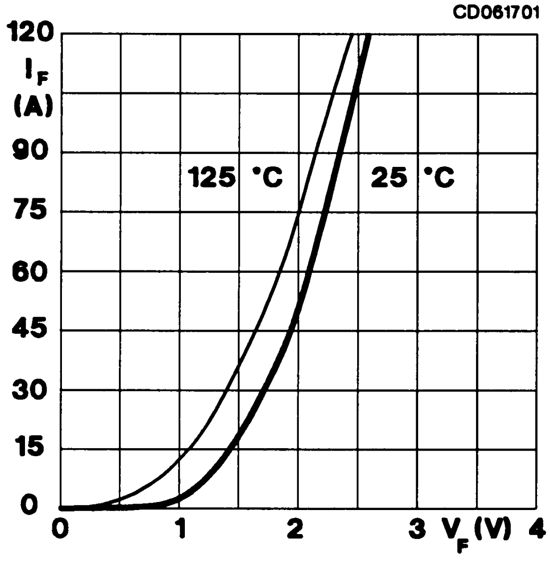


Fig. 17 Typ. CAL diode forward characteristic

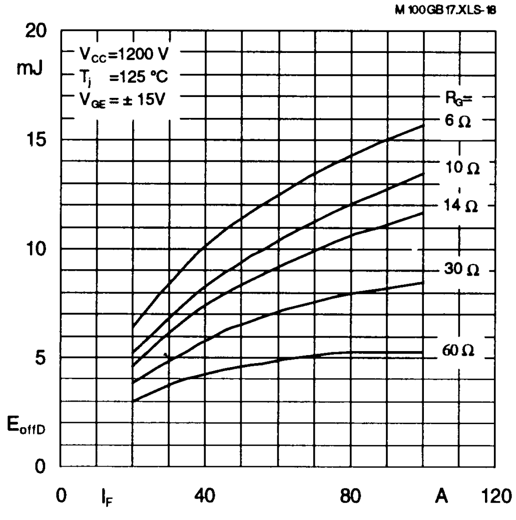


Fig. 18 Typ. Diode turn-off energy dissipation per pulse

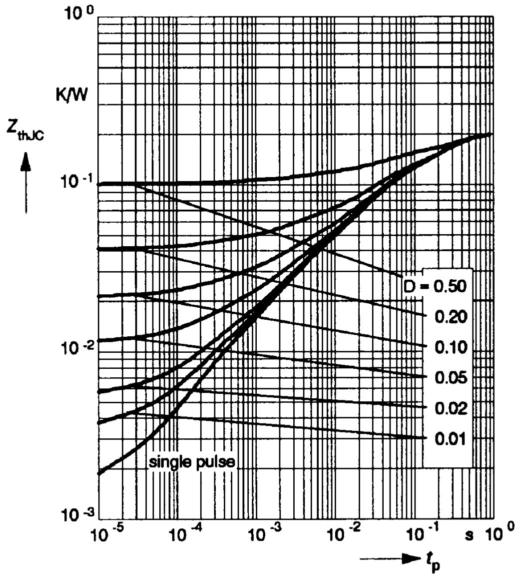


Fig. 19 Transient thermal impedance of IGBT: $Z_{thjc} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

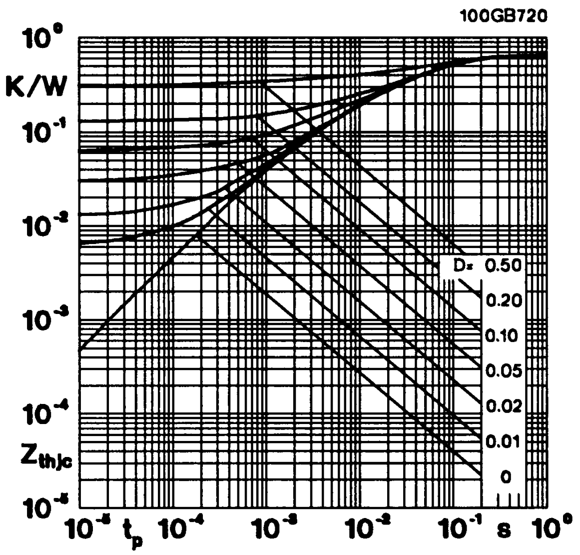


Fig. 20 Transient thermal impedance of inverse diode: $Z_{thjcD} = f(t_p)$

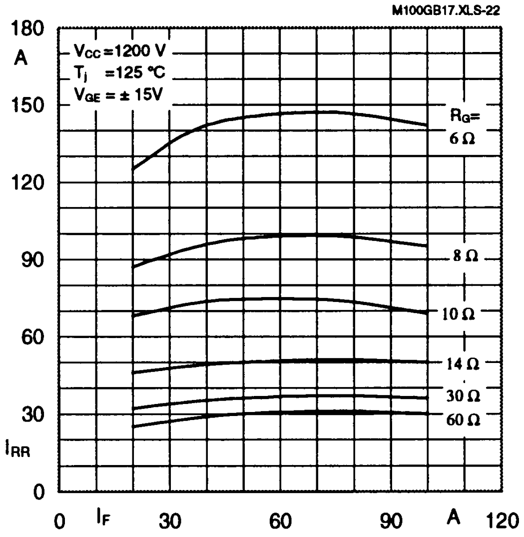


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

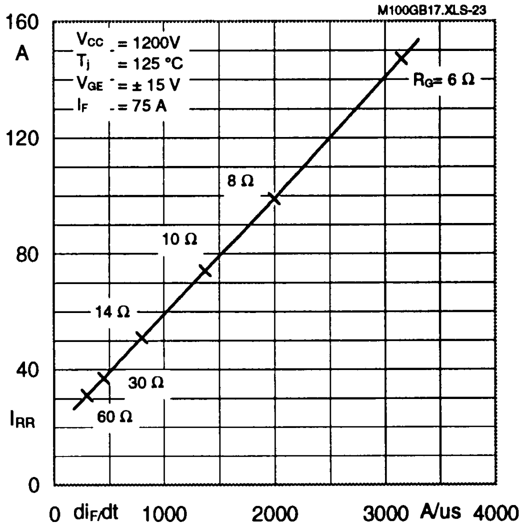


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

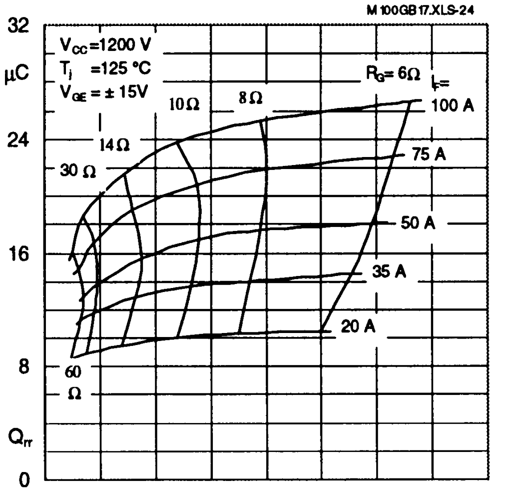
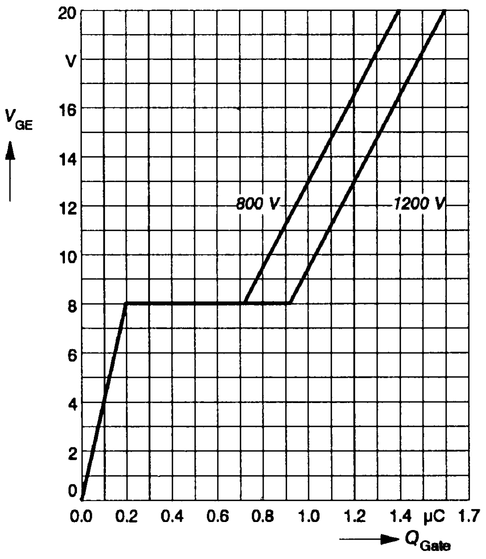
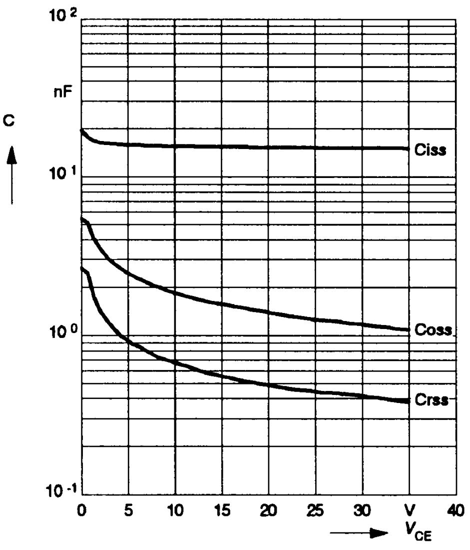


Fig. 24 Typ. CAL diode recovered charge Qrr



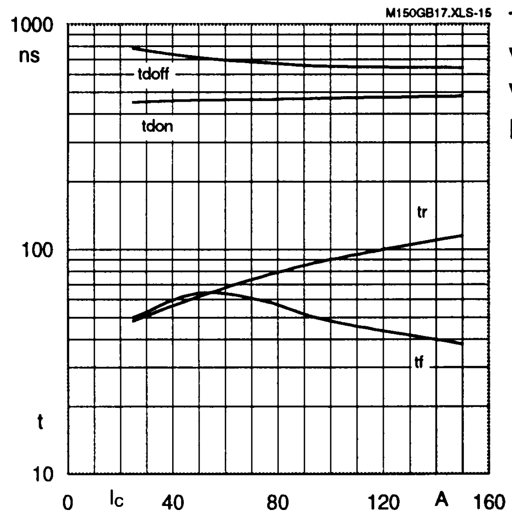
I_{Cpuls} = 100 A

Fig. 13 Typ. gate charge characteristic



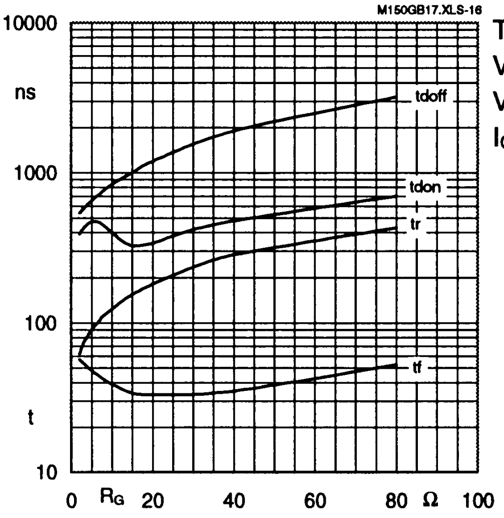
V_{GE} = 0 V
f = 1 MHZ

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



T_j = 125 °C
V_{CC} = 1200 V
V_{GE} = ± 15 V
R_g = 5 Ω

Fig. 15 Typ. switching times vs. I_C



T_j = 125 °C
V_{CC} = 1200 V
V_{GE} = ± 15 V
I_C = 100 A

Fig. 16 Typ. switching times vs. R_G

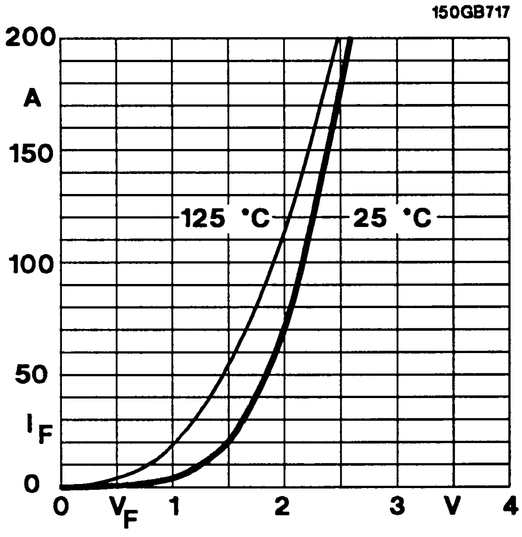


Fig. 17 Typ. CAL diode forward characteristic

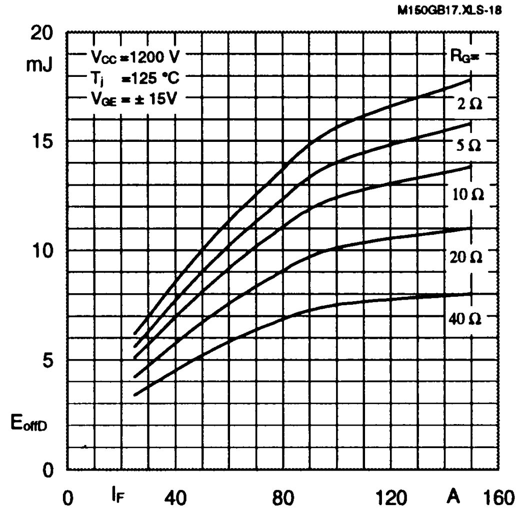


Fig. 18 Typ. Diode turn-off energy dissipation per pulse

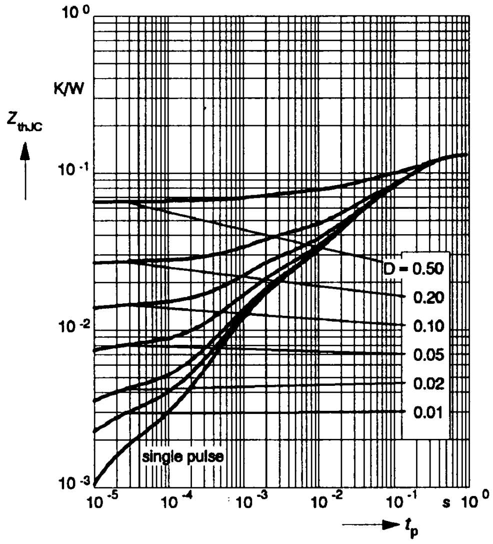


Fig. 19 Transient thermal impedance of IGBT: $Z_{thjc} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

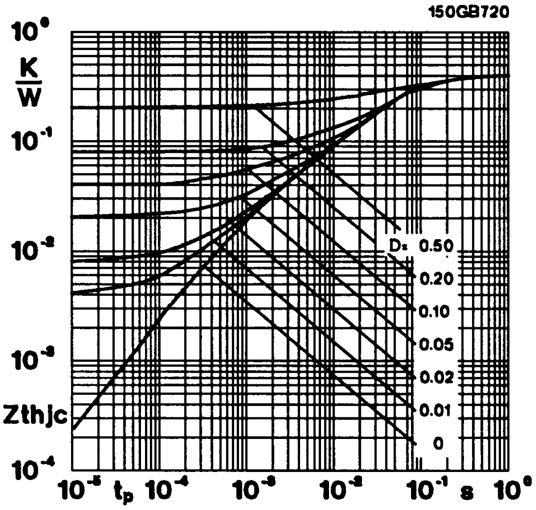


Fig. 20 Transient thermal impedance of inverse diode: $Z_{thjcD} = f(t_p)$

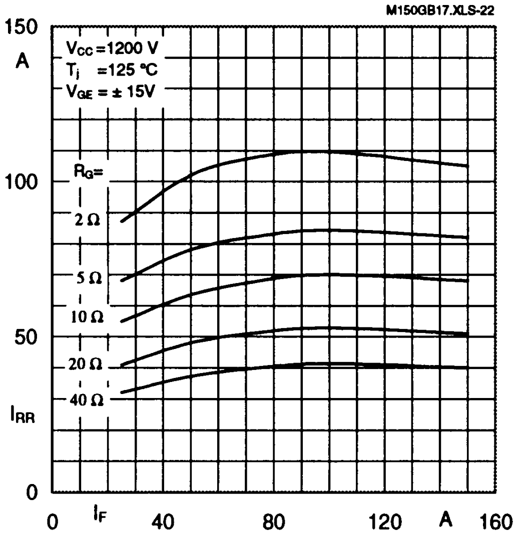


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

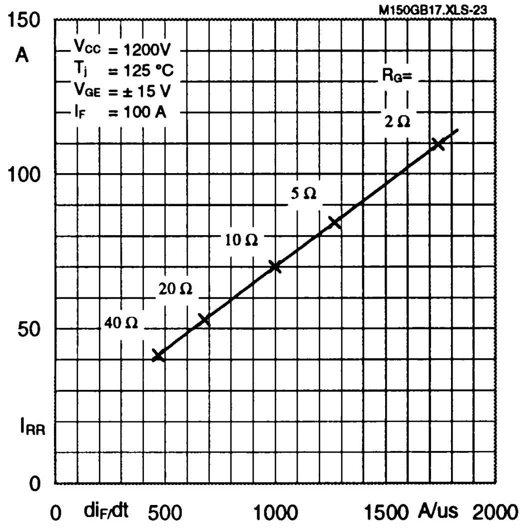


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

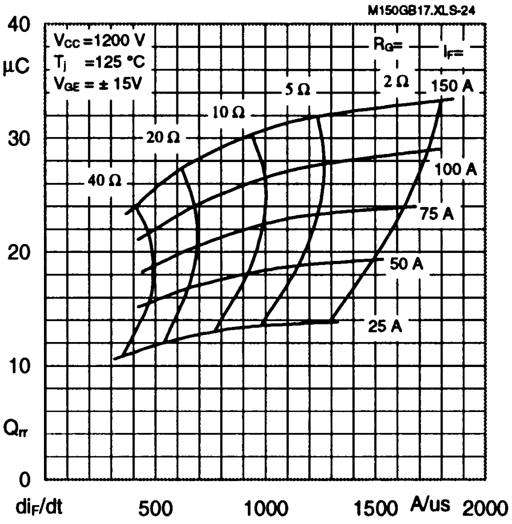


Fig. 24 Typ. CAL diode recovered charge Qrr of inverse diode