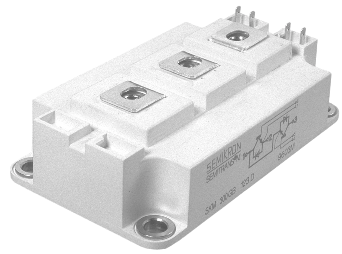
SEMIKRON

Absolute Maximum Ratings		Values	
Symbol	**Conditions** 1)		**Units**
V_{CES}		1200	V
V_{CGR}	R_{GE} = 20 kΩ	1200	V
I_C	T_{case} = 25/80 °C	200 / 160	A
I_{CM}	T_{case} = 25/80 °C; t_p = 1 ms	400 / 320	A
V_{GES}		± 20	V
P_{tot}	per IGBT, T_{case} = 25 °C	1380	W
T_j, (T_{stg})		–40 ... +150 (125)	°C
V_{isol}	AC, 1 min.	2500	V
humidity	IEC 60721-3-3	class 3K7/IE32	
climate	IEC 68 T.1	40/125/56	
Inverse Diode			
$I_F = -I_C$	T_{case} = 25/80 °C	200 / 130	A
$I_{FM} = -I_{CM}$	T_{case} = 25/80 °C; t_p = 1 ms	400 / 320	A
I_{FSM}	t_p = 10 ms; sin.; T_j = 150 °C	1450	A
I^2t	t_p = 10 ms; T_j = 150 °C	10 500	A^2s

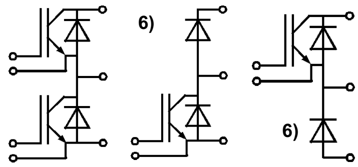
Characteristics					
Symbol	**Conditions** 1)	**min.**	**typ.**	**max.**	**Units**
$V_{(BR)CES}$	V_{GE} = 0, I_C = 4 mA	≥ V_{CES}			V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, I_C = 6 mA	4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0, $V_{CE} = V_{CES}$; T_j = 25 °C		0,2	3	mA
	V_{GE} = 0, $V_{CE} = V_{CES}$; T_j = 125 °C		12		mA
I_{GES}	V_{GE} = 20 V, V_{CE} = 0			1	µA
V_{CEsat}	I_C = 150 A; V_{GE} = 15 V; T_j = 25 °C		3,3	3,85	V
V_{CEsat}	I_C = 200 A; V_{GE} = 15 V; T_j = 25 °C		3,8		V
g_{fs}	V_{CE} = 20 V, I_C = 150 A	95			S
C_{CHC}	per IGBT			700	pF
C_{ies}	V_{GE} = 0; V_{CE} = 25 V; f = 1 MHz		10	13	nF
C_{oes}	V_{GE} = 0; V_{CE} = 25 V; f = 1 MHz		1,5	2	nF
C_{res}	V_{GE} = 0; V_{CE} = 25 V; f = 1 MHz		0,8	1,2	nF
L_{CE}				20	nH
$t_{d(on)}$	V_{CC} = 600 V; V_{GE} = –15 V / +15 V 3); I_C = 150 A, ind. load; $R_{Gon} = R_{Goff}$ = 4 Ω; T_j = 125 °C		75		ns
t_r			36		ns
$t_{d(off)}$			420		ns
t_f			25		ns
E_{on}			14		mWs
E_{off}			8		mWs
Inverse Diode 8) 6)					
$V_F = V_{EC}$	I_F = 150 A; V_{GE} = 0 V; T_j = 25 (125) °C		2,0(1,8)	2,5	V
$V_F = V_{EC}$	I_F = 200 A; V_{GE} = 0 V; T_j = 25 (125) °C		2,25(2,05)		V
V_{TO}	T_j = 125 °C 2)			1,2	V
r_t	T_j = 125 °C 2)		5	7	mΩ
I_{RRM}	I_F = 150 A; T_j = 25 (125) °C 2)		55(80)		A
Q_{rr}	I_F = 150 A; T_j = 25 (125) °C 2)		8(20)		µC
Thermal characteristics					
R_{thjc}	per IGBT			0,09	°C/W
R_{thjc}	per diode			0,25	°C/W
R_{thch}	per module			0,038	°C/W

SEMITRANS® M
Ultra Fast IGBT Modules

SKM 200 GB 125 D
SKM 200 GAL 125 D 6)
SKM 200 GAR 125 D 6)



SEMITRANS 3



GB GAL GAR

Features

- N channel, homogeneous Si
- Low inductance case
- **Short tail** current with low temperature dependence
- High short circuit capability, self limiting to 6 * I_{cnom}
- Fast & soft inverse CAL diodes 8)
- Isolated copper baseplate using DCB Direct Copper Bonding Technology
- Large clearance (13 mm) and creepage distances (20 mm)

Typical Applications

- Switched mode power supplies at f_{sw} > 20 kHz
- Resonant inverters up to 100 kHz
- Inductive heating
- Electronic welders at f_{sw} > 20 kHz

1) T_{case} = 25 °C, unless otherwise specified
2) $I_F = -I_C$, V_R = 600 V, $-di_F/dt$ = 1500 A/µs, V_{GE} = 0 V
3) Use V_{GEoff} = –5... –15 V
6) The free-wheeling diodes of the GAL and GAR type have the same data as the inverse Diodes of SKM 200 GA 125 D
8) CAL = Controlled Axial Lifetime Technology

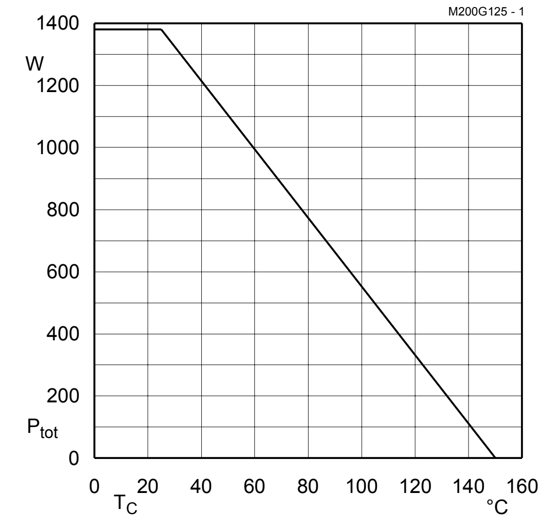


Fig. 1 Rated power dissipation P_{tot} = f (T_C)

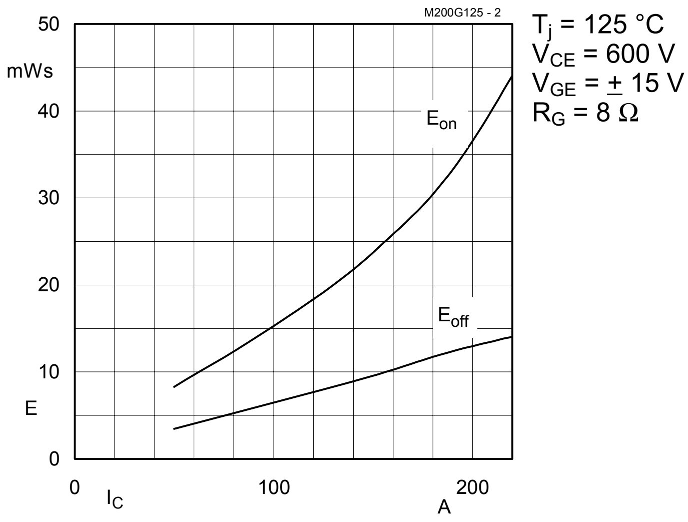


Fig. 2 Turn-on /-off energy = f (I_C)

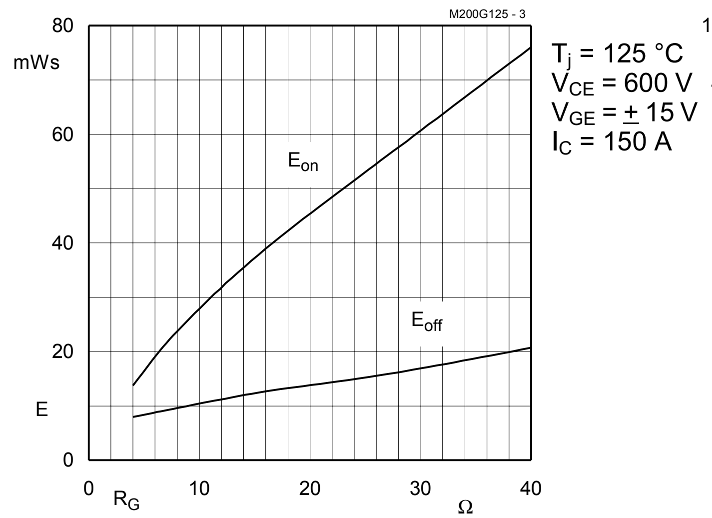


Fig. 3 Turn-on /-off energy = f (R_G)

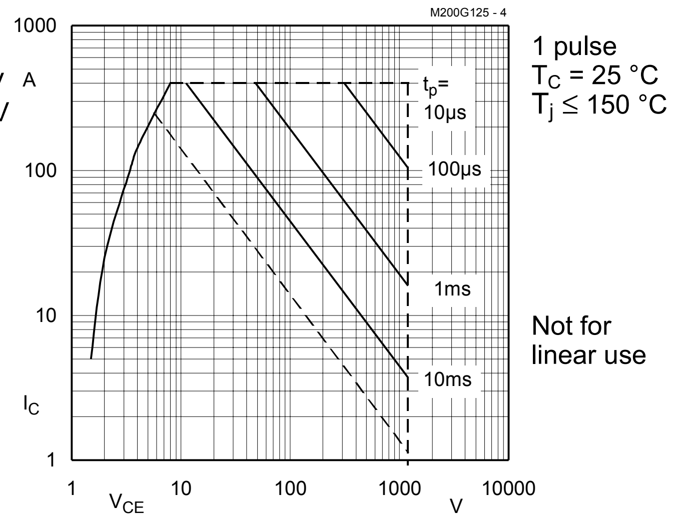


Fig. 4 Maximum safe operating area (SOA) I_C = f (V_{CE})

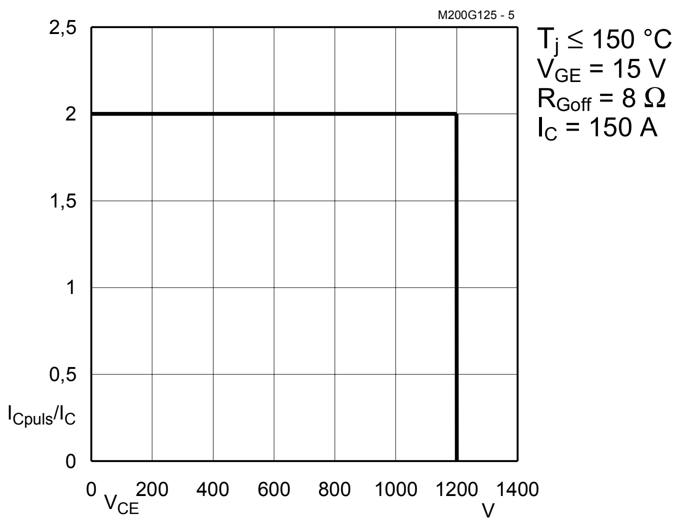


Fig. 5 Turn-off safe operating area (RBSOA)

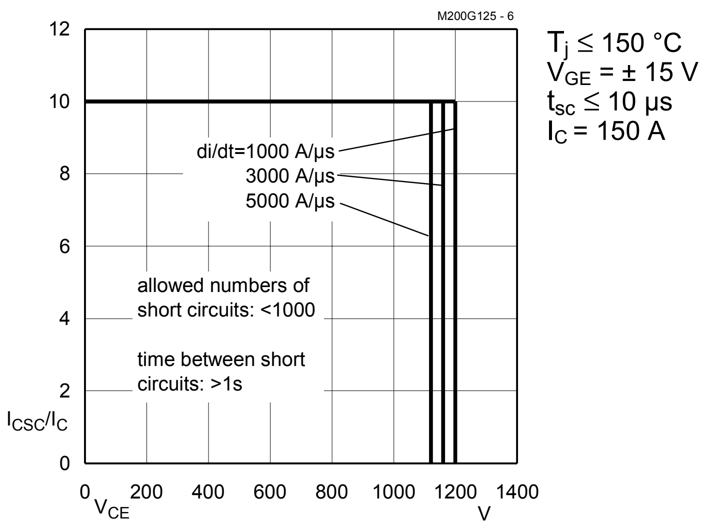


Fig. 6 Safe operating area at short circuit I_C = f (V_{CE})

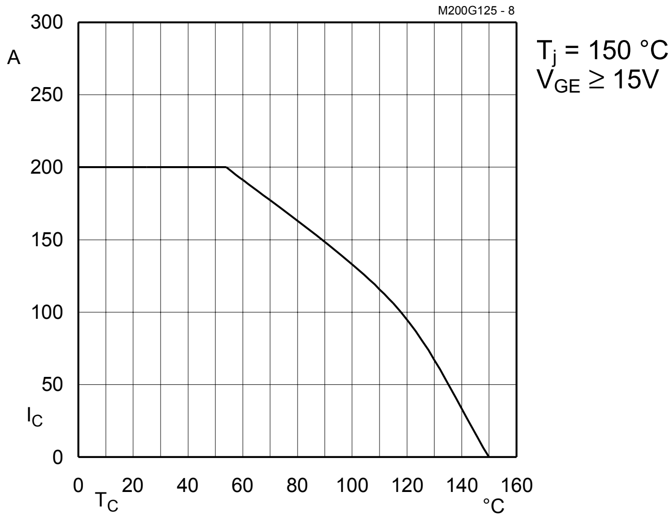


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

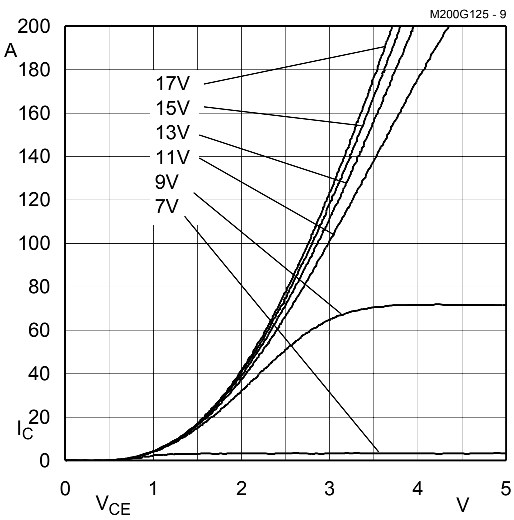


Fig. 9 Typ. output characteristic, t_p = 80 µs; 25 °C

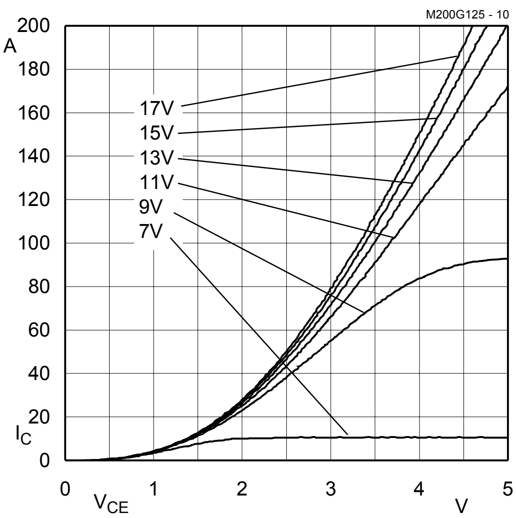


Fig. 10 Typ. output characteristic, t_p = 80 µs; 125 °C

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

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

$V_{CE(TO)(Tj)} \leq 1{,}4 + 0{,}003\ (T_j - 25)$ [V]

typ.: $r_{CE(Tj)} = 0{,}0127 + 0{,}000033\ (T_j - 25)$ [Ω]

max.: $r_{CE(Tj)} = 0{,}0153 + 0{,}000020\ (T_j - 25)$ [Ω]

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

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

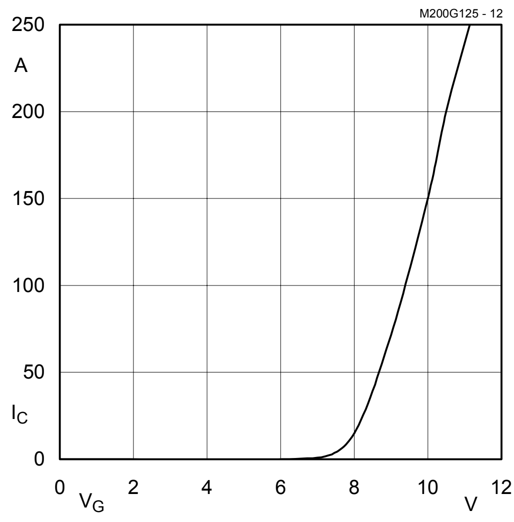


Fig. 12 Typ. transfer characteristic, t_p = 80 µs; V_{CE} = 20 V

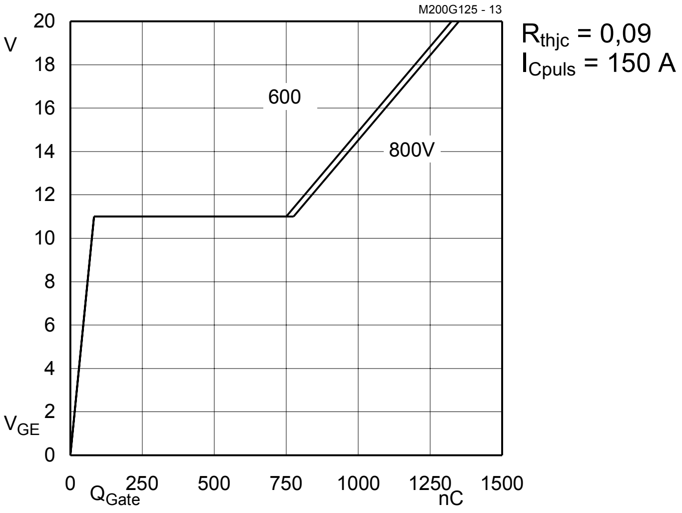


Fig. 13 Typ. gate charge characteristic

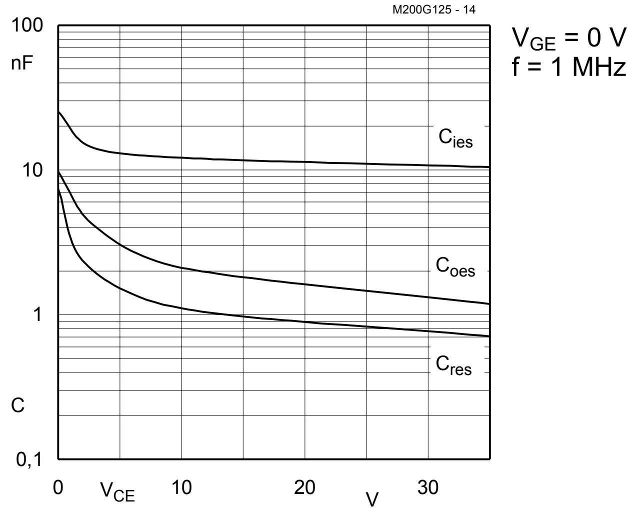


Fig. 14 Typ. capacitances vs.V_{CE}

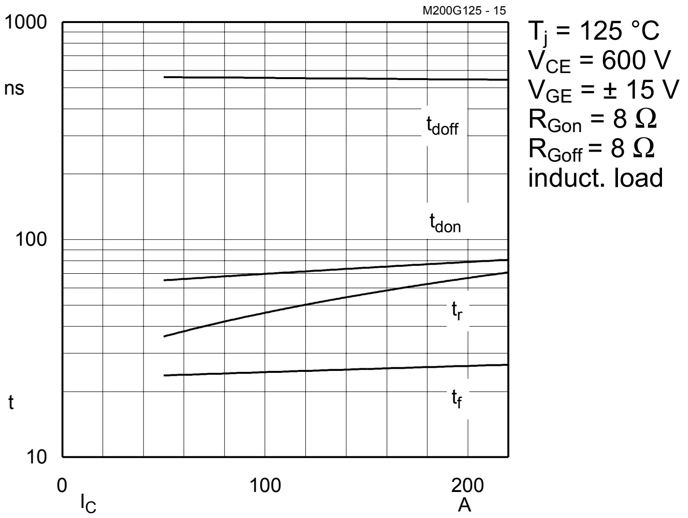


Fig. 15 Typ. switching times vs. I_C

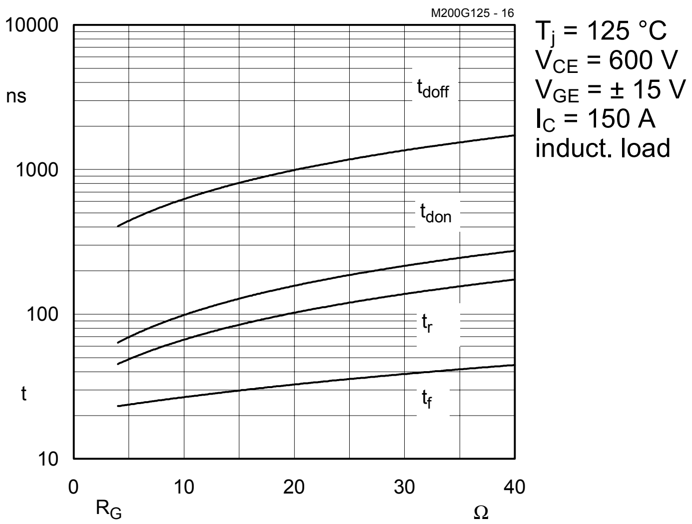


Fig. 16 Typ. switching times vs. gate resistor R_G

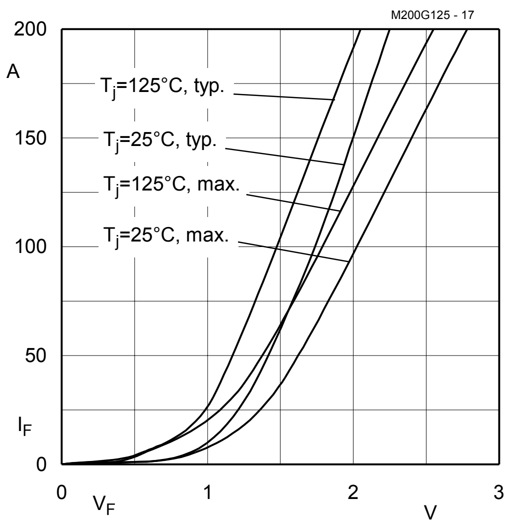


Fig. 17 Typ. CAL diode forward characteristic

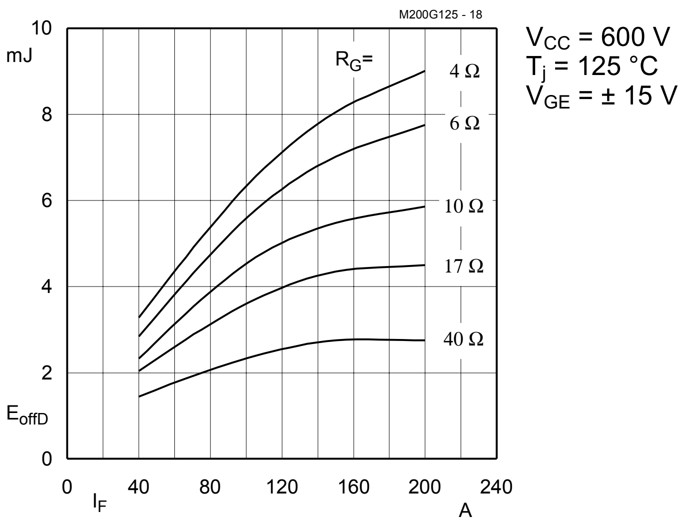


Fig. 18 Diode turn-off energy dissipation per pulse

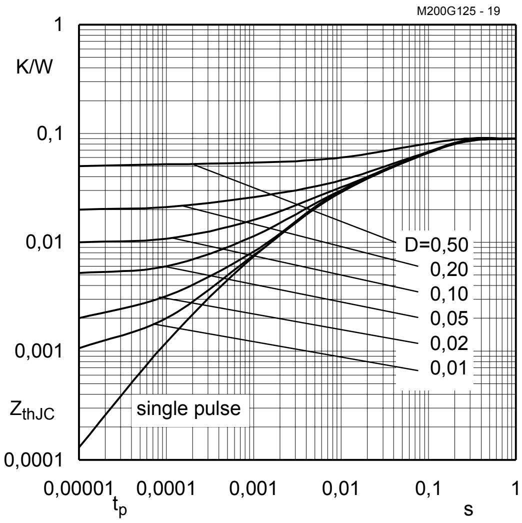


Fig. 19 Transient thermal impedance of IGBT
$Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

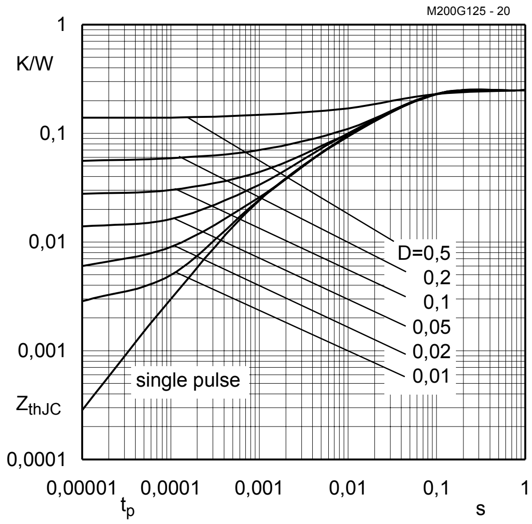
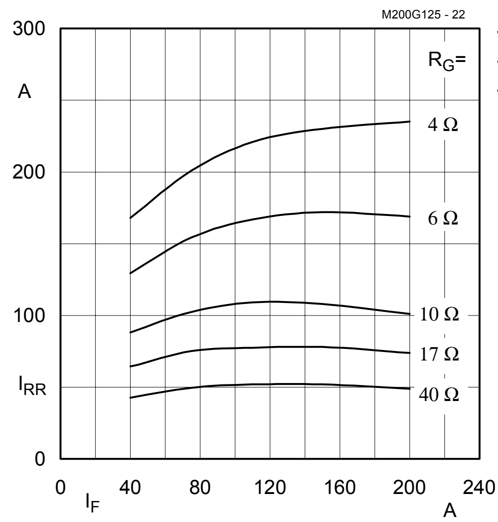
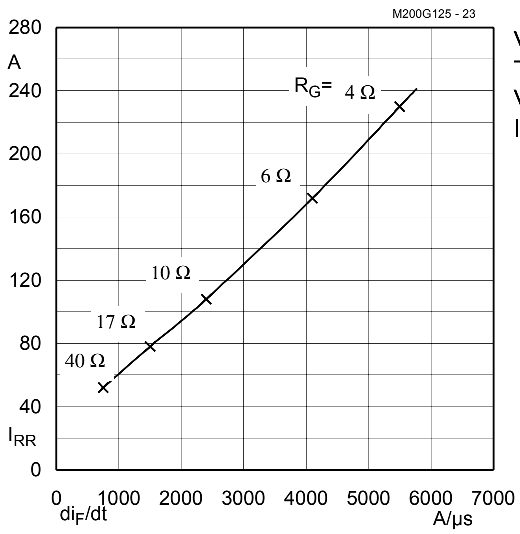


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$



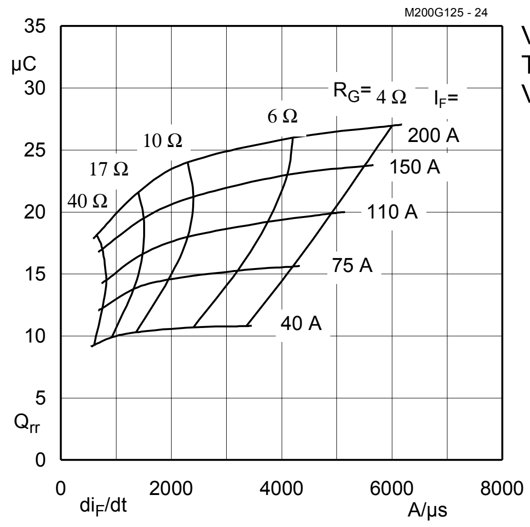
V_{CC} = 600 V
T_j = 125 °C
V_{GE} = ± 15 V

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



V_{CC} = 600 V
T_j = 125 °C
V_{GE} = ± 15 V
I_F = 150 A

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



V_{CC} = 600 V
T_j = 125 °C
V_{GE} = ± 15 V

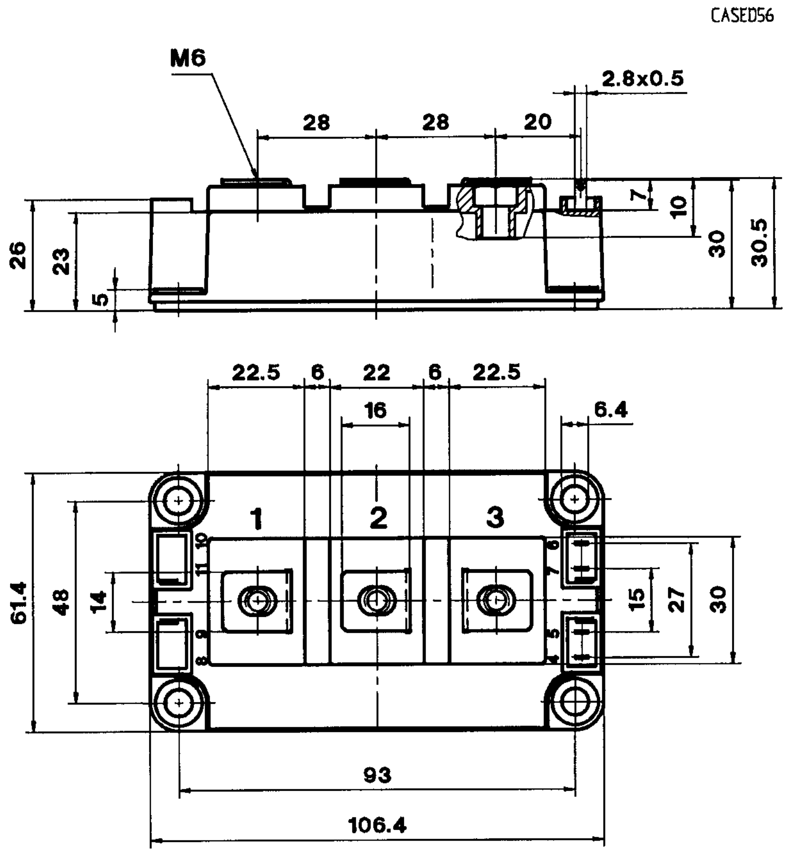
Fig. 24 Typ. CAL diode recovered charge

SEMITRANS 3

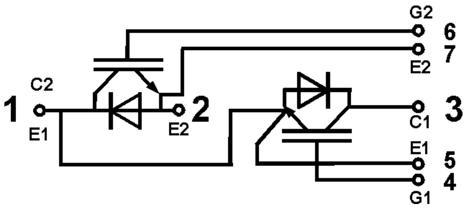
Case D 56

UL Recognized

File no. E 63 532



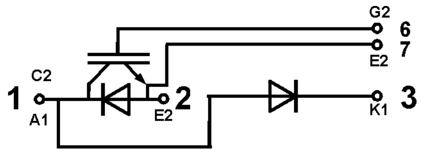
SKM 200 GB 125 D



Dimensions in mm

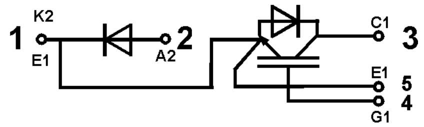
SKM 200 GAL 125 D

Case D 57 (→ D 56)



SKM 200 GAR 125 D

Case D 58 (→ D 56)



Case outline and circuit diagrams

[6)] Free-wheeling diode → page 1, remark 6

Mechanical Data

Symbol	Conditions		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	(M6)	2,5	–	5	Nm
	for terminals, US Units		22	–	44	lb.in.
a			–	–	5x9,81	m/s^2
w			–	–	325	g

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

Twelve devices are supplied in one SEMIBOX D without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 3).