

Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V _{CES}		1200	V
V _{CGR}	R _{GE} = 20 kΩ	1200	V
I _C	T _{case} = 25/80 °C	200 / 180	A
I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	400 / 360	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.	2 500 ⁷⁾	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Diodes		Inverse D. ⁹⁾	Series ⁶⁾
I _F = - I _C	T _{case} = 25/80 °C	25 / 15	260 / 180
I _{FM} = - I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	50 / 30	600 / 400

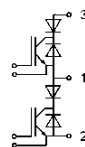
Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
V _{(BR)CES}	V _{GE} = 0, I _C = 4 mA	≥ V _{CES}	—	—	V
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 6 mA	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 } T _j = 25 °C	—	0,2	3	mA
	V _{CE} = V _{CES} } T _j = 125 °C	—	12	—	mA
I _{GES}	V _{GE} = 20 V, V _{CE} = 0	—	—	1	μA
V _{CEsat}	I _C = 150 A } V _{GE} = 15 V;	—	2,5(3,1)	3(3,7)	V
V _{CEsat}	I _C = 200 A } T _j = 25 (125) °C	—	2,8(3,6)	—	V
g _{fs}	V _{CE} = 20 V, I _C = 150 A	95	—	—	S
C _{CHC}	per IGBT	—	—	700	pF
C _{ies}	V _{GE} = 0	—	10	13	nF
C _{oes}	V _{CE} = 25 V	—	1,5	2	nF
C _{res}	f = 1 MHz	—	0,8	1,2	nF
L _{CE}		—	—	40	nH
t _{d(on)}	V _{CC} = 600 V	—	220	400	ns
t _r	V _{GE} = -15 V / +15 V ³⁾	—	100	200	ns
t _{d(off)}	I _C = 150 A, ind. load	—	600	800	ns
t _f	R _{Gon} = R _{Goff} = 5,6 Ω	—	70	100	ns
E _{on} ⁵⁾	T _j = 125 °C	—	24	—	mWs
E _{off} ⁵⁾		—	17	—	mWs
Inverse Diode ⁸⁾ D1, D2 ⁹⁾					
V _F = V _{EC}	I _F = 15 A } V _{GE} = 0 V;	—	2,0(1,8)	2,5	V
V _F = V _{EC}	I _F = 25 A } T _j = 25 (125) °C	—	2,3(2,1)	—	V
V _{TO}	T _j = 125 °C	—	—	1,2	V
r _T	T _j = 125 °C	—	45	70	mΩ
I _{RRM}	I _F = 150 A; T _j = 25 (125) °C ²⁾	—	12(16)	—	A
Q _{rr}	I _F = 150 A; T _j = 25 (125) °C ²⁾	—	1(2,7)	—	μC
Series Diodes D3, D4 ⁸⁾ ⁶⁾					
V _F = V _{EC}	I _F = 200 A } V _{GE} = 0 V;	—	2,0(1,8)	2,5	V
V _F = V _{EC}	I _F = 300 A } T _j = 25 (125) °C	—	2,25(2,1)	—	V
V _{TO}	T _j = 125 °C	—	—	1,2	V
r _T	T _j = 125 °C	—	3	5,5	mΩ
I _{RRM}	I _F = 200 A; T _j = 25 (125) °C ²⁾	—	70(105)	—	A
Q _{rr}	I _F = 200 A; T _j = 25 (125) °C ²⁾	—	10(26)	—	μC
Thermal Characteristics					
R _{thjc}	per IGBT	—	—	0,09	°C/W
R _{thjc}	per inverse/series diode	—	—	1,5/0,18	°C/W
R _{thch}	per module	—	—	0,038	°C/W

SEMITRANS® M IGBT Modules

SKM 200 GBD 123 D 1S



SEMITRANS 3



GBD

Features

- MOS input (voltage controlled)
- N channel, Homogeneous Si
- Low inductance case
- 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 Technology
- Large clearance (13 mm) and creepage distances (20 mm).

Typical Applications:

- Switching (not for linear use)
- Resonant inverters

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

⁵⁾ See fig. 2 + 3; R_{Goff} = 5,6 Ω

⁶⁾ Series diodes have the data of the inverse diodes of SKM 300 GB 123 D

⁸⁾ CAL = Controlled Axial Lifetime Technology.

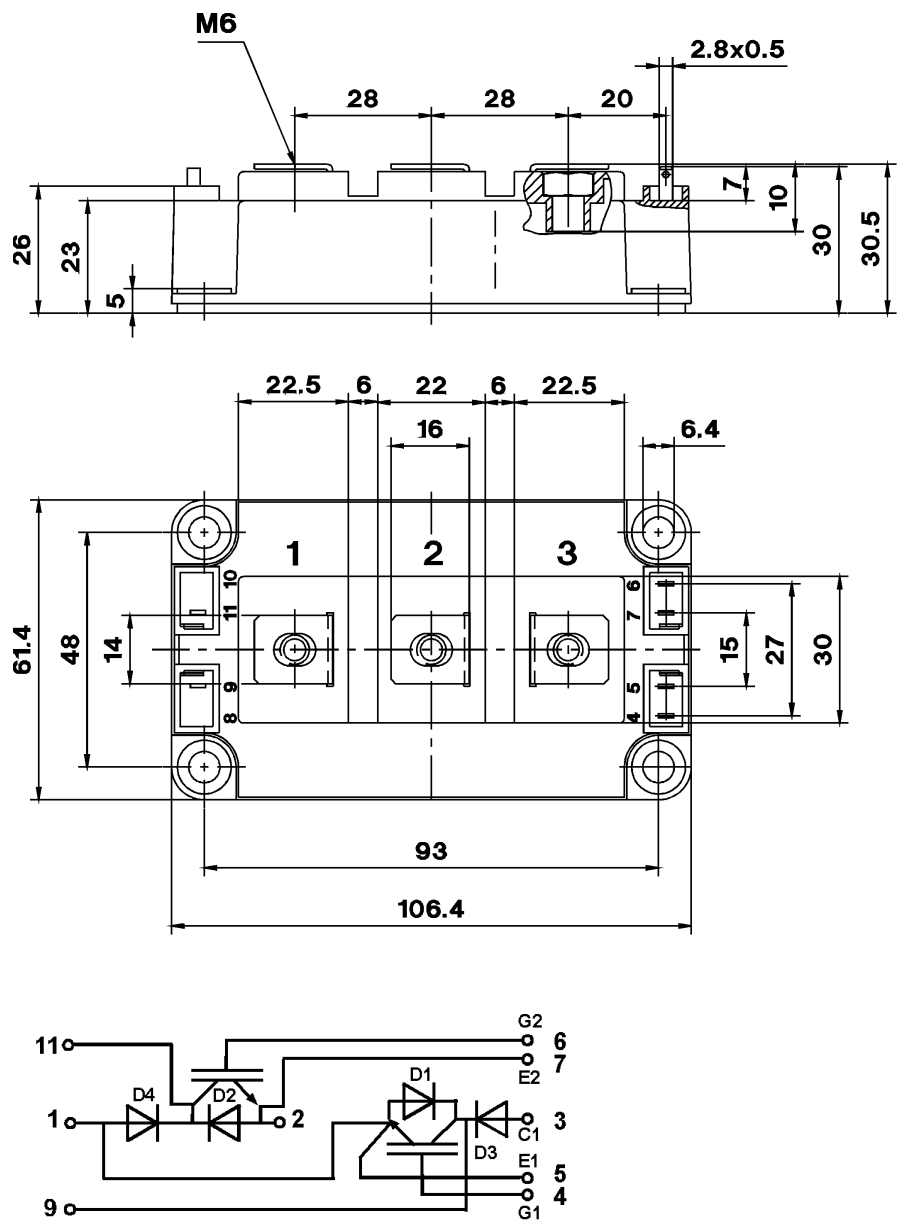
⁹⁾ → B6-156 for protection only

Cases and mech. data → B6-156

Diagrams → B6-150...153 (IGBT) and B6-172 and B6-173 (D3, D4)

SEMITRANS 3

Case D 56a
UL Recognized
File no. E 63 532



Dimensions in mm

Case outline and circuit diagrams

9) The inverse diodes D1 and D2 have the function of protective devices only. Data see type SKM 22GD123D (Fig. 17, 18, 22-24)

Mechanical Data		Values			Units
Symbol	Conditions	min.	typ.	max.	
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.

Three devices are supplied in one SEMIBOX A without mounting hardware, which can be ordered separately under Ident No. 33321100 (for 10 SEMITRANS 3). Larger packing units of 12 and 20 pieces are used if suitable.

Accessories → B 6 - 4
SEMIBOX → C - 1.

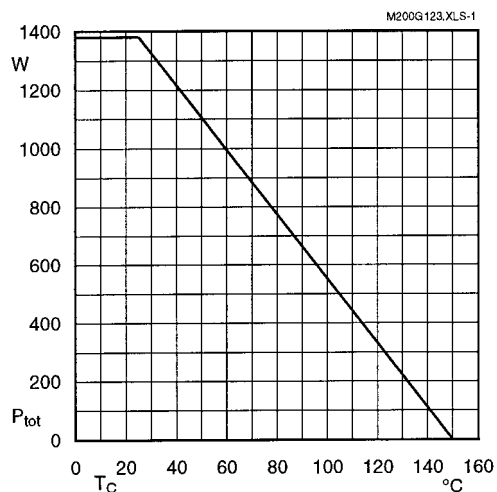


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

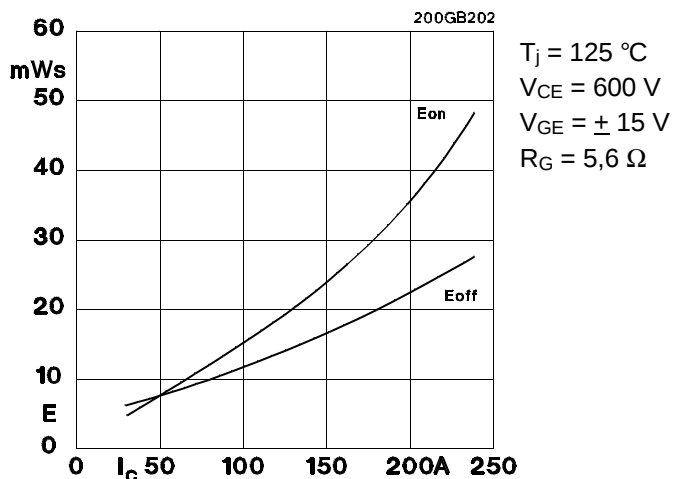


Fig. 2 Turn-on /-off energy = $f(I_C)$

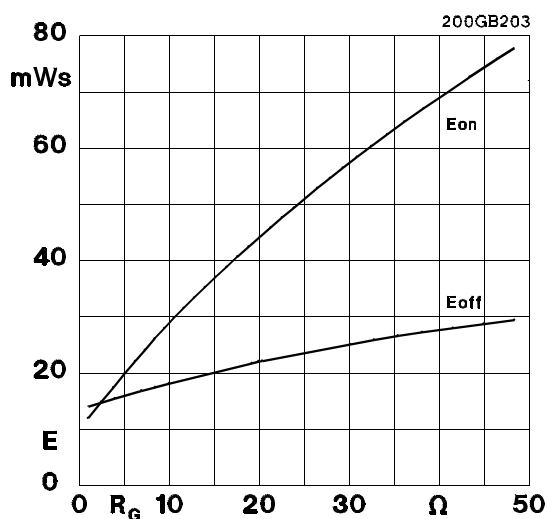


Fig. 3 Turn-on /-off energy = $f(R_G)$

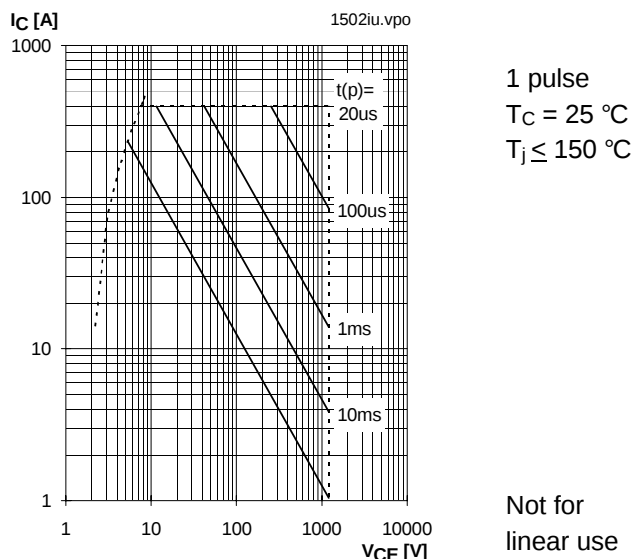


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

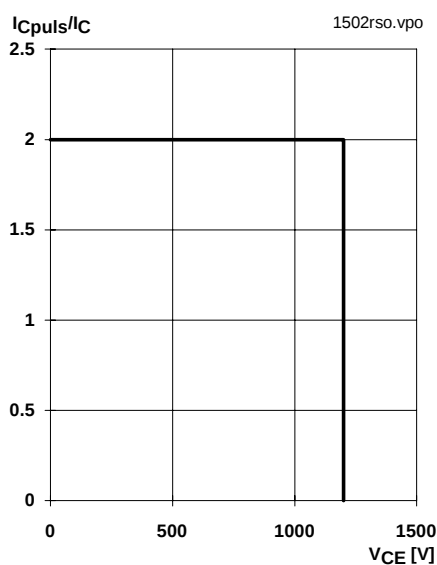


Fig. 5 Turn-off safe operating area (RBSOA)

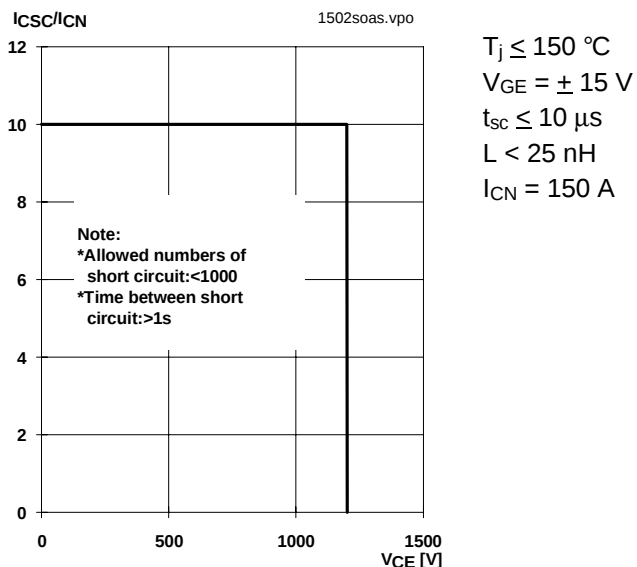


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

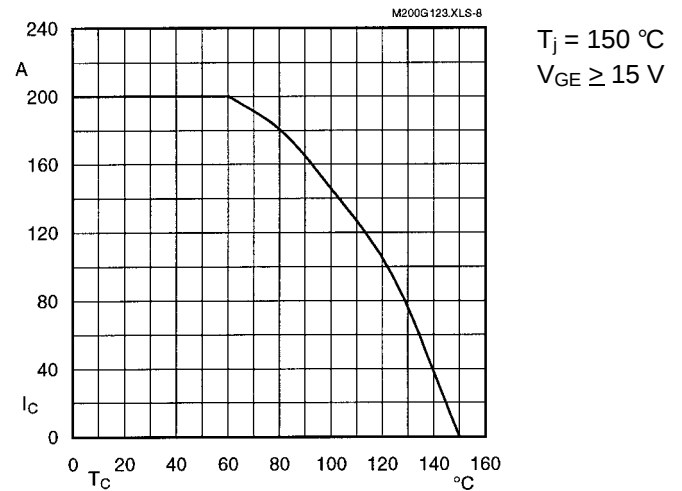


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

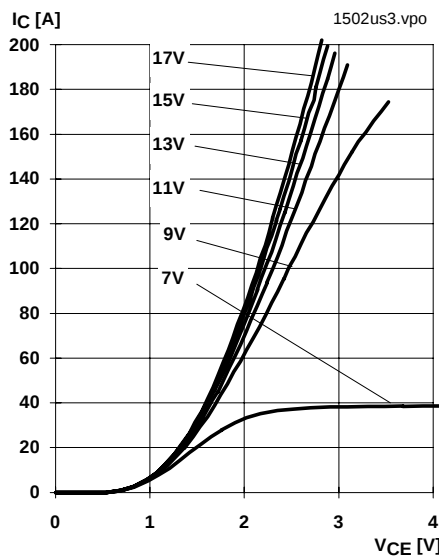


Fig. 9 Typ. output characteristic, $t_p = 80 \mu s$; $25^\circ C$

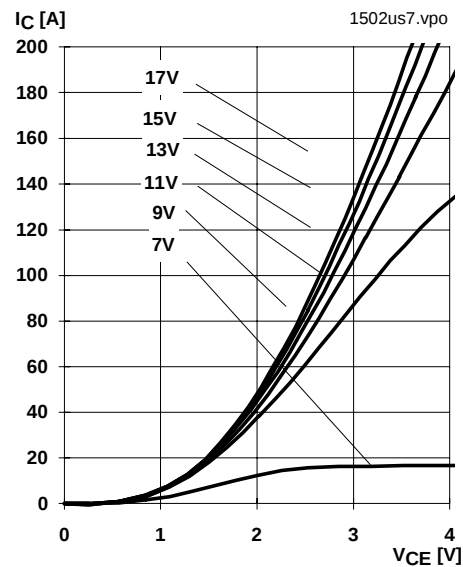


Fig. 10 Typ. output characteristic, $t_p = 80 \mu s$; $125^\circ C$

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

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

$$V_{CE(TO)(T_J)} \leq 1,5 + 0,002 (T_J - 25) [V]$$

$$\text{typ.: } r_{CE(T_J)} = 0,0066 + 0,000027 (T_J - 25) [\Omega]$$

$$\text{max.: } r_{CE(T_J)} = 0,0100 + 0,000033 (T_J - 25) [\Omega]$$

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

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

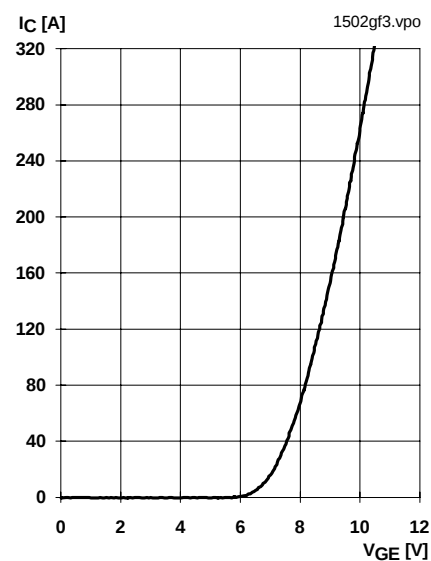


Fig. 12 Typ. transfer characteristic, $t_p = 80 \mu s$; $V_{CE} = 20 V$

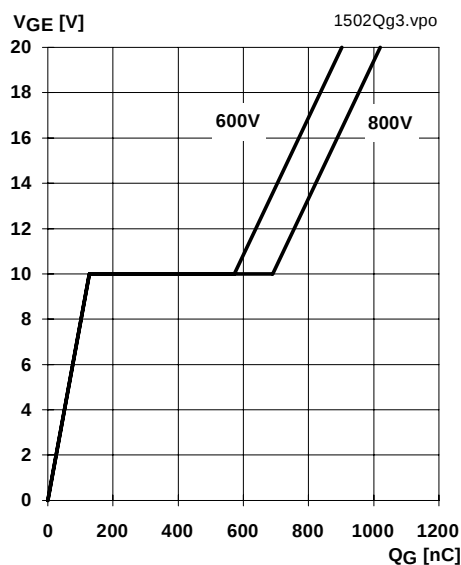
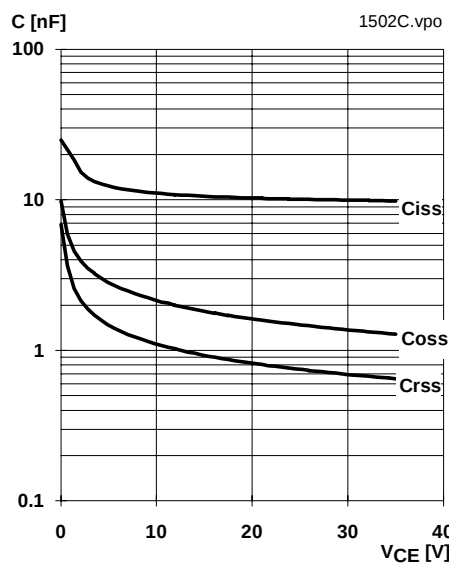


Fig. 13 Typ. gate charge characteristic

$I_{Cpuls} = 150 \text{ A}$



$V_{GE} = 0 \text{ V}$
 $f = 1 \text{ MHz}$

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

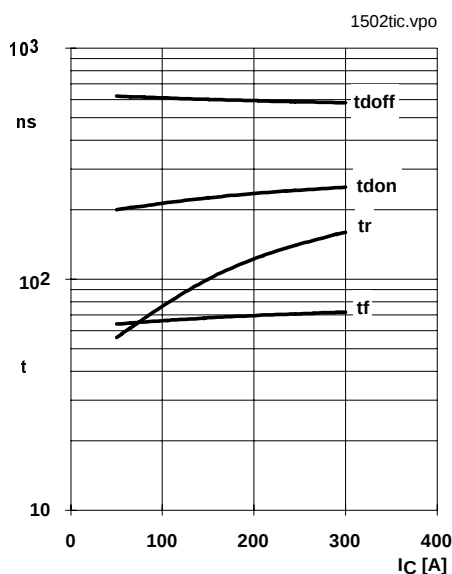


Fig. 15 Typ. switching times vs. I_C

$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{Gon} = 5,6 \text{ } \Omega$
 $R_{Goff} = 5,6 \text{ } \Omega$
induct. load

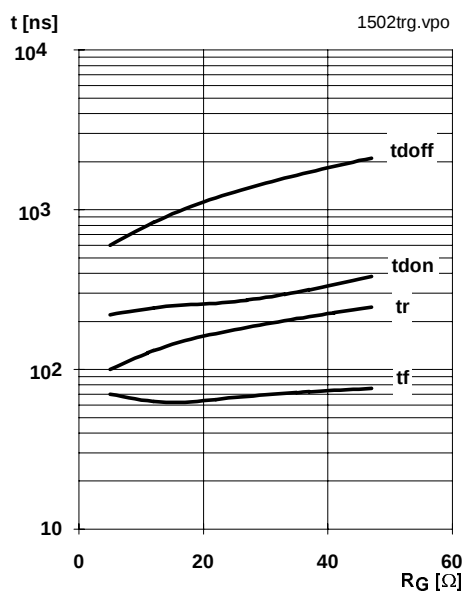


Fig. 16 Typ. switching times vs. gate resistor R_G

$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 150 \text{ A}$
induct. load

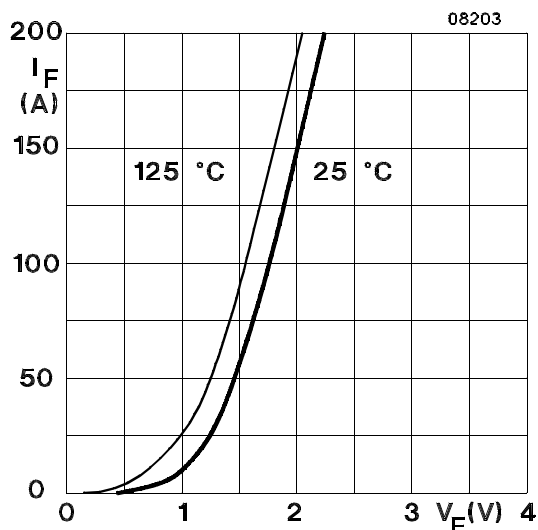


Fig. 17 Typ. CAL diode forward characteristic

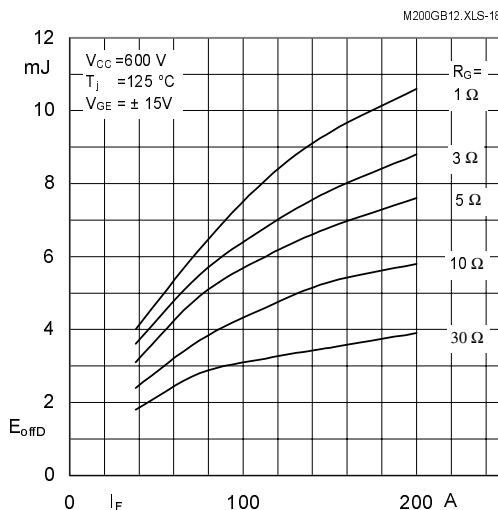


Fig. 18 Diode turn-off energy dissipation per pulse

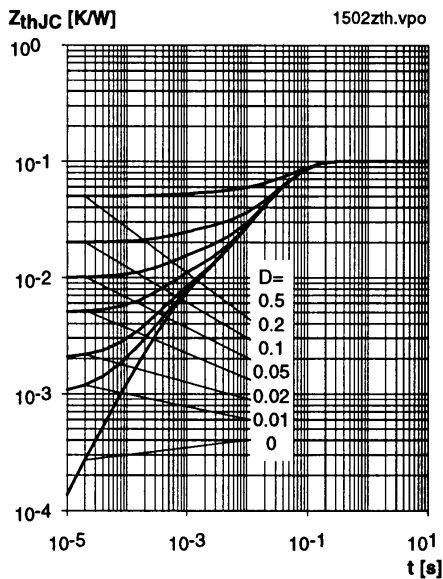


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

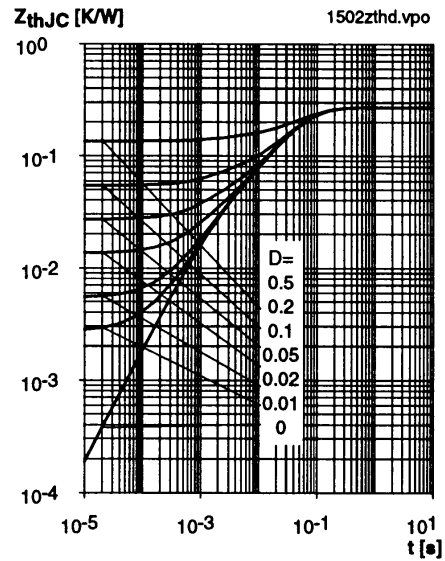


Fig. 20 Transient thermal impedance of inverse CAL diodes $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

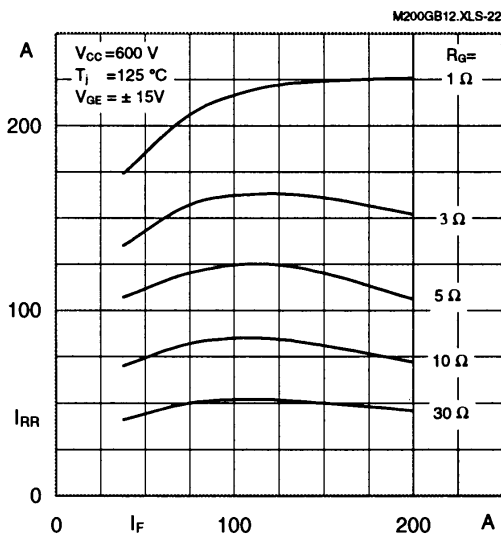


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F, R_G)$

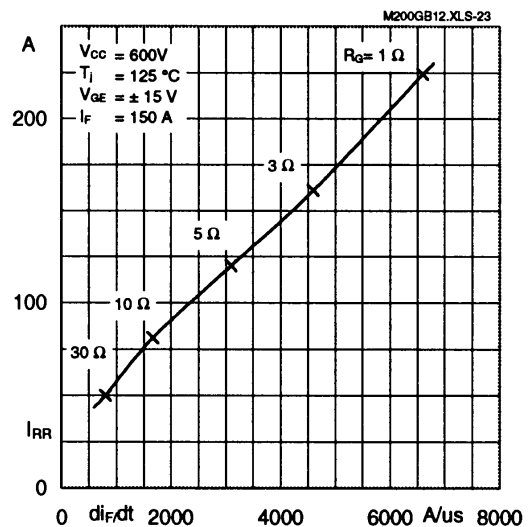


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di_F/dt)$

Typical Applications

include

- Switched mode power supplies
- DC servo and robot drives
- Inverters
- DC choppers (versions GAR; GAL)
- AC motor speed control
- Inductive heating
- UPS Uninterruptable power supplies
- General power switching applications

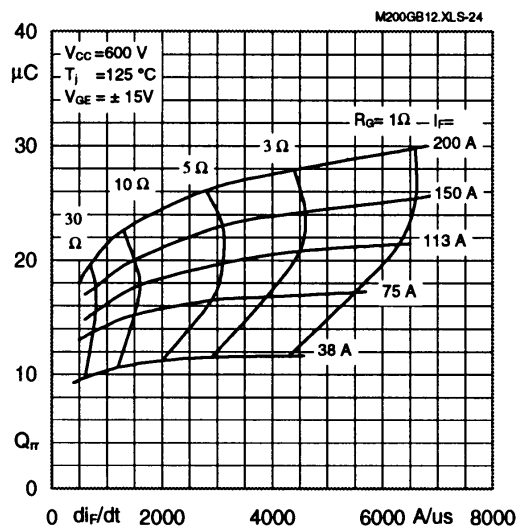


Fig. 24 Typ. CAL diode recovered charge $Q_{RR} = f(di/dt)$