

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	25 / 15	A
I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	50 / 30	A
V _{GES}		± 20	V
P _{tot}	per IGBT, T _{case} = 25 °C	145	W
T _j , (T _{stg})		- 40 ... +150 (125)	°C
V _{isol}	AC, 1 min.	2 500	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
I _F = - I _C	T _{case} = 25/80 °C	25 / 15	A
I _{FM} = - I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	50 / 30	A
I _{FSM}	t _p = 10 ms; sin.; T _j = 150 °C	200	A
I _t ²	t _p = 10 ms; T _j = 150 °C	200	A ² s

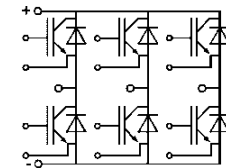
Characteristics					
Symbol	Conditions ¹⁾	min.	typ.	max.	Units
V _{(BR)GES}	V _{GE} = 0, I _C = 0,5 mA	≥ V _{CES}	-	-	V
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 1 mA	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 } T _j = 25 °C	-	0,3	0,5	mA
		V _{CE} = V _{CES} } T _j = 125 °C	-	1,8	-
I _{GES}	V _{GE} = 20 V, V _{CE} = 0	-	-	150	nA
V _{CEsat}	I _C = 15 A } V _{GE} = 15 V; } T _j = 25 (125) °C	-	2,5(3,1)	3(3,7)	V
V _{CEsat}		I _C = 22 A	-	3(3,7)	-
g _{fs}	V _{CE} = 20 V, I _C = 15 A	-	12	-	S
C _{CHC}	per IGBT	-	-	300	pF
C _{ies}	} V _{GE} = 0 } V _{CE} = 25 V } f = 1 MHz	-	1000	-	pF
C _{oes}		-	150	-	pF
C _{res}		-	70	-	pF
L _{CE}		-	-	60	nH
t _{d(on)}	} V _{CC} = 600 V } V _{GE} = + 15 V / - 15 V ³⁾ } I _C = 15 A, ind. load } R _{Gon} = R _{Goff} = 52 Ω } T _j = 125 °C	-	40	-	ns
t _r		-	35	-	ns
t _{d(off)}		-	350	-	ns
t _f		-	70	-	ns
E _{on} ⁵⁾		-	2	-	mWs
E _{off} ⁵⁾		-	1,4	-	mWs
Inverse Diode ⁸⁾					
V _F = V _{EC}	I _F = 15 A } V _{GE} = 0 V; } T _j = 25 (125) °C	-	2,0(1,8)	2,5	V
V _F = V _{EC}		I _F = 25 A	-	2,3(2,1)	-
V _{TO}	T _j = 125 °C	-	1,1	1,2	V
r _T	T _j = 125 °C	-	45	70	mΩ
I _{RR}	I _F = 15 A; T _j = 25 (125) °C ²⁾	-	12(16)	-	A
Q _{rr}	I _F = 15 A; T _j = 25 (125) °C ²⁾	-	1(2,7)	-	μC
Thermal Characteristics					
R _{thjc}	per IGBT	-	-	0,86	°C/W
R _{thjc}	per diode ⁸⁾	-	-	1,5	°C/W
R _{thch}	per module	-	-	0,05	°C/W

SEMITRANS® M IGBT Modules

SKM 22 GD 123 D
SKM 22 GD 123 D L*)



Sixpack



GD

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 diodes⁸⁾
- Isolated copper baseplate using DCB Direct Copper Bonding Technology
- Large clearance (9 mm) and creepage distances (13 mm).

Typical Applications

- Switched mode power supplies
- Three phase inverters for AC motor speed control
- General power switching applications
- Pulse frequencies also above 15 kHz

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

²⁾ I_F = - I_C, V_R = 600 V, - di_F/dt = 400 A/μs, V_{GE} = 0 V

³⁾ Use: V_{GEoff} = -5 ... -15 V

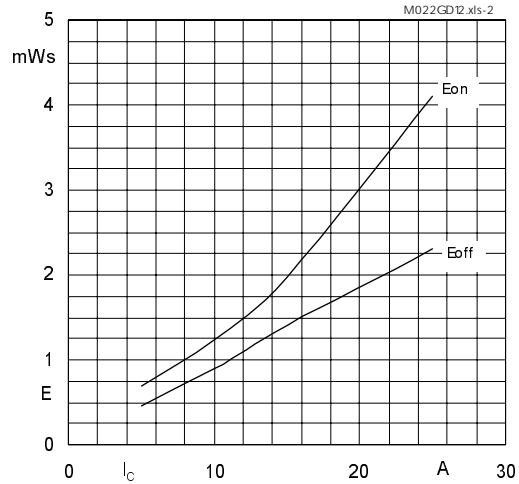
⁵⁾ See fig. 2 + 3; R_{Goff} = 52 Ω

⁸⁾ CAL = Controlled Axial Lifetime Technology.

***) Main terminals = 2 mm dia. Cases and mech. data → B6 - 68 Sixpack**

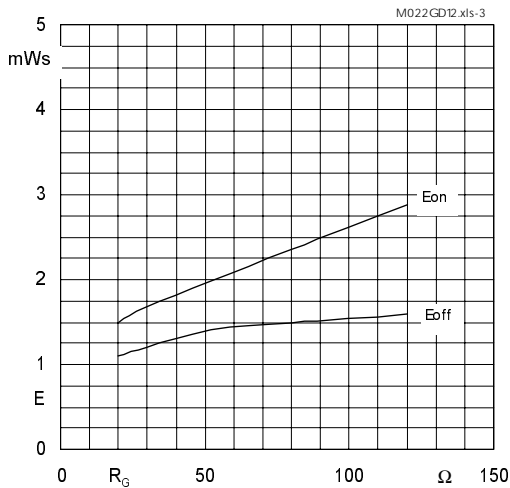


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$



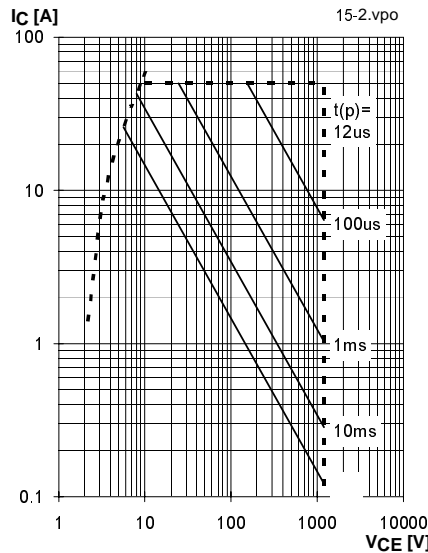
$T_j = 125\text{ °C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $R_G = 52\text{ }\Omega$

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



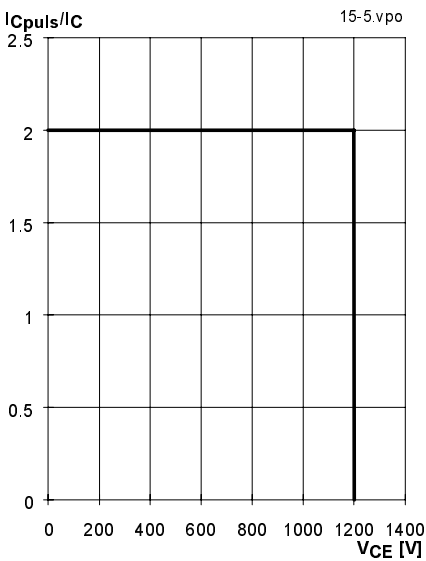
$T_j = 125\text{ °C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_C = 15\text{ A}$

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



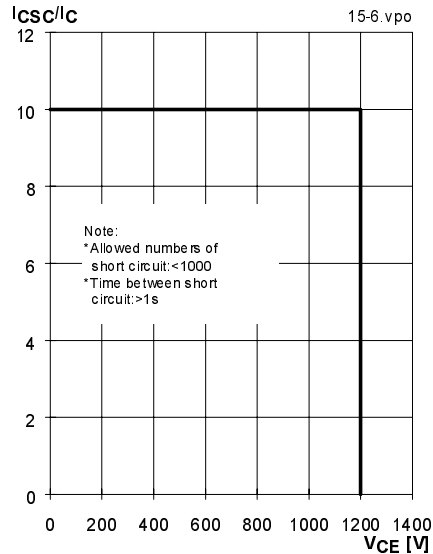
1 pulse
 $T_C = 25\text{ °C}$
 $T_j \leq 150\text{ °C}$

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



$T_j \leq 150\text{ °C}$
 $V_{GE} = \pm 15\text{ V}$
 $R_{Goff} = 52\text{ }\Omega$
 $I_C = 15\text{ A}$

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



$T_j \leq 150\text{ °C}$
 $V_{GE} = \pm 15\text{ V}$
 $t_{sc} \leq 10\text{ ms}$
 $L < 25\text{ nH}$
 $I_{CN} = 15\text{ A}$

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

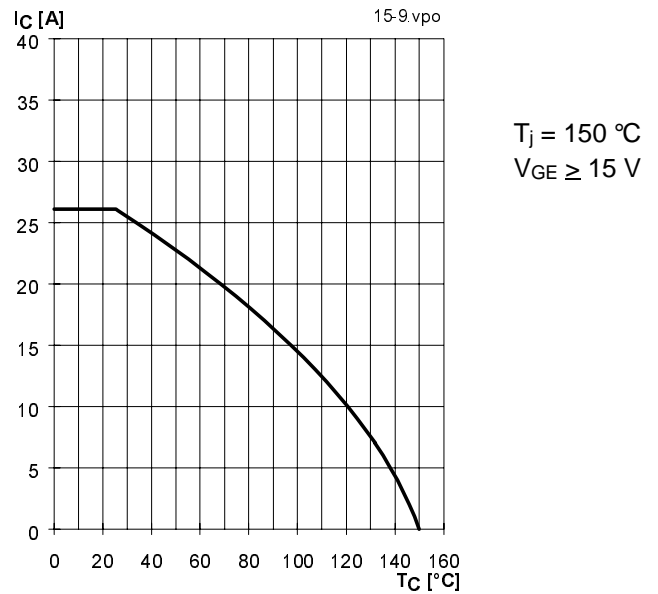


Fig. 8 Rated current vs. temperature $I_c = f(T_c)$

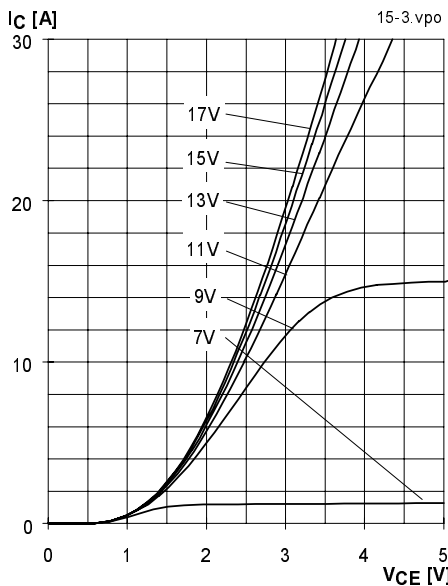


Fig. 9 Typ. output characteristic, $t_p = 80 \mu s$; $25 \text{ }^\circ\text{C}$

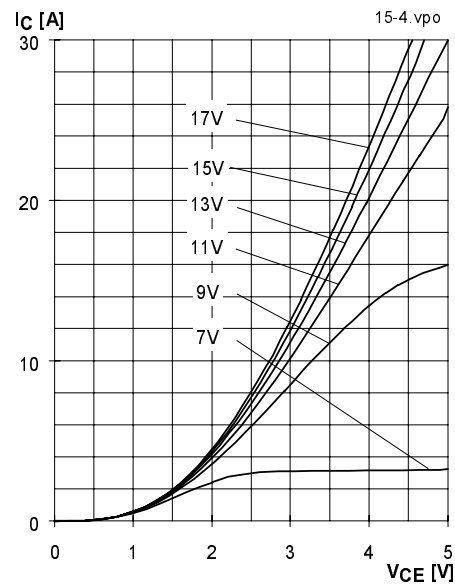


Fig. 10 Typ. output characteristic, $t_p = 80 \mu s$; $125 \text{ }^\circ\text{C}$

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

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

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

$$\text{typ.: } r_{CE(T_j)} = 0,067 + 0,00027 (T_j - 25) \text{ [\Omega]}$$

$$\text{max.: } r_{CE(T_j)} = 0,100 + 0,00033 (T_j - 25) \text{ [\Omega]}$$

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

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

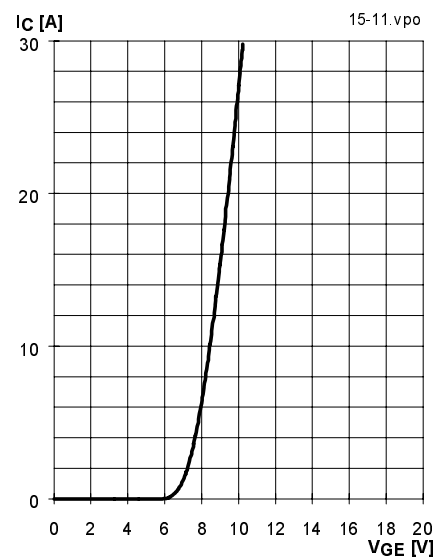


Fig. 12 Typ. transfer characteristic, $t_p = 80 \mu s$; $V_{CE} = 20 \text{ V}$

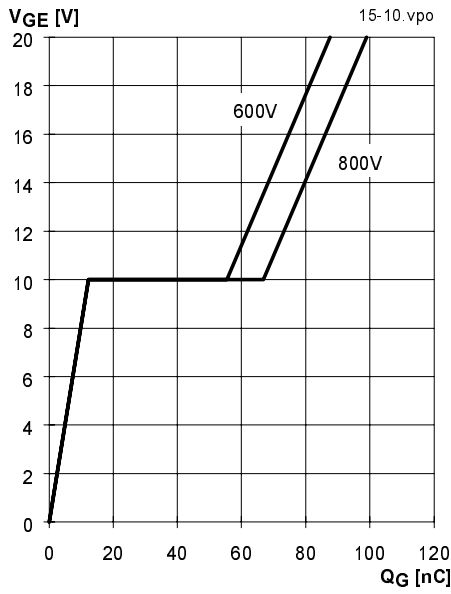
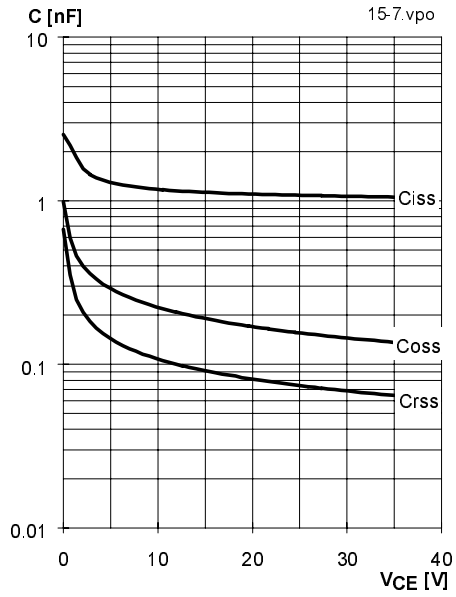


Fig. 13 Typ. gate charge characteristic

$I_{Cpuls} = 15 \text{ A}$



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

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

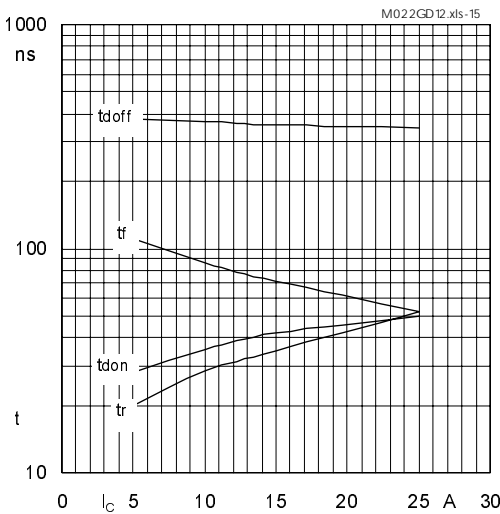
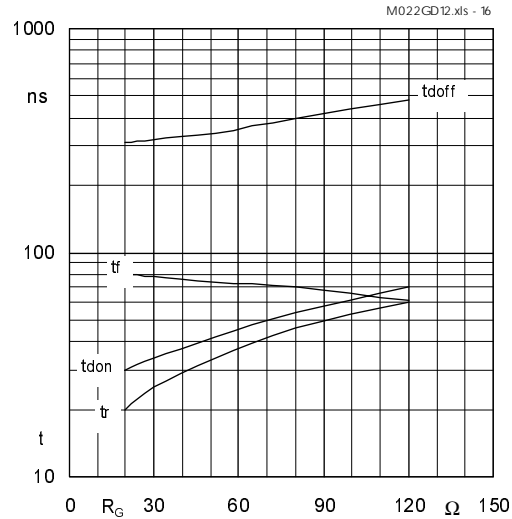


Fig. 15 Typ. switching times vs. I_C

$T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 600 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{Gon} = 52 \text{ } \Omega$
 $R_{Goff} = 52 \text{ } \Omega$
induct. load



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

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

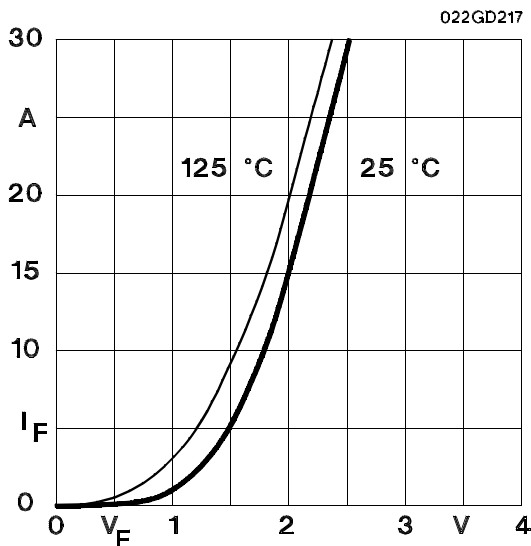


Fig. 17 Typ. CAL diode forward characteristic

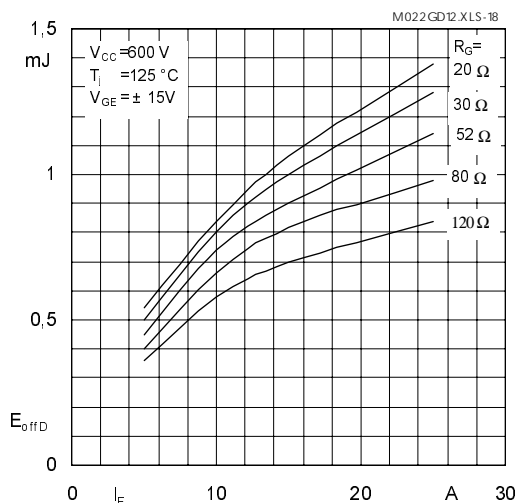


Fig. 18 Diode turn-off energy dissipation per pulse

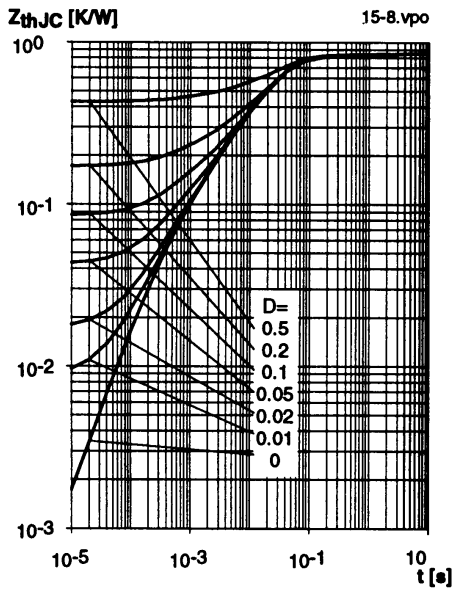


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

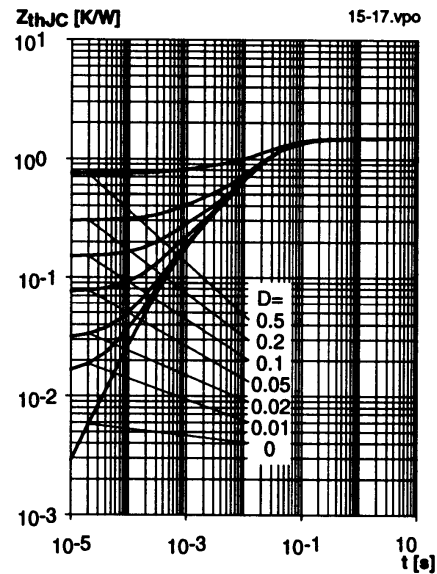


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

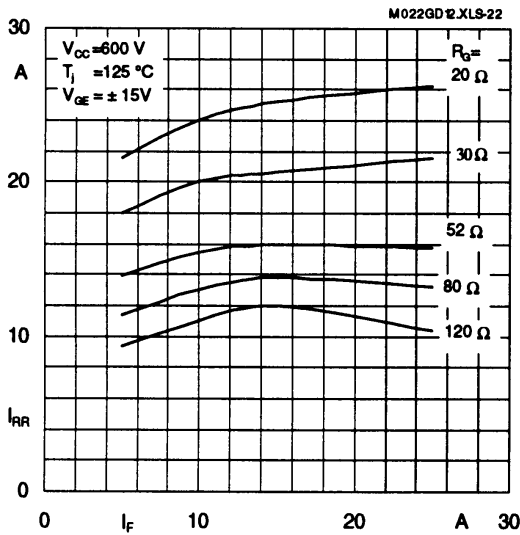


Fig. 22 CAL diode peak reverse recovery current
 $I_{RR} = f(I_F; R_G)$

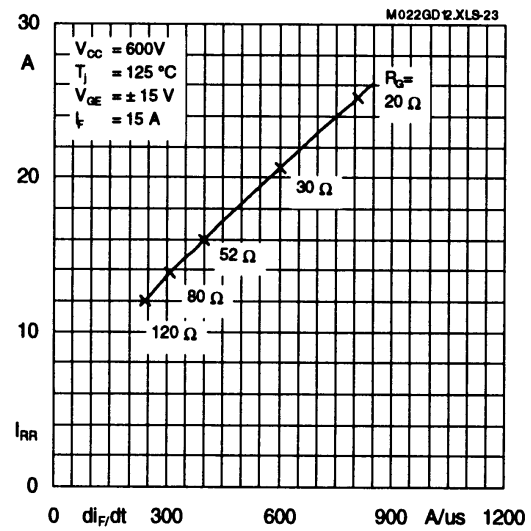


Fig. 23 CAL diode peak reverse recovery current
 $I_{RR} = (di/dt)$

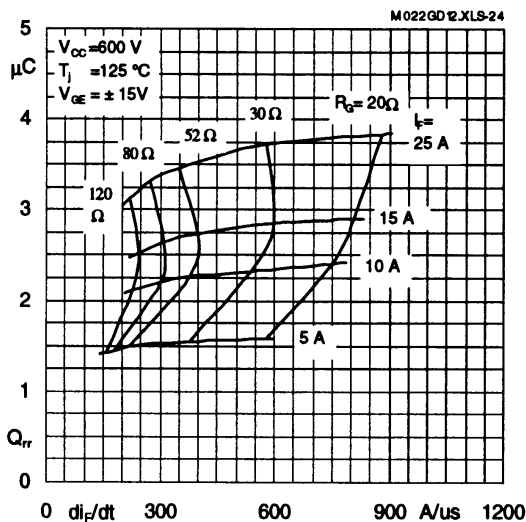


Fig. 24 CAL diode recovered charge $Q_{rr} = f(di/dt)$

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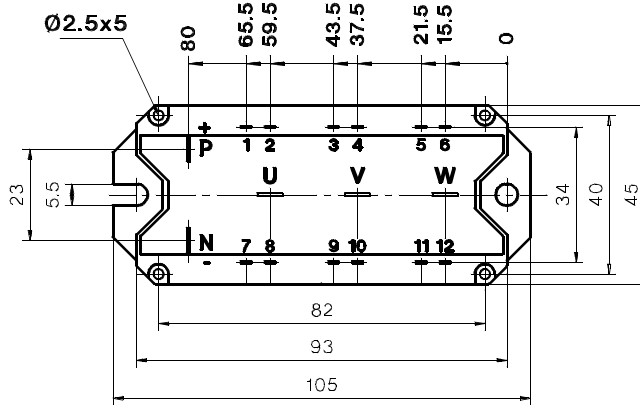
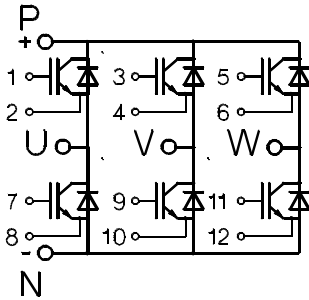
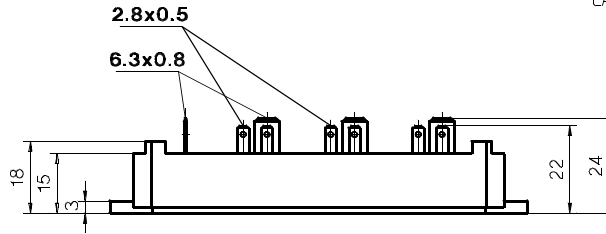
Case D 67

UL Recognized

File no. E 63 532

SKM 22 GD 123 D

CASED67



SEMITRANS Sixpack

Case D 68

UL Recognized

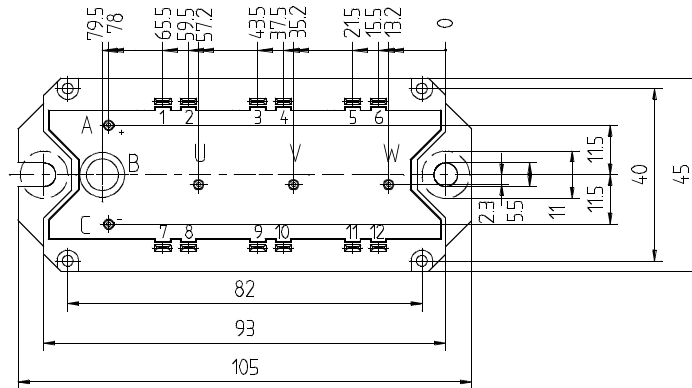
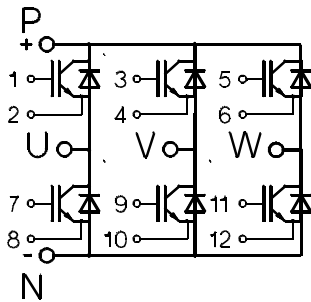
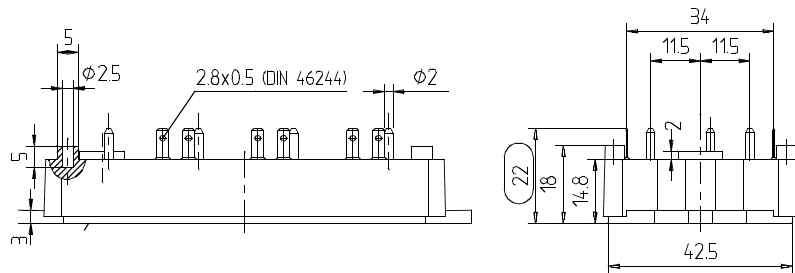
Special version on request

SKM 22 GD 123 DL

SKM 40 GD 123 DL

SKM 75 GD 123 DL

CASED68



Dimensions in mm

Case outlines and circuit diagrams

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

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

Two devices are supplied in one SEMIBOX A. Larger packing units (10 and 20 pieces) are used if suitable. SEMIBOX → C - 1.