

Absolute Maximum Ratings		Values	Units
Symbol	Conditions <sup>1)</sup>		
V <sub>CES</sub>		1200	V
V <sub>CGR</sub>	R <sub>GE</sub> = 20 kΩ	1200	V
I <sub>C</sub>	T <sub>case</sub> = 25/75 °C	100 / 75	A
I <sub>CM</sub>	T <sub>case</sub> = 25/75 °C; t <sub>p</sub> = 1 ms	200 / 150	A
V <sub>GES</sub>		± 20	V
P <sub>tot</sub>	per IGBT, T <sub>case</sub> = 25 °C	450	W
T <sub>j</sub> , (T <sub>stg</sub> )		-40 ... + 150 (125)	°C
V <sub>isol</sub>	AC, 1 min.	2 500 <sup>7)</sup>	V
humidity	DIN 40040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
I <sub>F</sub> = -I <sub>C</sub>	T <sub>case</sub> = 25/80 °C	75 / 50	A
I <sub>FM</sub> = -I <sub>CM</sub>	T <sub>case</sub> = 25/80 °C; t <sub>p</sub> = 1 ms	200 / 150	A
I <sub>FSM</sub>	t <sub>p</sub> = 10 ms; sin.; T <sub>j</sub> = 150 °C	550	A
I <sup>2</sup> t	t <sub>p</sub> = 10 ms; T <sub>j</sub> = 150 °C	1500	A <sup>2</sup> s

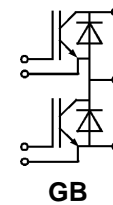
## SEMITRANS® M Low Loss IGBT Modules

### SKM 75 GB 124 D



SEMITRANS 2

Characteristics		min.	typ.	max.	Units
Symbol	Conditions <sup>1)</sup>				
V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0, I <sub>C</sub> = 4 mA	≥ V <sub>CES</sub>	-	-	V
V <sub>GE(th)</sub>	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 2 mA	4,5	5,5	6,5	V
I <sub>CES</sub>	V <sub>GE</sub> = 0 } T <sub>j</sub> = 25 °C	-	0,8	1	mA
		V <sub>CE</sub> = V <sub>CES</sub> } T <sub>j</sub> = 125 °C	-	3,5	-
I <sub>GES</sub>	V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0		-	-	200
V <sub>CESat</sub>	I <sub>C</sub> = 50 A } V <sub>GE</sub> = 15 V;	-	2,1(2,4)	2,45(2,85)	V
V <sub>CESat</sub>	I <sub>C</sub> = 75 A } T <sub>j</sub> = 25 (125) °C }	-	2,5(3,0)	-	V
g <sub>fs</sub>	V <sub>CE</sub> = 20 V, I <sub>C</sub> = 50 A	23	40	-	S
C <sub>CHC</sub>	per IGBT	-	-	350	pF
C <sub>ies</sub>	V <sub>GE</sub> = 0 } V <sub>CE</sub> = 25 V } f = 1 MHz }	-	3,3	4,3	nF
C <sub>oes</sub>		-	500	600	pF
C <sub>res</sub>		-	220	300	pF
L <sub>CE</sub>		-	-	30	nH
t <sub>d(on)</sub>	V <sub>CC</sub> = 600 V } V <sub>GE</sub> = -15 V / +15 V <sup>3)</sup> } I <sub>C</sub> = 50 A, ind. load } R <sub>Gon</sub> = R <sub>Goff</sub> = 22 Ω } T <sub>j</sub> = 125 °C }	-	60	100	ns
t <sub>r</sub>		-	55	100	ns
t <sub>d(off)</sub>		-	420	500	ns
t <sub>f</sub>		-	50	100	ns
E <sub>on</sub> <sup>5)</sup>		-	8	-	mWs
E <sub>off</sub> <sup>5)</sup>		-	6	-	mWs
Inverse Diode <sup>8)</sup>					
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 50 A } V <sub>GE</sub> = 0 V; } I <sub>F</sub> = 75 A } T <sub>j</sub> = 25 (125) °C }	-	2,0(1,8)	2,5	V
V <sub>F</sub> = V <sub>EC</sub>		-	2,25 (2,1)	-	V
V <sub>TO</sub>	T <sub>j</sub> = 125 °C	-	1,1	1,2	V
r <sub>t</sub>	T <sub>j</sub> = 125 °C	-	-	22	mΩ
I <sub>R</sub> RM	I <sub>F</sub> = 50 A; T <sub>j</sub> = 125 °C <sup>2)</sup>	-	39	-	A
Q <sub>rr</sub>	I <sub>F</sub> = 50 A; T <sub>j</sub> = 125 °C <sup>2)</sup>	-	7	-	μC
Thermal characteristics					
R <sub>thjc</sub>	per IGBT	-	-	0,27	°C/W
R <sub>thjc</sub>	per diode	-	-	0,60	°C/W
R <sub>thch</sub>	per module	-	-	0,05	°C/W



### Features

- MOS input (voltage controlled)
- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
- Low loss high density chips
- Low tail current
- High short circuit capability, self limiting to 6 \* I<sub>Cnom</sub>
- Latch-up free
- Fast & soft inverse CAL diodes <sup>8)</sup>
- Isolated copper baseplate using DCB Direct Copper Bonding Technology without hard mould
- Large clearance (10 mm) and creepage distances (20 mm)

### Typical Applications: → B 6 – 97

- Switching (not for linear use)

<sup>1)</sup> T<sub>case</sub> = 25 °C, unless otherwise specified

<sup>2)</sup> I<sub>F</sub> = - I<sub>C</sub>, V<sub>R</sub> = 600 V, -di<sub>F</sub>/dt = 800 A/μs, V<sub>GE</sub> = 0 V

<sup>3)</sup> Use V<sub>GEoff</sub> = -5... -15 V

<sup>5)</sup> See fig. 2 + 3; R<sub>Goff</sub> = 22 Ω

<sup>7)</sup> V<sub>isol</sub> = 4000 V<sub>rms</sub> on request

<sup>8)</sup> CAL = Controlled Axial Lifetime Technology

### Cases and mech. data → B 6 – 98

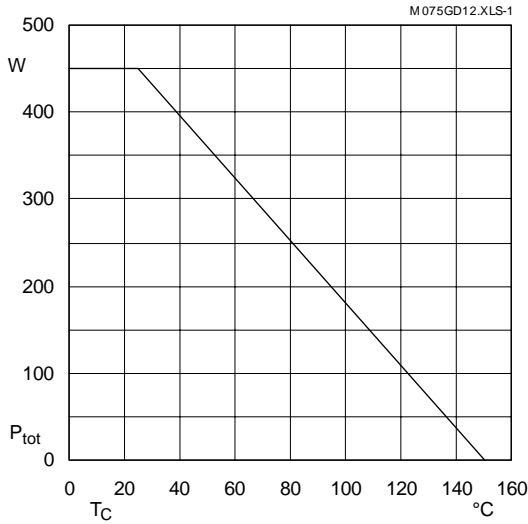


Fig. 1 Rated power dissipation  $P_{tot} = f(T_C)$

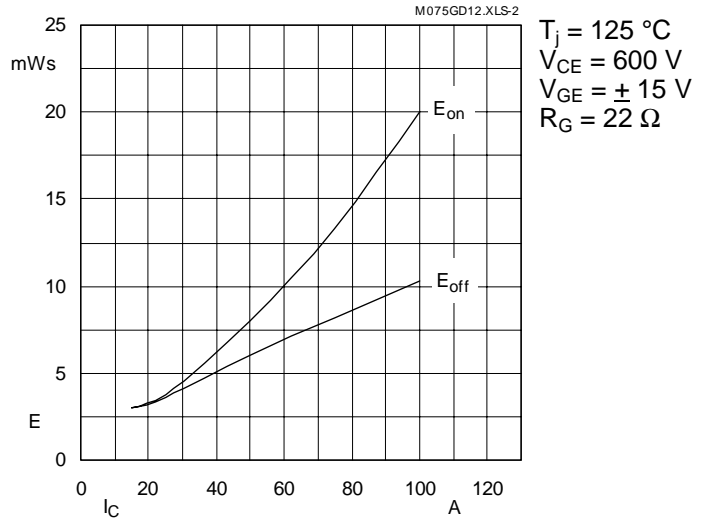


Fig. 2 Turn-on /-off energy =  $f(I_C)$

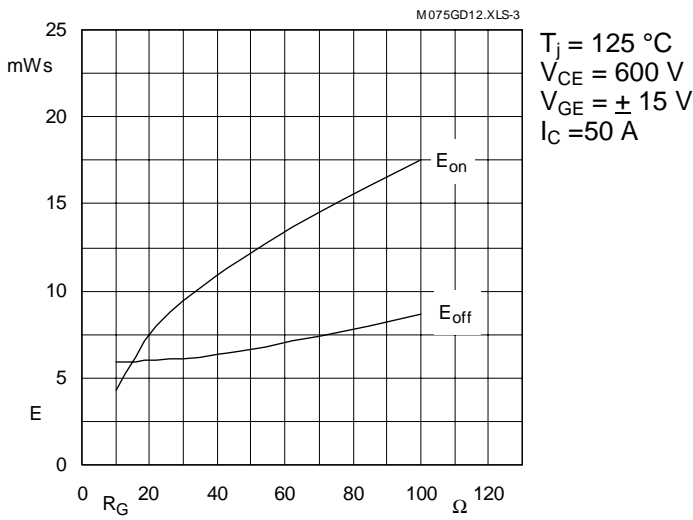


Fig. 3 Turn-on /-off energy =  $f(R_G)$

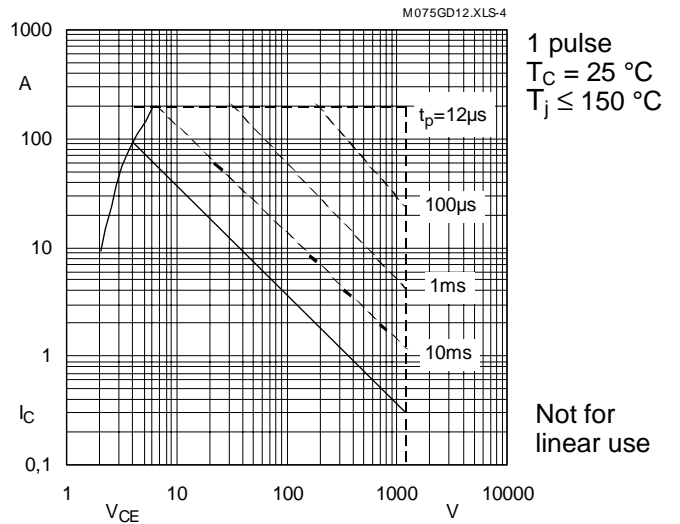


Fig. 4 Maximum safe operating area (SOA)  $I_C = f(V_{CE})$

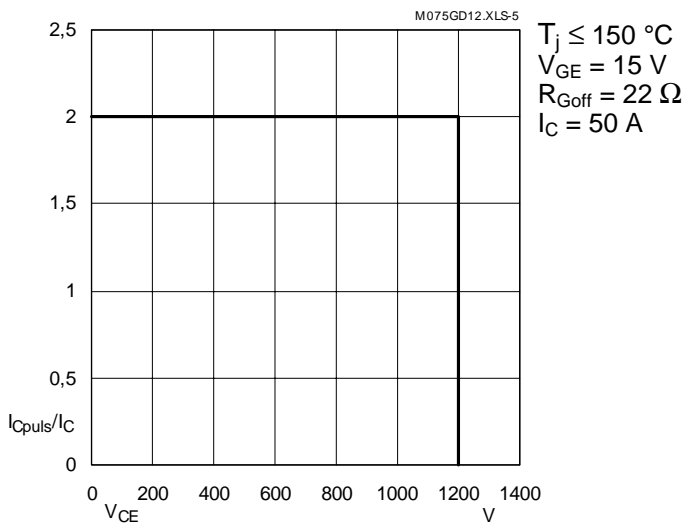


Fig. 5 Turn-off safe operating area (RBSOA)

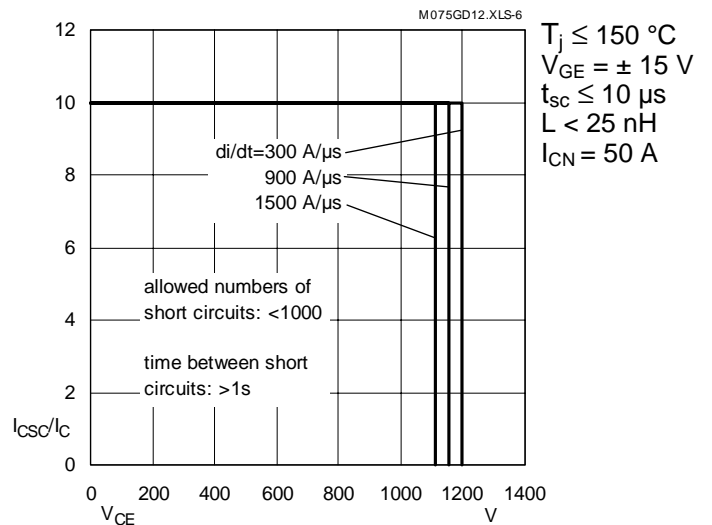


Fig. 6 Safe operating area at short circuit  $I_C = f(V_{CE})$

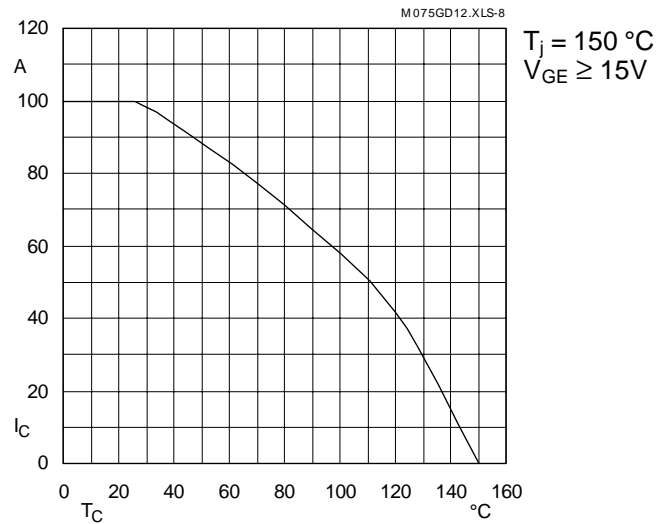


Fig. 8 Rated current vs. temperature  $I_C = f(T_C)$

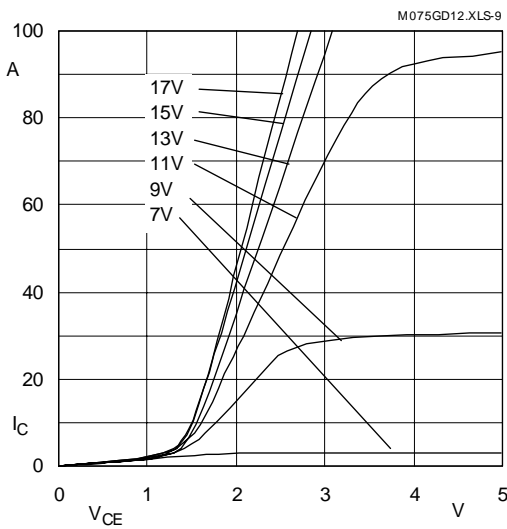


Fig. 9 Typ. output characteristic,  $t_p = 80 \mu s$ ;  $25 \text{ }^\circ\text{C}$

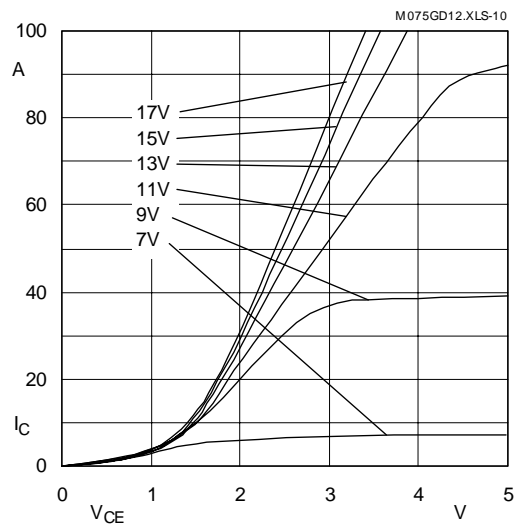


Fig. 10 Typ. output characteristic,  $t_p = 80 \mu s$ ;  $125 \text{ }^\circ\text{C}$

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

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

$$V_{\text{CE(TO)(Tj)}} \leq 1,3 + 0,0005 (T_j - 25) \text{ [V]}$$

$$\text{typ.: } r_{\text{CE(Tj)}} = 0,016 + 0,00005 (T_j - 25) \text{ [\Omega]}$$

$$\text{max.: } r_{\text{CE(Tj)}} = 0,023 + 0,00007 (T_j - 25) \text{ [\Omega]}$$

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

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

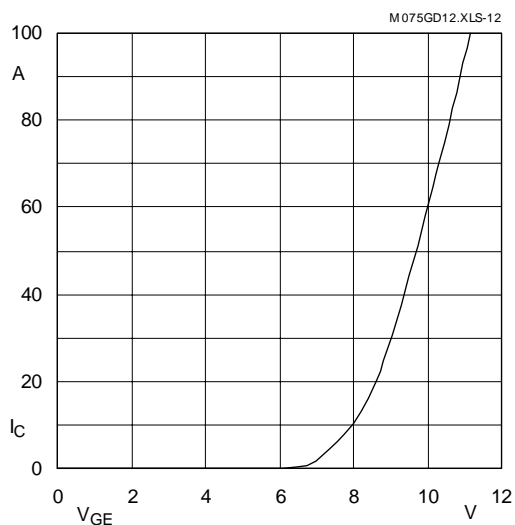


Fig. 12 Typ. transfer characteristic,  $t_p = 80 \mu s$ ;  $V_{\text{CE}} = 20 \text{ V}$

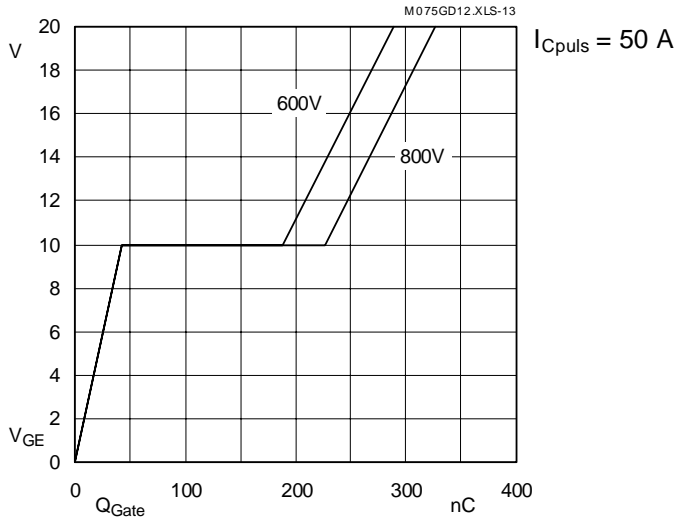


Fig. 13 Typ. gate charge characteristic

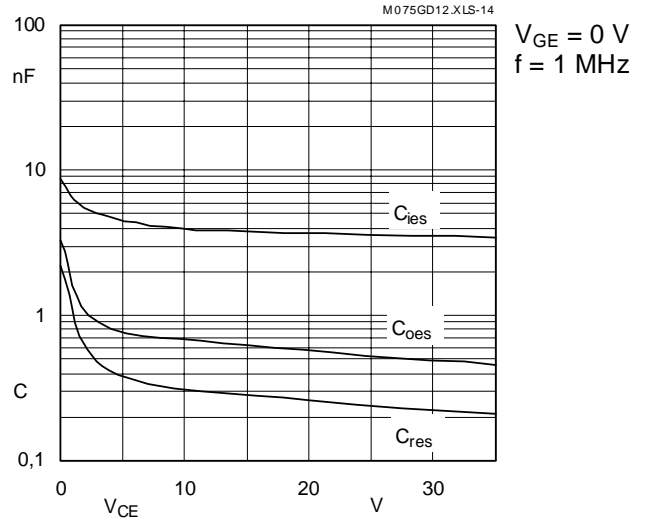


Fig. 14 Typ. capacitances vs.  $V_{CE}$

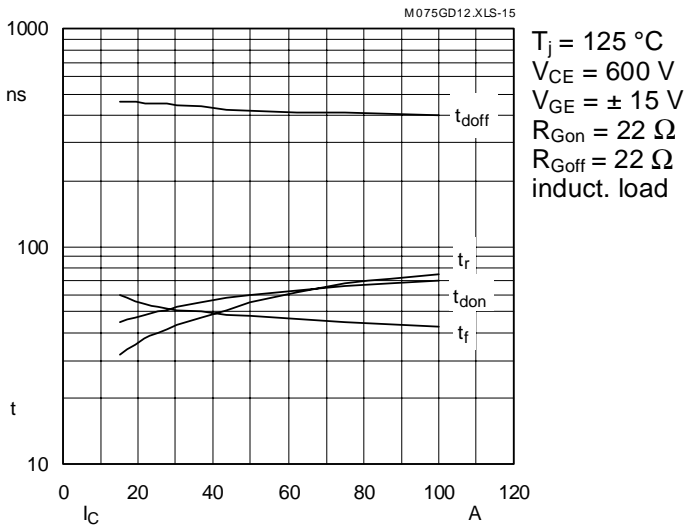


Fig. 15 Typ. switching times vs.  $I_C$

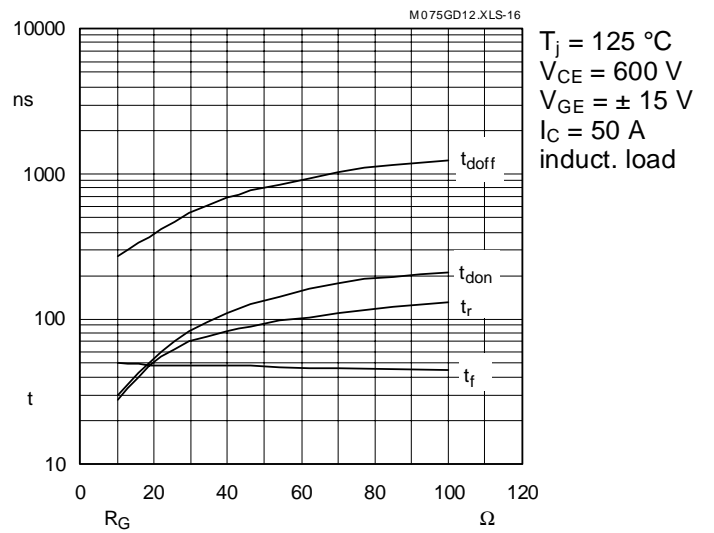


Fig. 16 Typ. switching times vs. gate resistor  $R_G$

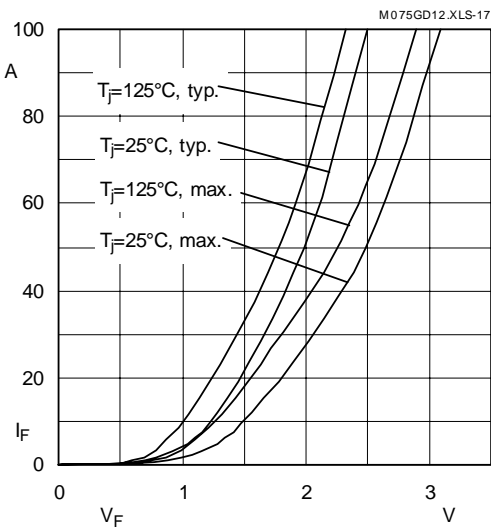


Fig. 17 Typ. CAL diode forward characteristic

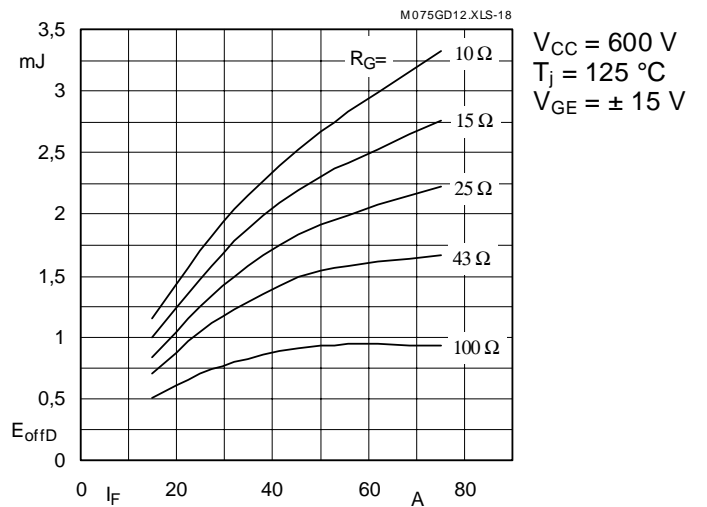


Fig. 18 Diode turn-off energy dissipation per pulse

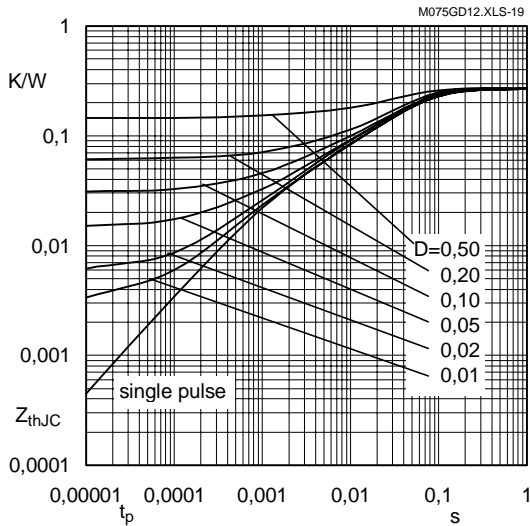


Fig. 19 Transient thermal impedance of IGBT  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

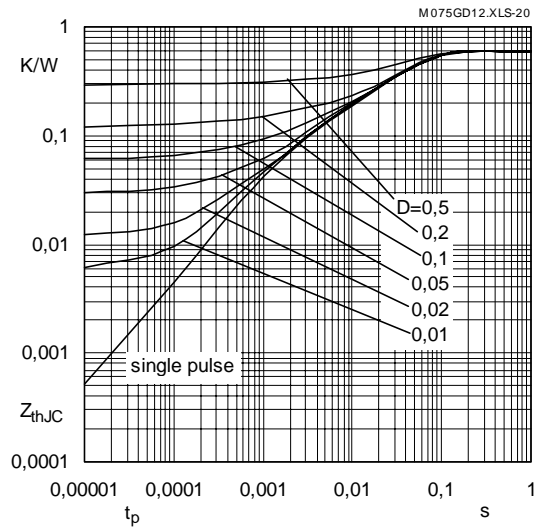


Fig. 20 Transient thermal impedance of inverse CAL diodes  
 $Z_{thJC} = f(t_p)$ ;  $D = t_p / t_c = t_p \cdot f$

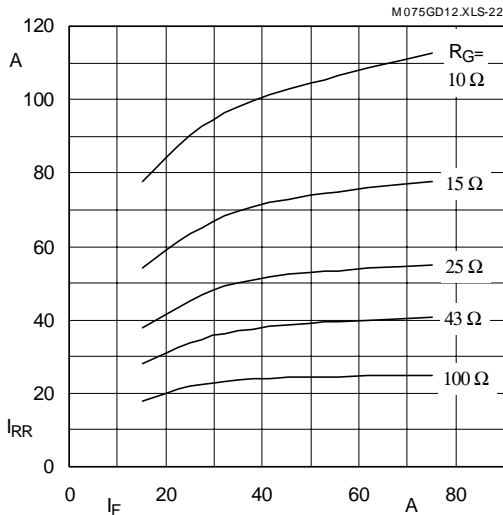


Fig. 22 Typ. CAL diode peak reverse recovery current  $I_{RR} = f(I_F; R_G)$

$V_{CC} = 600 \text{ V}$   
 $T_j = 125 \text{ }^\circ\text{C}$   
 $V_{GE} = \pm 15 \text{ V}$

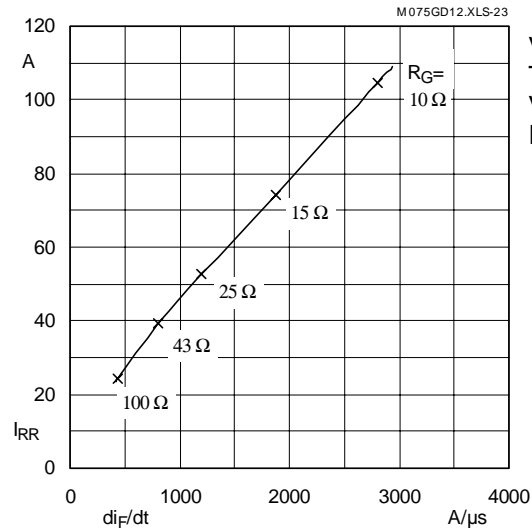


Fig. 23 Typ. CAL diode peak reverse recovery current  $I_{RR} = f(di/dt)$

$V_{CC} = 600 \text{ V}$   
 $T_j = 125 \text{ }^\circ\text{C}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_F = 50 \text{ A}$

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## Typical Applications

### include

- Switched mode power supplies
- DC servo and robot drives
- Inverters
- DC choppers
- AC motor speed control
- UPS Uninterruptable power supplies
- General power switching applications

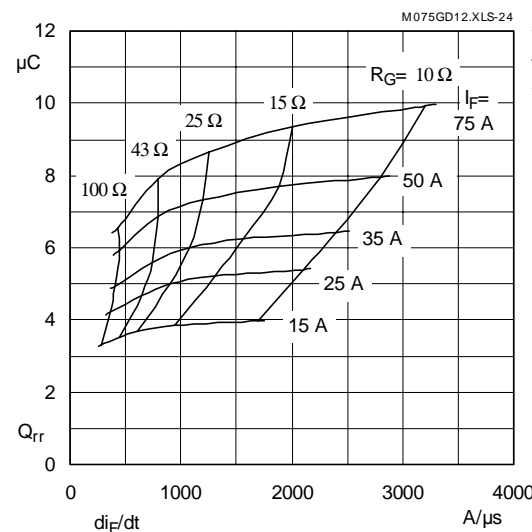
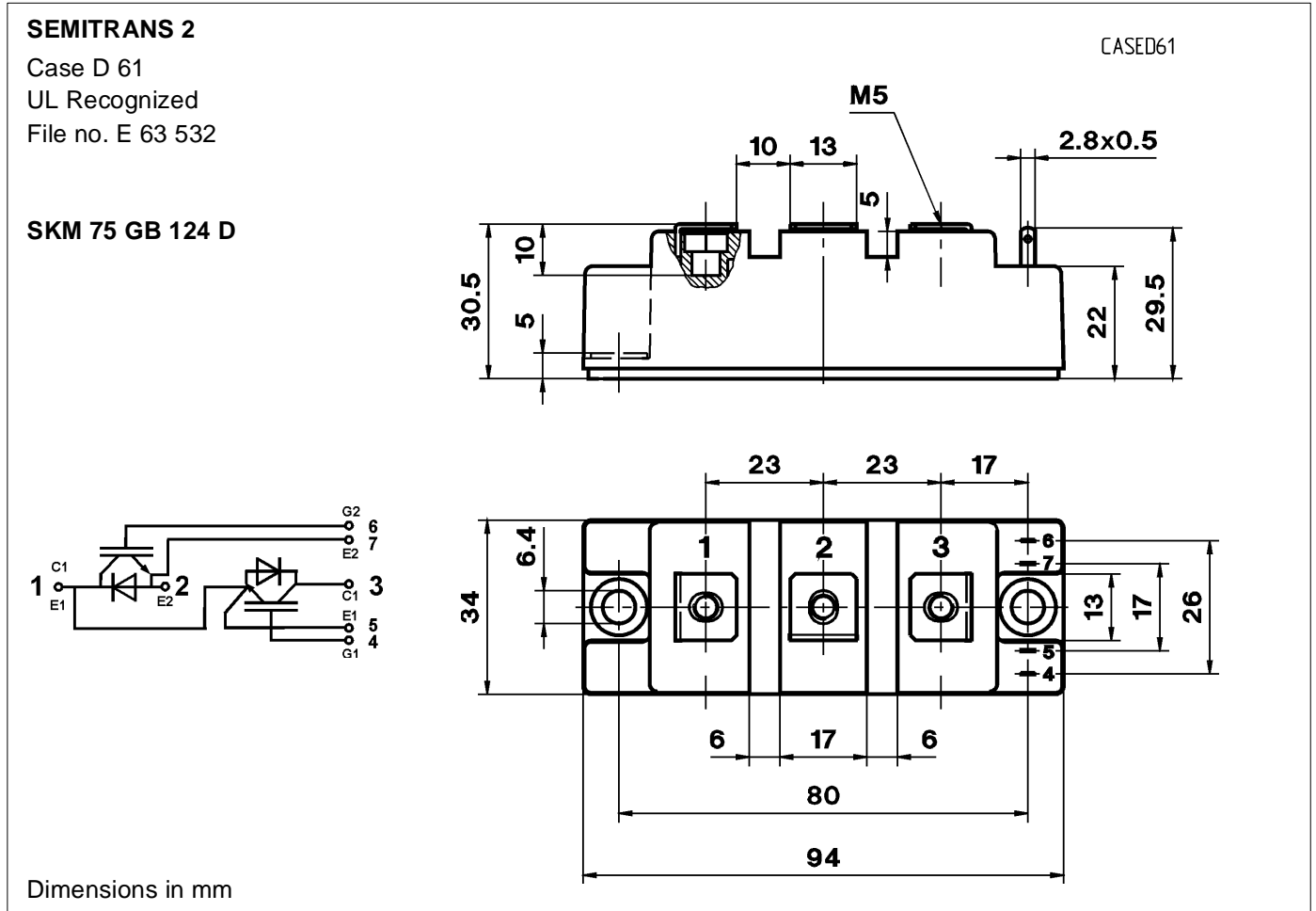


Fig. 24 Typ. CAL diode recovered charge

$V_{CC} = 600 \text{ V}$   
 $T_j = 125 \text{ }^\circ\text{C}$   
 $V_{GE} = \pm 15 \text{ V}$



Case outline and circuit diagram

Mechanical Data		Values			Units
Symbol	Conditions	min.	typ.	max.	
M <sub>1</sub>	to heatsink, SI Units (M6)	3	–	5	Nm
	to heatsink, US Units	27	–	44	lb.in.
M <sub>2</sub>	for terminals, SI Units (M5)	2,5	–	5	Nm
	for terminals, US Units	22	–	44	lb.in.
a		–	–	5x9,81	m/s <sup>2</sup>
w		–	–	160	g

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 or 42 pieces are used if suitable  
 Accessories → B 6 – 4  
 SEMIBOX → C – 1.