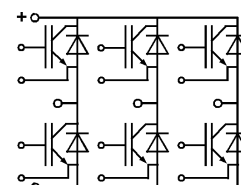


SEMITRANS® M Low Loss IGBT Modules

SKM 75 GD 124 D



Sixpack



GD

Features

- MOS input (voltage controlled)
- N channel, homogeneous Silicon structure (NPT- Non punch-through IGBT)
- Low loss high density chip
- Low tail current
- High short circuit capability, self limiting to $6 \cdot I_{cnom}$
- Latch-up free
- Fast & soft inverse CAL diodes⁸⁾
- Isolated copper baseplate using DCB Direct Copper Bonding Technology without hard mould
- Large clearance (9 mm) and creepage distances (13 mm)

Typical Applications

- Switched mode power supplies
- Three phase inverters for AC motor speed control

¹⁾ $T_{case} = 25^\circ\text{C}$, unless otherwise specified

²⁾ $I_F = -I_C$, $V_R = 600\text{ V}$, $-di_F/dt = 800\text{ A}/\mu\text{s}$, $V_{GE} = 0\text{ V}$

³⁾ Use $V_{GEoff} = -5 \dots -15\text{ V}$

⁸⁾ CAL = Controlled Axial Lifetime Technology

Case and mech. data → page 6

Absolute Maximum Ratings		Values	Units
Symbol	Conditions ¹⁾		
V_{CES}		1200	V
V_{CGR}	$R_{GE} = 20\text{ k}\Omega$	1200	V
I_C	$T_{case} = 25/60^\circ\text{C}$	90 / 75	A
I_{CM}	$T_{case} = 25/60^\circ\text{C}$; $t_p = 1\text{ ms}$	180 / 150	A
V_{GES}		± 20	V
P_{tot}	per IGBT, $T_{case} = 25^\circ\text{C}$	390	W
T_j , (T_{stg})		$-40 \dots +150$ (125)	$^\circ\text{C}$
V_{isol}	AC, 1 min.	2500	V
humidity	DIN 40 040	Class F	
climate	DIN IEC 68 T.1	40/125/56	
Inverse Diode			
$I_F = -I_C$	$T_{case} = 25/80^\circ\text{C}$	75 / 50	A
$I_{FM} = -I_{CM}$	$T_{case} = 25/80^\circ\text{C}$; $t_p = 1\text{ ms}$	180 / 150	A
I_{FSM}	$t_p = 10\text{ ms}$; sin.; $T_j = 150^\circ\text{C}$	550	A
I^2t	$t_p = 10\text{ ms}$; $T_j = 150^\circ\text{C}$	1500	A^2s

Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
$V_{(BR)CES}$	$V_{GE} = 0$, $I_C = 1\text{ mA}$	$\geq V_{CES}$	—	—	V
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 1\text{ mA}$	4,5	5,5	6,5	V
I_{CES}	$V_{GE} = 0$ } $T_j = 25^\circ\text{C}$	—	0,8	1	mA
	$V_{CE} = V_{CES}$ } $T_j = 125^\circ\text{C}$	—	3,5	—	mA
I_{GES}	$V_{GE} = 20\text{ V}$, $V_{CE} = 0$	—	—	200	nA
V_{CESat}	$I_C = 50\text{ A}$ } $V_{GE} = 15\text{ V}$;	—	2,1(2,4)	2,45(2,85)	V
V_{CESat}	$I_C = 75\text{ A}$ } $T_j = 25$ (125) $^\circ\text{C}$ }	—	2,5(3,0)	—	V
g_{fs}	$V_{CE} = 20\text{ V}$, $I_C = 50\text{ A}$	25	—	—	S
C_{CHC}	per IGBT	—	—	300	pF
C_{ies}	$V_{GE} = 0$	—	3800	4200	pF
C_{oes}	$V_{CE} = 25\text{ V}$	—	500	600	pF
C_{res}	$f = 1\text{ MHz}$	—	220	300	pF
L_{CE}		—	—	60	nH
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	—	60	—	ns
t_r	$V_{GE} = +15\text{ V} / -15\text{ V}^{3)}$	—	55	—	ns
$t_{d(off)}$	$I_C = 50\text{ A}$, ind. load	—	420	—	ns
t_f	$R_{Gon} = R_{Goff} = 22\text{ }\Omega$	—	50	—	ns
E_{on}	$T_j = 125^\circ\text{C}$	—	8	—	mWs
E_{off}		—	6	—	mWs
Inverse Diode ⁸⁾					
$V_F = V_{EC}$	$I_F = 50\text{ A}$ } $V_{GE} = 0\text{ V}$;	—	2,0(1,8)	2,5	V
$V_F = V_{EC}$	$I_F = 75\text{ A}$ } $T_j = 25$ (125) $^\circ\text{C}$ }	—	2,3(2,1)	—	V
V_{TO}	$T_j = 125^\circ\text{C}$	—	1,1	1,2	V
r_t	$T_j = 125^\circ\text{C}$	—	—	22	m Ω
I_{RRM}	$I_F = 50\text{ A}$; $T_j = 125^\circ\text{C}^{2)}$	—	39	—	A
Q_{rr}	$I_F = 50\text{ A}$; $T_j = 125^\circ\text{C}^{2)}$	—	7	—	μC
Thermal Characteristics					
R_{thjc}	per IGBT	—	—	0,32	$^\circ\text{C}/\text{W}$
R_{thjc}	per diode	—	—	0,6	$^\circ\text{C}/\text{W}$
R_{thch}	per module	—	—	0,05	$^\circ\text{C}/\text{W}$

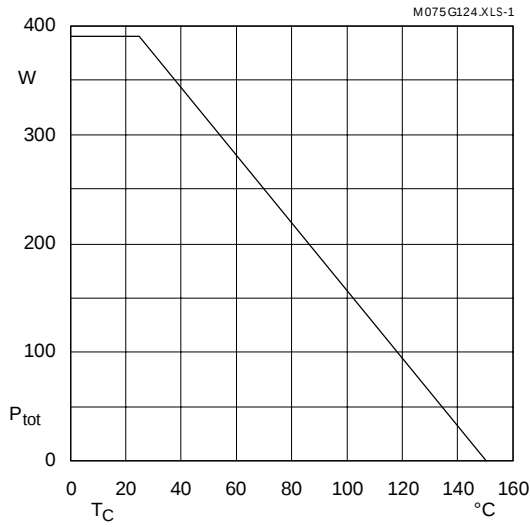


Fig. 1 Rated power dissipation $P_{tot} = f(T_C)$

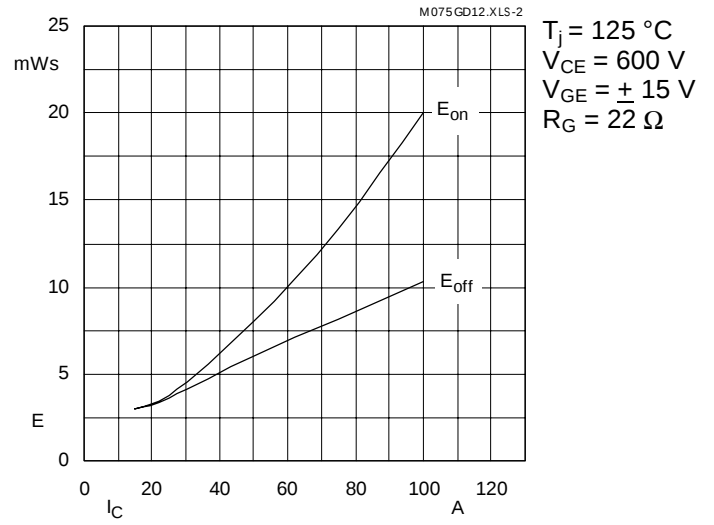


Fig. 2 Turn-on /-off energy = $f(I_C)$

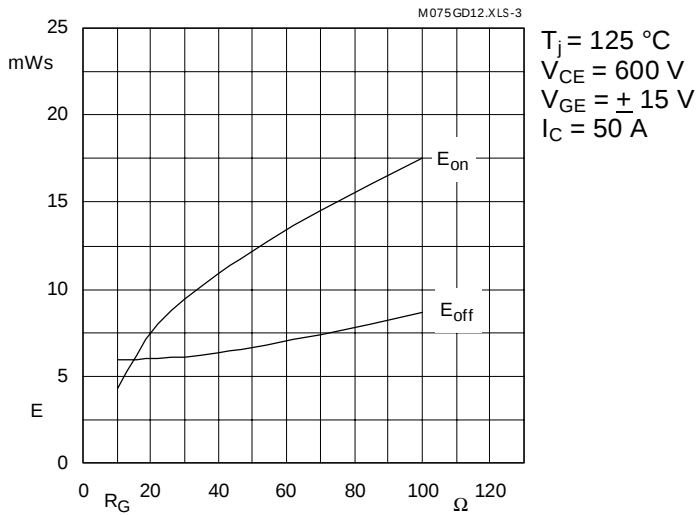


Fig. 3 Turn-on /-off energy = $f(R_G)$

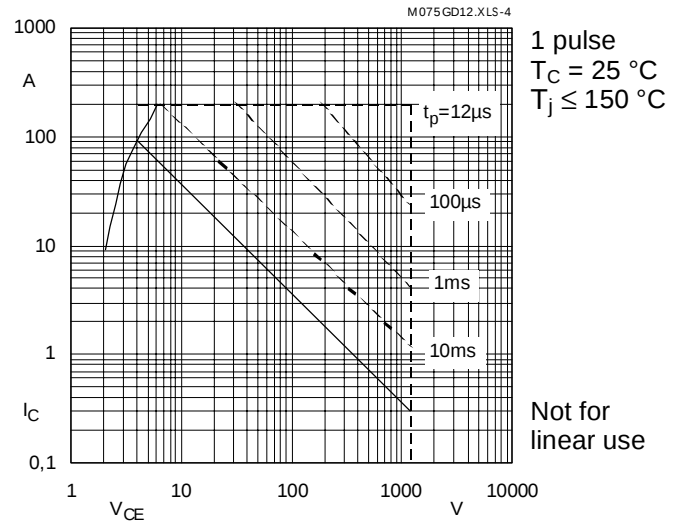


Fig. 4 Maximum safe operating area (SOA) $I_C = f(V_{CE})$

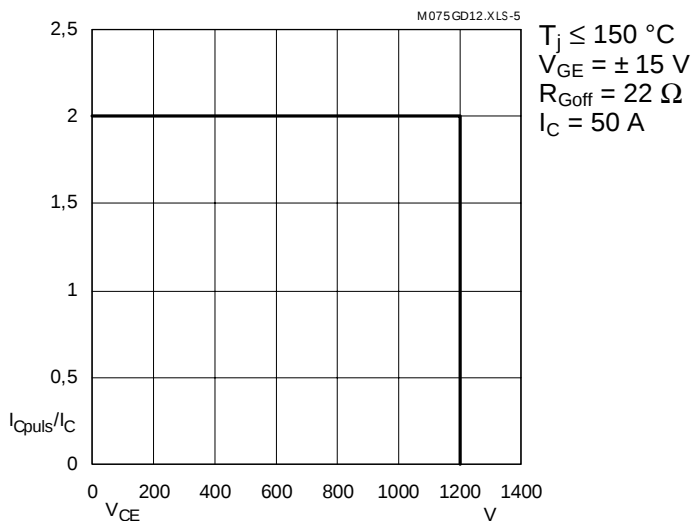


Fig. 5 Turn-off safe operating area (RBSOA)

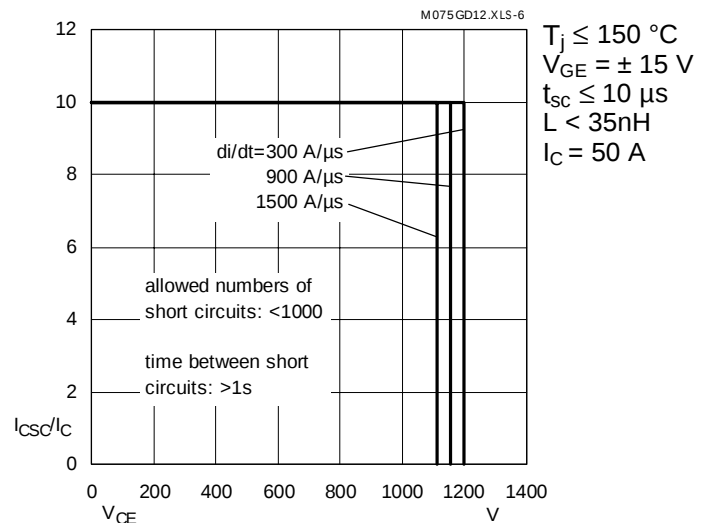


Fig. 6 Safe operating area at short circuit $I_C = f(V_{CE})$

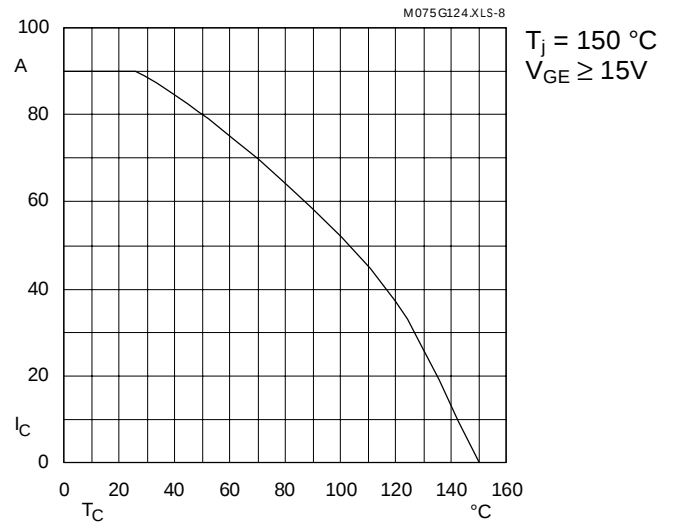


Fig. 8 Rated current vs. temperature $I_C = f(T_C)$

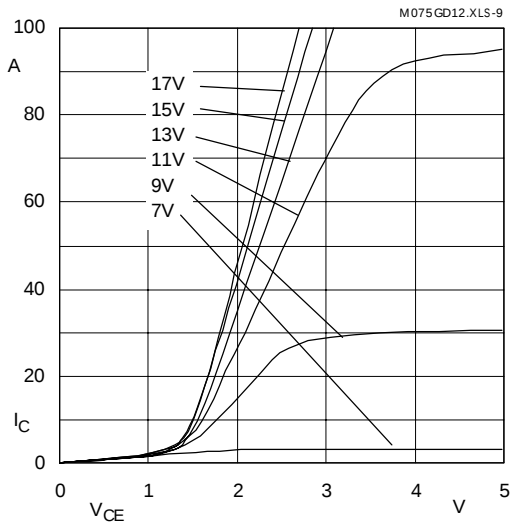


Fig. 9 Typ. output characteristic, $t_p = 80$ μs; 25 °C

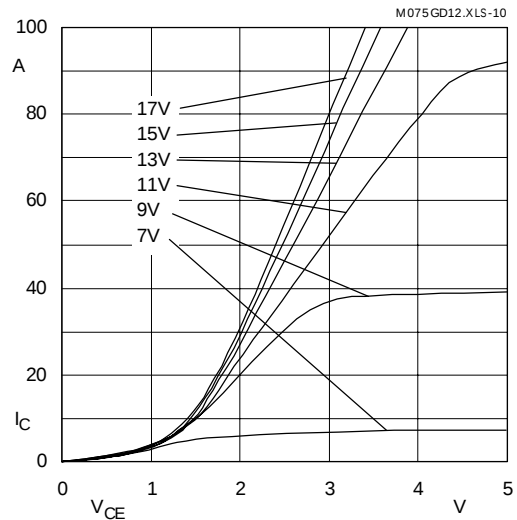


Fig. 10 Typ. output characteristic, $t_p = 80$ μs; 125 °C

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

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

$$V_{CE(TO)(T_j)} \leq 1,30 + 0,0005 (T_j - 25) [V]$$

$$\text{typ.: } r_{CE(T_j)} = 0,018 + 0,00005 (T_j - 25) [\Omega]$$

$$\text{max.: } r_{CE(T_j)} = 0,025 + 0,00005 (T_j - 25) [\Omega]$$

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

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

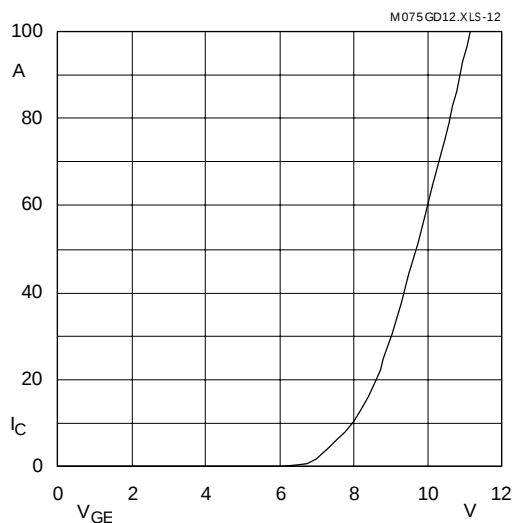


Fig. 12 Typ. transfer characteristic, $t_p = 80$ μs; $V_{CE} = 20$ V

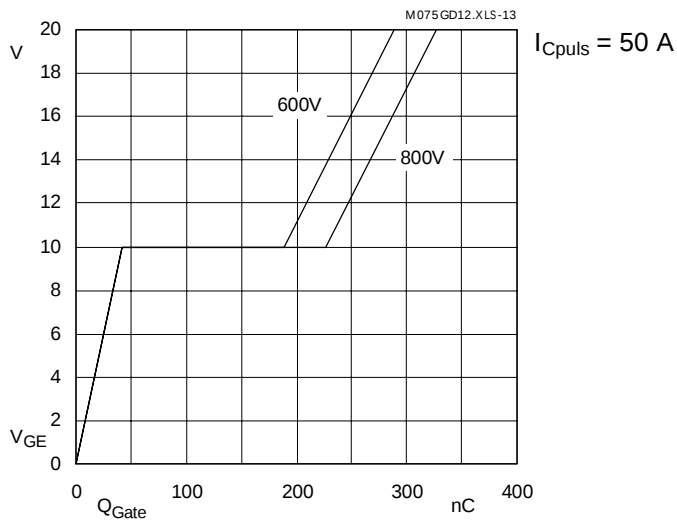


Fig. 13 Typ. gate charge characteristic

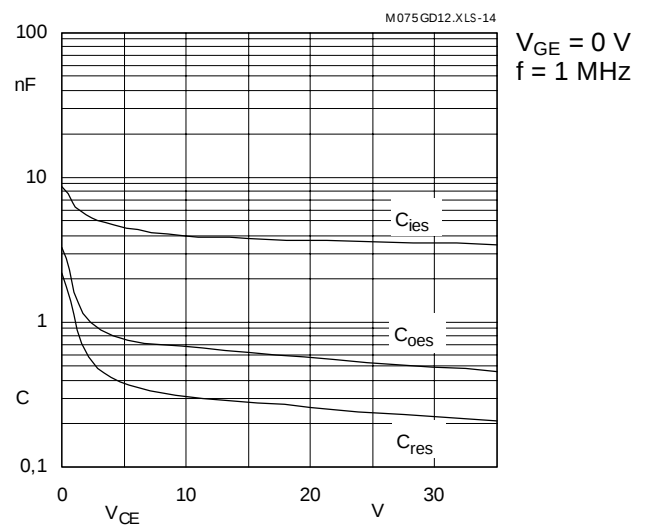


Fig. 14 Typ. capacitances vs. V_{CE}

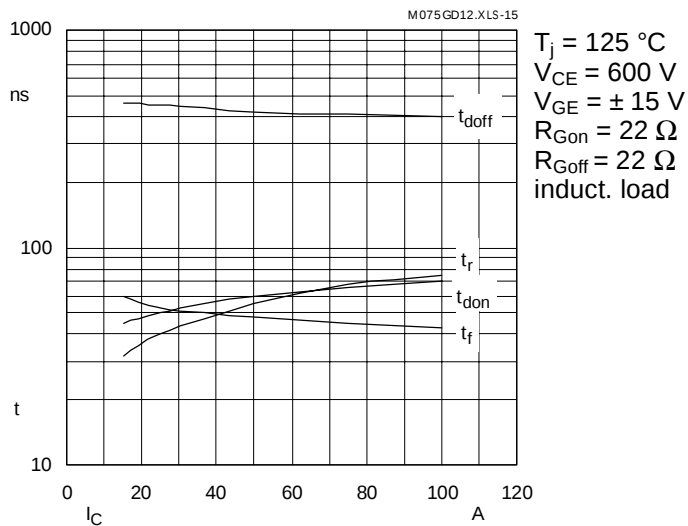


Fig. 15 Typ. switching times vs. I_C

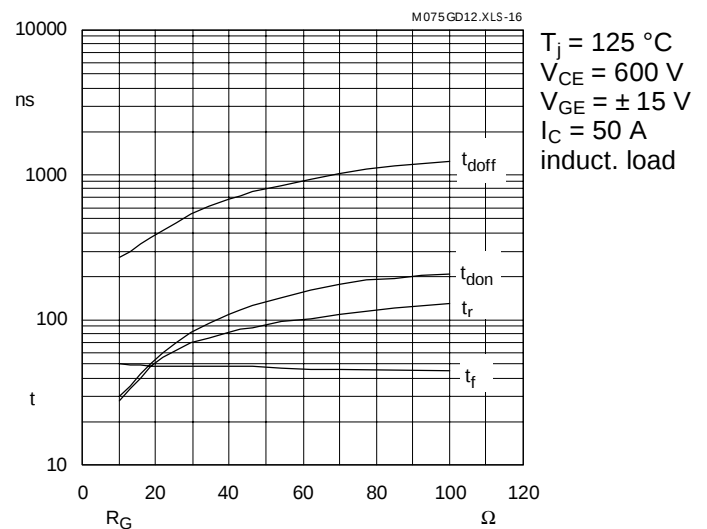


Fig. 16 Typ. switching times vs. gate resistor R_G

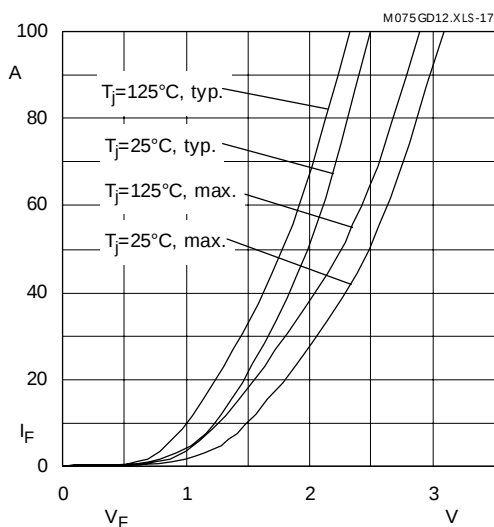


Fig. 17 Typ. CAL diode forward characteristic

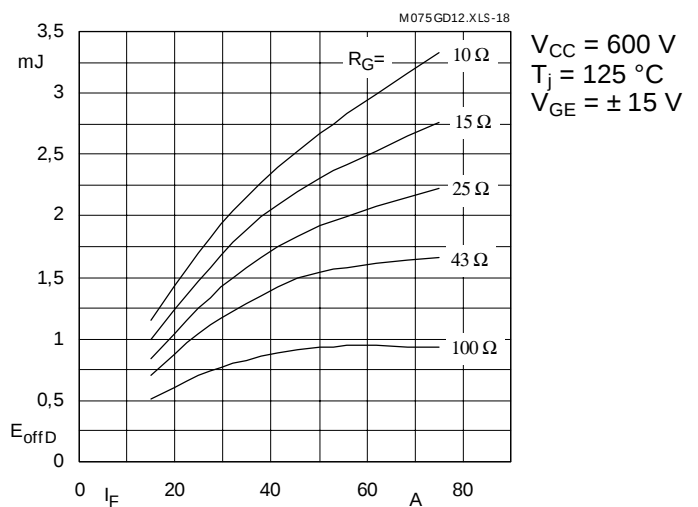


Fig. 18 Diode turn-off energy dissipation per pulse

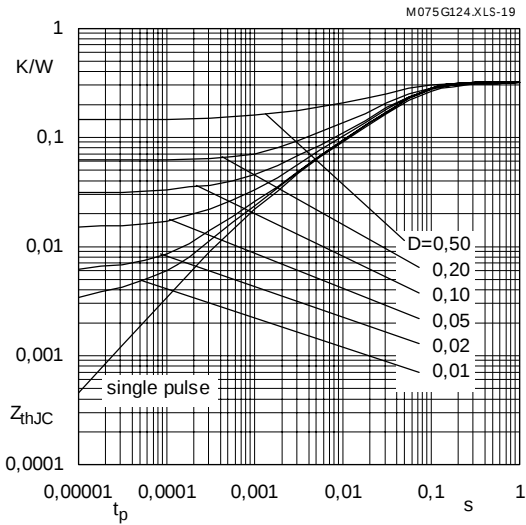


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

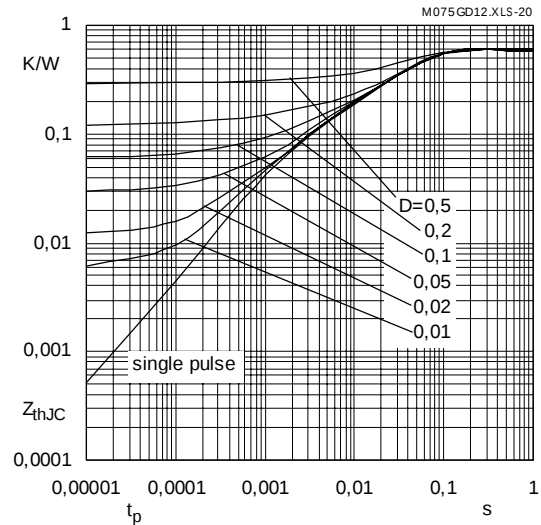


Fig. 20 Transient thermal impedance of inverse CAL diodes
 $Z_{thJC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

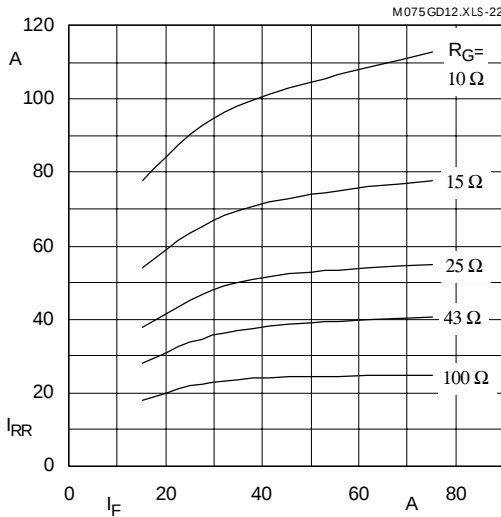


Fig. 22 Typ. CAL diode peak reverse recovery current $I_{RR} = f(I_F; R_G)$

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

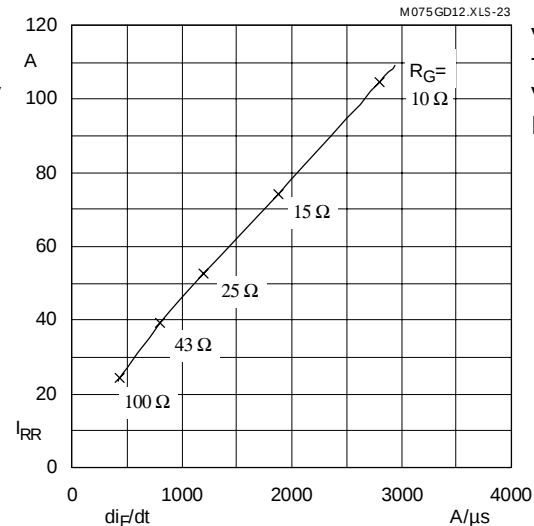


Fig. 23 Typ. CAL diode peak reverse recovery current $I_{RR} = f(di/dt)$

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

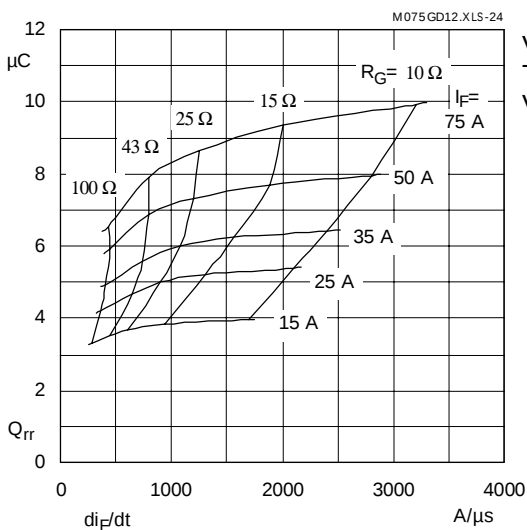
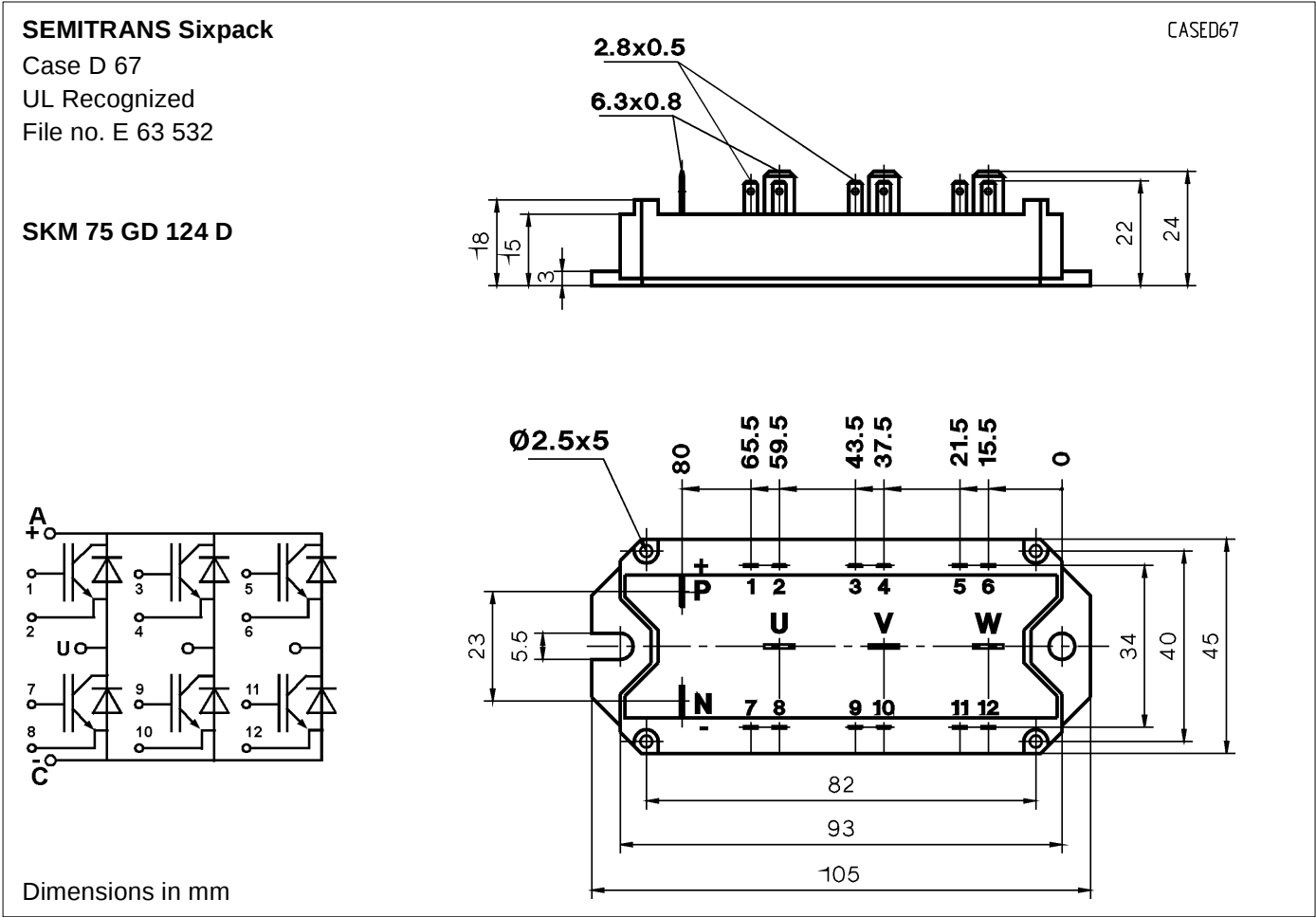


Fig. 24 Typ. CAL diode recovered charge

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

SKM 75 GD 124 D



Case outline and circuit diagram

Mechanical Data		Values			Units
Symbol	Conditions	min.	typ.	max.	
M ₁	to heatsink, SI Units (M5)	4	—	5	Nm
a	to heatsink, US Units	35	—	44	lb.in.
w		—	—	5x9,81	m/s ²
		—	—	175	g

This is an electrostatic discharge sensitive device (ESDS). 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 → page C - 1.