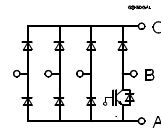


SEMITRANS® M IGBT Modules SKD 75 GAL 123 D Input bridge B6U with brake chopper

Preliminary Data



7D-Pack = 7 Diodes Pack



SKD 75 GAL

Features

- Round main terminals (2 mm \varnothing)
- Easy drilling of PCB
- Input diodes glass passivated
- 1400 V PIV, good for 500 V_{AC}
- High I²t rating (inrush current)
- IGBT is latch-up free, homogeneous silicon-structure
- High short circuit capability, self limiting to 6 * I_{cnom}^B)
- Fast & soft CAL diodes^B)
- Isolated copper baseplate using DGB Direct Copper Bonding Technology
- Large clearance (9 mm) and creepage distances (13 mm).

Typical Applications:

Input rectifier bridge (B6U) with brake chopper for PWM inverter drives using SEMITRANS SKM 75GD123D

- 1) T_{case} = 25 °C, unless otherwise specified
- 2) I_F = - I_C, V_R = 600 V, - di_F/dt = 500 A/ μ s, V_{GE} = 0 V
- 3) Use V_{GEoff} = -5 ... -15 V
- 8) CAL = Controlled Axial Lifetime Technology.
- 9) **Data D1 - D6, case and mech. data** → B6 - 130

Absolute Maximum Ratings		Values			Units
Symbol	Conditions ¹⁾				
V _{CES}		1200			V
V _{CGR}	R _{GE} = 20 k Ω	1200			V
I _C	T _{case} = 25/80 °C	75 / 45			A
I _{CM}	T _{case} = 25/80 °C; t _p = 1 ms	140 / 90			A
V _{GES}		± 20			V
P _{tot}	per IGBT/D1/D8, T _{case} =25 °C	350 / 125 / 125			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	55/150/56			
Diodes ⁹⁾		D1-6	D7	D8	
I _F	T _{case} = 80 °C	9)	15	30	A
I _{FM} = - I _{CM}	T _{case} = 80 °C; t _p = 1 ms		30	60	A
I _{FSM}	t _p = 10 ms; sin.; T _J = 150 °C	600	200	350	A
I ² t	t _p = 10 ms; T _J = 150 °C	1800	200	600	A ² s

Characteristics		min.	typ.	max.	Units
Symbol	Conditions ¹⁾				
V _{(BR)CES}	V _{GE} = 0, I _C = 1 mA	≥ V _{CES}	-	-	V
V _{GE(th)}	V _{GE} = V _{CES} , I _C = 2 mA	4,5	5,5	6,5	V
I _{CES}	V _{GE} = 0 { T _J = 25 °C V _{CE} = V _{CES} } T _J = 125 °C	-	0,8	1	mA
I _{GES}	V _{GE} = 20 V, V _{CE} = 0	-	-	200	nA
V _{CESat}	I _C = 50 A { V _{GE} = 15 V; } I _C = 75 A { T _J = 25 (125) °C }	-	2,5(3,1)	3(3,7)	V
V _{CESat}	I _C = 75 A { T _J = 25 (125) °C }	-	3(3,8)	-	V
g _{fs}	V _{CE} = 20 V, I _C = 25 A	-	40	-	S
C _{CHC}	per IGBT	-	-	350	pF
C _{ies}	V _{GE} = 0	-	3300	4300	pF
C _{oes}	V _{CE} = 25 V	-	500	650	pF
C _{res}	f = 1 MHz	-	220	300	pF
t _{d(on)}	V _{CC} = 600 V	-	44	100	ns
t _r	V _{GE} = +15 V / -15 V ³⁾	-	56	100	ns
t _{d(off)}	I _C = 50 A, ind. load	-	380	500	ns
t _f	R _{Gon} = R _{Goff} = 22 Ω	-	70	100	ns
E _{on}	T _J = 125 °C	-	8	-	mWs
E _{off}		-	5	-	mWs
Inverse Diode D7 ^B) of brake chopper					
V _F = V _{EC}	I _F = 15 A { V _{GE} = 0 V; } I _F = 25 A { T _J = 25 (125) °C }	-	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	-	1,1	1,2	V
r _T	T _J = 125 °C	-	45	70	m Ω
I _{RRM}	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)	-	μ C
FWD D8 of "GAL" brake chopper ^{B)}					
V _F = V _{EC}	I _F = 25 A { V _{GE} = 0 V; } I _F = 40 A { T _J = 25 (125) °C }	-	2,0 (1,8)	2,5	V
V _F = V _{EC}	I _F = 40 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	-	25	44	m Ω
I _{RRM}	I _F = 25 A; T _J = 25 (125) °C ²⁾	-	19(25)	-	A
Q _{rr}	I _F = 25 A; T _J = 25 (125) °C ²⁾	-	1,5(4,5)	-	μ C
Thermal Characteristics					
R _{thjc}	per IGBT / diode D1..6 ⁹⁾	-	-	0,35 / 1,0	°C/W
R _{thjc}	per diode D7 / D8	-	-	1,5 / 1,0	°C/W
R _{thch}	per module	-	-	0,05	°C/W

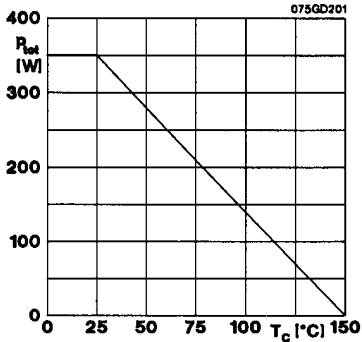


Fig. 1 Rated power dissipation $P_{tot} = f(T_c)$

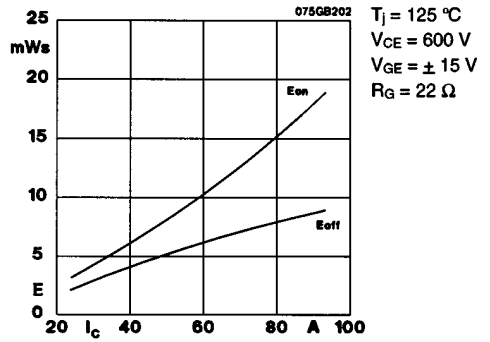


Fig. 2 Turn-on /-off energy $= f(I_c)$

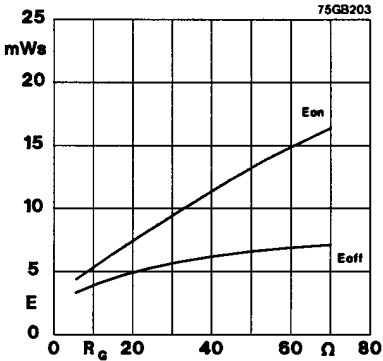


Fig. 3 Turn-on /-off energy $= f(R_g)$

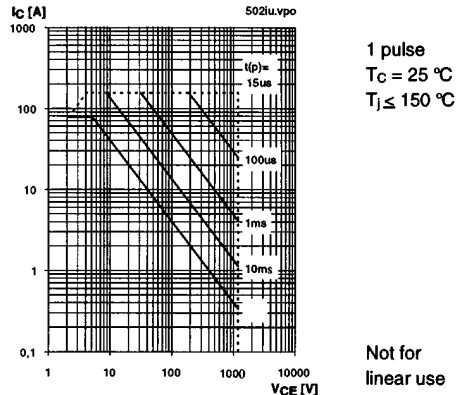


Fig. 4 Maximum safe operating area (SOA) $I_c = f(V_{CE})$

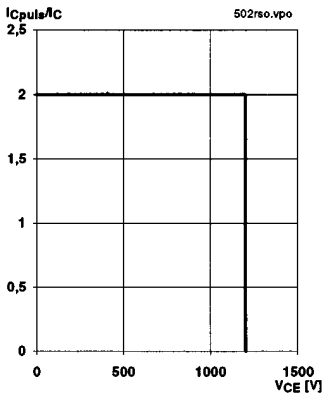


Fig. 5 Turn-off safe operating area (RBSOA)

$T_j \leq 150\text{ }^\circ\text{C}$
 $V_{GE} = 15\text{ V}$
 $R_{g(off)} = 22\text{ }\Omega$
 $I_c = 50\text{ A}$

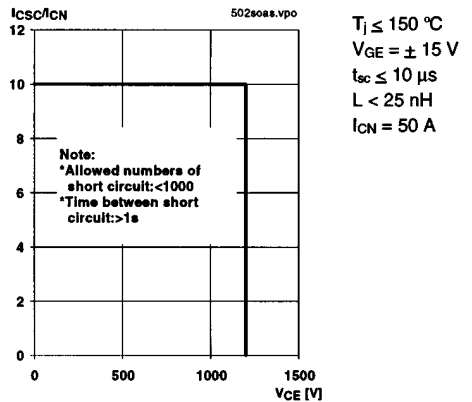


Fig. 6 Safe operating area at short circuit $I_c = f(V_{CE})$

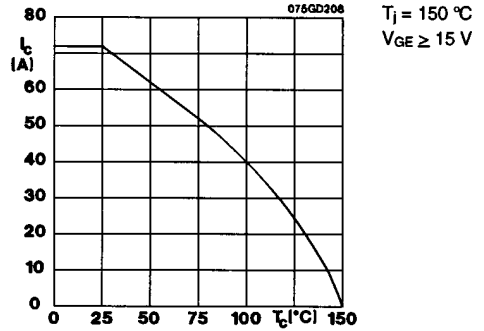


Fig. 8 Rated current vs. temperature $I_c = f(T_c)$

Fig. 7 Short circuit current vs. turn-on gate voltage

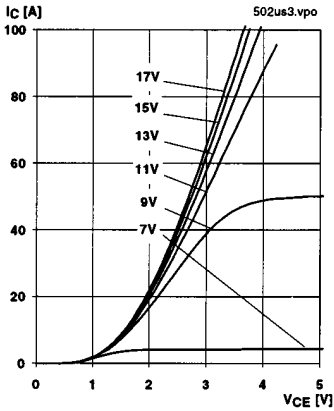


Fig. 9 Typ. output characteristic, $t_p = 80 \mu s$; $25 \text{ }^\circ\text{C}$

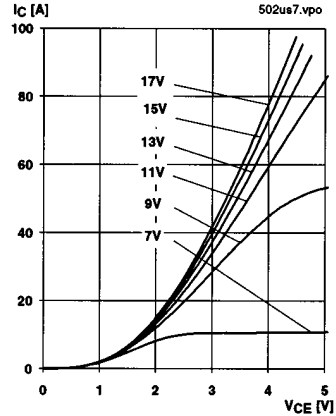


Fig. 10 Typ. output characteristic, $t_p = 80 \mu s$; $125 \text{ }^\circ\text{C}$

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

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

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

$$r_{CE(Tj)} = 0,020 + 0,00008 (T_j - 25) \text{ [\Omega]}$$

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

Fig. 11 Typ. saturation characteristic (IGBT)
Calculation elements and equations

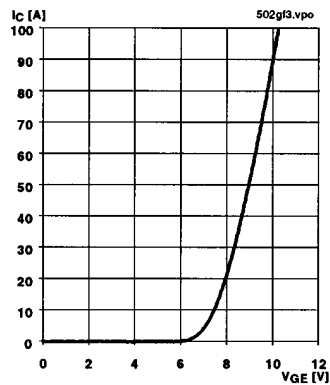


Fig. 12 Typ. transfer characteristic, $t_p = 80 \mu s$; $V_{CE} = 20 \text{ V}$

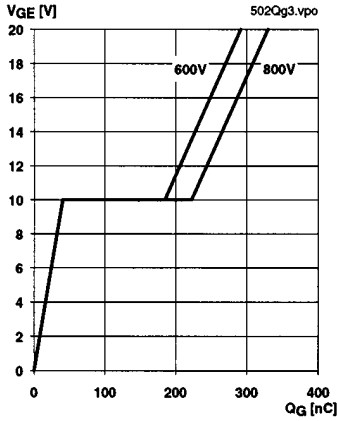


Fig. 13 Typ. gate charge characteristic

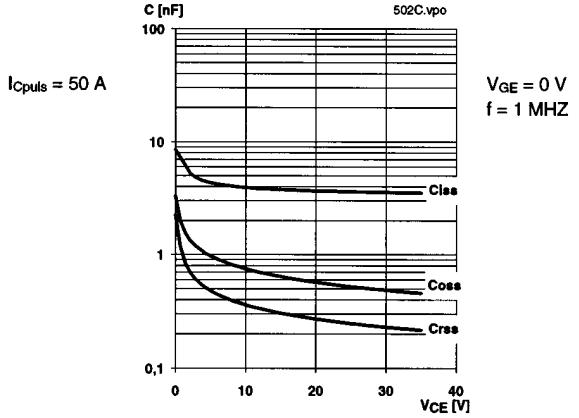


Fig. 14 Typ. capacitances vs. V_{CE}

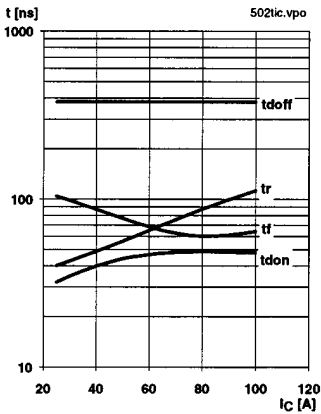


Fig. 15 Typ. switching times vs. I_C

$T_J = 125^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $R_{gon} = 22\ \Omega$
 $R_{goff} = 22\ \Omega$
 induct. load

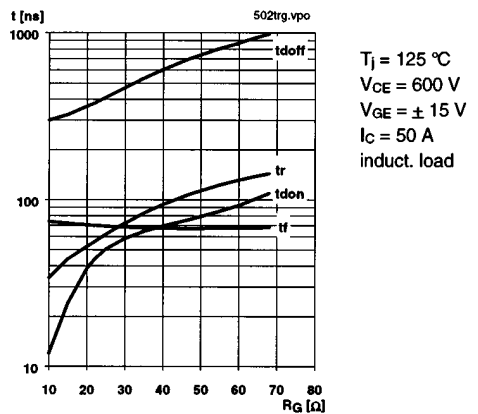


Fig. 16 Typ. switching times vs. gate resistor R_G

$T_J = 125^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_C = 50\text{ A}$
 induct. load

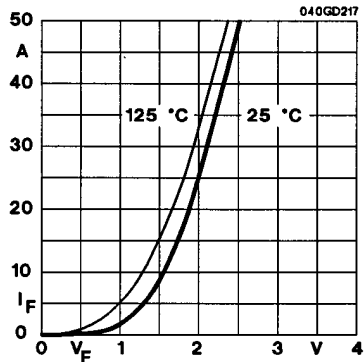


Fig. 17 Typ. CAL diode forward characteristic

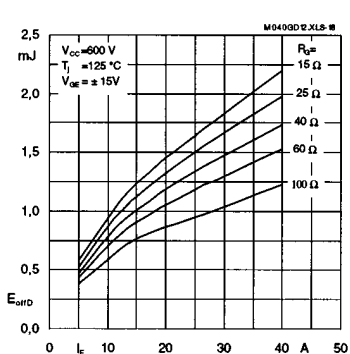


Fig. 18 Diode D8 turn-off energy dissipation per pulse

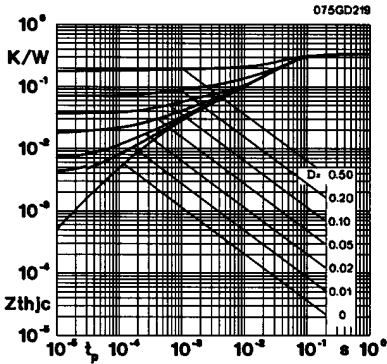


Fig. 19 Transient thermal impedance of IGBT
 $Z_{thjC} = f(t_p)$; $D = t_p / t_c = t_p \cdot f$

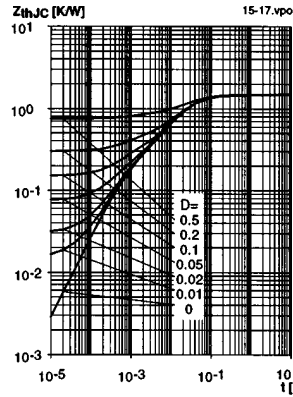


Fig. 20 Transient thermal impedance of inverse CAL diodes D7

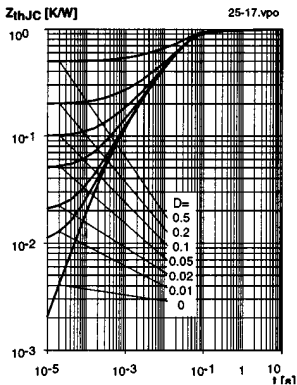


Fig. 21 Transient thermal impedance Z_{thjC} of freewheeling diode D8 and D1-D6

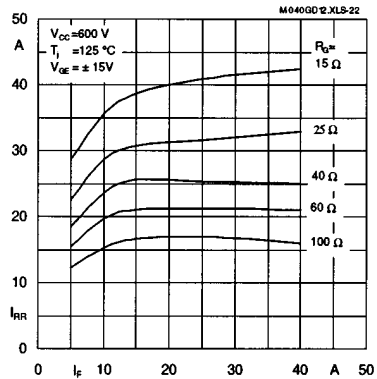


Fig. 22 Typ. CAL diode (D8) peak reverse recovery current ($I_{RR} = f(I_F; R_G)$)

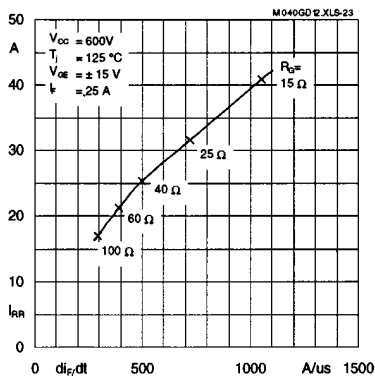


Fig. 23 Typ. CAL diode (D8) reverse recovery current $I_{RR} = f(di_F/dt)$

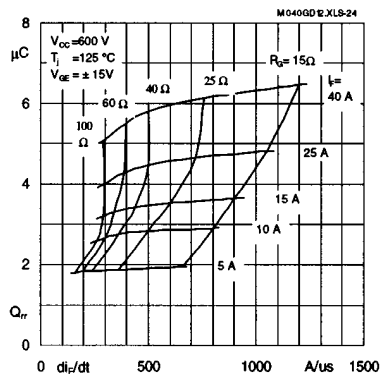


Fig. 24 Typ. CAL diode (D8) recovered charge $Q_{rr} = f(di/dt)$

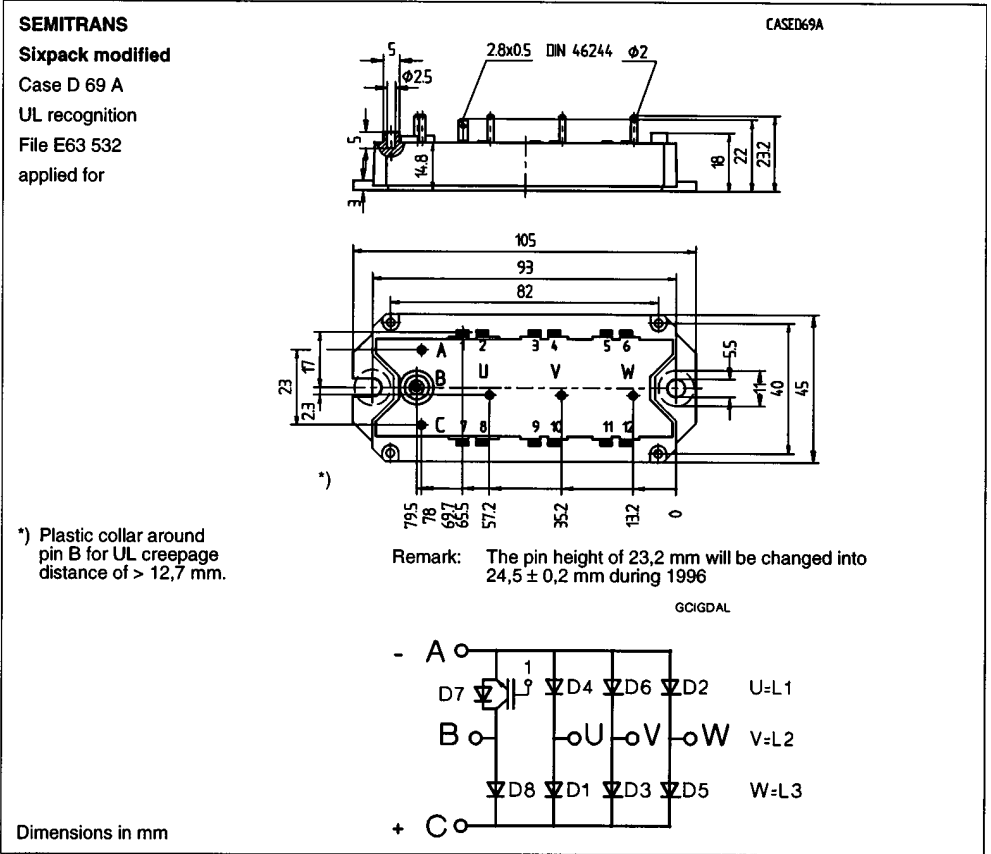


Fig. 21 Case outline and circuit diagram

Characteristics		Values			Units
Symbol	Conditions ¹⁾	min.	typ.	max.	
Input V_{RRM}	Bridge Rectifier D1...D6	1400	-	-	V
I_D	$T_{case} = 80\text{ °C}$;	-	-	100	A
V_F	$T_{vj} = 25\text{ °C}$; $I_F = 75\text{ A}$	-	-	1,45	V
V_{TO}	$T_{vj} = 150\text{ °C}$	-	-	0,8	V
r_T	$T_{vj} = 150\text{ °C}$	-	-	8,5	mΩ
R_{thjc}	D1...D6	-	-	1,0	K/W
T_{solder}	> 5 s max. 15 sec. (transfer)	-	180	250	°C
Mechanical Data					
M1	to heatsink, SI Units (M5)	4	-	5	Nm
	to heatsink, US Units	35	-	44	lb.in.
a		-	-	5x9,81	m/s ²
w		-	-	190	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 → page C - 1.