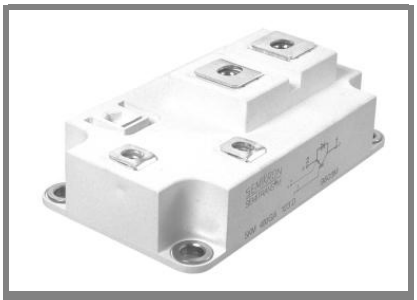
SKM 400GA123D



SEMITRANS® 4

IGBT Modules

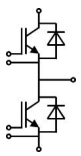
SKM 400GA123D

Features

- MOS input (voltage controlled)
- N channel, homgeneous Si
- Low inductance case
- Very low tail current with low temperature dependence
- High short circuit capability, self limiting to 6 x I_{cnom}
- Latch-up free
- Fast & soft inverse CAL diodes
- Isolated copper baseplate using DBC Direct Copper Bonding Technology
- Large clearance (12 mm) and creepage distances (20 mm)

Typical Applications

- Switching (not for linear use)



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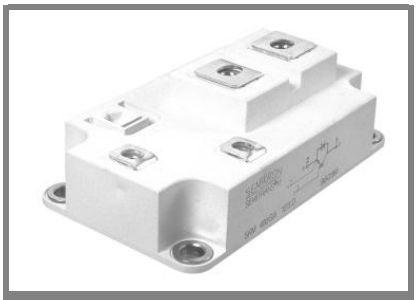
Absolute Maximum Ratings			T_c = 25 °C, unless otherwise specified	
Symbol	**Conditions**		**Values**	**Units**
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 150 °C	T_{case} = 25 °C	400	A
		T_{case} = 80 °C	360	A
I_{CRM}	I_{CRM}=2xI_{Cnom}		600	A
V_{GES}			± 20	V
t_{psc}	V_{CC} = 600 V; $V_{GE} \leq$ 20 V; V_{CES} < 1200 V	T_j = 125 °C	10	µs
Inverse Diode				
I_F	T_j = 150 °C	T_{case} = 25 °C	390	A
		T_{case} = 80 °C	260	A
I_{FRM}	I_{FRM}=2xI_{Fnom}		600	A
I_{FSM}	t_p = 10 ms; sin.	T_j = 150 °C	2880	A
Module				
$I_{t(RMS)}$			500	A
T_{vj}			- 40 ...+ 150	°C
T_{stg}			- 40 ...+ 125	°C
V_{isol}	AC, 1 min.		2500	V

Characteristics			T_c = 25 °C, unless otherwise specified			
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
IGBT						
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 12 mA		4,5	5,5	6,5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = V_{CES}	T_j = 25 °C		0,1	0,3	mA
V_{CE0}		T_j = 25 °C		1,4	1,6	V
		T_j = 125 °C		1,6	1,8	V
r_{CE}	V_{GE} = 15 V	T_j = 25°C		3,66	4,66	mΩ
		T_j = 125°C		5	6,33	mΩ
$V_{CE(sat)}$	I_{Cnom} = 300 A, V_{GE} = 15 V	T_j = °$C_{chiplev.}$		2,5	3	V
C_{ies}	V_{CE} = 25, V_{GE} = 0 V	f = 1 MHz		22	30	nF
C_{oes}				3,3	4	nF
C_{res}				1,2	1,6	nF
Q_G	V_{GE} = -8V - +20V			3000		nC
R_{Gint}	T_j = °C			1,25		Ω
$t_{d(on)}$	R_{Gon} = 3,3 Ω	V_{CC} = 600V		200	400	ns
t_r		I_C= 300A		115	220	ns
E_{on}		T_j = 125 °C		38		mJ
$t_{d(off)}$	R_{Goff} = 3,3 Ω	V_{GE} = ± 15V		720	900	ns
t_f				80	100	ns
E_{off}				40		mJ
$R_{th(j-c)}$	per IGBT				0,045	K/W



SEMITRANS® 4

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SKM 400GA123D

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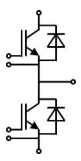

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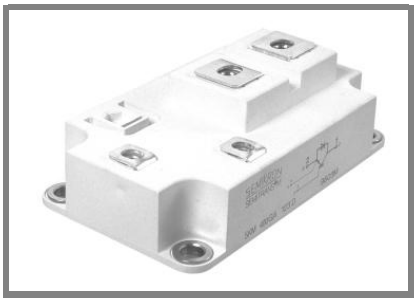
Characteristics

Symbol	Conditions		min.	typ.	max.	Units
Inverse Diode						
$V_F = V_{EC}$	I_{Fnom} = 300 A; V_{GE} = 0 V	T_j = 25 °C$_{chiplev.}$		2	2,5	V
		T_j = 125 °C$_{chiplev.}$		1,8		V
V_{F0}		T_j = 25 °C		1,1	1,2	V
		T_j = 125 °C				V
r_F		T_j = 25 °C		3	4,3	mΩ
		T_j = 125 °C				mΩ
I_{RRM}	I_F = 300 A	T_j = 25 °C		85		A
Q_{rr}	di/dt = 2000 A/µs			13		µC
E_{rr}	V_{GE} = 0 V; V_{CC} = 600 V					mJ
$R_{th(j-c)D}$	per diode				0,125	K/W
Freewheeling Diode						
$V_F = V_{EC}$	I_{Fnom} = A; V_{GE} = V	T_j = °C$_{chiplev.}$				V
V_{F0}		T_j = 25 °C				V
		T_j = 125 °C				V
r_F		T_j = 25 °C				V
		T_j = 125 °C				V
I_{RRM}	I_F = A	T_j = °C				A
Q_{rr}						µC
E_{rr}	V_{GE} = 0 V; V_{CC} = 600 V					mJ
	per diode					K/W
Module						
L_{CE}				15	20	nH
$R_{CC'+EE'}$	res., terminal-chip	T_{case}= 25 °C		0,18		mΩ
		T_{case}= 125 °C		0,22		mΩ
$R_{th(c-s)}$	per module				0,038	K/W
M_s	to heat sink M6		3		5	Nm
M_t	to terminals M6 (M4)		2,5 (1,1)		5 (2)	Nm
w					330	g

This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX.

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee expressed or implied is made regarding delivery, performance or suitability.



SEMITRANS® 4

IGBT Modules

SKM 400GA123D

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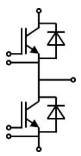

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Z_{th} Symbol	Conditions	Values	Units
$Z_{th(j-c)I}$			
R_i	i = 1	33	mk/W
R_i	i = 2	8,8	mk/W
R_i	i = 3	2,6	mk/W
R_i	i = 4	0,6	mk/W
tau_i	i = 1	0,05	s
tau_i	i = 2	0,009	s
tau_i	i = 3	0,0024	s
tau_i	i = 4	0,0001	s
$Z_{th(j-c)D}$			
R_i	i = 1	85	mk/W
R_i	i = 2	31	mk/W
R_i	i = 3	7,8	mk/W
R_i	i = 4	1,2	mk/W
tau_i	i = 1	0,0537	s
tau_i	i = 2	0,0086	s
tau_i	i = 3	0,003	s
tau_i	i = 4	0,0001	s

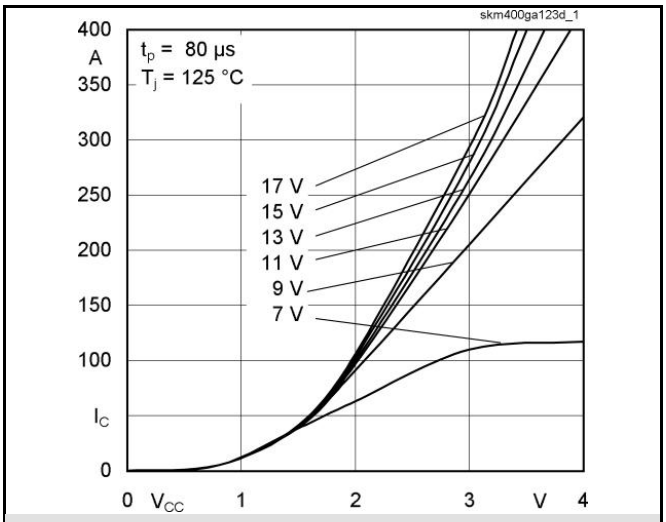


Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

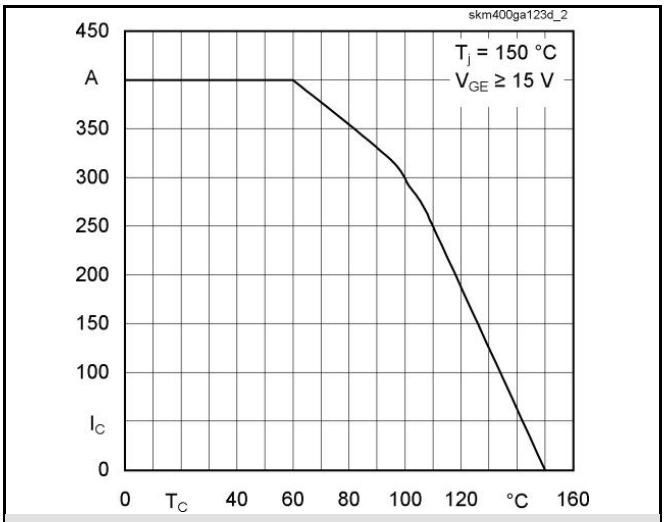


Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

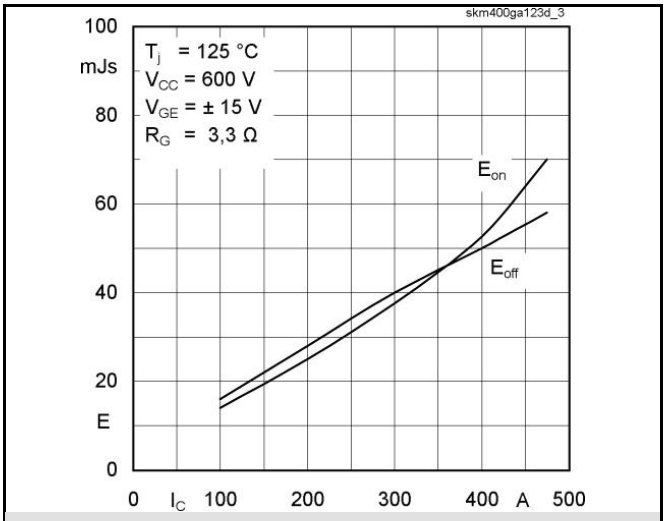


Fig. 3 Typ. turn-on /-off energy = f (I_C)

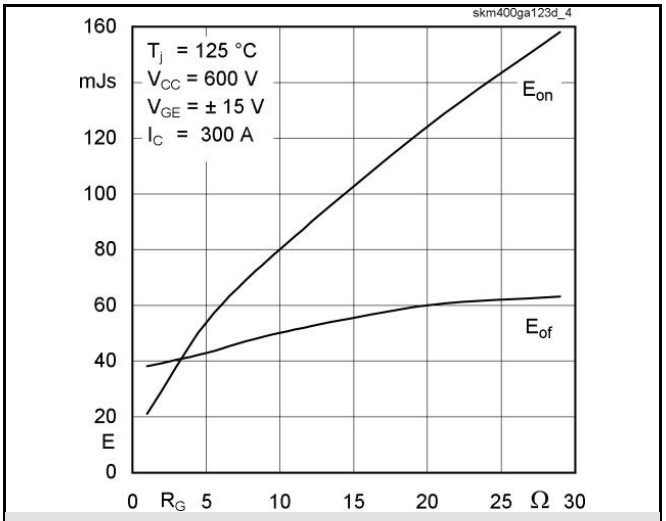


Fig. 4 Typ. turn-on /-off energy = f (R_G)

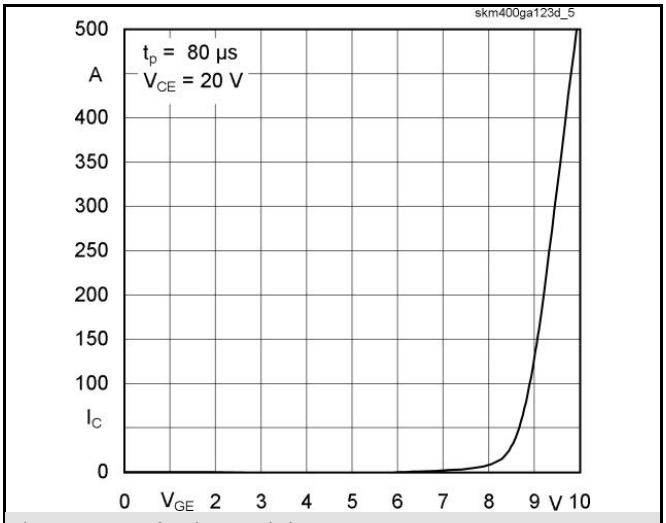


Fig. 5 Typ. transfer characteristic

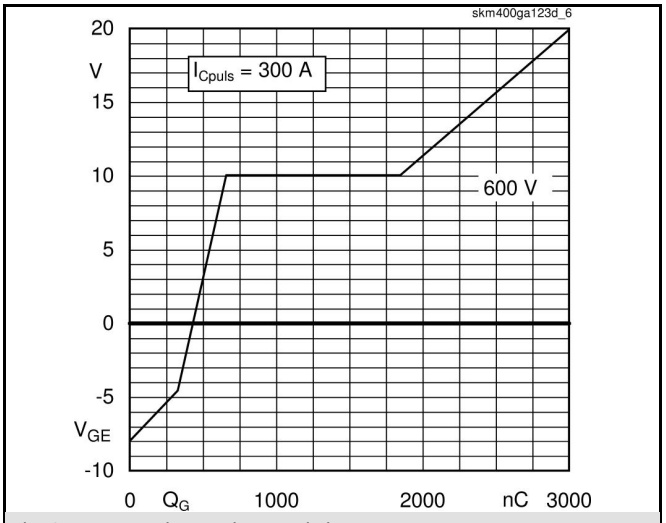


Fig. 6 Typ. gate charge characteristic

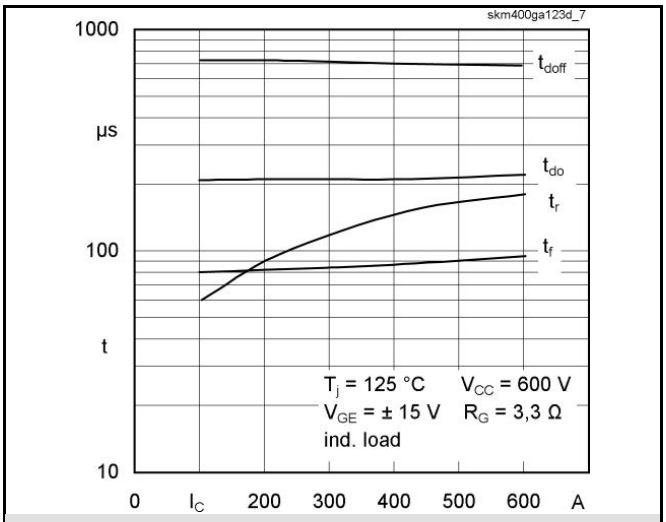


Fig. 7 Typ. switching times vs. I_C

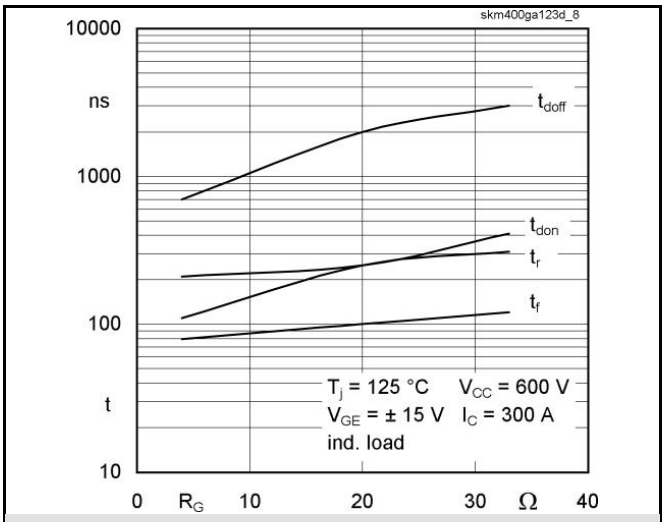


Fig. 8 Typ. switching times vs. gate resistor R_G

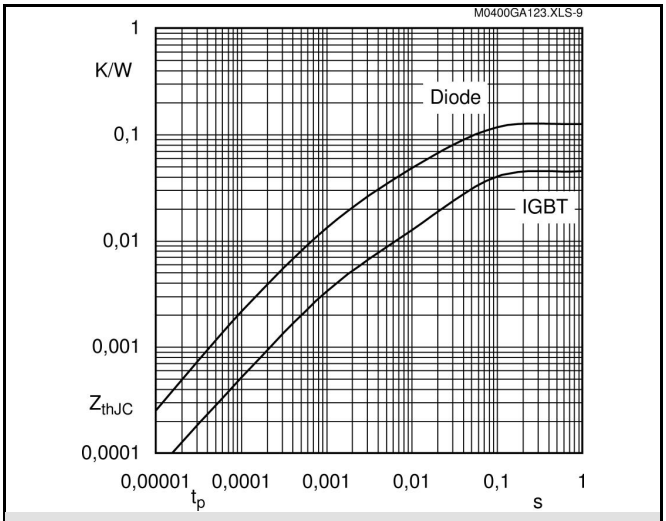


Fig. 9 Transient thermal impedance

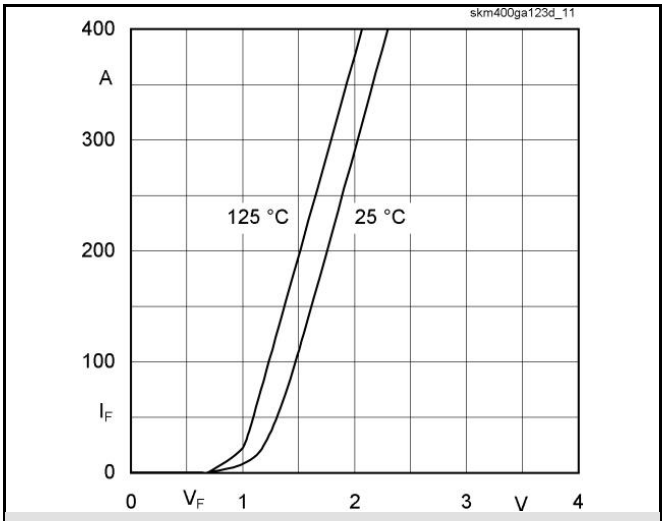


Fig. 10 CAL diode forward characteristic

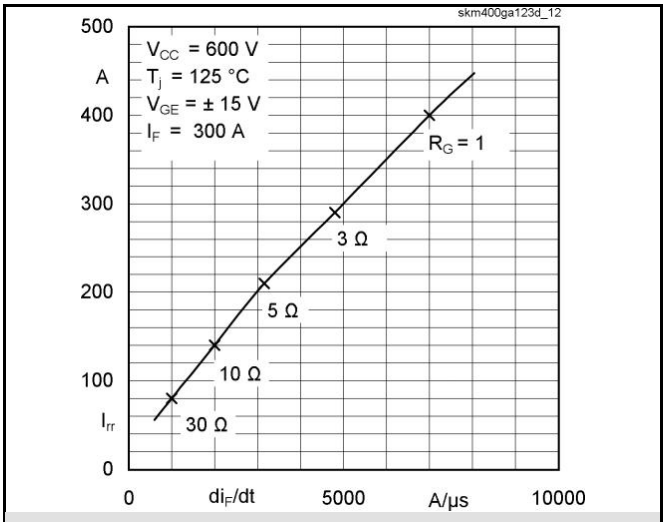


Fig. 11 Typ. CAL diode peak reverse recovery current

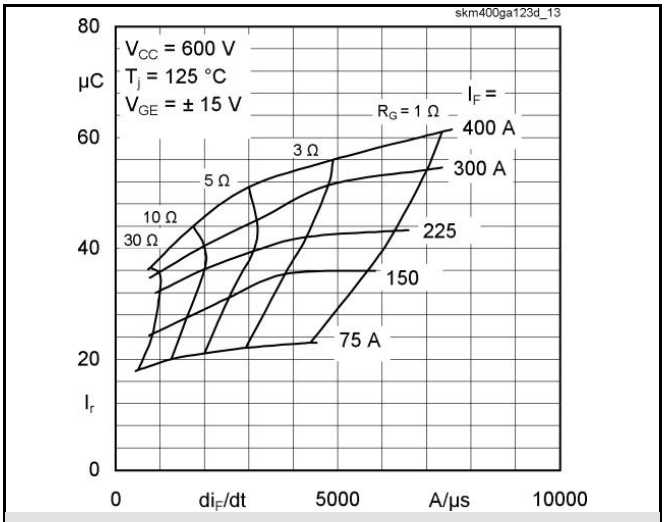
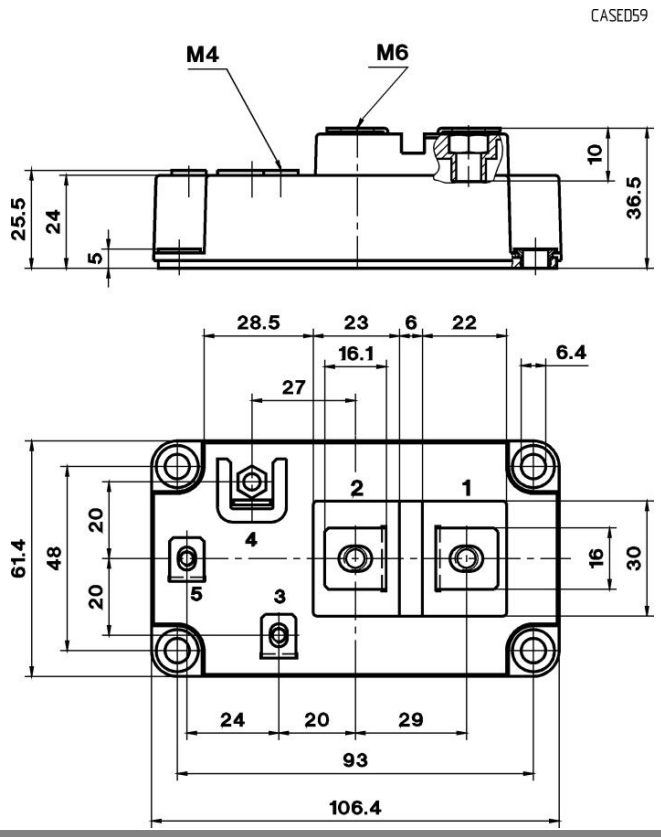


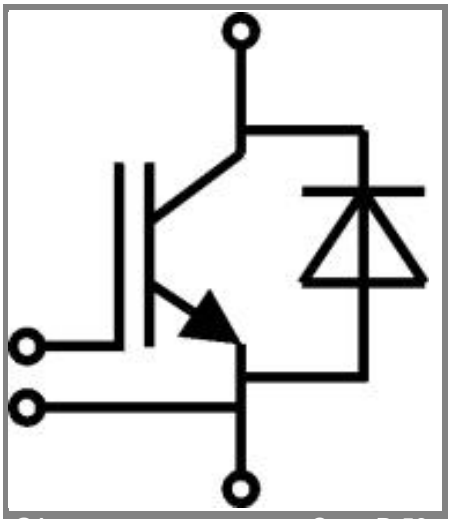
Fig. 12 Typ. CAL diode peak reverse recovery charge

SKM 400GA123D

UL Recognized File 63 532



Case D 59



GA Case D 59

