



SEMITRANS® 3

## High Speed IGBT4 Modules

### SKM300GB12F4

#### Target Data

#### Features

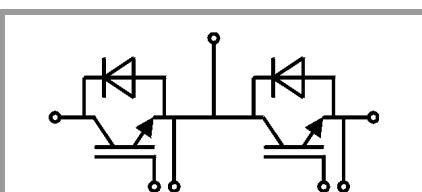
- High speed trench and field-stop IGBT
- CAL4 ultra-fast = soft switching 4. generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- For higher switching frequencies above 15kHz
- UL recognized, file no. E63532

#### Typical Applications\*

- UPS
- Electronic welders
- Inductive heating
- Switched mode power supplies

#### Remarks

- Case temperature limited to  $T_c = 125^\circ\text{C}$  max.
- Recommended  $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for  $T_j = 150^\circ\text{C}$



GB

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V <sub>CES</sub>	T <sub>j</sub> = 25 °C		1200	V
I <sub>C</sub>	T <sub>j</sub> = 175 °C	T <sub>c</sub> = 25 °C	380	A
		T <sub>c</sub> = 80 °C	289	A
I <sub>Cnom</sub>			300	A
I <sub>CRM</sub>	I <sub>CRM</sub> = 3xI <sub>Cnom</sub>		900	A
V <sub>GES</sub>			-20 ... 20	V
t <sub>psc</sub>	V <sub>CC</sub> = 800 V V <sub>GE</sub> ≤ 15 V V <sub>CES</sub> ≤ 1200 V	T <sub>j</sub> = 150 °C	10	μs
T <sub>j</sub>			-40 ... 175	°C
Inverse diode				
V <sub>RRM</sub>	T <sub>j</sub> = 25 °C		1200	V
I <sub>F</sub>	T <sub>j</sub> = 175 °C	T <sub>c</sub> = 25 °C	337	A
		T <sub>c</sub> = 80 °C	249	A
I <sub>Fnom</sub>			300	A
I <sub>FRM</sub>	I <sub>FRM</sub> = 2xI <sub>Fnom</sub>		600	A
I <sub>FSM</sub>	t <sub>p</sub> = 10 ms, sin 180°, T <sub>j</sub> = 25 °C		1368	A
T <sub>j</sub>			-40 ... 175	°C
Module				
I <sub>t(RMS)</sub>			500	A
T <sub>stg</sub>			-40 ... 125	°C
V <sub>isol</sub>	AC sinus 50 Hz, t = 1 min		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
V <sub>CE(sat)</sub>	I <sub>C</sub> = 300 A	T <sub>j</sub> = 25 °C		2.06	2.42	V
	V <sub>GE</sub> = 15 V chiplevel	T <sub>j</sub> = 150 °C		2.60	2.96	V
V <sub>CE0</sub>	chiplevel	T <sub>j</sub> = 25 °C		1.10	1.28	V
		T <sub>j</sub> = 150 °C		0.95	1.13	V
r <sub>CE</sub>	V <sub>GE</sub> = 15 V chiplevel	T <sub>j</sub> = 25 °C		3.2	3.8	mΩ
		T <sub>j</sub> = 150 °C		5.5	6.1	mΩ
V <sub>GE(th)</sub>	V <sub>GE</sub> =V <sub>CE</sub> , I <sub>C</sub> = 10.4 mA		5.2	5.8	6.4	V
I <sub>CES</sub>	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 1200 V, T <sub>j</sub> = 25 °C				4.0	mA
C <sub>ies</sub>	V <sub>CE</sub> = 25 V V <sub>GE</sub> = 0 V	f = 1 MHz		17.6		nF
C <sub>oes</sub>		f = 1 MHz		1.16		nF
C <sub>res</sub>		f = 1 MHz		0.94		nF
Q <sub>G</sub>	V <sub>GE</sub> = - 8 V...+ 15 V			1700		nC
R <sub>Gint</sub>	T <sub>j</sub> = 25 °C			0.7		Ω
t <sub>d(on)</sub>	V <sub>CC</sub> = 600 V	T <sub>j</sub> = 150 °C		40		ns
t <sub>r</sub>	I <sub>C</sub> = 300 A	T <sub>j</sub> = 150 °C		50		ns
E <sub>on</sub>	V <sub>GE</sub> = +15/-15 V	T <sub>j</sub> = 150 °C		27		mJ
t <sub>d(off)</sub>	R <sub>G on</sub> = 4.3 Ω	T <sub>j</sub> = 150 °C		357		ns
t <sub>f</sub>	R <sub>G off</sub> = 1 Ω	T <sub>j</sub> = 150 °C		68		ns
E <sub>off</sub>	di/dt <sub>on</sub> = 5990 A/μs di/dt <sub>off</sub> = 3600 A/μs du/dt = 4700 V/μs	T <sub>j</sub> = 150 °C		23		mJ
R <sub>th(j-c)</sub>	per IGBT				0.11	K/W
R <sub>th(c-s)</sub>	per IGBT (λ <sub>grease</sub> =0.81 W/(m²K))			0.05		K/W



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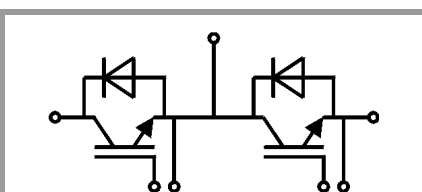
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 300 A	T <sub>j</sub> = 25 °C		2.42	2.79	V
	V <sub>GE</sub> = 0 V	T <sub>j</sub> = 150 °C		2.34	2.69	V
	chiplevel					
V <sub>F0</sub>		T <sub>j</sub> = 25 °C		1.53	1.77	V
	chiplevel	T <sub>j</sub> = 150 °C		1.12	1.36	V
r <sub>F</sub>		T <sub>j</sub> = 25 °C		3.0	3.4	mΩ
	chiplevel	T <sub>j</sub> = 150 °C		4.1	4.4	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 300 A	T <sub>j</sub> = 150 °C		315		A
Q <sub>rr</sub>	di/dt <sub>off</sub> = 5625 A/μs	T <sub>j</sub> = 150 °C		40		μC
E <sub>rr</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		12		mJ
	V <sub>CC</sub> = 600 V					
R <sub>th(j-c)</sub>	per diode				0.17	K/W
R <sub>th(c-s)</sub>	per diode (λ <sub>grease</sub> =0.81 W/(m*K))			0.051		K/W
Module						
L <sub>CE</sub>				15		nH
R <sub>CC'+EE'</sub>	measured per	T <sub>C</sub> = 25 °C		0.55		mΩ
	switch	T <sub>C</sub> = 125 °C		0.85		mΩ
R <sub>th(c-s)1</sub>	calculated without thermal coupling			0.013		K/W
R <sub>th(c-s)2</sub>	including thermal coupling, Ts underneath module (λ <sub>grease</sub> =0.81 W/(m*K))			0.021		K/W
M <sub>s</sub>	to heat sink M6		3		5	Nm
M <sub>t</sub>		to terminals M6	2.5		5	Nm
						Nm
w					325	g



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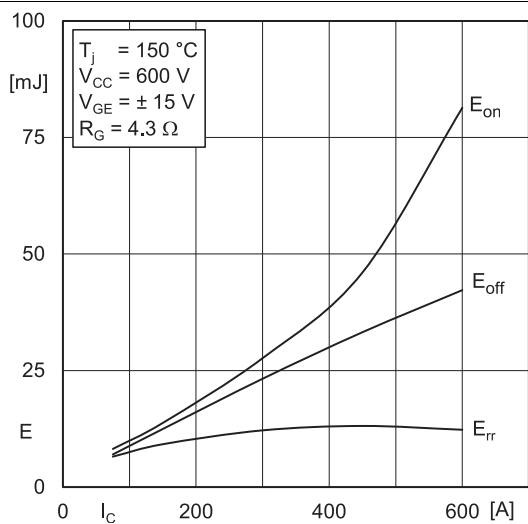


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

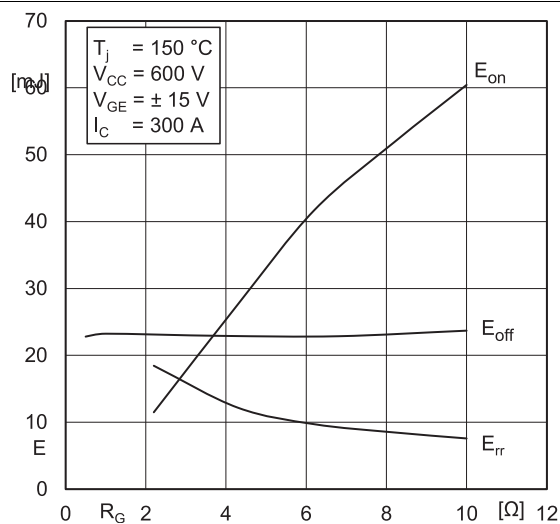


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

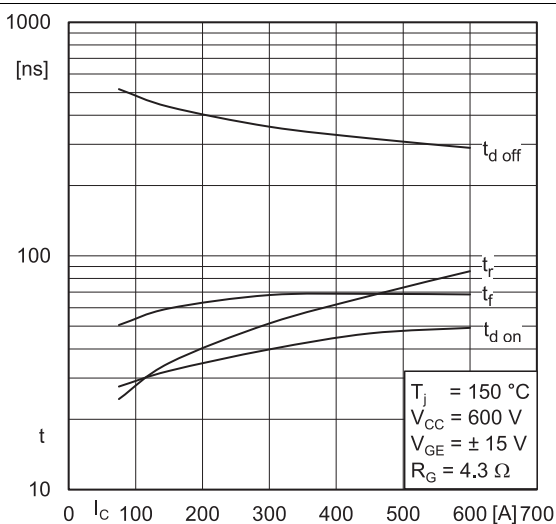


Fig. 7: Typ. switching times vs.  $I_C$

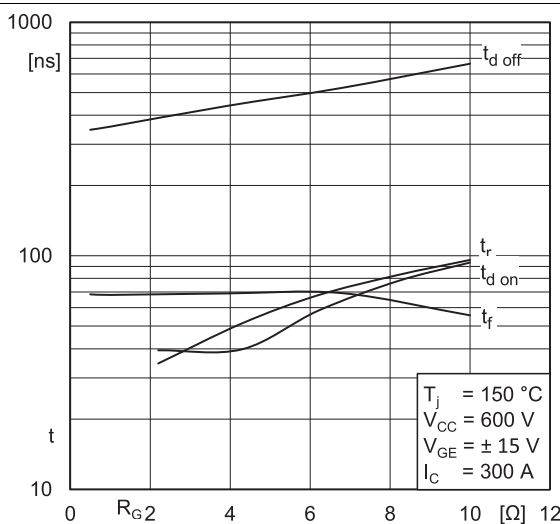


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

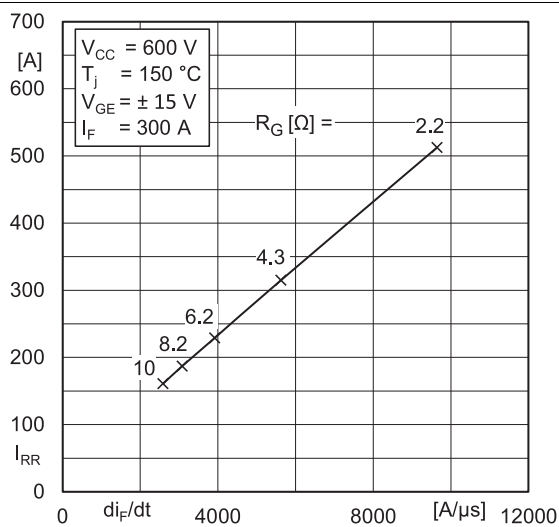


Fig. 11: CAL diode peak reverse recovery current

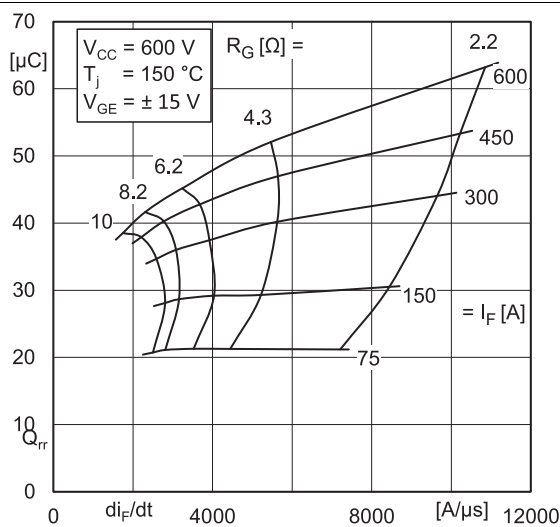
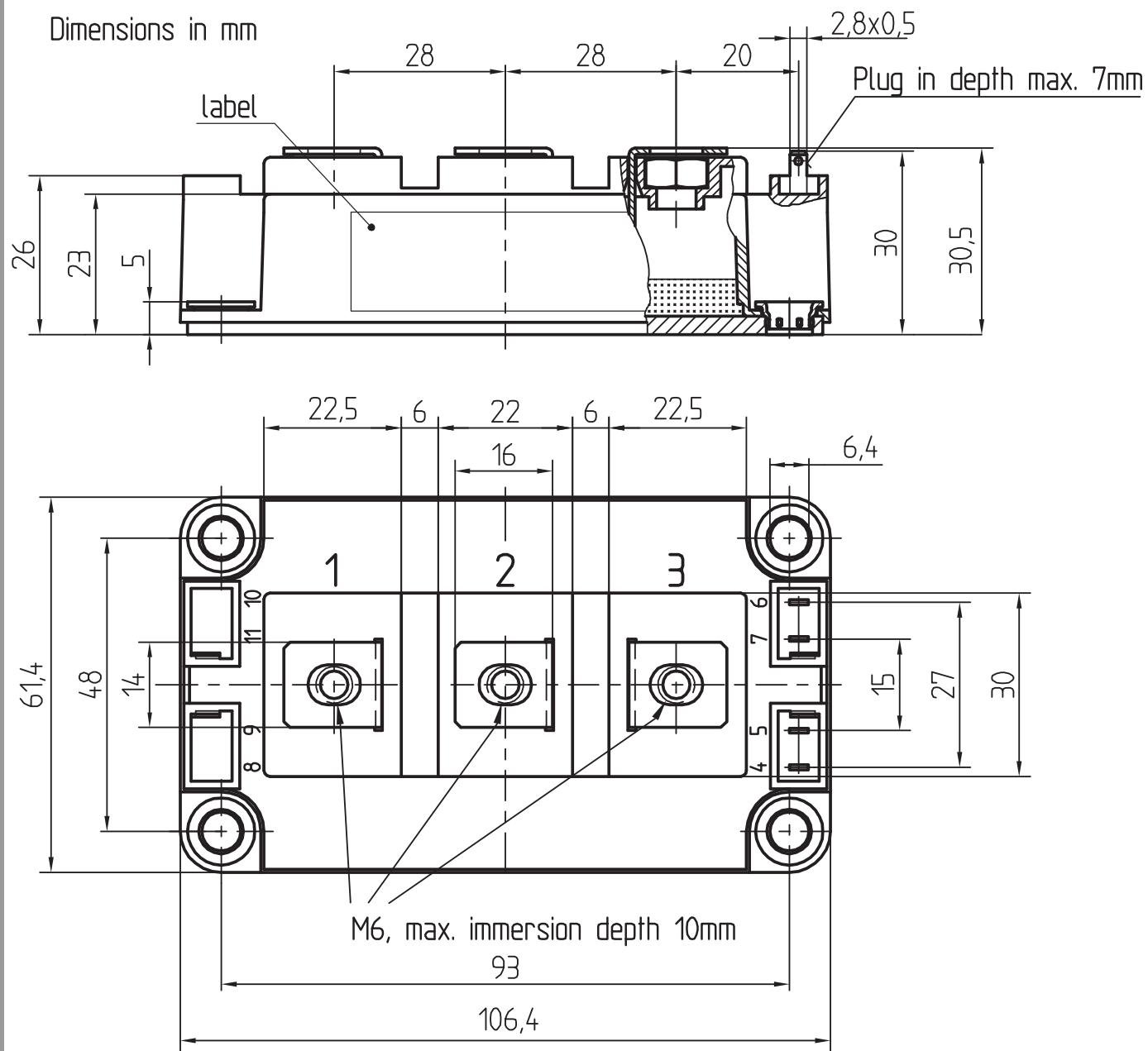
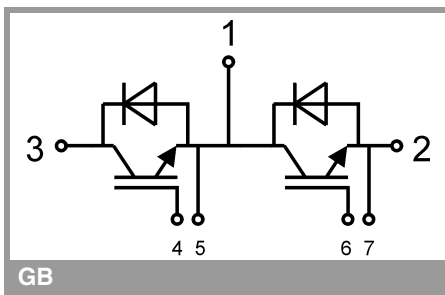


Fig. 12: Typ. CAL diode peak reverse recovery charge



General tolerance  $\pm 0,5$  mm

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

## **\*IMPORTANT INFORMATION AND WARNINGS**

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