



**SEMITRANS®3**

## IGBT4 Modules

SKM300GAL12E4

### Features

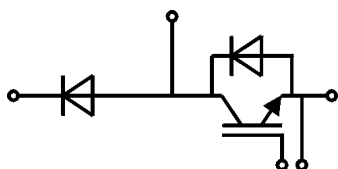
- IGBT4 = 4. Generation (Trench)IGBT
- VCEsat with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I<sub>CNOM</sub>
- Soft switching 4. Generation CAL diode (CAL4)

### Typical Applications

- DC/DC – converter
- Brake chopper
- Switched reluctance motor
- DC – motor

### Remarks

- Case temperature limited to T<sub>c</sub> = 125°C max, recomm. T<sub>op</sub> = -40 ... +150°C, product rel. results valid for T<sub>j</sub> = 150°



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Absolute Maximum Ratings					
Symbol	Conditions		Values	Unit	
<b>IGBT</b>					
V <sub>CES</sub>			1200	V	
I <sub>C</sub>	T <sub>j</sub> = 175 °C	T <sub>c</sub> = 25 °C	422	A	
		T <sub>c</sub> = 80 °C	324	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	T <sub>j</sub> = 150 °C	10	µs	
	V <sub>GE</sub> ≤ 15 V				
	V <sub>CES</sub> ≤ 1200 V				
T <sub>j</sub>			-40 ... 175	°C	
<b>Inverse diode</b>					
I <sub>F</sub>	T <sub>j</sub> = 175 °C	T <sub>c</sub> = 25 °C	353	A	
		T <sub>c</sub> = 80 °C	264	A	
I <sub>Fnom</sub>			300	A	
I <sub>FRM</sub>	I <sub>FRM</sub> = 3xI <sub>Fnom</sub>		900	A	
I <sub>FSM</sub>	t <sub>p</sub> = 10 ms, sin 180°, T <sub>j</sub> = 25 °C		1548	A	
T <sub>j</sub>			-40 ... 175	°C	
<b>Freewheeling diode</b>					
I <sub>F</sub>	T <sub>j</sub> = 175 °C	T <sub>c</sub> = 25 °C	353	A	
		T <sub>c</sub> = 80 °C	264	A	
I <sub>Fnom</sub>			300	A	
I <sub>FRM</sub>	I <sub>FRM</sub> = 3xI <sub>Fnom</sub>		900	A	
I <sub>FSM</sub>	t <sub>p</sub> = 10 ms, sin 180°, T <sub>j</sub> = 25 °C		1548	A	
T <sub>j</sub>			-40 ... 175	°C	
<b>Module</b>					
I <sub>t(RMS)</sub>			500	A	
T <sub>stg</sub>			-40 ... 125	°C	
V <sub>isol</sub>	AC sinus 50Hz, t = 1 min		4000	V	

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>IGBT</b>						
V <sub>CE(sat)</sub>	I <sub>C</sub> = 300 A	T <sub>j</sub> = 25 °C	1.85	2.1	V	
		T <sub>j</sub> = 150 °C	2.25	2.45	V	
V <sub>CE0</sub>		T <sub>j</sub> = 25 °C	0.8	0.9	V	
		T <sub>j</sub> = 150 °C	0.7	0.8	V	
r <sub>CE</sub>	V <sub>GE</sub> = 15 V	T <sub>j</sub> = 25 °C	3.5	4.0	mΩ	
		T <sub>j</sub> = 150 °C	5.2	5.5	mΩ	
V <sub>GE(th)</sub>	V <sub>GE</sub> =V <sub>CE</sub> , I <sub>C</sub> = 12 mA		5	5.8	6.5	V
I <sub>CES</sub>	V <sub>GE</sub> = 0 V	T <sub>j</sub> = 25 °C	0.1		0.3	mA
		T <sub>j</sub> = 150 °C				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				2.5	Ω



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- High short circuit capability, self limiting to 6 x I<sub>CNOM</sub>
- Soft switching 4. Generation CAL diode (CAL4)

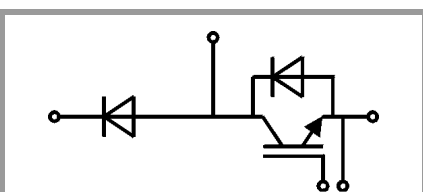
### Typical Applications

- DC/DC – converter
- Brake chopper
- Switched reluctance motor
- DC – motor

### Remarks

- Case temperature limited to T<sub>c</sub> = 125°C max, recomm.  
T<sub>op</sub> = -40 ... +150°C, product rel. results valid for T<sub>j</sub> = 150°

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
t <sub>d(on)</sub>	V <sub>CC</sub> = 600 V	T <sub>j</sub> = 150 °C		220		ns
t <sub>r</sub>	I <sub>C</sub> = 300 A	T <sub>j</sub> = 150 °C		44		ns
E <sub>on</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		27		mJ
t <sub>d(off)</sub>	R <sub>G on</sub> = 1.5 Ω	T <sub>j</sub> = 150 °C		520		ns
t <sub>f</sub>	R <sub>G off</sub> = 1.5 Ω	T <sub>j</sub> = 150 °C		117		ns
E <sub>off</sub>	di/dt <sub>on</sub> = 6100 A/μs	T <sub>j</sub> = 150 °C		39		mJ
	di/dt <sub>off</sub> = 3000 A/μs	T <sub>j</sub> = 150 °C				
R <sub>th(j-c)</sub>	per IGBT				0.11	K/W
Inverse diode						
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 300 A	T <sub>j</sub> = 25 °C		2.17	2.49	V
	V <sub>GE</sub> = 0 V	T <sub>j</sub> = 150 °C		2.11	2.42	V
	chip					
V <sub>F0</sub>		T <sub>j</sub> = 25 °C		1.3	1.5	V
		T <sub>j</sub> = 150 °C		0.9	1.1	V
r <sub>F</sub>		T <sub>j</sub> = 25 °C		2.9	3.3	mΩ
		T <sub>j</sub> = 150 °C		4.0	4.4	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 300 A	T <sub>j</sub> = 150 °C		345		A
Q <sub>rr</sub>	di/dt <sub>off</sub> = 7300 A/μs	T <sub>j</sub> = 150 °C		54		μC
E <sub>rr</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		23		mJ
	V <sub>CC</sub> = 600 V	T <sub>j</sub> = 150 °C				
R <sub>th(j-c)</sub>	per diode				0.17	K/W
Freewheeling diode						
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 300 A	T <sub>j</sub> = 25 °C		2.17	2.49	V
	V <sub>GE</sub> = 0 V	T <sub>j</sub> = 150 °C		2.11	2.42	V
	chip					
V <sub>F0</sub>		T <sub>j</sub> = 25 °C		1.3	1.5	V
		T <sub>j</sub> = 150 °C		0.9	1.1	V
r <sub>F</sub>		T <sub>j</sub> = 25 °C		2.9	3.3	mΩ
		T <sub>j</sub> = 150 °C		4.0	4.4	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 300 A	T <sub>j</sub> = 150 °C		345		A
Q <sub>rr</sub>	di/dt <sub>off</sub> = 7300 A/μs	T <sub>j</sub> = 150 °C		54		μC
E <sub>rr</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		23		mJ
	V <sub>CC</sub> = 600 V	T <sub>j</sub> = 150 °C				
R <sub>th(j-c)</sub>	per Diode				0.17	K/W
Module						
L <sub>CE</sub>				15	20	nH
R <sub>CC+EE'</sub>	terminal-chip	T <sub>C</sub> = 25 °C		0.25		mΩ
		T <sub>C</sub> = 125 °C		0.5		mΩ
R <sub>th(c-s)</sub>	per module			0.02	0.038	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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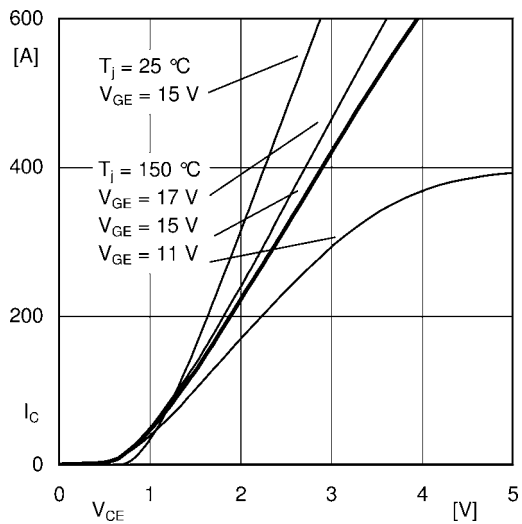


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

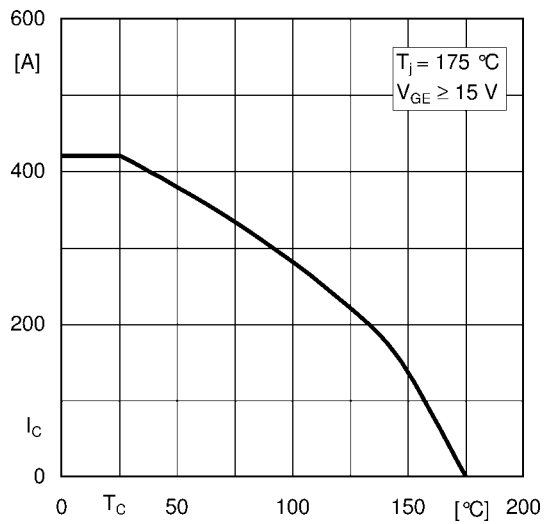


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

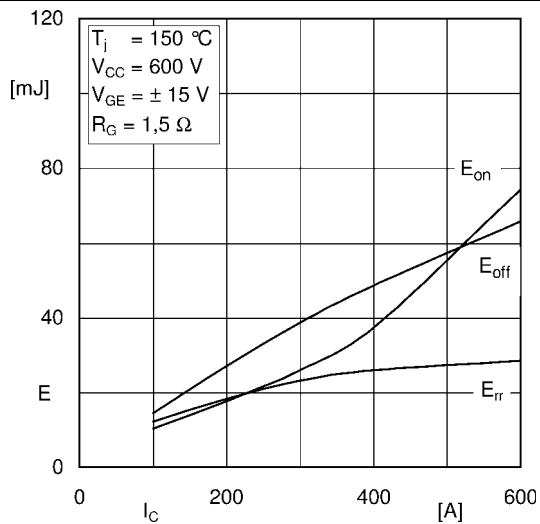


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

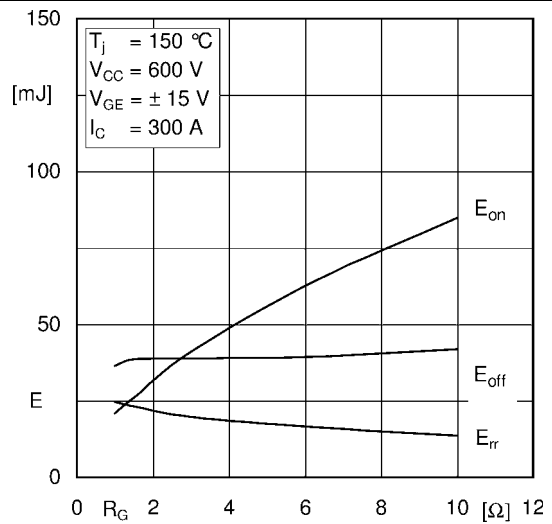


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

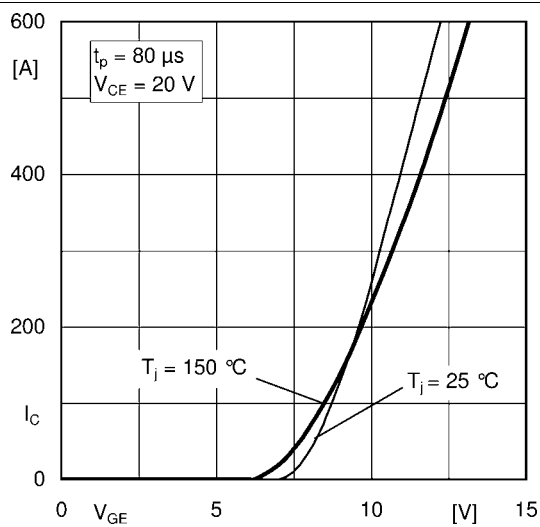


Fig. 5: Typ. transfer characteristic

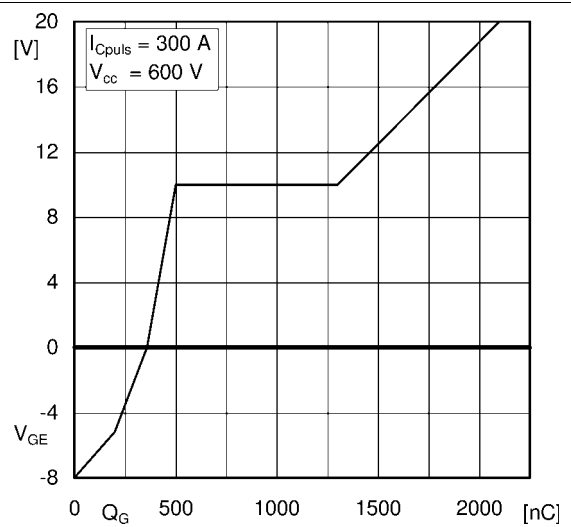


Fig. 6: Typ. gate charge characteristic

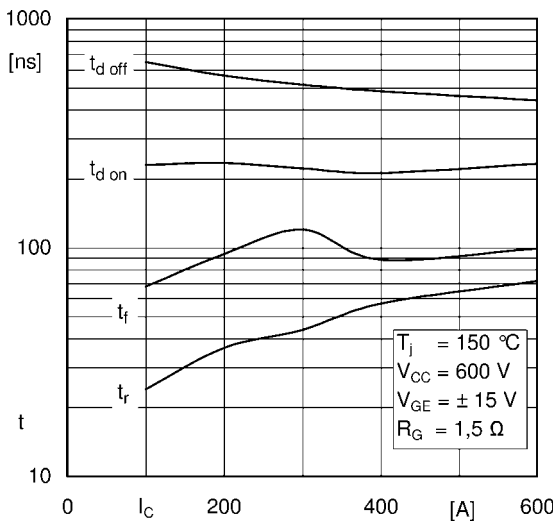


Fig. 7: Typ. switching times vs.  $I_C$

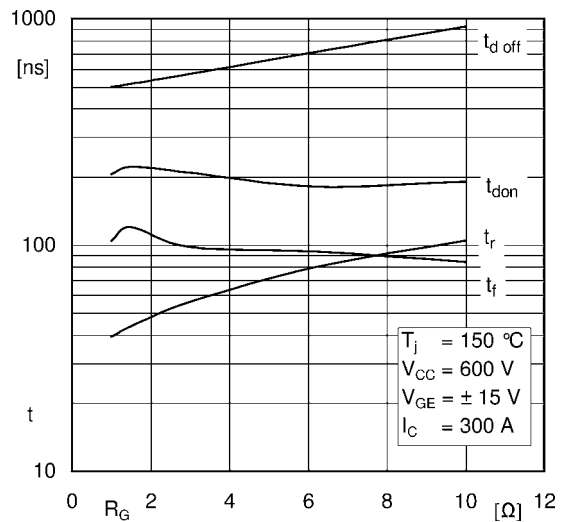


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

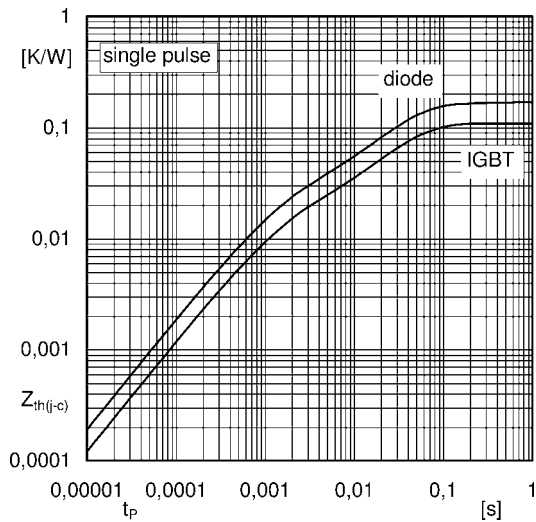


Fig. 9: Transient thermal impedance

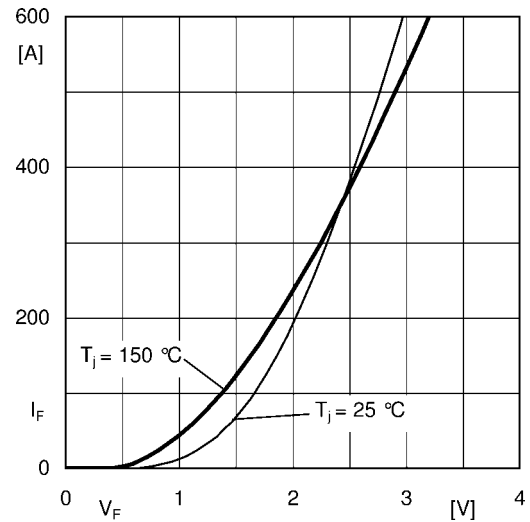


Fig. 10: CAL diode forward characteristic

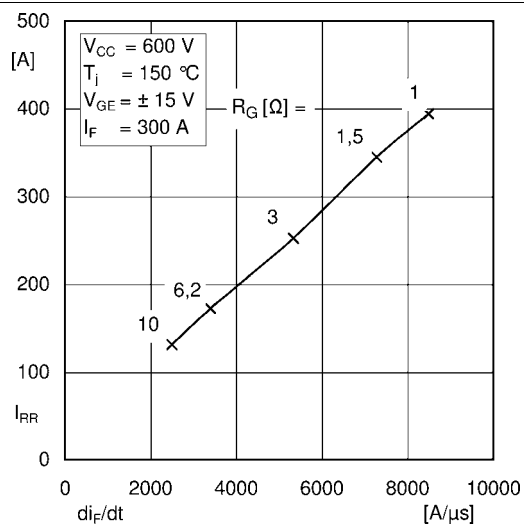


Fig. 11: CAL diode peak reverse recovery current

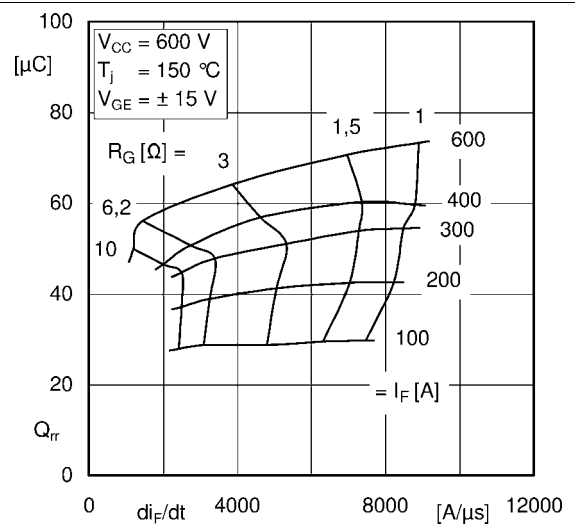
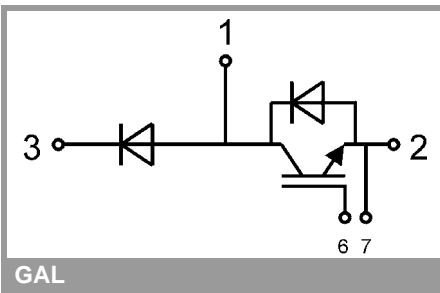


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

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