

# SKM200GAL12E4



SEMITRANS®3

## IGBT4 Modules

SKM200GAL12E4

### Features

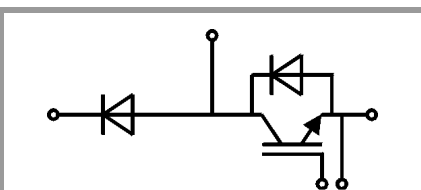
- IGBT4 = 4. Generation (Trench)IGBT
- VCEsat with positive temperature coefficient
- High short circuit capability, self limiting to  $6 \times I_{CNOM}$
- Soft switching 4. Generation CAL diode (CAL4)

### Typical Applications

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

### Remarks

- Case temperature limited to  $T_c = 125^\circ\text{C}$  max, recomm.  
Top =  $-40 \dots +150^\circ\text{C}$ , product rel. results valid for  $T_j = 150^\circ$



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## Absolute Maximum Ratings

Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$		1200	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	314	A
		$T_c = 80^\circ\text{C}$	242	A
$I_{Cnom}$		200	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	600	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10	$\mu\text{s}$
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	229	A
		$T_c = 80^\circ\text{C}$	172	A
$I_{Fnom}$		200	A	
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$	600	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	990	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Freewheeling diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	229	A
		$T_c = 80^\circ\text{C}$	172	A
$I_{Fnom}$		200	A	
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$	600	A	
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$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		500	A	
$T_{stg}$		-40 ... 125	$^\circ\text{C}$	
$V_{isol}$	AC sinus 50Hz, $t = 1\text{ min}$	4000	V	

## Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 200\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.8	2.05	V
		$T_j = 150^\circ\text{C}$	2.2	2.4	V
$V_{CE0}$		$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	5.0	5.8	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	7.5	8.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 7.6\text{ mA}$	5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	$\text{mA}$
		$T_j = 150^\circ\text{C}$			$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$		12.3		nF
$C_{oes}$	$V_{GE} = 0\text{ V}$		0.81		nF
$C_{res}$			0.69		nF
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		1130		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$		3.8		$\Omega$



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### Features

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

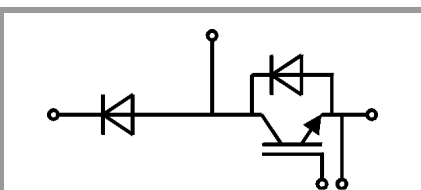
### Typical Applications

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

### Remarks

- Case temperature limited to T<sub>c</sub> = 125°C max, recomm. Top = -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		204		ns
t <sub>r</sub>	I <sub>C</sub> = 200 A	T <sub>j</sub> = 150 °C		40		ns
E <sub>on</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		21		mJ
t <sub>d(off)</sub>	R <sub>G on</sub> = 1 Ω	T <sub>j</sub> = 150 °C		490		ns
t <sub>f</sub>	R <sub>G off</sub> = 1 Ω	T <sub>j</sub> = 150 °C		107		ns
E <sub>off</sub>	di/dt <sub>on</sub> = 5500 A/μs	T <sub>j</sub> = 150 °C		27		mJ
	di/dt <sub>off</sub> = 2300 A/μs	T <sub>j</sub> = 150 °C				
R <sub>th(j-c)</sub>	per IGBT				0.14	K/W
Inverse diode						
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 200 A	T <sub>j</sub> = 25 °C		2.2	2.52	V
	V <sub>GE</sub> = 0 V	T <sub>j</sub> = 150 °C		2.15	2.47	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		4.5	5.1	mΩ
		T <sub>j</sub> = 150 °C		6.3	6.8	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 200 A	T <sub>j</sub> = 150 °C		174		A
Q <sub>rr</sub>	di/dt <sub>off</sub> = 4450 A/μs	T <sub>j</sub> = 150 °C		33		μC
E <sub>rr</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		13		mJ
	V <sub>CC</sub> = 600 V					
R <sub>th(j-c)</sub>	per diode				0.26	K/W
Freewheeling diode						
V <sub>F</sub> = V <sub>EC</sub>	I <sub>F</sub> = 200 A	T <sub>j</sub> = 25 °C		2.2	2.52	V
	V <sub>GE</sub> = 0 V	T <sub>j</sub> = 150 °C		2.15	2.47	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		4.5	5.1	mΩ
		T <sub>j</sub> = 150 °C		6.3	6.8	mΩ
I <sub>RRM</sub>	I <sub>F</sub> = 200 A	T <sub>j</sub> = 150 °C		174		A
Q <sub>rr</sub>	di/dt <sub>off</sub> = 4450 A/μs	T <sub>j</sub> = 150 °C		33.1		μC
E <sub>rr</sub>	V <sub>GE</sub> = ±15 V	T <sub>j</sub> = 150 °C		13		mJ
	V <sub>CC</sub> = 600 V					
R <sub>th(j-c)</sub>	per Diode				0.26	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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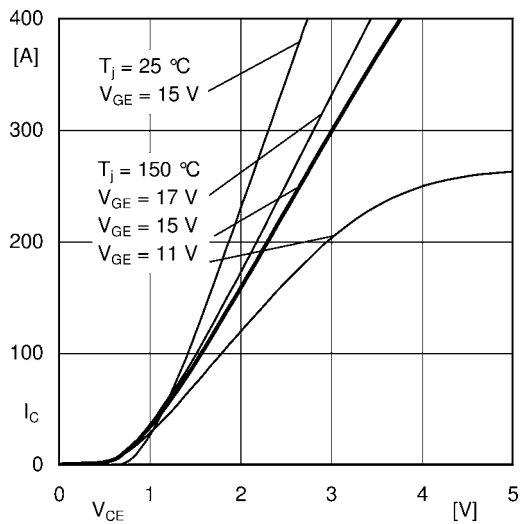


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

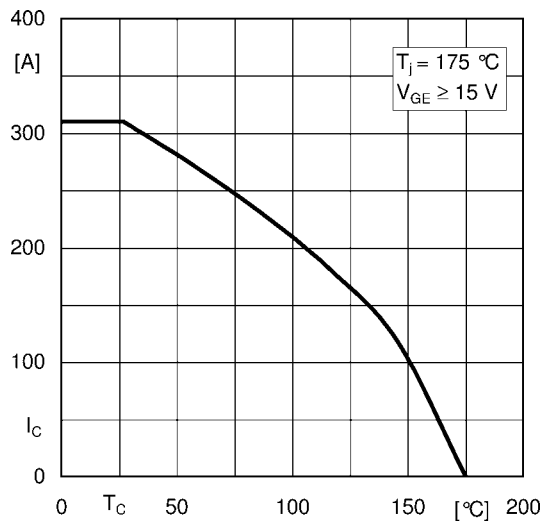


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

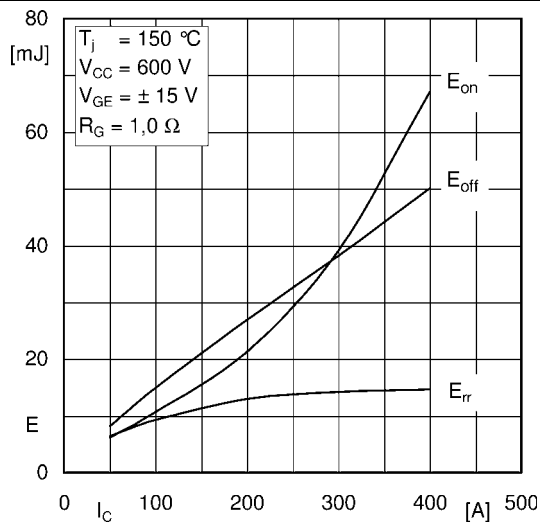


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

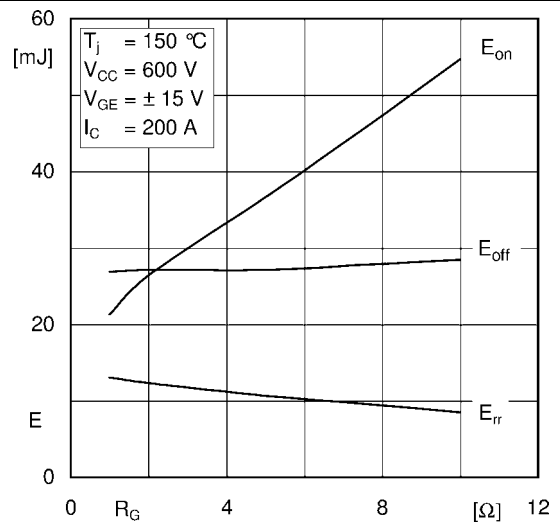


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

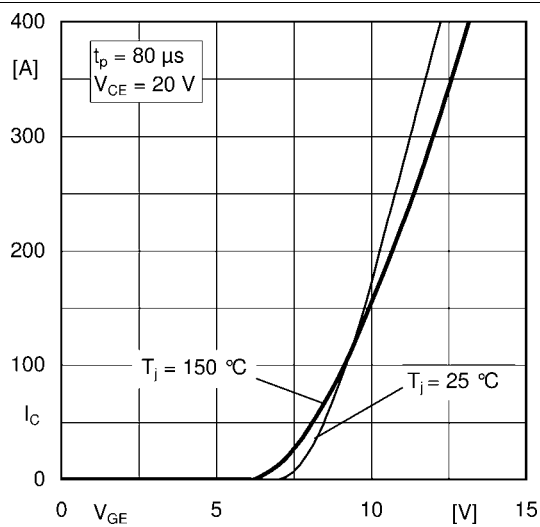


Fig. 5: Typ. transfer characteristic

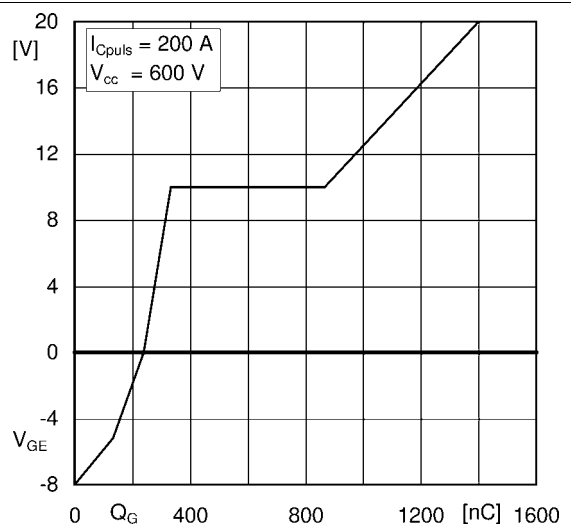


Fig. 6: Typ. gate charge characteristic

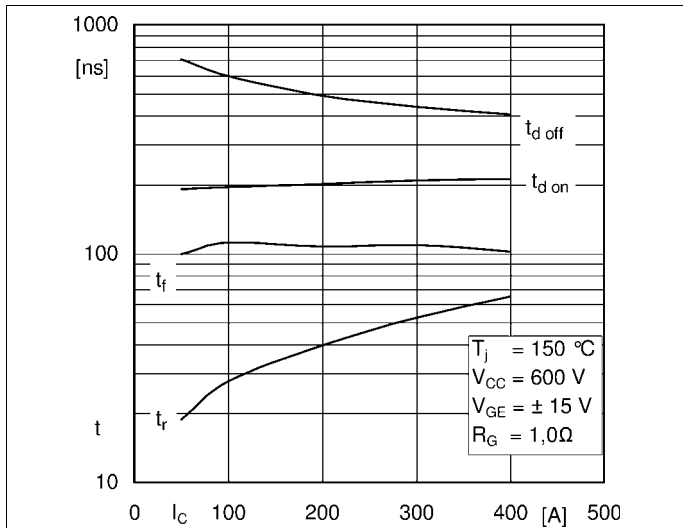


Fig. 7: Typ. switching times vs.  $I_C$

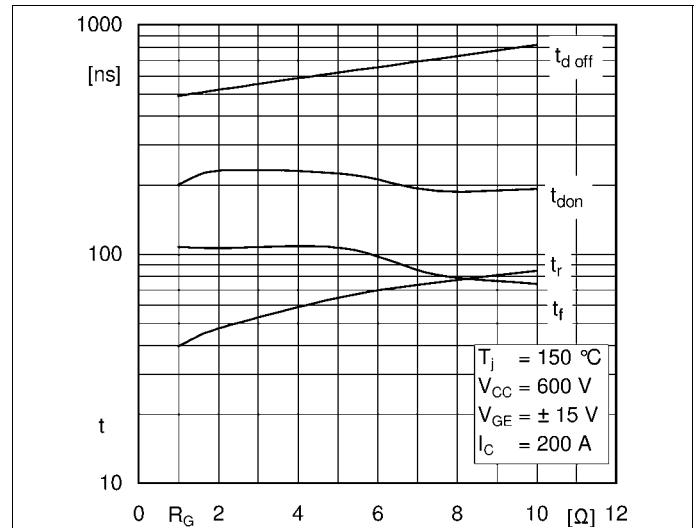


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

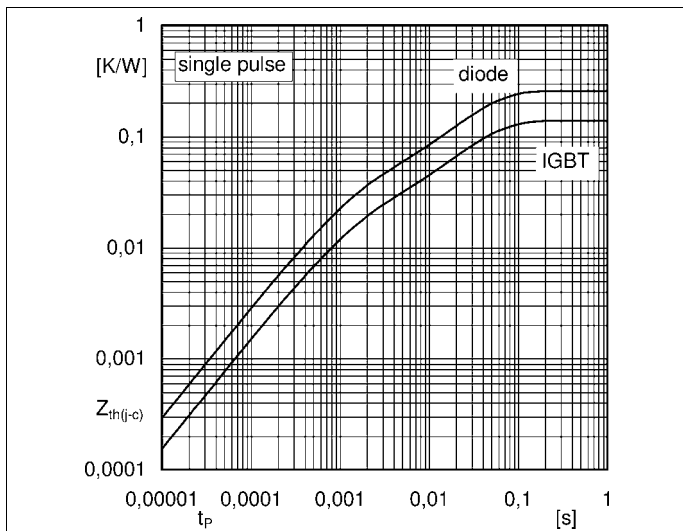


Fig. 9: Transient thermal impedance

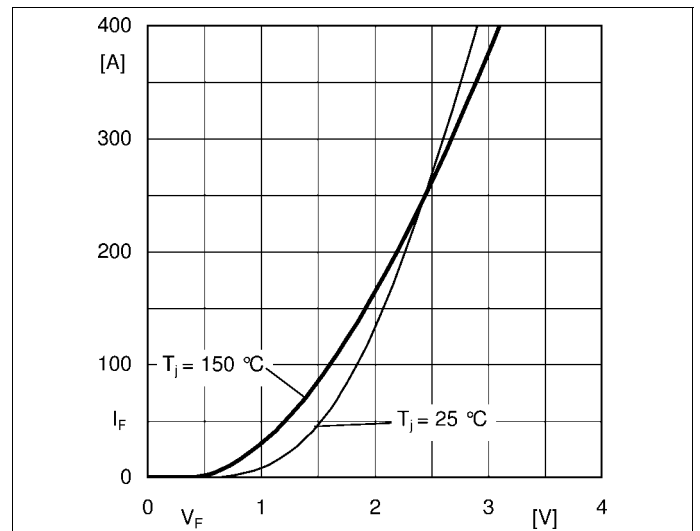


Fig. 10: CAL diode forward characteristic

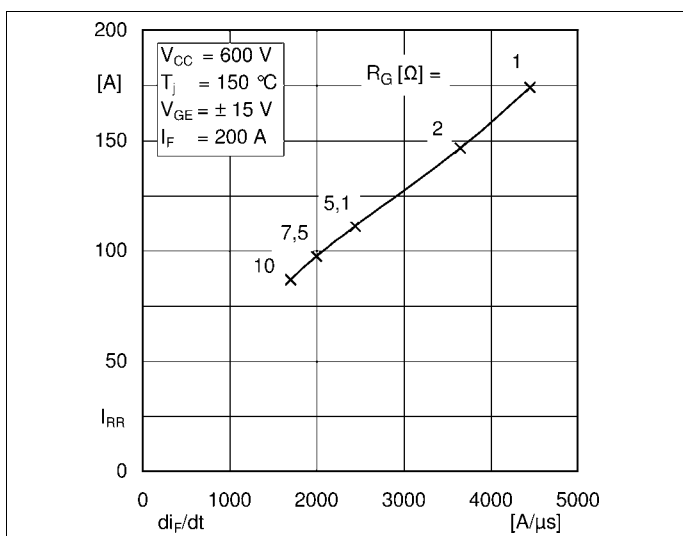


Fig. 11: CAL diode peak reverse recovery current

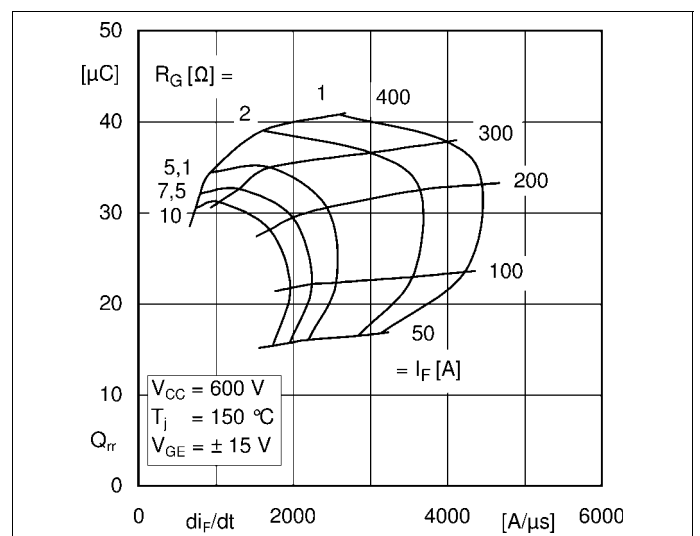
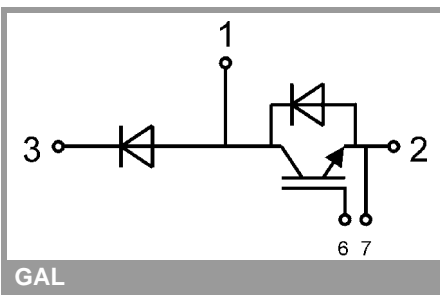


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

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