



SEMITRANS®3

IGBT4 Modules

SKM200GAL12E4

Features

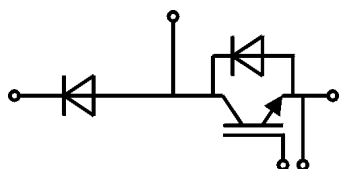
- IGBT4 = 4. Generation (Trench)IGBT
- VCEsat with positive temperature coefficient
- High short circuit capability, self limiting to $6 \times I_{CNOM}$
- Soft switching 4. Generation CAL diode (CAL4)

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
IGBT			
V_{CES}		1200	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$ $T_c = 80^\circ\text{C}$	A 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 μs
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$ $T_c = 80^\circ\text{C}$	229 A 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	$^\circ\text{C}$
Freewheeling diode			
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$ $T_c = 80^\circ\text{C}$	229 A 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	$^\circ\text{C}$
Module			
$I_{t(RMS)}$		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
IGBT					
$V_{CE(sat)}$	$I_C = 200\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.8 2.2	2.05 2.4	V V
V_{CE0}		$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	0.8 0.7	0.9 0.8	V V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	5.0 7.5	5.8 8.0	$\text{m}\Omega$ $\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 7.6\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	0.1	0.3	mA mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	12.3		nF
C_{oes}		$f = 1\text{ MHz}$	0.81		nF
C_{res}		$f = 1\text{ MHz}$	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		Ω



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- Soft switching 4. Generation CAL diode (CAL4)

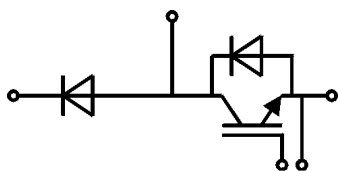
Typical Applications

- 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 $T_j = 150^\circ$

Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		204	ns
t_r	$I_C = 200\text{ A}$	$T_j = 150^\circ\text{C}$		40	ns
E_{on}	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		21	mJ
$t_{d(off)}$	$R_{G\ on} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		490	ns
t_f	$R_{G\ off} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		107	ns
E_{off}	$di/dt_{on} = 5500\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		27	mJ
$R_{th(j-c)}$	$di/dt_{off} = 2300\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$			0.14 K/W
	per IGBT				
Inverse diode					
$V_F = V_{EC}$	$I_F = 200\text{ A}$	$T_j = 25^\circ\text{C}$		2.2	2.52 V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.15	2.47 V
	chip				
V_{F0}		$T_j = 25^\circ\text{C}$		1.3	1.5 V
		$T_j = 150^\circ\text{C}$		0.9	1.1 V
r_F		$T_j = 25^\circ\text{C}$		4.5	5.1 m Ω
		$T_j = 150^\circ\text{C}$		6.3	6.8 m Ω
I_{RRM}	$I_F = 200\text{ A}$	$T_j = 150^\circ\text{C}$		174	A
Q_{rr}	$di/dt_{off} = 4450\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		33	μC
E_{rr}	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		13	mJ
	$V_{CC} = 600\text{ V}$				
$R_{th(j-c)}$	per diode			0.26	K/W
Freewheeling diode					
$V_F = V_{EC}$	$I_F = 200\text{ A}$	$T_j = 25^\circ\text{C}$		2.2	2.52 V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.15	2.47 V
	chip				
V_{F0}		$T_j = 25^\circ\text{C}$		1.3	1.5 V
		$T_j = 150^\circ\text{C}$		0.9	1.1 V
r_F		$T_j = 25^\circ\text{C}$		4.5	5.1 m Ω
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I_{RRM}	$I_F = 200\text{ A}$	$T_j = 150^\circ\text{C}$		174	A
Q_{rr}	$di/dt_{off} = 4450\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		33.1	μC
E_{rr}	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		13	mJ
	$V_{CC} = 600\text{ V}$				
$R_{th(j-c)}$	per Diode			0.26	K/W
Module					
L_{CE}				15	20 nH
$R_{CC'+EE'}$	terminal-chip	$T_C = 25^\circ\text{C}$		0.25	m Ω
		$T_C = 125^\circ\text{C}$		0.5	m Ω
$R_{th(c-s)}$	per module			0.02	0.038 K/W
M_s	to heat sink M6		3	5	Nm
M_t		to terminals M6	2.5	5	Nm
					Nm
w				325	g



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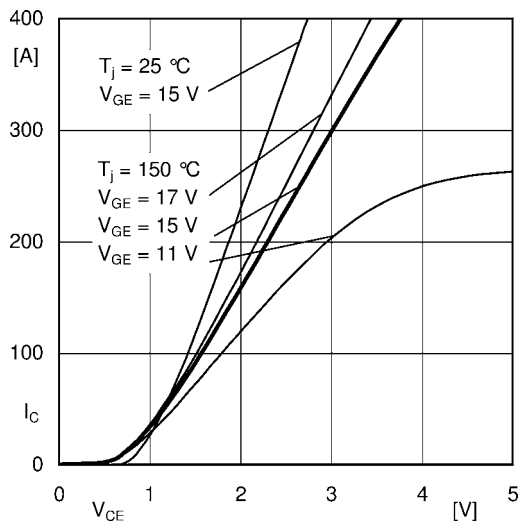


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_E'$

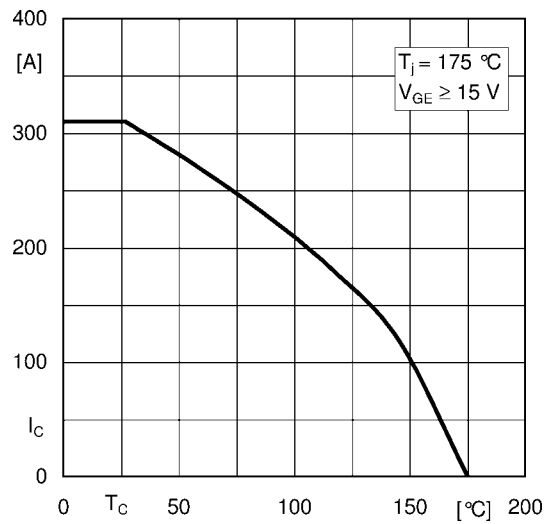


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

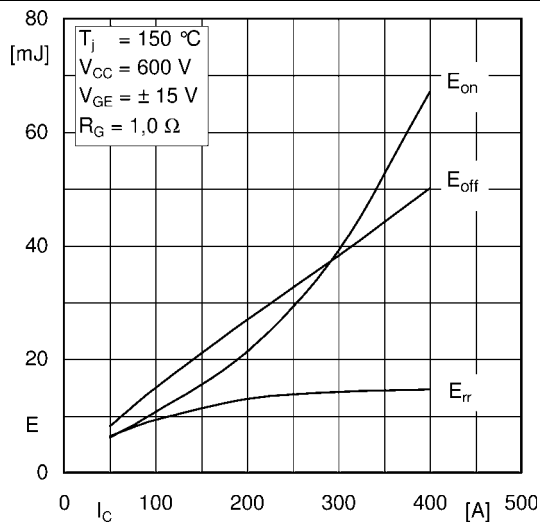


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

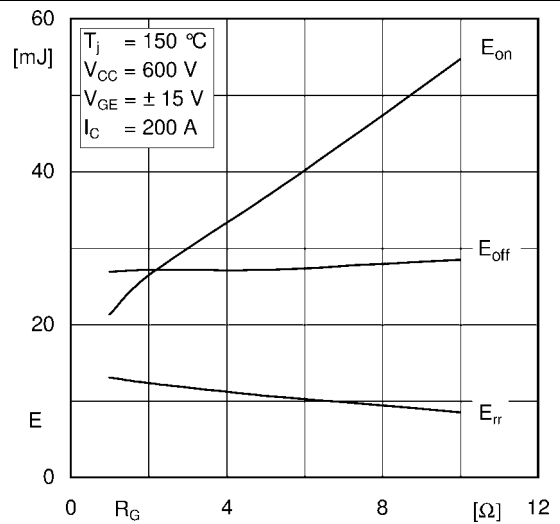


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

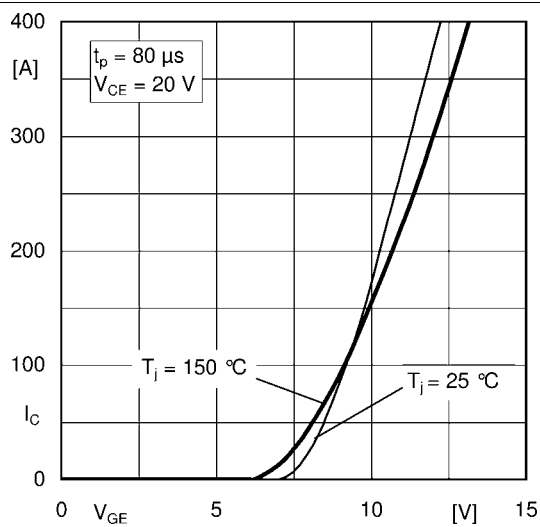


Fig. 5: Typ. transfer characteristic

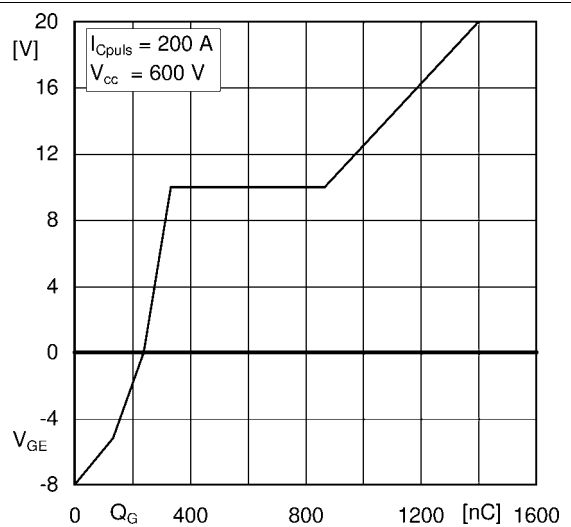


Fig. 6: Typ. gate charge characteristic

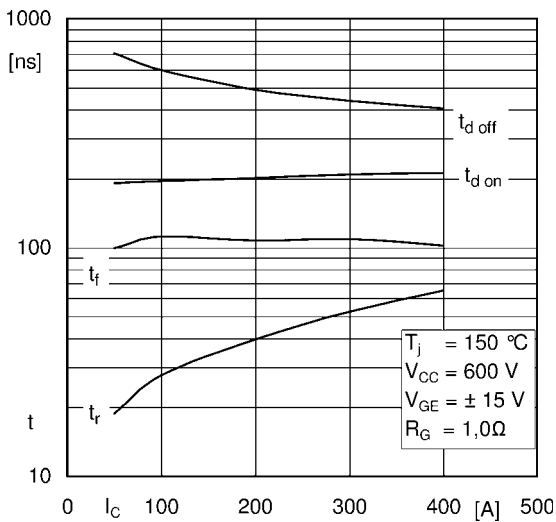


Fig. 7: Typ. switching times vs. I_C

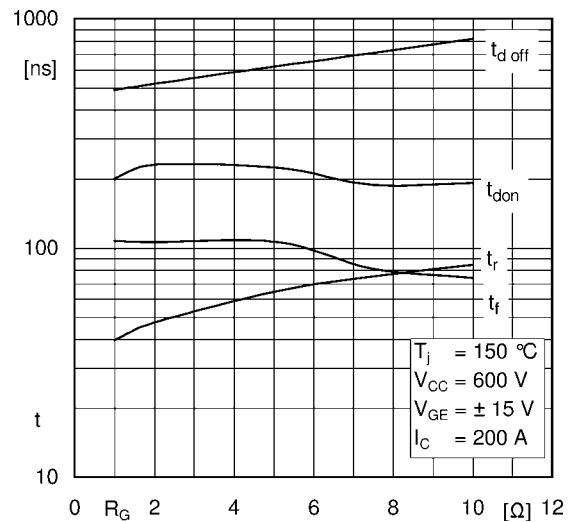


Fig. 8: Typ. switching times vs. gate resistor R_G

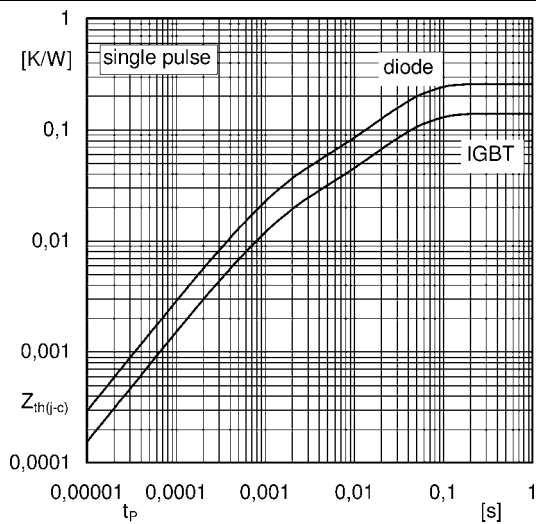


Fig. 9: Transient thermal impedance

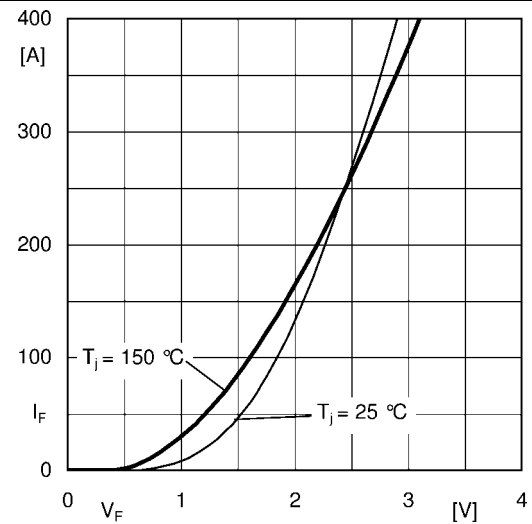


Fig. 10: CAL diode forward characteristic

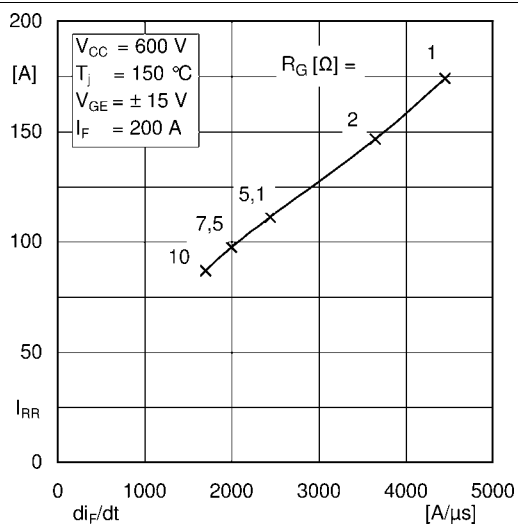


Fig. 11: CAL diode peak reverse recovery current

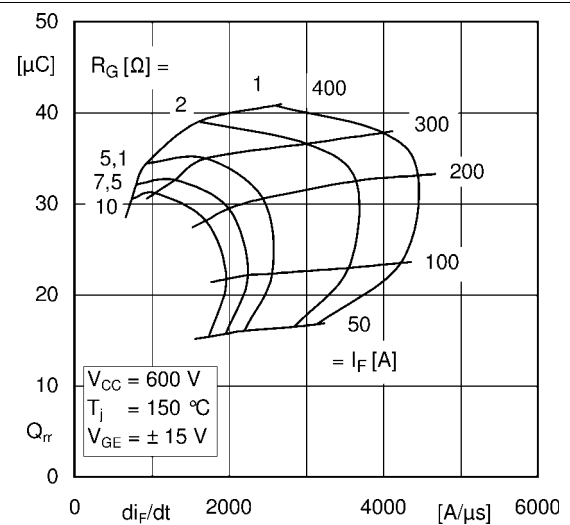
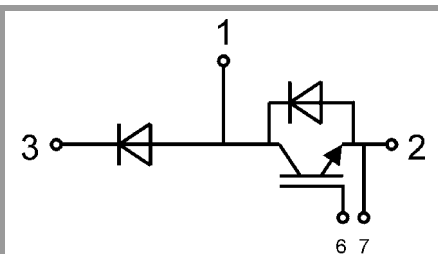


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

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