



SEMITRANS®3

Fast IGBT4 Modules

SKM150GB12T4G

Features

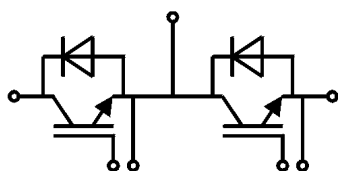
- IGBT4 = 4. Generation (Trench)IGBT
- VCEsat with positive temperature coefficient
- High short circuit capability, self limiting to $6 \times I_{CNOM}$
- Soft switching 4. Generation CAL diode (CAL4)

Typical Applications

- AC inverter drives
- UPS
- Electronic welders at fsw up to 20 kHz

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max, recomb. $T_{op} = -40 \dots +150^\circ\text{C}$, 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}		150	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	450	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	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$ $T_c = 80^\circ\text{C}$	183 A 137 A
I_{Fnom}		150	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	450	A
I_{FSM}	$t_p = 10\text{ ms}$, sin 180° , $T_j = 25^\circ\text{C}$	774	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					
$V_{CE(sat)}$	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.85 2.25	2.1 2.45	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}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	7.0 10.3	8.0 11.0	$\text{m}\Omega$ $\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}$, $I_C = 6\text{ mA}$	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}	$V_{CE} = 25\text{ V}$	$f = 1\text{ MHz}$	8.8		nF
C_{oes}	$V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.58		nF
C_{res}		$f = 1\text{ MHz}$	0.47		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		850		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		5.0		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	175		ns
t_r	$I_C = 150\text{ A}$	$T_j = 150^\circ\text{C}$	38		ns
E_{on}	$V_{GE} = \pm 15\text{ V}$ $R_{G on} = 1\text{ }\Omega$	$T_j = 150^\circ\text{C}$	18.7		mJ
$t_{d(off)}$	$R_{G off} = 1\text{ }\Omega$	$T_j = 150^\circ\text{C}$	400		ns
t_f	$di/dt_{on} = 4400\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	78		ns
E_{off}	$di/dt_{off} = 1800\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	14.1		mJ
$R_{th(j-c)}$	per IGBT			0.2	K/W



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- Soft switching 4. Generation CAL diode (CAL4)

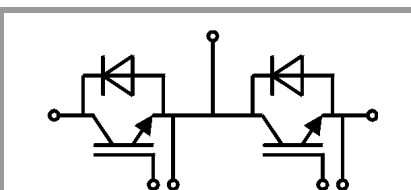
Typical Applications

- AC inverter drives
- UPS
- Electronic welders at fsw up to 20 kHz

Remarks

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

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 150 A V _{GE} = 0 V chip	T _j = 25 °C		2.17	2.49	V
		T _j = 150 °C		2.11	2.42	V
V _{F0}		T _j = 25 °C		1.3	1.5	V
		T _j = 150 °C		0.9	1.1	V
r _F		T _j = 25 °C		5.8	6.6	mΩ
		T _j = 150 °C		8.1	8.8	mΩ
I _{RRM}	I _F = 150 A di/dt _{off} = 3100 A/μs	T _j = 150 °C		116		A
Q _{rr}		T _j = 150 °C		26		μC
E _{rr}		T _j = 150 °C		9		mJ
R _{th(j-c)}	per diode				0.32	K/W
Module						
L _{CE}				15	20	nH
R _{CC'+EE'}	terminal-chip	T _C = 25 °C		0.25		mΩ
		T _C = 125 °C		0.5		mΩ
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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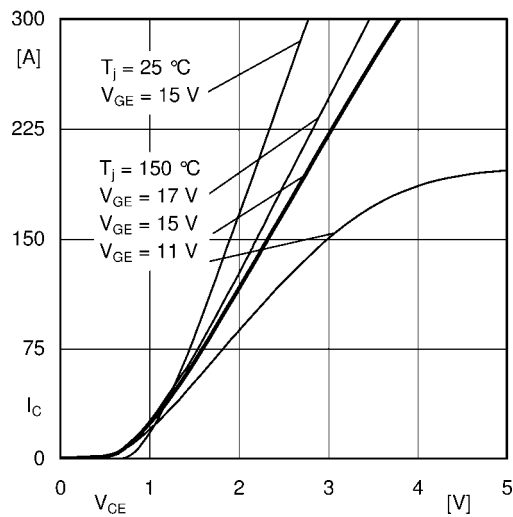


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_{E'}$

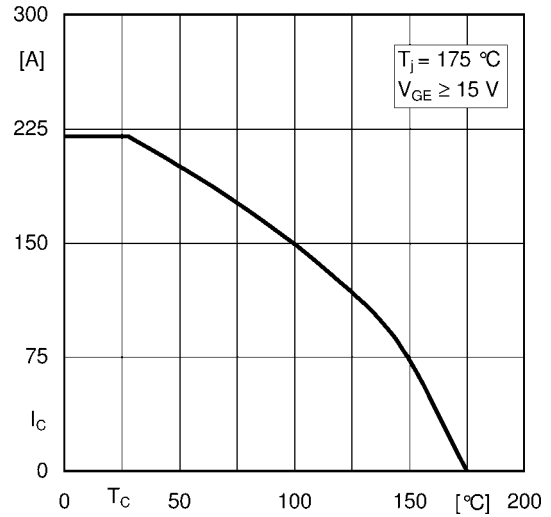


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

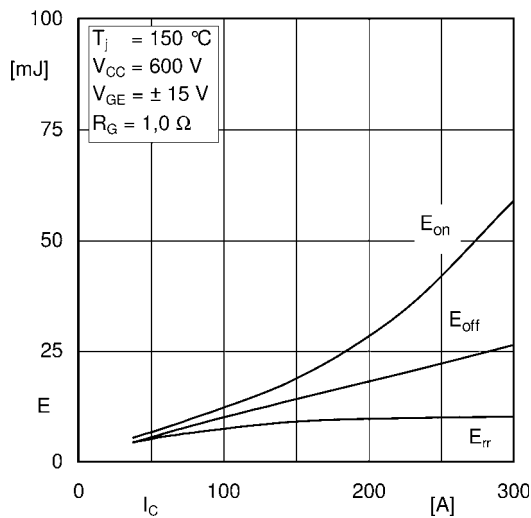


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

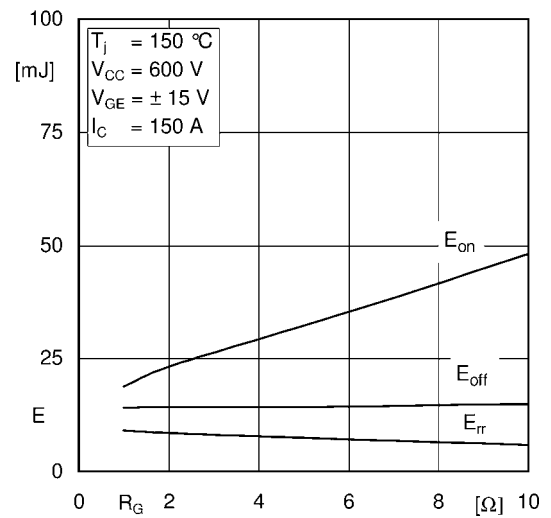


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

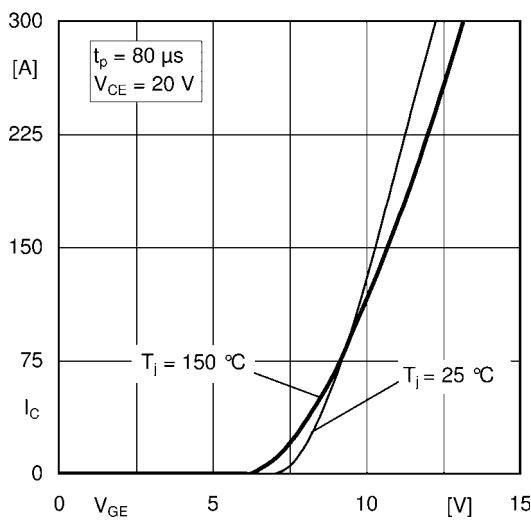


Fig. 5: Typ. transfer characteristic

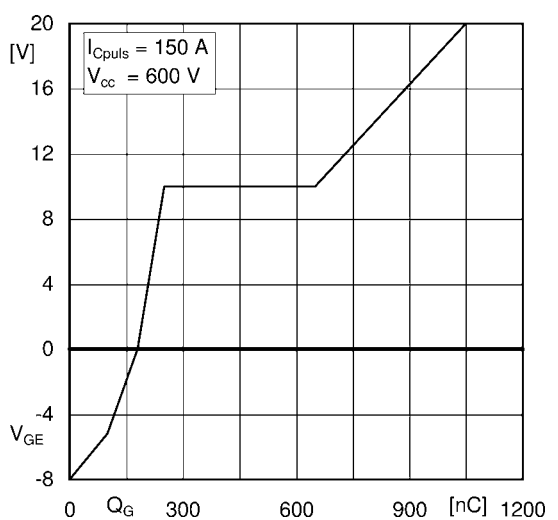


Fig. 6: Typ. gate charge characteristic

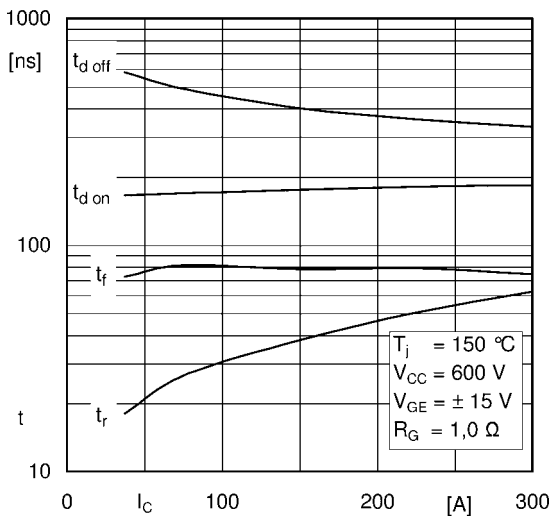


Fig. 7: Typ. switching times vs. I_C

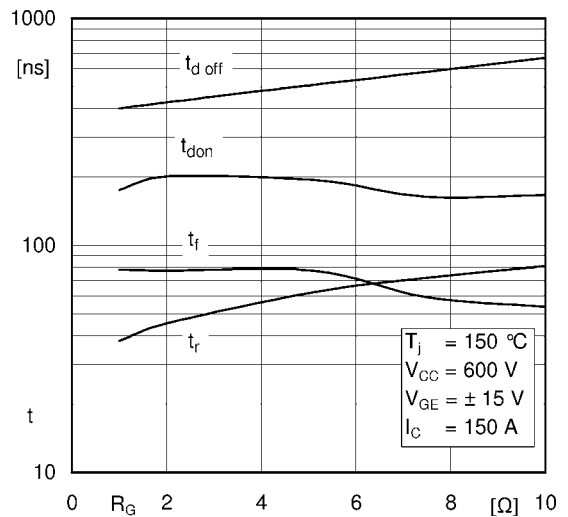


Fig. 8: Typ. switching times vs. gate resistor R_G

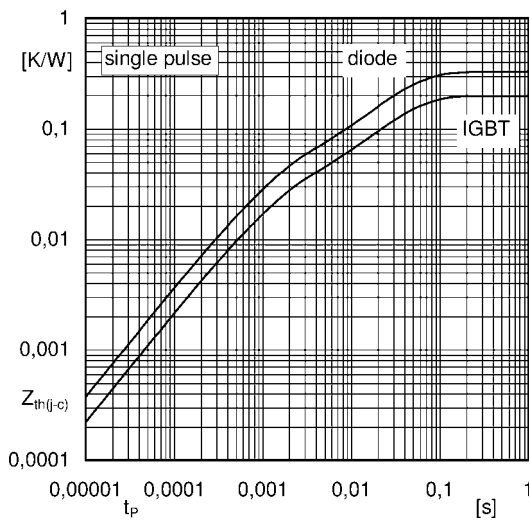


Fig. 9: Transient thermal impedance

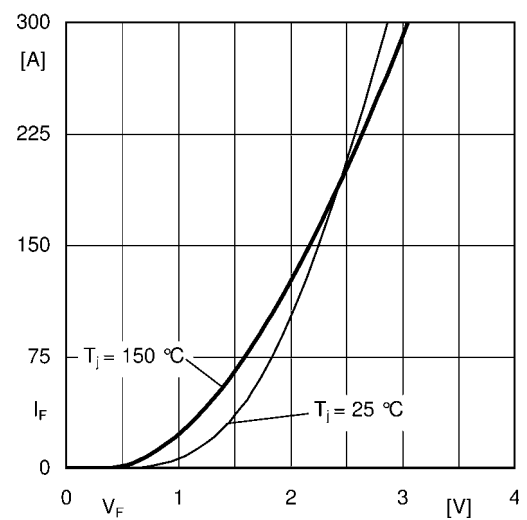


Fig. 10: CAL diode forward characteristic

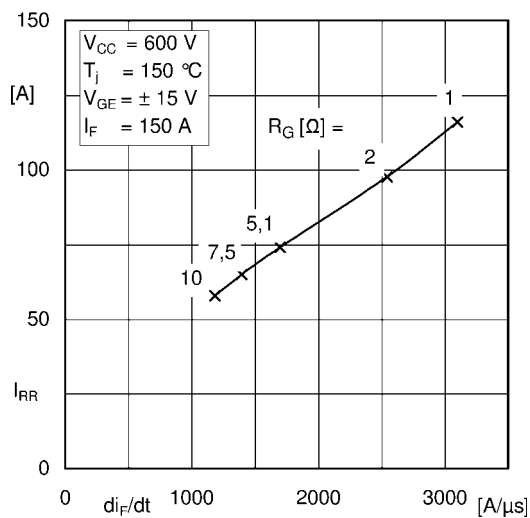


Fig. 11: CAL diode peak reverse recovery current

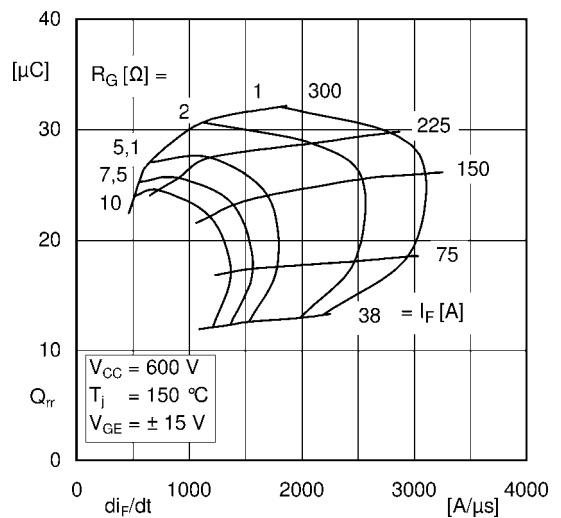
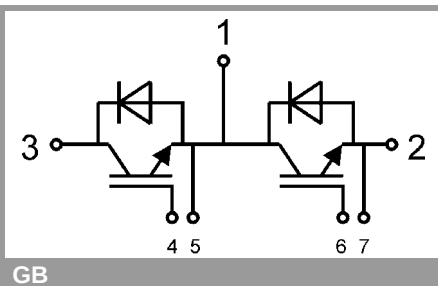


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

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