



SEMITRANS® 3

Fast IGBT4 Modules

SKM200GM12T4

Features

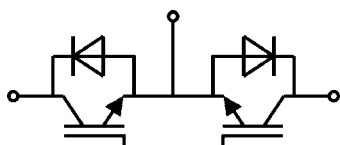
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I_{Cnom}
- Fast & soft inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Isolated copper baseplate using DBC Technology (Direct Copper Bonding)

Typical Applications

- Matrix Inverter

Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max, recomm.
 $T_{op} = -40 \dots +150^\circ\text{C}$, 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	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	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}	$V_{CC} = 800\text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
	$V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$			
T_j			-40 ... 175	$^\circ\text{C}$
Inverse diode				
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	$^\circ\text{C}$
Module				
$I_{t(RMS)}$			500	A
T_{stg}			-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50Hz, t = 1 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	$T_j = 25^\circ\text{C}$	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
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		mA
		$T_j = 150^\circ\text{C}$				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
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		185		ns
t_r	$I_C = 200\text{ A}$ $V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		40		ns
		$T_j = 150^\circ\text{C}$		21		mJ
E_{on}	$R_{Gon} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		21		mJ
$t_{d(off)}$	$R_{Goff} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		425		ns
t_f	$di/dt_{on} = 5500\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		82		ns
E_{off}	$di/dt_{off} = 2300\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		20		mJ
$R_{th(j-c)}$	per IGBT				0.14	K/W



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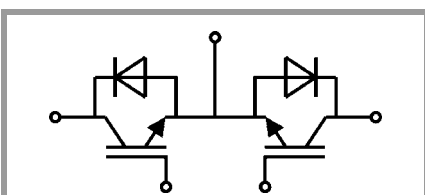
Typical Applications

- Matrix Inverter

Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 200 \text{ A}$ $V_{GE} = 0 \text{ V}$ chip	$T_j = 25^\circ\text{C}$		2.2	2.52	V
		$T_j = 150^\circ\text{C}$		2.15	2.47	V
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}	$V_{GE} = \pm 15 \text{ V}$ $V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$		13		mJ
$R_{th(j-c)}$	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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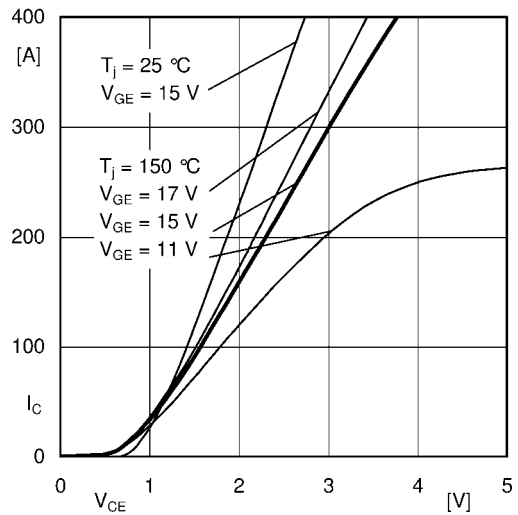


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

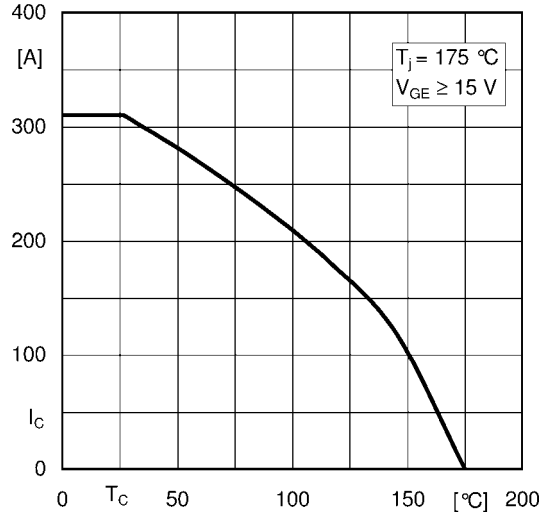


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

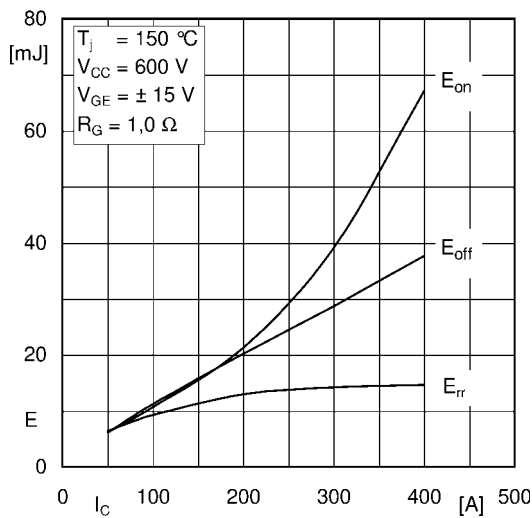


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

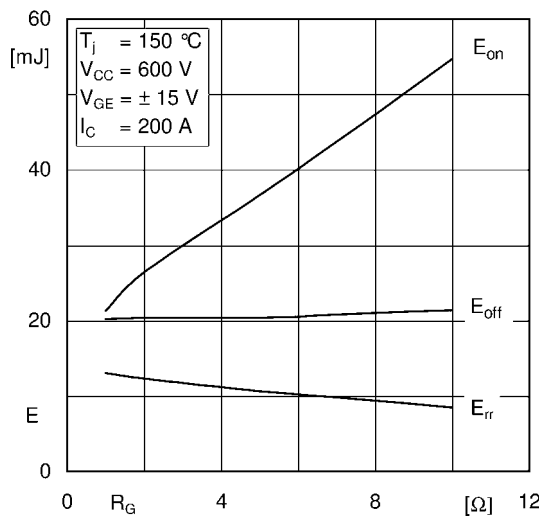


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

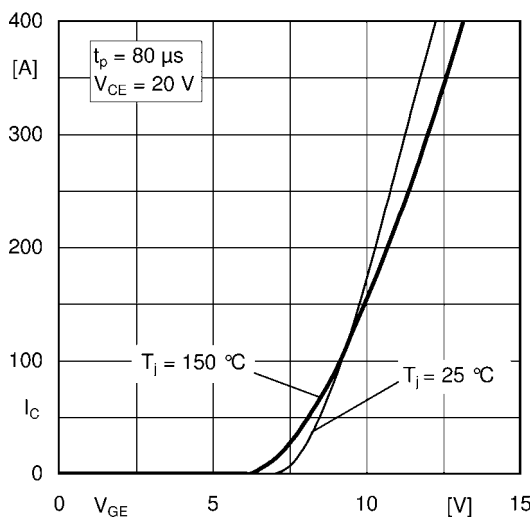


Fig. 5: Typ. transfer characteristic

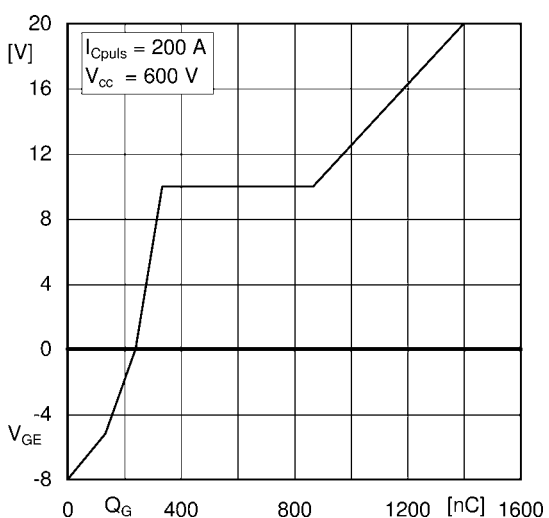


Fig. 6: Typ. gate charge characteristic

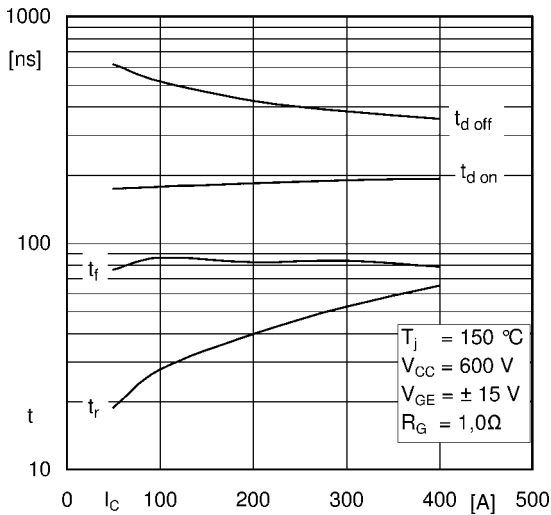


Fig. 7: Typ. switching times vs. I_C

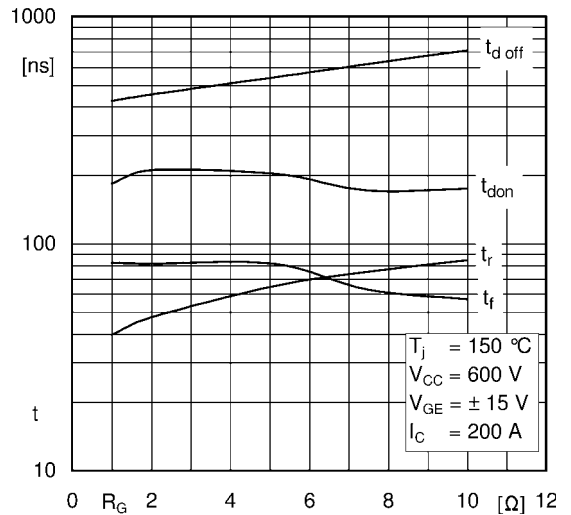


Fig. 8: Typ. switching times vs. gate resistor R_G

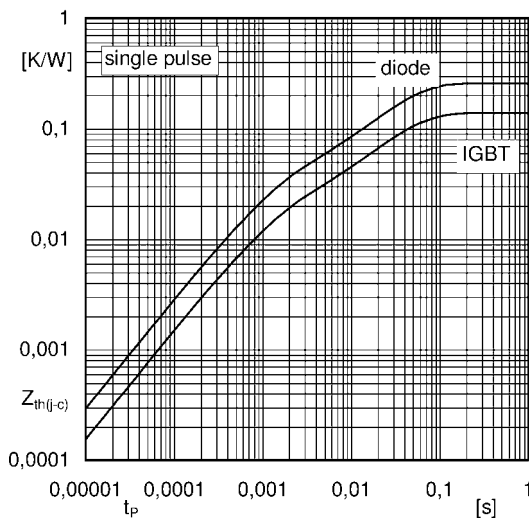


Fig. 9: Transient thermal impedance

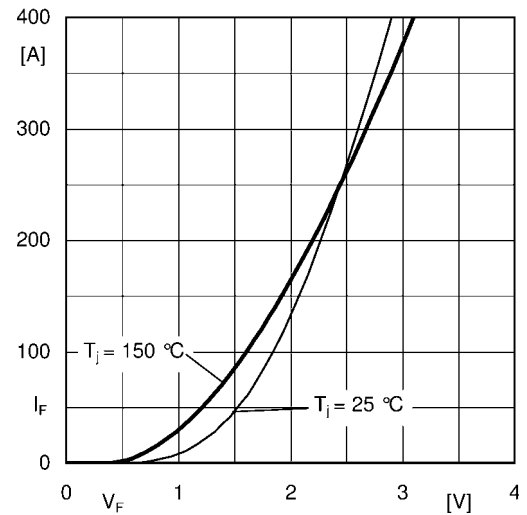


Fig. 10: CAL diode forward characteristic

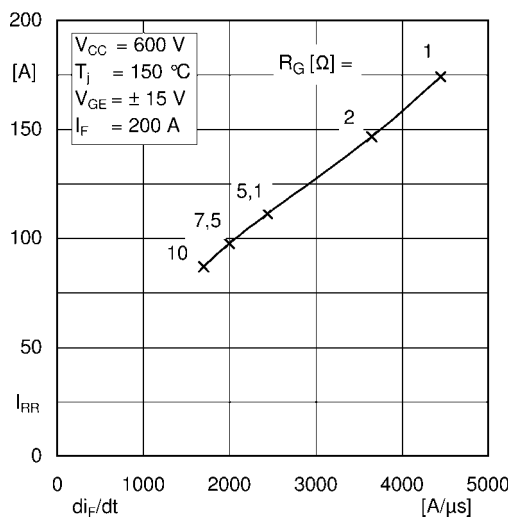


Fig. 11: CAL diode peak reverse recovery current

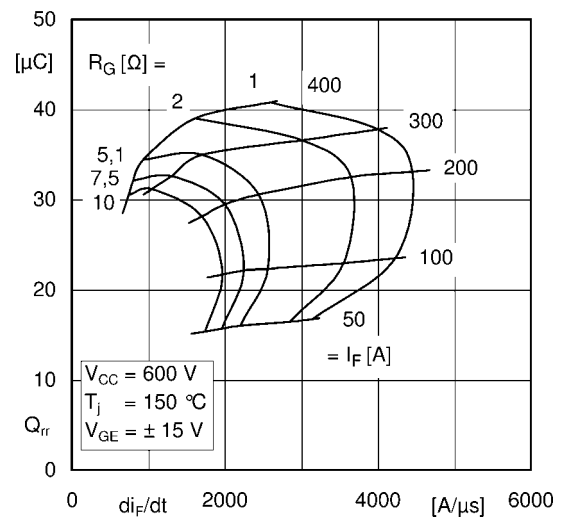
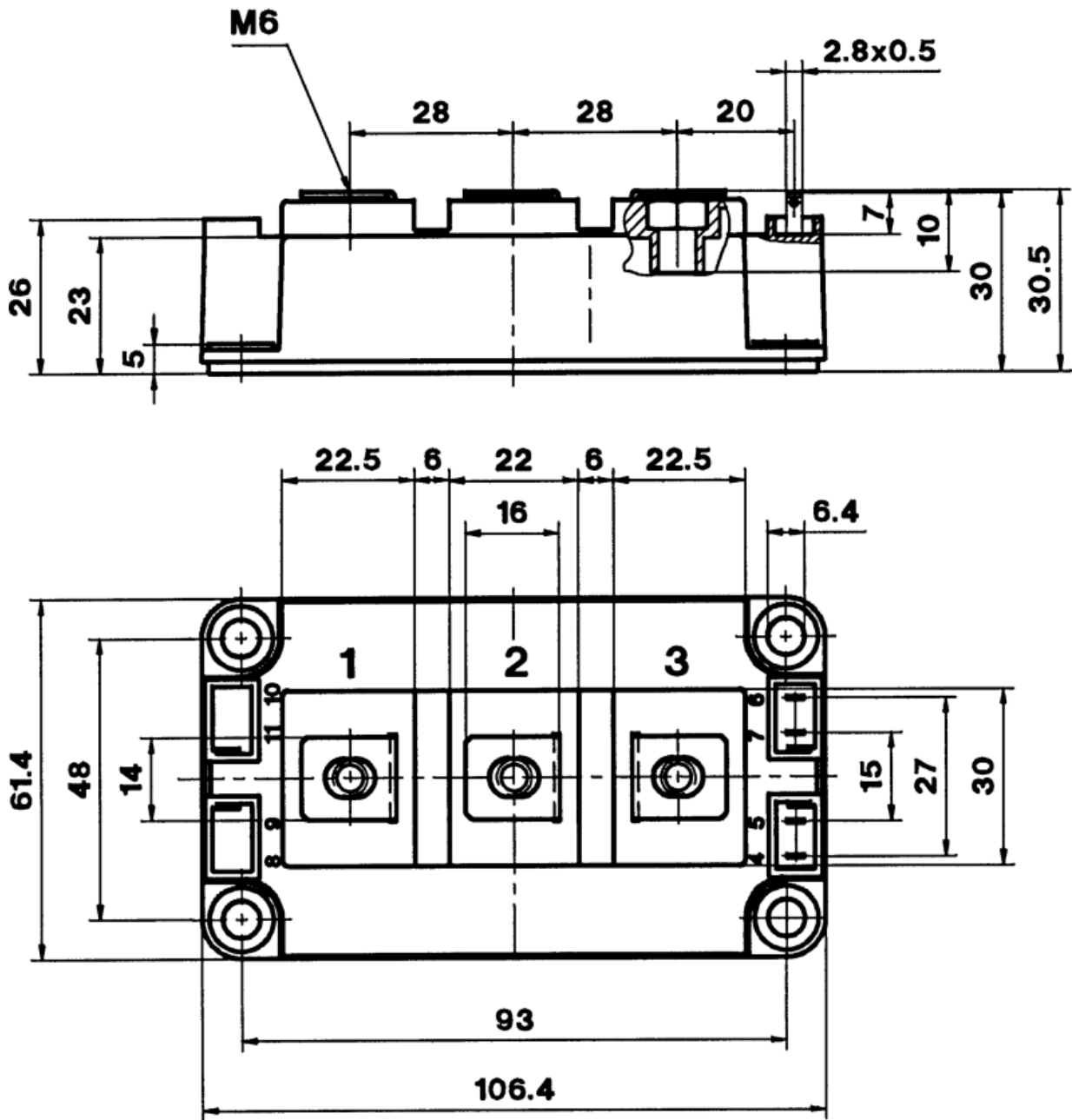
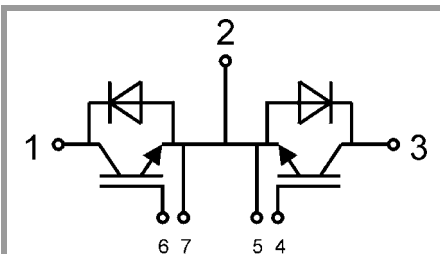


Fig. 12: Typ. CAL diode peak reverse recovery charge



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

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