SKM400GB12M7

SEMITRANS 3

IGBT M7 Modules

SKM400GB12M7

Features*

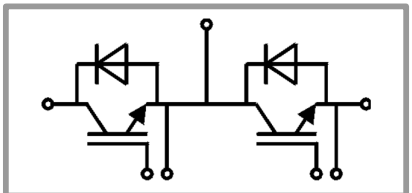
- $V_{CE(sat)}$ with positive temperature coefficient
- High overload capability
- Low loss high density IGBT´s
- Fast & soft switching inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Insulated copper baseplate using DBC Technology (Direct Bonded Copper)
- UL recognized, file no. E63532

Typical Applications

- AC inverter drives
- UPS

Remarks

- Max. case temperature limited to $T_C = T_S = 125$ °C
- Product reliability results are valid for $T_j = 150$ °C (recommended $T_{j,op}$ = -40...+150 °C)
- For storage and case temperature with TIM see document: "Technical Explanations Thermal Interface Materials"



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Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	555	A
		T_c = 80 °C	424	A
I_{Cnom}			400	A
I_{CRM}			800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 1200 V	T_j = 150 °C	8	µs
T_j			-40 ... 175	°C
Inverse diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_c = 25 °C	440	A
		T_c = 80 °C	329	A
I_{FRM}			800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		1980	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			500	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min		4000	V

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
$V_{CE(sat)}$	I_C = 400 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.55	1.85	V
		T_j = 150 °C		1.80		V
V_{CE0}	chiplevel	T_j = 25 °C		0.84	0.90	V
		T_j = 150 °C		0.72		V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.78	2.4	mΩ
		T_j = 150 °C		2.7		mΩ
$V_{GE(th)}$	V_{CE} = 10V, I_C = 40 mA		5.4	6	6.6	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				4.0	mA
C_{ies}	V_{CE} = 10 V V_{GE} = 0 V	f = 1 MHz		84.0		nF
C_{oes}		f = 1 MHz		2.61		nF
C_{res}		f = 1 MHz		1.12		nF
Q_G	V_{GE} = - 8V ... + 15 V			4000		nC
R_{Gint}	T_j = 25 °C			1.5		Ω
$t_{d(on)}$	V_{CC}= 600 V I_C= 400 A V_{GE} =+15/-15V $R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω di/dt_{on} = 6000 A/µs di/dt_{off} = 3350 A/µs	T_j = 150 °C		320		ns
t_r		T_j = 150 °C		66		ns
E_{on}		T_j = 150 °C		36		mJ
$t_{d(off)}$		T_j = 150 °C		420		ns
t_f		T_j = 150 °C		97		ns
E_{off}		T_j = 150 °C		48		mJ
$R_{th(j-c)}$	per IGBT				0.091	K/W
$R_{th(c-s)}$	per IGBT, P12 (reference)			0.038		K/W
$R_{th(c-s)}$	per IGBT, HP-PCM			0.027		K/W

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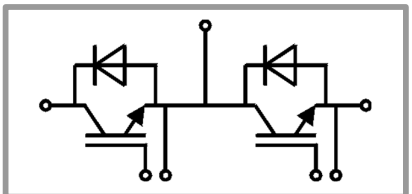

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	I_F = 400 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.20	2.52	V
		T_j = 150 °C		2.14		V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90		V
r_F	chiplevel	T_j = 25 °C		2.3	2.6	mΩ
		T_j = 150 °C		3.1		mΩ
I_{RRM}	V_{CC} = 600 V, I_F = 400 A, V_{GE} = -15 V, di/dt_{off} = 6650 A/µs	T_j = 150 °C		380		A
Q_{rr}		T_j = 150 °C		60		µC
E_{rr}		T_j = 150 °C		28		mJ
$R_{th(j-c)}$	per diode				0.14	K/W
$R_{th(c-s)}$	per diode, P12 (reference)			0.042		K/W
$R_{th(c-s)}$	per diode, HP-PCM			0.035		K/W
Module						
L_{CE}				15		nH
$R_{CC'+EE'}$	measured per switch	T_j = 25 °C		0.55		mΩ
		T_j = 150 °C		0.85		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling, P12 (reference)			0.0101		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, P12 (reference)			0.015		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, HP-PCM			0.0085		K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminal M6	2.5		5	Nm
				-		Nm
w					325	g

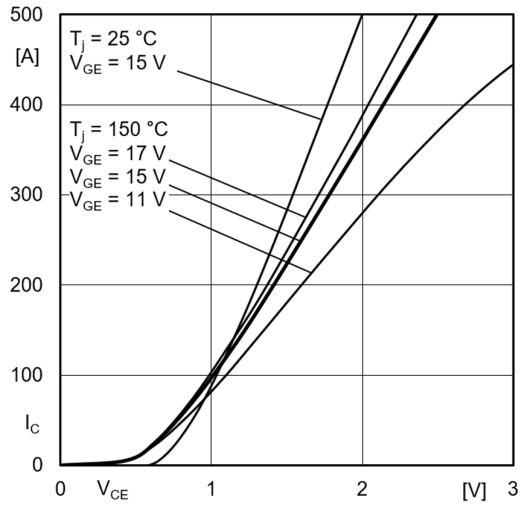


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

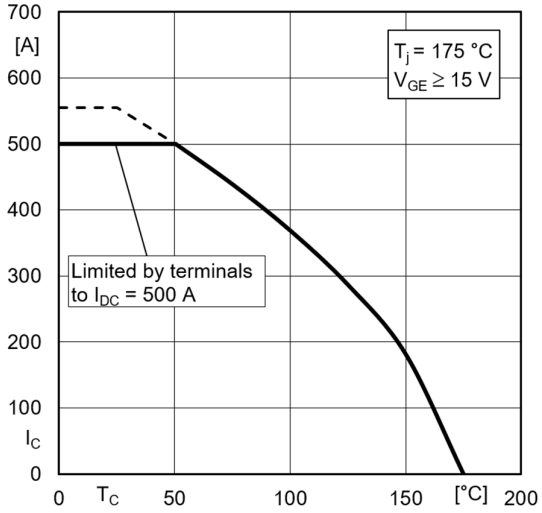


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

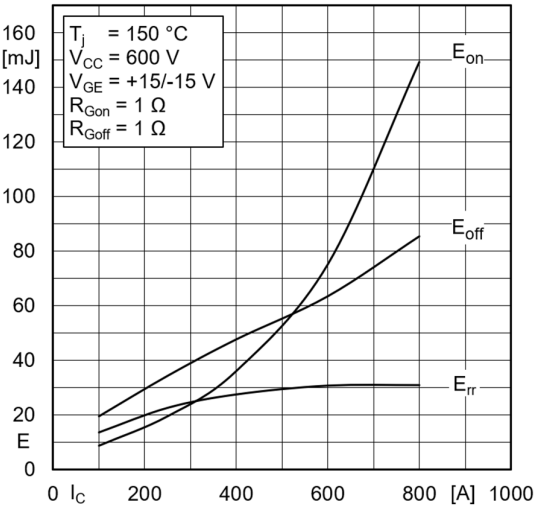


Fig. 3: Typ. turn-on /-off energy = f (I_C)

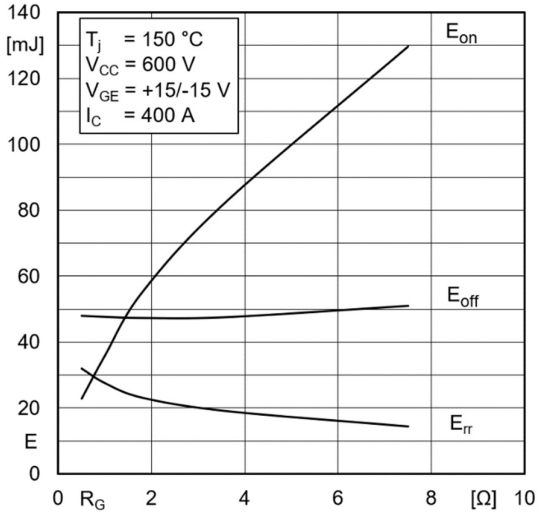


Fig. 4: Typ. turn-on /-off energy = f (R_G)

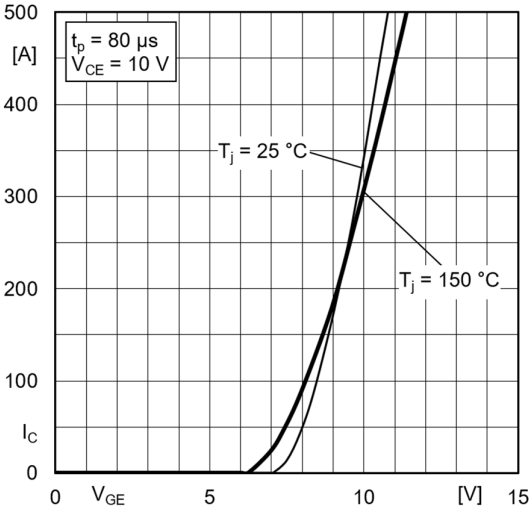


Fig. 5: Typ. transfer characteristic

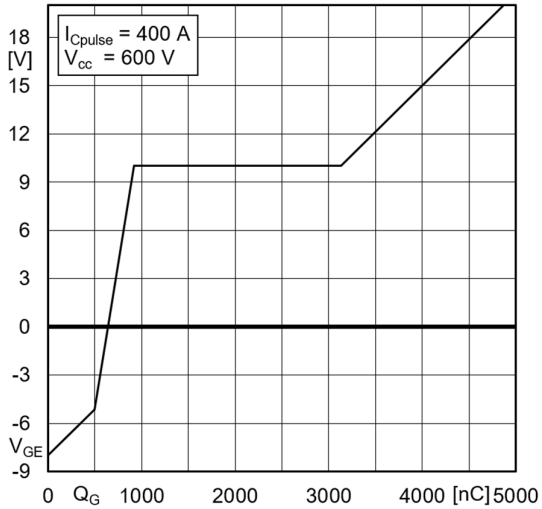


Fig. 6: Typ. gate charge characteristic

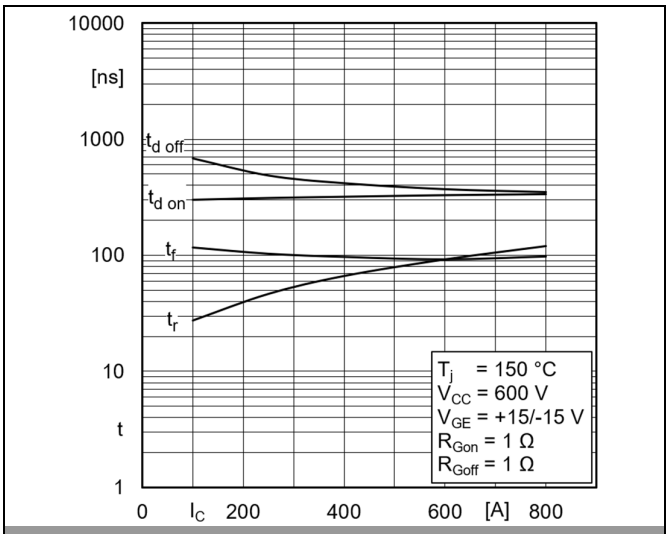


Fig. 7: Typ. switching times vs. I_C

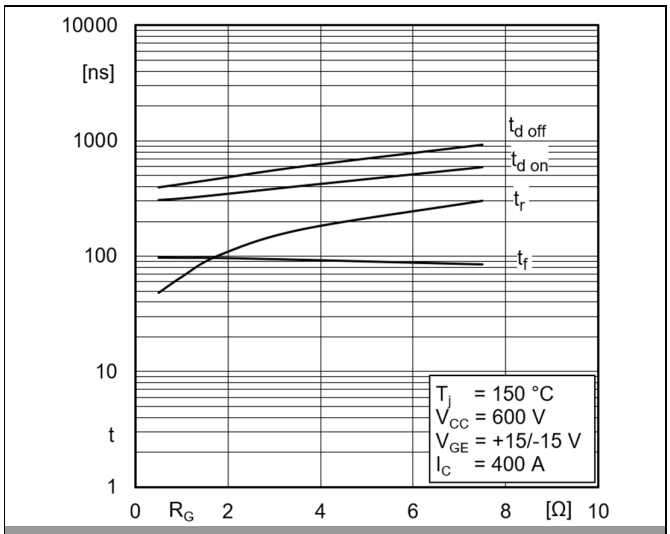


Fig. 8: Typ. switching times vs. gate resistor R_G

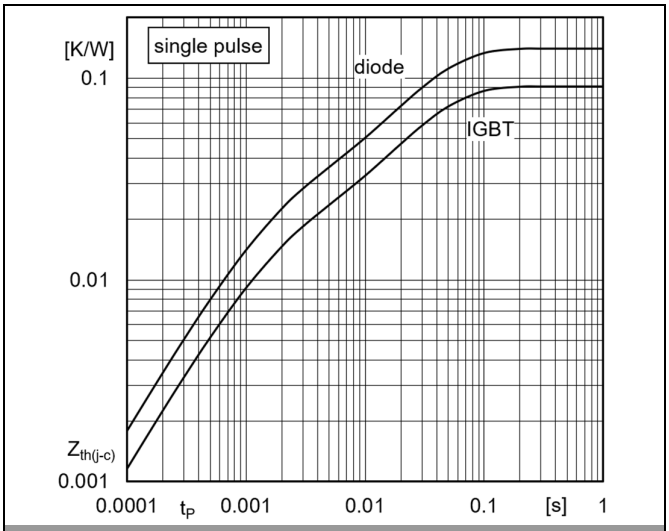


Fig. 9: Transient thermal impedance

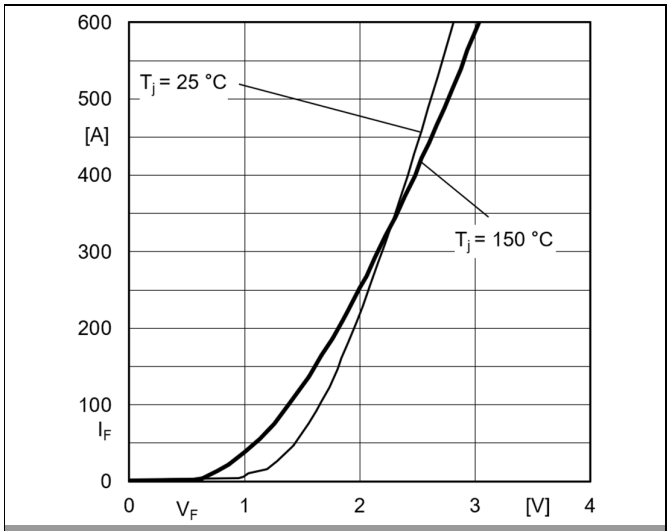


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

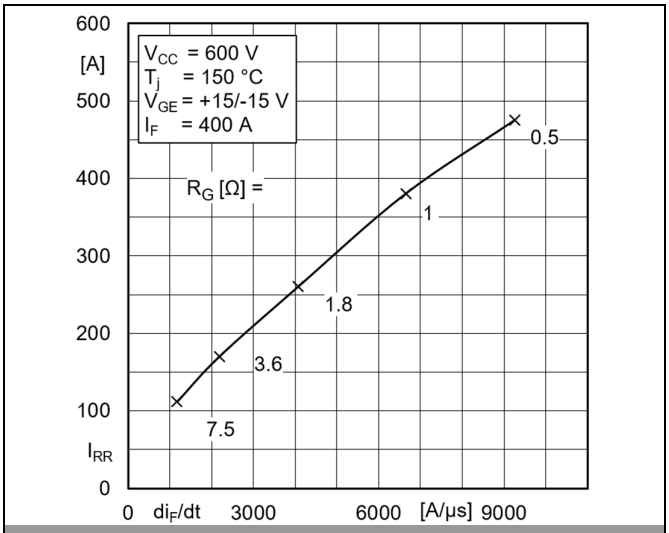


Fig. 11: CAL diode peak reverse recovery current

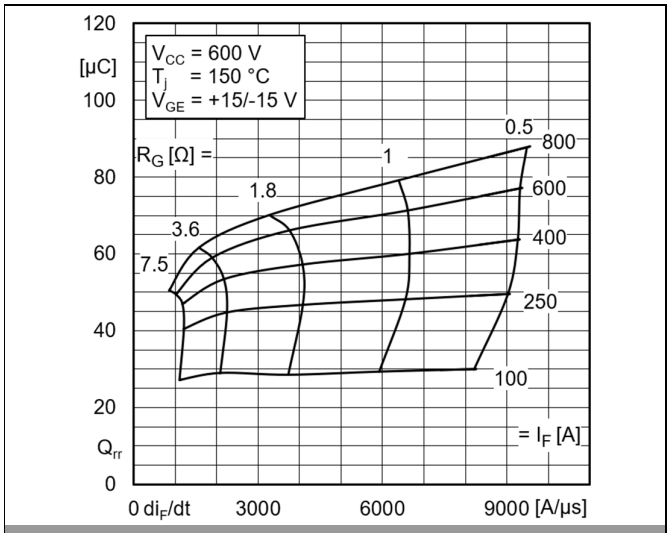
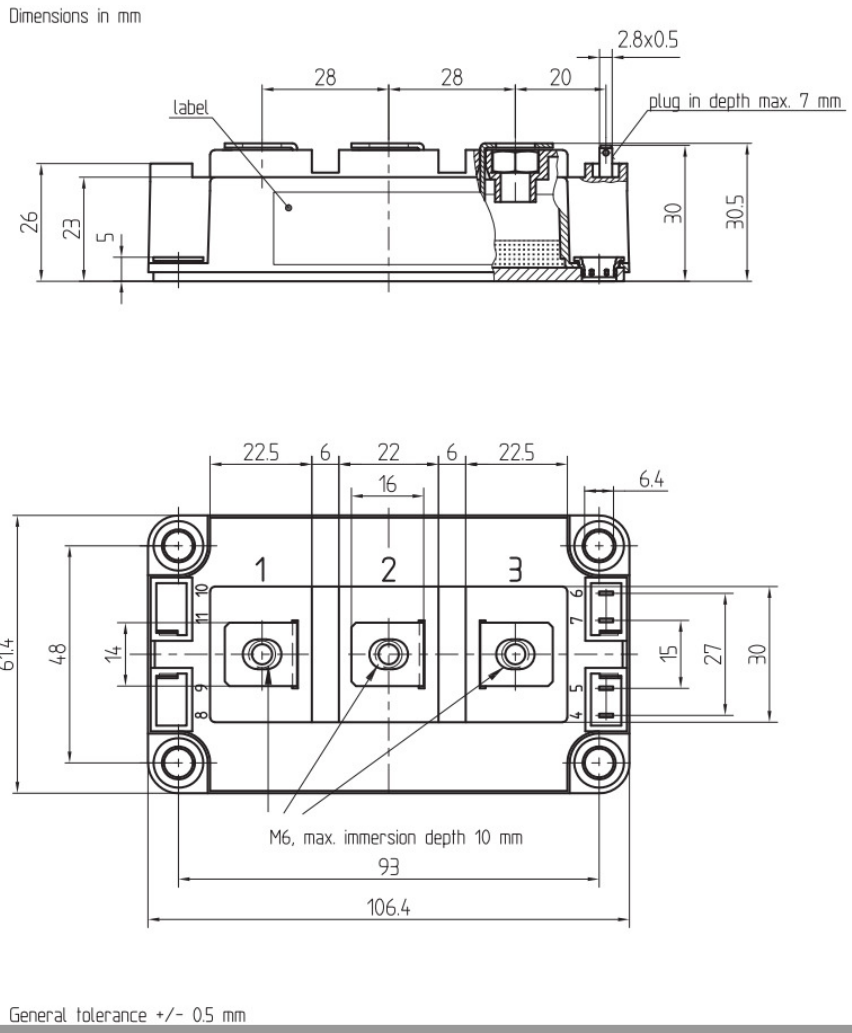
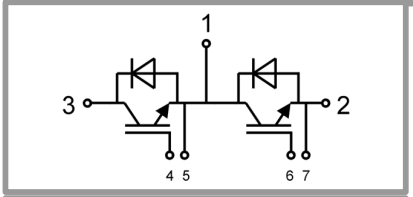


Fig. 12: Typ. CAL diode peak reverse recovery charge



Pinout and Dimensions



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This is an electrostatic discharge sensitive device (ESDS) according to international standard IEC 61340.

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