SKM460GM12M7

SEMITRANS 3

IGBT M7 Modules

SKM460GM12M7

Features*

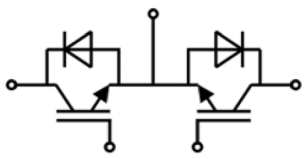
- $V_{CE(sat)}$ with positive temperature coefficient
- High overload capability
- Low loss high density IGBT´s
- Fast & soft switching inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Insulated copper baseplate using DBC Technology (Direct Bonded Copper)
- UL recognized,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

Typical Applications

- Matrix inverter
- Bidirectional switch

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	581	A
		T_c = 80 °C	442	A
I_{Cnom}			460	A
I_{CRM}			920	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	588	A
		T_c = 80 °C	439	A
I_{FRM}			1000	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		2304	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 = 460 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.54	1.93	V
		T_j = 150 °C		1.81		V
V_{CE0}	chiplevel	T_j = 25 °C		0.86	0.96	V
		T_j = 150 °C		0.75		V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.48	2.1	mΩ
		T_j = 150 °C		2.3		mΩ
$V_{GE(th)}$	V_{CE} = 10V, I_C = 46 mA		5.4	6	6.6	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				4.6	mA
C_{ies}	V_{CE} = 10 V V_{GE} = 0 V	f = 1 MHz		88.0		nF
C_{oes}		f = 1 MHz		2.76		nF
C_{res}		f = 1 MHz		1.08		nF
Q_G	V_{GE} = - 8V ... + 15 V			4100		nC
R_{Gint}	T_j = 25 °C			1.15		Ω
$t_{d(on)}$	V_{CC}= 600 V I_C= 460 A V_{GE} =+15/-15V $R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω di/dt_{on} = 6500 A/µs di/dt_{off} = 4350 A/µs dv/dt = 5900 A/µs	T_j = 150 °C		330		ns
t_r		T_j = 150 °C		83		ns
E_{on}		T_j = 150 °C		60		mJ
$t_{d(off)}$		T_j = 150 °C		400		ns
t_f		T_j = 150 °C		87		ns
E_{off}		T_j = 150 °C		49		mJ
$R_{th(j-c)}$	per IGBT				0.086	K/W
$R_{th(c-s)}$	per IGBT, P12 (reference)			0.032		K/W
$R_{th(c-s)}$	per IGBT, HP-PCM			0.023		K/W

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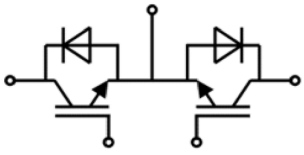

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	I_F = 460 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.05	2.36	V
		T_j = 150 °C		1.96		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		1.64	1.88	mΩ
		T_j = 150 °C		2.3		mΩ
I_{RRM}	V_{CC} = 600 V I_F = 460 A V_{GE} = -15 V di/dt_{off} = 6430 A/µs	T_j = 150 °C		430		A
Q_{rr}		T_j = 150 °C		77		µC
E_{rr}		T_j = 150 °C		33		mJ
$R_{th(j-c)}$	per diode				0.104	K/W
$R_{th(c-s)}$	per diode, P12 (reference)			0.034		K/W
$R_{th(c-s)}$	per diode, HP-PCM			0.024		K/W
Module						
L_{CE}				31		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)			0.0085		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, P12 (reference)			0.013		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, HP-PCM			0.0074		K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminal M6	2.5		5	Nm
				-		Nm
w					325	g

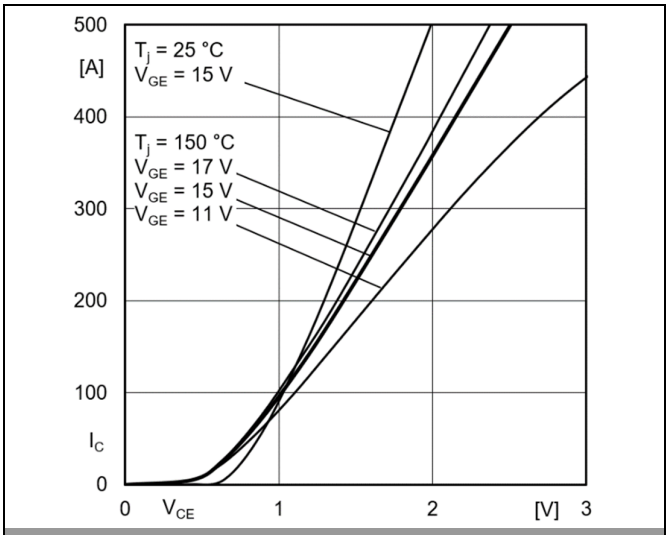


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

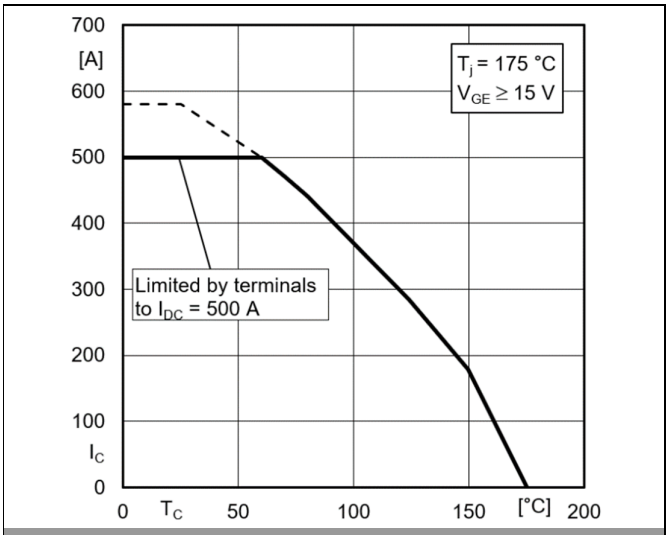


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

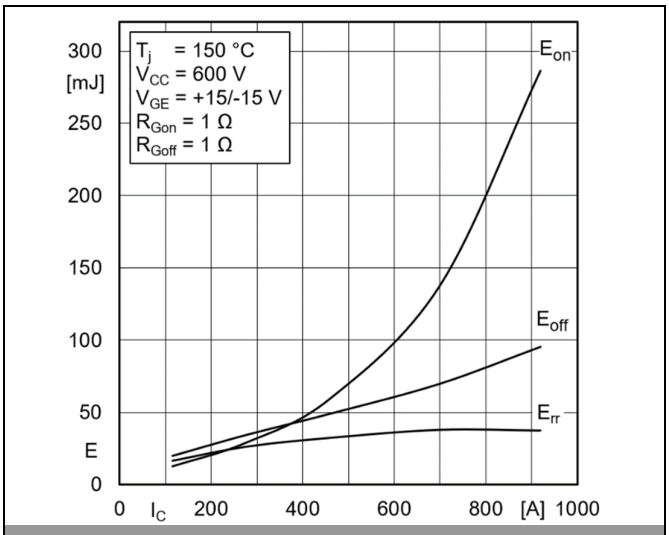


Fig. 3: Typ. turn-on /-off energy = f (I_C)

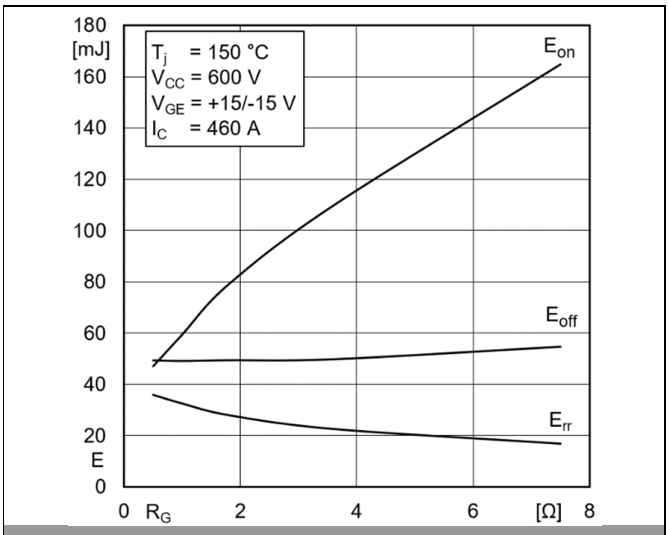


Fig. 4: Typ. turn-on /-off energy = f (R_G)

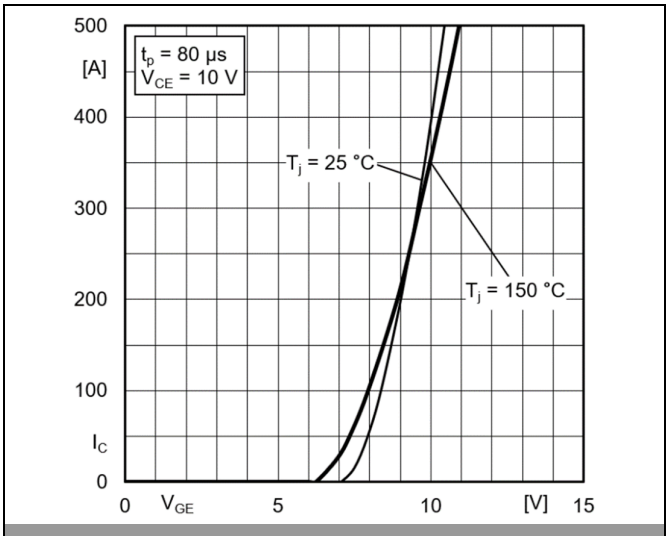


Fig. 5: Typ. transfer characteristic

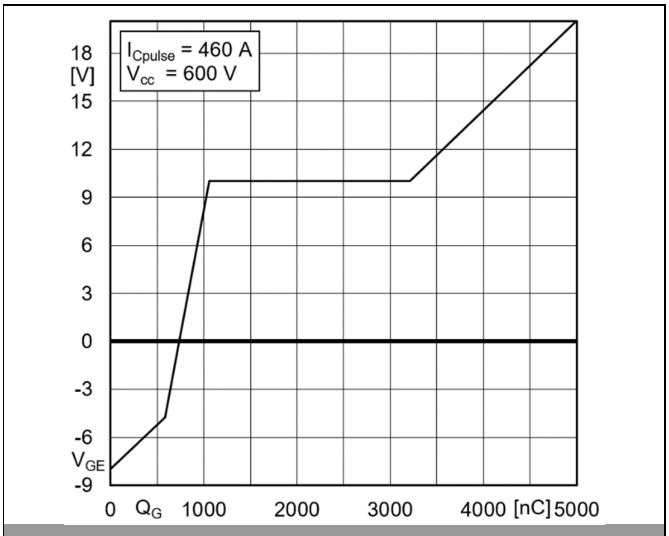


Fig. 6: Typ. gate charge characteristic

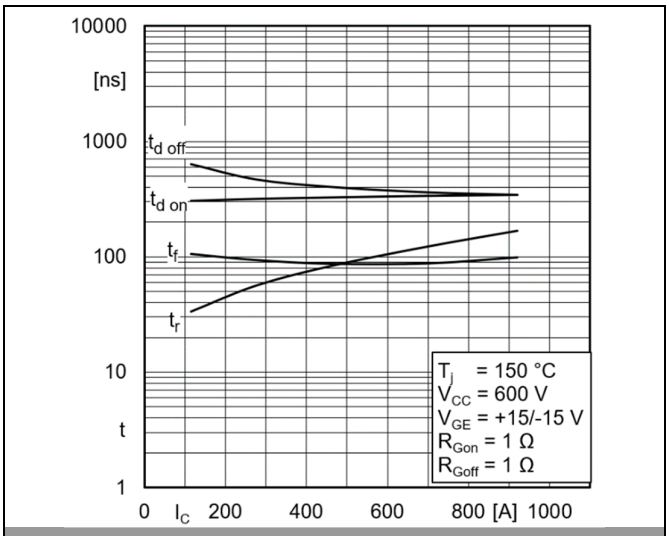


Fig. 7: Typ. switching times vs. I_C

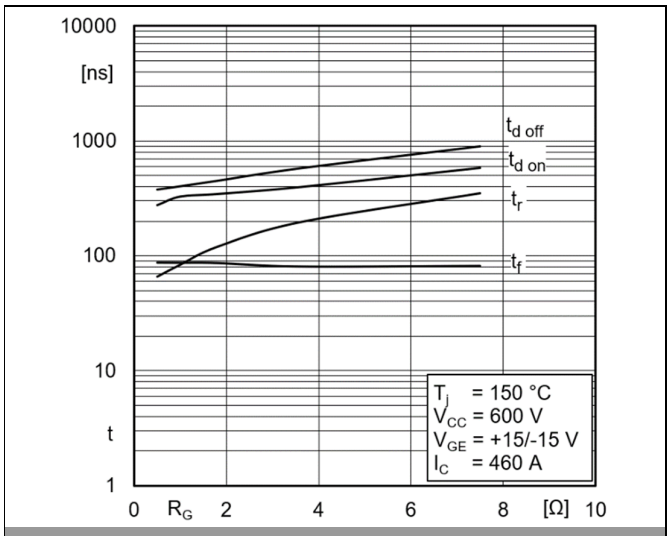


Fig. 8: Typ. switching times vs. gate resistor R_G

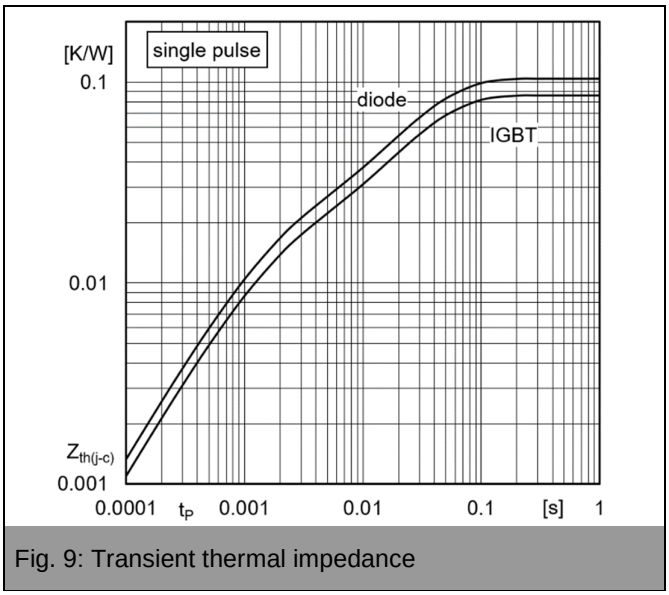


Fig. 9: Transient thermal impedance

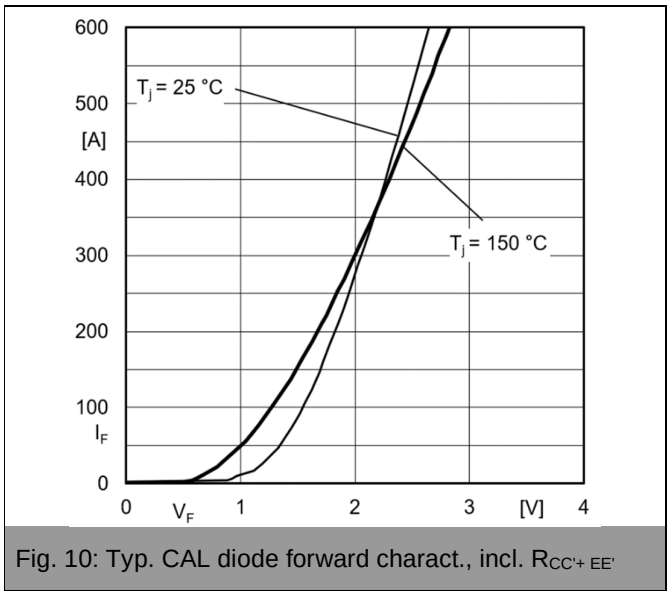
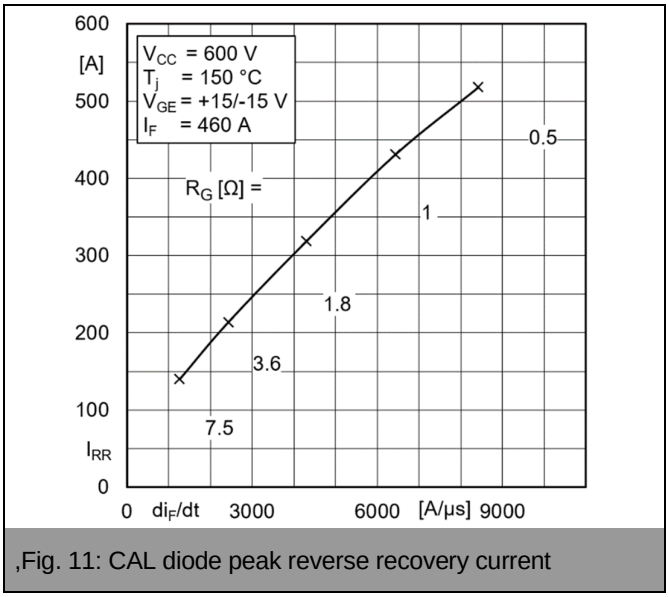


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$



,Fig. 11: CAL diode peak reverse recovery current

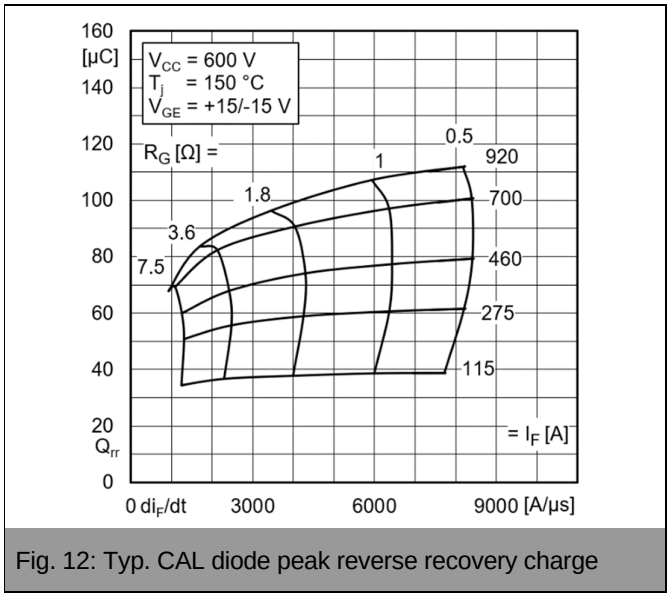
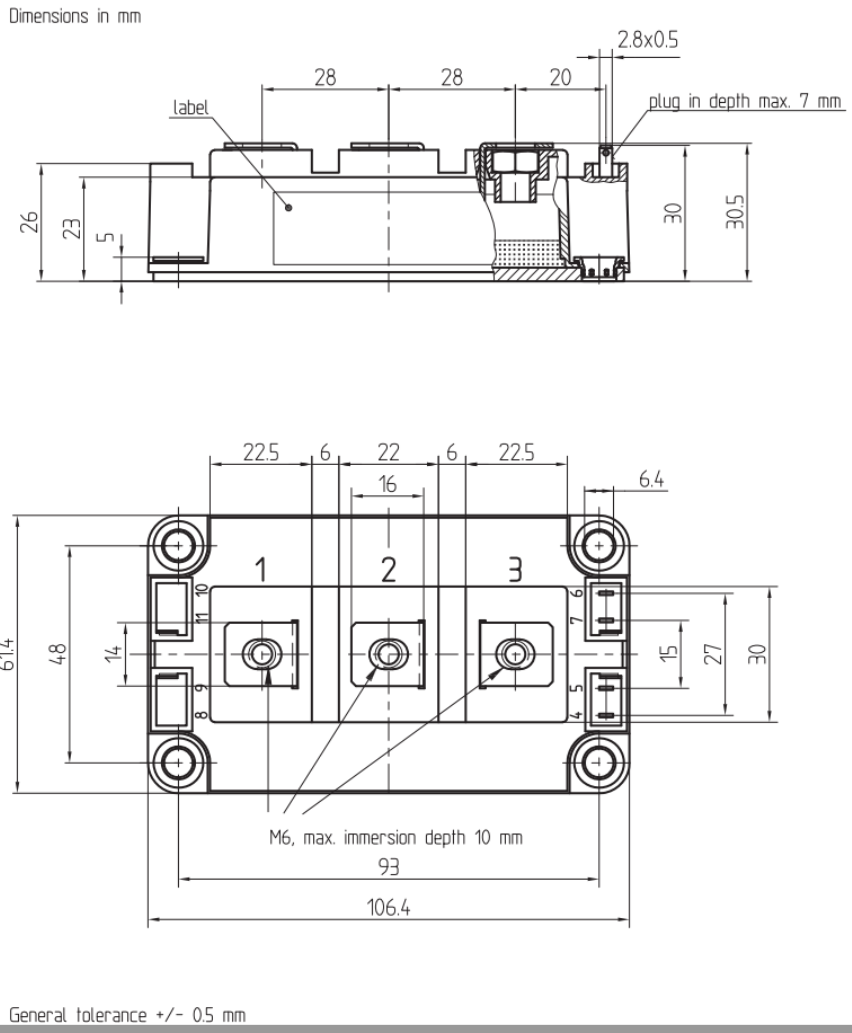
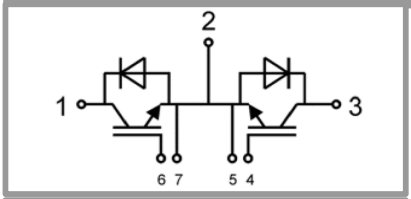


Fig. 12: Typ. CAL diode peak reverse recovery charge



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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