SEMITRANS 3

IGBT M7 Modules

SKM400GB12M7

Features*

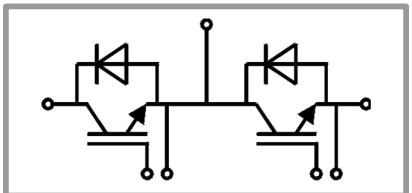
- $V_{CE(sat)}$ with positive temperature coefficient
- High overload capability
- Low loss high density IGBT´s
- Fast & soft switching inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Insulated copper baseplate using DBC Technology (Direct Bonded Copper)
- UL recognized, 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″



GB

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

SEMITRANS® 3

IGBT M7 Modules

SKM400GB12M7

Features*

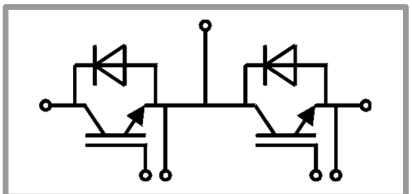
- $V_{CE(sat)}$ with positive temperature coefficient
- High overload capability
- Low loss high density IGBT´s
- Fast & soft switching inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Insulated copper baseplate using DBC Technology (Direct Bonded Copper)
- UL recognized, 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″



GB

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

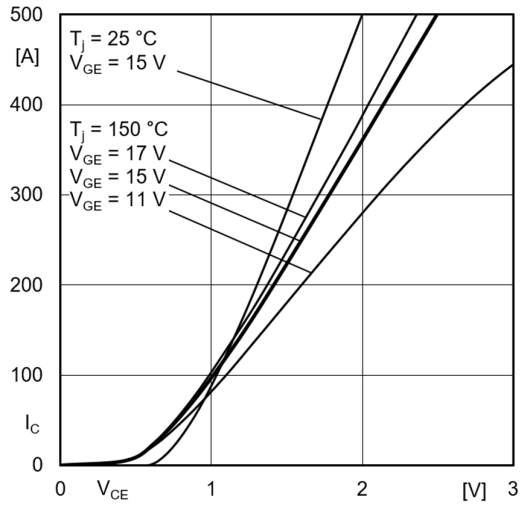


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

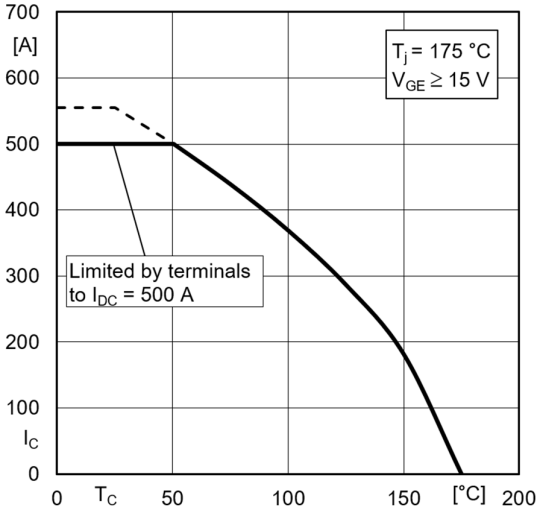


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

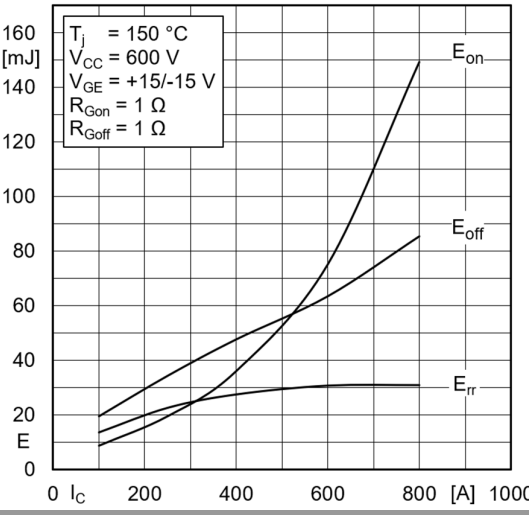


Fig. 3: Typ. turn-on /-off energy = f (I_C)

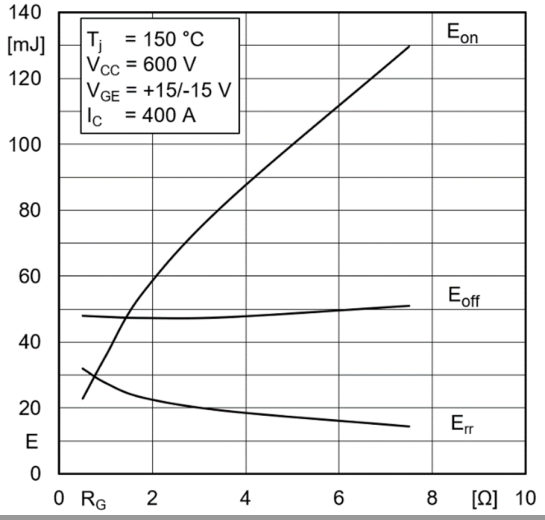


Fig. 4: Typ. turn-on /-off energy = f (R_G)

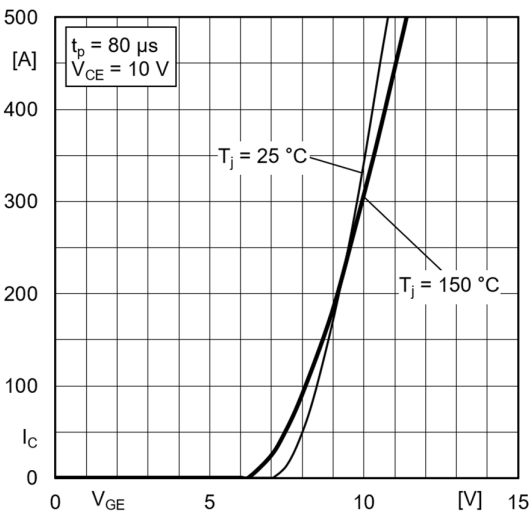


Fig. 5: Typ. transfer characteristic

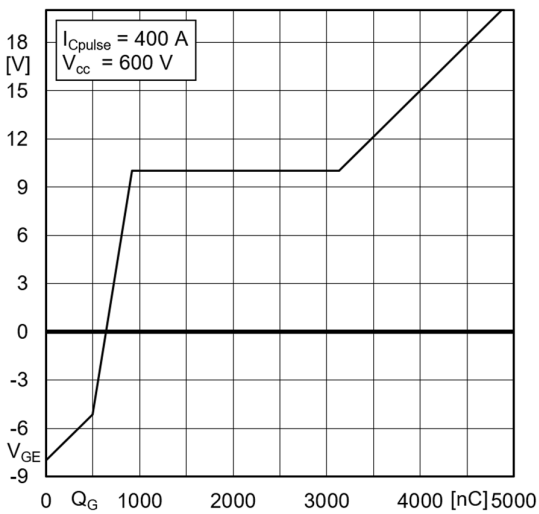


Fig. 6: Typ. gate charge characteristic

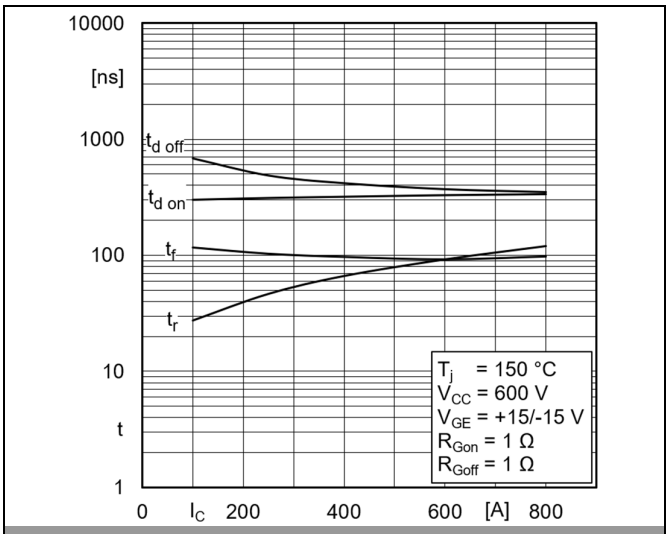


Fig. 7: Typ. switching times vs. I_C

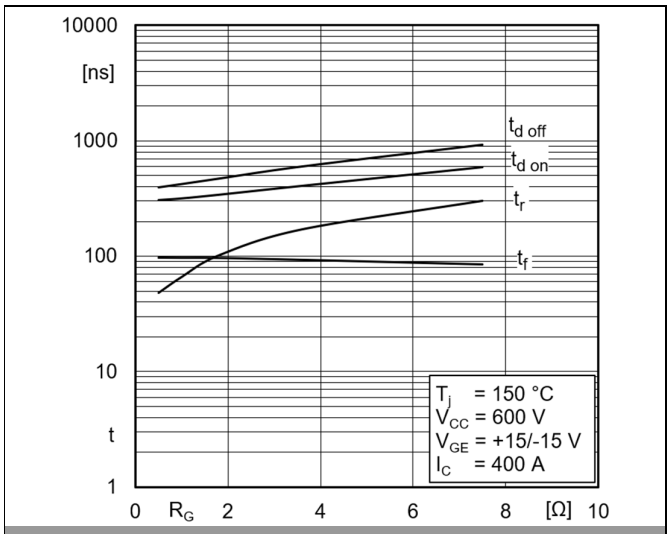


Fig. 8: Typ. switching times vs. gate resistor R_G

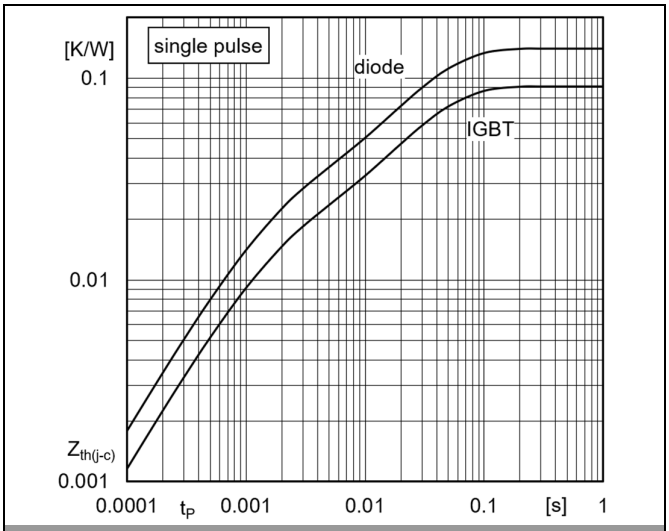


Fig. 9: Transient thermal impedance

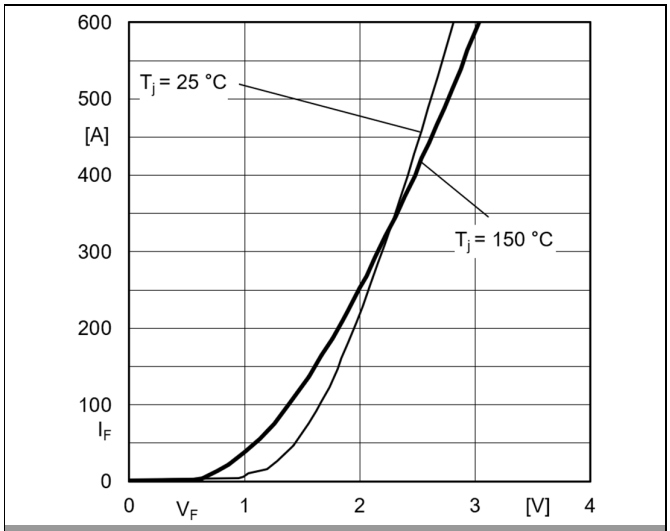


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

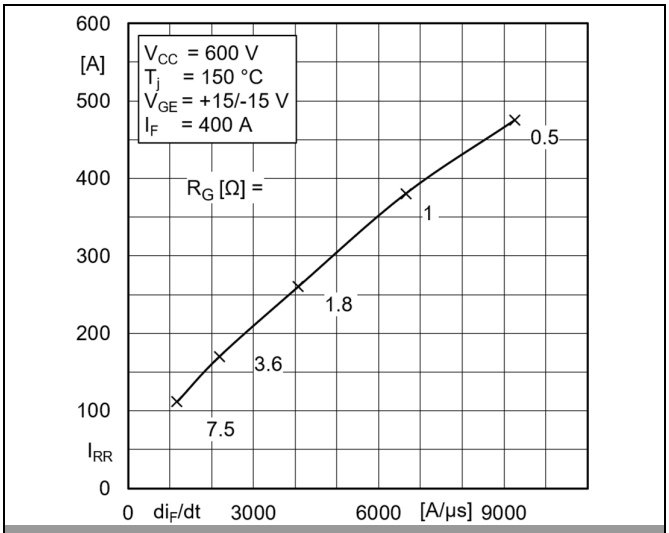


Fig. 11: CAL diode peak reverse recovery current

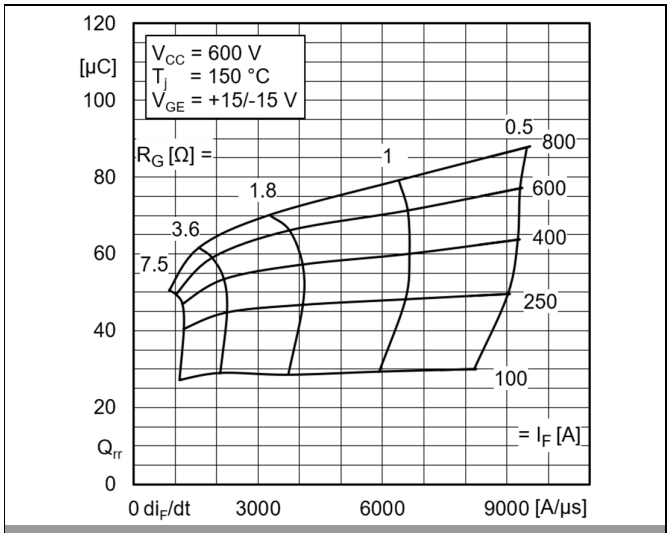
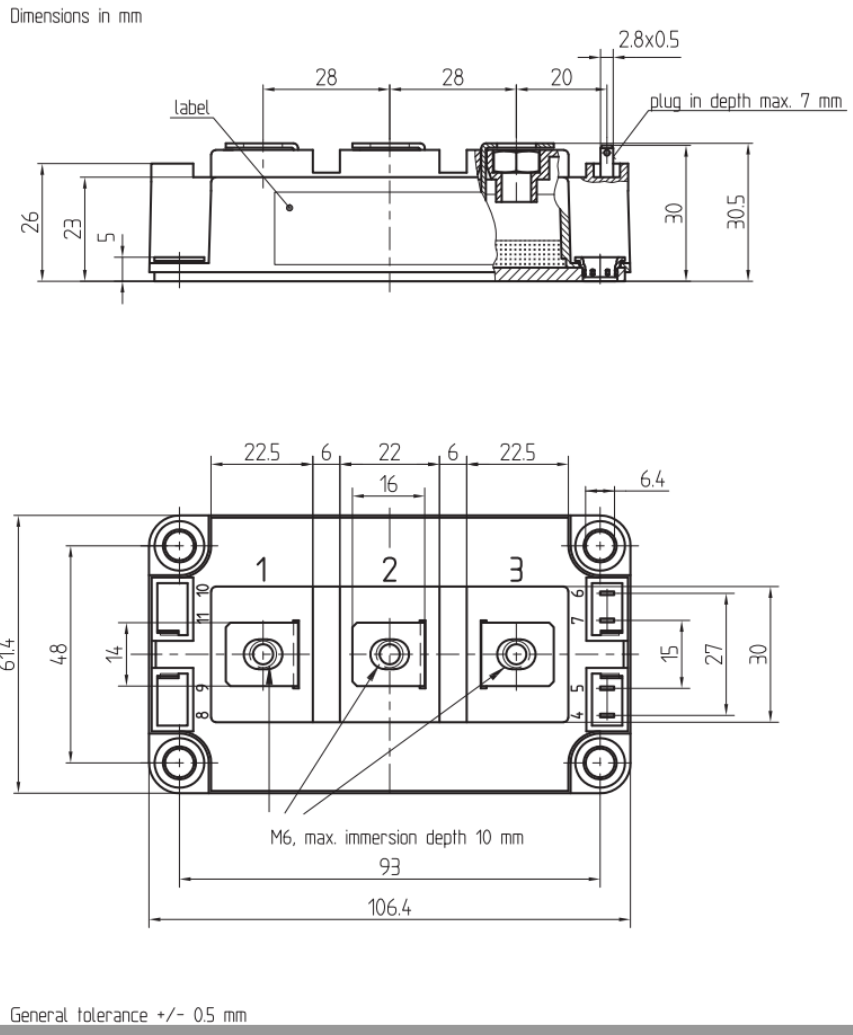
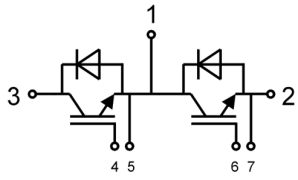


Fig. 12: Typ. CAL diode peak reverse recovery charge



Pinout and Dimensions



GB

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

***IMPORTANT INFORMATION AND WARNINGS**

The specifications of SEMIKRON products may not be considered as any guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of SEMIKRON products describe only the usual characteristics of SEMIKRON products to be expected in typical applications, which may still vary depending on the specific application. Therefore, products must be tested for the respective application in advance. Resulting from this, application adjustments of any kind may be necessary. Any user of SEMIKRON products is responsible for the safety of their applications embedding SEMIKRON products and must take adequate safety measures to prevent the applications from causing any physical injury, fire or other problem, also if any SEMIKRON product becomes faulty. Any user is responsible for making sure that the application design and realization are compliant with all laws, regulations, norms and standards applicable to the scope of application. Unless otherwise explicitly approved by SEMIKRON in a written document signed by authorized representatives of SEMIKRON, SEMIKRON products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury. No representation or warranty is given and no liability is assumed with respect to the accuracy, completeness and/or use of any information herein, including without limitation, warranties of non-infringement of intellectual property rights of any third party. SEMIKRON does not convey any license under its or a third party's patent rights, copyrights, trade secrets or other intellectual property rights, neither does it make any representation or warranty of non-infringement of intellectual property rights of any third party which may arise from a user's applications. Due to technical requirements our products may contain dangerous substances. For information on the types in question please contact the nearest SEMIKRON sales office. This document supersedes and replaces all previous SEMIKRON information of comparable content and scope. SEMIKRON may update and/or revise this document at any time.