



SEMITRANS® 3

IGBT4 Modules

SKM400GAL17E4

Features*

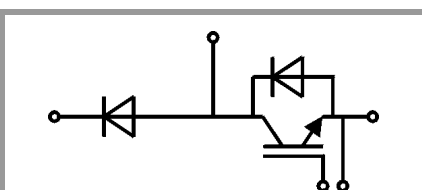
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-Diode
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated Gate resistor
- For switching frequencies up to 8kHz
- UL recognized, file no. E63532

Typical Applications

- Electronic welders
- DC/DC – converter
- Brake chopper
- Switched reluctance motor

Remarks

- Case temperature limited to $T_C = 125^\circ\text{C}$ max.
- Recommended $T_{j,op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$



GAL

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _j = 25 °C		1700	V
I _C	T _j = 175 °C	T _c = 25 °C	614	A
		T _c = 80 °C	474	A
I _{Cnom}			400	A
I _{CRM}			1200	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 1000 V V _{GE} ≤ 15 V V _{CES} ≤ 1700 V	T _j = 150 °C	10	µs
T _j			-40 ... 175	°C
Inverse diode				
V _{RRM}	T _j = 25 °C		1700	V
I _F	T _j = 175 °C	T _c = 25 °C	443	A
		T _c = 80 °C	327	A
I _{FRM}			800	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2340	A
T _j			-40 ... 175	°C
Freewheeling diode				
V _{RRM}	T _j = 25 °C		1700	V
I _F	T _j = 175 °C	T _c = 25 °C	443	A
		T _c = 80 °C	327	A
I _{FRM}			800	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		2340	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	T _j = 25 °C		1.92	2.20	V
	V _{GE} = 15 V chipelevel	T _j = 150 °C		2.30	2.60	V
V _{CE0}	chipelevel	T _j = 25 °C		0.80	0.90	V
		T _j = 150 °C		0.70	0.80	V
r _{CE}	V _{GE} = 15 V chipelevel	T _j = 25 °C		2.8	3.3	mΩ
		T _j = 150 °C		4.0	4.5	mΩ
V _{GE(th)}	V _{GE} =V _{CE} , I _C = 16 mA		5.2	5.8	6.4	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1700 V, T _j = 25 °C				5	mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		32.0		nF
C _{oes}		f = 1 MHz		1.36		nF
C _{res}		f = 1 MHz		1.16		nF
Q _G	V _{GE} = - 8 V...+ 15 V			3200		nC
R _{Gint}	T _j = 25 °C			1.9		Ω



SEMITRANS® 3

IGBT4 Modules

SKM400GAL17E4

Features*

- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-Diode
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated Gate resistor
- For switching frequencies up to 8kHz
- UL recognized, file no. E63532

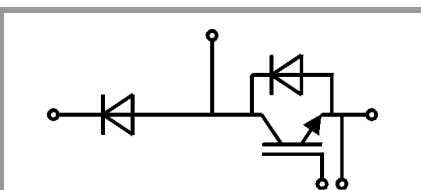
Typical Applications

- Electronic welders
- DC/DC – converter
- Brake chopper
- Switched reluctance motor

Remarks

- Case temperature limited to $T_C = 125^\circ\text{C}$ max.
- Recommended $T_{j,op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for $T_j = 150^\circ\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 1200 V	T _j = 150 °C		280		ns
t _r	I _C = 400 A	T _j = 150 °C		45		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		157		mJ
t _{d(off)}	R _{G on} = 2 Ω	T _j = 150 °C		760		ns
t _f	dI/dt _{on} = 10000 A/μs	T _j = 150 °C		140		ns
E _{off}	di/dt _{off} = 2300 A/μs dv/dt = 5600 V/μs	T _j = 150 °C		180		mJ
R _{th(j-c)}	per IGBT				0.066	K/W
R _{th(c-s)}	per IGBT, P12 (reference)			0.036		K/W
R _{th(c-s)}	per IGBT, HP-PCM			0.019		K/W
Inverse diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		2.00	2.40	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.16	2.57	V
V _{F0}	chiplevel	T _j = 25 °C		1.32	1.56	V
		T _j = 150 °C		1.08	1.22	V
r _F	chiplevel	T _j = 25 °C		1.71	2.1	mΩ
		T _j = 150 °C		2.7	3.4	mΩ
I _{RRM}	I _F = 400 A	T _j = 150 °C		615		A
Q _{rr}	di/dt _{off} = 10100 A/μs	T _j = 150 °C		150		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 1200 V	T _j = 150 °C		130		mJ
R _{th(j-c)}	per diode				0.13	K/W
R _{th(c-s)}	per diode, P12 (reference)			0.044		K/W
R _{th(c-s)}	per diode, HP-PCM			0.027		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 400 A	T _j = 25 °C		2.00	2.40	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.16	2.57	V
V _{F0}	chiplevel	T _j = 25 °C		1.32	1.56	V
		T _j = 150 °C		1.08	1.22	V
r _F	chiplevel	T _j = 25 °C		1.71	2.1	mΩ
		T _j = 150 °C		2.7	3.4	mΩ
I _{RRM}	I _F = 400 A	T _j = 150 °C		615		A
Q _{rr}	di/dt _{off} = 10100 A/μs	T _j = 150 °C		150		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 1200 V	T _j = 150 °C		130		mJ
R _{th(j-c)}	per diode				0.13	K/W
R _{th(c-s)}	per diode, P12 (reference)			0.044		K/W
R _{th(c-s)}	per diode, HP-PCM			0.027		K/W



GAL

SKM400GAL17E4



SEMITRANS® 3

IGBT4 Modules

SKM400GAL17E4

Features*

- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-Diode
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated Gate resistor
- For switching frequencies up to 8kHz
- UL recognized, file no. E63532

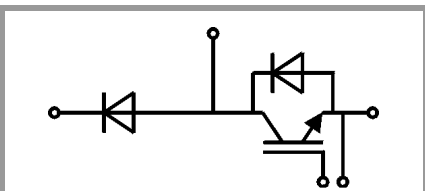
Typical Applications

- Electronic welders
- DC/DC – converter
- Brake chopper
- Switched reluctance motor

Remarks

- Case temperature limited to $T_C = 125^{\circ}\text{C}$ max.
- Recommended $T_{j,op} = -40 \dots +150^{\circ}\text{C}$
- Product reliability results valid for $T_J = 150^{\circ}\text{C}$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Module						
L _{CE}				15		nH
R _{CC'+EE'}	measured per switch	T _C = 25 °C		0.55		mΩ
		T _C = 125 °C		0.85		mΩ
R _{th(c-s)1}	calculated without thermal coupling			0.0198		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module, P12 (reference)			0.0201		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module, HP-PCM			0.0113		K/W
M _s	to heat sink M6		3		5	Nm
M _t		to terminals M6	2.5		5	Nm
						Nm
w					325	g



GAL

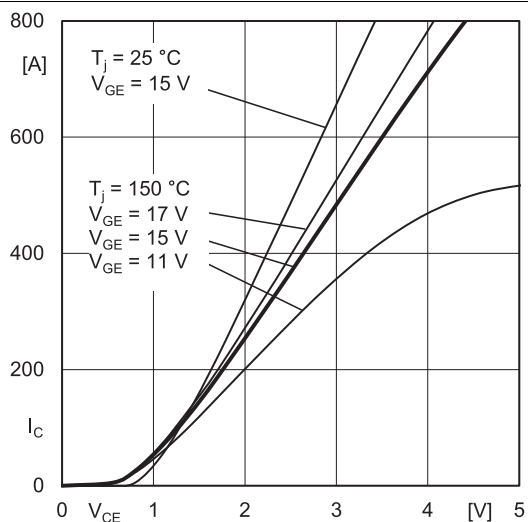


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + E_{E'}$

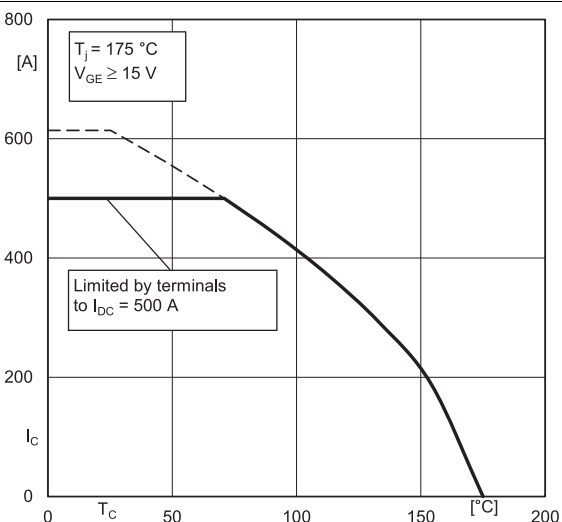


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

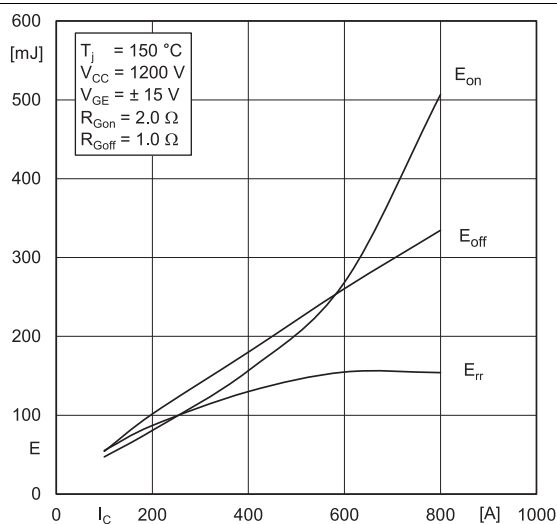


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

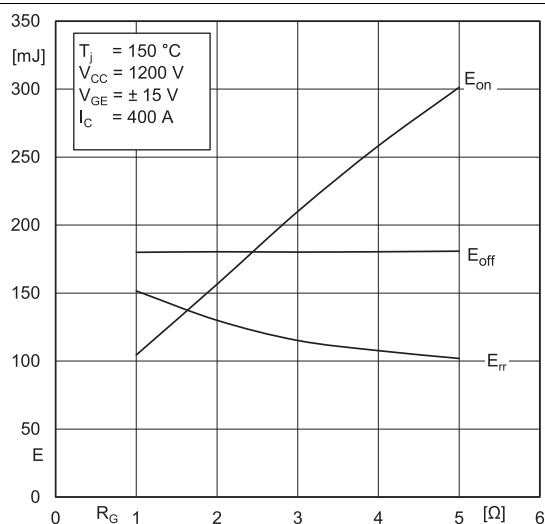


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

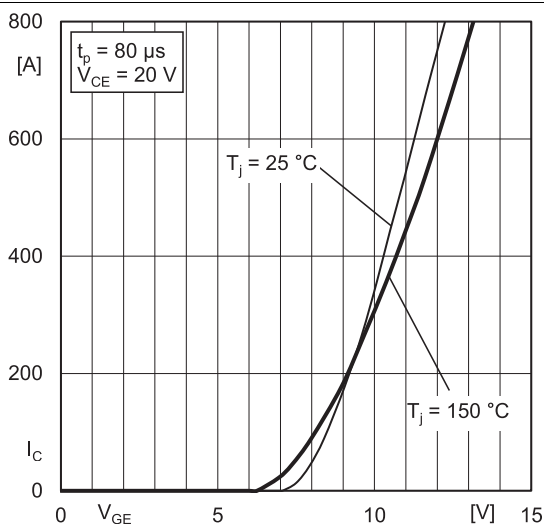


Fig. 5: Typ. transfer characteristic

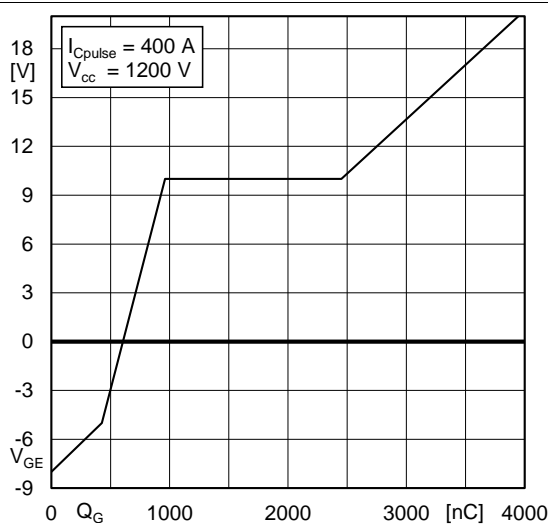


Fig. 6: Typ. gate charge characteristic

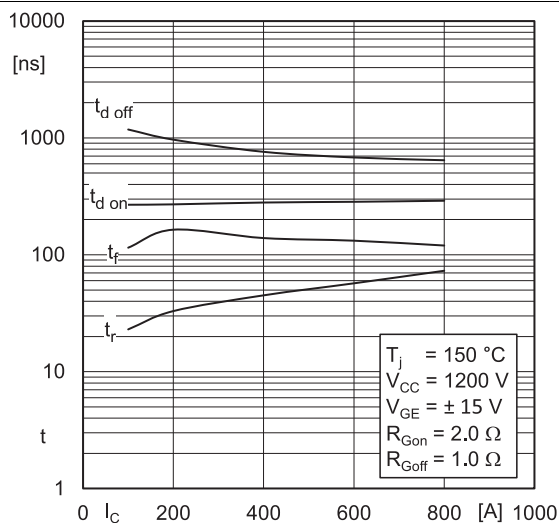


Fig. 7: Typ. switching times vs. I_C

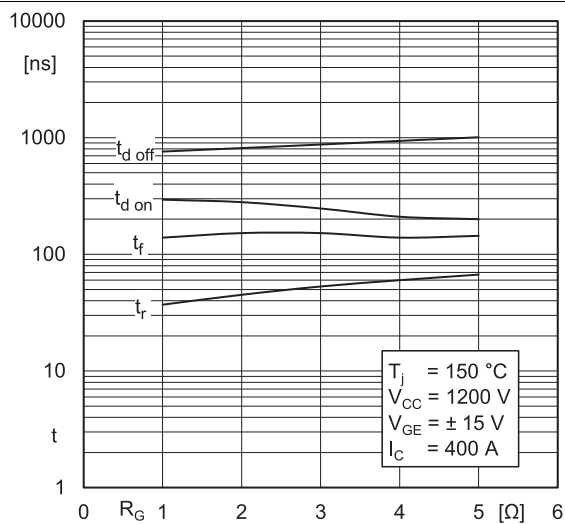


Fig. 8: Typ. switching times vs. gate resistor R_G

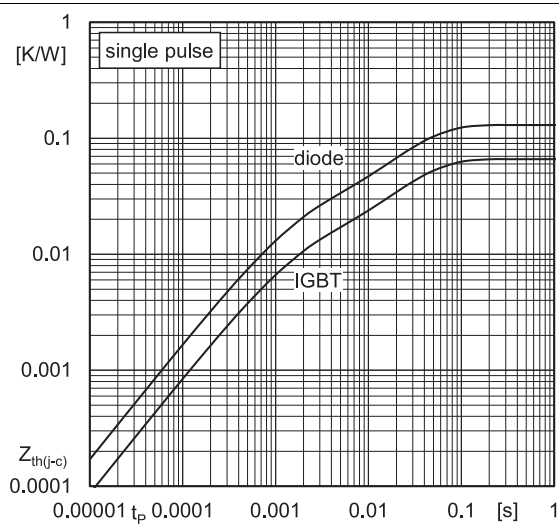


Fig. 9: Transient thermal impedance

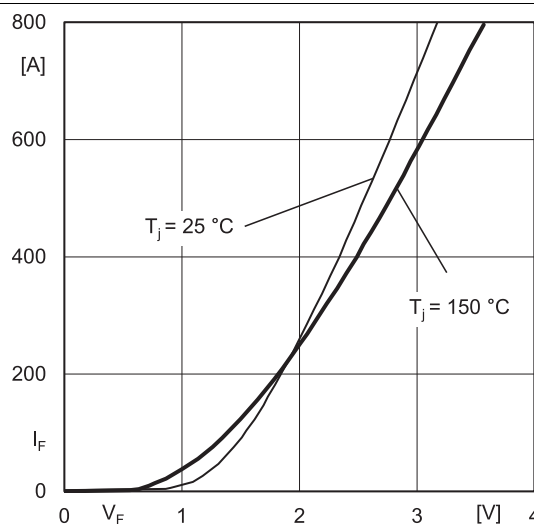


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'}+EE'$

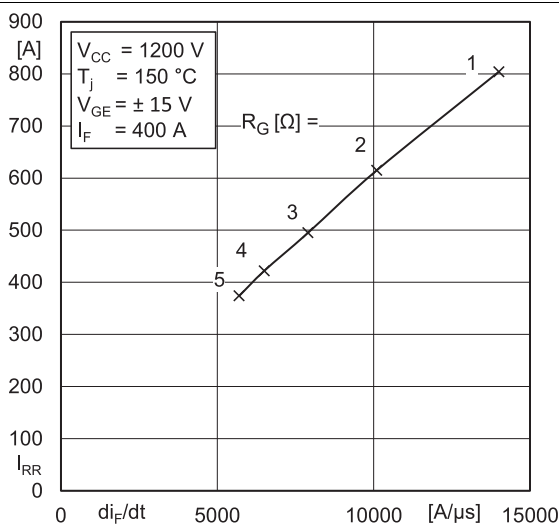


Fig. 11: Typ. CAL diode peak reverse recovery current

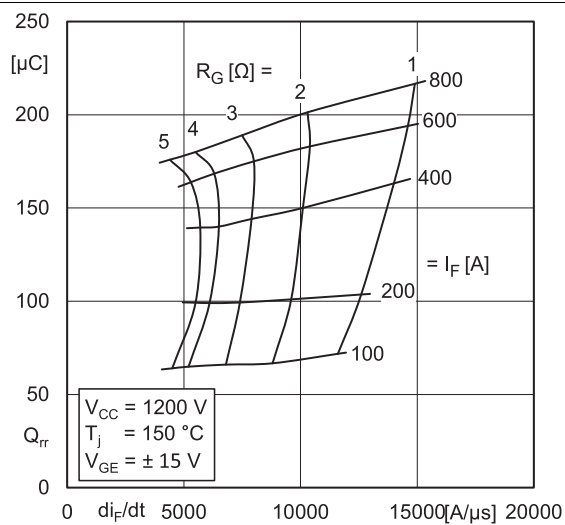
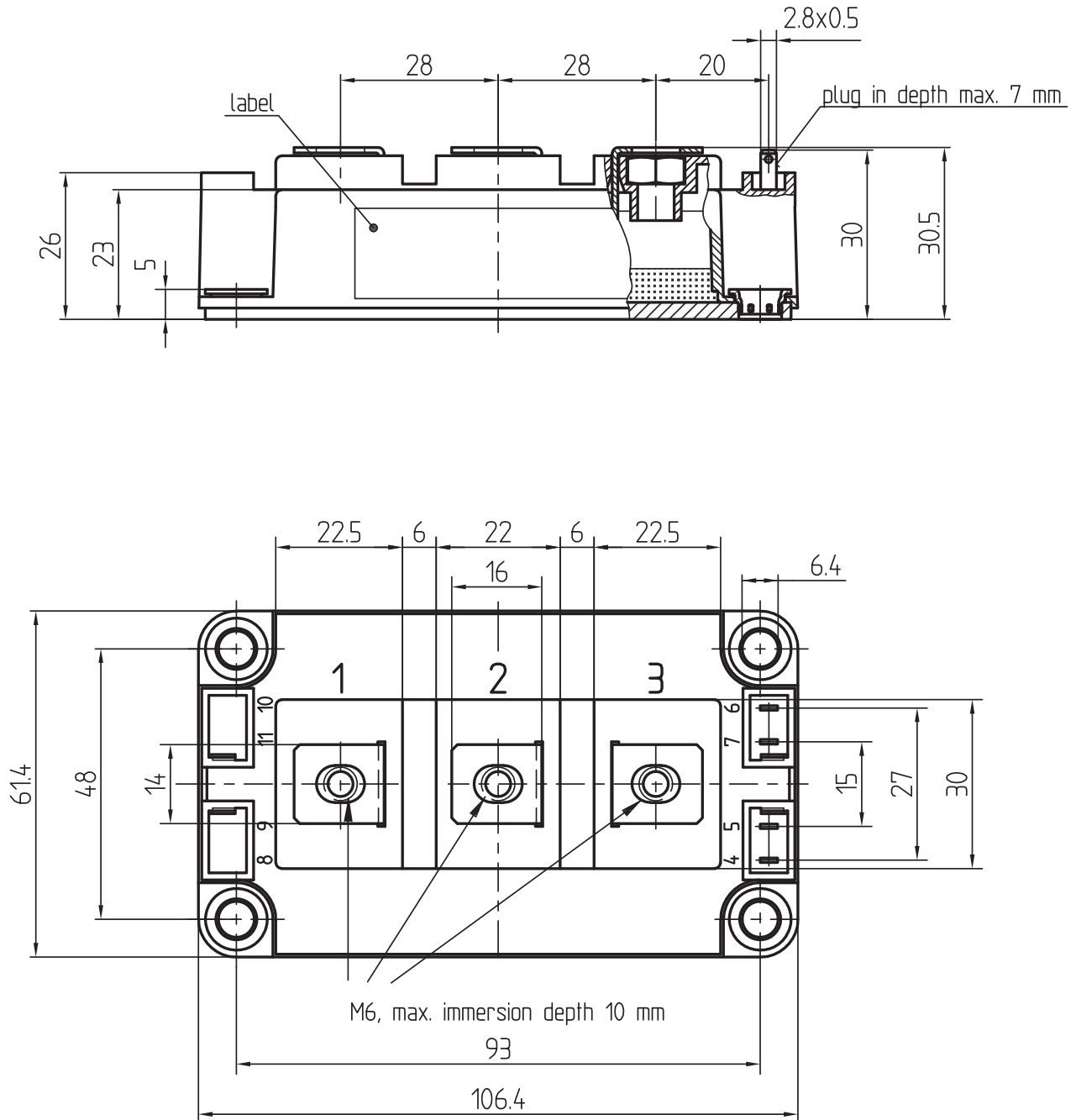


Fig. 12: Typ. CAL diode peak reverse recovery charge

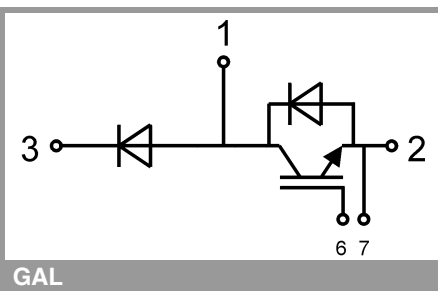
SKM400GAL17E4

Dimensions in mm



General tolerance +/- 0.5 mm

SEMITRANS 3



GAL

IMPORTANT INFORMATION AND WARNINGS

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

*The specifications of Semikron Danfoss products may not be considered as any guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of Semikron Danfoss products describe only the usual characteristics of Semikron Danfoss 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 Danfoss products is responsible for the safety of their applications embedding Semikron Danfoss products and must take adequate safety measures to prevent the applications from causing any physical injury, fire or other problem, also if any Semikron Danfoss 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 Danfoss in a written document signed by authorized representatives of Semikron Danfoss, Semikron Danfoss 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 Danfoss 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.