



SEMITRANS® 3

High Speed IGBT4 Modules

SKM200GB12F4

Features*

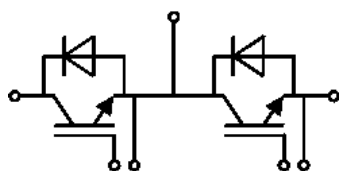
- High speed trench and field-stop IGBT
- CAL4 ultra-fast = soft switching 4. generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- For higher switching frequencies above 15kHz
- UL recognized, file no. E63532

Typical Applications

- UPS
- Electronic welders
- Inductive heating
- Switched mode power supplies

Remarks

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



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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	312	A
		T _c = 80 °C	239	A
I _{Cnom}			200	A
I _{CRM}	I _{CRM} = 2 x I _{Cnom}		400	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V R _{G on/off} ≥ 2 Ω	T _j = 150 °C	10	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	227	A
		T _c = 80 °C	167	A
I _{Fnom}			200	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		400	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		990	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					
$V_{CE(sat)}$	$I_C = 200\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	2.06	2.42	V
		$T_j = 150^\circ\text{C}$	2.59	2.97	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	1.10	1.28	V
		$T_j = 150^\circ\text{C}$	0.95	1.13	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	4.8	5.7	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	8.2	9.2	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 7.6\text{ mA}$	5.1	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25^\circ\text{C}$			2.7	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	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		1134		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		2.4		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 200\text{ A}$	$T_j = 150^\circ\text{C}$	127		ns
t_r	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	28		ns
E_{on}	$R_{G\text{ on}} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	7.5		mJ
$t_{d(off)}$	$R_{G\text{ off}} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	341		ns
t_f	$di/dt_{on} = 8800\text{ A}/\mu\text{s}$ $di/dt_{off} = 2500\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	66		ns
E_{off}	$dv/dt = 4570\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	15.7		mJ
$R_{th(j-c)}$	per IGBT			0.115	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		0.061		K/W



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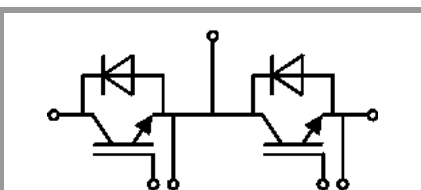
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		2.55	2.93	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		2.44	2.80	V
V _{F0}	chiplevel	T _j = 25 °C		1.51	1.75	V
		T _j = 150 °C		1.16	1.40	V
r _F	chiplevel	T _j = 25 °C		5.2	5.9	mΩ
		T _j = 150 °C		6.4	7.0	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		345		A
Q _{rr}	di/dt _{off} = 8000 A/μs	T _j = 150 °C		28		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _j = 150 °C		9.7		mJ
R _{th(j-c)}	per diode				0.233	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.081		K/W
Module						
L _{CE}				15		nH
R _{CC'+EE'}	measured per	T _C = 25 °C		0.55		mΩ
	switch	T _C = 125 °C		0.85		mΩ
R _{th(c-s)1}	calculated without thermal coupling			0.0174		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module (λ _{grease} =0.81 W/(m*K))			0.027		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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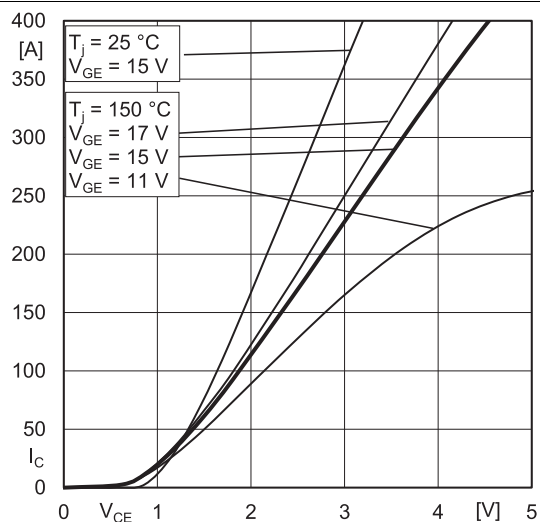


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + EE'$

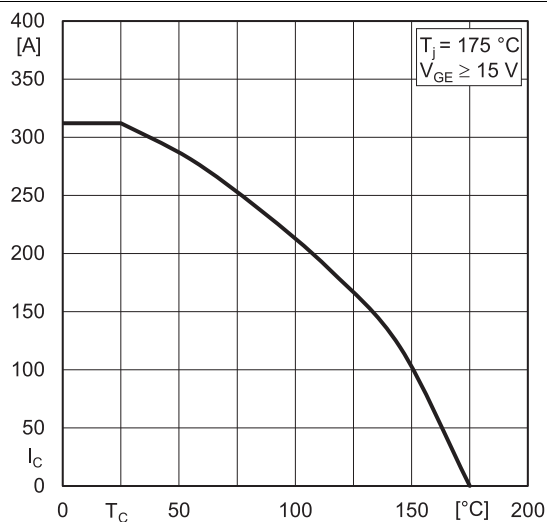


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

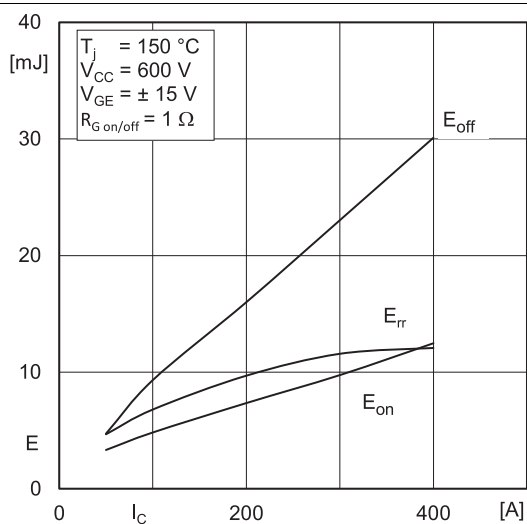


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

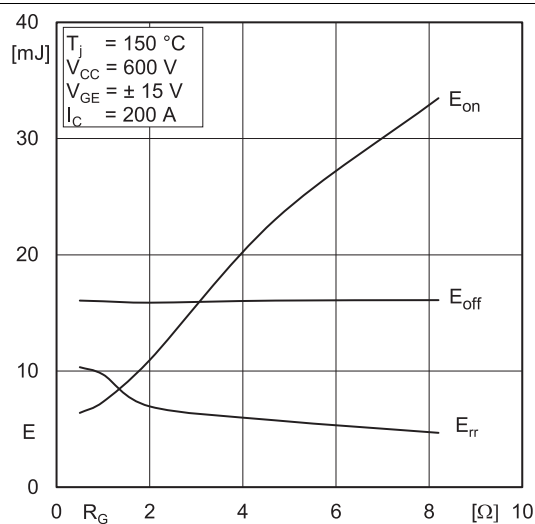


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

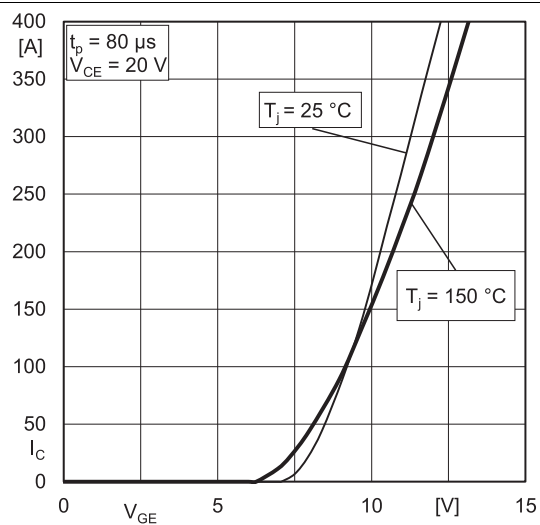


Fig. 5: Typ. transfer characteristic

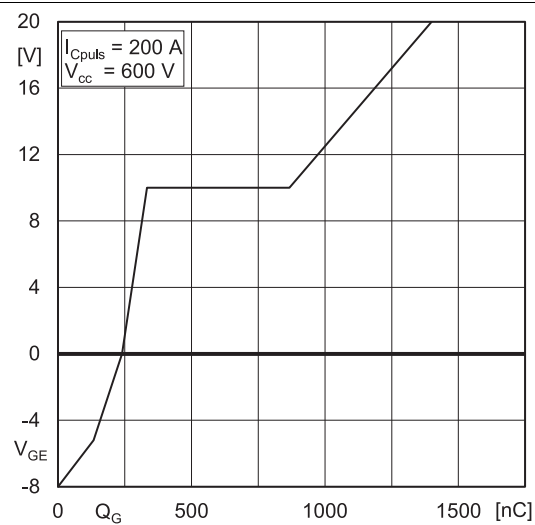


Fig. 6: Typ. gate charge characteristic

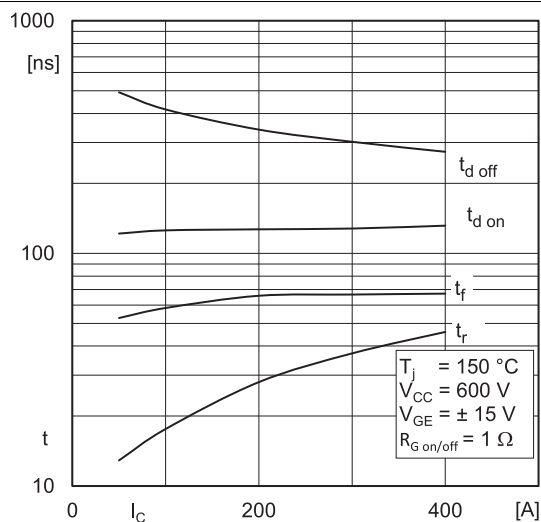


Fig. 7: Typ. switching times vs. I_C

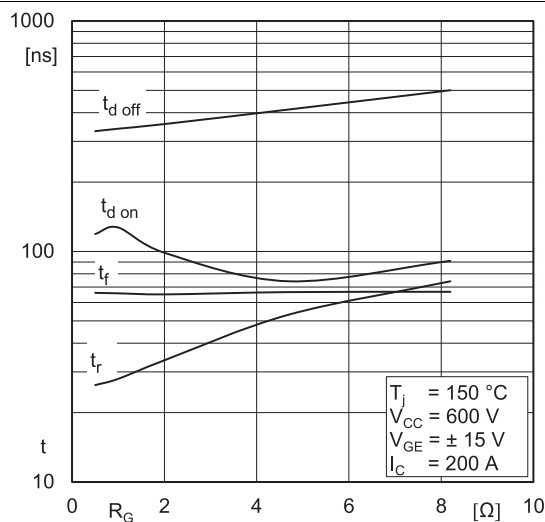


Fig. 8: Typ. switching times vs. gate resistor R_G

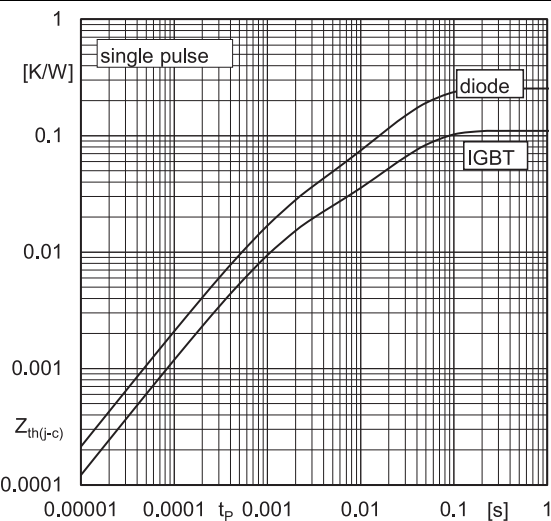


Fig. 9: Transient thermal impedance

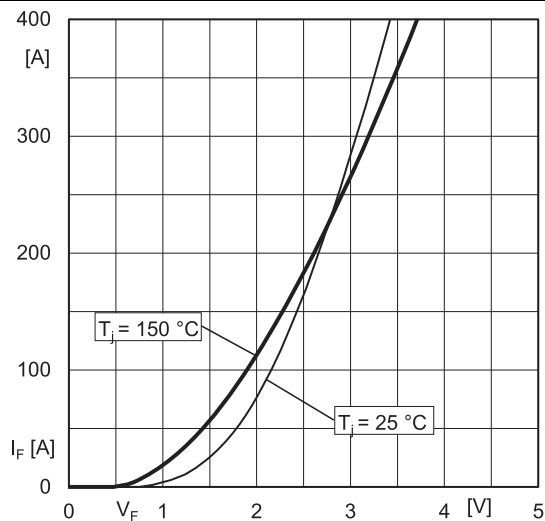


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

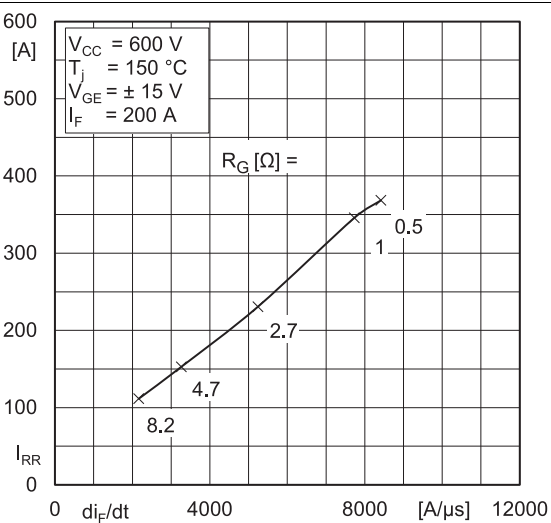


Fig. 11: Typ. CAL diode peak reverse recovery current

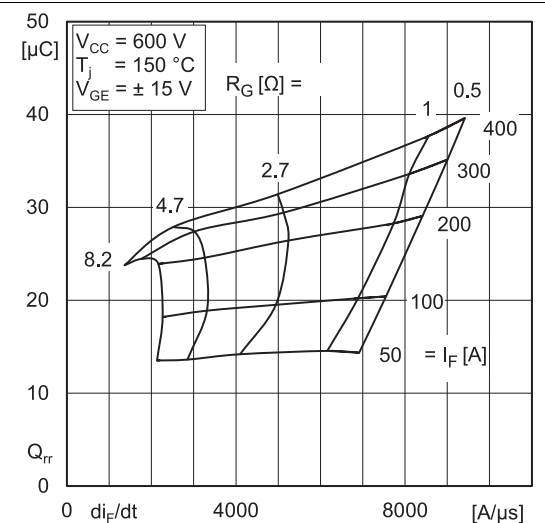
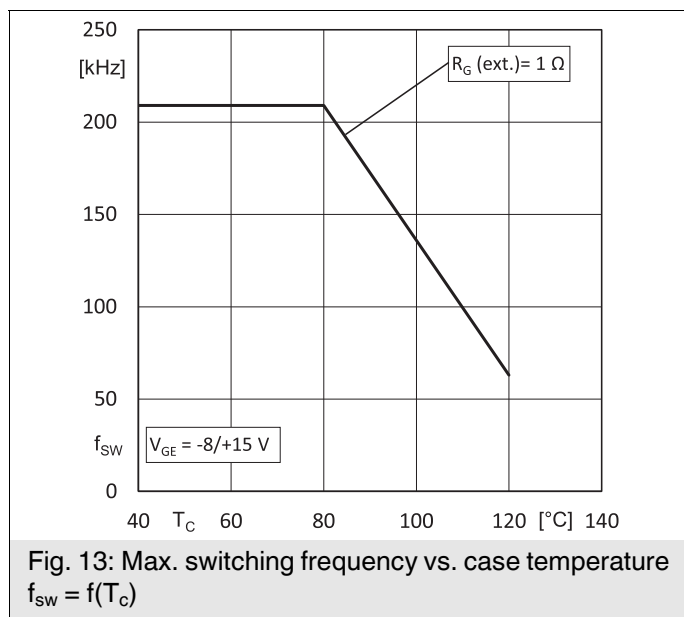
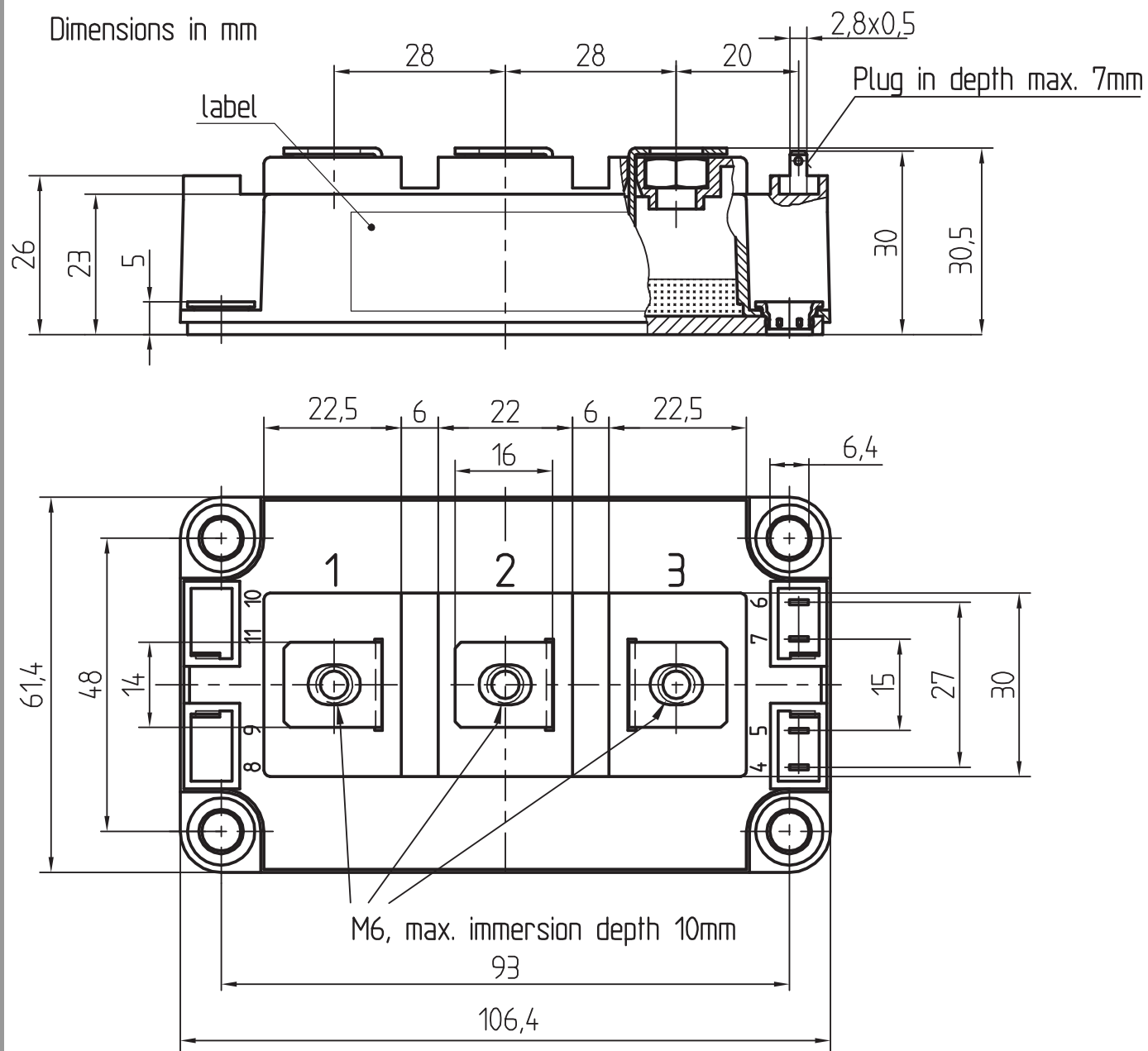


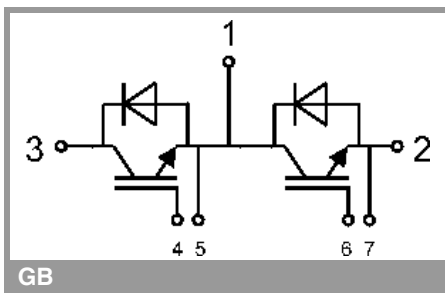
Fig. 12: Typ. CAL diode peak reverse recovery charge





General tolerance $\pm 0,5$ mm

SEMITRANS 3



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

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