

SKM400GB17E4



SEMITRANS® 3

IGBT4 Modules

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Features*

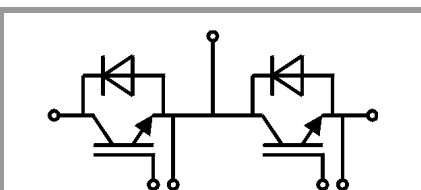
- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-Diode
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated Gate resistor
- For switching frequencies up to 8kHz
- UL recognized, file no. E63532

Typical Applications

- AC inverter drives
- UPS
- Electronic welders
- Public transport
- Wind power

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 $T_j = 150^\circ\text{C}$



GB

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$	1700	V	
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	614	A
		$T_c = 80^\circ\text{C}$	474	A
I_{Cnom}		400	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1200	A	
V_{GES}		-20 ... 20	V	
t_{psc}	$V_{CC} = 1000\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1700\text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
T_j		-40 ... 175	$^\circ\text{C}$	
Inverse diode				
V_{RRM}	$T_j = 25^\circ\text{C}$	1700	V	
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	443	A
		$T_c = 80^\circ\text{C}$	327	A
I_{Fnom}		400	A	
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	800	A	
I_{FSM}	$t_p = 10\text{ ms}$, $\sin 180^\circ$, $T_j = 25^\circ\text{C}$	2340	A	
T_j		-40 ... 175	$^\circ\text{C}$	
Module				
$I_{t(RMS)}$		500	A	
T_{stg}	module without TIM	-40 ... 125	$^\circ\text{C}$	
V_{isol}	AC sinus 50 Hz, $t = 1\text{ min}$	4000	V	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.92	2.20	V
		$T_j = 150^\circ\text{C}$	2.30	2.60	V
V_{CE0}	chiplevel	$T_j = 25^\circ\text{C}$	0.80	0.90	V
		$T_j = 150^\circ\text{C}$	0.70	0.80	V
r_{CE}	$V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	2.8	3.3	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	4.0	4.5	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 16\text{ mA}$	5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 1700\text{ V}$, $T_j = 25^\circ\text{C}$			5	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	36.0		nF
C_{oes}		$f = 1\text{ MHz}$	1.36		nF
C_{res}		$f = 1\text{ MHz}$	1.16		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		3200		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.9		Ω
$t_{d(on)}$	$V_{CC} = 1200\text{ V}$ $I_C = 400\text{ A}$	$T_j = 150^\circ\text{C}$	280		ns
t_r	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	45		ns
E_{on}	$R_{Gon} = 2\ \Omega$	$T_j = 150^\circ\text{C}$	157		mJ
$t_{d(off)}$	$R_{Goff} = 1\ \Omega$	$T_j = 150^\circ\text{C}$	760		ns
t_f	$di/dt_{on} = 10000\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	140		ns
E_{off}	$di/dt_{off} = 2300\text{ A}/\mu\text{s}$ $dv/dt = 5600\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	180		mJ
$R_{th(j-c)}$	per IGBT			0.066	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		0.028		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material		0.017		K/W



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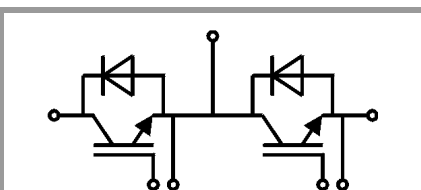
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 400\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.00	2.40	V
		$T_j = 150^\circ\text{C}$		2.16	2.57	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$		1.32	1.56	V
		$T_j = 150^\circ\text{C}$		1.08	1.22	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$		1.71	2.1	m Ω
		$T_j = 150^\circ\text{C}$		2.7	3.4	m Ω
I_{RRM}	$I_F = 400\text{ A}$	$T_j = 150^\circ\text{C}$		615		A
Q_{rr}	$di/dt_{off} = 10100\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		150		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 1200\text{ V}$	$T_j = 150^\circ\text{C}$		130		mJ
$R_{th(j-c)}$	per diode				0.13	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)			0.038		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.032		K/W
Module						
L_{CE}				15		nH
R_{CC+EE}	measured per switch	$T_c = 25^\circ\text{C}$		0.55		m Ω
		$T_c = 125^\circ\text{C}$		0.85		m Ω
$R_{th(c-s)1}$	calculated without thermal coupling ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)			0.0081		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)			0.013		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, pre-applied phase change material			0.009		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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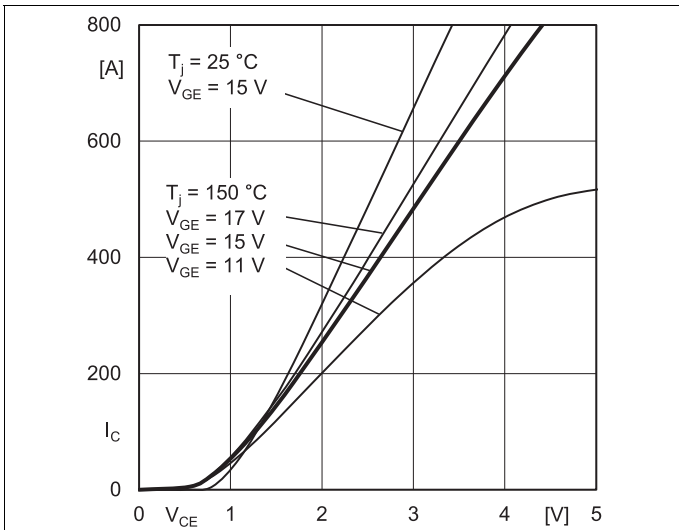


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

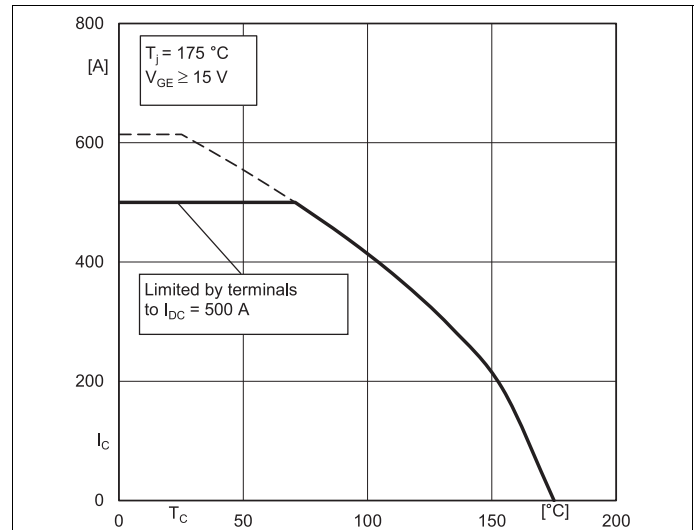


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

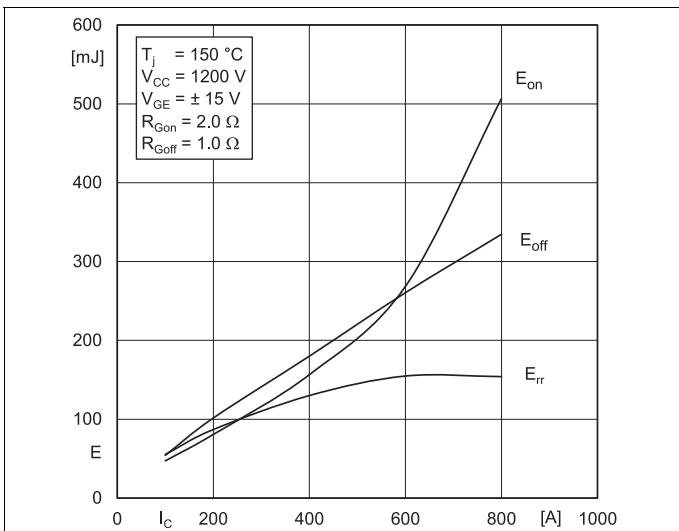


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

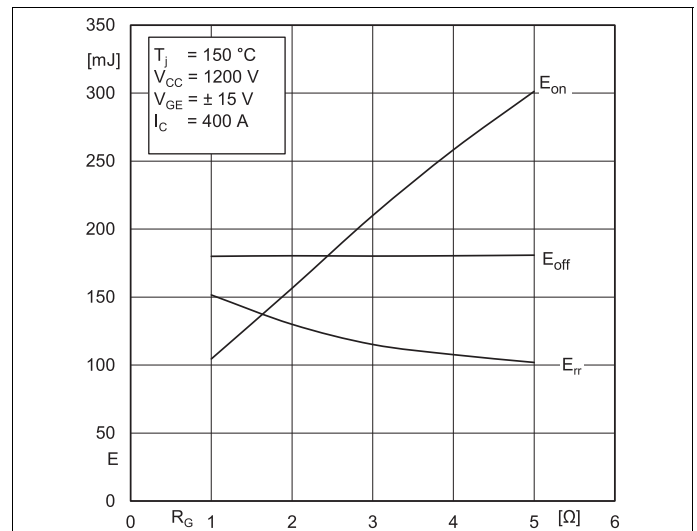


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

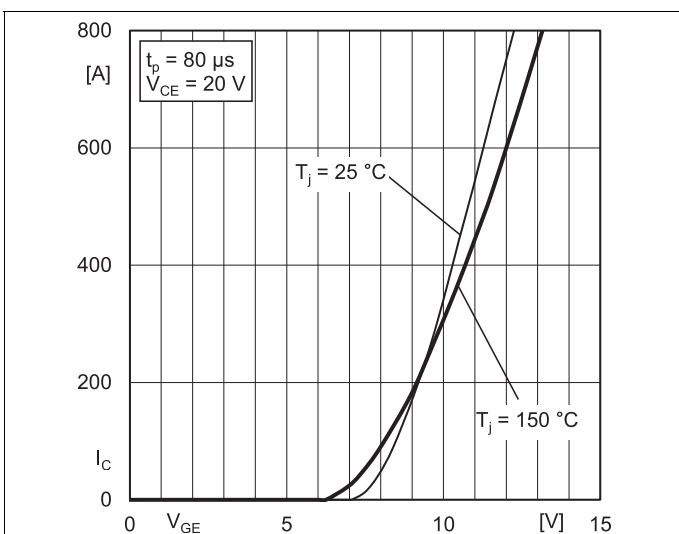


Fig. 5: Typ. transfer characteristic

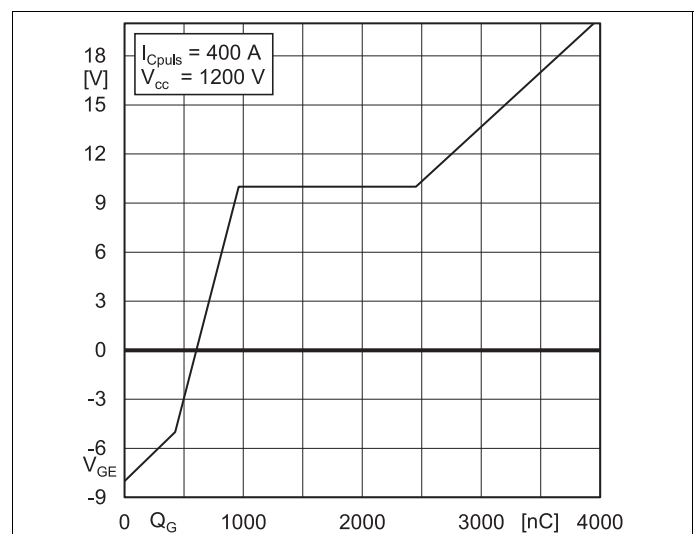


Fig. 6: Typ. gate charge characteristic

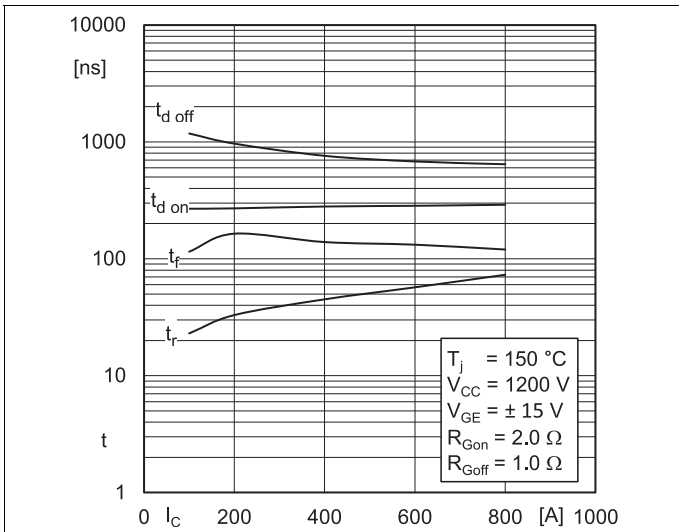


Fig. 7: Typ. switching times vs. I_C

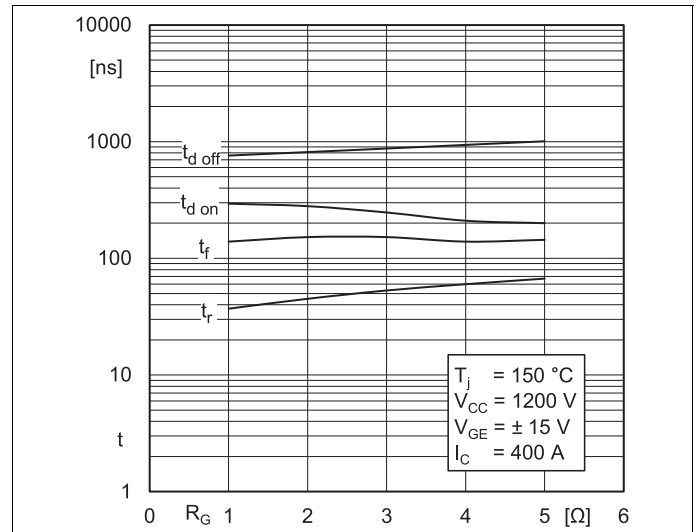


Fig. 8: Typ. switching times vs. gate resistor R_G

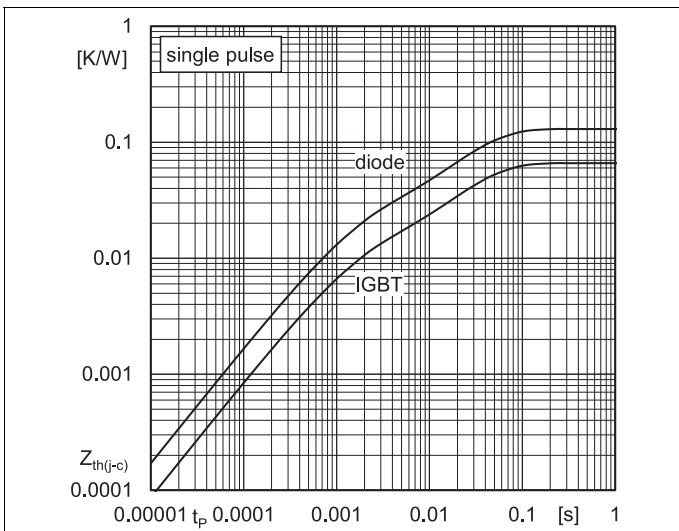


Fig. 9: Transient thermal impedance

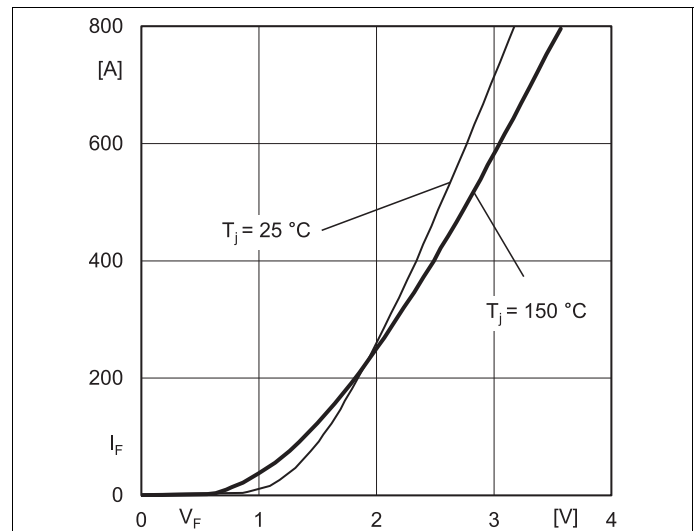


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

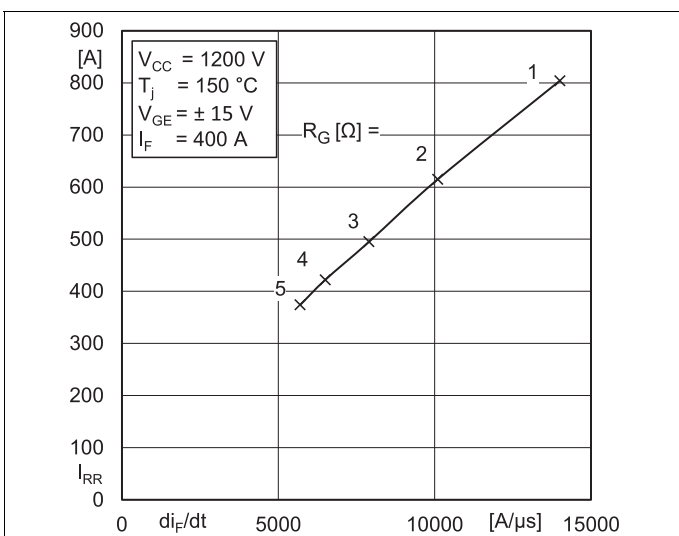


Fig. 11: Typ. CAL diode peak reverse recovery current

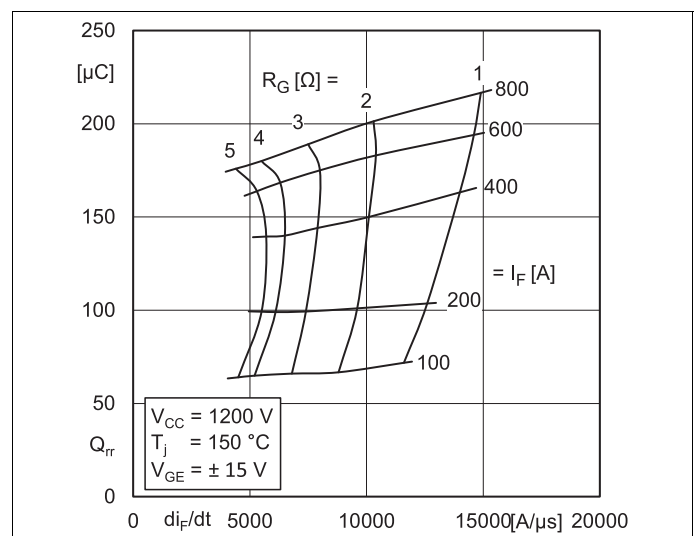
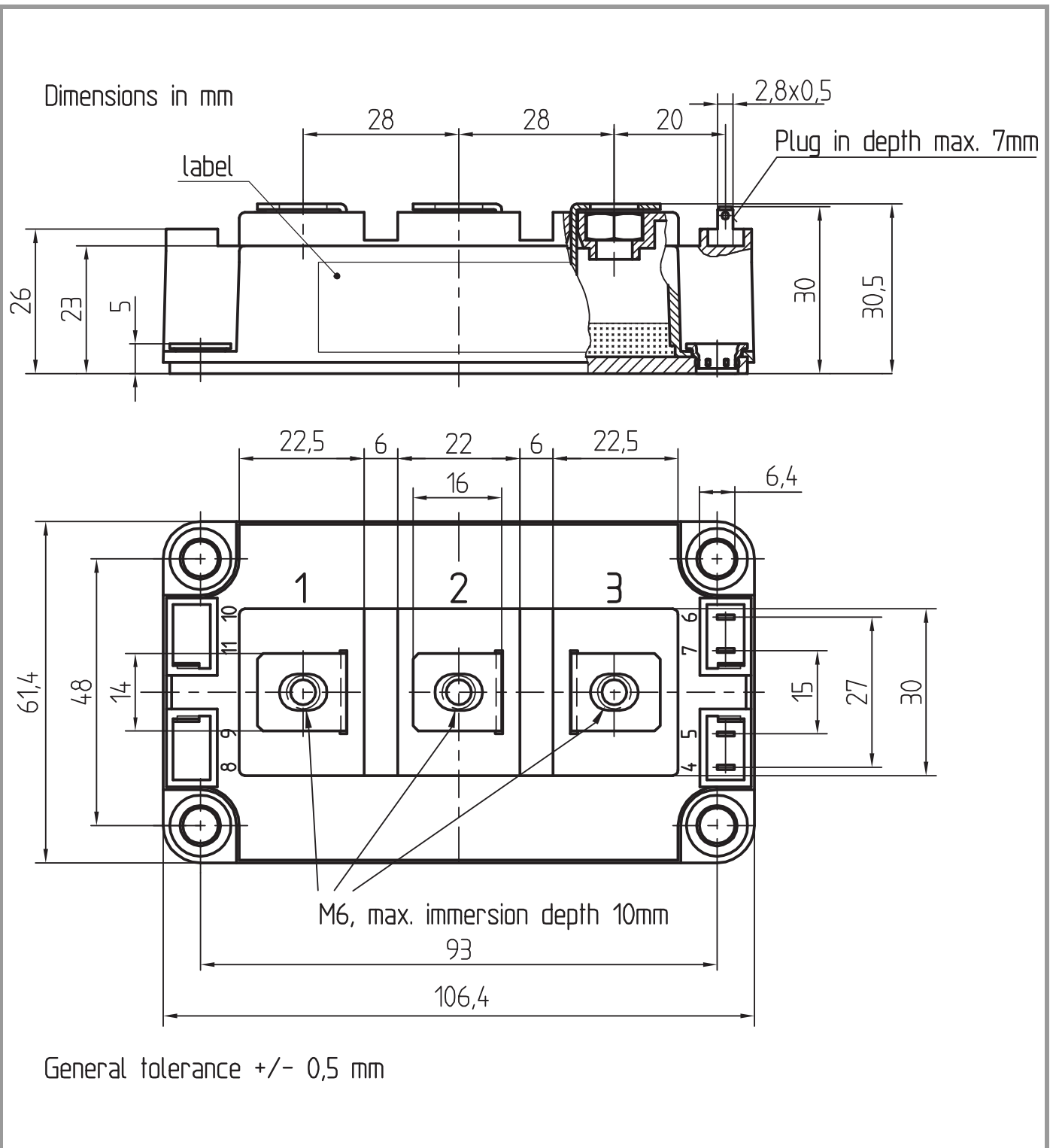
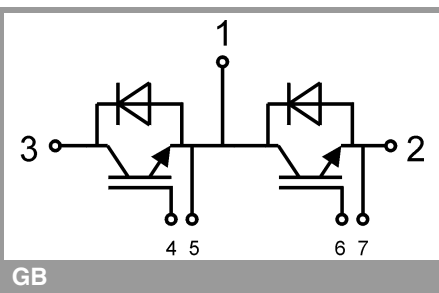


Fig. 12: Typ. CAL diode peak reverse recovery charge

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

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