



IGBT4 Modules

SKM450GB12E4

Features

- IGBT4 = 4th generation medium fast trench IGBT (Infineon)
- CAL4 = Soft switching 4th generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 12kHz
- UL recognized, file no. E63532

Typical Applications*

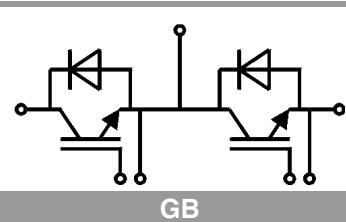
- AC inverter drives
- UPS

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

Absolute Maximum Ratings		Values	Unit
Symbol	Conditions		
IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_c	$T_j = 175^\circ\text{C}$	700	A
	$T_c = 25^\circ\text{C}$	538	A
I_{Cnom}	$T_c = 80^\circ\text{C}$	450	A
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1350	A
V_{GES}		-20 ... 20	V
t_{psc}	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	10	μs
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V
I_F	$T_j = 175^\circ\text{C}$	461	A
	$T_c = 25^\circ\text{C}$	345	A
I_{Fnom}	$T_c = 80^\circ\text{C}$	400	A
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$	1200	A
I_{FSM}	$t_p = 10\text{ ms, sin }180^\circ, T_j = 25^\circ\text{C}$	1980	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

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_c = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	1.84	2.07		V
	$T_j = 25^\circ\text{C}$			2.23	2.42
	$T_j = 150^\circ\text{C}$				V
V_{CE0}	chiplevel	0.80	0.90		V
	$T_j = 25^\circ\text{C}$			0.70	0.80
	$T_j = 150^\circ\text{C}$				V
r_{CE}	$V_{GE} = 15\text{ V}$ chiplevel	2.3	2.6		$\text{m}\Omega$
	$T_j = 25^\circ\text{C}$			3.4	3.6
	$T_j = 150^\circ\text{C}$				$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_c = 16.4\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25^\circ\text{C}$			5	mA
C_{ies}	$V_{CE} = 25\text{ V}$	27.2			nF
C_{oes}	$V_{GE} = 0\text{ V}$	1.76			nF
C_{res}	$f = 1\text{ MHz}$	1.50			nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$	2500			nC
R_{Gint}	$T_j = 25^\circ\text{C}$	1.9			Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	246			ns
t_r	$I_c = 450\text{ A}$	59			ns
E_{on}	$V_{GE} = +15/-15\text{ V}$	32			mJ
$t_{d(off)}$	$R_{G\text{ on}} = 1\text{ }\Omega$	529			ns
t_f	$R_{G\text{ off}} = 1\text{ }\Omega$	102			ns
	$di/dt_{on} = 8100\text{ A}/\mu\text{s}$				
	$di/dt_{off} = 3400\text{ A}/\mu\text{s}$				
E_{off}	$T_j = 150^\circ\text{C}$	60			mJ
$R_{th(j-c)}$	per IGBT			0.062	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^*\text{K})$)			0.028	K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material			0.017	K/W





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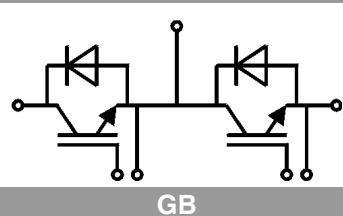
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- UPS

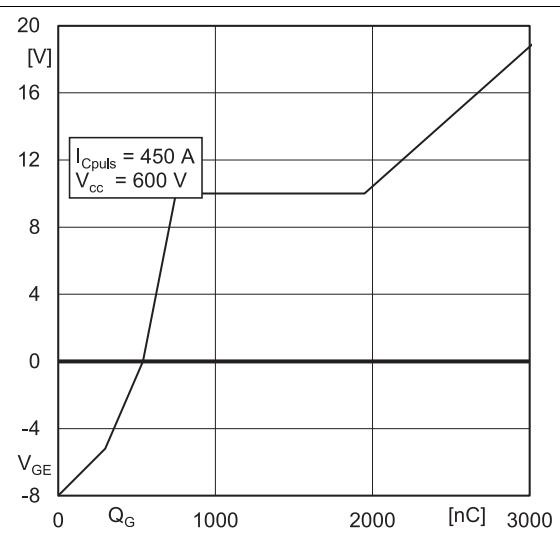
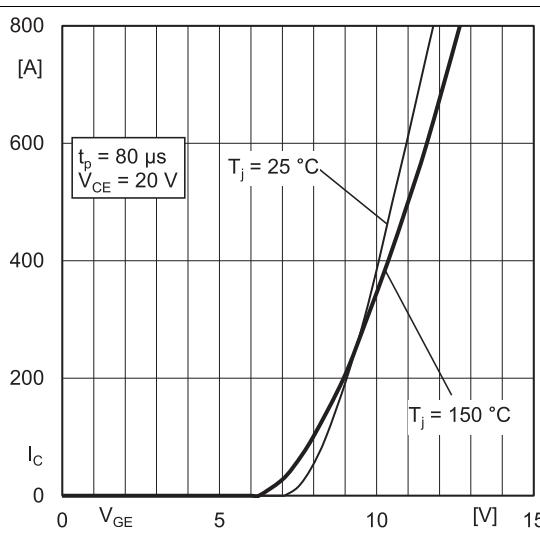
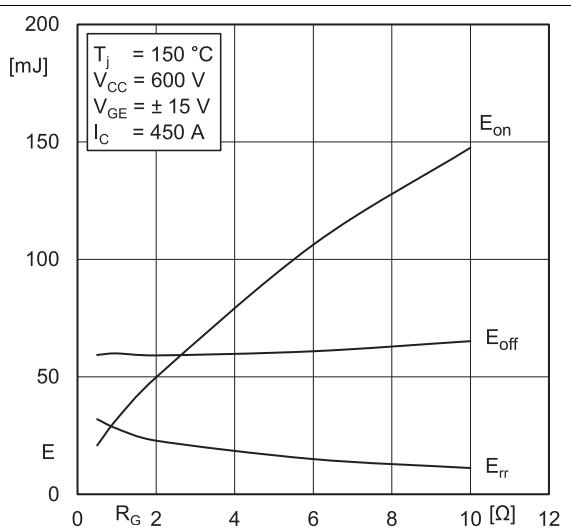
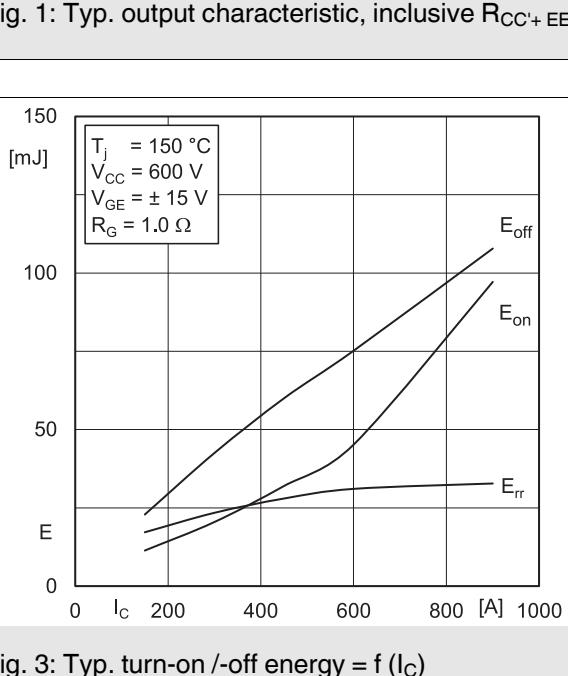
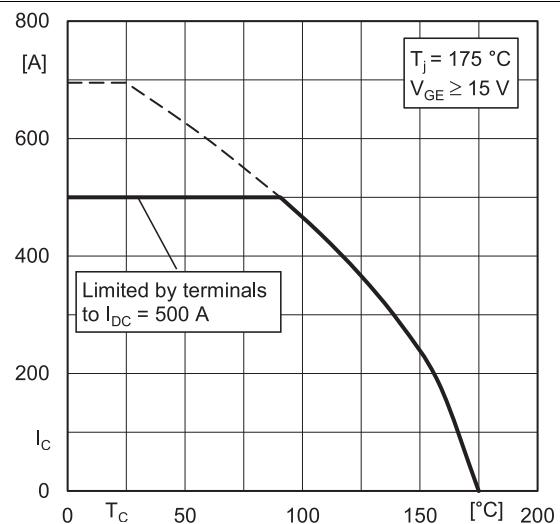
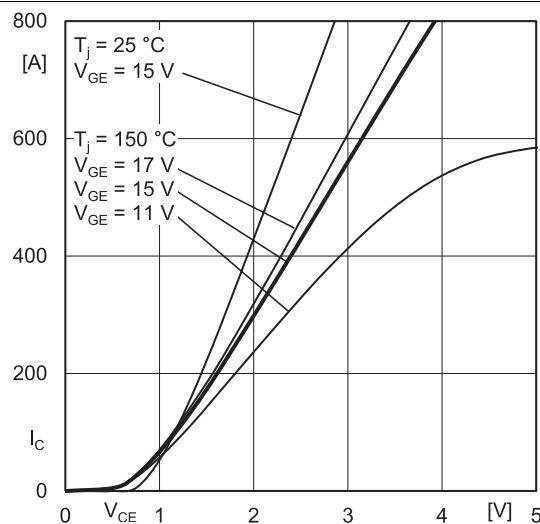
Remarks

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

Characteristics		Conditions	min.	typ.	max.	Unit
Symbol						
Inverse diode						
$V_F = V_{EC}$	$I_F = 450 \text{ A}$	$T_j = 25^\circ\text{C}$		2.31	2.65	V
	$V_{GE} = 0 \text{ V}$ chiplevel	$T_j = 150^\circ\text{C}$		2.31	2.64	V
V_{FO}	chiplevel	$T_j = 25^\circ\text{C}$	1.30	1.50	V	
		$T_j = 150^\circ\text{C}$	0.90	1.10	V	
r_F	chiplevel	$T_j = 25^\circ\text{C}$	2.3	2.6	$\text{m}\Omega$	
		$T_j = 150^\circ\text{C}$	3.1	3.4	$\text{m}\Omega$	
I_{RRM}	$I_F = 450 \text{ A}$	$T_j = 150^\circ\text{C}$		452		A
Q_{rr}	$\text{di/dt}_{\text{off}} = 8300 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		62		μC
E_{rr}	$V_{GE} = \pm 15 \text{ V}$	$T_j = 150^\circ\text{C}$		28		mJ
$R_{th(j-c)}$	per diode			0.13		K/W
$R_{th(c-s)}$	per diode ($\lambda_{\text{grease}}=0.81 \text{ W}/(\text{m}^*\text{K})$)			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			$\text{m}\Omega$
		$T_C = 125^\circ\text{C}$	0.85			$\text{m}\Omega$
$R_{th(c-s)1}$	calculated without thermal coupling		0.008			K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{\text{grease}}=0.81 \text{ W}/(\text{m}^*\text{K})$)		0.013			K/W
			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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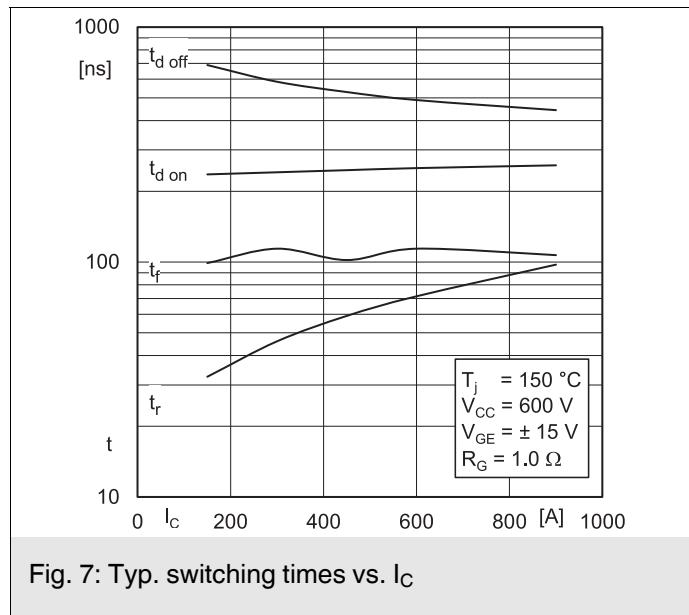


Fig. 7: Typ. switching times vs. I_C

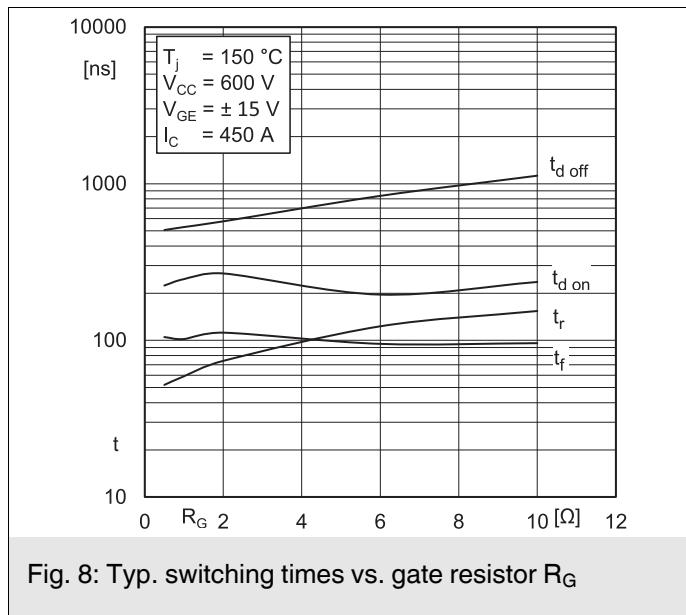


Fig. 8: Typ. switching times vs. gate resistor R_G

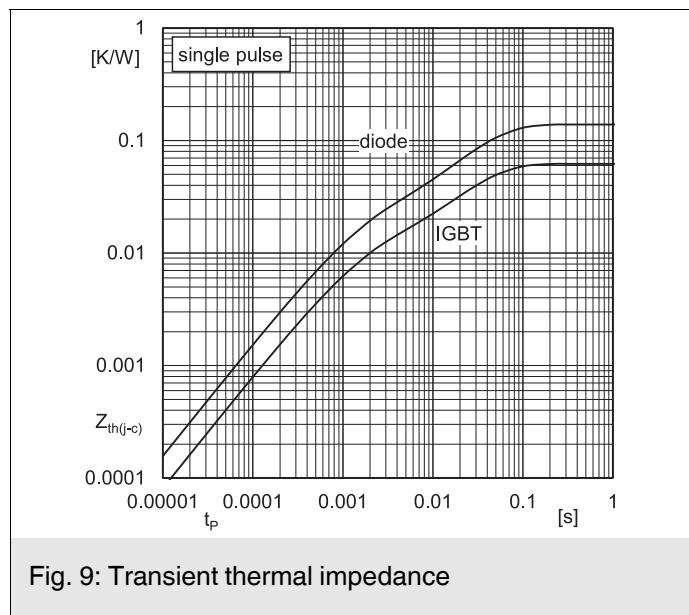


Fig. 9: Transient thermal impedance

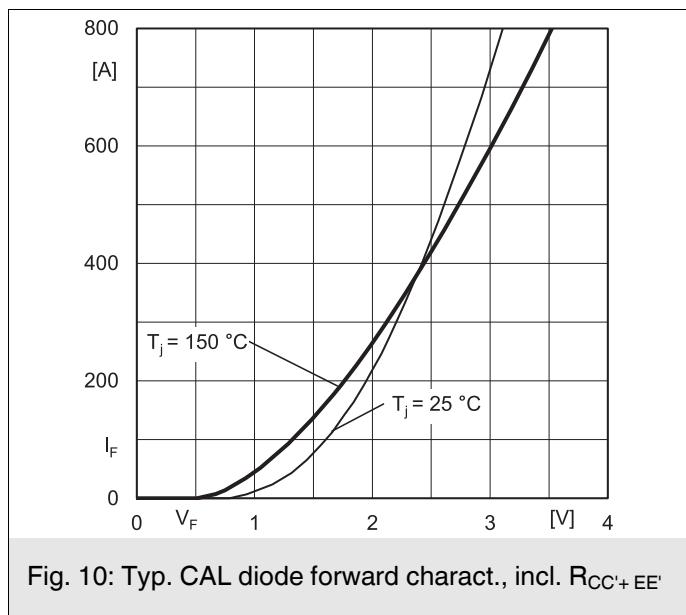


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC} + EE'$

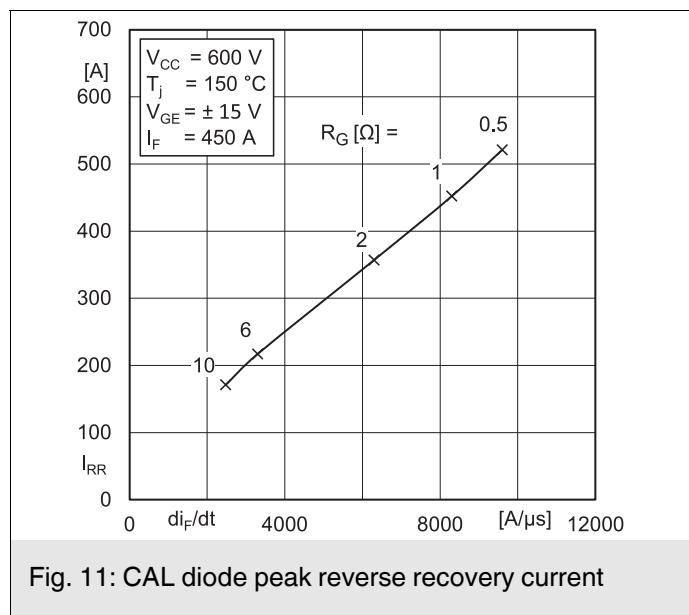


Fig. 11: CAL diode peak reverse recovery current

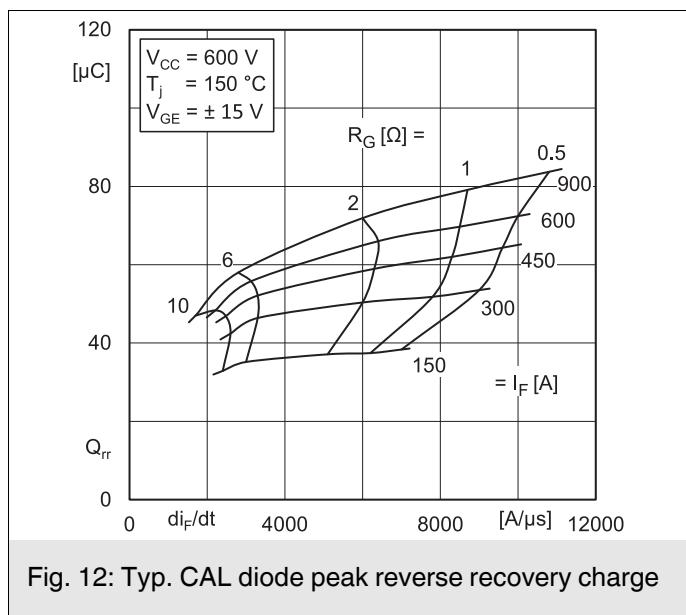
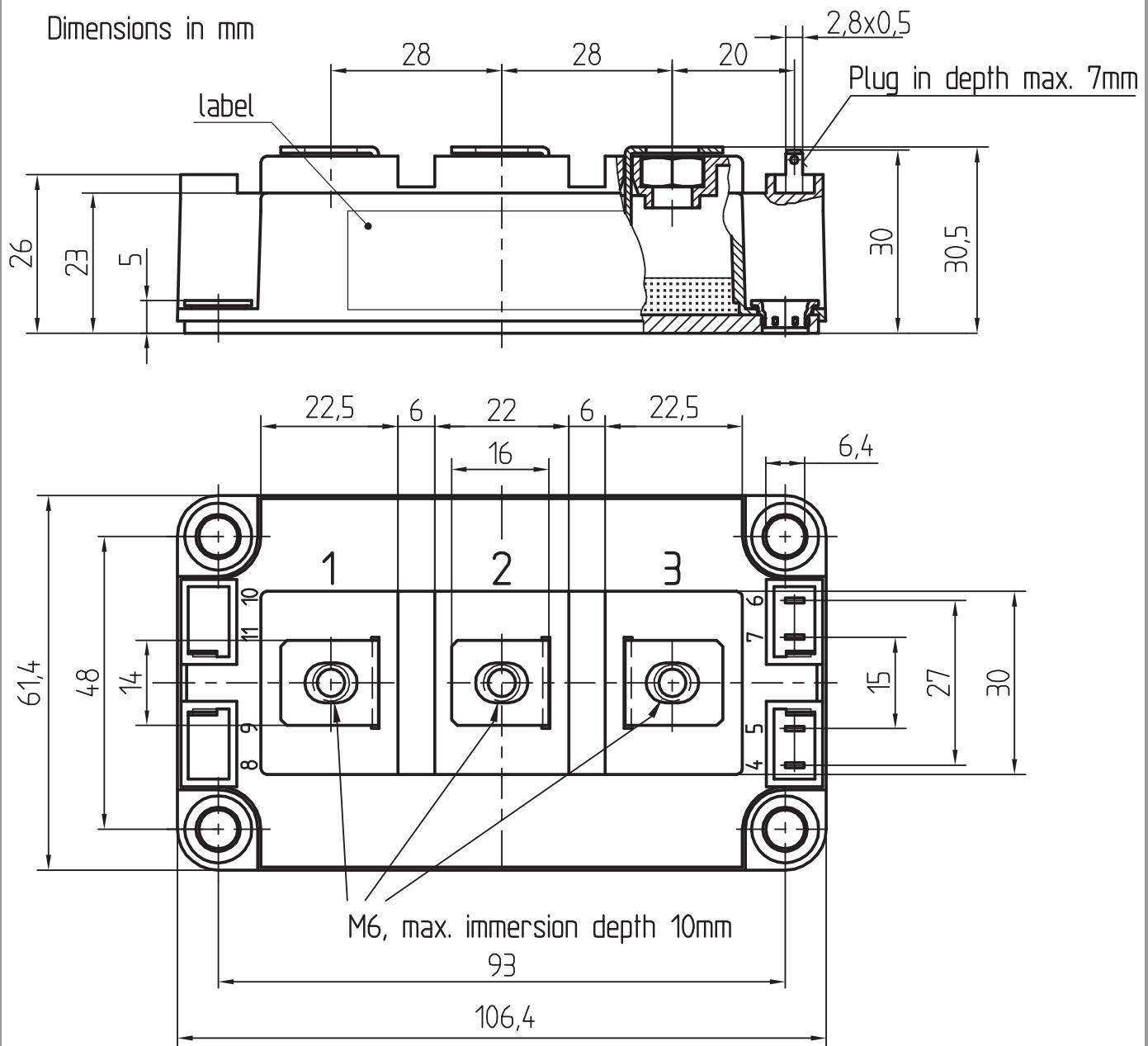
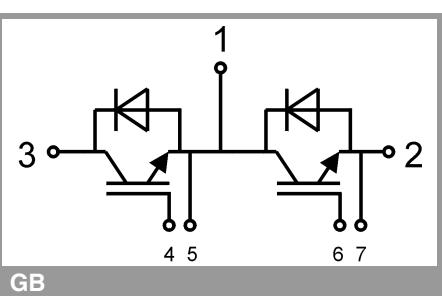


Fig. 12: Typ. CAL diode peak reverse recovery charge

Dimensions in mm



SEMITRANS 3



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

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