

# SKM450GB12T4



SEMITRANS® 3

## Fast IGBT4 Modules

### SKM450GB12T4

#### Features

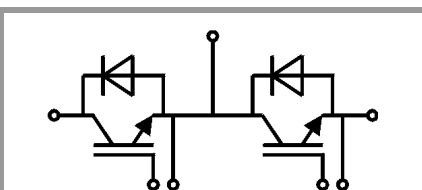
- IGBT4 = 4. generation fast trench IGBT (Infineon)
- CAL4 = Soft switching 4. generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- With integrated gate resistor
- For higher switching frequencies up to 20kHz
- UL recognized, file no. E63532

#### Typical Applications\*

- AC inverter drives
- UPS
- Electronic welders at fsw up to 20 kHz

#### 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
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$		1200	V
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	699	A
		$T_c = 80^\circ\text{C}$	538	A
$I_{Cnom}$			450	A
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$		1350	A
$V_{GES}$			-20 ... 20	V
$t_{psc}$	$V_{CC} = 800\text{ V}$	$T_j = 150^\circ\text{C}$	10	$\mu\text{s}$
	$V_{GE} \leq 15\text{ V}$			
	$V_{CES} \leq 1200\text{ V}$			
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Inverse diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	461	A
		$T_c = 80^\circ\text{C}$	345	A
$I_{Fnom}$			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	$^\circ\text{C}$
<b>Module</b>				
$I_{t(RMS)}$			500	A
$T_{stg}$			-40 ... 125	$^\circ\text{C}$
$V_{isol}$	AC sinus 50 Hz, $t = 1\text{ min}$		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>IGBT</b>						
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.84	2.07		V
		$T_j = 150^\circ\text{C}$	2.23	2.42		V
$V_{CE0}$	chipelevel	$T_j = 25^\circ\text{C}$	0.80	0.90		V
		$T_j = 150^\circ\text{C}$	0.70	0.80		V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	2.3	2.6		$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	3.4	3.6		$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 16.4\text{ mA}$		5.3	5.8	6.3	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$			5	$\text{mA}$
		$T_j = 150^\circ\text{C}$			-	$\text{mA}$
$C_{ies}$				27.2		nF
$C_{oes}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		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		$\Omega$
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		224		ns
$t_r$	$I_C = 450\text{ A}$ $V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$		59		ns
		$T_j = 150^\circ\text{C}$		32		mJ
$E_{on}$	$R_{Gon} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		32		mJ
$t_{d(off)}$	$R_{Goff} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		460		ns
$t_f$	$di/dt_{on} = 8300\text{ A}/\mu\text{s}$ $di/dt_{off} = 3800\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		91		ns
		$T_j = 150^\circ\text{C}$		49		mJ
$E_{off}$	$du/dt = 3700\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		49		mJ
$R_{th(j-c)}$	per IGBT				0.062	K/W

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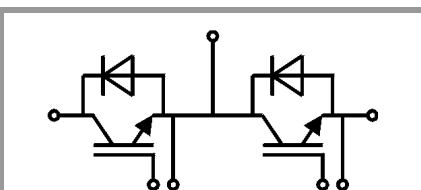
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#### Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.31	2.65	V
		$T_j = 150^\circ\text{C}$		2.31	2.64	V
$V_{F0}$	chipelevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
$r_F$	chipelevel	$T_j = 25^\circ\text{C}$		2.3	2.6	m $\Omega$
		$T_j = 150^\circ\text{C}$		3.1	3.4	m $\Omega$
$I_{RRM}$	$I_F = 450\text{ A}$	$T_j = 150^\circ\text{C}$		440		A
$Q_{rr}$	$di/dt_{off} = 8000\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		65		$\mu\text{C}$
$E_{rr}$	$V_{GE} = 15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		28		mJ
$R_{th(j-c)}$	per diode				0.13	K/W
<b>Module</b>						
$L_{CE}$				15		nH
$R_{CC'+EE'}$	measured per switch	$T_c = 25^\circ\text{C}$		0.55		m $\Omega$
		$T_c = 125^\circ\text{C}$		0.85		m $\Omega$
$R_{th(c-s)}$	per module			0.02	0.038	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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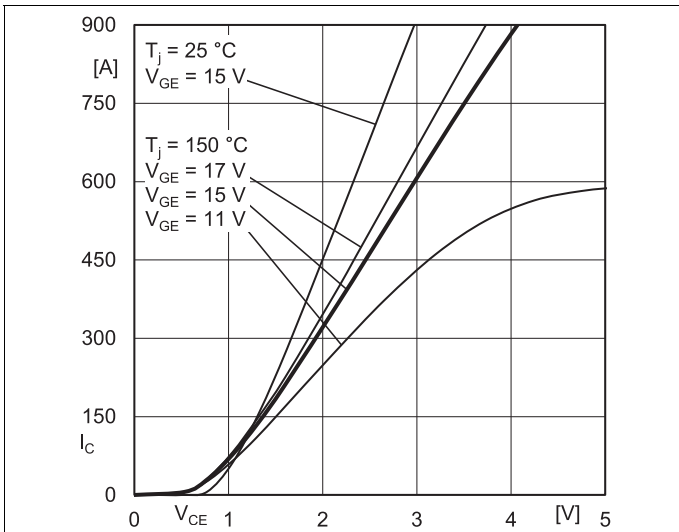


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

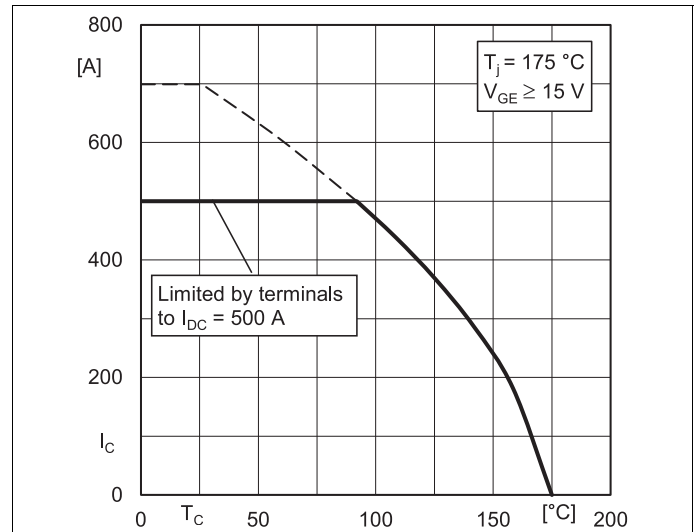


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

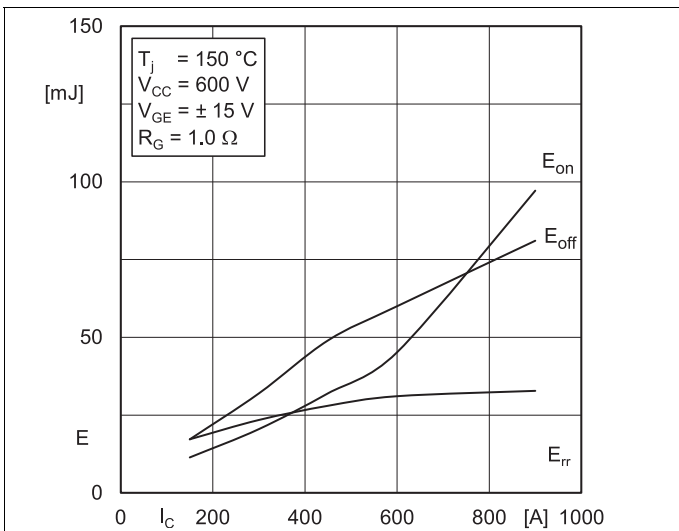


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

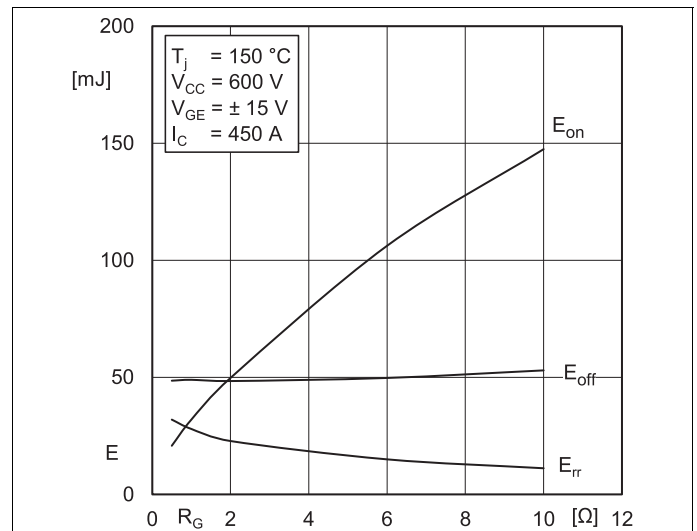


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

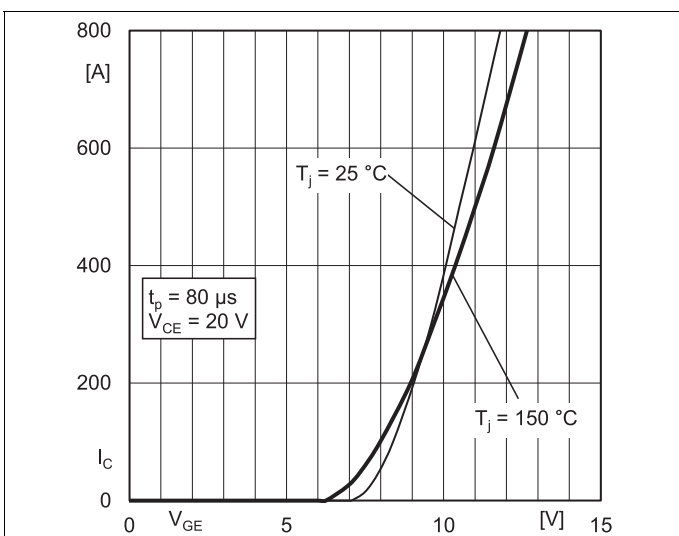


Fig. 5: Typ. transfer characteristic

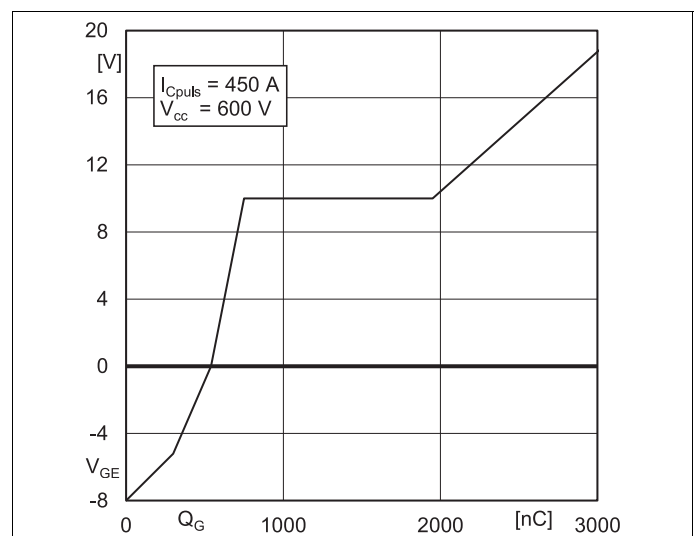


Fig. 6: Typ. gate charge characteristic

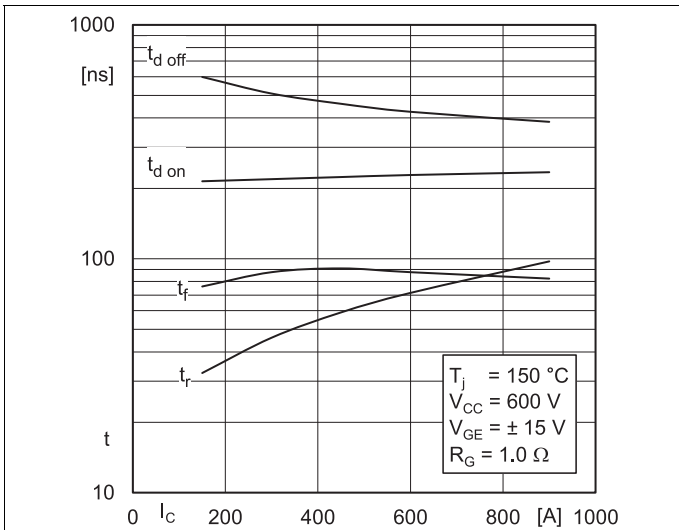


Fig. 7: Typ. switching times vs.  $I_C$

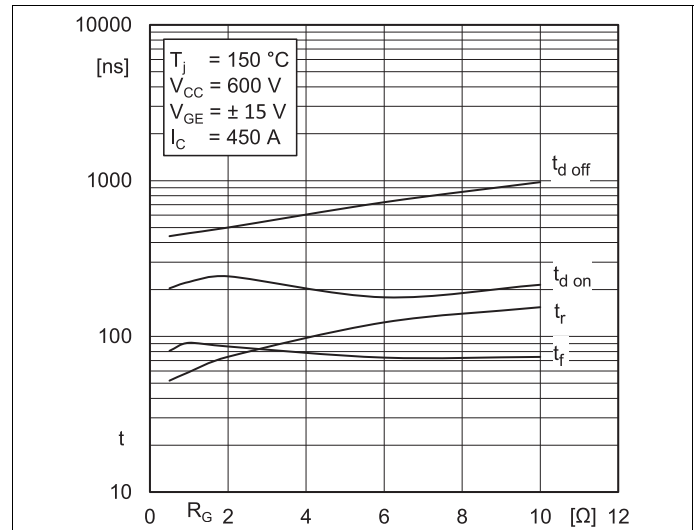


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

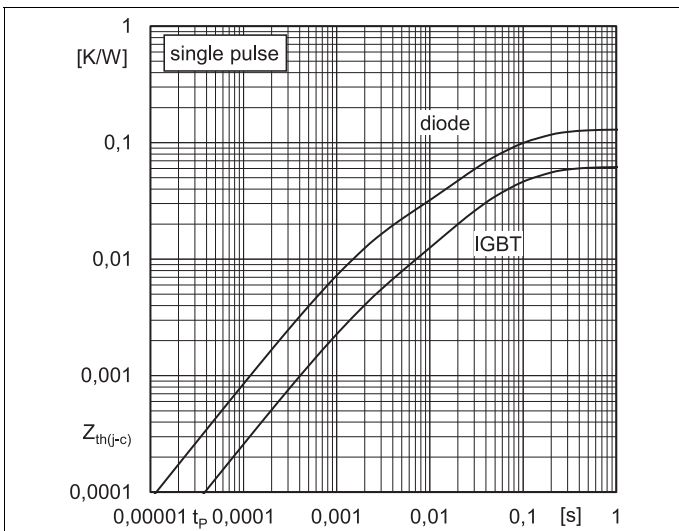


Fig. 9: Transient thermal impedance

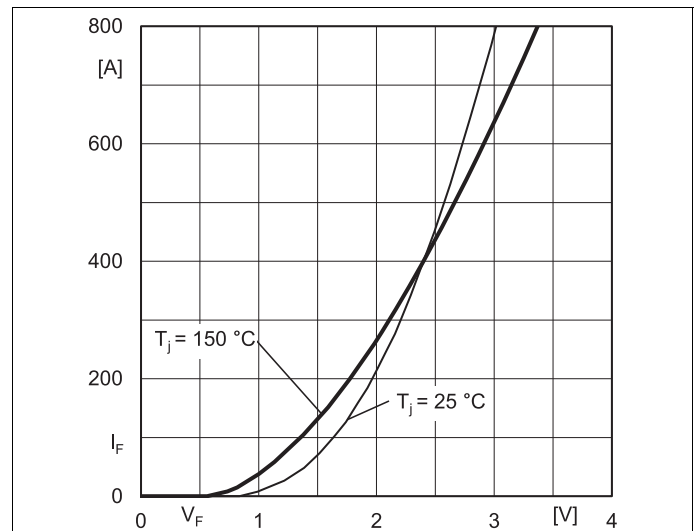


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

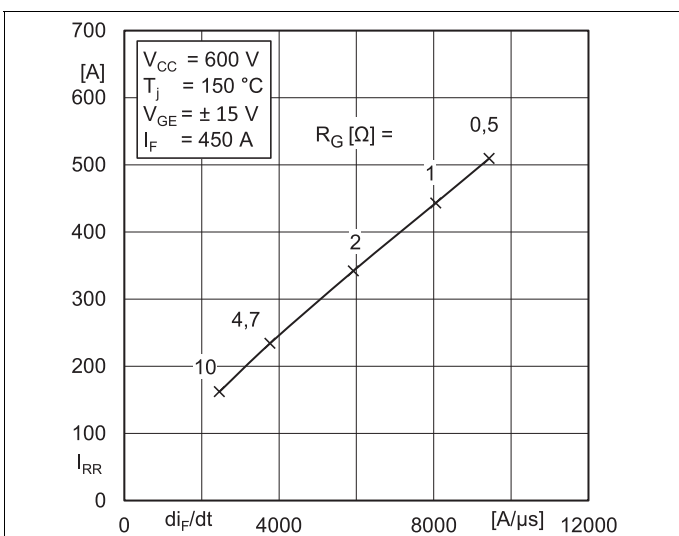


Fig. 11: CAL diode peak reverse recovery current

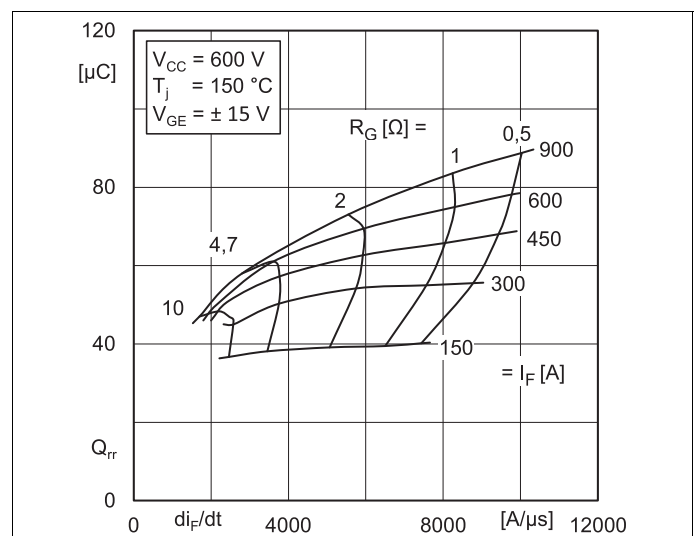
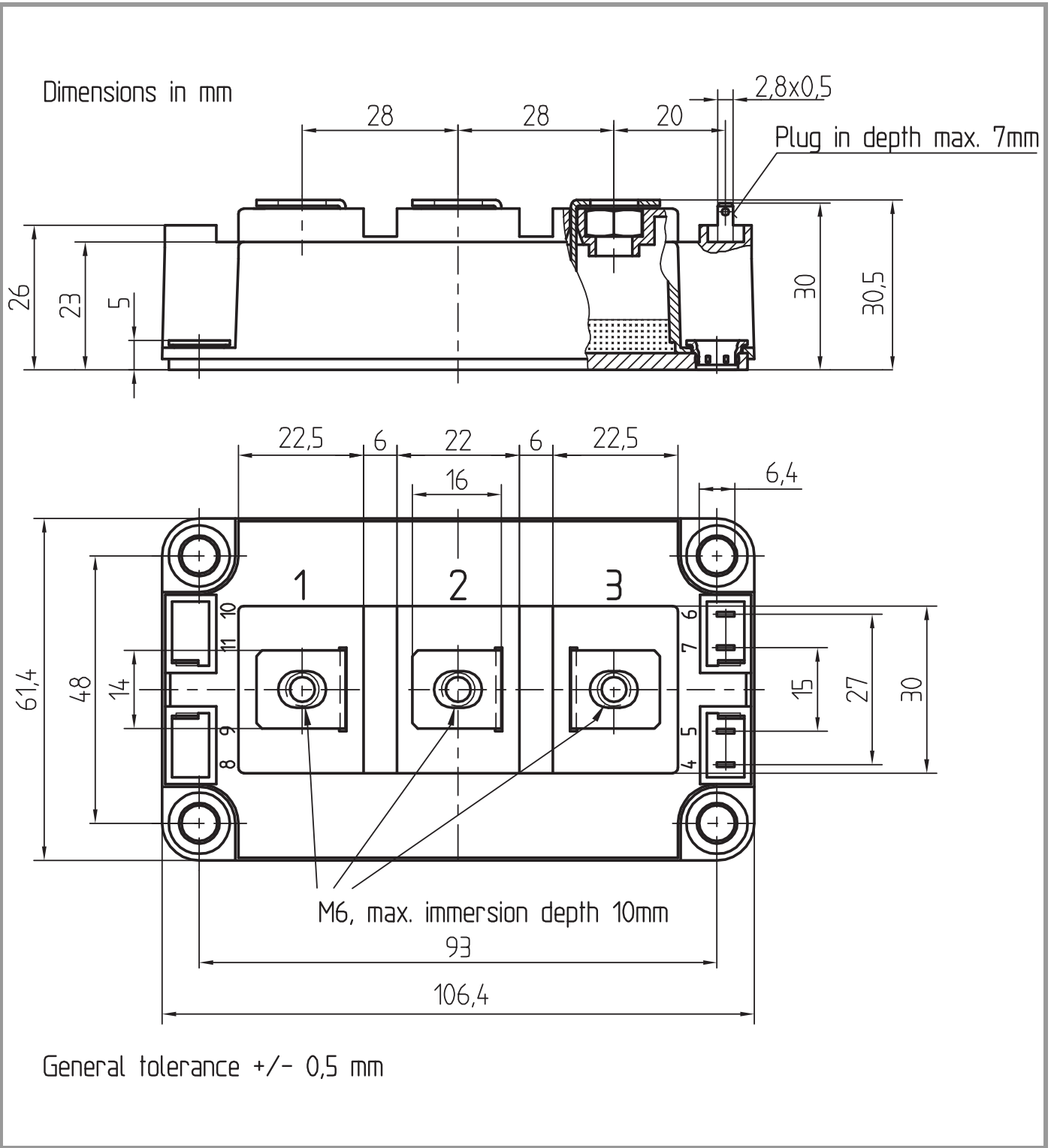
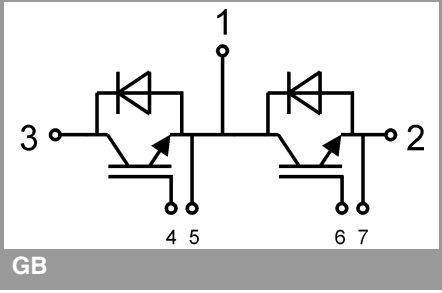


Fig. 12: Typ. CAL diode peak reverse recovery charge

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

## **\*IMPORTANT INFORMATION AND WARNINGS**

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