



**SEMITRANS® 3**

## Trench IGBT Modules

### SKM300GAL07E3

#### Target Data

#### Features

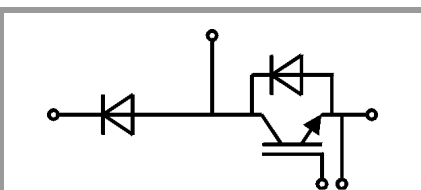
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability, self limiting to  $6 \times I_{Cnom}$
- Fast & soft inverse CAL diodes
- Insulated copper baseplate using DBC Technology (Direct Copper Bonding)
- With integrated gate resistor

#### 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  $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results valid for  $T_j = 150^\circ\text{C}$
- Use of soft  $R_G$  necessary



**GAL**

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	650	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	382	A
		$T_c = 80^\circ\text{C}$	297	A
$I_{Cnom}$		300	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	900	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 360\text{ V}$	$T_j = 150^\circ\text{C}$	6	$\mu\text{s}$
	$V_{GE} \leq 15\text{ V}$			
	$V_{CES} \leq 650\text{ V}$			
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$V_{RRM}$	$T_j = 25^\circ\text{C}$	650	V	
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	335	A
		$T_c = 80^\circ\text{C}$	244	A
$I_{Fnom}$		300	A	
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	600	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	2160	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Freewheeling diode</b>				
$V_{RRM}$	$T_j = 25^\circ\text{C}$	650	V	
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	335	A
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$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		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
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 300\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.45	1.90	V
		$T_j = 150^\circ\text{C}$	1.69	2.10	V
$V_{CE0}$	chipelevel	$T_j = 25^\circ\text{C}$	0.90	1.00	V
		$T_j = 150^\circ\text{C}$	0.82	0.90	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.83	3.0	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	2.9	4.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 4.8\text{ mA}$	5.1	5.8	6.4	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 650\text{ V}$	$T_j = 25^\circ\text{C}$		0.3	$\text{mA}$
		$T_j = 150^\circ\text{C}$		-	$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$		18.5		$\text{nF}$
$C_{oes}$	$V_{GE} = 0\text{ V}$		1.16		$\text{nF}$
$C_{res}$			0.55		$\text{nF}$
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		2400		$\text{nC}$
$R_{Gint}$	$T_j = 25^\circ\text{C}$		1.0		$\Omega$



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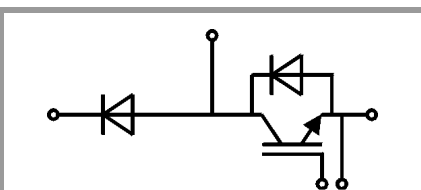
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		150		ns
$t_r$	$I_C = 300\text{ A}$	$T_j = 150^\circ\text{C}$		50		ns
$E_{on}$	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$		3		mJ
$t_{d(off)}$		$T_j = 150^\circ\text{C}$		810		ns
$t_f$	$di/dt_{on} = 7000\text{ A}/\mu\text{s}$ $di/dt_{off} = 4500\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		67		ns
$E_{off}$	$du/dt = 1700\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		14		mJ
$R_{th(j-c)}$	per IGBT				0.15	K/W
$R_{th(c-s)}$	per IGBT ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )			0.042		K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 300\text{ A}$	$T_j = 25^\circ\text{C}$		1.40	1.76	V
	$V_{GE} = 0\text{ V}$ chipllevel	$T_j = 150^\circ\text{C}$		1.39	1.77	V
$V_{F0}$	chipllevel	$T_j = 25^\circ\text{C}$		1.04	1.24	V
		$T_j = 150^\circ\text{C}$		0.85	0.99	V
$r_F$	chipllevel	$T_j = 25^\circ\text{C}$		1.19	1.76	m $\Omega$
		$T_j = 150^\circ\text{C}$		1.79	2.6	m $\Omega$
$I_{RRM}$	$I_F = 300\text{ A}$	$T_j = 150^\circ\text{C}$		313		A
$Q_{rr}$	$di/dt_{off} = 5400\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		31.5		$\mu\text{C}$
$E_{rr}$	$V_{GE} = \pm 15\text{ V}$ $V_{CC} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		6.4		mJ
$R_{th(j-c)}$	per diode				0.25	K/W
$R_{th(c-s)}$	per diode ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )			0.044		K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 300\text{ A}$	$T_j = 25^\circ\text{C}$		1.40	1.76	V
	$V_{GE} = 0\text{ V}$ chipllevel	$T_j = 150^\circ\text{C}$		1.39	1.77	V
$V_{F0}$	chipllevel	$T_j = 25^\circ\text{C}$		1.04	1.24	V
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$E_{rr}$	$V_{GE} = \pm 15\text{ V}$ $V_{CC} = 300\text{ V}$	$T_j = 150^\circ\text{C}$		6.4		mJ
$R_{th(j-c)}$	per diode				0.25	K/W
$R_{th(c-s)}$	per diode ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )			0.044		K/W
Module						
$L_{CE}$				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 $\Omega$
$R_{th(c-s)1}$	calculated without thermal coupling ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )			0.021		K/W
$R_{th(c-s)2}$	including thermal coupling, $T_s$ underneath module ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )			0.035		K/W
$M_s$	to heat sink M6			3	5	Nm
$M_t$	to terminals M6			2.5	5	Nm
						Nm
$w$					325	g

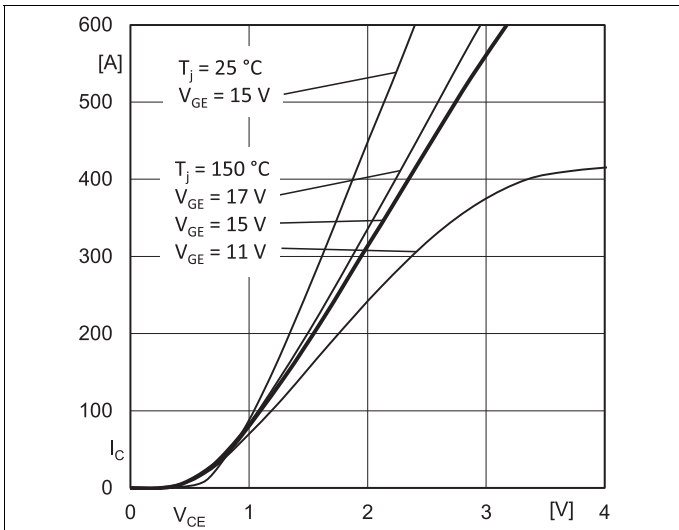


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

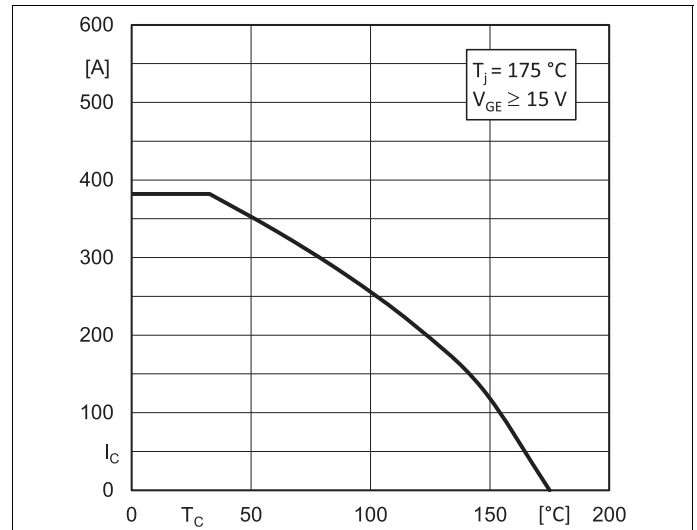


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

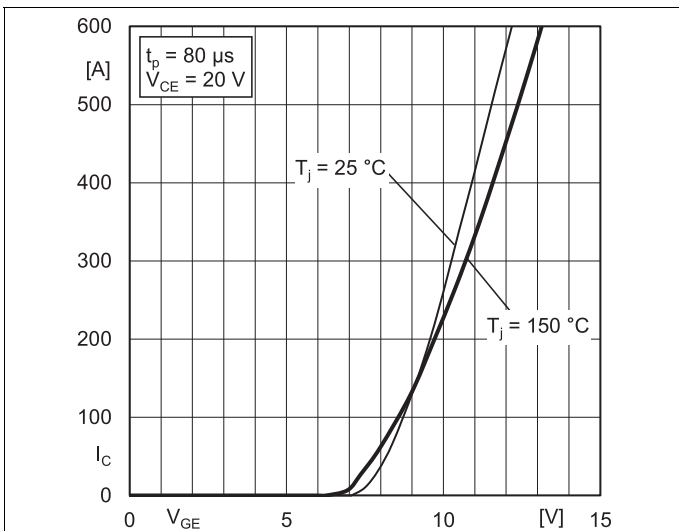


Fig. 5: Typ. transfer characteristic

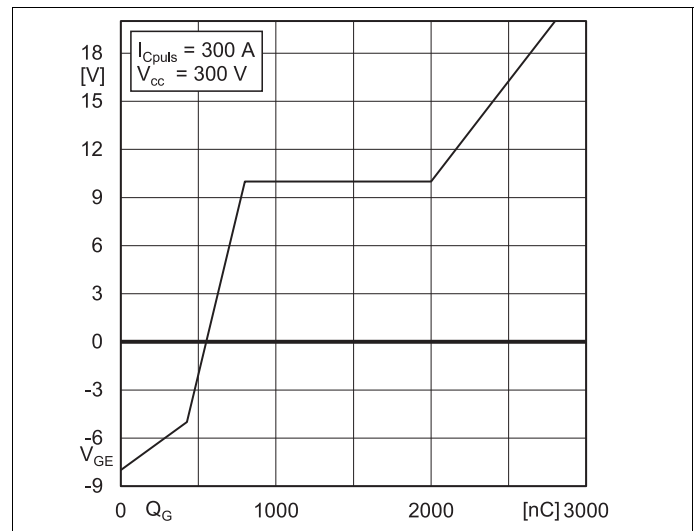


Fig. 6: Typ. gate charge characteristic

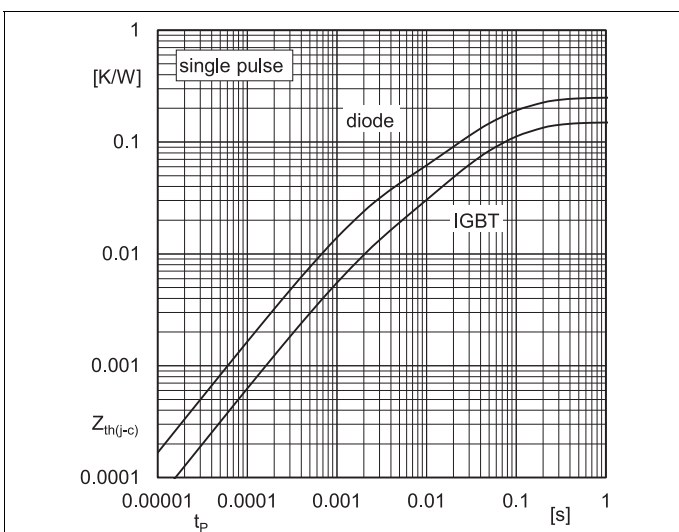


Fig. 9: Transient thermal impedance

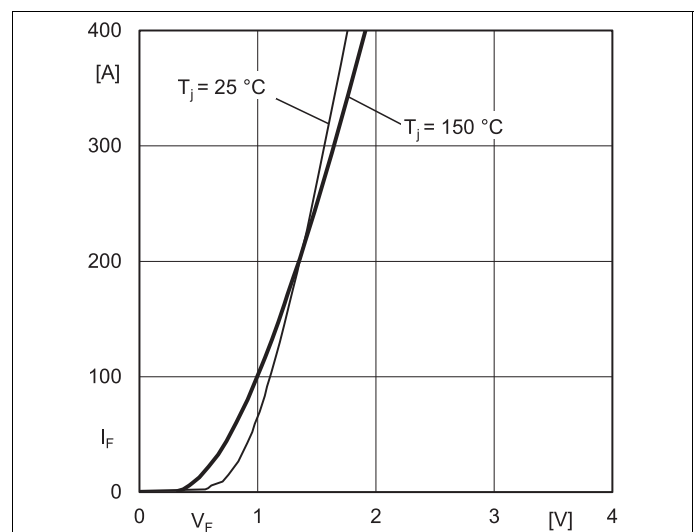


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC'+EE'}$

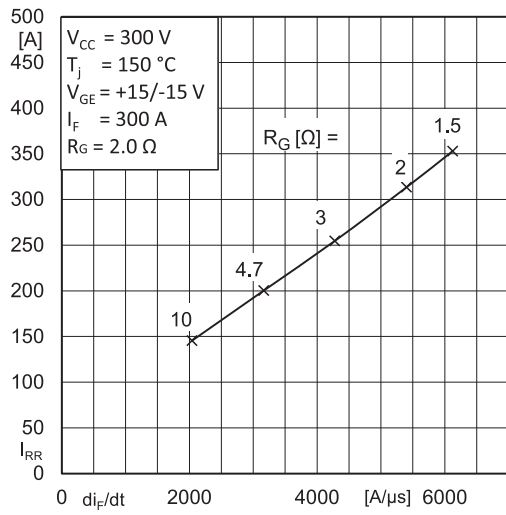


Fig. 11: CAL diode peak reverse recovery current

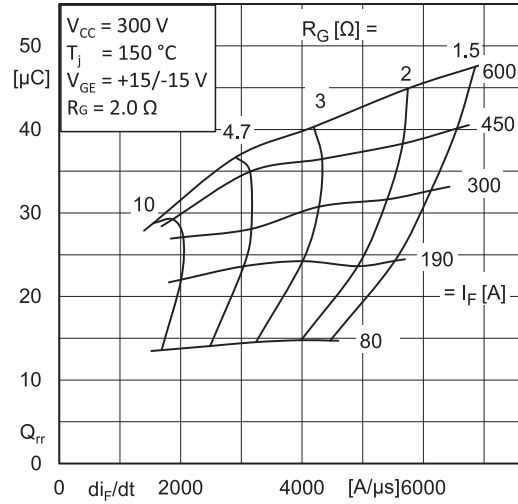
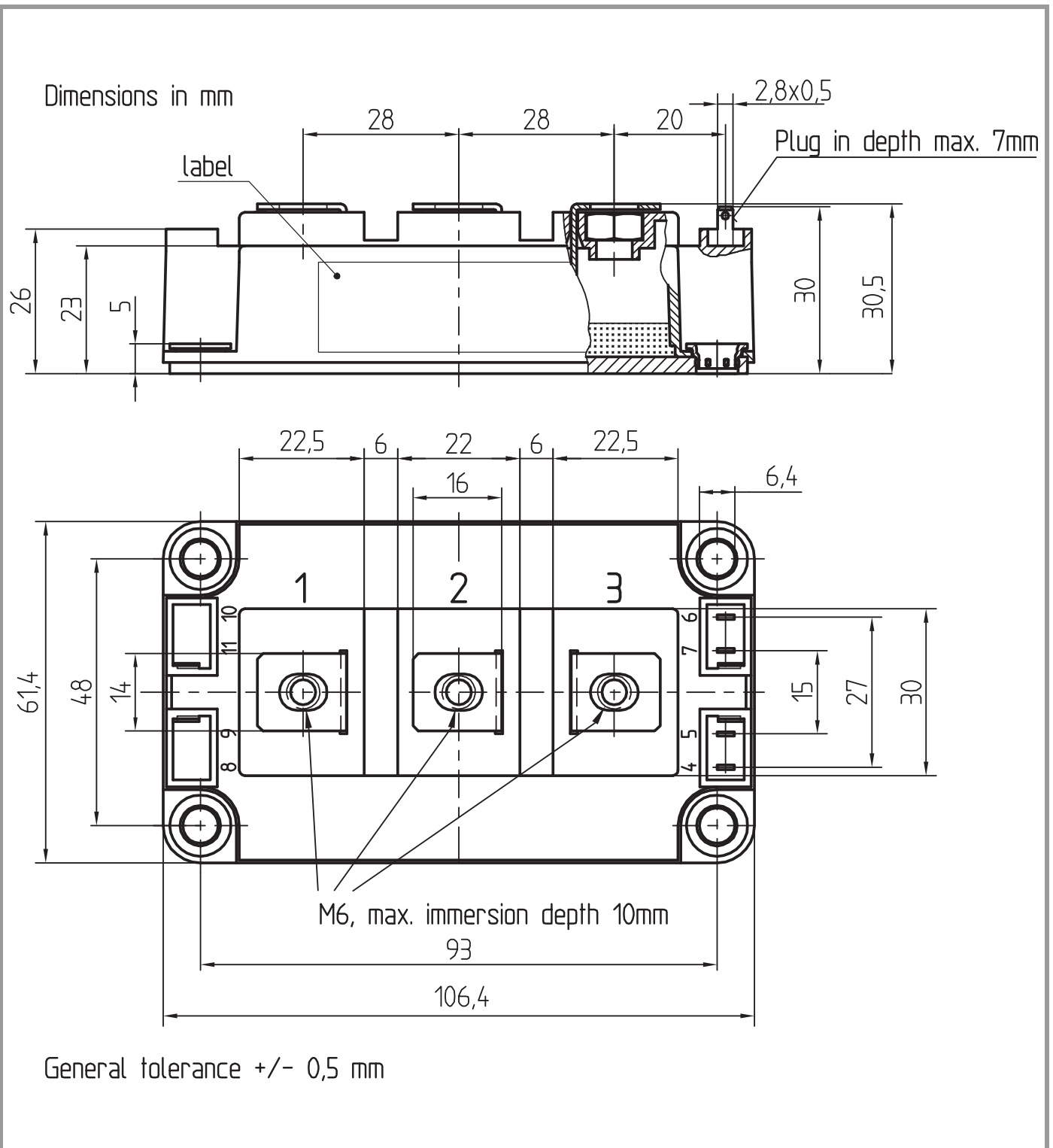
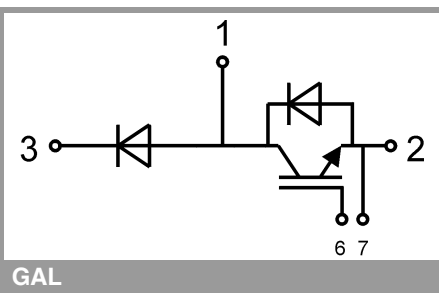


Fig. 12: Typ. CAL diode peak reverse recovery charge



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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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