

# SKM50GAL12T4



SEMITRANS® 2

## Fast IGBT4 Modules

### SKM50GAL12T4

#### Features

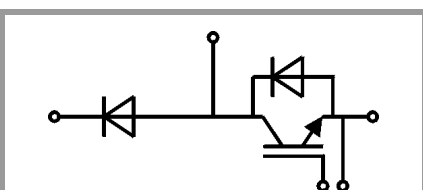
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability, self limiting to 6 x  $I_{Cnom}$
- Fast & soft inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Isolated copper baseplate using DBC Technology (Direct Copper Bonding)
- UL recognized, file no. E63532

#### Typical Applications\*

- DC/DC – converter
- Brake chopper
- Switched reluctance motor
- DC – motor

#### Remarks

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



GAL

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$		1200	V
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	81	A
		$T_c = 80^\circ\text{C}$	62	A
$I_{Cnom}$			50	A
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$		150	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>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	65	A
		$T_c = 80^\circ\text{C}$	49	A
$I_{Fnom}$			50	A
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$		150	A
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		270	A
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Freewheeling diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	65	A
		$T_c = 80^\circ\text{C}$	49	A
$I_{Fnom}$			50	A
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$		150	A
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		270	A
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Module</b>				
$I_{t(RMS)}$	$T_{terminal} = T_{terminal} < 80^\circ\text{C}$		200	A
$T_{stg}$			-40 ... 125	$^\circ\text{C}$
$V_{isol}$	AC sinus 50Hz, $t = 1\text{ min}$		4000	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>IGBT</b>						
$V_{CE(sat)}$	$I_C = 50\text{ A}$	$T_j = 25^\circ\text{C}$	1.85	2.1		V
		$T_j = 150^\circ\text{C}$	2.2	2.4		V
$V_{CE0}$		$T_j = 25^\circ\text{C}$	0.8	0.9		V
		$T_j = 150^\circ\text{C}$	0.7	0.8		V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	21.0	24.0		$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	30.0	32.0		$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 1.7\text{ mA}$		5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3		mA
		$T_j = 150^\circ\text{C}$				mA
$C_{ies}$	$V_{CE} = 25\text{ V}$	$V_{GE} = 0\text{ V}$	2.77			nF
$C_{oes}$		$f = 1\text{ MHz}$	0.20			nF
$C_{res}$		$f = 1\text{ MHz}$	0.16			nF
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		280			nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$		4.0			$\Omega$



**SEMITRANS® 2**

## Fast IGBT4 Modules

### SKM50GAL12T4

#### Features

- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability, self limiting to 6 x  $I_{cnom}$
- Fast & soft inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Isolated copper baseplate using DBC Technology (Direct Copper Bonding)
- UL recognized, file no. E63532

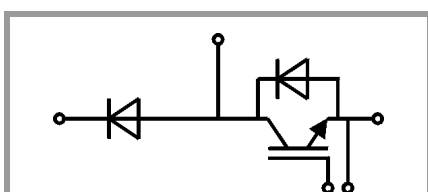
#### Typical Applications\*

- DC/DC – converter
- Brake chopper
- Switched reluctance motor
- DC – motor

#### Remarks

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

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		98		ns
$t_r$	$I_C = 50\text{ A}$	$T_j = 150^\circ\text{C}$		29		ns
$E_{on}$	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		5.5		mJ
$t_{d(off)}$	$R_{G\ on} = 8.2\ \Omega$	$T_j = 150^\circ\text{C}$		325		ns
$t_f$	$R_{G\ off} = 8.2\ \Omega$	$T_j = 150^\circ\text{C}$		75		ns
$E_{off}$	$di/dt_{on} = 1700\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		4.5		mJ
	$di/dt_{off} = 670\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per IGBT				0.53	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 50\text{ A}$	$T_j = 25^\circ\text{C}$		2.22	2.54	V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.18	2.50	V
	chip					
$V_{F0}$		$T_j = 25^\circ\text{C}$		1.3	1.5	V
		$T_j = 150^\circ\text{C}$		0.9	1.1	V
$r_F$		$T_j = 25^\circ\text{C}$		18.4	20.8	m $\Omega$
		$T_j = 150^\circ\text{C}$		25.6	28.0	m $\Omega$
$I_{RRM}$	$I_F = 50\text{ A}$	$T_j = 150^\circ\text{C}$		35		A
$Q_{rr}$	$di/dt_{off} = 1380\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		8.7		$\mu\text{C}$
$E_{rr}$	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		3.6		mJ
	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per diode				0.84	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 50\text{ A}$	$T_j = 25^\circ\text{C}$		2.22	2.54	V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.18	2.50	V
	chip					
$V_{F0}$		$T_j = 25^\circ\text{C}$		1.3	1.5	V
		$T_j = 150^\circ\text{C}$		0.9	1.1	V
$r_F$		$T_j = 25^\circ\text{C}$		18.4	20.8	m $\Omega$
		$T_j = 150^\circ\text{C}$		25.6	28.0	m $\Omega$
$I_{RRM}$	$I_F = 50\text{ A}$	$T_j = 150^\circ\text{C}$		35		A
$Q_{rr}$	$di/dt_{off} = 1380\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		8.7		$\mu\text{C}$
$E_{rr}$	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		3.6		mJ
	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per Diode				0.84	K/W
Module						
$L_{CE}$					30	nH
$R_{CC'+EE'}$	terminal-chip	$T_c = 25^\circ\text{C}$		0.65		m $\Omega$
		$T_c = 125^\circ\text{C}$		1		m $\Omega$
$R_{th(c-s)}$	per module			0.04	0.05	K/W
$M_s$	to heat sink M6			3	5	Nm
$M_t$		to terminals M5		2.5	5	Nm
						Nm
$w$					160	g



GAL

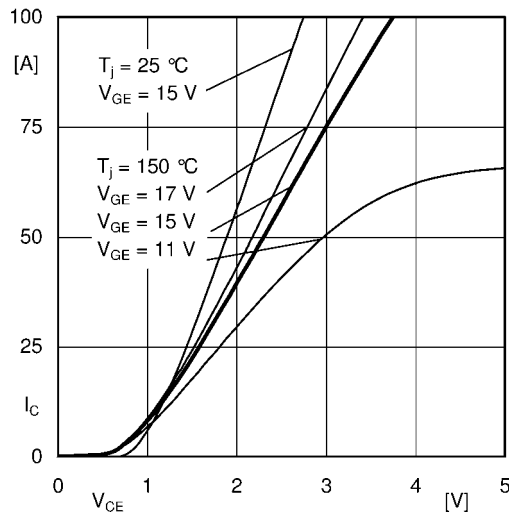


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

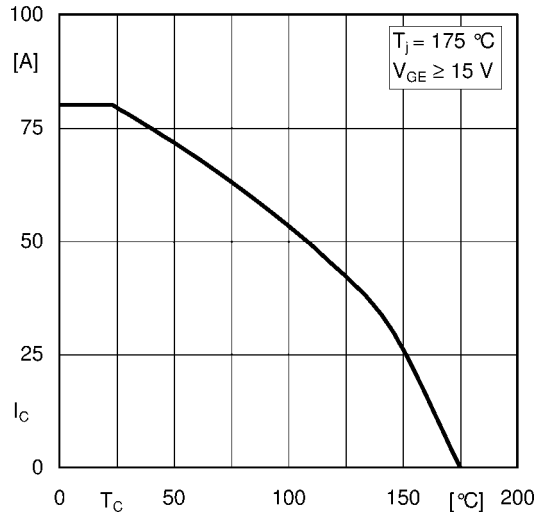


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

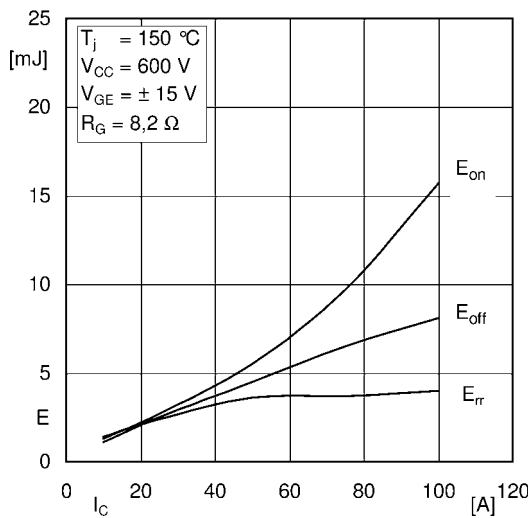


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

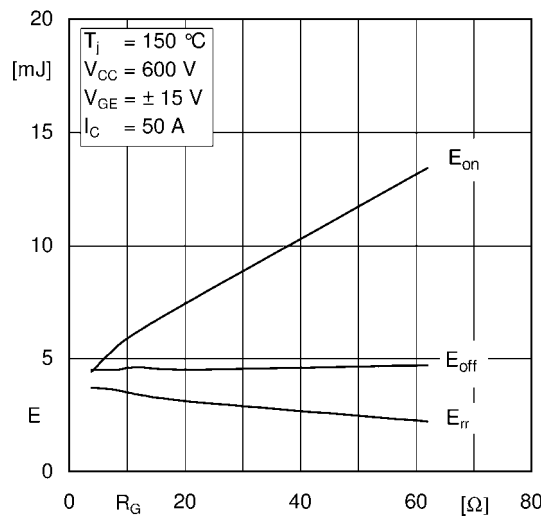


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

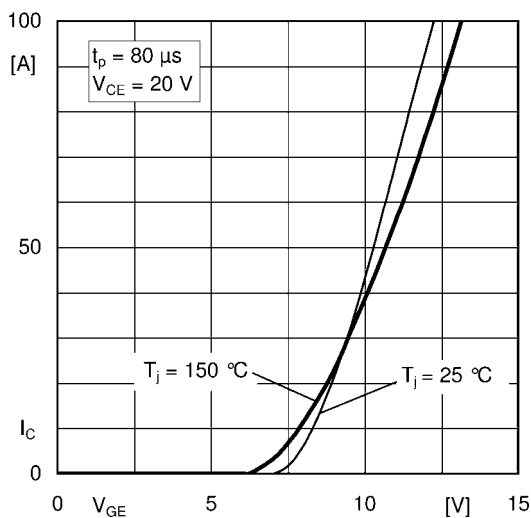


Fig. 5: Typ. transfer characteristic

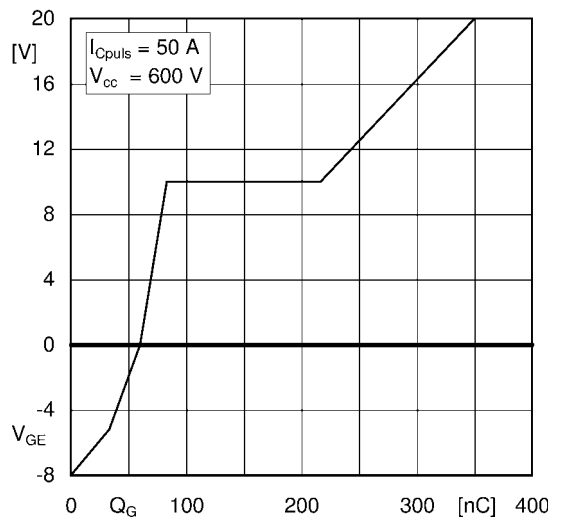


Fig. 6: Typ. gate charge characteristic

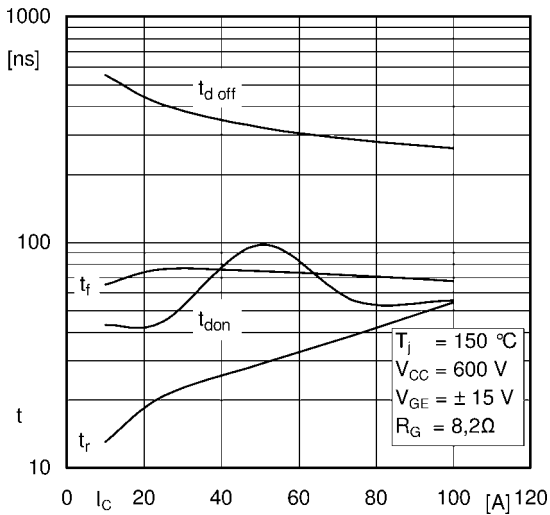


Fig. 7: Typ. switching times vs.  $I_C$

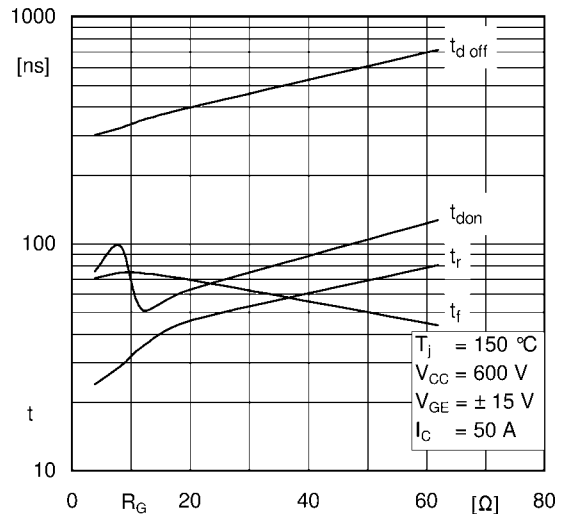


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

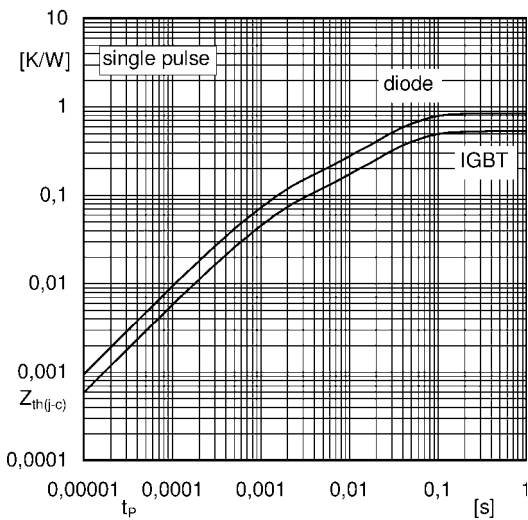


Fig. 9: Transient thermal impedance

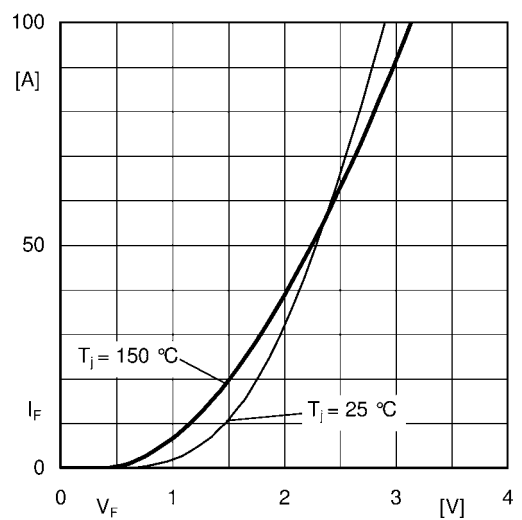


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

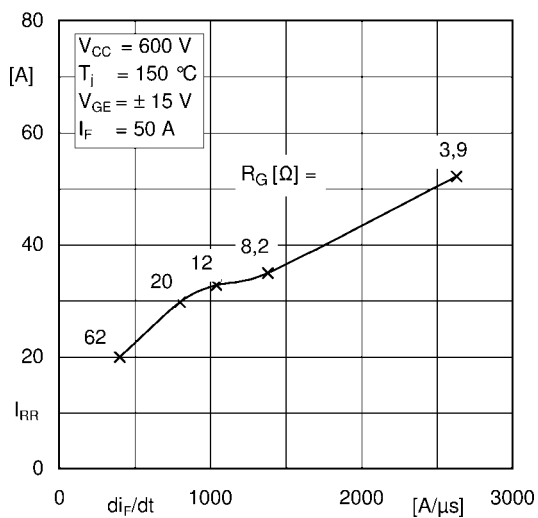


Fig. 11: CAL diode peak reverse recovery current

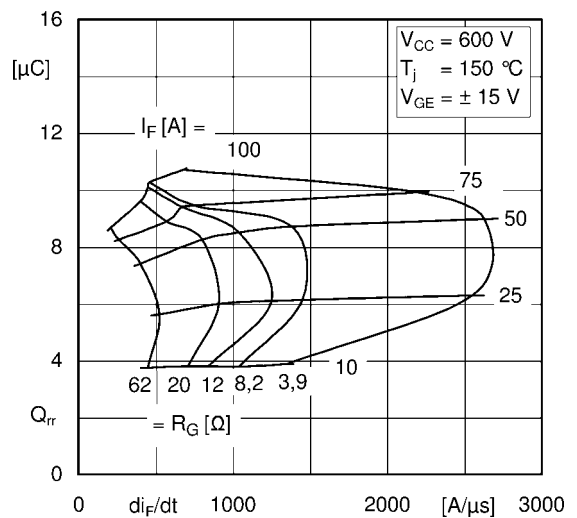
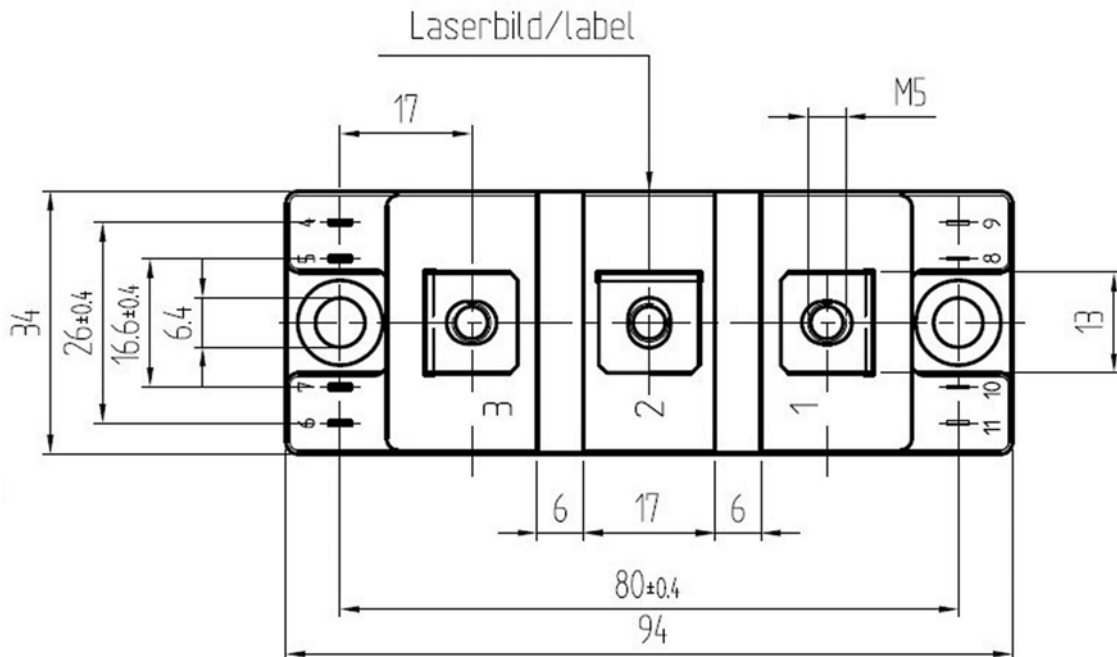
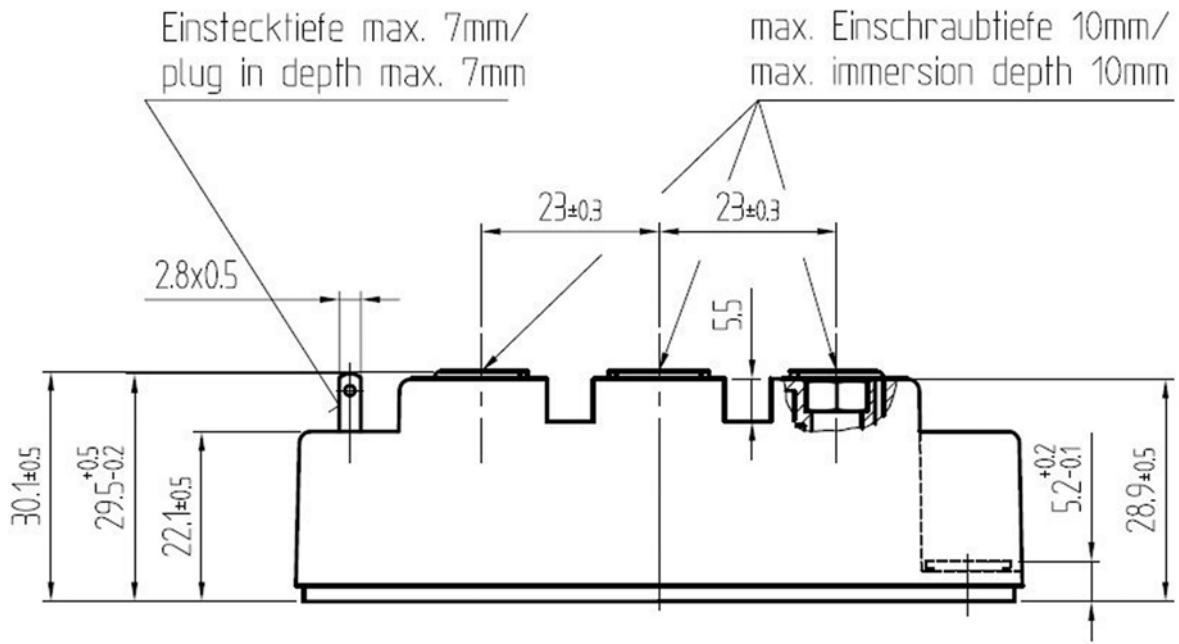
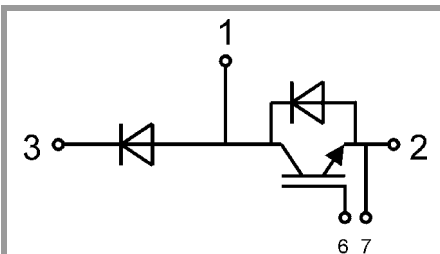


Fig. 12: Typ. CAL diode peak reverse recovery charge

# SKM50GAL12T4



SEMITRANS 2



GAL

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

\* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our personal.