

# SKM150GAR12V



SEMITRANS® 2

## SKM150GAR12V

### Features

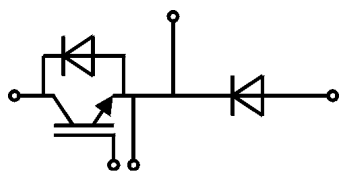
- V-IGBT = 6. Generation Trench V-IGBT (Fuji)
- CAL4 = Soft switching 4. Generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Copper Bonding)
- Increased power cycling capability
- With integrated gate resistor
- UL recognized, file no. E63532
- Lowest switching losses at High di/dt

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



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### Absolute Maximum Ratings

Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	231	A
		$T_c = 80^\circ\text{C}$	176	A
$I_{Cnom}$		150	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	450	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 720\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 125^\circ\text{C}$	10	$\mu\text{s}$
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	189	A
		$T_c = 80^\circ\text{C}$	141	A
$I_{Fnom}$		150	A	
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$	450	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	900	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Freewheeling diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	189	A
		$T_c = 80^\circ\text{C}$	141	A
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$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		200	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>					
$V_{CE(sat)}$	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.75	2.20	V
		$T_j = 150^\circ\text{C}$	2.20	2.48	V
$V_{CE0}$	chiplevel	$T_j = 25^\circ\text{C}$	0.94	1.04	V
		$T_j = 150^\circ\text{C}$	0.88	0.98	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	5.4	7.7	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	8.8	10	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 6\text{ mA}$	5.5	6	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$		0.3	$\text{mA}$
		$T_j = 150^\circ\text{C}$		-	$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$		9.0		$\text{nF}$
$C_{oes}$	$V_{GE} = 0\text{ V}$		0.89		$\text{nF}$
$C_{res}$			0.88		$\text{nF}$
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		1650		$\text{nC}$
$R_{Gint}$	$T_j = 25^\circ\text{C}$		5.0		$\Omega$

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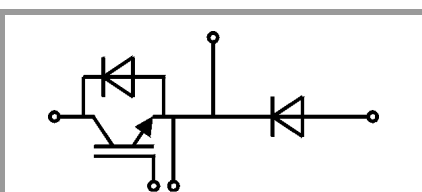
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		258		ns
$t_r$	$I_C = 150\text{ A}$	$T_j = 150^\circ\text{C}$		32		ns
$E_{on}$	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$		13.5		mJ
$t_{d(off)}$	$R_{G\ on} = 1.5\ \Omega$	$T_j = 150^\circ\text{C}$		388		ns
$t_f$	$R_{G\ off} = 1.5\ \Omega$	$T_j = 150^\circ\text{C}$		62		ns
$E_{off}$	$di/dt_{on} = 5400\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$				
	$di/dt_{off} = 1800\text{ A}/\mu\text{s}$			14.2		mJ
	$du/dt = 8100\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per IGBT				0.19	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 150\text{ A}$	$T_j = 25^\circ\text{C}$		2.14	2.46	V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.07	2.38	V
	chipllevel					
$V_{F0}$		$T_j = 25^\circ\text{C}$		1.30	1.50	V
	chipllevel	$T_j = 150^\circ\text{C}$		0.90	1.10	V
$r_F$		$T_j = 25^\circ\text{C}$		5.6	6.4	m $\Omega$
	chipllevel	$T_j = 150^\circ\text{C}$		7.8	8.5	m $\Omega$
$I_{RRM}$	$I_F = 150\text{ A}$	$T_j = 150^\circ\text{C}$		165		A
$Q_{rr}$	$di/dt_{off} = 5800\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		22		$\mu\text{C}$
$E_{rr}$	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		8.5		mJ
	$V_{CC} = 600\text{ V}$					
$R_{th(j-c)}$	per diode				0.31	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 150\text{ A}$	$T_j = 25^\circ\text{C}$		2.14	2.46	V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.07	2.38	V
	chipllevel					
$V_{F0}$		$T_j = 25^\circ\text{C}$		1.30	1.50	V
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$E_{rr}$	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		8.5		mJ
	$V_{CC} = 600\text{ V}$					
$R_{th(j-c)}$	per diode				0.31	K/W
Module						
$L_{CE}$				30		nH
$R_{CC+EE}$	measured per switch	$T_C = 25^\circ\text{C}$		0.65		m $\Omega$
		$T_C = 125^\circ\text{C}$		1.09		m $\Omega$
$R_{th(c-s)}$	calculated without thermal coupling ( $\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$ )			0.04	0.05	K/W
$M_s$	to heat sink M6			3	5	Nm
$M_t$						Nm
	to terminals M5			2.5	5	Nm
$w$					160	g

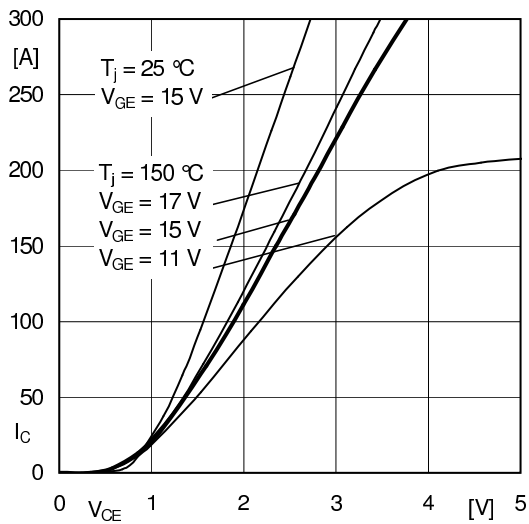


Fig. 1: Typ. output characteristic, inclusive  $R_{CC+EE}$

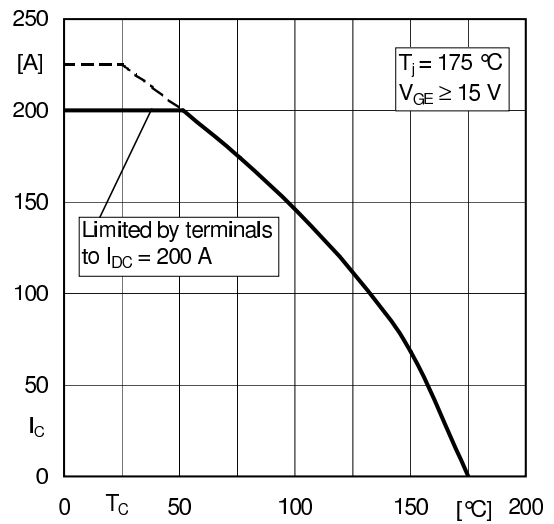


Fig. 2: Rated current vs. temperature  $I_c = f(T_c)$

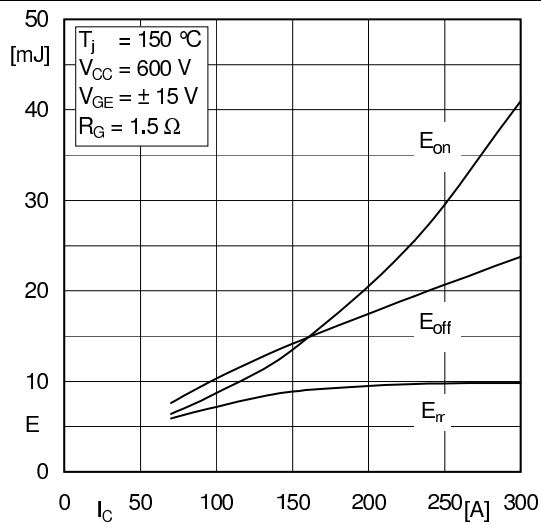


Fig. 3: Typ. turn-on /-off energy =  $f(I_c)$

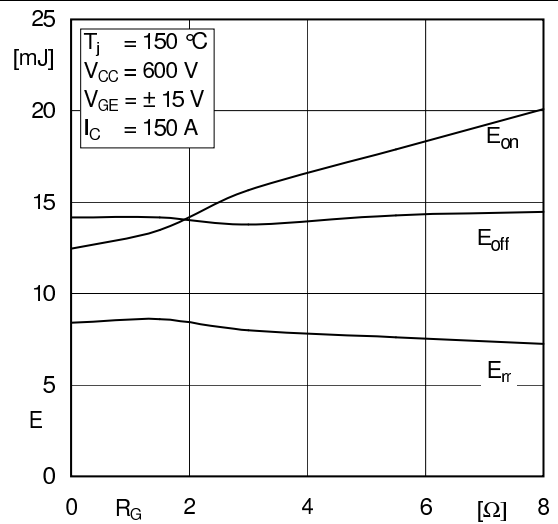


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

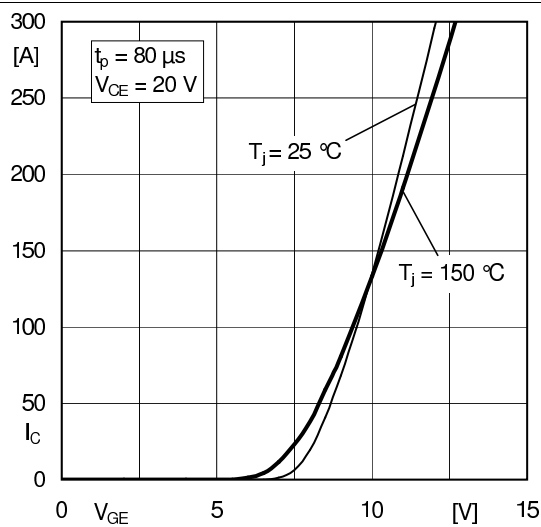


Fig. 5: Typ. transfer characteristic

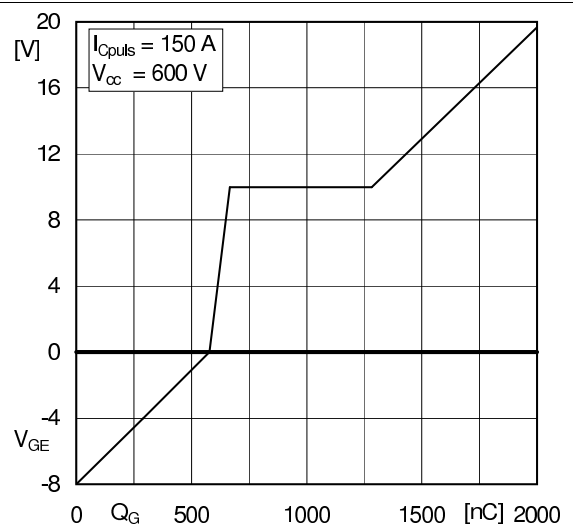


Fig. 6: Typ. gate charge characteristic

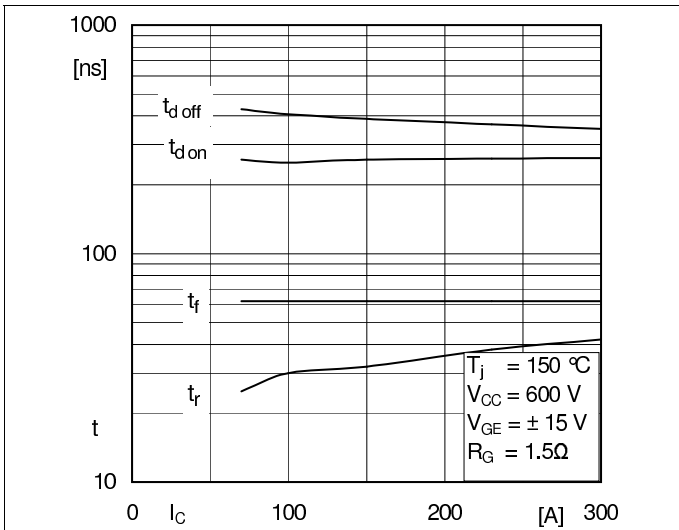


Fig. 7: Typ. switching times vs.  $I_C$

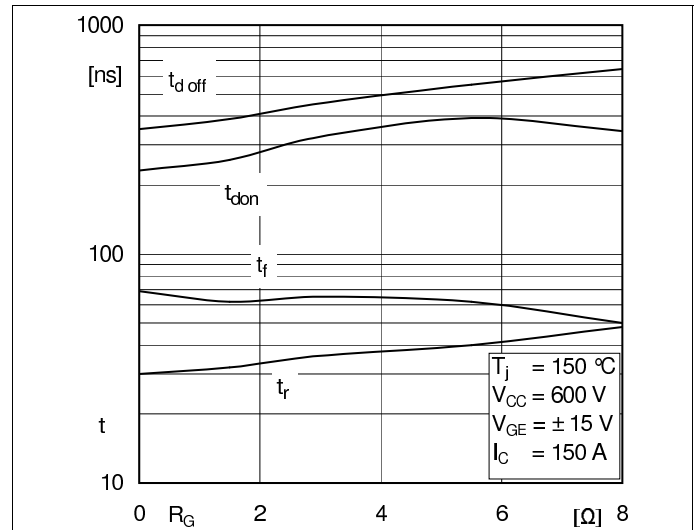


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

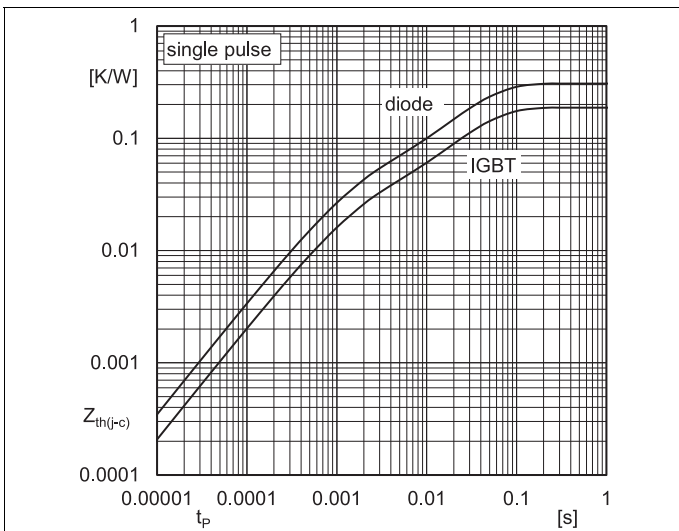


Fig. 9: Transient thermal impedance

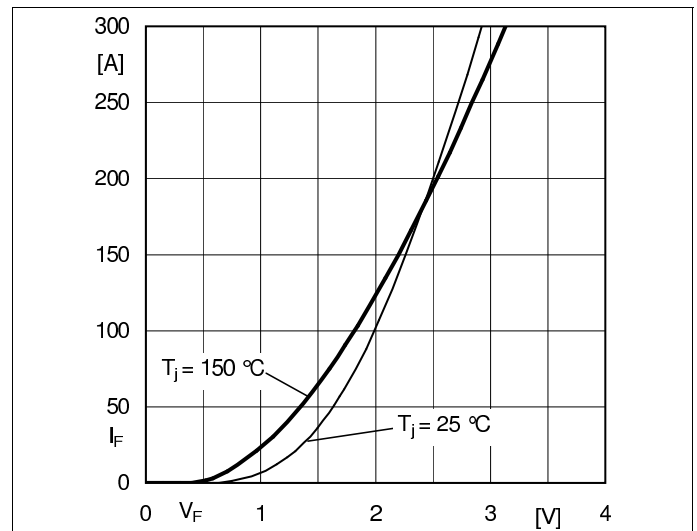


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

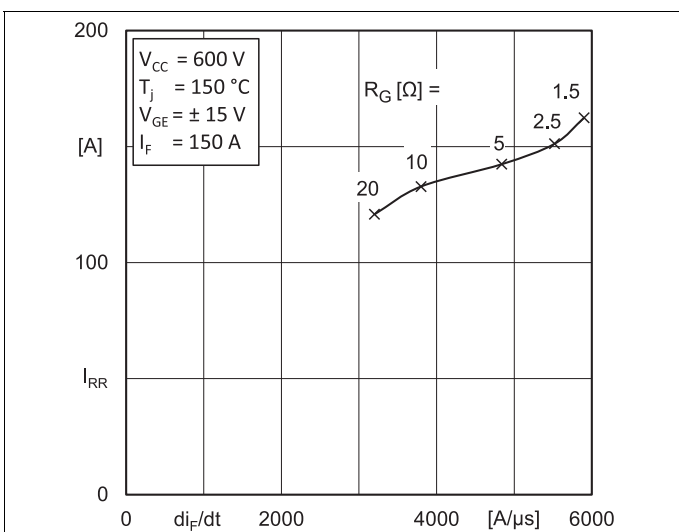


Fig. 11: CAL diode peak reverse recovery current

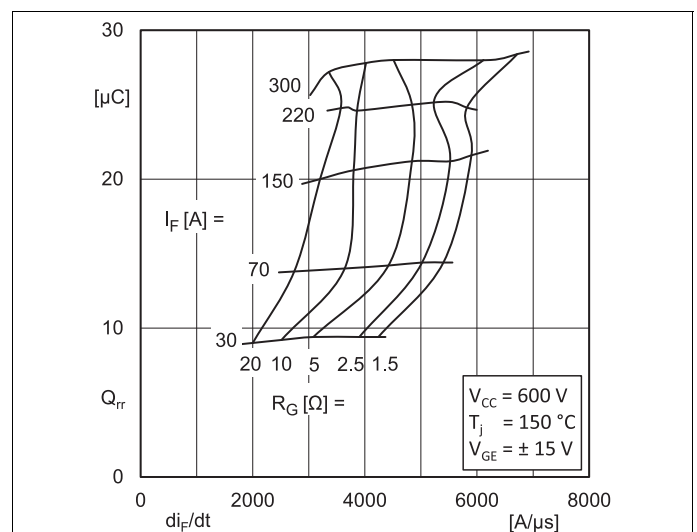
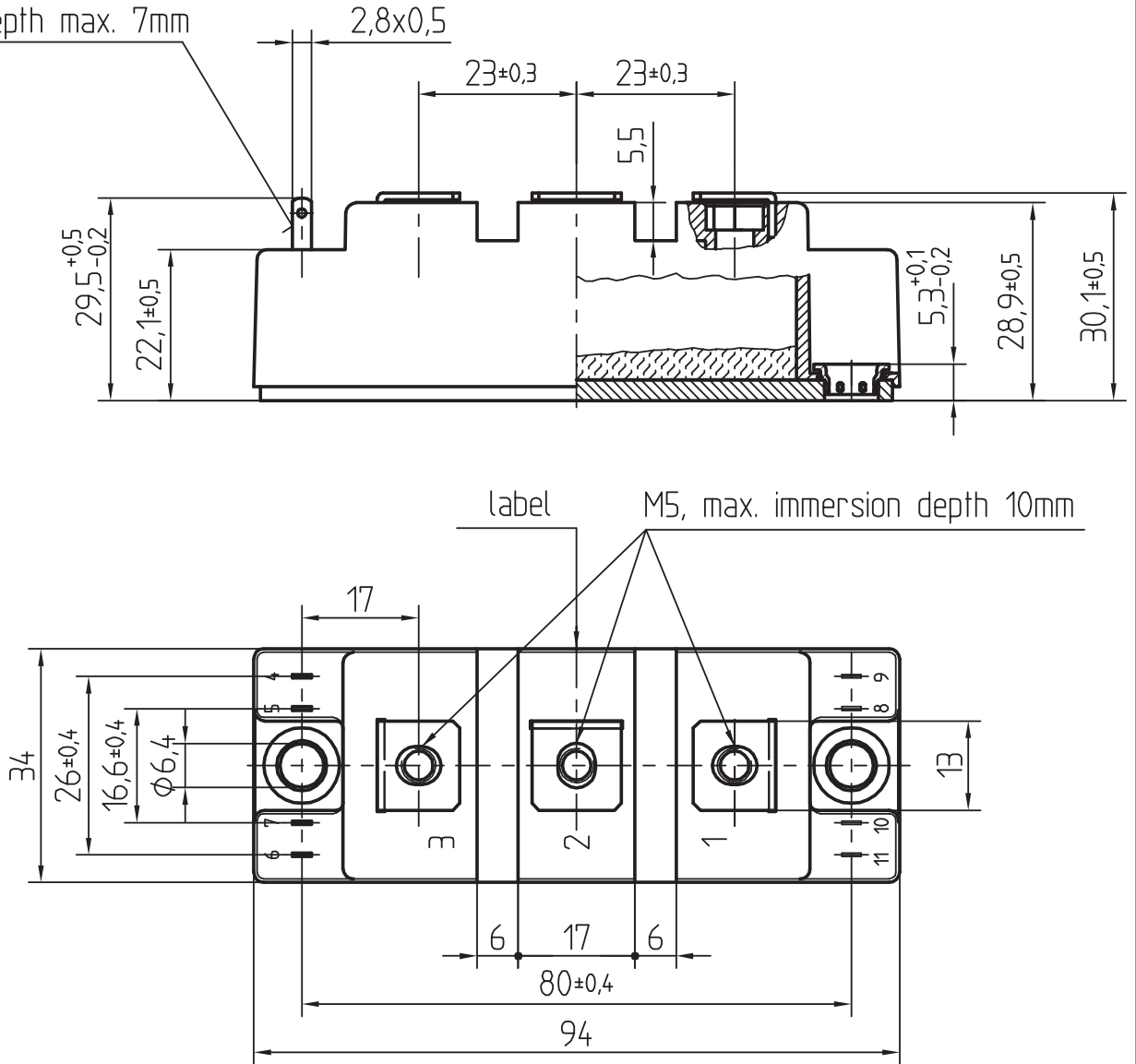


Fig. 12: Typ. CAL diode peak reverse recovery charge

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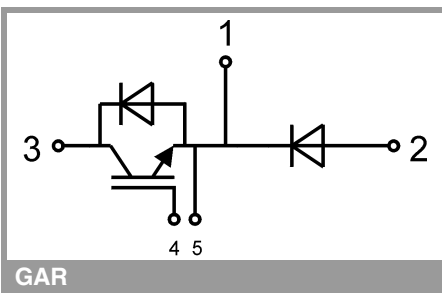
Dimensions in mm

Plug in depth max. 7mm



General tolerance +/- 0,5 mm

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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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