



**SEMITRANS® 2**

## Trench IGBT Modules

### SKM295GB066D

#### Features\*

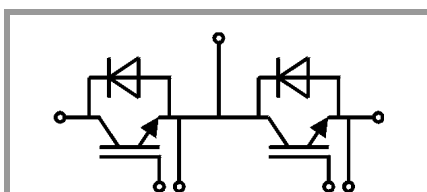
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability, self limiting to  $6 \times I_{Cnom}$
- Fast & soft switching inverse CAL diodes
- Large clearance (10 mm) and creepage distances (20 mm)
- Insulated copper baseplate using DBC Technology (Direct Bonded Copper)
-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

#### Typical Applications

- AC inverter drives
- UPS
- Electronic welders

#### Remarks

- Case temperature limited to  $T_c = 125^\circ\text{C}$  max, recommended  $T_{op} = -40 \dots +150^\circ\text{C}$
- Product reliability results are valid for  $T_j \leq 150^\circ\text{C}$
- Short circuit data: Use of soft  $R_G$  necessary!
- Take care of over-voltage caused by stray inductances



**GB**

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	600	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	362	A
		$T_c = 80^\circ\text{C}$	272	A
$I_{Cnom}$		300	A	
$I_{CRM}$		600	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 360\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 600\text{ V}$	$T_j = 150^\circ\text{C}$	6	$\mu\text{s}$
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	286	A
		$T_c = 80^\circ\text{C}$	209	A
$I_{FRM}$		400	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	1773	A	
$T_j$		-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>					
$V_{CE(sat)}$	$I_C = 300\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.45	1.85	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
		$T_j = 150^\circ\text{C}$	0.85	0.90	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.83	2.8	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	2.8	4.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 4.8\text{ mA}$	5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 600\text{ V}$	$T_j = 25^\circ\text{C}$		0.2	$\text{mA}$
		$T_j = 150^\circ\text{C}$		-	$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$	$f = 1\text{ MHz}$	18.5		nF
$C_{oes}$	$V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	1.15		nF
$C_{res}$		$f = 1\text{ MHz}$	0.55		nF
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		1700		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$		1.0		$\Omega$
$t_{d(on)}$	$V_{CC} = 300\text{ V}$ $I_C = 300\text{ A}$	$T_j = 150^\circ\text{C}$	94		ns
$t_r$	$V_{GE} = +15/-8\text{ V}$	$T_j = 150^\circ\text{C}$	157		ns
$E_{on}$	$R_{G on} = 5.6\ \Omega$	$T_j = 150^\circ\text{C}$	20.5		mJ
$t_{d(off)}$	$R_{G off} = 14\ \Omega$	$T_j = 150^\circ\text{C}$	1537		ns
$t_f$	$di/dt_{on} = 1770\text{ A}/\mu\text{s}$ $di/dt_{off} = 2450\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	112		ns
$E_{off}$	$dv/dt = 1160\text{ V}/\mu\text{s}$ $L_s = 32\text{ nH}$	$T_j = 150^\circ\text{C}$	22		mJ
$R_{th(j-c)}$	per IGBT			0.172	K/W



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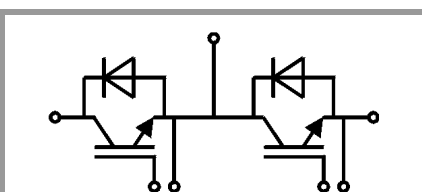
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 200 \text{ A}$ $V_{GE} = 0 \text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$		1.36	1.55	V
		$T_j = 150^\circ\text{C}$		1.35	1.54	V
$V_{F0}$	chipllevel	$T_j = 25^\circ\text{C}$		1.00	1.10	V
		$T_j = 150^\circ\text{C}$		0.85	0.95	V
$r_F$	chipllevel	$T_j = 25^\circ\text{C}$		1.82	2.3	m $\Omega$
		$T_j = 150^\circ\text{C}$		2.5	3.0	m $\Omega$
$I_{RRM}$	$I_F = 300 \text{ A}$	$T_j = 150^\circ\text{C}$		108		A
$Q_{rr}$	$di/dt_{off} = 1870 \text{ A}/\mu\text{s}$ $V_{GE} = -8 \text{ V}$	$T_j = 150^\circ\text{C}$		20		$\mu\text{C}$
$E_{rr}$	$V_{CC} = 300 \text{ V}$ $L_s = 32 \text{ nH}$	$T_j = 150^\circ\text{C}$		3		mJ
$R_{th(j-c)}$	per diode				0.29	K/W
<b>Module</b>						
$L_{CE}$				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
$M_t$		to terminals M5	2.5		5	Nm
				-		Nm
w					160	g



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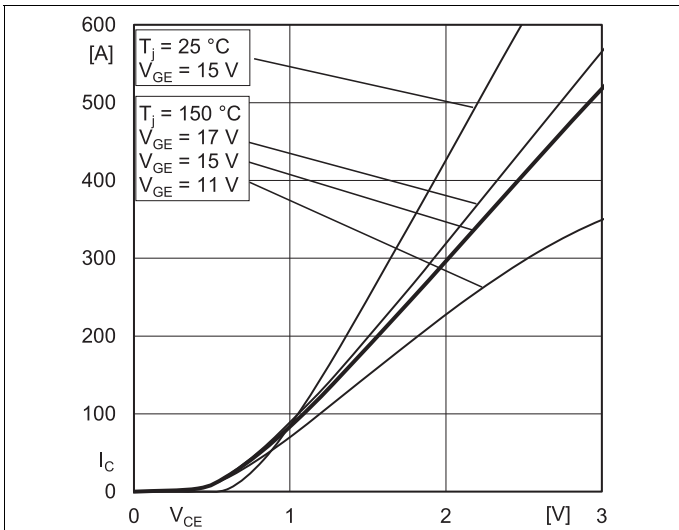


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

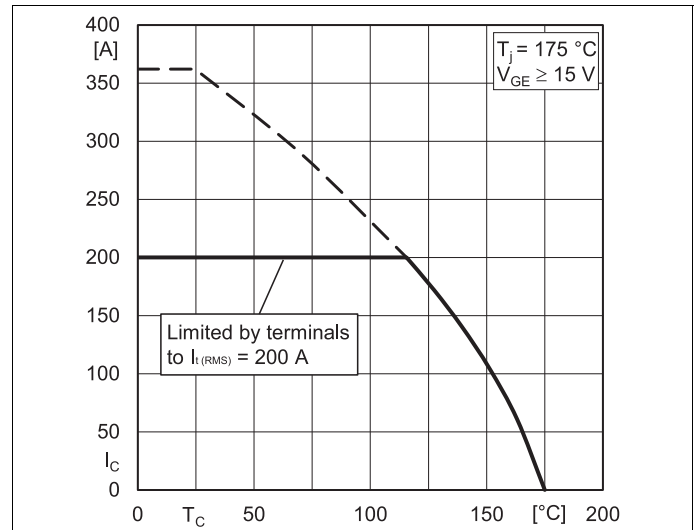


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

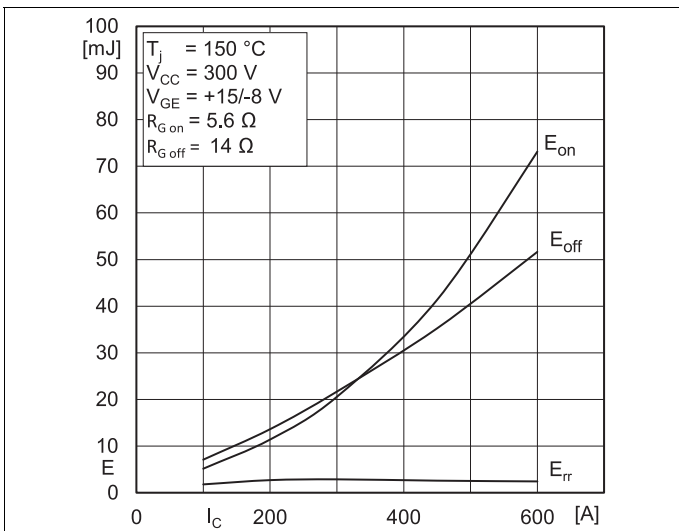


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

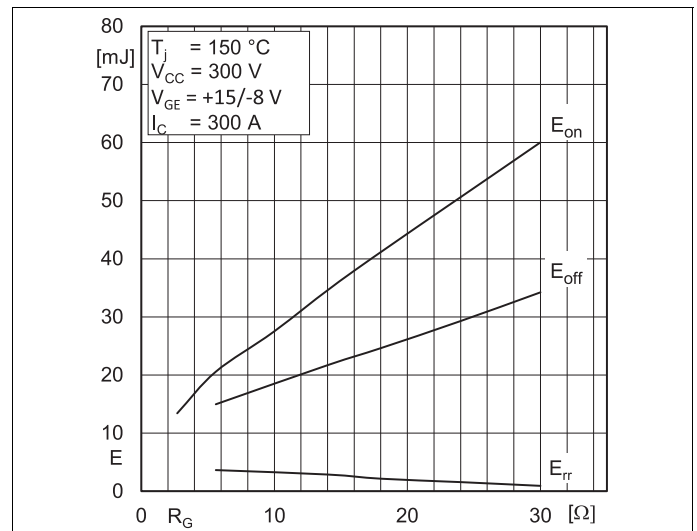


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

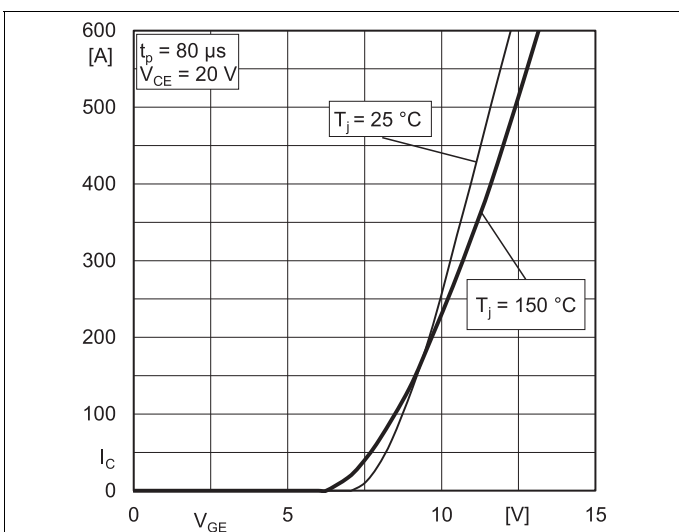


Fig. 5: Typ. transfer characteristic

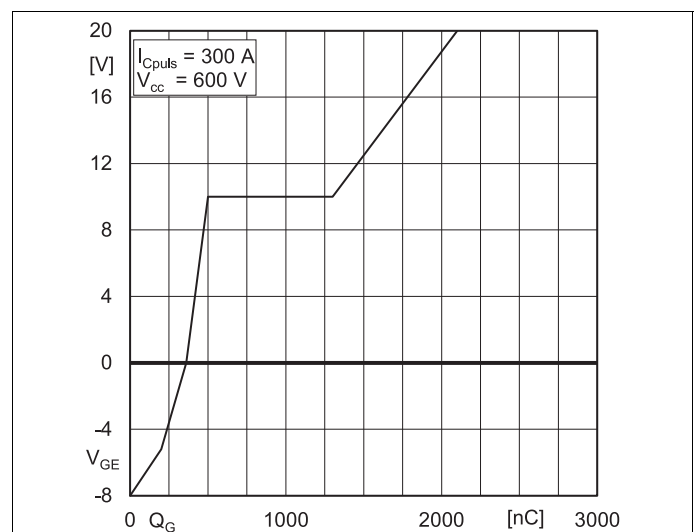


Fig. 6: Typ. gate charge characteristic

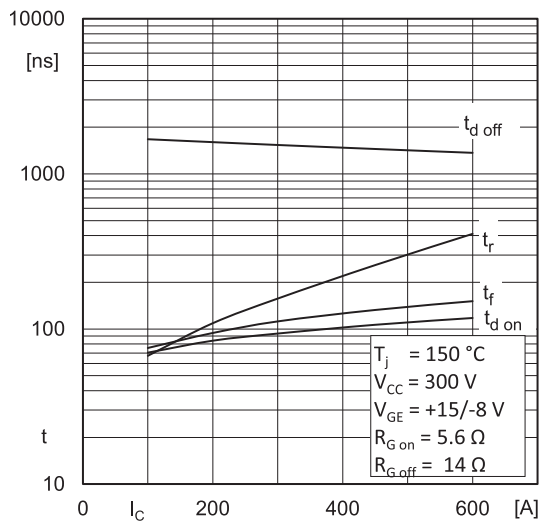


Fig. 7: Typ. switching times vs.  $I_C$

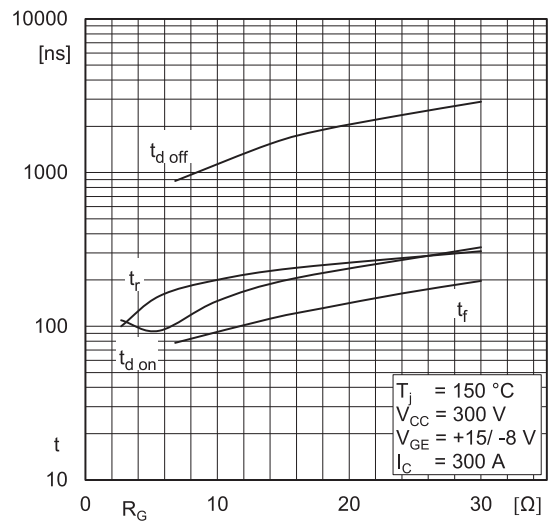


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

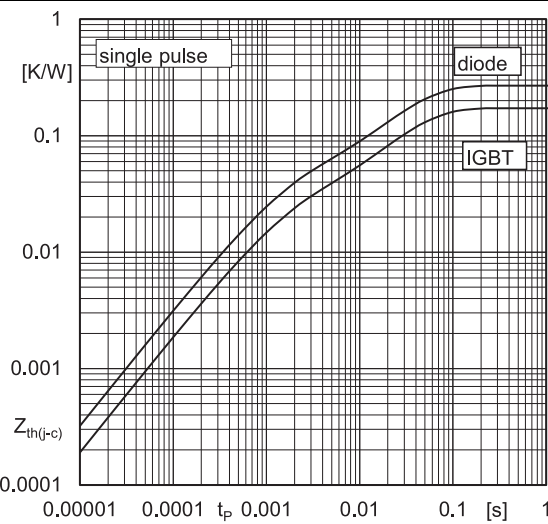


Fig. 9: Transient thermal impedance

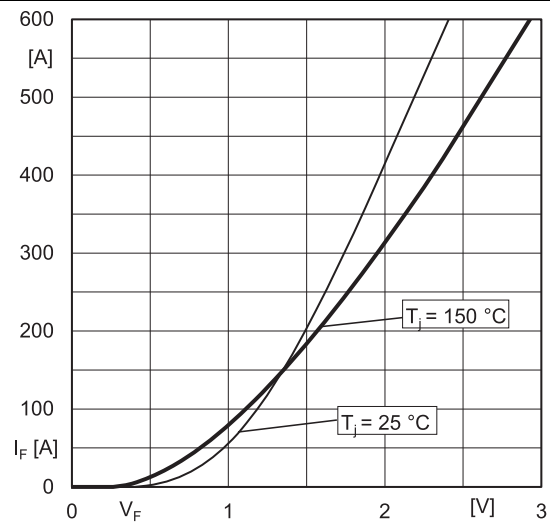


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

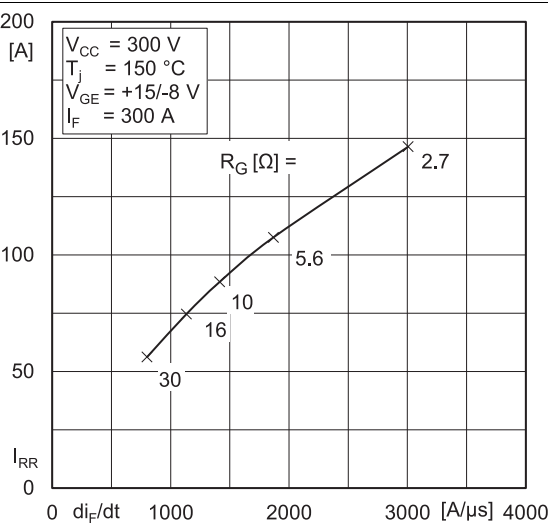


Fig. 11: Typ. CAL diode peak reverse recovery current

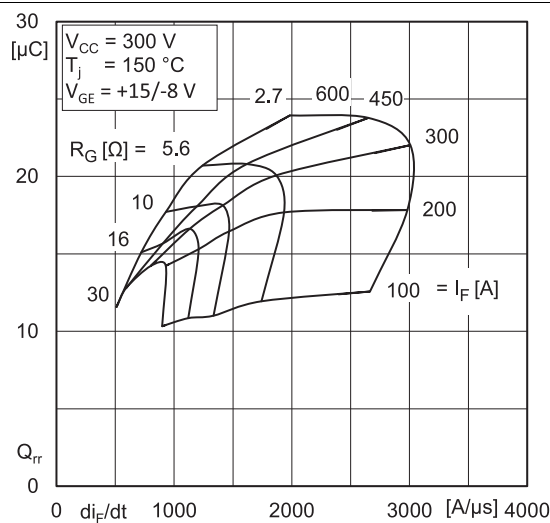
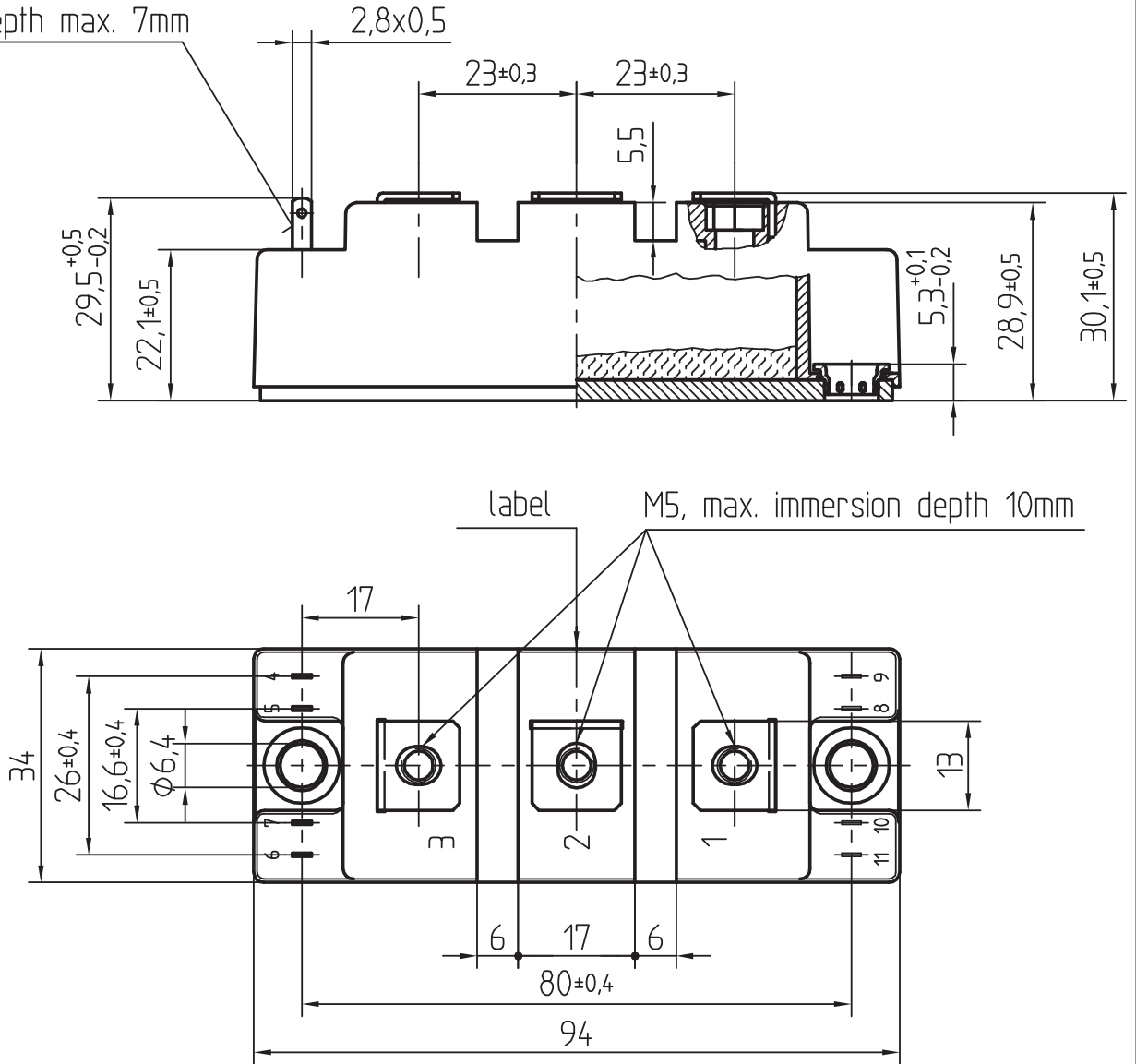


Fig. 12: Typ. CAL diode peak reverse recovery charge

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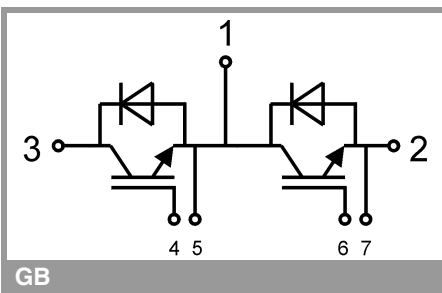
Dimensions in mm

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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