

SKM150GAR12V



SEMITRANS® 2

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Features

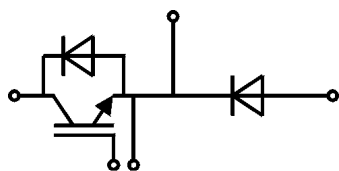
- V-IGBT = 6. Generation Trench V-IGBT (Fuji)
- CAL4 = Soft switching 4. Generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Copper Bonding)
- Increased power cycling capability
- With integrated gate resistor
- UL recognized, file no. E63532
- Lowest switching losses at High 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
IGBT			
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
		$T_c = 80^\circ\text{C}$	176
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
T_j		-40 ... 175	$^\circ\text{C}$
Inverse diode			
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	189
		$T_c = 80^\circ\text{C}$	141
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	$^\circ\text{C}$
Freewheeling diode			
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	189
		$T_c = 80^\circ\text{C}$	141
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I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	900	A
T_j		-40 ... 175	$^\circ\text{C}$
Module			
$I_{t(RMS)}$		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
IGBT					
$V_{CE(sat)}$	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.75	2.20	V
		$T_j = 150^\circ\text{C}$	2.20	2.48	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.94	1.04	V
		$T_j = 150^\circ\text{C}$	0.88	0.98	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	5.4	7.7	m Ω
		$T_j = 150^\circ\text{C}$	8.8	10	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 6\text{ mA}$	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	mA
		$T_j = 150^\circ\text{C}$	-		mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	9.0		nF
C_{oes}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.89		nF
C_{res}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.88		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		1650		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		5.0		Ω



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Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
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- Product reliability results valid for $T_j = 150^\circ\text{C}$

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 150\text{ A}$ $T_j = 150^\circ\text{C}$		258		ns
t_r	$V_{GE} = +15/-15\text{ V}$ $R_{G on} = 1.5\ \Omega$ $T_j = 150^\circ\text{C}$		32		ns
E_{on}	$R_{G off} = 1.5\ \Omega$ $T_j = 150^\circ\text{C}$		13.5		mJ
$t_{d(off)}$	$di/dt_{on} = 5400\text{ A}/\mu\text{s}$ $T_j = 150^\circ\text{C}$		388		ns
t_f	$di/dt_{off} = 1800\text{ A}/\mu\text{s}$ $T_j = 150^\circ\text{C}$		62		ns
E_{off}	$du/dt = 8100\text{ V}/\mu\text{s}$ $T_j = 150^\circ\text{C}$		14.2		mJ
$R_{th(j-c)}$	per IGBT			0.19	K/W

Inverse diode

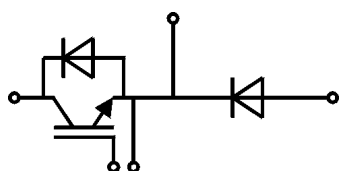
$V_F = V_{EC}$	$I_F = 150\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	2.14 2.07	2.46 2.38	V
V_{F0}	chiplevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.30 0.90	1.50 1.10	V
r_F	chiplevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	5.6 7.8	6.4 8.5	m Ω
I_{RRM}	$I_F = 150\text{ A}$ $T_j = 150^\circ\text{C}$		165		A
Q_{rr}	$di/dt_{off} = 5800\text{ A}/\mu\text{s}$ $V_{GE} = \pm 15\text{ V}$ $T_j = 150^\circ\text{C}$		22		μC
E_{rr}	$V_{CC} = 600\text{ V}$ $T_j = 150^\circ\text{C}$		8.5		mJ
$R_{th(j-c)}$	per diode			0.31	K/W

Freewheeling diode

$V_F = V_{EC}$	$I_F = 150\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	2.14 2.07	2.46 2.38	V
V_{F0}	chiplevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.30 0.90	1.50 1.10	V
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I_{RRM}	$I_F = 150\text{ A}$ $T_j = 150^\circ\text{C}$		165		A
Q_{rr}	$di/dt_{off} = 5800\text{ A}/\mu\text{s}$ $V_{GE} = \pm 15\text{ V}$ $T_j = 150^\circ\text{C}$		22		μC
E_{rr}	$V_{CC} = 600\text{ V}$ $T_j = 150^\circ\text{C}$		8.5		mJ
$R_{th(j-c)}$	per diode			0.31	K/W

Module

L_{CE}			30		nH
$R_{CC+EE'}$	measured per switch	$T_c = 25^\circ\text{C}$ $T_c = 125^\circ\text{C}$	0.65 1.09		m Ω
$R_{th(c-s)}$	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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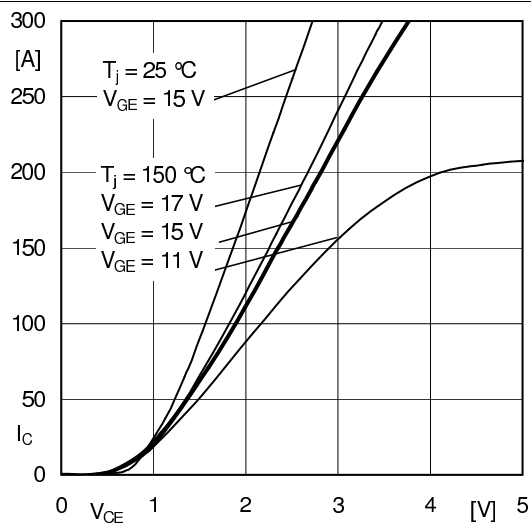


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + EE'$

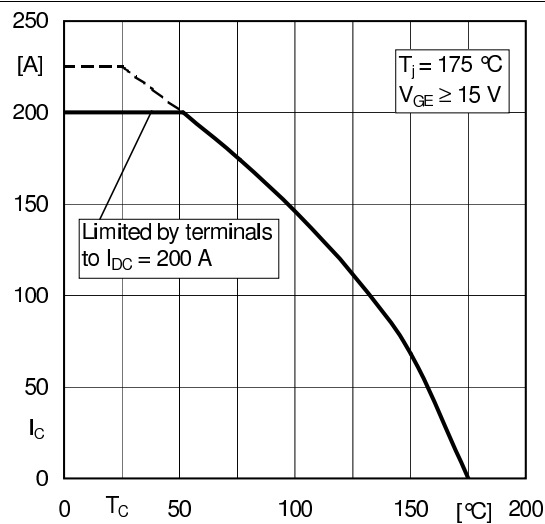


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

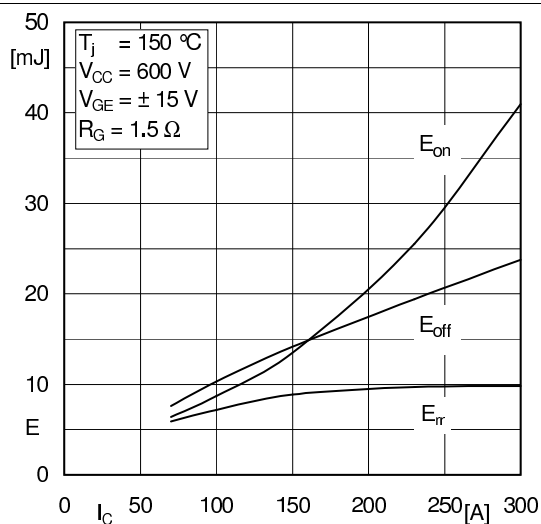


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

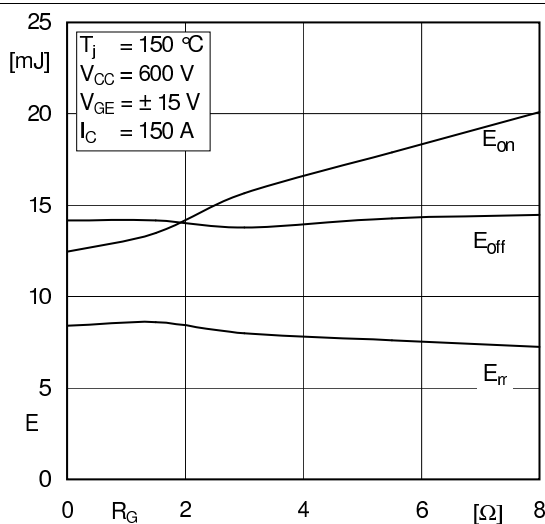


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

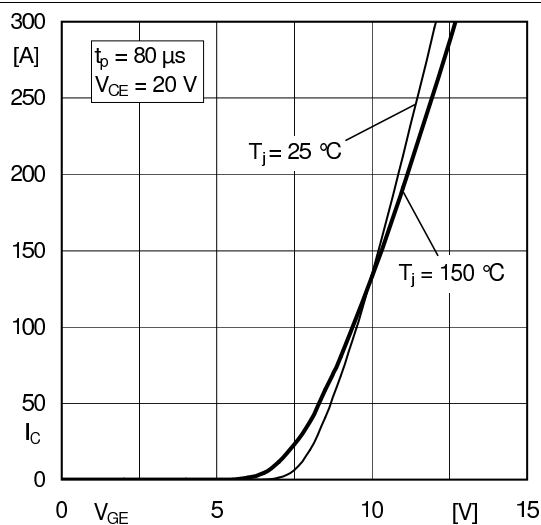


Fig. 5: Typ. transfer characteristic

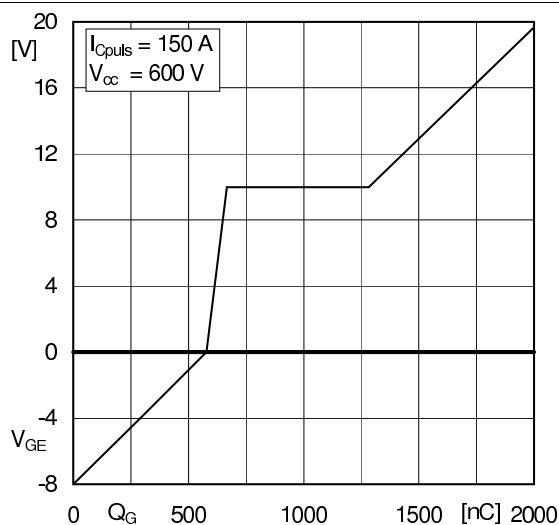


Fig. 6: Typ. gate charge characteristic

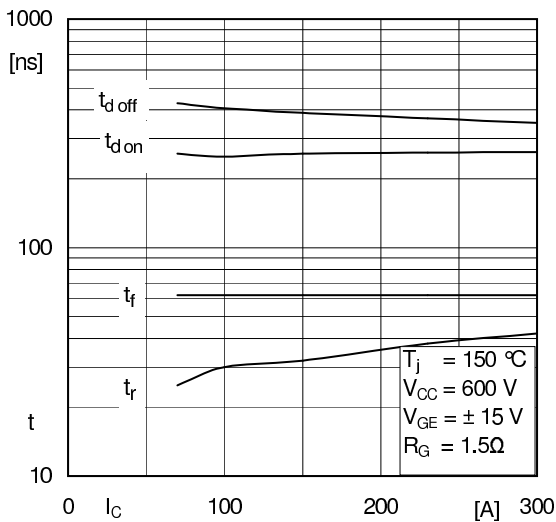


Fig. 7: Typ. switching times vs. I_C

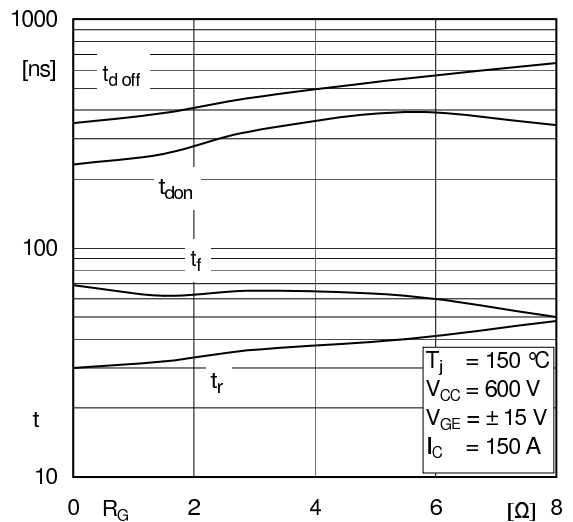


Fig. 8: Typ. switching times vs. gate resistor R_G

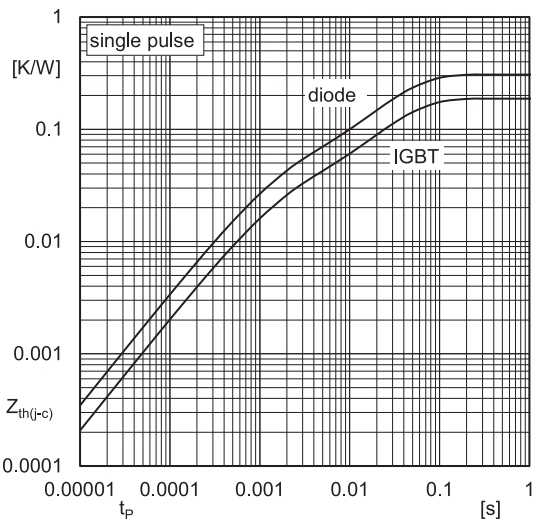


Fig. 9: Transient thermal impedance

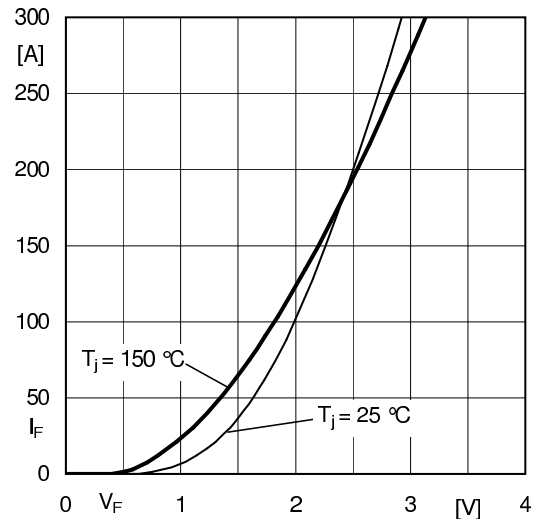


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

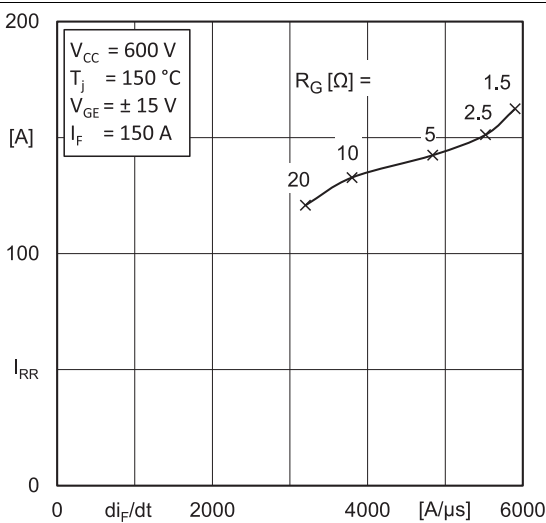


Fig. 11: CAL diode peak reverse recovery current

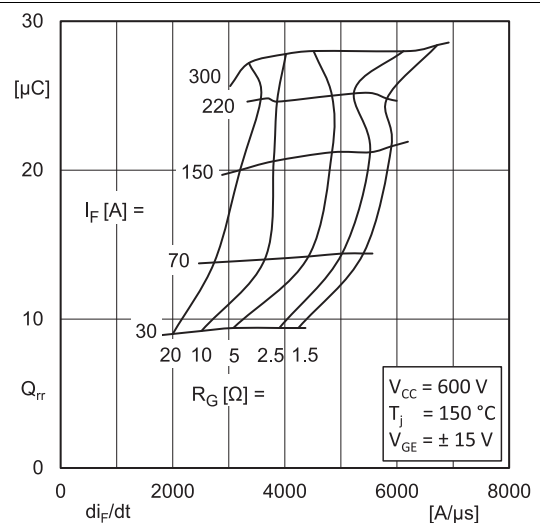
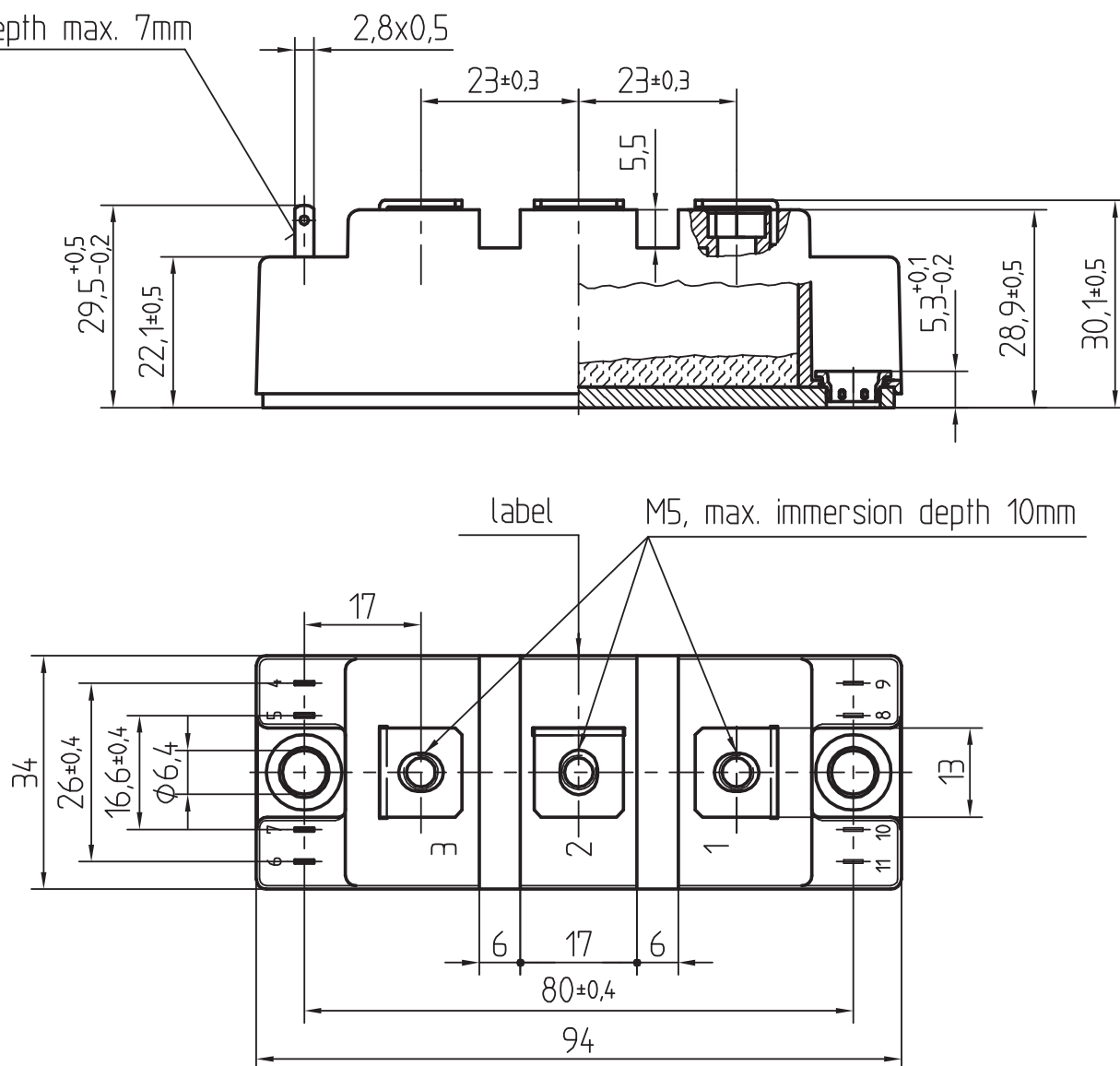


Fig. 12: Typ. CAL diode peak reverse recovery charge

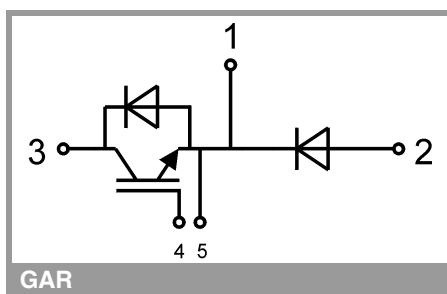
Dimensions in mm

Plug in depth max. 7mm



General tolerance $\pm 0,5$ mm

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

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