

SKM100GAR12F4



SEMITRANS® 2

High Speed IGBT4 Modules

SKM100GAR12F4

Features*

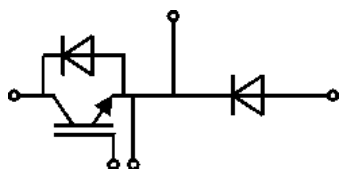
- High speed trench and field-stop IGBT
- CAL4 ultra-fast = soft switching 4. generation CAL-diode
- Insulated copper baseplate using DBC technology (Direct Bonded Copper)
- Increased power cycling capability
- For higher switching frequencies above 15kHz
- UL recognized, file no. E63532

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 °C		1200	V
I _C	T _j = 175 °C	T _c = 25 °C	153	A
		T _c = 80 °C	117	A
I _{Cnom}			100	A
I _{CRM}	I _{CRM} = 2 x I _{Cnom}		200	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	µs
T _j			-40 ... 175	°C
Inverse diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	111	A
		T _c = 80 °C	82	A
I _{Fnom}			100	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		200	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		550	A
T _j			-40 ... 175	°C
Freewheeling diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 175 °C	T _c = 25 °C	111	A
		T _c = 80 °C	82	A
I _{Fnom}			100	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		200	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		550	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}			200	A
T _{stg}	module without TIM		-40 ... 125	°C
V _{isol}	AC sinus 50 Hz, t = 1 min		4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 100\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	2.05	2.38	V
		$T_j = 150^\circ\text{C}$	2.55	2.93	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	1.10	1.28	V
		$T_j = 150^\circ\text{C}$	0.95	1.13	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	9.5	11	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	16	18	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 3.8\text{ mA}$	5.1	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$		1	mA
		$T_j = 150^\circ\text{C}$	-		mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	6.2		nF
C_{oes}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.41		nF
C_{res}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.35		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		567		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0		Ω



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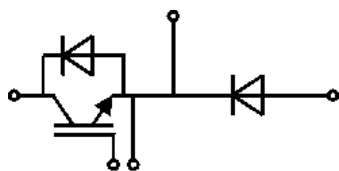
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Remarks

- Case temperature limited to $T_c = 125^\circ\text{C}$ max.
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Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 100\text{ A}$ $T_j = 150^\circ\text{C}$		12		ns
t_r	$V_{GE} = +15/-15\text{ V}$ $R_{G\ on} = 3.9\ \Omega$ $T_j = 150^\circ\text{C}$		20		ns
E_{on}	$R_{G\ off} = 3.9\ \Omega$ $T_j = 150^\circ\text{C}$		6.6		mJ
$t_{d(off)}$	$dI/dt_{on} = 5000\text{ A}/\mu\text{s}$ $T_j = 150^\circ\text{C}$		315		ns
t_f	$dI/dt_{off} = 1300\text{ A}/\mu\text{s}$ $T_j = 150^\circ\text{C}$		65		ns
E_{off}	$dV/dt = 4300\text{ V}/\mu\text{s}$ $L_s = 26\text{ nH}$ $T_j = 150^\circ\text{C}$		8		mJ
$R_{th(j-c)}$	per IGBT			0.238	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.122		K/W

Inverse diode

$V_F = V_{EC}$	$I_F = 100\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	2.55 2.46	2.93 2.80	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.51 1.16	1.75 1.40	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	10 13	12 14	m Ω
I_{RRM}	$I_F = 100\text{ A}$ $T_j = 150^\circ\text{C}$		200		A
Q_{rr}	$dI/dt_{off} = 5000\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$ $T_j = 150^\circ\text{C}$		16.5		μC
E_{rr}	$V_{CC} = 600\text{ V}$ $T_j = 150^\circ\text{C}$		6.3		mJ
$R_{th(j-c)}$	per diode			0.483	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.134		K/W

Freewheeling diode

$V_F = V_{EC}$	$I_F = 100\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	2.55 2.46	2.93 2.80	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	1.51 1.16	1.75 1.40	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	10 13	12 14	m Ω
I_{RRM}	$I_F = 100\text{ A}$ $T_j = 150^\circ\text{C}$		200		A
Q_{rr}	$dI/dt_{off} = 5000\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$ $T_j = 150^\circ\text{C}$		16.5		μC
E_{rr}	$V_{CC} = 600\text{ V}$ $T_j = 150^\circ\text{C}$		6.3		mJ
$R_{th(j-c)}$	per diode			0.483	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.134		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
$R_{th(c-s)1}$	calculated without thermal coupling ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.0639		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.071		K/W
M_s	to heat sink M6		3	5	Nm
M_t		to terminals M5	2.5	5	Nm
					Nm
w				160	g

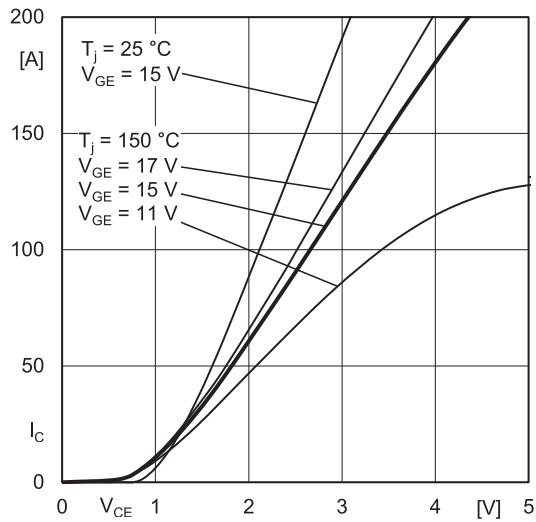


Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

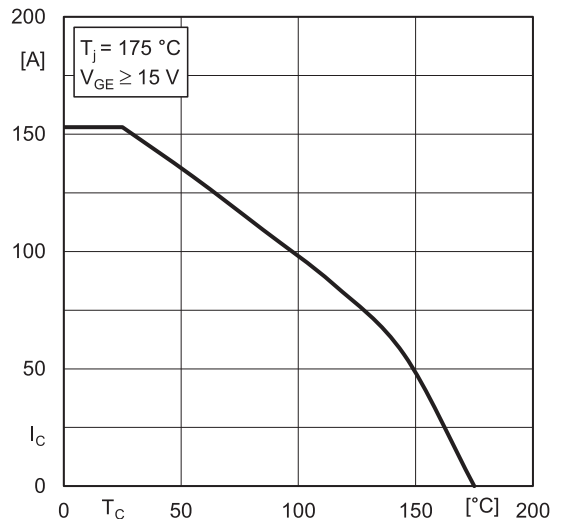


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

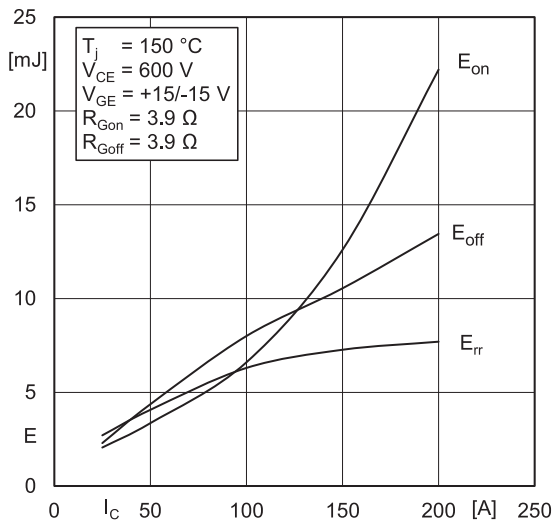


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

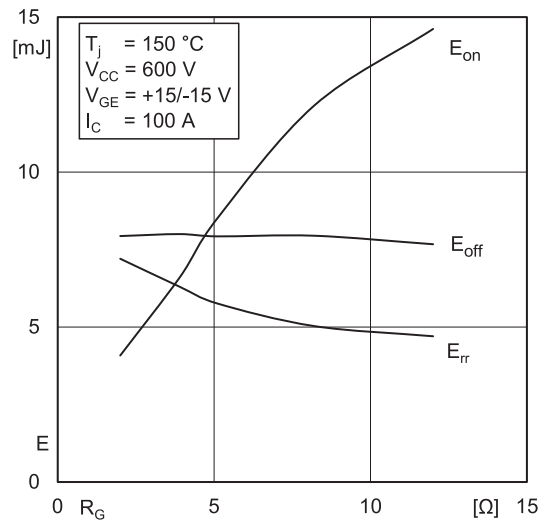


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

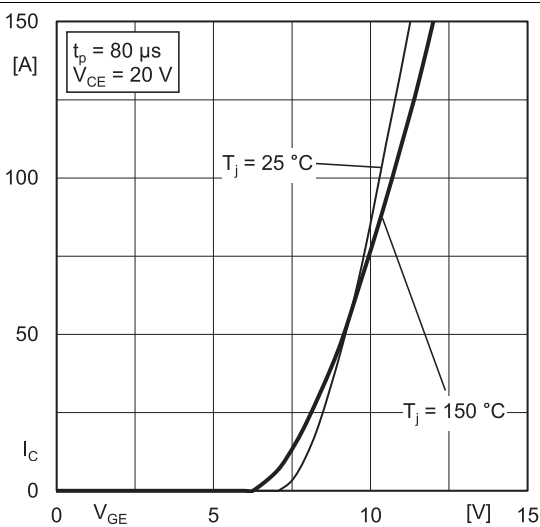


Fig. 5: Typ. transfer characteristic

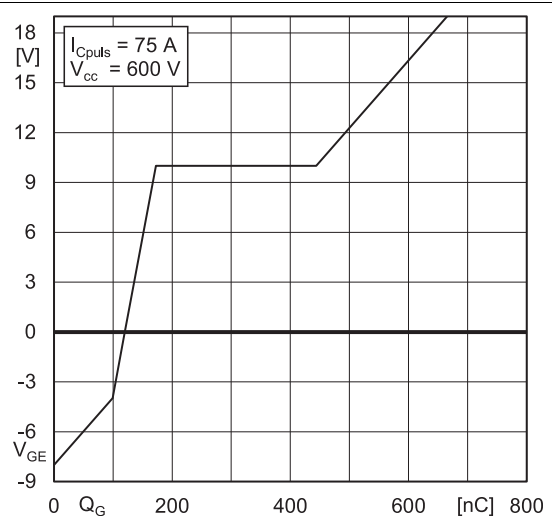


Fig. 6: Typ. gate charge characteristic

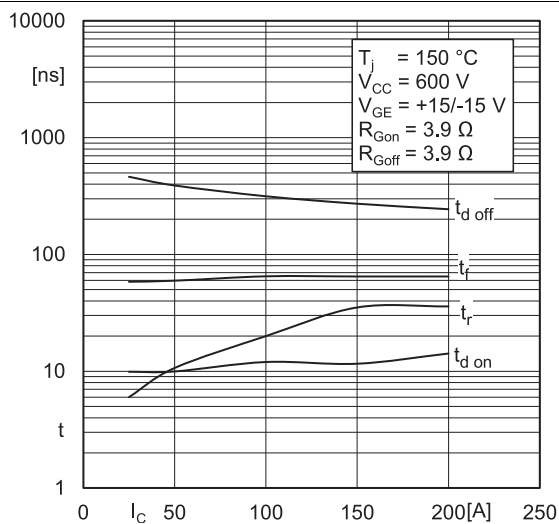


Fig. 7: Typ. switching times vs. I_C

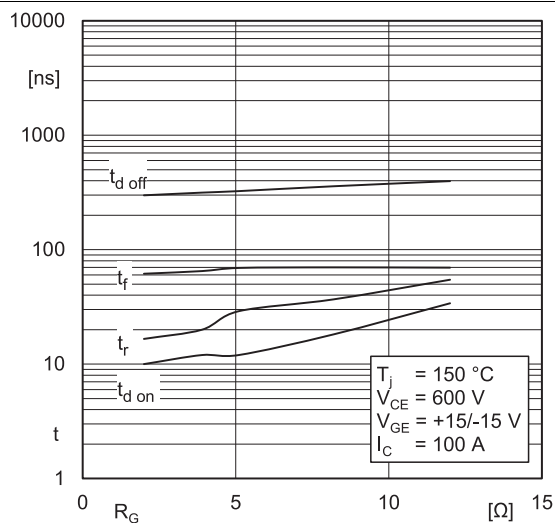


Fig. 8: Typ. switching times vs. gate resistor R_G

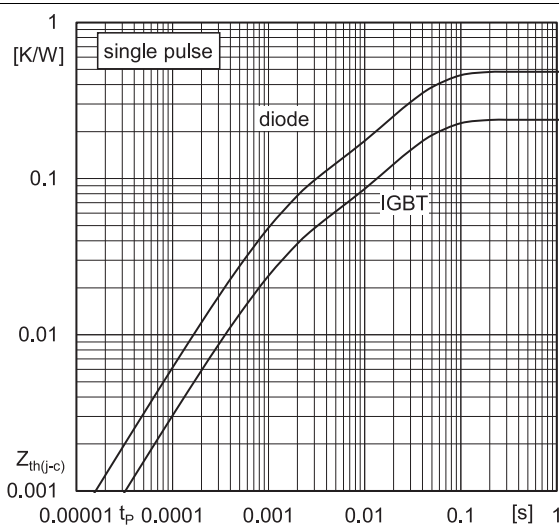


Fig. 9: Transient thermal impedance

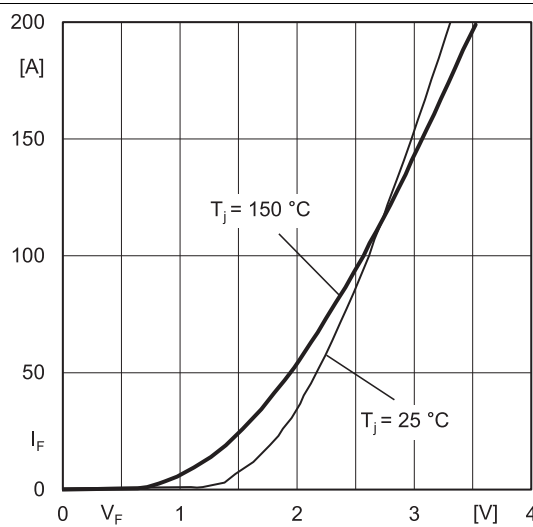


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

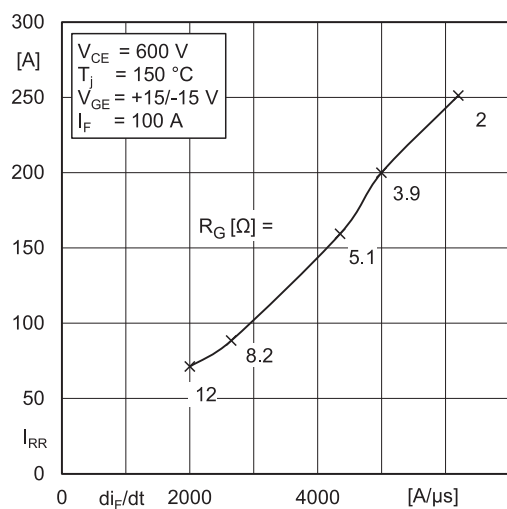


Fig. 11: Typ. CAL diode peak reverse recovery current

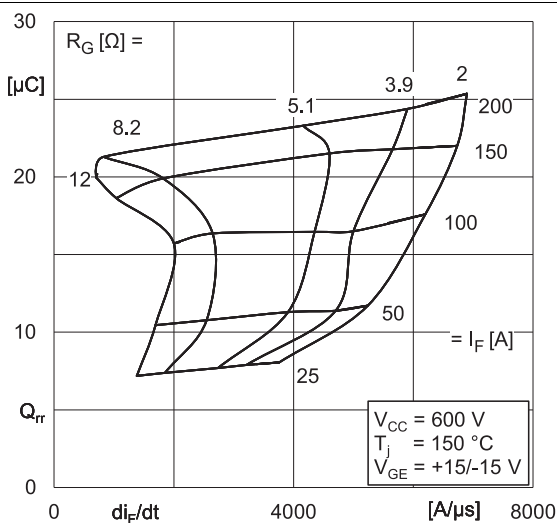
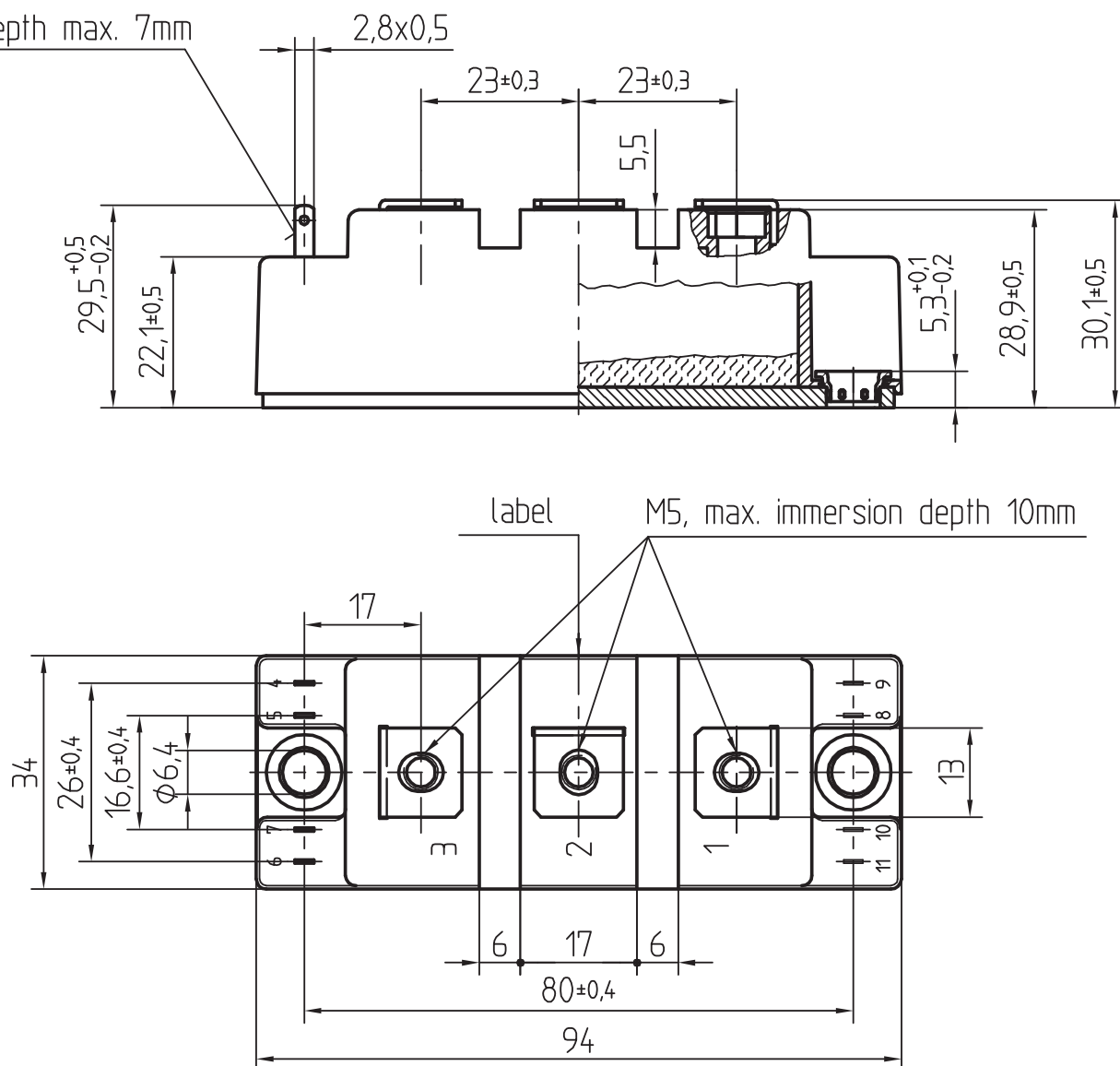


Fig. 12: Typ. CAL diode peak reverse recovery charge

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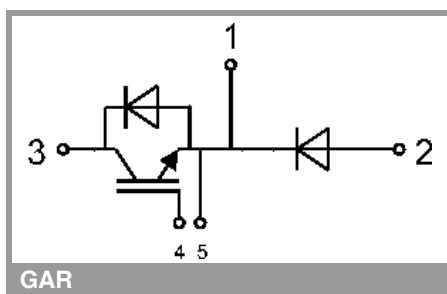
Dimensions in mm

Plug in depth max. 7mm



General tolerance $\pm 0,5$ mm

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

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