

SKiM609GAR12E4 V2



SKiM® 93

Trench IGBT Modules

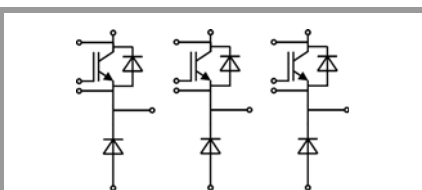
SKiM609GAR12E4 V2

Features*

- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Insulated by Al_2O_3 DBC (Direct Bonded Copper) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor

Remarks*

- Case temperature limited to $T_s = 125^\circ C$ max; $T_c = T_s$ (for baseplateless modules)
- Recommended $T_{op} = -40 \dots +150^\circ C$



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	$T_j = 25^\circ C$		1200	V
I_C	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ C$	748	A
		$T_j = 175^\circ C$	608	A
I_C	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ C$	845	A
		$T_j = 175^\circ C$	688	A
I_{Chom}			600	A
I_{CRM}			1800	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 800 \text{ V}, V_{GE} \leq 15 \text{ V}, T_j = 150^\circ C,$ $V_{CES} \leq 1200 \text{ V}$		10	μs
T_j			-40 ... 175	$^\circ C$
Inverse diode				
V_{RRM}	$T_j = 25^\circ C$		1200	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ C$	139	A
		$T_j = 175^\circ C$	110	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ C$	172	A
		$T_j = 175^\circ C$	137	A
I_{FRM}			300	A
I_{FSM}	10 ms, sin 180°, $T_j = 25^\circ C$		900	A
T_j			-40 ... 175	$^\circ C$
Freewheeling diode				
V_{RRM}	$T_j = 25^\circ C$		1200	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ C$	1328	A
		$T_j = 175^\circ C$	1052	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ C$	1418	A
		$T_j = 175^\circ C$	1126	A
I_{FRM}			1200	A
I_{FSM}	10 ms, sin 180°, $T_j = 25^\circ C$		6480	A
T_j			-40 ... 175	$^\circ C$
Module				
$I_{t(RMS)}$	$T_{terminal} = 80^\circ C$		700	A
T_{stg}			-40 ... 125	$^\circ C$
V_{isol}	AC sinus 50 Hz, $t = 1 \text{ min}$		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	$I_C = 600 \text{ A}$ $V_{GE} = 15 \text{ V}$ chiplevel	$T_j = 25^\circ C$	1.85	2.10		V
		$T_j = 150^\circ C$	2.25	2.45		V
V_{CE0}	chiplevel	$T_j = 25^\circ C$	0.80	0.90		V
		$T_j = 150^\circ C$	0.70	0.80		V
r_{CE}	$V_{GE} = 15 \text{ V}$ chiplevel	$T_j = 25^\circ C$	1.75	2.0		m Ω
		$T_j = 150^\circ C$	2.6	2.8		m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 24 \text{ mA}$		5	5.8	6.5	V
I_{CES}	$V_{GE} = 0 \text{ V}, V_{CE} = 1200 \text{ V}, T_j = 25^\circ C$		0.1	5		mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	35.2			nF
C_{oes}		$f = 1 \text{ MHz}$	2.32			nF
C_{res}		$f = 1 \text{ MHz}$	1.88			nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		3400			nC

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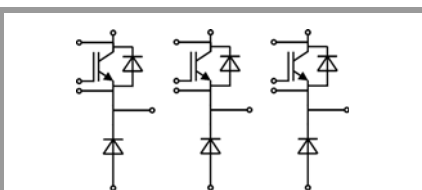
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
R_{Gint}	$T_j = 25^\circ C$			1.3		Ω
$t_{d(on)}$	$V_{CC} = 600 V$	$T_j = 150^\circ C$		150		ns
t_r	$I_C = 600 A$	$T_j = 150^\circ C$		121		ns
E_{on}	$V_{GE} = +15/-15 V$	$T_j = 150^\circ C$		136		mJ
$t_{d(off)}$	$R_{G on} = 4.1 \Omega$	$T_j = 150^\circ C$		808		ns
t_f	$R_{G off} = 4.1 \Omega$	$T_j = 150^\circ C$		100		ns
E_{off}	$di/dt_{on} = 5000 A/\mu s$ $di/dt_{off} = 4400 A/\mu s$	$T_j = 150^\circ C$		83		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 W/(mK)$			0.068		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 W/(mK)$			0.055		K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 150 A$	$T_j = 25^\circ C$		2.14	2.46	V
	chipllevel	$T_j = 150^\circ C$		2.07	2.38	V
V_{F0}	$I_F = 150 A$	$T_j = 25^\circ C$		1.30	1.50	V
	chipllevel	$T_j = 150^\circ C$		0.90	1.10	V
r_F	$I_F = 150 A$	$T_j = 25^\circ C$		5.6	6.4	m Ω
	chipllevel	$T_j = 150^\circ C$		7.8	8.5	m Ω
I_{RRM}	$I_F = 150 A$	$T_j = 150^\circ C$		153		A
Q_{rr}	$di/dt_{off} = 3300 A/\mu s$ $V_R = 600 V$	$T_j = 150^\circ C$		15		μC
E_{rr}	$V_{GE} = +15/-15 V$	$T_j = 150^\circ C$		9		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8 W/(mK)$			0.501		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5 W/(mK)$			0.361		K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 600 A$	$T_j = 25^\circ C$		1.67	1.93	V
	chipllevel	$T_j = 150^\circ C$		1.42	1.67	V
V_{F0}	$I_F = 600 A$	$T_j = 25^\circ C$		1.30	1.50	V
	chipllevel	$T_j = 150^\circ C$		0.90	1.10	V
r_F	$I_F = 600 A$	$T_j = 25^\circ C$		0.62	0.71	m Ω
	chipllevel	$T_j = 150^\circ C$		0.87	0.95	m Ω
I_{RRM}	$I_F = 600 A$	$T_j = 150^\circ C$		510		A
Q_{rr}	$di/dt_{off} = 5300 A/\mu s$ $V_R = 600 V$	$T_j = 150^\circ C$		123		μC
$E_{rr} \text{ } ^1)$	$V_{GE} = +/-15 V$	$T_j = 150^\circ C$		39		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8 W/(mK)$			0.051		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5 W/(mK)$			0.046		K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Temperature Sensor						
R_{100}	$T_r=100^\circ C (R_{25}=1000\Omega)$			$1670 \pm 1\%$		Ω
$R_{(T)}$	$R(T)=1k\Omega[1+A(T-25^\circ C)+B(T-25^\circ C)^2]$, $A = 7.64 \cdot 10^{-3} C^{-1}$, $B = 1.73 \cdot 10^{-5} C^{-2}$					

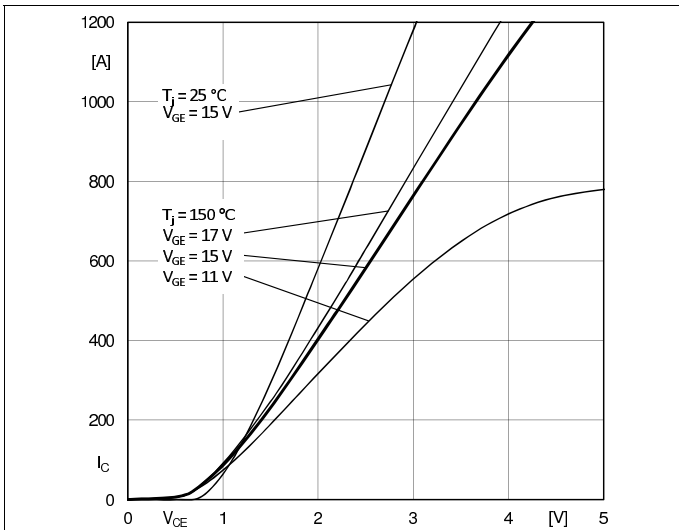


Fig. 1: Typ. output characteristic, inclusive R_{CC'+EE'}

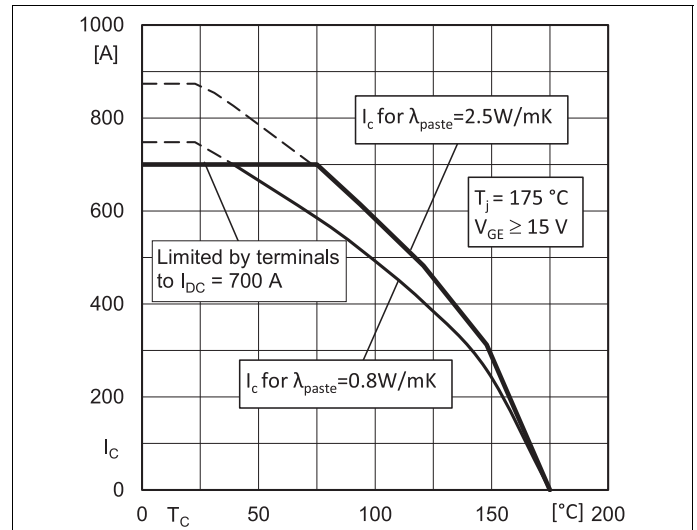


Fig. 2: Typ. rated current vs. temperature I_c = f(T_s)

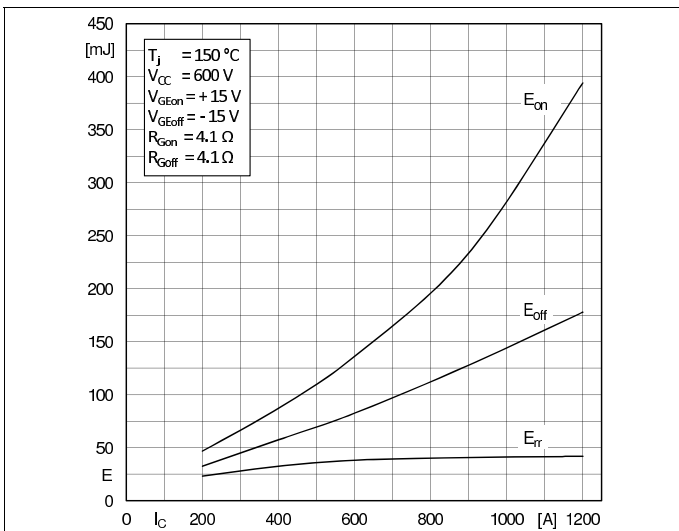


Fig. 3: Typ. turn-on /-off energy = f(I_c)

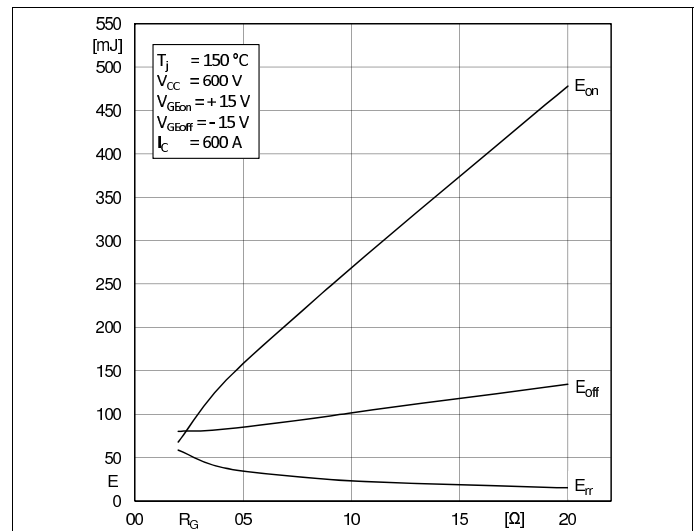


Fig. 4: Typ. turn-on /-off energy = f(R_G)

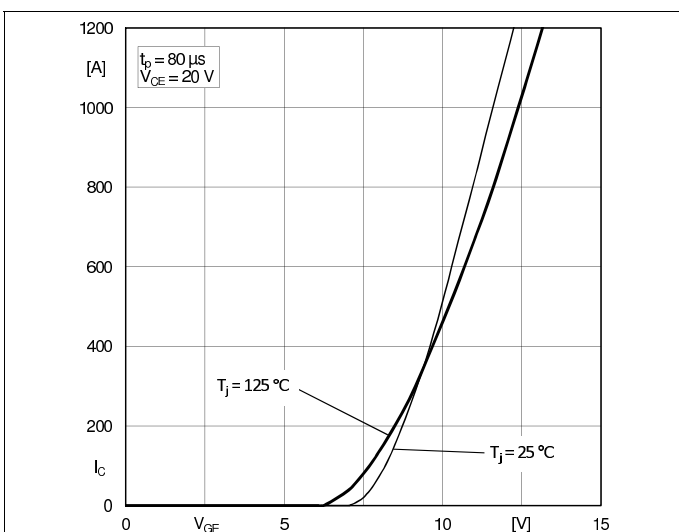


Fig. 5: Typ. transfer characteristic

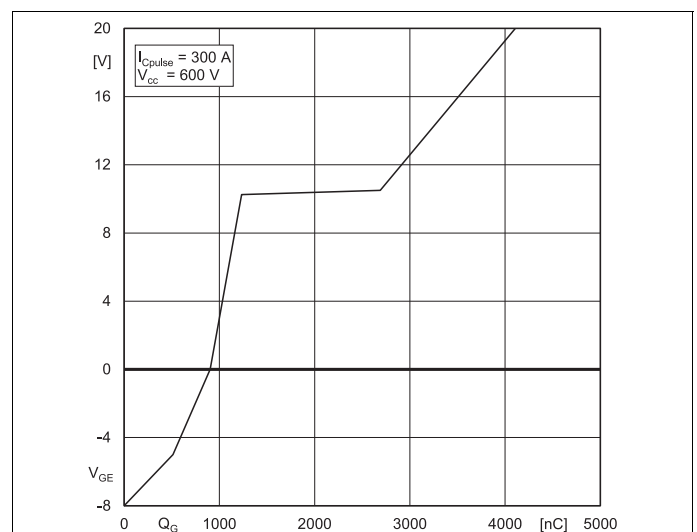


Fig. 6: Typ. gate charge characteristic

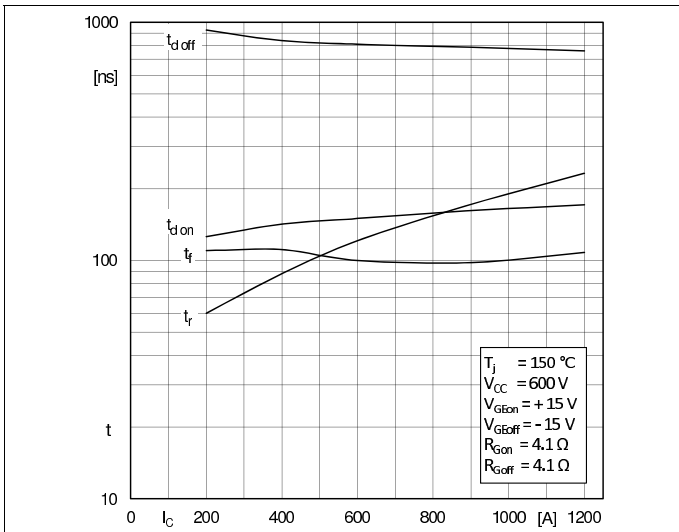


Fig. 7: Typ. switching times vs. I_c

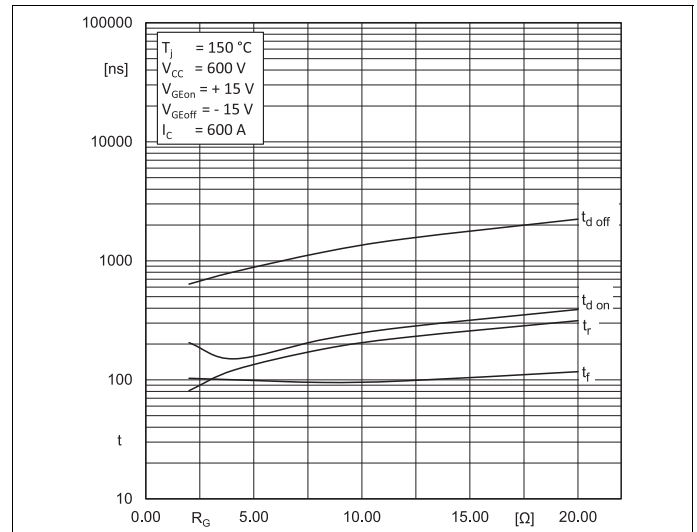


Fig. 8: Typ. switching times vs. gate resistor R_G

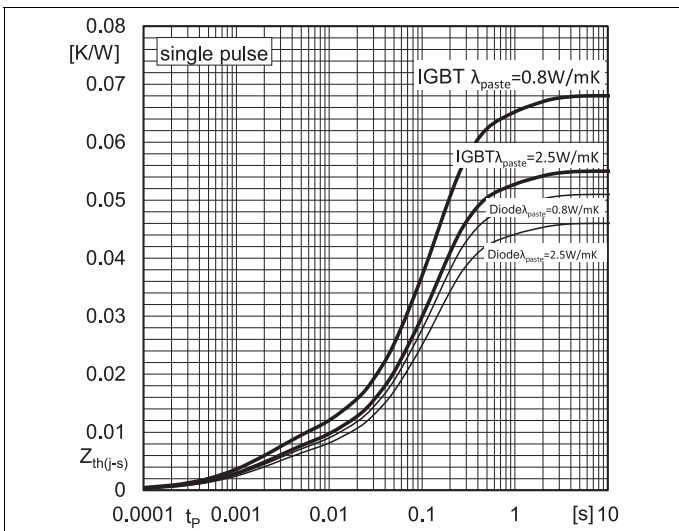


Fig. 9: Typ. transient thermal impedance

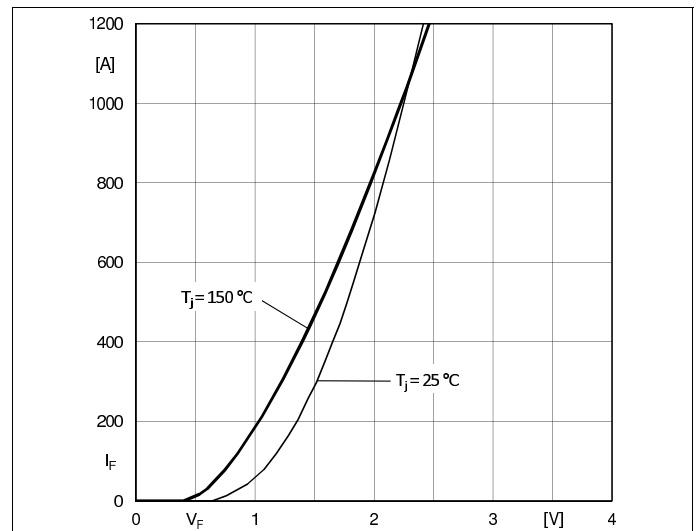


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC+EE'}$

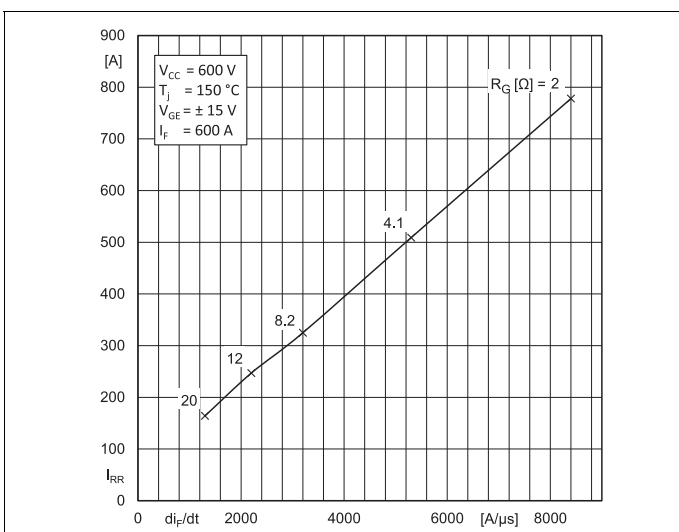


Fig. 11: Typ. CAL diode peak reverse recovery current

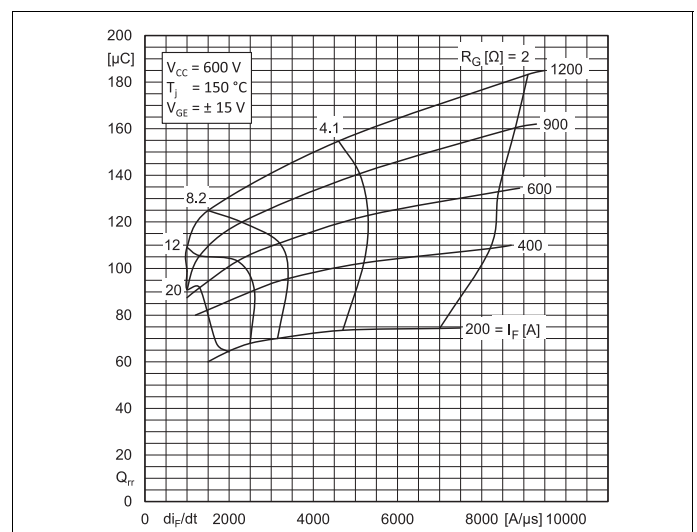
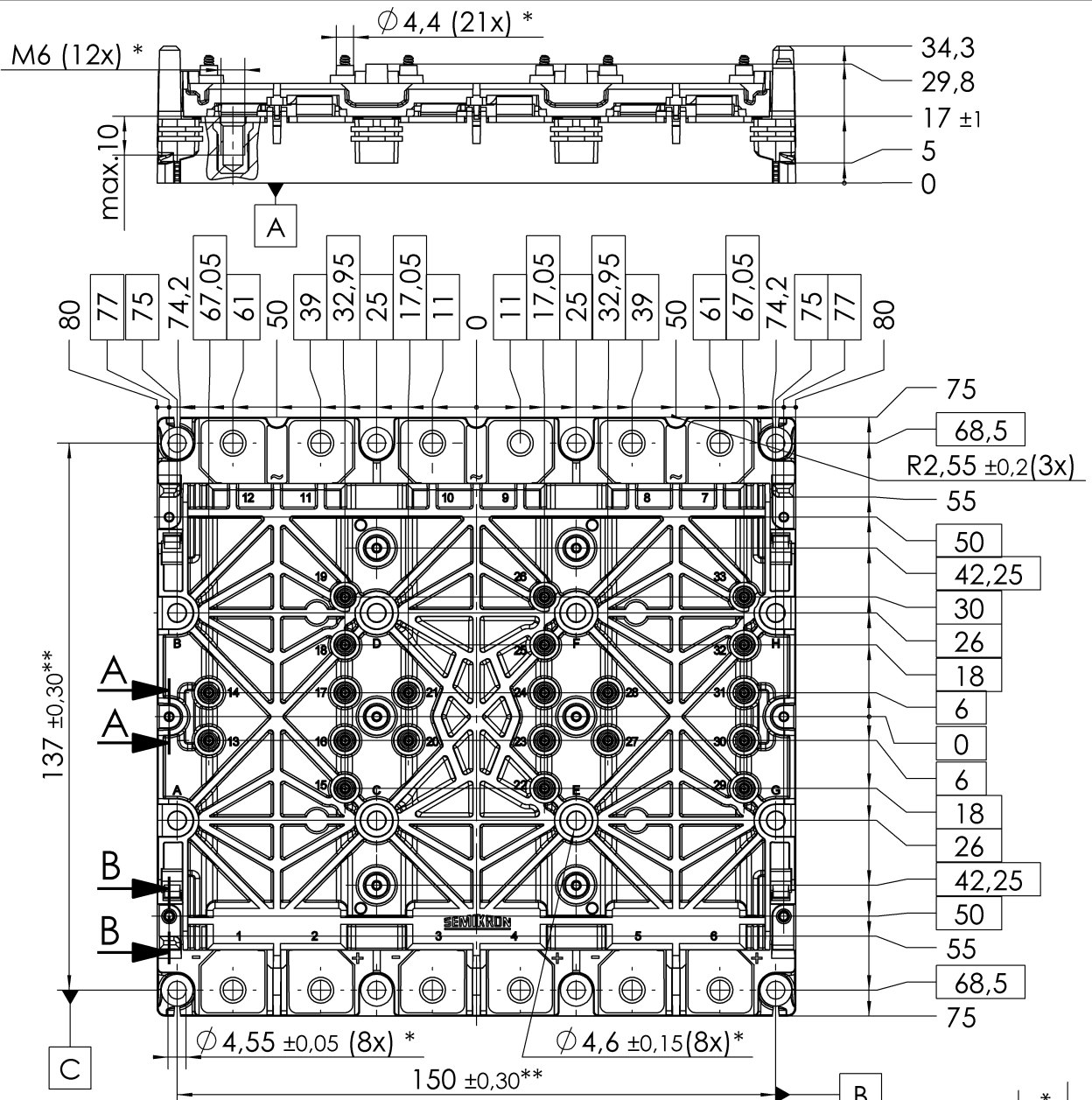
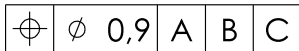


Fig. 12: Typ. CAL diode recovery charge

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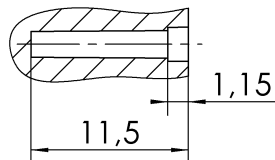
* all pos. dimensions valid when mounted



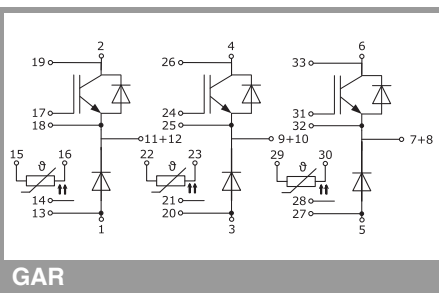
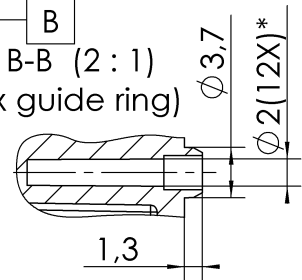
** valid for the outer 4 inserts

General Tolerances DIN ISO 2768-m
PCB spring landing pad = $\phi 3,5 \pm 0,2$

A-A (2:1)
(12x screw hole)



B-B (2:1)
(2x guide ring)



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This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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