SKiM609GAR12E4 V2

SKiM® 93

Trench IGBT Modules

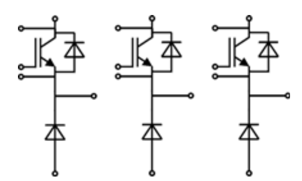
SKiM609GAR12E4 V2

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 x I_C
- Integrated temperature sensor

Remarks*

- Case temperature limited to T_s = 125°C max; T_c = T_s (for baseplateless modules)
- Recommended T_{op} = -40 … +150°C



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	748	A
		T_s = 70 °C	608	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	845	A
		T_s = 70 °C	688	A
I_{Cnom}			600	A
I_{CRM}			1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V, V_{GE} ≤ 15 V, T_j = 150 °C, V_{CES} ≤ 1200 V		10	µs
T_j			-40 ... 175	°C
Inverse diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	139	A
		T_s = 70 °C	110	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	172	A
		T_s = 70 °C	137	A
I_{FRM}			300	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		900	A
T_j			-40 ... 175	°C
Freewheeling diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	1328	A
		T_s = 70 °C	1052	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	1418	A
		T_s = 70 °C	1126	A
I_{FRM}			1200	A
I_{FSM}	10 ms, sin 180°, T_j = 25 °C		6480	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C		700	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min		2500	V

Characteristics

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

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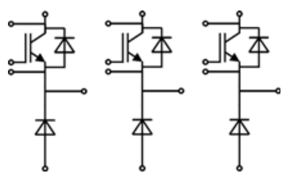

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
R_{Gint}	T_j = 25 °C			1.3		Ω
$t_{d(on)}$	V_{CC} = 600 V	T_j = 150 °C		150		ns
t_r	I_C = 600 A	T_j = 150 °C		121		ns
E_{on}	V_{GE} = +15/-15 V	T_j = 150 °C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

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

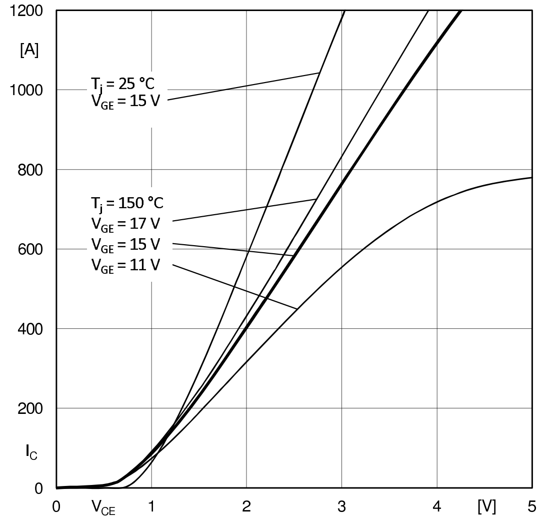


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

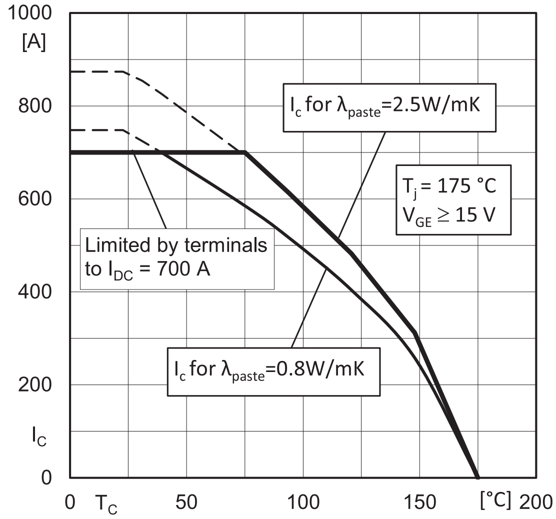


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

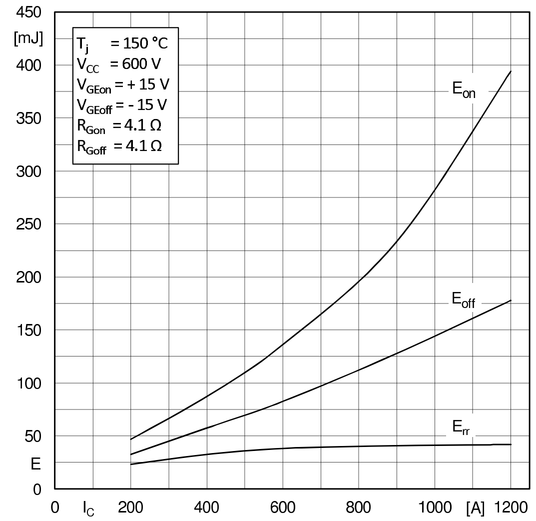


Fig. 3: Typ. turn-on /-off energy = f (I_C)

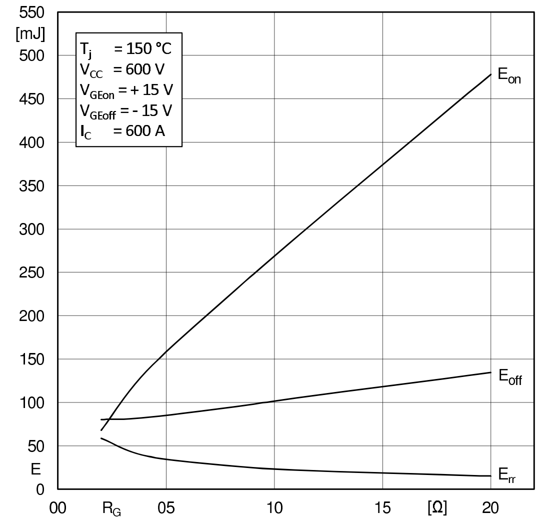


Fig. 4: Typ. turn-on /-off energy = f (R_G)

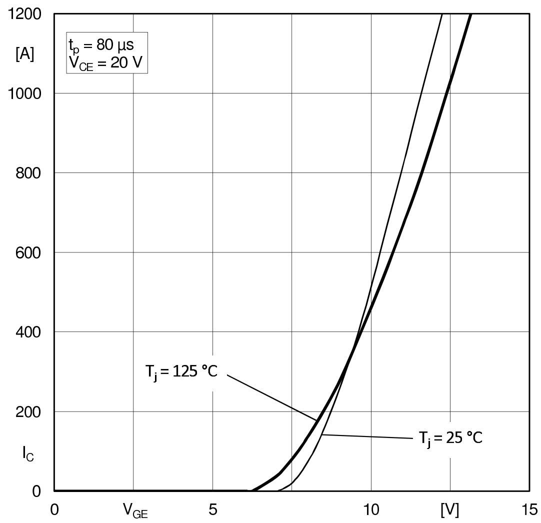


Fig. 5: Typ. transfer characteristic

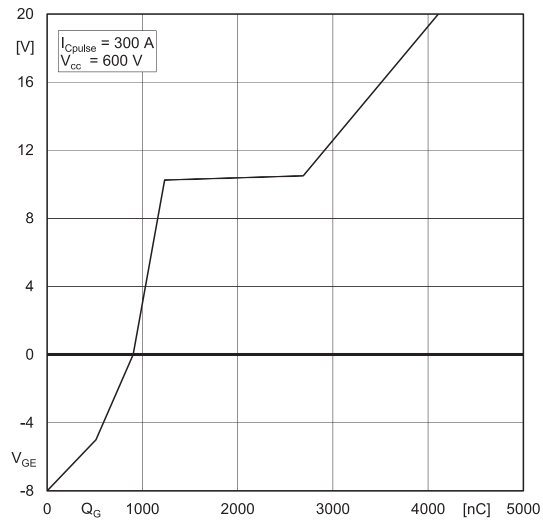


Fig. 6: Typ. gate charge characteristic

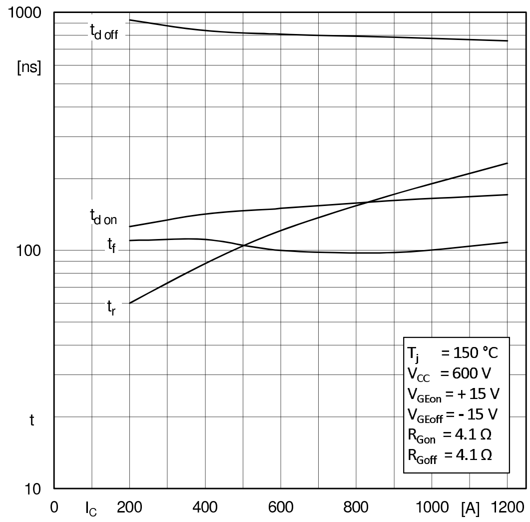


Fig. 7: Typ. switching times vs. I_C

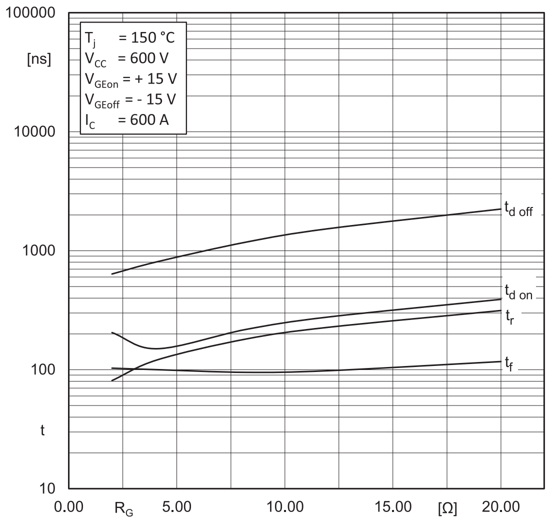


Fig. 8: Typ. switching times vs. gate resistor R_G

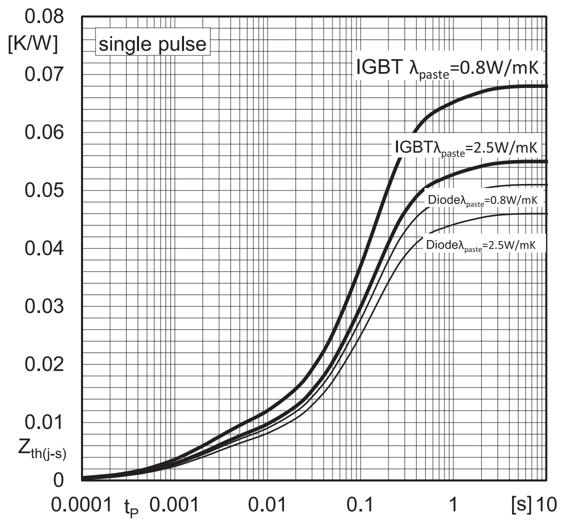


Fig. 9: Typ. transient thermal impedance

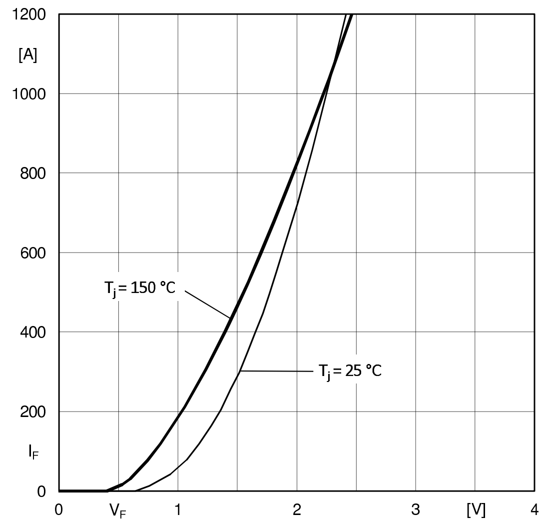


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+ EE'}$

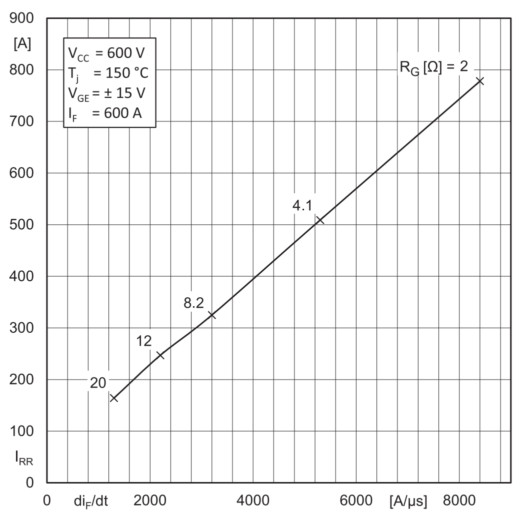


Fig. 11: Typ. CAL diode peak reverse recovery current

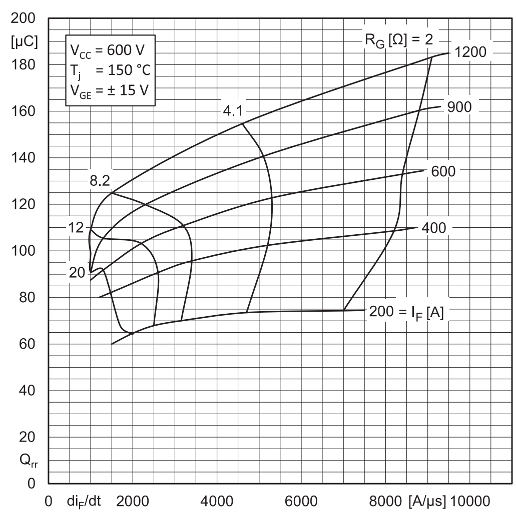
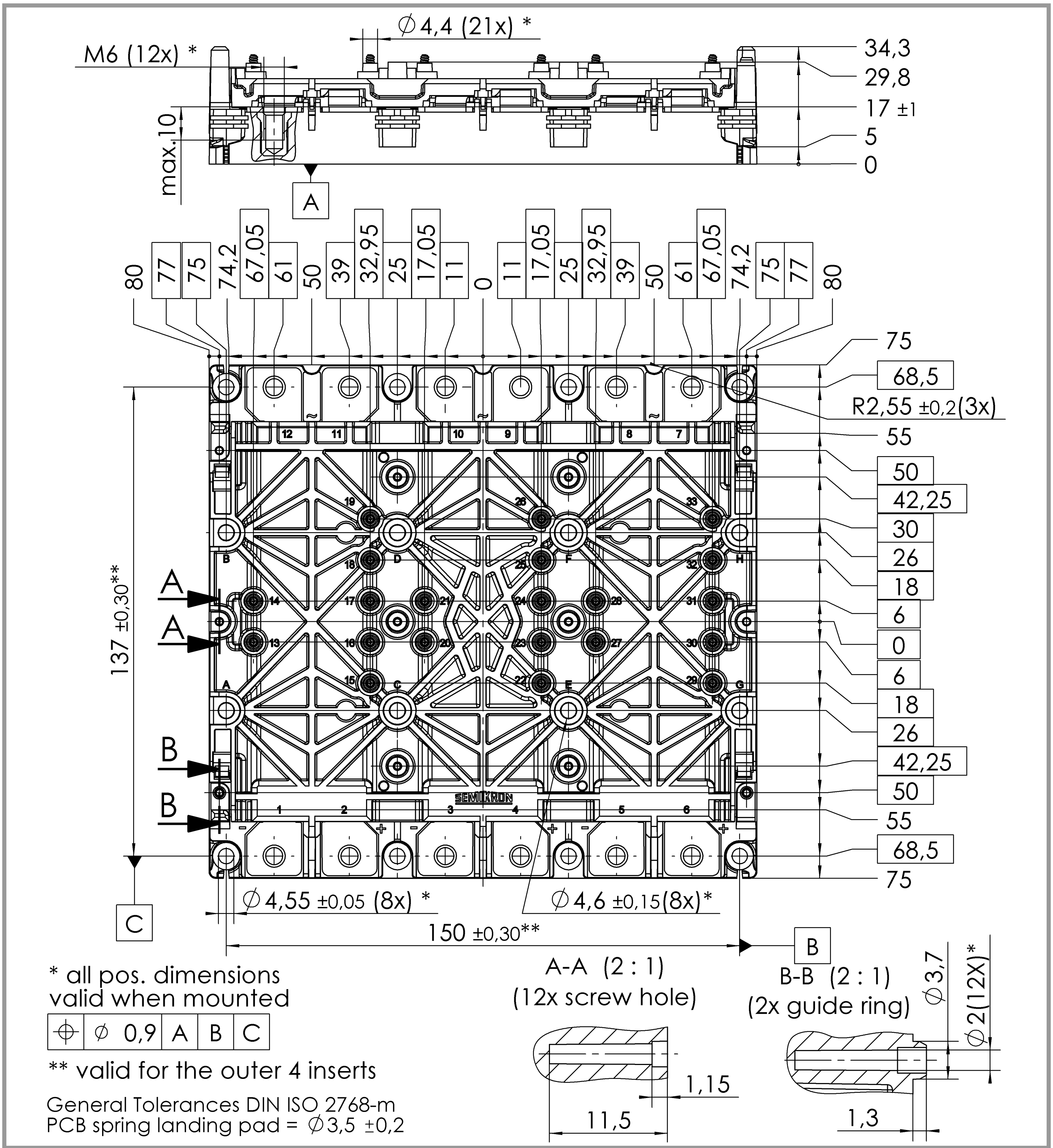
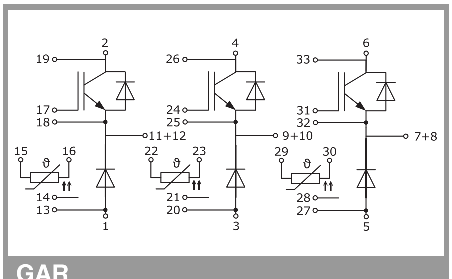


Fig. 12: Typ. CAL diode recovery charge


∅4,4 (21x) *
M6 (12x) *
max.10
34,3
29,8
17 ±1
5
0
A
R2,55 ±0,2(3x)
137 ±0,30**
∅4,55 ±0,05 (8x) *
∅4,6 ±0,15(8x)*
150 ±0,30**
C
B
* all pos. dimensions
valid when mounted
⌖ ∅ 0,9 A B C
** valid for the outer 4 inserts
General Tolerances DIN ISO 2768-m
PCB spring landing pad = ∅3,5 ±0,2
A-A (2 : 1)
(12x screw hole)
B-B (2 : 1)
(2x guide ring)
∅3,7
∅2(12X)*
1,15
11,5
1,3


11+12
9+10
7+8

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

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