SKiM® 93

Trench IGBT Modules

SKiM459GD12E4V2

Features

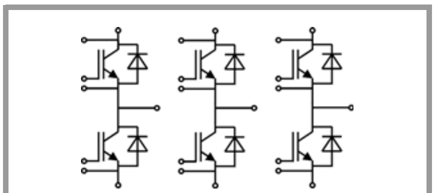
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Insulated by Al_2O_3 DBC (Direct Bonded Copper) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB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

Typical Applications*

- Automotive inverter
- High reliability AC inverter wind
- High reliability AC inverter drives

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
Inverter - 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	556	A
		T_s = 70 °C	452	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	716	A
		T_s = 70 °C	585	A
I_{Cnom}			450	A
I_{CRM}	I_{CRM} = 3 x I_{Cnom}		1350	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				
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	438	A
		T_s = 70 °C	347	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	530	A
		T_s = 70 °C	422	A
I_{Fnom}			450	A
I_{FRM}	I_{FRM} = 3 x I_{Fnom}		1350	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		2430	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
Inverter - IGBT						
$V_{CE(sat)}$	I_C = 450 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		2.3	2.7	mΩ
		T_j = 150 °C		3.4	3.7	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 18 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C			0.1	0.3	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		26.4		nF
C_{oes}		f = 1 MHz		1.74		nF
C_{res}		f = 1 MHz		1.41		nF
Q_G	V_{GE} = - 8 V...+ 15 V			2550		nC
R_{Gint}	T_j = 25 °C			1.7		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 450 A $R_{G\,on}$ = 1.3 Ω $R_{G\,off}$ = 1.3 Ω di/dt_{on} = 8340 A/µs di/dt_{off} = 3660 A/µs V_{GE} = +15/-15 V	T_j = 150 °C		276		ns
t_r		T_j = 150 °C		55		ns
E_{on}		T_j = 150 °C		22		mJ
$t_{d(off)}$		T_j = 150 °C		538		ns
t_f		T_j = 150 °C		114		ns
E_{off}		T_j = 150 °C		57		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.092		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.059		K/W

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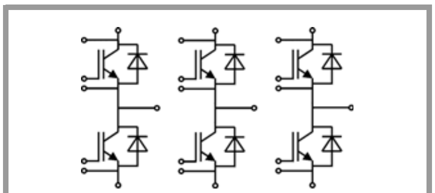

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse - Diode						
$V_F = V_{EC}$	I_F = 450 A	T_j = 25 °C		2.14	2.46	V
	chiplevel	T_j = 150 °C		2.07	2.38	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		1.87	2.1	mΩ
		T_j = 150 °C		2.6	2.8	mΩ
I_{RRM}	I_F = 450 A	T_j = 150 °C		570		A
Q_{rr}	di/dt_{off} = 8880 A/µs V_{GE} = +15/-15 V	T_j = 150 °C		80		µC
E_{rr}	V_{CC} = 600 V	T_j = 150 °C		40		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.155		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.115		K/W
Module						
L_{CE}				10	15	nH
$R_{CC'+EE'}$	measured per switch	T_s = 25 °C		0.3		mΩ
		T_s = 125 °C		0.5		mΩ
w				1042		g
Temperature Sensor						
R_{100}	T_r=100°C (R_{25}=1000Ω)			1670 ± 1%		Ω
R(T)	$R(T)=1k\Omega[1+A(T-25°C)+B(T-25°C)^2]$, $A = 7.64*10^{-3}°C^{-1}$, $B = 1.73*10^{-5}°C^{-2}$					

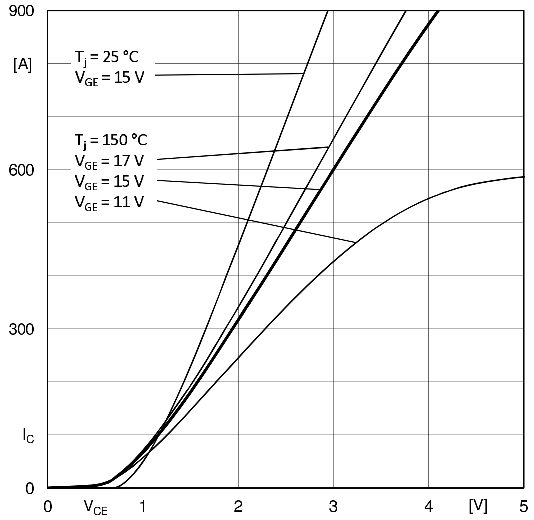


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+ EE'}$

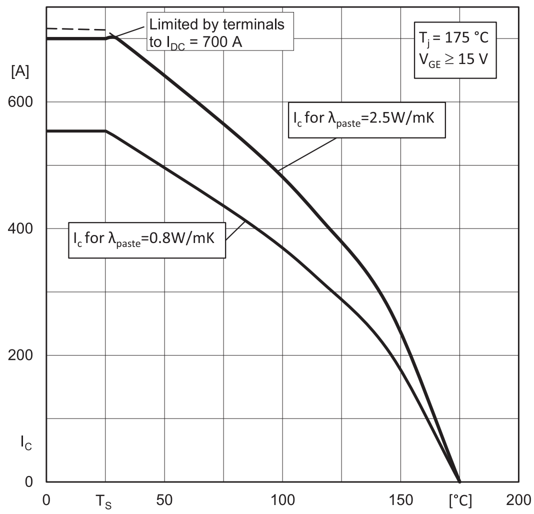


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

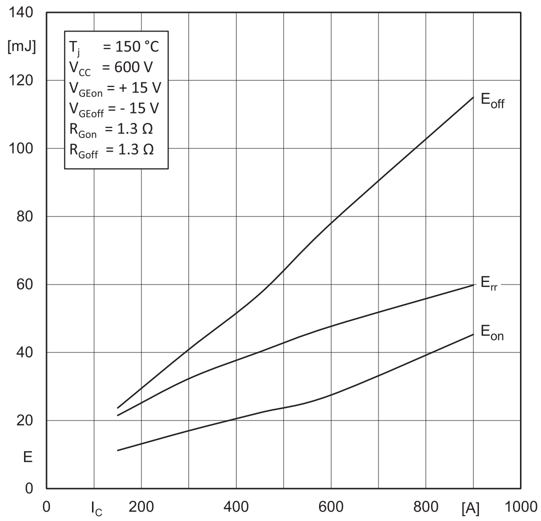


Fig. 3: Typ. turn-on /-off energy = f (I_C)

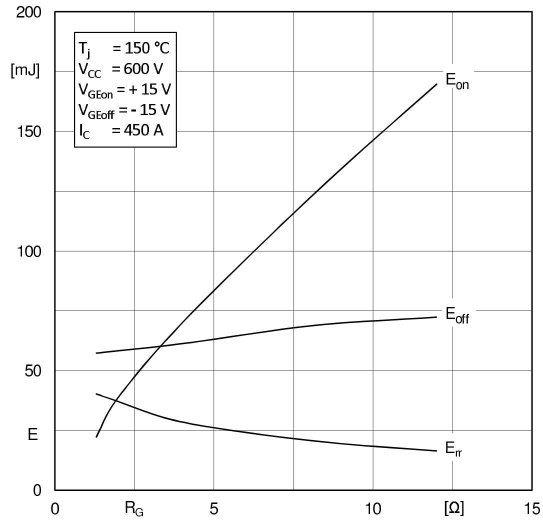


Fig. 4: Typ. turn-on /-off energy = f (R_G)

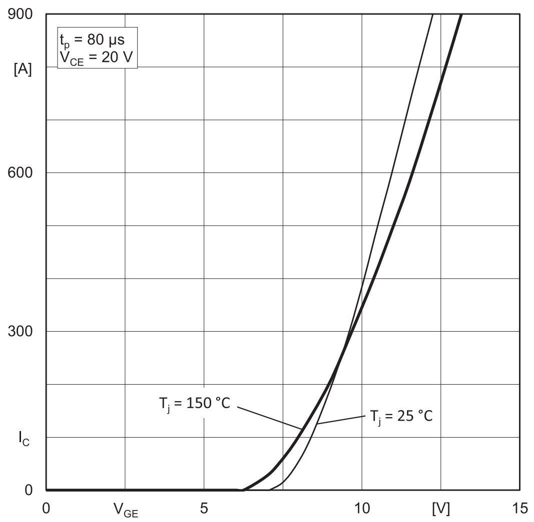


Fig. 5: Typ. transfer characteristic

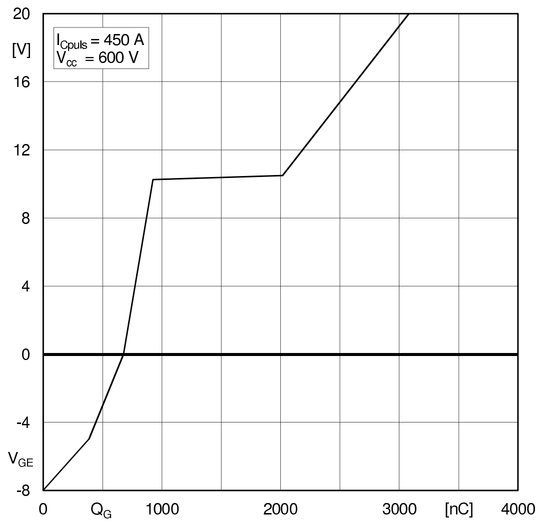


Fig. 6: Typ. gate charge characteristic

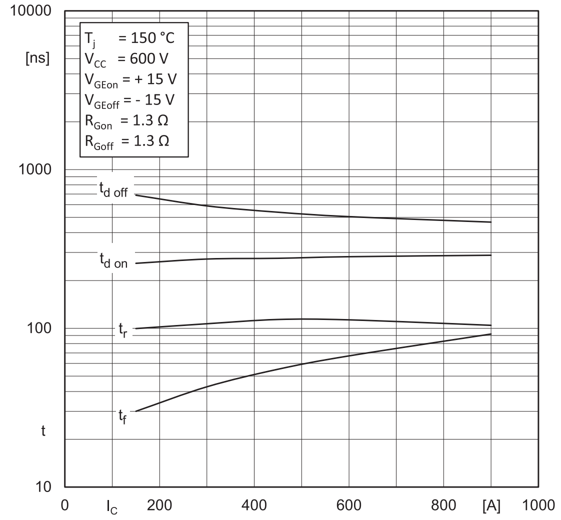


Fig. 7: Typ. switching times vs. I_C

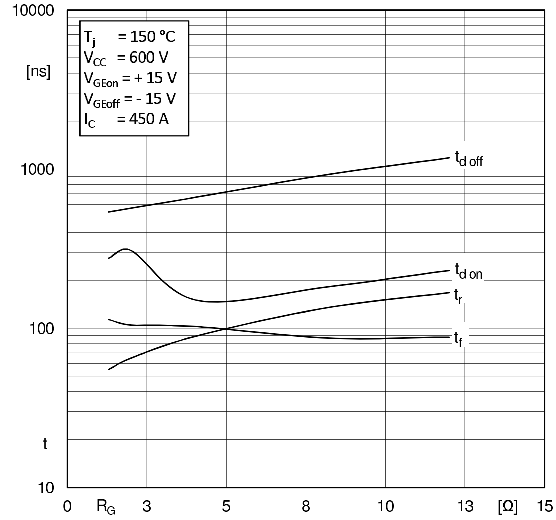


Fig. 8: Typ. switching times vs. gate resistor R_G

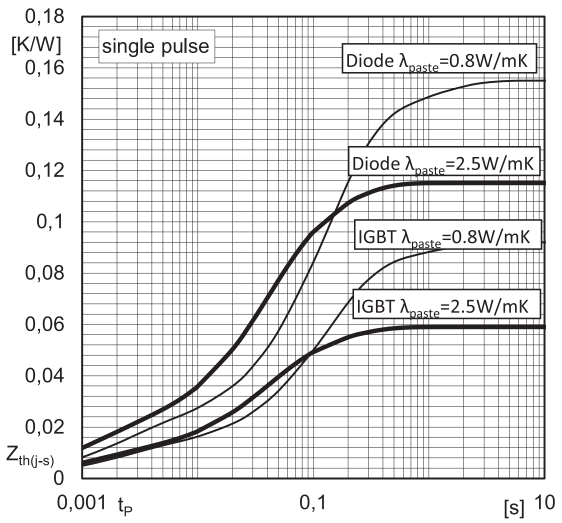


Fig. 9: Typ. transient thermal impedance

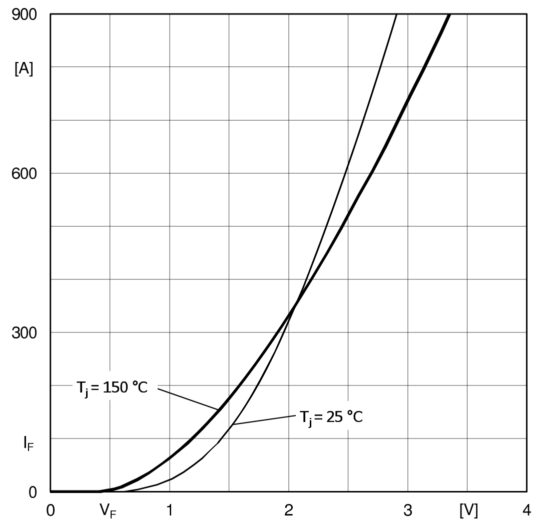


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+ EE'}$

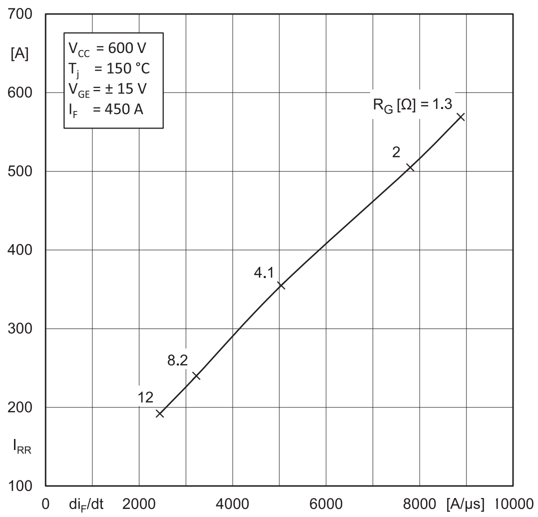


Fig. 11: Typ. CAL diode peak reverse recovery current

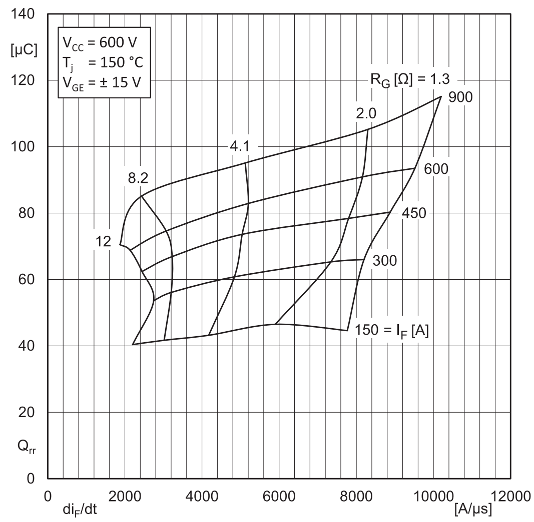
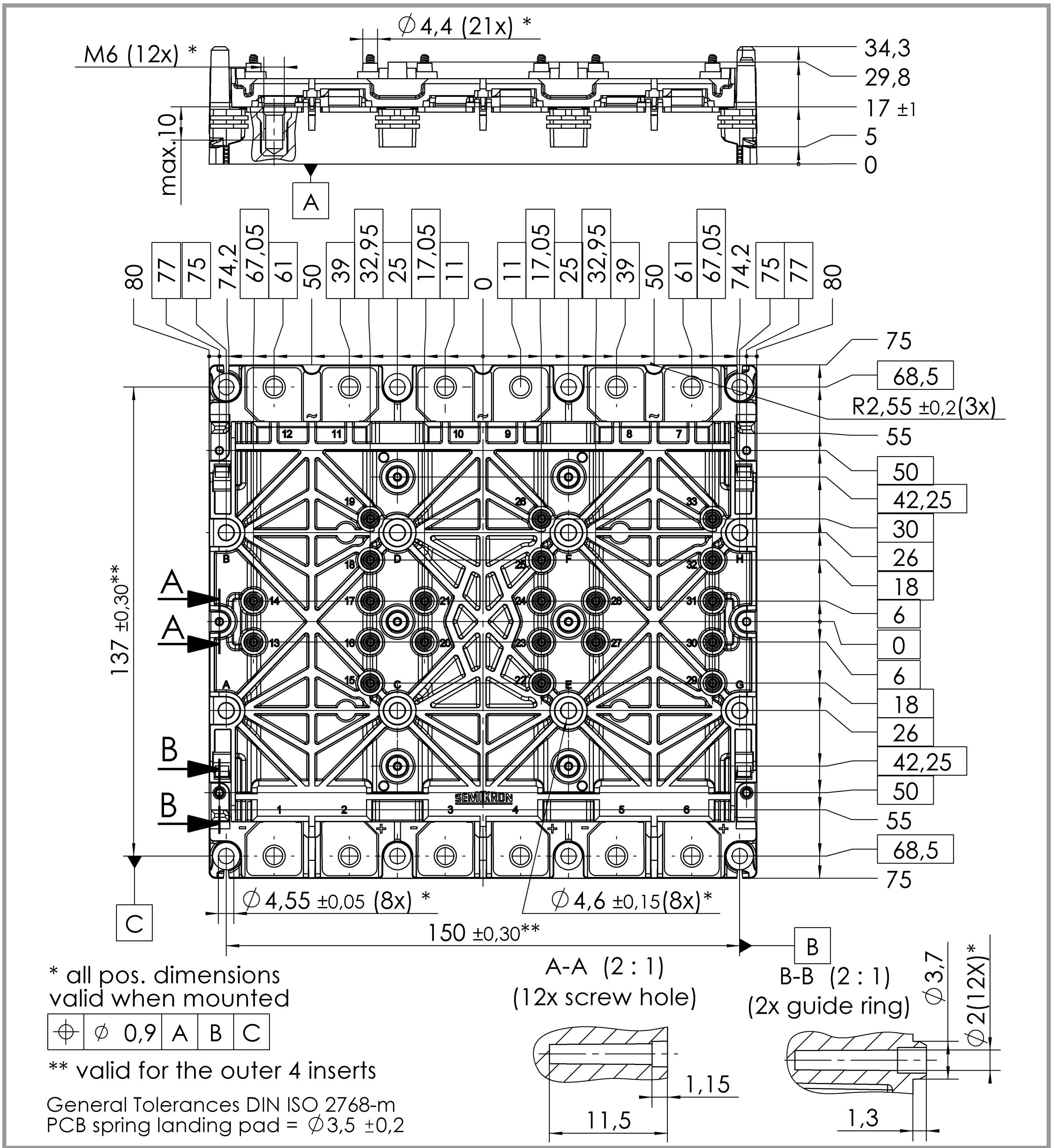
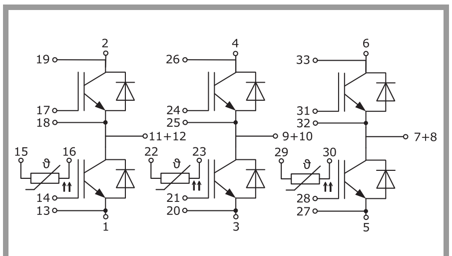


Fig. 12: Typ. CAL diode recovery charge



∅4,4 (21x) *
M6 (12x) *
34,3
29,8
17 ±1
5
0
max.10
A
80 77 75 74,2 67,05 61 50 39 32,95 25 17,05 11 0 11 17,05 25 32,95 39 50 61 67,05 74,2 75 77 80
75
68,5
R2,55 ±0,2(3x)
55
50
42,25
30
26
18
6
0
6
18
26
42,25
50
55
68,5
75
137 ±0,30**
A
A
B
B
C
∅4,55 ±0,05 (8x) *
∅4,6 ±0,15(8x)*
150 ±0,30**
B
SEMIKRON
* 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)
1,15
11,5
B-B (2 : 1)
(2x guide ring)
∅3,7
∅2(12X)*
1,3



2
4
6
19
26
33
17
18
24
25
31
32
11+12
9+10
7+8
15
16
22
23
29
30
14
13
21
20
28
27
1
3
5

GD

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

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