



SKiM® 93

Trench IGBT Modules

SKiM429GD17E4V5

Features*

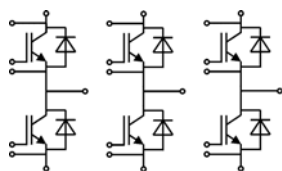
- IGBT 4 Trench Gate Technology
- Solderless sinter technology
- $V_{CE(sat)}$ with positive temperature coefficient
- Low inductance case
- Insulated by Al_2O_3 DBC (Direct Bonded Copper) ceramic substrate
- Pressure contact technology for thermal contacts
- Spring contact system to attach driver PCB to the control terminals
- High short circuit capability, self limiting to $6 \times I_C$
- Integrated temperature sensor
- 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 $T_s = 125^\circ\text{C}$ max; $T_c = T_s$ (for baseplateless modules)
- Recommended $T_{op} = -40 \dots +150^\circ\text{C}$



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}	T _j = 25 °C		1700	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	608	A
	T _j = 175 °C	T _s = 70 °C	489	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	785	A
	T _j = 175 °C	T _s = 70 °C	635	A
I _{Cnom}			420	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		1260	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 1000 V V _{GE} ≤ 15 V V _{CES} ≤ 1700 V	T _j = 150 °C	10	µs
T _j			-40 ... 175	°C
Inverse - Diode				
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	394	A
	T _j = 175 °C	T _s = 70 °C	308	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	482	A
	T _j = 175 °C	T _s = 70 °C	379	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 2 x I _{Fnom}		900	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		2322	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		3000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
$V_{CE(sat)}$	$I_C = 420 \text{ A}$ $V_{GE} = 15 \text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.90	2.25	V
		$T_j = 150^\circ\text{C}$	2.25	2.45	V
V_{CE0}	chiplevel	$T_j = 25^\circ\text{C}$	1.10	1.20	V
		$T_j = 150^\circ\text{C}$	1.00	1.10	V
r_{CE}	$V_{GE} = 15 \text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.90	2.5	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	3.0	3.2	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 16.8 \text{ mA}$	5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0 \text{ V}, V_{CE} = 1700 \text{ V}, T_j = 25^\circ\text{C}$			0.5	mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	33		nF
C_{oes}		$f = 1 \text{ MHz}$	1.38		nF
C_{res}		$f = 1 \text{ MHz}$	1.08		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		3360		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		2.7		Ω
$t_{d(on)}$	$V_{CC} = 1200 \text{ V}$ $I_C = 420 \text{ A}$	$T_j = 150^\circ\text{C}$	498		ns
t_r	$R_{G on} = 2.2 \Omega$	$T_j = 150^\circ\text{C}$	62		ns
E_{on}	$R_{G off} = 2.2 \Omega$	$T_j = 150^\circ\text{C}$	178		mJ
$t_{d(off)}$	$di/dt_{on} = 7450 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	922		ns
t_f	$di/dt_{off} = 1920 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	220		ns
E_{off}	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$	189		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W/(mK)}$		0.079		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W/(mK)}$		0.051		K/W



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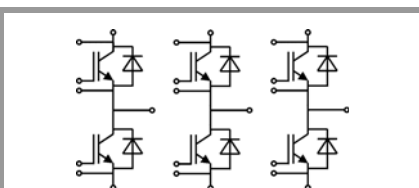
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse - Diode						
V _F = V _{EC}	I _F = 420 A V _{GE} = 0 V chiplevel	T _j = 25 °C		1.93	2.32	V
		T _j = 150 °C		2.04	2.43	V
V _{F0}	chiplevel	T _j = 25 °C		1.32	1.56	V
		T _j = 150 °C		1.08	1.22	V
r _F	chiplevel	T _j = 25 °C		1.46	1.80	mΩ
		T _j = 150 °C		2.3	2.9	mΩ
I _{RRM}	I _F = 420 A	T _j = 150 °C		577		A
Q _{rr}	di/dt _{off} = 7630 A/μs	T _j = 150 °C		150		μC
E _{rr}	V _{GE} = +15/-15 V V _{CC} = 1200 V	T _j = 150 °C		119		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.169		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			0.125		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)=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					



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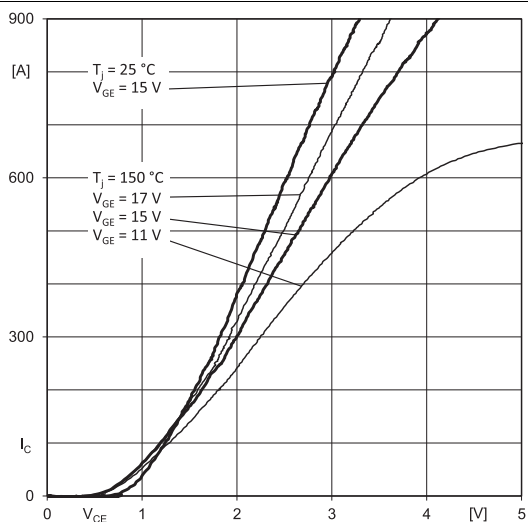
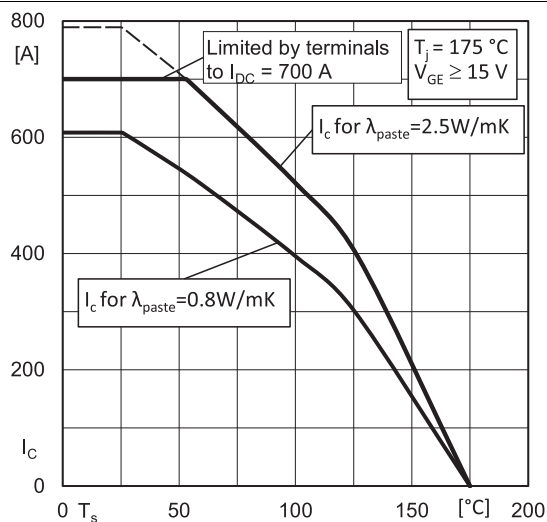
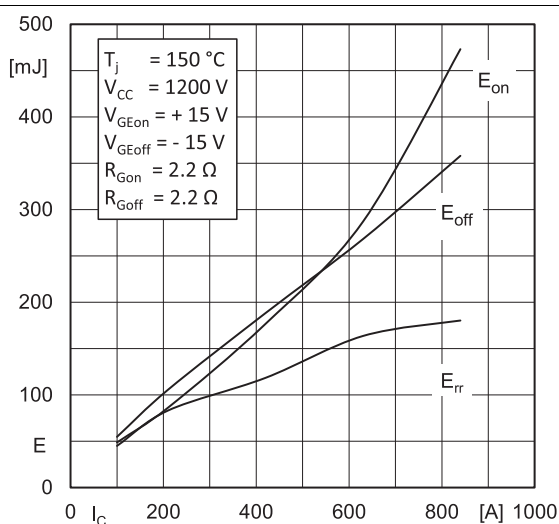
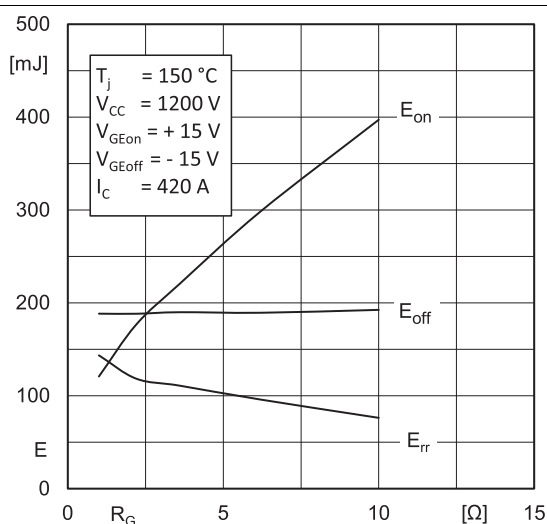
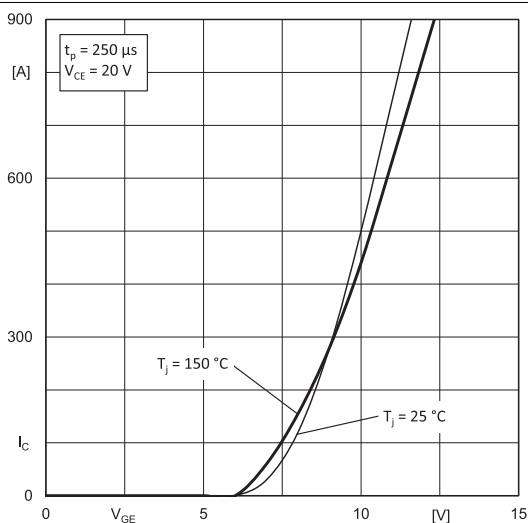

 Fig. 1: Typ. output characteristic, inclusive $R_{CC} + EE'$

 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

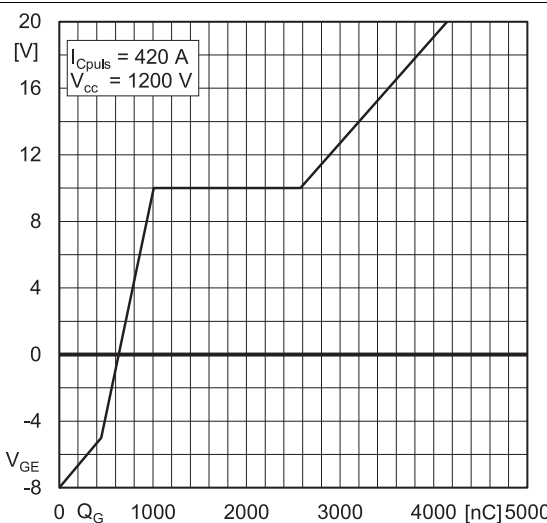


Fig. 6: Typ. gate charge characteristic

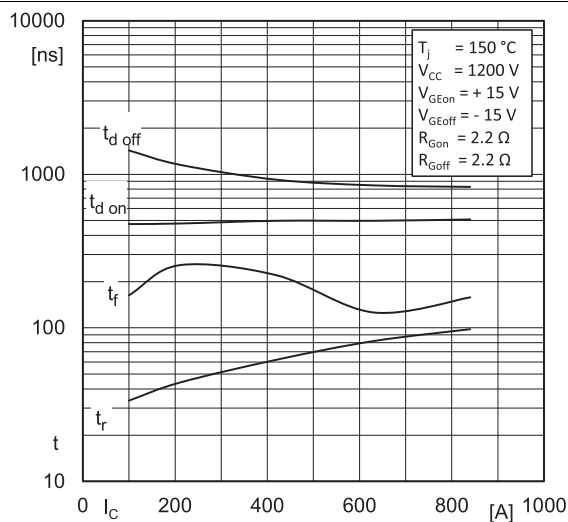


Fig. 7: Typ. switching times vs. I_C

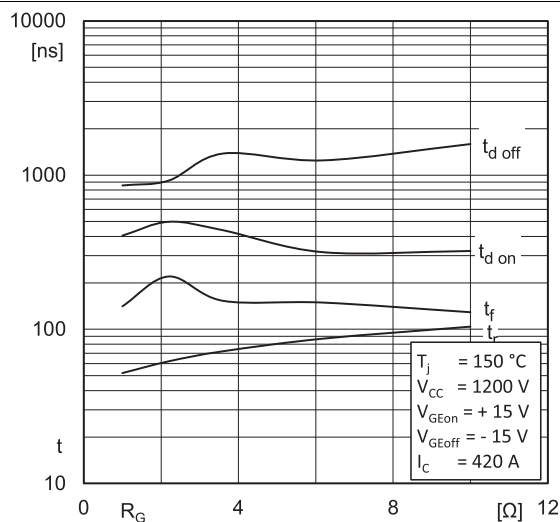


Fig. 8: Typ. switching times vs. gate resistor R_G

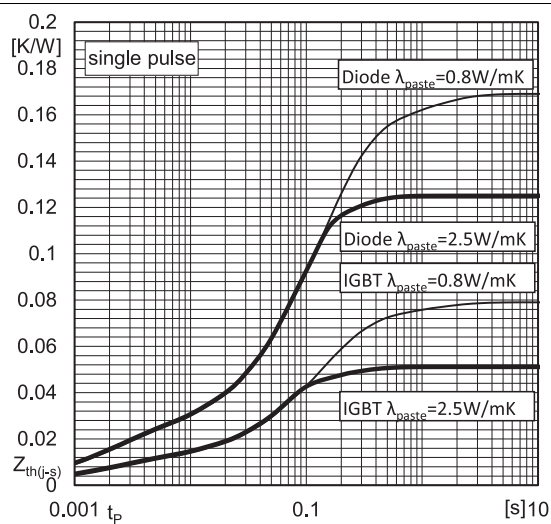


Fig. 9: Typ. transient thermal impedance

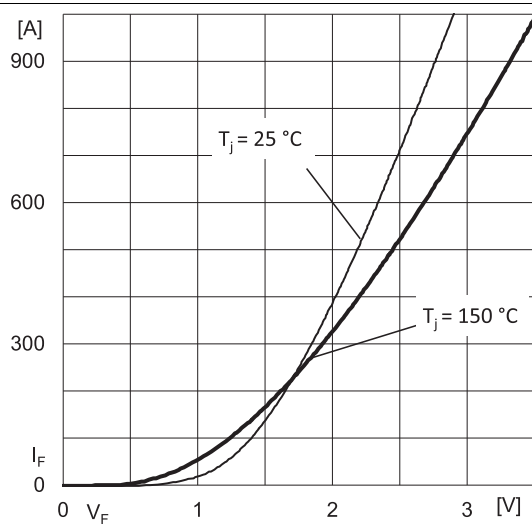


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

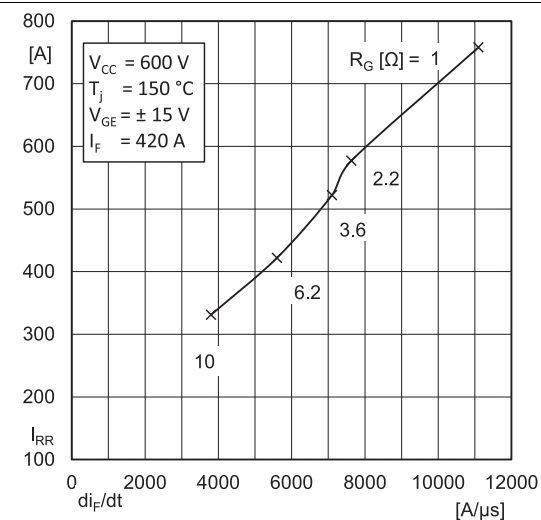


Fig. 11: Typ. CAL diode peak reverse recovery current

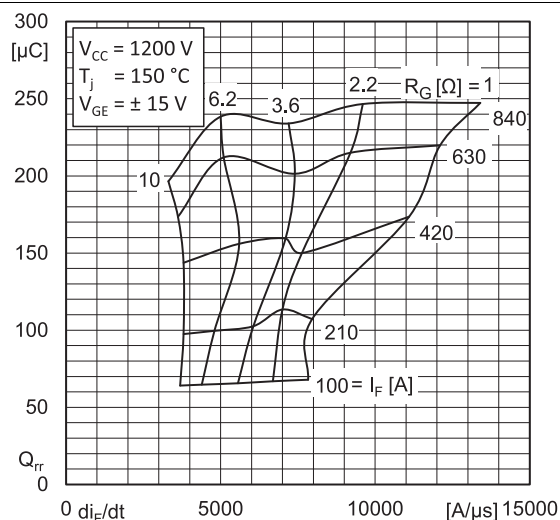
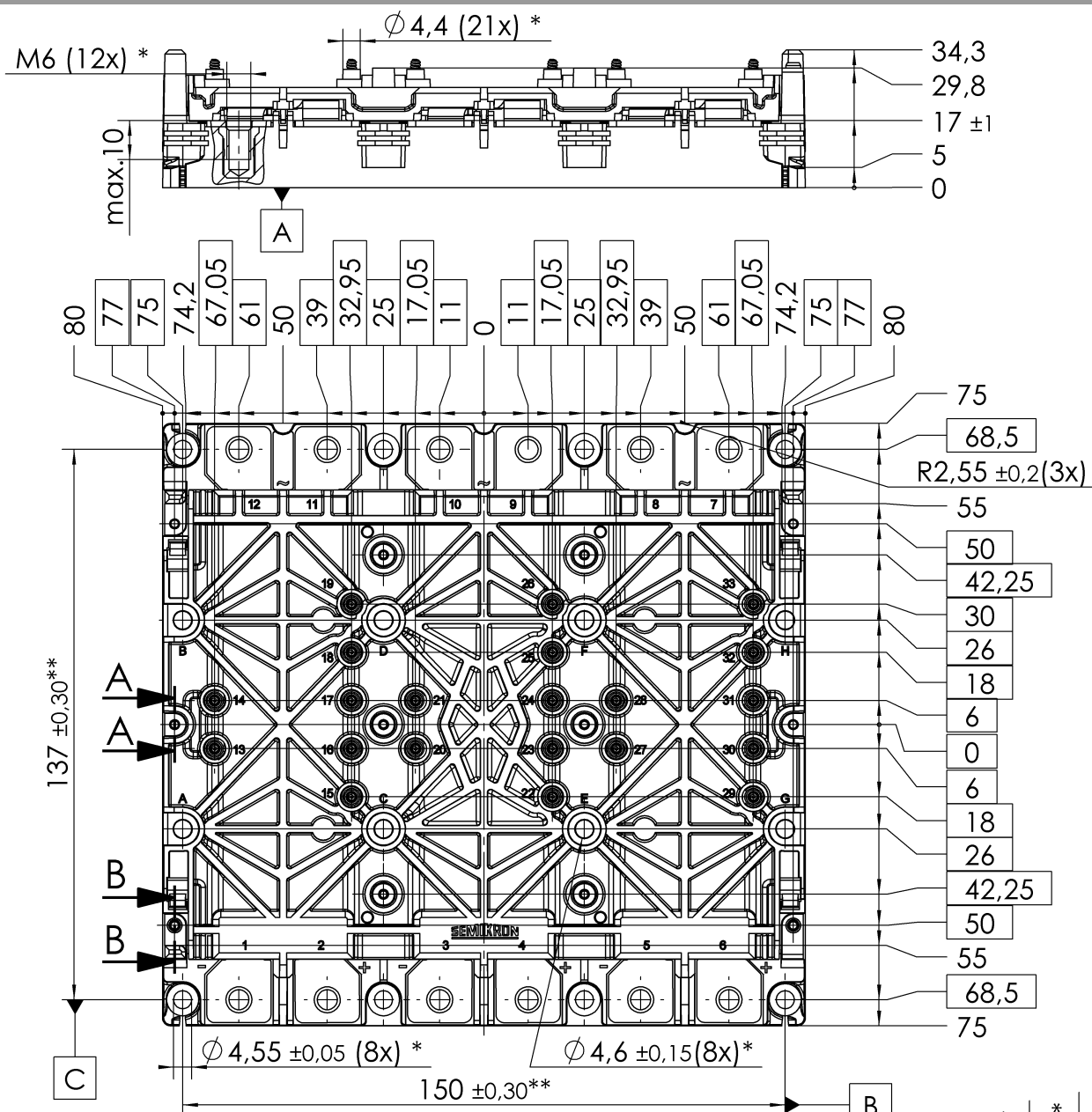


Fig. 12: Typ. CAL diode recovery charge

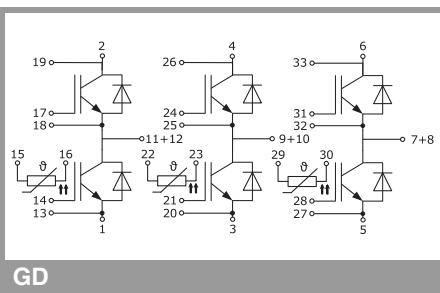


* all pos. dimensions valid when mounted

⌀ 0,9 A B C

** valid for the outer 4 inserts

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



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

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