

SEMiX453GAL17E4s



SEMiX® 3s

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Features

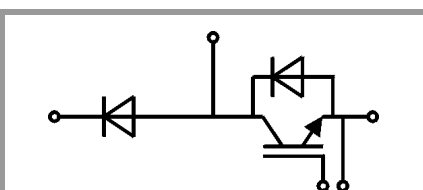
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^{\circ}\text{C}$ max.
- Product reliability results are valid for $T_J=150^{\circ}\text{C}$
- Dynamic values apply to the following combination of resistors:
 $R_{Gon,main} = 2,4 \Omega$
 $R_{Goff,main} = 2,4 \Omega$
 $R_{G,X} = 2,2 \Omega$
 $R_{E,X} = 0,5 \Omega$



GAL

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V _{CES}	T _j = 25 °C		1700	V
I _C	T _j = 175 °C	T _c = 25 °C	762	A
		T _c = 80 °C	579	A
I _{Cnom}			450	A
I _{CRM}	I _{CRM} = 3xI _{Cnom}		1350	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

V_{RRM}	$T_J = 25\text{ }^{\circ}\text{C}$		1700	V
I_F	$T_J = 175\text{ }^{\circ}\text{C}$	$T_c = 25\text{ }^{\circ}\text{C}$	482	A
		$T_c = 80\text{ }^{\circ}\text{C}$	354	A
I_{Fnom}			450	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms}$, $\sin 180^{\circ}$, $T_J = 25\text{ }^{\circ}\text{C}$		2565	A
T_i			-40 ... 175	$^{\circ}\text{C}$

Freewheeling diode

V _{RRM}	T _J = 25 °C		1700	V
I _F		T _c = 25 °C	482	A
		T _c = 80 °C	354	A
I _{Fnom}			450	A
I _{FRM}	I _{FRM} = 2xI _{Fnom}		900	A
I _{FSM}	t _p = 10 ms, sin 180°, T _J = 25 °C		2565	A
T _i			-40 ... 175	°C

Module

$I_{t(RMS)}$		600	A
T_{stg}		-40 ... 125	$^{\circ}\text{C}$
V_{isol}	AC sinus 50Hz, $t = 1 \text{ min}$	4000	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 450 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_J = 25^{\circ}\text{C}$	1.90	2.20	V
		$T_J = 150^{\circ}\text{C}$	2.26	2.45	V
V_{CE0}	chipelevel	$T_J = 25^{\circ}\text{C}$	1.1	1.2	V
		$T_J = 150^{\circ}\text{C}$	1	1.1	V
r_{CE}	$V_{GE} = 15 \text{ V}$ chipelevel	$T_J = 25^{\circ}\text{C}$	1.8	2.2	$\text{m}\Omega$
		$T_J = 150^{\circ}\text{C}$	2.8	3	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 18 \text{ mA}$	5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0 \text{ V}$ $V_{CE} = 1700 \text{ V}$	$T_J = 25^{\circ}\text{C}$		5	mA
					mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	36		nF
C_{oes}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	1.50		nF
C_{res}		$f = 1 \text{ MHz}$	1.14		nF
Q_G	$V_{GE} = -8 \text{ V...} + 15 \text{ V}$		3600		nC
R_{Gint}	$T_J = 25^{\circ}\text{C}$		1.67		Ω



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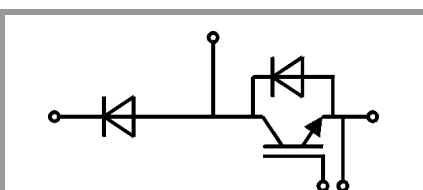
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 $R_{E,X} = 0,5 \Omega$



GAL

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 1200 V	T _j = 150 °C		455		ns
t _r	I _C = 450 A	T _j = 150 °C		65		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		250		mJ
t _{d(off)}	R _{G on} = 3.3 Ω	T _j = 150 °C		960		ns
t _f	R _{G off} = 3.3 Ω	T _j = 150 °C		170		ns
E _{off}	di/dt _{on} = 7000 A/μs di/dt _{off} = 2220 A/μs du/dt = 5160 V/μs L _s = 30 nH	T _j = 150 °C		190		mJ
t _{d(on)}	V _{CC} = 900 V	T _j = 150 °C		490		ns
t _r	I _C = 450 A	T _j = 150 °C		120		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		118		mJ
t _{d(off)}	R _{G on} = 3.3 Ω	T _j = 150 °C		900		ns
t _f	R _{G off} = 3.3 Ω	T _j = 150 °C		200		ns
E _{off}	di/dt _{on} = 4000 A/μs di/dt _{off} = 2050 A/μs du/dt = 4600 V/μs L _s = 80 nH	T _j = 150 °C		154		mJ
R _{th(j-c)}	per IGBT				0.056	K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25\text{ }^{\circ}\text{C}$		1.98	2.37	V
		$T_j = 150\text{ }^{\circ}\text{C}$		2.11	2.52	V
V_{F0}	chipelevel	$T_j = 25\text{ }^{\circ}\text{C}$	1.16	1.32	1.56	V
		$T_j = 150\text{ }^{\circ}\text{C}$		1.08	1.22	V
r_F	chipelevel	$T_j = 25\text{ }^{\circ}\text{C}$	1.2	1.5	1.8	mΩ
		$T_j = 150\text{ }^{\circ}\text{C}$		2.3	2.9	mΩ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150\text{ }^{\circ}\text{C}$		440		A
Q_{rr}	$di/dt_{off} = 6240\text{ A}/\mu\text{s}$	$T_j = 150\text{ }^{\circ}\text{C}$		150		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_R = 1200\text{ V}$	$T_j = 150\text{ }^{\circ}\text{C}$		100		mJ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150\text{ }^{\circ}\text{C}$		400		A
Q_{rr}	$di/dt_{off} = 3700\text{ A}/\mu\text{s}$	$T_j = 150\text{ }^{\circ}\text{C}$		150		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_R = 900\text{ V}$	$T_j = 150\text{ }^{\circ}\text{C}$		87		mJ
$R_{th(j-c)}$	per diode				0.125	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25\text{ }^{\circ}\text{C}$		1.98	2.37	V
		$T_j = 150\text{ }^{\circ}\text{C}$		2.11	2.52	V
V_{F0}	chipelevel	$T_j = 25\text{ }^{\circ}\text{C}$	1.16	1.32	1.56	V
		$T_j = 150\text{ }^{\circ}\text{C}$		1.08	1.22	V
r_F	chipelevel	$T_j = 25\text{ }^{\circ}\text{C}$	1.2	1.5	1.8	mΩ
		$T_j = 150\text{ }^{\circ}\text{C}$		2.3	2.9	mΩ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150\text{ }^{\circ}\text{C}$		440		A
Q_{rr}	$di/dt_{off} = 6240\text{ A}/\mu\text{s}$	$T_j = 150\text{ }^{\circ}\text{C}$		150		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_R = 1200\text{ V}$	$T_j = 150\text{ }^{\circ}\text{C}$		100		mJ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150\text{ }^{\circ}\text{C}$		400		A
Q_{rr}	$di/dt_{off} = 3700\text{ A}/\mu\text{s}$	$T_j = 150\text{ }^{\circ}\text{C}$		150		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_R = 900\text{ V}$	$T_j = 150\text{ }^{\circ}\text{C}$		87		mJ
$R_{th(j-c)}$	per diode				0.125	K/W

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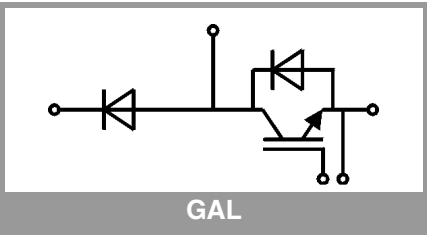
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 $R_{E,X} = 0,5\ \Omega$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Module						
L _{CE}			20			nH
R _{CC'+EE'}	res. terminal-chip	T _C = 25 °C	0.85			mΩ
		T _C = 150 °C	1.2			mΩ
R _{th(c-s)}	per module		0.04			K/W
M _s	to heat sink (M5)		3		5	Nm
M _t		to terminals (M6)	2.5		5	Nm
						Nm
w			300			g
Temperature Sensor						
R ₁₀₀	T _C =100°C (R ₂₅ =5 kΩ)		493 ± 5%			Ω
B _{100/125}	R _(T) =R ₁₀₀ exp[B _{100/125} (1/T-1/T ₁₀₀)]; T[K];		3550 ±2%			K



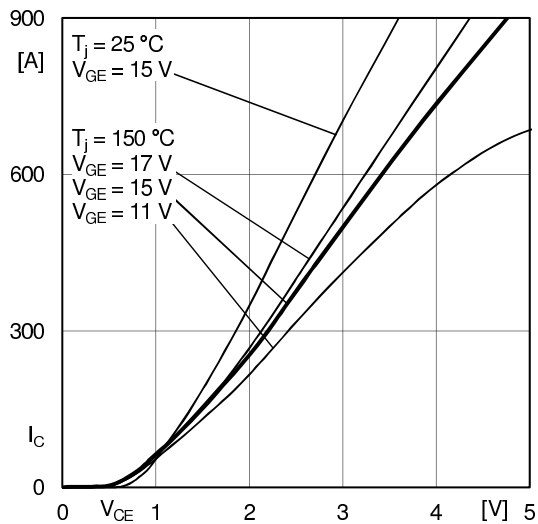


Fig. 1: Typ. output characteristic, inclusive $R_{CC'} + EE'$

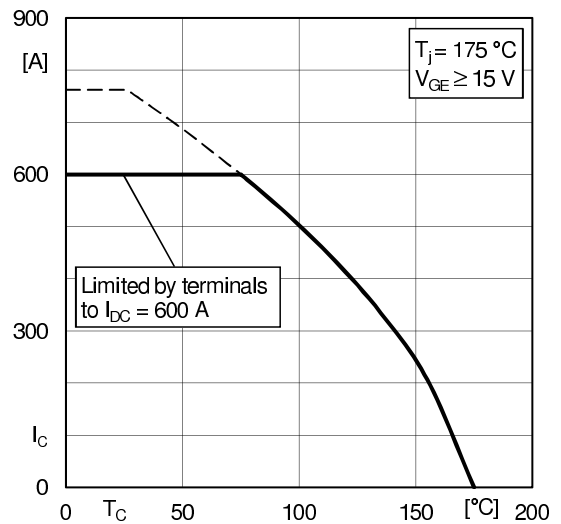


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

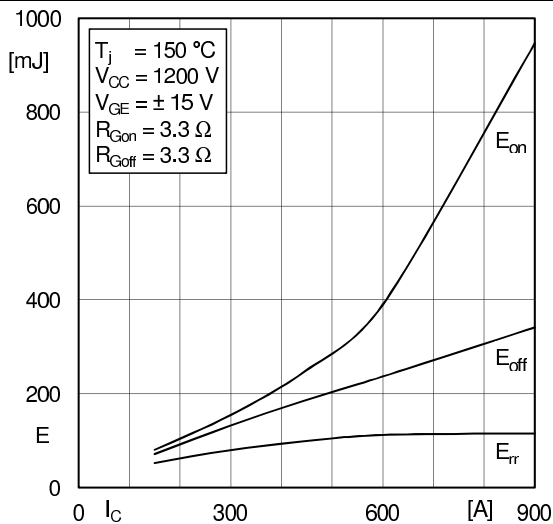


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

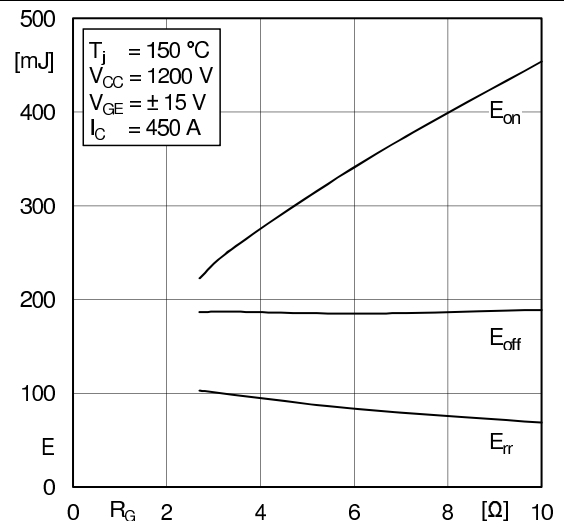


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

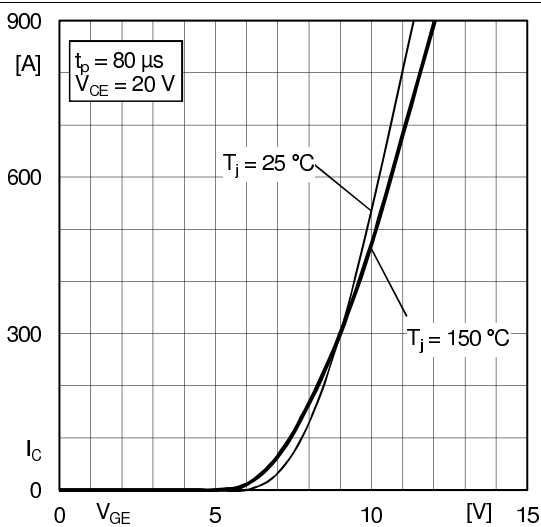


Fig. 5: Typ. transfer characteristic

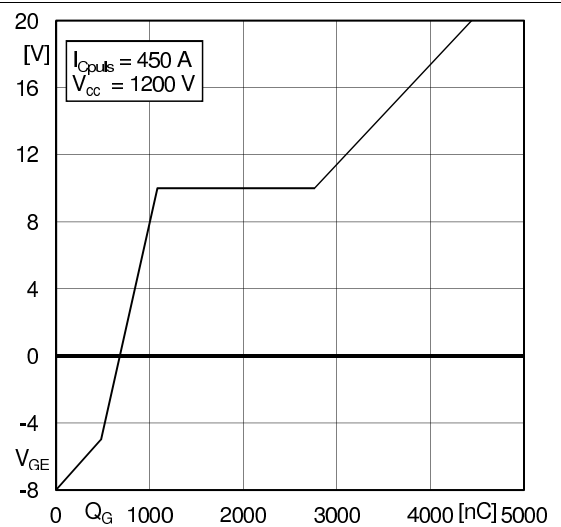


Fig. 6: Typ. gate charge characteristic

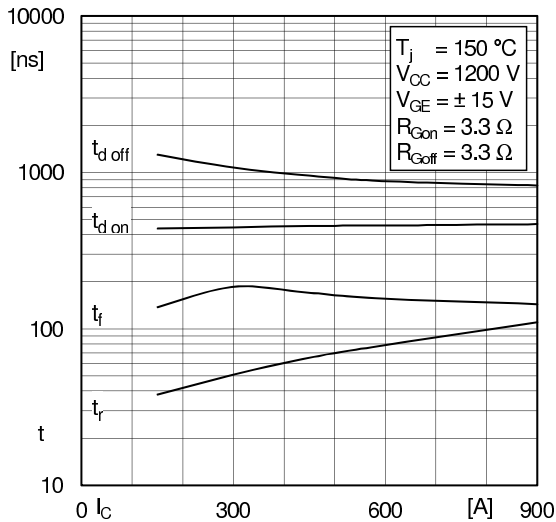


Fig. 7: Typ. switching times vs. I_C

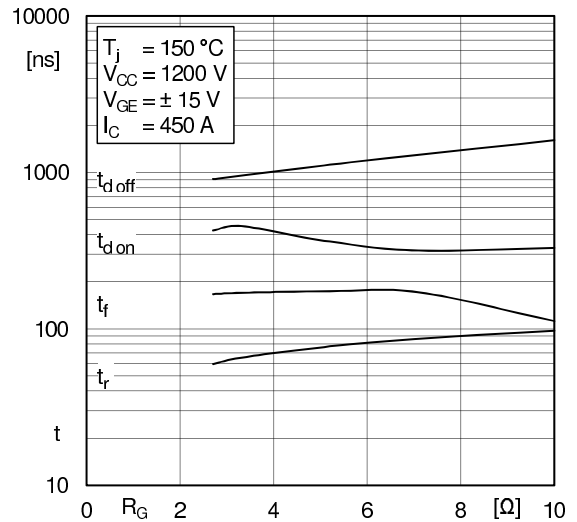


Fig. 8: Typ. switching times vs. gate resistor R_G

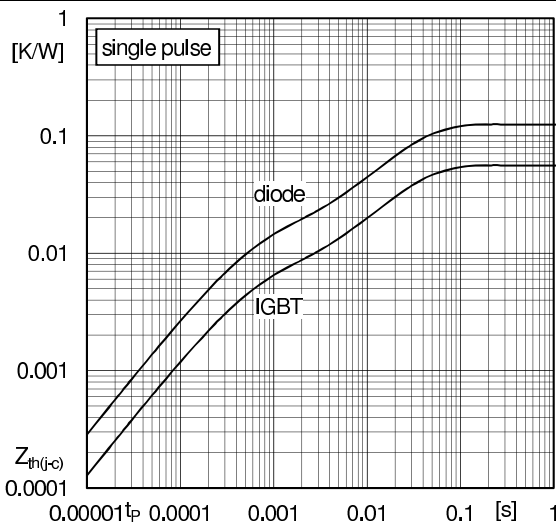


Fig. 9: Typ. transient thermal impedance

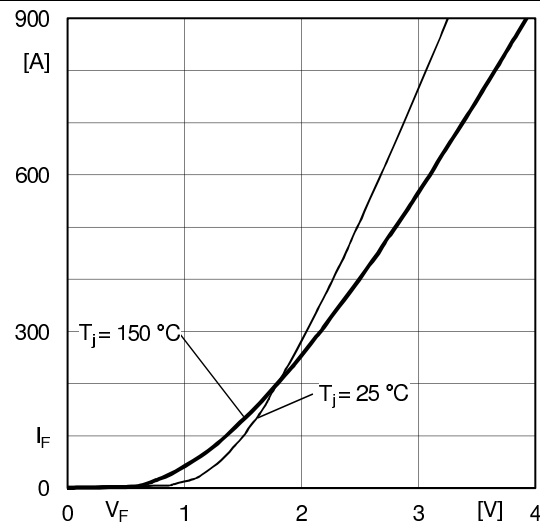


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

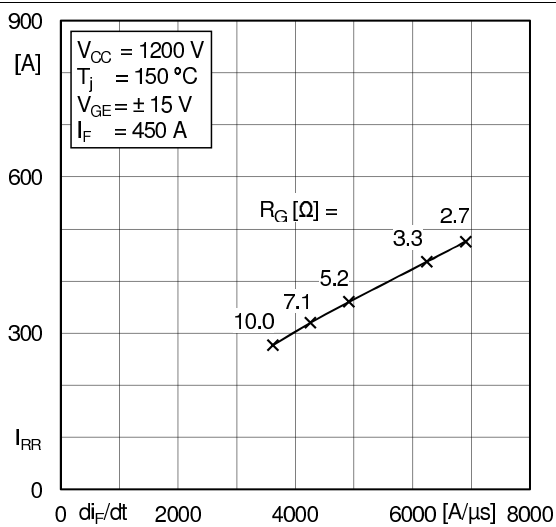


Fig. 11: Typ. CAL diode peak reverse recovery current

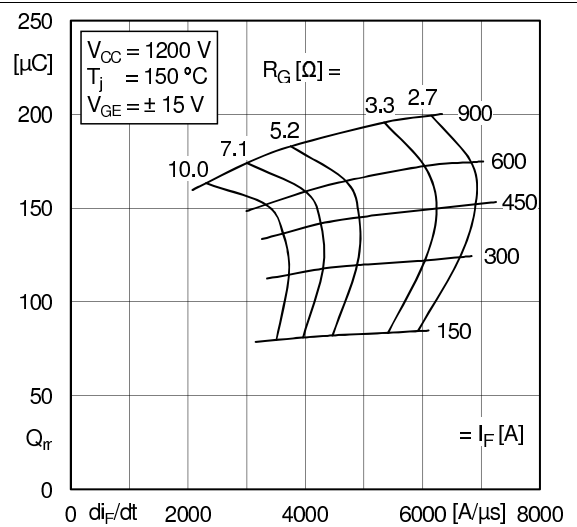
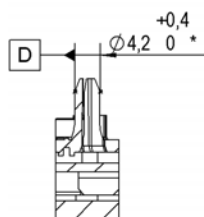


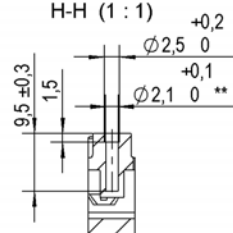
Fig. 12: Typ. CAL diode recovery charge

Case: SEMiX 3s

guide pin left
F-F (1 : 1)



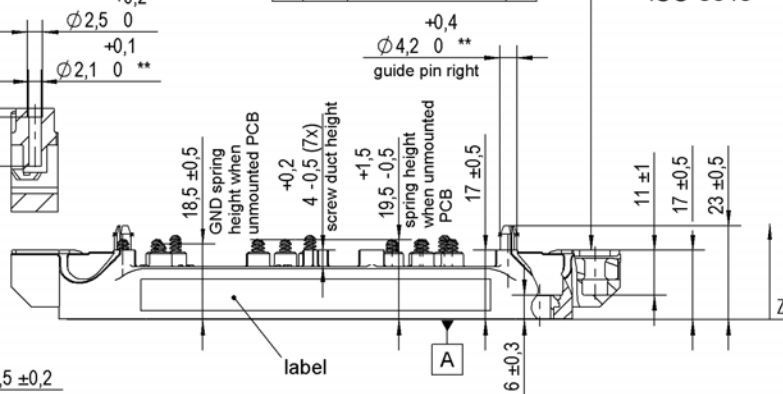
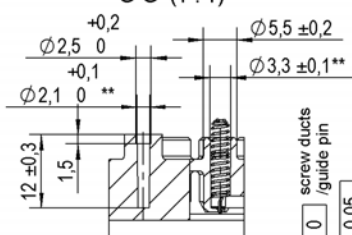
screw duct
(1x centre):
H-H (1 : 1)



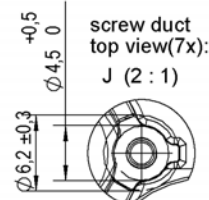
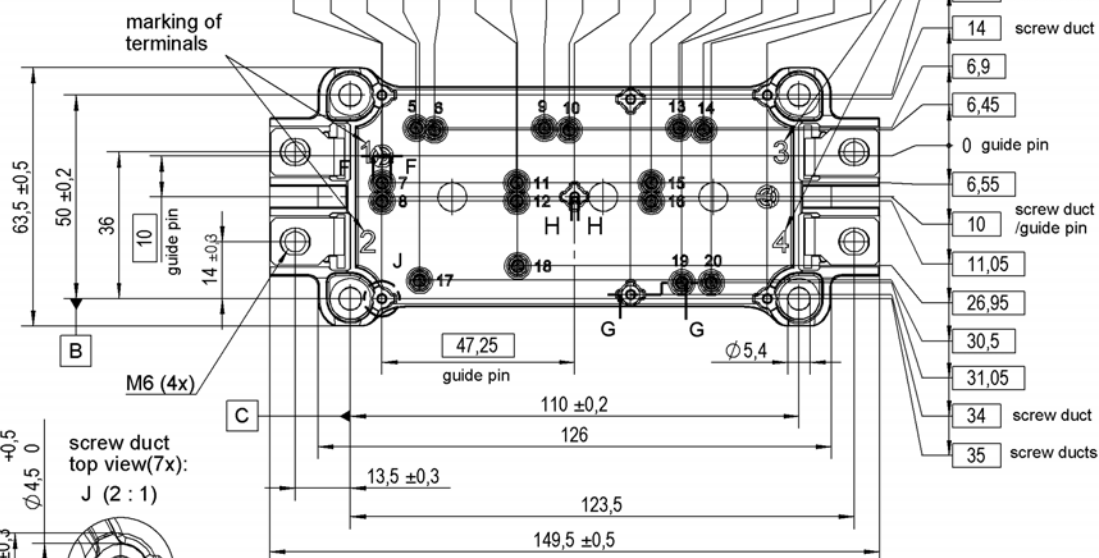
	0,3	connector 1-2 / 3-4
	0,2	each connector A

general tolerance:
ISO 2768-m
ISO 8015

screw duct (6x)
spring duct (16x):
G-G (1 : 1)



All measures in Z-direction
valid when mounted to heat sink



*guide pin left with

	Ø 0,25	A	B	C
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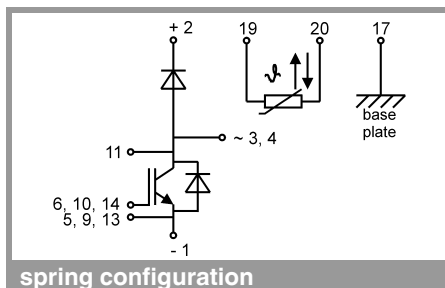
**screw ducts / spring ducts / guide pin right with

	Ø 0,5	A	B	D
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Rules for the contact PCB:

- holes guidepins = $\varnothing 4 \pm 0,1$ / position tolerance $\pm 0,1$
- holes for screws = $\varnothing 3,3 \pm 0,1$ / position tolerance $\pm 0,1$
- spring contact pad = $\varnothing 3,6 \pm 0,1$ / position tolerance $\pm 0,1$

SEMiX 3s



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

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.