SEMiX302GAR12T4s

SEMiX®2s

Trench IGBT Modules

SEMiX302GAR12T4s

Features

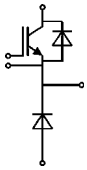
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognised file no. E63532

Typical Applications

- AC inverter drives
- UPS
- Electronic Welding

Remarks

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



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}			1200	V
I_C	T_j = 175 °C	T_c = 25 °C	463	A
		T_c = 80 °C	356	A
I_{Cnom}			300	A
I_{CRM}	I_{CRM} = 3xI_{Cnom}		900	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V $V_{GE} \leq$ 15 V T_j = 150 °C $V_{CES} \leq$ 1200 V		10	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	T_j = 175 °C	T_c = 25 °C	356	A
		T_c = 80 °C	266	A
I_{Fnom}			300	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		900	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C			A
T_j			-40 ... 175	°C
Freewheeling diode				
I_F	T_j = 175 °C	T_c = 25 °C	356	A
		T_c = 80 °C	266	A
I_{Fnom}			300	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		900	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C			A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			600	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50Hz, t = 1 min		4000	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	I_C = 300 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.8	2.05	V
		T_j = 150 °C		2.20	2.4	V
V_{CE0}		T_j = 25 °C		0.8	0.9	V
		T_j = 150 °C		0.7	0.8	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		3.3	3.8	mΩ
		T_j = 150 °C		5.0	5.3	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 12 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
		T_j = 150 °C				mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		18.6		nF
C_{oes}		f = 1 MHz		1.16		nF
C_{res}		f = 1 MHz		1.02		nF
Q_G	V_{GE} = - 8 V...+ 15 V			1700		nC
R_{Gint}	T_j = 25 °C			2.50		Ω

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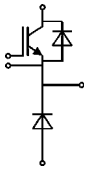

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	V_{CC} = 600 V			260		ns
t_r	I_C = 300 A			60		ns
E_{on}	T_j = 150 °C			30		mJ
$t_{d(off)}$	$R_{G\ on}$ = 1.9 Ω			490		ns
t_f	$R_{G\ off}$ = 1.9 Ω			90		ns
E_{off}	di/dt_{on} = 5000 A/µs di/dt_{off} = 2800 A/µs			33		mJ
$R_{th(j-c)}$	per IGBT				0.096	K/W
$R_{th(j-s)}$	per IGBT					K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 300 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.1	2.5	V
		T_j = 150 °C		2.1	2.4	V
V_{F0}		T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F		T_j = 25 °C	2.2	2.8	3.2	mΩ
		T_j = 150 °C	3.3	3.9	4.3	mΩ
I_{RRM}	I_F = 300 A di/dt_{off} = 4300 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		230		A
Q_{rr}		T_j = 150 °C		50		µC
E_{rr}		T_j = 150 °C		19		mJ
$R_{th(j-c)}$	per diode				0.17	K/W
$R_{th(j-s)}$	per diode					K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 300 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.1	2.5	V
		T_j = 150 °C		2.1	2.4	V
V_{F0}		T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F		T_j = 25 °C	2.2	2.8	3.2	mΩ
		T_j = 150 °C	3.3	3.9	4.3	mΩ
I_{RRM}	I_F = 300 A di/dt_{off} = 4300 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		230		A
Q_{rr}		T_j = 150 °C		50		µC
E_{rr}		T_j = 150 °C		19		mJ
$R_{th(j-c)}$	per diode				0.17	K/W
$R_{th(j-s)}$	per diode					K/W
Module						
L_{CE}				18		nH
$R_{CC'+EE'}$	res., terminal-chip	T_C = 25 °C		0.7		mΩ
		T_C = 125 °C		1		mΩ
$R_{th(c-s)}$	per module			0.045		K/W
M_s	to heat sink (M5)		3		5	Nm
M_t		to terminals (M6)	2.5		5	Nm
						Nm
w					250	g
Temperature sensor						
R_{100}	T_c=100°C (R_{25}=5 kΩ)			0,493 ±5%		kΩ
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; T[K];			3550 ±2%		K

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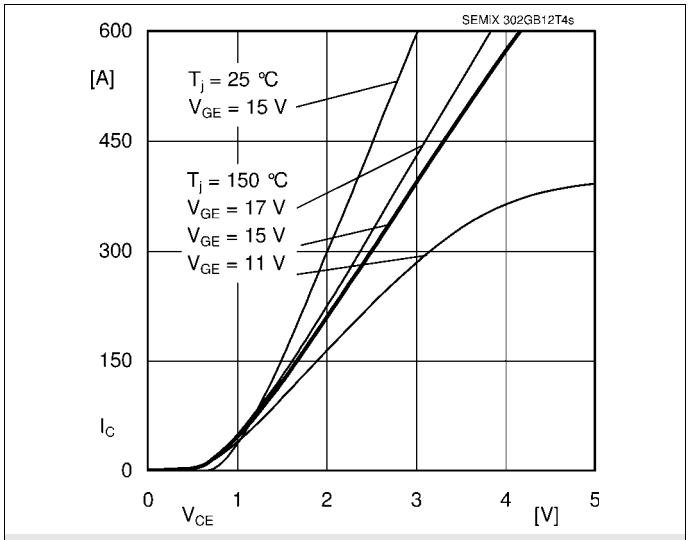

Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

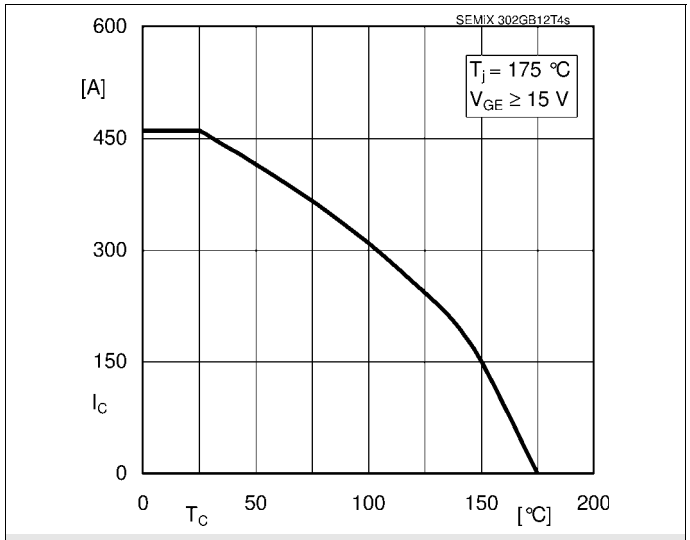

Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

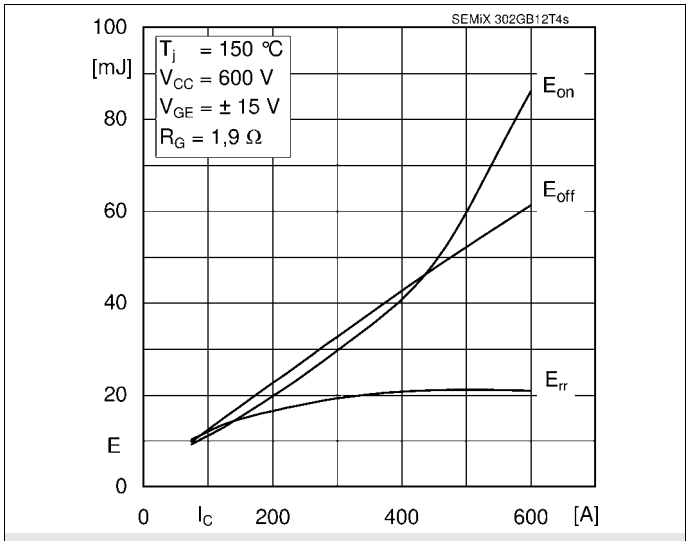

Fig. 3 Typ. turn-on /-off energy = f (I_C)

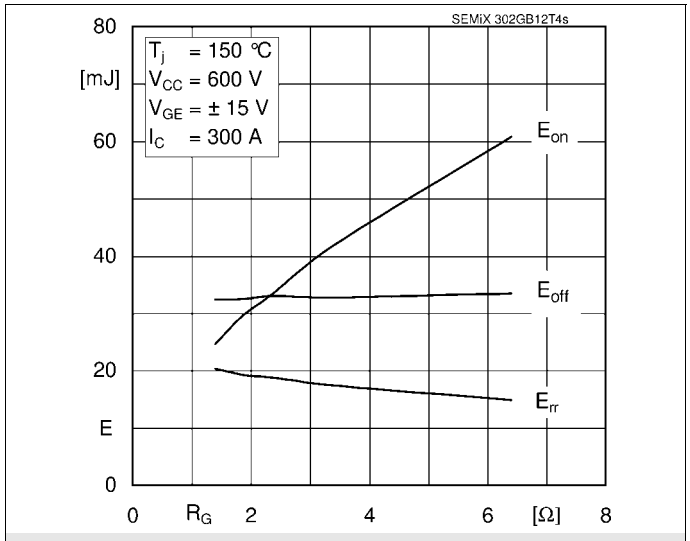

Fig. 4 Typ. turn-on /-off energy = f (R_G)

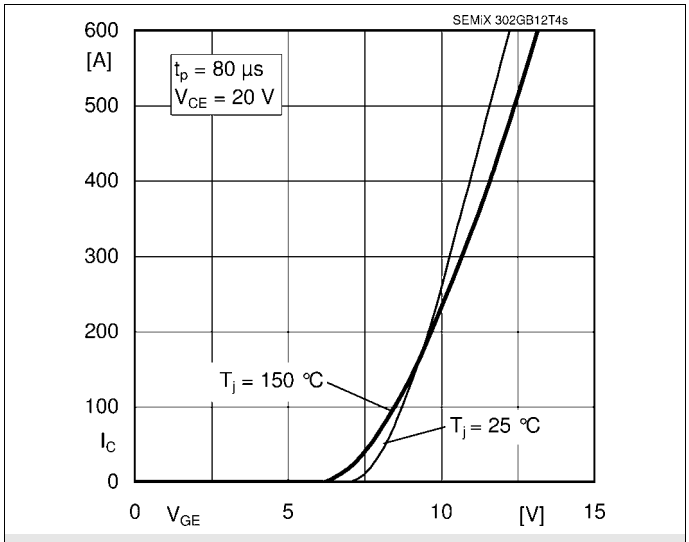

Fig. 5 Typ. transfer characteristic

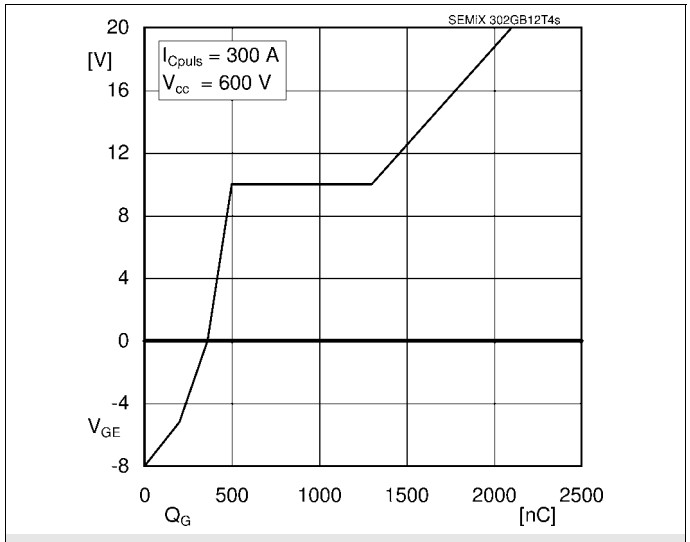

Fig. 6 Typ. gate charge characteristic

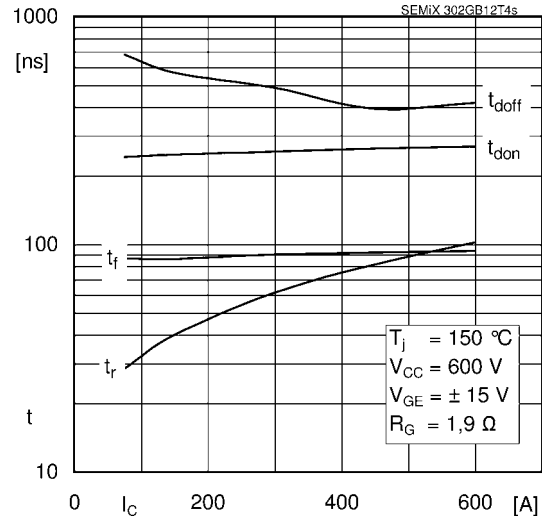

Fig. 7 Typ. switching times vs. I_C

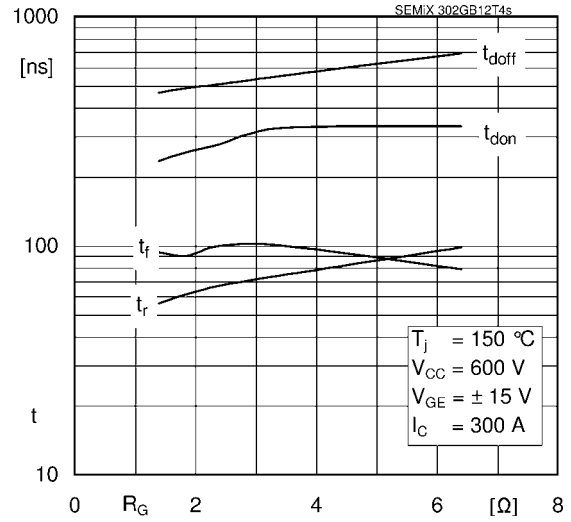

Fig. 8 Typ. switching times vs. gate resistor R_G

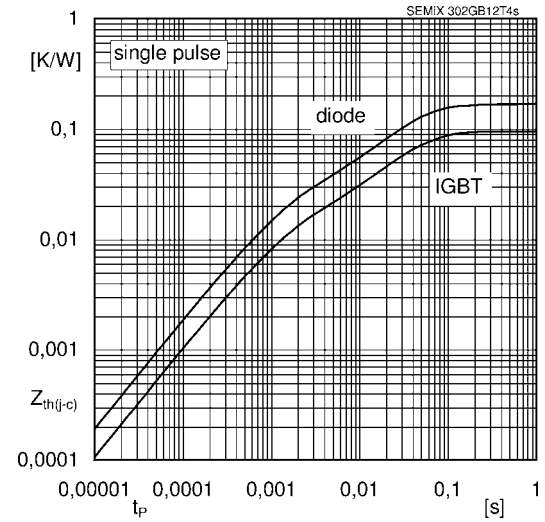

Fig. 9 Typ. transient thermal impedance

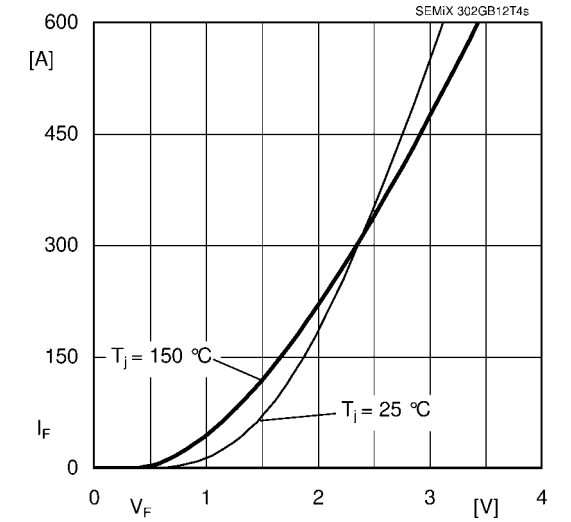

Fig. 10 Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

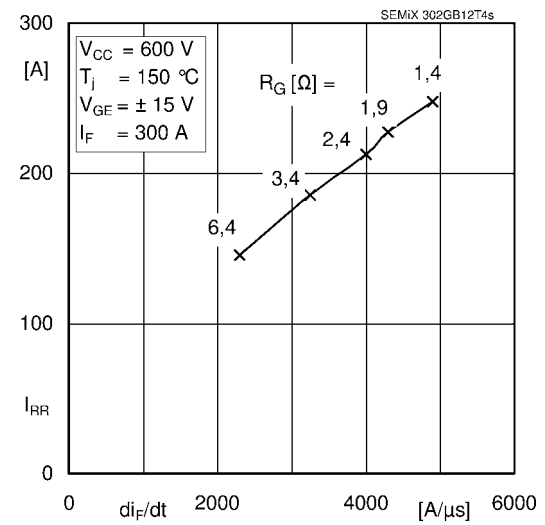

Fig. 11 Typ. CAL diode peak reverse recovery current

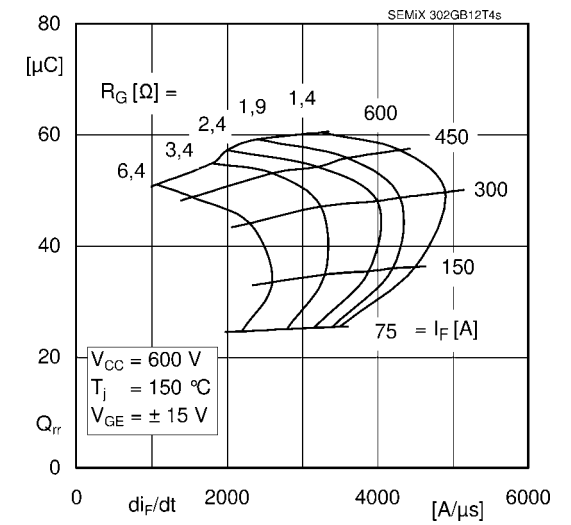

Fig. 12 Typ. CAL diode recovery charge

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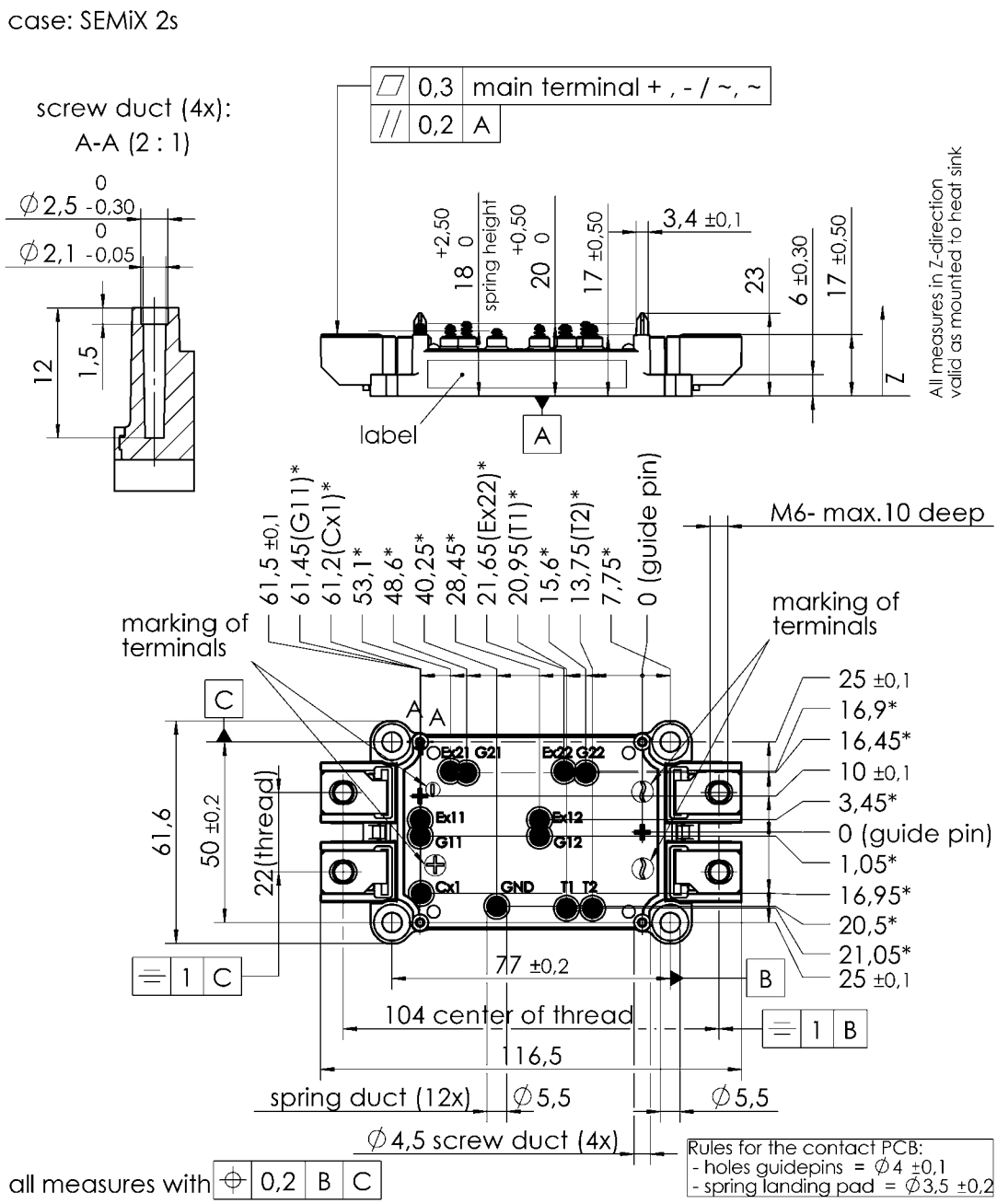

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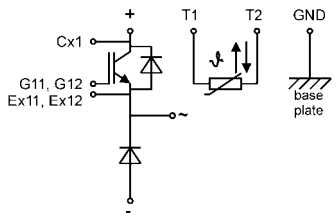

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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, Chapter IX

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