SEMiX® 3p

Trench IGBT Modules

SEMiX223GB12E4p

Features

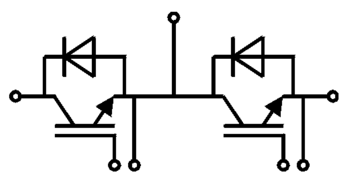
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Renewable energy systems

Remarks

- Product reliability results are valid for T_j=150°C
- V_{isol} between temperature sensor and power section is only 2500V
- For storage and case temperature with TIM see document “TP(*) SEMiX 3p”



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Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	326	A
		T_c = 80 °C	251	A
I_{Cnom}			225	A
I_{CRM}	I_{CRM} = 3xI_{Cnom}		675	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				
V_{RRM}	T_j = 25 °C		1200	V
I_F	T_j = 175 °C	T_c = 25 °C	287	A
		T_c = 80 °C	215	A
I_{Fnom}			225	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		675	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		1161	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			600	A
T_{stg}	module without TIM		-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 = 225 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		0.8	0.9	V
		T_j = 150 °C		0.7	0.8	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		4.7	5.3	mΩ
		T_j = 150 °C		6.9	7.3	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 9 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				3.0	mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		13.2		nF
C_{oes}		f = 1 MHz		0.87		nF
C_{res}		f = 1 MHz		0.71		nF
Q_G	V_{GE} = - 8 V...+ 15 V			1275		nC
R_{Gint}	T_j = 25 °C			3.3		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 225 A V_{GE} = +15/-15 V $R_{G\,on}$ = 1 Ω $R_{G\,off}$ = 1 Ω di/dt$_{on}$ = 6700 A/µs di/dt$_{off}$ = 2100 A/µs du/dt = 4000 V/µs L_s = 21 nH	T_j = 150 °C		135		ns
t_r		T_j = 150 °C		38		ns
E_{on}		T_j = 150 °C		14.1		mJ
$t_{d(off)}$		T_j = 150 °C		400		ns
t_f		T_j = 150 °C		92		ns
E_{off}		T_j = 150 °C		26.4		mJ
$R_{th(j-c)}$	per IGBT				0.14	K/W
$R_{th(c-s)}$	per IGBT (λ_{grease}=0.81 W/(m*K))			0.03		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material			0.021		K/W

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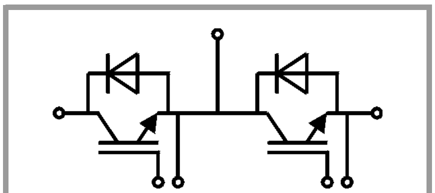

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse diode						
$V_F = V_{EC}$	I_F = 225 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.17	2.49	V
		T_j = 150 °C		2.11	2.42	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		3.9	4.4	mΩ
		T_j = 150 °C		5.4	5.9	mΩ
I_{RRM}	I_F = 225 A di/dt$_{off}$ = 6700 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		300		A
Q_{rr}		T_j = 150 °C		38		µC
E_{rr}		T_j = 150 °C		17		mJ
$R_{th(j-c)}$	per diode				0.2	K/W
$R_{th(c-s)}$	per diode (λ_{grease}=0.81 W/(m*K))			0.045		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.036		K/W
Module						
L_{CE}				20		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		1.2		mΩ
		T_C = 125 °C		1.65		mΩ
$Rth_{(c-s)1}$	calculated without thermal coupling			0.009		K/W
$Rth_{(c-s)2}$	including thermal coupling, Ts underneath module (λ_{grease}=0.81 W/(m*K))			0.013		K/W
$Rth_{(c-s)2}$	including thermal coupling, Ts underneath module, pre-applied phase change material			0.01		K/W
M_s	to heat sink (M5)		3		6	Nm
M_t		to terminals (M6)	3		6	Nm
						Nm
w					350	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

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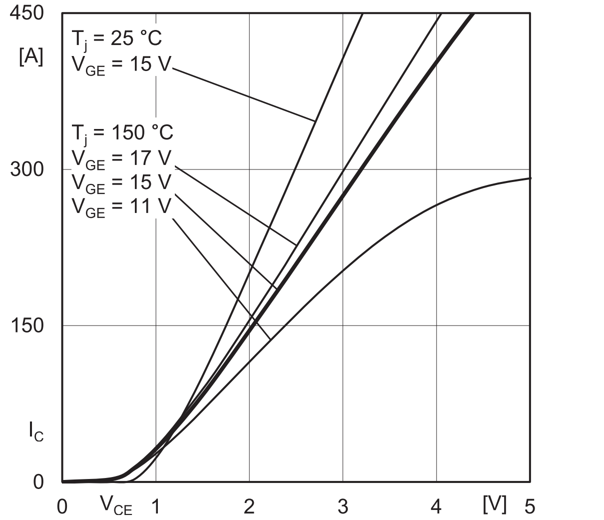

Fig. 1: Typ. output characteristic, inclusive $R_{CC'+ EE'}$

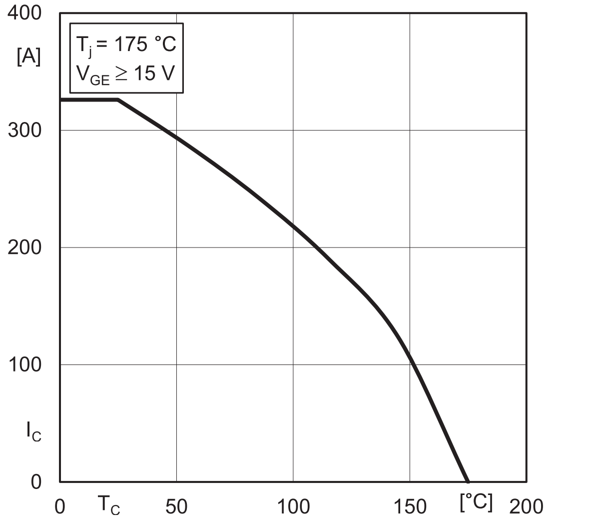

Fig. 2: Rated current vs. temperature $I_C = f (T_C)$

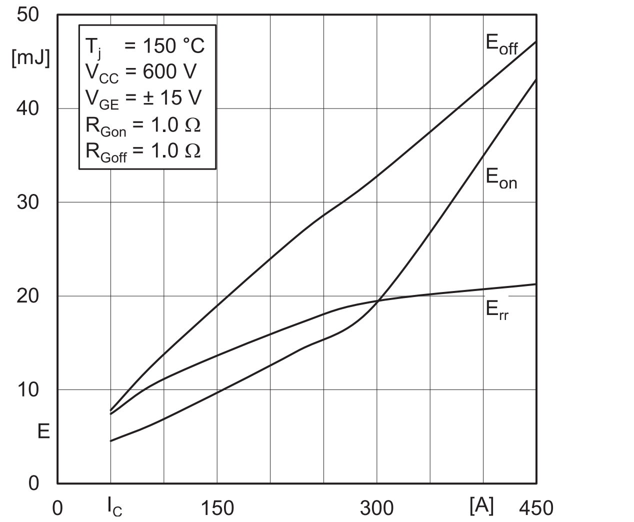

Fig. 3: Typ. turn-on /-off energy = f (I_C)

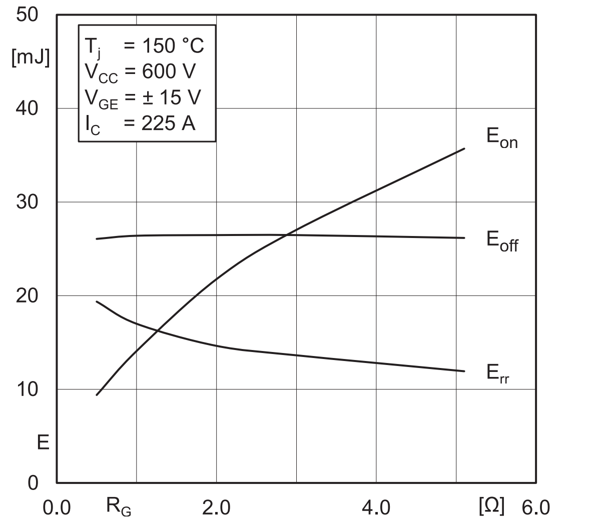

Fig. 4: Typ. turn-on /-off energy = f (R_G)

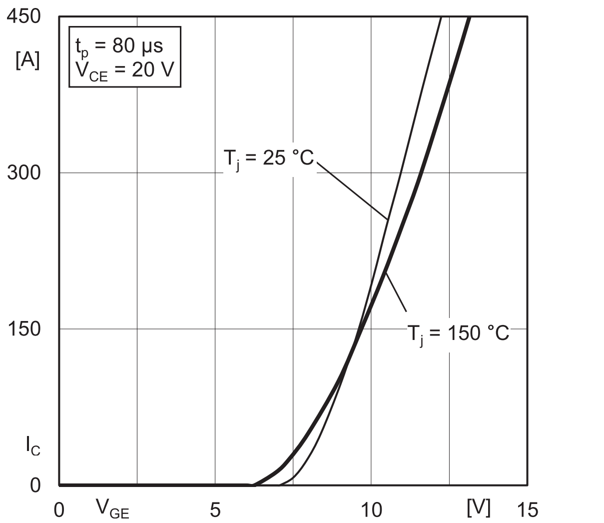

Fig. 5: Typ. transfer characteristic

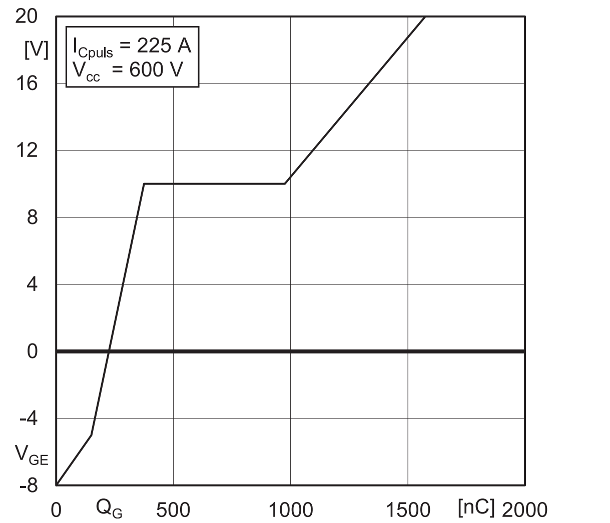

Fig. 6: Typ. gate charge characteristic

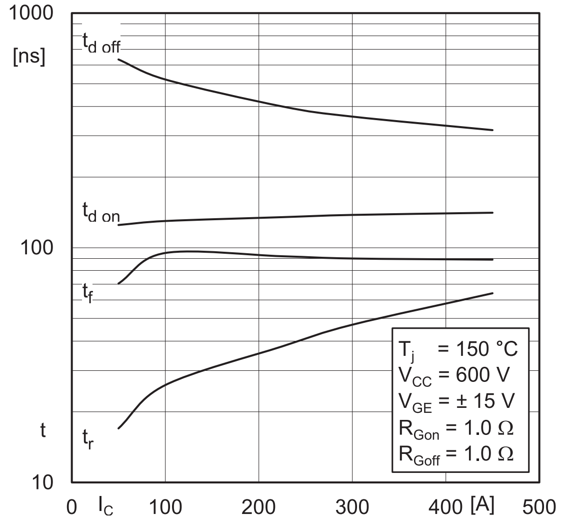

Fig. 7: Typ. switching times vs. I_C

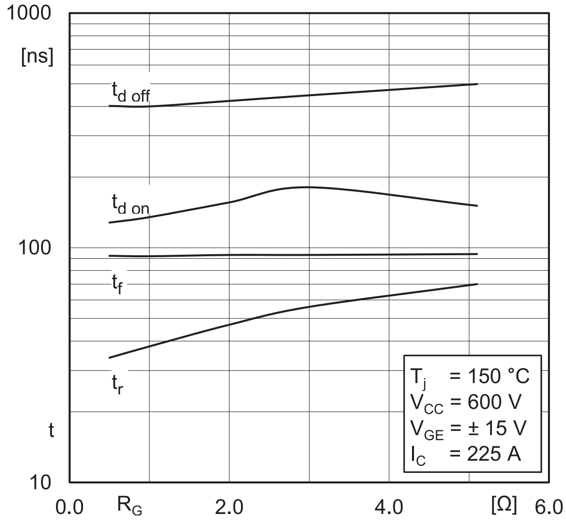

Fig. 8: Typ. switching times vs. gate resistor R_G

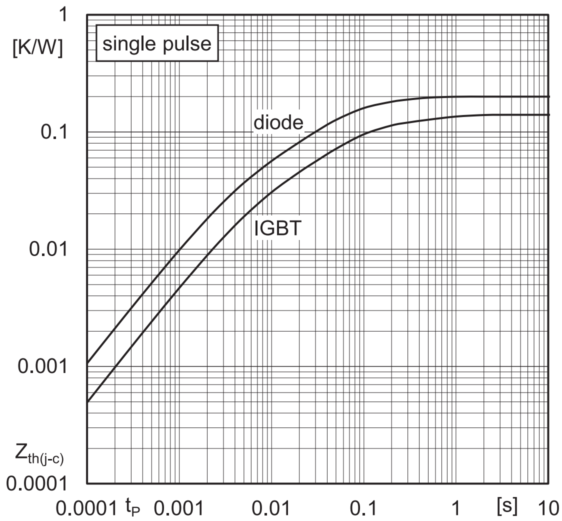

Fig. 9: Transient thermal impedance

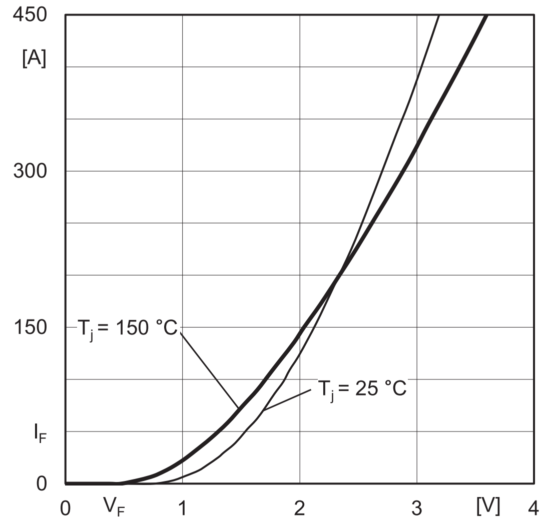

Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

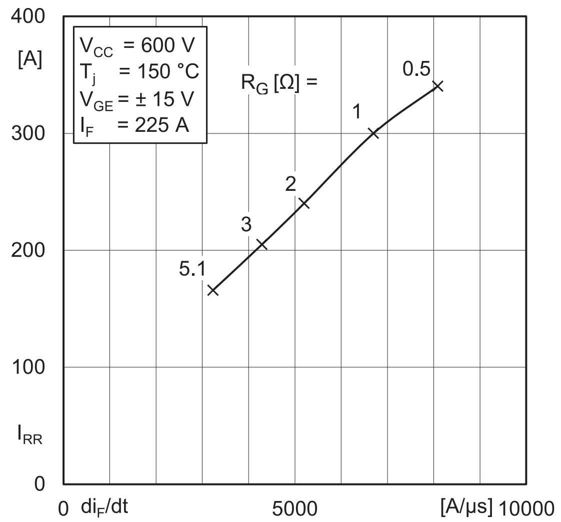

Fig. 11: Typ. CAL diode peak reverse recovery current

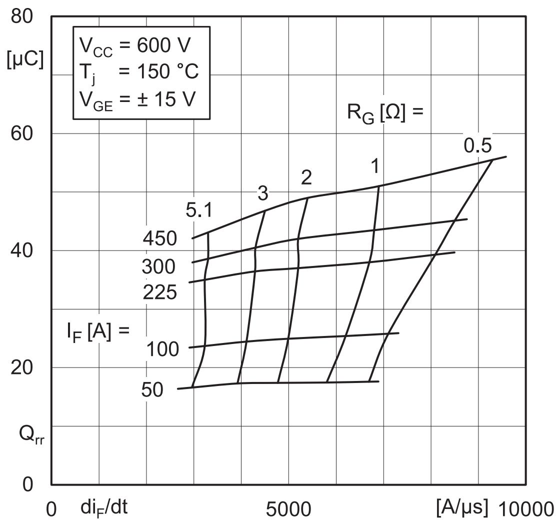

Fig. 12: Typ. CAL diode recovery charge

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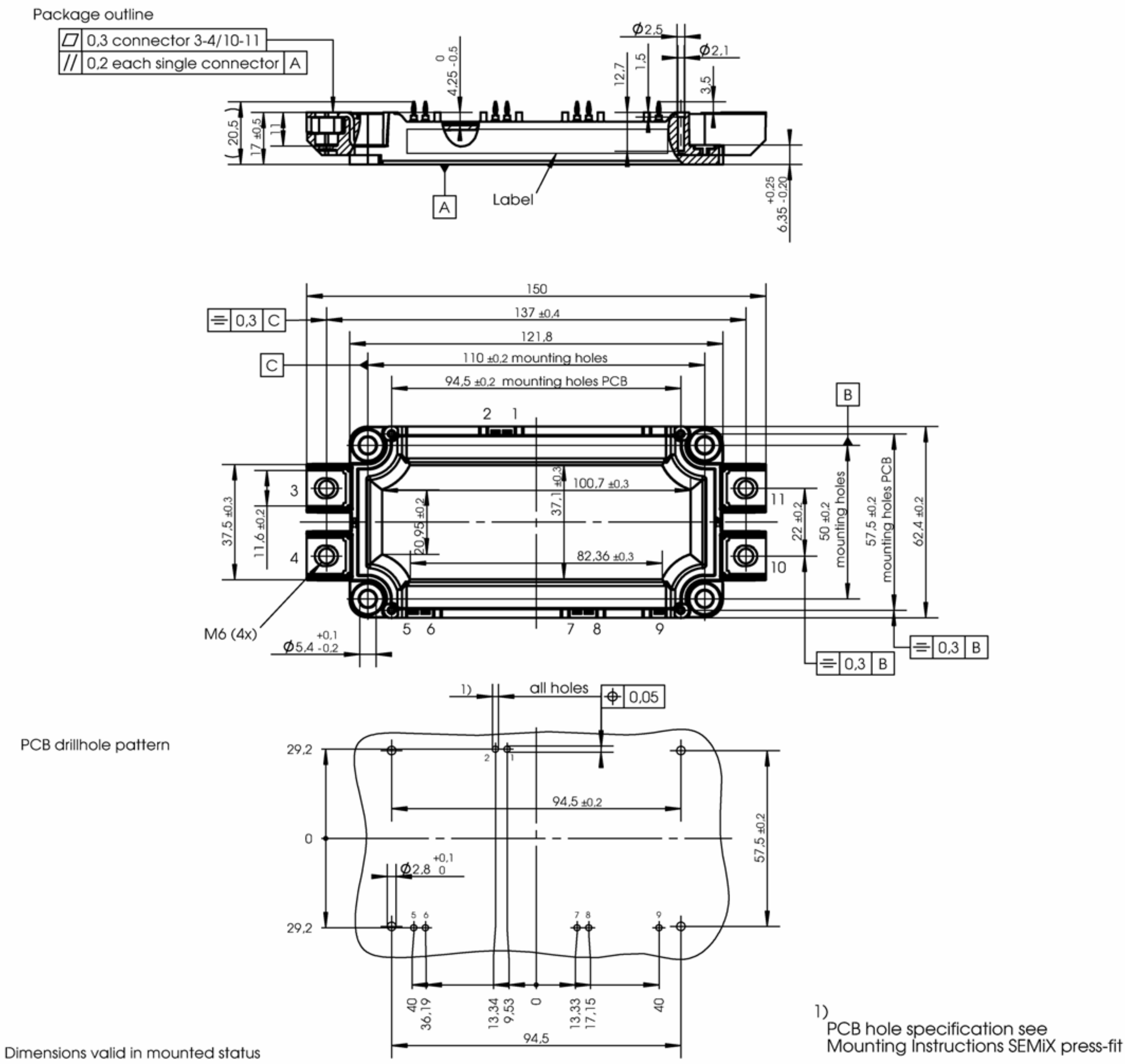

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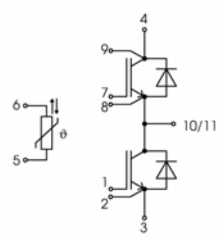

pinout

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

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