

SEMiX453GB17E4I50p



SEMiX® 3p shunt

Trench IGBT Modules

SEMiX453GB17E4I50p

Features*

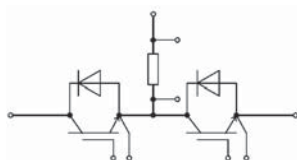
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- Current sensing shunt resistor
- UL recognized, file no. E63532

Typical Applications

- AC inverter drives
- UPS
- Renewable energy systems

Remarks

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



GB + shunt

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$	1700	V	
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	731	A
		$T_c = 80^\circ\text{C}$	555	A
I_{Cnom}		450	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$	1350	A	
V_{GES}		-20 ... 20	V	
t_{psc}	$V_{CC} = 1000\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1700\text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
T_j		-40 ... 175	$^\circ\text{C}$	
Inverse diode				
V_{RRM}	$T_j = 25^\circ\text{C}$	1700	V	
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	557	A
		$T_c = 80^\circ\text{C}$	412	A
I_{Fnom}		450	A	
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$	900	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	2565	A	
T_j		-40 ... 175	$^\circ\text{C}$	
Module				
$I_{t(RMS)}$	$T_c = 80^\circ\text{C}$	600	A	
T_{stg}	module without TIM	-40 ... 125	$^\circ\text{C}$	
V_{isol}	AC sinus 50Hz, $t = 1\text{ min}$	4000	V	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.90	2.20	V
		$T_j = 150^\circ\text{C}$	2.26	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	$T_j = 25^\circ\text{C}$	1.78	2.2	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	2.8	3.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 18\text{ mA}$	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
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	36.0		nF
C_{oes}		$f = 1\text{ MHz}$	1.50		nF
C_{res}		$f = 1\text{ MHz}$	1.14		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		3600		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.7		Ω
$t_{d(on)}$	$V_{CC} = 900\text{ V}$ $I_C = 450\text{ A}$	$T_j = 150^\circ\text{C}$	270		ns
t_r	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	90		ns
E_{on}	$R_{Gon} = 2.7\ \Omega$	$T_j = 150^\circ\text{C}$	153		mJ
$t_{d(off)}$	$R_{Goff} = 2.7\ \Omega$	$T_j = 150^\circ\text{C}$	815		ns
t_f	$di/dt_{on} = 4300\text{ A}/\mu\text{s}$ $di/dt_{off} = 2200\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	200		ns
E_{off}	$dv/dt = 3200\text{ V}/\mu\text{s}$ $L_s = 21\text{ nH}$	$T_j = 150^\circ\text{C}$	150		mJ
$R_{th(j-c)}$	per IGBT			0.06	K/W
$R_{th(c-s)}$	per IGBT ($\lambda_{grease} = 0.81\text{ W}/(\text{m}^2\text{K})$)		0.029		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material		0.02		K/W

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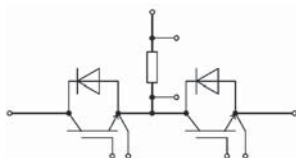
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Inverse diode					
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.98	2.37	V
		$T_j = 150^\circ\text{C}$	2.11	2.52	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$	1.32	1.56	V
		$T_j = 150^\circ\text{C}$	1.08	1.22	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$	1.46	1.80	mΩ
		$T_j = 150^\circ\text{C}$	2.3	2.9	mΩ
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 150^\circ\text{C}$	350		A
Q_{rr}	$di/dt_{off} = 4850\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$	130		μC
E_{rr}	$V_{CC} = 900\text{ V}$	$T_j = 150^\circ\text{C}$	73		mJ
$R_{th(j-c)}$	per diode			0.1	K/W
$R_{th(c-s)}$	per diode ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.048		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material		0.038		K/W
Module					
L_{CE}			20		nH
R_{CC+EE}	measured per switch, shunt excluded	$T_C = 25^\circ\text{C}$	0.95		mΩ
		$T_C = 125^\circ\text{C}$	1.25		mΩ
$R_{th(c-s)1}$	calculated without thermal coupling		0.009		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module ($\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$)		0.014		K/W
$R_{th(c-s)2}$	including thermal coupling, T_s underneath module, pre-applied phase change material		0.010		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}	$T_c=100^\circ\text{C}$ ($R_{25}=5\text{ k}\Omega$)		$493 \pm 5\%$		Ω
$B_{100/125}$	$R(T)=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; $T[K]$;		$3550 \pm 2\%$		K

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Shunt					
R_{Shunt}	Tolerance = $\pm 1\%$, $T_c = 20^\circ\text{C}$		0.50		mΩ
α				50	ppm/K
T_{Shunt}				170	°C
$R_{th(r-c)}$				3	K/W
P_{Shunt}	$T_c = 80^\circ\text{C}$			30	W



GB + shunt

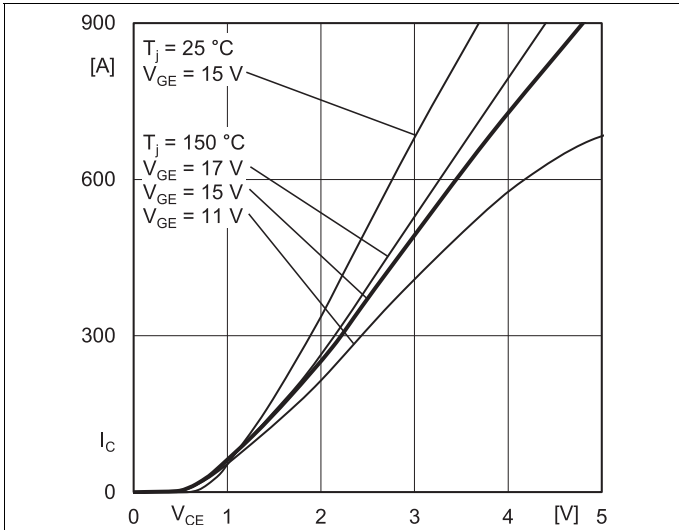


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

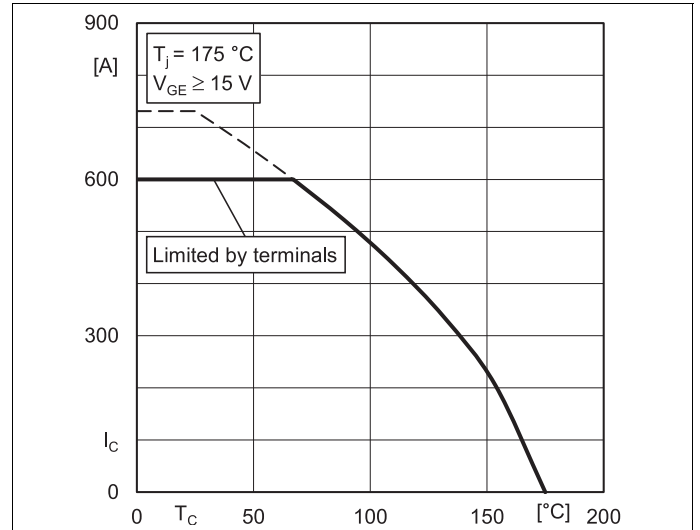


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

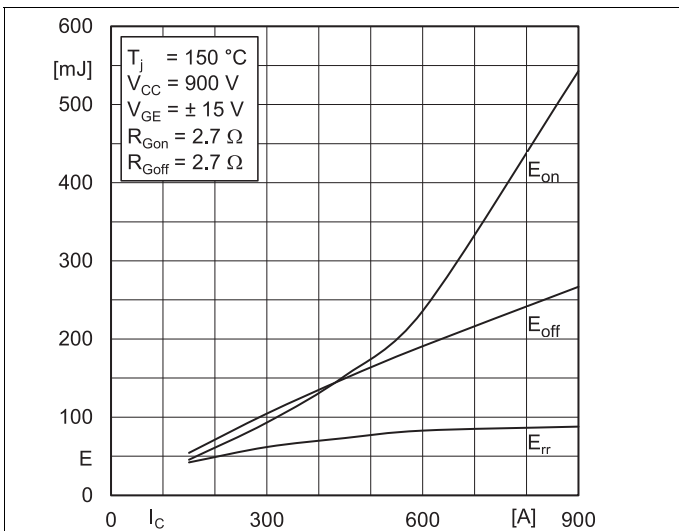


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

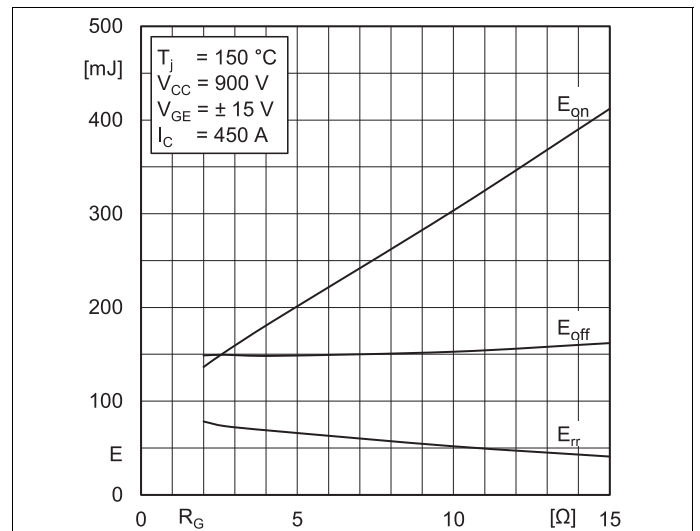


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

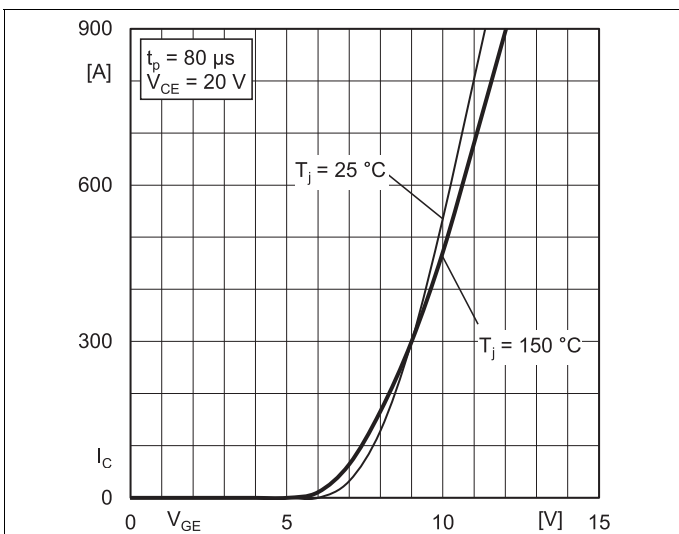


Fig. 5: Typ. transfer characteristic

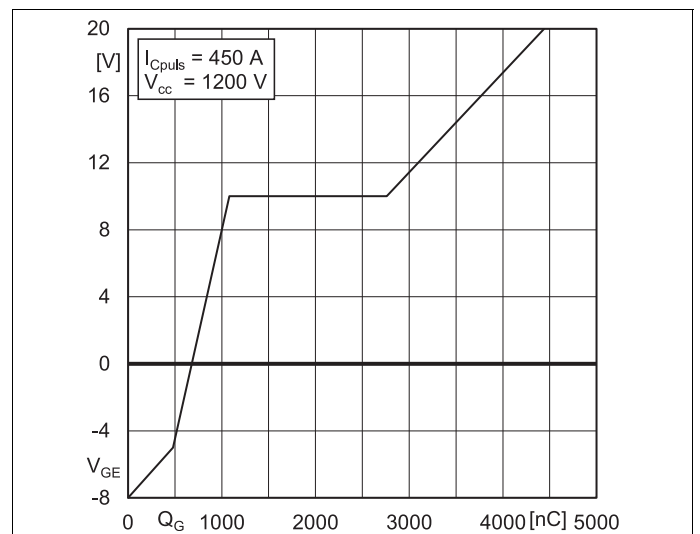


Fig. 6: Typ. gate charge characteristic

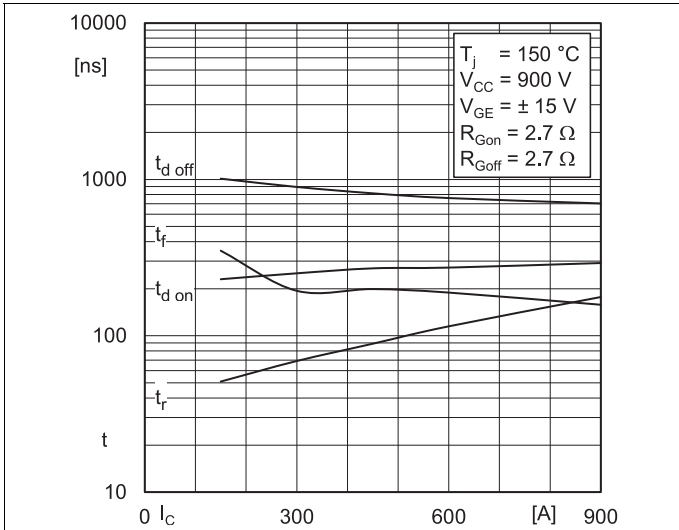


Fig. 7: Typ. switching times vs. I_C

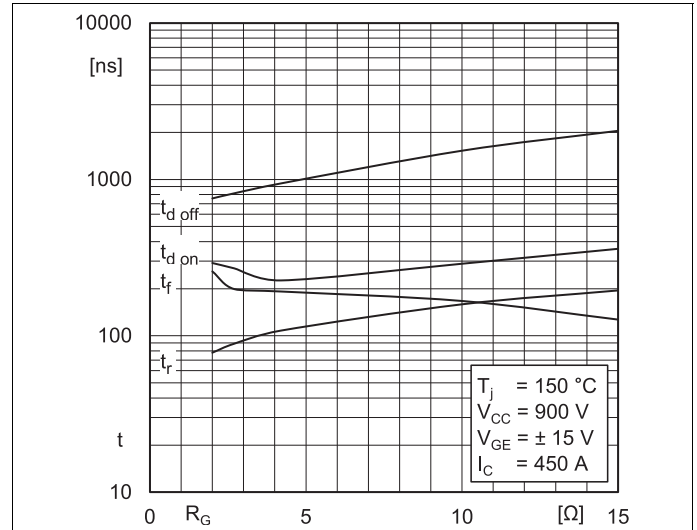


Fig. 8: Typ. switching times vs. gate resistor R_G

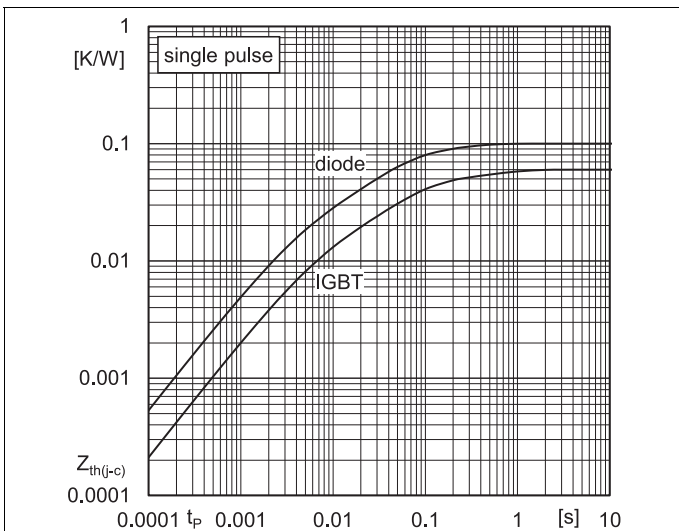


Fig. 9: Transient thermal impedance

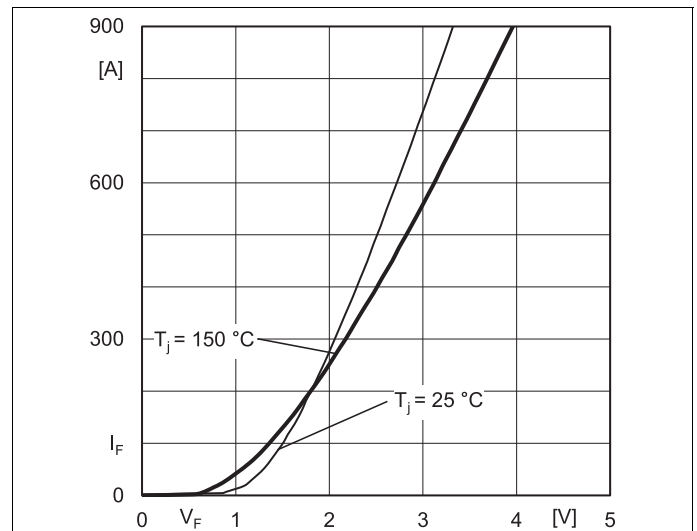


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

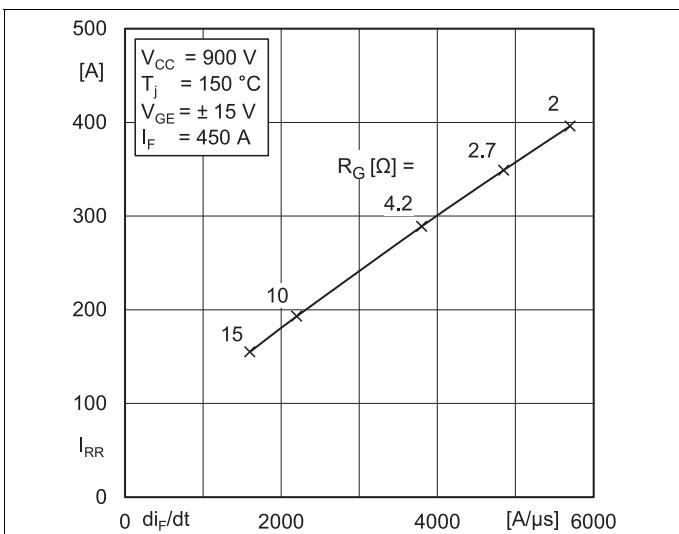


Fig. 11: Typ. CAL diode peak reverse recovery current

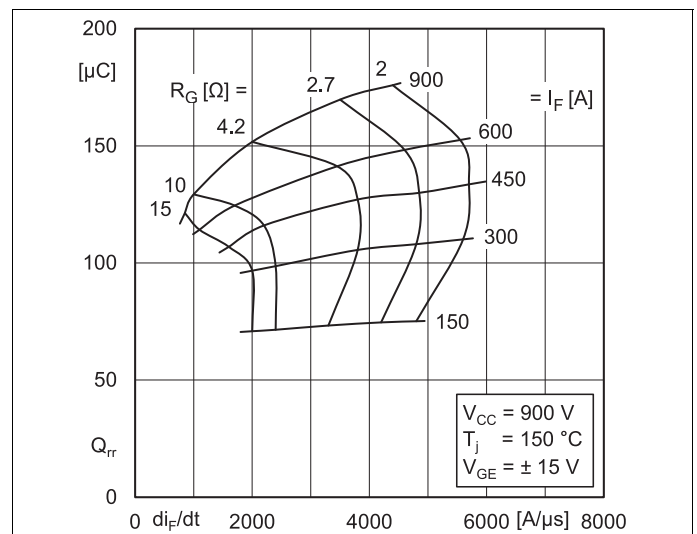


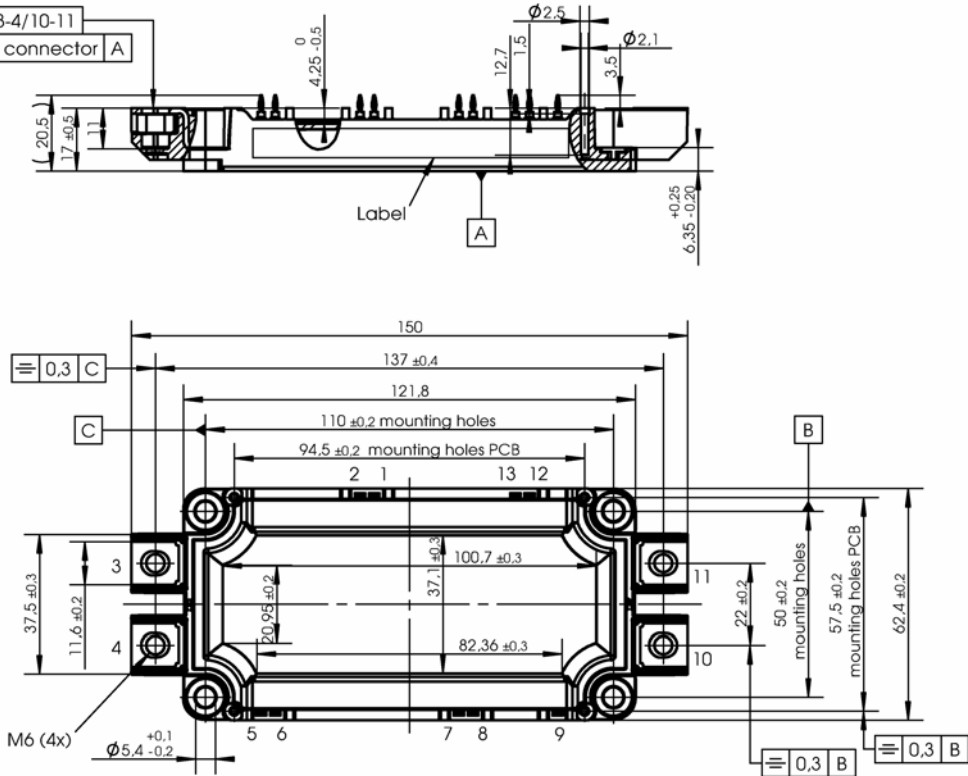


Fig. 12: Typ. CAL diode recovery charge

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Package outline

-  0.3 connector 3-4/10-11
-  0.2 each single connector A

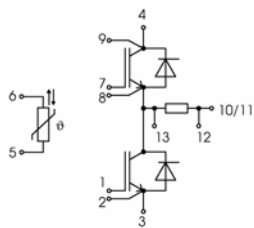


PCB drillhole pattern

Dimensions valid in mounted status

1) PCB hole specification see Mounting Instructions SEMiX press-fit

SEMiX 3p shunt



pinout

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

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