



SEMiX® 3p

Trench IGBT Modules

SEMiX603GAL17E4pV1

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

Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1700	V
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	835
		$T_c = 80^\circ\text{C}$	638
I_{Cnom}		600	A
I_{CRM}		1800	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
T_j		-40 ... 175	$^\circ\text{C}$

Inverse diode

V_{RRM}	$T_j = 25^\circ\text{C}$	1700	V
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	249
		$T_c = 80^\circ\text{C}$	184
I_{FRM}		400	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	1300	A
T_j		-40 ... 175	$^\circ\text{C}$

Freewheeling diode

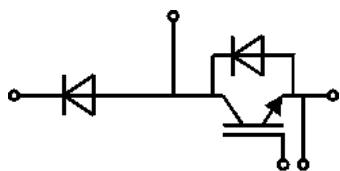
V_{RRM}	$T_j = 25^\circ\text{C}$	1700	V
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	703
		$T_c = 80^\circ\text{C}$	517
I_{FRM}		1200	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	3510	A
T_j		-40 ... 175	$^\circ\text{C}$

Module

$I_{t(RMS)}$		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					
$V_{CE(sat)}$	$I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.95	2.30	V
		$T_j = 150^\circ\text{C}$	2.48	2.80	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	1.02	1.20	V
		$T_j = 150^\circ\text{C}$	0.92	1.03	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.55	1.83	m Ω
		$T_j = 150^\circ\text{C}$	2.6	3.0	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 24\text{ mA}$	5.2	5.8	6.2	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1700\text{ V}, T_j = 25^\circ\text{C}$			5	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	46.5		nF
C_{oes}		$f = 1\text{ MHz}$	1.98		nF
C_{res}		$f = 1\text{ MHz}$	1.65		nF
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$		4800		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		1.1		Ω



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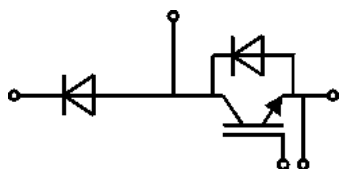
Typical Applications

- AC inverter drives
- UPS
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Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
t _{d(on)}	V _{CC} = 900 V	T _j = 150 °C		245		ns
t _r	I _C = 600 A	T _j = 150 °C		85		ns
E _{on}	V _{GE} = +15/-15 V	T _j = 150 °C		132		mJ
t _{d(off)}	R _{G on} = 2.4 Ω	T _j = 150 °C		710		ns
t _f	R _{G off} = 1 Ω	T _j = 150 °C		170		ns
E _{off}	di/dt _{on} = 7900 A/μs dv/dt = 3500 V/μs L _s = 25 nH	T _j = 150 °C		213		mJ
R _{th(j-c)}	per IGBT				0.049	K/W
R _{th(c-s)}	per IGBT (λ _{grease} =0.81 W/(m*K))			0.033		K/W
R _{th(c-s)}	per IGBT, pre-applied phase change material			0.023		K/W
Inverse diode						
V _F = V _{EC}	I _F = 200 A	T _j = 25 °C		1.88	2.23	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		1.96	2.32	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		2.8	3.4	mΩ
		T _j = 150 °C		4.4	5.5	mΩ
I _{RRM}	I _F = 200 A	T _j = 150 °C		325		A
Q _{rr}	di/dt _{off} = 4700 A/μs	T _j = 150 °C		70		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 900 V	T _j = 150 °C		53		mJ
R _{th(j-c)}	per diode				0.24	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.050		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.040		K/W
Freewheeling diode						
V _F = V _{EC}	I _F = 600 A	T _j = 25 °C		1.88	2.23	V
	V _{GE} = 0 V chiplevel	T _j = 150 °C		1.95	2.32	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		0.93	1.12	mΩ
		T _j = 150 °C		1.45	1.83	mΩ
I _{RRM}	I _F = 600 A	T _j = 150 °C		700		A
Q _{rr}	di/dt _{off} = 8000 A/μs	T _j = 150 °C		190		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 900 V	T _j = 150 °C		125		mJ
R _{th(j-c)}	per diode				0.088	K/W
R _{th(c-s)}	per diode (λ _{grease} =0.81 W/(m*K))			0.038		K/W
R _{th(c-s)}	per diode, pre-applied phase change material			0.030		K/W



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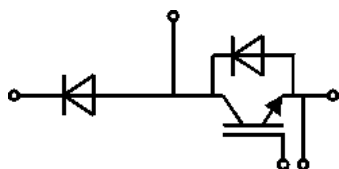
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Module						
L _{CE}				20		nH
R _{CC'+EE'}	measured per switch	T _C = 25 °C		0.95		mΩ
		T _C = 125 °C		1.25		mΩ
R _{th(c-s)1}	calculated without thermal coupling			0.01		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module (λ _{grease} =0.81 W/(m*K))			0.016		K/W
R _{th(c-s)2}	including thermal coupling, T _s underneath module, pre-applied phase change material			0.023		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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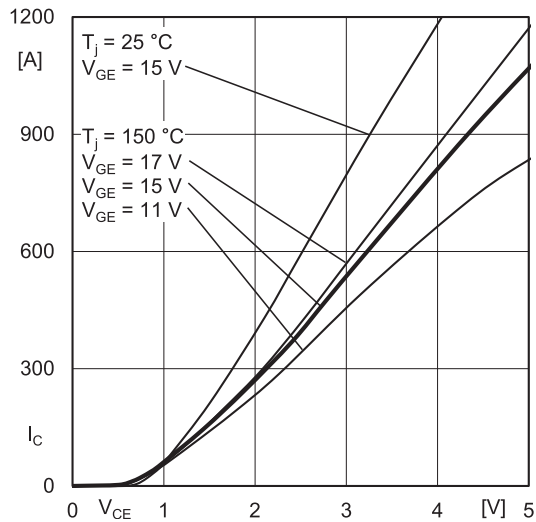


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

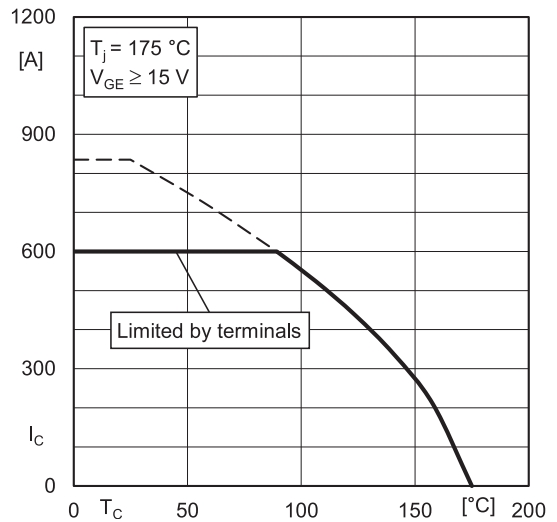


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

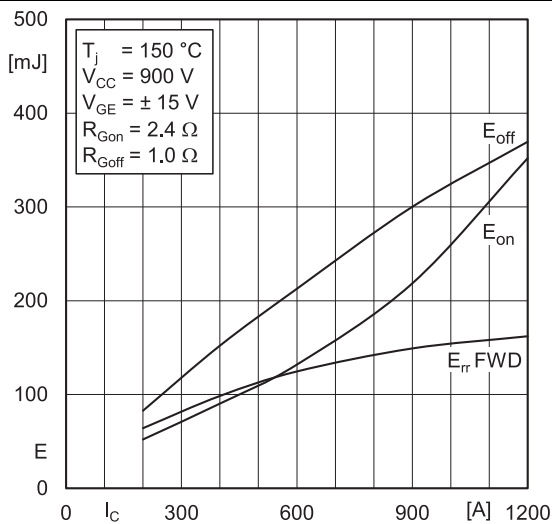


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

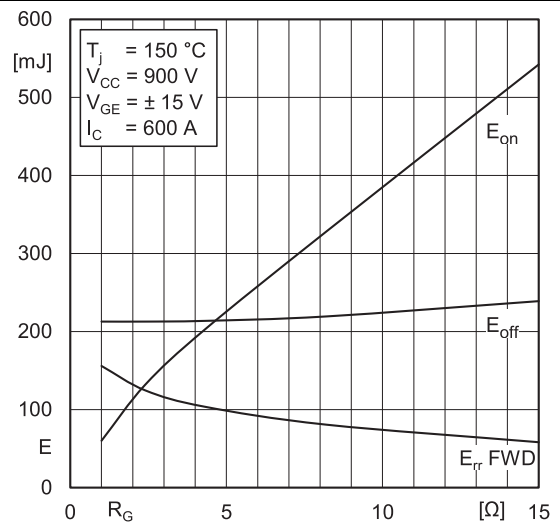


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

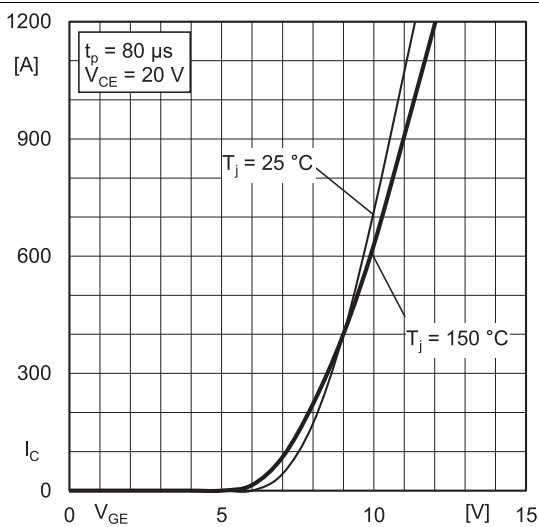


Fig. 5: Typ. transfer characteristic

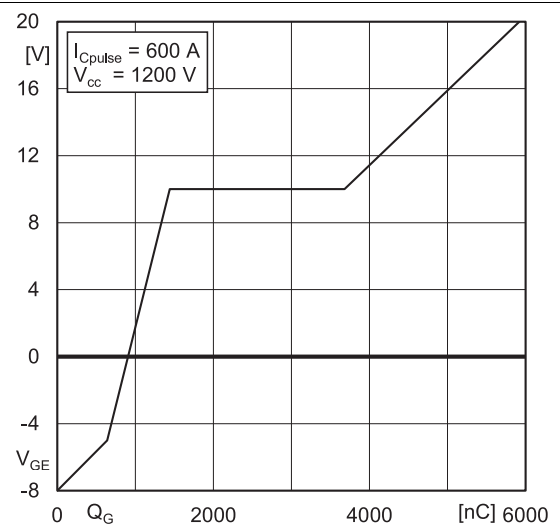


Fig. 6: Typ. gate charge characteristic

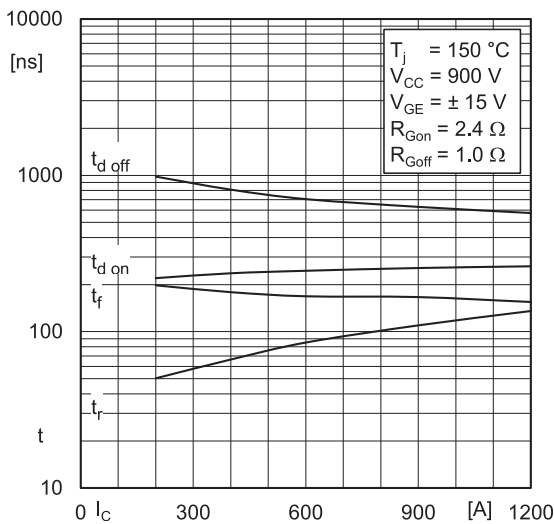
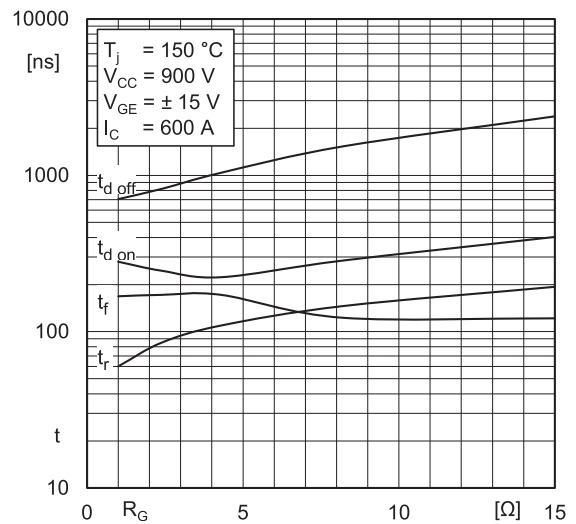
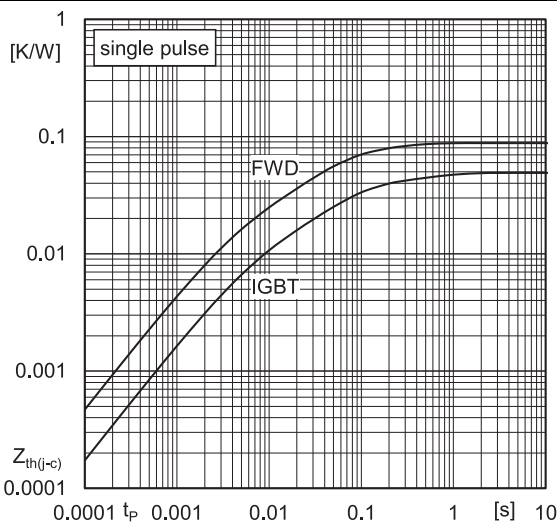
Fig. 7: Typ. switching times vs. I_C Fig. 8: Typ. switching times vs. gate resistor R_G 

Fig. 9: Transient thermal impedance

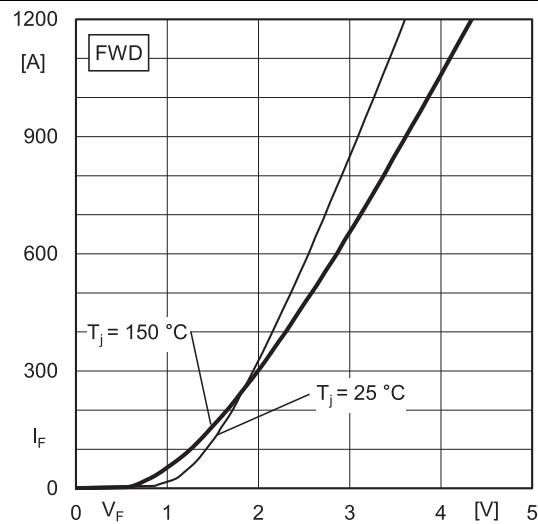
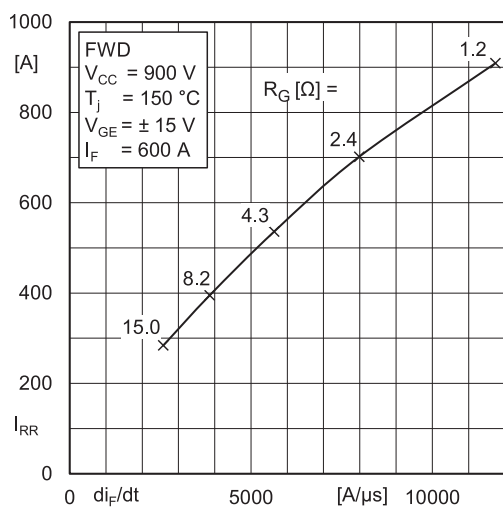
Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'}+EE'$ 

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

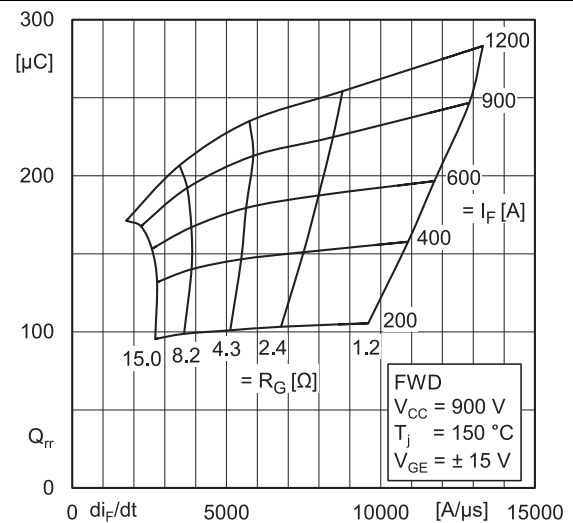
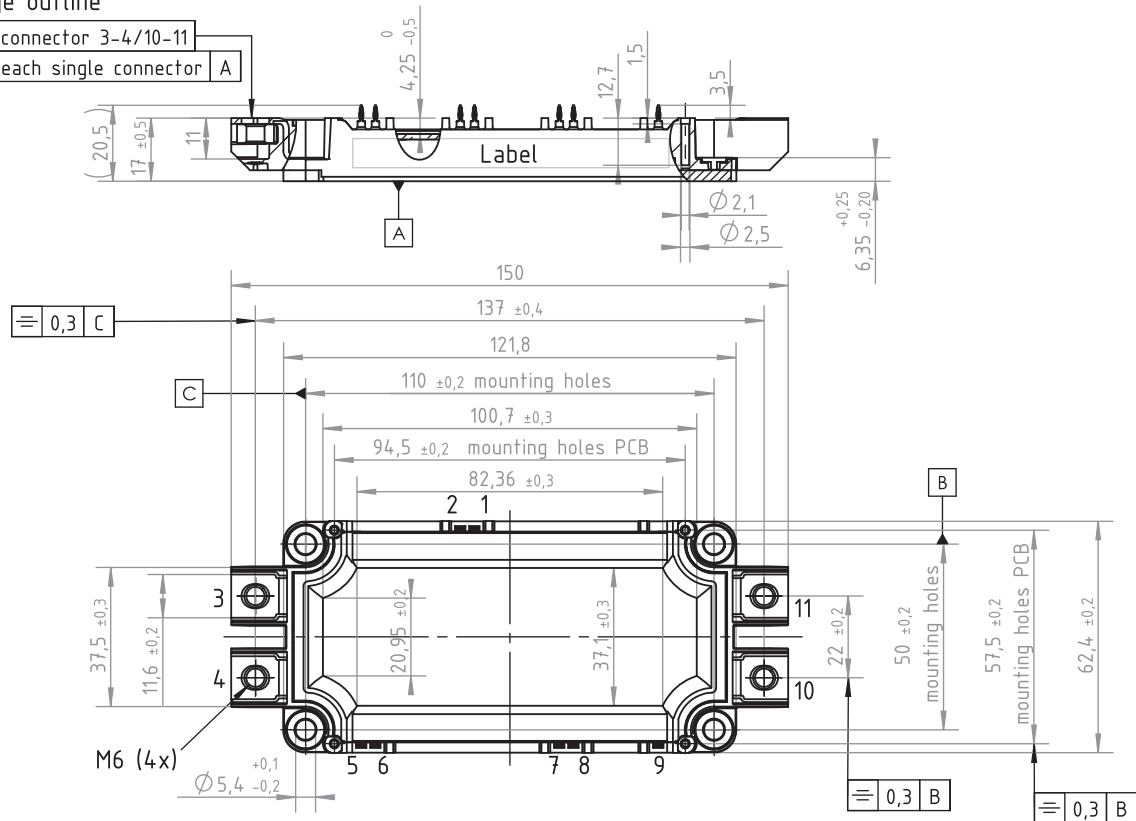


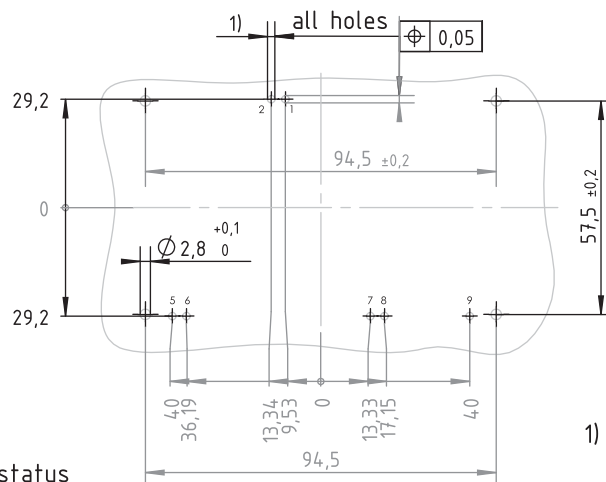
Fig. 12: Typ. CAL diode recovery charge

Package outline

	0,3 connector 3-4/10-11
	0,2 each single connector A



PCB drillhole pattern

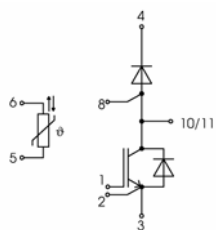


Dimensions in mm

Dimensions valid in mounted status

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

SEMiX 3p



pinout

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This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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