

# SEMiX453GB17E4Ip



SEMiX® 3p shunt

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### Features

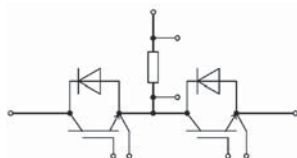
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- Current sensing shunt resistor
- UL recognized, file no. E63532

### 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	
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	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	$\mu\text{s}$
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$V_{RRM}$	$T_j = 25^\circ\text{C}$	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	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		210	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
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ 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		$\Omega$
$t_{d(on)}$	$V_{CC} = 900\text{ V}$ $I_C = 450\text{ A}$	$T_j = 150^\circ\text{C}$	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
$E_{off}$	$du/dt = 3200\text{ V}/\mu\text{s}$ $L_s = 21\text{ nH}$	$T_j = 150^\circ\text{C}$	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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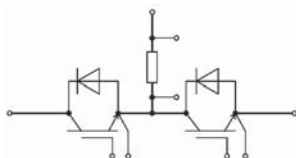
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$		1.98	2.37	V
		$T_j = 150^\circ\text{C}$		2.11	2.52	V
$V_{F0}$	chiplevel	$T_j = 25^\circ\text{C}$		1.32	1.56	V
		$T_j = 150^\circ\text{C}$		1.08	1.22	V
$r_F$	chiplevel	$T_j = 25^\circ\text{C}$		1.46	1.80	m $\Omega$
		$T_j = 150^\circ\text{C}$		2.3	2.9	m $\Omega$
$I_{RRM}$	$I_F = 450\text{ A}$	$T_j = 150^\circ\text{C}$		350		A
$Q_{rr}$	$di/dt_{off} = 4850\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		130		$\mu\text{C}$
$E_{rr}$	$V_{GE} = -15\text{ V}$ $V_{CC} = 900\text{ V}$	$T_j = 150^\circ\text{C}$		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
<b>Module</b>						
$L_{CE}$				20		nH
$R_{CC+EE}$	measured per switch, shunt excluded	$T_C = 25^\circ\text{C}$		1.2		m $\Omega$
		$T_C = 125^\circ\text{C}$		1.65		m $\Omega$
$R_{th(c-s)1}$	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			0.011		K/W
$M_s$	to heat sink (M5)		3		6	Nm
$M_t$		to terminals (M6)	3		6	Nm
						Nm
$w$					350	g
<b>Temperature Sensor</b>						
$R_{100}$	$T_c=100^\circ\text{C}$ ( $R_{25}=5\text{ k}\Omega$ )			$493 \pm 5\%$		$\Omega$
$B_{100/125}$	$R(T)=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$ ; $T[\text{K}]$			$3550 \pm 2\%$		K

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Shunt</b>						
$I_{Shunt}$	$T_c = 100^\circ\text{C}$ , $T_{Shunt,max} = 170^\circ\text{C}$ , $R_{th} = 4.0\text{ K/W}$				210	A
$R_{Shunt}$	Tolerance = $\pm 1\%$			0.40		m $\Omega$
$\alpha$					50	ppm/K



GB + shunt

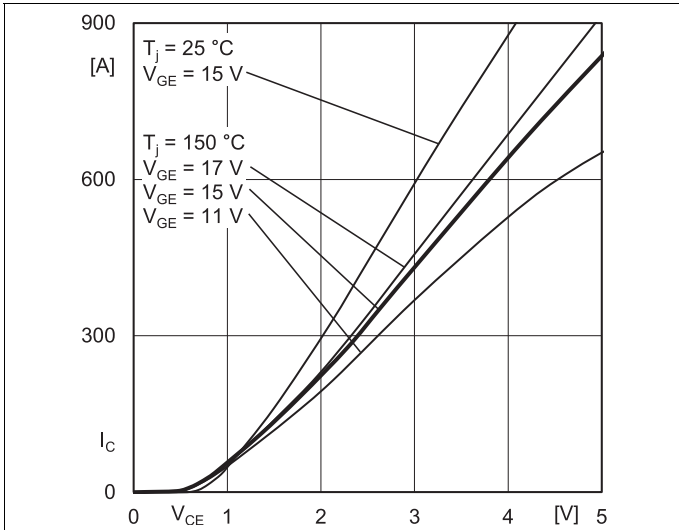


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

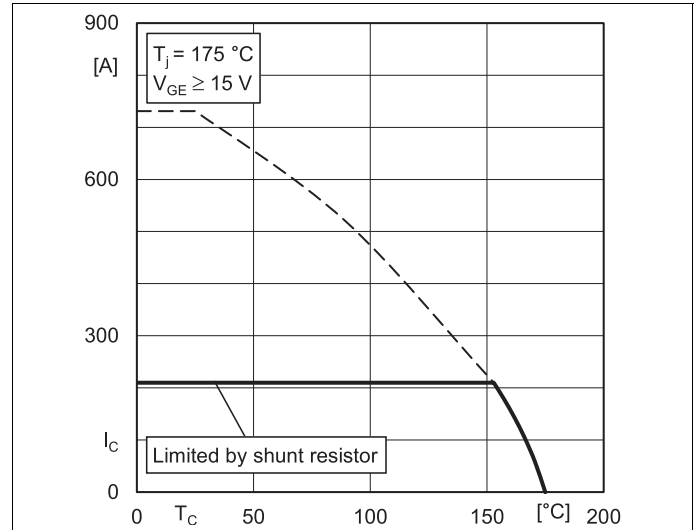


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

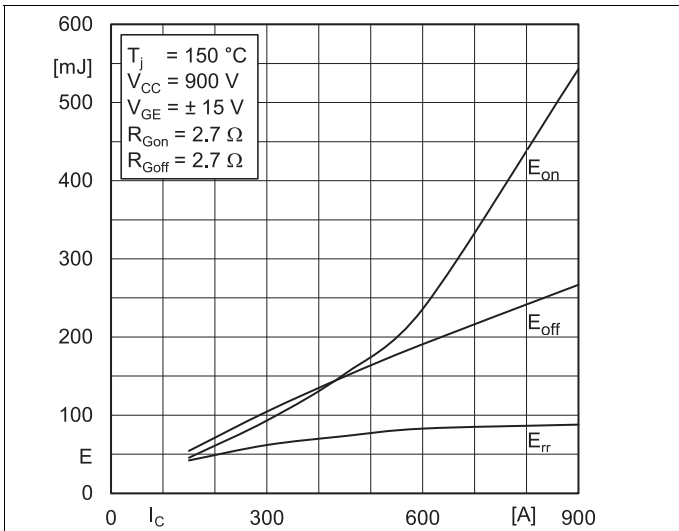


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

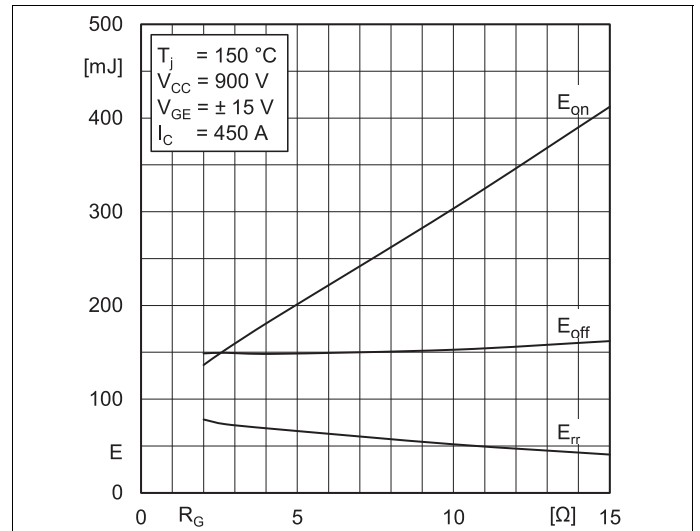


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

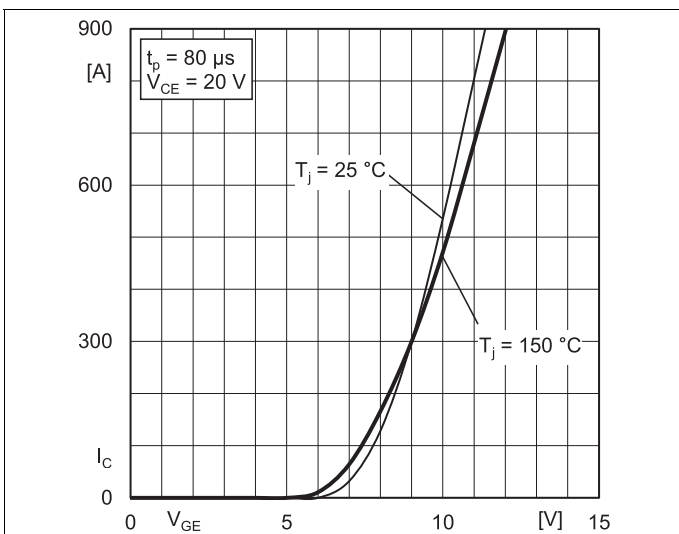


Fig. 5: Typ. transfer characteristic

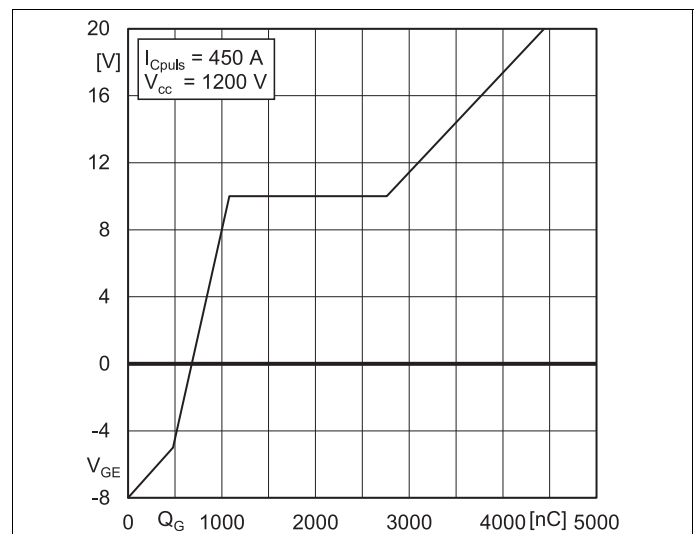
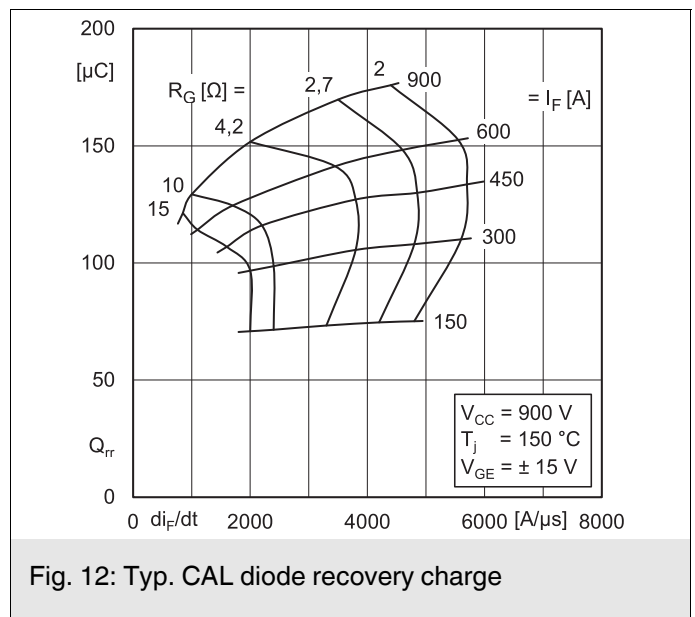
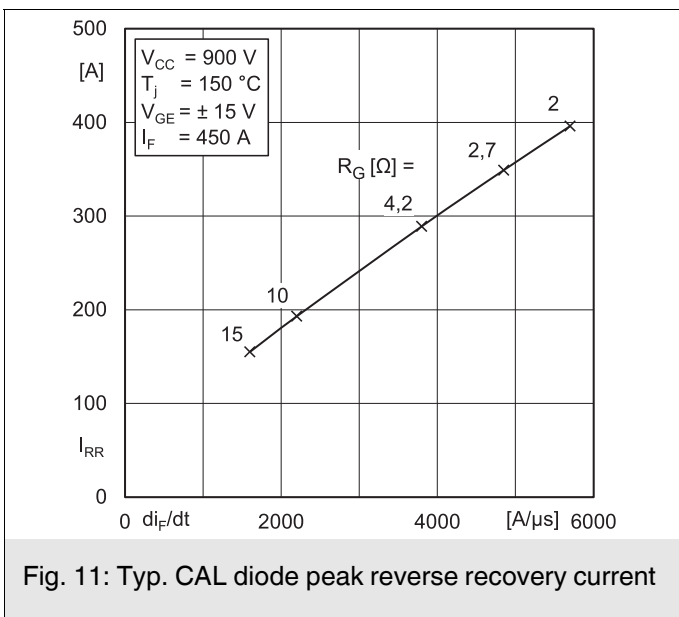
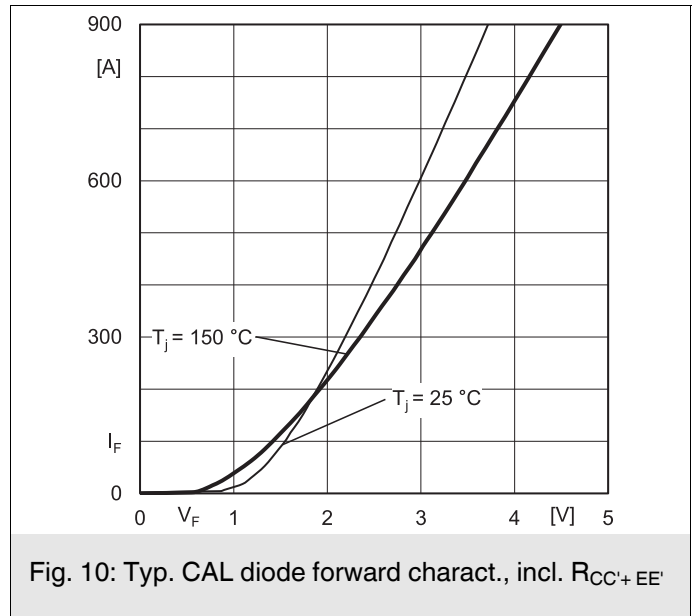
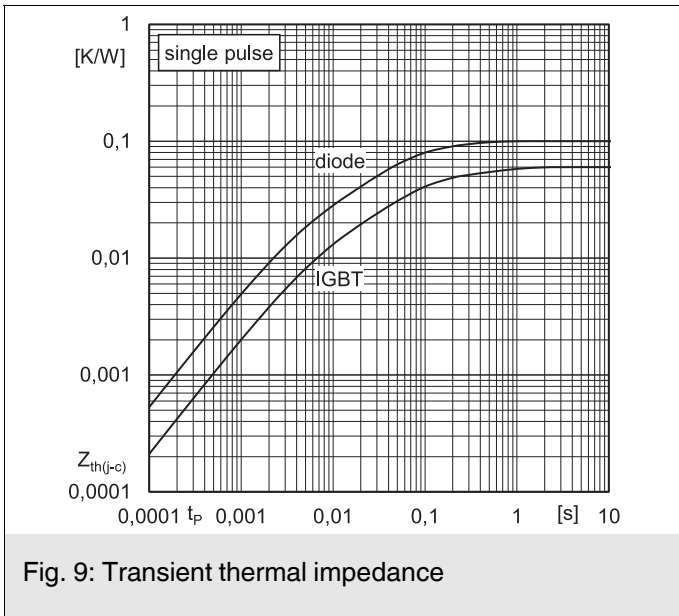
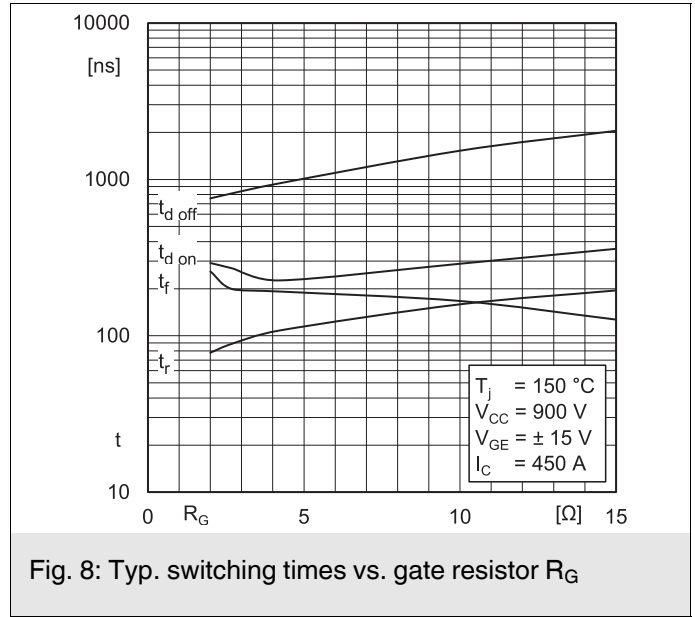
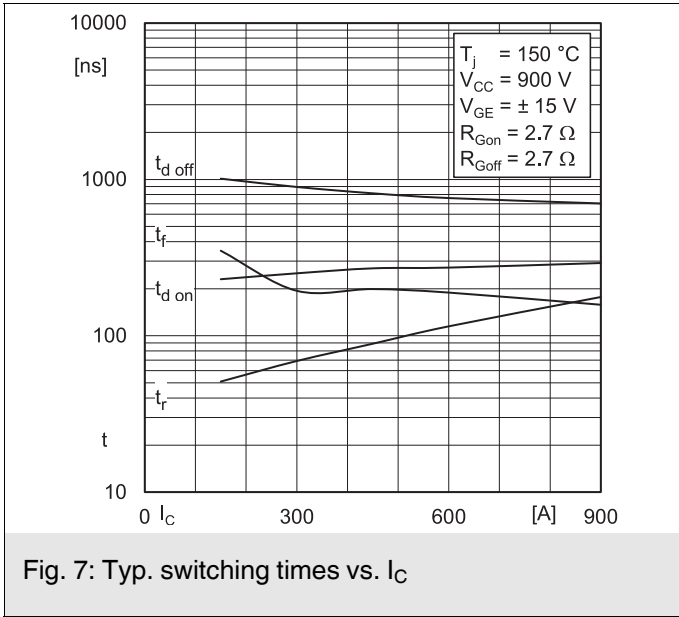
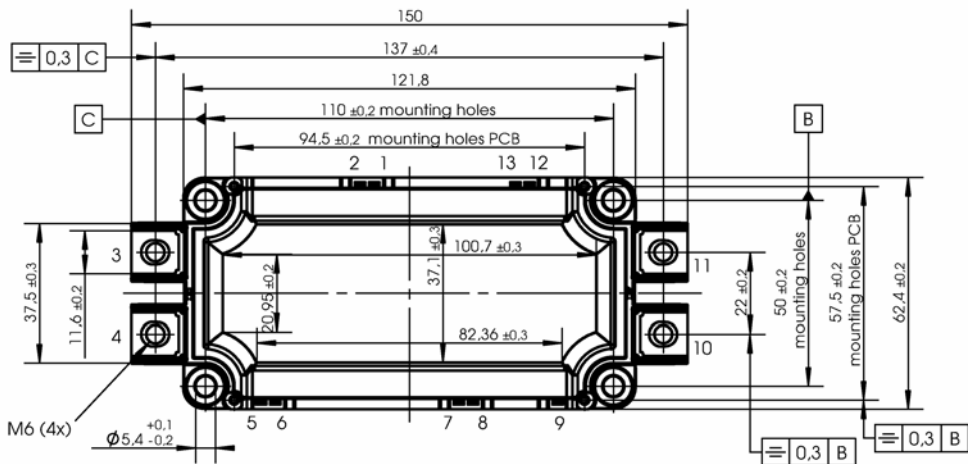
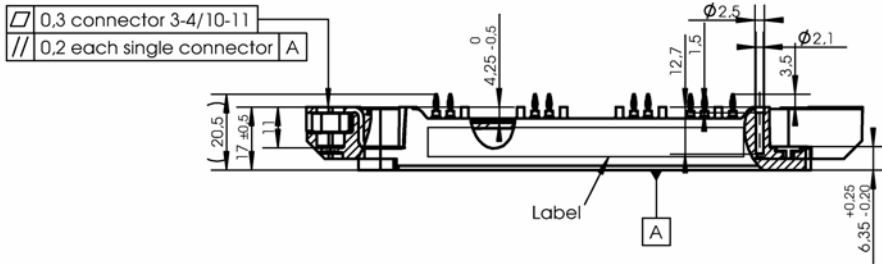


Fig. 6: Typ. gate charge characteristic

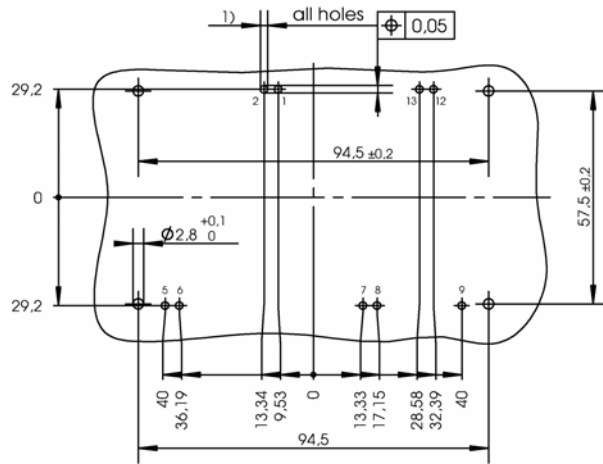


# SEMiX453GB17E4Ip

Package outline



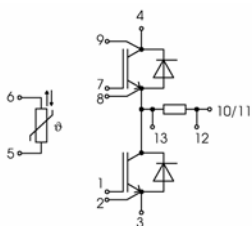
PCB drillhole pattern



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

Dimensions valid in mounted status

## SEMiX 3p shunt



pinout

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

## **\*IMPORTANT INFORMATION AND WARNINGS**

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