

# SEMiX453GB12E4p



SEMiX® 3p

## Trench IGBT Modules

### SEMiX453GB12E4p

#### Features

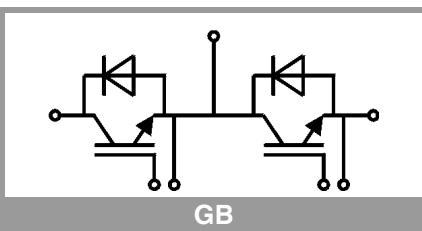
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability
- Press-fit pins as auxiliary contacts
- UL recognized, file no. E63532

#### 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



Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	678	A
		$T_c = 80^\circ\text{C}$	521	A
$I_{Cnom}$		450	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	1350	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 20\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 150^\circ\text{C}$	10	$\mu\text{s}$
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Inverse diode</b>				
$V_{RRM}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	578	A
		$T_c = 80^\circ\text{C}$	433	A
$I_{Fnom}$		450	A	
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$	1350	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	2430	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$		600	A	
$T_{stg}$		-40 ... 125	$^\circ\text{C}$	
$V_{isol}$	AC sinus 50Hz, t = 1 min	4000	V	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.80	2.05	V
		$T_j = 150^\circ\text{C}$	2.19	2.40	V
$V_{CE0}$	chipelevel	$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	2.2	2.6	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	3.3	3.6	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 18\text{ mA}$	5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$		5	$\text{mA}$
		$T_j = 150^\circ\text{C}$			$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	27.9		nF
$C_{oes}$		$f = 1\text{ MHz}$	1.74		nF
$C_{res}$		$f = 1\text{ MHz}$	1.53		nF
$Q_G$	$V_{GE} = -8\text{ V...} + 15\text{ V}$		2550		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$		1.67		$\Omega$
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	195		ns
$t_r$	$I_C = 450\text{ A}$ $V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	60		ns
		$T_j = 150^\circ\text{C}$	25		mJ
$E_{on}$	$R_{Gon} = 1.1\ \Omega$	$T_j = 150^\circ\text{C}$			mJ
$t_{d(off)}$	$R_{Goff} = 1.1\ \Omega$	$T_j = 150^\circ\text{C}$	510		ns
$t_f$	$di/dt_{on} = 7000\text{ A}/\mu\text{s}$ $di/dt_{off} = 3300\text{ A}/\mu\text{s}$ $du/dt = 4800\text{ V}/\mu\text{s}$ $L_s = 21\text{ nH}$	$T_j = 150^\circ\text{C}$	115		ns
		$T_j = 150^\circ\text{C}$	57		mJ
$E_{off}$					mJ
$R_{th(j-c)}$	per IGBT			0.066	K/W
$R_{th(c-s)}$	per IGBT ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )		0.03		K/W
$R_{th(c-s)}$	per IGBT, pre-applied phase change material		0.021		K/W

# SEMiX453GB12E4p



SEMiX® 3p

## Trench IGBT Modules

### SEMiX453GB12E4p

#### 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

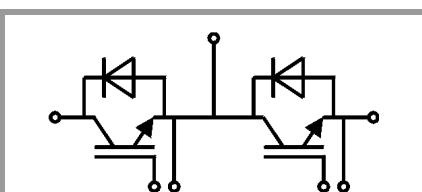
#### Typical Applications\*

- 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

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 450\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.14	2.46	V
		$T_j = 150^\circ\text{C}$		2.07	2.38	V
$V_{F0}$	chipelevel	$T_j = 25^\circ\text{C}$	1.1	1.3	1.5	V
		$T_j = 150^\circ\text{C}$	0.7	0.9	1.1	V
$r_F$	chipelevel	$T_j = 25^\circ\text{C}$	1.4	1.9	2.1	m $\Omega$
		$T_j = 150^\circ\text{C}$	2.3	2.6	2.8	m $\Omega$
$I_{RRM}$	$I_F = 450\text{ A}$	$T_j = 150^\circ\text{C}$		460		A
$Q_{rr}$	$di/dt_{off} = 7000\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		77		$\mu\text{C}$
$E_{rr}$	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		37		mJ
$R_{th(j-c)}$	per diode				0.1	K/W
$R_{th(c-s)}$	per diode ( $\lambda_{grease}=0.81\text{ W}/(\text{m}^2\text{K})$ )			0.045		K/W
$R_{th(c-s)}$	per diode, pre-applied phase change material			0.036		K/W
<b>Module</b>						
$L_{CE}$				20		nH
$R_{CC+EE}$	res. terminal-chip	$T_C = 25^\circ\text{C}$		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, Ts 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, Ts 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[K];			$3550 \pm 2\%$		K



GB

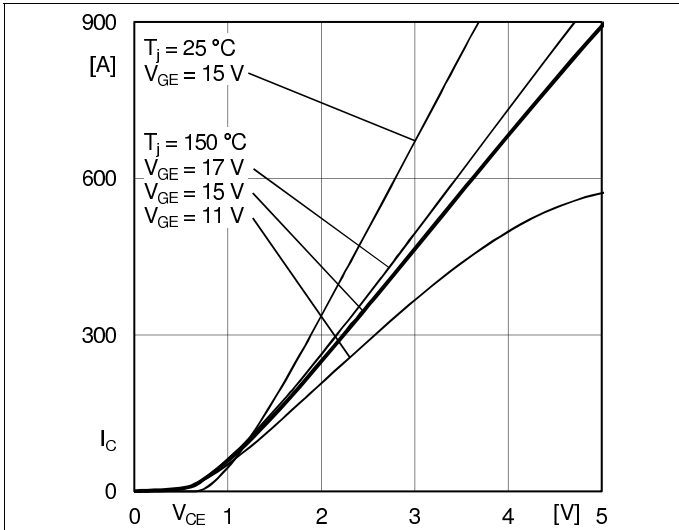


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

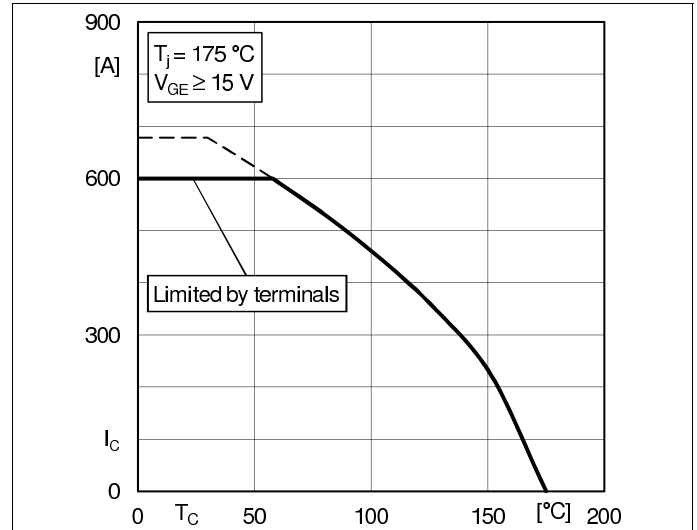


Fig. 2: Rated current vs. temperature  $I_c = f(T_C)$

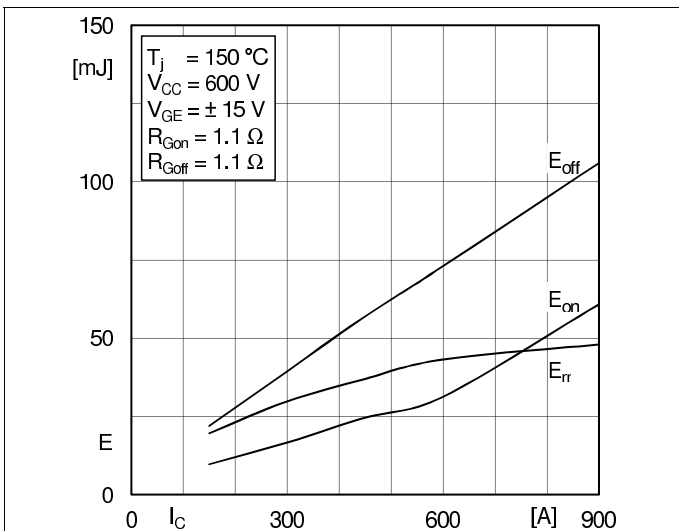


Fig. 3: Typ. turn-on /-off energy =  $f(I_c)$

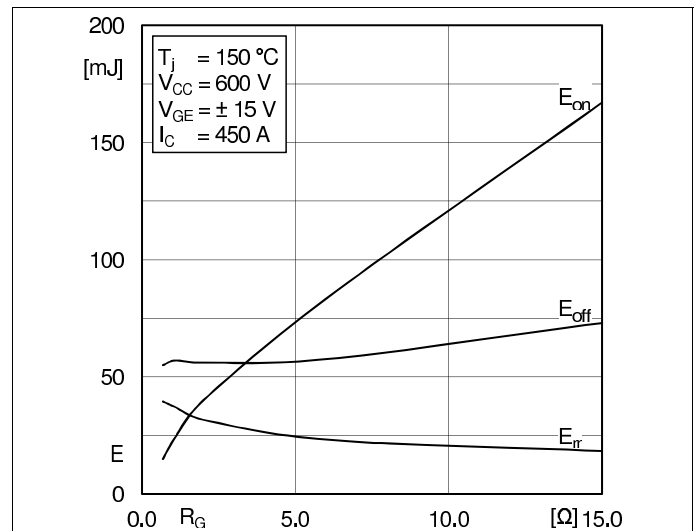


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

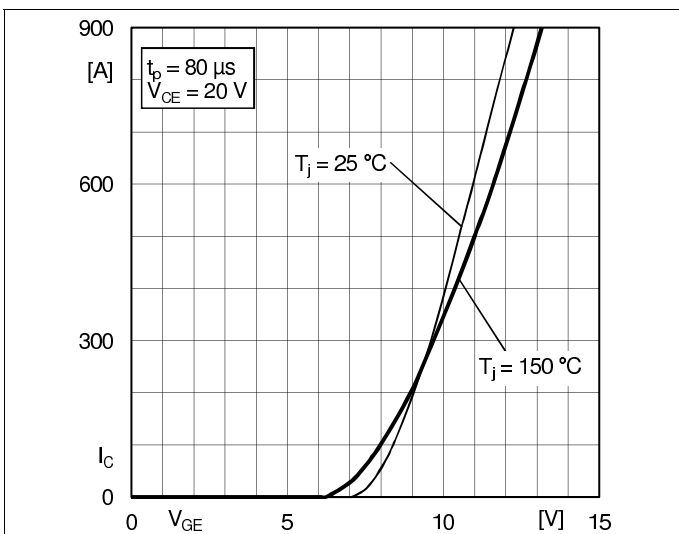


Fig. 5: Typ. transfer characteristic

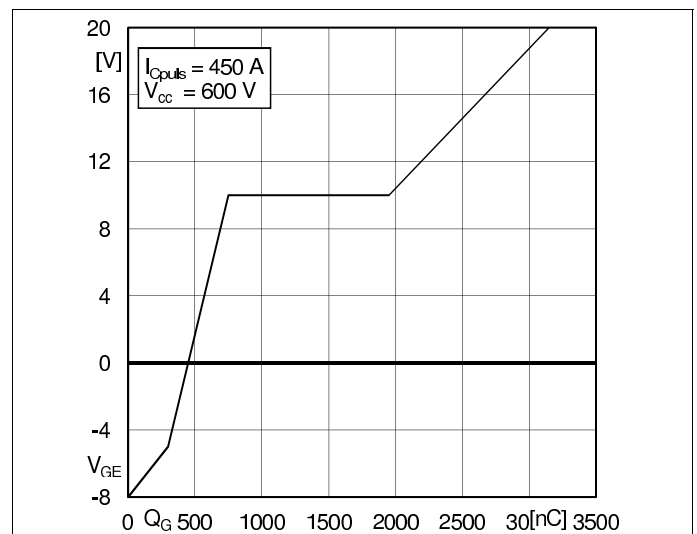
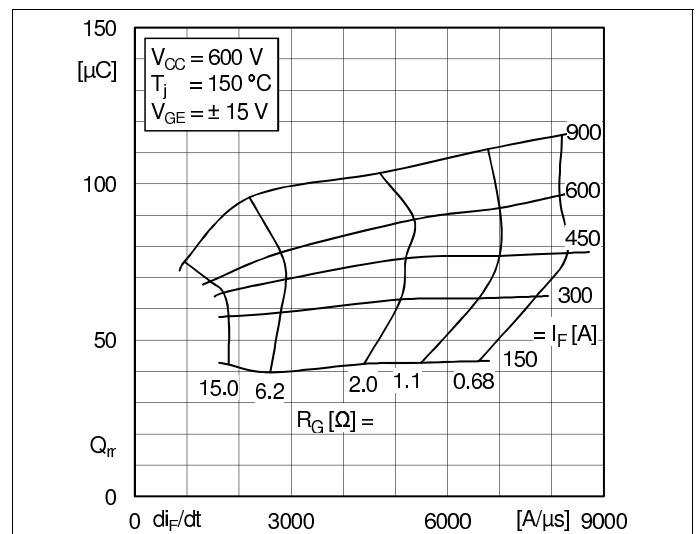
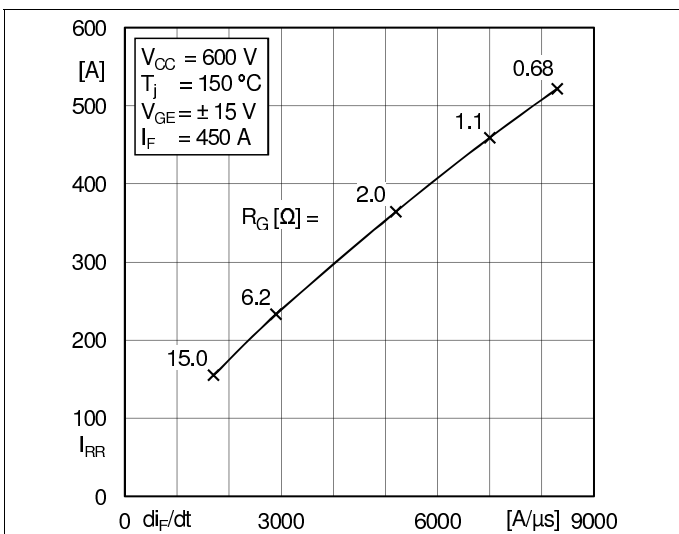
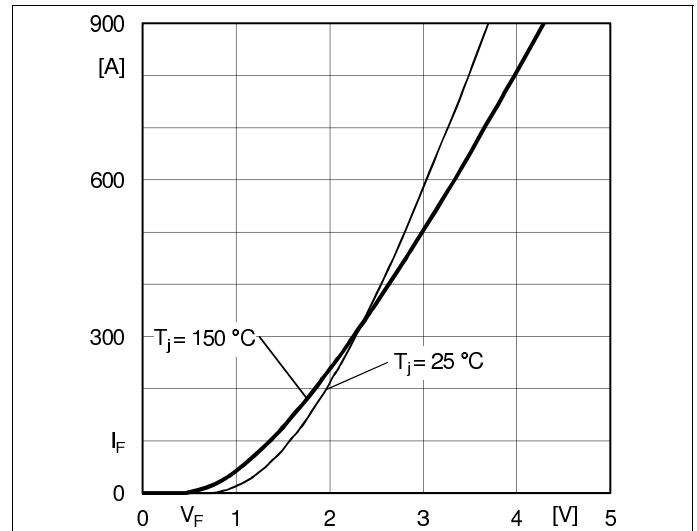
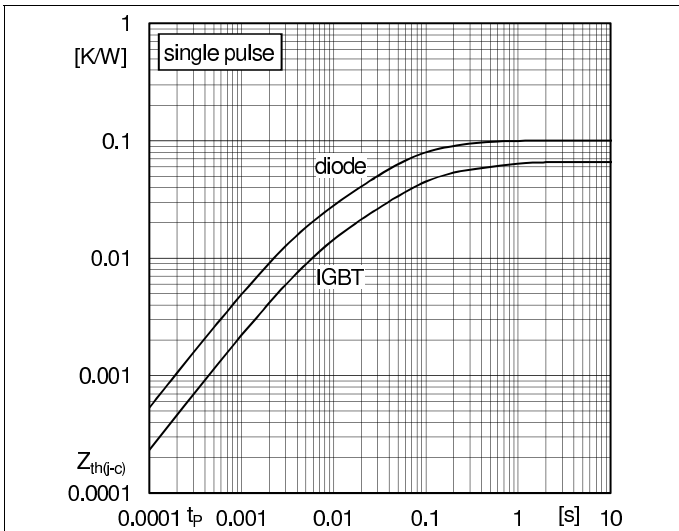
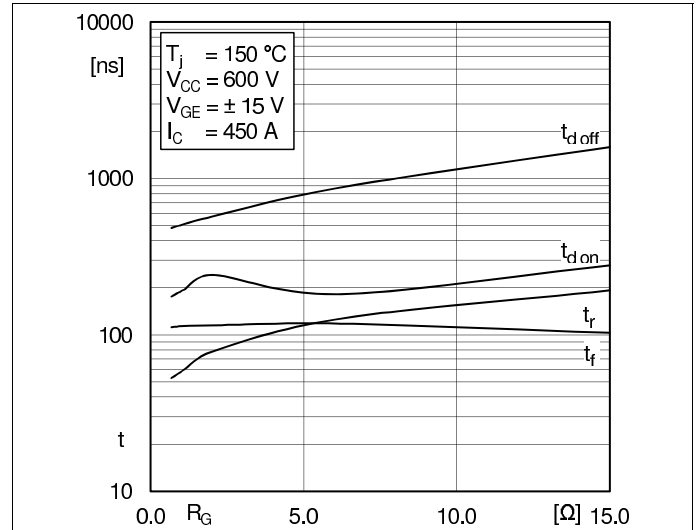
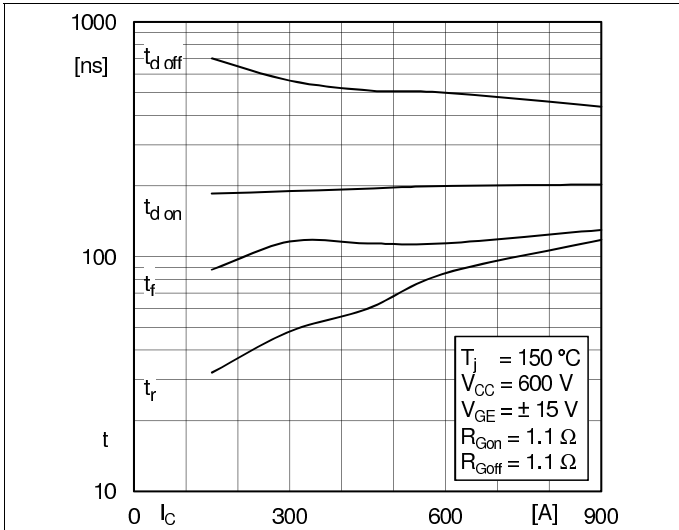




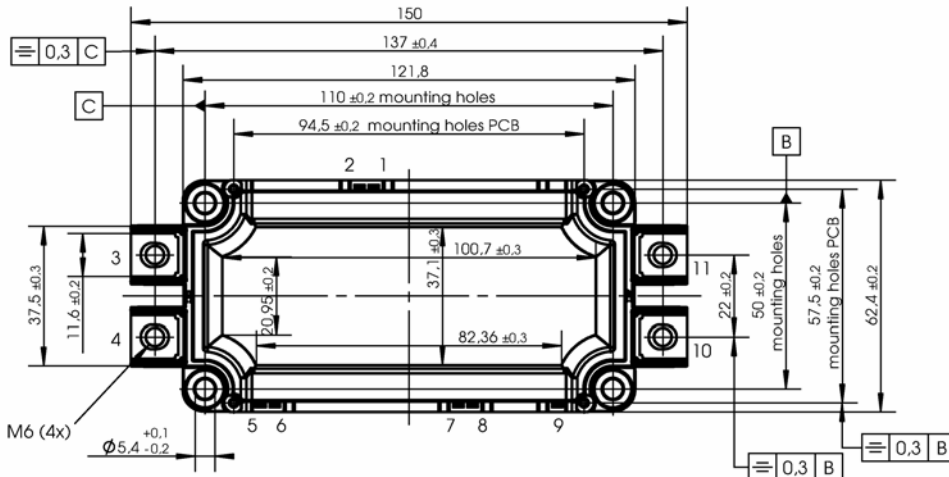
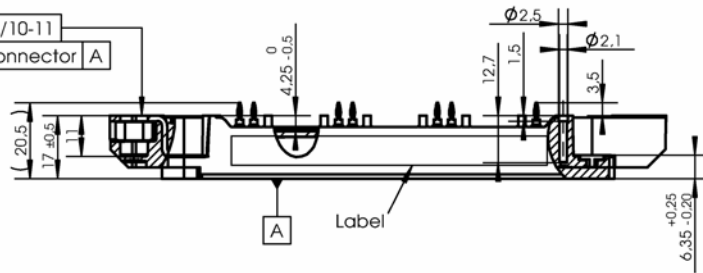
Fig. 6: Typ. gate charge characteristic



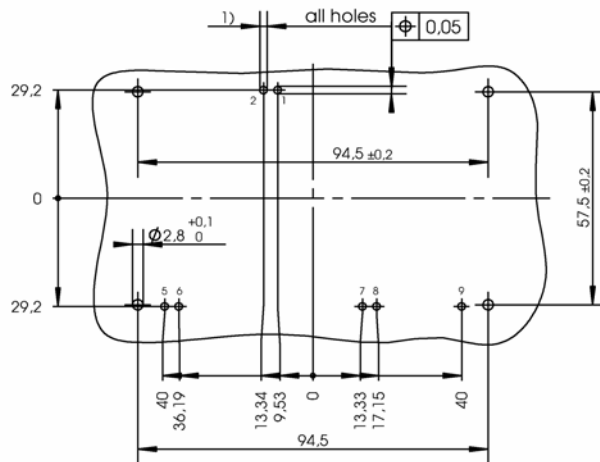
# SEMiX453GB12E4p

Package outline

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

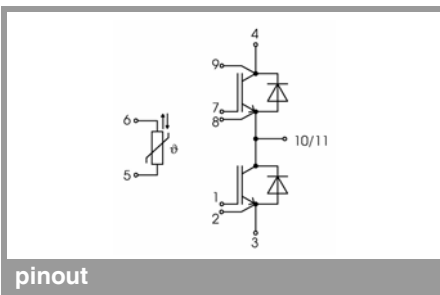


PCB drillhole pattern



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

Dimensions valid in mounted status



pinout

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

\* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.