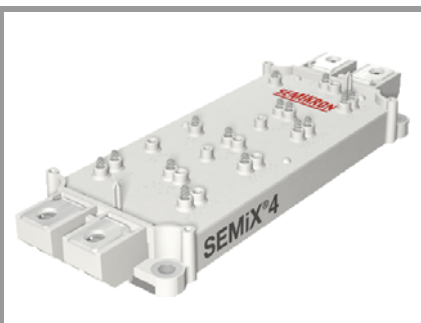


# SEMiX404GB12E4s



SEMiX<sup>®</sup>4s

## Trench IGBT Modules

SEMiX404GB12E4s

### Features

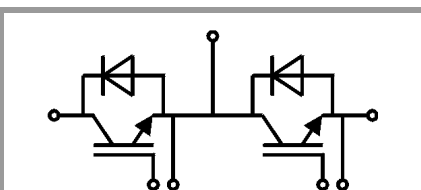
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability
- UL recognised file no. E63532

### Typical Applications

- AC inverter drives
- UPS
- Electronic Welding

### Remarks

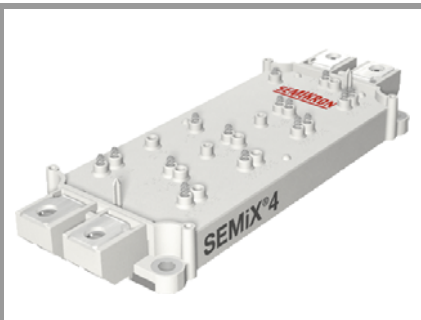
- Case temperature limited to  $T_C=125^\circ\text{C}$  max.
- Product reliability results are valid for  $T_j=150^\circ\text{C}$
- For short circuit: Soft  $R_{Goff}$  recommended  $R_{Goff} > 25 \Omega$
- Dynamic values apply to the following combination of resistors:  
 $R_{Gon,main} = 1,0 \Omega$   
 $R_{Goff,main} = 1,0 \Omega$   
 $R_{G,X} = 2,2 \Omega$   
 $R_{E,X} = 0,5 \Omega$



GB

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
<b>IGBT</b>				
$V_{CES}$			1200	V
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	618	A
		$T_c = 80^\circ\text{C}$	475	A
$I_{Cnom}$			400	A
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$		1200	A
$V_{GES}$			-20 ... 20	V
$t_{psc}$	$V_{CC} = 800\text{ V}$	$T_j = 150^\circ\text{C}$	10	$\mu\text{s}$
	$V_{GE} \leq 20\text{ V}$ $V_{CES} \leq 1200\text{ V}$			
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Inverse diode</b>				
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	440	A
		$T_c = 80^\circ\text{C}$	329	A
$I_{Fnom}$			400	A
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$		1200	A
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		1980	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, $t = 1\text{ min}$		4000	V

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>IGBT</b>					
$V_{CE(sat)}$	$I_C = 400\text{ A}$ $V_{GE} = 15\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.8	2.05	V
		$T_j = 150^\circ\text{C}$	2.2	2.4	V
$V_{CE0}$		$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
$r_{CE}$	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	2.5	2.9	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	3.8	4.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 15.2\text{ mA}$	5	5.8	6.5	V
$I_{CES}$	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	0.12	0.36	$\text{mA}$
		$T_j = 150^\circ\text{C}$			$\text{mA}$
$C_{ies}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	24.6		$\text{nF}$
$C_{oes}$		$f = 1\text{ MHz}$	1.62		$\text{nF}$
$C_{res}$		$f = 1\text{ MHz}$	1.38		$\text{nF}$
$Q_G$	$V_{GE} = -8\text{ V...} + 15\text{ V}$		2260		$\text{nC}$
$R_{Gint}$	$T_j = 25^\circ\text{C}$		1.88		$\Omega$
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	296		$\text{ns}$
$t_r$	$I_C = 400\text{ A}$	$T_j = 150^\circ\text{C}$	67		$\text{ns}$
		$T_j = 150^\circ\text{C}$	27		$\text{mJ}$
$E_{on}$	$R_{Gon} = 1.7 \Omega$	$T_j = 150^\circ\text{C}$	634		$\text{ns}$
$t_{d(off)}$	$R_{Goff} = 1.7 \Omega$	$T_j = 150^\circ\text{C}$	137		$\text{ns}$
$t_f$	$di/dt_{on} = 5800\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	59.7		$\text{mJ}$
$E_{off}$	$di/dt_{off} = 3700\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$			$\text{mJ}$
$R_{th(j-c)}$	per IGBT		0.072		$\text{K/W}$



SEMiX<sup>®</sup>4s

## Trench IGBT Modules

SEMiX404GB12E4s

### Features

- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability
- UL recognised file no. E63532

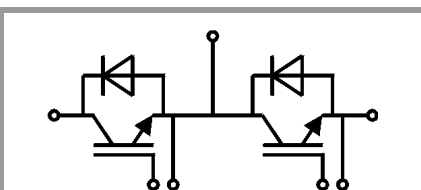
### Typical Applications

- AC inverter drives
- UPS
- Electronic Welding

### Remarks

- Case temperature limited to  $T_C=125^\circ\text{C}$  max.
- Product reliability results are valid for  $T_j=150^\circ\text{C}$
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 $R_{E,X} = 0,5 \Omega$

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 400 \text{ A}$	$T_j = 25^\circ\text{C}$		2.2	2.52	V
	$V_{GE} = 0 \text{ V}$	$T_j = 150^\circ\text{C}$		2.1	2.5	V
	chip					
$V_{F0}$		$T_j = 25^\circ\text{C}$	1.1	1.3	1.5	V
		$T_j = 150^\circ\text{C}$	0.7	0.9	1.1	V
$r_F$		$T_j = 25^\circ\text{C}$	2.0	2.3	2.5	m $\Omega$
		$T_j = 150^\circ\text{C}$	2.6	3.1	3.4	m $\Omega$
$I_{RRM}$	$I_F = 400 \text{ A}$	$T_j = 150^\circ\text{C}$		315		A
$Q_{rr}$	$di/dt_{off} = 4900 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		63		$\mu\text{C}$
$E_{rr}$	$V_{GE} = -15 \text{ V}$	$T_j = 150^\circ\text{C}$		26.4		mJ
	$V_{CC} = 600 \text{ V}$					
$R_{th(j-c)}$	per diode				0.14	K/W
<b>Module</b>						
$L_{CE}$				22		nH
$R_{CC'+EE'}$	res., terminal-chip	$T_C = 25^\circ\text{C}$		0.7		m $\Omega$
		$T_C = 125^\circ\text{C}$		1		m $\Omega$
$R_{th(c-s)}$	per module			0.03		K/W
$M_s$	to heat sink (M5)		3		5	Nm
$M_t$		to terminals (M6)	2.5		5	Nm
						Nm
$w$					400	g
<b>Temperatur 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



GB

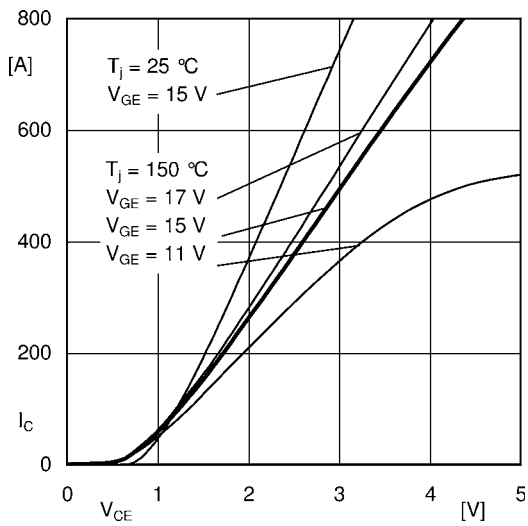


Fig. 1: Typ. output characteristic, inclusive  $R_{CC'+EE'}$

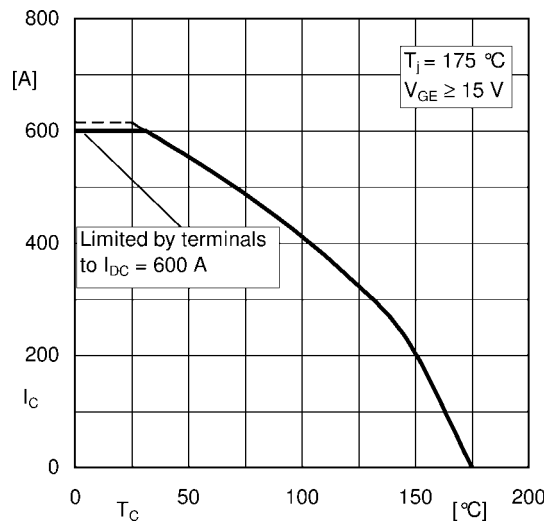


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

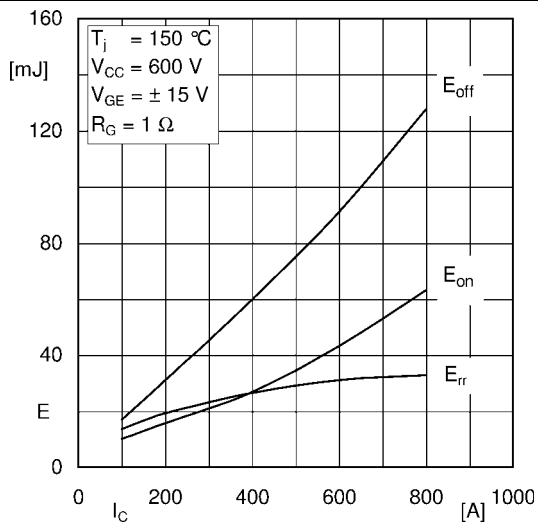


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

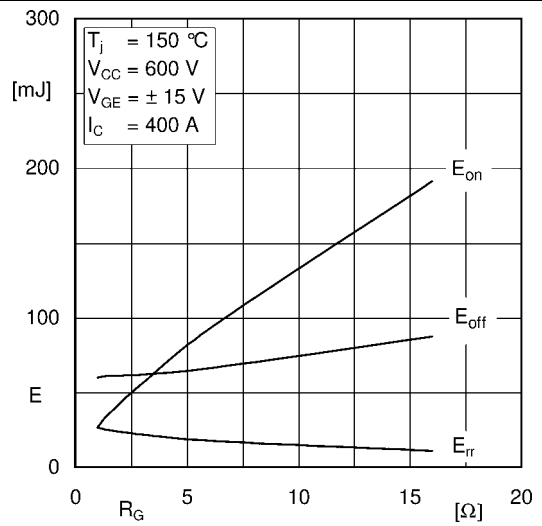


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

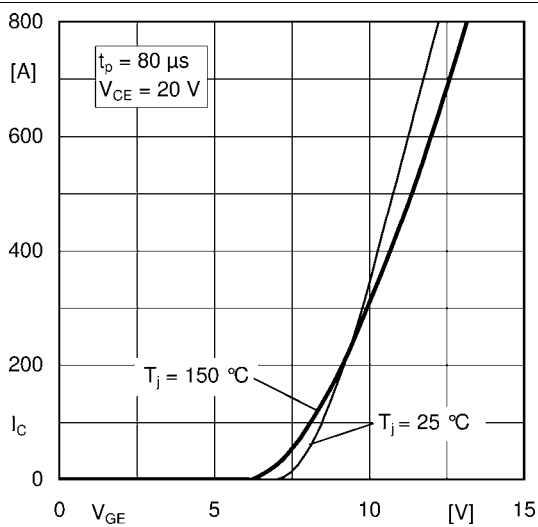


Fig. 5: Typ. transfer characteristic

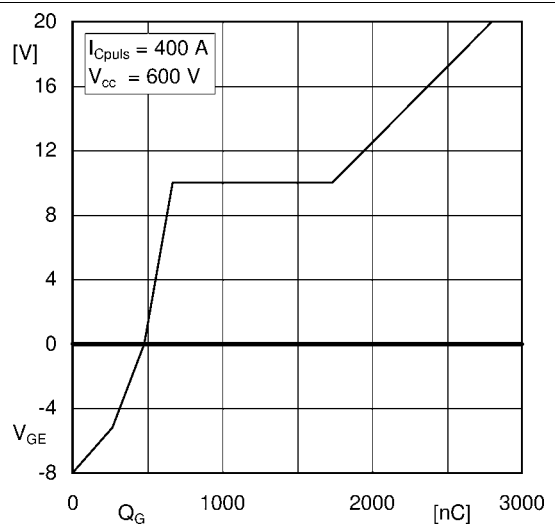


Fig. 6: Typ. gate charge characteristic

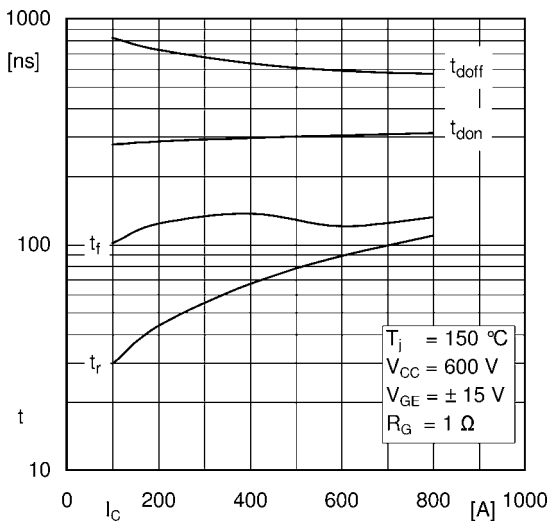


Fig. 7: Typ. switching times vs.  $I_C$

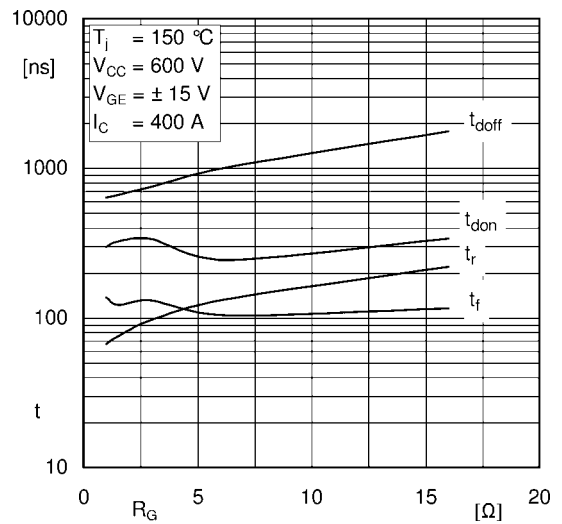


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

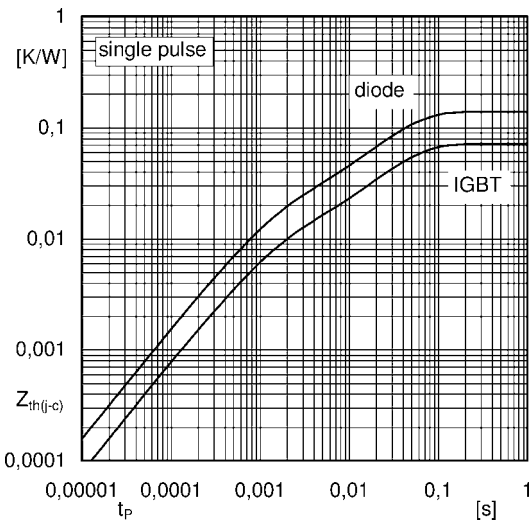


Fig. 9: Typ. transient thermal impedance

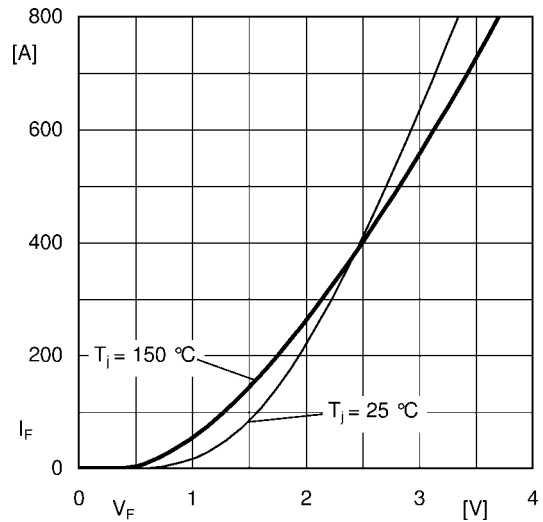


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

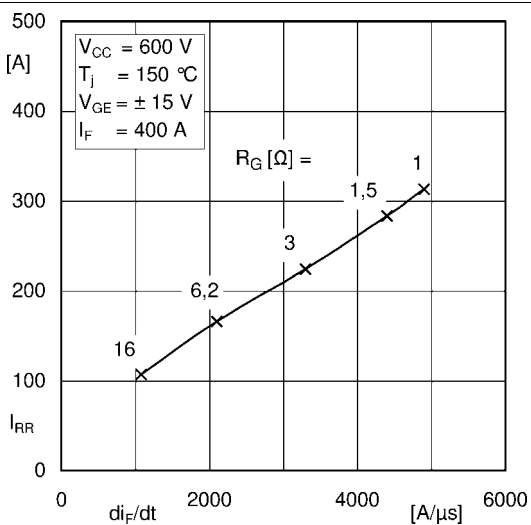


Fig. 11: Typ. CAL diode peak reverse recovery current

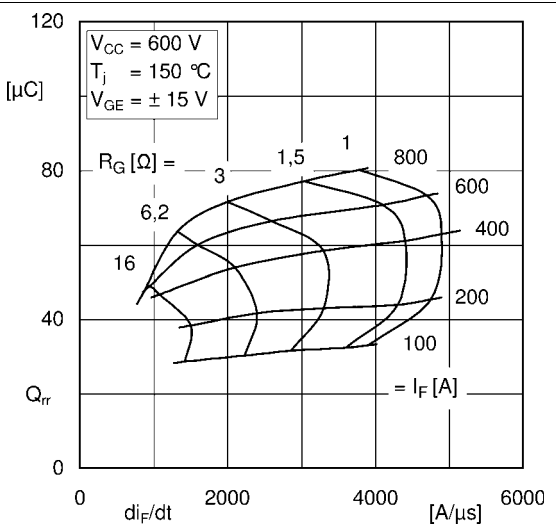
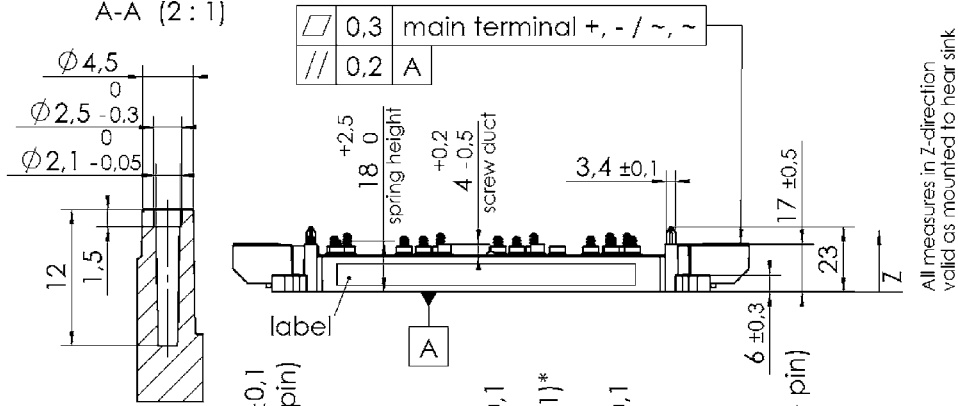


Fig. 12: Typ. CAL diode recovery charge

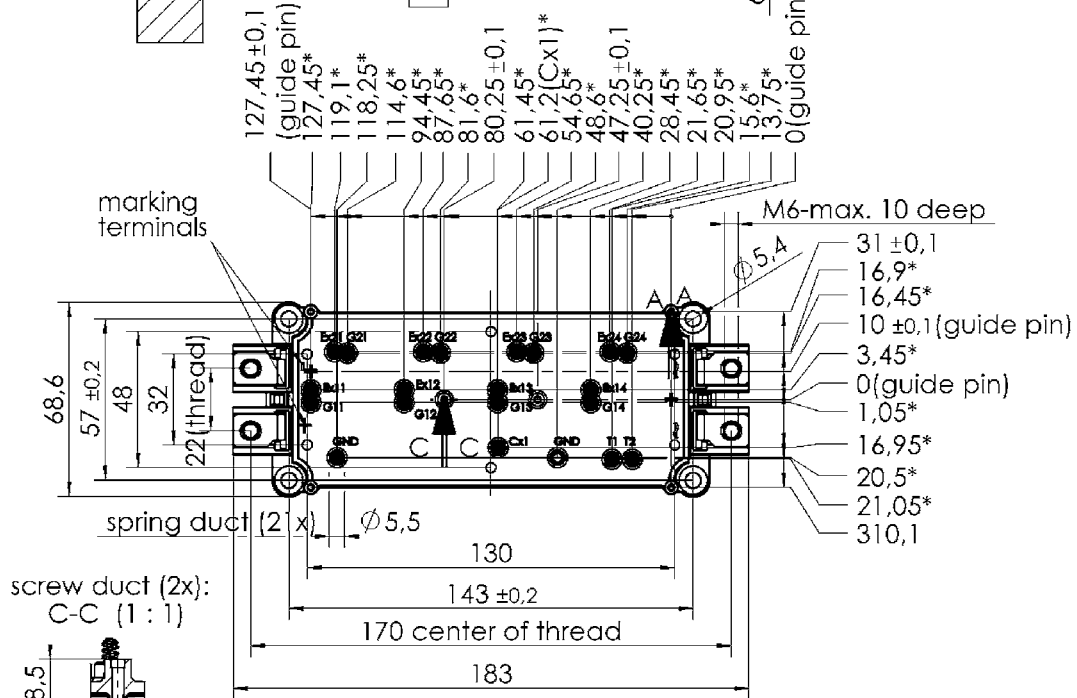
# SEMiX404GB12E4s

case: SEMiX 4s

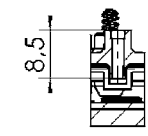
screw duct (4x):  
A-A (2 : 1)



All measures in Z-direction  
valid as mounted to heat sink



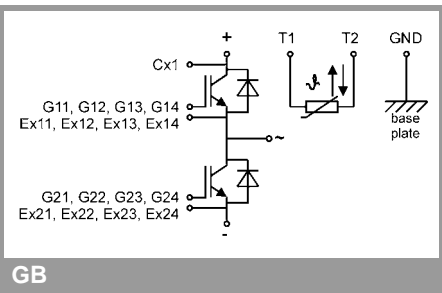
screw duct (2x):  
C-C (1 : 1)



\* all measures with  $\pm 0,2$

Rules for the contact PCB:  
- holes guidepins =  $\varnothing 4 \pm 0,1$   
- spring landing pad =  $\varnothing 3,5 \pm 0,2$

## SEMiX 4s



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

This technical information specifies semiconductor devices but promises no characteristics. No warranty or guarantee expressed or implied is made regarding delivery, performance or suitability.