

# SEMiX404GB17E4s



SEMiX® 4s

## SEMiX404GB17E4s

### Features

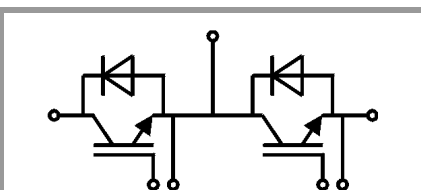
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$  with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

### 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  $T_j=150^\circ\text{C}$
- Dynamic values apply to the following combination of resistors:  
 $R_{Gon,main} = 2,35 \Omega$   
 $R_{Goff,main} = 2,35 \Omega$   
 $R_{G,X} = 2,2 \Omega$   
 $R_{E,X} = 0,5 \Omega$



GB

### Absolute Maximum Ratings

Symbol	Conditions	Values	Unit	
<b>IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	1700	V	
$I_C$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	633	A
		$T_c = 80^\circ\text{C}$	490	A
$I_{Cnom}$		400	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	1200	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	
$I_F$	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	412	A
		$T_c = 80^\circ\text{C}$	303	A
$I_{Fnom}$		400	A	
$I_{FRM}$	$I_{FRM} = 2 \times I_{Fnom}$	800	A	
$I_{FSM}$	$t_p = 10 \text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$	2340	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>					
$V_{CE(sat)}$	$I_C = 400 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$	1.90	2.20	V
		$T_j = 150^\circ\text{C}$	2.30	2.60	V
$V_{CE0}$	chipllevel	$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
$r_{CE}$	$V_{GE} = 15 \text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$	2.8	3.3	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	4	4.5	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C = 16 \text{ mA}$	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	$\text{mA}$
					$\text{mA}$
$C_{ies}$	$V_{CE} = 25 \text{ V}$		36		nF
$C_{oes}$	$V_{GE} = 0 \text{ V}$		1.36		nF
$C_{res}$			1.16		nF
$Q_G$	$V_{GE} = -8 \text{ V...} + 15 \text{ V}$		3200		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$		1.88		$\Omega$
$t_{d(on)}$	$V_{CC} = 1200 \text{ V}$		390		ns
$t_r$	$I_C = 400 \text{ A}$ $V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$	55		ns
$E_{on}$	$R_{Gon} = 3 \Omega$		190		mJ
$t_{d(off)}$	$R_{Goff} = 3 \Omega$		910		ns
$t_f$	$di/dt_{on} = 7380 \text{ A}/\mu\text{s}$ $di/dt_{off} = 2040 \text{ A}/\mu\text{s}$ $du/dt = 4950 \text{ V}/\mu\text{s}$ $L_s = 30 \text{ nH}$	$T_j = 150^\circ\text{C}$	170		ns
$E_{off}$			165		mJ

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 900 \text{ V}$	$T_j = 150^\circ\text{C}$		430		ns
$t_r$	$I_C = 400 \text{ A}$	$T_j = 150^\circ\text{C}$		100		ns
$E_{on}$	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$		90		mJ
$t_{d(off)}$	$R_{G on} = 3 \Omega$	$T_j = 150^\circ\text{C}$		860		ns
$t_f$	$R_{G off} = 3 \Omega$	$T_j = 150^\circ\text{C}$		200		ns
$E_{off}$	$di/dt_{on} = 4100 \text{ A}/\mu\text{s}$ $di/dt_{off} = 1700 \text{ A}/\mu\text{s}$ $du/dt = 4100 \text{ V}/\mu\text{s}$ $L_s = 80 \text{ nH}$	$T_j = 150^\circ\text{C}$		136		mJ
$R_{th(j-c)}$	per IGBT				0.062	K/W

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse diode</b>						
$V_F = V_{EC}$	$I_F = 400 \text{ A}$	$T_j = 25^\circ\text{C}$		2.00	2.40	V
	$V_{GE} = 0 \text{ V}$ chipelevel	$T_j = 150^\circ\text{C}$		2.15	2.57	V
$V_{F0}$	chipelevel	$T_j = 25^\circ\text{C}$	1.16	1.32	1.56	V
		$T_j = 150^\circ\text{C}$		1.08	1.22	V
$r_F$	chipelevel	$T_j = 25^\circ\text{C}$	1.4	1.7	2.1	m $\Omega$
		$T_j = 150^\circ\text{C}$		2.7	3.4	m $\Omega$
$I_{RRM}$	$I_F = 400 \text{ A}$	$T_j = 150^\circ\text{C}$		400		A
$Q_{rr}$	$di/dt_{off} = 5870 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		140		$\mu\text{C}$
$E_{rr}$	$V_{GE} = -15 \text{ V}$ $V_R = 1200 \text{ V}$	$T_j = 150^\circ\text{C}$		97		mJ
$I_{RRM}$	$I_F = 400 \text{ A}$	$T_j = 150^\circ\text{C}$		360		A
$Q_{rr}$	$di/dt_{off} = 3600 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		140		$\mu\text{C}$
$E_{rr}$	$V_{GE} = -15 \text{ V}$ $V_R = 900 \text{ V}$	$T_j = 150^\circ\text{C}$		85		mJ
$R_{th(j-c)}$	per diode				0.145	K/W
<b>Module</b>						
$L_{CE}$				22		nH
$R_{CC'+EE'}$	res. terminal-chip	$T_C = 25^\circ\text{C}$		0.95		m $\Omega$
		$T_C = 125^\circ\text{C}$		1.4		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>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



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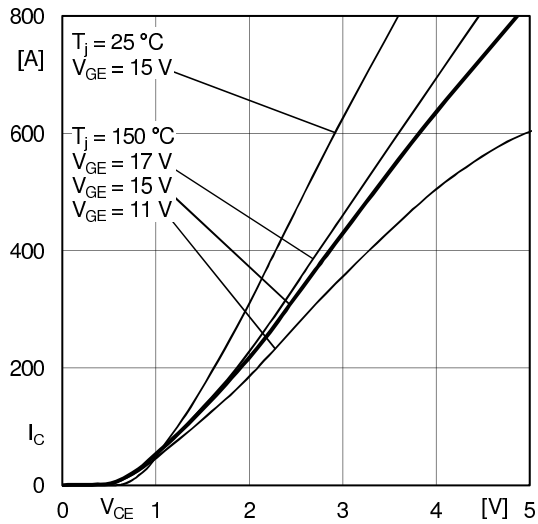


Fig. 1: Typ. output characteristic, inclusive  $R_{CC+EE}$

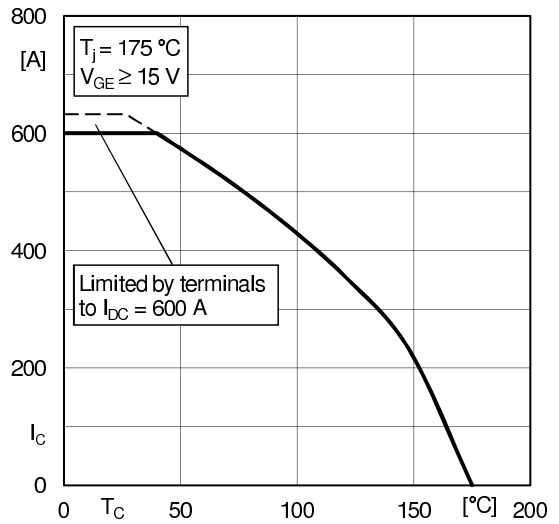


Fig. 2: Rated current vs. temperature  $I_C = f(T_C)$

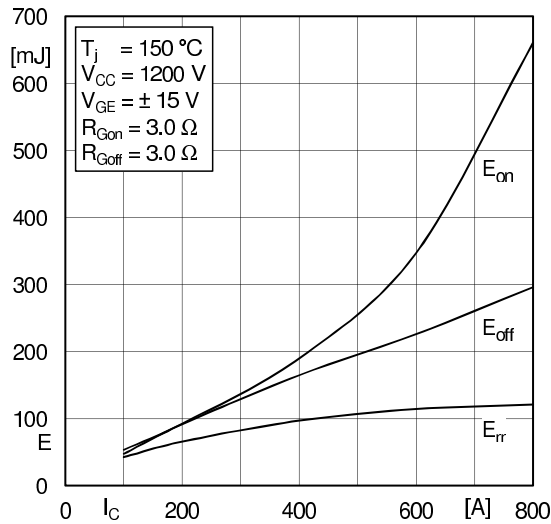


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

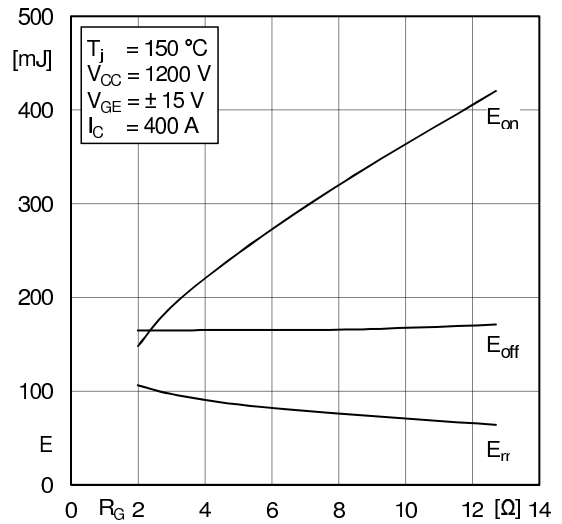


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

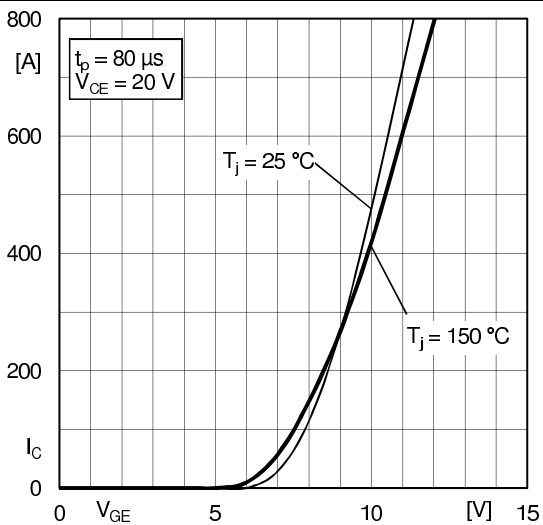


Fig. 5: Typ. transfer characteristic

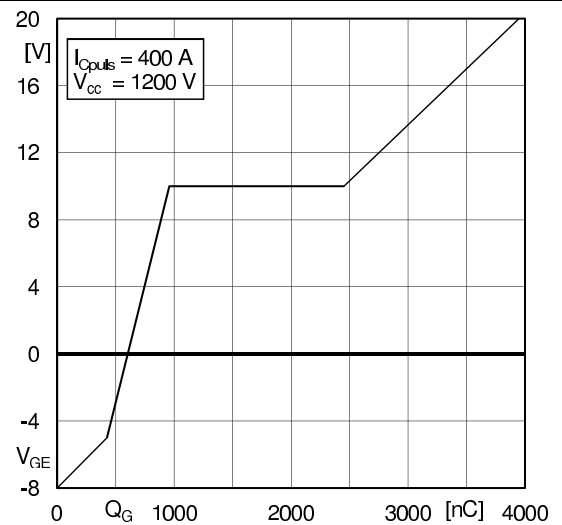


Fig. 6: Typ. gate charge characteristic

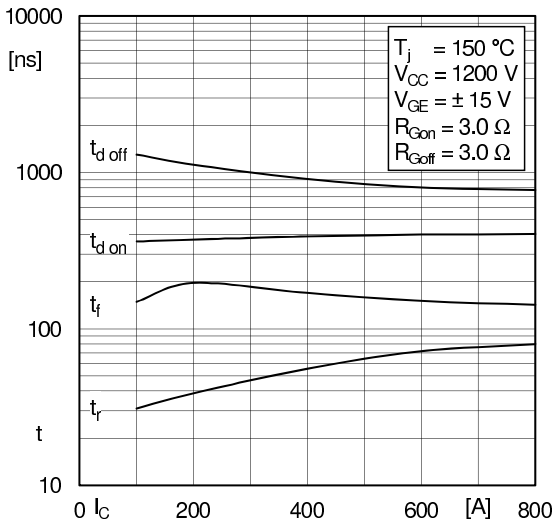


Fig. 7: Typ. switching times vs.  $I_C$

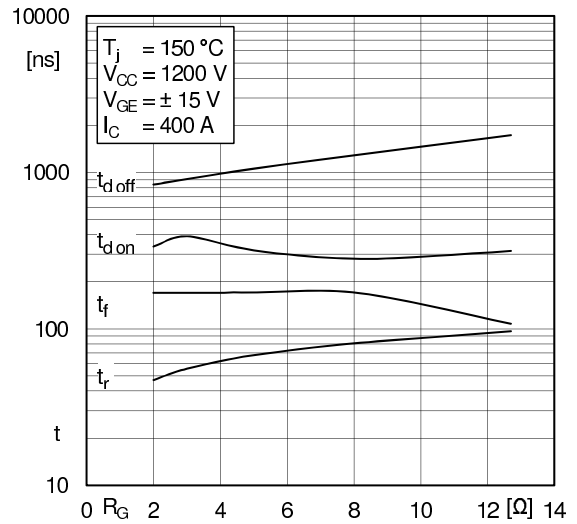


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

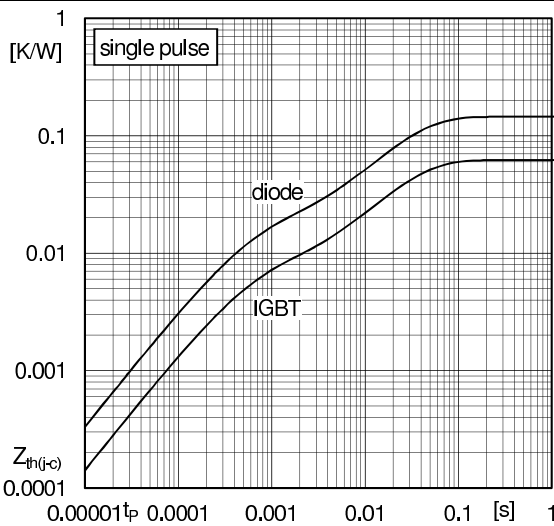


Fig. 9: Typ. transient thermal impedance

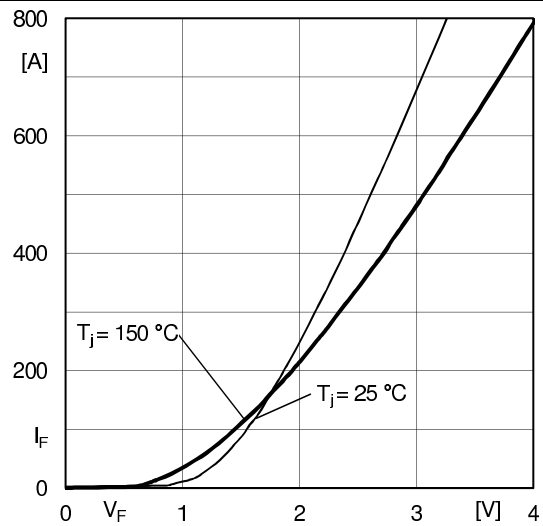


Fig. 10: Typ. CAL diode forward charact., incl.  $R_{CC+EE}$

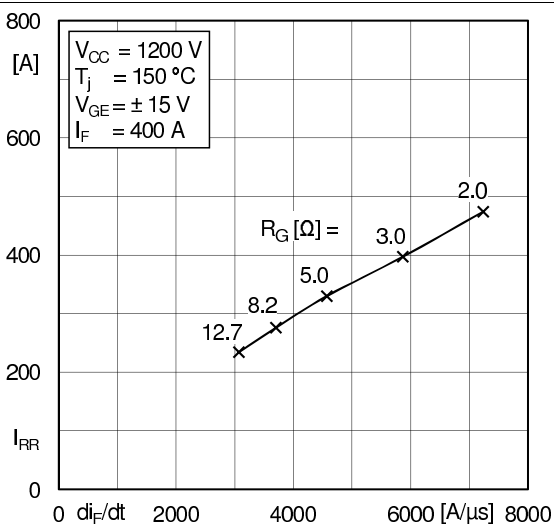


Fig. 11: Typ. CAL diode peak reverse recovery current

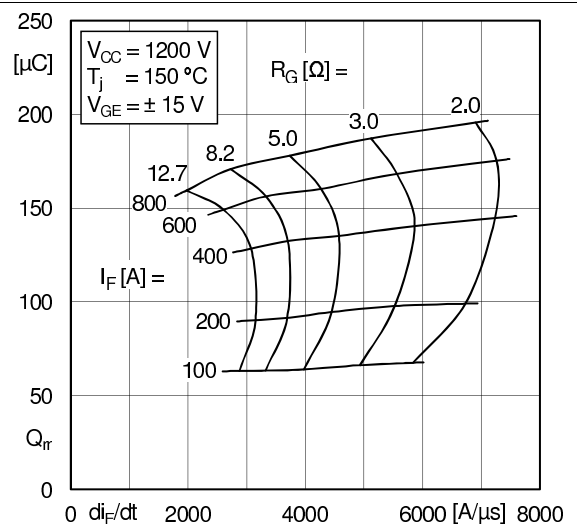
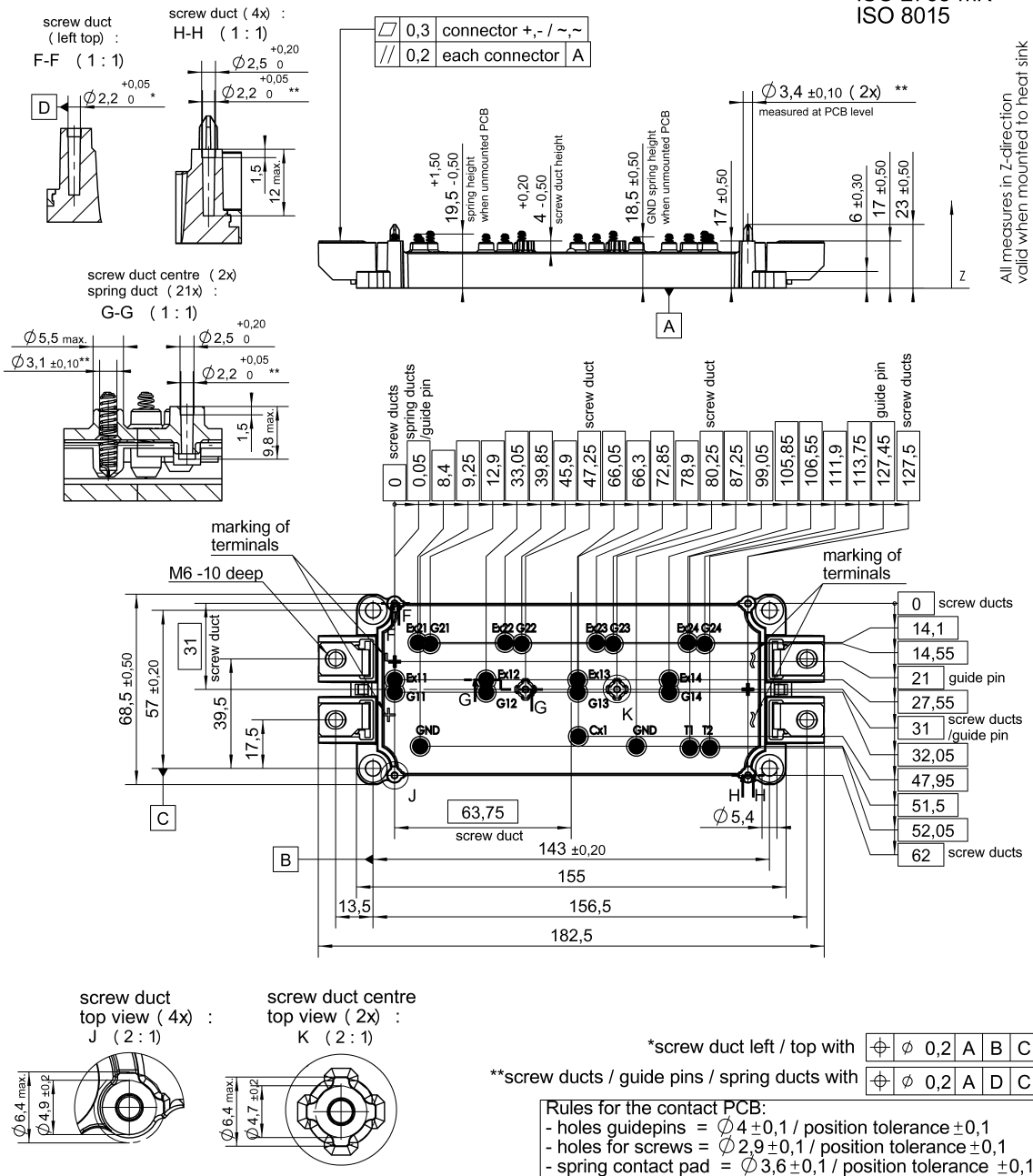


Fig. 12: Typ. CAL diode recovery charge

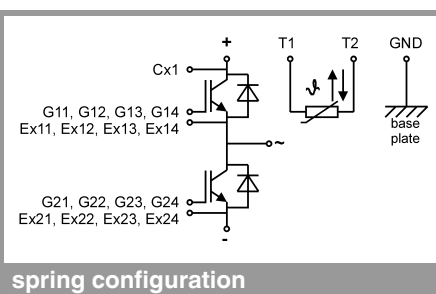
# SEMiX404GB17E4s

Case: SEMiX 4s

general tolerance:  
ISO 2768-mK  
ISO 8015



SEMiX 4s



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.