

SEMiX151GAL12E4s



SEMiX[®] 1s

Trench IGBT Modules

SEMiX151GAL12E4s

Features

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

Typical Applications*

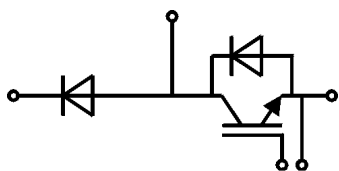
- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
- Product reliability results are valid for $T_j=150^\circ\text{C}$

Absolute Maximum Ratings					
Symbol	Conditions		Values	Unit	
IGBT					
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V	
I_C	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	232	A	
		$T_c = 80^\circ\text{C}$	179	A	
I_{Cnom}			150	A	
I_{CRM}	$I_{CRM} = 3 \times I_{Cnom}$		450	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		μs
T_j			-40 ... 175	$^\circ\text{C}$	
Inverse diode					
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	189	A	
		$T_c = 80^\circ\text{C}$	141	A	
I_{Fnom}			150	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		450	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		900	A	
T_j			-40 ... 175	$^\circ\text{C}$	
Freewheeling diode					
I_F	$T_j = 175^\circ\text{C}$	$T_c = 25^\circ\text{C}$	189	A	
		$T_c = 80^\circ\text{C}$	141	A	
I_{Fnom}			150	A	
I_{FRM}	$I_{FRM} = 3 \times I_{Fnom}$		450	A	
I_{FSM}	$t_p = 10\text{ ms, sin } 180^\circ, T_j = 25^\circ\text{C}$		900	A	
T_j			-40 ... 175	$^\circ\text{C}$	
Module					
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$		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
IGBT						
$V_{CE(sat)}$	$I_C = 150\text{ A}$ $V_{GE} = 15\text{ V}$ 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}	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	$T_j = 25^\circ\text{C}$	6.7	7.7		$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	10.0	10.7		$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 6\text{ mA}$		5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$			2.0	mA
		$T_j = 150^\circ\text{C}$				mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$			9.3	nF
C_{oes}		$f = 1\text{ MHz}$			0.58	nF
C_{res}		$f = 1\text{ MHz}$			0.51	nF
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$				850	nC
R_{Gint}	$T_j = 25^\circ\text{C}$				5.00	Ω



GAL

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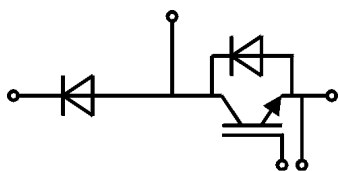
Typical Applications*

- AC inverter drives
- UPS
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Remarks

- Case temperature limited to $T_C=125^\circ\text{C}$ max.
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		204		ns
t_r	$I_C = 150\text{ A}$	$T_j = 150^\circ\text{C}$		42		ns
E_{on}	$V_{GE} = \pm 15\text{ V}$	$T_j = 150^\circ\text{C}$		16.6		mJ
$t_{d(off)}$	$R_{G\ on} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		468		ns
t_f	$R_{G\ off} = 1\ \Omega$	$T_j = 150^\circ\text{C}$		91		ns
E_{off}	$di/dt_{on} = 3900\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		18.4		mJ
	$di/dt_{off} = 2000\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per IGBT				0.19	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 150\text{ A}$	$T_j = 25^\circ\text{C}$		2.1	2.46	V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.1	2.4	V
	chipllevel					
V_{F0}		$T_j = 25^\circ\text{C}$	1.1	1.3	1.5	V
	chipllevel	$T_j = 150^\circ\text{C}$	0.7	0.9	1.1	V
r_F		$T_j = 25^\circ\text{C}$	4.3	5.6	6.4	m Ω
	chipllevel	$T_j = 150^\circ\text{C}$	6.7	7.8	8.5	m Ω
I_{RRM}	$I_F = 150\text{ A}$	$T_j = 150^\circ\text{C}$		115		A
Q_{rr}	$di/dt_{off} = 3400\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		23		μC
E_{rr}	$V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		8.9		mJ
	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per diode				0.31	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 150\text{ A}$	$T_j = 25^\circ\text{C}$		2.1	2.46	V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.1	2.4	V
	chipllevel					
V_{F0}		$T_j = 25^\circ\text{C}$	1.1	1.3	1.5	V
	chipllevel	$T_j = 150^\circ\text{C}$	0.7	0.9	1.1	V
r_F		$T_j = 25^\circ\text{C}$	4.3	5.6	6.4	m Ω
	chipllevel	$T_j = 150^\circ\text{C}$	6.7	7.8	8.5	m Ω
I_{RRM}	$I_F = 150\text{ A}$	$T_j = 150^\circ\text{C}$		115		A
Q_{rr}	$di/dt_{off} = 3400\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		23		μC
E_{rr}	$V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		8.9		mJ
	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$				
$R_{th(j-c)}$	per diode				0.31	K/W
Module						
L_{CE}				16		nH
R_{CC+EE}	res., terminal-chip	$T_C = 25^\circ\text{C}$		0.7		m Ω
		$T_C = 125^\circ\text{C}$		1		m Ω
$R_{th(c-s)}$	per module			0.075		K/W
M_s	to heat sink (M5)		3		5	Nm
M_t		to terminals (M6)	2.5		5	Nm
						Nm
w					145	g
Temperature Sensor						
R_{100}	$T_C = 100^\circ\text{C}$ ($R_{25} = 5\text{ k}\Omega$)			$493 \pm 5\%$		Ω
$B_{100/125}$	$R(T) = R_{100} \exp[B_{100/125}(1/T - 1/T_{100})]$; $T[K]$;			$3550 \pm 2\%$		K



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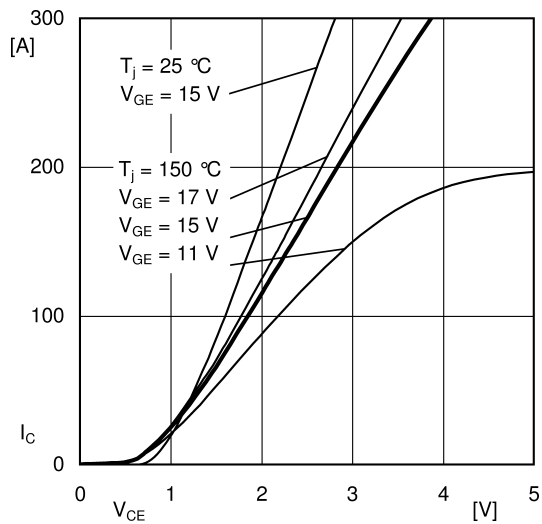


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

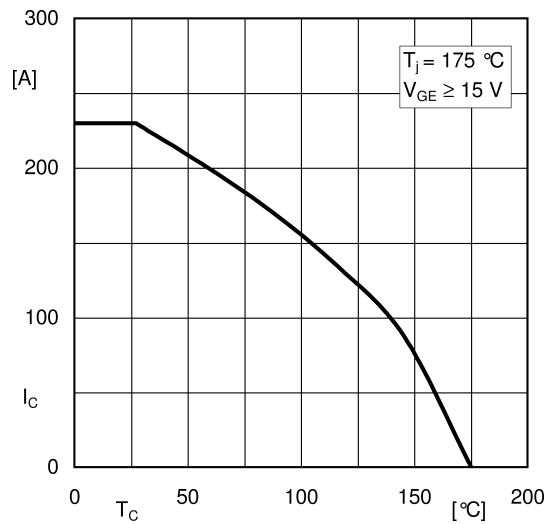


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

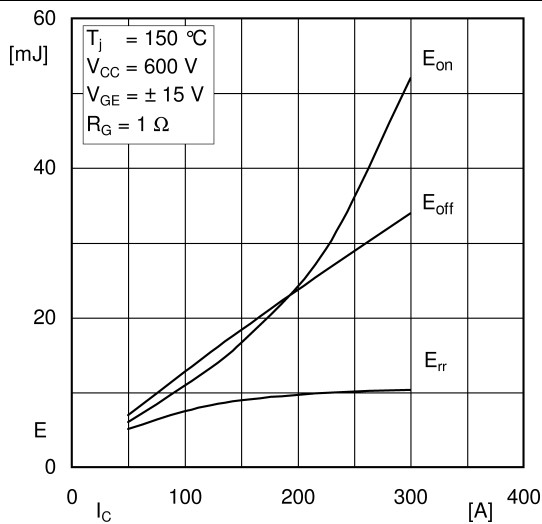


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

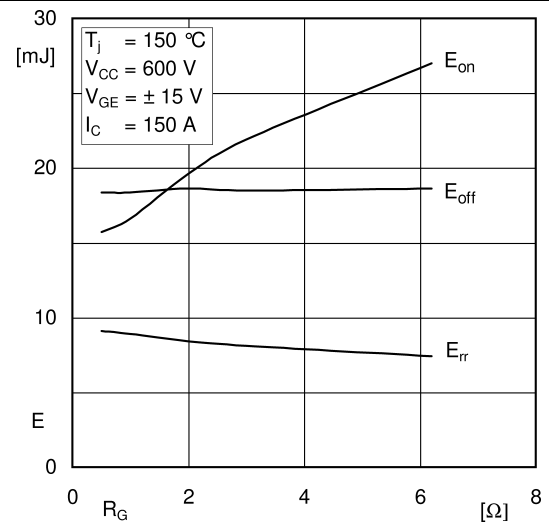


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

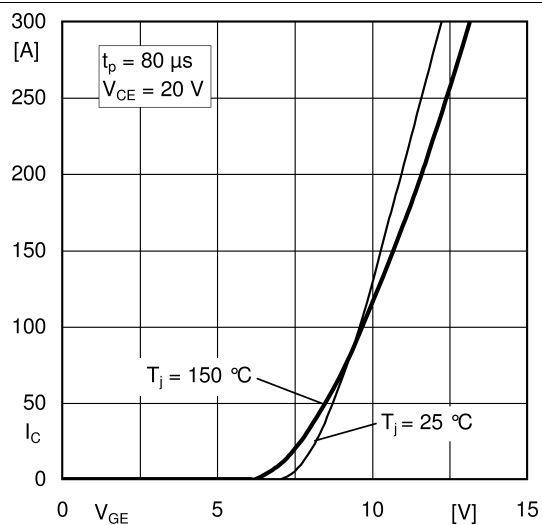


Fig. 5: Typ. transfer characteristic

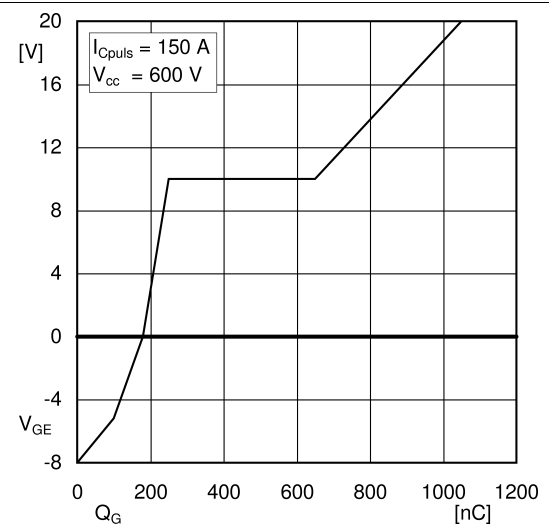


Fig. 6: Typ. gate charge characteristic

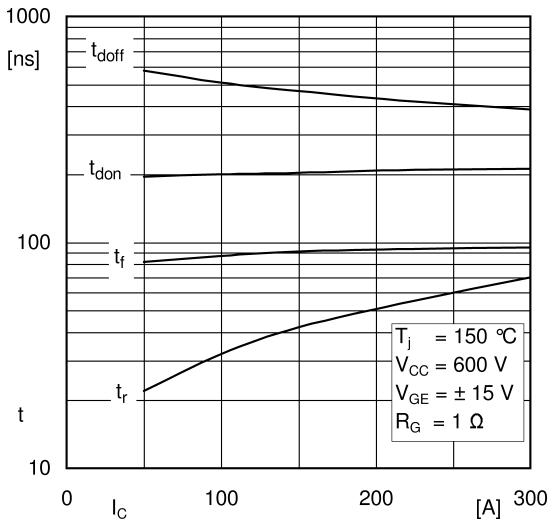


Fig. 7: Typ. switching times vs. I_C

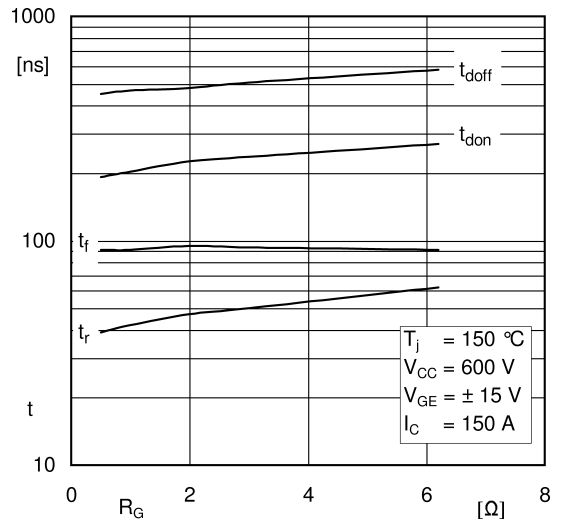


Fig. 8: Typ. switching times vs. gate resistor R_G

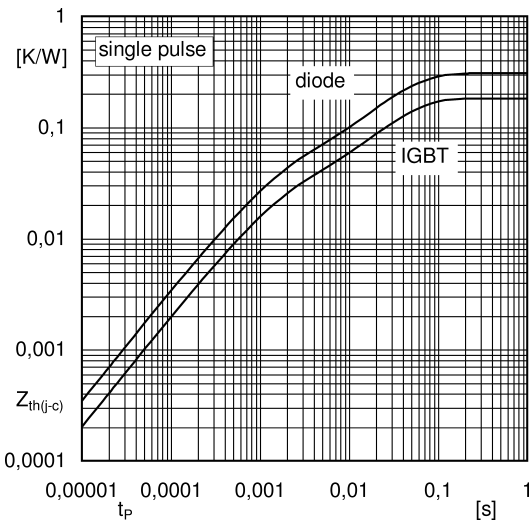


Fig. 9: Typ. transient thermal impedance

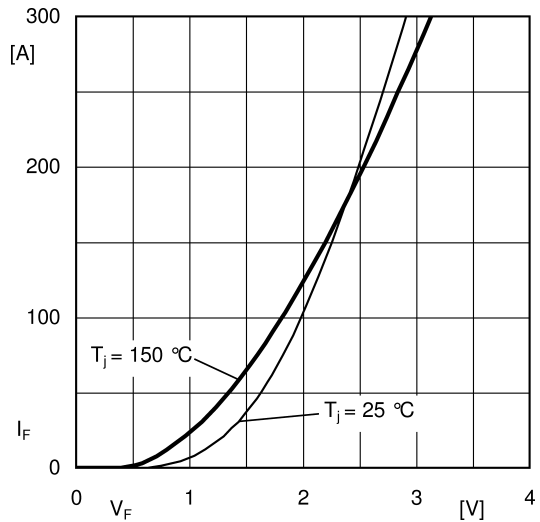


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

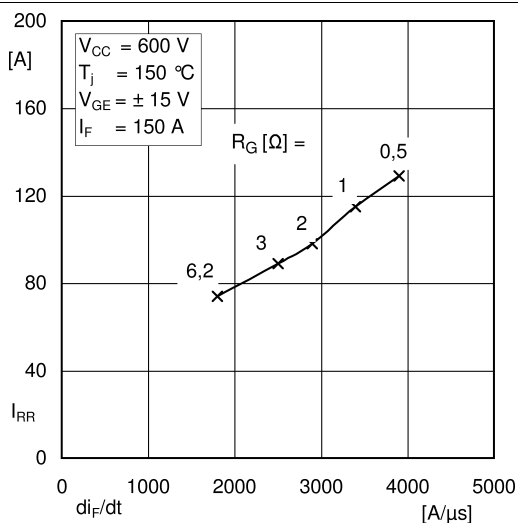


Fig. 11: Typ. CAL diode peak reverse recovery current

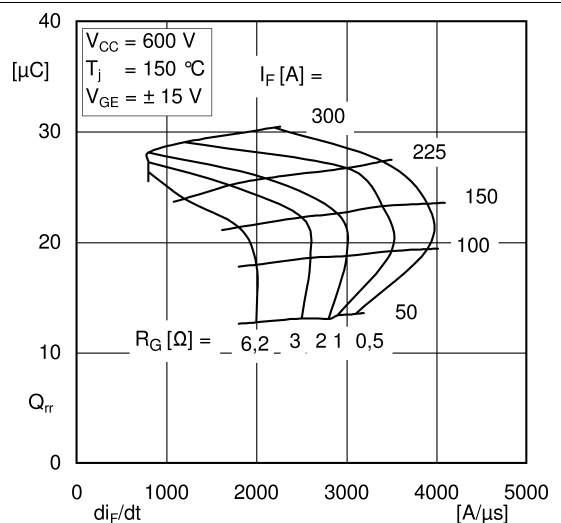
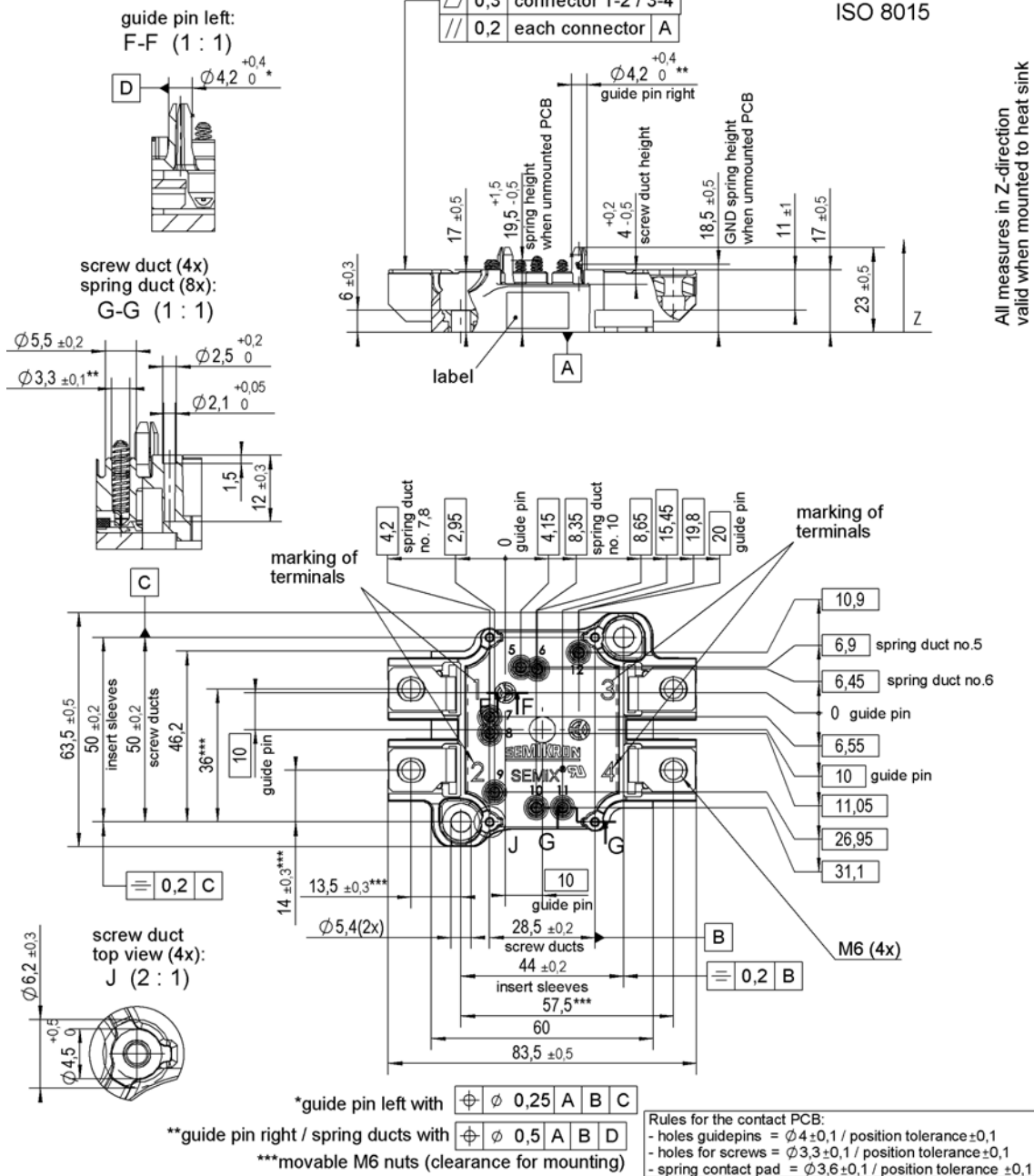


Fig. 12: Typ. CAL diode recovery charge

SEMiX151GAL12E4s

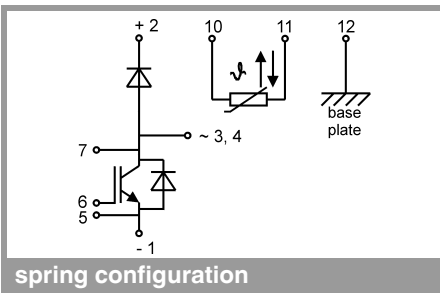
Case: SEMiX 1s

general tolerance:
ISO 2768-m
ISO 8015



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

SEMIX 1s



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.