

SEMiX653GAR176HDs



SEMiX® 3s

Trench IGBT Modules

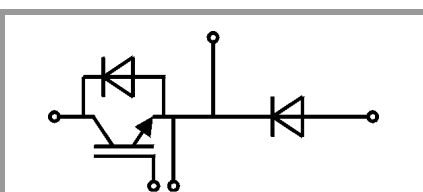
SEMiX653GAR176HDs

Features

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

Typical Applications*

- AC inverter drives
- UPS
- Electronic welders



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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	$T_j = 25\text{ °C}$		1700	V
I_C	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	619	A
		$T_c = 80\text{ °C}$	438	A
I_{Cnom}			450	A
I_{CRM}	$I_{CRM} = 2 \times I_{Cnom}$		900	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 1000\text{ V}$ $V_{GE} \leq 20\text{ V}$ $V_{CES} \leq 1700\text{ V}$	$T_j = 125\text{ °C}$	10	μs
T_j			-55 ... 150	$^{\circ}\text{C}$
Inverse diode				
I_F	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	545	A
		$T_c = 80\text{ °C}$	365	A
I_{Fnom}			450	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$		2900	A
T_j			-40 ... 150	$^{\circ}\text{C}$
Freewheeling diode				
I_F	$T_j = 150\text{ °C}$	$T_c = 25\text{ °C}$	545	A
		$T_c = 80\text{ °C}$	365	A
I_{Fnom}			450	A
I_{FRM}	$I_{FRM} = 2 \times I_{Fnom}$		900	A
I_{FSM}	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 25\text{ °C}$		2900	A
T_j			-40 ... 150	$^{\circ}\text{C}$
Module				
$I_{t(RMS)}$	$T_{terminal} = 80\text{ °C}$		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						
$V_{CE(sat)}$	$I_C = 450\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25\text{ °C}$		2	2.45	V
		$T_j = 125\text{ °C}$		2.5	2.9	V
V_{CE0}		$T_j = 25\text{ °C}$		1	1.2	V
		$T_j = 125\text{ °C}$		0.9	1.1	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25\text{ °C}$		2.2	2.8	$\text{m}\Omega$
		$T_j = 125\text{ °C}$		3.4	4.0	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 18\text{ mA}$		5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1700\text{ V}$	$T_j = 25\text{ °C}$			3	mA
		$T_j = 125\text{ °C}$				mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		39.6		nF
C_{oes}		$f = 1\text{ MHz}$		1.65		nF
C_{res}		$f = 1\text{ MHz}$		1.31		nF
Q_G	$V_{GE} = -8\text{ V...} + 15\text{ V}$			4200		nC
R_{Gint}	$T_j = 25\text{ °C}$			1.67		Ω

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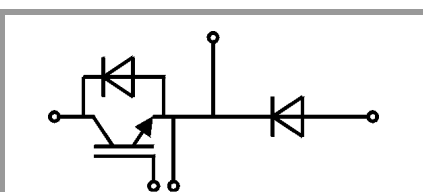
Features

- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
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Typical Applications*

- AC inverter drives
- UPS
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
$t_{d(on)}$	$V_{CC} = 1200\text{ V}$	$T_j = 125\text{ °C}$		290		ns
t_r	$I_C = 450\text{ A}$	$T_j = 125\text{ °C}$		90		ns
E_{on}	$V_{GE} = \pm 15\text{ V}$	$T_j = 125\text{ °C}$		300		mJ
$t_{d(off)}$	$R_{G\ on} = 3.6\ \Omega$	$T_j = 125\text{ °C}$		975		ns
t_f	$R_{G\ off} = 3.6\ \Omega$	$T_j = 125\text{ °C}$		190		ns
E_{off}		$T_j = 125\text{ °C}$		180		mJ
$R_{th(j-c)}$	per IGBT				0.054	K/W
Inverse diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$	$T_j = 25\text{ °C}$		1.7	1.90	V
	$V_{GE} = 0\text{ V}$	$T_j = 125\text{ °C}$		1.7	1.9	V
	chip					
V_{F0}		$T_j = 25\text{ °C}$	0.9	1.1	1.3	V
		$T_j = 125\text{ °C}$	0.7	0.9	1.1	V
r_F		$T_j = 25\text{ °C}$	1.3	1.3	1.3	m Ω
		$T_j = 125\text{ °C}$	1.8	1.8	1.8	m Ω
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 125\text{ °C}$		380		A
Q_{rr}	$di/dt_{off} = 4200\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		130		μC
E_{rr}	$V_{GE} = -15\text{ V}$	$T_j = 125\text{ °C}$		73		mJ
	$V_{CC} = 1200\text{ V}$					
$R_{th(j-c)}$	per diode				0.11	K/W
Freewheeling diode						
$V_F = V_{EC}$	$I_F = 450\text{ A}$	$T_j = 25\text{ °C}$		1.7	1.90	V
	$V_{GE} = 0\text{ V}$	$T_j = 125\text{ °C}$		1.7	1.9	V
	chip					
V_{F0}		$T_j = 25\text{ °C}$	0.9	1.1	1.3	V
		$T_j = 125\text{ °C}$	0.7	0.9	1.1	V
r_F		$T_j = 25\text{ °C}$	1.3	1.3	1.3	m Ω
		$T_j = 125\text{ °C}$	1.8	1.8	1.8	m Ω
I_{RRM}	$I_F = 450\text{ A}$	$T_j = 125\text{ °C}$		380		A
Q_{rr}	$di/dt_{off} = 4200\text{ A}/\mu\text{s}$	$T_j = 125\text{ °C}$		130		μC
E_{rr}	$V_{GE} = -15\text{ V}$	$T_j = 125\text{ °C}$		73		mJ
	$V_{CC} = 1200\text{ V}$					
$R_{th(j-c)}$	per diode				0.11	K/W
Module						
L_{CE}				20		nH
R_{CC+EE}	res., terminal-chip	$T_C = 25\text{ °C}$		0.7		m Ω
		$T_C = 125\text{ °C}$		1		m Ω
$R_{th(c-s)}$	per module			0.04		K/W
M_s	to heat sink (M5)		3		5	Nm
M_t		to terminals (M6)	2.5		5	Nm
						Nm
w					300	g
Temperatur Sensor						
R_{100}	$T_C = 100\text{ °C}$ ($R_{25} = 5\text{ k}\Omega$)			$493 \pm 5\%$		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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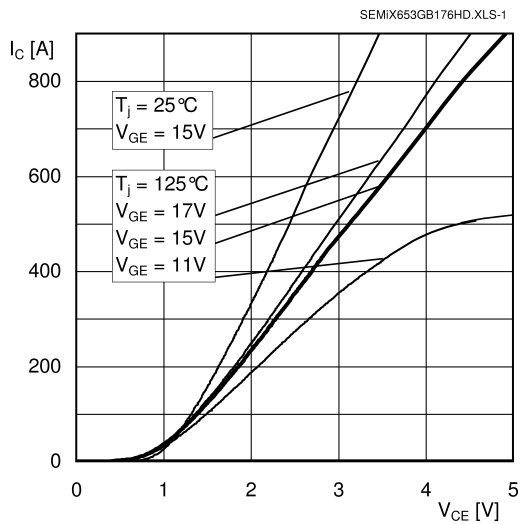


Fig. 1: Typ. output characteristic, inclusive R_{CC+EE}

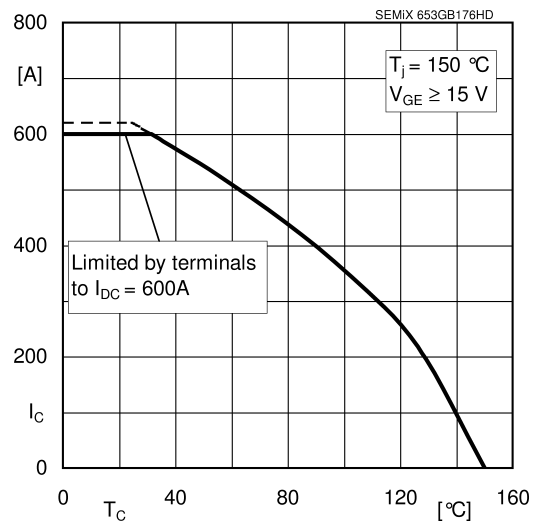


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

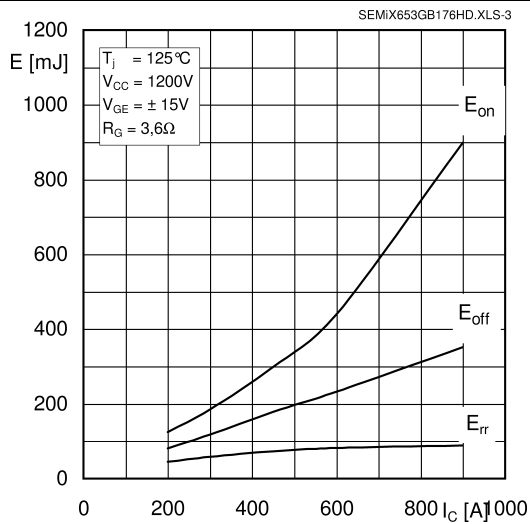


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

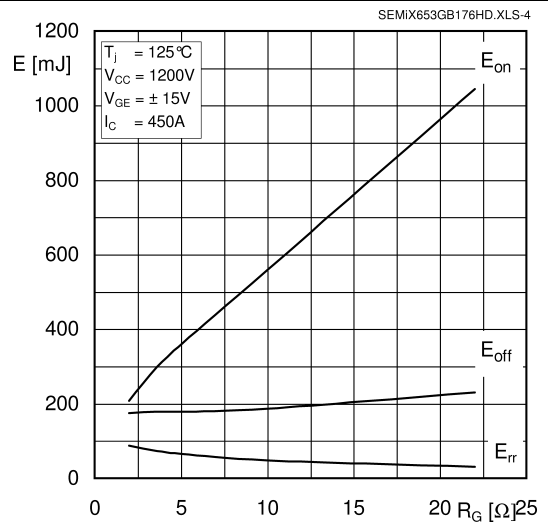


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

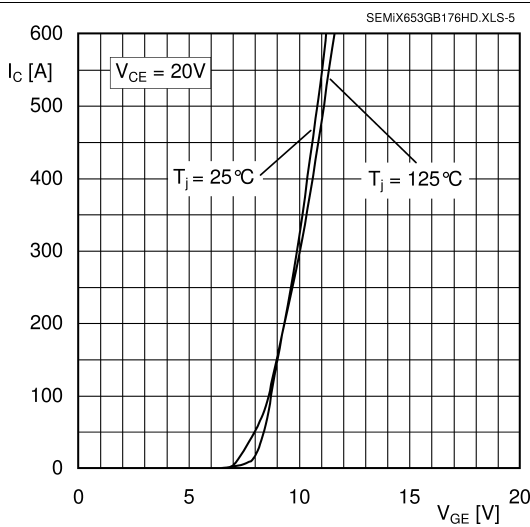


Fig. 5: Typ. transfer characteristic

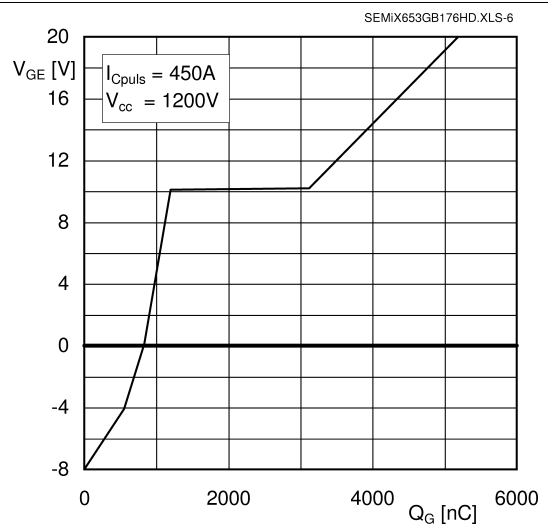


Fig. 6: Typ. gate charge characteristic

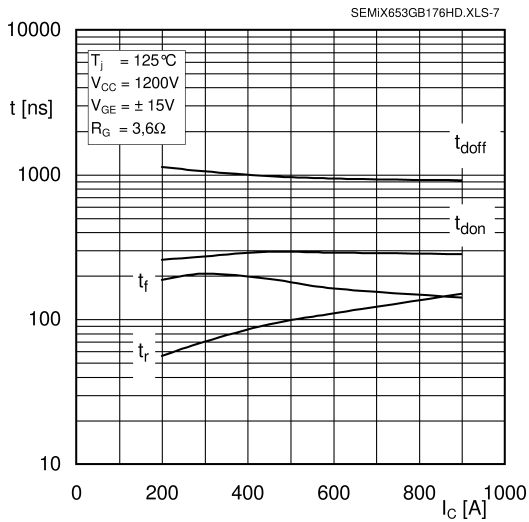


Fig. 7: Typ. switching times vs. I_C

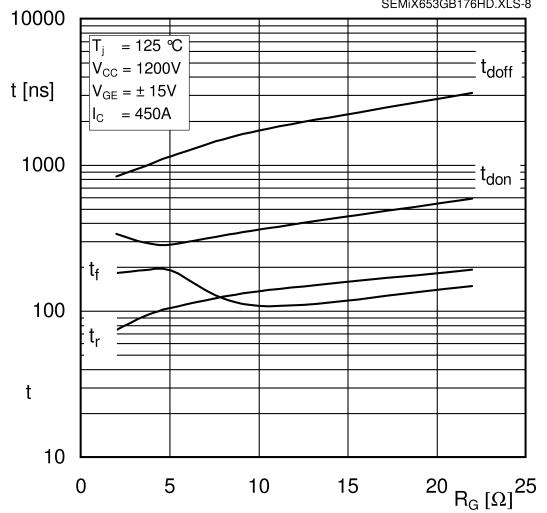


Fig. 8: Typ. switching times vs. gate resistor R_G

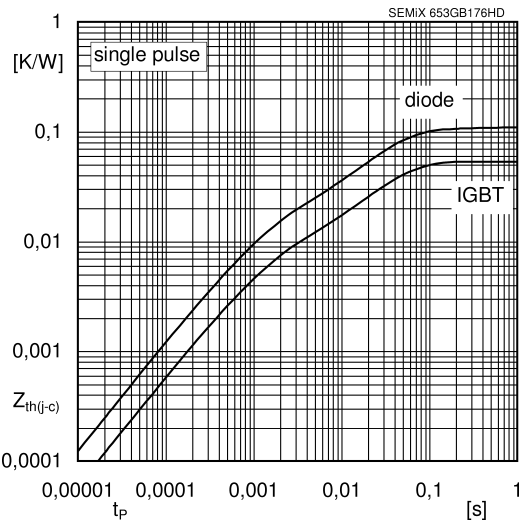


Fig. 9: Typ. transient thermal impedance

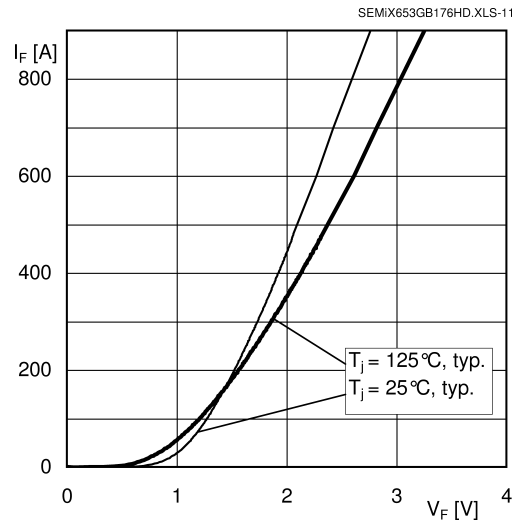


Fig. 10: Typ. CAL diode forward charact., incl. R_{CC+EE}

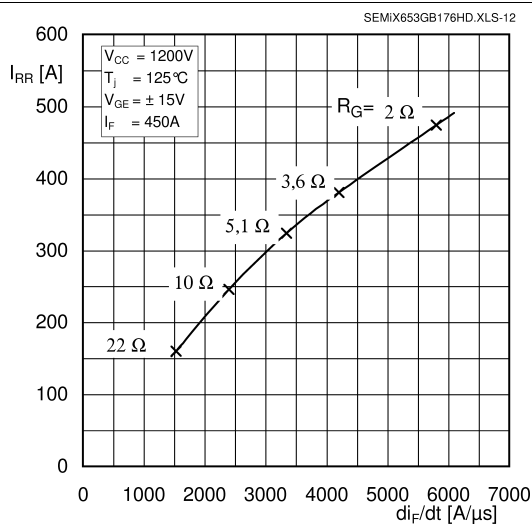


Fig. 11: Typ. CAL diode peak reverse recovery current

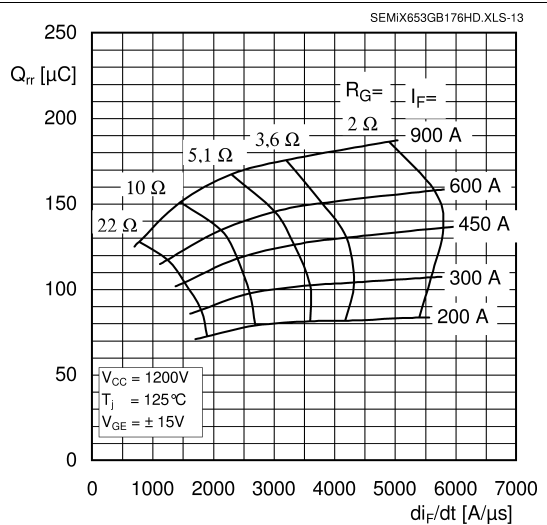
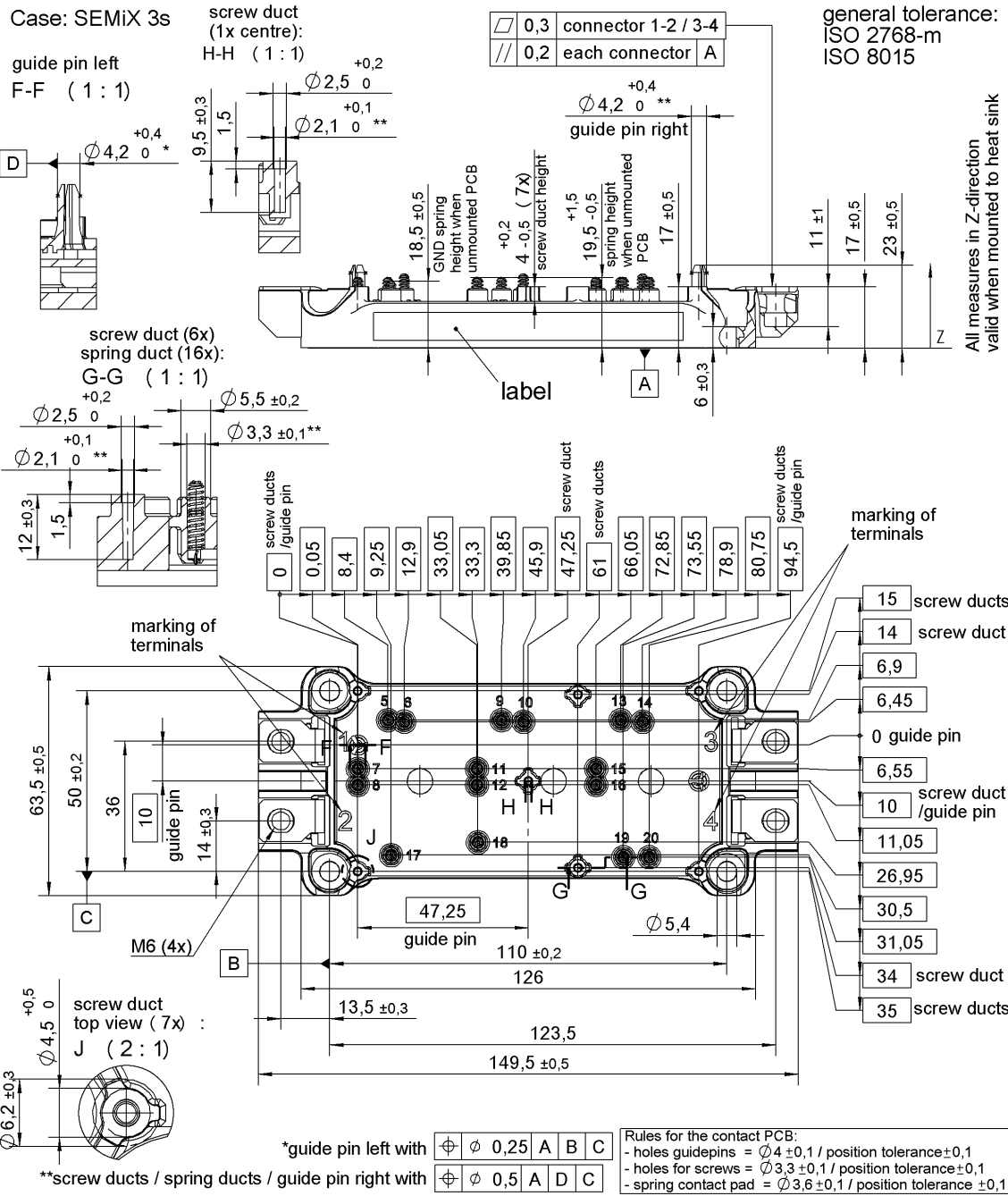
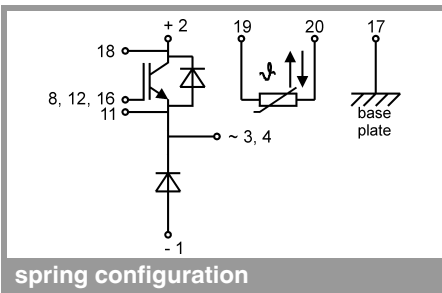


Fig. 12: Typ. CAL diode recovery charge

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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.