SEMiX® 4s

Trench IGBT Modules

SEMiX604GAL12E4s

Features

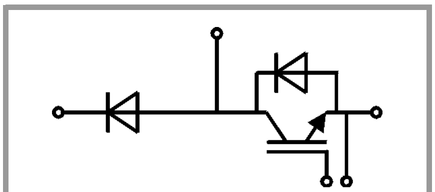
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognized, file no. E63532

Typical Applications*

- AC inverter drives
- UPS
- Electronic Welding

Remarks

- Case temperature limited to T_C=125°C max.
- Product reliability results are valid for T_j=150°C
- Dynamic values apply to the following combination of resistors:
  $R_{Gon,main}$ = 1,0 Ω
  $R_{Goff,main}$ = 6,2 Ω
  $R_{G,X}$ = 2,2 Ω
  $R_{E,X}$ = 0,5 Ω



GAL

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	916	A
		T_c = 80 °C	704	A
I_{Cnom}			600	A
I_{CRM}	I_{CRM} = 3xI_{Cnom}		1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 20 V V_{CES} ≤ 1200 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	T_j = 175 °C	T_c = 25 °C	707	A
		T_c = 80 °C	529	A
I_{Fnom}			600	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		1800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		3240	A
T_j			-40 ... 175	°C
Freewheeling diode				
I_F	T_j = 175 °C	T_c = 25 °C	707	A
		T_c = 80 °C	529	A
I_{Fnom}			600	A
I_{FRM}	I_{FRM} = 3xI_{Fnom}		1800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		3240	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C		600	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50Hz, t = 1 min		4000	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	I_C = 600 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.8	2.05	V
		T_j = 150 °C		2.2	2.4	V
V_{CE0}	chiplevel	T_j = 25 °C		0.8	0.9	V
		T_j = 150 °C		0.7	0.8	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.7	1.9	mΩ
		T_j = 150 °C		2.5	2.7	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 24 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V V_{CE} = 1200 V	T_j = 25 °C			5	mA
		T_j = 150 °C				mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		37.2		nF
C_{oes}		f = 1 MHz		2.32		nF
C_{res}		f = 1 MHz		2.04		nF
Q_G	V_{GE} = - 8 V...+ 15 V			3400		nC
R_{Gint}	T_j = 25 °C			1.25		Ω

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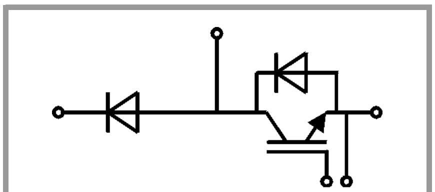


GAL

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
$t_{d(on)}$	V_{CC} = 600 V I_C = 600 A V_{GE} = ±15 V $R_{G\ on}$ = 1.7 Ω $R_{G\ off}$ = 6.9 Ω di/dt_{on} = 7100 A/µs di/dt_{off} = 6350 A/µs	T_j = 150 °C		374		ns
t_r		T_j = 150 °C		85		ns
E_{on}		T_j = 150 °C		35		mJ
$t_{d(off)}$		T_j = 150 °C		1277		ns
t_f		T_j = 150 °C		114		ns
E_{off}		T_j = 150 °C		110		mJ
$R_{th(j-c)}$	per IGBT				0.049	K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 600 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.1	2.46	V
		T_j = 150 °C		2.1	2.4	V
V_{F0}	chiplevel	T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F	chiplevel	T_j = 25 °C	1.1	1.4	1.6	mΩ
		T_j = 150 °C	1.7	1.9	2.1	mΩ
I_{RRM}	I_F = 600 A di/dt_{off} = 6000 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		430		A
Q_{rr}		T_j = 150 °C		100		µC
E_{rr}		T_j = 150 °C		44		mJ
$R_{th(j-c)}$	per diode				0.086	K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 600 A V_{GE} = 0 V chiplevel	T_j = 25 °C		2.1	2.46	V
		T_j = 150 °C		2.1	2.4	V
V_{F0}	chiplevel	T_j = 25 °C	1.1	1.3	1.5	V
		T_j = 150 °C	0.7	0.9	1.1	V
r_F	chiplevel	T_j = 25 °C	1.1	1.4	1.6	mΩ
		T_j = 150 °C	1.7	1.9	2.1	mΩ
I_{RRM}	I_F = 600 A di/dt_{off} = 6000 A/µs V_{GE} = -15 V V_{CC} = 600 V	T_j = 150 °C		430		A
Q_{rr}		T_j = 150 °C		100		µC
E_{rr}		T_j = 150 °C		44		mJ
$R_{th(j-c)}$	per diode				0.086	K/W
Module						
L_{CE}				22		nH
$R_{CC'+EE'}$	res., terminal-chip	T_C = 25 °C		0.7		mΩ
		T_C = 125 °C		1		mΩ
$R_{th(c-s)}$	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
Temperature Sensor						
R_{100}	T_c=100°C (R_{25}=5 kΩ)			493 ± 5%		Ω
$B_{100/125}$	$R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; T[K];			3550 ±2%		K

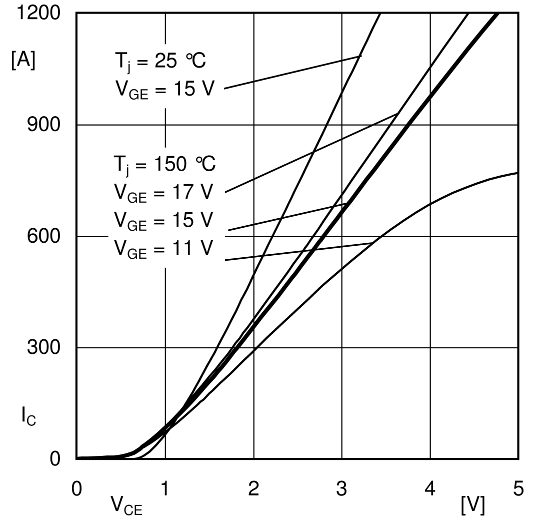


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

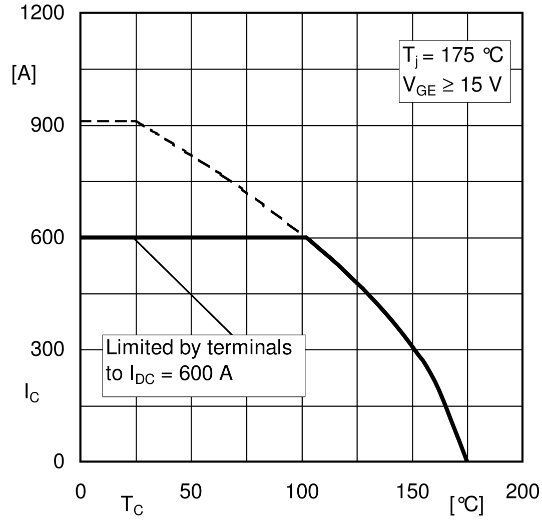


Fig. 2: Rated current vs. temperature $I_C = f (T_C)$

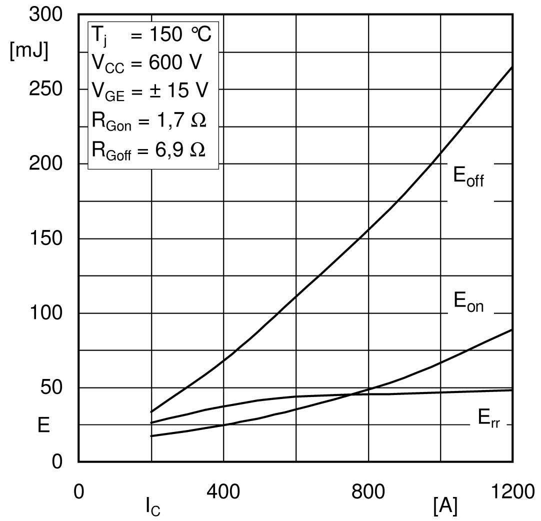


Fig. 3: Typ. turn-on /-off energy = f (I_C)

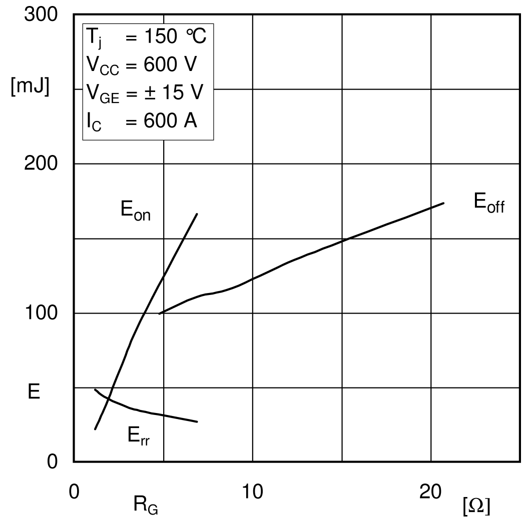


Fig. 4: Typ. turn-on /-off energy = f (R_G)

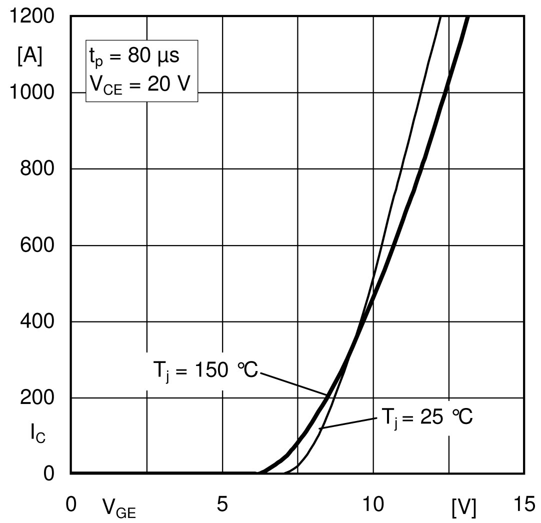


Fig. 5: Typ. transfer characteristic

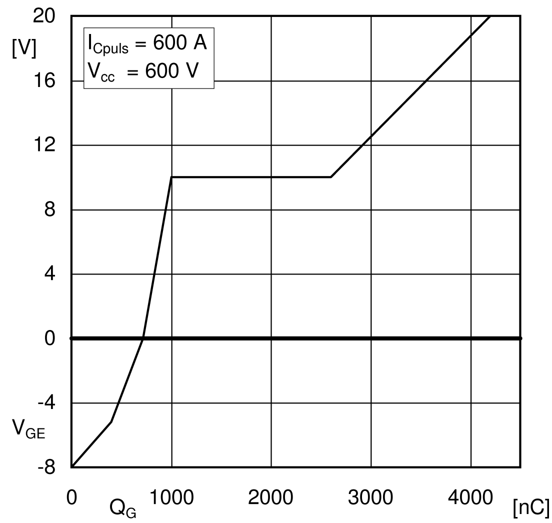


Fig. 6: Typ. gate charge characteristic

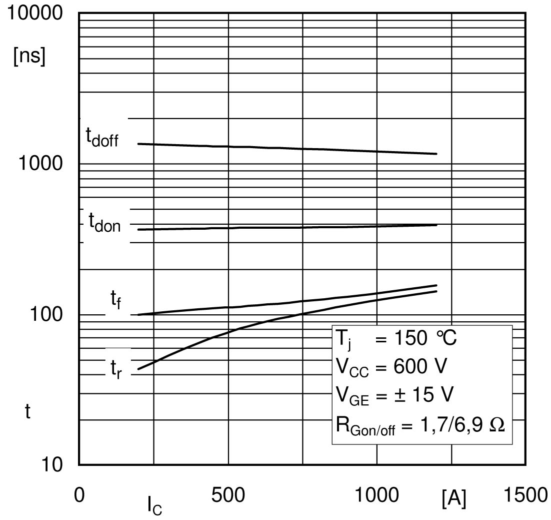


Fig. 7: Typ. switching times vs. I_C

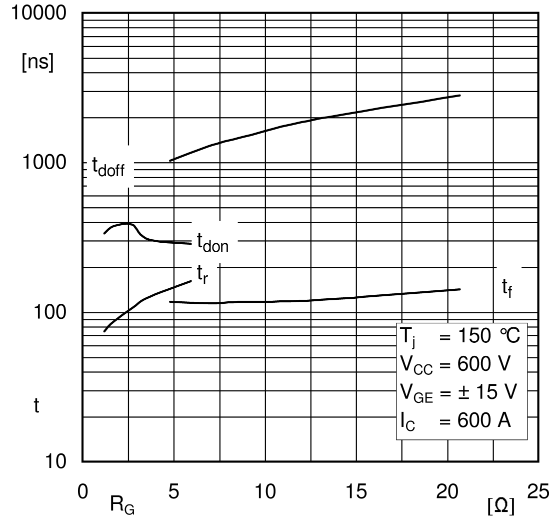


Fig. 8: Typ. switching times vs. gate resistor R_G

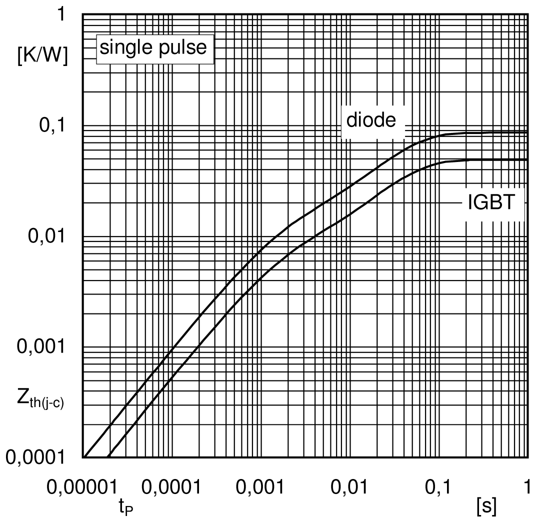


Fig. 9: Typ. transient thermal impedance

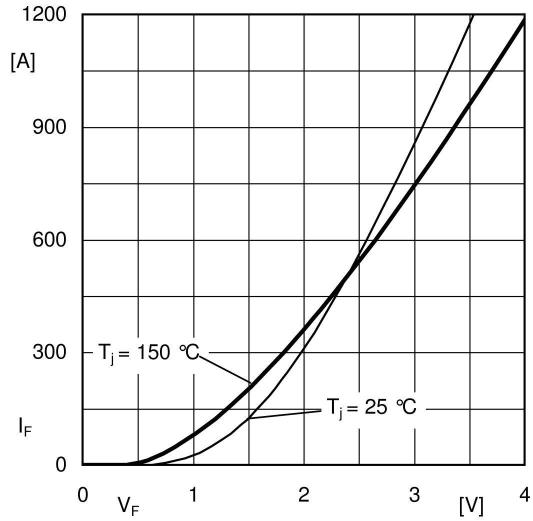


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

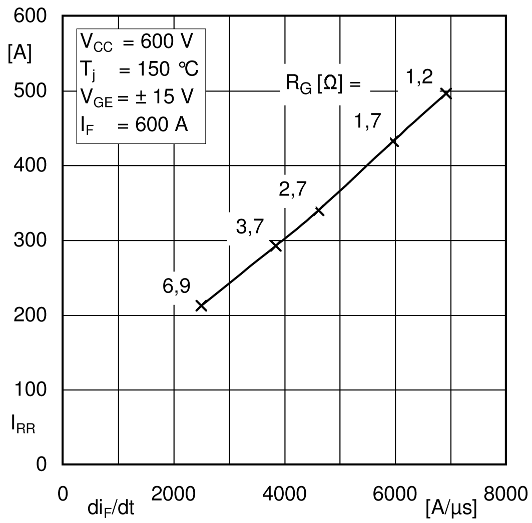


Fig. 11: Typ. CAL diode peak reverse recovery current

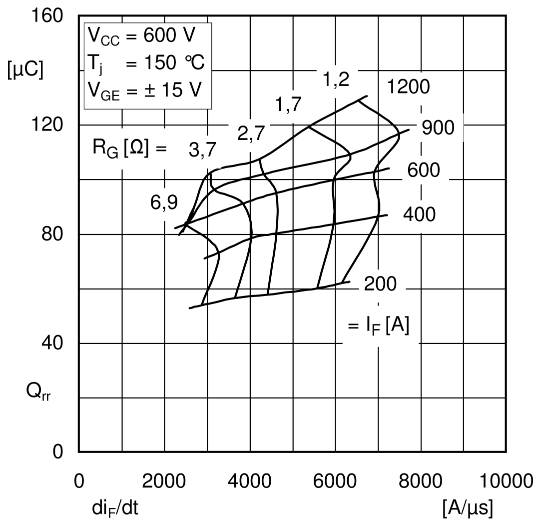
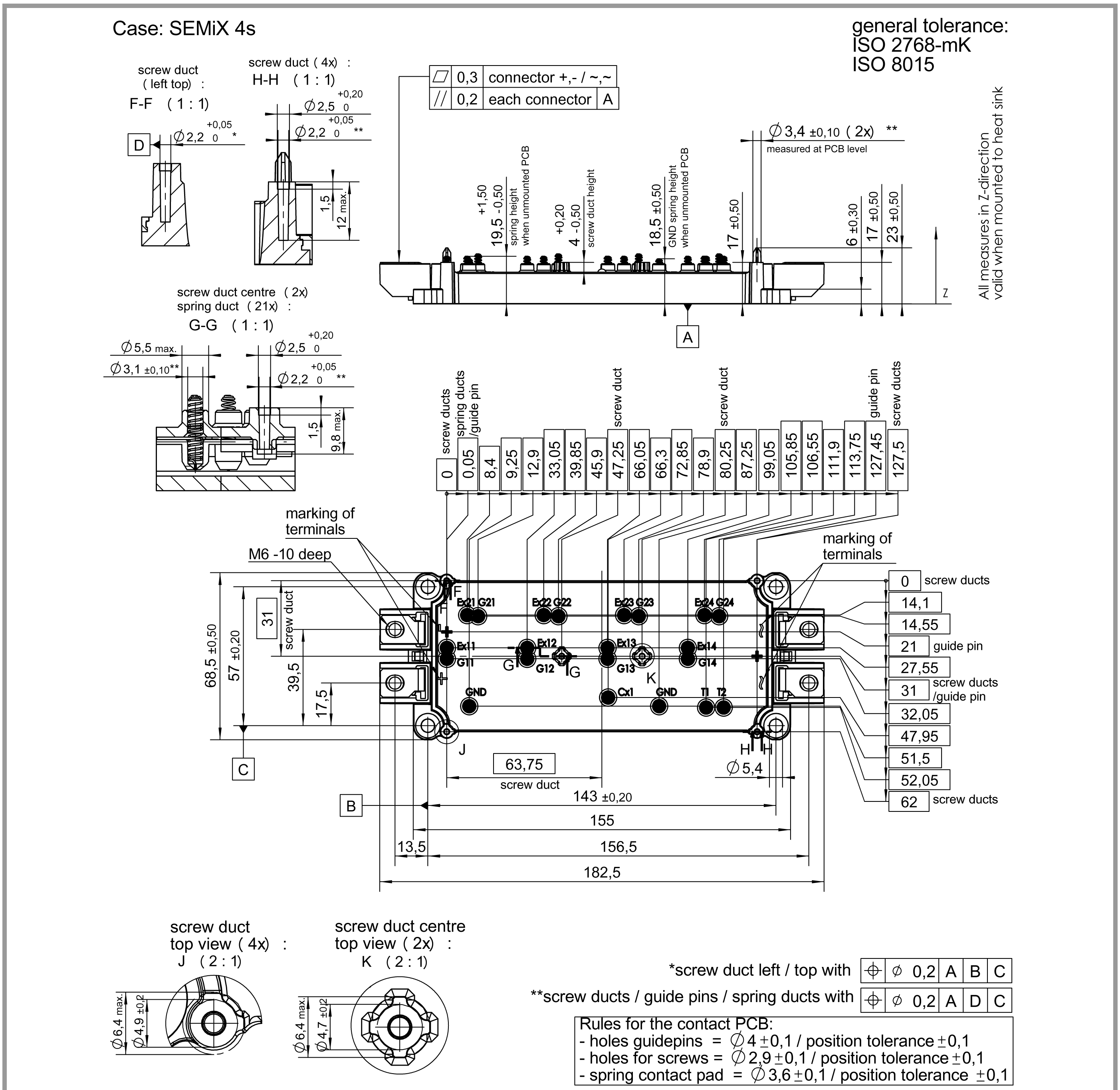


Fig. 12: Typ. CAL diode recovery charge



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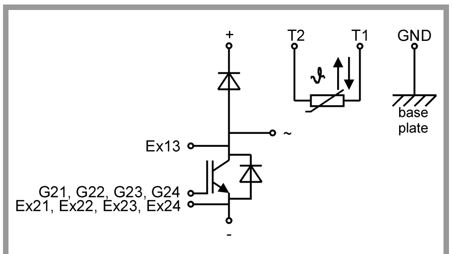

spring configuration

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.