SEMiX® 2s

Trench IGBT Modules

SEMiX402GAR066HDs

Features

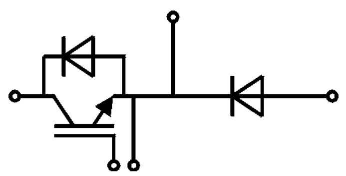
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- UL recognised file no. E63532

Typical Applications*

- Matrix Converter
- Resonant Inverter
- Current Source Inverter

Remarks

- Case temperature limited to T_C=125°C max.
- Product reliability results are valid for T_j=150°C
- For short circuit: Soft R_{Goff} recommended
- Take care of over-voltage caused by stray inductance



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Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
IGBT				
V_{CES}			600	V
I_C	T_j = 175 °C	T_c = 25 °C	502	A
		T_c = 80 °C	379	A
I_{Cnom}			400	A
I_{CRM}	I_{CRM} = 2xI_{Cnom}		800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 360 V V_{GE} ≤ 15 V V_{CES} ≤ 600 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	T_j = 175 °C	T_c = 25 °C	543	A
		T_c = 80 °C	397	A
I_{Fnom}			400	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		1800	A
T_j			-40 ... 175	°C
Freewheeling diode				
I_F	T_j = 175 °C	T_c = 25 °C	566	A
		T_c = 80 °C	412	A
I_{Fnom}			400	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		1800	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 = 400 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.45	1.85	V
		T_j = 150 °C		1.7	2.1	V
V_{CE0}		T_j = 25 °C		0.9	1	V
		T_j = 150 °C		0.85	0.9	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		1.4	2.1	mΩ
		T_j = 150 °C		2.1	3.0	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 6.4 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V V_{CE} = 600 V	T_j = 25 °C		0.15	0.45	mA
		T_j = 150 °C				mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		24.7		nF
C_{oes}		f = 1 MHz		1.54		nF
C_{res}		f = 1 MHz		0.73		nF
Q_G	V_{GE} = - 8 V...+ 15 V			3200		nC
R_{Gint}	T_j = 25 °C			1.00		Ω

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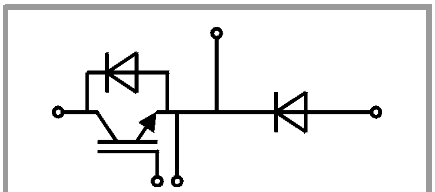

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
$t_{d(on)}$	V_{CC} = 300 V	T_j = 150 °C		150		ns
t_r	I_C = 400 A	T_j = 150 °C		125		ns
E_{on}	V_{GE} = ±15 V	T_j = 150 °C		22		mJ
$t_{d(off)}$	$R_{G\,on}$ = 4.5 Ω	T_j = 150 °C		900		ns
t_f	$R_{G\,off}$ = 4.5 Ω	T_j = 150 °C		65		ns
E_{off}		T_j = 150 °C		24		mJ
$R_{th(j-c)}$	per IGBT				0.12	K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 400 A	T_j = 25 °C		1.4	1.60	V
	V_{GE} = 0 V chip	T_j = 150 °C		1.4	1.6	V
V_{F0}		T_j = 25 °C	0.9	1	1.1	V
		T_j = 150 °C	0.75	0.85	0.95	V
r_F		T_j = 25 °C	0.8	1.0	1.3	mΩ
		T_j = 150 °C	1.1	1.4	1.6	mΩ
I_{RRM}	I_F = 400 A	T_j = 150 °C		250		A
Q_{rr}	di/dt_{off} = 3700 A/µs	T_j = 150 °C		47		µC
E_{rr}	V_{GE} = -8 V V_{CC} = 300 V	T_j = 150 °C		10		mJ
$R_{th(j-c)}$	per diode				0.15	K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 400 A	T_j = 25 °C		1.3	1.53	V
	V_{GE} = 0 V chip	T_j = 150 °C		1.3	1.5	V
V_{F0}		T_j = 25 °C	0.9	1	1.1	V
		T_j = 150 °C	0.75	0.85	0.95	V
r_F		T_j = 25 °C	0.7	0.9	1.1	mΩ
		T_j = 150 °C	1.0	1.2	1.4	mΩ
I_{RRM}	I_F = 400 A	T_j = 150 °C		250		A
Q_{rr}	di/dt_{off} = 3700 A/µs	T_j = 150 °C		47		µC
E_{rr}	V_{GE} = -8 V V_{CC} = 300 V	T_j = 150 °C		10		mJ
$R_{th(j-c)}$	per diode				0.15	K/W
Module						
L_{CE}				18		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			0.045		K/W
M_s	to heat sink (M5)		3		5	Nm
M_t		to terminals (M6)	2.5		5	Nm
						Nm
w					250	g
Temperatur 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

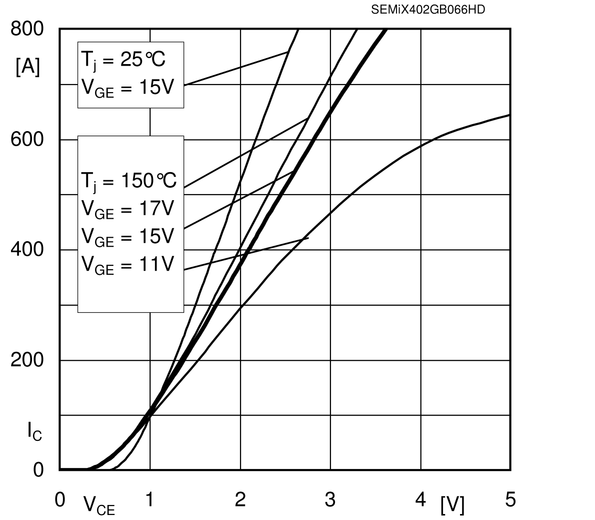


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+ EE'}$

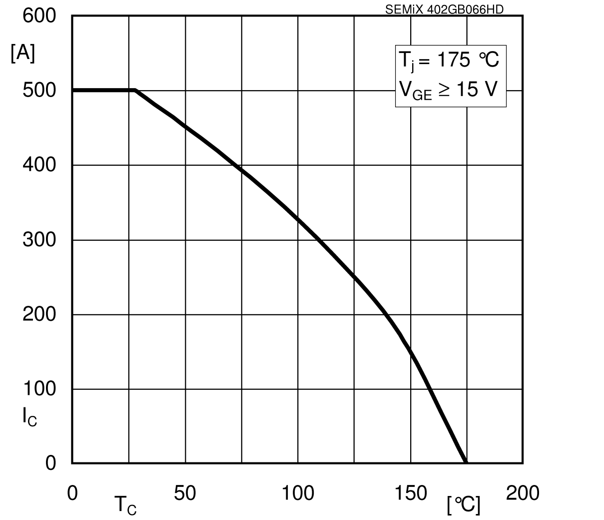


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

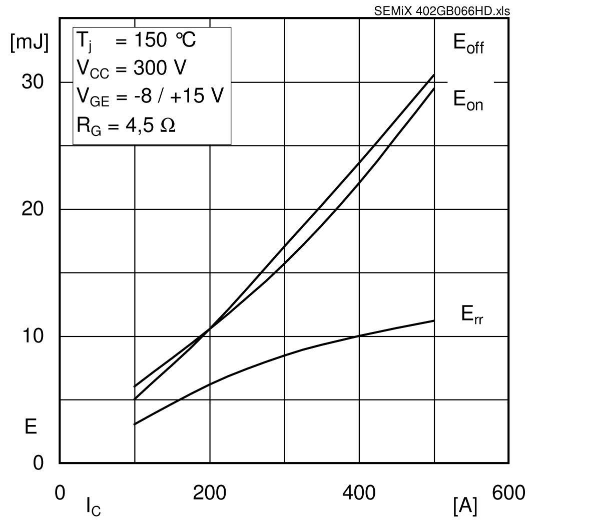


Fig. 3: Typ. turn-on /-off energy = f (I_C)

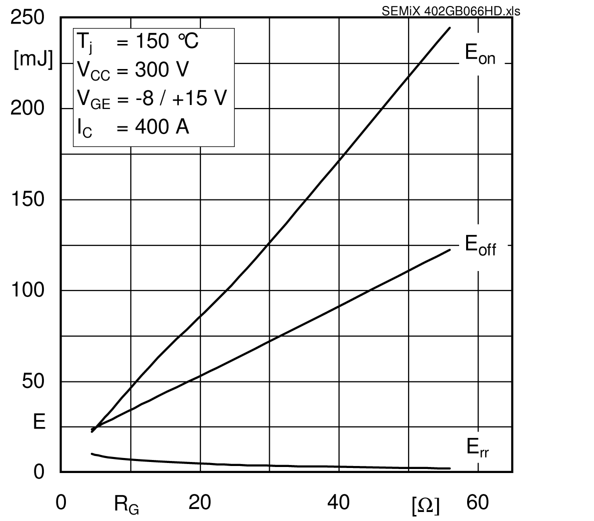


Fig. 4: Typ. turn-on /-off energy = f (R_G)

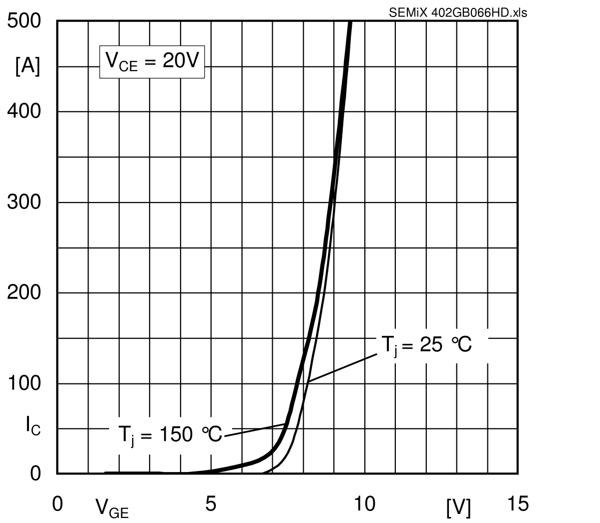


Fig. 5: Typ. transfer characteristic

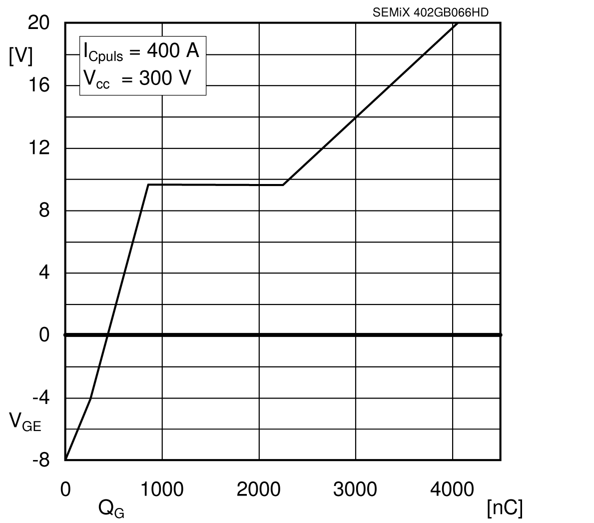


Fig. 6: Typ. gate charge characteristic

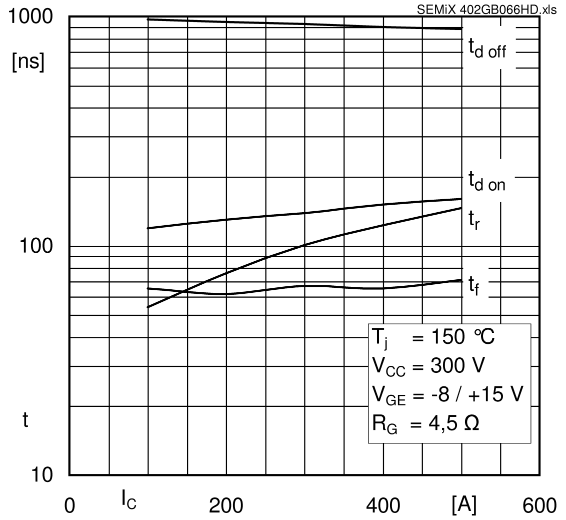


Fig. 7: Typ. switching times vs. I_C

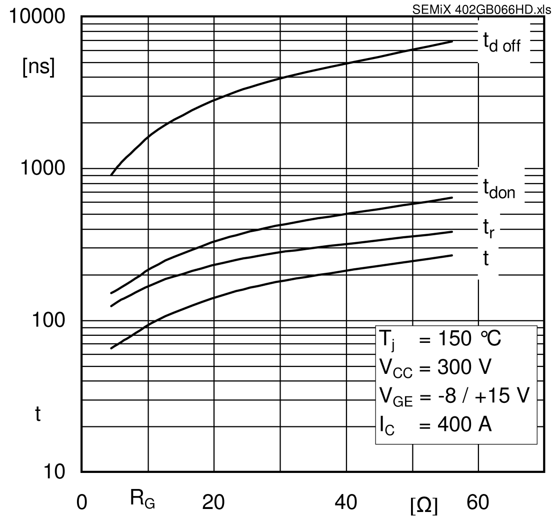


Fig. 8: Typ. switching times vs. gate resistor R_G

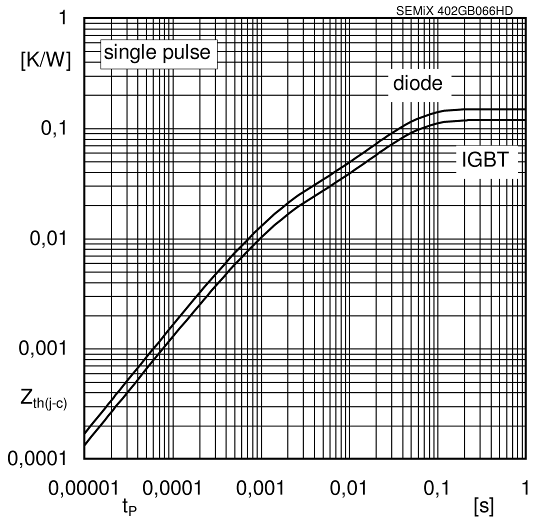


Fig. 9: Typ. transient thermal impedance

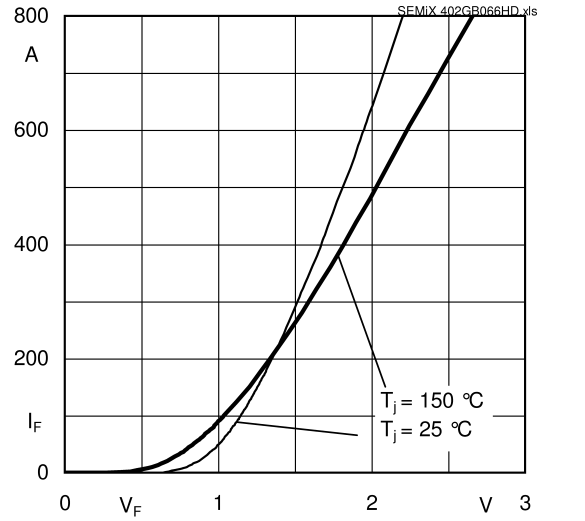


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

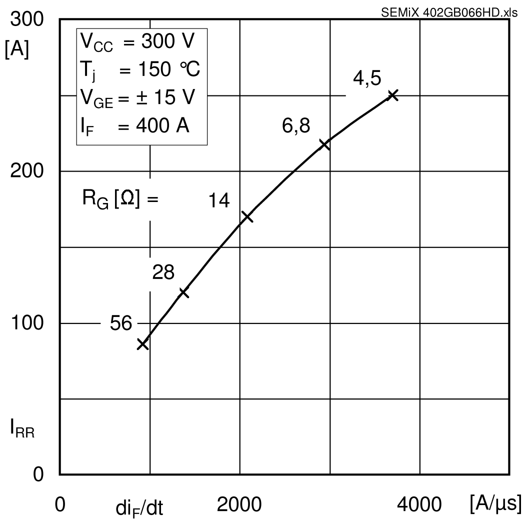


Fig. 11: Typ. CAL diode peak reverse recovery current

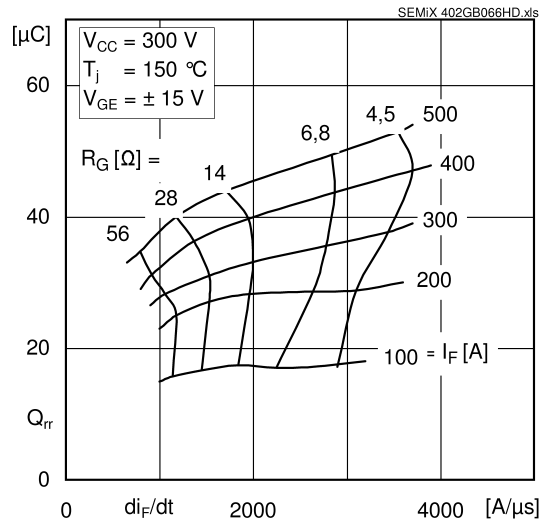
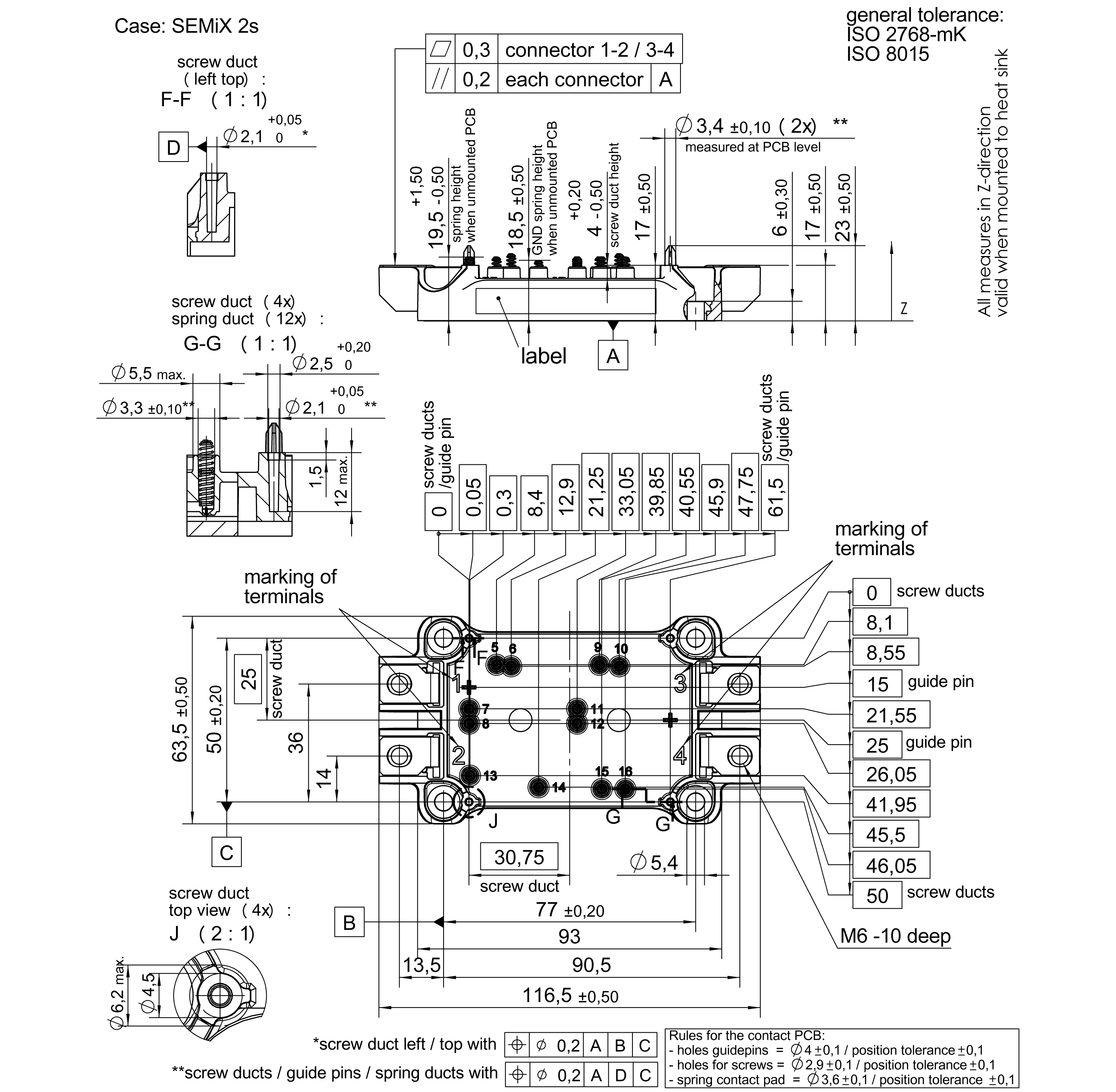


Fig. 12: Typ. CAL diode recovery charge



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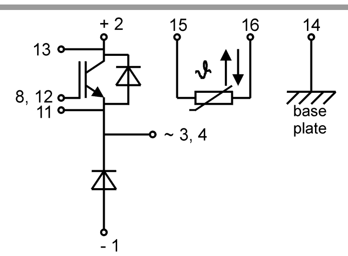

spring configuration

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.