MiniSKiiP® 2

3-phase bridge rectifier + brake chopper + 3-phase bridge inverter

SKiiP 24NAB176V1

Features

- Trench IGBTs
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

Remarks

- Max. case temperature limited to T_C=125°C
- Product reliability results valid for T_j≤125°C (recommended $T_{j,op}$=-40...+125°C)
- $I_{t(RMS)}$ limited to 20A for +B, B, -B, -DC/U, -DC/V, -DC/W power connectors
- The distance between terminals of temperature sensor and –DC/W is not sufficient for basic insulation
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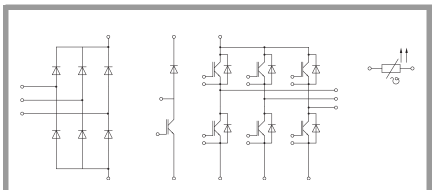

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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	T_j = 125 °C	T_s = 25 °C	33	A
		T_s = 70 °C	23	A
I_C	T_j = 150 °C	T_s = 25 °C	38	A
		T_s = 70 °C	29	A
I_{Cnom}			29	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		58	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 1200 V V_{GE} ≤ 20 V V_{CES} ≤ 1700 V	T_j = 125 °C	10	µs
T_j			-55 ... 150	°C
Chopper - IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	T_j = 125 °C	T_s = 25 °C	33	A
		T_s = 70 °C	23	A
I_C	T_j = 150 °C	T_s = 25 °C	38	A
		T_s = 70 °C	29	A
I_{Cnom}			29	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		58	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 1200 V V_{GE} ≤ 20 V V_{CES} ≤ 1700 V	T_j = 125 °C	10	µs
T_j			-55 ... 150	°C
Inverse - Diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	T_j = 125 °C	T_s = 25 °C	37	A
		T_s = 70 °C	24	A
I_F	T_j = 175 °C	T_s = 25 °C	48	A
		T_s = 70 °C	38	A
I_{Fnom}			40	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		80	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		280	A
T_j			-40 ... 175	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	T_j = 125 °C	T_s = 25 °C	37	A
		T_s = 70 °C	24	A
I_F	T_j = 175 °C	T_s = 25 °C	48	A
		T_s = 70 °C	38	A
I_{Fnom}			40	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		80	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		280	A
T_j			-40 ... 175	°C

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- The distance between terminals of temperature sensor and –DC/W is not sufficient for basic insulation
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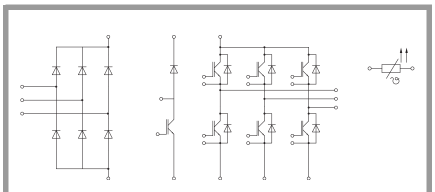

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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1800	V
I_F	T_s = 25 °C, T_j = 150 °C		59	A
I_{Fnom}	DC current		41	A
I_{FSM}	10 ms sin 180°	T_j = 25 °C	370	A
		T_j = 150 °C	270	A
I^2t	10 ms sin 180°	T_j = 25 °C	685	A^2s
		T_j = 150 °C	365	A^2s
T_j			-40 ... 150	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C, 20 A per spring		40	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, 1 min		2500	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$V_{CE(sat)}$	I_C = 29 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		2.00	2.45	V
		T_j = 125 °C		2.45	2.90	V
V_{CE0}	chiplevel	T_j = 25 °C		1	1.2	V
		T_j = 125 °C		0.9	1.1	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		34	43	mΩ
		T_j = 125 °C		53	62	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE} V, I_C = 1.2 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1700 V	T_j = 25 °C		0.1	0.3	mA
						mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		2.50		nF
C_{oes}		f = 1 MHz		0.11		nF
C_{res}		f = 1 MHz		0.08		nF
Q_G	- 8 V...+ 15 V			240		nC
R_{Gint}	T_j = 25 °C			32		Ω
$t_{d(on)}$	V_{CC} = 900 V	T_j = 125 °C		290		ns
t_r	I_C = 20 A	T_j = 125 °C		40		ns
E_{on}	$R_{G\ on}$ = 1 Ω	T_j = 125 °C		5.1		mJ
$t_{d(off)}$	$R_{G\ off}$ = 1 Ω, di/dt_{on} = 580 A/µs	T_j = 125 °C		690		ns
t_f	di/dt_{off} = 120 A/µs	T_j = 125 °C		120		ns
E_{off}	du/dt = 4000 V/µs, V_{GE} = +15/-15 V, L_s = 47 nH	T_j = 125 °C		6.3		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/K*m			0.91		K/W
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 29 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		2.00	2.45	V
		T_j = 125 °C		2.45	2.90	V
V_{CE0}	chiplevel	T_j = 25 °C		1	1.2	V
		T_j = 125 °C		0.9	1.1	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		34	43	mΩ
		T_j = 125 °C		53	62	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE} V, I_C = 1.2 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1700 V	T_j = 25 °C		0.1	0.3	mA
		T_j = 125 °C				mA
Q_G	- 8 V...+ 15 V			240		nC
R_{Gint}	T_j = 25 °C			32		Ω

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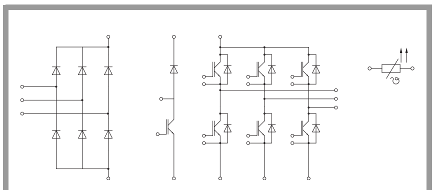

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Chopper - IGBT						
$t_{d(on)}$	V_{CC} = 900 V	T_j = 125 °C		290		ns
t_r	I_C = 20 A	T_j = 125 °C		40		ns
E_{on}	$R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω	T_j = 125 °C		5.1		mJ
$t_{d(off)}$	di/dt_{on} = 580 A/µs	T_j = 125 °C		690		ns
t_f	di/dt_{off} = 120 A/µs	T_j = 125 °C		120		ns
E_{off}	du/dt = 4000 V/µs V_{GE} = +15/-15 V L_s = 47 nH	T_j = 125 °C		6.3		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/K*m			0.91		K/W
Inverse - Diode						
$V_F = V_{EC}$	I_F = 40 A	T_j = 25 °C		2	2.4	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		2.1	2.6	V
V_{F0}	chiplevel	T_j = 25 °C		1.3	1.6	V
		T_j = 150 °C		1.1	1.2	V
r_F	chiplevel	T_j = 25 °C		17	20	mΩ
		T_j = 150 °C		27	33	mΩ
I_{RRM}	I_F = 20 A	T_j = 125 °C		32.7		A
Q_{rr}	di/dt_{off} = 620 A/µs	T_j = 125 °C		8.7		µC
E_{rr}	V_{GE} = -15 V V_{CC} = 900 V	T_j = 125 °C		4.9		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/K*m			1.14		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 40 A	T_j = 25 °C		2	2.4	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		2.1	2.6	V
V_{F0}	chiplevel	T_j = 25 °C		1.3	1.6	V
		T_j = 150 °C		1.1	1.2	V
r_F	chiplevel	T_j = 25 °C		17	20	mΩ
		T_j = 150 °C		27	33	mΩ
I_{RRM}	I_F = 20 A	T_j = 125 °C		32.7		A
Q_{rr}	di/dt_{off} = 620 A/µs	T_j = 125 °C		8.7		µC
E_{rr}	V_{GE} = -15 V V_{CC} = 900 V	T_j = 125 °C		4.9		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/K*m			1.14		K/W
Rectifier - Diode						
$V_F = V_{EC}$	I_F = 41 A	T_j = 25 °C		1.2	1.5	V
	V_{GE} = 0 V chiplevel	T_j = 125 °C		1.2	1.4	V
V_{F0}	chiplevel	T_j = 25 °C	0.6	0.9	1.1	V
		T_j = 125 °C		0.7	1	V
r_F	chiplevel	T_j = 25 °C		7.9	8.7	mΩ
		T_j = 125 °C		10	11	mΩ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/K*m			1.32		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w				55		g
L_{CE}				31		nH
Temperature Sensor						
R_{100}	T_r = 100 °C, tolerance = 3 %			1670 ± 3%		Ω
R(T)	R(T)=1000Ω[1+A(T-25°C)+B(T-25°C)^2], A = 7.635*10^{-3} °C^{-1}, B = 1.731*10^{-5} °C^{-2}					

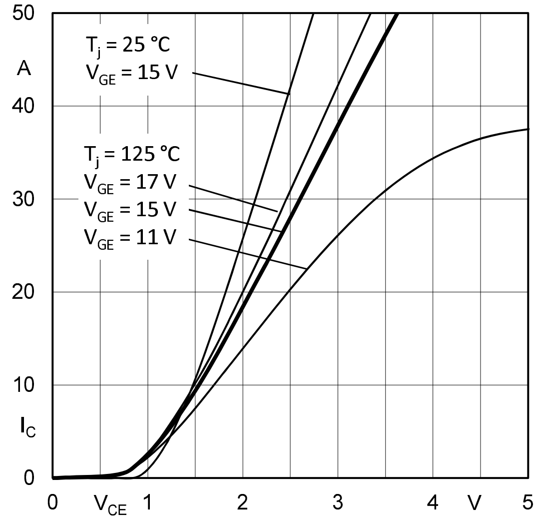


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

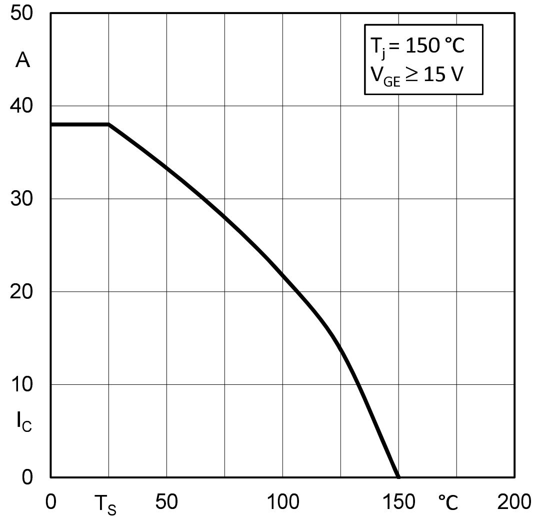


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

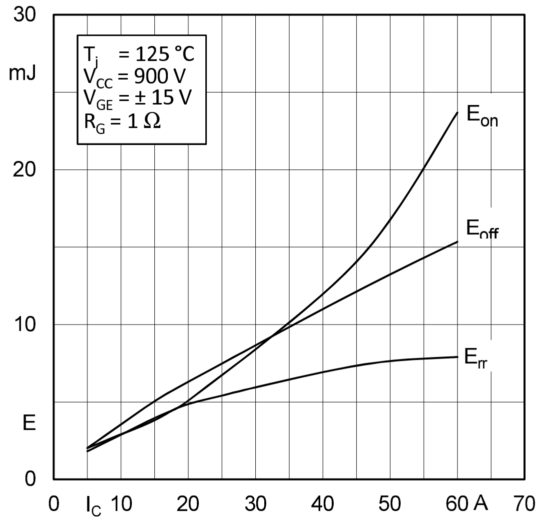


Fig. 3: Typ. turn-on /-off energy = f (I_C)

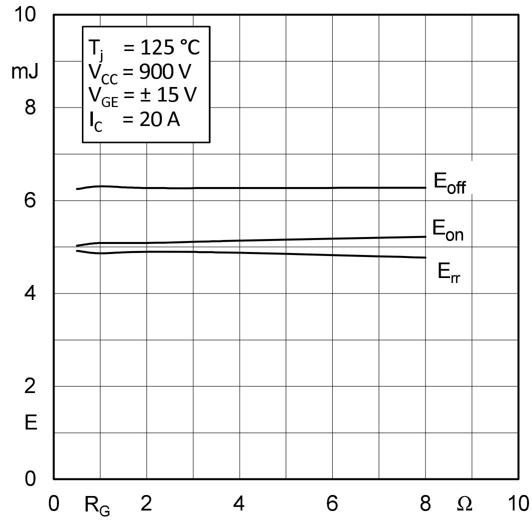


Fig. 4: Typ. turn-on /-off energy = f (R_G)

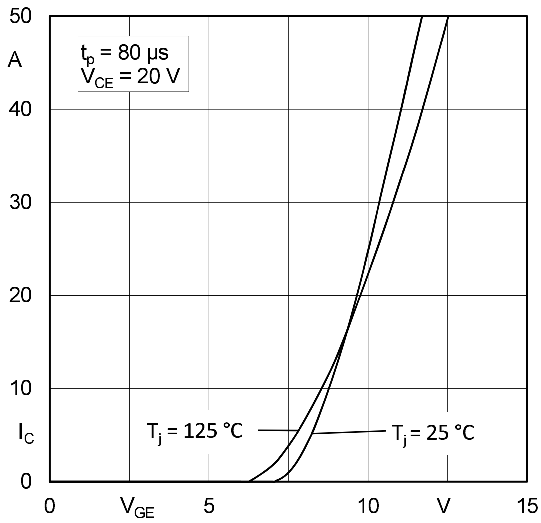


Fig. 5: Typ. transfer characteristic

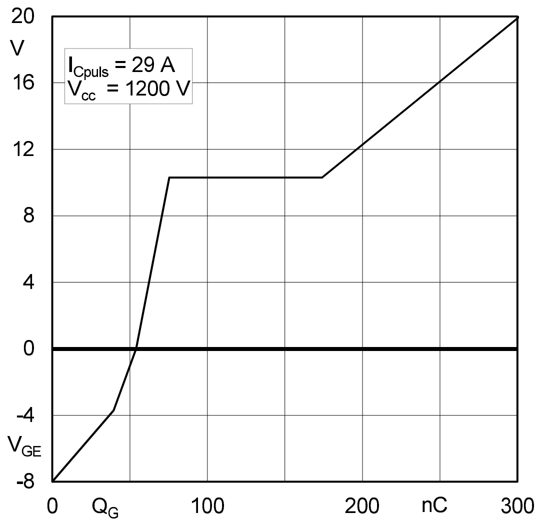


Fig. 6: Typ. gate charge characteristic

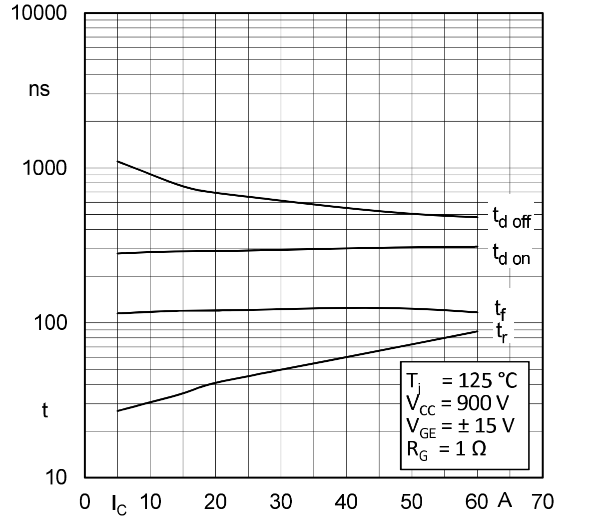


Fig. 7: Typ. switching times vs. I_C

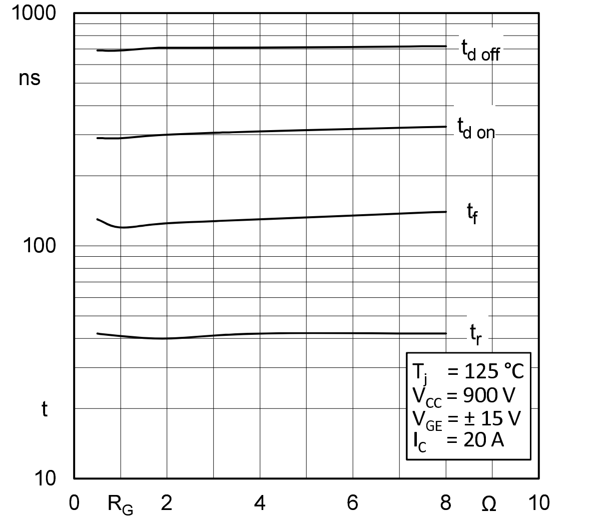


Fig. 8: Typ. switching times vs. gate resistor R_G

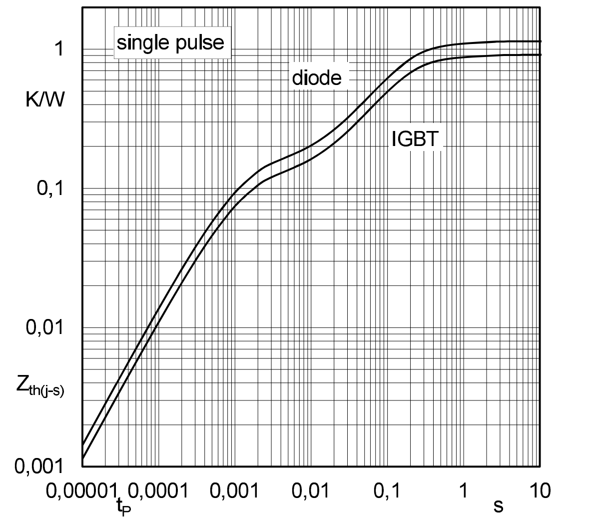


Fig. 9: Transient thermal impedance of IGBT and Diode

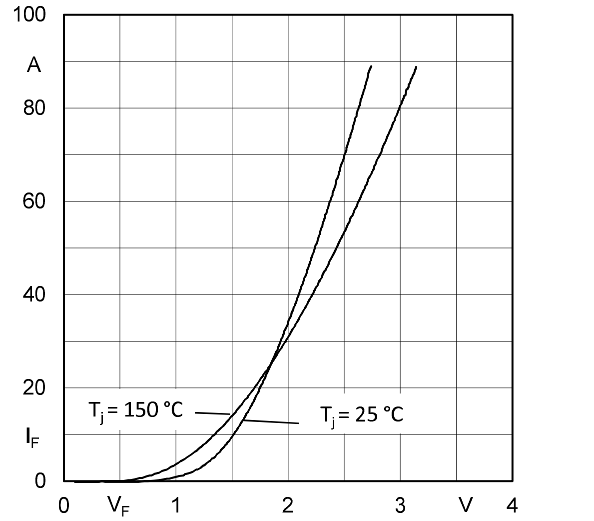


Fig. 10: CAL diode forward characteristic

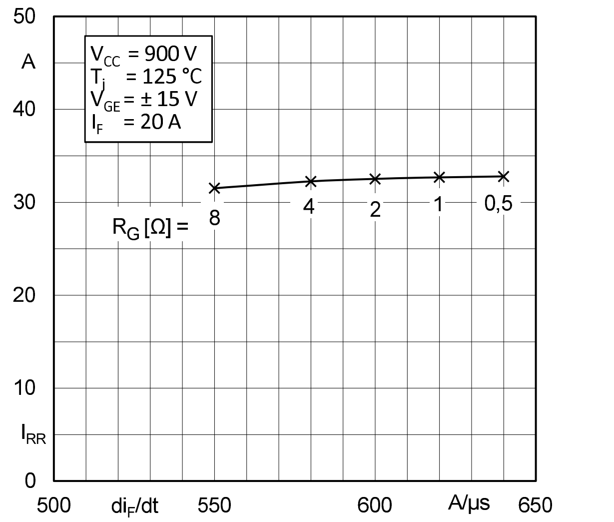


Fig. 11: Typ. CAL diode peak reverse recovery current

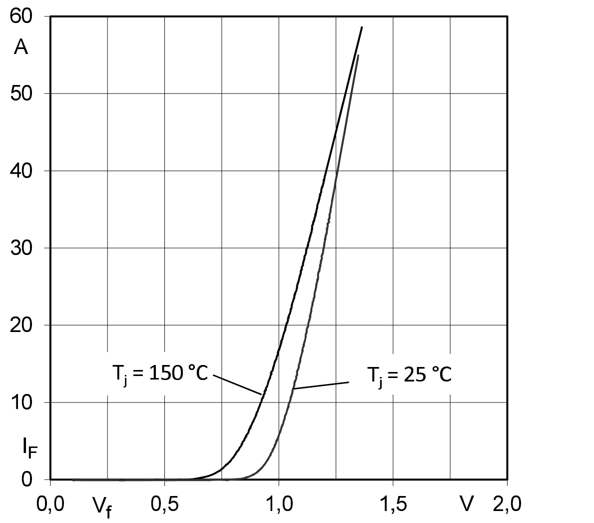
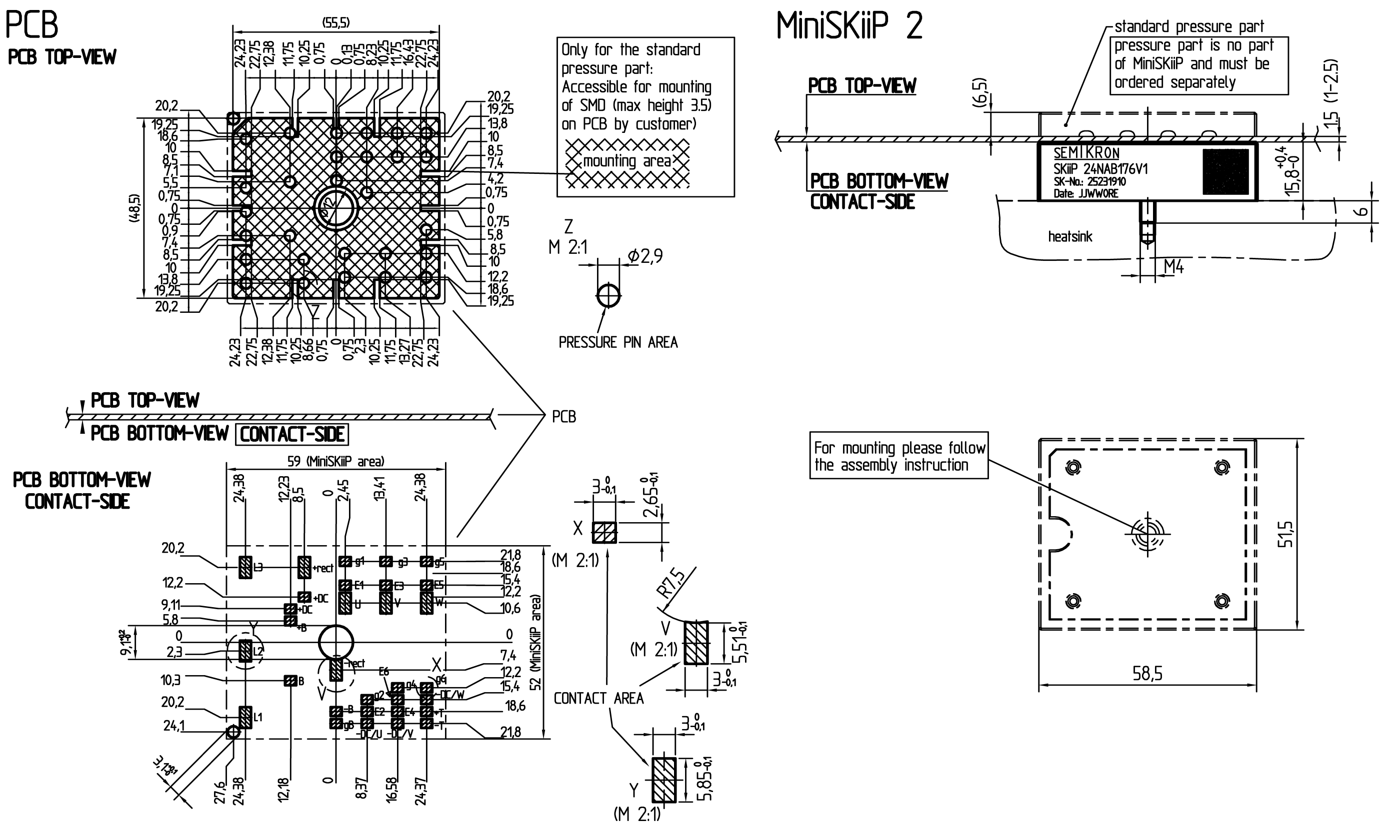
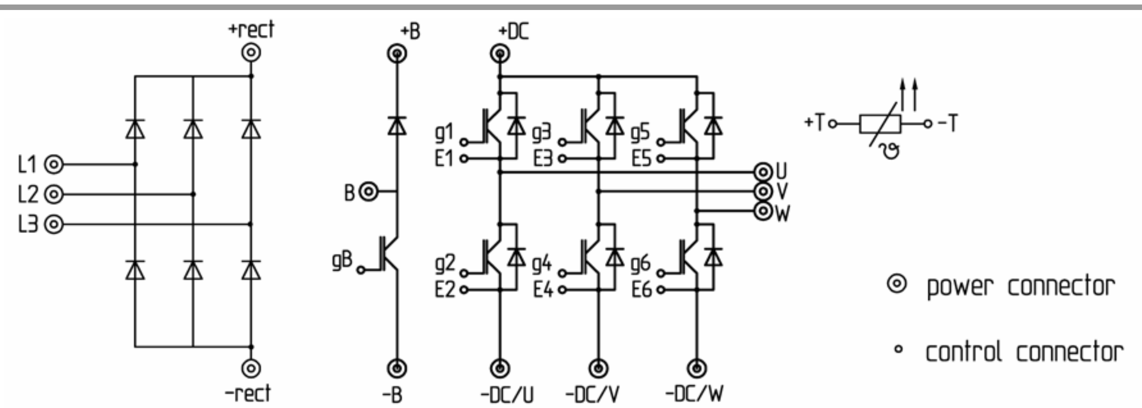


Fig. 12: Typ. input bridge forward characteristic



pinout, dimensions



pinout

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.

