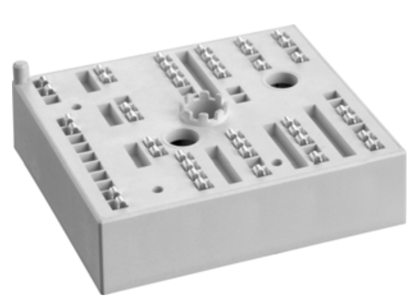

MiniSKiiP® 2

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

SKiiP 24NAB176V1

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- Trench IGBTs
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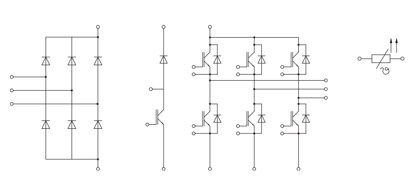
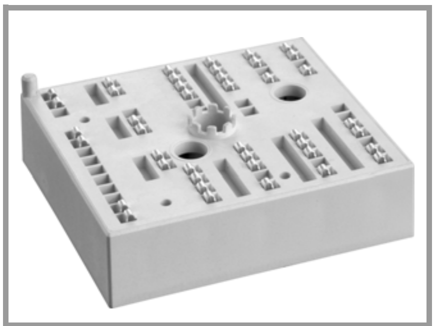


NAB

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 150 °C	T_s = 25 °C	38	A
		T_s = 70 °C	29	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	43	A
		T_s = 70 °C	33	A
I_{Cnom}			29	A
I_{CRM}			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	λ_{paste}=0.8 W/(mK) T_j = 150 °C	T_s = 25 °C	38	A
		T_s = 70 °C	29	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	43	A
		T_s = 70 °C	33	A
I_{Cnom}			29	A
I_{CRM}			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	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	48	A
		T_s = 70 °C	38	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	54	A
		T_s = 70 °C	43	A
I_{FRM}			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	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	48	A
		T_s = 70 °C	38	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	54	A
		T_s = 70 °C	43	A
I_{FRM}			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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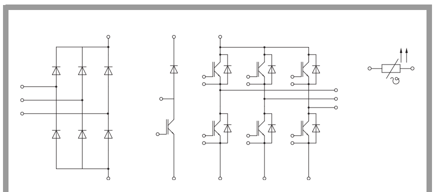
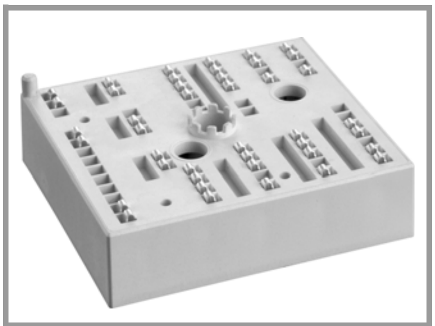


NAB

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1800	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	59	A
	T_j = 150 °C	T_s = 70 °C	42	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	66	A
	T_j = 150 °C	T_s = 70 °C	48	A
I_{FSM}	t_p = 10 ms	T_j = 25 °C	370	A
	sin 180°	T_j = 150 °C	270	A
i^2t	t_p = 10 ms	T_j = 25 °C	685	A^2s
	sin 180°	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}	module without TIM		-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	T_j = 25 °C		2.00	2.45	V
	V_{GE} = 15 V chiplevel	T_j = 125 °C		2.45	2.90	V
V_{CE0}	chiplevel	T_j = 25 °C		1.00	1.20	V
		T_j = 125 °C		0.90	1.10	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		34	43	mΩ
	chiplevel	T_j = 125 °C		53	62	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, 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				0.3	mA
C_{ies}	V_{CE} = 25 V	f = 1 MHz		2.50		nF
C_{oes}	V_{GE} = 0 V	f = 1 MHz		0.11		nF
C_{res}		f = 1 MHz		0.08		nF
Q_G	V_{GE} = - 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 $R_{G\,off}$ = 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}	dv/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/(mK)			0.91		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.73		K/W



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SKiiP 24NAB176V1

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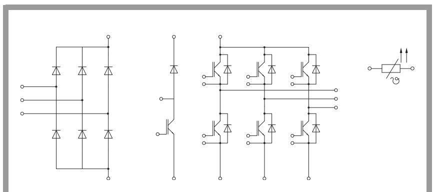
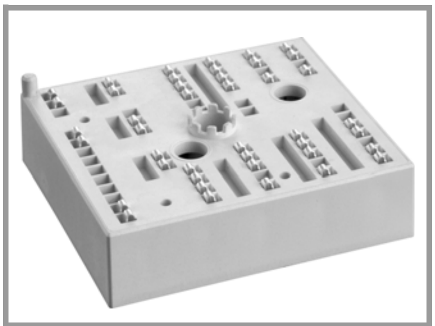


NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
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		1.00	1.20	V
		T_j = 125 °C		0.90	1.10	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}, 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				0.3	mA
Q_G	V_{GE} = - 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, $R_{G\ off}$ = 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}	dv/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/(mK)			0.91		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.73		K/W
Inverse - Diode						
$V_F = V_{EC}$	I_F = 40 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.00	2.38	V
		T_j = 150 °C		2.14	2.56	V
V_{F0}	chiplevel	T_j = 25 °C		1.32	1.56	V
		T_j = 150 °C		1.08	1.22	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, V_{GE} = -15 V	T_j = 125 °C		8.7		µC
E_{rr}	V_{CC} = 900 V	T_j = 125 °C		4.9		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.14		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.95		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 40 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.00	2.38	V
		T_j = 150 °C		2.14	2.56	V
V_{F0}	chiplevel	T_j = 25 °C		1.32	1.56	V
		T_j = 150 °C		1.08	1.22	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, V_{GE} = -15 V	T_j = 125 °C		8.7		µC
E_{rr}	V_{CC} = 900 V	T_j = 125 °C		4.9		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.14		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.95		K/W



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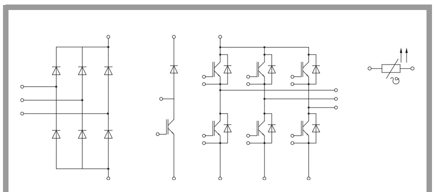


NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Rectifier - Diode						
$V_F = V_{EC}$	I_F = 41 A chiplevel	T_j = 25 °C		1.19	1.45	V
		T_j = 125 °C		1.17	1.42	V
V_{F0}	chiplevel	T_j = 25 °C	0.6	0.87	1.10	V
		T_j = 125 °C		0.75	0.97	V
r_F	chiplevel	T_j = 25 °C		7.9	8.7	mΩ
		T_j = 125 °C		10	11	mΩ
I_R	T_j = 145 °C, V_{RRM}				1.1	mA
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.32		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.12		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 (R_{25}=1000Ω)			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}					

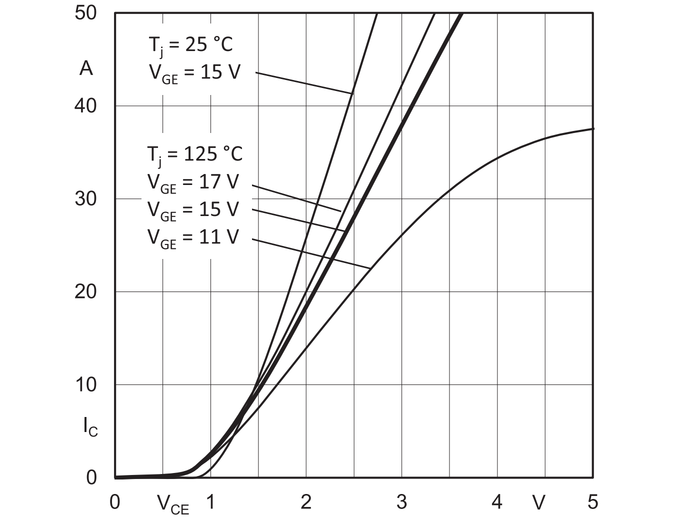


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+ EE'}$

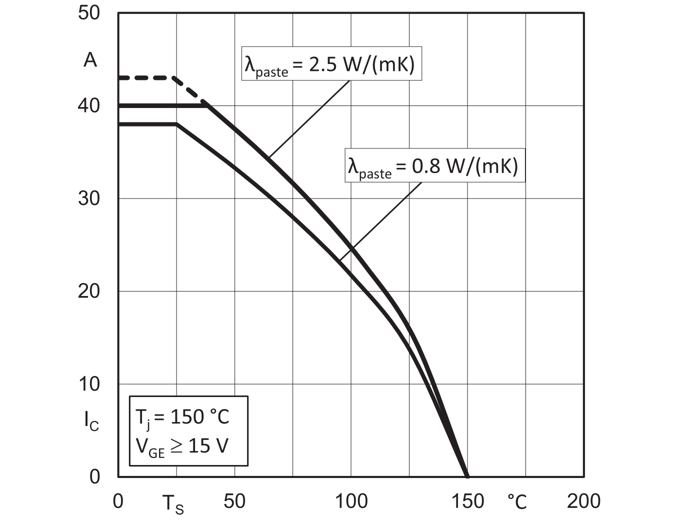


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

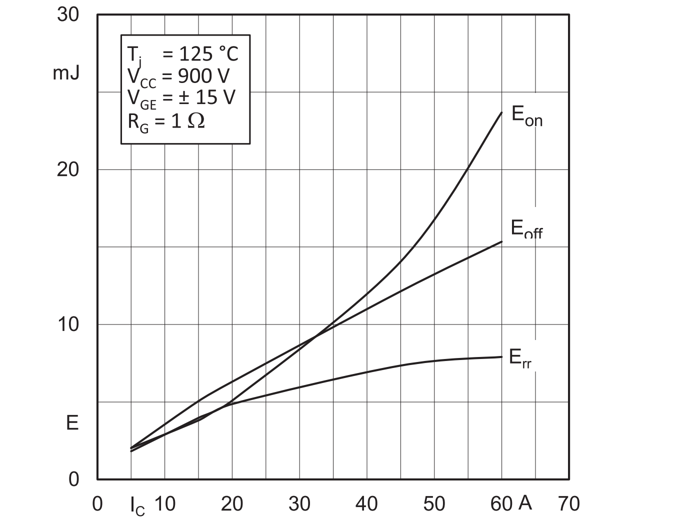


Fig. 3: Typ. turn-on /-off energy = f (I_C)

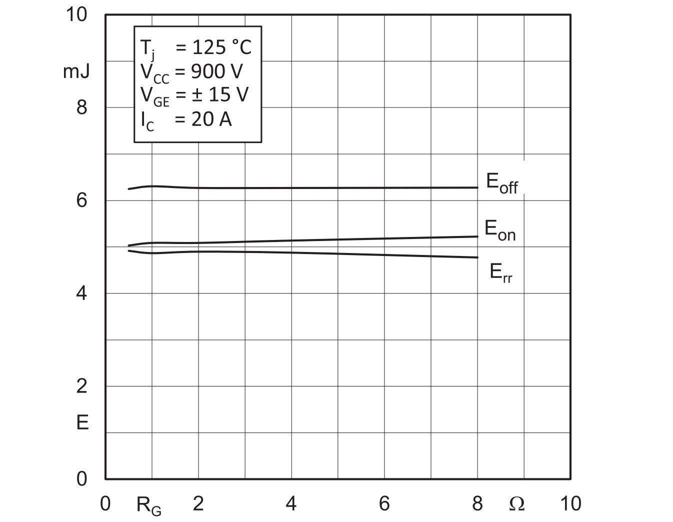


Fig. 4: Typ. turn-on /-off energy = f (R_G)

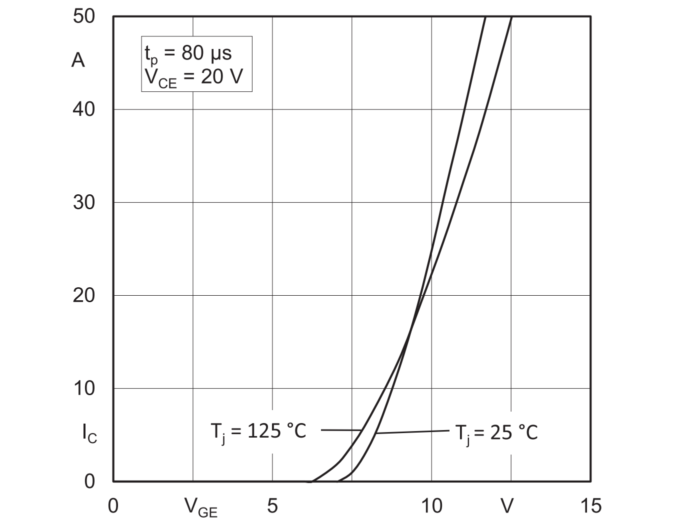


Fig. 5: Typ. transfer characteristic

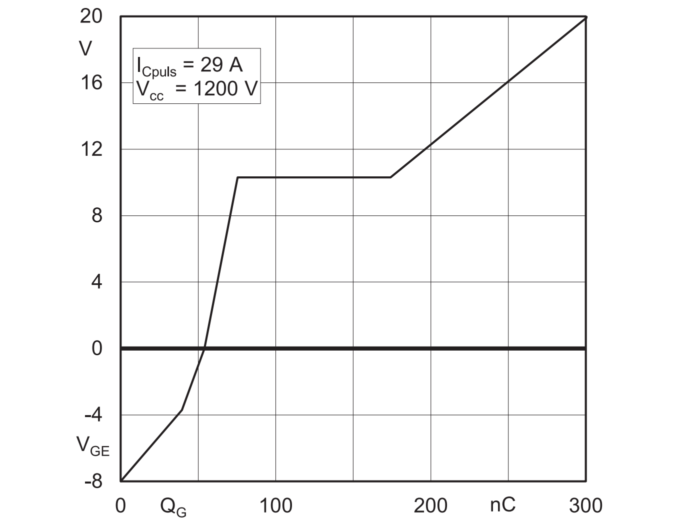


Fig. 6: Typ. gate charge characteristic

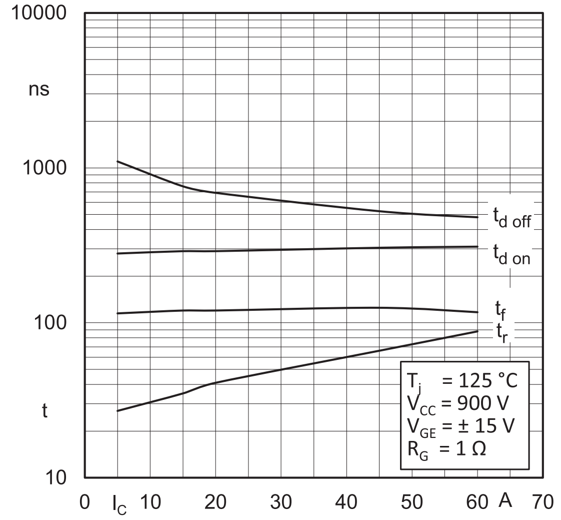


Fig. 7: Typ. switching times vs. I_C

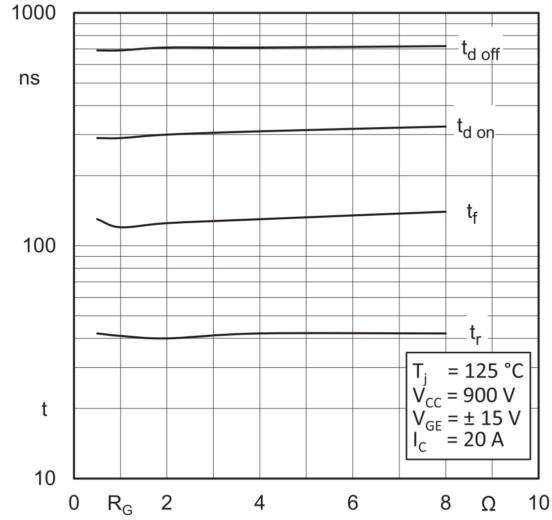


Fig. 8: Typ. switching times vs. gate resistor R_G

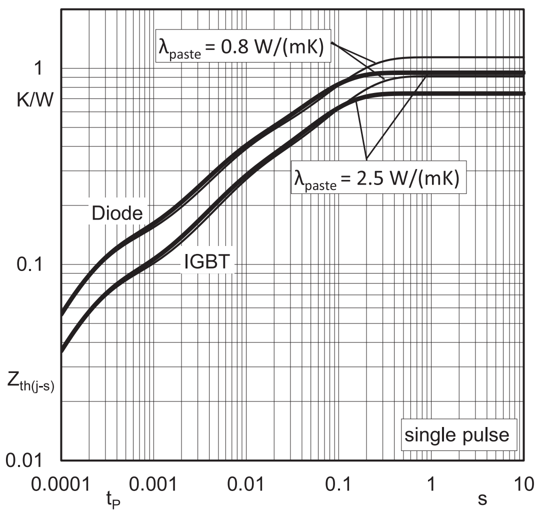


Fig. 9: Typ. transient thermal impedance

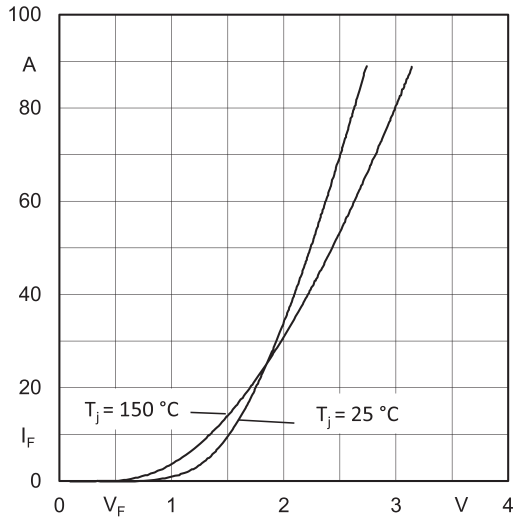


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

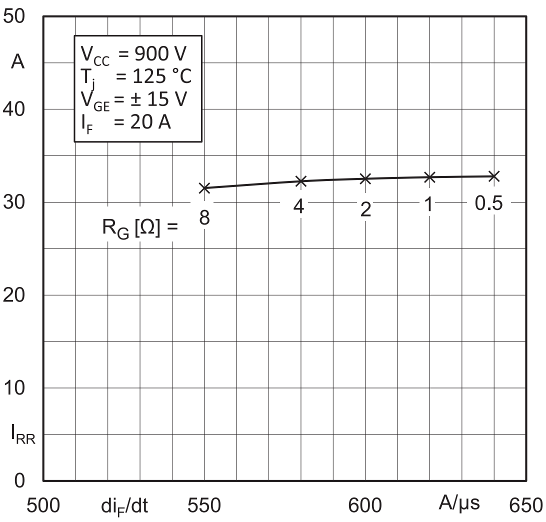


Fig. 11: Typ. CAL diode peak reverse recovery current

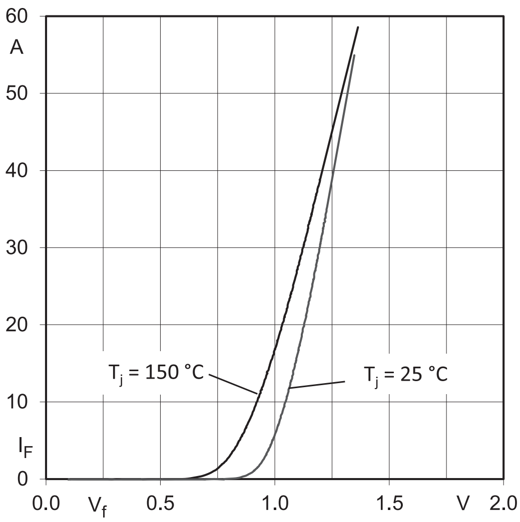
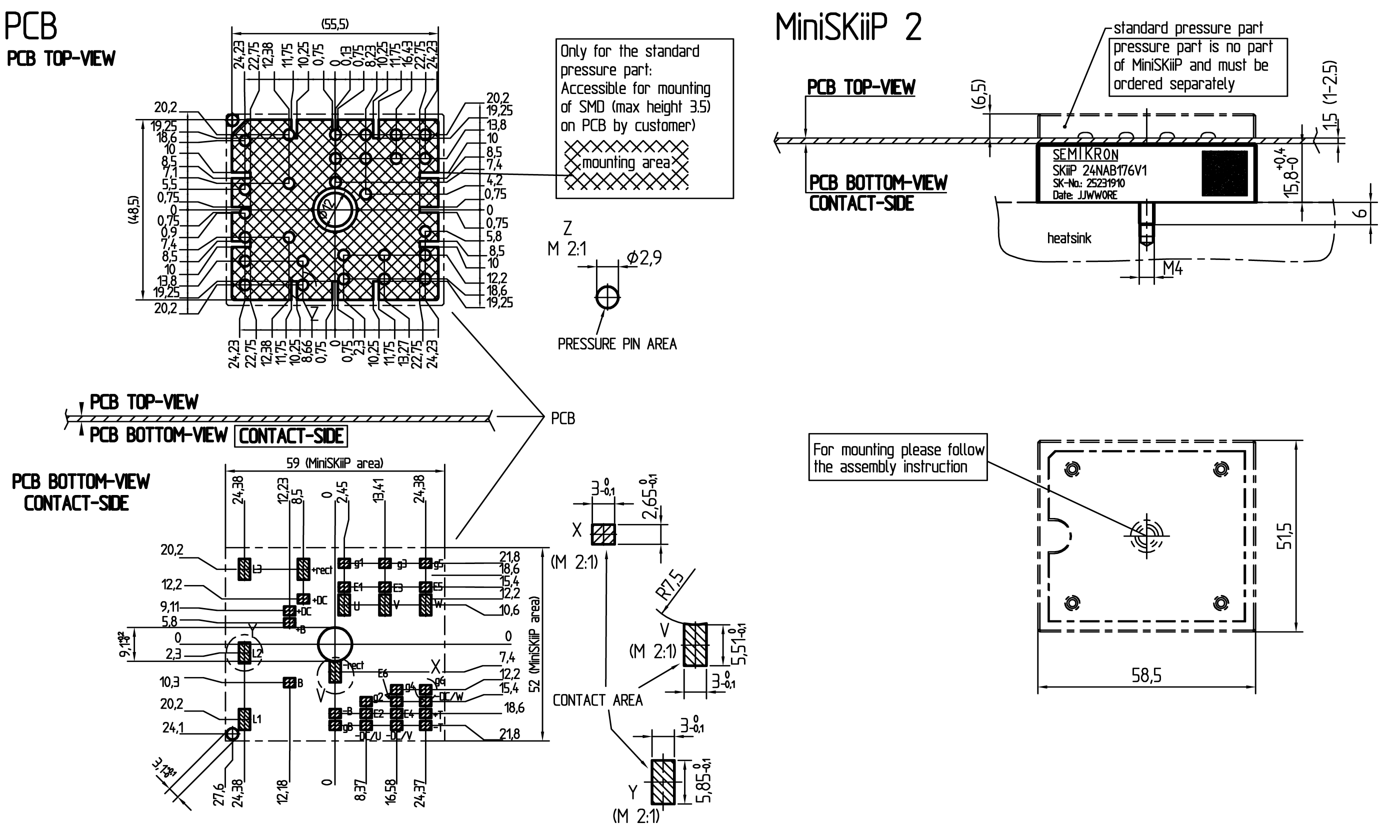
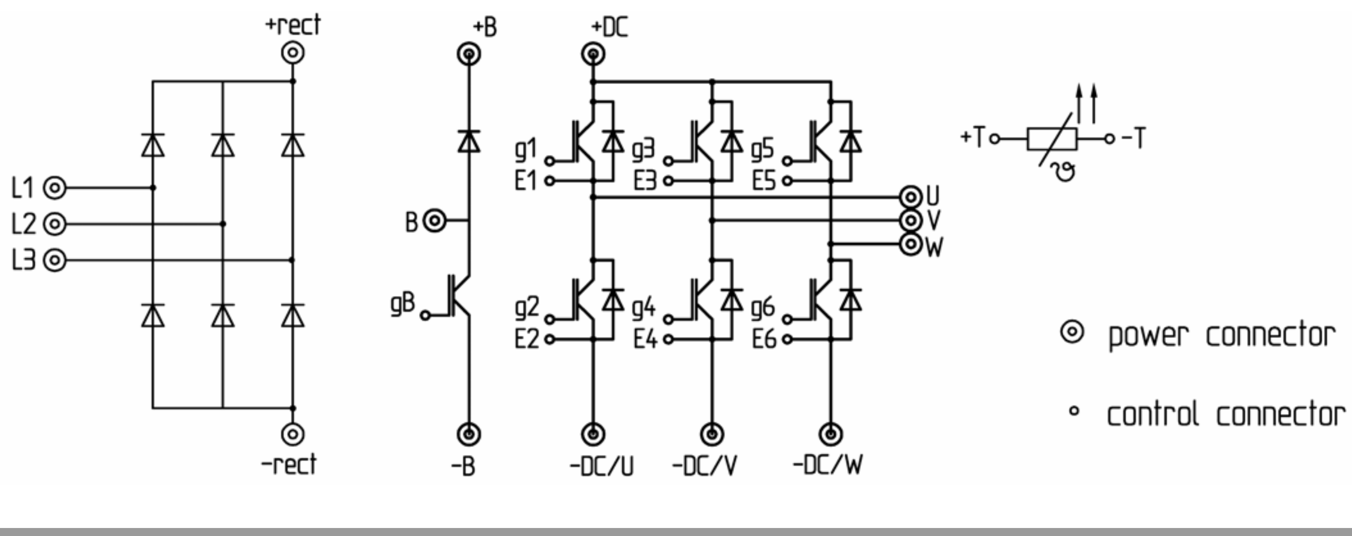


Fig. 12: Typ. input bridge forward characteristic incl. $R_{CC'+EE'}$



Pinout and Dimensions



Pinout

This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

***IMPORTANT INFORMATION AND WARNINGS**

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