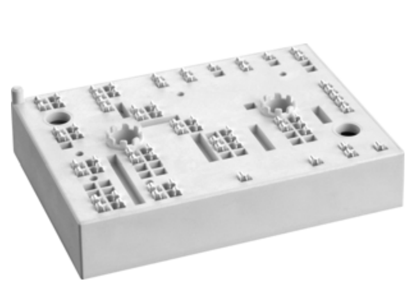


MiniSKiiP® 3

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

SKiiP 34NAB176V3

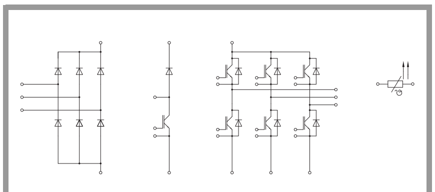
Features

- 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 40A for L1, L2, L3, U, V, W, -B, +B, B power connectors
- $I_{t(RMS)}$ limited to 20A for -DC/U, -DC/V, -DC/W power connectors
- Distance between terminals +TI-T and –DC/W; +B and +DC; -BI-DC/UIDC/V and –DC/W is not sufficient for basic insulation
- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information

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	67	A
		T_s = 70 °C	51	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	80	A
		T_s = 70 °C	61	A
I_{Cnom}			58	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		116	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	67	A
		T_s = 70 °C	51	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	80	A
		T_s = 70 °C	61	A
I_{Cnom}			58	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		116	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 = 150 °C	T_s = 25 °C	66	A
		T_s = 70 °C	47	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	77	A
		T_s = 70 °C	55	A
I_{Fnom}			55	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		110	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		550	A
T_j			-40 ... 150	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 150 °C	T_s = 25 °C	66	A
		T_s = 70 °C	47	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	77	A
		T_s = 70 °C	55	A
I_{Fnom}			55	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		110	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		550	A
T_j			-40 ... 150	°C



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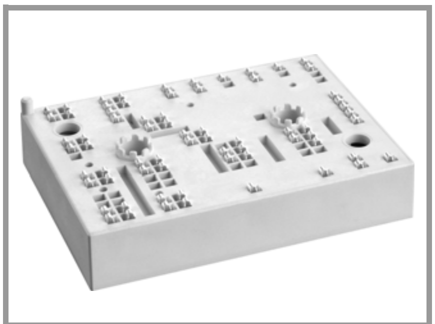

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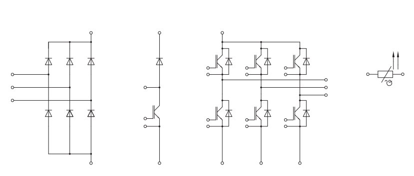

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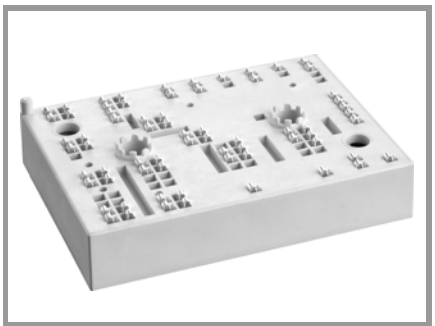
Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1800	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 150 °C	T_s = 25 °C	97	A
		T_s = 70 °C	70	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 150 °C	T_s = 25 °C	110	A
		T_s = 70 °C	80	A
I_{Fnom}	DC current		57	A
I_{FSM}	10 ms sin 180°	T_j = 25 °C	635	A
		T_j = 150 °C	490	A
I^2t	10 ms sin 180°	T_j = 25 °C	2000	A^2s
		T_j = 150 °C	1200	A^2s
T_j			-40 ... 150	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C, 20 A per spring		60	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 = 58 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		17	22	mΩ
		T_j = 125 °C		27	31	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE} V, I_C = 2.4 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
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		5.00		nF
C_{oes}		f = 1 MHz		0.21		nF
C_{res}		f = 1 MHz		0.17		nF
Q_G	- 8 V...+ 15 V			480		nC
R_{Gint}	T_j = 25 °C			16		Ω
$t_{d(on)}$	V_{CC} = 900 V	T_j = 125 °C		290		ns
t_r	I_C = 40 A	T_j = 125 °C		40		ns
E_{on}	$R_{G\ on}$ = 1 Ω $R_{G\ off}$ = 1 Ω	T_j = 125 °C		11.2		mJ
$t_{d(off)}$	di/dt_{on} = 990 A/µs	T_j = 125 °C		650		ns
t_f	di/dt_{off} = 250 A/µs	T_j = 125 °C		100		ns
E_{off}	du/dt = 4000 V/µs V_{GE} = +15/-15 V L_s = 45 nH	T_j = 125 °C		12.8		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.57		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.42		K/W



MiniSKiiP® 3

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SKiiP 34NAB176V3

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- $I_{t(RMS)}$ limited to 20A for -DC/U, -DC/V, -DC/W power connectors
- Distance between terminals +Tl-T and –DC/W; +B and +DC; -Bl-DC/UlDC/V and –DC/W is not sufficient for basic insulation
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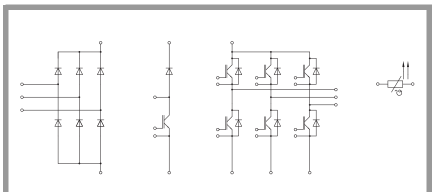

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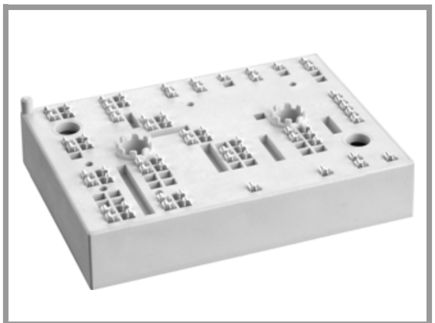
Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 58 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		17	22	mΩ
		T_j = 125 °C		27	31	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE} V, I_C = 2.4 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
Q_G	- 8 V...+ 15 V			480		nC
R_{Gint}	T_j = 25 °C			16		Ω
$t_{d(on)}$	V_{CC} = 900 V	T_j = 125 °C		290		ns
t_r	I_C = 40 A	T_j = 125 °C		40		ns
E_{on}	$R_{G\,on}$ = 1 Ω, $R_{G\,off}$ = 1 Ω	T_j = 125 °C		11.2		mJ
$t_{d(off)}$	di/dt_{on} = 990 A/µs	T_j = 125 °C		650		ns
t_f	di/dt_{off} = 250 A/µs	T_j = 125 °C		100		ns
E_{off}	du/dt = 4000 V/µs, V_{GE} = +15/-15 V, L_s = 45 nH	T_j = 125 °C		12.8		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.57		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.42		K/W
Inverse - Diode						
$V_F = V_{EC}$	I_F = 55 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.06	2.51	V
		T_j = 125 °C		1.79	2.22	V
V_{F0}	chiplevel	T_j = 25 °C		1.52	1.94	V
		T_j = 125 °C		1.17	1.57	V
r_F	chiplevel	T_j = 25 °C		9.7	10	mΩ
		T_j = 125 °C		11	12	mΩ
I_{RRM}	I_F = 40 A	T_j = 125 °C		62		A
Q_{rr}	di/dt_{off} = 1050 A/µs, V_{GE} = -15 V	T_j = 125 °C		13.5		µC
E_{rr}	V_{CC} = 900 V	T_j = 125 °C		6.6		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.84		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.68		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 55 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.06	2.51	V
		T_j = 125 °C		1.79	2.22	V
V_{F0}	chiplevel	T_j = 25 °C		1.52	1.94	V
		T_j = 125 °C		1.17	1.57	V
r_F	chiplevel	T_j = 25 °C		9.7	10	mΩ
		T_j = 125 °C		11	12	mΩ
I_{RRM}	I_F = 40 A	T_j = 125 °C		62		A
Q_{rr}	di/dt_{off} = 1050 A/µs, V_{GE} = -15 V	T_j = 125 °C		13.5		µC
E_{rr}	V_{CC} = 900 V	T_j = 125 °C		6.6		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.84		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.68		K/W



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SKiiP 34NAB176V3

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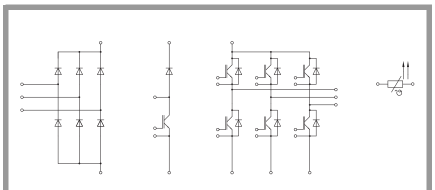

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Rectifier - Diode						
$V_F = V_{EC}$	I_F = 57 A V_{GE} = 0 V chiplevel	T_j = 25 °C		1.09	1.34	V
		T_j = 125 °C		1.04	1.29	V
V_{F0}	chiplevel	T_j = 25 °C	0.6	0.87	1.10	V
		T_j = 125 °C		0.75	0.97	V
r_F	chip	T_j = 25 °C		4.0	4.3	mΩ
		T_j = 125 °C		5.1	5.6	mΩ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			0.86		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.72		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w				82		g
L_{CE}				26		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}					

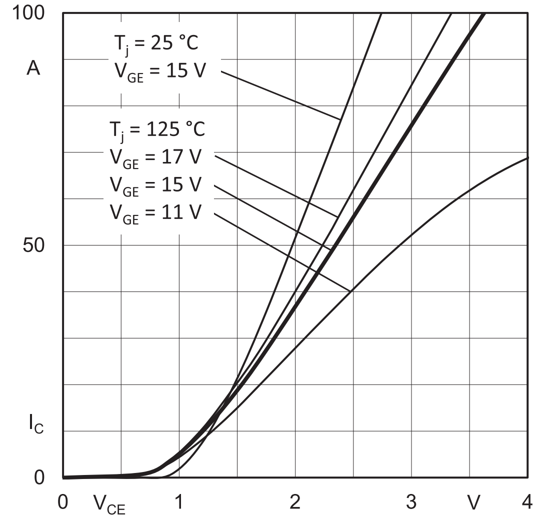


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+ EE'}$

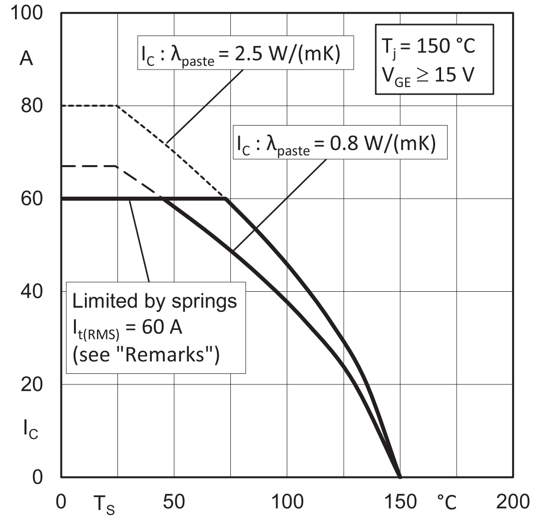


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

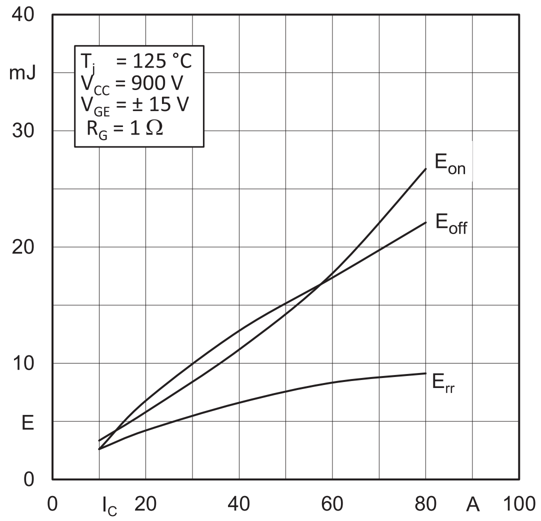


Fig. 3: Typ. turn-on /-off energy = f (I_C)

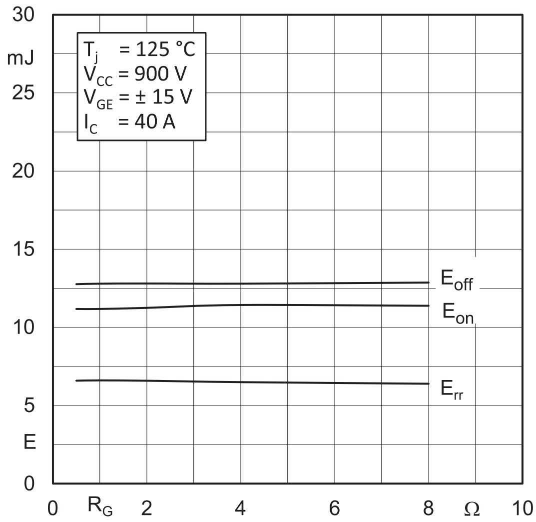


Fig. 4: Typ. turn-on /-off energy = f (R_G)

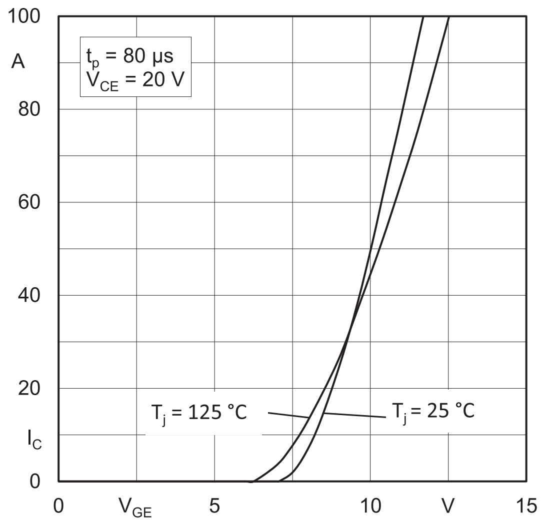


Fig. 5: Typ. transfer characteristic

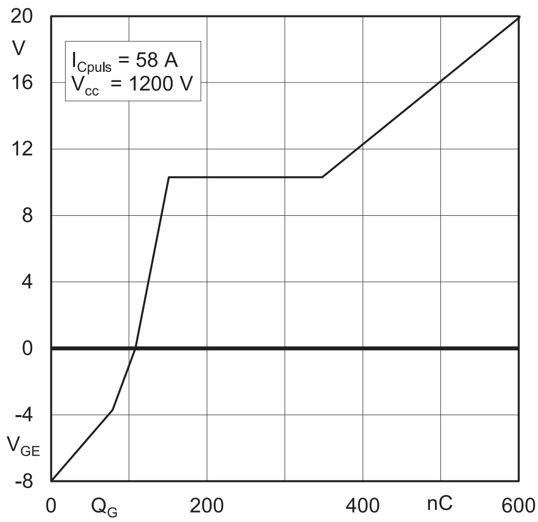


Fig. 6: Typ. gate charge characteristic

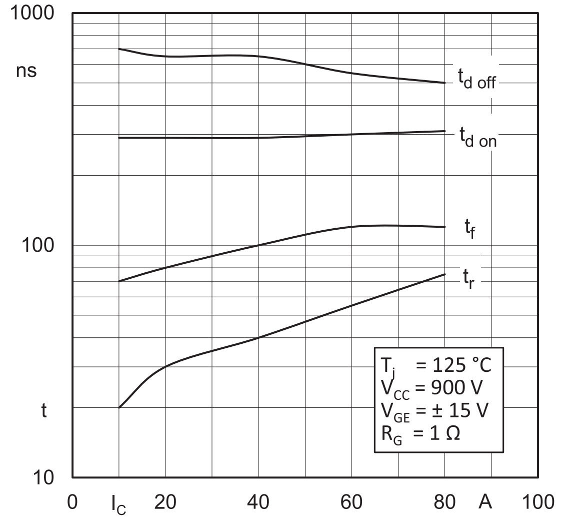


Fig. 7: Typ. switching times vs. I_C

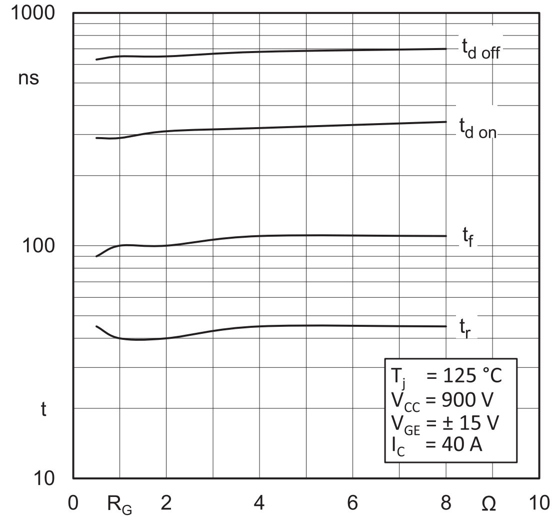


Fig. 8: Typ. switching times vs. gate resistor R_G

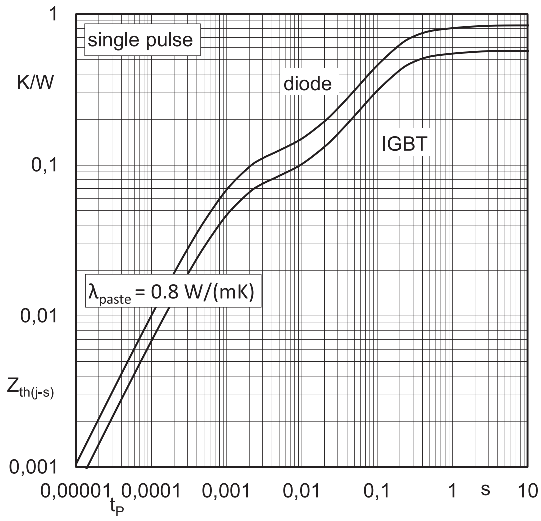


Fig. 9: Transient thermal impedance of IGBT and Diode

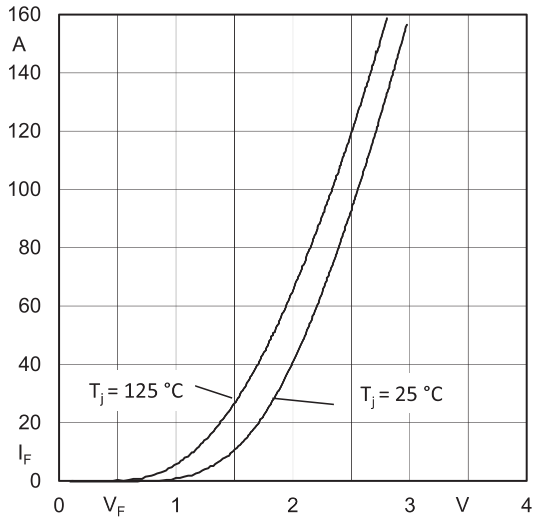


Fig. 10: CAL diode forward characteristic

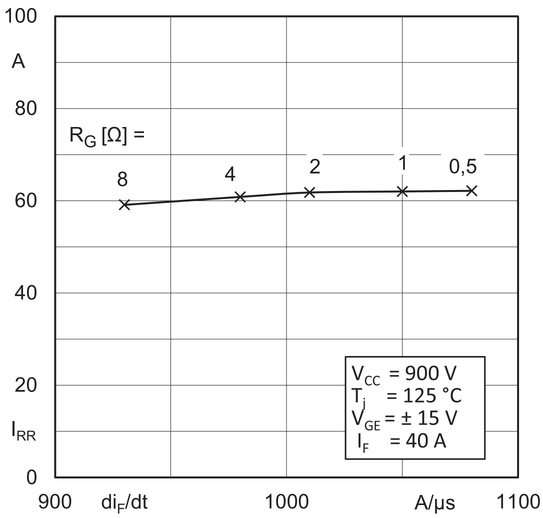


Fig. 11: Typ. CAL diode peak reverse recovery current

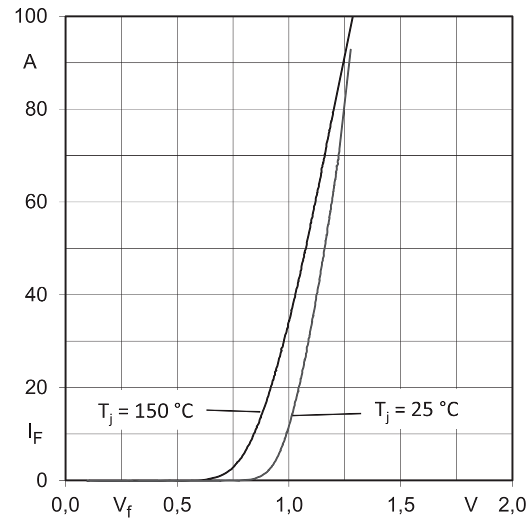
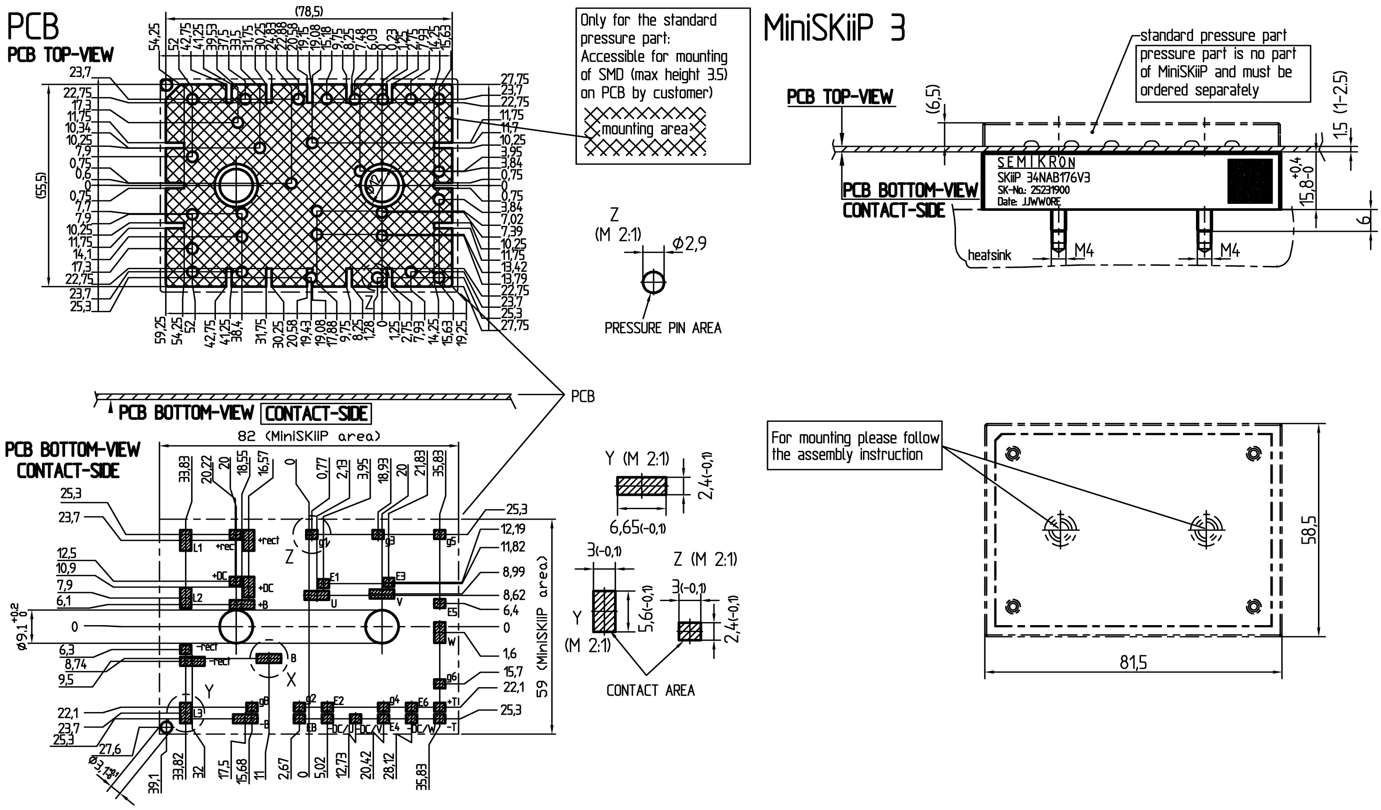
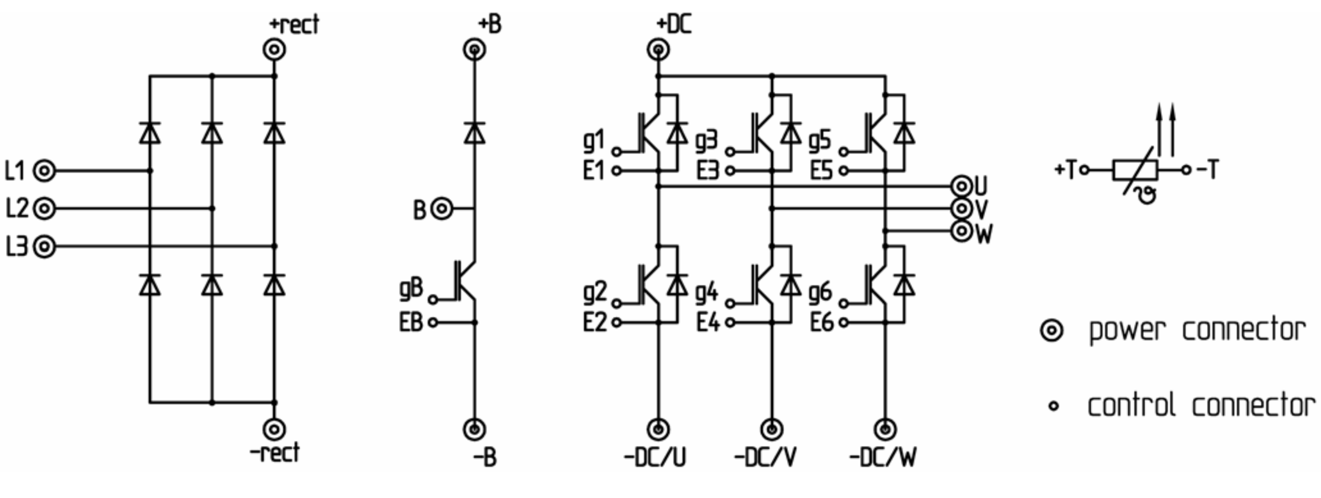


Fig. 12: Typ. input bridge forward characteristic



pinout, dimensions



pinout

This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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