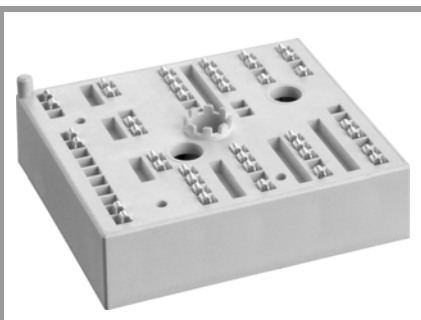


SKiiP 24NAB176V1



MiniSKiiP® 2

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

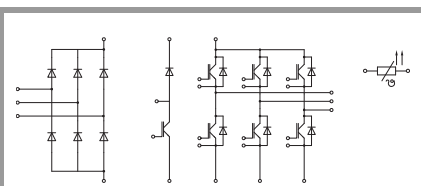
SKiiP 24NAB176V1

Features

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

Remarks

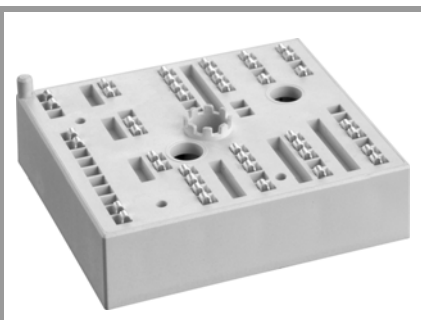
- Max. case temperature limited to $T_C=125^{\circ}\text{C}$
- Product reliability results valid for $T_j \leq 125^{\circ}\text{C}$ (recommended $T_{j,op} = -40 \dots +125^{\circ}\text{C}$)
- $I_{t(RMS)}$ limited to 20A for +B, B, -B, -DC/ U, -DC/V, -DC/W power connectors
- The distance between terminals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



NAB

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

SKiiP 24NAB176V1



MiniSKiiP® 2

3-phase bridge rectifier +
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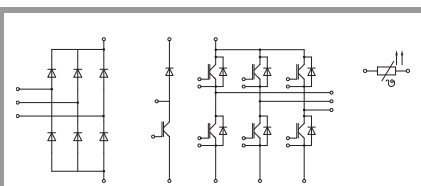
SKiiP 24NAB176V1

Features

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- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

Remarks

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- Product reliability results valid for $T_j \leq 125^\circ\text{C}$ (recommended $T_{j,op} = -40 \dots +125^\circ\text{C}$)
- $I_{t(RMS)}$ limited to 20A for +B, B, -B, -DC/U, -DC/V, -DC/W power connectors
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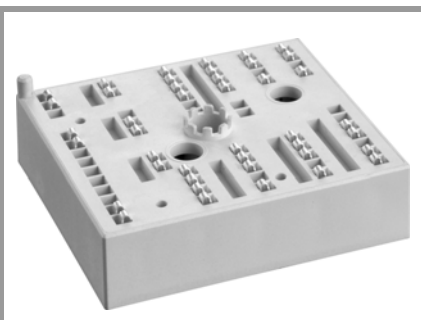


NAB

Absolute Maximum Ratings			
Symbol	Conditions	Values	Unit
Rectifier - Diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1800	V
I_F	$T_s = 25^\circ\text{C}, T_j = 150^\circ\text{C}$	59	A
I_{Fnom}	DC current	41	A
I_{FSM}	10 ms	$T_j = 25^\circ\text{C}$	A
	sin 180°	$T_j = 150^\circ\text{C}$	A
I^2t	10 ms	$T_j = 25^\circ\text{C}$	A ² s
	sin 180°	$T_j = 150^\circ\text{C}$	A ² s
T_j		-40 ... 150	°C
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}, 20\text{ A per spring}$	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					
$V_{CE(sat)}$	$I_C = 29\text{ A}$ $V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$	2.00	2.45	V
		$T_j = 125^\circ\text{C}$	2.45	2.90	V
V_{CE0}	chipllevel	$T_j = 25^\circ\text{C}$	1	1.2	V
		$T_j = 125^\circ\text{C}$	0.9	1.1	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$	34	43	mΩ
		$T_j = 125^\circ\text{C}$	53	62	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}\text{ V}, I_C = 1.2\text{ mA}$	5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1700\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	mA
					mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	2.50		nF
C_{oes}		$f = 1\text{ MHz}$	0.11		nF
C_{res}		$f = 1\text{ MHz}$	0.08		nF
Q_G	- 8 V...+ 15 V		240		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		32		Ω
$t_{d(on)}$	$V_{CC} = 900\text{ V}$ $I_C = 20\text{ A}$	$T_j = 125^\circ\text{C}$	290		ns
t_r	$R_{G\ on} = 1\ \Omega$ $R_{G\ off} = 1\ \Omega$	$T_j = 125^\circ\text{C}$	40		ns
E_{on}		$T_j = 125^\circ\text{C}$	5.1		mJ
$t_{d(off)}$	$di/dt_{on} = 580\text{ A}/\mu\text{s}$	$T_j = 125^\circ\text{C}$	690		ns
t_f	$di/dt_{off} = 120\text{ A}/\mu\text{s}$ $du/dt = 4000\text{ V}/\mu\text{s}$	$T_j = 125^\circ\text{C}$	120		ns
E_{off}	$V_{GE} = +15/-15\text{ V}$ $L_s = 47\text{ nH}$	$T_j = 125^\circ\text{C}$	6.3		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8\text{ W/K}^2\text{m}$		0.91		K/W
Chopper - IGBT					
$V_{CE(sat)}$	$I_C = 29\text{ A}$ $V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$	2.00	2.45	V
		$T_j = 125^\circ\text{C}$	2.45	2.90	V
V_{CE0}	chipllevel	$T_j = 25^\circ\text{C}$	1	1.2	V
		$T_j = 125^\circ\text{C}$	0.9	1.1	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$	34	43	mΩ
		$T_j = 125^\circ\text{C}$	53	62	mΩ
$V_{GE(th)}$	$V_{GE} = V_{CE}\text{ V}, I_C = 1.2\text{ mA}$	5.2	5.8	6.4	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1700\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	mA
		$T_j = 125^\circ\text{C}$			mA
Q_G	- 8 V...+ 15 V		240		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		32		Ω

SKiiP 24NAB176V1



MiniSKiiP® 2

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

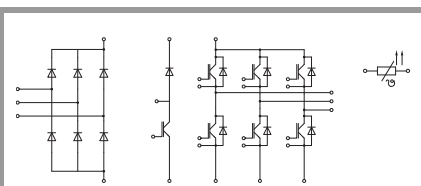
SKiiP 24NAB176V1

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 $T_C=125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 125^\circ\text{C}$ (recommended $T_{j,op} = -40 \dots +125^\circ\text{C}$)
- $I_{t(RMS)}$ 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
- The distance between terminals of +rect, +B and +DC not sufficient for basic insulation
- The distance between terminals of -B, -DC/U, DC/V and -DC/W not sufficient for basic insulation



NAB

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

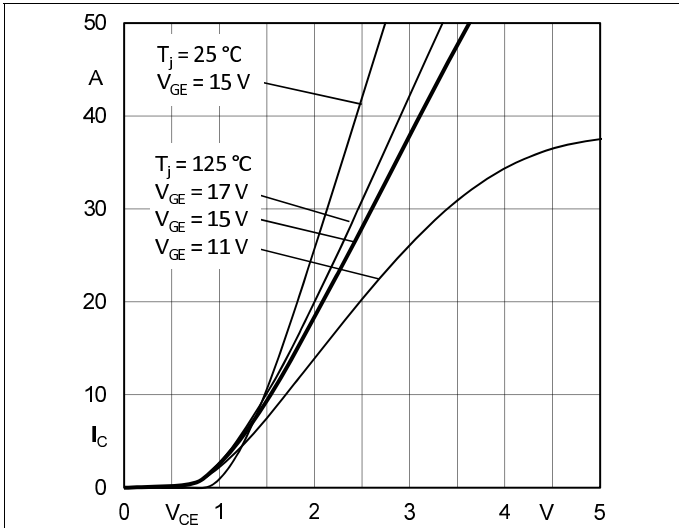


Fig. 1: Typ. output characteristic, inclusive R_{CC'+EE'}

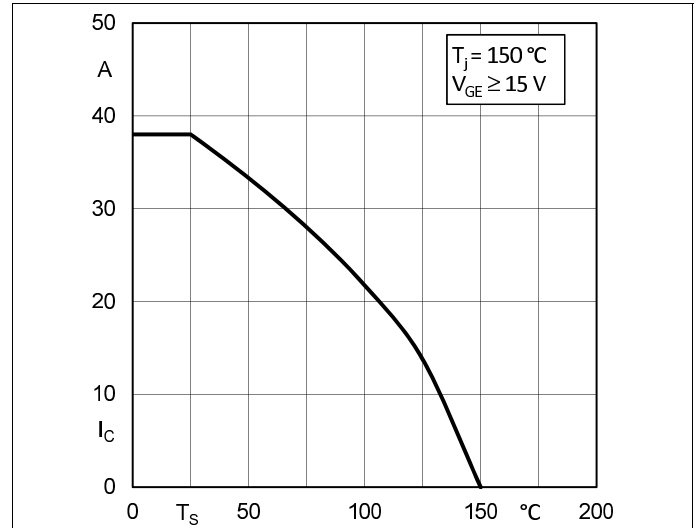


Fig. 2: Typ. rated current vs. temperature I_C = f(T_S)

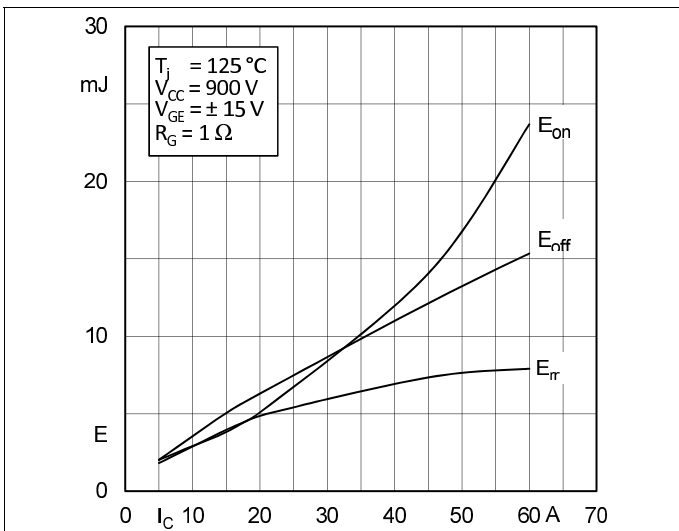


Fig. 3: Typ. turn-on /-off energy = f(I_C)

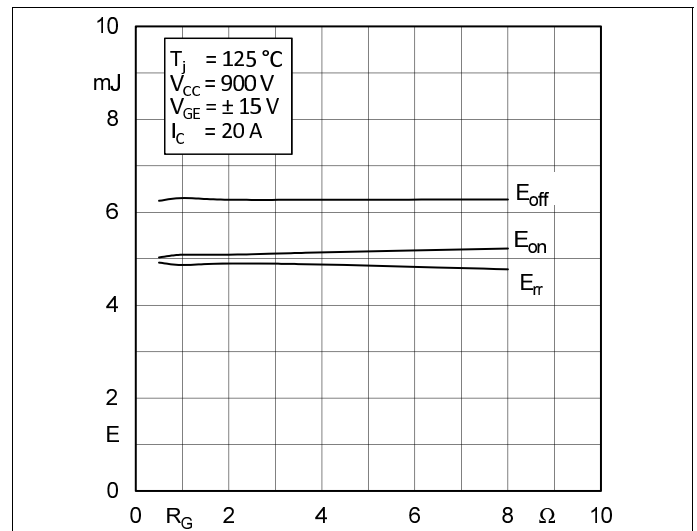


Fig. 4: Typ. turn-on /-off energy = f(R_G)

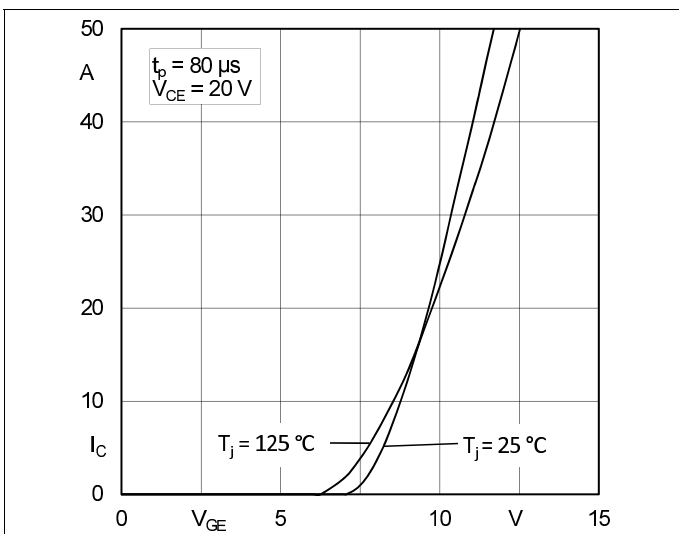


Fig. 5: Typ. transfer characteristic

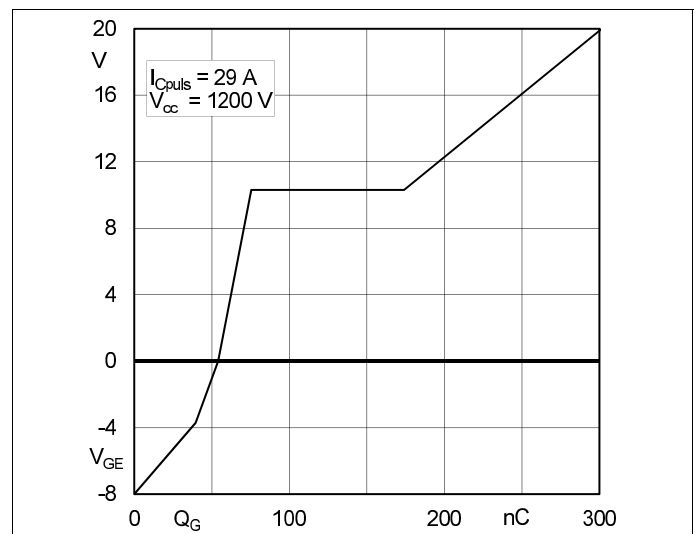


Fig. 6: Typ. gate charge characteristic

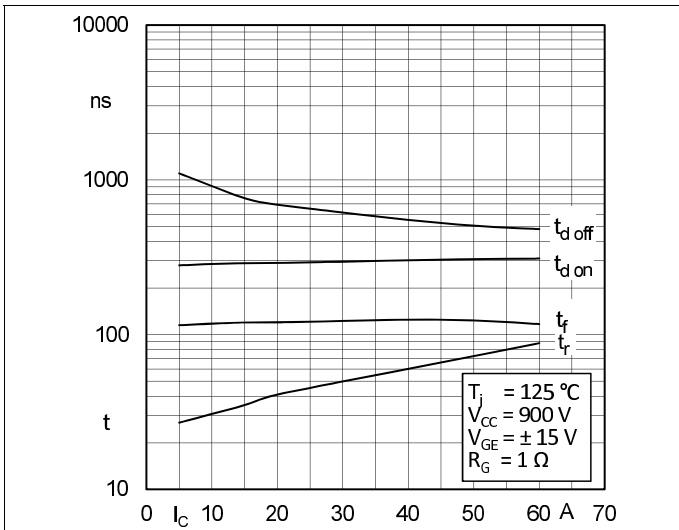


Fig. 7: Typ. switching times vs. I_c

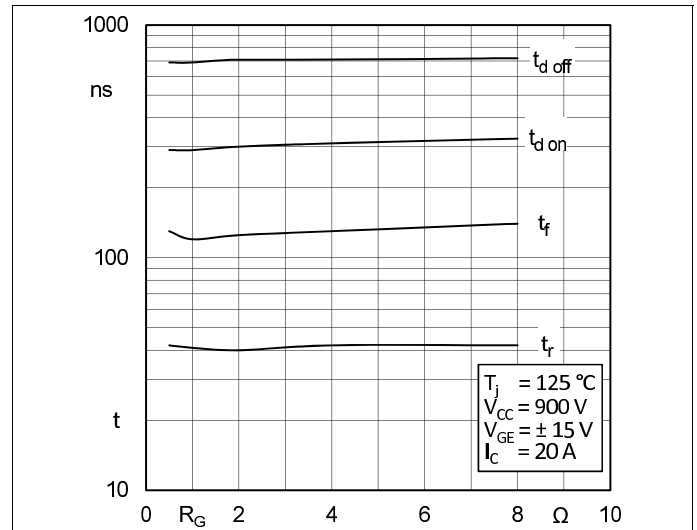


Fig. 8: Typ. switching times vs. gate resistor R_G

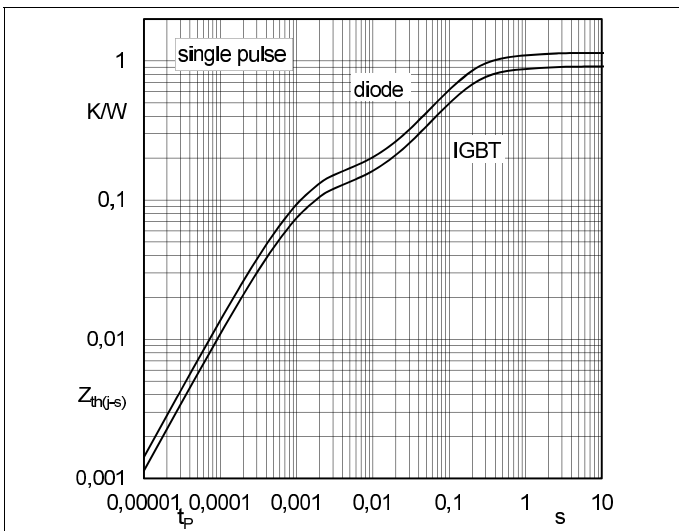


Fig. 9: Transient thermal impedance of IGBT and Diode

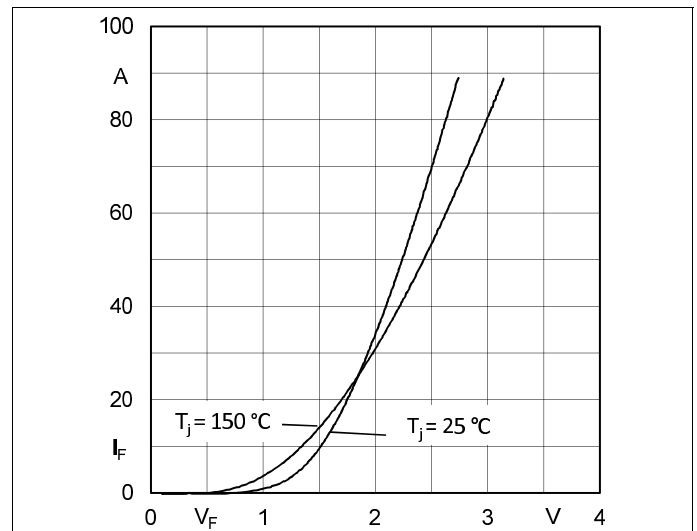


Fig. 10: CAL diode forward characteristic

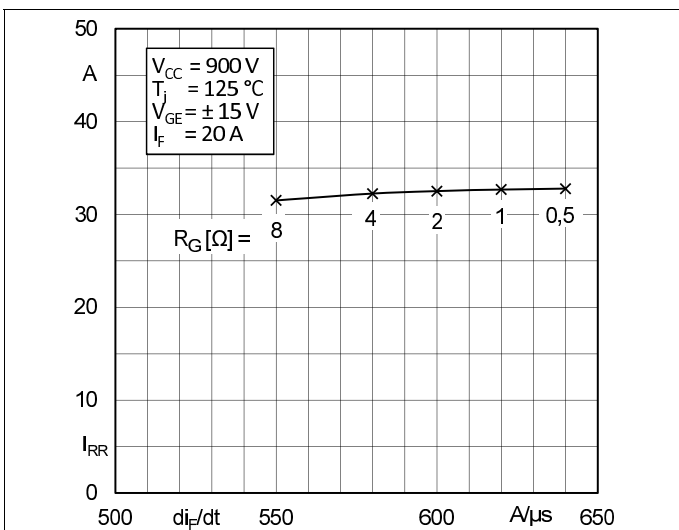


Fig. 11: Typ. CAL diode peak reverse recovery current

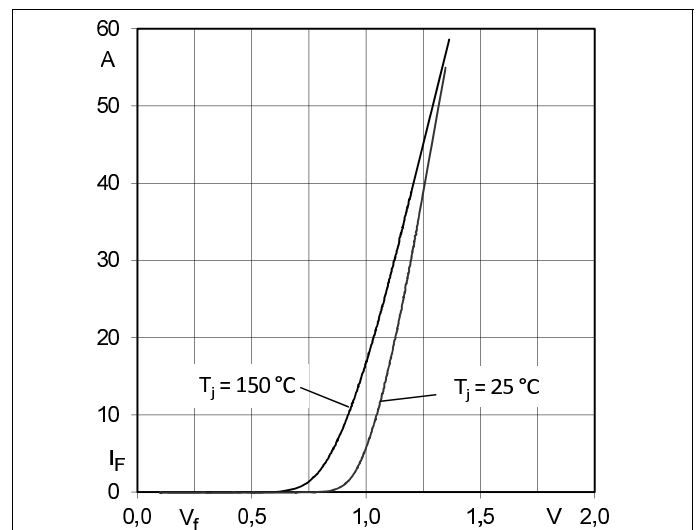
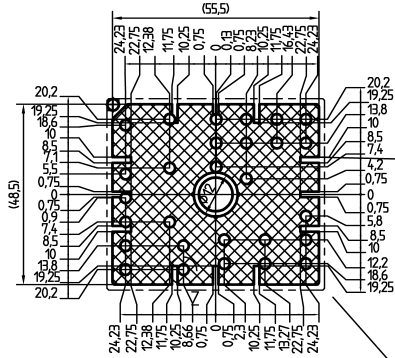


Fig. 12: Typ. input bridge forward characteristic

PCB PCB TOP-VIEW



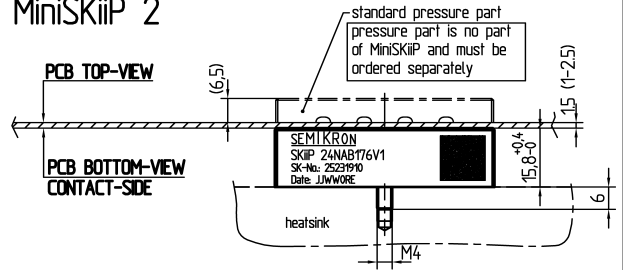
Only for the standard pressure part:
Accessible for mounting of SMD (max height 3.5) on PCB by customer

mounting area

Z
M 2:1
 $\phi 2,9$

PRESSURE PIN AREA

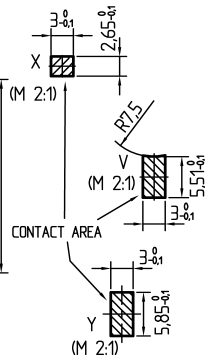
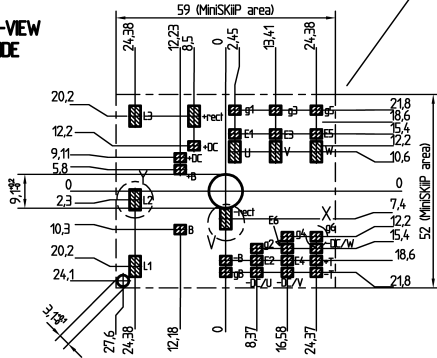
MiniSKiiP 2



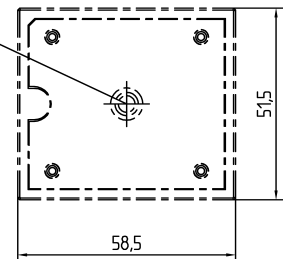
standard pressure part
pressure part is no part of MiniSKiiP and must be ordered separately

PCB TOP-VIEW PCB BOTTOM-VIEW CONTACT-SIDE

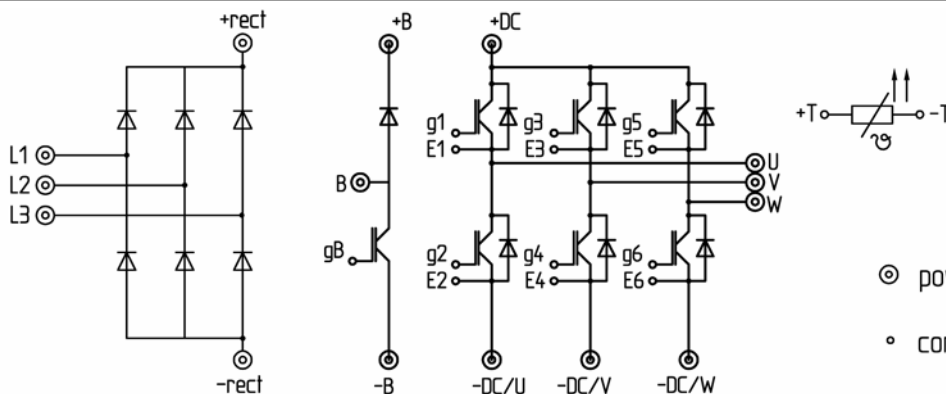
PCB BOTTOM-VIEW CONTACT-SIDE



For mounting please follow the assembly instruction



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.