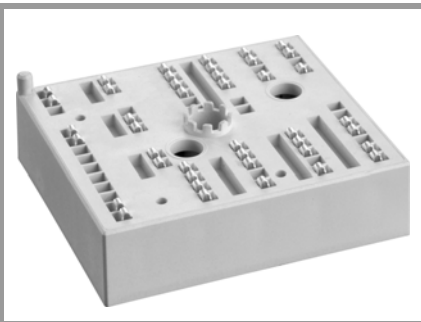


SKiiP 23NAB12T4V1



MiniSKiiP® 2

Converter-Inverter-Brake (CIB)

SKiiP 23NAB12T4V1

Features*

- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

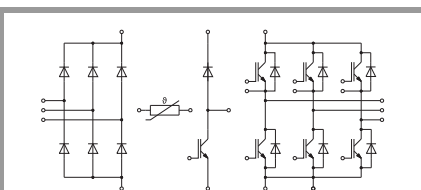
Typical Applications

- Inverter up to 14 kVA
- Typical motor power 7,5 kW

Remarks

- Max. case temperature limited to $T_C=125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$ (recommended $T_{j,op} = -40 \dots +150^\circ\text{C}$)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet. Please refer to both documents for further information

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V
I_C	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	37	A
		$T_j = 175^\circ\text{C}$	30	A
I_C	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	41	A
		$T_j = 175^\circ\text{C}$	34	A
I_{Chom}			25	A
I_{CRM}			75	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 800 \text{ V}$ $V_{GE} \leq 15 \text{ V}$ $V_{CES} \leq 1200 \text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
T_j			-40 ... 175	$^\circ\text{C}$
Chopper - IGBT				
V_{CES}	$T_j = 25^\circ\text{C}$		1200	V
I_C	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	37	A
		$T_j = 175^\circ\text{C}$	30	A
I_C	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	41	A
		$T_j = 175^\circ\text{C}$	34	A
I_{Chom}			25	A
I_{CRM}			75	A
V_{GES}			-20 ... 20	V
t_{psc}	$V_{CC} = 800 \text{ V}$ $V_{GE} \leq 15 \text{ V}$ $V_{CES} \leq 1200 \text{ V}$	$T_j = 150^\circ\text{C}$	10	μs
T_j			-40 ... 175	$^\circ\text{C}$
Inverse - Diode				
V_{RRM}	$T_j = 25^\circ\text{C}$		1200	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	32	A
		$T_j = 175^\circ\text{C}$	26	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	35	A
		$T_j = 175^\circ\text{C}$	28	A
I_{FRM}			75	A
I_{FSM}	$t_p = 10 \text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$		100	A
T_j			-40 ... 175	$^\circ\text{C}$
Freewheeling - Diode				
V_{RRM}	$T_j = 25^\circ\text{C}$		1200	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	32	A
		$T_j = 175^\circ\text{C}$	26	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	35	A
		$T_j = 175^\circ\text{C}$	28	A
I_{FRM}			75	A
I_{FSM}	$t_p = 10 \text{ ms, sin } 180^\circ, T_j = 150^\circ\text{C}$		100	A
T_j			-40 ... 175	$^\circ\text{C}$



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SKiiP 23NAB12T4V1



MiniSKiiP® 2

Converter-Inverter-Brake (CIB)

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Features*

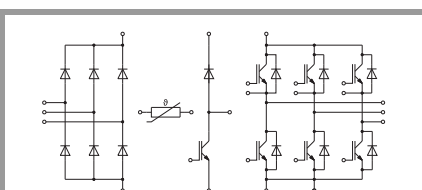
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- Max. case temperature limited to $T_C=125^\circ\text{C}$
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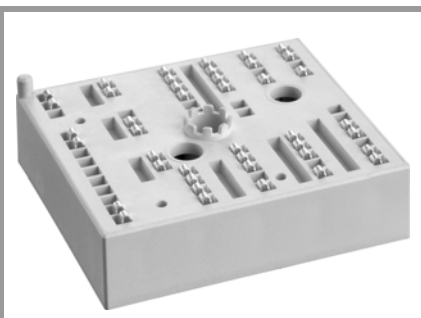


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Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	$T_j = 25^\circ\text{C}$		1600	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	52	A
		$T_j = 150^\circ\text{C}$	39	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	58	A
		$T_j = 150^\circ\text{C}$	44	A
I_{FSM}	$t_p = 10 \text{ ms}$ $\sin 180^\circ$	$T_j = 25^\circ\text{C}$	370	A
		$T_j = 150^\circ\text{C}$	270	A
i^2t	$t_p = 10 \text{ ms}$ $\sin 180^\circ$	$T_j = 25^\circ\text{C}$	685	A^2s
		$T_j = 150^\circ\text{C}$	365	A^2s
T_j			-40 ... 150	$^\circ\text{C}$
Module				
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$, 20 A per spring		40	A
T_{stg}	module without TIM		-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, 1 min		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$V_{CE(sat)}$	$I_C = 25 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.85	2.10		V
		$T_j = 150^\circ\text{C}$	2.25	2.45		V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	0.80	0.90		V
		$T_j = 150^\circ\text{C}$	0.70	0.80		V
r_{CE}	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	42	48		$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	62	66		$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 1 \text{ mA}$		5.3	5.8	6.3	V
I_{CES}	$V_{GE} = 0 \text{ V}$, $V_{CE} = 1200 \text{ V}$, $T_j = 25^\circ\text{C}$				1	mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	1.45			nF
C_{oes}		$f = 1 \text{ MHz}$	0.12			nF
C_{res}		$f = 1 \text{ MHz}$	0.05			nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$			142		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			0		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$ $I_C = 25 \text{ A}$ $R_{G on} = 24 \Omega$ $R_{G off} = 24 \Omega$	$T_j = 150^\circ\text{C}$	28			ns
t_r		$T_j = 150^\circ\text{C}$	40			ns
E_{on}		$T_j = 150^\circ\text{C}$	2.65			mJ
$t_{d(off)}$		$T_j = 150^\circ\text{C}$	295			ns
t_f		$T_j = 150^\circ\text{C}$	68			ns
E_{off}		$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$	2.3		
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W/(mK)}$			1.2		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W/(mK)}$			1		K/W

SKiiP 23NAB12T4V1



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Features*

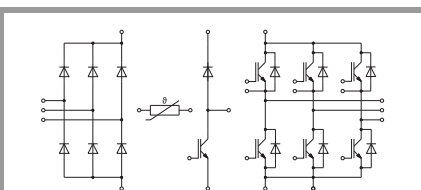
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- UL recognized: File no. E63532

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Remarks

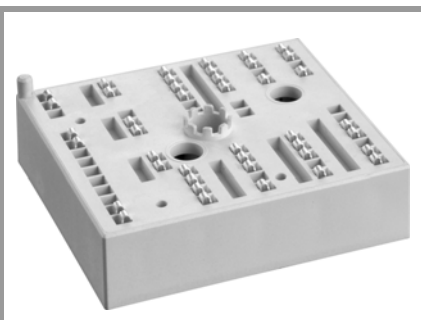
- Max. case temperature limited to $T_C=125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$ (recommended $T_{j,op} = -40 \dots +150^\circ\text{C}$)
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
$V_{CE(sat)}$	$I_C = 25\text{ A}$ $V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$		1.85	2.10	V
		$T_j = 150^\circ\text{C}$		2.25	2.45	V
V_{CE0}	chipllevel	$T_j = 25^\circ\text{C}$		0.80	0.90	V
		$T_j = 150^\circ\text{C}$		0.70	0.80	V
r_{CE}	$V_{GE} = 15\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$		42	48	m Ω
		$T_j = 150^\circ\text{C}$		62	66	m Ω
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 1\text{ mA}$		5.3	5.8	6.3	V
I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25^\circ\text{C}$				1	mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$		1.45		nF
C_{oes}		$f = 1\text{ MHz}$		0.12		nF
C_{res}		$f = 1\text{ MHz}$		0.05		nF
Q_G	$V_{GE} = -8\text{ V} \dots +15\text{ V}$			142		nC
R_{Gint}	$T_j = 25^\circ\text{C}$			0		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 25\text{ A}$	$T_j = 150^\circ\text{C}$		28		ns
t_r		$T_j = 150^\circ\text{C}$		40		ns
E_{on}	$R_{G\ on} = 24\ \Omega$ $R_{G\ off} = 24\ \Omega$	$T_j = 150^\circ\text{C}$		2.65		mJ
$t_{d(off)}$		$T_j = 150^\circ\text{C}$		295		ns
t_f	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$		68		ns
E_{off}		$T_j = 150^\circ\text{C}$		2.3		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1.2		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			1		K/W
Inverse - Diode						
$V_F = V_{EC}$	$I_F = 25\text{ A}$ $V_{GE} = 0\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$		2.41	2.74	V
		$T_j = 150^\circ\text{C}$		2.45	2.79	V
V_{F0}	chipllevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
r_F	chipllevel	$T_j = 25^\circ\text{C}$		44	50	m Ω
		$T_j = 150^\circ\text{C}$		62	68	m Ω
I_{RRM}	$I_F = 25\text{ A}$	$T_j = 150^\circ\text{C}$		24		A
Q_{rr}	$di/dt_{off} = 850\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		3.7		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		1.6		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1.52		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			1.29		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	$I_F = 25\text{ A}$ $V_{GE} = 0\text{ V}$ chipllevel	$T_j = 25^\circ\text{C}$		2.41	2.74	V
		$T_j = 150^\circ\text{C}$		2.45	2.79	V
V_{F0}	chipllevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
r_F	chipllevel	$T_j = 25^\circ\text{C}$		44	50	m Ω
		$T_j = 150^\circ\text{C}$		62	68	m Ω
I_{RRM}	$I_F = 25\text{ A}$	$T_j = 150^\circ\text{C}$		24		A
Q_{rr}	$di/dt_{off} = 850\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		3.7		μC
E_{rr}	$V_{GE} = -15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		1.6		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1.52		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			1.29		K/W

SKiiP 23NAB12T4V1



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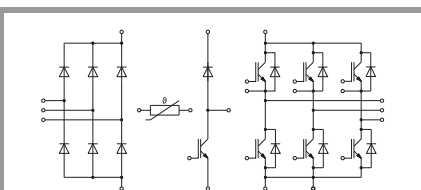
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Rectifier - Diode					
$V_F = V_{EC}$	I _F = 13 A chipelevel	T _j = 25 °C	1.00	1.21	V
		T _j = 125 °C	0.90	1.10	V
V _{F0}	chipelevel	T _j = 25 °C	0.88	0.98	V
		T _j = 125 °C	0.73	0.83	V
r _F	chipelevel	T _j = 25 °C	9.2	18	mΩ
		T _j = 125 °C	13	21	mΩ
I _R	T _j = 145 °C, V _{R_{RM}}			1.1	mA
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)		1.25		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)		1.06		K/W
Module					
M _s	to heat sink	2		2.5	Nm
w			55		g
L _{CE}			-		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				



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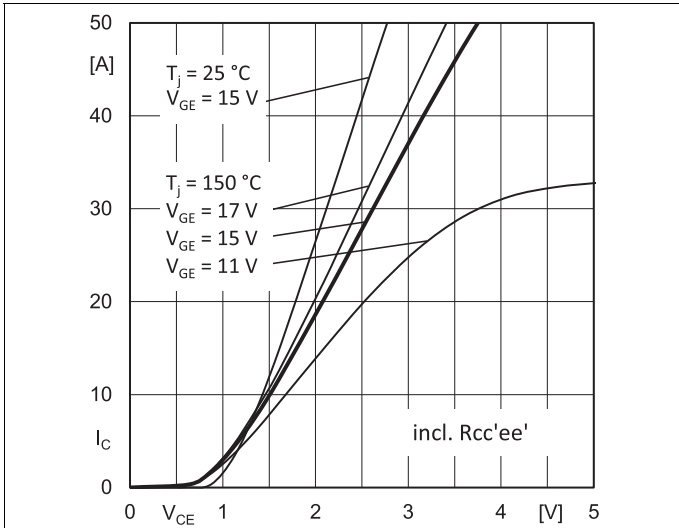


Fig. 1: Typ. output characteristic

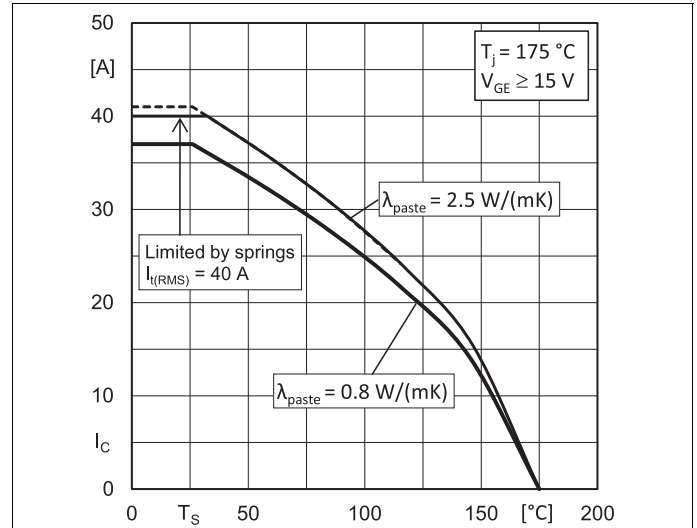


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_j)$

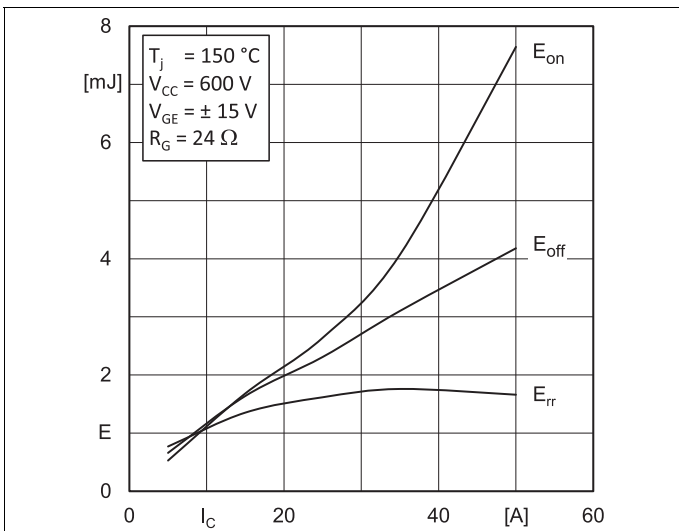


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

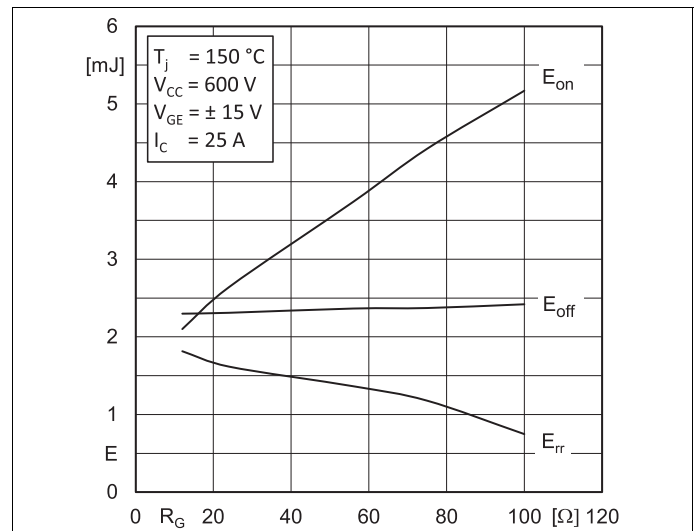


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

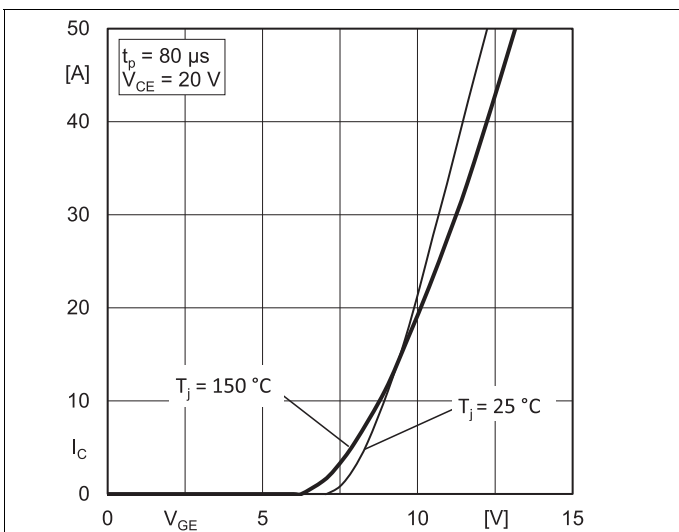


Fig. 5: Typ. transfer characteristic

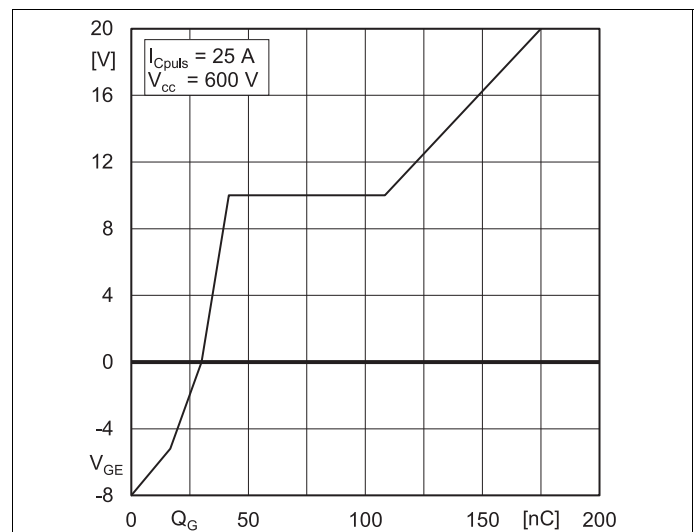


Fig. 6: Typ. gate charge characteristic

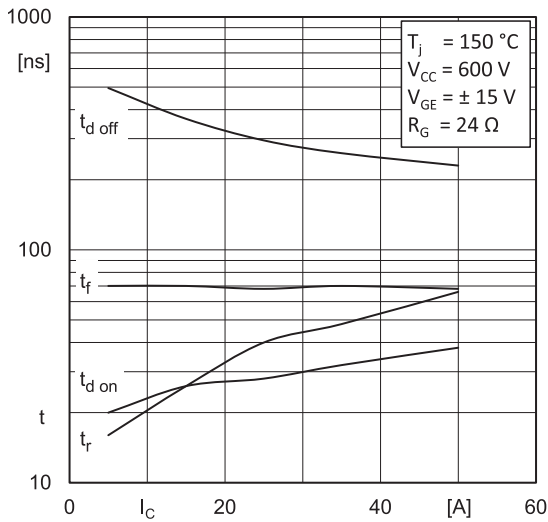


Fig. 7: Typ. switching times vs. I_C

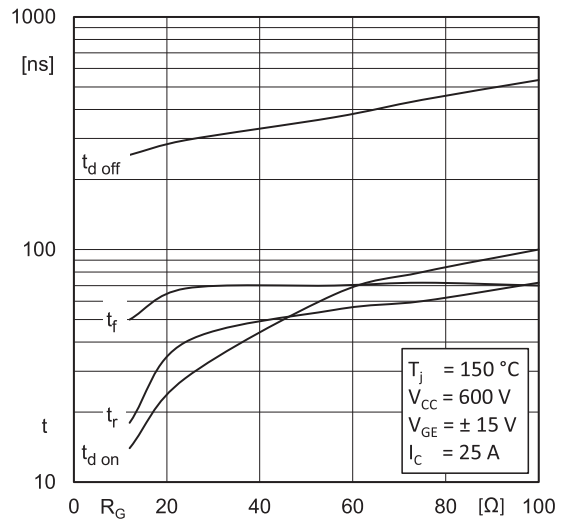


Fig. 8: Typ. switching times vs. gate resistor R_G

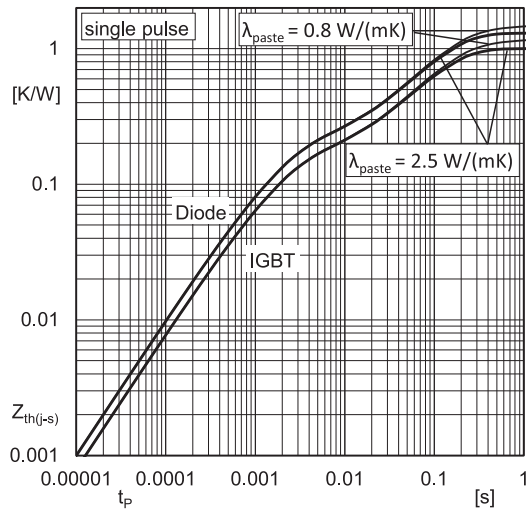


Fig. 9: Typ. transient thermal impedance

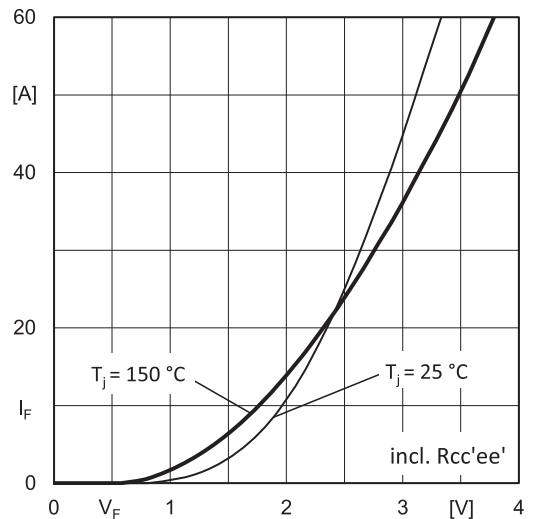


Fig. 10: Typ. CAL diode forward characteristic

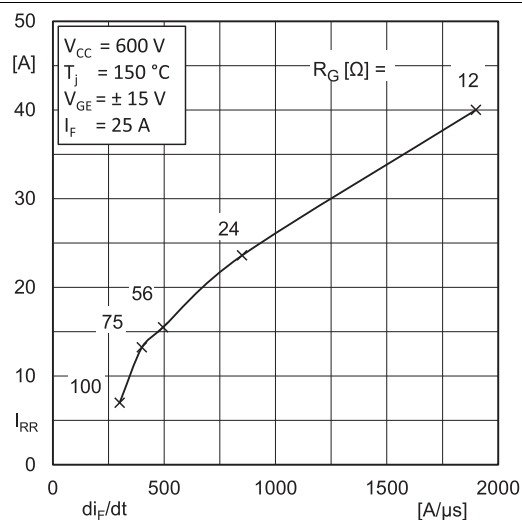


Fig. 11: Typ. CAL diode peak reverse recovery current

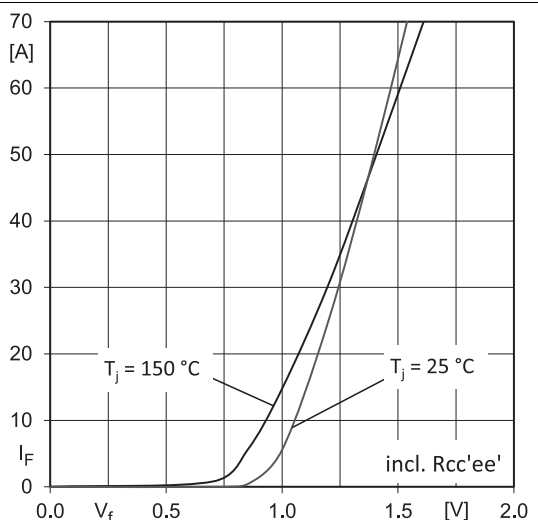
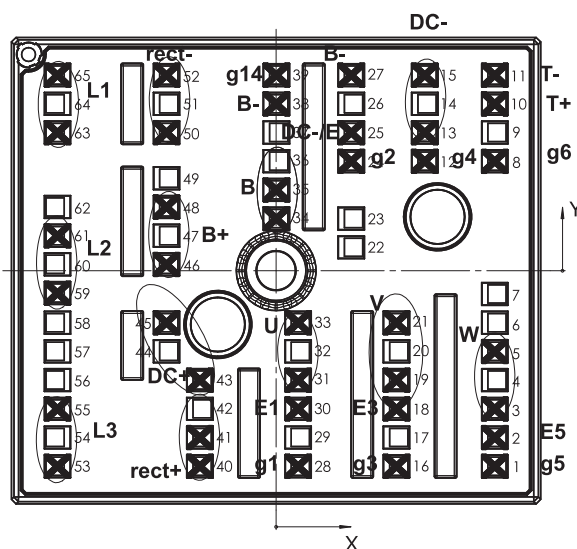


Fig. 12: Typ. input bridge forward characteristic

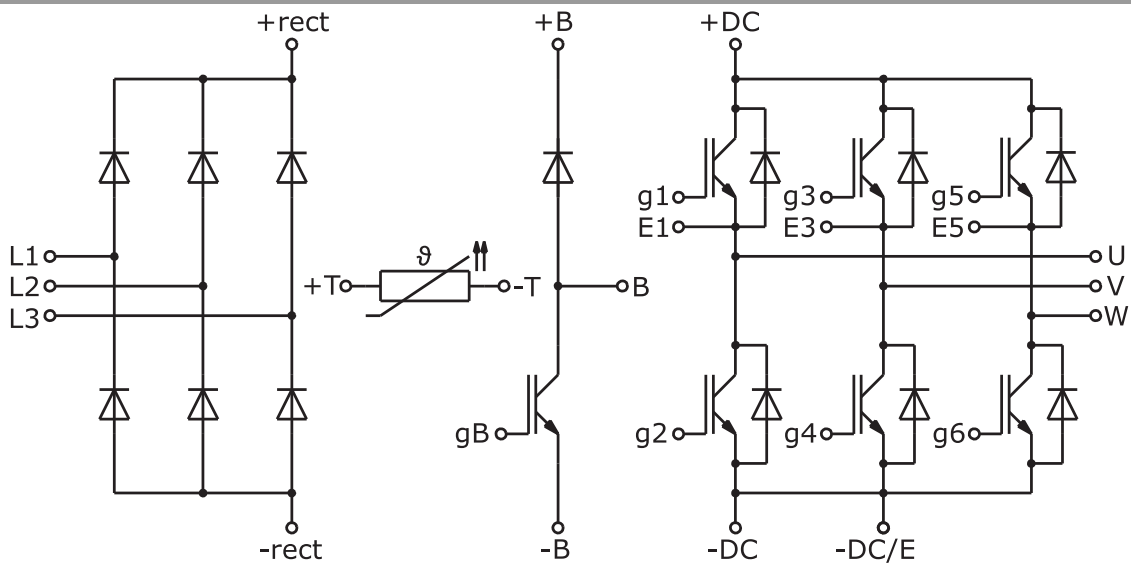
SKiP 23NAB12T4V1

Pin out											
Pin	X	Y	Function	Pin	X	Y	Function	Pin	X	Y	Function
1	24,38	-21,80	g5	23	8,38	5,80		45	-12,23	-5,80	DC+
2	24,38	-18,60	E5	24	8,38	12,20	g2	46	-12,23	0,70	B+
3	24,38	-15,40	W	25	8,38	15,40	DC-/E	47	-12,23	3,90	
4	24,38	-12,20		26	8,38	18,60		48	-12,23	7,10	B+
5	24,38	-9,00	W	27	8,38	21,80	B-	49	-12,23	10,30	
6	24,38	-5,80		28	2,46	-21,80	g1	50	-12,23	15,40	rect-
7	24,38	-2,60		29	2,46	-18,60		51	-12,23	18,60	
8	24,38	12,20	g6	30	2,46	-15,40	E1	52	-12,23	21,80	rect-
9	24,38	15,40		31	2,46	-12,20	U	53	-24,38	-21,80	L3
10	24,38	18,60	T+	32	2,46	-9,00		54	-24,38	-18,60	
11	24,38	21,80	T-	33	2,46	-5,80	U	55	-24,38	-15,40	L3
12	16,58	12,20	g4	34	0,03	5,80	B	56	-24,38	-12,20	
13	16,58	15,40	DC-	35	0,03	9,00	B	57	-24,38	-9,00	
14	16,58	18,60		36	0,03	12,20		58	-24,38	-5,80	
15	16,58	21,80	DC-	37	0,03	15,40		59	-24,38	-2,50	L2
16	13,42	-21,80	g3	38	0,03	18,60	B-	60	-24,38	0,70	
17	13,42	-18,60		39	0,03	21,80	g14	61	-24,38	3,90	L2
18	13,42	-15,40	E3	40	-8,51	-21,80	rect+	62	-24,38	7,10	
19	13,42	-12,20	V	41	-8,51	-18,60	rect+	63	-24,38	15,40	L1
20	13,42	-9,00		42	-8,51	-15,40		64	-24,38	18,60	
21	13,42	-5,80	V	43	-8,51	-12,20	DC+	65	-24,38	21,80	L1
22	8,38	2,60		44	-12,23	-9,00					

all values in mm



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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