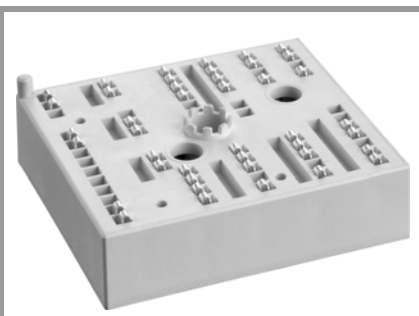


SKiiP 23NAB12T7V1



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

SKiiP 23NAB12T7V1

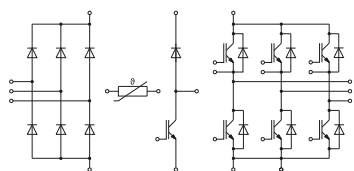
Features*

- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- New SKR PEP diode technology for enhanced power and environmental robustness
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

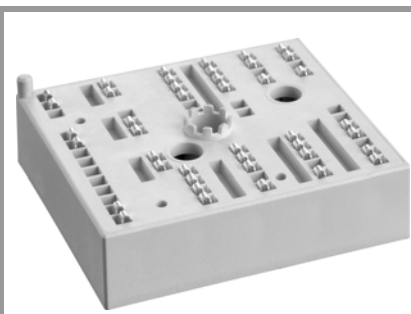
- Max. case temperature limited to $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_{j \leq 150^\circ\text{C}}$; $T_{j, \text{op}} > 150^\circ\text{C}$ during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please refer to both documents for further information
- For storage and case temperature with TIM see document "Technical Explanations Thermal Interface Materials"
- Inverter IGBT: T1 – T6
- Chopper IGBT: T14
- Inverse Diode: D1 – D6
- Freewheeling Diode: D13
- Rectifier Diode: D7 – D12

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	33	A
	T _j = 175 °C	T _s = 100 °C	27	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	37	A
	T _j = 175 °C	T _s = 100 °C	30	A
I _{Cnom}			25	A
I _{CRM}			50	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 175 °C	7	μs
T _j			-40 ... 175	°C
Chopper - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	33	A
	T _j = 175 °C	T _s = 100 °C	27	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	37	A
	T _j = 175 °C	T _s = 100 °C	30	A
I _{Cnom}			25	A
I _{CRM}			50	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 175 °C	7	μs
T _j			-40 ... 175	°C
Inverse - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	24	A
	T _j = 175 °C	T _s = 100 °C	20	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	27	A
	T _j = 175 °C	T _s = 100 °C	22	A
I _{FRM}			50	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		100	A
T _j			-40 ... 175	°C
Freewheeling - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	24	A
	T _j = 175 °C	T _s = 100 °C	20	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	27	A
	T _j = 175 °C	T _s = 100 °C	22	A
I _{FRM}			50	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		100	A
T _j			-40 ... 175	°C



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SKiiP 23NAB12T7V1



MiniSKiiP® 2

3-phase Converter-Inverter-Brake (CIB)

SKiiP 23NAB12T7V1

Features*

- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- New SKR PEP diode technology for enhanced power and environmental robustness
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

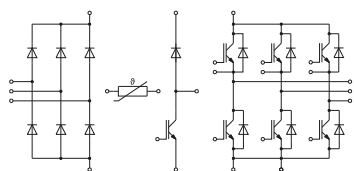
- Max. case temperature limited to $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$; $T_{j,op} > 150^\circ\text{C}$ during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please refer to both documents for further information
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- Inverter IGBT: T1 – T6
- Chopper IGBT: T14
- Inverse Diode: D1 – D6
- Freewheeling Diode: D13
- Rectifier Diode: D7 – D12

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V _{RRM}	T _j = 25 °C		1600	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 70 °C	49	A
	T _j = 175 °C	T _s = 100 °C	39	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	55	A
	T _j = 175 °C	T _s = 100 °C	43	A
I _{FSM}	t _p = 10 ms	T _j = 25 °C	370	A
	sin 180°	T _j = 150 °C	270	A
i ² t	t _p = 10 ms	T _j = 25 °C	685	A ² s
	sin 180°	T _j = 150 °C	365	A ² s
T _j			-40 ... 175	°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

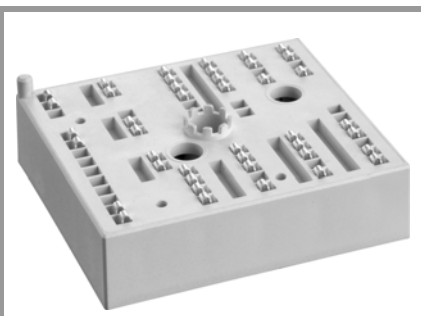
Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
$V_{CE(sat)}$	$I_C = 25 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.60	1.75	V
		$T_j = 150^\circ\text{C}$	1.78	1.93	V
		$T_j = 175^\circ\text{C}$	1.82	1.97	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	1.00	1.05	V
		$T_j = 150^\circ\text{C}$	0.80	0.85	V
		$T_j = 175^\circ\text{C}$	0.75	0.80	V
r_{CE}	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	24	28	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	39	43	$\text{m}\Omega$
		$T_j = 175^\circ\text{C}$	43	47	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 0.53 \text{ mA}$	5.15	5.8	6.45	V
I_{CES}	$V_{GE} = 0 \text{ V}$, $V_{CE} = 1200 \text{ V}$, $T_j = 25^\circ\text{C}$			1	mA
C_{ies}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	4.80		nF
C_{oes}		$f = 1 \text{ MHz}$	0.06		nF
C_{res}		$f = 1 \text{ MHz}$	0.02		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		350		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$ $I_C = 25 \text{ A}$ $R_{G on} = 12.8 \Omega$ $R_{G off} = 12.8 \Omega$	$T_j = 25^\circ\text{C}$	40		ns
		$T_j = 150^\circ\text{C}$	42		ns
		$T_j = 175^\circ\text{C}$	43		ns
t_r	$V_{GE} = +15/-15 \text{ V}$	$T_j = 25^\circ\text{C}$	38		ns
		$T_j = 150^\circ\text{C}$	44		ns
		$T_j = 175^\circ\text{C}$	47		ns
E_{on}	@ $T_j = 150^\circ\text{C}$: $di/dt_{on} = 590 \text{ A}/\mu\text{s}$ $di/dt_{off} = 280 \text{ A}/\mu\text{s}$ $dv/dt = 3600 \text{ V}/\mu\text{s}$	$T_j = 25^\circ\text{C}$	2		mJ
		$T_j = 150^\circ\text{C}$	2.8		mJ
		$T_j = 175^\circ\text{C}$	3		mJ



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SKiiP 23NAB12T7V1



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

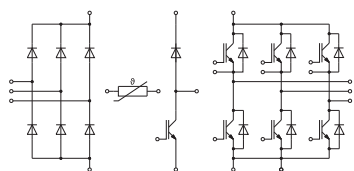
SKiiP 23NAB12T7V1

Features*

- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- New SKR PEP diode technology for enhanced power and environmental robustness
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

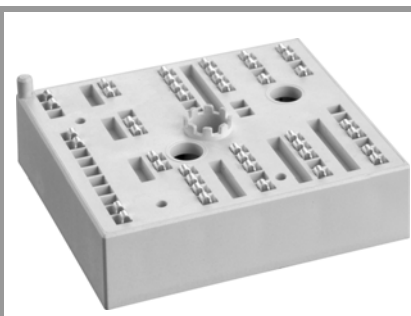
- Max. case temperature limited to $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$; $T_{j,op} > 150^\circ\text{C}$ during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please refer to both documents for further information
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- Inverter IGBT: T1 – T6
- Chopper IGBT: T14
- Inverse Diode: D1 – D6
- Freewheeling Diode: D13
- Rectifier Diode: D7 – D12



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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
t _{d(off)}	V _{CC} = 600 V	T _j = 25 °C		218		ns
	I _C = 25 A	T _j = 150 °C		308		ns
	R _{G on} = 12.8 Ω	T _j = 175 °C		333		ns
t _f	R _{G off} = 12.8 Ω	T _j = 25 °C		46		ns
	V _{GE} = +15/-15 V	T _j = 150 °C		71		ns
		T _j = 175 °C		87		ns
E _{off}	@ T _j = 150 °C:	T _j = 25 °C		1.6		mJ
	di/dt _{on} = 590 A/μs	T _j = 150 °C		2.8		mJ
	di/dt _{off} = 280 A/μs	T _j = 175 °C		3		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.32		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			1.11		K/W
Chopper - IGBT						
V _{CE(sat)}	I _C = 25 A	T _j = 25 °C		1.60	1.75	V
	V _{GE} = 15 V	T _j = 150 °C		1.78	1.93	V
	chipelevel	T _j = 175 °C		1.82	1.97	V
V _{CE0}		T _j = 25 °C		1.00	1.05	V
	chipelevel	T _j = 150 °C		0.80	0.85	V
		T _j = 175 °C		0.75	0.80	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		24	28	mΩ
	chipelevel	T _j = 150 °C		39	43	mΩ
		T _j = 175 °C		43	47	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.53 mA		5.15	5.8	6.45	V
I _{CES}	V _{GE} = 0 V, V _{CE} = 1200 V, T _j = 25 °C				1	mA
C _{ies}	V _{CE} = 25 V	f = 1 MHz		4.80		nF
C _{oes}	V _{GE} = 0 V	f = 1 MHz		0.06		nF
C _{res}		f = 1 MHz		0.02		nF
Q _G	V _{GE} = - 8V ... + 15 V			350		nC
R _{Gint}	T _j = 25 °C			0		Ω
t _{d(on)}	V _{CC} = 600 V I _C = 25 A R _{G on} = 12.8 Ω R _{G off} = 12.8 Ω V _{GE} = +15/-15 V @ T _j = 150 °C: di/dt _{on} = 590 A/μs di/dt _{off} = 280 A/μs dv/dt = 3600 V/μs	T _j = 25 °C		40		ns
		T _j = 150 °C		42		ns
		T _j = 175 °C		43		ns
t _r		T _j = 25 °C		38		ns
		T _j = 150 °C		44		ns
		T _j = 175 °C		47		ns
E _{on}		T _j = 25 °C		2		mJ
		T _j = 150 °C		2.8		mJ
		T _j = 175 °C		3		mJ
t _{d(off)}		T _j = 25 °C		218		ns
		T _j = 150 °C		308		ns
		T _j = 175 °C		333		ns
t _f		T _j = 25 °C		46		ns
		T _j = 150 °C		71		ns
		T _j = 175 °C		87		ns
E _{off}		T _j = 25 °C		1.6		mJ
	T _j = 150 °C		2.8		mJ	
	T _j = 175 °C		3		mJ	
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.32		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			1.11		K/W

SKiiP 23NAB12T7V1



MiniSKiiP® 2

3-phase Converter-Inverter-Brake (CIB)

SKiiP 23NAB12T7V1

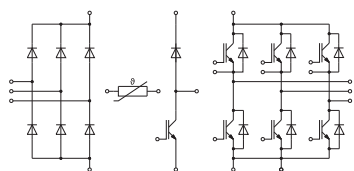
Features*

- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- New SKR PEP diode technology for enhanced power and environmental robustness
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

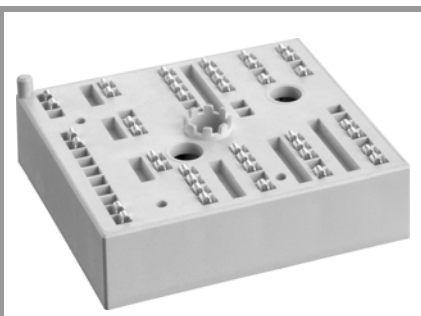
- Max. case temperature limited to $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$; $T_{j,op} > 150^\circ\text{C}$ during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please refer to both documents for further information
- For storage and case temperature with TIM see document "Technical Explanations Thermal Interface Materials"
- Inverter IGBT: T1 – T6
- Chopper IGBT: T14
- Inverse Diode: D1 – D6
- Freewheeling Diode: D13
- Rectifier Diode: D7 – D12

Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
Inverse - Diode					
$V_F = V_{EC}$	$I_F = 25\text{ A}$	$T_j = 25^\circ\text{C}$		2.41	2.74 V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.45	2.79 V
	chipelevel	$T_j = 175^\circ\text{C}$		2.30	2.62 V
V_{F0}		$T_j = 25^\circ\text{C}$		1.30	1.50 V
	chipelevel	$T_j = 150^\circ\text{C}$		0.90	1.10 V
		$T_j = 175^\circ\text{C}$		0.82	0.98 V
r_F		$T_j = 25^\circ\text{C}$		44	50 mΩ
	chipelevel	$T_j = 150^\circ\text{C}$		62	68 mΩ
		$T_j = 175^\circ\text{C}$		59	66 mΩ
I_{RRM}		$T_j = 25^\circ\text{C}$		15	A
		$T_j = 150^\circ\text{C}$		20	A
	$V_{CC} = 600\text{ V}$	$T_j = 175^\circ\text{C}$		23	A
Q_{rr}	$I_F = 25\text{ A}$	$T_j = 25^\circ\text{C}$		1.5	μC
	$V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		3.7	μC
		$T_j = 175^\circ\text{C}$		4.1	μC
E_{rr}	@ $T_j = 150^\circ\text{C}$:	$T_j = 25^\circ\text{C}$		0.48	mJ
	$di/dt_{off} = 610\text{ A/μs}$	$T_j = 150^\circ\text{C}$		1.4	mJ
		$T_j = 175^\circ\text{C}$		1.9	mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 0.8\text{ W/(mK)}$			1.68	K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 2.5\text{ W/(mK)}$			1.44	K/W
Freewheeling - Diode					
$V_F = V_{EC}$	$I_F = 25\text{ A}$	$T_j = 25^\circ\text{C}$		2.41	2.74 V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.45	2.79 V
	chipelevel	$T_j = 175^\circ\text{C}$		2.30	2.62 V
V_{F0}		$T_j = 25^\circ\text{C}$		1.30	1.50 V
	chipelevel	$T_j = 150^\circ\text{C}$		0.90	1.10 V
		$T_j = 175^\circ\text{C}$		0.82	0.98 V
r_F		$T_j = 25^\circ\text{C}$		44	50 mΩ
	chipelevel	$T_j = 150^\circ\text{C}$		62	68 mΩ
		$T_j = 175^\circ\text{C}$		59	66 mΩ
I_{RRM}		$T_j = 25^\circ\text{C}$		15	A
		$T_j = 150^\circ\text{C}$		20	A
	$V_{CC} = 600\text{ V}$	$T_j = 175^\circ\text{C}$		23	A
Q_{rr}	$I_F = 25\text{ A}$	$T_j = 25^\circ\text{C}$		1.5	μC
	$V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		3.7	μC
		$T_j = 175^\circ\text{C}$		4.1	μC
E_{rr}	@ $T_j = 150^\circ\text{C}$:	$T_j = 25^\circ\text{C}$		0.48	mJ
	$di/dt_{off} = 610\text{ A/μs}$	$T_j = 150^\circ\text{C}$		1.4	mJ
		$T_j = 175^\circ\text{C}$		1.9	mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 0.8\text{ W/(mK)}$			1.68	K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 2.5\text{ W/(mK)}$			1.44	K/W



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SKiiP 23NAB12T7V1



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

SKiiP 23NAB12T7V1

Features*

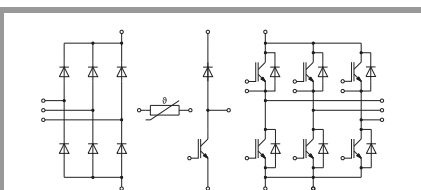
- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- New SKR PEP diode technology for enhanced power and environmental robustness
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

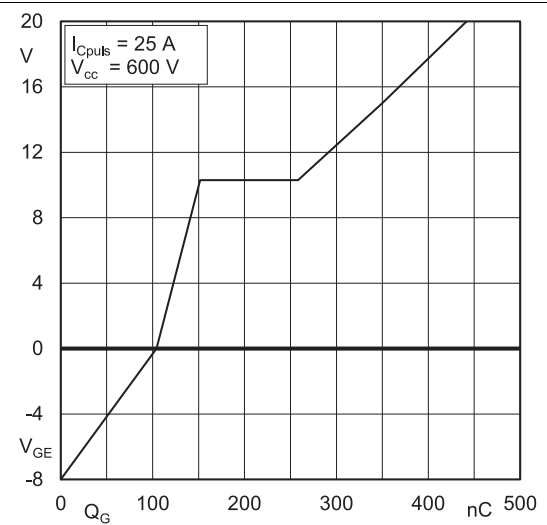
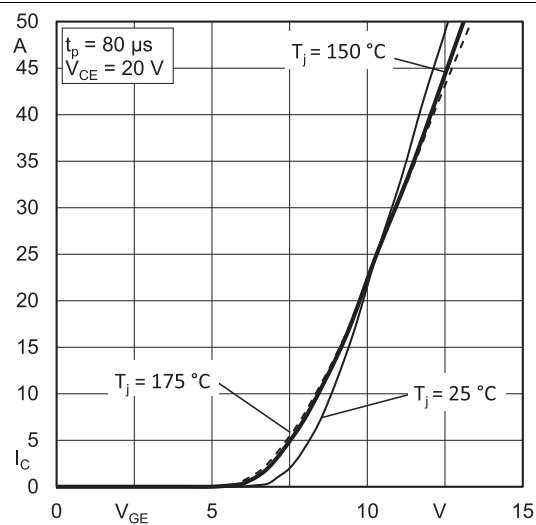
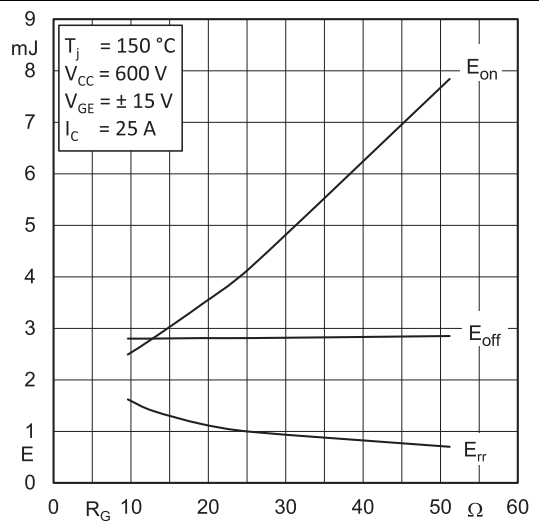
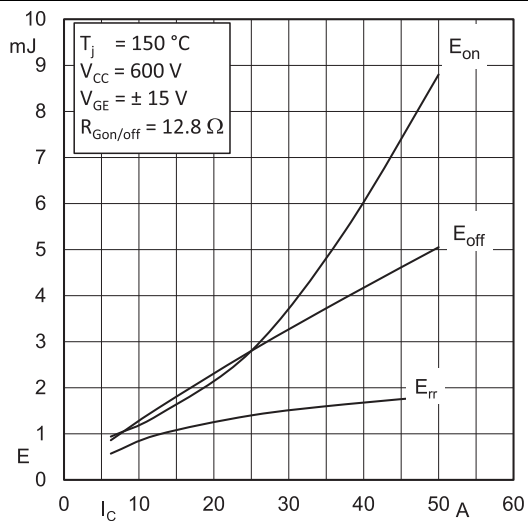
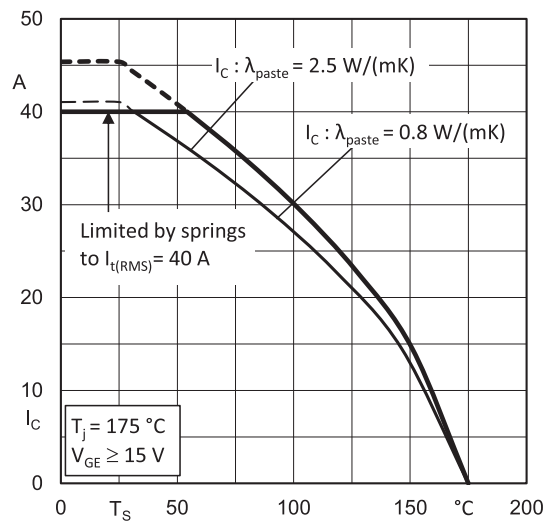
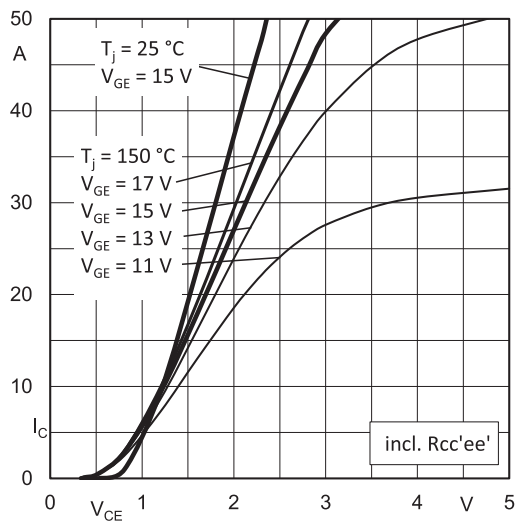
- Max. case temperature limited to $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$; $T_{j,op} > 150^\circ\text{C}$ during overload (Details see AN19-002)
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- Inverter IGBT: T1 – T6
- Chopper IGBT: T14
- Inverse Diode: D1 – D6
- Freewheeling Diode: D13
- Rectifier Diode: D7 – D12

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
V _F	I _F = 13 A chiplevel	T _j = 25 °C		0.97	1.20	V
		T _j = 150 °C		0.84	1.07	V
		T _j = 175 °C		0.82	1.05	V
V _{F0}	chiplevel	T _j = 25 °C		0.89	1.09	V
		T _j = 150 °C		0.73	0.92	V
		T _j = 175 °C		0.69	0.88	V
r _F	chiplevel	T _j = 25 °C		6.2	8.5	mΩ
		T _j = 150 °C		8.8	12	mΩ
		T _j = 175 °C		10.0	13	mΩ
I _R	T _j = 150 °C, V _{RRM}				1.7	mA
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.39		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.2		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					

Creepage distance (spring to spring) between temperature sensor and phase DC- = 3.2mm (CTI 600)



NAB



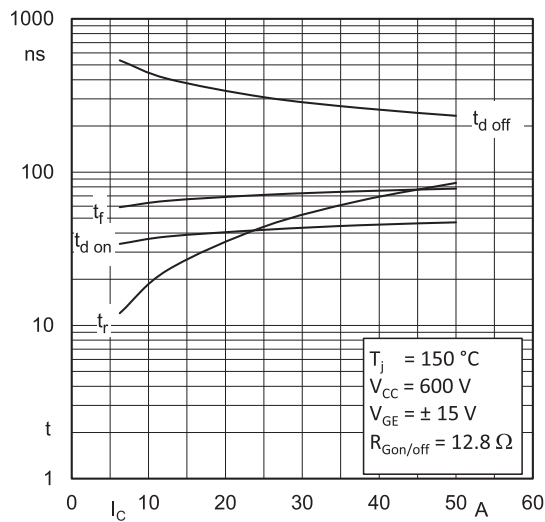


Fig. 7: Typ. switching times vs. I_C

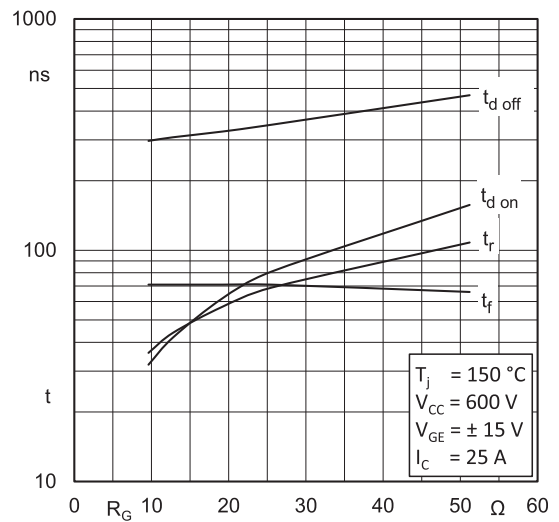


Fig. 8: Typ. switching times vs. gate resistor R_G

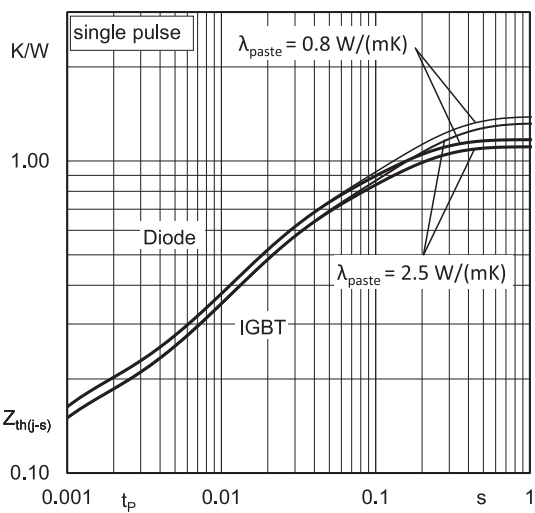


Fig. 9: Typ. transient thermal impedance

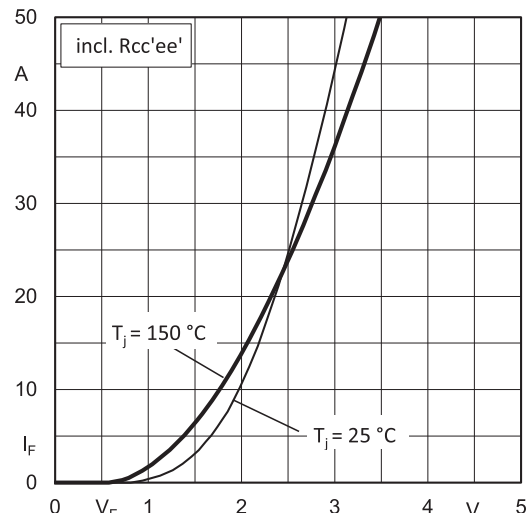


Fig. 10: Typ. CAL diode forward characteristic

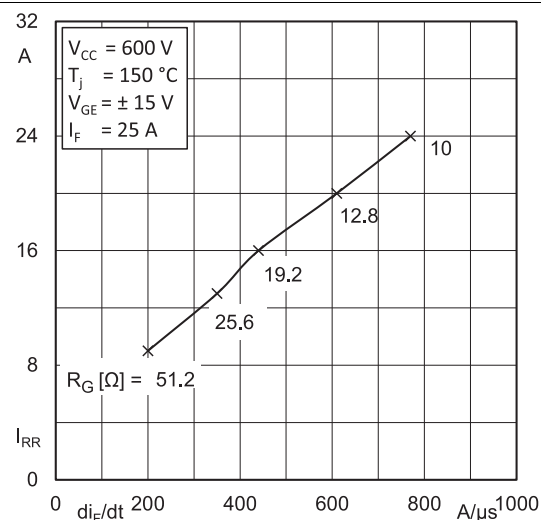


Fig. 11: Typ. CAL diode peak reverse recovery current

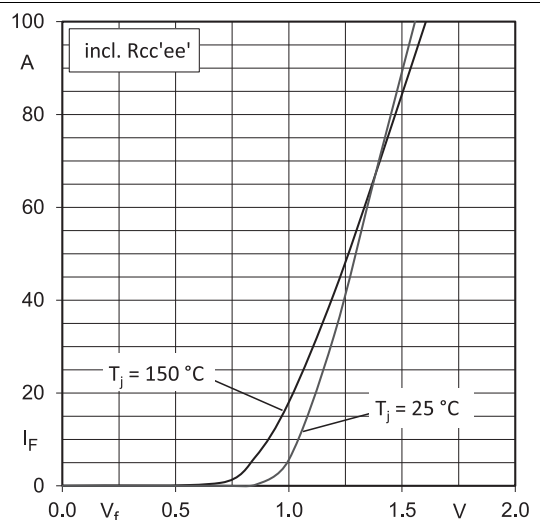
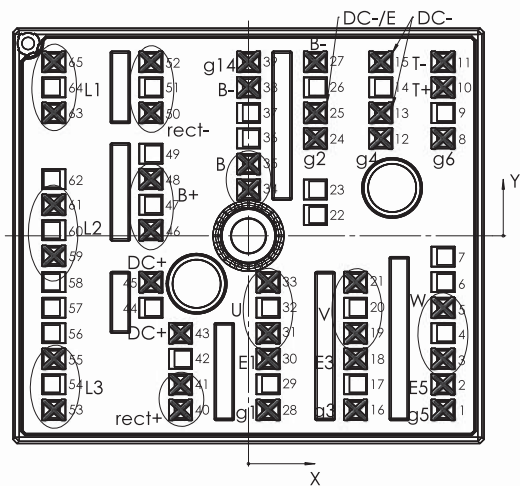


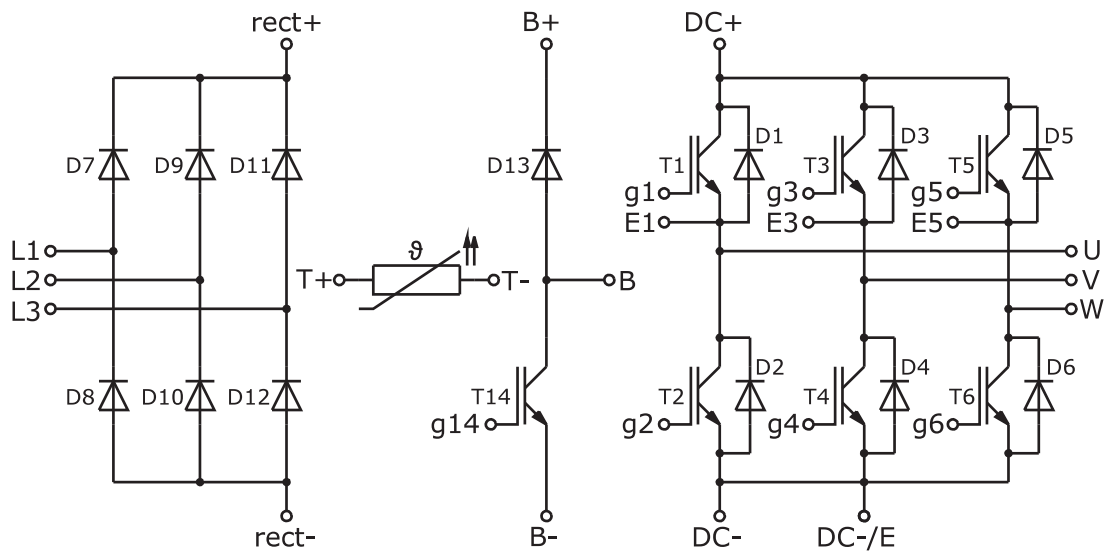
Fig. 12: Typ. input bridge forward characteristic

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

all values in mm



Pinout



Pinout

SKiiP 23NAB12T7V1

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

***IMPORTANT INFORMATION AND WARNINGS**

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