SKiiP 3-phase bridge

Absolute Maximum Ratings			
Symbol	**Conditions** [1]	**Values**	**Units**
V_{isol} [4]	AC, 1min	3000	V
T_{op} ,T_{stg}	Operating / stor. temperature	-25...+85	°C
IGBT and Inverse Diode			
V_{CES}		1200	V
V_{CC} [5]	Operating DC link voltage	900	V
I_C	IGBT	150	A
T_j [3]	IGBT + Diode	-40...+150	°C
I_F	Diode	150	A
I_{FM}	Diode, t_p < 1 ms	300	A
I_{FSM}	Diode, T_j = 150 °C, 10ms; sin	1440	A
I^2t (Diode)	Diode, T_j = 150 °C, 10ms	10	kAs^2
Driver			
V_{S1}	Stabilized Power Supply	18	V
V_{S2}	Non-stabilized Power Supply	30	V
f_{smax}	Switching frequency	20	kHz
dV/dt	Primary to secondary side	75	kV/µs

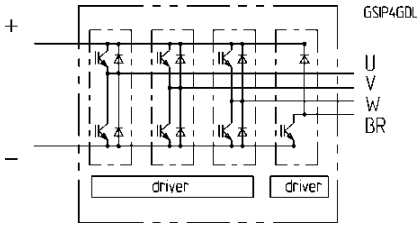
Characteristics						
Symbol	**Conditions** [1]		**min.**	**typ.**	**max.**	**Units**
IGBT[11]						
$V_{(BR)CES}$	Driver without supply		≥V_{CES}	–	–	V
I_{CES}	V_{GE} = 0,	T_j = 25 °C	–	–	0,4	mA
	V_{CE} = V_{CES}	T_j = 125 °C	–	10	–	mA
V_{TO}	T_j = 125 °C		–	–	1,38	V
r_T	T_j = 125 °C		–	–	14,7	mΩ
V_{Cesat}	I_C = 125A,	T_j = 125 °C	–	–	3,2	V
V_{Cesat}	I_C = 125A,	T_j = 25 °C	–	–	3,05	V
E_{on} + E_{off}	V_{CC}=600/900V,I_C=150A T_j = 125 °C		–	–	45/73	mJ
C_{CHC}	per Phase, AC side		–	1,4	–	nF
L_{CE}	Top, Bottom		–	15	–	nH
Inverse Diode [2]						
V_F = V_{EC}	I_F= 125A;	T_j = 125 °C	–	–	2,38	V
V_F= V_{EC}	I_F= 125A;	T_j = 25 °C	–	–	2,55	V
E_{on} + E_{off}	I_F= 150A;	T_j = 125 °C	–	–	6	mJ
V_{TO}	T_j = 125 °C		–	–	0,91	V
r_T	T_j = 125 °C		–	–	5,7	mΩ
Thermal Characteristics						
R_{thjs} [10]	per IGBT		–	–	0,180	K/W
R_{thjs} [10]	per Diode		–	–	0,375	K/W
R_{thsa} [6,10]	P16 heatsink; see case S5		–	–	33	K/KW
Driver						
I_{S1}	Supply current 15V-supply		340+260*f_s /f_{smax}+3,5*I_{AC}/A			mA
I_{S2}	Supply current 24V-supply		250+170*f_s /f_{smax}+2,6*I_{AC}/A			mA
$t_{interlock-driver}$	Interlock-time			2,3		µs
SKiiPPACK protection						
I_{TRIPSC}	Short circuit protection			188		A
I_{TRIPLG}	Ground fault protection			43		A
T_{TRIP}	Over-temp. protection			115		°C
U_{DCTRIP} [9]	U_{DC}-protection			920		V
Mechanical Data						
M1	DC terminals, SI Units		4	–	6	Nm
M2	AC terminals, SI Units		8	–	10	Nm

SKiiPPACK®

SK integrated intelligent Power PACK 3-phase bridge with brake chopper (E/A) SKiiP 132 GDL 120 - 412 CTV [7,9)]

Preliminary Data

Case S5



Features

- Short circuit protection, due to evaluation of current sensor signals
- Isolated power supply
- Low thermal impedance
- Optimal thermal management with integrated heatsink
- Pressure contact technology with increased power cycling capability, compact design
- Low stray inductance
- High power, small losses
- Over-temperature protection

1) $T_{heatsink}$ = 25 °C, unless otherwise specified
2) CAL = Controlled Axial Lifetime Technology (soft and fast)
3) without driver
4) Driver input to DC link / AC output to DC link / AC output to heatsink
5) with Semikron-DC link (low inductance)
6) other heatsinks on request
7) C - Integrated current sensors
T - Temperature protection
V - 15 V or 24 V power supply
9) options available for driver:
U - DC link voltage sense
F – Fiber optic connector
10) "$_s$" referenced to temperature sensor
11) NPT-technology with homogenous current-distribution

SKiiP Brake-chopper

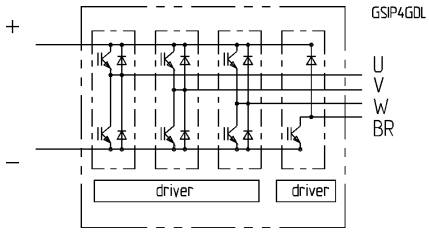
Absolute Maximum Ratings			
Symbol	**Conditions** [1]	**Values**	**Units**
V_{isol} [4]	AC, 1min	3000	V
T_{op} ,T_{stg}	Operating / stor. temperature	-25...+85	°C
IGBT and Freewheeling Diode			
V_{CES}		1200	V
V_{CC} [5]	Operating DC link voltage	900	V
I_C	IGBT	150	A
T_j [3]	IGBT + Diode	-40...+150	°C
I_F	Diode	150	A
I_{FM}	Diode, t_p < 1 ms	300	A
I_{FSM}	Diode, T_j = 150 °C, 10ms; sin	1440	A
I^2t (Diode)	Diode, T_j = 150 °C, 10ms	10	kAs^2
Driver			
V_{S1}	Stabilized Power Supply	18	V
V_{S2}	Non-stabilized Power Supply	30	V
f_{smax}	Switching frequency	5	kHz
dV/dt	Primary to secondary side	50	kV/µs

Characteristics						
Symbol	**Conditions** [1]		**min.**	**typ.**	**max.**	**Units**
IGBT[11]						
$V_{(BR)CES}$	Driver without supply		≥V_{CES}	–	–	V
I_{CES}	V_{GE} = 0,	T_j = 25 °C	–	–	0,4	mA
	V_{CE} = V_{CES}	T_j = 125 °C	–	10	–	mA
V_{TO}	T_j = 125 °C		–	–	1,38	V
r_T	T_j = 125 °C		–	–	14,7	mΩ
V_{Cesat}	I_C = 125A,	T_j = 125 °C	–	–	3,2	V
V_{Cesat}	I_C = 125A,	T_j = 25 °C	–	–	3,05	V
E_{on} + E_{off}	V_{CC}=600/900V, I_C=150A T_j = 125 °C		–	–	45/73	mJ
C_{CHC}	per Phase, AC side		–	1,4	–	nF
L_{CE}	Top, Bottom		–	15	–	nH
Freewheeling Diode [2]						
V_F = V_{EC}	I_F= 125A;	T_j = 125 °C	–	–	2,38	V
V_F= V_{EC}	I_F= 125A;	T_j = 25 °C	–	–	2,55	V
E_{on} + E_{off}	I_F= 150A;	T_j = 125 °C	–	–	6	mJ
V_{TO}	T_j = 125 °C		–	–	0,91	V
r_T	T_j = 125 °C		–	–	5,7	mΩ
Thermal Characteristics						
R_{thjs} [10]	per IGBT		–	–	0,180	K/W
R_{thjs} [10]	per Diode		–	–	0,375	K/W
R_{thsa} [6,10]	P16 heatsink; see case S5		–	–	33	K/KW
Driver						
I_{S1}	Supply current 15V-supply		67+10*f_s /f_{smax}+0*I_{AC}/A			mA
I_{S2}	Supply current 24V-supply		67+10*f_s /f_{smax}+0,0*I_{AC}/A			mA
$t_{interlock-driver}$	Interlock-time			2,3		µs
SKiiPPACK protection						
I_{TRIPSC}	Short circuit protection			V_{CEsat}-protection		A
I_{TRIPLG}	Ground fault protection			-		A
T_{TRIP}	Over-temp. protection			115		°C
U_{DCTRIP} [9]	U_{DC}-protection			920		V
Mechanical Data						
M1	DC terminals, SI Units		4	–	6	Nm
M2	AC terminals, SI Units		8	–	10	Nm

SKiiPPACK®

SK integrated intelligent Power PACK
3-phase bridge with brake chopper (E/A)
SKiiP
132 GDL 120 - 412 CTV [7,9)]

Preliminary Data
Case S5



Features

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4) Driver input to DC link / AC output to DC link / AC output to heatsink
5) with Semikron-DC link (low inductance)
6) other heatsinks on request
7) C - Integrated current sensors
T - Temperature protection
V - 15 V or 24 V power supply
8) E - adapted to 400 Vrms; U - adapted to 460 Vrms
9) options available for driver:
U - DC link voltage sense
F – Fiber optic connector
10) "s" referenced to temperature sensor
11) NPT-technology with homogenous current-distribution

PIN-array - 3-phase bridge driver SKiiPPACK type „GD and GDL”

X1:

Pin	signal	remark
1	shield	connected to GND, when shielded cable is used
2	BOT HB 1 IN[4)]	positive 15V CMOS logic; 10 kΩ impedance
3	ERROR HB 1 OUT [1)]	short circuit monitoring HB1 LOW = NO ERROR; open collector output; max. 30 V / 15 mA propagation delay 1 µs, min. pulsewidth error-memory-reset 8 µs
4	TOP HB 1 IN[4)]	positive 15V CMOS logic; 10 kΩ impedance
5	BOT HB 2 IN[4)]	positive 15V CMOS logic; 10 kΩ impedance
6	ERROR HB 2 OUT [1)]	short circuit monitoring HB2 LOW = NO ERROR; open collector output; max. 30 V / 15 mA propagation delay 1 µs, min. pulsewidth error-memory-reset 8 µs
7	TOP HB 2 IN[4)]	positive 15V CMOS logic; 10 kΩ impedance
8	BOT HB 3 IN[4)]	positive 15V CMOS logic; 10 kΩ impedance
9	ERROR HB 3 OUT [1)]	short circuit monitoring HB 3 LOW = NO ERROR; open collector output; max. 30 V / 15 mA propagation delay 1 µs, min. pulsewidth error-memory-reset 8 µs
10	TOP HB 3[4)]	positive 15V CMOS logic; 10 kΩ impedance
11	Overtemp. OUT [1)]	LOW = NO ERROR = ϑ_{DCB} < 115 ± 5°C open collector Output; max. 30 V / 15 mA „low“ output voltage < 0,6 V „high“ output voltage max. 30 V
12	reserved	
13	U_{DC} analog OUT	U_{DC} when using **option „U”** actual DC-link voltage, 9,0 V refer to U_{DCmax} max. output current 5 mA
14	+ 24 V_{DC} IN	24 V_{DC} (20 - 30 V)
15	+ 24 V_{DC} IN	don´t supply with 24 V, when using + 15 V_{DC} supply voltage monitoring threshold 15,6 V
16	+ 15 V_{DC} IN	15 V_{DC} ± 4 % power supply
17	+ 15 V_{DC} IN	don´t supply with 15 V, when using + 24 V_{DCIN} supply voltage monitoring threshold 13 V
18	GND	GND for power supply and
19	GND	GND for digital signals
20	Temp. analog OUT	
21	GND aux[2)]	
22	I analog OUT HB 1	current actual value, 8,0 V refer to 100 % I_C overcurrent trip level 10 V ⇔ 125 %; I_C @ 25 °C current value > 0 ⇔ SKiiP is source current value < 0 ⇔ SKiiP is sink
23	GND aux[2)]	
24	I analog OUT HB 2	current actual value, 8,0 V refer to 100 % I_C overcurrent trip level 10 V ⇔ 125 %; I_C @ 25 °C current value > 0 ⇔ SKiiP is source current value < 0 ⇔ SKiiP is sink
25	GND aux[2)]	
26	I analog OUT HB 3	current actual value, 8,0 V refer to 100 % I_C overcurrent trip level 10 V ⇔ 125 %; I_C @ 25 °C current value > 0 ⇔ SKiiP is source current value < 0 ⇔ SKiiP is sink

X10: halfbridge 1 (HB1) OUT

Pin	Signal
1	
2	
8	Collector 1=TOP (HB1)
11	Gate 1=TOP (HB1)
12	Emitter 1=TOP (HB1)
13	Collector 2=BOT (HB1)
16	Gate 2=BOT (HB1)
17	Emitter 2=BOT (HB1)

X11: halfbridge 2 (HB2) OUT

Pin	Signal
1	Temp.-Sensor (HB2)1
2	Temp.-Sensor (HB2)2
8	Collector 1=TOP (HB2)
11	Gate 1=TOP (HB2)
12	Emitter 1=TOP (HB2)
13	Collector 2=BOT (HB2)
16	Gate 2=BOT (HB2)
17	Emitter 2=BOT (HB2)

X12: halfbridge 3 (HB3) OUT

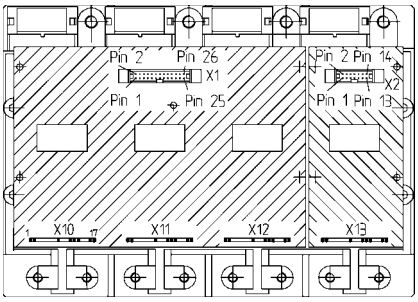
Pin	Signal
1	
2	
8	Collector 1=TOP (HB3)
11	Gate 1=TOP (HB3)
12	Emitter 1=TOP (HB3)
13	Collector 2=BOT (HB3)
16	Gate 2=BOT (HB3)
17	Emitter 2=BOT (HB3)

[1)] Open collector output, external pull up resistor necessary
[2)] GND aux = reference for analog output signals
[4)] „high“ (min) 11,2 V
„low“ (max) 5,4 V

PIN-array - brake chopper driver (used in SKiiPPACK type GDL)

X2:

Pin	signal	remark
1	shield	connected to GND, when shielded cable is used
2	CHOPPER ext. ON	LOW = IGBT ON „low“ (max) 5 V, I_{min} = 5 mA „high“ (min) 11,5 V propagation delay $t_{d(on)} \leq 20\ \mu s$ $t_{d(off)} \leq 25\ \mu s$
3	ERROR OUT[1)]	LOW = NO ERROR open collector Output; max. 30 V / 2,5 mA propagation delay $t_{PD(on)error} \leq 60\ \mu s$
4	RESET	LOW = RESET Reset-pulse-time $t_{PDRESET}$ > 300 ms connect this pin to open collector output **without** pull up resistor „low“ (max) 2 V, „high“ (min) 12 V
5	reserved	
6	+ 24 V_{DC} IN	don´t supply with 24 V, when using + 15 V_{DCIN} supply voltage monitoring threshold 15,6 V
7	+ 24 V_{DC} IN	
8	+ 15 V_{DC} IN	don´t supply with 15 V, when using + 24 V_{DCIN} supply voltage monitoring threshold 13 V
9	+ 15 V_{DC} IN	
10	GND	
11	GND	
12	reserved	
13	reserved	
14	reserved	



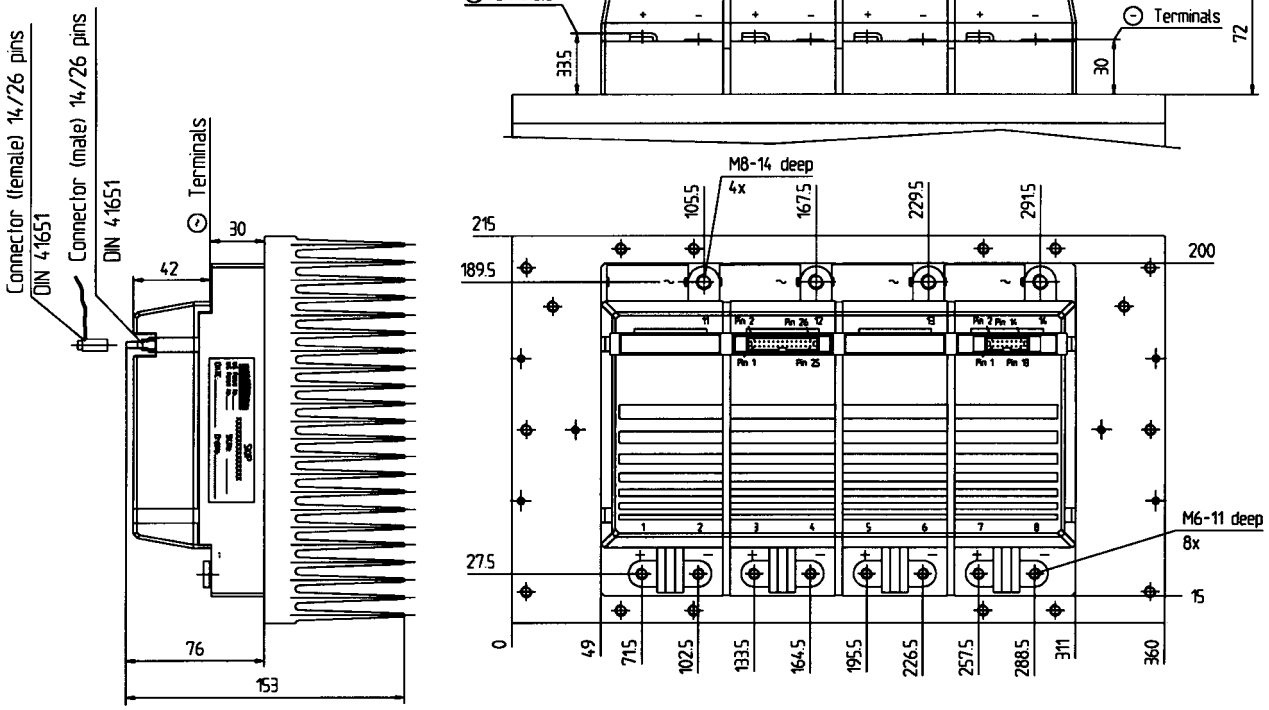
X13: halfbridge (HB4) OUT

Pin	Signal	remark
1	Temp.-sensor	
2	Temp.-sensor	
8	Collector 1=TOP (HB4)	U_Z monitoring
11	Gate 1=TOP (HB4)	connected with PIN 12
12	Emitter 1=TOP (HB4)	connected with PIN 11
13	Collector 2=BOT (HB4)	
16	Gate 2=BOT (HB4)	
17	Emitter 2=BOT (HB4)	

[1)] Open collector output, external pull up resistor necessary

Case S5 **SKiiPPACK 4 - GDL**

CASES5GDL



Weight without heatsink: 3,54 kg
P16: 8,46 kg