

### I. Power section

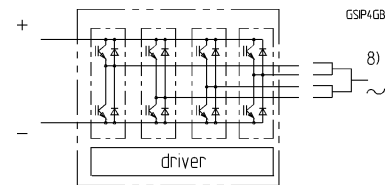
| Absolute maximum ratings |   | $T_s = 25^\circ\text{C}$ unless otherwise specified |                       |
|--------------------------|---|---|-----------------------|
| Symbol                   | Conditions  | Values  | Units                 |
| IGBT                     |   |   |                       |
| $V_{CES}$                | Operating DC link voltage                             | 600   | V                     |
| $V_{CC}^{1)}$            |   | 400   | V                     |
| $V_{GES}$                |   | $\pm 20$  | V                     |
| $I_C$                    |   | $T_s = 25 (70)^\circ\text{C}$                       | 1600 (1200)           |
| Inverse diode            |   |   |                       |
| $I_F = -I_C$             | $T_s = 25 (70)^\circ\text{C}$                         | 1600 (1200)   | A                     |
| $I_{FSM}$                | $T_j = 150^\circ\text{C}$ , $t_p = 10\text{ms}$ ; sin | 16000   | A                     |
| $I^2t$ (Diode)           | Diode, $T_j = 150^\circ\text{C}$ , 10ms               | 1280  | $\text{kA}^2\text{s}$ |
| $T_j, (T_{stg})$         | AC, 1min.   | -40 (-25) ... +150 (125)                            | $^\circ\text{C}$      |
| $V_{isol}$               |   | 2500  | V                     |

### SKiiP® 2

### SK integrated intelligent Power 2-pack

### SKiiP 1602GB061-459CTV

Case S4



| Characteristics $T_s = 25^\circ\text{C}$ unless otherwise specified                                      |   |              |           |           |                  |     |      |       |      |
|--|---|--------------|-----------|-----------|------------------|-----|------|-------|------|
| Symbol   | Conditions  | min.         | typ.      | max.      | Units            |     |      |       |      |
| IGBT   |   |              |           |           |                  |     |      |       |      |
| $V_{CESat}$  | $I_C = 1600\text{A}$ , $T_j = 25 (125)^\circ\text{C}$ | -            | 2,3 (2,6) | 2,6       | V                |     |      |       |      |
| $V_{CEO}$  | $T_j = 25 (125)^\circ\text{C}$                        | -            | 0,8 (0,7) | 1,0 (0,9) | V                |     |      |       |      |
| $r_{CE}$   | $T_j = 25 (125)^\circ\text{C}$                        | -            | 0,9 (1,2) | 1,0 (1,3) | $\text{m}\Omega$ |     |      |       |      |
| $I_{CES}$  | $V_{GE}=0, V_{CE}=V_{CES}, T_j=25(125)^\circ\text{C}$ | -            | (80)      | 1,6       | $\text{mA}$      |     |      |       |      |
| $E_{on} + E_{off}$   | $I_C=1600\text{A}$ , $V_{CC}=300\text{V}$             | -            | -         | 144       | $\text{mJ}$      |     |      |       |      |
|  | $T_j=125^\circ\text{C}$ , $V_{CC}=400\text{V}$        | -            | -         | 211       | $\text{mJ}$      |     |      |       |      |
| $R_{CC}^{EE}$  | terminal chip, $T_j = 125^\circ\text{C}$              | -            | 0,13      | -         | $\text{m}\Omega$ |     |      |       |      |
| $L_{CE}$   | top, bottom   | -            | 3,8       | -         | $\text{nH}$      |     |      |       |      |
| $C_{CHC}$  | per phase, AC-side                                    | -            | 3,2       | -         | $\text{nF}$      |     |      |       |      |
| Inverse diode  |   |              |           |           |                  |     |      |       |      |
| $V_F = V_{EC}$   | $I_F = 1600\text{A}$ ; $T_j = 25(125)^\circ\text{C}$  | -            | 1,5 (1,5) | 1,8       | V                |     |      |       |      |
| $V_{TO}$   | $T_j = 25 (125)^\circ\text{C}$                        | -            | 0,8 (0,6) | 1,0 (0,8) | V                |     |      |       |      |
| $r_T$  | $T_j = 25 (125)^\circ\text{C}$                        | -            | 0,4 (0,5) | 0,5 (0,6) | $\text{m}\Omega$ |     |      |       |      |
| $E_{RR}$   | $I_C=1600\text{A}$ , $V_{CC}=300\text{V}$             | -            | -         | 51        | $\text{mJ}$      |     |      |       |      |
|  | $T_j=125^\circ\text{C}$ , $V_{CC}=400\text{V}$        | -            | -         | 61        | $\text{mJ}$      |     |      |       |      |
| Mechanical data  |   |              |           |           |                  |     |      |       |      |
| $M_{dc}$   | DC terminals, SI Units                                | 6            | -         | 8         | Nm               |     |      |       |      |
| $M_{ac}$   | AC terminals, SI Units                                | 13           | -         | 15        | Nm               |     |      |       |      |
| w  | SKiiP® 2 System w/o heat sink                         | -            | 3,5       | -         | kg               |     |      |       |      |
| w  | heat sink   | -            | 8,5       | -         | kg               |     |      |       |      |
| Thermal characteristics (P16 heat sink; 275 $\text{m}^3/\text{h}$ ); "r" reference to temperature sensor |   |              |           |           |                  |     |      |       |      |
| $R_{thjrlGBT}$   | per IGBT  | -            | -         | 0,028     | $\text{K/W}$     |     |      |       |      |
| $R_{thjrdiode}$  | per diode   | -            | -         | 0,050     | $\text{K/W}$     |     |      |       |      |
| $R_{thra}$   | per module  | -            | -         | 0,033     | $\text{K/W}$     |     |      |       |      |
| $Z_{th}$   | $R_i$ (mK/W) (max.)                                   | $\tau_i$ (s) |           |           |                  |     |      |       |      |
|  |   | 1            | 2         | 3         | 4                |     |      |       |      |
| $IGBT_{jr}$  |   | 3            | 21        | 3         | -                | 1   | 0,13 | 0,001 | -    |
| $diode_{jr}$   |   | 6            | 39        | 6         | -                | 1   | 0,13 | 0,001 | -    |
| $heatsink_{ra}$  |   | 1,6          | 22,0      | 7,0       | 2,4              | 494 | 165  | 20    | 0,03 |

### Features

- SKiiP technology inside
- low loss IGBTs
- CAL diode technology
- integrated current sensor
- integrated temperature sensor
- integrated heat sink
- IEC 60721-3-3 (humidity) class 3K3/IE32 (SKiiP® 2 System)
- IEC 68T.1 (climate) 40/125/56 (SKiiP® 2 power section)

1) with assembly of suitable MKP capacitor per terminal (SEMIKRON type is recommended)

8) AC connection busbars must be connected by the user; copper busbars available on request

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## SKiiP 1602GB061-459CTV

### SKiiP 2®

### SK integrated intelligent Power

### SKiiP 1602GB061-459CTV

## II. Integrated gate driver

| Absolute maximum ratings            |                                 |               |       |
|-------------------------------------|---------------------------------|---------------|-------|
| Symbol                              | Term                            | Value         | Unit  |
| V <sub>S1</sub>                     | stabilized 15V power supply     | 18            | V     |
| V <sub>S2</sub>                     | unstabilized 24V power supply   | 30            | V     |
| V <sub>iH</sub>                     | input signal voltage (high)     | 15 + 0,3      | V     |
| dv/dt                               | secondary to primary side       | 75            | kV/μs |
| V <sub>isolIO</sub>                 | input / output (AC)             | 2500          | Vac   |
| V <sub>isol12</sub>                 | output 1 / output 2 (AC)        | 1500          | Vac   |
| f <sub>max</sub>                    | switching frequency             | 15            | kHz   |
| T <sub>op</sub> (T <sub>stg</sub> ) | operating / storage temperature | - 25 ... + 85 | °C    |

#### Gate driver features

- CMOS compatible inputs
- wide range power supply
- integrated circuitry to sense phase current, heat sink temperature and DC-bus voltage (option)
- short circuit protection
- over current protection
- over voltage protection (option)
- power supply protected against under voltage
- interlock of top/bottom switch
- isolation by transformers
- fibre optic interface (option for GB-types only)
- IEC 68T.1 (climate) 25/85/56 (SKiiP® 2 gate driver)

| Electrical characteristics (T <sub>a</sub> = 25 °C) |   |  | Values |      |      |       |
|---|---|--|--------|------|------|-------|
| Symbol  | Term  |  | min    | typ  | max. | Units |
| V <sub>S1</sub>                                     | supply voltage stabilized   |  | 14,4   | 15   | 15,6 | V     |
| V <sub>S2</sub>                                     | supply voltage non stabilized   |  | 20     | 24   | 30   | V     |
| I <sub>S1</sub>                                     | V <sub>S1</sub> = 15V   | $290 + 470 \cdot f / f_{max} + 1,3 \cdot (I_{AC}/A)$ |        |      |      | mA    |
| I <sub>S2</sub>                                     | V <sub>S2</sub> = 24V   | $220 + 320 \cdot f / f_{max} + 1,0 \cdot (I_{AC}/A)$ |        |      |      | mA    |
| V <sub>iT+</sub>                                    | input threshold voltage (High)  |  | 11,2   | –    | –    | V     |
| V <sub>iT-</sub>                                    | input threshold voltage (Low)   |  | –      | –    | 5,4  | V     |
| R <sub>in</sub>                                     | input resistance  |  | –      | 10   | –    | kΩ    |
| t <sub>d(on)IO</sub>                                | turn-on propagation time (system)   |  | –      | 1,1  | –    | μs    |
| t <sub>d(off)IO</sub>                               | turn-off propagation time (system)  |  | –      | 1,4  | –    | μs    |
| t <sub>pERRRESET</sub>                              | error memory reset time   |  | 9      | –    | –    | μs    |
| t <sub>TD</sub>                                     | top/bottom switch: interlock time   |  | –      | 3,3  | –    | μs    |
| I <sub>analogOUT</sub>                              | 8 V corresponds to  |  | –      | 1322 | –    | A     |
| I <sub>Vs1outmax</sub>                              | max. current of 15 V supply voltage (available when supplied with 24V)              |  | –      | –    | 50   | mA    |
| I <sub>AOmax</sub>                                  | output current at pin 12/14   |  | –      | –    | 5    | mA    |
| V <sub>ol</sub>                                     | logic low output voltage  |  | –      | –    | 0,6  | V     |
| V <sub>oH</sub>                                     | logic high output voltage   |  | –      | –    | 30   | V     |
| I <sub>TRIPSC</sub>                                 | over current trip level ( I <sub>analog OUT</sub> = 10V)                            |  | –      | 1652 | –    | A     |
| I <sub>TRIPLG</sub>                                 | ground fault protection   |  | –      | –    | –    | A     |
| T <sub>ip</sub>                                     | over temperature protection   |  | 110    | –    | 120  | °C    |
| U <sub>DCTRIP</sub>                                 | trip level of U <sub>DC</sub> -protection ( U <sub>analog OUT</sub> = 9V); (option) |  | 400    | –    | –    | V     |

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