

Target specification 5SFG 0580A12000x

## 1200 V, 580 A\*

### RoadPak SiC phase-leg module



- $V_{DSS} = 1200\text{ V}$
- $I_D = 2 \times 580\text{ A}^*$
- Molded package optimized for EV application
- Pin-fin structure for lowest thermal resistance
- lowest losses thanks to Silicon Carbide chip-set
- main terminals with holes (screw connection) or without holes for welding

\*Current rating based on chip rating times number of chips

#### Maximum rated values <sup>1)</sup>

| Parameter                                   | Symbol        | Conditions   | Min. | Max. | Unit |
|---|---------------|--|------|------|------|
| Drain-source voltage                        | $V_{DS}$      | $V_{GS} = 0\text{ V}$ , $T_{vj} \geq 25\text{ °C}$   |      | 1200 | V    |
| DC drain current                            | $I_D$         | $T_{Cool} = 55\text{ °C}$ , $T_{vj} = 175\text{ °C}$   |      | 580  | A    |
| Peak drain current                          | $I_{DM}$      | $t_p = 1\text{ ms}$ , duty cycle = 20%, $T_{Cool} = 55\text{ °C}$ , $T_{vj} = 175\text{ °C}$ |      | 1160 | A    |
| Gate-source voltage                         | $V_{GSS}$     |  | -4   | 15   | V    |
| Transient gate-source voltage <sup>2)</sup> | $V_{GSS,max}$ | Maximum values under transient events < 50 ns  | -8   | 19   | V    |
| DC reverse drain current (body diode)       | $I_{DR}$      | $V_{GS} = -4\text{ V}$ , $T_{Cool} = 55\text{ °C}$ , $T_{vj} = 175\text{ °C}$                |      | 280  | A    |
| Peak reverse drain current (body diode)     | $I_{DRM}$     | $V_{GS} = -4\text{ V}$ , $t_p = 1\text{ ms}$   |      | tbd  | A    |
| Surge source current (body diode)           | $I_{SSM}$     | $V_{GS} = -4\text{ V}$   |      | tbd  | A    |
| DC reverse drain current (channel open)     | $I_{DRS}$     | $V_{GS} = 15\text{ V}$ , $T_{Cool} = 55\text{ °C}$ , $T_{vj} = 175\text{ °C}$                |      | 580  | A    |
| Surge source current (channel open)         | $I_{SSX}$     | $V_{GS} = 15\text{ V}$   |      | tbd  | A    |
| Isolation voltage                           | $V_{isol}$    | 1 min, $f = 50\text{ Hz}$  |      | 4000 | V    |
| Junction temperature                        | $T_{vj}$      |  |      | 175  | °C   |
| Junction operating temperature              | $T_{vj(op)}$  |  | -40  | 175  | °C   |
| Storage temperature                         | $T_{stg}$     |  | -40  | 150  | °C   |
| Mounting torque                             | $M_s$         | Module to cooler with M4 screws  |      | 2.8  | Nm   |

<sup>1)</sup> Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

<sup>2)</sup> Based on chip capability

**MOSFET characteristic values <sup>3)</sup>**

| Parameter   | Symbol        | Conditions   | Min.                     | Typ. | Max. | Unit          |
|---|---------------|--|--------------------------|------|------|---------------|
| Drain-source breakdown voltage                        | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}$  | $T_{vj} = 175\text{ °C}$ | 1200 |      | V             |
|   |               |  | $T_{vj} = 25\text{ °C}$  | 1200 |      | V             |
|   |               |  | $T_{vj} = -40\text{ °C}$ | 1200 |      | V             |
| Static drain-source on-state resistance <sup>4)</sup> | $R_{DS(on)}$  | $I_D = 450\text{ A}, V_{GS} = 15\text{ V}$   | $T_{vj} = 25\text{ °C}$  | 2.9  | 3.1  | m $\Omega$    |
|   |               |  | $T_{vj} = 175\text{ °C}$ |      | 5.2  | 6.1           |
| Zero gate voltage drain current                       | $I_{DSS}$     | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$  | $T_{vj} = 25\text{ °C}$  | 2    | 10   | $\mu\text{A}$ |
|   |               |  | $T_{vj} = 175\text{ °C}$ | 4    | 20   | $\mu\text{A}$ |
| Gate-source leakage current                           | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = 15\text{ V}, T_{vj} = 25\text{ °C}$   |                          |      | 500  | nA            |
| Gate threshold voltage <sup>2)</sup>                  | $V_{GS(th)}$  | $I_D = 136\text{ mA}, V_{DS} = V_{GS}, T_{vj} = 25\text{ °C}$  | 1.7                      | 2.4  | 3.5  | V             |
| Gate charge <sup>2)</sup>                             | $Q_G$         | $I_D = 600\text{ A}, V_{DS} = 800\text{ V}, V_{GE} = -4\text{ V} \dots +15\text{ V}$   |                          | 1.1  |      | $\mu\text{C}$ |
| Input capacitance <sup>2)</sup>                       | $C_{ISS}$     | $V_{DS} = 1000\text{ V}, V_{GS} = 0\text{ V}, T_{vj} = 25\text{ °C}, f = 100\text{ kHz}$   |                          | 29   |      | nF            |
| Internal gate resistance <sup>2)</sup>                | $R_{Gint}$    |  |                          | 0.68 |      | $\Omega$      |
| Turn-on switching energy                              | $E_{on}$      | $V_{DD} = 800\text{ V}, I_D = 450\text{ A}, R_G = 0.47\text{ }\Omega, C_G = 94\text{ nF}, V_{GS} = -4 / +15\text{ V}, L_\sigma = 10\text{ nH}, \text{ inductive load}$ | $T_{vj} = 25\text{ °C}$  | 10   |      | mJ            |
|   |               |  | $T_{vj} = 175\text{ °C}$ | 22   |      | mJ            |
| Turn-off switching energy                             | $E_{off}$     | $V_{DD} = 800\text{ V}, I_D = 450\text{ A}, R_G = 1.5\text{ }\Omega, C_G = 94\text{ nF}, V_{GS} = -4 / +15\text{ V}, L_\sigma = 10\text{ nH}, \text{ inductive load}$  | $T_{vj} = 25\text{ °C}$  | 9    |      | mJ            |
|   |               |  | $T_{vj} = 175\text{ °C}$ | 12   |      | mJ            |

<sup>2)</sup> Based on chip capability

<sup>3)</sup> Characteristic values according to IEC 60747 – 8

<sup>4)</sup>  $R_{DS(on)}$  is given at chip level

**Body diode characteristic values <sup>5)</sup>**

| Parameter                              | Symbol    | Conditions   | Min.                                  | Typ. | Max. | Unit          |
|--|-----------|--|---------------------------------------|------|------|---------------|
| Diode forward voltage <sup>2) 6)</sup> | $V_{SD}$  | $I_S = 120 \text{ A}$ , $V_{GS} = -4 \text{ V}$  | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 4.6  |      | V             |
|  |           |  | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 4.2  |      | V             |
| Reverse recovery current               | $I_{rr}$  |  | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 100  |      | A             |
|  |           |  | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 170  |      | A             |
| Recovered charge                       | $Q_{rr}$  | $V_R = 800 \text{ V}$ ,<br>$I_F = 450 \text{ A}$ ,<br>$V_{GS} = -4 / +15 \text{ V}$ ,<br>$R_G = 0.47 \text{ } \Omega$ ,<br>$di/dt = 20 \text{ kA}/\mu\text{s}$<br>$L_\sigma = 10 \text{ nH}$<br>inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 11   |      | $\mu\text{C}$ |
|  |           |  | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 16   |      | $\mu\text{C}$ |
| Reverse recovery time                  | $t_{rr}$  |  | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 30   |      | ns            |
|  |           |  | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 55   |      | ns            |
| Reverse recovery energy                | $E_{rec}$ |  | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 1    |      | mJ            |
|  |           |  | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 3    |      | mJ            |

<sup>2)</sup> Based on chip capability

<sup>5)</sup> Characteristic values according to IEC 60747 – 2

<sup>6)</sup> Forward voltage is given at chip level

**Package properties <sup>7)</sup>**

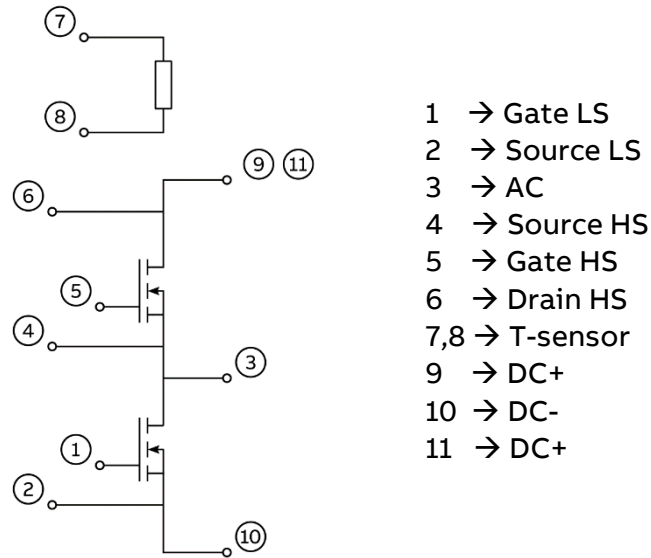
| Parameter                            | Symbol          | Conditions   | Min. | Typ.  | Max. | Unit       |
|--------------------------------------|-----------------|--|------|-------|------|------------|
| thermal resistance junction to fluid | $R_{th(j-f)}$   | $T_{in} = 55^\circ\text{C}$ , Coolant: 50% glycol/ 50% water, per switch, 10 l/min, $dP < 120 \text{ mbar}$ water-glycol |      | 114   | 120  | K/kW       |
| Comparative tracking index           | CTI             |  | 400  |       |      | V          |
| Module stray inductance              | $L_{\sigma DS}$ |  |      | 5     |      | nH         |
| Resistance, terminal-chip            | $R_{DD+SS}$     | $T_C = 25 \text{ }^\circ\text{C}$  |      | 0.117 |      | m $\Omega$ |
|                                      |                 | $T_C = 150 \text{ }^\circ\text{C}$   |      | 0.227 |      | m $\Omega$ |

**Mechanical properties <sup>7)</sup>**

| Parameter                 | Symbol | Conditions   | Min.           | Typ.  | Max. | Unit |
|---------------------------|--------|--|----------------|-------|------|------|
| Dimensions                | L      | AC terminal to DC terminal                         |                | 110   |      | mm   |
|                           | W      | Mold width   |                | 69    |      | mm   |
|                           | H      | Baseplate cooler surface to middle of PCB/pressfit |                | 17.35 |      | mm   |
| Clearance distance in air | $d_a$  | According to IEC 60664-1                           | Term. to base: | 6.9   |      | mm   |
|                           |        |  | Term. to term: | 3.3   |      | mm   |
| Surface creepage distance | $d_s$  | According to IEC 60664-1                           | Term. to base: | 8.5   |      | mm   |
|                           |        |  | Term. to term: | 8     |      | mm   |
| Mass                      | m      |  |                | 300   |      | g    |

<sup>7)</sup> Package and mechanical properties according to IEC 60747 – 15

## Electrical configuration



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