SCT3022KL
N-channel SiC power MOSFET

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**V<sub>DSS</sub>** 1200V  
**R<sub>DS(on) (Typ.)</sub>** 22mΩ  
**I<sub>D</sub>** 95A  
**P<sub>D</sub>** 427W

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**Features**

1) Low on-resistance  
2) Fast switching speed  
3) Fast reverse recovery  
4) Easy to parallel  
5) Simple to drive  
6) Pb-free lead plating; RoHS compliant

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**Application**

- Solar inverters  
- DC/DC converters  
- Switch mode power supplies  
- Induction heating  
- Motor drives

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**Absolute maximum ratings** (T<sub>a</sub> = 25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain - Source voltage</td>
<td>V&lt;sub&gt;DSS&lt;/sub&gt;</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>Continuous drain current</td>
<td>I&lt;sub&gt;D&lt;sup&gt;1&lt;/sup&gt;&lt;/sub&gt;</td>
<td>95</td>
<td>A</td>
</tr>
<tr>
<td>T&lt;sub&gt;c&lt;/sub&gt; = 25°C</td>
<td>I&lt;sub&gt;D&lt;sup&gt;1&lt;/sup&gt;&lt;/sub&gt;</td>
<td>67</td>
<td>A</td>
</tr>
<tr>
<td>T&lt;sub&gt;c&lt;/sub&gt; = 100°C</td>
<td>I&lt;sub&gt;D&lt;sup&gt;1&lt;/sup&gt;&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulsed drain current</td>
<td>I&lt;sub&gt;D,pulse&lt;sup&gt;2&lt;/sup&gt;&lt;/sub&gt;</td>
<td>237</td>
<td>A</td>
</tr>
<tr>
<td>Gate - Source voltage</td>
<td>V&lt;sub&gt;GSS&lt;/sub&gt;</td>
<td>-4 to 22</td>
<td>V</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>T&lt;sub&gt;j&lt;/sub&gt;</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>Range of storage temperature</td>
<td>T&lt;sub&gt;stg&lt;/sub&gt;</td>
<td>-55 to +175</td>
<td>°C</td>
</tr>
</tbody>
</table>
### Thermal resistance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal resistance, junction - case</td>
<td>$R_{thJC}$</td>
<td>- 0.27 0.35</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

### Electrical characteristics ($T_a = 25°C$)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain - Source breakdown voltage</td>
<td>$V_{(BR)DSS}$</td>
<td>$V_{GS} = 0V, I_D = 1mA$</td>
<td>1200 - -</td>
<td>V</td>
</tr>
<tr>
<td>Zero gate voltage drain current</td>
<td>$I_{DSS}$</td>
<td>$V_{DS} = 1200V, V_{GS} = 0V$ $T_j = 25°C$ $T_j = 150°C$</td>
<td>- 1 10 -</td>
<td>μA</td>
</tr>
<tr>
<td>Gate - Source leakage current</td>
<td>$I_{GSS+}$</td>
<td>$V_{GS} = +22V, V_{DS} = 0V$</td>
<td>- - 100</td>
<td>nA</td>
</tr>
<tr>
<td>Gate - Source leakage current</td>
<td>$I_{GSS-}$</td>
<td>$V_{GS} = -4V, V_{DS} = 0V$</td>
<td>- - -100</td>
<td>nA</td>
</tr>
<tr>
<td>Gate threshold voltage</td>
<td>$V_{GS(th)}$</td>
<td>$V_{DS} = 10V, I_D = 18.2mA$</td>
<td>2.7 - 5.6</td>
<td>V</td>
</tr>
<tr>
<td>Static drain - source on - state resistance</td>
<td>$R_{DS(on)}$</td>
<td>$V_{GS} = 18V, I_D = 36A$ $T_j = 25°C$ $T_j = 125°C$</td>
<td>- 22 28.6</td>
<td>mΩ</td>
</tr>
<tr>
<td>Gate input resistance</td>
<td>$R_G$</td>
<td>$f = 1MHz, open drain$</td>
<td>- 4 -</td>
<td>Ω</td>
</tr>
</tbody>
</table>
### Electrical characteristics \((T_a = 25^\circ C)\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transconductance</td>
<td>(g_{fs}^{*3})</td>
<td>(V_{DS} = 10V, I_D = 36A)</td>
<td>14.2</td>
<td>S</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>(C_{iss})</td>
<td>(V_{GS} = 0V)</td>
<td>2879</td>
<td>pF</td>
</tr>
<tr>
<td>Output capacitance</td>
<td>(C_{oss})</td>
<td>(V_{DS} = 800V)</td>
<td>237</td>
<td>pF</td>
</tr>
<tr>
<td>Reverse transfer capacitance</td>
<td>(C_{rss})</td>
<td>(f = 1MHz)</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>Effective output capacitance,</td>
<td>(C_{o(er)})</td>
<td>(V_{GS} = 0V) (V_{DS} = 0V) (V_{DS} = 600V)</td>
<td>213</td>
<td>pF</td>
</tr>
<tr>
<td>energy related</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn - on delay time</td>
<td>(t_{d(on)}^{*3})</td>
<td>(V_{DD} = 400V, I_D = 18A)</td>
<td>29</td>
<td>ns</td>
</tr>
<tr>
<td>Rise time</td>
<td>(t_{r}^{*3})</td>
<td>(V_{GS} = 18V/0V)</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Turn - off delay time</td>
<td>(t_{d(off)}^{*3})</td>
<td>(R_L = 22\Omega)</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>(t_{f}^{*3})</td>
<td>(R_G = 0\Omega)</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Turn - on switching loss</td>
<td>(E_{on}^{*3})</td>
<td>(V_{DD} = 600V, I_D=36A) (V_{GS} = 18V/0V) (R_G = 0\Omega) (L=250\mu H)</td>
<td>632</td>
<td>(\mu J)</td>
</tr>
<tr>
<td>Turn - off switching loss</td>
<td>(E_{off}^{*3})</td>
<td>*(E_{on}) includes diode reverse recovery</td>
<td>243</td>
<td></td>
</tr>
</tbody>
</table>

### Gate Charge characteristics \((T_a = 25^\circ C)\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total gate charge</td>
<td>(Q_g^{*3})</td>
<td>(V_{DD} = 600V)</td>
<td>178</td>
<td>nC</td>
</tr>
<tr>
<td>Gate - Source charge</td>
<td>(Q_{gs}^{*3})</td>
<td>(I_D = 36A)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Gate - Drain charge</td>
<td>(Q_{gd}^{*3})</td>
<td>(V_{GS} = 18V)</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Gate plateau voltage</td>
<td>(V_{(plateau)})</td>
<td>(V_{DD} = 600V, I_D = 36A)</td>
<td>9.6</td>
<td>V</td>
</tr>
</tbody>
</table>

*1 Limited only by maximum temperature allowed.
*2 \(PW \leq 10\mu s\), Duty cycle \(\leq 1\%
*3 Pulsed
### Body diode electrical characteristics (Source-Drain) \((T_a = 25°C)\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverse diode continuous, forward current</td>
<td>(I_{S^-1})</td>
<td>(T_c = 25°C)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Inverse diode direct current, pulsed</td>
<td>(I_{SM^-2})</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Forward voltage</td>
<td>(V_{SD^-3})</td>
<td>(V_{GS} = 0V, I_s = 36A)</td>
<td>-</td>
<td>3.2</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>(t_{tr^-3})</td>
<td>(I_{F} = 36A, V_R = 600V) (di/dt = 1100A/\mu s)</td>
<td>-</td>
<td>28</td>
</tr>
<tr>
<td>Reverse recovery charge</td>
<td>(Q_{rr^-3})</td>
<td></td>
<td>-</td>
<td>175</td>
</tr>
<tr>
<td>Peak reverse recovery current</td>
<td>(I_{rrm^-3})</td>
<td></td>
<td>-</td>
<td>12</td>
</tr>
</tbody>
</table>
●Electrical characteristic curves

**Fig. 1 Power Dissipation Derating Curve**

![Power Dissipation Derating Curve](image1)

- **Power Dissipation** : $P_D$ [W]
- **Junction Temperature** : $T_J$ [°C]

**Fig. 2 Maximum Safe Operating Area**

![Maximum Safe Operating Area](image2)

- **Drain Current** : $I_D$ [A]
- **Drain - Source Voltage** : $V_{DS}$ [V]
- **Operation in this area is limited by $R_{DS(ON)}$**

**Fig. 3 Typical Transient Thermal Resistance vs. Pulse Width**

![Transient Thermal Resistance vs. Pulse Width](image3)

- **Transient Thermal Resistance** : $R_{th}$ [K/W]
- **Pulse Width** : $P_W$ [s]
- **Operation in this area is limited by $R_{DS(ON)}$**

$T_a = 25^\circ C$

Single Pulse

$P_W = 100\mu s$

$P_W = 1 ms$

$P_W = 10 ms$

$P_W = 100 ms$
● Electrical characteristic curves

Fig. 4 Typical Output Characteristics (I)

![Diagram](image1)

Drain - Source Voltage: $V_{DS}$ [V]

Drain Current: $I_D$ [A]

Fig. 5 Typical Output Characteristics (II)

![Diagram](image2)

Drain - Source Voltage: $V_{DS}$ [V]

Drain Current: $I_D$ [A]

Fig. 6 $T_a = 150^\circ$C Typical Output Characteristics (I)

![Diagram](image3)

Drain - Source Voltage: $V_{DS}$ [V]

Drain Current: $I_D$ [A]

Fig. 7 $T_a = 150^\circ$C Typical Output Characteristics (II)

![Diagram](image4)

Drain - Source Voltage: $V_{DS}$ [V]

Drain Current: $I_D$ [A]
Electrical characteristic curves

Fig. 8 Typical Transfer Characteristics (I)

Fig. 9 Typical Transfer Characteristics (II)

Fig. 10 Gate Threshold Voltage vs. Junction Temperature

Fig. 11 Transconductance vs. Drain Current
Electrical characteristic curves

Fig. 12 Static Drain - Source On - State Resistance vs. Gate - Source Voltage

Fig. 13 Static Drain - Source On - State Resistance vs. Junction Temperature

Fig. 14 Static Drain - Source On - State Resistance vs. Drain Current

- Graphs show the relationship between various parameters such as gate-source voltage, junction temperature, and drain current.
- Key data points and conditions are highlighted on each graph.

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2016.06 - Rev.A
● Electrical characteristic curves

**Fig. 15 Typical Capacitance vs. Drain - Source Voltage**

- Capacitance: $C \text{ [pF]}$
- Drain - Source Voltage: $V_{DS} \text{ [V]}$

![Capacitance graph](image)

**Fig. 16 Coss Stored Energy**

- Coss Stored Energy: $E_{Coss} \text{ [μJ]}$
- Drain - Source Voltage: $V_{DS} \text{ [V]}$

![Coss Stored Energy graph](image)

**Fig. 17 Switching Characteristics**

- Switching Time: $t \text{ [ns]}$
- Drain Current: $I_D \text{ [A]}$

![Switching Characteristics graph](image)

**Fig. 18 Dynamic Input Characteristics**

- Total Gate Charge: $Q_g \text{ [nC]}$
- Gate - Source Voltage: $V_{GS} \text{ [V]}$

![Dynamic Input Characteristics graph](image)
Electrical characteristic curves

**Fig.19 Typical Switching Loss vs. Drain - Source Voltage**

- $T_a = 25^\circ C$
- $I_D = 36A$
- $V_{GS} = 18V/0V$
- $R_G = 0\Omega$
- $L = 250\mu H$

- $E_{on}$
- $E_{off}$

<table>
<thead>
<tr>
<th>$V_{DS}$ [V]</th>
<th>200</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E$ [mJ]</td>
<td>0</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>800</td>
</tr>
</tbody>
</table>

**Fig.20 Typical Switching Loss vs. Drain Current**

- $T_a = 25^\circ C$
- $V_{DD} = 600V$
- $V_{GS} = 18V/0V$
- $R_G = 0\Omega$
- $L = 250\mu H$

- $E_{on}$
- $E_{off}$

<table>
<thead>
<tr>
<th>$I_D$ [A]</th>
<th>0</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E$ [mJ]</td>
<td>0</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>800</td>
<td>1000</td>
</tr>
</tbody>
</table>

**Fig.21 Typical Switching Loss vs. External Gate Resistance**

- $T_a = 25^\circ C$
- $V_{DD} = 600V$
- $I_D = 36A$
- $V_{GS} = 18V/0V$
- $L = 250\mu H$

- $E_{on}$
- $E_{off}$

<table>
<thead>
<tr>
<th>$R_G$ [Ω]</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E$ [mJ]</td>
<td>0</td>
<td>800</td>
<td>1600</td>
<td>2400</td>
<td>3200</td>
<td>4000</td>
<td>4800</td>
</tr>
</tbody>
</table>

Drain - Source Voltage : $V_{DS}$ [V]

Drain Current : $I_D$ [A]

External Gate Resistance : $R_G$ [Ω]
- Electrical characteristic curves

**Fig. 22 Inverse Diode Forward Current vs. Source-Drain Voltage**

- Inverse Diode Forward Current: $I_s$ [A]
- Source-Drain Voltage: $V_{SD}$ [V]

**Fig. 23 Reverse Recovery Time vs. Inverse Diode Forward Current**

- Reverse Recovery Time: $t_{rr}$ [ns]
- Inverse Diode Forward Current: $I_s$ [A]
● Measurement circuits

Fig.1-1  Switching Time Measurement Circuit

![Switching Time Measurement Circuit](image1)

Fig.1-2  Switching Waveforms

![Switching Waveforms](image2)

Fig.2-1  Gate Charge Measurement Circuit

![Gate Charge Measurement Circuit](image3)

Fig.2-2  Gate Charge Waveform

![Gate Charge Waveform](image4)

Fig.3-1  Switching Energy Measurement Circuit

![Switching Energy Measurement Circuit](image5)

Fig.3-2  Switching Waveforms

![Switching Waveforms](image6)

Fig.4-1  Reverse Recovery Time Measurement Circuit

![Reverse Recovery Time Measurement Circuit](image7)

Fig.4-2  Reverse Recovery Waveform

![Reverse Recovery Waveform](image8)
Dimensions

TO-247N

UNIT: mm
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