**SCT3030KL**  
N-channel SiC power MOSFET

### Outline

<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>$V_{DSS}$</td>
<td>1200V</td>
<td>V</td>
</tr>
<tr>
<td>Resistance (Typ.)</td>
<td>$R_{DS(on)}$</td>
<td>30mΩ</td>
<td></td>
</tr>
<tr>
<td>Continuous drain current</td>
<td>$I_D$</td>
<td>72A</td>
<td></td>
</tr>
<tr>
<td>Pulsed drain current</td>
<td>$I_{D,pulse}$</td>
<td>180A</td>
<td></td>
</tr>
<tr>
<td>Gate - Source voltage (DC)</td>
<td>$V_{GSS}$</td>
<td>–4 to +22V</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Surge Voltage ($t_{surge} &lt; 300$ns)</td>
<td>$V_{GSS,surge}$</td>
<td>–4 to +26V</td>
<td></td>
</tr>
<tr>
<td>Recommended Drive Voltage</td>
<td>$V_{GS_{op}}$</td>
<td>0 / +18V</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>175°C</td>
<td></td>
</tr>
<tr>
<td>Range of storage temperature</td>
<td>$T_{stg}$</td>
<td>–55 to 175°C</td>
<td></td>
</tr>
</tbody>
</table>

### Inner Circuit

![Diagram of inner circuit](image)

1) Gate
2) Drain
3) Source

*1 Body Diode

### Packaging specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Packing</th>
<th>Tube</th>
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<tr>
<td></td>
<td>Reel size (mm)</td>
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</tr>
<tr>
<td></td>
<td>Tape width (mm)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Basic ordering unit (pcs)</td>
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<tr>
<td></td>
<td>Taping code</td>
<td>C11</td>
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<tr>
<td></td>
<td>Marking</td>
<td>SCT3030KL</td>
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</table>

### 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

### Application

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

### Absolute maximum ratings ($T_a = 25°C$)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Drain - Source voltage</td>
<td>$V_{DSS}$</td>
<td>1200V</td>
<td>V</td>
</tr>
<tr>
<td>Continuous drain current</td>
<td>$I_D$</td>
<td>72A</td>
<td>A</td>
</tr>
<tr>
<td>Continuous drain current at $T_a = 25°C$</td>
<td>$I_D$</td>
<td>51A</td>
<td>A</td>
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<tr>
<td>Continuous drain current at $T_a = 100°C$</td>
<td>$I_{D,pulse}$</td>
<td>180A</td>
<td>A</td>
</tr>
<tr>
<td>Gate - Source voltage (DC)</td>
<td>$V_{GSS}$</td>
<td>–4 to +22V</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Surge Voltage ($t_{surge} &lt; 300$ns)</td>
<td>$V_{GSS,surge}$</td>
<td>–4 to +26V</td>
<td></td>
</tr>
<tr>
<td>Recommended Drive Voltage</td>
<td>$V_{GS_{op}}$</td>
<td>0 / +18V</td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td>175°C</td>
<td></td>
</tr>
<tr>
<td>Range of storage temperature</td>
<td>$T_{stg}$</td>
<td>–55 to 175°C</td>
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TSQ50211-SCT3030KL  
14-Jun.2018 - Rev.005
### Thermal resistance

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<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
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<tbody>
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<td>Thermal resistance, junction - case</td>
<td>$R_{thJC}$</td>
<td>0.34 0.44</td>
<td>°C/W</td>
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### Electrical characteristics ($T_a = 25°C$)

<table>
<thead>
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<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
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<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>$V_{DS} = 1200V, V_{GS} = 0V$</td>
<td>-</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_j = 25°C$</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_j = 150°C$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Gate - Source leakage current</td>
<td>$I_{GSS+}$</td>
<td>$V_{GS} = +22V, V_{DS} = 0V$</td>
<td>-</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>-</td>
<td>nA</td>
</tr>
<tr>
<td>Gate threshold voltage</td>
<td>$V_{GS(th)}$</td>
<td>$V_{DS} = 10V, I_D = 13.3mA$</td>
<td>2.7</td>
<td>V</td>
</tr>
<tr>
<td>Static drain - source on - state resistance</td>
<td>$R_{DS(on)}$</td>
<td>$V_{GS} = 18V, I_D = 27A$</td>
<td>-</td>
<td>mΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_j = 25°C$</td>
<td>30</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>$T_j = 125°C$</td>
<td>39</td>
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<tr>
<td>Gate input resistance</td>
<td>$R_G$</td>
<td>$f = 1MHz$, open drain</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_j = 125°C$</td>
<td>5</td>
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</tbody>
</table>
### Electrical characteristics (Ta = 25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Transconductance</td>
<td>$g_{fs}$</td>
<td>$V_{DS} = 10V, I_D = 27A$</td>
<td>- 10.8 -</td>
<td>S</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{iss}$</td>
<td>$V_{GS} = 0V$</td>
<td>- 2222 -</td>
<td>pF</td>
</tr>
<tr>
<td>Output capacitance</td>
<td>$C_{oss}$</td>
<td>$V_{DS} = 800V$</td>
<td>- 180 -</td>
<td></td>
</tr>
<tr>
<td>Reverse transfer capacitance</td>
<td>$C_{rss}$</td>
<td>$f = 1MHz$</td>
<td>- 72 -</td>
<td></td>
</tr>
<tr>
<td>Effective output capacitance,</td>
<td>$C_{o(er)}$</td>
<td>$V_{GS} = 0V$</td>
<td>- 157 -</td>
<td>pF</td>
</tr>
<tr>
<td>energy related</td>
<td></td>
<td>$V_{DS} = 0V to 600V$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn - on delay time</td>
<td>$t_{d(on)}$</td>
<td>$V_{DD} = 400V, I_D = 18A$</td>
<td>- 24 -</td>
<td>ns</td>
</tr>
<tr>
<td>Rise time</td>
<td>$t_{r}$</td>
<td>$V_{GS} = 18V/0V$</td>
<td>- 42 -</td>
<td></td>
</tr>
<tr>
<td>Turn - off delay time</td>
<td>$t_{d(off)}$</td>
<td>$R_L = 22Ω$</td>
<td>- 61 -</td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>$t_{f}$</td>
<td>$R_G = 0Ω$</td>
<td>- 29 -</td>
<td></td>
</tr>
<tr>
<td>Turn - on switching loss</td>
<td>$E_{on}$</td>
<td>$V_{DD} = 600V, I_D=27A$</td>
<td>- 468 -</td>
<td>µJ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = 18V/0V$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$R_G = 0Ω, L=250µH$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*$E_{on}$ includes diode reverse recovery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn - off switching loss</td>
<td>$E_{off}$</td>
<td>-</td>
<td>- 204 -</td>
<td></td>
</tr>
</tbody>
</table>

### Gate Charge characteristics (Ta = 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>Total gate charge</td>
<td>$Q_g$</td>
<td>$V_{DD} = 600V$</td>
<td>- 131 -</td>
<td>nC</td>
</tr>
<tr>
<td>Gate - Source charge</td>
<td>$Q_{gs}$</td>
<td>$I_D = 27A$</td>
<td>- 30 -</td>
<td></td>
</tr>
<tr>
<td>Gate - Drain charge</td>
<td>$Q_{gd}$</td>
<td>$V_{GS} = 18V$</td>
<td>- 55 -</td>
<td></td>
</tr>
<tr>
<td>Gate plateau voltage</td>
<td>$V_{(plateau)}$</td>
<td>$V_{DD} = 600V, I_D = 27A$</td>
<td>- 9.6 -</td>
<td>V</td>
</tr>
</tbody>
</table>
Body diode electrical characteristics (Source-Drain) \( (T_a = 25^\circ C) \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverse diode continuous, forward current</td>
<td>( I_S ) (^1)</td>
<td>( T_c = 25^\circ 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} ) (^5)</td>
<td>( V_{GS} = 0V, I_S = 27A )</td>
<td>-</td>
<td>3.2</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>( t_{rr} ) (^5)</td>
<td>( I_F = 27A, V_R = 600V )</td>
<td>-</td>
<td>27</td>
</tr>
<tr>
<td>Reverse recovery charge</td>
<td>( Q_{rr} ) (^5)</td>
<td>( \text{di/dt} = 1100A/\mu s )</td>
<td>-</td>
<td>135</td>
</tr>
<tr>
<td>Peak reverse recovery current</td>
<td>( I_{rrm} ) (^5)</td>
<td></td>
<td>-</td>
<td>10</td>
</tr>
</tbody>
</table>

*1 Limited only by maximum temperature allowed.

*2 \( PW \leq 10\mu s \), Duty cycle \( \leq 1\% \)

*3 Example of acceptable \( V_{gs} \) waveform

*4 Please be advised not to use SiC-MOSFETs with \( V_{gs} \) below 13V as doing so may cause thermal runaway.

*5 Pulsed
*Electrical characteristic curves*

**Fig.1 Power Dissipation Derating Curve**

![Power Dissipation Derating Curve](image)

Case Temperature: $T_C$ [°C]

**Fig.2 Maximum Safe Operating Area**

![Maximum Safe Operating Area](image)

Drain Current: $I_D$ [A]

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](image)

Transient Thermal Resistance: $R_{th}$ [K/W]

$T_a = 25°C$

Single Pulse

Pulse Width: $P_W$ [s]
Electrical characteristic curves

Fig. 4 Typical Output Characteristics (I)
Drain Current : $I_D$ [A]
Drain - Source Voltage : $V_{DS}$ [V]
$T_a = 25^\circ\text{C}$
Pulsed

Fig. 5 Typical Output Characteristics (II)
Drain Current : $I_D$ [A]
Drain - Source Voltage : $V_{DS}$ [V]
$T_a = 25^\circ\text{C}$
Pulsed

Fig. 6 $T_j = 150^\circ\text{C}$ Typical Output Characteristics (I)
Drain Current : $I_D$ [A]
Drain - Source Voltage : $V_{DS}$ [V]
$T_a = 150^\circ\text{C}$
Pulsed

Fig. 7 $T_j = 150^\circ\text{C}$ Typical Output Characteristics (II)
Drain Current : $I_D$ [A]
Drain - Source Voltage : $V_{DS}$ [V]
$T_a = 150^\circ\text{C}$
Pulsed
Electrical characteristic curves

Fig. 8 Typical Transfer Characteristics (I)

Gate - Source Voltage \( V_{GS} \) [V]

Fig. 9 Typical Transfer Characteristics (II)

Gate - Source Voltage \( V_{GS} \) [V]

Fig. 10 Gate Threshold Voltage vs. Junction Temperature

Gate Threshold Voltage \( V_{GS(th)} \) [V]

Junction Temperature \( T_j \) [°C]

Fig. 11 Transconductance vs. Drain Current

Transconductance \( g_f \) [S]

Drain Current \( I_D \) [A]
● Electrical characteristic curves

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

![Graph](image-url)

- Gate - Source Voltage: $V_{GS}$ [V]
- Static Drain - Source On-State Resistance: $R_{DS(on)}$ [Ω]
- $T_a = 25°C$
Pulsed
- $I_D = 48A$
- $I_D = 27A$

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

![Graph](image-url)

- Junction Temperature: $T_j$ [°C]
- Static Drain - Source On-State Resistance: $R_{DS(on)}$ [Ω]
- $V_{GS} = 18V$
Pulsed
- $I_D = 48A$
- $I_D = 27A$

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

![Graph](image-url)

- Drain Current: $I_D$ [A]
- Static Drain - Source On-State Resistance: $R_{DS(on)}$ [Ω]
- $V_{GS} = 18V$
Pulsed
- $T_a = 150°C$
- $T_a = 125°C$
- $T_a = 75°C$
- $T_a = 25°C$
- $T_a = -25°C$
● Electrical characteristic curves

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

![Capacitance vs. Drain - Source Voltage](image)

- $T_a = 25^\circ C$
- $f = 1 \text{MHz}$
- $V_{GS} = 0 \text{V}$

**Fig. 16 Coss Stored Energy**

![Coss Stored Energy](image)

- $T_a = 25^\circ C$

**Fig. 17 Switching Characteristics**

![Switching Characteristics](image)

- $T_a = 25^\circ C$
- $V_{DD} = 400 \text{V}$
- $V_{GS} = 18 \text{V}$
- $R_G = 0 \Omega$
- Pulsed

**Fig. 18 Dynamic Input Characteristics**

![Dynamic Input Characteristics](image)

- $T_a = 25^\circ C$
- $V_{DD} = 600 \text{V}$
- $I_D = 27 \text{A}$
- Pulsed
● Electrical characteristic curves

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

- **Switching Energy**: $E \ [\mu J]$ vs. Drain - Source Voltage: $V_{DS} \ [V]$

- Conditions:
  - $T_a = 25^\circ C$
  - $I_D = 27A$
  - $V_{GS} = 18V/0V$
  - $R_G = 0\Omega$
  - $L = 250 \mu H$

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

- **Switching Energy**: $E \ [\mu J]$ vs. Drain Current: $I_D \ [A]$

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

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

- **Switching Energy**: $E \ [\mu J]$ vs. External Gate Resistance: $R_G \ [\Omega]$

- Conditions:
  - $T_a = 25^\circ C$
  - $V_{DD} = 600V$
  - $I_D = 27A$
  - $V_{GS} = 18V/0V$
  - $L = 250 \mu H$
Electrical characteristic curves

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

- Source - Drain Voltage: $V_{SD}$ [V]
- Inverse Diode Forward Current: $I_s$ [A]
- $V_{GS} = 0$ V Pulsed
- $T_a = 150$ºC
- $T_a = 75$ºC
- $T_a = 25$ºC
- $T_a = -25$ºC

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

- $T_a = 25$ºC
- $di/dt = 1100$ A/µs
- $V_R = 600$ V
- $V_{GS} = 0$ V Pulsed
**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)
Notes

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