SCT3080KR
N-channel SiC power MOSFET

<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>1200</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain current</td>
<td>$T_c = 25°C$</td>
<td>$I_D^{*1}$</td>
<td>31</td>
</tr>
<tr>
<td>Continuous Drain current</td>
<td>$T_c = 100°C$</td>
<td>$I_D^{*1}$</td>
<td>22</td>
</tr>
<tr>
<td>Pulsed Drain current</td>
<td>$I_{D,pulse}^{*2}$</td>
<td>77</td>
<td>A</td>
</tr>
<tr>
<td>Gate - Source voltage (DC)</td>
<td>$V_{GSS}$</td>
<td>-4 to +22</td>
<td>V</td>
</tr>
<tr>
<td>Gate - Source surge voltage ($t_{surge} &lt; 300\text{ns}$)</td>
<td>$V_{GSS_{surge}}^{*3}$</td>
<td>-4 to +26</td>
<td>V</td>
</tr>
<tr>
<td>Recommended drive voltage</td>
<td>$V_{GS_{op}}^{*4}$</td>
<td>0 / +18</td>
<td>V</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_j$</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>Range of storage temperature</td>
<td>$T_{stg}$</td>
<td>-55 to +175</td>
<td>°C</td>
</tr>
</tbody>
</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 ($T_a = 25°C$)

●Outline
TO-247-4L

●Inner circuit
Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.

●Packaging specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Packing</th>
<th>Tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reel size (mm)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Tape width (mm)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Basic ordering unit (pcs)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Taping code</td>
<td>C14</td>
<td></td>
</tr>
<tr>
<td>Marking</td>
<td>SCT3080KR</td>
<td></td>
</tr>
</tbody>
</table>

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TSQ50254-SCT3080KR
31.Jul.2019 - Rev.001
### 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>Drain - Source breakdown voltage</td>
<td>( V_{BR(DSS)} )</td>
<td>( V_{GS} = 0V, \ I_D = 1mA ) ( T_j = 25^\circ C ) ( T_j = -55^\circ C )</td>
<td>1200 - - V</td>
<td></td>
</tr>
<tr>
<td>Zero Gate voltage Drain current</td>
<td>( I_{DSS} )</td>
<td>( V_{GS} = 0V, \ V_{DS} = 1200V ) ( T_j = 25^\circ C ) ( T_j = 150^\circ C )</td>
<td>- 1 10 ( \mu A )</td>
<td></td>
</tr>
<tr>
<td>Gate - Source leakage current</td>
<td>( I_{GSS+} )</td>
<td>( V_{GS} = +22V, \ V_{DS} = 0V ) ( T_j = 25^\circ C ) ( T_j = 150^\circ C )</td>
<td>- - 100 ( nA )</td>
<td></td>
</tr>
<tr>
<td>Gate - Source leakage current</td>
<td>( I_{GSS-} )</td>
<td>( V_{GS} = -4V, \ V_{DS} = 0V ) ( T_j = 25^\circ C ) ( T_j = 150^\circ C )</td>
<td>- - -100 ( nA )</td>
<td></td>
</tr>
<tr>
<td>Gate threshold voltage</td>
<td>( V_{GS(th)} )</td>
<td>( V_{DS} = 10V, \ I_D = 5mA )</td>
<td>2.7 - 5.6 ( V )</td>
<td></td>
</tr>
<tr>
<td>Static Drain - Source on-state resistance</td>
<td>( R_{DS(on)} )</td>
<td>( V_{GS} = 18V, \ I_D = 10A ) ( T_j = 25^\circ C ) ( T_j = 150^\circ C )</td>
<td>- 80 104 ( \mu \Omega )</td>
<td></td>
</tr>
<tr>
<td>Gate input resistance</td>
<td>( R_G )</td>
<td>( f = 1MHz, ) open drain ( T_j = 25^\circ C ) ( T_j = 150^\circ C )</td>
<td>- 12 - ( \Omega )</td>
<td></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>- 0.70 0.91</td>
<td>( ^\circ C/W )</td>
</tr>
</tbody>
</table>

### Typical Transient Thermal Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{th1} )</td>
<td>( 8.52\times10^{-2} )</td>
<td>( K/W )</td>
</tr>
<tr>
<td>( R_{th2} )</td>
<td>( 4.15\times10^{-1} )</td>
<td>( K/W )</td>
</tr>
<tr>
<td>( R_{th3} )</td>
<td>( 2.06\times10^{-1} )</td>
<td>( K/W )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( C_{th1} )</td>
<td>( 1.22\times10^{-3} )</td>
<td>( Ws/K )</td>
</tr>
<tr>
<td>( C_{th2} )</td>
<td>( 6.20\times10^{-3} )</td>
<td>( Ws/K )</td>
</tr>
<tr>
<td>( C_{th3} )</td>
<td>( 3.49\times10^{-2} )</td>
<td>( Ws/K )</td>
</tr>
</tbody>
</table>

![Diagonal thermal resistance schematic]
### 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>$g_{fs}$</td>
<td>$V_{DS} = 10V$, $I_D = 10A$</td>
<td>-</td>
<td>S</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{iss}$</td>
<td>$V_{GS} = 0V$</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>Output capacitance</td>
<td>$C_{oss}$</td>
<td>$V_{DS} = 800V$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Reverse transfer capacitance</td>
<td>$C_{rss}$</td>
<td>$f = 1MHz$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Turn - on delay time</td>
<td>$t_{d(on)}$</td>
<td>$V_{DS} = 600V$, $I_D = 10A$</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Rise time</td>
<td>$t_r$</td>
<td>$V_{GS} = 0V/+18V$, $I_D = 10A$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Turn - off delay time</td>
<td>$t_{d(off)}$</td>
<td>$R_G = 0\Omega$, $L = 750\mu H$, $L_o = 50nH$, $C_o = 10pF$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>$t_f$</td>
<td>$V_{GS} = 0V/18V$, $I_D = 10A$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Turn - on switching loss</td>
<td>$E_{on}$</td>
<td>$E_{on}$ includes diode reverse recovery.</td>
<td>-</td>
<td>µJ</td>
</tr>
<tr>
<td>Turn - off switching loss</td>
<td>$E_{off}$</td>
<td>$E_{off}$</td>
<td>-</td>
<td></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>Body diode continuous, forward current</td>
<td>( I_S ) (^*1)</td>
<td>( T_c = 25^\circ C )</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Body 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_D = 10A )</td>
<td>-</td>
<td>3.2 V</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>( t_{rr} ) (^*5)</td>
<td>( I_F = 10A ) ( V_R = 600V )</td>
<td></td>
<td>17 ns</td>
</tr>
<tr>
<td>Reverse recovery charge</td>
<td>( Q_{rr} ) (^*5)</td>
<td>( di/dt = 2500A/\mu s ) ( L_o = 50nH, C_o = 10pF )</td>
<td>-</td>
<td>261 nC</td>
</tr>
<tr>
<td>Peak reverse recovery current</td>
<td>( I_{rrm} ) (^*5)</td>
<td>See Fig. 3-1, 3-2.</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

\(^*1\) Limited by maximum temperature allowed.

\(^*2\) \( P_W \leq 10\mu s, \text{Duty cycle} \leq 1\% \)

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

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Please note especially when using driver source that \( V_{GSS\_surge} \) must be in the range of absolute maximum rating.

\(^*4\) 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

Fig.2 Maximum Safe Operating Area

Fig.3 Typical Transient Thermal Resistance vs. Pulse Width
●Electrical characteristic curves

Fig.4 Typical Output Characteristics(I)

Fig.5 Typical Output Characteristics(II)

Fig.6 $T_j = 25^\circ C$ 3rd Quadrant Characteristics
Electrical characteristic curves

Fig. 7 $T_j = 150^\circ C$ Typical Output Characteristics (I)

Fig. 8 $T_j = 150^\circ C$ Typical Output Characteristics (II)

Fig. 9 $T_j = 150^\circ C$ 3rd Quadrant Characteristics

Fig. 10 Body Diode Forward Voltage vs. Gate - Source Voltage
●Electrical characteristic curves

Fig.11 Typical Transfer Characteristics (I)

Fig.12 Typical Transfer Characteristics (II)

Fig.13 Gate Threshold Voltage vs. Junction Temperature

Fig.14 Transconductance vs. Drain Current
● Electrical characteristic curves

**Fig. 15** Static Drain - Source On-State Resistance vs. Gate - Source Voltage

**Fig. 16** Static Drain - Source On-State Resistance vs. Junction Temperature

**Fig. 17** Static Drain - Source On-State Resistance vs. Drain Current

**Fig. 18** Normalized Drain - Source Breakdown Voltage vs. Junction Temperature
Electrical characteristic curves

Fig.19 Typical Capacitance vs. Drain - Source Voltage

- Capacitance: \( C \) [pF]
- \( C_{iss} \)
- \( C_{oss} \)
- \( C_{rss} \)

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

Fig.20 \( C_{oss} \) Stored Energy

- \( E_{oss} \) [\( \mu \text{J} \)]

\( T_a = 25^\circ C \)

Fig.21 Dynamic Input Characteristics

- Gate - Source Voltage: \( V_{GS} \) [V]
- Gate Charge: \( Q_g \) [nC]

\( T_a = 25^\circ C \)
\( V_{DD} = 600 \text{V} \)
\( I_B = 10 \text{A} \)
Pulsed

*Gate Charge Waveform

\( V_G \)
\( V_{GS} \)
\( Q_g \)
\( Q_{gs} \)
\( Q_{gd} \)
Electrical characteristic curves

**Fig. 22** Typical Switching Time vs. External Gate Resistance

- $T_a = 25°C$
- $V_{DD} = 600V$
- $V_{GS} = +18V/0V$
- $I_D = 10A$
- $L = 750\mu H$

**Fig. 23** Typical Switching Loss vs. Drain - Source Voltage

- $T_a = 25°C$
- $I_D = 10A$
- $V_{GS} = +18V/0V$
- $R_G = 0Ω$
- $L = 750\mu H$

**Fig. 24** Typical Switching Loss vs. Drain Current

- $T_a = 25°C$
- $V_{DD} = 600V$
- $V_{GS} = +18V/0V$
- $R_G = 0Ω$
- $L = 750\mu H$

**Fig. 25** Typical Switching Loss vs. External Gate Resistance

- $T_a = 25°C$
- $I_D = 10A$
- $V_{DD} = 600V$
- $V_{GS} = +18V/0V$
- $L = 750\mu H$
Measurement circuits and waveforms

Fig.1-1 Gate Charge Measurement Circuit

Fig.2-1 Switching Characteristics Measurement Circuit

Fig.2-2 Waveforms for Switching Time

Fig.2-3 Waveforms for Switching Energy Loss

Fig.3-1 Reverse Recovery Time Measurement Circuit

Fig.3-2 Reverse Recovery Waveform

\[ E_{on} = \int I_D \cdot V_{DS} \, dt \]

\[ E_{off} = \int I_D \cdot V_{DS} \, dt \]

\[ Q_{on} = \int I_D \, dt \]

\[ L \cdot 10\% \]

\[ L \cdot 90\% \]

\[ L \cdot 90\% \]

\[ L \cdot 90\% \]

\[ L \cdot 10\% \]
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ROHM Customer Support System

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