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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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**DESCRIPTION**

The 2SK3811 is N-channel MOS Field Effect Transistor designed for high current switching applications.

**FEATURES**

- Super low on-state resistance
  \[ R_{DS(on)} = 1.8 \, \text{m}\Omega \text{ MAX.} \quad (V_{GS} = 10 \, \text{V}, \text{ID} = 55 \, \text{A}) \]
- High Current Rating: \text{ID(DC)} = \pm 110 \, \text{A}

**ABSOLUTE MAXIMUM RATINGS (\text{T_A} = 25^\circ\text{C})**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Voltage (\text{V_{GS} = 0 , \text{V}})</td>
<td>\text{V_{DSS}}</td>
</tr>
<tr>
<td>Gate to Source Voltage (\text{V_{DS} = 0 , \text{V}})</td>
<td>\text{V_{GSS}}</td>
</tr>
<tr>
<td>Drain Current (DC) (\text{T_C = 25^\circ\text{C}})</td>
<td>\text{ID(DC)}</td>
</tr>
<tr>
<td>Drain Current (pulse) \text{Note1}</td>
<td>\text{ID(pulse)}</td>
</tr>
<tr>
<td>Total Power Dissipation (\text{T_C = 25^\circ\text{C}})</td>
<td>\text{P_T1}</td>
</tr>
<tr>
<td>Total Power Dissipation (\text{T_A = 25^\circ\text{C}})</td>
<td>\text{P_T2}</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>\text{T_{ch}}</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>\text{T_{stg}}</td>
</tr>
<tr>
<td>Single Avalanche Energy \text{Note2}</td>
<td>\text{E_{AS}}</td>
</tr>
<tr>
<td>Repetitive Avalanche Current \text{Note3}</td>
<td>\text{I_{AR}}</td>
</tr>
<tr>
<td>Repetitive Avalanche Energy \text{Note3}</td>
<td>\text{E_{AR}}</td>
</tr>
</tbody>
</table>

**Notes**

1. \text{PW} \leq 10 \, \mu\text{s}, \text{Duty Cycle} \leq 1%
2. Starting \text{T_{ch}} = 25^\circ\text{C}, \text{V_{DD}} = 20 \, \text{V}, \text{R_G} = 25 \, \Omega, \text{V_{GS}} = 20 \rightarrow 0 \, \text{V}, \text{L} = 100 \, \mu\text{H}
3. \text{R_G} = 25 \, \Omega, \text{T_{ch(peak)}} \leq 150^\circ\text{C}

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## ELECTRICAL CHARACTERISTICS (TA = 25°C)

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>$I_{DSS}$</td>
<td>$V_{GS} = 40 \text{ V}, V_{DS} = 0 \text{ V}$</td>
<td>10</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Leakage Current</td>
<td>$I_{GSS}$</td>
<td>$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$</td>
<td>±100</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Cut-off Voltage</td>
<td>$V_{GSOFF}$</td>
<td>$V_{DS} = 10 \text{ V}, I_{D} = 1 \text{ mA}$</td>
<td>2.0</td>
<td>3.0</td>
<td>4.0</td>
<td>V</td>
</tr>
<tr>
<td>Forward Transfer Admittance (^{Note})</td>
<td>$\left</td>
<td>y_{fn} \right</td>
<td>$</td>
<td>$V_{GS} = 10 \text{ V}, I_{D} = 55 \text{ A}$</td>
<td>45</td>
<td>89</td>
</tr>
<tr>
<td>Drain to Source On-state Resistance (^{Note})</td>
<td>$R_{DS(ON)}$</td>
<td>$V_{GS} = 10 \text{ V}, I_{D} = 55 \text{ A}$</td>
<td>1.4</td>
<td>1.8</td>
<td></td>
<td>mΩ</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>$C_{iss}$</td>
<td>$V_{DS} = 10 \text{ V}$</td>
<td>17700</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>$C_{oss}$</td>
<td>$V_{GS} = 0 \text{ V}$</td>
<td>2200</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>$C_{rss}$</td>
<td>$f = 1 \text{ MHz}$</td>
<td>1300</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-on Delay Time</td>
<td>$t_{(on)}$</td>
<td>$V_{DD} = 20 \text{ V}, I_{D} = 55 \text{ A}$</td>
<td>54</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Rise Time</td>
<td>$t_{r}$</td>
<td>$V_{GS} = 10 \text{ V}$</td>
<td>140</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Turn-off Delay Time</td>
<td>$t_{(off)}$</td>
<td>$R_{G} = 0 \text{ Ω}$</td>
<td>130</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Fall Time</td>
<td>$t_{f}$</td>
<td></td>
<td>21</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Total Gate Charge</td>
<td>$Q_{G}$</td>
<td>$V_{DD} = 32 \text{ V}$</td>
<td>260</td>
<td>nC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to Source Charge</td>
<td>$Q_{GS}$</td>
<td>$V_{DS} = 10 \text{ V}$</td>
<td>57</td>
<td></td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Gate to Drain Charge</td>
<td>$Q_{GD}$</td>
<td>$I_{D} = 110 \text{ A}$</td>
<td>83</td>
<td></td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Body Diode Forward Voltage (^{Note})</td>
<td>$V_{F(B-D)}$</td>
<td>$I_{F} = 110 \text{ A}, V_{GS} = 0 \text{ V}$</td>
<td>0.87</td>
<td>1.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>$t_{r}$</td>
<td>$I_{F} = 110 \text{ A}, V_{GS} = 0 \text{ V}$</td>
<td>60</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>$Q_{r}$</td>
<td>$di/dt = 100 \text{ A}/\mu\text{s}$</td>
<td>80</td>
<td></td>
<td></td>
<td>nC</td>
</tr>
</tbody>
</table>

\(^{Note}\) Pulsed

### TEST CIRCUIT 1 AVALANCHE CAPABILITY

![TEST CIRCUIT 1 AVALANCHE CAPABILITY](image1)

### TEST CIRCUIT 2 SWITCHING TIME

![TEST CIRCUIT 2 SWITCHING TIME](image2)

### TEST CIRCUIT 3 GATE CHARGE

![TEST CIRCUIT 3 GATE CHARGE](image3)
TYPICAL CHARACTERISTICS (TA = 25°C)

DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

FORWARD BIAS SAFE OPERATING AREA

TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE

FORWARD TRANSFER CHARACTERISTICS

FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

SWITCHING CHARACTERISTICS

DYNAMIC INPUT/OUTPUT CHARACTERISTICS

SOURCE TO DRAIN DIODE FORWARD VOLTAGE

REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT
SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD

I_{AS} - Single Avalanche Current - A

V_{DD} = 20 V
R_G = 25 \Omega
V_{GS} = 20 \rightarrow 0 V
Starting T_{ch} = 25°C

E_{AS} = 518 mJ

I_{AS} = 72 A

L - Inductive Load - H

SINGLE AVALANCHE ENERGY DERATING FACTOR

Energy Derating Factor - %

Starting T_{ch} - Starting Channel Temperature - °C

V_{DD} = 20 V
R_G = 25 \Omega
V_{GS} = 20 \rightarrow 0 V
I_{AS} \leq 72 A
PACKAGE DRAWING (Unit: mm)

TO-263 (MP-25ZP)

EQUIVALENT CIRCUIT

Remark  Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.
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