N0603N
N-channel MOSFET
60 V, 100 A, 4.6 mΩ

Features
- Low on-state resistance : R_DS(on) = 4.6 mΩ MAX. (V_GS = 10 V, I_D = 50 A)
- Low Ciss : Ciss = 7730 pF TYP. (V_DS = 25 V, V_GS = 0 V)
- High current : I_D(DC) = ±100 A
- RoHS Compliant
- Quality Grade : Standard
- Applications : For high current switching

Ordering Information

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Package</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>N0603N-S23-AY</td>
<td>TO-262, Pb-free</td>
<td>50 pcs / Magazine (Tube)</td>
</tr>
</tbody>
</table>

Note: 1. Pb-free means that this product does not contain lead in the external electrode.

Absolute Maximum Ratings (TA = 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to Source Voltage (V_GS = 0 V)</td>
<td>V_DSS</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Gate to Source Voltage (V_DS = 0 V)</td>
<td>V_GSS</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Drain Current (DC) (T_C = 25°C)</td>
<td>I_D(DC)</td>
<td>±100</td>
<td>A</td>
</tr>
<tr>
<td>Drain Current (pulse) Note2</td>
<td>I_D(pulse)</td>
<td>±400</td>
<td>A</td>
</tr>
<tr>
<td>Total Power Dissipation (T_C = 25°C)</td>
<td>P_T1</td>
<td>156</td>
<td>W</td>
</tr>
<tr>
<td>Total Power Dissipation (T_A = 25°C)</td>
<td>P_T2</td>
<td>1.5</td>
<td>W</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>T_ch</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_stg</td>
<td>−55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>Single Avalanche Current Note3</td>
<td>I_AS</td>
<td>55</td>
<td>A</td>
</tr>
<tr>
<td>Single Avalanche Energy Note3</td>
<td>E_AS</td>
<td>300</td>
<td>mJ</td>
</tr>
</tbody>
</table>

Notes: 2. PW ≤ 10 µs, Duty Cycle ≤ 1%
3. Starting T_ch = 25°C, R_g = 25 Ω, V_DD = 30 V, V_GS = 20 → 0 V, L = 100 µH

Thermal Resistance

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Max. Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel to Case Thermal Resistance</td>
<td>R_h(c-h)</td>
<td>0.80</td>
<td>°C/W</td>
</tr>
<tr>
<td>Channel to Ambient Thermal Resistance</td>
<td>R_h(c-A)</td>
<td>83.3</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

Notes: 4. This data is the designed target maximum value on Renesas’s measurement condition. (Not tested)
### Electrical Characteristics (TA = 25°C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>I_DSS</td>
<td>1</td>
<td></td>
<td></td>
<td>µA</td>
<td>V_{DS} = 60 V, V_{GS} = 0 V</td>
</tr>
<tr>
<td>Gate Leakage Current</td>
<td>I_GSS</td>
<td>±100</td>
<td></td>
<td></td>
<td>nA</td>
<td>V_{GS} = 20 V, V_{DS} = 0 V</td>
</tr>
<tr>
<td>Gate to Source Cut-off Voltage</td>
<td>V_{GS(off)}</td>
<td>2.0</td>
<td>4.0</td>
<td></td>
<td>V</td>
<td>V_{DS} = 10 V, I_D = 1 mA</td>
</tr>
<tr>
<td>Forward Transfer Admittance (^\text{Note}5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Drain to Source On-state Resistance (^\text{Note}5)</td>
<td>R_{DS(on)}</td>
<td>3.7</td>
<td>4.6</td>
<td></td>
<td>mΩ</td>
<td>V_{GS} = 10 V, I_D = 50 A</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>Ciss</td>
<td>7730</td>
<td></td>
<td></td>
<td>pF</td>
<td>V_{DS} = 25 V,</td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>Coss</td>
<td>560</td>
<td></td>
<td></td>
<td>pF</td>
<td>V_{GS} = 0 V,</td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>Crss</td>
<td>290</td>
<td></td>
<td></td>
<td>pF</td>
<td>f = 1 MHz</td>
</tr>
<tr>
<td>Turn-on Delay Time</td>
<td>t_{on}</td>
<td>35</td>
<td></td>
<td></td>
<td>ns</td>
<td>VDD = 30 V, I_D = 50 A,</td>
</tr>
<tr>
<td>Rise Time</td>
<td>t_r</td>
<td>12</td>
<td></td>
<td></td>
<td>ns</td>
<td>VGS = 10 V,</td>
</tr>
<tr>
<td>Turn-off Delay Time</td>
<td>t_{off}</td>
<td>76</td>
<td></td>
<td></td>
<td>ns</td>
<td>R_G = 0 Ω</td>
</tr>
<tr>
<td>Fall Time</td>
<td>t_f</td>
<td>14</td>
<td></td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Total Gate Charge</td>
<td>Q_G</td>
<td>133</td>
<td></td>
<td></td>
<td>nC</td>
<td>VDD = 48 V,</td>
</tr>
<tr>
<td>Gate to Source Charge</td>
<td>Q_GS</td>
<td>38</td>
<td></td>
<td></td>
<td>nC</td>
<td>VGS = 10 V,</td>
</tr>
<tr>
<td>Gate to Drain Charge</td>
<td>Q_GD</td>
<td>38</td>
<td></td>
<td></td>
<td>nC</td>
<td>I_D = 100 A</td>
</tr>
<tr>
<td>Body Diode Forward Voltage (^\text{Note}5)</td>
<td>V_{F(S-D)}</td>
<td>1.5</td>
<td></td>
<td></td>
<td>V</td>
<td>I_F = 100 A, V_{GS} = 0 V</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>t_{rr}</td>
<td>44</td>
<td></td>
<td></td>
<td>ns</td>
<td>I_F = 50 A, V_{GS} = 0 V,</td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>Q_{rr}</td>
<td>61</td>
<td></td>
<td></td>
<td>nC</td>
<td>di/dt = 100 A/µs</td>
</tr>
<tr>
<td>Notes: 5. Pulsed test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### TEST CIRCUIT 1 AVALANCHE CAPABILITY

- V_{GS} = 20 to 0 V
- B_{Vos} = V_{GS} – I_{DSS} * R_{D}

#### TEST CIRCUIT 2 SWITCHING TIME

- V_{os}:
  - 10%: V_{DS} Wave Form
  - 90%: V_{DS} Wave Form
- t:
  - 1 µs
  - Duty Cycle ≤ 1%

#### TEST CIRCUIT 3 GATE CHARGE

- V_{gs}:
  - 10%: V_{DS} Wave Form
  - 90%: V_{DS} Wave Form
- t:
  - t_{on}:
    - for
  - t_{off}:
    - for
Typical Characteristics

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

Notes:
6. Designed target value on Renesas measurement condition. (Tc = 25°C, unless otherwise specified)
7. This data is the designed value on Renesas's measurement condition. Renesas recommends that operating conditions are designed according to a document “Power MOSFET/IGBT Attention of Handling Semiconductor Devices (R07ZZ0010)“.
8. This data is the designed target maximum value on Renesas's measurement condition.
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE

FORWARD TRANSFER CHARACTERISTICS

GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE

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

\( R_{\text{DS(on)}} \) vs. CHANNEL TEMPERATURE

\( V_{GS} = 10 \text{ V} \)
\( I_{D} = 50 \text{ A} \)
Pulsed

CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE

\( C_{iss}, C_{oss}, C_{rss} \) - Capacitance - pF

SWITCHING CHARACTERISTICS

\( t_{\text{on}}, t_{\text{off}}, t_{\text{r}}, t_{\text{off}} \) - Switching Time - ns

\( V_{DD} = 30 \text{ V} \)
\( V_{GS} = 10 \text{ V} \)
\( R_{G} = 0 \Omega \)

DYNAMIC INPUT CHARACTERISTICS

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

SOURCE TO DRAIN DIODE FORWARD VOLTAGE

\( V_{F(S-D)} \) - Source to Drain Voltage - V

REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

\( t_{\text{rr}} \) - Reverse Recovery Time - ns

\( V_{GS} = 0 \text{ V} \)
di/dt = 100 A/\mu s

\( I_{F} \) - Diode Forward Current - A
Package Drawing (Unit: mm)

<table>
<thead>
<tr>
<th>Package Name</th>
<th>JEITA Package Code</th>
<th>RENESAS Code</th>
<th>Previous Code</th>
<th>MASS (Typ) [g]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-262</td>
<td>—</td>
<td>PRSS0004AR-A</td>
<td>TO-262A</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Unit: mm

Equivalent Circuit

![Equivalent Circuit Diagram]
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