N0605N
N-channel MOSFET
60 V, 80 A, 8.5 mΩ

Features
- Low on-state resistance: \( R_{\text{DS(on)}} = 8.5 \, \text{mΩ} \) max. (\( V_{\text{GS}} = 10 \, \text{V}, \, I_D = 40 \, \text{A} \))
- Low \( C_{\text{iss}} \): \( C_{\text{iss}} = 3300 \, \text{pF} \) typ. (\( V_{\text{DS}} = 25 \, \text{V} \))
- High current: \( I_{\text{D(DC)}} = \pm 80 \, \text{A} \)
- RoHS Compliant
- Quality Grade: Standard
- Applications: For high current switching

Ordering Information

<table>
<thead>
<tr>
<th>Orderable Part Number</th>
<th>Package</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>N0605N-S19-AY</td>
<td>TO-220AB, Pb-free Note1</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 (\( T_A = 25{\degree}\text{C} \))

<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_{\text{GS}} = 0 , \text{V} ))</td>
<td>( V_{\text{DS}} )</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Gate to Source Voltage (( V_{\text{DS}} = 0 , \text{V} ))</td>
<td>( V_{\text{GSS}} )</td>
<td>( \pm 20 )</td>
<td>V</td>
</tr>
<tr>
<td>Drain Current (DC) (( T_C = 25 , \text{°C} ))</td>
<td>( I_{\text{D(DC)}} )</td>
<td>( \pm 80 )</td>
<td>A</td>
</tr>
<tr>
<td>Drain Current (pulse) Note2</td>
<td>( I_{\text{D(pulse)}} )</td>
<td>( \pm 160 )</td>
<td>A</td>
</tr>
<tr>
<td>Total Power Dissipation (( T_C = 25 , \text{°C} ))</td>
<td>( P_{T1} )</td>
<td>92.6</td>
<td>W</td>
</tr>
<tr>
<td>Total Power Dissipation (( T_A = 25 , \text{°C} ))</td>
<td>( P_{T2} )</td>
<td>1.5</td>
<td>W</td>
</tr>
<tr>
<td>Channel Temperature</td>
<td>( T_{\text{ch}} )</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>( T_{\text{stg}} )</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>Single Avalanche Current Note3</td>
<td>( I_{\text{AS}} )</td>
<td>30</td>
<td>A</td>
</tr>
<tr>
<td>Single Avalanche Energy Note3</td>
<td>( E_{\text{AS}} )</td>
<td>92</td>
<td>mJ</td>
</tr>
</tbody>
</table>

Note: Continuous heavy load condition (e.g. high temperature/voltage/current or high variation of temperature) may affect a reliability even if it is within the absolute maximum ratings. Please consider derating condition for appropriate reliability in reference Renesas Semiconductor Reliability Handbook (Recommendation for Handling and Usage of Semiconductor Devices) and individual reliability data.

Notes: 2. \( PW \leq 10 \, \mu\text{s}, \, \text{Duty Cycle} \leq 1\% \)
3. Starting \( T_{\text{ch}} = 25 \, \text{°C}, \, V_{\text{DD}} = 30 \, \text{V}, \, R_G = 25 \, \Omega, \, V_{\text{GS}} = 20 \rightarrow 0 \, \text{V}, \, L = 100 \, \mu\text{H} \)

Thermal Resistance

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Max. Value Note4</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel to Case Thermal Resistance</td>
<td>( R_{\text{th}(\text{ch-C})} )</td>
<td>1.35</td>
<td>°C/W</td>
</tr>
<tr>
<td>Channel to Ambient Thermal Resistance</td>
<td>( R_{\text{th}(\text{ch-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>Ioss</td>
<td>1</td>
<td>µA</td>
<td></td>
<td></td>
<td>Vos = 60 V, Vgs = 0 V</td>
</tr>
<tr>
<td>Gate Leakage Current</td>
<td>Ioss</td>
<td>±100</td>
<td>nA</td>
<td></td>
<td></td>
<td>Vgs = ±20 V, Vds = 0 V</td>
</tr>
<tr>
<td>Gate to Source Cut-off Voltage</td>
<td>Vgs(off)</td>
<td>2.0</td>
<td>4.0</td>
<td>V</td>
<td></td>
<td>Vds = 10 V, Io = 1 mA</td>
</tr>
<tr>
<td>Forward Transfer Admittance [Note 5]</td>
<td></td>
<td></td>
<td>52</td>
<td>S</td>
<td></td>
<td>Vds = 5 V, Io = 40 A</td>
</tr>
<tr>
<td>Drain to Source On-state Resistance [Note 5]</td>
<td></td>
<td></td>
<td>6.8</td>
<td>8.5</td>
<td>mΩ</td>
<td>Vgs = 10 V, Io = 40 A</td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>Ciss</td>
<td>3300</td>
<td>pF</td>
<td></td>
<td></td>
<td>Vgs = 25 V</td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>Coss</td>
<td>240</td>
<td>pF</td>
<td></td>
<td></td>
<td>Vgs = 0 V</td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>Crss</td>
<td>140</td>
<td>pF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-on Delay Time</td>
<td>t(on)</td>
<td>27</td>
<td>ns</td>
<td></td>
<td></td>
<td>Vgs = 30 V, Io = 40 A</td>
</tr>
<tr>
<td>Rise Time</td>
<td>tr</td>
<td>14</td>
<td>ns</td>
<td></td>
<td></td>
<td>Vgs = 10 V, Ro = 0 Ω</td>
</tr>
<tr>
<td>Turn-off Delay Time</td>
<td>t(off)</td>
<td>54</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Time</td>
<td>tf</td>
<td>11</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Gate Charge</td>
<td>QG</td>
<td>57</td>
<td>nC</td>
<td></td>
<td></td>
<td>Vgs = 48 V</td>
</tr>
<tr>
<td>Gate to Source Charge</td>
<td>Qss</td>
<td>18</td>
<td>nC</td>
<td></td>
<td></td>
<td>Vgs = 10 V</td>
</tr>
<tr>
<td>Gate to Drain Charge</td>
<td>Qgd</td>
<td>16</td>
<td>nC</td>
<td></td>
<td></td>
<td>Io = 80 A</td>
</tr>
<tr>
<td>Body Diode Forward Voltage [Note 5]</td>
<td>Vf(S-D)</td>
<td>1.5</td>
<td>V</td>
<td></td>
<td></td>
<td>If = 80 A, Vgs = 0 V</td>
</tr>
<tr>
<td>Reverse Recovery Time</td>
<td>τr</td>
<td>38</td>
<td>ns</td>
<td></td>
<td></td>
<td>If = 80 A, Vgs = 0 V</td>
</tr>
<tr>
<td>Reverse Recovery Charge</td>
<td>Qrr</td>
<td>46</td>
<td>nC</td>
<td></td>
<td></td>
<td>di/dt = 100 A/µs</td>
</tr>
</tbody>
</table>

Notes: 5. Pulsed test

### 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

**DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA**

![Graph showing derating factor vs. case temperature]

**TOTAL POWER DISSIPATION vs. CASE TEMPERATURE**

![Graph showing total power dissipation vs. case temperature]

**FORWARD BIAS SAFE OPERATING AREA**

![Graph showing forward bias safe operating area]

**TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH**

![Graph showing transient thermal resistance vs. pulse width]

Notes:
6. Designed target value on Renesas measurement condition. (T_c = 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 (R07ZZ010)".
8. This data is the designed target maximum value on Renesas’s measurement condition.
DRAIN TO SOURCE ON-STATE
RESISTANCE vs. CHANNEL TEMPERATURE

CAPACITANCE vs. DRAIN TO SOURCE
VOLTAGE

SWITCHING CHARACTERISTICS

DYNAMIC INPUT CHARACTERISTICS

SOURCE TO DRAIN DIODE FORWARD
VOLTAGE

REVERSE RECOVERY TIME vs.
DRAIN CURRENT

\( I_D = 40 \text{A} \)
\( V_{GS} = 10 \text{V} \)
\( V_{DS} = 12 \text{V} \)
\( 30 \text{V} \)
\( 48 \text{V} \)
\( I_D = 80 \text{A} \)
\( V_{DD} = 30 \text{V} \)
\( V_{GS} = 10 \text{V} \)
\( R_G = 0 \text{Ω} \)
\( V_{DD} = 30 \text{V} \)
\( V_{GS} = 10 \text{V} \)
\( V_{DC} = 0 \text{V} \)
\( \text{Pulsed} \)
\( \text{Pulsed} \)
\( \text{Pulsed} \)
\( \text{Pulsed} \)

\( \frac{\text{di/dt}}{\text{μs}} = 100 \)

\( V_{GS} = 0 \text{V} \)
Package Drawings (Unit: mm)

<table>
<thead>
<tr>
<th>JEDEC Package Code</th>
<th>RENESAS Code</th>
<th>Previous Code</th>
<th>MASS (Typ) [g]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-220AB</td>
<td>PRSS0004AU-A</td>
<td>TO-220ABB</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Equivalent Circuit
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