MOSFET – N-Channel
Enhancement Mode Field
Effect Transistor

60 V, 0.28 A, 2 Ω

2N7002V/2N7002VA

Features
• Dual N-Channel MOSFET
• Low On-Resistance
• Low Gate Threshold Voltage
• Low Input Capacitance
• Fast Switching Speed
• Low Input/Output Leakage
• Ultra–Small Surface Mount Package
• This Device is Pb–Free, Halide Free and RoHS Compliant

MOSFET MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_DSS</td>
<td>Drain – Source Voltage</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>V_DGR</td>
<td>Gate – Gate Voltage (R_GS ≤ 1.0 MΩ)</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>V_GSS</td>
<td>Gate–Source Voltage</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>– Continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Pulsed</td>
<td>±40</td>
<td></td>
</tr>
<tr>
<td>I_D</td>
<td>Drain Current</td>
<td>280</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>– Continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Pulsed</td>
<td>1.5</td>
<td>A</td>
</tr>
<tr>
<td>T_J, T_STG</td>
<td>Junction and Storage Temperature Range</td>
<td>−55 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_D</td>
<td>Total Device Dissipation</td>
<td>250</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above T_A = 25°C</td>
<td>2.0</td>
<td>mW/°C</td>
</tr>
<tr>
<td>R_JA</td>
<td>Thermal Resistance, Junction–to–Ambient (Note 1)</td>
<td>500</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

Note 1: Device mounted on FR–4 PCB, 1 inch x 0.85 inch x 0.062 inch. Minimum land pad size.

MARKING DIAGRAM

PIN ASSIGNMENT

ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.
ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV_DSS</td>
<td>Drain to Source Breakdown Voltage</td>
<td>VGS = 0 V, ID = 10 μA</td>
<td>60</td>
<td>78</td>
<td>−</td>
<td>V</td>
</tr>
<tr>
<td>IDSS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>VGS = 60 V, VDS = 0 V</td>
<td>−</td>
<td>0.001</td>
<td>1.0</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VDS = 60 V, VGS = 0 V, TJ = 125°C</td>
<td>−</td>
<td>7</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>IGSS</td>
<td>Gate–Body Leakage</td>
<td>VGS = ±20 V, VDS = 0 V</td>
<td>−</td>
<td>0.2</td>
<td>±100</td>
<td>nA</td>
</tr>
</tbody>
</table>

ON CHARACTERISTICS (Note 2)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGSTh</td>
<td>Gate Threshold Voltage</td>
<td>VDS = VGS, ID = 250 μA</td>
<td>1.00</td>
<td>1.76</td>
<td>2.50</td>
<td>V</td>
</tr>
<tr>
<td>RDS(on)</td>
<td>Static Drain–Source On–Resistance</td>
<td>VGS = 5 V, ID = 0.05 A</td>
<td>−</td>
<td>1.6</td>
<td>7.5</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td>VGS = 10 V, ID = 0.5 A</td>
<td>−</td>
<td>−</td>
<td>2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>VGS = 10 V, ID = 0.5 A, TJ = 125°C</td>
<td>−</td>
<td>2.53</td>
<td>13.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID(on)</td>
<td>On–State Drain Current</td>
<td>VGS = 10 V, VDS = 7.5 V</td>
<td>1.50</td>
<td>1.43</td>
<td>−</td>
<td>A</td>
</tr>
<tr>
<td>gFS</td>
<td>Forward Transconductance</td>
<td>VDS = 10 V, ID = 0.2 A</td>
<td>80</td>
<td>356.5</td>
<td>−</td>
<td>mS</td>
</tr>
</tbody>
</table>

DYNAMIC CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciss</td>
<td>Input Capacitance</td>
<td>VDS = 25 V, VGS = 0 V, f = 1.0 MHz</td>
<td>−</td>
<td>37.8</td>
<td>50</td>
<td>pF</td>
</tr>
<tr>
<td>Coss</td>
<td>Output Capacitance</td>
<td>−</td>
<td>12.4</td>
<td>25</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Crss</td>
<td>Reverse Transfer Capacitance</td>
<td>−</td>
<td>6.5</td>
<td>7</td>
<td>pF</td>
<td></td>
</tr>
</tbody>
</table>

SWITCHING CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>td(on)</td>
<td>Turn–On Delay Time</td>
<td>VDD = 30 V, ID = 0.2 A VGEN = 10 V, RL = 150 Ω, RGEN = 25 Ω</td>
<td>−</td>
<td>5.85</td>
<td>20</td>
<td>ns</td>
</tr>
<tr>
<td>td(off)</td>
<td>Turn–Off Delay Time</td>
<td>−</td>
<td>12.5</td>
<td>20</td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
2. Short duration test pulse used to minimize self–heating effect.
TYPICAL PERFORMANCE CHARACTERISTICS

Figure 1. On–Region Characteristics

Figure 2. On–Resistance Variation with Gate Voltage and Drain Current

Figure 3. On–Resistance Variation with Temperature

Figure 4. On–Resistance Variation with Gate–Source Voltage

Figure 5. Transfer Characteristics

Figure 6. Gate Threshold Variation with Temperature

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TYPICAL ELECTRICAL CHARACTERISTICS (continued)

Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature

Figure 8. Power Derating

PACKAGE MARKING AND ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Device</th>
<th>Device Marking</th>
<th>Package</th>
<th>Shipping†</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N7002V</td>
<td>AB</td>
<td>SOT–563 (Pb–Free)</td>
<td>3000 / Tape &amp; Reel</td>
</tr>
<tr>
<td>2N7002VA</td>
<td>AC</td>
<td>SOT–563 (Pb–Free)</td>
<td>3000 / Tape &amp; Reel</td>
</tr>
</tbody>
</table>

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8911/D.
SOT-563
CASE 419BH
ISSUE O

DATE 31 AUG 2016

NOTES: UNLESS OTHERWISE SPECIFIED.

A. REFERENCE TO JEDEC MO293.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DOES NOT COMPLY JEDEC STANDARD VALUE.
D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSION.
F. LANDPATTERN RECOMMENDATION GENERATED WITH IPC LANDPATTERN GENERATOR