Field Effect Transistor - N-Channel, Enhancement Mode

2N7002K

Features
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input / Output Leakage
- Ultra–Small Surface Mount Package
- ESD HBM = 2000 V (Typical: 3000 V) as per JESD22 A114 and ESD CDM = 2000 V as per JESD22 C101
- This Device is Pb–Free, Halogen Free/BFR Free and is RoHS Compliant

ABSOLUTE MAXIMUM RATINGS (TA = 25°C unless otherwise specified)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDSS</td>
<td>Drain–Source Voltage</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>VDGR</td>
<td>Drain–Gate Voltage (RGS ≤ 1.0 MΩ)</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>VGSS</td>
<td>Gate–Source Voltage</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>ID</td>
<td>Drain Current</td>
<td>300</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Continuous</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulsed</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>TJ</td>
<td>Operating Junction Temperature Range</td>
<td>−55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>TSTG</td>
<td>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 (TA = 25°C unless otherwise specified)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD</td>
<td>Total Device Dissipation</td>
<td>350</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above TA = 25°C</td>
<td>2.8</td>
<td>mW/°C</td>
</tr>
<tr>
<td>RθJA</td>
<td>Thermal Resistance, Junction–to–Ambient (Note 1)</td>
<td>350</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

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

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.

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OFF CHARACTERISTICS (Note 2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BV_DSS</td>
<td>Drain–Source Breakdown Voltage</td>
<td>V_{GS} = 0 V, I_D = 10 μA</td>
<td>60</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td>I_DSS</td>
<td>Zero Gate Voltage Drain Current</td>
<td>V_{DS} = 60 V, V_{GS} = 0 V</td>
<td>–</td>
<td>1.0</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{DS} = 60 V, V_{GS} = 0 V, T_J = 125°C</td>
<td>–</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>I_GSS</td>
<td>Gate–Body Leakage</td>
<td>V_{GS} = ±20 V, V_{DS} = 0 V</td>
<td>–</td>
<td>±10</td>
<td>μA</td>
</tr>
<tr>
<td><strong>ON CHARACTERISTICS (Note 2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V_GS(th)</td>
<td>Gate Threshold Voltage</td>
<td>V_{DS} = V_{GS}, I_D = 250 μA</td>
<td>1.0</td>
<td>2.5</td>
<td>V</td>
</tr>
<tr>
<td>R_DS(ON)</td>
<td>Static Drain–Source On–Resistance</td>
<td>V_{GS} = 10 V, I_D = 0.5 A</td>
<td>–</td>
<td>2</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{GS} = 4.5 V, I_D = 200 mA</td>
<td>–</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>I_D(ON)</td>
<td>On–State Drain Current</td>
<td>V_{GS} = 10 V, V_{DS} = 7.5 V</td>
<td>1.5</td>
<td>–</td>
<td>A</td>
</tr>
<tr>
<td>g_f</td>
<td>Forward Transconductance</td>
<td>V_{DS} = 10 V, I_D = 0.2 A</td>
<td>200</td>
<td>–</td>
<td>mS</td>
</tr>
<tr>
<td><strong>DYNAMIC CHARACTERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C_{iss}</td>
<td>Input Capacitance</td>
<td>V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz</td>
<td>–</td>
<td>50</td>
<td>pF</td>
</tr>
<tr>
<td>C_{oss}</td>
<td>Output Capacitance</td>
<td></td>
<td>–</td>
<td>15</td>
<td>pF</td>
</tr>
<tr>
<td>C_{rss}</td>
<td>Reverse Transfer Capacitance</td>
<td></td>
<td>–</td>
<td>6</td>
<td>pF</td>
</tr>
<tr>
<td><strong>SWITCHING CHARACTERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t_D(ON)</td>
<td>Turn–On Delay Time</td>
<td>V_{DD} = 30 V, I_{DSS} = 200 mA, R_{G} = 10 Ω, V_{GS} = 10 V</td>
<td>–</td>
<td>5</td>
<td>ns</td>
</tr>
<tr>
<td>t_D(OFF)</td>
<td>Turn–Off Delay Time</td>
<td></td>
<td>–</td>
<td>30</td>
<td>ns</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
ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Top Mark</th>
<th>Package</th>
<th>Shipping†</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N7002K</td>
<td>7K</td>
<td>SOT–23 3L</td>
<td>3000 / Tape &amp; Reel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Pb–Free)</td>
<td></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, BRD8011/D.
SOT-23 (TO-236)
CASE 318-08
ISSUE AS

DATE: 30 JAN 2018

NOTES:
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH.
   MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF
   THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH,
   PROTRUSIONS, OR GATE BURRS.

RECOMMENDED
SOLDERING FOOTPRINT

XXXM = Specific Device Code
M = Date Code
/C0071 = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.
Pb-Free indicator, "G" or microdot " /C0071",
may or may not be present.

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
STYLE 7:
STYLE 8:
STYLE 9:
STYLE 10:
STYLE 11:
STYLE 12:
STYLE 13:
STYLE 14:

STYLE 15:

STYLE 16:

STYLE 17:

STYLE 18:

STYLE 19:

STYLE 20:

STYLE 21:

STYLE 22:

STYLE 23:

STYLE 24:

STYLE 25:

STYLE 26:

STYLE 27:

STYLE 28:

DIMENSIONS: MILLIMETERS

PITCH

RECOMMENDED
SOLDERING FOOTPRINT

TOP VIEW

SIDE VIEW

END VIEW

SIDE VIEW

TOP VIEW

END VIEW

NOTE:
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

SOT-23 (TO-236)

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