To learn more about ON Semiconductor, please visit our website at www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor’s system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.
2N7002T
N-Channel Enhancement Mode Field Effect Transistor

Features
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- Lead Free/RoHS Compliant

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Top Mark</th>
<th>Package</th>
<th>Packing Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N7002T</td>
<td>AA</td>
<td>SOT-523F 3L</td>
<td>Tape and Reel</td>
</tr>
</tbody>
</table>

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^\circ$C unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter Description</th>
<th>Value</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>Drain-Gate Voltage ($R_{GS} \leq 1.0 , M\Omega$)</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GSS}$</td>
<td>Gate-Source Voltage</td>
<td>Continuous: $\pm 20$; Pulsed: $\pm 40$</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>Drain Current</td>
<td>Continuous: 115; Continuous at 100°C: 73; Pulsed: 800</td>
<td>mA</td>
</tr>
<tr>
<td>$T_J$</td>
<td>Junction Temperature</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{STG}$</td>
<td>Storage Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>
### Thermal Characteristics

Values are at $T_A = 25^\circ$C unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_D$</td>
<td>Total Device Dissipation</td>
<td>200</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above $T_A = 25^\circ$C</td>
<td>1.6</td>
<td>mW/°C</td>
</tr>
<tr>
<td>$R_{JUA}$</td>
<td>Thermal Resistance, Junction-to-Ambient$(1)$</td>
<td>625</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.

### Electrical Characteristics

Values are at $T_A = 25^\circ$C unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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>0.001</td>
<td>1.0</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{DS} = 60$ V, $V_{GS} = 0$ V,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$T_J = 125^\circ$C</td>
<td>7</td>
<td>500</td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>$I_{GSS}$</td>
<td>Gate-Body Leakage</td>
<td>$V_{GS} = \pm 20$ V, $V_{DS} = 0$ V</td>
<td>0.2</td>
<td>±10</td>
<td>nA</td>
<td></td>
</tr>
</tbody>
</table>

**Off Characteristics$^{(2)}$**

- $B_{V_{DSS}}$: Drain-Source Breakdown Voltage
  - $V_{GS} = 0$ V, $I_D = 10$ µA
  - Min.: 60, Typ.: 78, Max.: V

**On Characteristics$^{(2)}$**

- $V_{GS(th)}$: Gate Threshold Voltage
  - $V_{DS} = V_{GS}$, $I_D = 250$ µA
  - Min.: 1.00, Typ.: 1.76, Max.: 2.00 V

- $R_{DS(ON)}$: Static Drain-Source On-Resistance
  - $V_{GS} = 5$ V, $I_D = 0.05$ A
  - Min.: 1.6 Ω, Typ.: 7.5 Ω

- $I_{D(ON)}$: On-State Drain Current
  - $V_{GS} = 10$ V, $V_{DS} = 7.5$ V
  - Min.: 0.50 A, Typ.: 1.43 A

- $g_{FS}$: Forward Transconductance
  - $V_{DS} = 10$ V, $I_D = 0.2$ A
  - Min.: 80.0 mS, Typ.: 356.5 mS

**Dynamic Characteristics**

- $C_{iss}$: Input Capacitance
  - $V_{DS} = 25$ V, $V_{GS} = 0$ V, $f = 1.0$ MHz
  - Min.: 37.8 pF, Typ.: 50 pF

- $C_{oss}$: Output Capacitance
  - $V_{GS} = 0$ V, $f = 1.0$ MHz
  - Min.: 12.4 pF, Typ.: 25 pF

- $C_{rss}$: Reverse Transfer Capacitance
  - $V_{DS} = 0$ V, $V_{GS} = 0$ V, $f = 1.0$ MHz
  - Min.: 6.5 pF, Typ.: 7 pF

**Switching Characteristics**

- $t_D(ON)$: Turn-On Delay Time
  - $V_{DD} = 30$ V, $I_D = 0.2$ A, $V_{GEN} = 10$ V, $R_L = 150$ Ω
  - Min.: 5.85 ns, Typ.: 20 ns

- $t_D(OFF)$: Turn-Off Delay Time
  - $V_{GEN} = 10$ V, $R_L = 150$ Ω, $R_{GEN} = 25$ Ω
  - Min.: 12.5 ns, Typ.: 20 ns

**Notes:**
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
Typical Performance Characteristics (Continued)

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

Figure 8. Power Derating
Physical Dimensions

Figure 9. 3-LEAD, SC89, EIAJ-SC89, 0.88MM WIDE, SOT523F

NOTES:
A) THIS PACKAGE CONFORMS TO EIAJ SC89 PACKAGING STANDARD.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DRAWING CONFORMS TO ASME Y14.5M-1994
D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

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<tr>
<th>Datasheet Identification</th>
<th>Product Status</th>
<th>Definition</th>
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<tr>
<td>Advance Information</td>
<td>Formative / In Design</td>
<td>Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.</td>
</tr>
<tr>
<td>Preliminary</td>
<td>First Production</td>
<td>Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.</td>
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<tr>
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