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.
2N3906 / MMBT3906 / PZT3906
PNP General-Purpose Amplifier

Description
This device is designed for general-purpose amplifier and switching applications at collector currents of 10 mA to 100 mA.

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Marking</th>
<th>Package</th>
<th>Packing Method</th>
<th>Pack Quantity</th>
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<tr>
<td>2N3906BU</td>
<td>2N3906</td>
<td>TO-92 3L</td>
<td>Bulk</td>
<td>10000</td>
</tr>
<tr>
<td>2N3906TA</td>
<td>2N3906</td>
<td>TO-92 3L</td>
<td>Ammo</td>
<td>2000</td>
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<tr>
<td>2N3906TAR</td>
<td>2N3906</td>
<td>TO-92 3L</td>
<td>Ammo</td>
<td>2000</td>
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<tr>
<td>2N3906TF</td>
<td>2N3906</td>
<td>TO-92 3L</td>
<td>Tape and Reel</td>
<td>2000</td>
</tr>
<tr>
<td>2N3906TFR</td>
<td>2N3906</td>
<td>TO-92 3L</td>
<td>Tape and Reel</td>
<td>2000</td>
</tr>
<tr>
<td>MMBT3906</td>
<td>2A</td>
<td>SOT-23 3L</td>
<td>Tape and Reel</td>
<td>3000</td>
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<tr>
<td>PZT3906</td>
<td>3906</td>
<td>SOT-223 4L</td>
<td>Tape and Reel</td>
<td>2500</td>
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</table>
Absolute Maximum Ratings\(^{(1)}\)

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 \(T_A = 25°C\) unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_{CEO})</td>
<td>Collector-Emitter Voltage</td>
<td>-40</td>
<td>V</td>
</tr>
<tr>
<td>(V_{CBO})</td>
<td>Collector-Base Voltage</td>
<td>-40</td>
<td>V</td>
</tr>
<tr>
<td>(V_{EBO})</td>
<td>Emitter-Base Voltage</td>
<td>-5.0</td>
<td>V</td>
</tr>
<tr>
<td>(I_C)</td>
<td>Collector Current - Continuous</td>
<td>-200</td>
<td>mA</td>
</tr>
<tr>
<td>(T_J, T_{STG})</td>
<td>Operating and Storage Junction Temperature Range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
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</table>

Note:
1. These ratings are based on a maximum junction temperature of 150°C.
2. These are steady-state limits. Fairchild Semiconductor should be consulted on applications involving pulsed or low-duty cycle operations.

Thermal Characteristics

Values are at \(T_A = 25°C\) unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>2N3906(^{(3)})</th>
<th>MMBT3906(^{(2)})</th>
<th>PZT3906(^{(3)})</th>
<th>Unit</th>
</tr>
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<tbody>
<tr>
<td>(P_D)</td>
<td>Total Device Dissipation</td>
<td>625</td>
<td>350</td>
<td>1,000</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td>Derate Above 25°C</td>
<td>5.0</td>
<td>2.8</td>
<td>8.0</td>
<td>mW/°C</td>
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<tr>
<td>(R_{JJC})</td>
<td>Thermal Resistance, Junction to Case</td>
<td>83.3</td>
<td></td>
<td></td>
<td>°C/W</td>
</tr>
<tr>
<td>(R_{JJA})</td>
<td>Thermal Resistance, Junction to Ambient</td>
<td>200</td>
<td>357</td>
<td>125</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

Notes:
2. Device is mounted on FR-4 PCB 1.6 inch X 1.6 inch X 0.06 inch.
3. PCB size: FR-4, 76 mm x 114 mm x 1.57 mm (3.0 inch x 4.5 inch x 0.062 inch) with minimum land pattern 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>Max.</th>
<th>Unit</th>
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<td></td>
<td><strong>OFF CHARACTERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>Collector-Emitter Breakdown Voltage$^{(4)}$</td>
<td>$I_C = -1.0 \ mA$, $I_B = 0$</td>
<td>-40</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)CBO}$</td>
<td>Collector-Base Breakdown Voltage</td>
<td>$I_C = -10 \ \mu A$, $I_E = 0$</td>
<td>-40</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>Emitter-Base Breakdown Voltage</td>
<td>$I_E = -10 \ \mu A$, $I_C = 0$</td>
<td>-5.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$I_{BL}$</td>
<td>Base Cut-Off Current</td>
<td>$V_{CE} = -30 \ V$, $V_{BE} = 3.0 \ V$</td>
<td>-50</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>$I_{CEX}$</td>
<td>Collector Cut-Off Current</td>
<td>$V_{CE} = -30 \ V$, $V_{BE} = 3.0 \ V$</td>
<td>-50</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td><strong>ON CHARACTERISTICS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC Current Gain$^{(4)}$</td>
<td>$I_C = -0.1 \ mA$, $V_{CE} = -1.0 \ V$</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -1.0 \ mA$, $V_{CE} = -1.0 \ V$</td>
<td>80</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>$I_C = -10 \ \mu A$, $V_{CE} = -1.0 \ V$</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -50 \ \mu A$, $V_{CE} = -1.0 \ V$</td>
<td>60</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>$I_C = -100 \ \mu A$, $V_{CE} = -1.0 \ V$</td>
<td>30</td>
<td></td>
<td></td>
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<tr>
<td>$V_{CE(sat)}$</td>
<td>Collector-Emitter Saturation Voltage</td>
<td>$I_C = -10 \ mA$, $I_B = -1.0 \ mA$</td>
<td>-0.25</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -50 \ \mu A$, $I_B = -5.0 \ mA$</td>
<td>-0.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{BE(sat)}$</td>
<td>Base-Emitter Saturation Voltage</td>
<td>$I_C = -10 \ mA$, $I_B = -1.0 \ mA$</td>
<td>-0.65</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = -50 \ \mu A$, $I_B = -5.0 \ mA$</td>
<td>-0.95</td>
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<tr>
<td></td>
<td><strong>SMALL SIGNAL CHARACTERISTICS</strong></td>
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<tr>
<td>$f_T$</td>
<td>Current Gain - Bandwidth Product</td>
<td>$I_C = -10 \ \mu A$, $V_{CE} = -20 \ V$, $f = 100 \ MHz$</td>
<td>250</td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>$C_{obo}$</td>
<td>Output Capacitance</td>
<td>$V_{CB} = -5.0 \ V$, $I_E = 0$, $f = 100 \ kHz$</td>
<td>4.5</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>$C_{ibo}$</td>
<td>Input Capacitance</td>
<td>$V_{EB} = -0.5 \ V$, $I_C = 0$, $f = 100 \ kHz$</td>
<td>10.0</td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>$NF$</td>
<td>Noise Figure</td>
<td>$I_C = -100 \ \mu A$, $V_{CE} = -5.0 \ V$, $R_S = 1.0 \ k\Omega$, $f = 10 \ Hz$ to $15.7 \ kHz$</td>
<td>4.0</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td></td>
<td><strong>SWITCHING CHARACTERISTICS</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$t_d$</td>
<td>Delay Time</td>
<td>$V_{CC} = -3.0 \ V$, $V_{BE} = -0.5 \ V$</td>
<td>35</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>$t_r$</td>
<td>Rise Time</td>
<td>$I_C = -10 \ mA$, $I_B = -1.0 \ mA$</td>
<td>35</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>$t_s$</td>
<td>Storage Time</td>
<td>$V_{CC} = -3.0 \ V$, $I_C = -10 \ mA$, $I_B1 = I_B2 = -1.0 \ mA$</td>
<td>225</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>$t_f$</td>
<td>Fall Time</td>
<td>$I_B1 = I_B2 = -1.0 \ mA$</td>
<td>75</td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

Note:
4. Pulse test: pulse width $\leq 300 \ \mu s$, duty cycle $\leq 2.0\%$. 

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Typical Performance Characteristics

Figure 1. Typical Pulsed Current Gain vs. Collector Current

Figure 2. Collector-Emitter Saturation Voltage vs. Collector Current

Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

Figure 4. Base-Emitter On Voltage vs. Collector Current

Figure 5. Collector Cut-Off Current vs. Ambient Temperature

Figure 6. Common-Base Open Circuit Input and Output Capacitance vs. Reverse Bias Voltage
Typical Performance Characteristics (Continued)

Figure 7. Noise Figure vs. Frequency

Figure 8. Noise Figure vs. Source Resistance

Figure 9. Switching Times vs. Collector Current

Figure 10. Turn-On and Turn-Off Times vs. Collector Current

Figure 11. Power Dissipation vs. Ambient Temperature
Typical Performance Characteristics (Continued)

Figure 12. Voltage Feedback Ratio

Figure 13. Input Impedance

Figure 14. Output Admittance

Figure 15. Current Gain
Physical Dimensions

TO-92 (Bulk)

Figure 16. 3-LEAD, TO92, JEDEC TO-92 COMPLIANT STRAIGHT LEAD CONFIGURATION (OLD TO92AM3)

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Physical Dimensions (Continued)

TO-92 (Ammo, Tape and Reel)

Figure 17. 3-LEAD, TO92, MOLDED 0.200 IN LINE SPACING LEAD FORM (J61Z OPTION)

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Physical Dimensions (Continued)

Figure 18. 3-LEAD, SOT23, JEDEC TO-236, LOW PROFILE

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Physical Dimensions (Continued)

Figure 19. MOLDED PACKAGE, SOT-223, 4-LEAD

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- FACT™
- FAST®
- FastsCore™
- FETBench™
- FPS™
- F-PFS™
- FRFET™
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- Green FFS™ e-Series™
- Gmax™
- GTO™
- IntelliMAX™
- ISOLPLANAR™
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- MicroFET™
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- mWSaver®
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- Programmable Active Drop™
- QuickSeries™
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- Solutions for Your Success™
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- STEALTH™
- SuperFET™
- SuperSOT™-3
- SuperSOT™-6
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- SyncFET™
- Sync-Lock™
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- TINYOPTO™
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PRODUCT STATUS DEFINITIONS

Definition of Terms

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<thead>
<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>
<td>No Identification Needed</td>
<td>Full Production</td>
<td>Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.</td>
</tr>
<tr>
<td>Obsolete</td>
<td>Not In Production</td>
<td>Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.</td>
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