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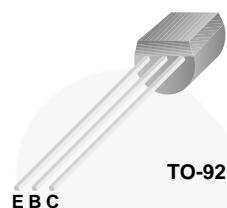
July 2014

PN222A

NPN General-Purpose Amplifier

Features

- This device is for use as a medium power amplifier and switch requiring collector currents up to 500mA.



Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|-------------|----------|----------|----------------|
| PN2222ABU | PN2222A | TO-92 3L | Bulk |
| PN2222ATA | PN2222A | TO-92 3L | Ammo |
| PN2222ATF | PN2222A | TO-92 3L | Tape and Reel |
| PN2222ATFR | PN2222A | TO-92 3L | Tape and Reel |

Absolute Maximum Ratings^{(1), (2)}

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 $T_A = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | Value | Unit |
|-----------|--|------------|------------------|
| V_{CEO} | Collector-Emitter Voltage | 40 | V |
| V_{CBO} | Collector-Base Voltage | 75 | V |
| V_{EBO} | Emitter-Base Voltage | 6.0 | V |
| I_C | Collector Current | 1.0 | A |
| T_{STG} | Operating and Storage Junction Temperature Range | -55 to 150 | $^\circ\text{C}$ |

Note:

- These rating are based on a maximum junction temperature of 150°C .
- These are steady-state limits. Fairchild Semiconductor should be consulted on applications involving pulsed or low-duty-cycle operation.

Thermal Characteristics⁽³⁾

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

| Symbol | Parameter | Max. | Unit |
|-----------------|---|------|---------------------------|
| P_D | Total Device Dissipation | 625 | mW |
| | Derate Above 25°C | 5.0 | mW/ $^\circ\text{C}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 83.3 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 200 | $^\circ\text{C}/\text{W}$ |

Note:

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 $T_A = 25^\circ\text{C}$ unless otherwise noted.

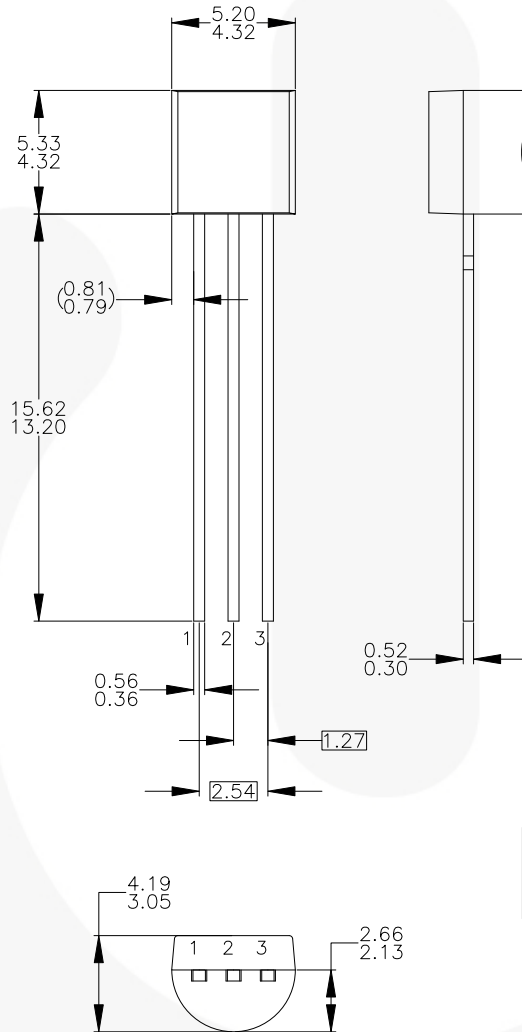
| Symbol | Parameter | Conditions | Min. | Max. | Unit |
|-------------------------------------|--|--|------|------|---------------|
| Off Characteristics | | | | | |
| $BV_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage ⁽⁴⁾ | $I_C = 10\text{ mA}, I_B = 0$ | 40 | | V |
| $BV_{(BR)CBO}$ | Collector-Base Breakdown Voltage | $I_C = 10\text{ }\mu\text{A}, I_E = 0$ | 75 | | V |
| $BV_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | $I_E = 10\text{ }\mu\text{A}, I_C = 0$ | 6.0 | | V |
| I_{CEX} | Collector Cut-Off Current | $V_{CE} = 60\text{ V}, V_{EB(off)} = 3.0\text{ V}$ | | 10 | nA |
| I_{CBO} | Collector Cut-Off Current | $V_{CB} = 60\text{ V}, I_E = 0$ | | 0.01 | μA |
| | | $V_{CB} = 60\text{ V}, I_E = 0, T_A = 125^\circ\text{C}$ | | 10 | |
| I_{EBO} | Emitter Cut-Off Current | $V_{EB} = 3.0\text{ V}, I_C = 0$ | | 10 | nA |
| I_{BL} | Base Cut-Off Current | $V_{CE} = 60\text{ V}, V_{EB(off)} = 3.0\text{ V}$ | | 20 | nA |
| On Characteristics | | | | | |
| h_{FE} | DC Current Gain | $I_C = 0.1\text{ mA}, V_{CE} = 10\text{ V}$ | 35 | | |
| | | $I_C = 1.0\text{ mA}, V_{CE} = 10\text{ V}$ | 50 | | |
| | | $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$ | 75 | | |
| | | $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}, T_A = -55^\circ\text{C}$ | 35 | | |
| | | $I_C = 150\text{ mA}, V_{CE} = 10\text{ V}^{(4)}$ | 100 | 300 | |
| | | $I_C = 150\text{ mA}, V_{CE} = 1\text{ V}^{(4)}$ | 50 | | |
| | | $I_C = 500\text{ mA}, V_{CE} = 10\text{ V}^{(4)}$ | 40 | | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage ⁽⁴⁾ | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ | | 0.3 | V |
| | | $I_C = 500\text{ mA}, I_B = 50\text{ mA}$ | | 1.0 | |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage ⁽⁴⁾ | $I_C = 150\text{ mA}, I_B = 15\text{ mA}$ | 0.6 | 1.2 | V |
| | | $I_C = 500\text{ mA}, I_B = 50\text{ mA}$ | | 2.0 | |
| Small Signal Characteristics | | | | | |
| f_T | Current Gain Bandwidth Product | $I_C = 20\text{ mA}, V_{CE} = 20\text{ V}, f = 100\text{ MHz}$ | 300 | | MHz |
| C_{obo} | Output Capacitance | $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ | | 8.0 | pF |
| C_{ibo} | Input Capacitance | $V_{EB} = 0.5\text{ V}, I_C = 0, f = 1\text{ MHz}$ | | 25 | pF |
| $rb'C_c$ | Collector Base Time Constant | $I_C = 20\text{ mA}, V_{CB} = 20\text{ V}, f = 31.8\text{ MHz}$ | | 150 | pS |
| NF | Noise Figure | $I_C = 100\text{ }\mu\text{A}, V_{CE} = 10\text{ V}, R_S = 1.0\text{ k}\Omega, f = 1.0\text{ kHz}$ | | 4.0 | dB |
| $Re(h_{ie})$ | Real Part of Common-Emitter High Frequency Input Impedance | $I_C = 20\text{ mA}, V_{CE} = 20\text{ V}, f = 300\text{ MHz}$ | | 60 | Ω |
| Switching Characteristics | | | | | |
| t_d | Delay Time | $V_{CC} = 30\text{ V}, V_{EB(off)} = 0.5\text{ V}, I_C = 150\text{ mA}, I_{B1} = 15\text{ mA}$ | | 10 | ns |
| t_r | Rise Time | | | 25 | ns |
| t_s | Storage Time | $V_{CC} = 30\text{ V}, I_C = 150\text{ mA}, I_{B1} = I_{B2} = 15\text{ mA}$ | | 225 | ns |
| t_f | Fall Time | | | 60 | ns |

Note:

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

Physical Dimensions

TO-92 (Bulk)



NOTES: UNLESS OTHERWISE SPECIFIED

- A) DRAWING WITH REFERENCE TO JEDEC TO-92 RECOMMENDATIONS.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DRAWING CONFORMS TO ASME Y14.5M-1994.
- D) TO-92 (92,94,96,97,98) PIN CONFIGURATION:

| PIN | 92 | | | 94 | | | 96 | | | 97 | | | 98 | | |
|-----|----|---|---|----|---|---|----|---|---|----|---|---|----|---|---|
| | P | F | M | P | F | M | B | F | M | P | F | M | P | F | M |
| 1 | E | S | S | E | S | S | B | D | G | C | G | D | C | G | D |
| 2 | B | D | G | C | G | D | E | S | S | B | D | G | E | S | S |
| 3 | C | G | D | B | D | G | C | G | D | E | S | S | B | D | G |

LEGEND:

- P - BIPOLAR
- F - JFET
- M - DMOS
- E - EMITTER
- B - BASE
- C - COLLECTOR
- D - DRAIN
- S - SOURCE
- G - GATE

- E) FOR PACKAGE 92, 94, 96, 97 AND 98: PIN CONFIGURATION DRAIN "D" AND SOURCE "S" ARE INTERCHANGEABLE AT JFET "F" OPTION.
- F) DRAWING FILENAME: MKT-ZA03DREV3.

Figure 1. 3-LEAD, TO92, JEDEC TO-92 COMPLIANT STRAIGHT LEAD CONFIGURATION (OLD TO92AM3)

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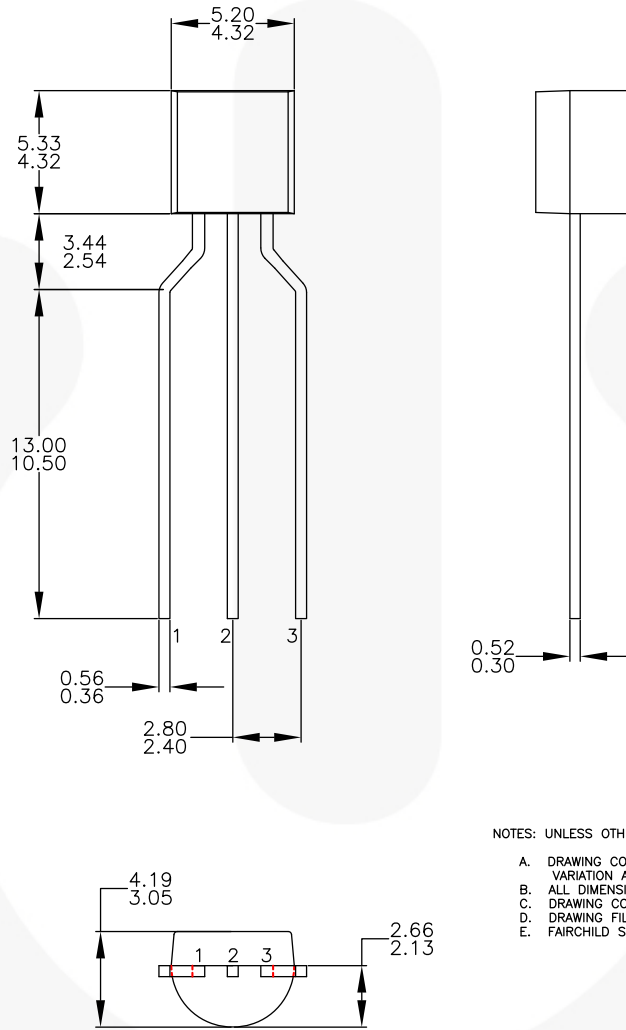
<http://www.fairchildsemi.com/dwg/ZA/ZA03D.pdf>

For current tape and reel specifications, visit Fairchild Semiconductor's online packaging area:

http://www.fairchildsemi.com/packaging_dwg/PKG-ZA03D_BK.pdf

Physical Dimensions (Continued)

TO-92 (Ammo, Tape and Reel)



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- A. DRAWING CONFORMS TO JEDEC MS-013, VARIATION AC.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5M-2009.
- D. DRAWING FILENAME: MKT-ZA03FREV3.
- E. FAIRCHILD SEMICONDUCTOR.

Figure 2. 3-LEAD, TO-92, MOLDED 0.200 IN LINE SPACING LEAD FORM (J61Z OPTION)

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