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ON Semiconductor®

## PN2907A / MMBT2907A / PZT2907A

### 60 V PNP General-Purpose Transistor

#### Features

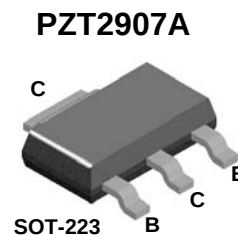
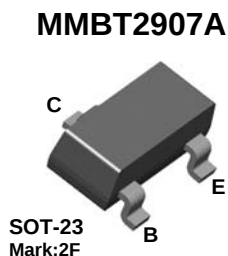
- High DC Current Gain ( $h_{FE}$ ) Range: 100 ~ 300
- High-Current Gain Bandwidth Product ( $f_T$ ): 200 MHz (Minimum)
- Maximum Turn-On Time ( $t_{on}$ ): 45 ns
- Maximum Turn-Off Time ( $t_{off}$ ): 100 ns
- Ultra-Small Surface-Mount Package: SOT-223 (PZT2907A)

#### Applications

- General-Purpose Amplifier
- Switch

#### Description

The PN2907A, MMBT2907A, and PZT2907A are 60 V PNP bipolar transistors designed for use as a general-purpose amplifier or switch in applications that require up to 500 mA. Offered in an ultra-small surface-mount package (SOT-223), the PZT2907A is ideal for space-constrained systems. The NPN complementary types are the PN2222A, MMBT2222A, and PZT2222A; respectively.



#### Ordering Information

| Part Number    | Top Mark | Package    | Packing Method |
|----------------|----------|------------|----------------|
| PN2907ABU      | 2907A    | TO-92 3L   | Bulk           |
| PN2907ATF      | 2907A    | TO-92 3L   | Tape and Reel  |
| PN2907ATFR     | 2907A    | TO-92 3L   | Tape and Reel  |
| PN2907ATA      | 2907A    | TO-92 3L   | Ammo           |
| PN2907ATAR     | 2907A    | TO-92 3L   | Ammo           |
| MMBT2907A      | 2F       | SOT-23 3L  | Tape and Reel  |
| MMBT2907A-D87Z | 2F       | SOT-23 3L  | Tape and Reel  |
| PZT2907A       | 2907A    | SOT-223 4L | Tape and Reel  |

## Absolute Maximum Ratings<sup>(1),(2)</sup>

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                        | -60         | V                |
| $V_{CBO}$      | Collector-Base Voltage                           | -60         | V                |
| $V_{EBO}$      | Emitter-Base Voltage                             | -5.0        | V                |
| $I_C$          | Collector Current - Continuous                   | -800        | mA               |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |

### Notes:

- These ratings are based on a maximum junction temperature of  $150^\circ\text{C}$ .
- These are steady-state limits. ON Semiconductor should be consulted on applications involving pulsed or low-duty cycle operations.

## Thermal Characteristics

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

| Symbol          | Parameter                               | Max.                   |                          |                         | Unit                      |
|-----------------|-----------------------------------------|------------------------|--------------------------|-------------------------|---------------------------|
|                 |                                         | PN2907A <sup>(4)</sup> | MMBT2907A <sup>(3)</sup> | PZT2907A <sup>(4)</sup> |                           |
| $P_D$           | Total Device Dissipation                | 625                    | 350                      | 1000                    | mW                        |
|                 | Derate Above $25^\circ\text{C}$         | 5.0                    | 2.8                      | 8.0                     | 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                    | 357                      | 125                     | $^\circ\text{C}/\text{W}$ |

### Notes:

- Device is mounted on FR-4 PCB 1.6 inch X 1.6 inch X 0.06 inch.
- PCB size: FR-4 76 x 114 x 1.57 mm<sup>3</sup> (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          |                                                     |                                                                                               |      |       |      |
| V <sub>(BR)CEO</sub>         | Collector-Emitter Breakdown Voltage <sup>(5)</sup>  | I <sub>C</sub> = -10 mA, I <sub>B</sub> = 0                                                   | -60  |       | V    |
| V <sub>(BR)CBO</sub>         | Collector-Base Breakdown Voltage                    | I <sub>C</sub> = -10 μA, I <sub>E</sub> = 0                                                   | -60  |       | V    |
| V <sub>(BR)EBO</sub>         | Emitter-Base Breakdown Voltage                      | I <sub>E</sub> = -10 μA, I <sub>C</sub> = 0                                                   | -5.0 |       | V    |
| I <sub>BL</sub>              | Base Cut-Off Current                                | V <sub>CE</sub> = -30 V, V <sub>EB</sub> = -0.5 V                                             |      | -50   | nA   |
| I <sub>CEX</sub>             | Collector Cut-Off Current                           | V <sub>CE</sub> = -30 V, V <sub>EB</sub> = -0.5 V                                             |      | -50   | nA   |
| I <sub>CBO</sub>             | Collector Cut-Off Current                           | V <sub>CB</sub> = -50 V, I <sub>E</sub> = 0                                                   |      | -0.02 | μA   |
|                              |                                                     | V <sub>CB</sub> = -50 V, I <sub>E</sub> = 0, T <sub>A</sub> = 150°C                           |      | -20   |      |
| On Characteristics           |                                                     |                                                                                               |      |       |      |
| h <sub>FE</sub>              | DC Current Gain                                     | I <sub>C</sub> = -0.1 mA, V <sub>CE</sub> = -10 V                                             | 75   |       |      |
|                              |                                                     | I <sub>C</sub> = -1.0 mA, V <sub>CE</sub> = -10 V                                             | 100  |       |      |
|                              |                                                     | I <sub>C</sub> = -10 mA, V <sub>CE</sub> = -10 V                                              | 100  |       |      |
|                              |                                                     | I <sub>C</sub> = -150 mA, V <sub>CE</sub> = -10 V <sup>(5)</sup>                              | 100  | 300   |      |
|                              |                                                     | I <sub>C</sub> = -500 mA, V <sub>CE</sub> = -10 V <sup>(5)</sup>                              | 50   |       |      |
| V <sub>CE(sat)</sub>         | Collector-Emitter Saturation Voltage <sup>(5)</sup> | I <sub>C</sub> = -150 mA, I <sub>B</sub> = -15 mA                                             |      | -0.4  | V    |
|                              |                                                     | I <sub>C</sub> = -500 mA, I <sub>B</sub> = -50 mA                                             |      | -1.6  |      |
| V <sub>BE(sat)</sub>         | Base-Emitter Saturation Voltage                     | I <sub>C</sub> = -150 mA, I <sub>B</sub> = -15 mA <sup>(5)</sup>                              |      | -1.3  | V    |
|                              |                                                     | I <sub>C</sub> = -500 mA, I <sub>B</sub> = -50 mA                                             |      | -2.6  |      |
| Small Signal Characteristics |                                                     |                                                                                               |      |       |      |
| f <sub>T</sub>               | Current Gain - Bandwidth Product                    | I <sub>C</sub> = -50 mA, V <sub>CE</sub> = -20 V, f = 100 MHz                                 | 200  |       | MHz  |
| C <sub>ob</sub>              | Output Capacitance                                  | V <sub>CB</sub> = -10 V, I <sub>E</sub> = 0, f = 100 kHz                                      |      | 8.0   | pF   |
| C <sub>ib</sub>              | Input Capacitance                                   | V <sub>EB</sub> = -2.0 V, I <sub>C</sub> = 0, f = 100 kHz                                     |      | 30    | pF   |
| Switching Characteristics    |                                                     |                                                                                               |      |       |      |
| t <sub>on</sub>              | Turn-On Time                                        | V <sub>CC</sub> = -30 V, I <sub>C</sub> = -150 mA, I <sub>B1</sub> = -15 mA                   |      | 45    | ns   |
| t <sub>d</sub>               | Delay Time                                          |                                                                                               |      | 10    | ns   |
| t <sub>r</sub>               | Rise Time                                           |                                                                                               |      | 40    | ns   |
| t <sub>off</sub>             | Turn-Off Time                                       | V <sub>CC</sub> = -6.0 V, I <sub>C</sub> = -150 mA, I <sub>B1</sub> = I <sub>B2</sub> = -15mA |      | 100   | ns   |
| t <sub>s</sub>               | Storage Time                                        |                                                                                               |      | 80    | ns   |
| t <sub>f</sub>               | Fall Time                                           |                                                                                               |      | 30    | ns   |

### Notes:

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

## Typical Performance Characteristics

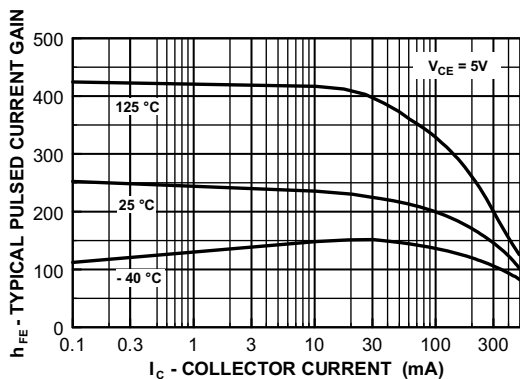


Figure 1. Typical Pulsed Current Gain vs. Collector Current

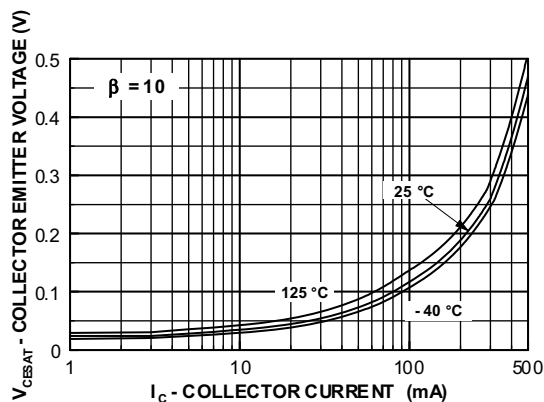


Figure 2. Collector-Emitter Saturation Voltage vs. Collector Current

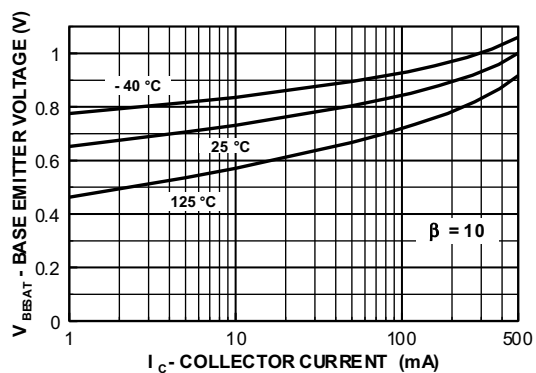


Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

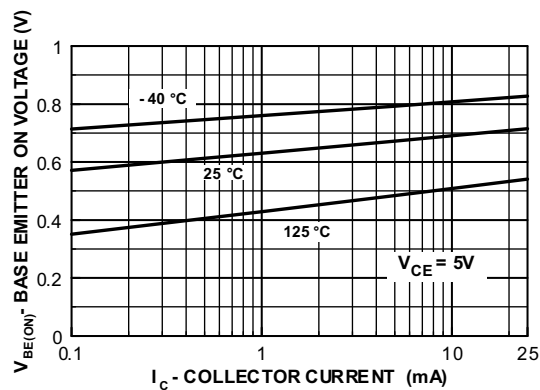


Figure 4. Base-Emitter On Voltage vs. Collector Current

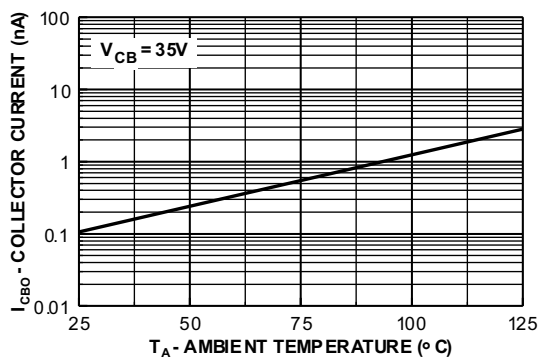


Figure 5. Collector Cut-Off Current vs. Ambient Temperature

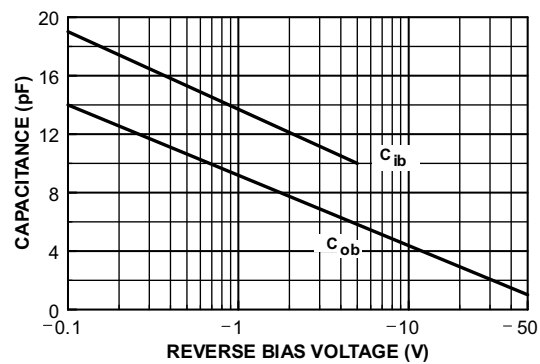


Figure 6. Input and Output Capacitance vs. Reverse Bias Voltage

## Typical Performance Characteristics (Continued)

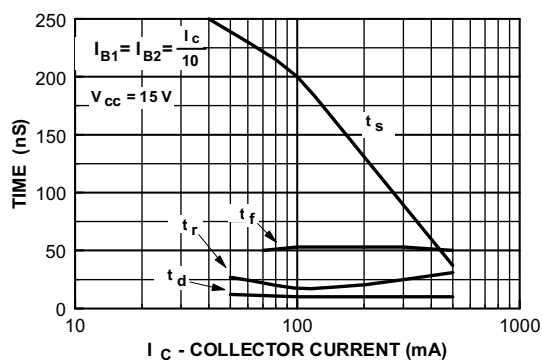


Figure 7. Switching Times vs. Collector Current

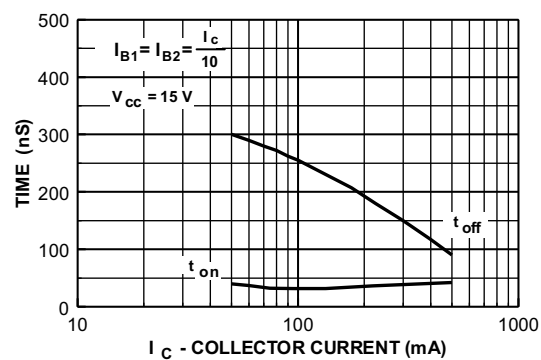


Figure 8. Turn-On and Turn-Off Times vs. Collector Current

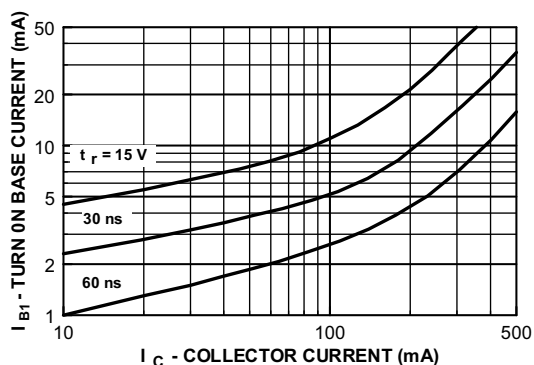


Figure 9. Rise Time vs. Collector and Turn-On Base Currents

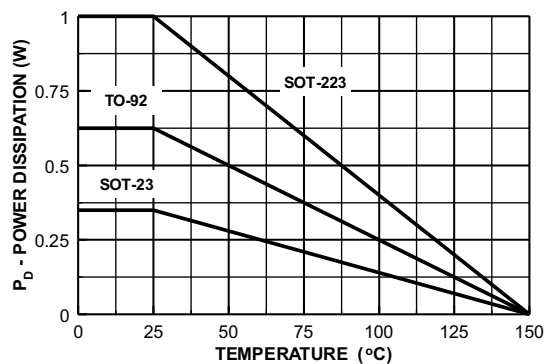


Figure 10. Power Dissipation vs. Ambient Temperature

# Typical Performance Characteristics ( $f = 1.0 \text{ kHz}$ )

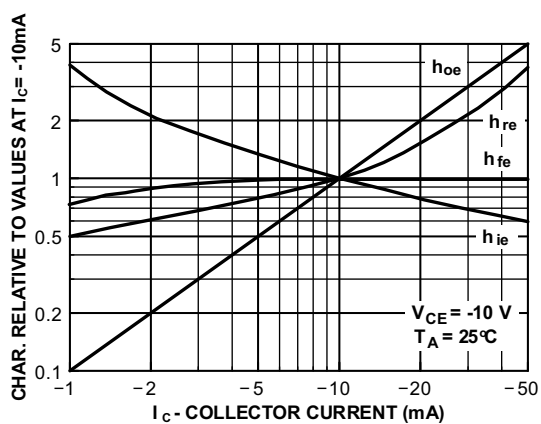


Figure 11. Common Emitter Characteristics

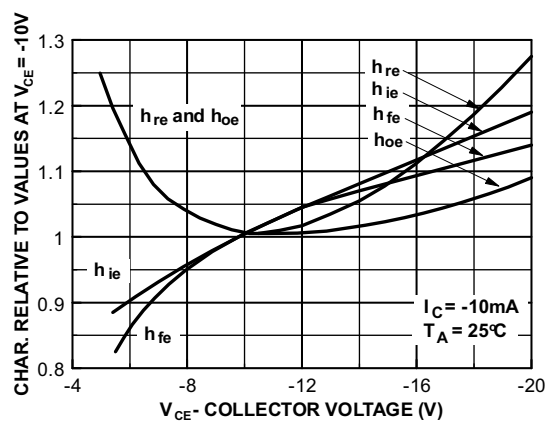


Figure 12. Common Emitter Characteristics

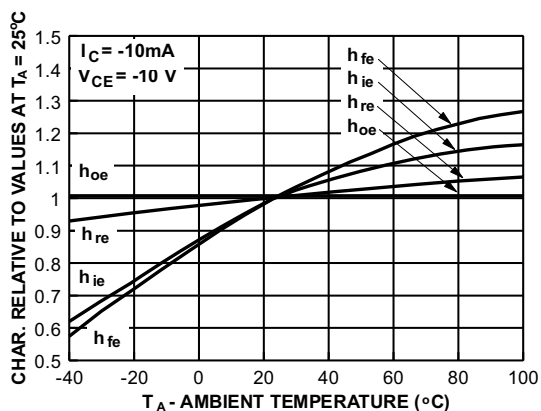
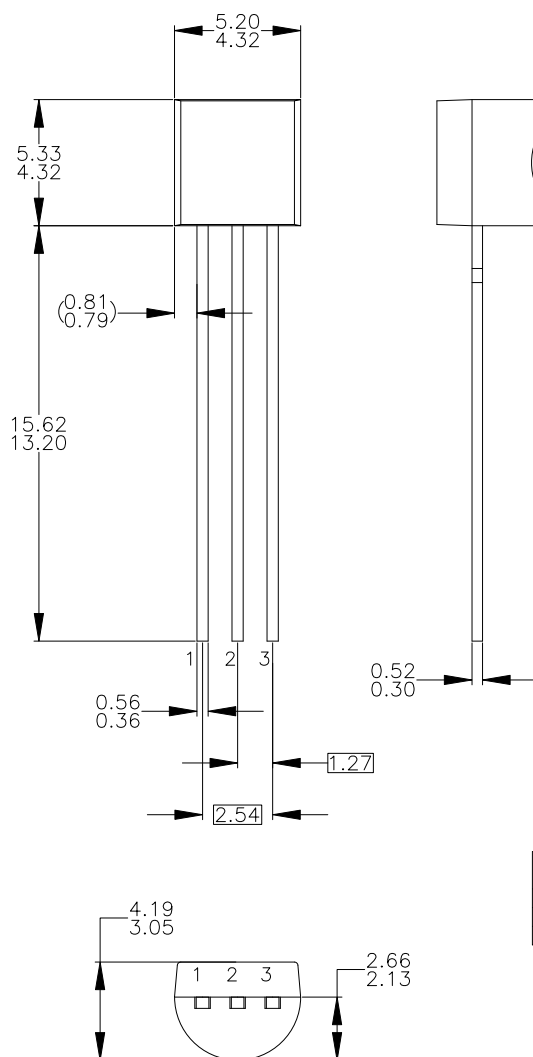


Figure 13. Common Emitter Characteristics

# 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  |
| 1   | E  | S  | S  | E  | S  |
| 2   | B  | D  | G  | C  | D  |
| 3   | C  | G  | D  | B  | G  |

LEGEND:

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

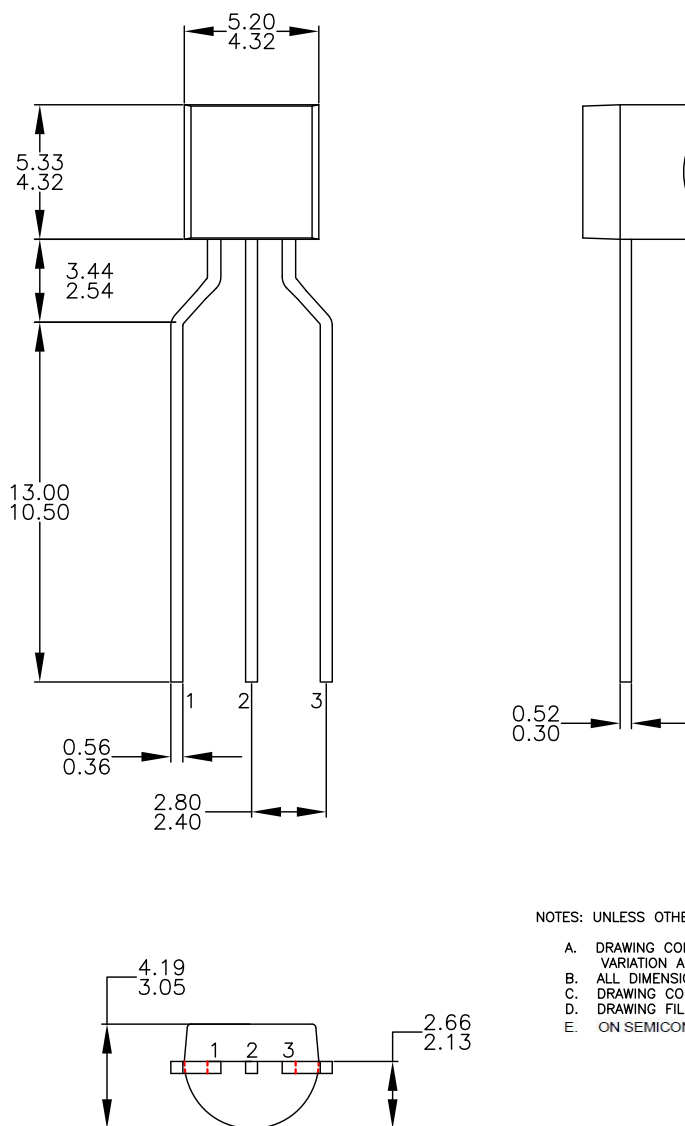
- E) FOR PACKAGE 92, 94, 96, 97 AND 98:  
PIN CONFIGURATION DRAIN "D" AND SOURCE "S"  
ARE INTERCHANGEABLE AT JFET "F" OPTION.
- F) DRAWING FILENAME: MKT-ZA03DREV3.

**Figure 14. 3-LEAD, TO92, JEDEC TO-92 COMPLIANT STRAIGHT LEAD CONFIGURATION (OLD TO92AM3) (ACTIVE)**

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## Physical Dimensions (Continued)

## TO-92 (Tape and Reel, Ammo)



NOTES: UNLESS OTHERWISE SPECIFIED

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- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5M-2009.
- D. DRAWING FILENAME: MKT-ZA03FREV3.
- E. ON SEMICONDUCTOR

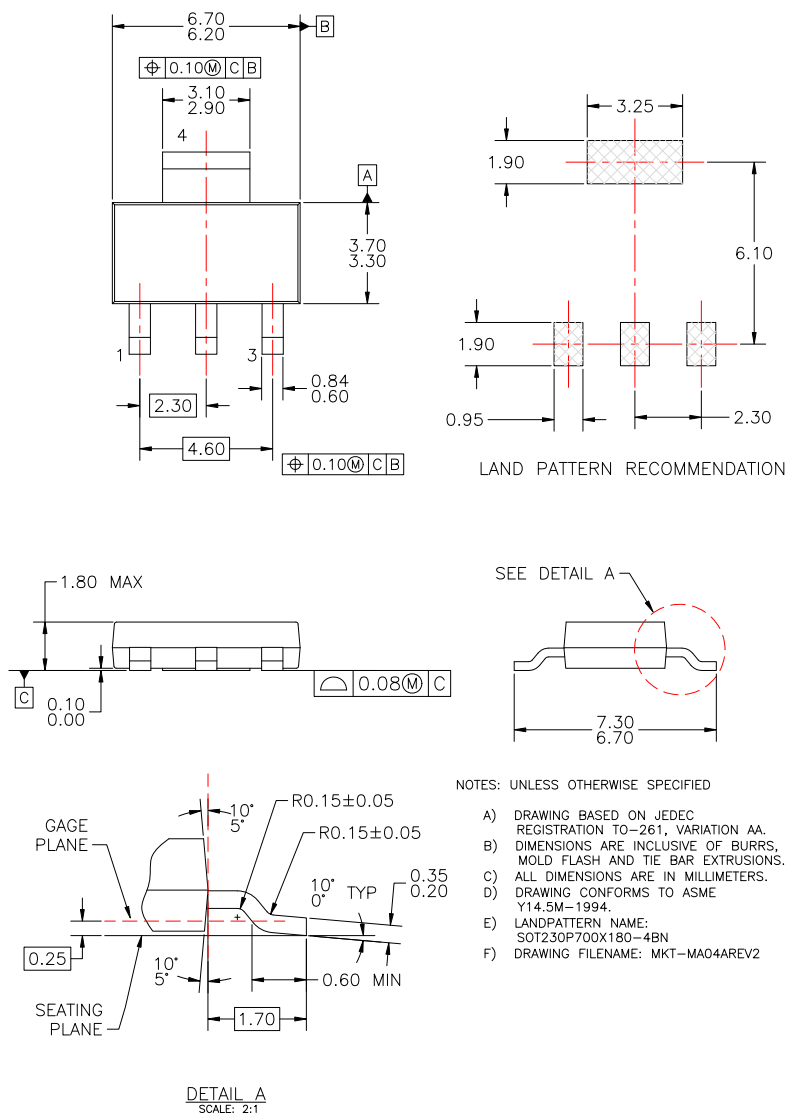
Figure 15. 3-LEAD, TO92, MOLDED 0.200 IN LINE SPACING LEAD FORM (J61Z OPTION) (ACTIVE)

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# Physical Dimensions (Continued)

## SOT-223



**Figure 17. MOLDED PACKAGING, SOT-223, 4-LEAD (ACTIVE)**

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