

## 2N3905



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-54151736  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

2N3905

### PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 100 mA.

#### Absolute Maximum Ratings\*

TA = 25°C unless otherwise noted

| Symbol                            | Parameter  | Value       | Units |
|-----------------------------------|--|-------------|-------|
| V <sub>CEO</sub>                  | Collector-Emitter Voltage                        | 40          | V     |
| V <sub>CBO</sub>                  | Collector-Base Voltage                           | 40          | V     |
| V <sub>EBO</sub>                  | Emitter-Base Voltage                             | 5.0         | V     |
| I <sub>C</sub>                    | Collector Current - Continuous                   | 200         | mA    |
| T <sub>J</sub> , T <sub>stg</sub> | Operating and Storage Junction Temperature Range | -55 to +150 | °C    |

\*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

#### NOTES:

- 1) These ratings are based on a maximum junction temperature of 150 degrees C.
- 2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

#### Thermal Characteristics

TA = 25°C unless otherwise noted

| Symbol           | Characteristic                                | Max    | Units |
|------------------|---|--------|-------|
|                  |   | 2N3905 |       |
| P <sub>D</sub>   | Total Device Dissipation<br>Derate above 25°C | 625    | mW    |
|                  |   | 5.0    | mW/°C |
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case          | 83.3   | °C/W  |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient       | 200    | °C/W  |

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(continued)

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### Electrical Characteristics

TA = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Max | Units |
|--------|-----------|-----------------|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-------|

#### OFF CHARACTERISTICS

|               |                                      |   |     |    |    |
|---------------|--------------------------------------|---|-----|----|----|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage* | $I_C = 1.0 \text{ mA}, I_B = 0$                 | 40  |    | V  |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage     | $I_C = 10 \mu\text{A}, I_E = 0$                 | 40  |    | V  |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage       | $I_E = 10 \mu\text{A}, I_C = 0$                 | 5.0 |    | V  |
| $I_{CEX}$     | Collector Cutoff Current             | $V_{CE} = 30 \text{ V}, V_{OB} = 3.0 \text{ V}$ |     | 50 | nA |
| $I_{BL}$      | Base Cutoff Current                  | $V_{CE} = 30 \text{ V}, V_{OB} = 3.0 \text{ V}$ |     | 50 | nA |

#### ON CHARACTERISTICS\*

|               |                                      |  |                            |              |        |
|---------------|--------------------------------------|--|----------------------------|--------------|--------|
| $h_{FE}$      | DC Current Gain                      | $V_{CE} = 1.0 \text{ V}, I_C = 0.1 \text{ mA}$<br>$V_{CE} = 1.0 \text{ V}, I_C = 1.0 \text{ mA}$<br>$V_{CE} = 1.0 \text{ V}, I_C = 10 \text{ mA}$<br>$V_{CE} = 1.0 \text{ V}, I_C = 50 \text{ mA}$<br>$V_{CE} = 1.0 \text{ V}, I_C = 100 \text{ mA}$ | 30<br>40<br>50<br>30<br>15 | 150          |        |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$<br>$I_C = 50 \text{ mA}, I_B = 5.0 \text{ mA}$   |                            | 0.25<br>0.40 | V<br>V |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage      | $I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$<br>$I_C = 50 \text{ mA}, I_B = 5.0 \text{ mA}$   | 0.65                       | 0.85<br>0.95 | V<br>V |

#### SMALL SIGNAL CHARACTERISTICS

|          |                           |  |     |     |                  |
|----------|---------------------------|--|-----|-----|------------------|
| $C_{ob}$ | Output Capacitance        | $V_{CB} = 5.0 \text{ V}, f = 1.0 \text{ MHz}$  |     | 4.5 | pF               |
| $C_{ib}$ | Input Capacitance         | $V_{EB} = 0.5 \text{ V}, f = 1.0 \text{ MHz}$  |     | 10  | pF               |
| $h_{re}$ | Small-Signal Current Gain | $I_C = 10 \text{ mA}, V_{CE} = 20 \text{ V},$<br>$f = 100 \text{ MHz}$   | 2.0 |     |                  |
| $h_{fe}$ | Small-Signal Current Gain | $I_C = 1.0 \text{ mA}, V_{CE} = 10 \text{ V},$   | 50  | 200 |                  |
| $h_{re}$ | Voltage Feedback Ratio    | $f = 1.0 \text{ KHz}$  | 0.1 | 5.0 | $\times 10^{-4}$ |
| $h_{ie}$ | Input Impedance           |  | 0.5 | 8.0 | k $\Omega$       |
| $h_{oe}$ | Output Impedance          |  | 1.0 | 40  | $\mu\text{mhos}$ |
| NF       | Noise Figure              | $V_{CE} = 5.0 \text{ V}, I_C = 100 \mu\text{A},$<br>$R_S = 1.0 \text{ k}\Omega,$<br>$B_W = 10 \text{ Hz to } 15.7 \text{ KHz}$ |     | 5.0 | dB               |

#### SWITCHING CHARACTERISTICS

|       |              |  |  |     |    |
|-------|--------------|--|--|-----|----|
| $t_d$ | Delay Time   | $V_{CC} = 3.0 \text{ V}, I_{CS} = 10 \text{ mA},$      |  | 35  | ns |
| $t_r$ | Rise Time    | $I_{B1} = 1.0 \text{ mA}, V_{OB(off)} = 3.0 \text{ V}$ |  | 35  | ns |
| $t_s$ | Storage Time | $V_{CC} = 3.0 \text{ V}, I_{CS} = 10 \text{ mA},$      |  | 200 | ns |
| $t_f$ | Fall Time    | $I_{B1} = I_{B2} = 1.0 \text{ mA}$                     |  | 60  | ns |

\*Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

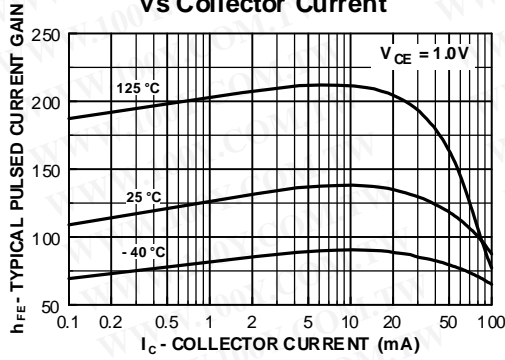
勝特力材料 886-3-5753170  
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**PNP General Purpose Amplifier**  
 (continued)

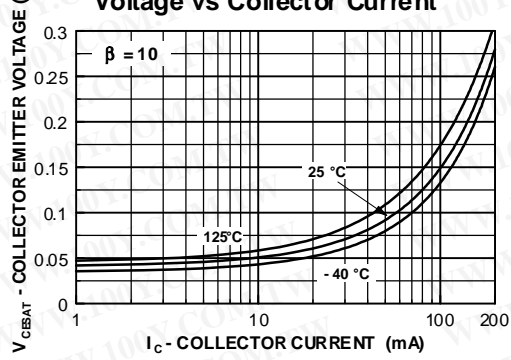
2N3905

**Typical Characteristics**

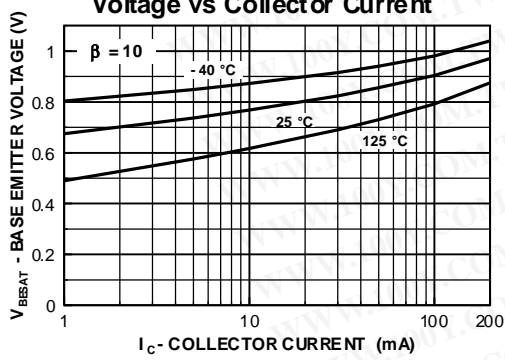
**Typical Pulsed Current Gain vs Collector Current**



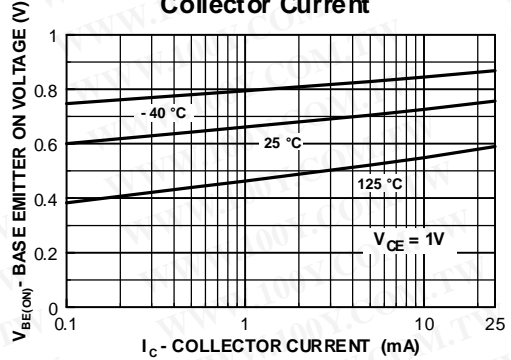
**Collector-Emitter Saturation Voltage vs Collector Current**



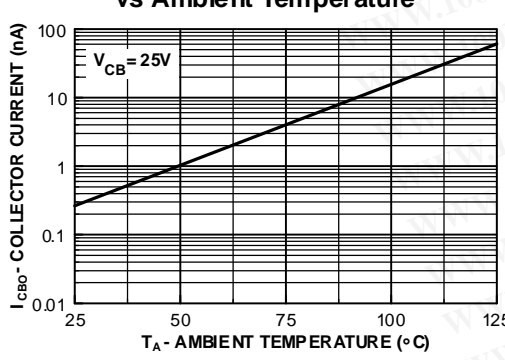
**Base-Emitter Saturation Voltage vs Collector Current**



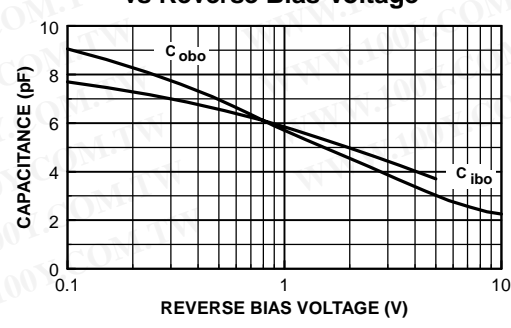
**Base Emitter ON Voltage vs Collector Current**



**Collector-Cutoff Current vs Ambient Temperature**

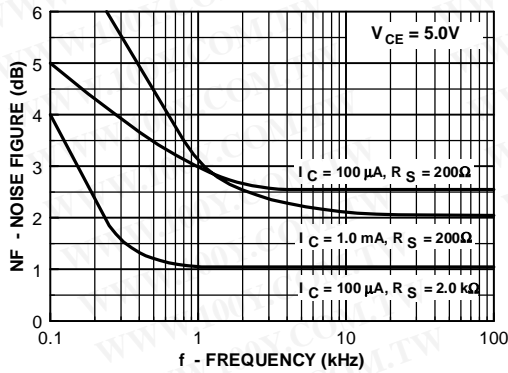


**Common-Base Open Circuit Input and Output Capacitance vs Reverse Bias Voltage**

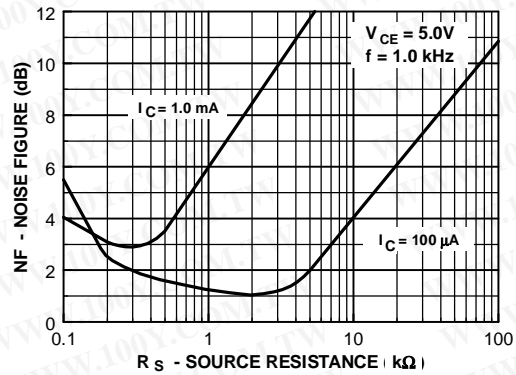


**Typical Characteristics** (continued)

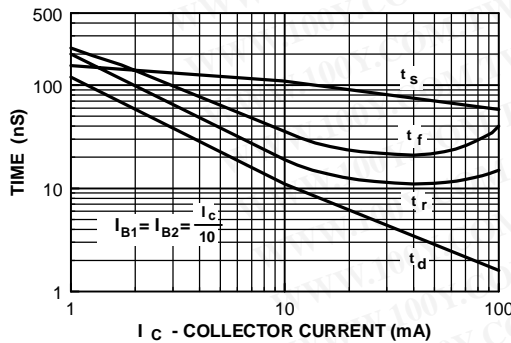
**Noise Figure vs Frequency**



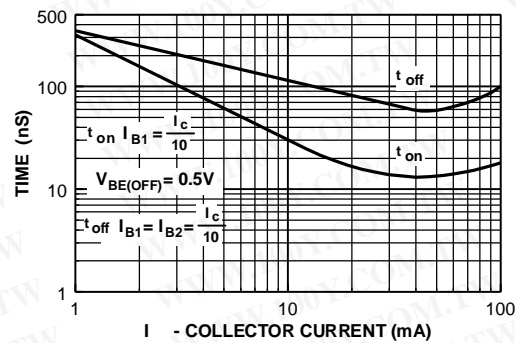
**Noise Figure vs Source Resistance**



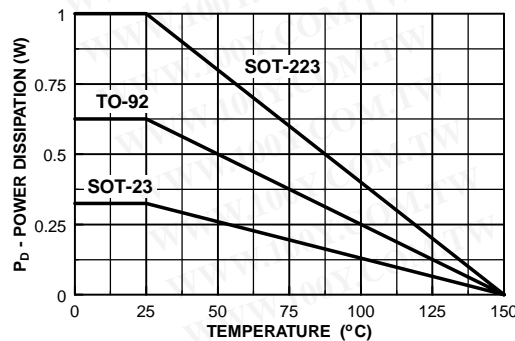
**Switching Times vs Collector Current**



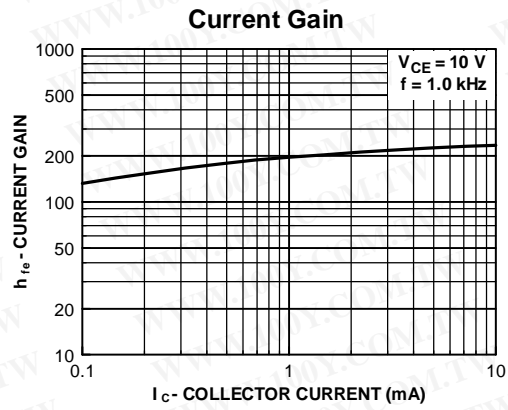
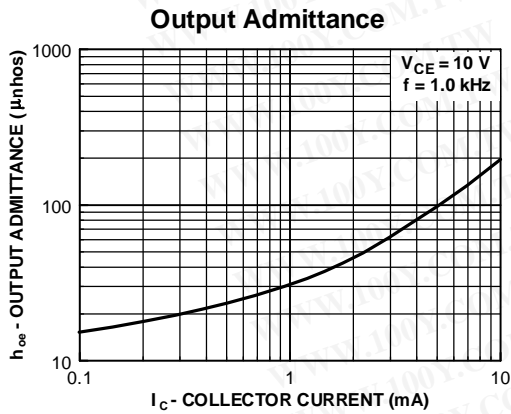
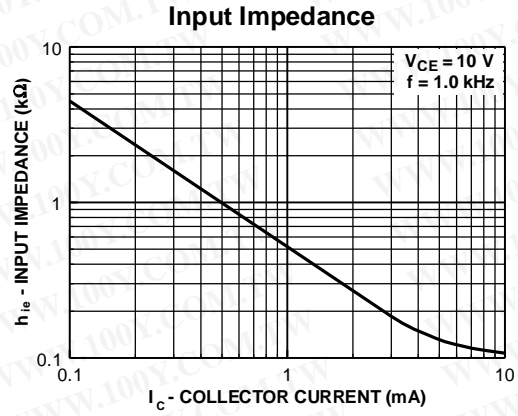
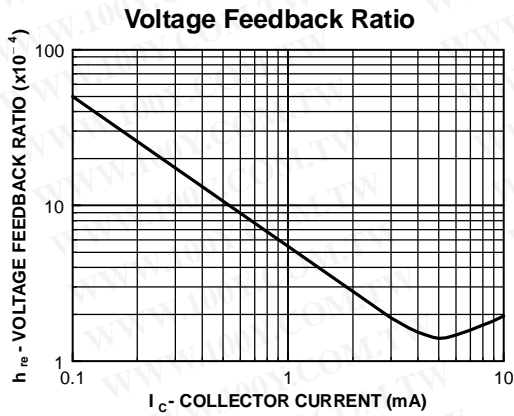
**Turn On and Turn Off Times vs Collector Current**



**Power Dissipation vs Ambient Temperature**



Typical Characteristics (continued)



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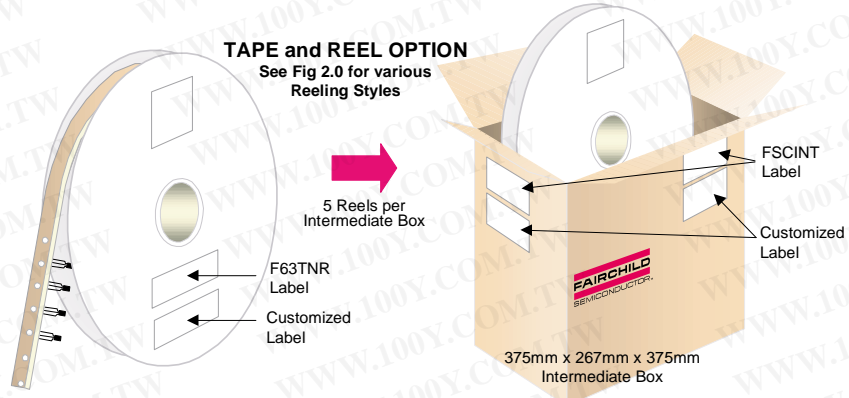
## TO-92 Tape and Reel Data

### TO-92 Packaging Configuration: Figure 1.0

FSCINT Label sample



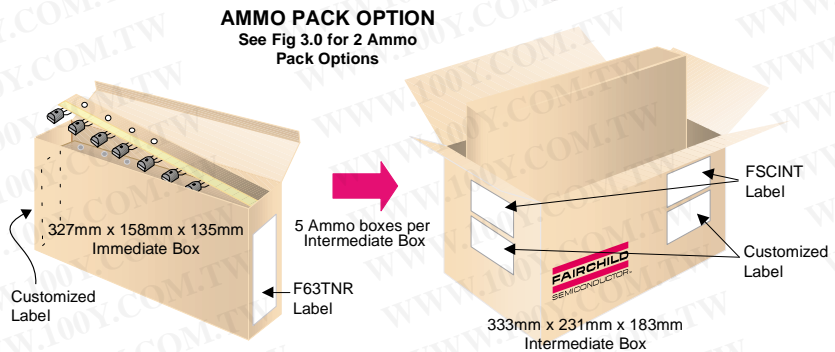
F63TNR Label sample



### TO-92 TNR/AMMO PACKING INFORMATION

| Packing | Style | Quantity | EOL code |
|---------|-------|----------|----------|
| Reel    | A     | 2,000    | D26Z     |
|         | E     | 2,000    | D27Z     |
| Ammo    | M     | 2,000    | D74Z     |
|         | P     | 2,000    | D75Z     |

Unit weight = 0.22 gm  
 Reel weight with components = 1.04 kg  
 Ammo weight with components = 1.02 kg  
 Max quantity per intermediate box = 10,000 units

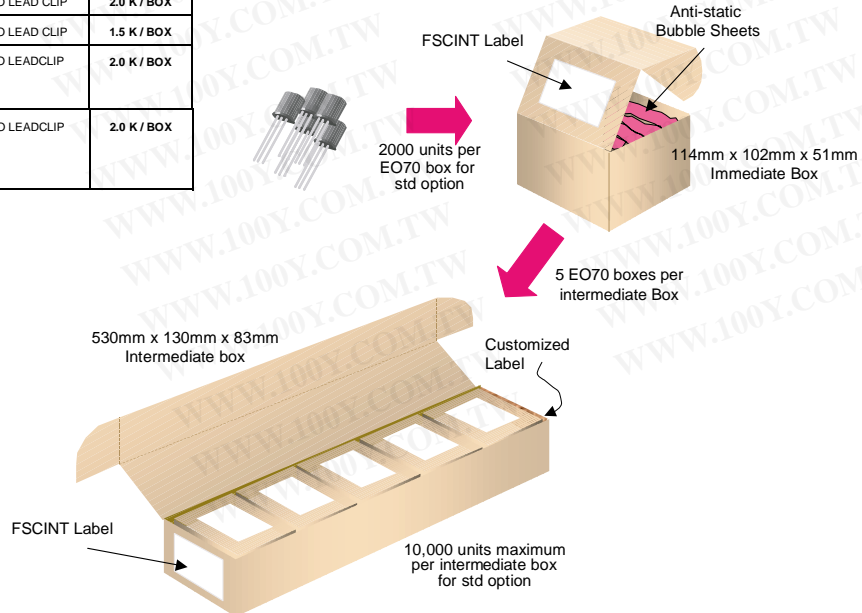


### (TO-92) BULK PACKING INFORMATION

| EOL CODE    | DESCRIPTION   | LEADCLIP DIMENSION | QUANTITY    |
|-------------|---|--------------------|-------------|
| J18Z        | TO-18 OPTION STD  | NO LEAD CLIP       | 2.0 K / BOX |
| J05Z        | TO-5 OPTION STD   | NO LEAD CLIP       | 1.5 K / BOX |
| NO EOL CODE | TO-92 STANDARD STRAIGHT FOR: PKG 92, 94 (NON PROELECTRON SERIES), 96                  | NO LEADCLIP        | 2.0 K / BOX |
| L34Z        | TO-92 STANDARD STRAIGHT FOR: PKG 94 (PROELECTRON SERIES BCXXX, BFXXX, BSRXXX), 97, 98 | NO LEADCLIP        | 2.0 K / BOX |

### BULK OPTION

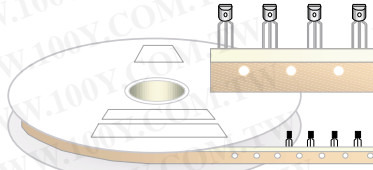
See Bulk Packing Information table



## TO-92 Tape and Reel Data, continued

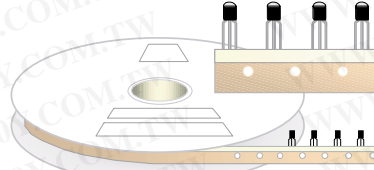
### TO-92 Reeling Style Configuration: Figure 2.0

Machine Option "A" (H)



Style "A", D26Z, D70Z (s/h)

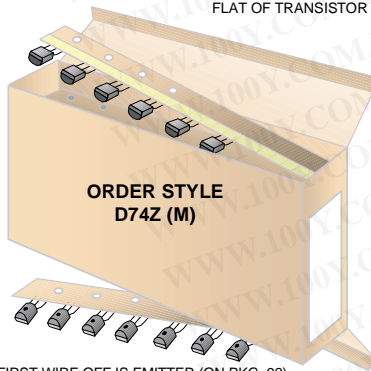
Machine Option "E" (J)



Style "E", D27Z, D71Z (s/h)

### TO-92 Radial Ammo Packaging Configuration: Figure 3.0

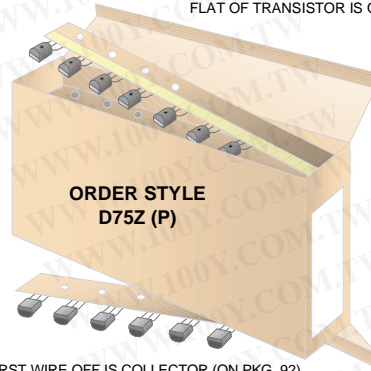
FIRST WIRE OFF IS COLLECTOR  
ADHESIVE TAPE IS ON THE TOP SIDE  
FLAT OF TRANSISTOR IS ON TOP



ORDER STYLE  
D74Z (M)

FIRST WIRE OFF IS EMITTER (ON PKG. 92)  
ADHESIVE TAPE IS ON BOTTOM SIDE  
FLAT OF TRANSISTOR IS ON BOTTOM

FIRST WIRE OFF IS EMITTER  
ADHESIVE TAPE IS ON THE TOP SIDE  
FLAT OF TRANSISTOR IS ON BOTTOM

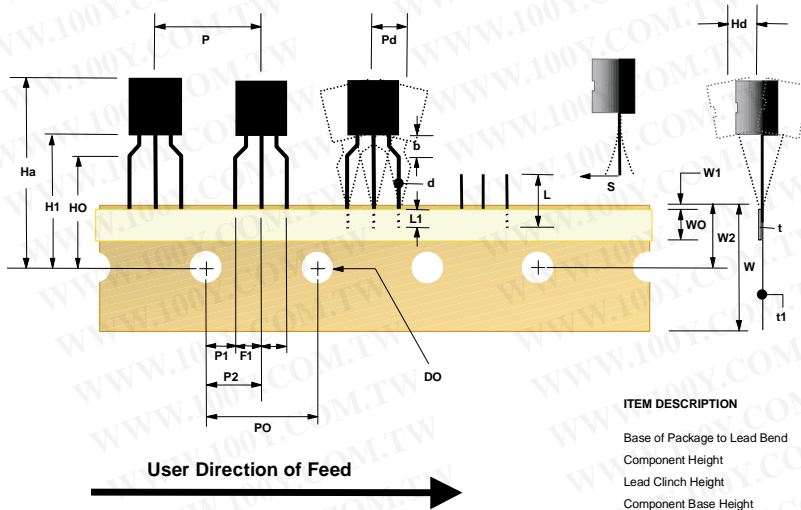


ORDER STYLE  
D75Z (P)

FIRST WIRE OFF IS COLLECTOR (ON PKG. 92)  
ADHESIVE TAPE IS ON BOTTOM SIDE  
FLAT OF TRANSISTOR IS ON TOP

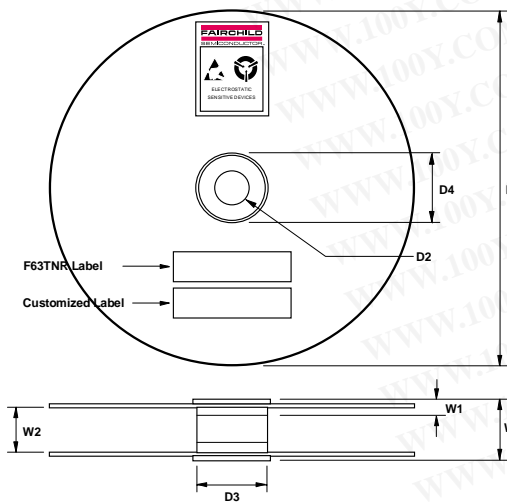
## TO-92 Tape and Reel Data, continued

**TO-92 Tape and Reel Taping  
 Dimension Configuration: Figure 4.0**



| ITEM DESCRIPTION                   | SYMBOL | DIMENSION              |
|------------------------------------|--------|------------------------|
| Base of Package to Lead Bend       | b      | 0.098 (max)            |
| Component Height                   | Ha     | 0.928 (+/- 0.025)      |
| Lead Clinch Height                 | HO     | 0.630 (+/- 0.020)      |
| Component Base Height              | H1     | 0.748 (+/- 0.020)      |
| Component Alignment ( side/side )  | Pd     | 0.040 (max)            |
| Component Alignment ( front/back ) | Hd     | 0.031 (max)            |
| Component Pitch                    | P      | 0.500 (+/- 0.020)      |
| Feed Hole Pitch                    | PO     | 0.500 (+/- 0.008)      |
| Hole Center to First Lead          | P1     | 0.150 (+0.009, -0.010) |
| Hole Center to Component Center    | P2     | 0.247 (+/- 0.007)      |
| Lead Spread                        | F1/F2  | 0.104 (+/- 0.010)      |
| Lead Thickness                     | d      | 0.018 (+0.002, -0.003) |
| Cut Lead Length                    | L      | 0.429 (max)            |
| Taped Lead Length                  | L1     | 0.209 (+0.051, -0.052) |
| Taped Lead Thickness               | t      | 0.032 (+/- 0.006)      |
| Carrier Tape Thickness             | t1     | 0.021 (+/- 0.006)      |
| Carrier Tape Width                 | W      | 0.708 (+0.020, -0.019) |
| Hold - down Tape Width             | WO     | 0.236 (+/- 0.012)      |
| Hold - down Tape position          | W1     | 0.035 (max)            |
| Feed Hole Position                 | W2     | 0.360 (+/- 0.025)      |
| Sprocket Hole Diameter             | DO     | 0.157 (+0.008, -0.007) |
| Lead Spring Out                    | S      | 0.004 (max)            |

**TO-92 Reel  
 Configuration: Figure 5.0**



Note : All dimensions are in inches.

| ITEM DESCRIPTION               | SYMBOL | MINIMUM | MAXIMUM |
|--------------------------------|--------|---------|---------|
| Reel Diameter                  | D1     | 13.975  | 14.025  |
| Arbor Hole Diameter (Standard) | D2     | 1.160   | 1.200   |
| (Small Hole)                   | D2     | 0.650   | 0.700   |
| Core Diameter                  | D3     | 3.100   | 3.300   |
| Hub Recess Inner Diameter      | D4     | 2.700   | 3.100   |
| Hub Recess Depth               | W1     | 0.370   | 0.570   |
| Flange to Flange Inner Width   | W2     | 1.630   | 1.690   |
| Hub to Hub Center Width        | W3     |         | 2.090   |

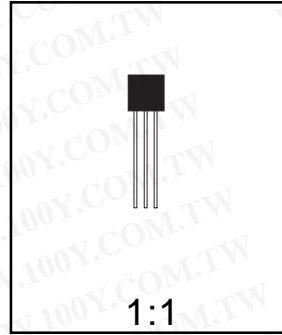
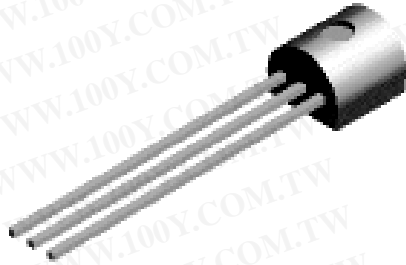
Note: All dimensions are inches



## TO-92 Package Dimensions



### TO-92 (FS PKG Code 92, 94, 96)



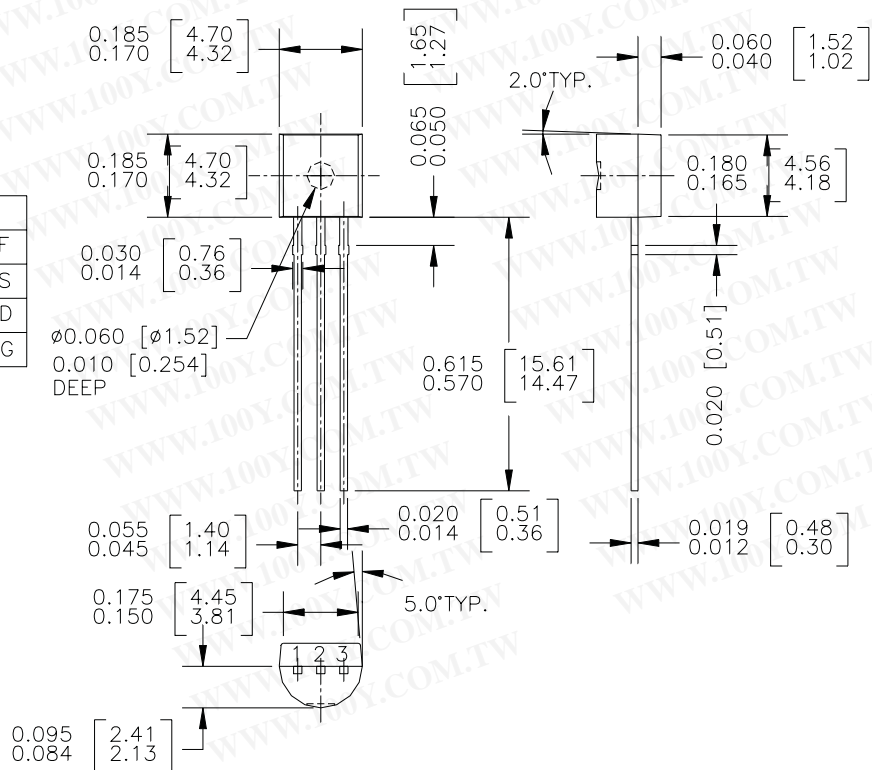
Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.1977

TO-92 (92,94,96)

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



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| Bottomless™          | GlobalOptoisolator™ | QFET™               | TinyLogic™ |
| CoolFET™             | GTO™                | QS™                 | UHC™       |
| CROSSVOLT™           | HiSeC™              | QT Optoelectronics™ | VCX™       |
| DOME™                | ISOPLANAR™          | Quiet Series™       |            |
| E <sup>2</sup> CMOS™ | MICROWIRE™          | SILENT SWITCHER®    |            |
| EnSigna™             | OPTOLOGIC™          | SMART START™        |            |
| FACT™                | OPTOPLANAR™         | SuperSOT™-3         |            |
| FACT Quiet Series™   | PACMAN™             | SuperSOT™-6         |            |
| FAST®                | POP™                | SuperSOT™-8         |            |

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition  |
|--------------------------|------------------------|---|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.  |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.   |
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