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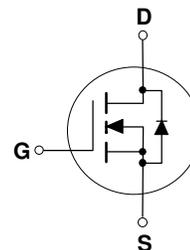
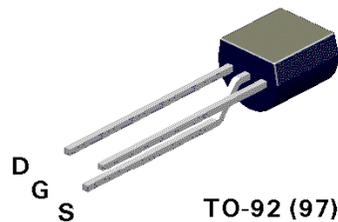
## BS270 N-Channel Enhancement Mode Field Effect Transistor

### General Description

These N-Channel enhancement mode field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance. They can be used in most applications requiring up to 500mA DC. These products are particularly suited for low voltage, low current applications such as small servo motor control, power MOSFET gate drivers, and other switching applications.

### Features

- 400mA, 60V.  $R_{DS(ON)} = 2\Omega @ V_{GS} = 10V$ .
- High density cell design for low  $R_{DS(ON)}$ .
- Voltage controlled small signal switch.
- Rugged and reliable.
- High saturation current capability.



### Absolute Maximum Ratings

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

| Symbol         | Parameter   | BS270      | Units                |
|----------------|---|------------|----------------------|
| $V_{DSS}$      | Drain-Source Voltage  | 60         | V                    |
| $V_{DGR}$      | Drain-Gate Voltage ( $R_{GS} \leq 1M\Omega$ )                                   | 60         | V                    |
| $V_{GSS}$      | Gate-Source Voltage - Continuous<br>- Non Repetitive ( $t_p < 50\mu s$ )        | $\pm 20$   | V                    |
|                |   | $\pm 40$   |                      |
| $I_D$          | Drain Current - Continuous<br>- Pulsed  | 400        | mA                   |
|                |   | 2000       |                      |
| $P_D$          | Maximum Power Dissipation<br>Derate Above $25^\circ\text{C}$                    | 625        | mW                   |
|                |   | 5          | mW/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range   | -55 to 150 | $^\circ\text{C}$     |
| $T_L$          | Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds | 300        | $^\circ\text{C}$     |

### THERMAL CHARACTERISTICS

|                 |   |     |                    |
|-----------------|---|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistacne, Junction-to-Ambient | 200 | $^\circ\text{C/W}$ |
|-----------------|---|-----|--------------------|

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| Symbol  | Parameter   | Conditions   | Min   | Typ  | Max   | Units         |
|---|---|--|---|------|-------|---------------|
| <b>OFF CHARACTERISTICS</b>                                    |   |  |   |      |       |               |
| $BV_{DSS}$  | Drain-Source Breakdown Voltage                        | $V_{GS} = 0\text{ V}, I_D = 10\ \mu\text{A}$   | 60  |      |       | V             |
| $I_{DSS}$   | Zero Gate Voltage Drain Current                       | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$  |   |      | 1     | $\mu\text{A}$ |
|   |   |  | $T_J = 125^\circ\text{C}$                         |      | 500   | $\mu\text{A}$ |
| $I_{GSSF}$  | Gate - Body Leakage, Forward                          | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$  |   |      | 10    | nA            |
| $I_{GSSF}$  | Gate - Body Leakage, Reverse                          | $V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$   |   |      | -10   | nA            |
| <b>ON CHARACTERISTICS</b> (Note 1)                            |   |  |   |      |       |               |
| $V_{GS(th)}$  | Gate Threshold Voltage                                | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$  | 1   | 2.1  | 2.5   | V             |
| $R_{DS(on)}$  | Static Drain-Source On-Resistance                     | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  |   | 1.2  | 2     | $\Omega$      |
|   |   |  | $T_J = 125^\circ\text{C}$                         | 2    | 3.5   |               |
| $V_{DS(on)}$  | Drain-Source On-Voltage                               | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  |   | 0.6  | 1     | V             |
|   |   |  | $V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$       | 0.14 | 0.225 |               |
| $I_{D(on)}$   | On-State Drain Current                                | $V_{GS} = 10\text{ V}, V_{DS} \geq 2 V_{DS(on)}$   | 2000  | 2700 |       | mA            |
|   |   |  | $V_{GS} = 4.5\text{ V}, V_{DS} \geq 2 V_{DS(on)}$ | 400  | 600   |               |
| $g_{FS}$  | Forward Transconductance                              | $V_{DS} \geq 2 V_{DS(on)}, I_D = 200\text{ mA}$  | 100   | 320  |       | mS            |
| <b>DYNAMIC CHARACTERISTICS</b>                                |   |  |   |      |       |               |
| $C_{iss}$   | Input Capacitance                                     | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$                         |   | 20   | 50    | pF            |
| $C_{oss}$   | Output Capacitance                                    |  |   | 11   | 25    | pF            |
| $C_{rss}$   | Reverse Transfer Capacitance                          |  |   | 4    | 5     | pF            |
| <b>SWITCHING CHARACTERISTICS</b> (Note 1)                     |   |  |   |      |       |               |
| $t_{on}$  | Turn-On Time  | $V_{DD} = 30\text{ V}, I_D = 500\text{ mA},$<br>$V_{GS} = 10\text{ V}, R_{GEN} = 25\ \Omega$ |   |      | 10    | ns            |
| $t_{off}$   | Turn-Off Time   |  |   |      | 10    | ns            |
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b> |   |  |   |      |       |               |
| $I_S$   | Maximum Continuous Drain-Source Diode Forward Current |  |   | 400  |       | mA            |
| $I_{SM}$  | Maximum Pulsed Drain-Source Diode Forward Current     |  |   | 2000 |       | mA            |
| $V_{SD}$  | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 400\text{ mA}$ (Note 1)  |   | 0.88 | 1.2   | V             |

Note:

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

## Typical Electrical Characteristics

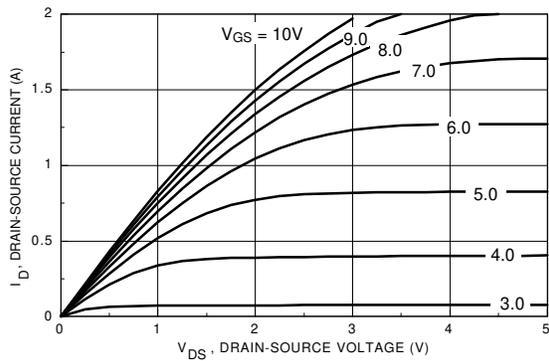


Figure 1. On-Region Characteristics.

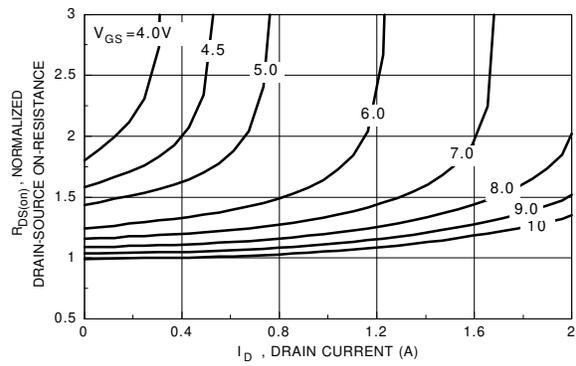


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

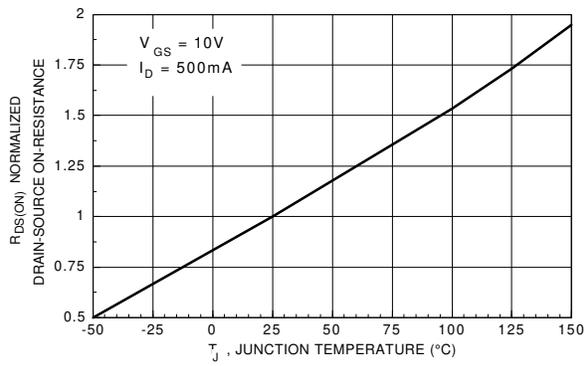


Figure 3. On-Resistance Variation with Temperature.

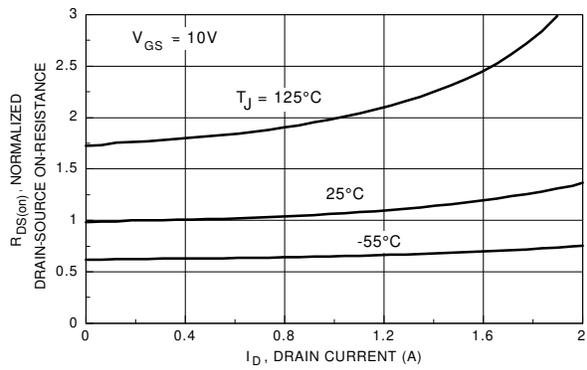


Figure 4. On-Resistance Variation with Drain Current and Temperature.

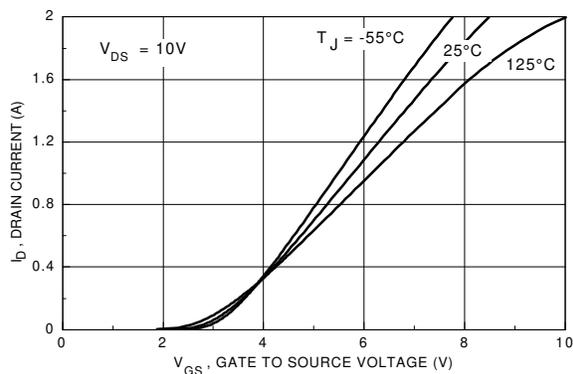


Figure 5. Transfer Characteristics.

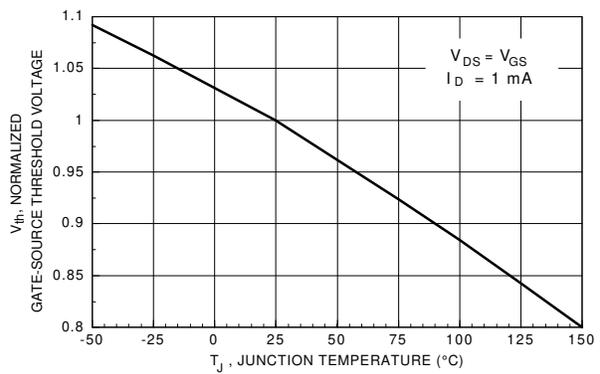
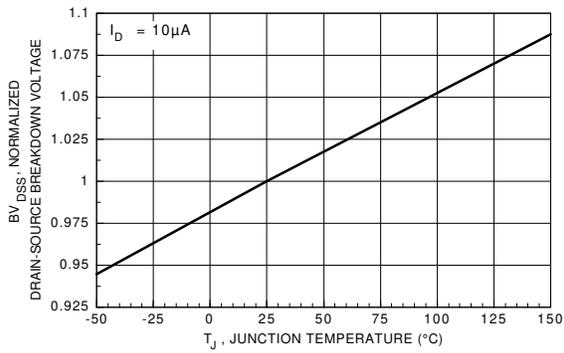
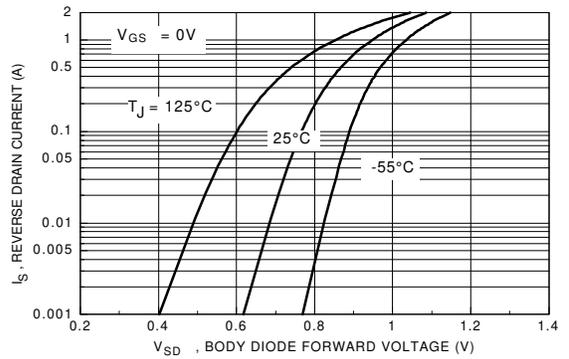


Figure 6. Gate Threshold Variation with Temperature.

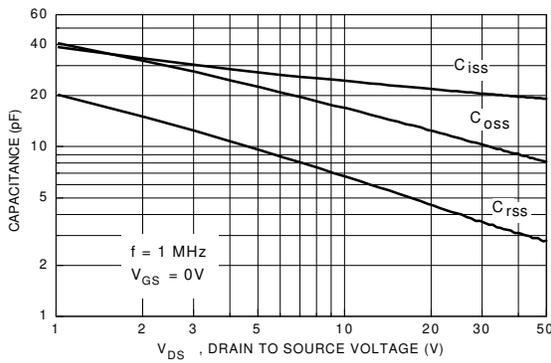
## Typical Electrical Characteristics (continued)



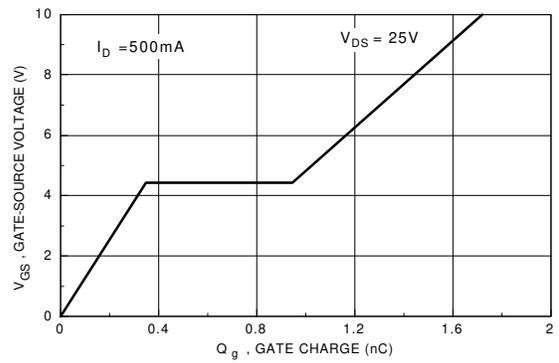
**Figure 7. Breakdown Voltage Variation with Temperature.**



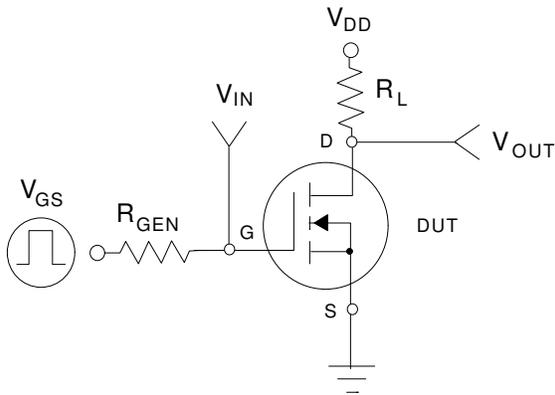
**Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.**



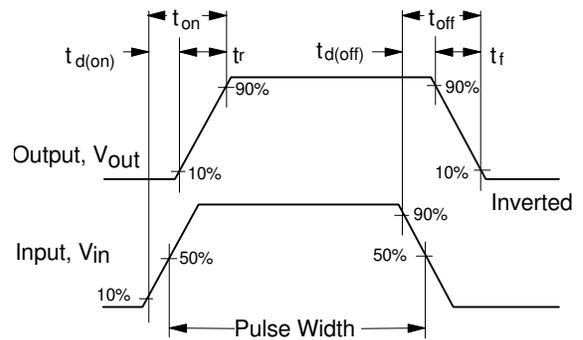
**Figure 9. Capacitance Characteristics.**



**Figure 10. Gate Charge Characteristics.**

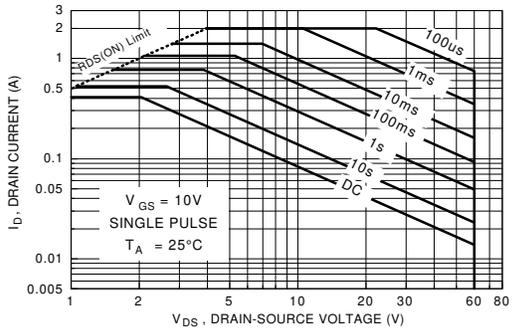


**Figure 11. Switching Test Circuit.**

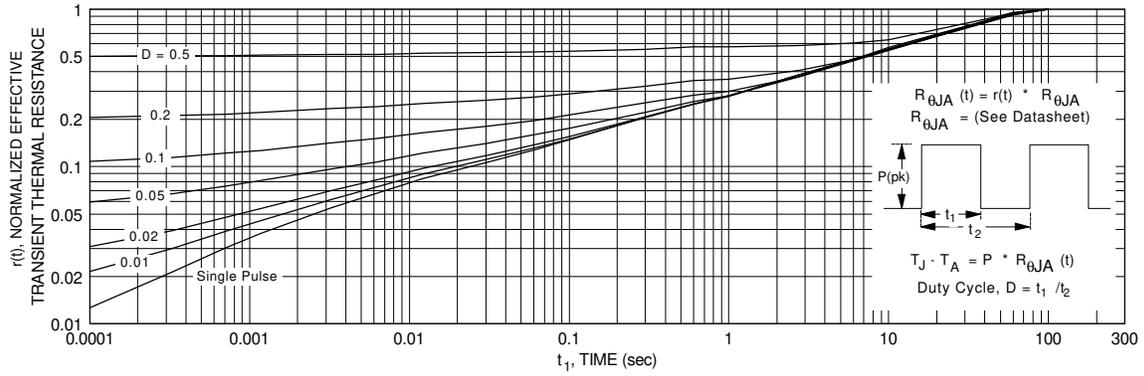


**Figure 12. Switching Waveforms.**

### Typical Electrical Characteristics (continued)



**Figure 13. Maximum Safe Operating Area.**



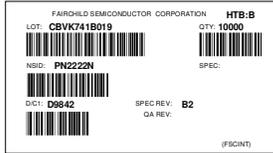
**Figure 14. Transient Thermal Response Curve.**

# TO-92 Tape and Reel Data

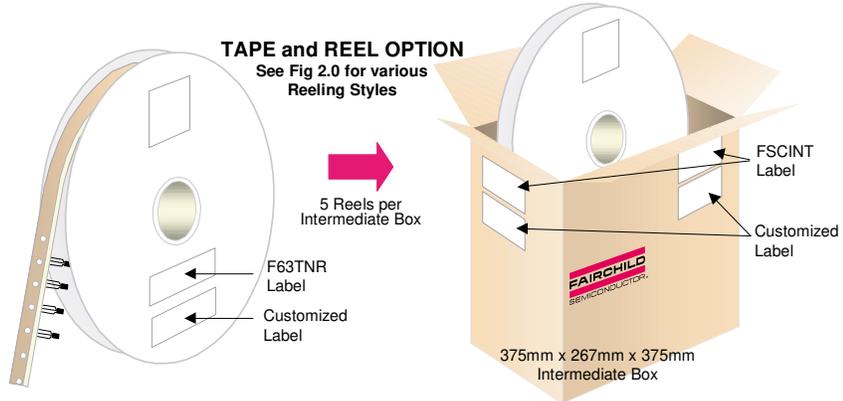


## TO-92 Packaging Configuration: Figure 1.0

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

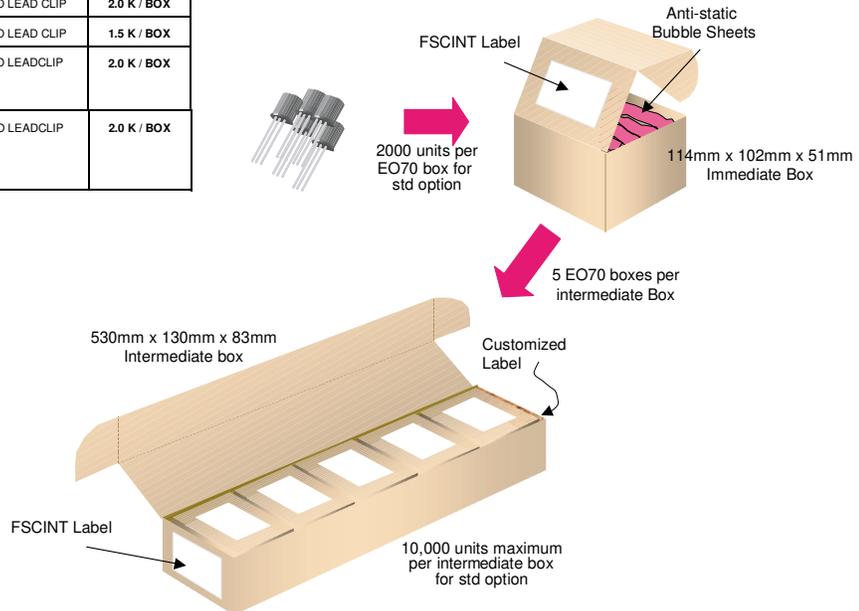


### (TO-92) BULK PACKING INFORMATION

| 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

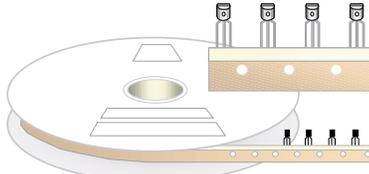


## TO-92 Tape and Reel Data, continued

### TO-92 Reeling Style

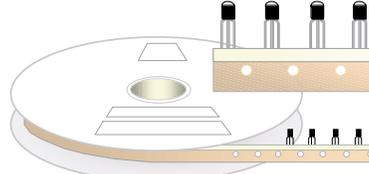
Configuration: Figure 2.0

#### Machine Option "A" (H)



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

#### Machine Option "E" (J)

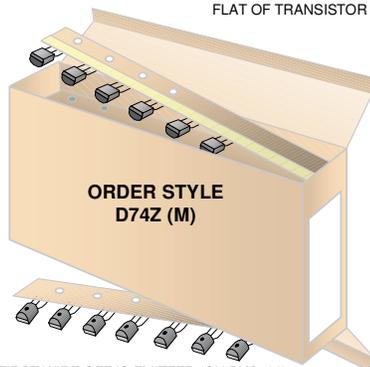


Style "E", D27Z, D71Z (s/h)

### TO-92 Radial Ammo Packaging

Configuration: Figure 3.0

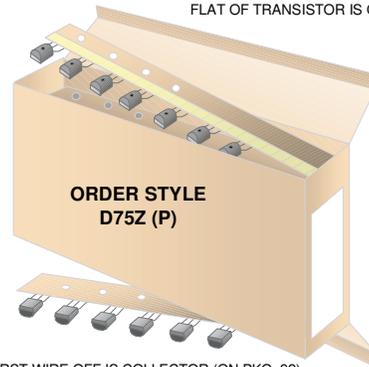
FIRST WIRE OFF IS COLLECTOR  
ADHESIVE TAPE IS ON THE TOP SIDE  
FLAT OF TRANSISTOR IS ON TOP



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

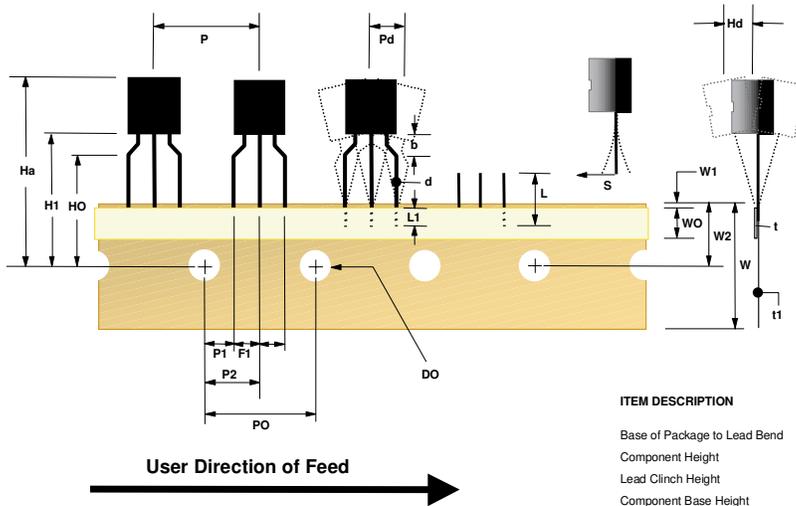


ORDER STYLE  
D75Z (P)

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

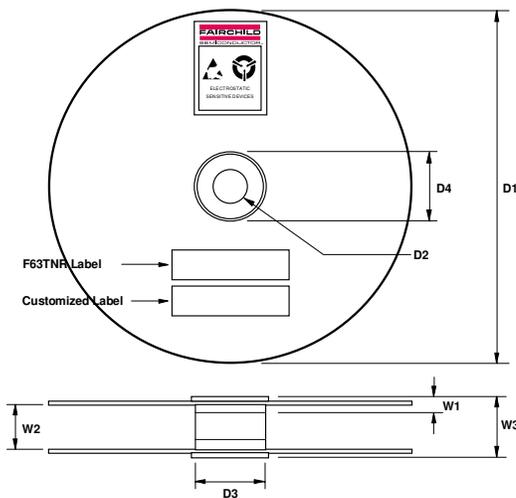
## TO-92 Tape and Reel Taping Dimension Configuration: Figure 4.0



| 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)            |

Note : All dimensions are in inches.

## TO-92 Reel Configuration: Figure 5.0



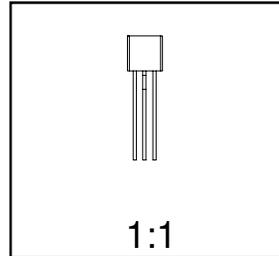
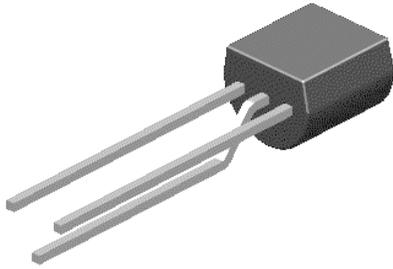
| ITEM DESCRIPTION               | SYMBOL | MINIMUM | MAXIMUM |
|--------------------------------|--------|---------|---------|
| Reel Diameter                  | D1     | 13.975  | 14.025  |
| Arbor Hole Diameter (Standard) | D2     | 1.160   | 1.200   |
| (Small Hole)                   | D2     | 0.650   | 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 in inches

# TO-92 Package Dimensions



## TO-92; TO-18 Reverse Lead Form (J35Z Option) (FS PKG Code 92, 94, 96)

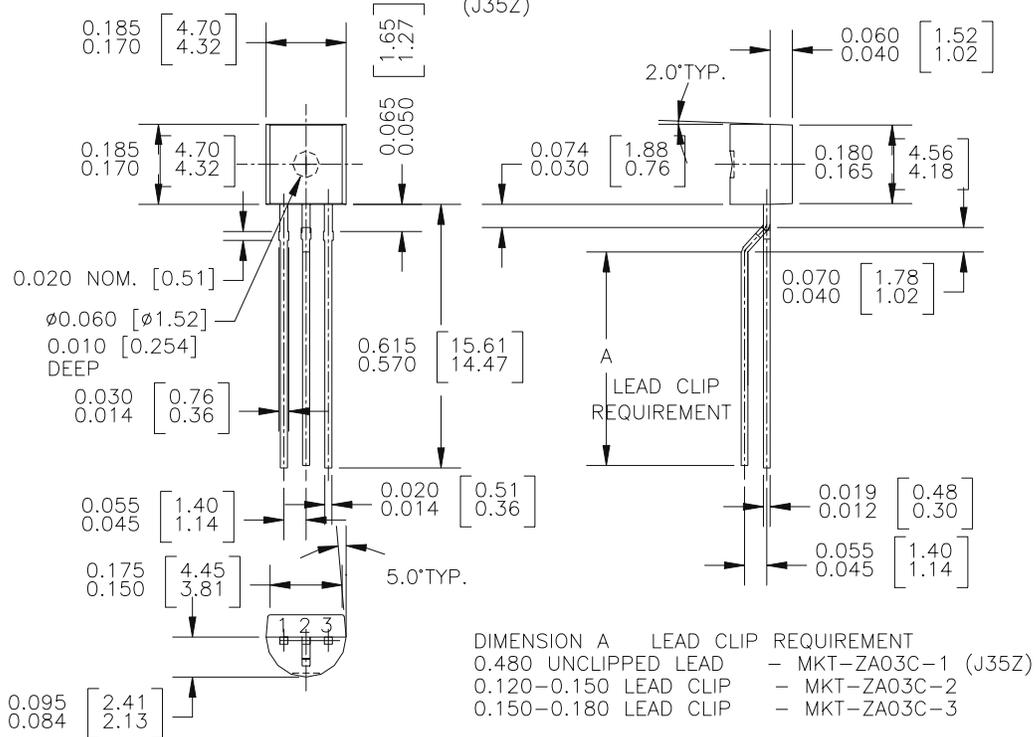


Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.22

TO-92(92,94,96,97\*,98\*);  
TO-18 REVERSE LEADFORM  
(J35Z)



**Note:** All package 97 or 98 transistors are leadformed to this configuration prior to bulk shipment. Order L34Z option if in-line leads are preferred on package 97 or 98.

\* Standard Option on 97 & 98 package code

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| Bottomless™          | GlobalOptoisolator™ | QFET™               | TinyLogic™ |
| CoolFET™             | GTO™                | QST™                | 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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