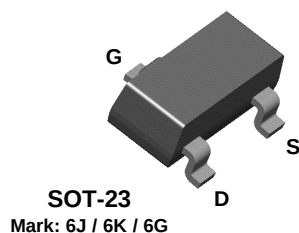
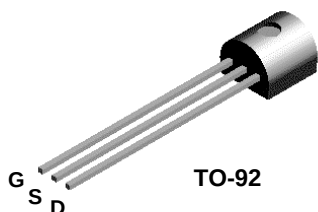


**PN4391  
PN4392  
PN4393**

**MMBF4391  
MMBF4392  
MMBF4393**



NOTE: Source & Drain  
are interchangeable

## N-Channel Switch

This device is designed for low level analog switching, sample and hold circuits and chopper stabilized amplifiers. Sourced from Process 51. See J111 for characteristics.

### Absolute Maximum Ratings\*

TA = 25°C unless otherwise noted

| Symbol                            | Parameter                                        | Value       | Units |
|-----------------------------------|--------------------------------------------------|-------------|-------|
| V <sub>DG</sub>                   | Drain-Gate Voltage                               | 30          | V     |
| V <sub>GS</sub>                   | Gate-Source Voltage                              | - 30        | V     |
| I <sub>GF</sub>                   | Forward Gate Current                             | 50          | 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       |
|------------------|-----------------------------------------------|-------------|----------------|-------------|
|                  |                                               | PN4391-4393 | *MMBF4391-4393 |             |
| P <sub>D</sub>   | Total Device Dissipation<br>Derate above 25°C | 625<br>5.0  | 350<br>2.8     | mW<br>mW/°C |
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case          | 125         |                | °C/W        |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient       | 357         | 556            | °C/W        |

\*Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

# N-Channel Switch

(continued)

## Electrical Characteristics

TA = 25°C unless otherwise noted

| Symbol                       | Parameter                        | Test Conditions                                                                                                                                                                                                                                                                                                                                                                                           | Min                                          | Max                                    | Units                                           |
|------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------|-------------------------------------------------|
| OFF CHARACTERISTICS          |                                  |                                                                                                                                                                                                                                                                                                                                                                                                           |                                              |                                        |                                                 |
| V <sub>(BR)GSS</sub>         | Gate-Source Breakdown Voltage    | I <sub>G</sub> = 1.0 $\mu$ A, V <sub>DS</sub> = 0                                                                                                                                                                                                                                                                                                                                                         | - 30                                         |                                        | V                                               |
| I <sub>GSS</sub>             | Gate Reverse Current             | V <sub>GS</sub> = - 15 V, V <sub>DS</sub> = 0<br>V <sub>GS</sub> = - 15 V, V <sub>DS</sub> = 0, T <sub>A</sub> = 150°C                                                                                                                                                                                                                                                                                    |                                              | - 1.0<br>- 0.2                         | nA<br>$\mu$ A                                   |
| V <sub>GS(off)</sub>         | Gate-Source Cutoff Voltage       | V <sub>DS</sub> = 20 V, I <sub>D</sub> = 1.0 nA                                                                                                                                                                                                                                                                                                                                                           | - 4.0<br>- 2.0<br>- 0.5                      | - 10<br>- 5.0<br>- 3.0                 | V<br>V<br>V                                     |
| V <sub>GS(f)</sub>           | Gate-Source Forward Voltage      | I <sub>G</sub> = 1.0 mA, V <sub>DS</sub> = 0                                                                                                                                                                                                                                                                                                                                                              |                                              | 1.0                                    | V                                               |
| I <sub>D(off)</sub>          | Drain Cutoff Leakage Current     | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = - 12 V<br>V <sub>DS</sub> = 20 V, V <sub>GS</sub> = - 7.0 V<br>V <sub>DS</sub> = 20 V, V <sub>GS</sub> = - 5.0 V<br>V <sub>DS</sub> = 20 V, V <sub>GS</sub> = - 12 V,<br>T <sub>A</sub> = 150°C<br>V <sub>DS</sub> = 20 V, V <sub>GS</sub> = - 7.0 V,<br>T <sub>A</sub> = 150°C<br>V <sub>DS</sub> = 20 V, V <sub>GS</sub> = - 5.0 V,<br>T <sub>A</sub> = 150°C | 4391<br>4392<br>4393<br>4391<br>4392<br>4393 | 0.1<br>0.1<br>0.1<br>0.2<br>0.2<br>0.2 | nA<br>nA<br>nA<br>$\mu$ A<br>$\mu$ A<br>$\mu$ A |
| ON CHARACTERISTICS           |                                  |                                                                                                                                                                                                                                                                                                                                                                                                           |                                              |                                        |                                                 |
| I <sub>DSS</sub>             | Zero-Gate Voltage Drain Current* | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0                                                                                                                                                                                                                                                                                                                                                               | 4391<br>4392<br>4393                         | 50<br>25<br>5.0                        | 150<br>75<br>30<br>mA<br>mA<br>mA               |
| V <sub>DS(on)</sub>          | Drain-Source On Voltage          | I <sub>D</sub> = 12 mA, V <sub>GS</sub> = 0<br>I <sub>D</sub> = 6.0 mA, V <sub>GS</sub> = 0<br>I <sub>D</sub> = 3.0 mA, V <sub>GS</sub> = 0                                                                                                                                                                                                                                                               | 4391<br>4392<br>4393                         | 0.4<br>0.4<br>0.4                      | V<br>V<br>V                                     |
| r <sub>DS(on)</sub>          | Drain-Source On Resistance       | I <sub>D</sub> = 1.0 mA, V <sub>GS</sub> = 0                                                                                                                                                                                                                                                                                                                                                              | 4391<br>4392<br>4393                         | 30<br>60<br>100                        | $\Omega$<br>$\Omega$<br>$\Omega$                |
| SMALL-SIGNAL CHARACTERISTICS |                                  |                                                                                                                                                                                                                                                                                                                                                                                                           |                                              |                                        |                                                 |
| r <sub>ds(on)</sub>          | Drain-Source On Resistance       | V <sub>DS</sub> = V <sub>GS</sub> = 0, f = 1.0 kHz                                                                                                                                                                                                                                                                                                                                                        | 4391<br>4392<br>4393                         | 30<br>60<br>100                        | $\Omega$<br>$\Omega$<br>$\Omega$                |
| C <sub>iss</sub>             | Input Capacitance                | V <sub>DS</sub> = 20, V <sub>GS</sub> = 0, f = 1.0 MHz                                                                                                                                                                                                                                                                                                                                                    |                                              | 14                                     | pF                                              |
| C <sub>rss</sub>             | Reverse Transfer Capacitance     | V <sub>GS</sub> = - 12 V, f = 1.0 MHz<br>V <sub>GS</sub> = - 7.0 V, f = 1.0 MHz<br>V <sub>GS</sub> = - 5.0 V, f = 1.0 MHz                                                                                                                                                                                                                                                                                 | 4391<br>4392<br>4393                         | 3.5<br>3.5<br>3.5                      | pF<br>pF<br>pF                                  |
| SWITCHING CHARACTERISTICS    |                                  |                                                                                                                                                                                                                                                                                                                                                                                                           |                                              |                                        |                                                 |
| t <sub>r</sub>               | Rise Time                        | I <sub>D(on)</sub> = 12 mA<br>I <sub>D(on)</sub> = 6.0 mA<br>I <sub>D(on)</sub> = 3.0 mA                                                                                                                                                                                                                                                                                                                  | 4391<br>4392<br>4393                         | 5.0<br>5.0<br>5.0                      | ns<br>ns<br>ns                                  |
| t <sub>f</sub>               | Fall Time                        | V <sub>GS(off)</sub> = 12 V<br>V <sub>GS(off)</sub> = 6.0 V<br>V <sub>GS(off)</sub> = 3.0 V                                                                                                                                                                                                                                                                                                               | 4391<br>4392<br>4393                         | 15<br>20<br>30                         | ns<br>ns<br>ns                                  |
| t <sub>on</sub>              | Turn-On Time                     | I <sub>D(on)</sub> = 12 mA<br>I <sub>D(on)</sub> = 6.0 mA<br>I <sub>D(on)</sub> = 3.0 mA                                                                                                                                                                                                                                                                                                                  | 4391<br>4392<br>4393                         | 15<br>15<br>15                         | ns<br>ns<br>ns                                  |
| t <sub>off</sub>             | Turn-Off Time                    | V <sub>GS(off)</sub> = 12 V<br>V <sub>GS(off)</sub> = 6.0 V<br>V <sub>GS(off)</sub> = 3.0 V                                                                                                                                                                                                                                                                                                               | 4391<br>4392<br>4393                         | 20<br>35<br>50                         | ns<br>ns<br>ns                                  |

\*Pulse Test: Pulse Width  $\leq$  300  $\mu$ s, Duty Cycle  $\leq$  1.0%

PN4391 / 4392 / 4393 / MMBF4391 / 4392 / 4393

# TO-92 Tape and Reel Data

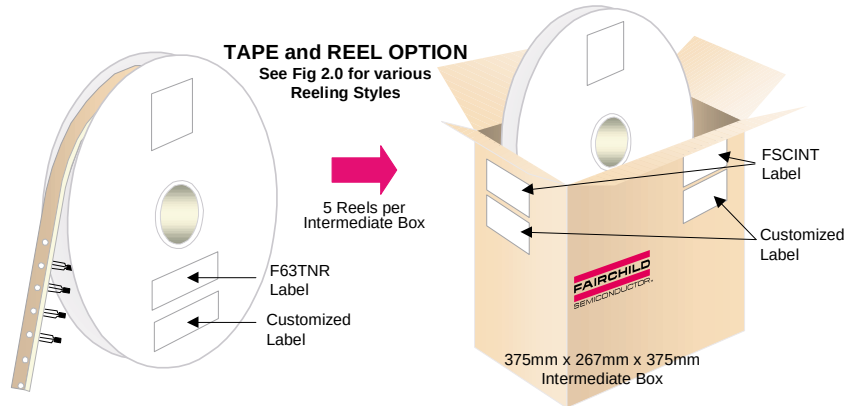


## TO-92 Packaging Configuration: Figure 1.0

FSCINT Label sample



F63TNR Label sample



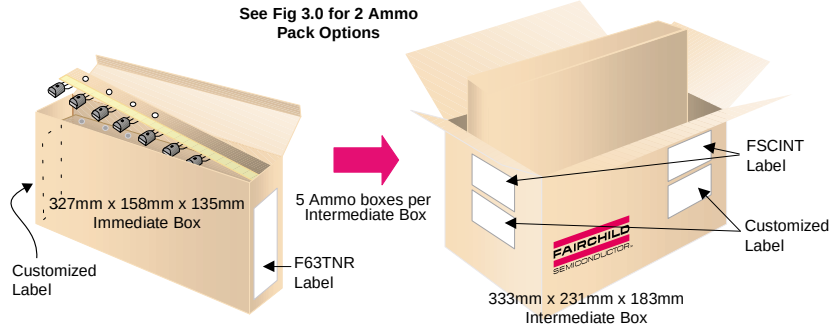
### TO-92 TNR/AMMO PACKING INFORMATION

| 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

### AMMO PACK OPTION

See Fig 3.0 for 2 Ammo Pack Options

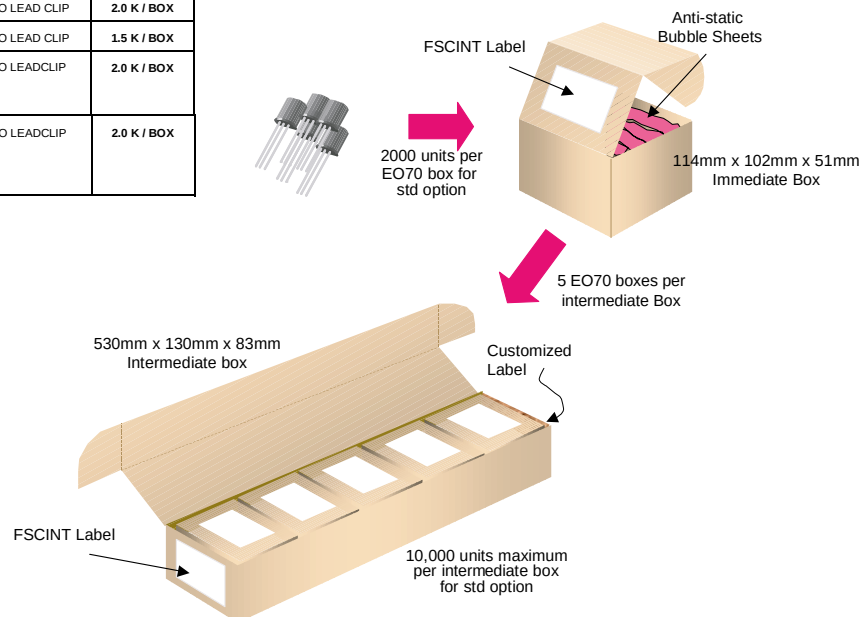


### (TO-92) BULK PACKING INFORMATION

| 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 |

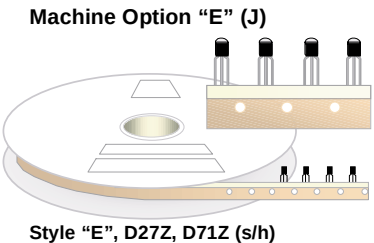
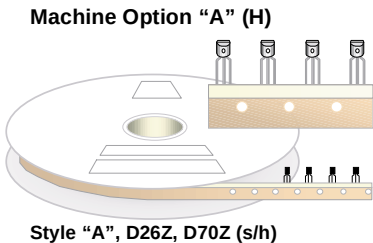
### BULK OPTION

See Bulk Packing Information table

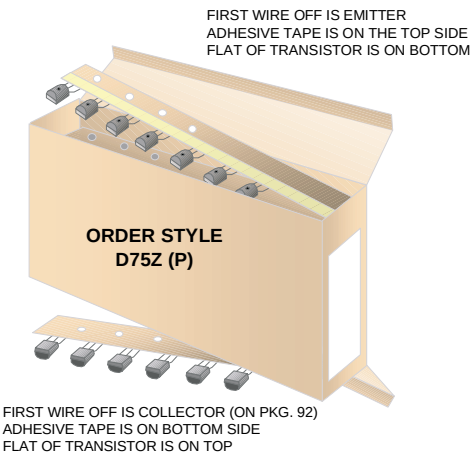
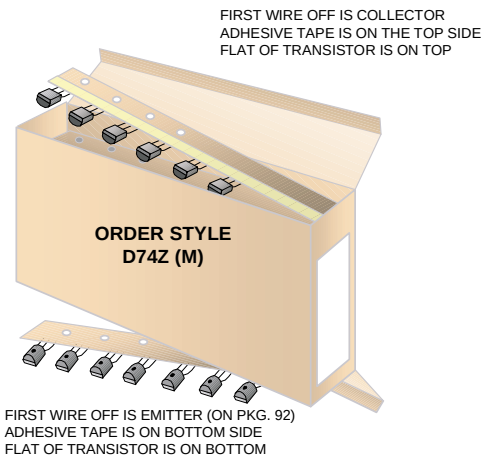


# TO-92 Tape and Reel Data, continued

## TO-92 Reeling Style Configuration: Figure 2.0

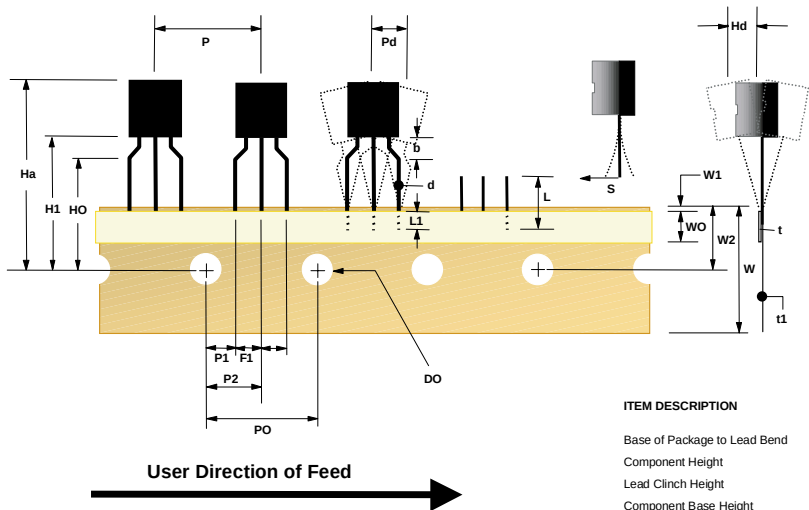


## TO-92 Radial Ammo Packaging Configuration: Figure 3.0



# TO-92 Tape and Reel Data, continued

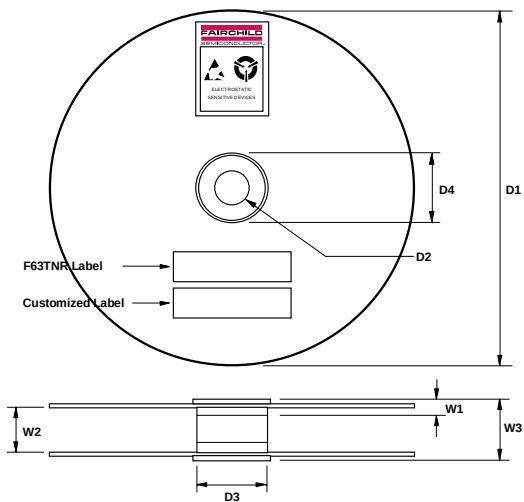
TO-92 Tape and Reel Taping  
Dimension Configuration: Figure 4.0



| 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



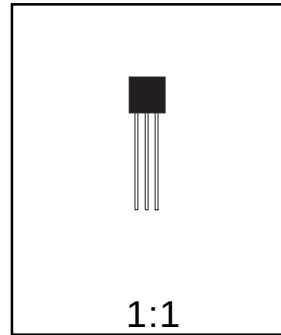
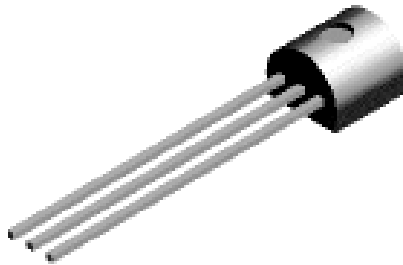
| ITEM DESCRIPTION               | SYMBOL | MINIMUM | MAXIMUM |
|--------------------------------|--------|---------|---------|
| Reel Diameter                  | D1     | 13.975  | 14.025  |
| Arbor Hole Diameter (Standard) | D2     | 1.160   | 1.200   |
| (Small Hole)                   | D2     | 0.650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

## TO-92 Package Dimensions



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



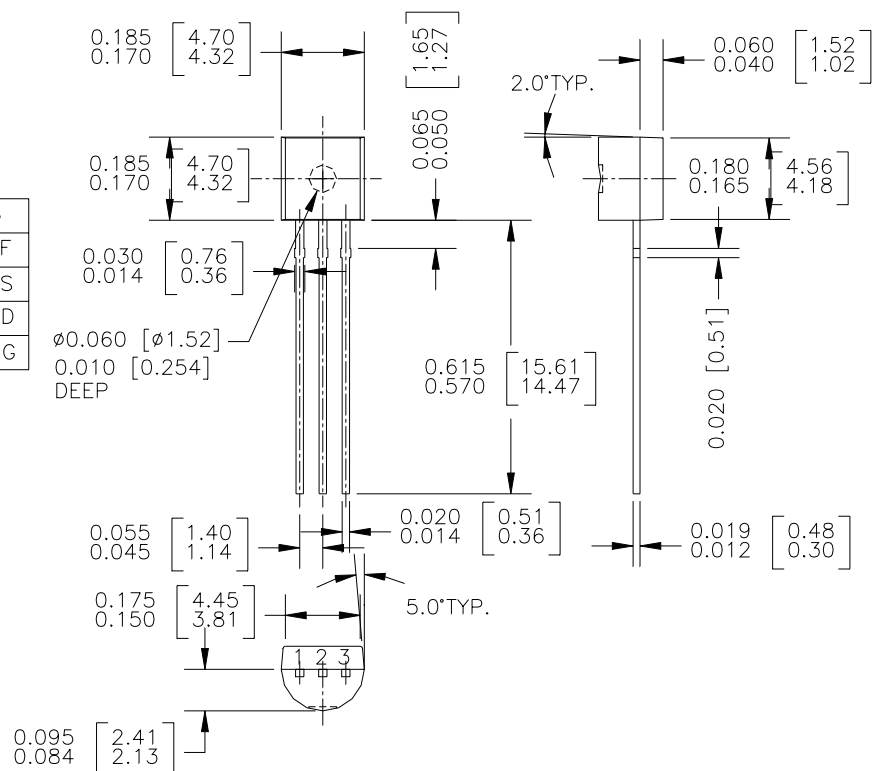
Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.1977

TO-92 (92,94,96)

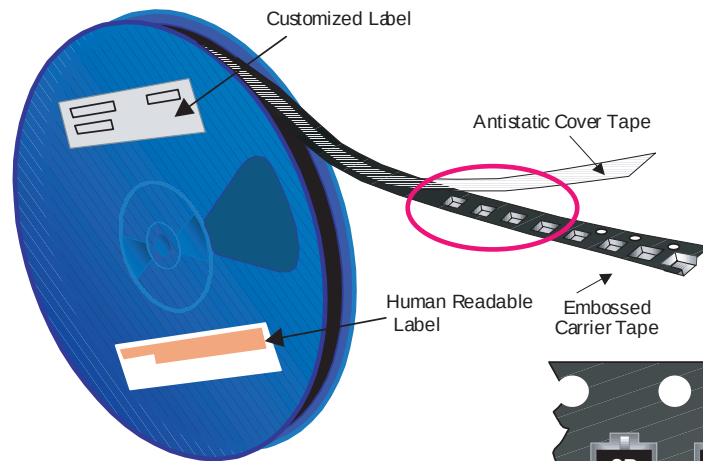
| PIN | 92 |   | 94 |   | 96 |   |
|-----|----|---|----|---|----|---|
|     | B  | F | B  | F | B  | F |
| 1   | E  | D | E  | D | B  | S |
| 2   | B  | S | C  | G | E  | D |
| 3   | C  | G | B  | S | C  | G |



## SOT-23 Tape and Reel Data



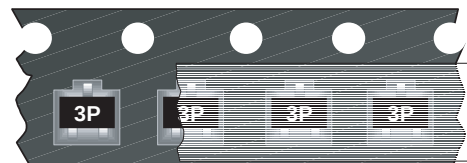
**SOT-23 Packaging Configuration:** Figure 10



### Packaging Description:

SOT-23 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 177mm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 10,000 units per 13" or 330mm diameter reel. This and some other options are described in the Packaging Information table.

These full reels are individually labeled and placed inside a standard intermediate made of recyclable corrugated brown paper with a Fairchild logo printing. One pizza box contains eight reels maximum. And these intermediate boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped.



### SOT-23 Unit Orientation

| SOT-23 Packaging Information |                         |            |
|------------------------------|-------------------------|------------|
| Packaging Option             | Standard (no flow code) | D87Z       |
| Packaging type               | TNR                     | TNR        |
| Qty per Reel/Tube/Bag        | 3,000                   | 10,000     |
| Reel Size                    | 7" Dia                  | 13"        |
| Box Dimension (mm)           | 187x107x183             | 343x343x64 |
| Max qty per Box              | 24,000                  | 30,000     |
| Weight per unit (gm)         | 0.0082                  | 0.0082     |
| Weight per Reel (kg)         | 0.1175                  | 0.4006     |
| Note/Comments                |                         |            |

343mm x 342mm x 64mm  
Intermediate box for L87Z Option

Human Readable Label

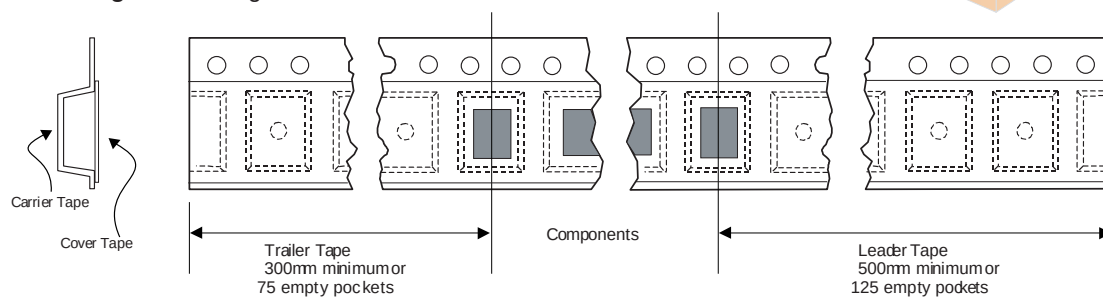
Human Readable Label sample



Human readable Label

187mm x 107mm x 183mm  
Intermediate Box for Standard Option

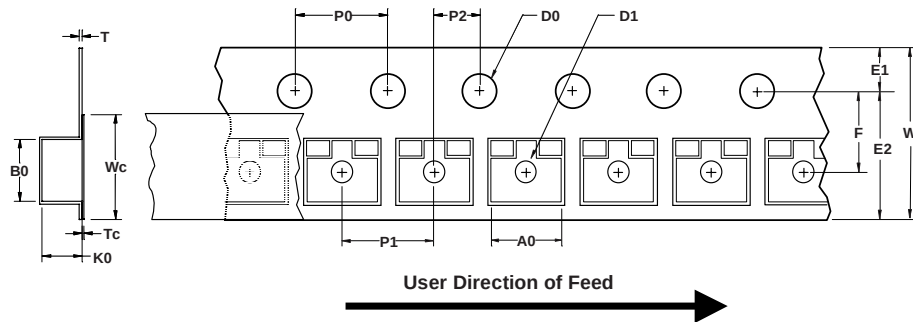
**SOT-23 Tape Leader and Trailer Configuration:** Figure 20



## SOT-23 Tape and Reel Data, continued

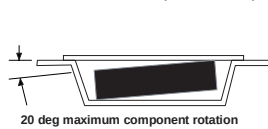
### SOT-23 Embossed Carrier Tape

Configuration: Figure 3.0

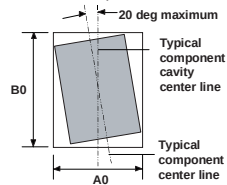


| Dimensions are in millimeter |                 |                 |               |                 |                   |                 |             |                 |               |               |                 |                   |               |                 |
|------------------------------|-----------------|-----------------|---------------|-----------------|-------------------|-----------------|-------------|-----------------|---------------|---------------|-----------------|-------------------|---------------|-----------------|
| Pkg type                     | A0              | B0              | W             | D0              | D1                | E1              | E2          | F               | P1            | P0            | K0              | T                 | Wc            | Tc              |
| SOT-23 (8mm)                 | 3.15<br>+/-0.10 | 2.77<br>+/-0.10 | 8.0<br>+/-0.3 | 1.55<br>+/-0.05 | 1.125<br>+/-0.125 | 1.75<br>+/-0.10 | 6.25<br>min | 3.50<br>+/-0.05 | 4.0<br>+/-0.1 | 4.0<br>+/-0.1 | 1.30<br>+/-0.10 | 0.228<br>+/-0.013 | 5.2<br>+/-0.3 | 0.06<br>+/-0.02 |

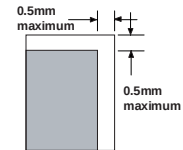
Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)  
Component Rotation

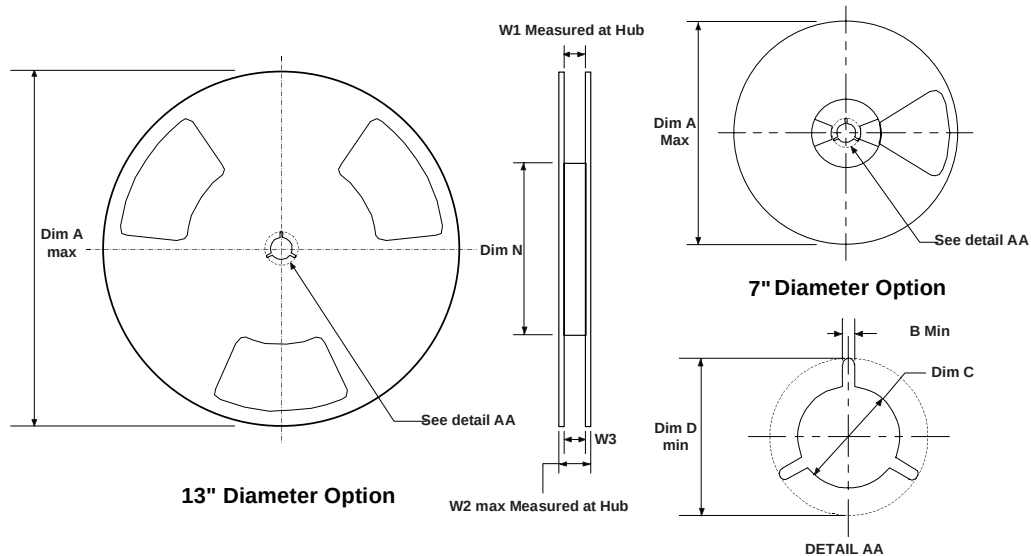


Sketch B (Top View)  
Component Rotation



Sketch C (Top View)  
Component lateral movement

### SOT-23 Reel Configuration: Figure 4.0



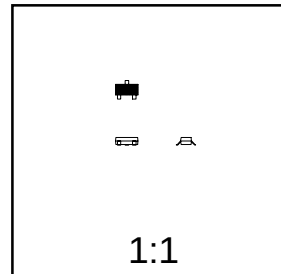
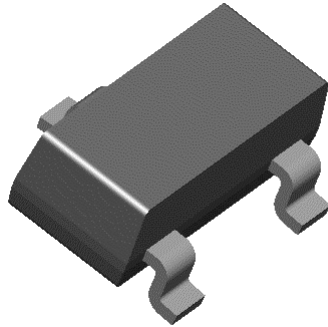
| Dimensions are in inches and millimeters |             |               |              |                                   |               |             |                                   |               |                             |
|------------------------------------------|-------------|---------------|--------------|-----------------------------------|---------------|-------------|-----------------------------------|---------------|-----------------------------|
| Tape Size                                | Reel Option | Dim A         | Dim B        | Dim C                             | Dim D         | Dim N       | Dim W1                            | Dim W2        | Dim W3 (LSL-USL)            |
| 8mm                                      | 7" Dia      | 7.00<br>177.8 | 0.059<br>1.5 | 512 +0.020/-0.008<br>13 +0.5/-0.2 | 0.795<br>20.2 | 2.165<br>55 | 0.331 +0.059/-0.000<br>8.4 +1.5/0 | 0.567<br>14.4 | 0.311 - 0.429<br>7.9 - 10.9 |
| 8mm                                      | 13" Dia     | 13.00<br>330  | 0.059<br>1.5 | 512 +0.020/-0.008<br>13 +0.5/-0.2 | 0.795<br>20.2 | 4.00<br>100 | 0.331 +0.059/-0.000<br>8.4 +1.5/0 | 0.567<br>14.4 | 0.311 - 0.429<br>7.9 - 10.9 |



## SOT-23 Package Dimensions



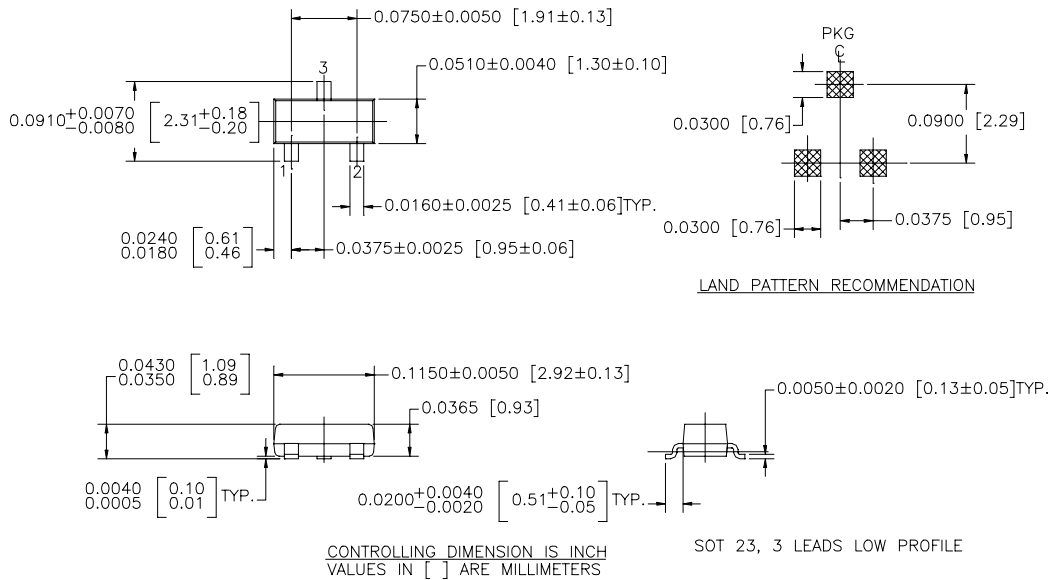
### SOT-23 (FS PKG Code 49)



Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.0082



NOTE : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH 150 MICROINCHES / 3.81 MICROMETERS  
MINIMUM TIN / LEAD (SOLDER) ON ALLOY 42
2. REFERENCE JEDEC REGISTRATION TO-236, VARIATION AB, ISSUE G, DATED JUL 1993

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