

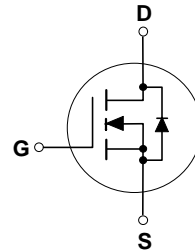
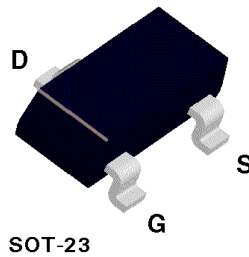
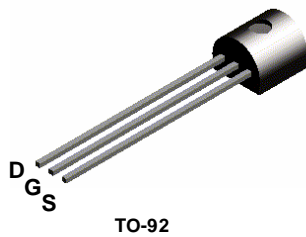
## 2N7000 / 2N7002 / NDS7002A N-Channel Enhancement Mode Field Effect Transistor

### 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 400mA DC and can deliver pulsed currents up to 2A. 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

- 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   | 2N7000     | 2N7002 | NDS7002A | Units                |
|----------------|---|------------|--------|----------|----------------------|
| $V_{DSS}$      | Drain-Source Voltage  | 60         |        |          | V                    |
| $V_{DGR}$      | Drain-Gate Voltage ( $R_{GS} \leq 1 \text{ M}\Omega$ )                          | 60         |        |          | V                    |
| $V_{GSS}$      | Gate-Source Voltage - Continuous  | $\pm 20$   |        |          | V                    |
|                | - Non Repetitive ( $t_p < 50\mu\text{s}$ )                                      | $\pm 40$   |        |          |                      |
| $I_D$          | Maximum Drain Current - Continuous  | 200        | 115    | 280      | mA                   |
|                | - Pulsed  | 500        | 800    | 1500     |                      |
| $P_D$          | Maximum Power Dissipation   | 400        | 200    | 300      | mW                   |
|                | Derated above $25^\circ\text{C}$  | 3.2        | 1.6    | 2.4      | 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 Resistance, Junction-to-Ambient | 312.5 | 625 | 417 | $^\circ\text{C}/\text{W}$ |
|-----------------|---|-------|-----|-----|---------------------------|

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

| Symbol                                      | Parameter                         | Conditions                                   | Type               | Min      | Typ         | Max  | Units         |
|---|-----------------------------------|--|--------------------|----------|-------------|------|---------------|
| <b>OFF CHARACTERISTICS</b>                  |                                   |  |                    |          |             |      |               |
| $BV_{DSS}$                                  | Drain-Source Breakdown Voltage    | $V_{GS} = 0\text{ V}, I_D = 10\ \mu\text{A}$ | All                | 60       |             |      | V             |
| $I_{DSS}$                                   | Zero Gate Voltage Drain Current   | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$  | 2N7000             |          |             | 1    | $\mu\text{A}$ |
|   |                                   | $T_J = 125^\circ\text{C}$                    |                    |          |             | 1    | $\text{mA}$   |
|   |                                   | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$  | 2N7002<br>NDS7002A |          |             | 1    | $\mu\text{A}$ |
| $T_J = 125^\circ\text{C}$                   |                                   |  |                    | 0.5      | $\text{mA}$ |      |               |
| $I_{GSSF}$                                  | Gate - Body Leakage, Forward      | $V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$  | 2N7000             |          |             | 10   | $\text{nA}$   |
|   |                                   | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$  | 2N7002<br>NDS7002A |          |             | 100  | $\text{nA}$   |
| $I_{GSSR}$                                  | Gate - Body Leakage, Reverse      | $V_{GS} = -15\text{ V}, V_{DS} = 0\text{ V}$ | 2N7000             |          |             | -10  | $\text{nA}$   |
|   |                                   | $V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$ | 2N7002<br>NDS7002A |          |             | -100 | $\text{nA}$   |
| <b>ON CHARACTERISTICS</b> (Note 1)          |                                   |  |                    |          |             |      |               |
| $V_{GS(th)}$                                | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = 1\text{ mA}$         | 2N7000             | 0.8      | 2.1         | 3    | V             |
|   |                                   | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$    | 2N7002<br>NDS7002A | 1        | 2.1         | 2.5  |               |
| $R_{DS(on)}$                                | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  | 2N7000             |          | 1.2         | 5    | $\Omega$      |
|   |                                   | $T_J = 125^\circ\text{C}$                    |                    |          | 1.9         | 9    |               |
|   |                                   | $V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$  | 2N7002<br>NDS7002A |          | 1.8         | 5.3  |               |
|   |                                   | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  |                    |          | 1.2         | 7.5  |               |
|   |                                   | $T_J = 100^\circ\text{C}$                    |                    |          | 1.7         | 13.5 |               |
|   |                                   | $V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$  |                    |          | 1.7         | 7.5  |               |
|   |                                   | $T_J = 100^\circ\text{C}$                    |                    |          | 2.4         | 13.5 |               |
|   |                                   | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  |                    | NDS7002A |             | 1.2  |               |
| $T_J = 125^\circ\text{C}$                   |                                   | 2  | 3.5                |          |             |      |               |
| $V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$ |                                   | 1.7  | 3                  |          |             |      |               |
|   |                                   |  | 2.8                | 5        |             |      |               |
| $V_{DS(on)}$                                | Drain-Source On-Voltage           | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  | 2N7000             |          | 0.6         | 2.5  | V             |
|   |                                   | $V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$  |                    |          | 0.14        | 0.4  |               |
|   |                                   | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  | 2N7002             |          | 0.6         | 3.75 |               |
|   |                                   | $V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$  |                    |          | 0.09        | 1.5  |               |
|   |                                   | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$  | NDS7002A           |          | 0.6         | 1    |               |
|   |                                   | $V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$  |                    |          | 0.09        | 0.15 |               |

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

| Symbol  | Parameter   | Conditions   | Type              | Min | Typ  | Max | Units |
|---|---|--|-------------------|-----|------|-----|-------|
| <b>ON CHARACTERISTICS</b> Continued (Note 1)                  |   |  |                   |     |      |     |       |
| $I_{D(ON)}$   | On-State Drain Current                                | $V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}$  | 2N7000            | 75  | 600  |     | mA    |
|   |   | $V_{GS} = 10\text{ V}, V_{DS} \geq 2 V_{DS(on)}$   | 2N7002            | 500 | 2700 |     |       |
|   |   | $V_{GS} = 10\text{ V}, V_{DS} \geq 2 V_{DS(on)}$   | NDS7002A          | 500 | 2700 |     |       |
| $g_{FS}$  | Forward Transconductance                              | $V_{DS} = 10\text{ V}, I_D = 200\text{ mA}$  | 2N7000            | 100 | 320  |     | mS    |
|   |   | $V_{DS} \geq 2 V_{DS(on)}, I_D = 200\text{ mA}$  | 2N7002            | 80  | 320  |     |       |
|   |   | $V_{DS} \geq 2 V_{DS(on)}, I_D = 200\text{ mA}$  | NDS7002A          | 80  | 320  |     |       |
| <b>DYNAMIC CHARACTERISTICS</b>                                |   |  |                   |     |      |     |       |
| $C_{iss}$   | Input Capacitance                                     | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$   | All               |     | 20   | 50  | pF    |
| $C_{oss}$   | Output Capacitance                                    |  | All               |     | 11   | 25  | pF    |
| $C_{rss}$   | Reverse Transfer Capacitance                          |  | All               |     | 4    | 5   | pF    |
| $t_{on}$  | Turn-On Time  | $V_{DD} = 15\text{ V}, R_L = 25\ \Omega,$<br>$I_D = 500\text{ mA}, V_{GS} = 10\text{ V},$<br>$R_{GEN} = 25$          | 2N7000            |     |      | 10  | ns    |
|   |   | $V_{DD} = 30\text{ V}, R_L = 150\ \Omega,$<br>$I_D = 200\text{ mA}, V_{GS} = 10\text{ V},$<br>$R_{GEN} = 25\ \Omega$ | 2N700<br>NDS7002A |     |      | 20  |       |
| $t_{off}$   | Turn-Off Time   | $V_{DD} = 15\text{ V}, R_L = 25\ \Omega,$<br>$I_D = 500\text{ mA}, V_{GS} = 10\text{ V},$<br>$R_{GEN} = 25$          | 2N7000            |     |      | 10  | ns    |
|   |   | $V_{DD} = 30\text{ V}, R_L = 150\ \Omega,$<br>$I_D = 200\text{ mA}, V_{GS} = 10\text{ V},$<br>$R_{GEN} = 25\ \Omega$ | 2N700<br>NDS7002A |     |      | 20  |       |
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b> |   |  |                   |     |      |     |       |
| $I_S$   | Maximum Continuous Drain-Source Diode Forward Current |  | 2N7002            |     |      | 115 | mA    |
|   |   |  | NDS7002A          |     |      | 280 |       |
| $I_{SM}$  | Maximum Pulsed Drain-Source Diode Forward Current     |  | 2N7002            |     |      | 0.8 | A     |
|   |   |  | NDS7002A          |     |      | 1.5 |       |
| $V_{SD}$  | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 115\text{ mA}$ (Note 1)  | 2N7002            |     | 0.88 | 1.5 | V     |
|   |   | $V_{GS} = 0\text{ V}, I_S = 400\text{ mA}$ (Note 1)  | NDS7002A          |     | 0.88 | 1.2 |       |

Note:

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

# Typical Electrical Characteristics

2N7000 / 2N7002 / NDS7002A

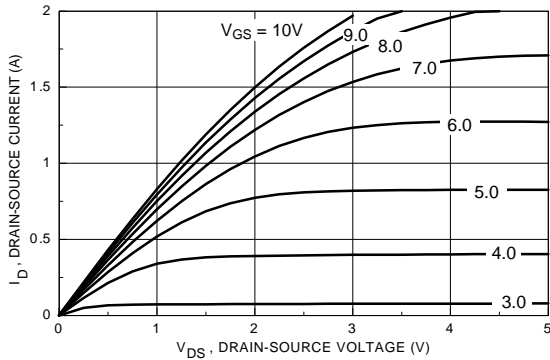


Figure 1. On-Region Characteristics

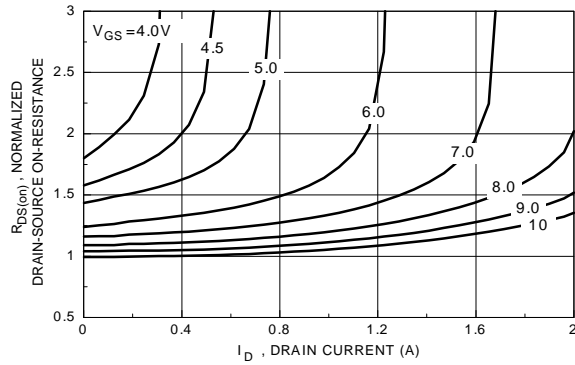


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

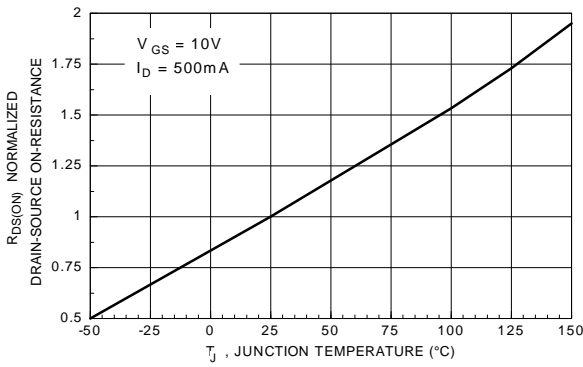


Figure 3. On-Resistance Variation with Temperature

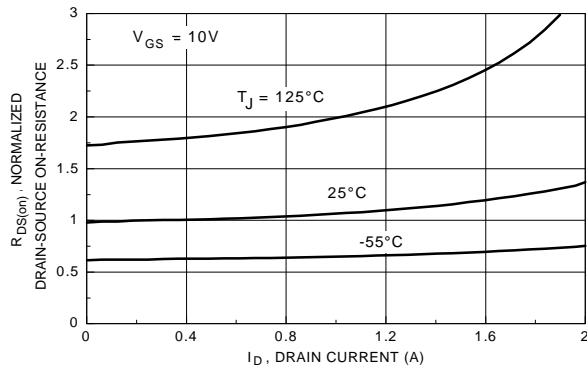


Figure 4. On-Resistance Variation with Drain Current and Temperature

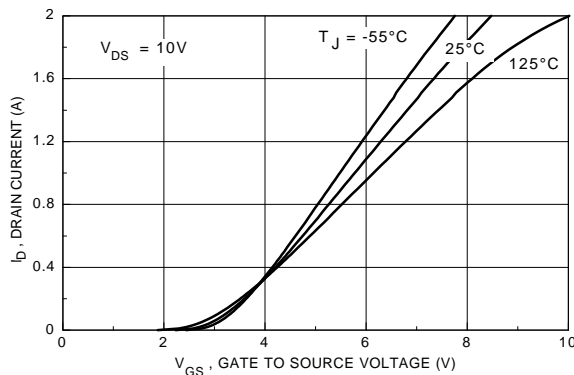


Figure 5. Transfer Characteristics

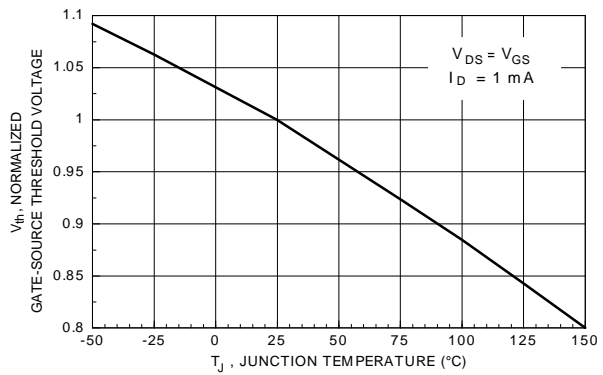


Figure 6. Gate Threshold Variation with Temperature

## Typical Electrical Characteristics (continued)

2N7000 / 2N7002 / NDS7002A

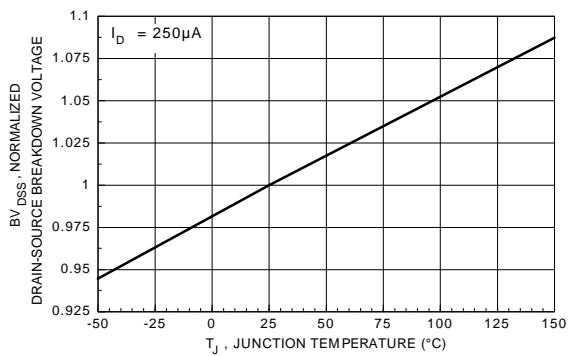


Figure 7. Breakdown Voltage Variation with Temperature

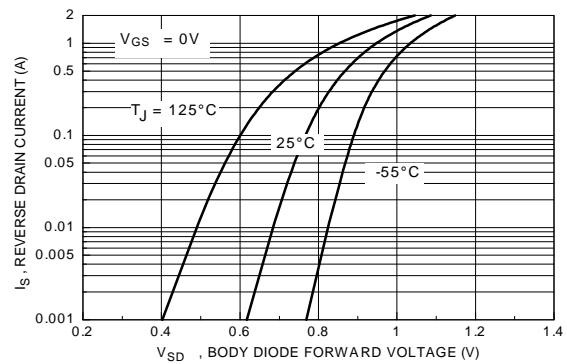


Figure 8. Body Diode Forward Voltage Variation with Temperature

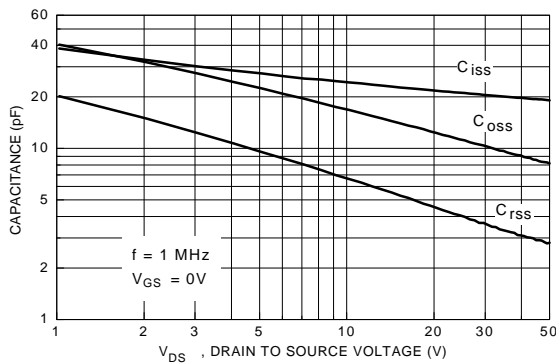


Figure 9. Capacitance Characteristics

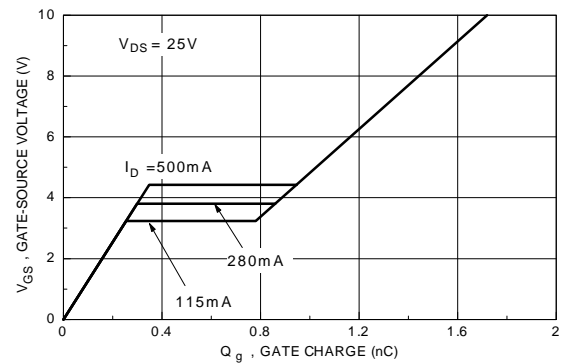


Figure 10. Gate Charge Characteristics

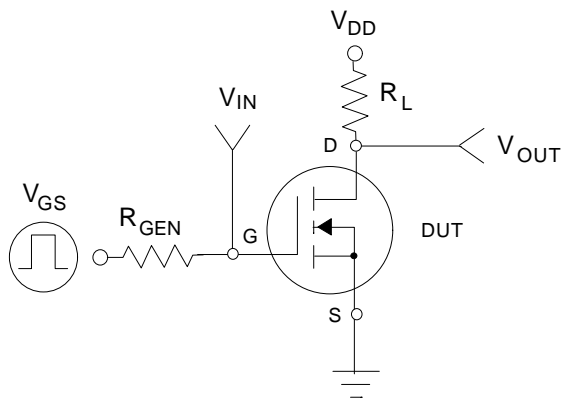


Figure 11.

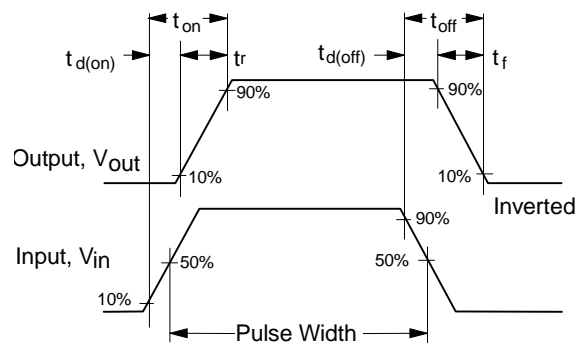
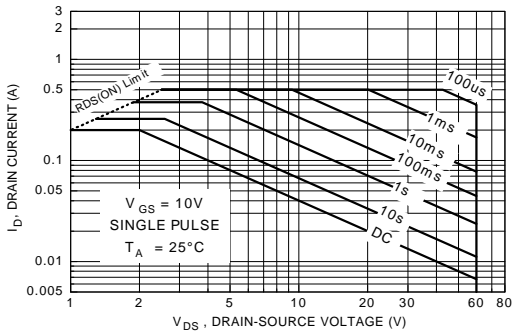
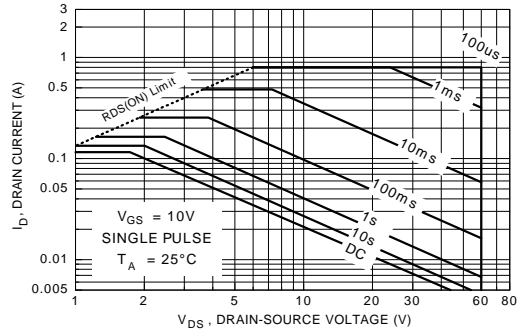


Figure 12. Switching Waveforms

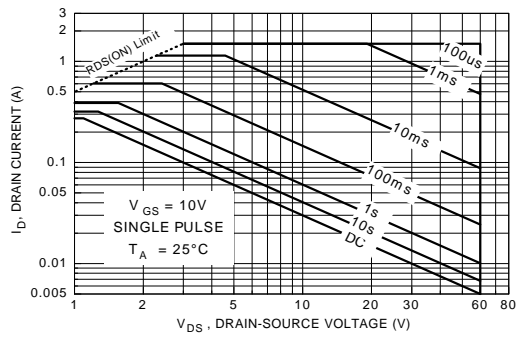
### Typical Electrical Characteristics (continued)



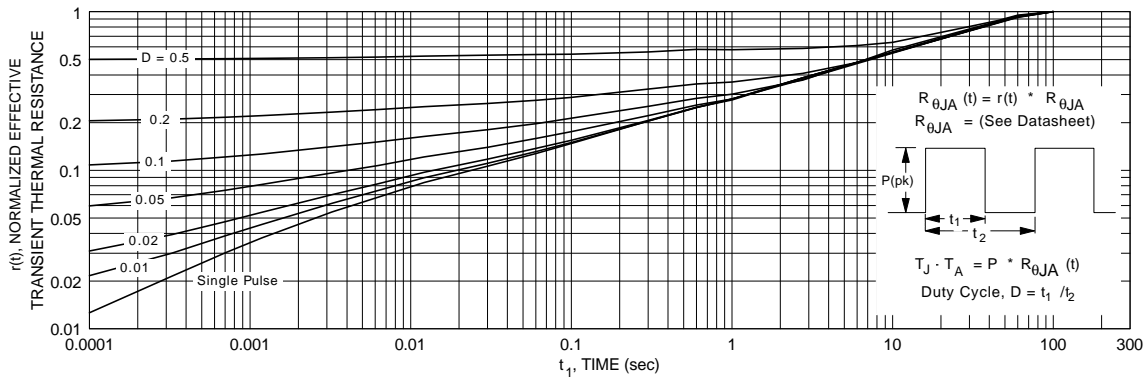
**Figure 13. 2N7000 Maximum Safe Operating Area**



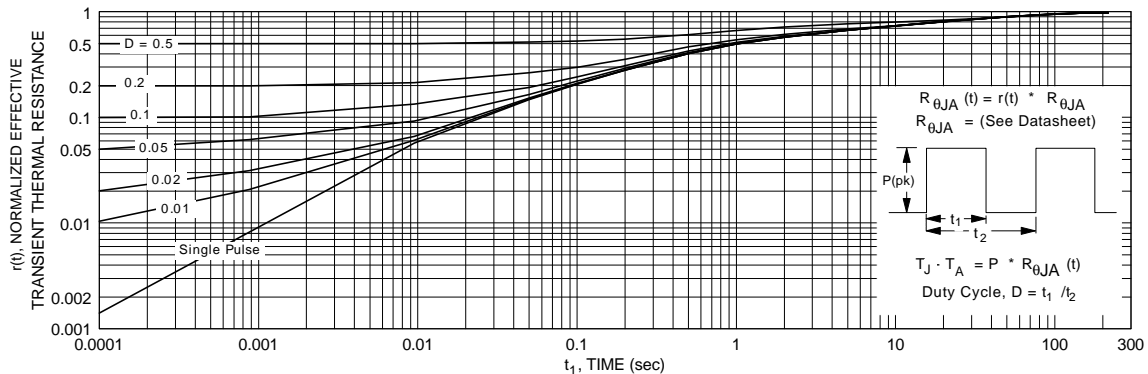
**Figure 14. 2N7002 Maximum Safe Operating Area**



**Figure 15. NDS7000A Maximum Safe Operating Area**



**Figure 16. TO-92, 2N7000 Transient Thermal Response Curve**



**Figure 17. SOT-23, 2N7002 / NDS7002A Transient Thermal Response Curve**

# TO-92 Tape and Reel Data and Package Dimensions

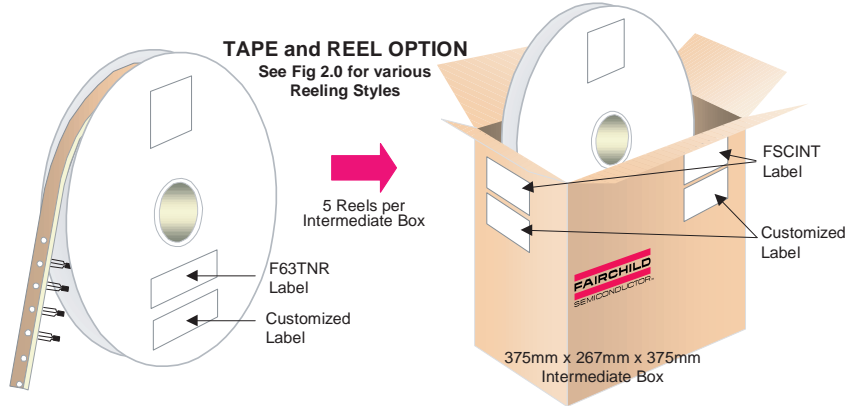


## TO-92 Packaging Configuration: Figure 1.0

FSCINT Label sample



F63TNR Label sample



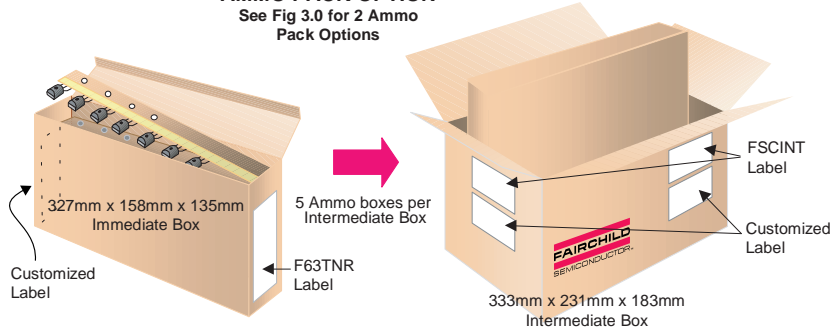
### TO-92 TNR/AMMO PACKING INFORMATION

| 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

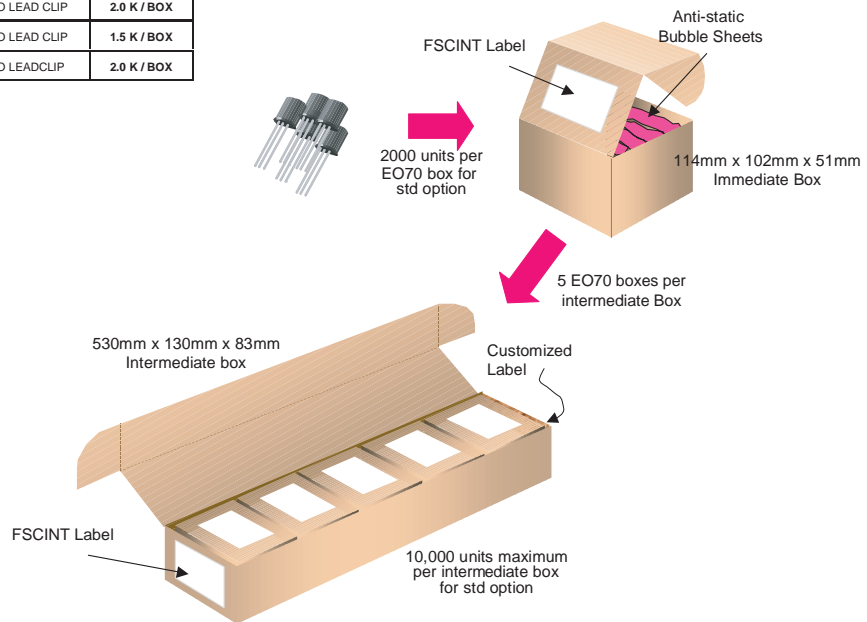


### (TO-92) BULK PACKING INFORMATION

| 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 | NO LEADCLIP        | 2.0 K / BOX |

### BULK OPTION

See Bulk Packing Information table

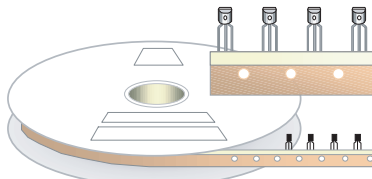


## TO-92 Tape and Reel Data and Package Dimensions, continued

### TO-92 Reeling Style

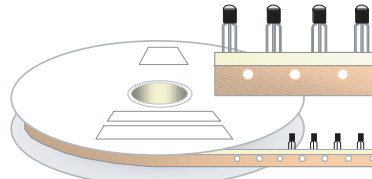
Configuration: Figure 2.0

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



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

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

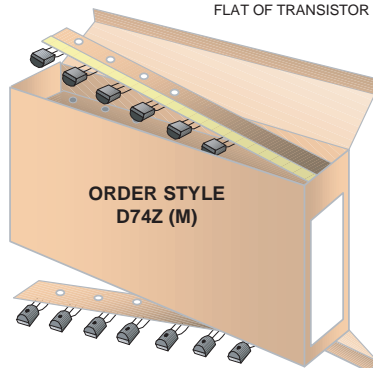


Style "E", D27Z, D71Z (s/h)

### TO-92 Radial Ammo Packaging

Configuration: Figure 3.0

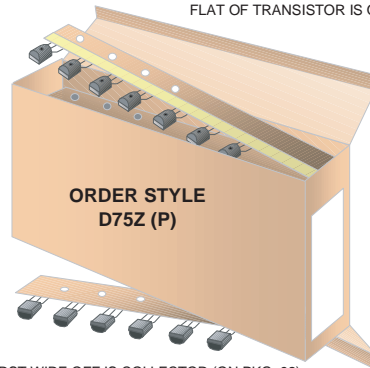
FIRST WIRE OFF IS COLLECTOR  
ADHESIVE TAPE IS ON THE TOP SIDE  
FLAT OF TRANSISTOR IS ON TOP



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



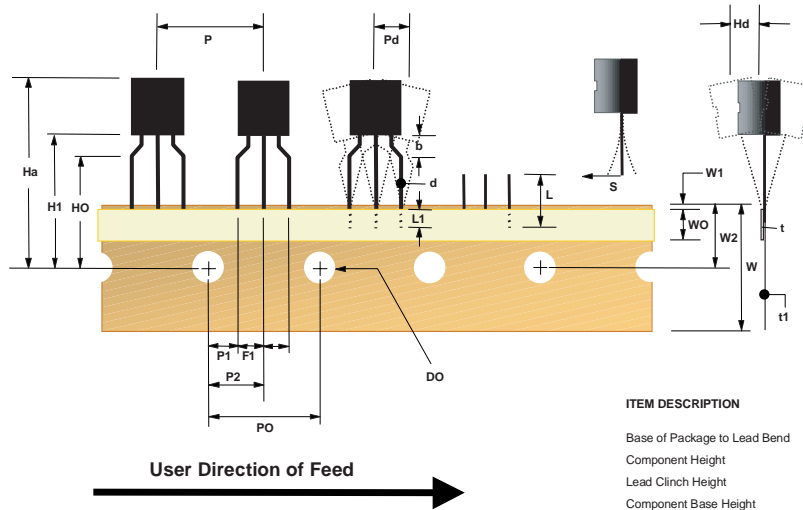
ORDER STYLE  
D75Z (P)

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 and Package Dimensions, continued

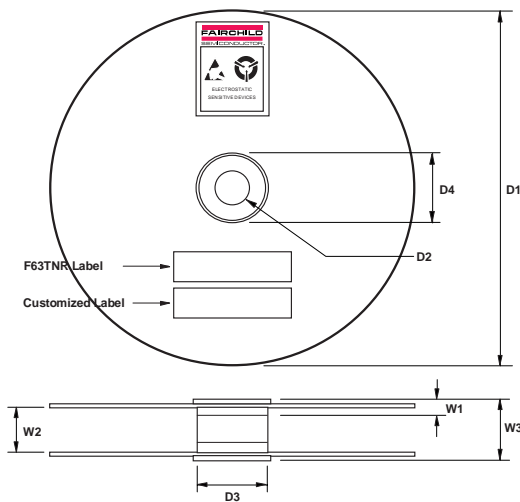
**TO-92 Tape and Reel Taping  
Dimension Configuration: Figure 4.0**



| 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**

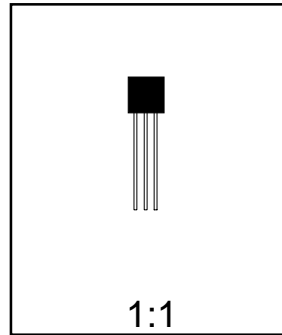
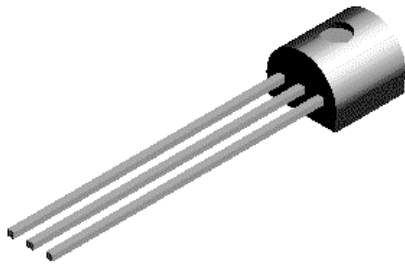


| ITEM DESCRIPTION               | SYMBOL | MINIMUM | MAXIMUM |
|--------------------------------|--------|---------|---------|
| Reel Diameter                  | D1     | 13.975  | 14.025  |
| Arbor Hole Diameter (Standard) | D2     | 1.160   | 1.200   |
| (Small Hole)                   | D2     | 0.650   | 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 Tape and Reel Data and Package Dimensions

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



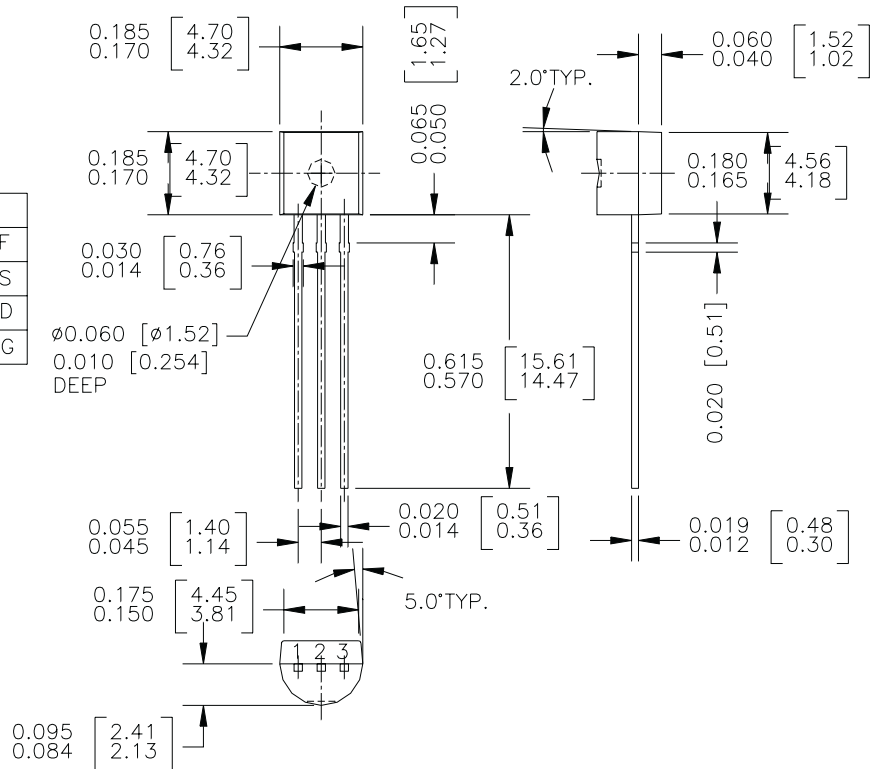
Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.1977

TO-92 (92,94,96)

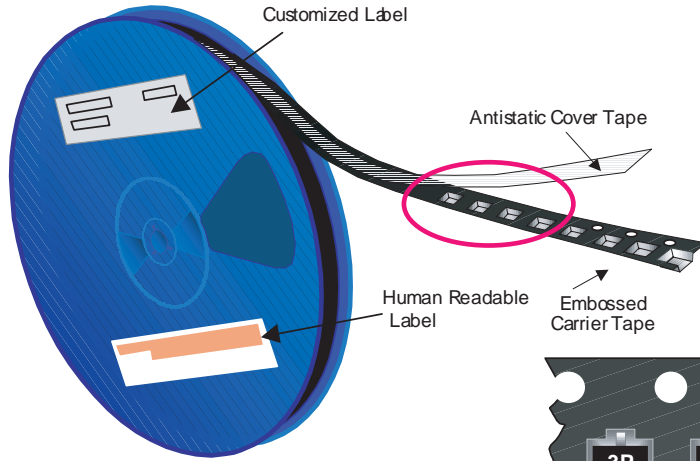
| PIN | 92 |   | 94 |   | 96 |   |
|-----|----|---|----|---|----|---|
|     | B  | F | B  | F | B  | F |
| 1   | E  | D | E  | D | B  | S |
| 2   | B  | S | C  | G | E  | D |
| 3   | C  | G | B  | S | C  | G |



# SOT-23 Tape and Reel Data and Package Dimensions



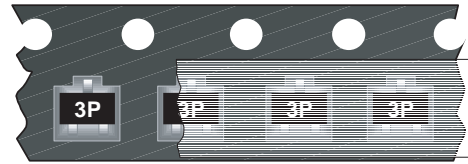
## SOT-23 Packaging Configuration: Figure 10



### Packaging Description:

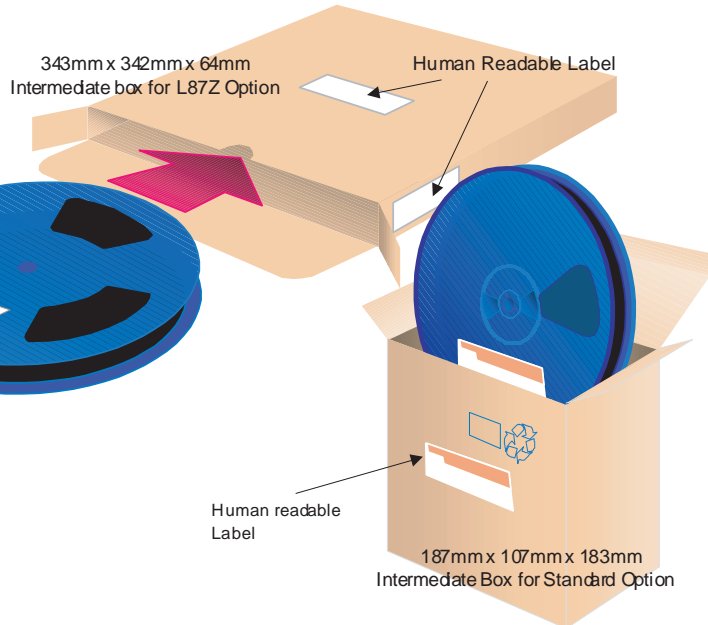
SOT-23 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in 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 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                |                         |            |

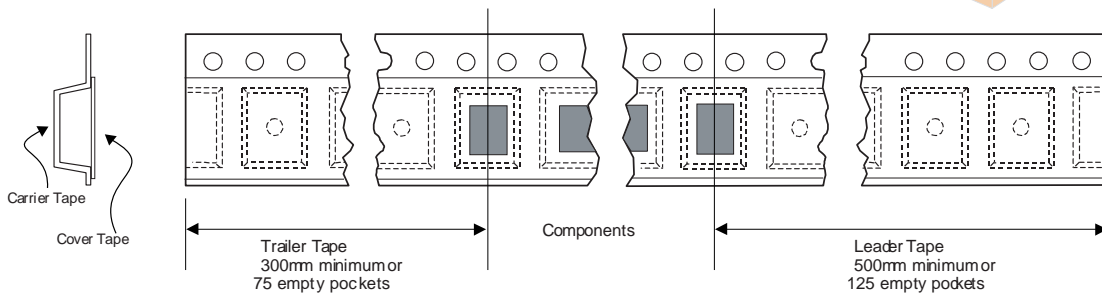
### SOT-23 Unit Orientation



### Human Readable Label sample

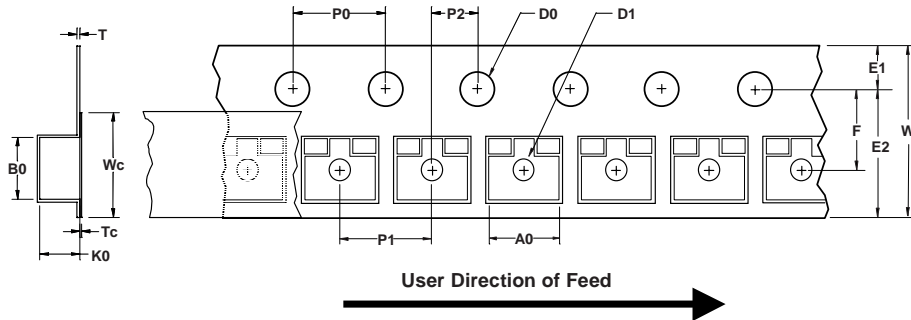


### SOT-23 Tape Leader and Trailer Configuration: Figure 20



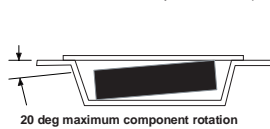
# SOT-23 Tape and Reel Data and Package Dimensions, continued

## SOT-23 Embossed Carrier Tape Configuration: Figure 3.0

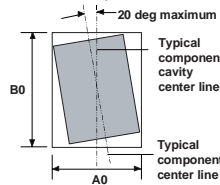


| Dimensions are in millimeter |               |               |             |               |                 |               |             |               |             |             |               |                 |             |               |
|------------------------------|---------------|---------------|-------------|---------------|-----------------|---------------|-------------|---------------|-------------|-------------|---------------|-----------------|-------------|---------------|
| 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 |

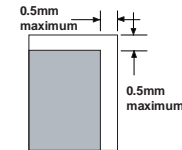
Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)  
Component Rotation

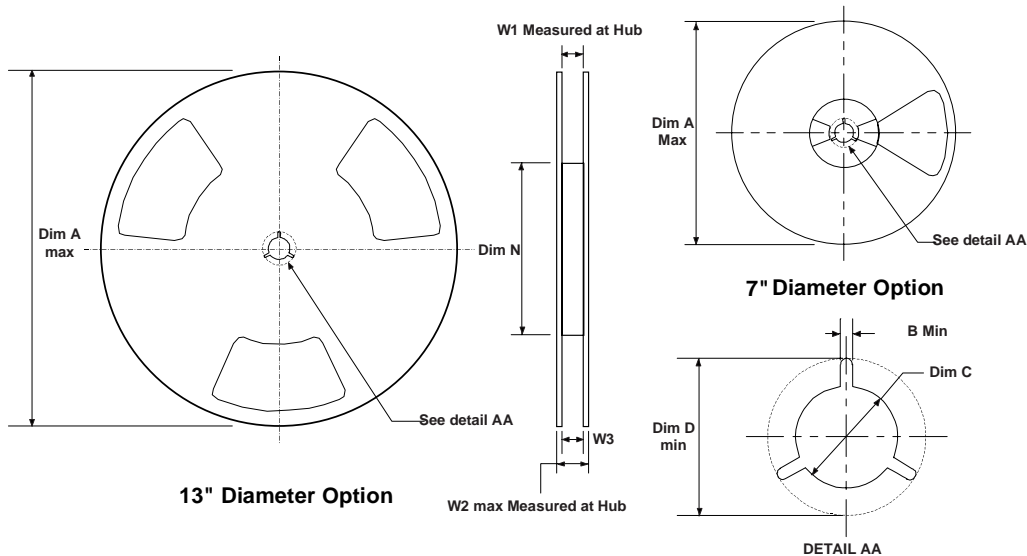


Sketch B (Top View)  
Component Rotation



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 |



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| FACT™                | QFET™         |            |
| FACT Quiet Series™   | QS™           |            |
| FAST®                | Quiet Series™ |            |
| FASTr™               | SuperSOT™-3   |            |
| GTO™                 | SuperSOT™-6   |            |
| HiSeC™               | SuperSOT™-8   |            |

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