



ON Semiconductor®

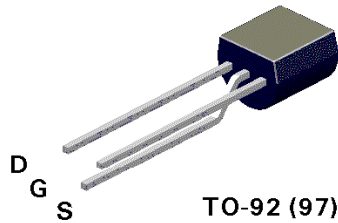
## BS270 N-Channel Enhancement Mode Field Effect Transistor

### General Description

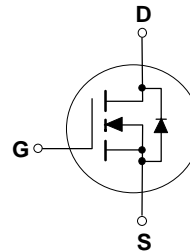
These N-Channel enhancement mode field effect transistors are produced using ON Semiconductor's proprietary, high cell density, DMOS technology. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance. They can be used in most applications 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.



TO-92 (97)



### 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	$\pm 20$	V
	- Non Repetitive ( $t_p < 50\mu s$ )	$\pm 40$	
$I_D$	Drain Current - Continuous	400	mA
	- Pulsed	2000	
$P_D$	Maximum Power Dissipation	625	mW
	Derate Above $25^\circ\text{C}$	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	$^\circ\text{C}/\text{W}$
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**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	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ $T_J = 125^\circ\text{C}$			1	$\mu\text{A}$
					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	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $T_J = 125^\circ\text{C}$		1.2	2	$\Omega$
			$V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		1.8	
$V_{DS(on)}$	Drain-Source On-Voltage	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		0.6	1	V
				0.14	0.225	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} \geq 2 V_{DS(on)}$ $V_{GS} = 4.5\text{ V}, V_{DS} \geq 2 V_{DS(on)}$	2000	2700		mA
			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	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		20	50	pF
$C_{oss}$	Output Capacitance			11	25	
$C_{rss}$	Reverse Transfer Capacitance			4	5	
<b>SWITCHING CHARACTERISTICS</b> (Note 1)						
$t_{on}$	Turn-On Time	$V_{DD} = 30\text{ V}, I_D = 500\text{ mA},$ $V_{GS} = 10\text{ V}, R_{GEN} = 25\ \Omega$			10	ns
$t_{off}$	Turn-Off Time				10	
<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	
$V_{SD}$	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

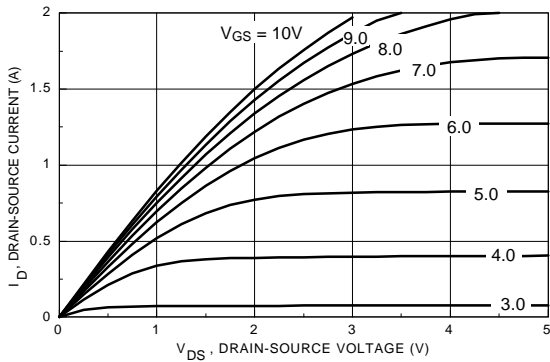


Figure 1. On-Region Characteristics.

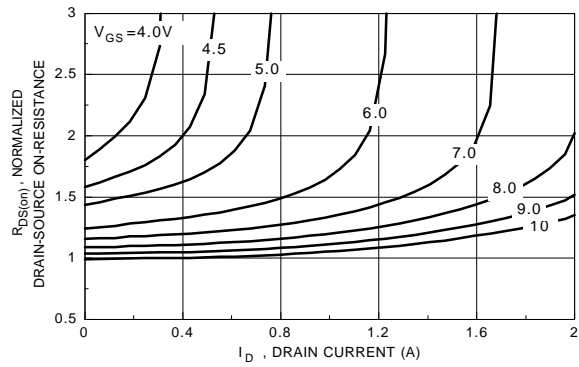


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

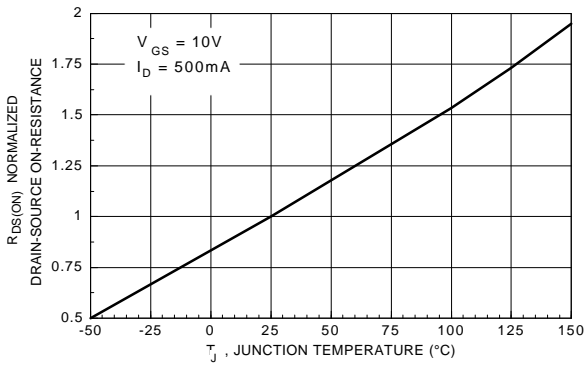


Figure 3. On-Resistance Variation with Temperature.

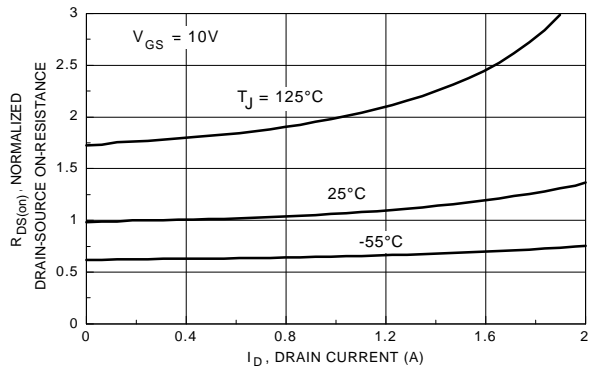


Figure 4. On-Resistance Variation with Drain Current and Temperature.

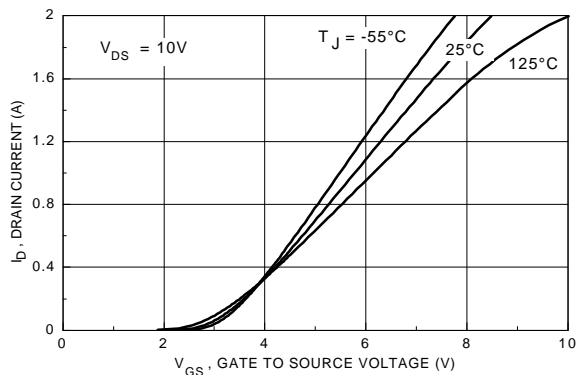


Figure 5. Transfer Characteristics.

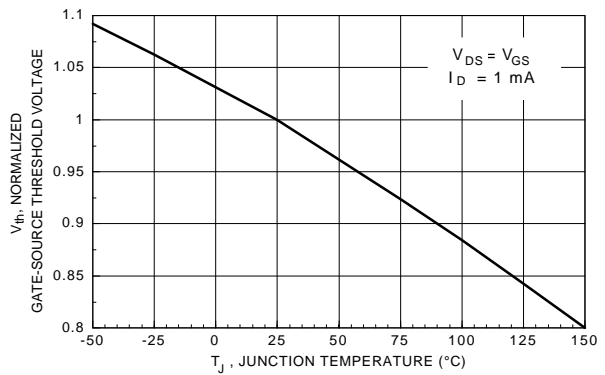
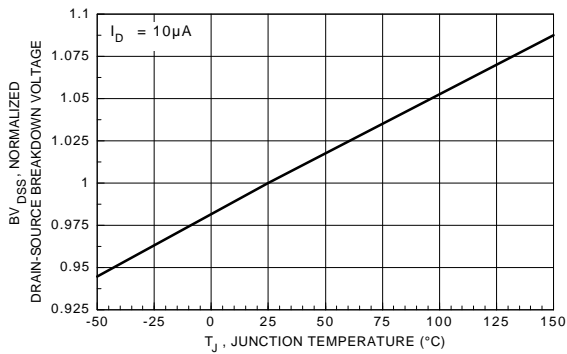
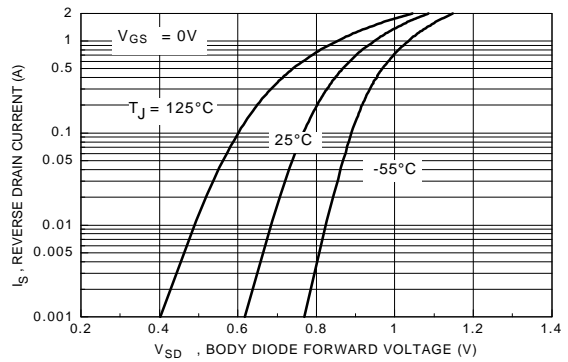


Figure 6. Gate Threshold Variation with Temperature.

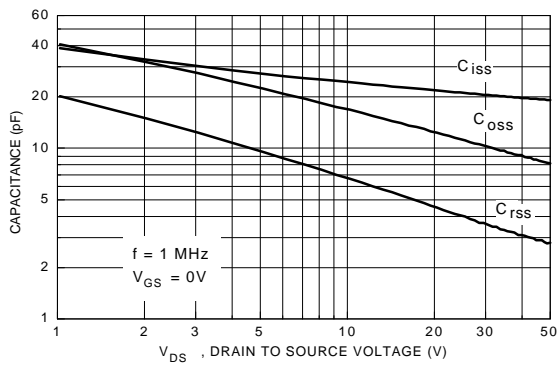
## Typical Electrical Characteristics (continued)



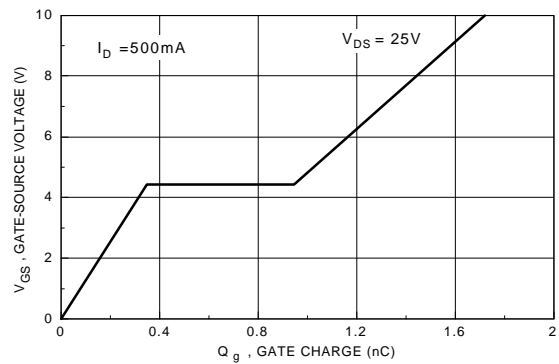
**Figure 7. Breakdown Voltage Variation with Temperature.**



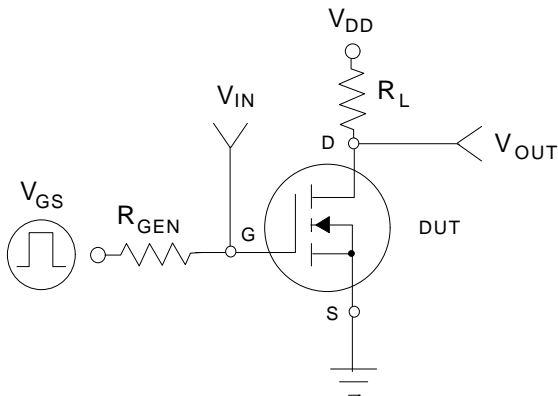
**Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.**



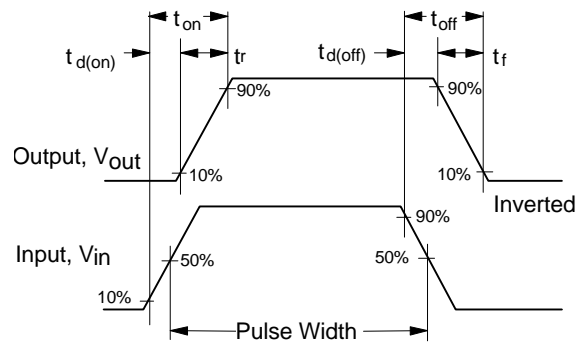
**Figure 9. Capacitance Characteristics.**



**Figure 10. Gate Charge Characteristics.**



**Figure 11. Switching Test Circuit.**



**Figure 12. Switching Waveforms.**

## Typical Electrical Characteristics (continued)

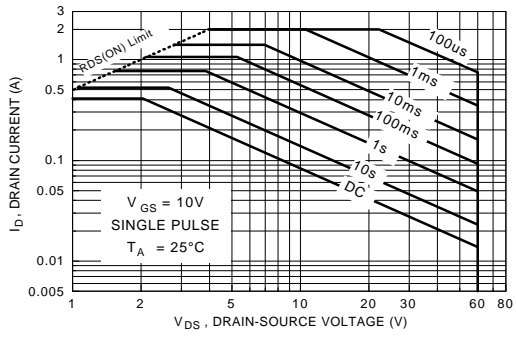


Figure 13. Maximum Safe Operating Area.

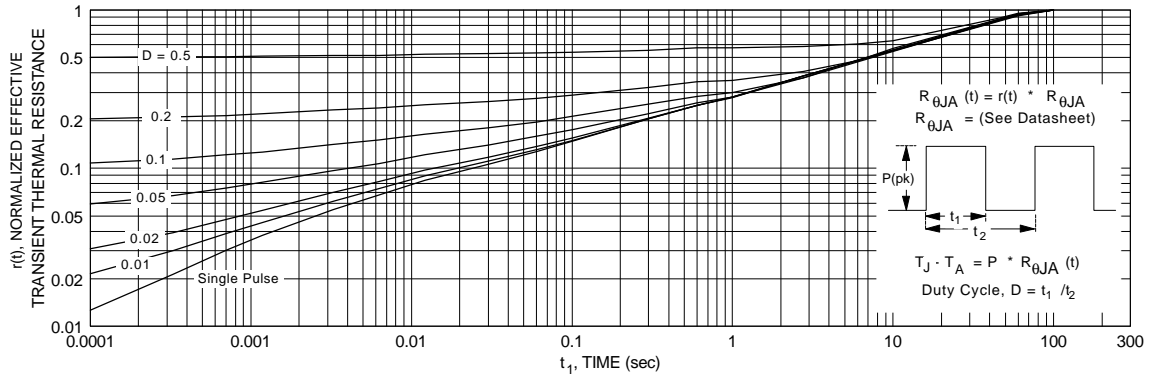


Figure 14. Transient Thermal Response Curve.

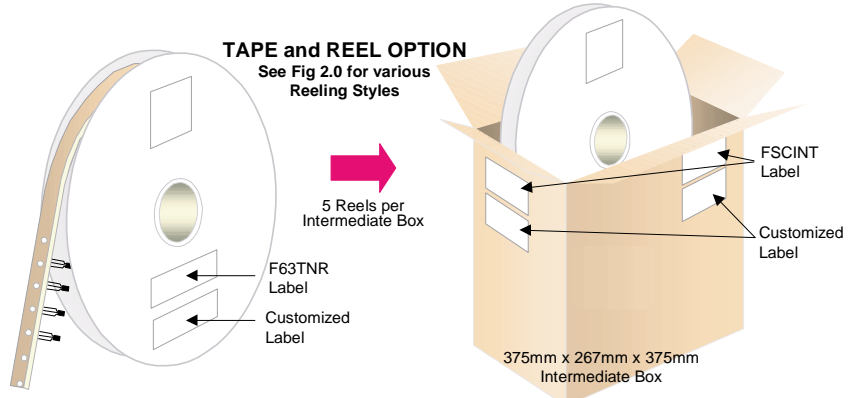
# TO-92 Tape and Reel Data

## TO-92 Packaging Configuration: Figure 1.0

FSCINT Label sample



F63TNR Label sample



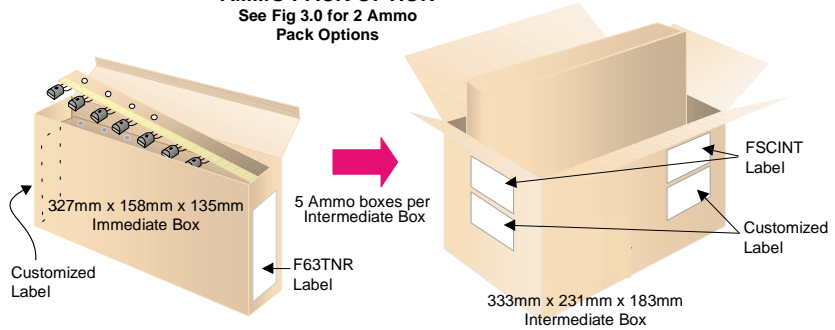
### TO-92 TNR/AMMO PACKING INFORMATION

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

### AMMO PACK OPTION

See Fig 3.0 for 2 Ammo Pack Options

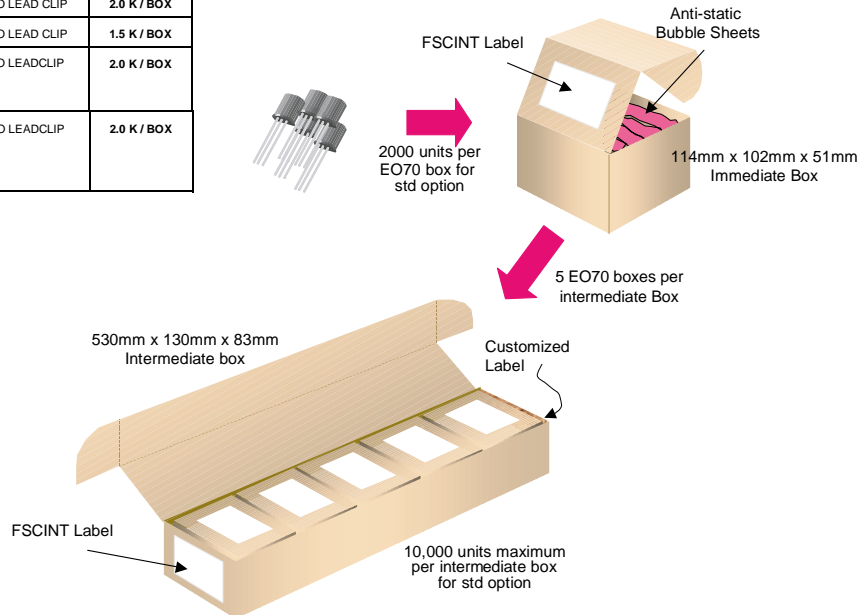


### (TO-92) BULK PACKING INFORMATION

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

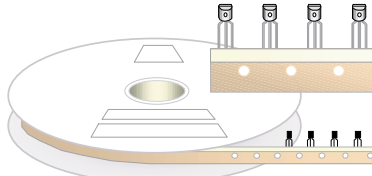


## TO-92 Tape and Reel Data, continued

### TO-92 Reeling Style

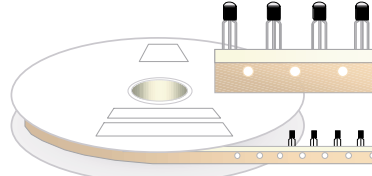
Configuration: Figure 2.0

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



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

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

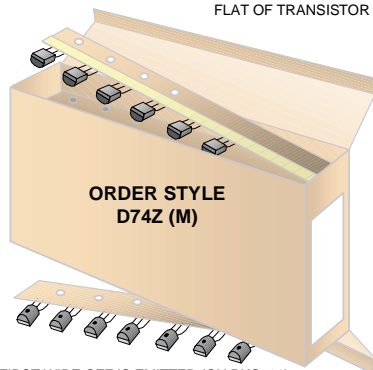


Style "E", D27Z, D71Z (s/h)

### TO-92 Radial Ammo Packaging

Configuration: Figure 3.0

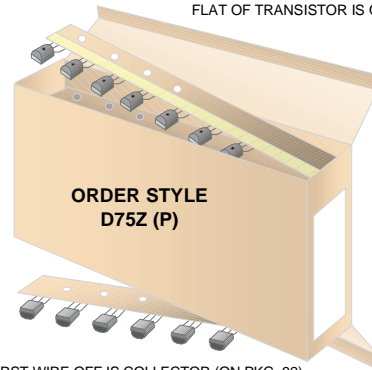
FIRST WIRE OFF IS COLLECTOR  
ADHESIVE TAPE IS ON THE TOP SIDE  
FLAT OF TRANSISTOR IS ON TOP



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

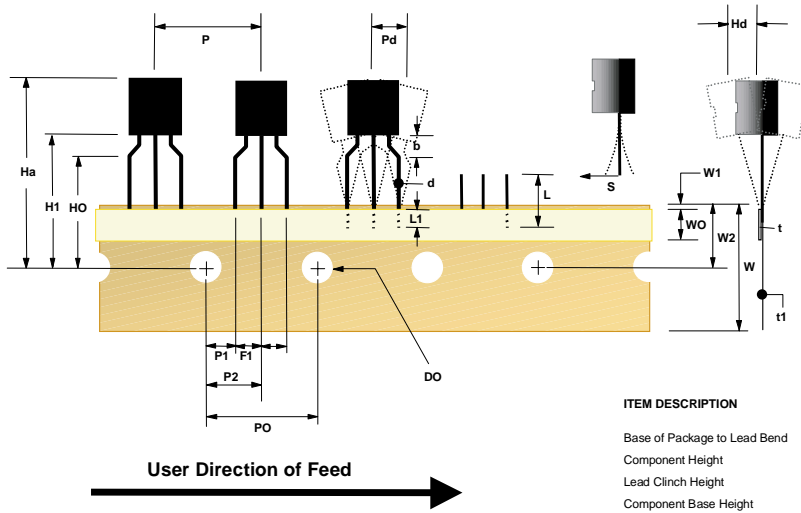


ORDER STYLE  
D75Z (P)

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

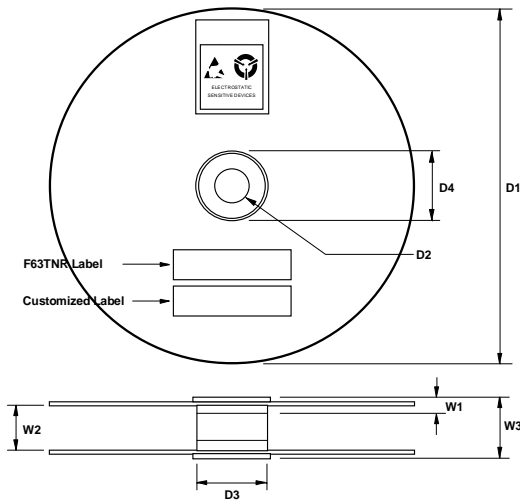
# TO-92 Tape and Reel Data, continued

## 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.

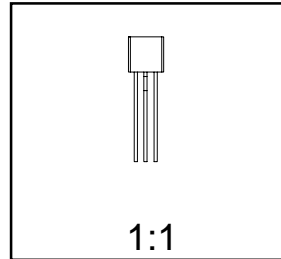
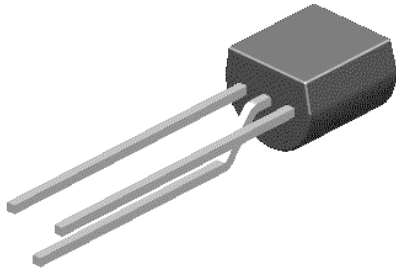
ITEM DESCRIPTION	SYMBOL	MINIMUM	MAXIMUM
Reel Diameter	D1	13.975	14.025
Arbor Hole Diameter (Standard)	D2	1.160	1.200
(Small Hole)	D2	0.650	0.700
Core Diameter	D3	3.100	3.300
Hub Recess Inner Diameter	D4	2.700	3.100
Hub Recess Depth	W1	0.370	0.570
Flange to Flange Inner Width	W2	1.630	1.690
Hub to Hub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

Note: All dimensions are in inches



# TO-92 Package Dimensions

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

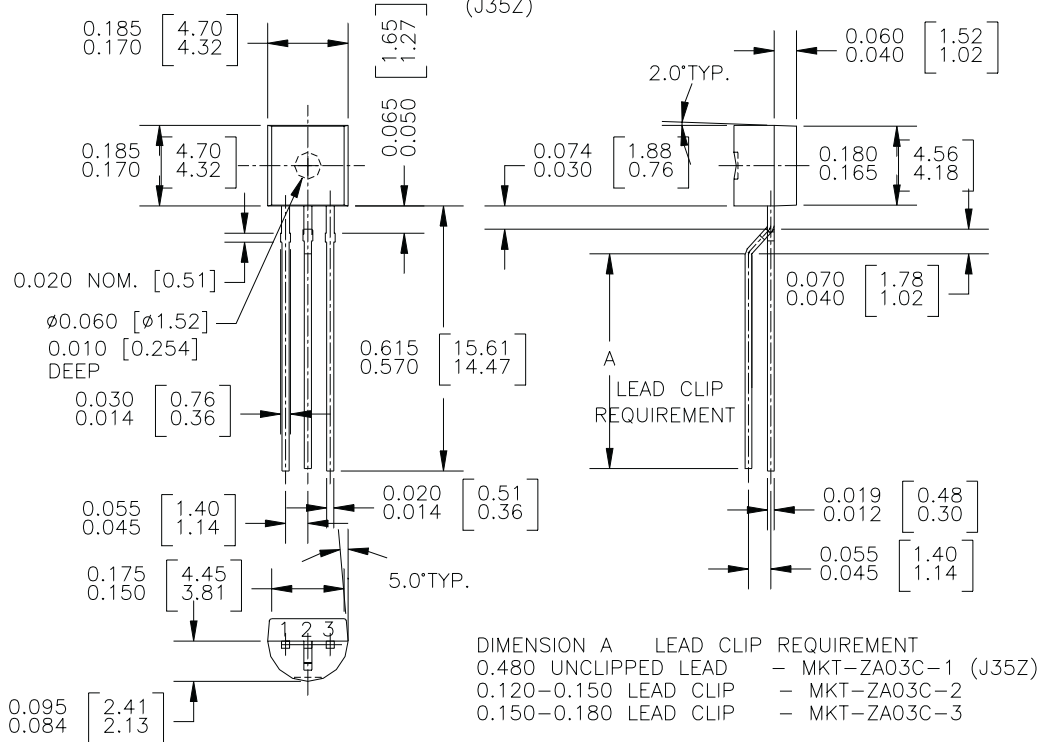


Scale 1:1 on letter size paper

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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