



## TN2219A (TN2222A)



### NPN General Purpose Amplifier

This device is for use as a medium power amplifier and switch requiring collector currents up to 500 mA. Sourced from Process 19. See PN2222A for characteristics.

#### Absolute Maximum Ratings\*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
$V_{CEO}$	Collector-Emitter Voltage	40	V
$V_{CBO}$	Collector-Base Voltage	75	V
$V_{EBO}$	Emitter-Base Voltage	6.0	V
$I_C$	Collector Current - Continuous	1.0	A
$T_J, T_{stg}$	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
		TN2219A	
$P_D$	Total Device Dissipation Derate above 25°C	1.0 8.0	W W/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	50	°C/W

# NPN General Purpose Amplifier

(continued)

TN2219A

## Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
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### OFF CHARACTERISTICS

$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	$I_C = 10 \text{ mA}$ , $I_B = 0$	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10 \text{ }\mu\text{A}$ , $I_E = 0$	75		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \text{ }\mu\text{A}$ , $I_C = 0$	6.0		V
$I_{CEX}$	Collector Cutoff Current	$V_{CE} = 60 \text{ V}$ , $V_{EB(OFF)} = 3.0 \text{ V}$		10	nA
$I_{CBO}$	Collector Cutoff Current	$V_{CB} = 60 \text{ V}$ , $I_E = 0$ $V_{CB} = 60 \text{ V}$ , $I_E = 0$ , $T_A = 150^\circ\text{C}$		10 10	nA $\mu\text{A}$
$I_{EBO}$	Emitter Cutoff Current	$V_{EB} = 3.0 \text{ V}$ , $I_C = 0$		10	nA
$I_{BL}$	Base Cutoff Current	$V_{CE} = 60 \text{ V}$ , $V_{EB(OFF)} = 3.0$		20	nA

### ON CHARACTERISTICS

$h_{FE}$	DC Current Gain	$I_C = 0.1 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ $I_C = 1.0 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ $I_C = 10 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ $I_C = 150 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ $I_C = 150 \text{ mA}$ , $V_{CE} = 1.0 \text{ V}$ $I_C = 500 \text{ mA}$ , $V_{CE} = 10 \text{ V}$	35 50 75 100 50 40	300	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage*	$I_C = 150 \text{ mA}$ , $I_B = 15 \text{ mA}$ $I_C = 500 \text{ mA}$ , $I_B = 50 \text{ mA}$		0.3 1.0	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage*	$I_C = 150 \text{ mA}$ , $I_B = 1.0 \text{ mA}$ $I_C = 500 \text{ mA}$ , $I_B = 5.0 \text{ mA}$	0.6	1.2 2.0	V V

### SMALL SIGNAL CHARACTERISTICS

$C_{obo}$	Output Capacitance	$V_{CB} = 10 \text{ V}$ , $I_E = 0$ , $f = 100 \text{ kHz}$		8.0	pF
$C_{ibo}$	Input Capacitance	$V_{EB} = 0.5 \text{ V}$ , $I_C = 0$ , $f = 100 \text{ kHz}$		25	pF
$h_{fe}$	Small-Signal Current Gain	$I_C = 1.0 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$ $I_C = 10 \text{ mA}$ , $V_{CE} = 10 \text{ V}$ , $f = 1.0 \text{ kHz}$	50 75	300 375	
$rb'C_C$	Collector Base Time Constant	$I_E = 20 \text{ mA}$ , $V_{CB} = 20 \text{ V}$ , $f = 31.8 \text{ MHz}$		150	pS
NF	Noise Figure	$I_C = 100 \text{ }\mu\text{A}$ , $V_{CE} = 10 \text{ V}$ , $R_S = 1.0 \text{ k}\Omega$ $f = 1.0 \text{ kHz}$ , $B_W = 1.0 \text{ kHz}$		4.0	dB
$Re(h_{ie})$	Real Part of Common-Emitter High Frequency Input Impedance	$I_C = 20 \text{ mA}$ , $V_{CE} = 20 \text{ V}$ , $f = 300 \text{ MHz}$		60	$\Omega$

### SWITCHING CHARACTERISTICS

$t_d$	Delay Time	$V_{CC} = 30 \text{ V}$ , $V_{BE(OFF)} = 0.5 \text{ V}$ ,		10	ns
$t_r$	Rise Time	$I_C = 150 \text{ mA}$ , $I_{B1} = 15 \text{ mA}$		25	ns
$t_s$	Storage Time	$V_{CC} = 30 \text{ V}$ , $I_C = 150 \text{ mA}$ ,		225	ns
$t_f$	Fall Time	$I_{B1} = I_{B2} = 15 \text{ mA}$		60	ns

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

## TO-226AE Tape and Reel Data



TO-226AE Packaging  
Configuration: Figure 1.0

FSCINT Label sample

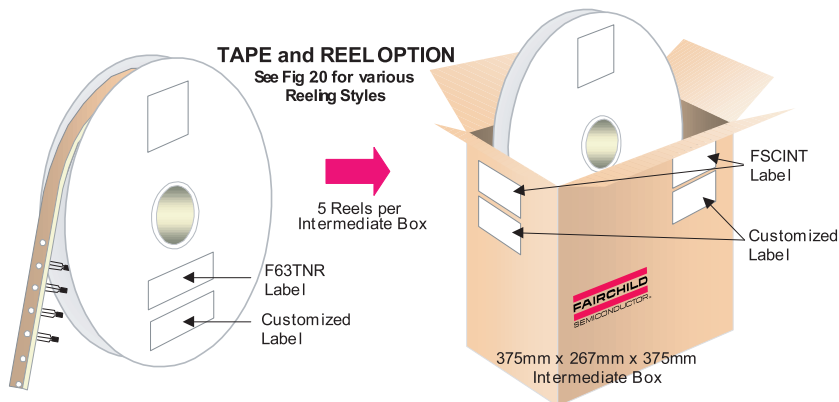


F63TNR Label sample



### TAPE and REEL OPTION

See Fig 20 for various Reeling Styles



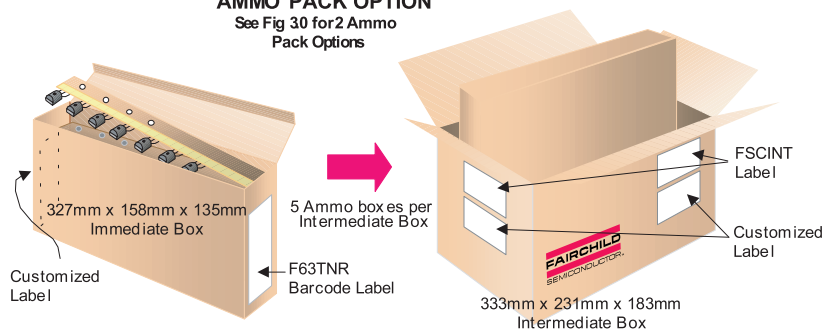
### AMMO PACK OPTION

See Fig 30 for 2 Ammo Pack Options

TO-226AE 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 = 0.300gm  
Reel weight with components = 0.868 kg  
Ammo weight with components = 0.880 kg  
Max quantity per intermediate box = 10,000 units

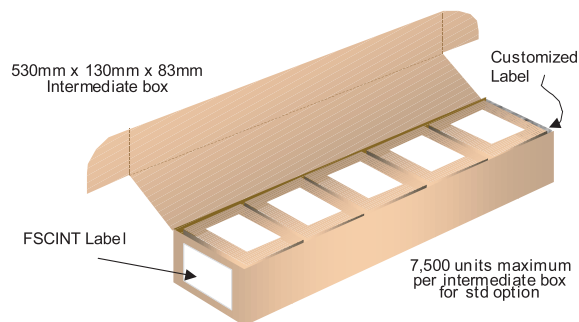
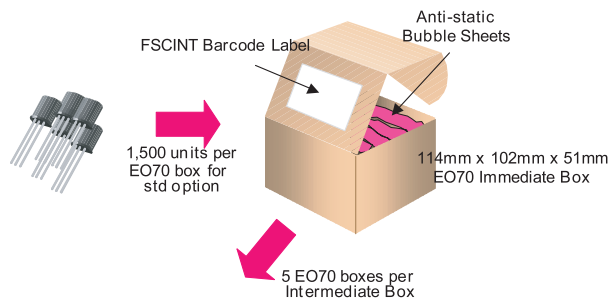


### BULK OPTION

See Bulk Packing Information table

(TO-226AE) BULK PACKING INFORMATION

EOL CODE	DESCRIPTION	LEADCLIP DIMENSION	QUANTITY
J18Z	TO-18 OPTION STD	NO LEAD CLIP	1.0 K / BOX
J05Z	TO-5 OPTION STD	NO LEAD CLIP	1.0 K / BOX
NO EOL CODE	TO-226 STANDARD STRAIGHT	NO LEADCLIP	1.5 K / BOX

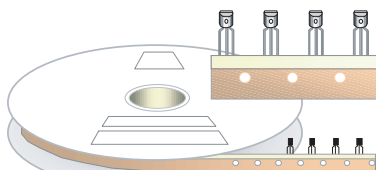


## TO-226AE Tape and Reel Data, continued

### TO-226AE Reeling Style

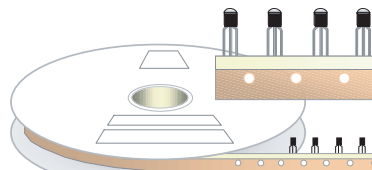
Configuration: Figure 2.0

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



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

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

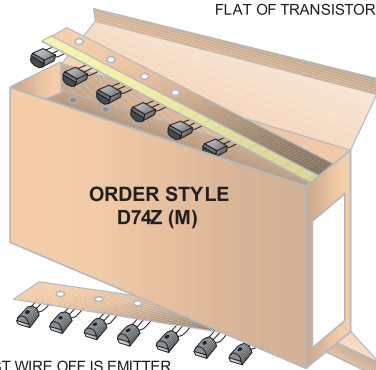


Style "E" D27Z, D71Z (s/h)

### TO-226AE Radial Ammo Packaging

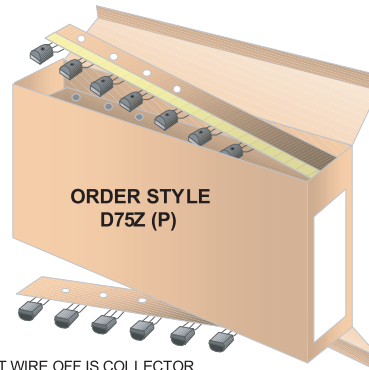
Configuration: Figure 3.0

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



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

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

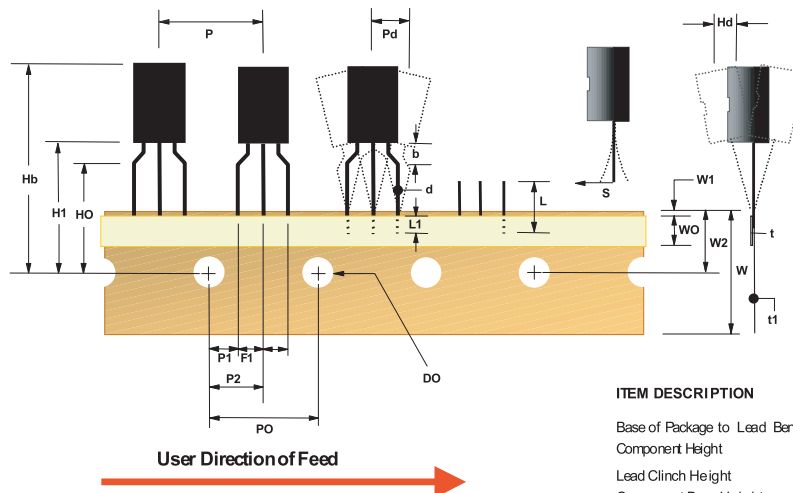


FIRST WIRE OFF IS COLLECTOR  
ADHESIVE TAPE IS ON BOTTOM SIDE  
FLAT OF TRANSISTOR IS ON TOP

## TO-226AE Tape and Reel Data, continued

### TO-226AE Tape and Reel Taping

Dimension Configuration: Figure 4.0

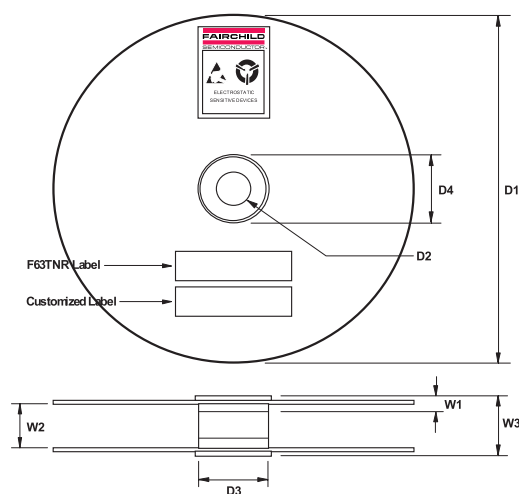


ITEM DESCRIPTION	SYMBOL	DIMENSION
Base of Package to Lead Bend	b	0.098 (max)
Component Height	Hb	1.078 (+/- 0.050)
Lead Clinch Height	HO	0.630 (+/- 0.020)
Component Base Height	H1	0.748 (+/- 0.020)
Component Alignment (side/side)	Pd	0.040 (max)
Component Alignment (front/back)	Hd	0.031 (max)
Component 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)
Out 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	W0	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-226AE Reel

Configuration: Figure 5.0



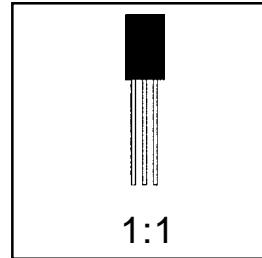
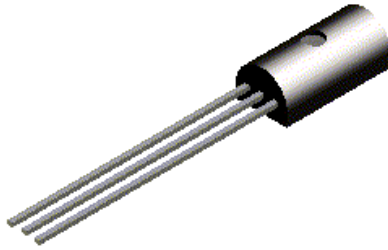
ITEM DESCRIPTION	SYMBOL	MINIMUM	MAXIMUM
Reel Diameter	D1	1.3975	14.025
Arbor Hole Diameter (Standard)	D2	1.160	1.200
(Small Hole)	D2	0.650	0.700
Core Diameter	D3	3.100	3.300
Hub Recess Inner Diameter	D4	2.700	3.100
Hub Recess Depth	W1	0.370	0.570
Flange to Flange Inner Width	W2	1.630	1.690
Hub to Hub Center Width	W3		2.090

Note: All dimensions are in inches

# TO-226AE Package Dimensions



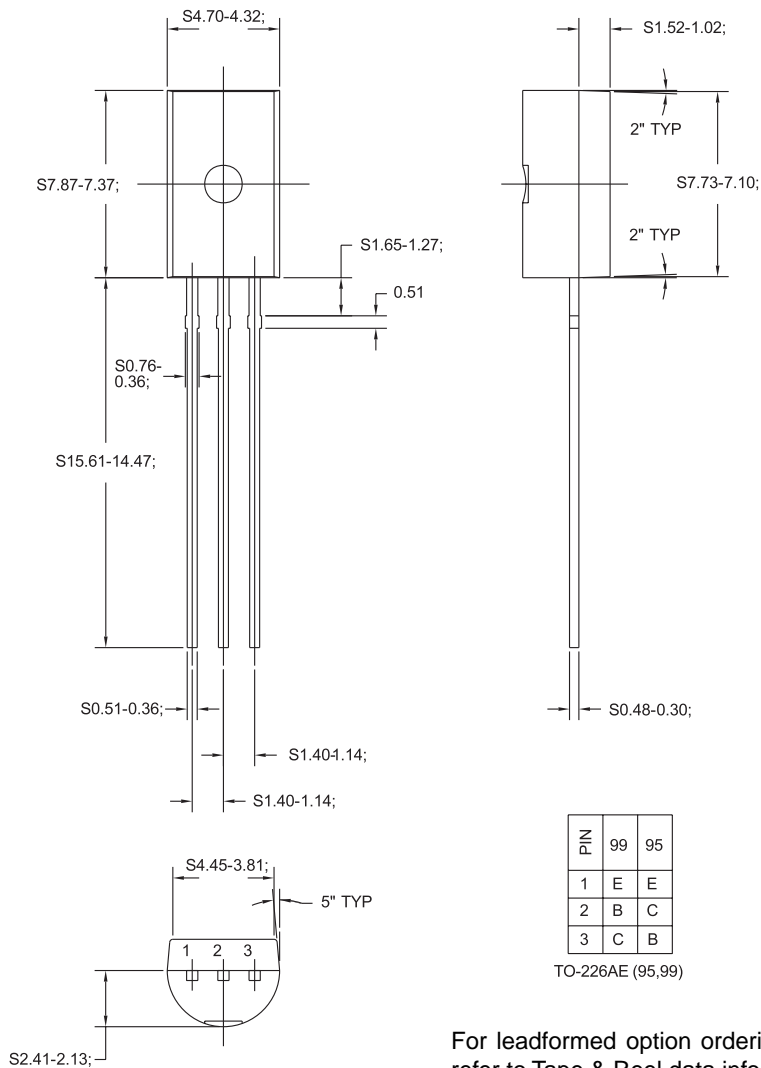
## TO-226AE (FS PKG Code 95, 99)



Scale 1:1 on letter size paper

Dimensions shown below are in:  
inches [millimeters]

Part Weight per unit (gram): 0.300



For leadformed option ordering,  
refer to Tape & Reel data information.

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