Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_B = 0	15		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA, V_{BE} = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	40		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	4.5		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 20 V, I_E = 0 V_{CB} = 20 V, I_E = 0, T_A = 125°C		0.4 30	µA µA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain*	I_C = 10 mA, V_{CE} = 1.0 V I_C = 10 mA, V_{CE} = 0.35 V, T_A = -55°C I_C = 100 mA, V_{CE} = 1.0 V	40 20 20	120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage*	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 1.0 mA, T_A = 125°C I_C = 30 mA, I_B = 3.0 mA I_C = 100 mA, I_B = 10 mA		0.2 0.3 0.25 0.5	V V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 1.0 mA, T_A = -55°C I_C = 10 mA, I_B = 1.0 mA, T_A = 125°C I_C = 30 mA, I_B = 3.0 mA I_C = 100 mA, I_B = 10 mA	0.7 0.59 	0.85 1.02 1.15 1.6	V V V V V
SMALL SIGNAL CHARACTERISTICS					
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz		4.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz		5.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 10 V, R_G = 2.0 kΩ, f = 100 MHz	5.0		
SWITCHING CHARACTERISTICS					
t_s	Storage Time	I_{B1} = I_{B2} = I_C = 10 mA		13	ns
t_{on}	Turn-On Time	V_{CC} = 3.0 V, I_C = 10 mA, I_{B1} = 3.0 mA		12	ns
t_{off}	Turn-Off Time	V_{CC} = 3.0 V, I_C = 10 mA, I_{B1} = 3.0 mA, I_{B2} = 1.5 mA		18	ns

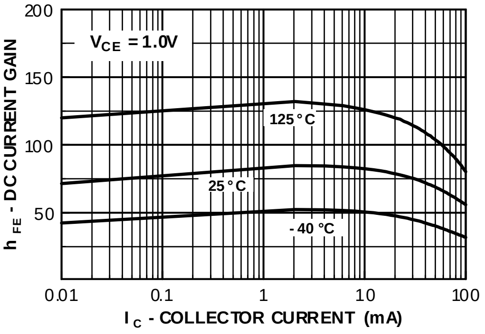
*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

Spice Model

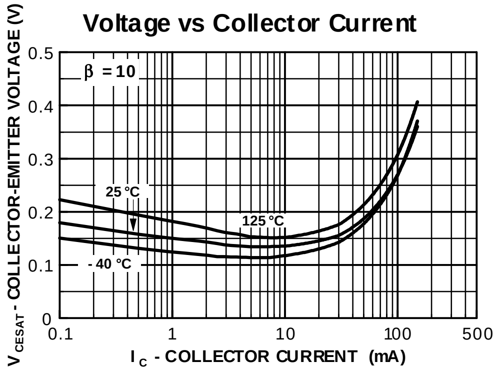
NPN (Is=44.14f Xti=3 Eg=1.11 Vaf=100 Bf=78.32 Ne=1.389 Ise=91.95f Ikf=.3498 Xtb=1.5 Br=12.69m Nc=2 Isc=0 Ikr=0 Rc=.6 Cjc=2.83p Mjc=86.19m Vjc=.75 Fc=.5 Cje=4.5p Mje=.2418 Vje=.75 Tr=1.073u Tf=227.6p Itf=.3 Vtf=4 Xtf=4 Rb=10)

Typical Characteristics

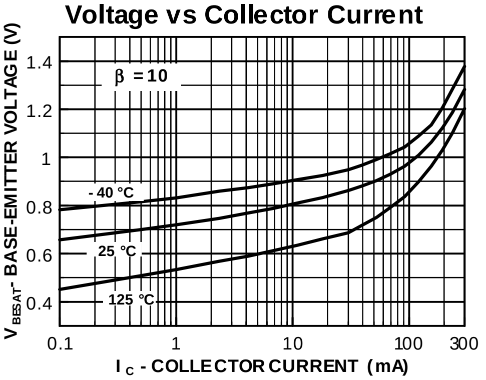
DC Current Gain
vs Collector Current



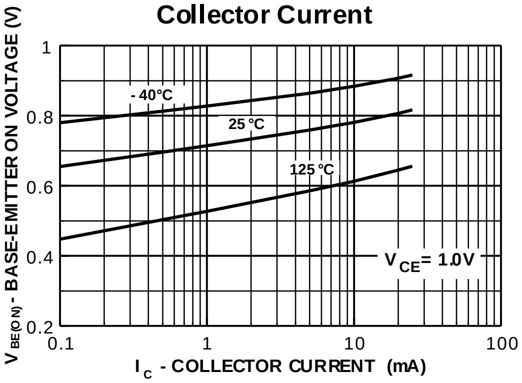
Collector-Emitter Saturation
Voltage vs Collector Current



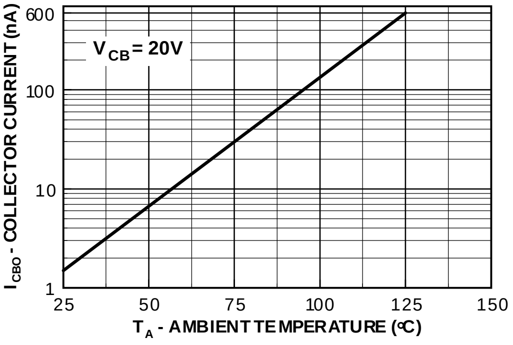
Base-Emitter Saturation
Voltage vs Collector Current



Base-Emitter ON Voltage vs
Collector Current

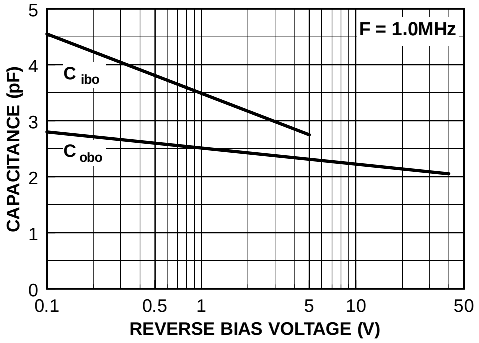


Collector-Cutoff Current
vs Ambient Temperature

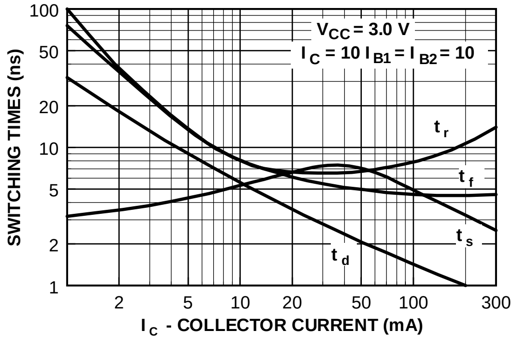


Typical Characteristics (continued)

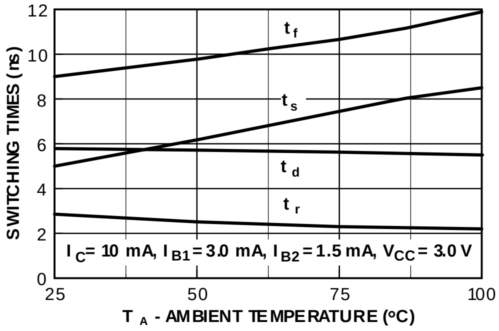
Output Capacitance vs Reverse Bias Voltage



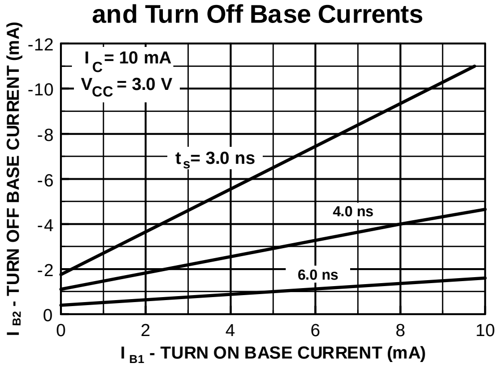
Switching Times vs Collector Current



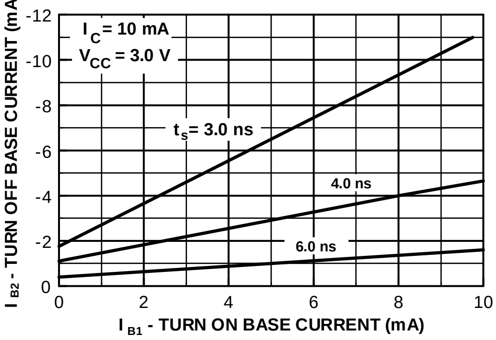
Switching Times vs Ambient Temperature



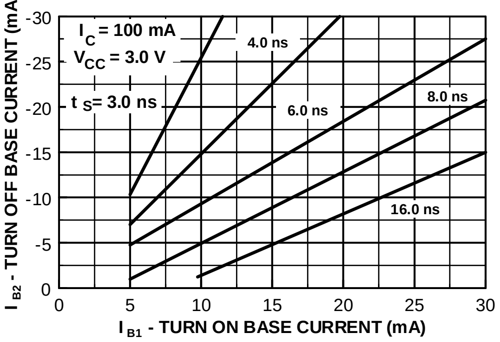
Storage Time vs Turn On and Turn Off Base Currents



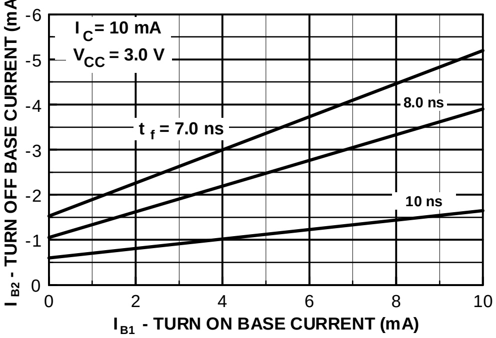
Storage Time vs Turn On and Turn Off Base Currents

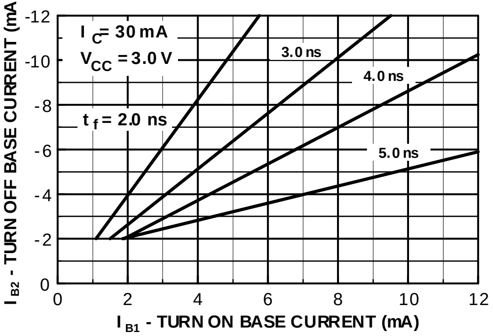


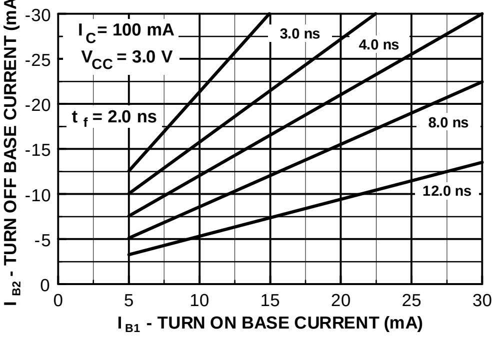
Storage Time vs Turn On and Turn Off Base Currents

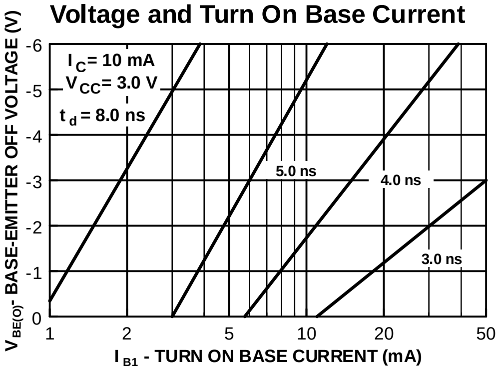


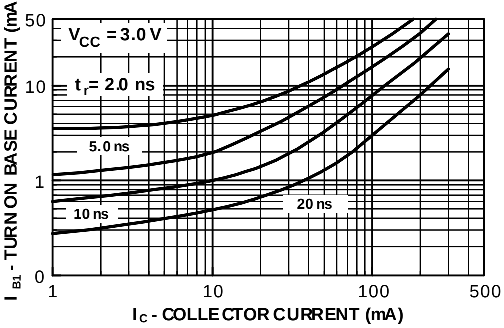
Typical Characteristics (continued)

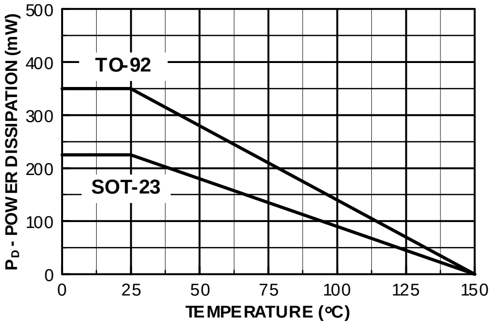

Fall Time vs Turn On and Turn Off Base Currents


Fall Time vs Turn On and Turn Off Base Currents

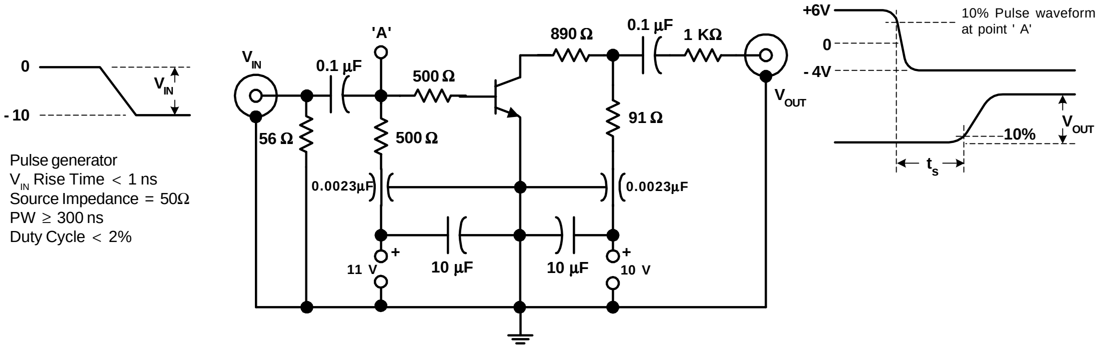

Fall Time vs Turn On and Turn Off Base Currents


Delay Time vs Base-Emitter OFF Voltage and Turn On Base Current


Rise Time vs. Turn On Base Current and Collector Current

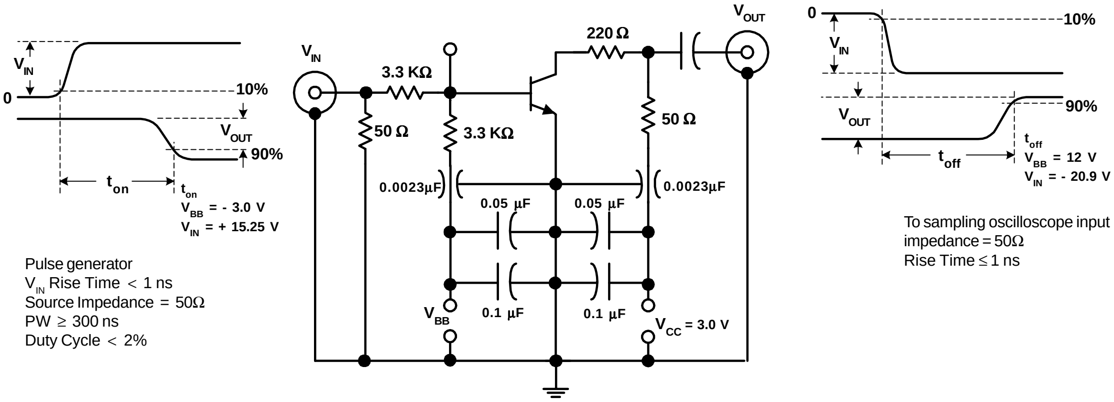

Power Dissipation vs Ambient Temperature

Test Circuits



Pulse generator
V_{IN} Rise Time < 1 ns
Source Impedance = 50Ω
PW ≥ 300 ns
Duty Cycle < 2%

FIGURE 1: Charge Storage Time Measurement Circuit



t_{on}
V_{BB} = - 3.0 V
V_{IN} = + 15.25 V

t_{off}
V_{BB} = 12 V
V_{IN} = - 20.9 V

Pulse generator
V_{IN} Rise Time < 1 ns
Source Impedance = 50Ω
PW ≥ 300 ns
Duty Cycle < 2%

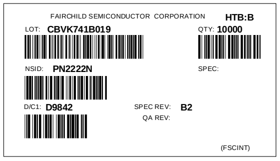
To sampling oscilloscope input impedance = 50Ω
Rise Time ≤ 1 ns

FIGURE 2: t_{ON}, t_{OFF} Measurement Circuit

TO-92 Tape and Reel Data

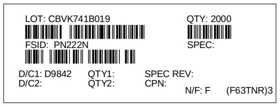
TO-92 Packaging
Configuration: Figure 1.0

FSCINT Label sample

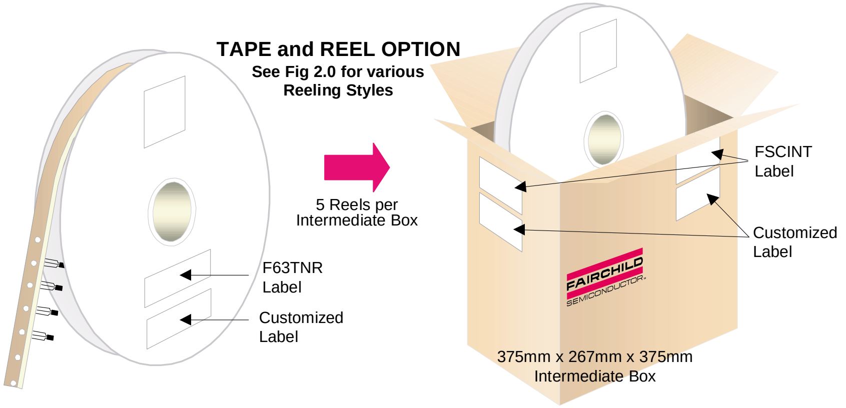


FAIRCHILD SEMICONDUCTOR CORPORATION HTB:B
LOT: CBVK741B019 QTY: 10000
NSID: PN2222N SPEC:
D/C1: D9842 SPEC REV: B2
QA REV:
(FSCINT)

F63TNR Label sample



LOT: CBVK741B019 QTY: 2000
FSID: PN222N SPEC:
D/C1: D9842 QTY1: SPEC REV:
D/C2: QTY2: CPN:
N/F: F (F63TNR)3



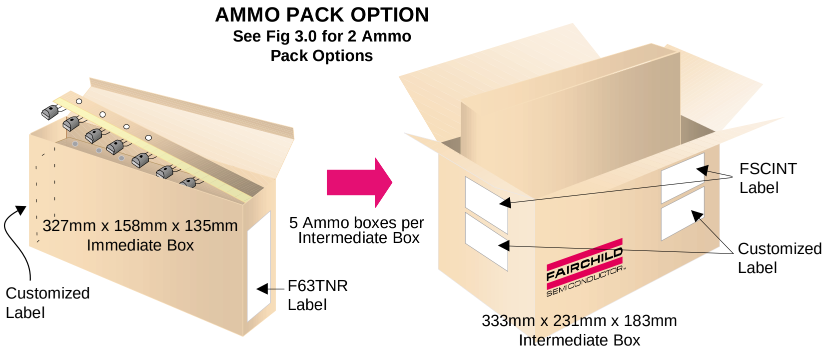
TAPE and REEL OPTION

See Fig 2.0 for various Reeling Styles

TO-92 TNR/AMMO PACKING INFROMATION

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

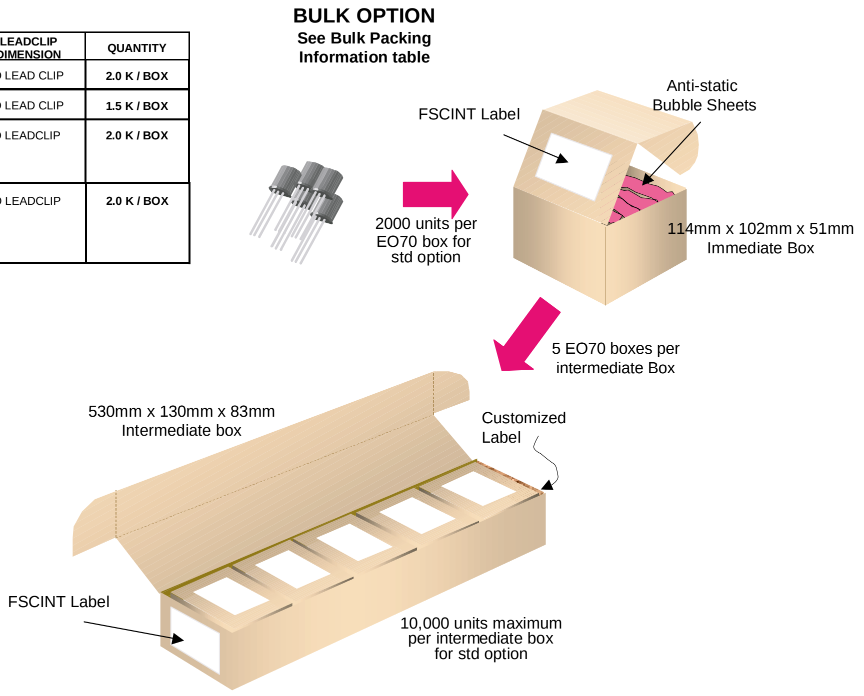


AMMO PACK OPTION

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

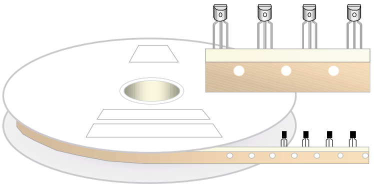
See Bulk Packing Information table

TO-92 Tape and Reel Data, continued

TO-92 Reeling Style

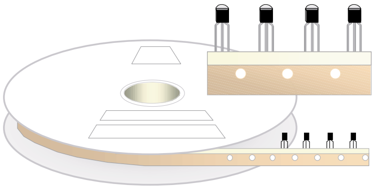
Configuration: Figure 2.0

Machine Option "A" (H)



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

Machine Option "E" (J)

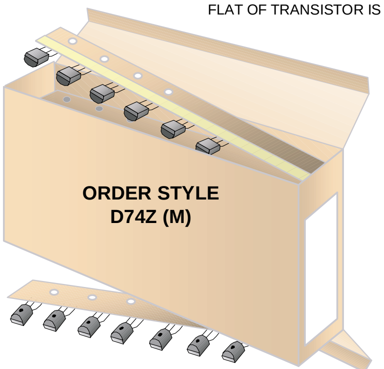


Style "E", D27Z, D71Z (s/h)

TO-92 Radial Ammo Packaging

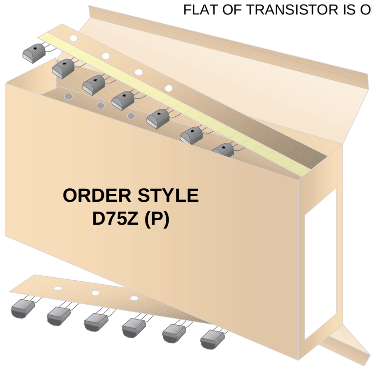
Configuration: Figure 3.0

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



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

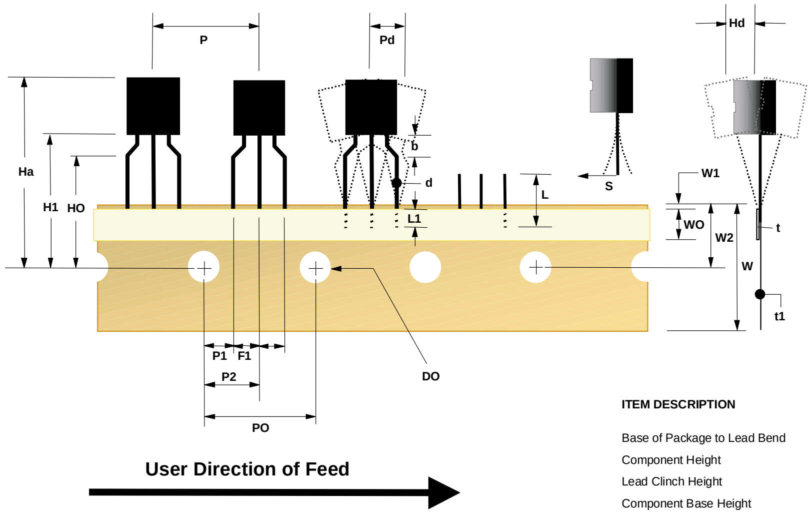
FIRST WIRE OFF IS EMITTER
ADHESIVE TAPE IS ON THE TOP SIDE
FLAT OF TRANSISTOR IS ON BOTTOM



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

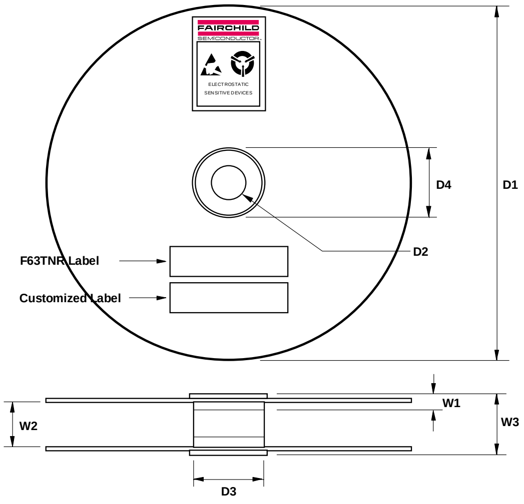
TO-92 Tape and Reel Taping
Dimension Configuration: Figure 4.0



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

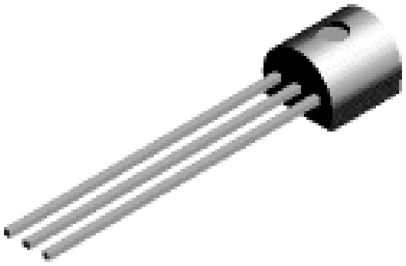


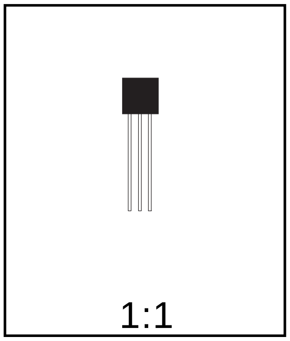
ITEM DESCRIPTION	SYSMBOL	MINIMUM	MAXIMUM
Reel Diameter	D1	13.975	14.025
Arbor Hole Diameter (Standard)	D2	1.160	1.200
(Small Hole)	D2	0.650	0.700
Core Diameter	D3	3.100	3.300
Hub Recess Inner Diameter	D4	2.700	3.100
Hub Recess Depth	W1	0.370	0.570
Flange to Flange Inner Width	W2	1.630	1.690
Hub to Hub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

Note: All dimensions are inches

TO-92 Package Dimensions

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





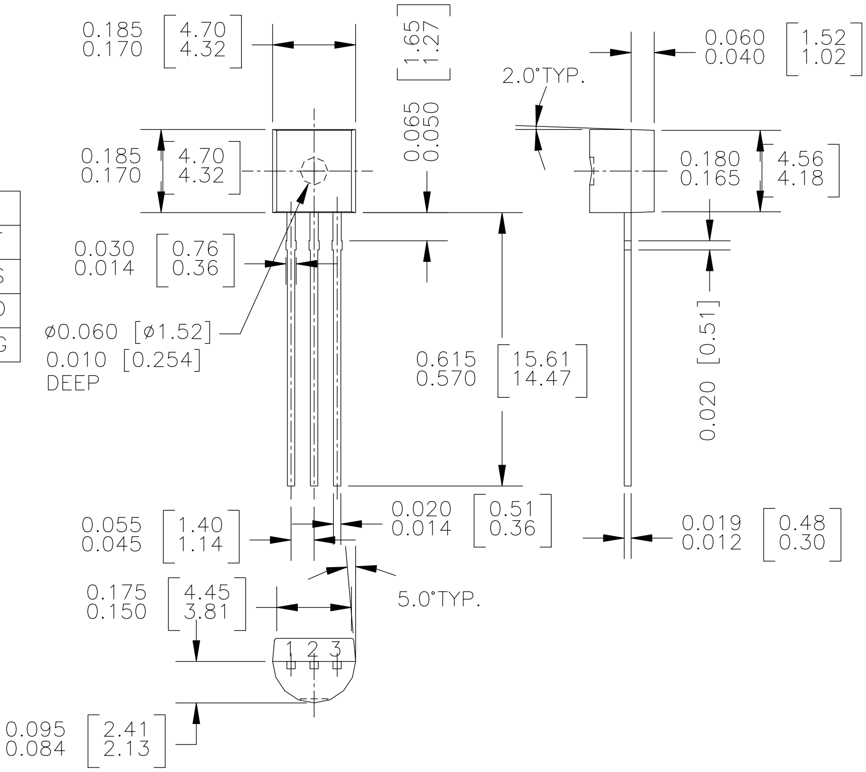
Scale 1:1 on letter size paper

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

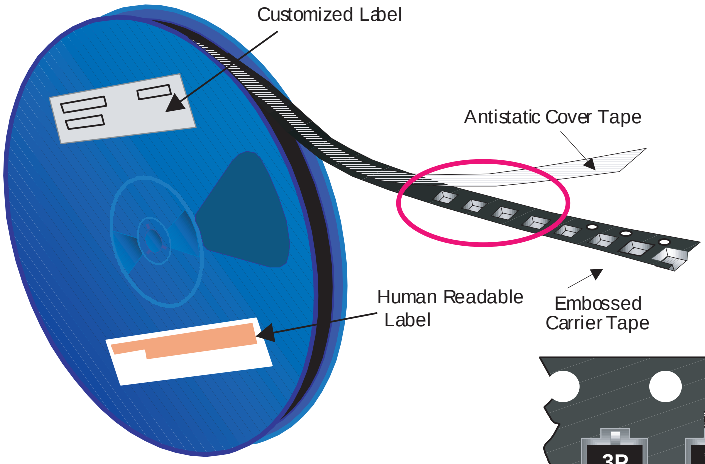


January 2000, Rev. B

SOT-23 Tape and Reel Data

FAIRCHILD
SEMICONDUCTOR TM

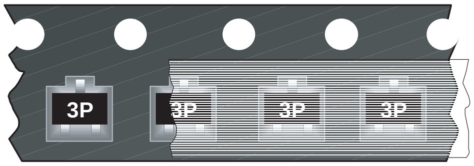
SOT-23 Packaging Configuration: Figure 10



Packaging Description:

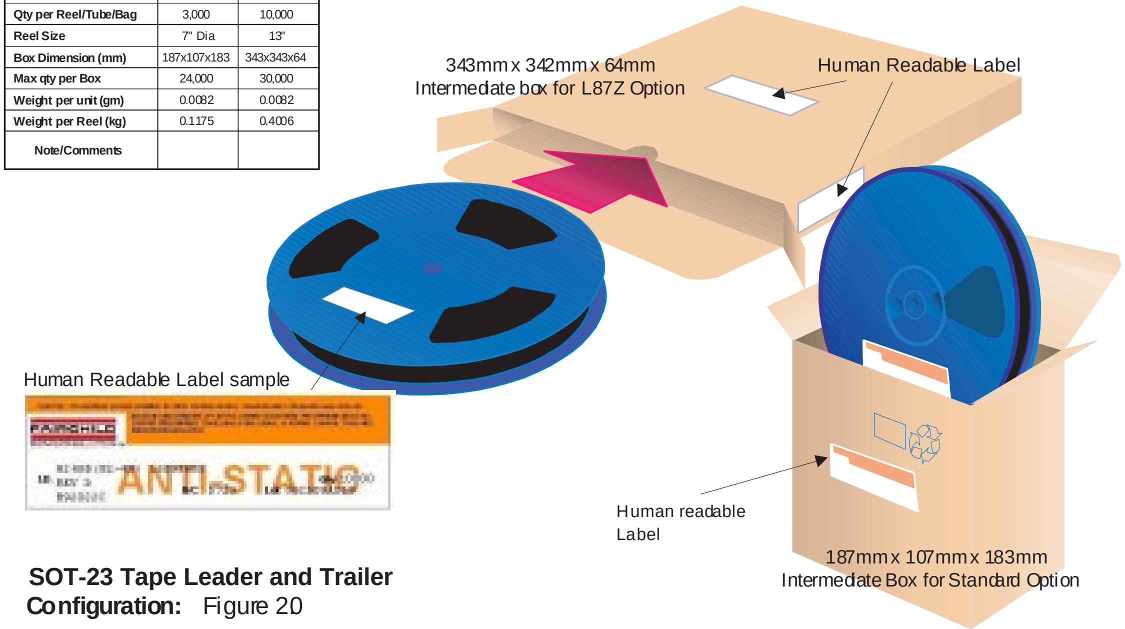
SOT-23 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 177cm 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 330cm 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.

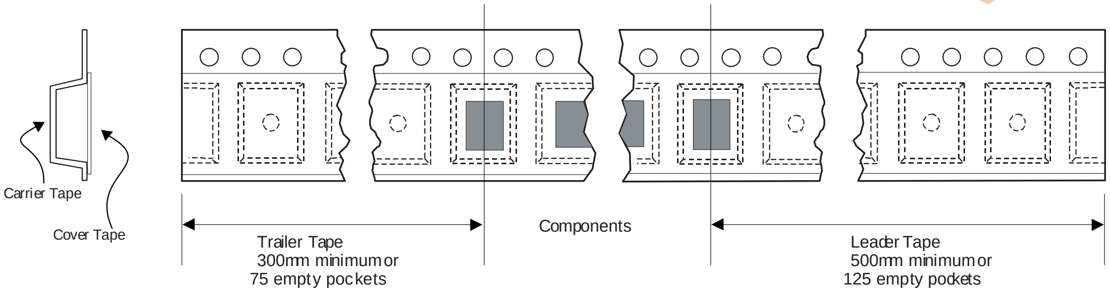


SOT-23 Unit Orientation

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		



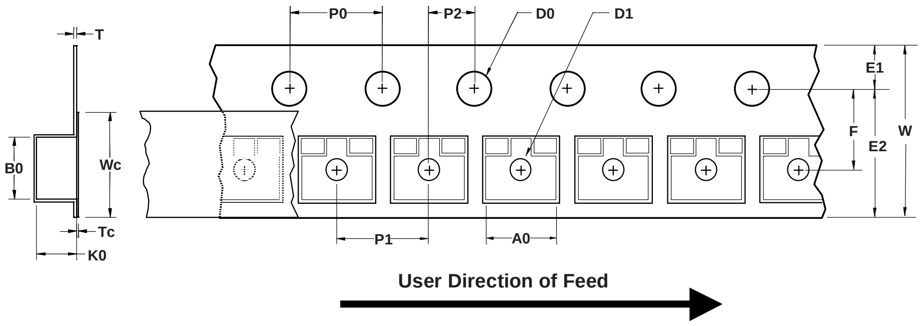
SOT-23 Tape Leader and Trailer Configuration: Figure 20



SOT-23 Tape and Reel Data, continued

SOT-23 Embossed Carrier Tape

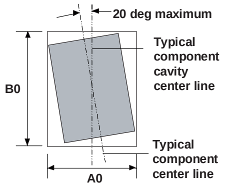
Configuration: Figure 3.0



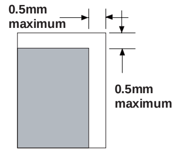
Dimensions are in millimeter													
Pkg type	**A0**	**B0**	**W**	**D0**	**D1**	**E1**	**E2**	**F**	**P1**	**P0**	**K0**	**T**	**Wc**	**Tc**
SOT-23 (8mm)	3.15 +/-0.10	2.77 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.30 +/-0.10	0.228 +/-0.013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

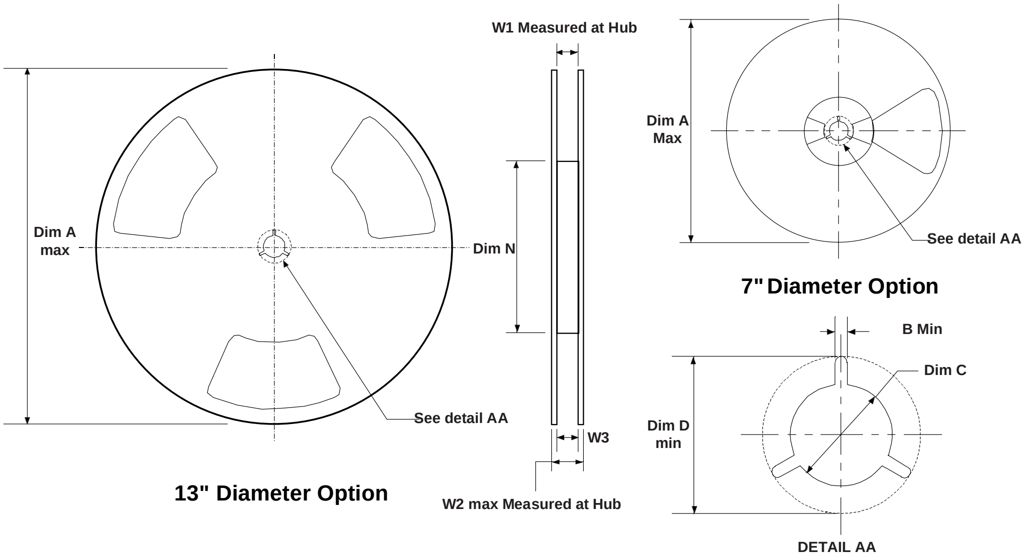


Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

SOT-23 Reel Configuration: Figure 4.0



13" Diameter Option

7" Diameter Option

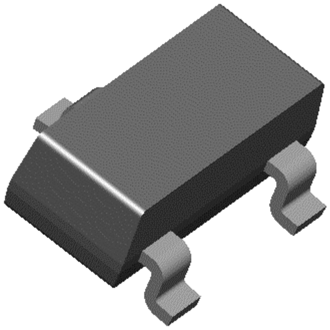
DETAIL AA

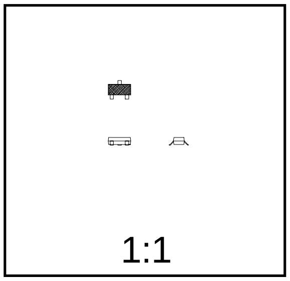
Dimensions are in inches and millimeters									
Tape Size	**Reel Option**	**Dim A**	**Dim B**	**Dim C**	**Dim D**	**Dim N**	**Dim W1**	**Dim W2**	**Dim W3 (LSL-USL)**
8mm	7" Dia	7.00 177.8	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	2.165 55	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 –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

SOT-23 Package Dimensions

FAIRCHILD
SEMICONDUCTOR ™

SOT-23 (FS PKG Code 49)

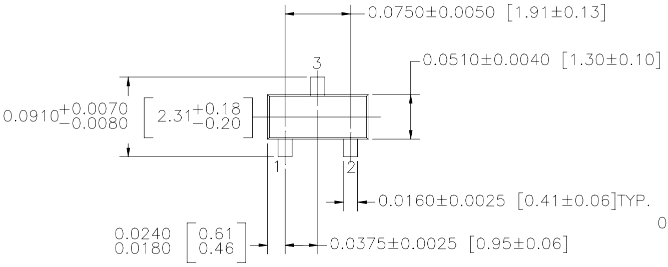


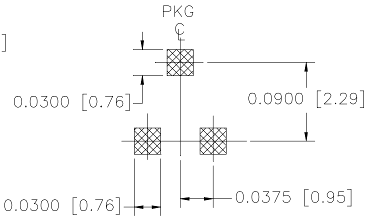


Scale 1:1 on letter size paper

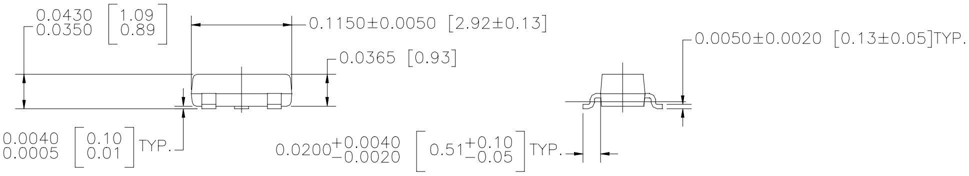
Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0082





LAND PATTERN RECOMMENDATION



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

SOT 23, 3 LEADS LOW PROFILE

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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No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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Rev. G