FAIRCHILD

SEMICONDUCTOR TM
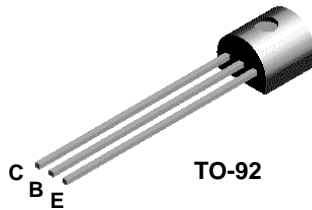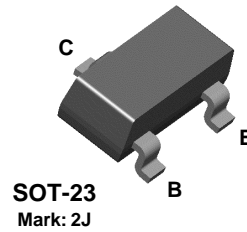
PN3640   MMBT3640

TO-92

C
B E

SOT-23
Mark: 2J

C
E
B

PNP Switching Transistor

This device is designed for very high speed saturated switching at collector currents to 100 mA. Sourced from Process 65. See PN4258 for characteristics.

Absolute Maximum Ratings*   TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	12	V
V_{CBO}	Collector-Base Voltage	12	V
V_{EBO}	Emitter-Base Voltage	4.0	V
I_C	Collector Current - Continuous	200	mA
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.
3) All voltages (V) and currents (A) are negative polarity for PNP transistors.

Thermal Characteristics   TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		PN3640	*MMBT3640	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

PNP Switching Transistor
(continued)

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	12		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 100 µA, V_{BE} = 0	12		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	12		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 100 µA, I_C = 0	4.0		V
I_{CES}	Collector Cutoff Current	V_{CE} = 6.0 V, V_{BE} = 0		0.01	µA
		V_{CE} = 6.0 V, V_{BE} = 0, T_A = 65°C		1.0	µA
I_B	Base Current	V_{CE} = 6.0 V, V_{BE} = 0		10	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	I_C = 10 mA, V_{CE} = 0.3 V	30	120	
		I_C = 50 mA, V_{CE} = 1.0 V	20		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		0.3	V
		I_C = 10 mA, I_B = 1.0 mA		0.2	V
		I_C = 50 mA, I_B = 5.0 mA		0.6	V
		I_C= 10 mA, I_B= 1.0 mA, T_A=65°C		0.25	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA	0.75	0.95	V
		I_C = 10 mA, I_B = 1.0 mA	0.8	1.0	V
		I_C = 50 mA, I_B = 5.0 mA		1.5	V
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 10 mA, V_{CE} = 5.0 V, f = 100 MHz	500		MHz
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz		3.5	pF
C_{ibo}	Input Capacitance	V_{BE} = 0.5 V, I_C = 0, f = 1.0 MHz		3.5	pF
SWITCHING CHARACTERISTICS					
t_d	Delay Time	V_{CC} = 6.0 V, $V_{BE(off)}$ = 1.9 V,		10	ns
t_r	Rise Time	I_C = 50 mA, I_{B1} = 5.0 mA		30	ns
t_s	Storage Time	V_{CC} = 6.0 V, I_C = 50 mA,		20	ns
t_f	Fall Time	I_{B1} = I_{B2} = 5.0 mA		12	ns
t_{on}	Turn-On Time	V_{CC} = 6.0 V, $V_{BE(off)}$ = 1.9 V, I_C = 50 mA, I_{B1} = 5.0 mA		25	ns
		V_{CC} = 1.5 V, I_C = 10 mA, I_{B1} = I_{B2} = 0.5 mA		60	ns
t_{off}	Turn-Off Time	V_{CC} = 6.0 V, $V_{BE(off)}$ = 1.9 V, I_C = 50 mA, I_{B1} = 5.0 mA		35	ns
		V_{CC} = 1.5 V, I_C = 10 mA, I_{B1} = I_{B2} = 0.5 mA		75	ns

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

NOTE: All voltages (V) and currents (A) are negative polarity for PNP transistors.

TO-92 Tape and Reel Data

FAIRCHILD
SEMICONDUCTOR ™

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

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
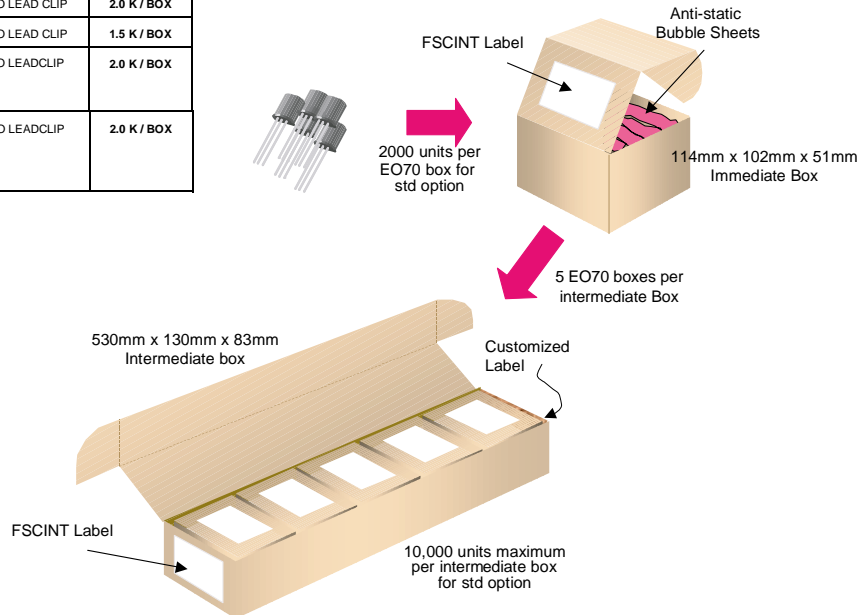Max quantity per intermediate box = 10,000 units
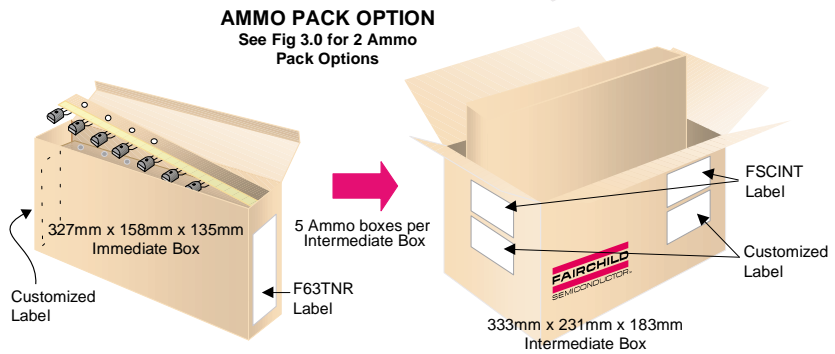
(TO-92) BULK PACKING INFORMATION

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

TAPE and REEL OPTION
See Fig 2.0 for various Reeling Styles

5 Reels per Intermediate Box

F63TNR Label

Customized Label

FSCINT Label

Customized Label

375mm x 267mm x 375mm Intermediate Box

AMMO PACK OPTION
See Fig 3.0 for 2 Ammo Pack Options

327mm x 158mm x 135mm Immediate Box

Customized Label

F63TNR Label

5 Ammo boxes per Intermediate Box

FSCINT Label

Customized Label

333mm x 231mm x 183mm Intermediate Box

BULK OPTION
See Bulk Packing Information table

FSCINT Label

Anti-static Bubble Sheets

2000 units per EO70 box for std option

114mm x 102mm x 51mm Immediate Box

5 EO70 boxes per intermediate Box

530mm x 130mm x 83mm Intermediate box

Customized Label

FSCINT Label

10,000 units maximum per intermediate box for std option

©2001 Fairchild Semiconductor Corporation

March 2001, Rev. B1

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
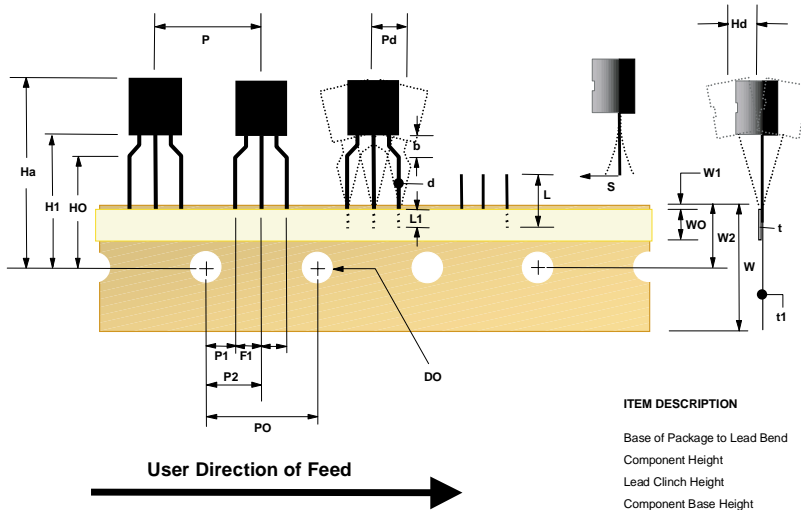FLAT OF TRANSISTOR IS ON BOTTOM

**ORDER STYLE
D75Z (P)**

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

September 1999, Rev. B

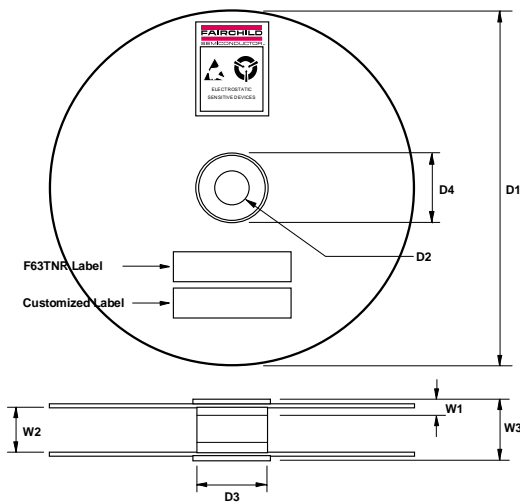# TO-92 Tape and Reel Data, continued

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

User Direction of Feed

TO-92 Reel
Configuration: Figure 5.0

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.

F63TNR Label

Customized Label

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

July 1999, Rev. A

TO-92 Package Dimensions

FAIRCHILD
SEMICONDUCTOR ™

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

1:1

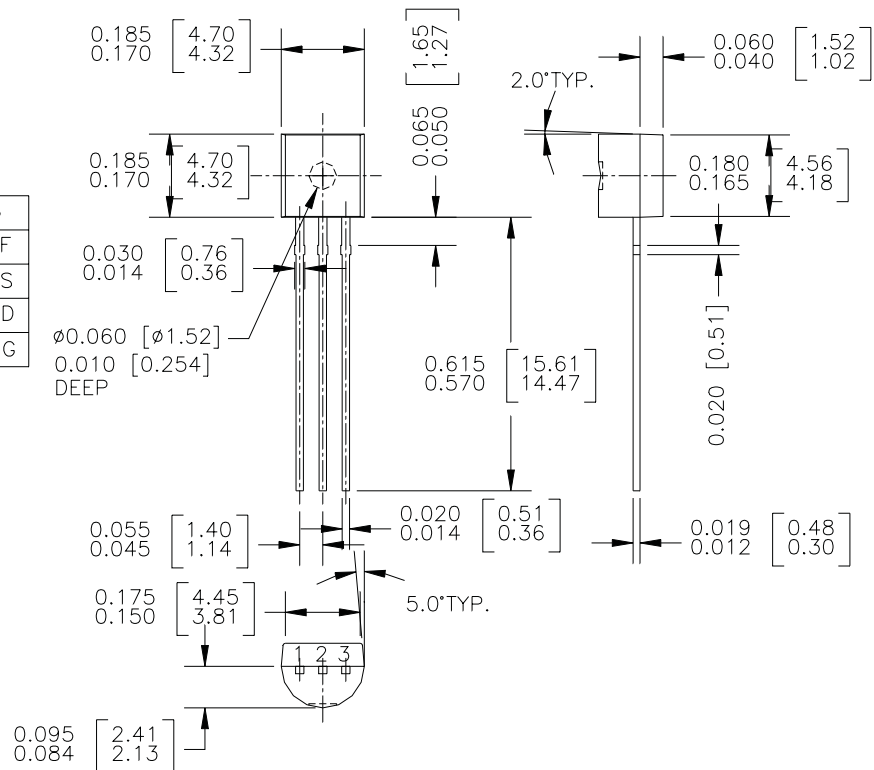Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

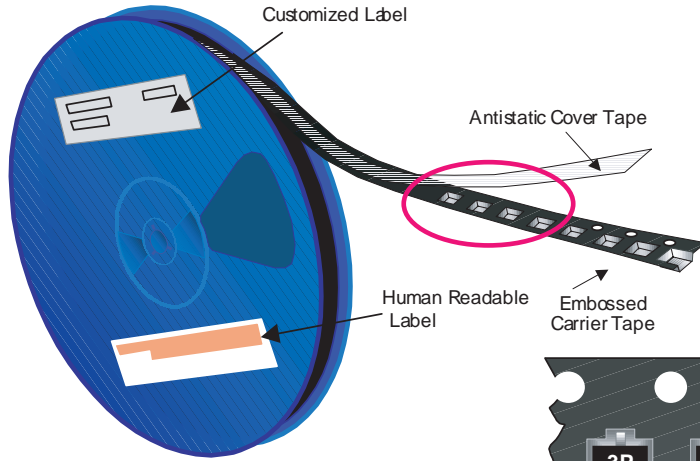Part Weight per unit (gram): 0.1977

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

0.185 / 0.170 [4.70 / 4.32]

1.65 / 1.27

0.060 / 0.040 [1.52 / 1.02]

2.0°TYP.

0.185 / 0.170 [4.70 / 4.32]

0.065 / 0.050

0.180 / 0.165 [4.56 / 4.18]

0.030 / 0.014 [0.76 / 0.36]

Ø0.060 [Ø1.52]
0.010 [0.254]
DEEP

0.615 / 0.570 [15.61 / 14.47]

0.020 [0.51]

0.055 / 0.045 [1.40 / 1.14]

0.020 / 0.014 [0.51 / 0.36]

0.019 / 0.012 [0.48 / 0.30]

0.175 / 0.150 [4.45 / 3.81]

5.0°TYP.

1 2 3

0.095 / 0.084 [2.41 / 2.13]

©2000 Fairchild Semiconductor International

January 2000, Rev. B

SOT-23 Tape and Reel Data

FAIRCHILD
SEMICONDUCTOR ™

SOT-23 Packaging
Configuration: Figure 10

Customized Label

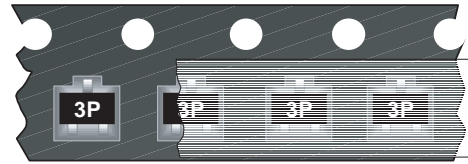Antistatic Cover Tape

Human Readable Label

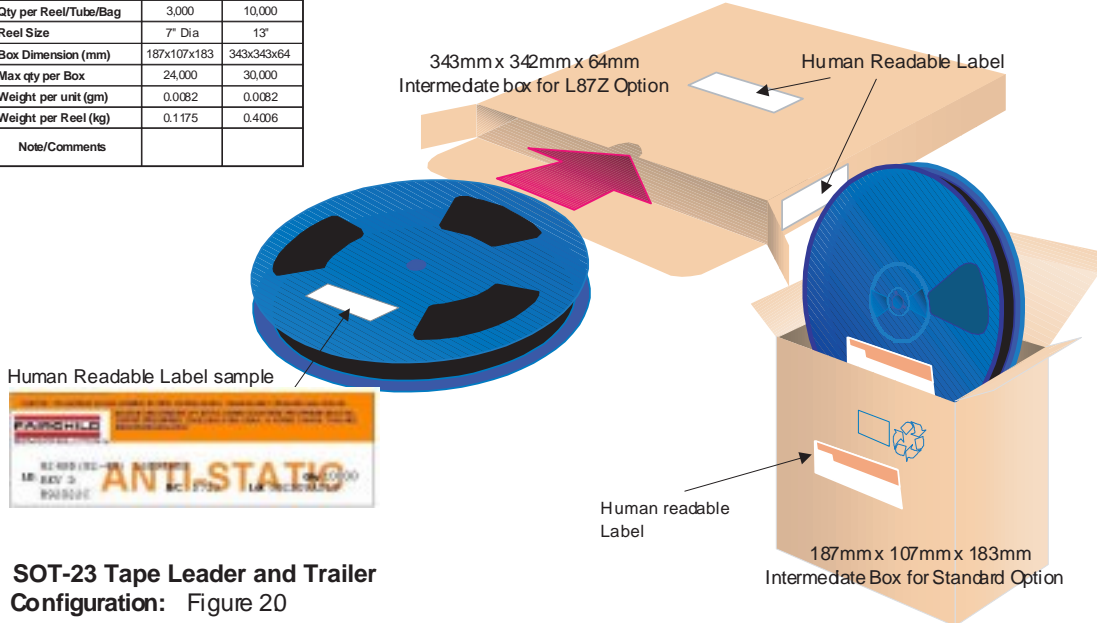Embossed Carrier Tape

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 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		

3P **3P** **3P** **3P**

SOT-23 Unit Orientation

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

Human Readable Label

Human Readable Label sample

ANTI-STATIC

Human readable Label

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

SOT-23 Tape Leader and Trailer
Configuration: Figure 20

Carrier Tape

Cover Tape

Trailer Tape
300mm minimum or
75 empty pockets

Components

Leader Tape
500mm minimum or
125 empty pockets

September 1999, Rev. C
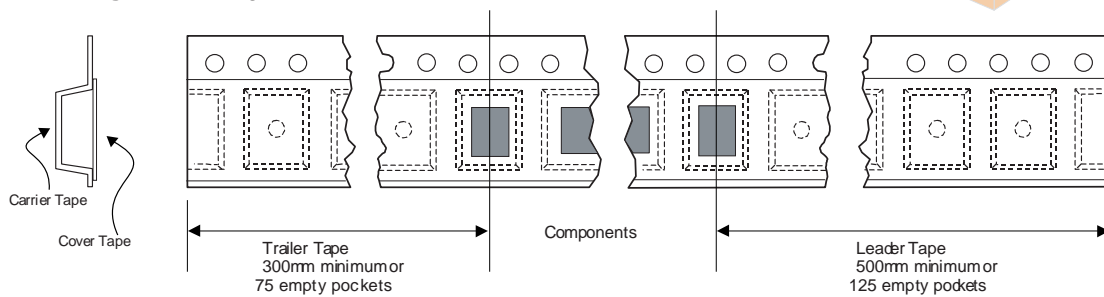
SOT-23 Tape and Reel Data, continued

SOT-23 Embossed Carrier Tape
Configuration: Figure 3.0

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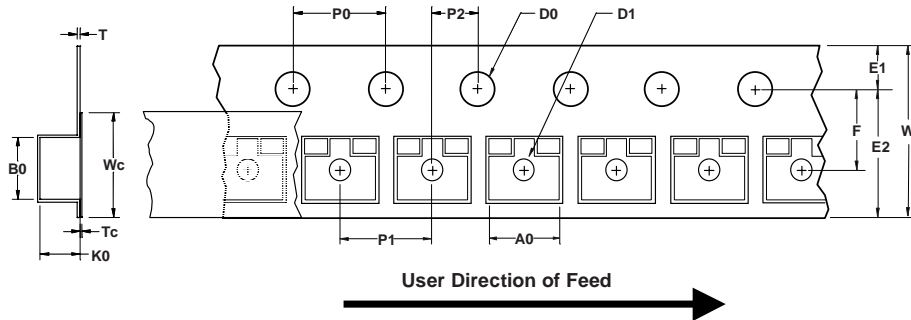
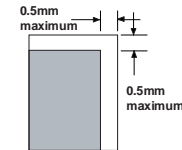|						Dimensions are in millimeter							
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SOT-23 (8mm)	3.15 +/-0.10	2.77 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.30 +/-0.10	0.228 +/-0.013	5.2 +/-0.3	0.06 +/-0.02

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).

20 deg maximum component rotation
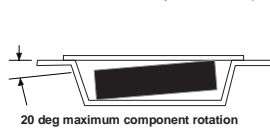
Sketch A (Side or Front Sectional View)
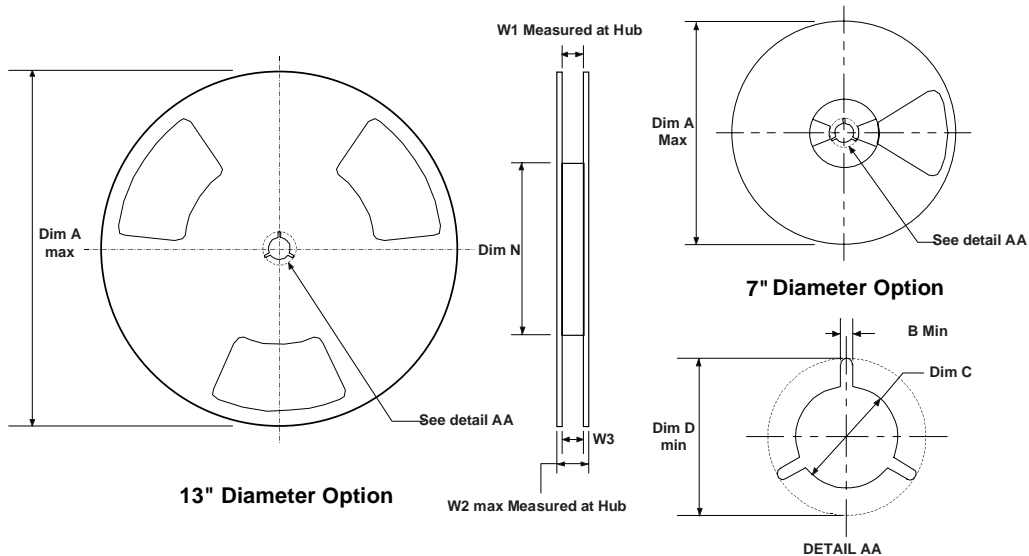**Component Rotation**

20 deg maximum
Typical component cavity center line
Typical component center line
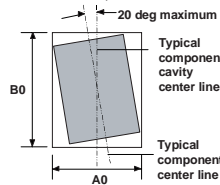
Sketch B (Top View)
Component Rotation

0.5mm maximum
0.5mm maximum

Sketch C (Top View)
Component lateral movement

SOT-23 Reel Configuration: Figure 4.0

W1 Measured at Hub

Dim A Max

See detail AA

7" Diameter Option

Dim A max

Dim N

See detail AA

13" Diameter Option

W2 max Measured at Hub

W3

B Min
Dim C
Dim D min

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

FAIRCHILD
SEMICONDUCTOR TM
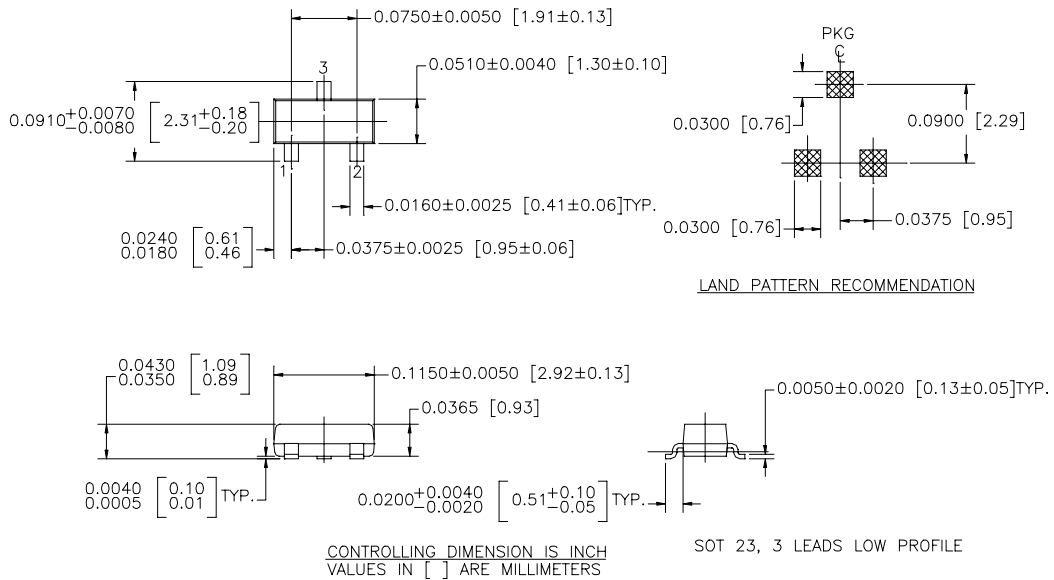
SOT-23 (FS PKG Code 49)
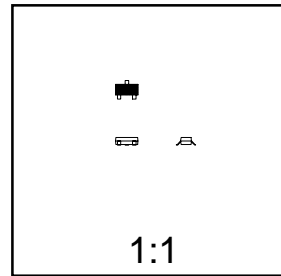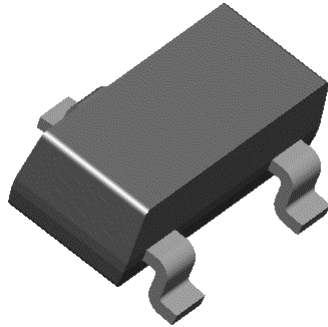
1:1

Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0082

0.0750±0.0050 [1.91±0.13]

0.0510±0.0040 [1.30±0.10]

$0.0910^{+0.0070}_{-0.0080}$ [$2.31^{+0.18}_{-0.20}$]

3

1   2

0.0160±0.0025 [0.41±0.06]TYP.

$\frac{0.0240}{0.0180}$ [$\frac{0.61}{0.46}$]

0.0375±0.0025 [0.95±0.06]

PKG
C

0.0300 [0.76]

0.0900 [2.29]

0.0300 [0.76]

0.0375 [0.95]

LAND PATTERN RECOMMENDATION

$\frac{0.0430}{0.0350}$ [$\frac{1.09}{0.89}$]

0.1150±0.0050 [2.92±0.13]

0.0365 [0.93]

0.0050±0.0020 [0.13±0.05]TYP.

$\frac{0.0040}{0.0005}$ [$\frac{0.10}{0.01}$]TYP.

$0.0200^{+0.0040}_{-0.0020}$ [$0.51^{+0.10}_{-0.05}$]TYP.

SOT 23, 3 LEADS LOW PROFILE

CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

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

September 1998, Rev. A1

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™	FASTr™	PowerTrench ®	SyncFET™
Bottomless™	GlobalOptoisolator™	QFET™	TinyLogic™
CoolFET™	GTO™	QS™	UHC™
CROSSVOLT™	HiSeC™	QT Optoelectronics™	VCX™
DOME™	ISOPLANAR™	Quiet Series™	
E²CMOS™	MICROWIRE™	SILENT SWITCHER ®	
EnSigna™	OPTOLOGIC™	SMART START™	
FACT™	OPTOPLANAR™	SuperSOT™-3	
FACT Quiet Series™	PACMAN™	SuperSOT™-6	
FAST ®	POP™	SuperSOT™-8	

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

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.
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.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. G