FAIRCHILD

SEMICONDUCTOR TM

February 1999

FDN360P

Single P-Channel PowerTrench™ MOSFET

General Description

This P-Channel Logic Level MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

Applications

- DC/DC converter
- Load switch
- Motor drives

Features

- -2 A, -30 V. $R_{DS(on)} = 0.080 \ \Omega$ @ $V_{GS} = -10$ V

  $R_{DS(on)} = 0.125 \ \Omega$ @ $V_{GS} = -4.5$ V.

- Low gate charge (5nC typical).

- Fast switching speed.

- High performance trench technology for extremely low $R_{DS(ON)}$.

- High power and current handling capability.

SuperSOT™-3
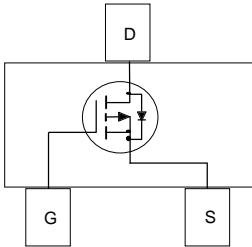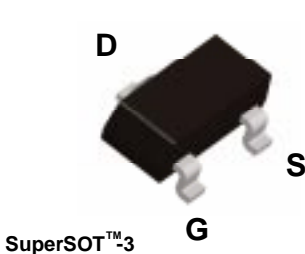
Absolute Maximum Ratings $T_A = 25°C$ unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		-30	V
V_{GSS}	Gate-Source Voltage		±20	V
I_D	Drain Current - Continuous	(Note 1a)	-2	A
	- Pulsed		-20	
P_D	Power Dissipation for Single Operation	(Note 1a)	0.5	W
		(Note 1b)	0.46	
T_J, T_{stg}	Operating and Storage Junction Temperature Range		-55 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	250	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	75	°C/W

Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
360	FDN360P	7''	8mm	3000 units

Electrical Characteristics $T_A = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = -250$ μA	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250$ μA, Referenced to 25°C		20		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -24$ V, $V_{GS} = 0$ V			-1	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 20$ V, $V_{DS} = 0$ V			100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -20$ V, $V_{DS} = 0$ V			-100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = -250$ μA	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250$ μA, Referenced to 25°C		-4		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10$ V, $I_D = -2$ A $V_{GS} = -10$ V, $I_D = -2$ A, $T_J = 125°C$ $V_{GS} = -4.5$ V, $I_D = -1.5$ A		0.060 0.080 0.095	0.080 0.136 0.125	Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10$ V, $V_{DS} = -5$ V	-20			A
g_{FS}	Forward Transconductance	$V_{DS} = -5$ V, $I_D = -2$ A		5.5		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = -15$ V, $V_{GS} = 0$ V, f = 1.0 MHz		420		pF
C_{oss}	Output Capacitance			140		pF
C_{rss}	Reverse Transfer Capacitance			60		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15$ V, $I_D = -1$ A, $V_{GS} = -10$ V, $R_{GEN} = 6$ Ω		9	18	ns
t_r	Turn-On Rise Time			8	16	ns
$t_{d(off)}$	Turn-Off Delay Time			18	29	ns
t_f	Turn-Off Fall Time			6	12	ns
Q_g	Total Gate Charge	$V_{DS} = -15$ V, $I_D = -2$ A, $V_{GS} = -10$ V,		5	7	nC
Q_{gs}	Gate-Source Charge			1.7		nC
Q_{gd}	Gate-Drain Charge			1.8		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				-0.42	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = -0.42$ A (Note 2)		-0.75	-1.2	V

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

a) 250°C/W when mounted on a 0.02 in² Pad of 2 oz. Cu.

b) 270°C/W when mounted on a 0.001 in² pad of 2 oz. Cu.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%
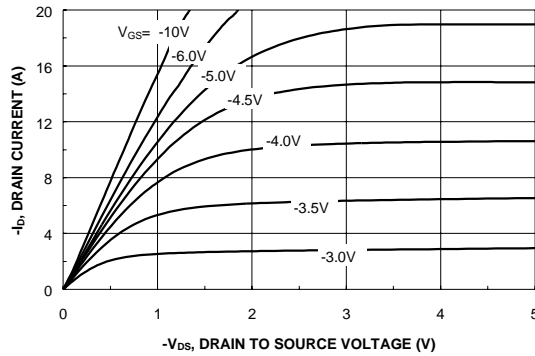
Typical Characteristics

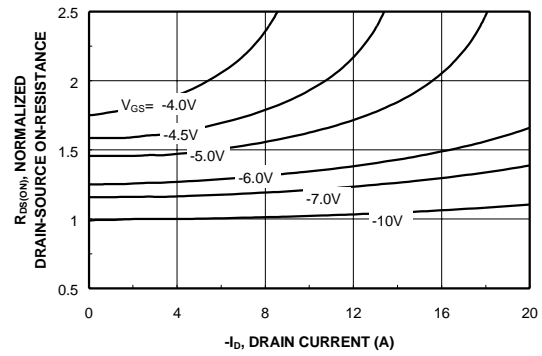
Figure 1. On-Region Characteristics.

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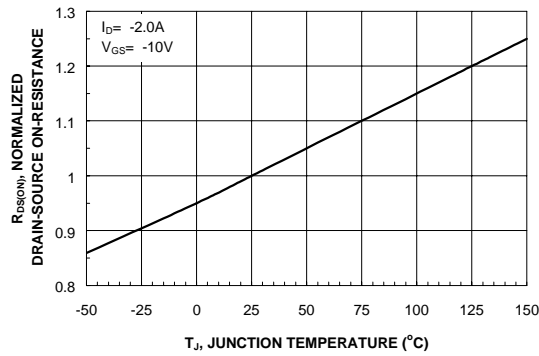

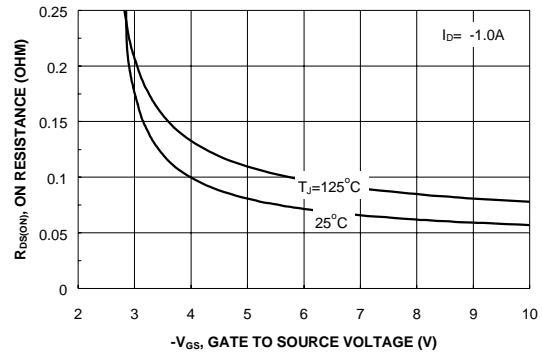**Figure 3. On-Resistance Variation with Temperature.**

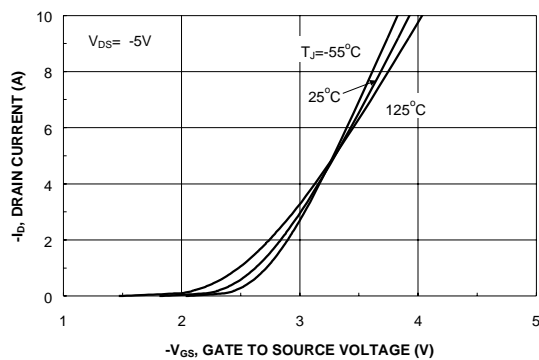**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

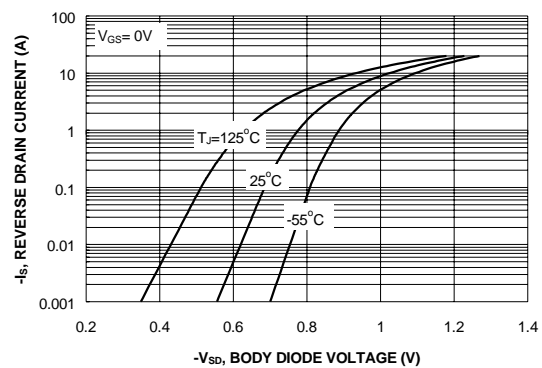**Figure 5. Transfer Characteristics.**

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.
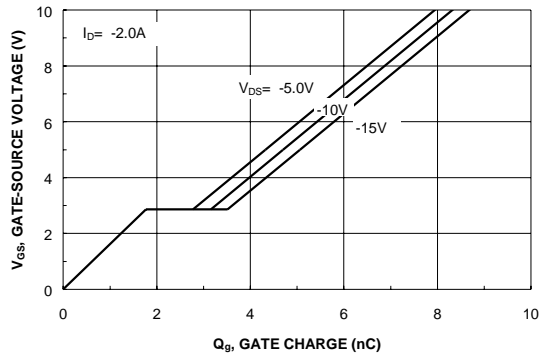
Typical Characteristics (continued)

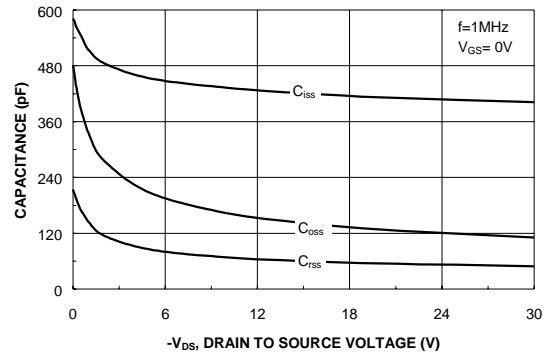**Figure 7. Gate Charge Characteristics.**
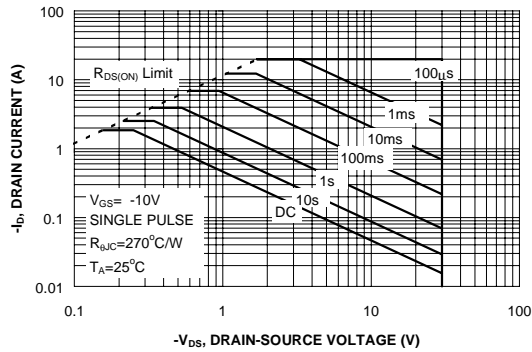

Figure 8. Capacitance Characteristics.

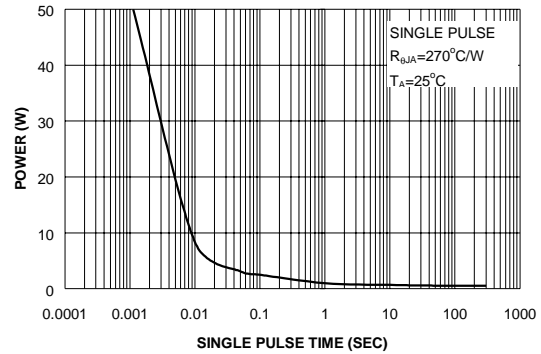**Figure 9. Maximum Safe Operating Area.**

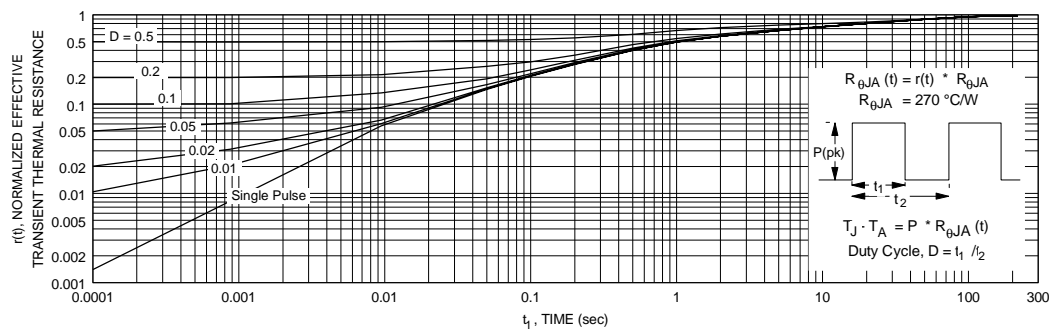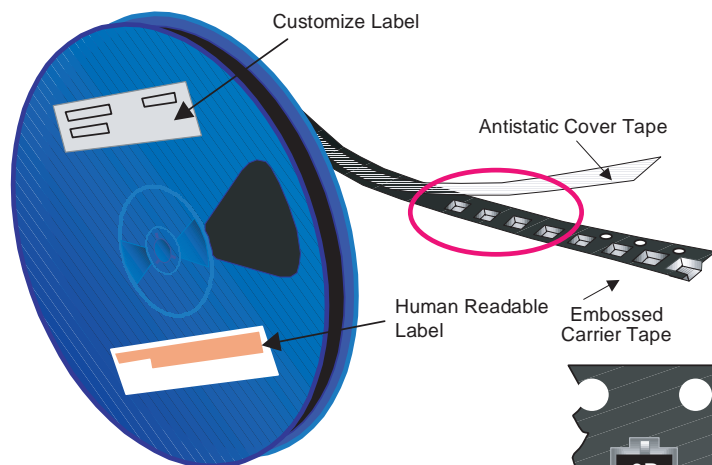**Figure 10. Single Pulse Maximum Power Dissipation.**

Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

SuperSOT™-3 Tape and Reel Data and Package Dimensions

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SSOT-3 Packaging
Configuration: Figure 1.0

Customize Label

Antistatic Cover Tape

Human Readable Label

Embossed Carrier Tape

Packaging Description:

SSOT-3 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.

3P 3P 3P 3P

SSOT-3 Std Unit Orientation

SSOT-3 Std 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)	0.0097	0.0097
Weight per Reel (kg)	0.1230	0.4150
Note/Comments		

343mm x 342mm x 64mm
Intermediate box for D87Z Option

Human Readable Label

Human Readable Label sample

CAUTION: This container provides protection for static sensitive devices. Handle device with caution upon removal.
MADE IN ONE OR MORE OF THE FOLLOWING COUNTRIES: PHILIPPINES | BRAZIL | EXPORT PROCESSING ZONE| MALAYSIA, CHINA , S. KOREA, TAIWAN, THAILAND, SINGAPORE AND JAPAN.

FAIRCHILD
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9249D (92-49) 16093603   Qty 10000
I.D. REV D
B92022C   **ANTI-STATIC**   D/C D739 Lot UG2509A019

Human Readable Label

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

SSOT-3 Tape Leader and Trailer
Configuration: Figure 2.0

Carrier Tape

Cover Tape

Trailer Tape
300mm minimum or
75 empty pockets

Components

Leader Tape
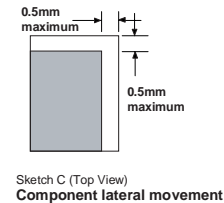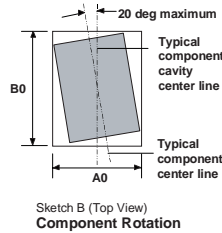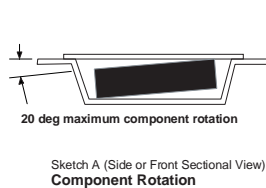500mm minimum or
125 empty pockets
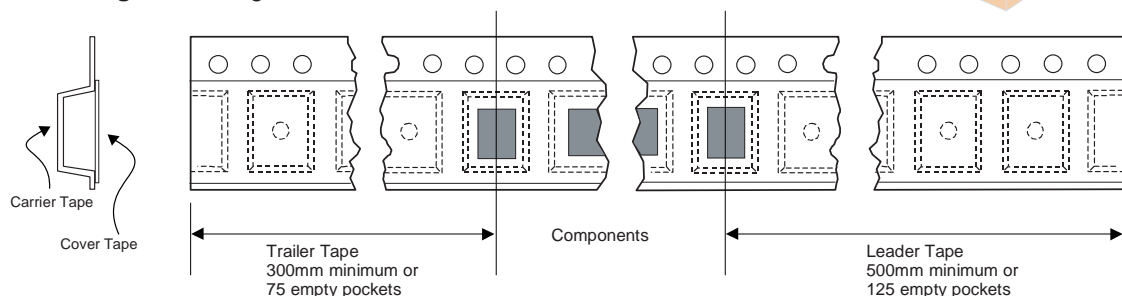
SuperSOT™-3 Tape and Reel Data and Package Dimensions, continued

SSOT-3 Embossed Carrier Tape
Configuration: Figure 3.0

User Direction of Feed
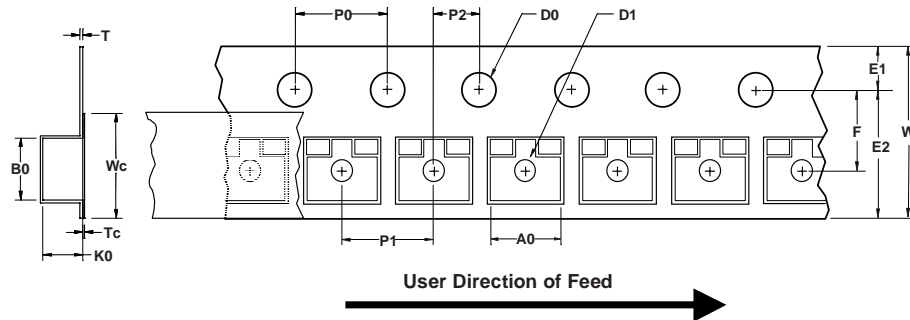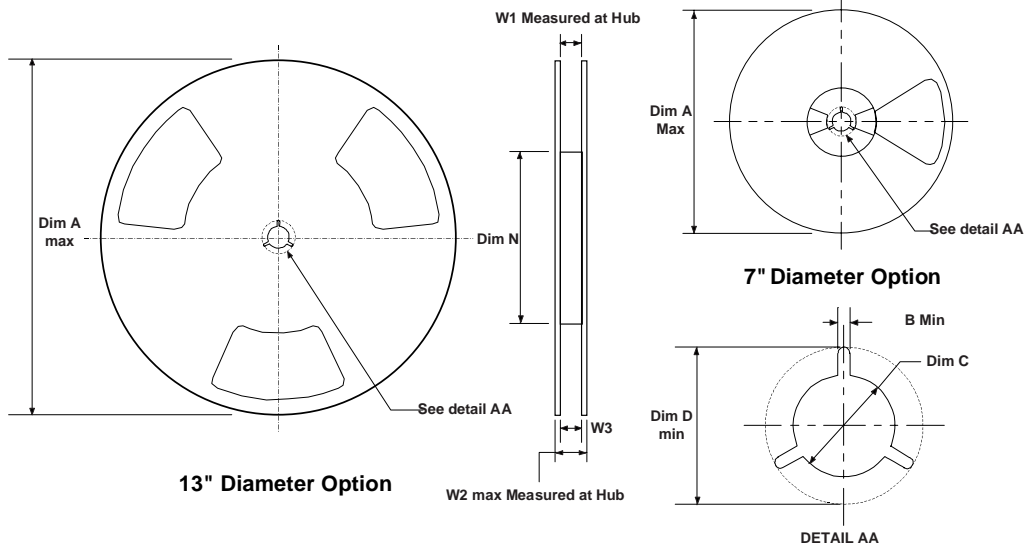
Dimensions are in millimeter													
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SSOT-3 (8mm)	3.15 +/-0.10	2.77 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.30 +/-0.10	0.228 +/-0.013	5.2 +/-0.3	0.06 +/-02

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).
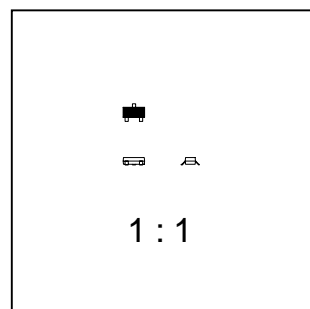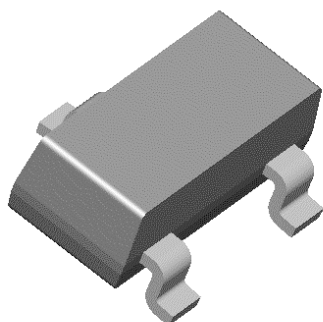
20 deg maximum component rotation

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

SSOT-3 Reel Configuration: Figure 4.0

W1 Measured at Hub

Dim A max

Dim N

See detail AA

13" Diameter Option

W2 max Measured at Hub

W3

Dim A Max

See detail AA

7" Diameter Option

B Min

Dim C

Dim D min

DETAIL AA

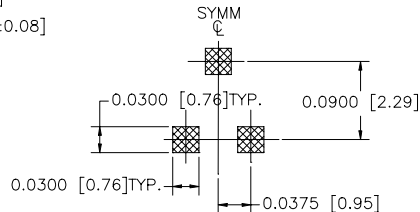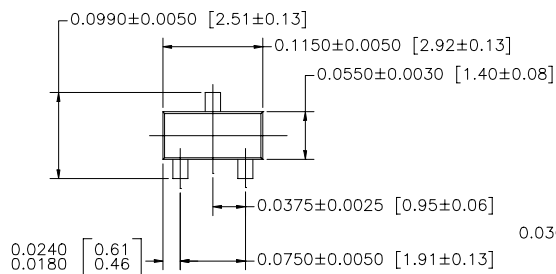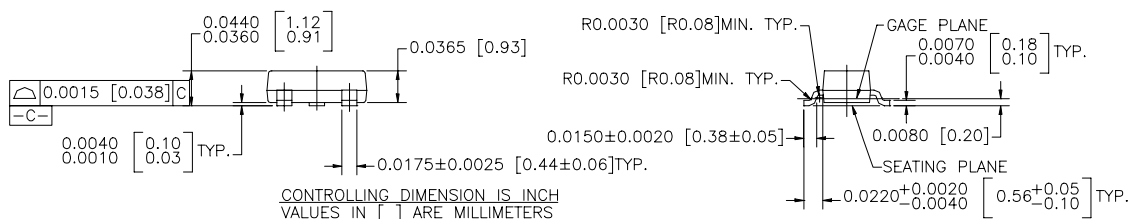| Dimensions are in inches and millimeters								
Tape Size	Reel Option	Dim A	Dim B	Dim C	Dim D	Dim N	Dim W1	Dim W2	Dim W3 (LSL-USL)
8mm	7" Dia	7.00 177.8	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	2.165 55	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 – 0.429 7.9 – 10.9
8mm	13" Dia	13.00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

SuperSOT™-3 (FS PKG Code 32)

1 : 1

Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0097

0.0990±0.0050 [2.51±0.13]

0.1150±0.0050 [2.92±0.13]

0.0550±0.0030 [1.40±0.08]

0.0375±0.0025 [0.95±0.06]

0.0240 [0.61]
0.0180 [0.46]

0.0750±0.0050 [1.91±0.13]

SYMM
℄

0.0300 [0.76]TYP.   0.0900 [2.29]

0.0300 [0.76]TYP.

0.0375 [0.95]

LAND PATTERN RECOMMENDATION

0.0440 [1.12]
0.0360 [0.91]

0.0365 [0.93]

△ 0.0015 [0.038] C

−C−

0.0040 [0.10] TYP.
0.0010 [0.03]

0.0175±0.0025 [0.44±0.06]TYP.

CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

R0.0030 [R0.08]MIN. TYP.

R0.0030 [R0.08]MIN. TYP.

GAGE PLANE
0.0070 [0.18] TYP.
0.0040 [0.10]

0.0150±0.0020 [0.38±0.05]

0.0080 [0.20]

SEATING PLANE

$0.0220^{+0.0020}_{-0.0040}$ $\left[0.56^{+0.05}_{-0.10}\right]$ TYP.

SUPER SOT , 3 LEADS

NOTES : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH TO BE 150 MICROINCHES / 3.81 MICROMETERS
   MINIMUM TIN/LEAD (SOLDER) ON COPPER.

2. NO JEDEC REGISTRATION AS OF DEC. 1995.

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CROSSVOLT™	POP™	UHC™
E²CMOS™	PowerTrench®	VCX™
FACT™	QFET™	
FACT Quiet Series™	QS™	
FAST®	Quiet Series™	
FASTr™	SuperSOT™-3	
GTO™	SuperSOT™-6	
HiSeC™	SuperSOT™-8	

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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.