

# FDT439N

## N-Channel 2.5V Specified Enhancement Mode Field Effect Transistor

### General Description

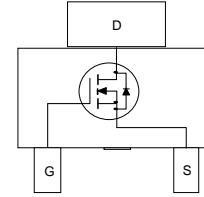
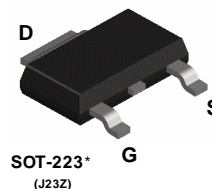
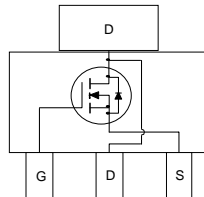
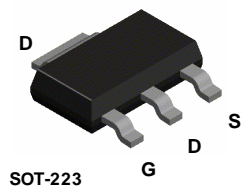
This N-Channel Enhancement mode field effect transistor is produced using Fairchild Semiconductor's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance, and provide superior switching performance. These products are well suited to low voltage, low current applications such as notebook computer power management, battery powered circuits, and DC motor control.

### Features

- 6.3 A, 30 V.  $R_{DS(on)} = 0.045 \Omega @ V_{GS} = 4.5 V$   
 $R_{DS(on)} = 0.058 \Omega @ V_{GS} = 2.5 V$
- Fast switching speed.
- High power and current handling capability in a widely used surface mount package.

### Applications

- DC/DC converter
- Load switch
- Motor driving



### Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter	FDT439N	Units	
V <sub>DSS</sub>	Drain-Source Voltage	30	V	
V <sub>GSS</sub>	Gate-Source Voltage	±8	V	
I <sub>D</sub>	Drain Current - Continuous (Note 1a)	6.3	A	
		20		
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a)	3	W	
		(Note 1b)		1.3
		(Note 1c)		1.1
T <sub>J</sub> , T <sub>sig</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C	

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	42	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	12	°C/W

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDT439N	FDT439N	13"	12mm	2500 units

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		40		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

### On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	0.4	0.67	1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-2.2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 4.5\text{ V}, I_D = 6.3\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 6.3\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 2.5\text{ V}, I_D = 5.5\text{ A}$		0.038 0.055 0.048	0.045 0.072 0.058	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$	10			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 6.3\text{ A}$		17		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		500		pF
$C_{oss}$	Output Capacitance			185		pF
$C_{riss}$	Reverse Transfer Capacitance			43		pF

### Switching Characteristics (Note 2)

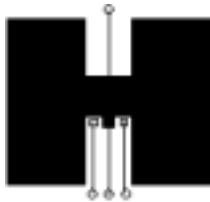
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$		6	12	ns
$t_r$	Turn-On Rise Time			10	18	ns
$t_{d(off)}$	Turn-Off Delay Time			30	48	ns
$t_f$	Turn-Off Fall Time			10	18	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 6.3\text{ A},$ $V_{GS} = 4.5\text{ V},$		10.7	15	nC
$Q_{gs}$	Gate-Source Charge			0.9		nC
$Q_{gd}$	Gate-Drain Charge			3.7		nC

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			2.5	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.5\text{ A}$ (Note 2)		0.8	1.2	V

#### Notes:

- $R_{\theta JA}$  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  $R_{\theta CA}$  is determined by the user's board design.



a)  $42^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz. copper.



b)  $95^\circ\text{C/W}$  when mounted on a  $0.066\text{ in}^2$  pad of 2 oz. copper.



c)  $110^\circ\text{C/W}$  when mounted on a minimum mounting pad.

Scale 1 : 1 on letter size paper

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

## Typical Characteristics

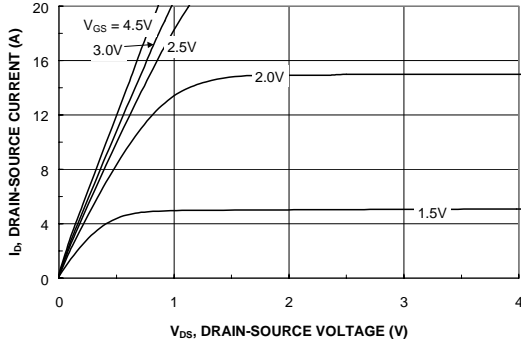


Figure 1. On-Region Characteristics.

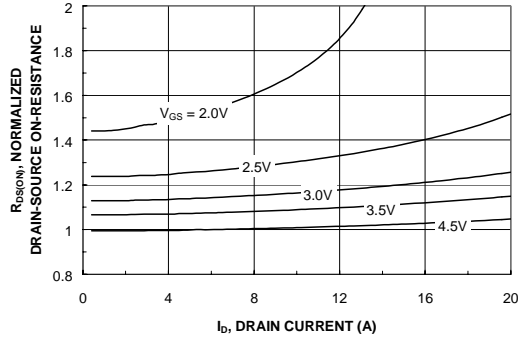


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

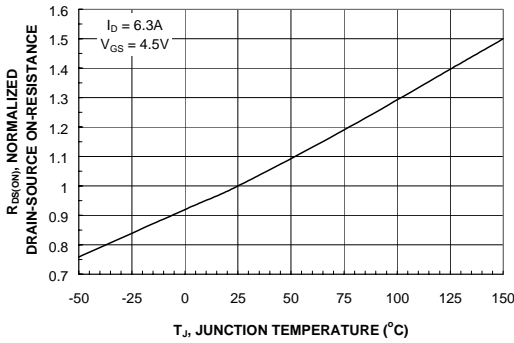


Figure 3. On-Resistance Variation with Temperature.

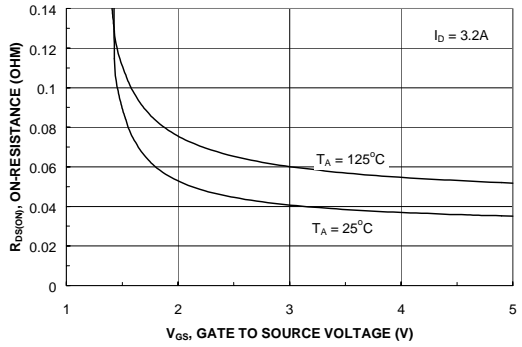


Figure 4. On-Resistance Variation with Gate-To-Source Voltage.

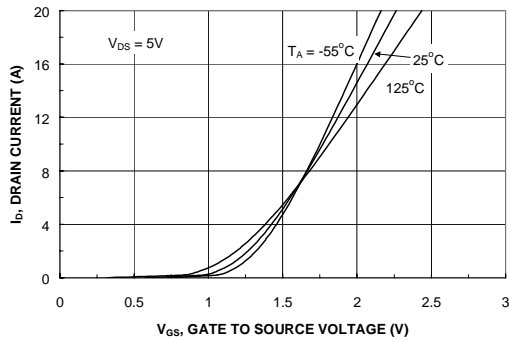


Figure 5. Transfer Characteristics.

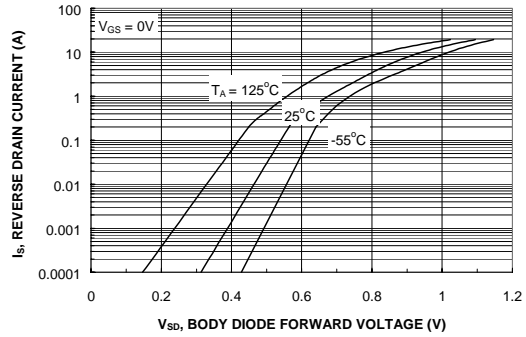
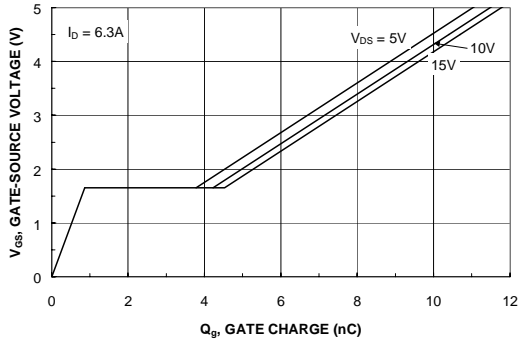
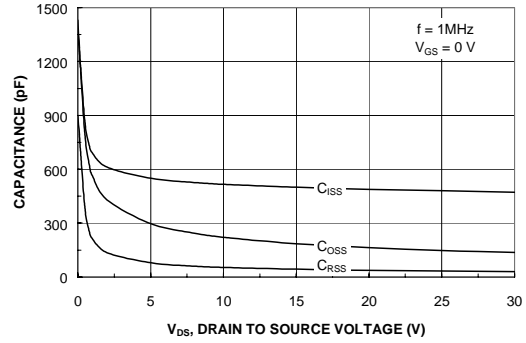


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

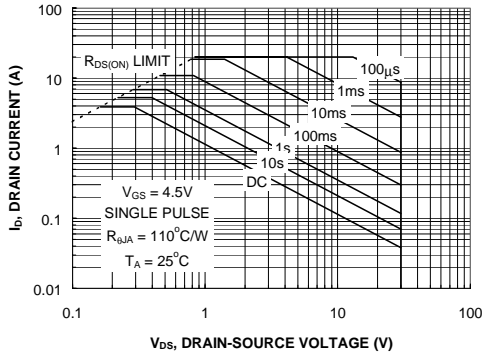
**Typical Characteristics** (continued)



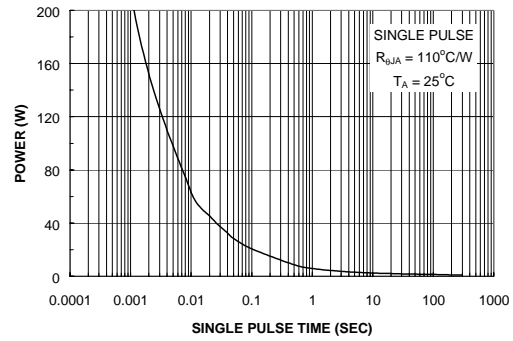
**Figure 7. Gate-Charge Characteristics.**



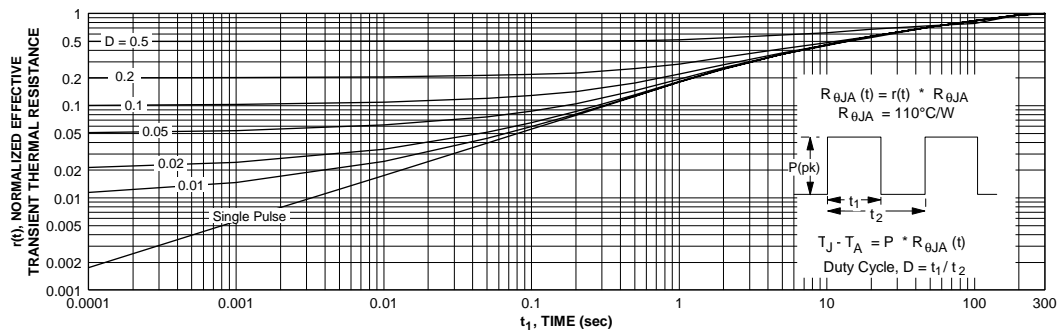
**Figure 8. Capacitance Characteristics.**



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



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



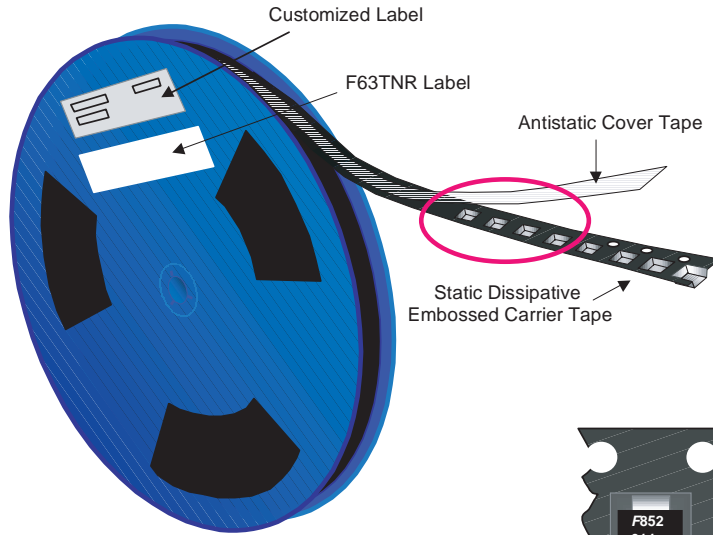
**Figure 11. Transient Thermal Response Curve.**

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

# SOT-223 Tape and Reel Data and Package Dimensions

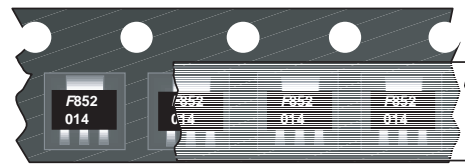


## SOT-223 Packaging Configuration: Figure 1.0

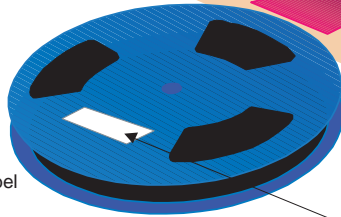
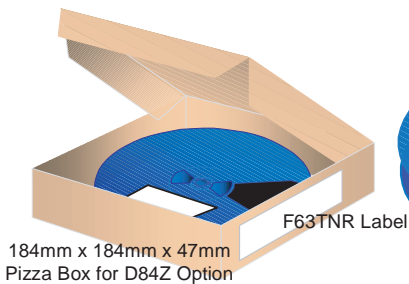
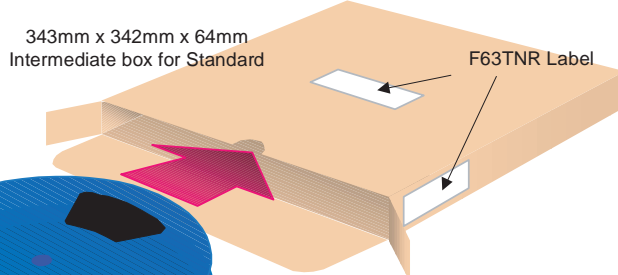


**Packaging Description:**  
 SOT-223 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 2,500 units per 13" or 330cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 500 units per 7" or 177cm diameter reel. This and some other options are further described in the Packaging Information table.  
 These full reels are individually barcode labeled and placed inside a standard intermediate box (illustrated in figure 1.0) made of recyclable corrugated brown paper. One box contains two reels maximum. And these boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.

SOT-223 Packaging Information		
Packaging Option	Standard (no flow code)	D84Z
Packaging type	TNR	TNR
Qty per Reel/Tube/Bag	2,500	500
Reel Size	13" Dia	7" Dia
Box Dimension (mm)	343x64x343	184x187x47
Max qty per Box	5,000	1,000
Weight per unit (gm)	0.1246	0.1246
Weight per Reel (kg)	0.7250	0.1532
Note/Comments		



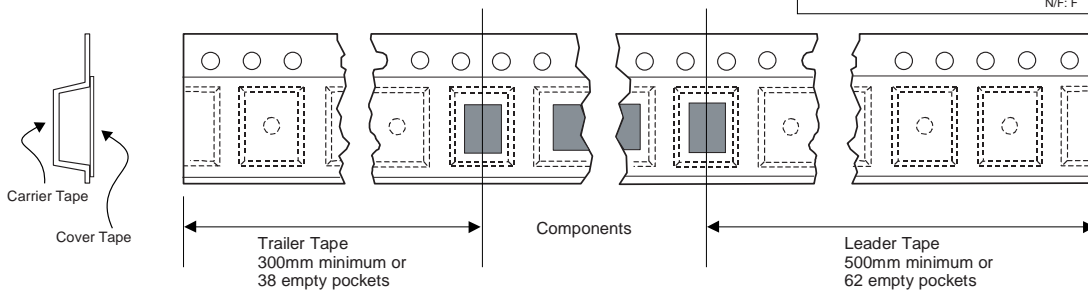
### SOT-223 Unit Orientation



**F63TNR Label sample**

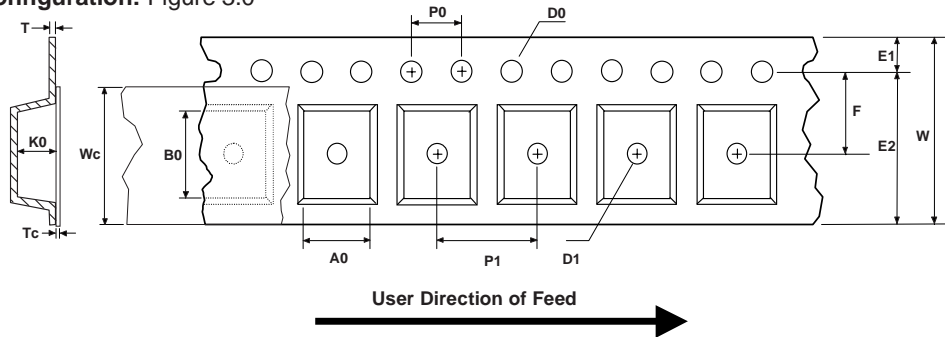
LOT: CBVK741B019	QTY: 3000
FSID: PN2222A	SPEC:
D/C1: D984Z	QTY1:
D/C2:	QTY2:
SPEC REV:	CPN:
	N/F: F
	(F63TNR)3

## SOT-223 Tape Leader and Trailer Configuration: Figure 2.0



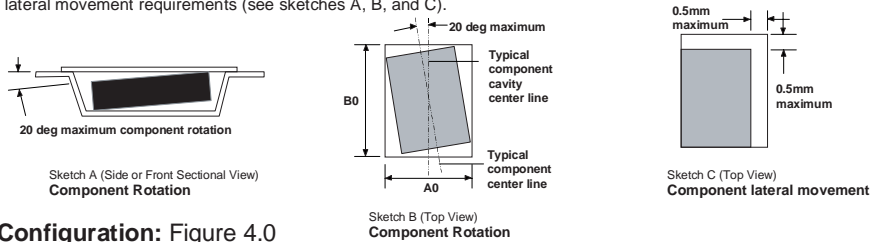
# SOT-223 Tape and Reel Data and Package Dimensions, continued

## SOT-223 Embossed Carrier Tape Configuration: Figure 3.0

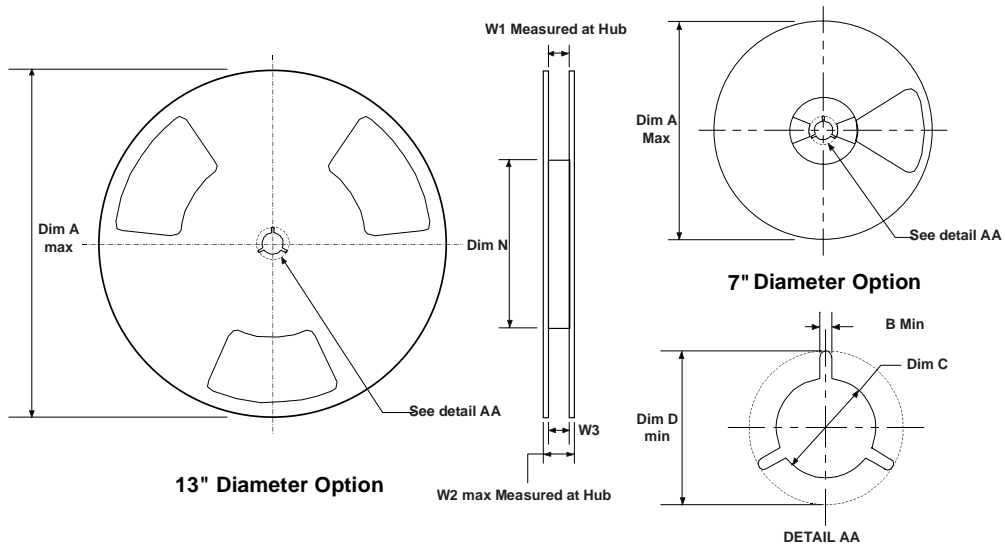


Dimensions are in millimeter														
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SOT-223 (12mm)	6.83 +/-0.10	7.42 +/-0.10	12.0 +/-0.3	1.55 +/-0.05	1.50 +/-0.10	1.75 +/-0.10	10.25 min	5.50 +/-0.05	8.0 +/-0.1	4.0 +/-0.1	1.88 +/-0.10	0.292 +/- 0.0130	9.5 +/-0.025	0.06 +/-0.02

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).



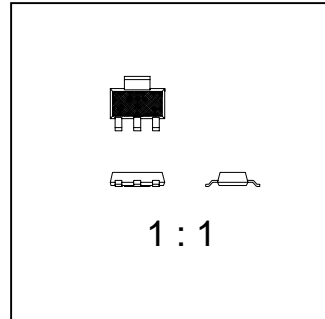
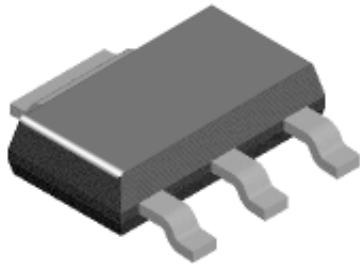
## SOT-223 Reel Configuration: Figure 4.0



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)
12mm	7" Dia	7.00 177.8	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	5.906 150	0.488 +0.078/-0.000 12.4 +2/0	0.724 18.4	0.469 - 0.606 11.9 - 15.4
12mm	13" Dia	13.00 330	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	7.00 178	0.488 +0.078/-0.000 12.4 +2/0	0.724 18.4	0.469 - 0.606 11.9 - 15.4

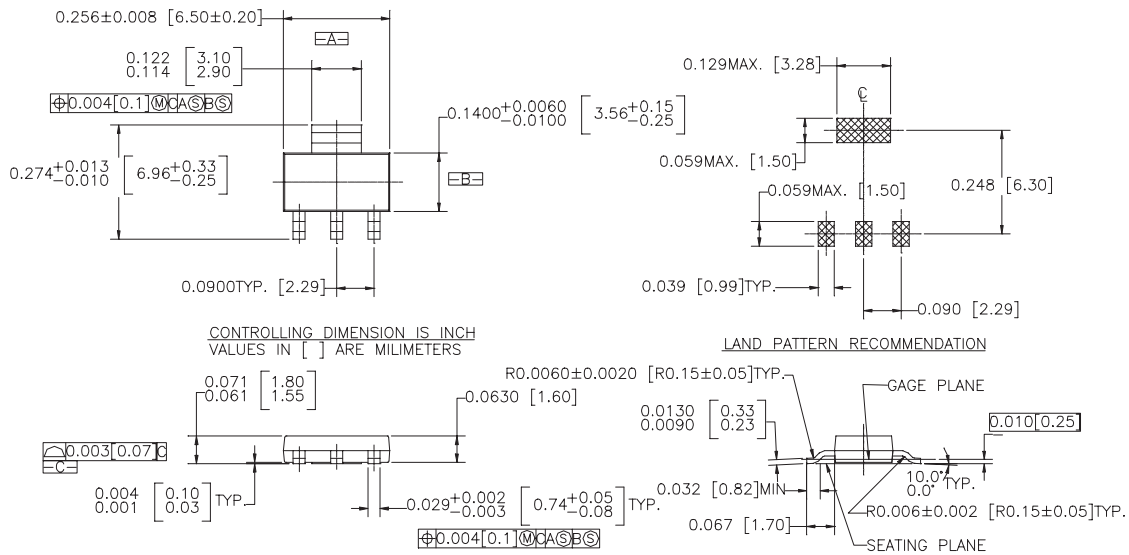
# SOT-223 Tape and Reel Data and Package Dimensions, continued

## SOT-223 (FS PKG Code 47)



Scale 1:1 on letter size paper

Part Weight per unit (gram): 0.1246



- NOTES : UNLESS OTHERWISE SPECIFIED
- STANDARD LEAD FINISH TO BE 150 MICRONS/ 3.81 MICROMETERS MINIMUM TIN/LEAD (SOLDER) ON COPPER.
  - REFERENCE JEDEC REGISTRATION TO-261, VARIATION AA, ISSUE A, DATED JAN 1990

SOT223, 4 LEADS

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CROSSVOLT™	POP™	UHC™
E <sup>2</sup> CMOS™	PowerTrench®	VCX™
FACT™	QFET™	
FACT Quiet Series™	QS™	
FAST®	Quiet Series™	
FASTr™	SuperSOT™-3	
GTO™	SuperSOT™-6	
HiSeC™	SuperSOT™-8	

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## PRODUCT STATUS DEFINITIONS

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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.
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