

# **FDT458P**

## **30V P-Channel PowerTrench<sup>®</sup> MOSFET**

### **General Description**

This P-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers, and battery chargers.

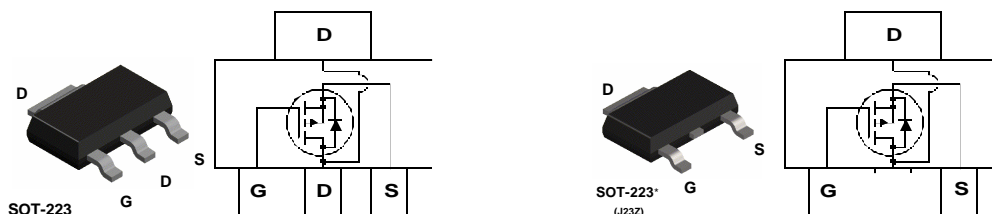
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable  $R_{DS(ON)}$  specifications.

### **Applications**

- Battery chargers
- Motor drives

### **Features**

- 3.4 A, -30 V.  $R_{DS(ON)} = 130\text{ m}\Omega$  @  $V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 200\text{ m}\Omega$  @  $V_{GS} = 4.5\text{ V}$
- Fast switching speed
- Low gate charge (2.5 nC typical)
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability in a widely used surface mount package



### **Absolute Maximum Ratings** $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	- 30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous (Note 1a)	3.4	A
	– Pulsed	10	
$P_D$	Maximum Power Dissipation (Note 1a)	3.0	W
	(Note 1b)	1.3	
	(Note 1c)	1.1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### **Thermal Characteristics**

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	42	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	12	$^\circ\text{C/W}$

### **Package Marking and Ordering Information**

Device Marking	Device	Reel Size	Tape width	Quantity
458P	FDT458P	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	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		-23		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, Forward	$V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

**On Characteristics (Note 2)**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = -10\text{ V}, I_D = -3.4\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -2.7\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -3.4\text{ A}, T_J = 125^\circ\text{C}$		105 157 147	130 200 210	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	-5			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -3.4\text{ A}$		3		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V},$		205		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		55		pF
$C_{rss}$	Reverse Transfer Capacitance			26		pF

**Switching Characteristics (Note 2)**

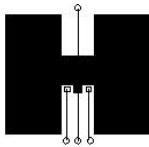
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = -15\text{ V}, I_D = -1\text{ A},$		4.5	9	ns
$t_r$	Turn–On Rise Time	$V_{GS} = -10\text{ V}, R_{GEN} = 6\text{ }\Omega$		12.5	23	ns
$t_{d(off)}$	Turn–Off Delay Time			11	20	ns
$t_f$	Turn–Off Fall Time			2	4	ns
$Q_g$	Total Gate Charge	$V_{DS} = -15\text{ V}, I_D = -3.4\text{ A},$		2.5	3.5	nC
$Q_{gs}$	Gate–Source Charge	$V_{GS} = -10\text{ V}$		0.7		nC
$Q_{gd}$	Gate–Drain Charge			1		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:**

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



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



b)  $95^\circ\text{C/W}$  when mounted on a .0066 in<sup>2</sup> pad of 2 oz copper



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

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%

# Typical Characteristics

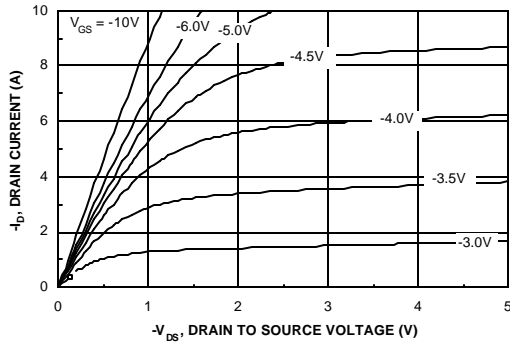


Figure 1. On-Region Characteristics.

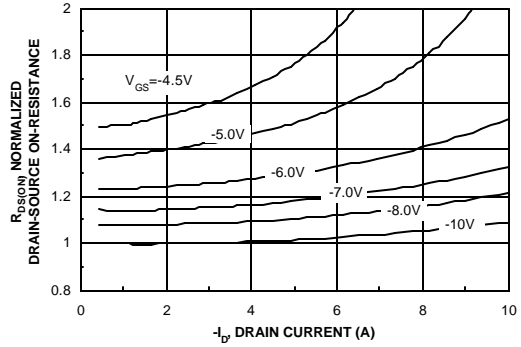


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

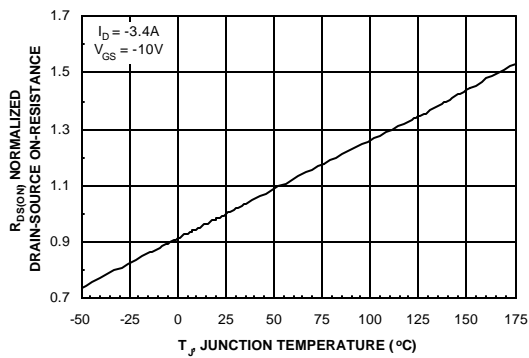


Figure 3. On-Resistance Variation with Temperature.

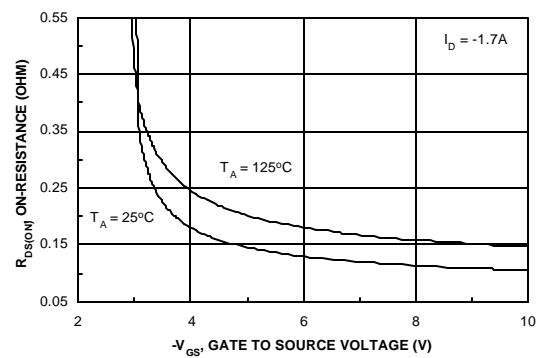


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

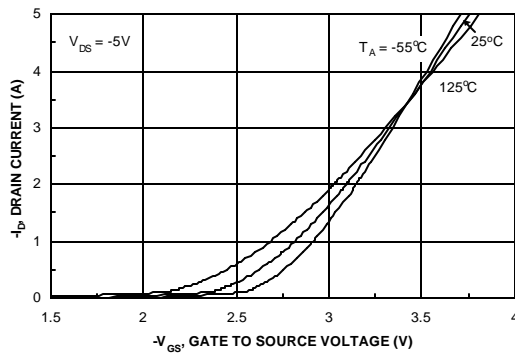


Figure 5. Transfer Characteristics.

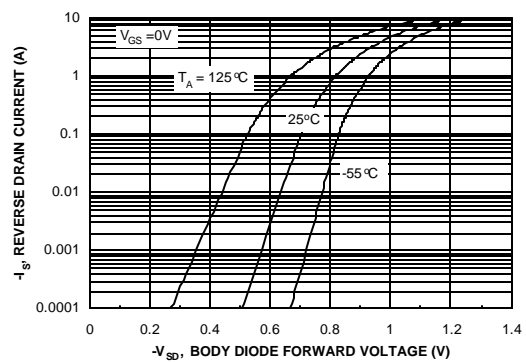


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

# Typical Characteristics

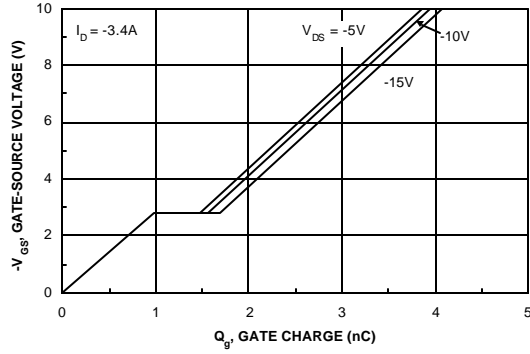


Figure 7. Gate Charge Characteristics.

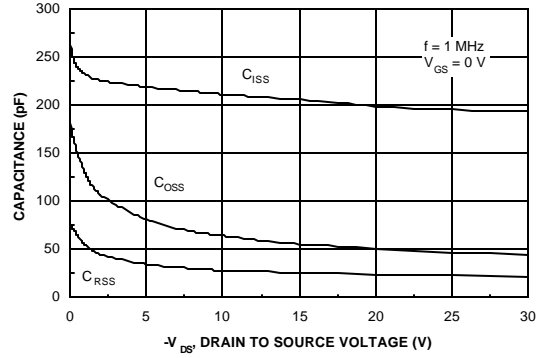


Figure 8. Capacitance Characteristics.

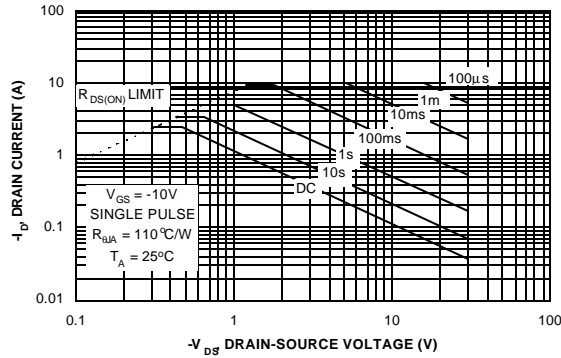


Figure 9. Maximum Safe Operating Area.

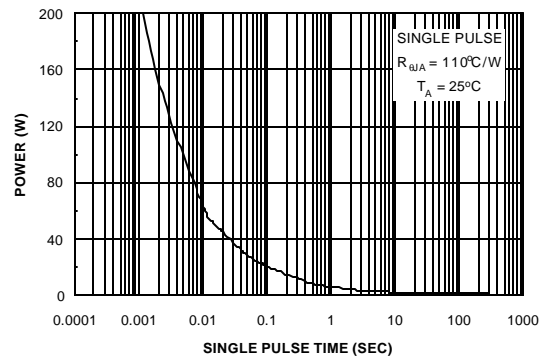


Figure 10. Single Pulse Maximum Power Dissipation.

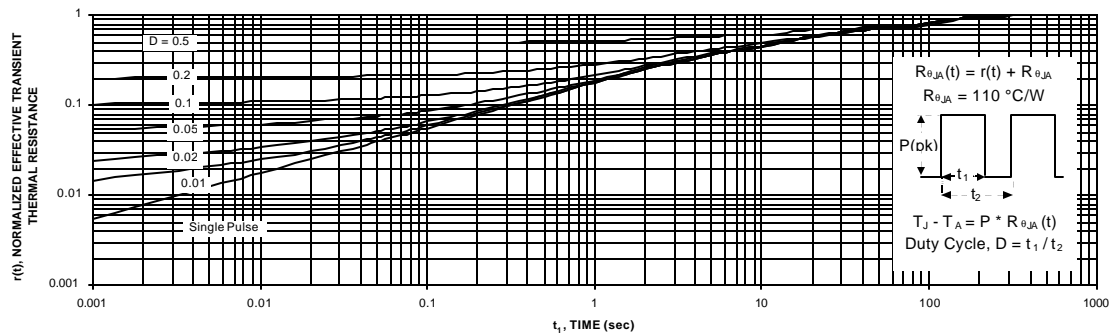


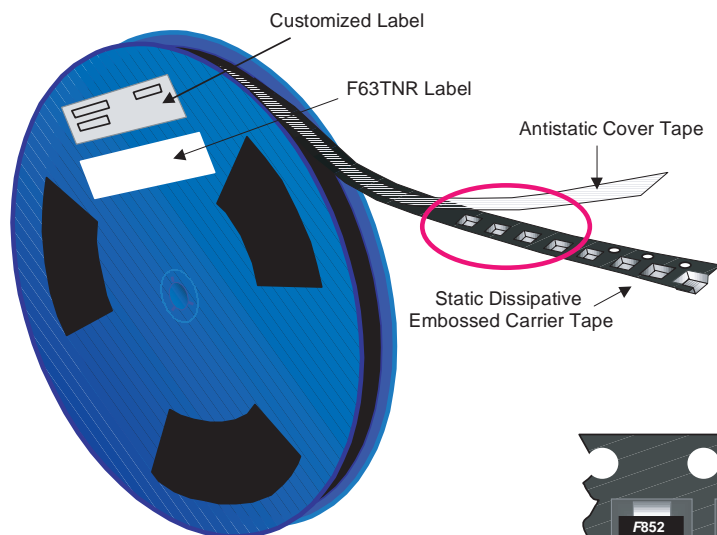
Figure 11. Transient Thermal Response Curve.

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

## SOT-223 Tape and Reel Data



### SOT-223 Packaging Configuration: Figure 1.0

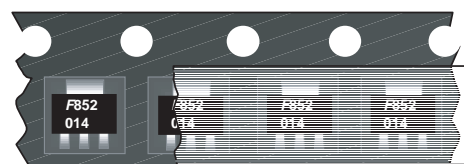


#### Packaging Description:

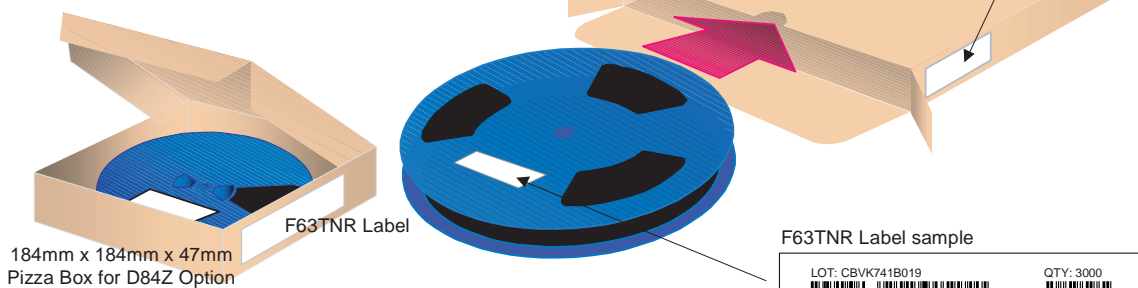
SOT-223 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts 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		

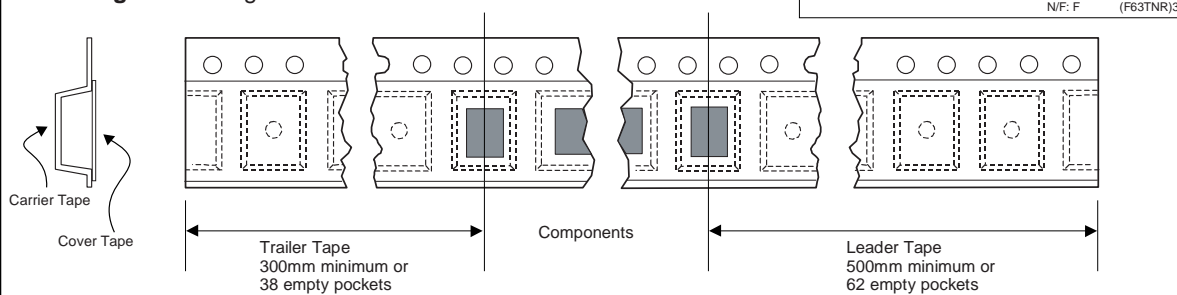


#### SOT-223 Unit Orientation



184mm x 184mm x 47mm  
Pizza Box for D84Z Option

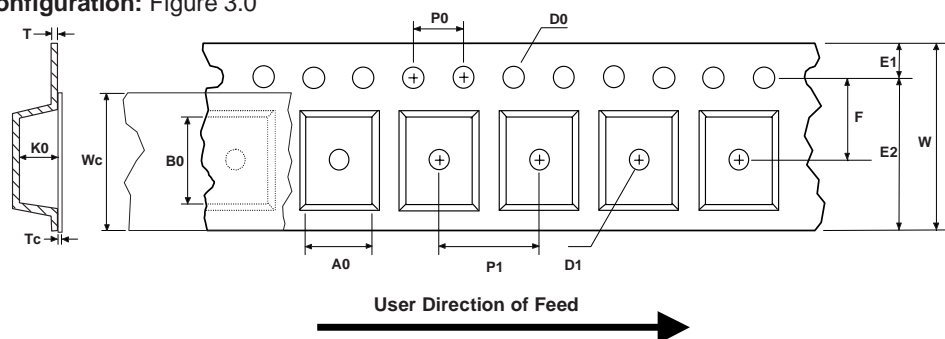
### SOT-223 Tape Leader and Trailer Configuration: Figure 2.0



## SOT-223 Tape and Reel Data, continued

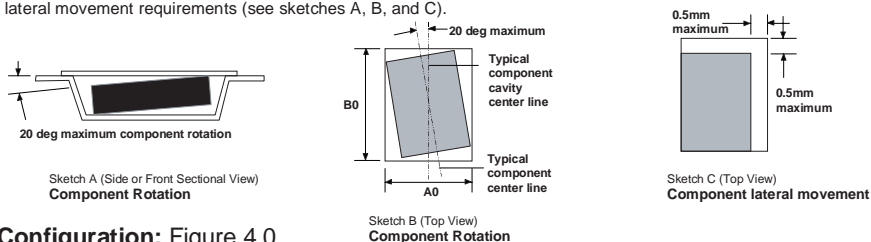
### SOT-223 Embossed Carrier Tape

Configuration: Figure 3.0

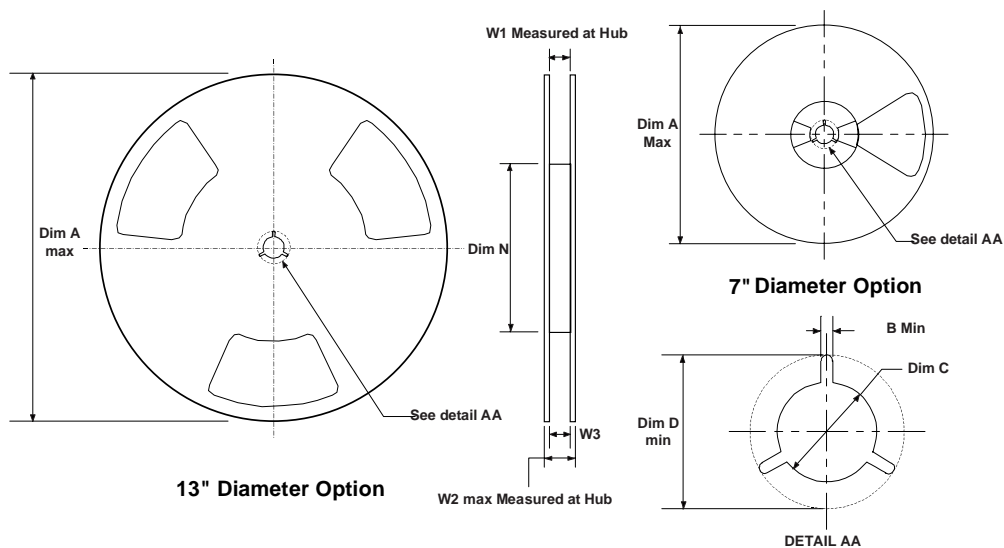


Dimensions are in millimeter														
Pkg type	A0	B0	W	D0	D1	E1	E2	F	P1	P0	K0	T	Wc	Tc
SOT-223 (12mm)	6.83 +/-0.10	7.42 +/-0.10	12.0 +/-0.3	1.55 +/-0.05	1.50 +/-0.10	1.75 +/-0.10	10.25 min	5.50 +/-0.05	8.0 +/-0.1	4.0 +/-0.1	1.88 +/-0.10	0.292 +/- 0.0130	9.5 +/-0.025	0.06 +/-0.02

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

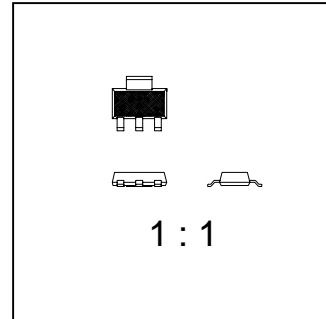
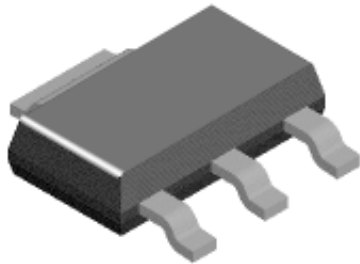


Dimensions are in inches and millimeters									
Tape Size	Reel Option	Dim A	Dim B	Dim C	Dim D	Dim N	Dim W1	Dim W2	Dim W3 (LSL-USL)
12mm	7" Dia	7.00 177.8	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	5.906 150	0.488 +0.078/-0.000 12.4 +2/0	0.724 18.4	0.469 - 0.606 11.9 - 15.4
12mm	13" Dia	13.00 330	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 Package Dimensions

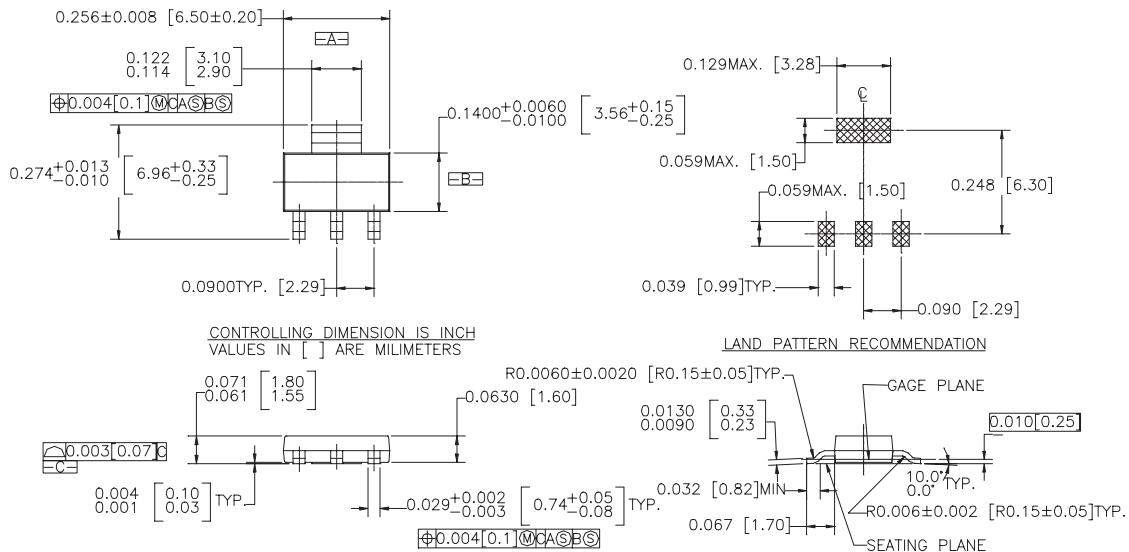


### SOT-223 (FS PKG Code 47)



Scale 1:1 on letter size paper

Part Weight per unit (gram): 0.1246



NOTES : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH TO BE 150 MICRONS/ 3.81 MICROMETERS

MINIMUM TIN/LEAD (SOLDER) ON COPPER.

2. REFERENCE JEDEC REGISTRATION TO-261, VARIATION AA, ISSUE A, DATED JAN 1990

SOT223, 4 LEADS

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CROSSVOLT™	GlobalOptoisolator™	Power247™	SuperSOT™-6
DenseTrench™	GTO™	PowerTrench <sup>®</sup>	SuperSOT™-8
DOMETM	HiSeC™	QFET™	SyncFET™
EcoSPARK™	ISOPLANAR™	QS™	TinyLogic™
E <sup>2</sup> CMOS™	LittleFET™	QT Optoelectronics™	TruTranslation™
EnSigna™	MicroFET™	Quiet Series™	UHC™
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Datasheet Identification	Product Status	Definition
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