



April 1999

FDN359AN
N-Channel Logic Level PowerTrench™ MOSFET

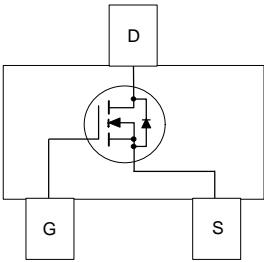
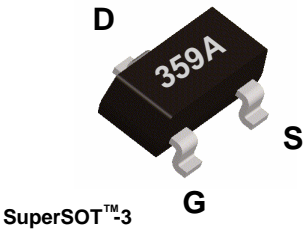
General Description

This N-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.

Features

- 2.7 A, 30 V. $R_{DS(ON)} = 0.046\ \Omega$ @ $V_{GS} = 10\text{ V}$
 $R_{DS(ON)} = 0.060\ \Omega$ @ $V_{GS} = 4.5\text{ V}$.
- Very fast switching.
- Low gate charge (5nC typical).
- High power version of industry standard SOT-23 package. Identical pin out to SOT-23 with 30% higher power handling capability.



Absolute Maximum Ratings $T_A = 25^{\circ}\text{C}$ unless other wise noted

| Symbol | Parameter | Ratings | Units |
|--------------------------------|---|------------|----------------------|
| V_{DS} | Drain-Source Voltage | 30 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | V |
| I_D | Maximum Drain Current - Continuous (Note 1a) | 2.7 | A |
| | - Pulsed | 15 | |
| P_D | Maximum Power Dissipation (Note 1a) | 0.5 | W |
| | (Note 1b) | 0.46 | |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to 150 | $^{\circ}\text{C}$ |
| THERMAL CHARACTERISTICS | | | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 250 | $^{\circ}\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1) | 75 | $^{\circ}\text{C/W}$ |

Electrical Characteristics (T_A = 25 °C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|--|---|--|-----|-------------------------|------------------------|--------|
| OFF CHARACTERISTICS | | | | | | |
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} = 0 V, I _D = 250 μA | 30 | | | V |
| ΔBV _{DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | I _D = 250 μA, Referenced to 25 °C | | 23 | | mV/ °C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 24 V, V _{GS} = 0 V T _J = 55°C | | | 1 10 | μA |
| I _{GSSF} | Gate - Body Leakage, Forward | V _{GS} = 20 V, V _{DS} = 0 V | | | 100 | nA |
| I _{GSSR} | Gate - Body Leakage, Reverse | V _{GS} = -20 V, V _{DS} = 0 V | | | -100 | nA |
| ON CHARACTERISTICS (Note) | | | | | | |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = 250 μA | 1 | 1.6 | 3 | V |
| ΔV _{GS(th)} /ΔT _J | Gate Threshold Voltage Temp. 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 = 2.7 A T _J =125°C V _{GS} = 4.5 V, I _D = 2.4 A | | 0.037 0.055 0.049 | 0.046 0.075 0.06 | Ω |
| I _{D(on)} | On-State Drain Current | V _{GS} = 10 V, V _{DS} = 5 V | 15 | | | A |
| g _{FS} | Forward Transconductance | V _{DS} = 5 V, I _D = 2.7 A | | 9.5 | | S |
| DYNAMIC CHARACTERISTICS | | | | | | |
| C _{iss} | Input Capacitance | V _{DS} = 10 V, V _{GS} = 0 V, f = 1.0 MHz | | 480 | | pF |
| C _{oss} | Output Capacitance | | | 120 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 45 | | pF |
| SWITCHING CHARACTERISTICS (Note) | | | | | | |
| t _{D(on)} | Turn - On Delay Time | V _{DD} = 5 V, I _D = 1 A, V _{GS} = 4.5 V, R _{GEN} = 6 Ω | | 6 | 12 | ns |
| t _r | Turn - On Rise Time | | | 13 | 24 | ns |
| t _{D(off)} | Turn - Off Delay Time | | | 15 | 27 | ns |
| t _f | Turn - Off Fall Time | | | 4 | 10 | ns |
| Q _g | Total Gate Charge | V _{DS} = 10 V, I _D = 2.7 A, V _{GS} = 5 V | | 5 | 7 | nC |
| Q _{gs} | Gate-Source Charge | | | 1.4 | | nC |
| Q _{gd} | Gate-Drain Charge | | | 1.6 | | 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) | | 0.65 | 1.2 | V |

Note:

1. R_{θJA} 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_{θJC} is guaranteed by design while R_{θJA} is determined by the user's board design.

Typical R_{θJA} using the board layouts shown below on FR-4 PCB in a still air environment :



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



b. 270°C/W when mounted on
a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Electrical Characteristics

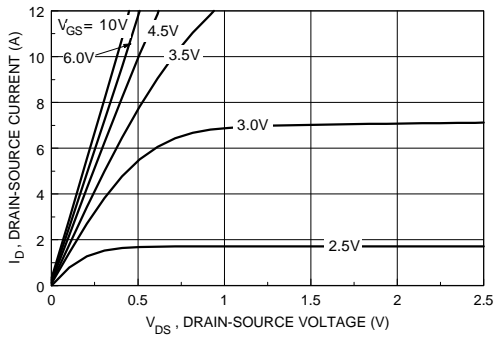


Figure 1. On-Region Characteristics.

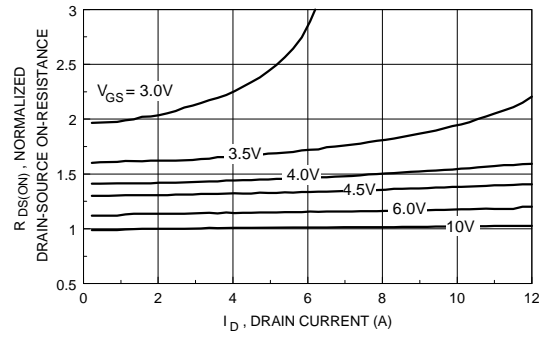


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

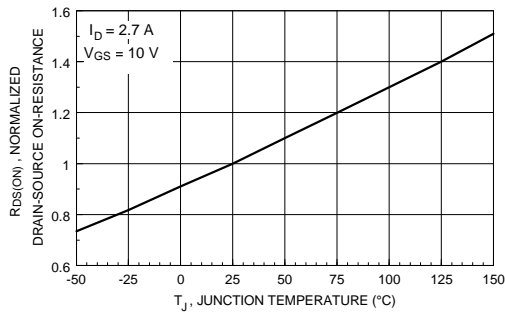


Figure 3. On-Resistance Variation with Temperature.

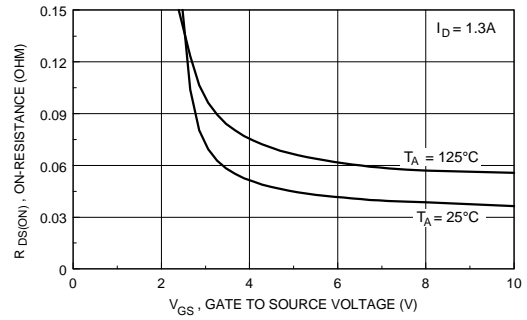


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

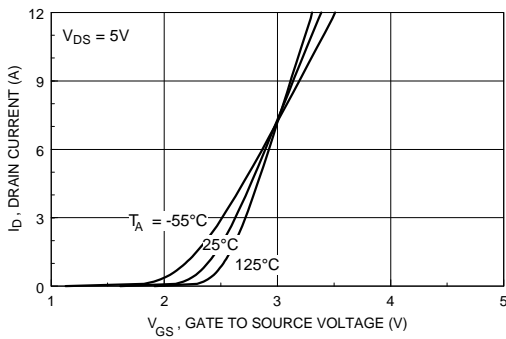


Figure 5. Transfer Characteristics.

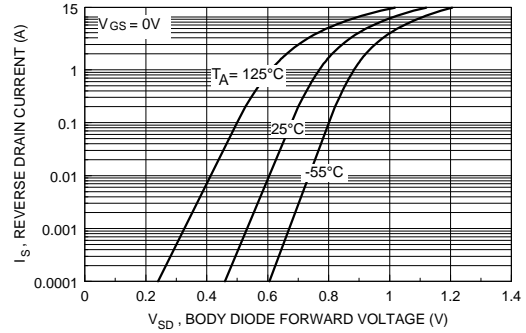


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics

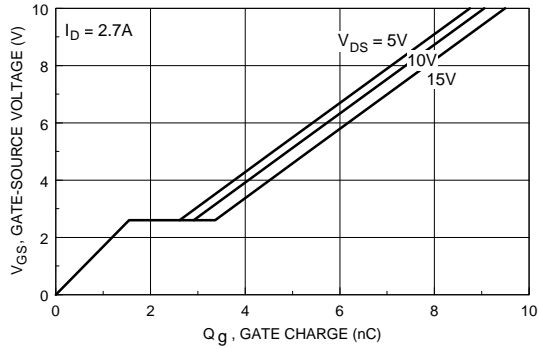


Figure 7. Gate Charge Characteristics.

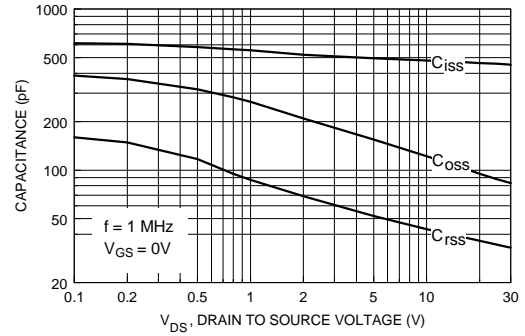


Figure 8. Capacitance Characteristics.

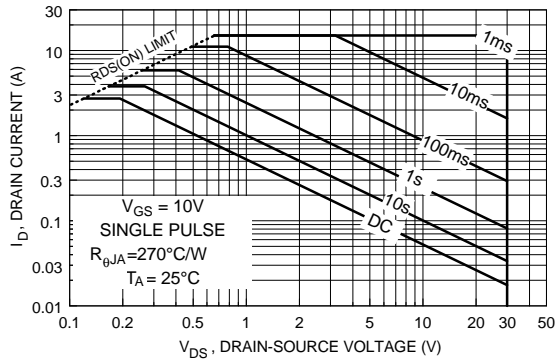


Figure 9. Maximum Safe Operating Area.

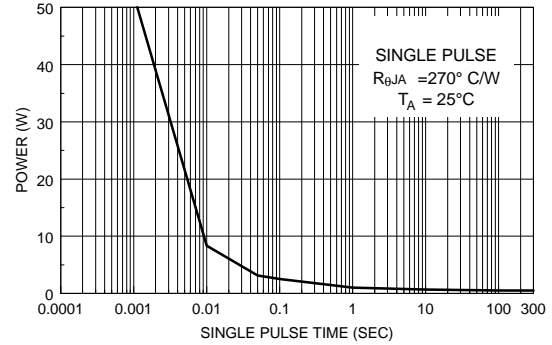


Figure 10. Single Pulse Maximum Power Dissipation.

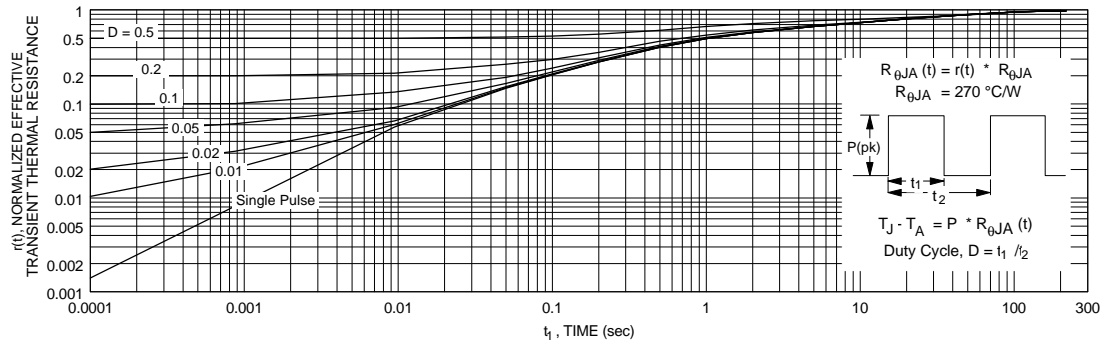


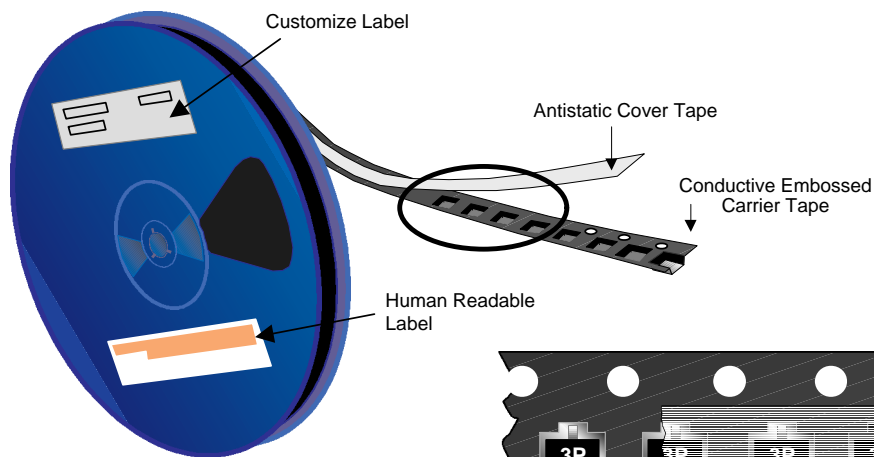
Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in note 1b.

Transient thermal response will change depending on the circuit board design.

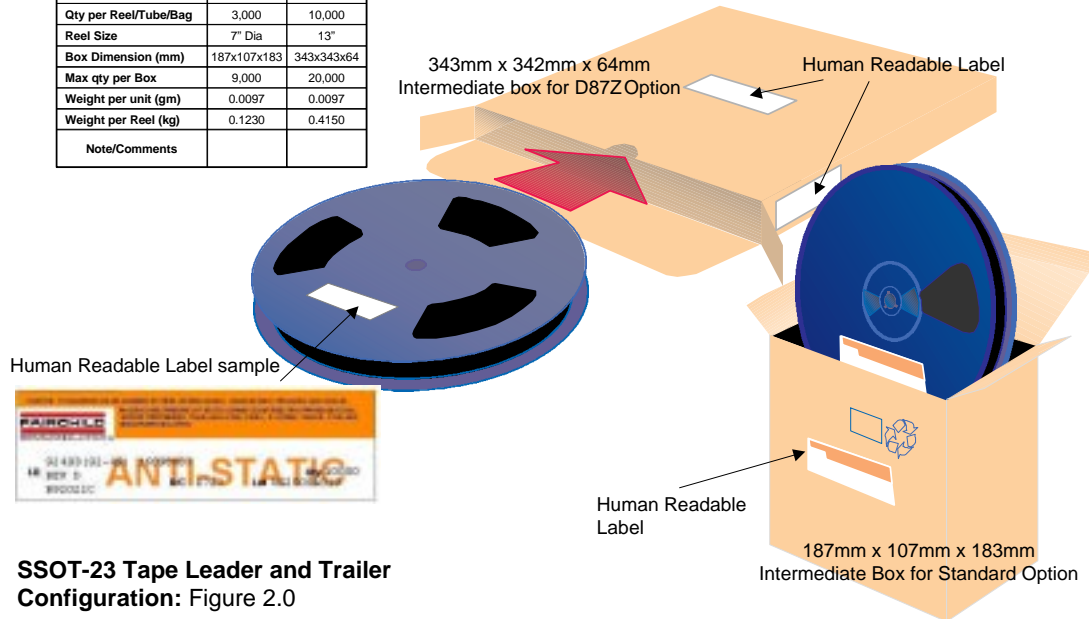
SuperSOT™-3 Tape and Reel Data and Package Dimensions

SSOT-3 Packaging Configuration: Figure 1.0

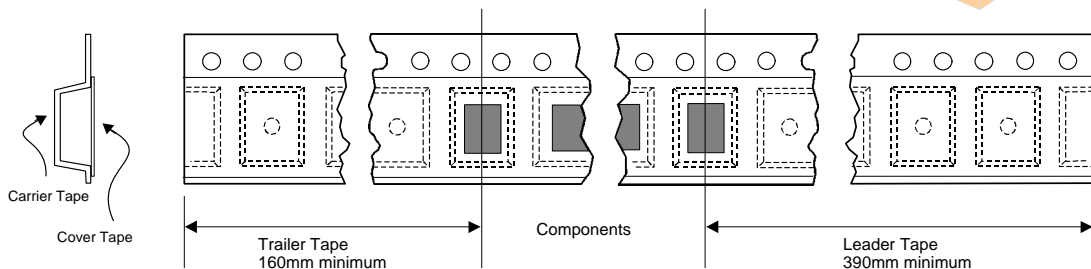


| SSOT-3 Std Packaging Information | | |
|----------------------------------|-------------------------|------------|
| Packaging Option | Standard (no flow code) | D87Z |
| Packaging type | TNR | TNR |
| Qty per Reel/Tube/Bag | 3,000 | 10,000 |
| Reel Size | 7" Dia | 13" |
| Box Dimension (mm) | 187x107x183 | 343x343x64 |
| Max qty per Box | 9,000 | 20,000 |
| Weight per unit (gm) | 0.0097 | 0.0097 |
| Weight per Reel (kg) | 0.1230 | 0.4150 |
| Note/Comments | | |

SSOT-3 Std Unit Orientation



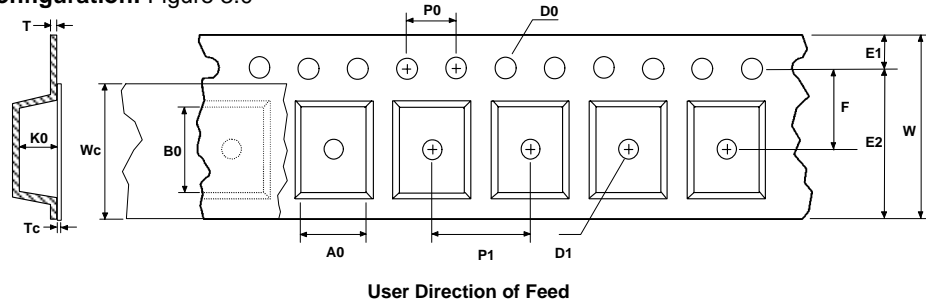
SSOT-23 Tape Leader and Trailer Configuration: Figure 2.0



SuperSOT™-3 Tape and Reel Data and Package Dimensions, continued

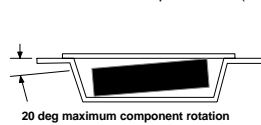
SSOT-3 Embossed Carrier Tape

Configuration: Figure 3.0

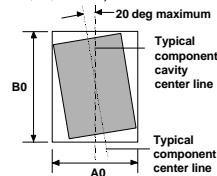


| Dimensions are in millimeter | | | | | | | | | | | | | | |
|------------------------------|-----------------|-----------------|---------------|-----------------|------------------|-----------------|-------------|-----------------|---------------|---------------|-----------------|-------------------|---------------|-----------------|
| Pkg type | A0 | B0 | W | D0 | D1 | E1 | E2 | F | P1 | P0 | K0 | T | Wc | Tc |
| SSOT-3 (8mm) | 3.15 +/-0.10 | 2.77 +/-0.10 | 8.0 +/-0.3 | 1.55 +/-0.05 | 1.00 +/-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 |

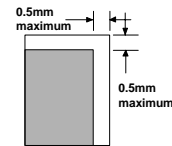
Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)
Component Rotation

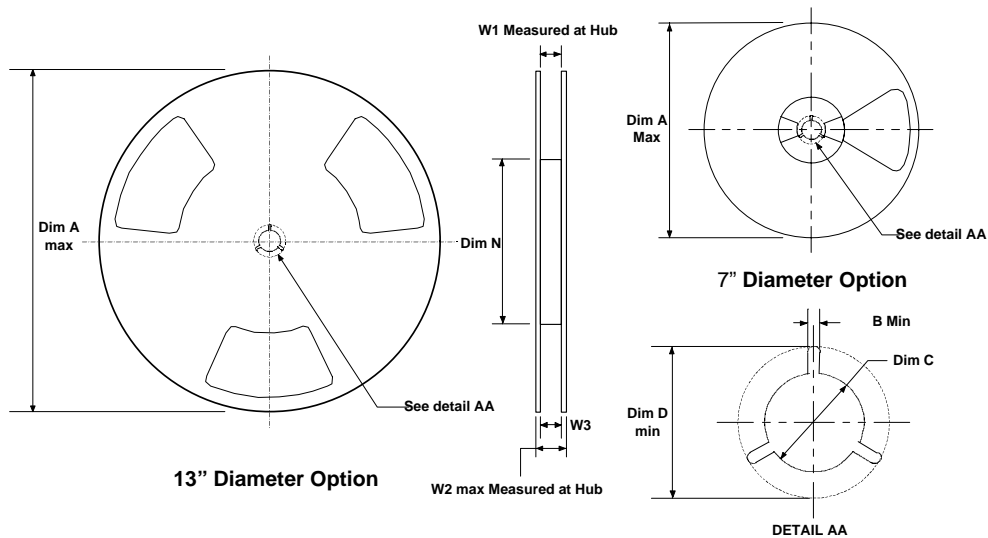


Sketch B (Top View)
Component Rotation



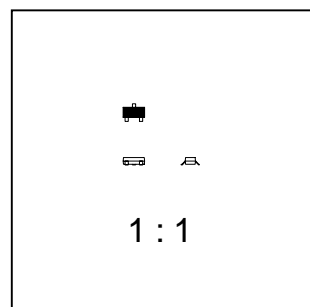
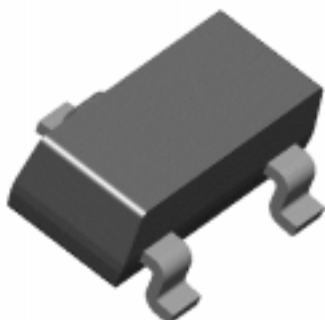
Sketch C (Top View)
Component lateral movement

SSOT-3 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) |
| 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 |

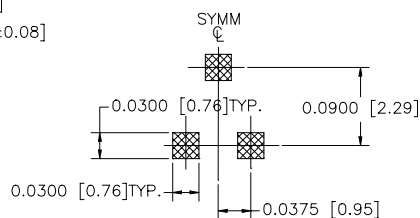
SuperSOT™-3 (FS PKG Code 32)



Dimensions shown below are in:
inches [mil limeters]

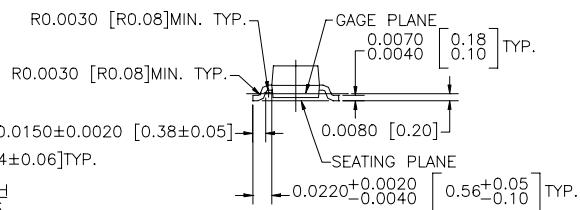
Technical drawing of a mechanical part with dimensions in mm and inches. The drawing shows a cross-section of a component with various features and dimensions. The dimensions are as follows:

- Overall width: 0.0990 ± 0.0050 [2.51 \pm 0.13]
- Top flange width: 0.1150 ± 0.0050 [2.92 \pm 0.13]
- Top flange thickness: 0.0550 ± 0.0030 [1.40 \pm 0.08]
- Internal width: 0.0375 ± 0.0025 [0.95 \pm 0.06]
- Bottom flange width: 0.0750 ± 0.0050 [1.91 \pm 0.13]
- Bottom flange thickness: 0.0240 [0.61] and 0.0180 [0.46]



Technical drawing of a shaft with a keyway and a pulley. The shaft has a diameter of 0.0015 [0.038] C. The keyway has a width of 0.0040 to 0.0010 [0.10 to 0.03] TYP. The pulley has a diameter of 0.0440 to 0.0360 [1.12 to 0.91] and a width of 0.0365 [0.93]. The shaft is shown with a cross-section and a side view.

CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS



SUPER SOT , 3 LEADS

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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