

FDD603AL

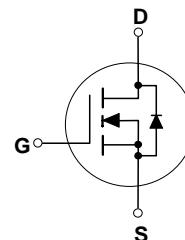
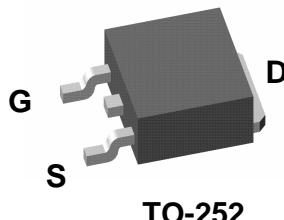
N-Channel Logic Level Enhancement Mode Field Effect Transistor

General Description

This N-Channel logic level enhancement mode power field effect transistor is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is tailored to minimize on-state resistance. These devices are particularly suited for low voltage applications such as DC/DC converters and high efficiency switching circuits where fast switching, low in-line power loss, and resistance to transients are needed.

Applications

- DC/DC converters
- Motor drives



Features

- 33 A, 30 V. $R_{DS(ON)} = 0.023 \Omega$ @ $V_{GS} = 10$ V
 $R_{DS(ON)} = 0.037 \Omega$ @ $V_{GS} = 4.5$ V.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged avalanche-rated internal source-drain diode can eliminate the need for external Zener Diode.
- High density cell design for extremely low $R_{DS(ON)}$.

Absolute Maximum Ratings

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

| Symbol | Parameter | Ratings | Units |
|----------------|---|-------------|------------------|
| V_{DSS} | Drain-Source Voltage | 30 | V |
| V_{GSS} | Gate-Source Voltage | ± 20 | V |
| I_D | Maximum Drain Current - Continuous $T_A = 25^\circ\text{C}$ (Note 1) | 33 | A |
| | $T_A = 25^\circ\text{C}$ (Note 1a) | 9.5 | |
| | Maximum Drain Current - Pulsed | 80 | |
| P_D | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$ (Note 1) | 39 | W |
| | $T_A = 25^\circ\text{C}$ (Note 1a) | 3.2 | |
| | $T_A = 25^\circ\text{C}$ (Note 1b) | 1.3 | |
| T_J, T_{stg} | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |

Thermal Characteristics

| | | | |
|-----------------|--|-----|---------------------------|
| R_{JC} | Thermal Resistance, Junction-to-Case (Note 1) | 2.5 | $^\circ\text{C}/\text{W}$ |
| R_{JA} | Thermal Resistance, Junction-to-Ambient (Note 1a) | 40 | $^\circ\text{C}/\text{W}$ |
| | (Note 1b) | 96 | $^\circ\text{C}/\text{W}$ |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape Width | Quantity |
|----------------|----------|-----------|------------|----------|
| FDD603AL | FDD603AL | 13" | 16mm | 2500 |

Electrical Characteristics

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|-----------------------------------|--|---|-----|-----|------|----------------------------|
| Off Characteristics | | | | | | |
| W_{DSS} | Single Pulse Drain-Source Avalanche Energy | $V_{DD} = 15\text{ V}$, $I_D = 12\text{ A}$ | | | 100 | mJ |
| I_{AR} | Maximum Drain-Source Avalanche Current | | | | 12 | A |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | 30 | | | V |
| ΔBV_{DSS} ΔT_J | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$, Referenced to 25°C | | 32 | | $\text{mV/}^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$ | | | 10 | μA |
| I_{GSSF} | Gate-Body Leakage Current, Forward | $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$ | | | 100 | nA |
| I_{GSSR} | Gate-Body Leakage Current, Reverse | $V_{GS} = -20\text{ V}$, $V_{DS} = 0\text{ V}$ | | | -100 | nA |

On Characteristics (Note 2)

| | | | | | | |
|--|--|--|----|-------------------------|-------------------------|----------------------------|
| $V_{GS(\text{th})}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 1 | 1.7 | 3 | V |
| $\Delta V_{GS(\text{th})}$ ΔT_J | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C | | -4.5 | | $\text{mV/}^\circ\text{C}$ |
| $R_{DS(\text{on})}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}$, $I_D = 9.5\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 9.5\text{ A}$, $T_J=125^\circ\text{C}$ $V_{GS} = 4.5\text{ V}$, $I_D = 7.5\text{ A}$ | | 0.016 0.024 0.026 | 0.023 0.035 0.037 | Ω |
| $I_{D(\text{on})}$ | On-State Drain Current | $V_{GS} = 10\text{ V}$, $V_{DS} = 10\text{ V}$ | 60 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = 10\text{ V}$, $I_D = 9.5\text{ A}$ | | 18 | | S |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|--|--|-----|--|-------------|
| C_{iss} | Input Capacitance | $V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$ $f = 1.0\text{ MHz}$ | | 670 | | pF |
| C_{oss} | Output Capacitance | | | 345 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 95 | | pF |

Switching Characteristics (Note 2)

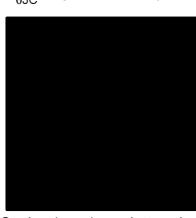
| | | | | | | |
|--------------|---------------------|--|--|-----|----|-------------|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 15\text{ V}$, $I_D = 1\text{ A}$ $V_{GS} = 10\text{ V}$, $R_{\text{GEN}} = 6\text{ }\Omega$ | | 10 | 20 | ns |
| t_r | Turn-On Rise Time | | | 16 | 30 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 27 | 45 | ns |
| t_f | Turn-Off Fall Time | | | 12 | 22 | ns |
| Q_g | Total Gate Charge | $V_{DS} = 10\text{ V}$, $I_D = 9.5\text{ A}$ $V_{GS} = 10\text{ V}$, | | 19 | 26 | nC |
| Q_{gs} | Gate-Source Charge | | | 3.5 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 5.5 | | nC |

Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | | |
|----------|--|--|----------|------|-----|------------|
| I_s | Maximum Continuous Drain-Source Diode Forward Current (Note 1) | | | 33 | A | |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}$, $I_s = 2.3\text{ A}$ | (Note 2) | 0.78 | 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 drain tab. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design. $R_{\theta JC}$ has been used to determine some maximum ratings.



Scale 1 : 1 on letter size paper

- a) $R_{\theta JA} = 40^\circ\text{C/W}$ when mounted
- on a 1 in^2 pad of 2oz copper.

- b) $R_{\theta JA} = 96^\circ\text{C/W}$ on a minimum
- mounting pad.

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

Typical Characteristics

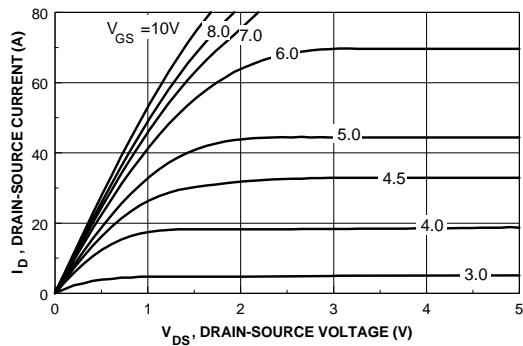


Figure 1. On-Region Characteristics.

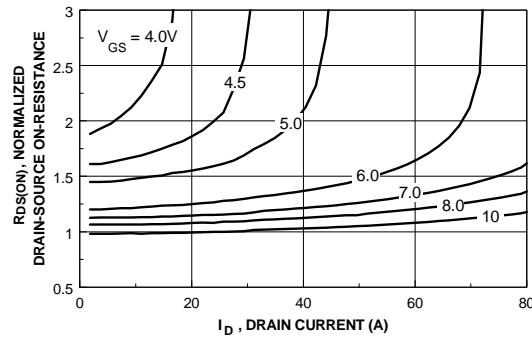


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

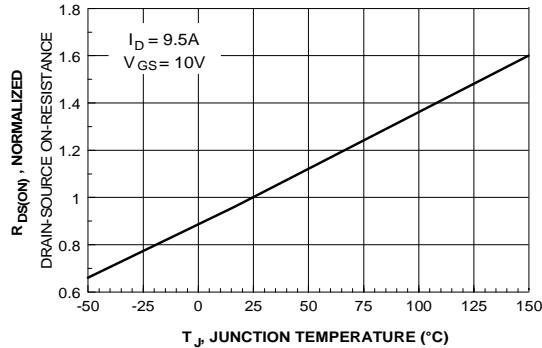


Figure 3. On-Resistance Variation with Temperature.

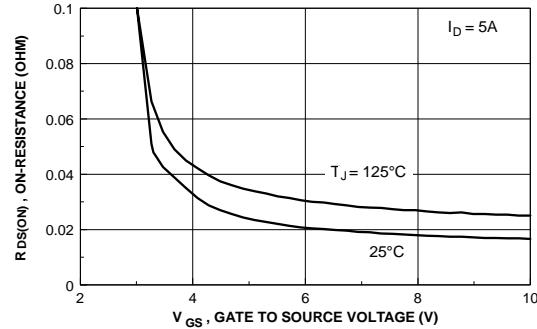


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

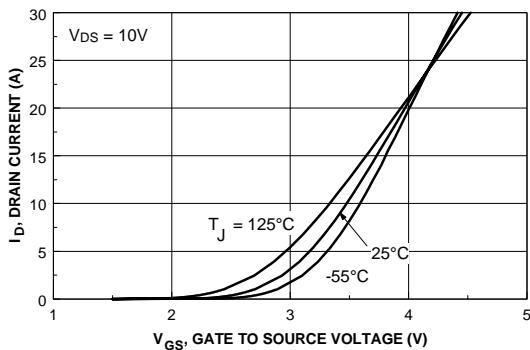


Figure 5. Transfer Characteristics.

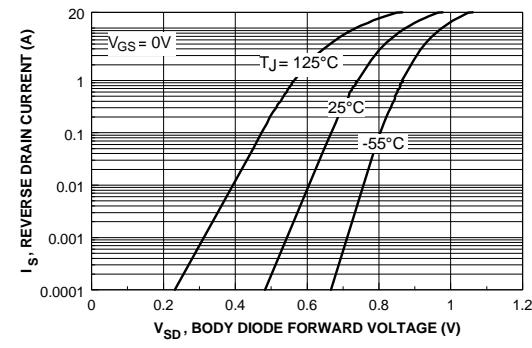


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

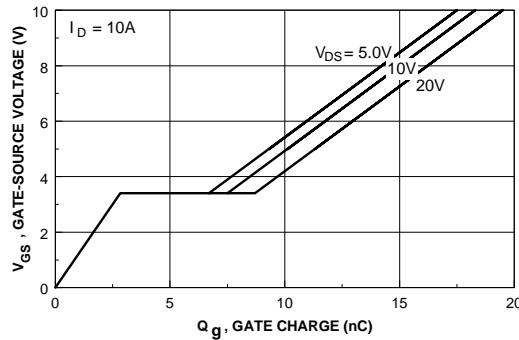


Figure 7. Gate-Charge Characteristics.

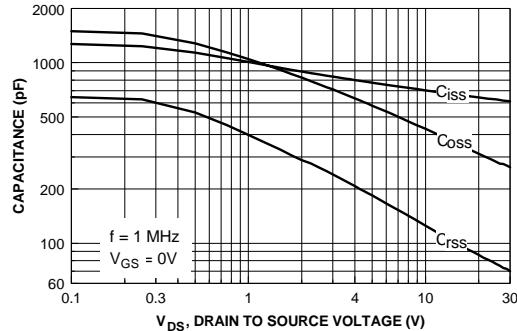


Figure 8. Capacitance Characteristics.

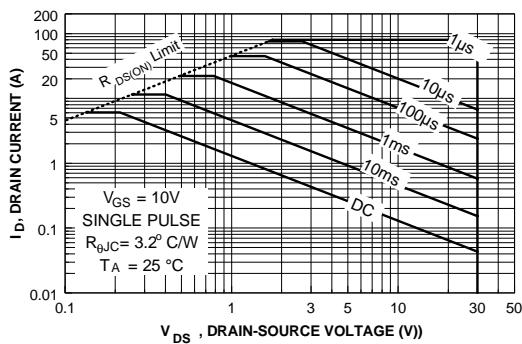


Figure 9. Maximum Safe Operating Area.

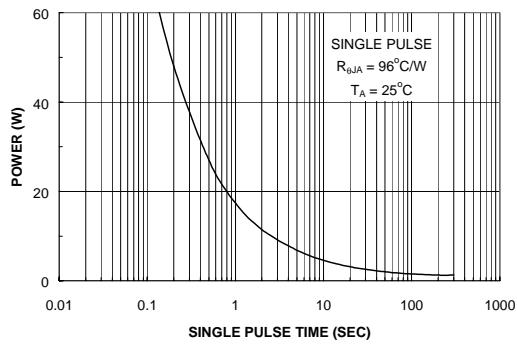


Figure 10. Single Pulse Maximum Power Dissipation.

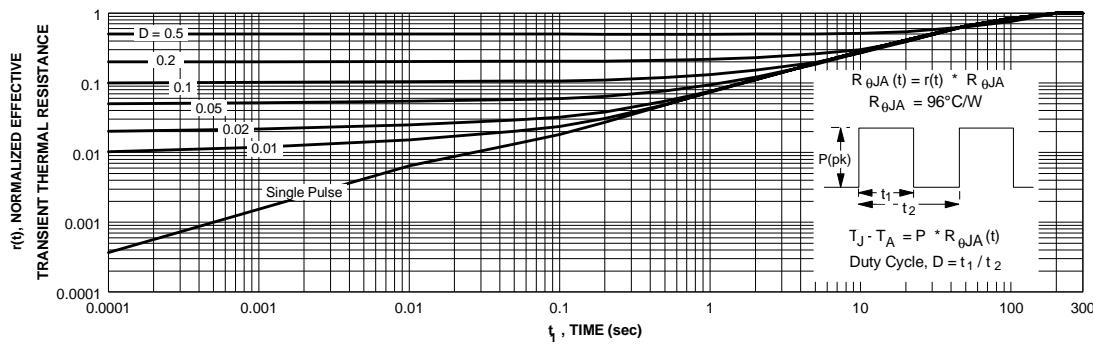


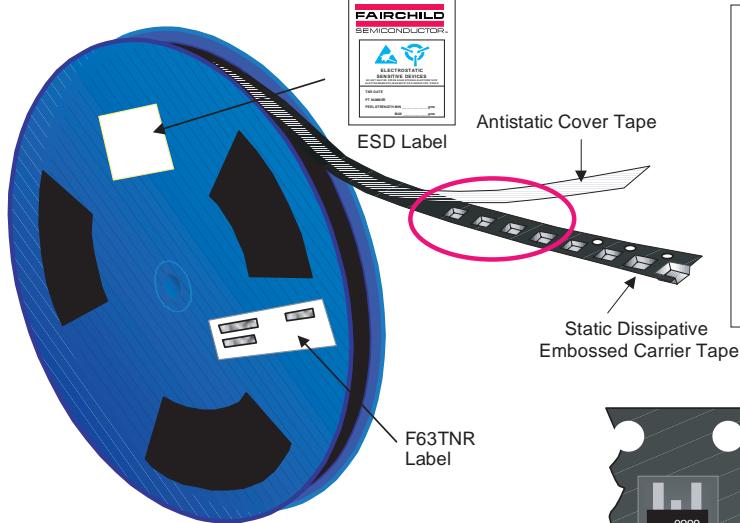
Figure 11. Transient Thermal Response Curve.

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

TO-252 Tape and Reel Data and Package Dimensions

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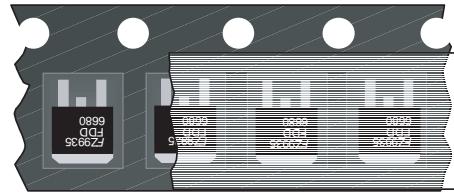
D-PAK (TO-252) Packaging Configuration: Figure 1.0



Packaging Description:

TO-252 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 2500 units per 13" or 330cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). This and some other options are further described in the Packaging Information table.

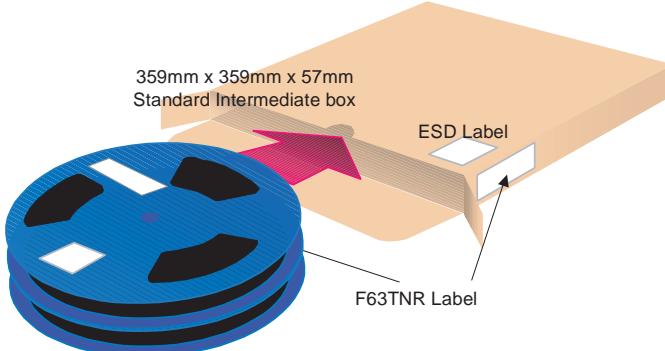
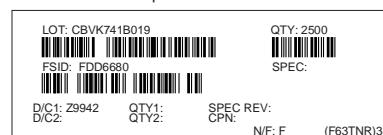
These full reels are individually barcode labeled and placed inside a standard intermediate box (illustrated in figure 1.0) made of recyclable corrugated brown paper. One box contains two reels maximum. And these boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.



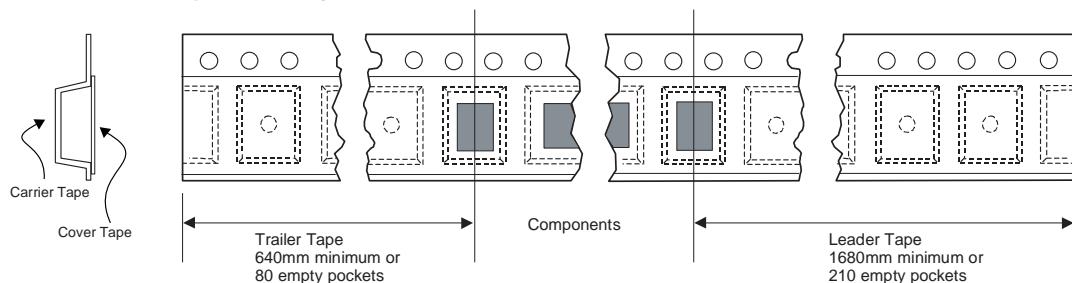
D-PAK (TO-252) Unit Orientation

| D-PAK (TO-252) Packaging Information | |
|--------------------------------------|-------------------------|
| Packaging Option | Standard (no flow code) |
| Packaging type | TNR |
| Qty per Reel/Tube/Bag | 2,500 |
| Reel Size | 13" Dia |
| Box Dimension (mm) | 359x359x57 |
| Max qty per Box | 5,000 |
| Weight per unit (gm) | 0.300 |
| Weight per Reel(kg) | 1.200 |
| Note/Comments | |

F63TNR Label sample



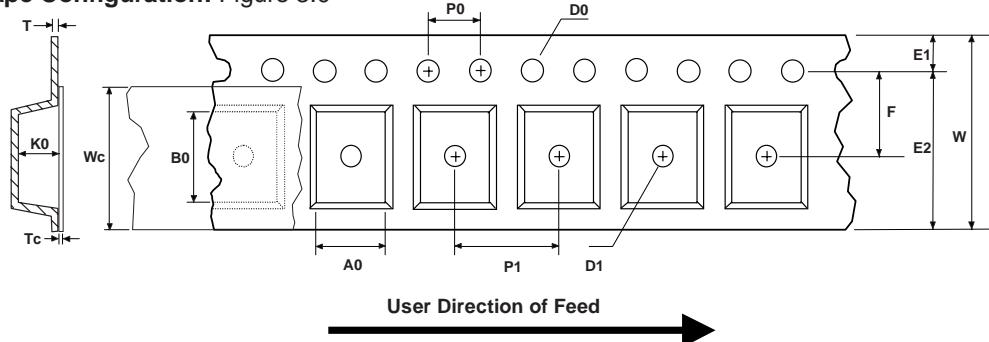
TO-252 (D-PAK) Tape Leader and Trailer Configuration: Figure 2.0



TO-252 Tape and Reel Data and Package Dimensions

D-PAK (TO-252) Embossed Carrier

Tape Configuration: Figure 3.0



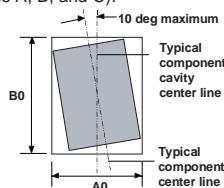
Dimensions are in millimeter

| Pkg type | A_0 | B_0 | W | D_0 | D_1 | E_1 | E_2 | F | P_1 | P_0 | K_0 | T | W_c | T_c |
|-----------------|------------------|-------------------|-----------------|------------------|-----------------|------------------|--------------|------------------|----------------|----------------|------------------|------------------|-----------------|------------------|
| TO252 (24mm) | 6.90 $+/-.10$ | 10.50 $+/-.10$ | 16.0 $+/-.3$ | 1.55 $+/-.05$ | 1.5 $+/-.10$ | 1.75 $+/-.10$ | 14.25 min | 7.50 $+/-.10$ | 8.0 $+/-.1$ | 4.0 $+/-.1$ | 2.65 $+/-.10$ | 0.30 $+/-.05$ | 13.0 $+/-.3$ | 0.06 $+/-.02$ |

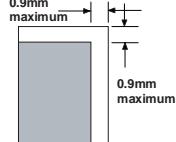
Notes: A_0 , B_0 , and K_0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).



Sketch A (Side or Front Sectional View)
Component Rotation

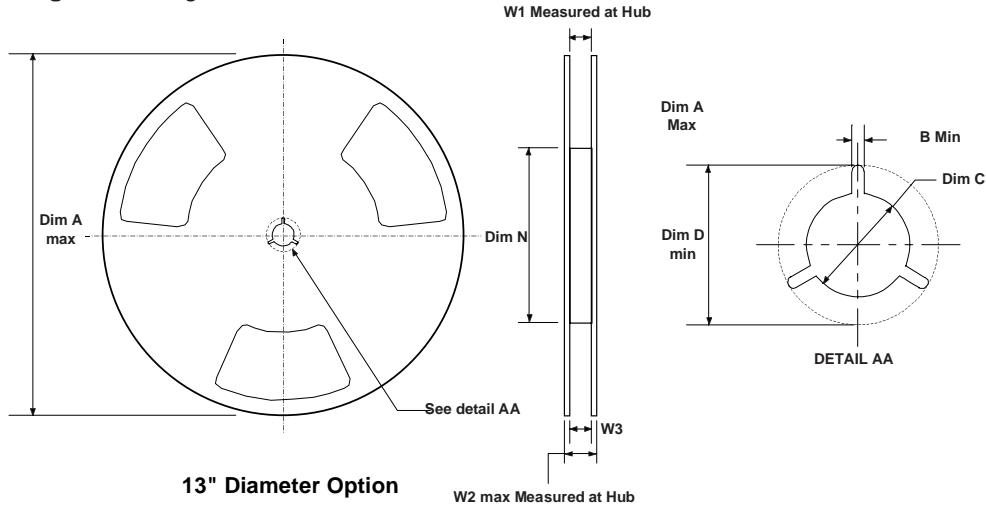


Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

D-PAK (TO-252) Reel Configuration: Figure 4.0



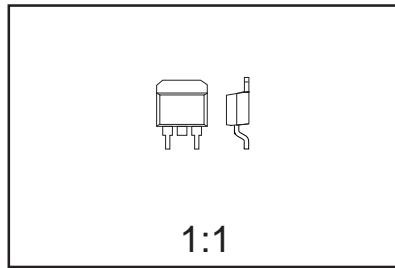
13" Diameter Option

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) |
|-----------|-------------|--------------|--------------|-----------------------------------|---------------|-------------|----------------------------------|---------------|------------------------------|
| 164mm | 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 | 0.646 +0.078/-0.000 16.4 +2/0 | 0.882 22.4 | 0.626 - 0.764 15.9 - 19.4 |

TO-252 Tape and Reel Data and Package Dimensions

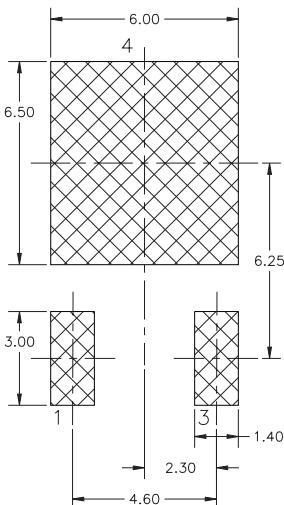
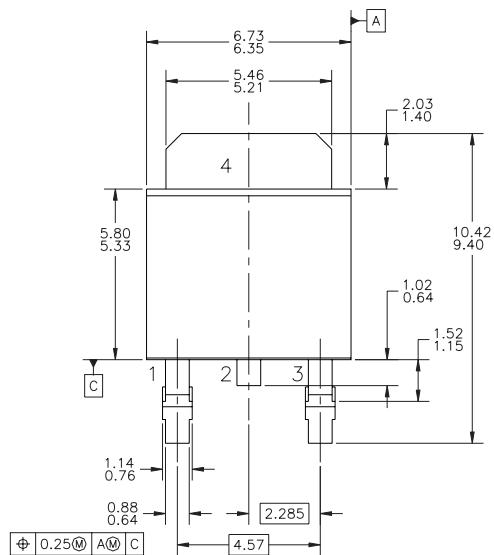
TO-252 (FS PKG Code AA)



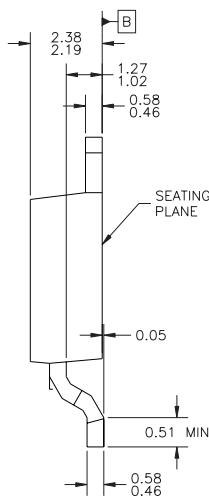
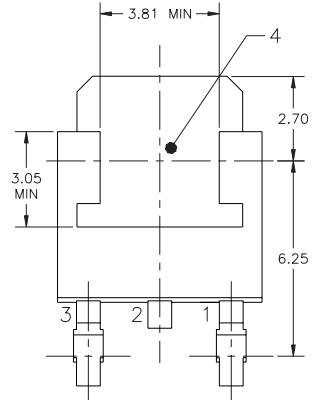
Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.300



LAND PATTERN RECOMMENDATION



NOTES: UNLESS OTHERWISE SPECIFIED

A) ALL DIMENSIONS ARE IN MILLIMETERS.

B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE B, VARIATION AB, ITEM 10.268, DATED SEPTEMBER 1988.

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