FAIRCHILD SEMICONDUCTOR™

July 1999

FDD6680

N-Channel Logic Level PWM Optimized PowerTrench™ MOSFET

General Description

This N-Channel Logic level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

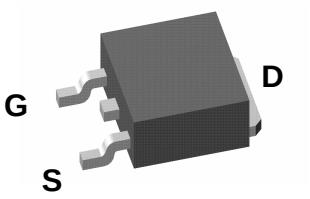
The MOSFET features faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(on)}$ specifications. The result is a MOSFET that is easier to drive, even at very high frequencies, and DC/DC power supply designs with higher overall efficiency.

Features

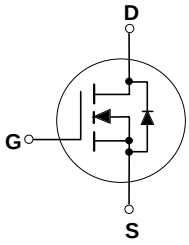
- 55 A, 30 V. $R_{DS(on)}$ = 0.010 Ω @ V_{GS} = 10 V
  $R_{DS(on)}$ = 0.015 Ω @ V_{GS} = 4.5 V.
- Optimized for use in high frequency DC/DC converters.
- Low gate charge (19nC typical).
- Very Fast switching.

Applications

- DC/DC converter
- Motor drives



TO-252



Absolute Maximum Ratings

T_C=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	Maximum Drain Current -Continuous	(Note 1)	55	A
		(Note 1a)	14	
	Maximum Drain Current -Pulsed		100	
P_D	Maximum Power Dissipation @ T_C = 25°C	(Note 1)	60	W
	T_A = 25°C	(Note 1a)	3.2	
	T_A = 25°C	(Note 1b)	1.3	
T_J, T_{stg}	Operating and Storage Junction Temperature Range		-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to- Case	(Note 1)	2.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to- Ambient	(Note 1a)	40	°C/W
		(Note 1b)	96	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD6680	FDD6680	13''	16mm	2500

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche ratings (Note 2)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 15 V, I_L = 55 A			170	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				55	A
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 = 250μA,Referenced to 25°C		18		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} = 20V, 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	2	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D =250μA,Referenced to 25°C		-5.5		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 14A V_{GS} = 10V, I_D = 14A, T_J =125°C V_{GS} = 4.5V, I_D = 12 A		0.008 0.013 0.012	0.010 0.017 0.015	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	50			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 14 A		38		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		2070		pF
C_{oss}	Output Capacitance			510		pF
C_{rss}	Reverse Transfer Capacitance			235		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		15	28	ns
t_r	Turn-On Rise Time			18	33	ns
$t_{d(off)}$	Turn-Off Delay Time			40	64	ns
t_f	Turn-Off Fall Time			18	33	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 14A, V_{GS} = 5V,		19	27	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			6		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				2.3	A
V_{SD}	Drain-Source Diode ForwardVoltage	V_{GS} = 0 V, I_S = 2.3 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 drain tab. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

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

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

Scale 1 : 1 on letter size paper

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

Typical Characteristics

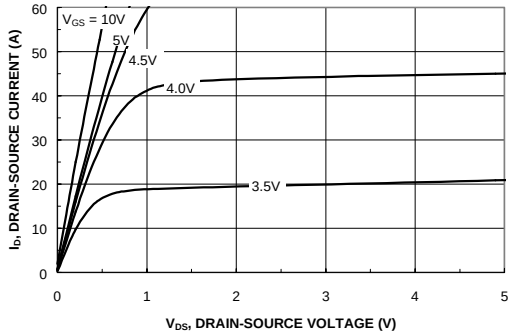


Figure 1. On-Region Characteristics.

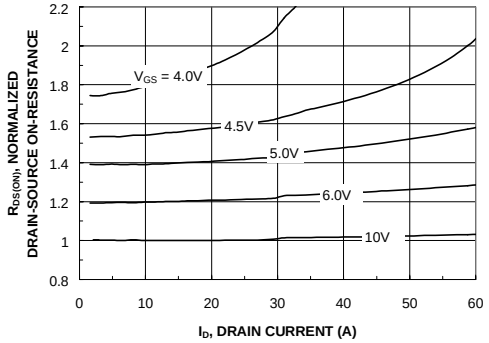


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

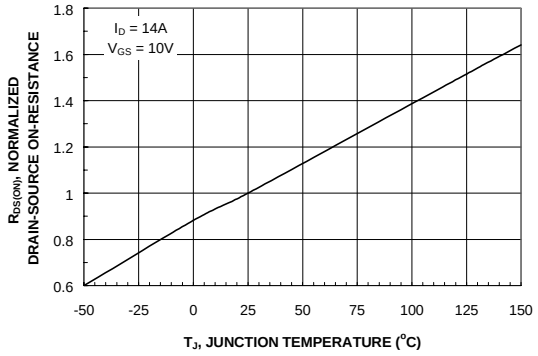


Figure 3. On-Resistance Variation with Temperature.

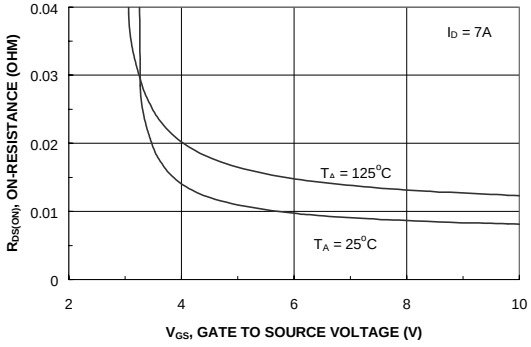


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

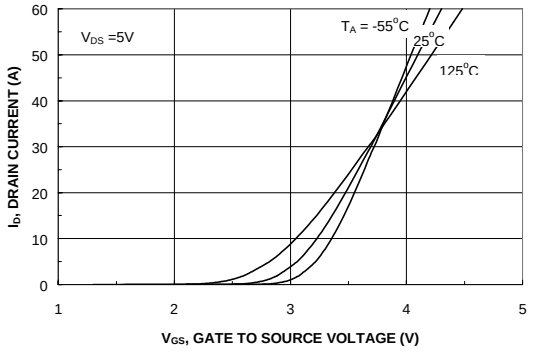


Figure 5. Transfer Characteristics.

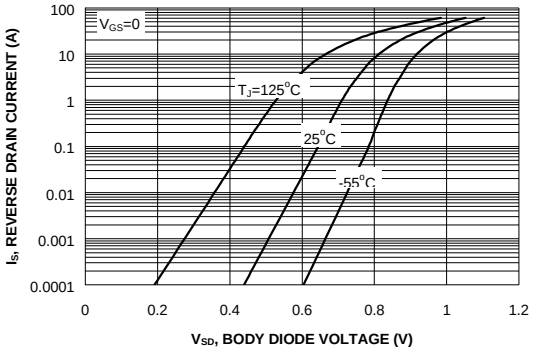


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

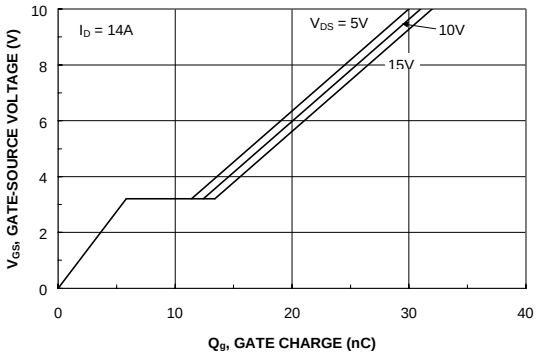


Figure 7. Gate-Charge Characteristics.

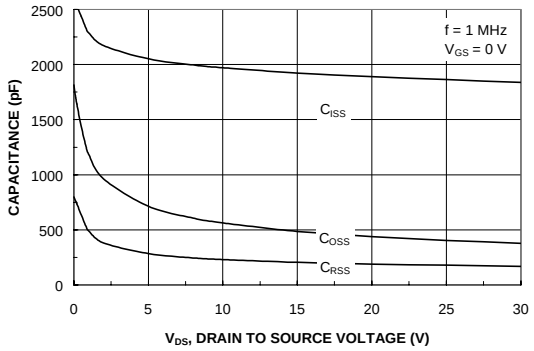


Figure 8. Capacitance Characteristics.

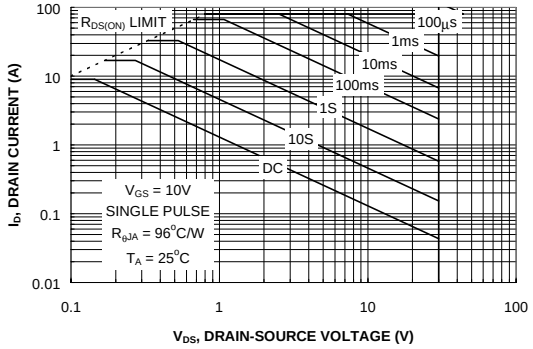


Figure 9. Maximum Safe Operating Area.

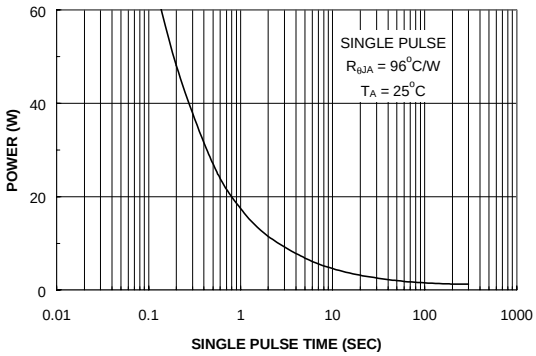


Figure 10. Single Pulse Maximum Power Dissipation.

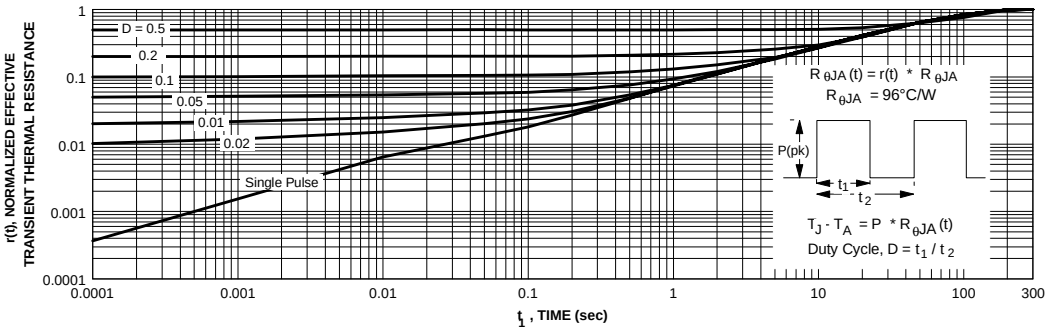


Figure 11. Transient Thermal Response Curve.

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

TO-252 Tape and Reel Data and Package Dimensions

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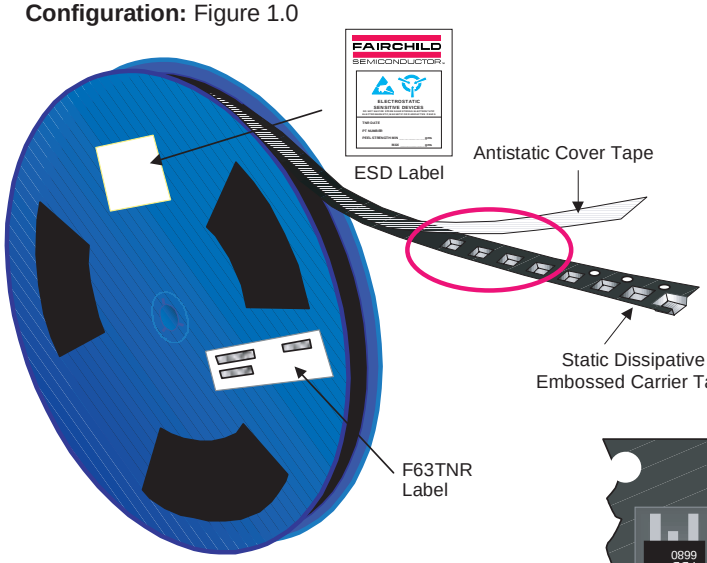
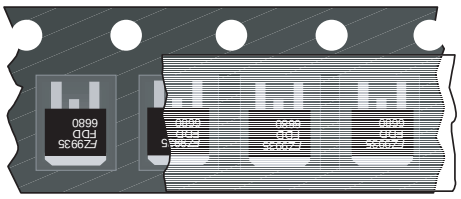
D-PAK (TO-252) Packaging Configuration: Figure 1.0



Packaging Description:

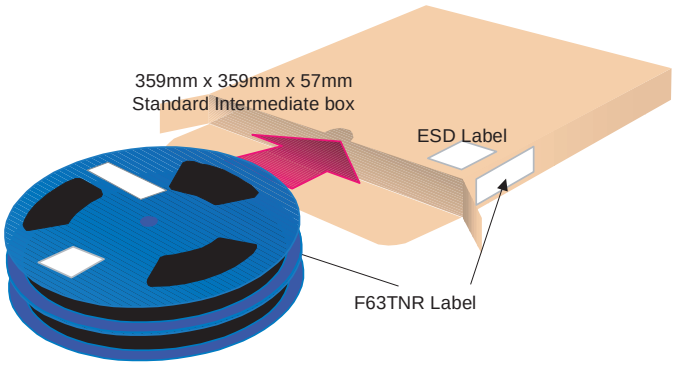
TO-252 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in 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.

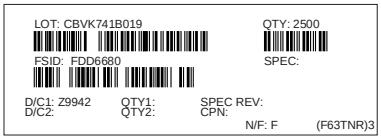


D-PAK (TO-252) Unit Orientation

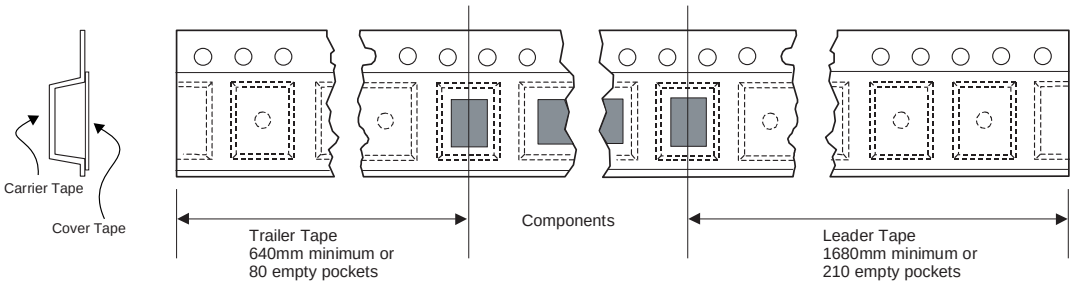
D-PAK (TO-252) Packaging Information	
Packaging Option	Standard (no flow code)
Packaging type	TNR
Qty per Reel/Tube/Bag	2,500
Reel Size	13" Dia
Box Dimension (mm)	359x359x57
Max qty per Box	5,000
Weight per unit (gm)	0.300
Weight per Reel(kg)	1.200
Note/Comments	



F63TNR Label sample



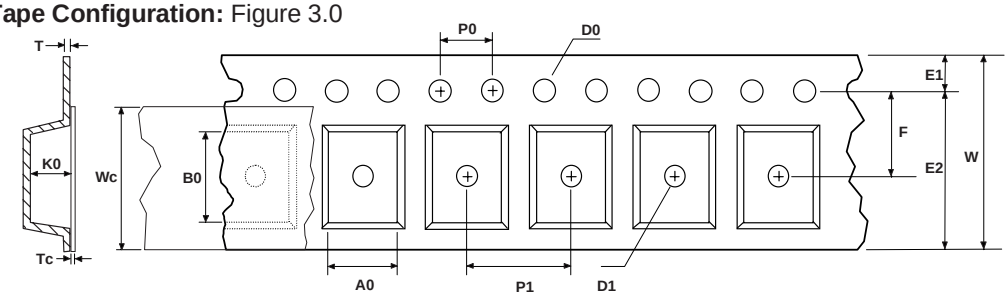
TO-252 (D-PAK) Tape Leader and Trailer Configuration: Figure 2.0



TO-252 Tape and Reel Data and Package Dimensions

D-PAK (TO-252) Embossed Carrier

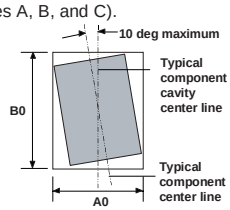
Tape Configuration: Figure 3.0



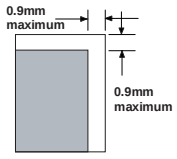
Dimensions are in millimeter														
Pkg type	**A0**	**B0**	**W**	**D0**	**D1**	**E1**	**E2**	**F**	**P1**	**P0**	**K0**	**T**	**Wc**	**Tc**
TO252 (24mm)	6.90 +/-0.10	10.50 +/-0.10	16.0 +/-0.3	1.55 +/-0.05	1.5 +/-0.10	1.75 +/-0.10	14.25 min	7.50 +/-0.10	8.0 +/-0.1	4.0 +/-0.1	2.65 +/-0.10	0.30 +/-0.05	13.0 +/-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



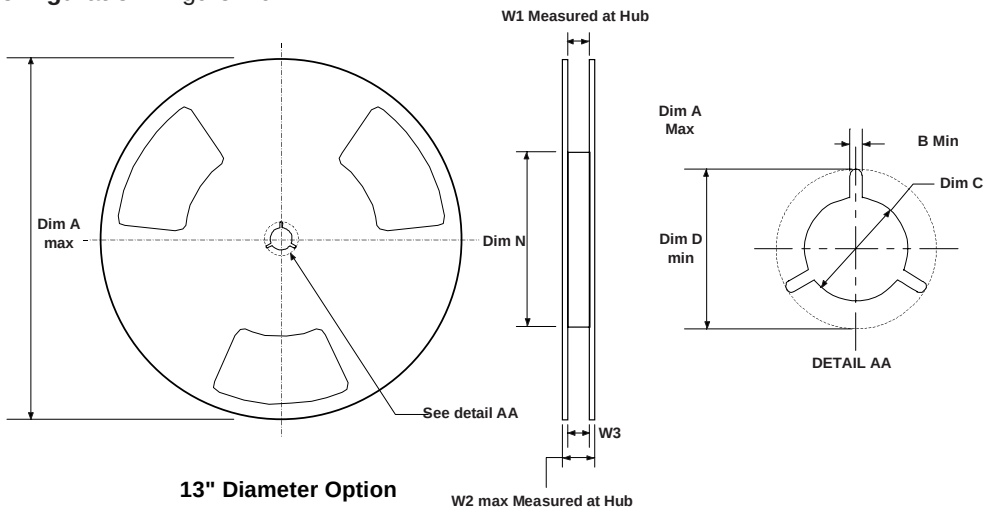
Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

D-PAK (TO-252) Reel

Configuration: Figure 4.0

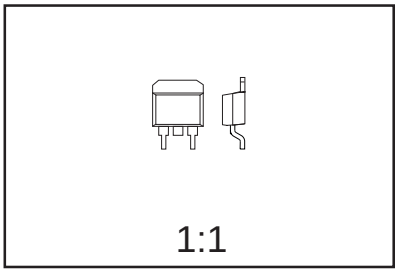


13" Diameter Option

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

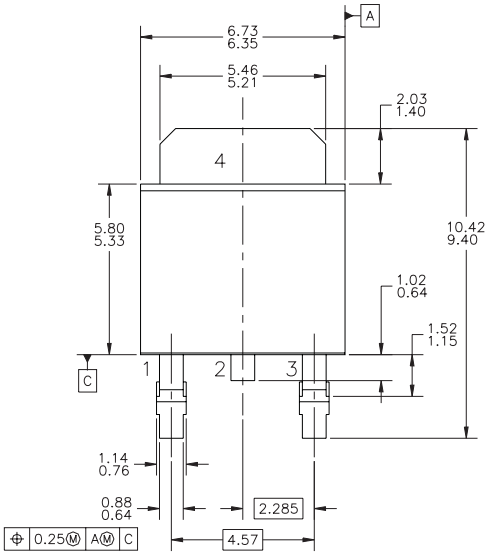
TO-252 (FS PKG Code AA)

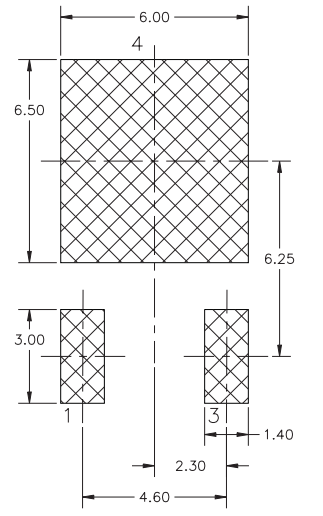


Scale 1:1 on letter size paper

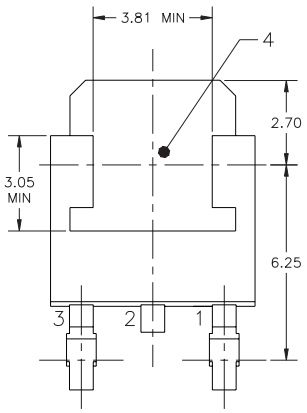
Dimensions shown below are in:
inches [millimeters]

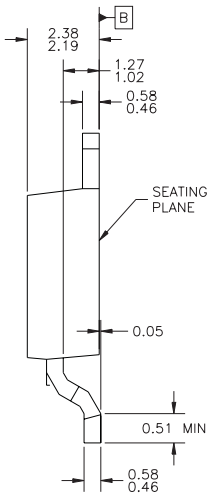
Part Weight per unit (gram): 0.300





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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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.
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