FAIRCHILD SEMICONDUCTOR™

July 2000

FDP6030BL/FDB6030BL

N-Channel Logic Level PowerTrench® MOSFET

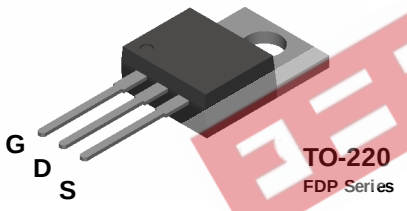
General Description

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.

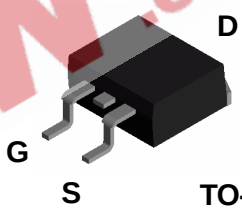
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(on)}$ specifications resulting in DC/DC power supply designs with higher overall efficiency.

Features

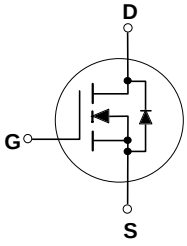
- 40 A, 30 V. $R_{DS(ON)}$ = 0.018 Ω @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 0.024 Ω @ V_{GS} = 4.5 V.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- High performance trench technology for extremely low $R_{DS(ON)}$.
- 175°C maximum junction temperature rating.



TO-220
FDP Series



TO-263AB
FDB Series



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter	FDP6030BL	FDB6030BL	Units
V_{DSS}	Drain-Source Voltage	30		V
V_{GSS}	Gate-Source Voltage	±20		V
I_D	Maximum Drain Current - Continuous (Note 1)	40		A
	- Pulsed	120		
P_D	Total Power Dissipation @ T_C = 25°C	60		W
	Derate above 25°C	0.36		W/°C
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-65 to +175		°C

Thermal Characteristics

$R\theta_{JC}$	Thermal Resistance, Junction-to-Case	2.5		°C/W
$R\theta_{JA}$	Thermal Resistance, Junction-to-Ambient	62.5		°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDB6030BL	FDB6030BL	13''	24mm	800
FDP6030BL	FDP6030BL	Tube	N/A	45

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
DRAIN-SOURCE AVALANCHE RATINGS (Note 1)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 15 V, I_D = 40 A			150	mJ
I_{AR}	Maximum Drain-Source Avalnche Current				40	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 = 250 µA, Referenced to 25°C		23		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} = 20 V, 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 1)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.6	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		-4.5		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 20 A, V_{GS} = 10 V, I_D = 20 A, T_J = 125°C V_{GS} = 4.5 V, I_D = 17 A		0.015 0.021 0.019	0.018 0.030 0.024	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 10 V	40			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 20 A		30		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		1160		pF
C_{oss}	Output Capacitance			250		pF
C_{rss}	Reverse Transfer Capacitance			100		pF
Switching Characteristics (Note 1)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		9	17	ns
t_r	Turn-On Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			23	37	ns
t_f	Turn-Off Fall Time			8	16	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 20 A, V_{GS} = 5 V		12	17	nC
Q_{gs}	Gate-Source Charge			3.2		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 (Note 1)				40	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 20 A (Note 1)		0.95	1.2	V

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

Typical Characteristics

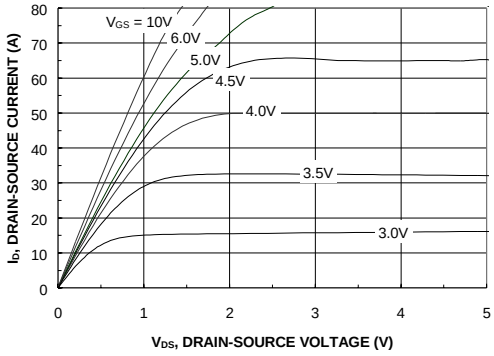


Figure 1. On-Region Characteristics.

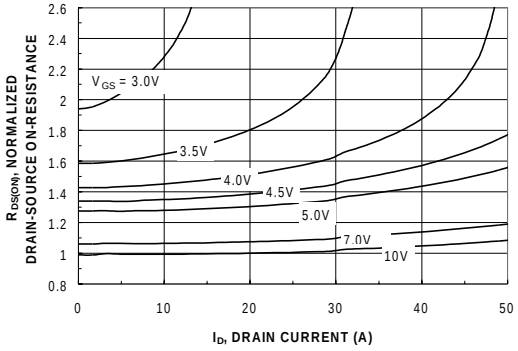


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

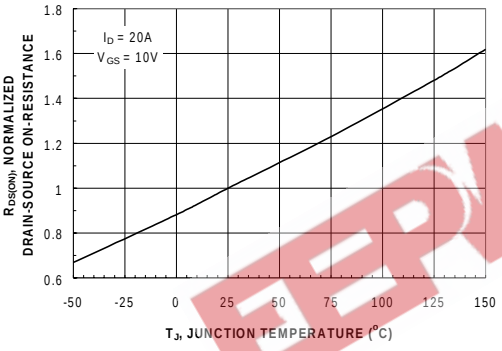


Figure 3. On-Resistance Variation with Temperature.

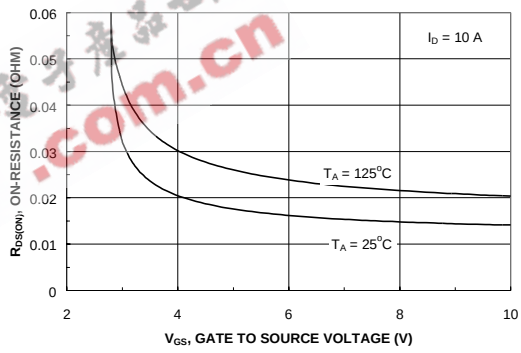


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

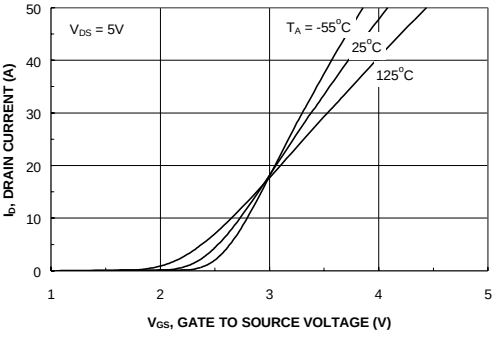


Figure 5. Transfer Characteristics.

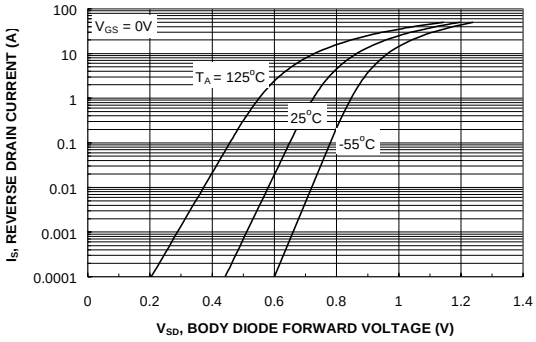


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

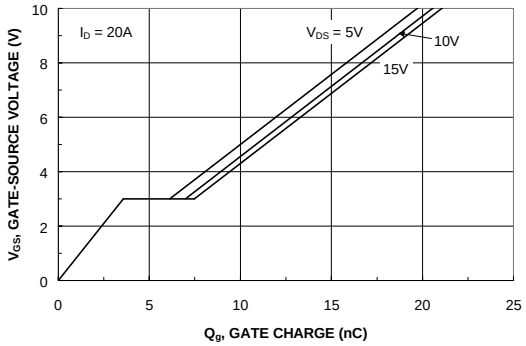


Figure 7. Gate-Charge Characteristics.

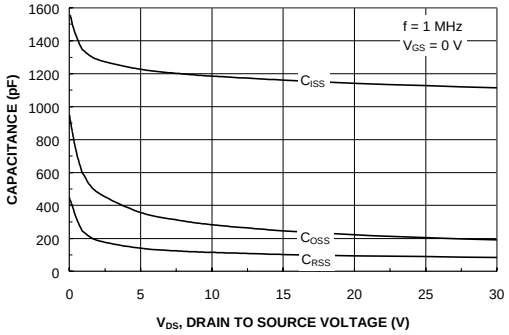


Figure 8. Capacitance Characteristics.

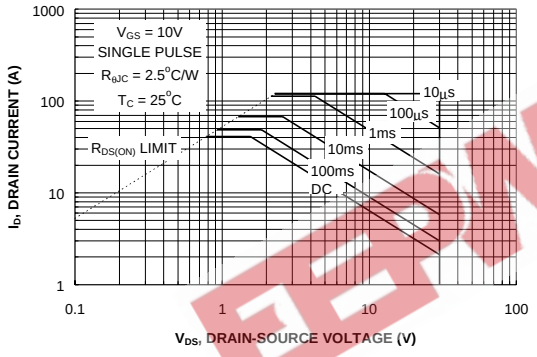


Figure 9. Maximum Safe Operating Area.

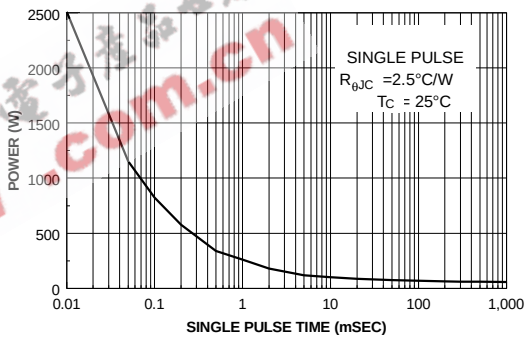


Figure 10. Single Pulse Maximum Power Dissipation.

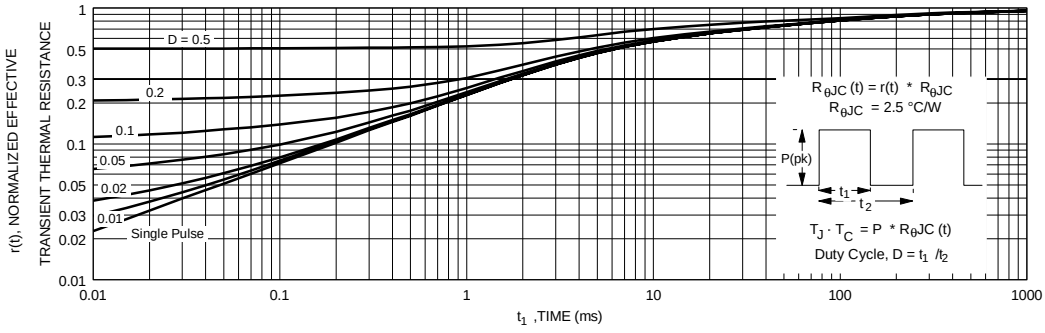


Figure 11. Transient Thermal Response Curve.

TO-220 Tape and Reel Data and Package Dimensions

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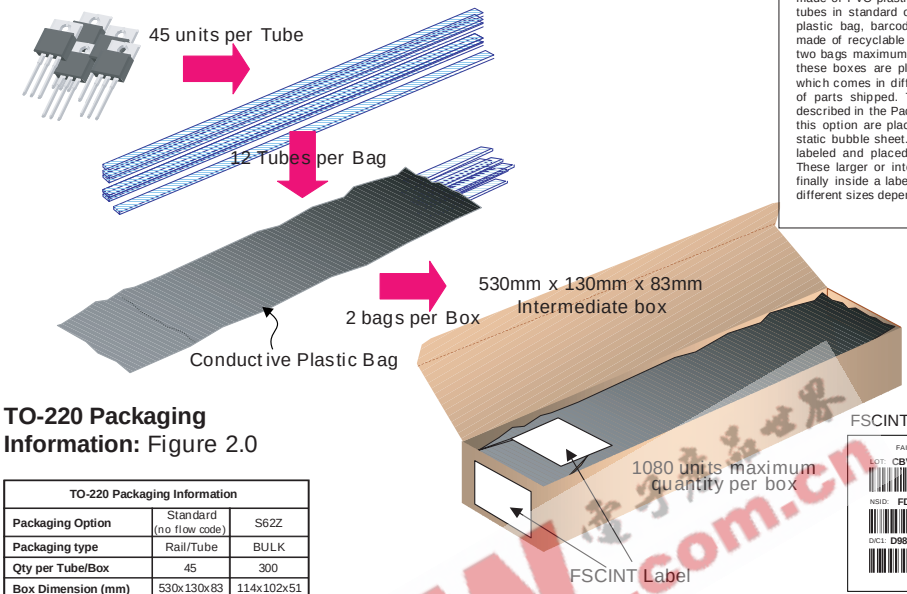
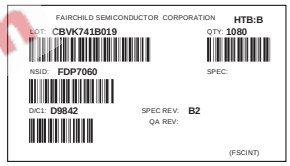
TO-220 Tube Packing
Configuration: Figure 1.0

Packaging Description:

TO-220 parts are shipped normally in tube. The tube is made of PVC plastic treated with anti-static agent.These tubes in standard option are placed inside a dissipative plastic bag, barcode labeled, and placed inside a box made of recyclable corrugated paper. One box contains two bags maximum (see fig. 1.0). And one or several of these boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped. The other option comes in bulk as described in the Packaging Information table. The units in this option are placed inside a small box laid with anti-static bubble sheet. These smaller boxes are individually labeled and placed inside a larger box (see fig. 3.0). These larger or intermediate boxes then will be placed finally inside a labeled shipping box which still comes in different sizes depending on the number of units shipped.



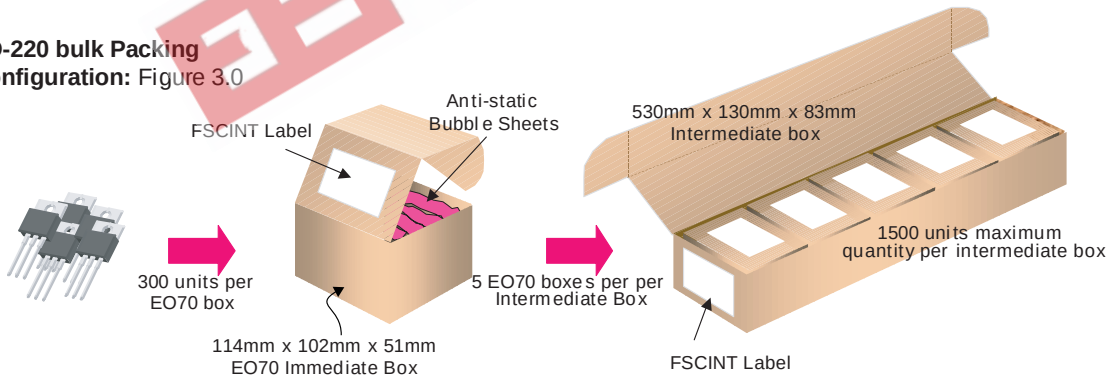
FSCINT Label sample



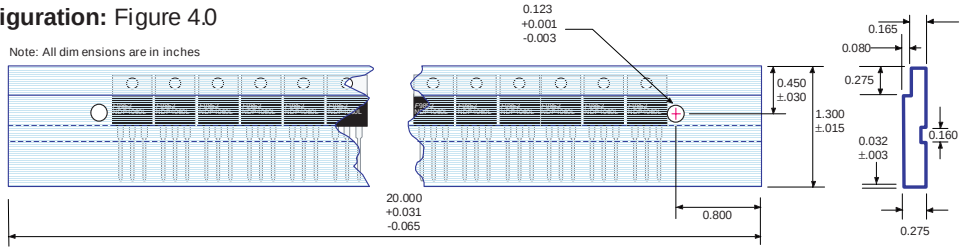
TO-220 Packaging
Information: Figure 2.0

TO-220 Packaging Information		
Packaging Option	Standard (no flow code)	S62Z
Packaging type	Rail/Tube	BULK
Qty per Tube/Box	45	300
Box Dimension (mm)	530x130x83	114x102x51
Max qty per Box	1,080	1,500
Weight per unit (gm)	1.4378	1.4378
Note/Comments		

TO-220 bulk Packing
Configuration: Figure 3.0

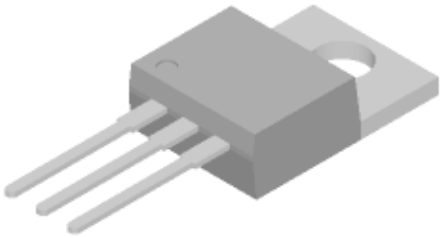


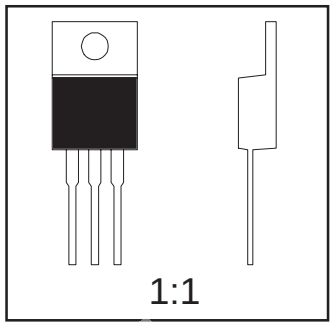
TO-220 Tube
Configuration: Figure 4.0



TO-220 Tape and Reel Data and Package Dimensions, continued

TO-220 (FS PKG Code 37)

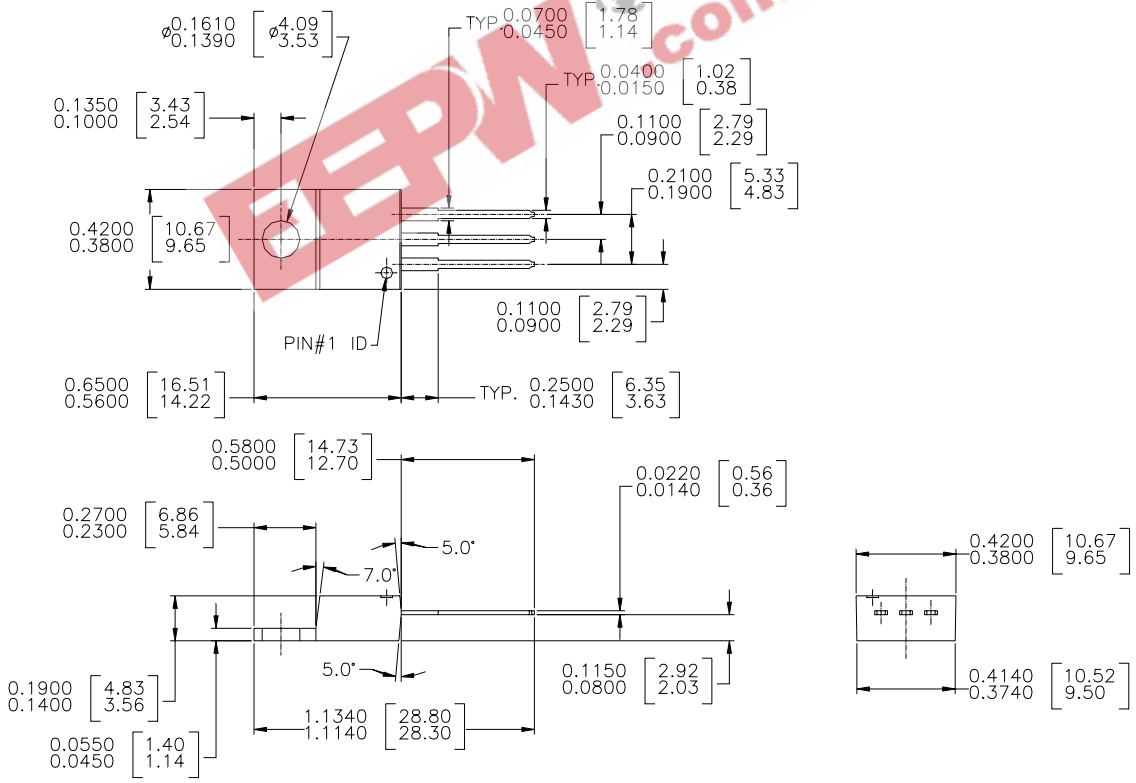




Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 1.4378



NOTE : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH :
200 MICROINCHES / 5.08 MICRON MINIMUM
LEAD / TIN 15/85 ON OLIN 194 COPPER OR EQUIVALENT

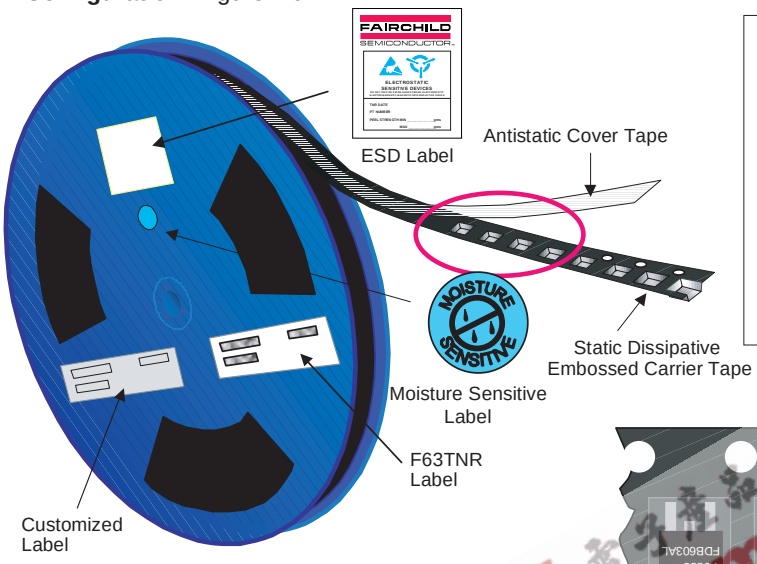
2. DIMENSION BASED ON JEDEC STANDARD TO-220
VARIATION AB, ISSUE J, DATED 3/24/87

TO 220 3 LEAD

TO-263AB/D²PAK Tape and Reel Data and Package Dimensions

FAIRCHILD SEMICONDUCTOR™

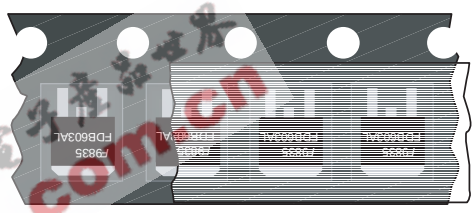
TO-263AB/D²PAK Packaging Configuration: Figure 1.0



Packaging Description:

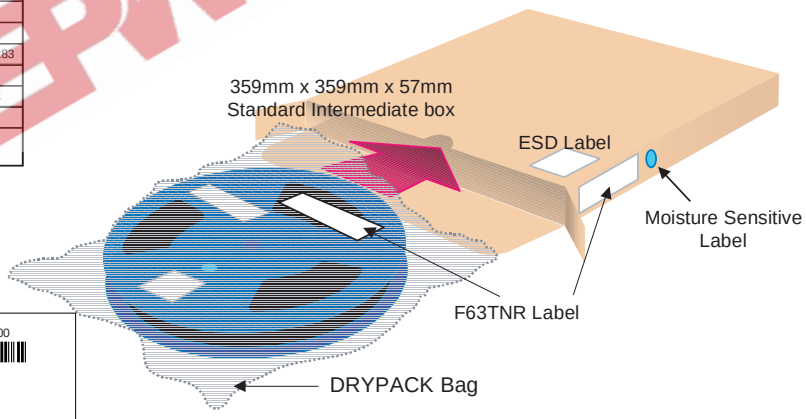
TO-263/D²PAK parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 800 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, dry packed, and placed inside a standard intermediate box (illustrated in figure 1.0) made of recyclable corrugated brown paper. One box contains one reel maximum. And these boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.

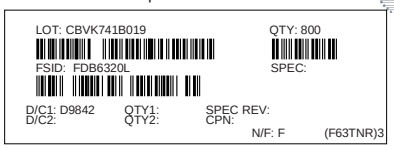


TO-263AB/D²PAK Unit Orientation

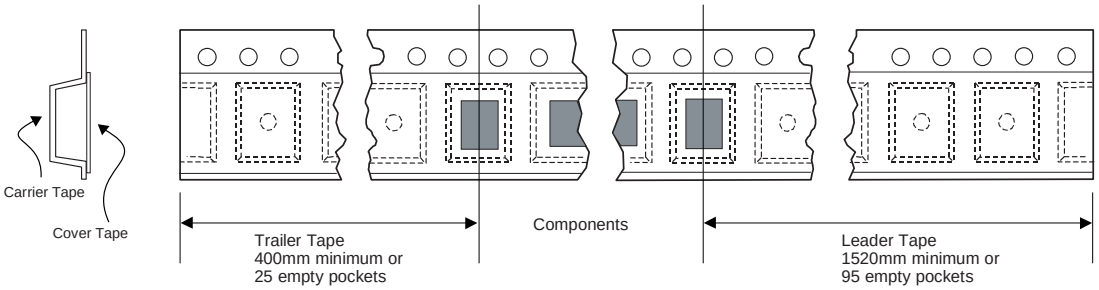
TO-263AB/D²PAK Packaging Information		
Packaging Option	Standard (no flow code)	L86Z
Packaging type	TNR	Rail/Tube
Qty per Reel/Tube/Bag	800	45
Reel Size	13" Dia	-
Box Dimension (mm)	359x359x57	530x130x83
Max qty per Box	800	1,080
Weight per unit (gm)	1.4378	1.4378
Weight per Reel	1.6050	-
Note/Comments		



F63TNR Label sample



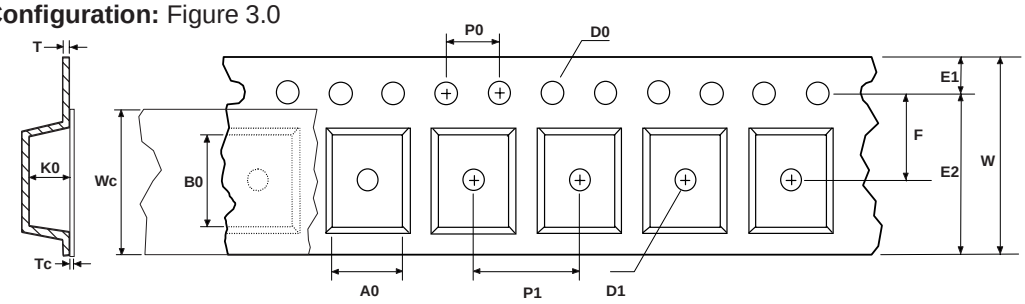
TO-263AB/D²PAK Tape Leader and Trailer Configuration: Figure 2.0



TO-263AB/D²PAK Tape and Reel Data and Package Dimensions, continued

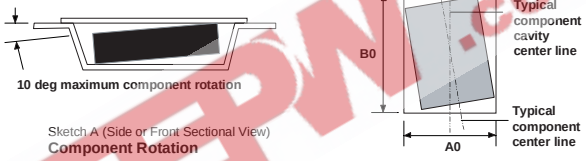
TO-263AB/D²PAK Embossed Carrier Tape

Configuration: Figure 3.0



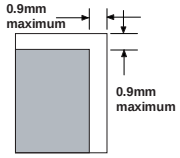
Dimensions are in millimeter														
Pkg type	**A0**	**B0**	**W**	**D0**	**D1**	**E1**	**E2**	**F**	**P1**	**P0**	**K0**	**T**	**Wc**	**Tc**
TO263AB/ D²PAK (24mm)	10.60 +/-0.10	15.80 +/-0.10	24.0 +/-0.3	1.55 +/-0.05	1.60 +/-0.10	1.75 +/-0.10	22.25 min	11.50 +/-0.10	16.0 +/-0.1	4.0 +/-0.1	4.90 +/-0.10	0.450 +/-0.150	21.0 +/-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

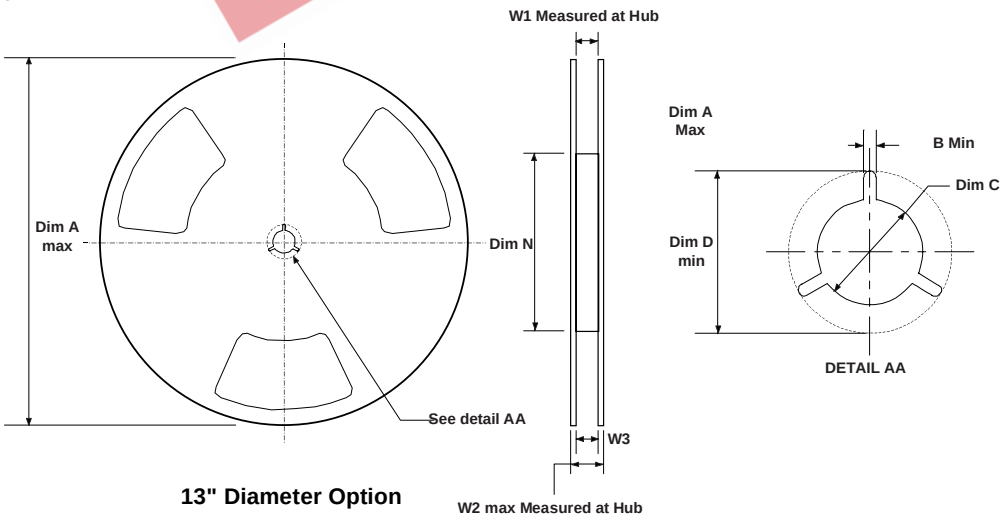
Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

TO-263AB/D²PAK Reel Configuration:

Figure 4.0

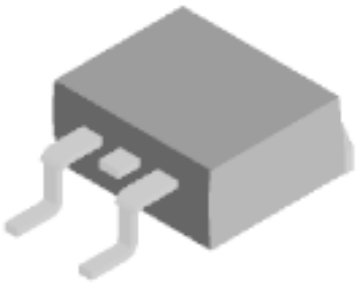


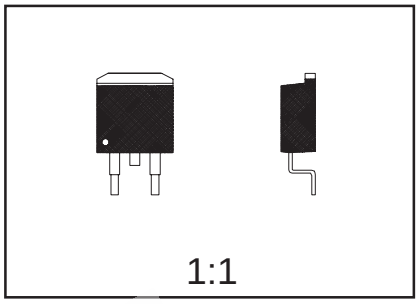
13" Diameter Option

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)**
24mm	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	0.961 +0.078/-0.000 24.4 +2/0	1.197 30.4	0.941 – 0.1.079 23.9 – 27.4

TO-263AB/D²PAK Tape and Reel Data and Package Dimensions, continued

TO-263AB/D²PAK (FS PKG Code 45)

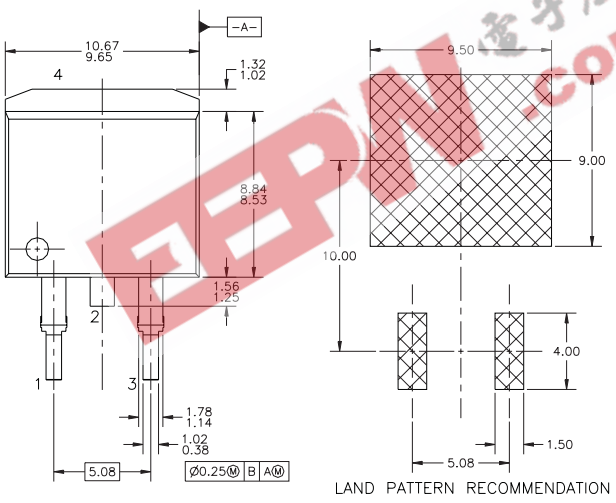




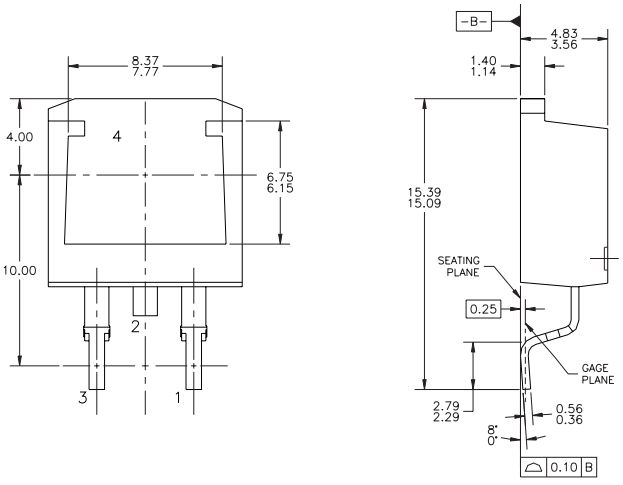
Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 1.4378



LAND PATTERN RECOMMENDATION



NOTES: UNLESS OTHERWISE SPECIFIED
A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) STANDARD LEAD FINISH:
200 MICROINCHES / 5.08 MICROMETERS MIN.
LEAD/TIN 15/85 ON OLIN 194 COPPER OR EQUIVALENT.
C) MAXIMUM VERTICAL BURR ON HEATSINK NOT TO EXCEED 0.003 INCH / 0.05mm.
D) NO PACKAGE CHIPS, CRACKS OR SURFACE IDENTIFICATION ALLOWED AFTER FORMING.
E) REFERENCE JEDEC, TO-263, ISSUE C, VARIATION AB, DATED 2/92.

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FAST®
FASTr™
GTO™
HiSeC™
ISOPLANAR™
MICROWIRE™
POP™
PowerTrench®
QFET™
QS™
Quiet Series™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TinyLogic™
UHC™
VCX™

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LIFE SUPPORT POLICY

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

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.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.