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November 2010

# FDD6N50TM\_F085

## 500V N-Channel MOSFET

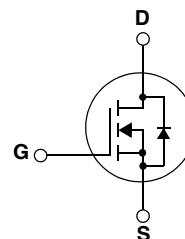
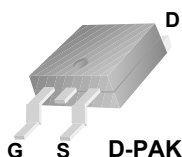
### Features

- 6A, 500V,  $R_{DS(on)} = 0.9\Omega @V_{GS} = 10V$
- Low gate charge ( typical 12.8 nC)
- Low  $C_{rss}$  ( typical 9 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Qualified to AEC Q101
- RoHS Compliant

### Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



### Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
$V_{DSS}$	Drain-Source Voltage	500	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ C$ ) - Continuous ( $T_C = 100^\circ C$ )	6 3.8	A A
$I_{DM}$	Drain Current - Pulsed (Note 1)	24	A
$V_{GSS}$	Gate-Source voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	270	mJ
$I_{AR}$	Avalanche Current (Note 1)	6	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	8.9	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ C$ ) - Derate above $25^\circ C$	89 0.71	W W/ $^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	1.4	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	83	$^\circ C/W$

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD6N50	FDD6N50TM_F085	D-PAK	380mm	16mm	2500

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

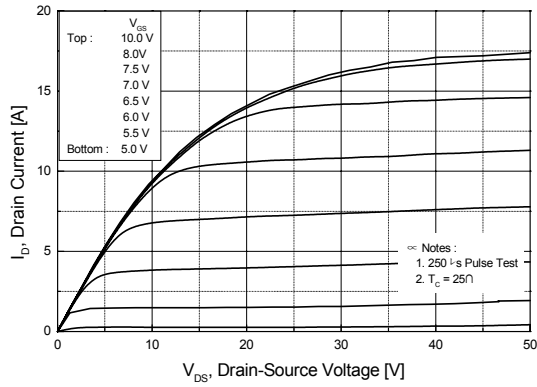
Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	500	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V V <sub>DS</sub> = 400V, T <sub>C</sub> = 125°C	--	--	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A	--	0.76	0.9	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 3A (Note 4)	--	2.5	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz	--	720	940	pF
C <sub>oss</sub>	Output Capacitance		--	95	190	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	9	13.5	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 250V, I <sub>D</sub> = 6A R <sub>G</sub> = 25Ω	--	6	20	ns
t <sub>r</sub>	Turn-On Rise Time		--	55	120	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	25	60	ns
t <sub>f</sub>	Turn-Off Fall Time		(Note 4, 5)	--	35	80
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 400V, I <sub>D</sub> = 6A V <sub>GS</sub> = 10V	--	12.8	16.6	nC
Q <sub>gs</sub>	Gate-Source Charge		--	3.7	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		(Note 4, 5)	--	5.8	--
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 6A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 6A di <sub>f</sub> /dt = 100A/μs (Note 4)	--	275	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	1.7	--	μC

### NOTES:

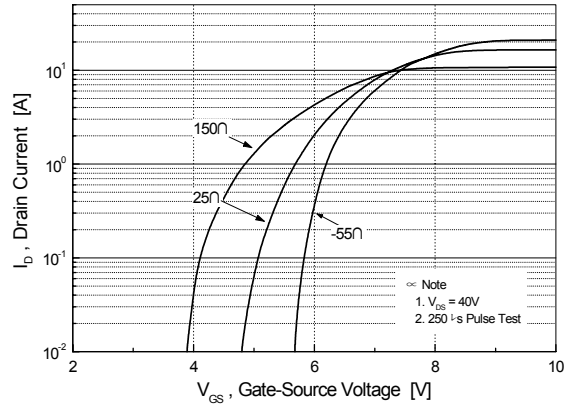
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub> = 6A, V<sub>DD</sub> = 50V, L = 13.5mH, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 6A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

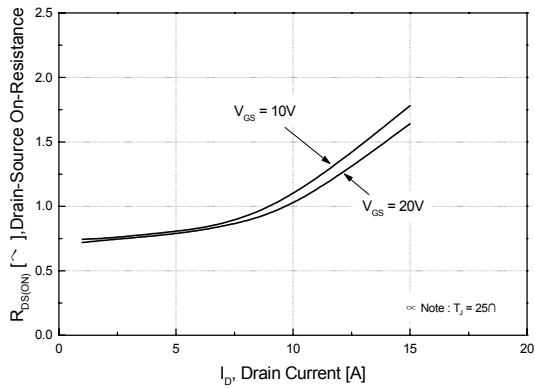
**Figure 1. On-Region Characteristics**



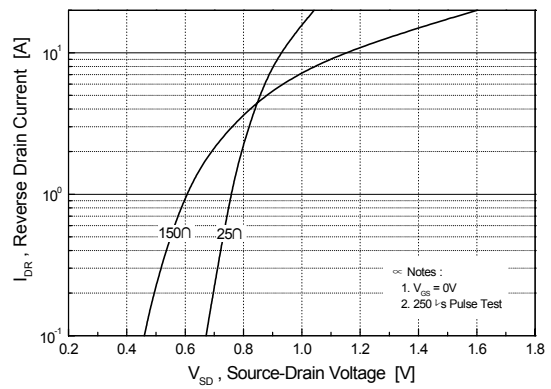
**Figure 2. Transfer Characteristics**



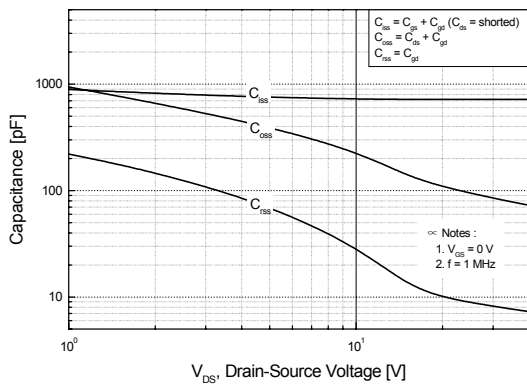
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



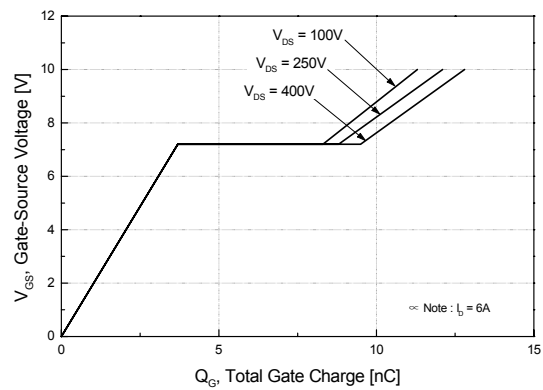
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

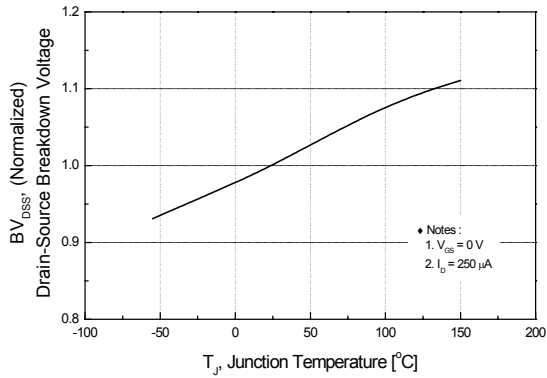


**Figure 6. Gate Charge Characteristics**

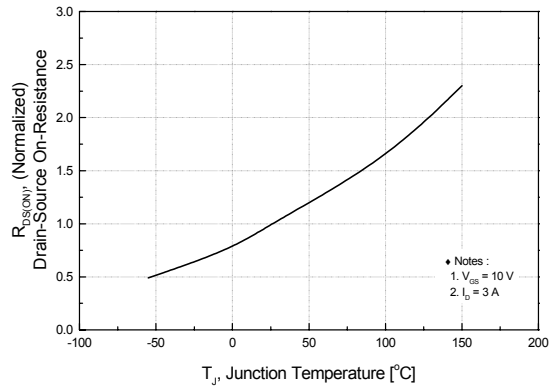


**Typical Performance Characteristics (Continued)**

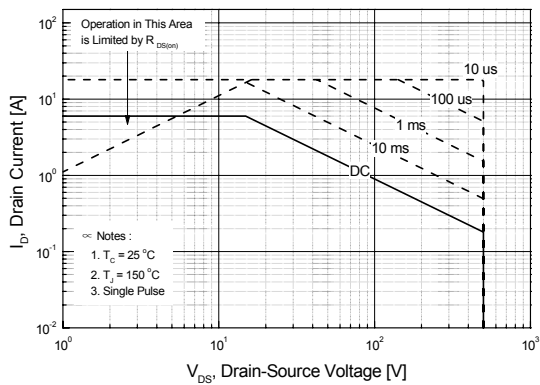
**Figure 7. Breakdown Voltage Variation vs. Temperature**



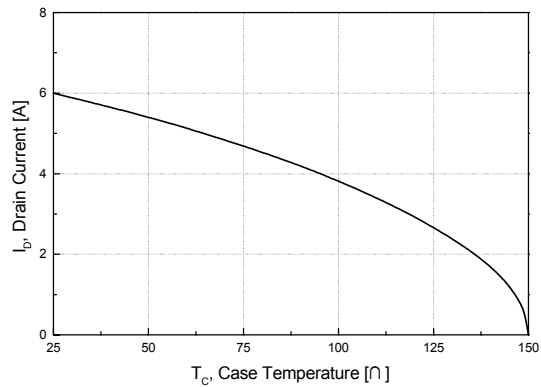
**Figure 8. On-Resistance Variation vs. Temperature**



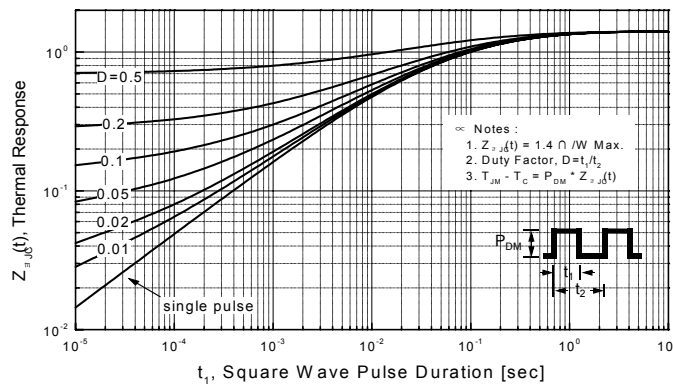
**Figure 9. Maximum Safe Operating Area**



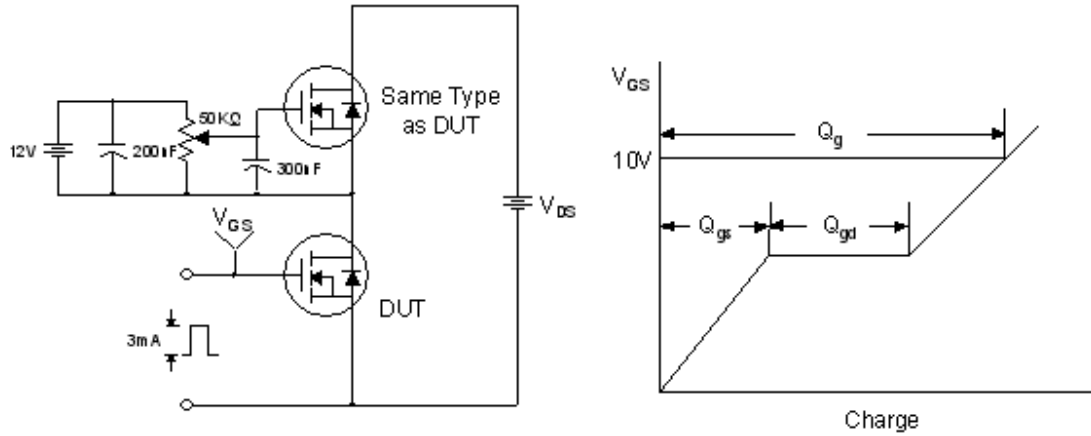
**Figure 10. Maximum Drain Current vs. Case Temperature**



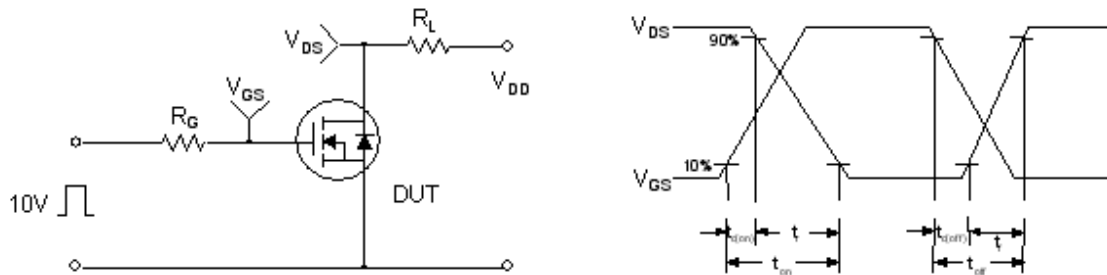
**Figure 11. Transient Thermal Response Curve**



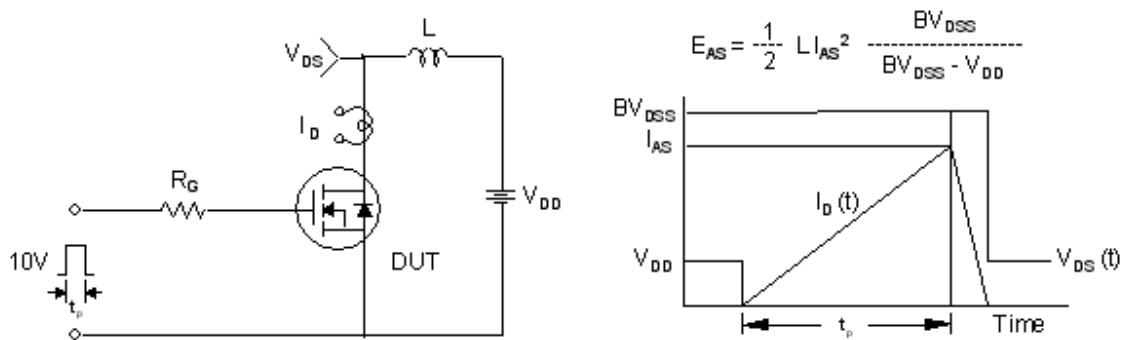
**Gate Charge Test Circuit & Waveform**



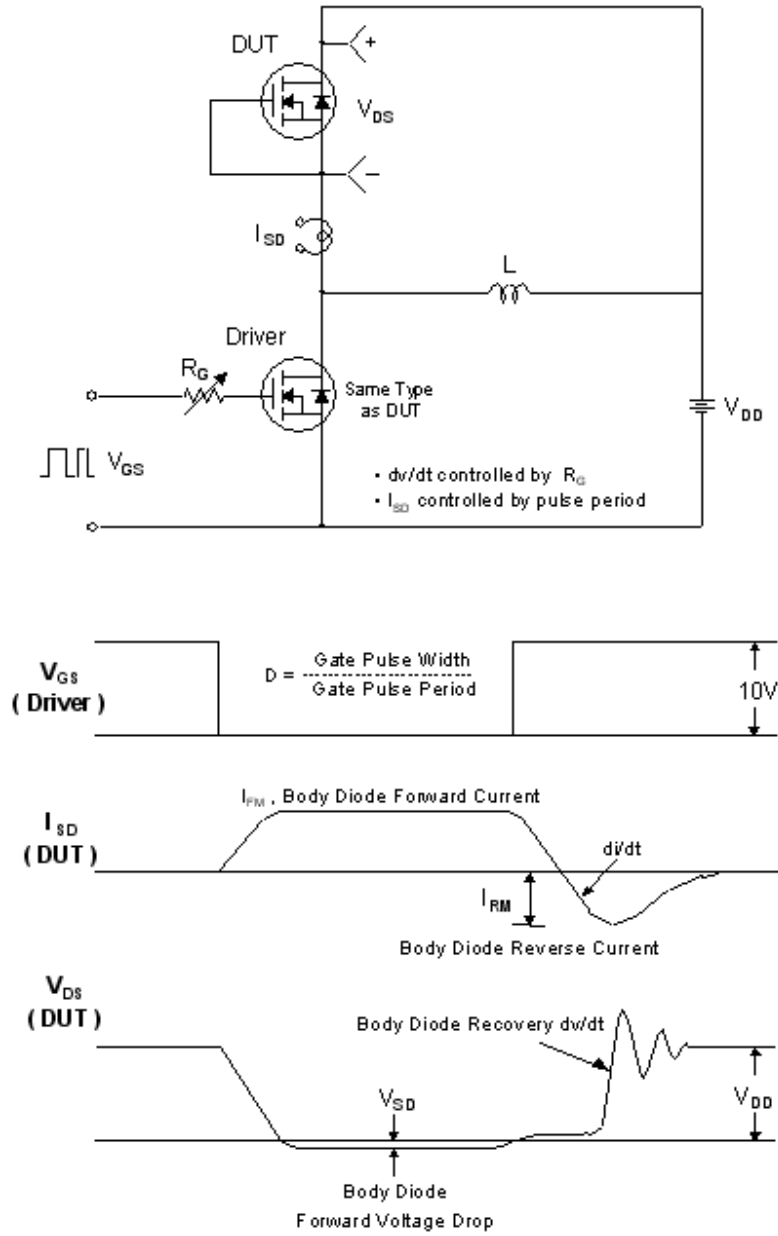
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

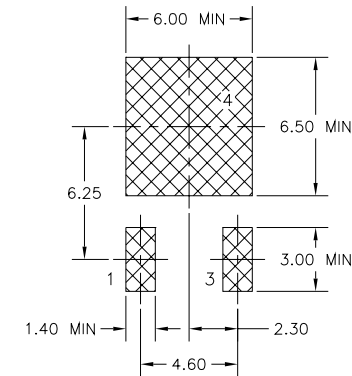
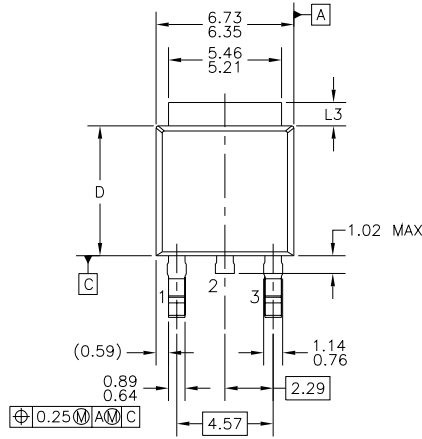


**Peak Diode Recovery dv/dt Test Circuit & Waveforms**

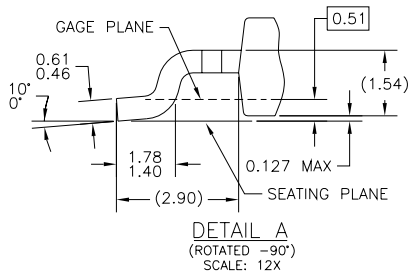
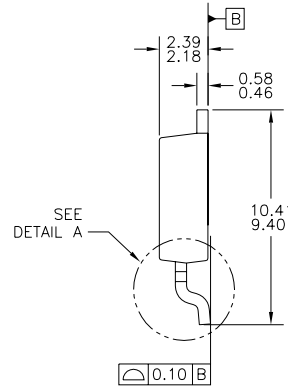
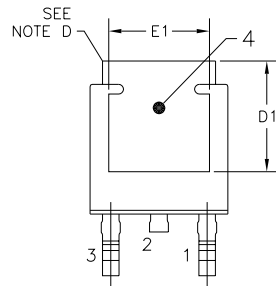


**Mechanical Dimensions**

**D-PAK**



LAND PATTERN RECOMMENDATION



- NOTES: UNLESS OTHERWISE SPECIFIED  
 A) ALL DIMENSIONS ARE IN MILLIMETERS.  
 B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA & AB, DATED NOV. 1999.  
 C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.  
 D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.  
 E) DIMENSIONS L3,D,E1&D1 TABLE:  

	OPTION AA	OPTION AB
L3	0.89-1.27	1.52-2.03
D	5.97-6.22	5.35-5.59
E1	4.32 MIN	3.81 MIN
D1	5.21 MIN	4.57 MIN

 F) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.

Dimensions in Millimeters





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| Auto-SPM™                | FRFET®                   | PowerTrench®                          |  |
| Build it Now™            | Global Power Resource SM | PowerXS™                              |  |
| CorePLUS™                | Green FPS™               | Programmable Active Droop™            |  |
| CorePOWER™               | Green FPS™ e-Series™     | QFET®                                 |  |
| CROSSVOLT™               | Gmax™                    | QS™                                   |  |
| CTL™                     | GTO™                     | Quiet Series™                         |  |
| Current Transfer Logic™  | IntelliMAX™              | RapidConfigure™                       |  |
| DEUXPEED®                | ISOPLANAR™               | ™                                     |  |
| Dual Cool™               | MegaBuck™                | Saving our world, 1mW/W/kW at a time™ |  |
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| EfficientMax™            | MicroFET™                | SmartMax™                             |  |
| ESBC™                    | MicroPak™                | SMART START™                          |  |
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| FACT®                    | Motion-SPM™              | SuperSOT™-3                           |  |
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Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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