

# FDD6N50F / FDU6N50F

## N-Channel MOSFET

500V, 5.5A, 1.15Ω

### Features

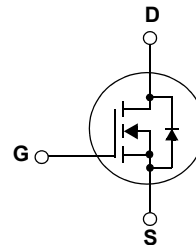
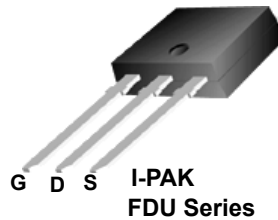
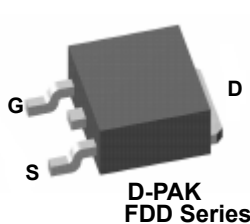
- $R_{DS(on)} = 0.95\Omega$  (Typ.) @  $V_{GS} = 10V, I_D = 2.75A$
- Low gate charge (Typ. 15nC)
- Low  $C_{rss}$  (Typ. 6.3pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- RoHS compliant



### Description

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

This advance 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.



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted\*

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain to Source Voltage	500	V
$V_{GSS}$	Gate to Source Voltage	±30	V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ\text{C}$ )	5.5
		-Continuous ( $T_C = 100^\circ\text{C}$ )	2.4
$I_{DM}$	Drain Current	- Pulsed (Note 1)	22
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	270
$I_{AR}$	Avalanche Current	(Note 1)	5.5
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	8.9
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	89
		- Derate above $25^\circ\text{C}$	0.71
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	83	

\*When mounted on the minimum pad size recommended (PCB Mount)

**Package Marking and Ordering Information**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD6N50F	FDD6N50FTM	D-PAK	380mm	16mm	2500
FDD6N50F	FDD6N50FTF	D-PAK	380mm	16mm	2000
FDU6N50F	FDU6N50FTU	I-PAK	-	-	70

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$	500	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.15	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 400\text{V}, T_C = 125^\circ\text{C}$	-	-	100	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 2.75\text{A}$	-	0.95	1.15	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40\text{V}, I_D = 2.75\text{A}$ (Note 4)	-	4.3	-	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	720	960	pF
$C_{oss}$	Output Capacitance		-	85	115	pF
$C_{rss}$	Reverse Transfer Capacitance		-	6.3	9.5	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400\text{V}, I_D = 6\text{A}$ $V_{GS} = 10\text{V}$ (Note 4, 5)	-	15	19.8	nC
$Q_{gs}$	Gate to Source Gate Charge		-	4.4	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	6.1	-	nC

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{V}, I_D = 6\text{A}$ $R_G = 25\Omega$ (Note 4, 5)	-	17	44	ns
$t_r$	Turn-On Rise Time		-	28.3	66.6	ns
$t_{d(off)}$	Turn-Off Delay Time		-	33.4	76.7	ns
$t_f$	Turn-Off Fall Time		-	20.5	51	ns

**Drain-Source Diode Characteristics**

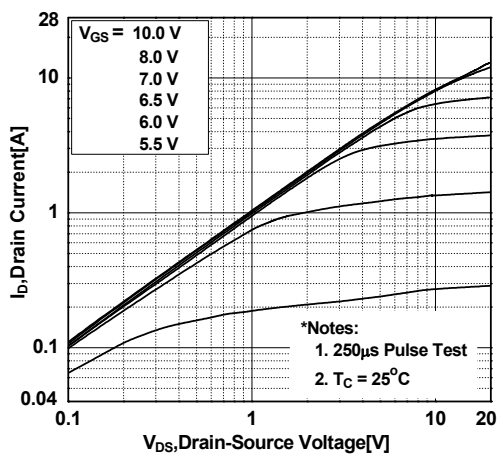
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	5.5	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	22	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 5.5\text{A}$	-	-	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 5.5\text{A}$	-	85	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$ (Note 4)	-	0.15	-	$\mu\text{C}$

**Notes:**

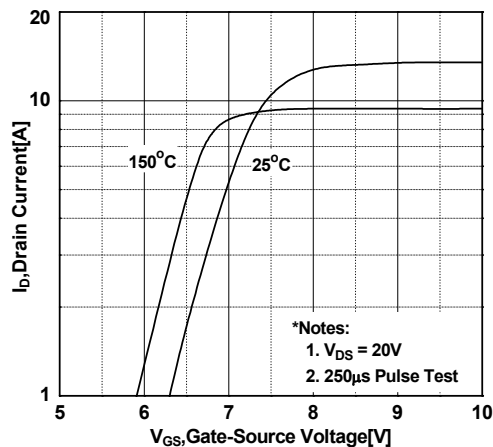
- 1: Repetitive Rating: Pulse width limited by maximum junction temperature
- 2:  $L = 16\text{mH}, I_{AS} = 5.5\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- 3:  $I_{SD} \leq 5.5\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
- 4: Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- 5: Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

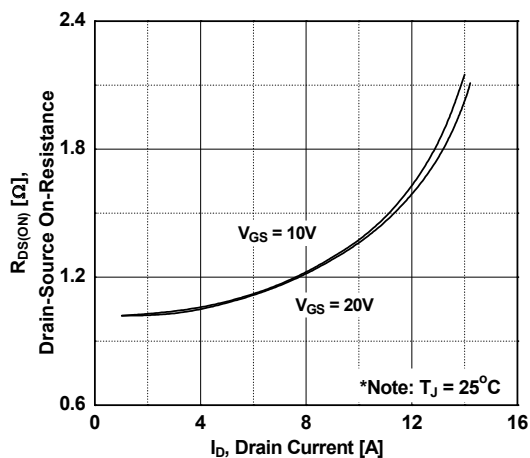
**Figure 1. On-Region Characteristics**



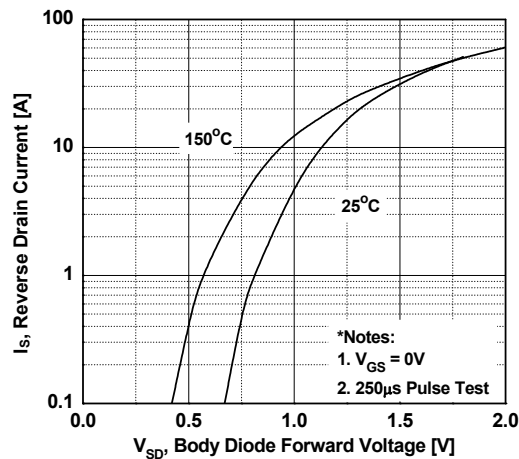
**Figure 2. Transfer Characteristics**



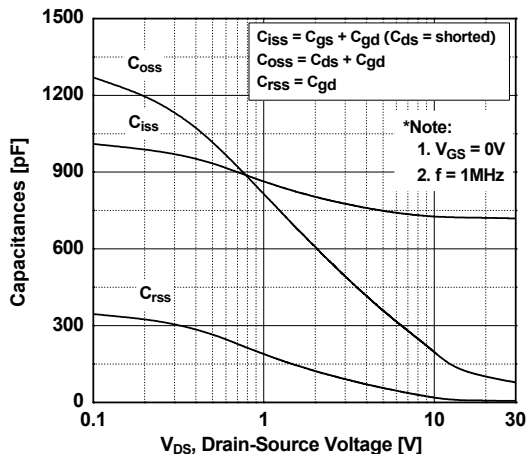
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



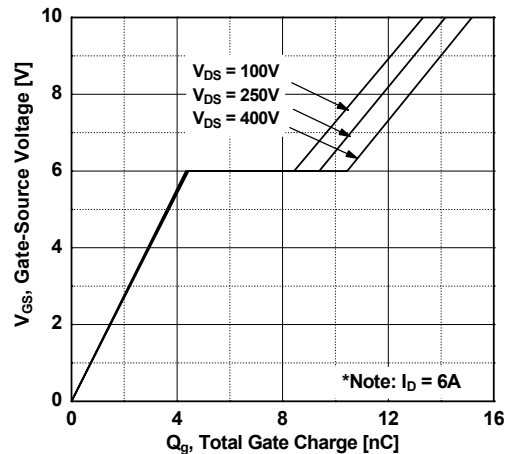
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

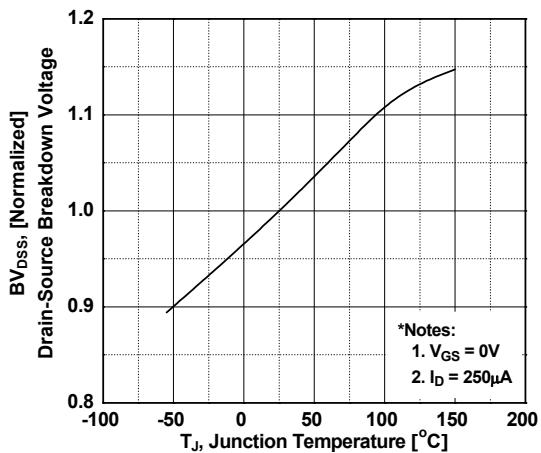


**Figure 6. Gate Charge Characteristics**

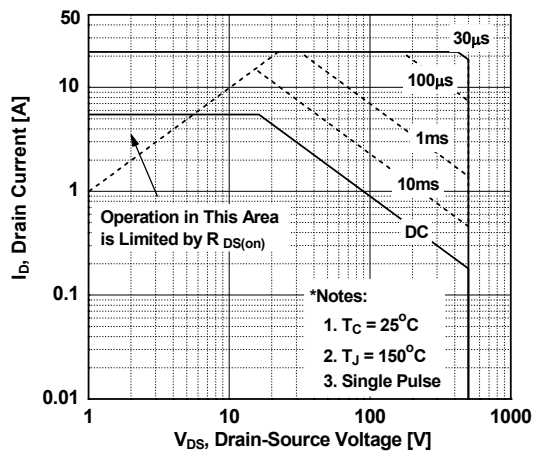


**Typical Performance Characteristics** (Continued)

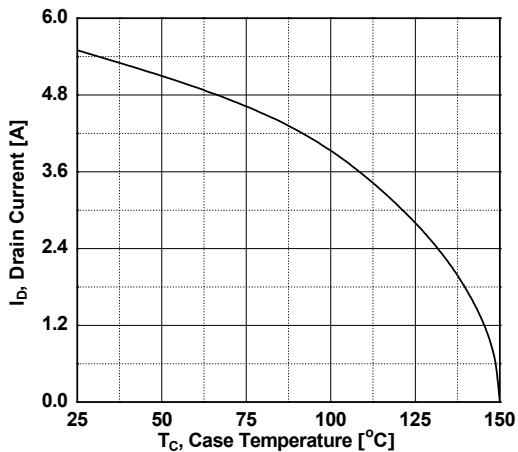
**Figure 7. Breakdown Voltage Variation vs. Temperature**



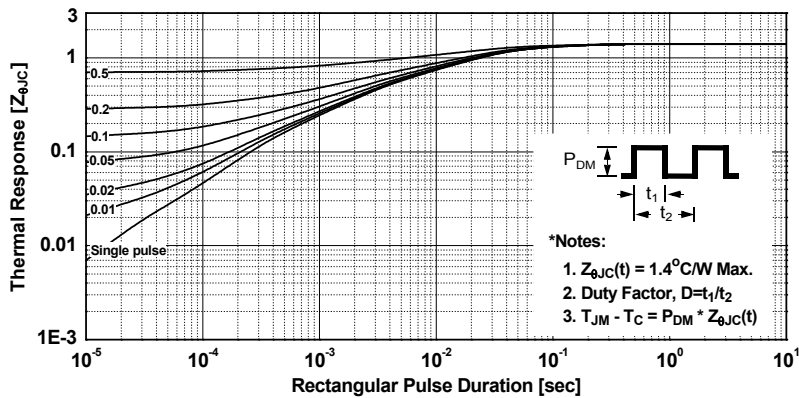
**Figure 8. Maximum Safe Operating Area**



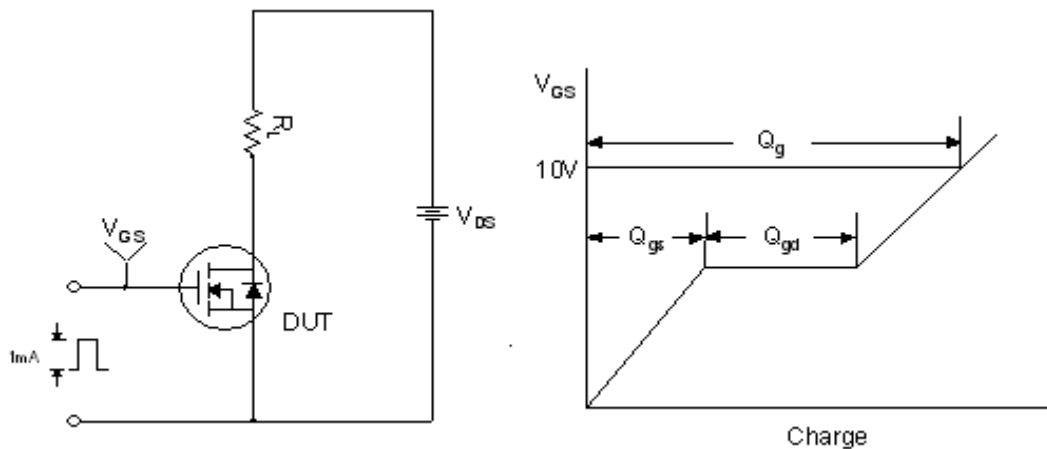
**Figure 9. Maximum Drain Current vs. Case Temperature**



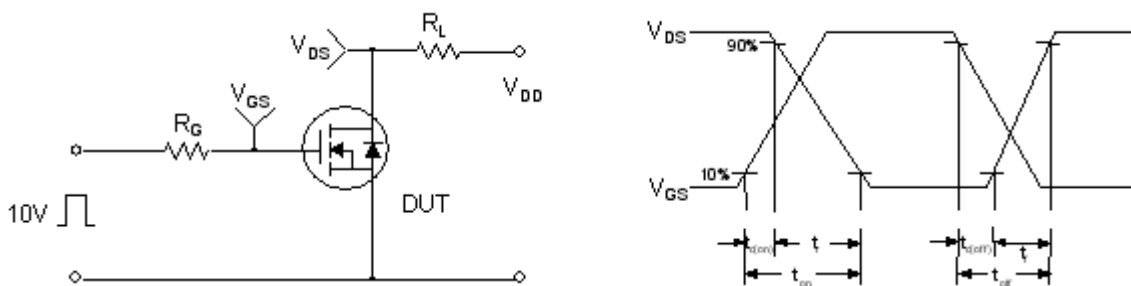
**Figure 10. Transient Thermal Response Curve**



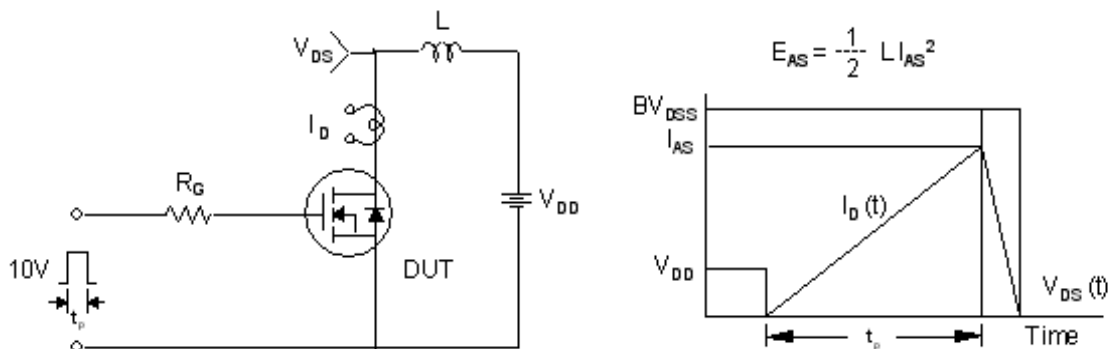
**Gate Charge Test Circuit & Waveform**



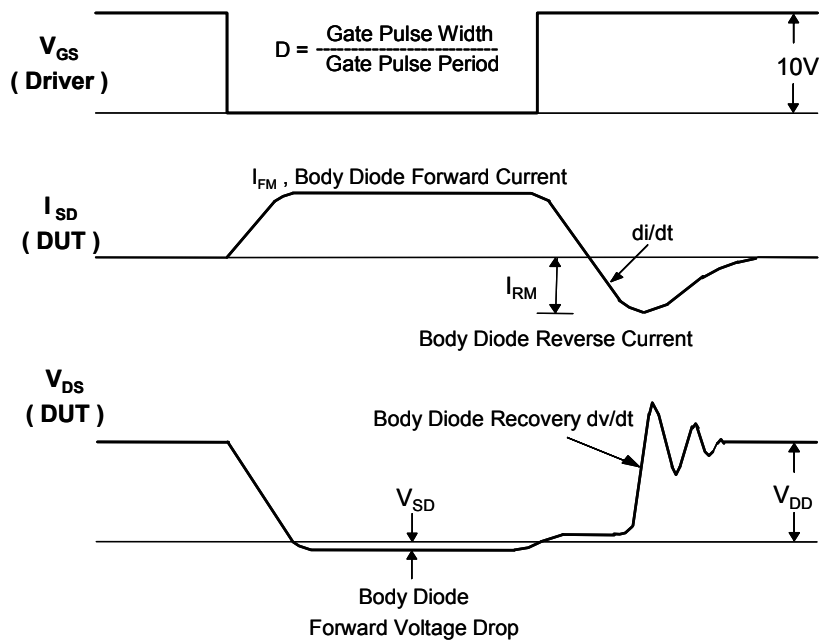
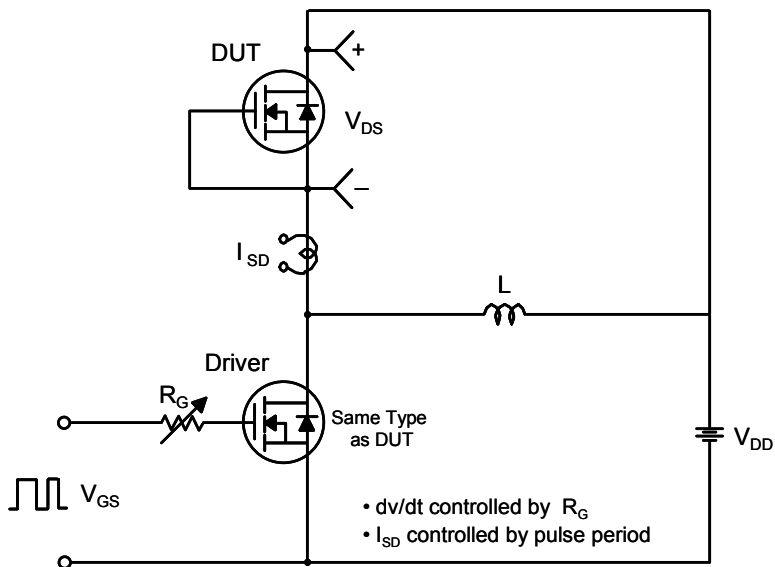
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

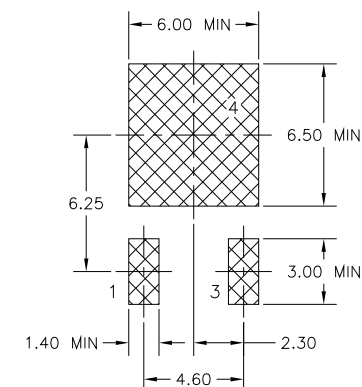
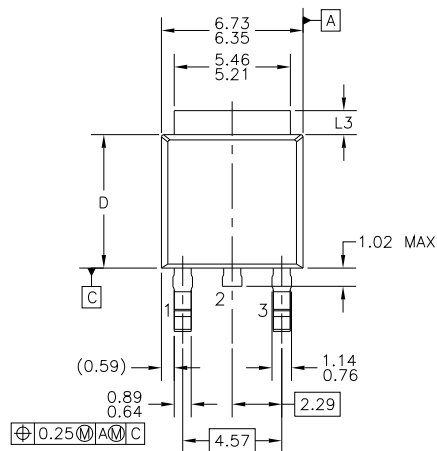


Peak Diode Recovery dv/dt Test Circuit & Waveforms

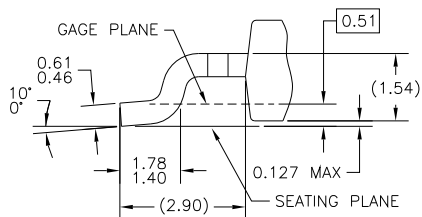
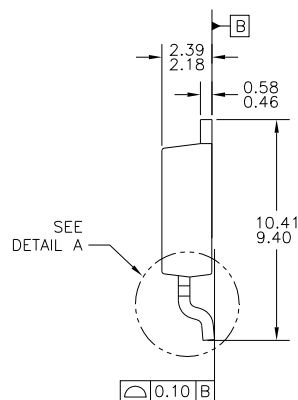
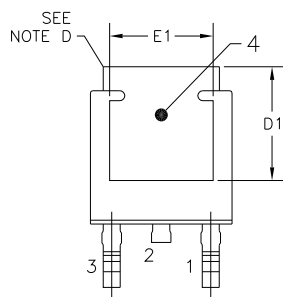


## Mechanical Dimensions

### D-PAK



LAND PATTERN RECOMMENDATION



DETAIL A  
(ROTATED -90°)  
SCALE: 12X

- 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 | 5.33-5.59 |
| 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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- |   |   |   |   |
|---|---|---|---|
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| AccuPower™  | FRFET®  | PowerXS™  | the power®  |
| AX-CAP™*  | Global Power ResourceSM   | Programmable Active Droop™  | franchise™  |
| BitSiC®   | Green Bridge™   | QFET®   | TinyBoost™  |
| Build it Now™   | Green FPS™  | QS™   | TinyBuck™   |
| CorePLUS™   | Green FPS™ e-Series™  | Quiet Series™   | TinyCalc™   |
| CorePOWER™  | Gmax™   | RapidConfigure™   | TinyLogic®  |
| CROSSVOLT™  | GTO™  | ™   | TINYOPTO™   |
| CTL™  | IntelliMAX™   |  | TinyPower™  |
| Current Transfer Logic™   | ISOPLANAR™  | Saving our world, 1mW/W/kW at a time™   | TinyPWM™  |
| DEUXPEED®   | Marking Small Speakers Sound Louder and Better™                                   | SignalWise™   | TinyWire™   |
| Dual Cool™  | MegaBuck™   | SmartMax™   | TranSiC®  |
| EcoSPARK®   | MICROCOUPLER™   | SMART START™  | TriFault Detect™  |
| EfficientMax™   | MicroFET™   | Solutions for Your Success™   | TRUECURRENT®*   |
| ESBC™   | MicroPak™   | SPM®  | µSerDes™  |
|  | MicroPak2™  | STEALTH™  |  |
| Fairchild®  | MillerDrive™  | SuperFET®   | UHC®  |
| Fairchild Semiconductor®  | MotionMax™  | SuperSOT™-3   | Ultra FRFET™  |
| FACT Quiet Series™  | Motion-SPM™   | SuperSOT™-6   | UniFET™   |
| FACT®   | mWSaver™  | SuperSOT™-8   | VCX™  |
| FAST®   | OptoHIT™  | SupreMOS®   | VisualMax™  |
| FastvCore™  | OPTOLOGIC®  | SyncFET™  | VoltagePlus™  |
| FETBench™   | OPTOPLANAR®   | Sync-Lock™  | XS™   |
| FlashWriter®*   |  |  |   |
| FPS™  |   |   |   |

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2. A critical component in 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.

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**PRODUCT STATUS DEFINITIONS**

**Definition of Terms**

Datasheet Identification	Product Status	Definition
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.