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October 2013

## FDPF5N50NZF N-Channel UniFET<sup>TM</sup> II FRFET<sup>®</sup> MOSFET 500 V, 4.2 A, 1.75 $\Omega$



FDPF5N50NZF — N-Channel UniFET<sup>TM</sup> II FRFET<sup>®</sup> MOSFET

## Features

- $R_{DS(on)}$  = 1.57  $\Omega$  (Typ.) @ V<sub>GS</sub> = 10 V, I<sub>D</sub> = 2.1 A
- Low Gate Charge (Typ. 9 nC)
- Low C<sub>rss</sub> (Typ. 4 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability
- ESD Improved Capability
- RoHS Compliant

## Applications

- LCD/LED TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

## Description

UniFET<sup>TM</sup> II MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on advanced planar stripe and DMOS technology. This advanced MOSFET family has the smallest on-state resistance among the planar MOSFET, and also provides superior switching performance and higher avalanche energy strength. In addition, internal gate-source ESD diode allows UniFET II MOSFET to withstand over 2kV HBM surge stress. The body diode's reverse recovery performance of UniFET II FRFET® MOSFET has been enhanced by lifetime control. Its trr is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.

D



## MOSFET Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted.

o Source Voltag o Source Voltage Current Current			500 ±25 4.2* 2.5*	V V A
Current	- Continuous (T <sub>C</sub> - Continuous (T <sub>C</sub>		4.2*	
Current	- Continuous (T <sub>C</sub>			A
Current		= 100°C)	2.5*	A
	- Pulsed		-	A
		(Note 1)	16*	А
Pulsed Avalanci	Single Pulsed Avalanche Energy		165	mJ
Avalanche Current		(Note 1)	4.2	A
Repetitive Avalanche Energy		(Note 1)	7.8	mJ
Peak Diode Recovery dv/dt		(Note 3)	20	V/ns
Dissinction	(T <sub>C</sub> = 25 <sup>o</sup> C)		30	W
Dissipation	- Derate above 25	5°C	0.24	W/ºC
Operating and Storage Temperature Range			-55 to +150	°C
	•	urpose,	300	°C
	Dissipation ing and Storage um Lead Tempe m Case for 5 S	Dissipation $(T_C = 25^{\circ}C)$ - Derate above 25 ing and Storage Temperature Range	$ \begin{array}{c c} (T_{C} = 25^{\circ}C) \\\hline - \text{ Derate above } 25^{\circ}C \\\hline \text{ing and Storage Temperature Range} \\\hline \text{um Lead Temperature for Soldering Purpose,} \\m Case for 5 Seconds \\\hline \end{array} $	$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$

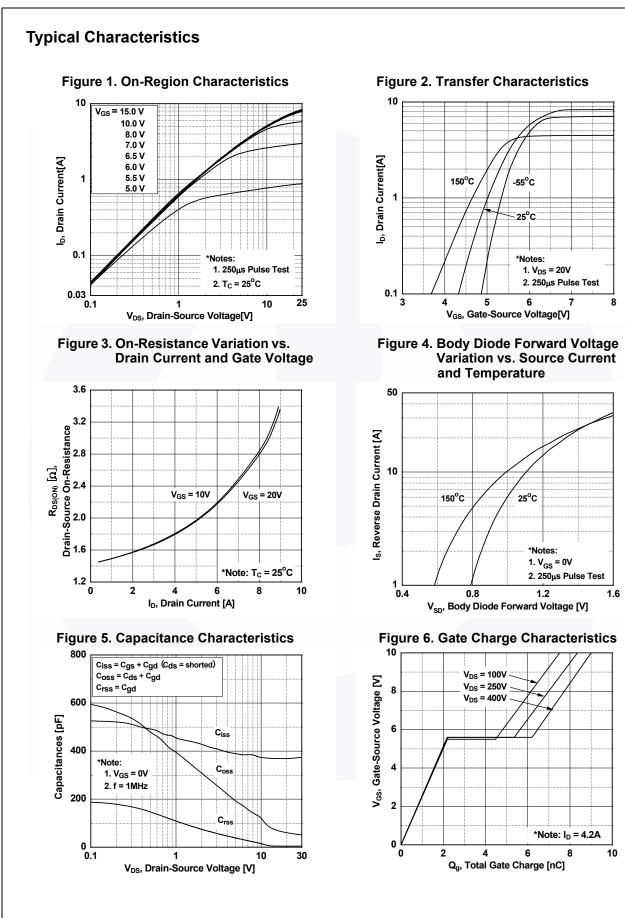
## **Thermal Characteristics**

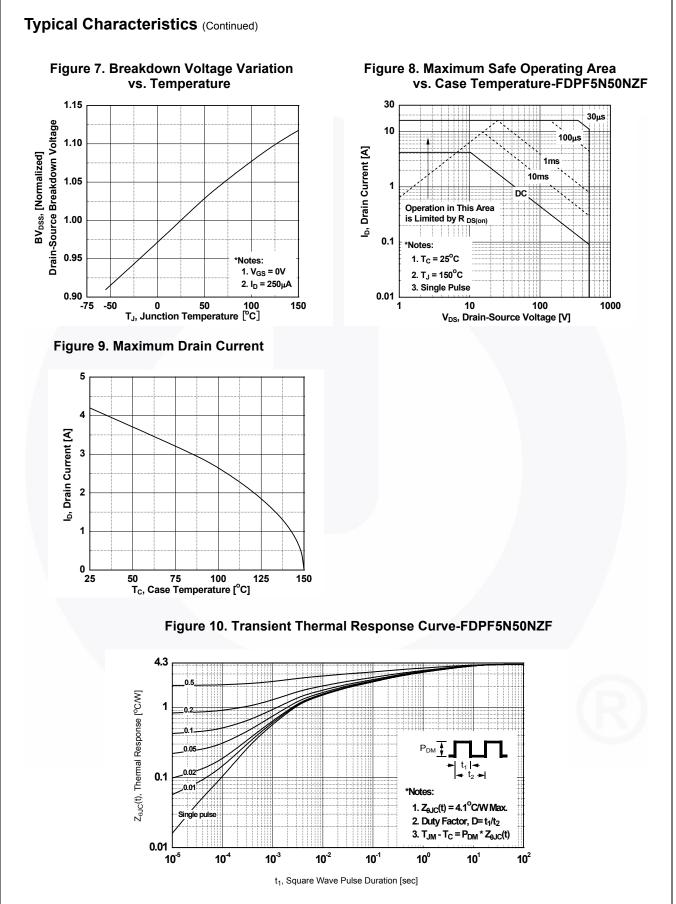
Symbol	Parameter	FDPF5N50NZF	Unit
$R_{ ext{ heta}JC}$	Thermal Resistance, Junction to Case, Max.	rmal Resistance, Junction to Case, Max. 4.1	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	°C/W

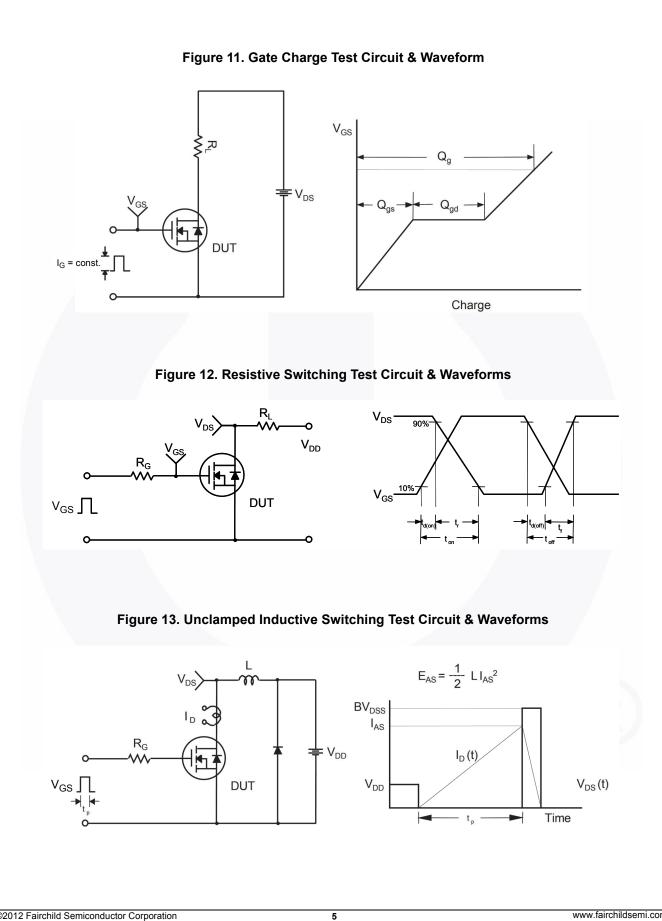
Device N	-		Pack	age	Reel Size	Таре	Width		Quantit	y
FDPF5N			TO-2	220F Tube		N/A		50 units		
Electric	al Chai	racteristics T <sub>C</sub> =	= 25°C unles	ss otherwis	se noted					
Symbol	ool Parameter			Test Conditions		Min.	Тур.	Max.	Unit	
Off Chara	acteristic	s								
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage		I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V, T <sub>C</sub> = 25 <sup>o</sup> C		500	-	-	V		
∆BV <sub>DSS</sub>		Breakdown Voltage Temperature					000			
$/\Delta T_{J}$	Coefficient			I <sub>D</sub> = 25	50µA, Referenced to	25°C	-	0.5	-	V/°C
				V <sub>DS</sub> =	$V_{DS} = 500V, V_{GS} = 0V$		-	-	10	
IDSS	Zero Gate Voltage Drain Current		ent	V <sub>DS</sub> =	400V, V <sub>GS</sub> = 0V,T <sub>C</sub> =	= 125ºC	-	-	100	μA
I <sub>GSS</sub>	Gate to	Body Leakage Curre	nt	V <sub>GS</sub> =	±25V, V <sub>DS</sub> = 0V		-	-	±10	μA
On Chara	cteristic	s								
V <sub>GS(th)</sub>		hreshold Voltage		V <sub>GS</sub> =	V <sub>DS</sub> , I <sub>D</sub> = 250μA		3.0	-	5.0	V
		Drain to Source On Re	sistance		10V, I <sub>D</sub> = 2.1A		-	1.57	1.75	Ω
TDS(on)								1		
<sub>9FS</sub> Dynamic	Forwar Charact	d Transconductance eristics apacitance		V <sub>DS</sub> =	20V, I <sub>D</sub> = 2.1A		-	4.2 365	- 485	S pF
g <sub>FS</sub> Dynamic C <sub>iss</sub> C <sub>oss</sub>	Forwar Charact Input C Output	eristics apacitance Capacitance		V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V		-	365 50	65	pF pF
9 <sub>FS</sub> Dynamic C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Forwar Charact Input C Output Revers	eristics apacitance Capacitance e Transfer Capacitanc	e	V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V		-	365 50 4	65 8	pF pF pF
9FS Dynamic C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub>	Forwar Charact Input C Output Revers Total G	eristics apacitance Capacitance e Transfer Capacitanc ate Charge at 10V	e	V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V Hz		-	365 50 4 9	65	pF pF pF nC
9FS Dynamic C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub> Q <sub>gs</sub>	Forwar Charact Input C Output Revers Total G Gate to	eristics apacitance Capacitance e Transfer Capacitanc ate Charge at 10V o Source Gate Charge	e	V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A		-	365 50 4 9 2	65 8	pF pF pF nC nC
9FS Dynamic C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub>	Forwar Charact Input C Output Revers Total G Gate to	eristics apacitance Capacitance e Transfer Capacitanc ate Charge at 10V	e	V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A	(Note 4)	-	365 50 4 9	65 8	pF pF pF nC
9FS Dynamic C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Forwar Charact Input C Output Revers Total G Gate to Gate to	eristics apacitance Capacitance e Transfer Capacitanc ate Charge at 10V o Source Gate Charge o Drain "Miller" Charge	e	V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A	(Note 4)	- - - - - -	365 50 4 9 2	65 8	pF pF pF nC nC
$g_{FS}$ <b>Dynamic</b> $C_{iss}$ $C_{rss}$ $C_{rss}$ $Q_{g(tot)}$ $Q_{gs}$ $Q_{gd}$ <b>Switching</b>	Forwar Charact Input C Output Revers Total G Gate to Gate to C C C C C C C C C C C C C C C C C C C	eristics apacitance Capacitance e Transfer Capacitanc ate Charge at 10V o Source Gate Charge o Drain "Miller" Charge	e	V <sub>DS</sub> =	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A	(Note 4)	- - - - - -	365 50 4 9 2	65 8	pF pF pF nC nC
$g_{FS}$ <b>Dynamic</b> $C_{iss}$ $C_{rss}$ $Q_{g(tot)}$ $Q_{gs}$ $Q_{gd}$ <b>Switching</b> $t_{d(on)}$	Forwar Fo	eristics apacitance Capacitance e Transfer Capacitanc ate Charge at 10V o Source Gate Charge Drain "Miller" Charge	e	$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{DD} =$	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A 10V 250V, I <sub>D</sub> = 4.2A	(Note 4)	- - - - - - - - - - - - - - - - - - -	365 50 4 9 2 4	65 8 12 - -	pF pF nC nC
9FS <b>Dynamic</b> C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub> Q <sub>gs</sub> Q <sub>gd</sub> <b>Switching</b> t <sub>d(on)</sub> t <sub>r</sub>	Forwar Fo	eristics apacitance Capacitance e Transfer Capacitance ate Charge at 10V o Source Gate Charge Drain "Miller" Charge cteristics n Delay Time	e	$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{DD} =$	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A 10V	(Note 4)		365 50 4 9 2 4 12	65 8 12 - - 35	pF pF nC nC nC
$C_{oss}$ $C_{rss}$ $Q_{g(tot)}$ $Q_{gs}$ $Q_{gd}$ <b>Switching</b> $t_{d(on)}$	Forwar Fo	eristics apacitance Capacitance e Transfer Capacitance ate Charge at 10V o Source Gate Charge Drain "Miller" Charge cteristics n Delay Time n Rise Time	e	$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{DD} =$	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A 10V 250V, I <sub>D</sub> = 4.2A	(Note 4)	-	365 50 4 9 2 4 4 12 19	65 8 12 - - 35 50	pF pF nC nC nC nC
$g_{FS}$ <b>Dynamic</b> $C_{iss}$ $C_{rss}$ $Q_{g(tot)}$ $Q_{gs}$ $Q_{gd}$ <b>Switching</b> $t_{d(on)}$ $t_r$ $t_q$ $t_{d(off)}$ $t_f$	Forwar Fo	eristics apacitance Capacitance e Transfer Capacitance ate Charge at 10V o Source Gate Charge o Drain "Miller" Charge Drain "Miller" Charge cteristics n Delay Time n Rise Time ff Delay Time ff Fall Time		$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{DD} =$	25V, V <sub>GS</sub> = 0V Hz 400V I <sub>D</sub> = 4.2A 10V 250V, I <sub>D</sub> = 4.2A		-	365 50 4 9 2 4 4 12 19 31	65 8 12 - - 35 50 70	pF pF nC nC nC nC ns ns
$g_{FS}$ <b>Dynamic</b> $C_{iss}$ $C_{oss}$ $C_{rss}$ $Q_{g(tot)}$ $Q_{gs}$ $Q_{gd}$ <b>Switching</b> $t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_r$ <b>Drain-Sou</b>	Forwar  Forwar	eristics apacitance Capacitance e Transfer Capacitance ate Charge at 10V Source Gate Charge Drain "Miller" Charge Drain "Miller" Charge cteristics n Delay Time n Rise Time ff Delay Time	  :S	$V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$	25V, $V_{GS} = 0V$ Hz 400V $I_D = 4.2A$ 10V 250V, $I_D = 4.2A$ 10V, $R_{GEN} = 25\Omega$		-	365 50 4 9 2 4 4 12 19 31	65 8 12 - - 35 50 70	pF pF nC nC nC nC ns ns
9 <sub>FS</sub> <b>Dynamic</b> C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub> Q <sub>gs</sub> <b>Q</b> <sub>gd</sub> <b>Switching</b> t <sub>d(on)</sub> t <sub>r</sub> t <sub>d(off)</sub> t <sub>f</sub> <b>Drain-Sou</b> I <sub>s</sub>	Forwar Fo	eristics capacitance capacitance e Transfer Capacitance ate Charge at 10V o Source Gate Charge o Drain "Miller" Charge cteristics n Delay Time n Rise Time ff Delay Time ff Fall Time de Characteristic	Source Did	$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$	$25V, V_{GS} = 0V$ Hz $400V I_D = 4.2A$ 10V $250V, I_D = 4.2A$ $10V, R_{GEN} = 25\Omega$ rd Current		-	365 50 4 9 2 4 4 12 19 31	65 8 12 - - 35 50 70 55	pF pF nC nC nC nS ns ns ns
9 <sub>FS</sub> <b>Dynamic</b> C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub> Q <sub>g(tot)</sub> Q <sub>gs</sub> Q <sub>gd</sub> <b>Switching</b> t <sub>d(on)</sub> t <sub>r</sub> t <sub>d(off)</sub> t <sub>f</sub> <b>Drain-Sou</b> I <sub>S</sub> I <sub>SM</sub>	Forwar Fo	eristics capacitance Capacitance e Transfer Capacitance ate Charge at 10V Source Gate Charge Drain "Miller" Charge teristics n Delay Time n Rise Time ff Delay Time ff Fall Time de Characteristic un Continuous Drain to	Source Did urce Diode F	$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$ $V_{GS} =$	$25V, V_{GS} = 0V$ Hz $400V I_D = 4.2A$ $10V$ $250V, I_D = 4.2A$ $10V, R_{GEN} = 25\Omega$ rd Current urrent		-	365 50 4 9 2 4 4 12 19 31	65 8 12 - - 35 50 70 55 4.2	pF pF nC nC nC nS ns ns ns
$g_{FS}$ <b>Dynamic</b> $C_{iss}$ $C_{rss}$ $Q_{g(tot)}$ $Q_{gs}$ $Q_{gd}$ <b>Switching</b> $t_{d(on)}$ $t_r$ $t_q$ $t_{d(off)}$ $t_f$	Forwar Fo	eristics capacitance Capacitance e Transfer Capacitance ate Charge at 10V o Source Gate Charge o Drain "Miller" Charge cteristics n Delay Time n Rise Time ff Delay Time ff Fall Time de Characteristic um Continuous Drain to source Capacitance ff Fall Time	Source Did urce Diode F	$V_{DS} =$ $V_{DS} =$ $f = 1M$ $V_{DS} =$ $V_{GS} =$	$25V, V_{GS} = 0V$ Hz $400V I_D = 4.2A$ 10V $250V, I_D = 4.2A$ $10V, R_{GEN} = 25\Omega$ rd Current		- - - -	365 50 4 9 2 4 4 12 19 31 22 - -	65 8 12 - - 35 50 70 55 4.2 16	pF pF nC nC nC nC nS ns ns ns A A

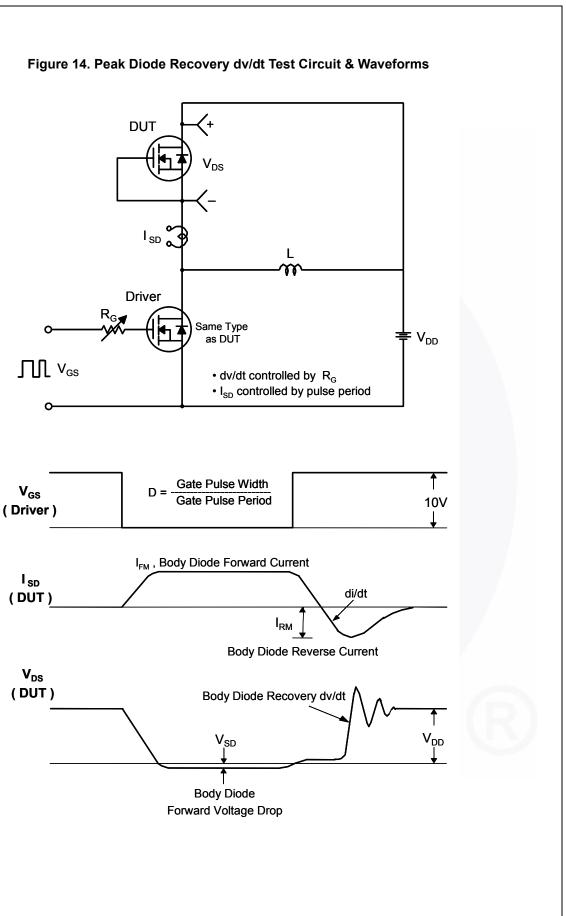
 $\begin{array}{l} 3. \ I_{SD} \leq 4.2A, \ di/dt \leq 200A/\mu s, \ V_{DD} \leq BV_{DSS}, \ Starting \ T_J = 25^\circ C \\ \ 4. \ Essentially \ Independent \ of \ Operating \ Temperature \ Typical \ Characteristics \\ \end{array}$ 

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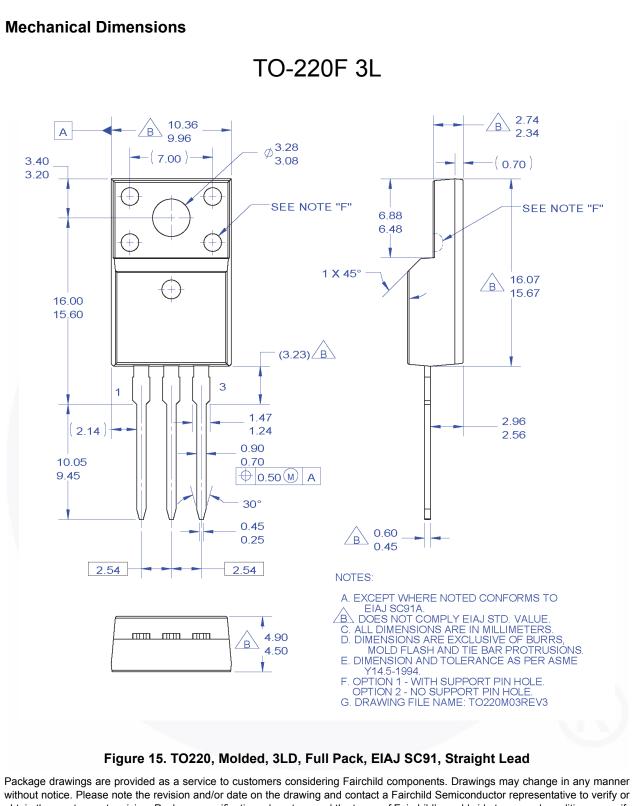








FDPF5N50NZF — N-Channel UniFET<sup>TM</sup> II FRFET<sup>®</sup> MOSFET



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**Dimension in Millimeters** 

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N-Channel UniFET<sup>TM</sup> II FRFET<sup>®</sup> MOSFE

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SvncFET™

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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.
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