

# FDP8N50NZ / FDPF8N50NZ

## N-Channel UniFET™ II MOSFET

500 V, 8 A, 850 mΩ

### Features

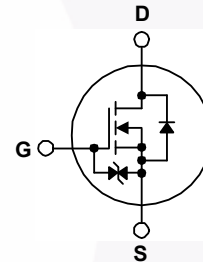
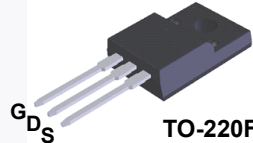
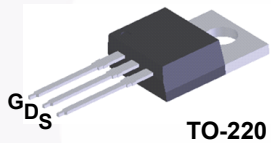
- $R_{DS(on)} = 770\text{ m}\Omega$  (Typ.) @  $V_{GS} = 10\text{ V}$ ,  $I_D = 4\text{ A}$
- Low Gate Charge (Typ. 14 nC)
- Low  $C_{rss}$  (Typ. 5 pF)
- 100% Avalanche Tested
- Improve dv/dt Capability
- ESD Improved Capability
- RoHS Compliant

### Applications

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

### Description

UniFET™ 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. 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.



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

Symbol	Parameter	FDP8N50NZ	FDPF8N50NZ	Unit
$V_{DSS}$	Drain to Source Voltage	500		V
$V_{GSS}$	Gate to Source Voltage	±25		V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	8	8*
		- Continuous ( $T_C = 100^\circ\text{C}$ )	4.8	4.8*
$I_{DM}$	Drain Current	- Pulsed (Note 1)	32	32*
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	122		mJ
$I_{AR}$	Avalanche Current (Note 1)	8		A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	13		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	10		V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	130	40.3
		- Derate above $25^\circ\text{C}$	1	0.3
$T_J, T_{STG}$	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		$^\circ\text{C}$

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FDP8N50NZ	FDPF8N50NZ	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.96	3.1	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	62.5	

## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8N50NZ	FDP8N50NZ	TO-220	Tube	N/A	50 units
FDPF8N50NZ	FDPF8N50NZ	TO-220F	Tube	N/A	50 units

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$ , $T_C = 25^\circ\text{C}$	500	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.5	-	$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}$ , $V_{GS} = 0\text{V}$ $V_{DS} = 400\text{V}$ , $T_C = 125^\circ\text{C}$	-	-	1 10	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 25\text{V}$ , $V_{DS} = 0\text{V}$	-	-	$\pm 10$	$\mu\text{A}$

### 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	$V_{GS} = 10\text{V}$ , $I_D = 4\text{A}$	-	0.77	0.85	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20\text{V}$ , $I_D = 4\text{A}$	-	6.3	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	565	735	pF
$C_{oss}$	Output Capacitance		-	80	105	pF
$C_{rss}$	Reverse Transfer Capacitance		-	5	8	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400\text{V}$ , $I_D = 8\text{A}$ $V_{GS} = 10\text{V}$	-	14	18	nC
$Q_{gs}$	Gate to Source Gate Charge		-	4	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	6	-	nC

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{V}$ , $I_D = 8\text{A}$ $R_G = 25\Omega$ , $V_{GS} = 10\text{V}$	-	17	45	ns
$t_r$	Turn-On Rise Time		-	34	80	ns
$t_{d(off)}$	Turn-Off Delay Time		-	43	95	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	27	60

### Drain-Source Diode Characteristics

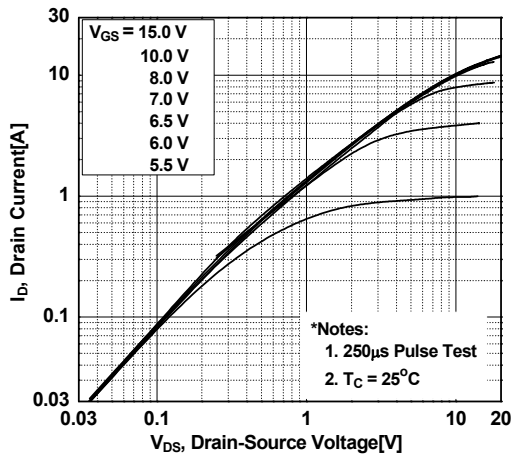
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	8	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	30	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}$ , $I_{SD} = 8\text{A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}$ , $I_{SD} = 8\text{A}$	-	228	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	1.43	-	$\mu\text{C}$

#### Notes:

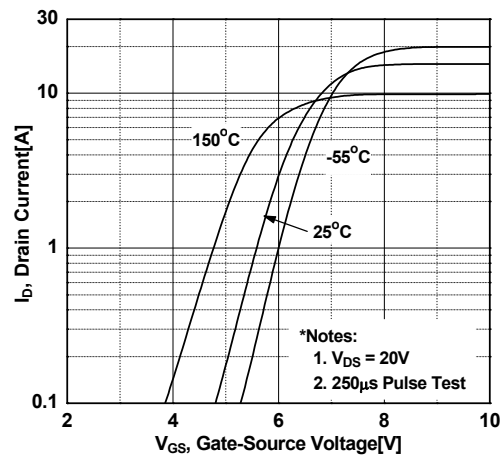
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 3.8\text{mH}$ ,  $I_{AS} = 8\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 8\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Characteristics

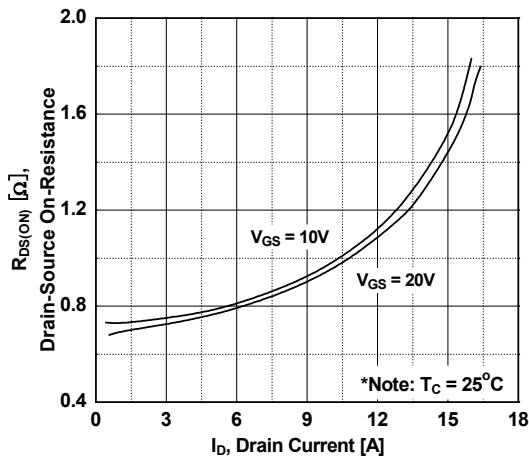
**Figure 1. On-Region Characteristics**



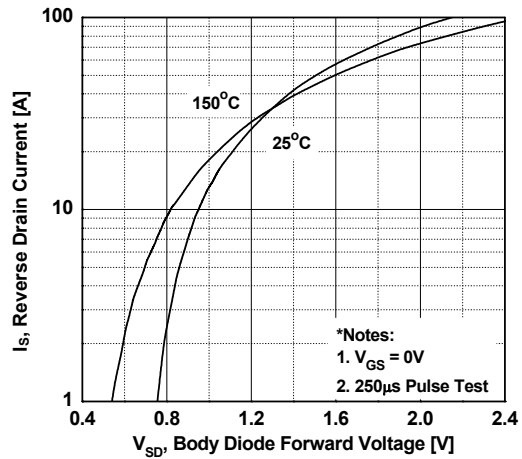
**Figure 2. Transfer Characteristics**



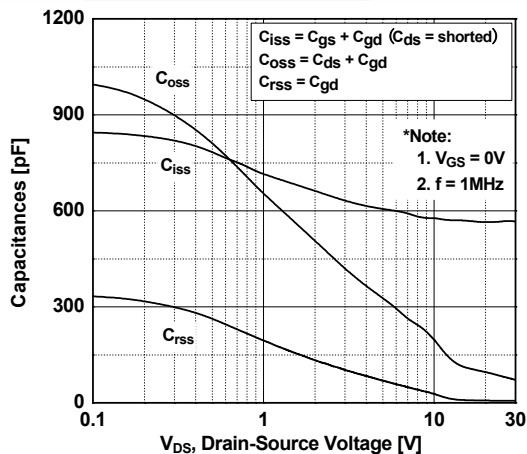
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



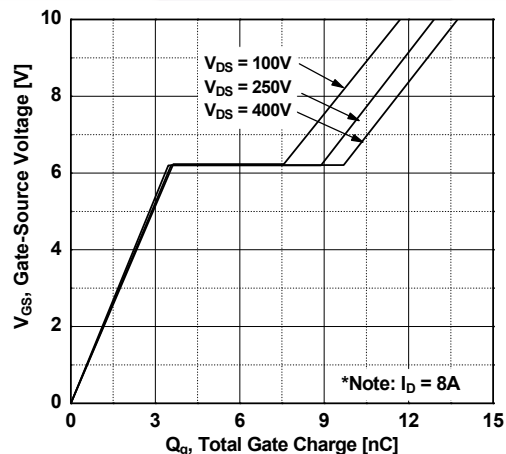
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

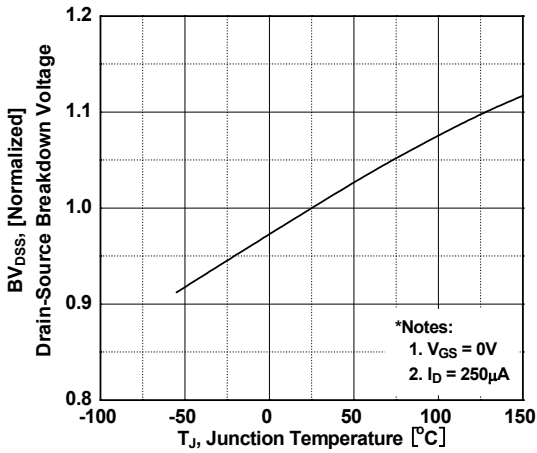


Figure 8. On-Resistance Variation vs. Temperature

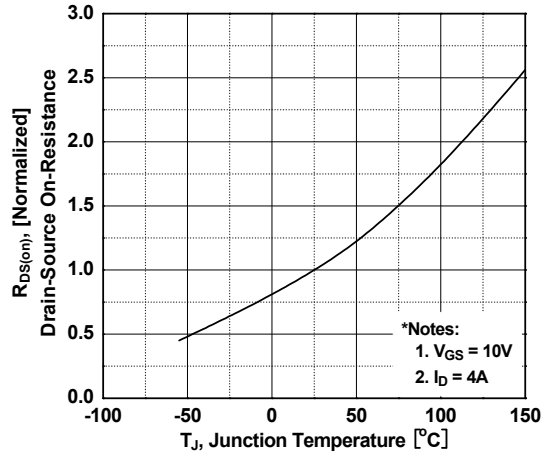


Figure 9. Maximum Safe Operating Area - FDP8N50NZ

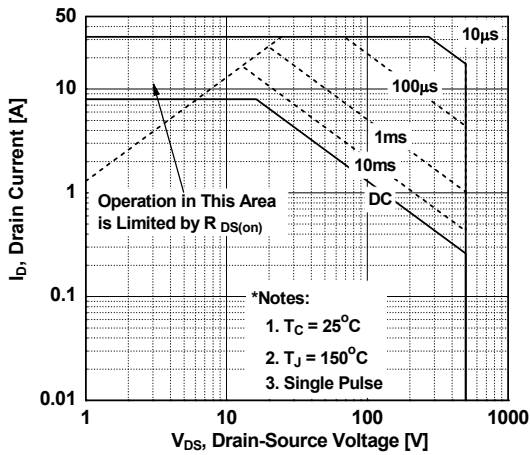


Figure 10. Maximum Safe Operating Area - FDPF8N50NZ

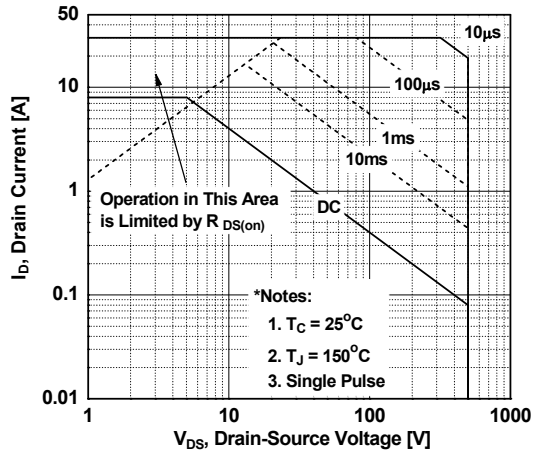


Figure 11. Maximum Drain Current vs. Case Temperature

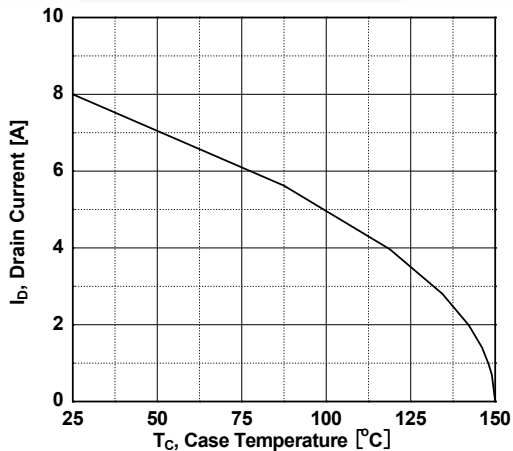
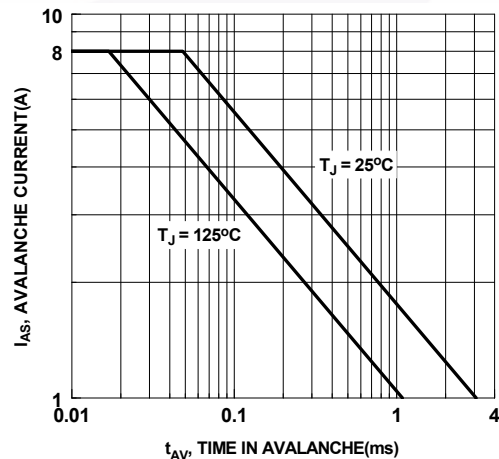


Figure 12. Unclamped Inductive Switching Capability



Typical Characteristics (Continued)

Figure 13. Transient Thermal Response Curve - FDP8N50NZ

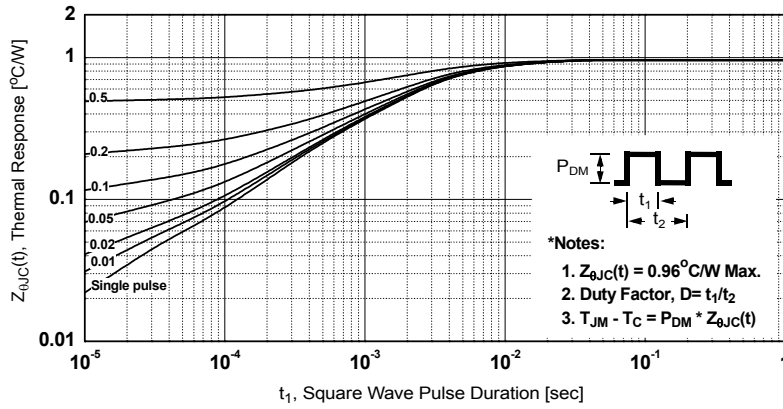
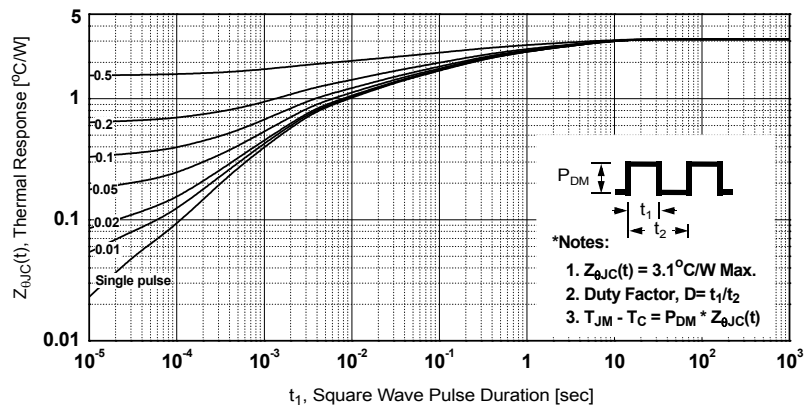
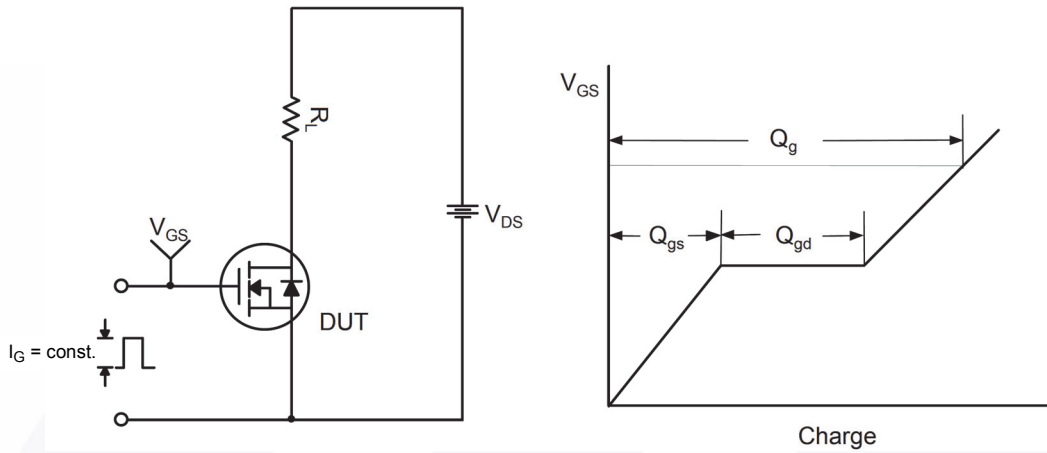


Figure 14. Transient Thermal Response Curve - FDPF8N50NZ



**Figure 15. Gate Charge Test Circuit & Waveform**



**Figure 16. Resistive Switching Test Circuit & Waveforms**



**Figure 17. Unclamped Inductive Switching Test Circuit & Waveforms**

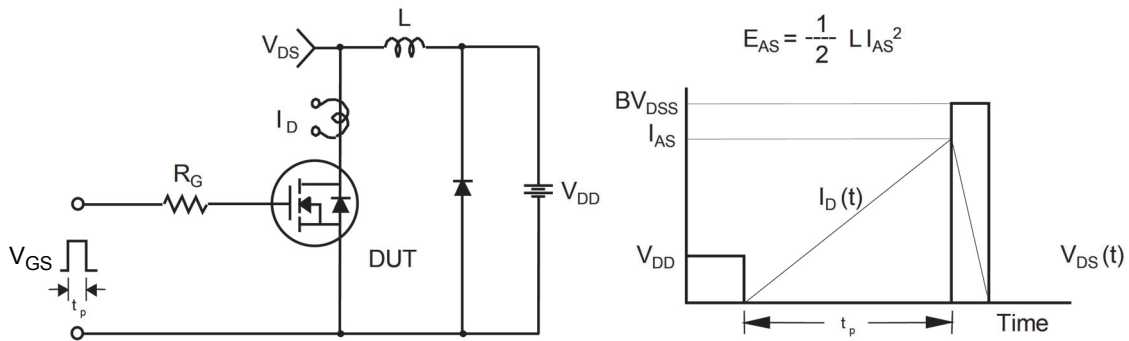
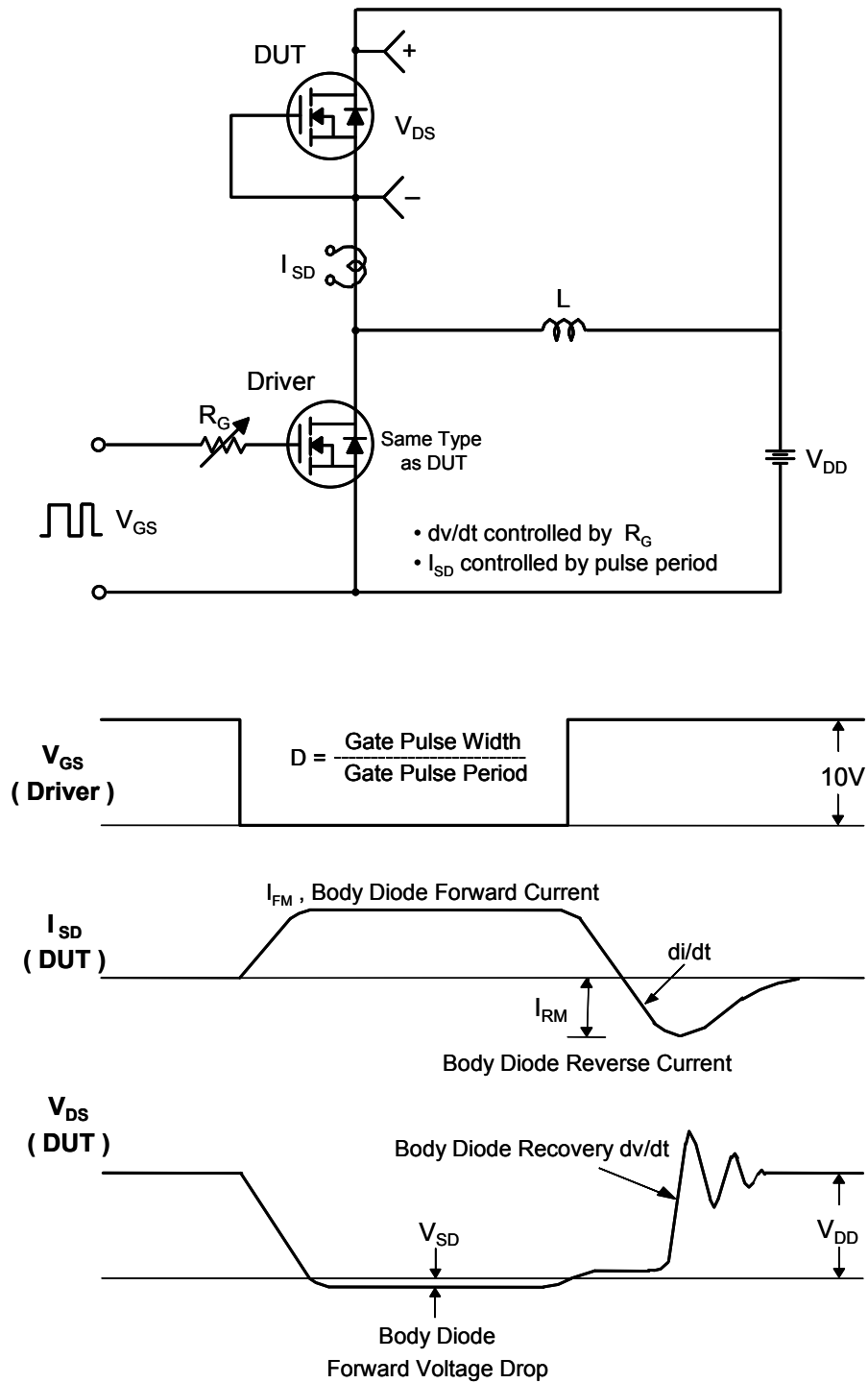
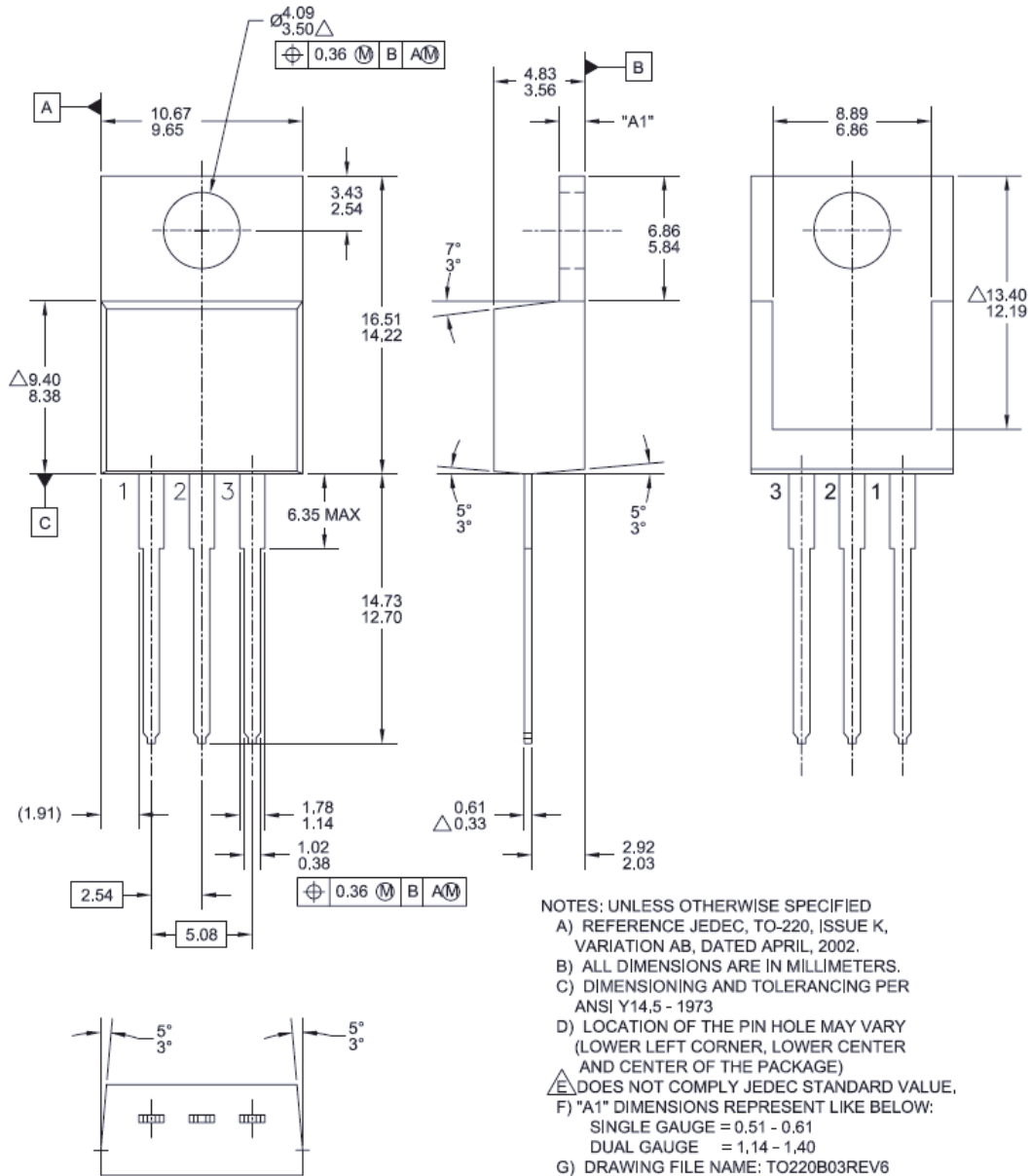


Figure 18. Peak Diode Recovery dv/dt Test Circuit & Waveforms



## Mechanical Dimensions

### TO-220 3L



**Figure 19. TO-220, Molded, 3Lead, Jedec Variation AB**

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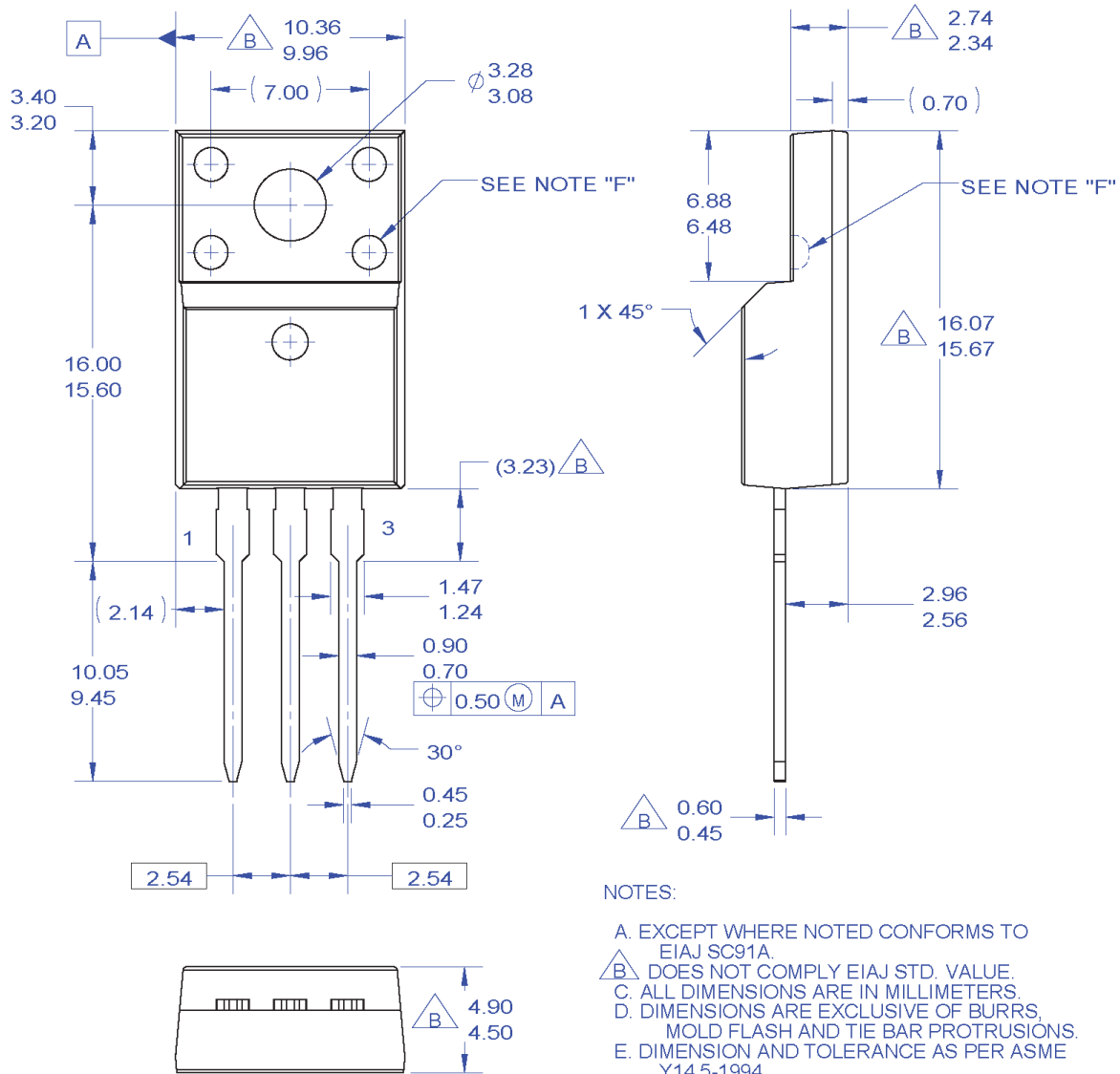
[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TT220-003](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT220-003)

Dimension in Millimeters



**Mechanical Dimensions**

**TO-220F 3L**



**NOTES:**

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.  
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV3

**Figure 20. TO220, Molded, 3LD, Full Pack, EIAJ SC91, Straight Lead**

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Dimension in Millimeters



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| AX-CAP®*                 | FRFET®                                                                                                                  | SYSTEM GENERAL®*                                                                            |
| BitSiC™                  | Global Power Resource <sup>SM</sup>                                                                                     | TinyBoost®                                                                                  |
| Build it Now™            | GreenBridge™                                                                                                            | TinyBuck®                                                                                   |
| CorePLUS™                | Green FPS™                                                                                                              | TinyCalc™                                                                                   |
| CorePOWER™               | Green FPS™ e-Series™                                                                                                    | TinyLogic®                                                                                  |
| CROSSVOLT™               | Gmax™                                                                                                                   | TINYOPTO™                                                                                   |
| CTL™                     | GTO™                                                                                                                    | TinyPower™                                                                                  |
| Current Transfer Logic™  | IntelliMAX™                                                                                                             | TinyPWM™                                                                                    |
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| EfficientMax™            | MICROCOUPLER™                                                                                                           | TRUECURRENT®*                                                                               |
| ESBC™                    | MicroFET™                                                                                                               | µSerDes™                                                                                    |
| <b>F</b> ®               | MicroPak™                                                                                                               |  SerDes™ |
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| FACT Quiet Series™       | MotionMax™                                                                                                              | UniFET™                                                                                     |
| FACT®                    | mWSaver®                                                                                                                | VCX™                                                                                        |
| FAST®                    | OptoHiT™                                                                                                                | VisualMax™                                                                                  |
| FastvCore™               | OPTOLOGIC®                                                                                                              | VoltagePlus™                                                                                |
| FETBench™                | OPTOPLANAR®                                                                                                             | XS™                                                                                         |
| FPS™                     |                                                                                                                         |                                                                                             |
|                          | PowerTrench®                                                                                                            |                                                                                             |
|                          | PowerXS™                                                                                                                |                                                                                             |
|                          | Programmable Active Droop™                                                                                              |                                                                                             |
|                          | QFET®                                                                                                                   |                                                                                             |
|                          | QS™                                                                                                                     |                                                                                             |
|                          | Quiet Series™                                                                                                           |                                                                                             |
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|                          | STEALTH™                                                                                                                |                                                                                             |
|                          | SuperFET®                                                                                                               |                                                                                             |
|                          | SuperSOT™-3                                                                                                             |                                                                                             |
|                          | SuperSOT™-6                                                                                                             |                                                                                             |
|                          | SuperSOT™-8                                                                                                             |                                                                                             |
|                          | SupreMOS®                                                                                                               |                                                                                             |
|                          | SyncFET™                                                                                                                |                                                                                             |

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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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