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October 2013

FDPF5N50NZF

N-Channel UniFETTM II FRFET[®] MOSFET 500 V, 4.2 A, 1.75 Ω

Features

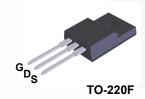
- $R_{DS(on)}$ = 1.57 Ω (Typ.) @ V_{GS} = 10 V, I_D = 2.1 A
- Low Gate Charge (Typ. 9 nC)
- Low C_{rss} (Typ. 4 pF)
- 100% Avalanche Tested
- · Improved dv/dt Capability
- · ESD Improved Capability
- · RoHS Compliant

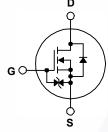
Applications

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

Description

UniFETTM 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 t_{rr} 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 bal-





MOSFET Maximum Ratings T_C = 25°C unless otherwise noted.

| Symbol | | Parameter | | FDPF5N50NZF | Unit |
|-----------------------------------|--|------------------------------|-------------|-------------|------|
| V _{DSS} | Drain to Source Voltage | е | | 500 | V |
| V _{GSS} | Gate to Source Voltage | ; | | ±25 | V |
| | Drain Current | - Continuous (T _C | = 25°C) | 4.2* | ^ |
| ID | Drain Current | - Continuous (T _C | = 100°C) | 2.5* | Α |
| I _{DM} | Drain Current | - Pulsed | (Note 1) | 16* | Α |
| E _{AS} | Single Pulsed Avalanche Energy (Note 2) | | 165 | mJ | |
| I _{AR} | Avalanche Current | | (Note 1) | 4.2 | Α |
| E _{AR} | Repetitive Avalanche Energy (Note | | (Note 1) | 7.8 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (Note 3) | | (Note 3) | 20 | V/ns |
| D | Dower Dissinction | $(T_C = 25^{\circ}C)$ | | 30 | W |
| Power Dissipation | | - Derate above 2 | 5°C | 0.24 | W/°C |
| T _J , T _{STG} | Operating and Storage | Temperature Range | -55 to +150 | °C | |
| TL | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | | | 300 | °C |

^{*}Drain current limited by maximum junction temperature

Thermal Characteristics

| Symbol | Parameter | FDPF5N50NZF | Unit |
|-----------------|---|-------------|-------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 4.1 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5 | *C/VV |

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FDPF5N50NZF Rev. C1

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Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-------------|---------|-----------|------------|----------|
| FDPF5N50NZF | FDPF5N50NZF | TO-220F | Tube | N/A | 50 units |

Electrical Characteristics T_C = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Тур. | Max. | Unit |
|--|--|---|------|------|------|------|
| Off Charac | cteristics | | | | | |
| BV _{DSS} | Drain to Source Breakdown Voltage | $I_D = 250 \mu A$, $V_{GS} = 0V$, $T_C = 25^{\circ}C$ | 500 | - | - | V |
| ΔBV _{DSS} / ΔΤ _J | Breakdown Voltage Temperature Coefficient | I _D = 250μA, Referenced to 25°C | - | 0.5 | - | V/°C |
| 1 | Zone Cote Voltage Dunin Comment | V _{DS} = 500V, V _{GS} = 0V | - | - | 10 | ^ |
| I _{DSS} Zero Gate Voltage Drain Current | $V_{DS} = 400V, V_{GS} = 0V, T_{C} = 125^{\circ}C$ | - | - | 100 | μА | |
| I _{GSS} | Gate to Body Leakage Current | $V_{GS} = \pm 25V, V_{DS} = 0V$ | - | - | ±10 | μΑ |

On Characteristics

| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_{D} = 250 \mu A$ | 3.0 | - | 5.0 | V |
|---------------------|--------------------------------------|--|-----|------|------|---|
| R _{DS(on)} | Static Drain to Source On Resistance | V _{GS} = 10V, I _D = 2.1A | - | 1.57 | 1.75 | Ω |
| 9 _{FS} | Forward Transconductance | $V_{DS} = 20V, I_{D} = 2.1A$ | ı | 4.2 | 1 | S |

Dynamic Characteristics

| C _{iss} | Input Capacitance | V = 25V V = 2V | - | 365 | 485 | pF |
|---------------------|-------------------------------|---|-----|-----|-----|----|
| C _{oss} | Output Capacitance | $V_{DS} = 25V, V_{GS} = 0V$ f = 1MHz | | 50 | 65 | pF |
| C _{rss} | Reverse Transfer Capacitance | 1 - 111112 | -\ | 4 | 8 | pF |
| Q _{g(tot)} | Total Gate Charge at 10V | | - \ | 9 | 12 | nC |
| Q_{gs} | Gate to Source Gate Charge | $V_{DS} = 400 V I_{D} = 4.2 A$ | - | 2 | - | nC |
| Q _{gd} | Gate to Drain "Miller" Charge | $V_{GS} = 10V$ (Note 4) | - | 4 | - | nC |

Switching Characteristics

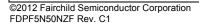
| $t_{d(on)}$ | Turn-On Delay Time | | | - | 12 | 35 | ns |
|---------------------|---------------------|---|----------|-----|----|----|----|
| t _r | Turn-On Rise Time | $V_{DD} = 250V, I_D = 4.2A$ | | - | 19 | 50 | ns |
| t _{d(off)} | Turn-Off Delay Time | V_{GS} = 10V, R_{GEN} = 25 Ω | | - / | 31 | 70 | ns |
| t _f | Turn-Off Fall Time | | (Note 4) | - | 22 | 55 | ns |

Drain-Source Diode Characteristics

| I _S | Maximum Continuous Drain to Source Diode Forward Current | | | - | 4.2 | Α |
|-----------------|--|--|---|------|-----|----|
| I _{SM} | Maximum Pulsed Drain to Source Diode Forward Current | | | - | 16 | Α |
| V_{SD} | Drain to Source Diode Forward Voltage | V _{GS} = 0V, I _{SD} = 4.2A | - | - | 1.5 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0V, I _{SD} = 4.2A | - | 87 | - | ns |
| Q _{rr} | Reverse Recovery Charge | $dI_F/dt = 100A/\mu s$ | - | 0.15 | - | μС |

Notes

- 1. Repetitive Rating: Pulse width limited by maximum junction temperature
- 2. L = 18.7mH, I $_{AS}$ = 4.2A, V $_{DD}$ = 50V, R $_{G}$ = 25 Ω , Starting T $_{J}$ = 25 $^{\circ}$ C
- 3. I_{SD} \leq 4.2A, di/dt \leq 200A/µs, V_{DD} \leq BV_DSS, Starting T_J = 25°C
- 4. Essentially Independent of Operating Temperature Typical Characteristics



Typical Characteristics

Figure 1. On-Region Characteristics

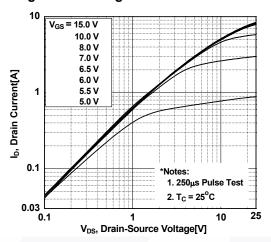


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

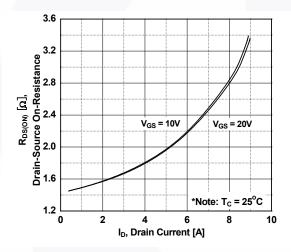


Figure 5. Capacitance Characteristics

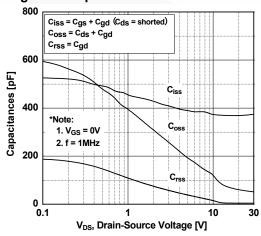


Figure 2. Transfer Characteristics

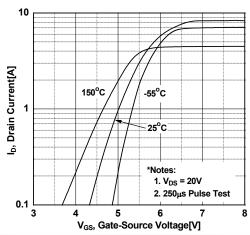


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

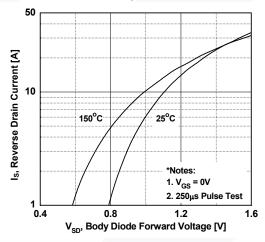
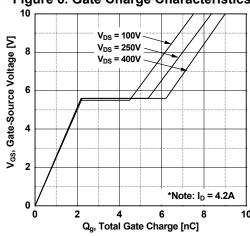


Figure 6. Gate Charge Characteristics



Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

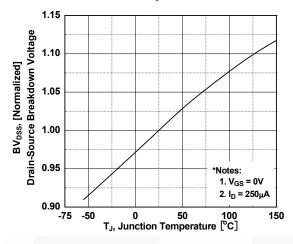


Figure 8. Maximum Safe Operating Area vs. Case Temperature-FDPF5N50NZF

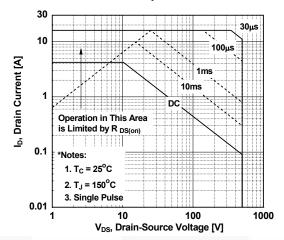


Figure 9. Maximum Drain Current

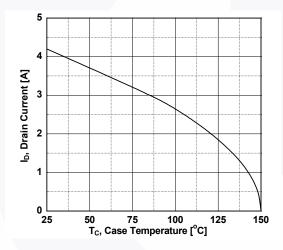
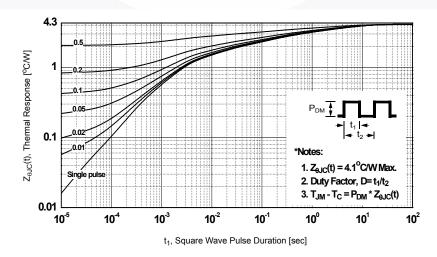


Figure 10. Transient Thermal Response Curve-FDPF5N50NZF



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Figure 11. Gate Charge Test Circuit & Waveform

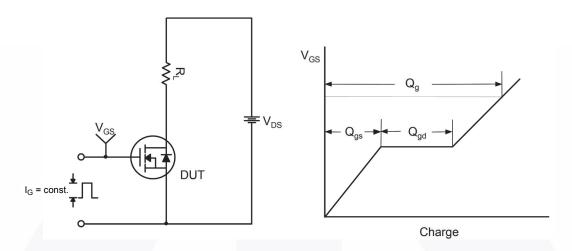


Figure 12. Resistive Switching Test Circuit & Waveforms

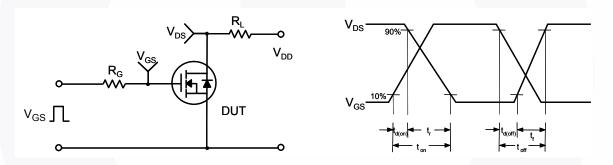
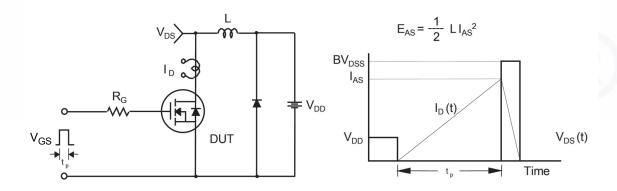
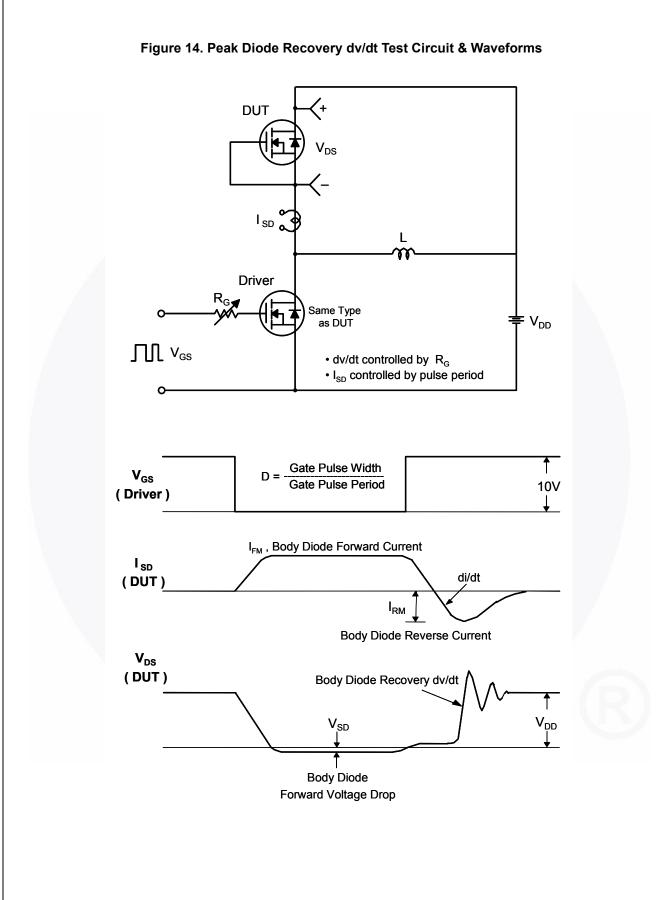


Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms





Mechanical Dimensions

TO-220F 3L

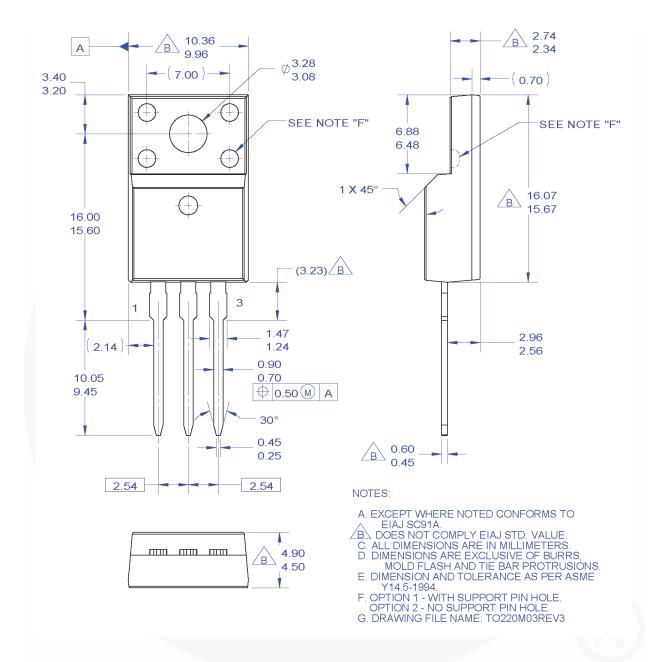


Figure 15. TO220, Molded, 3LD, Full Pack, EIAJ SC91, Straight Lead

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Dimension in Millimeters





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