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FDPF5N50UT

N-Channel UniFET™ Ultra FRFET™ MOSFET

500 V, 4 A, 2 Ω

Features

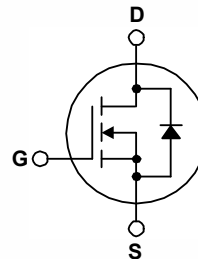
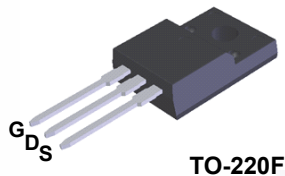
- $R_{DS(on)} = 1.65 \Omega$ (Typ.) @ $V_{GS} = 10 V, I_D = 2 A$
- Low Gate Charge (Typ. 11 nC)
- Low C_{rss} (Typ. 5 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

Applications

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

Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. UniFET Ultra FRFET™ MOSFET has much superior body diode reverse recovery performance. Its t_{rr} is less than 50nsec and the reverse dv/dt immunity is 20V/nsec while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore UniFET Ultra FRFET MOSFET can remove additional component and improve system reliability in certain applications that require performance improvement of the MOSFET's body diode. 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.



Absolute Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	FDPF5N50UT	Unit
V_{DSS}	Drain to Source Voltage	500	V
V_{GSS}	Gate to Source Voltage	±30	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ C$)	4*
		- Continuous ($T_C = 100^\circ C$)	2.4*
I_{DM}	Drain Current	- Pulsed (Note 1)	16*
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	216
I_{AR}	Avalanche Current	(Note 1)	4
E_{AR}	Repetitive Avalanche Energy	(Note 1)	8.5
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20
P_D	Power Dissipation	($T_C = 25^\circ C$)	28
		- Derate above $25^\circ C$	0.22
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ C$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FDPF5N50UT	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	4.5	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDPF5N50UT	FDPF5N50UT	TO-220F	Tube	N/A	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	$I_D = 250 \mu\text{A}$, $V_{GS} = 0 \text{ V}$, $T_J = 25^\circ\text{C}$	500	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C	-	0.7	-	$V/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 50 \text{ V}$, $V_{GS} = 0 \text{ V}$	-	-	25	μA
		$V_{DS} = 400 \text{ V}$, $T_C = 125^\circ\text{C}$	-	-	250	
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}$, $V_{DS} = 0 \text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250 \mu\text{A}$	3	-	5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}$, $I_D = 2 \text{ A}$	-	1.65	2	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40 \text{ V}$, $I_D = 2 \text{ A}$	-	4.8	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	-	485	650	pF
C_{oss}	Output Capacitance		-	65	90	pF
C_{rss}	Reverse Transfer Capacitance		-	5	8	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400 \text{ V}$, $I_D = 4 \text{ A}$, $V_{GS} = 10 \text{ V}$	-	11	15	nC
Q_{gs}	Gate to Source Gate Charge		-	3	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	5	-

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250 \text{ V}$, $I_D = 4 \text{ A}$, $V_{GS} = 10 \text{ V}$, $R_G = 25 \Omega$	-	14	38	ns
t_r	Turn-On Rise Time		-	21	52	ns
$t_{d(off)}$	Turn-Off Delay Time		-	27	64	ns
t_f	Turn-Off Fall Time		(Note 4)	-	20	50

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	4	A	
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	16	A	
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$, $I_{SD} = 4 \text{ A}$	-	-	1.6	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$, $I_{SD} = 4 \text{ A}$, $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	36	-	ns
Q_{rr}	Reverse Recovery Charge		-	33	-	nC

Notes:

- 1: Repetitive rating: pulse-width limited by maximum junction temperature.
- 2: $L = 27 \text{ mH}$, $I_{AS} = 4 \text{ A}$, $V_{DD} = 50 \text{ V}$, $R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
- 3: $I_{SD} \leq 4 \text{ A}$, $di/dt \leq 200 \text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
- 4: Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

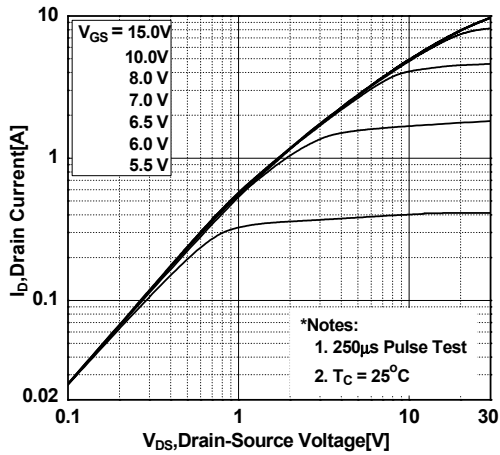


Figure 2. Transfer Characteristics

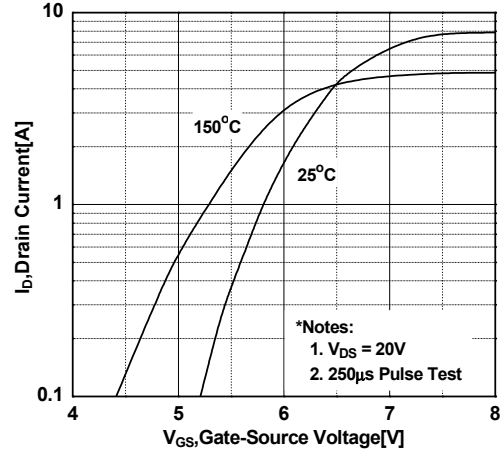


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

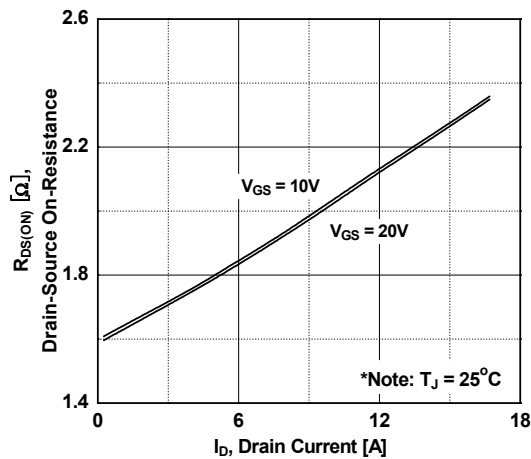


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

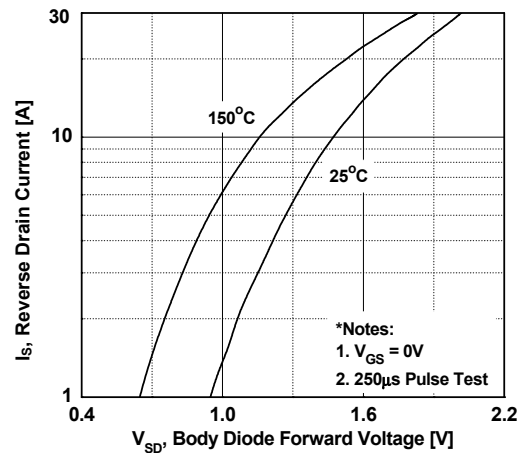


Figure 5. Capacitance Characteristics

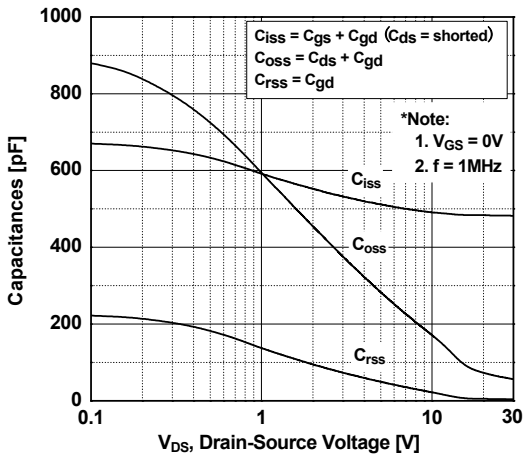
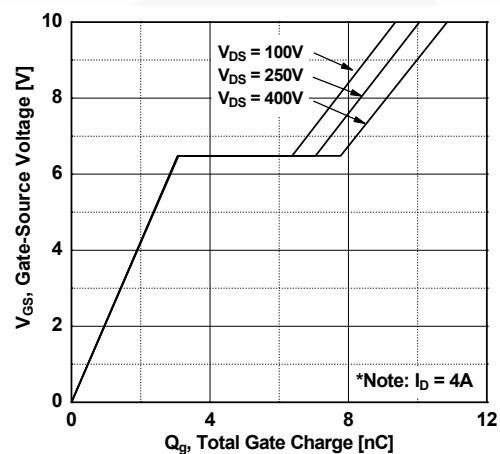


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

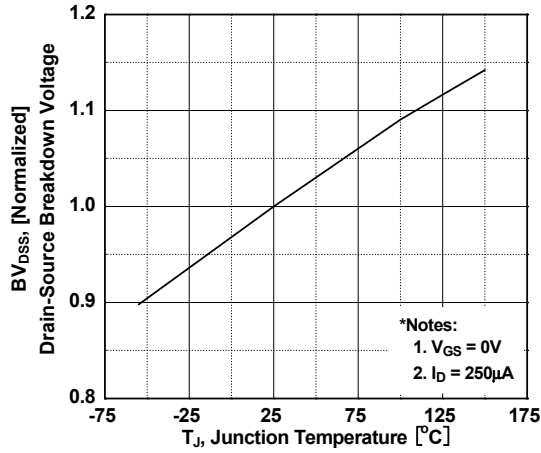


Figure 8. Maximum Safe Operating Area

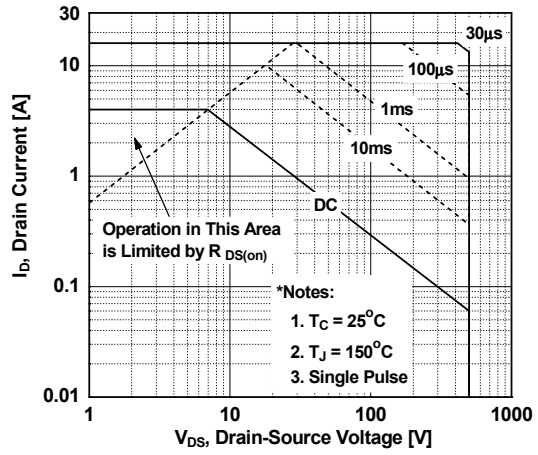


Figure 9. Maximum Drain Current vs. Case Temperature

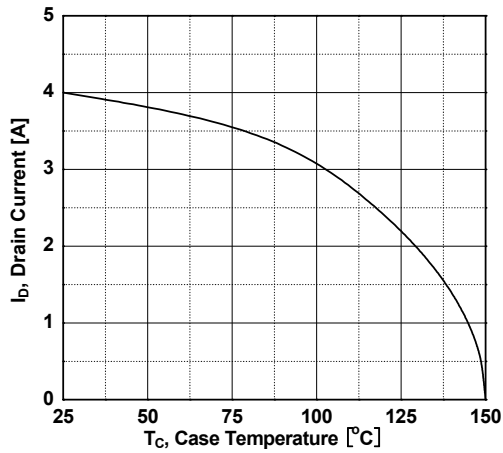
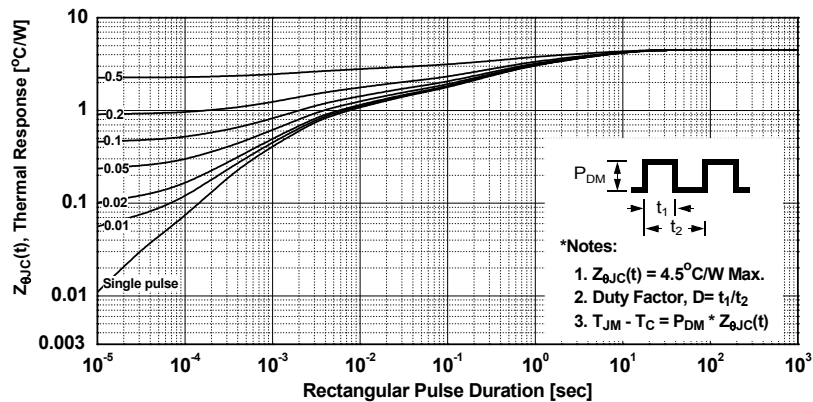


Figure 10. Transient Thermal Response Curve



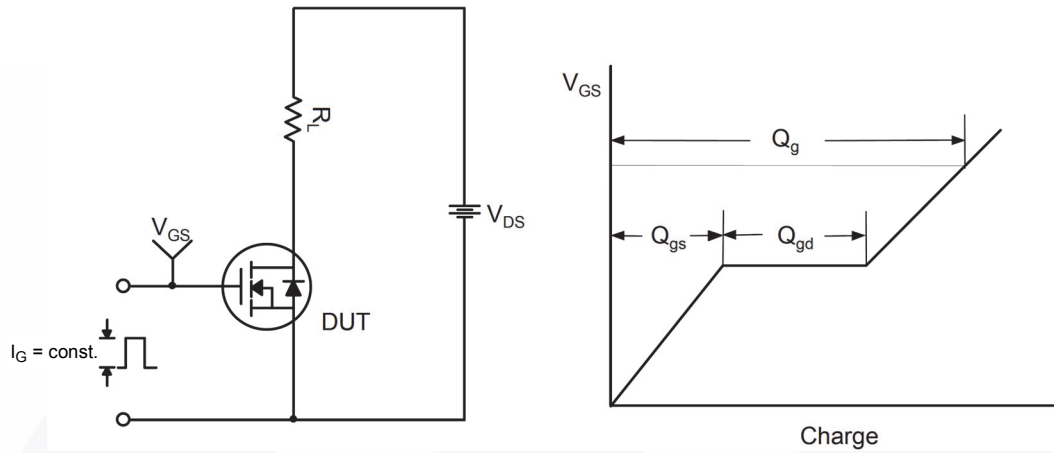


Figure 11. Gate Charge Test Circuit & Waveform

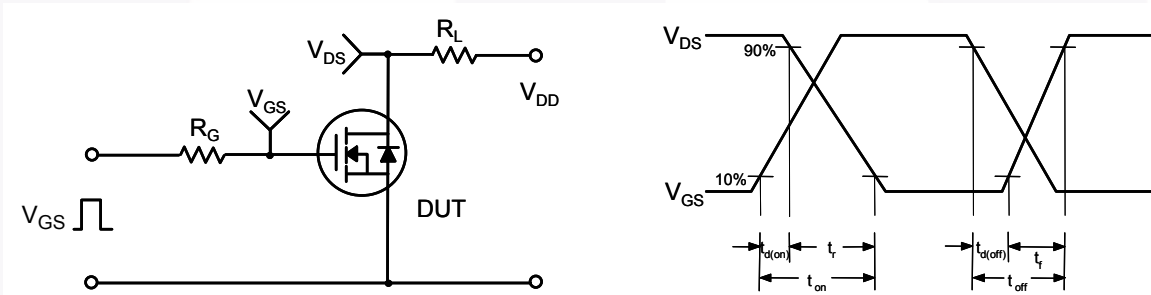


Figure 12. Resistive Switching Test Circuit & Waveforms

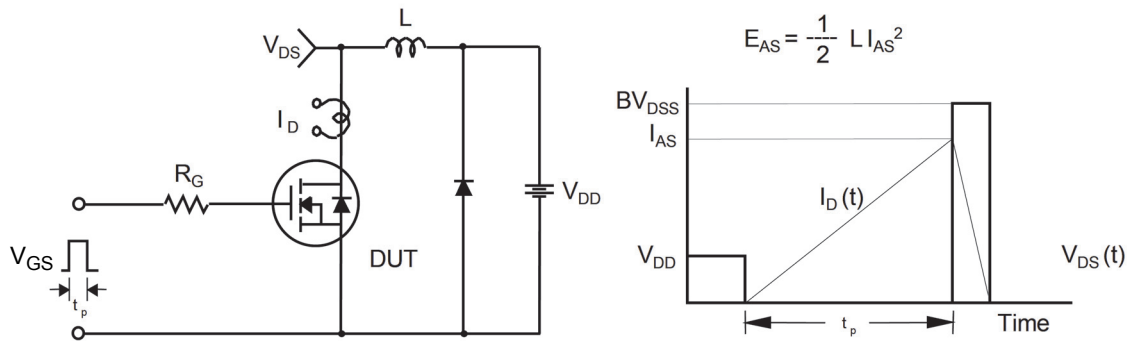


Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 14. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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