

FDH45N50F

500V N-Channel MOSFET, FRFET

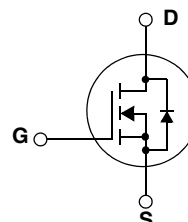
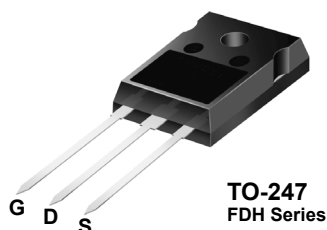
Features

- 45A, 500V, $R_{DS(on)} = 0.12\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typical 105 nC)
- Low C_{RSS} (typical 62 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Description

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

This advanced 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.



Absolute Maximum Ratings

Symbol	Parameter	FDH45N50F	Unit
V_{DSS}	Drain-Source Voltage	500	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	45 28.4	A A
I_{DM}	Drain Current - Pulsed (Note 1)	180	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1868	mJ
I_{AR}	Avalanche Current (Note 1)	45	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	62.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	50	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C	625 5	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	°C

Thermal Characteristics

Symbol	Parameter	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.2	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDH45N50F	FDH45N50F	TO-247	-	-	30

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA	500	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.5	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 500V, V _{GS} = 0V V _{DS} = 400V, T _C = 125°C	--	--	25 250	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 22.5A	--	0.105	0.12	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 22.5A (Note 4)	--	49.0	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	5100	6630	pF
C _{oss}	Output Capacitance		--	790	1030	pF
C _{rss}	Reverse Transfer Capacitance		--	62	--	pF
C _{oss}	Output Capacitance	V _{DS} = 400V, V _{GS} = 0V, f = 1.0MHz	--	161	--	pF
C _{oss eff.}	Effective Output Capacitance	V _{DS} = 0V to 400V, V _{GS} = 0V	--	342	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 250V, I _D = 48A R _G = 25Ω (Note 4, 5)	--	140	290	ns
t _r	Turn-On Rise Time		--	500	1010	ns
t _{d(off)}	Turn-Off Delay Time		--	215	440	ns
t _f	Turn-Off Fall Time		--	245	500	ns
Q _g	Total Gate Charge	V _{DS} = 400V, I _D = 48A V _{GS} = 10V (Note 4, 5)	--	105	137	nC
Q _{gs}	Gate-Source Charge		--	33	--	nC
Q _{gd}	Gate-Drain Charge		--	45	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	45	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	180	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 45A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 45A dI _F /dt = 100A/μs (Note 4)	--	188	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.64	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 1.46mH, I_{AS} = 48A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 45A, di/dt ≤ 1,200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

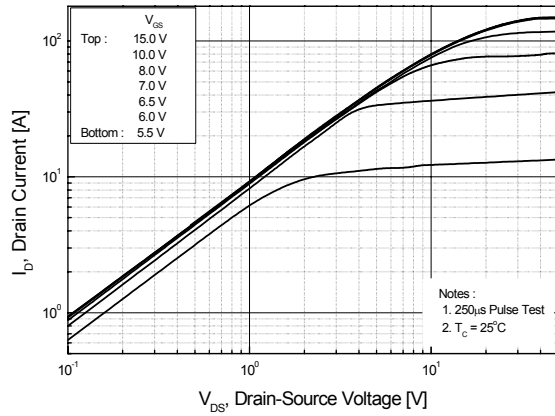


Figure 2. Transfer Characteristics

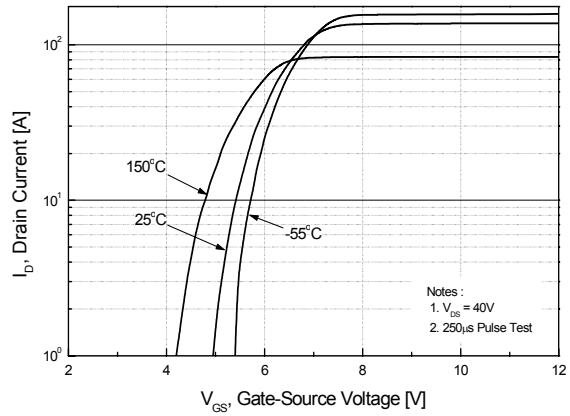


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

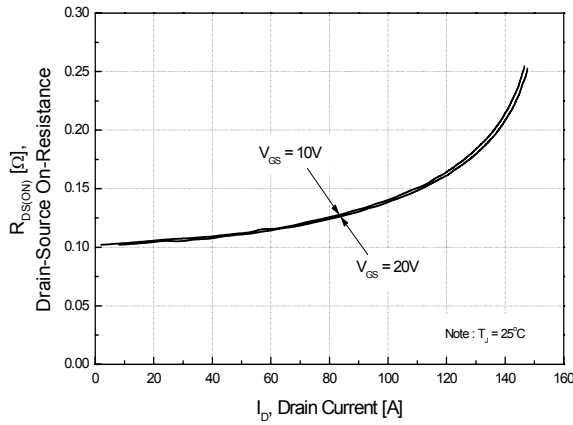


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

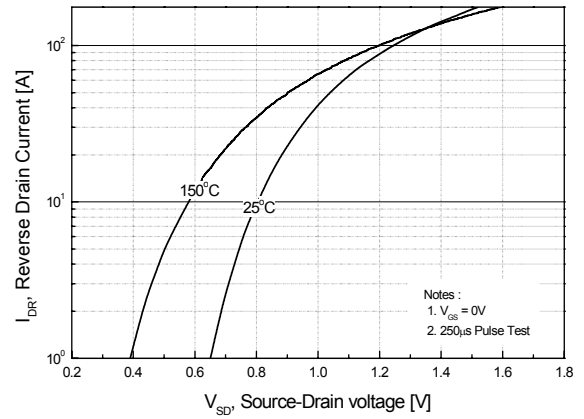


Figure 5. Capacitance Characteristics

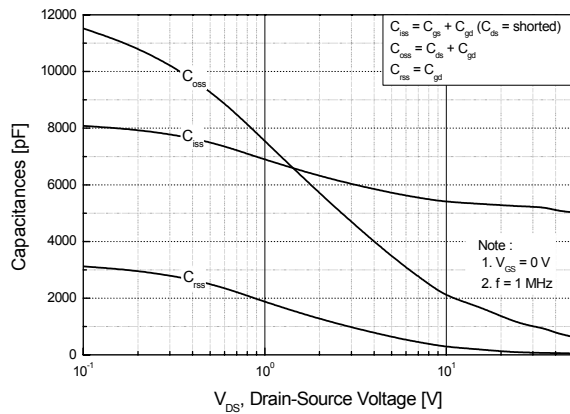
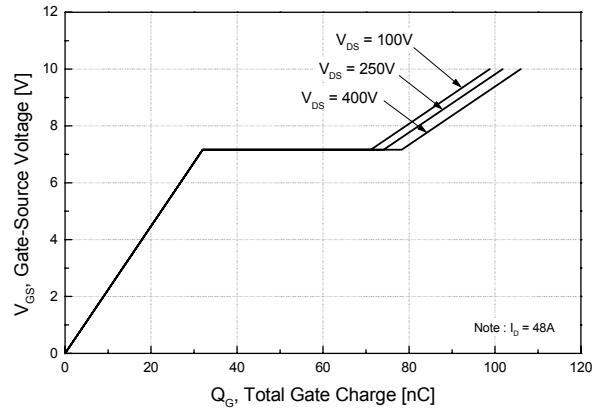


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

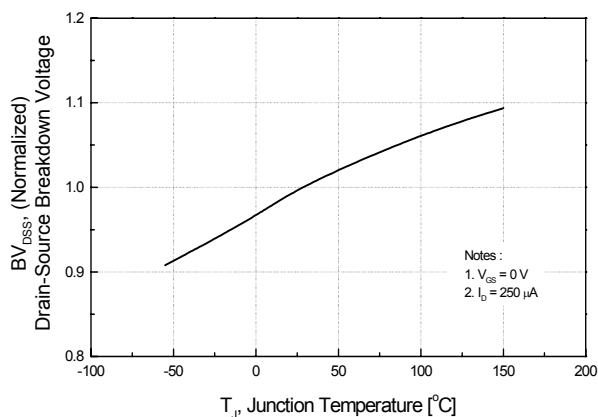


Figure 8. On-Resistance Variation vs. Temperature

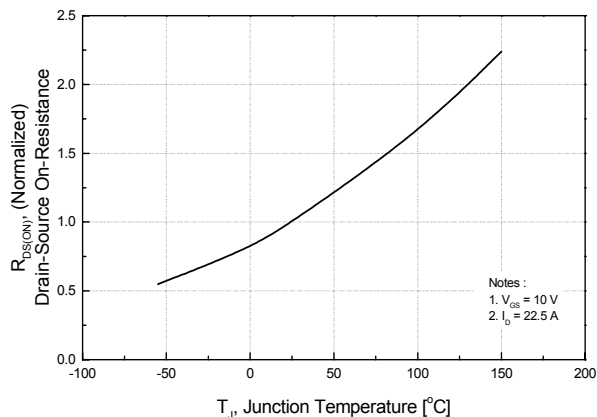


Figure 9. Maximum Safe Operating Area

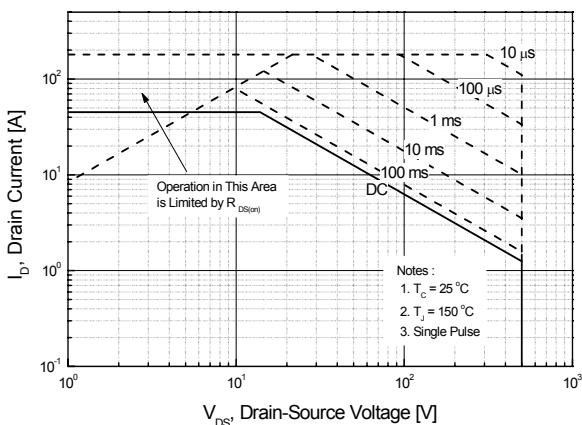


Figure 10. Maximum Drain Current vs. Case Temperature

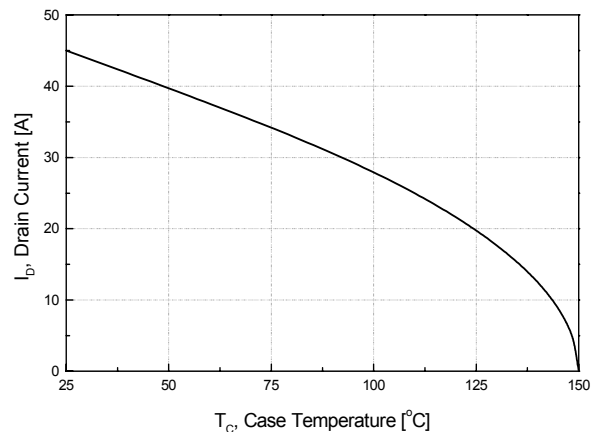


Figure 11. Typical Drain Current Slope vs. Gate Resistance

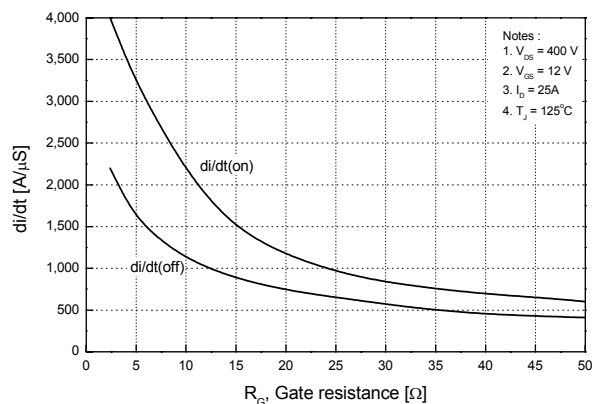
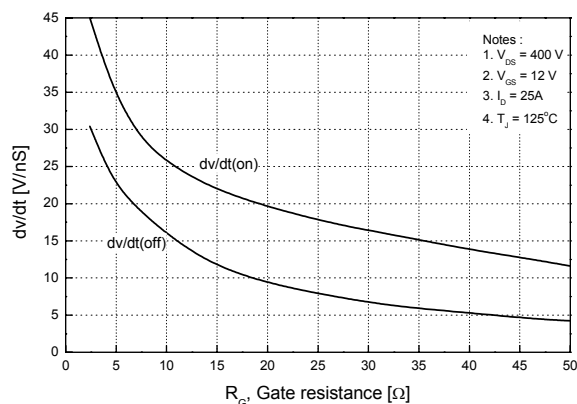


Figure 12. Typical Drain-Source Voltage Slope vs. Gate Resistance



Typical Performance Characteristics (Continued)

Figure 13. Typical Switching Losses vs. Gate Resistance

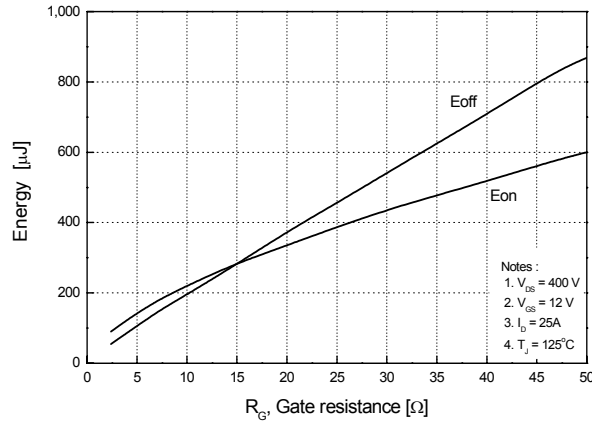


Figure 14. Unclamped Inductive Switching Capability

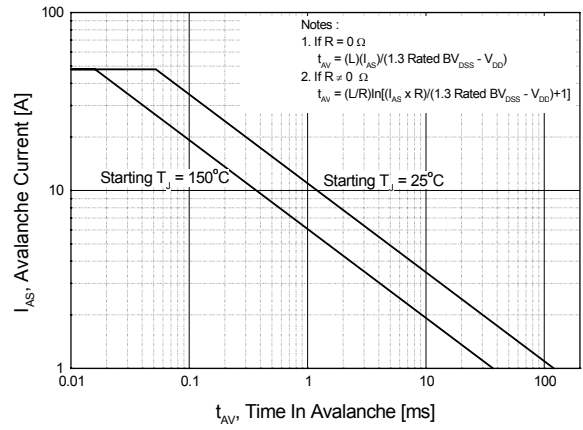
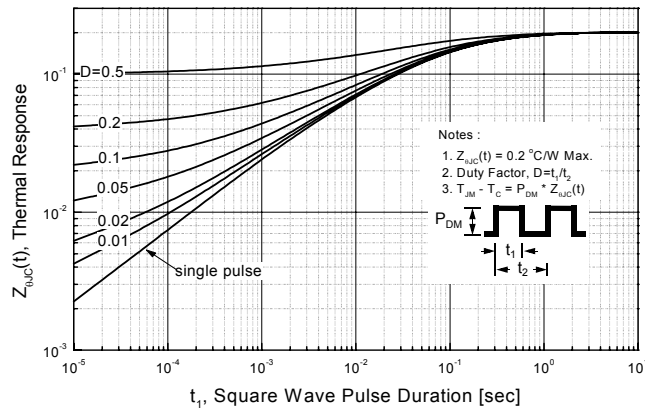


Figure 15. Transient Thermal Resistance Curve



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