FAIRCHILD SEMICONDUCTOR®

October 2003

FDH40N50F

N-Channel Fast Body-Diode SMPS Power MOSFET

42A, 500V, 0.130 Ohm

Applications

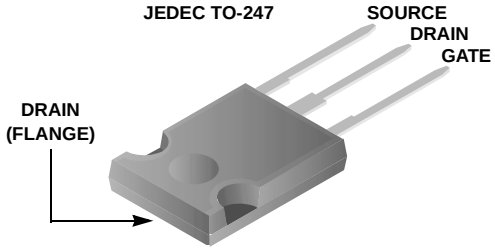
Switch Mode Power Supplies(SMPS), such as

- Half-Bridge
- Full-Bridge
- UPS
- Motor Drive
- PWM Inverters
- Phase Shifted PWMFB-ZVS Converters

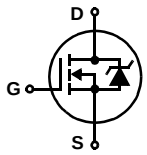
Features

- Reduced $R_{DS(ON)}$
- Higher Gate Threshold Voltage, 4V Typical
- Lower Qgd/Qgs Ratio, Low Gate Charge $Q_{g(tot)}$ results in Simple Drive Requirement
- Low Input Capacitance, Reduced Miller Capacitance
- Improved Switching Speed with Low EMI
- Optimized Antiparallel Diode with Low Trr and Soft Recovery
- 150°C Rated Junction Temperature
- High Reapplied dv/dt Ruggedness 80V/nsec

Package



Symbol



Absolute Maximum Ratings $T_J = 25^oC$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	500	V
V_{GS}	Gate to Source Voltage	±30	V
I_D	Drain Current Continuous ($T_C = 25^oC$, $V_{GS} = 10V$)	42	A
	Continuous ($T_C = 100^oC$, $V_{GS} = 10V$)	27	A
	Pulsed	Figure 10	A
P_D	Power dissipation Derate above 25°C	625 5.0	W W/°C
E_{AS}	Single Pulse Avalanche Energy[2]	1500	mJ
I_{AR}	Avalanche Current	42	A
dv/dt	Peak Diode Recovery[3]	20	V/ns
T_J, T_{STG}	Operating and Storage Temperature	-55 to 150	°C
	Soldering Temperature for 10 seconds	300 (1.6mm from case)	°C

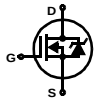
Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case	0.20	°C/W
$R_{\theta CS}$	Thermal Resistance Case to Sink, Flat, Greased Surface	0.24 TYP	°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
FDH40N50	FDH40N50F	TO-247	N/A	N/A	30

Electrical Characteristics T_J = 25°C (unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Statics							
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V		500	-	-	V
$\Delta B_{VDSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	Reference to 25°C, ID = 1mA		-	0.42	-	V/°C
$r_{DS(ON)}$	Drain to Source On-Resistance	V_{GS} = 10V, I_D = 21.0A		-	0.119	0.130	Ω
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA		3.0	4.0	5.0	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500V	T_C = 25°C	-	-	25	μA
		V_{GS} = 0V	T_C = 150°C	-	-	500	
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±30V		-	-	±100	nA
Dynamics							
g_{fs}	Forward Transconductance	V_{DS} = 50V, I_D = 21A		26	-	-	S
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 10V, V_{DS} = 400V, I_D = 42A		-	85	108	nC
Q_{gs}	Gate to Source Gate Charge			-	27	35	nC
Q_{gd}	Gate to Drain “Miller” Charge			-	30	37	nC
$t_{d(ON)}$	Turn-On Delay Time	V_{DD} = 250V, I_D = 42A, R_G = 2.15Ω, R_D = 5.95Ω		-	22	-	ns
t_r	Rise Time			-	123	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time			-	32	-	ns
t_f	Fall Time			-	65	-	ns
C_{ISS}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		-	4800	-	pF
C_{OSS}	Output Capacitance			-	640	-	pF
C_{RSS}	Reverse Transfer Capacitance			-	47	-	pF
$C_{O(er)}$	Effective Output Capacitance,energy related	V_{GS} = 0V, V_{DS} = 0V to 400V		-	275	-	pF
Drain-Source Diode Characteristics							
I_S	Continuous Source Current (Body Diode)	MOSFET symbol showing the integral reverse p-n junction diode. 		-	-	42	A
I_{SM}	Pulsed Source Current[1] (Body Diode)			-	-	168	A
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 42A		-	0.93	1.2	V
t_{rr}	Reverse Recovery Time	T_J = 25°C, I_{SD} = 42A, dI_{SD}/dt = 100A/μs		-	165	215	ns
Q_{RR}	Reverse Recovered Charge			-	0.720	0.940	μC
t_{rr}	Reverse Recovery Time	T_J = 125°C, I_{SD} = 42A, dI_{SD}/dt = 100A/μs		-	240	350	ns
Q_{RR}	Reverse Recovered Charge			-	1.4	2.1	μC

Notes:
1: Repetitive rating; pulse width limited by maximum junction temperature.
2: Starting T_J = 25°C, L = 1.78mH, I_{AS} = 42A
3: I_{SD} < 42A, di/dt < 1000A/usec, V_{DD} = 400Vdc, T_J = 125°C

Typical Characteristics

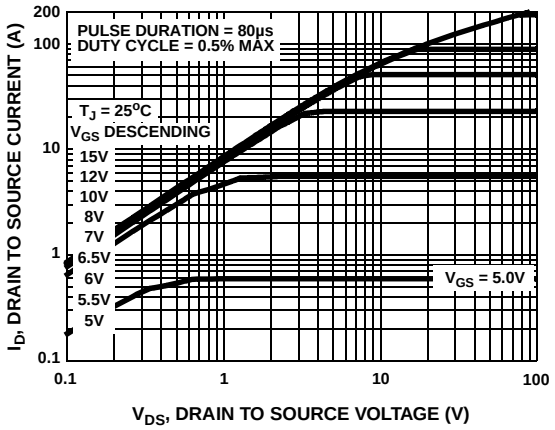


Figure 1. Output Characteristics

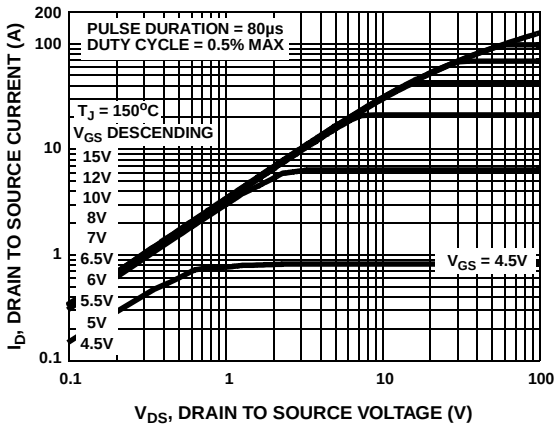


Figure 2. Output Characteristics

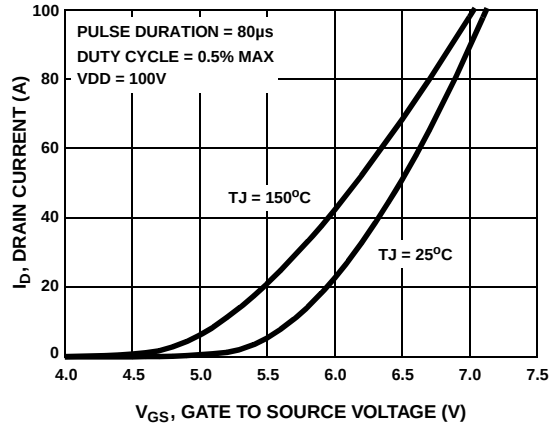


Figure 3. Transfer Characteristics

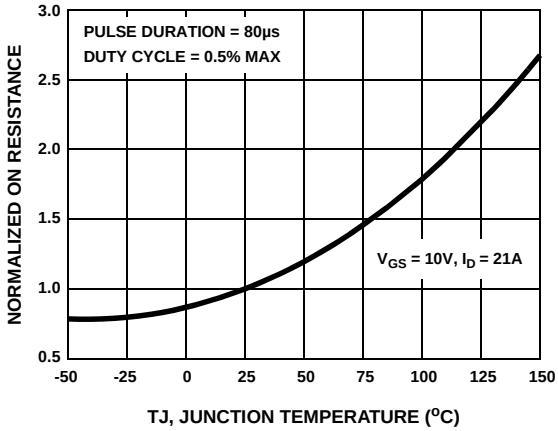


Figure 4. Normalized Drain To Source On Resistance vs Junction Temperature

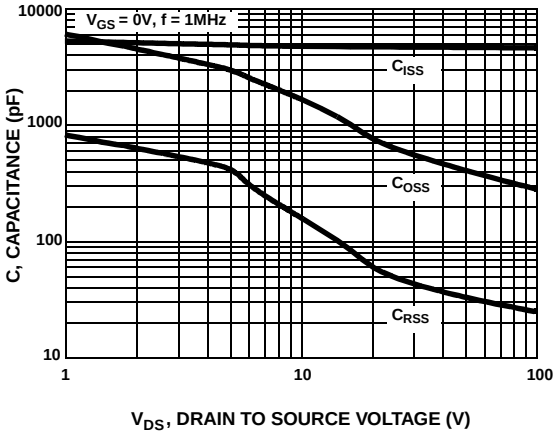


Figure 5. Capacitance vs Drain To Source Voltage

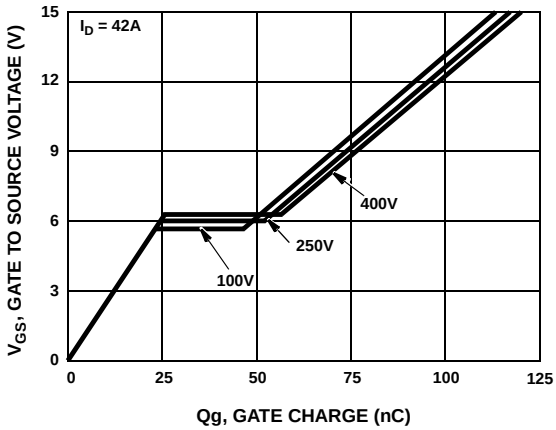


Figure 6. Gate Charge Waveforms For Constant Gate Current

Typical Characteristics

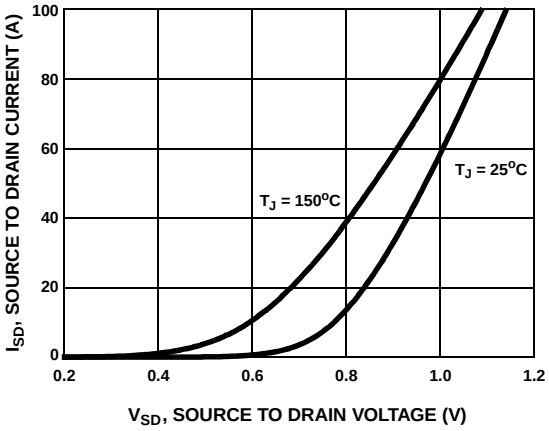


Figure 7. Body Diode Forward Voltage vs Body Diode Current

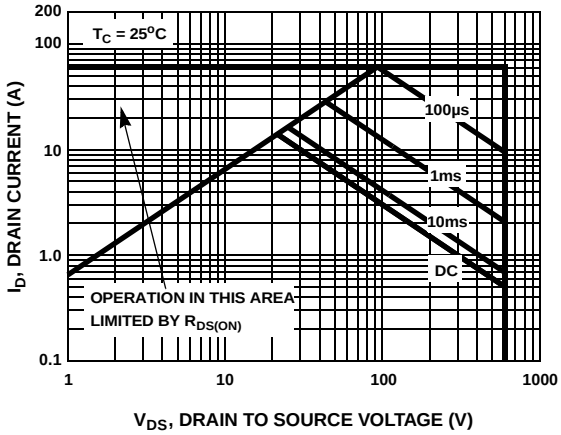


Figure 8. Maximum Safe Operating Area

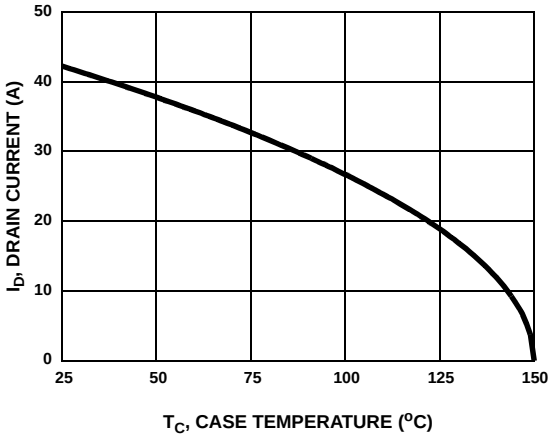


Figure 9. Maximum Drain Current vs Case Temperature

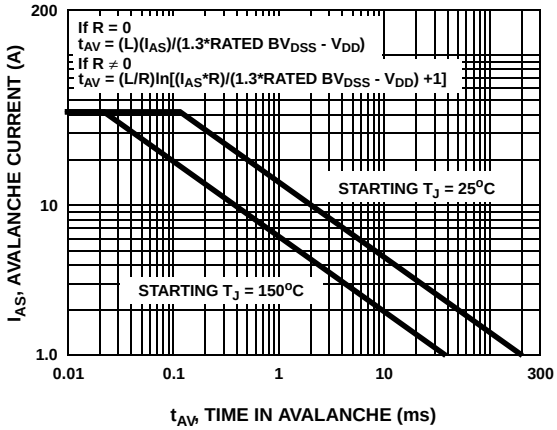


Figure 10. Unclamped Inductive Switching Capability

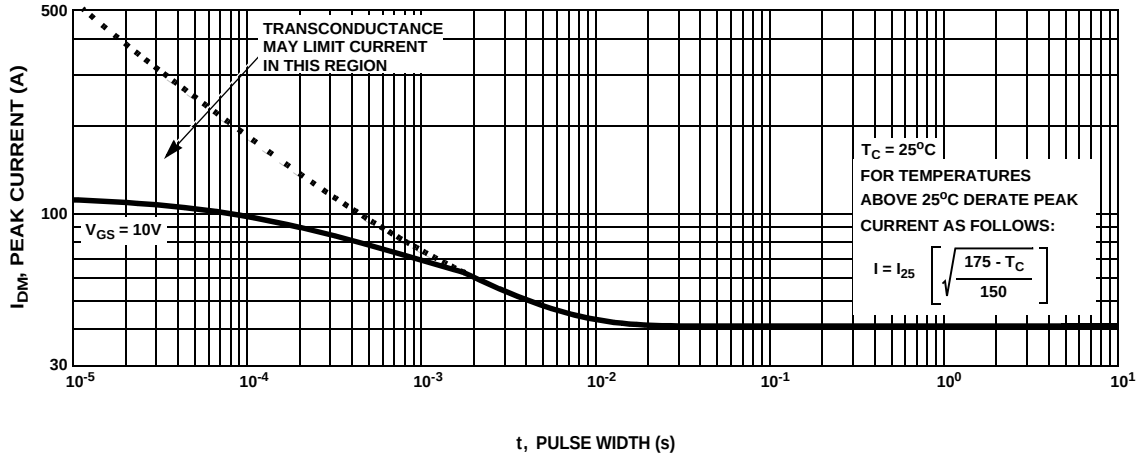


Figure 11. Peak Current Capability

Typical Characteristics

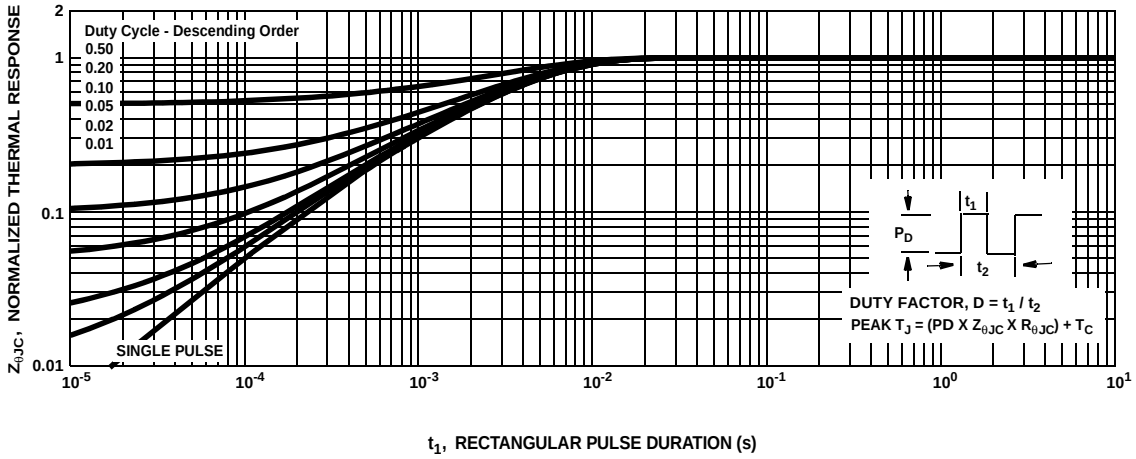


Figure 12. Normalized Transient Thermal Impedance, Junction to Case

Test Circuits and Waveforms

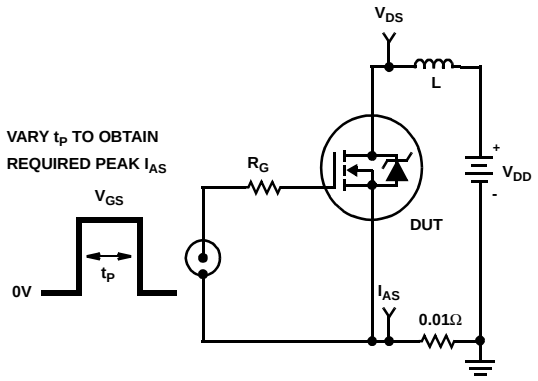


Figure 13. Unclamped Energy Test Circuit

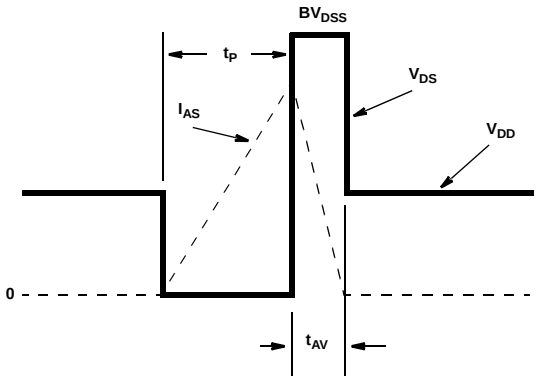


Figure 14. Unclamped Energy Waveforms

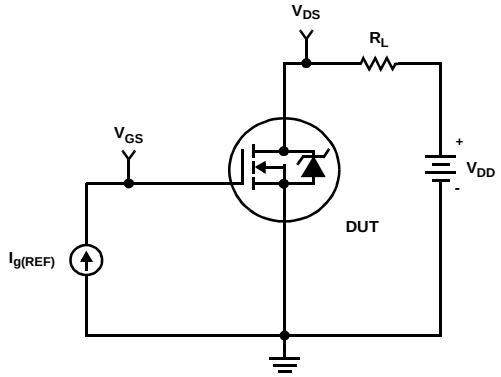


Figure 15. Gate Charge Test Circuit

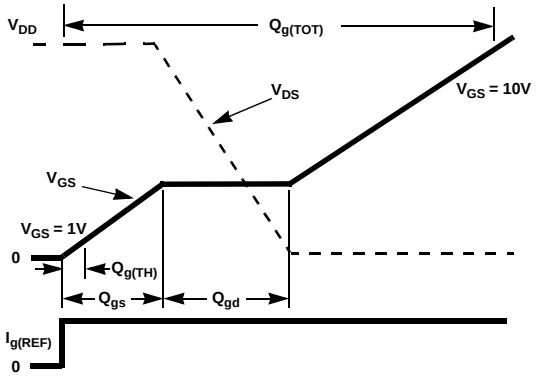


Figure 16. Gate Charge Waveforms

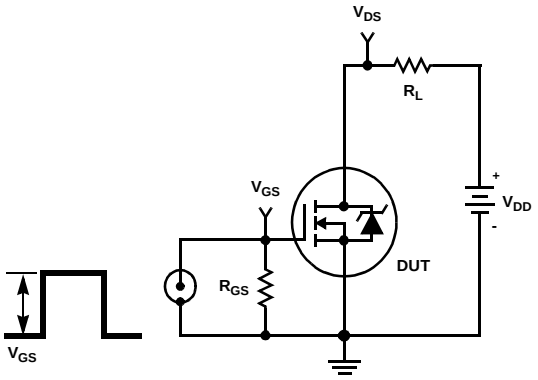


Figure 17. Switching Time Test Circuit

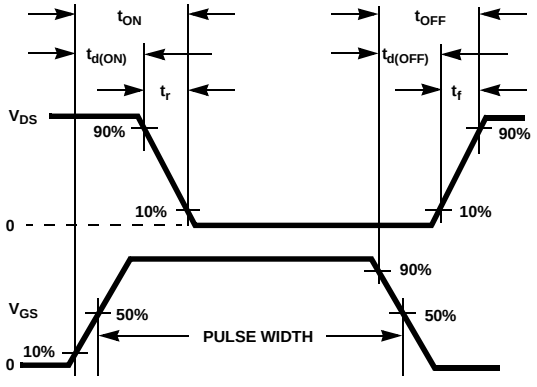


Figure 18. Switching Time Waveform

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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