FAIRCHILD
SEMICONDUCTOR®

March 2006

FDD8770/FDU8770
N-Channel PowerTrench® MOSFET
25V, 35A, 4.0mΩ

General Description

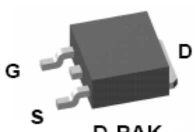
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

Features

- Max $r_{DS(on)} = 4.0m\Omega$ at $V_{GS} = 10V$, $I_D = 35A$
- Max $r_{DS(on)} = 5.5m\Omega$ at $V_{GS} = 4.5V$, $I_D = 35A$
- Low gate charge: $Q_{g(10)} = 52nC(Typ)$, $V_{GS} = 10V$
- Low gate resistance
- RoHS Compliant

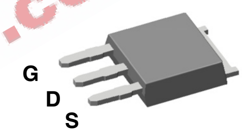
Application

- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture

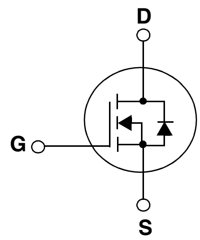


D-PAK
(TO-252)

I-PAK
(TO-251AA)



Short Lead I-PAK



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

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		25	V
V_{GS}	Gate to Source Voltage		±20	V
I_D	Drain Current -Continuous (Package Limited)		35	A
	-Continuous (Die Limited)		210	
	-Pulsed	(Note 1)	407	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	113	mJ
P_D	Power Dissipation		115	W
T_J, T_{STG}	Operating and Storage Temperature		-55 to 175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case TO-252,TO-251	1.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,TO-251	100	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient TO-252,1in^2 copper pad area	52	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD8770	FDD8770	TO-252AA	13"	12mm	2500 units
FDU8770	FDU8770	TO-251AA	N/A(Tube)	N/A	75 units
FDU8770	FDU8770_F071	TO-251AA	N/A(Tube)	N/A	75 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	25			V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		13.6		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20V, V_{GS} = 0V			1	μA
		V_{DS} = 20V, V_{GS} = 0V, T_J = 150°C			250	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V			±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, I_D = 250μA	1.2	1.6	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		-5.9		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 35A		3.3	4.0	mΩ
		V_{GS} = 4.5V, I_D = 35A		4.0	5.5	mΩ
		V_{GS} = 10V, I_D = 35A, T_J = 175°C		4.8	5.9	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz		2795	3720	pF
C_{oss}	Output Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz		685	915	pF
C_{rss}	Reverse Transfer Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz		450	675	pF
R_g	Gate Resistance	f = 1MHz		1.5		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 13V, I_D = 35A, V_{GS} = 10V, R_{GS} = 5Ω		10	20	ns
t_r	Rise Time	V_{DD} = 13V, I_D = 35A, V_{GS} = 10V, R_{GS} = 5Ω		12	22	ns
$t_{d(off)}$	Turn-Off Delay Time	V_{DD} = 13V, I_D = 35A, V_{GS} = 10V, R_{GS} = 5Ω		49	78	ns
t_f	Fall Time	V_{DD} = 13V, I_D = 35A, V_{GS} = 10V, R_{GS} = 5Ω		25	40	ns
Q_g	Total Gate Charge	V_{GS} = 0V to 10V, V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		52	73	nC
Q_g	Total Gate Charge	V_{GS} = 0V to 5V, V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		29	41	nC
Q_{gs}	Gate to Source Gate Charge	V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		8.1		nC
Q_{gd}	Gate to Drain “Miller”Charge	V_{DD} = 13V, I_D = 35A, I_g = 1.0mA		11		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 35A		0.84	1.25	V
		V_{GS} = 0V, I_S = 15A		0.79	1.0	V
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/μs		32	48	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/μs		25	38	nC

Notes:
1: Pulse time < 300μs, Duty cycle = 2%.
2: Starting T_J = 25°C, L = 0.3mH, I_{AS} = 27.5A , V_{DD} = 23V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

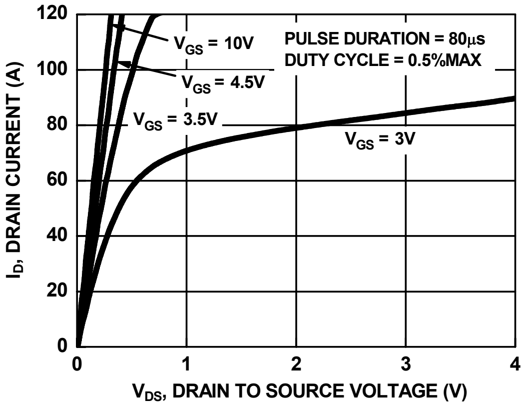


Figure 1. On Region Characteristics

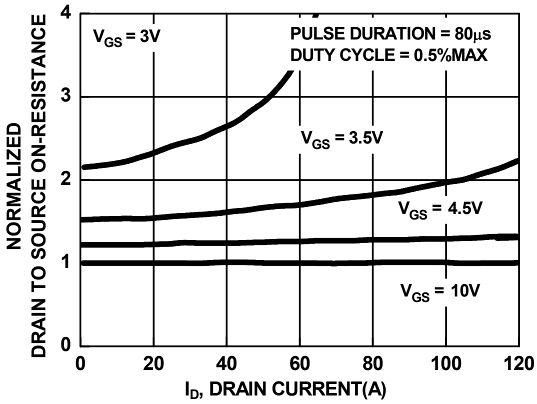


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

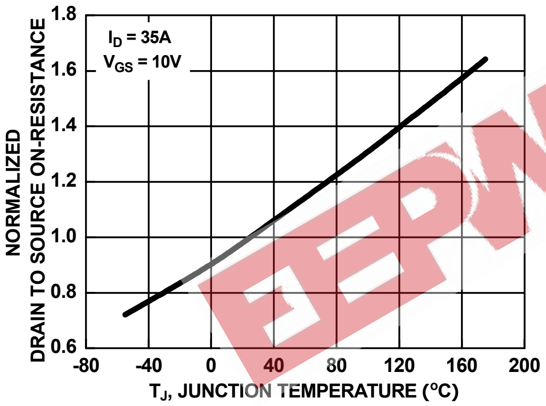


Figure 3. Normalized On Resistance vs Junction Temperature

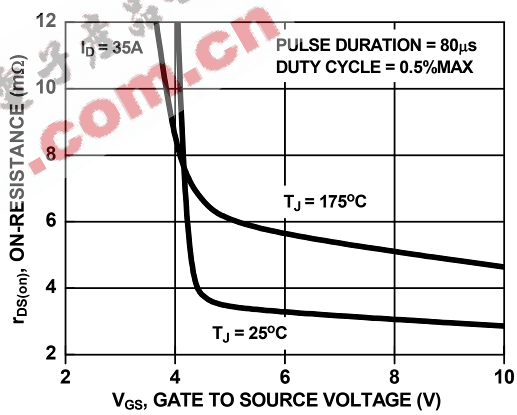


Figure 4. On-Resistance vs Gate to Source Voltage

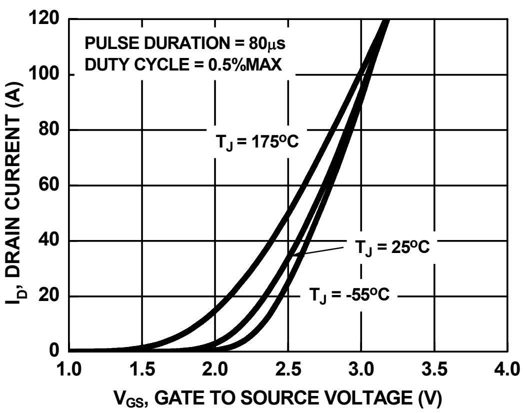


Figure 5. Transfer Characteristics

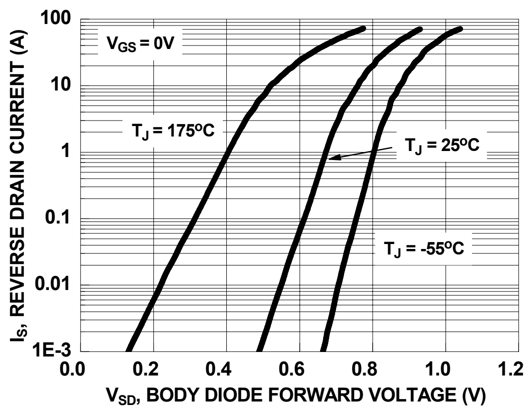


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

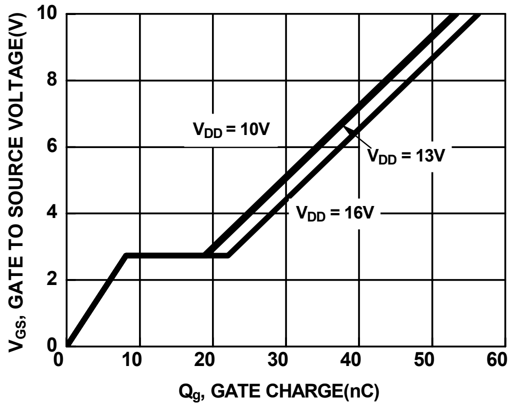


Figure 7. Gate Charge Characteristics

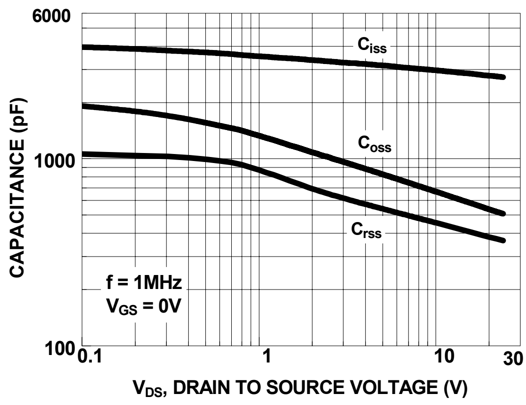


Figure 8. Capacitance vs Drain to Source Voltage

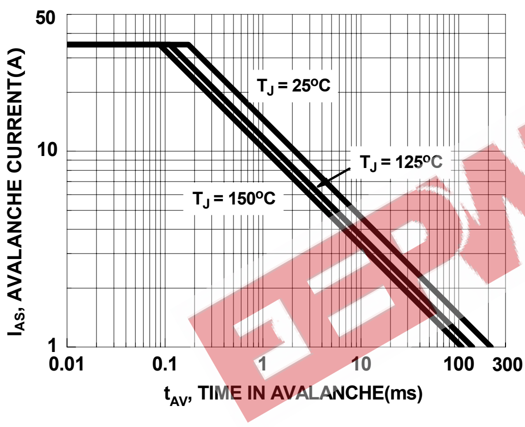


Figure 9. Unclamped Inductive Switching Capability

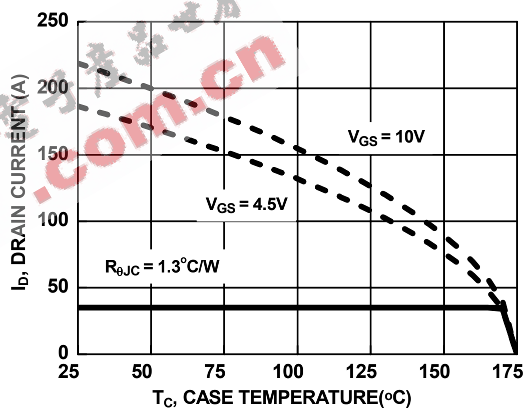


Figure 10. Maximum Continuous Drain Current vs Case Temperature

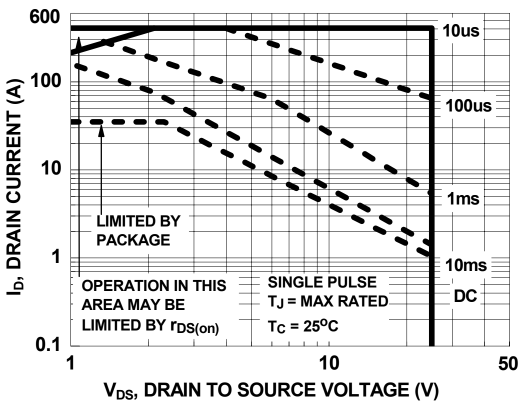


Figure 11. Forward Bias Safe Operating Area

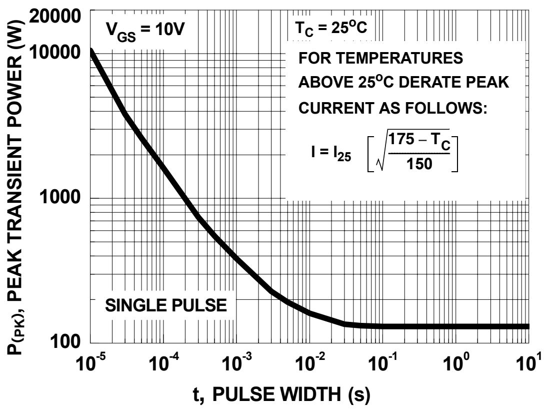


Figure 12. Single Pulse Maximum Power Dissipation

FDD8770/FDU8770 N-Channel PowerTrench® MOSFET

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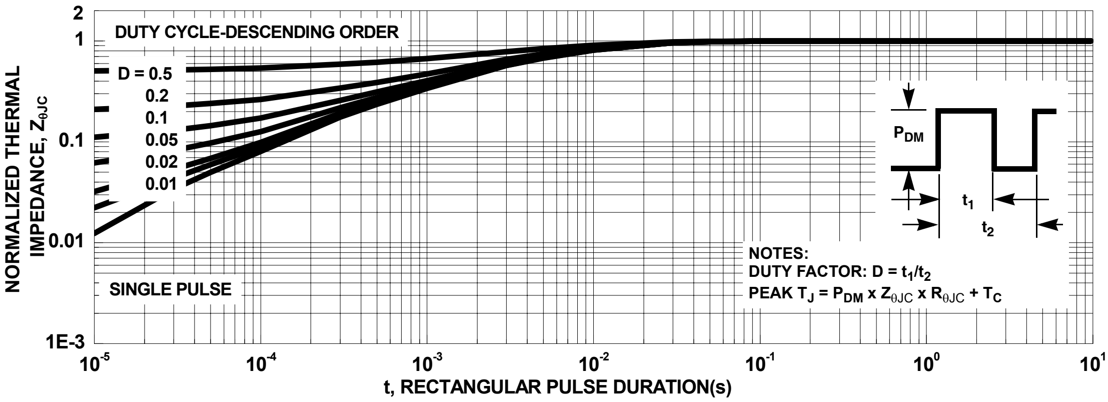

Figure 13. Transient Thermal Response Curve

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