FAIRCHILD SEMICONDUCTOR®

January 2007

FDD8586/FDU8586
N-Channel PowerTrench® MOSFET
20V, 35A, 5.5mΩ

Features

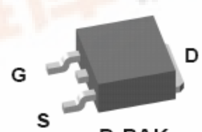
- Max $r_{DS(on)}$ = 5.5mΩ at V_{GS} = 10V, I_D = 35A
- Max $r_{DS(on)}$ = 8.5mΩ at V_{GS} = 4.5V, I_D = 33A
- Low gate charge: $Q_{g(TOT)}$ = 34nC(Typ), V_{GS} = 10V
- Low gate resistance
- 100% Avalanche tested
- RoHS compliant

General Description

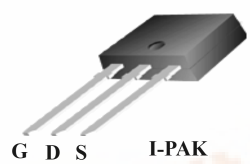
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$ and fast switching speed.

Application

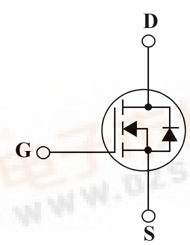
- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture



D-PAK
(TO-252)



I-PAK
(TO-251AA)



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	20	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous (Package Limited)	35	A
	-Continuous (Die Limited)	93	
	-Pulsed (Note 1)	354	
E_{AS}	Single Pulse Avalanche Energy (Note 2)	144	mJ
P_D	Power Dissipation	77	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	1.94	°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
FDD8586	FDD8586	TO-252AA	13”	12mm	2500 units
FDU8586	FDU8586	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						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		14.6		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16V, V_{GS} = 0V			1	μA
		V_{DS} = 16V, 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		-6.7		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 35A		4.0	5.5	mΩ
		V_{GS} = 4.5V, I_D = 33A		5.7	8.5	mΩ
		V_{GS} = 10V, I_D = 35A, T_J = 175°C		6.5	8.9	mΩ
g_{FS}	Forward Transcondductance	V_{DS} = 10V, I_D = 35A		175		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 10V, V_{GS} = 0V, f = 1MHz		1865	2480	pF
C_{oss}	Output Capacitance			550	730	pF
C_{rss}	Reverse Transfer Capacitance			335	445	pF
R_g	Gate Resistance	f = 1MHz		1.2		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 10V, I_D = 35A, V_{GS} = 10V, R_{GS} = 10Ω		9	18	ns
t_r	Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			47	75	ns
t_f	Fall Time			25	40	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V; V_{DD} = 10V, I_D = 35A, I_g = 1.0mA		34	48	nC
$Q_{g(5)}$	Total Gate Charge at 5V	V_{GS} = 0V to 5V; V_{DD} = 10V, I_D = 35A, I_g = 1.0mA		16	22	nC
Q_{gs}	Gate to Source Gate Charge	V_{DD} = 10V, I_D = 35A, I_g = 1.0mA		3.2		nC
Q_{gd}	Gate to Drain “Miller”Charge			5.9		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 35A		0.89	1.25	V
		V_{GS} = 0V, I_S = 15A		0.82	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/μs		30	45	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/μs		23	35	nC

Notes:
1: Pulse time < 300μs, Duty cycle = 2%.
2: Starting T_J = 25°C, L = 0.3mH, I_{AS} = 31A, V_{DD} = 18V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

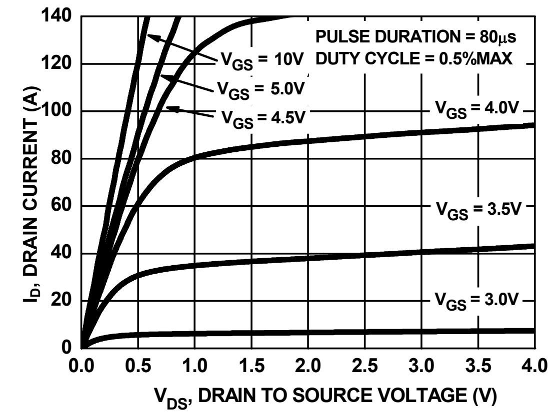


Figure 1. On Region Characteristics

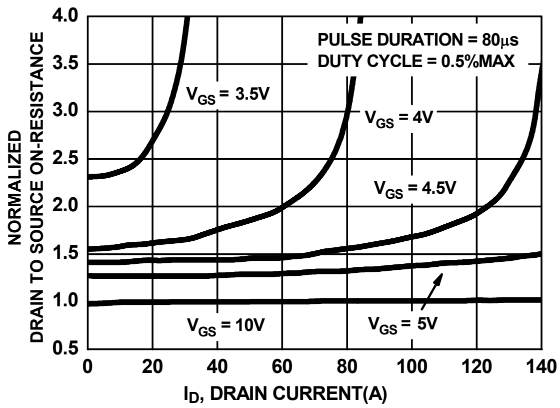


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

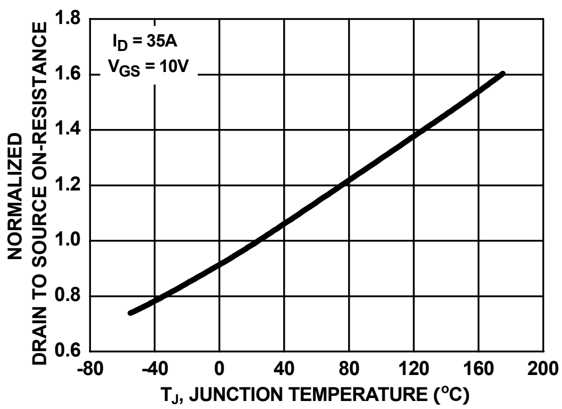


Figure 3. Normalized On Resistance vs Junction Temperature

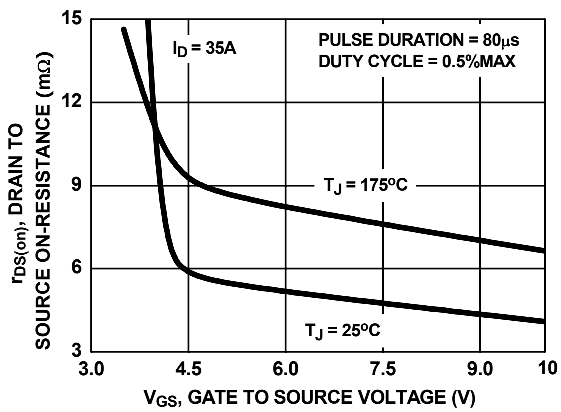


Figure 4. On-Resistance vs Gate to Source Voltage

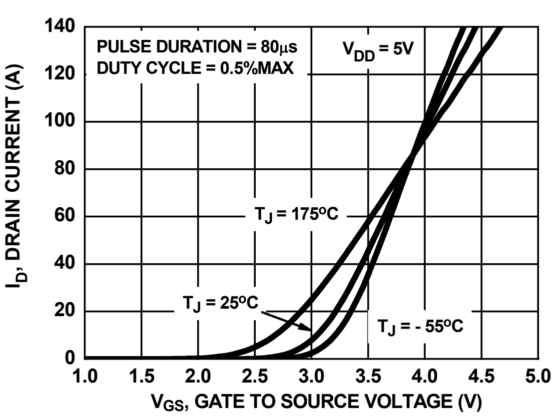


Figure 5. Transfer Characteristics

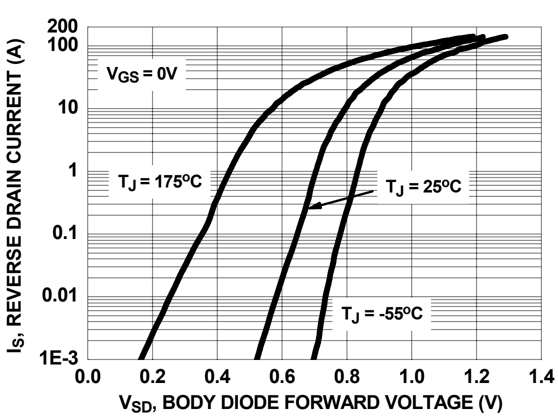


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

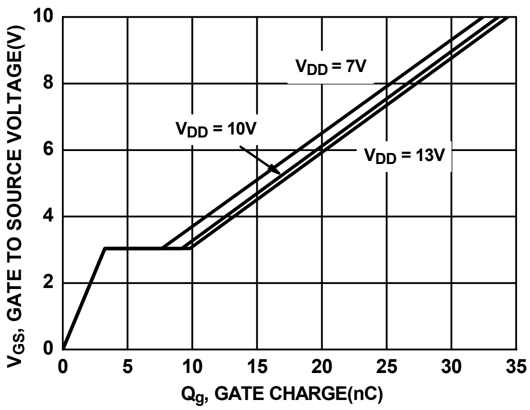


Figure 7. Gate Charge Characteristics

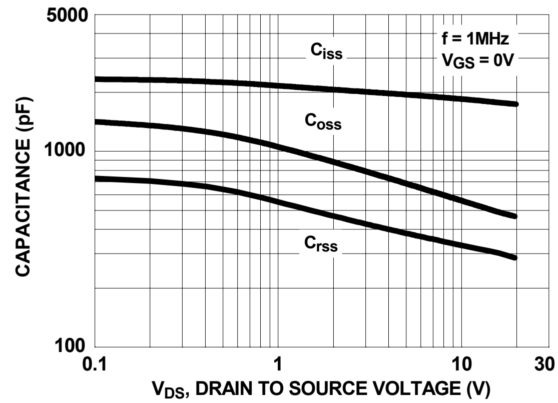


Figure 8. Capacitance vs Drain to Source Voltage

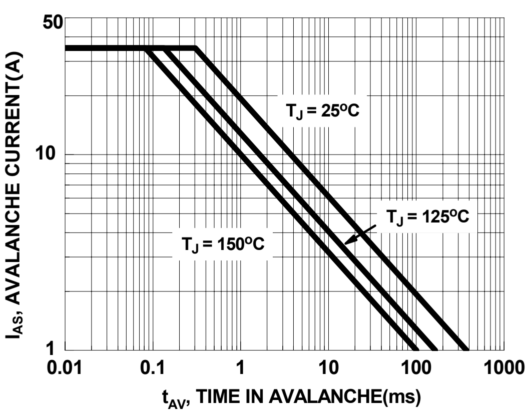


Figure 9. Unclamped Inductive Switching Capability

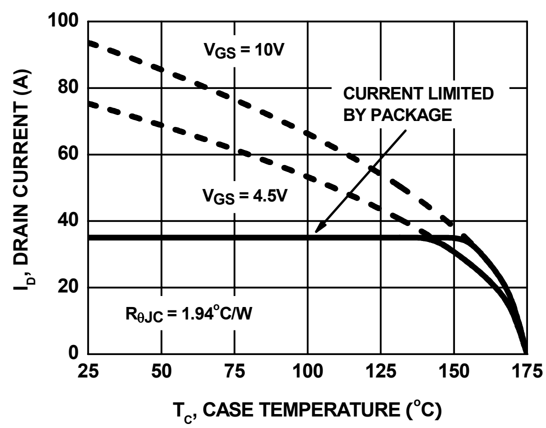


Figure 10. Maximum Continuous Drain Current vs Case Temperature

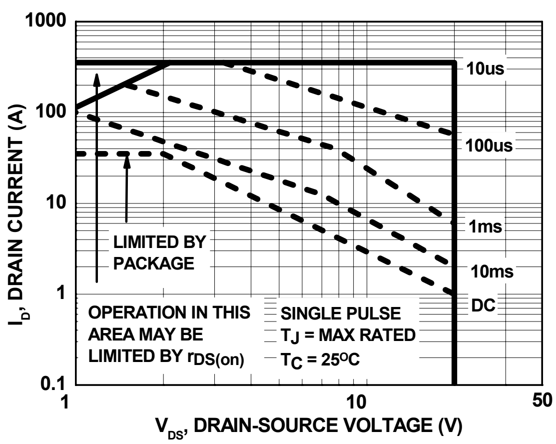


Figure 11. Forward Bias Safe Operating Area

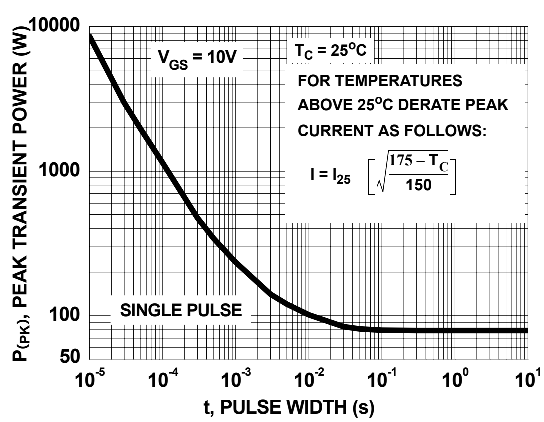


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

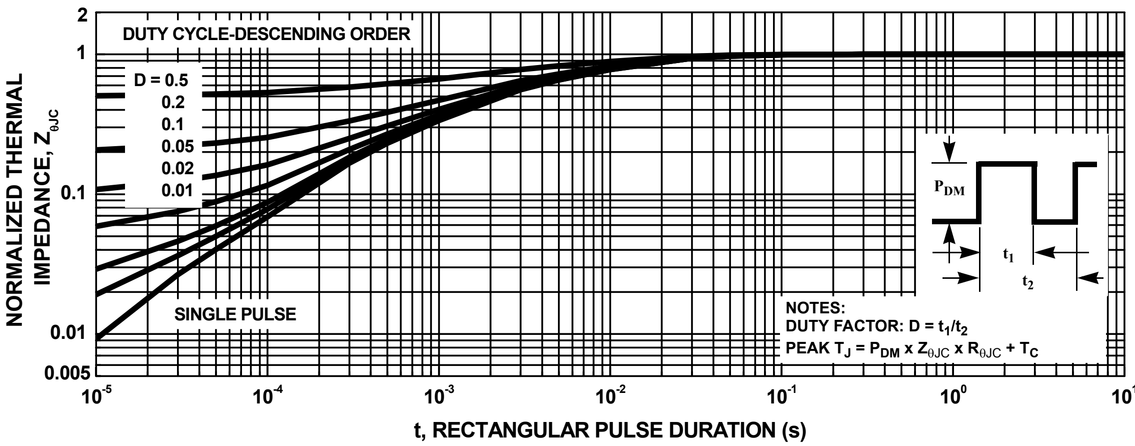


Figure 13. Transient Thermal Response Curve

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