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March 2015

FDD8782/FDU8782
N-Channel PowerTrench® MOSFET
## 25V, 35A, 11mΩ

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

Features

- Max $r_{DS(on)}$ = 11.0mΩ at V_{GS} = 10V, I_D = 35A
- Max $r_{DS(on)}$ = 14.0mΩ at V_{GS} = 4.5V, I_D = 35A
- Low gate charge: $Q_{g(10)}$ = 18nC(Typ), V_{GS} = 10V
- Low gate resistance
- Avalanche rated and 100% tested
- RoHS Compliant

D-PAK (TO-252)

I-PAK (TO-251AA)

Short Lead I-PAK
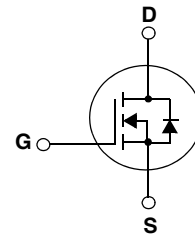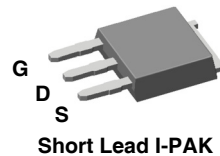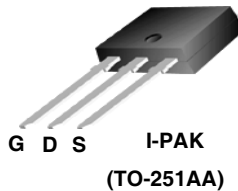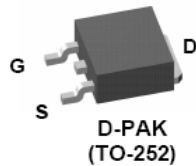
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

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)		54	
	-Pulsed	(Note 1)	321	
E_{AS}	Single Pulse Avalanche Energy	(Note 2)	72	mJ
P_D	Power Dissipation		50	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		3.0	°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
FDD8782	FDD8782	TO-252AA	13"	16mm	2500 units
FDU8782	FDU8782	TO-251AA	N/A(Tube)	N/A	75 units
FDU8782	FDU8782_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
$\dfrac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		14.3		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20V, V_{GS} = 0V			1	μA
		T_J = 150°C			250	
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	1.7	2.5	V
$\dfrac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250μA, referenced to 25°C		-6.5		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 35A		8.5	11.0	mΩ
		V_{GS} = 4.5V, I_D = 35A		11.0	14.0	
		V_{GS} = 10V, I_D = 35A T_J = 175°C		12.1	18.0	
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz		920	1220	pF
C_{oss}	Output Capacitance			230	310	pF
C_{rss}	Reverse Transfer Capacitance			160	240	pF
R_g	Gate Resistance	f = 1MHz		1.4		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 13V, I_D = 35A V_{GS} = 10V, R_{GS} = 9Ω		7	14	ns
t_r	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			22	36	ns
t_f	Fall Time			14	25	ns
Q_g	Total Gate Charge	V_{GS} = 0V to 10V		18	25	nC
Q_g	Total Gate Charge	V_{GS} = 0V to 5V	V_{DD} = 13V	9.4	13	nC
Q_{gs}	Gate to Source Gate Charge		I_D = 35A I_g = 1.0mA	3.1		nC
Q_{gd}	Gate to Drain "Miller"Charge			4.0		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 35A		0.96	1.25	V
		V_{GS} = 0V, I_S = 15A		0.86	1.2	
t_{rr}	Reverse Recovery Time	I_F = 35A, di/dt = 100A/μs		25	38	ns
Q_{rr}	Reverse Recovery Charge	I_F = 35A, di/dt = 100A/μs		17	26	nC

Notes:
1: Pulse time < 300us,Duty cycle = 2%.
2: Starting T_J = 25°C, L = 1.0mH, I_{AS} = 12A ,V_{DD} = 23V, V_{GS} = 10V.

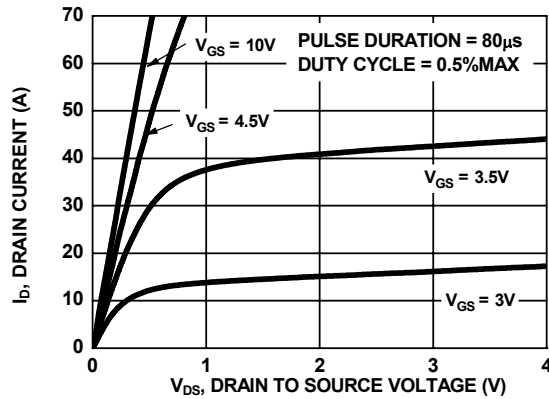## Typical Characteristics T_J = 25°C unless otherwise noted

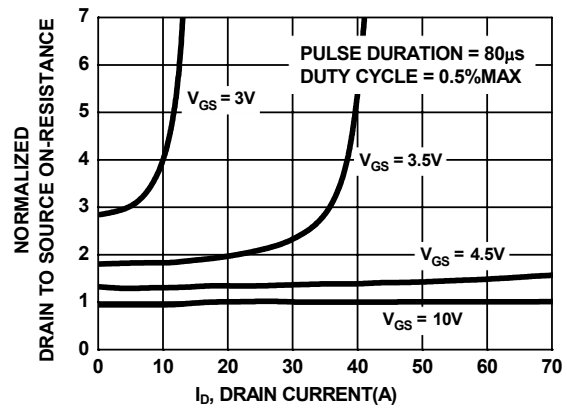**Figure 1. On Region Characteristics**

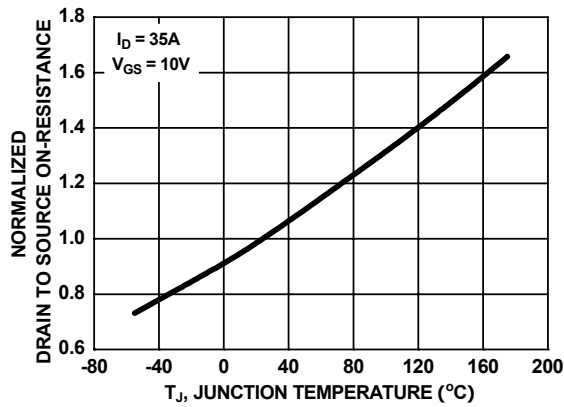**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

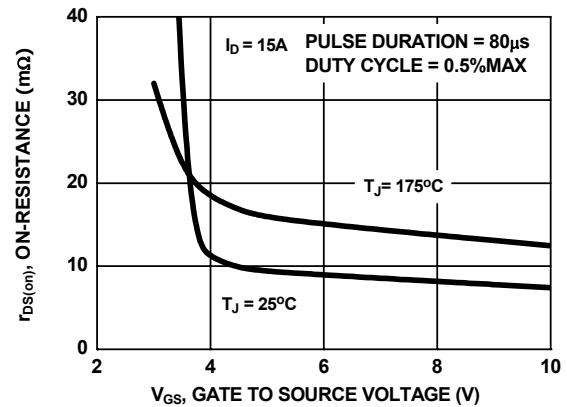**Figure 3. Normalized On Resistance vs Junction Temperature**

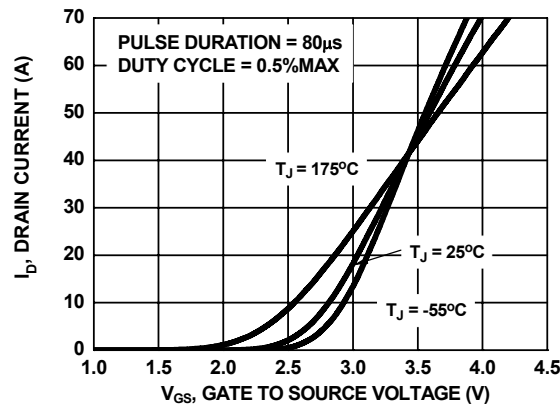**Figure 4. On-Resistance vs Gate to Source Voltage**
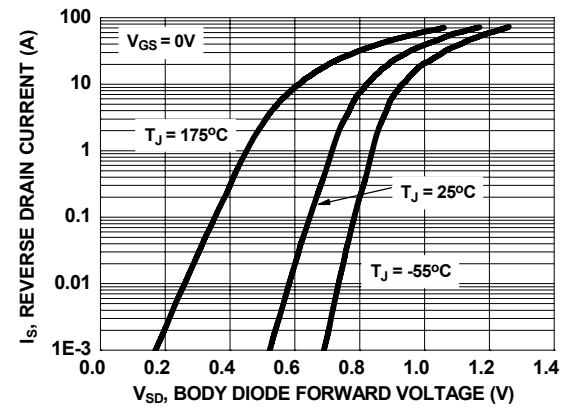
Figure 5. Transfer Characteristics

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

FDD8782/FDU8782 N-Channel PowerTrench® MOSFET
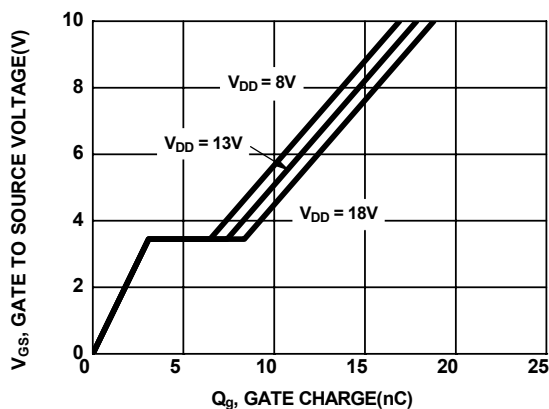
Figure 7. Gate Charge Characteristics
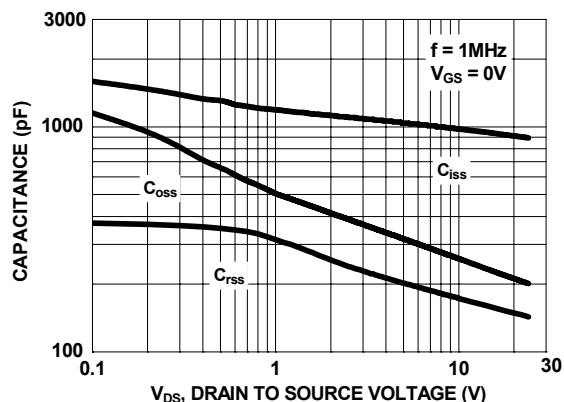
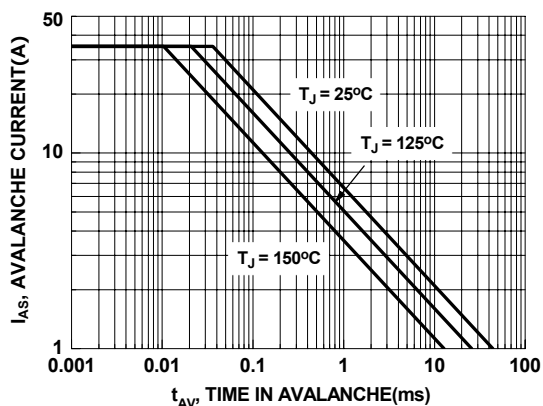**Figure 8. Capacitance vs Drain to Source Voltage**

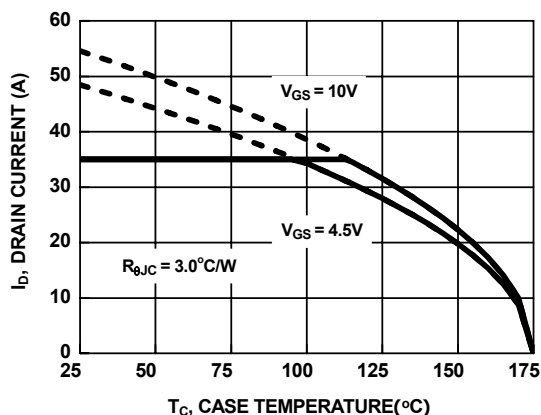**Figure 9. Unclamped Inductive Switching Capability**

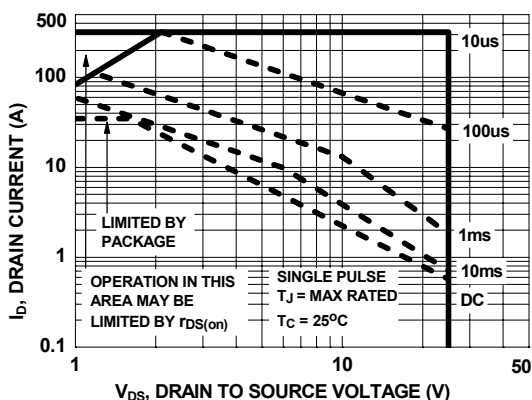**Figure 10. Maximum Continuous Drain Current vs Case Temperature**
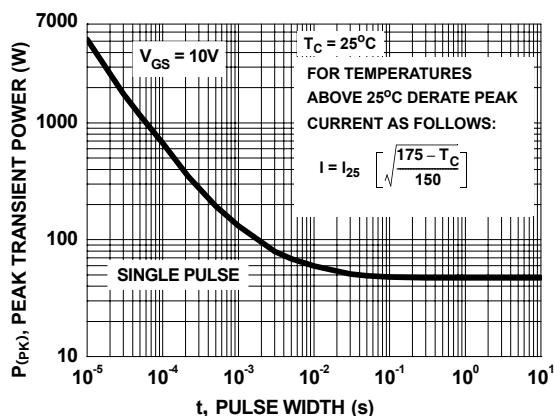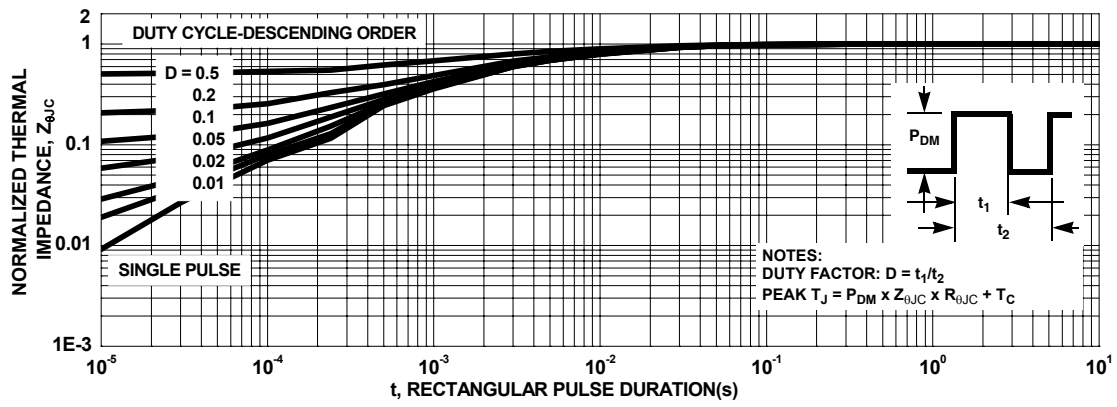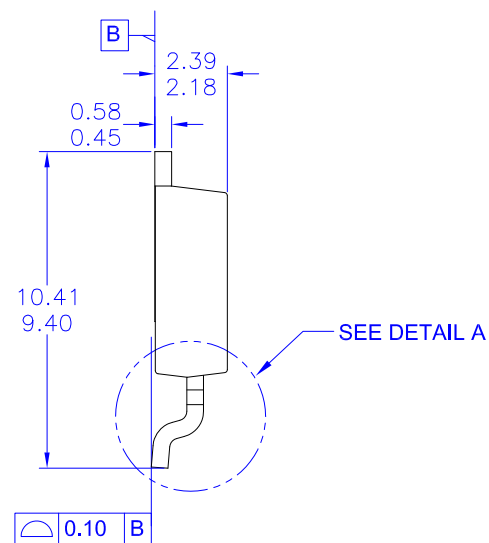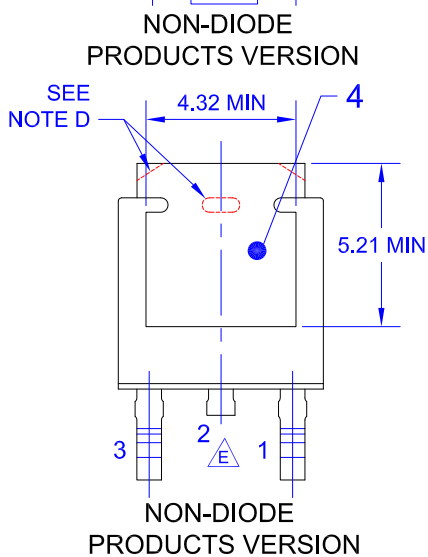

Figure 11. Forward Bias Safe Operating Area

Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25°C$ unless otherwise noted

Figure 13. Transient Thermal Response Curve

The chart shows:
- NORMALIZED THERMAL IMPEDANCE, $Z_{\theta JC}$ (y-axis)
- t, RECTANGULAR PULSE DURATION(s) (x-axis)
- DUTY CYCLE-DESCENDING ORDER
- D = 0.5, 0.2, 0.1, 0.05, 0.02, 0.01
- SINGLE PULSE

NOTES:
DUTY FACTOR: $D = t_1/t_2$
PEAK $T_J = P_{DM} \times Z_{\theta JC} \times R_{\theta JC} + T_C$

6.73 / 6.35

5.46 / 5.21

A

1.27 / 0.89

6.22 / 5.97

⟨E⟩ 1.02 MAX

C

1 2 3

0.25 MAX

ISOLATED PLASTIC
BODY STUB

(0.59)

1.14 / 0.76

0.89 / 0.64

2.29

| ⌖ | 0.25 Ⓜ | AⓂ | C |

4.57

NON-DIODE
PRODUCTS VERSION

DIODE
PRODUCTS VERSION

5.55 MIN

4

6.50 MIN

6.40

1 3

2.85 MIN

1.25 MIN

2.28

4.56

LAND PATTERN
RECOMMENDATION

SEE
NOTE D

4.32 MIN

4

5.21 MIN

3 2 ⟨E⟩ 1

NON-DIODE
PRODUCTS VERSION

3 2 1

DIODE
PRODUCTS VERSION

B

2.39 / 2.18

0.58 / 0.45

10.41 / 9.40

SEE DETAIL A

| ⌒ | 0.10 | B |

GAGE PLANE

0.51

0.61 / 0.45

10° / 0°

(1.54)

1.78 / 1.40

0.127 MAX

(2.90)

SEATING PLANE

DETAIL A
(ROTATED -90°)
SCALE: 12X

NOTES: UNLESS OTHERWISE SPECIFIED
A) THIS PACKAGE CONFORMS TO JEDEC, TO-252,
   ISSUE C, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER
   ASME Y14.5M-2009.
D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED
   CORNERS OR EDGE PROTRUSION.
⟨E⟩ TRIMMED METAL CENTER LEAD IS PRESENT ON FOR NON-DIODE PRODUCTS
F) DIMENSIONS ARE EXCLUSIVE OF BURS,
   MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD
   TO228P991X239-3N.
H) DRAWING NUMBER AND REVISION: MKT-TO252A03REV11

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