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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD™

March 2015

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.

Application

■ Vcore DC-DC for Desktop Computers and Servers

■ VRM for Intermediate Bus Architecture

Features

■ Max $r_{DS(on)}$ = 4.0mΩ at V_{GS} = 10V, I_D = 35A

■ Max $r_{DS(on)}$ = 5.5mΩ at V_{GS} = 4.5V, I_D = 35A

■ Low gate charge: $Q_{g(10)}$ = 52nC(Typ), V_{GS} = 10V

■ Low gate resistance

■ RoHS Compliant

LEAD-FREE IMPLEMENTATION

D-PAK
(TO-252)

I-PAK
(TO-251AA)

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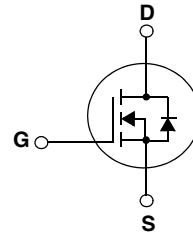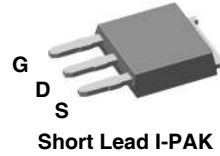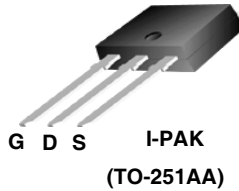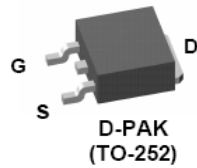
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

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-252,1in² 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''	16mm	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
			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	1.6	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	
		V_{GS} = 10V, I_D = 35A T_J = 175°C			4.8	5.9	
Dynamic Characteristics							
C$_{iss}$	Input Capacitance	V_{DS} = 13V, V_{GS} = 0V, f = 1MHz			2795	3720	pF
C$_{oss}$	Output Capacitance				685	915	pF
C$_{rss}$	Reverse Transfer Capacitance				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				12	22	ns
t$_{d(off)}$	Turn-Off Delay Time				49	78	ns
t$_f$	Fall Time				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			29	41	nC
Q$_{gs}$	Gate to Source Gate Charge				8.1		nC
Q$_{gd}$	Gate to Drain "Miller"Charge				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	
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.

FDD8770/FDU8770 N-Channel PowerTrench® MOSFET

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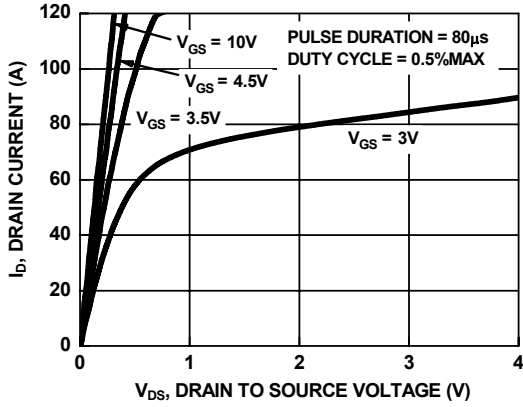

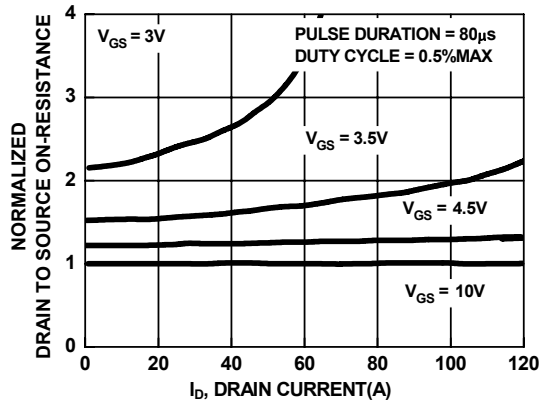**Figure 1.   On Region Characteristics**

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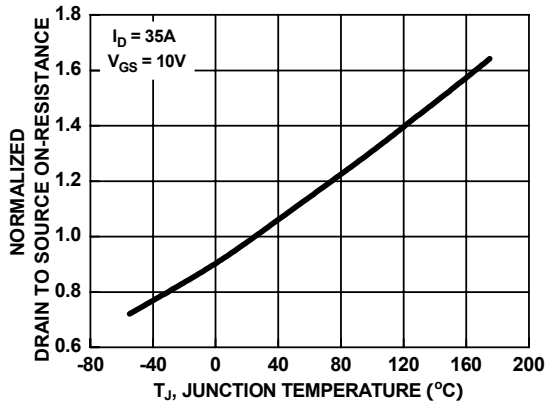

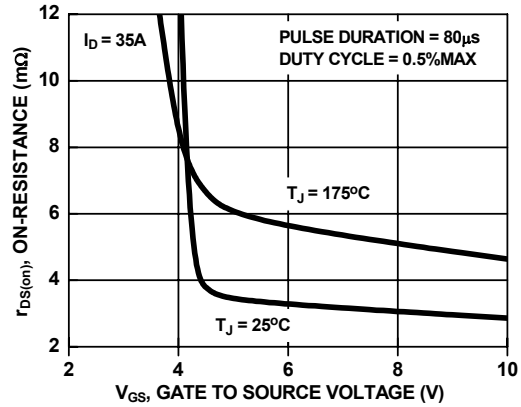**Figure 3.   Normalized On Resistance vs Junction Temperature**
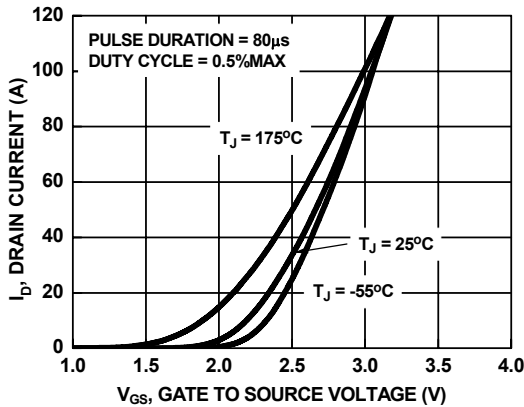

Figure 4.   On-Resistance vs Gate to Source Voltage
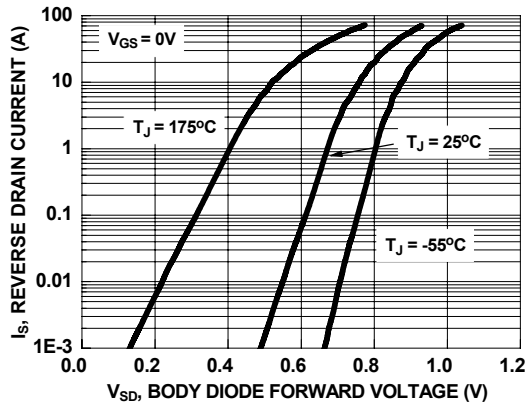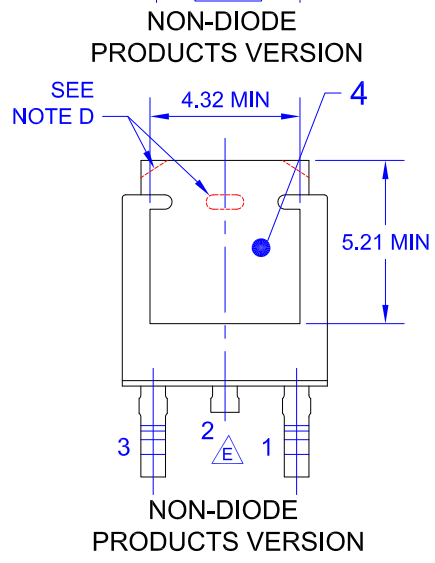

Figure 5.   Transfer Characteristics

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

FDD8770/FDU8770 Rev. 1.2

Typical Characteristics T_J = 25°C unless otherwise noted
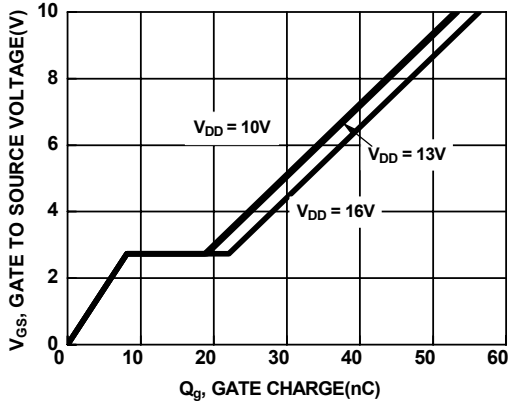
Figure 7. Gate Charge Characteristics
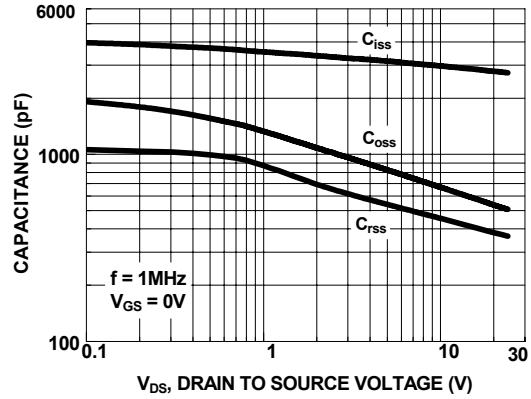
Figure 8. Capacitance vs Drain to Source Voltage
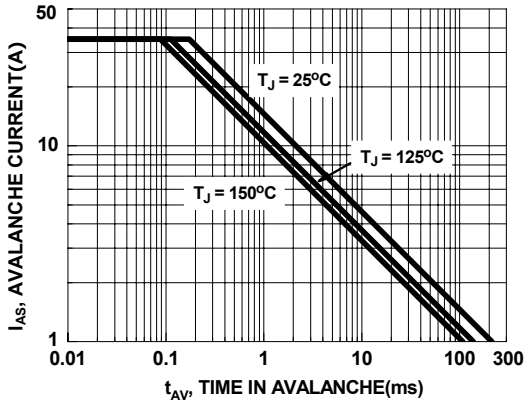
Figure 9. Unclamped Inductive Switching Capability
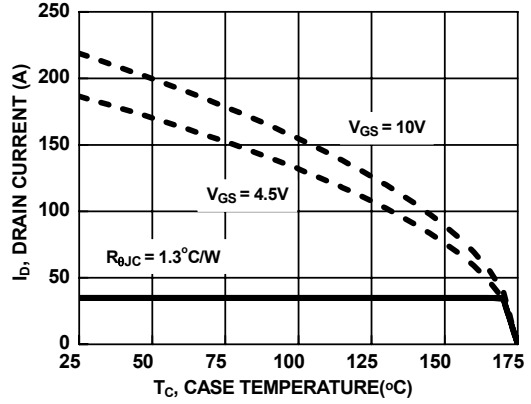
Figure 10. Maximum Continuous Drain Current vs Case Temperature
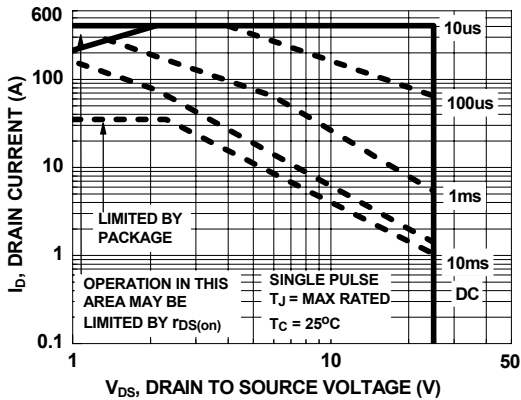
Figure 11. Forward Bias Safe Operating Area
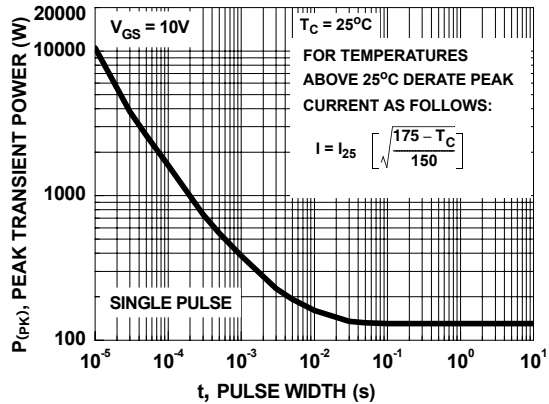
Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted
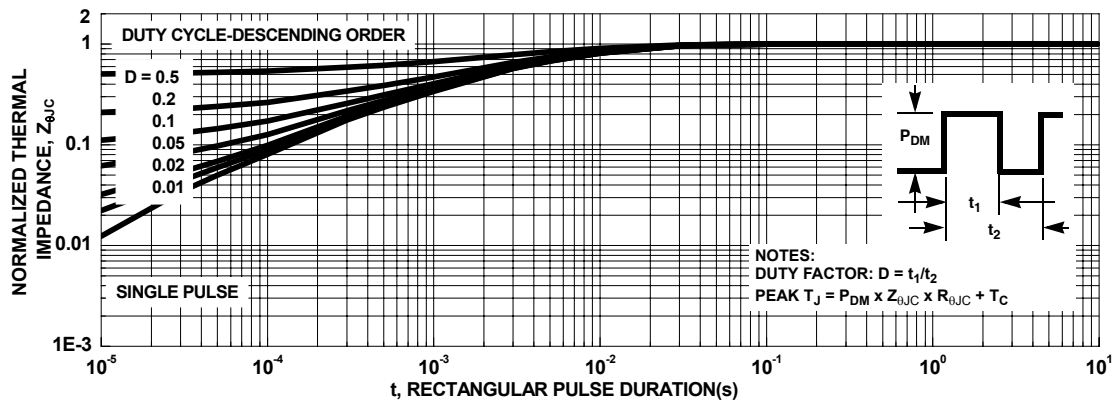
Figure 13. Transient Thermal Response Curve

6.73 / 6.35 [A]

5.46 / 5.21

1.27 / 0.89

6.22 / 5.97

[C]

[E] **1.02 MAX**

0.25 MAX

1   2   3

ISOLATED PLASTIC
BODY STUB

1   2   3

**DIODE
PRODUCTS VERSION**

(0.59)

1.14 / 0.76

0.89 / 0.64

| ⌖ | 0.25 Ⓜ | AⓂ | C |

2.29

4.57

**NON-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 |

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

GAGE PLANE

0.51

0.61 / 0.45

10° / 0°

(1.54)

1.78 / 1.40

0.127 MAX

(2.90)

SEATING PLANE
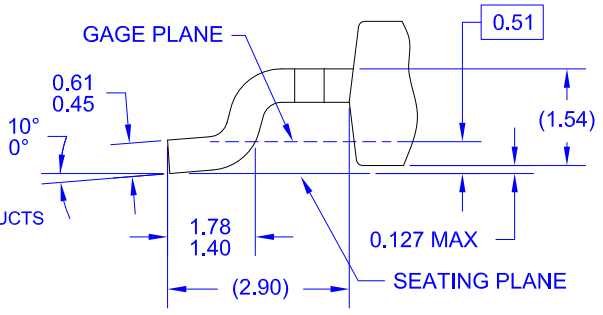
DETAIL A
(ROTATED -90°)
SCALE: 12X

FAIRCHILD™

PUBLICATION ORDERING INFORMATION

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