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March 2015

# FDD8770/FDU8770 N-Channel PowerTrench® MOSFET

**25V**, **35A**, **4.0m**Ω

#### **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.

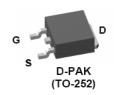
#### **Application**

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

#### **Features**

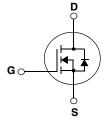
- Max  $r_{DS(on)} = 4.0 \text{m}\Omega$  at  $V_{GS} = 10 \text{V}$ ,  $I_D = 35 \text{A}$
- Max  $r_{DS(on)} = 5.5 m\Omega$  at  $V_{GS} = 4.5 V$ ,  $I_D = 35 A$
- Low gate charge: Q<sub>q(10)</sub> = 52nC(Typ), V<sub>GS</sub> = 10V
- Low gate resistance
- RoHS Compliant











#### MOSFET Maximum Ratings T<sub>C</sub> = 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
	Drain Current -Continuous (Package Limited)		35	
$I_D$	-Continuous (Die Limited)		210	Α
	-Pulsed	(Note 1)	407	
E <sub>AS</sub>	Single Pulse Avalanche Energy	(Note 2)	113	mJ
$P_D$	Power Dissipation		115	W
T <sub>J</sub> , T <sub>STG</sub>	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 <sup>2</sup> 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

Electrica	l Charac	teristics	$T_J = 2$	25°C unless	otherwise noted
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Symbol	Parameter	rest Conditions	IVIII	тур	IVIAX	Units
Off Char	acteristics					
B <sub>VDSS</sub>	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0V$	25			V
$\frac{\Delta B_{VDSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 $\mu$ A, referenced to 25°C		13.6		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V			1 250	μА
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±20V			±100	nA

#### **On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	1.2	1.6	2.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D$ = 250 $\mu$ A, referenced to 25°C		-5.9		mV/°C
r <sub>DS(on)</sub>	Drain to Source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 35A		3.3	4.0	
		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 35A		4.0	5.5	mΩ
	Drain to course on registance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 35A T <sub>J</sub> = 175°C		4.8	5.9	1115.2

#### **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V = 42V V = 0V	2795	3720	pF
Coss	Output Capacitance	$V_{DS} = 13V, V_{GS} = 0V,$ 	685	915	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 11/11/2	450	675	pF
R <sub>g</sub>	Gate Resistance	f = 1MHz	1.5		Ω

#### **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time	., ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	10	20	ns
t <sub>r</sub>	Rise Time	$V_{DD}$ = 13V, $I_{D}$ = 35A $V_{GS}$ = 10V, $R_{GS}$ = 5 $\Omega$	12	22	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS} = 10V, R_{GS} = 502$	49	78	ns
t <sub>f</sub>	Fall Time		25	40	ns
Qg	Total Gate Charge	V <sub>GS</sub> = 0V to 10V	52	73	nC
Qg	Total Gate Charge	$V_{GS} = 0V \text{ to } 5V$ $V_{DD} = 13V$ $I_{D} = 35A$	29	41	nC
Q <sub>gs</sub>	Gate to Source Gate Charge	$I_D = 35A$ $I_a = 1.0 \text{mA}$	8.1		nC
$Q_{gd}$	Gate to Drain "Miller" Charge	.g	11		nC

#### **Drain-Source Diode Characteristics**

V <sub>SD</sub>		V <sub>GS</sub> = 0V, I <sub>S</sub> = 35A	0.84	1.25	\/
		V <sub>GS</sub> = 0V, I <sub>S</sub> = 15A	0.79	1.0	v
t <sub>rr</sub>	Reverse Recovery Time	$I_F = 35A$ , di/dt = 100A/ $\mu$ s	32	48	ns
Q <sub>rr</sub>	Reverse Recovery Charge	$I_F = 35A$ , di/dt = 100A/ $\mu$ s	25	38	nC

Notes:
1: Pulse time < 300μs, Duty cycle = 2%.
2: Starting T<sub>J</sub> = 25°C, L = 0.3mH, I<sub>AS</sub> = 27.5A ,V<sub>DD</sub> = 23V, V<sub>GS</sub> = 10V.

#### Typical Characteristics $T_J = 25^{\circ}C$ unless otherwise noted

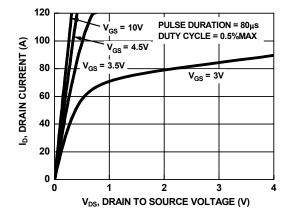


Figure 1. On Region Characteristics

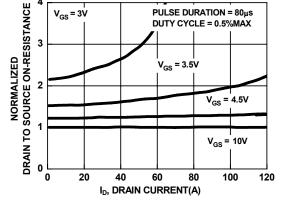


Figure 2. Normalized On-Resistance vs Drain **Current and Gate Voltage** 

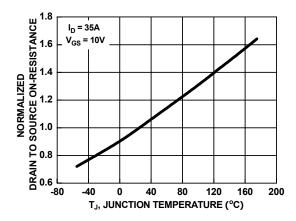


Figure 3. Normalized On Resistance vs Junction **Temperature** 

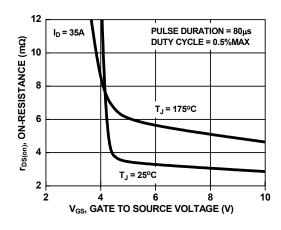


Figure 4. On-Resistance vs Gate to Source Voltage

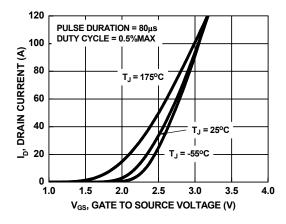


Figure 5. Transfer Characteristics

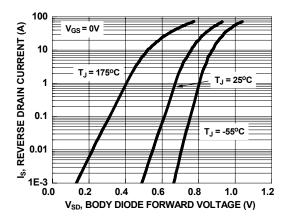


Figure 6. Source to Drain Diode Forward **Voltage vs Source Current** 

FDD8770/FDU8770 Rev. 1.2

#### Typical Characteristics T<sub>J</sub> = 25°C unless otherwise noted

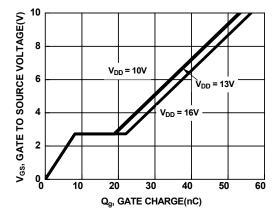


Figure 7. Gate Charge Characteristics

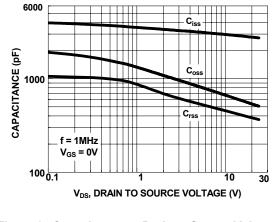


Figure 8. Capacitance vs Drain to Source Voltage

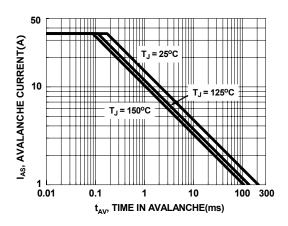


Figure 9. Unclamped Inductive Switching Capability

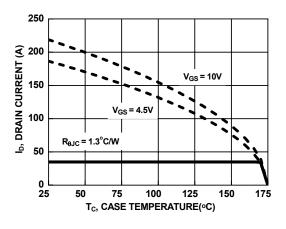


Figure 10. Maximum Continuous Drain Current vs Case Temperature

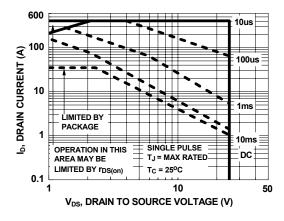


Figure 11. Forward Bias Safe Operating Area

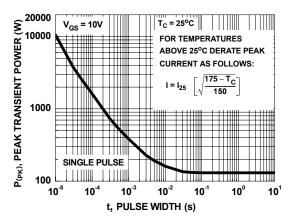


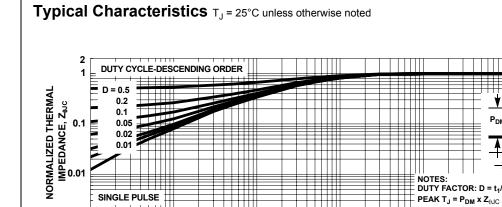
Figure 12. Single Pulse Maximum Power Dissipation

10<sup>1</sup>

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

10<sup>-1</sup>

10°



SINGLE PULSE

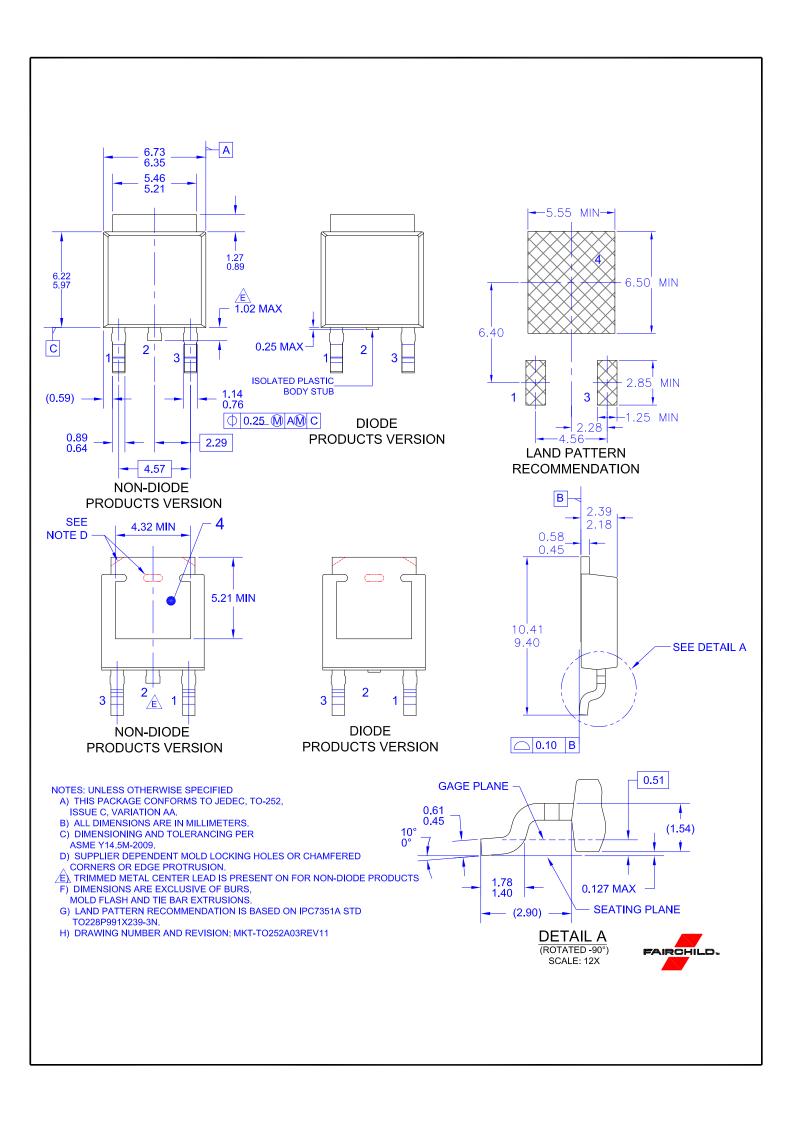
10⁴

1E-3

10<sup>-5</sup>

Figure 13. Transient Thermal Response Curve

10<sup>3</sup> 10<sup>2</sup> t, RECTANGULAR PULSE DURATION(s)



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#### Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru\_6 moschip.ru\_4 moschip.ru\_9