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November 2013

FDD3N40 / FDU3N40 N-Channel UniFETTM MOSFET 400 V, 2 A, 3.4 Ω

Features

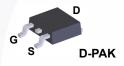
- $R_{DS(on)}$ = 3.4 Ω (Typ.) @ V_{GS} = 10 V, I_D = 1 A
- Low Gate Charge (Typ. 4.5 nC)
- Low C_{rss} (Typ. 3.7 pF)
- · 100% Avalanche Tested

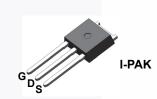
Applications

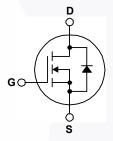
- LED TV
- · Consumer Appliances
- · Lighting
- Uninterruptible Power Supply

Description

UniFETTM MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.







Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol			Parameter	FDD3N40TM / FDU3N40TU	Unit
V _{DSS}	Drain-Source Voltage		400	V	
I _D			- Continuous (T _C = 25°C) - Continuous (T _C = 100°C)	2.0 1.25	A A
I _{DM}	Drain Current		- Pulsed (Note 1)	8.0	Α
V _{GSS}	Gate-Source voltage			±30	V
E _{AS}	Single Pulsed Avalanche Energy (Note			46	mJ
I _{AR}	Avalanche Current		(Note 1)	2	Α
E _{AR}	Repetitive Avalanche Energy		Energy (Note 1)	3	mJ
dv/dt	Peak Diode Recovery dv/dt		dv/dt (Note 3)	4.5	V/ns
P _D	Power Dissipa	ation	(T _C = 25°C) - Derate Above 25°C	30 0.24	W/°C
T _{J,} T _{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FDD3N40TM / FDU3N40TU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	4.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	110	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDD3N40TM	FDD3N40	DPAK	Tape and Reel	330 mm	16 mm	2500 units
FDU3N40TU	FDU3N40	IPAK	Tube	N/A	N/A	75 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Тур.	Max	Unit
Off Charac	cteristics					•
BV _{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_{D} = 250 μ A	400			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		0.4		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 400 V, V _{GS} = 0 V V _{DS} = 320 V, T _C = 125°C			1 10	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	-		100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V			-100	nA
On Charac	teristics					
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	3.0		5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 1 A		2.8	3.4	Ω
9 _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 1 A	-	2		S
Dynamic C	Characteristics					
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1 MHz		173	225	pF
C _{oss}	Output Capacitance			30	40	pF
C _{rss}	Reverse Transfer Capacitance			3.7	6	pF
Switching	Characteristics					
t _{d(on)}	Turn-On Delay Time	n Rise Time $V_{GS} = 10 \text{ V, R}_{G} = 25 \Omega$ If Delay Time		10	30	ns
t _r	Turn-On Rise Time			30	70	ns
t _{d(off)}	Turn-Off Delay Time			10	30	ns
t _f	Turn-Off Fall Time			25	60	ns
Qg	Total Gate Charge	V _{DS} = 320 V, I _D = 3 A,		4.5	6	nC
Q_{gs}	Gate-Source Charge	$V_{GS} = 320 \text{ V}, \text{ ib} = 3 \text{ A},$		1.2		nC
Q_{gd}	Gate-Drain Charge	(Note 4)	/	2		nC
Drain-Soul	rce Diode Characteristics and Maximur	n Ratings				
I _S	Maximum Continuous Drain-Source Diode Forward Current				2	Α
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				8	Α
V_{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2 A	1		1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3 A,	-	210		ns
Q _{rr}	Reverse Recovery Charge	dI _F /dt =100 A/μs		0.75	/	μС

Notes:

^{1.} Repetitive rating: pulse-width limited by maximum junction temperature.

^{2.} L = 20 mH, I $_{AS}$ = 2 A, V $_{DD}$ = 50 V, R $_{G}$ = 25 $\Omega,$ starting T $_{J}$ = 25 $^{\circ}C.$

^{3.} $I_{SD} \le 2$ A, di/dt ≤ 200 A/ μ s, $V_{DD} \le BV_{DSS}$, starting T_J = 25°C.

^{4.} Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

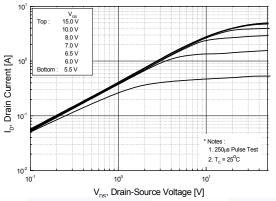
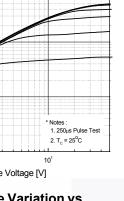


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage



Drain Current [A]

Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

V_{GS}, Gate-Source Voltage [V]

1. V_{DS} = 40V 2. 250μs Pulse Test

Figure 2. Transfer Characteristics

150°C

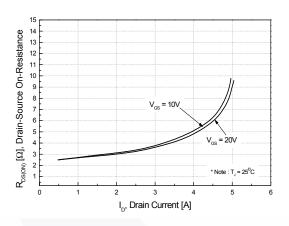
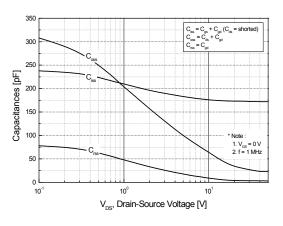
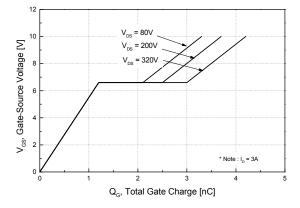


Figure 5. Capacitance Characteristics



l_{DR}, Reverse Drain Current [A] 10 0.2 0.4 0.6 1.6 1.8 V_{SD}, Source-Drain voltage [V]

Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

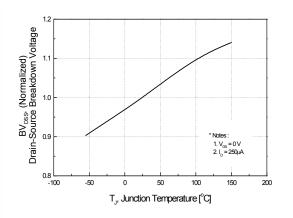


Figure 8. On-Resistance Variation vs. Temperature

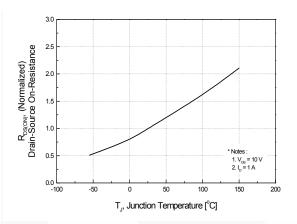


Figure 9. Maximum Safe Operating Area

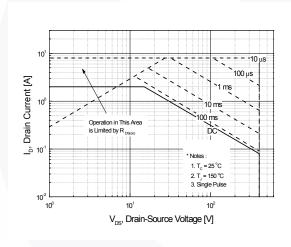


Figure 10. Maximum Drain Current vs. Case Temperature

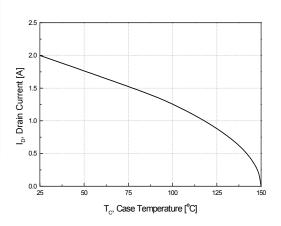
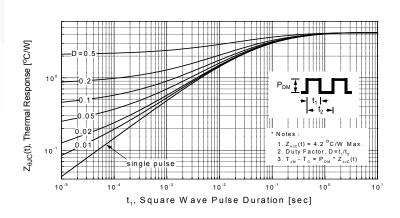


Figure 11. Transient Thermal Response Curve



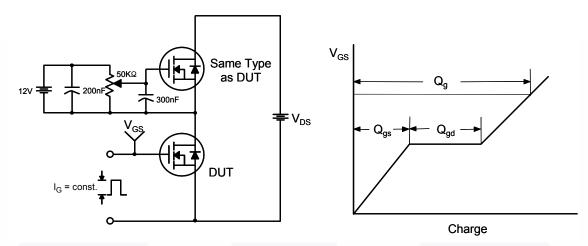


Figure 12. Gate Charge Test Circuit & Waveform

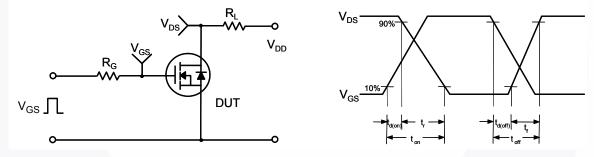


Figure 13. Resistive Switching Test Circuit & Waveforms

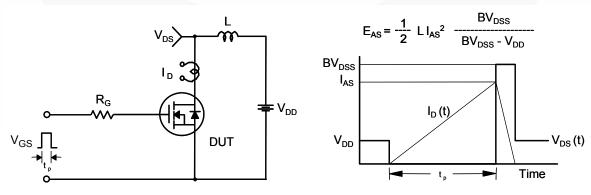


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

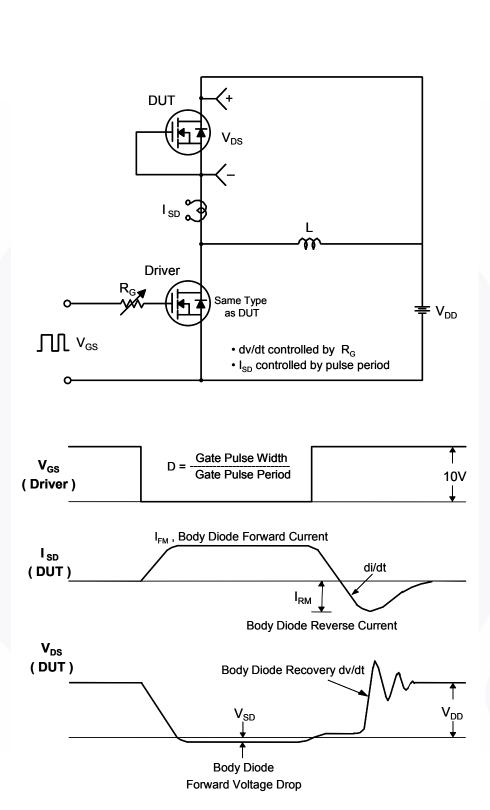


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

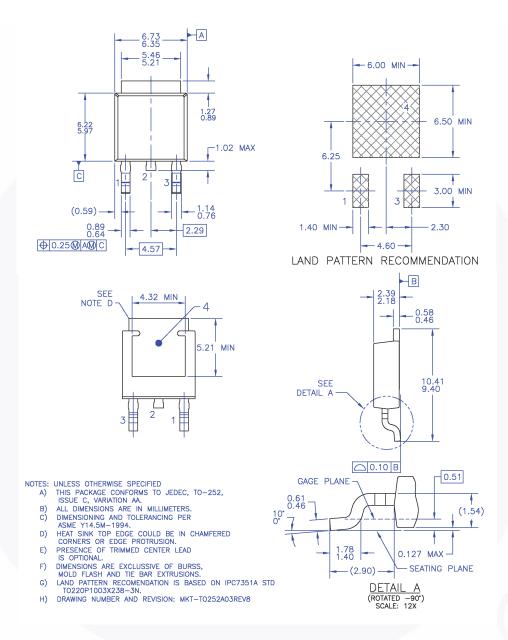


Figure 16. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB

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Mechanical Dimensions

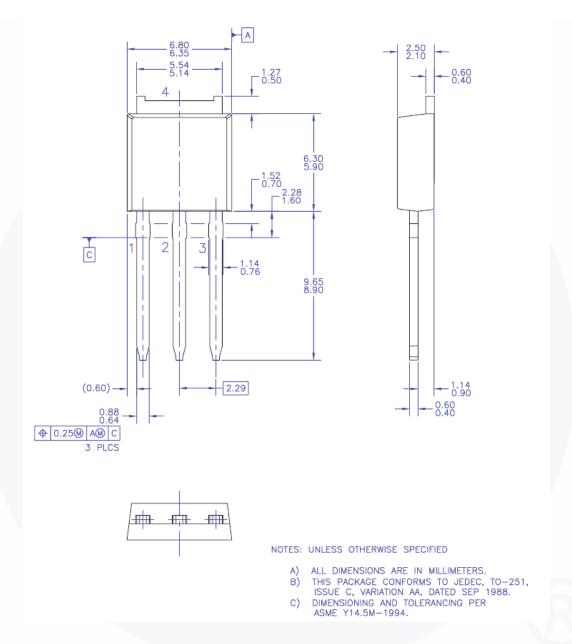


Figure 17. TO-251 (I-PAK), Molded, 3-Lead, Option AA

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