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May 2014



FDA24N40F

N-Channel UniFETTM FRFET[®] MOSFET 400 V, 23 A, 190 m Ω

Features

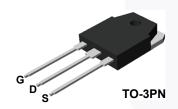
- $R_{DS(on)}$ = 150 m Ω (Typ.) @ V_{GS} = 10 V, I_D = 11.5 A
- Low Gate Charge (Typ. 46 nC)
- Low C_{rss} (Typ. 25 pF)
- 100% Avalanche Tested
- · RoHS Compliant

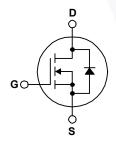
Applications

- · Uninterruptible Power Supply
- AC-DC 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. The body diode's reverse recovery performance of UniFET FRFET® MOSFET has been enhanced by lifetime control. Its trr is less than 100nsec and the reverse dv/dt immunity is 15V/ns while normal planar MOSFETs have over 200nsec and 4.5V/nsec respectively. Therefore, it can remove additional component and improve system reliability in certain applications in which the performance of MOSFET's body diode is significant. 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.





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

	Parameter		FDA24N40F	Unit	
Drain to Source Voltage	ource Voltage		400	V	
Gate to Source Voltage			±30	V	
Drain Current	- Continuous (T _C = 25°C)		23	_	
Diam Current	- Continuous (T _C = 100°C)		13.8	A	
Drain Current	- Pulsed	- Pulsed (Note 1)		Α	
Single Pulsed Avalanche Energy (Note:		(Note 2)	1190	mJ	
Avalanche Current		(Note 1)	23	Α	
Repetitive Avalanche Ene	Repetitive Avalanche Energy		23.5	mJ	
Peak Diode Recovery dv/	dt	(Note 3)	4.5	V/ns	
Dower Dissipation	(T _C = 25°C)		235	W	
Power Dissipation	- Derate Above 25°C		1.8	W/°C	
Operating and Storage Te	ing and Storage Temperature Range		-55 to +150	°C	
Maximum Lead Temperat	ture for Soldering, 1/8" from Case fo	r 5 Seconds	300	οС	
	Gate to Source Voltage Drain Current Drain Current Single Pulsed Avalanche Avalanche Current Repetitive Avalanche Ene Peak Diode Recovery dv/ Power Dissipation Operating and Storage Te		$ \begin{array}{c} \text{Drain to Source Voltage} \\ \text{Gate to Source Voltage} \\ \\ \text{Drain Current} \\ \end{array} \begin{array}{c} -\text{Continuous} \ (T_{\text{C}} = 25^{\circ}\text{C}) \\ -\text{Continuous} \ (T_{\text{C}} = 100^{\circ}\text{C}) \\ \end{array} \\ \text{Drain Current} \\ -\text{Pulsed} \\ \text{Single Pulsed Avalanche Energy} \\ \text{Avalanche Current} \\ \text{Repetitive Avalanche Energy} \\ \text{Repetitive Avalanche Energy} \\ \text{Power Dissipation} \\ \end{array} \begin{array}{c} (Note \ 1) \\ \text{Note 3)} \\ \\ \text{Power Description} \\ \end{array} $	$\begin{array}{c} \text{Drain to Source Voltage} & 400 \\ \text{Gate to Source Voltage} & \pm 30 \\ \\ \text{Drain Current} & - \text{Continuous} \left(T_{\text{C}} = 25^{\text{o}}\text{C} \right) & 23 \\ \\ - \text{Continuous} \left(T_{\text{C}} = 100^{\text{o}}\text{C} \right) & 13.8 \\ \\ \text{Drain Current} & - \text{Pulsed} & (\text{Note 1}) & 92 \\ \\ \text{Single Pulsed Avalanche Energy} & (\text{Note 2}) & 1190 \\ \\ \text{Avalanche Current} & (\text{Note 1}) & 23 \\ \\ \text{Repetitive Avalanche Energy} & (\text{Note 1}) & 23.5 \\ \\ \text{Peak Diode Recovery dv/dt} & (\text{Note 3}) & 4.5 \\ \\ \text{Power Dissipation} & \left(T_{\text{C}} = 25^{\text{o}}\text{C} \right) & 235 \\ \\ \text{- Derate Above 25^{\text{o}}\text{C}} & 1.8 \\ \\ \text{Operating and Storage Temperature Range} & -55 \text{ to +150} \\ \\ \end{array}$	

Thermal Characteristics

Symbol	Parameter	FDA24N40F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.53	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max. 40		C/VV

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA24N40F	FDA24N40F	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics $T_C = 25^{\circ}C$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	cteristics					
BV _{DSS}	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V, T_J = 25^{\circ} C$	400	-	-	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.5	-	V/°C
1	Zoro Cata Valtago Drain Current	V _{DS} = 400 V, V _{GS} = 0 V	-	-	10	μА
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 320 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	-	100	μΑ
I _{GSS}	Gate to Body Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V	-	-	±100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	3.0	-	5.0	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 11.5 A	1	0.15	0.19	Ω
9 _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 11.5 A	ı	29	1	S

Dynamic Characteristics

C _{iss}	Input Capacitance	V 05.V.V 0.V		-	2280	3030	pF
C _{oss}	Output Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1 MHz		-	370	490	pF
C _{rss}	Reverse Transfer Capacitance	1 - 1 1011 12	1 - 1 1011 12	-	25	38	pF
Q _{g(tot)}	Total Gate Charge at 10V	V _{DS} = 320 V, I _D = 23 A,		-	46	60	nC
Q_{gs}	Gate to Source Gate Charge	V _{GS} = 10 V		-	13	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		(Note 4)	-	18	-	nC

Switching Characteristics

t _{d(on)}	Turn-On Delay Time		-	40	90	ns
t _r	Turn-On Rise Time	$V_{DS} = 200 \text{ V}, I_{D} = 23 \text{ A},$	-	92	195	ns
t _{d(off)}	Turn-Off Delay Time	$V_{GS} = 10 \text{ V}, R_G = 25 \Omega$	-	120	250	ns
t _f	Turn-Off Fall Time	(Note 4)	-	75	160	ns

Drain-Source Diode Characteristics

IS	Maximum Continuous Drain to Source Diode Forward Current		-	-	23	Α
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	92	Α
V_{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 23 A	-	-	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _{SD} = 23 A,	-	110	-	ns
Q _{rr}	Reverse Recovery Charge	$dI_F/dt = 100 A/\mu s$	-	0.3	/ -	μС

Notes

- 1: Repetitive rating: pulse-width limited by maximum junction temperature.
- 2: L = 4.5 mH, I_{AS} = 23 A, V_{DD} = 50 V, R_G = 25 Ω , starting T_J = 25°C.
- 3: $I_{SD} \le 23$ 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

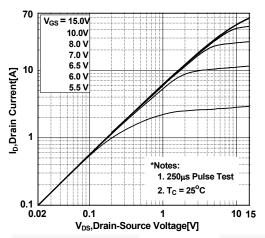


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

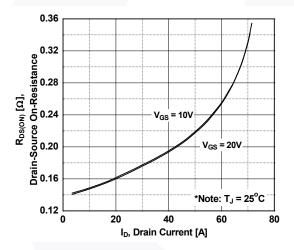


Figure 5. Capacitance Characteristics

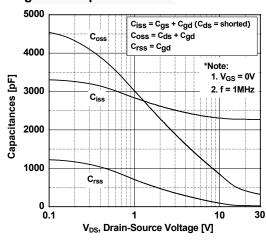


Figure 2. Transfer Characteristics

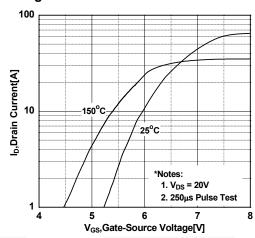


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

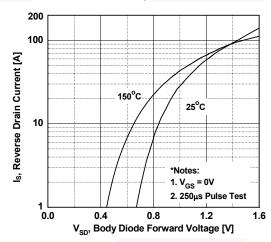
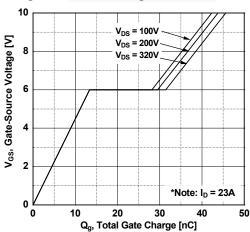


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

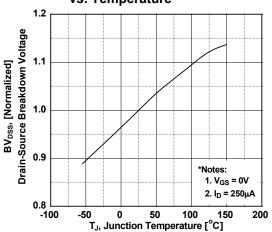


Figure 8. Maximum Safe Operating Area

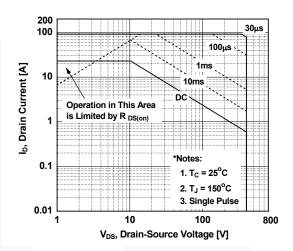


Figure 9. Maximum Drain Current vs. Case Temperature

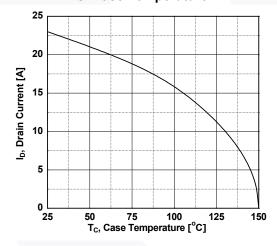
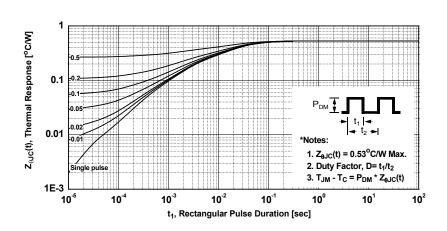


Figure 10. Transient Thermal Response Curve



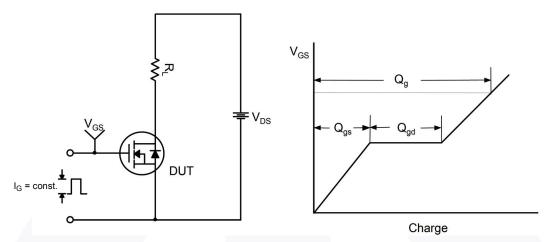


Figure 11. Gate Charge Test Circuit & Waveform

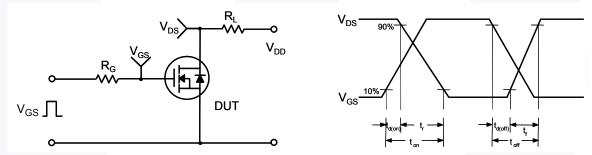


Figure 12. Resistive Switching Test Circuit & Waveforms

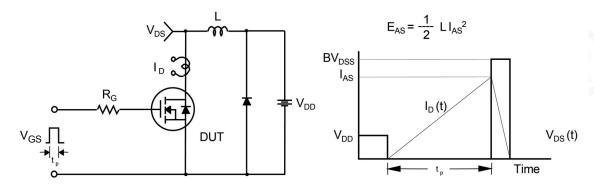


Figure 13. Unclamped Inductive Switching Test Circuit & Waveforms

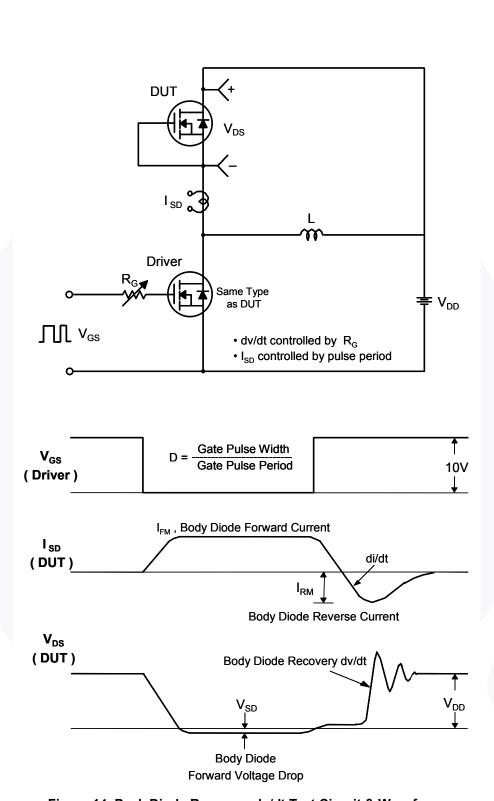
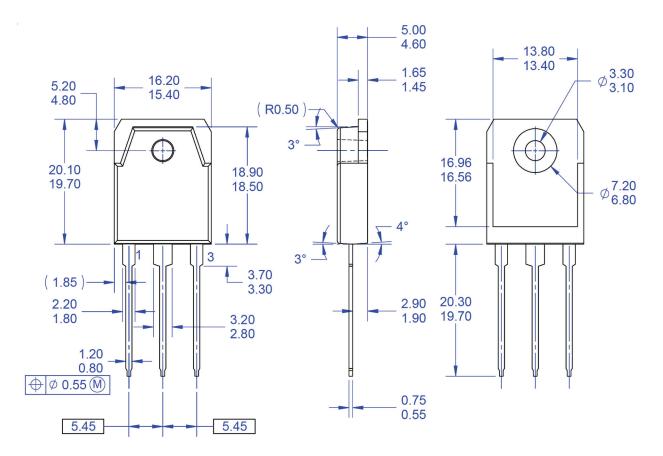
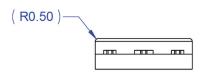


Figure 14. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions





NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- **DIMENSION AND TOLERANCING PER** ASME14.5-2009.
- D) DIMENSIONS ARE EXCLUSSIVE OF BURRS. MOLD FLASH, AND TIE BAR EXTRUSSIONS.
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Figure 15. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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