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May 2014

# FDA24N50

## N-Channel UniFET™ MOSFET

500 V, 24 A, 190 mΩ

### Features

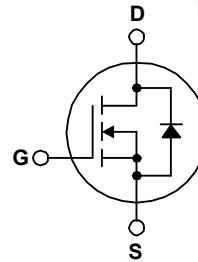
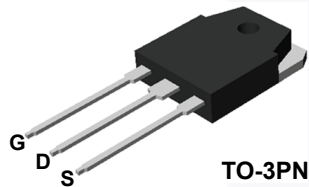
- $R_{DS(on)} = 160 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 12 \text{ A}$
- Low Gate Charge (Typ. 65 nC)
- Low  $C_{rss}$  (Typ. 35 pF)
- 100% Avalanche Tested
- RoHS Compliant

### Applications

- PDP TV
- Uninterruptible Power Supply
- AC-DC Power Supply

### Description

UniFET™ 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.



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FDA24N50	Unit
$V_{DSS}$	Drain to Source Voltage	500	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	24
		- Continuous ( $T_C = 100^\circ\text{C}$ )	14
$I_{DM}$	Drain Current - Pulsed (Note 1)	96	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	1872	mJ
$I_{AR}$	Avalanche Current (Note 1)	24	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	27	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	4.5	V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	270
		- Derate Above $25^\circ\text{C}$	2.2
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Parameter	FDA24N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.46	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA24N50	FDA24N50	TO-3PN	Tube	N/A	N/A	30 units

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 25^\circ\text{C}$	500	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	0.66	-	$V/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 500 \text{ V}$ , $V_{GS} = 0 \text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 400 \text{ V}$ , $T_C = 125^\circ\text{C}$	-	-	10	
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}$ , $V_{DS} = 0 \text{ V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 12 \text{ A}$	-	0.16	0.19	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20 \text{ V}$ , $I_D = 12 \text{ A}$	-	28	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	-	3120	4150	pF
$C_{oss}$	Output Capacitance		-	460	615	pF
$C_{rss}$	Reverse Transfer Capacitance		-	35	52	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 400 \text{ V}$ , $I_D = 24 \text{ A}$ , $V_{GS} = 10 \text{ V}$	-	65	85	nC
$Q_{gs}$	Gate to Source Gate Charge		-	18	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	26	-

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250 \text{ V}$ , $I_D = 24 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_G = 25 \Omega$	-	47	104	ns
$t_r$	Turn-On Rise Time		-	108	226	ns
$t_{d(off)}$	Turn-Off Delay Time		-	164	338	ns
$t_f$	Turn-Off Fall Time		(Note 4)	-	86	182

### Drain-Source Diode Characteristics

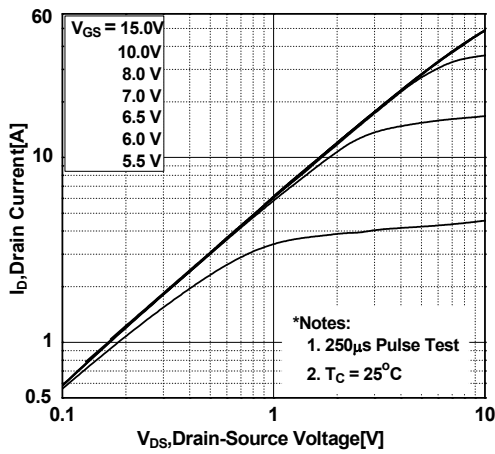
$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	24	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	96	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 24 \text{ A}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 24 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	540	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	8.1	-	$\mu\text{C}$

#### Notes:

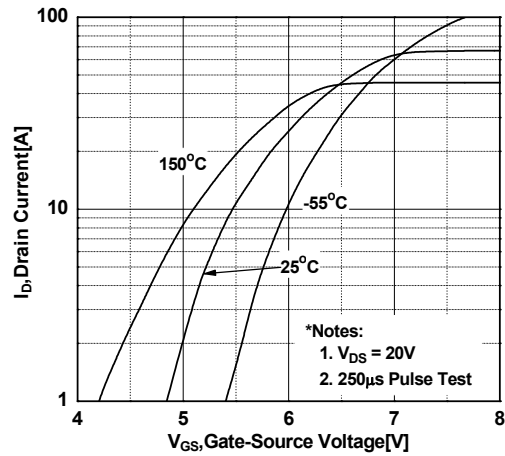
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 6.5 \text{ mH}$ ,  $I_{AS} = 24 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 24 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

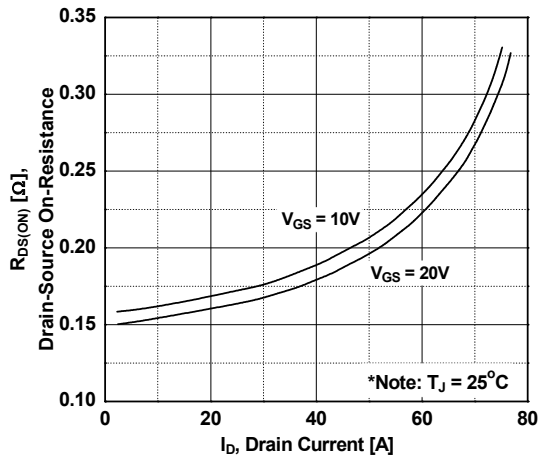
**Figure 1. On-Region Characteristics**



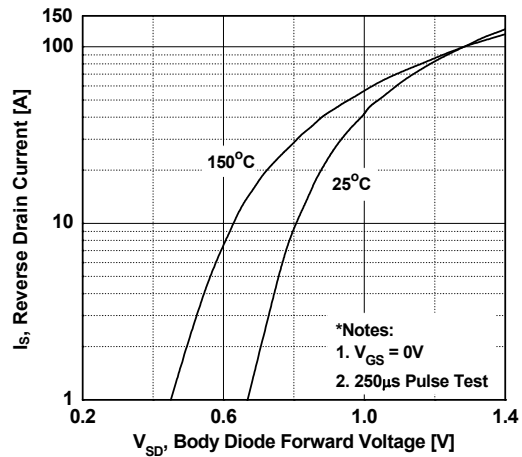
**Figure 2. Transfer Characteristics**



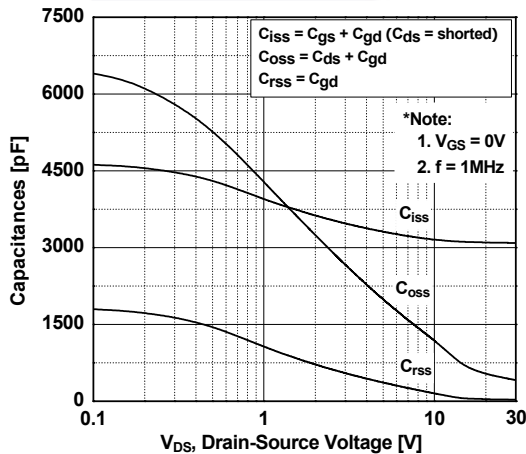
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



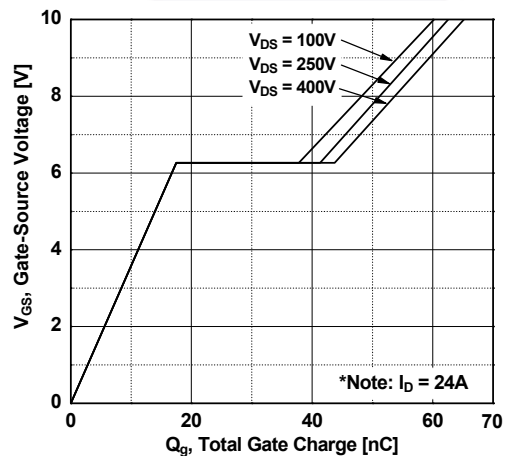
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

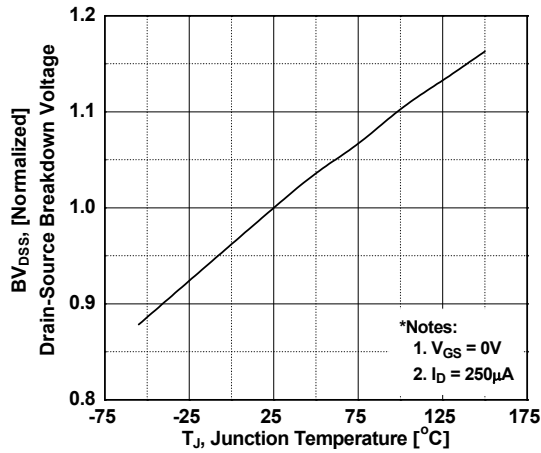


Figure 8. On-Resistance Variation vs. Temperature

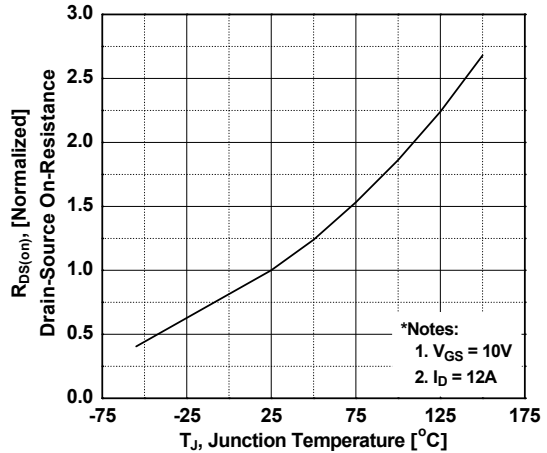


Figure 9. Maximum Safe Operating Area

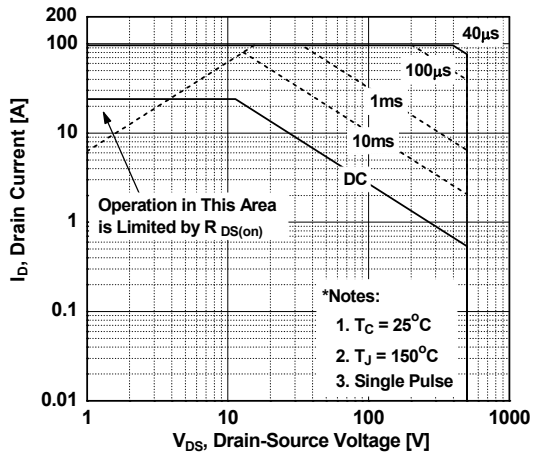


Figure 10. Maximum Drain Current vs. Case Temperature

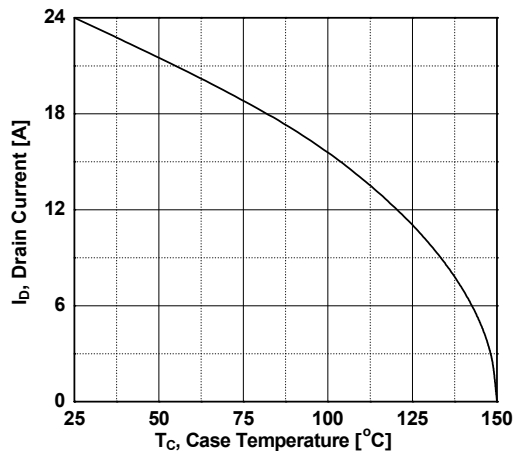
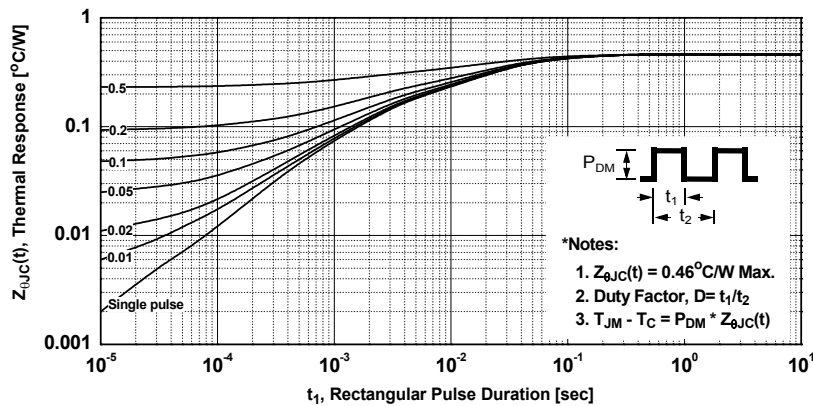


Figure 11. Transient Thermal Response Curve



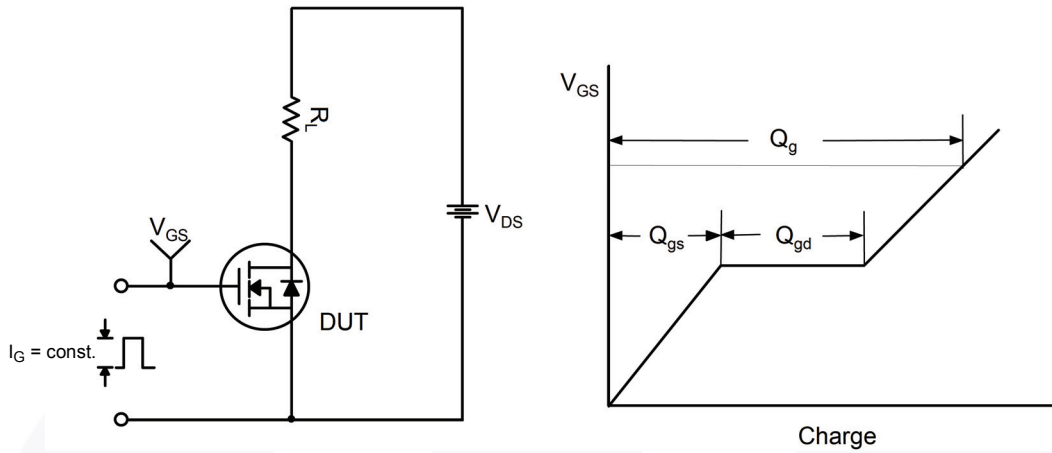


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

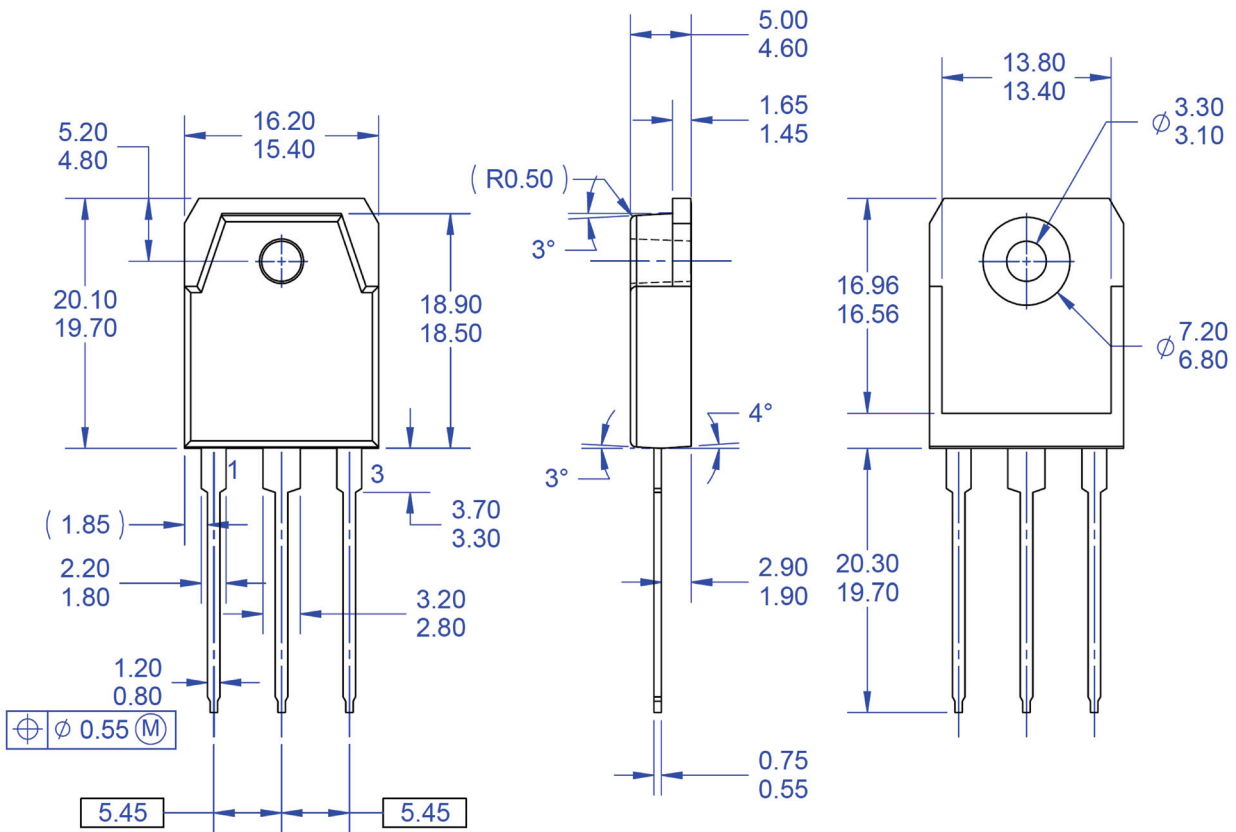


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



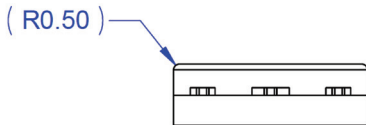
Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

**Mechanical Dimensions**



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
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**Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65**

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