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April 2014

# FDA59N25

## N-Channel UniFET™ MOSFET

250 V, 59 A, 49 mΩ



FDA59N25 — N-Channel UniFET™ MOSFET

### Features

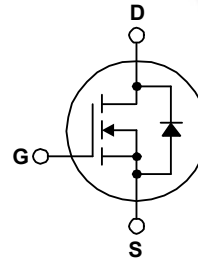
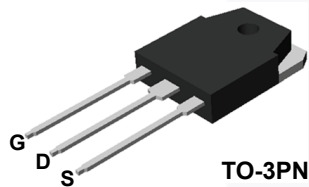
- $R_{DS(on)} = 49\text{ m}\Omega$  (Max.) @  $V_{GS} = 10\text{ V}$ ,  $I_D = 29.5\text{ A}$
- Low Gate Charge (Typ. 63 nC)
- Low  $C_{rss}$  (Typ. 70 pF)
- 100% Avalanche Tested
- RoHS Compliant

### 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.

### Applications

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



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

Symbol	Parameter	FDA59N25	Unit
$V_{DSS}$	Drain to Source Voltage	250	V
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage (Note 1,2)	300	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	59
		- Continuous ( $T_C = 100^\circ\text{C}$ )	35
$I_{DM}$	Drain Current - Pulsed (Note 1)	236	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	1458	mJ
$I_{AR}$	Avalanche Current (Note 1)	59	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	39.2	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )		392
		- Derate Above $25^\circ\text{C}$	3.2
$T_J, T_{STG}$	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	FDA59N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.32	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case to Sink, Typ.	0.24	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA59N25	FDA59N25	TO-3PN	Tube	N/A	N/A	30 units

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

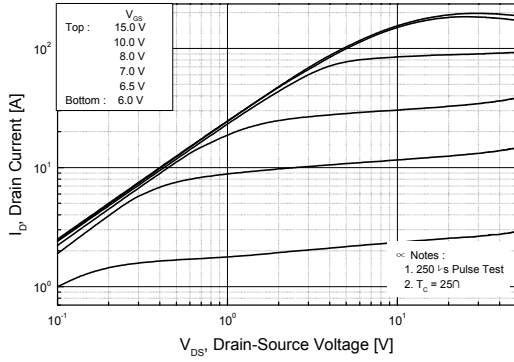
Symbol	Parameter	Conditions	Min.	Typ.	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	250	--	--	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	--	0.25	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 250 V, V <sub>GS</sub> = 0 V V <sub>DS</sub> = 200 V, T <sub>C</sub> = 125°C	--	--	1 10	μA μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	3.0	--	5.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 29.5 A	--	0.041	0.049	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 29.5 A	--	45	--	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz	--	3090	4020	pF
C <sub>oss</sub>	Output Capacitance		--	630	820	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		--	70	110	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 125 V, I <sub>D</sub> = 59 A V <sub>GS</sub> = 10 V, R <sub>G</sub> = 25 Ω  (Note 4)	--	70	150	ns
t <sub>r</sub>	Turn-On Rise Time		--	480	970	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	90	190	ns
t <sub>f</sub>	Turn-Off Fall Time		--	170	350	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 200 V, I <sub>D</sub> = 59 A V <sub>GS</sub> = 10 V  (Note 4)	--	63	82	nC
Q <sub>gs</sub>	Gate-Source Charge		--	18.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	30	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	59	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	236	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 59 A	--	--	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 59 A, di <sub>F</sub> /dt = 100 A/μs	--	190	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge		--	4.4	--	μC

### Notes:

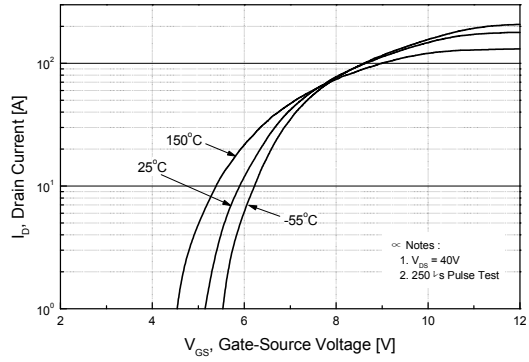
1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. L = 0.67 mH, I<sub>AS</sub> = 59 A, V<sub>DD</sub> = 50 V, R<sub>G</sub> = 25 Ω, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 59 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

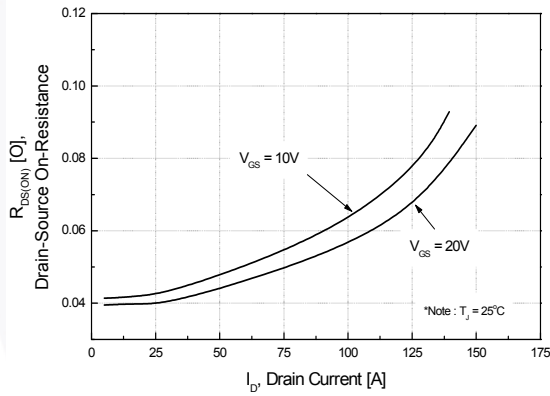
**Figure 1. On-Region Characteristics**



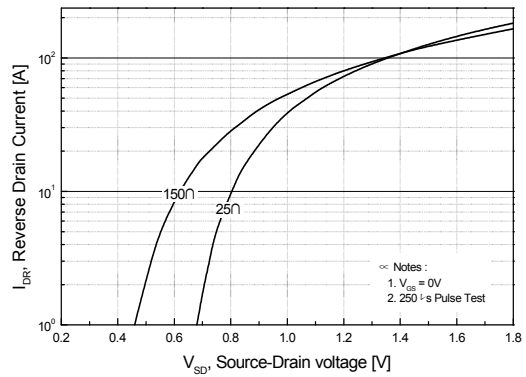
**Figure 2. Transfer Characteristics**



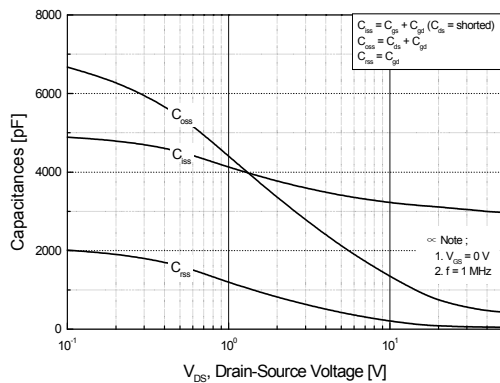
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



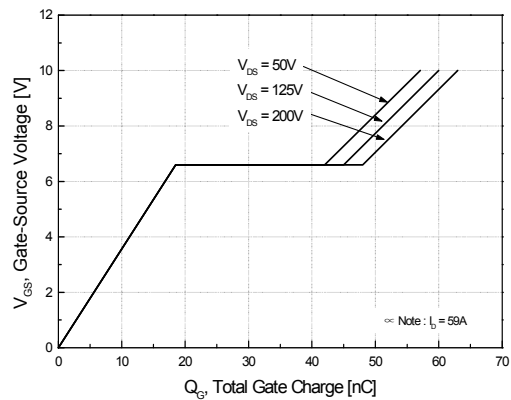
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

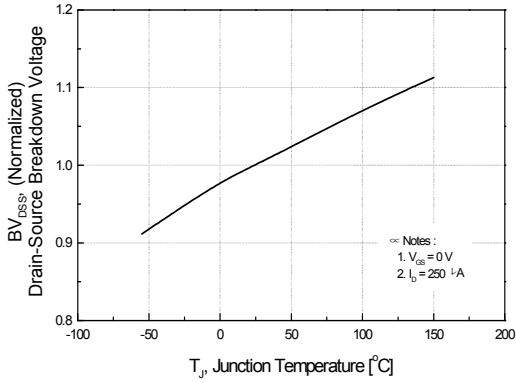


Figure 8. On-Resistance Variation vs. Temperature

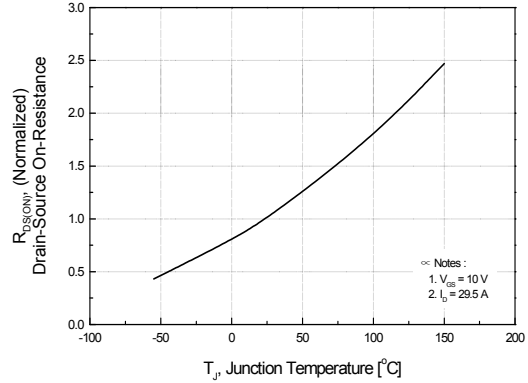


Figure 9. Maximum Safe Operating Area

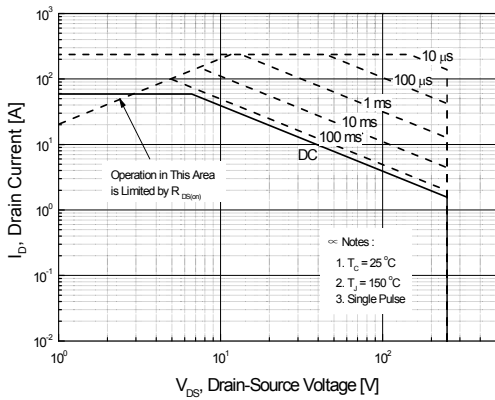


Figure 10. Maximum Drain Current vs. Case Temperature

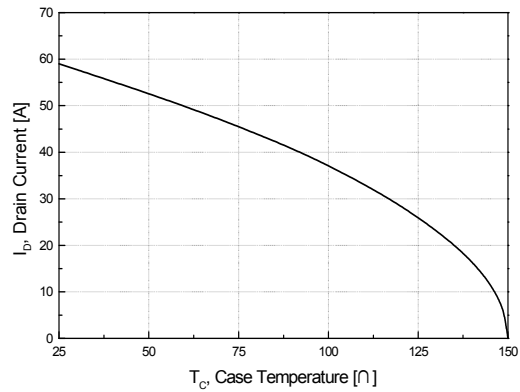
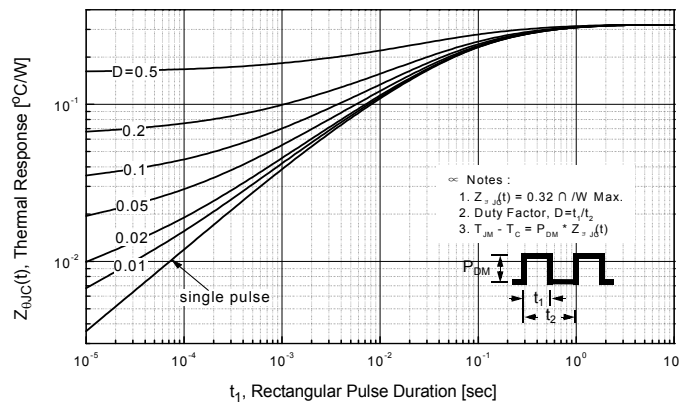


Figure 11. Transient Thermal Response Curve



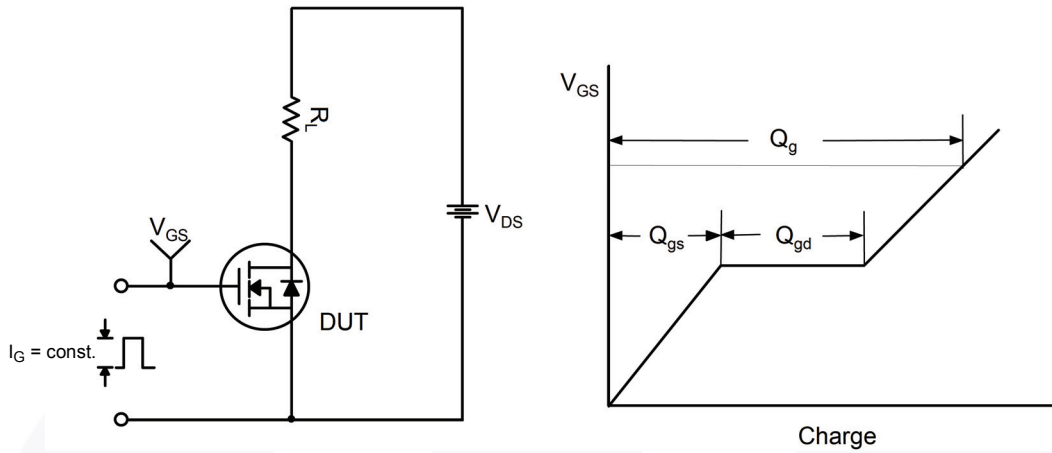


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

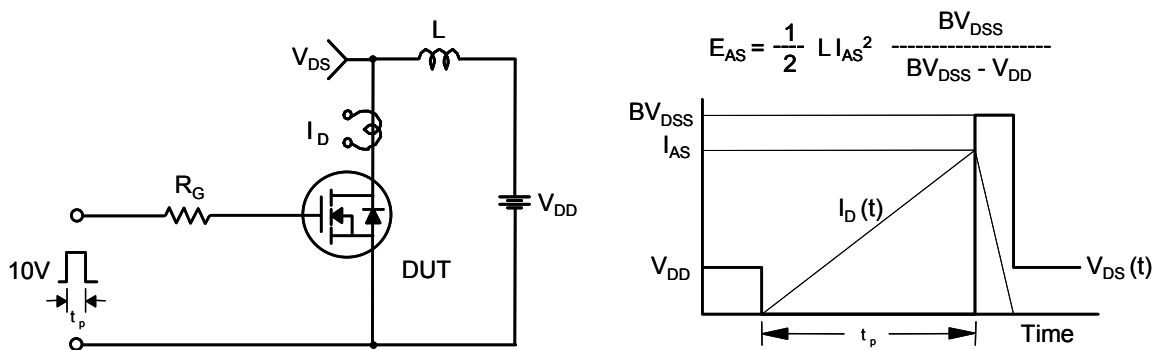
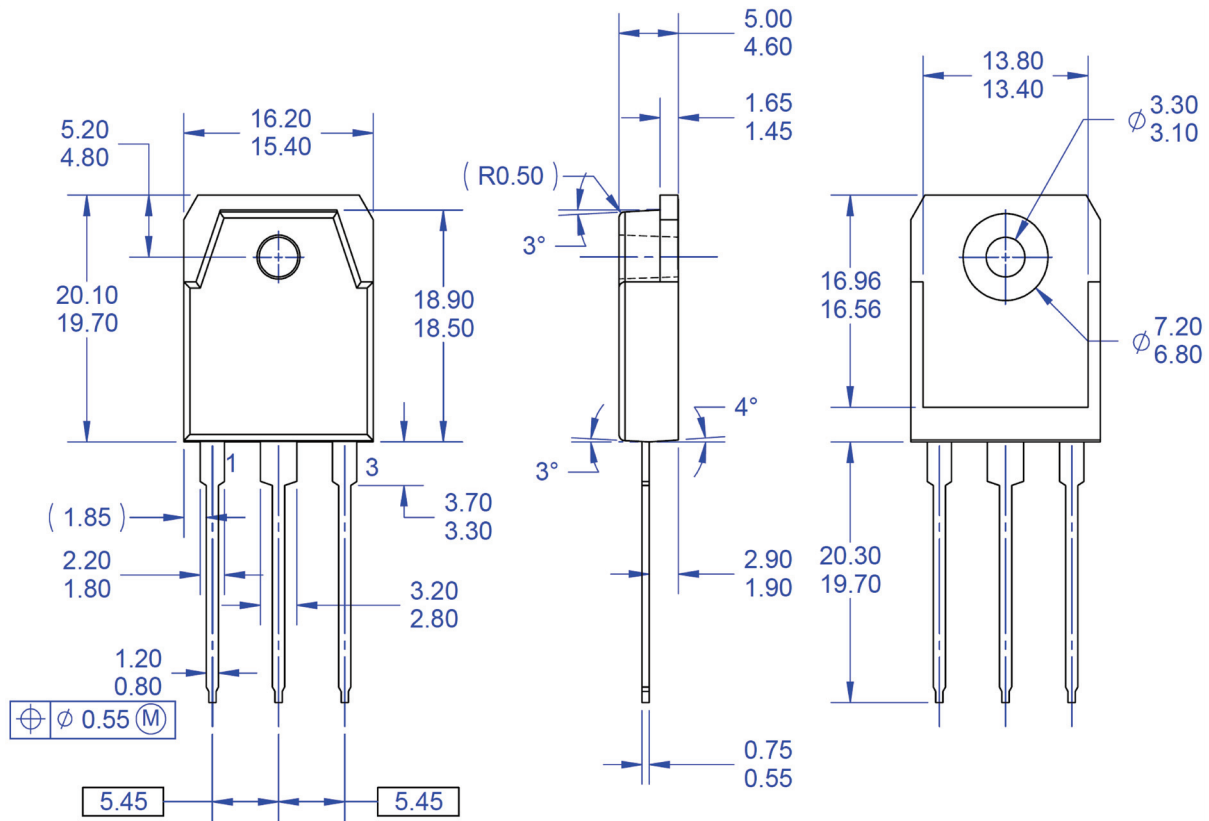


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



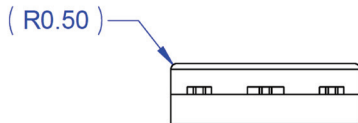
Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

**Mechanical Dimensions**



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**Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65**

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