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May 2014

FDA33N25

N-Channel UniFET™ MOSFET
250 V, 33 A, 94 mΩ

Features

- $R_{DS(on)}$ = 88 mΩ (Typ.) @ V_{GS} = 10 V, I_D =16.5 A
- Low Gate Charge (Typ. 36 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.

TO-3PN
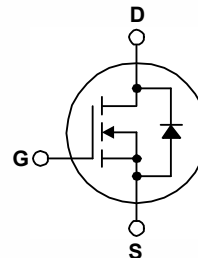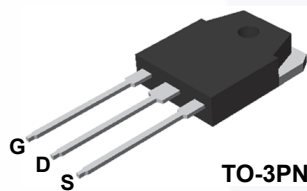
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter			FDA33N25	Unit
V_{DSS}	Drain to Source Voltage			250	V
V_{GSS}	Gate to Source Voltage			±30	V
I_D	Drain Current	- Continuous (T_C = 25°C)		33	A
		- Continuous (T_C = 100°C)		21	
I_{DM}	Drain Current	- Pulsed	(Note 1)	132	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	918	mJ
I_{AR}	Avalanche Current		(Note 1)	33	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	24.6	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C)		245	W
		- Derate Above 25°C		1.96	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	FDA33N25	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.51	°C/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
FDA33N25	FDA33N25	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V, T_J = 25°C	250	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	-	0.34	-	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 250 V, V_{GS} = 0 V	-	-	1	μA
		V_{DS} = 200 V, T_C = 125°C	-	-	10	
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 μA	3.0	-	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 16.5 A	-	0.088	0.094	Ω
g_{FS}	Forward Transconductance	V_{DS} = 20 V, I_D = 16.5 A	-	24.2	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1 MHz	-	1655	2200	pF
C_{oss}	Output Capacitance		-	315	420	pF
C_{rss}	Reverse Transfer Capacitance		-	35	55	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{DS} = 200 V, I_D = 33 A, V_{GS} = 10 V	-	36	46.8	nC
Q_{gs}	Gate to Source Gate Charge		-	10.8	-	nC
Q_{gd}	Gate to Drain "Miller" Charge	(Note 4)	-	16	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 125 V, I_D = 33 A, V_{GS} = 10 V, R_G = 25 Ω	-	33	76	ns
t_r	Turn-On Rise Time		-	142	293	ns
$t_{d(off)}$	Turn-Off Delay Time		-	77	165	ns
t_f	Turn-Off Fall Time	(Note 4)	-	68	146	ns
Drain-Source Diode Characteristics						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	33	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	132	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 33 A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_{SD} = 33 A, dI_F/dt = 100 A/μs	-	256	-	ns
Q_{rr}	Reverse Recovery Charge		-	2.3	-	μC

Notes:
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 1.35 mH, I_{AS} = 33 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 33 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical Characteristics

Typical Performance Characteristics
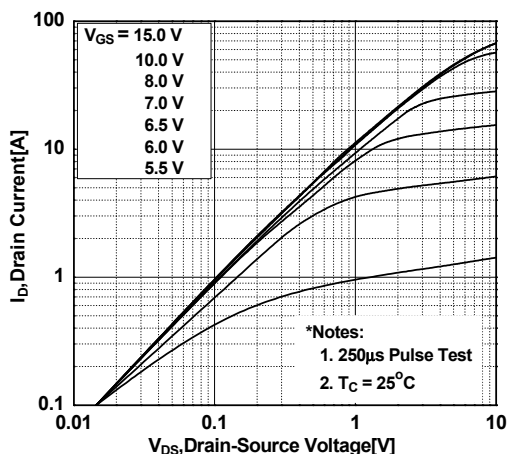
Figure 1. On-Region Characteristics

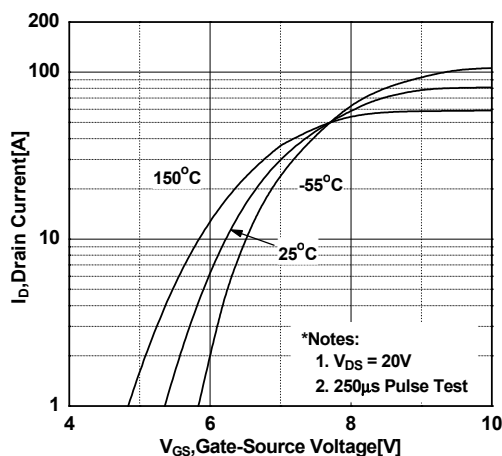
Figure 2. Transfer Characteristics

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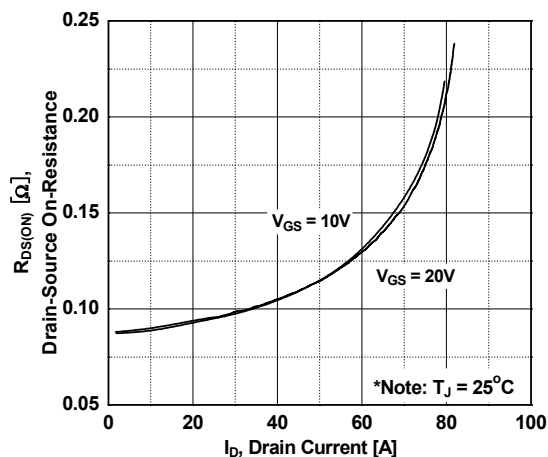

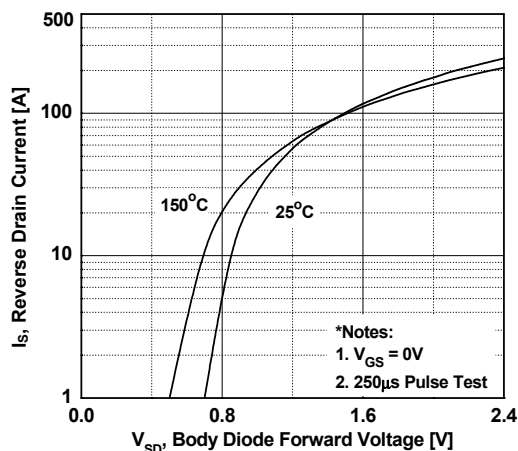### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

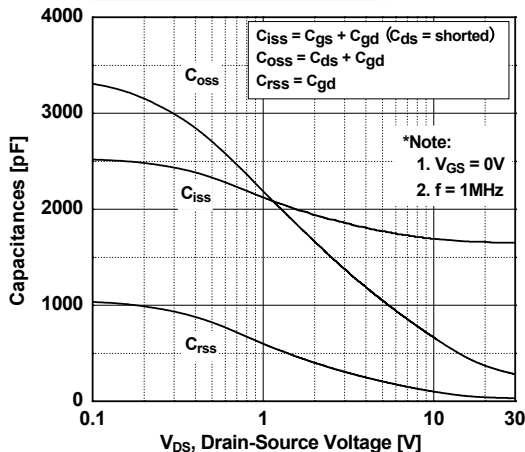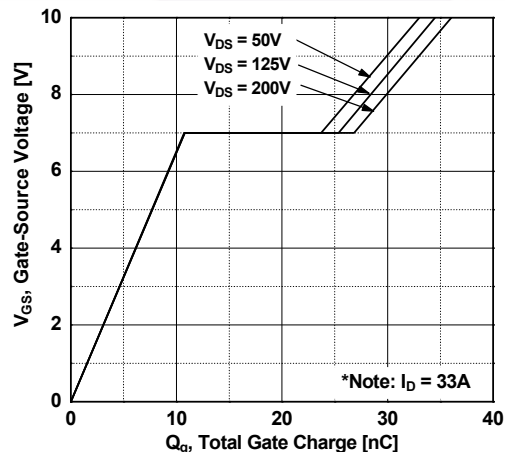### Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics

Typical Performance Characteristics (Continued)
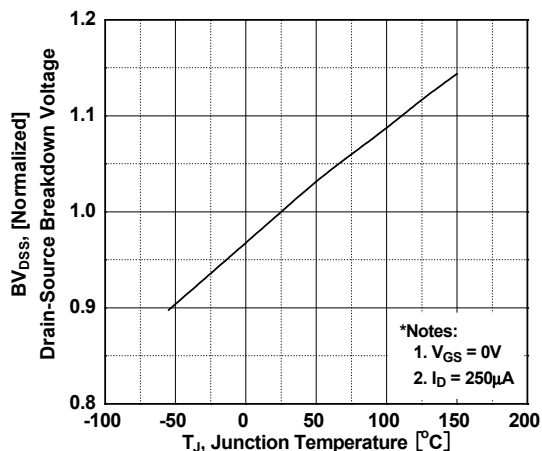
Figure 7. Breakdown Voltage Variation vs. Temperature

*Notes:
1. $V_{GS} = 0V$
2. $I_D = 250\mu A$

Figure 8. On-Resistance Variation vs. Temperature

*Notes:
1. $V_{GS} = 10V$
2. $I_D = 16.5A$
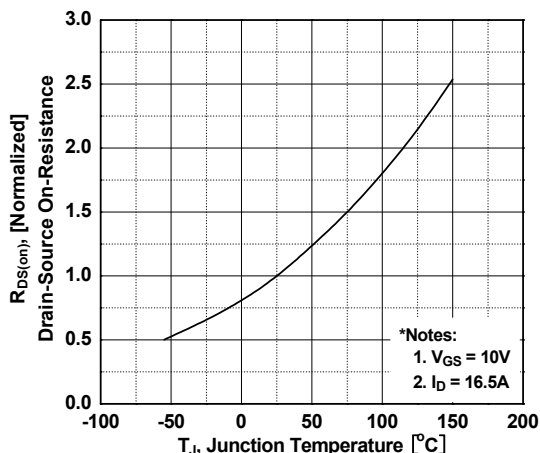
Figure 9. Maximum Safe Operating Area

Operation in This Area is Limited by $R_{DS(on)}$

20µs
100µs
1ms
10ms
DC

*Notes:
1. $T_C = 25^oC$
2. $T_J = 150^oC$
3. Single Pulse
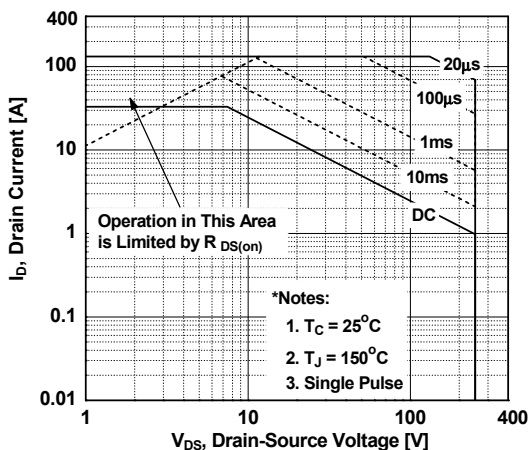
Figure 10. Maximum Drain Current vs. Case Temperature
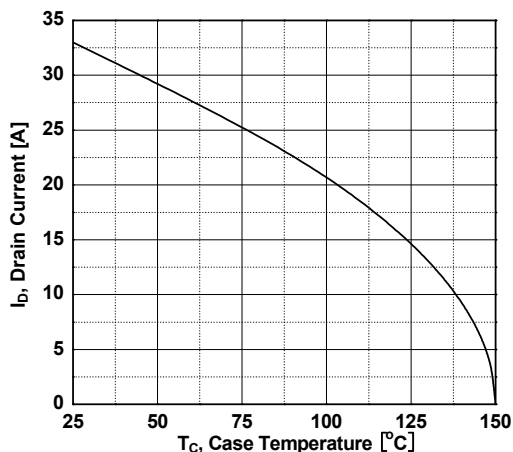
Figure 11. Transient Thermal Response Curve

0.5
0.2
0.1
0.05
0.02
0.01
Single pulse

P_{DM}

t_1
t_2

*Notes:
1. $Z_{\theta JC}(t) = 0.51^oC/W$ Max.
2. Duty Factor, $D = t_1/t_2$
3. $T_{JM} - T_C = P_{DM} * Z_{\theta JC}(t)$
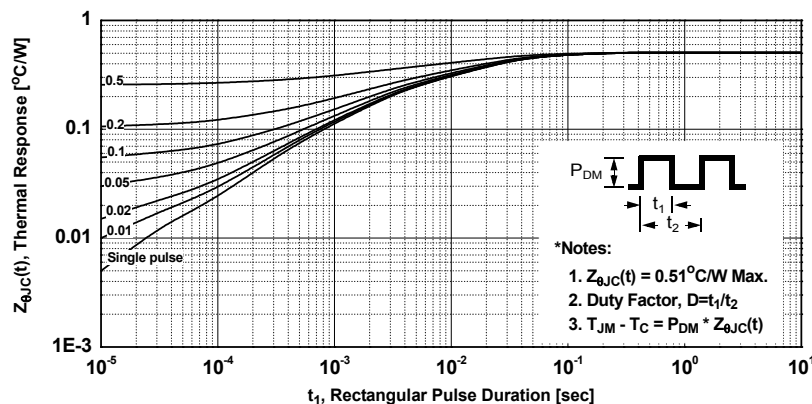
Figure 12. Gate Charge Test Circuit & Waveform
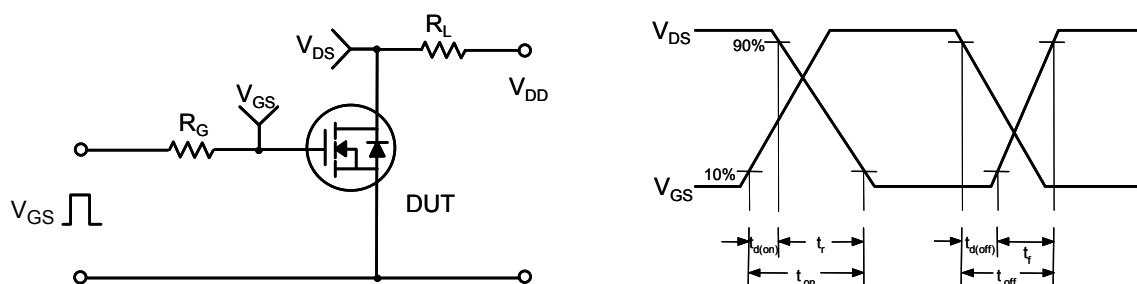
Figure 13. Resistive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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

Mechanical Dimensions

5.20
4.80

16.20
15.40

20.10
19.70

18.90
18.50

(1.85)

1

3

2.20
1.80

3.70
3.30

3.20
2.80

1.20
0.80

⌖ ⌀ 0.55 Ⓜ

5.45   5.45

5.00
4.60

1.65
1.45

(R0.50)

3°

3°

4°

2.90
1.90

0.75
0.55

13.80
13.40

⌀ 3.30
3.10

16.96
16.56

⌀ 7.20
6.80

20.30
19.70

(R0.50)
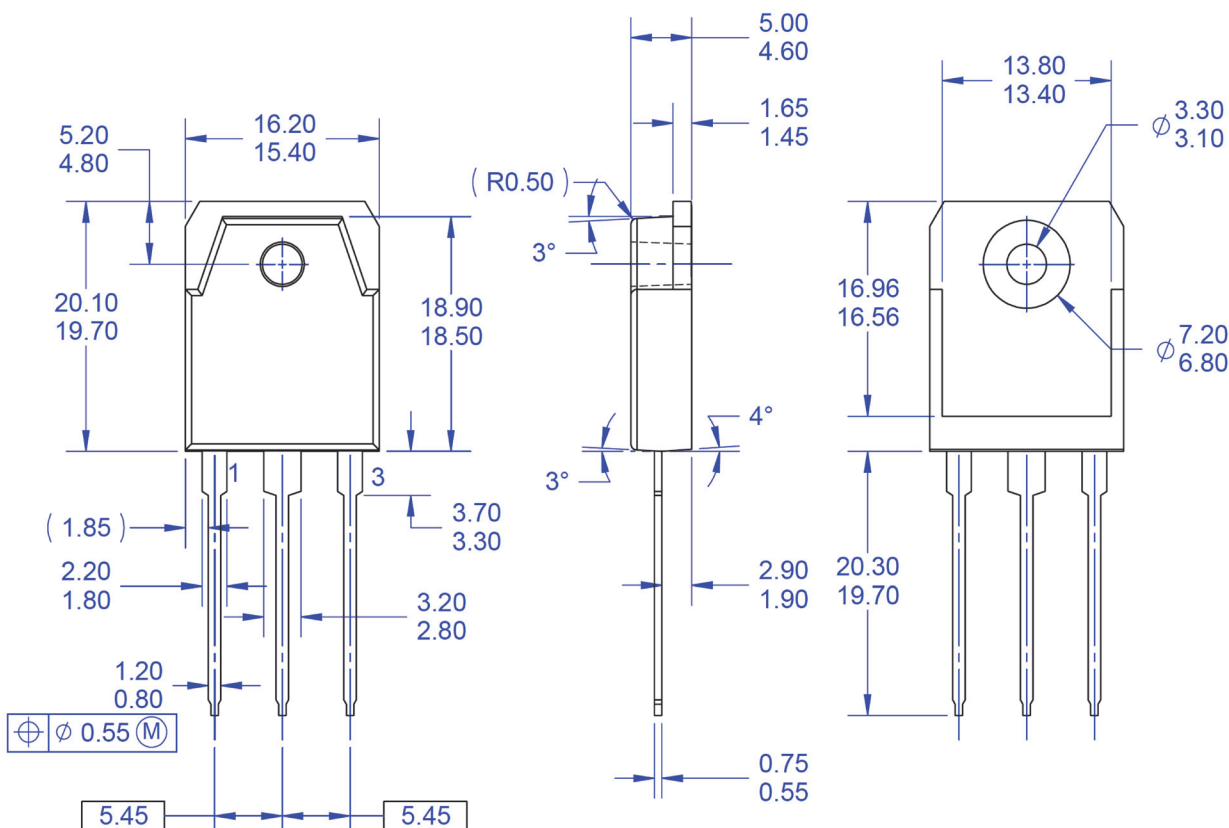
NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE CONFORMS TO EIAJ
     SC-65 PACKAGING STANDARD.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSION AND TOLERANCING PER
     ASME14.5-2009.
D) DIMENSIONS ARE EXCLUSSIVE OF BURRS,
     MOLD FLASH, AND TIE BAR EXTRUSSIONS.
E) DRAWING FILE NAME: TO3PN03AREV1.
F) FAIRCHILD SEMICONDUCTOR.
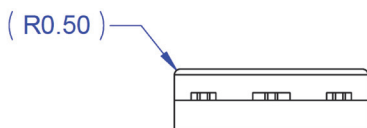
Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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Definition of Terms

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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