

# MOSFET – N-Channel, UniFET™

**250 V, 33 A, 94 mΩ**

## FDB33N25

### Description

UniFET™ MOSFET is onsemi'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.

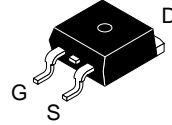
### Features

- $R_{DS(on)} = 94 \text{ m}\Omega$  (Max.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 16.5 \text{ A}$
- Low Gate Charge (Typ. 36.8 nC)
- Low  $C_{rss}$  (Typ. 39 pF)
- 100% Avalanche Tested
- These Devices are Pb-Free and are RoHS Compliant

### Applications

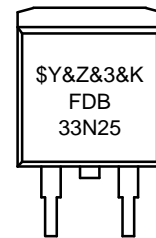
- PDP TV
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

$V_{DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
250 V	94 mΩ @ 10 V	33 A

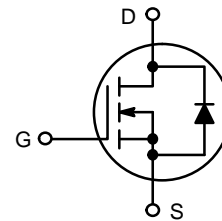


**D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)  
 CASE 418AJ**

### MARKING DIAGRAM



- \$Y = Logo
- &Z = Assembly Plant Code
- &3 = 3-Digit Date Code Format
- &K = 2-Digits Lot Run Traceability Code
- FDB33N25 = Device Code



**N-Channel**

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

# FDB33N25

## MOSFET MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain–Source Voltage	250	V
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ\text{C}$ )	33
		Continuous ( $T_C = 100^\circ\text{C}$ )	20.4
$I_{DM}$	Drain Current	Pulsed (Note 1)	132
$V_{GSS}$	Gate–Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	918	mJ
$I_{AR}$	Avalanche Current (Note 1)	33	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	23.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	235
		Derate Above $25^\circ\text{C}$	1.89
$T_J, T_{STG}$	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	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse–width limited by maximum junction temperature.
2.  $L = 1.35$  mH,  $I_{AS} = 33$  A,  $V_{DD} = 50$  V,  $R_G = 25$   $\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 33$  A,  $di/dt \leq 200$  A/ $\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction–to–Case, Max.	0.53	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction–to–Ambient (1 in <sup>2</sup> Pad of 2–oz Copper), Max.	40	
	Thermal Resistance, Junction–to–Ambient (Minimum Pad of 2–oz Copper), Max.	62.5	

# FDB33N25

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

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	–	–	1	μA
		V <sub>DS</sub> = 200 V, T <sub>C</sub> = 125°C	–	–	10	
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

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</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> = 16.5 A	–	0.077	0.094	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 16.5 A	–	26.6	–	S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	1640	2135	pF
C <sub>oss</sub>	Output Capacitance		–	330	430	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	39	59	pF

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn–On Delay Time	V <sub>DD</sub> = 125 V, I <sub>D</sub> = 33 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 25 Ω (Note 4)	–	35	80	ns
t <sub>r</sub>	Turn–On Rise Time		–	230	470	ns
t <sub>d(off)</sub>	Turn–Off Delay Time		–	75	160	ns
t <sub>f</sub>	Turn–Off Fall Time		–	120	250	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 200 V, I <sub>D</sub> = 33 A, V <sub>GS</sub> = 10 V (Note 4)	–	36.8	48	nC
Q <sub>gs</sub>	Gate–Source Charge		–	10	–	nC
Q <sub>gd</sub>	Gate–Drain Charge		–	17	–	nC

### DRAIN–SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I <sub>S</sub>	Maximum Continuous Drain–Source Diode Forward Current	–	–	33	A	
I <sub>SM</sub>	Maximum Pulsed Drain–Source Diode Forward Current	–	–	132	A	
V <sub>SD</sub>	Drain–Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 33 A	–	–	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 33 A, dI <sub>F</sub> /dt = 100 A/μs	–	220	–	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	1.71	–	μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

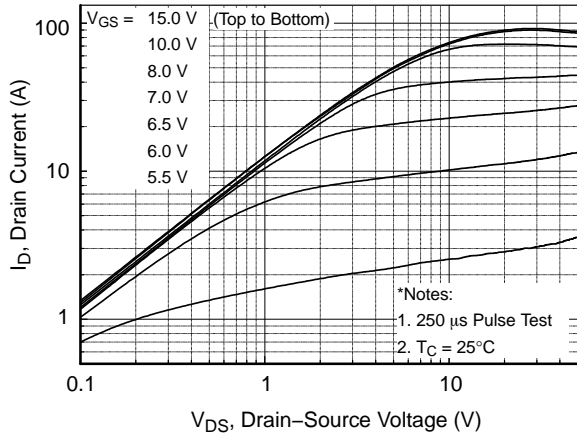


Figure 1. On-Region Characteristics

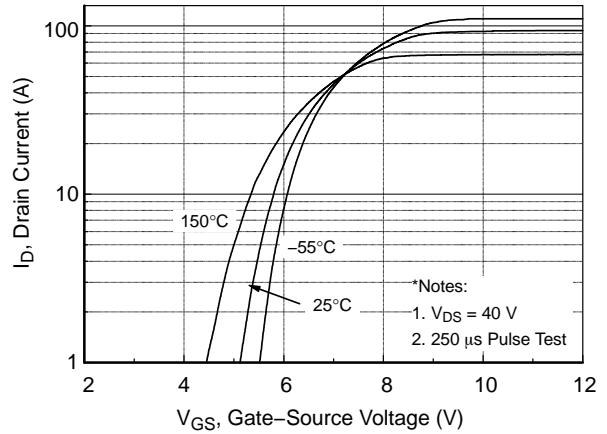


Figure 2. Transfer Characteristics

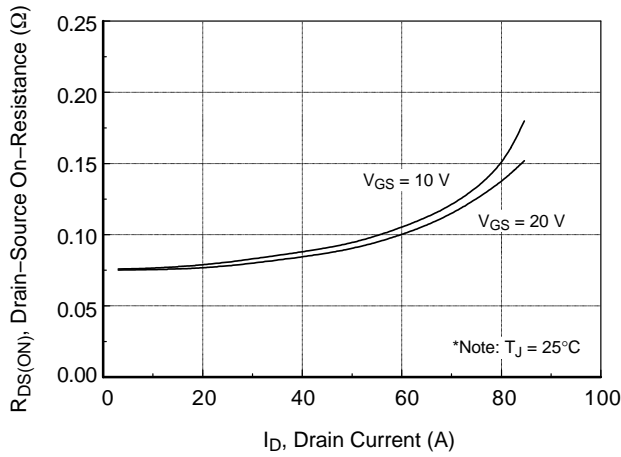


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

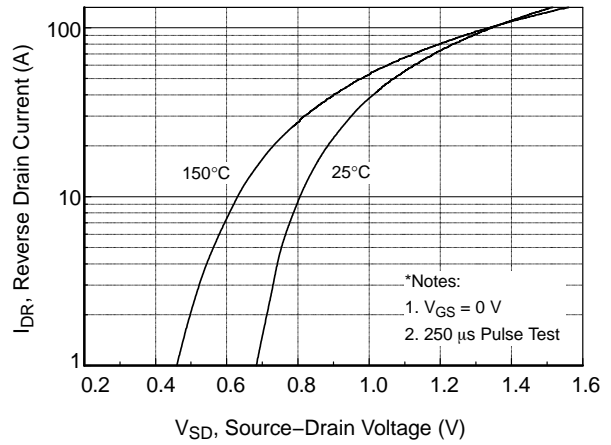


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

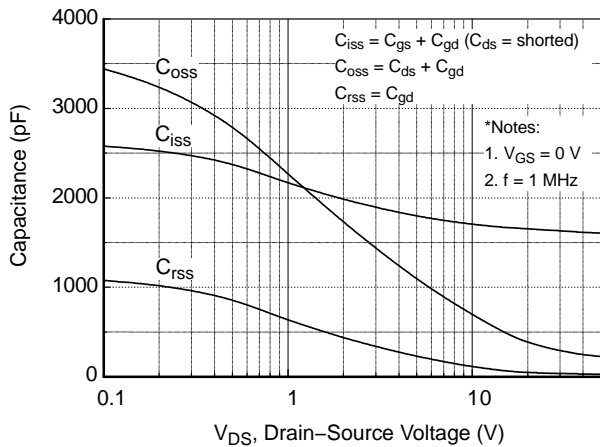


Figure 5. Capacitance Characteristics

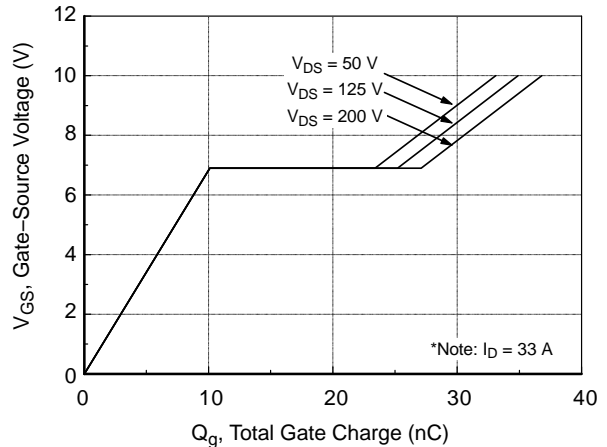


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

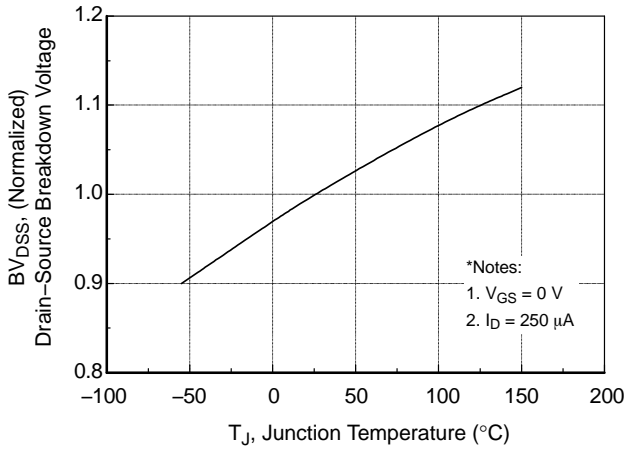


Figure 7. Breakdown Voltage Variation vs. Temperature

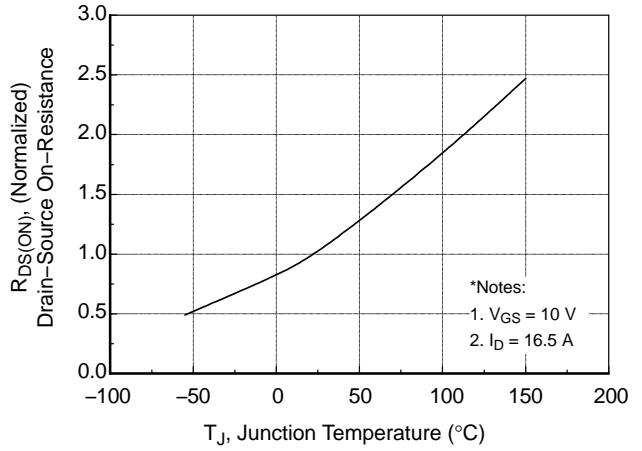


Figure 8. On-Resistance Variation vs. Temperature

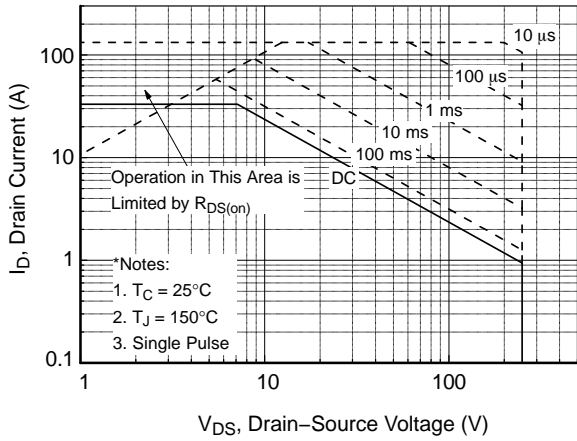


Figure 9. Maximum Safe Operating Area

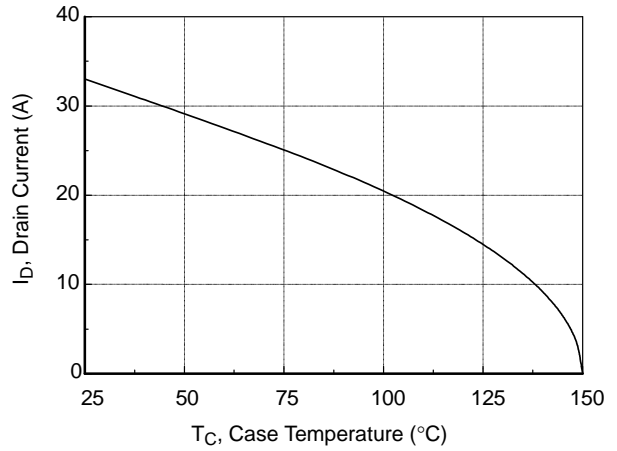


Figure 10. Maximum Drain Current vs. Case Temperature

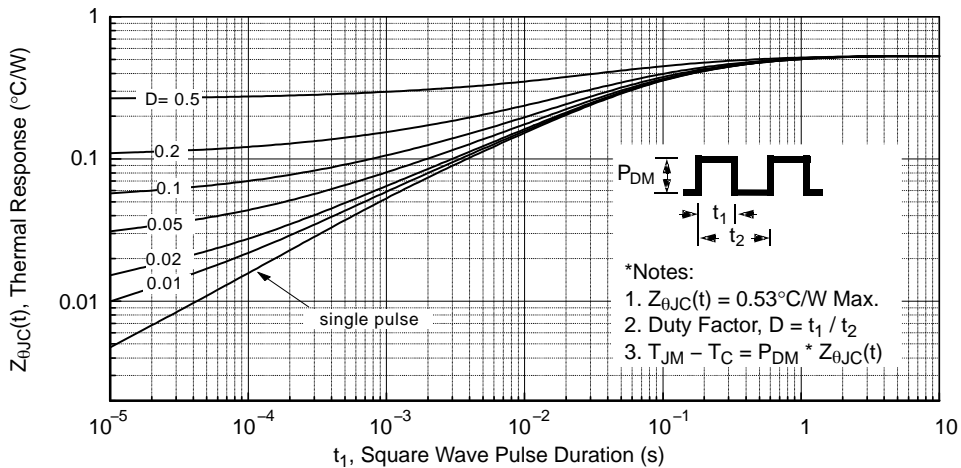


Figure 11. Transient Thermal Response Curve

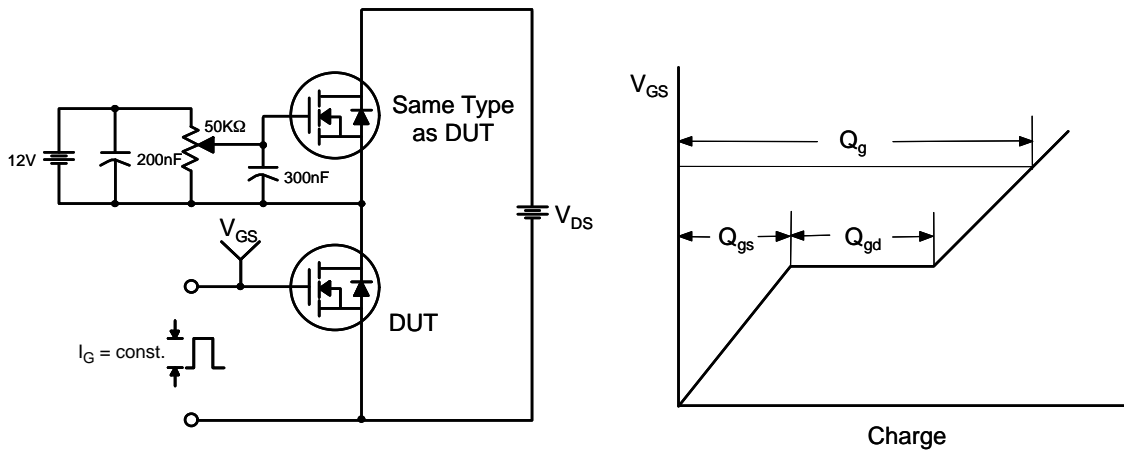


Figure 12. Gate Charge Test Circuit & Waveform

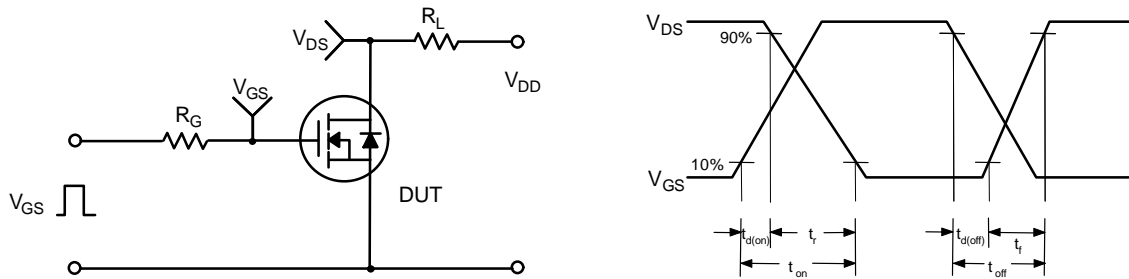


Figure 13. Resistive Switching Test Circuit & Waveforms

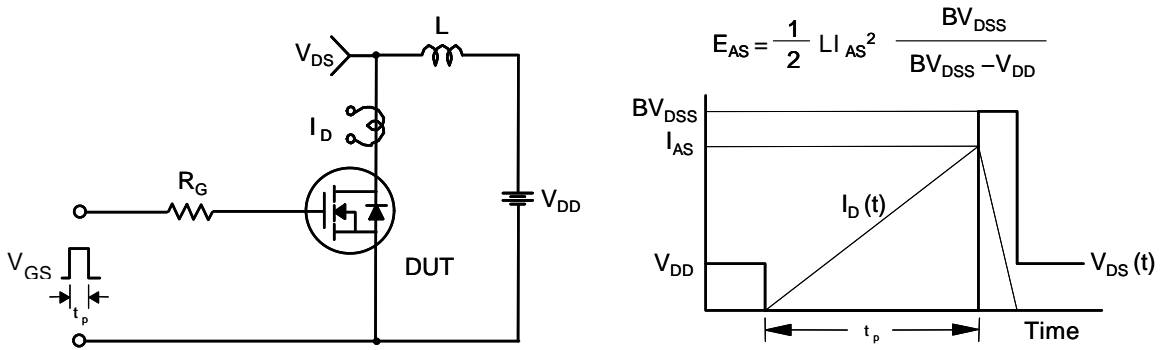
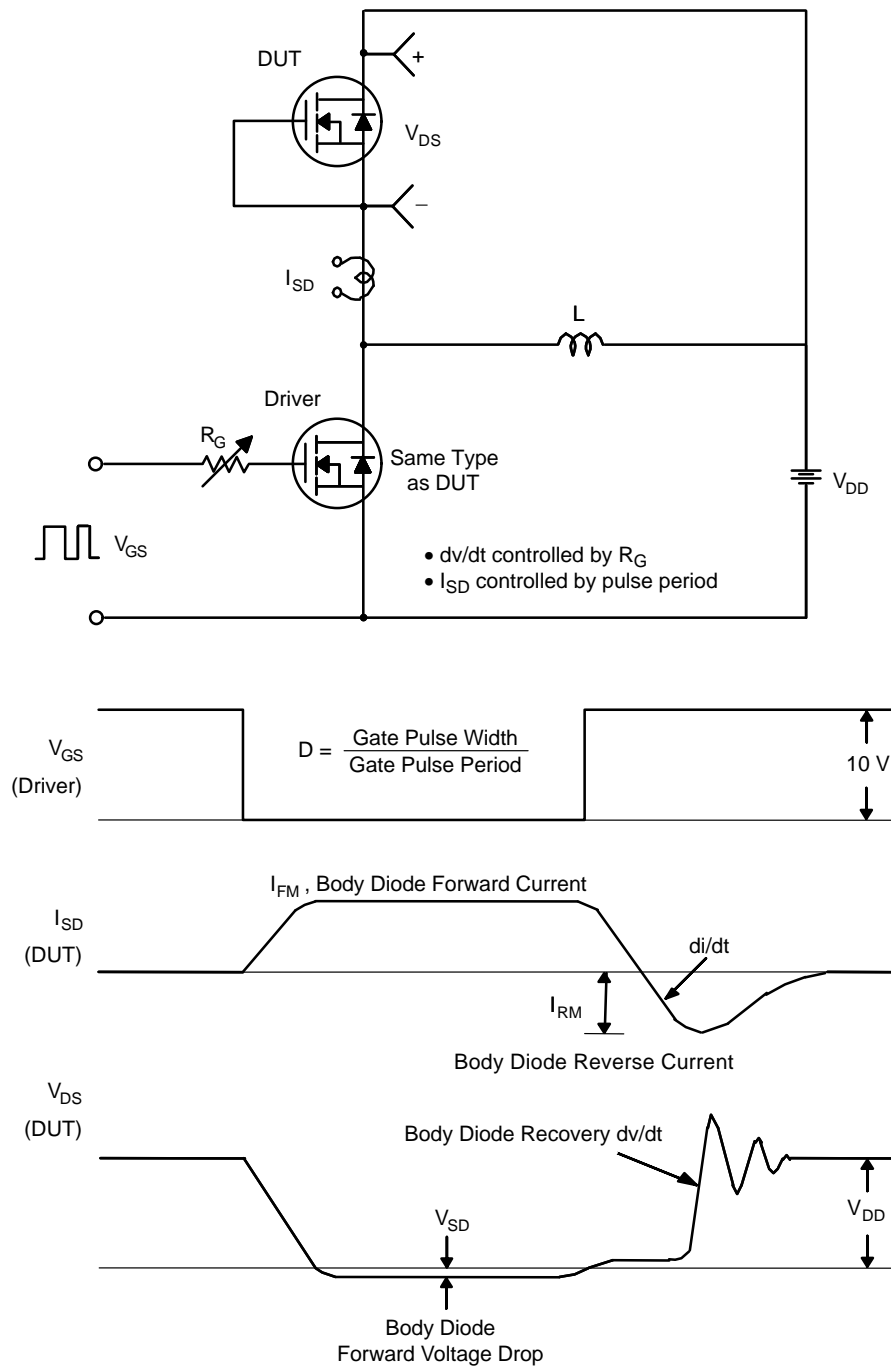


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

## FDB33N25



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

### PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping†
FDB33N25TM	FDB33N25	D <sup>2</sup> -PAK	800 / Tape & Reel

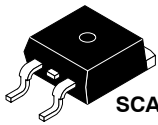
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



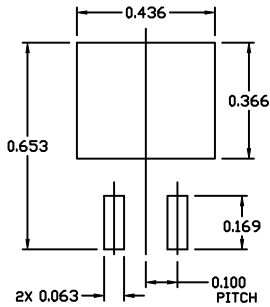
SCALE 1:1

### D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)

#### CASE 418AJ

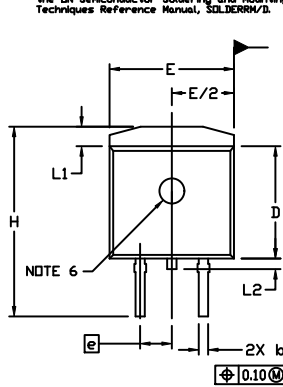
#### ISSUE F

DATE 11 MAR 2021



#### RECOMMENDED MOUNTING FOOTPRINT

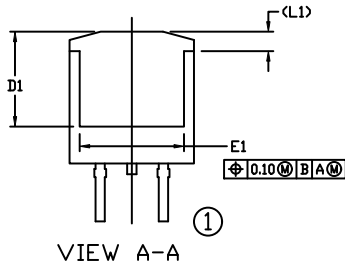
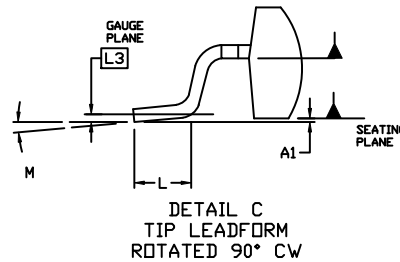
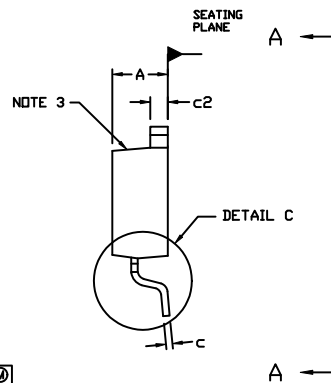
■ For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



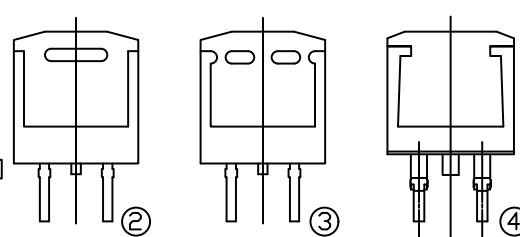
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
6. OPTIONAL MOLD FEATURE.
7. Ⓛ, Ⓞ ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100	BSC	2.54	BSC
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	---	0.066	---	1.68
L2	---	0.070	---	1.78
L3	0.010	BSC	0.25	BSC
M	0*	8*	0*	8*

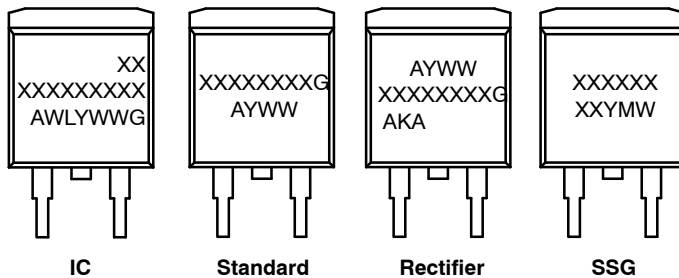


VIEW A-A



VIEW A-A  
OPTIONAL CONSTRUCTIONS

#### GENERIC MARKING DIAGRAMS\*



IC

Standard

Rectifier

SSG

- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- W = Week Code (SSG)
- M = Month Code (SSG)
- G = Pb-Free Package
- AKA = Polarity Indicator

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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<b>DESCRIPTION:</b>	<b>D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)</b>	<b>PAGE 1 OF 1</b>

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