

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

# MOSFET - UniFET™, N-Channel

## 300 V, 28 A, 129 mΩ

### FDB28N30TM

#### Description

UniFET™ MOSFET is ON 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.

#### Features

- Typical  $R_{DS(on)} = 108 \text{ m}\Omega$  at  $V_{GS} = 10 \text{ V}$ ,  $I_D = 14 \text{ A}$
- Low Gate Charge (Typical  $Q_g = 39 \text{ nC}$ )
- Low Reverse Transfer Capacitance  $C_{rss}$  (Typical  $C_{rss} = 35 \text{ pF}$ )
- 100% Avalanche Tested
- This Device is Pb-Free and is RoHS Compliant

#### Applications

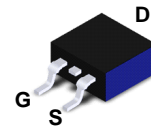
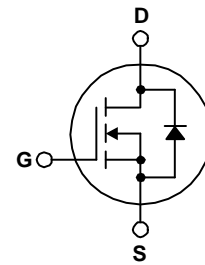
- Uninterruptible Power Supply
- AC-DC Power Supply



**ON Semiconductor®**

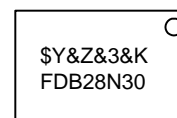
[www.onsemi.com](http://www.onsemi.com)

#### N-Channel



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

#### MARKING DIAGRAM



- |          |                         |
|----------|-------------------------|
| \$Y      | = ON Semiconductor Logo |
| &Z       | = Assembly Plant Code   |
| &3       | = Numeric Date Code     |
| &K       | = Lot Code              |
| FDB28N30 | = Specific Device Code  |

#### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDB28N30TM

## MOSFET MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Ratings	Units
V <sub>DSS</sub>	Drain to Source Voltage	300	V
V <sub>GSS</sub>	Gate to Source Voltage	±30	V
I <sub>D</sub>	Drain Current –Continuous (T <sub>C</sub> = 25°C)	28	A
	–Continuous (T <sub>C</sub> = 100°C)	19	
I <sub>DM</sub>	Drain Current –Pulsed (Note 1)	112	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	588	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	28	A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	25	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> = 25°C)	250	W
	–Derate above 25°C	2.0	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	–55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 seconds	300	°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 = 1.5 mH, I<sub>AS</sub> = 28 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> ≤ 28 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Units
R <sub>θJC</sub>	Maximum Thermal Resistance, Junction to Case	0.5	°C/W
R <sub>θJA</sub>	Maximum Thermal Resistance, Junction to Ambient (1 in <sup>2</sup> Pad of 2-oz Copper)	40	°C/W
R <sub>θJA</sub>	Maximum Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper)	62.5	°C/W

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping <sup>†</sup>
FDB28N30TM	FDB28N30	D <sup>2</sup> PAK-3 (TO-263, 3-LEAD) (Pb-Free)	800 units / Tape & Reel

<sup>†</sup>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

# FDB28N30TM

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
--------	-----------	-----------------	------	------	------	-------

### OFF CHARACTERISTICS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$ , $T_J = 25^\circ\text{C}$	300			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$		0.4		$\text{V}/^\circ\text{C}$
$I_{DSS}$	Drain-to-Source Leakage Current	$V_{DS} = 300 \text{ V}$ , $V_{GS} = 0 \text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 240 \text{ V}$ , $T_C = 125^\circ\text{C}$			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	$V_{GS} = 10 \text{ V}$ , $I_D = 14 \text{ A}$		0.108	0.129	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 40 \text{ V}$ , $I_D = 14 \text{ A}$		24.8		s

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$		1690	2250	pF
$C_{oss}$	Output Capacitance			305	405	pF
$C_{rSS}$	Reverse Transfer Capacitance			35	50	pF
$Q_g$	Total Gate Charge at 10 V	$V_{DS} = 240 \text{ V}$ , $I_D = 28 \text{ A}$ , $V_{GS} = 10 \text{ V}$ (Note 4)		39	50	nC
$Q_{gs}$	Gate to Source Gate Charge			12		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			17		nC

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 150 \text{ V}$ , $I_D = 28 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_G = 25 \Omega$ (Note 4)		35	80	ns
$t_r$	Turn-On Rise Time			135	280	ns
$t_{d(off)}$	Turn-Off Delay Time			79	168	ns
$t_f$	Turn-Off Fall Time			69	148	ns

### DRAIN-SOURCE DIODE CHARACTERISTICS

$I_S$	Maximum Continuous Drain to Source Diode Forward Current				28	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current				112	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 28 \text{ A}$			1.4	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 28 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$		279		ns
$Q_{rr}$	Reverse Recovery Charge			2.7		$\mu\text{C}$

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

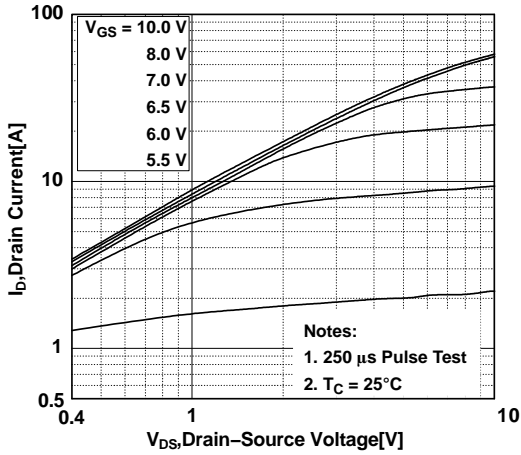


Figure 1. On-Region Characteristics

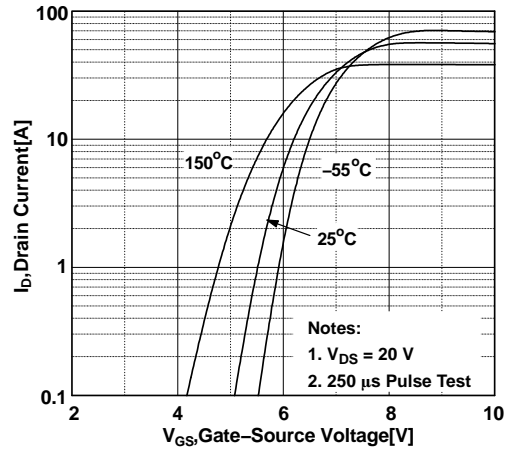


Figure 2. Transfer Characteristics

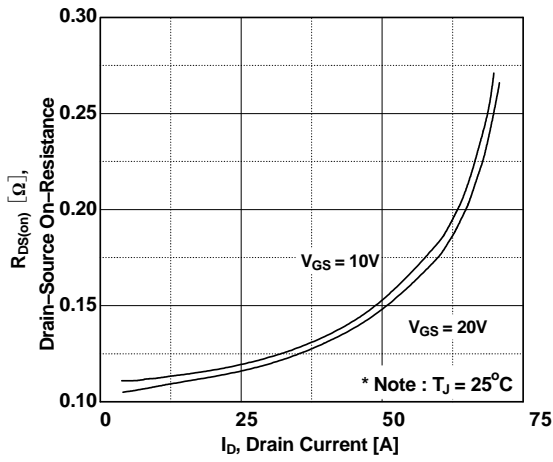


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

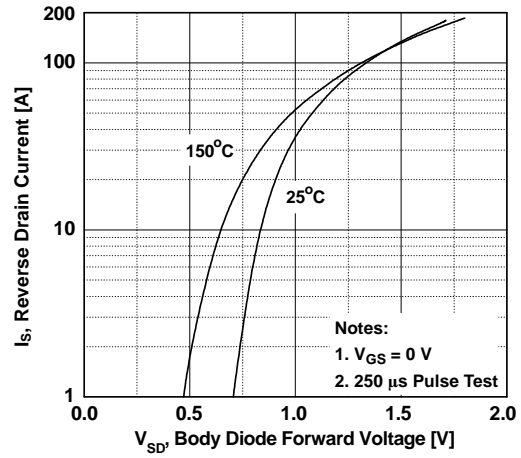


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

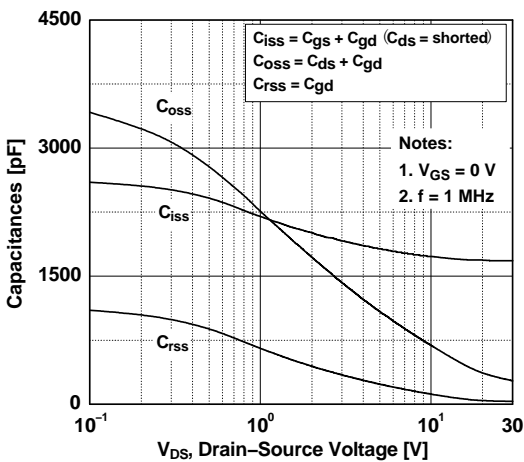


Figure 5. Capacitance Characteristics

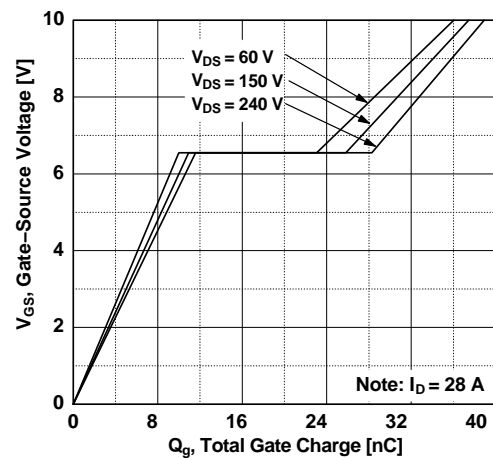


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

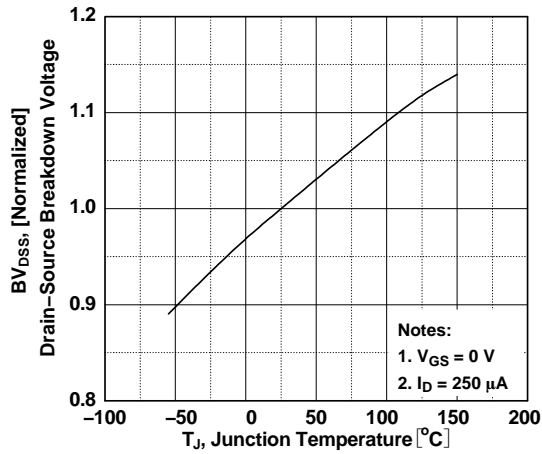


Figure 7. Breakdown Voltage Variation vs. Temperature

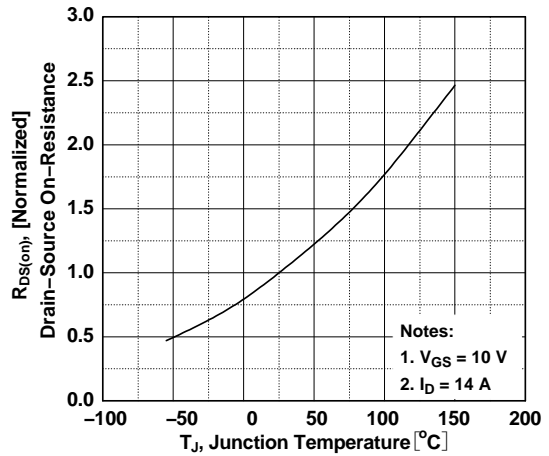


Figure 8. On-Resistance Variation vs. Temperature

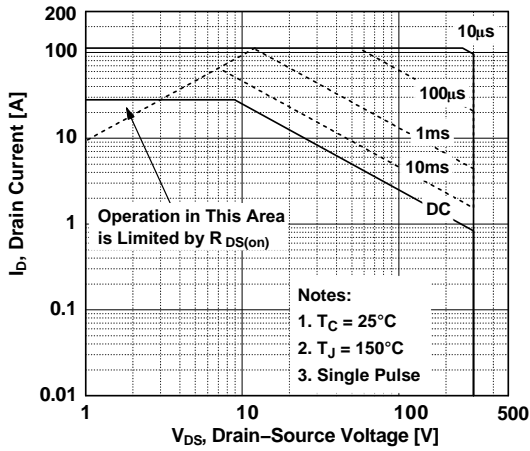


Figure 9. Maximum Safe Operating Area

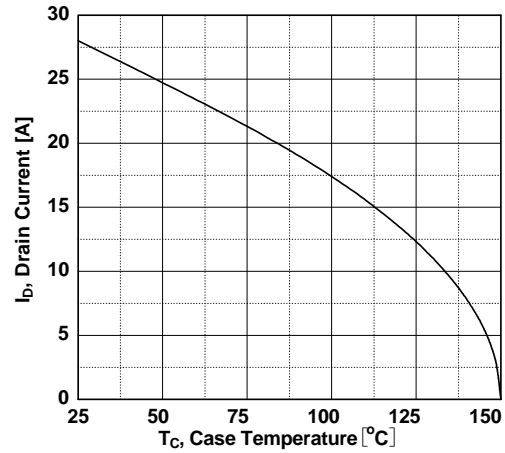


Figure 10. Maximum Drain Current vs. Case Temperature

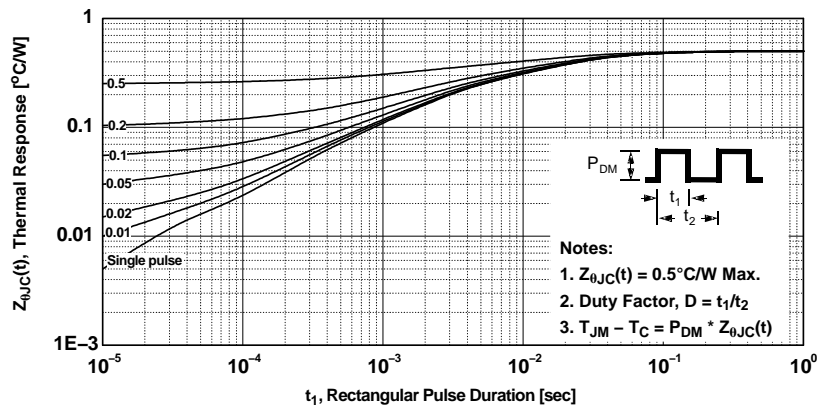


Figure 11. Transient Thermal Response Curve

# FDB28N30TM

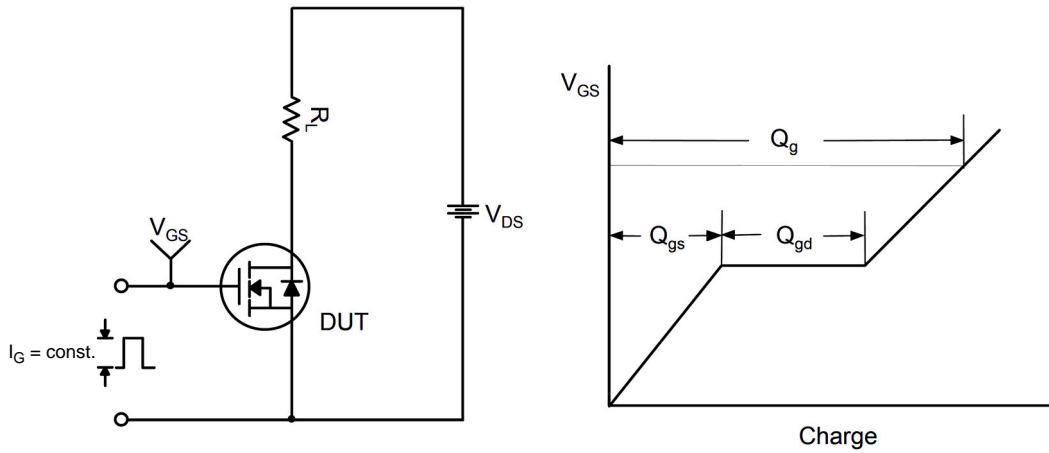


Figure 12. Gate Charge Test Circuit & Waveform

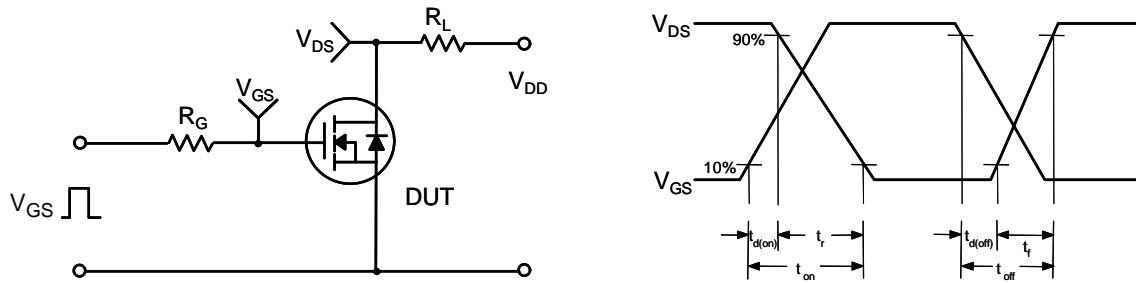


Figure 13. Resistive Switching Test Circuit & Waveform

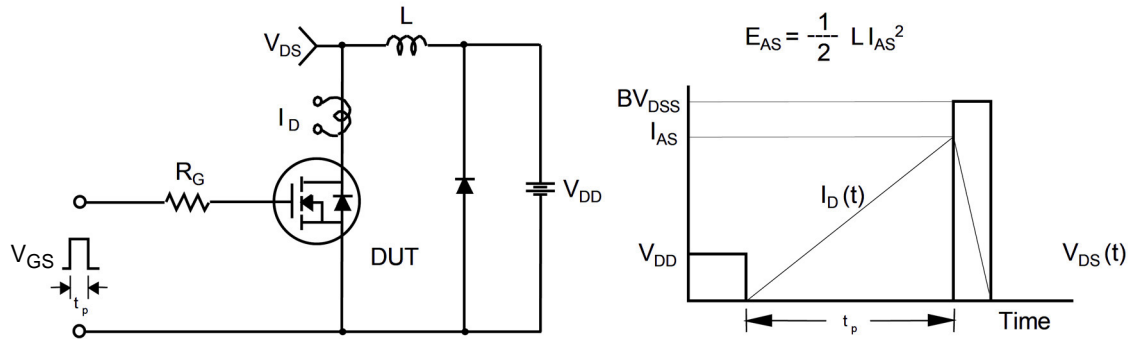


Figure 14. Unclamped inductive Switching Test Circuit & Waveform

# FDB28N30TM

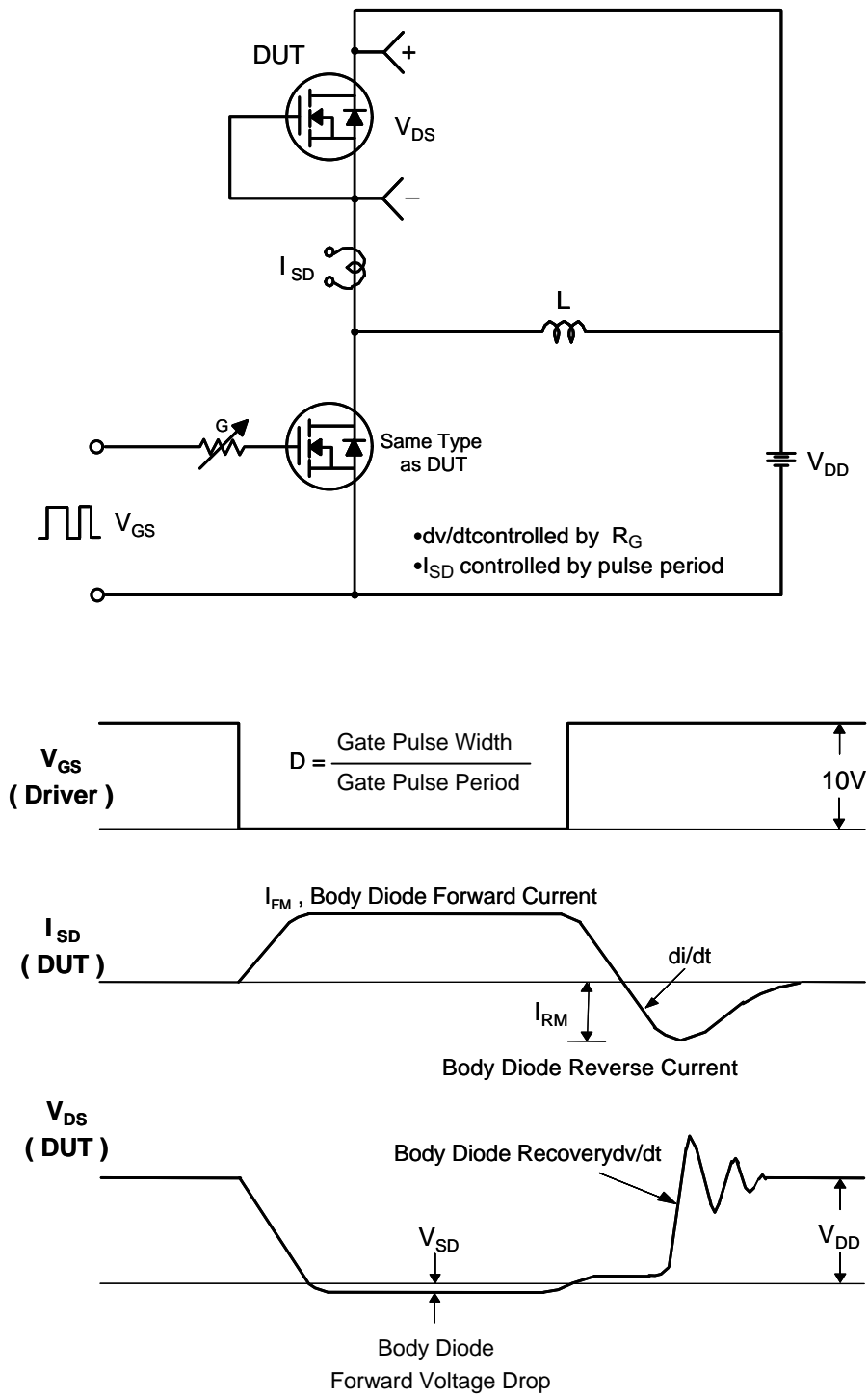


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveform



# 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

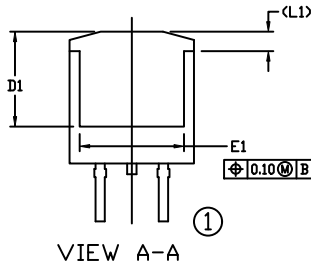
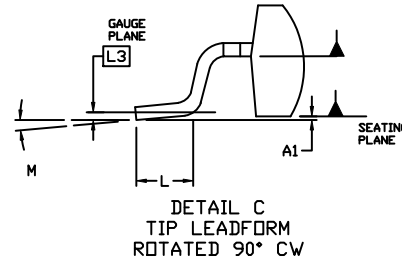
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



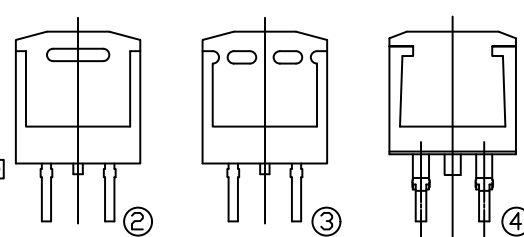
#### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- CONTROLLING DIMENSION: INCHES
- CHAMFER OPTIONAL.
- 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.
- THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- OPTIONAL MOLD FEATURE.
- ①, ② ... 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*

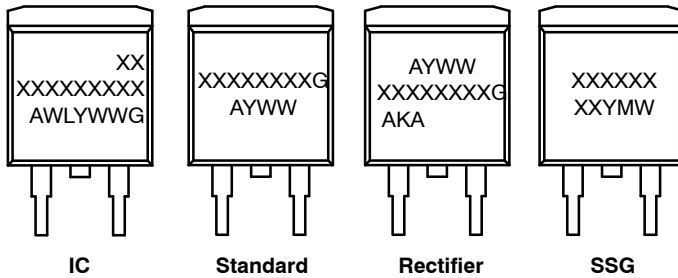


VIEW A-A



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.

<b>DOCUMENT NUMBER:</b>	<b>98AON56370E</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)</b>	<b>PAGE 1 OF 1</b>

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

North American Technical Support:  
Voice Mail: 1 800-282-9855 Toll Free USA/Canada  
Phone: 011 421 33 790 2910

### Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative

