

# FDMS86581

## MOSFET, N-Channel, POWERTRENCH<sup>®</sup>, 60 V, 30 A, 15 mΩ

### Features

- Typical  $R_{DS(on)}$  = 12.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 30$  A
- Typical  $Q_{G(tot)}$  = 13 nC at  $V_{GS} = 10$  V,  $I_D = 25$  A
- UIS Capability
- RoHS Compliant

### Applications

- DC–DC Power Supplies
- AC–DC Power Supplies
- Motor Control
- Load Switching

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

Symbol	Parameter	Ratings	Unit
$V_{DSS}$	Drain-to-Source Voltage	60	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous ( $V_{GS} = 10$ ) $T_C = 25^\circ\text{C}$ (Note 1)	30	A
	Pulsed Drain Current, $T_C = 25^\circ\text{C}$	See Figure 4	
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	13.5	mJ
$P_D$	Power Dissipation	50	W
	Derate Above $25^\circ\text{C}$	0.33	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature	$-55$ to $+175$	$^\circ\text{C}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient (Note 3)	50	$^\circ\text{C}/\text{W}$

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.

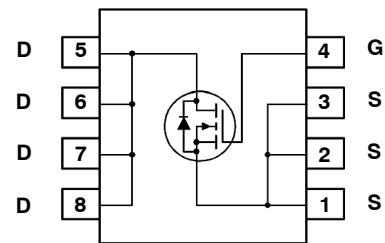
1. Current is limited by bondwire configuration.
2. Starting  $T_J = 25^\circ\text{C}$ ,  $L = 40$   $\mu\text{H}$ ,  $I_{AS} = 26$  A,  $V_{DD} = 60$  V during inductor charging and  $V_{DD} = 0$  V during time in avalanche.
3.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design, while  $R_{\theta JA}$  is determined by the board design. The maximum rating presented here is based on mounting on a 1 in<sup>2</sup> pad of 2 oz copper.



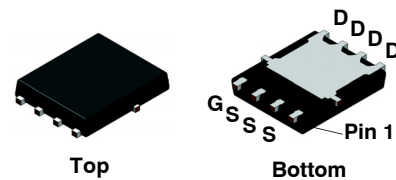
ON Semiconductor<sup>®</sup>

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

### ELECTRICAL CONNECTION

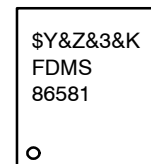


N-Channel MOSFET



Power 56  
(PQFN8 5x6)  
CASE 483AE

### MARKING DIAGRAM



- \$Y = ON Semiconductor Logo
- &Z = Assembly Plant Code
- &3 = Numeric Date Code
- &K = Lot Code
- FDMS86581 = Specific Device Code

### ORDERING INFORMATION

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

# FDMS86581

## PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Shipping <sup>†</sup>
FDMS86581	FDMS86581	Power 56	3000 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.

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

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

### OFF CHARACTERISTICS

B <sub>VDSS</sub>	Drain-to-Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V	60	–	–	V	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	T <sub>J</sub> = 25°C	–	–	1	A
			T <sub>J</sub> = 175°C (Note 4)	–	–	1	mA
I <sub>GSS</sub>	Gate-to-Source Leakage Current	V <sub>GS</sub> = ± 20 V	–	–	±100	nA	

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate to Source Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0	2.7	4.0	V	
R <sub>DS(on)</sub>	Drain to Source On Resistance	I <sub>D</sub> = 30 A, V <sub>GS</sub> = 10 V	T <sub>J</sub> = 25°C	–	12.5	15.0	mΩ
			T <sub>J</sub> = 175°C (Note 4)	–	25.1	30.1	mΩ

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	881	–	pF
C <sub>oss</sub>	Output Capacitance		–	281	–	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	15	–	pF
R <sub>G</sub>	Gate Resistance	f = 1 MHz	–	3.1	–	Ω
Q <sub>g(ToT)</sub>	Total Gate Charge	V <sub>GS</sub> = 0 to 10 V, V <sub>DD</sub> = 30 V, I <sub>D</sub> = 25 A	–	13	19	nC
Q <sub>g(th)</sub>	Threshold Gate Charge	V <sub>GS</sub> = 0 to 2 V, V <sub>DD</sub> = 30 V, I <sub>D</sub> = 25 A	–	2	–	nC
Q <sub>gs</sub>	Gate-to-Source Gate Charge	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 25 A	–	4	–	nC
Q <sub>gd</sub>	Gate-to-Drain "Miller" Charge		–	3	–	nC

### SWITCHING CHARACTERISTICS

t <sub>on</sub>	Turn-On Time	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 30 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω	–	–	20	ns
t <sub>d(on)</sub>	Turn-On Delay		–	9	–	ns
t <sub>r</sub>	Rise Time		–	5	–	ns
t <sub>d(off)</sub>	Turn-Off Delay		–	15	–	ns
t <sub>f</sub>	Fall Time		–	4	–	ns
t <sub>off</sub>	Turn-Off Time		–	–	28	ns

### DRAIN-SOURCE DIODE CHARACTERISTICS

V <sub>SD</sub>	Source-to-Drain Diode Voltage	I <sub>SD</sub> = 30 A, V <sub>GS</sub> = 0 V	–	–	1.25	V
		I <sub>SD</sub> = 15 A, V <sub>GS</sub> = 0 V	–	–	1.2	V
t <sub>rr</sub>	Reverse-Recovery Time	I <sub>F</sub> = 30 A, di <sub>SD</sub> /dt = 100 A/μs, V <sub>DD</sub> = 48 V	–	37	55	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	22	33	nC

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. The maximum value is specified by design at T<sub>J</sub> = 175°C. Product is not tested to this condition in production.

TYPICAL CHARACTERISTICS

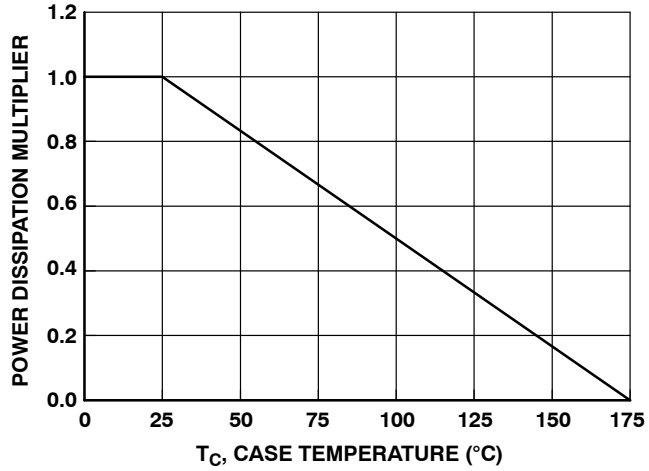


Figure 1. Normalized Power Dissipation vs. Case Temperature

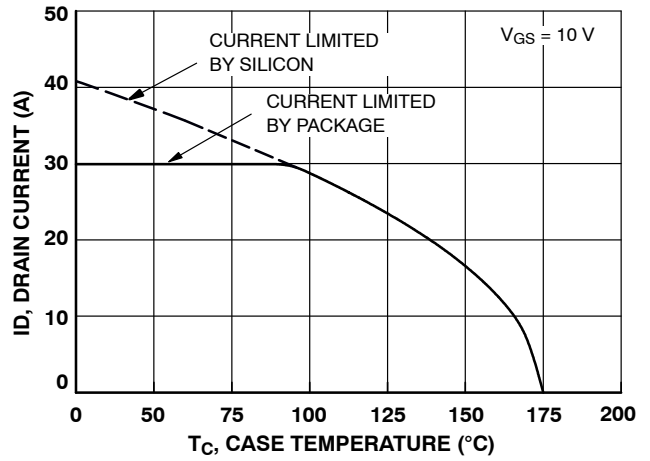


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

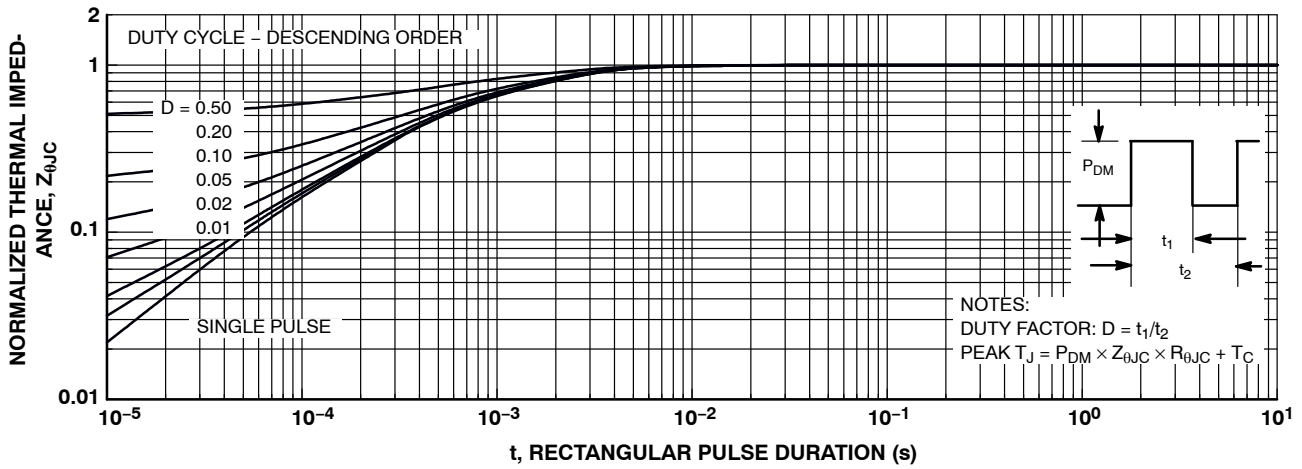


Figure 3. Normalized Maximum Transient Thermal Impedance

TYPICAL CHARACTERISTICS (continued)

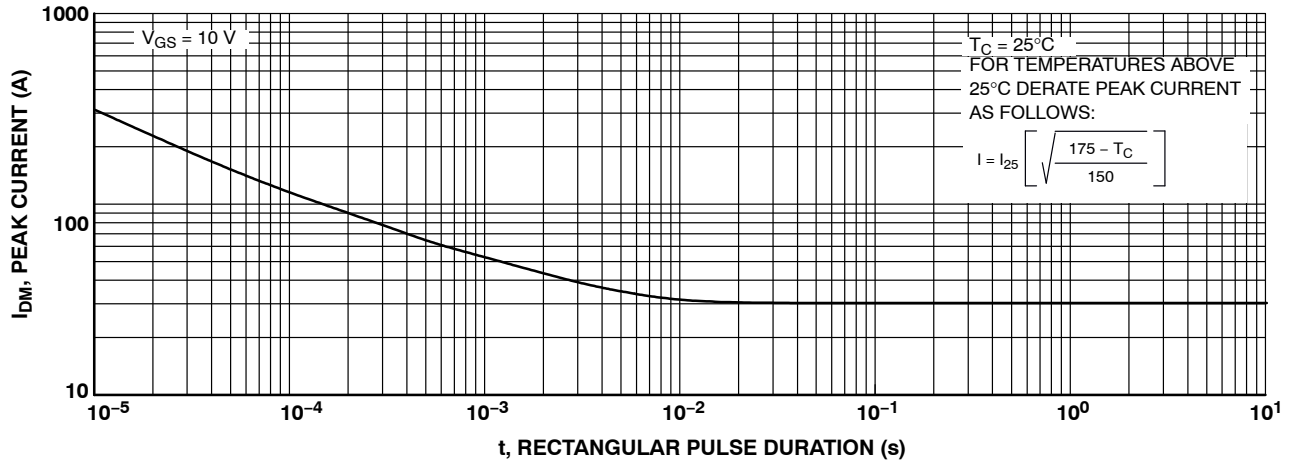


Figure 4. Peak Current Capability

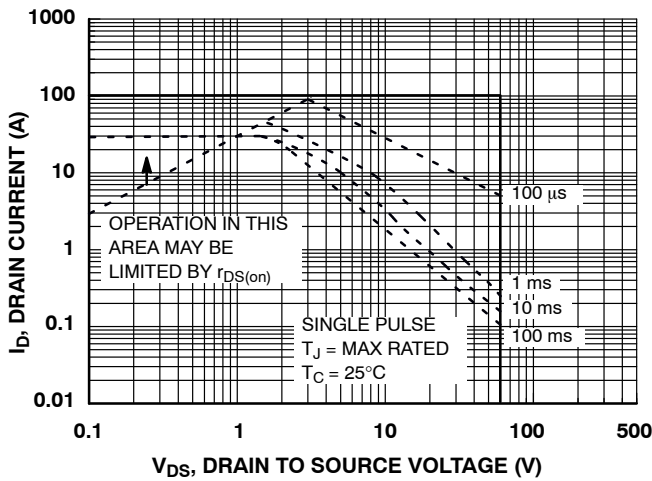
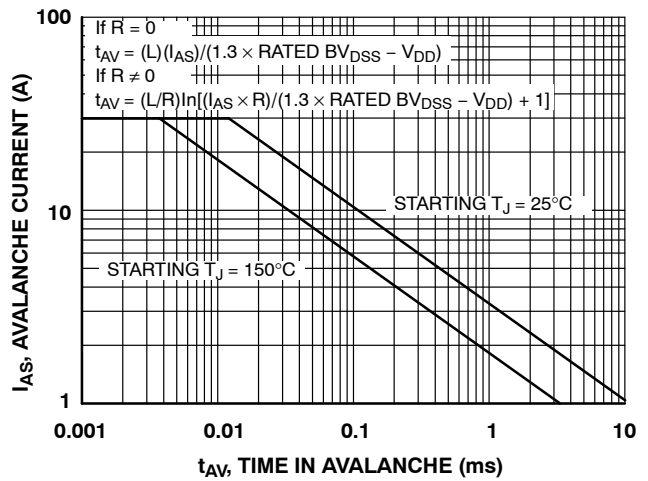


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to ON Semiconductor Application Notes [AN7514](#) and [AN7515](#).

Figure 6. Unclamped Inductive Switching Capability

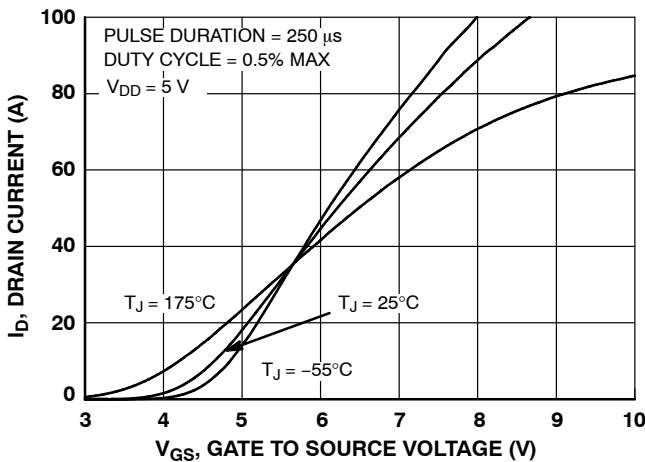


Figure 7. Transfer Characteristics

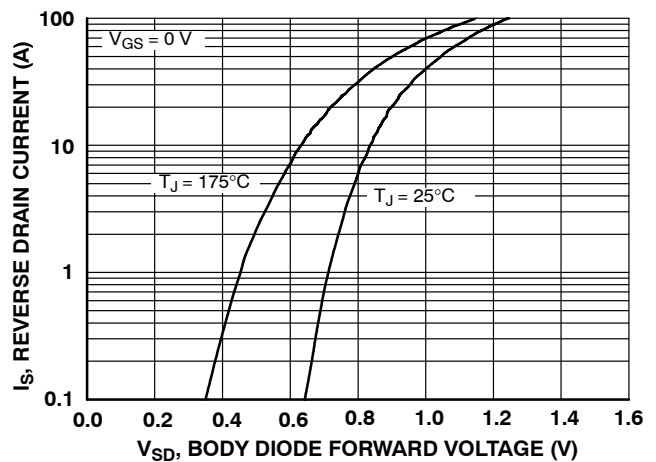


Figure 8. Forward Diode Characteristics

TYPICAL CHARACTERISTICS (continued)

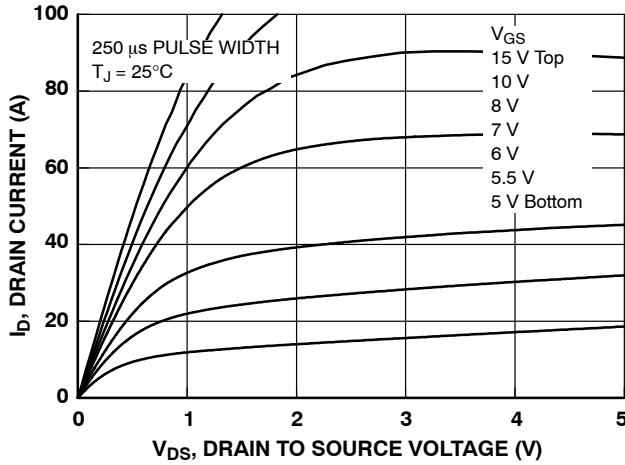


Figure 9. Saturation Characteristics

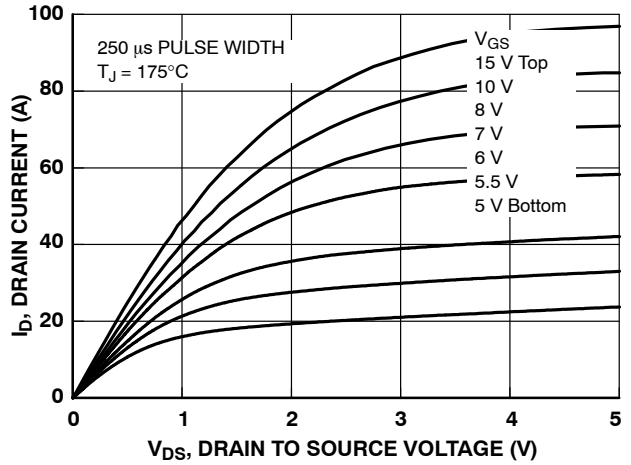


Figure 10. Saturation Characteristics

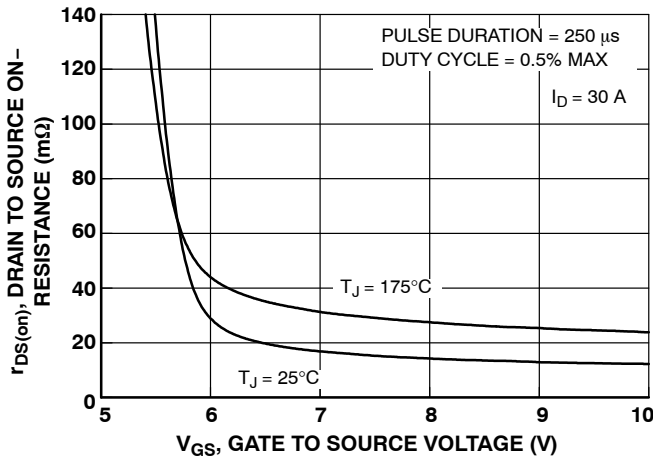


Figure 11.  $R_{DS(on)}$  vs. Gate Voltage

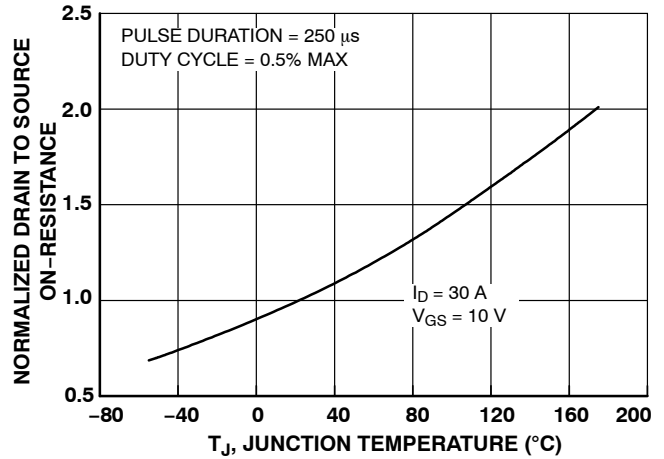


Figure 12. Normalized  $R_{DS(on)}$  vs. Junction Temperature

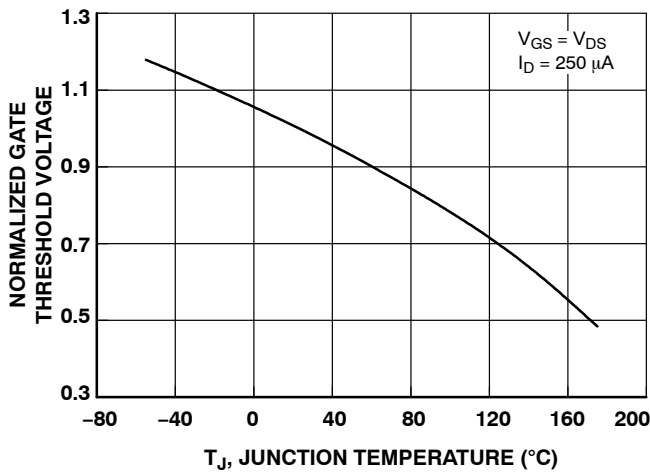


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

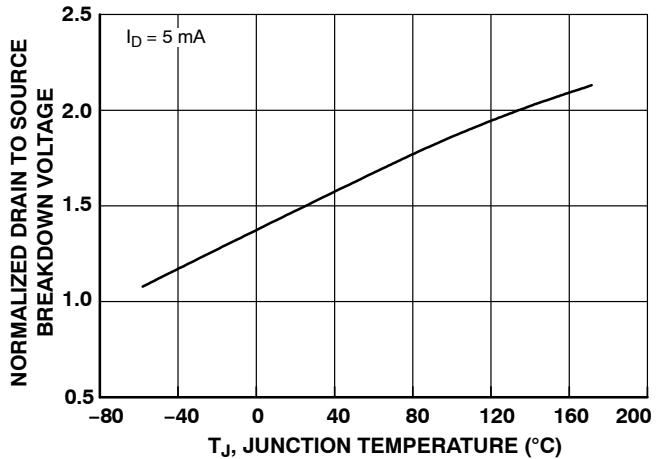


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

TYPICAL CHARACTERISTICS (continued)

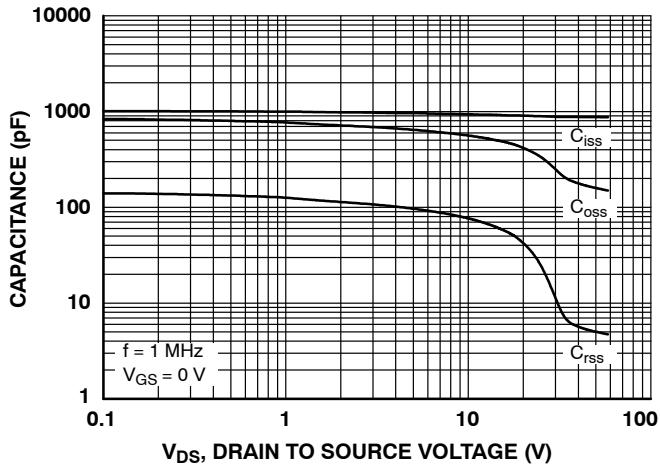


Figure 15. Capacitance vs. Drain to Source Voltage

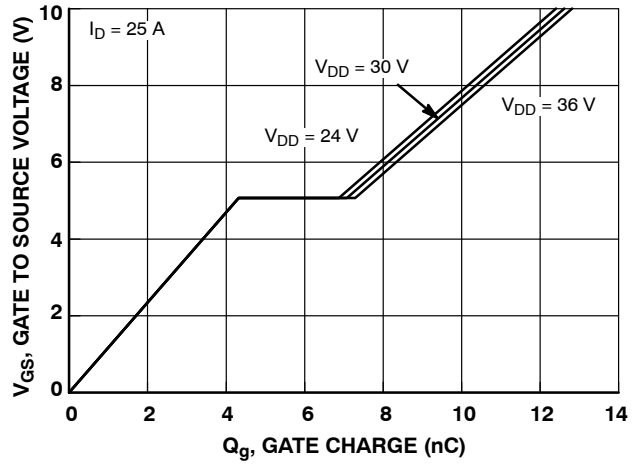
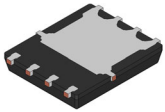


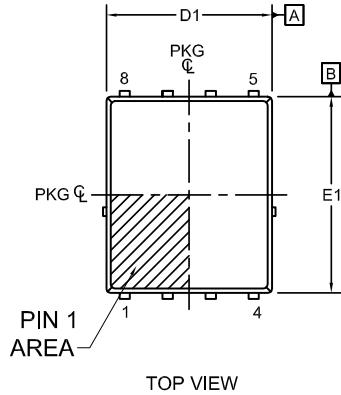
Figure 16. Gate Charge vs. Gate to Source Voltage

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



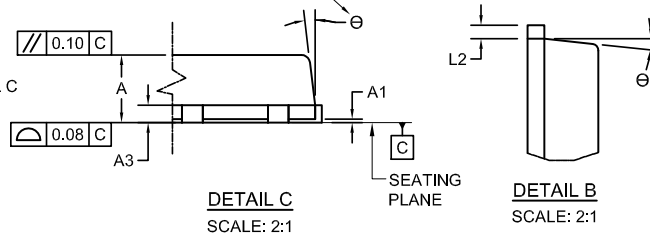
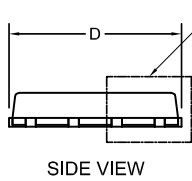
**PQFN8 5X6, 1.27P**  
CASE 483AE  
ISSUE C

DATE 21 JAN 2022

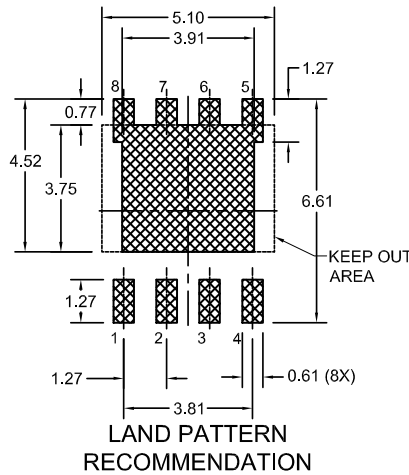
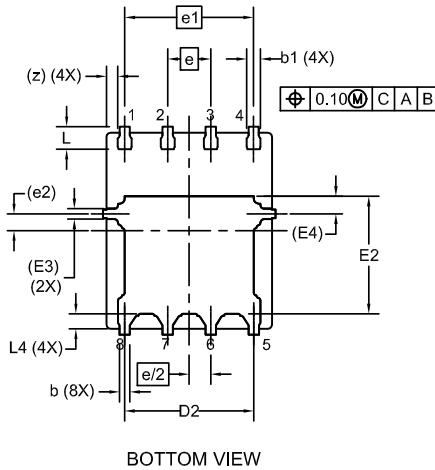


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
b	0.21	0.31	0.41
b1	0.31	0.41	0.51
A3	0.15	0.25	0.35
D	4.90	5.00	5.20
D1	4.80	4.90	5.00
D2	3.61	3.82	3.96
E	5.90	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.78
E3	0.30 REF		
E4	0.52 REF		
e	1.27 BSC		
e/2	0.635 BSC		
e1	3.81 BSC		
e2	0.50 REF		
L	0.51	0.66	0.76
L2	0.05	0.18	0.30
L4	0.34	0.44	0.54
z	0.34 REF		
θ	0°	-	12°



\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

<b>DOCUMENT NUMBER:</b>	<b>98AON13655G</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>PQFN8 5X6, 1.27P</b>	<b>PAGE 1 OF 1</b>

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the 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. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **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**'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). **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.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

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

**onsemi 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