

# MOSFET – P-Channel, POWERTRENCH®

**-20 V, -56 A, 6.5 mΩ**

## FDMC6688P

### General Description

This P-Channel MOSFET is produced using onsemi's advanced POWERTRENCH process that has been optimized for  $R_{DS(on)}$ , switching performance and ruggedness.

### Features

- Max  $R_{DS(on)}$  = 6.5 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -14$  A
- Max  $R_{DS(on)}$  = 9.8 mΩ at  $V_{GS} = -2.5$  V,  $I_D = -11$  A
- Max  $R_{DS(on)}$  = 20 mΩ at  $V_{GS} = -1.8$  V,  $I_D = -9$  A
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### Applications

- Load Switch
- Battery Management
- Power Management
- Reverse Polarity Protection

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

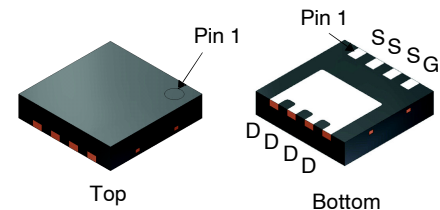
Symbol	Parameter	Ratings	Unit
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current -Continuous, $T_C = 25^\circ\text{C}$ -Continuous, $T_A = 25^\circ\text{C}$ (Note 1a) -Pulsed (Note 3)	-56 -14 -226	A
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$ $T_A = 25^\circ\text{C}$ (Note 1a)	30 2.3	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°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.

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

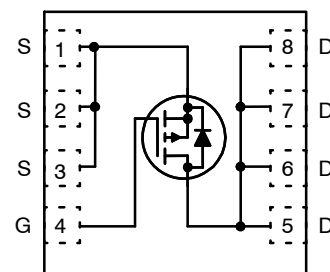
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	°C/W

$V_{DS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
-20 V	6.5 mΩ @ -4.5 V	-56 A
	9.8 mΩ @ -2.5 V	
	20 mΩ @ -1.8 V	

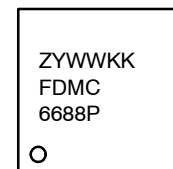


PQFN8 3.3X3.3, 0.65P  
(Power 33)  
CASE 483AX

### PIN ASSIGNMENT



### MARKING DIAGRAM



- Z = Assembly Plant Code
- YWW = Date Code (Year & Week)
- KK = Lot Traceability Code
- FDMC6688P = Specific Device Code

### ORDERING INFORMATION

Device	Package	Shipping†
FDMC6688P	PQFN8 (Power 33) (Pb-Free)	3,000 / Tape & Reel

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

# FDMC6688P

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
--------	-----------	-----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = -250 μA, V <sub>GS</sub> = 0 V	-20	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = -250 μA, referenced to 25°C	-	-16	-	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -16 V, V <sub>GS</sub> = 0 V	-	-	-1	μA
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±8 V, V <sub>DS</sub> = 0 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	-0.4	-0.75	-1	V
ΔV <sub>GS(th)</sub> / ΔT <sub>J</sub>	Gate to Source Threshold Voltage Temperature Coefficient	I <sub>D</sub> = -250 μA, referenced to 25°C	-	3	-	mV/°C
R <sub>DS(on)</sub>	Static Drain to Source On-Resistance	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -14 A	-	5.3	6.5	mΩ
		V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -11 A	-	7	9.8	
		V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -9 A	-	10.7	20	
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -14 A, T <sub>J</sub> = 125°C	-	7.3	11	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = -5 V, I <sub>D</sub> = -14 A	-	80	-	S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	4956	7435	pF
C <sub>oss</sub>	Output Capacitance		-	678	1020	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	618	930	pF
R <sub>g</sub>	Gate Resistance		-	4.5	-	Ω

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = -10 V, I <sub>D</sub> = -14 A, V <sub>GS</sub> = -4.5 V, R <sub>GEN</sub> = 6 Ω	-	19	35	ns
t <sub>r</sub>	Rise Time		-	33	53	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	119	190	ns
t <sub>f</sub>	Fall Time		-	68	109	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DD</sub> = -10 V, I <sub>D</sub> = -14 A, V <sub>GS</sub> = -4.5 V	-	44	61	nC
Q <sub>gs</sub>	Gate to Source Charge		-	7.4	-	nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge		-	11	-	nC

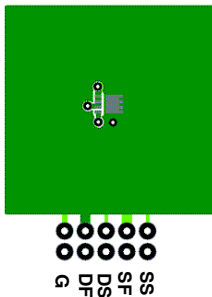
### DRAIN-SOURCE DIODE CHARACTERISTICS

V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -14 A (Note 2)	-	-0.8	-1.2	V
		V <sub>GS</sub> = 0 V, I <sub>S</sub> = -2 A (Note 2)	-	-0.6	-1.2	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = -14 A, di/dt = 100 A/μs	-	26	41	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	10	20	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.

#### NOTES:

- R<sub>θJA</sub> is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material. R<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.



- a. 53°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



- b. 125°C/W when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0 %.
- Pulse Id refers to Forward Bias Safe Operation Area.

TYPICAL CHARACTERISTICS

( $T_J = 25^\circ\text{C}$  Unless Otherwise Noted)

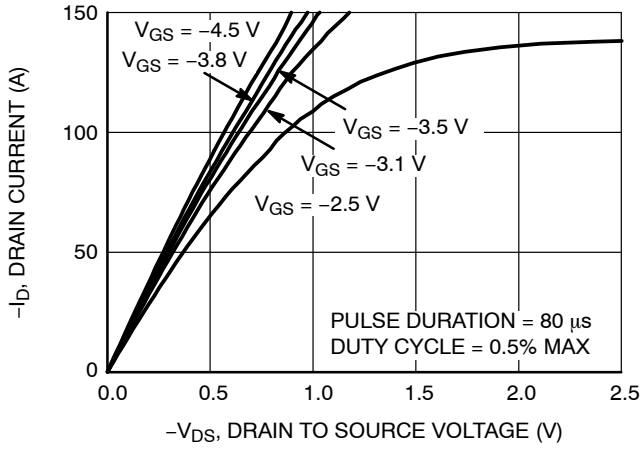


Figure 1. On-Region Characteristics

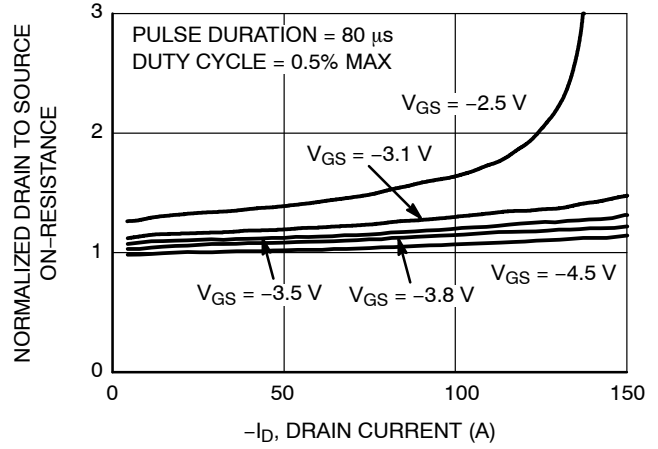


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

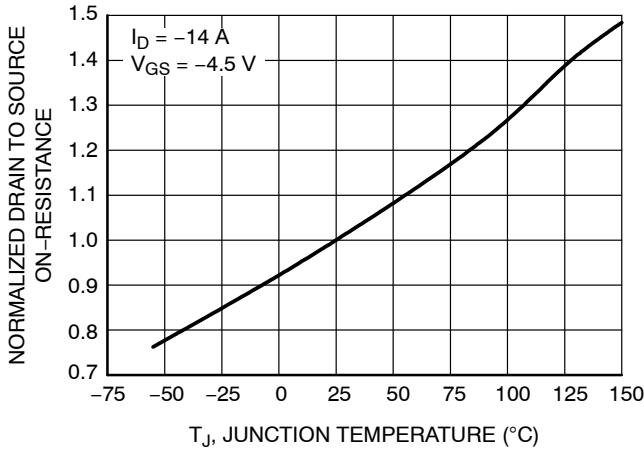


Figure 3. Normalized On-Resistance vs. Junction Temperature

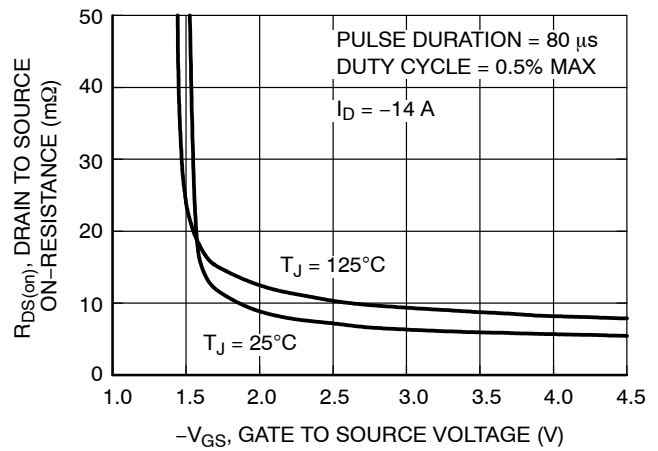


Figure 4. On-Resistance vs. Gate to Source Voltage

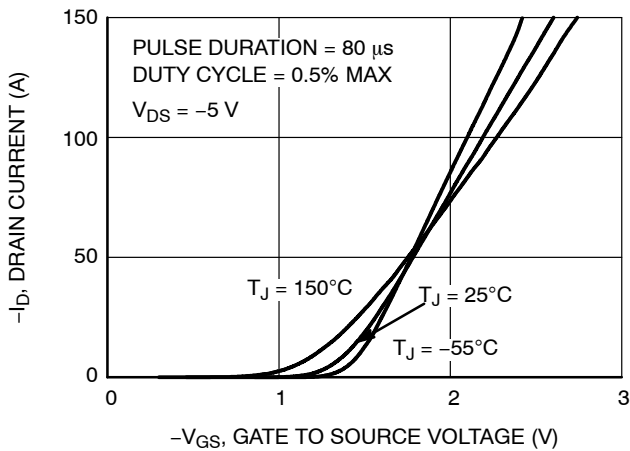


Figure 5. Transfer Characteristics

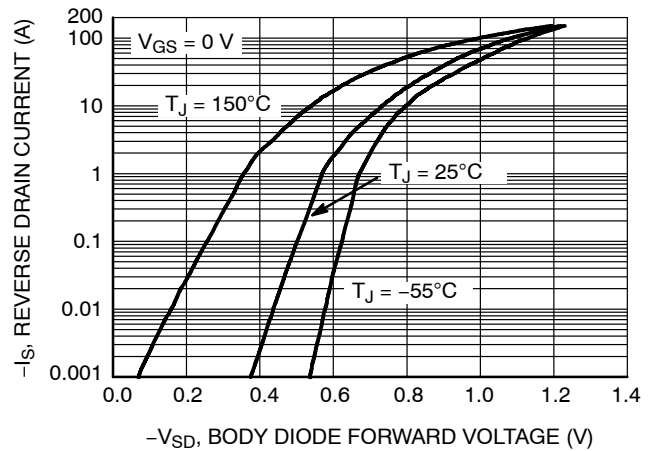


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

( $T_J = 25^\circ\text{C}$  Unless Otherwise Noted)

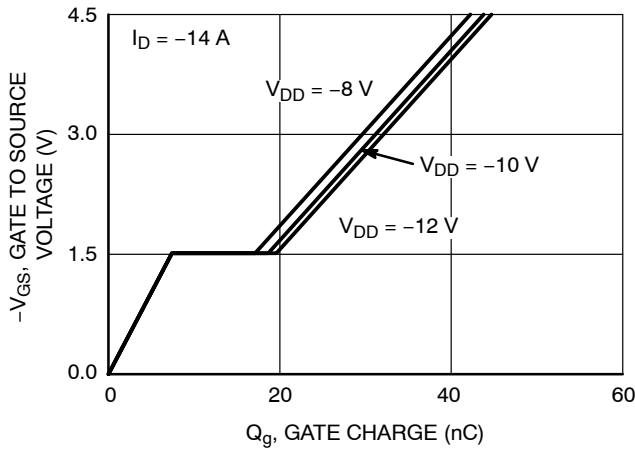


Figure 7. Gate Charge Characteristics

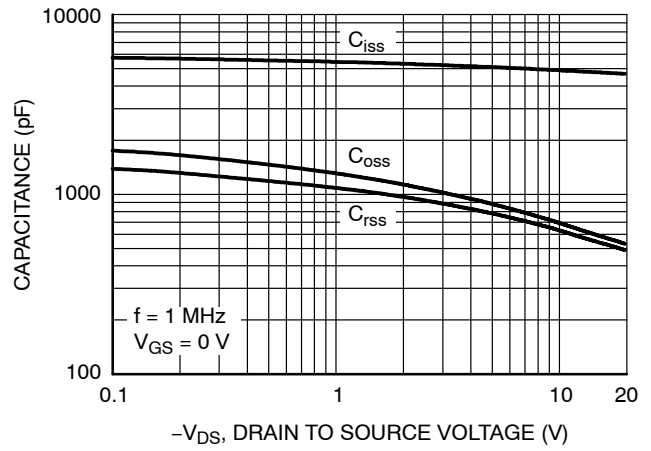


Figure 8. Capacitance vs. Drain to Source Voltage

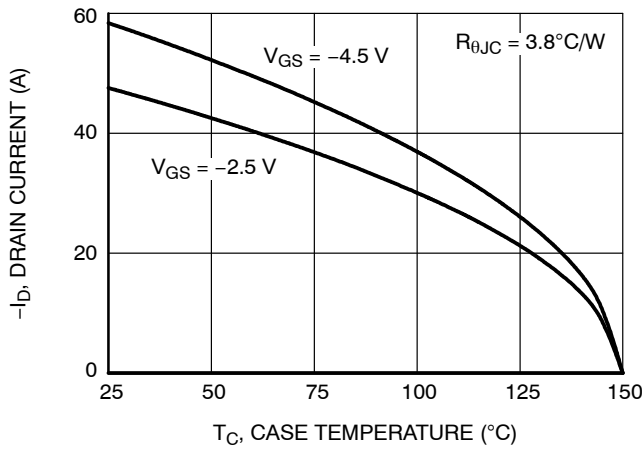


Figure 9. Maximum Continuous Drain Current vs. Case Temperature

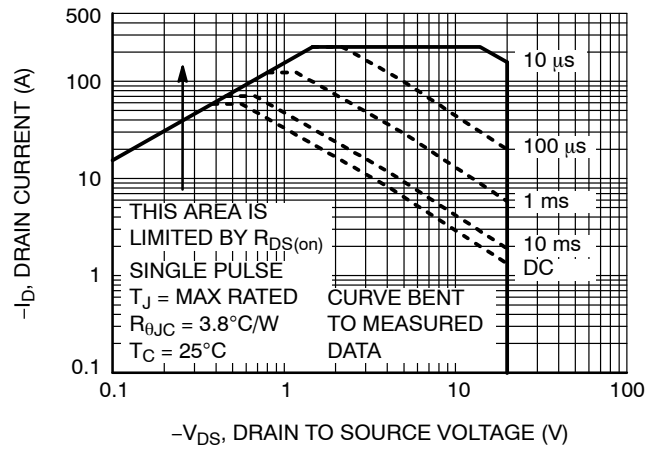


Figure 10. Forward Bias Safe Operating Area

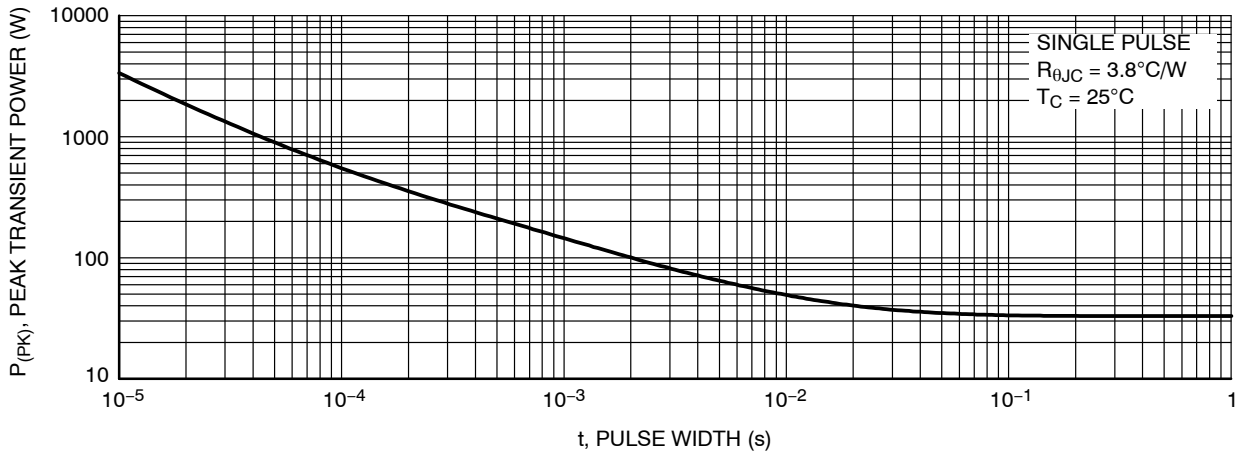


Figure 11. Single Pulse Maximum Power Dissipation

# FDMC6688P

## TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

( $T_J = 25^\circ\text{C}$  Unless Otherwise Noted)

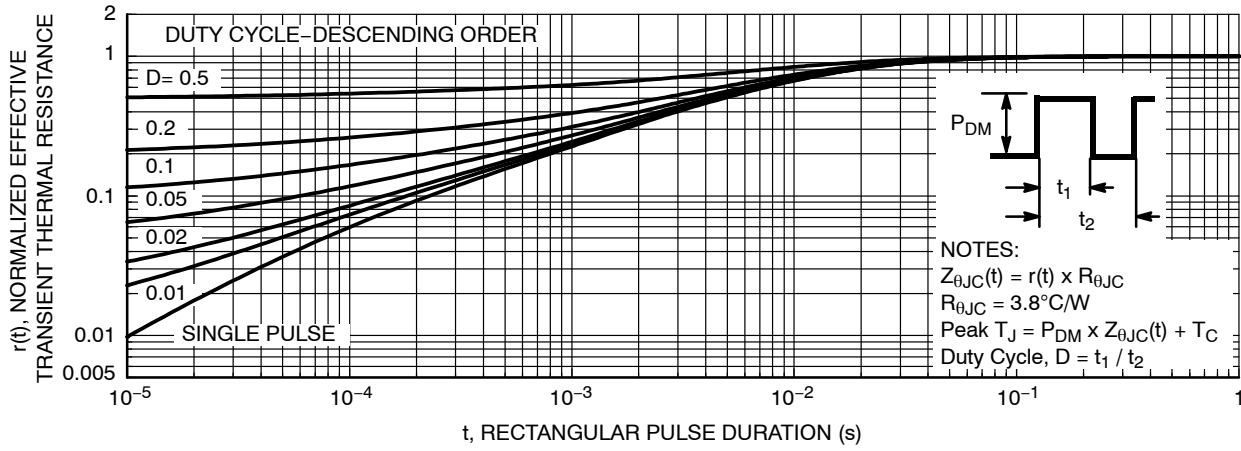
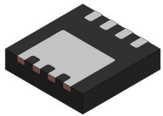


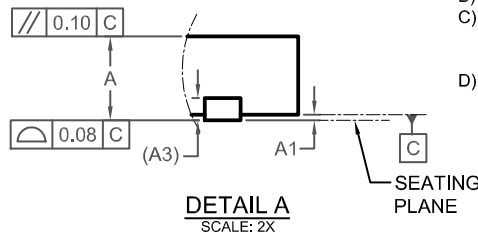
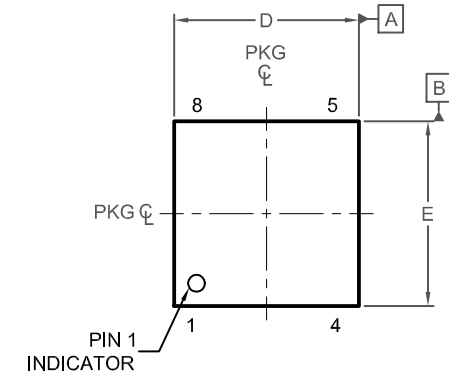
Figure 12. Junction-to-Case Transient Thermal Response Curve

POWERTRENCH is registered trademark of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.



**PQFN8 3.3X3.3, 0.65P**  
**CASE 483AX**  
**ISSUE B**

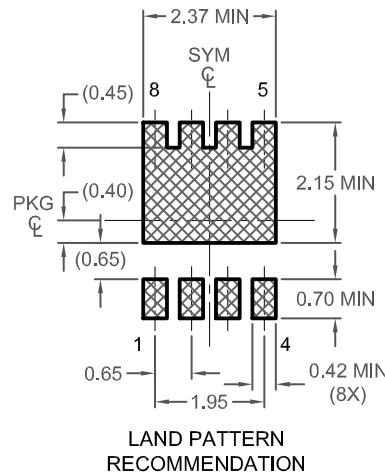
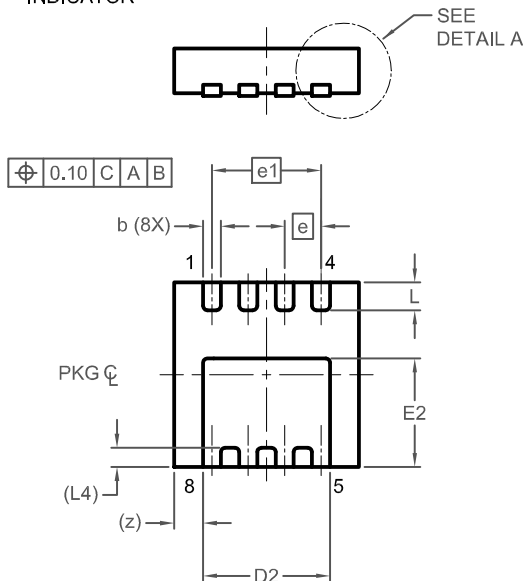
DATE 24 JUN 2022



NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	-	0.05
A3	0.20 REF		
b	0.27	0.32	0.37
D	3.20	3.30	3.40
D2	2.17	2.27	2.37
E	3.20	3.30	3.40
E2	1.84	1.94	2.04
e	0.65 BSC		
e1	1.95 BSC		
L	0.40	0.50	0.60
L4	0.34 REF		
z	0.52 REF		



\*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>98AON13673G</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 3.3X3.3, 0.65P</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.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)

