

# MOSFET – P-Channel, POWERTRENCH®

-100 V, -15 A, 67 mΩ

## FDMC86139P

### General Description

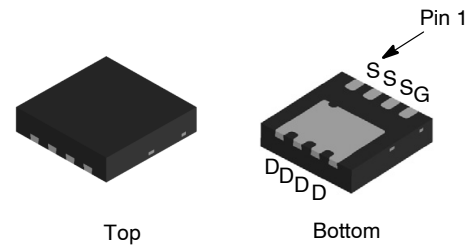
This P-Channel MOSFET is produced using onsemi's advanced POWERTRENCH technology. This very high density process is especially tailored to minimize on-state resistance and optimized for superior switching performance.

### Features

- Max  $r_{DS(on)}$  = 67 mΩ at  $V_{GS} = -10$  V,  $I_D = -4.4$  A
- Max  $r_{DS(on)}$  = 89 mΩ at  $V_{GS} = -6$  V,  $I_D = -3.6$  A
- Very Low RDS-On Mid Voltage P Channel Silicon Technology Optimised for Low Qg
- This Product is Optimised for Fast Switching Applications as well as Load Switch Applications
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

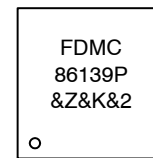
### Applications

- Active Clamp Switch
- Load Switch



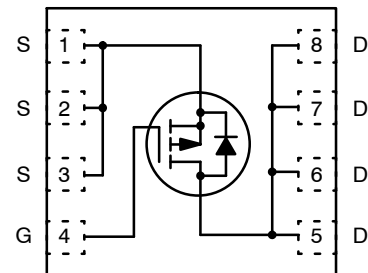
WDFN8 3.3x3.3, 0.65P  
CASE 511DH

### MARKING DIAGRAM



- FDMC = Specific Device Code
- 86139P = Specific Device Code
- &Z = Assembly Location
- &K = Lot Run Traceability Code
- &2 = Date Code (Year and Week)

### PIN ASSIGNMENT



P-Channel MOSFET

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# FDMC86139P

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

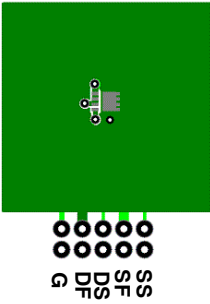
Symbol	Parameter	Rating	Unit	
$V_{DS}$	Drain to Source Voltage	100	V	
$V_{GS}$	Gate to Source Voltage	$\pm 25$	V	
$I_D$	Drain Current	Continuous	$T_C = 25^\circ\text{C}$	A
		Continuous (Note 1a)	$T_A = 25^\circ\text{C}$	
		Pulsed		
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	121	mJ	
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	40	W
	Power Dissipation (Note 1a)	$T_A = 25^\circ\text{C}$	2.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to + 150	$^\circ\text{C}$	

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.

## THERMAL CHARACTERISTICS

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.1	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a.  $53^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- Starting  $T_J = 25^\circ\text{C}$ ; P-ch:  $L = 3 \text{ mH}$ ,  $I_{AS} = -9 \text{ A}$ ,  $V_{DD} = -100 \text{ V}$ ,  $V_{GS} = -10 \text{ V}$ . 100% test at  $L = 0.1 \text{ mH}$ ,  $I_{AS} = -28 \text{ A}$

# FDMC86139P

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = -250 μA, V <sub>GS</sub> = 0 V	-100	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = -250 μA, referenced to 25°C	-	-63	-	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -80 V, V <sub>GS</sub> = 0 V	-	-	-1	μA
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±25 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	-2	-3	-4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I <sub>D</sub> = -250 μA, referenced to 25°C	-	7	-	mV/°C
r <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -4.4 A	-	56	67	mΩ
		V <sub>GS</sub> = -6 V, I <sub>D</sub> = -3.6 A	-	69	89	
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -4.4 A, T <sub>J</sub> = 125°C	-	87	104	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -4.4 A	-	12	-	S

## DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = -50 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	1001	1335	pF
C <sub>oss</sub>	Output Capacitance		-	178	240	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	10	15	pF
R <sub>g</sub>	Gate Resistance		0.1	1.6	3.2	Ω

## SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = -50 V, I <sub>D</sub> = -4.4 A, V <sub>GS</sub> = -10 V, R <sub>GEN</sub> = 6 Ω	-	11	20	ns
t <sub>r</sub>	Rise Time		-	2.5	10	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	17	30	ns
t <sub>f</sub>	Fall Time		-	4	10	ns
Q <sub>g(TOT)</sub>	Total Gate Charge	V <sub>DD</sub> = -50 V, I <sub>D</sub> = -4.4 A, V <sub>GS</sub> = 0 V to -10 V	-	16	22	nC
		V <sub>DD</sub> = -50 V, I <sub>D</sub> = -4.4 A, V <sub>GS</sub> = 0 V to -6 V	-	9.8	14	
Q <sub>gs</sub>	Total Gate Charge	V <sub>DD</sub> = -50 V, I <sub>D</sub> = -4.4 A	-	4.5	-	nC
Q <sub>gd</sub>	Gate to Drain "Miller" Charge		-	3.2	-	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> = -4.4 A (Note 2)	-	-0.84	-1.3	V
		V <sub>GS</sub> = 0 V, I <sub>S</sub> = -1.9 A (Note 2)	-	-0.79	-1.2	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = -4.4 A, di/dt = 100 A/μs	-	70	112	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	141	225	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.

TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

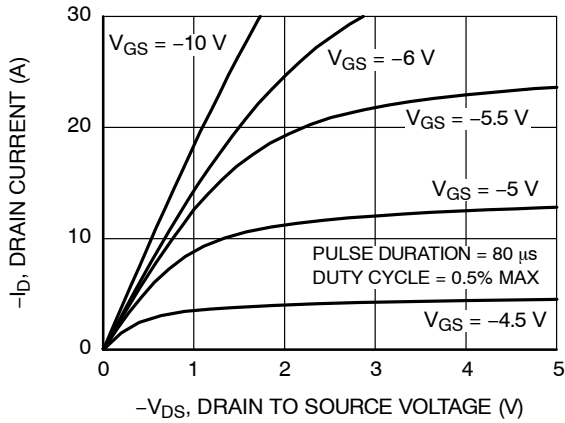


Figure 1. On Region Characteristics

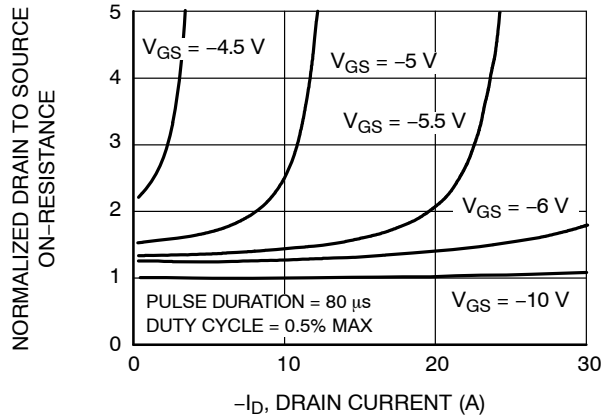


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

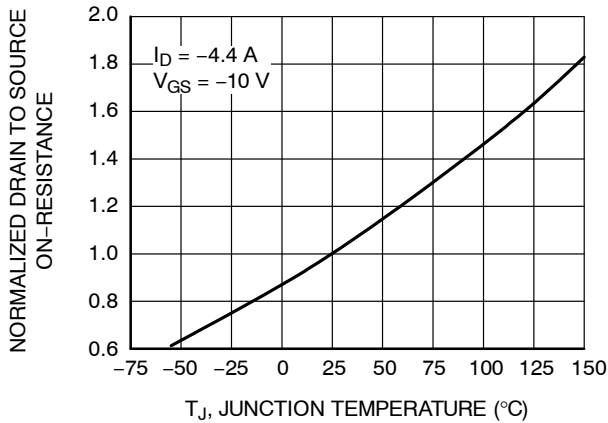


Figure 3. Normalized On Resistance vs. Junction Temperature

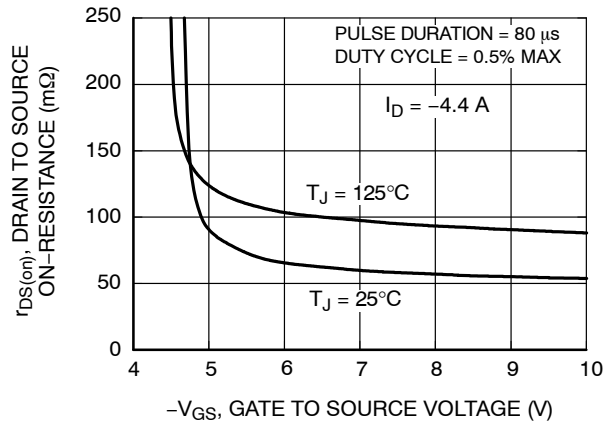


Figure 4. On-Resistance vs. Gate to Source Voltage

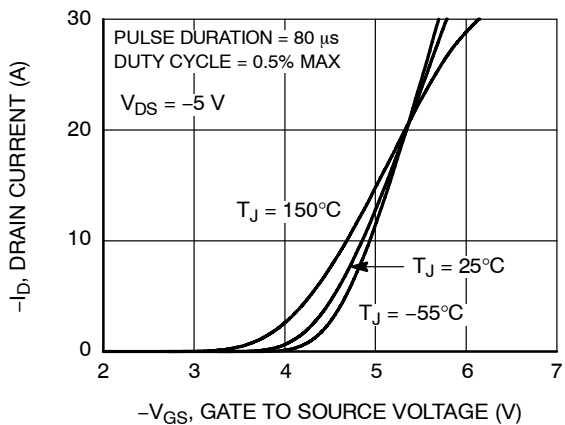


Figure 5. Transfer Characteristics

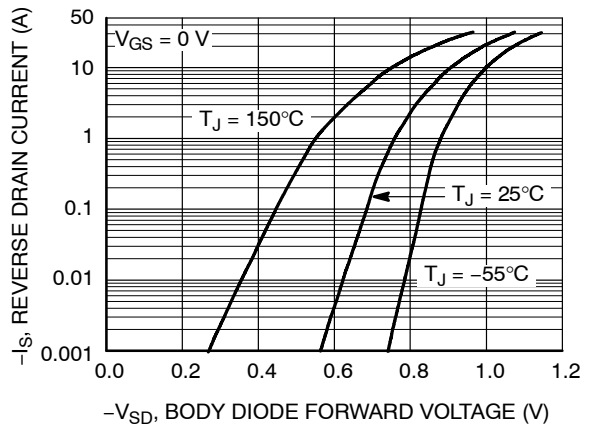


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted) (continued)

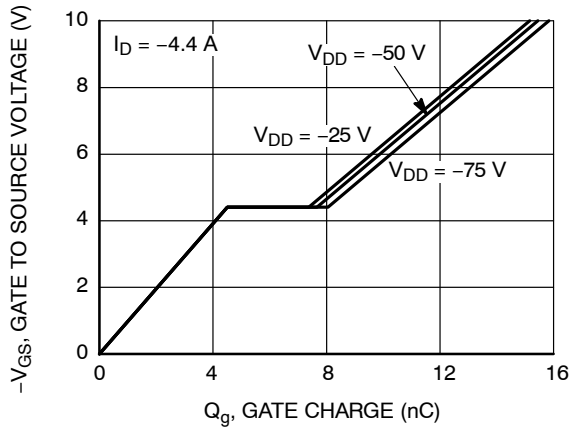


Figure 7. Gate Charge Characteristics

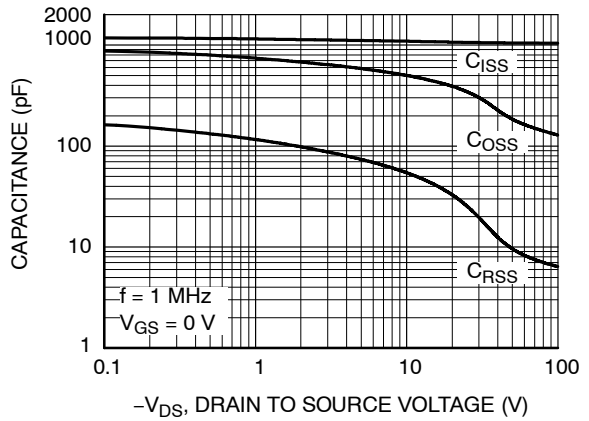


Figure 8. Capacitance vs. Drain to Source Voltage

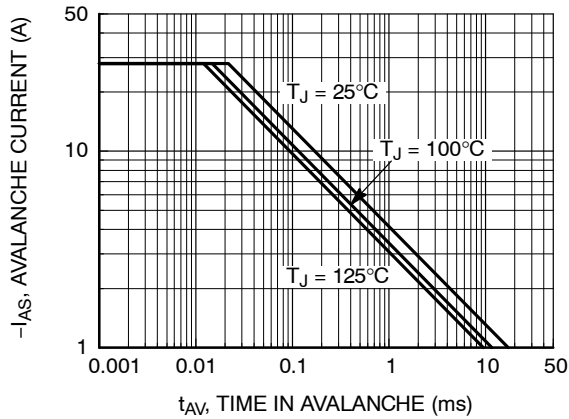


Figure 9. Unclamped Inductive Switching Capability

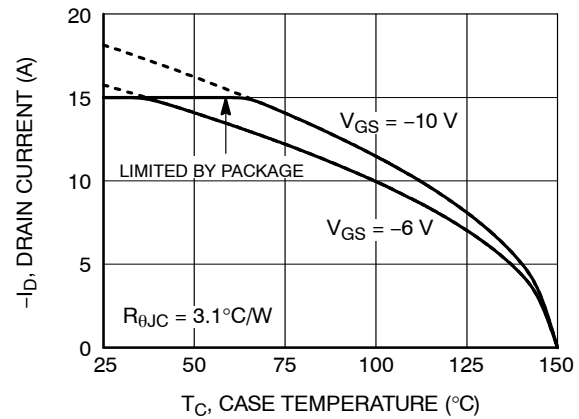


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

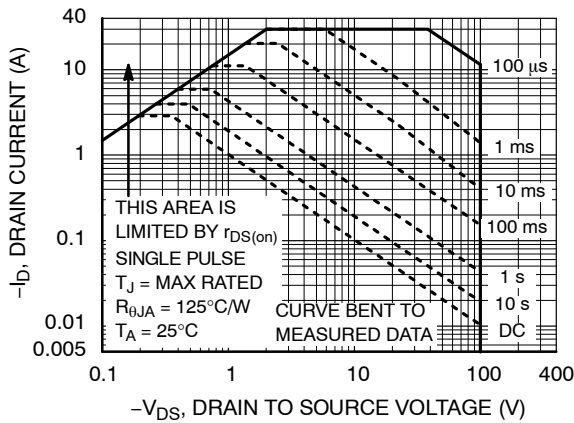


Figure 11. Forward Bias Safe Operating Area

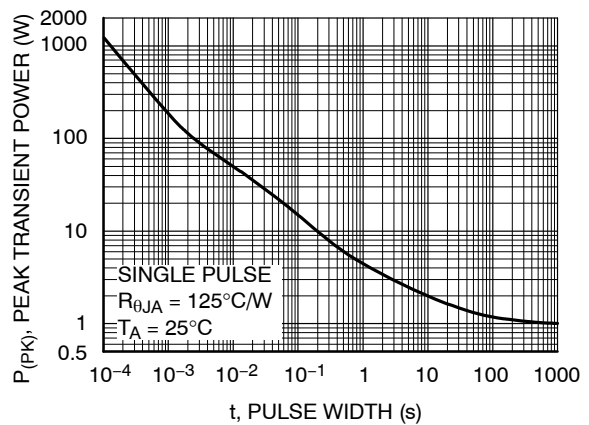


Figure 12. Single Pulse Maximum Power Dissipation

# FDMC86139P

## TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

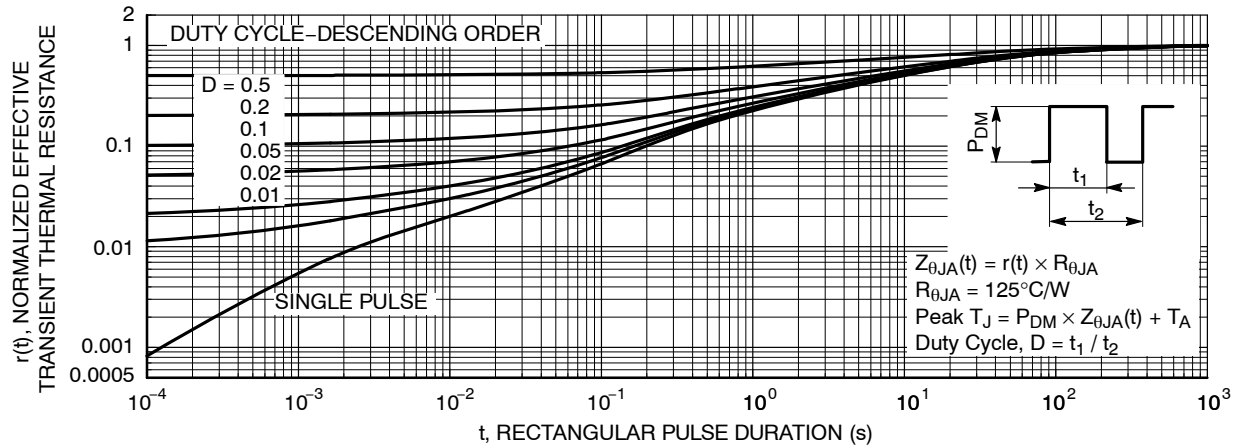


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

### ORDERING INFORMATION

Device	Device Marking	Package Type	Reel Size	Tape Width	Shipping <sup>†</sup>
FDMC86139P	FDMC86139P	WDFN8 3.3x3.3, 0.65P Power 33 (Pb-Free)	13"	12 mm	3000 / 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.

# MECHANICAL CASE OUTLINE

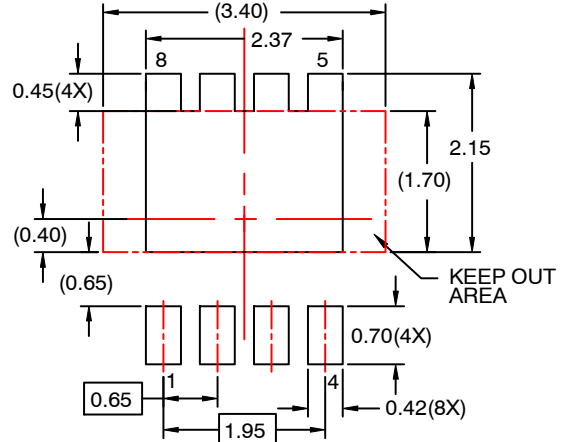
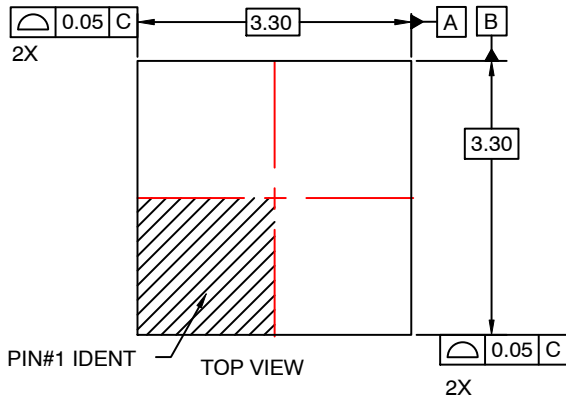
## PACKAGE DIMENSIONS

ON Semiconductor®



WDFN8 3.3x3.3, 0.65P  
CASE 511DH  
ISSUE O

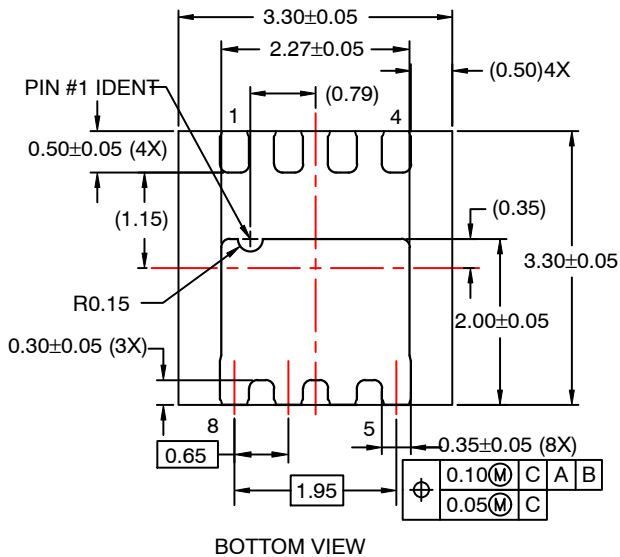
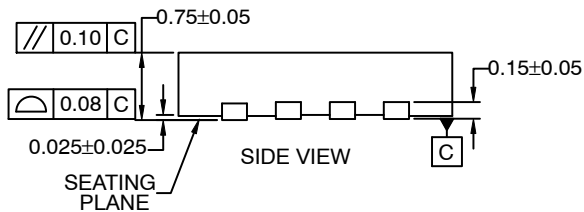
DATE 31 JUL 2016



RECOMMENDED LAND PATTERN

NOTES:

- A. DOES NOT CONFORM TO JEDEC REGISTRATION MO-229
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.



BOTTOM VIEW

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<b>DESCRIPTION:</b>	<b>WDFN8 3.3X3.3, 0.65P</b>	<b>PAGE 1 OF 1</b>

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