

# MOSFET– Specified, P-Channel, POWERTRENCH® 2.5 V

## FDS9431A

### General Description

This P-Channel 2.5 V specified MOSFET is produced using onsemi proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize onstate resistance and yet maintain superior switching performance.

### Features

- -3.5 A, -20 V.  $R_{DS(ON)} = 0.130 \Omega @ V_{GS} = -4.5 \text{ V}$   
 $R_{DS(ON)} = 0.180 \Omega @ V_{GS} = -2.5 \text{ V}$
- Fast Switching Speed
- High Density Cell Design for Extremely Low  $R_{DS(ON)}$ .
- High Power and Current Handling Capability
- These Device is Pb-Free and Halide Free

### Applications

- DC/DC Converter
- Power Management
- Load Switch
- Battery Protection

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

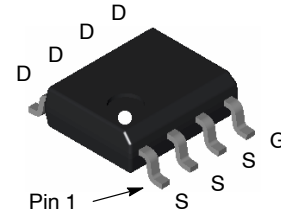
| Symbol         | Parameter                                                                     | Value             | Unit             |
|----------------|-------------------------------------------------------------------------------|-------------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                                                          | -20               | V                |
| $V_{GSS}$      | Gate-Source Voltage                                                           | $\pm 8$           | V                |
| $I_D$          | Drain Current<br>– Continuous (Note 1a)<br>– Pulsed                           | -3.5<br>-18       | A                |
| $P_D$          | Power Dissipation for Single Operation<br>(Note 1a)<br>(Note 1b)<br>(Note 1c) | 2.5<br>1.2<br>1.0 | W                |
| $T_J, T_{stg}$ | 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 $T_A = 25^\circ\text{C}$ unless otherwise noted

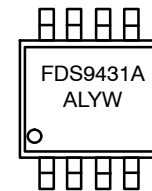
| Symbol          | Parameter                                         | Value | Unit               |
|-----------------|---------------------------------------------------|-------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 50    | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 25    | $^\circ\text{C/W}$ |

| $V_{DSS}$ | $R_{DS(on)} \text{ MAX}$                                           | $I_D \text{ MAX}$ |
|-----------|--------------------------------------------------------------------|-------------------|
| -20 V     | 0.130 $\Omega @ -4.5 \text{ V}$<br>0.180 $\Omega @ -2.5 \text{ V}$ | -3.5 A            |



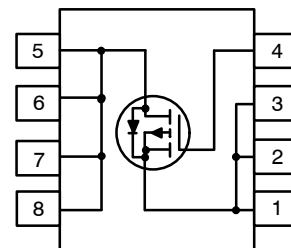
SOIC8  
CASE 751EB

### MARKING DIAGRAM



FDS9431A = Specific Device Code  
A = Assembly Site  
L = Wafer Lot Number  
YW = Assembly Start Week

### PIN ASSIGNMENT



### ORDERING INFORMATION

| Device   | Package                          | Shipping†             |
|----------|----------------------------------|-----------------------|
| FDS9431A | SOIC8<br>CASE 751EB<br>(Pb-Free) | 2500 /<br>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](#).

# FDS9431A

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

| Symbol                               | Parameter                                 | Test Conditions                                                    | Min | Typ | Max  | Unit                 |
|--------------------------------------|-------------------------------------------|--------------------------------------------------------------------|-----|-----|------|----------------------|
| <b>OFF CHARACTERISTICS</b>           |                                           |                                                                    |     |     |      |                      |
| $BV_{DSS}$                           | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$               | -20 | -   | -    | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ | -   | -28 | -    | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$                       | -   | -   | -1   | $\mu\text{A}$        |
| $I_{GSSF}$                           | Gate-Body Leakage, Forward                | $V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$                         | -   | -   | 100  | nA                   |
| $I_{GSSR}$                           | Gate-Body Leakage, Reverse                | $V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$                         | -   | -   | -100 | nA                   |

## ON CHARACTERISTICS (Note 2)

|                                        |                                                |                                                                                                                                                                            |     |                         |                         |                      |
|----------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------|-------------------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                                                                                                           | -1  | -1.6                    | -3                      | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$                                                                                                         | -   | 4.0                     | -                       | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain-Source On-Resistance              | $V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}$<br>$V_{GS} = -2.5\text{ V}, I_D = -3.0\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}, T_J = 125^\circ\text{C}$ | -   | 0.110<br>0.140<br>0.155 | 0.130<br>0.180<br>0.220 | $\Omega$             |
| $I_{D(on)}$                            | On-State Drain Current                         | $V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$                                                                                                                             | -10 | -                       | -                       | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = -5\text{ V}, I_D = -3.5\text{ A}$                                                                                                                                | -   | 6.5                     | -                       | S                    |

## DYNAMIC CHARACTERISTICS

|           |                              |                                                                        |   |     |   |    |
|-----------|------------------------------|------------------------------------------------------------------------|---|-----|---|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ | - | 405 | - | pF |
| $C_{oss}$ | Output Capacitance           |                                                                        | - | 170 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                        | - | 45  | - | pF |

## SWITCHING CHARACTERISTICS (Note 2)

|              |                     |                                                                                                    |   |     |     |    |
|--------------|---------------------|----------------------------------------------------------------------------------------------------|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = -5\text{ V}, I_D = -1\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$ | - | 6.5 | 13  | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                                    | - | 20  | 35  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                    | - | 31  | 50  | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                                    | - | 21  | 35  | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = -5\text{ V}, I_D = -3.5\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}$                          | - | 6   | 8.5 | nC |
| $Q_{gs}$     | Gate-Source Charge  |                                                                                                    | - | 0.8 | -   | nC |
| $Q_{gd}$     | Gate-Drain Charge   |                                                                                                    | - | 1.3 | -   | nC |

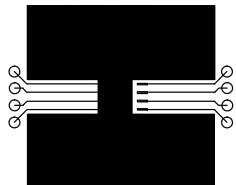
## DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

|                 |                                                       |                                                         |   |      |      |   |
|-----------------|-------------------------------------------------------|---------------------------------------------------------|---|------|------|---|
| I <sub>S</sub>  | Maximum Continuous Drain–Source Diode Forward Current |                                                         | – | –    | –2.1 | A |
| V <sub>SD</sub> | Drain–Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = –2.1 A (Note 2) | – | –0.7 | –1.2 | V |

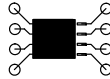
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## NOTES:

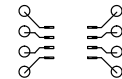
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C} / \text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.



b)  $105^\circ\text{C} / \text{W}$  when mounted on a  $0.04\text{ in}^2$  pad of 2 oz copper.



c)  $125^\circ\text{C} / \text{W}$  on a minimum mounting pad.

Scale 1:1 on letter size paper

- Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

## TYPICAL CHARACTERISTICS

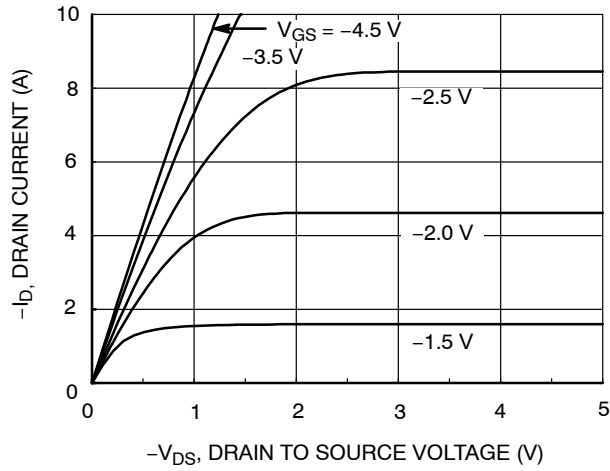


Figure 1. On-Region Characteristics

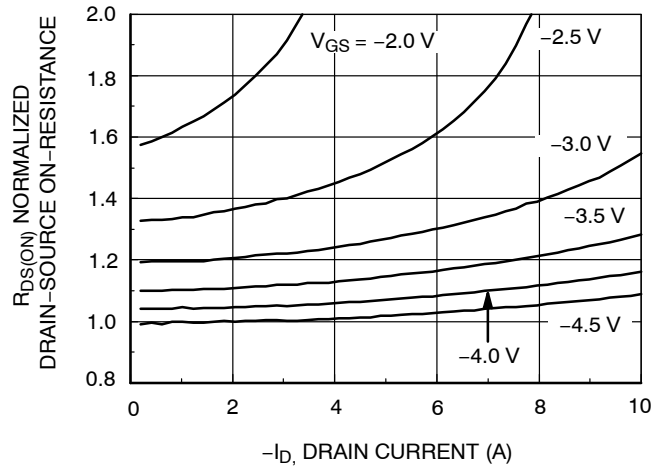


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

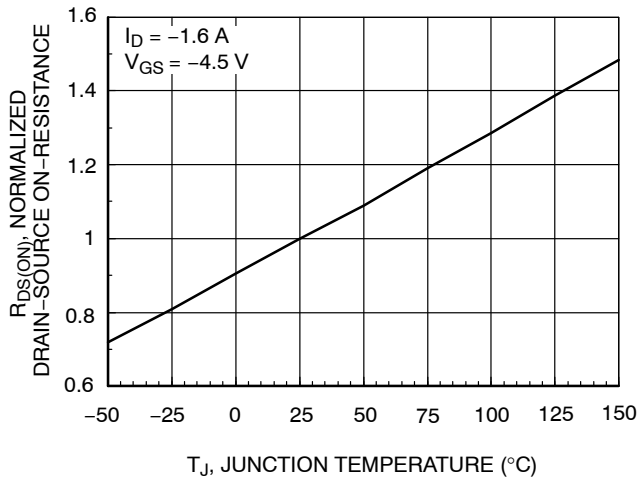


Figure 3. On-Resistance Variation with Temperature

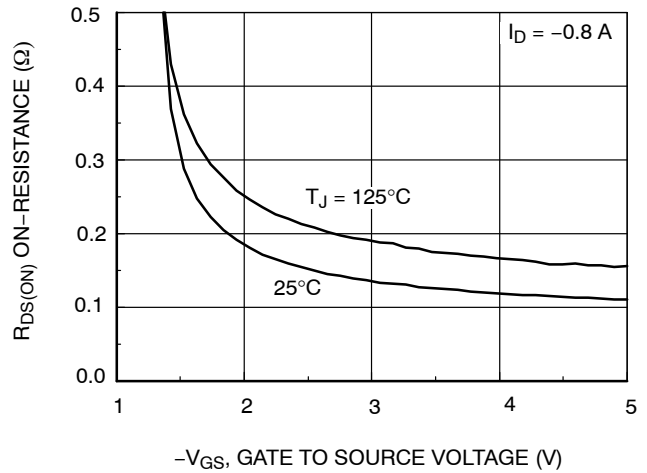


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

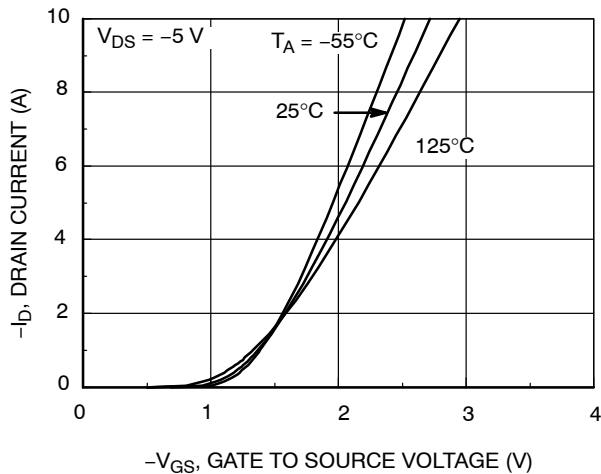


Figure 5. Transfer Characteristics

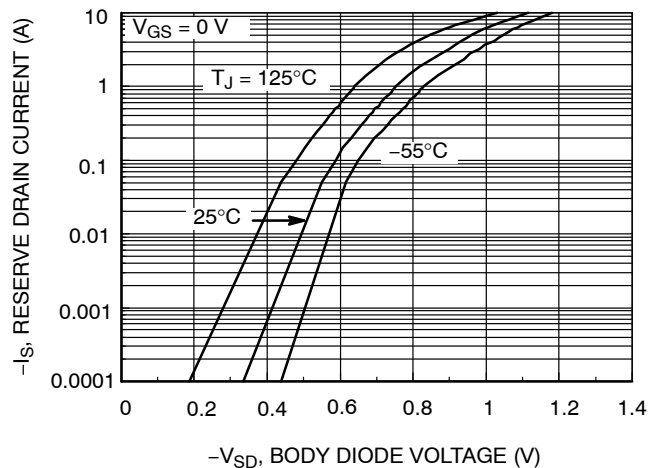


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL CHARACTERISTICS (continued)

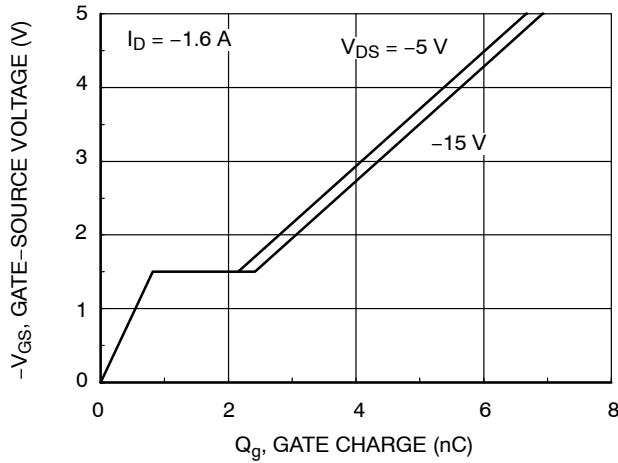


Figure 7. Gate Charge Characteristics

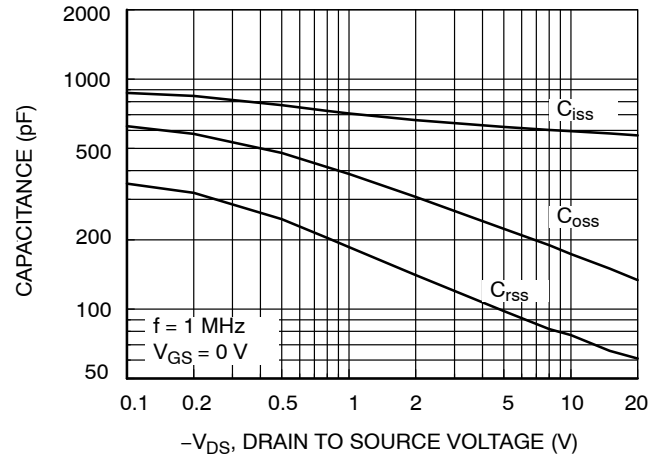


Figure 8. Capacitance Characteristics

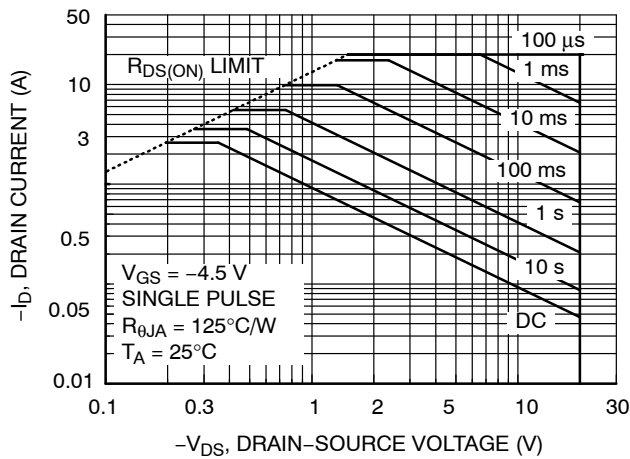


Figure 9. Maximum Safe Operating Area

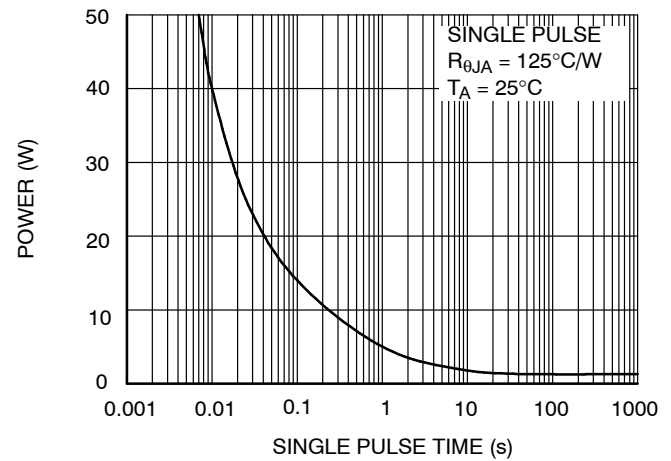


Figure 10. Single Pulse Maximum Power Dissipation

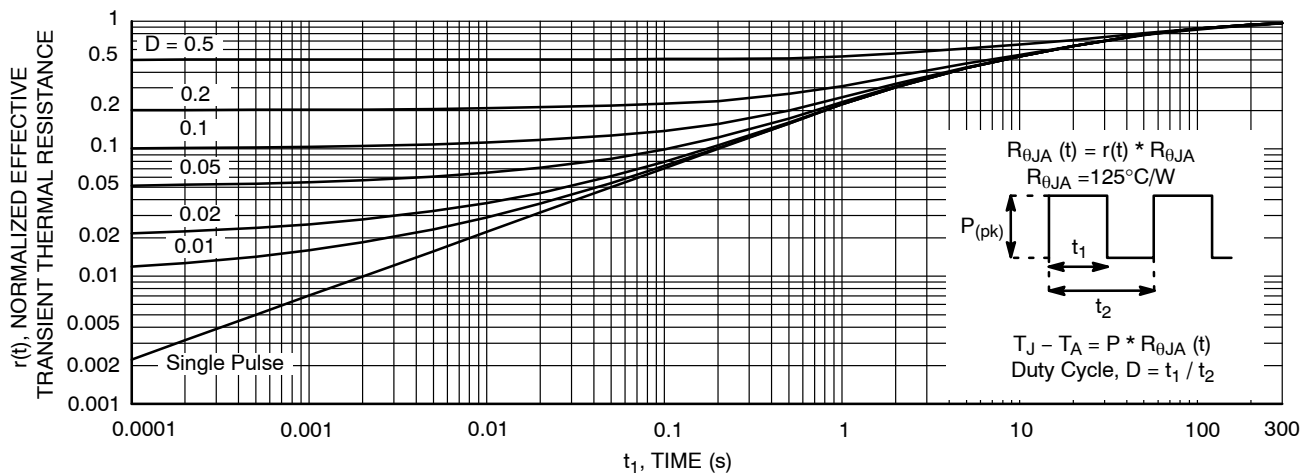


Figure 11. Transient Thermal Response Curve

Thermal characterization performed using the conditions described in Note 1c.  
Transient thermal response will change depending on the circuit board design.

# MECHANICAL CASE OUTLINE

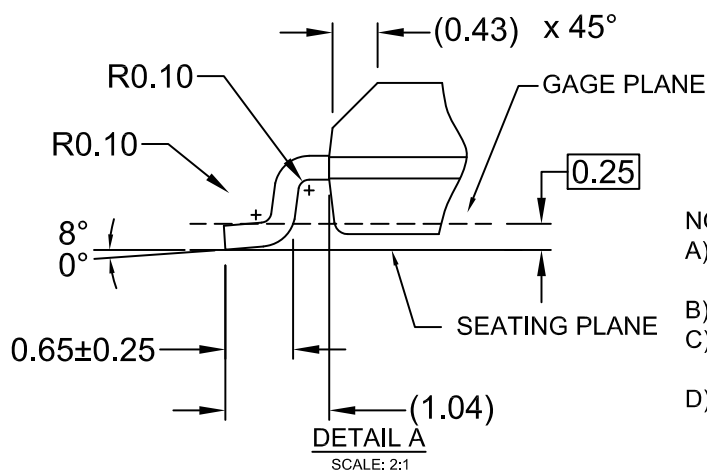
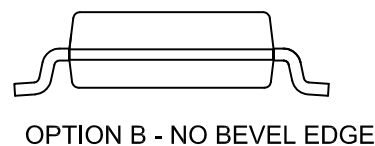
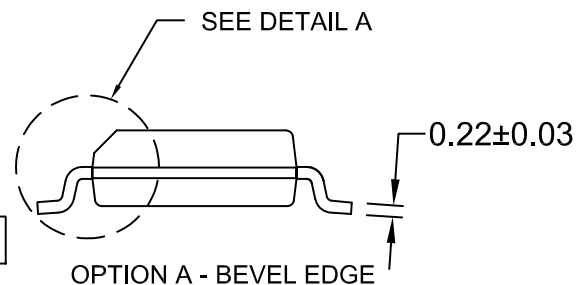
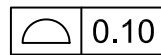
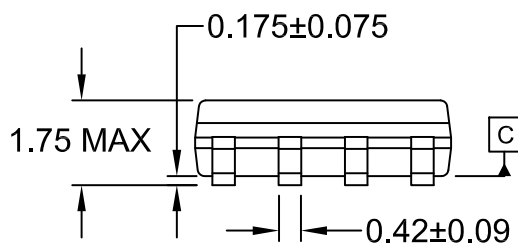
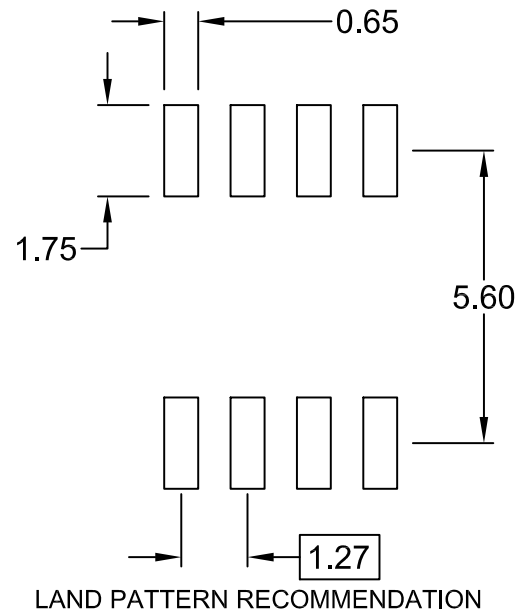
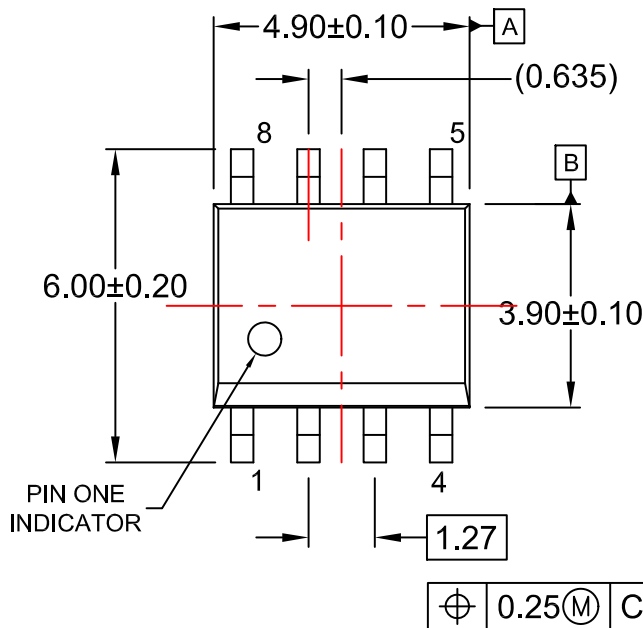
## PACKAGE DIMENSIONS

ON Semiconductor®

ON

SOIC8  
CASE 751EB  
ISSUE A

DATE 24 AUG 2017



### NOTES:

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M

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