

# MOSFET – N-Channel, POWERTRENCH®

**30 V, 7 A, 23 mΩ**

## FDS8984, FDS8984-F40

### General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of dc-dc converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $R_{DS(ON)}$  and fast switching speed.

### Features

- Max  $R_{DS(ON)} = 23 \text{ m}\Omega$  @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 7 \text{ A}$
- Max  $R_{DS(ON)} = 30 \text{ m}\Omega$  @  $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 6 \text{ A}$
- Low Gate Charge
- 100%  $R_G$  Tested
- This Device is Pb-Free and Halogen Free

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

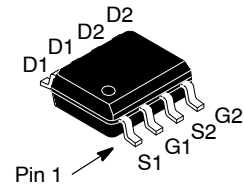
| Symbol         | Parameter                              | Ratings                | Unit                 |
|----------------|----------------------------------------|------------------------|----------------------|
| $V_{DS}$       | Drain to Source Voltage                | 30                     | V                    |
| $V_{GS}$       | Gate to Source Voltage                 | $\pm 20$               | V                    |
| $I_D$          | Drain Current                          | – Continuous (Note 1a) | 7                    |
|                |                                        | – Pulsed               | 30                   |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 2) | 32                     | mJ                   |
| $P_D$          | Power Dissipation for Single Operation | 1.6                    | W                    |
|                | Derate Above $25^\circ\text{C}$        | 13                     | mW/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature      | $-55$ 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

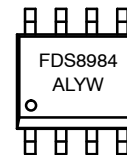
| Symbol          | Parameter                                         | Ratings | Unit               |
|-----------------|---------------------------------------------------|---------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 78      | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 40      | $^\circ\text{C/W}$ |

| $V_{DSS}$ | $R_{DS(ON)} \text{ MAX}$         | $I_D \text{ MAX}$ |
|-----------|----------------------------------|-------------------|
| 30 V      | 23 mΩ @ $V_{GS} = 10 \text{ V}$  | 7.0 A             |
|           | 30 mΩ @ $V_{GS} = 4.5 \text{ V}$ | 6.0 A             |



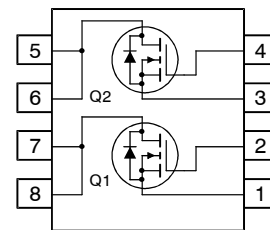
SOIC8  
CASE 751EB

### MARKING DIAGRAM



FDS8984 = Specific Device Code  
A = Assembly Site  
L = Wafer Lot Number  
YW = Assembly Start Week

### PIN ASSIGNMENT



N-Channel MOSFET

### ORDERING INFORMATION

| Device      | Package         | Shipping†          |
|-------------|-----------------|--------------------|
| FDS8984     | SOIC8 (Pb-Free) | 2500 / Tape & Reel |
| FDS8984-F40 | SOIC8 (Pb-Free) | 2500 / 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](http://www.onsemi.com/BRD8011/D).

# FDS8984, FDS8984-F40

## ELECTRICAL CHARACTERISTICS (T<sub>A</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                                                                         | 30 | –  | –        | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C                                                                            | –  | 23 | –        | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V<br>V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C | –  | –  | 1<br>250 | μA    |
| I <sub>GSS</sub>                     | Gate to Source Leakage Current            | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V                                                                         | –  | –  | ±100     | nA    |

### ON CHARACTERISTICS (Note 3)

|                                        |                                                          |                                                                                                                                                                       |             |                |                |       |
|----------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|----------------|-------|
| V <sub>GS(th)</sub>                    | Gate to Source Threshold Voltage                         | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                                                           | 1.2         | 1.7            | 2.5            | 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                                                                                                                           | –           | –4.3           | –              | mV/°C |
| R <sub>DS(on)</sub>                    | Drain to Source On-Resistance                            | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7 A<br>V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 6 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7 A, T <sub>J</sub> = 125°C | –<br>–<br>– | 19<br>24<br>26 | 23<br>30<br>32 | mΩ    |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                               |   |     |     |    |
|------------------|------------------------------|---------------------------------------------------------------|---|-----|-----|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz | – | 475 | 635 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                               | – | 100 | 135 | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                               | – | 65  | 100 | pF |
| R <sub>G</sub>   | Gate Resistance              | f = 1.0 MHz                                                   | – | 0.9 | 1.6 | Ω  |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |                               |                                                                                                 |   |     |    |    |
|---------------------|-------------------------------|-------------------------------------------------------------------------------------------------|---|-----|----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time            | V <sub>DD</sub> = 15 V, I <sub>D</sub> = 7 A,<br>V <sub>GS</sub> = 10 V, R <sub>GS</sub> = 33 Ω | – | 5   | 10 | ns |
| t <sub>r</sub>      | Rise Time                     |                                                                                                 | – | 9   | 18 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time           |                                                                                                 | – | 42  | 68 | ns |
| t <sub>f</sub>      | Fall Time                     |                                                                                                 | – | 21  | 34 | ns |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7 A                            | – | 9.2 | 13 | nC |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 5 V, I <sub>D</sub> = 7 A                             | – | 5.0 | 7  | nC |
| Q <sub>gs</sub>     | Gate to Source Gate Charge    |                                                                                                 | – | 1.5 | –  | nC |
| Q <sub>gd</sub>     | Gate to Drain "Miller" Charge |                                                                                                 | – | 2.0 | –  | nC |

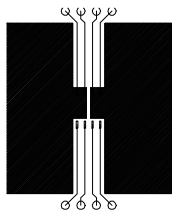
### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |                               |                                                                 |   |     |      |    |
|-----------------|-------------------------------|-----------------------------------------------------------------|---|-----|------|----|
| V <sub>SD</sub> | Source to Drain Diode Voltage | I <sub>SD</sub> = 7 A                                           | – | 0.9 | 1.25 | V  |
|                 |                               | I <sub>SD</sub> = 2.1 A                                         | – | 0.8 | 1.0  | V  |
| t <sub>rr</sub> | Diode Reverse Recovery Time   | I <sub>F</sub> = 7 A, d <sub>i</sub> /d <sub>t</sub> = 100 A/μs | – | –   | 33   | ns |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge |                                                                 | – | –   | 20   | nC |

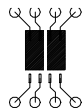
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### NOTES:

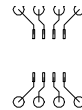
1. R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.



a. 78°C/W when mounted on a 0.5 in<sup>2</sup> pad of 2 oz copper



b. 125°C/W when mounted on a 0.02 in<sup>2</sup> pad of 2 oz copper



c. 135°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Starting T<sub>J</sub> = 25°C, L = 1 mH, I<sub>AS</sub> = 8 A, V<sub>DD</sub> = 27 V, V<sub>GS</sub> = 10 V.
3. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.

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

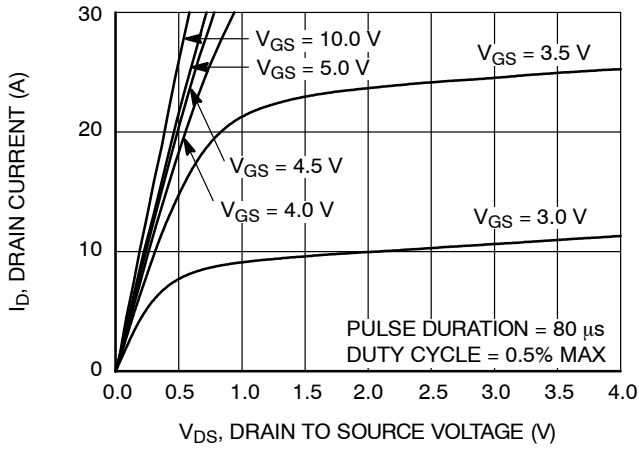


Figure 1. On Region Characteristics

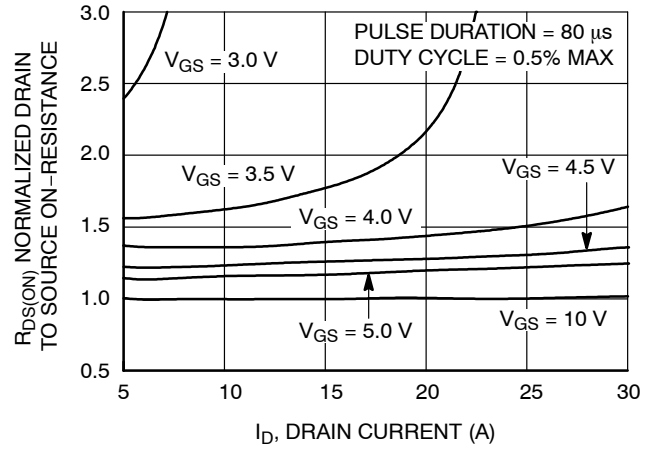


Figure 2. On-Resistance vs. Drain Current and Gate Voltage

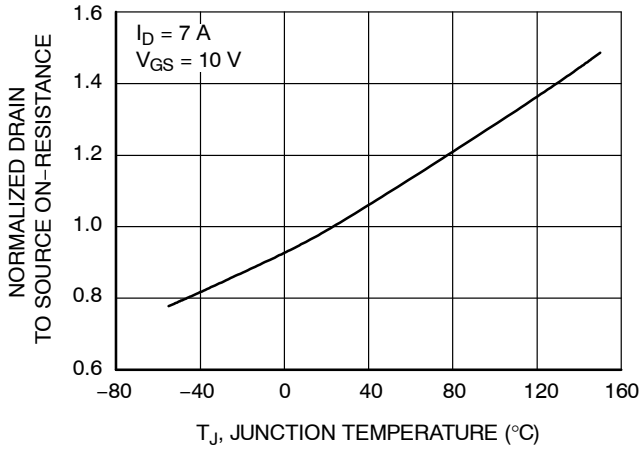


Figure 3. On-Resistance vs. Temperature

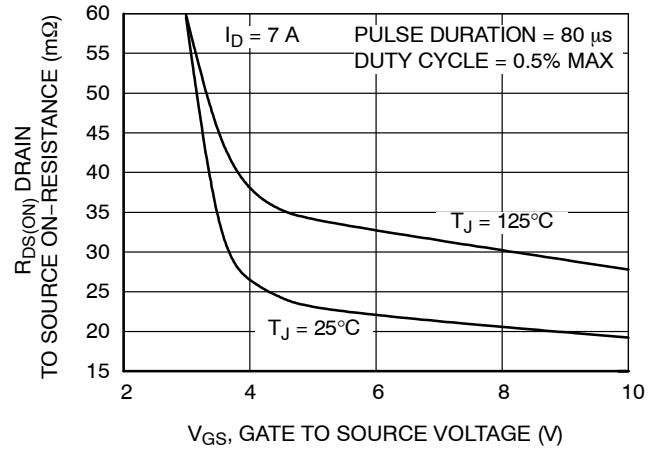


Figure 4. On-Resistance vs. Gate to Source Voltage

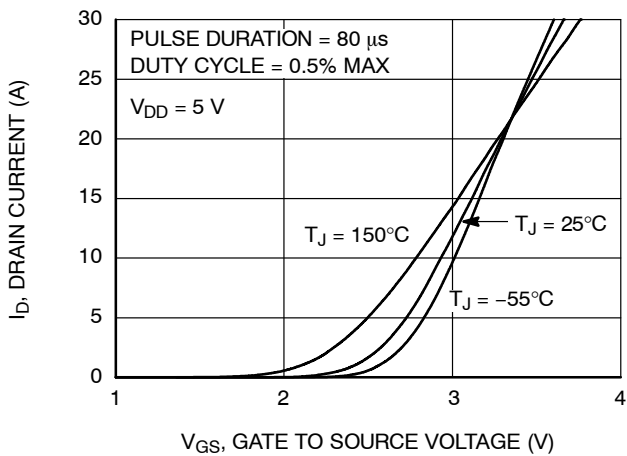


Figure 5. Transfer Characteristics

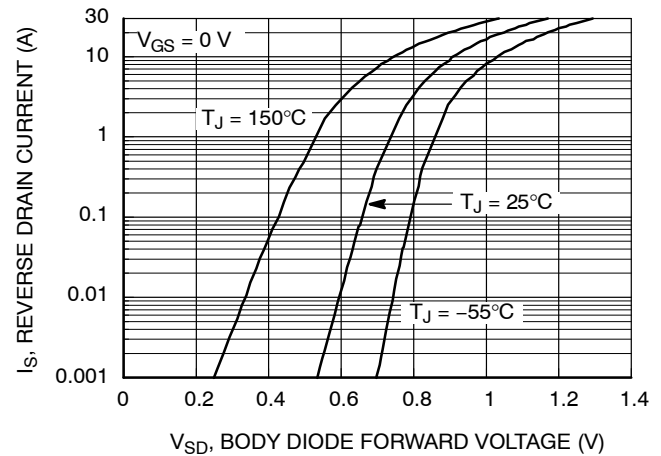


Figure 6. Source to Drain Forward Voltage vs. Source Current

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

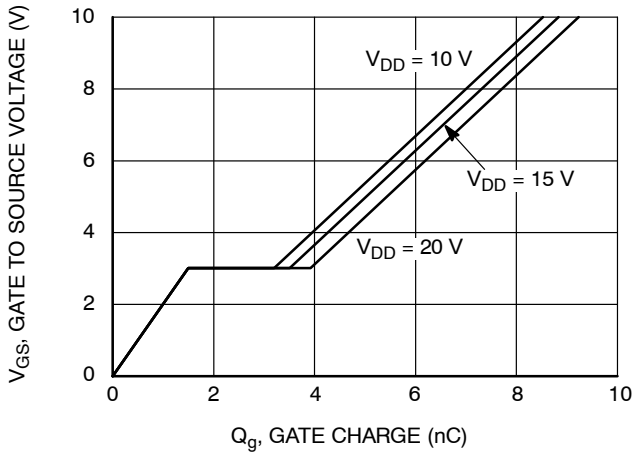


Figure 7. Gate Charge Characteristics

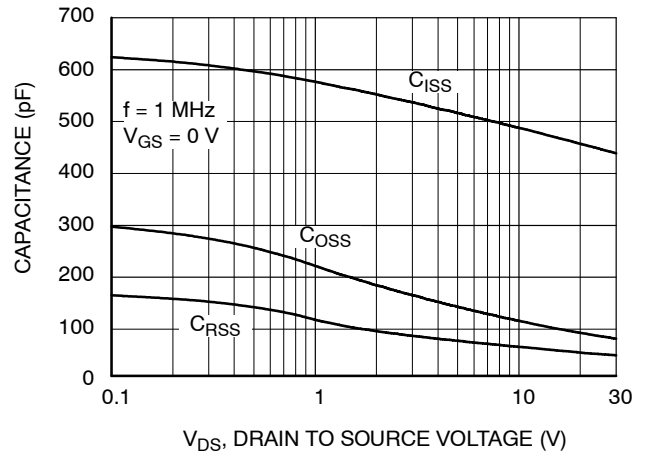


Figure 8. Capacitance vs. Drain to Source Voltage

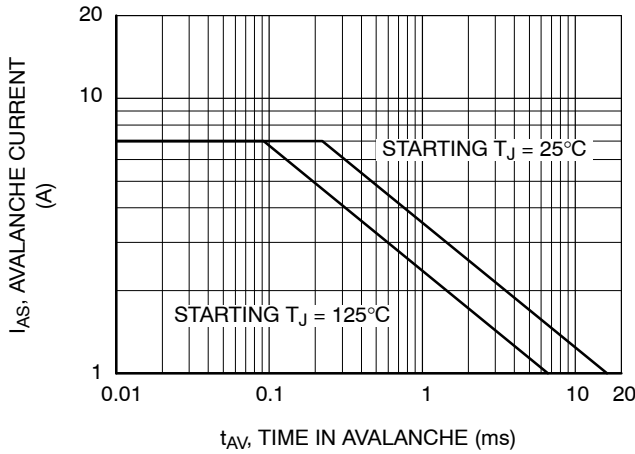


Figure 9. Unclamped Inductive Switching Capability

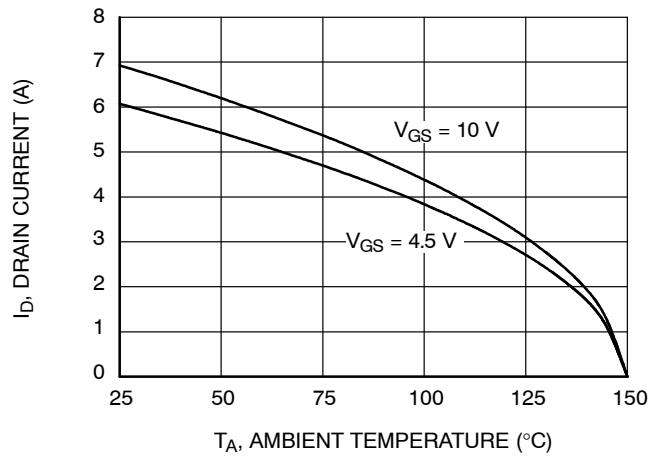


Figure 10. Maximum Continuous Drain Current vs. Ambient Temperature

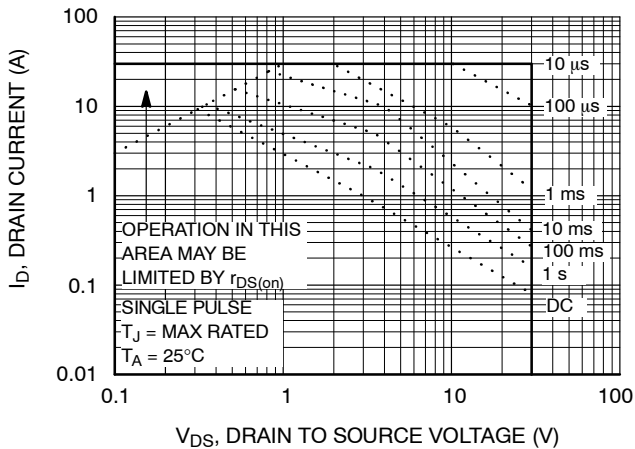


Figure 11. Forward Bias Safe Operating Area

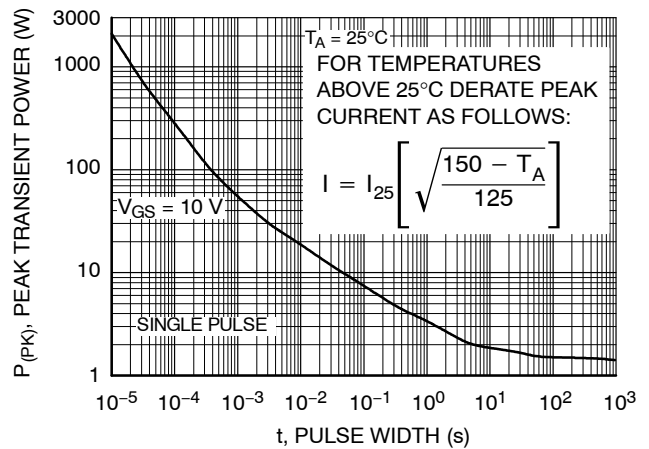


Figure 12. Single Pulse Maximum Power Dissipation

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

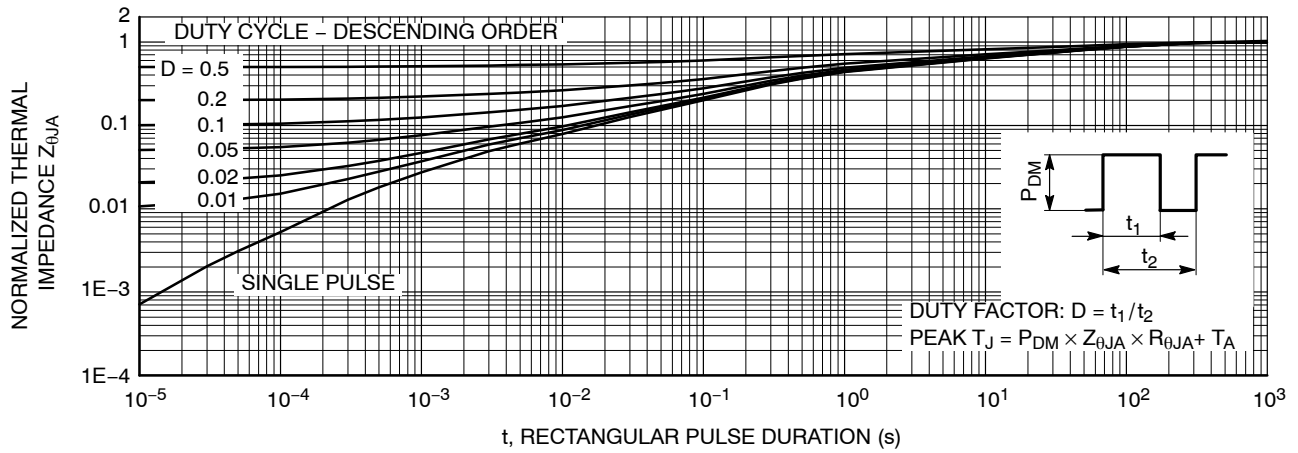


Figure 13. Transient Thermal Response Curve

# MECHANICAL CASE OUTLINE

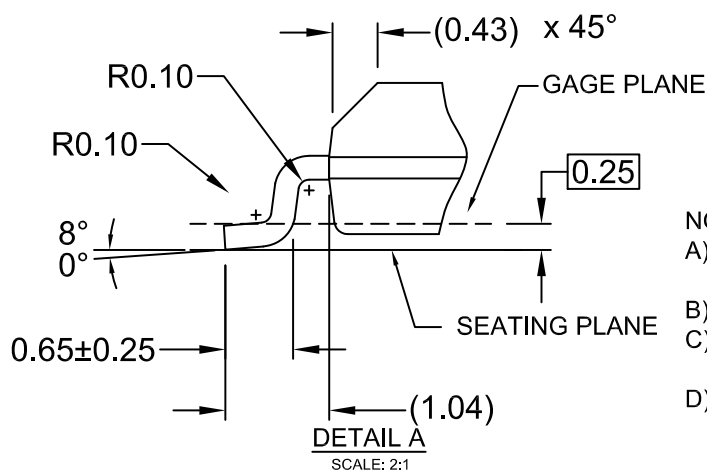
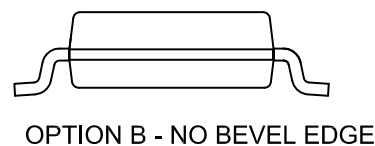
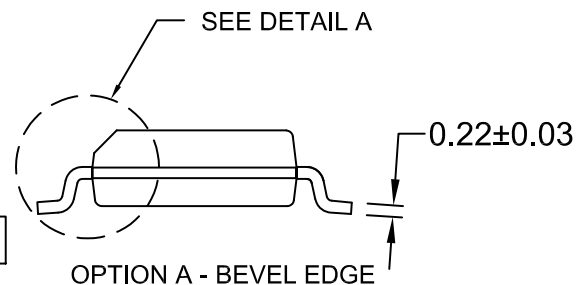
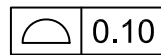
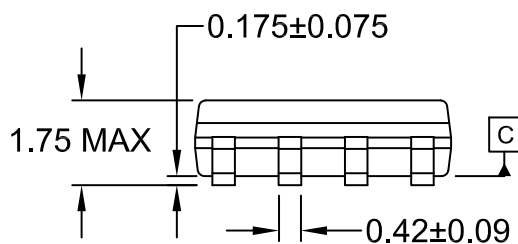
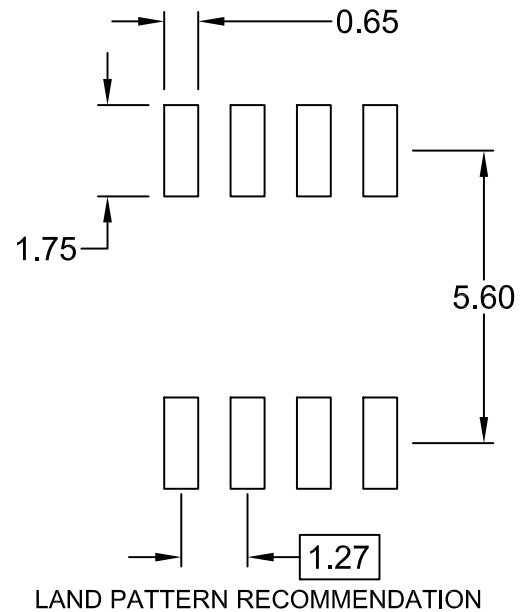
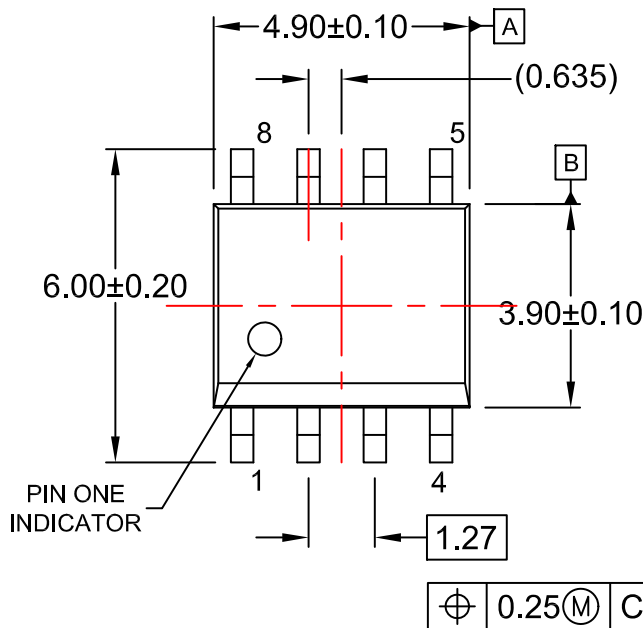
## PACKAGE DIMENSIONS

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.
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- D) LANDPATTERN STANDARD: SOIC127P600X175-8M

|                  |             |                                                                                                                                                                                  |
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