

# MOSFET – N-Channel, Shielded Gate, POWER trench®

150 V, 7.5 A, 19.8 mΩ

## FDS86240

### General Description

This N-Channel MOSFET is produced using onsemi's advanced POWER trench process that incorporates Shielded Gate technology. This process has been optimized for  $R_{DS(on)}$ , switching performance and ruggedness.

### Features

- Shielded Gate MOSFET Technology
- Max  $R_{DS(on)}$  = 19.8 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 7.5 A
- Max  $R_{DS(on)}$  = 26 mΩ at  $V_{GS}$  = 6 V,  $I_D$  = 6.4 A
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- 100% UIL Tested
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### ABSOLUTE MAXIMUM RATINGS

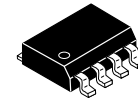
( $T_A$  = 25°C unless otherwise noted)

| Symbol         | Parameter                                                            | Ratings     | Unit |
|----------------|----------------------------------------------------------------------|-------------|------|
| $V_{DS}$       | Drain to Source Voltage                                              | 150         | V    |
| $V_{GS}$       | Gate to Source Voltage                                               | ±20         | V    |
| $I_D$          | Drain Current<br>– Continuous<br>– Pulsed (Note 4)                   | 7.5<br>199  | A    |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)                               | 220         | mJ   |
| $P_D$          | Power Dissipation<br>$T_C$ = 25°C (Note 1)<br>$T_A$ = 25°C (Note 1a) | 5.0<br>2.5  | W    |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                     | –55 to +150 | °C   |

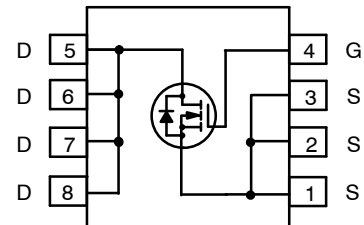
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

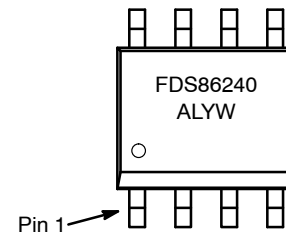
| Symbol          | Parameter                                         | Ratings | Unit |
|-----------------|---------------------------------------------------|---------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 1)     | 25      | °C/W |
| $R_{\theta JA}$ | Thermal Resistance,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



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CASE 751EB



### MARKING DIAGRAM



Pin 1

FDS86240 = Specific Device Code  
A = Assembly Site  
L = Wafer Lot Number  
YW = Assembly Start Week

### ORDERING INFORMATION

| Device   | Package                            | Shipping†             |
|----------|------------------------------------|-----------------------|
| FDS86240 | SOIC8<br>(Pb-Free/<br>Halide 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 Specification Brochure, [BRD8011/D](#).

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

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

**OFF CHARACTERISTICS**

|                                      |                                           |                                                             |     |     |           |                      |
|--------------------------------------|-------------------------------------------|-------------------------------------------------------------|-----|-----|-----------|----------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$           | 150 | –   | –         | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$ | –   | 105 | –         | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 120\ \text{V}$ , $V_{GS} = 0\ \text{V}$           | –   | –   | 1         | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$        | –   | –   | $\pm 100$ | nA                   |

**ON CHARACTERISTICS**

|                                        |                                                          |                                                                             |   |      |      |                      |
|----------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------|---|------|------|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$                                | 2 | 2.7  | 4    | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$                 | – | –11  | –    | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}$ , $I_D = 7.5\ \text{A}$                             | – | 17.3 | 19.8 | m $\Omega$           |
|                                        |                                                          | $V_{GS} = 6\ \text{V}$ , $I_D = 6.4\ \text{A}$                              | – | 19.7 | 26   |                      |
|                                        |                                                          | $V_{GS} = 10\ \text{V}$ , $I_D = 7.5\ \text{A}$ , $T_J = 125^\circ\text{C}$ | – | 30.8 | 35.3 |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 10\ \text{V}$ , $I_D = 7.5\ \text{A}$                             | – | 26   | –    | S                    |

**DYNAMIC CHARACTERISTICS**

|           |                              |                                                                        |   |      |      |          |
|-----------|------------------------------|------------------------------------------------------------------------|---|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 75\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$ | – | 1930 | 2570 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                        | – | 198  | 265  |          |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                        | – | 8.3  | 15   |          |
| $R_G$     | Gate Resistance              |                                                                        | – | 0.84 | –    | $\Omega$ |

**SWITCHING CHARACTERISTICS**

|              |                               |                                                                                                      |   |     |    |    |
|--------------|-------------------------------|------------------------------------------------------------------------------------------------------|---|-----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 75\ \text{V}$ , $I_D = 7.5\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_{GEN} = 6\ \Omega$ | – | 14  | 26 | ns |
| $t_r$        | Rise Time                     |                                                                                                      | – | 4.2 | 10 |    |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                      | – | 24  | 39 |    |
| $t_f$        | Fall Time                     |                                                                                                      | – | 4.9 | 10 |    |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\ \text{V}$ to $10\ \text{V}$ , $V_{DD} = 75\ \text{V}$ , $I_D = 7.5\ \text{A}$           | – | 28  | 40 | nC |
|              |                               | $V_{GS} = 0\ \text{V}$ to $5\ \text{V}$ , $V_{DD} = 75\ \text{V}$ , $I_D = 7.5\ \text{A}$            | – | 16  | 22 |    |
| $Q_{gs}$     | Gate to Source Charge         | $V_{DD} = 75\ \text{V}$ , $I_D = 7.5\ \text{A}$                                                      | – | 7.6 | –  | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                      | – | 5.3 | –  |    |

**DRAIN-SOURCE DIODE CHARACTERISTICS**

|          |                                       |                                                             |   |      |     |    |
|----------|---------------------------------------|-------------------------------------------------------------|---|------|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}$ , $I_S = 7.5\ \text{A}$ (Note 2)     | – | 0.77 | 1.3 | V  |
|          |                                       | $V_{GS} = 0\ \text{V}$ , $I_S = 2\ \text{A}$ (Note 2)       | – | 0.70 | 1.2 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 7.5\ \text{A}$ , $di/dt = 100\ \text{A}/\mu\text{s}$ | – | 75   | 120 | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                             | – | 109  | 175 | 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:**

- $R_{\theta JA}$  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.



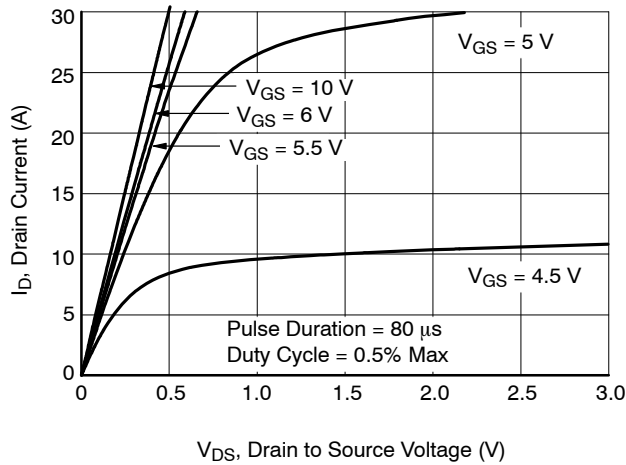
a)  $50^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz. copper.



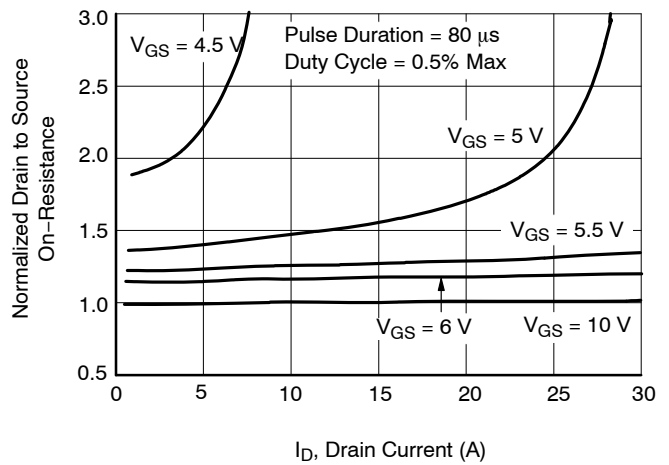
b)  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1\ \text{mH}$ ,  $I_{AS} = 21\ \text{A}$ ,  $V_{DD} = 135\ \text{V}$ ,  $V_{GS} = 10\ \text{V}$
- Pulsed  $I_d$  please refer to Figure 11 SOA graph for more details.

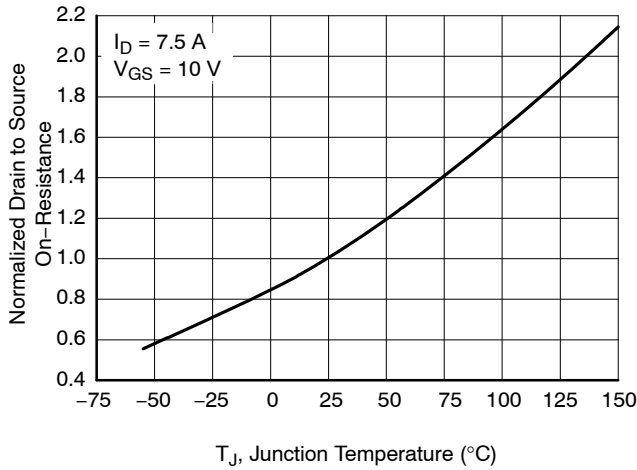
**TYPICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



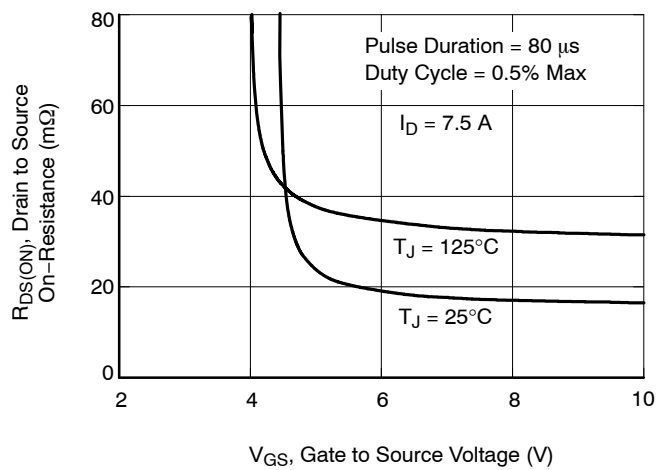
**Figure 1. On Region Characteristics**



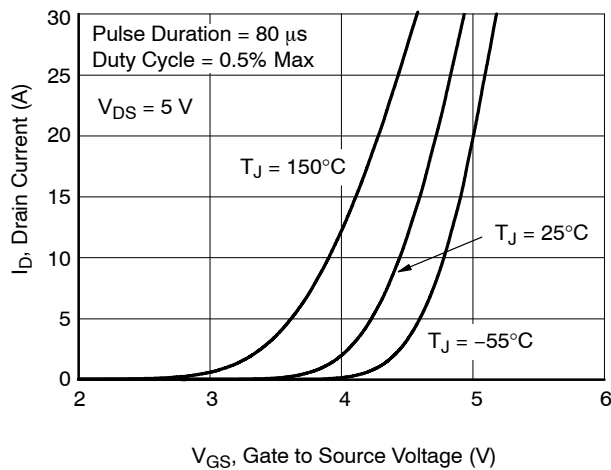
**Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage**



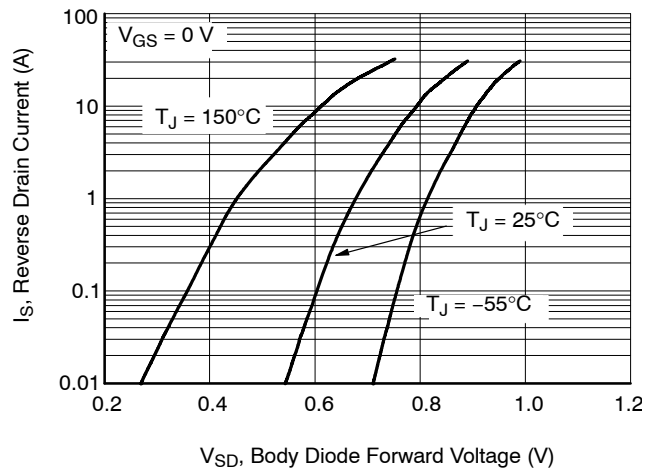
**Figure 3. Normalized On Resistance vs. Junction Temperature**



**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)

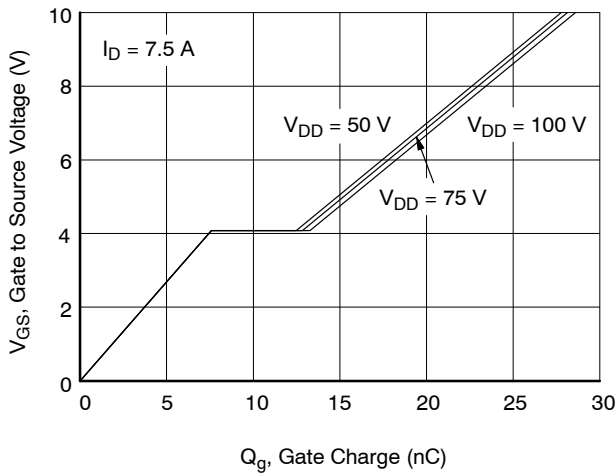


Figure 7. Gate Charge Characteristics

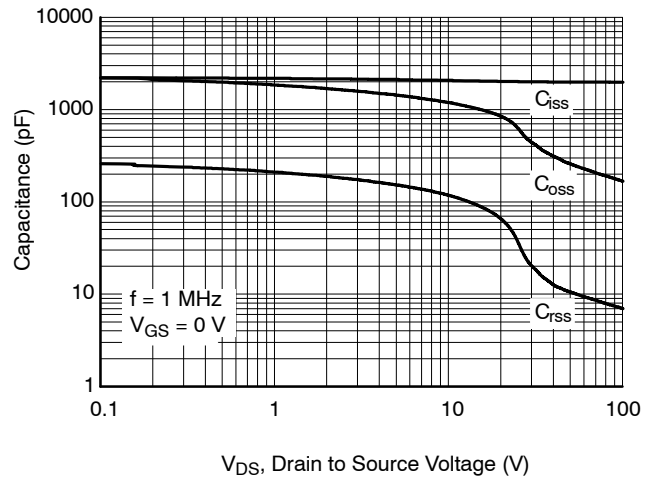


Figure 8. Capacitance vs. Drain to Source Voltage

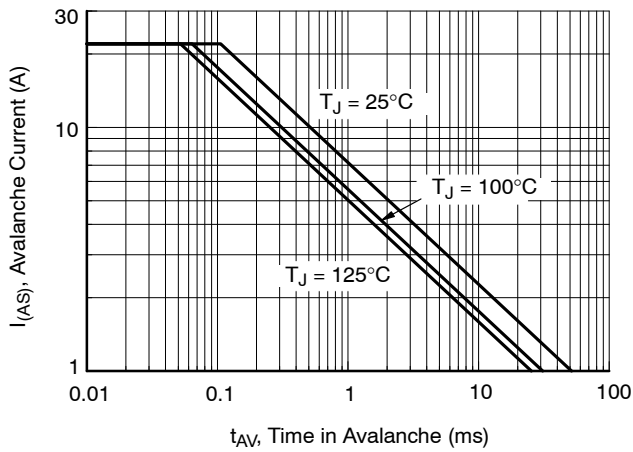


Figure 9. Unclamped Inductive Switching Capability

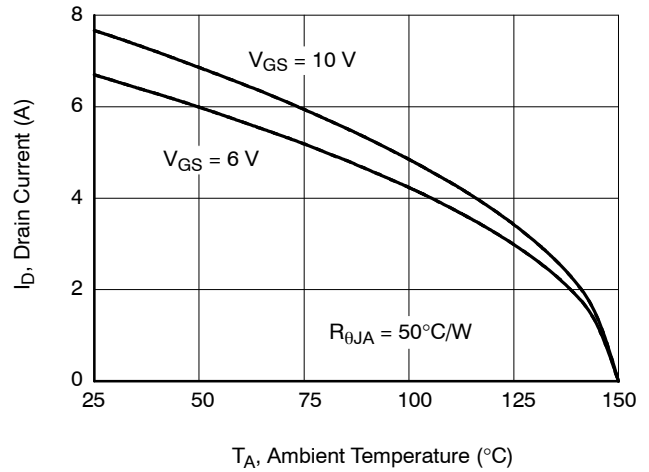


Figure 10. Maximum Continuous Drain Current vs. Ambient Temperature

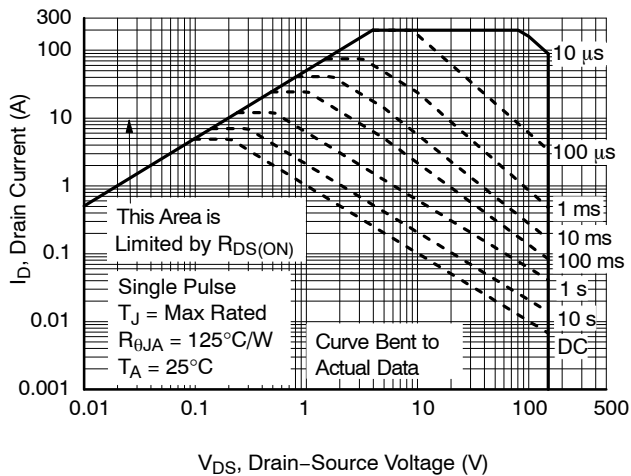


Figure 11. Forward Bias Safe Operating Area

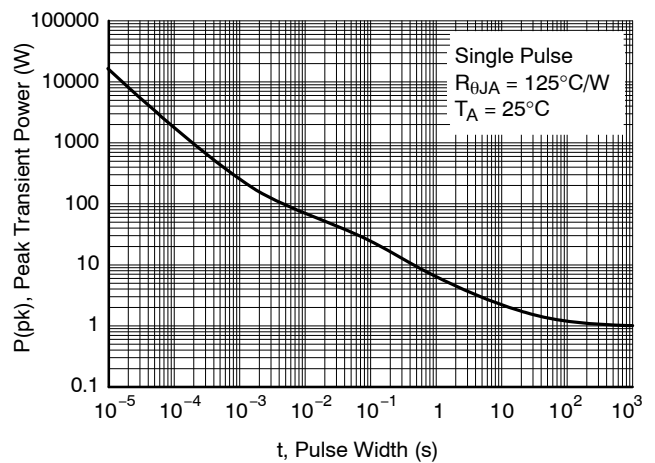


Figure 12. Single Pulse Maximum Power Dissipation

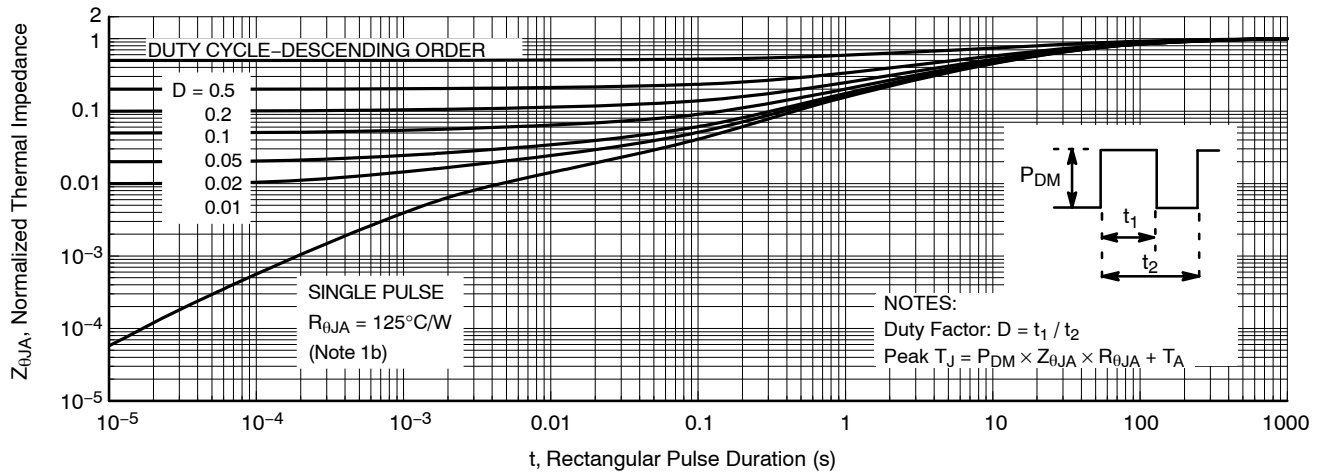
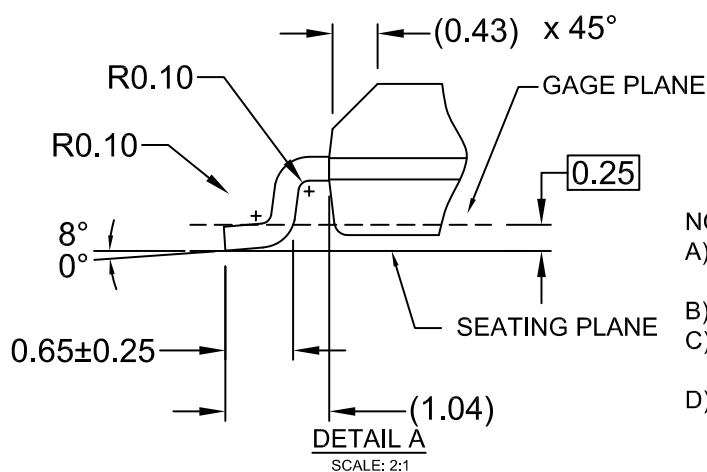
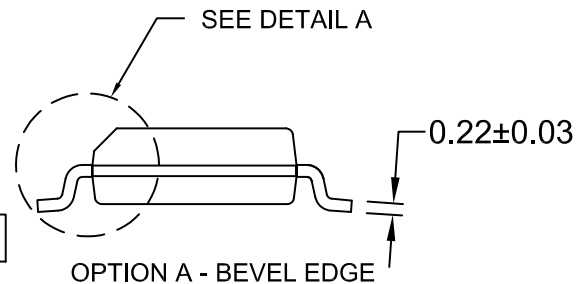
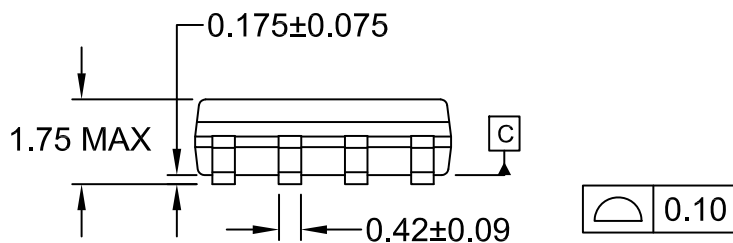
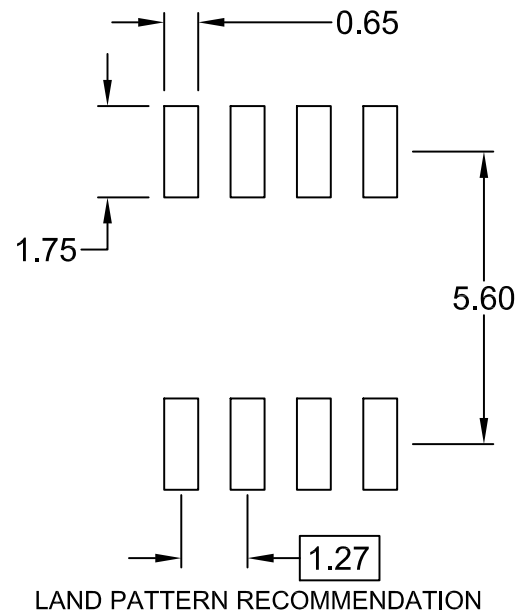
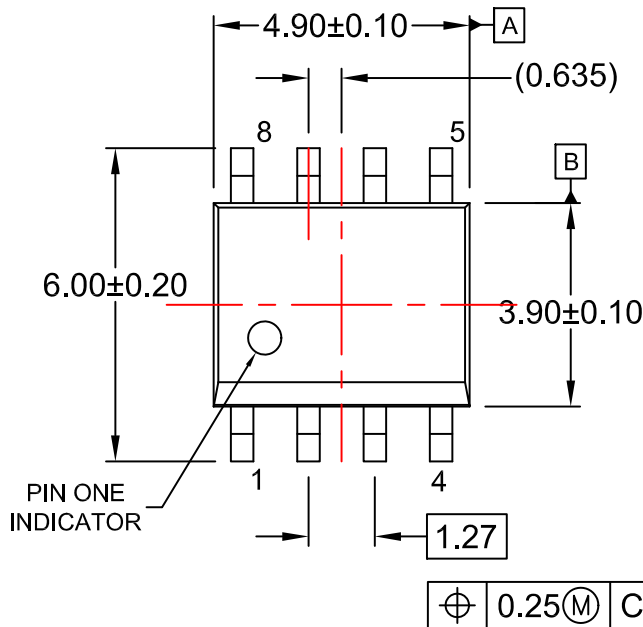
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise noted) (continued)

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

**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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