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October 2015

# FDMA86251

## Single N-Channel PowerTrench<sup>®</sup> MOSFET

150 V, 2.4 A, 175 mΩ

### Features

- Max  $r_{DS(on)}$  = 175 mΩ at  $V_{GS} = 10$  V,  $I_D = 2.4$  A
- Max  $r_{DS(on)}$  = 237 mΩ at  $V_{GS} = 6$  V,  $I_D = 2.0$  A
- Low Profile - 0.8 mm maximum in the new package MicroFET 2x2 mm
- Free from halogenated compounds and antimony oxides
- RoHS Compliant

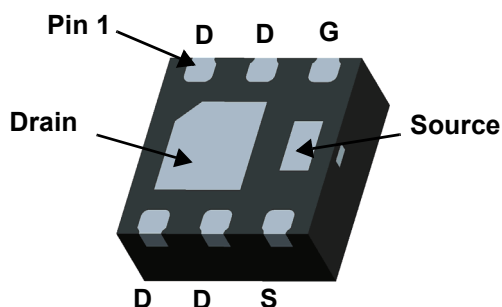


### General Description

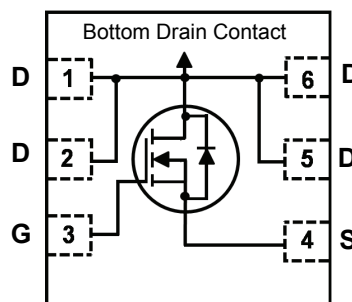
This device has been designed to provide maximum efficiency and thermal performance for synchronous buck converters. The low  $r_{DS(on)}$  and gate charge provide excellent switching performance.

### Applications

- DC – DC Primary Switch
- Load Switch



MicroFET 2X2 (Bottom View)



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted.

| Symbol         | Parameter                                                    | Ratings     | Units            |
|----------------|--------------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                      | 150         | V                |
| $V_{GS}$       | Gate to Source Voltage                                       | $\pm 20$    | V                |
| $I_D$          | Drain Current -Continuous $T_A = 25^\circ\text{C}$ (Note 1a) | 2.4         | A                |
|                | -Pulsed (Note 4)                                             | 12          |                  |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)                       | 13          | mJ               |
| $P_D$          | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)         | 2.4         | W                |
|                | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1b)         | 0.9         |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range             | -55 to +150 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                   |     |                    |
|-----------------|---------------------------------------------------|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 52  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1b) | 145 |                    |

### Package Marking and Ordering Information

| Device Marking | Device    | Package      | Reel Size | Tape Width | Quantity   |
|----------------|-----------|--------------|-----------|------------|------------|
| 251            | FDMA86251 | MicroFET 2X2 | 7"        | 8 mm       | 3000 units |

**Electrical Characteristics**  $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

**Off Characteristics**

|                                      |                                           |                                                                             |     |     |     |                        |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|-----|-----|-----|------------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$                      | 150 |     |     | V                      |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$ |     | 108 |     | 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            | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                          |     |     | 100 | nA                     |

**On Characteristics**

|                                        |                                                          |                                                                                     |     |     |     |                        |
|----------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------|-----|-----|-----|------------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$                                  | 2.0 | 2.8 | 4.0 | V                      |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$         |     | -9  |     | mV/ $^{\circ}\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\text{ V}$ , $I_D = 2.4\text{ A}$                                       |     | 148 | 175 | m $\Omega$             |
|                                        |                                                          | $V_{GS} = 6\text{ V}$ , $I_D = 2.0\text{ A}$                                        |     | 175 | 237 |                        |
|                                        |                                                          | $V_{GS} = 10\text{ V}$ , $I_D = 2.4\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$ |     | 272 | 333 |                        |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DD} = 5\text{ V}$ , $I_D = 2.4\text{ A}$                                        |     | 4.7 |     | S                      |

**Dynamic Characteristics**

|           |                              |                                                                        |     |     |     |          |
|-----------|------------------------------|------------------------------------------------------------------------|-----|-----|-----|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 75\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1\text{ MHz}$ |     | 259 | 363 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                        |     | 24  | 34  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                        |     | 1.5 | 2.4 | pF       |
| $R_g$     | Gate Resistance              |                                                                        | 0.1 | 1.5 | 3.0 | $\Omega$ |

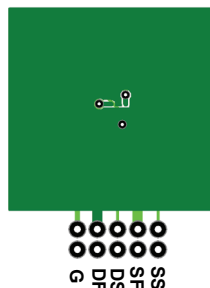
**Switching Characteristics**

|              |                               |                                                                                                         |                                                  |     |     |    |
|--------------|-------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 75\text{ V}$ , $I_D = 2.4\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$ |                                                  | 5.9 | 12  | ns |
| $t_r$        | Rise Time                     |                                                                                                         |                                                  | 1.7 | 10  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                         |                                                  | 10  | 20  | ns |
| $t_f$        | Fall Time                     |                                                                                                         |                                                  | 2.3 | 10  | ns |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\text{ V to }10\text{ V}$                                                                    | $V_{DD} = 75\text{ V}$ ,<br>$I_D = 2.4\text{ A}$ | 4.1 | 5.8 | nC |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\text{ V to }6\text{ V}$                                                                     |                                                  | 2.7 | 3.8 | nC |
| $Q_{gs}$     | Gate to Source Charge         |                                                                                                         |                                                  | 1.2 |     | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                         |                                                  | 1.0 |     | nC |

**Drain-Source Diode Characteristics**

|          |                                       |                                                           |  |     |     |    |
|----------|---------------------------------------|-----------------------------------------------------------|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$ , $I_S = 2.4\text{ A}$ (Note 2)     |  | 0.8 | 1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 2.4\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ |  | 49  | 79  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                           |  | 38  | 61  | nC |

Notes:

1:  $R_{\theta JA}$  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  $R_{\theta JA}$  is determined by the user's board design.a. 52  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.b. 145  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.2: Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.3:  $E_{AS}$  of 13 mJ is based on starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 3\text{ A}$ ,  $V_{DD} = 150\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.3\text{ mH}$ ,  $I_{AS} = 8\text{ A}$ .4: Pulsed  $I_d$  please refer to Fig 9 SOA graph for more details.

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

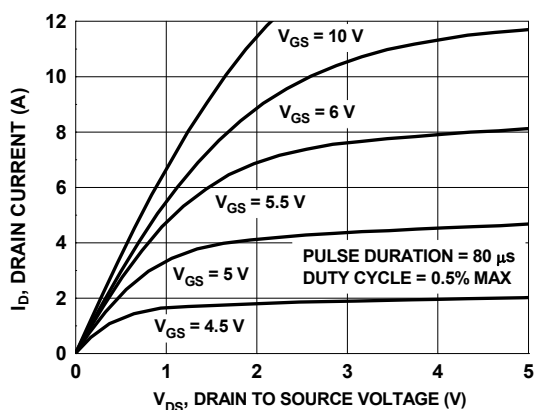


Figure 1. On Region Characteristics

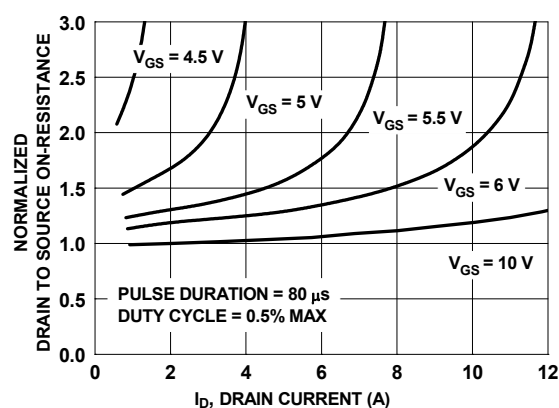


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

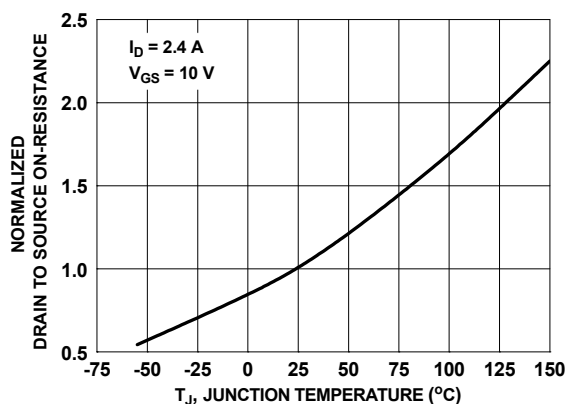


Figure 3. Normalized On Resistance vs. Junction Temperature

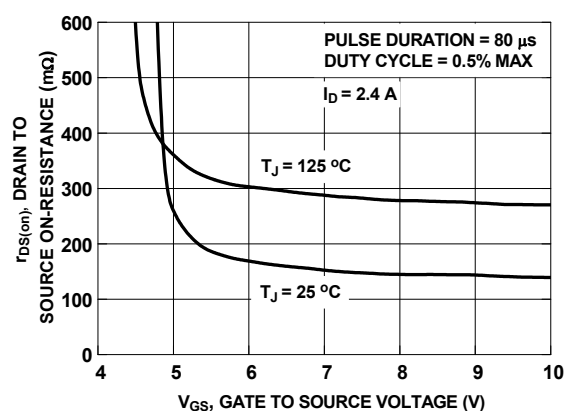


Figure 4. On-Resistance vs. Gate to Source Voltage

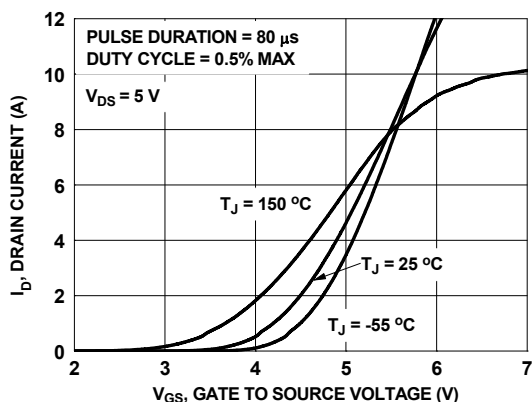


Figure 5. Transfer Characteristics

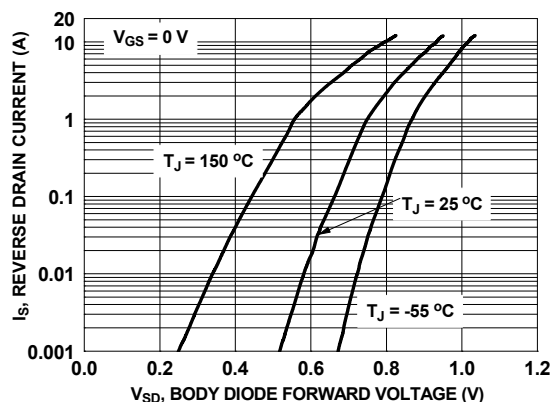


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

# Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

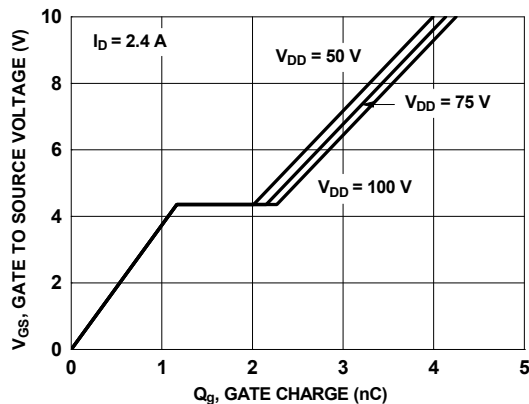


Figure 7. Gate Charge Characteristics

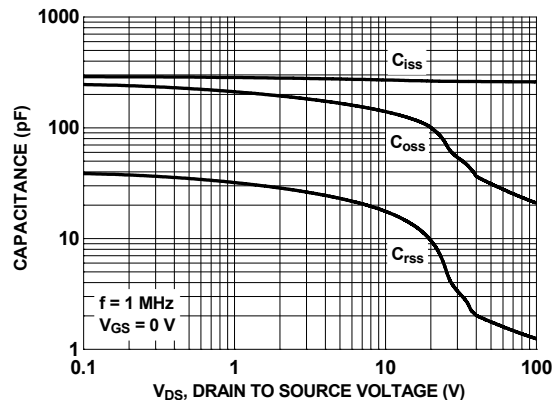


Figure 8. Capacitance vs. Drain to Source Voltage

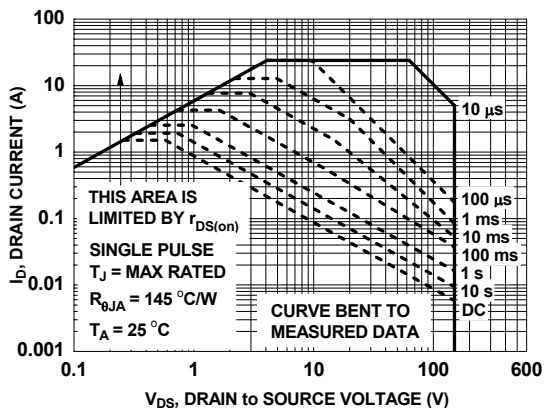


Figure 9. Forward Bias Safe Operating Area

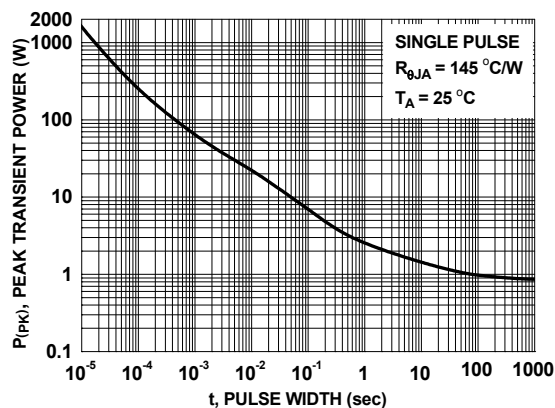


Figure 10. Single Pulse Maximum Power Dissipation

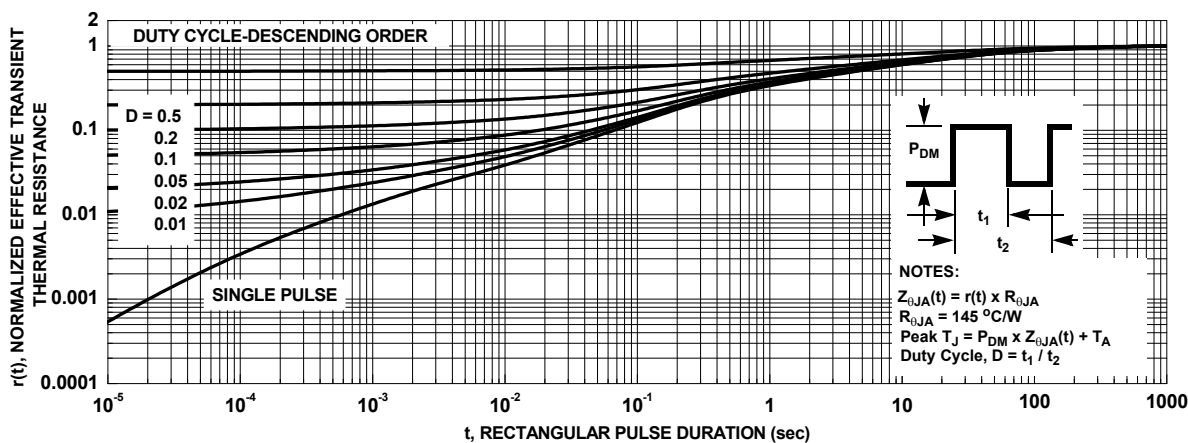
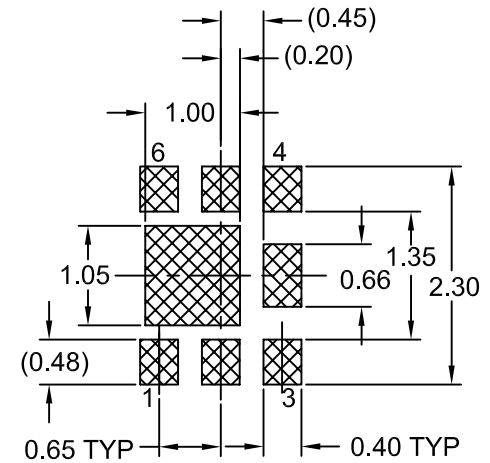
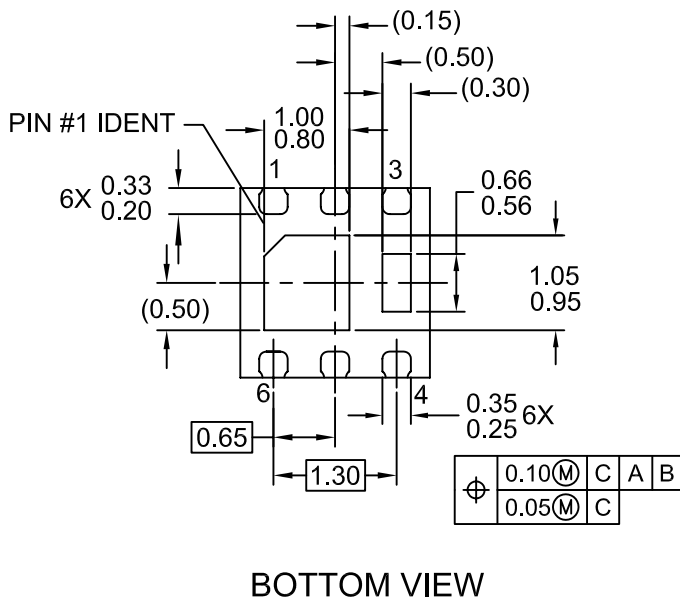
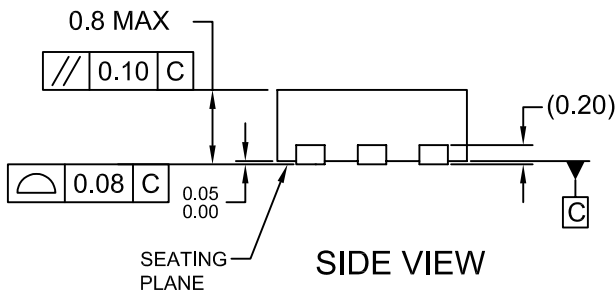
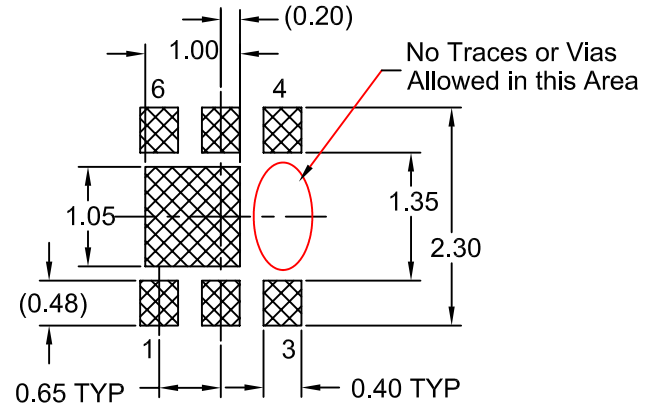
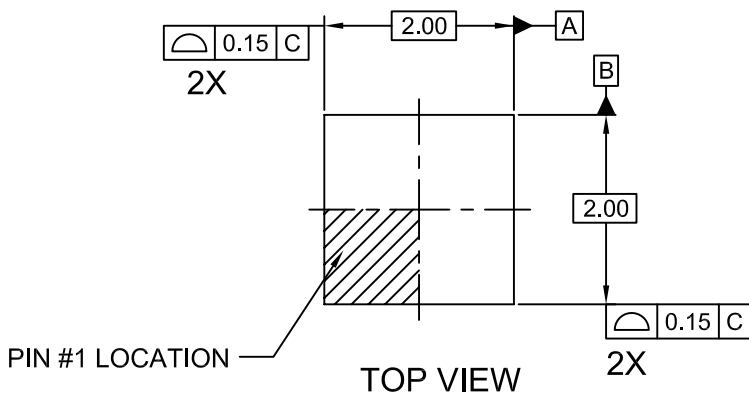


Figure 11. Junction-to-Ambient Transient Thermal Response Curve



## NOTES:

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-229 DATED AUG/2003
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