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ON Semiconductor®

# FDME820NZT

## N-Channel PowerTrench® MOSFET 20 V, 9 A, 18 mΩ

### Features

- Max  $r_{DS(on)}$  = 18 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 9$  A
- Max  $r_{DS(on)}$  = 24 mΩ at  $V_{GS} = 2.5$  V,  $I_D = 7.5$  A
- Max  $r_{DS(on)}$  = 32 mΩ at  $V_{GS} = 1.8$  V,  $I_D = 7$  A
- Low profile: 0.55 mm maximum in the new package MicroFET 1.6x1.6 Thin
- Free from halogenated compounds and antimony oxides
- HBM ESD protection level >2.5 kV (Note3)
- RoHS Compliant

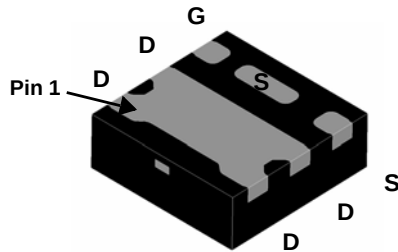


### General Description

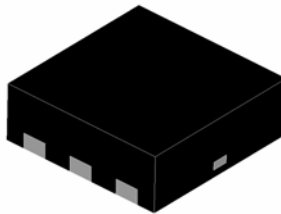
This Single N-Channel MOSFET has been designed using ON Semiconductor's advanced Power Trench process to optimize the  $r_{DS(on)}$  @  $V_{GS} = 1.8$  V on special MicroFET leadframe.

### Applications

- Li-Ion Battery Pack
- Baseband Switch
- Load Switch
- DC-DC Conversion

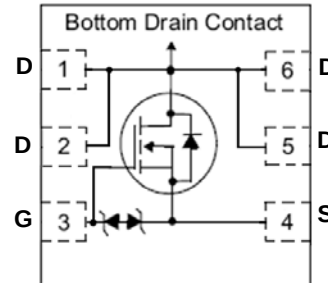


BOTTOM



TOP

MicroFET 1.6x1.6 Thin



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

| Symbol         | Parameter                                                                 | Ratings     | Units            |
|----------------|---------------------------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                                   | 20          | V                |
| $V_{GS}$       | Gate to Source Voltage                                                    | $\pm 12$    | V                |
| $I_D$          | Drain Current -Continuous $T_A = 25^\circ\text{C}$ (Note 1a)              | 9           | A                |
|                | -Pulsed                                                                   | 40          |                  |
| $P_D$          | Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$ (Note 1a) | 2.1         | W                |
|                | Power Dissipation for Single Operation $T_A = 25^\circ\text{C}$ (Note 1b) | 0.7         |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                          | -55 to +150 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                         |           |     |                    |
|-----------------|-----------------------------------------|-----------|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 70  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1b) | 190 |                    |

### Package Marking and Ordering Information

| Device Marking | Device     | Package               | Reel Size | Tape Width | Quantity   |
|----------------|------------|-----------------------|-----------|------------|------------|
| 8T             | FDME820NZT | MicroFET 1.6x1.6 Thin | 7"        | 8 mm       | 5000 units |

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

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

**Off Characteristics**

|                                      |                                           |                                                             |    |    |          |                      |
|--------------------------------------|-------------------------------------------|-------------------------------------------------------------|----|----|----------|----------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$           | 20 |    |          | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$ |    | 20 |          | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 16\ \text{V}$ , $V_{GS} = 0\ \text{V}$            |    |    | 1        | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 12\ \text{V}$ , $V_{DS} = 0\ \text{V}$        |    |    | $\pm 10$ | $\mu\text{A}$        |

**On Characteristics**

|                                        |                                                          |                                                                            |     |     |     |                      |
|----------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------|-----|-----|-----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$                               | 0.5 | 0.8 | 1.0 | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$                |     | -3  |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Drain to Source On Resistance                            | $V_{GS} = 4.5\ \text{V}$ , $I_D = 9\ \text{A}$                             |     | 14  | 18  | m $\Omega$           |
|                                        |                                                          | $V_{GS} = 2.5\ \text{V}$ , $I_D = 7.5\ \text{A}$                           |     | 17  | 24  |                      |
|                                        |                                                          | $V_{GS} = 1.8\ \text{V}$ , $I_D = 7\ \text{A}$                             |     | 26  | 32  |                      |
|                                        |                                                          | $V_{GS} = 4.5\ \text{V}$ , $I_D = 9\ \text{A}$ , $T_J = 125^\circ\text{C}$ |     | 19  | 24  |                      |

**Dynamic Characteristics**

|           |                              |                                                                           |  |     |  |          |
|-----------|------------------------------|---------------------------------------------------------------------------|--|-----|--|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 10\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$ |  | 865 |  | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                           |  | 203 |  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                           |  | 190 |  | pF       |
| $R_g$     | Gate Resistance              |                                                                           |  | 1.0 |  | $\Omega$ |

**Switching Characteristics**

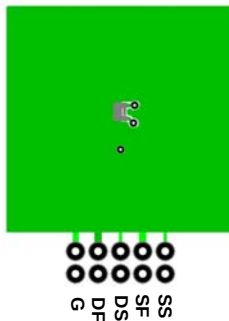
|              |                               |                                                                                                   |  |     |  |    |
|--------------|-------------------------------|---------------------------------------------------------------------------------------------------|--|-----|--|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 10\ \text{V}$ , $I_D = 4\ \text{A}$<br>$V_{GS} = 4.5\ \text{V}$ , $R_{GEN} = 2\ \Omega$ |  | 9   |  | ns |
| $t_r$        | Rise Time                     |                                                                                                   |  | 5   |  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                   |  | 19  |  | ns |
| $t_f$        | Fall Time                     |                                                                                                   |  | 5   |  | ns |
| $Q_g$        | Total Gate Charge             | $V_{DD} = 4.2\ \text{V}$ , $I_D = 3\ \text{A}$ , $V_{GS} = 4.3\ \text{V}$                         |  | 8.0 |  | nC |
| $Q_g$        | Total Gate Charge             | $V_{DD} = 4.2\ \text{V}$ , $I_D = 3\ \text{A}$ , $V_{GS} = 4.5\ \text{V}$                         |  | 8.5 |  | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    | $V_{DD} = 10\ \text{V}$ , $I_D = 9\ \text{A}$                                                     |  | 1.4 |  | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                   |  | 3.2 |  | nC |

**Drain-Source Diode Characteristics**

|          |                                       |                                                         |  |     |     |    |
|----------|---------------------------------------|---------------------------------------------------------|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}$ , $I_S = 1.6\ \text{A}$ (Note 2) |  | 0.7 | 1.2 | V  |
|          |                                       | $V_{GS} = 0\ \text{V}$ , $I_S = 9\ \text{A}$ (Note 2)   |  | 0.8 | 1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 9\ \text{A}$ , $di/dt = 100\ \text{A/us}$        |  | 18  |     | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                         |  | 4   |     | 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  $R_{\theta CA}$  is determined by the user's board design.



a.  $70^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b.  $190^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty cycle < 2.0%.

3. The diode connected between the gate and source serves only as protection ESD. No gate overvoltage rating is implied.

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

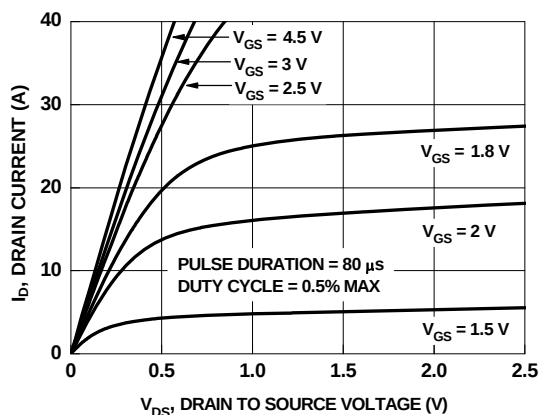


Figure 1. On Region Characteristics

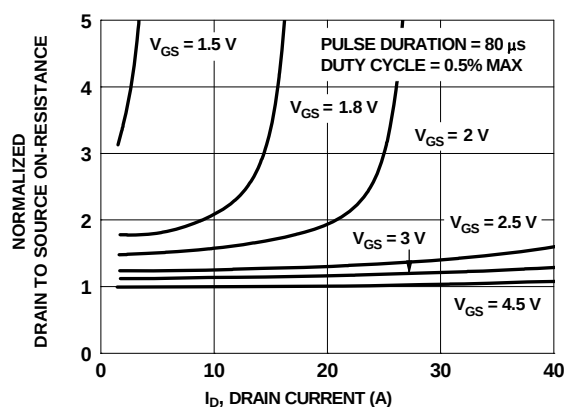


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

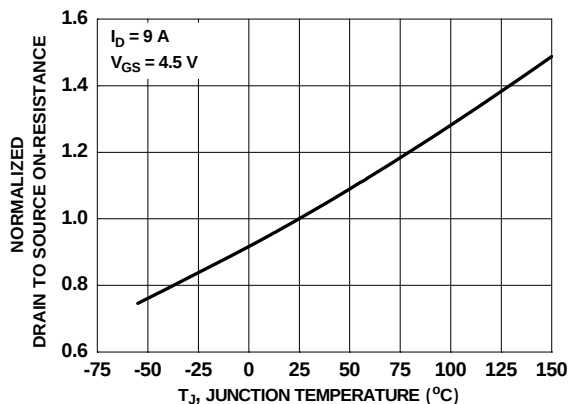


Figure 3. Normalized On Resistance vs Junction Temperature

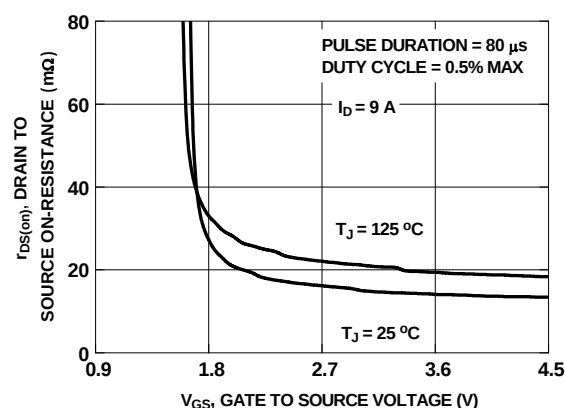


Figure 4. On-Resistance vs Gate to Source Voltage

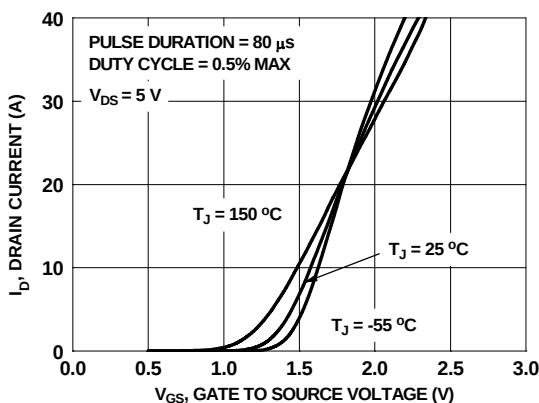


Figure 5. Transfer Characteristics

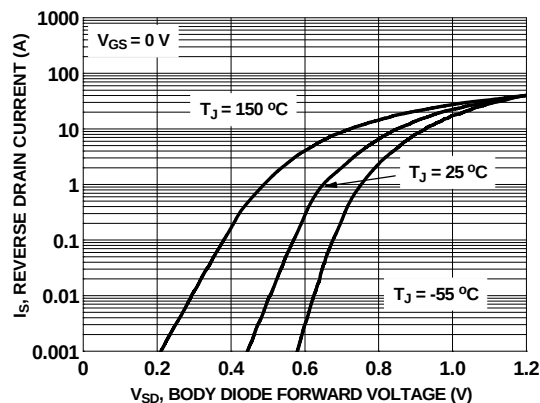


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

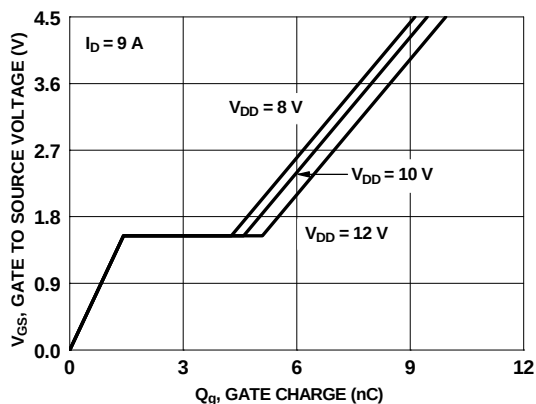


Figure 7. Gate Charge Characteristics

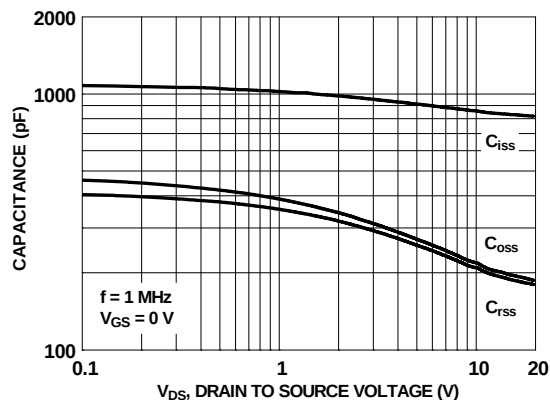


Figure 8. Capacitance vs Drain to Source Voltage

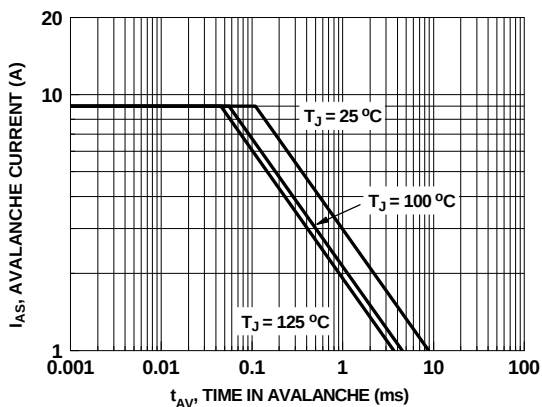


Figure 9. Unclamped Inductive Switching Capability

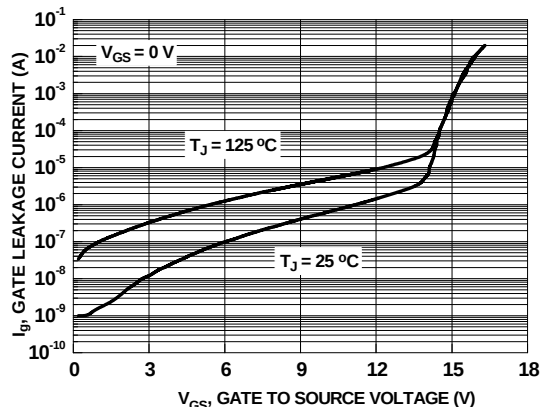


Figure 10. Gate Leakage Current vs Gate to Source Voltage

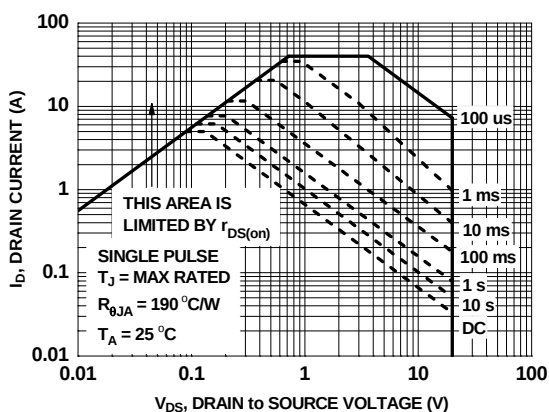


Figure 11. Forward Bias Safe Operating Area

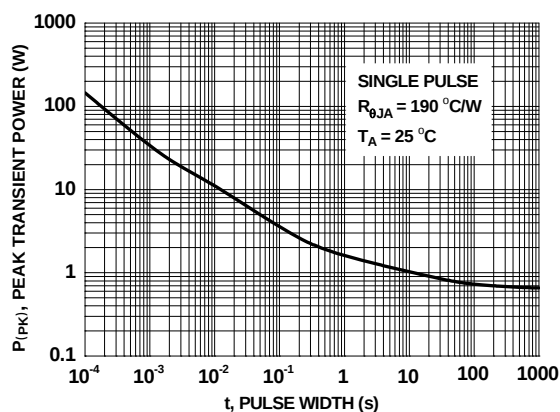
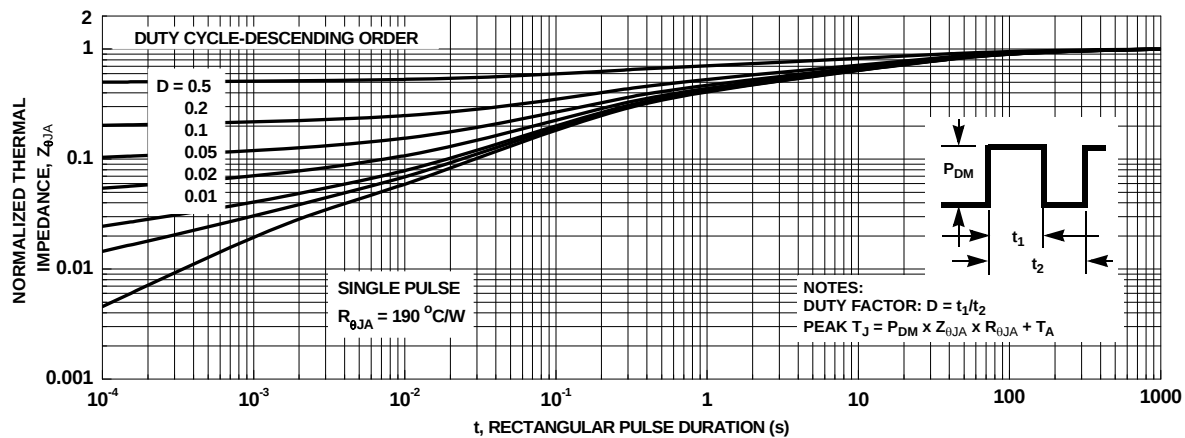
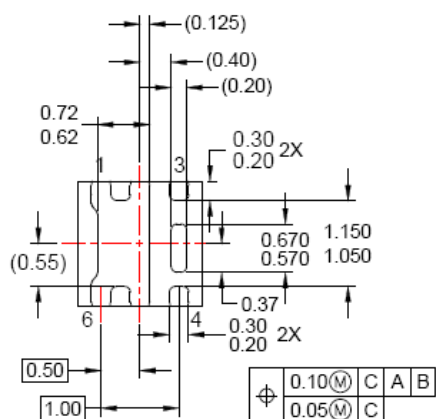
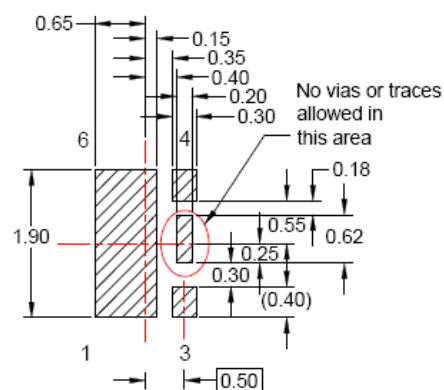
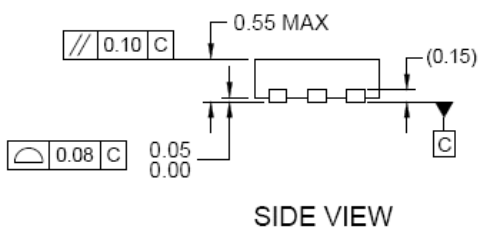
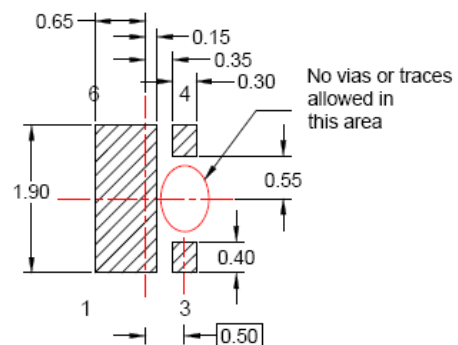
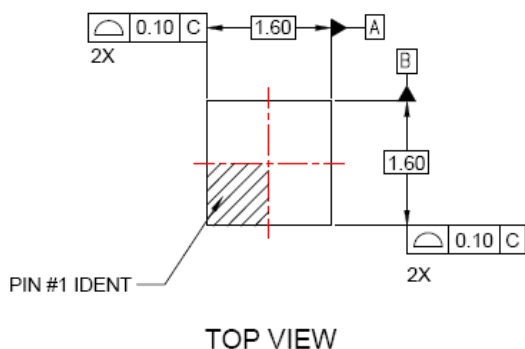


Figure 12. Single Pulse Maximum Power Dissipation

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



# Dimensional Outline and Pad Layout



## NOTES:

- DOES NOT FULLY CONFORM TO JEDEC REGISTRATION
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- DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
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