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# FDMA1430JP

## Integrated P-Channel PowerTrench<sup>®</sup> MOSFET and BJT -30 V, -2.9 A, 90 mΩ

July 2014

### Features

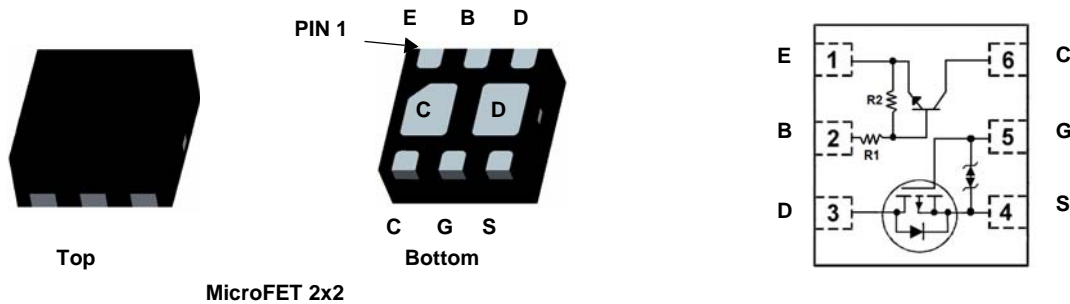
- Max  $r_{DS(on)}$  = 90 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -2.9$  A
- Max  $r_{DS(on)}$  = 130 mΩ at  $V_{GS} = -2.5$  V,  $I_D = -2.6$  A
- Max  $r_{DS(on)}$  = 170 mΩ at  $V_{GS} = -1.8$  V,  $I_D = -1.7$  A
- Max  $r_{DS(on)}$  = 240 mΩ at  $V_{GS} = -1.5$  V,  $I_D = -1$  A
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2
- HBM ESD protection level > 2 kV typical (Note 3)
- RoHS Compliant

### General Description

This device is designed specifically as a single package solution for loadswitching in cellular handset and other ultra-portable applications. It features a 50 V NPN BJT and a 30 V P-ch Trench MOSFET in the space saving MicroFET 2x2 package that offers exceptional thermal performance for its physical size and is well suited to linear mode applications.

### Application

- Loadswitching



### Maximum Ratings $T_A = 25$ °C unless otherwise noted

| Symbol         | Parameter  | Ratings                            | Units |
|----------------|--|------------------------------------|-------|
| $V_{DS}$       | Drain to Source Voltage                          | -30                                | V     |
| $V_{GS}$       | Gate to Source Voltage                           | ±8                                 | V     |
| $I_D$          | Drain Current -Continuous                        | $T_A = 25^\circ\text{C}$ (Note 1a) | -2.9  |
|                | -Pulsed  |                                    | -12   |
| $V_{CBO}$      | Collector-Base Voltage                           | (Note 4)                           | 50    |
| $V_{CEO}$      | Collector-Emitter Voltage                        | (Note 5)                           | 50    |
| $V_{EBO}$      | Emitter-Base Voltage                             |                                    | 10    |
| $I_C$          | Collector Current                                |                                    | 100   |
| $P_C$          | Collector Power Dissipation                      |                                    | 200   |
| $T_J$          | Junction Temperature                             |                                    | 150   |
| $P_D$          | Power Dissipation                                | $T_A = 25^\circ\text{C}$ (Note 1a) | 1.5   |
|                |  | $T_A = 25^\circ\text{C}$ (Note 1b) | 0.7   |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150                        | °C    |

### Thermal Characteristics

|                 |   |           |     |      |
|-----------------|---|-----------|-----|------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient(MOSFET) | (Note 1a) | 86  | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient(MOSFET) | (Note 1b) | 173 |      |

### Package Marking and Ordering Information

| Device Marking | Device     | Package      | Reel Size | Tape Width | Quantity   |
|----------------|------------|--------------|-----------|------------|------------|
| 143            | FDMA1430JP | MicroFET 2x2 | 7"        | 8 mm       | 5000 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         | $I_D = -250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$                    | -30 |     |         | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$ |     | -23 |         | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = -24\text{ V}$ , $V_{GS} = 0\text{ V}$                            |     |     | -1      | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 8\text{ V}$ , $V_{DS} = 0\text{ V}$                          |     |     | $\pm 1$ | $\mu\text{A}$        |

**On Characteristics**

|  |  |   |      |      |     |                      |
|--|--|---|------|------|-----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = -250\text{ }\mu\text{A}$                                     | -0.4 | -0.6 | -1  | 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 $25\text{ }^\circ\text{C}$              |      | 2.4  |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = -4.5\text{ V}$ , $I_D = -2.9\text{ A}$  |      | 67   | 90  | m $\Omega$           |
|  |  | $V_{GS} = -2.5\text{ V}$ , $I_D = -2.6\text{ A}$  |      | 81   | 130 |                      |
|  |  | $V_{GS} = -1.8\text{ V}$ , $I_D = -1.7\text{ A}$  |      | 98   | 170 |                      |
|  |  | $V_{GS} = -1.5\text{ V}$ , $I_D = -1\text{ A}$  |      | 114  | 240 |                      |
|  |  | $V_{GS} = -4.5\text{ V}$ , $I_D = -2.9\text{ A}$ ,<br>$T_J = 125\text{ }^\circ\text{C}$ |      | 102  | 133 |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = -5\text{ V}$ , $I_D = -2.9\text{ A}$  |      | 11   |     | S                    |

**Dynamic Characteristics**

|           |                              |   |  |     |     |    |
|-----------|------------------------------|---|--|-----|-----|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -15\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$f = 1\text{ MHz}$ |  | 438 | 580 | pF |
| $C_{oss}$ | Output Capacitance           |   |  | 47  | 70  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |   |  | 41  | 60  | pF |

**Switching Characteristics**

|              |                               |   |   |     |     |    |
|--------------|-------------------------------|---|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = -15\text{ V}$ , $I_D = -1\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$ |   | 4.8 | 10  | ns |
| $t_r$        | Rise Time                     |   |   | 4.4 | 10  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |   |   | 67  | 107 | ns |
| $t_f$        | Fall Time                     |   |   | 21  | 33  | ns |
| $Q_g$        | Total Gate Charge             |   | $V_{DD} = -15\text{ V}$ , $I_D = -2.9\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}$ |     | 7.2 | 10 |
| $Q_{gs}$     | Gate to Source Charge         |   |   | 0.7 |     | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |   |   | 1.6 |     | nC |

**Drain-Source Diode Characteristics**

|          |                                       |  |  |      |      |    |
|----------|---------------------------------------|--|--|------|------|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$ , $I_S = -1.1\text{ A}$ (Note 2)     |  | -0.7 | -1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = -2.9\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ |  | 16   | 29   | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |  |  | 5    | 10   | nC |

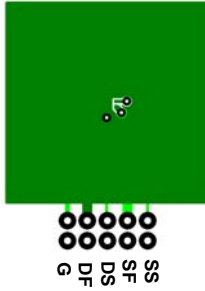
**BJT Characteristics**

|               |                                      |  |     |     |     |               |
|---------------|--------------------------------------|--|-----|-----|-----|---------------|
| $I_{CBO}$     | Collector Cut-off Current            | $V_{CB} = 40\text{ V}$ , $I_E = 0\text{ A}$                      |     |     | 0.1 | $\mu\text{A}$ |
| $h_{FE}$      | DC Current Gain                      | $V_{CE} = 5\text{ V}$ , $I_C = 5\text{ mA}$                      | 68  |     |     |               |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C = 10\text{ mA}$ , $I_B = 0.5\text{ mA}$                     |     |     | 0.3 | V             |
| $f_T$         | Current Gain Bandwidth Product       | $V_{CE} = 10\text{ V}$ , $I_C = 5\text{ mA}$                     |     | 250 |     | MHz           |
| $C_{ob}$      | Output Capacitance                   | $V_{CB} = 10\text{ V}$ , $I_E = 0\text{ A}$ , $f = 1\text{ MHz}$ |     | 3.7 |     | pF            |
| $V_{I(off)}$  | Input Off Voltage                    | $V_{CE} = 5\text{ V}$ , $I_C = 100\text{ }\mu\text{A}$           | 0.5 |     |     | V             |
| $V_{I(on)}$   | Input On Voltage                     | $V_{CE} = 0.2\text{ V}$ , $I_C = 5\text{ mA}$                    |     |     | 1.3 | V             |
| R1            | Input Resistor                       |  |     | 4.7 |     | k $\Omega$    |
| R1/R2         | Resistor Ratio                       |  |     | 0.1 |     |               |

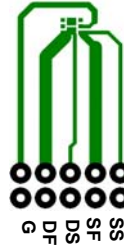
## Electrical Characteristics

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> 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.



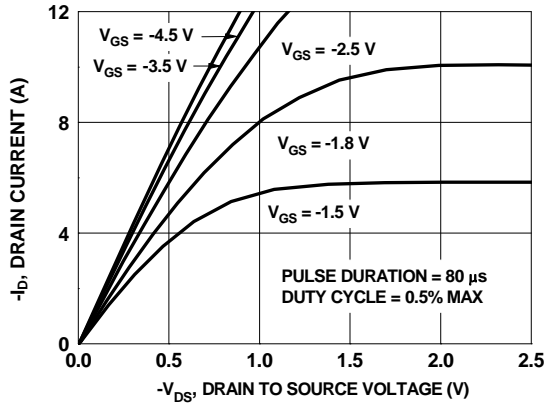
a. 86 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz. copper



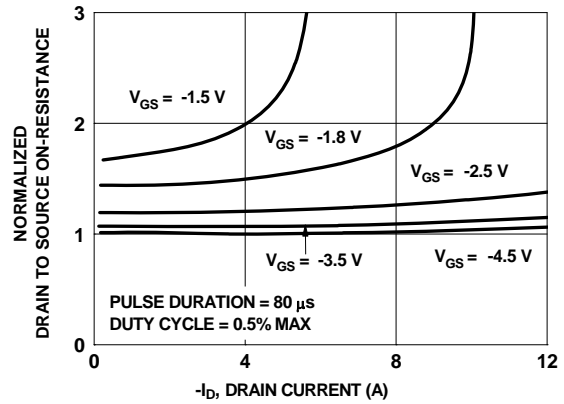
b. 173 °C/W when mounted on a minimum pad of 2 oz copper

- 2. Pulse Test : Pulse Width < 300 us, Duty Cycle < 2.0%
- 3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.
- 4. Guaranteed by  $I_{cbo}$
- 5. Guaranteed by  $I_{ceo}$

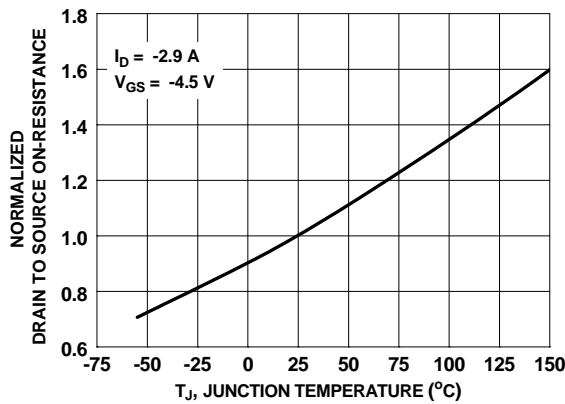
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



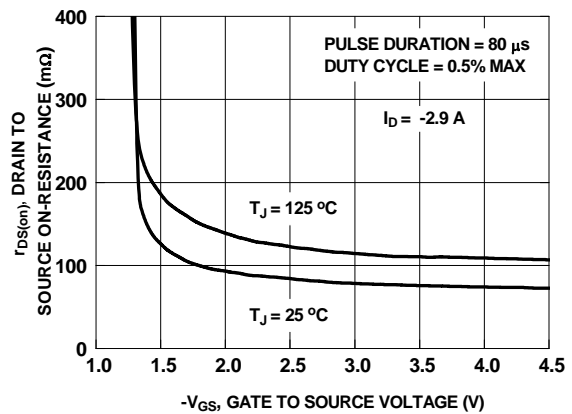
**Figure 1. On-Region Characteristics**



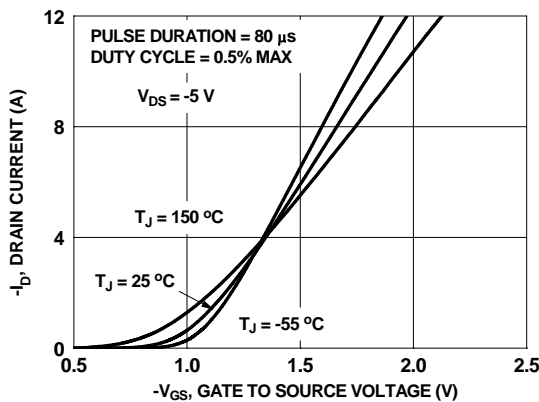
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



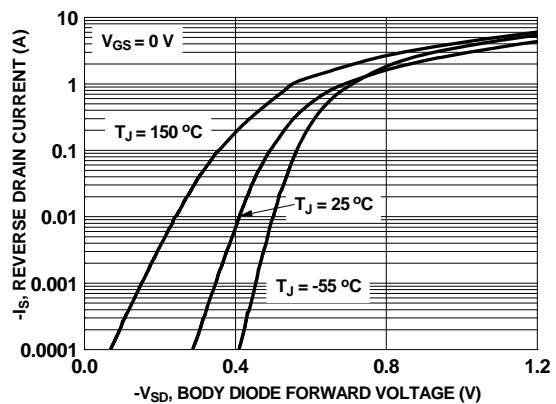
**Figure 3. Normalized On-Resistance vs Junction Temperature**



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

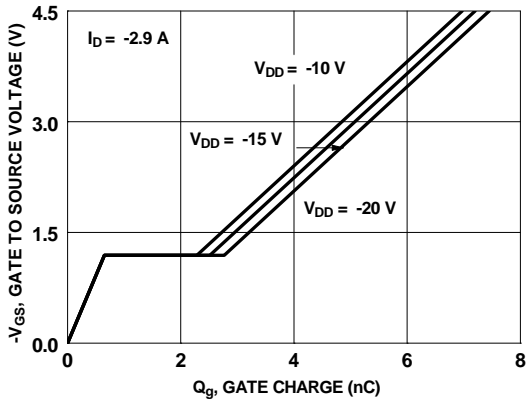


**Figure 5. Transfer Characteristics**

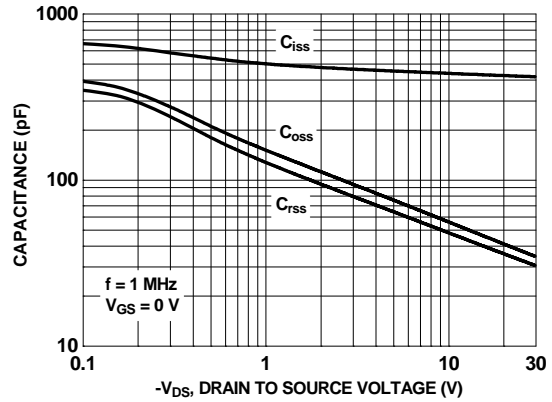


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

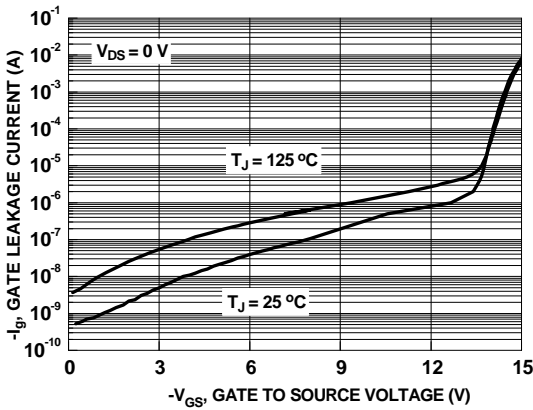
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



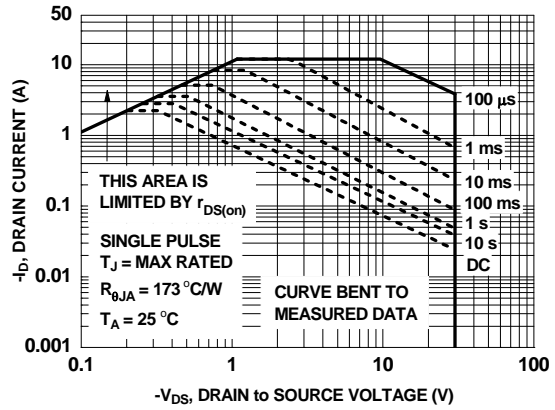
**Figure 7. Gate Charge Characteristics**



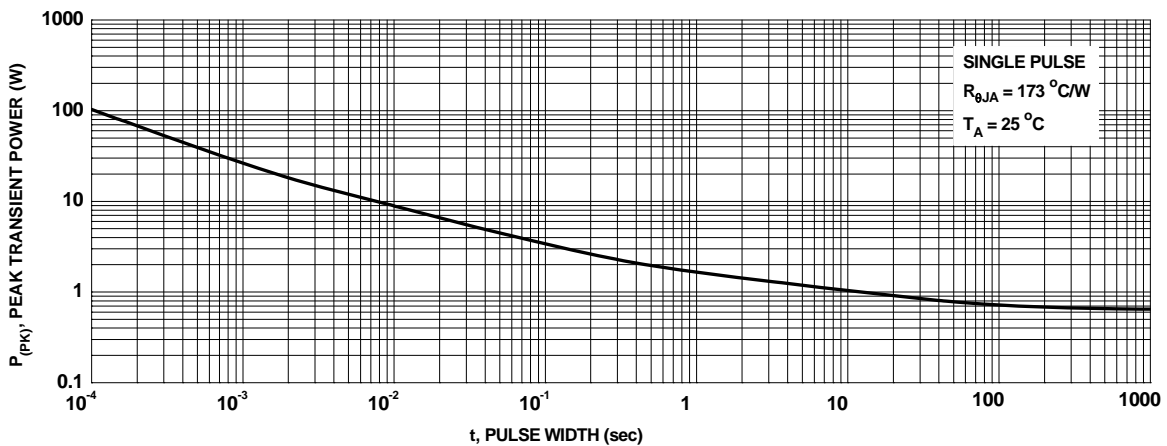
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Gate Leakage vs Gate to Source Voltage**

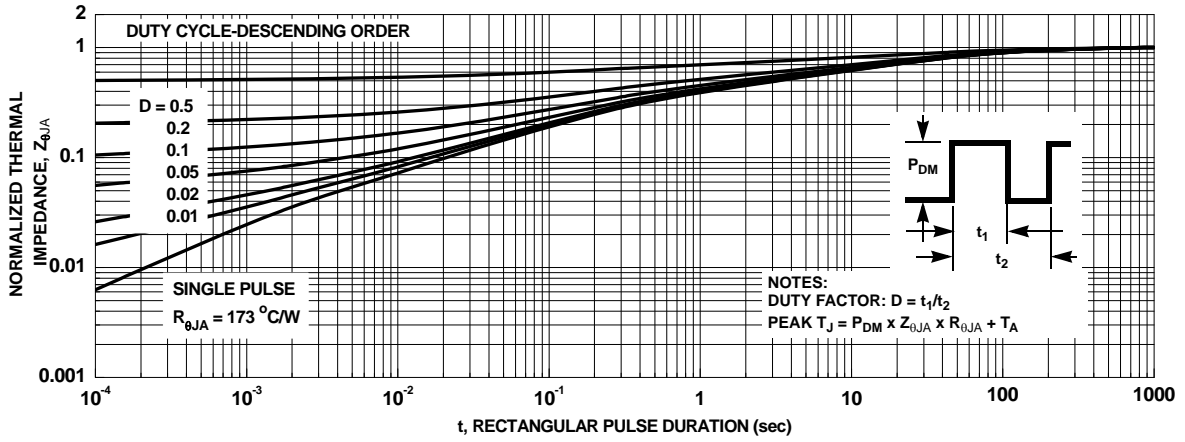


**Figure 10. Forward Bias Safe Operating Area**



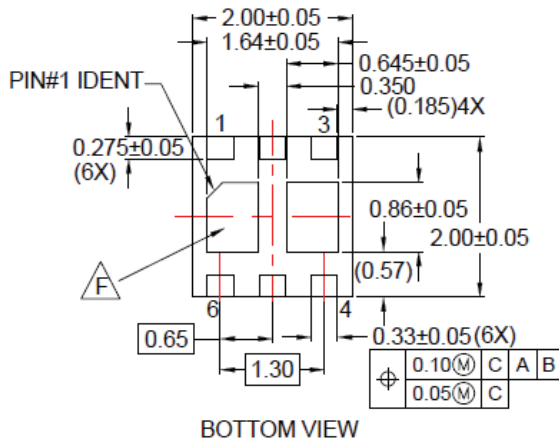
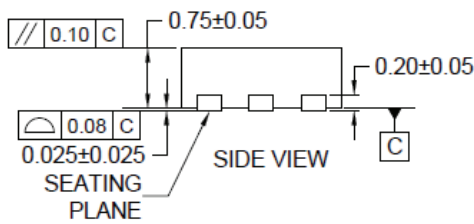
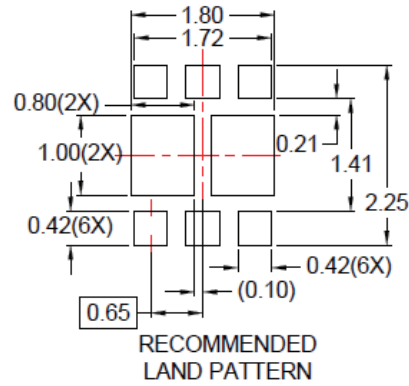
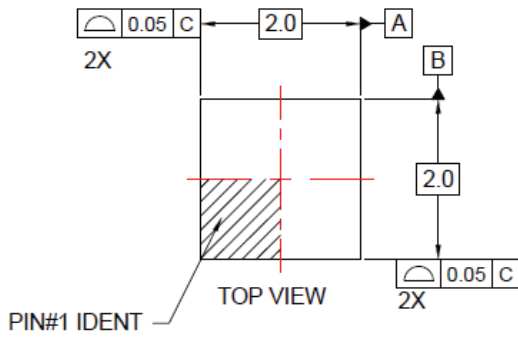
**Figure 11. Single Pulse Maximum Power Dissipation**

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



**Figure 12. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



### NOTES:

- A. CONFORM TO JADEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
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| Datasheet Identification | Product Status        | Definition  |
|--------------------------|-----------------------|---|
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