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# FDMT800152DC

## N-Channel Dual Cool™ 88 PowerTrench® MOSFET

150 V, 72 A, 9.0 mΩ

### Features

- Max  $r_{DS(on)}$  = 9.0 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 13\text{ A}$
- Max  $r_{DS(on)}$  = 11.5 mΩ at  $V_{GS} = 6\text{ V}$ ,  $I_D = 11\text{ A}$
- Advanced Package and Silicon combination for low  $r_{DS(on)}$  and high efficiency
- Next generation enhanced body diode technology, engineered for soft recovery
- Low profile 8x8mm MLP package
- MSL1 robust package design
- 100% UIL tested
- RoHS Compliant

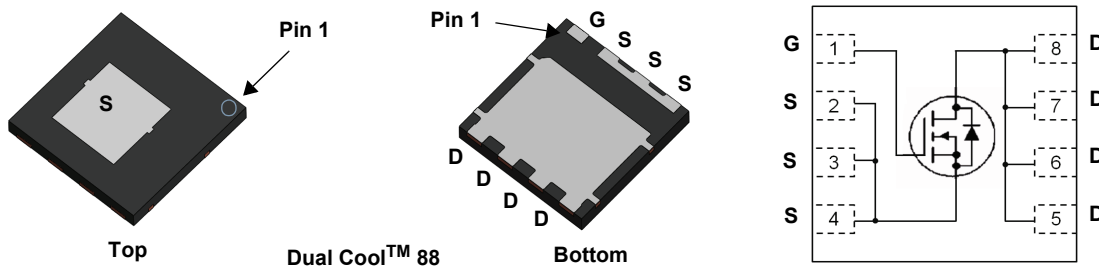


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process. Advancements in both silicon and Dual Cool™ package technologies have been combined to offer the lowest  $r_{DS(on)}$  while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance.

### Applications

- OringFET / Load Switching
- Synchronous Rectification
- DC-DC Conversion



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

| Symbol         | Parameter  | Ratings                        | Units |
|----------------|--|--------------------------------|-------|
| $V_{DS}$       | Drain to Source Voltage                          | 150                            | V     |
| $V_{GS}$       | Gate to Source Voltage                           | ±20                            | V     |
| $I_D$          | Drain Current -Continuous                        | $T_C = 25\text{ °C}$ (Note 5)  | 72    |
|                | -Continuous                                      | $T_C = 100\text{ °C}$ (Note 5) | 45    |
|                | -Continuous                                      | $T_A = 25\text{ °C}$ (Note 1a) | 13    |
|                | -Pulsed  | (Note 4)                       | 413   |
| $E_{AS}$       | Single Pulse Avalanche Energy                    | (Note 3)                       | 726   |
| $P_D$          | Power Dissipation                                | $T_C = 25\text{ °C}$           | 113   |
|                | Power Dissipation                                | $T_A = 25\text{ °C}$ (Note 1a) | 3.2   |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150                    | °C    |

### Thermal Characteristics

|                 |   |                |     |      |
|-----------------|---|----------------|-----|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | (Top Source)   | 2.0 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | (Bottom Drain) | 1.1 |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a)      | 38  |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1b)      | 81  |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1i)      | 15  |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1j)      | 21  |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1k)      | 9   |      |

### Package Marking and Ordering Information

| Device Marking | Device       | Package       | Reel Size | Tape Width | Quantity   |
|----------------|--------------|---------------|-----------|------------|------------|
| 800152DC       | FDMT800152DC | Dual Cool™ 88 | 13"       | 13.3 mm    | 3000 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         | $I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}$              | 150 |     |     | V             |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$ |     | 114 |     | mV/°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                         | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$                            | 2.0 | 2.9  | 4.0  | V          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$          |     | -11  |      | mV/°C      |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}, I_D = 13\ \text{A}$                          |     | 6.9  | 9.0  | m $\Omega$ |
|  |  | $V_{GS} = 6\ \text{V}, I_D = 11\ \text{A}$                           |     | 8.6  | 11.5 |            |
|  |  | $V_{GS} = 10\ \text{V}, I_D = 13\ \text{A}, T_J = 125^\circ\text{C}$ |     | 14.6 | 19   |            |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 5\ \text{V}, I_D = 13\ \text{A}$                           |     | 41   |      | S          |

**Dynamic Characteristics**

|           |                              |   |     |      |      |          |
|-----------|------------------------------|---|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 75\ \text{V}, V_{GS} = 0\ \text{V},$<br>$f = 1\ \text{MHz}$ |     | 4196 | 5875 | pF       |
| $C_{oss}$ | Output Capacitance           |   |     | 379  | 530  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |   |     | 16   | 30   | pF       |
| $R_g$     | Gate Resistance              |   | 0.1 | 1.3  | 3.3  | $\Omega$ |

**Switching Characteristics**

|              |                               |  |  |     |    |    |    |
|--------------|-------------------------------|--|--|-----|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 75\ \text{V}, I_D = 13\ \text{A},$<br>$V_{GS} = 10\ \text{V}, R_{GEN} = 6\ \Omega$ |  | 24  | 39 | ns |    |
| $t_r$        | Rise Time                     |  |  | 13  | 23 | ns |    |
| $t_{d(off)}$ | Turn-Off Delay Time           |  |  | 36  | 58 | ns |    |
| $t_f$        | Fall Time                     |  |  | 7.9 | 16 | ns |    |
| $Q_{g(TOT)}$ | Total Gate Charge             |  | $V_{GS} = 0\ \text{V to } 10\ \text{V}$          |     | 59 | 83 | nC |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\ \text{V to } 6\ \text{V}$   | $V_{DD} = 75\ \text{V},$<br>$I_D = 13\ \text{A}$ |     | 38 | 53 | nC |
| $Q_{gs}$     | Gate to Source Charge         |  |  |     | 18 |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  |  |     | 12 |    | nC |

**Drain-Source Diode Characteristics**

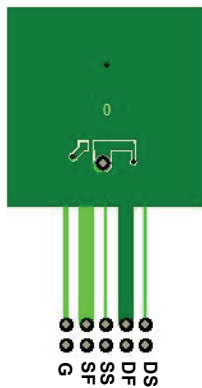
|          |                                       |   |  |     |     |    |
|----------|---------------------------------------|---|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}, I_S = 2.9\ \text{A}$ (Note 2)    |  | 0.7 | 1.1 | V  |
|          |                                       | $V_{GS} = 0\ \text{V}, I_S = 13\ \text{A}$ (Note 2)     |  | 0.8 | 1.2 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 13\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$ |  | 95  | 152 | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |   |  | 187 | 299 | nC |

## Thermal Characteristics

|                 |   |                |     |                             |
|-----------------|---|----------------|-----|-----------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | (Top Source)   | 2.0 | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | (Bottom Drain) | 1.1 |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a)      | 38  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1b)      | 81  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1c)      | 26  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1d)      | 34  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1e)      | 14  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1f)      | 16  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1g)      | 26  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1h)      | 60  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1i)      | 15  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1j)      | 21  |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1k)      | 9   |                             |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1l)      | 11  |                             |

### NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta CA}$  is determined by the user's board design.



a. 38  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 81  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

- c. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- d. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- e. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- f. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- g. 200FPM Airflow, No Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- h. 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- i. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- j. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- k. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- l. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper

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

3.  $E_{AS}$  of 726 mJ is based on starting  $T_j = 25^{\circ}\text{C}$ ; N-ch: L = 3 mH,  $I_{AS} = 22\text{ A}$ ,  $V_{DD} = 150\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at L = 0.1 mH,  $I_{AS} = 69\text{ A}$ .

4. Pulsed Id please refer to Fig 11 SOA graph for more details.

5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

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

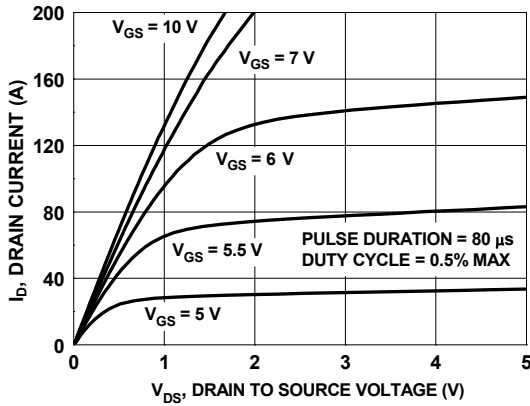


Figure 1. On-Region Characteristics

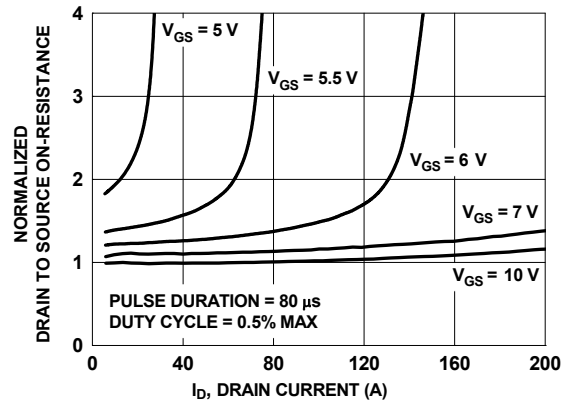


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

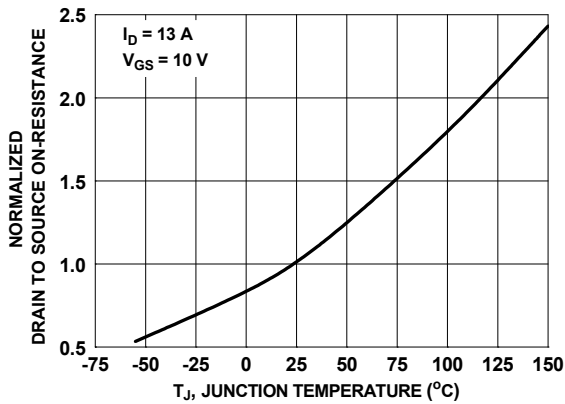


Figure 3. Normalized On-Resistance vs. Junction Temperature

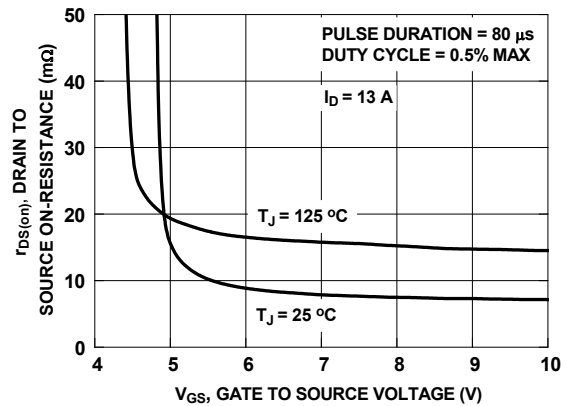


Figure 4. On-Resistance vs. Gate to Source Voltage

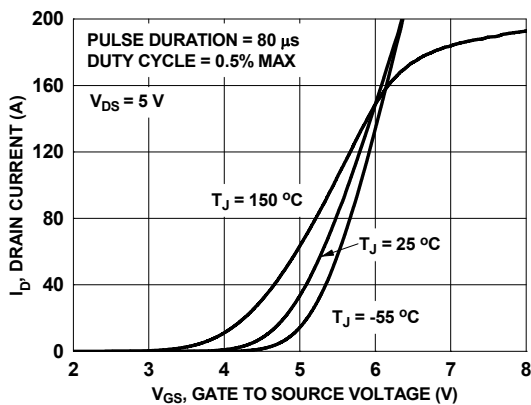


Figure 5. Transfer Characteristics

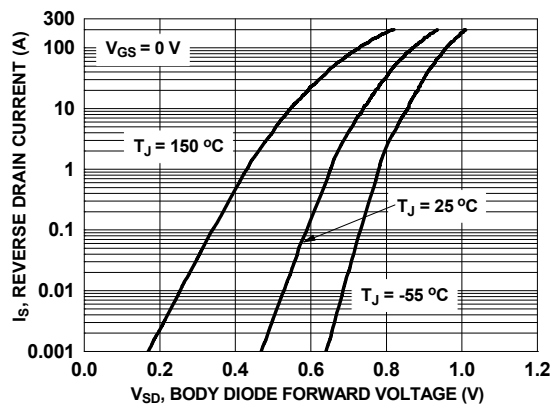
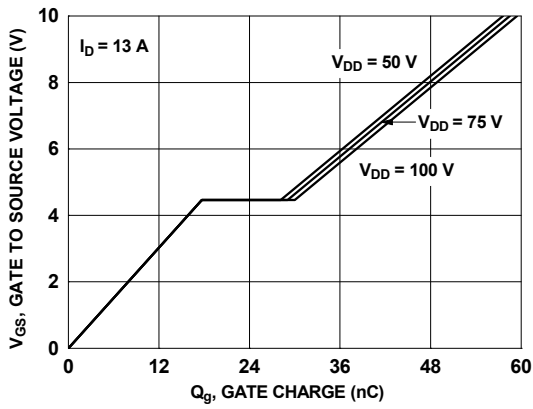
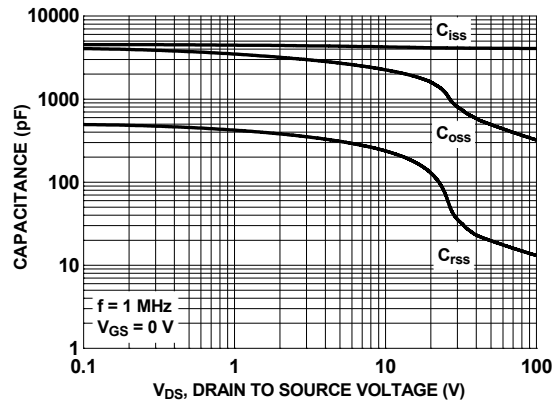


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

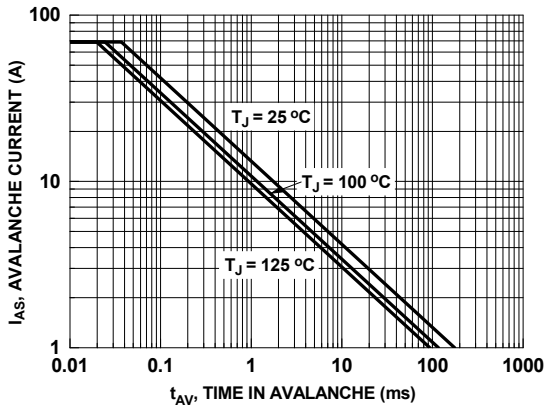
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted.



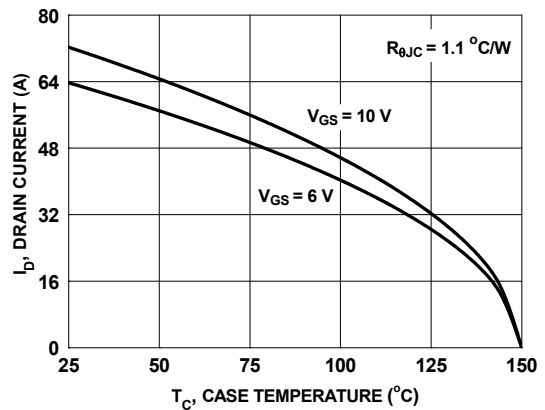
**Figure 7. Gate Charge Characteristics**



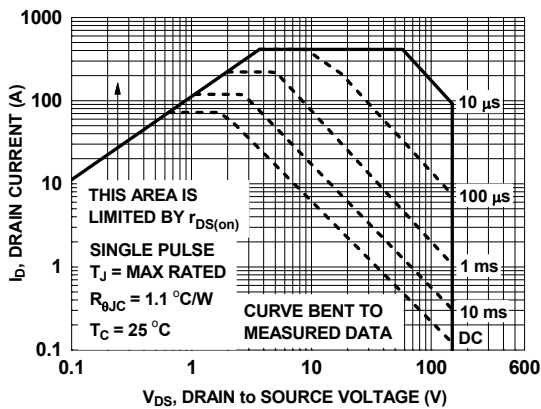
**Figure 8. Capacitance vs. Drain to Source Voltage**



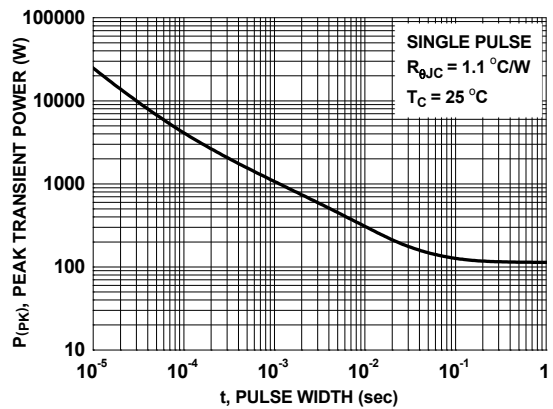
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs. Case Temperature**

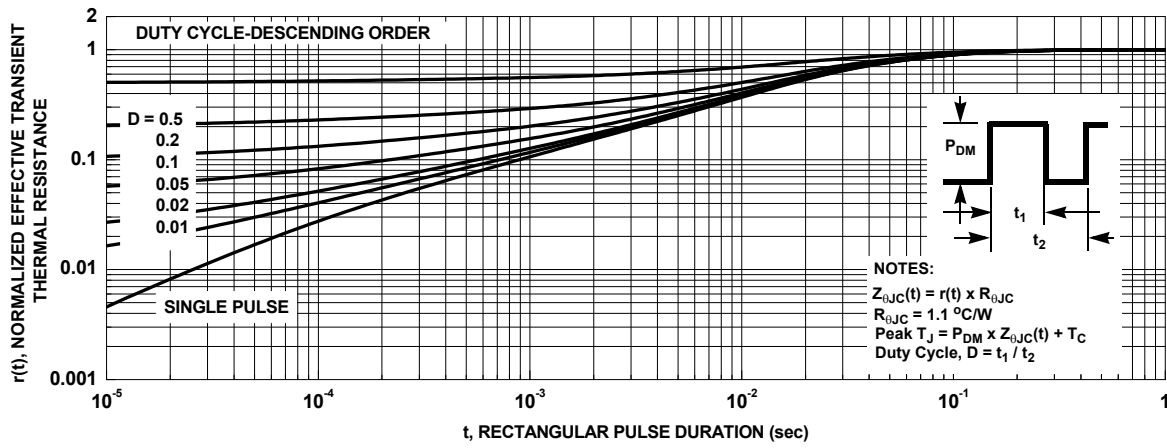


**Figure 11. Forward Bias Safe Operating Area**

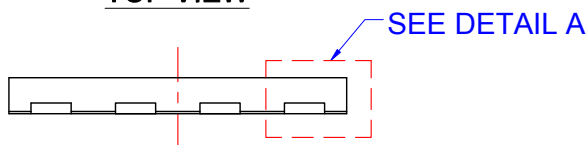
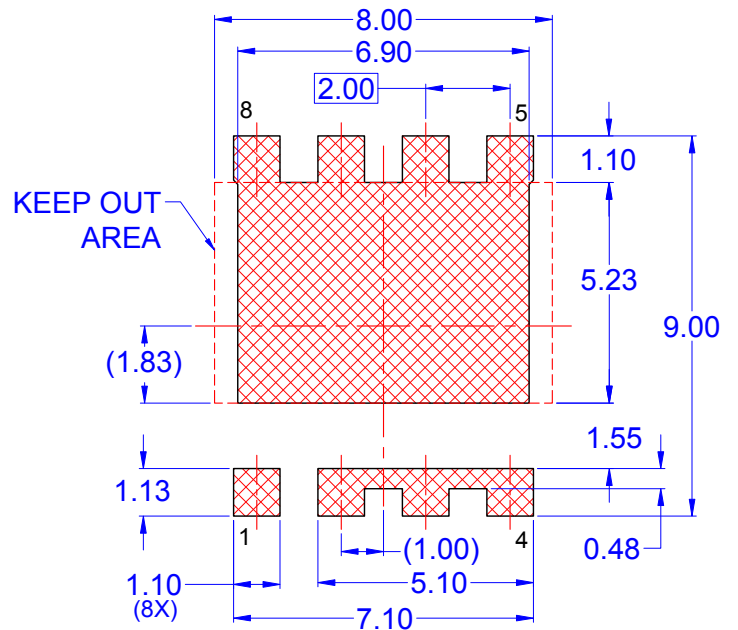
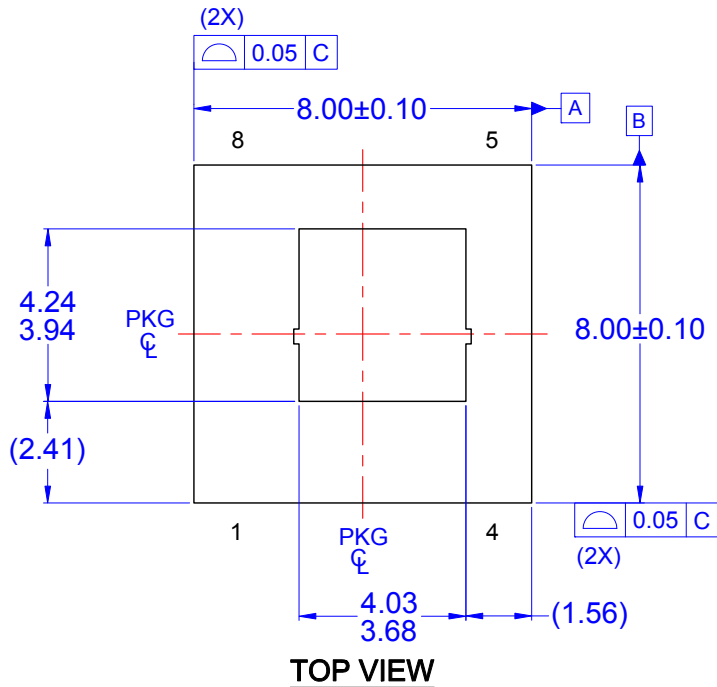


**Figure 12. Single Pulse Maximum Power Dissipation**

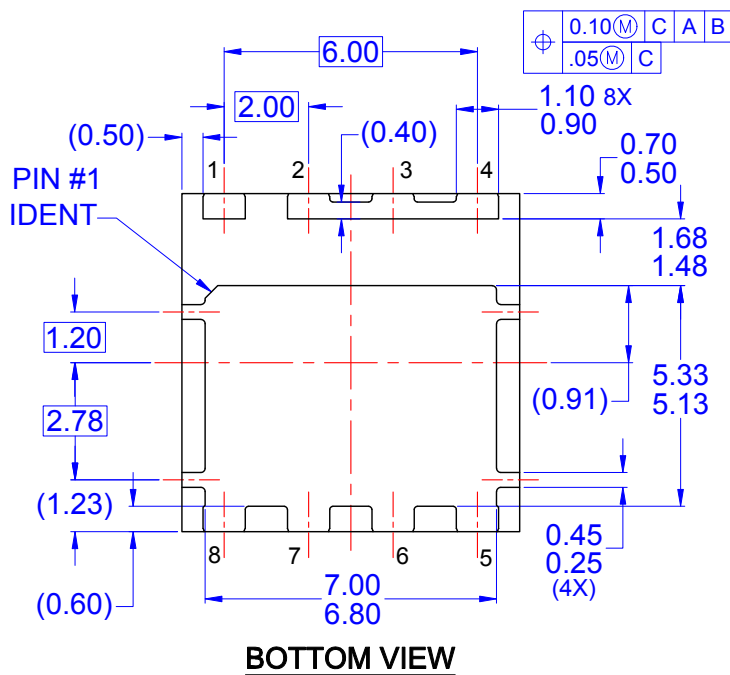
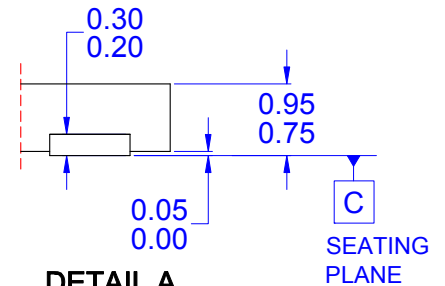
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



**Figure 13. Junction-to-Case Transient Thermal Response Curve**



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