

# MOSFET – P-Channel, POWER TRENCH®

**-100 V, -50 A, 22 mΩ**

## FDMS86163P

### General Description

This P-Channel MOSFET is produced using onsemi's advanced POWER TRENCH process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Features

- Max  $r_{DS(on)}$  = 22 mΩ at  $V_{GS} = -10$  V,  $I_D = -7.9$  A
- Max  $r_{DS(on)}$  = 30 mΩ at  $V_{GS} = -6$  V,  $I_D = -5.9$  A
- Very Low RDS-on Mid Voltage P-Channel Silicon Technology Optimised for Low Qg
- This Product is Optimised for Fast Switching Applications As Well As Load Switch Applications
- 100% UIL Tested
- This Device is Pb-Free, Halogen Free/BFR Free and is RoHS Compliant

### Applications

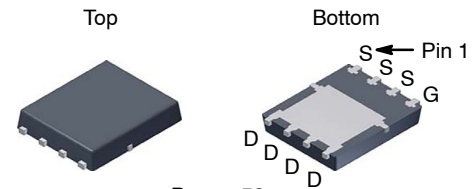
- Active Clamp Switch
- Load Switch

### MOSFET MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Parameter  | Parameter | Symbol         | Value       | Unit             |
|--|-----------|----------------|-------------|------------------|
| Drain-to-Source Voltage                            |           | $V_{DS}$       | -100        | V                |
| Gate-to-Source Voltage                             |           | $V_{GS}$       | ±25         | V                |
| Drain Current –Continuous $T_C = 25^\circ\text{C}$ |           | $I_D$          | -50         | A                |
| –Continuous $T_A = 25^\circ\text{C}$ (Note 1a)     |           |                | -7.9        |                  |
| –Pulsed (Note 4)                                   |           |                | -100        |                  |
| Single Pulse Avalanche Energy (Note 3)             |           | $E_{AS}$       | 486         | mJ               |
| Power Dissipation $T_C = 25^\circ\text{C}$         |           | $P_D$          | 104         | W                |
| $T_A = 25^\circ\text{C}$ (Note 1a)                 |           |                | 2.5         |                  |
| Operating and Storage Junction Temperature Range   |           | $T_J, T_{STG}$ | -55 to +150 | $^\circ\text{C}$ |

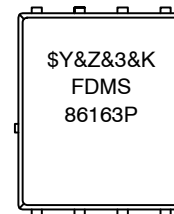
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

| $BV_{DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|------------|------------------|-----------|
| -100 V     | 22 mΩ @ -10 V    | -50 A     |



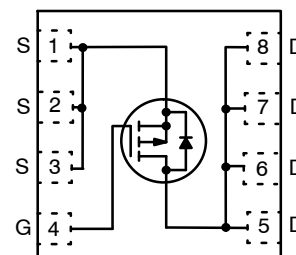
Power 56  
PQFN8  
CASE 483AE

### MARKING DIAGRAM



\$Y = onsemi Logo  
 &Z = Assembly Location  
 &3 = 3-Digit Date Code  
 &K = Lot Code  
 FDMS86163P = Specific Device Code

### PIN CONNECTION



### ORDERING INFORMATION

| Device     | Package             | Shipping†             |
|------------|---------------------|-----------------------|
| FDMS86163P | PQFN-8<br>(Pb-Free) | 3000 /<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.

**THERMAL CHARACTERISTICS**

| Symbol          | Parameter  | Value | Unit |
|-----------------|--|-------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case             | 1.2   | °C/W |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient (Note 1a) | 50    |      |

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

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

**OFF CHARACTERISTICS**

|                              |   |  |      |     |           |               |
|------------------------------|---|--|------|-----|-----------|---------------|
| $B_{VDSS}$                   | Drain to Source Breakdown Voltage         | $I_D = -250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$           | -100 | -   | -         | V             |
| $\Delta B_{VDSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ | -    | -59 | -         | mV/°C         |
| $I_{DSS}$                    | Zero Gate Voltage Drain Current           | $V_{DS} = -80\ \text{V}$ , $V_{GS} = 0\ \text{V}$            | -    | -   | -1        | $\mu\text{A}$ |
| $I_{GSS}$                    | Gate to Source Leakage Current            | $V_{GS} = \pm 25\ \text{V}$ , $V_{DS} = 0\ \text{V}$         | -    | -   | $\pm 100$ | nA            |

**ON CHARACTERISTICS**

|                                |  |   |    |      |    |            |
|--------------------------------|--|---|----|------|----|------------|
| $V_{GS(th)}$                   | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = -250\ \mu\text{A}$                                 | -2 | -2.8 | -4 | V          |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                  | -  | 6.2  | -  | mV/°C      |
| $r_{DS(on)}$                   | Static Drain to Source On Resistance                     | $V_{GS} = -10\ \text{V}$ , $I_D = -7.9\ \text{A}$                             | -  | 17.8 | 22 | m $\Omega$ |
|                                |  | $V_{GS} = -6\ \text{V}$ , $I_D = -5.9\ \text{A}$                              | -  | 21.3 | 30 |            |
|                                |  | $V_{GS} = -10\ \text{V}$ , $I_D = -7.9\ \text{A}$ , $T_J = 125^\circ\text{C}$ | -  | 29   | 36 |            |
| $g_{FS}$                       | Forward Transconductance                                 | $V_{DS} = -10\ \text{V}$ , $I_D = -7.9\ \text{A}$                             | -  | 29   | -  | S          |

**DYNAMIC CHARACTERISTICS**

|           |                              |   |     |      |      |          |
|-----------|------------------------------|---|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = -50\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$ | -   | 3070 | 4085 | pF       |
| $C_{oss}$ | Output Capacitance           |   | -   | 501  | 670  |          |
| $C_{rss}$ | Reverse Transfer Capacitance |   | -   | 21   | 35   |          |
| $R_g$     | Gate Resistance              |   | 0.1 | 2.6  | 5.3  | $\Omega$ |

**SWITCHING CHARACTERISTICS**

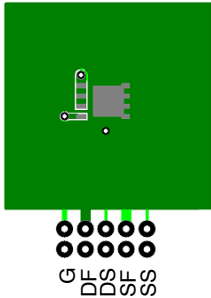
|                     |                               |  |   |   |      |    |    |
|---------------------|-------------------------------|--|---|---|------|----|----|
| t <sub>d(on)</sub>  | Turn-On Delay                 | V <sub>DD</sub> = -50 V, I <sub>D</sub> = -7.9 A,<br>V <sub>GS</sub> = -10 V, R <sub>GEN</sub> = 6 Ω |   | – | 17   | 30 | ns |
| t <sub>r</sub>      | Rise Time                     |  |   | – | 8.8  | 18 |    |
| t <sub>d(off)</sub> | Turn-Off Delay                |  |   | – | 33   | 53 |    |
| t <sub>f</sub>      | Fall Time                     |  |   | – | 6.9  | 14 |    |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>GS</sub> = 0 V to -10 V   | V <sub>DD</sub> = -50 V,<br>I <sub>D</sub> = -7.9 A | – | 42   | 59 | nC |
| Q <sub>g</sub>      | Total Gate Charge             | V <sub>GS</sub> = 0 V to -6 V  |   | – | 26   | 37 |    |
| Q <sub>gs</sub>     | Gate to Source Gate Charge    | V <sub>DD</sub> = -50 V, I <sub>D</sub> = -7.9 A   |   | – | 11.8 | –  |    |
| Q <sub>gd</sub>     | Gate to Drain “Miller” Charge |  |   | – | 7.1  | –  |    |

ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified) (continued)

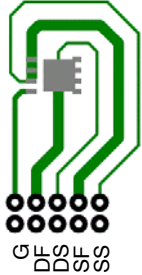
| Symbol                             | Parameter                             | Conditions  | Min | Typ   | Max  | Unit |
|------------------------------------|---------------------------------------|---|-----|-------|------|------|
| DRAIN-SOURCE DIODE CHARACTERISTICS |                                       |   |     |       |      |      |
| V <sub>SD</sub>                    | Source to Drain Diode Forward Voltage | V <sub>GS</sub> = 0 V, I <sub>S</sub> = -7.9 A (Note 2) | -   | -0.81 | -1.3 | V    |
|                                    |                                       | V <sub>GS</sub> = 0 V, I <sub>S</sub> = -2 A (Note 2)   | -   | -0.75 | -1.2 |      |
| t <sub>rr</sub>                    | Reverse Recovery Time                 | I <sub>F</sub> = -7.9 A, di/dt = 100 A/μs               | -   | 63    | 102  | ns   |
| Q <sub>rr</sub>                    | Reverse Recovery Charge               |   | -   | 132   | 210  | 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.

1. R<sub>θJA</sub> 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<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.



a) 50°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b) 50°C/W when mounted on a minimum pad of 2 oz copper

- 2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
- 3. Starting T<sub>J</sub> = 25°C; P-ch: L = 3 mH, I<sub>AS</sub> = -18 A, V<sub>DD</sub> = -100 V, V<sub>GS</sub> = -10 V. 100% test at L = 0.1 mH, I<sub>AS</sub> = -58 A.
- 4. Pulse Id refers to Figure 11. Forward Bias Safe Operation Area.

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

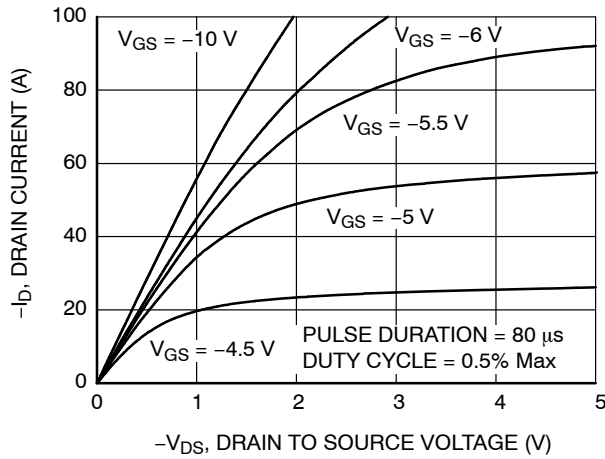


Figure 1. On Region Characteristics

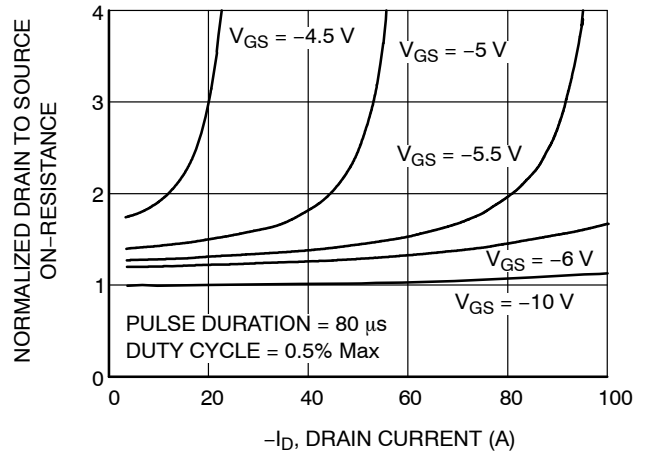


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

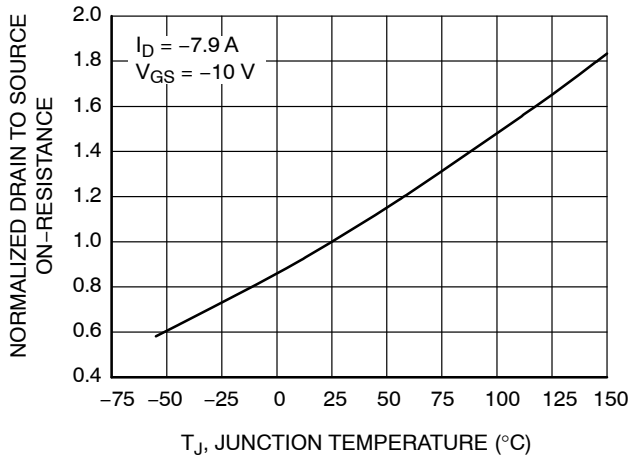


Figure 3. Normalized On Resistance vs. Junction Temperature

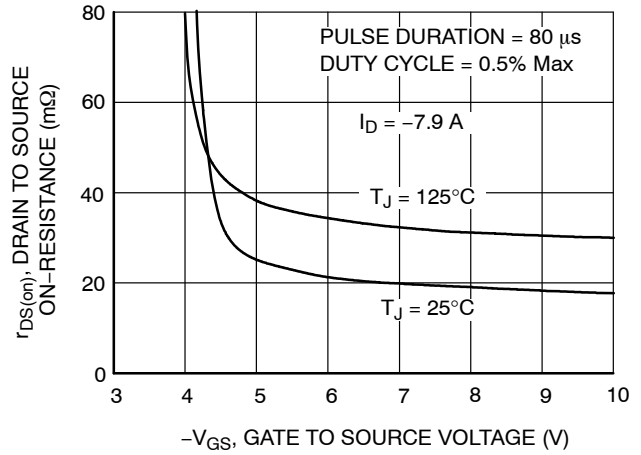


Figure 4. On-Resistance vs. Gate to Source Voltage

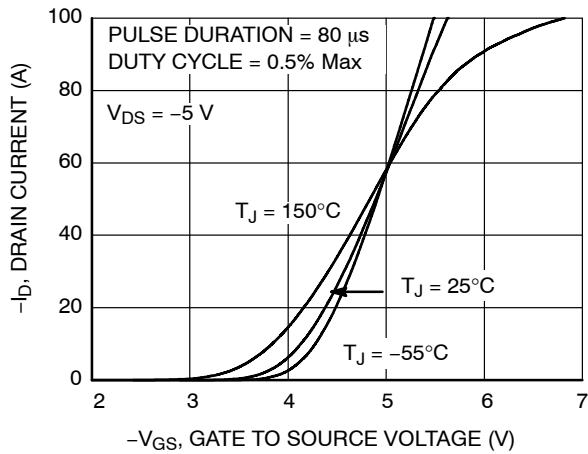


Figure 5. Transfer Characteristics

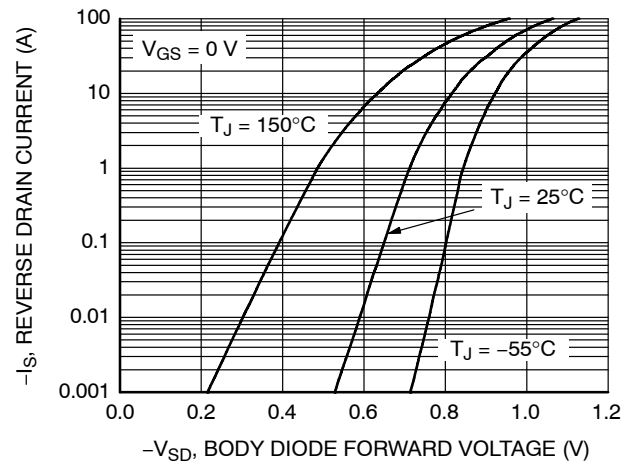


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

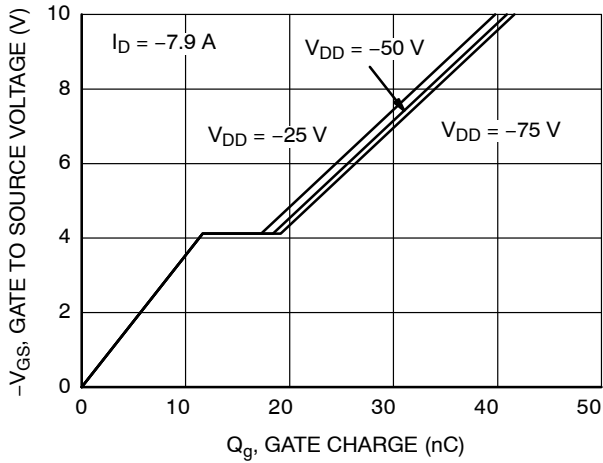


Figure 7. Gate Charge Characteristics

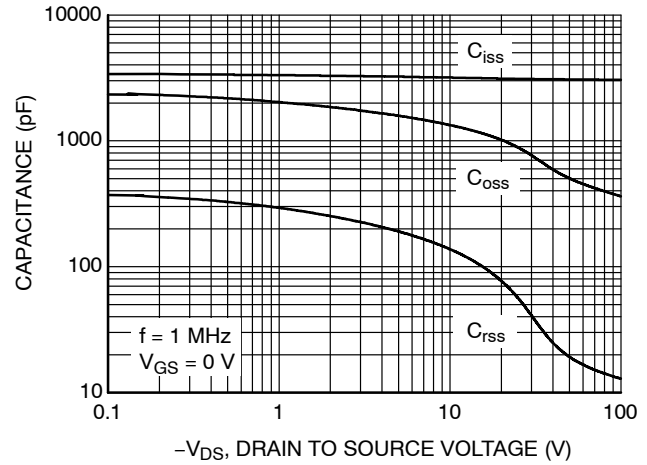


Figure 8. Capacitance vs. Drain to Source Voltage

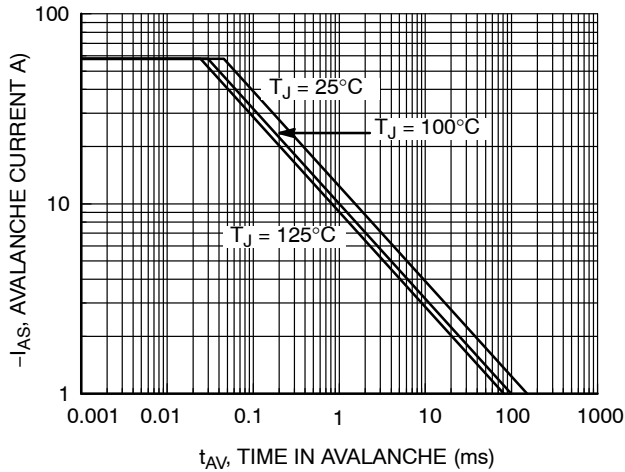


Figure 9. Unclamped Inductive Switching Capability

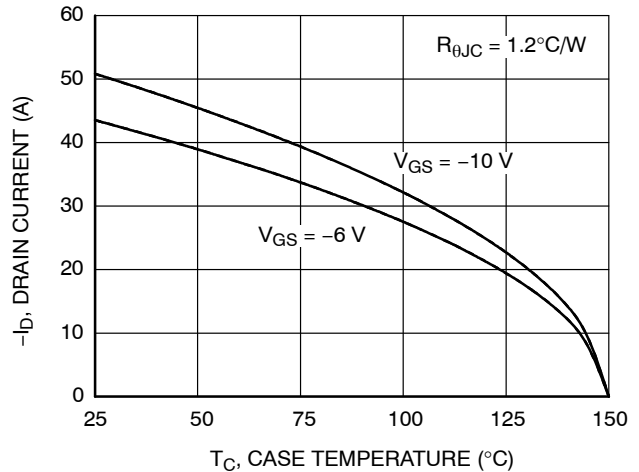


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

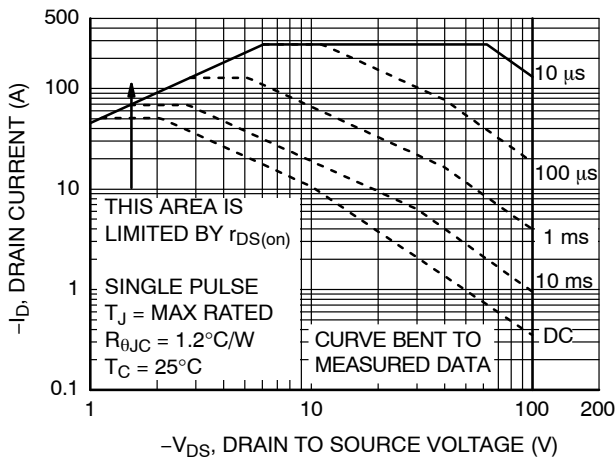


Figure 11. Forward Bias Safe Operating Area

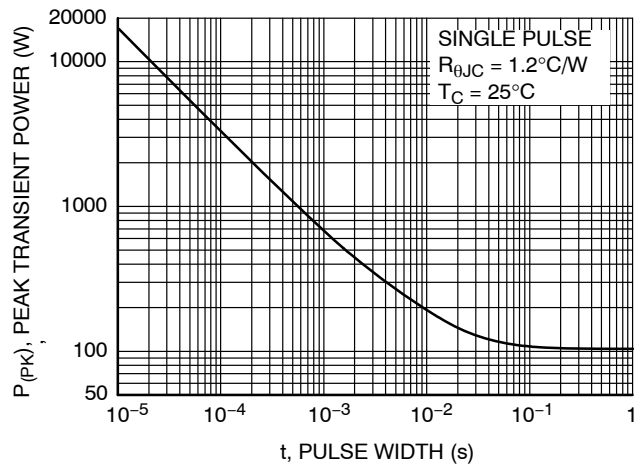


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted) (continued)

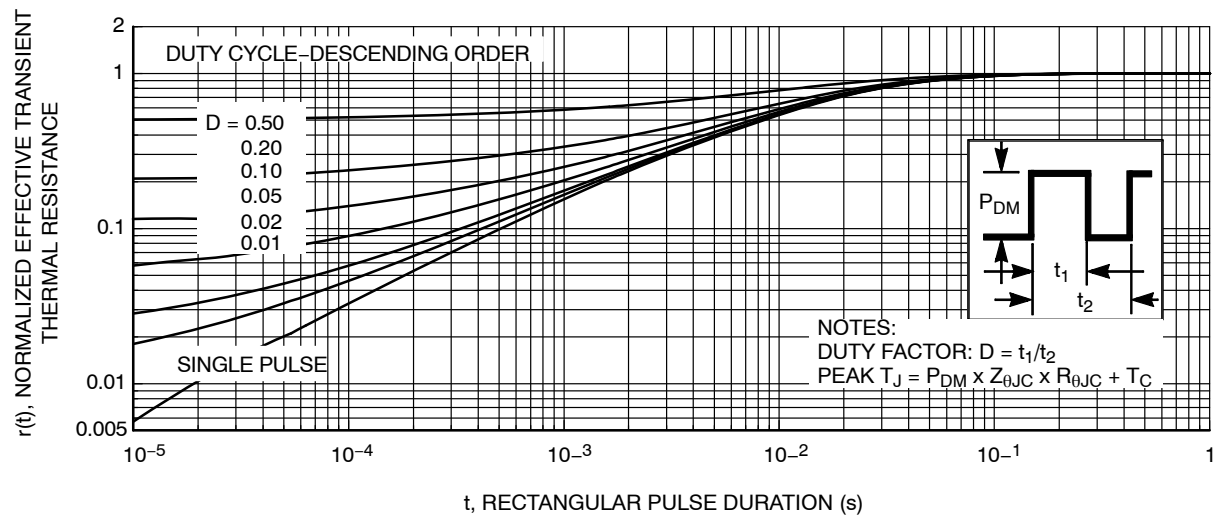
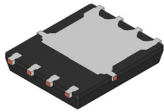
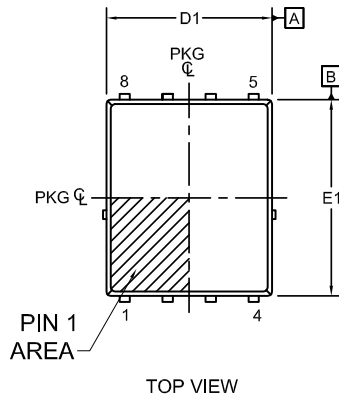


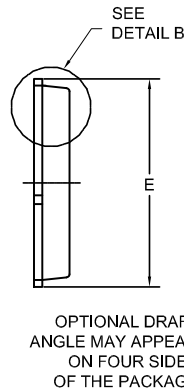
Figure 13. Junction-to-Case Transient Thermal Response Curve


**PQFN8 5X6, 1.27P**  
**CASE 483AE**  
**ISSUE C**

DATE 21 JAN 2022

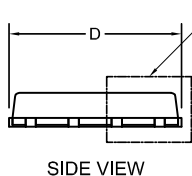


TOP VIEW

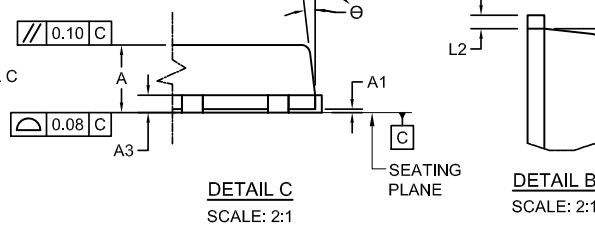
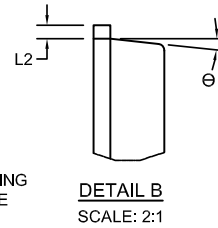
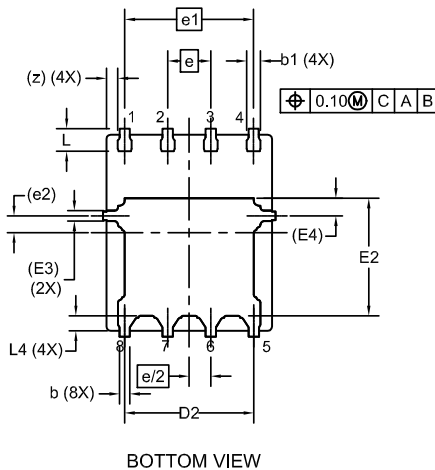


## NOTES:

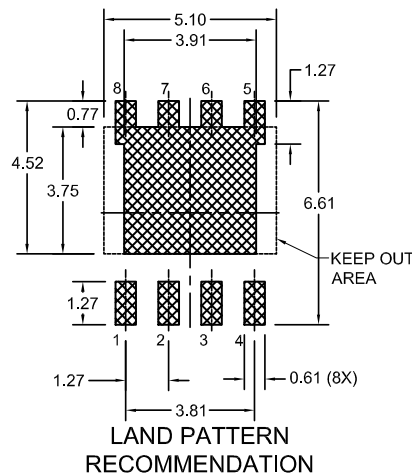
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



SIDE VIEW


DETAIL C  
SCALE: 2:1

DETAIL B  
SCALE: 2:1


BOTTOM VIEW


LAND PATTERN  
RECOMMENDATION

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.00        | -    | 0.05 |
| b   | 0.21        | 0.31 | 0.41 |
| b1  | 0.31        | 0.41 | 0.51 |
| A3  | 0.15        | 0.25 | 0.35 |
| D   | 4.90        | 5.00 | 5.20 |
| D1  | 4.80        | 4.90 | 5.00 |
| D2  | 3.61        | 3.82 | 3.96 |
| E   | 5.90        | 6.15 | 6.25 |
| E1  | 5.70        | 5.80 | 5.90 |
| E2  | 3.38        | 3.48 | 3.78 |
| E3  | 0.30 REF    |      |      |
| E4  | 0.52 REF    |      |      |
| e   | 1.27 BSC    |      |      |
| e/2 | 0.635 BSC   |      |      |
| e1  | 3.81 BSC    |      |      |
| e2  | 0.50 REF    |      |      |
| L   | 0.51        | 0.66 | 0.76 |
| L2  | 0.05        | 0.18 | 0.30 |
| L4  | 0.34        | 0.44 | 0.54 |
| z   | 0.34 REF    |      |      |
| Θ   | 0°          | -    | 12°  |

DOCUMENT NUMBER: 98AON13655G

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DESCRIPTION: PQFN8 5X6, 1.27P

PAGE 1 OF 1

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