

# MOSFET – N-Channel, POWERTRENCH<sup>®</sup>, Shielded Gate

80 V, 136 A, 3.5 mΩ

**FDMS3D5N08LC**

## General Description

This N-Channel MV MOSFET is produced using onsemi's advanced POWERTRENCH process that incorporates Shielded Gate technology. This process has been optimized to minimise on-state resistance and yet maintain superior switching performance with best in class soft body diode.

## Features

- Shielded Gate MOSFET Technology
- Max  $R_{DS(on)}$  = 3.5 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 45 A
- Max  $R_{DS(on)}$  = 5.1 mΩ at  $V_{GS}$  = 4.5 V,  $I_D$  = 36 A
- 50% Lower  $Q_{rr}$  than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

## Typical Applications

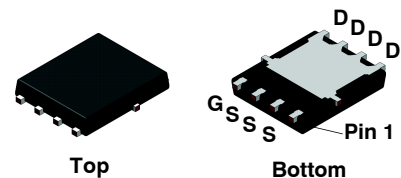
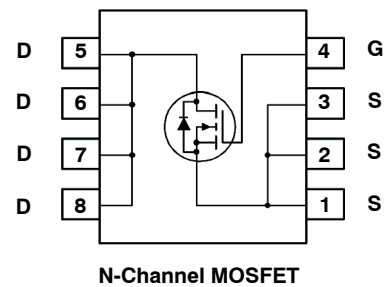
- Primary DC–DC MOSFET
- Synchronous Rectifier in DC–DC and AC–DC
- Motor Drive
- Solar

## MOSFET MAXIMUM RATINGS ( $T_A$ = 25°C unless otherwise noted)

| Symbol               | Parameter                                        | Ratings     | Unit |
|----------------------|--------------------------------------------------|-------------|------|
| $V_{DS}$             | Drain to Source Voltage                          | 80          | V    |
| $V_{GS}$             | Gate to Source Voltage                           | ±20         | V    |
| $I_D$                | Drain Current – Continuous $T_C$ = 25°C (Note 5) | 136         | A    |
|                      | – Continuous $T_C$ = 100°C (Note 5)              | 86          |      |
|                      | – Continuous $T_A$ = 25°C (Note 1a)              | 19          |      |
|                      | – Pulsed (Note 4)                                | 745         |      |
| $E_{AS}$             | Single Pulse Avalanche Energy                    | 486         | mJ   |
| $P_D$                | Power dissipation $T_C$ = 25°C                   | 125         | W    |
|                      | Power dissipation $T_A$ = 25°C (Note 1a)         | 2.5         |      |
| $T_J$ ,<br>$T_{STG}$ | Operating and Storage Junction Temperature Range | –55 to +150 | °C   |

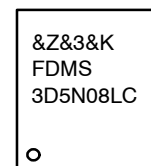
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## ELECTRICAL CONNECTION



PQFN8 5x6  
(Power 56)  
CASE 483AE

## MARKING DIAGRAM



&Z = Assembly Plant Code  
&3 = Numeric Date Code  
&K = Lot Code  
FDMS3D5N08LC = Specific Device Code

## ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDMS3D5N08LC

## THERMAL CHARACTERISTICS

| Symbol          | Parameter                                         | Ratings | Unit |
|-----------------|---------------------------------------------------|---------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 1.0     | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50      |      |

## PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device       | Package                             | Shipping <sup>†</sup>      |
|----------------|--------------|-------------------------------------|----------------------------|
| FDMS3D5N08LC   | FDMS3D5N08LC | PQFN8 5×6<br>(Pb-Free/Halogen Free) | 3000 Units/<br>Tape & Reel |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|--------|-----------|----------------|-----|-----|-----|------|
|--------|-----------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                      |                                           |                                                             |    |    |           |               |
|--------------------------------------|-------------------------------------------|-------------------------------------------------------------|----|----|-----------|---------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$           | 80 | –  | –         | V             |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$ | –  | 69 | –         | mV/°C         |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 64\ \text{V}$ , $V_{GS} = 0\ \text{V}$            | –  | –  | 1         | $\mu\text{A}$ |
| $I_{GSS}$                            | Gate-to-Source Leakage Current            | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$        | –  | –  | $\pm 100$ | nA            |

### ON CHARACTERISTICS

|                                        |                                                          |                                                                            |     |      |     |            |
|----------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------|-----|------|-----|------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$                               | 1.0 | 1.4  | 2.5 | V          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$                | –   | –5.2 | –   | mV/°C      |
| $R_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}$ , $I_D = 45\ \text{A}$                             | –   | 2.8  | 3.5 | m $\Omega$ |
|                                        |                                                          | $V_{GS} = 4.5\ \text{V}$ , $I_D = 36\ \text{A}$                            | –   | 4.0  | 5.1 |            |
|                                        |                                                          | $V_{GS} = 10\ \text{V}$ , $I_D = 45\ \text{A}$ , $T_J = 125^\circ\text{C}$ | –   | 4.8  | 6.0 |            |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 5\ \text{V}$ , $I_D = 45\ \text{A}$                              | –   | 300  | –   | S          |

### DYNAMIC CHARACTERISTICS

|           |                              |                                                                        |     |      |      |          |
|-----------|------------------------------|------------------------------------------------------------------------|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 40\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$ | –   | 4375 | 6125 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                        | –   | 1025 | 1435 |          |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                        | –   | 39   | 60   |          |
| $R_g$     | Gate Resistance              |                                                                        | 0.1 | 1.4  | 3    | $\Omega$ |

### SWITCHING CHARACTERISTICS

|         |                               |                                                  |                          |   |    |     |    |
|---------|-------------------------------|--------------------------------------------------|--------------------------|---|----|-----|----|
| td(on)  | Turn – On Delay Time          | VDD = 40 V, ID = 45 A,<br>VGS = 10 V, RGEN = 6 Ω |                          | – | 12 | 22  | ns |
| tr      | Rise Time                     |                                                  |                          | – | 20 | 36  |    |
| tD(off) | Turn – Off Delay Time         |                                                  |                          | – | 70 | 112 |    |
| tf      | Fall Time                     |                                                  |                          | – | 22 | 35  |    |
| Qg      | Total Gate Charge             | VGS = 0V to 10 V                                 | VDD = 40 V,<br>ID = 45 A | – | 59 | 82  | nC |
| Qg      | Total Gate Charge             | VGS = 0V to 4.5 V                                |                          | – | 28 | 39  |    |
| Qgs     | Gate to Source Charge         |                                                  |                          | – | 10 | –   |    |
| Qgd     | Gate to Drain “Miller” Charge |                                                  |                          | – | 7  | –   |    |
| Qoss    | Output Charge                 | VDD = 40 V, VGS = 0 V                            |                          | – | 56 | –   | nC |
| Qsync   | Total Gate Charge Sync.       | VDS = 0 V, ID = 45 A                             |                          | – | 55 | –   |    |

# FDMS3D5N08LC

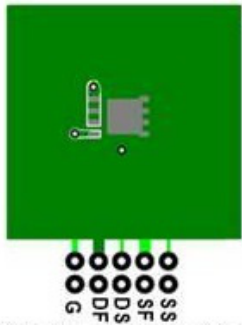
## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

| Symbol                                    | Parameter                             | Test Condition                                         | Min | Typ | Max | Unit |
|-------------------------------------------|---------------------------------------|--------------------------------------------------------|-----|-----|-----|------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS</b> |                                       |                                                        |     |     |     |      |
| $V_{SD}$                                  | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 2.1\text{ A}$ (Note 2)     | –   | 0.7 | 1.2 | V    |
|                                           |                                       | $V_{GS} = 0\text{ V}, I_S = 45\text{ A}$ (Note 2)      | –   | 0.8 | 1.3 |      |
| $t_{rr}$                                  | Reverse Recovery Time                 | $I_F = 22\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$  | –   | 25  | 39  | ns   |
| $Q_{rr}$                                  | Reverse Recovery Charge               |                                                        | –   | 86  | 137 | nC   |
| $t_{rr}$                                  | Reverse Recovery Time                 | $I_F = 22\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}$ | –   | 20  | 32  | ns   |
| $Q_{rr}$                                  | Reverse Recovery Charge               |                                                        | –   | 186 | 297 | nC   |

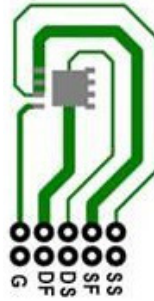
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material.  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b)  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- $E_{AS}$  of 486 mJ is based on starting  $T_J = 25^\circ\text{C}$ ; N-ch:  $L = 3\text{ mH}$ ,  $I_{AS} = 18\text{ A}$ ,  $V_{DD} = 80\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% tested at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 57\text{ A}$ .
- Pulsed  $I_D$  please refer to Figure 11 SOA graph for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

## TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED

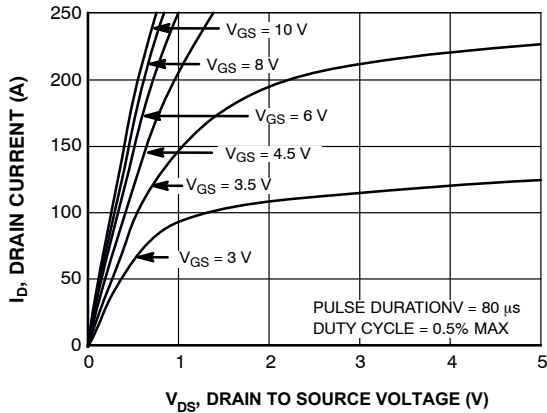


Figure 1. On Region Characteristics

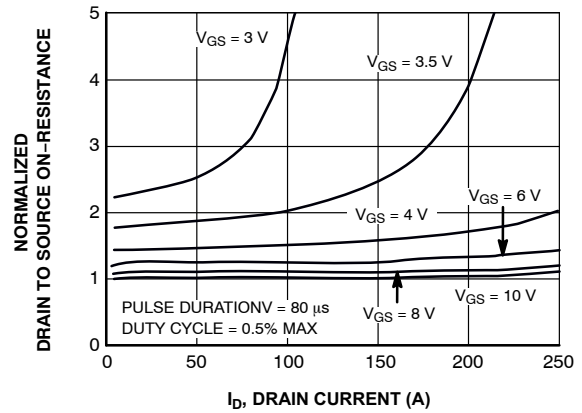


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED (CONTINUED)

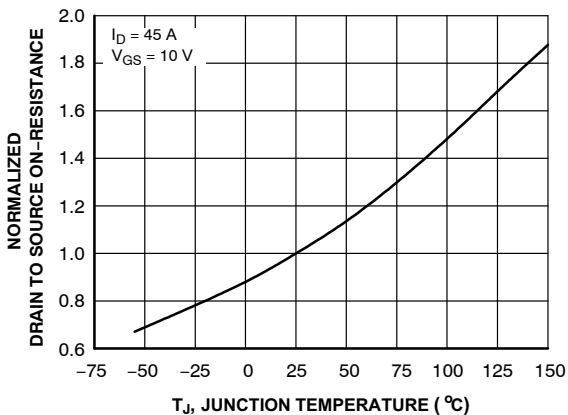


Figure 3. Normalized On Resistance vs. Junction Temperature

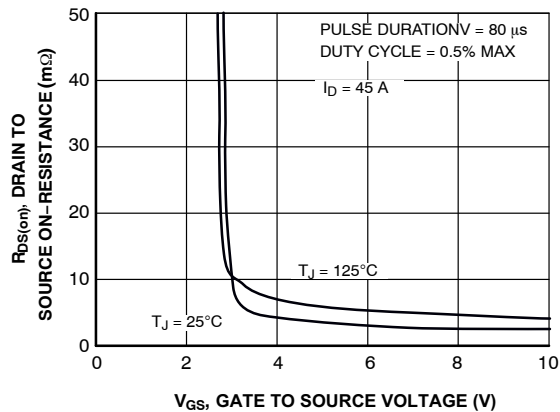


Figure 4. On-Resistance vs. Gate to Source Voltage

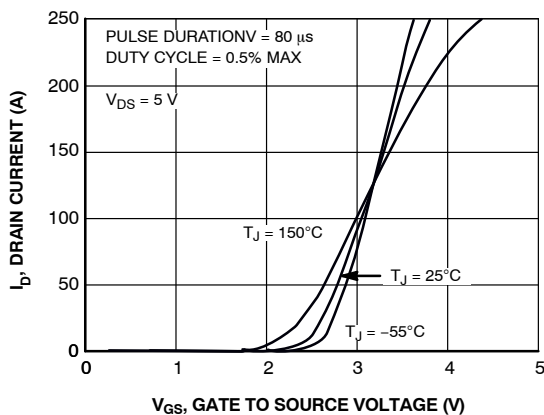


Figure 5. Transfer Characteristics

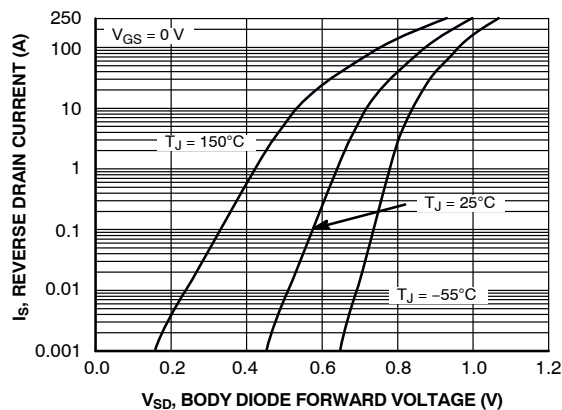


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

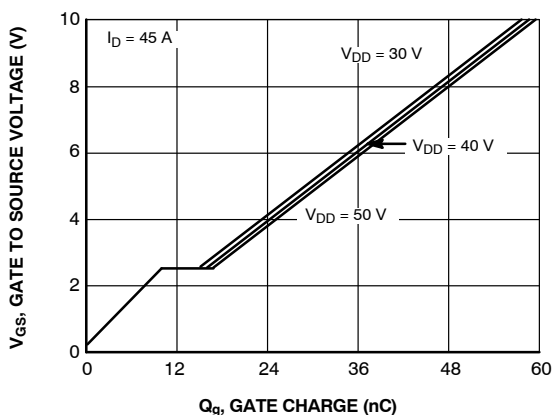


Figure 7. Gate Charge Characteristics

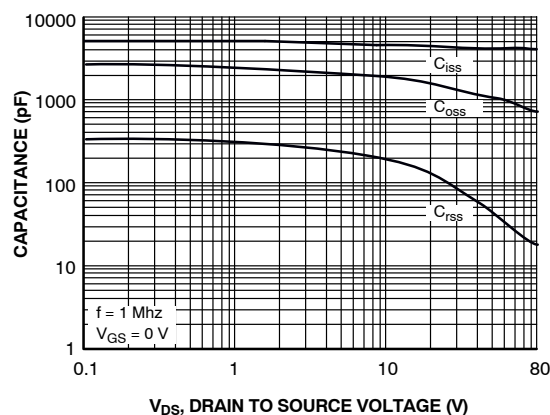


Figure 8. Capacitance vs. Drain to Source Voltage

# FDMS3D5N08LC

## TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED (CONTINUED)

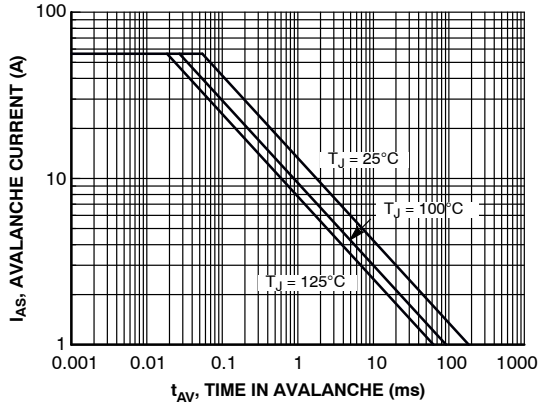


Figure 9. Unclamped Inductive Switching Capability

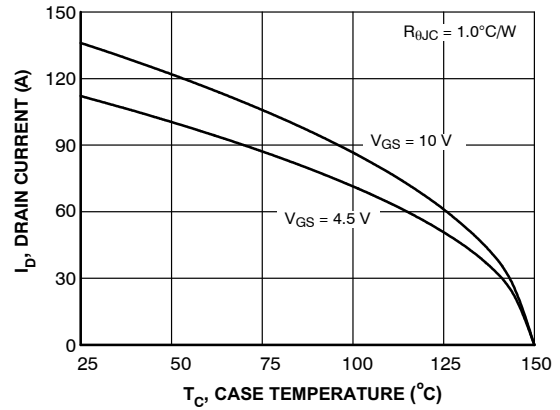


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

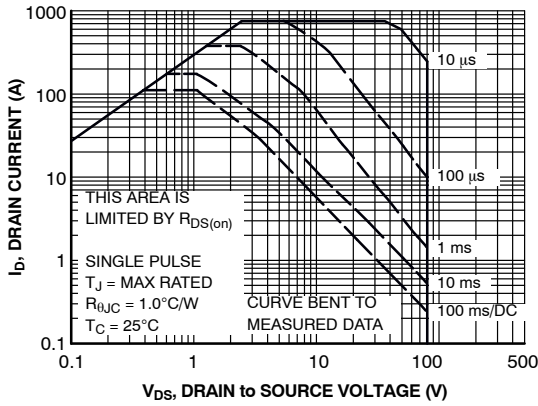


Figure 11. Unclamped Inductive Switching Capability

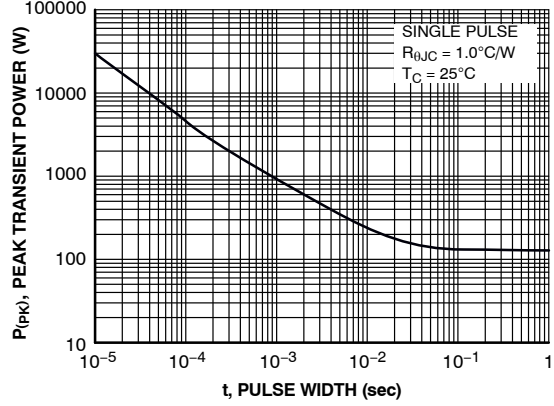


Figure 12. Maximum Continuous Drain Current vs. Case Temperature

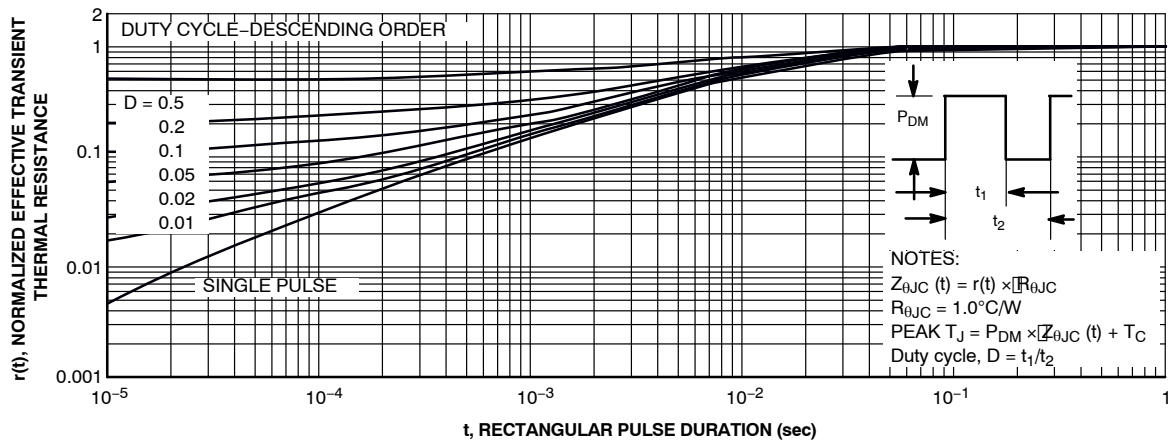
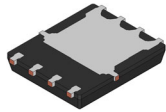


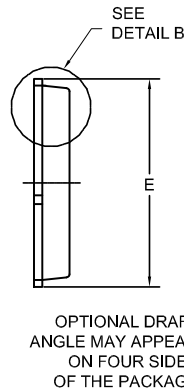
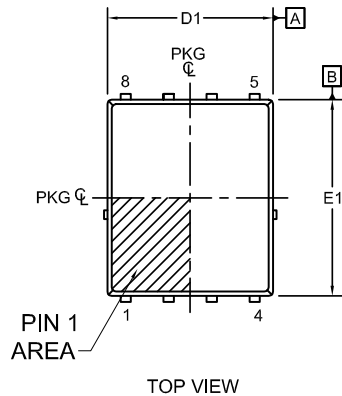
Figure 13. Junction-to-Case Transient Thermal Response Curve

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



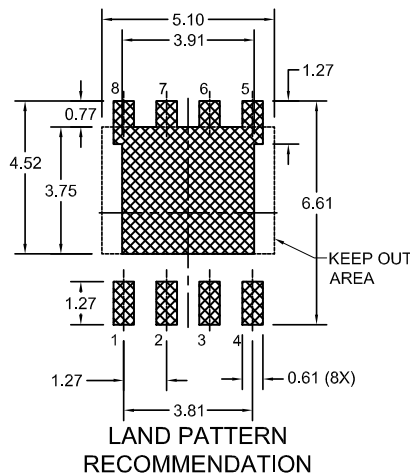
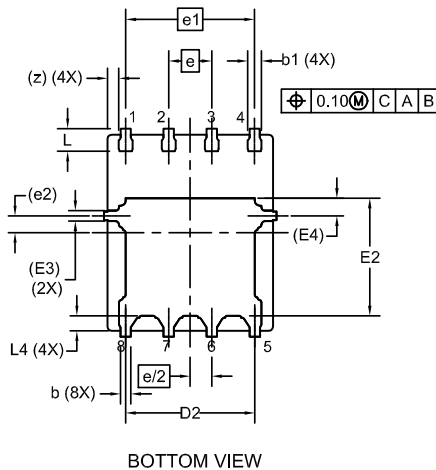
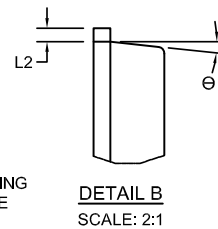
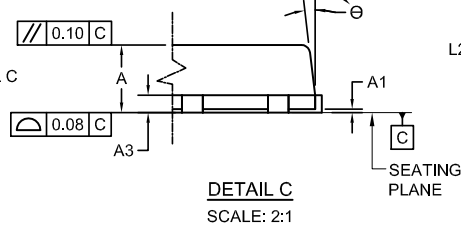
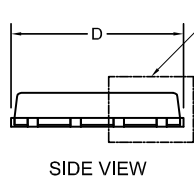
**PQFN8 5X6, 1.27P**  
**CASE 483AE**  
**ISSUE C**

DATE 21 JAN 2022



## 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.



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

|                         |                         |                                                                                                                                                                                     |
|-------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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