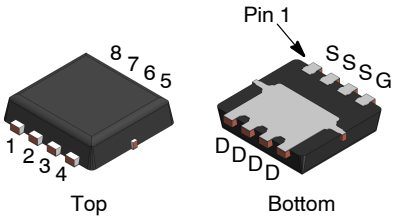
# MOSFET – N-Channel, POWERTRENCH®

## 30 V, 12 A, 11.5 mΩ

# FDMC7696

| $V_{DS}$ | $r_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 30 V | 11.5 mΩ @ 10 V | 12 A |
| | 14.5 mΩ @ 4.5 V | |




**WDFN8 3.3x3.3, 0.65P**
**CASE 511DR**

### General Description

This N−Channel MOSFET is produced using **onsemi**'s advanced POWERTRENCH process that has been especially tailored to minimize the on−state resistance. This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.

### Features

- Max $r_{DS(on)}$ = 11.5 mΩ at $V_{GS}$ = 10 V, $I_D$ = 12 A
- Max $r_{DS(on)}$ = 14.5 mΩ at $V_{GS}$ = 4.5 V, $I_D$ = 10 A
- High Performance Technology for Extremely Low $r_{DS(on)}$
- This Device is Pb−Free, Halide Free and RoHS Compliant

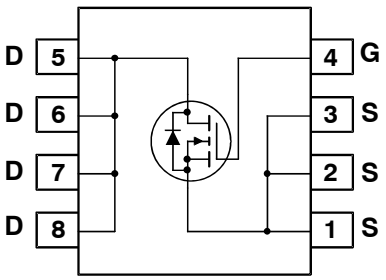
### Applications

- DC/DC Buck Converters
- Notebook Battery Power Management
- Load Switch in Notebook

### MARKING DIAGRAM


| | |
|---|---|
| $Y | = Logo |
| &Z | = Assembly Plant Code |
| &2 | = 2−Digit Date Code Format |
| &K | = 2−Digits Lot Run Traceability Code |
| FDMC7696 | = Device Code |

### PIN ASSIGNMENT




### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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

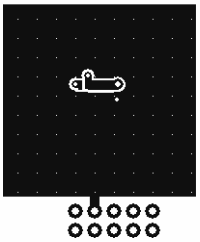
| Symbol | Parameter | | | Ratings | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | | | 30 | V |
| $V_{DSt}$ | Drain to Source Transient Voltage ($t_{Transient}$ < 100 ns) | | | 33 | V |
| $V_{GS}$ | Gate to Source Voltage (Note 3) | | | ±20 | V |
| $I_D$ | Drain Current | Continuous (Package limited) | $T_C$ = 25°C | 20 | A |
| | | Continuous (Silicon limited) | $T_C$ = 25°C | 38 | |
| | | Continuous (Note 1a) | $T_A$ = 25°C | 12 | |
| | | Pulsed | | 50 | |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 2) | | | 21 | mJ |
| $P_D$ | Power Dissipation | | $T_C$ = 25°C | 25 | W |
| | Power Dissipation (Note 1a) | | $T_A$ = 25°C | 2.4 | |
| $T_J$, $T_{STG}$ | 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.

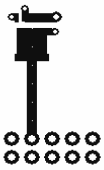
**THERMAL CHARACTERISTICS**

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 5.0 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 53 | |

1. $R_{\theta JA}$ is determined with the device mounted on a 1 $in^2$ 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. 53°C/W when mounted on a 1 $in^2$ pad of 2 oz copper



b. 125°C/W when mounted on a minimum pad of 2 oz copper

2. $E_{AS}$ of 21 mJ is based on starting $T_J$ = 25°C; L = 0.3 mH, $I_{AS}$ = 12 A, $V_{DD}$ = 27 V, $V_{GS}$ = 10 V.
3. As an N−ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 30 | – | – | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25°C | – | 14 | – | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 24 V, $V_{GS}$ = 0 V | – | – | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current, Forward | $V_{GS}$ = 20 V, $V_{DS}$ = 0 V | – | – | 100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 1.2 | 2.0 | 3.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25°C | – | –6 | – | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 12 A | – | 8.5 | 11.5 | mΩ |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 10 A | – | 11.5 | 14.5 | |
| | | $V_{GS}$ = 10 V, $I_D$ = 12 A, $T_J$ = 125°C | – | 11.6 | 15.7 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5 V, $I_D$ = 12 A | – | 45 | – | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1 MHz | – | 1075 | 1430 | pF |
| $C_{oss}$ | Output Capacitance | | – | 380 | 505 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | – | 40 | 55 | pF |
| $R_g$ | Gate Resistance | | 0.2 | 1.0 | 2.0 | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn−On Delay Time | $V_{DD}$ = 15 V, $I_D$ = 12 A, $V_{GS}$ = 10 V, $R_{GEN}$ = 6 Ω | – | 9 | 18 | ns |
| $t_r$ | Rise Time | | – | 2 | 10 | ns |
| $t_{d(off)}$ | Turn−Off Delay Time | | – | 19 | 33 | ns |
| $t_f$ | Fall Time | | – | 2 | 10 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 V to 10 V, $V_{DD}$ = 15 V, $I_D$ = 12 A | – | 16 | 22 | nC |
| | | $V_{GS}$ = 0 V to 5 V, $V_{DD}$ = 15 V, $I_D$ = 12 A | – | 8 | 11 | |
| $Q_{gs}$ | Gate to Source Charge | $V_{DD}$ = 15 V, $I_D$ = 12 A | – | 3.2 | – | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | – | 1.8 | – | nC |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 1.9 A (Note 4) | – | 0.75 | 1.2 | V |
| | | $V_{GS}$ = 0 V, $I_S$ = 12 A (Note 4) | – | 0.84 | 1.2 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 12 A, di/dt = 100 A/μs | – | 25 | 40 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | – | 9 | 18 | 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.

4. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.

## TYPICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted)

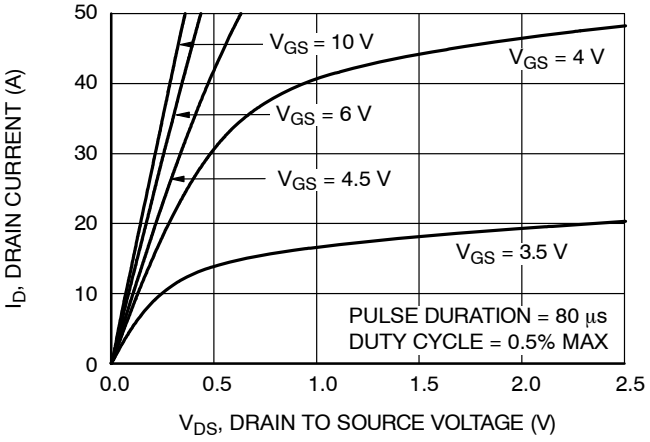



**Figure 1. On Region Characteristics**

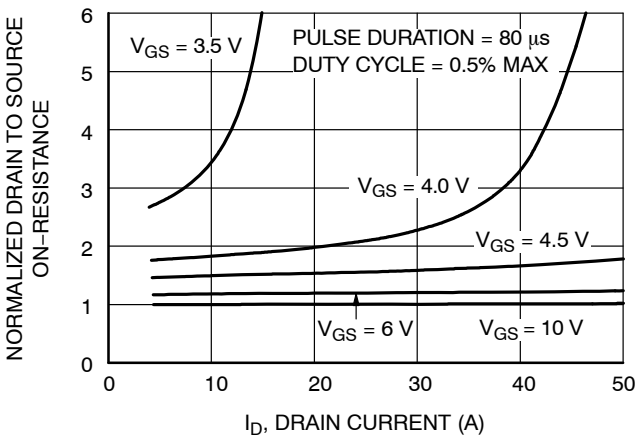



**Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage**

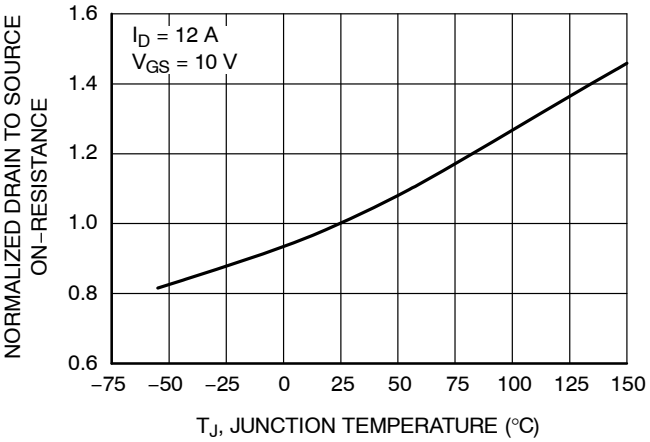



**Figure 3. Normalized On−Resistance vs. Junction Temperature**

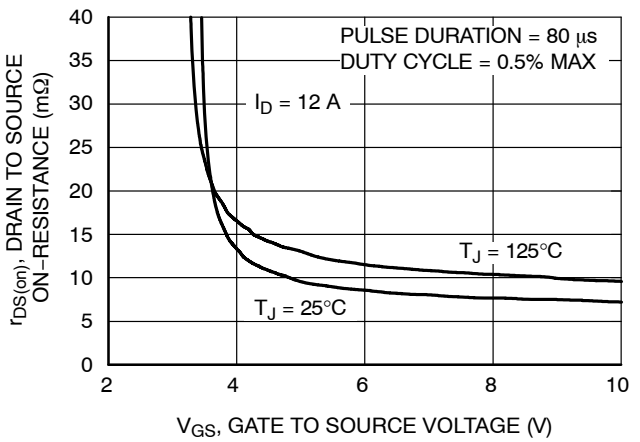



**Figure 4. On−Resistance vs. Gate to Source Voltage**

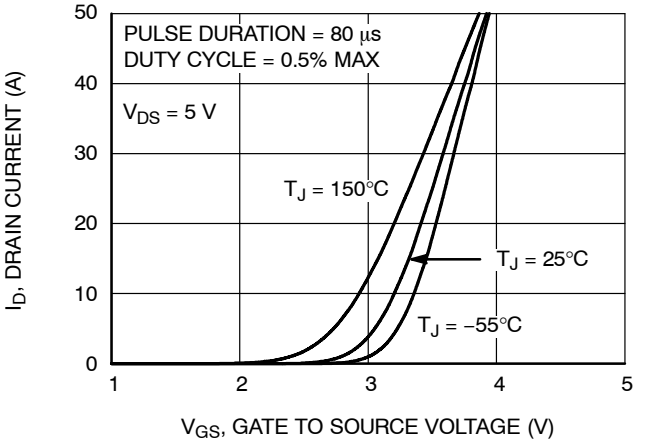



**Figure 5. Transfer Characteristics**

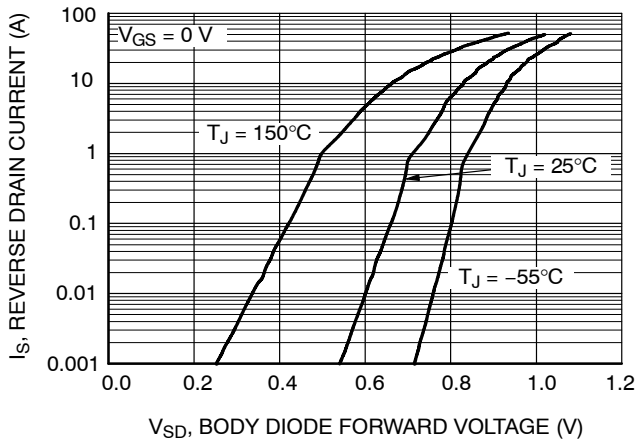



**Figure 6. Source to Drain Diode Forward Voltage vs. Source Current**

## TYPICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted) (continued)

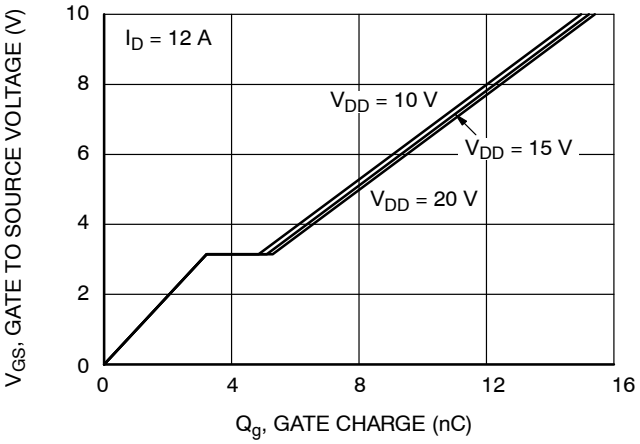



**Figure 7. Gate Charge Characteristics**

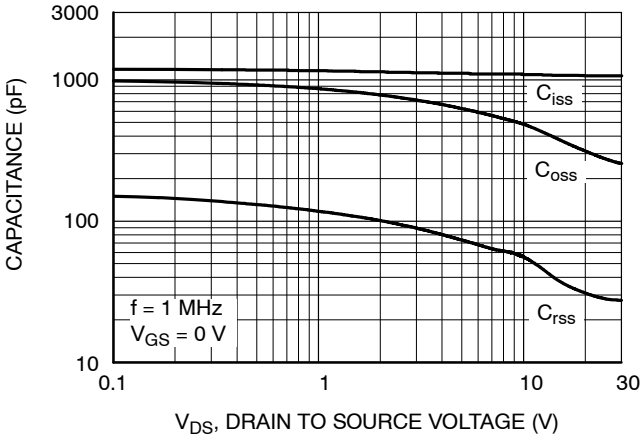



**Figure 8. Capacitance vs. Drain to Source Voltage**

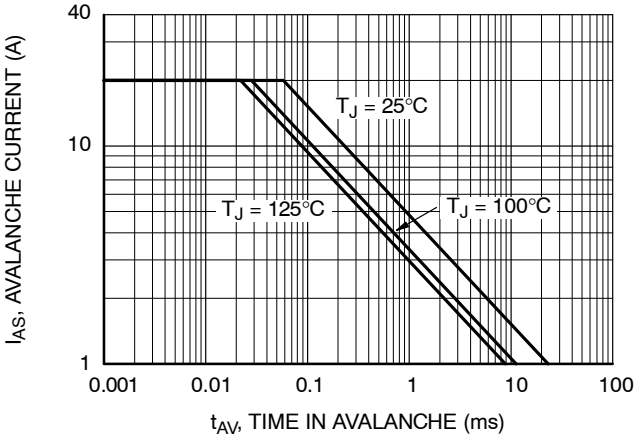



**Figure 9. Unclamped Inductive Switching Capability**

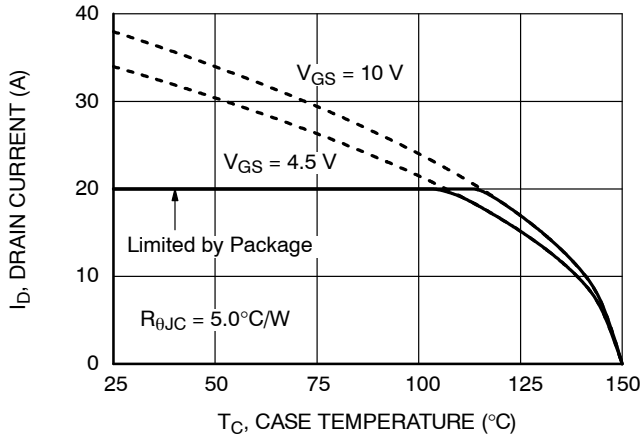



**Figure 10. Maximum Continuous Drain Current vs. Case Temperature**

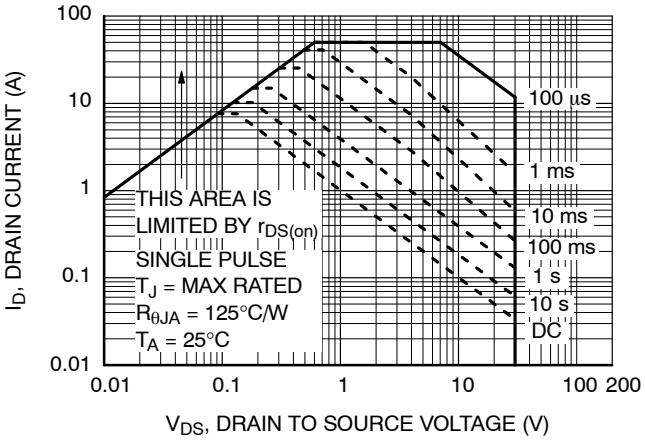



**Figure 11. Forward Bias Safe Operating Area**

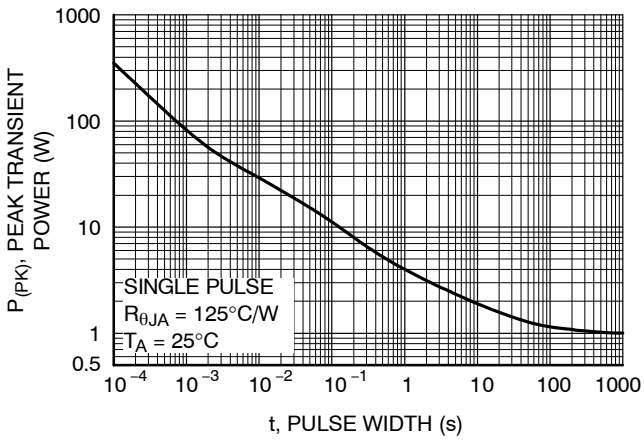



**Figure 12. Single Pulse Maximum Power Dissipation**

## TYPICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted) (continued)

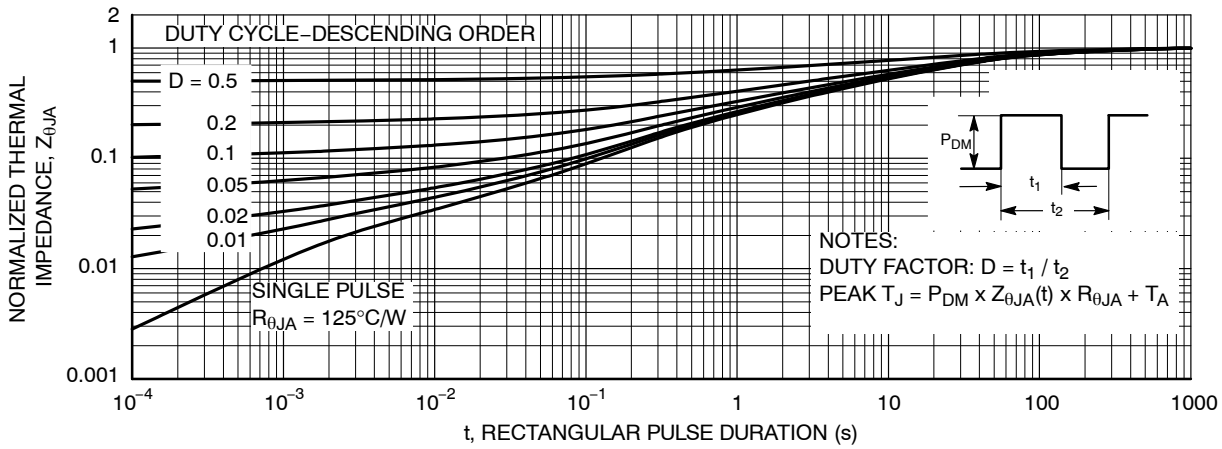
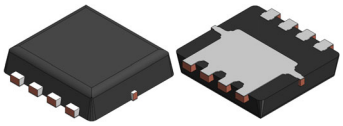



**Figure 13. Junction−to−Ambient Transient Thermal Response Curve**

### PACKAGE MARKING AND ORDERING INFORMATION

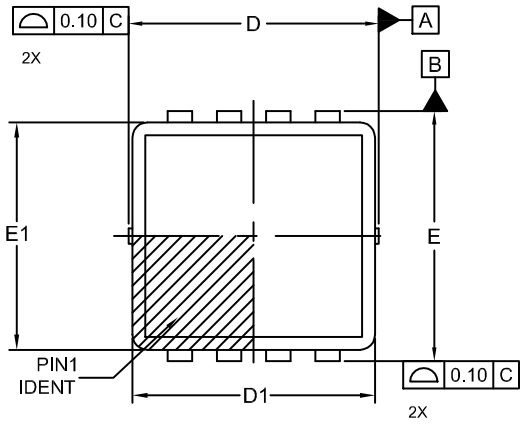
| Device | Device Marking | Package Type | Reel Size | Tape Width | Shipping† |
|---|---|---|---|---|---|
| FDMC7696 | FDMC7696 | WDFN8 3.3x3.3, 0.65P (Pb−Free) | 13” | 12 mm | 3000 / Tape & Reel |

†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.

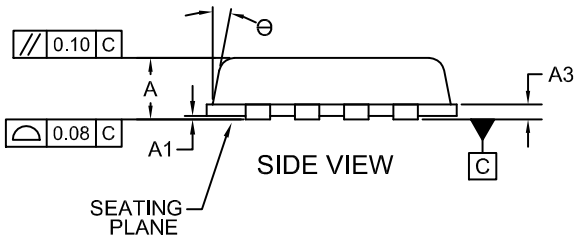


**WDFN8 3.3x3.3, 0.65P**
CASE 511DR
ISSUE B

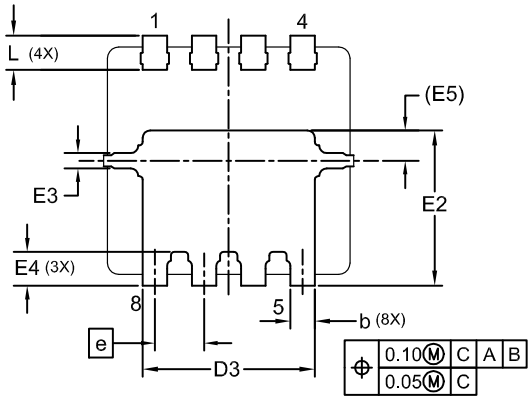
DATE 02 FEB 2022




TOP VIEW



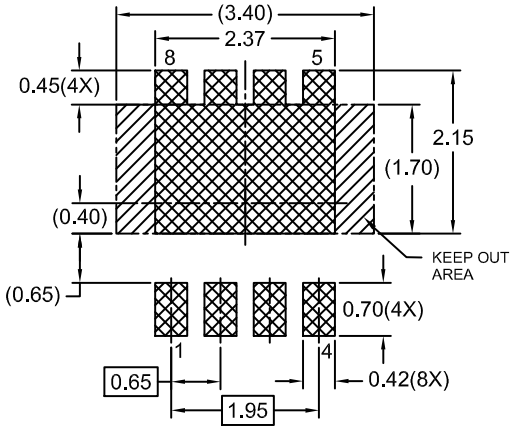

SIDE VIEW




BOTTOM VIEW

NOTES:
A. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
B. SEATING PLANE IS DEFINED BY TERMINAL TIPS ONLY
C. BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH PROTRUSIONS NOR GATE BURRS. MOLD FLASH PROTRUSION OR GATE BURR DOES NOT EXCEED 0.150MM.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.15 | 0.20 | 0.25 |
| b | 0.27 | 0.32 | 0.37 |
| D | 3.20 | 3.30 | 3.40 |
| D1 | 3.10 | 3.20 | 3.30 |
| D3 | 2.17 | 2.27 | 2.37 |
| E | 3.20 | 3.30 | 3.40 |
| E1 | 2.90 | 3.00 | 3.10 |
| E2 | 1.95 | 2.05 | 2.15 |
| E3 | 0.15 | 0.20 | 0.25 |
| E4 | 0.30 | 0.40 | 0.50 |
| E5 | 0.40 REF | | |
| e | 0.65 BSC | | |
| L | 0.30 | 0.40 | 0.50 |
| θ | 0° | - | 12° |




RECOMMENDED LAND PATTERN

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

**GENERIC MARKING DIAGRAM***


XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON13650G** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **WDFN8 3.3x3.3, 0.65P** | **PAGE 1 OF 1** |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
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