# MOSFET - Power, Single N-Channel

## 80 V, 9 mΩ, 58 A

*Product Preview*

# NVTYS009N08HL

**ON Semiconductor®**

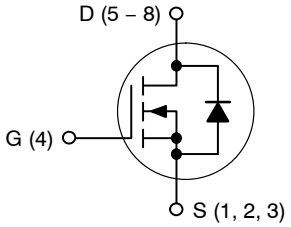
www.onsemi.com

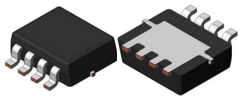
### Features

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 80 V | 9 mΩ @ 10 V | 58 A |
| | 10.9 mΩ @ 4.5 V | |

**N−Channel**



**LFPAK8**
**3.3x3.3**
**CASE 760AD**

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

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 80 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3, 4) | Steady State | $T_C$ = 25°C | $I_D$ | 58 | A |
| | | $T_C$ = 100°C | | 41 | |
| Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3) | | $T_C$ = 25°C | $P_D$ | 73 | W |
| | | $T_C$ = 100°C | | 37 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4) | Steady State | $T_A$ = 25°C | $I_D$ | 12 | A |
| | | $T_A$ = 100°C | | 9 | |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 3) | | $T_A$ = 25°C | $P_D$ | 3.2 | W |
| | | $T_A$ = 100°C | | 1.6 | |
| Pulsed Drain Current | $T_C$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | 279 | A |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 61 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($I_{L(pk)}$ = 3.4 A) | | | $E_{AS}$ | 199 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °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.

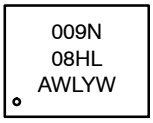
### THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case − Steady State (Note 3) | $R_{\theta JC}$ | 2 | °C/W |
| Junction−to−Ambient − Steady State (Note 3) | $R_{\theta JA}$ | 46 | |

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Psi (Ψ) is used as required per JESD51−12 for packages in which substantially less than 100% of the heat flows to single case surface.
3. Surface−mounted on FR4 board using a 650 $mm^2$, 2 oz. Cu pad.
4. Continuous DC current rating. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

### MARKING DIAGRAM




A = Assembly Location
WL = Wafer Lot
Y = Year
W = Work Week

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

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

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | | 80 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 53.4 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 80 V | $T_J$ = 25°C | | | 10 | μA |
| | | | $T_J$ = 125°C | | | 250 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = 20 V | | | | 100 | nA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 70 μA | | 1.2 | | 2.2 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | $I_D$ = 70 μA, ref to 25°C | | | −5.84 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 10 A | | | 7.5 | 9 | mΩ |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 10 A | | | 9.2 | 10.9 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 5 V, $I_D$ = 10 A | | | 46.5 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, f = 1.0 MHz $V_{DS}$ = 40 V | | | 1402 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | | 187 | | pF |
| Output Capacitance | $C_{oss}$ | | | | 10.5 | | pF |
| Threshold Gate Charge | $Q_{G(TH)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 40 V, $I_D$ = 10 A | | | 2 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 40 V, $I_D$ = 10 A | | | 24 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 3.5 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 4.3 | | |
| **SWITCHING CHARACTERISTICS** (Note 6) | | | | | | | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{GS}$ = 6.0 V, $V_{DS}$ = 64 V, $I_D$ = 10 A, $R_G$ = 6 Ω | | | 11 | | ns |
| Turn−Off Delay Time | $t_{d(off)}$ | | | | 29 | | |
| Rise Time | $t_r$ | | | | 10 | | |
| Fall Time | $t_f$ | | | | 9 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 10 A | $T_J$ = 25°C | | 0.8 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.7 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, dI/dt = 100 A/μs, $I_S$ = 10 A | | | 39 | | ns |
| Charge Time | $t_a$ | | | | 20 | | |
| Discharge Time | $t_b$ | | | | 20 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 27 | | nC |

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

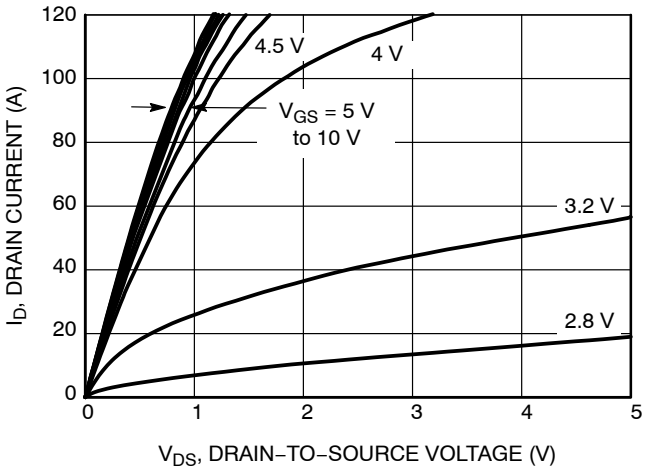



**Figure 1. On−Region Characteristics**

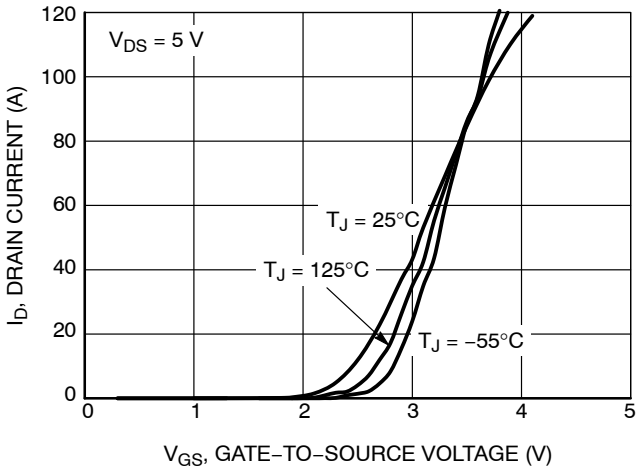



**Figure 2. Transfer Characteristics**

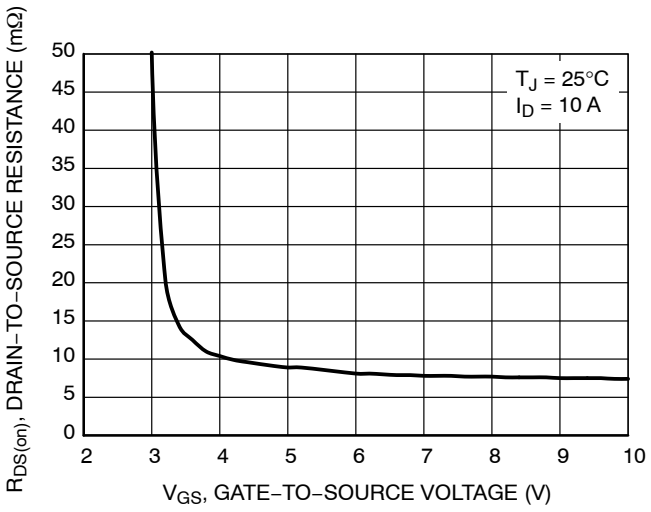



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

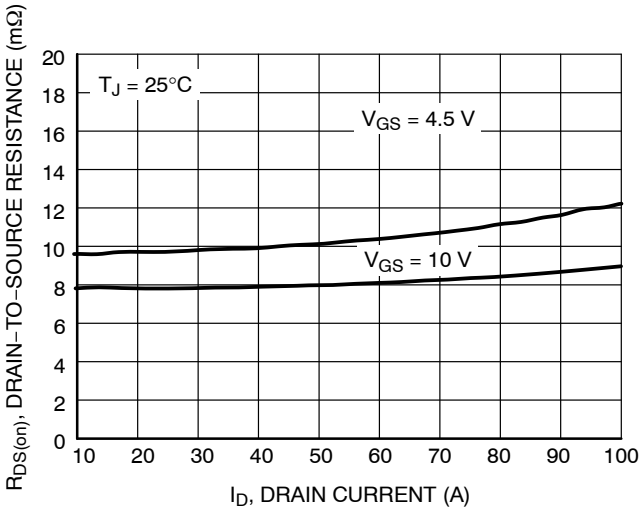



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

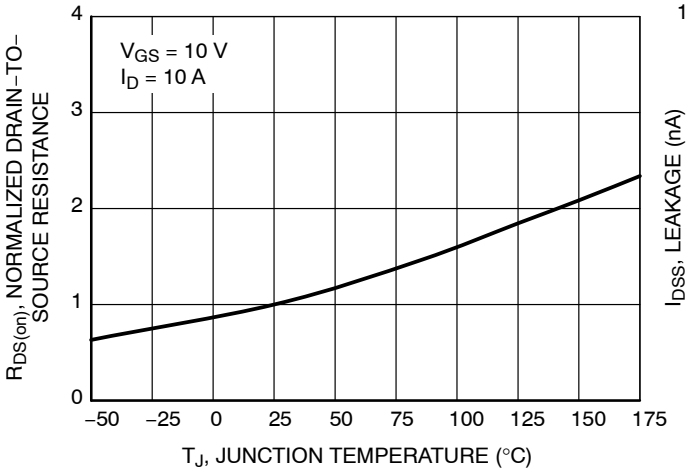



**Figure 5. On−Resistance Variation with Temperature**

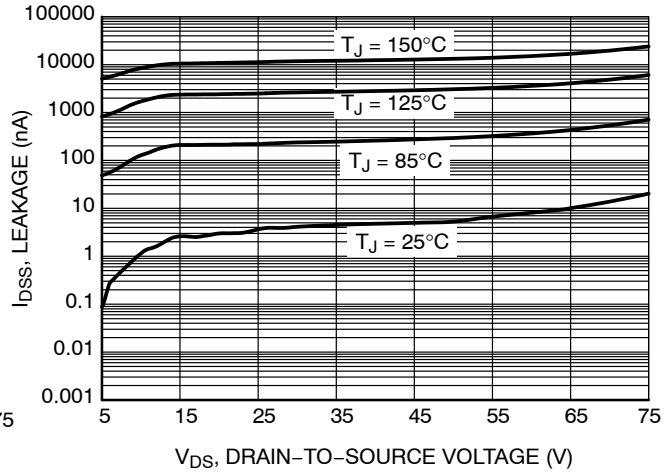



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

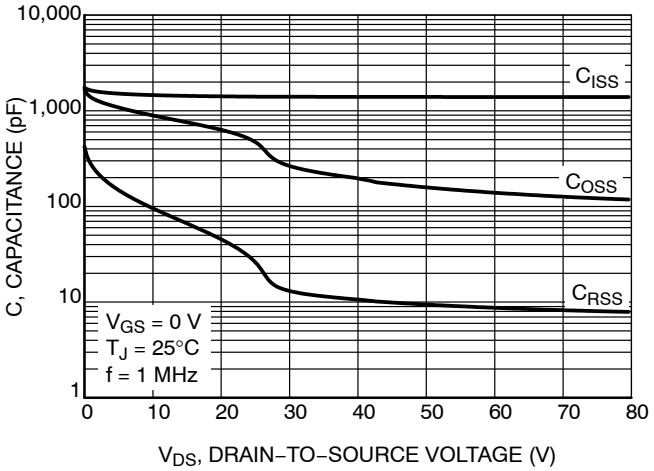



**Figure 7. Capacitance Variation**

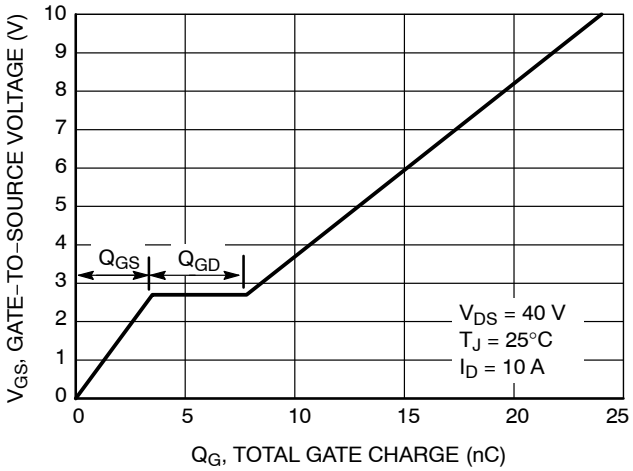



**Figure 8. Gate−to−Source vs. Total Charge**

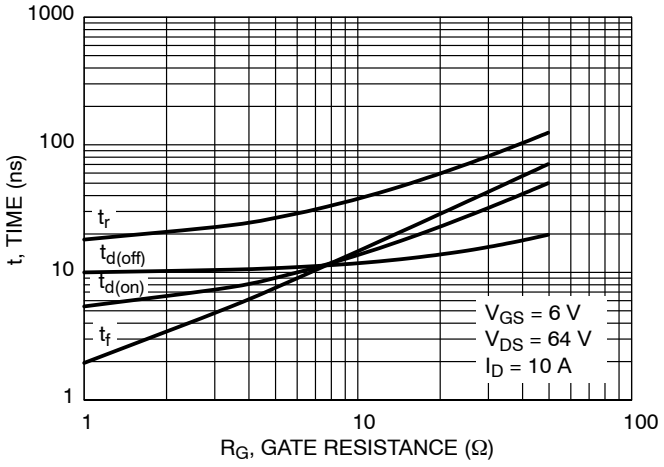



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

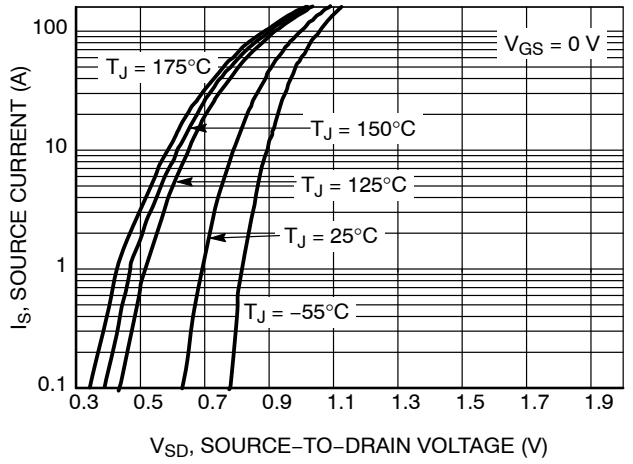



**Figure 10. Diode Forward Voltage vs. Current**

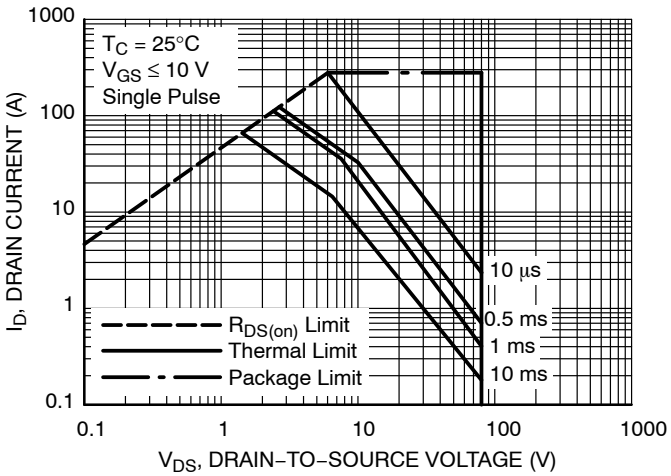



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

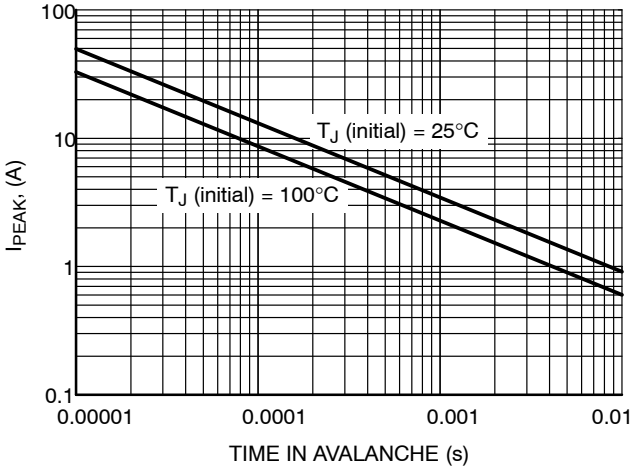



**Figure 12. Maximum Drain Curent vs. Time in Avalanche**

## TYPICAL CHARACTERISTICS

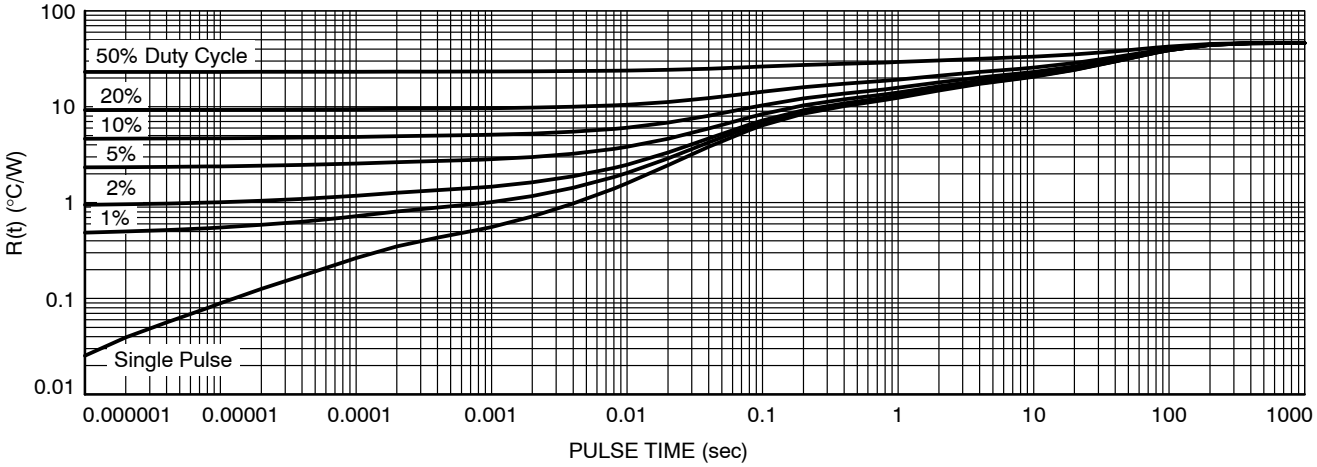
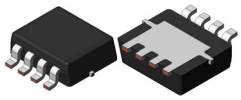



**Figure 13. Thermal Characteristics**

### DEVICE ORDERING INFORMATION

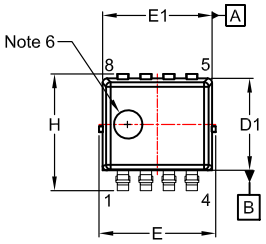
| Device | Marking | Package | Shipping† |
|---|---|---|---|
| NVTYS009N08HLTWG | 009N<br>08HL | LFPAK8<br>(Pb−Free) | 3000 / Tape & Reel |

†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.

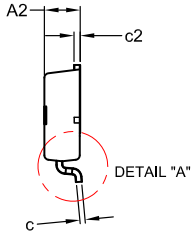


**LFPAK8 3.3x3.3, 0.65P**
CASE 760AD
ISSUE E

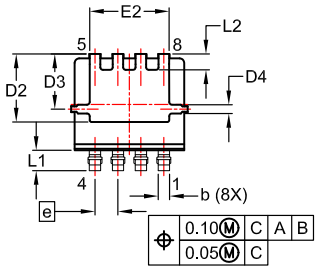
DATE 16 NOV 2020



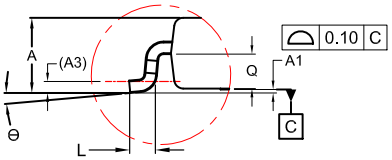

TOP VIEW



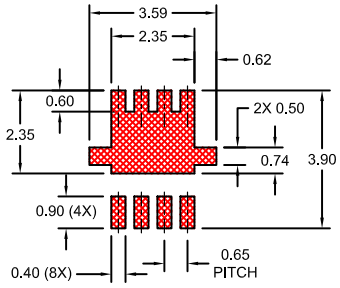

SIDE VIEW




BOTTOM VIEW




DETAIL 'A'
SCALE: 2:1




LAND PATTERN
RECOMMENDATION

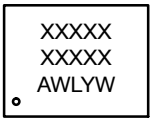
*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS OR BURRS SHALL NOT EXCEED 0.150mm PER SIDE.
4. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
6. OPTIONAL MOLD FEATURE.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.95 | 1.05 | 1.15 |
| A1 | 0.00 | 0.05 | 0.10 |
| A2 | 0.95 | 1.00 | 1.05 |
| A3 | | 0.15 REF | |
| b | 0.27 | 0.32 | 0.37 |
| c | 0.12 | 0.17 | 0.22 |
| c2 | 0.12 | 0.17 | 0.22 |
| D1 | 2.50 | 2.60 | 2.70 |
| D2 | 1.82 | 1.92 | 2.02 |
| D3 | 1.46 | 1.56 | 1.66 |
| D4 | 0.20 | 0.25 | 0.30 |
| E | 3.20 | 3.30 | 3.40 |
| E1 | 3.00 | 3.10 | 3.20 |
| E2 | 2.15 | 2.25 | 2.35 |
| e | | 0.65 BSC | |
| H | 3.20 | 3.30 | 3.40 |
| L | 0.25 | 0.37 | 0.50 |
| L1 | 0.48 | 0.58 | 0.68 |
| L2 | 0.35 | 0.45 | 0.55 |
| Q | 0.45 | 0.50 | 0.55 |
| θ | 0° | 4° | 8° |

## GENERIC MARKING DIAGRAM*




XXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
W = Work Week

*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:** | **98AON05544H** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
| **DESCRIPTION:** | **LFPAK8 3.3x3.3, 0.65P** | **PAGE 1 OF 1** |

## ADDITIONAL INFORMATION

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**For additional information, please contact your local Sales Representative at** www.onsemi.com/support/sales