# MOSFET - Power, Single N-Channel, STD Gate, µ8FL
## 40 V, 1.43 mΩ, 178 A

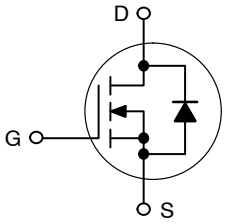
# NVTFWS1D3N04XM

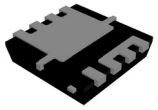
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | $I_D$ MAX |
|---|---|---|
| 40 V | 1.43 mΩ @ 10 V | 178 A |

### Features
- Low RDS(on) to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Small Footprint (3.3 x 3.3 mm) for Compact Design
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications
- Motor Drive
- Battery Protection
- Synchronous Rectification

N−CHANNEL MOSFET



**WDFNW8**
**(µ8FL)**
**CASE 515AP**

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

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain−to−Source Voltage | | $V_{DSS}$ | 40 | V |
| Gate−to−Source Voltage | DC | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $T_C$ = 25°C | $I_D$ | 178 | A |
| | $T_C$ = 100°C | | 126 | |
| Power Dissipation | $T_A$ = 25°C | $P_D$ | 83 | W |
| Pulsed Drain Current | $T_C$ = 25°C, $t_p$ = 10 µs | $I_{DM}$ | 895 | A |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | $I_S$ | 71 | A |
| Single Pulse Avalanche Energy ($I_{LPK}$ = 17.2 A) | | $E_{AS}$ | 281 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | $T_L$ | 260 | °C |

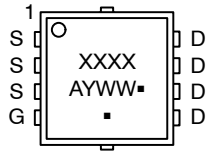
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Case (Note 2) | $R_{\theta JC}$ | 1.8 | °C/W |
| Thermal Resistance, Junction−to−Ambient (Notes 1, 2) | $R_{\theta JA}$ | 46.4 | |

1. Surface mounted on FR4 board using 650 mm2, 2 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

### MARKING DIAGRAM




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

(Note: Microdot may be in either location)

### ORDERING INFORMATION
See detailed ordering and shipping information on page 5 of this data sheet.

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 1 mA, $T_J$ = 25°C | 40 | – | – | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $\Delta V_{(BR)DSS}/\Delta T_J$ | $I_D$ = 1 mA, Referenced to 25°C | – | 15 | – | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 40 V, $T_J$ = 25°C | – | – | 1 | μA |
| | | $V_{DS}$ = 40 V, $T_J$ = 125°C | – | – | 100 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = 20 V, $V_{DS}$ = 0 V | – | – | 100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 20 A, $T_J$ = 25°C | – | 1.24 | 1.43 | mΩ |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 90 μA, $T_J$ = 25°C | 2.5 | 3 | 3.5 | V |
| Gate Threshold Voltage Temperature Coefficient | $\Delta V_{GS(th)}/\Delta T_J$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 90 μA | – | −7.34 | – | mV/°C |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 5 V, $I_D$ = 20 A | – | 103 | – | S |
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | – | 2288 | – | pF |
| Output Capacitance | $C_{OSS}$ | | – | 1449 | – | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | – | 22 | – | |
| Total Gate Charge | $Q_{G(tot)}$ | $V_{DD}$ = 32 V, $I_D$ = 50 A, $V_{GS}$ = 10 V | – | 36 | – | nC |
| Threshold Gate Charge | $Q_{G(th)}$ | | – | 7 | – | |
| Gate−to−Source Charge | $Q_{GS}$ | | – | 11 | – | |
| Gate−to−Drain Charge | $Q_{GD}$ | | – | 7 | – | |
| Gate Resistance | $R_G$ | f = 1 MHz | – | 0.7 | – | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS}$ = 0/10 V, $I_D$ = 50 A, $V_{DD}$ = 32 V, $R_G$ = 0 Ω | – | 21 | – | ns |
| Rise Time | $t_r$ | | – | 8 | – | |
| Turn-Off Delay Time | $t_{d(off)}$ | | – | 34 | – | |
| Fall Time | $t_f$ | | – | 8 | – | |
| **SOURCE−TO−DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $I_S$ = 20 A, $V_{GS}$ = 0 V, $T_J$ = 25°C | – | 0.79 | 1.2 | V |
| | | $I_S$ = 20 A, $V_{GS}$ = 0 V, $T_J$ = 125°C | – | 0.64 | – | |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS}$ = 0 V, $I_S$ = 50 A, dI/dt = 100 A/μs, $V_{DD}$ = 32 V | – | 48 | – | ns |
| Charge Time | $t_a$ | | – | 20 | – | |
| Discharge Time | $t_b$ | | – | 28 | – | |
| Reverse Recovery Charge | $Q_{RR}$ | | – | 48 | – | 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.

## TYPICAL PERFORMANCE CHARACTERISTICS

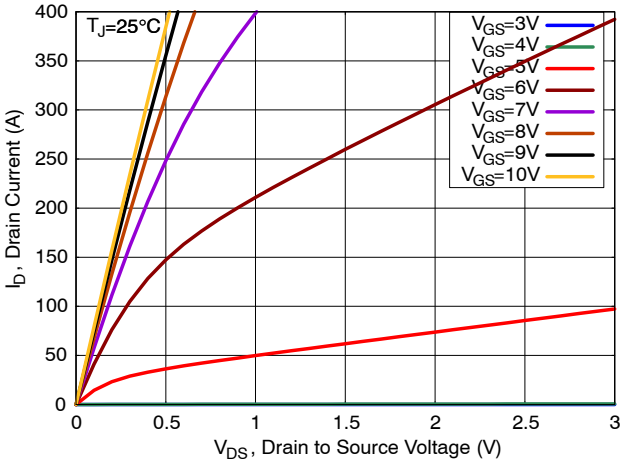



**Figure 1. On−Region Characteristics**

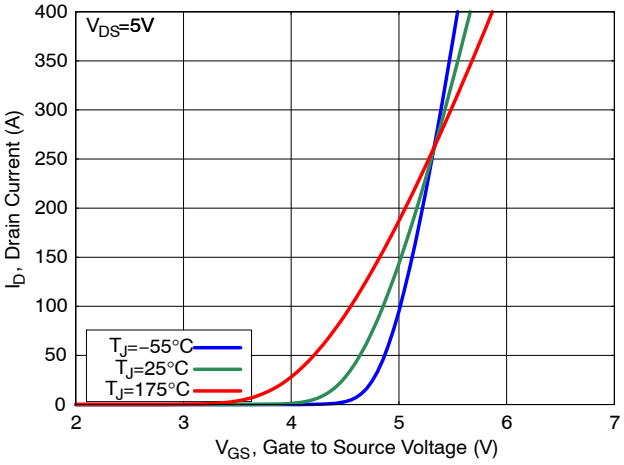



**Figure 2. Transfer Characteristics**

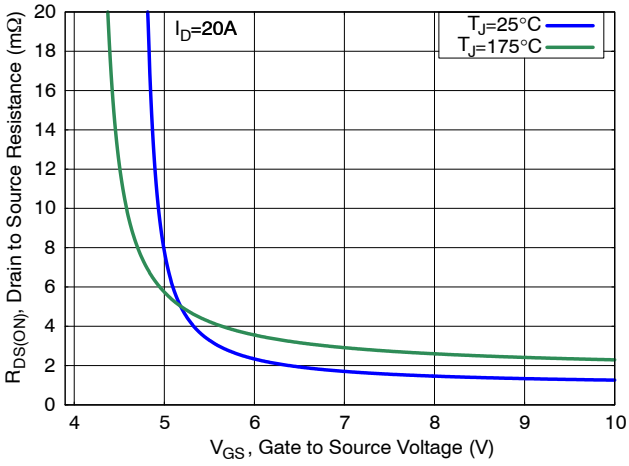



**Figure 3. On−Resistance vs. Gate Voltage**

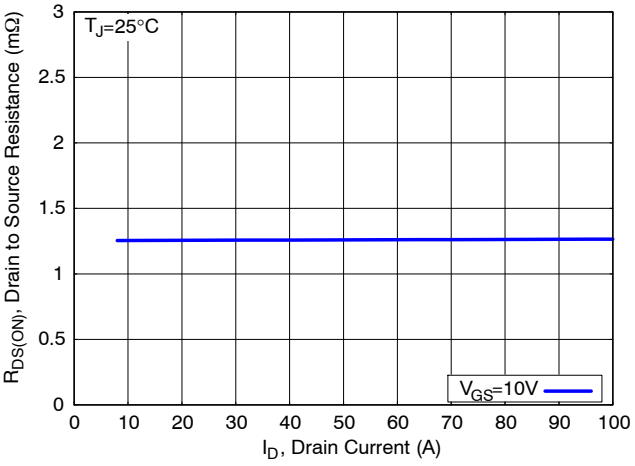



**Figure 4. On−Resistance vs. Drain Current**

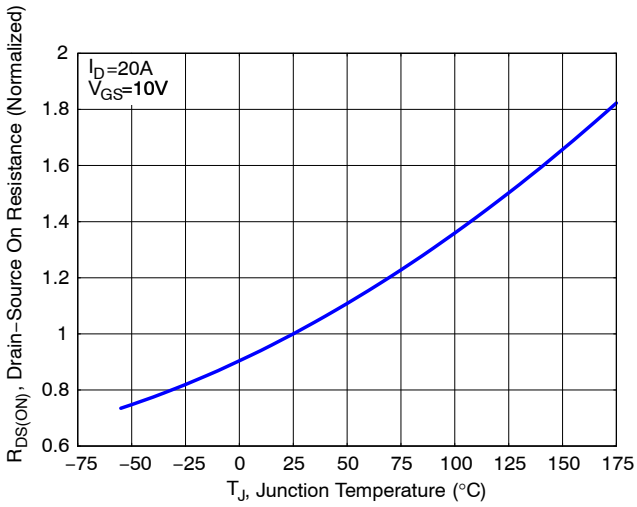



**Figure 5. Normalized ON Resistance vs. Junction Temperature**

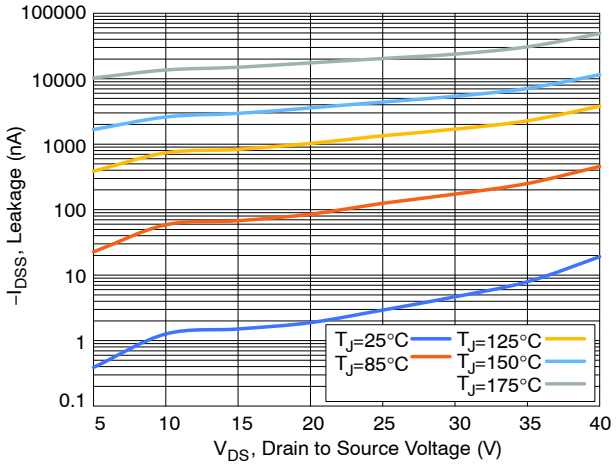



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL PERFORMANCE CHARACTERISTICS

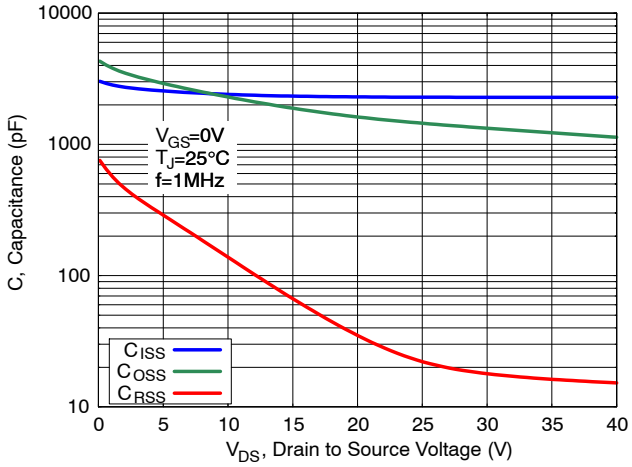



**Figure 7. Capacitance Characteristics**

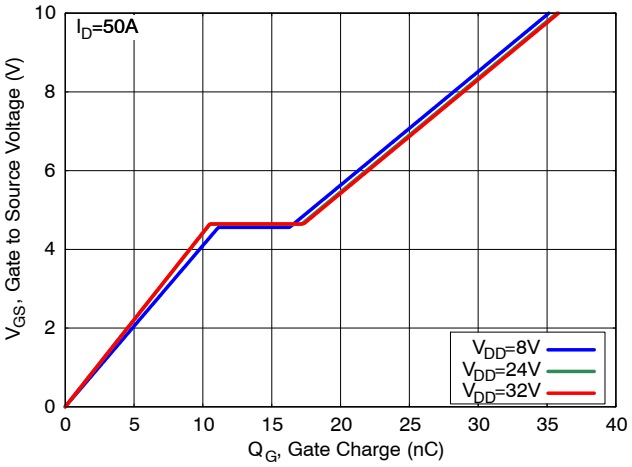



**Figure 8. Gate Charge Characteristics**

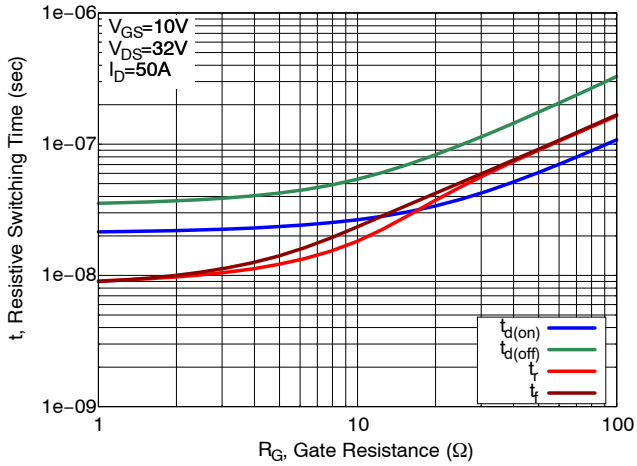



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

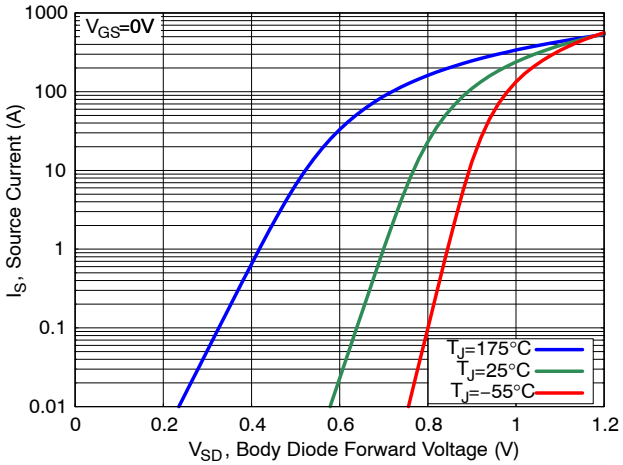



**Figure 10. Diode Forward Characteristics**

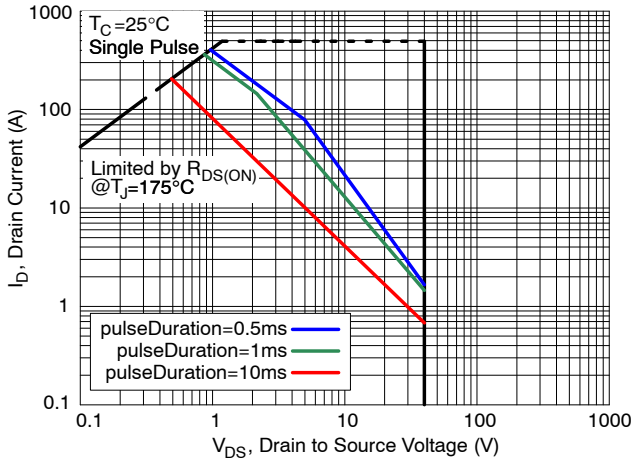



**Figure 11. Safe Operating Area (SOA)**

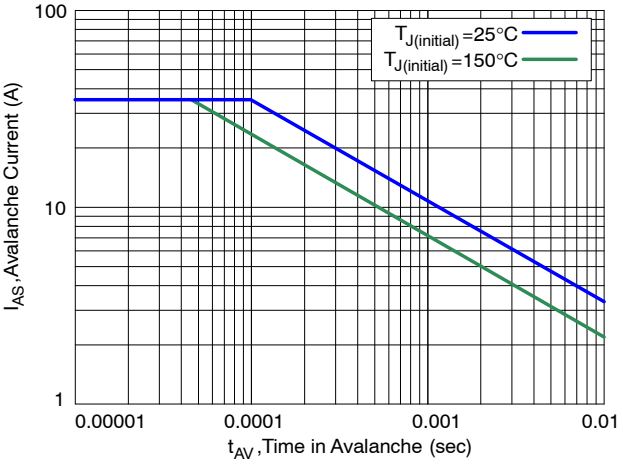



**Figure 12. Avalanche Current vs. Pulse Time (UIS)**

## TYPICAL PERFORMANCE CHARACTERISTICS

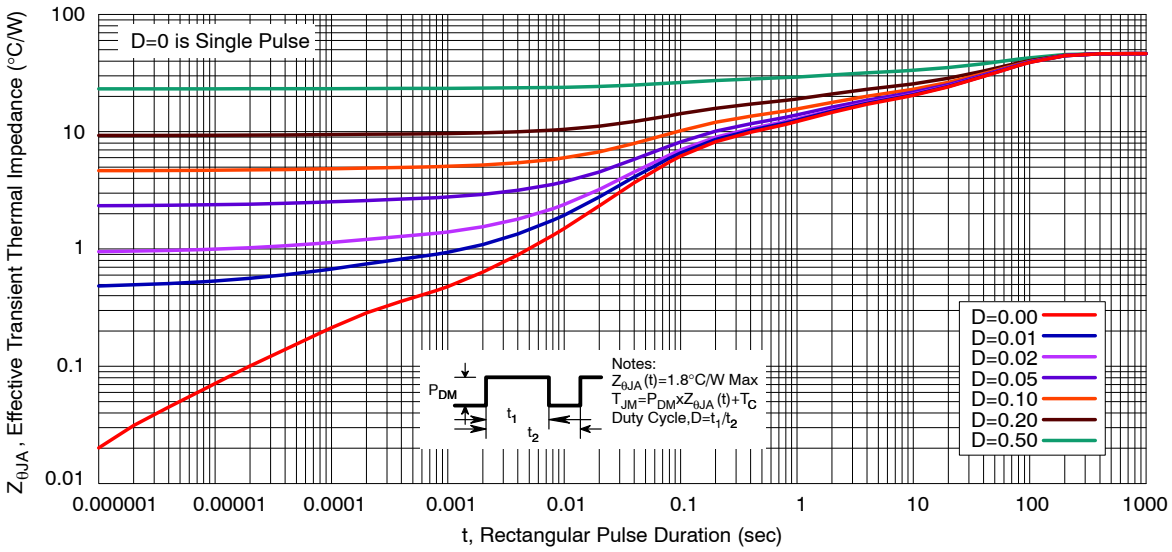
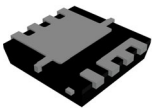



**Figure 13. Transient Thermal Response**

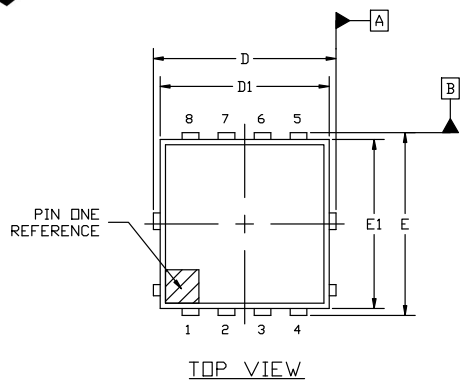
## PACKAGE MARKING AND ORDERING INFORMATION

| Part Number | Top Marking | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| NVTFWS1D3N04XMTAG | 1D3W | WDFNW8 | Tape & Reel | N/A | N/A | 1500 Units |

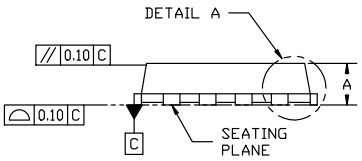


**WDFNW8 3.30x3.30x0.75, 0.65P**
CASE 515AP
ISSUE A

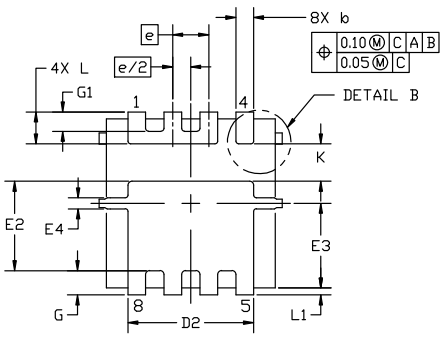
DATE 07 NOV 2023




TOP VIEW



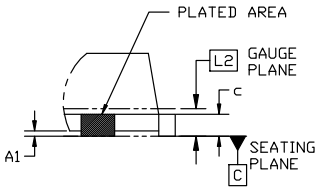

SIDE VIEW



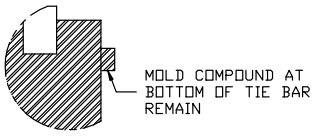

BOTTOM VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
4. FULL-CUT u8FL FUSED WF.

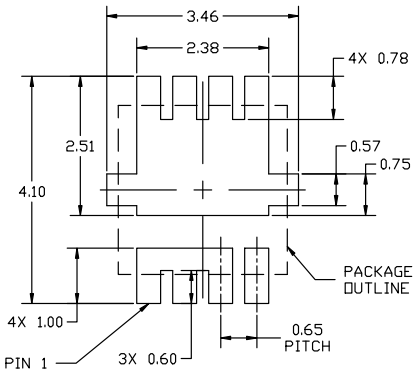



DETAIL "A"
SCALE 2:1




DETAIL "B"
SCALE 2:1

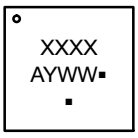
| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | ---- | 0.05 |
| b | 0.23 | 0.33 | 0.43 |
| c | 0.15 | 0.20 | 0.25 |
| D | 3.20 | 3.30 | 3.40 |
| D1 | 2.95 | 3.13 | 3.30 |
| D2 | 1.98 | 2.20 | 2.40 |
| E | 3.20 | 3.30 | 3.40 |
| E1 | 2.80 | 3.00 | 3.15 |
| E2 | 1.40 | 1.60 | 1.80 |
| E3 | 1.35 | 1.50 | 1.60 |
| E4 | 0.15 | 0.25 | 0.40 |
| e | 0.65 BSC | | |
| G | 0.30 | 0.43 | 0.55 |
| G1 | 0.25 | 0.35 | 0.45 |
| K | 0.55 | 0.75 | 0.95 |
| L | 0.35 | 0.52 | 0.65 |
| L1 | 0.06 | 0.15 | 0.30 |
| L2 | 0.25 BSC | | |




RECOMMENDED MOUNTING FOOTPRINT*

* 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: | 98AON24557H | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
|---|---|---|
| DESCRIPTION: | WDFNW8 3.30x3.30x0.75, 0.65P | PAGE 1 OF 1 |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

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