

# MOSFET - Power, Single N-Channel, STD Gate, SO8FL

40 V, 1.3 mΩ, 195 A

NVMFWS1D3N04XM

## Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Small Footprint (5 x 6 mm) with Compact Design
- AECQ101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

## Applications

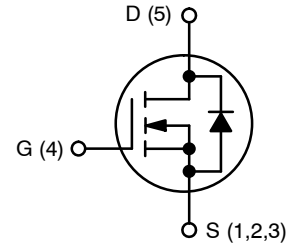
- Motor Drive
- Battery Protection
- Synchronous Rectification

## MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

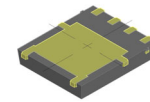
| Parameter  |   | Symbol         | Value       | Unit               |
|--|---|----------------|-------------|--------------------|
| Drain-to-Source Voltage  |   | $V_{DSS}$      | 40          | V                  |
| Gate-to-Source Voltage   | DC  | $V_{GS}$       | $\pm 20$    | V                  |
| Continuous Drain Current   | $T_C = 25^{\circ}\text{C}$                                    | $I_D$          | 195         | A                  |
|  | $T_C = 100^{\circ}\text{C}$                                   |                | 138         |                    |
| Power Dissipation  | $T_C = 25^{\circ}\text{C}$                                    | $P_D$          | 90          | W                  |
| Continuous Drain Current<br>$R_{\theta JA}$                          | $T_A = 25^{\circ}\text{C}$                                    | $I_{DA}$       | 40          | A                  |
|  | $T_A = 100^{\circ}\text{C}$                                   |                | 28          |                    |
| Pulsed Drain Current   | $T_C = 25^{\circ}\text{C}$ ,<br>$t_p = 10\text{ }\mu\text{s}$ | $I_{DM}$       | 900         | A                  |
| Operating Junction and Storage Temperature Range                     |   | $T_J, T_{STG}$ | -55 to +175 | $^{\circ}\text{C}$ |
| Source Current (Body Diode)  |   | $I_S$          | 74.5        | A                  |
| Single Pulse Avalanche Energy<br>( $I_{PK} = 11.1\text{ A}$ )        |   | $E_{AS}$       | 306         | mJ                 |
| Lead Temperature for Soldering Purposes<br>(1/8" from case for 10 s) |   | $T_L$          | 260         | $^{\circ}\text{C}$ |

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.

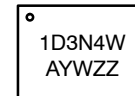
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX                 | $I_D$ MAX |
|---------------|----------------------------------|-----------|
| 40 V          | 1.3 mΩ @ $V_{GS} = 10 \text{ V}$ | 195 A     |



N-CHANNEL MOSFET



DFNW5 (SO-8FL)  
CASE 507BA



1D3N4W = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Assembly Lot Code

## ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NVMFWS1D3N04XM

## THERMAL CHARACTERISTICS

| Parameter  | Symbol          | Value | Unit |
|--|-----------------|-------|------|
| Thermal Resistance, Junction-to-Case (Note 2)        | $R_{\theta JC}$ | 1.67  | °C/W |
| Thermal Resistance, Junction-to-Ambient (Notes 1, 2) | $R_{\theta JA}$ | 40.1  |      |

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

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

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

### OFF CHARACTERISTICS

|   |                                   |  |    |    |     |               |
|---|-----------------------------------|--|----|----|-----|---------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$                     | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$ | 40 |    |     | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $\Delta V_{(BR)DSS} / \Delta T_J$ | $I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$           |    | 15 |     | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$                         | $V_{DS} = 40\text{ V}, T_J = 25^\circ\text{C}$                   |    |    | 10  | $\mu\text{A}$ |
|   |                                   | $V_{DS} = 40\text{ V}, T_J = 125^\circ\text{C}$                  |    |    | 100 |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$                         | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$                      |    |    | 100 | nA            |

### ON CHARACTERISTICS

|  |                                  |   |     |       |     |            |
|--|----------------------------------|---|-----|-------|-----|------------|
| Drain-to-Source On Resistance                  | $R_{DS(on)}$                     | $V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$       |     | 1.17  | 1.3 | m $\Omega$ |
| Gate Threshold Voltage                         | $V_{GS(TH)}$                     | $V_{GS} = V_{DS}, I_D = 100\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$ | 2.5 |       | 3.5 | V          |
| Gate Threshold Voltage Temperature Coefficient | $\Delta V_{GS(TH)} / \Delta T_J$ | $V_{GS} = V_{DS}, I_D = 100\text{ }\mu\text{A}$                         |     | -7.23 |     | mV/°C      |
| Forward Trans-conductance                      | $g_{FS}$                         | $V_{DS} = 5\text{ V}, I_D = 20\text{ A}$                                |     | 105   |     | S          |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                              |              |   |  |      |  |          |
|------------------------------|--------------|---|--|------|--|----------|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$   |  | 2459 |  | pF       |
| Output Capacitance           | $C_{OSS}$    |   |  | 1578 |  |          |
| Reverse Transfer Capacitance | $C_{RSS}$    |   |  | 23.3 |  |          |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DD} = 32\text{ V}; I_D = 50\text{ A}$ |  | 38.6 |  | nC       |
| Threshold Gate Charge        | $Q_{G(TH)}$  |   |  | 7.2  |  |          |
| Gate-to-Source Charge        | $Q_{GS}$     |   |  | 11.3 |  |          |
| Gate-to-Drain Charge         | $Q_{GD}$     |   |  | 7.4  |  |          |
| Gate Resistance              | $R_G$        | $f = 1\text{ MHz}$  |  | 0.72 |  | $\Omega$ |

### SWITCHING CHARACTERISTICS

|                     |              |  |  |      |  |    |
|---------------------|--------------|--|--|------|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | Resistive Load,<br>$V_{GS} = 0/10\text{ V}, V_{DD} = 32\text{ V},$<br>$I_D = 50\text{ A}, R_G = 0\text{ }\Omega$ |  | 19.1 |  | ns |
| Rise Time           | $t_r$        |  |  | 6.2  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 30.4 |  |    |
| Fall Time           | $t_f$        |  |  | 5.2  |  |    |

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

|                         |          |   |  |      |  |    |
|-------------------------|----------|---|--|------|--|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 25^\circ\text{C}$                                      |  | 0.8  |  | V  |
|                         |          | $V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 125^\circ\text{C}$                                     |  | 0.65 |  |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, I_S = 50\text{ A},$<br>$di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 32\text{ V}$ |  | 46   |  | ns |
| Charge Time             | $t_a$    |   |  | 22   |  |    |
| Discharge Time          | $t_b$    |   |  | 24   |  |    |
| Reverse Recovery Charge | $Q_{RR}$ |   |  | 55   |  | 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 CHARACTERISTICS

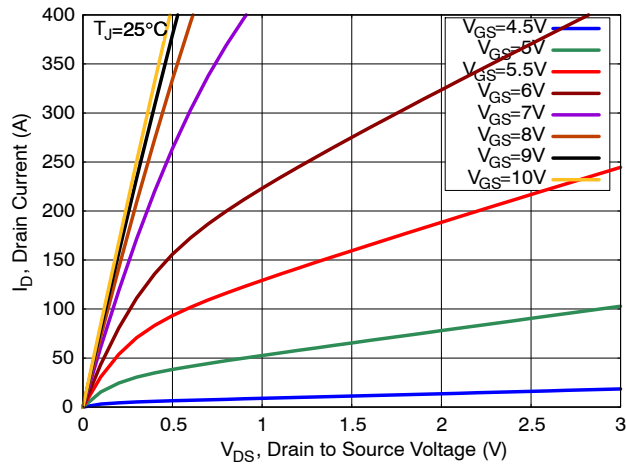


Figure 1. On-Region Characteristics

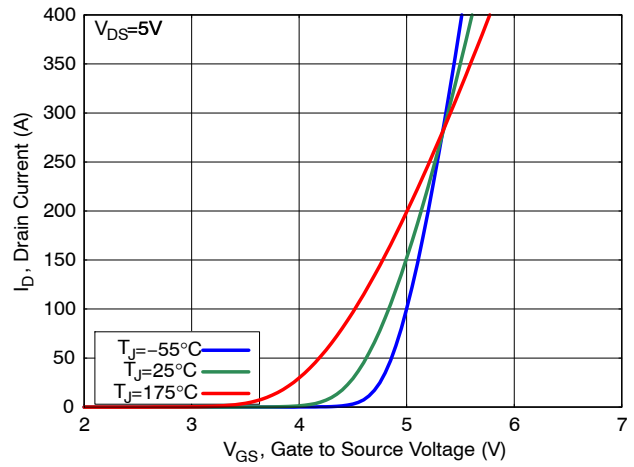


Figure 2. Transfer Characteristics

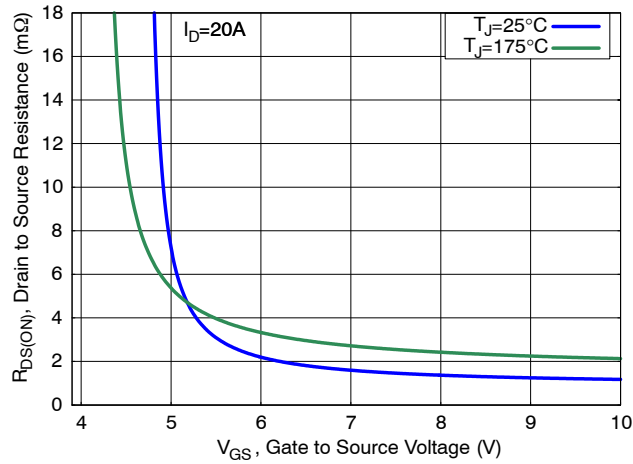


Figure 3. On-Resistance vs.  $V_{GS}$

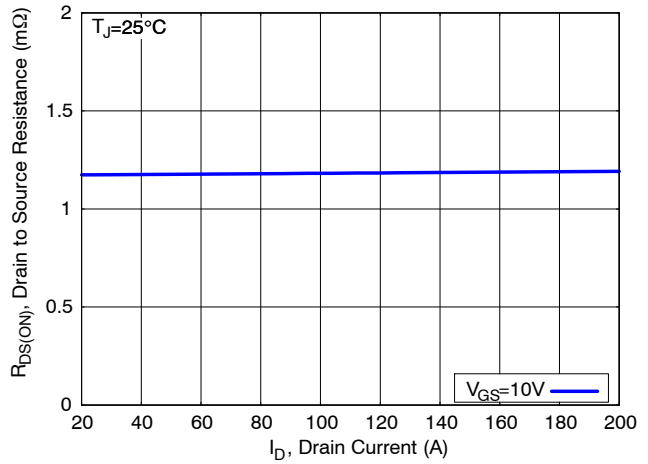


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

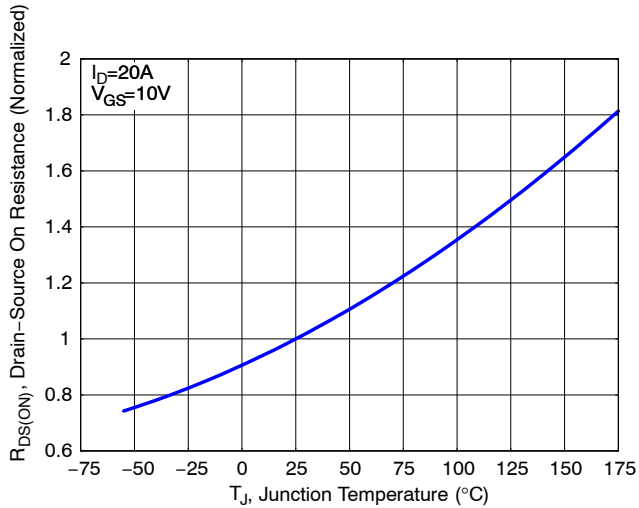


Figure 5. On-Resistance Variation with Temperature

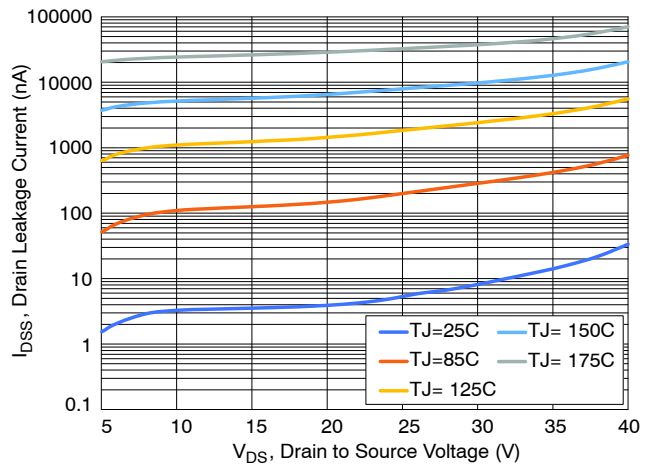


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

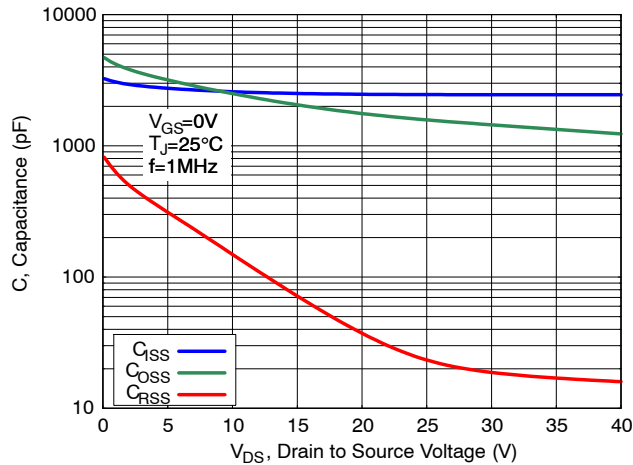


Figure 7. Capacitance Characteristics

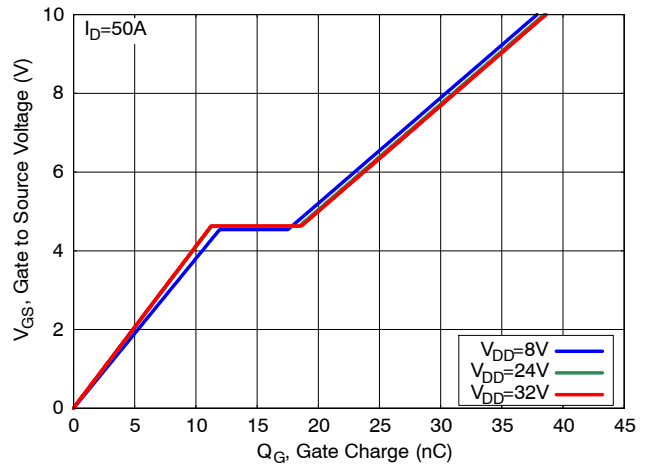


Figure 8. Gate-to-Source Voltage vs. Total Charge

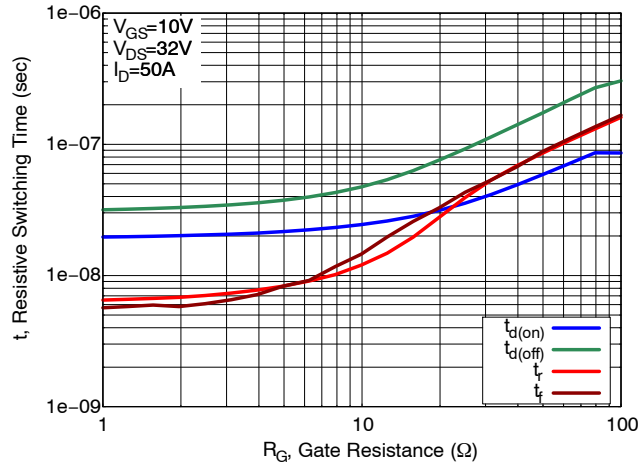


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

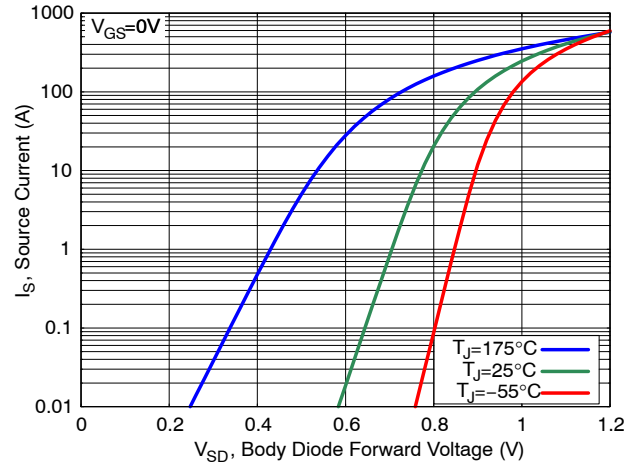


Figure 10. Diode Forward Voltage vs. Current

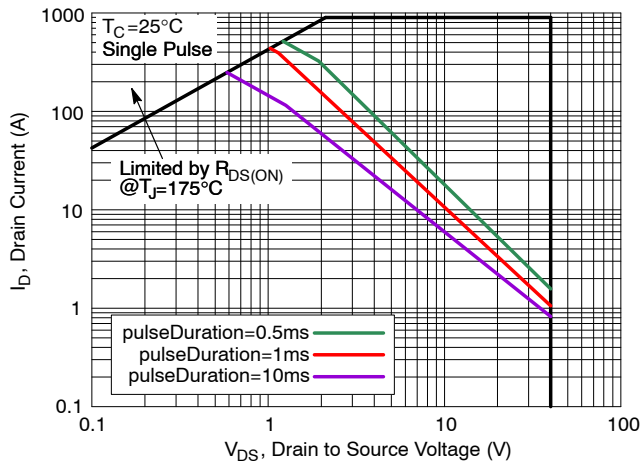


Figure 11. Safe Operating Area (SOA)

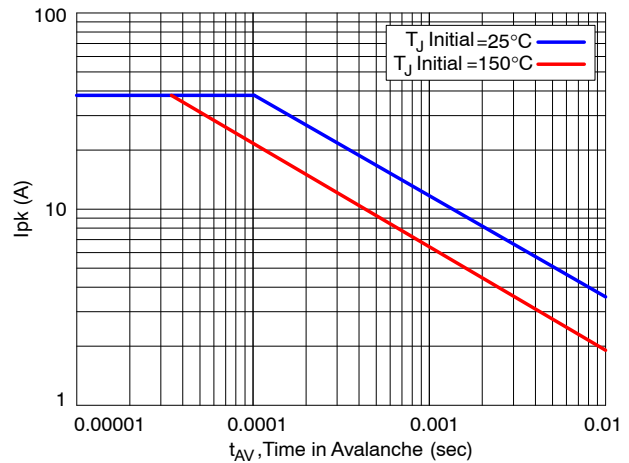


Figure 12. Avalanche Current vs Pulse Time (UIS)

# NVMFWS1D3N04XM

## TYPICAL CHARACTERISTICS

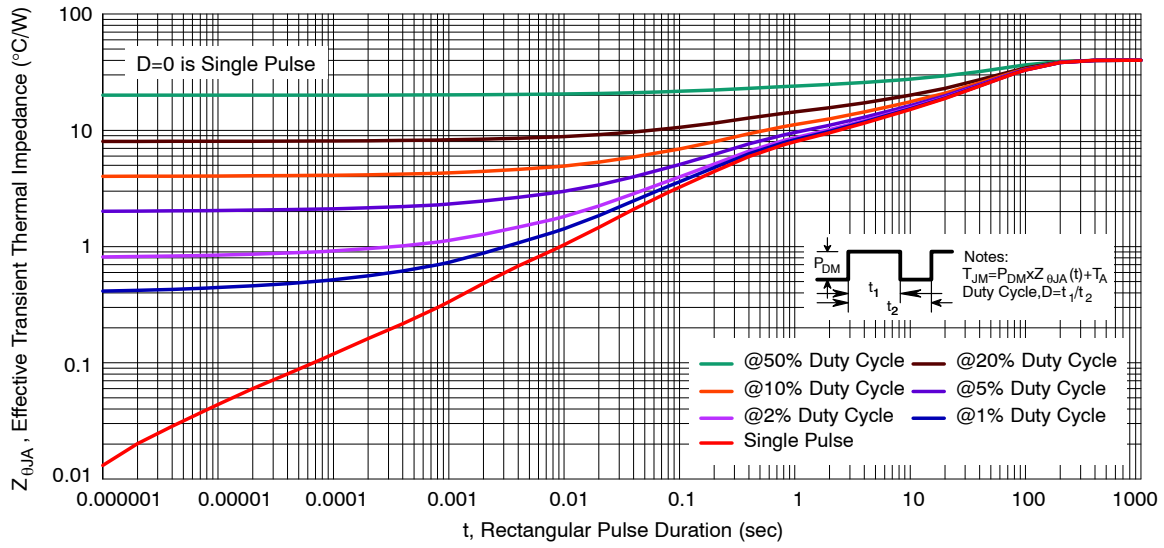
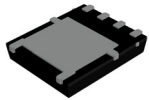


Figure 13. Transient Thermal Response

### ORDERING INFORMATION

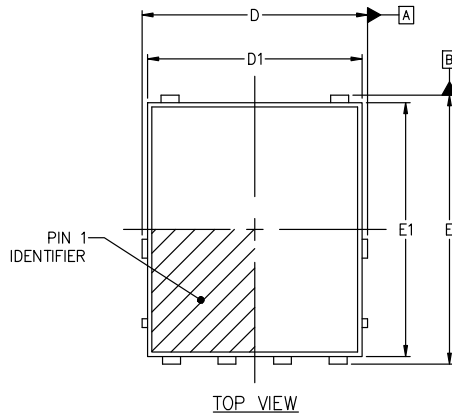
| Device            | Marking | Package            | Shipping†          |
|-------------------|---------|--------------------|--------------------|
| NVMFWS1D3N04XMT1G | 1D3N4W  | DFNW5<br>(Pb-Free) | 1500 / Tape & Reel |

†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.

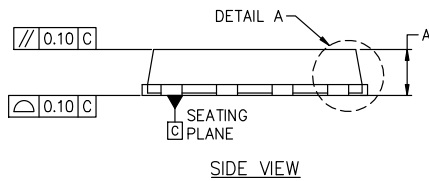


DFNW5 4.90x5.90x1.00, 1.27P  
CASE 507BA  
ISSUE C

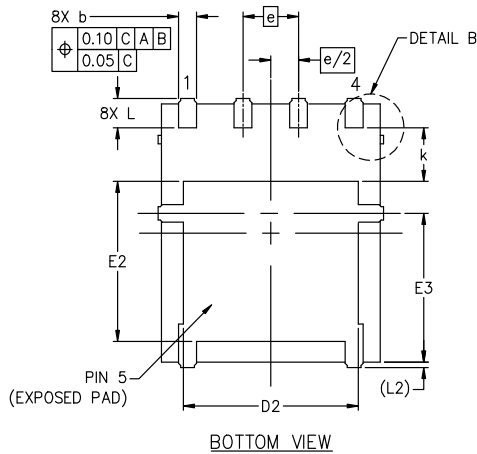
DATE 19 SEP 2024



TOP VIEW



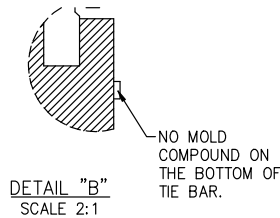
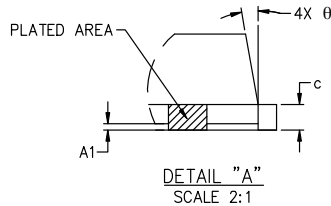
SIDE VIEW



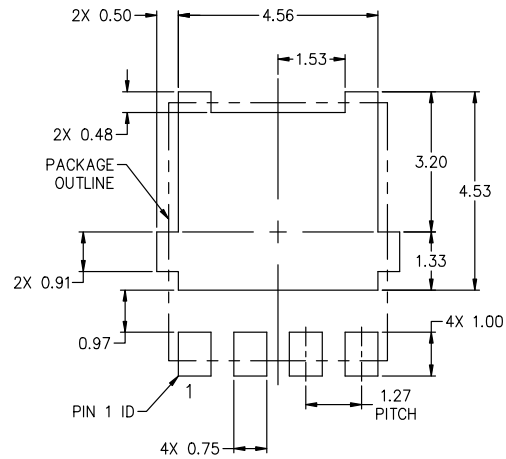
BOTTOM VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
4. THIS PACKAGE CONTAINS WETTABLE FLANK DESIGN FEATURES TO AID IN FILLET FORMATION ON THE LEADS DURING MOUNTING.



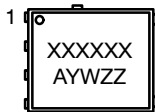
| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN         | NOM  | MAX  |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.00        | ---  | 0.05 |
| b   | 0.33        | 0.41 | 0.51 |
| c   | 0.23        | 0.28 | 0.33 |
| D   | 5.00        | 5.15 | 5.30 |
| D1  | 4.70        | 4.90 | 5.10 |
| D2  | 3.80        | 4.00 | 4.20 |
| E   | 6.00        | 6.15 | 6.30 |
| E1  | 5.70        | 5.90 | 6.10 |
| E2  | 3.45        | 3.65 | 3.85 |
| E3  | 3.00        | 3.40 | 3.80 |
| e   | 1.27 BSC    |      |      |
| k   | 1.20        | 1.35 | 1.50 |
| L   | 0.51        | 0.57 | 0.71 |
| L2  | 0.15 REF.   |      |      |
| θ   | 0°          | 6°   | 12°  |



RECOMMENDED MOUNTING FOOTPRINT\*

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

GENERIC  
MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

\*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.

|                  |                             |  |
|------------------|-----------------------------|--|
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| DESCRIPTION:     | DFNW5 4.90x5.90x1.00, 1.27P | PAGE 1 OF 1  |

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