

# MOSFET - Power, Single N-Channel, DFN5/DFNW5 30 V, 6.0 mΩ, 51 A

## NVMFS4C310N

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- AEC-Q101 Qualified and PPAP Capable
- NVMFS4C310NWF – Wettable Flanks Option for Enhanced Optical Inspection
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

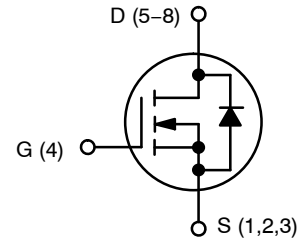
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter                                                                    | Symbol         | Value                           | Unit             |
|------------------------------------------------------------------------------|----------------|---------------------------------|------------------|
| Drain-to-Source Voltage                                                      | $V_{DS}$       | 30                              | V                |
| Gate-to-Source Voltage                                                       | $V_{GS}$       | $\pm 20$                        | V                |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2 and 4)                  | $I_D$          | $T_A = 25^\circ\text{C}$<br>17  | A                |
|                                                                              |                | $T_A = 100^\circ\text{C}$<br>12 |                  |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2 and 4)                         | $P_D$          | $T_A = 25^\circ\text{C}$<br>3.5 | W                |
|                                                                              |                | $T_C = 25^\circ\text{C}$<br>51  |                  |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3 and 4)               | $I_D$          | $T_C = 25^\circ\text{C}$<br>36  | A                |
|                                                                              |                | $T_C = 100^\circ\text{C}$<br>32 |                  |
| Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3 and 4)                      | $P_D$          | 32                              | W                |
| Pulsed Drain Current                                                         | $I_{DM}$       | 132                             | A                |
| Operating Junction and Storage Temperature                                   | $T_J, T_{STG}$ | $-55$ to $+175$                 | $^\circ\text{C}$ |
| Source Current (Body Diode)                                                  | $I_S$          | 21                              | A                |
| Single Pulse Drain-to-Source Avalanche Energy ( $I_L = 25 A_{pk}$ ) (Note 3) | $E_{AS}$       | 31                              | mJ               |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)            | $T_L$          | 260                             | $^\circ\text{C}$ |

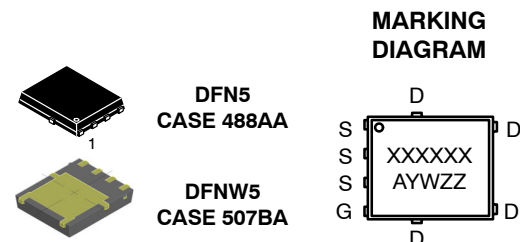
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.
3. Assumes heat-sink sufficiently large to maintain constant case temperature independent of device power.
4. Continuous DC current rating. Maximum current for pulses as long as one second is higher but dependent on pulse duration and duty cycle.

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 30 V          | 6.0 mΩ @ 10 V            | 51 A              |
|               | 9.0 mΩ @ 4.5 V           |                   |



N-CHANNEL MOSFET



4C10N = Specific Device Code for NVMFS4C310N  
4C10WF = Specific Device Code of NVMFS4C310NWF  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

| Device          | Package         | Shipping†          |
|-----------------|-----------------|--------------------|
| NVMFS4C310NT1G  | DFN5 (Pb-Free)  | 1500 / Tape & Reel |
| NVMFS4C310NWF1G | DFNW5 (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.

# NVMFS4C310N

## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit |
|---------------------------------------------|-----------------|-------|------|
| Junction-to-Case (Drain)                    | $R_{\theta JC}$ | 4.7   | °C/W |
| Junction-to-Ambient – Steady State (Note 5) | $R_{\theta JA}$ | 43    |      |

5. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.

## 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                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 30                        |      |     | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |                                                     |                           | 14.5 |     | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$         | $T_J = 25^\circ\text{C}$  |      | 1.0 | $\mu\text{A}$ |
|                                                           |                   |                                                     | $T_J = 125^\circ\text{C}$ |      | 10  |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$         |                           |      | 100 | nA            |

### ON CHARACTERISTICS (Note 6)

|                                            |                  |                                                 |     |     |     |            |
|--------------------------------------------|------------------|-------------------------------------------------|-----|-----|-----|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 1.3 |     | 2.2 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                 |     | 4.7 |     | mV/°C      |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}, I_D = 30\text{ A}$       |     | 5.0 | 6.0 | m $\Omega$ |
|                                            |                  | $V_{GS} = 4.5\text{ V}, I_D = 30\text{ A}$      |     | 7.5 | 9.0 |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = 1.5\text{ V}, I_D = 15\text{ A}$      |     | 43  |     | S          |

### CHARGES AND CAPACITANCES

|                              |              |                                                                  |  |      |  |    |
|------------------------------|--------------|------------------------------------------------------------------|--|------|--|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$    |  | 1000 |  | pF |
| Output Capacitance           | $C_{OSS}$    |                                                                  |  | 580  |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |                                                                  |  | 160  |  |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ |  | 9.7  |  | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |                                                                  |  | 1.5  |  |    |
| Gate-to-Source Charge        | $Q_{GS}$     |                                                                  |  | 2.8  |  |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |                                                                  |  | 4.8  |  |    |
| Gate Plateau Voltage         | $V_{GP}$     |                                                                  |  | 3.2  |  | V  |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$  |  | 18.6 |  | nC |

### SWITCHING CHARACTERISTICS (Note 7)

|                     |              |                                                                                           |  |     |  |    |
|---------------------|--------------|-------------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\text{ }\Omega$ |  | 9.0 |  | ns |
| Rise Time           | $t_r$        |                                                                                           |  | 34  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                           |  | 14  |  |    |
| Fall Time           | $t_f$        |                                                                                           |  | 7.0 |  |    |
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\text{ }\Omega$  |  | 7.0 |  | ns |
| Rise Time           | $t_r$        |                                                                                           |  | 26  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                           |  | 18  |  |    |
| Fall Time           | $t_f$        |                                                                                           |  | 4.0 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |          |                                          |                           |  |      |     |   |
|-----------------------|----------|------------------------------------------|---------------------------|--|------|-----|---|
| Forward Diode Voltage | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 10\text{ A}$ | $T_J = 25^\circ\text{C}$  |  | 0.80 | 1.1 | V |
|                       |          |                                          | $T_J = 125^\circ\text{C}$ |  | 0.67 |     |   |

# NVMFS4C310N

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

| Parameter                                 | Symbol   | Test Condition                                                                    | Min | Typ  | Max | Unit |
|-------------------------------------------|----------|-----------------------------------------------------------------------------------|-----|------|-----|------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS</b> |          |                                                                                   |     |      |     |      |
| Reverse Recovery Time                     | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$<br>$I_S = 30\text{ A}$ |     | 26.7 |     | ns   |
| Charge Time                               | $t_a$    |                                                                                   |     | 14.1 |     |      |
| Discharge Time                            | $t_b$    |                                                                                   |     | 12.6 |     |      |
| Reverse Recovery Charge                   | $Q_{RR}$ |                                                                                   |     | 13.7 |     | 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.

6. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

7. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

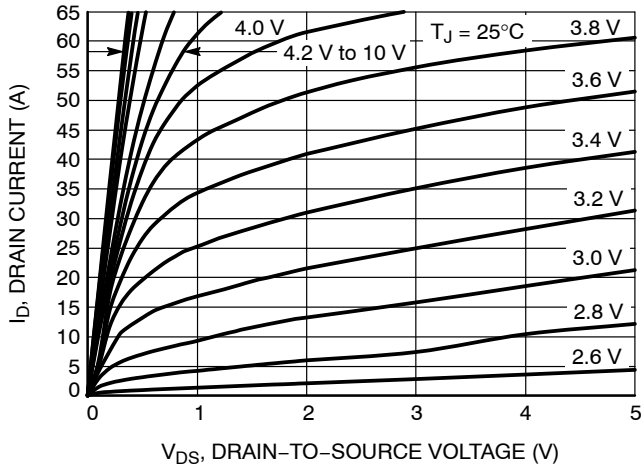


Figure 1. On-Region Characteristics

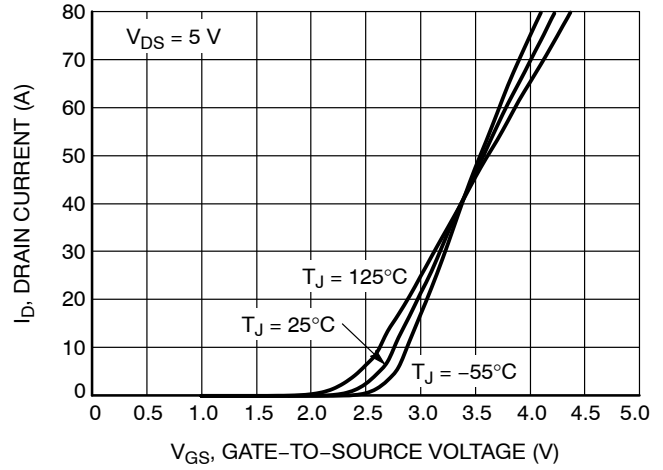


Figure 2. Transfer Characteristics

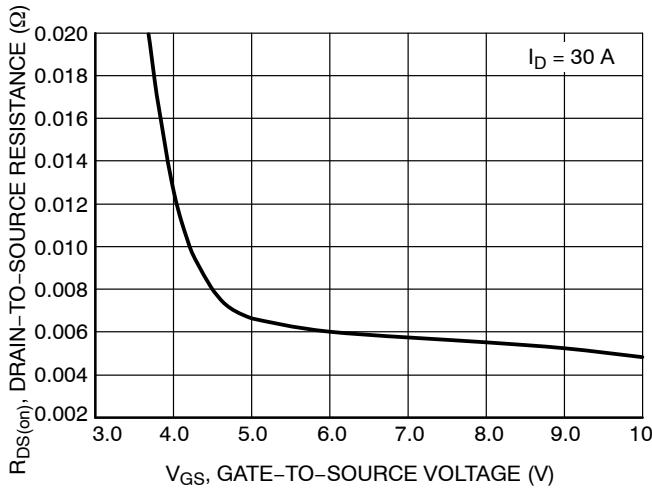


Figure 3. On-Resistance vs.  $V_{GS}$

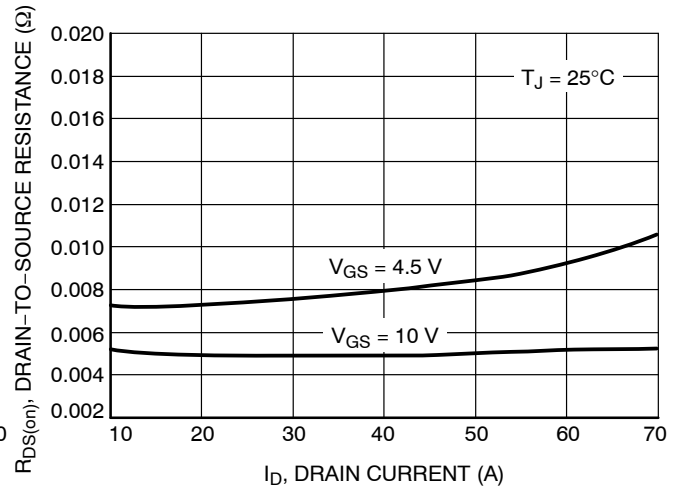


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

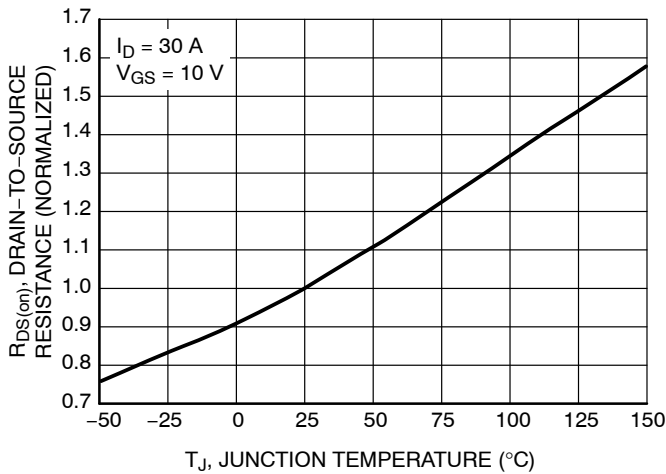


Figure 5. On-Resistance Variation with Temperature

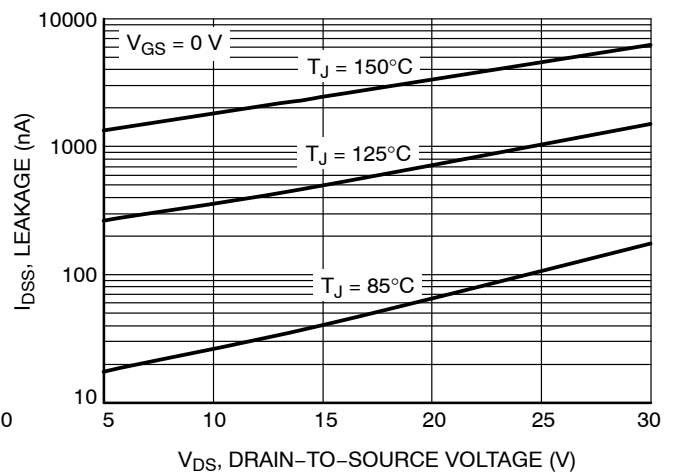


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

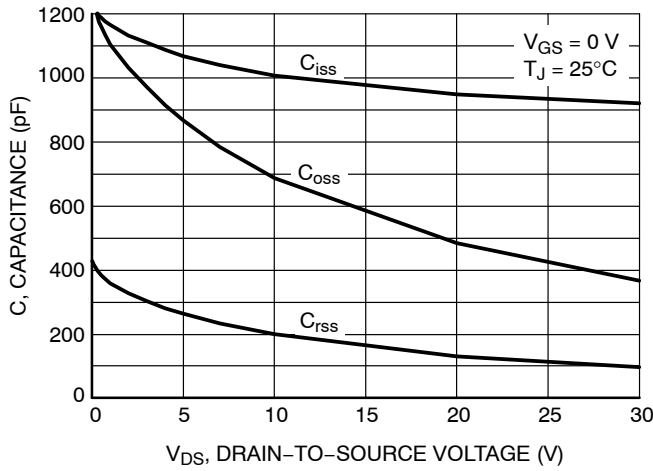


Figure 7. Capacitance Variation

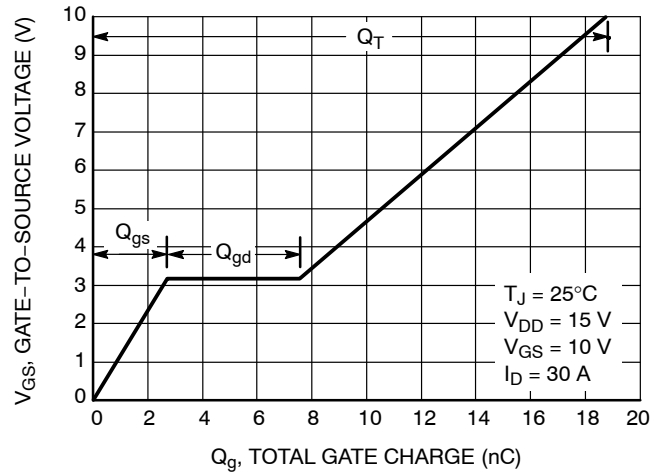


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

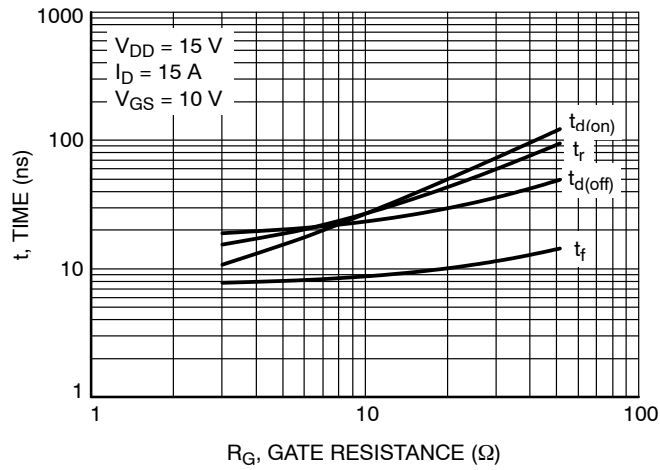


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

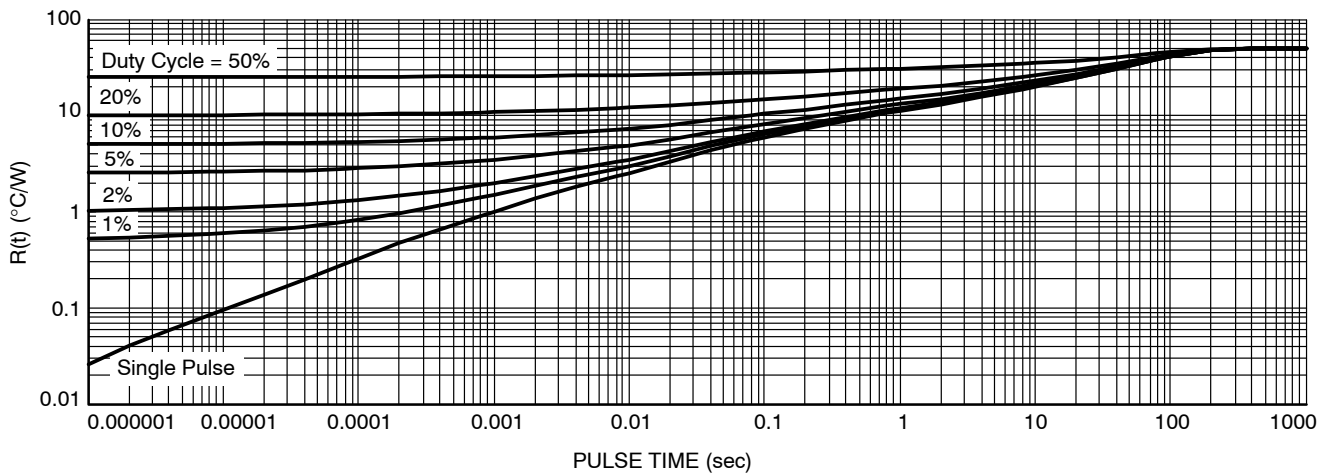


Figure 10. Thermal Response



SCALE 2:1

**DFN5 5x6, 1.27P**  
**(SO-8FL)**  
**CASE 488AA**  
**ISSUE N**

DATE 25 JUN 2018



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| 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 |
| e   | 1.27 BSC    |       |      |
| G   | 0.51        | 0.575 | 0.71 |
| K   | 1.20        | 1.35  | 1.50 |
| L   | 0.51        | 0.575 | 0.71 |
| L1  | 0.125 REF   |       |      |
| M   | 3.00        | 3.40  | 3.80 |
| θ   | 0°          | ---   | 12°  |

**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.



\*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

|                         |                                 |                                                                                                                                                                                  |
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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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