

MOSFET – Power, Single P-Channel

-60 V, -14 A, 52 mΩ

NVTFS5116PL

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
- NVTFS5116PLWF – Wettable Flanks Product
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter | Symbol | Value | Unit | |
|---|--|------------------------------|------------------|---|
| Drain-to-Source Voltage | V_{DSS} | -60 | V | |
| Gate-to-Source Voltage | V_{GS} | ± 20 | V | |
| Continuous Drain Current $R_{\psi J-mb}$ (Notes 1, 2, 3, 4) | Steady State | $T_{mb} = 25^\circ\text{C}$ | I_D -14 | A |
| | | $T_{mb} = 100^\circ\text{C}$ | -10 | |
| Power Dissipation $R_{\psi J-mb}$ (Notes 1, 2, 3) | Steady State | $T_{mb} = 25^\circ\text{C}$ | P_D 21 | W |
| | | $T_{mb} = 100^\circ\text{C}$ | 10 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4) | Steady State | $T_A = 25^\circ\text{C}$ | I_D -6 | A |
| | | $T_A = 100^\circ\text{C}$ | -4 | |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 3) | Steady State | $T_A = 25^\circ\text{C}$ | P_D 3.2 | W |
| | | $T_A = 100^\circ\text{C}$ | 1.6 | |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | I_{DM} -126 | A | |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +175 | $^\circ\text{C}$ | |
| Source Current (Body Diode) | I_S | -17 | A | |
| Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}, V_{DD} = 50 \text{ V}, V_{GS} = 10 \text{ V}, I_{L(pk)} = 30 \text{ A}, L = 0.1 \text{ mH}, R_G = 25 \Omega$) | E_{AS} | 45 | 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.

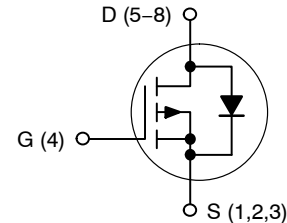
THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

| Parameter | Symbol | Value | Unit |
|--|-----------------|-------|---------------------------|
| Junction-to-Mounting Board (top) – Steady State (Notes 2, 3) | $R_{\psi J-mb}$ | 7.2 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 47 | |

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 mm², 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.

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|------------------|-----------|
| -60 V | 52 mΩ @ -10 V | -14 A |
| | 72 mΩ @ -4.5 V | |

P-Channel MOSFET

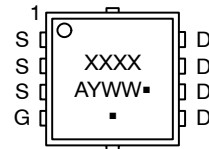


WDFN8
($\mu 8\text{FL}$)
CASE 511AB



WDFN8
($\mu 8\text{FL WF}$)
CASE 515AN

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

NVTF5116PL

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

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

OFF CHARACTERISTICS

| | | | | | | |
|-----------------------------------|---------------|---|---------------------------|--|-----------|---------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | -60 | | | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$ | $T_J = 25^\circ\text{C}$ | | -1.0 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | -10 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS (Note 5)

| | | | | | | |
|-------------------------------|--------------|---|----|----|----|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$ | -1 | | -3 | V |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -7\text{ A}$ | | 37 | 52 | m Ω |
| | | $V_{GS} = -4.5\text{ V}, I_D = -7\text{ A}$ | | 51 | 72 | |
| Forward Transconductance | g_{FS} | $V_{DS} = 15\text{ V}, I_D = -5\text{ A}$ | | 11 | | S |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|--|--|------|--|----|
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -25\text{ V}$ | | 1258 | | pF |
| Output Capacitance | C_{oss} | | | 127 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 84 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -48\text{ V}, I_D = -7\text{ A}$ | | 14 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 1 | | |
| Gate-to-Source Charge | Q_{GS} | | | 4 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 8 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -10\text{ V}, V_{DS} = -48\text{ V}, I_D = -7\text{ A}$ | | 25 | | nC |

SWITCHING CHARACTERISTICS (Note 6)

| | | | | | | |
|---------------------|--------------|--|--|----|--|----|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -48\text{ V}, I_D = -7\text{ A}$ | | 14 | | ns |
| Rise Time | t_r | | | 68 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 24 | | |
| Fall Time | t_f | | | 36 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|--|---------------------------|----|-------|-------|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = -7\text{ A}$ | $T_J = 25^\circ\text{C}$ | | -0.79 | -1.20 | V |
| | | | $T_J = 125^\circ\text{C}$ | | -0.64 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = -7\text{ A}$ | | 21 | | ns | |
| Charge Time | t_a | | | 16 | | | |
| Discharge Time | t_b | | | 5 | | | |
| Reverse Recovery Charge | Q_{RR} | | | 24 | | | 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.

5. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

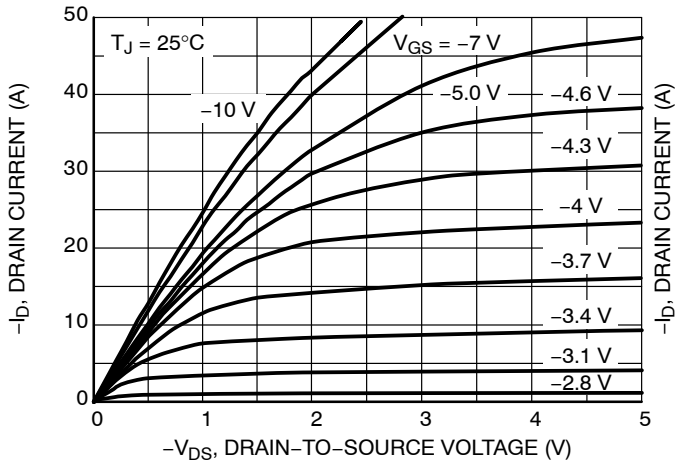


Figure 1. On-Region Characteristics

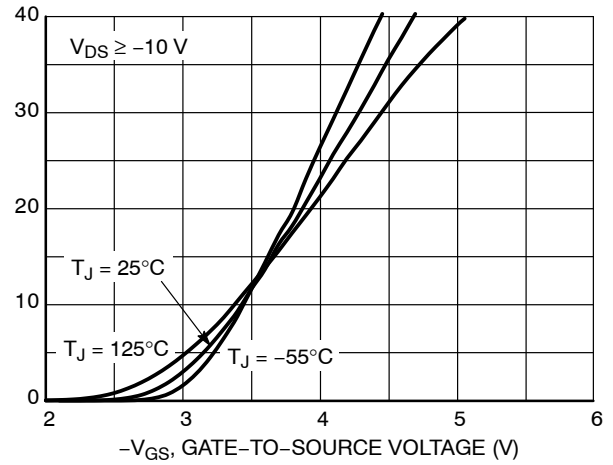


Figure 2. Transfer Characteristics

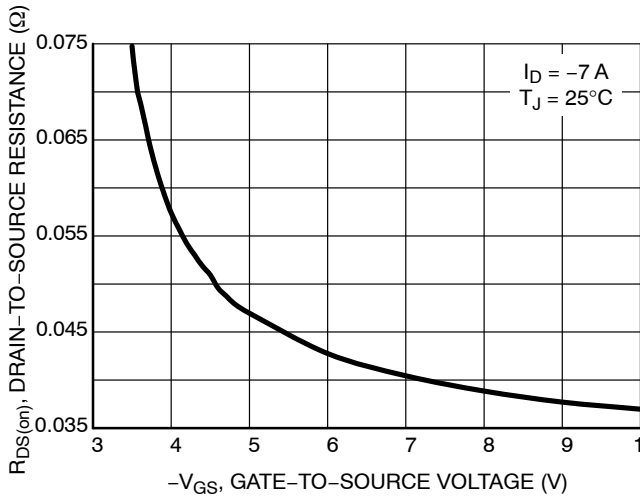


Figure 3. On-Resistance vs. Gate-to-Source Voltage

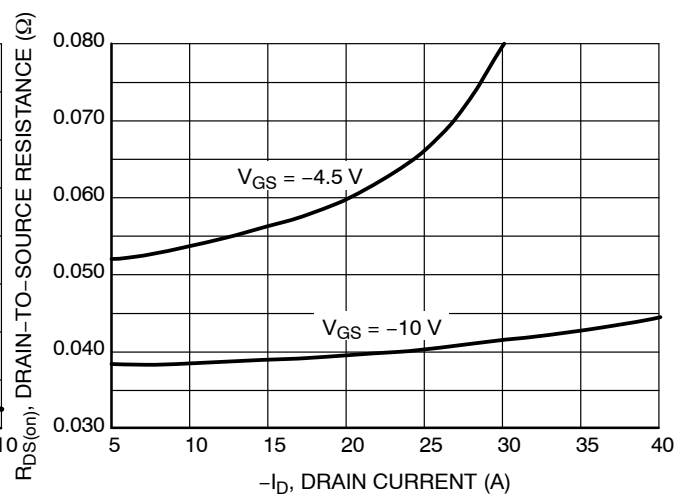


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

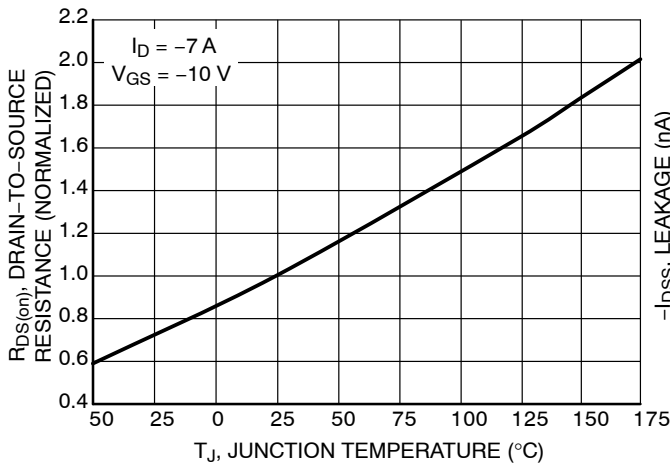


Figure 5. On-Resistance Variation with Temperature

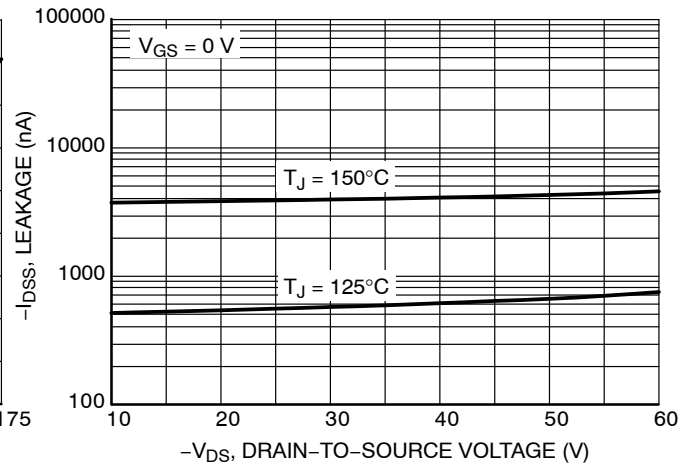


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NVTF5116PL

TYPICAL CHARACTERISTICS

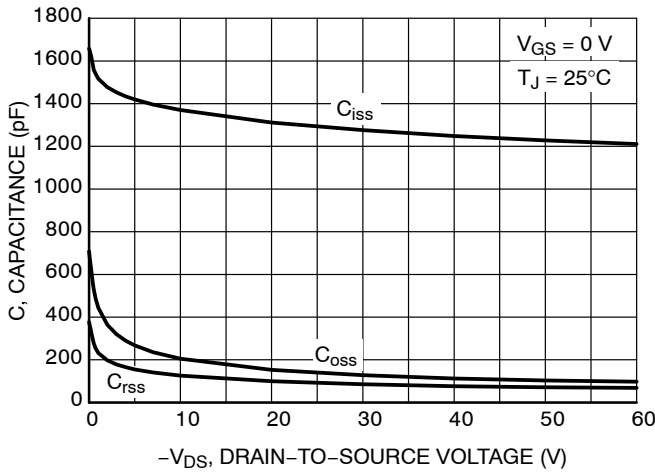


Figure 7. Capacitance Variation

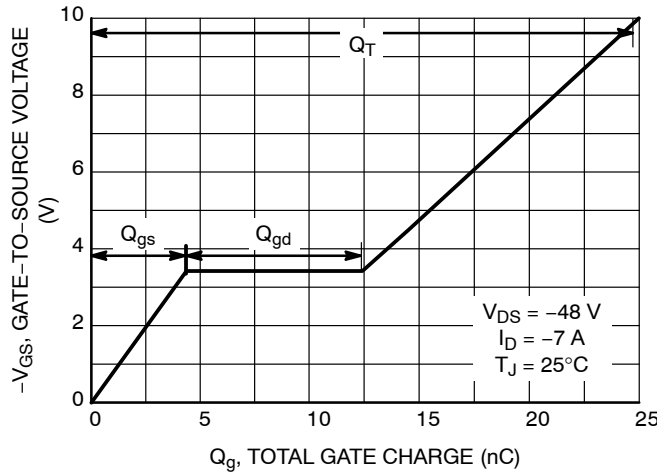


Figure 8. Gate-to-Source Voltage vs. Total Charge

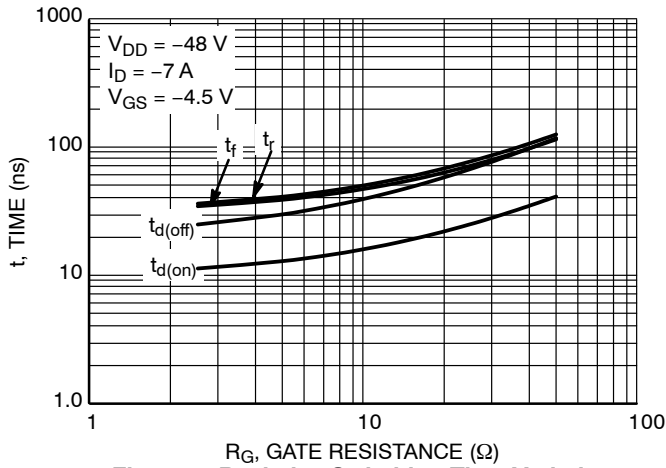


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

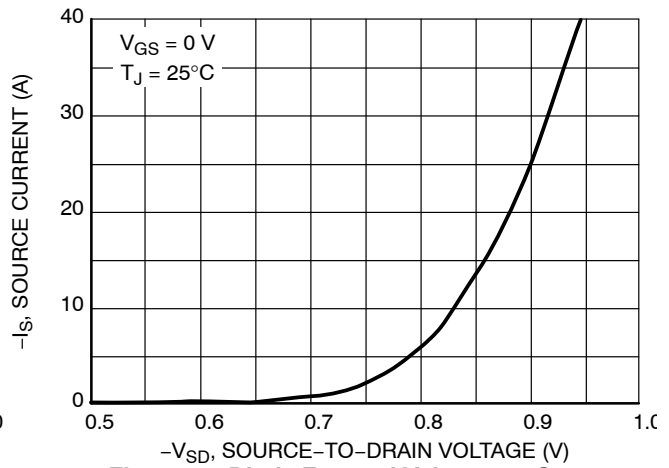


Figure 10. Diode Forward Voltage vs. Current

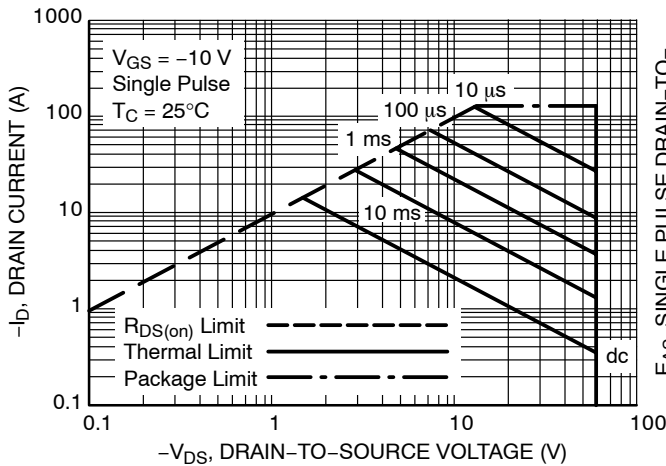


Figure 11. Maximum Rated Forward Biased Safe Operating Area

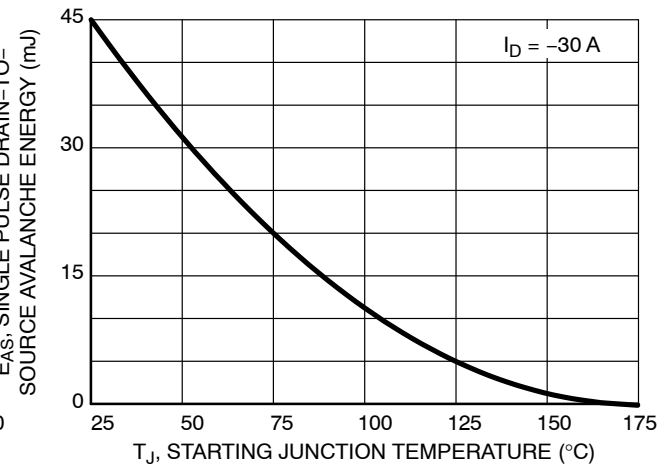


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

NVTFS5116PL

TYPICAL CHARACTERISTICS

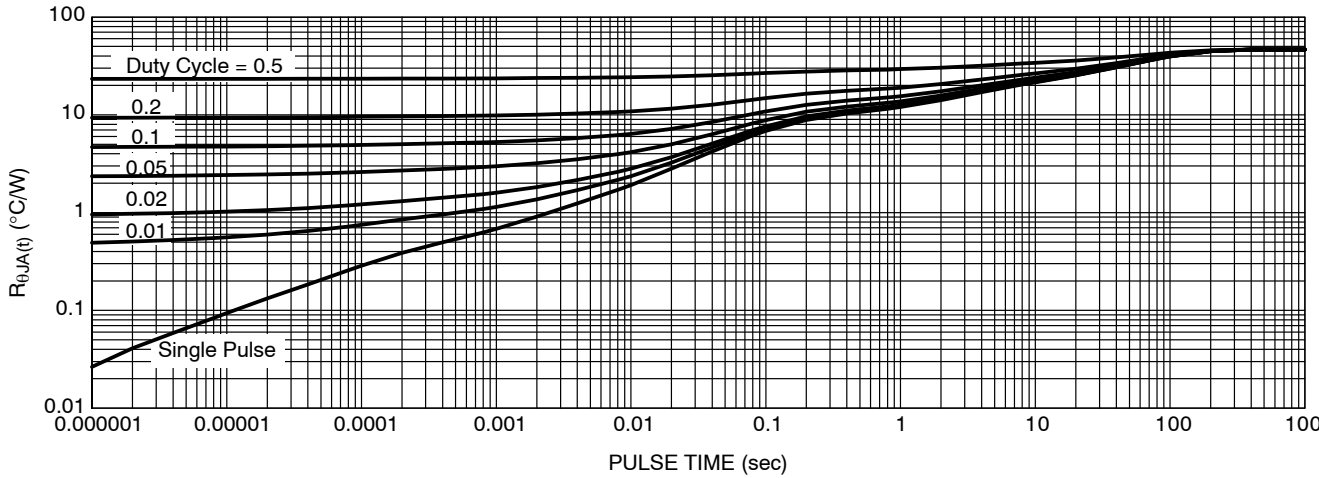


Figure 13. Thermal Response

DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping [†] |
|------------------|---------|--|-----------------------|
| NVTFS5116PLTAG | 5116 | WDFN8 3.3x3.3, 0.65P (Pb-Free) | 1500 / Tape & Reel |
| NVTFS5116PLWFTAG | 16LW | WDFN8 3.3x3.3, 0.65P (Pb-Free) | 1500 / Tape & Reel |
| NVTFS5116PLTWG | 5116 | WDFN8 3.3x3.3, 0.65P (Pb-Free) | 5000 / Tape & Reel |
| NVTFS5116PLWFTWG | 16LW | WDFNW8 3.3x3.3, 0.65P (Full-Cut μ 8FL WF) (Pb-Free, Wettable Flanks) | 5000 / 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.

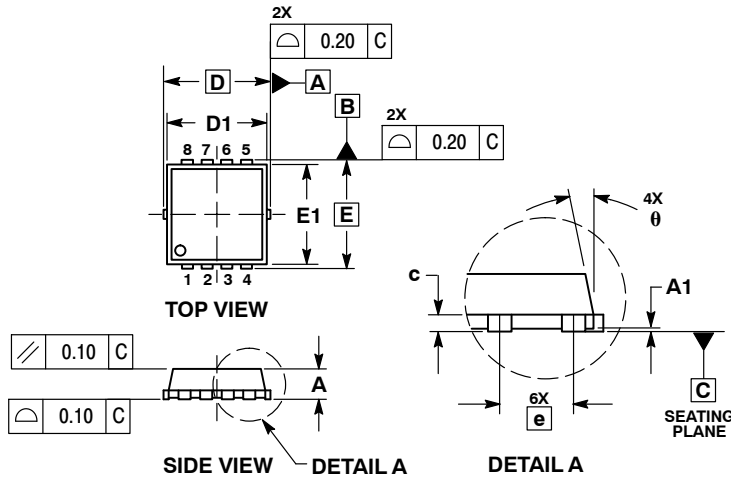
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

WDFN8 3.3x3.3, 0.65P
CASE 511AB
ISSUE D

DATE 23 APR 2012



NOTES:

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

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 | 0.028 | 0.030 | 0.031 |
| A1 | 0.00 | --- | 0.05 | 0.000 | --- | 0.002 |
| b | 0.23 | 0.30 | 0.40 | 0.009 | 0.012 | 0.016 |
| c | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 3.30 BSC | | | 0.130 BSC | | |
| D1 | 2.95 | 3.05 | 3.15 | 0.116 | 0.120 | 0.124 |
| D2 | 1.98 | 2.11 | 2.24 | 0.078 | 0.083 | 0.088 |
| E | 3.30 BSC | | | 0.130 BSC | | |
| E1 | 2.95 | 3.05 | 3.15 | 0.116 | 0.120 | 0.124 |
| E2 | 1.47 | 1.60 | 1.73 | 0.058 | 0.063 | 0.068 |
| E3 | 0.23 | 0.30 | 0.40 | 0.009 | 0.012 | 0.016 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| G | 0.30 | 0.41 | 0.51 | 0.012 | 0.016 | 0.020 |
| K | 0.65 | 0.80 | 0.95 | 0.026 | 0.032 | 0.037 |
| L | 0.30 | 0.43 | 0.56 | 0.012 | 0.017 | 0.022 |
| L1 | 0.06 | 0.13 | 0.20 | 0.002 | 0.005 | 0.008 |
| M | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| θ | 0° | --- | 12° | 0° | --- | 12° |



GENERIC MARKING DIAGRAM*



- XXXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb-Free Package

*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.

SOLDERING 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.

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



WDFNW8 3.3x3.3, 0.65P (Full-Cut μ 8FL WF)

CASE 515AN
ISSUE O

DATE 25 AUG 2020



TOP VIEW



DETAIL A



SIDE VIEW



DETAIL B

NOTES:

1. DIMENSIONING AND TOLERANCING PER: ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN. | NDM. | MAX. |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | ---- | 0.05 |
| b | 0.23 | 0.30 | 0.40 |
| c | 0.15 | 0.20 | 0.25 |
| D | 3.05 | 3.30 | 3.55 |
| D1 | 2.95 | 3.05 | 3.15 |
| D2 | 1.98 | 2.11 | 2.24 |
| E | 3.05 | 3.30 | 3.55 |
| E1 | 2.95 | 3.05 | 3.15 |
| E2 | 1.47 | 1.60 | 1.73 |
| E3 | 0.23 | 0.30 | 0.40 |
| e | 0.65 BSC | | |
| G | 0.30 | 0.41 | 0.51 |
| K | 0.65 | 0.80 | 0.95 |
| L | 0.30 | 0.43 | 0.59 |
| L1 | 0.06 | 0.13 | 0.20 |
| M | 1.40 | 1.50 | 1.60 |



BOTTOM VIEW



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.

| | | |
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