# MOSFET - Power, Single N-Channel

## 60 V, 6.8 mΩ, 70 A

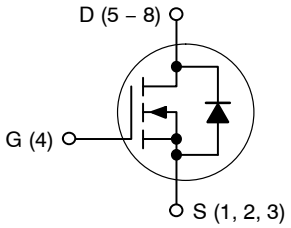
# NVTFS5C670NL

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 60 V | 6.8 mΩ @ 10 V | 70 A |
| | 10 mΩ @ 4.5 V | |

**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
- NVTFS5C670NLWF – Wettable Flanks Product
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

**N−Channel**

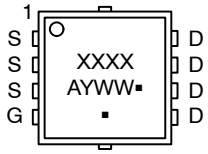




**WDFN8**
**(μ8FL)**
**CASE 511AB**

**WDFNW8**
**(μ8FL 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.

**MAXIMUM RATINGS** ($T_J$ = 25°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 $R_{\theta JC}$ (Notes 1, 2, 3, 4) | Steady State | $T_C$ = 25°C | $I_D$ | 70 | A |
| | | $T_C$ = 100°C | | 49 | |
| Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3) | | $T_C$ = 25°C | $P_D$ | 63 | W |
| | | $T_C$ = 100°C | | 31 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4) | Steady State | $T_A$ = 25°C | $I_D$ | 16 | A |
| | | $T_A$ = 100°C | | 11 | |
| 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 | $T_A$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | 440 | A |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 68 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($I_{L(pk)}$ = 3.6 A) | | | $E_{AS}$ | 166 | 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) | $R_{\theta JC}$ | 2.4 | °C/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 $mm^2$, 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.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°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 V, $I_D$ = 250 μA | | 60 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 27 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 60 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 | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 50 μA | | 1.2 | | 2.0 | V |
| Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | −4.7 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 35 A | | 5.6 | 6.8 | mΩ |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 35 A | | 8.0 | 10 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 15 V, $I_D$ = 35 A | | | 82 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 25 V | | | 1400 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 690 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 15 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V; $I_D$ = 35 A | | | 9.0 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 48 V; $I_D$ = 35 A | | | 20 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 48 V; $I_D$ = 35 A | | | 2.5 | | nC |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 4.5 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 2.0 | | |
| Plateau Voltage | $V_{GP}$ | | | | 3.1 | | V |
| **SWITCHING CHARACTERISTICS** (Note 6) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V, $I_D$ = 35 A, $R_G$ = 2.5 Ω | | | 11 | | ns |
| Rise Time | $t_r$ | | | | 60 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 15 | | |
| Fall Time | $t_f$ | | | | 4 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 35 A | $T_J$ = 25°C | | 0.9 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.8 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/d_t$ = 100 A/μs, $I_S$ = 35 A | | | 34 | | ns |
| Charge Time | $t_a$ | | | | 17 | | |
| Discharge Time | $t_b$ | | | | 17 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 19 | | 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 ≤ 300 μs, duty cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

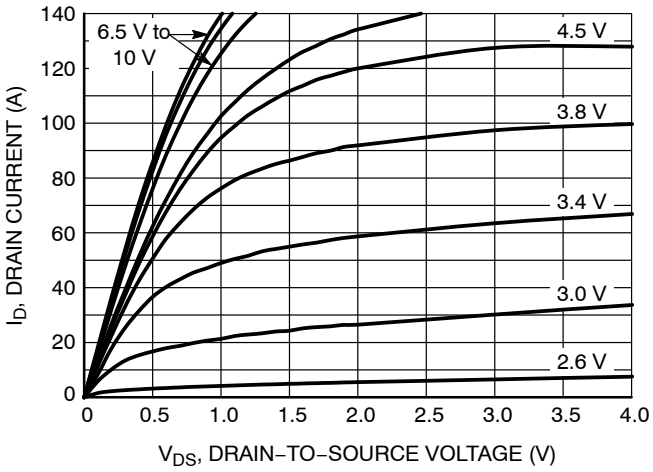



**Figure 1. On−Region Characteristics**

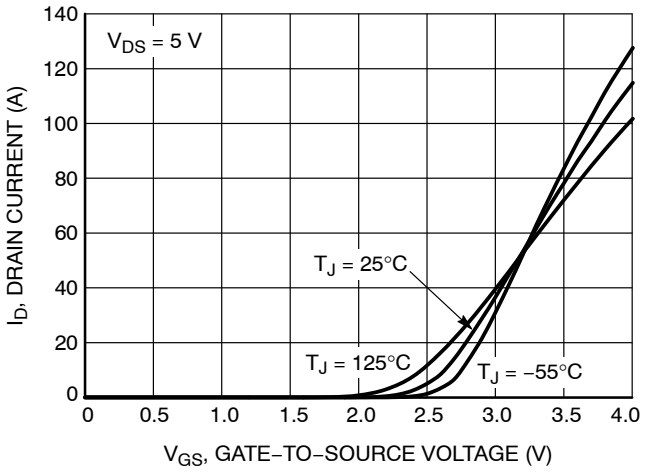



**Figure 2. Transfer Characteristics**

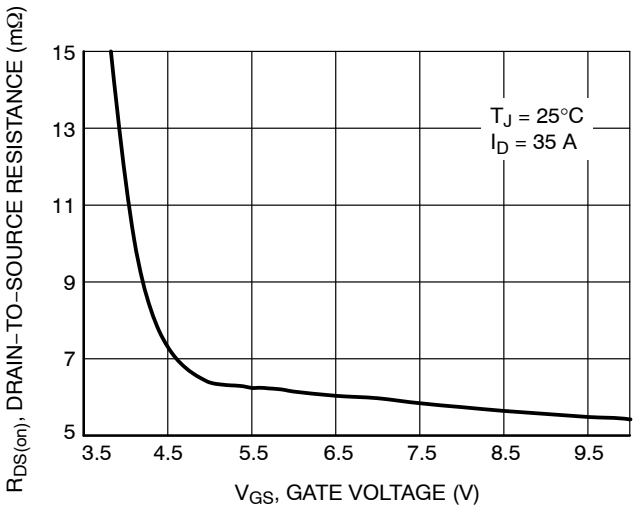



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

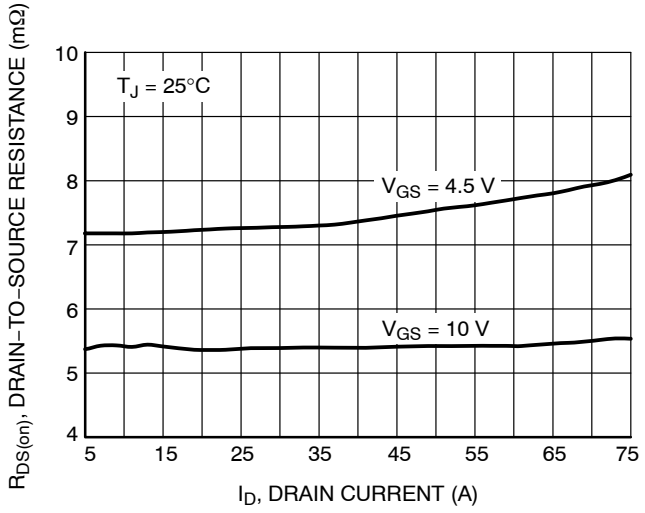



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

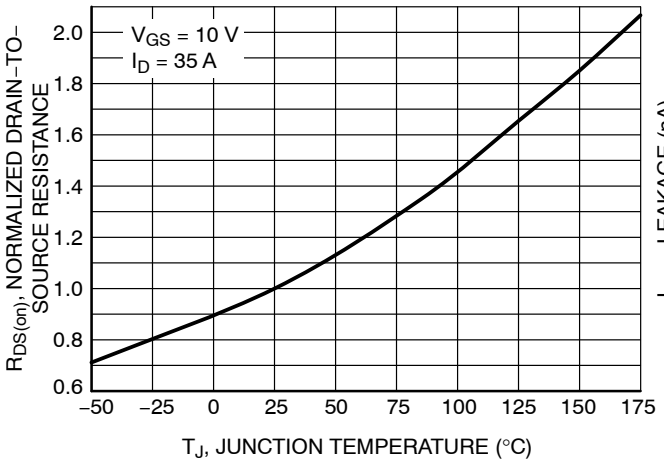



**Figure 5. On−Resistance Variation with Temperature**

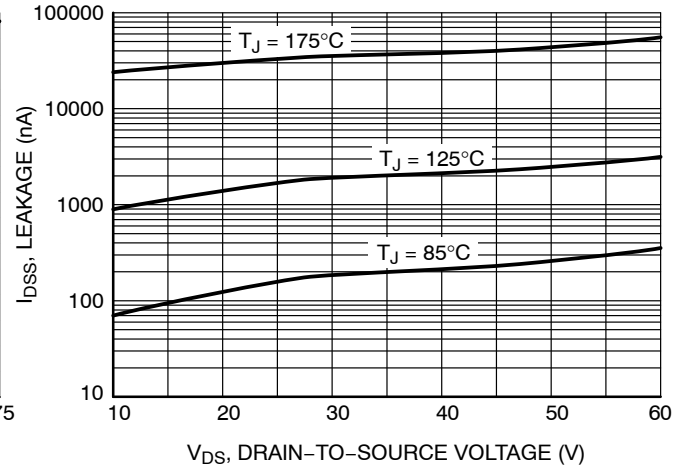



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

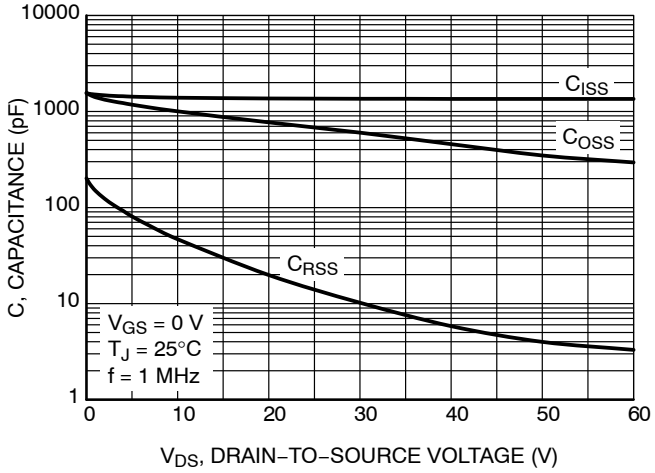



**Figure 7. Capacitance Variation**

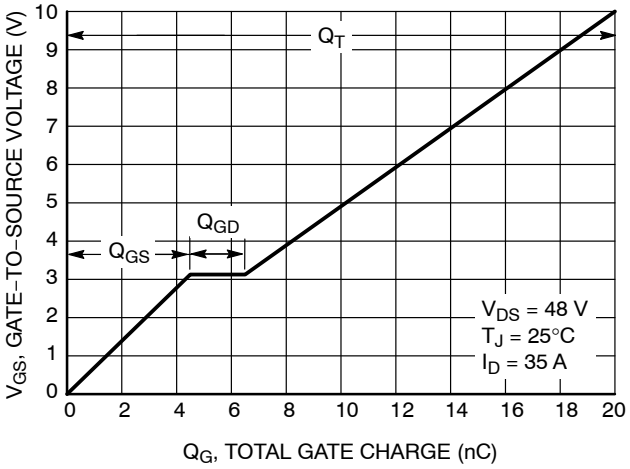



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

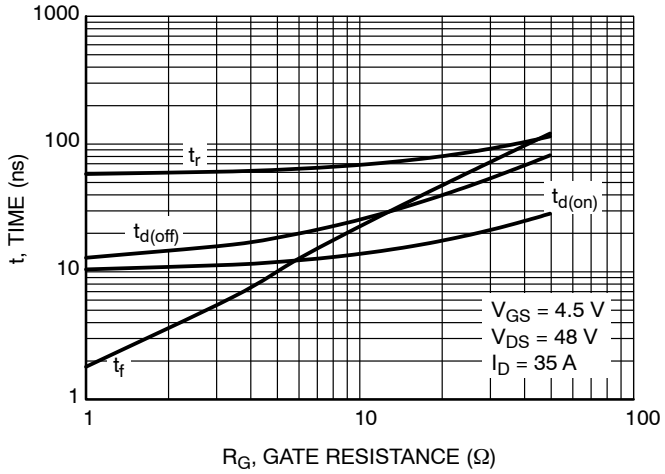



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

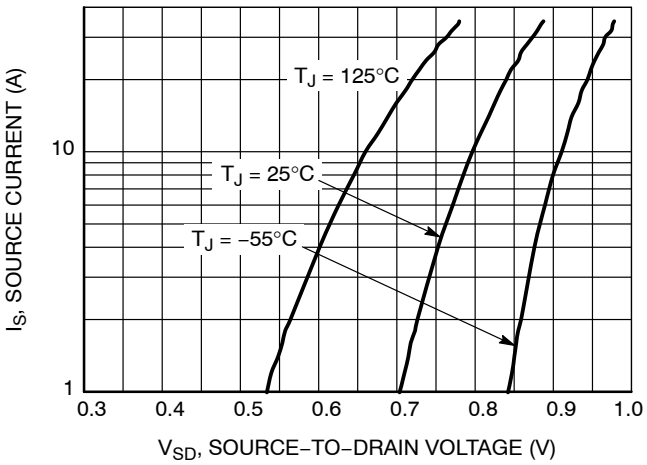



**Figure 10. Diode Forward Voltage vs. Current**

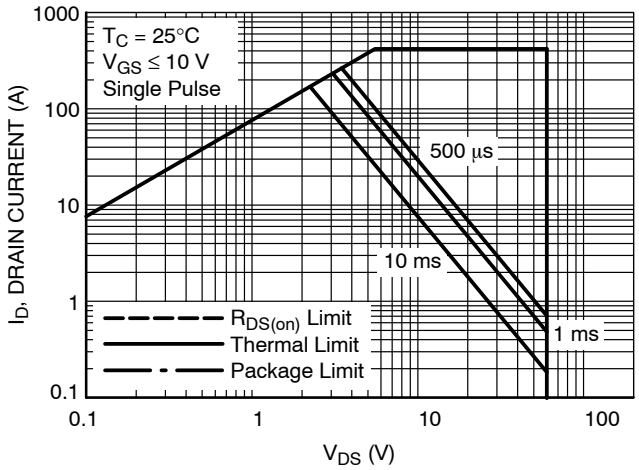



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

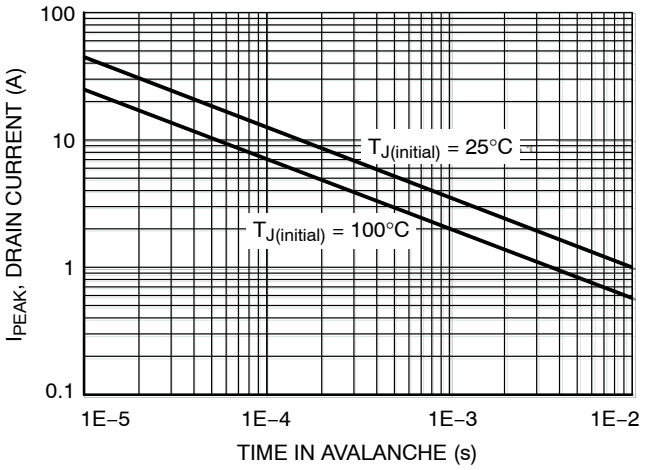



**Figure 12. Maximum Drain Current vs. Time in Avalanche**

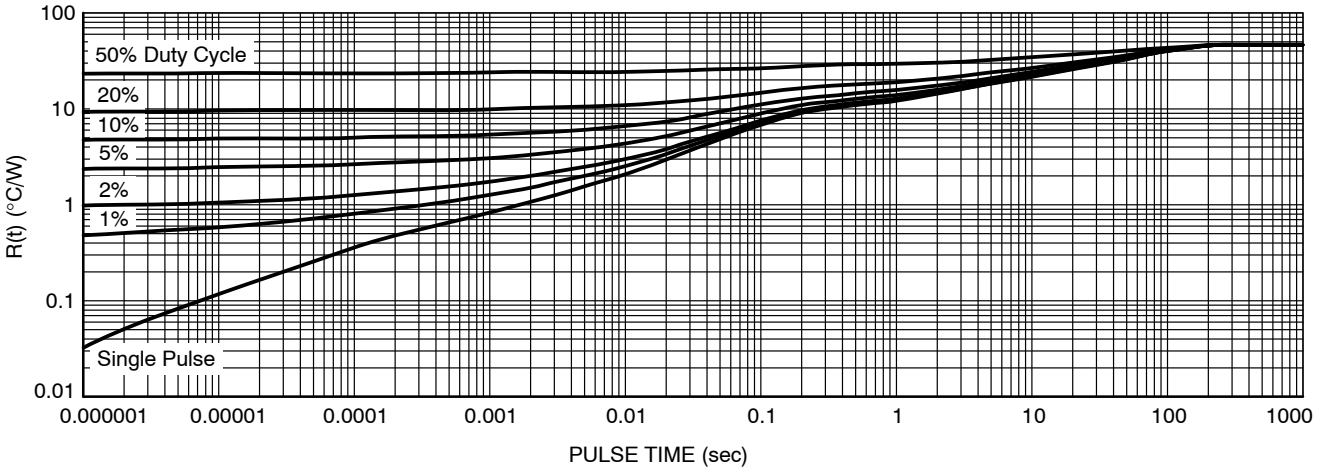



**Figure 13. Thermal Characteristics**

## DEVICE ORDERING INFORMATION

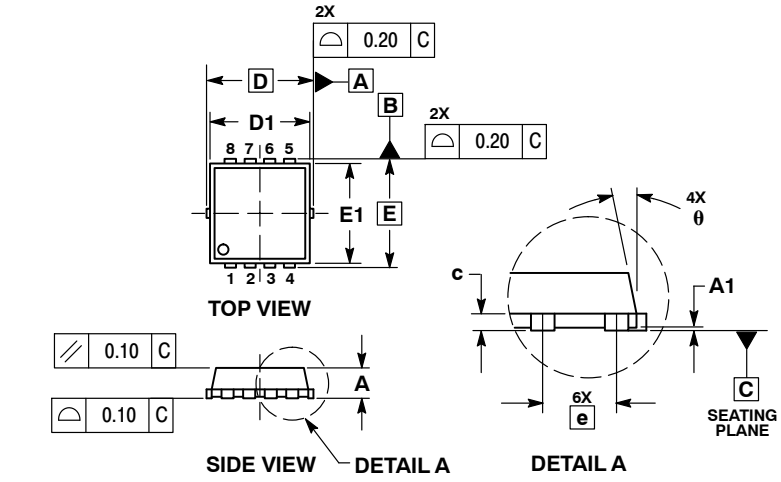
| Device | Marking | Package | Shipping† |
|---|---|---|---|
| NVTFS5C670NLTAG | 670L | WDFN8<br>(Pb−Free) | 1500 / Tape & Reel |
| NVTFS5C670NLWFTAG | 70LW | WDFNW8<br>(Pb−Free, Wettable Flanks) | 1500 / Tape & Reel |

†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.

**SCALE 2:1**

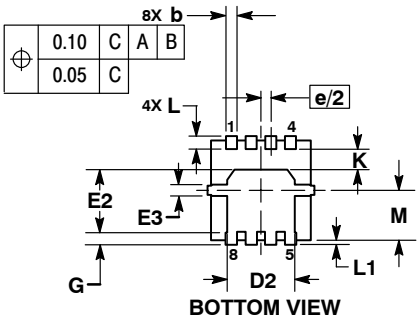
**WDFN8 3.3x3.3, 0.65P**
CASE 511AB
ISSUE D

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.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | 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 ° |

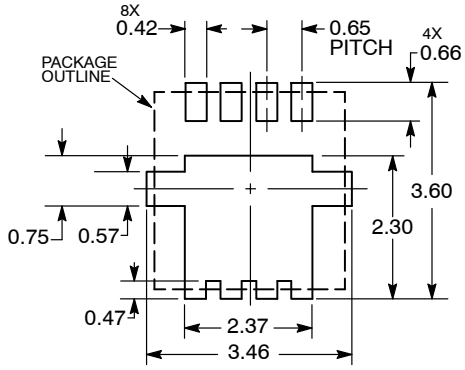



## GENERIC MARKING DIAGRAM*


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.

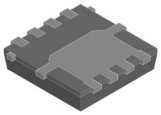
## SOLDERING FOOTPRINT*




DIMENSION: MILLIMETERS

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

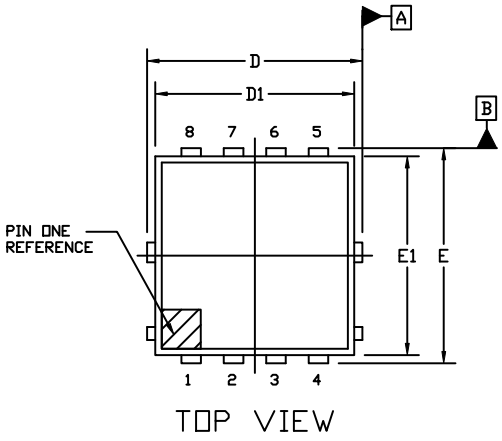
| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON30561E** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| **DESCRIPTION:** | **WDFN8 3.3X3.3, 0.65P** | **PAGE 1 OF 1** |



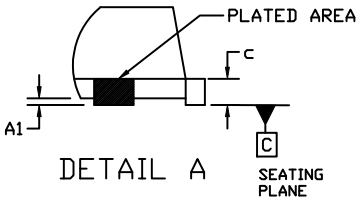
## WDFNW8 3.3x3.3, 0.65P (Full−Cut μ8FL WF)

CASE 515AN
ISSUE O

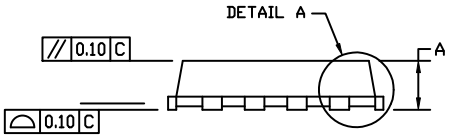
DATE 25 AUG 2020



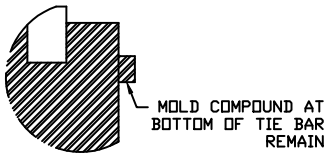

TOP VIEW




DETAIL A




SIDE VIEW

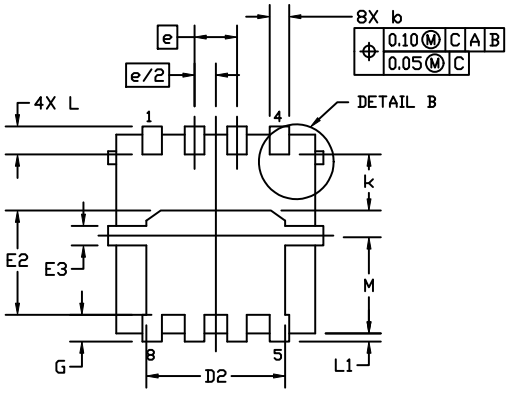



DETAIL B

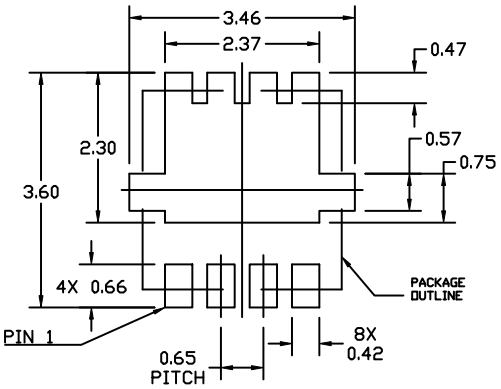
NOTES:

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.

| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN. | NOM. | 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 |



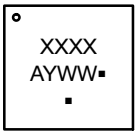

BOTTOM VIEW




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.

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98AON24556H** | 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 3.3x3.3, 0.65P (Full−Cut μ8FL WF)** | | **PAGE 1 OF 1** |

## ADDITIONAL INFORMATION

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