# NVTFS5820NL

# Power MOSFET
## 60 V, 11.5 mΩ, Single N−Channel, μ8FL

**Features**

- Small Footprint (3.3x3.3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low $Q_G$ and Capacitance to Minimize Driver Losses
- NVTFS5820NLWF − Wettable Flanks Product
- AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

**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 $R_{\Psi J-mb}$ (Notes 1, 2, 3, 4) | Steady State | $T_{mb}$ = 25°C | $I_D$ | 29 | A |
| | | $T_{mb}$ = 100°C | | 20 | |
| Power Dissipation $R_{\Psi J-mb}$ (Notes 1, 2, 3) | | $T_{mb}$ = 25°C | $P_D$ | 21 | W |
| | | $T_{mb}$ = 100°C | | 10 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1 & 3, 4) | Steady State | $T_A$ = 25°C | $I_D$ | 11 | A |
| | | $T_A$ = 100°C | | 8.0 | |
| 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 | | $I_{DM}$ | 247 | A |
| Current limited by package (Note 4) | $T_A$ = 25°C | | $I_{DmaxPkg}$ | 70 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{stg}$ | −55 to 175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 17 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($T_J$ = 25°C, $V_{DD}$ = 50 V, $V_{GS}$ = 10 V, $I_{L(pk)}$ = 31 A, L = 0.1 mH, $R_G$ = 25 Ω) | | | $E_{AS}$ | 48 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °C |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**THERMAL RESISTANCE MAXIMUM RATINGS** (Note 1)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Mounting Board (top) − Steady State (Note 2, 3) | $R_{\Psi J-mb}$ | 7.3 | °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. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

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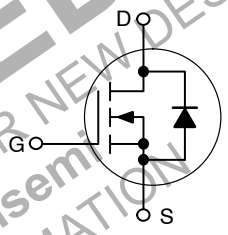
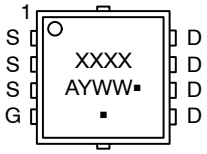
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 60 V | 11.5 mΩ @ 10 V | 29 A |
| | 15 mΩ @ 4.5 V | |

**N−Channel**




**MARKING DIAGRAM**


**WDFN8**
**(μ8FL)**
**CASE 511AB**




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.

**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 | $V_{(BR)DSS}/T_J$ | | | | 57 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 60 V | $T_J$ = 25°C | | | 1.0 | μA |
| | | | $T_J$ = 125°C | | | 10 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 1.5 | | 2.3 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 6.2 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 8.7 A | | 10.1 | 11.5 | mΩ |
| | | $V_{GS}$ = 4.5 V | $I_D$ = 7.3 A | | 13.0 | 15 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 5 V, $I_D$ = 10 A | | | 24.6 | | S |
| **CHARGES, CAPACITANCES AND GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 25 V | | | 1462 | | pF |
| Output Capacitance | $C_{oss}$ | | | | 150 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | | 96 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 48 V, $I_D$ = 10 A | | | 28 | | nC |
| | | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V, $I_D$ = 10 A | | | 15 | | |
| Threshold Gate Charge | $Q_{G(TH)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V, $I_D$ = 10 A | | | 1 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 4 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 8 | | |
| Plateau Voltage | $V_{GP}$ | | | | 3 | | V |
| Gate Resistance | $R_G$ | | | | 0.62 | | Ω |
| **SWITCHING CHARACTERISTICS** (Note 6) | | | | | | | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 48 V, $I_D$ = 10 A, $R_G$ = 2.5 Ω | | | 10 | | ns |
| Rise Time | $t_r$ | | | | 28 | | |
| Turn−Off Delay Time | $t_{d(off)}$ | | | | 19 | | |
| Fall Time | $t_f$ | | | | 22 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 10 A | $T_J$ = 25°C | | 0.79 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.65 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $d_{IS}/d_t$ = 100 A/μs, $I_S$ = 10 A | | | 19 | | ns |
| Charge Time | $t_a$ | | | | 13 | | |
| Discharge Time | $t_b$ | | | | 6 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 15 | | nC |

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

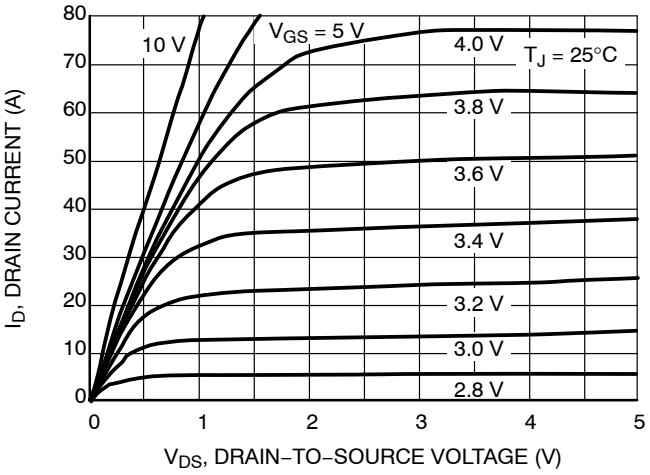



**Figure 1. On−Region Characteristics**

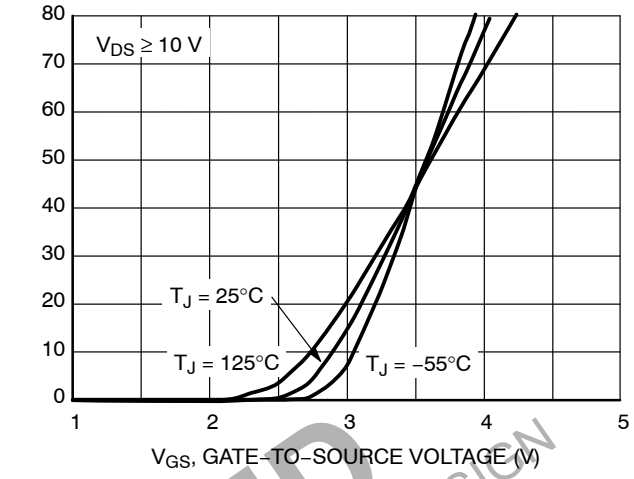



**Figure 2. Transfer Characteristics**

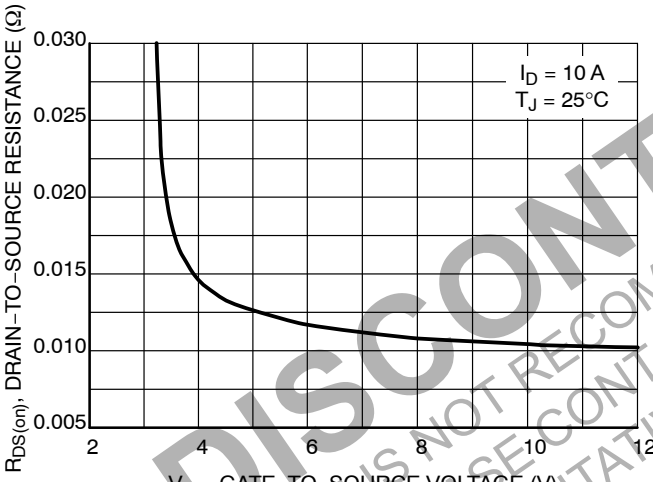



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

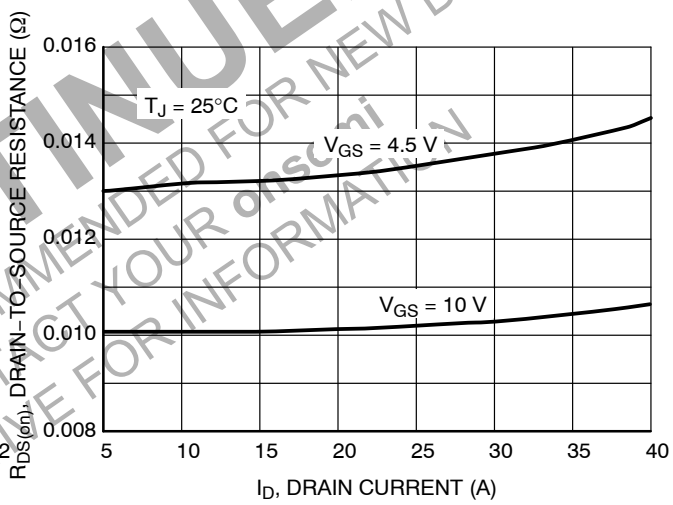



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

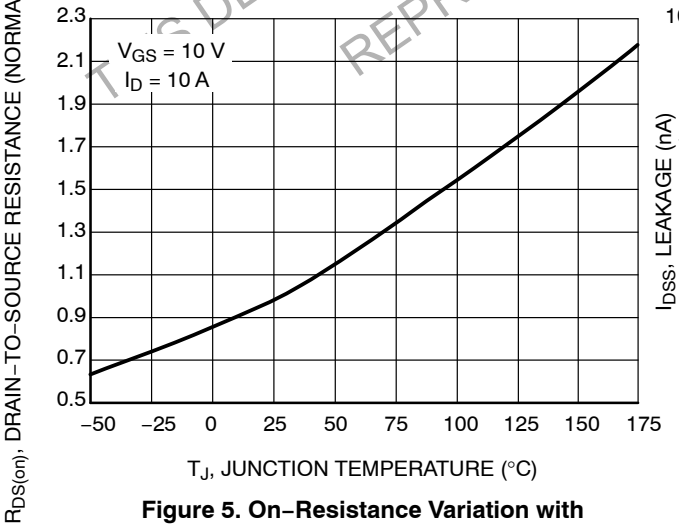



**Figure 5. On−Resistance Variation with Temperature**

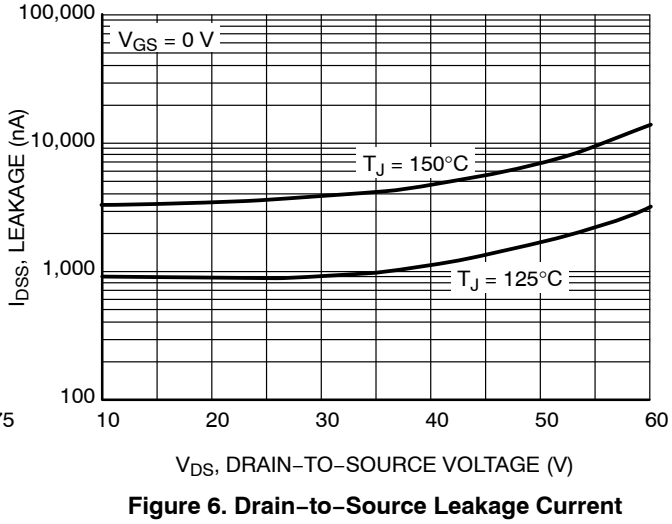



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

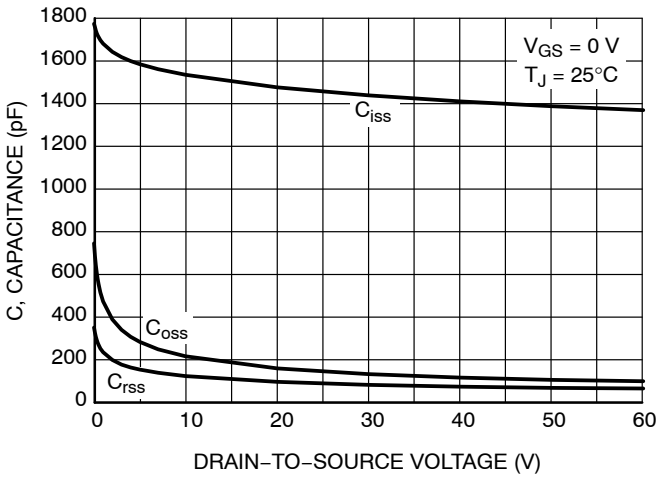



**Figure 7. Capacitance Variation**

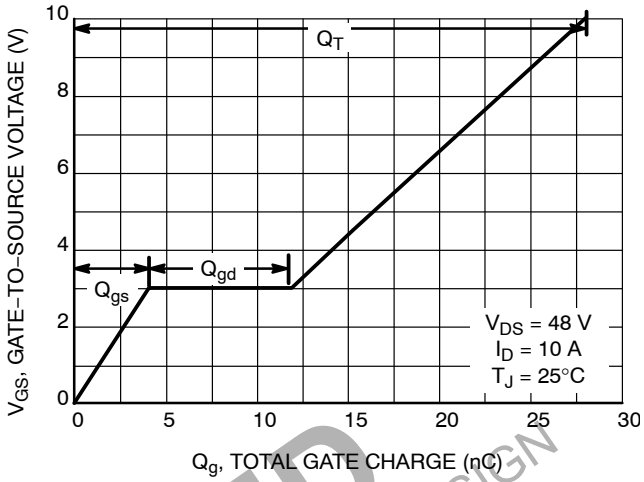



**Figure 8. Gate−to−Source Voltage vs. Total Charge**

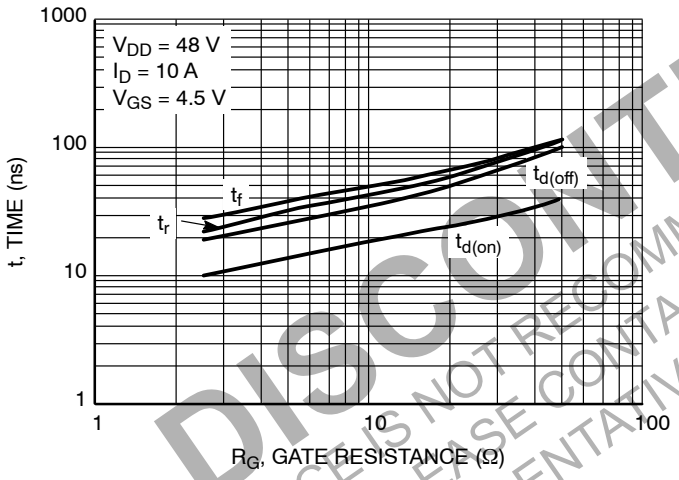



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

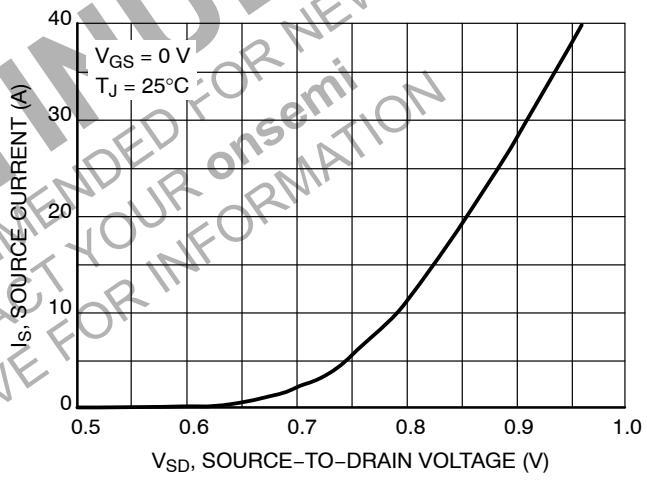



**Figure 10. Diode Forward Voltage vs. Current**

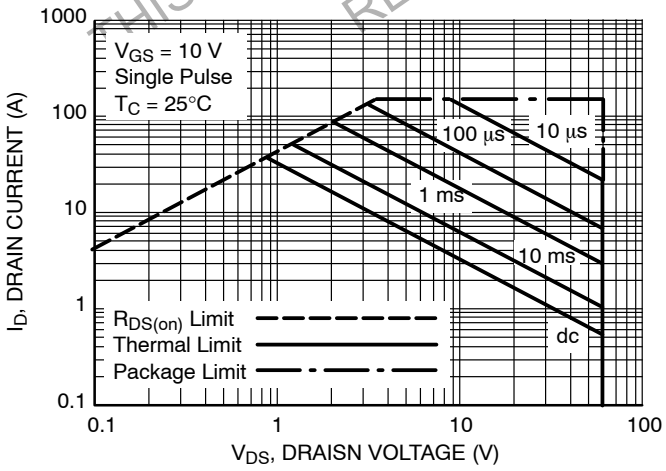



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

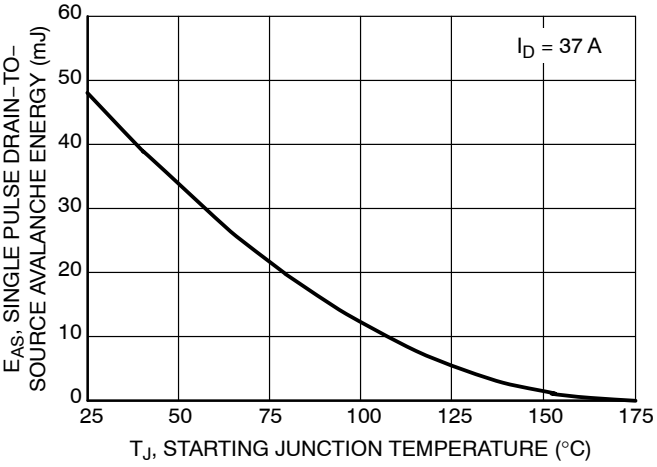



**Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature**

## TYPICAL CHARACTERISTICS

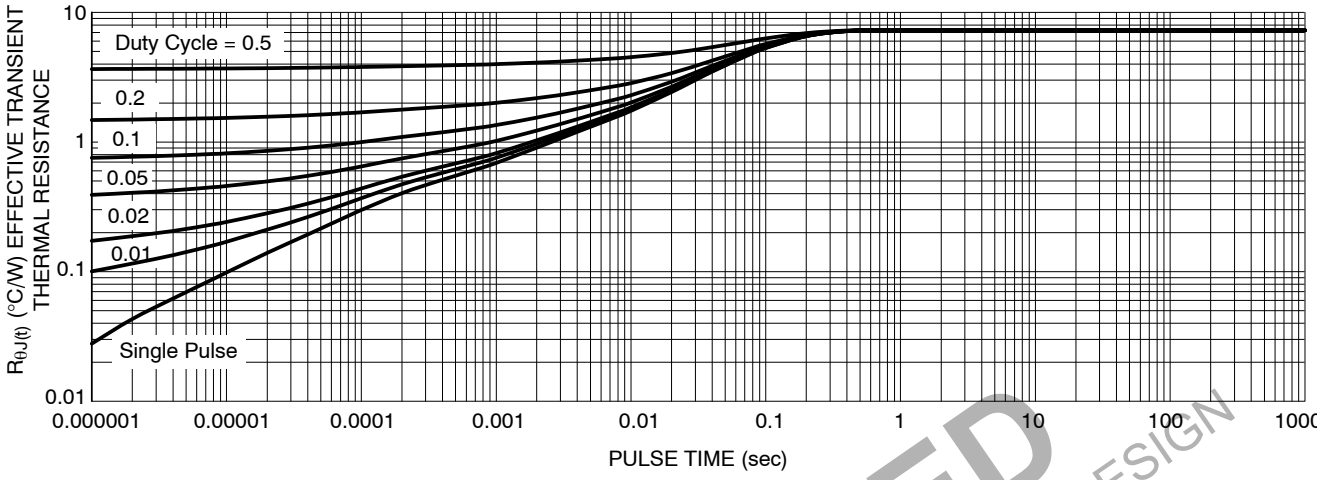



**Figure 13. Thermal Response**



### DEVICE ORDERING INFORMATION

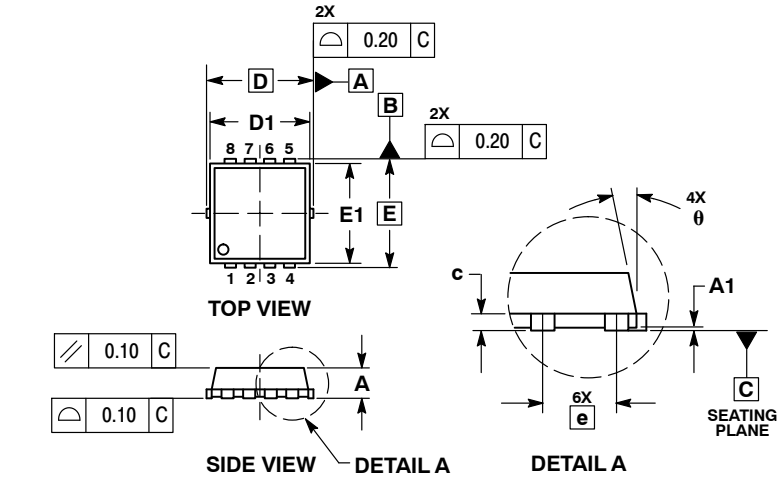
| Device | Marking | Package | Shipping† |
|---|---|---|---|
| NVTFS5820NLTAG | 5820 | WDFN8 (Pb−Free) | 1500 / Tape & Reel |
| NVTFS5820NLWFTAG | 20LW | WDFN8 (Pb−Free) | 1500 / Tape & Reel |
| NVTFS5820NLTWG | 5820 | WDFN8 (Pb−Free) | 5000 / Tape & Reel |
| NVTFS5820NLWFTWG | 20LW | WDFN8 (Pb−Free) | 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.

**SCALE 2:1**

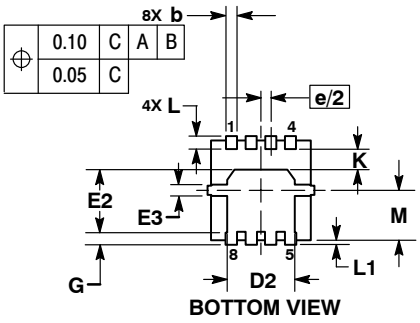
**WDFN8 3.3x3.3, 0.65P**
CASE 511AB
ISSUE D

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 ° |

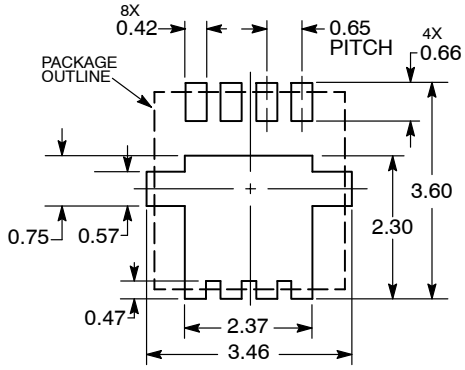



## GENERIC MARKING DIAGRAM*


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** |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
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